COMMUNITY ASSISTANCE
PLANNING REPORT NO. 327

A LAKE PROTECTION AND AQUATIC PLANT MANAGEMENT PLAN FOR PLEASANT LAKE

WALWORTH COUNTY WISCONSIN

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Chapter I

INTRODUCTION

PURPOSE OF PLAN

Research shows that the health of a lake or stream is usually a direct reflection of the use and management of the land within its watershed. Research also shows that interventions are often necessary to maintain or improve the conditions of these resources. Located within U.S. Public Land Survey Section 24 and 25, Township 4 North, Range 16 East, in the Town of LaGrange and Troy, Walworth County (see Map 1), Pleasant Lake, together with its watershed, is a high-quality natural resource (see "Pleasant Lake Characteristics and Assets" section below). The purpose of this plan is to provide a framework to protect and improve the land and water resources of Pleasant Lake and its watershed with a focus on *protecting* this existing high-quality resource from human impacts and *preventing* future degradation from occurring. The recommendations provided in this report are appropriate and feasible lake management measures for enhancing and preserving the native plant community and water quality of Pleasant Lake, while still providing the public with opportunities for safe and enjoyable recreation within the Lake's watershed.

It is important to note that this plan complements another existing plan[1] and programs and ongoing management actions in the Pleasant Lake watershed, and it represents the continuing commitments of government agencies, municipalities, and citizens to diligent lake planning and natural resource protection. Additionally, it was designed to assist State agencies, local units of government, nongovernmental organizations, businesses, and citizens in developing strategies that will benefit the natural assets of Pleasant Lake. By using the strategies outlined in this plan, results will be achieved that enrich and preserve the natural environment.

This planning program was funded, in part, by the Pleasant Lake Protection and Rehabilitation District (PLPRD) and, in part, through a Chapter NR 190 Lake Management Planning grant awarded to the PLPRD and administered by the WDNR. 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.*[2]

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[1]*SEWRPC Memorandum Report No. 174,* An Aquatic Plant Management Plan for Pleasant Lake, *December 2009.*

[2]*This plan has been prepared pursuant to the standards and requirements set forth in the following chapters of the* Wisconsin Administrative Code*: Chapter NR 1, "Public Access Policy for Waterways;" Chapter NR 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."*

Map 1

LOCATION MAP OF PLEASANT LAKE WATERSHED

SOURCE: SEWRPC.

PLEASANT LAKE CHARACTERISTICS AND ASSETS

Pleasant Lake is a 145-acre[3] lake with a maximum water depth of 29 feet (see Map 2 for the Lake's bathymetry). The Lake's levels are maintained by an outlet structure located on the southeastern side of the Lake, which ultimately discharges to Honey Creek. The Wisconsin Department of Natural Resources (WDNR) has classified the Lake as a seepage lake, meaning that the Lake depends mainly on precipitation falling directly on the Lake, runoff from the surrounding area, and groundwater flow for its source of water. Table 1 further details the hydrologic and morphologic characteristics of the Lake. Chapter II provides more details on the importance of these characteristics.

Pleasant Lake and its watershed have a wide range of assets, particularly given their limited sizes. For example, Pleasant Lake is able to support a variety of recreational opportunities as is evidenced by the recreational survey completed by Southeastern Wisconsin Regional Planning Commission (SEWRPC) staff in the summer of 2013 (see Chapter II for more details), which shows that lake users engage in full-body contact uses (such as swimming from the beach) as well as fishing, canoeing, and kayaking. The Lake is also able to support a wide variety of wildlife including largemouth bass, panfish, northern pike, and walleye. Additionally, as is also further described in Chapter II, the Lake's watershed contains a critical species habitat area, and a variety of wetlands, uplands, and woodlands. It is also expected that the Lake and its watershed support several species of reptiles and amphibians that live in and around the Lake, as well as a number of bird species that inhabit the area during migration.[4]

Table 1

HYDROLOGY AND MORPHOMETRY OF PLEASANT LAKE

Parameter	Measurement
Size	
Surface Area of Lake	145 acres
Total Tributary Area	976 acres
Lake Volume	1740 acre-feet
Residence Time[a]	0.30 years
Shape	
Length of Lake	0.7 mile
Width of Lake	0.5 mile
Length of Shoreline	2.8 miles
Shoreline Development Factor[b]	1.62
General Lake Orientation	NW-SE
Depth	
Maximum Depth	29 feet
Mean Depth	12 feet
Percentage of Lake Area	
Less than Three feet	17 percent
Greater than 20 feet	25 percent

NOTE: The total tributary area for Pleasant Lake has been recorded in earlier reports to be 1,910 acre-feet and 155 acres. The area determined for this report is based on ground elevation contours developed from a year 2003 digital terrain model.

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

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

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

LAKE PROTECTION PROGRAMS AND GOALS

General lake protection goals and objectives for Pleasant Lake, aimed at maintaining and enhancing the Lake's many assets, were developed as a part of this planning process. These goals and objectives were developed in consultation with the PLPRD, as well as in consultation with the public. These goals include:

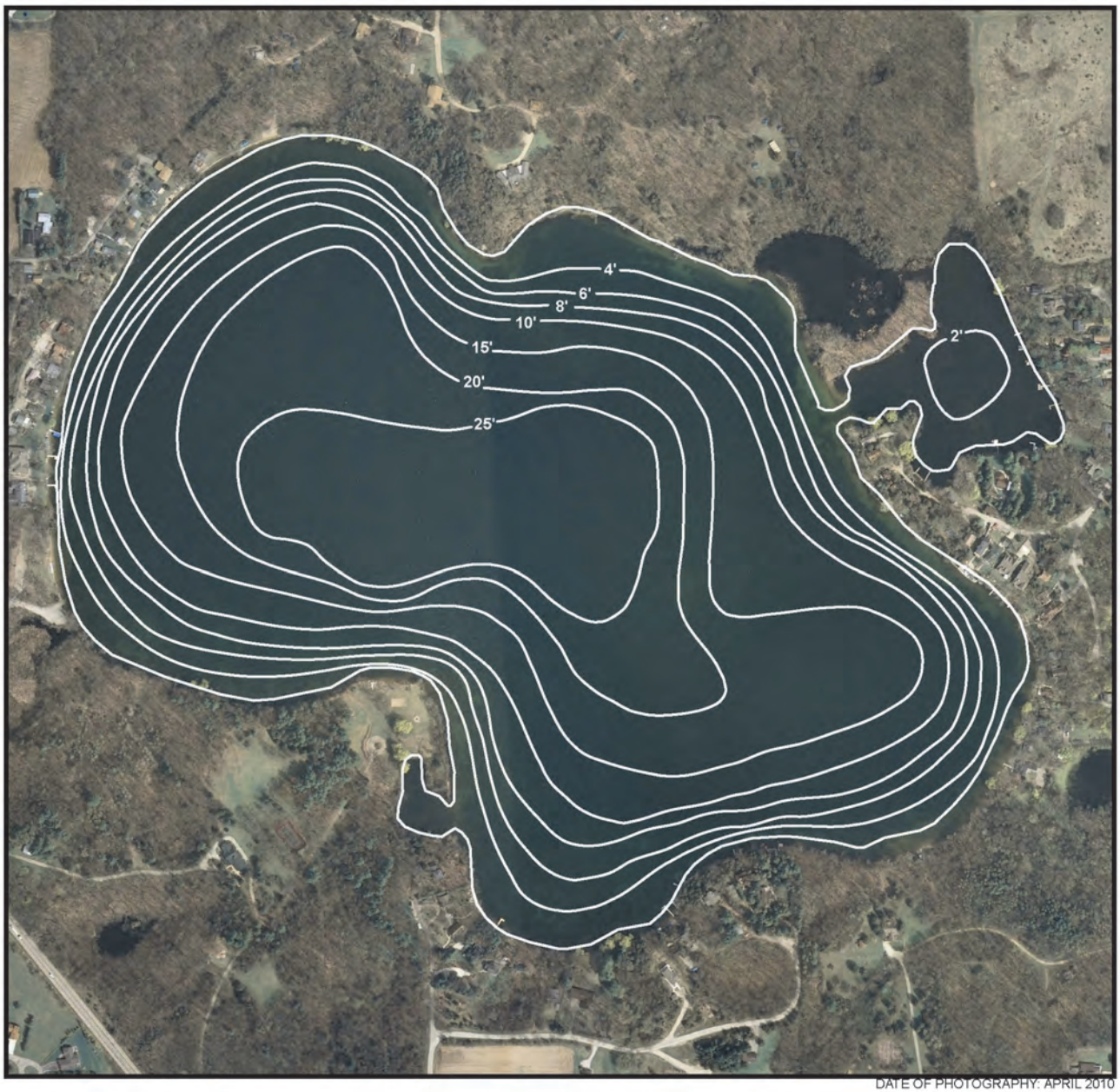
1. To document the aquatic plant community and fishery of Pleasant Lake, with emphasis on the occurrence and distribution of nonnative species – This plan details the aquatic plant survey completed by SEWRPC staff in 2013 for the purpose of understanding the aquatic plant community, and it summarizes fish surveys completed by WDNR staff.

[3]*A Lake area of 145 acres is reported on the WDNR website. However, WDNR reported the surface area of Pleasant Lake as 155 acres in a lake survey conducted in February 1954.*

[4]*These estimates are based on bird, amphibian, and reptile databases for the Region.*

Map 2

PLEASANT LAKE BATHYMETRY



DATE OF PHOTOGRAPHY: APRIL 2010

—20'— WATER DEPTH CONTOUR IN FEET

Source: Wisconsin Department of Natural Resources and SEWRPC.

N

0 0.05 0.1 Miles

0 250 500 Feet

2. To describe existing conditions in the Pleasant Lake watershed including identification and quantification of potential point and nonpoint sources of pollution, nutrient and contaminant inputs, and nutrient and contaminant balances – This plan identifies pollution sources, and provides nutrient load estimates which can direct pollution control management efforts;

3. To identify the extent of any existing and potential future water quality problems likely to be experienced in the Lake, including an assessment of the Lake's water quality using monitoring data being collected as part of ongoing programs along with estimates of changes in these conditions in the future – This plan includes an evaluation of a comprehensive set of water quality data for Pleasant Lake, draws conclusions from those data, and provides recommendations based on the evaluation of those data; and

4. To formulate appropriate lake protection programs, including public information and education strategies and other actions necessary to address the identified problems and issues of concern – This plan uses the information described above to develop a comprehensive set of specific lake protection recommendations to protect and enhance Pleasant Lake, and provides recommendations related to the issues and concerns of Pleasant Lake residents, including an aquatic plant management plan.

Implementation of the recommended actions set forth herein should serve as an important step in achieving the lake use/protection objectives over time.

Chapter II

ISSUES AND CONCERNS

INTRODUCTION

Despite Pleasant Lake being a valuable resource, as discussed in Chapter I of this report, it is subject to a number of existing and potential future problems and issues of concern. To better define and understand these issues, and to provide for the continued recreational use of the Lake, the Pleasant Lake Protection & Rehabilitation District (PLPRD) executed an agreement with the Southeastern Wisconsin Regional Planning Commission (SEWRPC) to investigate the causes of community concerns and to develop a comprehensive lake management plan to address those causes.

As a part of this planning program, four general issues of concern to be addressed in the management plan were identified through consultations with the PLPRD and Pleasant Lake community members. Two additional concerns were identified by SEWRPC.

This chapter presents a summary of each of the issues of concern (see Table 2) and seeks to answer the questions posed by Lake residents during the consultations. This chapter also presents information relevant to understanding the recommendations provided in Chapter III of this report.

ISSUE 1: AQUATIC PLANT MANAGEMENT

Aquatic plant management is a significant area of concern, which was the initial and primary purpose of this planning effort. Therefore, this section first discusses the general need for aquatic plant management by evaluating the current state of aquatic plants in Pleasant Lake, and then discusses management alternatives.

Aquatic Plants in Pleasant Lake

To investigate the need for aquatic plant management, SEWRPC staff completed an aquatic plant survey in the summer of 2013, using point intercept methodology.[1] This survey revealed that the five most dominant plant

[1]*The point intercept method uses predetermined points arranged in a grid pattern across the entire lake surface as sampling sites. Each site is located using global positioning system (GPS) technology and a single rake haul is taken at that site. A quantitative assessment of the rake fullness, on a scale of zero to three, is then made for each species identified. Further details on the methodology can be found in Wisconsin Department of Natural Resources, Publication No. PUB-SS-1068 2010.*

species in Pleasant Lake, in descending order of abundance, were: spiny naiad (*Najas marina*, invasive[2]), muskgrass (*Chara* spp.), sago pondweed (*Stuckenia pectinata*), eel-grass/wild celery (*Vallisneria americana*), and bushy pondweed (*Najas flexilis)* (see Table 3 for the list of aquatic plant species that were found and for characterization of their abundance and dominance). Individual distribution maps for each species found are included in Appendix A, along with text explaining the ecological significance of each plant and guidance on their identification.

Table 2

ISSUES AND CONCERNS OF PLEASANT LAKE

	Issues and Concerns
1	Aquatic Plant Management
2	Blue-Green and Floating Algae
3	Water Quality
4	Water Quantity
5	Wildlife
6	Implementation

Source: SEWRPC.

Of the 183 sites shallow enough to be sampled in Pleasant Lake in the summer of 2013, just over half had heavy vegetation.[3] Of those sites, the Bay was one of the locations that **contained heavy vegetation which is known to interfere with recreational use** (such as lilies). These results indicate that the Lake has levels of plants that deter recreational use in the Bay and the potential to affect recreational use in the nearshore area, thereby warranting aquatic plant management.

It is important, however, to note that even though a plant impedes access to a lake, it should not necessarily be eliminated or even significantly reduced because it may serve other beneficial functions. For example, the white water lily (one of the plants that is known to impede navigation) plays a major role in providing shade, habitat, and food for fish and other important aquatic organisms. It also plays a significant role in preventing shoreline erosion, as it can dampen waves that would otherwise damage the shoreline. Additionally, the shade that this plant provides helps reduce the growth of other plants, such as Eurasian watermilfoil and coontail, because it limits the amount of sunlight that reaches those plants. Given these benefits, removal of native "nuisance" plants (especially white water lilies) beyond the needs for gaining access to the Lake, should be avoided.

It is also important to note that all lakes have plants. In fact, in a moderately fertile lake such as Pleasant Lake, it is actually normal to have high amounts of aquatic plant growth in shallow areas. Additionally, it is important to note that **native aquatic plants form an integral part of a lake ecosystem**. These plants serve a number of valuable functions, including improving water quality by using excess nutrients, providing habitat for invertebrates and fish, stabilizing lake bottom sediments, and supplying food and oxygen to the Lake through photosynthesis.

With 18 different native submerged and floating species of aquatic plants, the 2013 survey also revealed that Pleasant Lake contains a **very good diversity of aquatic species** (see Map 3), especially for a lake of its size. School Section Lake in Waukesha County, which is comparable to Pleasant Lake in size, has 20 native species[4] and Wind Lake in Racine County, which is larger than Pleasant Lake has 16 native species.[5] This indicates that the diversity of the native plants within the Lake are a crucial part of the Lake's health. Therefore, the native plants should be protected to the greatest extent practical. This conclusion is further supported by an aquatic plant

[2]*Spiny naiad was added to the NR 40 list as a restricted species in 2015, meaning it is not allowed to be transported, transferred, or introduced without a permit. For further discussion, see section "Other Aquatic Plant Management Issues of Concern."*

[3]*Heavy vegetation in this context refers to a rake fullness measurement of three (see Appendix A for schematic).*

[4]*SEWRPC Community Assistance Planning Report No. 319,* A Lake Protection Plan for School Section Lake, *December 2014.*

[5]*SEWRPC Community Assistance Planning Report No. 198,* A Lake Management Plan for Wind Lake (2nd Edition), *June 2008.*

Table 3

ABUNDANCE DATA FOR AQUATIC PLANT SPECIES IN PLEASANT LAKE: 2013

Aquatic Plant Species	Native or Invasive	Number of Sites Found	Frequency of Occurrence[a]	Relative Density[b]	Dominance Value[c]
Najas marina (spiny naiad)	Invasive	144	78.69	2.78	218.76
Chara spp. (muskgrass)	Native	119	65.03	2.91	189.24
Potamogeton pectinatus (Sago pondweed)	Native	59	32.24	2.36	76.09
*Vallisneria americana (*eel-grass/wild celery*)*	Native	41	22.40	2.22	49.73
Najas flexilis (bushy pondweed)	Native	19	9.29	2.24	20.81
Potamogeton gramineus (variable pondweed)	Native	25	13.66	1.52	20.76
Myriophyllum spicatum (Eurasian water milfoil)	Invasive	14	7.65	2.14	16.37
Potamogeton illinoensis (Illinois pondweed)	Native	16	8.74	1.75	15.30
Nymphaea odorata (white water lily)	Native	9	4.92	2.89	14.22
Potamogeton amplifolius (large-leaf pondweed)	Native	12	6.56	2.08	13.64
Potamogeton natans (floating-leaf pondweed)	Native	7	3.83	2.71	10.38
Potamogeton zosteriformis (flat-stem pondweed)	Native	7	3.83	2.14	8.20
Nuphar advena (yellow pond lily)	Native	3	1.64	3.33	5.46
Potamogeton pusillus (small pondweed)	Native	3	1.64	1.33	2.18
Potamogeton foliosus (leafy pondweed)	Native	2	1.09	1.50	1.64
Elodea canadensis (waterweed)	Native	1	0.55	1.00	0.55
Myriophyllum sibiricum (native milfoil)	Native	1	0.55	1.00	0.55
Potamogeton strictifolius (stiff pondweed)	Native	1	0.55	1.00	0.55
Zosterella dubia (water stargrass)	Native	1	0.55	1.00	0.55

NOTE: There were 217 sampling sites arrayed over Pleasant Lake; 183 had vegetation.

[a]The **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.

[b]The **relative density** is the sum of density ratings for a species divided by the number of sampling points with vegetation.

[c]*The **dominance value** of a species is derived from a combination of how often it was observed at sampling sites that had some kind of vegetation present and its relative density at those sites; it provides an indication of the dominance of a species within a community.*

Source: SEWRPC.

survey undertaken by SEWRPC in 2007,[6] which noted the high species richness in the plant community, identifying 17 native species with similar dominance as the 2013 survey (see Table 4).[7] A WDNR 1967 survey reported the presence of white-stem pondweed (*Potamogeton praelongus*)[8] that was not reported in the 2007 or

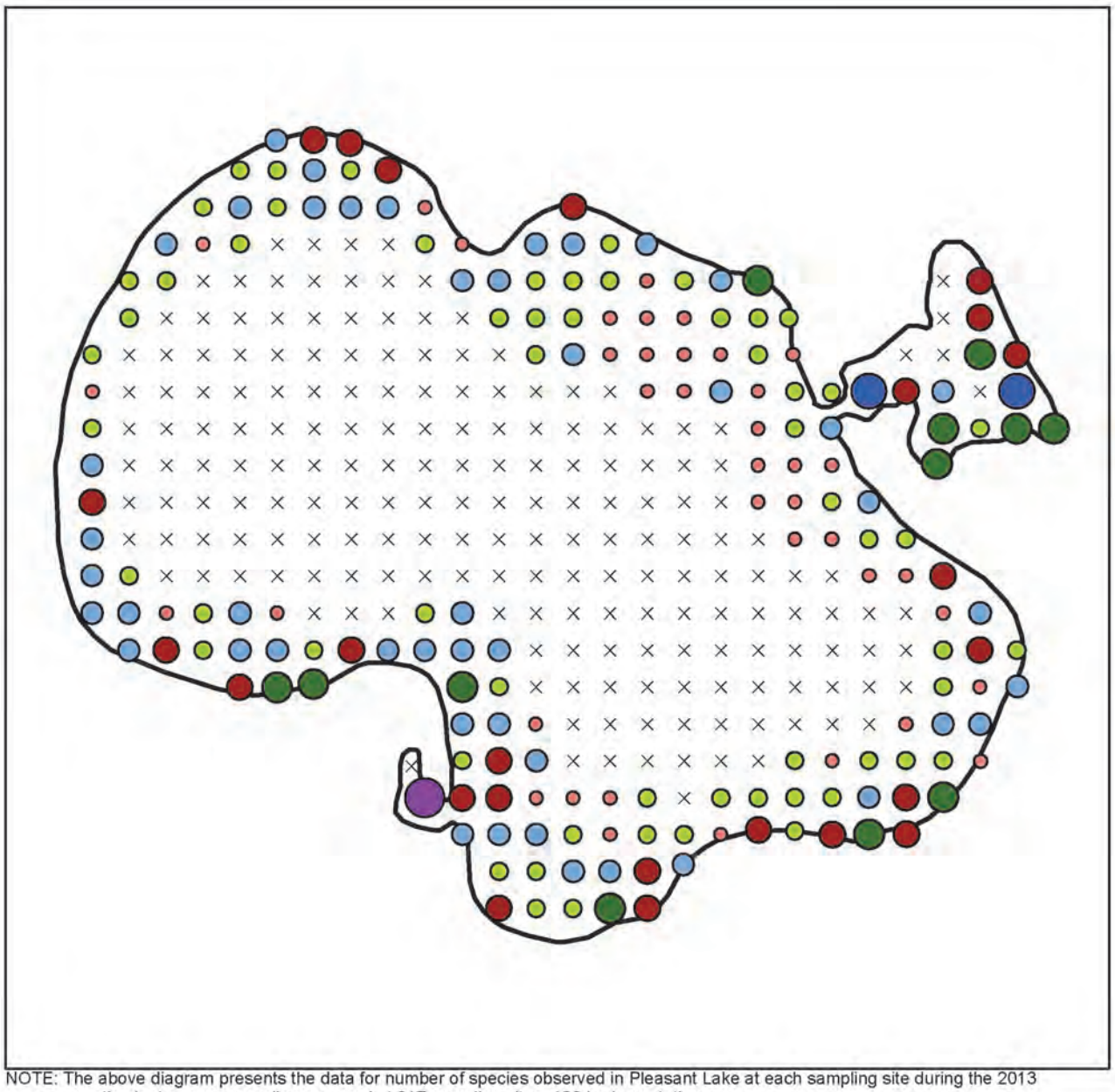
[6]*SEWRPC Memorandum Report No. 174,* An Aquatic Plant Management Plan for Pleasant Lake, Walworth County, Wisconsin, *December 2009*.

[7]*A direct comparison between the 2007 and 2013 aquatic plant surveys was not made due to the different methodologies that were undertaken for each of the surveys (transect versus point intercept surveys).*

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

Map 3

AQUATIC PLANT SURVEY SITES AND SPECIES RICHNESS IN PLEASANT LAKE: 2013



NOTE: The above diagram presents the data for number of species observed in Pleasant Lake at each sampling site during the 2013 aquatic plant survey; sampling occurred at 217 sampling sites, 183 had vegetation.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Table 4

TRANSECT SURVEY OF SUBMERGENT AQUATIC PLANT SPECIES OBSERVED IN PLEASANT LAKE: AUGUST 2007

Aquatic Plant Species	Number of Sites Found	Frequency of Occurrence[a]	Relative Density[b]	Importance Value[c]
Ceratophyllum demersum (coontail)	5	4.3	2.0	8.6
Chara vulgaris (muskgrass)	92	79.3	3.4	267.2
Elodea canadensis (waterweed)	1	0.9	1.0	0.9
Myriophyllum sibiricum (northern water milfoil)	24	20.7	1.7	35.3
Myriophyllum spicatum (Eurasian water milfoil)	10	8.6	1.8	15.5
Najas flexilis (bushy pondweed)	37	31.9	2.4	76.7
Najas marina (spiny naiad)	87	75.0	2.6	196.6
Potamogeton amplifolius (large-leaf pondweed)	11	9.5	1.6	15.5
Potamogeton foliosis (leafy pondweed)	1	0.9	1.0	0.9
Potamogeton gramineus (variable pondweed)	26	22.4	2.2	49.1
Potamogeton illinoensis (Illinois pondweed)	6	5.2	1.7	8.6
Potamogeton natans (floating-leaf pondweed)	3	2.6	1.3	3.5
Potamogeton pectinatus (Sago pondweed)	53	45.7	2.1	94.8
Potamogeton pusillus (small pondweed)	4	3.5	2.0	6.9
Potamogeton zosteriformis (flat-stem pondweed)	11	9.5	1.6	15.5
Ranunculus longirostris (white water crowfoot)	1	0.9	1.0	0.9
Utricularia sp. (bladderwort)	6	5.2	1.5	7.8
Vallisneria americana (water celery/eel-grass)	43	37.1	2.1	79.3
Zosterella dubia (water stargrass)	8	6.9	1.6	11.2

NOTE: Sampling occurred at 116 sampling sites along 32 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.

2013 survey which indicates a decrease in water quality since 1967.[9] See Table 5 for a comparison of species presence in Pleasant Lake during the 1967, 2007, and 2013 field surveys.

The Lake also contains a community of **Eurasian water milfoil (*Myriophyllum spicatum*), a *nonnative* species,** that was also found in the 2013 survey. The presence of this nonnative species; which has the capability to displace native plant species and interfere with recreational use, further indicates the need to actively manage its population. Map 4 shows the distribution and density of Eurasian water milfoil in Pleasant Lake.

[9]*Of the pondweeds that occur in the Region, white-stem pondweed is of special importance because of its sensitivity to changes in water quality and tolerance of turbidity. It is considered a valuable water quality indicator species, since its disappearance from a lake is usually an indication of deteriorating water quality.*

Table 5

COMPARISON OF ABUNDANCE DATA FOR AQUATIC PLANT SPECIES IN PLEASANT LAKE: 1967, 2007, AND 2013

Aquatic Plant Species	Dominance Value[a] (2013)	Importance Value[b] (2007)	Species Presence (1967)
Najas marina (spiny naiad)	219.13	196.6	- -
Chara spp. (muskgrass)	189.07	267.2	X
Potamogeton pectinatus (Sago pondweed)	75.96	94.8	X
*Vallisneria americana (*eel-grass/wild celery*)*	49.73	79.3	X
Najas flexilis (bushy pondweed)	21.86	76.7	X
Potamogeton gramineus (variable pondweed)	20.77	49.1	- -
Myriophyllum spicatum (Eurasian water milfoil)	16.39	15.5	- -
Potamogeton illinoensis (Illinois pondweed)	15.30	8.6	- -
Nymphaea odorata (white water lily)	14.21	- -	X
Potamogeton amplifolius (large-leaf pondweed)	13.66	15.5	X
Potamogeton natans (floating-leaf pondweed)	10.38	3.5	X
Potamogeton zosteriformis (flat-stem pondweed)	8.2	15.5	X
Nuphar advena (yellow pond lily)	5.46	- -	X
Potamogeton pusillus (small pondweed)	2.19	6.9	- -
Potamogeton foliosus (leafy pondweed)	1.64	0.9	- -
Elodea canadensis (waterweed)	0.55	0.9	X
Myriophyllum sibiricum (native milfoil)	0.55	35.3	X
Potamogeton strictifolius (stiff pondweed)	0.55	- -	- -
Zosterella dubia (water stargrass)	0.55	11.2	- -
Ceratophyllum demersum (coontail)	- -	8.6	X
Ranunculus longirostris (white water crowfoot)	- -	0.9	X
Utricularia sp. (bladderwort)	- -	7.8	- -
Potamogeton praelongus (white-stem pondweed)	- -	- -	X
Potamogeton crispus (curly-leaf pondweed)	- -	- -	X

NOTE: Another narrow-leaf Potamogeton species was found in the 1967 survey but was unable to be identified.

[a]*The **dominance value** of a species is derived from a combination of how often it was observed at sampling sites that had some kind of vegetation present and its relative density at those sites; it provides an indication of the dominance of a species within a community.*

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

Source: Wisconsin Department of Natural Resources and SEWRPC.

Aquatic Plant Management Alternatives

The Lake residents have two main concerns, including:

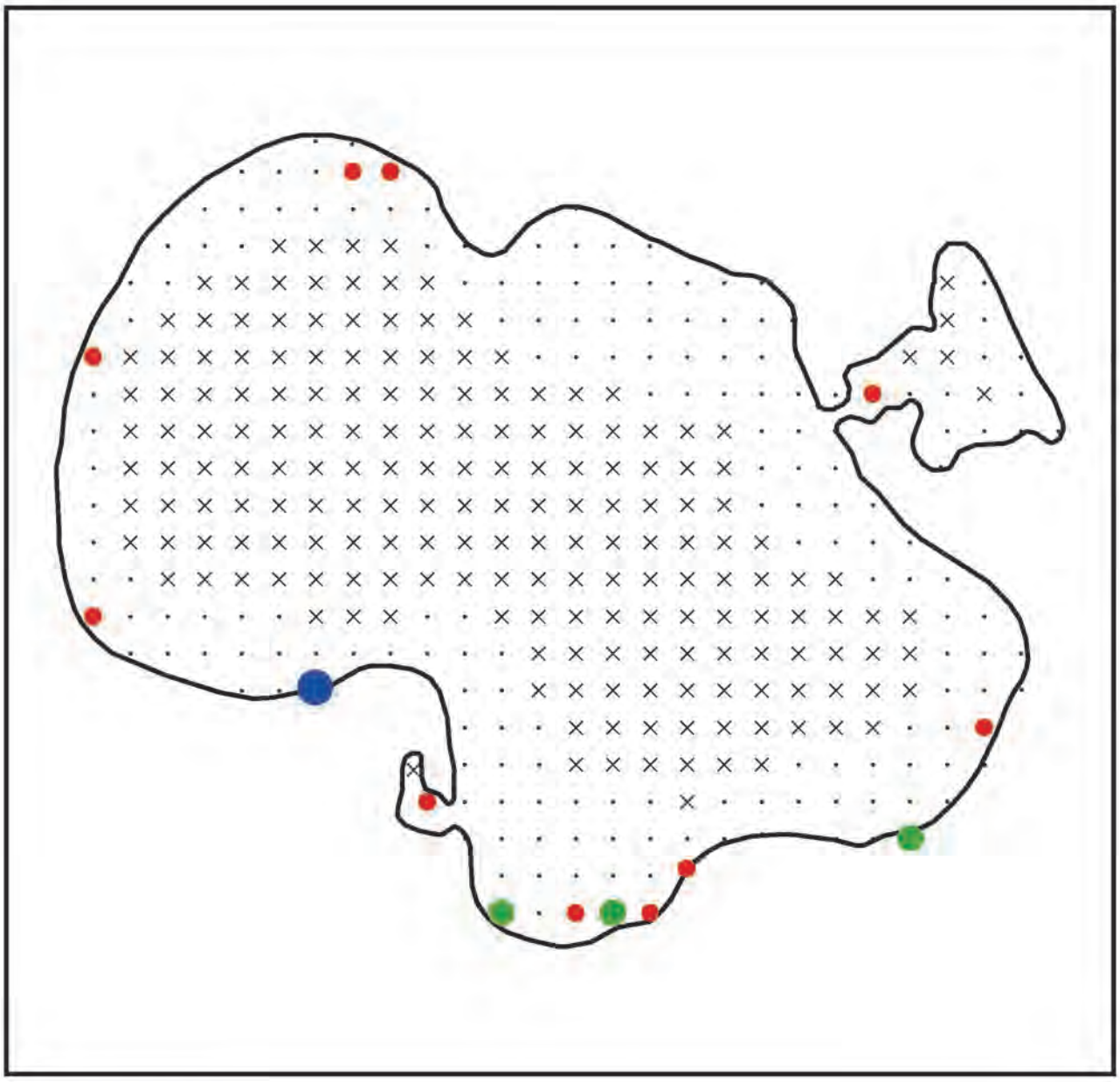
1. The desire to continue the effective Eurasian water milfoil control; and

2. The desire to maintain access to and around the Bay.

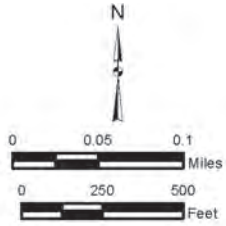
The management alternatives described in this section seek to monitor and control aquatic plant growth that has already occurred in the Lake. There are, however, many other activities that contribute to *preventing* aquatic plant growth in the Lake in general (which would avoid the adverse effects that result from many in-lake control alternatives). Consequently, a brief summary of these measures is also included at the end of this section.

Map 4

EURASIAN WATER MILFOIL OCCURRENCE IN PLEASANT LAKE: 2013



RAKE FULLNESS RATING



Source: SEWRPC.

Figure 1

COINCIDENCE OF EURASIAN WATER MILFOIL AND NATIVE PONDWEED

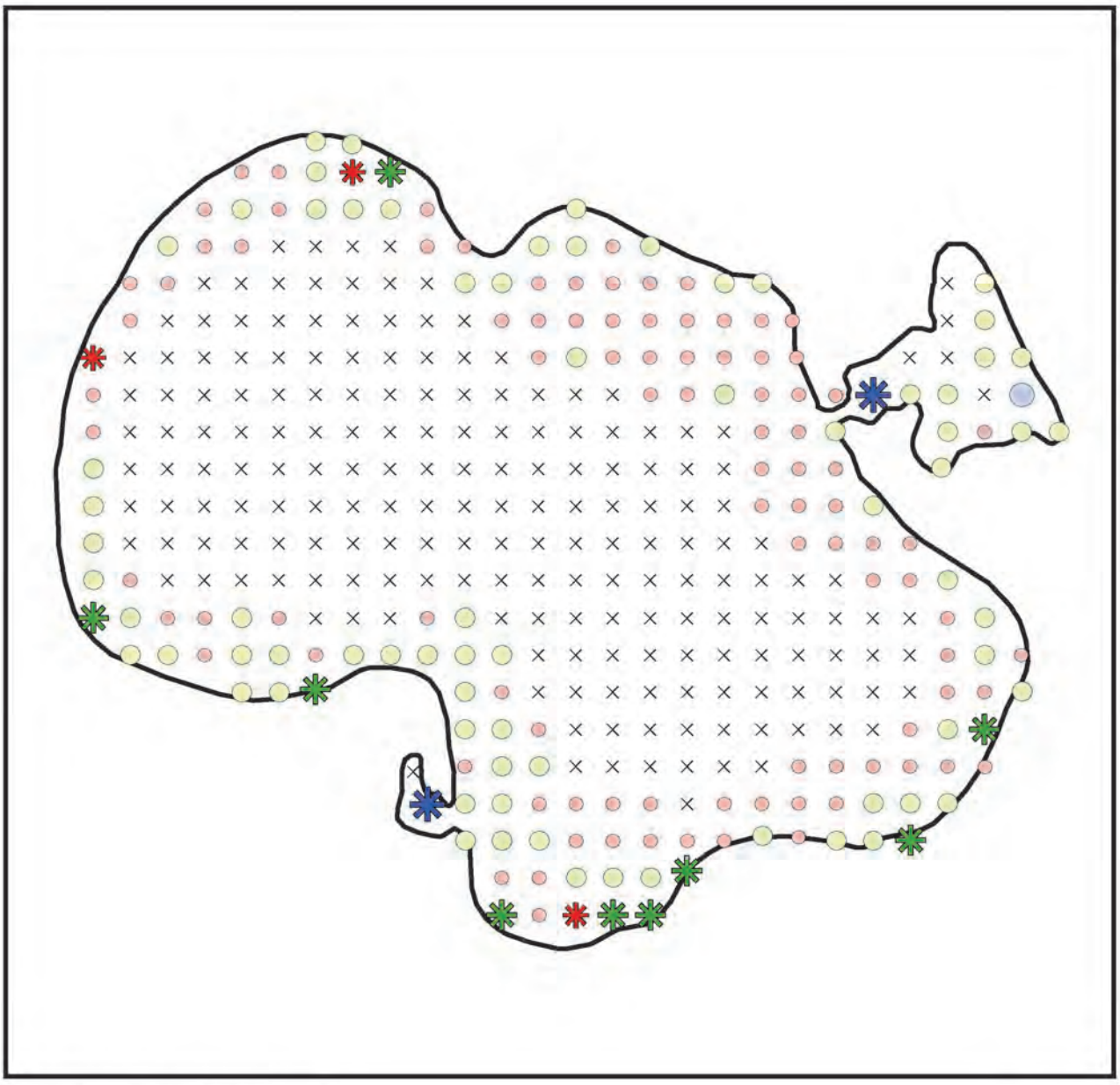
Source: SEWRPC.

It is important to note that there are conflicting interests when it comes to aquatic plant management in general. This is because one goal may interfere with the accomplishment of another. Eurasian water milfoil eradication, for example, could be accomplished with heavy chemical treatment; however, given that Eurasian water milfoil coexists with native plants (see Figure 1 and Map 5), including a very similar looking native milfoil plant (see Figure 2 and Appendix A), this technique would fail to accomplish the goal of preserving native plant populations. Consequently, the initial recommendations made in this section are informed by all of the goals that need to be accomplished under this management plan, namely access maintenance, control of Eurasian water milfoil, and protection of native species.

Aquatic plant management measures can be classed into five groups: 1) *physical measures*, which include lake bottom coverings; 2) *biological measures*, which include the use of organisms, including herbivorous insects; 3) *manual measures*, which involve the manual removal of plants by individuals; 4) *mechanical measures*, which include harvesting and removal of aquatic plants with a machine known as a harvester, or the use of suction harvesting; and 5) *chemical measures*, which include the use of aquatic herbicides to kill nuisance and nonnative aquatic plants. All of these control measures are stringently regulated. Additionally, most of the alternatives require a State of Wisconsin permit. Chemical controls, for example, require a permit and are regulated under Chapter NR 107 of the *Wisconsin Administrative Code*, while placement of bottom covers, a physical measure,

Map 5

COINCIDENCE OF EURASIAN WATER MILFOIL WITH NATIVE AQUATIC PLANTS: 2013



NATIVE SPECIES RICHNESS[a]

- NOT SAMPLED
- LOW
- MEDIUM
- HIGH
- LOW NATIVE SPECIES RICHNESS WITH EURASIAN WATER MILFOIL (EWM)
- MEDIUM WITH EWM
- HIGH WITH EWM

N

0 0.05 0.1 Miles

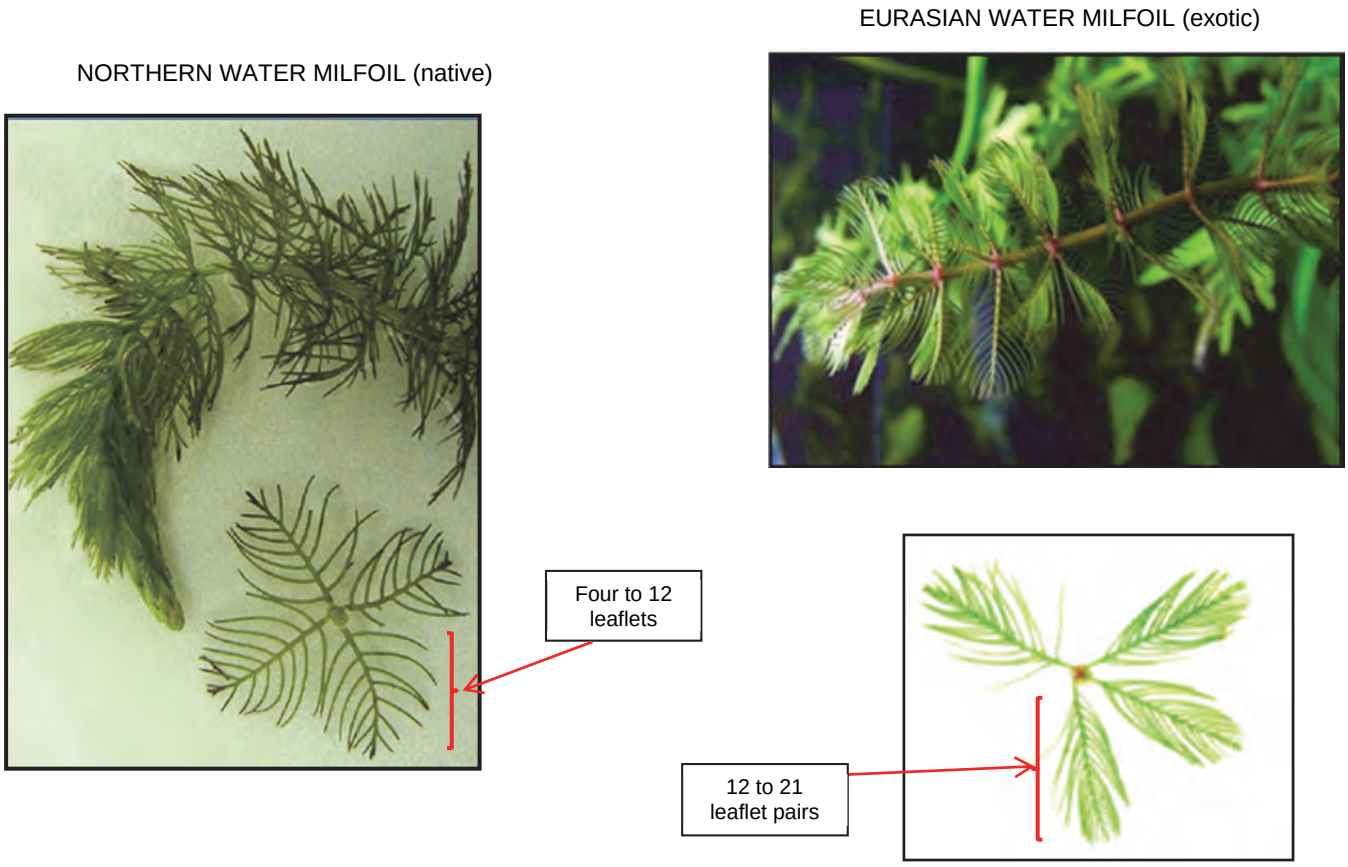
0 250 500 Feet

[a]Native species richness refers to the number of native plants present at sampling site: Low=1 or 2; Medium=3, 4 or 5; and High=6 or 7.

Source: SEWRPC.

Figure 2

COMPARISON OF NATIVE AND EURASIAN WATER MILFOIL



Source: SEWRPC.

requires a Wisconsin Department of Natural Resources (WDNR) permit under Chapter 30 of the *Wisconsin Statutes*. All other aquatic plant management practices are regulated under Chapter NR 109 of the *Wisconsin Administrative Code*.

The aquatic plant management elements presented in this section consider alternative management measures consistent with the provisions of Chapters NR 103, NR 107, and NR 109 of the *Wisconsin Administrative Code*. Further, the alternative aquatic plant management measures are consistent with the requirements of Chapter NR 7 of the *Wisconsin Administrative Code*, and with the public recreational boating access requirements relating to eligibility under the State cost-share grant programs set forth in Chapter NR 1 of the *Wisconsin Administrative Code*.

Physical Measures

Lake bottom covers and light screens provide limited control of rooted plants by creating a physical barrier that reduces or eliminates the sunlight available to the plants. They are often used to create swimming beaches on muddy shores, to improve the appearance of lakefront property, and to open channels for motor boats. Various materials can be used with varied success rates. For example, pea gravel, which is usually widely available and relatively inexpensive, is often used as a cover material despite the fact that plants readily recolonize areas where pea gravel is used. Other options include synthetic materials, such as polyethylene, polypropylene, fiberglass, and nylon, which can provide relief from rooted plants for several years. These materials, known as bottom screens or barriers, generally have to be placed and removed annually, as they are susceptible to disturbance by watercraft propellers and to the build-up of gasses from decaying plant biomass trapped under the barriers. In the case of

Pleasant Lake, the need to encourage native aquatic plant growth while simultaneously controlling the growth of exotic species, often in the same location, suggests that the placement of lake bottom covers as a method to control for aquatic plant growth is not consistent with the objective of encouraging native aquatic plant growth. Thus, such measures are not considered viable.

Biological Measures

Biological controls offer an alternative approach to controlling nuisance plants. Classical biological control techniques use herbivorous insects to control nuisance plants,[10] specifically *Eurhychiopsis lecontei*, an aquatic weevil species, used for the purpose of controlling Eurasian water milfoil. However, these insects are no longer commercially available and therefore not viable. If these insects were to become commercially available in Wisconsin, this may be a viable option to consider in the future, subject to further investigation. High boat traffic can limit the efficacy of these programs. Thus, given that high boat traffic is not allowed on the Lake, such a control approach could be viable.

Manual Measures

The manual removal of specific types of vegetation provides a highly selective means of controlling the growth of nuisance aquatic plant species, including Eurasian water milfoil. There are two common manual removal methods: raking and hand-pulling.

Raking is conducted in nearshore areas with specially designed rakes. This method provides an opportunity to remove nonnative plants in shallow nearshore areas and also provides a **safe and convenient method for controlling aquatic plants in deeper nearshore waters around piers and docks**. The advantage of the rakes is that 1) they are relatively inexpensive (costing between $100 and $150 each), 2) they are easy and generate immediate results, and 3) they immediately remove the plant material from a lake without a waiting period, thereby preventing sedimentation from decomposing plant material. Should the lake residents decide to implement this method of control, an interested party could acquire a number of these specially designed rakes for use by the riparian owners on a trial basis. Considering Pleasant Lake does not have a large population of Eurasian water milfoil in any one location the use of raking is not viable.

The second manual control, hand-pulling of stems where they occur in isolated stands, provides an alternative means of controlling plants such as Eurasian water milfoil. **This method is particularly helpful when attempting to target nonnative plants in the high growth season, when native and nonnative species often coexist**. This is because this method allows for higher selectivity than rakes, mechanical harvesting, and chemical treatments, and, therefore, results in fewer losses of native plants. Additionally, the physical removal of the plants also prevents sedimentation, which could help maintain water depths in the Lake. Given these advantages, manual removal of Eurasian water milfoil through hand-pulling is considered a viable option in Pleasant Lake where practical. It could be employed by volunteers or homeowners, as long as they are trained on proper identification of Eurasian water milfoil. WDNR provides a multitude of guidance materials, including an instructional video, on the manual removal of plants, if this management alternative is to be engaged.

Pursuant to Pleasant Lake Ordinance No. PL 2011-01 (see Appendix B), both raking and hand-pulling of aquatic plants in an area that consists of 20 feet along the shoreline and 30 feet out into the Lake (i.e., 30 feet of shoreline, including any piers, boatlifts, swimrafts or other water use devices, extending 100 feet into a lake), is allowed with a WDNR permit, provided that the hand-pulled plant material is removed from the Lake. Any other **manual**

[10] *B. Moorman, "A Battle with Purple Loosestrife: A Beginner's Experience with Biological Control,"* Lake Line, *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.*

removal would also require a State permit, unless employed in the control of designated nonnative invasive species, such as Eurasian water milfoil. In general, State permitting requirements for manual aquatic plant removal call for all hand-pulled material to be removed from a lake.

Mechanical Measures

Traditional Harvesting

Aquatic plants can also be harvested mechanically with specialized equipment known as harvesters. This equipment consists of a cutting apparatus that 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 sedimentation as well as plant growth, as it removes the plant biomass, which would otherwise decompose and release nutrients into a lake. Mechanical harvesting is particularly effective for large-scale plant growth.

An advantage of mechanical aquatic plant harvesting is that the harvester, when properly operated, typically **leaves enough plant material in a lake to provide shelter for aquatic wildlife and to stabilize the lake bottom sediments**. Aquatic plant harvesting also has been shown to facilitate the growth of native aquatic plants by allowing light penetration to the lakebed. Finally, harvesting does not kill native plants in the way that other control methods do. Instead, this method simply cuts them back.

A disadvantage of mechanical harvesting is that the harvesting operations may cause **fragmentation of plants and, thus, unintentionally facilitate the spread of Eurasian water milfoil**, which utilizes fragmentation as a means of propagation, particularly in areas where plant roots have been removed. This further emphasizes the need to prevent harvesting which removes the roots of native plants. Harvesting may also disturb bottom sediments in shallow areas, thereby increasing turbidity and resulting in deleterious effects, including the smothering of fish breeding habitat and nesting sites. Disrupting the bottom sediments also could increase the risk of nonnative species recolonization, as these species tend to thrive under disturbed bottom conditions. To this end, **most WDNR-issued permits do not allow deep cut harvesting[11] in areas having a water depth of less than three feet,** which would limit the utility of this alternative in some littoral areas of a lake and especially in the inlets and outlets. Nevertheless, if done correctly and carefully and accomplished under suitable conditions, harvesting has been shown to be of benefit in maintaining navigation lanes and ultimately reducing the regrowth of nuisance plants while increasing the prevalence of native plants.

Another disadvantage of harvesting is that some cut **plant fragments can escape the collection system on the harvester**. This side effect occurs fairly frequently on lakes where harvesting is used. Generally, to compensate for this, most harvesting programs include a plant pickup program which includes using the harvester to pick up any large amounts of floating plant materials, as well as a program to pick up plants from lakefront property owners who have raked plant debris onto their docks. This kind of program, when completed systematically, can help alleviate the aesthetic consequences of plant debris left along the lake shore.

If aquatic plant growth reached the point where the plant density is so heavy that the Bay becomes unnavigable, a small harvester (similar to the one depicted in Figure 3) would be permitted for use in the Bay to create small access lanes.

Suction Harvesting

In addition to harvesting with a harvester, there is an emerging harvesting method called Diver Assisted Suction Harvesting (DASH). DASH, also known as suction harvesting, is a mechanical process where divers select individual aquatic plants by their roots\ at the bottom of the lake, and then insert the whole plant into a suction device which takes the plant up to the surface of the lake for disposal. The process is essentially a more efficient

[11]*Deep cut harvesting is harvesting to a distance of only one foot from the lake bottom. This is not allowed in shallow areas because it is challenging to properly ensure that the harvester does not hit the lake bottom in these areas.*

method for hand-pulling plants within a lake. This method was first permitted in Wisconsin in 2014. Long-term evaluations will take place to determine the efficacy of the tech-nique. However, there appear to be many advantages to the method, including: 1) **lower possibility of plant fragmentation** in comparison to harvesting and traditional hand-pulling, thereby reducing regrowth of invasive plants like Eurasian water milfoil; 2) **increased selectivity in terms of plant removal** in comparison to harvesting with a harvester, thereby reducing the loss of native plants, and 3) **lower frequency of fish habitat disturbances**. DASH is considered a viable option for Pleasant Lake, given the small, localized beds of Eurasian water milfoil.

Figure 3

SMALL-SCALE HARVESTER

NOTE: This photo shows a harvester which is used on another southeastern Wisconsin lake. This picture is being used solely to show the technology. No particular brand is being advocated.

Source: SEWRPC.

Both mechanical harvesting and suction harvesting are regulated by WDNR and require a permit for operation. Non-compliance with the permit require-ments is legally enforceable with a fine or with the removal of the permit completely. The information and recommendations provided in this report will help meet the requirements for these permits, which can be granted for up to a five-year period.[12] At the end of that period, a new plant management plan will need to be developed to determine the success of the management technique. This updated plan should be based on a new aquatic plant survey and should evaluate the harvesting activities that occurred in the Lake during the harvesting period.[13] The operation of these techniques is overseen by the WDNR aquatic invasive species coordinator for the region.[14]

Chemical Measures

Chemical treatment with herbicides is a short-term method for controlling heavy growths of nuisance aquatic plants. Chemicals are generally applied to growing plants in either liquid or granular form. The advantages of using chemical herbicides to control aquatic plant growth are the relatively low cost, as well as the ease, speed, and convenience of application. The disadvantages associated with chemical control include:

1. **Unknown and/or conflicting evidence about long-term effects of chemicals on fish, fish food sources, and humans**—Chemicals that are approved by the U.S. Environmental Protection Agency to treat aquatic plants have been studied to rule out short-term (acute) effects on humans and wildlife. Additionally, some studies are also conducted to determine the long-term (chronic) effects of the

[12]*Five-year permits are granted so that a consistent aquatic plant management plan can be implemented over that time. This process allows the aquatic plant management measures that are undertaken to be evaluated at the end of the permit cycle.*

[13]*Aquatic plant harvesters must report harvesting activities as one of the permit requirements.*

[14]*Information on the current aquatic invasive species coordinator can be found on the WDNR website.*

chemical on animals (e.g., the effects of being exposed to these herbicides on an annual basis). However, it is often impossible to conclusively state that there will be no effects on a long-term basis, due to the constraints of animal testing, time restraints, and other issues. Additionally, long-term studies have not been completed on all of the potentially affected species[15] and there are conflicting studies/opinions regarding the role of the chemical 2,4-D as a carcinogen in humans[16] (see Appendix C for further facts on 2,4-D). For some lake property owners, the risk of using that chemical may, therefore, be considered too great, despite the legality of the measure. Consequently, the concerns of lakefront owners should be taken into consideration whenever chemicals are used. Additionally, if chemicals are used, they should be used as early in the season as possible to allow sufficient time for the chemical to decompose in time for swimmers and lake users to utilize the lake in the summer.[17]

2. **A risk of increased algal blooms due to the eradication of macrophyte competitors**—When nutrients exist in a lake, plants or algae will grow. Generally, if plants are not the primary user of the nutrients, algae has a tendency to take over. Overall, the loss of native plants and excessive use of chemicals must therefore be avoided, particularly if fish populations are to be maintained at a healthy level (fish require aquatic plants for food, shelter, and oxygen). Further details on this topic are discussed in the "Algal Blooms" section of this chapter.

3. **A potential increase in organic sediments, and associated anoxic conditions that can cause fish kills**—When chemicals are used on large mats of aquatic plants, the dead plant material generally settles to the bottom of a lake and subsequently decomposes. This process leads to an accumulation of sediments. Additionally, this process can also lead to a loss of oxygen in the deep areas of a lake as bacteria use the oxygen to decompose the plants (particularly in stratified lakes like Pleasant Lake). Extensive loss of oxygen can potentially create conditions that no longer support fish, causing fish kills. This process emphasizes the need to limit chemical control to early spring, when Eurasian water milfoil has yet to form dense mats.

4. **Adverse effects on desirable aquatic organisms due to loss of native species**—Native plants, such as pondweeds, provide food and spawning habitat for fish and other wildlife. Consequently, if native plants are unintentionally lost due to chemical application, the fish and wildlife populations often suffer. Consequently, if chemical application were to occur, only chemicals which target Eurasian water milfoil should be used in the early spring (when native plants have not yet emerged).

5. **A need for repeated treatments due to existing seed banks and/or plant fragments**—As mentioned previously, chemical treatment is not a one-time solution. The fact that the plants are not specifically removed from the lake increases the possibility for seeds/fragments to remain in the lake after treatment, thereby allowing for a resurgence of the species in the next year. Additionally, if large areas are left void of plants (both native and invasive) this leaves an area of disturbance (i.e., an area without an established plant community), which tends to be where Eurasian water milfoil thrive. In short, chemically treating large areas can sometimes leave opportunities for re-infestation. Consequently, repeated treatments would likely be needed if chemical treatment were to be employed.

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[15]*U.S. Environmental Protection Agency, EPA-738-F-05-002,* 2,4-D RED Facts, *June 2005.*

[16]*M.A. Ibrahim,* et al., *"Weight of the evidence on the human carcinogenicity of 2,4-D,"* Environmental Health Perspectives*, Vol. 96, December 1991, p. 213-222.*

[17]*Though the labels allow swimming in 2,4-D-treated lakes after 24 hours, it is possible that some swimmers may want more of a wait time to ensure that they receive less exposure to the chemical. Consequently, allowing for extra time is recommended so that residents and Lake users can feel comfortable that they are not being unduly exposed.*

As discussed earlier, there also are complicating factors associated with the application of chemicals to lakes, namely the coincidence of Eurasian water milfoil with native species, the physical similarities between Northern (native) and Eurasian water milfoil, and the presence of hybrid Eurasian water milfoil. However, **due to the early growth period of Eurasian water milfoil, there is an effective way to target the plant with chemicals while minimizing the first two of these factors by using chemical treatment in the early spring only**. Early spring treatments have the advantage of being more effective due to the colder water temperatures, enhancing the herbicidal effects and reducing the concentrations needed. As discussed above, they also reduce human exposure (swimming does not generally happen in very early spring) and limit the potential for collateral damage to native species.

Table 6

CHEMICAL CONTROLS ON PLEASANT LAKE: 1950-2008

Year	Macrophyte Control		
	Sodium Arsenite (pounds)	2,4-D (pounds)	Endothall/ Aquathol (pounds)
1950-1969	1,352	- -	- -
1977	- -	- -	30.0
1985	- -	- -	20.0
1999	- -	156	- -
2000	- -	350	- -
2001	- -	380	- -
2002	- -	300	- -
2004	- -	394	- -
2006	- -	1,189	- -
2007	- -	420	- -
2008	- -	731 + 9 gallons	- -
Total	1,352	3920 + 9 gallons	50.0

NOTE: Gallons represent liquid forms of chemical and pounds represent the granular form.

Source: Wisconsin Department of Natural Resources and SEWRPC.

Another factor to consider is that **chemicals have been used in Pleasant Lake previously** (see Table 6), without apparent negative effects on the native plant community. Consequently, use of early *spring* chemical controls is considered a viable option for Pleasant Lake if Eurasian water milfoil populations begin to take over the Lake. Use of chemical herbicides in aquatic environments is **stringently regulated and requires a WDNR permit and WDNR staff oversight during applications**. Therefore, preparation for these treatments should begin as early in the year as possible. Additionally, chemical treatment should only be done in areas where Eurasian water milfoil can be found during treatment, to prevent loss of native species.

If Eurasian water milfoil beds become very dense, an *early spring* whole lake treatment, which involves the distribution of a low concentration of chemicals throughout the Lake, could be an option to be considered. For WDNR to consider permitting a whole lake treatment, specific conditions would need to be met. Specifically, an aquatic plant survey must indicate that the Lake has 75 percent frequency of occurrence[18] of Eurasian water milfoil, along with rake fullness density values over the majority of the sample sites (see Map 4 for schematic of rake fullness).

Other Aquatic Plant Management Issues of Concern

With spiny naiad (*Najas marina*, see Appendix A) being added to the WDNR NR 40[19] list, it is important to note that this plant can become a nuisance in lakes of poor water quality with hard water;[20] however, these conditions

[18]*Seventy-five percent frequency of occurrence of Eurasian water milfoil means that 75 percent of the sites that were found to contain plants were found to have Eurasian water milfoil.*

[19]*The NR40 list is a compilation of species (both flora and fauna, terrestrial and aquatic) that are non-native to the State of Wisconsin and are, therefore, listed as either restricted or prohibited. For more information or for the list of species go to http://dnr.wi.gov/topic/invasives/classification.html.*

[20]*Paul M. Skawinski Aquatic Plants of the Upper Midwest 2nd Ed. 2014*

Table 7

WATERSHED MANAGEMENT EFFORTS AND ASSOCIATED BENEFITS TO AQUATIC PLANT COMMUNITIES

Measure	Goal	Benefit
Nutrient Management	Prevents phosphorous from entering the Lake	Lowers amount of nutrients available to support aquatic plant and algal growth
Sediment Reduction	Prevents loss of water depth	Will prevent growth of plants further into the Lake (as plants grow in shallow areas of lakes)
Buffer Development and Wetland Enhancement	Increases filtration of pollutants and sediments	See benefits associated with Nutrient Management and Sediment Reduction

Source: SEWRPC.

are not present in Pleasant Lake. Spiny naiad can also provide great habitat and food for fish and macroinvertebrates.[21] Therefore, at this time no management is recommended for this species as it is a beneficial plant to the ecosystem of Pleasant Lake.[22]

There is also the possibility of new invasive species establishing a community in a lake; this is always a real threat and one that community members should be aware of and proactive about. **There are many aquatic invasive species that pose a threat to Wisconsin lakes, e.g. hydrilla (*Hydrilla verticillata*) or starry stonewort (*Nitellopsis obtusa*).** These species can cause harm to the ecology of a lake; therefore, recommendations to protect Pleasant Lake against new invasives are discussed in Chapter III of this report.

The recommendations that resulted from the discussions in this section call for monitoring and controlling aquatic plant growth that has already occurred in the Lake. There are, however, many other activities that contribute to *preventing* aquatic plant growth in the Lake, in general (which would avoid the adverse effects that result from many in-lake control alternatives). A number of factors in lakes lead to the creation of a lake environment conducive to "excessive" plant growth, both in terms of Eurasian water milfoil and native plants (see Table 7). Poor water quality with high phosphorous content (which can result from polluted surface water runoff into the Lake), for example, provides the building blocks that all plants need to thrive and eventually reach what is perceived as a nuisance level. Consequently, the implementation of recommendations to improve water quality conditions needs to be a part of any comprehensive aquatic plant management plan. This is why many of the issues of concern discussed below are also considered priorities and why recommendations related to these factors are included in Chapter III of this report.

ISSUE 2: BLUE-GREEN AND FLOATING ALGAE

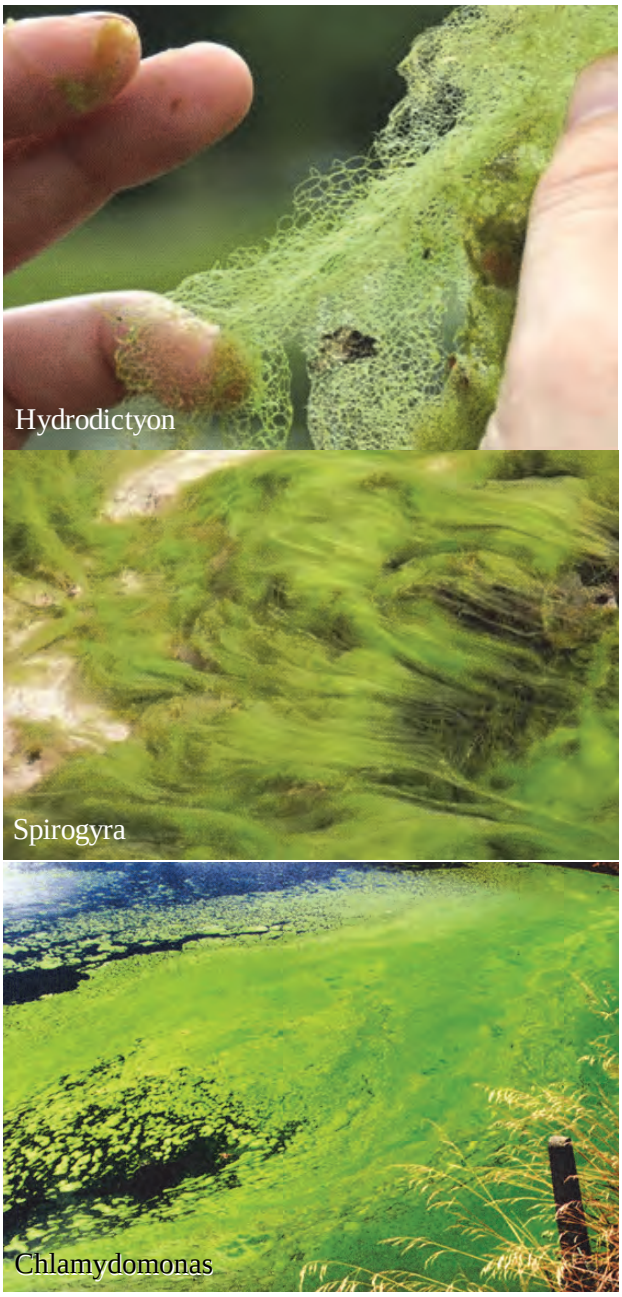
Blue-green and floating algae are ongoing issues of concern for Pleasant Lake residents and users, as the Lake has experienced spring algal blooms. Before discussing excessive algae growth and management, however, it is important to note that the presence of **algae is often a healthy part of any ecosystem**. Not only is it one of the primary components of a lake food chain, but certain kinds of algae also can produce oxygen in the same way that plants can. There are a number of kinds of algae, from filamentous algae to blue-green algae. The majority of algae strains are beneficial in lakes (see Figure 4), in moderation. However, the presence of toxic strains (see Figure 5), as well as excessive growth patterns, when they occur, should be considered an issue of concern. As with aquatic plants, algae generally grow at faster rates in the presence of phosphorus (particularly in areas which are stagnant). Consequently, when toxic or high volumes of algae begin to grow in a lake, this often indicates a problem with phosphorus pollution.

[21] *Wisconsin Lakes Partnership.* Through the Looking Glass: A Field Guide to Aquatic Plants, *2nd Ed., 2013*

[22] *As discussed with WDNR Water Resources Management Specialist*

Figure 4

DIFFERENT TYPES OF NON TOXIC ALGAE



Source: Lewis Lab, University of New Mexico, Landcare Research.

Figure 5

EXAMPLES OF TOXIC ALGAE

Source: National Oceanic and Atmospheric Administration, St. John's River Water Management District.

There are two primary ways to monitor algae levels. The first is to collect chlorophyll-*a* measurements, which indicate suspended algae levels in the water column (i.e., the green color in water). The second is to collect the algae and have it identified to determine if the algae is nontoxic. While samples have not been taken for identification, chlorophyll-*a* measurements have been taken in the Lake. Table 8 shows the average summer chlorophyll-*a* measurements, revealing relatively low concentrations in the last ten years with the exception of 2012 when Lake residents noted an uncharacteristically large algal bloom that June. There have been a few other years since the start of chlorophyll-*a* measurements in 1993, including 1997, 1999, and 2005, that have had above average chlorophyll-*a* measurements. As chlorophyll-*a* measures over 10 µg/l typically indicate green coloration of the water, Pleasant Lake is unlikely to have common algal issues as concentrations generally have not exceeded 4 µg/l. However, as these concentrations are affected by nutrient levels, recommendations for water quality measurements are discussed in Chapter III of this report.

In general, **the most permanent method for preventing excessive and toxic algae growth are:**

1. **To manage water quality with a focus on phosphorus reduction—** Phosphorus pollution is often the cause of excessive algal growth. Consequently, the water quality recommendations discussed in Chapter III should be implemented.

2. **To maintain a healthy and active native plant community—**As mentioned in the "Chemical Measures" subsection of this chapter, the maintenance of a healthy, robust native plant community is tied to the prevention of excessive algal blooms. This is because the two directly compete for phosphorus (i.e., when nutrients are in the Lake, plants or algae will grow). Consequently, the careful implementation of the Aquatic Plant Management recommendations provided in Chapter III and the communication of this nutrient-growth relationship to residents (to encourage conservative hand-pulling of vegetation) should be considered a priority.

Table 8

CHLOROPHYLL-A CONCENTRATIONS FOR PLEASANT LAKE

Year	Average (µg/l)	Minimum (µg/l)	Maximum (µg/l)	Count
2013	2.60	2.27	2.93	2
2012	8.12	2.52	8.12	1
2011	1.23	1.23	6.18	1
2010	1.36	1.09	1.82	3
2009	1.93	0.75	3.11	2
2008	2.02	1.10	3.47	3
2006	1.66	1.05	2.27	2
2005	11.67	2.41	21.40	3
2004	3.53	2.55	4.49	4
2003	4.23	1.50	6.21	3
2002	3.01	1.65	4.04	3
2000	3.30	2.60	4.00	4
1999	6.88	3.00	13.50	4
1998	3.23	3.08	3.47	4
1997	6.34	5.15	8.00	4
1995	1.23	1.23	1.23	1
1994	4.22	1.61	5.98	5
1993	6.81	3.77	14.40	4

Source: Wisconsin Department of Natural Resources.

In addition to these measures, in-lake measures and manual removal methods which could also be engaged include:

1. **Alum treatments**—Alum treatments involve spreading a chemical over the surface of a lake which precipitates as a solid and carries the algae to the bottom of the lake. This is a temporary solution which can often be cost prohibitive. However, if algae become excessive this method could be considered.

2. **Aeration**—This process involves pumping air to the bottom of a lake to prevent stratification and anoxic conditions in the deep part of the lake. This process then prevents internal loading (i.e., the release of phosphorus from deep sediments) and reduces the occurrence of algae blooms during the mixing periods. This method is only necessary if internal loading is excessive.

3. **Manual removal**—Manual removal of algae, using a suction device has recently been tested within the Region. This measure, though legal, is currently in only the early stages of application. Additionally, "skimming" of algae has been tried by lake managers with little success. Consequently, it would be necessary to further investigate these kinds of measures prior to implementation.

All of the above measures are generally implemented when algal blooms become so excessive that they greatly inhibit recreational use. This is because each of them is only temporarily effective, and repeated implementation of these measures can be cost prohibitive. Since Pleasant Lake has had only minor issues with algal blooms, these methods are not recommended and are, therefore, not further discussed within this report.

ISSUE 3: WATER QUALITY

Current and future water quality conditions continue to be important issues for many Pleasant Lake residents who have expressed concerns about the effects on the Lake and its ecosystem of increasing development pressure around the Lake and in the watershed.

As part of the discussion of water quality within Pleasant Lake, it is first important to define what water quality means, as many individuals have varying levels of understanding. Water quality is often discussed in terms of visual cues. Algal blooms or cloudy water, for example, can lead an observer to come to the conclusion that the water in a lake is "unclean;" however, to determine the water quality of a lake, lake managers and residents can look at very specific parameters which affect water quality or are indicators of water quality conditions. The most commonly used of these parameters are phosphorus, water clarity, chlorophyll-*a*, and dissolved oxygen; which act as indicators of larger issues in a lake (see Table 9 for details on these parameters). Nutrient pollution from phosphorus containing fertilizers, for example, can cause a lake's phosphorus levels to increase, its clarity to decrease (due to algal growth in the water column), and chlorophyll-*a* (a measure of algae content) to increase. These measurements, therefore, should be monitored over time to detect changes and potential issues.

In addition to phosphorus, water clarity, chlorophyll-*a*, and dissolved oxygen measurements, a number of other parameters can also be measured to determine the "general health" of a lake. These parameters can be selected to be measured depending on what the purpose of the monitoring effort is. *E-coli* and chloride measurements,[23] for example, are frequently taken on some lakes to determine safety in terms of swimming or the extent of man-made pollution entering the Lake, respectively.

To develop a water quality maintenance and improvement program, there are several factors which need to be investigated and considered. These factors include:

1. **The past and current water quality of a lake**—To determine what water quality management efforts are needed, it is important to establish the current conditions in a lake. To do this, concentrations of the aforementioned parameters (e.g., phosphorus, water clarity, chlorophyll-*a*) should be measured, and compared to past levels to determine if the water quality has been changing over time. Additionally, the parameters that have progressively been getting worse can help determine which pollutants should be targeted for reduction. This information, in combination with general characteristics of the Lake which can help provide the context for understanding water quality data, will help determine the extent of water quality problems, as well as the best method for water quality management.

2. **A lake's watershed characteristics, including land use and associated pollutant loadings**—The pollutants which enter a lake are highly dependent on the land surrounding the lake (i.e., its watershed). This is because different kinds of land use produce different kinds of pollutants (see Figure 6). For example, agricultural land use can be a significant contributor of sediments and nutrients (from fertilizers and soil loss), depending on the type of agricultural practices that are used (e.g., tillage farming can loosen soils and make it easier for these pollutants to enter the waterways). Similarly, urban land uses, such as residential land use, can contribute a significant amount of heavy metals, oils, and nutrients, depending on how residents use their land (e.g., oil leaked from cars onto pavement and fertilizers on lawns may drain to a lake during a rain event). Given this connection, it is important to determine what the current and planned land use is within the watershed. Using these land use conditions, models can be applied to estimate the amount of pollution that is likely entering the lake from these sources. Knowing this can help identify which areas are likely contributing to any water quality deterioration, and can help determine where in the watershed to focus pollution reduction efforts.

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[23] *Chlorides are used as an indicator of man-made pollution because they are usually only naturally present in low quantities. High chloride levels may result from road salt or fertilizer application and private onsite wastewater treatment systems that discharge to groundwater which provides baseflow for streams and lakes.*

Table 9

DESCRIPTION OF PRIMARY WATER QUALITY PARAMETERS AND THEIR REGIONAL AVERAGES

Parameter (in milligrams per liter (mg/l) unless otherwise noted)	Description	Regional Average	Existing Standards	Average for Pleasant Lake	Range for Pleasant Lake
Chlorophyll-*a*	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. Chlorophyll-*a* levels above 0.10 mg/l generally result in a green coloration of the water that may be severe enough to impair recreational activities, such as swimming or waterskiing	43	- -	4.08	0.75-21.40
Total Phosphorus	Phosphorus, which can enter a lake from natural and manmade sources, is a fundamental building block for plant growth. However, excessive levels of phosphorus in lakes can lead to nuisance levels of plant growth, unsightly algal blooms, decreased water clarity, and oxygen depletion that can stress or kill fish and other aquatic life. Statewide standards exist for phosphorus concentrations in lakes A concentration of less than 0.030 mg/l is the concentration considered necessary to limit algal and aquatic plant growths to levels consistent with recreational water use objectives	- -	0.02-0.04[a]	0.04	0.003-0.280
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 deplete oxygen during the decay process. A concentration of about 5.0 mg/l is considered the minimum level below which oxygen-consuming organisms, such as fish, become stressed, while fish are unlikely to survive when dissolved oxygen concentrations drop below 2.0 mg/l	10-12	- -	9.38	0.00-24.60
Water Clarity (feet)	Measured with a Secchi disk, a black-and-white, eight-inch-diameter disk, which is lowered into the water until a depth is reached at which the disk is no longer visible. It can be affected by physical factors, such as suspended particles, and by various biologic factors, including seasonal variations in planktonic algal populations living in a lake	5	- -	12.38	4.25-30.00

[a]See Wisconsin Administrative Code NR 102.06.

Source: SEWRPC.

3. **The filtration ability of a lake's watershed and shorelines**—Several natural features can help filter pollutants which would otherwise directly enter a lake. These features, such as wetlands and vegetative buffers (both man-made and natural), can significantly decrease the amount of pollution which ultimately enters a lake through using up and/or trapping pollutants prior to their entering the lake.

Each of these three factors is discussed below.

Water Quality and Lake Characteristics Evaluation

As previously mentioned, the evaluation of water quality depends on monitoring data. In general, this monitoring data is used to determine the level and nature of pollution within a lake and the risks associated with that pollution. When evaluating water quality within a lake, it is important to know the following characteristics:

1. **Whether or not the lake stratifies and, if it does, when the lake mixes**—Stratification refers to a state where the temperature difference (and associated density difference) between the surface waters of a lake (i.e., the epilimnion) and the deep waters of the lake (i.e. the hypolimnion) is great enough to prevent gases and pollutants from mixing between the two layers (see Figure 7). In the summer, this process is caused by sunlight warming only the top of the lake (where the sunlight can penetrate). In the winter the process is caused by cool air making the surface waters cooler than deep waters. It is important to know if stratification occurs because "stratification" is generally followed by a mixing period which causes the top and bottom layers to become the same temperature in the fall and the spring. When a lake is fully mixed, pollutants which had accumulated in the bottom during stratification may be mixed into the entire water column. In general, when measuring phosphorus and chlorophyll-*a*, the levels found during this mixing period are compared to the standards to determine if there is a pollution issue.

2. **If internal loading is occurring**—Internal loading can happen when a lake stratifies. This is because oxygen, produced by plants at the surface of the lake, cannot enter the hypolimnion due to the barrier formed by the stratification process. Consequently, after oxygen is used up in the bottom layer of the lake (by fish and bacteria), the area becomes anoxic. Once this occurs, bacteria use a different process to decompose materials which accumulate at the bottom of the lake (anaerobic decomposition) which can release phosphorus from sediments. That released phosphorus would have otherwise remained trapped in the sediments and unavailable to

Figure 6

ILLUSTRATIONS OF LAND USE AFFECTING WATERBODIES

NATURAL STREAM ECOSYSTEM

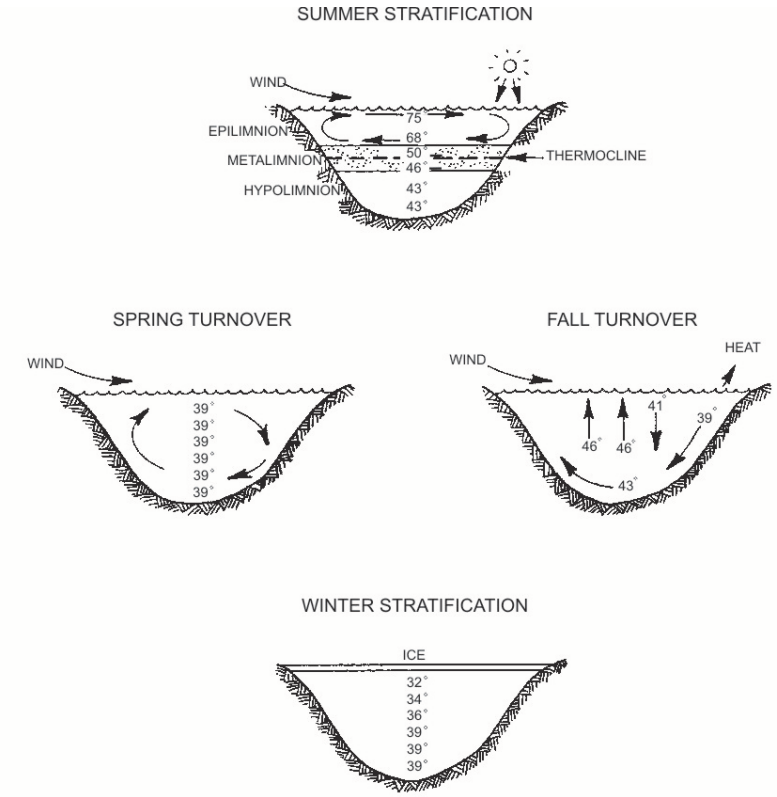
AGRICULTURAL STREAM ECOSYSTEM

URBAN STREAM ECOSYSTEM

*Source: Illustrations by Frank Ippolito/*www.productionpost.com. *Modified from D.M. Carlisle and others,* The quality of our Nation's waters—Ecological health in the Nation's streams, 1993-2005: U.S. Geological Survey Circular 1391*, 120 p.,* http://pubs.usgs.gov/circ/1391/*, 2013, and SEWRPC.*

Figure 7

THERMAL STRATIFICATION OF LAKES



Source: University of Wisconsin-Extension and SEWRPC.

plants and algae. This phosphorus can then mix into the water column during the mixing period, thereby causing plant and algae growth problems (both of which occur with high phosphorus levels). If this is occurring, a water quality management plan should focus on in-lake phosphorus management efforts in addition to pollution prevention.

3. **The lake's current and past trophic statuses**—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 (nutrient poor), mesotrophic (moderately fertile), and eutrophic (nutrient rich) (see Figure 8). Each of these states can happen naturally, and do shift upwards as a part of the natural lake aging process (see Figure 9); however, if a lake shifts upwards to a higher trophic level at a fast rate, this can be indication of pollution issues. Another indication of severe pollution is when a lake enters the "hyper-eutrophic" level which indicates highly enriched lakes (see Figure 10). This state does not occur naturally (i.e., without contribution of man-made pollution).

4. **A lake's residence time**—Residence time, also known as retention time or flushing rate, refers to the average length of time that water remains in a lake. This is significant because it can help determine how quickly pollution problems can be solved. In lakes with short retention times, for example, nutrients and pollutants will be flushed out fairly quickly, meaning that management efforts could likely focus only on preventing pollution from the watershed. In contrast, lakes with long retention times tend to accumulate nutrients that can eventually become concentrated in their bottom sediments, meaning that in addition to preventing pollution, it is also necessary to engage in in-lake water quality management efforts.

To determine the preceding characteristics for Pleasant Lake, SEWRPC staff completed a comprehensive water quality inventory.

Pleasant Lake has some water quality data dating back to 1960; however, most of the data is from 1990 through the present, making it possible to see long-term changes and trends in the Lake over the years for vertical temperature and dissolved oxygen profiles (Figure 11), secchi depth (Figure 12), dissolved oxygen (Figure 13), and phosphorus (Figure 14). This data indicates that **Pleasant Lake does stratify most summers,**[24] **apparently has no internal loading (Figure 11 does not indicate anoxic conditions in the deeper parts of the Lake), and is meso-oligotrophic** (see Figure 15).[25] In general, these conditions indicate that the Lake is relatively healthy.

Finally, though flow measurements[26] (which are often used to develop highly accurate retention times) were not available for the Lake, SEWRPC staff did use a model[27] to determine an approximation of **the retention time in Pleasant Lake. That time was estimated to be 0.3 year,** a reasonably fast flushing rate. The features in place within the watershed that act to control phosphorus input to the Lake, along with the relatively fast flushing time, have resulted in low phosphorus concentrations within the Lake. It is important to maintain land management practices, and to establish new practices where appropriate to continue to control nutrient inflow to the Lake and to maintain healthy dissolved oxygen levels.

Ultimately, Pleasant Lake has good water quality. Therefore, monitoring of the Lake and its watershed should continue, to determine when water quality is decreasing and to proactively address pollutants. Recommendations are set forth in Chapter III of this report.

Watershed Characteristics and Pollutant Loadings

As mentioned above, different land uses can contribute different types of pollution to a lake. Though it is normal for some sediments and nutrients to enter a lake from the surrounding lands (contributing to the natural lake aging process), it becomes an issue of concern when people introduce pollutants (such as heavy metals, fertilizers, and oils) which would not have otherwise entered the system. Issues also arise when land is disturbed, through tilling and construction, which causes soils to loosen, erode, and eventually enter streams and lakes.

Given these connections between the practices around a lake and lake water quality, it is important to characterize the area which drains to a lake (i.e., its watershed) to determine potential pollution sources and risks to the lake's water quality. Several items need to be examined to complete this characterization, including:

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[24]*Pleasant Lake typically stratifies most summers in June and early July, see SEWRPC Memorandum Report No. 174,* An Aquatic Plant Management Plan for Pleasant Lake, Walworth County, Wisconsin, *December 2009, Figure 2 for the temperature and dissolved oxygen profiles depicting stratification. The WDNR also has this data, along with more recent data at http://dnr.wi.gov/lakes/CLMN/Station.aspx?id=653217.*

[25]*The trophic status of Pleasant Lake was determined using the Wisconsin Trophic State Index value formula using Secchi-disk measurements, total phosphorus levels, and chlorophyll-*a *levels from 1990-2013.*

[26]*Flow measurements that are used to calculate retention times refer to a measurement of the rate at which volumes of water enter and exit the Lake.*

[27]*The calculation of Pleasant Lake's retention time was based on relating the average annual volume of precipitation which falls on the watershed, reduced by a factor to account for infiltration and other losses where appropriate, and the water volume of the Lake to estimate how quickly water is pushed out of the Lake through the outlet.*

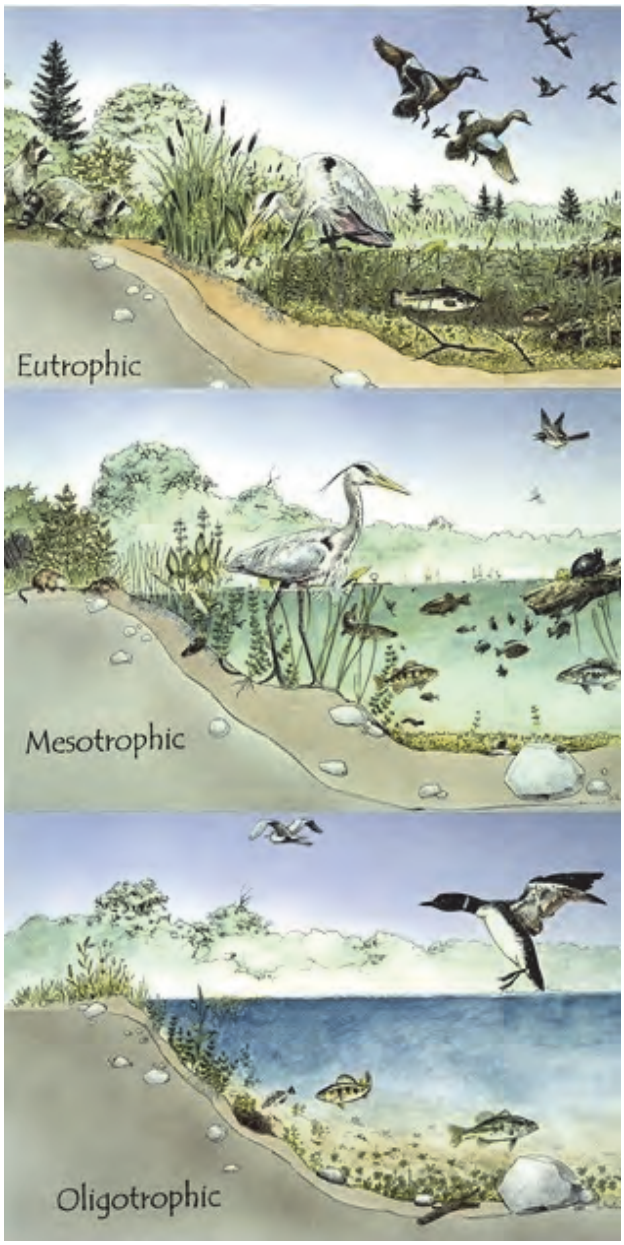
1. **The location and extent of a lake's watershed**—Before beginning to characterize a watershed, it is first necessary to delineate that watershed. The process of delineation essentially involves analyzing elevation data on the land surface surrounding a lake to determine the area draining towards the lake. Completing this analysis provides the basis for which we can begin to determine whether potential pollutant sources are valid. If a nonpoint pollution source is near to a lake but outside of the watershed, for example, surface runoff from that source would not reach the lake, and, therefore, is not an issue of concern in terms of water quality.

2. **The type and location of existing land use within the watershed**—The extent and location of current land use within the watershed can help determine the potential causes of pollution to a lake. Current land use conditions can be represented in models to estimate total pollutant loads that could be entering a lake. Once these loads are determined, it is then possible to determine where to focus management efforts (e.g., if agriculture is the primary source of phosphorus, this may be an effective place to begin pollution reduction efforts).

3. **The type and location of past land use changes within the watershed** - Being aware of past land use changes can provide a context for understanding what caused past issues within a lake, particularly when looked at along with contemporaneous water quality monitoring data or well-known historical issues. If a long-term lake property owner, for example, remembers or has record of the years of high aquatic plant growth, large algal blooms, or low or high lake levels, those conditions can be looked at in terms of the historical land use changes to determine if something happened within the watershed to cause an issue (such as an increase in agricultural land use or development). This information can be helpful in future planning because it offers insight into how a lake might react to similar situations.

Figure 8

ILLUSTRATION OF TROPHIC STATES



Source: DH Environmental Consulting, 1995.

4. **The nature and location of planned land use within the watershed**—In addition to current land use in the watershed, it is also possible to estimate land use changes that will occur in the future. Knowing this information is important as it helps determine which areas may need to be targeted for management efforts in the future, as well as determine the potential extent of future pollution issues.

Figure 9

ILLUSTRATION OF AGING AFFECTING TROPHIC STATUS

Source: Wisconsin Department of Natural Resources.

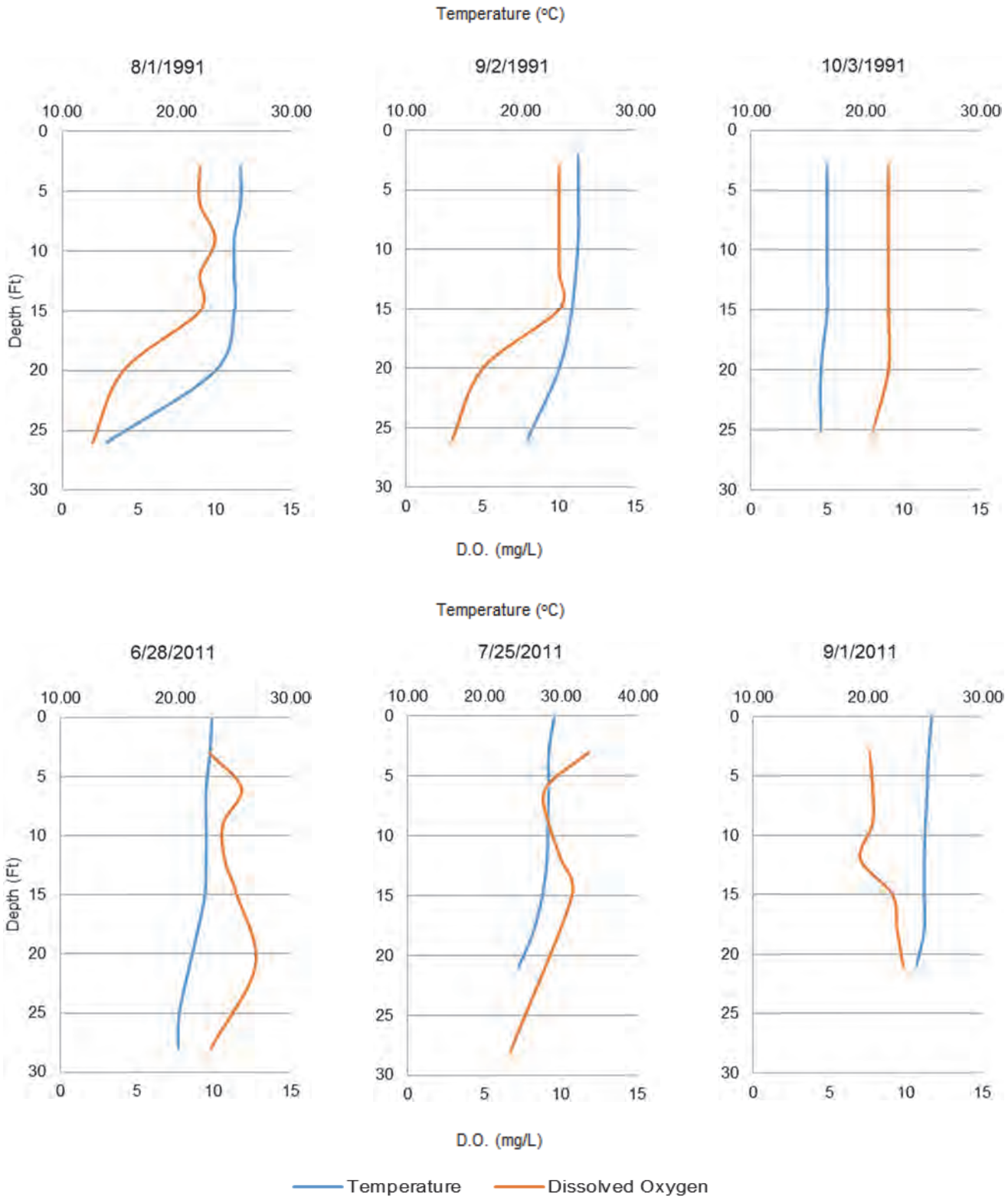
Figure 10

PHOTOGRAPH OF A HYPER-EUTROPHIC LAKE

Source: University of Minnesota, College of Natural Resources, 2003.

Figure 11

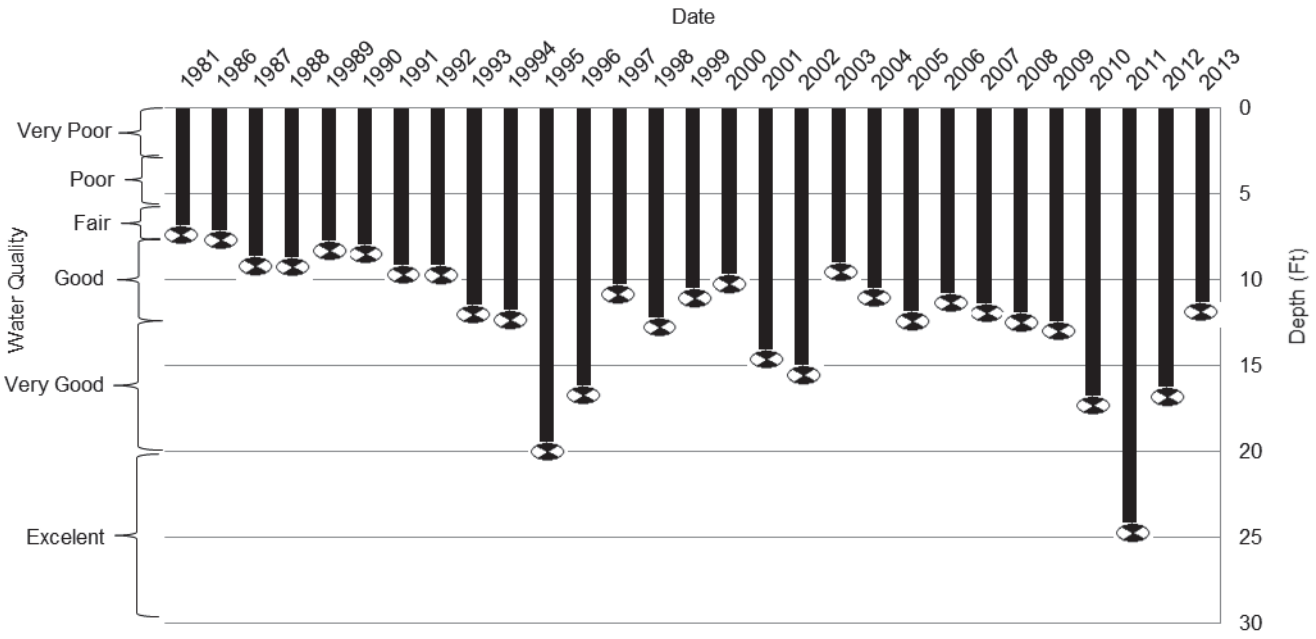
PROFILES FOR PLEASANT LAKE: 1991-2011



Source: Wisconsin Department of Natural Resources and SEWRPC.

Figure 12

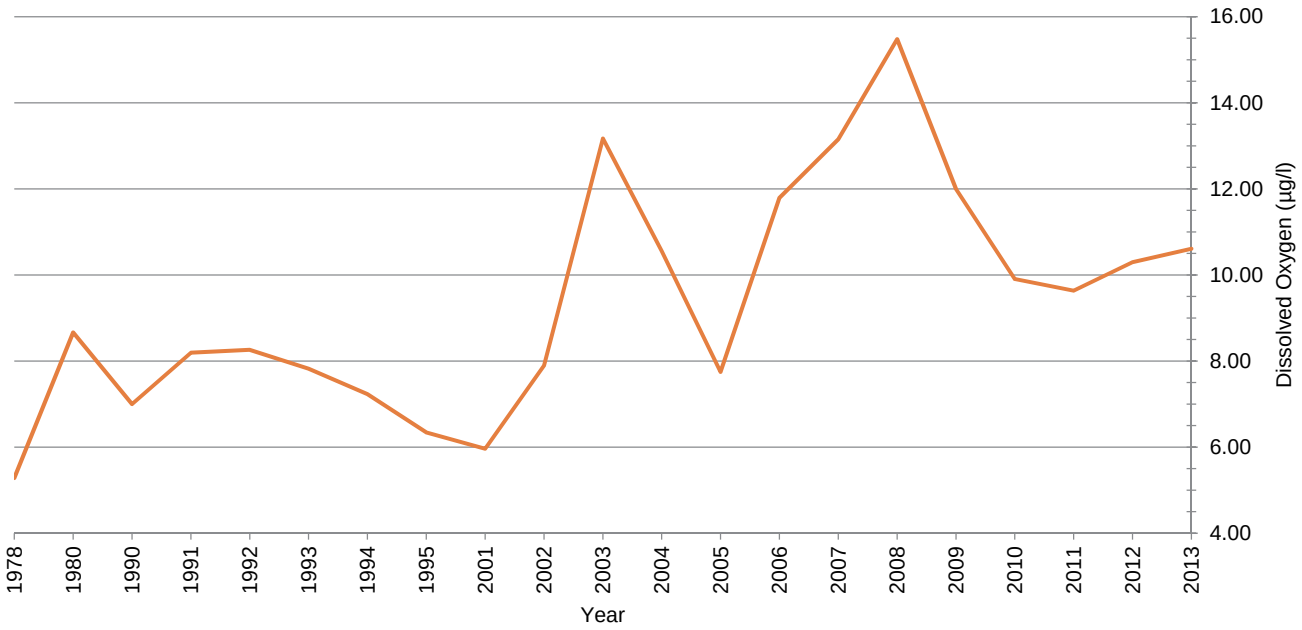
SECCHI-DISK MEASUREMENTS FOR PLEASANT LAKE: 1981-2013



Source: *Wisconsin Department of Natural Resources and SEWRPC.*

Figure 13

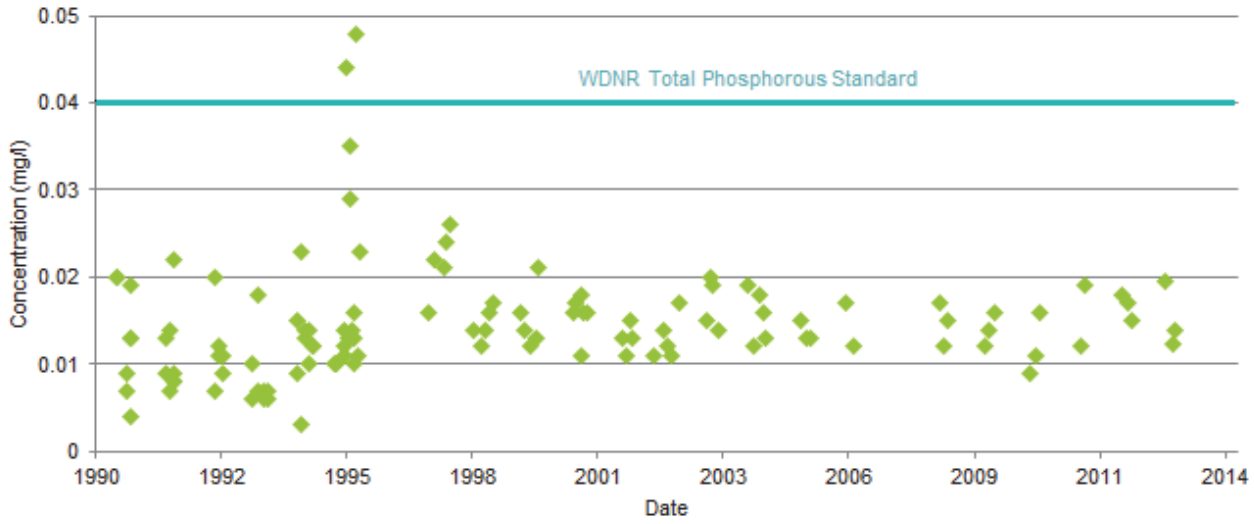
LAKE SURFACE LAYER DISSOLVED OXYGEN MEASUREMENTS FOR PLEASANT LAKE: 1978-2013



Source: *Wisconsin Department of Natural Resources and SEWRPC.*

Figure 14

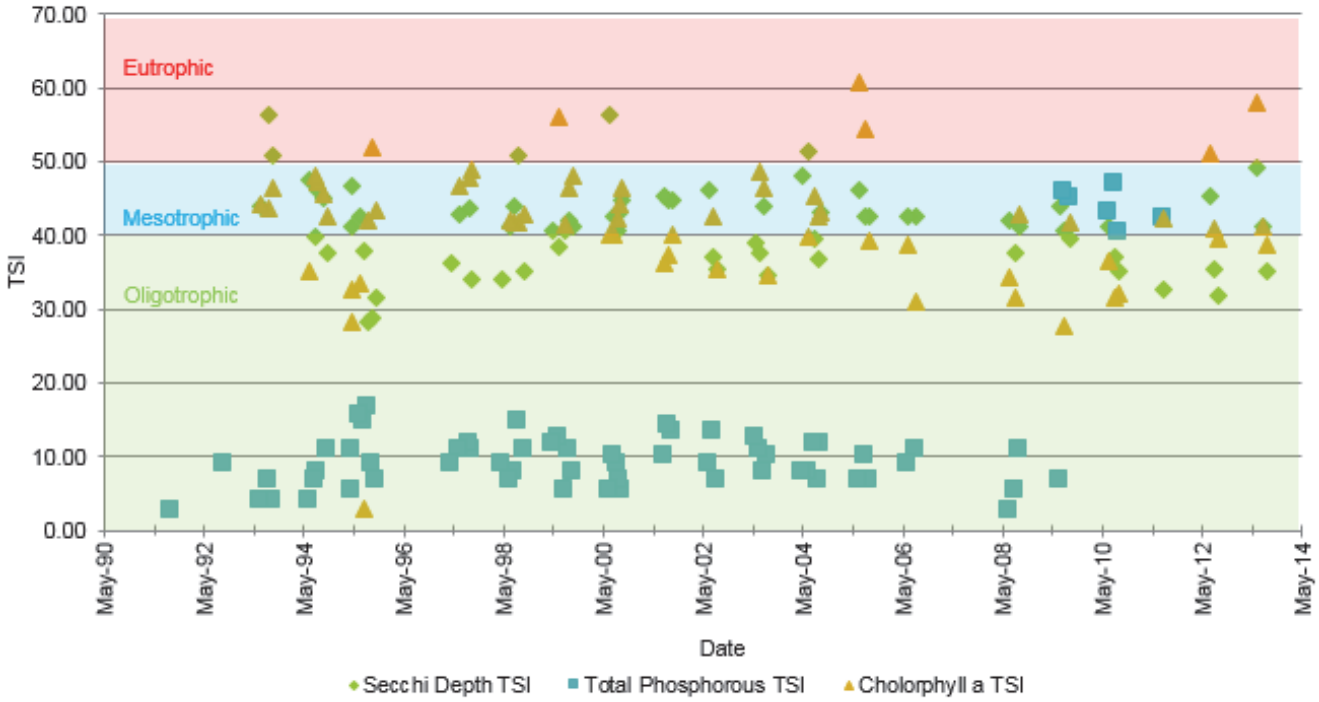
PHOSPHORUS MEASUREMENTS FOR PLEASANT LAKE: 1990-2013



Source: Wisconsin Department of Natural Resources and SEWRPC.

Figure 15

TROPHIC STATE INDEX VALUES FOR PLEASANT LAKE: 1990-2013



Source: Wisconsin Department of Natural Resources and SEWRPC.

5. **The location of septic systems in the watershed (if applicable)**—Private onsite wastewater treatments systems (POWTS), or septic systems, can be a significant source of phosphorus pollution when not properly maintained, and may also be a source of chloride. Consequently, it is important to investigate if such systems exist within the watershed.

The Pleasant Lake watershed area was determined based on two-foot interval ground elevation contours developed from a year 2014 digital terrain model. Existing year 2010 land use and planned year 2035 land use within the watershed were quantified by urban and rural categories, and that land use information was used with two models that calculate pollutant loadings.[28] Pollutant loading characteristics are described below.

Pleasant Lake's watershed, shown on Map 6, is situated within the Town of LaGrange, Walworth County and a small portion of the Town of Troy, on the southern border of Wisconsin. The **total land area, which drains to Pleasant Lake from the northwest to the southeast, is approximately 976 acres,** or about 1.5 square miles.

The year 2010 land use in Pleasant Lake's watershed, as shown on Map 7, are comprised of about 13 percent urban uses and about 87 percent rural uses (see Table 10). One percent of the total watershed area is wetland (located to the east and north of the Lake), 2 percent is open lands other than agricultural, 16 percent is water, 22 percent is woodlands, and 46 percent is agricultural. Using this land use data, the unit area load-based (UAL) model was used to estimate pollutant loadings (sediment, phosphorus, copper, and zinc) which could potentially be entering the Lake.[29] These calculations indicate that urban land use is the only significant source of heavy metals. Therefore, urban areas should be targeted if heavy metals become an issue within the Lake in the future.

Two models were used to estimate the in-lake surface water total phosphorus concentration.[30] The WiLMS model utilized the land use data to estimate a 0.023mg/l phosphorus concentration, this value is somewhat above the average annual phosphorus concentration of 0.014 mg/l (see Figure 14). This could mean that infiltration throughout the watershed is taking-up some of the phosphorus loads prior to entering the Lake and that without these buffers phosphorus concentrations could be higher. The OECD model calculated a 0.003mg/l value of phosphorus in the Lake, which is relatively low in comparison with the observed average. These values bracket the average, and they, along with the 0.014 mg/l average, are all well below the Wisconsin State standard of 0.040 mg/l.

The OECD model was calculated using the 2035 expected land use, and also projected an in-Lake phosphorus value of 0.003 mg/l. **According to the projected 2035 land use these estimates, as well as the observed phosphorus data in Figure 14, indicate that the in-lake phosphorus values will remain healthy.**

Historical urban development within the watershed is shown on Map 8 and represented in Table 11. Changes in population and households over time are shown in Table 12. These changes can also be seen through comparison of aerial photographs representing conditions in 1963, when SEWRPC first obtained regionwide aerial photography, and 2010 as shown in Figure 16. Since 1960, the largest increase in urban land use occurred from 1990 to 2000. The limited water quality data that is available indicates that little change to the water quality has occurred over the years for which the data was collected.

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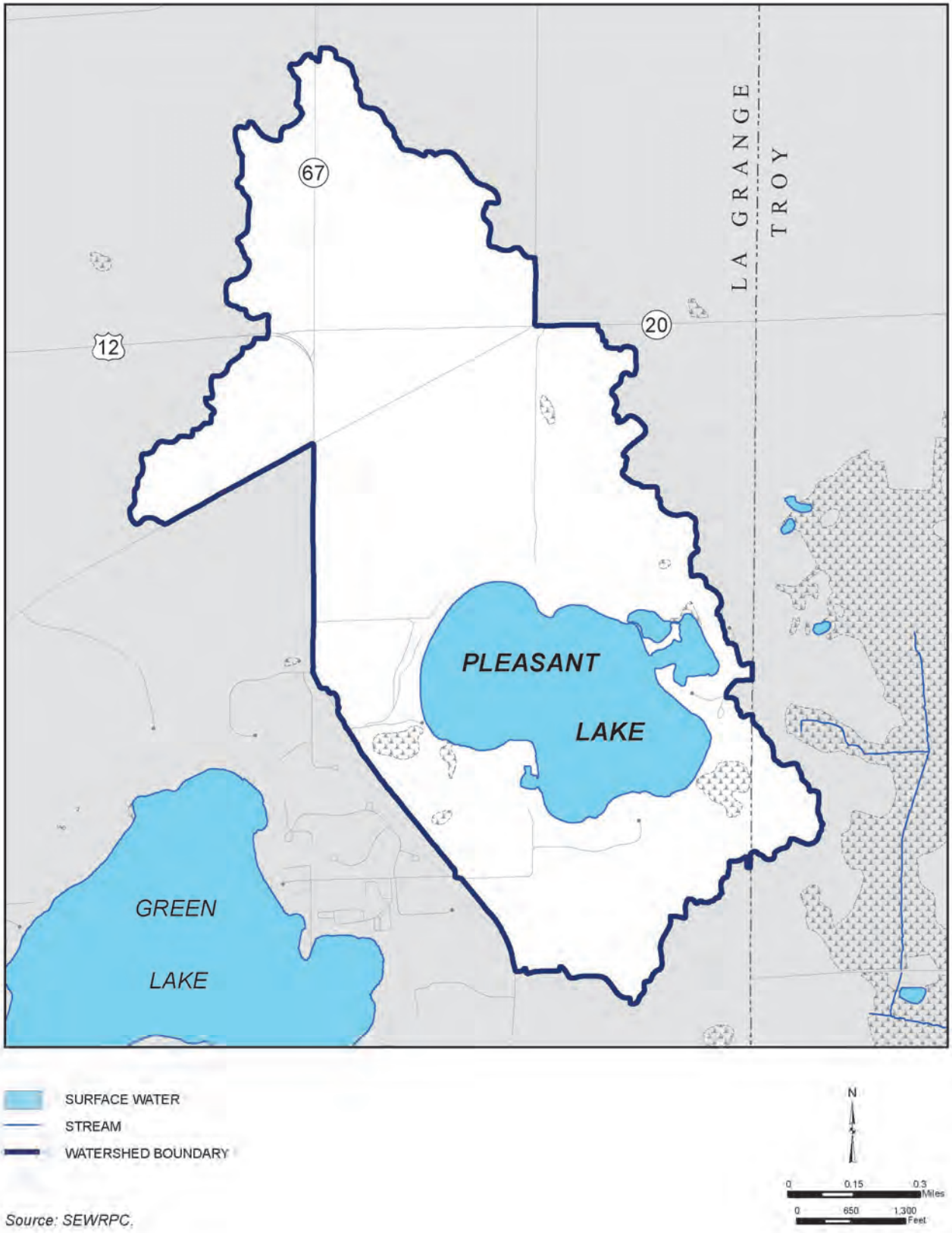
[28]*Wisconsin Lake Model Spreadsheet (WiLMS version 3.0) and the unit area load-based (UAL) models.*

[29]*The calculations for nonpoint source phosphorus, suspended solids, and urban-derived metal inputs to Pleasant Lake were estimated using the unit area load-based (UAL) model developed for use within the Southeastern Wisconsin Region. This model operates on the general principal that a given land use will produce a typical mass of pollutants on an annual basis.*

[30]Wisconsin Lake Model Spreadsheet (WiLMS version 3.0) and Organization for Economic Cooperation and Development (OECD)

Map 6

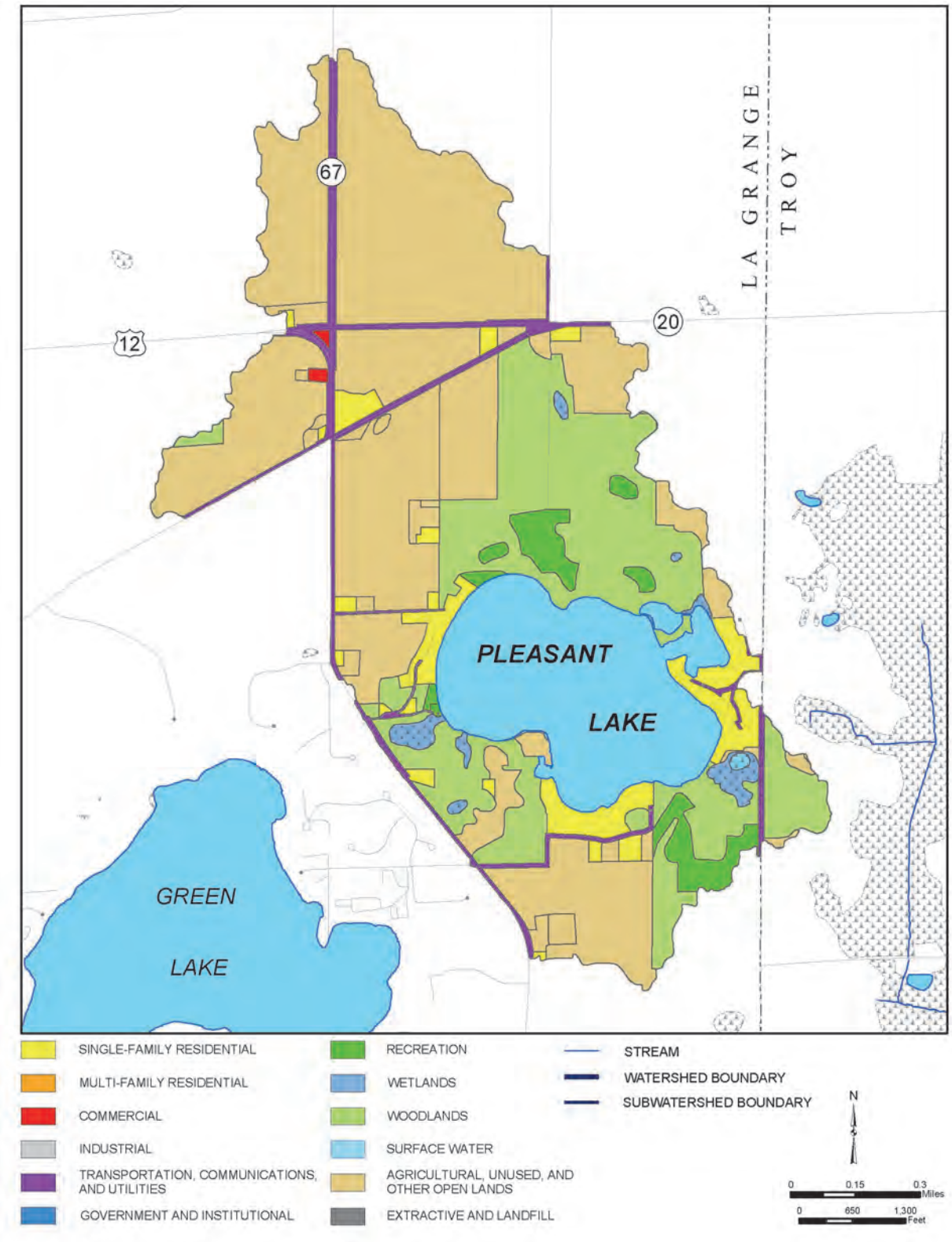
THE PLEASANT LAKE WATERSHED



Source: SEWRPC.

Map 7

EXISTING LAND USE WITHIN THE PLEASANT LAKE WATERSHED: 2010



Source: SEWRPC.

Table 10

EXISTING AND PLANNED LAND USE WITHIN THE TOTAL DRAINAGE AREA TRIBUTARY TO PLEASANT LAKE: 2010 AND 2035

Land Use Categories[a]	2010		2035	
	Acres	Percent of Total Tributary Drainage Area	Acres	Percent of Total Tributary Drainage Area
Urban				
Residential				
Single-Family, Suburban Density	0	0.0	0	0
Single-Family, Low Density	30	3.1	34	3.5
Single-Family, Medium Density	27	2.8	27	2.8
Single-Family, High Density	0	0.0	0	0.0
Multi-Family	0	0.0	0	0.0
Commercial	1	0.1	7	0.7
Industrial	0	0.0	0	0.0
Governmental and Institutional	0	0.0	0	0.0
Transportation, Communication, and Utilities	40	4.1	40	4.1
Recreational	32	3.3	80	8.2
Subtotal	130	13.4	188	19.3
Rural				
Agricultural	445	45.6	392	40.2
Other Open Lands	20	2.0	15	1.5
Wetlands	13	1.3	13	1.3
Woodlands	214	21.9	214	21.9
Water	154	15.8	154	15.8
Extractive	0	0.0	0	0.0
Landfill	0	0.0	0	0.0
Subtotal	846	86.6	788	80.7
Total	976	100	976	100

[a]*Parking included in associated use.*

Source: SEWRPC.

Year 2035 planned land use[31] for the Pleasant Lake watershed is shown on Map 9. Map 10 shows the areas within the watershed where land use is forecasted to change from rural to urban uses by 2035, based upon a comparison of the existing year 2010 land use map (see Map 7) and the planned land use map (see Map 9). As can be seen on Maps 7, 9, and 10 there is little change in land use anticipated between 2010 and 2035. As summarized in Table 10, **agricultural land uses are expected to decrease from about 46 percent of the watershed area in 2010, to about 40 percent in 2035**. The anticipated land use changes would involve

Table 11

HISTORICAL URBAN GROWTH IN THE PLEASANT LAKE WATERSHED

Year	Land Growth in Urban Use (acres)
1950	28.2
1963	22.0
1980	0.3
1985	48.6

Source: SEWRPC.

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

Map 8

HISTORICAL URBAN GROWTH WITHIN THE PLEASANT LAKE WATERSHED: 1850-2010

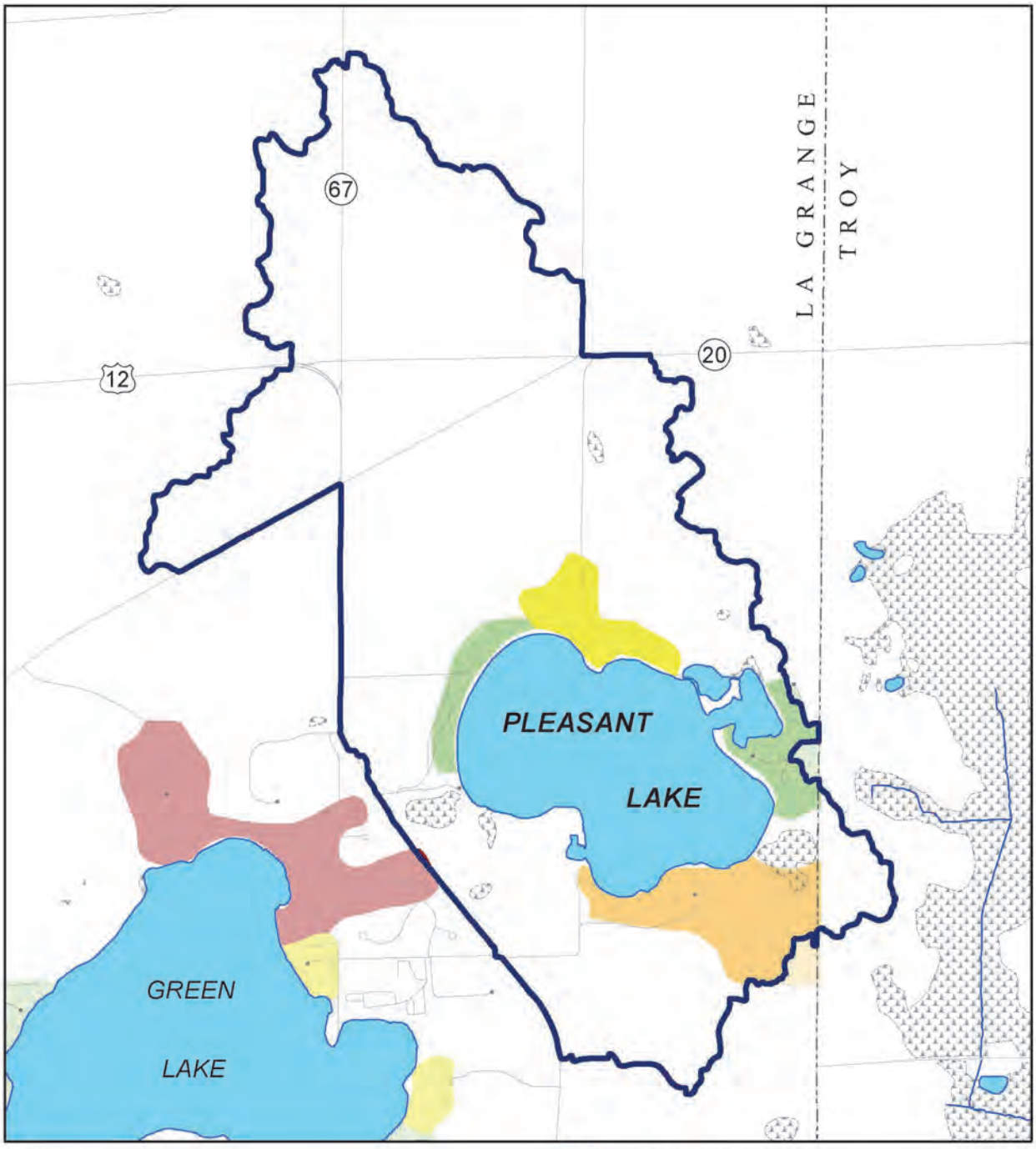


Table 12

POPULATION AND HOUSEHOLDS IN THE PLEASANT LAKE WATERSHED: 1960-2010

Year	Population	Change from Previous Decade		Households	Change from Previous Decade	
		Number	Percent		Number	Percent
1960	64	- -	- -	18	- -	- -
1970	107	43	67	34	16	89
1980	96	-11	-10	36	2	6
1990	90	-6	-6	32	-4	-11
2000	174	84	93	62	30	94
2010	172	-2	-1	66	4	6
Planned 2035	192	20	12	71	5	8

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

conversion of some rural land to recreational use and conversion of some agricultural and open land to residential and commercial use. Table 13 indicates the possibility of relatively modest reductions in annual sediment and phosphorus loads due to planned land use changes between 2010 and 2035, but relatively large increases in heavy metals contributed by urban land uses. Thus, there would be the potential for increases in heavy metals delivered to the Lake and for limited sediment pollution related to erosion during the construction associated with the conversion of land from agricultural to residential and commercial use. Consequently, recommendations to mitigate these risks and ensure the continued health of the Lake are included in Chapter III.

Finally, **the watershed does not have a sanitary sewer system.** Without proper maintenance septic systems can malfunction, possibly causing bacterial contamination and increased phosphorus loadings to the Lake and the groundwater. Therefore, maintenance of current systems and any new systems is discussed in Chapter III of this report.

Pollution Mitigation

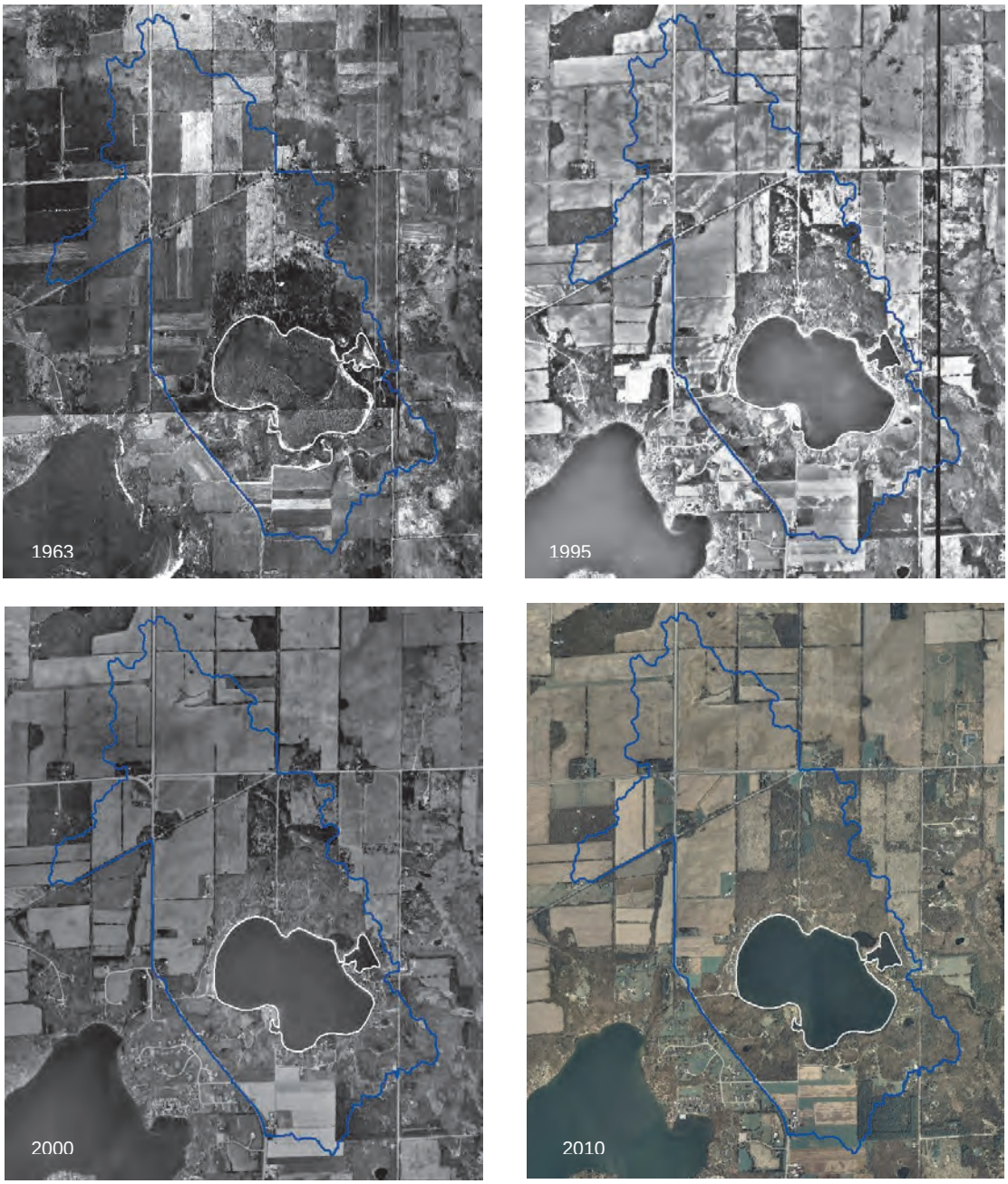
There are several stormwater and land management features that serve to filter or remove pollutants prior to their entering a lake system. It is, therefore, necessary to evaluate where these features exist within the watershed to determine if there are any pollution sources which are potentially entering the Lake directly (without any filtration). These features are as follows:

1. **Stormwater detention or retention ponds**—Stormwater management ponds, when properly maintained, can capture and store water during rainfall events, slowing the flow of the water, and allowing many pollutants, such as sediments and heavy metals, to settle out before reaching downstream water bodies. These ponds need to periodically be dredged and may require other maintenance to ensure they function properly. **Stormwater detention or retention ponds in a lake's watershed are a useful means of protecting, or improving lake water quality by significantly reducing pollution loads to the lake**.

2. **Wetlands**—Wetlands, which are generally characterized by wet soils and wetland based plants, are beneficial to the health of a lake, particularly when located at, or near, a lake's inlet. These areas slow down water flowing towards the lake, causing sediments and heavy metals to settle (in a similar fashion to stormwater management ponds). Additionally, **the plant life located in wetlands is able to use up pollutants such as phosphorus and incorporate them into biomass** (thereby preventing the pollutant from entering the lake and causing algae and plant growth there instead). These natural features are invaluable ecosystems and are well known as "nature's pollution filtration system." Knowing where wetlands are located can help determine if a pollution source is a high risk to waters downstream from the wetlands.

Figure 16

HISTORICAL AERIAL PHOTOGRAPHS OF PLEASANT LAKE

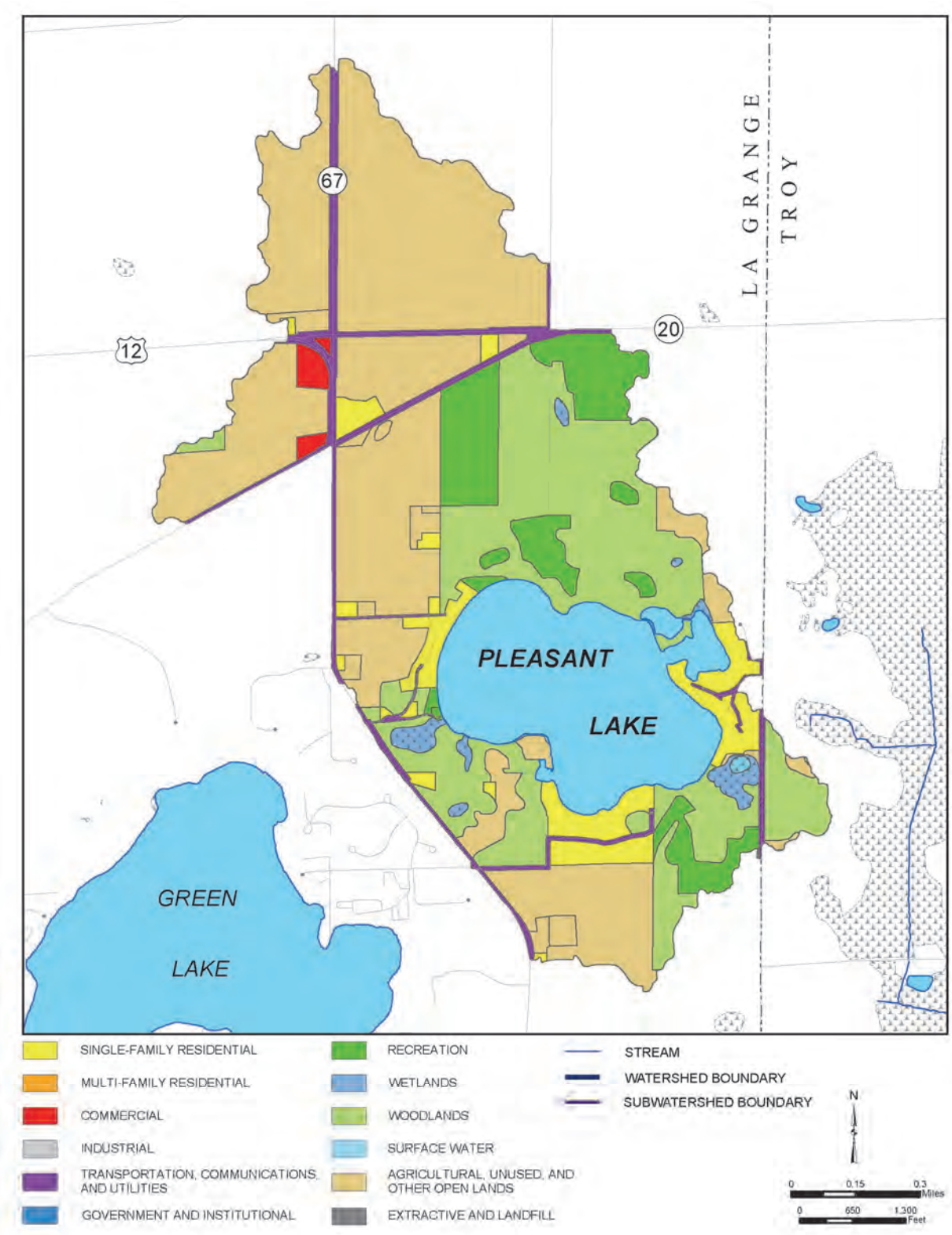


Source: SEWRPC.

3. **Natural terrestrial buffers (e.g., forests or prairies with extensive natural vegetation)**—Natural buffers primarily refer to natural terrestrial vegetative features such as forests or prairies. These areas, like wetlands, have extensive vegetation which can slow water down and incorporate pollutants into biomass. Consequently, **these areas, located in an area which intercepts water flowing towards the lake system, can help lower pollution risks to the lake**. Additionally, enhancing these features, particularly in areas adjacent to a waterbody, can also play a crucial role in ensuring the watershed can naturally reduce the amount of pollution entering that waterbody.

Map 9

PLANNED LAND USE WITHIN THE PLEASANT LAKE WATERSHED: 2035



Source: SEWRPC.

Map 10

2010 AGRICULTURAL AND OPEN LANDS CONVERTED TO URBAN DEVELOPMENT UNDER PLANNED 2035 LAND USE CONDITIONS WITHIN THE PLEASANT LAKE WATERSHED

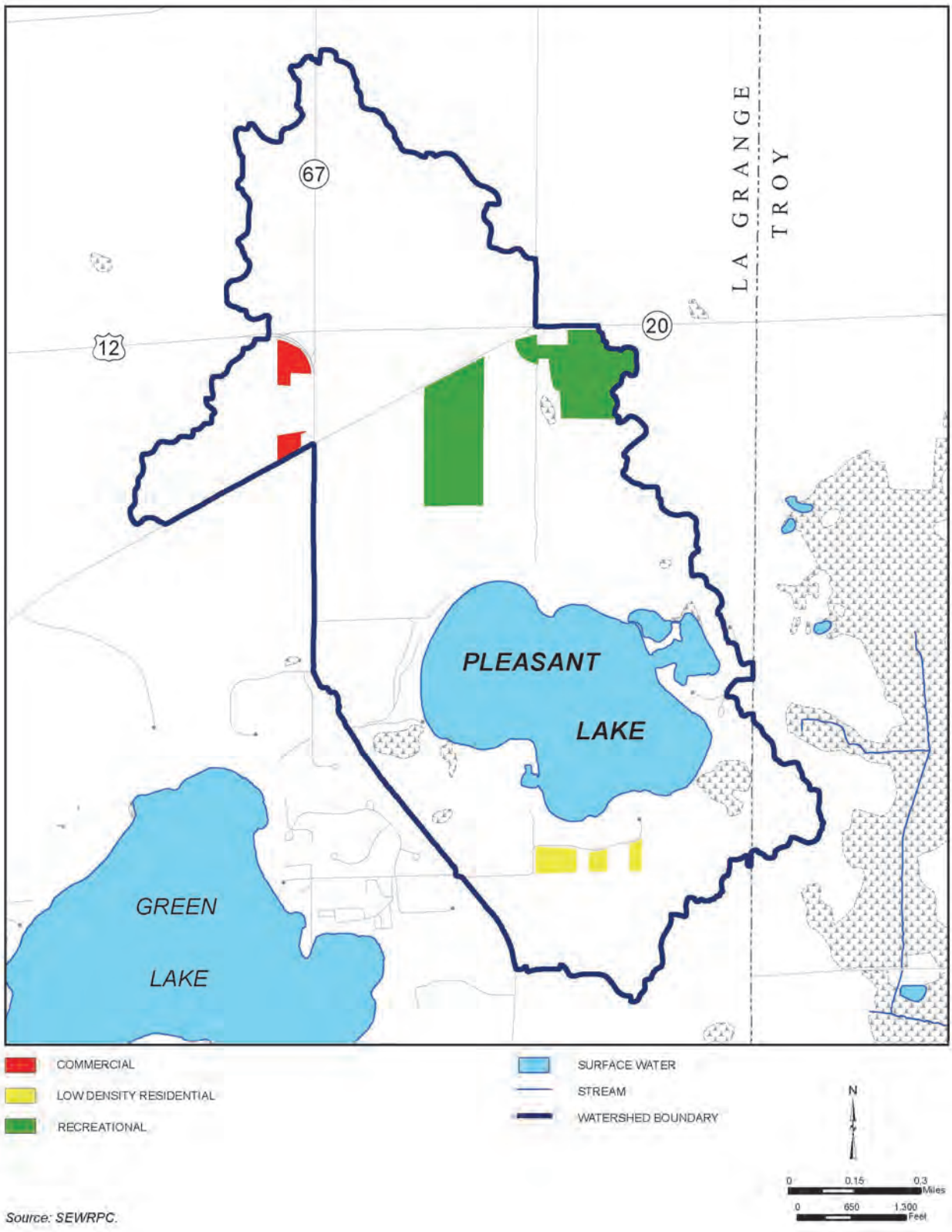


Table 13

ESTIMATED ANNUAL POLLUTANT LOADINGS BY LAND USE CATEGORY WITHIN THE AREA TRIBUTARY TO PLEASANT LAKE: 2010 AND 2035

Land Use Category	Pollutant Loads: 2010			
	Sediment (tons)	Phosphorus (pounds)	Copper (pounds)	Zinc (pounds)
Urban				
Residential	1.64	13.29	0.54	4.08
Commercial	0.39	1.20	0.22	1.49
Industrial	0.00	0.00	0.00	0.00
Governmental	0.00	0.00	0.00	0.00
Transportation, Communication, and Utilities	0.19	4.40	0.00	0.00
Recreational	0.38	8.64	0.00	0.00
Subtotal	2.61	27.53	0.76	5.57
Rural				
Agricultural	100.13	382.70	0.00	0.00
Other Open Lands	0.10	2.20	0.00	0.00
Wetlands	0.02	0.52	0.00	0.00
Woodlands	0.40	8.56	0.00	0.00
Water	14.48	20.02	0.00	0.00
Subtotal	115.12	414.00	0.00	0.00
Total	117.72	441.53	0.76	5.57

Land Use Category	Pollutant Loads: 2035			
	Sediment (tons)	Phosphorus (pounds)	Copper (pounds)	Zinc (pounds)
Urban				
Residential	1.68	14.09	0.54	4.12
Commercial	2.74	8.40	1.54	10.43
Industrial	0.00	0.00	0.00	0.00
Governmental	0.00	0.00	0.00	0.00
Transportation, Communication, and Utilities	0.19	4.40	0.00	0.00
Recreational	0.96	21.60	0.00	0.00
Subtotal	5.58	48.49	2.08	14.55
Rural				
Agricultural	88.20	337.12	0.00	0.00
Other Open Lands	0.07	1.65	0.00	0.00
Wetlands	0.02	0.52	0.00	0.00
Woodlands	0.40	8.56	0.00	0.00
Water	14.48	20.02	0.00	0.00
Subtotal	103.1672	367.87	0.00	0.00
Total	108.7427	416.36	2.08	14.55

Source: SEWRPC.

4. **Man-made buffers (e.g., grassed waterways, vegetative strips)—**Manmade buffers can take a number of forms, from grassed waterways, to vegetative strips, to gardens located along the shoreline. Buffers are generally constructed to intercept the flow of water towards a river or lake. They function in a similar way to natural buffers (i.e., slowing water down to settle and use pollutants prior to their entering the waterbody); however, they do need to be carefully designed, with native plants, to ensure that they function well. **Constructing buffers can enhance the water quality of a lake without giving up the use of land for residential or agricultural purposes**. Further details on man-made buffers and their efficacy are included in Appendix D.

5. **Aquatic Vegetative Buffers—**In-lake vegetation near the shore, such as bulrushes and cattails, can also, to some degree filter and assimilate nutrients and sediment. Consequently, encouraging their survival and enhancement can help improve the water quality of a lake.

To locate each of the features described above, SEWRPC staff completed an inventory of the detention basins, wetlands, and natural features, such as woodlands, within the watershed using existing databases, mapping software, and aerial imagery. Additionally, to identify the extent of shoreline buffers, SEWRPC staff completed a field assessment of the Pleasant Lake shoreline in the summer of 2014. These inventories are discussed below.

One percent (13 acres) of the Pleasant Lake watershed is comprised of wetlands. They are located primarily at the southeastern and western end of Pleasant Lake (see Map 7), providing the Lake with a degree of pollution and sediment reduction from surface water runoff which enters the Lake from these areas of the watershed. The potential to naturally remove pollutants in combination with the many other benefits provided by wetlands, illustrates how crucial the maintenance of these wetlands are for Pleasant Lake. Consequently, recommendations related to maintaining and enhancing wetland functions are also included in Chapter III of this report.

Woodlands, uplands, and other "natural areas," as mentioned above, can also act as buffers to water-bodies. About 22 percent of the Pleasant Lake watershed is composed of these woodlands. Woodlands and other "natural areas" are particularly valuable when located in areas adjacent to a lake (see Map 7). Consequently, these areas should be protected to the greatest extent practical to protect the water quality of the Lake (see Chapter III for recommendations).

Man-made buffers and vegetative buffers along the shoreline and near shore areas of Pleasant Lake are shown on Map 11. Figure 17 illustrates common shoreline protection techniques. The majority of the Lake shoreline has either man-made[32] or vegetative buffers, primarily vegetative buffers and rip-rap. The Lake also has a developed woodland around the eastern side of the Lake creating a natural shoreline for that area. Natural shorelines offer substantial protection against erosive forces. "Soft" shoreline protection, referred to as "vegetative shore protection" (see Figure 18), is increasingly popular with riparian owners. This shoreline protection not only protects the shoreline but improves the viewshed and provides natural habitat for wildlife. These and other vegetative buffers also provide the Lake with some protection from the pollution which could otherwise enter the Lake (e.g., lawn clippings, fertilizers, oils from cars). However, **there is a portion of the shoreline which is mowed up to the water line**. These areas pose risks to the Lake, consequently, enhancement of shoreline buffers along the shorelines should be considered a high priority. Recommendations related to this topic are further discussed in Chapter III of this report.

Buffer creation and the enhancement of existing buffers and wetlands should be crucial aspects of protecting the water quality of Pleasant Lake. This reflects the goals of the *Wisconsin's Healthy Lakes Implementation Plan,* which focuses on habitat restoration, runoff, and erosion control projects to improve and protect the health of our lakes through shoreline owner participation (see Appendix E). Buffer and wetland maintenance and development should be targeted at strategic areas in the watershed that produce runoff

[32]*Man-made buffers are highly regulated on Pleasant Lake, see Appendix B for more information.*

Map 11

SHORELINE ASSESSMENT FOR PLEASANT LAKE, WALWORTH COUNTY: 2014

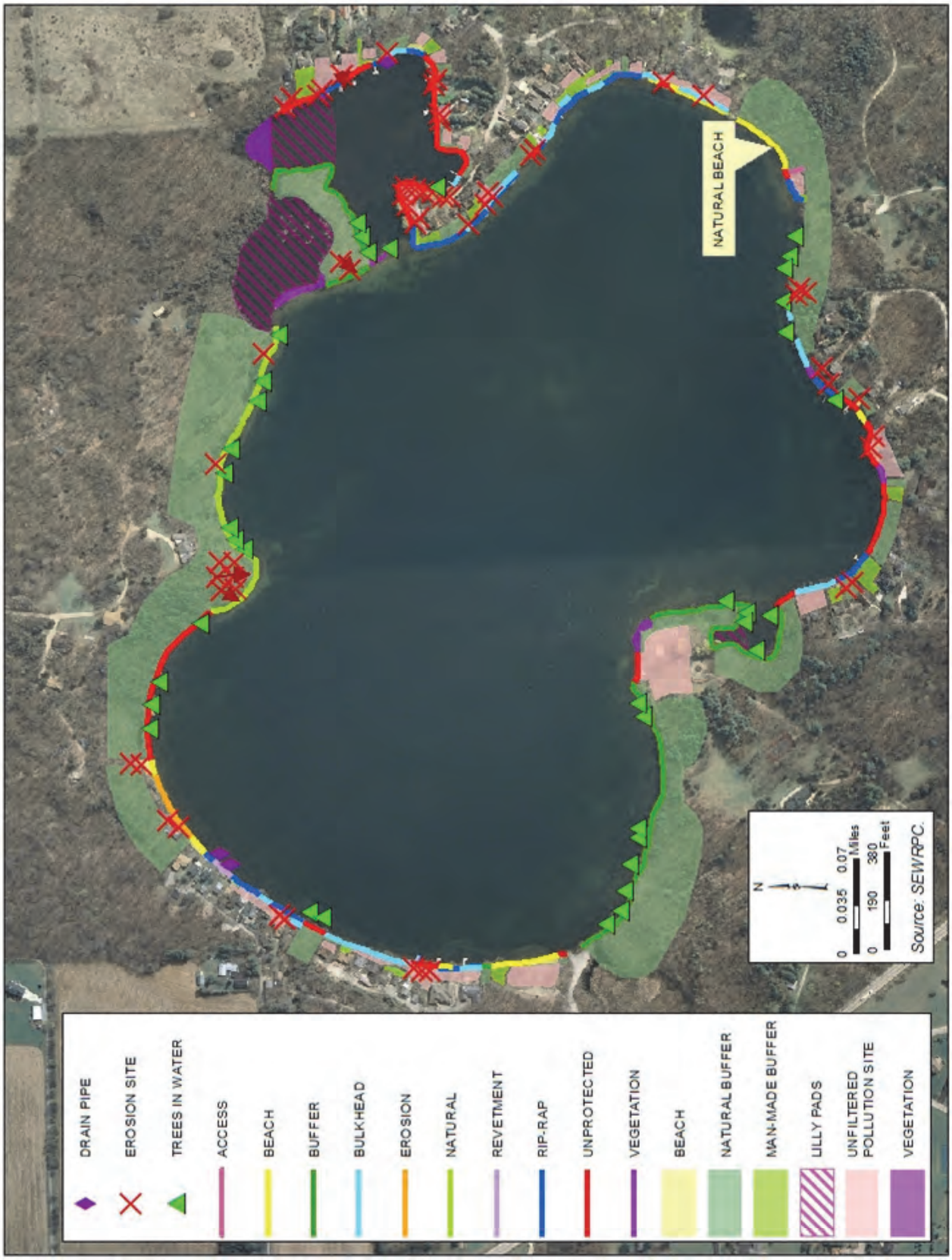


Figure 17

TYPICAL SHORELINE PROTECTION TECHNIQUES

RIPRAP

NATURAL VEGETATIVE

BULKHEAD

REVETMENT

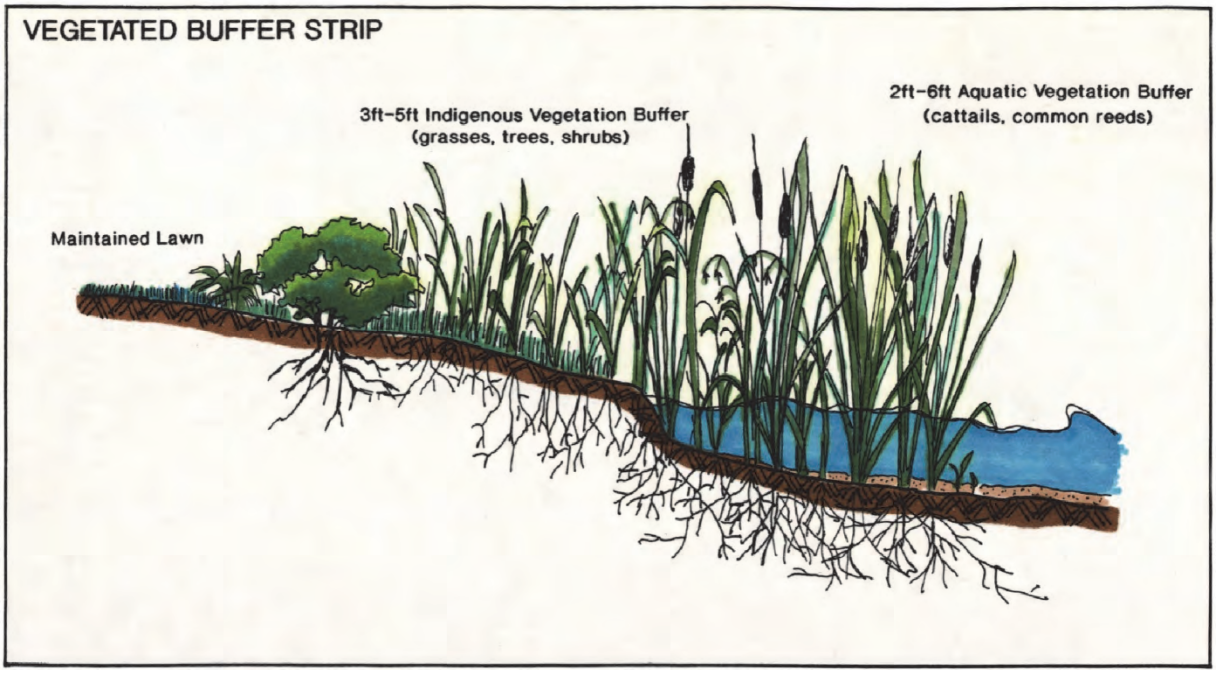
Source: SEWRPC.

which does not have a chance to filter through an existing buffer or wetland system prior to entering the Lake. Some of these areas within the watershed were determined by comparing the flow pathways of the water within the watershed[33] to the locations of the natural and man-made features discussed above (as represented in Map 11). Runoff from the open lands expected to be converted to urban uses, as depicted on Map 10, would flow through a woodland prior to entering the Lake, as would much of the agricultural land. However, there are a few agricultural areas whose runoff would not flow through a buffer. Consequently, agricultural and urban land not tributary to adequate buffers should be targeted for pollution reduction efforts and/or buffer enhancement projects. Recommendations related to water quality enhancement within Chapter III will focus primarily on these areas.

[33]*Flow pathways within the Pleasant Lake watershed were determined using elevation data and field investigations.*

Figure 18

NATURAL SHORELINE BUFFER SCHEMATIC AND EXAMPLE



Source: Washington County Planning and Parks Department and SEWRPC.

ISSUE 4: WATER QUANTITY

Two water quantity issues concern Pleasant Lake residents: flooding, and potential loss of access in and out of the Bay. Each are discussed below.

Flooding
Lake levels have been an issue of concern for Pleasant Lake shoreline owners since 1974, with focus placed on shoreline flooding great enough to damage property. Pleasant Lake is a seepage lake and therefore does not have a perennial outlet. To maintain desirable water levels, the WDNR approved installation of an engineered outlet in 1975. This outlet consists of a 770-foot-long, 10-inch diameter concrete drain pipe set at the ordinary high-water mark elevation of 880.6 feet above National Geodetic Vertical Datum, 1929 adjustment (NGVD 29), as defined by the WDNR.[34] An April 24, 2014, letter report prepared by R.A. Smith National concluded that the upstream end of the outlet pipe "has been lifted (nearly 0.2 feet), possibly by ice, and the invert is at 880.78 feet." That raised invert along with problems with the pipe clogging with debris, has resulted in higher than intended Lake levels. Since the 2000s the water levels in the Lake have been as high as 1.5 feet above the ordinary high water mark (880.6 feet above NGVD 29). These elevated water levels flood low-lying residential yards and cause other damage to shoreline properties. Damage has also been exacerbated by wind created wave action on the western shoreline. Since it has not been possible to maintain the Lake level at the elevation of the defined ordinary high-water mark it became necessary to restore the Lake to the prescribed high-water mark elevation through reconstruction of the outlet structure. Without a properly functioning outlet structure the water levels in the Lake have increased, and have caused, and will likely continue to cause, property and shoreline damage.

A new outlet structure was designed by R.A. Smith National and the project was bid on in November of 2014, with the project having been contracted to GMS Excavators, Inc. The new structure includes a one-foot-deep drop box inlet structure located near the current inlet pipe with a new 10-inch pipe between the inlet drop structure and the manhole where Hancock Lane turns from the west to the southwest. The pipe slopes toward the manhole so it will completely drain when there is no flow from the Lake. From there the new pipe will connect with the existing pipe discharging from the manhole to the east (see Appendix F, alternative No. 3). This project was finished in November of 2015.

The new outlet structure is intended to better maintain the normal Lake level at the ordinary high-water mark elevation and to reduce the risk of flooding. It is recommended in Chapter III that water levels be regularly measured and recorded to document fluctuations in Lake water surface elevation.

Bay
A second concern arises when managing water levels. Some Lake residents speculate that restoring the approved outlet structure, the lower water levels will significantly change conditions in the Bay on account of the Bay's shallow water depth. Lower water elevation raises two concerns for the Bay residents:

1. The Bay may become unnavigable, and

2. There may be loss of wildlife and other negative effects on the ecological value.

[34]*In the case of Diana Shooting Club v. Husting, 156 Wis. 261 of the Wisconsin Supreme Court, the ordinary high-water mark refers to the "point on the bank or shore up to which the presence and action of the water is so continuous as to leave a distinct mark either by erosion, destruction, terrestrial vegetation or other easily recognized characteristic."*

With respect to the Bay becoming unnavigable, this is an unprecedented event; going back to the mid 1900's there has been no recorded water loss to the Bay that has prevented boat access. However, if such events were to occur the WDNR completed an Integrated Sensitive Area Report in March 2009 that identified four sensitive areas in the Lake, the Bay being one of them, and listed management recommendations for each area. One of the recommendations was limited dredging in the Bay to maintain a navigational channel if the water became less than 24 inches deep (see Appendix G). Therefore, limited dredging in the Bay for navigation channels is a viable option for WDNR consideration, as discussed in Chapter III.

The water depths in the Bay are shallow, a decrease in water levels in the Bay would likely lead to increased abundance of bulrushes and cattails. As for the current aquatic plants found in the Bay (e.g., white water lily, variable pondweed, eelgrass), each have the ability to live in shallow water, especially eelgrass, which is typically found in water that is 'ankle-deep.'[35] Not only are these aquatic plants still viable in the Bay but they are great habitat and food sources for waterfowl, shore birds, and fish. With lower water levels, there would be a potential for increased abundance of bulrushes and cattails. While this would inhibit the boat access it would not harm the ecological value of the Bay, the growth of these emergent plants could lead to a potential improvement in the ecology of the Bay. To maintain access, narrow navigational lanes would be considered by the WDNR if water levels were below 24 inches as discussed in the Aquatic Plant Management section of Chapter III.

If water levels in the Bay decrease, this concern becomes a more significant issue in years of drought. Since Pleasant Lake is a seepage lake and, therefore, dependent on groundwater flow and precipitation, the following are other factors that should be kept in mind to help maintain Lake water levels.

Surface Water Runoff Management and Baseflow Recharge Rate Maintenance

Surface Water Management

Runoff from large, intense rainfall events moves across the land surface and through streams at a higher than average velocity. This speed can be decreased when the water encounters detention or retention basins, buffers, or wetlands which slow the flow; storing and gradually releasing it; and, in some instances, allowing the water to soak into the ground. Much of the water which soaks into the ground becomes part of the groundwater baseflow that moves slowly towards a lake, maintaining flow to a lake over a period well beyond the day of the rain event.

However, if buffers and wetlands do not exist to store and gradually release the runoff, the runoff could more rapidly enter a lake and, depending on the lake size and outlet characteristics, quickly flow out of the lake. In this case, a smaller volume of water is kept within the watershed to gradually supply the lake over time.

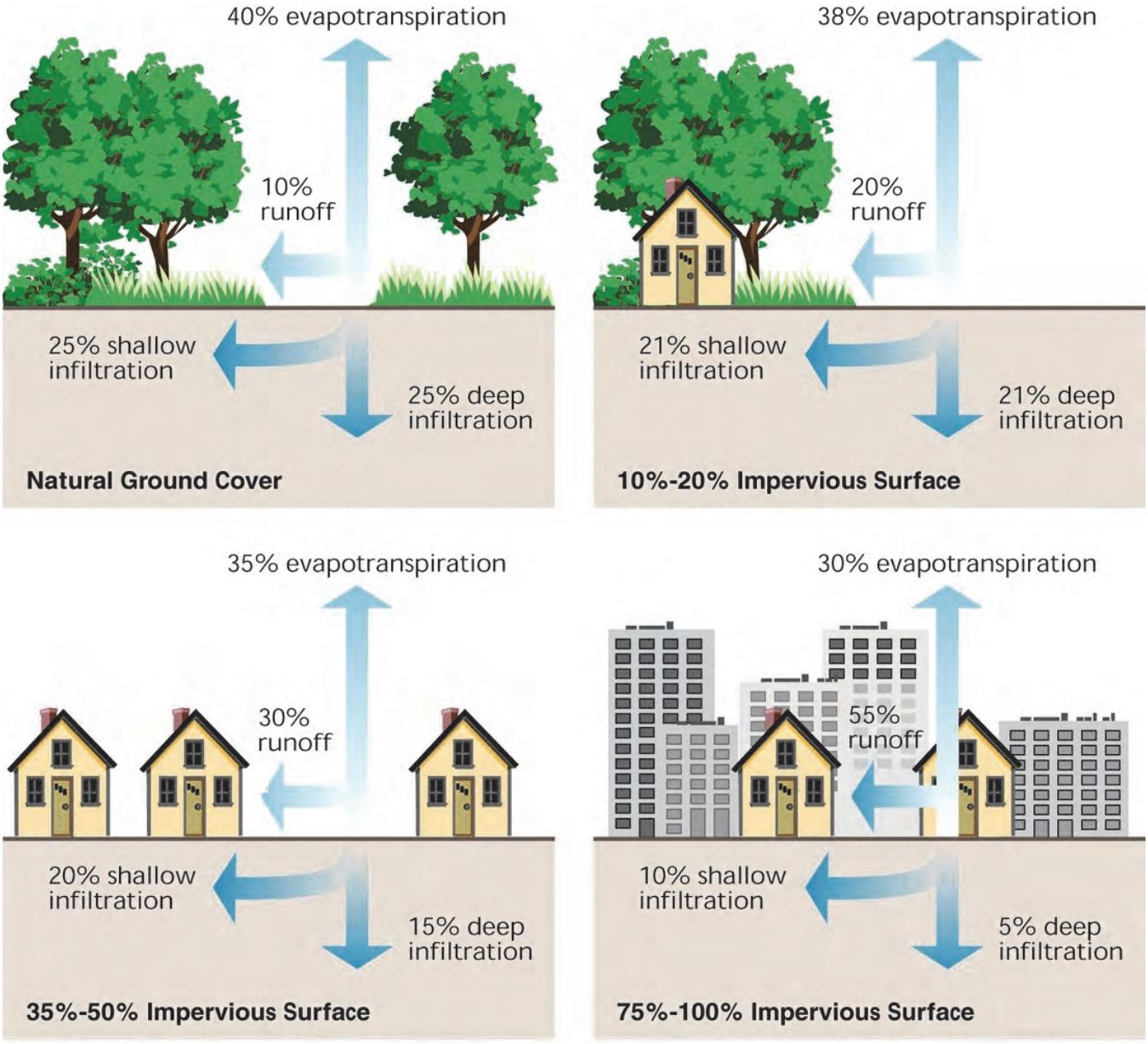
Impervious surfaces greatly increase the volume and velocity of runoff after a rainfall (see Figure 19). Consequently, reducing or preventing impervious cover, or installing measures meant to reduce the runoff from impervious cover (such as rain gardens or buffers), are crucial components in ensuring consistent volumes of water supply to a lake. To determine where improvements can be made to maintain and extend the volume of water supplied to Pleasant Lake, there are several factors that need to be assessed. These include:

1. **The location and extent of current urban land use within the watershed**—Urban land uses generally have a much higher percentage of impervious cover than rural land uses. Consequently, to assess where management efforts can be made to reduce the amount of impervious cover (or where efforts can be made to slow down or reduce the runoff leaving these areas) it is necessary to identify where urban land use exists.

[35] *S. Borman, R. Korth, and J. Temte.* Through the Looking Glass… A Field Guide to Aquatic Plants, *Merril, WI, 2014, 2nd Ed.*

Figure 19

SCHEMATIC OF THE EFFECTS OF IMPERVIOUS SURFACES ON RUNOFF AND GROUNDWATER RECHARGE



Source: Federal Interagency Stream Restoration Working Group.

2. **The location and extent of planned land use changes within the watershed**—Since urban land use has a higher percentage of impervious cover, it is important to know where rural land is expected to be converted to urban land in the future. In such cases, extra precautions can be taken to implement management efforts which will reduce runoff velocity and/or volume when the development occurs in the future.

3. **The location and extent of natural areas and stormwater management structures**—As mentioned previously, stormwater retention and detention basins and natural areas (e.g., buffers, grassed waterways, and woodlands) serve to slow down water, in some cases to store and gradually release water, and to promote infiltration of water into the soil. Consequently, if runoff passes through these kinds of areas, it can modulate runoff peaks and increase the time over which a volume of runoff is supplied to a lake.

To help target water volume management efforts, the SEWRPC staff inventoried the three preceding factors for the Pleasant Lake watershed using geographic information system techniques and 2010 color digital orthophotography, collected under a Regional orthophotography program administered by the Commission. Current and planned land use data are shown on Maps 7 and 9. **Urban land use currently occupies about 13 percent of the watershed**. Additionally, through comparing the 2010 and 2035 land use data, it can be seen that **a portion of the watershed which is currently in agricultural uses would be converted to residential and commercial uses under planned year 2035 conditions** (see Map 10). The development of the northern commercial development will pass through the woodland to filter pollutants. However, runoff from the development of the single-family residential area south of the Lake will not pass through a wetland or other buffered locations to filter pollutants (see Map 12). This could be a concern if infiltration practices, stormwater management, and buffer enhancement are not considered priorities in these new developments. Consequently, recommendations related to this new planned development, as well as general recommendations for slowing, storing, and infiltrating runoff, are included in Chapter III of this report.

Maps 7, 11, and 12 also indicate, as was discussed in the water quality section, that, while most of the runoff from within the watershed enters a natural feature which could aid with infiltration, **runoff from the majority of the developed shoreline properties does not flow through a feature that would promote infiltration**. Consequently, recommendations to increase water infiltration on the shoreline properties are also included in Chapter III of this report.

Baseflow Recharge Rate Maintenance

Baseflow refers to water which reaches the Lake from groundwater. This groundwater is generally replenished through recharge (rainfall which soaks into the ground and enters the aquifer system). **Baseflow is crucial to Pleasant Lake because it provides water supply during times when surface runoff may be scarce** (e.g., during droughts). Consequently, maintaining the recharge of the aquifers which supply Pleasant Lake is important.

Generally, the depletion of groundwater flow happens for one of two reasons: 1) over pumping the aquifer that supplies the baseflow, thereby causing springs to run dry and 2) reducing or eliminating the recharge of the subsurface aquifers through land use changes that increase impervious cover. The first of these most commonly occurs when a high capacity well, or wells, are installed in the vicinity of a waterbody without proper consideration for the effect they might have on the aquifer. Since this is not currently occurring in the Pleasant Lake watershed, it is not considered an issue of concern. However, if a high capacity well were proposed in the Lake's groundwatershed in the future, its effect on Lake levels should be carefully investigated, and, if those effects were found to be significant, they should be mitigated.[36]

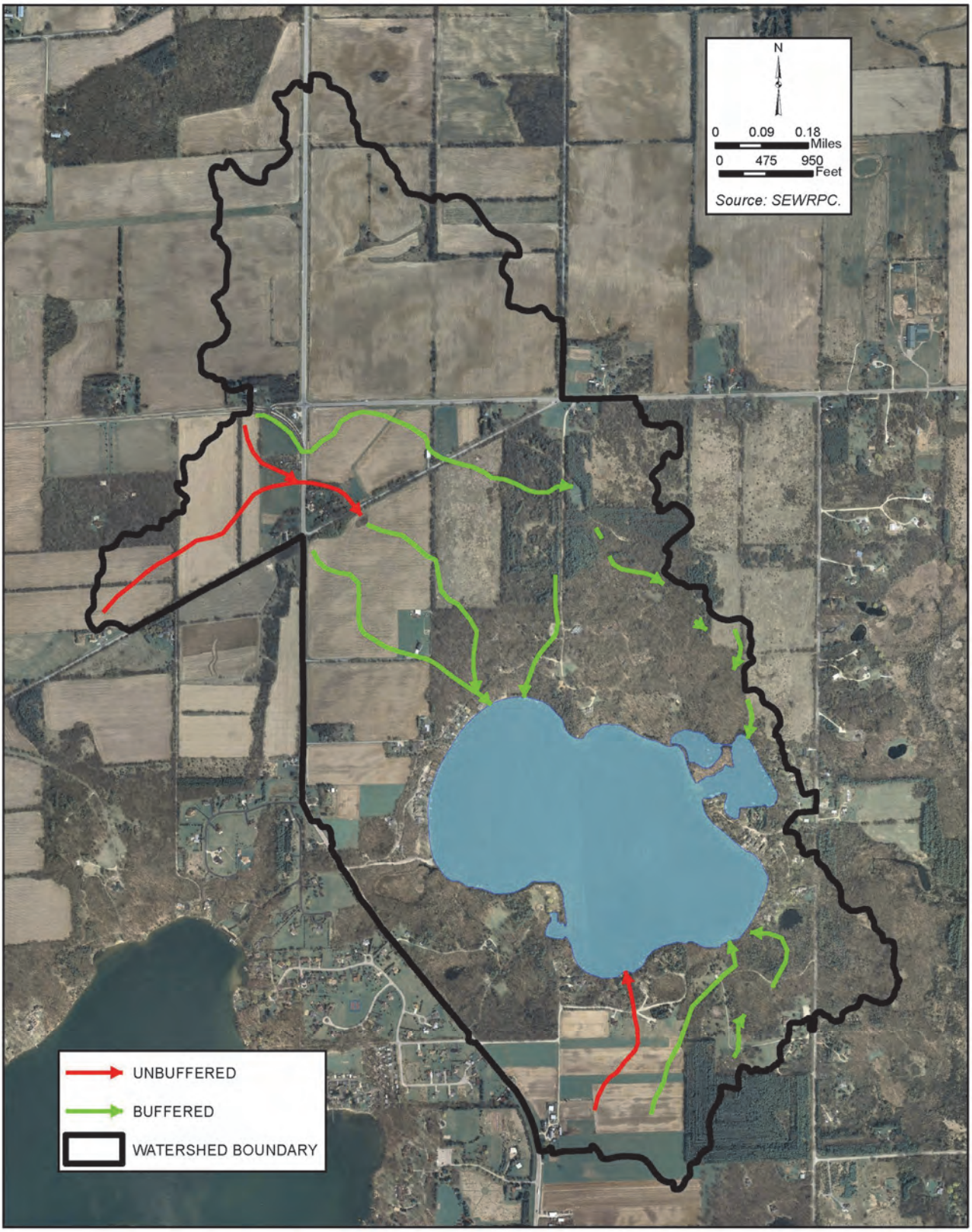
The second of these (i.e., loss of aquifer recharge) happens most commonly because groundwater recharge is not considered when development decisions are made. Consequently, it is necessary to determine what areas need to be protected to maintain the baseflow to Pleasant Lake. To determine this, there are two factors which need to be analyzed, including:

1. **The direction of groundwater flow**—When attempting to ensure adequate baseflow to a lake, it is important to know where the groundwater is coming from. In fact, groundwater recharge, which feeds the aquifer system (and in turn feeds the Lake), does not always come from areas solely within the surface watershed. This is because subterranean geologic formations can direct the flow of groundwater in a different direction than the surface water. To make an approximate determination of this direction of flow, it is possible to analyze groundwater elevation contours which are established from depth measurements taken at different groundwater wells within the Region and referenced to a common datum, such as NGVD 29. These boundaries are interpreted in a similar way to ground

[36]*SEWRPC Planning Report No. 52,* A Regional Water Supply Plan for Southeastern Wisconsin, *December 2010.*

Map 12

WATER FLOW PATHWAYS IN THE PLEASANT LAKE WATERSHED



surface elevation data (i.e., water flows downhill), and can be used to get general groundwater flow directions. When performing such an analysis it is necessary to also consider the locations of streams, ponds, and lakes, other than the waterbody of interest, relative to the groundwater flow direction. A stream or pond located down gradient from the highest groundwater contour, and upgradient from the waterbody for which it is desired to estimate the contributing groundwatershed, may intercept all, or some, of the groundwater flow, in effect creating one of the groundwatershed boundaries.

2. **The groundwater recharge potential in the area which is likely contributing to the groundwater supply**—Groundwater recharge potential is based on the amount of impervious cover and soil characteristics. An area with no impervious cover and highly permeable soils, for example, would be classified as high or very high groundwater recharge potential, whereas an area with lower permeability (e.g., clay soils) would be classified as low potential. Establishing areas of groundwater recharge potential enables identification of the highest priority areas for which infiltration functions should be protected (e.g., the areas where impervious surfaces should be avoided or where appropriate infiltration facilities should be implemented).

To determine where management efforts should be employed to protect groundwater recharge to Pleasant Lake, SEWRPC staff analyzed groundwater elevation contours and the groundwater recharge potential in the areas surrounding the Lake.[37] This inventory was not confined to the surface watershed, as was the case for the other inventories completed in this report, because the groundwater flow may be coming from outside of the watershed. The results of these inventories are described below.

Map 13 shows the general water table elevations, in feet above NGVD 29, in the Pleasant Lake area. As indicated on the map, **these groundwater table elevations reflect a general north to south flow of groundwater to Pleasant Lake, thereby indicating that the groundwater recharge area for the Lake's baseflow, may be located outside of the surface watershed**. These results cannot be considered conclusive, however, without further study; consequently, recommendations to determine groundwater flows and the recharge area are included in Chapter III of this report.

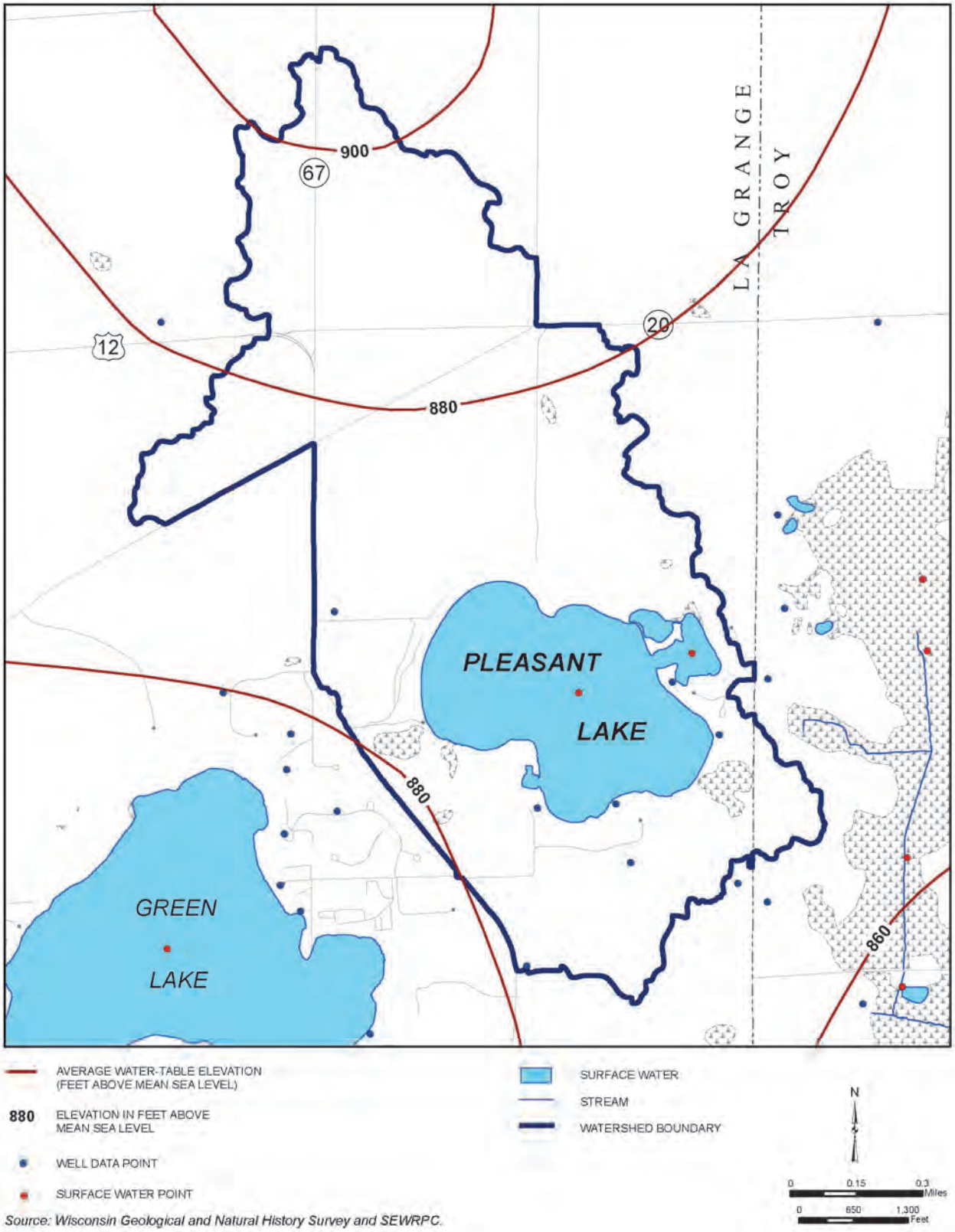
Given that the groundwater flowing to Pleasant Lake appears to be flowing from the north, Map 14 shows the groundwater recharge potential for not only the Pleasant Lake watershed but also for the areas to the north. There are some high and very high recharge areas located just north of the watershed, which seem to be largely located within cropland areas which flows in a westerly direction, bypassing Pleasant Lake. It is possible that some of the potential recharge area is between the croplands and Pleasant Lake, but outside of the Lake surface watershed, may contribute groundwater to Pleasant Lake**. More studies would be needed to develop a conclusive understanding of which areas to protect to ensure continued baseflow to Pleasant Lake**. Consequently, recommendations related to the investigation of these recharge areas are also included in Chapter III.

Even without further study, however, some projects can be undertaken to improve the volume and timing of water delivered to the Lake. In the interest of encouraging these kinds of actions, Chapter III of this report further details a number of recommendations focused on increasing infiltration in the moderate and high groundwater recharge potential areas in the Pleasant Lake watershed and in the areas that may contribute to Pleasant Lake's baseflow (i.e., limited areas north of the Lake as well as the areas directly adjacent to the Lake). These recommendations should be implemented and engaged where practical.

[37] *Ibid.*

Map 13

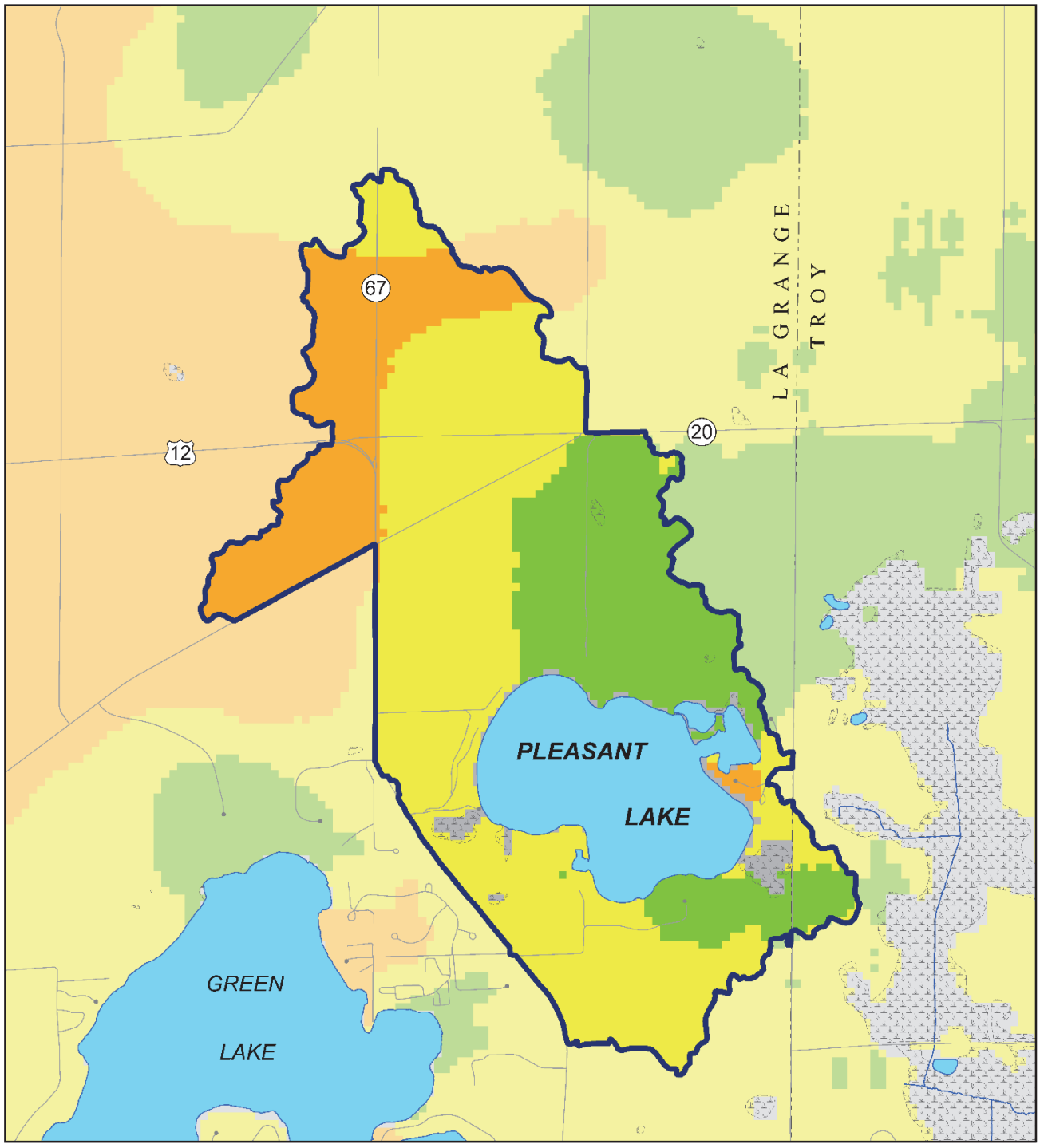
DEPTH TO SEASONAL HIGH GROUNDWATER WITHIN THE PLEASANT LAKE WATERSHED



Source: Wisconsin Geological and Natural History Survey and SEWRPC.

Map 14

ESTIMATES OF GROUNDWATER RECHARGE POTENTIAL WITHIN THE PLEASANT LAKE WATERSHED



GROUNDWATER RECHARGE POTENTIAL

- MODERATE
- HIGH
- VERY HIGH
- UNDEFINED

Source: SEWRPC and Natural Resources Conservation Service.

- SURFACE WATER
- STREAM
- WATERSHED BOUNDARY

Colors outside the watershed boundary are reduced in intensity to show the adjacent extent and distribution of each legend category.

N

0 0.15 0.3 Miles

0 750 1,500 Feet

ISSUE 5: WILDLIFE

The protection and enhancement of the aquatic and terrestrial wildlife populations which depend on Pleasant Lake was identified as an issue of concern by SEWRPC staff and Pleasant Lake residents. Investigation of the Lake and its watershed by the SEWRPC staff, identified the following considerations related to aquatic and terrestrial wildlife:

1. Fishing was identified as a primary recreational use of the Lake, as was verified by the 2013 recreational survey (see Table 14 and 15);

2. A species of special concern is present in the Lake—the lake chubsucker (*Erimyzon sucetta*), which was designated in 2008;[38]

3. The Lake has a history of natural walleye reproduction and a healthy fish population is present in the Lake, according to a 2008 WDNR fish population study (see Table 16), indicating the need for continued effective management;

4. A critical species habitat site[39] is located within the Lake's watershed (see Map 15);

5. About 15 species of amphibians and 17 species of reptiles are expected to be present in the Lake's watershed (amphibians and reptiles, including frogs, toads, salamanders, turtles, and snakes, are vital components of a lake ecosystem);

6. The Lake's watershed is likely to support a significant population of waterfowl, including mallards, wood duck, and blue-winged teal, particularly during the migration seasons; and

7. The Lake's watershed is likely to support both small and large mammals, such as foxes and whitetail deer.

A healthy fish, bird, amphibian, reptile, and mammal population requires: 1) good water quality, 2) sufficient water levels, 3) healthy aquatic plant populations, and 4) well maintained aquatic and terrestrial habitat. Additionally, wildlife populations can also be enhanced by the implementation of "best management practices." Since aquatic plant management, water quality, and water quantity have been discussed previously in this chapter, this section will focus on the maintenance and expansion of habitat, and on the use of best management practices to enhance wildlife populations. In general, these practices vary depending on the type of wildlife that is to be enhanced. This section will, therefore, first discuss *aquatic wildlife enhancement,* and then move on the *terrestrial wildlife enhancement.*

Aquatic Wildlife Enhancement

As mentioned above, aside from aquatic plant, water quality, and water quantity management, aquatic wildlife populations can be enhanced through implementation of best management practices and enhancement of aquatic habitat. Each is discussed below.

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[38]*Wisconsin Department of Natural Resources - Natural Heritage Inventory.*

[39]*Critical species habitats are designated based on various parameters, and specifically delineate the areas which need to be protected to maintain specific species of concern. The area within the Pleasant Lake watershed is discussed further in the Amendment to SEWRPC Planning Report No. 42,* Amendment to the Regional Natural Areas and Critical Species Habitat Protection and Management Plan for Southeastern Wisconsin, *December 2010. Juniper Knoll Camp Woods was designated due to the presence of* Besseya bullii (kittentails), *a State-designated threatened species.*

Table 14

RECREATIONAL SURVEY ON PLEASANT LAKE—WEEKDAYS: SUMMER 2013

		Active Recreational Watercraft and Related Activities on Pleasant Lake								
		Time and Date								
		6:00 a.m. to 8:00 a.m.	8:00 a.m. to 10:00 a.m.		10:00 a.m. to Noon		Noon to 2:00 p.m.		2:00 p.m. to 4:00 p.m.	
Category	Observation	August 1	July 17	August 16	August 20	August 29	July 25	August 27	August 6	August 29
Type of Watercraft (number in use)	Pontoon boat	0	0	0	0	1	1	0	1	0
	Fishing boat	0	3	8	3	2	0	0	3	1
	Kayak/canoe	0	0	0	1	0	5	3	3	0
	Sailboat	0	0	0	0	0	1	0	0	0
	Wind board/paddle board	0	0	0	0	0	2	0	0	0
Activity of Watercraft (number engaged)	Motorized cruise/pleasure Low speed	0	0	0	0	0	1	0	1	0
	Fishing	0	3	8	3	3	0	1	3	1
	Rowing/paddling/pedaling	0	0	0	1	0	7	2	3	0
	Sailing/windsurfing	0	0	0	0	0	1	0	0	0
Total	On water	0	3	8	4	3	9	3	7	1
		Recreational Activities Observed on Pleasant Lake								
Activity (average number of people)	Park goer	0	21	0	2	0	10	25	13	8
	Beach swimming[a]	0	19	0	0	3	17	24	27	8
	Pier/boat/raft swimming	0	0	0	0	0	1	3	2	0
	Canoeing/kayaking	0	0	0	2	0	6	2	3	0
	Sailboating	0	0	0	0	0	2	0	0	0
	Wind Surfing/Paddle Boarding	0	0	0	0	0	2	0	0	0
	Fishing from Boats	0	5	16	6	7	0	0	5	1
	Fishing from Shore	0	1	0	0	0	1	0	0	0
	Low-Speed Cruising	0	0	0	0	0	0	0	4	0

NOTE: Pleasant Lake is designated as a “no-wake” lake by Town of LaGrange ordinances.

[a]*There is one public beach on Pleasant Lake; it is part of LaGrange Park located on the western shore of Pleasant Lake and is owned and operated by the Town of LaGrange for LaGrange residents. In addition, there are two camps on the Lake that are owned and operated by Girl Scouts of America, both camps have beaches. A number of riparian homeowners swim off their shorelines. Data in the table referring to “Beach Swimming” includes all these types of swimmer access facilities.*

Source: SEWRPC.

Aquatic Best Management Practices

Aquatic best management practices refer to activities in which homeowners and resource managers can engage, such as catch and release fishing and fish stocking, which will improve the fishery within the Lake. To determine the most needed and effective practices, it is important to know:

1. **The population and size structure of the fish species present in a lake**—Studies which examine the species, populations, and sizes of the fish in a lake can help managers understand the issues that might be facing the fish populations. If low numbers of juvenile fish are found, for example, this may indicate that the fish are not spawning in the lake, and, therefore, that habitat needs to be improved. Similarly, if too many juveniles are found, with few large fish populations, this may indicate that over-fishing is a factor limiting the growth of fish, thereby indicating that catch and release should be promoted in the lake. This type of information can, therefore, help lake managers target fish population enhancement efforts effectively.

Table 15

RECREATIONAL SURVEY ON PLEASANT LAKE—WEEKENDS: SUMMER 2013

		Active Recreational Watercraft and Related Activities on Pleasant Lake				
		Time and Date				
		8:00 a.m. to 10:00 a.m.	10:00 a.m. to Noon	Noon to 2:00 p.m.	2:00 p.m. to 4:00 p.m.	
Category	Observation	July 20	August 10	August 18	July 27	August 24
Type of Watercraft (number in use)	Pontoon boat	0	0	1	2	3
	Fishing boat	2	4	6	1	2
	Kayak/canoe	5	1	2	1	4
	Other (tube fishers)	2	0	0	0	0
Activity of Watercraft (number engaged)	Motorized cruise/pleasure Low speed	0	0	1	0	3
	Fishing	2	4	6	3	2
	Rowing/paddling/pedaling	5	1	2	1	4
	Other (tube fishers)	2	0	0	0	0
Total	On water	9	5	9	4	9
		Recreational Activities Observed on Pleasant Lake				
Activity (average number of people)	Park goer	0	4	14	0	0
	Beach swimming[a]	0	0	8	2	12
	Pier/boat/raft swimming	4	0	8	0	0
	Canoeing/kayaking	4	3	4	2	0
	Fishing from Boats	8	8	14	6	3
	Fishing from Shore	0	4	0	0	1
	Low-Speed Cruising	0	0	8	3	0

NOTE: Pleasant Lake is designated as a "no-wake" lake by Town of LaGrange ordinances.

[a]*There is one public beach on Pleasant Lake; it is part of LaGrange Park located on the western shore of Pleasant Lake and is owned and operated by the Town of LaGrange for LaGrange residents. In addition, there are two camps on the Lake that are owned and operated by Girl Scouts of America, both camps have beaches. A number of riparian homeowners swim off their shorelines. Data in the table referring to "Beach Swimming" includes all these types of swimmer access facilities.*

Source: SEWRPC.

2. **The history of fish stocking in a lake**—To evaluate the information found in fish population studies, it is important to know how many fish of different sizes have been introduced through stocking activities. If only the large fish which were stocked exist in a lake, for example, it is likely that no natural spawning is actually taking place, meaning that the lake's fishery is greatly dependent on fish stocking. This, therefore, might indicate that stocking needs to continue until spawning can be established in the lake.

Table 16

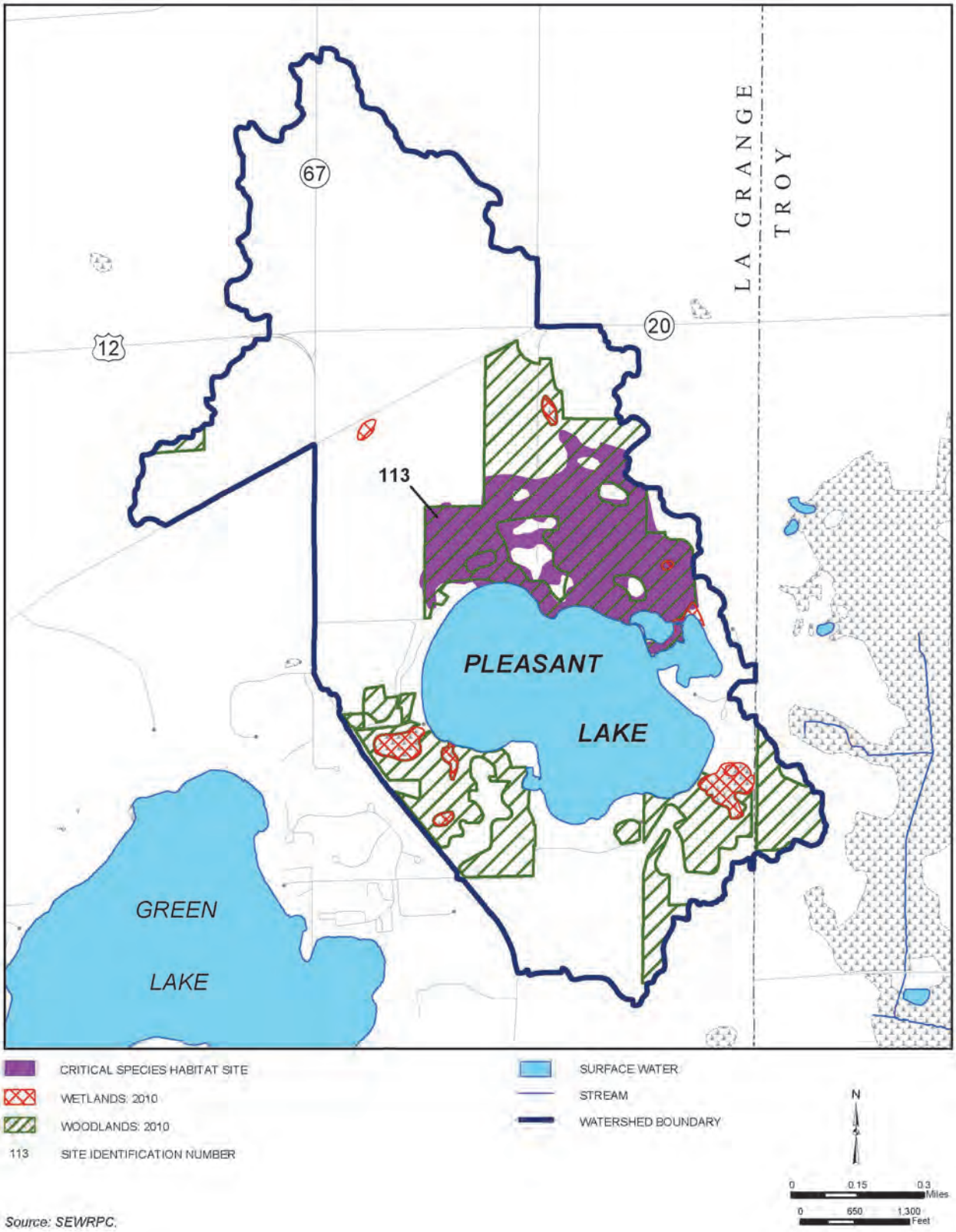
FISH SURVEY IN PLEASANT LAKE: 2008

Species Collected	Average Length (inches)
Black Crappie	8.3
Blue Gill	6.2
Largemouth Bass	10.9
Northern Pike	24.8
Pumpkinseed	6.8
Walleye	16.8
Yellow Perch	6.5

Source: Wisconsin Department of Natural Resources.

Map 15

CRITICAL SPECIES HABITAT, WETLANDS, AND WOODLANDS WITHIN THE PLEASANT LAKE WATERSHED



Source: SEWRPC.

SEWRPC staff completed an inventory of the studies and stocking efforts completed by WDNR since 1982. This inventory revealed that largemouth bass are reported to be "abundant" in Pleasant Lake, while panfish, northern pike and walleye were listed as "present."[40] A fish survey conducted in 2008 (see Table 17), by electrofishing,[41] noted the presence of these fish in the Lake but also revealed abundance of largemouth bass. Pleasant Lake is one of the few lakes in Walworth County that has documented history of natural reproduction by walleye. This, along with the 726 large fingerling walleye that were stocked in 2014 through the Wisconsin Walleye Initiative, allows for the opportunity to reach a sustainable walleye fishery on Pleasant Lake.[42] Therefore, management of the walleye habitat within the Lake should be a priority.

Table 17

FISH STOCKED INTO PLEASANT LAKE

Year	Species Stocked	Number Stocked	Average Length (inches)
1982	Northern pike	310	Yearling
1985	Northern pike	310	8.00
1990	Northern pike	50,000	1.00
1992	Northern pike	310	9.00
1994	Northern pike	310	7.50
1999	Northern pike	310	7.20
2001	Northern pike	500	7.60
2001	Northern pike	2,129,410	0.30
2006	Walleye	5,000	1.40
2008	Walleye	5,425	1.60
2010	Walleye	5,425	1.70
2012	Walleye	5,425	1.66
2013	Northern Pike	245	8.90

Source: Wisconsin Department of Natural Resources and SEWRPC.

Overall, WDNR concludes in its reports that **Pleasant Lake has a generally healthy fish population**. This indicates that the current practices in the Lake seem to be maintaining a viable fishery. Consequently, maintenance of the current practices and aquatic habitats (see Aquatic Habitat subsection below) within the Lake will be crucial. While Pleasant Lake has a healthy fish population, the WDNR reports **also indicate that many of the fish present in the Lake are not naturally reproducing.** As the fishery on the Lake has been maintained thus far by fish stocking, see Table 17, periodic fish stocking should continue to maintain a viable fishery. Recommendations related to both of these conclusions are included in Chapter III of this report.

Aquatic Habitat

Aquatic habitat enhancement generally refers to encouraging native aquatic plant (particularly pondweed) growth within a lake, as these plants provide food, shelter, and spawning areas for fish. Additionally, aquatic habitat enhancement also involves protecting wetlands (see "Terrestrial Habitat" section below) and encouraging the presence of woody debris along the shorelines, as areas with woody debris mimic natural environments and provide shelter for fish populations.

To determine the state of the aquatic habitat within the Lake, SEWRPC staff completed an aquatic plant survey in the summer of 2013 (see "Aquatic Plant" section), and completed a shoreline assessment in the summer of 2014 (see "Pollution Mitigation Abilities" section). The results of the aquatic plant survey revealed that **Pleasant Lake has very good plant diversity, with 9 different pondweed species,**[43] **while the shoreline assessment**

[40]*Department of Natural Resources Lake Page:* http://dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=741500

[41]*Electrofishing is a process where an electrical pulse is placed in the water, causing fish to be temporarily stunned and float to the top of the lake. This process allows for fisheries biologists to record fish types, counts, and sizes without harming the fish populations.*

[42]*Personal communication from the regional WDNR fisheries biologist.*

[43]*Pondweed species are significant in a lake because they serve as excellent habitat by providing food and shelter to many aquatic organisms.*

Figure 20

EXAMPLE OF DIFFERENT TYPES OF WETLANDS

PHOTO A—MARSH WETLAND

PHOTO B—SCRUB/SHRUB WETLAND

PHOTO C—FORESTED WETLAND

Source: Photo A—SEWRPC, Photo B—University of New Hampshire Cooperative Extension, and Photo C—Prince William Conservation Alliance.

concluded there are various areas around the Lake with woody debris in the water. These conclusions indicate that the current aquatic plant community and woody debris along the shorelines should be maintained, to the greatest extent practical. Consequently, recommendations related to both are presented in Chapter III of this report.

Terrestrial Wildlife

As with aquatic wildlife enhancement, there are two general practices (aside from aquatic plant, water quality, and water quantity management) that can enhance terrestrial wildlife populations, namely: best management practices and terrestrial habitat enhancement. Each is discussed below.

Terrestrial Best Management Practices

The way people manage their land and treat wild animals can have a significant impact on terrestrial wildlife populations. Turtles, for example, need to travel a long distance from their home lake to lay their eggs. If pathways to acceptable habitats are not available, or are dangerous due to pets, fences, or traffic, the turtles will not have the opportunity to increase their population. Many conservation organizations have developed "best management practices," or behaviors, which homeowners and managers can engage in to improve the wildlife populations within the watershed.

Though some of these best management practices are species- or animal-type specific (e.g., spaying or neutering cats to reduce their desire to kill birds) many of these recommendations relate to general practices that can benefit all wildlife. In general, best management practices for wildlife enhancement can be targeted to agricultural and residential land uses. Agricultural measures tend to focus on encouraging land management that allows for habitat enhancement, such as allowing fallen trees to naturally decompose where practical, or allowing for uneven landscapes (which create spawning areas). Alternatively, residential measures tend to focus on practices that landowners can install to provide habitat, such as installing a pool garden or preventing the introduction of nonnative plants and insects. There are also recommendations which are generally applicable to both types of landowners. For example, killing native wildlife, particularly amphibians, reptiles, and birds, is generally not advised.

Communication to the public regarding these best management practices may provide a means of encouraging wildlife populations without having to make major investments. Consequently, the implementation of measures to increase the use of these practices is included in the recommendations set forth in Chapter III of this report.

Terrestrial Habitat

Terrestrial wildlife needs large, well connected areas of natural habitat. Consequently, the protection and expansion of natural habitat is crucial if wildlife populations are to be maintained or enhanced. Open space natural areas can generally be classified as either wetlands or uplands as described below:

1. **Wetlands**—Wetlands are defined based on hydrology, hydric soils, and the presence of wetland plants. There are many types of wetlands (see Figure 20), from the traditionally understood wetland, with cattails and bulrushes, to forested wetlands. Most wildlife, both aquatic and terrestrial, has been found to rely on, or associate with, wetlands for at least a part of their lives. This includes crustaceans, mollusks, aquatic insects, fish, amphibians, reptiles, mammals (e.g., deer, muskrats, beavers), and resident bird species, (e.g., turkey and migrant species such as sandhill and whooping cranes).

2. **Uplands—**Uplands are areas which are not classified as wetlands or floodplains. They are often characterized by the presence of drier, more stable soils. Like wetlands, natural uplands can also exist in many forms (e.g., prairies, woodlands) and also provide many critical functions for many upland game and nongame species of wildlife through the provision of critical breeding, nesting, resting, and feeding grounds as well as refuge from predators. Unlike wetlands, however, the dry and stable soils make uplands more desirable for urban development and, therefore, such areas are more challenging to protect.

As mentioned above, **both wetlands and uplands are critical to wildlife populations**. However, **the dynamic interactions and movement between these two types of land are also crucial** because many terrestrial organisms spend part of their time in the wetlands and the rest of their time in upland areas. For example, amphibians live most of their lives in upland areas but depend on wetlands for breeding. Consequently, if the connection between the uplands and wetlands are severed (e.g., if a road is placed between the two land types) this makes it dangerous, if not impossible, for amphibians to gain access to their breeding grounds, thereby lowering their ability to procreate. In fact, habitat fragmentation (i.e., the splitting up of large connected habitat areas) has been cited as the primary cause of wildlife population decreases globally.[44] Therefore, the protection and expansion of uplands and wetlands, as well as the protection of their connectivity, is necessary if wildlife populations are to be maintained or enhanced.

To determine the extent of the uplands and wetlands which exist in the Pleasant Lake watershed, as well as to determine the state of the connections between these two areas, SEWRPC staff completed an inventory of the wetlands and uplands (woodlands) within the Pleasant Lake watershed, as shown on Map 15. The wetlands are located primarily at the southwestern and southeastern ends of Pleasant Lake, while the uplands are primarily southwest, southeast, and north of the Lake. **There is also a clear connection between the wetland and upland complexes, indicating that there is valuable habitat within the watershed**. Consequently, the protection and expansion of these complexes should be made a priority to maintain and enhance wildlife populations.

It is important to note, however, that the protection and enhancement of wetlands and uplands requires a number of actions, including:

[44]Effects of Habitat Fragmentation on Biodiversity, *Lenore Fahrig, Annual Review of Ecology, Evolution, and Systematics, Vol. 34, 2003, pp. 487-515.*

1. Preventing and/or limiting development within the wetlands and certain upland areas;

2. Ensuring that any development that does occur does not cut off the connection between uplands and wetlands;

3. Expanding uplands and/or wetlands where practical (e.g., reestablishing wetlands that are currently farmed or reforesting cleared areas); and

4. Ensuring that wetlands and uplands continue to function properly by controlling and/or removing any invasive plant species that are introduced to those areas.

Therefore, it is important to incorporate all of these components into a comprehensive management plan. Consequently, recommendations related to each of these actions are included in Chapter III of this report. Additionally, guidance as to the implementation of these actions is included in the "Implementation" section below and in Chapter III.

Other Wildlife Issues

The presence of aquatic birds (primarily geese) on the shorelines was also mentioned as an issue of concern. Goose control along Pleasant Lake has been managed in the past through oiling of goose eggs. Other management options are the installation of naturally vegetated buffers that may discourage the congregation of geese along the shoreline. Consequently, a recommendation related to the continued management of egg oiling and the installation of buffers is further emphasized in Chapter III of this plan as a part of the wildlife recommendations.

ISSUE 6: IMPLEMENTATION

Another all-encompassing issue of concern that was discussed throughout this planning process was the need for guidance on the implementation of the plan recommendations. A big step toward implementation of a plan is the development of an action plan with timelines, goals, and identification of responsible parties. These kinds of targets can help the implementing agencies to gauge progress over time and can help motivate participants, ensuring that the plan is implemented in the long term.

To develop an action plan, however, it is important to know what implementation would involve. Consequently, it is important to note that some of the recommendations can be achieved using regulation while others involve proactively implementing new management efforts. Both are discussed below.

Regulatory Implementation

Regulatory implementation refers to the maintenance and improvement of water quality, water quantity, and wildlife populations, through the use of local, State, and Federal laws. A number of regulations relating to activities within the Pleasant Lake watershed, such as zoning ordinances, boating and in-Lake ordinances, and State regulations, help protect the Lake by mitigating pollution, preventing or limiting development, and ensuring best management practices.

Ordinances

Zoning ordinances dictate where development can take place, the types of development allowed, and the terms that need to be met for development to be permitted. Consequently, **zoning can be a particularly effective tool for protecting buffers, wetlands, uplands, and shorelands when environmental considerations are taken into account during the formulation of zoning decisions**. A way for these environmental considerations to be taken in account within Wisconsin is for the local zoning authorities and other regulatory agencies to use SEWRPC-designated environmental corridors (see Figure 21) in applying conservancy zoning district regulations to help determine where development is permitted and not permitted, and to determine the extent of development that is allowed.

Figure 21

SYNOPSIS OF SEWRPC-DESIGNATED ENVIRONMENTAL CORRIDORS

SEWRPC has embraced and applied the environmental corridor concept developed by Philip Lewis (Professor Emeritus of Landscape Architecture at the University of Wisconsin-Madison) since 1966 with the publication of its first regional land use plan. Since then, SEWRPC has refined and detailed the mapping of environmental corridors, enabling the corridors to be incorporated directly into regional, county, and community plans and to be reflected in regulatory measures. The preservation of environmental corridors remains one of the most important recommendations of the regional plan. Corridor preservation has now been embraced by numerous county and local units of government as well as by State and Federal agencies. The environmental corridor concept conceived by Lewis has become an important part of the planning and development culture in southeastern Wisconsin.

Environmental corridors are divided into the following three categories.

- **Primary environmental corridors** contain concentrations of our most significant natural resources. They are at least 400 acres in size, at least two miles long, and at least 200 feet wide.
- **Secondary environmental corridors** contain significant but smaller concentrations of natural resources. They are at least 100 acres in size and one mile long, unless they link primary corridors.
- **Isolated natural resource areas** contain significant remaining resources that are not connected to environmental corridors. They are at least five acres in size and at least 200 feet wide.

Key Features of Environmental Corridors

- Lakes, rivers, and streams
- Undeveloped shorelands and floodlands
- Wetlands
- Woodlands
- Prairie remnants
- Wildlife habitat
- Rugged terrain and steep slopes
- Unique landforms or geological formations
- Unfarmed poorly drained and organic soils
- Existing outdoor recreation sites
- Potential outdoor recreation sites
- Significant open spaces
- Historical sites and structures
- Outstanding scenic areas and vistas

Source: SEWRPC.

Table 18

LAND USE REGULATIONS WITHIN THE AREA TRIBUTARY TO PLEASANT LAKE IN WALWORTH COUNTY BY CIVIL DIVISION

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 WDNR approved	Floodland and shoreland only	Adopted
Town of LaGrange	County ordinance	County ordinance	County ordinance	County ordinance	County ordinance
Town of Troy.....	County ordinance	County ordinance	County ordinance	County ordinance	County ordinance

Source: SEWRPC.

The **Pleasant Lake watershed has three different units of government who have different regulatory authorities** that apply to Lake protection, including the Towns of LaGrange and Troy, as well as, Walworth County (see Table 18 and Map 16).

Walworth County has zoning authority in the majority of the watershed. This is advantageous because the general zoning ordinance for **Walworth County** specifically states that **environmental corridors are to be protected and maintained**. The fact that these corridors are used in zoning decisions means that the areas within the Pleasant Lake watershed that are contained within environmental corridors (see Map 17), are well protected.

In addition to general zoning, **shoreland zoning and construction site erosion control and stormwater management ordinances also play a key part in protecting the resources within the watershed**. Shoreland zoning in Wisconsin, for example, which is administered by Walworth County in this instance, follows statewide standards to create building setbacks around navigable waters.[45] Additionally, stormwater management and construction erosion control ordinances help minimize water pollution, flooding, and other negative impacts of urbanization on water resources (lakes, streams, wetlands, and groundwater) and property owners, both during and after construction activities.

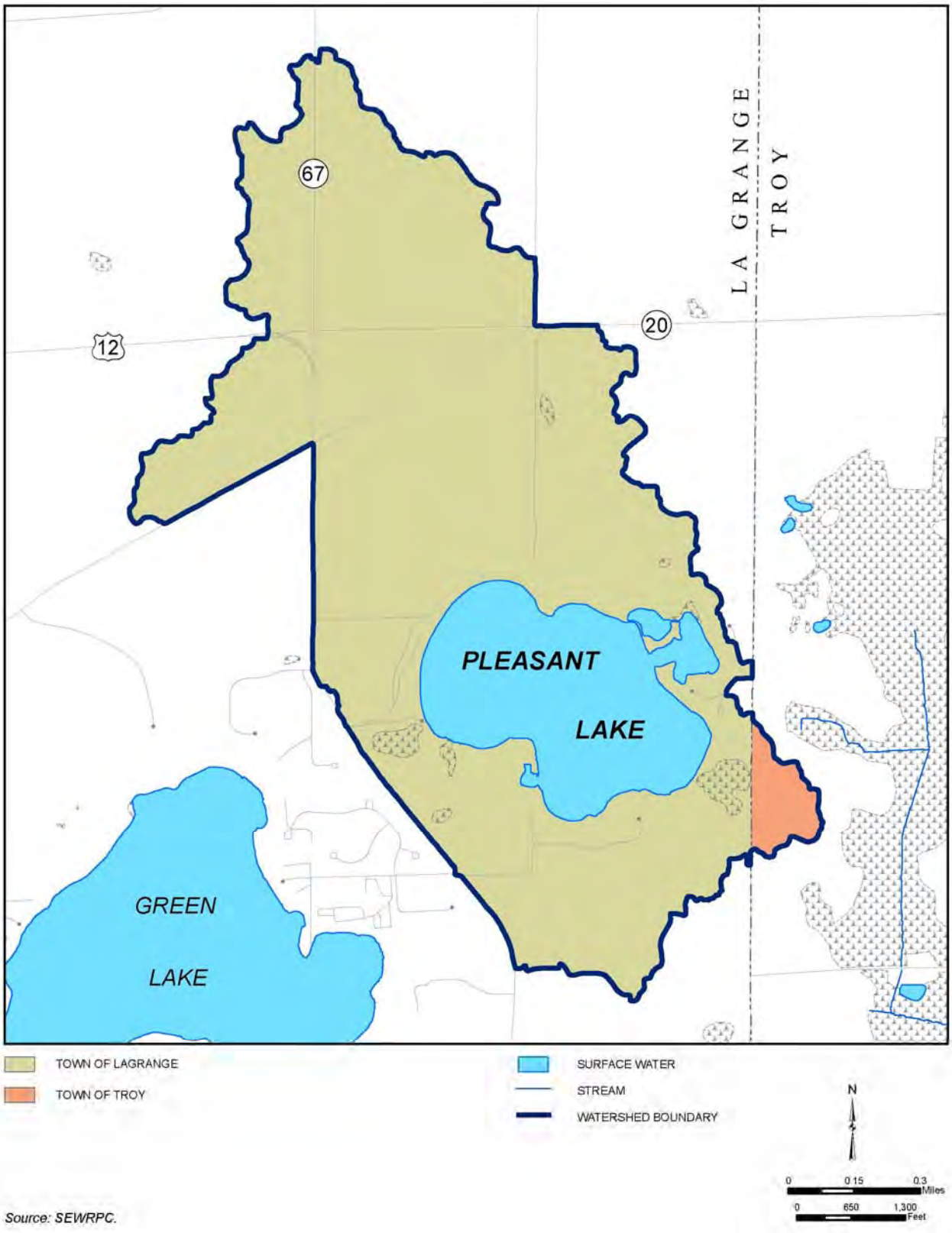
Boating and In-Lake Ordinances

Boating and in-lake ordinances regulate the use of the Lake in general, and, when implemented properly, **can help prevent inadvertent damage to the Lake such as overfishing or extensive shoreline erosion from wave action hitting the shoreline**. The boating ordinance for the Town of LaGrange (including Pleasant Lake) is provided in Appendix H. This ordinance is generally enforced by a warden or by the local law enforcement agency.

[45]*The 2015-2017 State Budget (Act 55) changed State law relative to shoreland zoning. Under Act 55 a shoreland zoning ordinance may not regulate a matter more restrictively than it is regulated by a State shoreland-zoning standard unless the matter is not regulated by a standard in Chapter NR 115, "Wisconsin's Shoreland Protection Program," of the* Wisconsin Administrative Code. *(Examples of unregulated matters may involve wetland setbacks, bluff setbacks, development density, and stormwater standards.) In addition, under Act 55, a local shoreland zoning ordinance may not require establishment or expansion of a vegetative buffer on already developed land and may not establish standards for impervious surfaces unless those standards consider a surface to be pervious if its runoff is treated or is discharged to an internally drained pervious area.*

Map 16

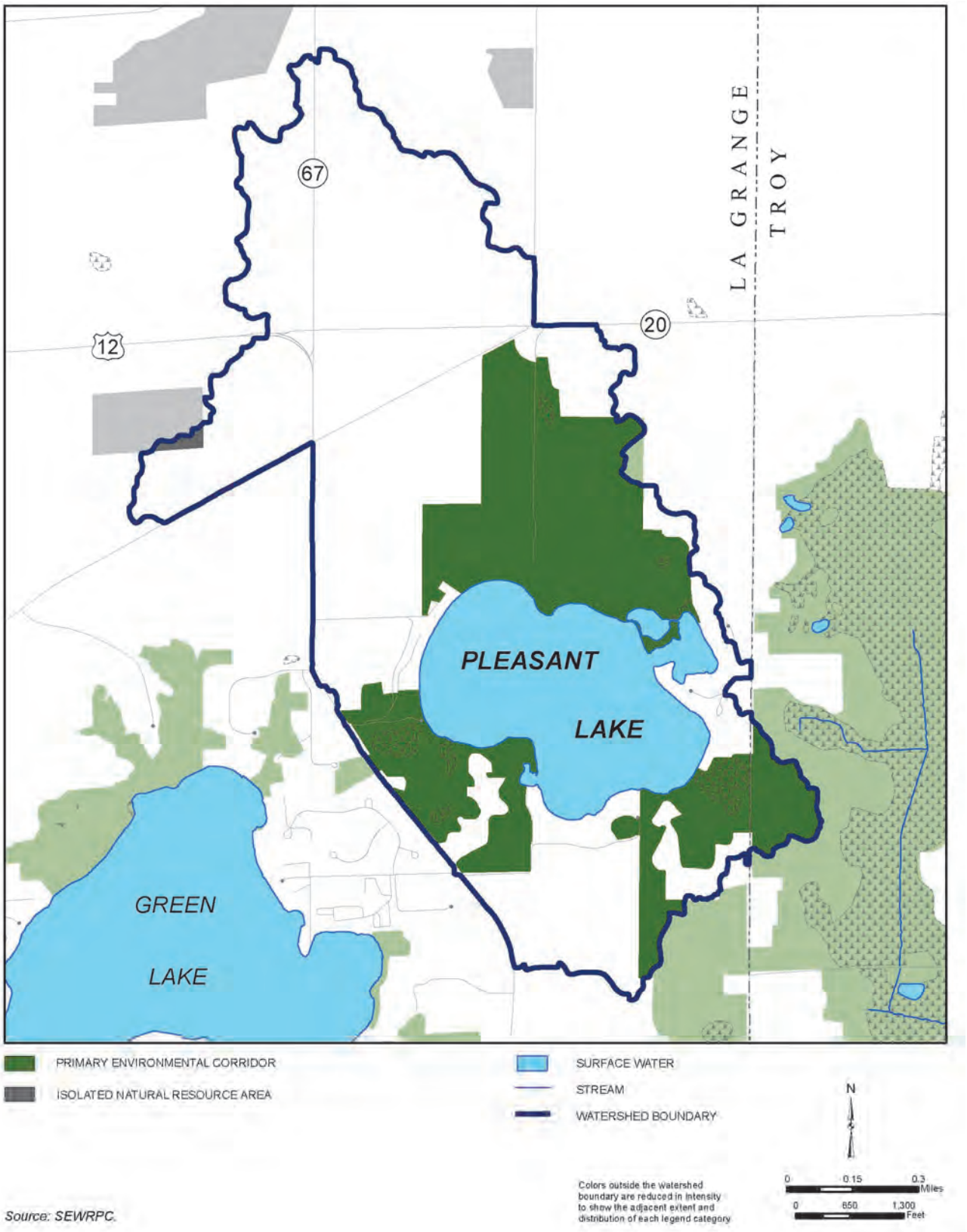
CIVIL DIVISIONS WITHIN THE PLEASANT LAKE WATERSHED: 2015



Source: SEWRPC.

Map 17

ENVIRONMENTAL CORRIDORS WITHIN THE PLEASANT LAKE WATERSHED: 2010



State Regulations
The State Legislature required the WDNR to develop performance standards for controlling nonpoint source pollution from agricultural and nonagricultural land and from transportation facilities. The performance standards, which are set forth in Chapter NR 151, "Runoff Management," of the *Wisconsin Administrative Code*, set forth requirements for best management practices. There are also regulations with respect to construction sites, wetland protective areas, and buffer standards.

The regulations described above play a crucial part in maintaining the health of the Lake and of all the resources within the Pleasant Lake watershed. However, even though developers, residents, and Lake users are legally obligated to adhere to the ordinances, limited resources within the enforcement bodies at a State, County, and municipal level can sometimes make the task of ensuring compliance difficult. Consequently, Chapter III provides recommendations on the best ways for lake organizations to work with regulatory agencies to help them enforce the existing ordinances and regulations to the greatest extent practical.

Proactive Management Efforts
In addition to continued and enhanced ordinance enforcement, there are also a number of recommendations made under this plan which seek to proactively improve conditions within the Lake through voluntary management efforts. Chapter III provides details on these recommendations, and provides guidance on their implementation. However, there are a number of challenges that were identified for Pleasant Lake which currently limit the ability of Lake residents to engage in the management efforts provided in this report. Some of these factors include:

1. **Lack of consistent funding sources for Lake management efforts**—There were several concerns about the costs of aquatic plant management within the Lake as well as the costs that would be associated with management efforts recommended under this plan. A list of available grants for lake management efforts is included in Chapter III.

2. **Institutional capacity—**Institutional capacity refers to the capacity that agencies within the watershed have to implement projects in terms of knowledge, staff, and other resources. Map 14 depicts the civil divisions within the watershed and Table 17 lists the land use regulations enforced by those civil divisions. There are many resources to help residents and Lake users implement management measures, however, some guidance will likely be necessary to ensure that those attempting management projects are completing the projects in an effective way.

3. **Institutional cooperation**— Pleasant Lake has both an association (Pleasant Lake Property Owners Association) and a district (PLPRD) that have a shared interest in the health of the Lake. Lake associations are voluntary groups where membership and dues are both voluntary. However, because they are not a government body, like a district, they have the ability to act more quickly on some issues. Lake districts are considered "special purpose units of government" and are a taxing body; they also have some capabilities in regulating lake use (e.g., boating ordinances, sewage management).[46] With there being two lake groups on Pleasant Lake it may be in their best interest to split implementation of projects, keeping in mind which group may be better suited for each project. Maintaining this open line of communication may be crucial to ensuring effective implementation of this plan.

4. **Volunteer and Interest Base** – The planning process for Pleasant Lake has revealed that the many stakeholders have a strong connection to the Lake. However, it was noted that the participants in the planning process were composed of almost entirely lakeshore or near-lakeshore residents. To increase the advocacy and volunteer base (for projects like handpulling or wetland invasive species monitoring) it may be necessary to reach a wider interest group.

[46]*For more information visit wisconsinlakes.org or contact Eric Olson at eolson@uwsp.edu*

All of the funding, institutional, and involvement issues considered in this report subsection are highly relevant to most if not every recommendation under the plan. Consequently, Chapter III provides some recommendations and suggested actions which seek to ensure that the above capacity issues are addressed.

In addition to capacity building, communicating the details of this plan will also be crucial to encouraging voluntary management efforts. For example, communicating the difference between native and nonnative plants, and the fact that removal of plants can spur algae growth, are important to ensure that homeowners understand why a "clean" shoreline is not always the best option for a lake (and to ensure that homeowners maintain a healthy plant community on the shoreline). Consequently, another major recommendation in Chapter III is communicating the necessary and important components of this plan.

SUMMARY

All of the issues of concern expressed by Pleasant Lake residents during the development of this plan have merit. Additionally, as discussed in the "Aquatic Plant Growth" section of this report, addressing these issues will contribute to maintaining the aquatic plant population within Pleasant Lake and improving the general health of the Lake. Therefore, each issue has associated recommendations set forth in Chapter III. It is important to note that, despite the issues of concern in Pleasant Lake, there are also a number of opportunities to help ensure the sustainable use of Pleasant Lake and its watershed. The implementation of the recommendations provided in Chapter III of this report will capitalize on those opportunities.

Chapter III

LAKE MANAGEMENT RECOMMENDATIONS AND IMPLEMENTATION

INTRODUCTION

Pleasant Lake is a precious resource to its users and nearby residents. This chapter provides recommendations that address the issues of concern in Chapter II in order to maintain and enhance the health of the Lake and to encourage its continued enjoyment. The recommendations provided in this chapter are based upon the preliminary recommendations that were also provided in Chapter II.

The recommendations made in this chapter cover a wide range of programs, and seek to address every aspect that influences the health and recreational use of Pleasant Lake. Consequently, it may not be feasible to implement every one of these recommendations in the immediate future. The priority of each recommendation is, therefore, indicated throughout the chapter, to guide Lake managers in targeting priority projects. Eventually, however, all of the recommendations should be addressed, subject to possible modification based on analysis of logistics or changing conditions, as well as based on the findings of future aquatic plant surveys and water quality monitoring.

The measures described in this chapter are primarily focused on those which can be implemented through collaboration between the Pleasant Lake Rehabilitation and Protection District, Pleasant Lake Association, the Town of LaGrange, and Pleasant Lake residents. However, partnerships with WDNR, developers, landowners, and other nearby municipalities may be necessary to ensure the long-term ecological health of Pleasant Lake. Therefore, those engaging in management efforts on Pleasant Lake are encouraged to continuously seek out projects and partnerships which will aid in achieving the recommendations contained within the plan.

Though the logistics for implementing each recommendation may not be fully laid out, this chapter does provide some suggestions for potential projects. It is important to know, however, that these project suggestions do not necessarily constitute recommendations as they are presented to provide the implementing entities with ideas about the types of projects they may want to pursue. In short, this chapter is meant to provide a context for understanding what needs to be done, as well as to help the reader picture what those efforts might look like.

ISSUE 1: AQUATIC PLANT MANAGEMENT

As discussed in Chapter II of this report, Pleasant Lake supports a diverse aquatic plant community capable of supporting a warm water fishery as well as a wide range of recreational uses. However, the 2013 survey (see Appendix A for distribution maps), also indicates a small community of the invasive Eurasian water milfoil, which could potentially threaten the native aquatic plant community if not managed properly. This section,

therefore, details a comprehensive aquatic plant management plan, based on the preliminary recommendations provided in Chapter II.

The combined recommendations presented below (which constitute the recommended aquatic plant management plan) were formed to balance three major goals, including 1) to improve access to the Lake; 2) to protect the native aquatic plant community; and 3) to effectively control Eurasian water milfoil populations. The plan was also formed with provisions to ensure that current recreational use of the Lake (i.e., swimming, boating, and fishing) is maintained to the greatest extent practical. The plan took into consideration all of the common, State approved, aquatic plant management alternatives (see Chapter II), including manual, biological, physical, chemical, and mechanical measures.

Aquatic Plant Management Recommendations

The most effective plans for managing nuisance and invasive aquatic plant growth rely on a combination of methods and techniques. Therefore, to enhance access of Pleasant Lake while maintaining the quality and diversity of the biological communities, four aquatic plant management techniques are recommended under this plan, including:

1. **Manual removal (i.e., hand-pulling) of Eurasian water milfoil.** This should be completed in early spring and is considered a high priority as it is the primary technique for removal of Eurasian water milfoil in Pleasant Lake. No permit is needed for hand pulling (for an individual riparian landowner[1]) as long as the effort targets Eurasian water milfoil only, and as long as all plant materials are removed from the Lake. It is also recommended that residents engaging in this effort be educated on the need to prevent extensive loss of native plants and general plant identification prior to the implementation of this campaign. This will ensure that this measure does not harm (or adversely affect) local wildlife and plant communities.

2. **Mechanical harvesting to create access lanes in the Bay** if dense aquatic plant growth makes the Bay unnavigable, only in areas where Eurasian water milfoil is absent, should be considered a medium priority. This recommendation is made with several specifications to ensure continued recreational use of the Lake and to ensure the health of the native plant community, including:

    a. **Leaving at least one foot of plant material at the Lake bottom while harvesting** should be considered a high priority**.** This is done to prevent sediment disturbance and to ensure that native plants communities are maintained (disturbing the sediment uproots native plants and leaves an opportunity for Eurasian water milfoil to take over). Leaving one foot of plant material will likely not be an issue in the areas with depths greater than three feet. However, in the regions where depths are less than three feet, special care should be employed. Consequently, as can also be seen on Map 18, all areas which are less than three feet deep are designated as “shallow cut only” areas. This means that, in these areas, only the “top cut” technique (see Figure 22) should be used. Harvesting should not occur where the harvester is unable to leave one foot of plant material (raking and hand pulling should be used instead of harvesting in these areas).

        1) A small-scale harvester (similar to the one depicted in Figure 3) should be used to harvest narrow lanes.

[1]*If a lake district or other group wants to complete a project that consists of removing invasive species along the shoreline a NR 109 permit is necessary, as the removal of invasive plants is not being completed along an individual’s own property.*

Map 18

AQUATIC PLANT MANAGEMENT PLAN FOR PLEASANT LAKE

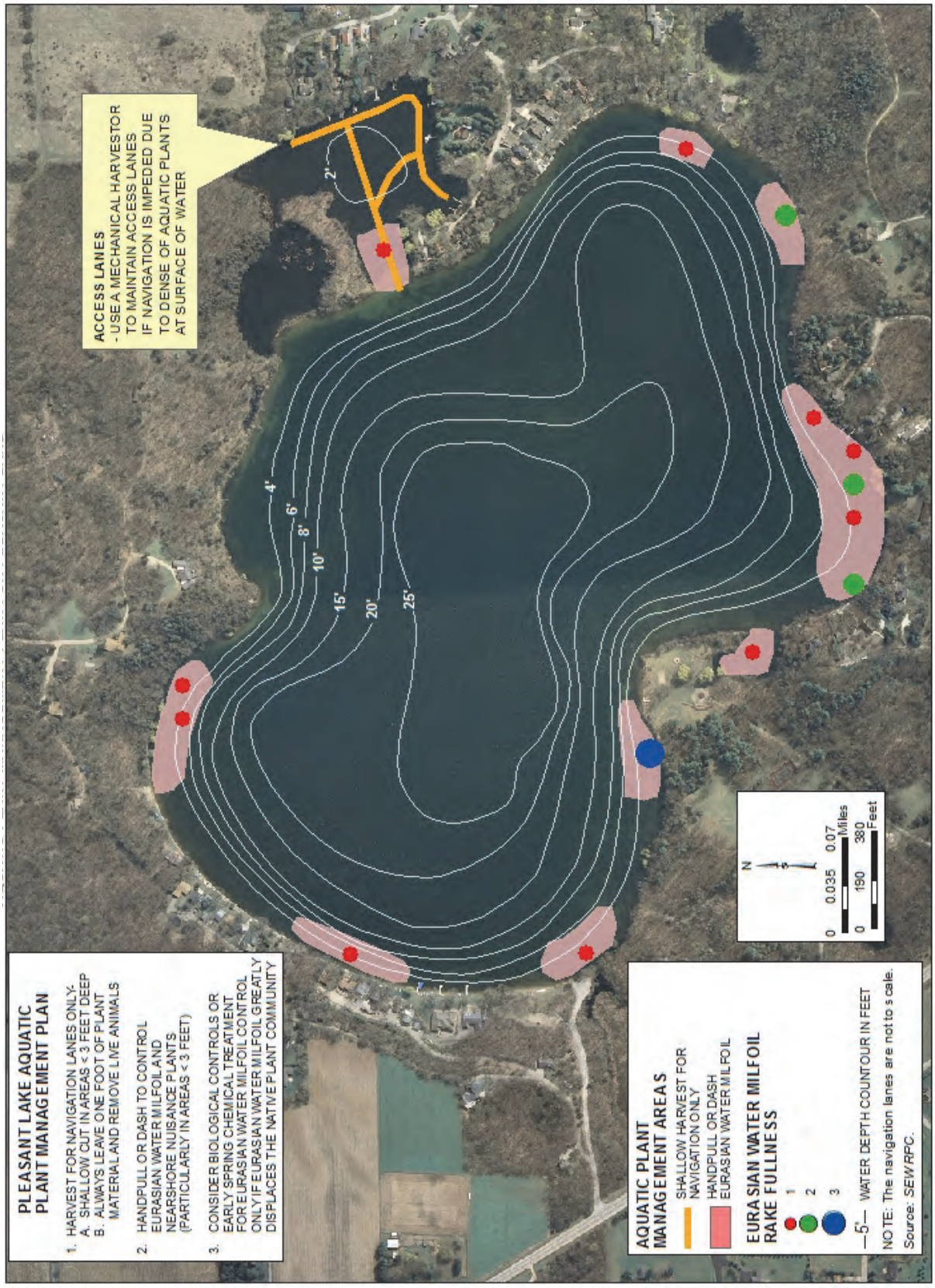
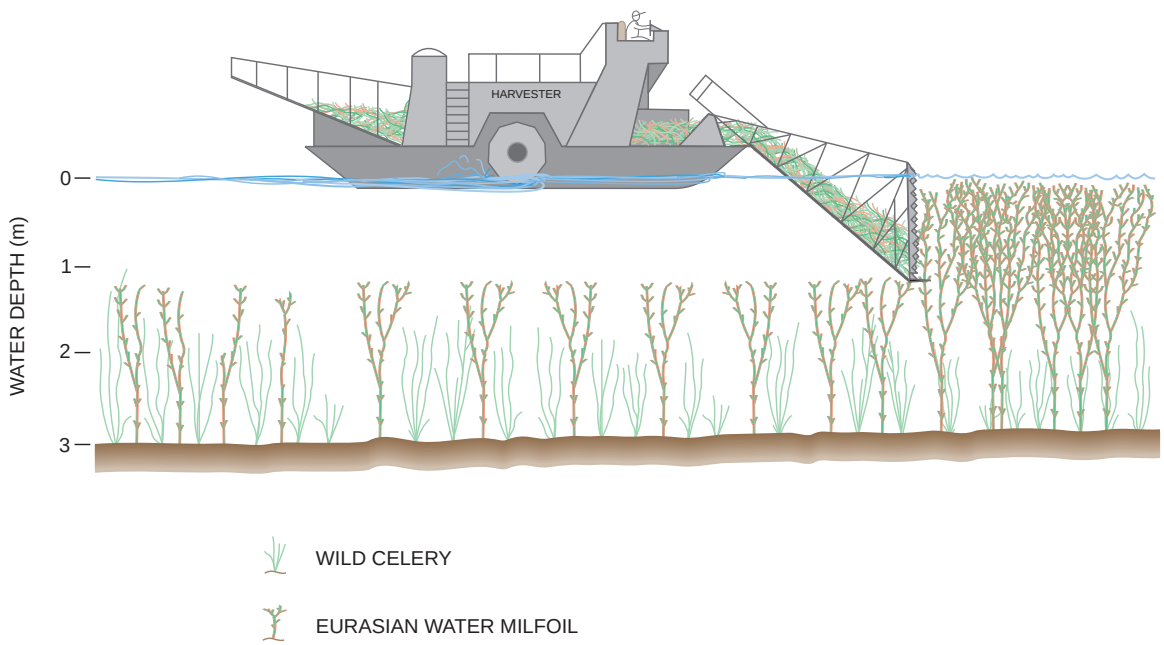


Figure 22

PLANT CANOPY REMOVAL OR "TOP CUTTING" WITH AN AQUATIC PLANT HARVESTER



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

Source: Wisconsin Department of Natural Resources and SEWRPC.

b. It should be a high priority to **inspect all cut plants for any live animals and those animals which are found should be returned to the Lake immediately**. This is because some animals can get caught in the harvester, particularly when cutting larger mats of plants. Consequently, it is necessary to go through the cut materials to make sure that live animals are removed to the greatest extent practical.

c. **Harvesting should not occur in the early spring** (high priority) to prevent disturbance of fish spawning. This is because some studies have suggested that spawning can be significantly disturbed by harvesting activities. Thus, avoiding harvesting during this time would be highly beneficial to the Lake's fishery.

d. **All harvester operators should undergo training to ensure that the harvesting specifications are sufficiently implemented** (high priority). This training should be provided by the regional WDNR aquatic invasive species coordinator and should cover, at a minimum 1) "deep-cut" versus "shallow-cut" techniques and when to employ each according to this plan; 2) review of the plan, and associated permit, and review of the need to restrict cutting in shallow areas; and 3) plant identification to encourage the maintenance of native plant communities.

e. Since harvesting activities create fragmented plants which accumulate on the shorelines, the harvesting program should include the **implementation of a comprehensive plant pick up program** which all residents can use (high priority). This will help ensure that harvesting activities do not become a nuisance for other Lake residents. This program could include residents raking plants and placing them on their pier for weekly pick up or could include a regular effort on the part of the harvester operators to pick up plants which are cut. This effort should be as collaborative as practical.

3. **Consideration of diver assisted suction harvesting (DASH) for control of Eurasian water milfoil if it begins displacing the native community.** If the Eurasian water milfoil population grows and becomes more dominant in the Lake (based on another aquatic plant survey), measures other than hand pulling may be necessary. If this occurs, the use of the DASH system should be considered (medium priority).

4. **Chemical treatment of Eurasian water milfoil in areas where hand-pulling is not practical, if Eurasian water milfoil begins to take over the Lake** (medium priority). Only herbicides that somewhat selectively control Eurasian water milfoil, such as 2,4-D and endothal,[2] should be used and extra precaution should be taken to prevent the loss of native aquatic species. It is recommended to limit chemical treatments to early spring. A WDNR permit, as well as WDNR staff supervision, is required to implement this recommendation. Map 18 was developed using the Eurasian water milfoil distribution which occurred in Pleasant Lake during the 2013 aquatic plant survey; however, changes in communities are possible from year to year. Consequently, the abundance of Eurasian water milfoil in the Lake, along with its coincidence with native plant species, will need to be re-evaluated on an annual basis if this recommendation is implemented.

As mentioned previously, Map 18 is provided to help future aquatic plant managers implement the aquatic plant management plan recommendations. However, aquatic plant management must be conducted based on what is occurring at the time of treatment. Consequently, a **reevaluation of this aquatic plant management plan in three to five years** (at the end of the five-year permitting cycle) is recommended. This effort should include a comprehensive aquatic plant survey. This will help Lake managers evaluate the effectiveness of the aquatic plant management plan and make appropriate changes to the plan. This reevaluation should be considered a medium priority, however, this should change to a higher priority if the plant community changes drastically (e.g., if Eurasian water milfoil begins to take over).

Other Recommendations

As discussed in Chapter II, there is a distinct risk that a new invasive species (e.g., curly leafed pondweed or starry stonewort) could enter the Lake (see Figure 23). To prevent this from occurring, it is recommended (high priority) that Lake residents be educated on how to prevent these species from entering the waters (see Appendix I). Additionally, it is also recommended that consideration be given to enrolling in the WDNR Clean Boats Clean Waters program (i.e., the State program targeting invasive species prevention),[3] to proactively encourage Lake users to inspect and clean their boats and equipment prior to putting them in the Lake and again when leaving the Lake. This will help ensure that invasive species have a lower probability of entering Pleasant Lake (as well as other waterbodies) and causing new issues.

If a new infestation were to occur, efforts to quickly eradicate the species (if possible)[4] should be employed immediately to ensure that the new invasive species does not become established. If a new species is detected, the WDNR has funding that can aid in early eradication, particularly as it pertains to aquatic plants. Therefore, **citizen monitoring for new invasive species is recommended** as a high priority. The Wisconsin Citizen Lake Monitoring Network (CLMN) provides training to help local citizens engage in these efforts.

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[2]*Wisconsin Department of Natural Resources PUBL-WR-236 90,* Chemical Fact Sheet: 2,4-D, *May 1990; Wisconsin Department of Natural Resources PUBL-WR-237 90,* Chemical Fact Sheet: Endothal, *May 1990.*

[3]*Further information about Clean Boats Clean Waters can be found on the WDNR website at: http://dnr.wi.gov/lakes/cbcw/.*

[4]*Starry stonewort is a new infestation to the State of Wisconsin and has yet to be eradicated from any lake in Wisconsin. Therefore, prevention is currently the only way to ensure a lake remains free of starry stonewort.*

Figure 23

AQUATIC INVASIVE SPECIES WATCHLIST

Source: Paul Skawinski, Skawinski, P. M. (2014). *Aquatic Plants of the Upper Midwest: A Photographic Field Guide to Our Underwater Forests*. Wausau, Wisconsin, USA: Self-Published; *Wisconsin Department of Natural Resources; Vic Ramey, University of Florida; and SEWRPC.*

Additionally, as described in Chapter II, a number of conditions can cause excessive plant growth, leading to the onset of aquatic plants at nuisance levels. Accordingly, efforts to mitigate these nuisance conditions—which often go along with improving the overall quality of the Lake and its watershed—can also reduce the amount of plant growth in general. Consequently, **implementation of the recommendations highlighted in the "Issue 3: Water Quality" section of this chapter is also important** for aquatic plant management.

ISSUE 2: BLUE-GREEN AND FLOATING ALGAE

As was mentioned in Chapter II, though algae was an issue of concern, there is not currently any evidence supporting the need for any in-Lake management efforts for algal growth. Consequently, the recommendations provided in this section focus on monitoring algal growth, preparing Lake residents on how to respond if algae growth becomes excessive, and on preventing excessive algal growth. The three recommendations are as follows:

1. **Monitoring algae in the Lake** should be considered. This effort should focus on monitoring chlorophyll-*a* (medium priority), as described in the water quality monitoring recommendation below. Additionally, if large amounts of suspended algae begin to grow in the future, this monitoring could also include collecting and identifying any new algae to check whether it is a toxic strain (low priority).

2. **Warning residents to not enter the water in the event of an excessive algal bloom** should be considered a high priority if excessive algal blooms containing toxic strains occur. Therefore, a method for communicating that water conditions are not conducive to swimming should be developed.

3. **Maintaining and improving water quality** through implementing recommendations provided in the "Issue 3: Water Quality" section of this chapter.

Implementing the above recommendations will help ensure that algae growth in the Lake does not become unmanageable. However, **if further monitoring reveals excessive or highly increased levels of algal growth, reevaluation of these recommendations, including reconsideration of in-Lake management efforts, should be considered** a medium priority.

ISSUE 3: WATER QUALITY

As described in Chapter II, Pleasant Lake has good water quality. The data indicates that Pleasant Lake has low to moderate levels of nutrients (i.e., oligo-mesotrophic). As was mentioned in Chapter II, management efforts to maintain water quality in Pleasant Lake should focus primarily on six strategies, namely:

1. **Continuation of a comprehensive water quality monitoring effort** should be considered a high priority. This monitoring generally would occur at the deep hole site (i.e., the point above the deepest part of the Lake) and should include measurements of water clarity (i.e., Secchi depth), total phosphorus concentrations at the surface, chlorophyll-*a* concentrations at the surface, temperature profiles throughout the water column, and dissolved oxygen concentrations throughout the water column. The Wisconsin Citizen Lake Monitoring Network (CLMN) provides training and guidance on monitoring the health of lakes. Volunteers monitor water clarity and dissolved oxygen throughout the open water season (preferably every 10 to 14 days) and monitor water chemistry (i.e., phosphorus and chlorophyll-*a* concentrations) four times per year (two weeks after ice off and during the last two weeks of June, July, and August). In addition, chlorides should also be monitored on an annual basis to gauge if concentrations are increasing over time to levels that could cause damage to the Lake ecosystem. Phosphorus should also be sampled at the bottom of the Lake to determine if internal loading is occurring. Finally, it may be advantageous to complete an inventory of historical observations of Lake conditions which could add to the narrative of the Lake's past water quality.

2. **Development and protection of buffers and wetlands** should be considered a medium priority; however, if water quality becomes an issue based on future monitoring, this priority level may increase. These efforts should begin by targeting direct residential inflow sources (i.e., the Lake shoreline properties) as well as the adjacent properties. The implementation of this recommendation could involve:

    a. Continued application of limits on development in SEWRPC-delineated primary environmental corridors through County zoning. This will help protect existing natural buffer and wetland systems.

    b. Continued enforcement of shoreland setback requirements (i.e., 75 feet from the ordinary high water mark) along navigable waters in the watershed and continuation of active enforcement of construction site erosion control and stormwater management ordinances.

    c. Provision of informational materials to shoreland property owners on the benefits of buffers to encourage their installation around the Lake. These materials could include instructions on installation. Such programs would be most productive if accompanied by an incentive program.

    d. Consideration of a shoreline best management practice and shoreline buffer enhancement program. This program could encourage the development of rain gardens or buffers along the shoreline. WDNR recently introduced a "Healthy Lakes" grant program that could help fund some of these efforts.

e. Consideration of obtaining conservation easements and purchasing wetlands and uplands, followed by subsequent buffer maintenance and/or installation.

3. **Protecting buffer and wetland functionality**, through efforts to control invasive species which threaten their ecological value, should be considered a medium priority. The major recommendation in this regard is to **monitor and control any purple loosestrife that may occur in wetlands**. This species, with a characteristic purple flower, as shown in Figure 24, spreads quickly and replaces the plants in the wetland that are useful for pollution reduction purposes and for habitat. Consequently, it is recommended that a visual survey of appropriate locations in the watershed be made to determine whether purple loosestrife is a problem. If it is found to be an issue, removal[5] should be a priority.

4. **Stringent enforcement of construction site erosion control and stormwater management ordinances** should be considered a medium priority. However, this priority level should increase at the onset of the major residential construction. Enforcement of these ordinances should be completed by the responsible regulatory entities in a manner consistent with current practices,[6] however, local citizens can help by reporting potential violations to the appropriate authorities.

5. **Encouragement of pollution reduction efforts along the shorelines (Best Management Practices)** is currently recommended, but is considered a low priority. However, if water quality issues are found under future monitoring efforts, the priority level should increase. Pollution reduction measures include eliminating use of fertilizer where practical, ensuring cars are not leaking fluids on driveways, maintaining rain gardens to which roof runoff can drain, preventing soil erosion, properly disposing of leaf litter and grass clippings, and properly storing salts and other chemicals so they do not drain to the Lake. Communicating these best management practices, and engaging in a campaign to encourage their use (e.g., offering to pick up grass clipping or leaves from aging homeowners) will likely help reduce water quality problems.

6. **Maintenance of septic systems** is considered a high priority. Such maintenance is regulated by Walworth County.[7] Outreach to educate septic system owners on the maintenance of their systems could have a positive impact on the Lake with minimal effort. This effort, for example, could include a program where septic users sign up to be automatically reminded of when they should maintain their septic tanks. Washington County provides information on the operation and maintenance of "Private Onsite Wastewater Treatment Systems" on its website and an educational poster.[8] This

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[5]*Removal of purple loosestrife can be accomplished through manual removal, chemical treatment, or biological controls (through the release of a specialized herbivorous insect). If purple loosestrife is found in small populations, manual removal should be implemented (with extra precautions taken to ensure no seed dispersal during removal), whereas chemical or biological controls should be employed if dense populations are found. This campaign could be completed using volunteers or through partnering with other organizations.*

[6]*Enforcement of the construction site erosion control and stormwater management ordinances is addressed in the* Walworth County Land Disturbance, Construction Site Erosion and Sediment Control, Conservation Standards for Vegetation Removal, Pond Construction and Retaining Wall Construction. *Consequently, the implementation of this recommendation in a manner consistent with that plan should be a priority for the County.*

[7]*Chapter SPS 383, "Private Onsite Wastewater Treatment Systems," of the* Wisconsin Administrative Code *sets forth regulations related to administration and enforcement, design and installation, management, and monitoring of septic systems.*

[8]*http://www.co.washington.wi.us/uploads/docs/powtsposter.pdf.*

Figure 24

EXAMPLE OF PURPLE LOOSESTRIFE ON A LAKE SHORE

Source: The Nature Conservancy.

guidance states that septic systems should be pumped at recommended intervals of two years for mound systems and three years for all other systems. This maintenance is of most importance to locations adjacent to the Lake (as shown on Map 19); therefore efforts should target these areas first. If phosphorus concentrations increase (upon data reevaluation) it may be necessary to consider the installation of sanitary sewer service.

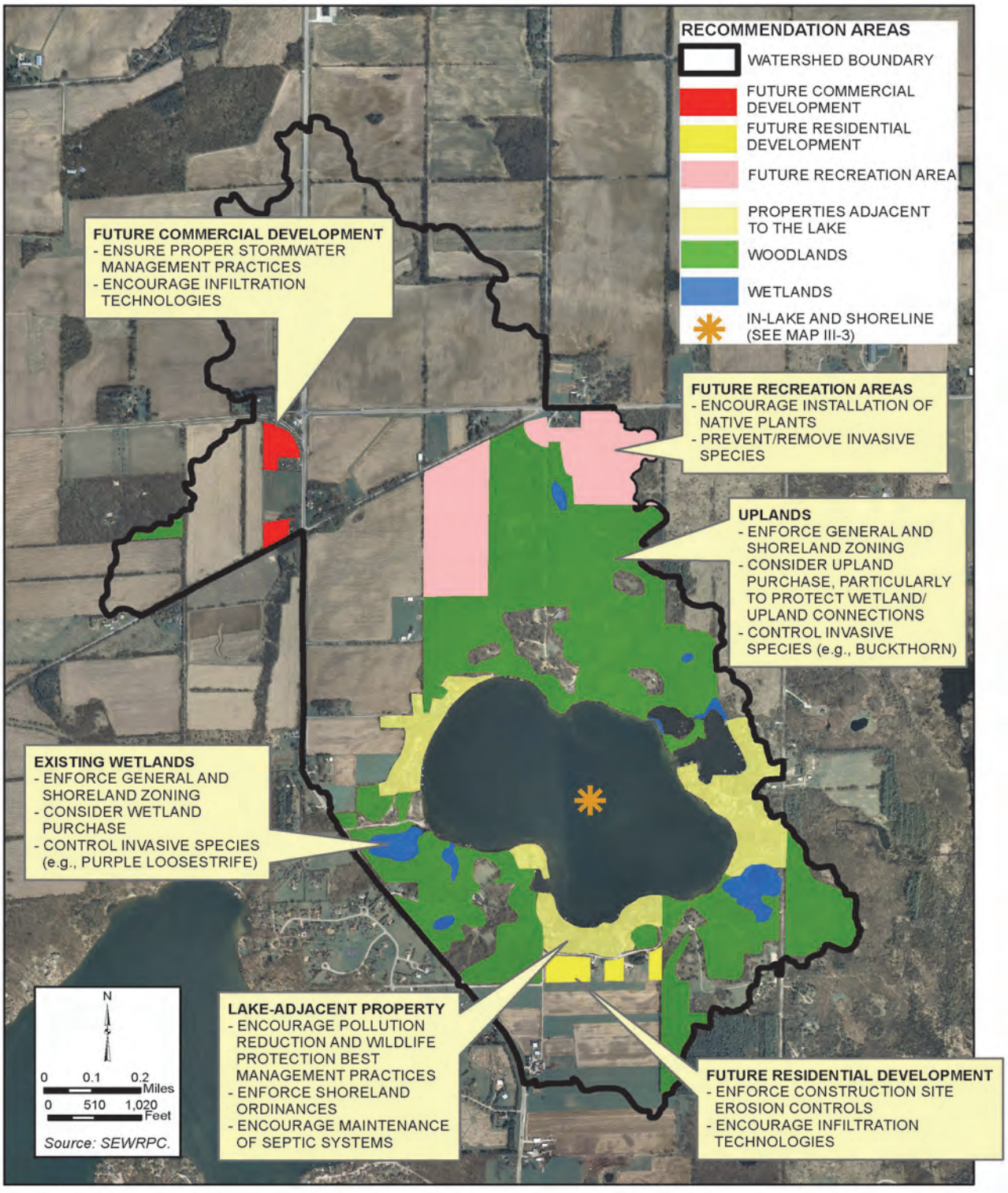
Implementation of these recommendations will significantly contribute to keeping track of and maintaining the water quality within Pleasant Lake.

ISSUE 4: WATER QUANTITY

As discussed in the Chapter II, the outlet structure's maintenance of water levels has an effect on the shoreland properties and potentially on the health of the Bay. The water levels also may be affected by variations in the groundwater supply. Consequently, the following recommendations are made to address the effects of the new outlet structure to the Bay and water quantity measurements,

Map 19

SELECTED RECOMMENDATIONS FOR THE PLEASANT LAKE WATERSHED



1. **Water level monitoring** should be considered a high priority**.** This can be achieved through the staff gauges RA Smith National installed in the fall of 2015. Readings should be recorded weekly to monitor water levels so that any issues can be detected early and a long-term Lake level record is obtained.

2. **Dredging of the Bay** should be considered a high priority if the water levels decrease enough to make the Bay unnavigable. The WDNR sensitive area report lists dredging as a viable option to be considered if the water depth in the Bay is less than 24 inches. This will enable access in and out of the Bay. Dredging requires a permit from the WDNR. There is a permitting process, outlined on the WDNR website,[9] that explains the exemptions and different types of permits available.

    a. **Determining the water depth in the Bay** is necessary to determine if there is a need for dredging a navigation channel. As residents on Pleasant Lake have had opposing stances on this issue it may be best to have multiple people go out and take measurements together, or have a neutral entity[10] take the water depth measurements. Water depth measurements should be obtained at several locations along the alignment of the access channel from the Lake to the Bay.

3. **Harvesting access lanes in the Bay** is considered a high priority if the decrease in water levels causes the bulrushes and cattails to grow further out into the Bay and access lanes need to be cut for boat use in the Bay. This will have to be permitted by WDNR.

4. **Implementation of measures to promote infiltration in near shore residential areas** is a medium priority. Implementation of this recommendation could involve:

    a. Improving infiltration of rainfall and snowmelt through installation of innovative BMPs that are associated with low-impact development, including rain garden projects[11] (see Figure 25). (Some of these projects can be partially funded through the WDNR "Healthy Lakes" initiative.); and

Figure 25

EXAMPLE OF A RAIN GARDEN

NOTE: Further details are provided on Natural Resource Conservation Service and Wisconsin Department of Natural Resources websites at: http://www.nrcs.usda.gov/Internet/FSE_PLANTMATERIALS/publications/ndpmctn7278.pdf; and http://dnr.wi.gov/topic/Stormwater/raingarden/

Source: U.S. Department of Agriculture, Natural Resource Conservation Service.

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[9]*More information available at http://dnr.wi.gov/topic/waterways/construction/dredging.html*

[10]*If the Lake District decides on bringing in a neutral party for determining if water depth in the Bay is low enough for a dredging permit, the SEWRPC staff could take these measurements.*

[11]*Rain gardens are depressed gardens which maintain native plants and help water infiltrate into the ground rather than entering the Lake through surface runoff. The installation of rain gardens can help reduce the amount of erosion and unfiltered pollution which enters the Lake and can stabilize baseflow to the Lake.*

b. Retrofitting current urban development (e.g., disconnection of downspouts, installation of permeable pavement) which could be encouraged through an educational outreach program and through providing resources to lakeshore property.

5. **Reducing the impacts of future urban development** is a medium priority. This recommendation can be implemented by:

   a. Enforcing the infiltration recommendations in the current Walworth County – Land Disturbance, Construction Site Erosion and Sediment Control, Conservation Standards for Vegetation Removal, Pond Construction and Retaining Wall Construction which sets criteria for infiltration requirements;[12]

   b. Purchasing land or obtaining conservation easements on agricultural and other open lands with high groundwater recharge potential; and

   c. Promoting the consideration of groundwater conditions when designing new developments. This could include encouraging developers to incorporate infiltration considerations in site designs and local government consideration of groundwater recharge during review of development proposals.

6. **Continuing to protect wetlands and uplands through enforcement of the County Zoning ordinance** as discussed in the "Issue 3: Water Quality" section of this chapter.

As with the other recommendations made in this chapter, any drastic future changes in Lake levels will spur the need for a reevaluation of the recommendations above. Consequently, **a periodic reevaluation is recommended** as a high priority if water levels issues arise.

ISSUE 5: WILDLIFE

As discussed in Chapter II, wildlife is a key indicator of Lake health. Additionally, the presence of wildlife increases recreational use and enjoyment of the Lake and the functionality of the Lake as an ecosystem. To enhance wildlife within the Pleasant Lake watershed, the following recommendations are made:

1. **Continuing current fish stocking practices** should be considered a medium priority. These activities will help ensure that the fishery is maintained while efforts to increase fish spawning are engaged. This should specifically focus on walleye as natural reproduction is possible.

2. **Current fishing practices and ordinances** should be continued because the current fishery appears to be healthy. This requires no direct change, and would, therefore, be a low priority, unless current recreational uses drastically change.

3. **Improving aquatic habitat in the Lake by allowing or installing woody debris and/or vegetative buffers along the Lake's edge** should be considered a medium priority (see Map 20**).**

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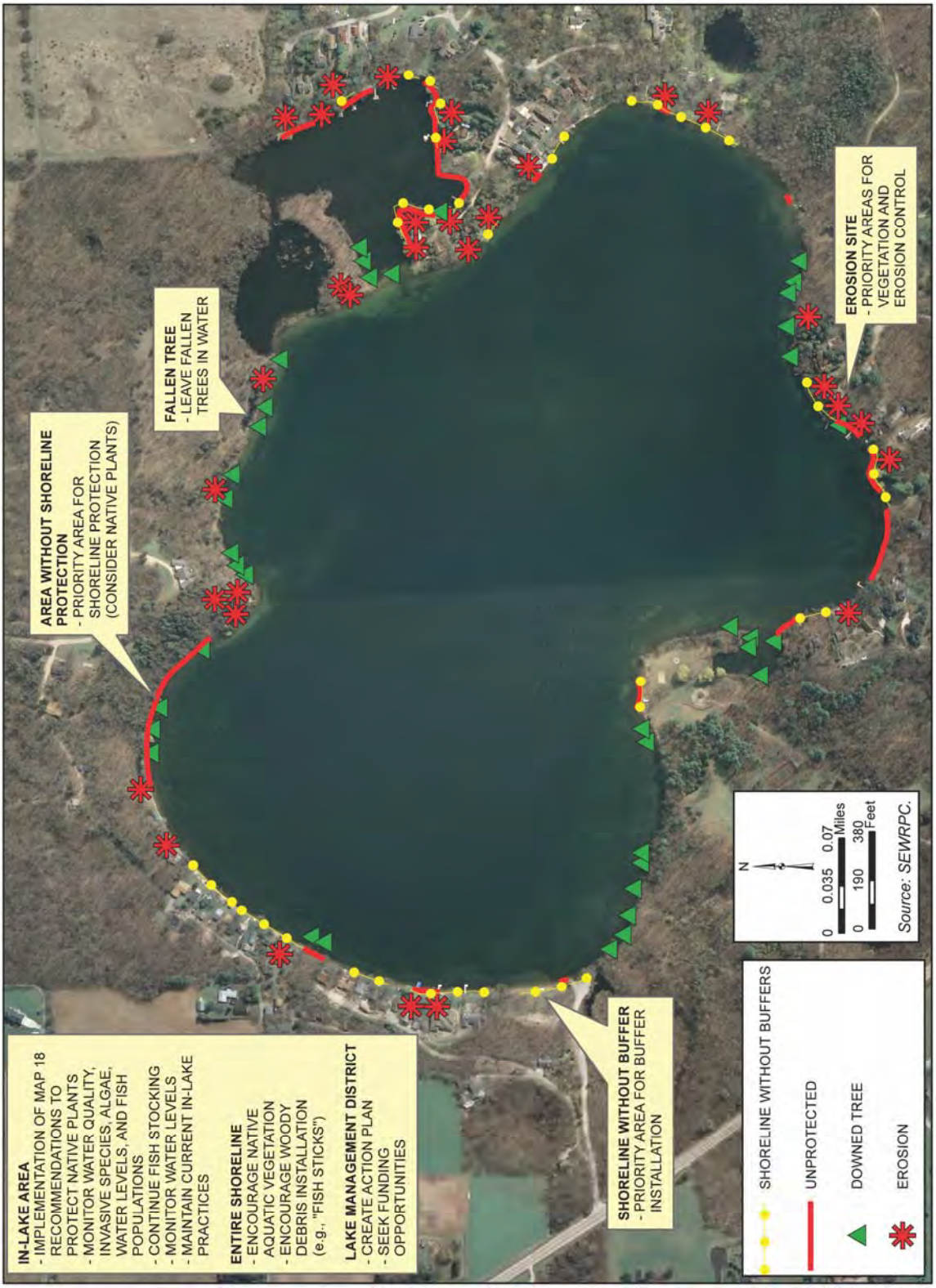
[12]*MuniCode*, Walworth County - Land Disturbance, Construction Site Erosion and Sediment Control, Conservation Standards for Vegetation Removal, Pond Construction and Retaining Wall Construction, *Chapter 26, Article II. This recommendation can be found at: https://www.municode.com/library/wi/walworth_county/codes/code_of_ordinances?nodeId=WACOCOOR_CH26EN_ARTIILADICOSIERSECOCOSTVEREPOCOREWACO_DIV2COTESTSPCOSIERSECOGUPRPESTSIDRSTCOTE*

Map 20

IN-LAKE, SHORELINE, AND INSTITUTIONAL RECOMMENDATIONS



Implementation of this recommendation could take the form of educational or incentive-based programs to encourage riparian landowners to install "fish sticks"[13] (see Figure 26) or to leave fallen trees in the water, and to develop buffer systems along the shoreline. WDNR grant money is available through the "Healthy Lakes" program on a competitive basis for the implementation of "fish sticks" projects.

4. **Encouraging the adoption of best management practices to improve wildlife populations** should be considered as a medium priority (although this should increase to a higher priority if wildlife populations decline). This could be achieved through voluntary, educational, or incentive-based programs for properties adjacent to the shoreline, and by directly implementing these practices on public and protected lands. If this recommendation is implemented, a complete list of best management practices should be compiled and provided to landowners.

5. **Ensuring proper implementation of the aquatic plant management plan** described earlier in this chapter (see "Issue 1: Aquatic Plant Management" section), specifically as it relates to avoiding inadvertent damage to native species should be considered.

6. **Preserving and expanding wetland and terrestrial wildlife habitat, while making efforts to ensure connectivity between these natural areas,** should be considered. This could be achieved through implementation of the buffer and wetland protection recommendations provided in the "Issue 3: Water Quality" section of this chapter.

Figure 26

EXAMPLES OF COMPLETED "FISH STICKS" PROJECTS

Source: Wisconsin Department of Natural Resources.

7. **Continue managing goose populations by oiling eggs** should be considered a medium priority. This will help maintain the goose population at a non-nuisance population level. Permit required in order to oil goose eggs. Also, the establishment of shoreline vegetation as recommended elsewhere under this plan should be effective in managing goose populations.

[13]*Natural shorelines generally have hundreds of fallen trees per mile along the shoreline. "Fish sticks" is a term coined for engineered installation of woody debris (logs) along lake shorelines to mimic these natural conditions. Generally these projects involve anchoring logs into the shore so that the log is oriented perpendicular to the shoreline.*

In general, keeping track of fish and wildlife populations will help Lake managers detect any potential issues. Consequently, **continued monitoring of fish populations, and periodic recording of the types of animals found on the Lake and within its watershed, is also recommended** as a medium priority.

ISSUE 6: IMPLEMENTATION

As discussed in Chapter II, the methods to implement the recommendations set forth above depend on the type of recommendation. For example, several important recommendations relate to enforcement of current ordinances (e.g., shoreline setbacks, zoning, construction site erosion control, and boating) by the municipality, the counties, or law enforcement, which often have limited resources available to effect enforcement.

Consequently, the following recommendations (medium priority), aimed at local citizens and management groups are made to enhance the ability of the responsible entities to monitor and enforce these regulations:

1. **Maintaining relationships with the County and municipal zoning administrators as well as law enforcement officers**. This will help build relationships with the responsible entities so that communication can be facilitated when needed.

2. **Keeping track of the activities within the watershed**, such as construction or erosion, that appear to be affecting the Lake and then subsequently notifying the relevant regulatory entity about these activities; and

3. **Proactively educating community members within the watershed about the relevant ordinances**. This will help ensure that residents know that permits are required for almost all construction within the watershed and that such permits offer opportunities to regulate activities that could harm the Lake.

In addition to regulatory enforcement, there are also a number of voluntary and/or incentive-based recommendations. These require proactive efforts to protect and manage the Lake. As was discussed in Chapter II, a number of factors restrict the ability of local citizens and management groups to effectively take on Lake management projects. Consequently, the following recommendations aimed at reducing these restrictions are made:

1. **Apply for WDNR grants when available** to support the implementation of the programs within this plan (high priority). Table 19 provides a list of potential grants that can be used to implement the plan recommendations. Individual lakeshore property owners on Pleasant Lake are also eligible for funding through the WDNR Health Lakes Grant program (see Table 19 & Appendix E for more details), but the PLPRD must apply on the property owners behalf. The PLPRD is a qualified sponsor and the state of Wisconsin's Healthy Lakes Implementation Plan has been fully integrated into the comprehensive planning goals and recommendations of this plan. In addition, also note that the PLPRD is eligible for Board of Commissioners of Public Lands loan program to implement projects for this Lake (see Appendix J).

2. **Encourage engagement of Lake users and residents in future management efforts** (medium priority) to add to the donor and volunteer base who are working towards improving the Lake. This should include cooperation with the Pleasant Lake Property Owners Association and volunteer groups (e.g., Boy Scout troops, church groups). Not only will their engagement on future efforts benefit the Lake but they will also benefit the economic value of their properties.

3. **Encourage key players to attend meetings, conferences and/or training programs to build their "lake management knowledge"** which will enhance "institutional capacity" (medium priority) Some examples of events are the Wisconsin Lakes Conference (which targets local lake managers

Table 19

WISCONSIN DEPARTMENT OF NATURAL RESOURCES GRANTS AVAILABLE TO HELP WITH PLAN IMPLEMENTATION

Deadline	WDNR Grant[a]	Potentially Eligible Recommendations (Corresponding recommendation numbers in Table III-2)
December 10	Lake Management Planning (Small Scale and Large Scale)	All Planning-Based Projects 4, 11 (partial), 13, and 22
	Aquatic Invasive Species (AIS) - Education, Prevention, & Planning - Clean Boats Clean Waters	Invasive species prevention programs 5 and 31 (partial)
Year Round	AIS Early Detection & Response	Response to new infestation (none at the moment)
	AIS Maintenance & Containment	Aquatic plant maintenance costs such as the cost of permits, monitoring and record keeping 4, and 7 (partial)
February 1	Lake Protection - Land/Easement Acquisition - Wetland & Shoreline Habitat Restoration	Projects such as land purchases and wetland restoration to improve water quality and wildlife 16 and 17
	Lake Protection - Lake Management Plan Implementation	Many of the recommendations within the plan with the exception of those pertaining to aquatic plant management (discussion with WDNR for more information)
	Lake Protection - Healthy Lakes Initiative	Infiltration projects, natural vegetation on shorelines, fish sticks, and erosion control 23 and 26
	AIS Established Population Control	Generally used for WDNR Invasive species programs (e.g., purple loosestrife) or for new techniques (e.g., a new comprehensive technique to eradicate) 17

[a]Further information on all of these grants is available at *http://dnr.wi.gov/aid/surfacewater.html*

Source: Wisconsin Department of Natural Resources and SEWRPC

specifically) and the "Lake Leaders" training program (which teaches the basics of lake management and provides ongoing resources to lake managers), both of which are hosted by the University of Wisconsin Extension. Additionally, courses, regional summits, and general meetings can also be used for this purpose. Any attendance at these events should include follow up documents/meetings so that the "lessons learned" can be communicated to the larger Lake group.

4. **Continuing to ensure inclusivity and transparency with respect to all Lake management activities** (high priority). These efforts should be done through public meetings and consensus building. This way conflicts can be mitigated prior to the actual implementation of any particular program.

5. **Monitor all management efforts to form "lessons learned" and communicate these to future Lake managers** (medium priority). This will help further increase the "institutional capacity" of lake management entities. This could take the form of annual meetings and/or reports to compile and report successes. These records should then be kept for future generations.

Additionally, as discussed in Chapter II, a major recommendation that should be considered a high priority is the **creation of an action plan which highlights action items, timelines, goals, and responsible parties**. This document will help ensure that the plan recommendations are implemented in a timely, comprehensive, transparent, and effective manner. Additionally, an action plan can help ensure that all responsible parties are held accountable for their portion of the plan's implementation.

As a final note, a major recommendation to promote implementation of this plan is the **education of the Lake residents, users, and governing bodies** on the content of this plan. A campaign to communicate the relevant information in the plan should therefore be given a high priority.

SUMMARY AND CONCLUSIONS

To aid in the implementation of the plan recommendations, Table 20 provides a brief summary of the all the recommendations, as well as their priority level. Additionally, Map 19 and Map 20, in combination with the aquatic plant management recommendation map (see Map 18), indicate where the recommendations should be implemented. These maps will provide current and future Pleasant Lake managers with a visual representation of where to target management efforts.

As stated in the introduction, this chapter is intended to stimulate ideas and action. The recommendations should, therefore, provide a starting point for addressing the issues that have been identified in Pleasant Lake and its watershed. Successful implementation of the plan will require vigilance, cooperation, and enthusiasm, not only from local management groups, but also from State and regional agencies, Walworth County, municipalities, and Lake residents. The recommended measures will provide the water quality and habitat protection necessary to maintain and establish conditions in the watershed that are suitable for the maintenance and improvement of the natural beauty and ambience of Pleasant Lake and its ecosystems, and the enjoyment of its human population today and in the future.

Table 20

SUMMARY OF RECOMMENDATIONS

Number[a]	Recommendations	Suggested Priority Level
ISSUE 1: AQUATIC PLANT MANAGEMENT		
1	Manual removal of Eurasian water milfoil wherever feasible, as well as educating the public on these efforts	HIGH
2	WDNR hosted training of all harvester operators	HIGH
3	Implementation of a comprehensive and consistent plant pickup program	HIGH
4	Reevaluation in three to five years with a new aquatic plant survey	HIGH
5	Implementation of an invasive species prevention and monitoring program	HIGH
6	Use of small scale or spot chemical treatment for Eurasian water milfoil where hand-pulling is not practical	MEDIUM
7	Harvesting for access lanes in the Bay (NOTE: Harvesting activities must leave one foot of plant material and must not occur during fish spawning periods. Additionally, animals caught in the harvester should be returned to the Lake). Annual reporting will be required.	MEDIUM if the Bay becomes unnavigable due to dense aquatic plant growth
8	DASH *does not currently appear warranted;* however, this technique should be considered as a first resort for the control of Eurasian water milfoil if the plant community begins to take over native populations	MEDIUM if Eurasian water milfoil begins to take over
	Implementation of "ISSUE 3: WATER QUALITY" recommendations to reduce the conditions which encourage aquatic plant growth.	- -
ISSUE 2: BLUE-GREEN AND FLOATING ALGAE		
9	Communicating that lake users should not enter the Lake if algae looks "unhealthy"	HIGH if large blooms occur
10	Monitoring for chlorophyll-*a*	MEDIUM
11	In-lake management efforts *are not currently recommended*; however this should be reevaluated if algal blooms become excessive in the Lake	MEDIUM if large algal blooms occur
12	Monitoring for toxic blue green algae if a large algal bloom is found	LOW
	Implementation of "ISSUE 1: AQUATIC PLANT MANAGEMENT" recommendations to ensure that a healthy native plant community exists in the Lake to compete with algae growth	- -
	Implementation of "ISSUE 3: WATER QUALITY" recommendations to reduce the conditions which encourage algal growth	- -

Table 20 (continued)

Number[a]	Recommendations	Suggested Priority Level
	ISSUE 3: WATER QUALITY	
13	Continuation of a comprehensive water quality monitoring effort	HIGH
14	Maintenance of septic systems within the watershed, especially on lots adjacent to the Lake	HIGH
15	Continued enforcement of construction site erosion control and stormwater management ordinances	MEDIUM
16	Protection of current buffers and wetlands in the watershed through enforcement of zoning and shoreline setback requirements as well as through land purchases	MEDIUM
17	Protection of current buffer and wetland functionality through a campaign to control invasive plant species	MEDIUM
18	Targeted shoreline pollution reduction efforts through communication of Best Management Practices if pollutant concentrations (such as for phosphorus)	LOW
	ISSUE 4: WATER QUANTITY	
19	Monitor and record Lake water levels using the water level gauges	HIGH
20	Dredging of the Bay to maintain navigation lanes	HIGH only if water depth in the channel falls below 24 inches
21	Harvesting access lanes in the Bay if after water depth loss in the Bay leads to further growth of bulrushes and cattails	HIGH
22	Reevaluation of the above recommendations if water levels drop or rise drastically.	HIGH with water level issues
23	Targeting shoreline properties for infiltration projects	MEDIUM
24	A campaign to reduce the impacts of future urban development (e.g., increase the use of infiltration technologies in new developments within the watershed)	MEDIUM
	Implementation of recommendation number 15 (i.e., enforcing zoning ordinances) in "ISSUE 3: WATER QUALITY" section to help ensure groundwater infiltration	- -
	ISSUE 5: WILDLIFE	
25	Continuation of fish stocking and oiling goose eggs	MEDIUM
26	Introduction of woody debris (e.g., fish sticks or fallen trees) onto the Lake's shoreline as well as encourage vegetative buffers on the shorelines	MEDIUM
27	Communication and encouragement regarding implementing wildlife best management practices along the shoreline and in the rest of the watershed	MEDIUM
28	Periodic monitoring of fish and wildlife populations	MEDIUM
29	Maintenance of current practices in terms of boating ordinances and fishing practices, with prioritization on removal of carp and release of pike while fishing.	LOW
	Implementation of "ISSUE 1: AQUATIC PLANT MANAGEMENT" recommendations to encourage habitat and food availability	- -
	Implementation of "ISSUE 3: WATER QUALITY" section recommendation numbers 15 and 16 (i.e., buffer and wetland protection) to encourage habitat expansion and fish spawning	- -
	ISSUE 6: IMPLEMENTATION	
30	Creation of an action plan which highlights action items, timelines, and responsible parties	HIGH
31	Develop a communication plan to educate residents and managers on the important information provided in this plan	HIGH
32	Apply for grants to help cover some of the costs associated with the implementation of this plan	HIGH
33	Continue to ensure inclusivity and transparency in all Lake management activities	HIGH
34	Actively seek to ensure that the management authorities on the Lake improve "institutional capacity" (i.e., knowledge of lake management and available resources)	MEDIUM
35	Encourage the participation of lake users as well as lake residents in management efforts so as to acquire a wider volunteer base	MEDIUM
36	Actively monitor management efforts and their effects to develop and communicate "lessons learned"	MEDIUM as more management occurs

[a]Numbers were assigned to any new recommendation, recommendations within each issue were organized by priority level. Numbers were not provided for recommendations which were reiterated due to their utility in solving multiple issues

Source: SEWRPC.

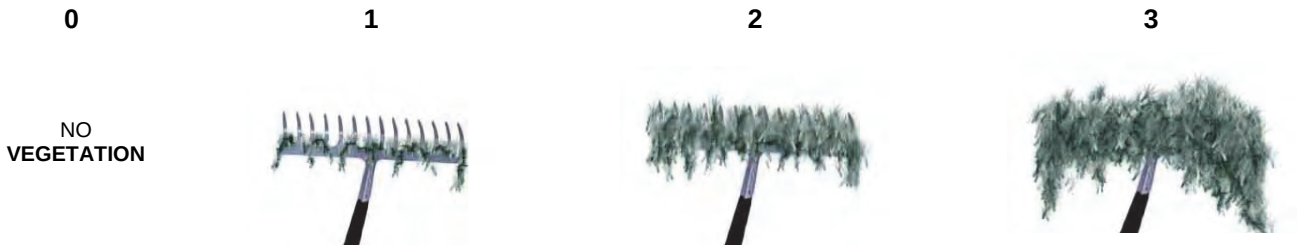
APPENDICES

Appendix A

PLEASANT LAKE
AQUATIC PLANT SPECIES DETAILS

Figure A-1

RAKE FULLNESS RATINGS



Source: Wisconsin Department of Natural Resources and SEWRPC.

SOURCES OF INFORMATION:

Borman, S., Korth, R., & Temte, J. (1997). *Through the Looking Glass: A Field Guide to Aquatic Plants.* Stevens Point, WI, USA: Wisconsin Lakes Partnership.

Robert W. Freckman Herbarium: *http://wisplants.uwsp.edu*

Skawinski, P. M. (2011). *Aquatic Plants of the Upper Midwest: A Photographic Field Guide to Our Underwater Forests*. Wausau, Wisconsin, USA: Self-Published.

University of Michigan Herbarium: *http://www.michiganflora.net/home.aspx*

Chara spp.

Native

Muskgrasses

Algae (not vascular plants)

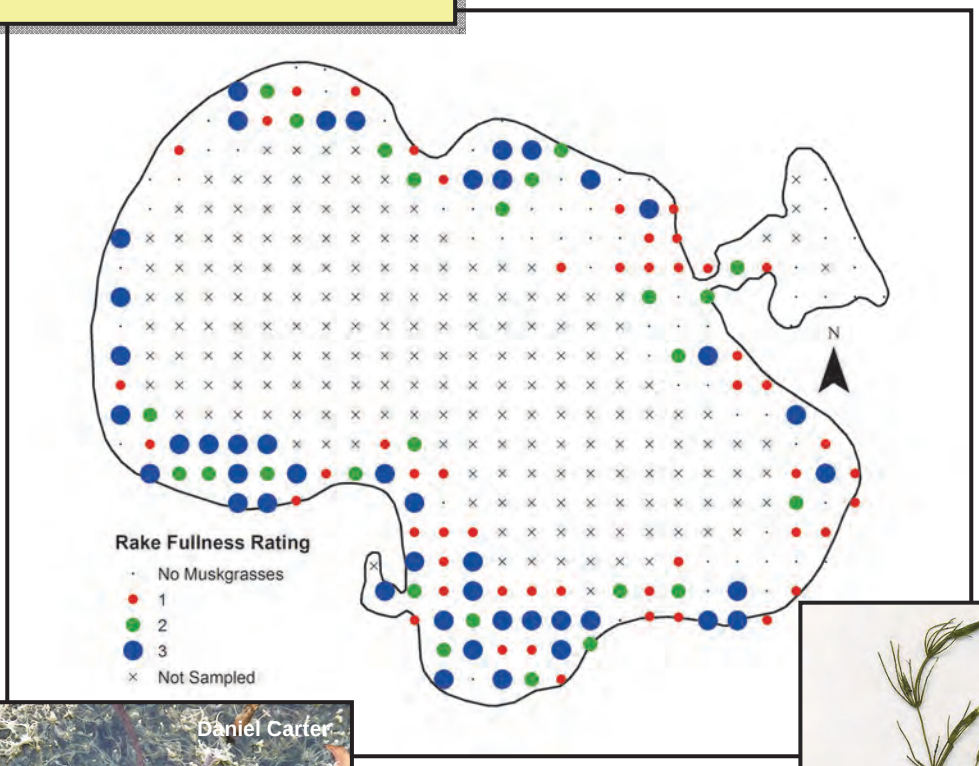
Identifying Features

- Leaf-like, ridged side branches develop in whorls of six or more
- Often encrusted with calcium carbonate, which appears white upon drying (see photo on left, below)
- Yellow reproductive structures develop along the whorled branches in summer
- Emits a garlic-like odor when crushed

Stoneworts (*Nitella* spp.) are similar large algae, but their branches are smooth rather than ridged and more delicate

Ecology

- Found in shallow or deep water over marl or silt, often growing in large colonies in hard water
- Overwinters as rhizoids (cells modified to act as roots) or fragments
- Stabilizes bottom sediments, often among the first species to colonize open areas
- Food for waterfowl and excellent habitat for small fish



Elodea canadensis — Common Waterweed

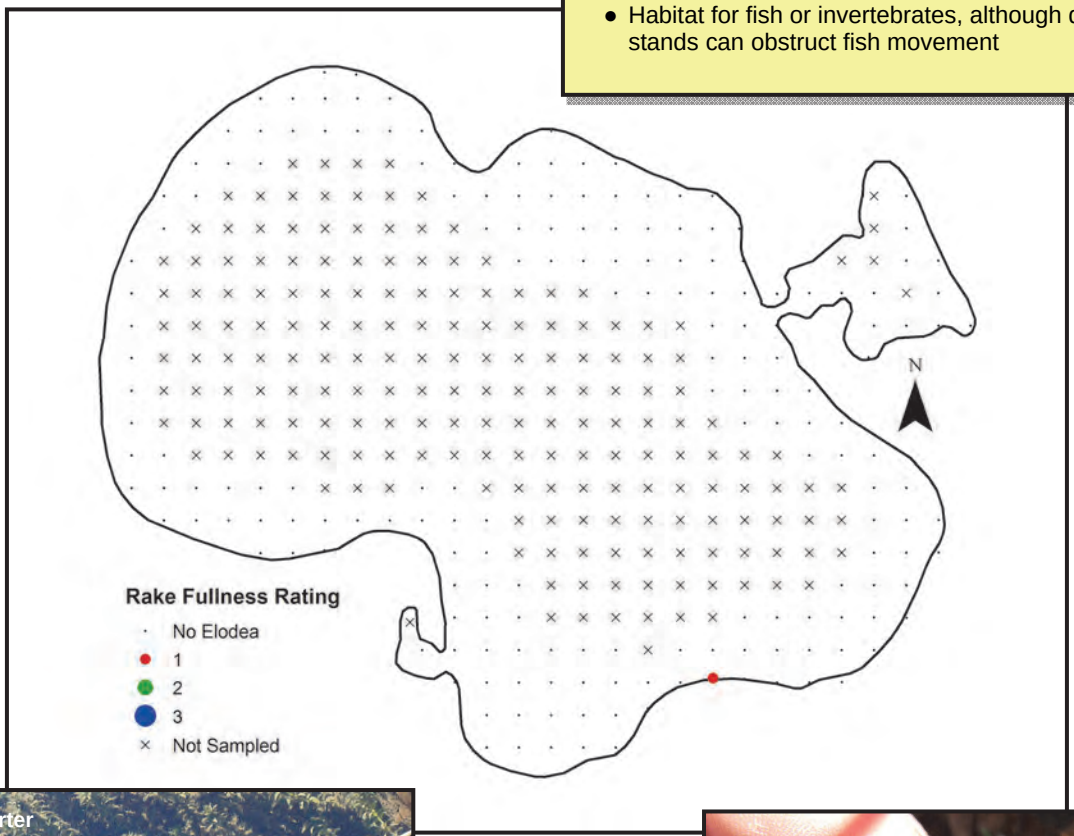
Native

Identifying Features

- Slender stems, occasionally rooting
- Leaves lance-shaped, in whorls of three (rarely two or four), 6.0 to 17 mm long and averaging 2.0 mm wide
- When present, tiny male and female flowers on separate plants (females more common), raised to the surface on thread-like stalks

Ecology

- Found in lakes and streams over soft substrates tolerating pollution, eutrophication and disturbed conditions
- Often overwinters under the ice
- Produces seeds only rarely, spreading primarily via stem fragments
- Provides food for muskrat and waterfowl
- Habitat for fish or invertebrates, although dense stands can obstruct fish movement




Daniel Carter


Daniel Carter

Myriophyllum sibiricum — Northern Water Milfoil

Native

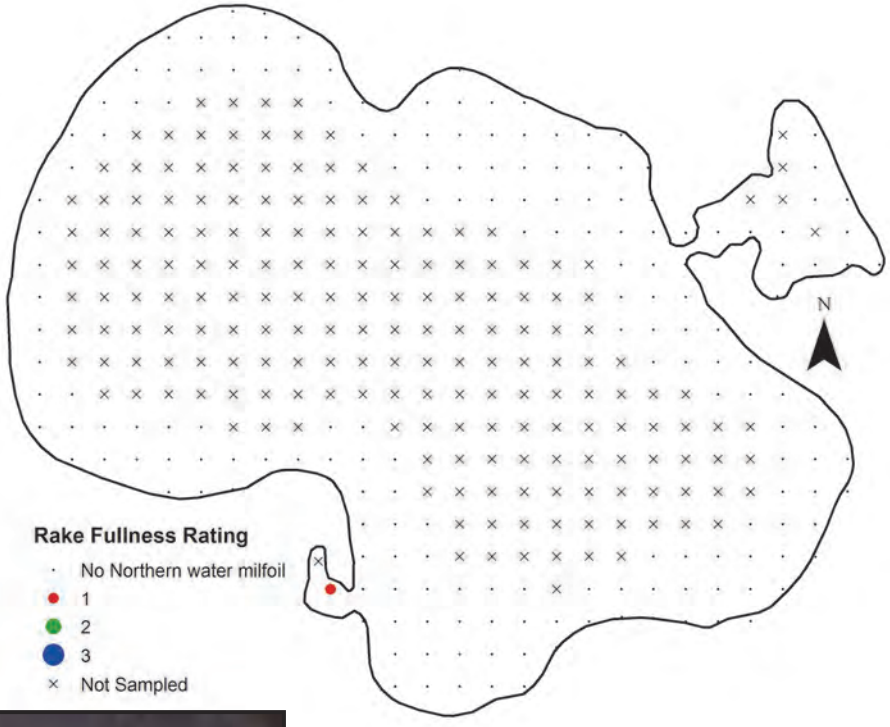
Identifying Features

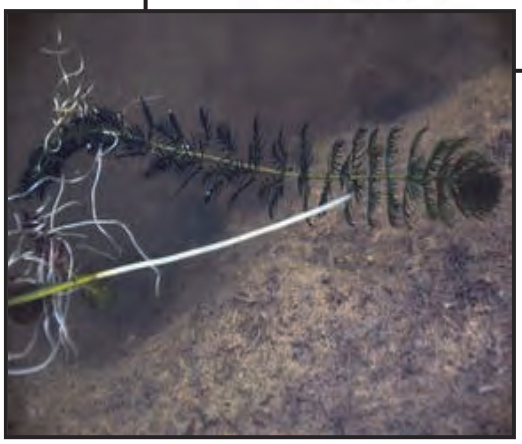
- Light-colored, stout stems
- Leaves in whorls of four to five, divided into four to 12 pairs of leaflets, lower leaflets longer than the upper ones
- Forms winter buds (turions) in autumn

Northern water milfoil is similar to other water milfoils. Eurasian water milfoil (*M. spicatum*) tends to produce more leaflets per leaf and have more delicate, pinkish stems

Ecology

- Found in lakes and streams, shallow and deep
- Overwinters as winter buds and/or hardy rootstalks
- Consumed by waterfowl
- Habitat for fish and aquatic invertebrates
- Hybridizes with Eurasian water milfoil, resulting in plants with intermediate characteristics





Myriophyllum spicatum — Eurasian Water Milfoil

Nonnative/Exotic

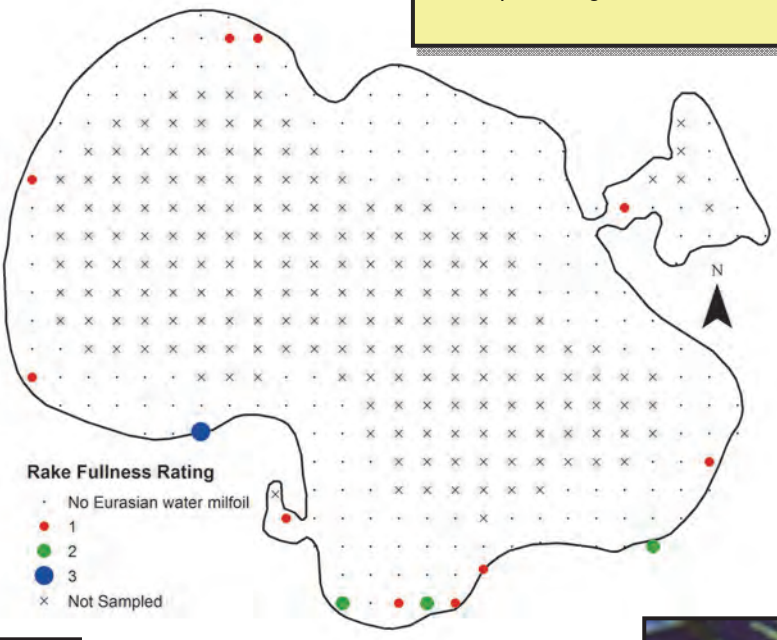
Identifying Features

- Stems spaghetti-like, often pinkish, growing long with many branches near the water surface
- Leaves with 12 to 21 pairs of leaflets
- Produces no winter buds (turions)

Eurasian water milfoil is similar to northern water milfoil (*M. sibiricum*). However, northern water milfoil has five to 12 pairs of leaflets per leaf and stouter white or pale brown stems

Ecology

- Hybridizes with northern (native) water milfoil, resulting in plants with intermediate characteristics
- Invasive, growing quickly, forming canopies, and getting a head-start in spring due to an ability to grow in cool water
- Grows from root stalks and stem fragments in both lakes and streams, shallow and deep; tolerates disturbed conditions
- Provides some forage to waterfowl, but supports fewer aquatic invertebrates than mixed stands of aquatic vegetation



Najas flexilis — Bushy Pondweed or Slender Naiad

Native

Identifying Features

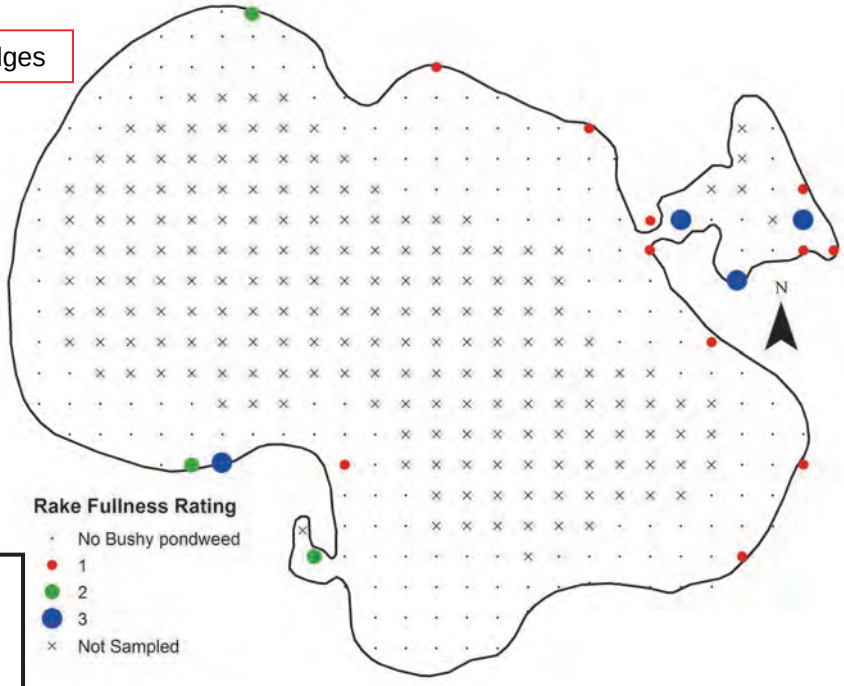
- Leaves narrow (0.4 to 1.0 mm) and pointed with broader bases where they attach to the stem and finely serrated margins
- Flowers, when present, tiny and located in leaf axils
- Variable size and spacing of leaves, as well as compactness of plant, depending on growing conditions

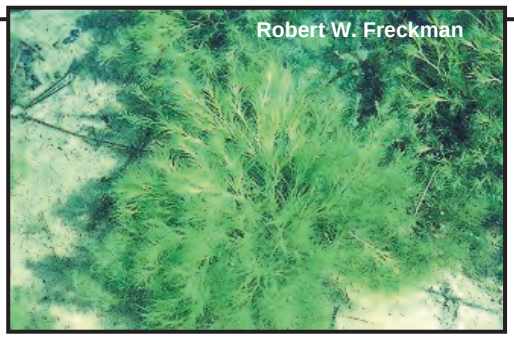
Two other *Najas* occur in southeastern Wisconsin. Southern naiad (*N. guadalupensis*) has wider leaves (to 2.0 mm). Spiny naiad (*N. marina*) has coarsely toothed leaves with spines along the midvein below

Ecology

- In lakes and streams, shallow and deep, often in association with wild celery
- *One of the most important forages of waterfowl*
- An annual plant that completely dies back in fall and regenerates from seeds each spring; also spread by stem fragments during the growing season

Leaves narrow with serrated edges





Najas marina — Spiny Naiad

Nonnative/Exotic

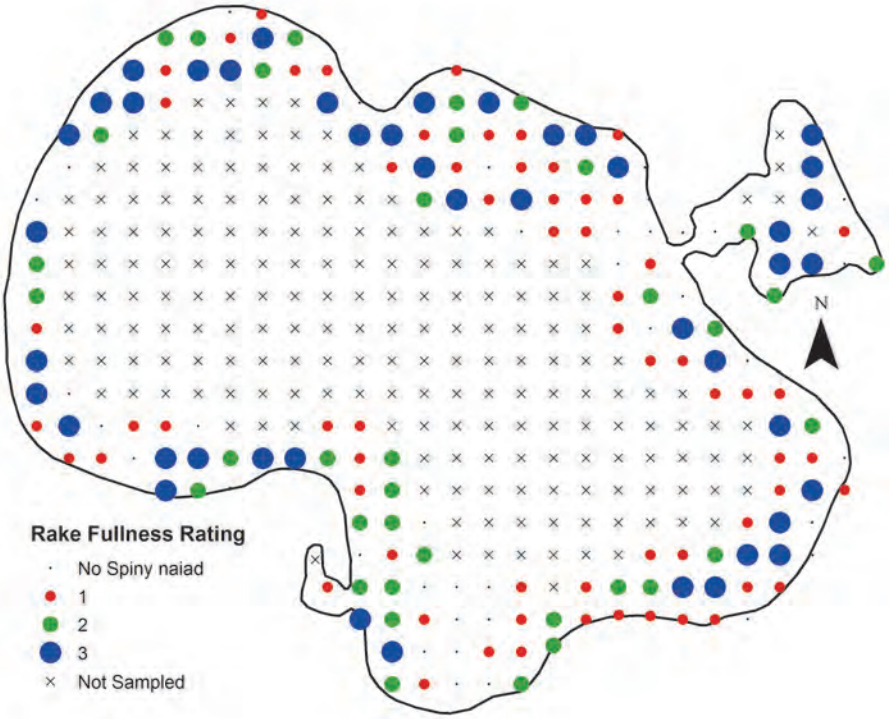
Identifying Features

- Stems stiff and spiny, often branching many times
- Leaves stiff, 1.0 to 4.0 mm thick, with coarse teeth along the margins and midvein on the underside

Spiny naiad is quite distinct from other naiads due to its larger, coarsely toothed leaves and the irregularly pitted surface of its fruits. Spiny naiad is presumably introduced in Wisconsin, but it is considered native in other states, including Minnesota

Ecology

- Alkaline lakes, water quality ranging from good to poor
- An annual, regenerating from seed each year
- Occurs as separate male and female plants
- Capable of growing aggressively




Kristian Peters

Nuphar variegata — Spatterdock

Native

Identifying Features

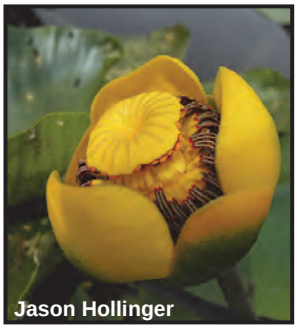
- Leaf stalks winged in cross-section
- Most leaves floating on the water surface, heart-shaped, and notched, with rounded lobes at the base
- Yellow flowers, 2.5 to 5.0 cm wide, often with maroon patches at the bases of the sepals (petal-like structures) when viewed from above

Unlike spatterdock, the similar yellow pond lily (*Nuphar advena*) has leaf stalks that are not winged in cross-section, leaves that more often emerge above the water surface, and leaf lobes that are more pointed. Spatterdock is superficially similar to water lilies (*Nymphea* spp.), but it has yellow versus white flowers and leaves are somewhat heart-shaped versus round. American lotus (*Nelumbo lutea*) is also similar, but its leaves are round and un-notched, and its flowers are much larger

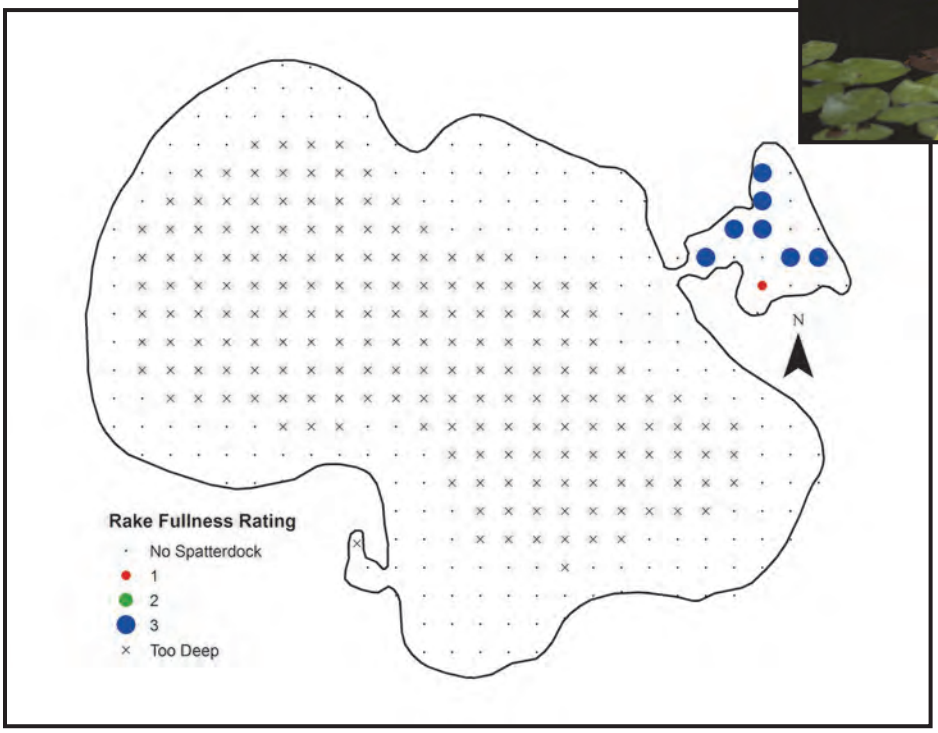
Ecology

- In sun or shade and mucky sediments in shallows and along the margins of ponds, lakes, and slow-moving streams
- Overwinters as a perennial rhizome
- Flowers opening during the day, closing at night, with the odor of fermented fruit
- Buffers shorelines
- Provides food for waterfowl (seeds), deer (leaves and flowers), and muskrat, beaver, and porcupine (rhizomes)
- Habitat for fish and aquatic invertebrates

Ron Edwards



Jason Hollinger



Nymphaea odorata — White Water Lily

Native

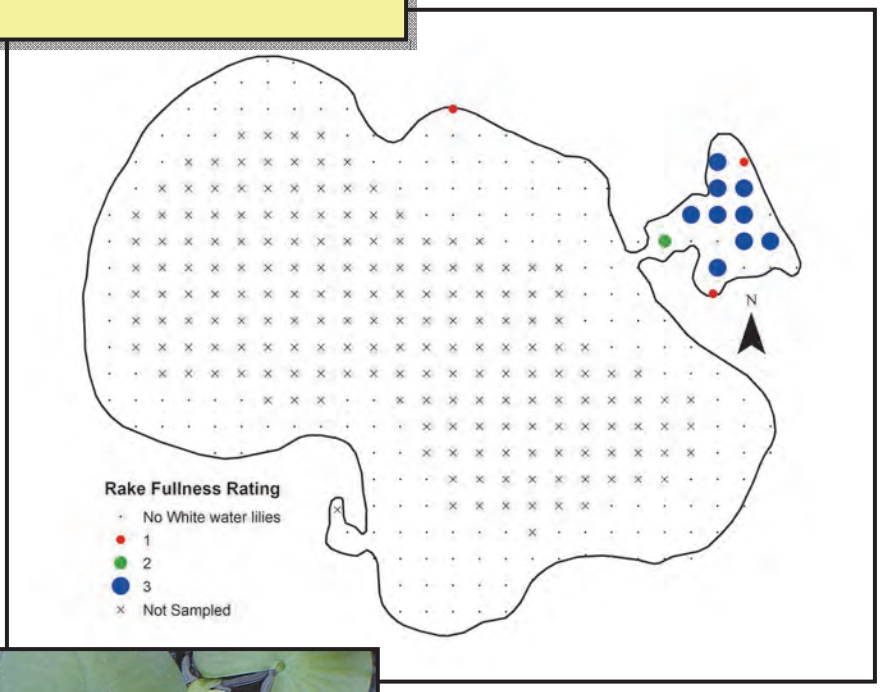
Identifying Features

- Leaf stalks round in cross-section with four large air passages
- Floating leaves round (four to 12 inches wide under favorable conditions), *with a notch* from the outside to the center, and reddish-purple underneath
- Flowers white with a yellow center, three to nine inches wide

Pond lilies (*Nuphar* spp.) are superficially similar, but have yellow flowers and leaves somewhat heart-shaped. American lotus (*Nelumbo lutea*) is also similar, but its leaves are *unnotched*

Ecology

- Found in shallow waters over soft sediments
- Leaves and flowers emerge from rhizomes
- Flowers opening during the day, closing at night
- Seeds consumed by waterfowl, rhizomes consumed by mammals



Potamogeton amplifolious — Large-Leaf Pondweed

Native

Identifying Features

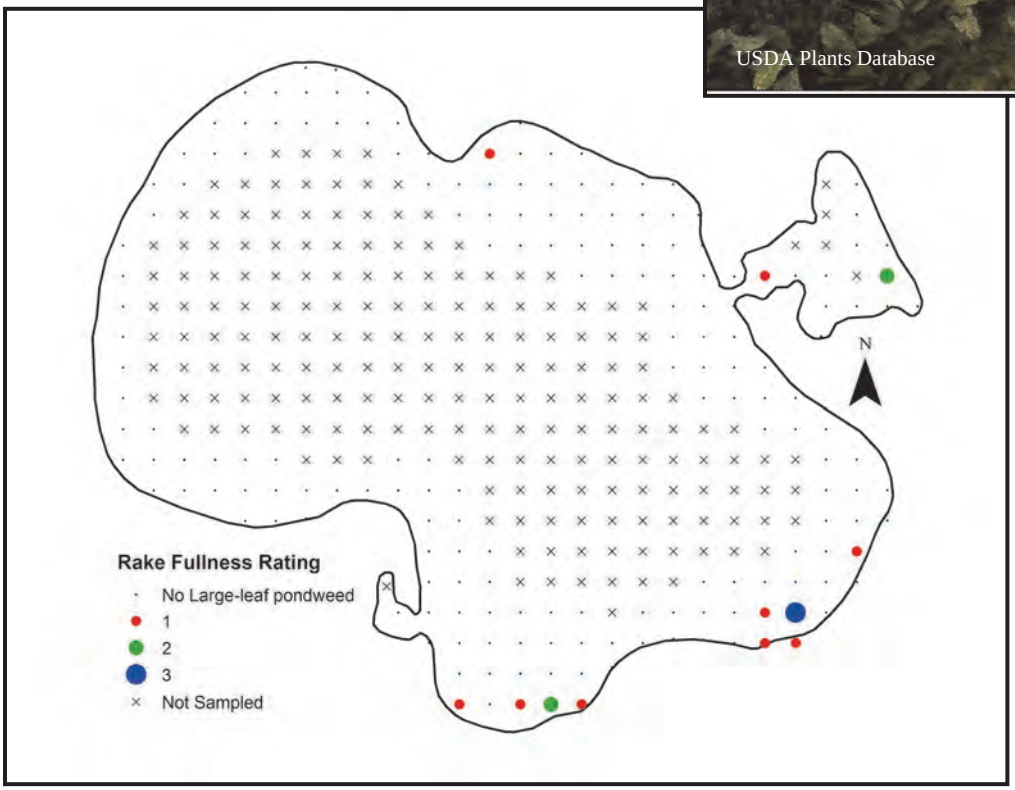
- When produced, floating leaves 2-23 cm long *with 27-49 veins* and petiole longer than leaf blade
- Submersed leaves large and sickle-shaped, 4-7 cm wide, 8-20 cm long, *with more than 19 veins*, and folded upwards along the sides
- White stipules up to 12 cm long

Large-leaf pondweed may be distinguished from Illinois pondweed (*P. illinoensis*) by the greater number of veins on submersed and floating leaves.

Ecology

- Soft substrate, shallow and deep lakes
- Emerges in spring from buds formed along rhizomes
- Provides food for waterfowl, muskrat, beaver, and deer
- Provides habitat and/or food for fish, muskrat, waterfowl, and insects

USDA Plants Database



Potamogeton foliosus — Leafy Pondweed

Native

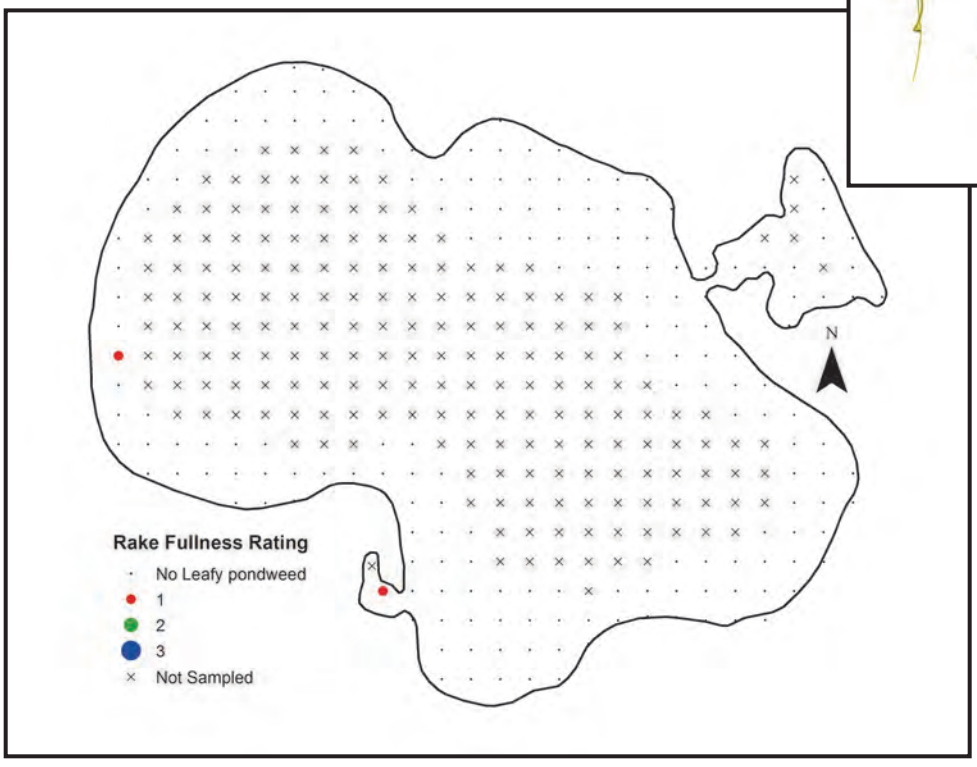
Identifying Features

- Narrow, submersed leaves (one-half to three inches long and one-half to two mm wide), narrowing slightly near the stem, with 3-5 veins, and the leaf tip usually tapering to a point
- No floating leaves
- Flowers and fruit on short stalks in the axils of the upper leaves

Leafy pondweed is similar to small pondweed (*P. pusillus*), when not in flower and fruit. However, unlike small pondweed, it lacks glands where the leaves meet the stem. The flowers and fruits of small pondweed are borne on longer, more slender stalks and in whorls that are spaced apart.

Ecology

- Prefers shallow waters over soft sediments in lakes and streams
- Overwinters as rhizomes or winter buds (turions)
- *Tolerates eutrophic waters and can improve water quality in such environments*
- Fruits fed upon by waterfowl and available earlier in the year than most other aquatic fruits
- Cover for invertebrates and juvenile fish



Potamogeton gramineus — Variable Pondweed

Native

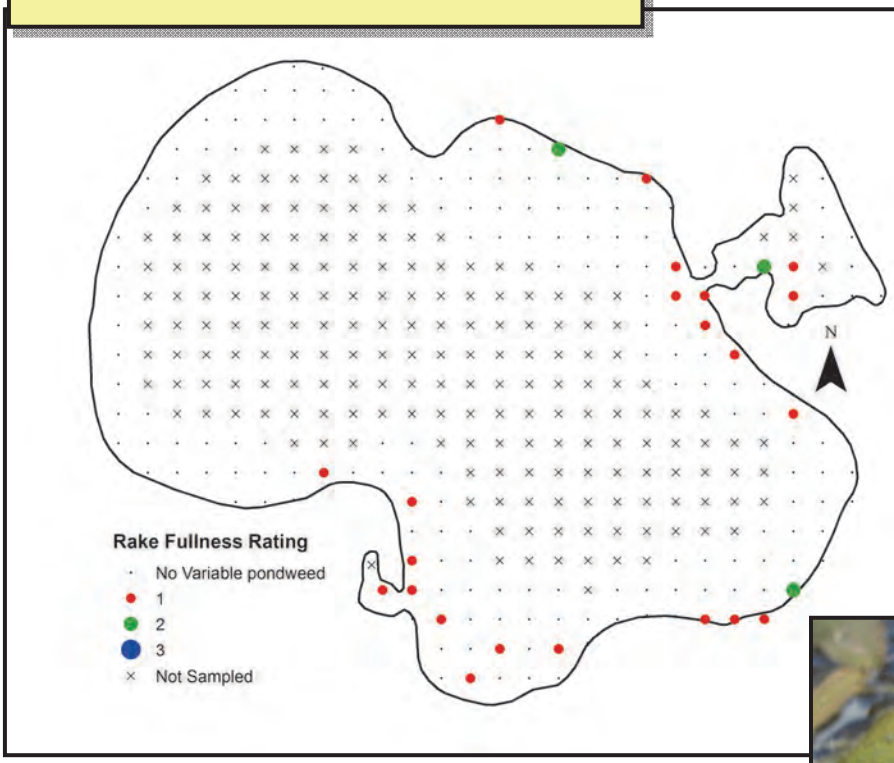
Identifying Features

- Often heavily branched
- Submerged leaves narrow to lance-shaped, with three to seven veins, smooth margins, without stalks, but the blade tapering to the stem
- Floating leaves with 11 to 19 veins and a slender stalk that is usually longer than the blade
- Often covered with calcium carbonate in hard water

Variable pondweed is similar to Illinois pondweed (*P. illinoensis*), but Illinois pondweed has submerged leaves with nine to 19 veins

Ecology

- Shallow to deep water, often with muskgrass, wild celery, and/or slender naiad; requires more natural areas that receive little disturbance
- Overwinters as rhizomes or winter buds (turions)
- Provides food for waterfowl, muskrat, deer, and beaver
- Provides habitat for fish and aquatic invertebrates



Potamogeton illinoensis — Illinois Pondweed

Native

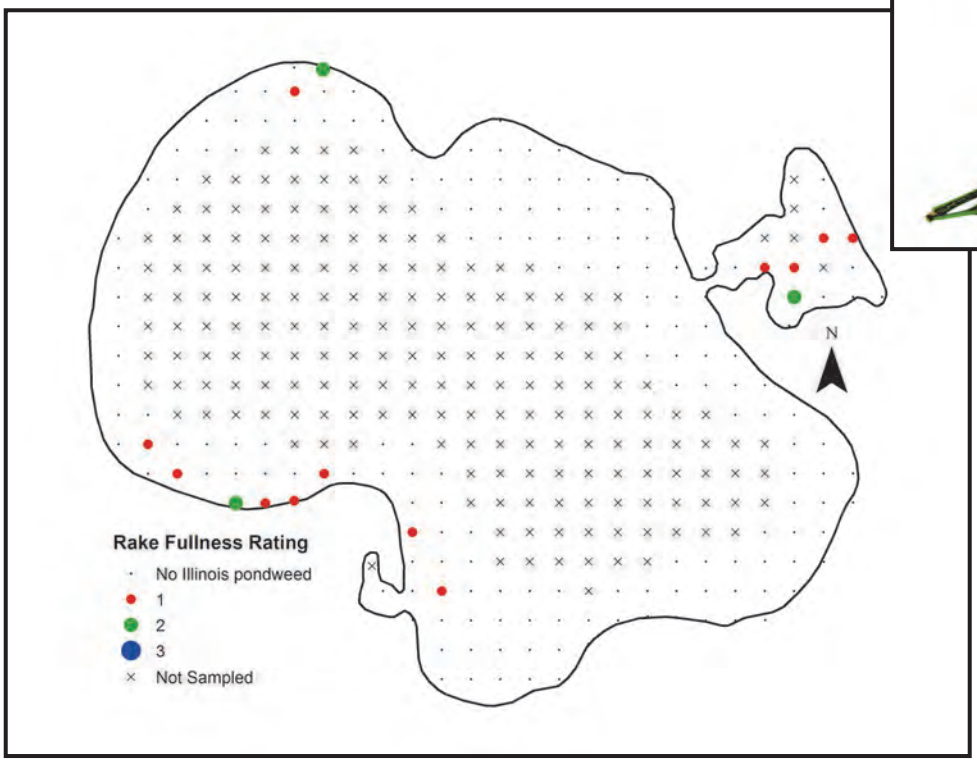
Identifying Features

- Stout stems up to 2.0 m long, often branched
- Submerged leaves with nine to 19 veins (midvein prominent) on short stalks (up to 4.0 cm) or attached directly to the stem
- Floating leaves, if produced, elliptical, with 13 to 29 veins
- Often covered with calcium carbonate in hard water

Variable pondweed (*P. gramineus*) is similar to Illinois pondweed, but differs in having three to seven veins on submerged leaves

Ecology

- Lakes with clear water, shallow or deep, neutral or hard, over soft sediments
- Overwinters as rhizomes or remains green under the ice
- Provides food for waterfowl, muskrat, deer, and beaver
- Provides excellent habitat for fish and aquatic invertebrates



Potamogeton natans — Floating-Leaf Pondweed

Native

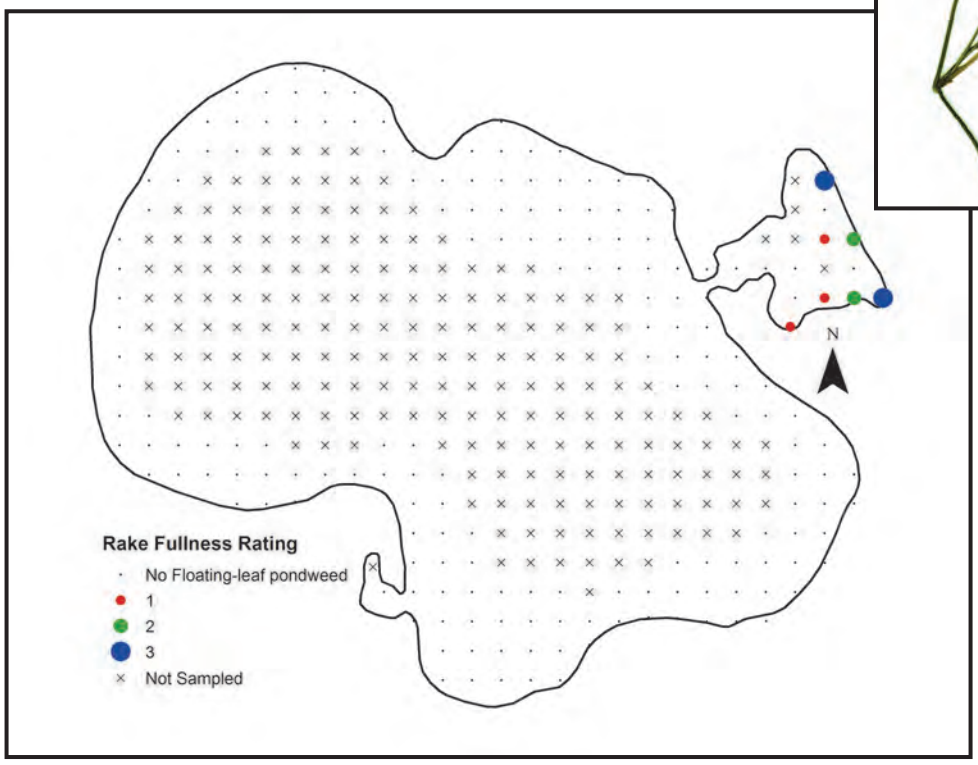
Identifying Features

- Floating leaves (5.0 to 10 cm long) with heart-shaped bases and 17 to 37 veins
- Floating leaf stalks bent where they meet the leaf, causing the leaf to be held at roughly a 90-degree angle to the stalk
- Submersed leaves (1.0 to 2.0 mm wide) linear and stalk-like, with three to five veins

Floating-leaf pondweed is similar to Oakes' pondweed (*P. oakesianus*) and spotted pondweed (*P. pulcher*). Oake's pondweed is smaller, with floating leaves 2.5 to 6.0 cm long and submersed leaves 0.25 to 1.0 mm wide. Spotted pondweed differs in having small black spots on its stems and leaf stalks and lance-shaped submersed leaves with wavy margins

Ecology

- Usually in shallow waters (<2.5 m) over soft sediment
- Emerges in spring from buds formed along rhizomes
- Provides food for waterfowl, muskrat, beaver, and deer
- Holds fruit on stalks until late in the growing season, which provides valuable feeding opportunities for waterfowl
- Provides good fish habitat



Potamogeton pectinatus — Sago Pondweed

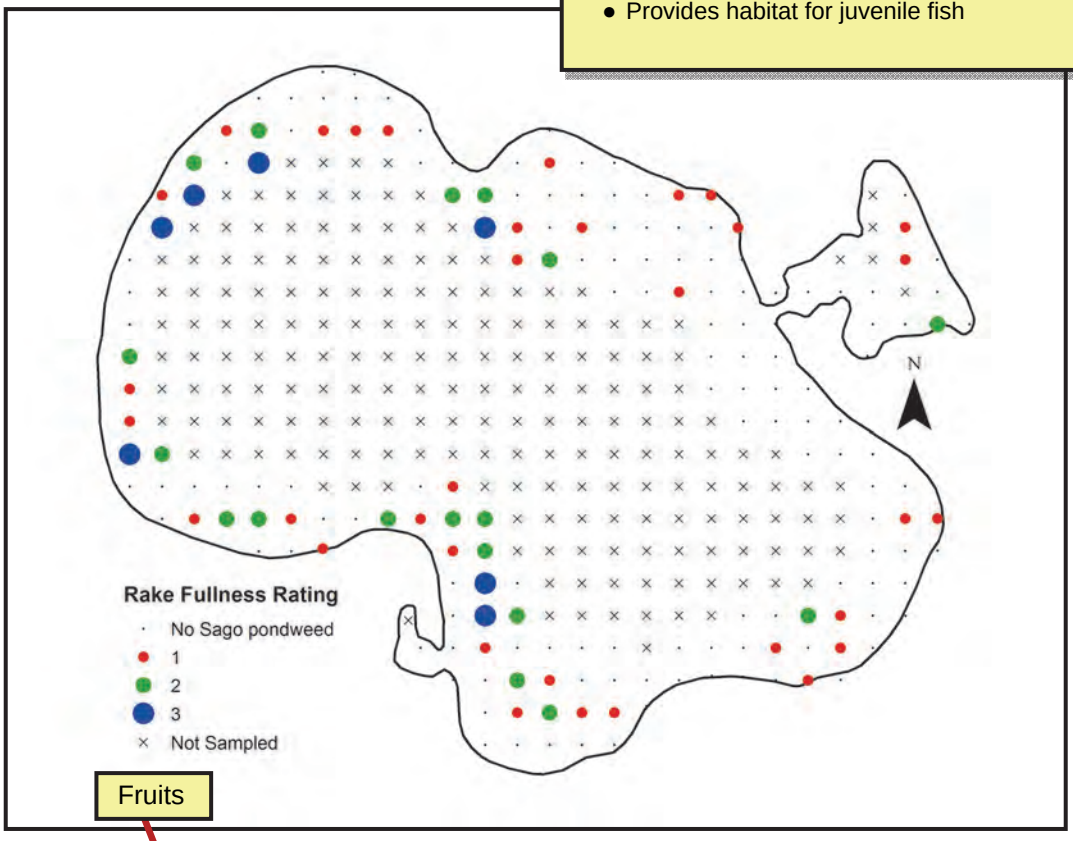
Native

Identifying Features

- Stems often *slightly zig-zagged* and forked multiple times, yielding a fan-like form
- Leaves one to four inches long, very thin, and ending in a sharp point
- Whorls of fruits spaced along the stem may appear as beads on a string

Ecology

- Lakes and streams
- Overwinters as rhizomes and starchy tubers
- Tolerates murky water and disturbed conditions
- Provides abundant fruits and tubers, which are an *important food for waterfowl*
- Provides habitat for juvenile fish



Potamogeton pusillus — Small Pondweed

Native

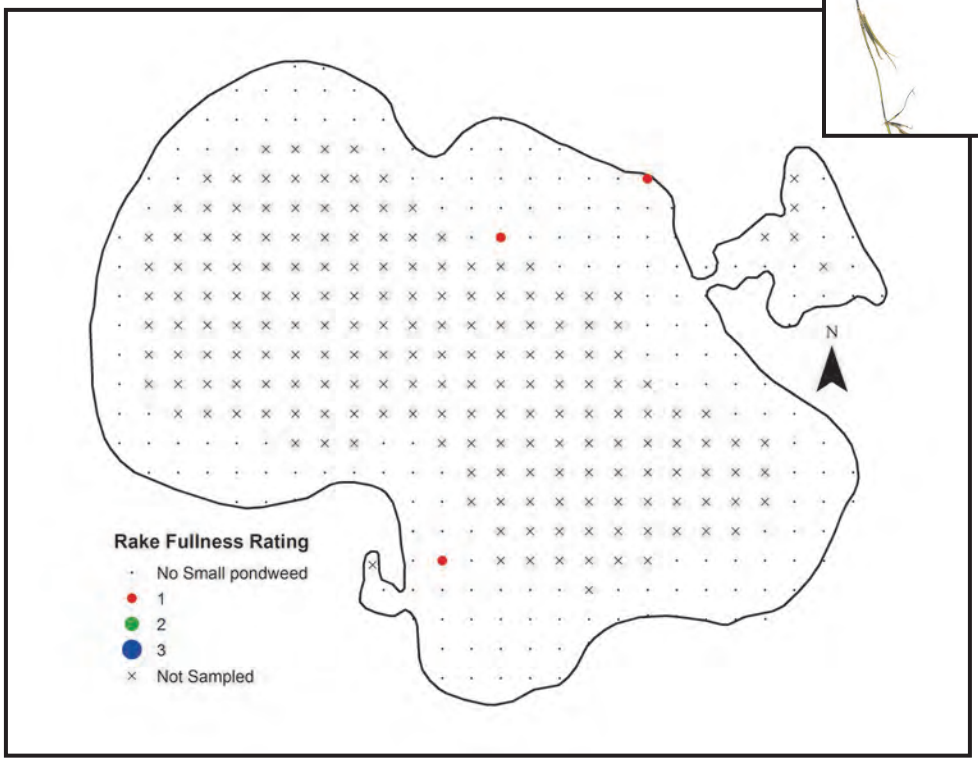
Identifying Features

- Narrow, submersed leaves (1-7 cm long and 0.2-2.5 mm wide), attaching directly to the stem, with 3 veins, leaf tips blunt or pointed, and often with raised glands where the leaf attaches to the stem
- Produces no floating leaves
- Numerous winter buds (turions) produced with rolled, inner leaves resembling cigars
- Flowers and fruits produced in whorls spaced along slender stalk

Small pondweed is similar to leafy pondweed (*P. foliosus*), when not in flower and fruit. However, unlike leafy pondweed, it often has raised glands where the leaves meet the stem. The flowers and fruits of small pondweed are also borne on longer, more slender stalks and in whorls that are spaced apart.

Ecology

- Shallow or deep waters over soft sediments in lake and streams
- Overwinters as rhizomes or winter buds (turions)
- Food for waterfowl, muskrat, deer, and beaver
- Cover for invertebrates and fish



Potamogeton strictifolius — Stiff Pondweed

Native

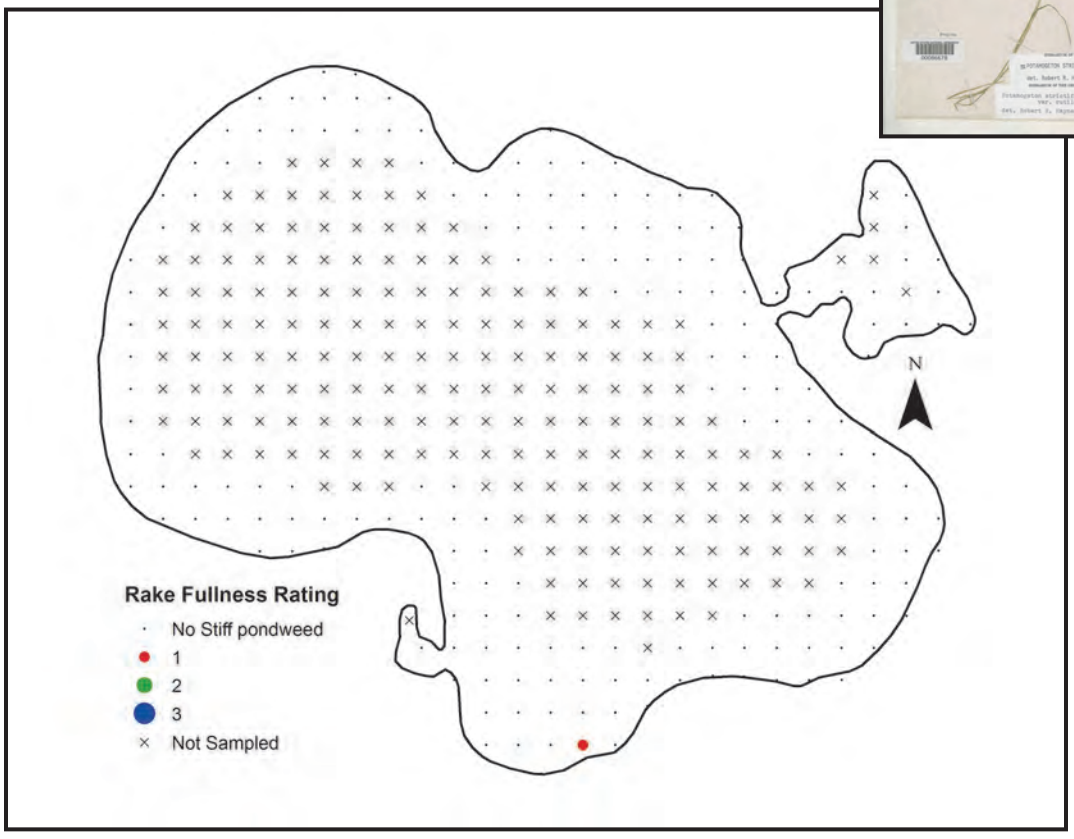
Identifying Features

- Stems slender and flattened
- Leaves 2-6 cm long, with 3-5 veins, usually with paired glands at their bases, and sharply pointed or tipped with a fine bristle
- Stipule white, free from leaves, 7-15 mm and becoming fibrous by midsummer
- Fruits round, without ridges, and 2-3 mm long

Stiff pondweed is similar to small pondweed (*Potamogeton pusillus*), but it differs in having glands at the bases of its leaves, flattened stems, and stipules that are not free from the stems.

Ecology

- Found in lakes, shallow and deep
- Produces overwintering buds known as turions
- Relatively uncommon in southeastern Wisconsin



Potamogeton zosteriformis — Flat-Stem Pondweed

Native

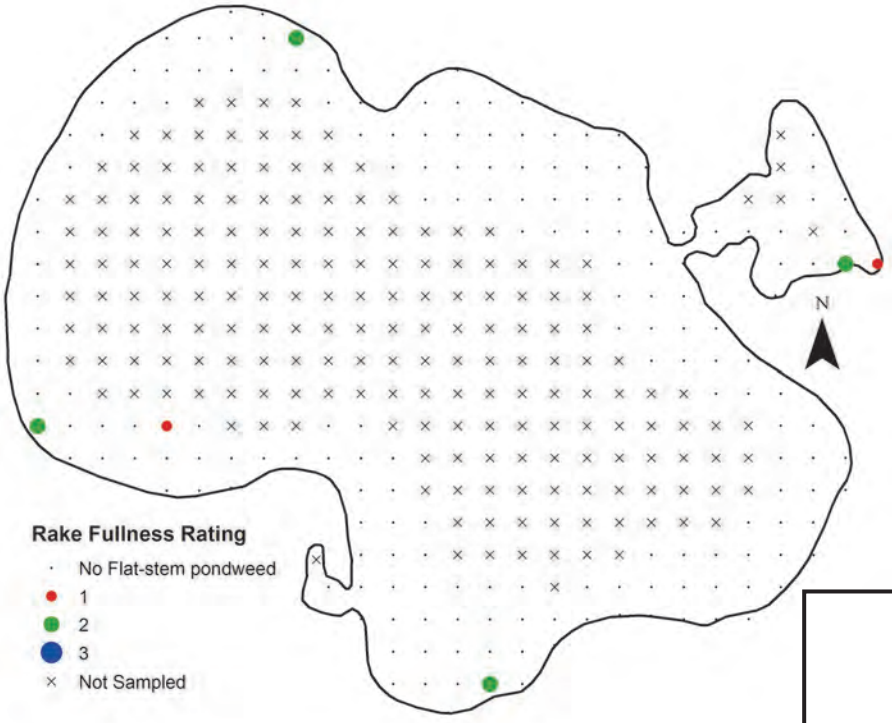
Identifying Features

- Stems strongly flattened
- Leaves up to four to eight inches long, pointed, with a prominent midvein and many finer, parallel veins
- Stiff winter buds consisting of tightly packed ascending leaves

Flat-stem pondweed may be confused with yellow stargrass (*Zosterella dubia*), but the leaves of yellow stargrass lack a prominent midvein.

Ecology

- Found at a variety of depths over soft sediment in lakes and streams
- Overwinters as rhizomes and winter buds
- Has antimicrobial properties
- Provides food for waterfowl, muskrat, beaver, and deer
- Provides cover for fish and aquatic invertebrates



Vallisneria americana — Eelgrass

Native

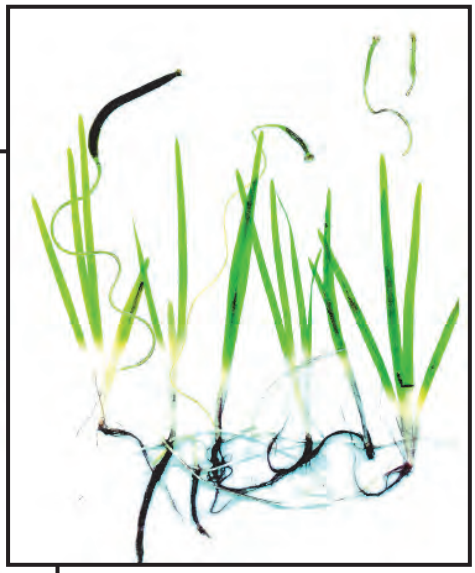
Identifying Features

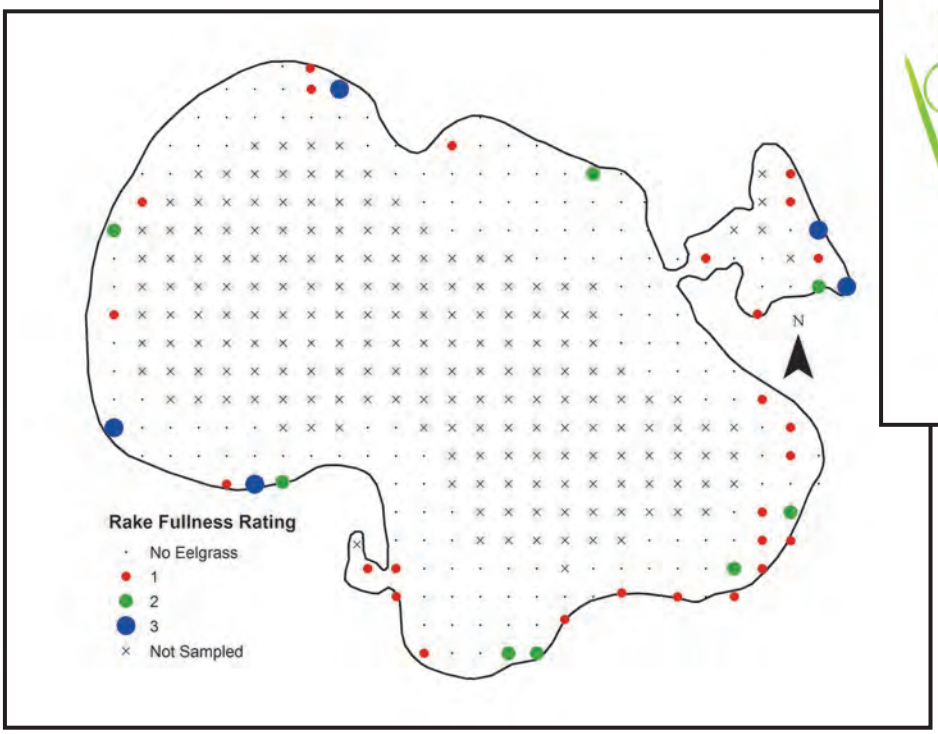
- Leaves ribbon-like, up to two meters long, with a prominent stripe down the middle, and emerging in clusters along creeping rhizomes
- Male and female flowers on separate plants, female flowers raised to the surface on spiral-coiled stalks

The foliage of eelgrass could be confused with the submersed leaves of bur-reeds (*Sparganium* spp.) or arrowheads (*Sagittaria* spp.), but the leaves of eelgrass are distinguished by their prominent middle stripe. The leaves of ribbon-leaf pondweed (*Potamogeton epihydrus*) are also similar to those of eelgrass, but the leaves of the former are alternately arranged along a stem rather than arising from the plant base

Ecology

- Firm substrates, shallow or deep, in lakes and streams
- Spreads by seed, by creeping rhizomes, and by offsets that break off and float to new locations in the fall
- All portions of the plant consumed by waterfowl; an especially important food source for Canvasback ducks
- Provides habitat for invertebrates and fish





Zosterella dubia — Water Stargrass

Native

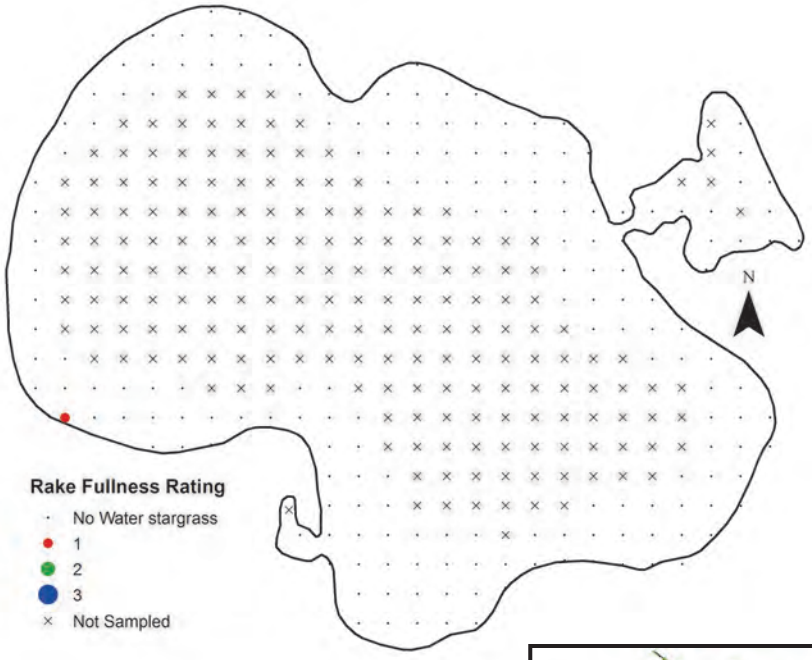
Identifying Features

- Stems slender, slightly flattened, and branching
- Leaves narrow, alternate, with no stalk, and lacking a prominent midvein
- When produced, flowers conspicuous, yellow, and star-shaped (usually in shallow water) or inconspicuous and hidden in the bases of submersed leaves (in deeper water)

Yellow stargrass may be confused with pondweeds that have narrow leaves, but it is easily distinguished by its lack of a prominent midvein and, when present, yellow blossoms

Ecology

- Found in lakes and streams, shallow and deep
- Tolerates somewhat turbid waters
- Overwinters as perennial rhizomes
- Limited reproduction by seed
- Provides food for waterfowl and habitat for fish




Scott Loarie

Appendix B

AN ORDINANCE TO REGULATE ENVIRONMENTALLY SENSITIVE AREAS ON PLEASANT LAKE

ORDINANCE NO. PL 2011-01

AN ORDINANCE TO REGULATE ENVIRONMENTALLY SENSITIVE AREAS ON PLEASANT LAKE

WHEREAS the Department of Natural Resources study dated March 5, 2009, has determined that the areas listed below are environmentally sensitive, that is, areas of critical or unique fish and wildlife habitat, or areas of water quality or erosion control benefitting Pleasant Lake; and

WHEREAS preservation of the aquatic plants in the environmentally sensitive areas will assist in preserving the fish and wildlife habitat,

NOW THEREFORE, the Town Board of LaGrange adopts this ordinance.

SECTION I. LOCATIONS OF ENVIRONMENTALLY SENSITIVE AREAS

The waters adjacent to the following locations are hereby designated as sensitive areas and are outlined on the attached map # 1 prepared by the DNR.

Sensitive area 1 is a small bay on the northeast side of Pleasant Lake almost totally isolated from the main lake. This sensitive area is part of Camp Juniper Knoll, operated by the Girl Scouts of Chicago. This approximately three-acre plant community consists of open water, deep marsh, and shallow marsh.

Sensitive area 2 is a bay located just east of sensitive area 1 and is known locally as "The Bay".

Sensitive area 3 locally known as "The Pond" is located in the southeast part of Pleasant Lake on the property designated PL 86-100

Sensitive area 4 includes most of the remaining shoreline of Pleasant Lake with the exception of the developed shoreline. Three shoreline areas are excluded from the shore out to 60 feet (see Map 1)

SECTION II. CIRCUMVENTION OF THIS ENVIRONMENTAL ORDINANCE

A riparian land owner is not permitted to avoid the intent of this ordinance by grounding, anchoring or tying up motorized boats (other than a canoe or kayak) to the shoreline without having a pier. Such activity destroys and/or erodes the shoreline and is detrimental to Pleasant Lake. Riparian owners are required to have appropriate and legal mooring for their boats in the form of an approved pier.

SECTION III. GENERAL CONTROLS

In all DNR designated Sensitive Areas no person shall do any of the following:

1. No chemical treatment of any kind without the proper DNR permit
2. None of the following in-lake activities are allowed:
    a. Filling
    b. Aquatic plant screens
    c. Wetland alterations
    d. Boardwalks
    e. Pea gravel/sand blankets
    f. Dredging
3. No harvesting of large-leaf and floating-leaf pond plants is allowed except as noted in Sensitive Area 2.
4. No fallen trees shall be removed in Sensitive Areas 1 & 3and in Sensitive Area 2 from PL 32 west to the mouth of the Bay.
5. Any environmental altering activities done in the environmentally sensitive areas without obtaining a permit from the Town of LaGrange.

SECTION IV. NEW PIERS

Construction of new piers in environmentally sensitive areas will be restricted based on the recommendations contained in the Pleasant Lake (Walworth County, Wisconsin) Integrated Sensitive Area Report March 5, 2009, and this ordinance

SECTION V. SPECIFIC AREA CONTROLS

1. No new piers, slips, boardwalks or mooring facilities in Sensitive Areas 1 & 3 will be permitted. All existing piers, slips, boardwalks or mooring facilities in Sensitive Area 2 will be grandfathered as of the date of the adoption of this Ordinance. In Sensitive Area 2 no piers are permitted along the currently undeveloped shoreline. No new piers will be permitted along the currently developed shoreline. Existing piers may be repaired or replaced but must be in the footprint of the current pier.

In Sensitive Area 4 existing piers may be repaired or replaced but must be in the footprint of the current pier. New piers will be permitted. The number of new moorings permitted will be limited and based upon the carrying capacity of the resource. In no event shall there be more than one slip per household and slips must be clustered with a MINIMUM of 6 slips per pier. Piers are to be located and clustered in such a way as to minimize the impact on the resource.

All new development of piers or slips in Sensitive Area 4 shall require a permit from the Town of LaGrange.

2. No motorized boating is allowed in Sensitive Areas 1 & 3.No motorized boating is allowed outside of the developed channels in Sensitive Area 2 except for electric trolling motors.
The channel starts at the survey stake on the northeast corner of PL 32 and follows the shoreline south and east to PL 44. The channel extends from the shoreline out to 50 feet.

3. Management Recommendations for Sensitive Area #2
Please note that this section of recommendations makes a distinction between the currently undeveloped shoreline and the currently developed shoreline. Any land that is subsequently developed will still be held to the standard of "currently undeveloped" for the purposes of interpreting this recommendation document. The currently developed shoreline includes portions of the southern shoreline of the bay as well as portions of the eastern shoreline of the bay.

A. No **new** mechanical harvesting permits should be issued in this sensitive area. One mechanical harvesting permit is on file (originally issued in 2005). A total Of 0.36 acres is permitted for harvesting. The depth of the harvest may not exceed thirty inches downward from the surface of the water. This permit will continue to be issued but with a time of year restriction (No harvesting before August 1st of any given year starting in 2008). The permit cannot be transferred to a new landowner. The existing permit should be assigned to the Lake Management District when the current holder is no longer a property owner.

B. Manual removal permits should be limited to a maximum of 20 feet along each landowner's shoreline and a maximum of 30 feet from the shoreline out into the lake. A NR 109 permit is needed for manual removal. Manual removal permits should only be issued in the area where the pier and boats are located for each property and should only be issued along the currently developed shoreline.

C. A DNR permit should not be issued for any of the following along the currently developed shoreline.

Filling of wetlands	Rip Rap
Aquatic plant screens	Recreational floating devices
Sea Walls/Retaining Walls	Pea Gravel/Sand Blankets

D. Limited dredging to maintain the navigational channel may be considered if the water depth in the navigational channel becomes less than 30 inches deep. The navigational channel is located mainly along the currently developed shoreline.

E. A DNR permit should not be issued for any of the following along the

undeveloped shoreline.

Dredging	Pea Gravel/Sand Blankets
Filling of wetlands	Rip Rap
Aquatic plant screens	Recreational floating devices
Sea Walls/Retaining Walls	New Piers

F. A DNR permit should not be issued for boardwalk or ramp construction along the currently undeveloped shoreline. A rustic canoe access path can be marked for any new residential development.

4. Management Recommendations for Sensitive Area #3

A. A DNR permit should not be issued for any of the following:

Dredging	Pea Gravel/Sand Blankets
Filling of wetlands	Rip Rap
Aquatic plant screens	New Piers
Boat Ramps	Sea Walls/Retaining Walls
Recreational floating devices	

5. Management Recommendations for Sensitive Area #4

A. Do not remove fallen trees along shoreline, except where navigation is impaired. If navigation is impaired by a fallen tree, cut into smaller pieces and place outside of boating lane.

B. A DNR permit should not be issued for any of the following:

Dredging	Pea Gravel/Sand Blankets
Filling of wetlands	Wetland removal
New Sea Walls	

C. No new rip rap should be permitted if shoreline littoral zone has emergent vegetation such as bulrush, pickerelweed, sedges, etc. Existing rip rap should be maintained in compliance with Natural Resources Code 328.

D. Manual removal permits should be limited to a maximum of 20 feet along each landowner's shoreline and a maximum of 30 feet from the shoreline out into the lake. A NR 109 permit is needed for manual removal. Manual removal permits should only be issued in the area where the pier and boats are located for each property.

E. No mechanical aquatic plant removal should be permitted. Manual removal Of exotic species such as Eurasian water milfoil, curly leaf pondweed or Purple loosestrife will require a permit.

SECTION VI. PRE-EXISTING PIERS, WHARFS, AND MOORING FACILITIES IN ALL AREAS

A. In order to protect the legitimate rights of persons with pre-existing piers, wharfs and mooring facilities, all persons with a wharf, pier or mooring facility legally in place in all areas of Pleasant Lake as of January 1, 2012, shall provide the following information to the Town of LaGrange: Name of riparian owner, address of owner, address where pier is located, year pier was first placed in Pleasant Lake, length of pier, width of pier and number of mooring facilities. All persons failing to provide this information with the Town shall be deemed not to own a pier, wharf or mooring facility with rights as a pre-existing pier, wharf or mooring facility and such structures shall conform to the standards established in the current DNR regulations.

SECTION VII. PARTIES TO A VIOLATION

Whoever directly commits a violation of this ordinance or aids and abets a violation, including property owners and contractors, is as responsible as the person who directly commits the acts in violation of this ordinance, even though he or she did not directly commit the offense and although the person who directly committed the offense has not been found guilty.

SECTION VIII. ENFORCEMENT

1. The Town of LaGrange may enforce this by civil action or citation issued by the Town Attorney upon the request of the Town Board.
2. First offense. Any person violating any section of the ordinance shall forfeit not less than $200 nor more than $500 plus allowable statutory costs each first offense within 1 yr.
3. Second and subsequent offenses. Any person violating any section of this offense within one (1) year. ordinance shall forfeit not less than $ 600.00 nor more than $1500 plus allowable statutory costs for the second offense within one (1) year.
4. Bond is set at one-half the maximum forfeiture.
5. Violation of each provision of this ordinance is a separate offense. Each day a violation continues is a separate offense.
6. Failure to pay the forfeiture shall subject the violator to a term in the Walworth County Jail.

upon request of

SECTION IX. SEVERABILITY AND REPEAL

1. The provisions of this ordinance shall be deemed severable and it is expressly declared that the Town Board would have passed the other provisions of this ordinance irrespective as to whether or not one or more provisions may be declared invalid and any provision of this ordinance or the application thereof to

any person or circumstance is held invalid, the remainder of the ordinance and the application of such provisions, other persons or circumstances shall not be affected thereby.

2. All ordinances and parts of ordinances in conflict with this ordinance heretofore enacted by the Town of LaGrange are hereby repealed.

Adopted by the LaGrange Town Board on motion of Supervisor Callaway seconded by Supervisor Sukala on the 14th day of Feb, 2011

Attest:

Crystal Hoffmann

Crystal Hoffmann, Town Clerk

Approved:

Susan E Taylor

Donald D Sukala

John F. Callaway

Appendix C

2,4-D Chemical Fact Sheet

2,4-D Chemical Fact Sheet

Formulations

2,4-D is an herbicide that is widely used as a household weed-killer, agricultural herbicide, and aquatic herbicide. It has been in use since 1946, and was registered with the EPA in 1986 and re-reviewed in 2005. The active ingredient is 2,4-dichloro-phenoxyacetic acid. There are two types of 2,4-D used as aquatic herbicides: dimethyl amine salt and butoxyethyl ester. Both liquid and slow-release granular formulations are available. 2,4-D is sold under the trade names Aqua-Kleen, Weedar 64 and Navigate (product names are provided solely for your reference and should not be considered endorsements nor exhaustive).

Aquatic Use and Considerations

2,4-D is a widely-used herbicide that affects plant cell growth and division. It affects primarily broad-leaf plants. When the treatment occurs, the 2,4-D is absorbed into the plant and moved to the roots, stems, and leaves. Plants begin to die in a few days to a week following treatment, but can take several weeks to decompose. Treatments should be made when plants are growing.

For many years, 2,4-D has been used primarily in small-scale spot treatments. Recently, some studies have found that 2,4-D moves quickly through the water and mixes throughout the waterbody, regardless of where it is applied. Accordingly, 2,4-D has been used in Wisconsin experimentally for whole-lake treatments.

2,4-D is effective at treating the invasive Eurasian watermilfoil (*Myriophyllum spicatum*). Desirable native species that may be affected include native milfoils, coontail (*Ceratophyllum demersum*), naiads (*Najas* spp.), elodea (*Elodea canadensis*) and duckweeds (*Lemna* spp.). Lilies (*Nymphaea* spp. and *Nuphar* spp.) and bladderworts (Utricularia spp.) also can be affected.

Post-Treatment Water Use Restrictions

There are no restrictions on eating fish from treated water bodies, human drinking water or pet/livestock drinking water. Following the last registration review in 2005, the ester products require a 24-hour waiting period for swimming. Depending on the type of waterbody treated and the type of plant being watered, irrigation restrictions may apply for up to 30 days. Certain plants, such as tomatoes and peppers and newly seeded lawn, should not be watered with treated water until the concentration is less than 5 parts per billion (ppb).

Herbicide Degradation, Persistence and Trace Contaminants

The half-life of 2,4-D (the time it takes for half of the active ingredient to degrade) ranges from 12.9 to 40 days depending on water conditions. In anaerobic lab conditions, the half-life has been measured up to 333 days. After treatment, the 2,4-D concentration in the water is reduced primarily through microbial activity, off-site movement by water, or adsorption to small particles in silty water. It is slower to degrade in cold or acidic water, and appears to be slower to degrade in lakes that have not been treated with 2,4-D previously.

There are several degradation products from 2,4-D: 1,2,4-benzenetriol, 2,4-dichlorophenol, 2,4-dichloroanisole, chlorohydroquinone (CHQ), 4-chlorophenol and volatile organics.

Impacts on Fish and Other Aquatic Organisms

Toxicity of aquatic 2,4-D products vary depending on whether the formulation is an amine or an ester 2,4-D. The ester formulations are toxic to fish and some important invertebrates such as water fleas (*Daphnia*) and midges at application rates; the amine formulations are not toxic to fish or invertebrates at application rates. Loss of habitat following treatment may cause reductions in populations of invertebrates with either formulation, as with any herbicide treatment. These organisms only recolonize the treated areas as vegetation becomes re-established.

Available data indicate 2,4-D does not accumulate at significant levels in the bodies of fish that have been tested. Although fish that are exposed to 2,4-D will take up some of the chemical, the small amounts that accumulate are eliminated after exposure to 2,4-D ceases.

On an acute basis, 2,4-D is considered moderately to practically nontoxic to birds. 2,4-D is not toxic to amphibians at application rates; effects on reptiles are unknown. Studies have shown some endocrine disruption in amphibians at rates used in lake applications, and DNR is currently funding a study to investigate endocrine disruption in fish at application rates.

As with all chemical herbicide applications it is very important to read and follow all label instructions to prevent adverse environmental impacts.

Human Health

Adverse health effects can be produced by acute and chronic exposure to 2,4-D. Those who mix or apply 2,4-D need to protect their skin and eyes from contact with 2,4-D products to minimize irritation, and avoid inhaling the spray. In its consideration of exposure risks, the EPA believes no significant risks will occur to recreational users of water treated with 2,4-D.

Concerns have been raised about exposure to 2,4-D and elevated cancer risk. Some (but not all) epidemiological studies have found 2,4-D associated with a slight increase in risk of non-Hodgkin's lymphoma in high exposure populations (farmers and herbicide applicators). The studies show only a possible association that may be caused by other factors, and do not show that 2,4-D causes cancer. The EPA determined in 2005 that there is not sufficient evidence to classify 2,4-D as a human carcinogen.

The other chronic health concern with 2,4-D is the potential for endocrine disruption. There is some evidence that 2,4-D may have estrogenic activities, and that two of the break-down products of 2,4-D (4-chlorophenol and 2,4-dichloroanisole) may affect male reproductive development. The extent and implications of this are not clear and it is an area of ongoing research.

For Additional Information

Environmental Protection Agency
Office of Pesticide Programs
www.epa.gov/pesticides

Wisconsin Department of Agriculture, Trade, and Consumer Protection
http://datcp.wi.gov/Plants/Pesticides/

Wisconsin Department of Natural Resources
608-266-2621
http://dnr.wi.gov/lakes/plants/

Wisconsin Department of Health Services
http://www.dhs.wisconsin.gov/

National Pesticide Information Center
1-800-858-7378
http://npic.orst.edu/

Wisconsin Department of Natural Resources
Box 7921
Madison, WI 53707-7921

DNR PUB-WT-964 2012

Appendix D

SEWRPC RIPARIAN BUFFER GUIDE NO. 1
"MANAGING THE WATER'S EDGE"

Managing the Water's Edge

Making Natural Connections

Problem Statement:

Despite significant research related to buffers, there remains no consensus as to what constitutes optimal riparian buffer design or proper buffer width for effective pollutant removal, water quality protection, prevention of channel erosion, provision of fish and wildlife habitat, enhancement of environmental corridors, augmentation of stream baseflow, and water temperature moderation.

Southeastern Wisconsin Regional Planning Commission

Our purpose in this document is to help protect and restore water quality, wildlife, recreational opportunities, and scenic beauty.

This material was prepared in part with funding from the U.S. Environmental Protection Agency Great Lakes National Program Office provided through CMAP, the Chicago Metropolitan Agency for Planning.

Introduction

Perhaps no part of the landscape offers more variety and valuable functions than the natural areas bordering our streams and other waters.

These unique "riparian corridor" lands help filter pollutants from runoff, lessen downstream flooding, and maintain stream baseflows, among other benefits. Their rich ecological diversity also provides a variety of recreational opportunities and habitat for fish and wildlife. Regardless of how small a stream, lake, or wetland may be, adjacent corridor lands are important to those water features and to the environment.

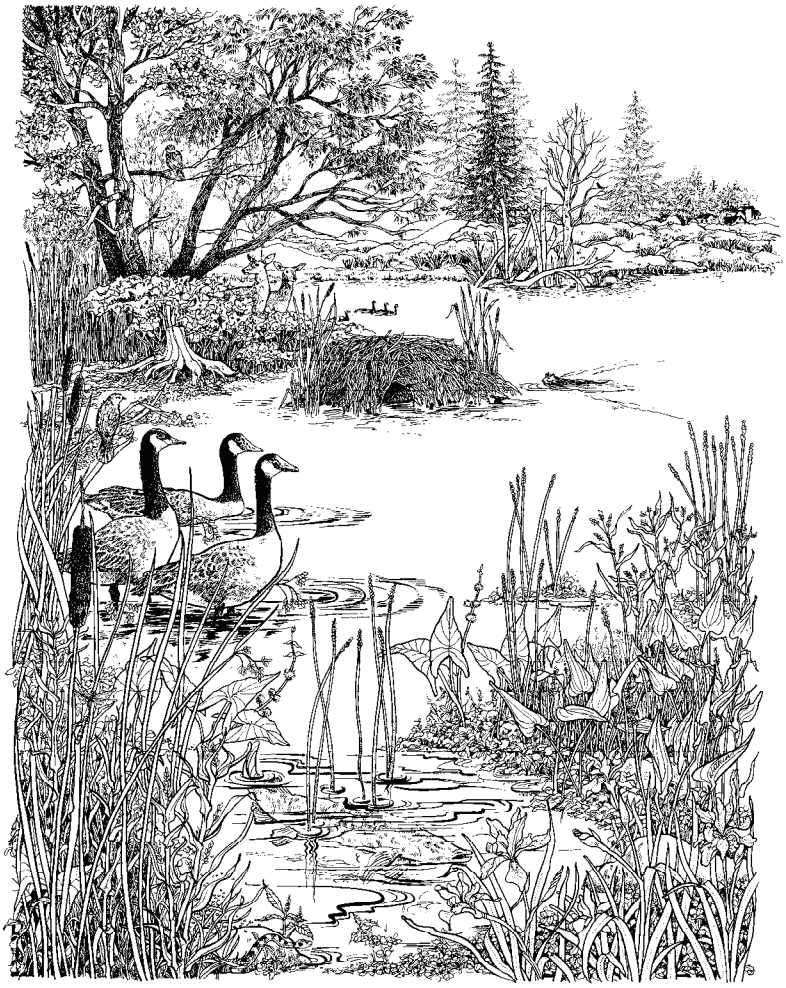
Along many of our waters, the riparian corridors no longer fulfill their potential due to the encroachment of agriculture and urban development. This publication describes common problems encountered along streamside and other riparian corridors, and the many benefits realized when these areas are protected or improved. It also explains what landowners, local governments, and other decision-makers can do to capitalize on waterfront opportunities, and identifies some of the resources available for further information. While much of the research examined here focuses on stream corridors, the ideas presented also apply to areas bordering lakes, ponds, and wetlands throughout the southern Lake Michigan area and beyond. This document was developed as a means to facilitate and communicate important and up-to-date general concepts related to riparian buffer technologies.

Riparian corridors are unique ecosystems that are exceptionally rich in biodiversity

Contents

What Are Riparian Corridors? Riparian Buffer Zones?

The word riparian comes from the Latin word *ripa*, which means bank. However, in this document we use riparian in a much broader sense and refer to land adjoining any water body including ponds, lakes, streams, and wetlands. This term has two additional distinct meanings that refer to 1) the "natural or relatively undisturbed" corridor lands adjacent to a water body inclusive of both wetland and upland flora and fauna and 2) a buffer zone or corridor lands in need of protection to "buffer" the effects of human impacts such as agriculture and residential development.



University of Wisconsin—Extension

The word buffer literally means something that cushions against the shock of something else (noun), or to lessen or cushion that shock (verb). Other useful definitions reveal that a buffer can be something that serves to separate features, or that is capable of neutralizing something, like filtering pollutants from stormwater runoff. Essentially, buffers and buffering help protect against adverse effects.

Riparian buffer zones function as core habitat as well as travel corridors for many wildlife species.

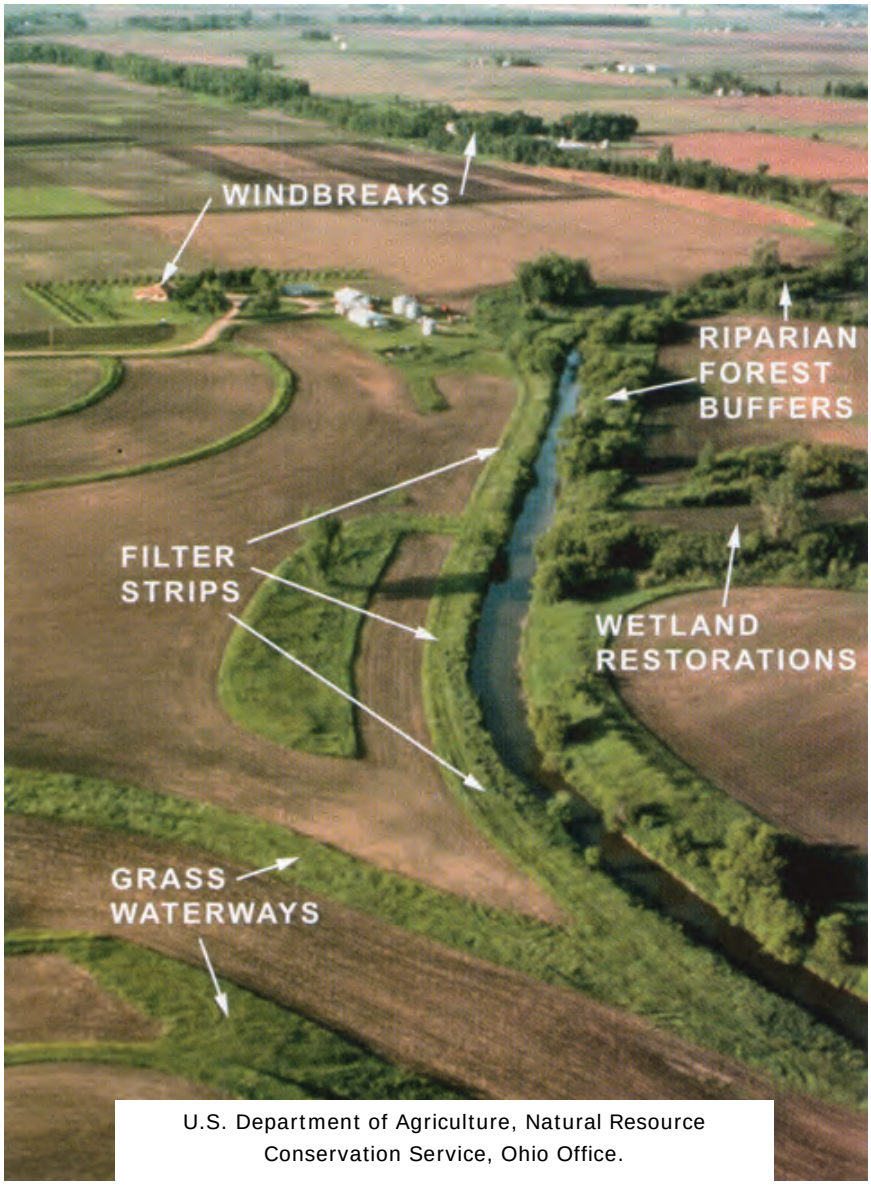
Riparian buffers are zones adjacent to waterbodies such as lakes, rivers, and wetlands that simultaneously protect water quality and wildlife, including both aquatic and terrestrial habitat. These zones minimize the impacts of human activities on the landscape and contribute to recreation, aesthetics, and quality of life. **This document summarizes how to maximize both water quality protection and conservation of aquatic and terrestrial wildlife populations using buffers.**

What Are Riparian Corridors? Riparian Buffer Zones?

Buffers **can** include a range of complex vegetation structure, soils, food sources, cover, and water features that offer a variety of habitats contributing to diversity and abundance of wildlife such as mammals, frogs, amphibians, insects, and birds. Buffers can consist of a variety of canopy layers and cover types including ephemeral (temporary-wet for only part of year) wetlands/seasonal ponds/spring pools, shallow marshes, deep marshes, wetland meadows, wetland mixed forests, grasslands, shrubs, forests, and/or prairies. Riparian zones are areas of transition between aquatic and terrestrial ecosystems, and they can potentially offer numerous benefits to wildlife and people such as pollution reduction and recreation.

In the water resources literature, riparian buffers are referred to in a number of different ways. Depending on the focus and the intended function of a buffer, or a buffer-related feature, buffers may be referred to as stream corridors, critical transition zones, riparian management areas, riparian management zones, floodplains, or green infrastructure.

It is important to note that within an agricultural context, the term buffer is used more generally to describe filtering best management practices most often at the water's edge. Other practices which can be interrelated may also sometimes be called buffers. These include grassed waterways, contour buffer strips, wind breaks, field border, shelterbelts, windbreaks, living snow fence, or filter strips. These practices may or may not be adjacent to a waterway as illustrated in the photo to the right. For example, a grassed waterway is designed to filter sediment and reduce erosion and may connect to a riparian buffer. These more limited-purpose practices may link to multipurpose buffers, but by themselves, they are not adequate to provide the multiple functions of a riparian buffer as defined here.



U.S. Department of Agriculture, Natural Resource Conservation Service, Ohio Office.

Beyond the Environmental Corridor Concept

The term "environmental corridors" (also known as "green infrastructure") refers to an interconnected green space network of natural areas and features, public lands, and other open spaces that provide natural resource value. Environmental corridor planning is a process that promotes a systematic and strategic approach to land conservation and encourages land use planning and practices that are good for both nature and people. It provides a framework to guide future growth, land development, and land conservation decisions in appropriate areas to protect both community and natural resource assets.

Environmental corridors are an essential planning tool for protecting the most important remaining natural resource features in Southeastern Wisconsin and elsewhere. Since development of the environmental corridor concept, there have been significant advancements in landscape ecology that have furthered understanding of the spatial and habitat needs of multiple groups of organisms. In addition, advancements in pollutant removal practices, stormwater control, and agriculture have increased our understanding of the effectiveness and limitations of environmental corridors. In protecting water quality and providing aquatic and terrestrial habitat, there is a need to better integrate new technologies through their application within riparian buffers.

SEWRPC has embraced and applied the environmental corridor concept developed by Philip Lewis (Professor Emeritus of Landscape Architecture at the University of Wisconsin-Madison) since 1966 with the publication of its first regional land use plan. Since then, SEWRPC has refined and detailed the mapping of environmental corridors, enabling the corridors to be incorporated directly into regional, county, and community plans and to be reflected in regulatory measures. The preservation of environmental corridors remains one of the most important recommendations of the regional plan. Corridor preservation has now been embraced by numerous county and local units of government as well as by State and Federal agencies. The environmental corridor concept conceived by Lewis has become an important part of the planning and development culture in Southeastern Wisconsin.

Beyond the Environmental Corridor Concept

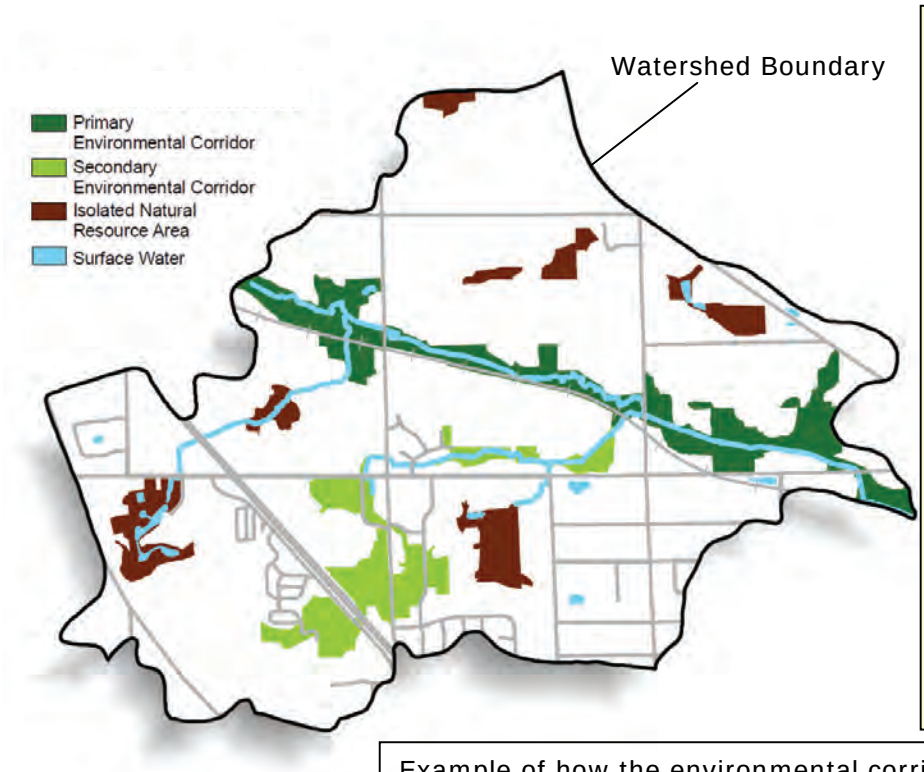
Environmental corridors are divided into the following three categories.

- **Primary environmental corridors** contain concentrations of our most significant natural resources. They are at least 400 acres in size, at least two miles long, and at least 200 feet wide.
- **Secondary environmental corridors** contain significant but smaller concentrations of natural resources. They are at least 100 acres in size and at least one mile long, unless serving to link primary corridors.
- **Isolated natural resource areas** contain significant remaining resources that are not connected to environmental corridors. They are at least five acres in size and at least 200 feet wide.

Key Features of Environmental Corridors

- Lakes, rivers, and streams
- Undeveloped shorelands and floodlands
- Wetlands
- Woodlands
- Prairie remnants
- Wildlife habitat
- Rugged terrain and steep slopes
- Unique landforms or geological formations
- Unfarmed poorly drained and organic soils
- Existing outdoor recreation sites
- Potential outdoor recreation sites
- Significant open spaces
- Historical sites and structures
- Outstanding scenic areas and vistas

Beyond the Environmental Corridor Concept

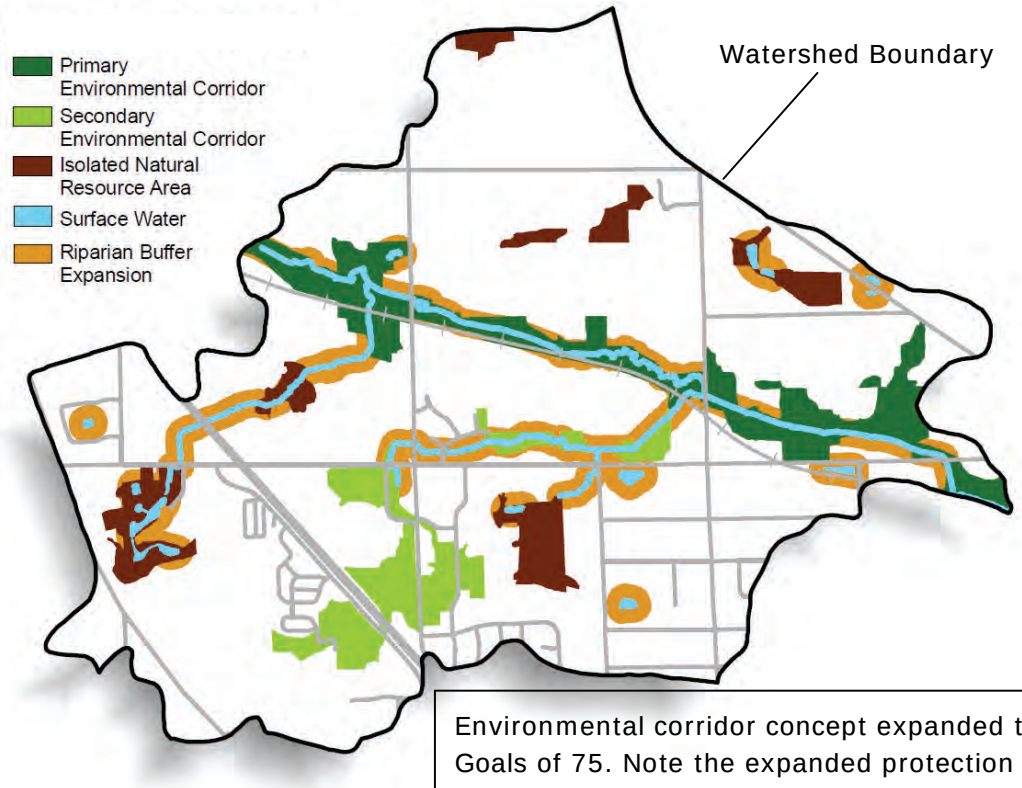


The Minimum Goals of **75** within a Watershed

75% minimum of total stream length should be naturally vegetated to protect the functional integrity of the water resources. (Environment Canada, How Much Habitat is Enough? A Framework for Guiding Habitat Rehabilitation in Great lakes Areas of Concern, Second Edition, 2004)

75 foot wide minimum riparian buffers from the top edge of each stream bank should be naturally vegetated to protect water quality and wildlife. (SEWRPC Planning Report No 50, A Regional Water Quality Management Plan for the Greater Milwaukee Watersheds, December 2007)

Example of how the environmental corridor concept is applied on the landscape. For more information see "Plan on It!" series **Environmental Corridors: Lifelines of the Natural Resource Base** at http://www.sewrpc.org/SEWRPC/LandUse/EnvironmentalCorridors.htm



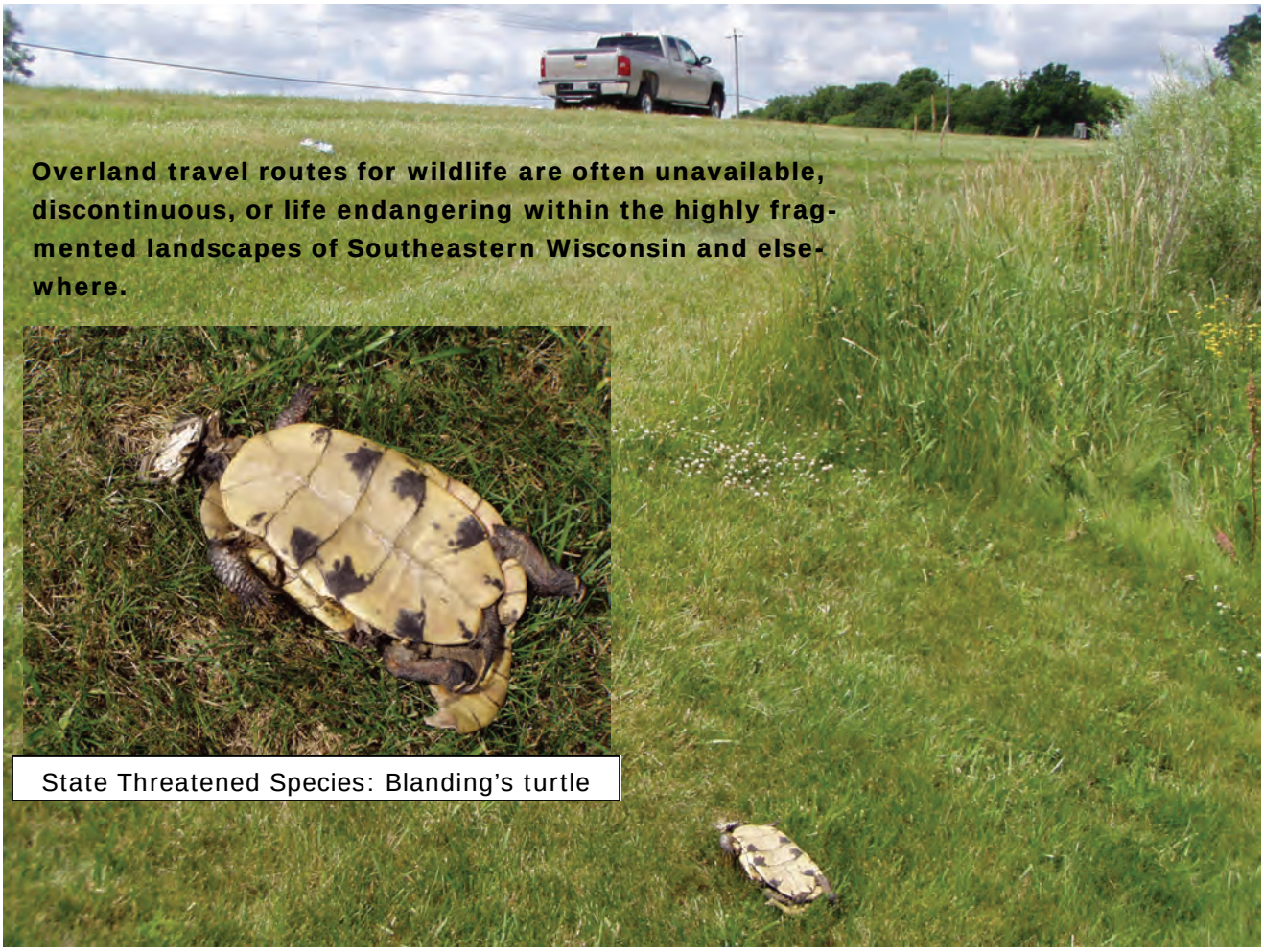
Environmental corridor concept expanded to achieve the Goals of 75. Note the expanded protection in addition to the connection of other previously isolated areas.

Habitat Fragmentation—The Need for Corridors

Southeastern Wisconsin is a complex mosaic of agricultural and urban development. Agricultural lands originally dominated the landscape and remain a major land use. However, such lands continue to be converted to urban uses. Both of these dominant land uses fragment the landscape by creating islands or isolated pockets of wetland, woodland, and other natural lands available for wildlife preservation and recreation. By recognizing this fragmentation of the landscape, we can begin to mitigate these impacts.

New developments should incorporate water quality and wildlife enhancement or improvement objectives as design criteria by looking at the potential for creating linkages with adjoining lands and water features.

At the time of conversion of agricultural lands to urban uses, there are opportunities to re-create and expand riparian buffers and environmental corridors reconnecting uplands and waterways and restoring ecological integrity and scenic beauty locally and regionally. For example, placement of roads and other infrastructure across stream systems could be limited so as to maximize continuity of the riparian buffers. This can translate into significant cost savings in terms of reduced road maintenance, reduced salt application, and limited bridge or culvert maintenance and replacements. This simple practice not only saves the community significant amounts of money, but also improves and protects quality of life. Where necessary road crossings do occur, they can be designed to provide for safe fish and wildlife passage.

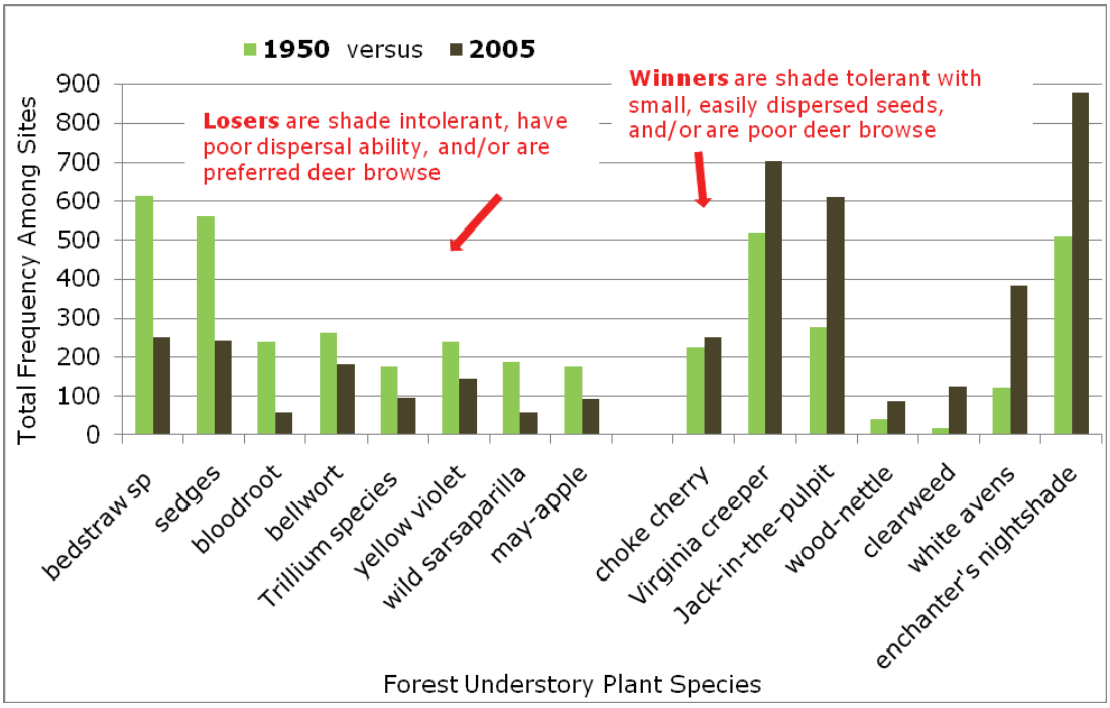


Overland travel routes for wildlife are often unavailable, discontinuous, or life endangering within the highly fragmented landscapes of Southeastern Wisconsin and elsewhere.

State Threatened Species: Blanding's turtle

Habitat Fragmentation—The Need for Corridors

Forest understory plant species abundance among stands throughout Southern Wisconsin



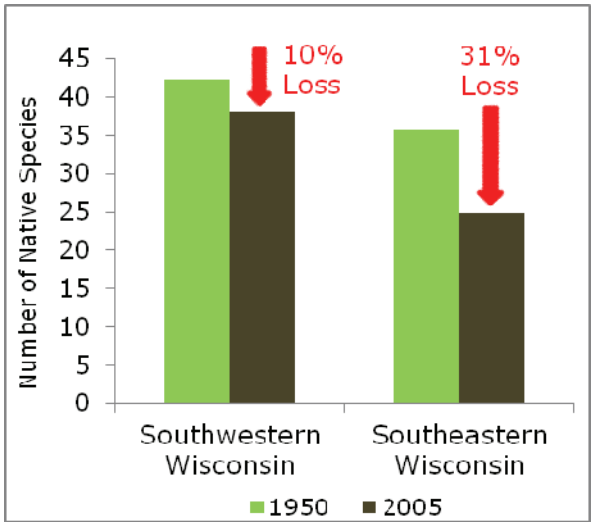
Forest fragmentation has led to significant plant species loss within Southern Wisconsin

(Adapted from David Rogers and others, 2008, Shifts in Southern Wisconsin Forest Canopy and Understory Richness, Composition, and Heterogeneity, Ecology, 89 (9): 2482-2492)

"...these results confirm the idea that large intact habitat patches and landscapes better sustain native species diversity. It also shows that people are a really important part of the system and their actions play an increasingly important role in shaping patterns of native species diversity and community composition. Put together, it is clear that one of the best and most cost effective actions we can take toward safeguarding native diversity of all types is to protect, enhance and create corridors that link patches of natural habitat."
Dr. David Rogers, Professor of Biology at the University of Wisconsin-Parkside

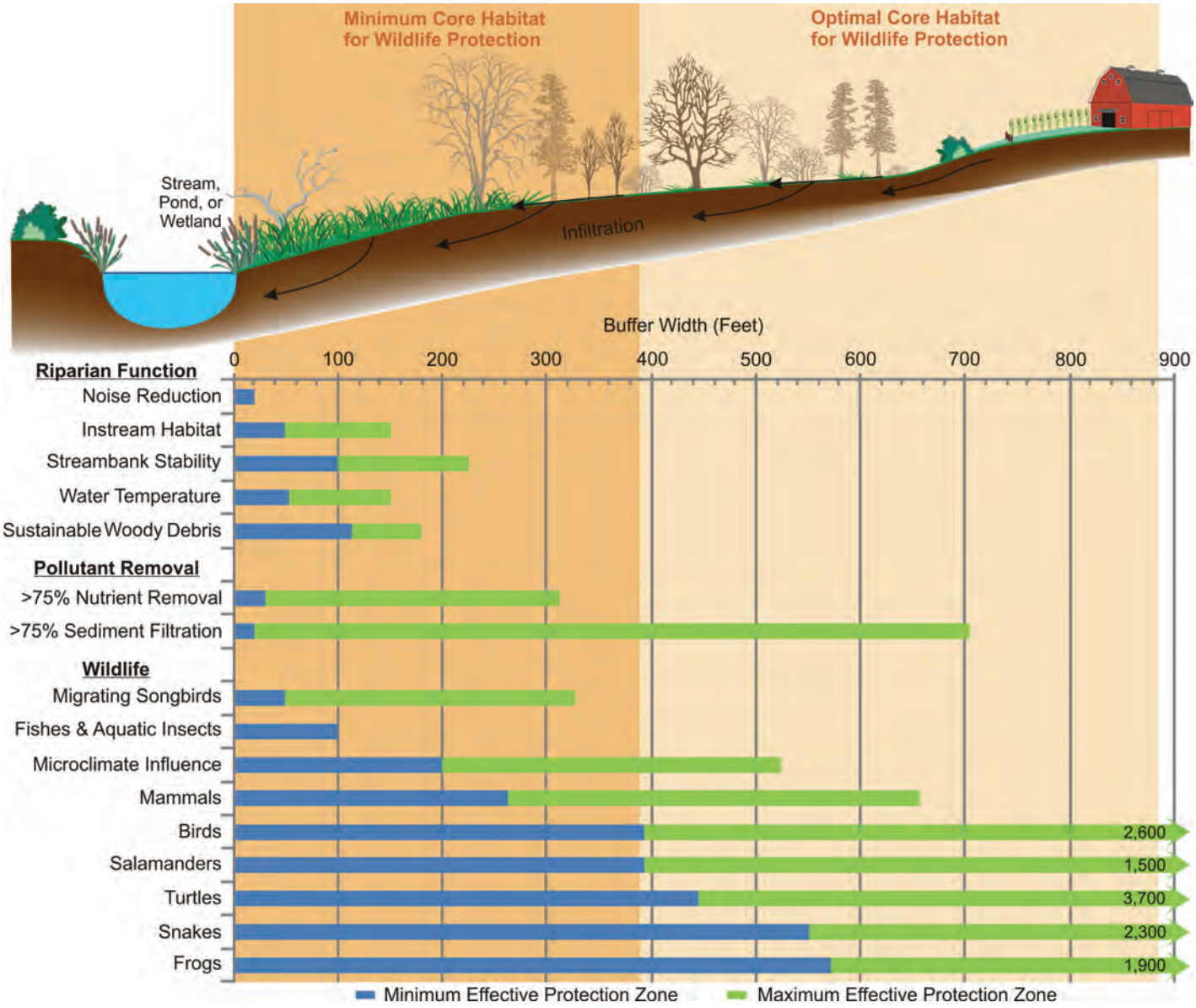
Since the 1950s, forests have increasingly become more fragmented by land development, both agricultural and urban, and associated roads and infrastructure, which have caused these forests to become isolated "islands of green" on the landscape. In particular, there has been significant loss of forest understory plant species over time (shrubs, grasses, and herbs covering the forest floor.) It is important to note that **these forests lost species diversity even when they were protected as parks or natural areas**.

One major factor responsible for this decline in forest plant diversity is that routes for native plants to re-colonize isolated forest islands are largely cut-off within fragmented landscapes. For example, the less fragmented landscapes in Southwestern Wisconsin lost fewer species than the more fragmented stands in Southeastern Wisconsin. In addition, the larger-sized forests and forests with greater connections to surrounding forest lands lost fewer species than smaller forests in fragmented landscapes.



Wider is Better for Wildlife

Why? Because buffer size is the engine that drives important natural functions like food availability and quality, access to water, habitat variety, protection from predators, reproductive or resting areas, corridors to safely move when necessary, and help in maintaining the health of species' gene pools to prevent isolation and perhaps extinction.



One riparian buffer size does not fit all conditions or needs. There are many riparian buffer functions and the ability to effectively fulfill those functions is largely dependent on width. Determining what buffer widths are needed should be based on what functions are desired as well as site conditions. For example, as shown above, water temperature protection generally does not require as wide a buffer as provision of habitat for wildlife. Based on the needs of wildlife species found in Wisconsin, the minimum core habitat buffer width is about 400 feet and the optimal width for sustaining the majority of wildlife species is about 900 feet. Hence, the value of large undisturbed parcels along waterways which are part of, and linked to, an environmental corridor system. The minimum effective buffer width distances are based on data reported in the scientific literature and the quality of available habitats within the context of those studies.

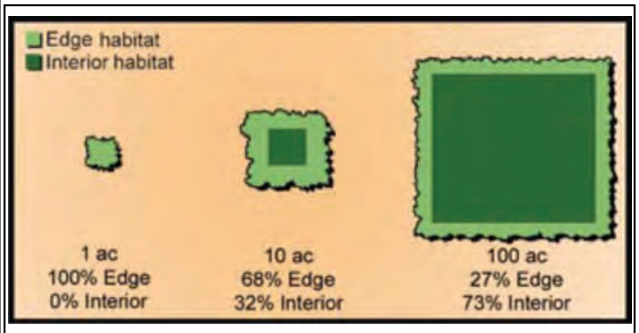
Wider is Better for Wildlife

Wildlife habitat needs change within and among species. **Minimum Core Habitat and Optimum Core Habitat distances were developed from numerous studies to help provide guidance for biologically meaningful buffers to conserve wildlife biodiversity.** These studies documented distances needed for a variety of biological (life history) needs to sustain healthy populations such as breeding, nesting, rearing young, foraging/feeding, perching (for birds), basking (for turtles), and overwintering/dormancy/hibernating. These life history needs require different types of habitat and distances from water, for example, one study found that Blanding's turtles needed approximately 60-foot-wide buffers for basking, 375 feet for overwintering, and up to 1,200 feet for nesting to bury their clutches of eggs. Some species of birds like the Blacked-capped chickadee or white breasted nuthatch only need about 50 feet of buffer, while others like the wood duck or great blue heron require 700-800 feet for nesting. Therefore, **understanding habitat needs for wildlife species is an important consideration in designing riparian buffers.**

Although *Ambystoma* salamanders require standing water for egg laying and juvenile development, most other times of the year they can be found more than 400 feet from water foraging for food.

Wisconsin Species	Mimimum Core Habitat (feet)	Optimum Core Habitat (feet)	Number of Studies
Frogs	571	1,043	9
Salamanders	394	705	14
Snakes	551	997	5
Turtles	446	889	27
Birds	394	787	45
Mammals	263	No data	11
Fishes and Aquatic Insects	100	No data	11
Mean	388	885	

This approach was adapted from *R.D. Semlitsch and J.R. Bodie, 2003, Biological Criteria for Buffer Zones around Wetlands and Riparian Habitats for Amphibian and Reptiles, Conservation Biology, 17(5):1219-1228*. These values are based upon studies examining species found in Wisconsin and represent mean linear distances extending outward from the edge of an aquatic habitat. The Minimum Core Habitat and Optimum Core Habitat reported values are based upon the mean minimum and mean maximum distances recorded, respectively. Due to a low number of studies for snake species, the recommended distances for snakes are based upon values reported by *Semlitsch and Bodie.*

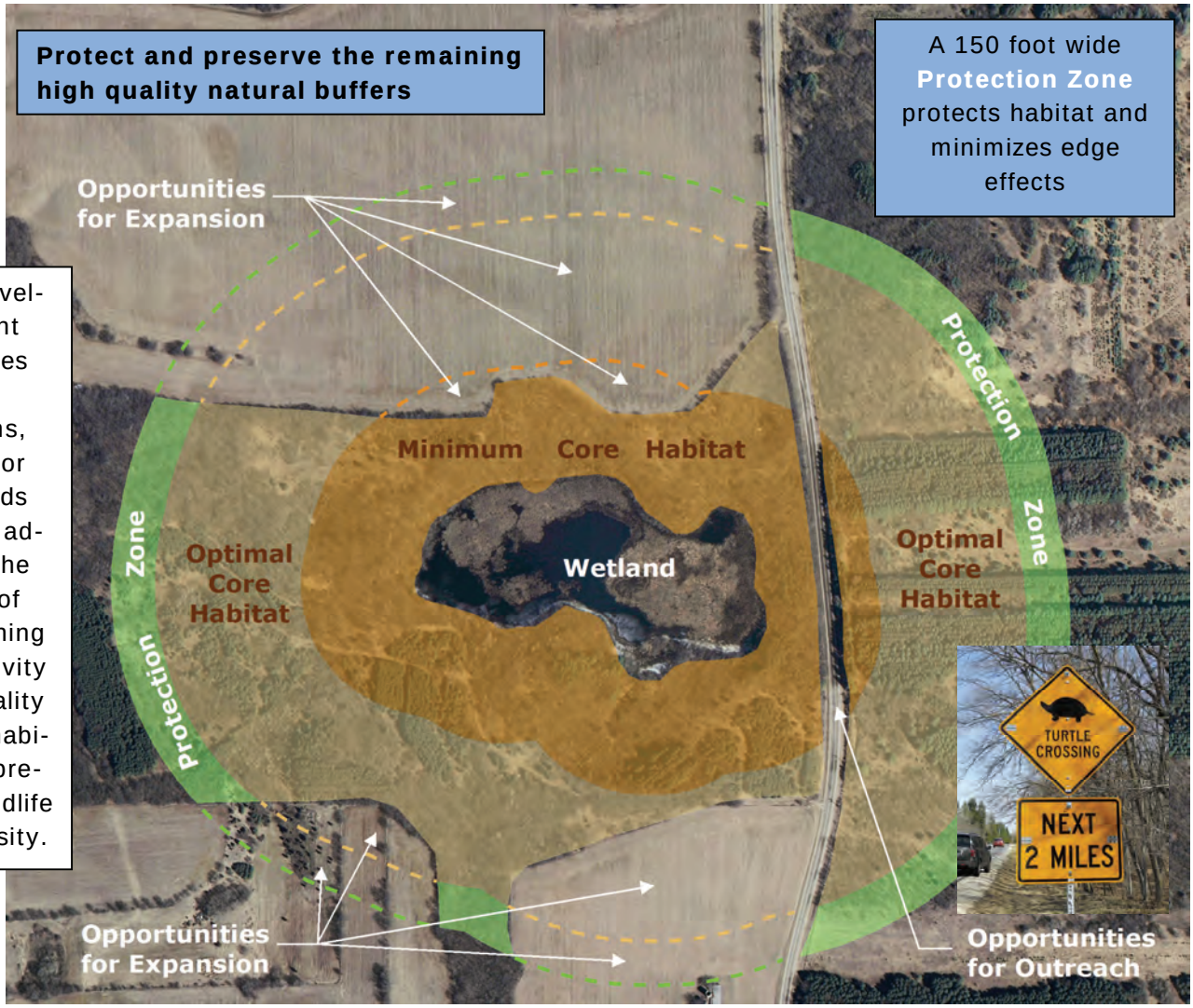


"***Large patches typically conserve a greater variety and quality of habitats, resulting in higher species diversity and abundance."*** *Larger patches contain greater amounts of interior habitat and less edge effects, which benefits interior species, by providing safety from parasitism, disease, and invasive species.*

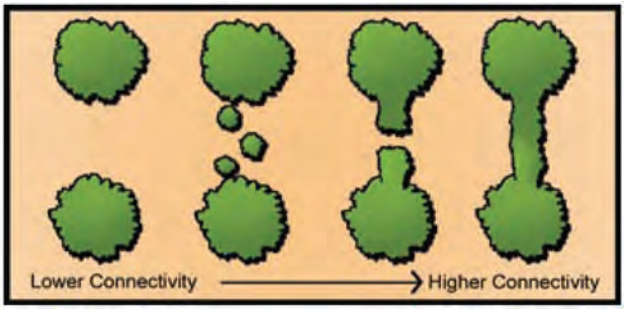
(Bentrup, G. 2008. Conservation buffers: design guidelines for buffers, corridors, and greenways. Gen. Tech. Rep. SRS-109. Asheville, NC: Department of Agriculture, Forest Service, Southern Research Station)

Maintaining Connections is Key

Like humans, all forms of wildlife require access to clean water. Emerging research has increasingly shown that, in addition to water, more and more species such as amphibians and reptiles cannot persist without landscape connectivity between quality wetland and upland habitats. Good connectivity to upland terrestrial habitats is essential for the persistence of healthy sustainable populations, because these areas provide vital feeding, overwintering, and nesting habitats found nowhere else. Therefore, both aquatic and terrestrial habitats are essential for the preservation of biodiversity and they should ideally be managed together as a unit.



Land development practices near streams, lakes, or wetlands need to address the issue of maintaining connectivity with quality upland habitats to preserve wildlife biodiversity.

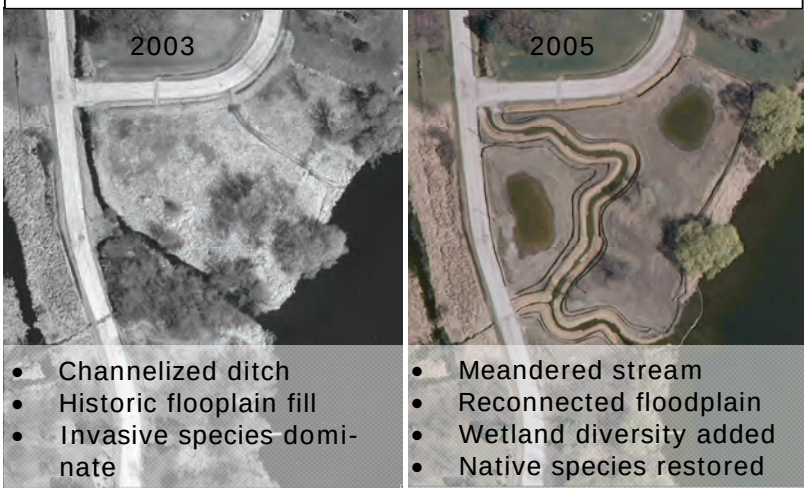


Increasing connectivity among quality natural landscapes (wetlands, woodlands, prairies) can benefit biodiversity by providing access to other areas of habitat, increasing gene flow and population viability, enabling recolonization of patches, and providing habitat (Bentrup 2008).

Basic Rules to Better Buffers

Protecting the integrity of native species in the region is an objective shared by many communities. The natural environment is an essential component of our existence and contributes to defining our communities and neighborhoods. Conservation design and open space development patterns in urbanizing areas and farm conservation programs in rural areas have begun to address the importance of maintaining and restoring riparian buffers and connectivity among corridors.

There are opportunities to improve buffer functions to improve water quality and wildlife habitat, even in urban situations

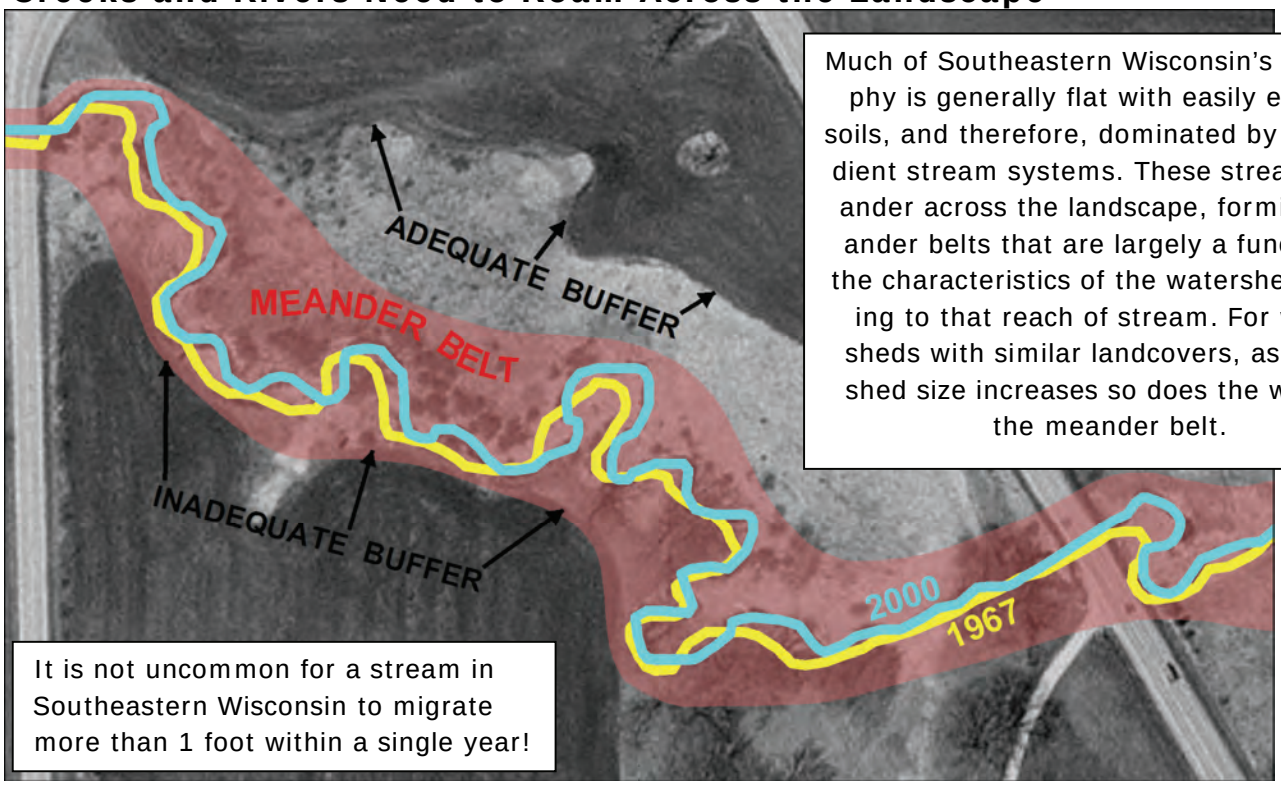


How wide should the buffer be? Unfortunately, there is no one-size-fits all buffer width adequate to protect water quality, wildlife habitat, and human needs. Therefore, the answer to this question depends upon the predetermined needs of the landowner and community objectives or goals.
As riparian corridors become very wide, their pollutant removal (buffering) effectiveness may reach a point of diminishing returns compared to the investment involved. However, the prospects for species diversity in the corridor keep increasing with buffer width. For a number of reasons, 400- to 800-foot-wide buffers are not practical along all lakes, streams, and wetlands within Southeastern Wisconsin. Therefore, communities should develop guidelines that remain flexible to site-specific needs to achieve the most benefits for water resources and wildlife as is practical.

Key considerations to better buffers/corridors:

- Wider buffers are better than narrow buffers for water quality and wildlife functions
- Continuous corridors are better than fragmented corridors for wildlife
- Natural linkages should be maintained or restored
- Linkages should not stop at political boundaries
- Two or more corridor linkages are better than one
- Structurally diverse corridors (e.g., diverse plant structure or community types, upland and wetland complexes, soil types, topography, and surficial geology) are better than corridors with simple structures
- Both local and regional spatial and temporal scales should be considered in establishing buffers
- Corridors should be located along dispersal and migration routes
- Corridors should be located and expanded around rare, threatened, or endangered species
- Quality habitat should be provided in a buffer whenever possible
- Disturbance (e.g. excavation or clear cutting vegetation) of corridors should be minimized during adjacent land use development
- Native species diversity should be promoted through plantings and active management
- Non-native species invasions should be actively managed by applying practices to preserve native species
- Fragmentation of corridors should be reduced by limiting the number of crossings of a creek or river where appropriate
- Restoration or rehabilitation of hydrological function, streambank stability, instream habitat, and/or floodplain connectivity should be considered within corridors.
- Restoration or retrofitting of road and railway crossings promotes passage of aquatic organisms

Creeks and Rivers Need to Roam Across the Landscape



Much of Southeastern Wisconsin's topography is generally flat with easily erodible soils, and therefore, dominated by low gradient stream systems. These streams meander across the landscape, forming meander belts that are largely a function of the characteristics of the watershed draining to that reach of stream. For watersheds with similar landcovers, as watershed size increases so does the width of the meander belt.

It is not uncommon for a stream in Southeastern Wisconsin to migrate more than 1 foot within a single year!

Healthy streams naturally meander or migrate across a landscape over time. Streams are transport systems for water and sediment and are continually eroding and depositing sediments, which causes the stream to migrate. When the amount of sediment load coming into a stream is equal to what is being transported downstream—and stream widths, depths, and length remain consistent over time—it is common to refer to that stream as being in a state of **"dynamic equilibrium."** In other words the stream retains its physical dimensions (equilibrium), but those physical features are shifted, or migrate, over time (dynamic).

Room to Roam

Riparian buffer widths should take into account the amount of area that a stream needs to be able to self-adjust and maintain itself in a state of dynamic equilibrium. … These are generally greater than any minimum width needed to protect for pollutant removal alone.

Streams are highly sensitive, and they respond to changes in the amounts of water and sediment draining to them, which are affected by changing land use conditions. For example, streams can respond to increased discharges of water by increased scour (erosion) of bed and banks that leads to an increase in stream width and depth—or "degradation." Conversely, streams can respond to increased sedimentation (deposition) that leads to a decrease in channel width and depth—or "aggradation."

Why Should You Care About Buffers?

Economic Benefits:

- Increased value of riparian property
- Reduced lawn mowing time and expense
- Increased shade to reduce building cooling costs
- Natural flood mitigation protection for structures or crops
- Pollution mitigation (reduced nutrient and contaminant loading)
- Increased infiltration and groundwater recharge
- Prevented loss of property (land or structures) through erosion
- Greater human and ecological health through biodiversity

Recreational Benefits:

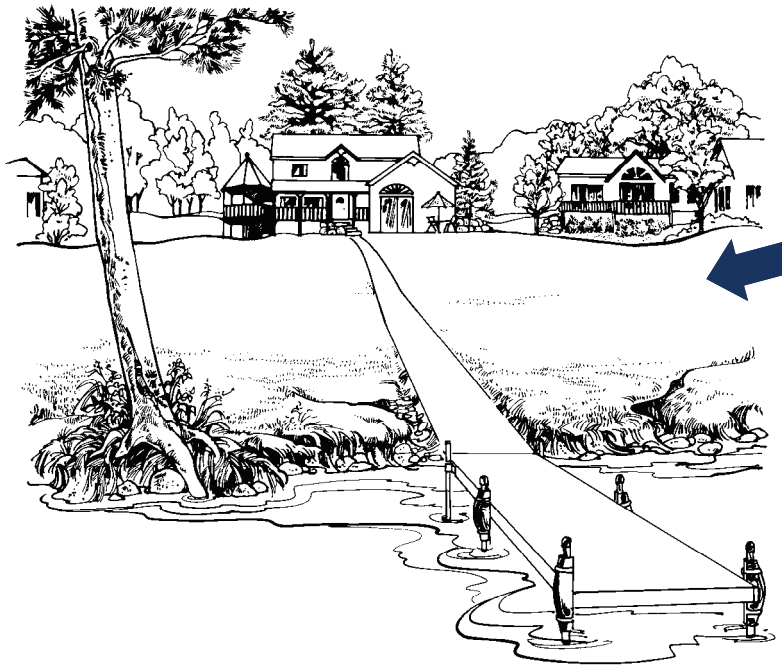
- Increased quality of the canoeing/kayaking experience
- Improved fishing and hunting quality by improving habitat
- Improved bird watching/wildlife viewing quality and opportunities
- Increased potential for expansion of trails for hiking and bicycling
- Opportunities made available for youth and others to locally reconnect with nature

Riparian buffers make sense and are profitable monetarily, recreationally, and aesthetically!

Social Benefits:

- Increased privacy
- Educational opportunities for outdoor awareness
- Improved quality of life at home and work
- Preserved open space/balanced character of a community
- Focal point for community pride and group activities
- Visual diversity
- Noise reduction

A Matter of Balance



University of Wisconsin—Extension

Although neatly trimmed grass lawns are popular, these offer limited benefits for water quality or wildlife habitat. A single house near a waterbody may not seem like a "big deal," but the cumulative effects of many houses can negatively impact streams, lakes, and wetlands.

All the lands within Southeastern Wisconsin ultimately flow into either the Mississippi River or the Great Lakes systems. The cumulative effects of agriculture and urban development in the absence of mitigative measures, ultimately affects water quality in those systems. Much of this development causes increases in water runoff from the land into wetlands, ponds, and streams. This runoff transports water, sediments, nutrients, and other pollutants into our waterways that can lead to a number of problems, including flooding that can cause crop loss or building damage; unsightly and/or toxic algae blooms; increased turbidity; damage to aquatic organisms from reduced dissolved oxygen, lethal temperatures, and/or concentrations of pollutants; and loss of habitat.

Riparian buffers are one of the most effective tools available for defending our waterways. Riparian buffers can be best thought of as forming a living, self-sustainable protective shield. This shield protects investments in the land and all things on it as well as our quality of life locally, regionally, and, ultimately, nationally. Combined with stormwater management, environmentally friendly yard care, effective wastewater treatment, conservation farming methods, and appropriate use of fertilizers and other agrichemicals, **riparian buffers complete the set of actions that we can take to minimize impacts to our shared water resources.**

Lakeshore buffers can take many forms, which require a balancing act between lake viewing, access, and scenic beauty. Lakeshore buffers can be integrated into a landscaping design that complements both the structural development and a lakeside lifestyle. Judicious placement of access ways and shoreline protection structures, and preservation or reestablishment of native vegetation, can enhance and sustain our use of the environment.

University of Wisconsin—Extension

Case Study—Agricultural Buffers

Agricultural nonpoint source pollution runoff continues to pose a threat to water quality and aquatic ecosystems within Wisconsin and elsewhere. In an effort to address this problem, the Wisconsin Buffer Initiative was formed with the goal of designing a buffer implementation program to achieve science-based, cost-effective, water quality improvements (report available online at http://www.soils.wisc.edu/extension/nonpoint/wbi.php).

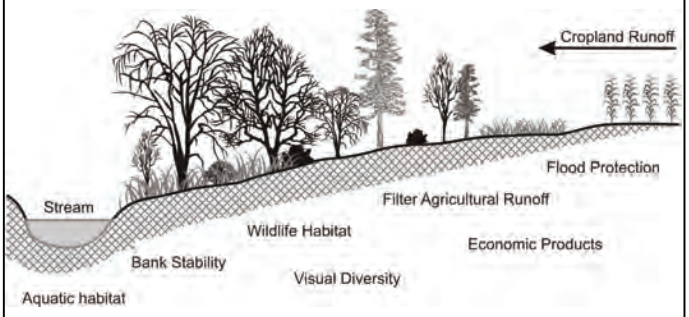
Challenge:
Buffers may take land out of cultivated crop production and require additional cost to install and maintain. Cost sharing, paid easements, and purchase of easements or development rights may sometimes be available to offset costs.

Benefits:
Buffers may offset costs by producing perennial crops such as hay, lumber, fiber, nuts, fruits, and berries. In addition, they provide visual diversity on the landscape, help maintain long-term crop productivity, and help support healthier fish populations for local enjoyment.

While it is true that riparian buffers alone may not always be able to reduce nutrient and sediment loading from agricultural lands, WBI researchers found that "…***riparian buffers are capable of reducing large percentages of the phosphorus and sediment that are currently being carried by Wisconsin streams. Even in watersheds with extremely high loads (top 10%), an average of about 70% of the sediment and phosphorus can be reduced through buffer implementation***." (*Diebel, M.J. and others, 2009, Landscape planning for agricultural nonpoint source pollution reduction III: Assessing Phosphorus and sediment reduction potential, Environmental Management, 43:69-83.*).

Federal and state natural resource agencies have long recognized the need to apply a wide range of Best Management Practices on agricultural lands to improve stream water quality. Although there are many tools available in the toolbox to reduce pollutant runoff from agricultural lands, such as crop rotations, nutrient and manure management, conservation tillage, and contour plowing, riparian buffers are one of the most effective tools to accomplish this task. Their multiple benefits and inter-connectedness from upstream to downstream make riparian buffers a choice with watershed-wide benefits.

Determine what benefits are needed.



The USDA in *Agroforestry Notes* (AF Note-4, January 1997) outlines a four step process for designing riparian buffers for Agricultural lands:

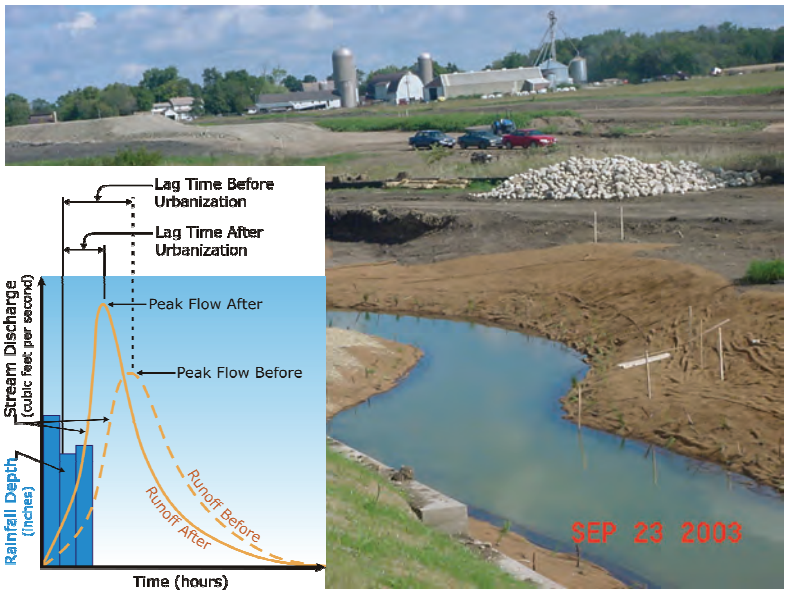
1-Determine what buffers functions are needed
2-Identify the best types of vegetation to provide the needed benefits
3-Determine the minimum acceptable buffer width to achieve desired benefits
4-Develop an installation and maintenance plan

Drain tiles can bypass infiltration and filtration of pollutants by providing a direct pathway to the water and "around" a buffer. This is important to consider in design of a buffer system which integrates with other agricultural practices.

Case Study—Urbanizing Area Buffers

When development occurs near a waterbody, the area in driveways, rooftops, sidewalks, and lawns increases, while native plants and undisturbed soils decrease. As a result, the ability of the shoreland area to perform its natural functions (flood control, pollutant removal, wildlife habitat, and aesthetic beauty) is decreased. In the absence of mitigating measures, one the consequences of urban development is an increase in the amount of stormwater, which runs off the land instead of infiltrating into the ground. Therefore, **urbanization impacts the watershed, not only by reducing groundwater recharge, but also by changing stream hydrology** through increased stormwater runoff volumes and peak flows. This means less water is available to sustain the baseflow regime. The urban environment also contains increased numbers of pollutants and generates greater pollutant concentrations and loads than any other land use. This reflects the higher density of the human population and associated activities, which demand measures to protect the urban water system.

Mitigation of urban impacts may be as simple as not mowing along a stream corridor or changing land management and yard care practices, or as complex as changing zoning ordinances or widening riparian corridors through buyouts.



Comparison of hydrographs before and after urbanization. Note the rapid runoff and greater peak streamflow tied to watershed development. (Adapted from Federal Interagency Stream Restoration Working Group (FISRWG), Stream Corridor Restoration: Principles, Processes, and Practices, October 1998)

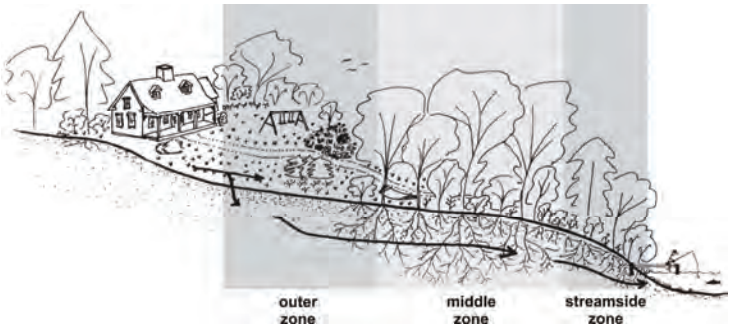
Challenge:

Urban development requires balancing flood protection, water quality protection, and the economic viability of the development.

Opportunities:

Buffers may offset costs by providing adequate space for providing long-term water quantity and water quality protection. In addition, they provide visual diversity on the landscape, wildlife habitat and connectedness, and help maintain property values.

Anatomy of an urban riparian buffer



The most effective urban buffers have three zones:

Outer Zone-Transition area between the intact buffer and nearest permanent structure to capture sediment and absorb runoff.

Middle Zone-Area from top of bank to edge of lawn that is composed of natural vegetation that provides wildlife habitat as well as improved filtration and infiltration of pollutants.

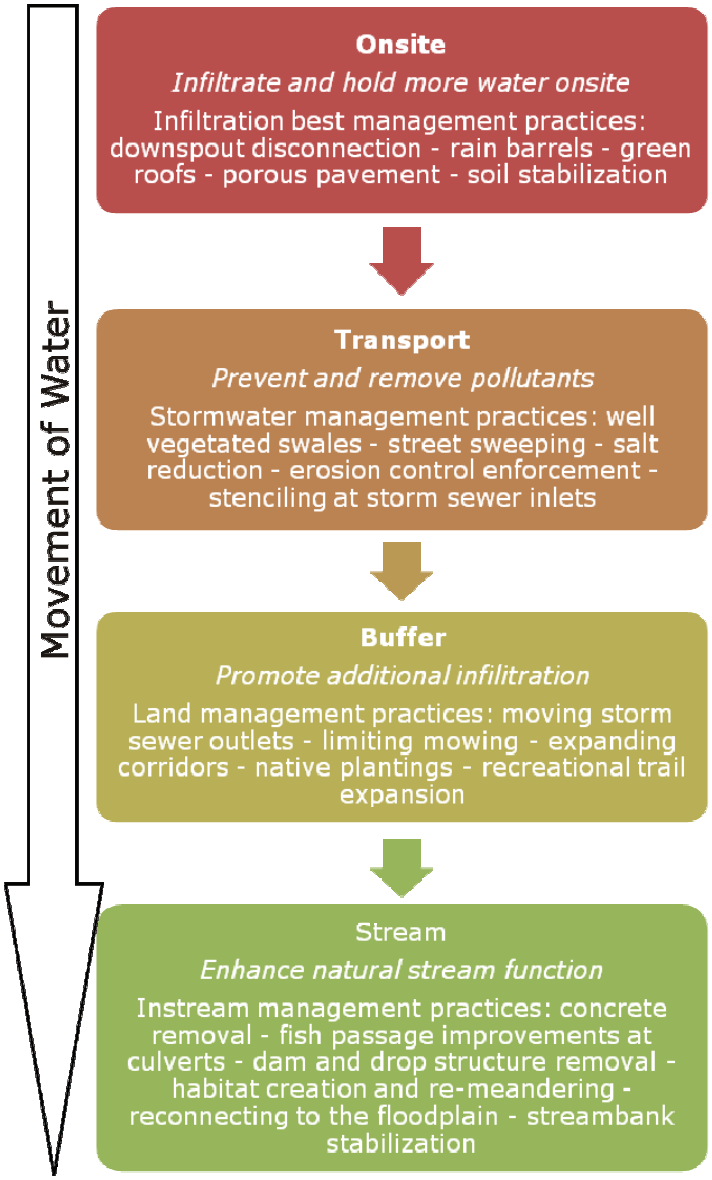
Streamside Zone-Area from the water's edge to the top of the bank or uplands that provides critical connection between water, wetland, and upland habitats for wildlife as well as protect streams from bank erosion

(Fact sheet No. 6 Urban Buffer in the series Riparian Buffers for Northern New Jersey)

Case Study—Urban Buffers

Placement of riparian buffers in established urban areas is a challenge that requires new and innovative approaches. In these areas, historical development along water courses limits options and requires balancing flood management protection versus water quality and environmental protection needs. Consequently, some municipalities have begun to recognize the connections between these objectives and are introducing programs to remove flood-prone structures and culverts from the stream corridors and allow recreation of the stream, restoring floodplains, and improving both the quality of life and the environment.

In urban settings it may be necessary to limit pollution and water runoff before it reaches the buffer.



Challenge:
There are many potential constraints to establishing, expanding, and/or managing riparian buffers within an urban landscape. Two major constraints to establishment of urban buffers include:

1) **Limited or confined space to establish buffers** due to encroachment by structures such as buildings, roadways, and/or sewer infrastructure;
2) **Fragmentation of the landscape** by road and railway crossings of creeks and rivers that disrupt the linear connectedness of buffers, limiting their ability to provide quality wildlife habitat.

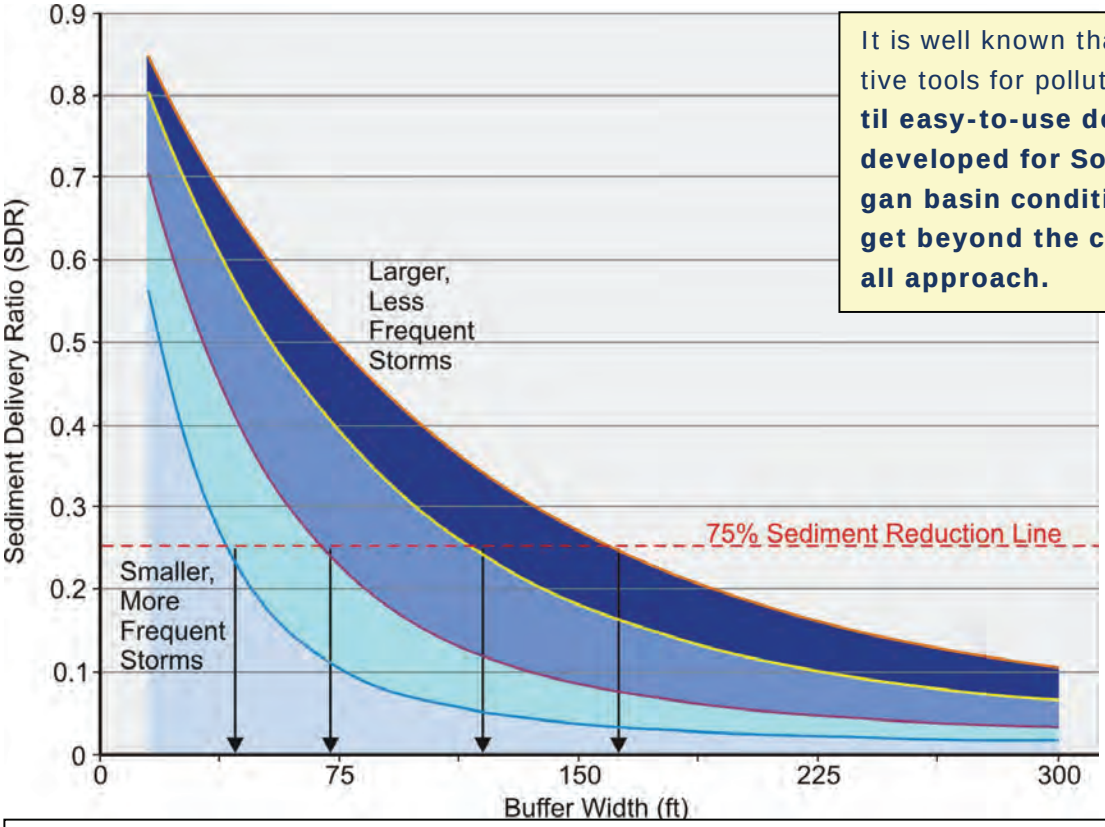
Much traditional stormwater infrastructure intercepts runoff and diverts it directly into creeks and rivers, bypassing any benefits of buffers to infiltrate or filter pollutants. This is important to consider in design of a buffer system for urban waterways, which begin in yards, curbsides, and construction sites, that are figuratively as close to streams as the nearest storm sewer inlet.

A Buffer Design Tool

Design aids are needed to help municipalities, property owners, and others take the "guesswork" out of determining adequate buffer widths for the purpose of water resource quality protection. While there are various complex mathematical models that can be used to estimate sediment and nutrient removal efficiencies, they are not easily applied by the people who need them including homeowners, farmers, businesses and developers.

To fill this gap, design aid tools are being developed using factors such as slope, soils, field length, incoming pollutant concentrations, and vegetation to allow the user to identify and test realistic buffer widths with respect to the desired percent pollutant load reduction and storm characteristics. By developing a set of relationships among factors that determine buffer effectiveness, the width of buffer needed to meet specific goals can be identified.

In the example below, 50-foot-wide buffers are necessary to achieve 75 % sediment removal during small, low intensity storms, while buffers more than 150 feet wide are necessary to achieve the same sediment reduction during more severe storms. Based on this information, decision-makers have the option of fitting a desired level of sediment removal into the context of their specific conditions. Under most conditions, a 75-foot width will provide a minimum level of protection for a variety of needs (SEWRPC PR No. 50, Appendix O.)



It is well known that buffers are effective tools for pollutant removal, but **until easy-to-use design aid tools are developed for Southern Lake Michigan basin conditions, we can never get beyond the current one size fits all approach.**

This generalized graph depicts an example of model output for an optimal buffer width to achieve a 75% sediment reduction for a range of soil and slope, vegetation, and storm conditions characteristic of North Carolina. *(Adapted from Muñoz-Carpena R., Parsons J.E.. 2005. VFSMOD-W: Vegetative Filter Strips Hydrology and Sediment Transport Modeling System v.2.x. Homestead, FL: University of Florida. http://carpena.ifas.ufl.edu/vfsmod/citations.shtml)*

Buffers Are A Good Defense

Today's natural resources are under threat. These threats are immediate as in the case of chemical accidents or manure spills, and chronic as in the case of stormwater pollution carrying everything from eroded soil, to fertilizer nutrients, to millions of drips from automobiles and other sources across the landscape. Non-native species have invaded, and continue to invade, key ecosystems and have caused the loss of native species and degradation of their habitats to the detriment of our use of important resources.

> ***"Riparian ecosystems are naturally resilient,*** *provide linear habitat connectivity, link aquatic and terrestrial ecosystems, and create thermal refugia for wildlife: all characteristics that can contribute to ecological adaptation to climate change."*
>
> *(N. E. Seavy and others, Why Climate Change Makes Riparian Restoration More Important Than Ever: Recommendations for Practice and Research, 2009, Ecological Restoration 27(3):330-338)*

A more subtle, but growing, concern is the case of stresses on the environment resulting from climate change. Buffers present an opportunity for natural systems to adapt to such changes by providing the space to implement protective measures while also serving human needs. **Because riparian buffers maintain an important part of the landscape in a natural condition, they offer opportunities for communities to adjust to our changing world.**

Well-managed riparian buffers are a good defense against these threats. In combination with environmental corridors, buffers maintain a sustainable reserve and diversity of habitats, plant and animal populations, and genetic diversity of organisms, all of which contribute to the long-term preservation of the landscape. Where they are of sufficient size and connectivity, riparian buffers act as reservoirs of resources that resist the changes that could lead to loss of species.

Refuge or protection from increased water temperatures as provided by natural buffers is important for the preservation of native cold-water, cool-water, and warm-water fishes and their associated communities.

Buffers Provide Opportunities

River, lake, and wetland systems and their associated riparian lands form an important element of the natural resource base, create opportunities for recreation, and contribute to attractive and well-balanced communities. These resources can provide an essential avenue for relief of stress among the population and improve quality of life in both urban and rural areas. Such uses also sustain industries associated with outfitting and supporting recreational and other uses of the natural environment, providing economic opportunities. Increasing access and assuring safe use of these areas enhances public awareness and commitment to natural resources. Research has shown that property values are higher adjoining riparian corridors, and that such natural features are among the most appreciated and well-supported parts of the landscape for protection.

We demand a lot from our riparian buffers!

Sustaining this range of uses requires our commitment to protect and maintain them.

Summary

The following guidance suggestions highlight key points to improve riparian corridor management and create a more sustainable environment.

Riparian corridors or buffers along our waters may contain varied features, but all are best preserved or designed to perform multiple important functions.

Care about buffers because of their many benefits. Riparian buffers make sense and are profitable monetarily, recreationally, aesthetically, as well as environmentally.

Enhance the environmental corridor concept. Environmental corridors are special resources which deserve protection. They serve many key riparian corridor functions, but in some cases, could also benefit from additional buffering.

Avoid habitat fragmentation of riparian corridors. It is important to preserve and link key resource areas, making natural connections and avoiding habitat gaps.

Employ the adage "wider is better" for buffer protection. While relatively narrow riparian buffers may be effective as filters for certain pollutants, that water quality function along with infiltration of precipitation and runoff and the provision of habitat for a host of species will be improved by expanding buffer width where feasible.

Allow creeks and rivers room to roam across the landscape. Streams are dynamic and should be buffered adequately to allow for natural movement over time while avoiding problems associated with such movement.

Consider and evaluate buffers as a matter of balance. Riparian buffers are a living, self-sustainable shield that can help balance active use of water and adjoining resources with environmental protection.

Agricultural buffers can provide many benefits. Riparian buffers in agricultural settings generally work well, are cost-effective, and can provide multiple benefits, including possibly serving as areas to raise certain crops.

Urban buffers should be preserved and properly managed. Though often space-constrained and fragmented, urban buffers are important remnants of the natural system. Opportunities to establish or expand buffers should be considered, where feasible, complemented by good stormwater management, landscaping, and local ordinances, including erosion controls.

A buffer design tool is needed and should be developed. Southeastern Wisconsin and the Southern Lake Michigan Basin would benefit from development of a specific design tool to address the water quality function of buffers. Such a tool would improve on the currently available general guidance on dimensions and species composition.

Buffers are a good defense. Combined with environmental corridors, riparian buffers offer a good line of defense against changes which can negatively impact natural resources and the landscape.

MORE TO COME

Future editions in a riparian buffer planning series are being explored with the intent of focusing on key elements of this critical land and water interface. Topics may include:

- Information sharing and development of ordinances to integrate riparian buffers into existing land management plans and programs
- Integration of stormwater management practices and riparian buffer best management practices
- Application of buffers within highly constrained urban corridors with and without brownfield development
- Installation of buffers within rural or agricultural lands being converted to urban uses
- Utilization of buffers in agricultural areas and associated drainage systems
- Integration of riparian buffers into environmental corridors to support resources preservation, recreation and aesthetic uses
- Preservation of stream courses and drainageways to minimize maintenance and promote protection of infrastructure
- Guidance for retrofitting, replacement, or removal of infrastructure such as dams and road crossings, to balance transportation, recreation, aesthetic, property value, and environmental considerations.
- Protection of groundwater recharge and discharge areas
- Protection of high quality, sensitive coastal areas, including preservation of recreational potential

MORE INFORMATION

This booklet can be found at http://www.sewrpc.org/RBMG-no1 . Please visit the website for more information, periodic updates, and a list of complementary publications.

* * *

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Appendix E

WISCONSIN'S HEALTHY LAKES IMPLEMENTATION PLAN

WISCONSIN'S HEALTHY LAKES IMPLEMENTATION PLAN

TABLE OF CONTENTS

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The statewide Healthy Lakes initiative is a true, collaborative team effort. The Healthy Lakes Implementation Plan describes relatively simple and inexpensive best practices that lakeshore property owners can implement. The Plan also includes funding/accountability, promotion, and evaluation information so we can grow and adapt the Plan and our statewide strategy to implement it into the future. Working together, we can make Healthy Lakes for current and future generations.

Design and layout by Amy Kowalski, UWEX Lakes

INTRODUCTION

Wisconsin's lakes define our state, local communities, and our own identities. Fond memories of splashing in the water, seeing moonlight reflect off the lake, and catching a lunker last a lifetime. With over 15,000 lakes dotting the landscape, it's no surprise that fishing alone generates a $2.3 billion economic impact each year , and the majority of property tax base rests along shorelines in some of our counties. Unfortunately, we've learned through science that our love for lakes causes management challenges, including declines in habitat and water quality. In fact, the loss of lakeshore habitat was the number one stressor of lake health at a national scale. Lakes with poor lakeshore habitat tend to have poor water quality. Working together to implement *Wisconsin's Healthy Lakes Implementation Plan* (Plan), we can improve and protect our lakes for future generations to enjoy, as well.

This Plan identifies relatively simple habitat and water quality best practices that may be implemented on the most typical lakeshore properties in Wisconsin. We encourage do-it-yourselfers to use these practices but have also created a Wisconsin Department of Natural Resources (DNR) Lake Classification and Protection Grant *Healthy Lakes* sub-category for funding assistance. Furthermore, local partners like lake groups and counties may choose to integrate the Plan into their lake management, comprehensive planning, and shoreland zoning ordinance efforts.

It's important to consider this plan in the context of the lake and local community's management complexity. The best practices' effectiveness will increase cumulatively with additional property owner participation and depend on the nature and location of the lake. For example, if every property owner implemented appropriate Healthy Lakes best practices on a small seepage lake, also known as a pothole or kettle lake, within a forested watershed, the impact would be greater than on a large impoundment in an agricultural region of Wisconsin. Nevertheless, all lakes will benefit from these best practices, and even with limited impact, they are a piece of the overall lake management puzzle that lakeshore property owners can directly control. More lakeshore property owners choosing to implement Healthy Lakes best practices through time means positive incremental change and eventually success at improving and protecting our lakes for everyone.

GOALS AND OBJECTIVES

Wisconsin's Healthy Lakes Implementation Plan goal is to protect and improve the health of our lakes by increasing lakeshore property owner participation in habitat restoration and runoff and erosion control projects.

- Statewide objective: single-parcel participation in Healthy Lakes will increase 100% in 3 years (i.e. 2015 to 2017).
- Individual lake objective: lake groups or other partners may identify their own habitat, water quality, and/or participation goal(s) through a local planning and public participation process.
  - Partners may adopt this Plan, as is by resolution, or integrate the Plan into a complimentary planning process such as lake management or comprehensive planning.

Wisconsin's Healthy Lakes Implementation Plan, and the diversion and rock infiltration practices in particular, are not intended for heavily developed parcels, sites with large volumes of runoff, or sites with complex problems that may require engineering design. Technical assistance and funding are still available for these sites; contact your county land and water conservation department or local DNR lakes biologist for more information.

The target audience for this Plan and implementation of the associated practices is lakeshore property owners, including: permanent and seasonal homeowners, municipalities, and businesses.

It will be necessary to do additional planning work to implement Wisconsin's Healthy Lakes Plan and, again, the level of effort will depend on the complexity of the lake and its local community. Planning could be as simple as site-specific property visits and development of design plans, to integrating the Plan into a broader and more comprehensive effort. Your lake group, county land and water conservation department, non-profit conservation association, UW-extension lakes specialist or local educator, and/or DNR lake biologist can provide planning guidance or contacts.

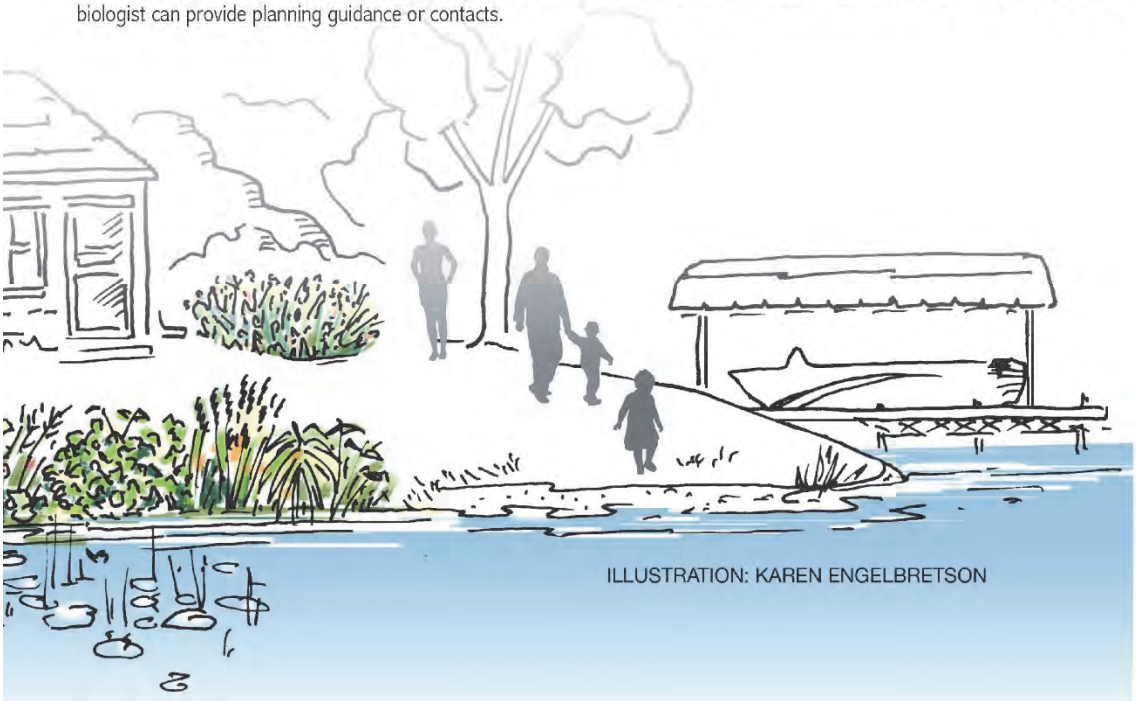


ILLUSTRATION: KAREN ENGELBRETSON

DEFINITIONS

Best practice: a working method, described in detail, which has consistently shown results.

Divert: redirect runoff water.

Habitat: where a plant or animal lives.

Infiltrate: soak into the ground.

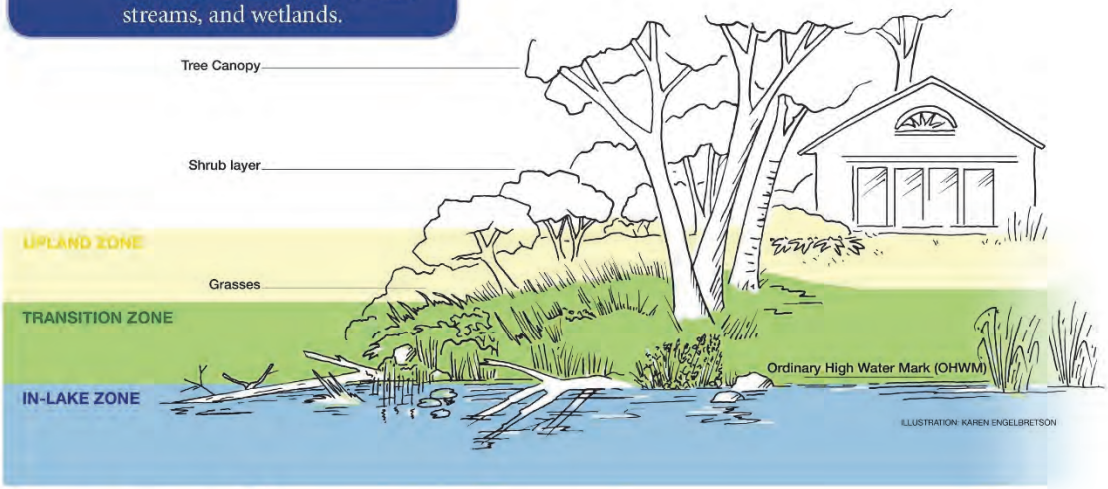
Installed: project cost that includes all materials, labor, and transportation.

Runoff: rain and snowmelt that doesn't soak into the ground and instead moves downhill across land and eventually into lakes, streams, and wetlands.

Wisconsin's Healthy Lakes Implementation Plan divides a typical lakeshore parcel into the following 3 management zones: 1) in-lake, 2) transition, and 3) upland (see illustration below). Best practices are identified for each zone. A team selected these practices based on customer feedback. These practices are:

- relatively simple and inexpensive to implement,
- appropriate for typical lakeshore properties, and
- beneficial to lake habitat and/or water quality.

The Plan also provides cost ranges and averages and technical, regulatory, and funding information for each practice. Fact sheets for each best practice support the Plan and provide more technical detail, and additional guidance is referenced if it currently exists. There is also a funding and administration FAQ fact sheet for those considering pursuing Healthy Lakes grants.



BEST PRACTICES

Best practice descriptions follow. Each description defines the practice, identifies lake health benefits, provides cost ranges and averages based on recent projects, and identifies additional technical and regulatory information. The costs provided are installed costs, which include all materials, labor, and transportation but do not include technical assistance, including design and project management/administration work. Cost ranges are a result of geographic location, property conditions like soils and slopes, and contractor supply and proximity to the project site.

ZONE 1: IN-LAKE

PRACTICE 1 | FISH STICKS

...large woody habitat structures that utilize whole trees grouped together resulting in the placement of more than one tree per 50 feet of shoreline. Fish Sticks structures are anchored to the shore and are partially or fully submerged.

Bony Lake, Bayfield County - Pamela Toshner

LAKE HEALTH BENEFITS	Improve fish and wildlife habitat Prevent shoreline erosion
COSTS	**Range** - $100-$1000 per cluster (3-5 trees), installed **Average** - Cost per unit (3-5 trees) averages $500, installed
TECHNICAL REQUIREMENTS	Healthy Lakes Fact Sheet Series: *Fish Sticks* http://tinyurl.com/healthylakes DNR Fish Sticks Best Practices Manual http://dnr.wi.gov (search for *Fish Sticks best practices*)
REGULATORY INFORMATION	DNR: **Habitat Structure - Fish Sticks General Permit** ($303 fee unless DNR grant-funded) Fish Sticks must comply with the local shoreland zoning ordinance. Consult with your county or municipal zoning staff.
HEALTHY LAKES GRANT FUNDING	Maximum of $1000/cluster of 3-5 trees Fish Sticks may be a stand-alone grant activity only if the vegetation protection area (i.e. buffer) complies with local shoreland zoning. If not, the property owner must commit to leaving a 350 ft^2 area un-mowed at the base of the cluster(s) or implement native plantings (Practice 2).

ZONE 2: TRANSITION

PRACTICE 2 | 350 FT² NATIVE PLANTINGS

...template planting plans with corresponding lists of native plants suited to the given function of the plan. The 350 ft² area should be planted adjacent to the lake and include a contiguous area, rather than be planted in patches. Functions are based on the goals for the site. For example, one property owner may want to increase bird and butterfly habitat while another would like to fix an area with bare soil. Native planting functions include the following: lakeshore, bird/butterfly habitat, woodland, low-growing, deer resistant, and bare soil area plantings.

Green Lake, Green Lake County - Lisa Reas

LAKE HEALTH BENEFITS	Improve wildlife habitat Slow water runoff Promote natural beauty
COSTS	**Range** - $480-$2400 for 350 ft² area, installed **Average** - $1000 per 350 ft², installed
TECHNICAL REQUIREMENTS	Healthy Lakes Fact Sheet Series: *350 ft² Native Plantings* http://tinyurl.com/healthylakes 350 ft² Native Plantings Best Practices Manual
REGULATORY INFORMATION	DNR: an aquatic plant chemical control permit may be necessary if using herbicides in or adjacent to the lakeshore. Native plantings must comply with the local shoreland zoning ordinance. Consult with your county or municipal zoning staff.
HEALTHY LAKES GRANT FUNDING	Maximum of $1000/350 ft² native plantings installed and implemented according to the technical requirements. Only one 350 ft² native planting per property per year is eligible for funding. The native plantings dimension must be 350 ft² of contiguous area at least 10 feet wide and installed along the lakeshore. Final shape and orientation to the shore are flexible.

ZONE 2: TRANSITION

PRACTICE 3 | DIVERSION PRACTICE

...includes a water bar, diverter, and broad-based dip. These practices use a berm or shallow trench to intercept runoff from a path or road and divert it into a dispersion area. Depending on the site, multiple diversion practices may be necessary.

http://awwatersheds.org

LAKE HEALTH BENEFITS	Divert runoff water.
COSTS	**Range** - $25-$3750, installed **Average** - $200, installed
TECHNICAL REQUIREMENTS	Healthy Lakes Fact Sheet Series: *Diversion Practice* http://tinyurl.com/healthylakes
REGULATORY INFORMATION	DNR: none. Diversion practices must comply with the local shoreland and floodplain zoning ordinance. Consult with your county or municipal zoning staff.
HEALTHY LAKES GRANT FUNDING	Maximum of $1000/diversion practice installed and implemented according to the technical requirements. Healthy Lakes diversion practice grant funding is not intended for large, heavily developed parcels, sites with large volumes of runoff, or sites with complex problems that may require engineering design.

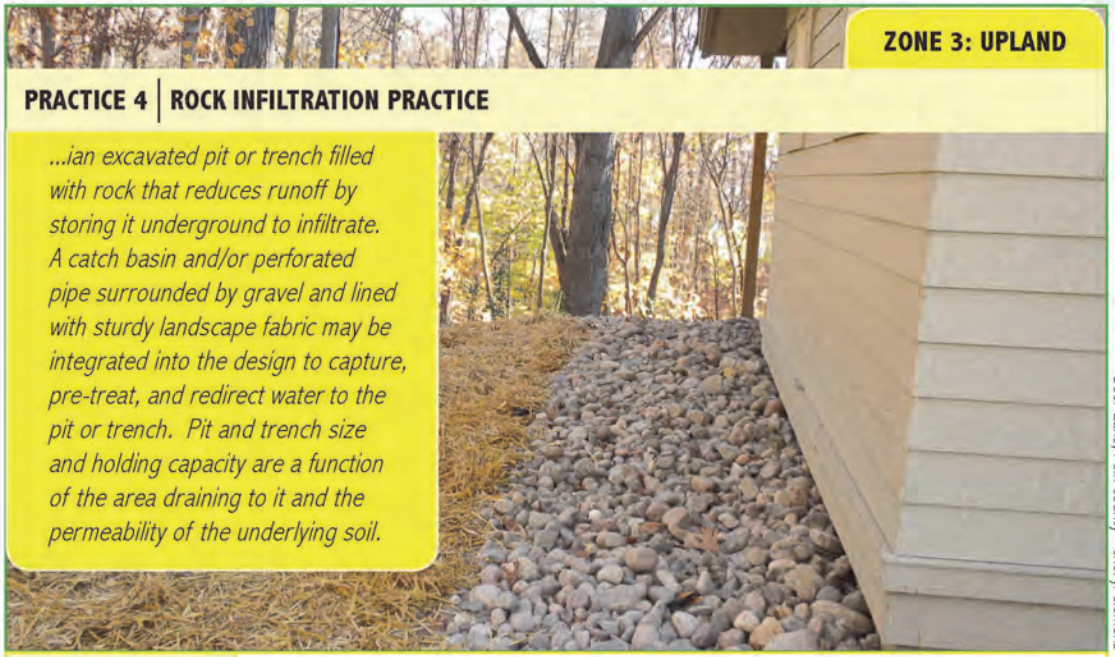
ZONE 3: UPLAND

PRACTICE 3 | DIVERSION PRACTICE

...includes a water bar, diverter, and broad-based dip. These practices use a berm or shallow trench to intercept runoff from a path or road and divert it into a dispersion area. Depending on the site, multiple diversion practices may be necessary.

http://awwatersheds.org

LAKE HEALTH BENEFITS	Divert runoff water.
COSTS	**Range** - $25-$3750, installed **Average** - $200, installed
TECHNICAL REQUIREMENTS	Healthy Lakes Fact Sheet Series: *Diversion Practice* http://tinyurl.com/healthylakes
REGULATORY INFORMATION	DNR: none. Diversion practices must comply with the local shoreland and floodplain zoning ordinance. Consult with your county or municipal zoning staff.
HEALTHY LAKES GRANT FUNDING	Maximum of $1000/diversion practice installed and implemented according to the technical requirements. Healthy Lakes diversion practice grant funding is not intended for large, heavily developed parcels, sites with large volumes of runoff, or sites with complex problems that may require engineering design.



ZONE 3: UPLAND

PRACTICE 4 | ROCK INFILTRATION PRACTICE

...ian excavated pit or trench filled with rock that reduces runoff by storing it underground to infiltrate. A catch basin and/or perforated pipe surrounded by gravel and lined with sturdy landscape fabric may be integrated into the design to capture, pre-treat, and redirect water to the pit or trench. Pit and trench size and holding capacity are a function of the area draining to it and the permeability of the underlying soil.

Deer Lake, Polk County - Cheryl Clemens

LAKE HEALTH BENEFITS	Divert runoff water. Clean runoff water. Infiltrate runoff water.
COSTS	**Range** - $510-$9688 per rock infiltration practice, installed **Average** - $3800 per rock infiltration practice, installed
TECHNICAL REQUIREMENTS	Healthy Lakes Fact Sheet Series: *Rock Infiltration Practice* http://tinyurl.com/healthylakes
REGULATORY INFORMATION	DNR: none. Rock infiltration practices must comply with the local shoreland zoning ordinance. Consult with your county or municipal zoning staff.
HEALTHY LAKES GRANT FUNDING	Maximum of $1000/rock infiltration practice installed and implemented according to the technical requirements. Healthy Lakes rock infiltration practice grant funding is not intended for heavily developed parcels, sites with large volumes of runoff, or sites with complex problems that may require engineering design.

ZONE 3: UPLAND

PRACTICE 5 | RAIN GARDEN

...a landscaped shallow depression with loose soil designed to collect roof and driveway runoff.

Shell Lake, Washburn County - Brent Edlin

LAKE HEALTH BENEFITS	Improve wildlife habitat. Divert runoff water. Clean runoff water. Infiltrate runoff water. Promote natural beauty.
COSTS	**Range** - $500-$9000 per rain garden, installed **Average** - $2500 per rain garden, installed
TECHNICAL REQUIREMENTS	Healthy Lakes Fact Sheet Series: *Rain Garden* http://tinyurl.com/healthylakes *Rain Gardens: A How-to Manual for Homeowners* http://dnr.wi.gov/topic/Stormwater/documents/RgManual.pdf
REGULATORY INFORMATION	DNR: none. Rain gardens must comply with the local shoreland zoning ordinance. Consult with your county or municipal zoning staff.
HEALTHY LAKES GRANT FUNDING	Maximum of $1000/rain garden installed and implemented according to the technical requirements. Healthy Lakes rain garden grant funding is not intended for heavily developed parcels, sites with large volumes of runoff, or sites with complex problems that may require engineering design.

FUNDING AND ACCOUNTABILITY

Administrative details and the application process are described in detail in the DNR's Water Grant Application and Guidelines (http://dnr.wi.gov/ search for surface water grants) and the Healthy Lakes website (http://tinyurl/healthylakes) and *Administration and Funding FAQ* fact sheet.

Healthy Lakes grant funding highlights:

- 75% state share grant with a maximum award of $25,000, including up to 10% of the state share available for technical assistance and project management. Technical assistance and project management do not include labor and are based on the entire state share of the grant, not the best practice caps.
- 25% match from sponsors, participating property owners or other partners. The grant sponsor may determine individual property owner cost share rates, provided the state's share of the practice caps ($1000) and total grant award (75%) are not exceeded. The grant sponsor's match may include technical assistance and project management costs beyond the state's 10% share.
- Sponsor may apply on behalf of multiple property owners, and the property owners do not have to be on the same lake.
- Standard 2-year grant timeline to encourage shovel-ready projects.
- Landowners may sign a participation pledge to document strong interest in following through with the project.
- Standard deliverables, including a signed Conservation Commitment with operation and maintenance information and 10-year requirement to leave projects in place. Also:
  - Native plantings must remain in place according to local zoning specs if within the vegetation protection area (i.e. buffer).
  - Fish Sticks projects require a 350 ft^2 native planting at shoreline base or commitment not to mow, if the property does not comply with the shoreland vegetation protection area (i.e. buffer) specifications described in the local shoreland zoning ordinance.
- Standardized application and reporting forms and process.
- 10% of projects randomly chosen each year for self-reporting and/or professional site visits.

PROMOTION

Wisconsin's Healthy Lakes Implementation Plan will be supported and promoted as a statewide program. Lake groups, counties, towns, villages, cities, and other partners may choose to adopt and implement the Plan as is or to integrate into their own planning processes. Statewide promotion, shared and supported by all partners, includes the following:

- A Healthy Lakes logo/brand.
- A website with plan, practice, and funding detail to be housed on the Wisconsin Department of Natural Resources' and University of Wisconsin-Extension Lakes' websites. It may also include the following:
  - Link to science and supporting plans.
  - Shoreline restoration video.
  - How-to YouTube clips.
  - Tips on how to communicate and market healthy lakeshores.
  - Maps with project locations without personally identifiable information.

EVALUATION OF RESULTS

Wisconsin's Healthy Lakes Implementation Plan and results will be evaluated annually and updated in 2017, if warranted. Best practices may be modified, removed, or added depending on the results evaluation.

Lime Lake, Portage County - Robert Korth

The following information will be collected to support an objective evaluation:

- County and lake geographic distribution and participation in Healthy Lakes projects.
- Lakeshore property owner participation in Healthy Lakes projects, including numbers and locations of best practices implemented.
- Standardized Healthy Lakes grant project deliverable report including:
  - Numbers of Fish Sticks trees and clusters.
  - Dimensional areas restored.
  - Structure/floral diversity (i.e. species richness).
  - Impervious surface area and estimated water volumes captured for infiltration.

The results may be used to model nutrient loading reductions at parcel, lake, and broader scales and to customize future self-reporting options, like plant mortality and fish and wildlife observations, for lakeshore property owners.

ACKNOWLEDGEMENTS

Amy Kowalski

L to R: Patrick Goggin, Jane Malischke, Pamela Toshner, Carroll Schaal, Tom Onofrey, Dave Ferris

Wisconsin's Healthy Lakes Implementation Plan and corresponding technical information and grant funding are the results of a collaborative and participatory team effort. We would like to thank the staff, agency, business, and citizen partners, including *Advanced Lake Leaders*, who provided feedback for our team, including the many partners who completed a customer survey and provided valuable comments during the public review of proposed DNR guidance. We would like to express our gratitude to the following contributors and information sources, respectively: Cheryl Clemens, John Haack, Dave Kafura, Amy Kowalski, Jesha LaMarche, Flory Olson, Tim Parks, Bret Shaw, Shelly Thomsen, Scott Toshner, Bone Lake Management District, Maine Lake Smart Program, and Vermont Lake Wise Program.

We appreciate your continued feedback as our Healthy Lakes initiative evolves into the future. Please contact DNR Lake Biologist Pamela Toshner (715) 635-4073 or pamela.toshner@wisconsin.gov if you have comments or questions.

Appendix F

R.A. SMITH NATIONAL'S SUMMARY OF OPTIONS FOR THE PLEASANT LAKE DRAWDOWN IMPROVEMENTS

R.A. Smith National
Beyond Surveying and Engineering

April 24, 2014

Mr. David Stamm, Chairman
Pleasant Lake Protection and Rehabilitation District
W4947 Oakwood Drive
East Troy, WI 53120

Re: Summary of Options for the Pleasant Lake Drawdown Improvements

Dear Mr. Stamm:

Pleasant Lake currently has problems associated with the drawdown of the lake during times of increased rainfall. The existing lake outlet consists of a 10-inch diameter pipe from the lake to east of Pleasant Lake Road, for a total length of approximately 770 feet. The end of the pipe in the lake has been lifted, possibly by ice, and the invert is at 880.78 feet, which is higher than the Wisconsin Department of Natural Resources (WDNR) approved lake elevation of 880.6 feet. The higher pipe invert means that the lake elevation will need to rise to 880.78 feet before any flow leaves the lake and the pipe would only flow full when the lake elevation is higher than the top of the pipe (881.61 feet.)

The existing pipe has two 90 degree bends that do not occur at manholes and are difficult to clean, which reduces the flow from the lake. The drainage east of Pleasant Lake Road is assumed to be a pipe that flows freely to an outlet northeast of Hancock Lane. Verification that there is free flow of water to the east was not part of our scope of work and our assumption is based on observations made by PLPRD (and us) at the manhole on Hancock Lane, west of Pleasant Lake Road.

The lake drainage was evaluated in 1988 by Paul Johnson from our company who is now retired. Part of the recommendation at that time was to create a swale between the lake and the small pond located south of Hancock Lane. Regulations have changed since 1988. The WDNR has stated that any pipe or swale connection between the two water bodies would be considered a breach of the lake and, essentially, a lake enlargement and could not be permitted by them.

To increase flow from the lake during periods of high water, a drop box inlet structure in the lake is recommended. The structure would have a permanent overflow elevation of 880.6 feet as required by the WDNR. Water would flow into the structure to an outlet pipe that would be completely submerged at elevation 880.6 and above. The drop box inlet structure utilizes the entire capacity of the pipe which means higher flow through the pipe and more water leaving the lake during periods of high lake levels.

The amount of flow through the pipe increases with the depth of the pipe below the overflow elevation of 880.6, the size of the pipe, and the slope of the pipe. Initial analyses evaluated up to a 12-inch diameter pipe and an invert 2.5 feet below the overflow elevation. A pipe constructed lower than one foot below the WDNR water level requirement would need a new outlet east of Pleasant Lake Road to accommodate the flows and have a reasonable pipe slope. Since we were not aware of what was downstream east of Pleasant Lake Road, we performed a limited elevation survey this past winter and determined that the elevations would allow a free flowing ditch from the pipe outlet to the wetland area. This option was not pursued further because the Pleasant Lake Protection and Rehabilitation District (PLPRD) did not receive additional grant monies to perform additional design work and wetland delineation, as well as the additional cost it would be for construction of the project.

16745 W. Bluemound Rd., Suite 200 • Brookfield, WI 53005 • (262) 781-1000 • Fax (262) 781-8466
Appleton, WI • Orange, CA • Pittsburgh, PA • rasmithnational.com

After preliminary evaluation of various flow models, the DNR stated that they did not want a pipe larger than 10 inches because of the potentially higher flows to the downstream property. The PLPRD stated that it appeared from viewing the manhole just west of Pleasant Lake Road that there was free flow to the east. The final alternatives are discussed below. All the alternatives except the "Minor Modifications" alternative include a drop box inlet structure in the lake.

Alternatives

1. Construct a two (2) foot deep drop box inlet structure in the lake at or near the current inlet pipe location and install a new 10-inch pipe between the inlet drop structure and the east side of Pleasant Lake Road. From that point, an open ditch would be constructed to the northeast to a point where water can flow by gravity into the wetlands. Work would include a drop box inlet structure at the lake, 770 feet of new pipe, 4 new manholes, approximately 730 feet of open ditching through the wooded area east of Pleasant Lake Road and restoration of disturbed areas. Estimate of probable construction costs is $111,000

2. Construct a one (1) foot deep drop box inlet structure in the lake at or near the current inlet pipe location and install a new 10-inch pipe between the inlet drop structure and the manhole located west of Pleasant Lake Road. No work would be performed beyond that manhole and assumes free flow of water to the east. Work would include a drop box inlet structure at the lake, 670 feet of new pipe, 2 new manholes and restoration of disturbed areas. Estimate of probable construction costs is $55,000

3. Construct a one (1) foot deep drop box inlet structure in the lake at or near the current inlet pipe location and install a new 10-inch pipe between the inlet drop structure and the manhole located where Hancock Lane turns from the west to the southwest. The slope of the pipe would be below recommended pipe slope required to be "self-cleaning" (that is, having velocities at 2 feet per second); however, the pipe would slope to the existing manhole so that it would drain out when there is no flow from the lake. From that point of connection, no work would be performed to the east. Work would include a drop box inlet structure at the lake, 310 feet of new pipe, 2 new manholes and restoration of disturbed areas. Estimate of probable construction costs is $36,000

4. Make minor modifications to the existing system. Work would include installing new manholes at the pipe bends and "line" the pipe with a cured-in-place pipe material that would essentially provide a like-new pipe for better hydraulics. Estimate of probable construction costs is $37,000

Discussion of Alternatives

During the development of alternatives, we considered variations of each alternative to determine how to maximize the drawdown of the lake, while being sensitive to construction costs and the larger picture of making sure that the recommended alternative would service the PLPRD long term. In evaluating the alternatives, we are making a key assumption in that the water that flows out of the manhole near the intersection of Hancock Lane and Pleasant Lake Road does in fact flow freely, without obstruction to the east. Any blockage or grade problems east of Pleasant lake Road can affect the anticipated flows in the pipes west of Pleasant Lake Road.

Alternate 1 includes a two-foot deep drop box inlet structure with the top of the structure being at the water level dictated by the WDNR (880.6). The pipe slopes associated with alternative 1 meet the recommended slopes for self-cleaning the pipe; however, the pipe elevations end up below the existing manhole elevations. This alternative also requires ditching to the east to assure gravity flow. Alternates 2 and 3 include a one-foot drop box structure with slopes in the pipes that are below the recommended minimum. We have compared the resulting draw down time for each of the three alternatives and conclude that in the 100-year storm (5.88 inch storm), the draw down time for alternative 1 is approximately 9 weeks as compared to 11 weeks for the other alternatives. In the ten-year storm (3.62 inch storm), the draw down time for alternative 1 is approximately 4 weeks as compared

to 5 weeks for alternatives 2 and 3. In the 2-year storm (2.57 inch storm), the draw time is approximately the same for all three alternatives at 2 weeks.

Consideration was also given to performing minor repairs to the existing system; however, the repairs noted above would not change the hydraulic characteristics of the current drawdown pipe situation, this does not address the problems identified by the PLPRD.

Recommendation

We recommend pursuing alternative No. 3--based on the fact that the draw down time difference between the three alternatives is not significant and the length of new pipe and manholes is shorter than the others which minimizes construction costs.

When the PLPRD selects an alternative, we will complete the final plans, prepare the specifications and bidding documents, bid the project out and submit the permits to the WDNR. This work can be completed approximately 60 days after the notice of the selected alternative.

Should you have any questions, please contact me at (262) 317-3307 or tim.barbeau@rasmithnational.com.

Sincerely,

Timothy G. Barbeau, PE. RLS
Project Manager

bth:H:\1110155\Doc\EL 140424 Stamm Report TGB.docx

Appendix G

WDNR COMPLETED SENSITIVE AREA DESIGNATION FOR PLEASANT LAKE

Final – March 5, 2009

Pleasant Lake (Walworth County, Wisconsin)
Integrated Sensitive Area Report

Assessment Dates:	August 17, 2005 August 29, 2005 October 11, 2005 July 5, 2006
Number of Sensitive Areas Surveyed:	4 total
Site Evaluators:	Doug Welch, Fisheries Biologist Jenny Herrmann, Wildlife Technician Heidi Bunk, Lakes Biologist Pam Schense, Water Regulation and Zoning Ozzie Mohr, Commissioner Lars Higdon, Lake Resident Rick Callaway, Town Appointed Commissioner Doug Behrens, Commissioner
Authors:	Mike Hemmingsen, Water Resources Specialist Heidi Bunk, Lakes Biologist

General Lake Information

Pleasant Lake is located in north central Walworth County near the intersection of Highway 67 and Highway 20. The lake has an area of approximately 154 acres, a maximum depth of about 29 feet, and an average depth of approximately 12.4 feet. Pleasant Lake is an ice block kettle at the border of a terminal moraine and outwash terrace. The steep slopes on all but the southeast side of the lake represent moraine deposits while the gentler terrain southeast of the lake reflects outwash deposits.

The Pleasant Lake watershed (drainage basin) is approximately 216 acres. Land use within the watershed consists of 91 acres of agricultural land, 60 acres of low density residential area, 55 acres of woodlands, and 10 acres of wetlands. Data from observation wells indicates that the western half of the lake is a region of groundwater inflow and the eastern half of the lake is a region of groundwater outflow.

Pleasant Lake now has multiple recreational uses including the seasonal activities of: fishing, pleasure boating, swimming, small craft sailing, ice fishing, cross-country skiing, ice-skating, and hunting. The lake also provides natural scenic beauty throughout the year, and opportunities for walking, jogging, bird watching, and picnicking. The entire lake is “Slow, No Wake”.

Pleasant Lake supports a moderately diverse fish population. Northern pike, walleye, largemouth bass, forage fish and panfish are all present on the lake. Doug Welch, DNR Fisheries Biologist, conducted an electrofishing survey in May 2000. A fyke net survey and seine net survey was conducted in August 2000. Bluegill and largemouth bass were the most numerous fish found in the lake. The average length of bluegill caught was 5.7 inches, with a range of 1.4 inches to 7.8 inches. The average length of largemouth bass caught was 10.5 inches, with a range of 5.4 inches to 15.9 inches. The surveys also documented warmouth, pumpkinseed, yellow bullhead, grass pickerel, brown bullhead, rock bass, Iowa darter and johnny darter. The next fish survey is scheduled for 2008.

Exotic Species

Exotic species, most notably zebra mussels, Eurasian watermilfoil, and purple loosestrife have invaded southeastern Wisconsin lakes. Boaters traveling from lake to lake often facilitate the propagation of exotic species. The introduction of exotic species into a lake ecosystem can lead to a decline in the native plant population and cause problems with nutrient loading. Also, the disturbance of lake bottoms from human activity (boating, plant harvesting, chemical treatments, etc.) enhances the colonization and/or expansion of exotic species. Two simple steps to prevent the spread of exotic species include 1) Removing aquatic plants, animals, and mud from trailers and boats before leaving the water access; and 2) Draining water from boats, motors, bilges, live wells, and bait containers before leaving the water access.

Eurasian watermilfoil is present in Pleasant Lake. Eurasian watermilfoil is one of eight milfoil species currently found in Wisconsin. It is often misidentified as one of its seven native cousins, and vice versa. In many areas within the Lakes, this non-native milfoil has established large monocultures and out competed many native plants. These dense beds of milfoil not only impede the growth of native plant species but also inhibit fish movement and create navigational problems for boaters.

The regenerative ability of Eurasian watermilfoil is another obstacle when attempting to control this species. Fragments of Eurasian watermilfoil detached by harvesting, boating, and other recreational activities can float to non-colonized areas of the lake or downstream to additional lakes in the drainage system and create new colonies. Therefore, when controlling Eurasian watermilfoil, selective chemicals and harvesting, coupled with skimming, often produces the best results. In some lakes, biological agents such as the milfoil weevil have helped suppress milfoil populations. However, the most effective “treatment” of exotic milfoil is prevention through public education.

Curly-leaf pondweed is another submerged, exotic species found in Many Wisconsin lakes. Like Eurasian watermilfoil, curly-leaf often grows into large,

homogenous stands. It can crowd out native vegetation, create navigational problems, and limit fish movement. Curly-leaf pondweed dies off in mid-summer, increasing nutrient availability in the water column. This often contributes to summer algal blooms and decreasing water quality.

The unusual life cycle of curly-leaf pondweed makes management difficult. The plant germinates as temperatures decrease in fall. Curly-leaf is highly tolerant of cold temperatures and reduced sunlight, continuing to grow under lake ice and snow cover. With ice-off and increasing water temperatures in the spring, the plant produces fruit, flowers, and buds (turions). Turions are the main reproductive mechanism of curly-leaf. To control the species in lakes, the plant must be combated before turions become viable. Most plant harvesters have not started cutting when curly-leaf is most susceptible and a small window of opportunity exists for chemical treatment. Therefore, prevention through public education is once again very important.

Purple loosestrife, a hardy perennial native to Europe, is another exotic species common to Wisconsin. Since its introduction to North America in the early 1800s, purple loosestrife has become common in gardens and wetlands, and around lakes, rivers, and roadways. The species is highly invasive and thrives in disturbed areas. Purple loosestrife plants often out compete native plants, resulting in the destruction of food, cover, and nesting sites for wildlife and fish.

Purple loosestrife most often spreads when seeds adhere to animals. Humans should be aware of picking up seeds on clothing and equipment when in the vicinity of the plant. Loosestrife can be controlled manually, biologically, or with a broad-leaf herbicide. Young plants can be pulled, but adult plants have large root structures and must be excavated with a garden fork. Biological control is most effective on large stands of purple loosestrife. Five different insects are known to feed on this plant. Four of those have been used as control agents in the United States. Of the five species, *Galerucella pusilla* and *G. calmariensis* are leaf-eating beetles; *Nanophyes brevis* and *N. marmoratus* are flower-eating beetles; and *Hylobius trasversovittatus* is a root-boring weevil. Only *N. brevis* has not been released in the United States (WDNR 2003). Lastly and most importantly, prevention through public education plays an important role in the management of this species.

Shoreland Management

Wisconsin's Shoreland Management Program, a partnership between state and local governments, works to protect clean water, habitat for fish and wildlife, and natural scenic beauty. The program establishes minimum standards for lot sizes, structural setbacks, shoreland buffers, vegetation removal, and other activities within the shoreland zone. The shoreland zone includes land within 1000 feet of lakes, 300 feet of rivers, and floodplains. Current research shows that present standards are probably inadequate for the protection of water resources (Woodford and Meyer 2003, Garn 2002). Therefore,

many communities have chosen to go beyond minimum standards to ensure protection of our natural resources. This report provides management guidelines for activities within the lake and in the immediate shoreland areas. Before any recommendations in this report are completed, please check with the Department of Natural Resources and local units of government for required approvals.

Walworth County administers several ordinances that help protect the water quality, recreational use, scenic beauty and wildlife habitat of Pleasant Lake. Walworth County regulates the use, development and construction activities on land adjacent to Pleasant Lake. The Walworth County Shoreland Zoning Ordinance limits vegetation removal, earth movements, placement of structures, water view and water access within 1000 feet of the edge of Pleasant Lake.

The Walworth County Zoning Ordinance and Subdivision Ordinance includes Conservation Development Design Standards as a tool to protect the County's resource base, including County lakes and lakeshores. Walworth County also requires Construction Site Erosion Control Plans and Post-construction Storm Water Management Plans on most construction sites and developments.

The Town of LaGrange has developed local ordinances regarding pyramiding (Ordinance 2005-001), piers (Ordinance 2001-02), fertilizers (Ordinance 03-007) and conservation subdivisions (Ordinance 2004-04). Pyramiding is defined as "the use of a lot zoned for residential use in a manner that increases the number of persons who have access to a lake, to a greater degree than would occur if a single family property owner were using a single lot fronting on a lake." The conservation subdivision ordinance for the Town of LaGrange adopts the Walworth County ordinance.

A vital step in protecting our water resources is to maintain effective vegetative buffers. A shoreland buffer should extend from the water onto the land at least 35 to 50 feet. Studies have shown that buffers less than 35 feet are not effective in reducing nutrient loading. (Wenger, 1999) Wider buffers of 50 feet or more can help provide important wildlife habitat for songbirds, turtles, frogs, and other animals, as well as filter pollutants from runoff. (Castelle 1994) In general, no mowing should occur in the buffer area, except perhaps in a viewing access corridor. The plant composition of a buffer should match the flora found in natural Wisconsin lakeshores. A buffer should include three layers - herbaceous, shrub, and tree.

In addition, citizens living on Pleasant Lake and the community at large should investigate other innovative ways to reduce the impacts of runoff flowing into the lake while improving critical shoreline habitat (see A. Greene 2003). This may include the use of phosphorus-free fertilizers, installing rain gardens, setting the lawnmower at a higher mower height, decreasing the area of impervious surfaces, or restoring aquatic plant communities.

Introduction

Department personnel conducted Pleasant Lake sensitive area designation surveys on August 17, 2005, August 29, 2005, October 11, 2005 and July 5th, 2006, following the Wisconsin Department of Natural Resources' sensitive area survey protocol. This study utilized an integrated team of DNR resource managers with input from multiple disciplines: water regulation and zoning, fisheries, lake biology, and wildlife. Four lake residents also participated in the survey.

Sensitive areas are defined in Wisconsin Administrative Code NR 107.05 (3)(i)(1) 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 to the body of water*. **Department resource managers determined that the entire lake met the criteria, with the exception of select portions of the developed shoreline. Three shoreline areas are excluded from the shore out to 60 feet** (see Map 1).

The companion document, *Guidelines for Protecting, Maintaining, and Understanding Lake Sensitive Areas*, provides additional information to help interpret lake sensitive area reports. The document is designed to help people understand the important factors that determine the health of a lake's ecosystem. It discusses aquatic plant sensitive areas, shoreland use and lakeshore buffers, gravel and coarse rock rubble habitat, large woody cover, and various water regulation and zoning issues.

Overview of Sensitive Area Designations

Sensitive areas often have aquatic or wetland vegetation, terrestrial vegetation, gravel or rubble lake substrate, or areas that contain large woody cover (fallen trees or logs). These areas provide water quality benefits to the lake, reduce shoreline erosion, and provide habitat necessary for seasonal and/or life stage requirements of fish, invertebrates, and wildlife. A designated sensitive area alerts interested parties (i.e., DNR personnel, county zoning personnel, lake associations, etc.) that the area contains critical habitat vital to sustaining a healthy lake ecosystem, or may feature an endangered plant or animal. Information presented in a sensitive area report may discourage certain permits from being approved within these sites.

Whole Lake Recommendations:

Several recommendations from Department staff pertain to Pleasant Lake as a whole rather than to individual sensitive areas:

1. Native aquatic plant beds should be protected and maintained whether located in the sensitive area or in the excluded shoreline.
2. Prevent the spread of exotic species through sign postings, education, etc. and control exotic species where established.
3. Create shoreland buffers and maintain existing buffers, especially in areas not currently developed.
4. Monitor water quality for early detection of changes and possible degradation.
5. Maintain the whole lake "Slow No Wake" ordinance. This ordinance minimizes boat motor disturbance of aquatic plants, fish and wildlife.
6. Recommendations regarding **local and county zoning**:
    - Strictly enforce shoreland and wetland ordinances by maintaining buffers, removing non conforming structures and limited impervious surfaces
    - New development should comply with the Walworth County Land Use Plan
    - Require a buffer / "no touch" zone for grading projects along the currently undeveloped shoreline. This buffer / "no touch" zone should be at least 100 feet from the edge of the wetland back into the (landward) upland portion of parcels.
    - Require a buffer / "no touch" zone for grading projects located along steep slopes. The zone should extend at least 100 feet from the edge of a steep slope towards the landward side of the parcel.
    - Grading proposals should be strictly examined for superior erosion control and nutrient management plans.
    - Maintain Town of LaGrange Ordinance 2004-04, An Ordinance to Amend the Land Division Ordinance and Adopt Conservation Development Design for Subdivisions.
    - Maintain Town of LaGrange Ordinance 2005-001, An Ordinance to Regulate Access to Lakes Within the Town of LaGrange (Pyramiding).
    - Maintain Town of LaGrange Ordinance 2006-04, An Ordinance to Regulate Wharfs, Piers and Mooring Facilities and Establish a Pierhead Line for Lauderdale Lakes.
    - Maintain Town of LaGrange Ordinance 03-007, An Ordinance to Regulate Fertilizers Near Lakes.

Resource Value of Sensitive Area Site 1 – Pleasant Lake

Sensitive area 1 is a small bay on the northeast side of Pleasant Lake almost totally isolated from the main lake. This sensitive area is part of Camp Juniper Knoll, operated by the Girl Scouts of Chicago. This approximately three-acre plant community consists of open water, deep marsh, and shallow marsh.

The Southeastern Wisconsin Regional Planning Commission (SEWRPC) conducted a plant survey on sensitive area #1 in 1999. The following 30 plants were observed: marsh fern, broad-leaf cat-tail, narrow-leaf cat-tail, long-leaf pondweed, flat-stemmed pondweed, reed canary grass, spike-rush, soft-stemmed bulrush, hard-stemmed bulrush, river bulrush, sedge, lake sedge, wooly sedge, bottlebrush sedge, lesser duckweed, sand-bar willow, stinging nettle, yellow water lily, silver maple, jewelweed, river-bank grape, purple loosestrife, red osier dogwood, tufted loosestrife, green ash, hoary vervain, cutleaf bugleweed, deadly nightshade, bladderwort, and boneset.

Sensitive area 1 provides northern pike with spawning habitat, nursery area, feeding area, and protective cover. This is unique to Pleasant Lake because of the abundance of water lilies. Largemouth bass, bluegills, pumpkinseed, and yellow perch use the area for feeding, nursery, and for cover from predators. This area is generally not navigable from the main lake.

Management Recommendations for Sensitive Area #1

1. Do not remove fallen trees along the shoreline.

2. A no motor zone is recommended for this area to protect emergent vegetation. No aquatic plant removal (either mechanical or manual) should be permitted.

3. A DNR permit should not be issued for any of the following:

Dredging	Pea gravel/sand blankets
Filling of wetlands	Rip Rap
Aquatic plant screens	New Piers
Boat Ramps	Sea Walls/Retaining Walls
Recreational floating devices	Boardwalks

4. No chemical treatment should be allowed except to target an infestation of an exotic species such as purple loosestrife, Eurasian watermilfoil or curly leaf pondweed. Biological controls such as the purple loosestrife beetle and the milfoil weevil should be considered where appropriate.

Resource Value of Sensitive Area Site 2 – The Bay

Sensitive area 2 is a bay located just east of sensitive area 1 and is known locally as “The Bay.” The area acts as a nutrient buffer to reduce algae blooms, a biological buffer that reduces the likelihood of exotic invasions, a physical buffer that protects against shoreline erosion, and a diverse aquatic plant community that allows for sediment stabilization. See Appendix 1 for a complete list of aquatic plants found in sensitive areas of Pleasant Lake.

Sensitive area habitat includes near-shore terrestrial, shoreline, and littoral zone locations. Bottom substrate is composed of silt and detritus and shoreland buffer consists of 50 percent wooded-wetland and 50 percent developed shoreline. Herbaceous plant growth is present, lawn is common, and trees are abundant on the shoreland buffer. The wetland consists of a deep marsh and large woody cover is present at a rate of 3-6 pieces / 30 meters of shoreline. The natural scenic beauty (NSB) rating is average overall but good on the undeveloped side.

This sensitive area provides excellent spawning habitat for northern pike. Yellow perch will drape their eggs over the submergent vegetation in this area. Excellent nursery, feeding and cover habitat is available for northern pike, largemouth bass, bluegill, pumpkinseed, crappie, yellow perch and minnows. Largemouth bass and bluegill will build spawning nests in areas of this bay where relatively thin layers of silt are underlain with sand and gravel.

Table 3. Plants observed in sensitive area 2.

	Emergent	**Submergent**	**Algae**	**Exotic**
PRESENT (0-25% Cover)	*Pontederia* (pickerelweed) *Scirpus* (bulrush) *Nuphar advena* (yellow water lily)	*Elodea* (waterweed)	Filamentous (algae)	*Myriophyllum spicatum* (Eurasian watermilfoil)
COMMON (26-50% Cover)				
ABUNDANT (51-75% Cover)	*Typha* (cattail)	*Vallisneria* (wild celery)		
DOMINANT (76-100% Cover)	*Nymphaea odorata* (white water lily)	*Utricularia* (bladderwort)	*Chara* (muskgrass)	

Management Recommendations for Sensitive Area # 2

Please note that this section of recommendations makes a distinction between the currently undeveloped shoreline and the currently developed shoreline. Any land that is subsequently developed will still be held to the standard of "currently undeveloped" for the purposes of interpreting this recommendation document. The currently developed shoreline includes portions of the southern shoreline of the bay as well as portions of the eastern shoreline of the bay. Map 2 denotes the "currently developed" shoreline.

1. Do not remove fallen trees along shoreline, except where navigation is impaired. If navigation is impaired by a fallen tree, cut into smaller pieces and place outside of boating lane.

2. The no wake zone should be maintained for this area to protect emergent, submergent and floating leafed aquatic vegetation.

3. No chemical treatment allowed except to target an infestation of an exotic species such as purple loosestrife, Eurasian watermilfoil or curly leaf pondweed. Biological controls such as the purple loosestrife beetle and the milfoil weevil should be considered where appropriate.

4. No **new** mechanical harvesting permits should be issued in this sensitive area. One mechanical harvesting permit is on file (originally issued in 2005). A total of 0.36 acres is permitted for harvesting. The depth of the harvest may not exceed two feet downward from the surface of the water. This permit will continue to be issued but with a time of year restriction (No harvesting before August 1st of any given year starting in 2008). The permit cannot be transferred to a new landowner.

5. Manual removal permits should be limited to a maximum of 20 feet along each landowner's shoreline and a maximum of 30 feet from the shoreline out into the lake. A NR 109 permit is needed for manual removal. Manual removal permits should only be issued in the area where the pier and boats are located for each property and should only be issued along the currently developed shoreline.

6. A DNR permit should not be issued for any of the following along the currently developed shoreline:

Filling of wetlands	Rip Rap
Aquatic plant screens	Recreational floating devices
Sea Walls/Retaining Walls	Pea Gravel/Sand Blankets

7. New piers along the currently developed shoreline will be permitted. The number of moorings allowed will be equal to that listed in State Statutes 30.12 (1g) (f). This would allow for two moorings for the first 50 feet of frontage owned and one additional mooring for each additional 50 feet of frontage owned.

8. Limited dredging to maintain the navigational channel may be considered if the water depth in the navigation channel becomes less than two feet deep. The navigational channel is located mainly along the currently developed shoreline.

9. A DNR permit should not be issued for any of the following along the undeveloped shoreline:

Dredging	Pea gravel/sand blankets
Filling of wetlands	Rip Rap
Aquatic plant screens	Recreational floating devices
Sea Walls/Retaining Walls	New Piers

10. A DNR permit should not be issued for boardwalk or ramp construction along the currently undeveloped shoreline. If condos or a subdivision are built, a rustic canoe access path can be marked.

In summary, the ecological community of Sensitive Area 2 has distinctly unique features when compared to the waterbody due to the abundant native aquatic plants and the undeveloped shoreline. This site provides a visual buffer from shoreline structures, roads, and boat traffic. Aquatic plants in the sensitive area include emergents, algae, potamogetons (pondweeds), exotics, free floating, floating leaf, and submergent vegetation. Wet edge plants include herbs, sedges, rushes, shrubs, and grasses. Game fish, panfish, fryfish and forage fish utilize the sensitive area. Wildlife utilizing the sensitive area include furbearers, waterfowl, shore birds (including wood ducks and brood), amphibians, and reptiles. This site provides an excellent educational area to explore by canoe.

Resource Value of Sensitive Area Site 3 – The Pond

Sensitive area 3, locally known as "The Pond" in Pleasant Lake serves as a wildlife refuge. The area also supports many small fish, green heron, and great blue heron. The substrate in Sensitive Area 3 consists of 2" of silt on top of hard sand. A large amount of woody cover and snags (standing and fallen branches in the water) are present. This sensitive area acts as a nesting area for upland wildlife and a feeding area for ducks. Song birds such as the belted kingfisher use this area for nesting and feeding. Frogs and toads use the sensitive area for shelter/cover, nesting and feeding. Turtles use the area for shelter/cover and feeding. Floating leaf vegetation, shrubs/brush and snag trees are all important habitat components present at this site. Water depth in Sensitive Area #3 is an average of approximately 1.5 feet.

Table 5. Plants observed in sensitive area 3.

	Emergents	**Submergents**	**Exotics**	**Free Floating**
PRESENT (0-25% Cover)		*Potamogeton amplifolius* (large-leaf pondweed) *P. illinoensis* (Illinois pondweed)	*Myriophyllum spicatum* (Eurasian watermilfoil)	
COMMON (26-50% Cover)		*Najas flexilis* (slender naiad) *Vallisneria* (wild celery) *Najas marina* (Spiney naiad) *P. zosteriformis* (flat-stemmed pondweed)		
ABUNDANT (51-75% Cover)		*Stuckenia pectinata* (sago pondweed) *Chara* (muskgrass)		*Nymphaea odorata* (white water lily)
DOMINANT (76-100% Cover)				

Management Recommendations for Sensitive Area # 3

1. Do not remove fallen trees along the shoreline.

2. A no motor zone is recommended for this area to protect emergent and floating leafed vegetation. No mechanical aquatic plant removal should be permitted. Manual removal of exotic species such as Eurasian water milfoil, curly leaf pondweed or purple loosestrife will require a permit.

3. A DNR permit should not be issued for any of the following:

   Dredging
   Filling of wetlands
   Aquatic plant screens
   Boat Ramps
   Recreational floating devices
   Pea gravel/sand blankets
   Rip Rap
   New Piers
   Sea Walls/Retaining Walls

4. Boardwalks will be allowed on a case by case basis to provide open water access only for a riparian landowner. Watercraft moored at the boardwalk must be able to navigate the water without any additional dredging. The number of moorings allowed will be less than "reasonable use" as defined by state law.

5. No chemical treatment should be allowed except to target an infestation of an exotic species such as purple loosestrife, Eurasian watermilfoil or curly leaf pondweed. Biological controls such as the purple loosestrife beetle and the milfoil weevil should be considered where appropriate.

Resource Value of Sensitive Area # 4 – Pleasant Lake

Sensitive area # 4 includes most of the remaining shoreline of Pleasant Lake with the exception of the developed shoreline. Three shoreline areas are excluded from the shore out to 60 feet (see Map 1). Aquatic plants typically noted in this sensitive area included large leaf pondweed, long leaf pondweed, sago pondweed, wild celery, flat stemmed pondweed, Illinois pondweed, slender naiad, water stargrass, spiny naiad, white water lily, chara and Eurasian watermilfoil.

The excluded areas of shoreline lacked aquatic plant diversity, had a higher concentration of exotic species (mainly Eurasian watermilfoil and often lacked plant cover altogether. The three excluded areas are outlined in pink on Map 1 and extend from the shoreline out 60 feet into the water. Sensitive Area #4 includes plant communities along the excluded shoreline that are greater than 60 feet from shore.

The substrate along the majority of the shoreline was either rock, gravel, sand or a combination of the three. Mollusks, mainly snails and native mussels, were found along the majority of the shoreline in Sensitive Area # 4. Shorebirds, especially herons, were documented feeding along many of the sandbars containing mollusks.

Management Recommendations for Sensitive Area # 4

1. Do not remove fallen trees along shoreline, except where navigation is impaired. If navigation is impaired by a fallen tree, cut into smaller pieces and place outside of boating lane.

2. No chemical treatment should be allowed except to target an infestation of an exotic species such as purple loosestrife, eurasian watermilfoil or curly leaf pondweed. Biological controls such as the purple loosestrife beetle and the milfoil weevil should be considered where appropriate.

3. New piers will be permitted. The number of moorings allowed will be less than listed in State Statutes 30.12 (1g) (f). The number of moorings permitted will be limited and based on the carrying capacity of the resource. Boats will likely be required to be grouped on a shared pier to minimize impact.

4. A DNR permit should not be issued for any of the following:

Dredging	Pea gravel/sand blankets
Filling of wetlands	Wetland removal
New sea walls	

5. No new rip rap should be permitted if shoreline littoral zone has emergent vegetation such as bulrush, pickerelweed, sedges, etc. Existing rip rap should be maintained in compliance with Natural Resource Code 328.

6. Manual removal permits should be limited to a maximum of 20 feet along each landowner's shoreline and a maximum of 30 feet from the shoreline out into the lake. A NR 109 permit is needed for manual removal. Manual removal permits should only be issued in the area where the pier and boats are located for each property.

7. No mechanical aquatic plant removal should be permitted. Manual removal of exotic species such as Eurasian water milfoil, curly leaf pondweed or purple loosestrife will require a permit.

CONCLUSION

The majority of Pleasant Lake has been designated as a sensitive area. There are four distinct plant communities and three excluded shorelines. The excluded shorelines contained rip rap or sea walls along the shoreline and the lake bed near the piers was often devoid of vegetation (likely due to boat traffic and hand raking).

Landowners living in the excluded shorelines must still follow all applicable state, county and local permitting requirements. New laws were passed by the State Legislature in 2004. Landowners with existing sea walls that need replacement should check the Department of Natural Resources website to see if replacement is possible. The website can be found at: http://dnr.wi.gov/org/water/fhp/waterway/erosioncontrol.shtml.

Sensitive area 2, locally known as "The Bay" is actively managed by both the Pleasant Lake Management District and individual landowners. Chemical treatment for Eurasian watermilfoil occurs in the spring (by the District), and landowners manually rake up plants. There is one historical harvesting permit issued each year to an individual landowner. The aquatic plant community is very diverse. Management activities conducted in future years need to continue to balance the management of Eurasian watermilfoil and the preservation of valuable native plant species.

A large area of Eurasian watermilfoil is present on the southeast corner of Pleasant Lake. The Pleasant Lake Management District should continue actively managing the area for control of Eurasian watermilfoil.

Pleasant Lake enjoys a largely sandy or rock/cobble substrate as well as a healthy aquatic plant community. Water clarity is generally good. The fish community is moderately diverse. Game fish size structure is slightly below average. Preservation of native plant communities (regardless of location in the lake) will help preserve the value of Pleasant Lake for fish and wildlife.

APPENDIX 1 - Aquatic plants within sensitive areas of Pleasant Lake

Emergent	Area 1	Area 2	Area 3	Area 4
Rubus (red raspberry)				X
Zizania (wild rice)				
Typha (cattail)	X	X		X
Jancus (rush)	X			
Scirpus (bulrush)	X	X		X
Eleocharis (spike-rush)				
Carex (sedges)	X			X
Decodon (water-willow)				X
Pontederia (pickerelweed)		X		
Vitis (riverbank grape)	X			
Acorus (sweet flag)				
Aster (aster)				X
Thelypteris (marsh fern)	X			
Glyceria (mannagrass)				
Ambrosia artemisiifolia (ragweed)				X
Bidens (beggar Tick)				
Vitis Hederacea (virginia creeper)				X
Iris (blue flag)				
Eupatorium (joe pye weed)				X
Eupatorium (boneset)	X			X
Polygonum (smartweed)				X
Arundo (giant reed)				
Phalaris (reed canarygrass)	X			
Lycopus americanus Muhl. (Bugleweed)				X
Asclepias (marsh milkweed)				
Verbena (horay vervain)	X			
Coreopsis (tick seed)				
Impatiens (jewelweed)	X			X
Rumex (marsh dock)				
Cornus (dogwood)	X			X
Salix (willow)	X			
Solidago (goldenrod)				X

Submergent	**Area 1**	**Area 2**	**Area 3**	**Area 4**
Myriophyllum sibiricum (northern watermilfoil)				
Chara (muskgrass)		X	X	X
Potamogeton amplifolius (large-leaf pondweed)			X	X
Potamogeton nodosus (longleaf pondweed)	X			
Elodea (waterweed)		X		
Utricularia (bladderwort)	X	X		
Ceratophyllum (coontail)				
Stuckenia pectinata (sago pondweed)			X	X
Ranunculus trichophyllus (water crow foot)				
Vallisneria (wild celery)		X	X	X
P. zosteriformis (flat-stemmed pondweed)	X		X	X
P. illinoensis (Illinois pondweed)			X	X
Najas flexilis (slender naiad)			X	X
Heteranthera dubia (water stargrass)				X
Najas marina (spiney naiad)			X	X

Free-floating	**Area 1**	**Area 2**	**Area 3**	**Area 4**
Nuphar advena (yellow water lily)	X	X		
Nymphaea odorata (white water lily)		X	X	X
Wolffia (watermeal)				
P. natans (floating-leaf pondweed)				
Lemna (duckweed)	X			
Spirodela (large duckweed)				

Exotic				
Myriophyllum spicatum (Eurasian watermilfoil)		X	X	X
P. crispus (curly-leaf pondweed)				
Lythrum (purple loosestrife)	X			

Algae				
Chara (muskgrass)		X	X	X
filamentous		X		

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Map 2

Source: Wisconsin Department of Natural Resources.

Appendix H

BOATING ORDINANCE FOR TOWN OF LAGRANGE (PLEASANT LAKE INCLUDED)

Title: Water Traffic Ordinance 07

Effective Date: 6/1/2007

Category: Lakes

STATE OF WISCONSIN
TOWNS OF LAGRANGE & SUGAR CREEK
WALWORTH COUNTY

ORDINANCE NO. 2008-02

AN ORDINANCE TO REGULATE WATER TRAFFIC, BOATING AND WATER SPORTS UPON THE WATERS OF LAUDERDALE LAKES, WALWORTH COUNTY, WISCONSIN

The Town Boards of LaGrange and Sugar Creek ordain as follows:

SECTION I. REPEAL OF CONFLICTING ORDINANCES
All ordinances regulating water traffic, boats, boating or water sports upon the waters covered by this ordinance and all ordinances and parts of ordinances in conflict with this ordinance heretofore enacted by the Towns of LaGrange and Sugar Creek, Walworth County, Wisconsin, are hereby repealed.

SECTION II. APPLICABILITY

A. This ordinance shall apply to the waters of Lauderdale Lakes, the Town of LaGrange and the Town of Sugar Creek, unless otherwise specified. (March 1983)

B. Drivers or operators of all boats by means of which aquaplanes, water ski or similar objects are being towed, and the riders of such aquaplanes, water skis or similar objects, must conform to the same rules and clearances as provided for in this ordinance.

SECTION III. DEFINITIONS

A. The definitions set forth in Section 30.01 and 30.50, Wisconsin Statutes, as amended from time to time, are adopted by reference.

B. “Swimming zone” means an authorized area marked by regulatory markers to designate a swimming area.

C. “Slow-no-wake” is defined as the slowest possible speed so as to maintain steerage.

SECTION IV. STATE LAWS ADOPTED
The statutory provisions describing and defining regulations with respect to water traffic, boats, boating and related water activities in the following enumerated sections of the Wisconsin Statutes, exclusive of any provisions therein relating to the penalties to be imposed or the punishment for violation of said statutes, are hereby adopted and by reference made a part of this ordinance as if fully set forth herein as amended, repealed or recreated by the State of Wisconsin from time to time. Any act required to be performed or prohibited by the provisions of any statute incorporated by reference herein is required or prohibited by this ordinance.

30.16 Removal of Obstructions to Navigation
30.501 Capacity Plate on Boat
30.51 Operation of Unnumbered Boats Prohibited
30.52 Certificate of Number
30.53 Identification Number to be Displayed on Boat; Certificate to be Carried
30.54 (2) Transfer of Ownership of Numbered Boat
30.55 Notice of Abandonment or Destruction of Boat or Change of Address
30.60 Classification of Motor Boats
30.61 Lighting Equipment

30.62 Other Equipment
30.63 (2) Use of Certain Outboard Motors Restricted and Draining Fuel into Lake Prohibited (March 1983)
30.64 Patrol Boats (March 1983)
30.65 Traffic Rules
30.66 Speed Restrictions
30.67 Accidents and Accident Reports
30.675 Distress Signal Flag
30.68 Prohibited Operations
30.69 Water Skiing
30.70 Skin Diving
30.71 Boats Equipped with Toilets
30.99 Parties to a Violation (March 1983)
287.81 Littering

SECTION V. AIRCRAFT LANDING ON LAKES
It is hereby prohibited for any aircraft to land upon the surface of Lauderdale Lakes within the corporate limits of the Towns of LaGrange or Sugar Creek, Walworth County, Wisconsin, except in case of emergency.

SECTION VI. ADDITIONAL TRAFFIC RULES
In addition to the provisions of the Wisconsin Statutes adopted in this ordinance, the following rules shall apply to boats or persons using the waters covered by this ordinance. (May 1989)

A. Mooring Lights Required. No person shall moor or anchor any boat, raft, buoy or other floating object, or permit the same to drift in the traffic lane described in this ordinance between sunset and sunrise unless there is prominently displayed thereon a bright white light of sufficient intensity and placed so as to be visible from any direction (360 degrees) for a distance of two (2) miles on a dark night with clear atmosphere. (March 1983)

B. Lights Required for Row Boats and Sailboats Without Motors. No person shall operate any boat propelled by muscular power or any sailboat not equipped with a motor in the traffic lane described in Section VII of this ordinance, between the hours of sunset and sunrise, unless there is prominently displayed thereon, a bright white light of sufficient intensity and placed so as to be visible from any direction (360 degrees) for a distance of two (2) miles on a dark night with clear atmosphere. (March 1983)

C. Use of Spot Lamps Restricted. No person aboard a boat, other than a law enforcement officer or a person in need of assistance to prevent bodily injury or destruction of property shall direct the beam of any spot lamp or any similar device so as to project any glaring light into the eyes of another boat operator. (March 1983)

D. No person shall operate any boat, when there are any persons or objects so situated as to obstruct the view of the operator to the front or to the side, or as to interfere with the operator’s control of the operating mechanisms of the boat. Spot lamps and horns placed on the foredeck of any boat and signal lamps or speakers of authorized patrol boats shall not be considered a violation of this section. (March 1983)

E. No person shall take or operate any boat without the consent of the owner. (March 1983)

F. All boating traffic shall be in a counter clockwise direction entering from the West in the narrow channel formed on the North by Don-Jean Bog and on South shoreline properties LL307 through LL311 only on weekends and Holidays, Memorial Day through Labor Day.

SECTION VII. ORGANIZED EVENTS AND DISPLAYS

A. No person or persons shall organize or participate in any event or play upon the surface of Lauderdale Lakes without first obtaining a permit for such activity from the Town Board of the Town of LaGrange, Walworth County Wisconsin.

B. Request for said permit for organized events or displays shall be sent to the Town Board in triplicate before the first Monday of the month preceding the event.
C. Request for said permit shall describe the event, time of the event, and define what part of the lake to be used.
D. Upon action by the Town Board of the Town of LaGrange, one copy of the permit shall be returned to the applicant, one copy to the Water Safety Patrol, and one copy to be retained by the Town Clerk.

SECTION VIII. SWIMMING REGULATIONS

A. Swimming from Boats Regulated. No person shall swim from any boat unless such boat is anchored.
B. Distance from Shore or Base. No person shall swim more than ONE HUNDRED (100) FEET from shore or from the end of any pier or more than FIFTY (50) FEET from any anchored raft or boat unless he or she is accompanied by a boat manned by a competent person having immediately available a U.S. Coast Guard approved Type IV personal flotation device for each swimmer being escorted in addition to those required to be on board under applicable regulations. Such boat shall stay reasonably close to and guard such swimmer or swimmers. A person manning such an escort boat shall be considered competent if he can, in fact, observe the swimmer or swimmers, throw the flotation device to them should the need arise, and is otherwise qualified to operate the escort boat under applicable regulations. (March 1983)
C. Hours Limited. No person may swim more than 100 feet from shore, or the projecting extremities, of piers or wharfs from sunset to sunrise.

SECTION IX. WATER SKIING

In addition to the provisions of the Wisconsin statutes adopted in this ordinance, the following regulations apply to boats and persons using the waters covered by this ordinance:

A. Careful and Prudent Operation. A person operating a boat having in tow a person on water skis, aquaplane or similar device and the users of such water skis, aquaplane or similar devices shall operate such boat or use such device in a careful and prudent manner and at a reasonable distance from persons and property so as not to endanger the life or property of any person, and shall conform to all applicable rules and clearances as provided for in this ordinance.
B. Hours Limited. For water-skiing, aquaplaning or similar activity requiring the use of a towing boat are allowed from sunrise to sunset, except on Saturdays and Sundays and Holidays when such activities may not commence until 9 a.m.
C. Area Limited. No person shall engage in water-skiing, aquaplaning or similar activity outside the traffic lane described in Section VII of this ordinance.
D. Observer required. No person shall operate a boat having in tow a person on water skis, aquaplane or similar device unless there is in the boat a competent person, in addition to the operator, in a position to observe the progress of the person being towed. An observer shall be considered competent if the observer can, in fact, observe the person being towed and relay any signals to the operator. This observer requirement does not apply to Class A motorboats actually operated by the person being towed and so constructed as to be incapable of carrying the operator in or on the motorboat.
E. Number of Skiers Limited. No more than two (2) persons shall use towlines as a means of water skiing, aquaplaning or similar activity behind a boat.
F. Flotation Required.
    1. All persons engaged in water skiing, aquaplaning or similar activity shall wear U.S. Coast Guard approved Type I, II or III Personal Flotation Devices. However, persons engaged in trick skiing may elect to wear a non-Coast Guard approved personal flotation device, other than a so-called “ski-belt.” A trick skier shall be identified by skiing positions which readily differentiate the skier from the ordinary “front-forward” skier, and also by the following:
        (a) Skis: Short, wide or swivel skis, wakeboards and similar devices; and
        (b) Towrope: Less than 75 feet.
    2. Persons engaged in barefoot skiing may elect to wear a non-Coast Guard approved barefoot wet suit designed specifically for the activity.

3. Whenever a water skier elects to wear a non-Coast Guard approved device pursuant to these regulations, there shall be a Coast Guard approved device carried in the boat for the use of such skier.

G. Restrictions. No person operating a boat having in tow a person on water skis, tube, aquaplane or similar device, nor the users of such water-skis, aquaplanes, tubes or similar devices, shall engage in such activity within one hundred (100) feet of any occupied anchored boat or marked swimming area or public boat landing.

H. Exceptions. Duly authorized water ski tournaments, competitions, exhibitions or trials therefore, for which a permit has been given by the Town of LaGrange pursuant to this ordinance, shall be exempt from the following provisions of this Section: Paragraph (b) (Hours limited) where adequate lighting is provided and at designated times and places for which notice was given.

Paragraph (c) (Area limited) at designated times and places for which notice was given.
Paragraph (e) (Numbers of skiers limited) at designated times and places for which notice was given.
Paragraph (f) (Flotation required) where pick-up boats are provided and at designated times and places for which notice was given.

SECTION X. SPEED RESTRICTIONS

A. Shore Zone.
1. Except under §30.69(3) relating to water skiing, no person may operate a motorboat within 100 feet of the shoreline or any dock, raft, pier or buoyed restricted area at a speed in excess of slow-no-wake.
2. Except under §30.69(3)(a), (c), or (d) relating to water skiing, no person may operate a personal watercraft with 200 feet of the shoreline at a speed in excess of slow-no-wake.

B. Except for Law enforcement and/or rescue vessels, and except when or where such speed would otherwise be prohibited by law or is otherwise regulated by this ordinance, all persons must operate a motorboat at the minimum speed to maintain control of the boat but in no case shall the speed exceed ten miles per hour (10 MPH) from sunset to sunrise on weekdays and 9 a.m. on Saturdays, Sundays and Holidays.

C. Except for law enforcement and/or rescue vessels no person shall operate a boat on the Lauderdale Lakes on Holidays and weekends from Memorial Day through Labor Day at a speed in excess of fifty miles per hour (50 MPH) from sunrise to sunset.

D. Except for law enforcement and/or rescue vessels, no person may operate a motorboat on the waters of Middle Lake wet of a line from LL741 (W6734 Park Lane) on the north and LL 506E (W5534 Lost Nation Road) on the south at a speed in excess of “slow-no-wake” speed. A designee of the Town Board of LaGrange is authorized and directed to place and maintain appropriate regulatory markers to advise the public of the location of said zone. (May 1989)

SECTION XI. MARKERS, NAVIGATION AIDS AND POSTING

A. The designee of the LaGrange Town Board is authorized and directed to place and maintain authorized markers, navigation aids and signs as shall be appropriate to advise the public of the provisions of this ordinance and to post and maintain a copy of this ordinance at all public access points within the jurisdiction of the Towns of LaGrange and Sugar Creek, Walworth County, Wisconsin

B. Standard Markers. No person shall place or maintain any marker upon waters of the lake except the designee of the Town Board of LaGrange.

C. Interference with Markers Prohibited. No person shall without authority remove, damage, destroy, moor or attach any watercraft to any buoy, beacon or marker placed in the waters by authority of the United States.

D. Race course markers, water ski course markers, water ski jumps, and similar devices may be temporarily placed in the traffic lane during the hours between sunrise and sunset when authorized by the Town Board of the Town of LaGrange upon application to the LaGrange Town Clerk.

SECTION XII. REGULATION OF ICEBOUND WATERS

A. Permit.

1. No person shall remove ice or cause its removal from Lauderdale Lakes without first obtaining a permit from the Town Board of LaGrange or Sugar Creek, depending upon the location of the proposed ice removal. (April 1983)
2. The application for permit shall be made in writing and filed in the office of the Clerk of the Town of LaGrange or Sugar Creek. The application shall describe the area from which the ice will be removed together with any additional details that the Town Board might require. It shall also state the name, residence and post office, and telephone number of the applicant.

B. Ice Holes.
1. Any person or persons who shall remove ice or cause its removal from Lauderdale Lakes shall place around the margin of the opening made by such removal, a fence, by setting posts of not less than two (2) by four (4) inches in size with a fence board thoroughly nailed thereto not less than 3½ feet above the surface of the ice on said lakes.
2. Any person or persons creating ice holes by aeration of water may, in lieu of the requirements of sub (1), erect and maintain a barricade around such holes consisting of uprights spaced every twenty-five (25) feet or less, connected by a continuous rope, cord or similar material placed 3½ feet off the surface of the ice. The connecting rope, cord or similar material shall have reflectorized ribbon or tape attached to it, so as to be highly visible, and shall be of sufficient strength to permit retrieval of the barricade following melting of ice. Any person or persons erecting such barricade shall remove the barricade and all parts thereof from the ice or water immediately after the ice has melted.
3. Removal of ice shall not interfere with the rights of the public to lawfully use the icebound waters of Lauderdale Lakes. Removal of ice for a distance of more than ten (10) feet beyond any existing pier is prohibited.
4. Each day during which an opening exists in violation of this ordinance is a separate offense.
5. Removal of ice shall not interfere with the rights of neighboring riparian proprietors. Removal of ice along the shoreline of neighboring riparian properties, except by permission of the owner or owners, is hereby declared to be a public nuisance and the maintenance of such ice holes may be abated by action at the suit of the Town. (April 1983)

C. This section shall not apply to ice fishermen as long as the hole or removal of ice does not leave a hole in the ice greater than twelve (12) inches at its greatest dimension.

SECTION XIII. ENFORCEMENT, POWERS, PENALTIES AND DEPOSITS

A. This ordinance shall be enforced by the officers of the Water Safety Patrol, which shall be operated under the jurisdiction of the Town of LaGrange, Walworth County, Wisconsin and the Lauderdale Lakes Lake Management District. Every Water Safety Patrol officer appointed shall be a qualified law enforcement officer or in training for such. To the extent that the Water Safety Patrol operates within the Towns of LaGrange and Sugar Creek on Lauderdale Lakes, the authority of said officers shall be limited to the waters of Pleasant Lake and the Lauderdale Lakes, unless said officers, in the enforcement of their duties are, by other law, permitted to pursue such duties off the water, including other properties owned by the Town of LaGrange such as the boat launch ramps and the Town park on Pleasant Lake.

B. The members of the Water Safety Patrol shall have supervision over the waters of Lauderdale Lakes and Pleasant Lake and may stop and board any boat for the purpose of enforcing any provisions of this ordinance and for conducting search and rescue operations, if the officers have reasonable cause to believe there is a violation, is about to be a violation, or has been a violation of such ordinances, or the stopping and boarding of any boat is essential to conduct a search and rescue operation. Said officers may arrest any person found on the waters of Lauderdale Lakes, or within the Towns of LaGrange or Sugar Creek, violating such ordinance, whether at the time of arrest the person is on the waterways or upon land, except as above set forth with respect to the Township of Sugar Creek. Such persons will be delivered to the Circuit Court of Walworth County and the arresting officer shall make and execute a complaint charging such person with the offense committed unless otherwise provided by law. Provisions relating to citations, arrests, questioning, releases, searches, deposits and stipulations of no contests in the Wisconsin Statutes, as they are amended or repealed and recreated from time to time hereafter, shall apply to all civil forfeiture violations. Provisions relating to complaints, arrests,

questioning and releases and searches under Sections 968.01 to 968.256 as they may be from time to time hereafter amended, shall apply to all criminal violations, unless otherwise provided by law.

C. All actions to recover forfeitures and penalty assessments under this ordinance are civil actions in the name of the Town of LaGrange, shall be heard in Circuit Court of Walworth County, and shall be recovered under the procedure set forth in the Wisconsin Statutes. (March 1983)

D.

(1) Wisconsin state boating penalties as found in Section 30.80, Wis. Stats., as amended from time to time, and deposits as established in the Uniform Deposit and Bail Schedule established by the Wisconsin Judicial Conference, are adopted by reference for all violations for which there is a statutory counterpart.

(2) Any person who unlawfully obstructs navigation under this ordinance shall forfeit not more than Fifty Dollars ($50.00) for each offense. Each day the obstruction exists is a separate offense.

(3) The forfeitures and bail schedule for offenses in this ordinance for which no statutory counterpart exists are all assessments imposed by statute, court costs and fees, and as follows:

Forfeiture Offense Minimum Maximum Bail

a. Aircraft Landing on Lakes, Sec. V. $50 $ 500 $2000 $ 750
b. Mooring Lights Required, Sec. VI.A. $50 $ 100 $250 $ 50
c. Lights for Row Boats and Sailboats, Sec.VI.B. $50 $ 100 $250 $ 50
d. Use of Spot Lamps Restricted, Sec. VI.C. $50 $ 100 $250 $ 50
e. Operator View Restricted, Sec. VI.D. $50 $ 100 $250 $ 50
f. Operation Without Consent, Sec. VI.E. $100 $1000 $2500 $250
g. Don Jean Bog Traffic, Sec. VI.F. $50 $100 $250 $ 50
h. Events and Displays without Notice, Sec. VII. $100 $ 500 $2000 $ 250
i. Swimming From Unanchored Boat, Sec. VIII.A. $ 50 $100 $250 $ 50
j. Swimming in Restricted Areas or at Restricted Times, Sec. VIII.B. and C. $ 50 $100 $250 $ 50
k. Careful and Prudent Operation, Sec. IX.A. $100 $100 $250 $100
l. Hours limited for water skiing, Sec IX.B. $100 $100 $250 $100
m. Area limited for water skiing, Sec. IX.C $100 $100 $250 $100
n. Observer required for water skiing, Sec. IX.D. $100 $100 $250 $100
o. Excess number of skiers, Sec. IX.E. $ 50 $100 $250 $ 50
p. Water-skier Flotation Violation, Sec. IX.F. $100 $ 100 $250 $ 50
q. 100 Foot restriction, Sec. IX.G. $100 $100 $250 $ 50
r. Speed in Shore Zone, Sec. X.A. 1 & 2 $ 50 $500 $2000 $250
s. Speed Excess of 10 MPH, Sec. X.B. $ 50 $500 $2000 $250
t. Speed in Excess of 50 MPH, Sec. X. C. $50 $500 $2000 $250
u. Speed Excess Slow-No-Wake, Sec. X. D. $ 50 $500 $2000 $250
v. Unauthorized Marker Placement, Sec. XI.B. $50 $ 100 $250 $ 50
w. Interference with Markers, Sec. XI.C. $100 $ 100 $250 $ 50
x. Ice Violation, Sec. XII. $50 $ 100 $250 $ 50
y. The above forfeitures and bail amounts shall be double for a second or third subsequent offense within a three (3) year period.

(4) Any person violating any provisions of this ordinance for which a penalty is not set forth above shall, upon conviction thereof, forfeit not more than $2,000, nor less than $50 for each violation, together with penalty assessments and the costs of prosecution and in default of payment of such forfeiture, assessments and costs of prosection shall be imprisoned in the County Jail until full payment is made, but not exceeding sixty (60) days. (April 1990)

SECTION XIV. SEVERABILITY

The provisions of this ordinance shall be deemed severable and it is expressly declared that the Town Boards would have passed the other provisions of this ordinance irrespective as to whether or not one or more provisions may be declared invalid and any provision of this ordinance or the application thereof to any person or

circumstance is held invalid, the remainder of the ordinance and the application of such provisions other persons or circumstances shall not be affected thereby.

SECTION XV. EFFECTIVE DATE AND CLERK'S DUTY

A. This ordinance shall take effect and be in force from and after its passage and publication as provided by law, and after review by the Department of Natural Resources.

B. The LaGrange Clerk is directed to file a signed copy of this ordinance with the Department of Natural Resources in Madison, Wisconsin.

Enacted by the Town Board of LaGrange this 2008.
Approved:
Frank Taylor, Town Chairman
F. Mark Bromley, Supervisor
Don Sukala, Supervisor
Richard Callaway, Supervisor
Jeff Schramm, Supervisor

ATTEST:
Crystal L. Hoffmann, Town Clerk, LaGrange

Enacted by the Town Board of Sugar Creek this ____ day of _____, 2008.
Approved:
ATTEST:
Diane Boyd, Town Clerk, Sugar Creek

Appendix I

INFORMATION FOR PREVENTING TRANSMISSION AND INTRODUCTION OF AQUATIC INVASIVE SPECIES

FOR MORE INFORMATION

If you would like more information about aquatic invasive species, the problems they cause, regulations to prevent their spread, or methods and permits for their control, contact one of the following offices:

Wisconsin Department Of Natural Resources
888-WDNRINFO
DNR.WI.GOV search "Aquatic Invasives"

University of Wisconsin- Extension
(715) 346-2116
WWW.UWSP.EDU/CNR/UWEXLAKES

Wisconsin Sea Grant
(608) 262-0905
WWW.SEAGRANT.WISC.EDU
WWW.PROTECTYOURWATERS.NET

Thanks to the following for supporting educational efforts on aquatic invasive species:

- *U.S. Fish and Wildlife Service*
- *Great Lakes Indian Fish and Wildlife Commission*
- *National Park Service*

This publication is available in alternative format (large print, Braille, audiotape, etc.) upon request. For information call 608-267-7694.

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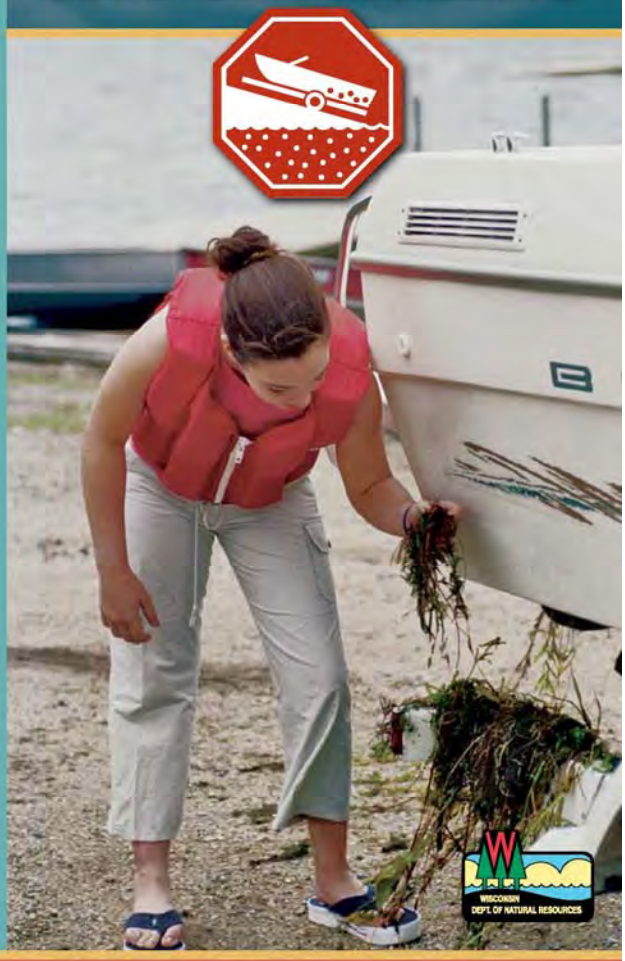
STOP Aquatic HITCHHIKERS



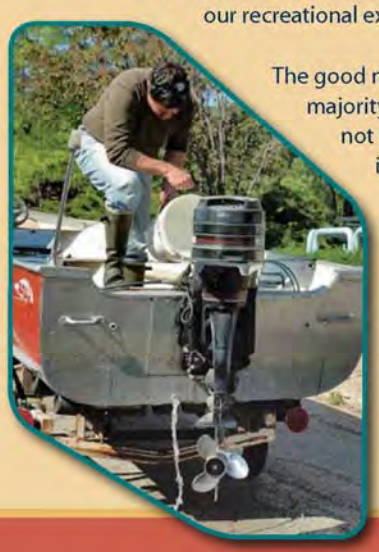
DNR.WI.GOV search "Aquatic Invasives"

ENJOYING THE GREAT OUTDOORS

Enjoying the great outdoors is important to many of us. Boating, fishing, hunting, and wildlife watching are traditions that we want to preserve for our children and their children. Today, these traditions are at risk. Aquatic invaders such as zebra mussels, purple loosestrife, Eurasian water-milfoil, bighead and silver carp, threaten our valuable waters and recreation. These and other non-native, or exotic, plants and animals do not naturally occur in our waters and are called invasive species because they cause ecological or economic harm.

These invasive species can get into lakes, rivers, and wetlands by "hitching" rides with anglers, boaters, and other outdoor recreationists, who transport them from one waterbody to another.

Once established, these "aquatic hitchhikers," can harm native fisheries, degrade water quality, disrupt food webs and reduce the quality of our recreational experiences.



The good news is that the majority of waters are not yet infested with invasive species and by taking the necessary steps you can help protect our valuable waters.

If you think you have found an INVASIVE SPECIES:

REPORT NEW SIGHTINGS

If you suspect a new infestation of an invasive plant or animal, save a specimen and report it to a local Department of Natural Resources or Sea Grant office. Wisconsin has "ID" cards, websites, and volunteer monitoring networks to help you identify and report invasive species.

CONSULT YOUR NATURAL RESOURCE AGENCY

Do-it-yourself control treatments may be illegal and can make matters worse by harming native fish, wildlife, and plants. Before attempting to control an invasive species or add new plants along your shoreline, contact your local Department of Natural Resources office. DNR staff can provide recommendations and notify you what permits are required.

STOP AQUATIC HITCHHIKERS

IS A NATIONAL CAMPAIGN THAT HELPS RECREATIONAL USERS TO SOLUTION TO STOP THE TRANSPORT AND SPREAD OF AQUATIC IN

IN WISCONSIN IT IS THE LAW...

INSPECT boats, trailers, and equipment

REMOVE all attached aquatic plants, animals, and mud before launching and before leaving the water access.

Many invasive species spread by attaching themselves to boats, trailers, and equipment and "hitching a ride" to another waterbody. Therefore, Wisconsin law requires that you remove these aquatic hitchhikers before you launch your boat or leave the access area.

DRAIN all water from your boat, motor, bilge, live wells, bait containers and all equipment before leaving the water access.

Many types of invasive species are very small and easily overlooked. In fact, some aquatic hitchhikers, like zebra mussel larvae, are invisible to the naked eye. To prevent the transport of these aquatic hitchhikers drain water from all equipment before you leave the access area.

For more information visit:
DNR.WI.GOV and search "bait laws"

Draining ballast water and lake or river water can prevent the spread of aquatic invasive species and fish diseases, like VHS.

NEVER MOVE plants or live fish away from a waterbody.

In Wisconsin, it is illegal to transport any aquatic plants, mud, live fish or live fish eggs away from any state waterbody. This includes live gamefish and roughfish, like gizzard shad. There are exceptions for minnows obtained from a Wisconsin licensed bait dealer or registered fish farm, which may be transported away live and used again:

- ***On the same waterbody, or***
- ***On any other waterbody if no lake or river water, or other fish were added to their container***

BUY minnows from a Wisconsin licensed bait dealer.

For more information on collecting your own minnows visit:
DNR.WI.GOV and search "VHS Prevention"

DISPOSE of unwanted bait and other animals or aquatic plants in the trash.

When possible, dispose of unwanted bait in the trash at access points. Never release them into the environment.

If possible, dispose of ALL unwanted bait (including earthworms) in a trash can at the boat landing or access point. Otherwise, take them home and dispose of them by placing them in the trash, composting them, or using them in a garden as fertilizer. Likewise, other aquatic plants or animals that you collect, or buy in a pet store, should NEVER be released into the wild.

BECOME PART OF THE
VASIVE SPECIES.

Aquatic hitchhikers can spread in many ways such as on recreational equipment, and in water. Fortunately, there are a few simple actions you can take to prevent them from spreading.

WISCONSIN REGULATION

Wisconsin has several laws to prevent the spread of aquatic invasive species and the fish disease Viral Hemorrhagic Septicemia (VHS). Failure to follow Wisconsin law can result in fines up to or exceeding **$2000**. Don't be caught unaware!

OTHER WATER USES:

ADDITIONAL STEPS:

Although not required by WI law, additional steps are highly recommended, particularly if you are transporting a boat and/or equipment from one waterbody to another. Additional steps include:

- ***SPRAY, RINSE, or DRY*** boats and recreational equipment to remove or kill species that were not visible when leaving a waterbody. Before transporting to another water: ***Spray/rinse with high pressure, and/or hot tap water (above 104° F or 40° C), especially if moored for more than a day. OR Dry for at least five days.***

- ***DISINFECT*** boats and recreational equipment to kill species and fish diseases that were not visible when leaving a waterbody. Many aquatic hitchhikers can survive out of water for some period of time. ***To prevent their spread, you can sanitize your boat, trailer or equipment by washing it with a mixture of 2 Tbs of household bleach per 1 gallon of water.***

Don't get caught spreading aquatic invasive plants or animals! Wisconsin laws, as highlighted above, can apply to many types of water activities, not just boating and fishing. Although these activities might not seem dangerous, they CAN establish and spread invasive species. It is important you follow the steps above for all water activities in order to prevent the spread of aquatic invasive species. These activities include:

- ***Using personal watercraft***
- ***Shore and fly-fishing***
- ***Sailing***
- ***Scuba Diving***
- ***Waterfowl hunting***

FAILURE TO FOLLOW WISCONSIN LAWS CAN LEAD TO FINES.

For additional information contact your local DNR staff or visit:

DNR.WI.GOV

Protect Your Boat

Zebra mussels attach to a variety of materials, including fiberglass, aluminum, wood, and steel and may damage a boat's finish. Veligers are extremely small and can be drawn into engine passages. Once they settle out in the engine cooling system, they can grow into adults and may block intake screens, internal passages, hoses, seacocks, and strainers. The best ways for boat owners to avoid these types of damage are:

- **Use a boatlift** to completely remove the watercraft from the water when not in use.
- **Run your boat regularly** if it is moored in zebra mussel infested waters. Run the engine at least twice a week at slow speeds (about 4-½ mph) for 10 to 15 minutes. Monitor engine temperatures – if you notice an increase, it may mean that zebra mussels are clogging your cooling system. Immediately inspect the system and remove any zebra mussels. The end of boating season is also a good time to inspect and clean the cooling system.

- **Lift the motor out of the water between uses if mooring.** Fully discharge any water that may still remain in the lower portion of the cooling system.
- **Tip down the motor and discharge the water when leaving a waterbody** to reduce the likelihood of transporting veligers (in water) to another waterbody.
- **Clean your boat and equipment.** Physically remove (scrape) adult mussels from your boat, trailer, and equipment by hand. Young zebra mussels and veligers may be too small to see. Wash your boat with high-pressure hot water (use water >104°F if possible). Use high-pressure cold water if hot water is not available. *(Avoid pressure washing classic wooden boats or others not made of metal.)*
- **Apply anti-fouling paints or coatings to the hull and the engine's cooling system** to prevent zebra mussel attachment. It is best to purchase these from an area boat dealer or your local marina. Anti-fouling paints that are copper based can be used in Wisconsin, and typically need to be reapplied every one to two years. In-line strainers can also be installed in the engine's cooling system.
- **Use motor "muffs", also known as motor flushers, to remove zebra mussels and other materials from your boat engine or personal watercraft.** Clamp the motor flusher onto the lower unit over the cooling inlets on either side of the motor, and screw the nozzle of your garden hose into it. Run the boat engine for approximately 10 minutes or as suggested by the manufacturer.

Amy Bellows, WI DNR

Special note of caution for anglers

Dispose of unwanted bait in the trash - do not transfer bait or water from one waterbody to another. Larval zebra mussels or other invasive species could be present in the water with the bait.

Help prevent aquatic hitchhikers from catching a ride on your boat or equipment:

- ✓ **Inspect** and **remove** aquatic plants and animals,
- ✓ **Drain** water,
- ✓ **Dispose** of unwanted bait in the trash,
- ✓ **Rinse** with hot and/or high-pressure water, OR
- ✓ **Dry** for 5 days.

Clean Boats . . . Clean Waters

For a list of known zebra mussel infested waters, visit:
www.dnr.wi.gov/org/water/wm/GLWSP/exotics/zebra.html

WISCONSIN DEPT. OF NATURAL RESOURCES

UW Extension

STOP AQUATIC HITCHHIKERS!™

PRINTED ON RECYCLED PAPER

Sea Grant

Cover photo: L. Pohlod. Inset: Great Lakes Sea Grant Network
Designed by L. Pohlod, Blue Sky Design, LLC *PUB-WT-383 2004*

Zebra mussel identification and life cycle

Mature zebra mussels look like small D-shaped clams. Their yellowish-brown shells have alternating light and dark stripes.

Ohio Sea Grant

Zebra mussels can reach a maximum of 2 inches in length, though most are smaller than an inch. They are typically found attached to solid objects, often growing in large clusters.

Ontario Ministry of Natural Resources

Amy Bellows, WI DNR

Zebra mussels begin as eggs, then develop into free-swimming larvae (called **veligers**), which are microscopic. The veliger photos shown above were taken with the aid of a microscope. Veligers are spread by currents; after about three weeks, they settle out and firmly attach themselves to hard surfaces, where they grow into adults. Their lifespan is typically three to five years. They begin to reproduce after a year or two - females can release up to one million eggs per year!

James Lubner, University of Wisconsin Sea Grant

What do zebra mussels do?

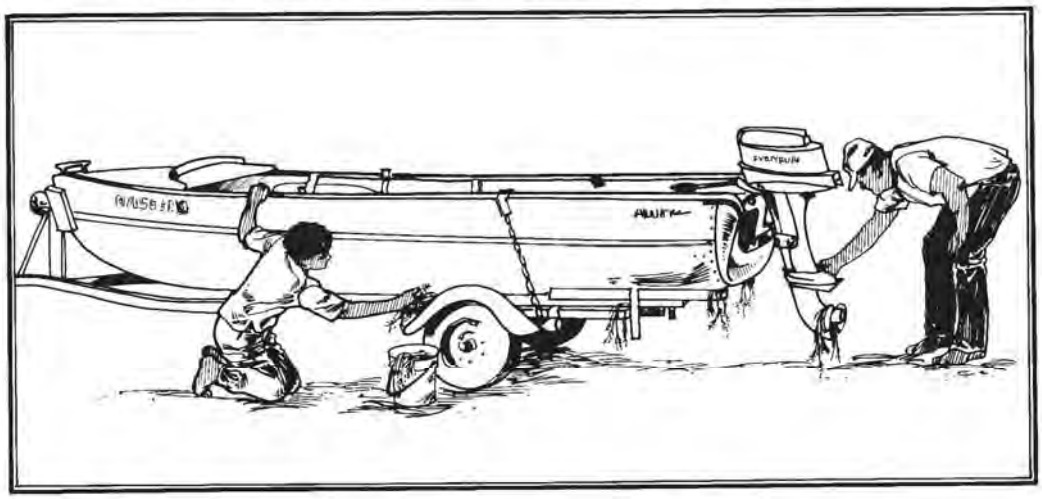
Zebra mussels are **filter feeders** that can filter large volumes of water (up to 1 Liter/day). In some cases they can filter the whole volume of a lake in a few months. They remove plankton – tiny plants and animals – from the water. What they eat (and what they don't eat) ultimately ends up on the lake or river bottom. Plankton is an important food source for young fish, native mussels, and other aquatic organisms. Zebra mussels may concentrate this food at the bottom, leaving open water species with **less to eat**!

Because they are so good at filtering, zebra mussels often **make water clearer**. This may force **light-sensitive fish**, like salmon and walleye, into deeper water to seek shelter from the sun. Increased light penetration allows aquatic plants to grow in deeper water and spread to a larger area. This may help smaller fish to survive by giving them places to hide, but makes it harder for large, predatory fish to find food. **Thicker plant growth** may also cause problems for boaters and anglers.

Don Schloesser, Great Lakes Science Center, National Biological Services

Zebra mussels cause people additional problems. They **clog water intakes and pipes** – large water users on the Great Lakes spent $120 million from 1989 to 1994 to combat zebra mussels. They also **attach to piers, boatlifts, boats, and motors**, which can cause damage requiring costly repair and maintenance. Even when they die, their **sharp shells** wash up on beaches, creating foul odors and cutting the feet of swimmers.

How can I help prevent the spread of zebra mussels?



Microscopic veligers may be carried in livewells, bait buckets, bilge water – any water that's transported to another waterbody. They can also travel in currents to downstream waters. Adults can attach to boats or boating equipment that are moored in the water. They frequently attach to aquatic plants, which themselves may hitch a ride on boats and equipment. For these reasons, it is important to take the following steps to prevent the spread of zebra mussels and other aquatic invasive species while boating:

Before moving your boat from one water body to another:

- ✓ **Inspect** and **remove** aquatic plants, animals, and mud from your boat, trailer, and equipment,
- ✓ **Drain** all water from your equipment (boat, motor, bilges, transom wells, live wells, etc.),
- ✓ **Dispose** of unwanted bait in the trash, not in the water,
- ✓ **Rinse** your boat and equipment with hot (> 104˚F) and/or high pressure water, particularly if moored for more than one day, OR
- ✓ **Dry** your boat and equipment thoroughly (in the sun) for five days.

Pressure washing note:

Avoid pressure washing classic and wooden boats, along with canoes and kayaks that are not made of metal. These types of boats should be drained, cleared of all plant and animal materials, and left in the sun to dry completely.

Effective May 2002, Section 30.715, WI Act 16 prohibits launching a boat or placing a boat or trailer in navigable waters if it has aquatic plants or zebra mussels attached.

Appendix J

BOARD OF COMMISSIONERS OF PUBLIC LANDS LOAN PROGRAM FACT SHEETS

BOARD OF COMMISSIONERS OF PUBLIC LANDS 1848

Managing Wisconsin's trust assets for public education

Douglas La Follette, *Secretary of State*
Matt Adamczyk, *State Treasurer*
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Tia Nelson, *Executive Secretary*

Fact Sheet - General Obligation Loans

Eligible Borrowers:	Wisconsin towns, villages, cities, counties, school districts, technical college districts, public inland lake protection and rehabilitation districts, town sanitary districts, metropolitan sewerage districts, metropolitan sewerage systems, joint sewerage systems, consortiums, cooperative educational service agencies (CESAs), federated public library systems, and drainage districts.
Loan Process:	Simple and transparent, with funds available 30-45 days from initial application.
Loan Security:	Loans become a general obligation of the borrower and require the borrower to levy a tax sufficient to make principal and interest payments when due.
Loan Purpose:	Loans of 10 years or less may be made to facilitate the performance of any power or duty of the borrowing municipality, including operations and maintenance. Loans greater than 10 years are restricted to the financing or refinancing of public purpose projects including "the acquisition, leasing, planning, design, construction, development, extension, enlargement, renovation, rebuilding, repair or improvement of land, waters, property, highways, buildings, equipment, or facilities", or any purpose otherwise allowed by law.
Economic Development Lending:	BCPL is a major source of funding for economic development projects throughout the State of Wisconsin including pass-through loans for private development, funding development incentives, TID infrastructure loans, land acquisition and development for business parks, and others. BCPL flexibility in the repayment schedule if projections are not met is critical to many borrowers.
Payments:	Annual payments are due March 15 each year. Loans funded between September 1 and March 14 do not have a payment scheduled for the following March 15. BCPL can provide custom amortization schedules for projects that may take time to generate expected revenues, or that need coordination with other debt payment schedules.
Prepayment:	Prepayments are allowed without penalty between January 1 and August 31 each year, with 30 days prior written notice. This flexibility is extremely valuable, as future budget priorities are difficult to forecast. Many finance directors get stuck with higher rate bonds and are forced to wait years prior to refunding. This is never a problem if you borrow from BCPL.
Terms:	1 year to 20 year fixed rate loans.
Current Rates:	Loan Term 1-2 Years 2.50% 3-5 years 3.00% 6-10 years 3.25% 11-20 years 3.75%
Rate Lock:	Market-based interest rates are locked at the time of application for a period of 60 days at no cost to Borrower. This rate also remains locked following final board approval and throughout the 4-month draw period, which helps provides financial stability during the entire loan process.
Fees:	No application fees, origination fees or prepayment fees. No fees period!
Best Part:	Interest earned by BCPL is distributed to communities statewide for the funding of public school library materials. Check out the BCPL website to see the annual contribution made to your school district. This annual payment effectively reduces local tax levies by providing schools another source of funding. How many bankers or bond dealers can say that?

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Fact Sheet - Revenue Obligation Loans

Eligible Borrowers:	Wisconsin towns, villages, cities, counties, school districts, technical college districts, public inland lake protection and rehabilitation districts, town sanitary districts, metropolitan sewerage districts, metropolitan sewerage systems, joint sewerage systems, consortiums, cooperative educational service agencies (CESAs), federated public library systems, drainage districts.
Loan Process:	Simple and transparent, with funds available as soon as 30-60 days. Revenue loans have greater documentation and underwriting requirements than general obligation loans, and may require a slightly longer time period to complete the loan process.
Loan Security:	Loans are secured by a pledge and assignment of the revenues generated by a specific project. These revenues may include tax increments allocated to the borrower for project costs within a tax incremental district. A failure by the borrower to remit loan payments when due requires BCPL interception of state aid payments.
Loan Purpose:	Loans may be made for the financing or refinancing of a project as defined by Wis. 67.04 (ar): the acquisition, leasing, planning, design, construction, development, extension, enlargement, renovation, rebuilding, repair or improvement of land, waters, property, highways, buildings, equipment, or facilities.
Payments:	Annual payments are due March 15 each year. Loans funded between September 1 and March 14 do not have a payment scheduled for the following March 15. Amortization schedules are normally calculated to include equal annual payments, but BCPL can provide custom amortization schedules for projects that may take time to generate expected revenues, or that need coordination with other debt payment schedules.
Prepayment:	Prepayments are allowed without penalty between January 1 and August 31 each year, with 30 days prior written notice. This flexibility is extremely valuable, as future budget priorities are difficult to forecast. Many finance directors get stuck with higher rate bonds and are forced to wait years prior to refunding. This is never a problem if you borrow from BCPL.
Terms:	1 year to 30 year fixed rate loans.
Rates:	Interest rates are locked at the time of application. Rates will vary depending on the risk assessment from BCPL transaction underwriting including a review of the strength and stability of the pledged revenues, along with other risk factors.
Underwriting:	Loans secured by a pledge of tax increment allocations are limited to an amount so that annual payments would not exceed 80% of the shared revenue received by the borrower in the year prior to the loan application. Underwriting criteria on other loan and project types will vary.
Fees:	No application fees, origination fees or prepayment fees. No fees period!
Best Part:	Interest earned by BCPL is distributed to communities statewide for the funding of public school library materials. Check out the BCPL website to see the annual contribution made to your school district. This annual payment effectively reduces local tax levies by providing schools another source of funding. How many bankers or bond dealers can say that?