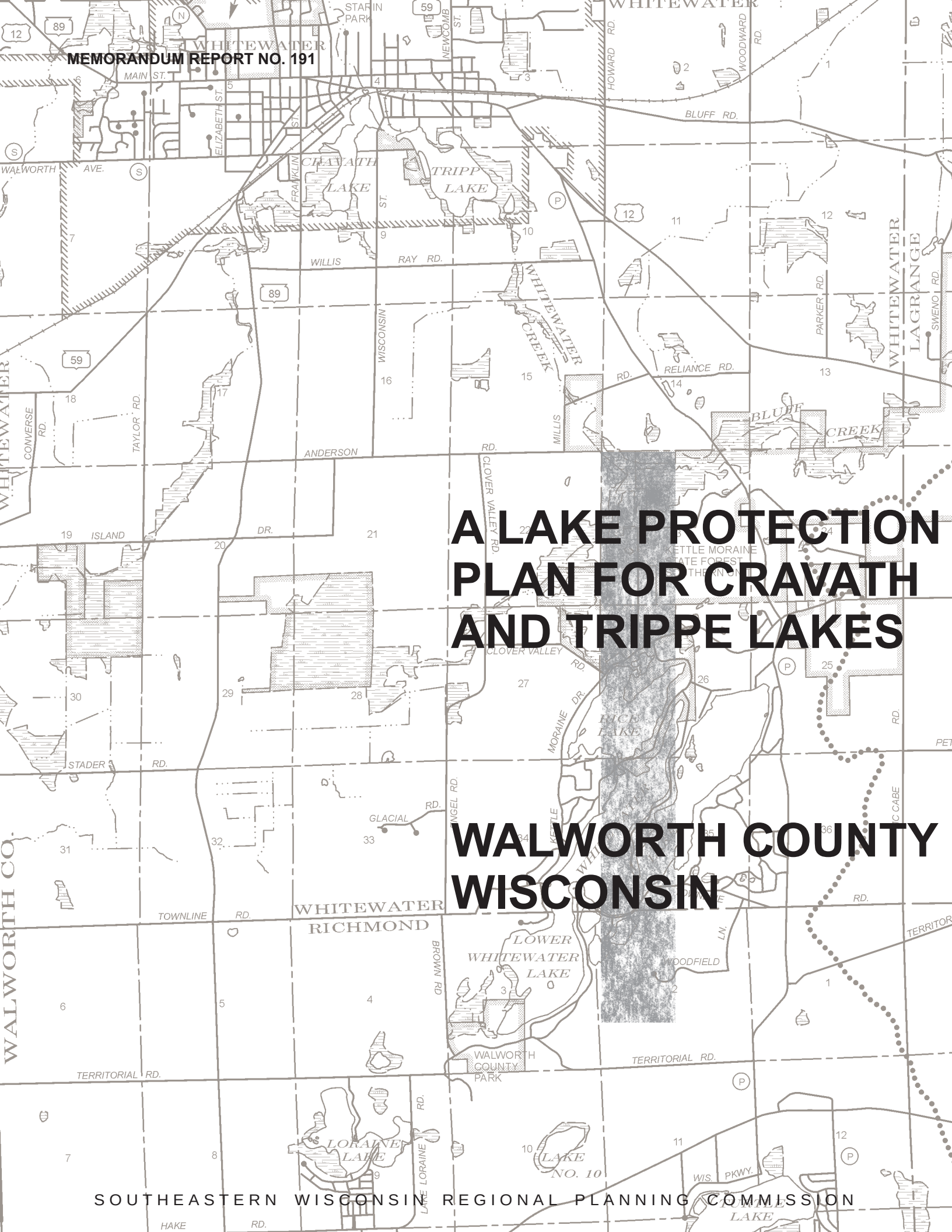
MEMORANDUM REPORT NO. 191

A LAKE PROTECTION PLAN FOR CRAVATH AND TRIPPE LAKES

WALWORTH COUNTY WISCONSIN



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MEMORANDUM REPORT
NUMBER 191

A LAKE PROTECTION PLAN FOR CRAVATH AND TRIPPE LAKES

WALWORTH COUNTY, WISCONSIN

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Chapter I

INTRODUCTION

BACKGROUND

Cravath Lake, a 68-acre impounded drainage lake on Spring Brook, is located largely within the City and Town of Whitewater in Walworth County. Trippe Lake—whose name appears variously as Trapp Lake and Tripp Lake—is a 113-acre drainage lake located on Whitewater Creek, immediately upstream of Cravath Lake.[1,2] The Lakes are located within U.S. Public Land Survey Township 4 North, Range 15 East, Sections 3 and 4, and 9 and 10, in northwestern Walworth County. The two lakes are situated on the southern side of the City of Whitewater, and both the lakes and their immediate tributary areas have been partially incorporated into the City's park and open space system where they provide a variety of urban recreational services including walking trails, fishing spots, and limited boating/canoeing, as well as serving as visual amenities. Outflow from Trippe Lake flows into the Cravath Lake and thence northerly, via the Whitewater Creek, to the Bark River, a tributary stream of the Rock River. Water quality in the Creek was historically degraded by the discharge to the Creek of treated effluent from the old City of Whitewater wastewater treatment plant, which was upgraded in 1982. Subsequent to this upgrade, the quality of the effluent has improved, as has the quality of the River, which is now categorized as fair by the Wisconsin Department of Natural Resources (WDNR).[3]

The location of Cravath and Trippe Lakes within the City of Whitewater in the greater Milwaukee and Chicago metropolitan areas may be expected to contribute to a continued demand for further urban development. The presence of the University of Wisconsin-Whitewater campus is expected to contribute to this demand, particularly for residential development. Such development in the vicinity of the Lakes is likely to result in concomitant demands for outdoor and water-based recreational opportunities. Currently, these opportunities are provided for through City park and open space lands located on the Lakes.

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[1]*For the purposes of this report, the spelling "Trippe Lake" has been adopted; however, the lake name appears as Tripp Lake (Trapp Lake) in Wisconsin Department of Natural Resources Publication No. PUBL-WT-280-98-REV,* Lower Rock River Basin: Water Quality Management Plan*, October 1998, and in Wisconsin Department of Natural Resources Publication No. PUBL-FH-800 2005,* Wisconsin Lakes*, 2005.*

[2]*The Lakes are apparently named in honor of James Trippe, the original proprietor of the town site, and Prosper Cravath, the initial surveyor and a leading citizen of the town; see Fred G. Kraege,* Whitewater*, Arcadia Publishing, 128 pages, May 2006. ISBN: 9780738540078.*

[3]*See SEWRPC Community Assistance Planning Report No. 94, 2nd Edition,* Sanitary Sewer Service Area for the City of Whitewater, Walworth County, Wisconsin*, March 1995, as amended.*

In addition to the parklands, other open lands, including a cemetery, occupy portions of the Lake shores. Such development limits the area available for urban density development or redevelopment within the areas immediately tributary to the Lakes. Nevertheless, the community recently has witnessed the development of multi-family condominiums that effectively increases the density of dwelling units adjacent to the Lakes. These types of development have a direct influence on stormwater, increasing the volume and rate at which stormwater flows off of the impervious surfaces—roofs, driveways, and walkways—associated with this type of infrastructure, which, pursuant to current state regulatory requirements, must be mitigated using stormwater management practices.

Upstream of the Lakes lies an active agricultural area that surrounds the two inflowing tributary streams—Whitewater Creek, which rises from Whitewater (and Rice) Lakes in the Southern Unit of the Kettle Moraine State Forest, and Spring Brook. From Whitewater Lake to Trippe Lake at Whitewater, the water quality of the Whitewater Creek is considered good by the WDNR. An approximately 1.9-mile reach of Whitewater Creek from its confluence with Bluff Creek downstream to Willis Ray Road in the Town of Whitewater is considered to have the potential to become a Class II trout water segment; however, the WDNR considers that additional land acquisition and habitat improvement would be necessary to achieve this potential.[4] Nevertheless, the active agricultural use of portions of this watershed has led to concerns over the generation of sediments through erosion and streambank failures and the introduction of other agricultural contaminants which may be deposited into the Lakes.

As a consequence of the widespread nature of these concerns, the Cravath and Trippe Lakes community residents have expressed a clear desire to investigate and quantify these concerns, and to define any issues of concern. As an initial step in this process, the City of Whitewater created an *ad hoc* lakes committee to study, evaluate, and document a range of remedial and organizational measures, contributing to an effective organizational mechanism for the management of the root causes of the community concerns, and, ultimately, to a lake protection plan for the Lakes. This report is a response to the request of the City of Whitewater *Ad Hoc* Lakes Committee for assistance in conducting the diagnostic analysis and protection plan formulation.

HISTORY OF THE LAKES

Trippe and Cravath Lakes share a long history. This history begins with the founding of what was to become the City of Whitewater, within which the Lakes are situated, at the confluence of Whitewater Creek and Spring Brook. The then Town was named for the soft, white clay that lined the streams flowing through the area.[5] Samuel Prince, the first settler, erected a cabin on his 60-acre claim in 1837, and a gristmill, sawmill, paper mill, and numerous stores were soon established in this agricultural area. Twenty-one years later, the Town of Whitewater "came of age" as the Milwaukee and Mississippi Railroad built a station in the Town on its Milwaukee to Prairie du Chien route, and the Esterly Grain Harvester Company and Whitewater Wagon Company, among others, transformed the Town of Whitewater into an industrial town. The Town was incorporated as a Village that same year, and, in 1885, the then Village of Whitewater became a City. In 1868, the State's second normal school—later the University of Wisconsin-Whitewater—located here, further changing the character of the community.

Cravath Lake was created in the mid-1850s to provide motive power to a gristmill that was built on Whitewater Creek, and Trippe Lake was (recreated) in the mid-1860s to power a paper mill, nominally the first such mill in the State of Wisconsin. Early drawings of the area compiled by Kraege show watercraft such as sail boats and

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[4] *Wisconsin Department of Natural Resources Publication No. PUBL-WT-280-98-REV,* op. cit.

[5] *Fred G. Kraege,* op. cit.*; see also Prosper Cravath, Spencer Steele, and Albert Salisbury (editor),* Early Annals of Whitewater, 1837-1867*, The Whitewater Federation of Women's Clubs, 1906; available in the Cornell University Library Digital Collection.*

rowboats operating on these impounded waters.[6] In this regard, Kraege has documented several previous impoundments constructed in this area, which were subsequently washed out or destroyed, prior to the current dams being constructed. Kraege also notes an early record of Whitewater Creek being relatively shallow, with a depth of 2.5 feet where the then-Territorial Road crossed the Creek and merged with Main Street.

While the mills and factories that led to the establishment of the City of Whitewater and to the creation of the Lakes have faded into history, the Lakes have remained as a focal point of the City of Whitewater. In this regard, the functions of these waterbodies have gone from supporting the economic heart of the City to becoming a focal point for recreation and natural resources. In turn, this changing use has led to increasing concern for these waterbodies and efforts by the residents of the City of Whitewater to protect and improve their water quality.

PURPOSE OF THIS PLAN

This report sets forth inventories of lake water quality and the aquatic plant communities present within Cravath and Trippe Lakes, and summarizes previous planning and monitoring programs conducted on the Lakes by the WDNR,[7] and the Southeastern Wisconsin Regional Planning Commission (SEWRPC).[8] These inventories were supplemented by field surveys conducted by SEWRPC, in cooperation with the City of Whitewater and University of Wisconsin-Whitewater, during August of 2008. The aquatic plant surveys were conducted by SEWRPC staff using the modified Jesson and Lound transect method developed by the WDNR.[9]

This report further represents part of the ongoing commitment of the City of Whitewater to sound planning with respect to the Lakes and is designed as part of a program of lake-related information gathering, evaluation, and lake management action planning process being undertaken by the City of Whitewater in cooperation with other governmental and nongovernmental organizations and agencies, including the WDNR, Walworth County, and SEWRPC.[10] In particular, the Cravath and Trippe Lakes communities participate in the University of Wisconsin-Extension (UWEX) Citizen Lake Monitoring Network (CLMN), formerly the WDNR Self-Help Monitoring Program, and the City of Whitewater maintains an ongoing program of lake management.

This planning program was funded, in part, through an NR 190 Lake Management Planning Grant administered by the WDNR and awarded to the City of Whitewater. The Lakes have adequate public recreational boating access pursuant to Chapter NR 1 of the *Wisconsin Administrative Code*.[11]

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[6]Ibid.

[7]*Wisconsin Department of Natural Resources Publication No. PUBL-WT-280-98-REV,* op. cit.

[8]*SEWRPC Planning Report No. 30,* A Regional Water Quality Management Plan for Southeastern Wisconsin—2000, *Volume Two,* Alternative Plans, *February 1979.*

[9]*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.*

[10]*This planning program addresses Goal 2 of the nine City of Whitewater Goals forming the foundation for the City's Comprehensive Plan; namely, to "preserve our natural resources—including Whitewater Creek, the two lakes, and the Kettle Moraine—to support the strength of the economy, local quality of life, and the health of natural communities in and around Whitewater." See City of Whitewater,* City of Whitewater Comprehensive Plan, 2030*, February 2010.*

[11]*Wisconsin Department of Natural Resources Publication No. PUBL-FH-800 2005,* op. cit.

LAKE PROTECTION PROGRAM GOALS AND OBJECTIVES

The lake protection goals and objectives for Cravath Lake and Trippe Lake were developed in consultation with the City of Whitewater and its *ad hoc* lakes committee. 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 Cravath Lake and Trippe Lake;

2. Effectively control the quantity and density of aquatic plant growths in portions of the Lakes' basins 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 waterbodies;

3. Effectively maintain the water quality of Cravath Lake and Trippe Lake 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 waterbodies; and,

4. Promote a quality, water-based experience for residents and visitors to Cravath Lake and Trippe Lake consistent with the policies and objectives of the WDNR as set forth in the regional water quality management plan.[12]

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.*[13] 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.

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[12]*SEWRPC Planning Report No. 30,* op. cit., *as amended; see also SEWRPC Memorandum Report No. 93,* A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report*, March 1995.*

[13]*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 40, "Invasive Species Identification, Classification and Control;" Chapter NR 103, "Water Quality Standards for Wetlands;" Chapter NR 107, "Aquatic Plant Management;" and, Chapter NR 109, "Aquatic Plants Introduction, Manual Removal and Mechanical Control Regulations."*

Chapter II

INVENTORY FINDINGS

INTRODUCTION

The physical characteristics of a lake and its watershed are important factors in evaluating existing and likely future water quality conditions and their attendant lake and watershed 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. These characteristics, therefore, must be considered in the lake management planning process. Accordingly, this chapter provides pertinent information on the physical characteristics of Cravath and Trippe Lakes and their tributary areas, land use conditions, and chemical and biological environments, as well as past and present management practices and recreational uses and facilities as the basis for the lake protection plan set forth in Chapter V.

WATERBODY CHARACTERISTICS

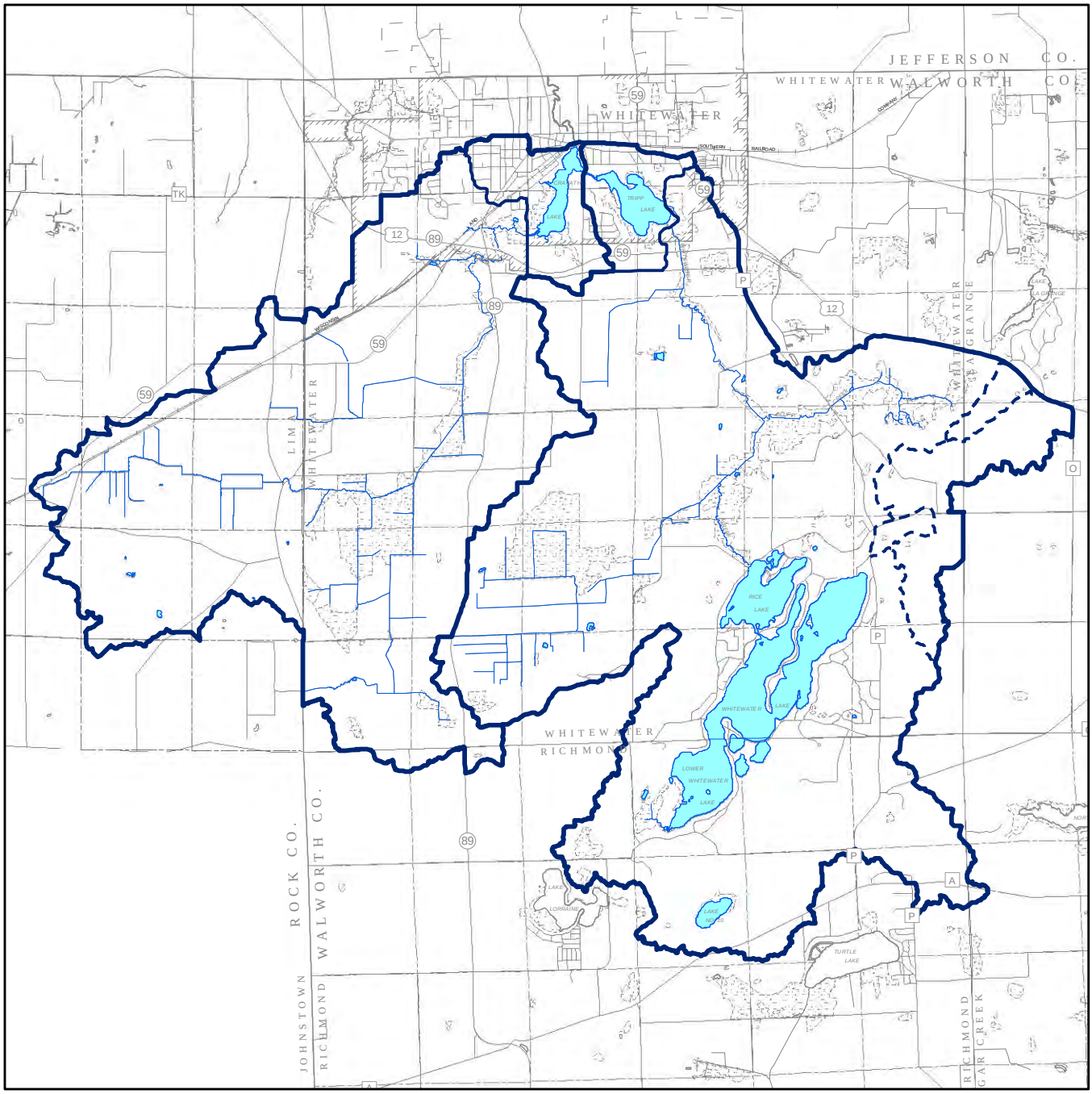
Cravath and Trippe Lakes are located in the City of Whitewater, Walworth County, Wisconsin, as shown on Map 1. The Wisconsin Department of Natural Resources (WDNR) has classified both lakes as drainage, or through-flow, lakes having a defined inflow and outflow. The Lakes depend principally on their inflowing streams, together with direct precipitation onto the lake surfaces, as their sources of water. Whitewater Creek flows into Trippe Lake from the southeast, while Spring Brook flows into Cravath Lake from the southwest. Water from Trippe Lake discharges through a short stretch of stream into Cravath Lake. Water levels in both lakes have been augmented by dams which control the outflows from the waterbodies to Whitewater Creek, a tributary stream to the Bark River.

Hydrographical characteristics of the Cravath-Trippe Lakes system are set forth in Table 1. Cravath Lake consists of two shallow, natural basins, oriented in approximately a north-south direction; Trippe Lake has a single basin and is oriented in a northeast-southwest direction. Cravath Lake has a surface area of 68 acres, a volume of about 186 acre-feet, a maximum depth of 10 feet, and a mean depth of three feet. Trippe Lake has a surface area of 113 acres, a volume of 338 acre-feet, a maximum depth of eight feet, and a mean depth of approximately three feet. The bathymetries of the Lakes are shown on Maps 2 and 3.

Cravath Lake and Trippe Lake are each nearly one mile in length and have shoreline lengths that are almost equal, at 2.8 miles and 2.7 miles, respectively. Cravath Lake has a shoreline development factor of 2.4, indicating that, due to its elongated shape, bays, and points, the shoreline is about two and one-half times longer than that of a perfectly circular lake of the same area. Trippe Lake has a shoreline development factor of 1.8, making it slightly

Map 1

LOCATION OF CRAVATH AND TRIPPE LAKES



TOTAL TRIBUTARY AREA BOUNDARY

DIRECT TRIBUTARY AREA BOUNDARY

INTERNALLY DRAINED AREA BOUNDARY WHERE NOT COINCIDENT WITH THE WATERSHED OR SUBWATERSHED BOUNDARIES

SURFACE WATER

N

0 4,000 8,000 Feet

Source: Rock County Land Information Office and SEWRPC.

Table 1

HYDROLOGY AND MORPHOMETRY OF CRAVATH AND TRIPPE LAKES

Parameter	Cravath Lake	Trippe Lake
Size		
Surface Area of Lake	68 acres	113 acres
Total Tributary Area	22,464	12,360
Lake Volume	186.5 acre-feet	338 acre-feet
Residence Time[a]	0.25	1.75
Shape		
Length of Lake	0.9 mile	0.9 mile
Width of Lake	0.2 mile	0.4 mile
Length of Shoreline	2.8 miles	2.7 miles
Shoreline Development Factor[b]	2.4	1.8
General Lake Orientation	N-S	SE-NW
Depth		
Mean Depth	3 feet	3 feet
Maximum Depth	10 feet	8 feet
Percentage of Lake Area		
Less than Three Feet	63	- -
Greater than 20 Feet	0	0

[a] *Water residence time is the time required for a volume of water equal to the volume of the lake to enter the waterbody.*

[b] *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.

more circular in shape than Cravath Lake. In contrast, nearby Pleasant Lake in northeast Walworth County has a development factor of about 1.6, reflecting that Lake's more circular shape, while the Lauderdale Lakes have an overall shoreline development factor of 3.6, reflecting that waterbody's highly irregular shoreline.[1]

Shoreline development factor is often related to the level of biological activity in a lake: the greater a lake's shoreline development factor (due to greater shoreline contour irregularity), the greater is the likelihood that the lake contains shallow, nearshore areas and areas containing habitat suitable for plant and animal life. In other words, lakes with highly irregular shorelines usually provide more shallow-water, nearshore habitat areas (or "littoral zone") suitable for plant and animal life than more circular, deeper lakes.

Biological activity in a lake, in turn, can be influenced by the availability of such shoreline habitat as well as other physical factors, such as lake bottom sediment composition and lake-basin contours. As shown on Maps 2 and 3, both Cravath and Trippe Lakes are lakes with large expanses of shallow water containing areas with relatively flat lake bottom contours. Observations made during the 2008 surveys of the aquatic plant communities in the Lakes indicated that the bottom sediments of both Lakes are mainly comprised of silt and other soft materials. A preponderance of soft bottom sediments and the relative flatness of the lake bottom contours are conditions consistent with high levels of biological activity.

TRIBUTARY AREA AND LAND USE CHARACTERISTICS

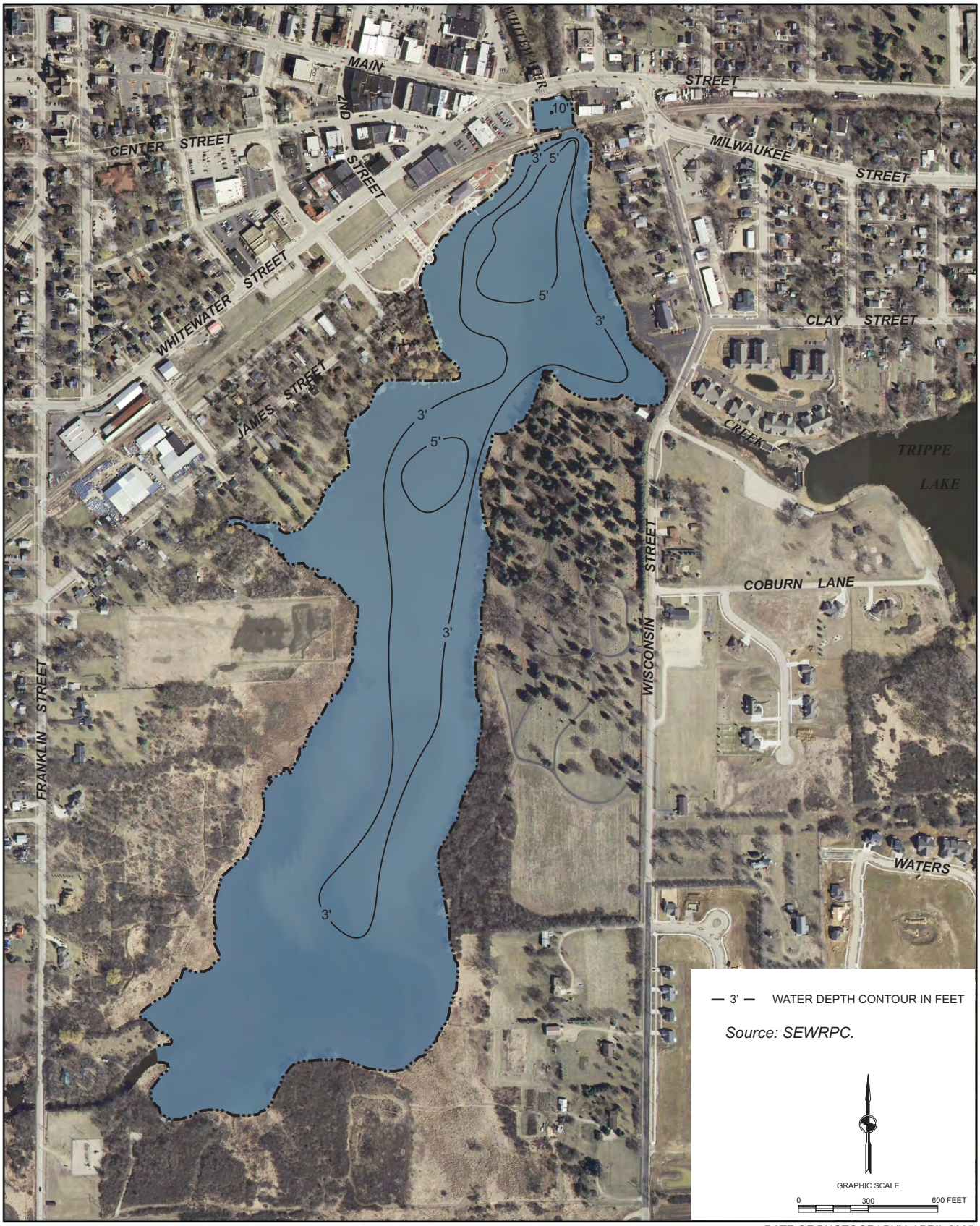
The Lakes and their direct tributary areas are situated in the northwestern corner of Walworth County. As shown on Map 4, the areas directly tributary to Cravath and Trippe Lakes are situated mostly within the City of Whitewater, with small portions of the tributary areas being situated in the Town of Whitewater, both in Walworth County. The area which drains directly to Cravath Lake is approximately 641 acres, or about one square mile, in areal extent; the area directly tributary to Trippe Lake is about 506 acres, or about 0.8 square mile.

The total drainage area tributary to the Lakes is significantly greater than their direct drainage areas. In the case of Trippe Lake, the tributary area includes the upstream portion of Whitewater Creek to its headwaters in Whitewater Lake. This approximately 12,524-acre, or 19.6-square-mile tributary area includes portions of the Towns of LaGrange, Richmond, Sugar Creek, and Whitewater, all in Walworth County. The total area tributary to Cravath Lake includes the area tributary to Trippe Lake as well as the upstream area tributary to Spring Brook. This tributary area totals about 22,464 acres, or 35.1 square miles, in areal extent, and encompasses portions of the Town of Whitewater, in Walworth County, and the Town of Lima, in Rock County.

[1] *See SEWRPC Memorandum Report No. 174,* An Aquatic Plant Management Plan for Pleasant Lake, Walworth County, Wisconsin, *December 2009; and, SEWRPC Memorandum Report No. 143,* An Aquatic Plant Management Plan for the Lauderdale Lakes, Walworth County, Wisconsin, *August 2001.*

Map 2

BATHYMETRIC MAP OF CRAVATH LAKE



DATE OF PHOTOGRAPHY: APRIL 2005

Map 3

BATHYMETRIC MAP OF TRIPPE LAKE

DATE OF PHOTOGRAPHY: APRIL 2005

— 4' — WATER DEPTH CONTOUR IN FEET

MONITORING SITE

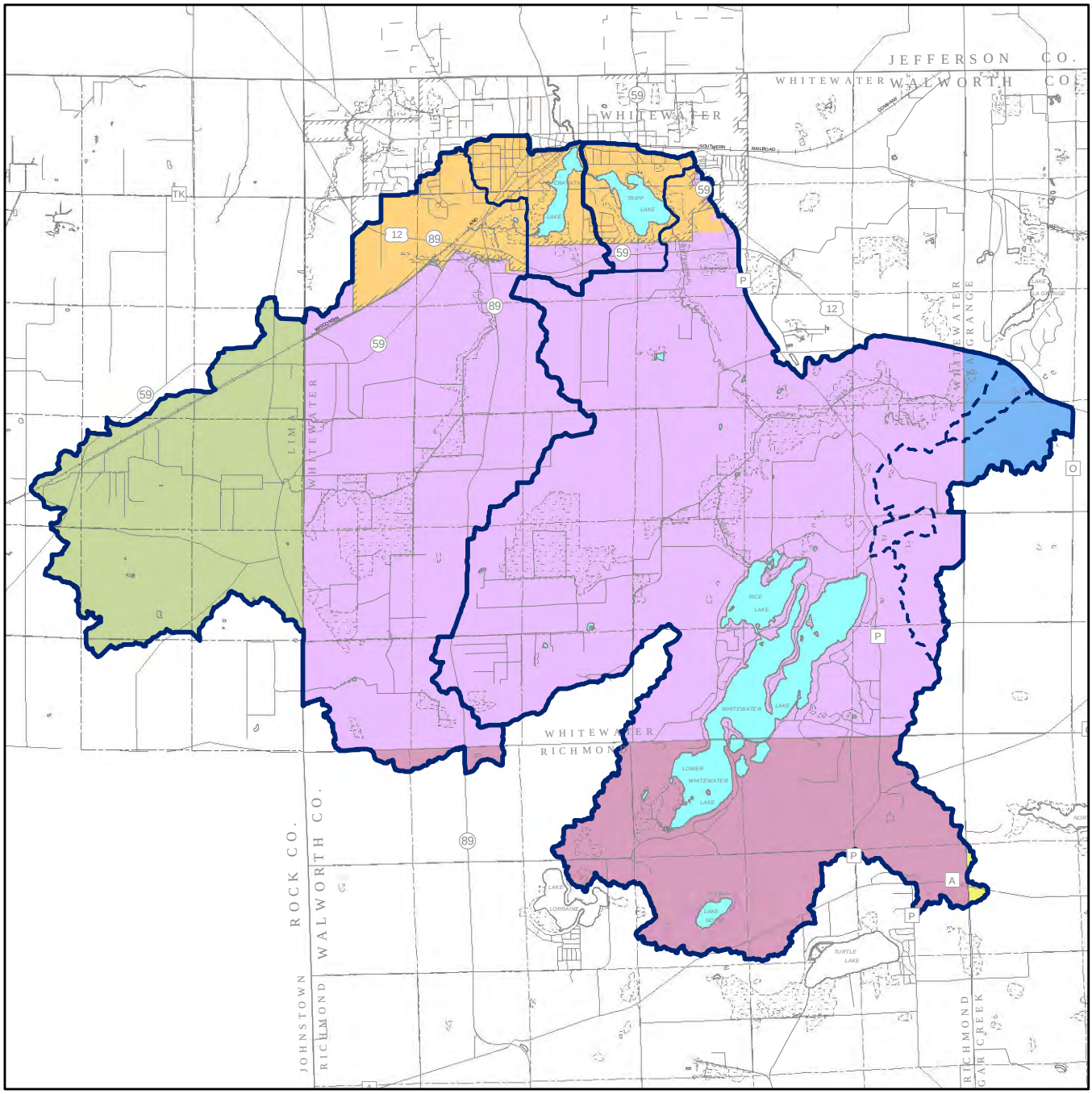
Source: U.S. Geological Survey and SEWRPC.

GRAPHIC SCALE

0 300 600 FEET

Map 4

CIVIL DIVISION BOUNDARIES WITHIN THE CRAVATH AND TRIPPE LAKES TOTAL TRIBUTARY AREA



Source: Rock County Land Information Office and SEWRPC.

Table 2

POPULATION AND HOUSEHOLDS WITHIN THE AREA DIRECTLY TRIBUTARY TO CRAVATH LAKE: 1960-2000

Year	Population	Households
1960	2,215	682
1970	2,581	711
1980	2,172	786
1990	2,342	829
2000	2,636	933

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

Table 3

POPULATION AND HOUSEHOLDS WITHIN THE AREA DIRECTLY TRIBUTARY TO TRIPPE LAKE: 1960-2000

Year	Population	Households
1960	819	190
1970	721	234
1980	698	264
1990	722	295
2000	815	318

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

Population

Both the population and numbers of households within the areas tributary to Cravath and Trippe Lakes have generally increased since 1960. However, this increase has been sporadic and not altogether constant over this period, as shown in Tables 2 and 3. For example, although the numbers of households within the area directly tributary to Cravath Lake have increased fairly steadily between 1960 and 2000, as shown in Table 2, the population of the area actually decreased between 1970 and 1980 before resuming its upward trend. The greatest increase in population occurred between 1960 and 1970 when the numbers of people increased by nearly 17 percent, from 2,215 persons to 2,581 persons; the greatest increase in the numbers of households occurred between 1990 and 2000 when the numbers increased by just over 12 percent, from 829 to 933 households.

In the area directly tributary to Trippe Lake, as shown in Table 3, the changes in population and numbers of households were similar to those for Cravath Lake. However, there are several notable exceptions. First, the population in the area directly tributary to Trippe Lake decreased not only between 1970 and 1980, but also between 1960 and 1970, with the result that it was not until 2000 that the population in the tributary area to Trippe Lake recovered to its 1960 level. Further, while the numbers of households had evidenced a fairly steady increase from 1960 through 2000, similar to those around nearby Cravath Lake, the greatest increase in numbers of households in the tributary area occurred between 1960 and 1970. Subsequently, in contrast to the observations from the tributary area to Cravath Lake, the rate of increase in the numbers of households has steadily diminished from around 23 percent for the decade between 1960 and 1970, to about 13 percent over the decade between 1970 and 1980, to about 12 percent between 1980 and 1990, and to about 8 percent between 1990 and 2000. Thus, while the numbers of households in the area directly tributary to Trippe Lake have been increasing since 1960, the rate of increase has been steadily slowing.

The populations and numbers of households in the combined area tributary to both Cravath and Trippe Lakes are shown in Table 4. The population in this combined area generally increased from 1960 through 2000, although the drop in population between 1970 and 1980 observed in the areas directly tributary to the individual Lakes was also evidenced areawide, as would be expected. The numbers of households in the combined tributary area showed a fairly steady increase from 1960 through 2000, with the largest increase (about 21 percent) occurring from 1960 to 1970.

Land Uses

As shown in Table 5, year 2000 land uses in the area directly tributary to Cravath Lake are about evenly distributed between urban and rural uses, with residential uses being the major urban use and agricultural uses being the chief rural use. In Table 6, year 2000 land uses in the area directly tributary to Trippe Lake remain mostly rural, with over 37 percent of the land in agriculture and only about 15 percent of the land in urban uses.

Table 4

POPULATION AND HOUSEHOLDS WITHIN THE TOTAL AREA TRIBUTARY TO CRAVATH AND TRIPPE LAKES: 1960-2000

Year	Population	Households
1960	4,862	1,338
1970	5,616	1,623
1980	5,210	1,901
1990	5,500	2,061
2000	6,304	2,428

NOTE: All areas approximated by whole U.S. Public Land Survey quarter section. Area in Rock County approximated by census blocks. Data above includes population and households located within internally drained portions of the total tributary area.

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

The year 2000 land uses within the total area tributary to Cravath and Trippe Lakes are primarily rural, with agricultural uses being the dominant rural land use. Although the majority of the urban lands are located in close proximity to the Lakes—primarily in the City of Whitewater, the shorelines of the Lakes are largely undeveloped, being comprised primarily of wetlands, parklands, and other open lands. This is a contrast to the highly developed residential shorelines common to most lakes in the Region, including the upstream Whitewater and Rice Lakes that form part of the total area tributary to the Cravath-Trippe Lake system. Map 5 shows the existing land uses within the combined tributary area of the Lakes as of 2000; those uses are tabulated in Table 7.

Future changes in land use within the direct and total areas tributary to Cravath and Trippe Lakes are likely to include limited further urban development, infilling of already platted lots, and possible redevelopment of existing properties. Under proposed year 2035 conditions, as shown on Map 6 and summarized in Table 7, urban land uses in the total area tributary to the Lakes are expected to nearly double, from about 5 percent of the land coverage in 2000 to about 10 percent of the land coverage in 2035. These changes are projected to occur largely in the forms of single-family residential, multi-family residential, commercial, and industrial development in the areas near the Lakes, and mostly as the result of the conversion of agricultural and other open and unused lands. Agricultural uses are anticipated to decrease from about 65 percent of the land coverage in the year 2000, to about 56 percent of the land coverage under planned year 2035 conditions. These land use changes have the potential to modify the nature and delivery of nonpoint source contaminants to the Lakes, with concomitant impacts on the aquatic plant communities within the waterbody. In contrast, existing wetlands and woodlands are projected to be largely left intact with only slight loss of acreage from these uses.

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 protection methods in use on Cravath and Trippe Lakes was conducted by Southeastern Wisconsin Regional Planning Commission (SEWRPC) staff during August of 2008. As shown on Map 7, the great majority of the shoreline of Cravath Lake was in a natural state, with a few short isolated stretches of riprap and bulkhead found primarily along the southern end of the Lake. Trippe Lake, as shown on Map 8, also had a shoreline mostly in a natural state, with a few isolated short stretches of riprap or bulkhead, mostly at the northwestern end of the Lake. In addition, there was one sand beach area present along the Trippe Lake shoreline, located in the City Park at the northwestern end of the Lake.

There were no obvious, serious erosion-related problems observed on either Cravath Lake or Trippe Lake. The majority of the shorelines were in a naturally vegetated state. This is consistent with requirements set forth in Chapter NR 328, shore erosion control structures in navigable waterways, and with the recommendations set forth in the SEWRPC publication, *Managing the Water's Edge: Making Natural Connections*.[2] These "soft" structures provide habitat, shelter, and food resources for a variety of terrestrial and aquatic wildlife as well as having visual amenity value for humans.

[2]*See SEWRPC publication, Managing the Water's Edge: Making Natural Connections, May 2010:* http://www.sewrpc.org/SEWRPCFiles/Environment/RecentPublications/ManagingtheWatersEdge-brochure.pdf.

Table 5

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

Land Use Categories[a]	2000		2035	
	Acres	Percent of Tributary Area	Acres	Percent of Tributary Area
Urban				
Residential	174	27.1	230	36.0
Commercial	12	1.9	12	1.9
Industrial	10	1.6	29	4.5
Governmental and Institutional	46	7.2	50	7.8
Transportation, Communication, and Utilities	86	13.4	143	22.3
Recreational	3	0.5	6	0.9
Subtotal	331	51.7	470	73.4
Rural				
Agricultural and Other Open Lands	156	24.3	15	2.3
Wetlands	50	7.8	49	7.7
Woodlands	- -	- -	- -	- -
Surface Water	76	11.8	76	11.8
Extractive	28	4.4	31	4.8
Landfill	- -	- -	- -	- -
Subtotal	310	48.3	171	26.6
Total	641	100.0	641	100.0

[a]*Parking included in associated use.*

Source: SEWRPC.

WATER QUALITY

Water quality data for Trippe Lake have been collected since 2004 under the auspices of the University of Wisconsin-Extension (UWEX) Citizen Lake Monitoring Network (CLMN), formerly known as the WDNR Self-Help Monitoring Program. Water quality data for Cravath Lake either have not been collected or were of such recent nature so as not to be available at the time this report was being prepared. Nevertheless, such water quality data as were available are summarized in Table 8. The sampling site location used for data collection on Trippe Lake is shown on Map 3.

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 biological 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 to a depth at which the disk is no longer visible. This depth is known as the "Secchi-disk reading." The Secchi-disk reading can be related to the depth of light penetration into the water column of the lake. Light is one important component that sustains the growths of aquatic plants in lakes. Consequently, Secchi-disk measurements comprise an important part of the aforementioned UWEX CLMN program in which citizen volunteers assist in lake water quality monitoring efforts.

Table 6

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

Land Use Categories[a]	2000		2035	
	Acres	Percent of Tributary Area	Acres	Percent of Tributary Area
Urban				
Residential	78	15.4	160	31.6
Commercial	22	4.3	26	5.1
Industrial	7	1.4	7	1.4
Governmental and Institutional	2	0.4	5	1.0
Transportation, Communication, and Utilities	37	7.3	93	18.4
Recreational	6	1.2	51	10.1
Subtotal	152	30.0	342	67.6
Rural				
Agricultural and Other Open Lands	190	37.6	- -	- -
Wetlands	53	10.5	53	10.5
Woodlands	2	0.4	2	0.4
Surface Water	109	21.5	109	21.5
Extractive	- -	- -	- -	- -
Landfill	- -	- -	- -	- -
Subtotal	354	70.0	164	32.4
Total	506	100.0	506	100.0

[a]*Parking included in associated use.*

Source: SEWRPC.

Secchi-Disk Measurements

As shown in Table 8, Secchi-disk measurements for 2004 and for 2006 through 2009 at the deep hole in Trippe Lake averaged 6.2 feet, indicative of generally fair water quality. The average Secchi-disk transparency reported by the WDNR for the Southeastern Wisconsin Region is 4.9 feet.[3,4] Since the water color at the sampling site was often reported as brown, yellow, or green, the Secchi-disk depths are likely to have been influenced by a combination of turbidity due to suspended solids and/or algae.

Satellite-Derived Water Clarity Estimates

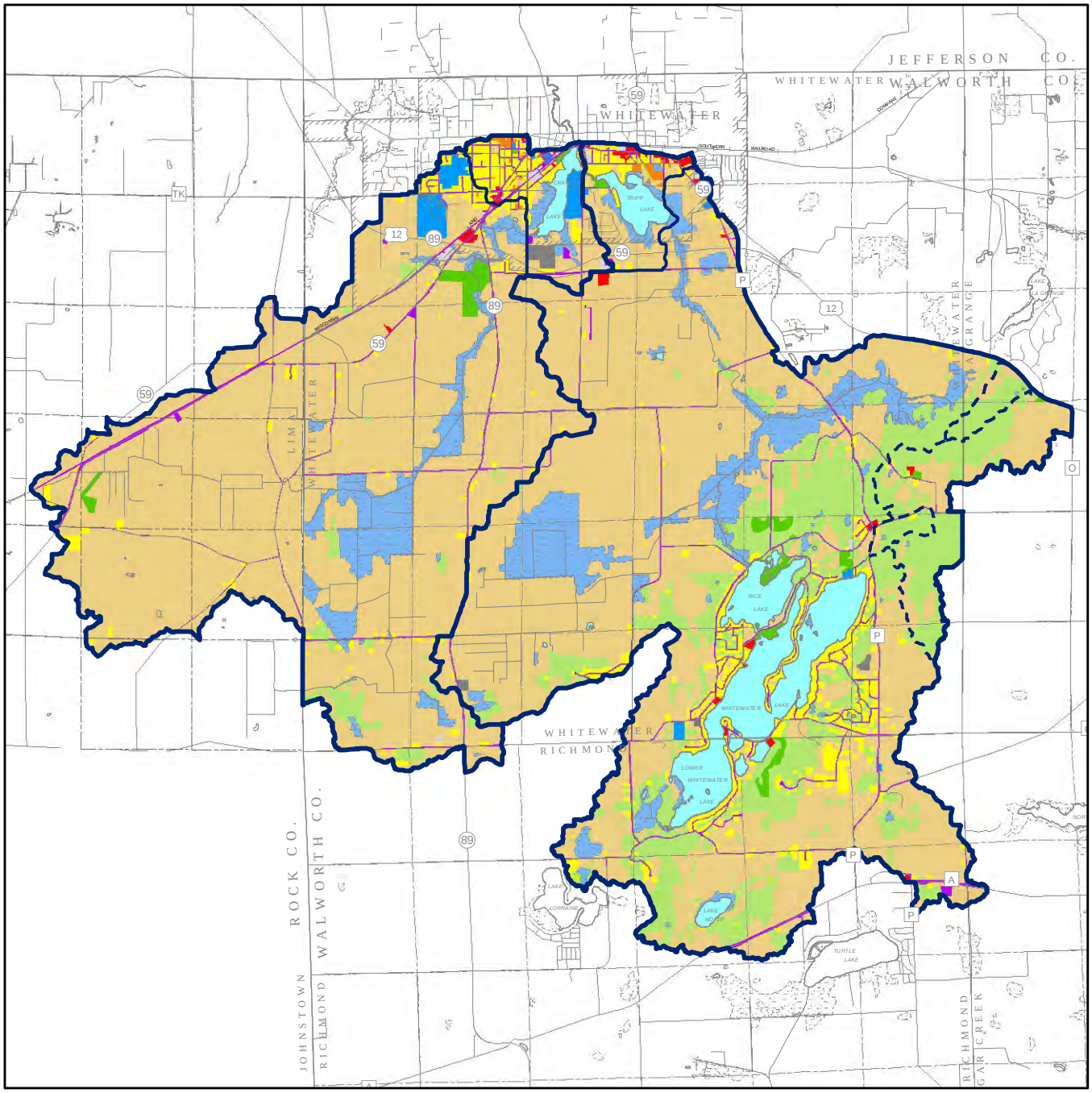
In addition to direct in-lake measurements of water clarity using a Secchi-disk, transparency in many Wisconsin lakes has been measured using remote sensing technology. The Environmental Remote Sensing Center (ERSC), established in 1970 at the University of Wisconsin-Madison, was one of the first remote sensing facilities in the

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

[4]*Secchi-disk transparency was estimated using the relationship between phosphorus concentration and water clarity developed by the Organization for Economic Cooperation and Development,* Eutrophication of Waters: Monitoring, Assessment and Control*, OECD, 1982; using the forecast phosphorus concentration of 33.0 µg/l for Trippe Lake—see Pollutants Loadings and Sources, below—the annual average Secchi-disk transparency should be about 5.2 feet, which is consistent with the observed water clarity in that Lake.*

Map 5

EXISTING LAND USE WITHIN THE CRAVATH AND TRIPPE LAKES TOTAL TRIBUTARY AREA: 2000



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

- TOTAL TRIBUTARY AREA BOUNDARY
- DIRECT TRIBUTARY AREA BOUNDARY
- INTERNALLY DRAINED AREA BOUNDARY WHERE NOT COINCIDENT WITH THE WATERSHED OR SUBWATERSHED BOUNDARIES

N

0 4,000 8,000 Feet

Source: Rock County Land Information Office and SEWRPC.

Table 7

EXISTING AND PLANNED LAND USE WITHIN THE TOTAL AREA TRIBUTARY TO CRAVATH AND TRIPPE LAKES: 2000 AND 2035

Land Use Categories[a]	2000		2035	
	Acres	Percent of Tributary Area	Acres	Percent of Tributary Area
Urban				
Residential	1,091	4.9	2,160	9.6
Commercial	72	0.3	262	1.2
Industrial	35	0.2	220	1.0
Governmental and Institutional	166	0.7	175	0.8
Transportation, Communication, and Utilities	790	3.5	1,355	6.0
Recreational	187	0.8	289	1.3
Subtotal	2,341	10.4	4,461	19.9
Rural				
Agricultural and Other Open Lands	14,585	64.9	12,475	55.6
Wetlands	1,901	8.5	1,889	8.4
Woodlands	2,460	11.0	2,445	10.9
Surface Water	1,134	5.0	1,134	5.0
Extractive	35	0.2	54	0.2
Landfill	8	<0.1	6	<0.1
Subtotal	20,123	89.6	18,003	80.1
Total	22,464	100.0	22,464	100.0

NOTE: Data above excludes internally drained portions of the total tributary area.

[a]*Parking included in associated use.*

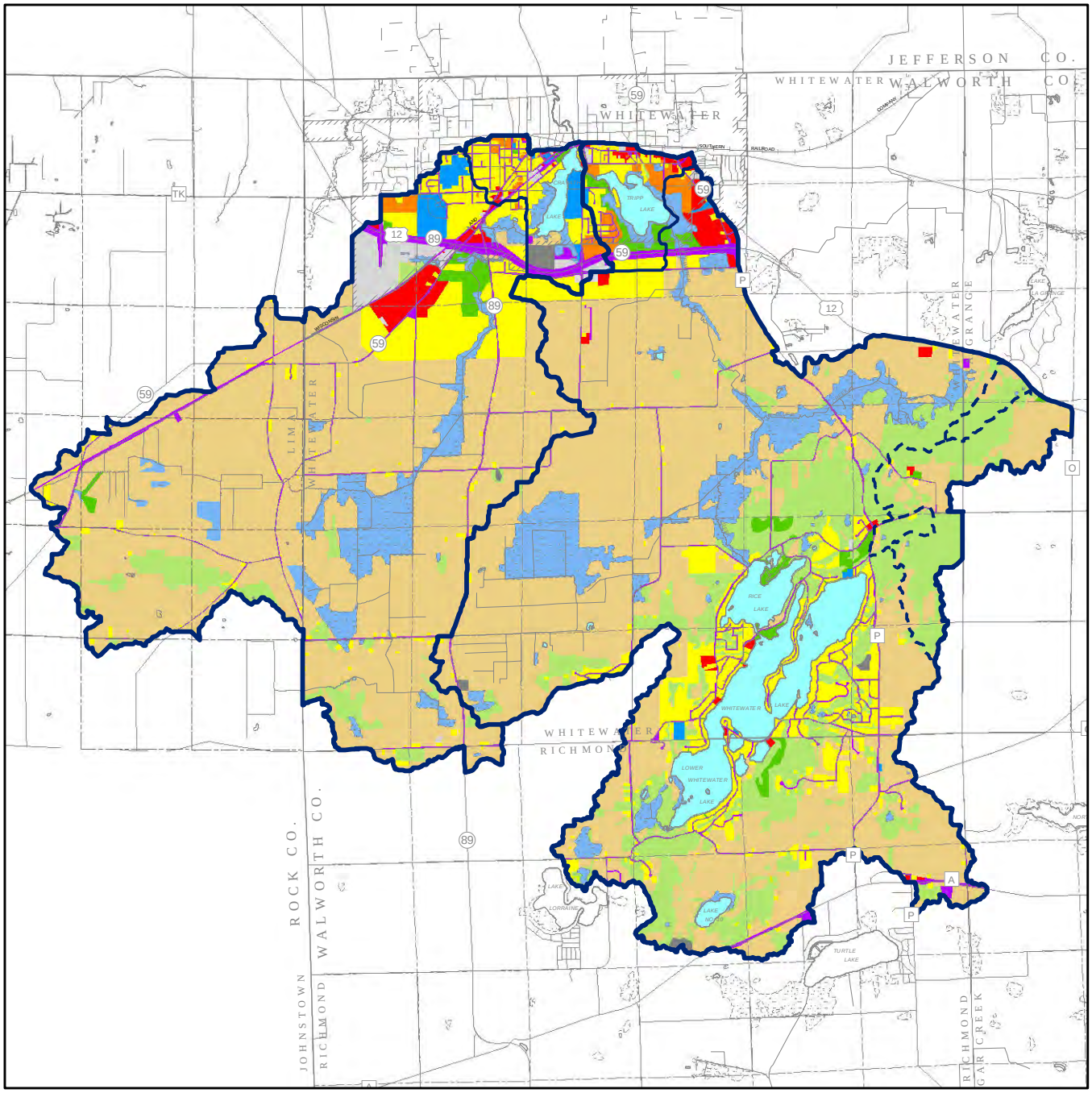
Source: SEWRPC.

United States. Using data gathered by satellite remote sensing over a three-year period, the ERSC generated a map based on a mosaic of satellite images showing the estimated water clarity of the largest 8,000 lakes in Wisconsin. The WDNR, through its volunteer Self-Help Monitoring Program (now the CLMN), was able to gather water clarity measurements from about 800 lakes, or about 10 percent of Wisconsin's largest lakes. Of these, the satellite remote sensing technology utilized by ERSC was able to accurately estimate clarity, providing a basis for extrapolating water clarity estimates to the remaining 90 percent of lakes. Measurements collected through ERSC remote sensing program from 1999 through 2005, estimated the average water clarity of Cravath Lake to be 2.6 feet, a value indicative of generally poor water quality. Trippe Lake was estimated to have average water clarity of 2.5 feet, also indicative of generally poor water quality. Such transparencies are substantially lower than the measured in-lake transparencies reported by the CLMN program. This would suggest that: (a) the water clarity of the lakes has improved in the years since the ERSC study, (b) the occurrence of interferences with the remote sensing instruments resulted in lower than expected water clarity estimates, or (c) observational "errors" such that the signals from Trippe and Cravath Lakes differ from those of the larger population of lakes included in the study, possibly related to the shallow natures of these impoundments.[5]

[5]*The shallow nature of the impoundments could affect transparency estimates in a number of ways, including introduction of interference as a result of: sensors penetrating to the lake bottoms, impacts of wind-induced turbidity not experienced at the times that the volunteer observer recorded transparency readings, or the presence of rooted, emergent, or floating leaved aquatic plants appearing to the sensors as algae.*

Map 6

PLANNED LAND USE WITHIN THE CRAVATH AND TRIPPE LAKES TOTAL TRIBUTARY AREA: 2035



SINGLE-FAMILY RESIDENTIAL

MULTI-FAMILY RESIDENTIAL

COMMERCIAL

INDUSTRIAL

TRANSPORTATION, COMMUNICATIONS, AND UTILITIES

GOVERNMENTAL AND INSTITUTIONAL

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WETLANDS

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SURFACE WATER

AGRICULTURAL, UNUSED, AND OTHER OPEN LANDS

EXTRACTIVE AND LANDFILL

TOTAL TRIBUTARY AREA BOUNDARY

DIRECT TRIBUTARY AREA BOUNDARY

INTERNALLY DRAINED AREA BOUNDARY WHERE NOT COINCIDENT WITH THE WATERSHED OR SUBWATERSHED BOUNDARIES

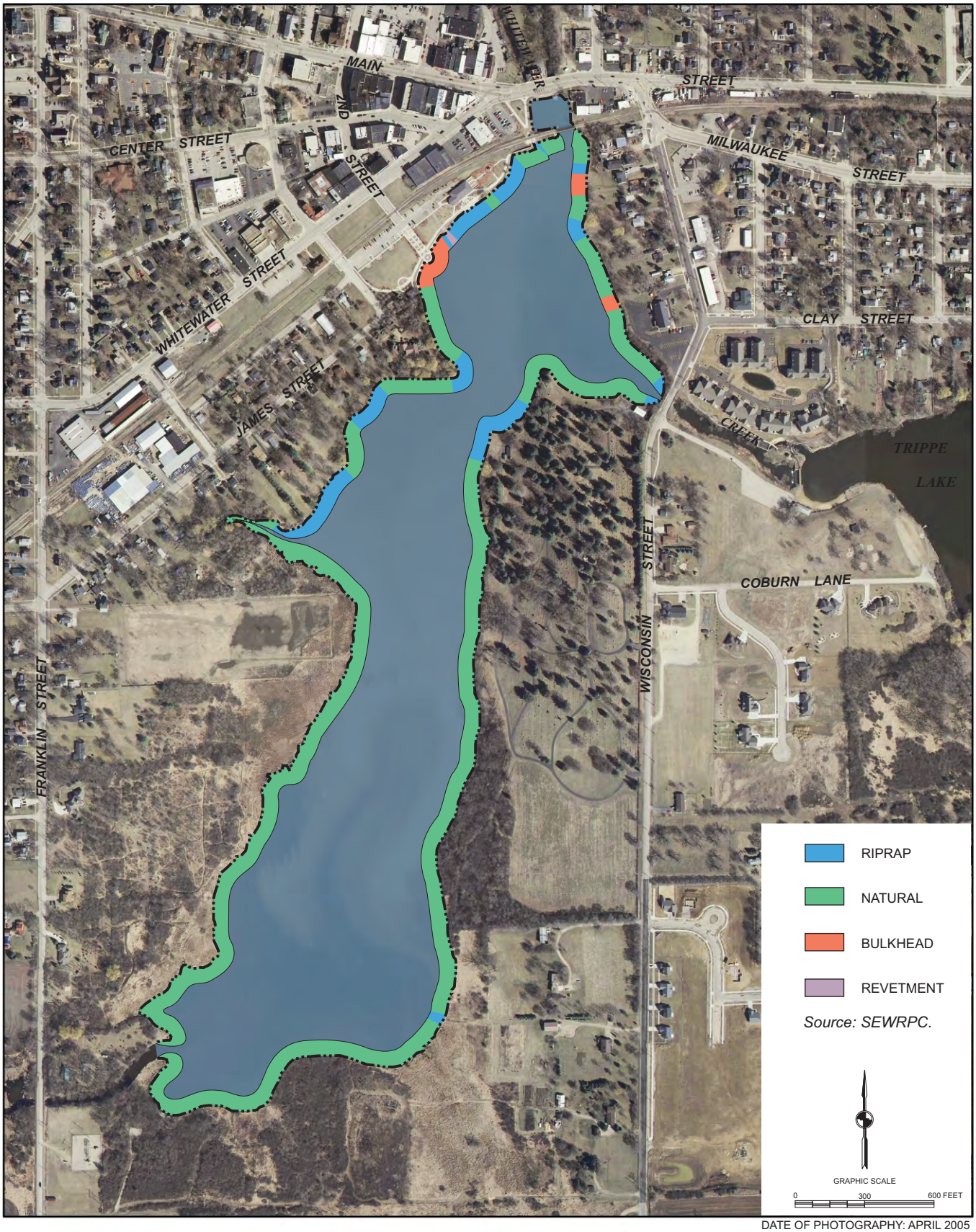
N

0 4,000 8,000 Feet

Source: Rock County Land Information Office and SEWRPC.

Map 7

SHORELINE PROTECTION STRUCTURES ON CRAVATH LAKE: 2008



DATE OF PHOTOGRAPHY: APRIL 2005

Map 8

SHORELINE PROTECTION STRUCTURES ON TRIPPE LAKE: 2008

DATE OF PHOTOGRAPHY: APRIL 2005

RIPRAP

BEACH

NATURAL

BULKHEAD

REVETMENT

GRAPHIC SCALE

0 300 600 FEET

Source: SEWRPC.

Table 8

WATER CLARITY FOR TRIPPE LAKE: 2004-2010

Year	Secchi Mean (feet)	Secchi Range (feet)	Secchi Count
2004	6.6	6.6-6.6	1
2005	- -	- -	- -
2006	6.5	6.5-6.5	1
2007	6.1	5.3-7.3	4
2008	5.7	5.0-6.0	3
2009	6.0	6.0-6.0	1
2010	6.0	3.5-7.5	9

Source: Wisconsin Department of Natural Resources and SEWRPC.

Effects of Zebra Mussels

With respect to changing in-lake conditions, a possible influence on water clarity in lakes in Southeastern Wisconsin is zebra mussels (*Dreissena polymorpha*). Zebra mussels are a nonnative species of shellfish that are having varied impacts on the inland lakes of the Upper Midwest as a result of their filter feeding proclivities. These impacts include the disruption of the food chain by removing significant amounts of bacteria and smaller phytoplankton which serve as food for larval and juvenile fishes and many forms of zooplankton; the resultant improvement of water clarity, in turn, can lead to increased growths of rooted aquatic plants, including Eurasian water milfoil. Zebra mussels also can alter the aquatic plant communities by 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, interfering with the competitive strategy of the Eurasian water milfoil plants. Such action contributes to improved growths of native aquatic plants or growths of filamentous algae too large to be ingested by the zebra mussels. To date, however, Cravath Lake and Trippe Lake are not listed by the WDNR as having established populations of these animals.[6]

Effects of Wastewater Treatment Plant Upgrades

Another possible influence on changing in-lake conditions would be the upgrading of the City of Whitewater wastewater treatment facility, as recommended in the Regional Water Quality Management Plan.[7] While the relocation, upgrading, or implementation of additional wastewater treatment practices within the drainage area tributary to the Lakes would be likely to have a profound effect on water quality and clarity, the City of Whitewater had commissioned the new plant in response to this recommendation during 1982,[8] and no further changes were indicated as being required of this plant in the then foreseeable future. Consequently, implementation of upgraded wastewater treatment processes is unlikely to account for the differences in water clarity noted between the CLMN measurements and ERSC observations.

By eliminating these factors—zebra mussels and changes in wastewater treatment practices, it is most likely that the differences between the ERSC observations and CLMN measurements are associated with the shallow nature of the impoundments and possible interferences due to the abundant growths of aquatic plants in the Lakes (see Aquatic Plants: Distribution and Management Areas, below).

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[6]*Trippe and Cravath Lakes should continue to be monitored periodically for zebra mussel larvae or veligers. Regardless of the seeming beneficial impacts of these animals, the overall effect is that, as zebra mussels and other invasive species spread to inland lakes and rivers, they increase the environmental, aesthetic, and economic costs to water users.*

[7]*See SEWRPC Planning Report 30,* A Regional Water Quality Management Plan for Southeastern Wisconsin–2000*, Volume Three,* Recommended Plan*, June 1979.*

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

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 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 utilize oxygen in the decay process.

When a lake becomes stratified—that is, when a thermal gradient (called a "thermocline") or chemical gradient ("chemocline") 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.

Where oxygen levels are depleted in the hypolimnion, 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 summerkills, or, alternatively, are driven into the warmer water portions of the lake where their condition and competitive success may be severely impaired. Additionally, this condition, common to many shallow lakes in Wisconsin, can lead to winter fish kills if oxygen stores are not sufficient to meet the total demand.

Due to the generally shallow nature of Trippe Lake, as well as the thermal and dissolved oxygen profiles that have been recorded, it seems unlikely that Trippe Lake stratifies; if it stratifies at all, the Lake is likely to be weakly stratified with respect to both temperature and dissolved oxygen concentrations. In the case of Cravath Lake, the shallow nature of that impoundment would suggest that this lake is even less likely to stratify, even weakly. The available dissolved oxygen concentration data for these Lakes, limited to only a few measurements taken in Trippe Lake during 2004, 2008, and 2009, showed adequate dissolved oxygen concentrations near the surface of the Lake to a depth of three feet. Although dissolved oxygen concentrations generally decreased with depth, they did not drop below the 5.0 milligrams per liter (mg/l) level generally considered to be the minimum necessary to support fish and some other forms of aquatic life.

In addition to biological consequences, a 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. Internal loading can occur during aerobic conditions, such as those observed in Trippe and Cravath Lakes. While there was fair agreement between predicted (33.0 μg/l) and observed (43.5 μg/l) levels of phosphorus in Trippe Lake,[9] the slightly higher observed concentration would suggest that other pollution sources, including internal, atmospheric, and groundwater, and onsite sewage disposal system sources outside of the City of Whitewater sewerage system, are likely to have contributed to the loading.

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[9]*Forecast nutrient loads are based upon land uses in the drainage basin, and were predicted as an output from the Wisconsin Lake Model Spreadsheet (WiLMS); 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; phosphorus concentration was calculated using the shallow lakes and reservoir relationship described in Organization for Economic Cooperation and Development,* op. cit.

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 micrograms per liter (μg/l), with a median concentration of about 10 μg/l.[10] Chlorophyll-*a* levels above about 10 μg/l generally result in a green coloration of the water that may be severe enough to impair recreational activities, such as swimming or waterskiing.[11]

For Trippe and Cravath Lakes, data on chlorophyll-*a* concentrations are extremely limited: there was one measurement taken from Trippe Lake during June of 2008 and two additional measurements taken during the summer of 2009. These samples indicated low levels of chlorophyll-*a* in the Lakes, that ranged from 3 μg/l to 6 μg/l. These concentrations are significantly less than the regional average, and well below the level of 10 μg/l which, as mentioned, is the level above which some recreational activities may be impaired. These values, however, are consistent with the predicted total phosphorus concentration for Trippe Lake—the predicted total phosphorus concentration of 33.0 μg/l, when used in the phosphorus-chlorophyll concentration relationship developed by the Organization for Economic Cooperation and Development (OECD),[12] yields an annual average chlorophyll-*a* concentration of about 6.6 μg/l. It is possible that the lower observed chlorophyll-*a* concentrations reflect the competition for nutrients between rooted aquatic macrophytes and the free-floating phytoplankton as well as possible shading of the water column by the rooted plants.

Nutrient Characteristics

Aquatic plants and algae require nutrients such 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 the others. The ratio of total nitrogen (N) to total phosphorus (P) in lake water (the N:P ratio) indicates which nutrient is most likely to be limiting aquatic plant growth in a lake.[13] Where the N:P ratio is greater than 14:1, phosphorus is most likely to be the limiting nutrient. If the ratio is less than 10:1, nitrogen is most likely to be the limiting nutrient. Because data for total nitrogen are lacking for the Cravath-Trippe Lake system, it was not possible to evaluate the N:P ratios in these Lakes. However, because of the availability of nitrogen from the atmosphere, most freshwater inland lakes are phosphorus limited, meaning that the addition of phosphorus to these lakes would be likely to result in increased growths of aquatic plants.

Total phosphorus concentrations include phosphorus contained in plant and animal fragments suspended in the lake water, phosphorus bound to sediment particles, and phosphorus dissolved in the water column. Total phosphorus is, therefore, usually considered a good 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

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[10]Ibid.

[11]*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.*

[12]*Organization for Economic Cooperation and Development,* op. cit.

[13]*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.*

consistent with recreational water use objectives, as well as with water use objectives aimed at maintaining a warmwater fishery and other aquatic life.[14]

During 2008 and 2009, the summer average total phosphorus concentrations in Trippe Lake were 43.5 μg/l. These concentrations exceed both the Regional guideline value and the action level established in the *Wisconsin Administrative Code*, suggesting that Trippe Lake is capable of supporting abundant growths of aquatic plants. Given the similarities in water clarity between the two Lakes, it is likely that Cravath Lake also has phosphorus concentrations that exceed the State and Regional guidelines.

Seasonal gradients of phosphorus concentrations between the epilimnion and hypolimnion of a lake reflect the biogeochemistry of this growth element. When aquatic organisms die, they usually sink to the bottom of the lake, where they are decomposed. Phosphorus from these organisms is then either stored in the bottom sediments or rereleased into the water column. Because phosphorus is not highly soluble in water, it readily forms insoluble precipitates with calcium, iron, and aluminum under aerobic conditions and accumulates, predominantly, in the lake sediments. As noted above, should the bottom waters of a lake become depleted of oxygen during stratification, certain chemical changes occur such that phosphorus becomes soluble and is more readily released from the sediments in a process known as internal loading. However, based upon the few available data for both phosphorus and dissolved oxygen concentrations in Trippe and Cravath Lakes, the output of the modeled total phosphorus concentration in Trippe Lake, and the shallow nature of the two impoundments, it is likely that internal loading, while not a major concern, does contribute some phosphorus to the water columns of the Lakes. This conclusion is substantiated by the fact that the observed phosphorus concentration (43.5 μg/l), while greater than the most likely phosphorus concentration (33.0 μg/l), was less than the highest likely phosphorus concentration (85.0 μg/l) predicted by the WiLMS model.[15]

POLLUTION LOADINGS AND SOURCES

Pollutant loads to a lake 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, such as the Cravath-Trippe Lake system, pollutant loads transported by inflowing streams, by precipitation falling directly onto the Lakes' surfaces, and runoff from the tributary areas immediately surrounding the Lakes, in the absence of identifiable or point source discharges from industries or wastewater treatment facilities, comprise the principal routes by which contaminants enter the waterbodies.[16] Currently, there are no

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[14]*The Natural Resources Board of the State of Wisconsin, acting at their June 2010 Board Meeting adopted Board Order WT-25-08, which set forth revisions to Chapters NR 102 and NR 217 of the* Wisconsin Administrative Code *related to phosphorus water quality standards criteria and WPDES permit provisions for phosphorus. Pursuant to Section NR 102.06, an action level of 40 μg/l of total phosphorus was adopted for shallow lakes and reservoirs as the level above which water quality concerns are likely to arise.*

[15]*John C. Panuska and Jeff C. Kreider, Wisconsin Department of Natural Resources Publication No. PUBL-WR-363-94,* op. cit.

[16]*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.*

significant point source discharges of pollutants into Cravath and Trippe Lakes. For this reason, the discussion that follows is based upon nonpoint source pollutant loadings to the Lakes.

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.

Nonpoint source phosphorus, suspended solids, and urban-derived metals inputs to Cravath and Trippe Lakes were estimated using the WiLMS version 3.0,[17] and the unit area load-based models developed for use within the Southeastern Wisconsin Region.[18] It should be noted that, with respect to the estimated phosphorus loads, the promulgation of Section 94.643 of the *Wisconsin Statutes* during 2009, limiting the use and sale of fertilizers containing phosphorus, should reduce the loads from urban areas below the loads forecast using the WiLMS and unit area load models.

Sediment Loadings

Cravath Lake

The estimated sediment loadings to Cravath Lake from its direct tributary area under existing year 2000 and planned year 2035 conditions and as set forth in the adopted regional land use plan[19] are shown in Table 9. A total annual sediment loading of 71.0 tons was estimated to be contributed to Cravath Lake from its direct tributary area under year 2000 conditions, as shown in Table 9. Of the likely annual sediment load, it was estimated that about 42.3 tons per year, or about 60 percent of the total loading, were contributed by runoff from rural lands, mostly from agricultural sources, and 22.4 tons, or about 31 percent, contributed by urban lands. Approximately 6.3 tons, or about 9 percent of the annual sediment load, were contributed by atmospheric deposition onto the lake surface.

Under 2035 conditions, the annual sediment load to the Lake from its direct tributary area is anticipated to diminish as a result of conversion of agricultural lands to urban land uses. The most likely annual sediment load to the Lake under buildout conditions is estimated to be about 42.1 tons. Of the forecast sediment load anticipated for Cravath Lake, about 3.6 tons of sediment are estimated to be contributed to the Lake from rural sources and 31.4 tons from urban sources. Approximately 7.1 tons of sediment per year are estimated to continue to be contributed by direct precipitation onto the lake surface.

Table 10 shows the estimated sediment loadings to Cravath Lake from its total tributary area under existing year 2000 conditions. A total annual sediment loading of 3,371.0 tons was estimated to be contributed to Cravath Lake from its total tributary area under year 2000 conditions. Of the likely annual sediment load, it was estimated that 3,175.1 tons per year, or about 94 percent of the total loading, were contributed by runoff from rural lands, mostly from agricultural sources, and 105.6 tons, or about 3 percent, contributed by urban lands. Approximately 90.3 tons, or about 3 percent of the annual sediment load, were contributed by atmospheric deposition onto the lake surface. Under 2035 conditions, the annual sediment load to the Lake from its total tributary area is anticipated to diminish.

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[17] *John C. Panuska and Jeff C. Kreider, Wisconsin Department of Natural Resources Publication No. PUBL-WR-363-94,* op. cit.

[18] *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.*

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

Table 9

ESTIMATED ANNUAL POLLUTANT LOADINGS BY LAND USE CATEGORY WITHIN THE AREA DIRECTLY TRIBUTARY TO CRAVATH LAKE: 2000 AND 2035

Land Use Category	Pollutant Loads: 2000			
	Sediment (tons)	Phosphorus (pounds)	Copper (pounds)	Zinc (pounds)
Urban				
Residential	1.7	34.8	0.0	1.6
Commercial	4.7	14.4	2.6	3.0
Industrial	3.8	11.7	2.2	1.5
Governmental	11.7	62.1	3.2	24.8
Transportation	0.4	9.5	0.0	0.0
Recreational	<0.1	0.8	0.0	0.0
Subtotal	22.4	133.3	8.0	30.9
Rural				
Agricultural	35.1	134.1	- -	- -
Wetlands	0.1	2.0	- -	- -
Woodlands	- -	- -	- -	- -
Water	7.1	9.9	- -	- -
Extractive	6.3	24.1	- -	- -
Subtotal	48.6	170.1	- -	- -
Total	71.0	303.4	8.0	30.9

Land Use Category	Pollutant Loads: 2035			
	Sediment (tons)	Phosphorus (pounds)	Copper (pounds)	Zinc (pounds)
Urban				
Residential	2.2	46.0	0.0	1.6
Commercial	4.7	14.4	2.6	3.0
Industrial	10.9	33.9	6.4	1.5
Governmental	12.8	67.5	3.5	24.8
Transportation	0.7	15.7	0.0	0.0
Recreational	<0.1	1.6	0.0	0.0
Subtotal	31.4	179.0	12.5	30.9
Rural				
Agricultural	3.4	12.9	- -	- -
Wetlands	0.1	2.0	- -	- -
Woodlands	- -	- -	- -	- -
Water	7.1	9.9	- -	- -
Extractive	0.1	3.4	- -	- -
Subtotal	10.7	28.2	- -	- -
Total	42.1	207.2	12.5	30.9

Source: SEWRPC.

Trippe Lake

The estimated sediment loadings to Trippe Lake from its direct tributary area under existing year 2000 and planned year 2035 conditions as set forth in the adopted regional land use plan[20] are shown in Table 11. A total annual sediment loading of 65.9 tons was estimated to be contributed to Trippe Lake from its direct tributary area under year 2000 conditions. Of the likely annual sediment load, it was estimated that 43.0 tons per year, or about 65 percent of the total loading, were contributed by runoff from rural lands, mostly from agricultural sources, and

[20]Ibid.

Table 10

ESTIMATED ANNUAL POLLUTANT LOADINGS BY LAND USE CATEGORY WITHIN THE TOTAL AREA TRIBUTARY TO CRAVATH LAKE: 2000

Land Use Category	Pollutant Loads: 2000			
	Sediment (tons)	Phosphorus (pounds)	Copper (pounds)	Zinc (pounds)
Urban				
Residential	8.9	182.0	0.0	1.5
Commercial	8.5	26.0	4.8	3.0
Industrial	20.9	65.0	12.2	1.5
Governmental	38.0	201.2	10.5	24.8
Transportation	27.2	54.5	118.9	0.0
Recreational	2.1	47.4	0.0	0.0
Subtotal	105.6	576.1	146.4	30.8
Rural				
Agricultural	3,165.5	12,100.0	- -	- -
Wetlands	3.0	64.3	- -	- -
Woodlands	4.2	90.0	- -	- -
Water	90.3	124.7	- -	- -
Extractive	2.4	55.2	- -	- -
Subtotal	3,265.4	12,434.2	- -	- -
Total	3,371.0	13,010.3	146.4	30.8

Source: SEWRPC.

12.7 tons, or about 19 percent, contributed by urban lands. Approximately 10.2 tons, or about 16 percent of the annual sediment load, were contributed by atmospheric deposition onto the lake surface.

Under 2035 conditions, the annual sediment load to the Lake from its total tributary area is anticipated to diminish as a result of the conversion of agricultural lands to urban land uses. The most likely annual sediment load to the Lake under buildout conditions is estimated to be 27.0 tons. Of the forecast sediment load anticipated for Trippe Lake, about 0.2 ton of sediment is estimated to be contributed to the Lake from rural sources. Urban sources are expected to contribute the majority of the sediment, estimated at about 16.6 tons per year. Approximately 10.2 tons of sediment per year are estimated to continue to be contributed by direct precipitation onto the lake surface.

Table 12 shows the estimated sediment loadings to Trippe Lake from its total tributary area under existing year 2000 conditions. A total annual sediment loading of about 1,671.9 tons was estimated to be contributed to Trippe Lake from its total tributary area under year 2000 conditions. Of the likely annual sediment load, it was estimated that 1,548.3 tons per year, or about 93 percent of the total loading, were contributed by runoff from rural lands, mostly from agricultural sources, and 33.6 tons, or about 2 percent, contributed by urban lands. Approximately 90.0 tons, or about 5 percent of the annual sediment load, were contributed by atmospheric deposition onto the lake surface. Under 2035 conditions, the annual sediment load to the Lake from its total tributary area is anticipated to diminish.

Phosphorus Loadings

Cravath Lake

As shown in Table 9, existing year 2000 phosphorus loads to Cravath Lake from its direct tributary area were identified and quantified using SEWRPC land use inventory data.[21] It was estimated that, under year 2000

[21]Ibid.

Table 11

ESTIMATED ANNUAL POLLUTANT LOADINGS BY LAND USE CATEGORY WITHIN THE AREA DIRECTLY TRIBUTARY TO TRIPPE LAKE: 2000 AND 2035

Land Use Category	Pollutant Loads: 2000			
	Sediment (tons)	Phosphorus (pounds)	Copper (pounds)	Zinc (pounds)
Urban				
Residential	0.7	15.6	0.0	1.6
Commercial	8.6	26.4	4.8	3.0
Industrial	2.6	8.2	1.5	1.5
Governmental	0.5	2.7	0.1	24.8
Transportation	0.2	4.1	0.0	0.0
Recreational	<0.1	1.6	0.0	0.0
Subtotal	12.7	58.6	6.4	30.9
Rural				
Agricultural	42.8	163.4	- -	- -
Wetlands	0.1	2.1	- -	- -
Woodlands	<0.1	0.1	- -	- -
Water	10.2	14.2	- -	- -
Extractive	- -	- -	- -	- -
Subtotal	53.2	179.8	- -	- -
Total	65.9	238.4	6.4	30.9

Land Use Category	Pollutant Loads: 2035			
	Sediment (tons)	Phosphorus (pounds)	Copper (pounds)	Zinc (pounds)
Urban				
Residential	1.6	32.0	0.0	1.6
Commercial	10.1	31.2	5.7	3.0
Industrial	2.6	8.2	1.5	1.5
Governmental	1.3	6.7	0.3	24.8
Transportation	0.4	10.2	0.0	0.0
Recreational	0.6	13.8	0.0	0.0
Subtotal	16.6	102.1	7.5	30.9
Rural				
Agricultural	0.0	0.0	- -	- -
Wetlands	0.1	2.1	- -	- -
Woodlands	<0.1	0.1	- -	- -
Water	10.2	14.2	- -	- -
Extractive	- -	- -	- -	- -
Subtotal	10.4	16.4	- -	- -
Total	27.0	118.5	7.5	30.9

Source: SEWRPC.

conditions, the total phosphorus load to Cravath Lake from its direct tributary area was 303 pounds. Of the annual total phosphorus load, it was estimated that 160 pounds per year, or about 53 percent of the total loading, were contributed by runoff from rural lands, mostly agricultural, and 133 pounds per year, or about 44 percent, were contributed by runoff from urban lands, mostly from residential sources. About 10 pounds, or about 3 percent, were contributed by direct precipitation onto the lake surface.

Table 12

ESTIMATED ANNUAL POLLUTANT LOADINGS BY LAND USE CATEGORY WITHIN THE TOTAL AREA TRIBUTARY TO TRIPPE LAKE: 2000

Land Use Category	Pollutant Loads: 2000			
	Sediment (tons)	Phosphorus (pounds)	Copper (pounds)	Zinc (pounds)
Urban				
Residential	6.8	139.2	0.0	1.5
Commercial	5.1	15.6	2.9	3.0
Industrial	5.2	16.4	3.0	1.5
Governmental	3.5	18.9	1.0	24.8
Transportation	12.0	24.0	52.3	0.0
Recreational	1.0	24.6	0.0	0.0
Subtotal	33.6	238.7	59.2	30.8
Rural				
Agricultural	1,539.2	5,883.2	- -	- -
Wetlands	1.8	39.4	- -	- -
Woodlands	3.7	83.0	- -	- -
Water	90.0	124.5	- -	- -
Extractive	3.6	50.2	- -	- -
Subtotal	1,638.3	6,180.3	- -	- -
Total	1,671.9	6,419.0	59.2	30.8

Source: SEWRPC.

Table 9 also shows the estimated phosphorus loads to Cravath Lake from its direct tributary area under planned year 2035 conditions. Under 2035 conditions, the annual total phosphorus load to the Lake is anticipated to diminish as agricultural activities within the area directly tributary to Cravath Lake are replaced by urban residential land uses. The most likely annual total phosphorus load to the Lake under the planned conditions is estimated to be 207 pounds. Of the total annual forecast phosphorus load of phosphorus to Cravath Lake, 18 pounds per year, or about 9 percent of the total loading, are estimated to be contributed by runoff from rural land, and 179 pounds per year, or about 86 percent, from urban land. About 10 pounds, or about 5 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 decrease, but that the distribution of the sources of the phosphorus load to the Lake may change, with the amount of phosphorus being contributed from urban sources increasing, while the amount of phosphorus from rural sources will decrease.

Table 10 shows estimated phosphorus loads to Cravath Lake from its total tributary area under year 2000 conditions. It was estimated that, under year 2000 conditions, the total phosphorus load to Cravath Lake from its total tributary area was about 13,010 pounds. Of the annual total phosphorus load, it was estimated that 12,309 pounds per year, or about 95 percent of the total loading, were contributed by runoff from rural lands, mostly agricultural, and 576 pounds per year, or about 4 percent, were contributed by runoff from urban lands, mostly from residential sources. About 125 pounds, or about 1 percent, were contributed by direct precipitation onto the lake surface.

Trippe Lake

As shown in Table 11, existing year 2000 phosphorus loads to Trippe Lake from its direct tributary area were identified and quantified using SEWRPC land use inventory data.[22] It was estimated that, under year 2000 conditions, the total phosphorus load to Trippe Lake from its direct tributary area was 238 pounds. Of the annual total phosphorus load, it was estimated that 165 pounds per year, or about 69 percent of the total loading, were contributed by runoff from rural lands, mostly agricultural, and 59 pounds per year, or about 25 percent, were contributed by runoff from urban lands, mostly from residential sources. About 14 pounds, or about 6 percent, were contributed by direct precipitation onto the lake surface.

Table 11 also shows the estimated phosphorus loads to Trippe Lake from its direct tributary area under planned year 2035 conditions. Under 2035 conditions, as set forth in the adopted regional land use plan,[23] the annual total phosphorus load to the Lake is anticipated to diminish as agricultural activities within the area directly tributary to Trippe Lake are replaced by urban residential land uses. The most likely annual total phosphorus load to the Lake under the planned conditions is estimated to be 118 pounds. Of the total annual forecast phosphorus load to Trippe Lake, two pounds per year, or about 2 percent of the total loading, are estimated to be contributed by runoff from rural land, and 102 pounds per year, or about 86 percent, from urban land. About 14 pounds, or about 12 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 decrease, but that the distribution of the sources of the phosphorus load to the Lake may change, with the amount of phosphorus being contributed from urban sources experiencing an increase, while the amount of phosphorus from rural sources will decrease.

Table 12 shows estimated phosphorus loads to Trippe Lake from its total tributary area under year 2000 conditions. It was estimated that, under year 2000 conditions, the total phosphorus load to Trippe Lake from its total tributary area was 6,419 pounds. Of the annual total phosphorus load, it was estimated that 6,056 pounds per year, or about 94 percent of the total loading, were contributed by runoff from rural lands, mostly agricultural, and 239 pounds per year, or about 4 percent, were contributed by runoff from urban lands, mostly from residential sources. About 124 pounds, or about 2 percent, were contributed by direct precipitation onto the lake surface.

Phosphorus release from the lake bottom sediments, or internal loading, as discussed above, does not appear to have been a contributing factor to the total phosphorus loading to either Cravath or Trippe Lake.

Urban Heavy Metals Loadings

Urbanization brings with it increased use of metals and other materials that contribute pollutants to aquatic systems.[24] The majority of these metals becomes associated with sediment particles,[25] and, consequently, is likely to be encapsulated into the bottom sediments of a lake.

Cravath Lake

The estimated loadings of copper and zinc likely to be contributed to Cravath Lake from its direct tributary area under existing year 2000 and forecast year 2035 land use conditions are shown in Table 9. In 2000, eight pounds of copper and 31 pounds of zinc were estimated to be contributed annually to Cravath Lake from its direct tributary area, all from urban lands. Under planned year 2035 conditions, as set forth in the adopted regional land

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

[23]Ibid.

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

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

use plan,[26] the annual zinc load to the Lake is anticipated to remain about the same as estimated under existing year 2000 conditions, but it is estimated that the copper load to the Lake may increase to about 12 pounds per year.

Estimated loadings of copper and zinc to Cravath Lake from its total tributary area under existing year 2000 conditions are shown in Table 10. In 2000, 146 pounds of copper and 31 pounds of zinc were estimated to be contributed annually to Cravath Lake from its total tributary area, all from urban lands.

Trippe Lake

The estimated loadings of copper and zinc likely to be contributed to Trippe Lake from its direct tributary area under existing year 2000 and forecast year 2035 land use conditions as set forth in the adopted regional land use plan,[27]are shown in Table 11. In 2000, six pounds of copper and 31 pounds of zinc were estimated to be contributed annually to Trippe Lake from its direct tributary area, all from urban lands. Under planned year 2035 conditions, the annual heavy metal loads to the Lake are anticipated to remain at about the same as those estimated under existing year 2000 conditions, with a slight increase in copper loading to about seven pounds per year.

Estimated loadings of copper and zinc to Trippe Lake from its total tributary area under existing year 2000 conditions are shown in Table 12. In 2000, 59 pounds of copper and 31 pounds of zinc were estimated to be contributed annually to Trippe Lake from its total tributary area, 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.

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

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

[27]Ibid.

Table 13

**TROPHIC STATE INDICATOR (TSI)
FOR TRIPPE LAKE: 2004-2009**

Year	Average TSI Based on Secchi	Average TSI Based on Chlorophyll-*a*	Average TSI Based on Total Phosphorus
2004	55	- -	56
2005	- -	- -	- -
2006	49	- -	- -
2007	54	- -	- -
2008	55	42	55
2009	55	46	58

Source: Wisconsin Department of Natural Resources and SEWRPC.

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,[28] and the Carlson Trophic State Index (TSI),[29] with a variation known as the Wisconsin Trophic State Index value (WTSI).[30] 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.

Based upon data gathered during the aforementioned ERSC satellite remote sensing study, Cravath Lake was estimated to have a TSI value of 64; Trippe Lake was estimated to have a value of 64, also. A value above 50 is generally indicative of the enriched conditions associated with eutrophic lakes. As shown in Table 13, Secchi-disk data for the deep hole in Trippe Lake indicate a TSI of about 55 while chlorophyll-*a* data for Trippe Lake indicate a TSI of about 44 and total phosphorus data indicate a TSI of about 56; these values are suggestive of eutrophic conditions. As set forth in the regional water quality management plan,[31] Cravath and Trippe Lakes are classified as eutrophic waterbodies. Such determination is consistent with the aforementioned physical factors of the Lakes—to wit, lake bottom sediment composition and lake bottom contours—and with the available, albeit limited, water quality data obtained from the Lakes.

AQUATIC PLANTS: DISTRIBUTION AND MANAGEMENT AREAS

Aquatic Plant Diversity in Cravath and Trippe Lakes

For the current study, SEWRPC staff conducted aquatic plant surveys on Cravath and Trippe Lakes during August of 2008, the results of which are shown in Tables 14 and 15 and Maps 9 and 10. Overall, Trippe Lake contained a greater diversity of aquatic plant species than did Cravath. Of note is the identification of eight different species of pondweed in Trippe Lake. A critical key to the ability of an ecosystem, such as a lake, to maintain its ecological integrity is through *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. The presence of a diverse community of pondweed is generally considered to be indicative of a healthy lake and good habitat for fishes and aquatic life.

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[28]*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.*

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

[30]*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.*

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

Table 14

AQUATIC PLANT SPECIES OBSERVED IN CRAVATH LAKE: JULY 2008

Aquatic Plant Species	Number of Sites Found	Frequency of Occurrence[a]	Relative Density[b]	Importance Value[c]
Ceratophyllum demersum (coontail)	18	51.4	2.9	148.6
Elodea canadensis (waterweed)	7	20.0	1.4	28.6
Lemna minor (duckweed)	1	2.9	4.0	11.4
Myriophyllum spicatum (Eurasian water milfoil)	18	51.4	2.2	111.4
Nuphar advena (yellow water lily)	1	2.9	4.0	11.4
Nymphaea odorata (white water lily)	4	11.4	1.5	17.1
Potamogeton crispus (curly-leaf pondweed)	12	34.3	1.5	51.4
Potamogeton pectinatus (Sago pondweed)	23	65.7	2.3	151.4
Potamogeton pusillus (small pondweed)	1	2.9	1.0	2.9
Potamogeton zosteriformis (flat-stem pondweed)	1	2.9	1.0	2.9

NOTE: Sampling occurred at 35 sampling sites along 13 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.

During the 2008 survey, 10 different aquatic plant species were observed in Cravath Lake. The dominant species were Sago pondweed (*Potamogeton pectinatus*) and coontail (*Ceratophyllum demersum*), although Eurasian water milfoil (*Myriophyllum spicatum*), was also present in significantly large numbers. A complete list of species observed in Cravath Lake during the 2008 survey is found in Table 14 and shown on Map 9. In Trippe Lake, during the 2008 survey, 14 different species were observed: the dominant species was coontail, although Eurasian water milfoil, waterweed (*Elodea canadensis*), and white water lily (*Nymphaea odorata*), were also present in significant numbers. Table 15 contains the listing for Trippe Lake, with Map 10 depicting the locations of the plant species within Trippe Lake. By comparison, the nearby Lauderdale Lakes, for example, contained an aquatic plant community comprised of 19 different aquatic plant species.[32]

A complete species list of submersed aquatic plant species, compiled from the results of the 2008 SEWRPC aquatic plant survey in Cravath and Trippe Lakes, is set forth in Table 16, along with comments on the ecological significance of each plant on the list. Representative illustrations of these aquatic plants can be found in Appendix A.

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

Table 15

AQUATIC PLANT SPECIES OBSERVED IN TRIPPE LAKE: JULY 2008

Aquatic Plant Species	Number of Sites Found	Frequency of Occurrence[a]	Relative Density[b]	Importance Value[c]
Ceratophyllum demersum (coontail)	26	100.0	4.0	396.2
Elodea canadensis (waterweed)	15	57.7	2.3	130.8
Lemna minor (duckweed)	3	11.5	3.3	38.5
Myriophyllum spicatum (Eurasian water milfoil)	21	80.8	2.6	211.5
Nelumbo lutea (American lotus)	--[d]	--	--	--
Nymphaea odorata (white water lily)	15	57.7	2.3	130.8
Potamogeton amplifolius (large-leaf pondweed)	5	19.2	1.4	26.9
Potamogeton crispus (curly-leaf pondweed)	5	19.2	1.6	30.8
Potamogeton foliosis (leafy pondweed)	1	3.9	2.0	7.7
Potamogeton illinoensis (Illinois pondweed)	3	11.5	1.3	15.4
Potamogeton natans (floating-leaf pondweed)	3	11.5	1.7	19.2
Potamogeton nodosus (long-leaf pondweed)	1	3.9	1.0	3.9
Potamogeton pectinatus (Sago pondweed)	10	38.5	1.9	73.1
Potamogeton zosteriformis (flat-stem pondweed)	6	23.1	1.0	23.1
Vallisneria americana (wild celery/eel-grass)	6	23.1	2.7	61.5

NOTE: Sampling occurred at 26 sampling sites along nine 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.*

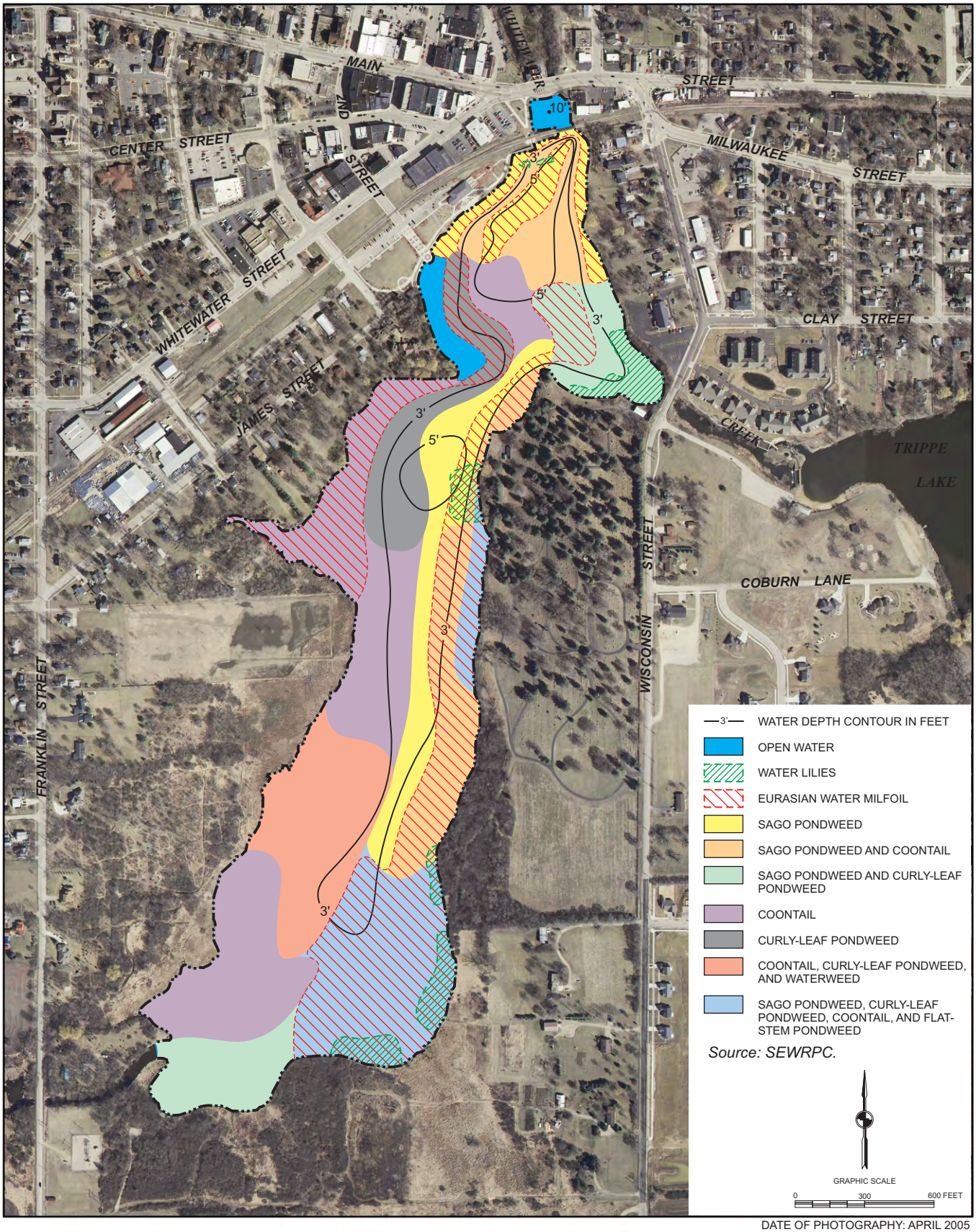
[d]*Ms. Heidi Bunk of the Wisconsin Department of Natural Resources staff has noted the presence of this floating leaved aquatic plant in Trippe Lake.*

Source: SEWRPC.

Aquatic plant communities do undergo cyclical and periodic changes, which reflect, in part, changing climatic conditions on an interannual scale and, also in part, the evolution of the aquatic plant community in response to changing hydroclimate conditions in the Lake; these latter, including factors, such as changes in long-term nutrient loading, sedimentation rates, and recreational use patterns. The former, interannual, changes occur over a period of three to seven years and may be temporary. The latter, evolutionary, occur over a decadal period or longer and are longer-lasting. Also, some species, such as the pondweeds, exhibit distinct seasonality, with individual species having well-defined growing periods that reflect water temperature, insolation, and other factors. In addition, the change in the Eurasian water milfoil population in a lake may reflect the results of aquatic management practices and/or may be a reflection of a periodicity the species naturally experiences. Such periodicity, especially in Eurasian water milfoil populations, has been observed elsewhere in southeastern Wisconsin, and potentially reflects the influences of a combination of stressors. These stressors include biological factors, such as the activities of naturally occurring Eurasian water milfoil weevils, as well as climatic and limnological factors, such as insolation, water temperature, and lake circulation patterns.

Map 9

AQUATIC PLANT COMMUNITY DISTRIBUTION IN CRAVATH LAKE: 2008



DATE OF PHOTOGRAPHY: APRIL 2005

Map 10

AQUATIC PLANT COMMUNITY DISTRIBUTION IN TRIPPE LAKE: 2008

DATE OF PHOTOGRAPHY: APRIL 2005

—4'— WATER DEPTH CONTOUR IN FEET

OPEN WATER

AREA THAT COULD NOT BE SURVEYED

WATER LILIES

EURASIAN WATER MILFOIL

COONTAIL AND WATERWEED

COONTAIL, WATERWEED, CURLY-LEAF PONDWEED, FLAT-STEM PONDWEED, AND LARGE-LEAF PONDWEED

COONTAIL AND CURLY-LEAF PONDWEED

COONTAIL, LARGE-LEAF PONDWEED, FLAT-STEM PONDWEED, FLOATING-LEAF PONDWEED, AND ILLINOIS PONDWEED

COONTAIL, WATERWEED, SAGO PONDWEED, WILD CELERY, FLOATING-LEAF PONDWEED, AND ILLINOIS PONDWEED

COONTAIL, WATERWEED, SAGO PONDWEED, CURLY-LEAF PONDWEED, FLAT-STEM PONDWEED, AND LARGE-LEAF PONDWEED

GRAPHIC SCALE

0 300 600 FEET

Source: SEWRPC.

Table 16

POSITIVE ECOLOGICAL SIGNIFICANCE OF AQUATIC PLANT SPECIES PRESENT IN CRAVATH AND TRIPPE 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
Elodea canadensis (waterweed)	Provides shelter and support for insects which are valuable as fish food
Lemna spp. (duckweed)	Small duckweed is prized for its nutritional value as food for waterfowl; extensive rafts of duckweed can provide shelter for fish and even inhibit mosquito reproduction
Myriophyllum spicatum (Eurasian water milfoil)	None known; nonnative
Nelumbo lutea (American lotus)	Provides good shade and fair shelter for fishes; waterfowl sometimes eat the seeds, and muskrat eat the roots
Nuphar advena (yellow water lily)	Seeds provide food for waterfowl; leaves, stems, and flowers are food for deer; rhizomes are food source for muskrat and beaver; leaves provide shelter and shade for fish and habitat for invertebrates
Nymphaea odorata (white water lily)	Seeds provide food for waterfowl; leaves, stems, and flowers are food for deer; rhizomes are food source for muskrat and beaver; leaves provide shelter and shade for fish and habitat for invertebrates
Potamogeton amplifolius (large-leaf pondweed)	Offers shade, shelter and foraging for fish; valuable food for waterfowl
Potamogeton crispus (curly-leaf pondweed)	Nonnative
Potamogeton foliosis (leafy pondweed)	Provides food for geese and ducks; food for muskrat, beaver and deer; good surface area for insects and cover for juvenile fish
Potamogeton illinoensis (Illinois pondweed)	Provides shade and shelter for fish; harbor for insects; seeds are eaten by wildfowl
Potamogeton natans (floating-leaf pondweed)	Provides food for waterfowl, muskrat, beaver and deer; good fish habitat
Potamogeton nodosus (long-leaf pondweed)	Fruit is food source for waterfowl; habitat and foraging opportunities for fish
Potamogeton pectinatus (Sago pondweed)	This plant is the most important pondweed for ducks, in addition to providing food and shelter for young fish
Potamogeton pusillus (small pondweed)	Provides food for ducks, geese, muskrat, beaver, and deer, and provides food and shelter for fish
Potamogeton zosteriformis (flat-stem pondweed)	Provides some food for ducks
Vallisneria americana (wild celery/eel-grass)	Provides good shade and shelter, supports insects, and is valuable fish food

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.

Lack of aquatic plant survey data prior to 2008 precludes the ability to determine what changes in the aquatic plant community may be occurring in either Cravath Lake or Trippe Lake. Since both of the 2008 surveys were conducted using the modified Jesson and Lound transect method as promulgated by the WDNR, this

methodology, when utilized in successive aquatic plant surveys, will allow the statistical evaluation of changes in the aquatic plant community within the Lakes.[33]

Aquatic Plant Species of Special Significance

Native Aquatic Plants

There was one native plant species observed in the survey of Trippe Lake of exceptionally high ecological value: large-leaf pondweed (*Potamogeton amplifolius*), also known as musky weed or bass weed. This plant, as fishers well know, enjoys a reputation as a highly valuable provider of fish habitat. Additionally, this plant has achieved some measure of success as an introduced aquatic plant in transplanting efforts in Lac La Belle and Okauchee Lake, in Waukesha County, Wisconsin, making it a potentially valuable partner in littoral zone restoration projects.[34]

Nonnative Species

During the 2008 aquatic plant surveys of Cravath and Trippe Lakes, several nonnative aquatic plant species of special significance were observed. Two of these species, Eurasian water milfoil and curly-leaf pondweed (*Potamogeton crispus*), are considered detrimental to the ecological health of the Lakes and are declared nuisance species identified in Chapters NR 40 and NR 109 of the *Wisconsin Administrative Code*.

Eurasian water milfoil is one of eight milfoil species found in Wisconsin and the only one known to be exotic or nonnative. Because of its nonnative nature, Eurasian water milfoil has few natural enemies that can inhibit its 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.

Curly-leaf pondweed is 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 and makes management of this species difficult. 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

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[33]*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.*

[34]*Wisconsin Lakes Partnership,* Through the Looking Glass…A Field Guide to Aquatic Plants, Wisconsin Lakes Partnership, University of Wisconsin-Extension, *1999.*

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.

Past and Present Aquatic Plant Management Practices

An aquatic plant management program has been carried out on Trippe Lake in a documented manner since 1950; Cravath Lake has, only recently, been the subject of documented management efforts. Records of aquatic plant management efforts were first maintained by the WDNR beginning in 1950. Prior to 1950, aquatic plant management interventions were 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*.

Since 1950, the aquatic plant management activities in Cravath and Trippe Lakes could be characterized as primarily a chemical control program designed to minimize nuisance growths of aquatic macrophytes. A cumulative summary of chemical applications for Cravath Lake is shown in Table 17; cumulative totals for Trippe Lake are set forth in Table 18. Between 1950 and 1969, as shown in the tables, approximately 4,874 pounds of sodium arsenite were applied to Trippe Lake; none was applied to Cravath Lake.

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. The applications and accumulations of arsenic were found to present potential health hazards to both humans and aquatic life. In drinking water supplies, arsenic was suspected of being carcinogenic and, under certain conditions, arsenic has leached into and contaminated groundwater, especially in sandy soils that serve as a source of drinking water in some communities. The U.S. Environmental Protection Agency-recommended drinking water standard for arsenic is a maximum level of 0.05 mg/l.

Currently, since 2001, aquatic plant control has been focused on managing nuisance growths of Eurasian water milfoil. This control program utilizes a combination of granular and liquid 2,4-D to target Eurasian water milfoil growths in the Lakes, as documented in Tables 17 and 18.[35]

FISHERIES AND WILDLIFE

The WDNR reports that, in both Cravath Lake and Trippe Lake, panfish are considered to be "common," largemouth bass and northern pike are considered to be "present."[36] Also present are the following State-designated special-concern species: American eel, (*Anguilla rostrata*), in Cravath Lake; lake chubsucker, (*Erimyzon* sucetta), in Trippe Lake; and, least darter, (*Etheostoma microperca*), in Whitewater Creek, upstream of Trippe Lake.

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[35] *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.*

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

Table 17

CHEMICAL CONTROLS ON CRAVATH 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)	2,4-D (pounds)	Diquat (gallons)	Glyphosate (gallons)	Endothall/ Aquathol (gallons)
1950-2008	0.0	- -	- -	- -	- -	- -	- -	- -	- -	- -
2009	9.0	- -	- -	- -	- -	27.0	- -	- -	- -	- -
2010	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Total	9.0	- -	- -	- -	- -	27.0	- -	- -	- -	- -

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table 18

CHEMICAL CONTROLS ON TRIPPE 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)	2,4-D (pounds)	Diquat (gallons)	Glyphosate (gallons)	Endothall/ Aquathol (gallons)
1950-1969	- -	- -	- -	- -	4,784	- -	- -	- -	- -	- -
1970-1996	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
1997	2.0	- -	- -	- -	- -	- -	200	- -	- -	- -
1998-2000	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
2001	13.0	- -	- -	- -	- -	- -	1,300	- -	- -	- -
2002	52.3	- -	- -	- -	- -	12.0	225	- -	- -	- -
2003	13.3	- -	- -	- -	- -	40.0	450	- -	- -	- -
2004	3.5	- -	- -	- -	- -	- -	350	- -	- -	- -
2005	9.8	- -	- -	- -	- -	10.0	650	- -	- -	- -
2006	8.0	- -	- -	- -	- -	- -	800	- -	- -	- -
2007	8.0	- -	- -	- -	- -	- -	800	- -	- -	- -
2008	7.0	- -	- -	- -	- -	29.0	- -	- -	- -	- -
2009	6.5	- -	- -	- -	- -	- -	650	- -	- -	- -
2010	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -
Total	- -	- -	- -	- -	4,784	91.0	5,425	- -	- -	- -

Source: Wisconsin Department of Natural Resources and SEWRPC.

Stocking of Cravath Lake with northern pike occurred between 1985 and 2001, as shown in Table 19; intermittent stocking of northern pike occurred from 1982 through 2001 on Trippe Lake, as shown in Table 20.

With respect to wildlife, and given the urbanization of land uses present around the shorelands of the Lakes, most of the wildlife remaining are urban-tolerant species: 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; and, 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 Lakes. The remaining undeveloped areas provide the best-quality cover for many wildlife species.

Table 19

FISH STOCKED INTO CRAVATH LAKE: 1985-2001

Year	Species Stocked	Number	Average Fish Length (inches)
1985	Northern pike	130	8.00
1991	Northern pike	300	8.00
1992	Northern pike	140	8.00
1994	Northern pike	136	7.50
1999	Northern pike	136	7.20
2001	Northern pike	170	7.60

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table 20

FISH STOCKED INTO TRIPPE LAKE: 1982-2001

Year	Species Stocked	Number	Average Fish Length (inches)
1982	Northern pike	230	- -
1985	Northern pike	230	8.00
1991	Northern pike	500	8.00
1992	Northern pike	230	8.00
1994	Northern pike	452	7.75
1999	Northern pike	226	7.20
2001	Northern pike	282	7.60

Source: Wisconsin Department of Natural Resources and SEWRPC.

The Cravath and Trippe Lakes total 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 Cravath-Trippe 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 Lakes tributary area.

WDNR-Designated Sensitive Areas and SEWRPC-Designated Critical Species Habitat

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

SEWRPC also has identified natural areas and critical species habitat areas within the Southeastern Wisconsin Region.[37] In this regard, the following natural areas contain intact native plant and animal communities of local and statewide significance and are shown on Map 11:

1. Bluff Creek Fens: A WDNR- owned, 106-acre excellent-quality springs and associated calcerous fens located at intervals along the headwaters of Bluff Creek;

2. Bluff Creek Woods: A part privately owned and part WDNR-owned, 338-acre extensive dry-mesic woods on rough glacial terrain, dominated by mature red oaks;

3. Clover Valley Fen State Natural Area: A WDNR-owned, 112-acre parcel, containing a series of 11,000-year-old peat mounds that rise eight to 10 feet above the surrounding lowland, formed by accumulations of partially decayed vegetation around slowly flowing springs;

4. Lake No. 10: A privately owned, 40-acre small, undeveloped lake in a kettle depression, containing deep and shallow marsh;

5. Lone Tree Trail Oak Woods: A WDNR-owned, 265-acre, former mosaic of xeric oak forest, open oak woodland, and oak savanna now overgrown with shrubs and containing the State-designated threatened kittentails (*Besseya bullii*);

6. Whitewater Oak Woods: A part WDNR-owned and part 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;

7. 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; and

8. Rock Shrub Fen: A privately owned, 46-acre, good-quality wetland complex.

Of the abovelisted sites, the following have been classified as NA-1, identifying them as sites of statewide or greater significance: Bluff Creek Fens, Clover Valley Fen State Natural Area, and Bluff Creek Woods. All other sites listed above have been classified as NA-3, identifying them as areas of local significance.

Critical aquatic habitat areas located within the Cravath-Trippe Lakes tributary area include:

1. Bluff Creek: 1.9 miles of high-quality fast, hard, cold-water Class I trout stream with a classification of AQ-1, identifying it as a site of statewide or greater significance;

2. Trippe Lake: Classified as AQ-2, identifying it as a site of countywide or regional significance; and

3. Cravath Lake, Whitewater Creek, Whitewater Lake, Rice Lake, and Lake No. 10: All rated as AQ-3, identifying them as sites of local significance.

In addition to the abovelisted sites, the Cravath-Trippe Lakes tributary area contains several other sites that, although not located within designated natural areas, provide critical habitat for State-designated threatened plant species of concern, Sullivant's milkweed, *Asclepias sullivantii*; Mills Road Prairie; Anderson Road; and Island Road Prairie.

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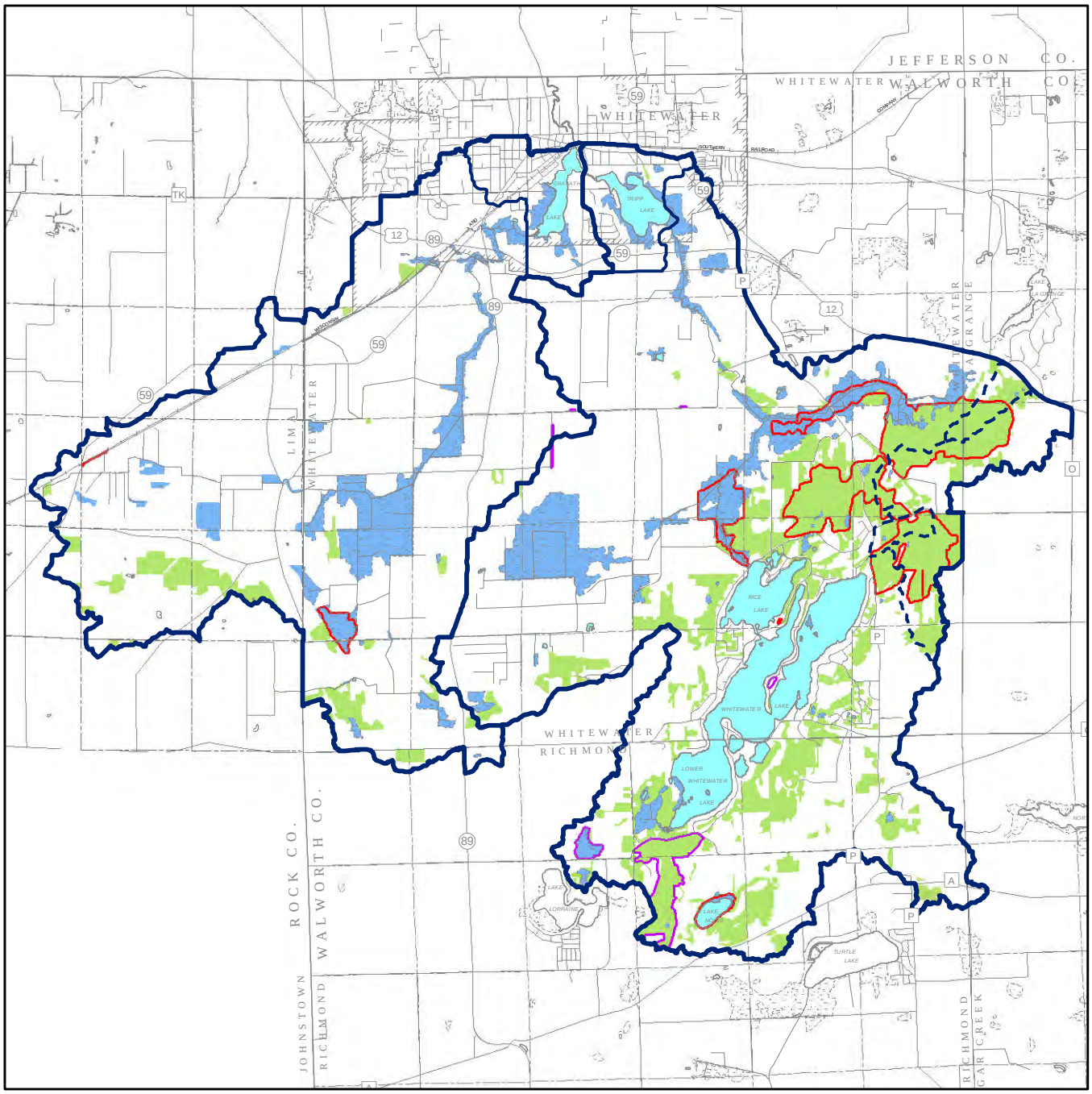
[37]*SEWRPC Planning Report No. 42*, A Regional Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin, *September 1997*.

Map 11

WETLANDS, WOODLANDS, AND NATURAL AREAS WITHIN THE CRAVATH AND TRIPPE LAKES TOTAL TRIBUTARY AREA



Natural Area

Critical Species Habitat Site

Woodlands

Wetlands

Surface Water

Total Tributary Area Boundary

Direct Tributary Area Boundary

Internally Drained Area Boundary where not Coincident with the Watershed or Subwatershed Boundaries

N

0 4,000 8,000 Feet

NOTE: Critical species habitat data not available in Rock County.

Source: Rock County Land Information Office and SEWRPC.

In the Cravath and Trippe Lakes tributary area, the lakeshores located within the environmental corridors, as shown on Map 12, should be candidates for immediate protection through proper zoning or through public ownership. Of the areas not already publicly owned, the remaining areas of natural shoreline and riparian wetland areas are perhaps the most sensitive areas in need of greatest protection.

RECREATIONAL USES AND FACILITIES

As set forth in the regional water quality management plan, Cravath and Trippe Lakes are multi-purpose waterbodies serving a variety of recreational uses and are used year-round as a visual amenity.[38] Active recreational uses include paddleboating, canoeing, kayaking, swimming, and fishing during the summer months, and cross-country skiing, snowmobiling, and ice-fishing during the winter; popular passive recreational uses include walking, bird watching, and picnicking. The Lakes do not experience intense recreational boating use. Public access to the Lakes is provided through two city-owned and operated sites: on Cravath Lake, at the north end of the Lake adjacent to the recreational-concession facility in the city park; on Trippe Lake, located on the northwestern shore of the Lake in the city park. Both Lakes are deemed to have adequate public access as defined in Chapter NR 1 of the *Wisconsin Administrative Code,* which establishes quantitative standards for determining the adequacy of public recreation boating access, setting maximum and minimum standards based upon available parking facilities for car-top and car-trailer units.

Surveys of watercraft docked or moored on the Lakes were conducted by SEWRPC staff in 2008 for the current study. During the current study, a total of 27 watercraft were observed either moored in the water or stored on land in the shoreland areas around the Lakes, as shown in Table 21, 16 around Cravath Lake, and 11 around Trippe Lake.

The types of 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. For example, in a similar survey conducted on nearby Lake Wandawega in 2007, about 15 percent of watercraft were motorized with pontoon boats comprising the single largest category of motorized watercraft. The 2008 survey on nearby Lauderdale Lakes showed motorized watercraft accounted for about 73 percent of all watercraft with powerboats comprising the single largest category of motorized watercraft. This would indicate that recreational high-speed boating is more of a major active recreational use on the Lauderdale Lakes than on Wandawega Lake. On Cravath and Trippe Lakes, only two motorized boats, both fishing boats, were observed; all other watercraft were nonmotorized and comprised of canoes, paddleboats, and rowboats. This observation is consistent with what would be expected in light of the fact that both Lakes are “no wake” waterbodies.

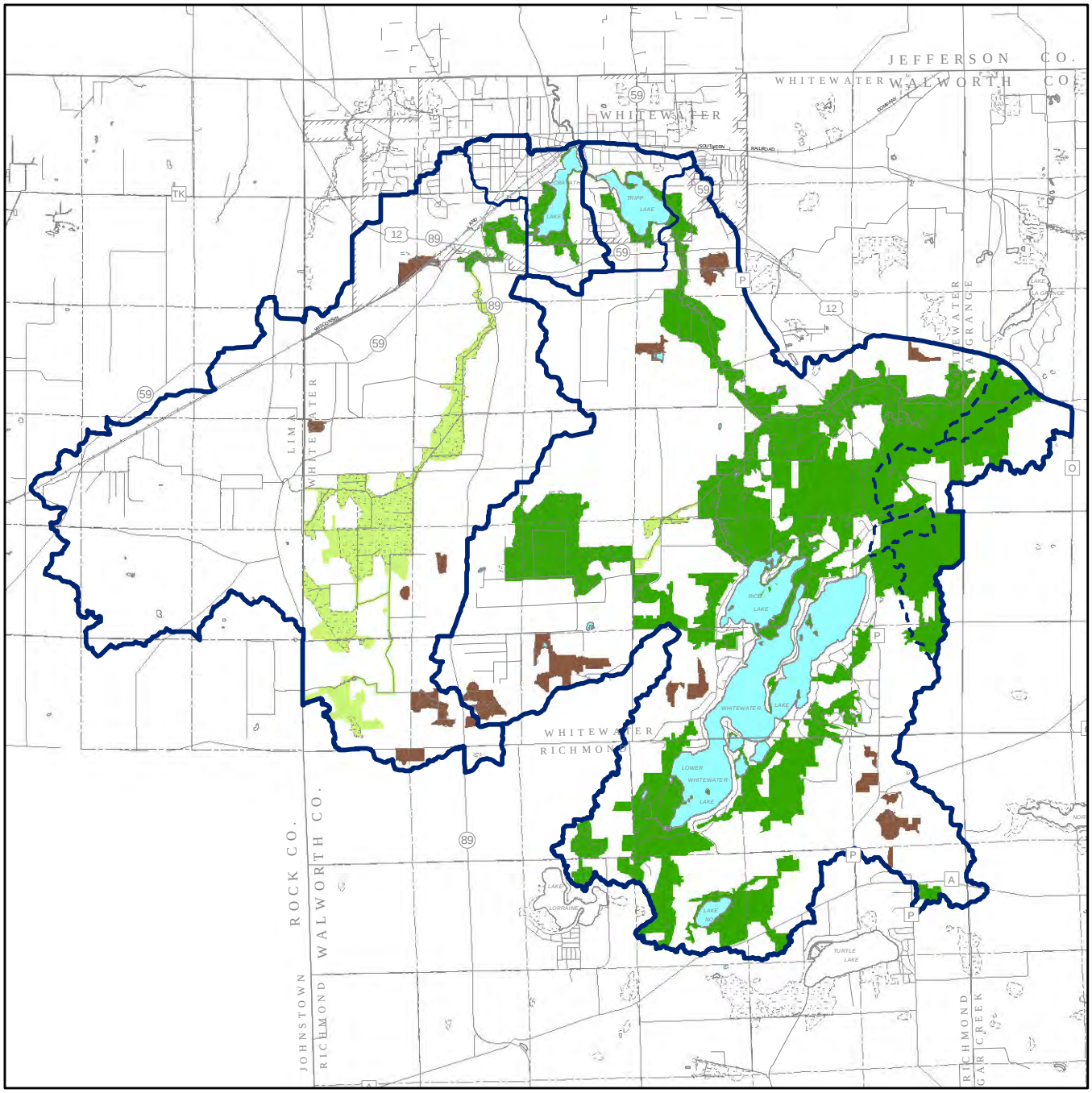
To assess the degree of recreational boat use on a lake, it has been estimated that, in southeastern Wisconsin, the number of watercraft operating on a lake at any given time is between about 2 percent and 5 percent of the total number of watercraft docked and moored. On both Lakes combined, this would amount to only about one or two boats.

There is a range of opinions on the issue of what constitutes optimal boating density, or number of acres of open water available in which to operate a boat on a lake. In this regard, during the mid-1980s, an average area of about 16 acres per powerboat or sailboat was, at that time, considered suitable for the safe and enjoyable use of a boat on a lake. Over time, motorized watercrafts of all kinds have steadily increased in power and speed. For safe waterskiing and fast boating, the regional park and open space plan suggested an area of 40 acres per boat as the

[38]*SEWRPC Planning Report No. 30,* op. cit. *See also SEWRPC Memorandum Report No. 93,* A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report, *March 1995.*

Map 12

ENVIRONMENTAL CORRIDORS AND ISOLATED NATURAL RESOURCE AREAS WITHIN THE CRAVATH AND TRIPPE LAKES TOTAL TRIBUTARY AREA: 2005



Primary Environmental Corridor

Secondary Environmental Corridor

Isolated Natural Resource Area

Surface Water

Total Tributary Area Boundary

Direct Tributary Area Boundary

Internally Drained Area Boundary where not Coincident with the Watershed or Subwatershed Boundaries

N

0 4,000 8,000 Feet

NOTE: This data not available in Rock County.

Source: Rock County Land Information Office and SEWRPC.

Table 21

WATERCRAFT DOCKED OR MOORED ON CRAVATH AND TRIPPE LAKES: 2008[a]

Type of Watercraft—Cravath Lake									
Powerboat	Fishing Boat	Pontoon Boat	Personal Watercraft	Canoe	Sailboat	Kayak	Paddleboat	Rowboat	Total
0	0	0	0	5	0	0	7	4	16

Type of Watercraft—Trippe Lake									
Powerboat	Fishing Boat	Pontoon Boat	Personal Watercraft	Canoe	Sailboat	Kayak	Paddleboat	Rowboat	Total
0	2	0	0	3	0	0	1	5	11

Type of Watercraft—Total for Both Lakes									
Powerboat	Fishing Boat	Pontoon Boat	Personal Watercraft	Canoe	Sailboat	Kayak	Paddleboat	Rowboat	Total
0	2	0	0	8	0	0	8	9	27

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

Source: SEWRPC.

minimum area necessary for safe operations.[39] Since both Lakes are "no wake" waterbodies, eliminating high-speed boat use, it is unlikely that densities of any type of watercraft would reach levels as to be considered problematic or a safety issue.

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 weekday and a typical summer weekend day were conducted by SEWRPC staff. The results of these surveys are shown in Table 22. As shown in the table, overall there was very little use of watercraft on either Cravath Lake or Trippe Lake. No watercraft were observed to be in use on Trippe Lake on either a weekday or weekend day. On Cravath Lake, canoes and paddleboats were the most commonly used watercraft, and even then only in fairly small numbers.

Table 23 shows the various types of recreational activities engaged in by people using Cravath and Trippe Lakes during a typical summer weekday and a typical summer weekend in 2008. The most popular weekday and weekend recreational activities on the Lakes, both as a whole and individually, were: fishing from shore, going to the parks, and canoeing/paddleboating. Fishing from boats was also engaged in on Cravath Lake.

Recreational boating activities on Cravath and Trippe Lakes are currently regulated through City of Whitewater ordinances as appended hereto in Appendix B.

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

Table 22

WATERCRAFT IN USE ON CRAVATH AND TRIPPE LAKES: SUMMER 2008

Cravath Lake									
Date and Time	Powerboat	Pontoon Boat	Fishing Boat	Personal Watercraft	Sailboat	Canoe/ Kayak	Wind Surf Board	Paddleboat	Total
Thursday, July 17									
9:00 a.m. to 10:00 a.m.	0	0	0	0	0	0	0	0	0
1:30 p.m. to 2:30 p.m.	0	0	0	0	0	4	0	3	7
Sunday, July 20									
9:00 a.m. to 10:00 a.m.	0	0	1	0	0	1	0	0	2
1:30 p.m. to 2:30 p.m.	0	0	0	0	0	0	0	0	0

Trippe Lake									
Date and Time	Powerboat	Pontoon Boat	Fishing Boat	Personal Watercraft	Sailboat	Canoe/ Kayak	Wind Surf Board	Paddleboat	Total
Thursday, July 17									
9:00 a.m. to 10:00 a.m.	0	0	0	0	0	0	0	0	0
1:30 p.m. to 2:30 p.m.	0	0	0	0	0	0	0	0	0
Sunday, July 20									
9:00 a.m. to 10:00 a.m.	0	0	0	0	0	0	0	0	0
1:30 p.m. to 2:30 p.m.	0	0	0	0	0	0	0	0	0

Total for Both Lakes									
Date and Time	Powerboat	Pontoon Boat	Fishing Boat	Personal Watercraft	Sailboat	Canoe/ Kayak	Wind Surf Board	Paddleboat	Total
Thursday, July 17									
9:00 a.m. to 10:00 a.m.	0	0	0	0	0	0	0	0	0
1:30 p.m. to 2:30 p.m.	0	0	0	0	0	4	0	3	7
Sunday, July 20									
9:00 a.m. to 10:00 a.m.	0	0	1	0	0	1	0	0	2
1:30 p.m. to 2:30 p.m.	0	0	0	0	0	0	0	0	0

Source: SEWRPC.

LOCAL ORDINANCES

As shown in Table 24, the Towns of LaGrange, Richmond, Sugar Creek, and Whitewater have each adopted the Walworth County ordinances in regard to general zoning, floodland zoning, and shoreland or shoreland-wetland zoning; the Towns of Richmond and Whitewater have adopted the Walworth County ordinances in regards to subdivision control; the Towns of LaGrange and Sugar Creek have adopted both Town and Walworth County ordinances regarding subdivision control; the Towns of Sugar Creek and Whitewater have adopted the Walworth County ordinances regarding construction site erosion control and stormwater management; the Town of LaGrange has adopted its own ordinance regarding construction site erosion control/stormwater management; 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; and the City of Whitewater has adopted its own ordinances regarding general zoning, floodland zoning, shoreland or shoreland-wetland zoning, subdivision control, and construction site erosion control and stormwater management. The Town of Lima, in Rock County, has adopted Rock County ordinances in regards to floodland, shoreland and shoreland-wetland zoning, as well as construction site erosion control and stormwater management and has adopted the County's and its own ordinances regarding subdivision control. Rock County has no general zoning, hence the Town of Lima has adopted its own general zoning ordinances.

Table 23

PARTICIPANTS ENGAGED IN WATER-BASED RECREATION IN/ON CRAVATH AND TRIPPE LAKES: SUMMER 2008

Cravath Lake										
Date and Time	Fishing from Shoreline	Pleasure Boating	Skiing/ Tubing	Sailing	Operating Personal Watercraft	Swimming	Fishing from Boats	Canoeing/ Paddle Boating	Park Goers	Total
Thursday, July 17										
9:00 a.m. to 10:00 a.m.	8	0	0	0	0	0	0	0	8	16
1:30 p.m. to 2:30 p.m.	3	0	0	0	0	0	0	12	9	24
Total for the Day	11	0	0	0	0	0	0	12	17	40
Percent	28	0	0	0	0	0	0	30	42	100
Sunday, July 20										
9:00 a.m. to 10:00 a.m.	2	0	0	0	0	0	1	1	2	6
1:30 p.m. to 2:30 p.m.	4	0	0	0	0	0	0	0	12	16
Total for the Day	6	0	0	0	0	0	1	1	14	22
Percent	27	0	0	0	0	0	5	5	63	100

Trippe Lake										
Date and Time	Fishing from Shoreline	Pleasure Boating	Skiing/ Tubing	Sailing	Operating Personal Watercraft	Swimming	Fishing from Boats	Canoeing/ Paddle Boating	Park Goers	Total
Thursday, July 17										
9:00 a.m. to 10:00 a.m.	0	0	0	0	0	0	0	0	3	3
1:30 p.m. to 2:30 p.m.	0	0	0	0	0	0	0	0	2	2
Total for the Day	0	0	0	0	0	0	0	0	5	5
Percent	0	0	0	0	0	0	0	0	100	100
Sunday, July 20										
9:00 a.m. to 10:00 a.m.	5	0	0	0	0	0	0	0	3	8
1:30 p.m. to 2:30 p.m.	14	0	0	0	0	0	0	0	4	18
Total for the Day	19	0	0	0	0	0	0	0	7	26
Percent	73	0	0	0	0	0	0	0	27	100

Total for Both Lakes										
Date and Time	Fishing from Shoreline	Pleasure Boating	Skiing/ Tubing	Sailing	Operating Personal Watercraft	Swimming	Fishing from Boats	Canoeing/ Paddle Boating	Park Goers	Total
Thursday, July 17										
9:00 a.m. to 10:00 a.m.	8	0	0	0	0	0	0	0	11	19
1:30 p.m. to 2:30 p.m.	3	0	0	0	0	0	0	12	11	26
Total for the Day	11	0	0	0	0	0	0	12	22	45
Percent	24	0	0	0	0	0	0	27	49	100
Sunday, July 20										
9:00 a.m. to 10:00 a.m.	7	0	0	0	0	0	1	1	5	14
1:30 p.m. to 2:30 p.m.	18	0	0	0	0	0	0	0	16	34
Total for the Day	25	0	0	0	0	0	1	1	21	48
Percent	52	0	0	0	0	0	2	2	44	100

Source: SEWRPC.

Table 24

LAND USE REGULATIONS WITHIN THE AREA TRIBUTARY TO CRAVATH AND TRIPPE LAKES IN WALWORTH COUNTY BY CIVIL DIVISION: 2003

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 LaGrange	County ordinance	County	County	County and Town	Adopted
Town of Richmond	County ordinance	County	County	County	- -[a]
Town of Sugar Creek	County ordinance	County	County	County and Town	County
Town of Whitewater	County ordinance	County	County	County	County
City of Whitewater	City ordinance	City ordinance	City ordinance	City ordinance	City ordinance
Rock County	- -	Adopted	Adopted	Adopted	Adopted
Town of Lima	Adopted	County	County	County and Town	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.

Chapter III

COMMUNITY QUESTIONNAIRE SURVEY

INTRODUCTION

An integral part of the process of lake protection plan formulation was the conduct of a questionnaire-based survey of City of Whitewater residents.[1] The questionnaire was developed jointly by the University of Wisconsin-Whitewater (UWW), the Southeastern Wisconsin Regional Planning Commission (SEWRPC), and the City of Whitewater *Ad Hoc* Lake Committee. Initial framing of the issues of concern to be addressed in the survey commenced during the autumn of 2008, with collaborative scoping meetings held under the auspices of the City of Whitewater *Ad Hoc* Lake Committee, and in which SEWRPC staff and UWW staff participated. These discussions helped to identify the broad thematic areas to be addressed, and the specific types of information to be collected, through a survey of City residents. Detailed survey design commenced during the spring of 2009, with the questionnaire being sent to all residential properties within the City during the summer of 2009.

SURVEY DESIGN

A mail-drop questionnaire survey instrument—the Trippe and Cravath Lakes Community Survey—was developed to collect a broad spectrum of primary information from residents of the City of Whitewater.

The overall purpose of the survey was to assess residents' uses of Trippe and Cravath Lakes, their uses of lakes other than Trippe and Cravath Lakes, their levels of awareness and concern related to various issues affecting the Lakes, and their willingness to pay for conducting programs that would improve Trippe and Cravath Lakes. The initial scoping meetings identified a number of distinct categories of information to be targeted through the survey. Survey design began with the categories of information and questions identified during these meetings, and proceeded through several iterations of refinement and review. The main types of questions included in the survey instrument were designed to gather information and insights from the City of Whitewater residents with regard to the following topic areas:

- Opinions regarding the importance of a range of issues affecting the State of Wisconsin and City of Whitewater—these questions helped to identify the relative importance ascribed by residents to various issues, including enhancement of "the quality of environmental resources such as recreational lakes."

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[1]*This chapter was prepared by Professor Mark E. Eiswerth, Ms. Paige Peterson, and Ms. Christie Kornhoff, Economics Department, Hyland Hall, College of Business & Economics, University of Wisconsin-Whitewater 53190.*

- Basic information on the resident's dwelling in the City of Whitewater—these questions were designed to gather basic information on where the respondent's property was located in relation to Trippe and Cravath Lakes, and on how often the dwelling was typically occupied. Given that a percentage of the City's residential properties are occupied by students attending UWW, questions were included to ascertain the distance from the respondent's dwelling to the Lakes; the identity of the Lake closest to the dwelling; ownership status; the length of time the respondent has lived in the dwelling; the length of time the respondent has lived in the City of Whitewater; and, the residency status of the respondent—whether full time or part time, including the number of months, by season, that the respondent lives in the City of Whitewater.

- The respondent's use of Cravath and/or Trippe Lakes—these questions asked respondents if they or an immediate family member had visited either Cravath Lake or Trippe Lake within the last 12 months. For those respondents who had visited either Cravath Lake or Trippe Lake, the survey sought to determine the numbers of visits made by the respondent or family members to the Lakes during that period of time. The survey also sought to determine the kinds of recreational activities (boating, fishing, etc.) in which the respondent or their family members typically engaged while at Cravath or Trippe Lakes. These are key questions that help to establish the recreational use patterns of residents. Other questions sought to ascertain the mode of transportation used by residents to access the Lakes (motor vehicle, on foot, etc.) and boat ownership patterns.

- The respondent's activities at lakes other than Trippe and Cravath Lakes—these questions sought to identify whether respondents or their families had visited other lakes within the past 12 months; how many days they spent at other lakes over the past year; and, the favorite lakes that respondents liked to visit. These questions sought to characterize alternate lake sites that are utilized by City of Whitewater residents.

- Respondent awareness and concern about various issues affecting Trippe and Cravath Lakes—these questions were included to identify the level of awareness of issues relevant to Trippe and Cravath Lakes. Respondents also were asked to indicate their levels of concern about various problems associated with the Lakes. Specifically, respondents were asked about their levels of concern regarding the two issues dealt with in the contingent valuation scenarios described below; namely, 1) aquatic plant species present in Trippe and Cravath Lakes, and 2) sediments present in the Lakes, related to loss of depth and changes in water quality. Respondents also were asked to indicate how these problems affected (if at all) the quality of their enjoyment of Trippe and Cravath Lakes.

- Willingness to pay for improvements in lake quality—these questions formed an important center-piece of the survey. Respondents were presented with three potential programs to improve Trippe and Cravath Lakes, and were asked to indicate their willingness-to-pay (WTP) to support the improvement programs, through payment of additional property taxes, each year for the next 10 years. The three improvement programs included: 1) the conduct of aquatic plant management programs within Trippe and Cravath Lakes, 2) sediment removal from the Lakes, and 3) the conduct of both aquatic plant control and sediment removal. These lake improvement scenarios are described more fully below.

- Respondent demographic characteristics—these questions sought to ascertain characteristics of respondents including annual income, education, and age.

A copy of the Trippe and Cravath Lakes Community Survey instrument is appended to this report as Appendix C. Two versions of the survey instrument were prepared and randomly distributed to potential residential respondents; the two versions included a) scenarios 1 and 3, and b) scenarios 2 and 3, as summarized above.

The Trippe and Cravath Lakes Community Surveys were mailed to all residents of the City of Whitewater during the summer of 2009. The mailing was accompanied by an advanced media release disseminated in area newspapers, including the *Whitewater Register* (June 18, 2009) and *Janesville Gazette* (June 20, 2009).

Returned surveys were carefully tabulated and evaluated by UWW staff. A total of 432 surveys, or 16 percent of the 2,748 surveys mailed, were completed and returned by respondents. The responses to the survey are summarized below, and tabular summaries are presented in Appendix D.

OVERVIEW OF SURVEY RESULTS

Respondent Characteristics

Through map-based analysis of the street addresses used in the mail survey sample, it was determined that a large number of the respondents lived very close to the Lakes. Approximately 51 percent of the respondents lived within one-half mile or less of the closest Lake's shoreline, and 69 percent lived within one mile or less from the shoreline. Approximately 66 percent of the respondents indicated that their dwellings were located closer to Cravath Lake than to Trippe Lake. Only 12 percent of the respondents indicated that they actually lived directly on one of these Lakes.

The majority of the respondents (88 percent) owned their residence in the City of Whitewater while 12 percent rented their homes. The average respondent has lived at their current residence for 14 years, and has lived in the City of Whitewater for 27 years. Almost all of the respondents (94 percent) were year-round residents of the City of Whitewater. Among those who were not year-round residents (6 percent), most lived in the City of Whitewater for between seven and eight months of the year; the average number of months spent in the City during the Fall, Summer, Spring, and Winter was 2.45, 2.25, 1.70, and 0.70 months, respectively.

The survey did not ask respondents to report their exact annual household incomes; rather, respondents were asked to select from an income range listed in the survey that best described their incomes. The resulting survey data indicated that the total annual household incomes of the respondents were diverse. The largest percentage of respondents (13 percent) fell into the $50,000 to $59,999 per year range. The next most common income range was $40,000 to $49,999 per year (12 percent of respondents). Roughly 11 percent of respondents fell into the $30,000 to $39,999 per year range and an equal percentage (11 percent) into the $100,000-$149,000 per year range. About one-half of the respondents reported an annual household income of less than $50,000.

Respondents were also diverse with respect to education, although a large percentage are relatively well educated. The highest percentage of respondents (36 percent) indicated they had completed a graduate degree. This was followed by those who had completed a four-year degree (20 percent of respondents), those who had completed some college or technical school (19 percent). Those with a high school certificate comprised 12 percent of the respondents; those who had completed some graduate classes (8 percent); and, those who had completed a two-year degree (4 percent).

The survey did not ask respondents to indicate their exact age, but rather to indicate their age range among the several ranges indicated in the survey. The largest percentage of respondents (24 percent) fell into the 55 to 64 years age range. Approximately 45 percent of the respondents were 54 years of age or younger.

Additional details regarding the characteristics of the respondents are presented in tabular format in Appendix D.

Use of Trippe and Cravath Lakes

The majority of respondents (76 percent) reported that either they or an immediate family member had visited either Trippe Lake or Cravath Lake at least once within the past 12 months. On average, respondents visited the Lakes 32 times within the past year, with the largest number of respondents (46 percent) visiting between one and 10 times. These survey data indicate a relatively high rate of visitation to the Lakes by City of Whitewater residents.

The most popular activities at Trippe and Cravath Lakes, ranked in order of the percentage of respondents that engaged in the activities, were as follows:

- Attending community special events (74 percent of respondents)
- Relaxing/entertaining (66 percent)
- Exercising (47 percent)
- Watching wildlife/birds (45 percent)
- Fishing (not including ice fishing) (32 percent)
- Picnicking (26 percent)

Relatively few respondents indicated that they used the Lakes for canoeing/kayaking (14 percent), ice fishing (7 percent), or swimming or wading (62 percent).

A substantial number of respondents (27 percent) owned a boat, and among boat owners most had either a fishing boat with outboard motor (48 percent) or canoe (45 percent). Despite this, very few respondents used their boats on Trippe and Cravath Lakes, as reported below. Finally, respondents were evenly split on how they typically travelled to the Lakes: 51 percent reported that they travelled there on foot, while the same percentage travelled there by motor vehicle. Only 18 percent of the respondents travelled to the Lakes by bicycle.

Activities at Other Lakes

The majority of the survey respondents (62 percent) had visited lakes other than Trippe and Cravath Lakes during the past 12 months. Among those who had visited other lakes, the average number of days spent at the lakes was 17 days per year, with approximately 62 percent spending between one day and 10 days per year, and 17 percent spending between 11 and 20 days per year at the other lakes.

Respondents' favorite lakes to visit were within driving distance of their homes. These lakes, ranked in order of the percentage of respondents that listed a specific lake as their favorite, were as follows:

- Whitewater Lake (20 percent of respondents)
- Geneva Lake (8 percent)
- ***Cravath Lake*** (6 percent)
- Lake Michigan (7 percent)
- Rice Lake (4 percent)
- Delavan Lake (4 percent)
- Pleasant Lake (4 percent)
- Lauderdale Lakes (3 percent)
- Ottawa Lake (3 percent)
- ***Trippe Lake*** (3 percent)
- Turtle Lake (2 percent)
- Rock Lake (2 percent)

A complete listing of favorite lakes is included in Appendix D.

Survey Respondents' Views on Lake Topics and Other Issues

Opinions on a Range of Issues Affecting the State of Wisconsin and the City of Whitewater

In survey research it often is useful to gauge the relative importance that respondents place on a variety of issues, including and in addition to the primary issue focused on in the survey. This survey asked residents to indicate how important (on a 5-point Likert scale, with 1 = "Not at all important" and 5 = "Extremely important") they felt it would be to undertake various actions in their area. Ranked in order of importance, the results were as follows:

1. Make state and local government more efficient (mean score = 3.98/5)–identified by 37 percent of respondents as "extremely important."

2. Address the economic crisis by stemming the loss of jobs in your area (mean score = 3.96/5)–identified by 36 percent of respondents as "extremely important."

3. Improve schools in your area (mean score = 3.59/5)–identified by 28 percent of respondents as "extremely important."

4. Preserve working agricultural lands in your area (mean score = 3.53/5)–identified by 24 percent of respondents as "extremely important."

5. Enhance the quality of environmental resources such as recreational lakes (mean score = 3.46/5)–identified by 25 percent of respondents as "extremely important."

6. Develop more restaurants and shops in your area (mean score = 3.13/5)–identified by 19 percent of respondents as "extremely important."

7. Create more local hiking and biking trails (mean score = 2.59/5)–identified by 9 percent of respondents as "extremely important."

8. Increase local security against terrorism (mean score = 2.41/5)–identified by 7 percent of respondents as "extremely important."

The results above indicate that City of Whitewater residents do believe it is important to enhance the quality of environmental resources such as recreational lakes. However, residents on average attached greater importance to other issues, including state and local government efficiency, job loss, education, and the preservation of agricultural lands.

Levels of Awareness of Trippe and Cravath Lake Issues

This section of the survey listed seven issues that are relevant for Trippe and Cravath Lakes. Respondents were asked to indicate their level of awareness with each of these issues on a three-point scale (1 = "I am not at all aware of this possible issue"; 2 = "I am somewhat aware of this issue"; and, 3 = "I am very much aware of this issue").

The survey results showed that mean awareness scores for various lake-related issues range from 1.81/3 to 2.53/3. Respondents reported being most aware of the issue that "the Lake's water clarity is poor" (mean awareness score =2.53/3). The complete set of issues and accompanying awareness scores, ranked in order from highest to lowest, are:

1. The Lakes' water clarity is poor (mean awareness score = 2.53/3)

2. Residential development is occurring along Lakes (mean score = 2.44/3)

3. Agricultural runoff may affect Lake water quality (mean score = 2.32/3)

4. The Lakes are shallow (mean score = 2.28/3)

5. Sanding and salting of roads may affect Lake water quality (mean score = 2.24/3)

6. The Lakes have large amounts of aquatic plants (mean score = 2.16/3)

7. Commercial development is occurring near the Lakes (mean score = 1.81/3)

Levels of Concern Regarding Key Problems at Trippe and Cravath Lakes

As described in the following sections, the balance of the survey focused on two issues in particular that were identified by the *Ad Hoc* Committee as being important at Trippe and Cravath Lakes: undesirable aquatic plants, and sedimentation of the Lakes that has caused loss of depth and changes in water quality. In relation to these issues, the results above indicate that residents are relatively quite aware of poor water clarity in the Lakes, while somewhat less aware of shallowness of the Lakes and the presence of large amounts of aquatic plants. A complete presentation of the issue awareness results appears in tabular format in Appendix D.

The survey included the following text to introduce respondents to the two key problems:

> "Resource managers currently are concerned about the quality of Cravath and Trippe Lakes and resulting negative impacts on our ability to enjoy them. Undesirable weed species (for example, Eurasian water milfoil) are present in and around these lakes. Such weeds crowd out native aquatic plants (e.g., lily pads); reduce the quality of habitat for sportfish; and make it difficult to swim or operate boats. Resource managers are concerned about the deposits of sediment into these lakes. Too much sediment makes the lakes too shallow to support recreational uses such as swimming and boating, and increases problems with odor and poor water clarity."

The survey then asked respondents to rate their levels of concern for these problems at the lakes, using a 5-point Likert scale with 1 = "Not at all concerned," 2 = "A little concerned," 3 = "Somewhat concerned," 4 = "Very concerned," and 5 = "Extremely concerned."

The mean responses to this question for the two issues were similar, with a score of 3.52 for aquatic plant species and 3.59 for sedimentation. Approximately 28 percent and 26 percent of residents, respectively, were "extremely concerned" or "very concerned" about aquatic plant species present in the Lakes. In addition, 25 percent were "somewhat concerned" about this problem. Only 9 percent of residents were "not at all concerned" about aquatic plants.

With regard to sediment in the Lakes and associated decreases in depth and changes in water quality, 30 percent and 27 percent of residents were "extremely concerned" and "very concerned," respectively. Approximately 23 percent were "somewhat concerned," while only 9 percent were not at all concerned.

In general, the above results suggest that the average City of Whitewater resident's level of concern about these two key issues is substantial (in both cases, closer to very concerned than somewhat concerned). The results also indicate that residents are roughly equally concerned about these two problems at the Lakes.

Effect of Concerns on Lake Enjoyment

The survey also asked respondents to indicate how these two problems (aquatic plants and sediment in the Lakes) "affect (if at all) the quality of your enjoyment of Cravath and Trippe Lakes." Respondents were asked to circle one number using a 5-point Likert scale with 1 = "Does not at all reduce my enjoyment of these Lakes," 2 = "Reduces my enjoyment of these Lakes a little," 3 = "Somewhat reduces my enjoyment of these Lakes," 4 = "Reduces my enjoyment of these Lakes a lot," and 5 = "Reduces my enjoyment of these Lakes extremely."

The impact of aquatic plants on enjoyment of the Lakes (mean response = 3.28/5) was found to be slightly greater than the impact of sediment and its associated loss of depth and changes in water quality (mean response = 3.19/5). For both impacts, however, the mean response was between "somewhat reduces enjoyment" and "reduces enjoyment a lot." In total, 48 percent of respondents indicated that aquatic plants reduced their enjoyment either

"a lot" (= 4) or "extremely" (= 5). Similarly, 47 percent indicated that sedimentation and its accompanying impacts in the Lakes reduced their enjoyment "a lot" or "extremely." For the majority of respondents (72 percent in the case of aquatic plants and 69 percent for sediment), these lake problems reduced their quality of enjoyment of Trippe and Cravath Lakes at least "somewhat" and more than "a little."

Responses to Willingness to Pay Scenarios for Weed Control and Sediment Removal

The next module of the survey comprised a key component of this research project. It addressed residents' Willingness-to-Pay (WTP) for programs that would improve the Lakes in relation to the two key issues referenced above (aquatic plants and sediments). This section began with the following text:

> "The next several questions ask about your willingness to pay for conducting programs to improve Cravath and Trippe Lakes. In order to conduct the programs, money will need to be raised. This may be done by creating a "special tax district" affecting you and your neighbors living in the City of Whitewater. Money to fund the programs would be raised through increased property taxes, and all money raised would be used only for the lake programs. When answering, please consider your income, other things you spend money on, and the many other possible programs that could be funded by your local government."

Then, the survey included three WTP scenarios and questions related to the following three programs: 1) aquatic plant control, 2) sediment removal, and 3) a program combining both aquatic plant control and sediment removal. The scenarios/questions and corresponding survey results are discussed in turn in the following three sections.

Willingness to Pay for the Aquatic Plant Control Program

The scenario/question for aquatic plant control was as follows:

> PLEASE CONSIDER CAREFULLY THE FOLLOWING PROPOSED SCENARIO FOR WEED CONTROL AT CRAVATH AND TRIPPE LAKES:
>
> As mentioned above, Cravath and Trippe Lakes currently have undesirable weed species. Resource managers are considering a weed removal program. Weed removal may be done by hand pulling and raking or by using approved chemicals that do not affect humans or wildlife. Resource managers would use the method considered to be safest and most cost-effective, and the method would be repeated as necessary to control weeds. The program will:
>
> - Enhance the habitat for fish, including those caught by recreational anglers
> - Reduce unpleasant physical contact with weeds while engaging in water-based recreation such as swimming
> - Result in visual improvements to the lakes
> - Allow native plant species to return
> - Improve the biological functioning of the lake
>
> This weed control program by itself will NOT address the buildup of sediment in the lakes, which is discussed next.
>
> How much would you be willing to pay in additional property taxes each year, for the next 10 years, in order to do the weed control program? (Circle one number.)

$0	$3	$10	$40	$125	$450	$1,500	$5,000
$1	$5	$15	$60	$200	$650	$2,250	More than $5,000
$2	$8	$25	$90	$300	$1,000	$3,300	Don't know

Table 25

SURVEY RESPONDENTS' WILLINGNESS TO PAY FOR A WEED CONTROL PROGRAM FOR TRIPPE AND CRAVATH LAKES THROUGH INCREASED PROPERTY TAXES EACH YEAR

Amount (dollars per year)	Frequency	Percent
$0	98	24.56
$1-$9	29	7.27
$10-$25	97	24.31
$26-$99 (Mean = $67.46)	74	18.55
$100-$300	57	14.29
$301-$999	7	1.75
$1,000-$5,000	3	0.75
More than $5,000	1	0.25
Don't Know	33	8.27
Total	399	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

The results of the aquatic plant control program WTP scenario are shown in Table 25, in which the WTP responses are grouped into different bins (ranges, or categories). The mean WTP was $67/yr. Among those with a nonzero WTP, the largest percentage of residents (24 percent) was willing to pay between $10 per year and $25 per year for aquatic plant control. In the next largest bin, 19 percent of residents were willing to pay between $26 per year and $99 per year. Note, however, that a sizeable percentage of respondents (25 percent) had zero bids; indicating that they would not be willing to pay for the aquatic plant control program.

Willingness to Pay for the Sediment Removal Program

The scenario/question for sediment removal was as follows:

PLEASE CONSIDER CAREFULLY THE FOLLOWING PROPOSED SCENARIO FOR SEDIMENT REMOVAL AT CRAVATH AND TRIPPE LAKES:

As mentioned above, Cravath and Trippe Lakes currently have large deposits of sediment. Resource managers are considering a sediment removal program. Sediment removal is done using precision land-based or water-based equipment, and the extracted sediment would be removed from the area and deposited safely outside of Whitewater. The method would be repeated as necessary to control sediment. The program will:

- Create deeper lakes
- Allow for better swimming and watercraft operation, including creating new areas that currently cannot be used for water-based recreation
- Reduce odor and increase water clarity

This Sediment Removal Program by itself will NOT reduce the undesirable weeds in the lakes, which was discussed previously.

How much would you be willing to pay in additional property taxes each year, for the next 10 years, in order to do the sediment removal program? (Circle one number.)

$0	$3	$10	$40	$125	$450	$1,500	$5,000
$1	$5	$15	$60	$200	$650	$2,250	More than $5,000
$2	$8	$25	$90	$300	$1,000	$3,300	Don't know

The results of the sediment removal program WTP question are shown in Table 26. The mean WTP was $72 per year, very close to, but slightly higher than, the WTP for the aquatic plant control program, which had a WTP of $67 per year. Among those with a nonzero WTP, the largest percentage of residents (22.5 percent) was willing to pay between $10 per year and $25 per year for sediment removal. In the next largest bin, 19.5 percent of residents were willing to pay between $26 per year and $99 per year. Similar to the results for the aquatic plant control program scenario, a substantial percentage of respondents (25.5 percent) had zero bids; that is, they were not willing to pay for a sediment removal program at Trippe and Cravath Lakes.

Table 26

SURVEY RESPONDENTS' WILLINGNESS TO PAY FOR A SEDIMENT REMOVAL PROGRAM FOR TRIPPE AND CRAVATH LAKES THROUGH INCREASED PROPERTY TAXES EACH YEAR

Amount (dollars per year)	Frequency	Percent
$0	102	25.50
$1-$9	23	5.75
$10-$25	90	22.50
$26-$99 (Mean = $72.27)	78	19.50
$100-$300	62	15.50
$301-$999	7	1.75
$1,000-$5,000	4	1.00
More than $5,000	1	0.25
Don't Know	33	8.25
Total	400	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

Table 27

SURVEY RESPONDENTS' WILLINGNESS TO PAY FOR BOTH WEED CONTROL AND SEDIMENT REMOVAL PROGRAMS FOR TRIPPE AND CRAVATH LAKES THROUGH INCREASED PROPERTY TAXES EACH YEAR

Amount (dollars per year)	Frequency	Percent
$0	93	23.54
$1-$9	15	3.80
$10-$25	62	15.70
$26-$99	78	19.76
$100-$300 (Mean = $113.24)	90	22.78
$301-$999	19	4.81
$1,000-$5,000	7	1.77
More than $5,000	2	0.51
Don't Know	29	7.34
Total	395	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

Willingness to Pay for a Combination of Both Programs (Aquatic Plant Control plus Sediment Removal)
Finally, the survey asked respondents to indicate their WTP for a combination program that would involve both aquatic plant control and sediment removal. A motivation for posing this question was to explore whether the average City of Whitewater resident considers the two potential programs to be substitutes or complements. If they are considered to be complementary programs (the perceived benefits yielded from undertaking one of them would enhance the perceived benefits obtained from the other), then one might expect the WTP for the combined program to be greater than the sum of the two WTP values for the individual programs. On the other hand, if the programs are considered by residents to be substitutes for one another, then one would expect the WTP for the combined program to be less than the sum of the two WTP values for the individual programs.

The scenario/question for a combination program including both weed control and sediment removal was as follows:

> FINALLY, PLEASE CONSIDER CAREFULLY A COMBINATION OF BOTH PROGRAMS:
>
> Resource managers are considering BOTH weed control AND sediment removal. This will result in all of the benefits listed above for BOTH of these programs. How much would you be willing to pay in additional property taxes each year, for the next 10 years, in order to do both the weed control program and the sediment removal program? (Circle one number.)

$0	$3	$10	$40	$125	$450	$1,500	$5,000
$1	$5	$15	$60	$200	$650	$2,250	More than $5,000
$2	$8	$25	$90	$300	$1,000	$3,300	Don't know

The results of the WTP question for the combination program (aquatic plant control plus sediment removal) are shown in Table 27. The mean WTP was $113 per year. This is less than the sum of the mean WTP values for the two individual programs ($67.46 + $72.27 = $139.73), perhaps indicating that the average resident considers the aquatic plant control and sediment removal programs to be substitutes rather than complements. Alternatively, it may be the case that there is a limit on the total amount that the average resident is willing to pay for overall improvement of the Lakes, and that this is made manifest by the WTP values elicited when the possibility of a combination program is proposed.

Among those respondents with a nonzero WTP, the largest percentage (23 percent) was willing to pay between $100 per year and $300 per year for a combination program of aquatic control plus sediment removal. In the next largest bin, 20 percent of residents were willing to pay between $26 per year and $99 per year. Similar to the results for the individual programs, a substantial percentage of respondents (24 percent) had zero bids; they were unwilling to pay for a combination program of aquatic plant control plus sediment removal at Trippe and Cravath Lakes.

SUMMARY

There were 432 responses to the approximately 2,803 questionnaires sent out. The numbers of responses (15 percent) were within the expected rate of response for a statistically valid survey. However, not all 432 respondents answered every question.

About one-half of the respondents were determined to live within one-half mile of the Lakes, based upon the mapping analysis associated with the coding of the survey instruments. In contrast, roughly the same percentage of respondents, when asked to estimate the distance to the nearest waterbody, thought that they lived between one-half mile and two miles away from the nearest Lake. About 90 percent of respondents reported that they did not live on either Lake. Somewhat more than twice as many respondents live closer to Cravath Lake (two-thirds of respondents) than the number living close to Trippe Lake (one-quarter of respondents).

The majority (88 percent) of respondents owned the residences in which they lived, with the average length of residence in the home being just under 15 years. The respondents, however, indicated that on average they lived in the City for just over 25 years. Most (94 percent) were year round residents. Of the seasonal residents, the average length of residence was about eight months annually, with summer and fall being the most likely months of residence.

About three-quarters of respondents reported visiting the Lakes during the previous year, with about one-half of those respondents visiting the Lakes between one and 10 times. The average number of visits to the Lakes during a year was reported to be about 30. About one-half of respondents reported visiting the lakes for community events, relaxation, and/or exercise. Boating was the activity in which the fewest numbers of respondents participated. Bird watching, fishing, and picnicking each occupied about 10 percent of the respondents.

The numbers of people visiting the Lakes were equally divided with respect to the mode of travel, with about 40 percent each using motor vehicles or travelling on foot.

One-quarter of respondents owned a boat, with (outboard motorized) fishing boats and canoes being the most common types of boats owned.

Two-thirds of respondents also visited other lakes in the area in the last year, with about two-thirds of these respondents doing so on between one and 10 occasions; the average number of visits to other lakes was about 15. Other lakes visited included a range of lakes across the state, but one-fifth of respondents indicated Whitewater Lake as their typical destination and about one-tenth indicated Geneva Lake as their destination.

A majority of respondents (slightly more than one-half) noted that they felt that enhanced or improved local environmental resources, numbers of shops and restaurants, agricultural lands, and schools were important. More efficient government and job loss were identified as highly important; recreational trails and security from terrorism were noted as being of lesser importance.

There was a moderate level of awareness of lake issues on average: lake issues included shallow depths, weeds, residential and commercial development in their vicinity, poor water clarity, and the role of agricultural runoff and the role of road salts on lake water quality.

There was a somewhat greater level of concern expressed by respondents with aquatic plants and sediment being of moderate concern. These issues also led to some reduction in the level of enjoyment experienced by lake users. About one half of the respondents also noted other problems of concern that affected their enjoyment of these resources.

With regard to the willingness to pay, the respondents were almost equally divided between those who did not want to pay (one-quarter of respondents indicating $0) and those willing to pay $10 to $25, for **either** aquatic plant control **or** sediment removal. Insofar as willingness to pay for both aquatic plant control and sediment removal was concerned, about one-quarter also indicated that they did not want to pay, while an equal number indicated a willingness to pay between $100 and $300 for **both** of these activities (about $115 being the average).

The median income level of respondents was about $50,000 per year. Two-fifths of respondents had a post graduate degree, and one-fifth each had either a four-year degree or technical qualification. Almost all (95 percent) respondents indicated that they were not university students; the median age of respondents being about 55 years.

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Chapter IV

ISSUES OF CONCERN

INTRODUCTION

Cravath and Trippe Lakes and their associated tributary areas generally are able to support a variety of recreational opportunities—both through the Southern Unit of the Kettle Moraine State Forest, which extends from the City of Whitewater in Walworth County to the Village of Dousman in Waukesha County, and through the City of Whitewater Park and Recreation System—as well as some limited lake-oriented activities conducted on Trippe and Cravath Lakes. However, there are a number of existing and potential future problems and issues of concern that should be addressed in this lake protection plan to enhance these recreational opportunities and contribute to the quality of life experiences of the citizens of the City and the State. Based upon the inventory data included in Chapter II, these issues of concern can be determined to include: urban development and stormwater management, public recreational water use, sediment management and water quality, hydrology, aquatic plant management, and institutional development.

In addition to the issues of concern identified through this planning program, the University of Wisconsin-Whitewater conducted a mail drop questionnaire survey of the City of Whitewater households during 2009. This survey was designed to evaluate and assess the legitimate demands of the lake residents for access to water-based recreational opportunities and maintenance of residential ambience within the City. The survey instrument is included herein as Appendix C. The results of the survey have been summarized in Chapter III of this report. Based upon the responses to the questionnaire survey documented in Chapter III, the lake-oriented issues of concern to the City of Whitewater respondents include: public recreational water use, sediment management and water quality, and aquatic plant management.

This chapter utilizes the scientific data and information gathered from Cravath Lake and Trippe Lake to define from a technical base the major land and lake concerns. As stated in Chapter II of this report, this chapter is based on the premise that in-lake concerns are a reflection of land use and management in the drainage areas tributary to the Lakes. While it is true that lakes, as accreting systems, will trap and metabolize nutrients and other contaminants that are generated from the upstream watershed by natural processes, humans can and do accelerate this process of mobilizing contaminants and hastening the process of lake aging, or eutrophication. Further, because impoundments generally have larger watershed than natural lakes, these waterbodies are often subjected to much more rapid enrichment than their natural counterparts. In the cases of Trippe and Cravath Lakes, both of which are impoundments, this process was further accelerated by their urban location and the intensive use of the lakes as hydropower sources—in their early history, by their use as stormwater management systems—in their middle history, and as recreational and aesthetic resources—at the present time.

URBAN DEVELOPMENT AND STORMWATER MANAGEMENT

Human activities upon the land surface result in the generation and mobilization of contaminants that are transported to lakes by rainfall, wind, and runoff. In urban areas, which generally include significant areas of impervious surface in the form of roadways, walkways, rooftops, and related stormwater conveyance systems, this mobilization and transport of contaminants can be enhanced in the absence of mitigating measures. Additionally, where such activities involve the exposure of the soil surface, larger contaminant loads result. Thus, erosion during construction and generation of nonpoint source pollutants associated with new urban development often represent potentially significant threats to water quality. The majority of lands within the total tributary area of Cravath and Trippe Lakes are under agricultural use or are designated as open lands. As these lands are developed, land disturbing activities associated with construction and redevelopment, along with increases in urban land uses and associated impervious surfaces, will increase runoff into the Lakes, subject to Chapter NR 151 guidance on runoff management, and may increase some nonpoint source pollutant loadings that represent a potentially significant threat to the Lake's water quality. Consequently, urban areas, urban development, and associated stormwater management are important issues to be considered.

PUBLIC RECREATIONAL WATER USE

As evident from the results of the recreational surveys conducted by Southeastern Wisconsin Regional Planning Commission (SEWRPC) staff on Cravath and Trippe Lakes in 2008, and presented in Chapter II, the Lakes currently do not appear to be subjected to the same types and intensities of recreational use as many other lakes in Southeastern Wisconsin. These observations by Commission staff were supplemented by a further assessment of the present and forecast future recreational uses of Cravath and Trippe Lakes through a mail drop questionnaire survey, conducted in 2008 by the University of Wisconsin-Whitewater. This latter survey, as noted in Chapter III, was conducted pursuant to UWEX Lakes Partnership guidelines and current Wisconsin Department of Natural Resources (WDNR) protocols.

A majority of respondents (slightly more than one-half) to the survey noted that they felt that enhanced or improved local environmental resources, numbers of shops and restaurants, agricultural lands, and schools were important. More efficient government and job loss were identified as highly important; while recreational trails and security from terrorism were noted as being of lesser importance. There was a moderate level of awareness of lake issues: lake issues identified by respondents included shallow depths, weeds (aquatic plants), residential and commercial development in their vicinity, poor water clarity, and the role of agricultural runoff and the role of road salts on lake water quality. There was a somewhat greater level of concern expressed by respondents with weeds and sediment being of moderate concern. These issues also led to some reduction in the level of enjoyment experienced by lake users. About one half of the respondents also noted other problems of concern that affected their enjoyment of these resources.

Consequently, recreation and recreational use issues are important issues to be considered both from the point of view of the diagnostic analysis as well as from the point of view of the people of the City of Whitewater.

HYDROLOGY

Lake issues of concern identified by respondents included shallow depths. The depths of the two impoundments were recurring themes during public meetings held throughout the process of formulating and executing this planning program. Considerable concern over the sources of the sediments being deposited in the Lakes was noted, both in terms of the loss of recreational use opportunities due to the presence of muck and in terms of the need to identify measures to minimize future inputs of sediment to the impoundments and remediate the sediments currently present in the basins of the Lakes.

The issue of loss of lake depth has several contributing factors, including that related to water as the transport medium for sediments eroded from the land surface within the drainage area and transported to the Lakes. It is also associated with the growth, death, and decay of aquatic plants within the Lake basins, which in turn is related

to the water quality status, presence of abundant quantities of plant nutrients, and shallow nature of the Lakes. In this regard, shallow lakes, of which Trippe and Cravath Lakes are representative, are characterized by abundant growths of aquatic plants. This latter issue of concern is elaborated below.

For the purposes of this plan element, it is the former issue of concern, sediment transported and deposited in the Lakes from their watersheds—and the associated loss of lake depth, that is of interest, especially since it engages stormwater management concerns of the City of Whitewater.[1] Consequently, hydrological issues are important issues to be considered.

SEDIMENT MANAGEMENT AND WATER QUALITY

Lake issues of concern identified by respondents, together with loss of lake depth, included poor water clarity, and the role of agricultural runoff and the role of road salts in degrading lake water quality. Related to the hydrological concerns noted above, the influx of sediments and contaminants, and resultant decline in water quality, are the manifestations of poor quality water identified by the majority of the respondents to the community questionnaire survey. In this regard, turbid water and an abundance of rooted, floating leaved, and emergent aquatic plants in the two lakes are classic characteristics of shallow lakes.

The degree to which these symptoms are related to historical management practices, such as the discharge of wastewaters noted in Chapter II, have relevance for the determination of possible remedial measures, a principle example of which would include dredging the accumulated sediments. While this type of remedial measure entails significant costs and involves potentially costly and time-consuming permitting—required pursuant to Chapter 30 of the *Wisconsin Statutes*—and sediment testing—required pursuant to Chapter NR 347 of the *Wisconsin Administrative Code*, Sediment Sampling and Analysis, Monitoring Protocol and Disposal Criteria for Dredging Projects—sediment management is an important consideration in terms of maintaining water quality conditions in the Lakes that are consistent with the desired uses of the Lakes, as expressed by respondents to the questionnaire survey summarized in Chapter III. Consequently, sediment management and water quality are important issues to be considered.

AQUATIC PLANT MANAGEMENT

Lake issues of concern identified by respondents included weeds (aquatic plants); among these aquatic plants, the presence of Eurasian water milfoil (*Myriophyllum spicatum*) and curly-leaf pondweed (*Potamogeton crispus*) in the basins of Cravath and Trippe Lakes is an important issue of concern. These invasive aquatic plants often outcompete native aquatic plants and, without management, frequently dominates the plant communities in the lakes of southeastern Wisconsin, to the detriment of native plant species and their associated fish and wildlife populations.

There also is increasing evidence that Eurasian water milfoil will hybridize with native or northern water milfoil, increasing the invasive nature of this genus.[2] The recent aquatic plant surveys of Cravath and Trippe Lakes conducted by SEWRPC staff suggest that Eurasian water milfoil has achieved sufficient abundance within the Lakes that it is interfering with human recreational and aesthetic use of the Lakes as natural resources. As discussed in Chapter II and documented in Chapter III, aquatic plants in general and Eurasian water milfoil in particular are widespread in the Lakes and, therefore, aquatic plant management is an issue that should be considered.

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[1]*The City of Whitewater is not an MS4 municipality designated pursuant to Section NR 216.02(3) of the* Wisconsin Administrative Code.

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

INSTITUTIONAL DEVELOPMENT

As the Cravath and Trippe Lakes community seeks a more active role in the management of the Lakes, it is essential that an adequate institutional base to support such activities be developed. Currently, the community-based lake management activities are being carried out by the City of Whitewater. To facilitate the conduct of this institutional organization analysis, the City has formed an *Ad Hoc* Lake Committee as an interim organization. Pursuant to Section 62.23(18) of the *Wisconsin Statutes*, cities "may improve lakes and rivers within the city and … may make improvements therein throughout the county in which such city shall be located in aid of navigation, and for the protection and welfare of public health and wildlife." However, the Wisconsin Legislature also has established other mechanisms for the purpose of lake and stream management. Public lake organizations may be established through the creation of special purpose units of government pursuant to Chapter 33 of the *Wisconsin Statutes*, as public inland lake protection and rehabilitation districts, or, pursuant to Section 66.0827 of the *Wisconsin Statutes*, as utility districts, especially stormwater utilities. Private lake organizations include nonstock, not-for-profit corporations established under Chapter 181 of the *Wisconsin Statutes*. The specific type(s) of organization(s) to be created should be based upon the decision of the community. Consequently, institutional development is an important issue to be considered.

Chapter V

ALTERNATIVE AND RECOMMENDED LAKE PROTECTION AND MANAGEMENT PRACTICES

INTRODUCTION

Cravath and Trippe Lakes generally contain a robust, though not highly diverse, aquatic plant community capable of supporting a warmwater fishery, albeit with some areas that suffer impairment of recreational opportunities and other lake-oriented activities due to an overabundance of aquatic macrophytes. For example, in those areas of the Lakes where Eurasian water milfoil (*Myriophyllum spicatum*) is abundant, certain recreational uses are limited, the aesthetic quality of the Lakes is 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. 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.

In this chapter, alternative and recommended actions for addressing the issues of concerns described in Chapter IV are presented. These measures are focused primarily on those measures which can be implemented by the City of Whitewater, with lesser emphasis given to those measures which are applicable to other agencies having jurisdiction within the area tributary to the Lakes.

URBAN DEVELOPMENT AND STORMWATER MANAGEMENT

Background

The City of Whitewater was issued a general permit pursuant to Chapter NR 216 stormwater discharge permitting requirements on November 1, 2006. This designation is based on the Federal decennial census and applicable to the owner or operator of a municipal separate storm sewer system (MS4) serving incorporated areas with a population of 100,000 or more, and requires that owner or operator to implement measures to reduce total suspended solids loads, including the conduct of informational and educational programming, elimination of cross-connections between sanitary and storm sewers, reduction of construction site erosion, and implementing street-sweeping and leaf litter collection programs. Chapter II of this report has shown that planned future development within the tributary areas to both Trippe and Cravath Lakes will become increasingly urbanized during the planning period. As this shift in land use occurs, stormwater management will become increasingly important to protecting or rehabilitating the water quality of the Lakes.

The conversion of rural agricultural lands draining to both Trippe and Cravath Lakes to urban land uses and other land uses such as those associated with the Southern Unit of the Kettle Moraine State Forest and other conservancy lands being acquired by private conservation organizations will have the effect of reducing the current sediment and phosphorus loads to the Lakes, as noted in Chapter II. While conversion of agricultural lands to urban land uses can introduce other contaminants to the Lakes, as documented in Chapter II, such conversions will be subject to State stormwater management requirements set forth in Chapter NR 151 of the *Wisconsin Administrative Code*. These requirements limit the change in runoff from urban land development sites, and consequently modify the conveyance of contaminants from the land surface into waterways.

While urbanization brings a decrease in some pollutant loadings, urban runoff adds additional contaminants of concern to the mix of pollutants entering the Lakes, specifically metals as shown in Tables 9 through 12 in Chapter II. These contaminants are generally highly reactive with sediment particles, so the sediment retention requirements of Chapter NR 151 of the *Wisconsin Administrative Code* are likely to retain some of the additional urban contaminants of concern. Thus, stormwater management has been determined to be an important concern facing Cravath and Trippe Lakes.

Water quality is one of the key parameters used to determine the overall health of a waterbody and its ability to support a varied array of aesthetic and recreational uses, and other uses such as navigation, water supply, and hydropower generation—many of Wisconsin's impounded waterbodies began life as working waterways supporting grist or saw mills, as in the case of Trippe and Cravath Lakes. The importance of good water quality can hardly be underestimated, as it impacts nearly every facet of the natural balances and relationships that exist in a lake between the myriad of abiotic and biotic elements present, as well as influencing and determining, to a large extent, the human interactions with the aquatic environment. Because of the importance water quality plays in the functioning of a lake ecosystem and the human uses thereof, careful monitoring of this lake element represents a fundamental management tool. Not only does monitoring allow for an assessment of lake "health," it provides early warning of imbalances in the aquatic ecosystem so that active interventions can be undertaken in a timely (and cost-effective) manner. In the cases of Cravath and Trippe Lakes, water quality data, such as those summarized in Chapter II of this report, form the basis for the identification for the remedial measures set forth herein.

Alternative Management Measures

Urban Stormwater Management

Stormwater management, and the control of nonpoint source pollution from urban and urbanizing areas, has been recognized as an important issue facing the State of Wisconsin. In the case of urban lakes, such as Trippe and Cravath Lakes, urban stormwater management is an essential element in the protection and rehabilitation of water quality. Alternative stormwater management measures, summarized in Appendix E, range from relatively low-cost informational programming, informing citizens of "good housekeeping practices" that can be implemented through small changes in household behavior, to the construction of stormwater treatment systems, which have high construction and operation costs. While these latter practices have been applied in various parts of the world—such as in the case of the Wahnbach Reservoir in Germany,[1] the alternative practices considered for use by the City of Whitewater stop short of these comprehensive treatment systems, focusing instead on subregional stormwater ponds, infiltration, and informational programming.

2009 Wisconsin Acts 9 and 63, enacted by the Wisconsin Legislature have contributed to reducing the discharge of phosphorus containing substances into the environment. 2009 Wisconsin Act 9 has restricted the use and sale of fertilizer containing phosphorus and other turf fertilizers within the State. Under the provisions of this Act, which created Section 94.643 of the *Wisconsin Statutes*, the application of fertilizers on urban lands containing phosphorus is limited to those specific cases where soil tests document a need for such soil amendments. In

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

Southeastern Wisconsin, few, if any, soils fall within this category.[2] This has meant that much of the fertilizer applied prior to the adoption of 2009 Wisconsin Act 9 was washed off the land surface and into the Region's waterways.[3] 2009 Wisconsin Act 63 amended Sections 100.28 (2) (a) and (b) and 100.28 (2m) (a) and (b) of the *Wisconsin Statutes* to restrict the amount of phosphorus in certain, nonhousehold cleaning agents. As shown in Appendix E, these measures are likely to reduce nonpoint source phosphorus inputs to the Lakes from urban areas by up to 5 percent.

The use of street sweeping, catch basin cleaning, and seasonal leaf and clipping collection measures are additional measures that are being implemented by the City of Whitewater. These measures have been combined with public informational programming to alert residents to dates and times of collections, recommended yard care practices, and related issues. These practices also can help to reduce nonpoint source phosphorus inputs to the Lakes from urban areas by up to 5 percent, as shown in Appendix E.

As of October 1, 2007, the City of Whitewater, through City of Whitewater Ordinance Chapter 16.10, Stormwater Utility and Management Services, created a Stormwater Utility tasked with the "collection and disposal of stormwater," providing "services to all properties within the City of Whitewater and the surrounding areas, including those properties not currently served by the system." The Ordinance also provided for a system or charges to offset the "cost of operating and maintaining the city stormwater management system and financing necessary repairs, replacements, improvements and extensions thereof should, to the extent practicable, be allocated in relationship to the services received from the system," in order to protect the health, safety and welfare of the public. In support of the implementation of this Ordinance, the City also promulgated guidelines for the implementation of erosion control and stormwater management practices in the City. These measures, as shown in Appendix E, can reduce nonpoint source pollution in runoff by 10 percent or more.[4]

Water Quality Monitoring

The University of Wisconsin-Extension (UWEX) operates the Citizen Lake Monitoring Network (CLMN), formerly the Wisconsin Department of Natural Resources (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 water clarity 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 Surface Water Information Management System (SWIMS) data base containing lake water quality information for most of the lakes in Wisconsin and is accessible on-line through the WDNR website. 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. Since 2004, a limited amount of data has been collected on an intermittent basis as part of the abovedescribed programs on Trippe Lake; no data have been recorded for Cravath Lake.

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

[3]*See U.S. Geological Survey Water-Resources Investigations Report 02–4130,* Effects of Lawn Fertilizer on Nutrient Concentration in Runoff from Lakeshore Lawns, Lauderdale Lakes, Wisconsin, *July 2002.*

[4]*See SEWRPC Technical Report No. 18,* State of the Art of Water Pollution Control in Southeastern Wisconsin, *Volume 3,* Urban Storm Water Runoff, *July 1977; see also University of Wisconsin-Extension Publication No. G3691-P,* The Wisconsin Storm Water Manual: Technical Design Guidelines for Storm Water Management Practices, *2000; and, Wisconsin Department of Natural Resources,* Wisconsin Construction Site Best Management Practice Handbook, *1994, and associated Storm Water Construction and Post-Construction Technical Standards:* http://dnr.wi.gov/runoff/stormwater/techstds.htm.

In addition to the UWEX volunteer-based CLMN program, the University of Wisconsin-Stevens Point (UWSP) also offers several volunteer-conducted water quality sampling programs. Under these latter programs, volunteers collect water samples and send them to the UWSP 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 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.

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.[5] 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 UWSP 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. 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 UWSP program, even with State cost-share availability.

Recommended Management Measures

Beyond the actions indicated above as ongoing implementation of the City of Whitewater Stormwater Ordinance requirements by the City of Whitewater Stormwater Utility,[6] including implementation of the public awareness activities associated with these Ordinance requirements,[7] it is recommended that the landowners immediately adjacent to the Lakes be encouraged to adopt shoreland landscaping practices designed to maintain the ecological integrity of the shorelands.[8] These practices also can be applied in areas around stormwater management basins elsewhere in the drainage areas tributary to the Lakes.[9] These additional actions could contribute to reducing nonpoint source pollution by a further 10 percent.

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[5]*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.*

[6]*The City ordinance has established the goal of reducing sediment suspended in runoff by 40 percent.*

[7]*Outreach activities relating to stormwater management are being conducted under the auspices of the Rock River Stormwater Group, a consortium of 15 organizations within the Rock River Basin, on the theme of "Clean Waters, Bright Future." See:*
http://www.ci.whitewater.wi.us/index.php?option=com_content&view=category&layout=blog&id=149&itemid=545.

[8]*SEWRPC riparian buffer guide, "Managing the Water's Edge: Making Natural Connections," May 2010. See* www.sewrpc.org/data and resources.

[9]*University of Wisconsin-Extension Publication No. GWQ045,* Storm Water Basins: Using Natural Landscaping for Water Quality & Esthetics [sic]—A Primer on Planting and Managing Native Landscaping for Storm Water Basins, *2005.*

In order to monitor the responses of the Lakes to improved stormwater management and nonpoint source pollution control practices, it is recommended that the City of Whitewater participate in the CLMN program sponsored by the UWEX for both Cravath and Trippe Lakes. Data gathered as part of this program should be presented annually by the volunteers at meetings of the Whitewater City Council, 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 Lakes are subjected.

It is further recommended that the City of Whitewater 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 UWSP WEAL lake sampling program or USGS program on a periodic basis every three to five years. The use of either the UWSP 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.

PUBLIC RECREATIONAL WATER USE

Background

As noted in Chapter III of this report, the City of Whitewater community expressed a moderate level of awareness of lake issues in general, including awareness of depth, aquatic plants, urban development, water clarity, and the role of agricultural runoff and road salts on lake water quality. The community had a somewhat greater level of concern with respect to aquatic plants and sediments related to a reduction in the level of enjoyment experienced by lake users. About one half of the respondents also noted other issues of concern that affected their enjoyment and use of these resources.

Public recreational access to the two Lakes is focused on City parklands having lake frontage. These two parks offer the following amenities:[10]

- Trippe Lake Park—"Located along Trippe Lake in the southwest quadrant of the City, activities at this park include volleyball, ice skating, boating, fishing, cross country skiing, and swimming. This park also includes an open shelter, a bath house, a picnic area, a small orchard, play equipment, and restroom facilities."

- Cravath Lake Waterfront Park—"This park is located along the north side of Cravath Lake and near the south side of the downtown. The Lakefront Center community building is located here as well as an outdoor performance stage, boat launch, lakefront promenade, and a rail underpass to Lake Street."

Alternative Management Measures

With respect to recreational boating, 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, both Cravath and Trippe Lakes are deemed to have adequate public access, although the types of watercraft are limited by the lack of water depth and abundant growth of aquatic plants. Chapter NR 1 of the *Wisconsin Administrative Code* sets maximum and minimum standards based upon available parking facilities for car-top and car-trailer units. Although currently considered adequate, the access sites should continue to be periodically monitored to ensure consistency with public recreational boating access standards.

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[10]*City of Whitewater*, City of Whitewater Comprehensive Plan, 2030, *February 2010.*

In addition to ensuring continued eligibility for State of Wisconsin natural resources enhancement funds, public access points on the Lakes form an initial point of contact between the community and the Lakes. Consequently, placement of signage and related notices regarding issues of concern—such as nonnative species—is recommended. The WDNR has advisory notices regarding species such as Eurasian water milfoil and zebra mussel available upon request, and encourages placement of this signage at appropriate locations around the public recreational boating access sites. These sites also form excellent points of contact for disseminating water quality data, such as the periodic Secchi disc transparency measurements recommended above. Where these sites include public beaches and other amenities through which people may come into full- or partial-body contact with the water, placement of signage relating to coliform bacterial levels is also recommended.

Public access areas can be used to showcase good shoreland management practices and other shorescaping techniques (see below) that are recommended for replication elsewhere on the Lake shores. Given the large length of shoreline of both Trippe and Cravath Lakes that is in public ownership, or under the private ownership of the Hillside Cemetery, installation of shoreland buffers comprised of native vegetation would form not only an attractive border to the City's amenities, but also encourage other property owners to adopt similar shorescaping practices.

Recommended Management Measures

In addition to the existing public recreational boating access, it is recommended that appropriate signage at the public recreational boating access site be provided to alert users of Eurasian water milfoil, zebra mussels, and other nonnative invasive species. Such information should also be included in the City's informational programming, consistent with the aquatic plant management measures set forth in this plan. Should public use of the boat launch facilities at either Cravath Lake or Trippe Lake increase significantly, the City also might consider participating in the University of Wisconsin-Extension (UWEX) Clean Boats-Clean Waters Program.

IN-LAKE SEDIMENT MANAGEMENT AND HYDROLOGY

Background

A recurring theme at the various public meetings convened by the City of Whitewater *Ad Hoc* Lakes Committee meeting was the lack of depth within the Lake basins, and the loss of recreational boating opportunities. This concern also is expressed by the citizens of the City through the community-based questionnaire survey, summarized in Chapter III of this report.

As noted in Chapter III, the issue of sediment in the Lakes was noted to be as a major issue of concern by the respondents to the community survey, scoring 3.59 out of a total of 5.0. Respondents not only indicated that poor water clarity was the most significant issue of concern, ranking 2.53 out of a score of 3.0, but also that agricultural runoff and shallow depths were important issues of concern, ranking 2.32 and 2.28 out of a score of 3.0, respectively. Additionally, sanding and salting of roads was considered a major issue of concern that could contribute particulates to the Lakes, ranking 2.24 out of a score of 3.0. This loss of depth was considered to be an issue that reduced the enjoyment of the Lakes by the respondents "by a lot," ranking 3.19 out of a score of 5.0, although the presence of abundant growths of aquatic plants was noted as a slightly more significant concern with respect to loss of enjoyment, scoring 3.28 out of a total of 5.0. Nevertheless, respondents were slightly more willing to pay for the removal of depth-related limits to navigation than they were for aquatic plant management, indicating that, on average, they would be willing to pay $72 per year to support a remediation program.

Based upon the historical sources documented in Chapter I, it is likely that the Lakes were never deep lakes. However, as accreting systems within what historically was an agricultural landscape, it is equally likely that there has been significant sediment retention in the impoundments since Trippe and Cravath Lakes were formed in the 1800s. As the lands within the Whitewater Creek subwatershed have been incorporated into the State Forest, the contribution of soils from the watershed surrounding the Creek will have declined proportionately, as forested lands are considered to be well-protected from erosion as a consequence of the tree canopy, growth of shrubs, and presence of grasses that are characteristic of woodlands. Consequently, to a significant extent, sources of sediment within the Whitewater Creek subwatershed can be considered to have been controlled to a significant

degree. Such control of sediment sources within the subwatershed is a prerequisite to the implementation of measures to remediate sediment deposition in Trippe Lake. This is not the case within the Spring Brook subwatershed, although it is estimated that land conversion from agricultural land uses to urban land uses is likely to have reduced sediments loading from this subwatershed. In this case, application of the stormwater management and agricultural best management practices noted above are expected to minimize sediment export from these lands.

Alternative Management Measures

Erosion Control and Shoreline Stabilization

Shoreline erosion was not evident around the Lakes, and no serious problems were identified, although a survey of streambanks within the Spring Brook subwatershed did result in the identification of some areas of bank instability. The shorelands of Trippe and Cravath Lakes, themselves, were well vegetated. Consequently, shoreland maintenance activities should focus on the provision of vegetative buffer strips immediately adjacent to the Lakes as the simplest, least costly, and most natural method of reducing shoreline erosion (see Figure 1). This technique employs natural vegetation, rather than maintained lawns, within five to 10 feet of the lakeshore or the establishment of emergent aquatic vegetation from two to six feet lakeward of the eroding shoreline. Aquatic species, such as cattails (*Typha* spp.) and common reed (*Phragmites communis*), may be suitable in the littoral areas, while taller grasses, forbs, and shrubs also should be encouraged on the shoreline. Some transplanting or seeding with carefully chosen indigenous plant types can decrease the time of this succession of plant species. Desirable plant species which may be expected and encouraged to invade the 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 (*Sparnanium eurvcarvum*), 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 vuniceus*), and white cedar (*Thuia 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 the lawn grass and the above-ground portion of the plants will protect the soil against the erosive forces of rainfall and wave action. A narrow path to the lake can 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.

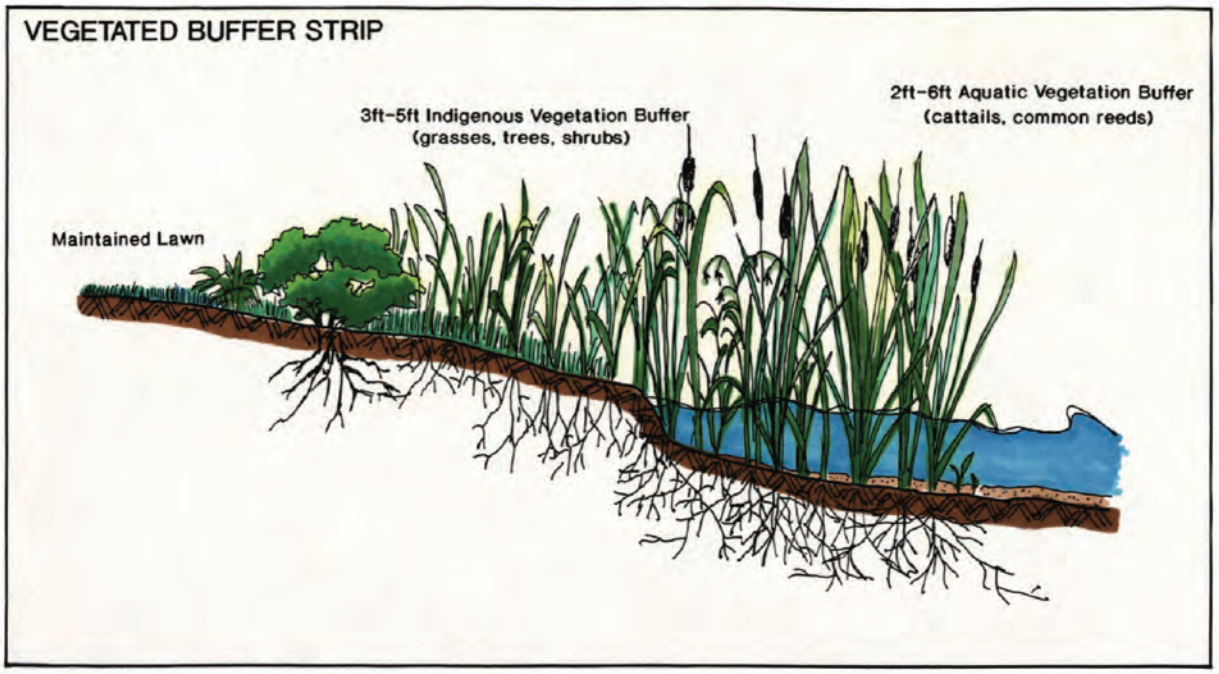
Rock riprap is a highly effective method of shoreline erosion control applicable to many types of erosion problems in areas highly susceptible to wind and wave erosion, especially in areas of low banks and shallow water. Use of this technique, however, is limited to areas with exposure to higher intensity wind waves, ice action, or boat wakes, pursuant to Chapter NR 328 of the *Wisconsin Administrative Code*. Given the relatively short wind fetch on the Lakes and the lack of high speed recreational boating traffic, use of this method is unlikely to be permitted by the WDNR. The advantages of this technique, which 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, are that the structure is highly flexible and not readily weakened by movements caused by settling or ice expansion, it can be constructed in stages, and it requires little or no maintenance. The disadvantages of a rock revetment are that it limits the use of the immediate shoreline in that the rough, irregular rock surfaces are unsuitable for walking; a relatively large amount of filter material and rocks needs to be transported to the lakeshore; and excavation and shaping of the shore slope may cause temporary disruptions and contribute sediment to the lake. Even if improperly constructed, the revetment may fail because of washout of the filter material. A rock revetment constructed along a 300 foot shoreline by a private contractor would involve a total capital cost of about $7,500, or about $25 per linear foot.

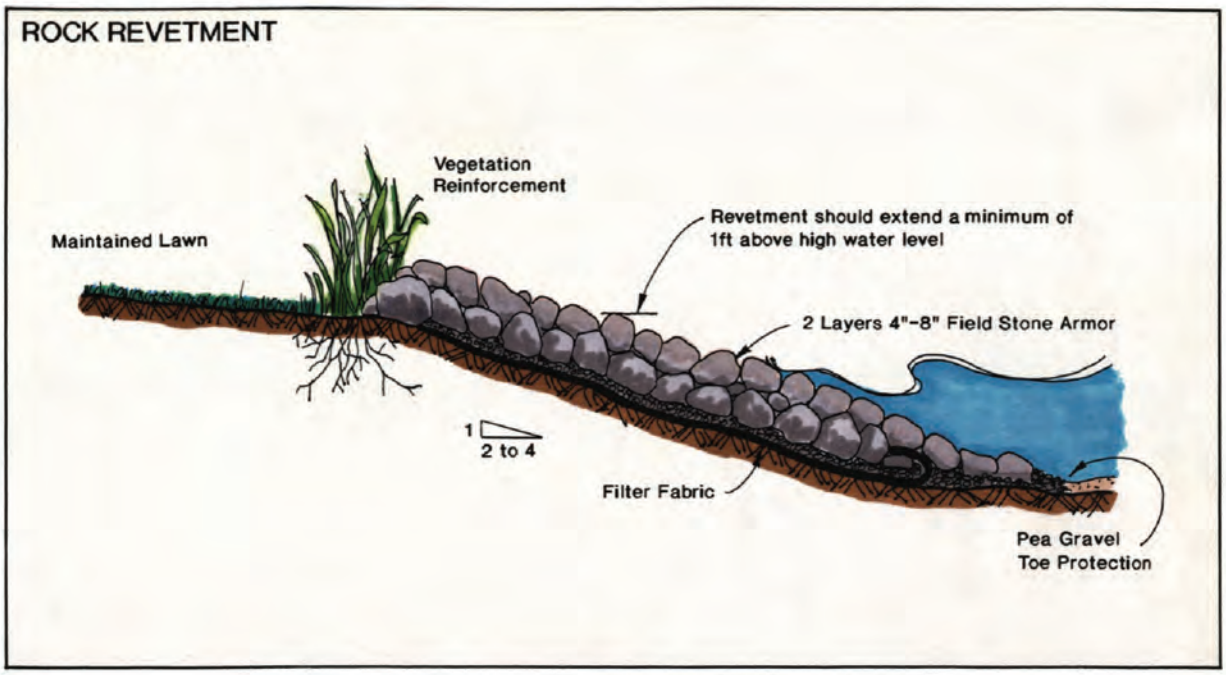
Dredging

Sediment removal is a restoration measure that is carried out using a variety of techniques, both land-based and water-based, depending on the extent and nature of the sediment removal to be carried out. For large-scale applications, a barge mounted hydraulic or cutter-head dredge is generally used. For smaller-scale operations a

Figure 1

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.

shore-based drag-line system is typically employed. Both methods are expensive, especially if a suitable disposal site is not located close to the dredge site. Costs for removal and disposal begin at between $15 and $20 per cubic yard; with the cost of sediment removal alone beginning at about $5.00 per cubic yard. Effectiveness of dredging varies with the effectiveness of watershed controls in reducing or minimizing the sediment sources. Federal and State permits are required for use of this option. A recommended checklist provided by the WDNR is included as Appendix E.

Dredging is the only restoration technique that directly removes the accumulated products of degradation and sediment from a lake system and can return a lake to a younger "age." If carried to the extreme, dredging can be used to, in effect, construct a new lake with a size and depth to suit the management objectives. Dredging has been used in other lakes to increase water depth; remove toxic materials; decrease sediment oxygen demand, preventing fish winterkills and nutrient recycling; and decrease macrophyte growth. The main objective of dredging Trippe and Cravath Lakes would be to increase water depth to permit a greater range of recreational activities and increased public safety.

In part, this increase in depth would marginally reduce the areal extent of macrophyte growth. The theoretical maximum depth of macrophyte colonization in the Lakes, under present conditions of water clarity, is about one and one-half feet.[11] To reduce the extent of macrophyte growth—and enhance the range of recreational uses, sections of the bottom would have to be deepened to greater than this depth by dredging. Dredging may have serious, though generally short term, adverse effects on the Lakes. These adverse effects could include increased turbidity caused by sediment resuspension, toxicity from dissolved constituents released by the dredging, oxygen depletion as organic sediments mix with the overlying water, water temperature alterations, and destruction of benthic habitats. There may also be impacts at upland spoil disposal sites, such as odor problems, restricted use of the site, and disturbances associated with heavy truck traffic. In the longer term, disruption of the lake ecosystem by dredging can encourage the colonization of disturbed portions of the lakebed by less desirable species of aquatic plants and animals, including Eurasian water milfoil, which is present in the Lakes. While dredging results in an immediate increase in lake depth, such increases may be short-lived if the sources of sediment being deposited in the Lakes are not controlled within the drainage areas tributary to the Lakes. As noted above, while the sediment loading to Trippe Lake has been largely controlled as a result of the incorporation of large portions of that Lake's watershed into the State Forest, the sediment load reaching Cravath Lake comes primarily from urban and agricultural lands tributary to the Spring Creek. Further sediment is generated from streambank erosion. All of these sources are subject to effective control through the adoption, implementation, and maintenance of recommended control measures within the watershed, which measures should be considered the primary means of limiting sediment accumulation in Cravath Lake prior to consideration being given to dredging. Only after such practices are implemented should major sediment removal projects be considered, and then only in limited areas of the Lake.

Dredging of lakebed material from navigable waters of the State requires a WDNR Chapter 30 permit and a U.S. Army Corps of Engineers Chapter 404 permit. In addition, current solid waste disposal regulations define dredge material as a solid waste. Chapter NR 180 of the *Wisconsin Administrative Code* requires that any dredging project of over 3,000 cubic yards submit preliminary disposal plans to the WDNR for review and potential solid waste licensing of the disposal site. Because sodium arsenite was applied to Trippe Lake in the 1950s and 1960s, as discussed in Chapter II, sediment samples may need to be analyzed to determine the extent and severity of any residual arsenic contamination.

Dredging of both Trippe and Cravath Lakes could be accomplished with several different types of equipment, including a hydraulic cutterhead dredge mounted on a floating barge; or bulldozer and backhoe equipment if part of the Lake were drained; or a clamshell, or bucket, dragline dredge from the shoreline. Hydraulic cutterhead

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[11]*North American Lake Management Society, Terrene Institute, and U.S. Environmental Protection Agency.* Managing Lakes and Reservoirs, Third Edition*, 2001, page 268.*

dredging is the most commonly employed method in the United States. The dredge is typically a rotating auger or cutterhead on the end of a ladder that is lowered to the sediment-water interface. Sediment excavated by the cutterhead is pumped as a slurry of 10 to 20 percent solids by a centrifugal pump to the disposal site. This pumping usually limits the distance between the lake and disposal site to less than a mile, even using intermediate booster pumps. Because of the large volume of slurry produced, a relatively large disposal site is typically required. Water returned from the disposal site, whether returned to the lake or a stream, would have to meet effluent water quality standards of the State and would be subject to State permitting.

Assuming dredging of about one-third of the lake areas in order to increase the depth by about two feet, about 40 acre-feet or about 64,500 cubic yards of material would be dredged from Cravath Lake and a further 75 acre-feet or about 121,000 cubic yards of material from Trippe Lake. At a cost of about $25 per cubic yard,[12] such a project would have costs of approximately $1,612,500 in the case of Cravath Lake and of approximately $3,025,000 in the case of Trippe Lake.[13] More limited dredging of navigational lanes—to provide for boating lanes of 50 feet in width and five feet in depth with 2:1 sloping sides, extending from the five-foot depth contour around the perimeter of the lake basin—would reduce the volume of material to be dredged, and therefore the costs, to about 5,000 cubic yards ($125,000) in the case of Cravath Lake and to about 3,000 cubic yards ($75,000) in the case of Trippe Lake. Provision of navigation lanes would create ovoid circuits within the lake basins which would require buoyage to demarcate the locations of the boating areas.

Draining the lake and removing sediment with conventional earth-moving equipment has some advantages over hydraulic dredging since it would not require a large disposal or dewatering site in the immediate area. Draining is also more advantageous for dragline dredging because it does not require the removal of a large number of trees and would probably involve less disturbance of the shoreline to provide access for trucks and equipment.

Recommended Management Measures

Continued use of vegetative shoreline protection measures around Trippe and Cravath Lakes is recommended. The relatively small surface area of these waterbodies is likely to be such that more intrusive shoreline protection measures would not be allowable under the provisions of Chapter NR 328 of the *Wisconsin Administrative Code*.

While extensive dredging of Trippe and Cravath Lakes is not considered a viable alternative at this time, some limited deepening of navigational lanes to permit the free flow of boating traffic is considered a viable alternative. Limited deepening of the waterbodies would enhance their roles as stormwater/flood management facilities as well as enhance public safety by limiting the volumes of flocculent sediment present in the Lake basins.

AQUATIC PLANT MANAGEMENT MEASURES

Background

As stated in Chapter II, recent aquatic plant management activities in Cravath and Trippe Lakes can be categorized as primarily chemical herbicide treatments to control aquatic plant growths in the Lakes. In addition, individual householders on the Lakes are known to have engaged in manual harvesting in the vicinities of their

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[12]*The estimated cost of $25 per cubic yard is estimated based upon hydraulic dredging costs of $5 per cubic yard to mobilize the slurry from the lakebeds and about $20 per cubic yard to transport the material to a confined disposal facility off the Lakes.*

[13]*The Wisconsin Department of Natural Resources staff indicate that a dredging project involving approximately one-third of the lake areas would probably be considered a "major ecosystem alteration," subject to a Chapter NR 150 environmental analysis and, potentially, to an environmental impact statement that would have to consider, among other aspects, loss of habitat for reptiles, amphibians, and fishes; loss of aquatic plant diversity, especially in Trippe Lake; loss of refugia for zooplankton and fishes, especially young-of-the-year fishes; loss of wading bird feeding area; and, loss of fish feeding area.*

piers and docks. These measures, and the other shoreland and aquatic macrophyte management measures set forth in this plan, consider alternative measures consistent with the provisions of Chapters NR 40, NR 103, NR 107, and NR 109 of the *Wisconsin Administrative Code*. The alternative aquatic plant management measures also are consistent with the requirements of Chapters NR 7 and NR 198 of the *Wisconsin Administrative Code*, and with the public recreational boating access requirements relating to the eligibility under the State cost-share grant programs, set forth under Chapter NR 1 of the *Wisconsin Administrative Code*.[14]

As noted in Chapter III, the large numbers of aquatic plants in the Lakes were identified as an issue of concern by the respondents to the community survey, with respondents indicating that the large amounts of aquatic plants were an important concern, scoring 3.52 out of a total of 5.0. Respondents indicated that the abundant growths of aquatic plants was the most significant issue of concern facing the Lakes, ranking 2.16 out of a score of 3.0. Respondents indicated a willingness to pay for aquatic plant management in the Lakes at a rate of about $67 per year on average. This was slightly less than the average willingness to pay for sediment management.

Alternative 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. 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 WDNR permit under Chapter 30 of the *Wisconsin Statutes*. Costs range from minimal for manual removal of plants using rakes and hand-pulling, to upwards of $75,000 for the purchase of a mechanical plant harvester, for which the operational costs can approach $2,500 to $25,000 per year depending on staffing and operation policies.

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. They have been used to create swimming beaches on muddy shores, to improve the appearance of lakefront property, and to open channels for motorboating. Sand and gravel are usually widely available and relatively inexpensive to use as cover materials, but plants readily recolonize areas so covered in about a year. Synthetic materials, such as polyethylene, polypropylene, fiberglass, and nylon, can provide relief from rooted plants for several years. However, 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 buildup of gasses from decaying plant biomass trapped under the barriers. In the case of Cravath and Trippe 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 Cravath and Trippe Lakes.

Biological Measures

Biological controls offer an alternative approach to controlling nuisance plants, particularly purple loosestrife (*Lythrum salicaria*), and invasive shoreland wetland plant, and Eurasian water milfoil. Classical biological control

[14]*The willingness to pay for both aquatic plant and sediment management, as noted in Chapter III, was slightly less than the willingness to pay for each remedial effort individually, averaging $113 per year as opposed to a combined investment of $139 per year for the individual elements.*

techniques have been successfully used to control both nuisance plants with herbivorous insects.[15] Recent evidence shows that *Galerucella pucilla* and *Galerucella calmariensis*, beetle species, and *Hylobius transversovittatus* and *Nanophyes brevis*, weevil species, have potential as biological control agents for purple loosestrife.[16] 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.[17] Given the absence of motorized watercraft on both Cravath and Trippe Lakes, the use of artificially maintained populations of *Eurhychiopsis lecontei* as a means of aquatic plant management and Eurasian water milfoil control, in addition to the use of insects as a means of shoreland wetland plant management, is considered to be viable. However, the use of biological control agents in concert with the use of aquatic herbicides is not considered to be a viable option.

The use of grass carp, *Ctenopharyngodon idella*, an alternative biological control used elsewhere in the United States, is not permitted in Wisconsin. Grass carp are a designated invasive species pursuant to Chapter NR 40 of the *Wisconsin Administrative Code*.

Manual and Mechanical Measures

The physical removal of specific types of vegetation by selective harvesting of plants provides a highly selective means of controlling the growths of nuisance aquatic plant species, including purple loosestrife and Eurasian water milfoil. Pursuant to Chapter NR 109 of the *Wisconsin Administrative Code*, manual harvesting of aquatic plants within a 30-foot-wide corridor along a 100-foot length of shoreline would be allowed without a WDNR permit, provided the plant material is removed from the lake. 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.

In the shoreland area, where purple loosestrife may be expected to occur, bagging and cutting loosestrife plants prior to the application of chemical herbicides 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.

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[15]*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.*

[16]*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.*

[17]*Contrast the experiences reported on Whitewater Lake in SEWRPC Memorandum Report No. 177,* An Aquatic Plant Management Plan for Whitewater and Rice Lakes, Walworth County, Wisconsin*, March 2010, with those reported on Spring Lake in SEWRPC Memorandum Report No. 149,* A Lake Protection Plan for Spring Lake and Willow Spring Lake, Waukesha County, Wisconsin*, August 2004, which yielded widely differing results: Spring Lake, with limited motorized watercraft traffic, achieved a significant level of control as a result of a naturally occurring weevil population, although this control was several years in the making.*

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 City of Whitewater 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.

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 the Cravath and Trippe Lakes, where practicable and feasible.

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. Consequently, mechanical harvesting, due to the vast expanses of shallow waters and loose bottom sediments in the Lakes, is not a viable option for much of Cravath and Trippe Lakes.

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. Widespread chemical treatment, therefore, is not considered a viable option for Cravath and Trippe 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.

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.

Use of early spring or late fall chemical controls,[18] targeting growths of Eurasian water milfoil and purple loosestrife in and around the Lake, is considered a viable option for Cravath and Trippe 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 Cravath and Trippe 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 City of Whitewater 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-wide length 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 and purple loosestrife. Manual control should target nonnative species.

- *Alternative*: It is recommended that the use of chemical herbicides be limited to controlling nuisance growths of nonnative species, particularly Eurasian water milfoil and purple loosestrife. It is recommended that chemical applications, if undertaken, be made by licensed applicators in early spring or late fall, subject to State permitting requirements,[19] 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 milfoil, such as 2,4-D and endothall, should be used;[20] for the control of purple loosestrife, the use of glyphosate could be considered for application to the cut stems of the plants after the seed heads have been bagged and cut.[21] Both Eurasian water milfoil and purple loosestrife are "restricted" pursuant to Chapter NR 40, and declared invasive species pursuant to Chapter NR 109, of the *Wisconsin Administrative Code*. This alternative should not be employed should the following alternative of the use of biological control agents be adopted.

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[18]*It should be noted that, at the time of writing, late fall herbicide treatments are considered to be experimental in Wisconsin and will not typically be permitted by the WDNR at this time, pending further research into the use of such treatments. It also is noted that many aquatic plants become dormant during the late fall and winter, die back, and do not meet the nuisance standards established pursuant to Chapter NR 107 of the* Wisconsin Administrative Code *as the basis for the application of aquatic herbicides. Consequently, late fall applications of herbicides are not recommended.*

[19]Ibid. *Late fall herbicide treatments are considered to be experimental in Wisconsin and will not typically be permitted by the WDNR at this time.*

[20]*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; see also Wisconsin Department of Natural Resources PUBL-WR-237 90,* Chemical Fact Sheet: Endothall, *May 1990.*

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

- *Alternative:* It is recommended that the use of biological control agents such as *Eurhychiopsis lecontei* be considered to control the growth of Eurasian water milfoil, and that the use of the beetle species *Galerucella pucilla* and *Galerucella calmariensis*, and of the weevil species *Hylobius transversovittatus* and *Nanophyes brevis*, be considered to control the growth of purple loosestrife, in and around Trippe and Cravath Lakes. In order for this alternative to provide a consistent level of treatment of the designated target invasive species, the control agents would have to be stocked annually by service providers and/or volunteers. Both Eurasian water milfoil and purple loosestrife are "restricted" pursuant to Chapter NR 40, and declared invasive species pursuant to Chapter NR 109, of the *Wisconsin Administrative Code*. This alternative should not be employed should the foregoing alternative of the use of chemical herbicides be adopted.

- The use of algicides, such as Cutrine Plus,[22] is not recommended because there are few significant, recurring filamentous algal or planktonic algal problems in Cravath and Trippe Lakes and valuable macroscopic algae, such as *Chara* and *Nitella*, are killed by this product. Maintenance of shoreland areas around docks and piers remains the responsibility of individual property owners.

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

- It also is recommended that the City of Whitewater 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 species, designated pursuant to Chapter NR 109 of the *Wisconsin Administrative Code*, using appropriate control measures,[23] is recommended throughout the Lakes.

INSTITUTIONAL DEVELOPMENT

Background

The City of Whitewater created the *Ad Hoc* Lakes Committee, in part, as a vehicle to explore organizational options under which the City could implement and sustain lake management activities, the identification of which formed the major charge to this Committee. Consequently, as part of this planning program, the issue of lake management organizations is an issue to be considered.

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

[23]*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.

Alternative Institutional Measures

The City of Whitewater, defined as a city of the fourth class based upon its population, has specific powers of governance that include the power to collect, treat, and otherwise manage wastewater—pursuant to Section 62.18 of the *Wisconsin Statutes*, and for city planning—pursuant to Section 62.23 of the *Wisconsin Statutes*, this latter including authority over "waterways" that form part of the City's overall surface water drainage plan. As used in this Section, waterways include "rivers, streams, creeks, ditches, drainage channels, watercourses, lakes, bays, ponds, impoundment reservoirs, retention and detention basins, marshes and other surface water areas, regardless of whether the areas are natural or artificial." Additionally, a City may "improve lakes and rivers within the city" and, "where a navigable stream traverses or runs along the border of a city," "make improvements therein throughout the county in which such city shall be located in aid of navigation, and for the protection and welfare of public health and wildlife." Thus, a City has the necessary authority to undertake the major actions recommended in this plan.

Additionally, Cities have authority under Chapter 66 of the *Wisconsin Statutes* to create special purpose utility districts and/or undertake public works projects that would be consistent with the actions necessary to implement the major recommendations set forth herein. Indeed, as noted above, the City of Whitewater has already created a Stormwater Utility to manage stormwater within the City. Certain actions recommended herein could be undertaken by the Utility, especially insofar as those actions are designed to manage stormwater and stormwater-borne contaminants that may currently be entering the aquatic environment.

Beyond the actions of the municipal government, the *Wisconsin Statutes* provide for both special purpose governmental entities and private sector entities that can be created to manage lakes within the State. These include voluntary associations incorporated under Chapter 181 of the *Wisconsin Statutes*, which, despite having a somewhat greater number of restrictions imposed upon them, may be considered to be "qualified associations" for purposes of obtaining State cost-share grants. Because of their voluntary nature, membership levels, and, therefore, income levels, of associations often fluctuate from year-to-year. Thus, when such associations take on specific tasks, such as aquatic plant management, for example, the community often elects to create a public inland lake protection and rehabilitation, or lake management, district.

Lake management districts are special purpose governmental units formed under Chapter 33 of the *Wisconsin Statutes* for the specific purpose of managing and protecting lake water quality. Inclusion in the district, once the district is created, is mandatory; registered voters and persons owning property within the district become the electors of the district for purposes of district governance. When created within Cities, lake districts can be created by action of the City Council, who then become the Board of Commissioners of the District. In this case, it is possible for the electors to petition for self-governance, which would establish a five- or seven-member Board of Commissioners who would conduct the day-to-day affairs of the District. Lake management districts have the capability of raising public funds subject to majority approval of the district budget at the annual meeting of the district. For this reason, lake management districts can provide a more stable financial base from which to undertake lake management activities. Nevertheless, lake associations and lake districts often operate in harmony around lakes throughout Wisconsin.

Considerations relating to the definition of a lake management district boundary include the extent to which the drainage area tributary to a lake is included in a district, and, in the case of a chain of lakes, the numbers of lakes to be included. It is rarely practical to include a lake's total tributary drainage area within a lake management district. However, based upon guidance provided by UWEX, it is recommended that the entire lakeshore, all riparian property, areas directly affecting the lake and/or which are included in planned service areas, and entire parcels be included.[24] In a number of cases in Southeastern Wisconsin, lake districts have been created by

[24]*University of Wisconsin-Extension,* People of the Lakes: A Guide for Wisconsin Lake Organizations, Eleventh Edition, *2006.*

incorporated municipalities that include the entire municipality.[25] In many of these cases, the districts developed and implemented comprehensive lake management plans.[26]

Recommended Institutional Measures

It is recommended that the City of Whitewater consider forming a public inland lake protection and rehabilitation district around Trippe and Cravath Lakes, the boundaries of which should be coincident with those of the City. This area would encompass both Lakes. Creation of a lake management district for the Trippe and Cravath Lakes would enhance the ability of the Whitewater community to manage the Lakes on a sustainable basis, and provide a sound fiscal base from which to conduct lake management activities. This action would be consistent with the level of concern expressed by a majority of the respondents to the citywide questionnaire survey. In addition, the formation of the public inland lake protection and rehabilitation district under Chapter 33 of the *Wisconsin Statutes* would provide the citizens of the City of Whitewater, as electors and property owners within the proposed district, with a dedicated governmental entity focused on Trippe and Cravath Lakes and their management. The lake district would be a forum, through the annual meeting of the district, within which the community could establish priorities, set budgets, and implement lake management actions associated with plan implementation.

PUBLIC INFORMATIONAL AND EDUCATIONAL PROGRAMMING

Background

As part of the overall citizen informational and educational programming to be conducted in the community, residents around and visitors to the Lakes 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 Lakes should focus on the need to minimize the spread of nuisance aquatic invasive species, such as purple loosestrife and Eurasian water milfoil, and to minimize the introduction of contaminants into the Lakes as a result of household activities. Such an informational program would supplement and enhance the informational programming efforts being undertaken by the City in partnership with the Rock River Stormwater Group outreach activities.

Alternative Information and Education Measures

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

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[25]*Examples of such Districts include the Fowler Lake Management District created by the City of Oconomowoc in Waukesha County and the Twin Lakes Lake Management District created by the Village of Twin Lakes in Kenosha County. In each of these cases, the municipal board also serves as the Board of Commissioners of the lake districts, which are independent special purpose units of government even though the persons forming the Board of Commissioners also serve as alderpersons or trustees of the general purpose units of government. It should be noted that a public inland lake protection and rehabilitation district, once formed in this manner, retains the boundary of the municipality as of the date of creation of the district and future changes to the municipal boundary do not change the lake district boundary without action by the lake management district to modify the boundary.*

[26]*See SEWRPC Community Assistance Planning Report No. 187,* A Management Plan for Fowler Lake, Waukesha County, Wisconsin, *March 1994; SEWRPC Community Assistance Planning Report No. 302,* A Lake Management Plan For Elizabeth Lake And Lake Mary, Kenosha County, Wisconsin, *Volume 1,* Inventory Findings, *July 2009; SEWRPC Community Assistance Planning Report No. 302,* A Lake Management Plan For Elizabeth Lake And Lake Mary, Kenosha County, Wisconsin, *Volume 2,* Alternatives and Recommended Plan, *July 2009.*

spend considerable time and money removing desirable plant species from a lake without considering their environmental impact.

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 City of Whitewater. 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 Adopt-A-Lake program and 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 the Lakes. Citizen monitoring under the auspices of the CLMN program, as recommended above, and community awareness of the positive value of native aquatic plant communities, for example, are important opportunities for public informational programming and participation.

Recommended Management Measures

Inclusion of specific public informational and educational programming within the activities of the City of Whitewater is recommended. These programs should focus on the value and impacts of these plants on water quality, fish, and 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.

As part of their ongoing commitment to the effective managing of Cravath and Trippe Lakes, the elected officials, staff, and citizens of the City of Whitewater 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. Walworth County, UWEX, Wisconsin Lakes (WAL), the North American Lake Management Society (NALMS), and WDNR, all produce written materials and conduct meetings and seminars dealing with lake management issues. Publications, such as *LakeTides*, 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 and regional lakes workshop, held annually in Green Bay, Wisconsin, and Waukesha, Wisconsin, respectively, provide valuable opportunities to learn about important and timely developments in lake management and learn about lake issues from experts in their fields. 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 arising from a study of the issues of concern related to Cravath and Trippe Lakes in the City of Whitewater, and examines existing and anticipated conditions, potential lake management and protection problems, and recreational use issues affecting the Lakes. The plan sets forth recommended actions and management measures for the resolution of those problems. The recommended plan is summarized in Table 28 and shown on Maps 13 and 14.

Cravath and Trippe Lakes were found to be eutrophic lakes of somewhat below average water quality. Preservation of environmental corridor lands, especially within the shoreland areas situated immediately adjacent to the Lakes, is recommended. Walworth County and the City of Whitewater should support appropriate land management and stormwater management practices designed to reduce nonpoint source pollutant discharges into

Table 28

RECOMMENDED PROTECTION PLAN ELEMENTS FOR CRAVATH AND TRIPPE LAKES

Plan Element	Subelement	Management Measures	Management Responsibility
Urban Development and Stormwater Management	Stormwater Management	Continue to implement the City of Whitewater Stormwater Ordinance	City of Whitewater, City of Whitewater Stormwater Utility
		Support activities by the City of Whitewater Stormwater Utility, including informational programming	City of Whitewater
		Adopt environmentally-friendly shorescaping practices around Trippe and Cravath Lakes and around stormwater management ponds and facilities	City of Whitewater, private landowners
	Water Quality Monitoring	Participate in UWEX CLMN volunteer monitoring of Trippe and Cravath Lakes: continue participation in the case of Trippe Lake and initiate participation in the case of Cravath Lake	WDNR, UWEX, City of Whitewater, University of Wisconsin-Whitewater
		Consider periodic participation in comprehensive water quality monitoring using either the USGS or UWSP WEAL	USGS/UWSP, City of Whitewater
	Public Recreational Water Use	Maintain recreational boating access from the public access sites pursuant to Chapter NR 7 guidelines	WDNR, City of Whitewater
		Maintain signage at public access sites regarding invasive species and WDNR Clean Boats-Clean Waters Program; provide disposal containers for disposal of plant material removed from watercraft at boat launch sites	WDNR, UWEX, City of Whitewater
Sediment Management and Hydrology	Shoreline Protection Management	Continue to use vegetative buffer strips for shoreline protection in the riparian shoreland areas of the Lakes; reconstruction may require WDNR Chapter 30, *Wisconsin Statutes*, permits	City of Whitewater, private landowners
		Maintain existing shoreline and streambank protection structures and repair as necessary using vegetative means insofar as practicable	Walworth County, Town of Whitewater, City of Whitewater, WDNR, private landowners
	Lake Level and Dam Operations	Maintain dam structures; continue dam operations in accordance with WDNR permit	City of Whitewater
	Dredging	Consider selective dredging to deepen about one-third of the areas of each Lakes by about two feet to enhance public recreational boating access, public safety, flood storage, and ecological integrity of the Lakes—subject to WDNR Chapter 30, *Wisconsin Statutes*, permitting	WDNR, City of Whitewater
Aquatic Plant Management	Manual Harvesting	Manually harvest around piers and docks as necessary[a] and collect floating plant fragments from shoreland areas to minimize rooting of Eurasian water milfoil and deposition of organic materials in the Lakes	Private landowners
		Manually harvest within public beach areas as necessary and collect floating plant fragments from shoreland areas to minimize rooting of Eurasian water milfoil and deposition of organic materials in the Lakes	City of Whitewater, private landowners
		Where they occur, manually remove isolated stands of purple loosestrife through bagging, cutting, herbicide application to cut stems	WDNR, City of Whitewater, private landowners
	Buffer Strips	Encourage growth of native plants in the Lakes through use of vegetated buffer strips and control of Eurasian water milfoil	WDNR, City of Whitewater, private landowners

Table 28 (continued)

Plan Element	Subelement	Management Measures	Management Responsibility
Aquatic Plant Management (continued)	Chemical Controls	Limit the use of aquatic herbicides as an alternative to the control of nuisance nonnative aquatic plant growths where necessary; specifically target Eurasian water milfoil[b]	WDNR, City of Whitewater, private landowners
	Biological Controls	Alternatively, consider the use of biological control agents to minimize the growths of Eurasian water milfoil and purple loosestrife	WDNR, City of Whitewater, private landowners
	Aquatic Plant Monitoring	Monitor shorelines and open water areas for new growths of nonnative invasive species and immediately report any new growths to the City of Whitewater	City of Whitewater, private landowners
		Conduct periodic in-lake reconnaissance surveys of aquatic plant communities and update aquatic plant management plan every three to five years	City of Whitewater
		Conduct additional periodic monitoring of the aquatic plant community for the early detection and control of future-designated nonnative species that may occur	WDNR, City of Whitewater
	Targeted Informational Programming	Continue informational programming focusing on "good housekeeping" practices for landowners	City of Whitewater
Institutional Development	Lake Management District	Consider creation of a public inland lake protection and rehabilitation district within the City of Whitewater, serving both Trippe and Cravath Lakes	City of Whitewater
Public Informational and Educational Programming	Community-based Programming	Participate in informational and educational programming opportunities such as those offered annually by UWEX at the statewide Lakes Convention and/or Southeastern Wisconsin Lakes Workshop	UWEX, City of Whitewater, private landowners
		Continue to provide informational materials and pamphlets on lake-related topics, especially the importance of aquatic plants and the protection of ecologically significant areas	City of Whitewater, WDNR, UWEX
		Consider offering public informational programming on topics of lake-oriented interest and education	City of Whitewater, WDNR, UWEX
		Maintain awareness of current developments in the area of lake management through informative publications such as "Lake Tides" (available free through the Wisconsin Lakes Partnership) and attendance at lake education conventions, workshops, and seminars	City of Whitewater
	School-based Programming	Encourage inclusion of lake studies in environmental curricula (e.g., Pontoon Classroom, Project WET, Adopt-A-Lake)	Area school districts, UWEX, WDNR, Town and City of Whitewater

NOTE: CB,CW = UWEX Clean Boats, Clean Waters Program
CLMN = UWEX Citizen Lake Monitoring Network
UWEX = University of Wisconsin Extension
UWSP = University of Wisconsin-Stevens Point
WDNR = Wisconsin Department of Natural Resources
WEAL = Water and Environmental Analysis Laboratory

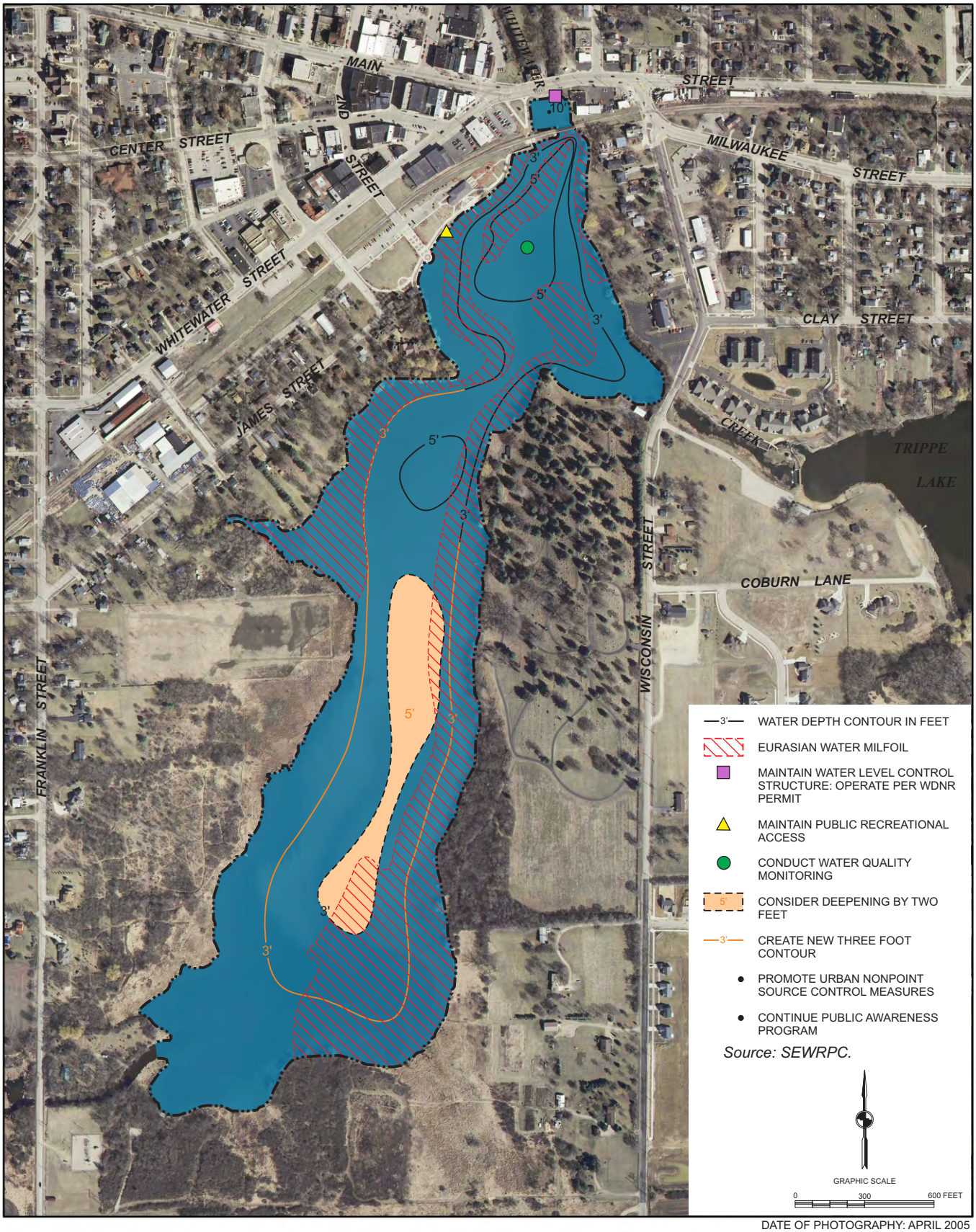
[a]*Manual harvesting beyond a 30-linear-foot width of shoreline is subject to WDNR individual permitting pursuant to Chapter NR 109 of the* Wisconsin Administrative Code*.*

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

Source: SEWRPC.

Map 13

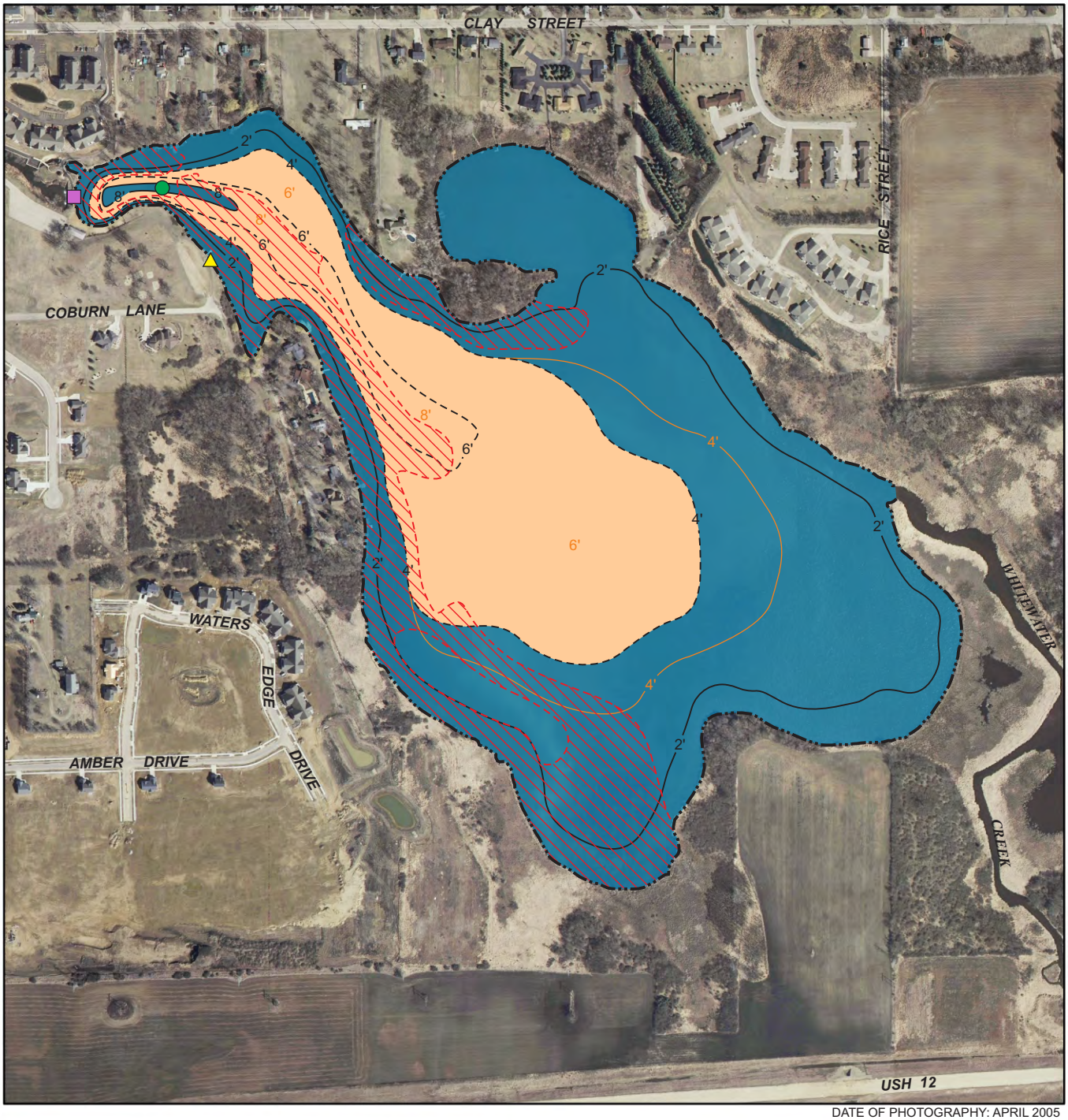
RECOMMENDED PROTECTION PLAN ELEMENTS FOR CRAVATH LAKE



DATE OF PHOTOGRAPHY: APRIL 2005

Map 14

RECOMMENDED PROTECTION PLAN ELEMENTS FOR TRIPPE LAKE



DATE OF PHOTOGRAPHY: APRIL 2005

—4'— WATER DEPTH CONTOUR IN FEET

EURASIAN WATER MILFOIL

MAINTAIN WATER LEVEL CONTROL STRUCTURE: OPERATE PER WDNR PERMIT

MAINTAIN PUBLIC RECREATIONAL ACCESS

CONDUCT WATER QUALITY MONITORING

6' CONSIDER DEEPENING BY TWO FEET

—4'— CREATE NEW FOUR FOOT CONTOUR

- PROMOTE URBAN AND RURAL NONPOINT SOURCE CONTROL MEASURES
- CONTINUE PUBLIC AWARENESS PROGRAM

GRAPHIC SCALE

0 300 600 FEET

Source: SEWRPC.

the Lakes. Further, the City of Whitewater should promote appropriate shoreline management practices, including the use of vegetative buffer strips, where applicable.

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 Lakes, encourage a biologically diverse community of native aquatic plants, and limit the spread of nonnative invasive plant species. The plan recommends the use of manual harvesting of nuisance plants in those areas where the depth of water and bottom substrate support such activity, with subsequent removal of cut material from the Lakes; limited use of chemical herbicides mainly in areas where nuisance levels of nonnative invasive species are present; and, monitoring for invasive species. The plan further recommends periodic in-lake aquatic plant surveys every three to five years to monitor changes in the aquatic plant community and assess effectiveness of aquatic plant management techniques.

The plan recommends 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.

With regard to recreational uses of the 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.

From an organizational standpoint, the plan recommends consideration of the formation of a public inland lake protection and rehabilitation district, around both Lakes, by and serving the City of Whitewater as a dedicated governmental entity tasked with the protection and rehabilitation of the two Lakes.

The recommended plan also includes continuation of an ongoing program of public information and education, focusing on providing riparian residents and lake users with an improved understanding of the lake ecosystem. 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 Lakes should be made available to riparian property owners, thereby providing riparian residents with alternatives to traditional activities. Additionally, staff, elected officials, and citizens of the City of Whitewater are encouraged to maintain and broaden their awareness of current developments in the area of lake management through participation in meetings, seminars, conventions and other lake management-related events, and educational opportunities.

Adherence to the recommendations contained in this plan should provide the basis for a set of protection actions that are: aligned with the goals and objectives set forth in Chapter I; reflective of the ongoing commitment by the City of Whitewater, to sound planning with respect to the Lakes; and sensitive to current needs, as well as those in the immediate future.

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APPENDICES

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Appendix A

ILLUSTRATIONS OF COMMON AQUATIC PLANTS FOUND IN CRAVATH AND TRIPPE LAKES

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Coontail (*ceratophyllum demersum*)

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

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

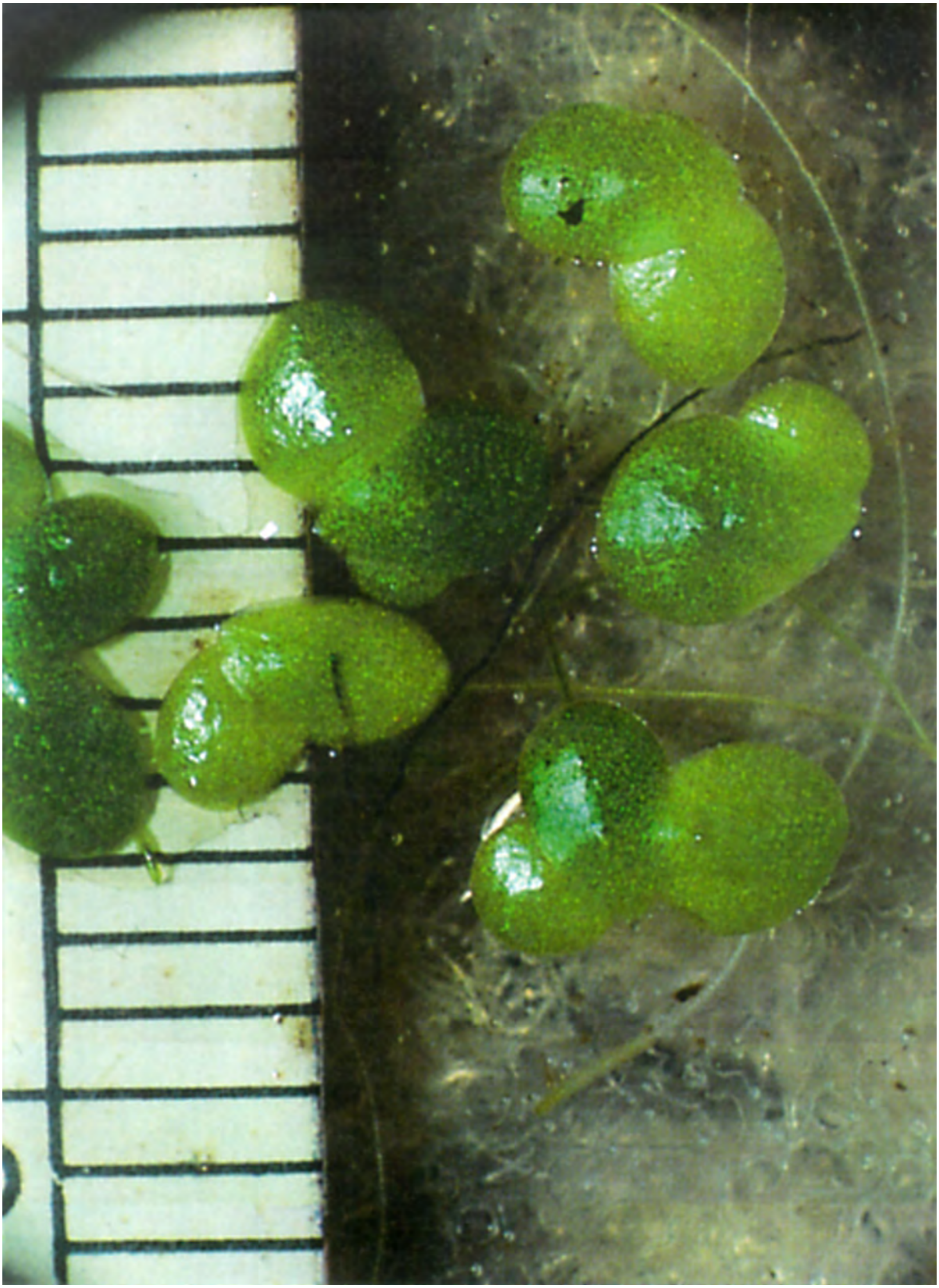
Flat-Stem Pondweed (*potamogeton zosteriformis*)

Floating-Leaf Pondweed (*potamogeton natans*)

Illinois Pondweed (*potamogeton illinoensis*)

Large-Leaf Pondweed (*potamogeton amplifolius*)

Leafy Pondweed (*potamofeton foliosus*)

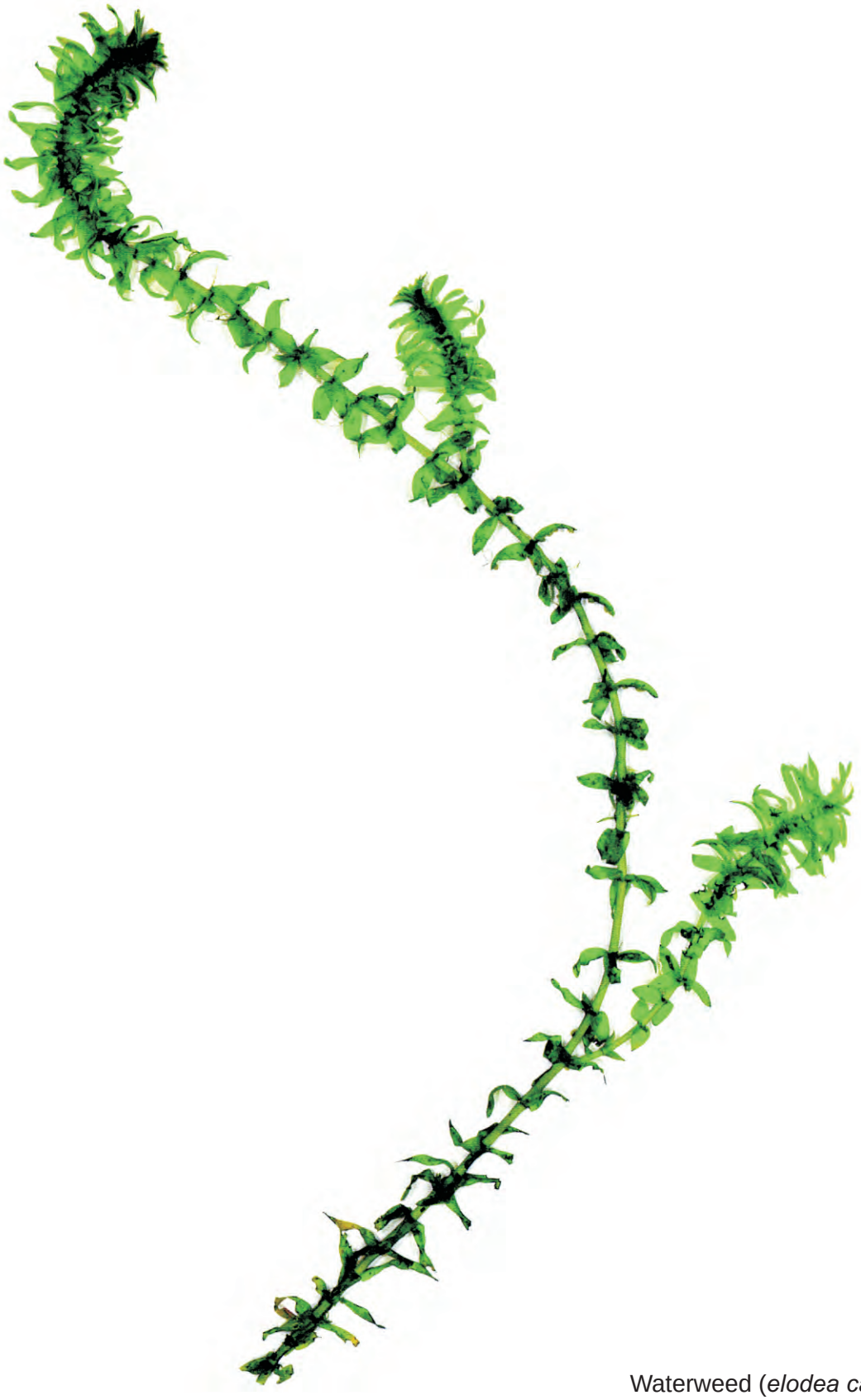


Lesser Duckweed (*lemna minor*)

NOTE: Plant species in photograph are not shown proportionate to actual size

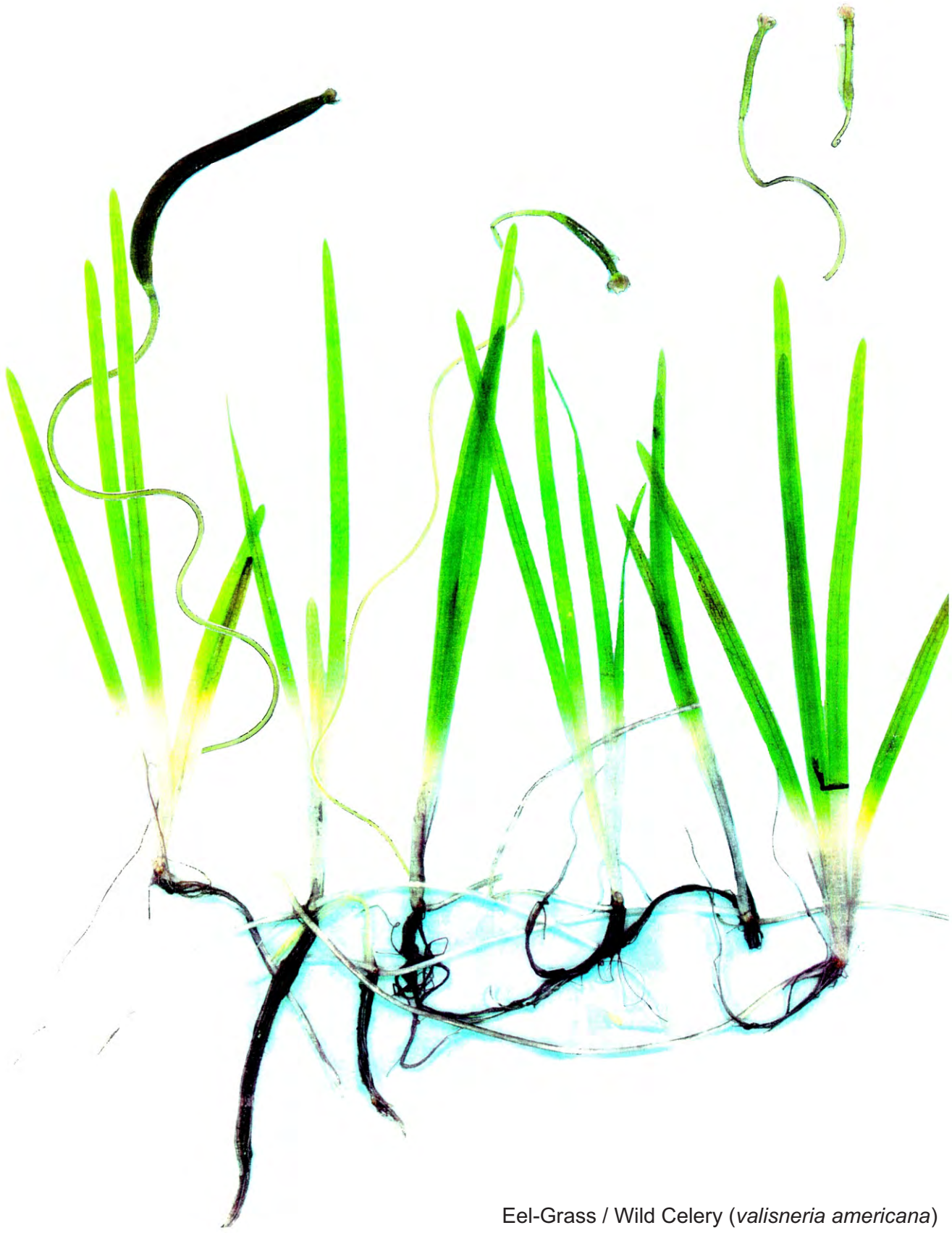
Source: Steve D. Eggers and Donald M. Reed, Wetland Plants and Plant Communities of Minnesota & Wisconsin*, 2nd Edition, 1997*

Long Leaved Pondweed
(*potamogeton nodosus*)



Waterweed (*elodea canadensis*)

White Water Lily (*nymphaea odorata*)



Eel-Grass / Wild Celery (*valisneria americana*)

Yellow Water Lily (*nuphar variegatum*)

Appendix B

BOATING AND OTHER ORDINANCES APPLICABLE TO CRAVATH AND TRIPPE LAKES

CHAPTER 7.38 REGULATIONS PERTAINING TO CITY PARKS

7.38.010 Closing of parks--Closing of Starin Park roads--Possession of alcoholic beverages.
(a) Closing of Parks. All city parks shall be closed from 12:00 a.m. to 6:00 a.m., except that Brewery Hill Park shall close at dusk. A permit may be issued for use of the city parks at times other than that set forth herein. Said permit may be issued by the city clerk.

(b) Closing of Starin Park Roads. All roadways beyond the gated area in Starin Park shall be closed to vehicular traffic from November 1 to April 1 of each year. This provision shall not apply to city service and city authorized vehicles.

(c) Possession of Alcoholic Beverages. No alcoholic beverage will be permitted in any city park other than Starin Park. A permit may be granted by the common council pertaining to consumption of alcoholic beverages in parks other than Starin Park, Cravath Lake Park and Tripp Lake Park. Also, the city clerk may issue permits allowing the consumption of alcoholic beverages in Cravath Lake Park, Tripp Lake Park, Starin Park Community Building and other municipal buildings as deemed appropriate by the city manager.

(Ord. 1539A § 1, 2003; Ord. 1538A § 1, 2003; Ord. 1504 § 1, 2002; Ord. 1489 § 1, 2001; Ord. 1359 § 1, 1996).
(Ord. No. 1693A, § 1, 8-5-2008)

7.38.025 Slow-no-wake areas.
(a) Definitions. "Slow-no-wake" means that speed at which a boat moves as slowly as possible while still maintaining steerage control.

(b) Applicability and Enforcement.

(1) The provisions of this section shall apply to the waters of Tripp Lake and Cravath Lake.

(2) This section shall be enforced by police officers of the City of Whitewater and the city manager or his designee.

(c) Intent. The intent of this section is to provide safe and healthful conditions for the enjoyment of aquatic recreation consistent with public rights and interests.

(d) Controlled Area. No person shall operate a boat faster than slow-no-wake speed in the waters of Tripp Lake and Cravath Lake at any time.

(e) Posting Requirements. (a) The City of Whitewater shall place and maintain a copy of this section at all public access points within the jurisdiction of the City of Whitewater.

(f) Penalties. Wisconsin state boating penalties as found in § 30.80, Wis. Stats., and any amendments or revisions thereto are adopted by reference.

(g) Severability. The provisions of this section shall be deemed severable and it is expressly declared that the City of Whitewater council would have passed the other provisions of this section irrespective of whether or not one or more provisions may be declared invalid. If any provision of this section or the application to any person or circumstances is held invalid, the remainder of the section and the application of such provisions to other persons or circumstances shall not be affected.

(h) State Boating and Safety Laws Adopted. State boating laws as found in §§ 30.50 to 30.71, Wis. Stats., and any amendments or revision thereto are adopted by reference.
(Ord. 1400 § 1, 1998).

7.38.030 Penalty.

Any person violating the subsections of this chapter relating to possession of alcohol in parks shall be subject to a penalty of not less than $150.00 nor more than $300.00 for the first offense, and for second and subsequent offenses, not less than $200.00 nor more than $340.00, together with the costs of prosecution. Any person violating any other section of this chapter for which a penalty has not been provided shall be subject to a penalty of not less than $50.00 nor more than $150.00, together with the costs of prosecution.

(Ord. 1428 § 9, 1999: Ord. 1341 § 1(part), 1996; Ord. 983 § 22(part), 1982).

CHAPTER 11.48 MISCELLANEOUS PROVISIONS

11.48.020 Driving, littering and fish shacks on ice on Tripp and Cravath Lakes.

(a) It is unlawful for any person to drive a motor vehicle on the ice on Tripp Lake and/or Cravath Lake in the city, until the same have been declared safe for such use by the chief of police of the city. All motor vehicles upon the ice shall be removed within one hour after being so notified by the police department of the city to do so.

(b) The placing or leaving of debris or any kind of trash, beer cans, etc. on the ice or placing same in the lakes or on public property is prohibited.

(c) All fishing shacks shall be removed from the ice on the date specified by state law or order of the conservation commission, and the same shall be removed from public property within twenty-four hours after same have been placed thereon.

(Ord. 585 § 1, 1967: prior code § 12.19(A)).

CHAPTER 16.10 STORMWATER UTILITY AND MANAGEMENT SERVICES

16.10.010 Purpose and necessity--Authorization.

The common council of the City of Whitewater find that the management of stormwater and other surface water discharges within and beyond Whitewater Creek, Tripp Lake, Cravath Lake, and other bodies of water within the city is a matter that affects the health, safety and welfare of the city, its citizens and businesses and others in the surrounding area. All real property in the city, including property owned by public and tax-exempt entities contributes runoff and either uses or benefits from the stormwater system.

Failure to effectively manage stormwater affects the sanitary sewer utility operations of the city by, among other things, increasing the likelihood of infiltration and inflow into the sanitary sewer system. Surface water runoff may cause nonpoint source pollution, erosion of lands, threaten residences and businesses with water damage, and create environmental damage to the rivers, streams and other bodies of water within and adjacent to the city. A system for the collection and disposal of stormwater provides services to all properties within the City of Whitewater and surrounding areas, including those properties not currently served by the system. The cost of operating and maintaining the city stormwater management system and financing necessary repairs, replacements, improvements and extensions thereof should, to the extent practicable, be allocated in relationship to the services received from the system. In order to protect the health, safety and welfare of the public, the common council exercises its authority to establish a stormwater utility and establish the rates for stormwater management services.

In promulgating the regulations contained in this chapter, the city is acting pursuant to authority granted by Chapters 62 and 66 of the *Wisconsin Statutes*, including, but not limited to, Sections 62.04, 62.11, 62.16(2), 62.18, 66.0101, 66.0621, 66.080, 66.0811, 66.0813, 66.0703, and 66.0627.

(Ord. 1672A (part), 2008: Ord. 1647A (part), 2007).

16.16.010 Authority.

This chapter is adopted by the City of Whitewater under the authority granted by Section 62.234, Wis. Stats. This chapter supersedes all provisions of an ordinance previously enacted under Section 62.23, Wis. Stats., that relate to stormwater management regulations. Except as otherwise specified in Section 62.234, Wis. Stats., Section 62.23, Wis. Stats., applies to this chapter and to any amendments to this chapter.

The provisions of this chapter are deemed not to limit any other lawful regulatory powers of the same governing body.

The City of Whitewater hereby designates the director of public works to administer and enforce the provisions of this chapter.

The requirements of this chapter to not pre-empt more stringent stormwater management requirements that may be imposed by any of the following:

(a) Wisconsin Department of Natural Resources administrative rules, permits or approvals including those authorized under Sections 281.16 and 283.33, Wis. Stats.

(b) Targeted non-agricultural performance standards promulgated in rules by the Wisconsin Department of Natural Resources under Section NR 151.004, Wis. Adm. Code.

(Ord. 1559A §1, 2004).

16.16.020 Findings of fact.

The City of Whitewater finds that uncontrolled, post-construction runoff has a significant impact upon water resources and the health, safety and general welfare of the community and diminishes the public enjoyment and use of natural resources. Specifically, uncontrolled post-construction runoff can:

(a) Degrade physical stream habitat by increasing stream bank erosion, increasing streambed scour, diminishing groundwater recharge, diminishing stream base flows and increasing stream temperature;

(b) Diminish the capacity of lakes and streams to support fish, aquatic life, recreational and water supply uses by increasing pollutant loading of sediment, suspended solids, nutrients, heavy metals, bacteria, pathogens and other urban pollutants;

(c) Alter wetland communities by changing wetland hydrology and by increasing pollutant loads;

(d) Reduce the quality of groundwater by increasing pollutant loading;

(e) Threaten public health, safety, property and general welfare by overtaxing storm sewers, drainage ways and other minor drainage facilities;

(f) Threaten public health, safety, property and general welfare by increasing major flood peaks and volumes;

(g) Undermine floodplain management efforts by increasing the incidence and levels of flooding.

(Ord. 1559A §2, 2004).

16.16.030 Purpose and intent.

(a) Purpose. The general purpose of this chapter is to establish long-term, post-construction runoff management requirements that will diminish the threats to public health, safety, welfare and the aquatic environment. Specific purposes are to:

(1) Further the maintenance of safe and healthful conditions;

(2) Prevent and control the adverse effects of stormwater prevent and control soil erosion; prevent and control water pollution; protect spawning grounds, fish and aquatic life; control building sites, placement of structures and land uses; preserve ground cover and scenic beauty; and promote sound economic growth;

(3) Control exceedance of the safe capacity of existing drainage facilities and receiving water bodies; prevent undue channel erosion; control increases in the scouring and transportation of particulate matter and prevent conditions that endanger downstream property.

(b) Intent. It is the intent of the City of Whitewater that this chapter regulates post-construction stormwater discharges to waters of the state. This chapter may be applied on a site-by-site basis. The City of Whitewater recognizes, however, that the preferred method of achieving the stormwater performance standards set forth in this chapter is through the preparation and implementation of comprehensive, systems-level stormwater management plans that cover hydrologic units, such as watersheds, on a municipal and regional scale. Such plans may prescribe regional stormwater devices, practices or systems, any of which may be designed to treat runoff from more than one site prior to discharge to waters of the state. Where such plans are in conformance with the performance standards developed under Section 281.16, Wis. Stats., for regional stormwater management measures and have been approved by the City of Whitewater, it is the intent of this chapter that the approved plan be used to identify post-construction management measures acceptable for the community.

(Ord. 1559A §3, 2004).

Appendix C

COMMUNITY QUESTIONNAIRE SURVEY INSTRUMENT

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Trippe and Cravath Lakes Community Survey

Trippe & Cravath Lakes Improvement Committee
Southeastern Wisconsin Regional Planning Commission
University of Wisconsin – Whitewater, Fiscal and Economic Research Center

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1) To begin the survey, we would like to get your opinion on a range of issues affecting the State of Wisconsin and City of Whitewater. The table below lists several actions that could be taken in your area. Please circle the number in each row that best indicates how important it would be to you to….

	Not at all important	A little important	Moderately important	Very important	Extremely important
Improve schools in your area	**1**	**2**	**3**	**4**	**5**
Make state and local government more efficient	**1**	**2**	**3**	**4**	**5**
Address the economic crisis by stemming the loss of jobs in your area	**1**	**2**	**3**	**4**	**5**
Increase local security against terrorism	**1**	**2**	**3**	**4**	**5**
Create more local hiking and biking trails	**1**	**2**	**3**	**4**	**5**
Increase the quality of environmental resources such as recreational lakes	**1**	**2**	**3**	**4**	**5**
Preserve working agricultural lands in your area	**1**	**2**	**3**	**4**	**5**
Develop more restaurants and shops in your area	**1**	**2**	**3**	**4**	**5**

Your Home/Apartment in Whitewater

2) How long have you or your family lived in your current house or apartment? _____*(Years)*

3) How many years have you lived in Whitewater? _____ *(Years)*

4) Do you live in Whitewater all 12 months of the year?

❑ Yes ❑ No

If not, how many months per year on average do you live in Whitewater during the various seasons? *(Please fill in blanks with best estimates, ranging from 0 to 3 months.)*

I/my family live in Whitewater:

____ months in Summer (June-Aug)
____ months in Fall (Sept-Nov)
____ months in Winter (Dec-Feb)
____ months in Spring (Mar-May)

5a) Do you live on a lake?

❑ Yes ❑ No

5b) If no, approximately how far do you live from the nearest lake? [Please provide best estimate.]

(Check only 1 box.)

- ❑ Less than ¼ mile
- ❑ Between ¼ and ½ mile
- ❑ Between ½ and 1 mile
- ❑ Between 1 and 2 miles
- ❑ More than 2 miles: _____ miles (fill in blank)
- ❑ Don't know

6) What lake is located closest to where you live?

- ❑ Cravath Lake
- ❑ Trippe Lake
- ❑ Don't know

Because of funding requirements, local governments cannot address every issue. This survey is about environmental problems that affect lakes near your home. Reduction in quality of lakes is one issue faced by resource managers. Even if you do not use lake resources, your opinions and responses are just as important as those who do.

Your Use of Cravath and Trippe Lakes in Whitewater

7) Did you or an immediate family member visit either Cravath Lake or Trippe Lake within the last 12 months ?

❑ Yes ❑ No **If "yes," please continue. If "no," skip to question 9.**

8a) How many total visits did you or an immediate family member make within the last 12 months to either Cravath Lake or Trippe Lake? _____

8b) When you or your family go to Cravath or Trippe Lakes, what activities do you do there? (*Please ✓all that apply below)*:

- ❑ Fishing (not including ice fishing)
- ❑ Ice fishing
- ❑ Motor boating
- ❑ Sailing
- ❑ Canoeing/kayaking
- ❑ Swimming or wading
- ❑ Watching wildlife/birds
- ❑ Waterfowl hunting
- ❑ Relaxing/entertaining
- ❑ Picnicking
- ❑ Snowmobiling
- ❑ Exercising
- ❑ Attending community special events
- ❑ Other (please specify: _____)

8c) When you visit these lakes, how do you usually get there? *(Please ✓ ONE below).*

- ❑ By car
- ❑ By bicycle
- ❑ On foot
- ❑ Other (please specify: _____)

9) Do you own a boat? ❑ Yes ❑ No

If so, what type?

- ❑ Canoe
- ❑ Sailboat
- ❑ Paddle boat
- ❑ Fishing (outboard motor)
- ❑ Fishing (inboard motor)
- ❑ Other (please specify: _____)

Your Activities at Lakes other than Cravath/Trippe Lakes

10) Did you or an immediate family member visit any lakes OTHER THAN Cravath or Trippe Lakes within the last 12 months

❑ Yes ❑ No **If "yes," please continue. If "no," skip to question 12.**

11a) How many days did you or an immediate family member spend at lakes within the last 12 months? _____ days ***(provide best estimate)***

11b) What is your favorite lake to visit within driving distance of your home?

Name of lake: _____, in _____ (City/State)

11c) Why is this your favorite lake?

_____

_____

_____

Your Level of Awareness Regarding Issues that are Relevant to Cravath and Trippe Lakes in Whitewater

12) The table below shows a list of issues that are relevant for Cravath and Trippe lakes. Please indicate your level of awareness with these issues.

(Please circle one number in each row.)

	I am…….		
Issues	**Not at all aware** of this possible issue	**Somewhat aware** of this issue	**Very much aware** of this issue
a) The lakes are shallow	1	2	3
b) The lakes have large amounts of aquatic weeds	1	2	3
c) Residential development is occurring along the lakes' shores	1	2	3
d) Commercial development is occurring near the lakes	1	2	3
e) Water clarity in the lakes is poor	1	2	3
f) Agricultural runoff may affect local water quality	1	2	3
g) Sanding and salting of roads during winter months may affect local water quality	1	2	3

Your Level of Concern Regarding Issues that may be Relevant to Cravath and Trippe Lakes

Resource managers currently are concerned about the quality of Cravath and Trippe Lakes and resulting negative impacts on our ability to enjoy them. (1) First, undesirable weed species (for example, Eurasian water milfoil) are present in and around these lakes. Such weeds crowd out native aquatic plants (e.g., lily pads); reduce the quality of habitat for sportfish; and make it difficult to swim or operate boats. (2) Second, resource managers are concerned about the influx of sediment into these lakes. Too much sediment makes the lakes too shallow to support recreational uses such as swimming and boating, and increases problems with odor and poor water clarity.

13) Are there other problems related to Cravath and Trippe Lakes about which you are concerned?

14) How concerned are you about various problems at Cravath and Trippe Lakes? Please indicate your <u>levels of concern</u> in the table below.

(Please circle only one number in each row.)

. I am…….

Issues	I am **not at all concerned** about this issue	I am **a little concerned** about this issue	I am **somewhat concerned** about this issue	I am **very concerned** about this issue	I am **extremely concerned** about this issue
A) Aquatic weed species are present in Cravath and Trippe Lakes	1	2	3	4	5
B) Sediment in the lakes has caused loss of depth and changed water quality	1	2	3	4	5
C) Other problems (if any) that you mention in Question 13 above	1	2	3	4	5

15) How do various problems affect (if at all) the <u>quality of your enjoyment</u> of Cravath and Trippe Lakes?

(Please circle only one number in each row.)

…….. This issue….

Issue	**Does not at all reduce** my enjoyment of these lakes	**Reduces** my enjoyment of these lakes a little	**Somewhat reduces** my enjoyment of these lakes	**Reduces** my enjoyment of these lakes a lot	Reduces my enjoyment of these lakes extremely
A) Weed species are present in and around Cravath and Trippe Lakes	1	2	3	4	5
B) Sediment in the lakes has caused loss of depth and changed water quality	1	2	3	4	5
C) Other problems (if any) that you mention in Question 13 above	1	2	3	4	5

The next several questions ask about your willingness to pay for conducting programs to improve Cravath and Trippe Lakes. In order to conduct the programs, money will need to be raised. This may be done by creating a "special tax district" affecting you and your neighbors living in the City of Whitewater. Money to fund the programs would be raised through increased property taxes, and all money raised would be used only for the lake programs. When answering, please consider your income, other things you spend money on, and the many other possible programs that could be funded by your local government.

16) PLEASE CONSIDER CAREFULLY THE FOLLOWING PROPOSED SCENARIO FOR <u>WEED CONTROL</u> AT CRAVATH AND TRIPPE LAKES:

As mentioned above, Cravath and Trippe Lakes currently have undesirable weed species. Resource managers are considering a weed removal program. Weed removal may be done by hand pulling and raking or by using approved chemicals that do not affect humans. Resource managers would use the method considered to be safest and most cost-effective, and the method would be repeated as necessary to control weeds. The program will:

- **Enhance the habitat for fish, including those caught by recreational anglers**
- **Reduce unpleasant physical contact with weeds while engaging in water-based recreation such as swimming**
- **Result in visual improvements to the lakes**
- **Allow native plant species to return**
- **Improve the biological functioning of the lake**

This weed control program by itself will NOT address the buildup of sediment in the lakes, which is discussed next.

How much would you be willing to pay in additional property taxes each year, for the next 10 years, in order to achieve the outcomes described above from the Weed Control Program? *(Circle one number.)*

$0	**$3**	**$10**	**$40**	**$125**	**$450**	**$1,500**	**$5,000**
$1	**$5**	**$15**	**$60**	**$200**	**$650**	**$2,250**	**More than $5,000**
$2	**$8**	**$25**	**$90**	**$300**	**$1,000**	**$3,300**	**Don't know**

16a) Please explain why you circled the dollar amount for Weed Control that you did:

17) PLEASE CONSIDER CAREFULLY THE FOLLOWING PROPOSED SCENARIO FOR <u>SEDIMENT REMOVAL</u> AT CRAVATH AND TRIPPE LAKES:

As mentioned above, Cravath and Trippe Lakes currently have large deposits of sediment. Resource managers are considering a sediment removal program. Sediment removal is done using precision land-based or water-based equipment, and the extracted sediment would be removed from the area and deposited safely outside of Whitewater. The method would be repeated as necessary to control sediment. The program will:

- **Create deeper lakes**
- **Allow for better swimming and watercraft operation, including creating new areas that currently cannot be used for water-based recreation**
- **Reduce odor and increase water clarity**

This Sediment Removal Program by itself will NOT reduce the undesirable weeds in the lakes, which was discussed previously

How much would you be willing to pay in additional property taxes each year, for the next 10 years, in order to achieve the outcomes described above from the Sediment Removal Program? *(Circle one number.)*

$0	**$3**	**$10**	**$40**	**$125**	**$450**	**$1,500**	**$5,000**
$1	**$5**	**$15**	**$60**	**$200**	**$650**	**$2,250**	**More than $5,000**
$2	**$8**	**$25**	**$90**	**$300**	**$1,000**	**$3,300**	**Don't know**

17a) Please explain why you circled the dollar amount for Sediment Removal that you did:

18) FINALLY, PLEASE CONSIDER CAREFULLY ONE MORE ALTERNATIVE FOR CRAVATH AND TRIPPE LAKES:

Resource managers are considering a program that would include *BOTH* weed control *AND* sediment removal. This will result in all of the benefits listed above for *BOTH* of these programs.

How much would you be willing to pay in additional property taxes each year, for the next 10 years, in order to achieve the outcomes described for both the Weed Control Program and the Sediment Removal Program? *(Circle one number.)*

$0	**$3**	**$10**	**$40**	**$125**	**$450**	**$1,500**	**$5,000**
$1	**$5**	**$15**	**$60**	**$200**	**$650**	**$2,250**	**More than $5,000**
$2	**$8**	**$25**	**$90**	**$300**	**$1,000**	**$3,300**	**Don't know**

18a) Please explain why you circled the dollar amount for Weed Control AND Sediment Removal that you did:

_____

_____

_____

_____

General Information and Public Opinions

19) What is your household's total annual income from all sources? *(Check one.)*

- ❑ Below $20,000
- ❑ $20,000 - $29,999
- ❑ $30,000 - $39,999
- ❑ $40,000 - $49,999
- ❑ $50,000 - $59,999
- ❑ $60,000 - $69,999
- ❑ $70,000 - $79,999
- ❑ $80,000 - $89,999
- ❑ $90,000 - $99,999
- ❑ $100,000 - $149,999
- ❑ $150,000 - $199,999
- ❑ $200,000 - $299,999
- ❑ Over $300,000

20) What level of education have you completed? *(Check one.)*

- ❑ High school or less
- ❑ Some college or technical school
- ❑ Completed two-year degree
- ❑ Completed four-year degree
- ❑ Completed some graduate classes
- ❑ Completed graduate degree

21) What is your age in years? *(Check one.)*

- ❑ Under 22
- ❑ 23-25
- ❑ 26-29
- ❑ 30-34
- ❑ 35-39
- ❑ 40-44
- ❑ 45-49
- ❑ 50-54
- ❑ 55-64
- ❑ 65-75
- ❑ Over 75 years

22) Are you currently a university student? ❑ Yes ❑ No

Appendix D

SUMMARY STATISTICS FROM THE TRIPPE AND CRAVATH LAKES SURVEY[1]

[1]*This appendix was prepared by Ms. Paige Peterson and Professor Mark E. Eiswerth, Economics Department, Hyland Hall, College of Business & Economics, University of Wisconsin-Whitewater 53190.*

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SECTION D.1. GENERAL INFORMATION ON RESPONDENT'S RESIDENCE IN WHITEWATER

Table D-1

PROXIMITY OF SURVEY RESPONDENTS TO TRIPPE AND CRAVATH LAKE'S SHORELINE (AS COMPUTED THROUGH MAPPING ANALYSIS)

Distance from House to Shoreline (miles)	Frequency	Percent
Less than 1/4	114	27.40
Between 1/4 and 1/2	100	24.04
Between 1/2 and 3/4	49	11.78
Between 3/4 and 1	22	5.29
Between 1 and 1 1/4	53	12.74
Between 1 1/4 and 1 1/2	21	5.05
Between 1 1/2 and 1 3/4	34	8.17
Between 1 3/4 and 2	10	2.40
Over 2	5	1.20
Out of Town	7	1.68
Total	416	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-2

SURVEY RESPONDENTS' PERCEIVED DISTANCE FROM THE NEAREST LAKE (TRIPPE OR CRAVATH)

Location	Frequency	Percent
Live on Lake	48	11.76
Less than 1/4 Mile	72	17.65
Between 1/4 and 1/2 Mile	55	13.48
Between 1/2 and 1 Mile	78	19.12
Between 1 and 2 Miles	125	30.64
More than 2 Miles	23 (mean = 3.82 miles)	5.64
Don't Know	7	1.72
Total	408	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-3

NUMBER OF SURVEY RESPONDENTS OWNING OR RENTING THEIR RESIDENCE

Status	Frequency	Percent
Own	377	87.67
Rent	53	12.33
Total	430	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-4

LENGTH OF SURVEY RESPONDENTS' RESIDENCE (YEARS)

Location	Frequency	Average (years)
Current Residence	426	14.17
City of Whitewater	429	26.93

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-5

NUMBER OF YEAR ROUND SURVEY RESPONDENTS

Status	Frequency	Percent
Year Round	406	93.98
Seasonal	26	6.02
Total	432	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-6

MONTHS OF RESIDENCE IN WHITEWATER HOME FOR SEASONAL SURVEY RESPONDENTS

Season	Average Months in Residence
Summer (June-August)	2.25
Fall (September-November)	2.45
Winter (December-February)	0.70
Spring (March-May)	1.70
Total	7.75

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-7

SURVEY RESPONDENTS LOCATED ON TRIPPE OR CRAVATH LAKE

Location	Frequency	Percent
On Lake	49	11.53
Not on Lake.....	376	88.47
Total	425	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-8

LAKE LOCATED NEAREST TO SURVEY RESPONDENT

Location	Frequency	Percent
Cravath	268	65.61
Trippe.....	108	26.10
Both	24	5.85
Don't Know.....	10	2.44
Total	410	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

SECTION D.2. RESPONDENTS' USE OF CRAVATH AND TRIPPE LAKES

Table D-9

SURVEY RESPONDENTS VISITING EITHER CRAVATH OR TRIPPE LAKE WITHIN THE PAST 12 MONTHS

Response	Frequency	Percent
Yes	324	76.24
No	101	23.76
Total	425	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-10

SURVEY RESPONDENTS' AVERAGE NUMBER OF VISITS TO CRAVATH OR TRIPPE LAKE DURING THE PAST 12 MONTHS

Visits	Frequency	Percent
0	101	26.17
1-10	177	45.85
11-20	42	10.88
21-30	20	5.18
31-40 (average = 31.61)	9	2.33
41-50	6	1.55
51-60	3	0.78
61-70	0	0.00
71-80	1	0.26
81-90	0	0.00
91-100	9	2.33
101-200	4	1.04
201-300	5	1.30
More than 300	9	2.33
Total	425	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-11

SURVEY RESPONDENTS' ACTIVITIES WHILE VISITING CRAVATH OR TRIPPE LAKE

Type	Frequency	Percent
Attending Community Special Events	252	74.12
Relaxing/Entertaining	224	65.88
Exercising	159	46.76
Watching Wildlife/Birds	152	44.70
Fishing (not including ice fishing)	108	31.76
Picnicking	90	26.47
Canoeing/Kayaking	49	14.41
Other	35	10.29
Ice Fishing	25	7.35
Swimming or Wading	21	6.18
Waterfowl Hunting	8	2.35
Motor Boating	7	2.06
Snowmobiling	2	0.59
Sailing	1	0.29
Total	340	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-12

SURVEY RESPONDENTS' MODE OF TRAVEL TO CRAVATH OR TRIPPE LAKES

Type	Frequency	Percent
Motor Vehicle	176	50.87
Foot	176	50.87
Bicycle	63	18.21
Other	5	1.44
Total	346	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-13

SURVEY RESPONDENTS OWNING A BOAT

Response	Frequency	Percent
Own a Boat	116	26.91
Do Not Own a Boat	315	73.09
Total	431	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-14

TYPE OF BOAT OWNED BY SURVEY RESPONDENTS

Type	Frequency	Percent
Fishing (outboard motor)	56	47.46
Canoe	53	44.92
Other	23	19.49
Fishing (inboard motor)	8	6.78
Paddle Boat	5	4.24
Sailboat	2	1.69
Total	118	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

SECTION D.3. PROPERTY OWNERS' EXPERIENCES WITH OTHER LAKES

Table D-15

SURVEY RESPONDENTS VISITING LAKES OTHER THAN CRAVATH OR TRIPPE LAKES WITHIN THE PAST 12 MONTHS

Response	Frequency	Percent
Yes	261	62.00
No	160	38.00
Total	421	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-16

NUMBER OF DAYS SURVEY RESPONDENTS VISITED OTHER LAKES WITHIN THE PAST 12 MONTHS

Visits	Frequency	Percent
1-10	159	61.87
11-20 (average = 16.76)	44	17.12
21-30	25	9.73
31-40	8	3.11
41-50	9	3.50
51-60	5	1.95
61-70	1	0.39
71-80	1	0.39
81-90	0	0.00
91-100	1	0.39
101-150	1	0.39
151-200	2	0.78
More than 200	1	0.39
Total	425	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-17

FAVORITE LAKES VISITED BY SURVEY RESPONDENTS

Lake	Location	Frequency	Percent
Whitewater Lake	Whitewater, WI	50	19.69
Geneva Lake	Lake Geneva, WI	20	7.87
Cravath Lake	Whitewater, WI	14	5.52
Lake Michigan	Milwaukee, WI	19	7.48
Rice Lake	Whitewater, WI	11	4.33
Delavan Lake	Delavan, WI	10	3.94
Pleasant Lake	LaGrange, WI	9	3.54
Lauderdale Lakes	Elkhorn, WI	7	2.76
Ottawa Lake	Eagle, WI	7	2.76
Trippe Lake	Whitewater, WI	7	2.76
Turtle Lake	Delavan, WI	6	2.36
Rock Lake	Lake Mills, WI	6	2.36
Devil's Lake	Baraboo, WI	5	1.97
Blue Spring Lake	Palmyra, WI	4	1.57
Mendota Lake	Madison, WI	4	1.57
Monona Lake	Madison, WI	3	1.18
Castle Rock Lake	New Lisbon, WI	2	0.79
Chippewa Lake	Hayward, WI	2	0.79
Crystal Lake	Neshkoro, WI	2	0.79
Gilbert Lake	Wild Rose, WI	2	0.79
LaGrange Lake	LaGrange, WI	2	0.79
Nebagamon Lake	Nebagamon, WI	2	0.79
Red Cedar Lake	Cambridge, WI	2	0.79
Sandy Beach Lake	Lake Mills, WI	2	0.79
Lake Superior	Bayfield, WI	2	0.79
Other	WI	54	21.26
Total	- -	254	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

SECTION D.4. SURVEY RESPONDENTS' VIEWS ON LAKE TOPICS AND OTHER ISSUES

Table D-18

SURVEY RESPONDENTS' OPINIONS ON THE IMPORTANCE OF ISSUES AFFECTING THE STATE OF WISCONSIN AND CITY OF WHITEWATER

Survey Respondents' Opinions on the Importance of Certain Issues		Not At All Important 1	2	3	4	Extremely Important 5	Total
Enhance Local Environmental Resources	Issue	33	60	101	107	103	404
	Percent	8.17	14.85	25.00	26.49	25.50	100.00
	Mean	- -	- -	3.46	- -	- -	- -
Develop More Restaurants and Shops in Local Area	Issue	55	63	124	86	76	404
	Percent	13.61	15.59	30.69	21.29	18.81	100.00
	Mean	- -	- -	3.13	- -	- -	- -
Preserve Agricultural Land	Issue	26	56	94	132	95	403
	Percent	6.45	13.90	23.33	32.75	23.57	100.00
	Mean	- -	- -	3.53	- -	- -	- -
More Efficient Governments	Issue	9	19	94	131	150	403
	Percent	2.23	4.71	23.33	32.51	37.22	100.00
	Mean	- -	- -	- -	3.98	- -	- -
Create More Recreational Trails	Issue	88	116	95	58	37	394
	Percent	22.34	29.44	24.11	14.72	9.39	100.00
	Mean	- -	2.59	- -	- -	- -	- -
Terrorism Security	Issue	113	108	103	48	26	398
	Percent	28.39	27.14	25.88	12.06	6.53	100.00
	Mean	- -	2.41	- -	- -	- -	- -
Improve Local Schools	Issue	27	42	109	109	110	397
	Percent	6.80	10.58	27.46	27.46	27.71	100.00
	Mean	- -	- -	3.59	- -	- -	- -
Job Loss	Issue	14	23	69	144	143	393
	Percent	3.56	5.85	17.56	36.64	36.39	100.00
	Mean	- -	- -	- -	3.96	- -	- -

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-19

SURVEY RESPONDENTS' LEVEL OF AWARENESS OF CRAVATH AND TRIPPE LAKES ISSUES

Relevant Issues for Trippe and Cravath Lakes		Not At All Aware 1	Somewhat Aware 2	Very Much Aware 3	Total
The Lakes Are Shallow	Issue	86	131	206	423
	Percent	20.33	30.97	48.70	100.00
	Mean	- -	2.28	- -	- -
The Lakes Have Large Amounts of Aquatic Weeds	Issue	36	92	299	427
	Percent	8.43	21.55	70.02	100.00
	Mean	- -	2.16	- -	- -
Residential Development is Occurring along the Lakes	Issue	56	126	245	427
	Percent	13.11	29.51	57.38	100.00
	Mean	- -	2.44	- -	- -
Commercial Development is Occurring near the Lakes	Issue	171	163	93	427
	Percent	40.05	38.17	21.78	100.00
	Mean	1.81	- -	- -	- -
The Lakes' Water Clarity is Poor	Issue	45	111	270	426
	Percent	10.56	26.06	63.38	100.00
	Mean	- -	- -	2.53	- -
Agricultural Runoff May Affect Water Quality	Issue	76	140	211	427
	Percent	17.80	32.79	49.41	100.00
	Mean	- -	2.32	- -	- -
Sanding and Salting of Roads May Affect Water Quality	Issue	75	176	177	428
	Percent	17.52	41.12	41.36	100.00
	Mean	- -	2.24	- -	- -

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-20

SURVEY RESPONDENTS' LEVEL OF CONCERN FOR VARIOUS PROBLEMS AT CRAVATH AND TRIPPE LAKES

Survey Respondents' Concern About Certain Issues		Not At All Concerned 1	A Little Concerned 2	Somewhat Concerned 3	Very Concerned 4	Extremely Concerned 5	Total
Aquatic Weed Species Are Present in Cravath and Trippe Lakes	Issue	40	47	107	109	119	422
	Percent	9.48	11.14	25.36	25.83	28.20	100.00
	Mean	- -	- -	3.52	- -	- -	- -
Sediment in Cravath and Trippe Lakes Has Caused Loss of Depth and Changed Water Quality	Issue	39	44	97	113	128	421
	Percent	9.26	10.45	23.04	26.84	30.40	100.00
	Mean	- -	- -	3.59	- -	- -	- -
Other Problems	Issue	38	20	42	44	75	219
	Percent	17.35	9.13	19.18	20.09	34.25	100.00
	Mean	- -	- -	3.45	- -	- -	- -

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-21

EFFECT OF PROBLEMS ON RESPONDENTS' QUALITY OF ENJOYMENT OF CRAVATH AND TRIPPE LAKES

Survey Respondents' Concern About Certain Issues		Does Not Reduce Enjoyment	Reduces Enjoyment a Little	Somewhat Reduces Enjoyment	Reduces Enjoyment a Lot	Reduces Enjoyment Extremely	Total
Aquatic Weed Species Are Present in Cravath and Trippe Lakes	Issue	76	41	98	84	111	410
	Percent	18.54	10.00	23.90	20.49	27.07	100.00
	Mean	- -	- -	3.28	- -	- -	- -
Sediment in Cravath and Trippe Lakes Has Caused Loss of Depth and Changed Water Quality	Issue	86	44	88	88	102	408
	Percent	21.08	10.78	21.57	21.57	25.00	100.00
	Mean	- -	- -	3.19	- -	- -	- -
Other Problems	Issue	55	18	47	33	64	217
	Percent	25.35	8.29	21.66	15.21	29.49	100.00
	Mean	- -	- -	3.15	- -	- -	- -

Source: University of Wisconsin-Whitewater and SEWRPC.

SECTION D.5. RESPONSES TO WILLINGNESS TO PAY SCENARIOS FOR WEED CONTROL AND SEDIMENT REMOVAL

Table D-22

SURVEY RESPONDENTS' WILLINGNESS TO PAY FOR A WEED CONTROL PROGRAM FOR TRIPPE AND CRAVATH LAKES THROUGH INCREASED PROPERTY TAXES EACH YEAR

Amount (dollars per year)	Frequency	Percent
$0	98	24.56
$1-9	29	7.27
$10-25	97	24.31
$26-99 (mean = $67.46)	74	18.55
$100-300	57	14.29
$301-999	7	1.75
$1,000-5,000	3	0.75
More than $5,000	1	0.25
Don't Know	33	8.27
Total	399	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-23

SURVEY RESPONDENTS' WILLINGNESS TO PAY FOR A SEDIMENT REMOVAL PROGRAM FOR TRIPPE AND CRAVATH LAKES THROUGH INCREASED PROPERTY TAXES EACH YEAR

Amount (dollars per year)	Frequency	Percent
$0	102	25.50
$1-9	23	5.75
$10-25	90	22.50
$26-99 (mean = $72.27)	78	19.50
$100-300	62	15.50
$301-999	7	1.75
$1,000-5,000	4	1.00
More than $5,000	1	0.25
Don't Know	33	8.25
Total	400	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-24

SURVEY RESPONDENTS' WILLINGNESS TO PAY FOR BOTH WEED CONTROL AND SEDIMENT REMOVAL PROGRAMS FOR TRIPPE AND CRAVATH LAKES THROUGH INCREASED PROPERTY TAXES EACH YEAR

Amount (dollars per year)	Frequency	Percent
$0	93	23.54
$1-9	15	3.80
$10-25	62	15.70
$26-99	78	19.76
$100-300 (mean = $113.24)	90	22.78
$301-999	19	4.81
$1,000-5,000	7	1.77
More than $5,000	2	0.51
Don't Know	29	7.34
Total	395	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

SECTION D.6. SURVEY RESPONDENT DEMOGRAPHIC DATA

Table D-25

SURVEY RESPONDENTS' TOTAL ANNUAL HOUSEHOLD INCOME

Income	Frequency	Percent
Below $20,000	32	8.44
$20,000-$29,999	42	11.08
$30,000-$39,999	43	11.35
$40,000-$49,999	45	11.87
$50,000-$59,999	49	12.93
$60,000-$69,999	34	8.97
$70,000-$79,999	29	7.65
$80,000-$89,999	30	7.92
$90,000-$99,999	16	4.22
$100,000-$149,000	43	11.35
$150,000-$199,999	8	2.11
$200,000-$299,999	5	1.32
$300,000 or More	3	0.08
Total	379	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-26

SURVEY RESPONDENTS' HIGHEST LEVEL OF EDUCATION COMPLETED

Level of Education	Frequency	Percentage
High School or Less	48	11.65
Some College or Technical School	78	18.93
Completed Two-Year Degree	18	4.37
Completed Four-Year Degree	84	20.39
Completed Some Graduate Classes	35	8.50
Completed Graduate Degree	149	36.17
Total	412	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-27

SURVEY RESPONDENTS THAT ARE CURRENTLY A UNIVERSITY STUDENT

Response	Frequency	Percent
Yes	21	5.04
No	396	94.96
Total	417	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

Table D-28

SURVEY RESPONDENTS' AGE

Age	Frequency	Percent
Under 22	9	2.17
23-25	8	1.93
26-29	14	3.38
30-34	24	5.80
35-39	26	6.28
40-44	24	5.80
45-49	32	7.73
50-54	47	11.35
55-64	101	24.40
65-75	74	17.87
Over 75	55	13.29
Total	414	100.00

Source: University of Wisconsin-Whitewater and SEWRPC.

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Appendix E

WISCONSIN DEPARTMENT OF NATURAL RESOURCES CHAPTER 30 DREDGING PERMIT GUIDANCE AND APPLICATION

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State of Wisconsin
Department of Natural Resources

APPLICATION FOR LAKE DREDGING
Form 3500-53I (R 1/2002)

The Wisconsin Department of Natural Resources helps protect your rights in public waters as well as public safety, by ensuring adequate planning and design of projects affecting fish and wildlife habitat, water quality and natural scenic beauty. This is done through permit and plan approval requirements for individual water projects. Chapters 30 and 31 of the Wisconsin Statutes require written permits for certain activities on or near a waterway: for example, to place any material below the ordinary high water mark (such as rock riprap, fish cribs, culverts, fords, etc.); to construct a bridge, dredge material from a lake or stream; create a pond; or to construct, operate, or maintain a dam. A single pier or wharf can generally be placed without a permit, provided state standards are met; more extensive piers or marinas require a permit.

Before submitting this application for a lake dredging permit, please contact your county, city or village zoning department to find out if your project site is in either a mapped wetland or floodplain and if local zoning restrictions could affect your project. Please see the Wetland Information topic (found in the Waterway and Wetland Permits Web Page) or request Wetland Packet #20 in addition to this packet for details.

A complete application with detailed drawings will help us make a decision about your application for a permit. The following information is necessary for a complete application.

To help us make a decision in the shortest time possible, please submit the following information:

1. **A copy of your deed or similar proof of ownership** (e.g. land contract, current property tax receipt).

2. **Good photographs that clearly show the existing project area.** Remember, too much snow cover or vegetation may obscure important details. If possible, have another person stand near the project area for size reference.

3. **Five (5) copies of a completed application Form 3500-53 including applicant information page and project plans.** When completing your application, **please use a ballpoint pen with black ink.** The site location sketch and plan drawings (see Sample Drawing) should be clear and to scale and have enough detail to find the site and understand the project proposal. **Please follow the sample drawing and information requirements pages attached. Also, make sure your phone number (both business and home) and property address or fire number is on the application. Plans may be submitted on a separate page(s), but please submit five (5) copies.**

4. **Five (5) copies of a narrative description of your proposal**, on a separate blank page. Please state:
   - what the project is,
   - how you intend to carry out the project, including methods, materials and equipment,
   - your proposed construction schedule and sequence of work,
   - what temporary and permanent erosion control measures will be used, and
   - the location of any disposal area for dredged or excavated materials.

5. **Five (5) copies of site maps.** Provide copies of relevant maps (when possible), such as USGS topographic map, Wisconsin Wetland Inventory map, FEMA floodplain maps, soil or zoning maps, with the project location clearly identified.

6. **The appropriate application fee (complete Form 3500-53A).**

If you have questions or problems in filling out or completing the application requirements, please call or contact the Water Management Specialist for the county where your project is located.

When you are finished compiling your application materials, remember to check your application for completeness. Then make copies of all materials so that you can submit **five copies** of the requested information to the Department. We also recommend that you keep a complete copy for your own records. Remember, incomplete applications may cause a delay in processing.

NOTE: Depending upon the type, complexity, and location of your proposed project, **processing can take 60 working days (3 months) or longer to complete a review, public notice and any required environmental analysis if your application is completed in detail.**

Thank you for contacting the Wisconsin Department of Natural Resources.
Enclosed are the project application materials you have requested.

Lake Dredging Information Requirements

All applications to remove material from a lakebed require the following information, on the application form and plan drawing sheet supplied or additional sheets if necessary.

1. In the **"proposed materials"** box, indicate what equipment and method of excavation will be used. The application must contain a description of the sequence of construction events including the installation of temporary and permanent erosion control measures and final landscaping and stabilization measures for the spoil disposal area.

2. In the **"location sketch"** box, sketch or trace a map that clearly indicates the location of the project. Recommended scale is 1" = 2000'. The map should enable the Department investigator to locate the project site.

3. The **top view** should include the following information:

   a. The location of the shoreline and the location of the cross-section.
   b. The proposed dredge area.
   c. The spoil disposal area. NOTE: If spoils are to be hauled from the site for disposal, provide a map showing where disposal will occur.
   d. Floodplain and wetland boundary.
   e. Depth contours up to the limit of the proposed dredging.
   f. The scale of the top view and a north arrow.

Note: Spoil disposal is not allowed in wetlands or floodplains.

4. The **cross-section view** of the project should be selected approximately perpendicular to the lake and include the following:

   a. The normal water level in the lake.
   b. A profile of the existing bottom and the proposed dredged bottom.
   c. The scale or dimensions of the drawing.

5. Proper erosion control measures, including the use of staked hay bales and silt fencing, must be used and maintained during and after the construction of this project. All erodible areas must be immediately seeded and mulched with a fast growing grass mixture. This grass seed mixture must become established and stabilize all erodible areas. These erosion control measures must adequately protect the waterway and wetlands from erosion and run-off.

Please select the scale of the drawing carefully to fit all the necessary information on the application form. If necessary, use additional sheets. Be sure to draw all the plans as accurately as possible. The Department may require additional information to evaluate the project.

Please send the completed application to the Water Management Specialist for the county where your project is located (a complete listing of addresses by county can be found on the Waterway and Wetland Permits web page link below).

http://dnr.wi.gov/waterways

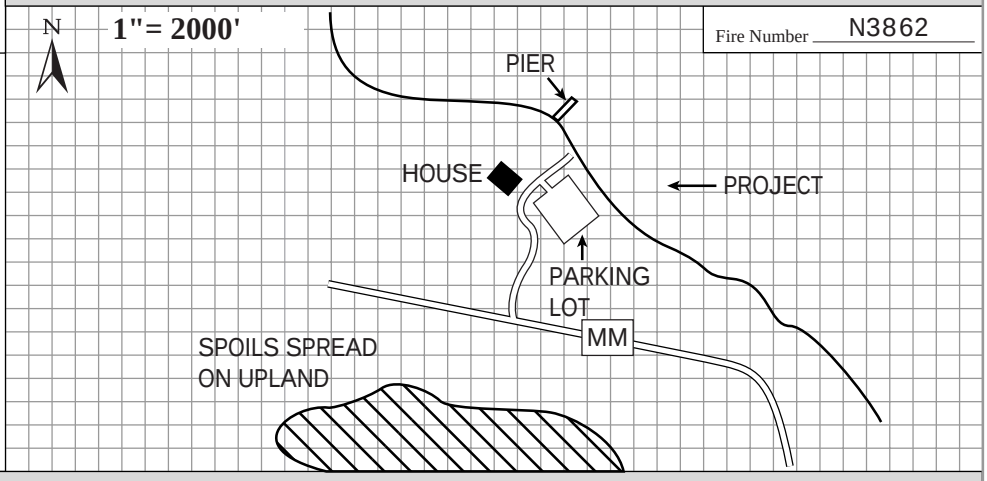
DRAWINGS OF PROPOSED ACTIVITY SHOULD BE PREPARED IN ACCORDANCE WITH SAMPLE DRAWING

Proposed Materials

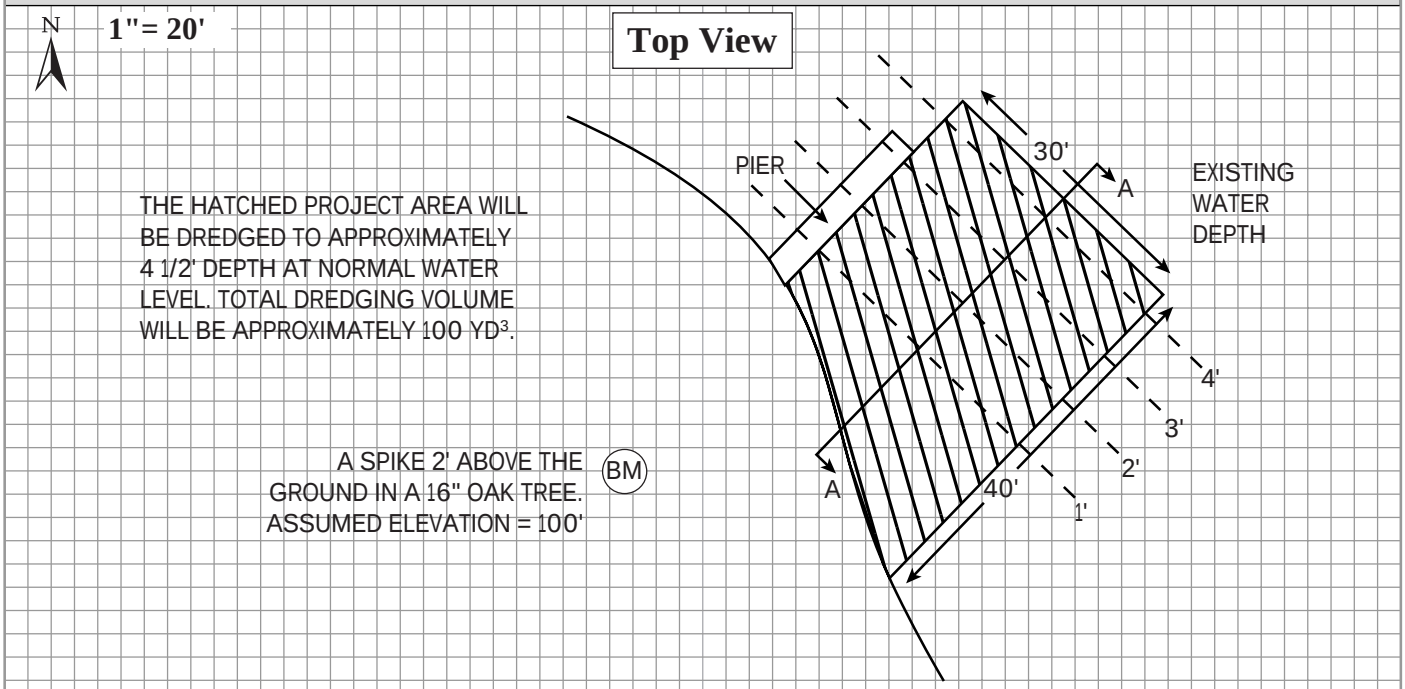
Excavation will be by clamshell dredge. Spoils will be hauled off site to an upland location. Totaldredge volume is approximately 100 cubic yards.

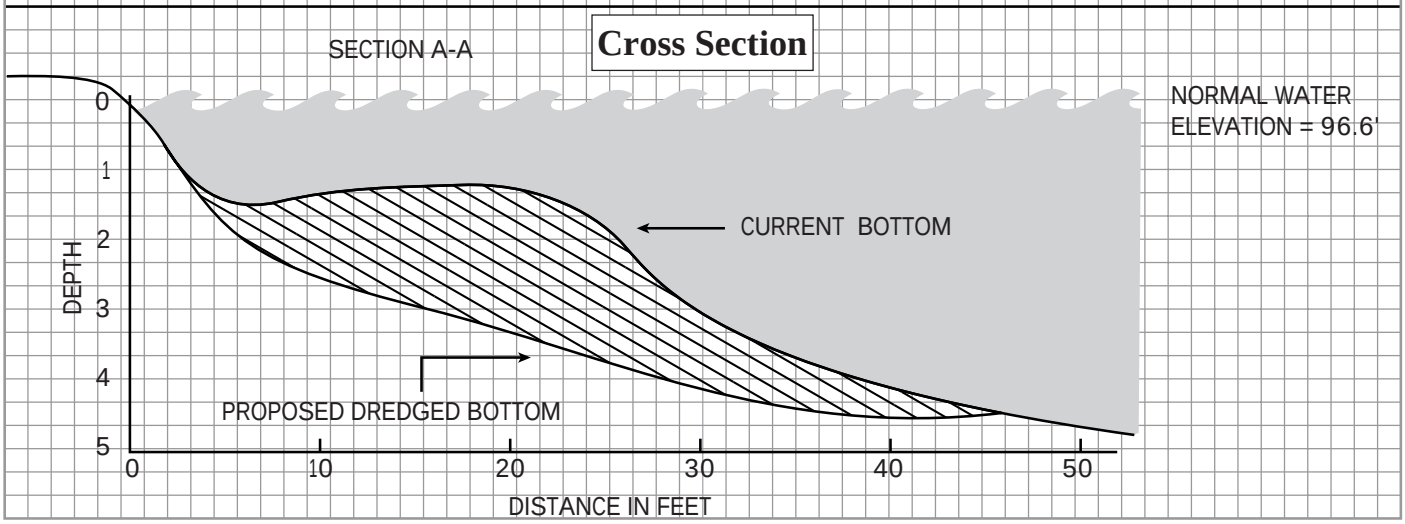
Location Sketch (Indicate scale.) Show route to project site: include nearest main road and crossroad.

LAKE DREDGING SAMPLE DRAWING



Project Plans. (Include top view and typical cross sections. Clearly identify features and dimensions or indicate scale.) Use additional sheets if necessary.





State of Wisconsin
Department of Natural Resources
(Return to appropriate DNR Regional/Service Center Office)

State / Federal Application for Water Regulatory Permits and Approvals

Form 3500-053 (R 4/01)

PLEASE COMPLETE BOTH PAGES 1 & 2 OF THIS APPLICATION. PRINT OR TYPE. The Department requires use of this form for any application filed pursuant to Chapter 30, Wis. Stats. The Department will not consider your application unless you complete and submit this application form. Personally identifiable information on this form will not be used for any other purpose, but it must be made available to requesters under Wisconsin's open records law [s. 19.31-19.39, Wis. Stats.].

1. Applicant (Individual or corporate name)

Address

City, State, Zip Code | Fire Number

Telephone No. (Include area code) | Tax Parcel Number

2. Agent/Contractor (firm name)

Address

City, State, Zip Code

Telephone No. (Include area code)

3. If applicant is not owner of the property where the proposed activity will be conducted, provide name and address of owner and include letter of authorization from owner. Owner must be the applicant or co-applicant for structure, diversion and stream realignment activities.

Owner's Name | Address | City, State, Zip Code

4. Is the applicant a business? ☐ Yes ☐ No

If YES, is the permit or approval you are applying for necessary for you to conduct this business in the State of Wisconsin?

☐ Yes ☐ No

If YES, please explain why (attach additional sheets if necessary):

5. Project Location

Address _____

Village/City/Town _____

Fire Number _____ Tax Parcel Number _____

Waterway _____

County _____

Govt. Lot _____ OR ____1/4,____1/4, of Section _____ ,

Township _____North, Range _____ (East) (West)

6. Adjoining Riparian (Neighboring Waterfront Property Owner) Information

Name of Riparian #1 | Address | City, State, Zip Code

Name of Riparian #2 | Address | City, State, Zip Code

7. Project Information (Attach additional sheets if necessary)

(a) Describe proposed activity (include how this project will be constructed)

(b) Purpose, need and intended use of project

(c) I have applied for or received permits from the following agencies: (Check all that apply)

☐ Municipal ☐ County ☐ Wis. DNR ☐ Corps of Engineers

(d) Date activity will begin if permit is issued _____; be completed: _____.

(e) Is any portion of the requested project now complete? ☐ Yes ☐ No

If yes, identify the completed portion on the enclosed drawings and indicate here the date activity was completed:

I hereby certify that the information contained herein is true and accurate. I also certify that I am entitled to apply for a permit, or that I am the duly authorized representative or agent of an applicant who is entitled to apply for a permit. Any inaccurate information submitted may result in permit revocation, the imposition of a forfeiture(s) and requirement of restoration.

Signature of Applicant(s) or Duly Authorized Agent | Date Signed

LEAVE BLANK - FOR RECEIVING AGENCY USE ONLY

Corps of Engineers Process No.	Wisconsin DNR File No.	
Received By	Date Received	Date Application Was Complete

Drawings of proposed activity should be prepared in accordance with sample drawing.

Proposed Materials

Location Sketch (Indicate scale)
Show route to project site: include nearest main road and crossroad.

N 1" = _____ ft.

Fire Number _____

Project Plans (Include top view and typical cross sections. Clearly identify features and dimensions or indicate scale.)
Use additional sheets if necessary.

N 1" = _____ ft.

Top View

Cross Section