Big Round Lake

Comprehensive Lake Management Plan

Polk County, Wisconsin

October 2015

Sponsored By
Big Round Lake Protection and Rehabilitation District

Prepared By
Harmony Environmental
Finding a balance
People Land Water

Funded By
Big Round Lake Protection and Rehabilitation District
Wisconsin Department of Natural Resources

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Introduction

This is a comprehensive lake management plan (CLMP) for Big Round Lake in Polk County, Wisconsin. A lake management plan was most recently developed in 2004. A plan update is needed to continue lake district eligibility for WDNR grants and to guide ongoing lake management activities. The plan will guide the Big Round Lake Protection & Rehabilitation District (Lake District) and the Wisconsin Department of Natural Resources (WDNR) in lake management over the next ten years (from 2016 through 2026).

The Big Round Lake P&R District was formed in 1967.

The plan is sponsored by and developed for the Lake District with input from an advisory committee including lake residents, tribal representatives, county staff, WDNR staff, and consultants. Harmony Environmental facilitated plan discussions and wrote plan content.

The plan includes data about the plant community, watershed, and water quality of Big Round Lake. It presents a strategy for lake management actions to achieve the lake management plan goals.

Big Round Lake Comprehensive Lake Management Plan Goals

The Big Round Lake community is knowledgeable about and engaged in lake stewardship. A knowledgeable and engaged community will support remaining plan goals.

Prevent the introduction and spread of aquatic invasive species.

Understand water quality to potentially reduce the severity of algae blooms.

Preserve and enhance great fishing on Big Round Lake.

This plan is guided by public input, scientific data, and requirements from the Wisconsin Department of Natural Resources (WDNR). WDNR regulations require a management plan for certain aquatic plant management activities and to obtain grants that fund aquatic invasive species and other lake management activities. WDNR guidelines determine the required plan contents and necessary public input.

The plan is also structured to meet requirements of NR 191.45 (2). The WDNR's aquatic plant management planning guidelines and Northern Region Aquatic Plant Management Strategy (Summer 2007) also framed the development of the plan. The results of studies using WDNR sampling protocol and plant survey methods were utilized in plan development.

Public Input for Plan Development

Three advisory committee meetings were held to guide the development of the Big Round Lake Comprehensive Lake Management Plan (CLMP). Results of a public opinion survey influenced selection of management goals and objectives and the actions chosen to reach them. The plan was presented to the public at the Big Round Lake Protection and Rehabilitation District annual meeting held Saturday, June 28, 2015 at the Georgetown Hall.

The advisory committee expressed a variety of concerns that are reflected in the goals and objectives for lake management in this plan. The committee also guided implementation strategies in the plan. Committee input is summarized in the meeting agendas included as Appendix A.

Following advisory committee review, the draft plan update was made available to lake residents and other interested parties. Residents were made aware of the availability of the draft with notices published in the Polk County Ledger and Intercounty Leader. The plan was available for review between September 8 and September 30 by request. Plan comments were accepted by Harmony Environmental via email and US mail through September 30, 2015.

Public Opinion Survey

The Big Round Lake public opinion survey was completed in the spring of 2015. Results of the survey are reported in Appendix B. Surveys were sent and returned via US Mail.

Survey response and distribution was as follows:

- Surveys distributed: 180
- Surveys received through 04/15/15: 97
- Response rate: 54%

Survey results related to specific resource concerns and management actions are included throughout this plan in related sections.

Overall concerns related to the lake were captured in the question: *Using the following scale, please tell us how concerned you are about the impact each of the following items currently or potentially may have on Big Round Lake (check one box for each item).*

Results are illustrated in Figure 1 below. Highest concerns were related to aquatic invasive species, fishing quality, water quality, and algae.

Responses were scored with responses recorded as follows: Very concerned = 4, Fairly concerned = 3, Unsure = 2, Not too concerned= 1, Not at all concerned= 0, then averaged for each question.

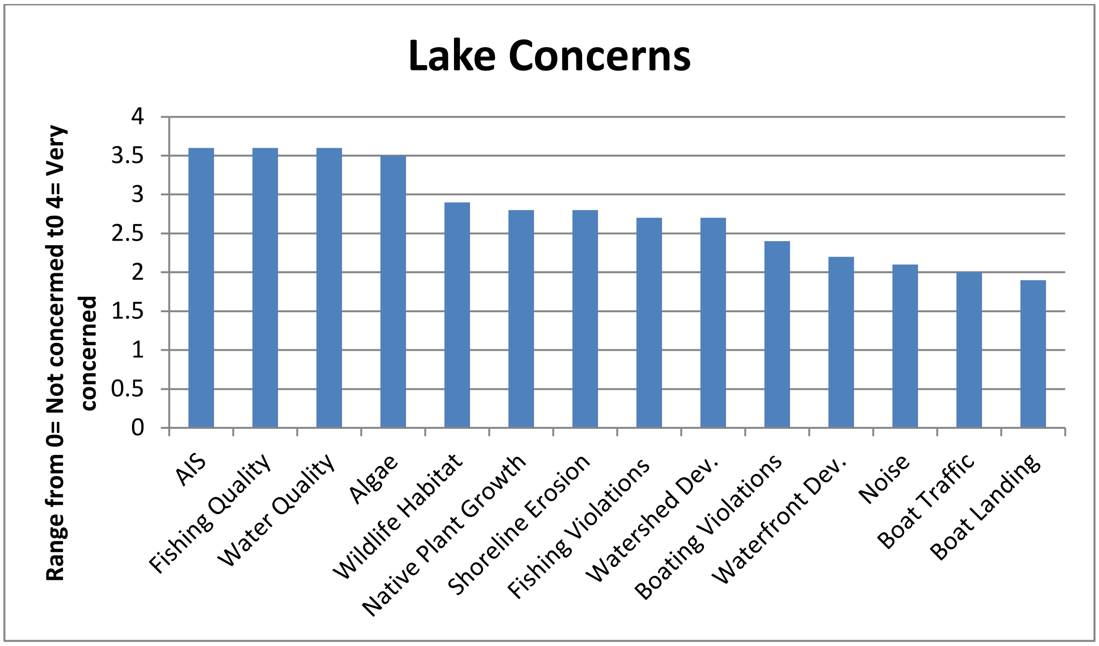

Figure 1.Concerns Related to the Big Round Lake

Big Round Lake

Big Round Lake is located in Polk County, Wisconsin in the town of Georgetown. The lake watershed is in the towns of Georgetown and Bone Lake. Its water body identification code is 2627400. It is a 1,014 acre lake with a maximum depth of 17 feet. Information about the lake is reported in Table 1 below.

Table 1. Big Round Lake Information

Lake	Type	Lake Acres	Trophic State	Shoreline Length	Watershed/ Lake Ratio	Max Depth (ft.)	Mean Depth (ft.)
Big Round Lake	Drainage	1,014	Eutrophic	5.3 miles[2]	16:1	17	10

From WDNR 2015: http://dnr.wi.gov/lakes/LakePages/LakeDetail

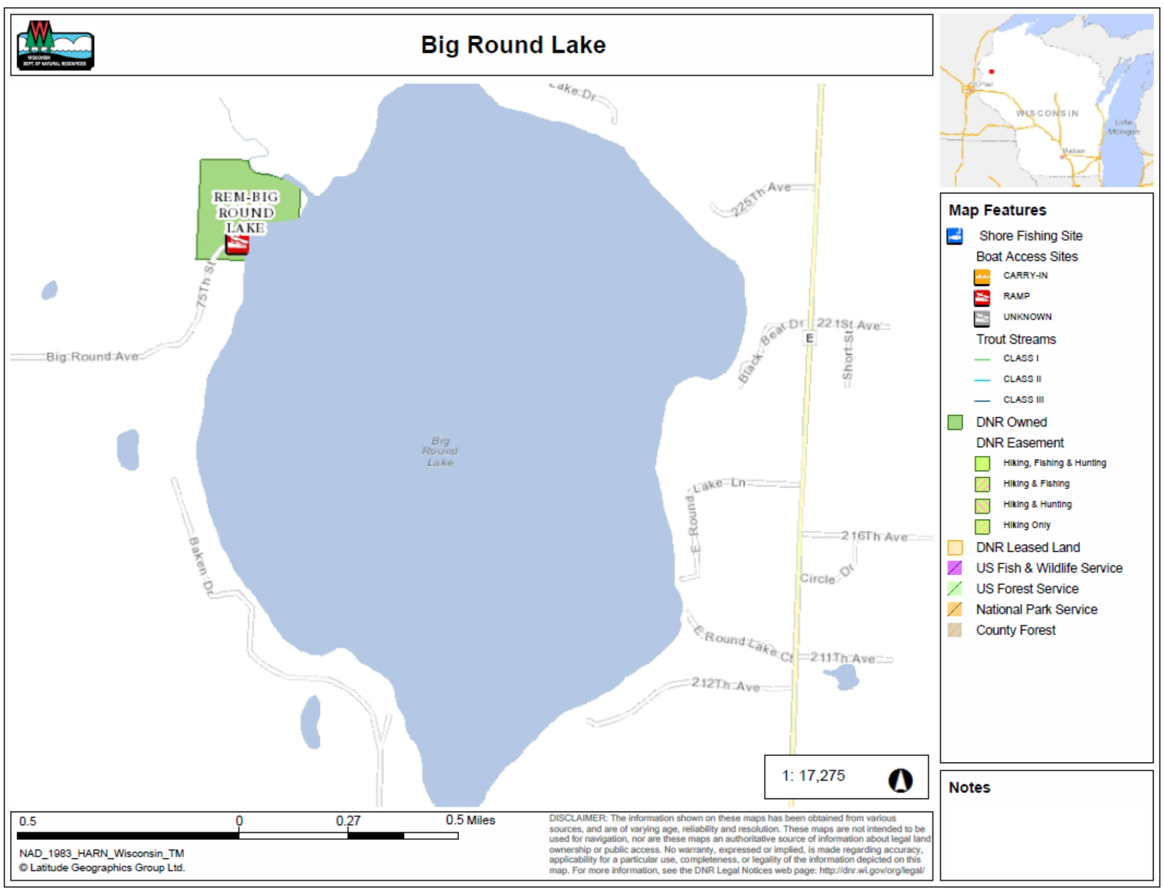

Figure 2. Big Round Lake Map

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[2] USGS, 2000

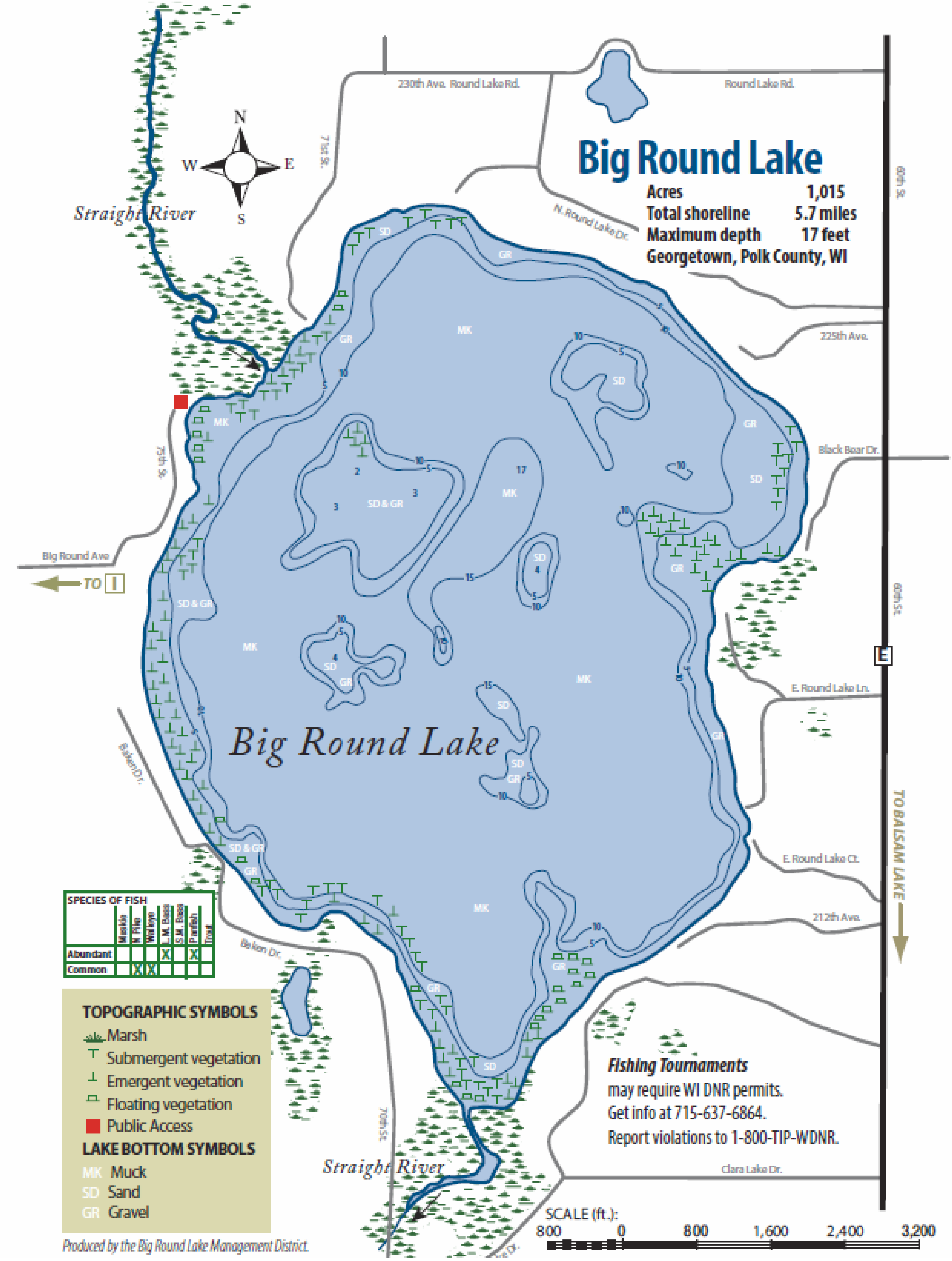

Figure 3. Big Round Lake Topographic Map

Water Quality

Water Designations[3]

Big Round Lake does not have a specific water quality designation. However, it appears that the lake could be readily listed as an impaired water if the Wisconsin Department of Natural Resources had phosphorus data in its data base. The lake is likely classified as a shallow lowland drainage lake, and the phosphorus standard for recreational use for that lake class is 40 ppb[4] total phosphorus (TP) for the monitoring period from July 15 – September 15. The average TP results for this time period from 2003 – 2012 is 92 ppb, although samples are not taken at consistent intervals (St. Croix Tribe, 2014).

Trophic State

Trophic state describes the productivity of a lake. The least productive or nutrient-rich lakes are oligotrophic lakes. The most productive lakes are referred to as eutrophic. Those in the middle are called mesotrophic. More productive lakes have more nutrients available for algae growth. If a watershed with little runoff and phosphorus sources surrounds a lake, the water will tend to have low phosphorus levels. This will result in limited plant and algae growth, causing it to be classified as an oligotrophic lake. As shown in Table 1, Big Round Lake is classified as eutrophic. Trophic state results are available for the lake based on secchi depth only in the DNR data base. These results are included as Figure 4.

A trophic state graph was also created based on phosphorus and chlorophyll data collected by the St. Croix Tribe. Because the WDNR reports only July and August results in their trophic state graphs, it is these months reported here for ready comparison with other lakes. The results are included as Figure 5.

[3] http://dnr.wi.gov/topic/SurfaceWater/orwerw.html
[4] Personal email communication Alex Smith, DNR Lakes Biologist July 27, 2015.

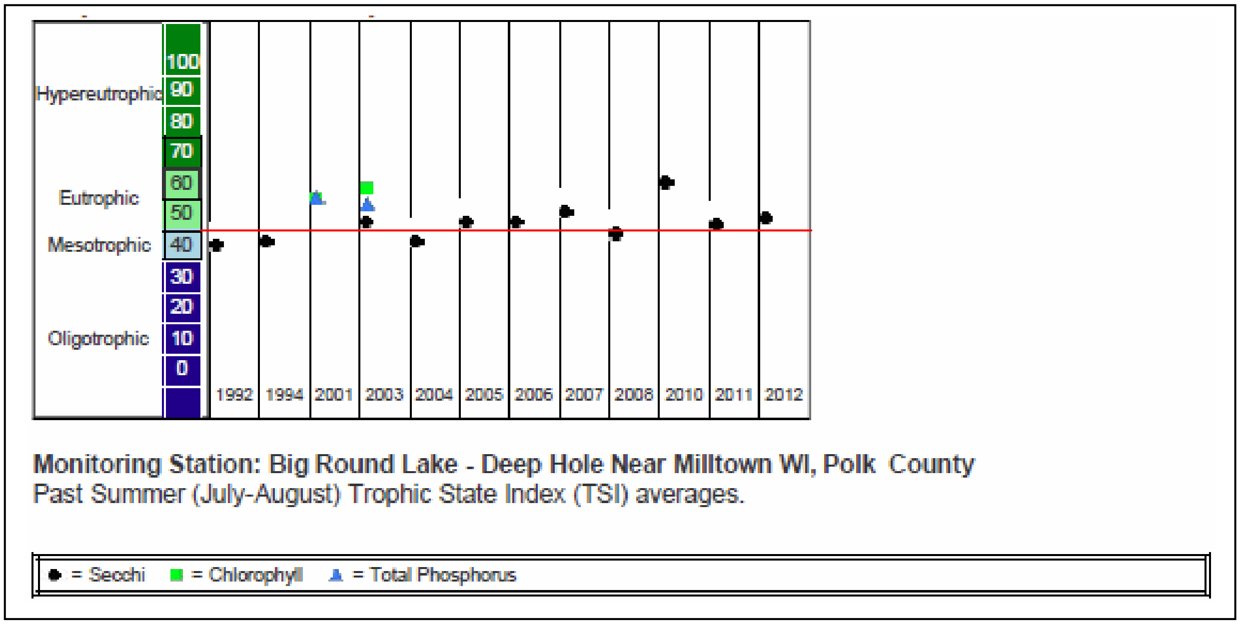

Figure 4. Trophic State Index Graph (Secchi Depth Results)

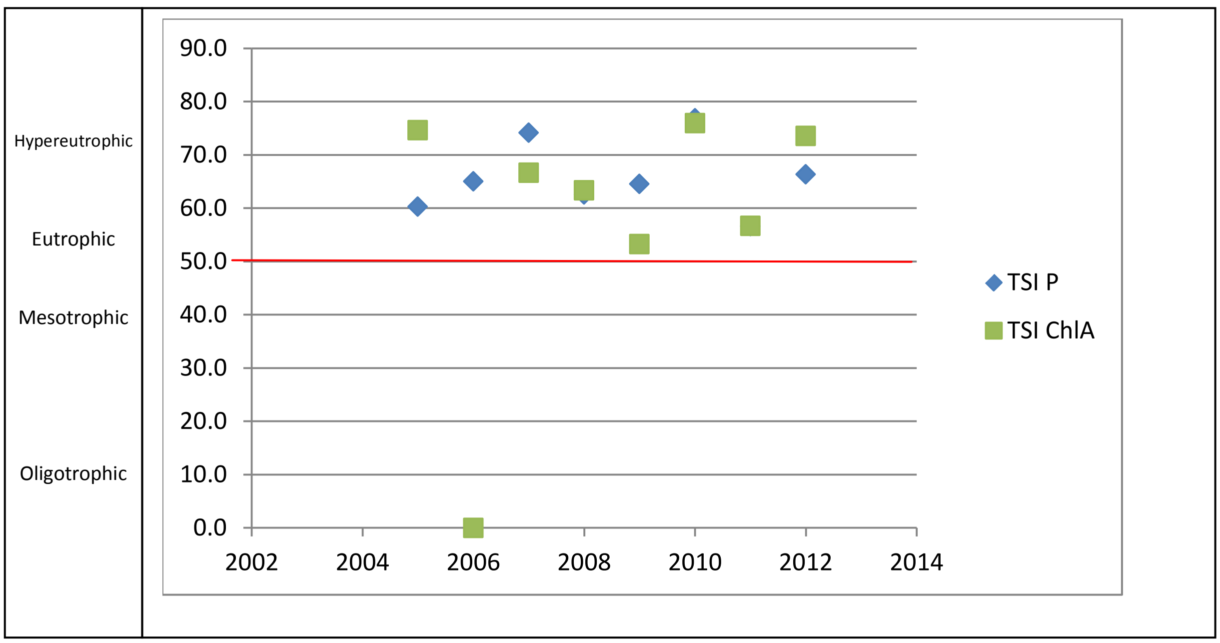

Figure 5. Trophic State Index Graph (TP and ChlA July and August Results)

Secchi Depth Results[5]

Secchi depths are the most commonly collected and available self-help lake monitoring data. Secchi depths measure water clarity. The secchi depth reported is the depth at which the black and white secchi disk is no longer visible when it is lowered into the water. Greater secchi depths occur with greater water clarity. Secchi depth results for Big Round Lake are shown in Figure 6.

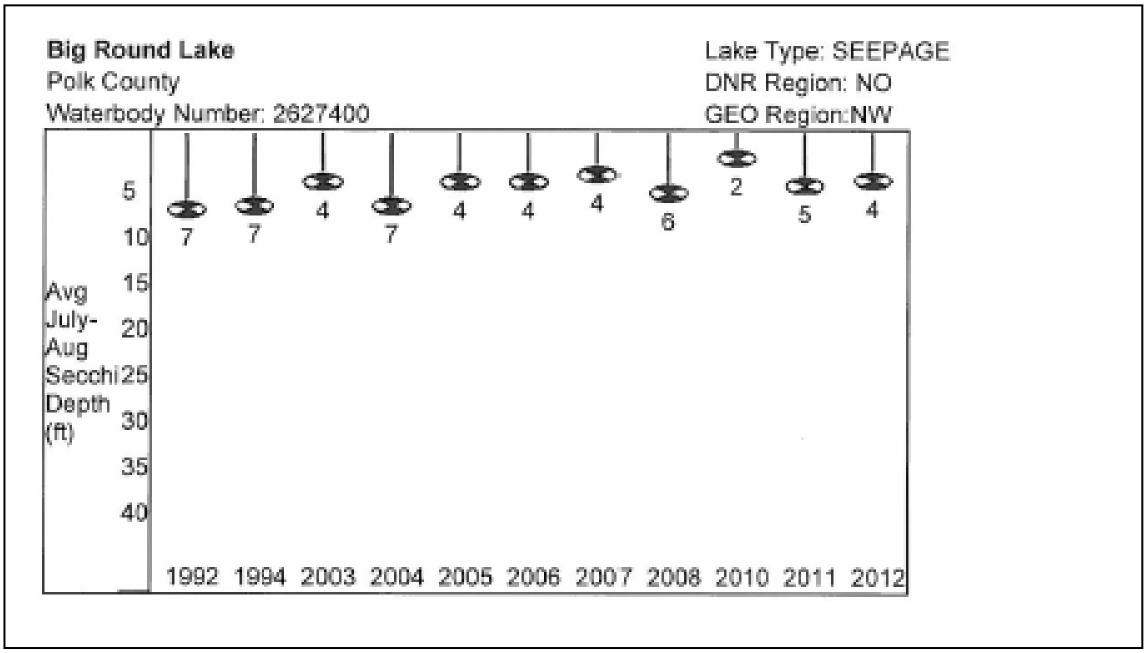

Figure 6. Big Round Lake July and August Secchi Depth Averages

During a typical summer, the lake clarity decreases with increased algae growth as the summer progresses. This is illustrated with secchi depth results from 2009 when regular secchi depth samples were taken.

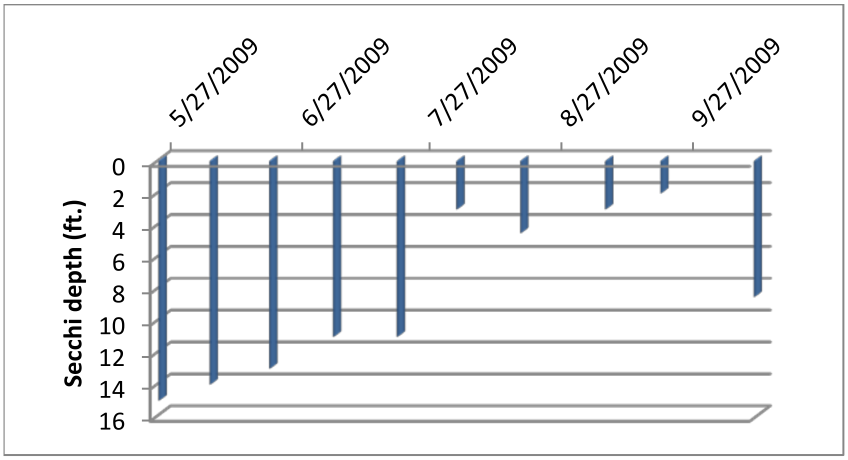

Figure 7. Secchi Depths May - October 2009

[5] Wisconsin Department of Natural Resources Citizen Lake Monitoring results (http://dnr.wi.gov/lakes/CLMN).

Algae Growth

Little information is available about the algae growing in the lake. In 2003 the dominant late summer algae species was *Microcystis,* a blue green algae. *Oscillatoria* (long straight filament) and *Anabaena* (spiral filament) blue green algae species were also present in the lake. (McComas, Lake Management Plan for Big Round Lake, Polk County, Wisconsin, 2004)

Blue green algae, technically known as cyanobacteria, are microscopic organisms that are naturally present in Wisconsin waterbodies at low levels. When conditions are favorable (usually in summer) the number of algae can increase dramatically, forming pea-soup blooms and scums on the water surface.

Blue green algae (or cyanobacteria) are of concern because these blooms can produce neurotoxins and hepatotoxins that may be harmful to human and animal health. Cyanobacterial blooms can occur at any time during the growing season, but are most common in late summer and fall. Blooms can look like foam, scum, or mats that float on the surface of the water, but some blooms present are as a thick “pea-soup” without a scum layer. The scum layer can be blue, bright green, brown, or red. Human and animal exposure may result in breathing problems, ear and eye irritation, vomiting, or skin rashes. Pets, livestock, or wildlife such as birds and fish can also be sensitive to blue green algae toxin exposure. Individuals with suspected exposure should seek medical attention (http://dhs.wisconsin.gov/eh/bluegreenalgae, 2009).

Cyanobacterial toxins are classified as neurotoxins and hepatotoxins. Neurotoxins are sometimes produced by *Anabaena* and *Oscillatoria* species. Symptoms of exposure include muscle cramps, twitching, paralysis, cardiac or respiratory failure, and death in animals. Hepatotoxins are produced by *Microcystis* and *Cylidrospermopsis* species (Cyanobacteria and Human Health , June 2004). *Gloeotrichia* species produce toxins that can cause skin irritation and liver damage (King, 2005).

Not all cyanobacteria produce toxins, but the presence of blue green algae is a marker for a potential hazard. (Polk County, 2013)

Historical Water Quality

A sediment core, or paleoecologic study, was conducted in 2006 by the Wisconsin Department of Natural Resources. The purpose of the study was to assess historical water quality and sediment accumulation from the watershed.

Diatoms are types of algae. By examining the types of algae present, it is possible to “reconstruct” historical phosphorus levels in the lake. Blue-green algae were common throughout the sediment core. The report concludes that the lake has always had moderate phosphorus levels with a significant plant community. Researchers found that the diatom community has changed little over the past 150 years. During this time, the estimated mean summer secchi depth was 6.5 to 7.5 feet. There was perhaps a slight increase in nutrient levels since the mid-1960s. Increased phosphorus throughout the summer implied internal loading from within the lake.

Big Round Lake had a recent low sediment accumulation rate of 0.1 inch/year. This rate is higher than it was in Big Round Lake 100 years ago but less than in most lakes. Soil erosion also appeared to be lower than most other lakes, and was not a significant nutrient source. More potassium observed in the sediment from the past 20 years was concluded to be most likely from lawn fertilizer. (Garrison, 2006)

Internal Phosphorus Loading

With low oxygen levels, lake sediments tend to release phosphorus, a phenomenon known as internal loading. Water temperature creates relatively stable, segregated layers based on density of water at various temperatures. If a lake stays stratified by water temperature, phosphorus released from the sediments is generally contained in the lower lake layer (the hypolimnion) until fall turnover. Because Big Round Lake is relatively shallow for its size, it appears the lake can mix over the summer (McComas, Lake Management Plan for Big Round Lake, Polk County, Wisconsin, 2004).

Dissolved oxygen (DO) and temperature profiles are not completed regularly for Big Round Lake. The 2004 Lake Management Plan reported that temperature and oxygen profiles were completed in 2002. It reports that the lake was stratified by temperature in July, but that oxygen was present at all depths. Bottom water samples collected by the Tribe in 2001-2003 also show little difference in phosphorus levels in top and bottom samples. However, in a 1980 WDNR feasibility study, dissolved oxygen was depleted in bottom waters suggesting phosphorus was released from bottom sediments. A 2000 USGS report also states that the lake weakly stratifies in the summer but that dissolved oxygen can be depleted in the deepest areas of the lake (Saad, 2000).

Because the information regarding internal loading is limited and inconclusive, additional study of internal loading of phosphorus in Big Round Lake is recommended.

Watershed

A watershed is the land area that drains to a body of water. The lake watershed is outlined in Figure 8. Land uses are generally visible in the aerial photo included in this figure. The 12-digit HUC code for the watershed is 070300050702.

Land use classification for the watershed is available from the Purdue University Online Watershed Delineation Tool by watershed HUC code.[6] Land use is itemized in Table 2 and illustrated in Figure 9. The lake watershed is more than 50% forested, followed by grass/pasture (24%), open water, and residential.

Table 2. Big Round Lake Watershed Land Use

Land Use Type	Area (acres)	% of Total
Forest	8,994.5	52.7
Low-Density Residential	569.9	3.3
High-Density Residential	4.3	.02
Grass/Pasture	4,233.2	24.8
Agriculture	734.4	4.3
Open Water	2,526.1	14.8
Total	**17,062.4**	99.9

Watershed and Water Quality

The watershed to lake area ratio is 15.8:1. This is a watershed of moderate size. A small watershed tends to reduce the nutrient load of the lake because there is a lower volume of runoff.

Phosphorus is the nutrient that most influences algae growth in most area lakes because it is the limited ingredient for algae growth. A phosphorus limited lake has a nitrogen to phosphorus (N:P) ratio of at least 10 to 1. Lakes are considered nitrogen limited, or sensitive to the amount of nitrogen inputs into a lake, when TN:TP ratios are less than 10. Only about 10% of Wisconsin lakes are limited by nitrogen. In contrast, lakes are considered phosphorus limited, or sensitive to the amount of phosphorus inputs into a lake, when the TN:TP ratio is above 15. Lakes with values between 10 and 15 are considered transitional. In transitional lakes it is impossible to determine which nutrient, either nitrogen or phosphorus, is limiting algae growth (Byron Shaw, Christine Mechenich, and Lowell Klessig, 2004). Total nitrogen is found by adding nitrate/nitrite and total Kjeldahl nitrogen.

A single sample date was located where both total phosphorus and total nitrogen were measured (7/18/12) (St. Croix Tribe, 2014). Total Kjeldahl nitrogen was .46 mg/L and nitrate/nitrite was below detection limits. Total phosphorus was .029 mg/L. This corresponded to a N:P ratio of 15.9:1, indicating that Big Round Lake is phosphorus limited.

[6] https://engineering.purdue.edu/mapserve

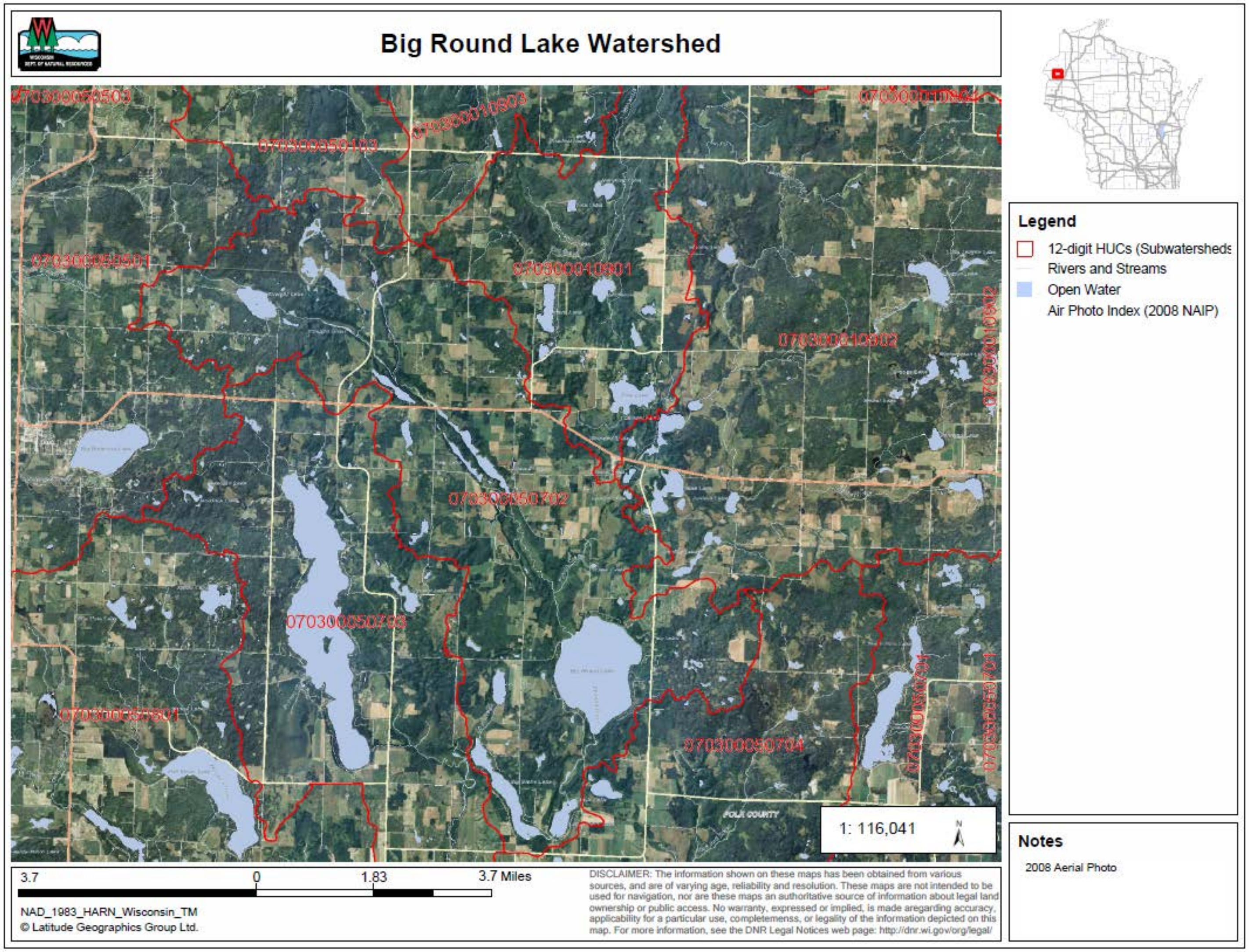

Figure 8. Big Round Lake Watershed

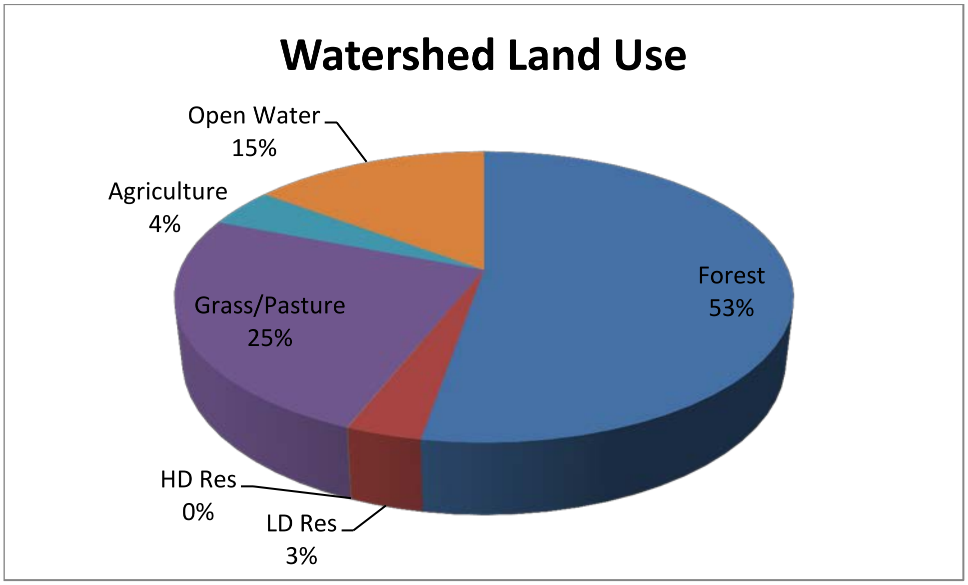

Figure 9. Big Round Lake Watershed Land Use

Phosphorus in Watershed Runoff

Phosphorus is found dissolved in runoff water and carried in soil particles that erode from bare soil. Phosphorus runoff from the watershed is determined by how land is used in the watershed along with watershed soils and topography. When a watershed is maintained in natural vegetation, there is less runoff of pollutants that impact the lakes. Agricultural, commercial, and residential lands tend to contribute greater amounts of phosphorus in runoff. Soil erosion is reduced when there is good vegetative cover. Water flow is slowed by tall vegetation, and forest groundcovers and fallen leaves allow runoff water to soak into the ground. In summary, anything that reduces soil erosion and/or the amount of runoff water flowing from a portion of the watershed reduces pollution to the lake.

Forested areas have less runoff and less phosphorus concentration in runoff due to tree cover breaking raindrops, more infiltration of water into the soil, and less erosion. High density residential areas along lakes have greater phosphorus loads since more runoff is generated from hard surfaces and lawns and much less water tends to be infiltrated into the soil.

Watershed land use and activities can influence water quality and lake sediment characteristics in localized areas. Excess erosion, for example, could lead to an accumulation of nutrient-rich sediment which may be more likely to support invasive aquatic plant growth (Wang, 2008) (Brenkert & Amundsen).

Soil types also influence how much water runs off the land from the watershed. The watershed (not including open water areas) is made up of soils from the hydrologic groups: A soils have a high infiltration rate and low runoff potential. D soils are at the other extreme with very slow infiltration rates and high runoff potential. They may have clay near the surface, a high water table, or are shallow over an impervious surface. The Big Round Lake watershed consists of primarily B soils which are silty and loamy with moderate runoff potential. (USDA, 1979)

Table 3. Watershed Hydrologic Soil Groups

Hydrologic Soil Group	Acres	% of Watershed
A	863.5	5.9
B	10,486.9	72.1
C	1320	9.1
D	1,865.9	12.8
	14,536.3	99.9

Straight River Water Quality

The Straight River drains most of the Big Round Lake watershed. The river also flows from the lake. The St. Croix Tribe of Chippewa Indians Environmental and Natural Resources Department monitored water quality in the Straight River inflow and outflow and shared water quality data for the inflow from 2008-2012 and for the outflow from 2001-2012.

- Total phosphorus average for all inflow samples is 43 ppb (2008-2012). Range = 16-92 ppb.
- Total phosphorus average for all downstream samples is 51 ppb (2008-2012). Range = 21-91 ppb.
- In lake total phosphorus averages 55 ppb (2008-2012). Range = 14-180 ppb.

This shows that the Straight River has low pollutant loading to Big Round Lake. In fact, water which flows to the lake is, on average, of lower nutrient content that water in the lake or flowing from the lake. The Straight River was estimated to contribute 1,570 pounds of phosphorus in the 2004 lake plan. Over 16,048 acres (the watershed not including the lake), this amounts to only .097 pounds of phosphorus per acre per year.

Lake Modeling

A lake model was not included in the scope of this management plan, and therefore, a phosphorus budget was not developed. Modeling completed for the 2004 plan estimated a total annual P load of 8,000 pounds with contributions listed in Table 4. However, this load is estimated based on a lake phosphorus concentration of 98 ppb TP. Actual annual total phosphorus from 2008-2012 is 55 ppb. Additional water quality analysis and modeling is needed.

Table 4. 2003 Phosphorus Loading by Land Use: WILMS Model (McComas 2004)

Land use	***Likely Load Estimate from WILMS (lbs./year)***	***% of Total Phosphorus Load***
Straight River (watershed)[7]	1,570	20
Curlyleaf Pondweed Dieback	945	12
Septic Systems[8]	150	2
Groundwater[9]	160	2
Rainfall (precipitation on lake)[10]	508	6
In lake phosphorus load	4,667	58
	8,000	100

Watershed/Water Quality Recommendations

The sources of phosphorus and algae blooms to Big Round Lake remain a bit of a puzzle. Big Round Lake is a eutrophic lake with frequent summer algae blooms including blue green blooms which may produce algal toxins. However, the Straight River has low phosphorus loading rates. It also appears from sediment core results that the lake has been a nutrient-rich system with blue green algae blooms for the past 150 years.

It is difficult to make water quality recommendations without a better understanding of the lake phosphorus budget – especially phosphorus that is from internal loading from lake sediments and waterfront properties (not reflected in Straight River water quality). For health and safety, it would be prudent to better understand blue green algae and the toxins they potentially produce in the lake.

Recommendations from the 2004 Lake Management Plan include:

- ✓ Study phosphorus loading from CLP and lake sediments
    - ▪ Implement a long term CLP control program
    - ▪ Consider aeration or lake sediment alum treatment
- ✓ Implement watershed projects focusing on agricultural management
- ✓ Properly maintain septic systems
- ✓ Restore natural shorelines
- ✓ Protect walleye and northern pike habitat
- ✓ Conduct ongoing education

[7] 40 ppb average TP, annual flow based on 20 cfs
[8] Based on 30 permanent and 150 seasonal residences
[9] Estimated in 1980 WDNR study (measured 27 ppb and estimated 160 lbs. based on areas which flow to the lake)
[10] 0.5 lbs./surface acre

- ✓ Monitor lake water quality

Aquatic Habitats

Lake Use

There is one public boat landing on the lake as illustrated in Figure 2. There is a private boat landing on the northwest corner of the lake owned by the Tribe.

Shorelines and Shallows

Natural shorelines benefit waterfront owners in significant ways by absorbing and filtering runoff thereby maintaining water quality, controlling flood waters, stabilizing shorelines, providing habitat on the shore and in the water, and establishing a natural green screen. (UWEX, 2014)

The area where the water meets the land is critically important to fish and wildlife. In Wisconsin, 80% of endangered or threatened species spend all or part of their lives in shoreland areas. Important habitat elements in the water include emergent, floating, and submerged aquatic plants and woody debris. On the land, bird diversity and abundance is directly related to shoreland trees, shrubs, and groundcovers. Amphibians benefit from wet areas and gentle slopes next to the water. (UWEX, Protecting Our Living Shores, 2014)

Woody cover in lakes, provided by fallen trees and branches, are used by fish, birds, and turtles. In Wisconsin lakes, over 15 different fish species may inhabit a single downed tree at a time. Smallmouth bass construct their spawning beds next to large rocks or woody cover. Studies of northern Wisconsin shorelines find this cover decreases with residential development. (UWEX, Protecting Our Living Shores, 2014)

Shoreline Inventory

Blue Water Science inventoried shoreland conditions in 2003 both along the shoreline (first 15 feet) and further upland. Natural vegetation was recorded in two categories: at least 50% and at least 75% natural vegetation. Wisconsin standards generally require a natural buffer zone that extends at least 35 feet deep along at least 70% of the property.

Results: 24% of parcels met inventory criteria of at least 75% natural upland
34% of parcels met inventory criteria of at least 75% natural shoreline

These results are compared to several Minnesota lakes.

<u>Recommendations</u>

General recommendations and descriptions for improving natural shoreland conditions are made including: naturalization, accelerated naturalization, and restoration. (McComas, 2003)

Critical Habitat Areas

The Department of Natural Resources transitioned from sensitive area designations to designations of *critical habitat areas* that include both *sensitive areas* and *public rights features*. S*ensitive areas* offer critical or unique fish and wildlife habitat, including seasonal or lifestage requirements, or offer water quality or erosion control benefits to the area (Administrative code 107.05(3) (1) (1)). Wisconsin Department of Natural Resources is given the authority for the identification and protection of sensitive areas of the lake in this code. *Public rights features* are areas that fulfill the right of the public for navigation, quality and quantity of water, fishing, swimming, or natural scenic beauty. Protecting these *critical habitat areas* requires the protection of shoreline and in-lake habitat. A *critical habitat area* designation provides a framework for management decisions that impact the ecosystem of the lake.

Ten sensitive areas are designated on Big Round Lake. Designations are for aquatic vegetation (including wild rice) or rocky substrate. Gravel and coarse rock rubble spawning areas are sites B, F, H, and J. Remaining sites are designated for aquatic vegetation. Wild rice is present in sensitive areas A, D, and I along the western shoreline.

Recommendations

- ✓ Install or preserve a vegetative buffer at least 35 feet deep to capture runoff – especially near rocky substrate sensitive areas.
- ✓ Leave woody debris in the water
- ✓ Prevent erosion and nutrient runoff adjacent to sensitive areas
- ✓ Protect wild rice
- ✓ Monitor for purple loosestrife
- ✓ Protect areas adjacent to sensitive areas with conservation easements, deed restrictions, and zoning regulation.

(WDNR, 1999)

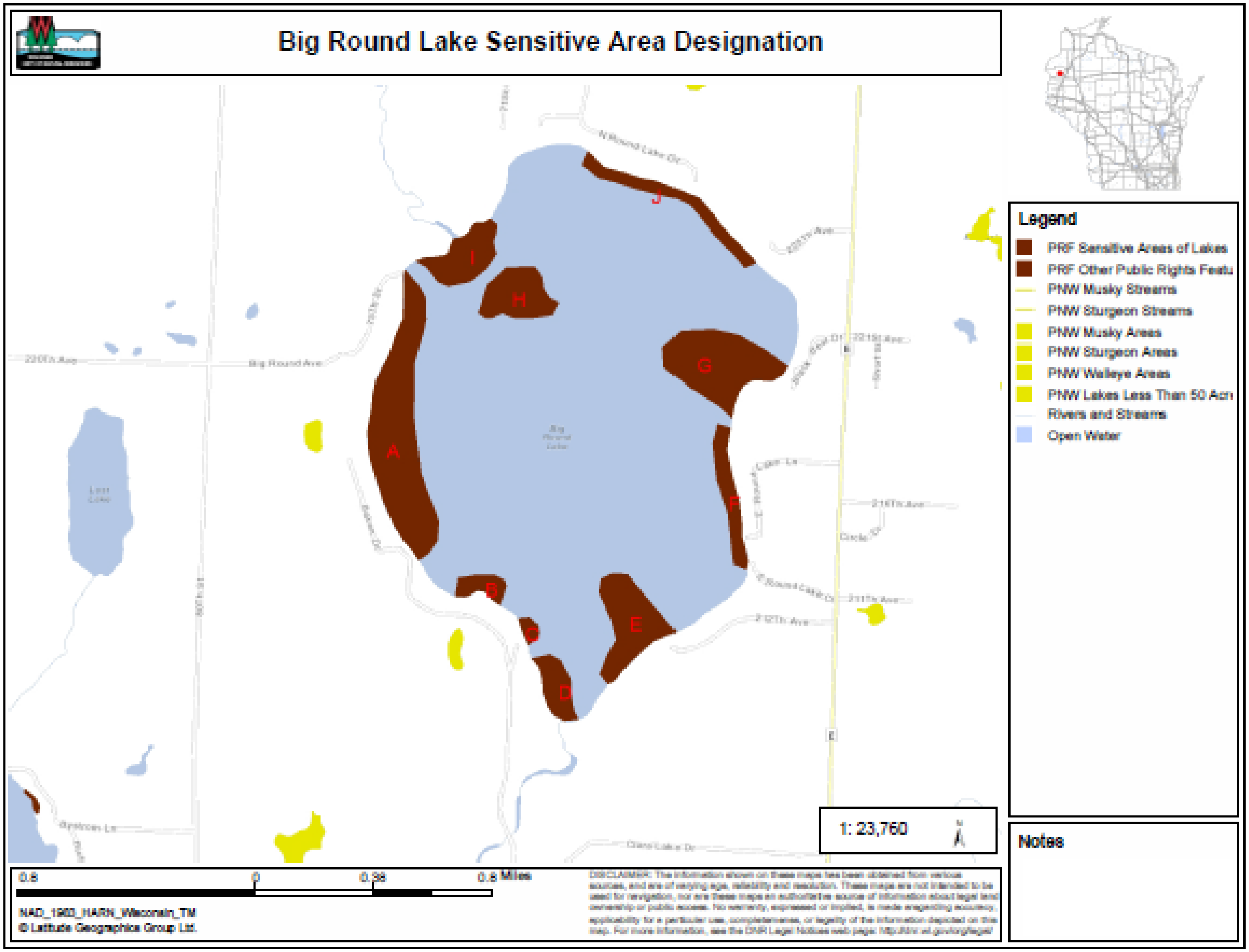

Figure 10. Big Round Lake Sensitive Area Designations

Functions and Values of Native Aquatic Plants

Naturally occurring native plants provide a diversity of habitat, help maintain water quality, sustain the fishing quality for which Big Round Lake is known, and support common lakeshore wildlife from loons to frogs.

Water Quality

Aquatic plants can improve water quality by absorbing phosphorus, nitrogen, and other nutrients from the water that could otherwise fuel nuisance algae growth. Some plants can even filter and break down pollutants. Plant roots and underground stems help to prevent resuspension of sediments from the lake bottom. Stands of emergent plants (with stems that protrude above the water surface) and floating plants help to blunt wave action and prevent erosion at the shoreline.

Fishing

Habitat created by aquatic plants provides food and shelter for both young and adult fish. Invertebrates living on or beneath plants are a primary food source for fish. Other fish such as bluegills graze directly on the plants themselves. Plant beds provide important spawning habitat for many fish species.

Waterfowl

Plants offer food, shelter, and nesting material. Birds eat both the invertebrates that live on plants and the plants themselves.[11]

Protection against Invasive Species

Non-native invasive species threaten native plants in Northern Wisconsin. The most common are Eurasian water milfoil (EWM) and curly leaf pondweed (CLP). These species are described as opportunistic invaders. This means that these “invaders” benefit where an opening occurs from removal of plants. Without competition from other plants, invasive species may successfully become established in a lake. Removal of native vegetation not only diminishes the natural qualities of a lake, it may increase the risk that an invasive species can successfully invade onto the site where native plants have been removed. This concept is easily observed on land where bared soil is quickly taken over by weeds that establish themselves as new occupants of the site. While not a providing a guarantee against invasive plants, protecting and allowing the native plants to remain may reduce the success of a new invasive species becoming established in a lake or continued spread of Eurasian water milfoil. Invasive species can change many of the natural features of a lake and often lead to expensive annual control plans. Native vegetation may cause localized concerns to some users, but as a natural feature of lakes, they generally do not cause harm.[12]

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[11] Above paragraphs summarized from Through the Looking Glass. Borman etal. 1997.

[12] Taken from Aquatic Plant Management Strategy. DNR Northern Region. Summer 2007.

Fish Community

Common fish species of Big Round are listed in the WDNR web pages[13] as summarized below.

Table 5. Fish of Big Round Lake

Species	Abundance
Panfish	Common
Walleye	Common
Largemouth bass	Common
Northern pike	Present
Muskellunge	Present

Wisconsin Department of Natural Resources fish surveys help to assess fish populations on the lake. **Blue gill** average size has increased by about ½ inch per age class from the 1997 survey to the 2012/13 survey. **Largemouth bass** catch rates were high but have decreased from the 1997 survey to 2012/13.

Walleye

The 2012/13 Wisconsin Department of Natural Resources survey concluded there are 1.1 walleye/acre which is the lowest documented abundance in Big Round Lake over the years. Angler walleye harvest has also decreased. Walleye of varying sizes (fry, small fingerlings, and large fingerlings) were stocked from 1987-2011. The report recommends stocking large fingerlings at a density of 10 fish per acre every other year. (Cole, 2013)

As part of a special walleye initiative, the WDNR plans to stock 20, 8-9 inch fingerling walleye per acre marked with antibiotic dye every other year (odd numbered years) in Big Round Lake. Shocking will be completed each fall with a comprehensive fish survey every 6 years. The Tribe will also stock 5,000 walleye each year. [14]

<u>WDNR Recommendations</u>

- ✓ No fish regulation changes are suggested.
- ✓ Encourage lakeshore owners to minimize disturbance of the lakeshore and littoral zone to protect fish and wildlife habitat and water quality.

(Cole, 2013)

[13] http://dnr.wi.gov/lakes/LakePages

[14] 2015 Big Round Lake Tribal/District Joint Meeting Notes.

Table 6. Tribal Walleye Stocking Big Round

	Age Class		
Year	Fry	Fingerlings	Comments
1987	0	17,280	
1988	0	3,270	
1989	0	0	
1990	0	32,805	
1991	389,614	28,906	
1992	126,622	2,914	
1993	0	16,356	
1995	0	0	
1996	0	21,126	
1997	0	0	
1998	123,360	16,820	
1999	500,000	0	
2000	340,000	0	
2001	152,960	102,351	
2002	0	0	
2003	292,158	52,473	
2004	246,847	0	
2005	125,385	51,567	
2006	0	9,961	
2007	103,133	2,334	
2008	0	0	
2009	332,896	271	
2010	56,809	0	
2011	0	9,211	2.4" fish
2012	0	0	
2013	0	18,054	443= 4"+ fish
2014	175,838	0	
Totals	2,965,622	385,699	

(St. Croix Tribe, 2017)

Table 7. WDNR Walleye Stocking Big Round

Year	Fry	Small Fingerling	Fingerling	Large Fingerling	Yearling	Length (in.)
1972	7,840					3.00
1973					48	9.00
1973			29,975			3.00
1974			30,016			3.00
1975			40,790			3.80
1977			36,872			3.67
1979			50,852			3.00
1981			50,860			3.00
1983	3,072,000					1.00
1983			17,820			3.00
1985			50,974			3.00
1986			5,508			3.00
1987			192,750			4.00
1988	1,015,000					1.00
1988			54,688			3.00
1989	1,015,000					3.00
1989			50,750			3.00
1990			45,080			4.00
1991			50,744			2.00
1992			50,435			2.50
1994			50,976			2.00
1996			9,792			2.40
1997				30,450		3.80
1998		19,560				2.55
1999		51,911				1.70
2001		50,750				1.30
2003		50,750				1.93
2005		50,800				1.50
2009		35,525				1.60
2011				10,150		6.33
2013				5,075		6.50

Fishing Activity

A 2012 WDNR creel survey reports fishing effort and results by species for the season. Selected results from that creel survey are included in Table 8 below. Methods are described in the report.

Table 8. Creel Survey Results Big Round Lake 2012

Species	Hours of Effort	Percent of Hours	Total Catch	Total Harvest	Harvest Rate (Hours/Fish)	Mean Length Harvested (in.)
Bluegill	23,370	60.6	64,746	42,986	1.84	8.3
Largemouth Bass	4,864	12.6	19,130	749	0.15	14.8
Black Crappie	3,984	10.3	5,968	3,700	0.93	9.7
Pumpkinseed	3,381	8.8	1,531	1,025	0.30	7.8
Walleye	1,114	2.9	315	49	0.04	19.7
Yellow Perch	1,111	2.9	1,636	607	0.55	10.3
Northern Pike	512	1.3	628	47	0.09	23.3
Rock Bass	125	0.3	1,318	195	1.56	8.5
Muskellunge	80	0.2	0	0	-	-
Smallmouth Bass	9	0.0	2	0	-	-

Public Opinion Survey Results

Fishing is a popular activity on Big Round Lake with 94% of respondents indicating they had fished in the lake within the last three years. When respondents were asked to rank the top three lake activities most enjoyed, open water fishing was selected most frequently, and it was most often chosen in the top three ranked activities. Having a diverse high quality fishery was ranked as very important by 72% of respondents and fairly important by 17%. The most important fish species was clearly walleye, followed by bluegill and crappie.

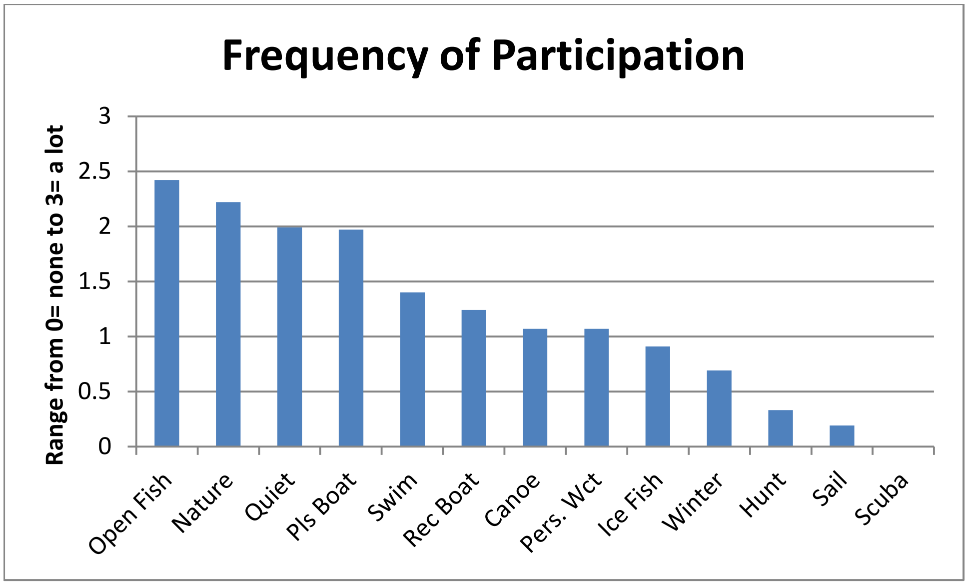


Figure 11.How often does your family participate in the following activities on Big Round Lake?

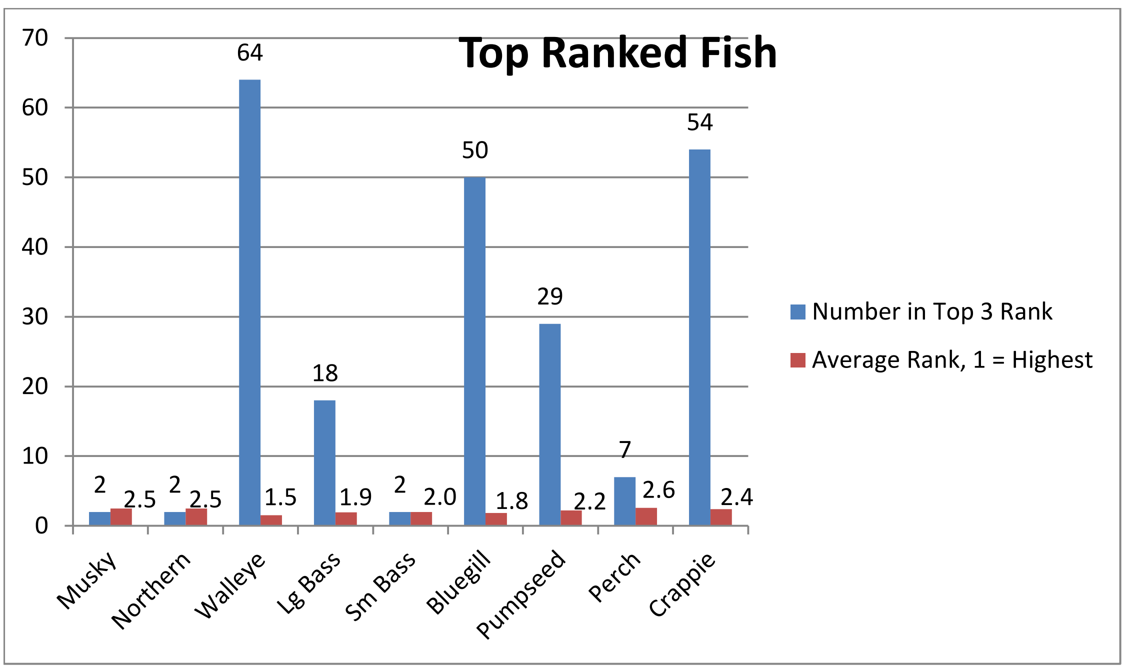


Figure 12. Please rank the top three most important fish species for you.

Plant Community

The Polk County Land and Water Resources Department conducted a point intercept aquatic macrophyte survey in August 2013 to evaluate the plant community in Big Round Lake. The county completed a previous survey in 2008. Plant surveys were completed according to standard WDNR protocol. The full survey report is available as a separate document and summarized in following sections. Survey methods are included in Appendix C.

The survey used sample point grids generated by the Wisconsin Department of Natural Resources. At each sample point where plants are likely to grow, a rake was used to collect plant samples. The samples were evaluated for plant density for each species with rake density ratings as described in Table 9 and illustrated in Figure 13 below.

Table 9. Aquatic Plant Survey Rake Density Ratings

Rake density rating	Criteria for rake density rating
1	Plant present, occupies less than ½ of tine space
2	Plant present, occupies more than ½ tine space
3	Plant present, occupies all or more than tine space
v	Plant not sampled but observed within 6 feet of boat

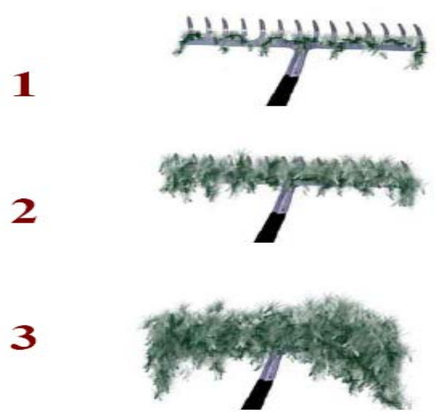


Figure 13. Illustration of Rake Plant Density

Point Intercept Survey Results

(Polk County, 2013)

Big Round Lake had 506 sample points in the survey grid, with 348 points within the defined littoral depth. The littoral zone depth (where plants grow) extended to 13.5 feet. Of the littoral points, 246 (71%) had vegetation present as shown in Table 10.

The diversity of plants in Big Round Lake is moderate. Nineteen different species were sampled on the rake. The Simpson's diversity index of 0.86. Table 11 lists the species sampled and viewed and their frequency statistics.

Changes were evident from 2008 through 2013 as reported in Table 10. Most of these statistics show declining aquatic plant quality. However, it is difficult to make conclusions based on this data because plant growth can vary considerably from year to year.

Table 10. Big Round Lake 2013 and 2008 Macrophyte Survey Statistic Summary

Big Round Lake Survey Stats	2013	2008
Total number of sample sites in survey	506	506
Total number of sites with vegetation	246	353
Total number of sites shallower than maximum depth of plants	348	476
Frequency of occurrence at sites shallower than maximum depth of plants	71%	74.2%
Simpson Diversity Index	0.86	0.87
Maximum depth of plants (ft)	13.5	16
Average number of all species per site (shallower than max depth)	1.8	2.18
Average number of all species per site (veg. sites only)	2.55	2.94
Species Richness	19	22
Species Richness (including visuals)	21	30

Coontail, the most dominant plant species was found at 149 sites. This is in contrast to white-stem pondweed, which was found at only one site across the entire lake. (Figure 14)

Table 11. Big Round Lake Plant Species

Plant species	Frequency of occurrence within vegetated areas (%)	Frequency of occurrence at sites shallower than max. depth of plants (%)	Relative Frequency (%)
Coontail	60.57	42.82	23.73
Small pondweed	44.31	31.32	17.36
Forked duckweed	38.62	27.30	15.13
Flat-stem pondweed	30.49	21.55	11.94
Filamentous algae	25.61	18.10	
Common waterweed	15.85	11.21	6.21
Wild celery	12.60	8.91	4.94
Curly-leaf pondweed	11.38	8.05	4.46
Clasping-leaf pondweed	9.35	6.61	3.66
Muskgrasses	7.32	5.17	2.87
Slender naiad	7.32	5.17	2.87
Northern water milfoil	6.50	4.60	2.55
Sago pondweed	2.85	2.01	1.11
Illinois pondweed	2.44	1.72	0.96
Softstem bulrush	1.63	1.15	0.64
Large-leaf pondweed	1.22	0.86	0.48
Northern wild rice	1.22	0.86	0.48
Spatterdock	0.81	0.57	0.32
Aquatic moss	0.81	0.57	
White-stem pondweed	0.41	0.29	0.16
Arrowhead	0.41	0.29	0.16

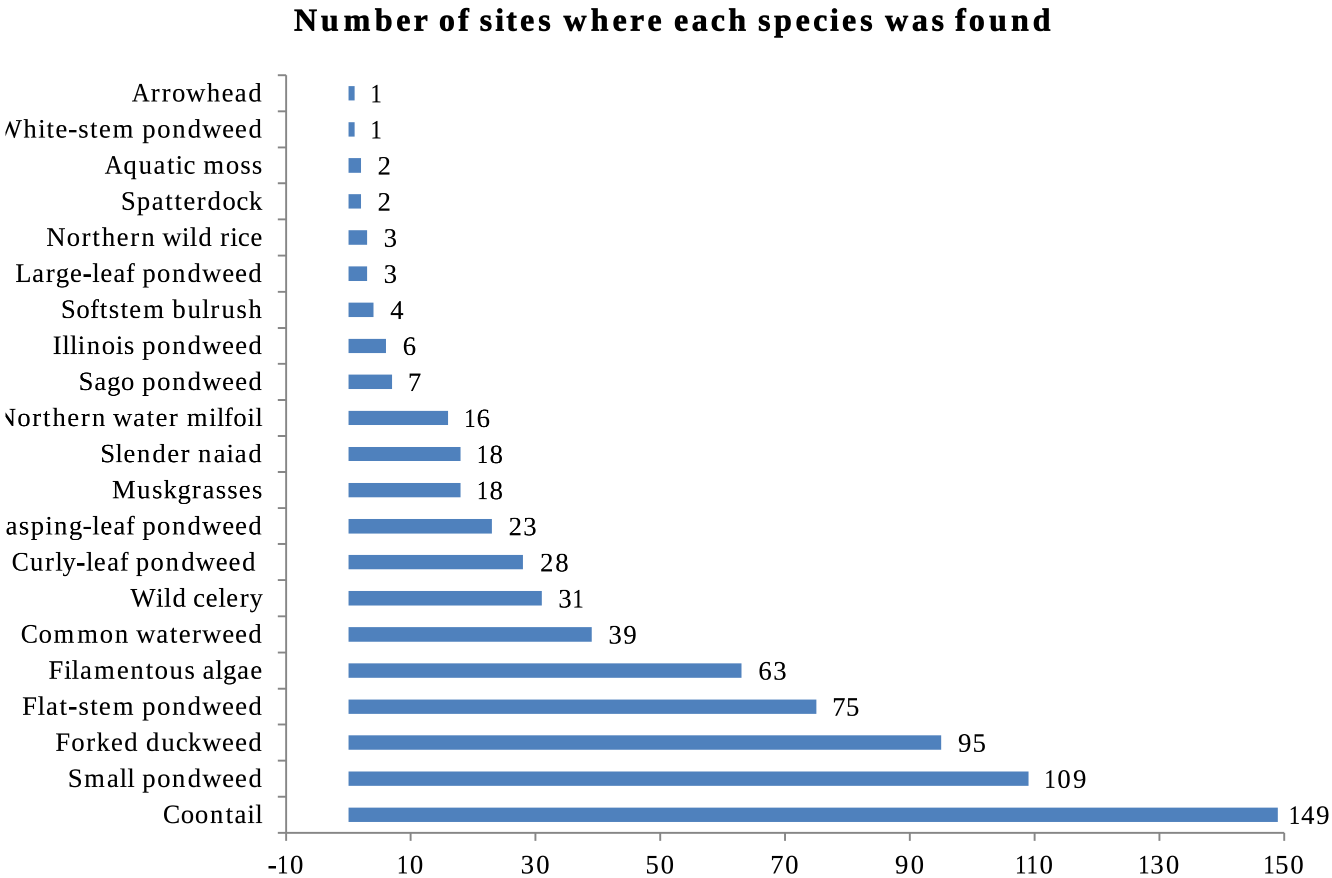


Figure 14. Number of Sites Where Each Species Was Found

Floristic Quality Index

Evaluation of the plant community can indicate changes in habitat and water quality from human development using a tool known as the Floristic Quality Index (FQI). This index uses the number of species sampled on the rake (N) and a conservatism value (C) given to some species. The greater the conservatism value (ranges from 1-10), the less tolerant the plant is to changes in habitat disturbances. The habitat changes are compared to characteristics in the lake prior to human disturbances.

Dr. Stanley Nichols of UW-Extension surveyed numerous lakes in various eco-regions around Wisconsin. He then calculated the median number of species, median conservatism value, and the median FQI for each eco-region. (Nichols, 1999)

The Floristic Quality Index (FQI) for Big Round Lake is 23.3. This is close to the median for other lakes evaluated within the North Central Hardwood Forest Ecoregion of 20.9.

Table 12. Big Round Lake and Eco-region FQI

Big Round Lake FQI	Big Round FQI 2013	Big Round FQI 2008	Eco-region Median
N	17	NA	14
mean C	5.6	NA	5.6
FQI	23.3	25.9	20.9

Transect Survey Results

(McComas, 2015)

Blue Water Science completed early and late season aquatic plant, transect surveys from 2005 to 2015. This survey records the presence of species along fixed transects distributed around the lake. Survey results include a list of species present along with their percent occurrence along these transects.

Curly leaf pondweed frequency of occurrence allows the creation of maps of estimated areas of CLP growth in the lake each June. Relative rake density from 0 to 5 is recorded for CLP.

Early and late season transect survey results demonstrate that the number of aquatic plant species has remained somewhat stable with a range of from 10 to 16 species detected during the survey each year. The distribution of plants shows typical year-to-year variability. As native plant species and curly leaf pondweed presence are observed and recorded, the surveys provide a check on potential additional invasive species present.

Curly Leaf Pondweed

Curly leaf pondweed (CLP) is a non-native invasive plant found in many area lakes. It has been in Big Round Lake at least as early as 1978, and monitored regularly in 2003 and from 2005 to 2015.

Blue Water Science assessed the potential for nuisance growth of CLP by analyzing Big Round Lake sediments. Nuisance growth of CLP is predicted with low sediment bulk density, high organic matter, high pH, and low iron. The map in Figure 15 predicts the potential for CLP growth based on these characteristics. Predicted areas of light nuisance growth are shown with yellow dots and predicted areas with non-nuisance growth are shown with green dots. (McComas, 2004) Growth of CLP tends to be light to moderate in Big Round Lake (McComas, 2015). Results are shown in Figure 16.

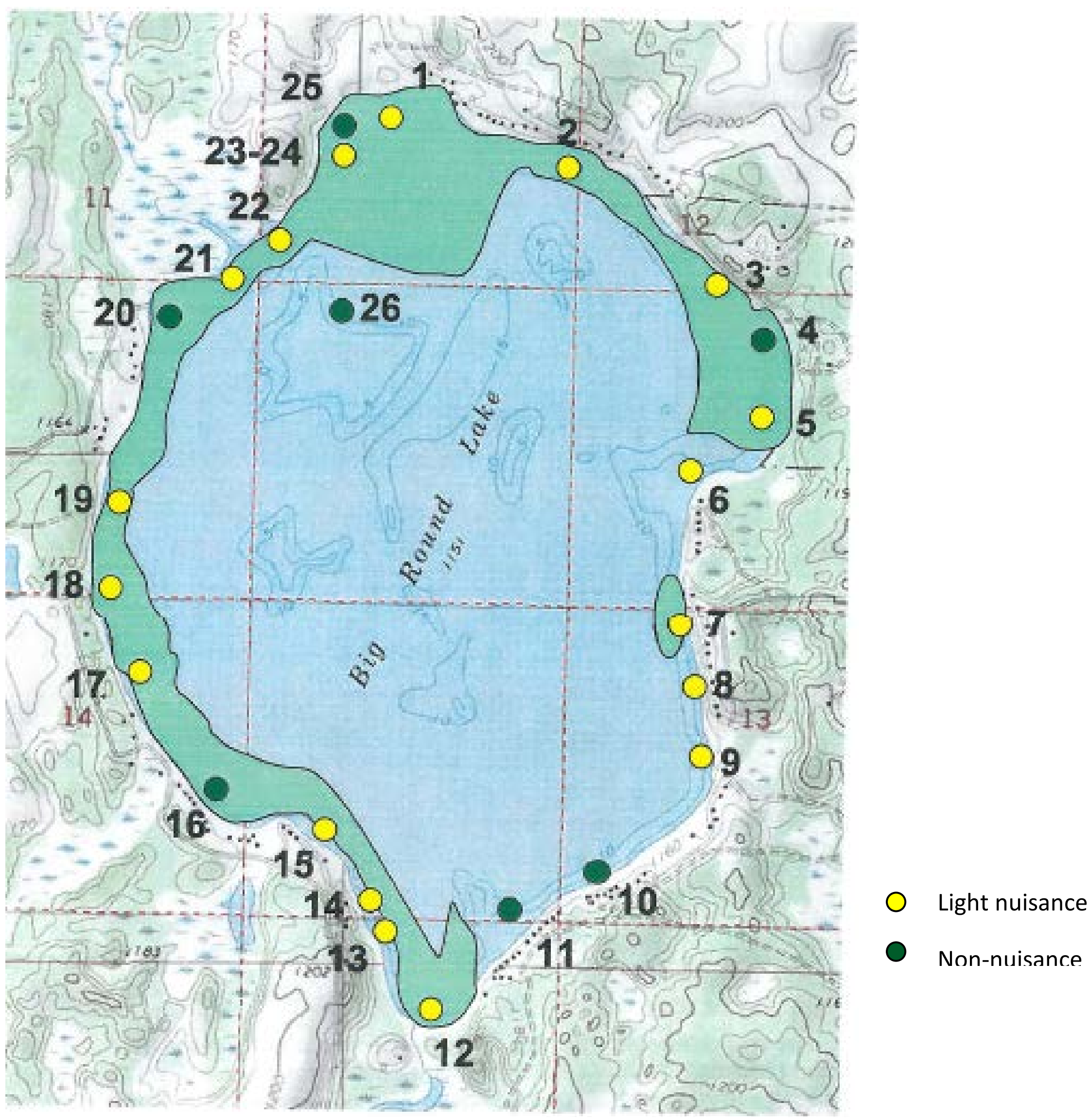


Figure 15. Predicted growth of Curly Leaf Pondweed Big Round Lake (McComas, 2004)

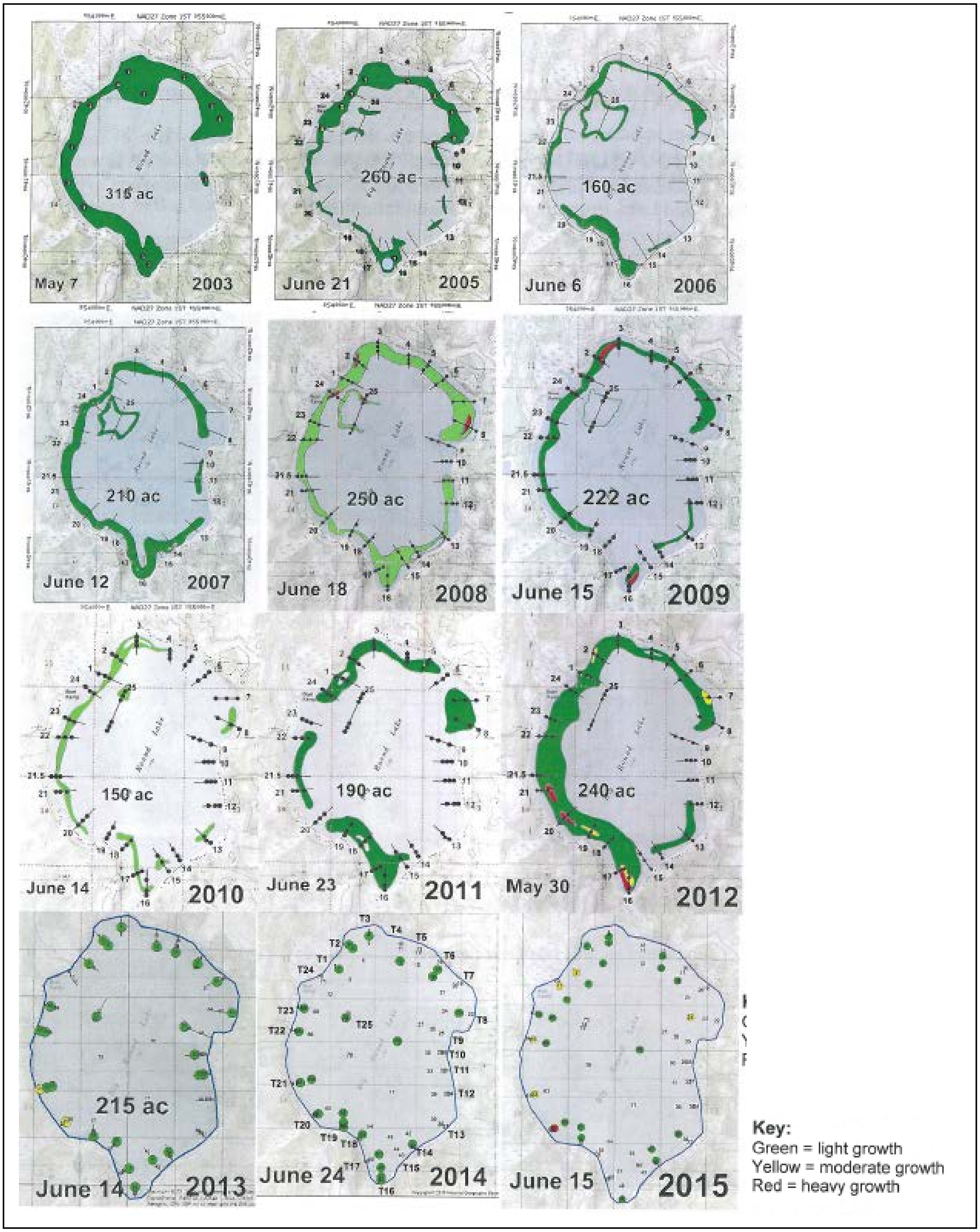


Figure 16. Curly Leaf Pondweed Distribution in Big Round Lake 2003 and 2005-2015 (from McComas, 2015)

Eurasian Water Milfoil Potential

Eurasian water milfoil is not currently present in Big Round Lake. Blue Water Science examined the potential for its growth by examining lake sediments in 2004. The analysis concluded that the potential growth of EWM is predicted to be mostly light on a long term basis. However, heavy growth could occur on the north and south ends of the lake. Heavy growth was predicted to occur where sediment nitrogen was over 10 ppm and organic matter content was less than 20 percent. (McComas, 2004)

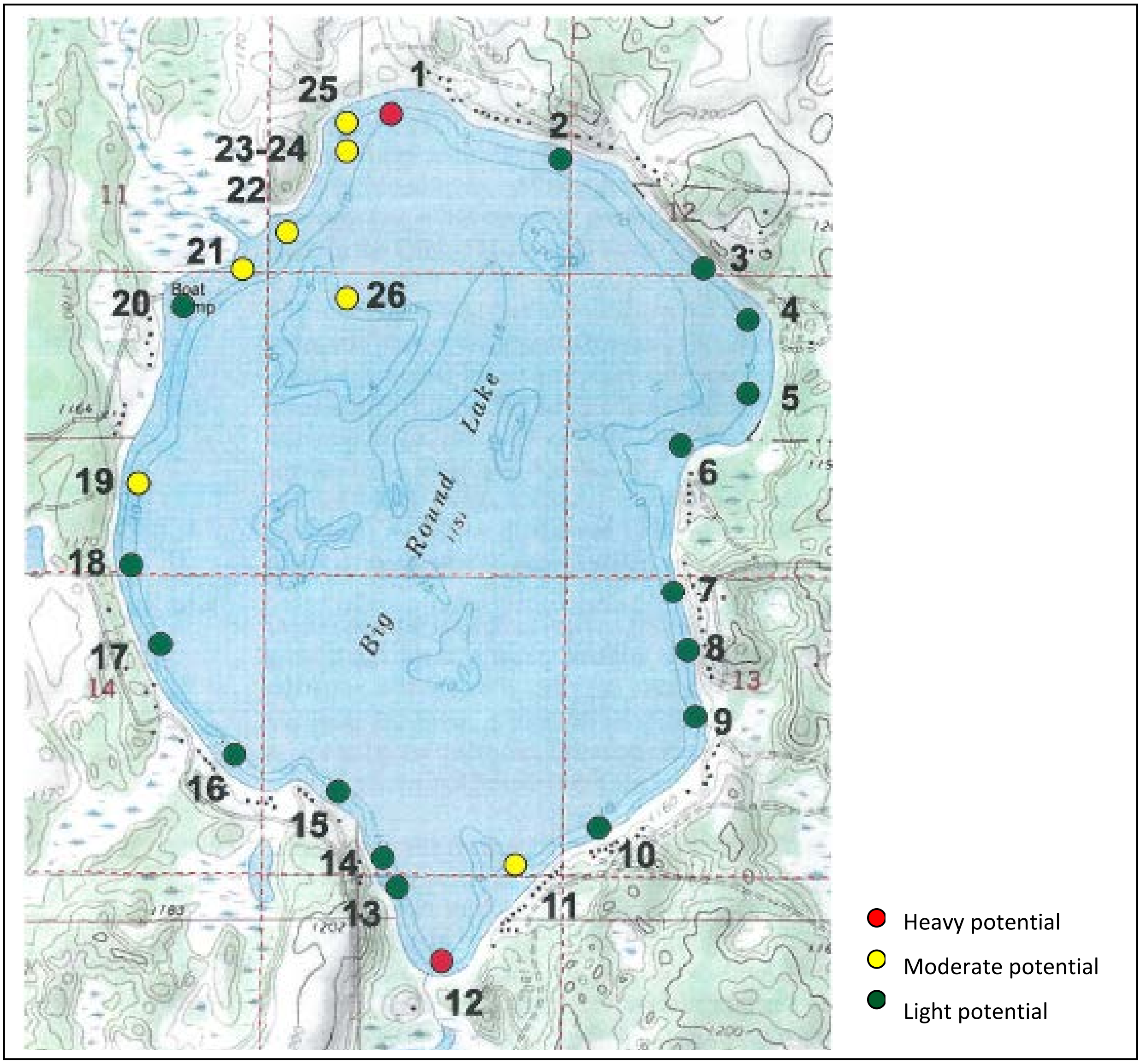


Figure 17. Potential for Eurasian Water Milfoil Growth (McComas, 2004)

Aquatic Plant Management

Because active plant management is not currently proposed for Big Round Lake, plan sections overviewing aquatic plant management method options are included as Appendix E.

Current Aquatic Plant Management Activities

Big Round Lake aquatic plant management activities emphasize prevention of aquatic invasive species (AIS). Prevent efforts include ILIDS camera monitoring, the Clean Boats Clean Waters program, invasive species surveys, and resident education.

ILIDs Camera Monitoring
The Lake District purchased and Environmental Sentry Protection, LLC installed a video camera and signage at the public boat landing in 2012. The camera monitors boater landing use and behavior at the landings. It also serves as a reminder for boaters to clean boats and trailers upon entering and leaving the lake. Data available from the camera video review includes number of launches (by month, day of the week, and hour of the day). It can also provide evidence of aquatic plants present on boats and equipment before or after launch. This evidence can be used in enforcement of do not transport ordinances and regulations.

Clean Boats Clean Waters (CBCW) Program
Clean Boats Clean Waters educators provide boaters with information on the threat posed by Eurasian Milfoil and other invasive species. They offer tips on how to keep boats, trailers, and equipment free of aquatic hitchhikers. CBCW staff and volunteers also collect information on boater behavior, concerns, and knowledge of existing local and state laws related to anti-AIS measures.

The Big Round Lake District's Clean Boats, Clean Waters Program has operated regularly since 2012, educating boaters on the need to be good stewards of the lake. In addition to performing watercraft inspections, ramp attendants present AIS educational material to boaters. The program is staffed by both paid staff and volunteers. Boaters travel from many lakes including most frequently Balsam Lake, Bone Lake, and Cedar Lake. Eurasian water milfoil was discovered on Cedar Lake June 26, 2015.

Table 13. Recent Clean Boats Clean Waters Program Statistics

Year	**2012**	**2013**	**2014**
Boats Inspected	220	434	343
People Contacted	359	501	611
Inspection Hours	86	171	159
Boaters Aware of Laws	98%	89%	?%

Invasive Species Surveys (McComas, 2015)
Invasive species surveys are conducted as part of the early and late season aquatic plant surveys conducted by Blue Water Science.

Zebra mussel surveys were completed at 40 sites on the lake in August of 2011-2014, and no evidence of zebra mussels was found. McComas predicts that the potential for zebra mussel growth is low to moderate based on a number of factors including calcium concentrations and pH. Chinese mystery snails were found during this survey but judged to have a neutral impact on the lake.

Table 14. Recommendations for Aquatic Invasive Species Monitoring (McComas, 2015)

Curly leaf pondweed	Annual early season consultant or resident surveys
Eurasian water milfoil	Annual consultant or resident surveys
Purple loosestrife	Annual resident surveys
Zebra mussels	Mussel monitoring devices
Rusty crayfish	Crayfish traps for early detection

AIS Education
Resident education occurs through information on the web site and presentations at annual meetings. Extensive information is available through the Wisconsin Department of Natural Resources and the University of Wisconsin Extension. Volunteer training is also available from WDNR and UWEX along with the Polk County Land and Water Resources Department.

Lake Management Activities

A range of management activities are available to address aquatic invasive species, water quality, and habitat concerns. Categories for consideration include the following:

- Information and Education
- Incentives
- Conservation Practices
- Land Preservation
- Enforcement/Land Use Planning
- Lake Studies/Evaluation
- In-Lake Management
- Monitoring and Rapid Response
- Aquatic Plant Management

Information and Education

Providing information and education to lake residents, visitors, and policymakers is an important component of any lake management program. There is an abundance of printed and web information to help explain lake ecology and management methods. The University of Wisconsin Extension (http://learningstore.uwex.edu) and the Wisconsin Department of Natural Resources (http://dnr.wi.gov/lakes/publications) have many resources available. Lake organizations also develop informational materials specific to their lake and management program.

Information can be distributed using a variety of methods including:

- Packets of information for new homeowners
- Notebooks with pertinent information
- Brochures
- Web sites
- Newsletters
- Newspapers
- Workshops and training sessions

Distributing information can certainly increase knowledge. A key consideration is that sometimes people have the knowledge of lake concerns, but still do not make desired behavioral changes. It is important to identify the specific behaviors to be changed and the barriers to those behavioral changes, then to design programs that overcome these barriers. For example, concerns about native vegetation blocking views to water where children are swimming can be a barrier to the installation of shoreland buffers. To address this concern, information about shoreland buffers can emphasize planting lower growing plants and maintaining viewing corridors so the waterfront is still visible.

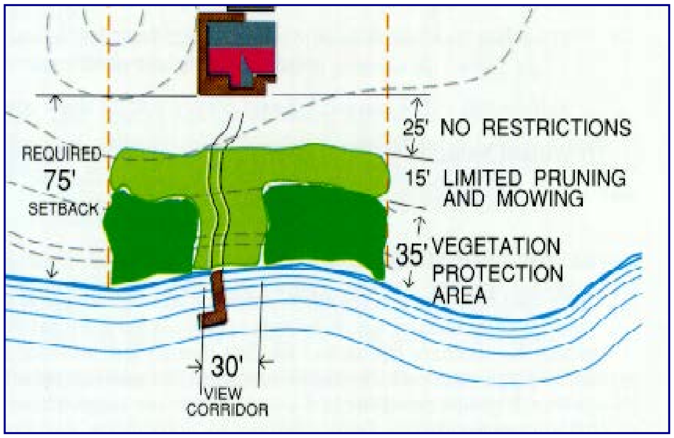


Figure 18. Example Shoreland Buffer Diagram

Incentives

Incentives are frequently provided along with information and education to encourage behavior changes. Examples of incentives include payments, tax credits, and recognition. The Burnett County Shoreland Incentive Program uses cost sharing, an annual property tax rebate, participation shirts and hats, and shoreline signs as incentives to encourage participation. Enrollment in the program involves signing a perpetual covenant to restore and maintain a shoreland buffer on a waterfront property in Burnett County.

Conservation Practices

Conservation practices, frequently called best management practices, are installed to reduce pollutants and improve riparian habitat. For lake management, many conservation practices focus on reducing erosion, slowing water flow, and encouraging infiltration. Many times these practices use native vegetation to accomplish pollutant reduction objectives. For the most effective installation of conservation practices, the most likely participants where significant sources of pollution can be addressed are targeted.

Installation of conservation practices is likely to require some form of technical assistance. For simple practices, this assistance might be in the form of a guidebook. Many practices will require on-site visits with designs prepared by technicians. More complicated practices may require design by professional engineers.

Large scale practices and multiple small scale practices are likely to require significant funding for design and installation. Some lake organizations provide direct financial and technical assistance. It is more common for lake organizations to work together with a county and/or another nonprofit organization. DNR Lake Protection Grants are available for both small and large-scale practices with Lake Management Plan approval.

Agricultural Best Management Practices

Large-scale best management practices might involve changing tillage practices, implementing nutrient management plans, converting crop fields to a more permanent vegetative cover, restoring wetlands, and/or constructing sedimentation basins. A list of potential agricultural best management practices is included as **Error! Reference source not found.**.

Table 15. Selected Agricultural Best Management Practices[15]

Practice	Description
Conservation Tillage	Any tillage or planting system that maintains at least 30% of the soil surface covered by residue after planting to reduce soil erosion by water. Examples of conservation tillage include no-till, strip-till, or vertical-tillage.
Crop Rotation	Reduces soil erosion and nutrient applications by alternating row crops with forage crops such as alfalfa.
Cover Crops	Reduces soil erosion and improves soil tilth and structure by providing vegetative cover on fields in the fall after harvest and before spring planting.
Detention/Sedimentation Basin	Reduces the flood peak, sediment, nutrient, and contaminant loading by retaining runoff and letting soil particles and attached nutrients and contaminants settle out in the basin.
Grassed Waterways	Reduces erosion, nutrient, and contaminant loading by having runoff flow over a grassy area as it moves toward a waterbody. Soil is protected and grass helps utilize nutrients and trap contaminants.
Integrated Pest Management	Reduces pesticide applications, improves effectiveness of application, and uses more pest-resistant cultivars.
Livestock Fencing	Livestock exclusion from concentrated flow areas and other surface waters eliminates erosion and provides vegetated buffer areas to intercept nutrient laden surface runoff before it enters flow areas or surface water.
Nutrient Management Planning	Reduces nutrient loading by managing proper timing, amount, and form of fertilizer and manure application to fields.

Nutrient management planning helps to manage the amount, source, placement, form, and timing of the application of nutrients and soil amendments. All nutrient sources, including soil reserves, commercial fertilizer, manure, organic byproducts, legume crops, and crop residues are accounted for and properly utilized. These criteria are intended to minimize nutrient entry into surface water, groundwater, and atmospheric resources while maintaining and improving the physical, chemical, and biological condition of the soil.

[15] Adapted from Managing Lakes and Reservoirs, (pg. 187) North American Lake Management Society, 2001.

A detention/sedimentation basin can be an effective way to treat agricultural and urban pollutants when treatment near the source is not possible. Sedimentation basins were used in nearby Deer Lake subwatersheds both to settle out sediment from farm fields and to reduce the flow rate in intermittent streams where erosion was occurring.

Figure 19. A Sedimentation Basin in a Deer Lake Subwatershed

Funding for agricultural best management practices may be available through the Polk County Land and Water Resources Department which receives funding from the Department of Agriculture, Trade and Consumer Protection. Federal funding sources include the Farm Services Agency and Natural Resources Conservation Service. A DNR Lake Protection Grant or Targeted Runoff Management Grant may also fund some agricultural projects. Local tax revenue could also be used for agricultural projects.

Waterfront Runoff Mitigation Practices

Waterfront runoff mitigation practices include rock pits or trenches, rain gardens, and shoreline buffers. Nearby Deer Lake, Bone Lake, Balsam Lake, and Burnett County offer programs and education materials to encourage waterfront runoff practices. These programs could be used as examples, and educational materials developed for these programs could be used on Big Round Lake.

Figure 21. Rain Gardens Collect and Infiltrate Runoff Water (photo by Steve Palmer)

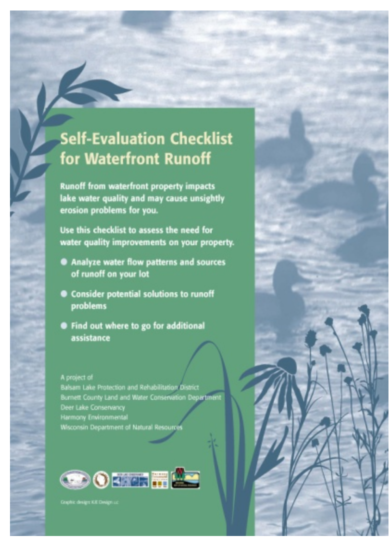


Figure 20. A Checklist for Waterfront Runoff Evaluation

Land Preservation

Land preservation involves purchasing land or putting land in conservation easements to preserve natural areas or to ensure that conservation practices will remain in place. A conservation easement is a voluntary legal agreement that restricts some land uses to protect important conservation values.

There are several nearby examples of land preservation donations, purchases, and conservation easements. The Cedar Lake Protection and Rehabilitation District and Star Prairie Fish and Game helped the Star Prairie Land Preservation Trust accept the donation of 63 acres of land with 1,400 feet of Cedar Lake shoreline in 2005. To ensure that conservation practices remain in place, the Deer Lake Conservancy has easements or owns land where the practices are installed. In some cases, the Deer Lake Conservancy purchased highly erodible crop lands planted to row crops and converted the fields to native prairie. The Half Moon Lake Conservancy accepted a donation of 40 acres of natural area along Harder Creek, the largest tributary flowing into the lake.

Figure 22. McMurtrie Preserve during a Cedar Lake Winter (photo by Dan Davison)

District Involvement in Planning and Zoning

Lake District involvement in enforcement of state and local regulations and planning activities can help to protect lakes. Local regulations including shoreland zoning and plans are summarized in Appendix F. Shoreland zoning is in place within 1,000 feet of lakes and 300 feet of rivers and streams. Lake District members can report potential violations of regulations and ordinances to assist with appropriate enforcement. However, it is important to note that the Lake District cannot establish or enforce laws (except for boating laws under certain circumstances). Involvement in planning activities can help to ensure that land uses that protect the lake are in place in the watershed. Plans might be developed at the town, county, or state level.

In-Lake Management

Options for in-lake management include aeration, dredging, and alum treatment, among others. These techniques generally require in-depth study, detailed permits, and significant funding. Nearby examples include Lake Wapogasset and Bear Trap Lake where an alum treatment was completed in 2001 and Cedar Lake where an aeration system was in operation through 2012. An internal loading study, to better estimate phosphorus loading from lake sediments and evaluate options for managing this load, is recommended for Big Round Lake.

Lake Studies/Evaluation

Recommendations for ongoing study and evaluation are included in the implementation plan – in particular those to manage phosphorus and algae growth. It is common for studies to identify further work that is needed to better understand the lake. It is important to understand why data is being collected before taking the time and spending the money to do it.

Monitoring and Rapid Response

The activity is intended to control any new invasive species that are found in the lake. Rapid response protocols include the following:

- monitoring for invasive species
- education of lake residents and visitors
- contacts to confirm invasive species identification
- procedures for notification
- plans for removal and control
- funding contingencies and grants.

The Big Round Lake AIS Rapid Response Plan is included as Appendix J.

Aquatic Plant Management

Aquatic plant management options are reviewed in Appendix E. The only active management under consideration for Big Round Lake is control of curly leaf pondweed if there long-term spread to nuisance levels.

Choosing Management Options

To choose from the many management options that are available, it is important to do the following:

- Set clear goals and objectives
- Understand potential results
- Prioritize activities
- Consider social and political feasibility
- Investigate funding possibilities
- Seek available assistance

The goals, objectives, and action items in the implementation plan seek to incorporate the above considerations.

Social and political feasibility of various activities can be demonstrated, in part, by the results of the public opinion survey. The survey asked respondents to indicate the importance of various lake district activities from 0 = Not at all important, 1 = Not too important, 2 = Unsure, 3 = Fairly important, and 4 = Very important. Ranking of activities is reported in Table 16.

Table 16. Ranked Importance of Various Lake District Activities

Lake Activities	Average Importance
Monitor for aquatic invasive species	**3.7**
Support fish habitat preservation and improvement	**3.7**
Education to prevent the spread of AIS such as the Clean Boats, Clean Waters program.	**3.6**
Monitor lake water quality	**3.6**
Support land use regulations that would protect lake water quality	3.3
Be an advocate for the protection of wetlands in the Big Round Lake area	3.2
Education regarding steps that individual property owners can take to reduce water pollution	3.1
Support mandatory septic tank inspections for all properties	2.9
Technical assistance to assist waterfront owners with reducing runoff and erosion	2.7
Cost sharing to assist waterfront owners with shoreline restoration	2.2

CLMP Implementation Strategy

Plan goals, objectives, and strategies or actions are detailed below. The work plan in Appendix H details how action steps will be carried out listing timeline, board/committee assignment, resources needed, and partners. This work plan will be updated annually in May to keep actions and budgets current.

Goals are broad statements of direction.
Objectives are the detailed direction or desired results under each goal.
Actions are the means to reach the selected goals and objectives.

Plan Goals

The Big Round Lake community is knowledgeable about and engaged in lake stewardship.
A knowledgeable and engaged community will support remaining plan goals.

Prevent the introduction and spread of aquatic invasive species.

Understand water quality to potentially reduce the severity of algae blooms.

Preserve and enhance great fishing on Big Round Lake.

GOAL: The Big Round Lake community is knowledgeable about and engaged in lake stewardship.

OBJECTIVES:

AIS concerns are understood.

People can identify AIS that threaten Big Round Lake (or know who to contact).

Volunteers participate in lake monitoring activities.

There is good attendance at lake-related events such as the annual meetings.

Evaluation Measures

Number of volunteers working on special projects and serving on the board and committees

Inquiries regarding invasive species

Annual meeting attendance

ACTIONS:

Maintain and promote the web site: bigroundlake.com

Mailings (occasional)

Coordination and training for volunteers

Presentations/workshops at annual meeting. *Encourage attendance by emphasizing fishing, inviting new property owners.*

Training/conferences for board members

GOAL: Prevent the introduction and spread of aquatic invasive species.

OBJECTIVES:

Boaters inspect, clean, and drain boats, trailers, and equipment.

Identify aquatic invasive species (AIS) as soon as possible after introduction to the lake.

Rapidly and aggressively respond to new introductions of invasive species such as Eurasian water milfoil.

Evaluation Measures

No new AIS detected during AIS and point intercept surveys

CBCW contacts

Effectiveness of AIS response

ILIDS reports: boats/trailers with vegetation present

Additional Data

ILIDS reports also provide information about boats using the landing

ACTIONS:

Clean Boats, Clean Waters program

ILIDS cameras (including video review)

Consultant AIS surveys: zebra mussels, EWM, others

Consultant CLP monitoring. Consider control methods if CLP has long-term (=> 3 years) spread to nuisance levels.

Volunteer AIS meander surveys, zebra mussel veliger tows

Implement rapid response plan including contingency fund for AIS response.

Conduct whole lake point intercept survey according to WDNR methods every 5-7 years.

GOAL: Understand water quality to potentially reduce the severity of algae blooms.

OBJECTIVES:

Sources of phosphorus which lead to algae blooms are understood.

Algae blooms occur later in the season and with less severity.

Blue green algae growth is minimized.

<u>Evaluation Measures</u>

Phosphorus budget developed

Chlorophyll a, Total Phosphorus, and Secchi results (evaluate annually)

Temperature and oxygen profiles

Algae abundance and biomass

ACTIONS:

Develop a phosphorus budget for the lake.

> Focus: internal load (top bottom TP, temp and oxygen profiles at a minimum) and waterfront

Consider lake management actions to address significant, manageable phosphorus sources.

Monitor lake water quality each growing season. Include secchi depth and TP and Chla sampling.

Review sediment core results using new diatom data training set from Science Museum of Minnesota.

Consider gathering a new sediment core to analyze algal pigments to understand blue green algae presence and prevalence.

Measure current algae abundance and biomass including potential toxin producers.

GOAL: Preserve and enhance great fishing on Big Round Lake.

OBJECTIVES:

Support WDNR and St. Croix Tribe fish management efforts.

Encourage quality fish habitat.

Evaluation Measures

WDNR fish shocking and creel survey results

WDNR walleye survey results

Tribal fish survey data

ACTIONS:

Provide input for WDNR and Tribal fish management

Educate lake residents to encourage natural shorelines (educational materials and presentations).

FISH STOCKING

DNR: 20 large fingerling/acre, marked w/antibiotic, every other year, shocking each fall, comp. survey every 6 years.

TRIBE: Stocks walleye

CLMP Work Plan

The Big Round Lake CLMP Work Plan, included as Appendix H, outlines how each action will be accomplished listing a timeline, assignments, resources needed, funding sources, and partners. The work plan will be reviewed each year and updated as needed. Actions may be modified as new information becomes available. The Lake District board will approve updated implementation charts including modified management actions.

Funding Plan Implementation

The main sources of implementation funds are Lake District tax revenues and Wisconsin Department of Natural Resources grants. Potential grant sources are listed in the Big Round Lake CLMP Work Plan funding source column for each action item. The WDNR Surface Water Grant Program has two major types of grants: planning and management. Planning grants are due each year by December 10. Management grants are due each year by February 1. Additional detail for the most likely grant sources for initial CLMP implementation is provided in Table 17 below.

Table 17. Wisconsin Department of Natural Resources Surface Water Grants for Plan Implementation

Grant Type	Due Date	Maximum Award	Maximum Grant DNR %
Large Scale Lake Planning	December 10	$25,000	67%
Small Scale Lake Planning	December 10	$3,000	67%
AIS Education, Planning, Prevention	December 10	$150,000 (Categories above and below $50,000)	75%
AIS Clean Boats, Clean Waters	December 10	$4,000/landing/year	75%
Lake Protection: CLMP Plan Implementation	February 1	$200,000	75%
Lake Protection: Healthy Lakes Projects	February 1	$25,000	75%
AIS Early Detection and Rapid Response	Anytime	$20,000	75%

Volunteer Hours and In-Kind Contributions

Volunteers provide significant hours that are used to match grant programs. Use of boats and equipment also provides match for WDNR grants.

Appendix A. Advisory Committee Meetings

Big Round Lake Management Plan Meeting

Polk County Justice Center, Community Room

Balsam Lake, WI (SW corner of CTY I (W) and HWY 46 (N))

April 29, 2015

3:00 to 5:00 p.m.

AGENDA

Review Public Opinion Survey Results – Lake District (HANDOUT)

Tribal Public Opinion Survey Distribution

Lake Management Concerns – Brainstorm Potential Goals

Available Background Information/ Existing Activities (HANDOUT)

Suggested Activities to Address Management Concerns

- Existing Focus
- Review/Modifications?
- New Lake Management Activities?

NEXT MEETING: May 20, 2015 (Polk County Justice Center**,** Community Room)

ANNUAL MEETING: June 27, 2015 (Georgetown Hall)

Big Round Lake Management Plan Meeting

Polk County Justice Center, Community Room

Balsam Lake, WI (SW corner of CTY I (W) and HWY 46 (N))

May 20, 2015

3:00 to 5:00 p.m.

AGENDA

Tribal Public Opinion Survey Distribution

Review Goals, Objectives, and Actions outlined in Meeting 1 notes

Action Information Attached:

- Example Rapid Response Plan (from Church Pine, Round and Big Lakes)
- Example Internal Load Studies (from Bone and Big Lakes)
- Alum Treatment Information (from Cedar Lake)
- Citizen Lake Monitoring Schedule

Information Still to Come:

- Natural Shoreline Restoration Programs
- Historical Land Use

ANNUAL MEETING: June 27, 2015 (Georgetown Hall)

Big Round Lake Management Plan Meeting

Polk County Justice Center, Community Room

Balsam Lake, WI (SW corner of CTY I (W) and HWY 46 (N))

July 28, 2015

3:00 to 4:45 p.m.

AGENDA

Review Goals, Objectives, and Actions

Discuss highlighted text

Identify evaluation measures (vs. activity tracking)

Example work plan format

Process for plan review

Appendix B. Lake User Survey Results

Big Round Lake
Public Opinion Survey

SURVEY RESULTS THROUGH APRIL 15, 2015
180 SURVEYS DISTRIBUTED, 97 RECEIVED: 54% RESPONSE RATE
4 RETURNED UNDELIVERABLE
The number of responses for each question is indicated beneath each survey response.

General Information

1. Which of the following best describes your type of property and how often you stay at it? If you own more than one property please refer to the property you consider your primary property when answering the remaining questions. (Check one for each column)

   Property Type

   100% Property owner

   0% Property renter

   93 responses

   Length of Stay

   13% Year round resident

   87% Seasonal resident – not my permanent address (Stay seasonally, weekends, vacations, and/or holidays)

   91 responses

2. How long have you owned or rented property on Big Round Lake? (If less than one year, write 1)
   20.3 years (average) 1-57 years (range) 95 responses

3. Please check the line which best describes your lake residence.

   49%__House

   36%__Cottage

   7%___Mobile Home

   7%___Other (describe) garages or undeveloped lots

   98 responses (1 answered twice)

4. How many watercraft do you have at the lake? (include boats, canoes, kayaks, jet skis, etc.). If none, please enter zero. 2.6 (average) 0 to 8 (range)
   97 responses

Lake Usage

5. This next question asks for two pieces of information. First, please indicate how often you and/or your family participate in each of the following activities on Big Round Lake.
   Second, using the last column of the chart below, rank the three activities you and/or your family most enjoy. Place a 1 for the most enjoyable, 2 for your second most enjoyable, and 3 for your third most enjoyable.
   Responses were scored with a lot = 3, some = 2, little = 1, none = 0 then averaged for each question.
   For Top 3 Rank, only those results where directions were followed with one of each ranking 1, 2, and 3 was written were used.

	Average Frequency (higher = more frequent)	**Number of Responses**		**Number in Top 3 Rank**	**Average Rank (lower number = higher rank)**
Canoeing & kayaking	1.07	83		7	2.4
Hunting	0.33	83		5	2.4
Ice fishing	0.91	87		7	2.4
Open water fishing	2.42	91		59	1.6
Nature viewing	2.22	89		19	2.1
Quiet reflection, reading	1.99	88		22	2.3
Personal watercraft	1.07	82		6	2.2
Pleasure boating (Sightseeing, cruising)	1.97	88		37	1.9
Recreational boating (Waterskiing, tubing)	1.24	83		19	2.4
Sailing/Wind surfing	0.19	83		0	
Scuba diving	0	83		0	
Swimming	1.4	88		13	2.0
Winter recreation (Snowmobiling, cross country skiing, snowshoeing)	0.69	85		1	3
Other (please specify) upkeep, socializing, paddle boarding, etc.		6			

Concerns

6. Using the following scale, please tell us how concerned you are about the impact each of the following items currently or potentially may have on Big Round Lake. (check one box for each item).
Responses were scored with Very concerned = 4, Fairly concerned = 3, Unsure = 2, Not too concerned= 1, Not at all concerned= 0 then averaged for each question.

	Average concern	Number of responses			
Algae growth	3.5	92			
Aquatic invasive species	3.6	92			
Native aquatic plant growth	2.8	90			
Boating violations	2.4	92			
Fishing violations	2.7	91			
Boat traffic/congestion	2.0	92			
Boat landing ease of use	1.9	91			
Waterfront development	2.2	90			
Development in the area that drains to the lake	2.7	92			
Fishing quality	3.6	90			
Degradation of wildlife habitat	2.9	90			
Shoreline erosion	2.8	92			
Water quality	3.6	92			
Noise	2.1	91			
Other (please specify)____________________ ______________________					

Aquatic Invasive Species

7. Prior to receiving this survey had you heard of aquatic invasive species (AIS)?

    96% Yes

    2% Unsure

    2% No (If no skip to question # 10)

    96 responses

8. Do you believe aquatic invasive species are present in Big Round Lake?

    27% Yes

    62% Unsure

    12% No

    94 responses

9. How confident are you that you could identify the aquatic invasive species listed in the table below? Indicate the appropriate response by checking one box for each row.

	Very confident	Fairly confident	Not too confident	Not at all confident
Curly-Leaf Pondweed	20%	28%	33%	19%
Eurasian Water Milfoil	17%	30%	33%	20%

94 responses

Water Quality

10. Using the following scale, what impact, if any, do you believe each of the following practices have on the water quality of Big Round Lake? (check one box for each item)
Responses were scored with Large negative impact = -2, Small negative impact = -1, No impact = 0, Small positive impact = +1, Large positive impact = +2, Unsure = 0, then averaged for each question.

	Average impact	Number of responses				
Failing septic systems	-1.3	87				
Runoff from impervious surfaces such as blacktop or concrete driveways	-0.9	89				
Installation of sand or pea gravel swimming beaches	-0.3	83				
Large scale removal of native aquatic plants	-0.4	81				
Large scale removal of invasive aquatic plants	+1.2	85				
Operation of watercraft at speeds that create waves in shallow water areas	-0.8	86				
Rain gutters and downspouts draining toward the lake	-0.5	81				
Maintaining near-shore aquatic vegetation such as bulrushes, lily pads and cattails	+1.0	82				
Maintaining vegetation on land near the shore	+0.9	86				
Allowing trees and fallen branches to stay in the lake	+0.1	79				
Installing rock along the shoreline	+0.6	79				

Fishery

11. How important to you, if at all, is having a diverse, high quality fishery in Big Round Lake?
   2%_ Not at all important

   2%_ Not too important

   7%_ Unsure

   17%Fairly important

   _72%Very important

   96 responses

12. Have you fished Big Round Lake in the last three years?
   94%Yes
   6%_ No (If no skip to question # 15)
   96 responses

13. Please rank the top three most important fish species for you in Big Round Lake.
   (Rank 1 as most important, 2 as next, then 3 as next most important)

Number of responses ranked in top three reported on the line and average ranking reported after the fish species. Responses where directions were not followed were not used.

2___ Muskellunge (2.5)

2___ Northern Pike (2.5)

64__Walleye (1.5)

18__ Largemouth Bass (1.9)

2___ Smallmouth Bass (2.0)

50_ Bluegill (1.8)

29_ Pumpkinseed (2.2)

7__ Yellow Perch (2.6)

54_ Crappie (2.4)

14. Assuming you catch a legal size fish, please indicate your likelihood of keeping that fish up to the regulated bag limit. (check one for each type of fish)

Number of responses indicated after species	Definitely release	Probably release	Unsure	Probably keep	Definitely keep
Muskellunge (86)	80%	13%	5%	1%	1%
Northern Pike (86)	51%	31%	3%	12%	2%
Walleye (90)	13%	14%	1%	45%	26%
Largemouth Bass (88)	30%	28%	11%	23%	8%
Smallmouth Bass (84)	43%	23%	10%	17%	8%
Bluegill (90)	10%	9%	1%	40%	40%
Pumpkinseed (88)	13%	15%	3%	39%	31%
Yellow Perch (88)	20%	17%	11%	28%	23%
Crappie (90)	9%	10%	2%	32%	47%

Activities of Big Round Lake District

15. Using the following scale, please indicate how important you feel it is for the Big Round Lake Protection and Rehabilitation District to pursue each of the following activities for Big Round Lake. (check one for each item)
Responses were scored with Not at all important = 0, Not too important = 1, Unsure = 2, Fairly important = 3, and Very important = 4, then averaged for each question.

	Average importance	Number of responses			
Be an advocate for the protection of wetlands in the Big Round Lake area	3.2	93			
Education to prevent the spread of AIS such as the Clean Boats, Clean Waters program.	3.6	95			
Cost sharing to assist waterfront owners with shoreline restoration	2.2	94			
Technical assistance to assist waterfront owners with reducing runoff and erosion	2.7	94			
Education regarding steps that individual property owners can take to reduce water pollution	3.1	95			
Monitor lake water quality	3.6	95			
Monitor for aquatic invasive species	3.7	94			
Support mandatory septic tank inspections for all properties	2.9	94			
Support fish habitat preservation and improvement	3.7	94			
Support land use regulations that would protect lake water quality	3.3	95			

About You

16. Check the two best ways to communicate with you regarding proposed planning, management or educational projects related to Big Round Lake. (count is shown prior to each item)

    74__ Direct mail (letters, newsletters, brochures)

    54__ E-mail

    3___ Facebook

    17_ Lake District web site

    3__ I prefer not to be contacted

    0_ Other (please list) ________________________________

17. What is your gender?

    23_ Female

    75___ Male

    Number of responses is shown. Some indicated both

18. Please check the line which best describes your employment status.

    50_____Retired

    42_____Full-time employment

    7______Part-time employment

    0______Unemployed

    Number of responses is shown. Some chose more than one.

19. Please indicate your age. I am _62 (average)_years old.

Range = 40-89

In the space below, please include any other comments you may have regarding Big Round Lake or the activities of the Big Round Lake Protection and Rehabilitation District.

Comments included on a separate sheet.

THANK YOU FOR TAKING TIME TO COMPLETE THIS SURVEY!!

PLEASE RETURN IN THE STAMPED, SELF ADDRESSED ENVELOPE PROVIDED TO:

HARMONY ENVIRONMENTAL, 516 KELLER AVE. S, AMERY, WI 54001 BY March 25th.

Appendix C. Aquatic Plant Survey Methods

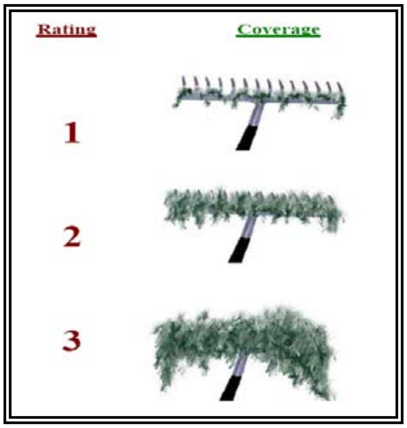
A point intercept method was employed for the aquatic macrophyte sampling. The Wisconsin Department of Natural Resources (WDNR) generated the sampling point grid for each lake.

A handheld Global Positioning System (GPS) located the sampling points in the field. The WDNR guidelines for point location accuracy were followed with the location arrow touching the point using an 80 foot resolution window. Only plants sampled at predetermined sampled points were used in the statistical analysis. If no plants were sampled at a particular depth, one point beyond that depth was sampled.

At each sample point, a double-sided 14-tine rake was used to rake a one meter tow off the bow of the boat. All plants contained on the rake and those that fell off of rake were identified and rated for rake density. The rake density value criteria are shown in the diagram and table below. Those plants that were within six feet were recorded as "viewed," but no rake density rating was given.

A boat survey was conducted in areas that appeared to be under-sampled, such as bays. Plants viewed and/or sampled during boat surveys were recorded along with the type of habitat. Boat survey data were not used in the statistical analysis nor was the density recorded.

Rake Density Criteria



	Criteria for rake density rating
1	Plant present, occupies less than ½ of tine space
2	Plant present, occupies more than ½ tine space
3	Plant present, occupies all or more than tine space
v	Plant not sampled but observed within 6 feet of boat

The depth and predominant bottom type was also recorded for each sample point. Caution must be used in using the sediment type in deeper water, as it is difficult to discern between muck and sand with a rope rake. All plants needing verification were bagged and cooled for later examination. Each species was mounted and pressed for a voucher collection and submitted to the WDNR for review. On rare occasions, a single plant may be needed for verification, not allowing it to be used as a voucher specimen, and this species may be missing from the collection.

Data analysis methods
Data collected was entered into a spreadsheet for analysis. The following statistics were generated from the spreadsheet:

- Frequency of occurrence
- Relative frequency
- Total points in sample grid
- Total points sampled
- Sample points with vegetation
- Simpson's diversity index
- Maximum plant depth
- Species richness
- Floristic Quality Index

An explanation of each of these statistics is provided below.

Frequency of occurrence: Frequency is expressed as a percentage by dividing the number of sites the plant is sampled by the number of sites. Frequency of occurrence can be calculated for the entire littoral zone - depths at or less than the maximum depth plants were found, regardless if vegetation was present. Frequency of occurrence can also be calculated for only the percentage of sample points where the plant was sampled for only points containing vegetation. In either case, the greater this value, the more frequent the plant is in the lake. If one wants to compare how frequent a plant is in the littoral zone, we look at the frequency of all points below maximum depth with plants. This frequency value allows the analysis of how common plants are where they could grow based upon depth. If one wants to focus only on where plants are actually present, then one would look at frequency at points in which plants were present. Frequency of occurrence is usually reported using sample points where vegetation was present.

Frequency of Occurrence Example

Plant A sampled at 35 of 150 littoral points = 35/150 = 0.23 = 23%

Plant A's frequency of occurrence = 23% considering littoral zone depths

Plant A sampled at 12 of 40 vegetated points = 12/40 = 0.30 = 30%

Plant A's frequency of occurrence = 30% in vegetated areas

These two frequencies can tell us how commonly the plant was sampled in the littoral zone or how commonly the plant was sampled at points plants actually grow. Generally, the second will have a higher frequency.

Relative frequency: This value shows the frequency of a particular plant relative to other plants as a percentage. Relative frequency is not dependent on the number of points sampled. The relative frequency of all plants will add to 100%. This means that if plant A had a relative frequency of 30%, it occurred 30% of the time compared to all plants sampled or makes up 30% of all plants sampled. This value allows us to see which plants are the dominant species in the lake. The higher the relative frequency, the more common the plant is compared to the other plants, and therefore, the more frequent in the plant community.

Relative Frequency Example

Suppose we were sampling 10 points in a very small lake and got the following results:

	Frequency sampled
Plant A present at 3 sites	3 of 10 sites
Plant B present at 5 sites	5 of 10 sites
Plant C present at 2 sites	2 of 10 sites
Plant D present at 6 sites	6 of 10 sites

So one can see that Plant D is the most frequently sampled at all points with 60% (6/10) of the sites having plant D. However, the relative frequency allows us to see what the frequency is compared to other plants. It is calculated by dividing the number of times a plant is sampled by the total times all plants are sampled. If we add all frequencies (3+5+2+6), we get a sum of 16. We can calculate the relative frequency by dividing the individual frequency by the total.

Plant A = 3/16 = 0.1875 or 18.75%
Plant B = 5/16 = 0.3125 or 31.25%
Plant C = 2/16 = 0.125 or 12.5%
Plant D = 6/16 = 0.375 or 37.5%

Now we can compare the plants to one another. Plant D is still the most frequent, but the relative frequency tells us that of all plants sampled at those 10 sites, 37.5% of them are Plant D. This is much lower than the frequency of occurrence (60%) because although we sampled Plant D at 6 of 10 sites, we were sampling many other plants too thereby giving a lower frequency when compared to those other plants. This then gives a true measure of the dominant plants present.

Total point in sample grid: The WDNR establishes a sample point grid that covers the entire lake. GPS coordinates are provided to locate the points.

Number of points sampled: This may not be the same as the total points in the sample grid. When doing a survey, we do not sample at depths outside of the littoral zone (the area where plants can grow). Once the maximum depth of plants is established, many of the points deeper than this are eliminated to save time and effort.

Sample sites with vegetation: The number of sites where plants were actually sampled. This gives a good idea of the plant coverage of the lake. If 10% of all sample points had vegetation, it implies about 10% coverage of plants in the whole lake, assuming an adequate number of sample points have been established. We also look at the number of sample sites with vegetation in the littoral zone. If 10% of the littoral zone had sample points with vegetation, then the plant coverage in the littoral zone would be estimated at 10%.

Simpson's diversity index: Simpson's diversity index measures plant community diversity. This value can run from 0 to 1.0. The greater the value, the more diverse the plant community is in a particular lake. In theory, the value is the chance that two species sampled will be different. An index of "1" means that the two will always be different (very diverse) and a "0" would indicate that they will never be different (only one species found). The higher the diversity in the native plant community, the healthier the lake ecosystem.

Simpson's Diversity Example

If one sampled a lake and found a single plant, the Simpson's diversity would be "0". This is because if we randomly sampled two plants, there would be a 0% chance of them being different, since there is only one plant.

If every plant sampled were different, then the Simpson's diversity would be "1". This is because if two plants were randomly sampled, there would be a 100% chance they would be different, since every plant is different.

These are extreme and theoretical scenarios, but they demonstrate how this index works. The greater the Simpson's index is for a lake, the greater the diversity, since it represents a greater chance of two randomly sampled plants being different.

Maximum depth of plants: This depth indicates the deepest that plants were sampled. Generally, clearer lakes have a greater maximum depth of plants, while lower water clarity limits light penetration and reduces the depth at which plants are found.

Species richness: The number of different individual species found in the lake. There is a number for the species richness of plants sampled and another number that takes into account plants viewed but not actually sampled during the survey.

Floristic Quality Index: The Floristic Quality Index (FQI) is an index developed by Dr. Stanley Nichols of the University of Wisconsin-Extension. This index is a measure of the plant community response to development (and human influence) on the lake. It takes into account the species of aquatic plants sampled and their tolerance for changing water quality and habitat quality. The index uses a conservatism value assigned to various plants ranging from 1 to 10. A high conservatism value indicates that a plant is intolerant, while a lower value indicates tolerance. Those plants with higher values are more apt to respond adversely to water quality and habitat changes that are largely due to human influence (Nichols, 1999). The FQI is calculated using the number of species and the average conservatism value of all species used in the index.

The Floristic Quality Index formula is:

FQI = Mean C ·√N

Where C is the conservatism value and N is the number of species (only species sampled on rake).

Therefore, a higher FQI indicates a healthier aquatic plant community which is an indication of better plant habitat. This value can be compared to the median for other lakes in the assigned eco-region. There are four eco-regions used throughout Wisconsin. These are Northern Lakes and Forests, Northern Central Hardwood Forests, Driftless Area, and Southeastern Wisconsin Till Plain.

Summary of Northern Lakes and Forests and Flowages Median Values for Floristic Quality Index:
(Nichols, 1999)

	Northern Lakes	Flowages
Median species richness	13	23.5
Median conservatism	6.7	6.2
Median Floristic Quality	24.3	28.3

*Floristic Quality has a significant correlation with area of lake (+), alkalinity (-), conductivity(-), pH(-) and Secchi depth (+). In a positive correlation, as a value rises so will FQI, while with a negative correlation, as a value rises, the FQI will decrease.

Appendix D. Invasive Species Information

Curly Leaf Pondweed

Curly leaf pondweed is specifically designated as an invasive aquatic plant (along with Eurasian water milfoil and purple loosestrife) to be the focus of a statewide program to control invasive species in Wisconsin. Invasive species are defined as a "non-indigenous species whose introduction causes or is likely to cause economic or environmental harm or harm to human health (23.22(c)."

The Wisconsin Comprehensive Management Plan for Aquatic Invasive Species describes curly leaf pondweed impacts as follows:

> It is widely distributed throughout Wisconsin lakes, but the actual number of waters infested is not known. Curly leaf pondweed is native to northern Europe and Asia where it is especially well adapted to surviving in low temperature waters. It can actively grow under the ice while most plants are dormant, giving it a competitive advantage over native aquatic plant species. By June, curly leaf pondweed can form dense surface mats that interfere with aquatic recreation. By mid-summer, when other aquatic plants are just reaching their peak growth for the year, it dies off. Curly leaf pondweed provides habitat for fish and invertebrates in the winter and spring when most other plants are reduced to rhizomes and buds, but the mid-summer decay creates a sudden loss of habitat. The die-off of curly leaf pondweed also releases a surge of nutrients into the water column that can trigger algal blooms and create turbid water conditions. In lakes where curly leaf pondweed is the dominant plant, the summer die-off can lead to habitat disturbance and degraded water quality. In other waters where there is a diversity of aquatic plants, the breakdown of curly leaf may not cause a problem.[16]

The state of Minnesota DNR web site explains that curly leaf pondweed often causes problems due to excessive growth. At the same time, the plant provides some cover for fish, and some waterfowl species feed on the seeds and winter buds.[17]

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[16] Wisconsin's Comprehensive Management Plan to Prevent Further Introductions and Control Existing Populations of Aquatic Invasive Species. Prepared by Wisconsin DNR. September 2003.

[17] Information from Minnesota DNR (www.dnr.state.mn.us/aquatic_plants).

The following description is taken from a Great Lakes Indian Fish and Wildlife Commission handout.

Curly Leaf Pondweed (*Potamogeton crispus*)[18]

Identification

Curly leaf pondweed is an invasive aquatic species found in a variety of aquatic habitats, including permanently flooded ditches and pools, rivers, ponds, inland lakes, and even the Great Lakes. Curly leaf pondweed prefers alkaline or high nutrient waters one to three meters deep. Its leaves are strap-shaped with rounded tips and undulating and finely toothed edges. Leaves are not modified for floating and are generally alternate on the stem. Stems are somewhat flattened and grow to as long as two meters. The stems are dark reddish-green to reddish-brown, with the mid-vein typically tinged with red. Curly leaf pondweed is native to Eurasia, Africa, and Australia and now spread throughout most of the United States and southern Canada.

Characteristics

New plants typically establish in the fall from freed turions (branch tips). The winter form is short, with narrow, flat, relatively limp, bluish-green leaves. This winter form can grow beneath the ice and is highly shade-tolerant. Rapid growth begins with warming water temperatures in early spring – well ahead of native aquatic plants.

Reproduction and Dispersal

Curly leaf pondweed reproduces primarily vegetatively. Numerous turions are produced in the spring. These turions consist of modified, hardened, thorny leaf bases interspersed with a few to several dormant buds. The turions are typically 1.0 to 1.7 cm long and 0.8 to 1.4 cm in diameter. Turions separate from the plant by midsummer and may be carried in the water column supported by several leaves. Humans and waterfowl may also disperse turions. Stimulated by cooler water temperatures, they germinate in the fall, over-wintering as a small plant. The next summer they mature, producing reproductive tips of their own. Curly leaf pondweed rarely produces flowers.

Ecological Impacts

Rapid early season growth may form large, dense patches at the surface. This canopy overtops most native aquatic plants, shading them and significantly slowing their growth. The canopy lowers water temperature and restricts absorption of atmospheric oxygen into the water. The dense canopy formed often interferes with recreational activities such as swimming and boating.

In late spring, curly leaf pondweed dies back, releasing nutrients that may lead to algae blooms. Resulting high oxygen demand caused by decaying vegetation can adversely affect fish populations. The foliage of curly leaf pondweed is relatively high in alkaloid compounds possibly making it unpalatable to insects and other herbivores.

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[18] Information from GLIFWC Plant Information Center (http://www.glifwc.org/epicenter).

Curly Leaf Pondweed Control[19]

Small populations of curly leaf pondweed in otherwise un-infested water bodies should be attacked aggressively. Hand pulling, suction dredging, or spot treatments with contact herbicides are recommended. Cutting should be avoided because fragmentation of plants may encourage their re-establishment. In all cases, care should be taken to remove all roots and plant fragments, to keep them from re-establishing.

Control of large populations requires a long-term commitment that may not be successful. A prudent strategy includes a multi-year effort aimed at killing the plant before it produces turions, thereby depleting the seed bank over time. It is also important to maintain, and perhaps augment, native populations to retard the spread of curly leaf and other invasive plants. Invasive plants may aggressively infest disturbed areas of the lake, such as those where native plant nuisances have been controlled through chemical applications.

Purple Loosestrife[20]

Purple loosestrife (*Lythrum salicaria)* is a non-native plant common in Wisconsin. By law, purple loosestrife is a nuisance species in Wisconsin. It is illegal to sell, distribute, or cultivate the plants or seeds, including any of its cultivars.

Purple loosestrife is a perennial herb 3 to7 feet tall with a dense bushy growth of 1 to 50 stems. The stems, which range from green to purple, die back each year. Showy flowers vary from purple to magenta, possess 5 to 6 petals aggregated into numerous long spikes, and bloom from July to September. Leaves are opposite, nearly linear, and attached to four-sided stems without stalks. It has a large, woody taproot with fibrous rhizomes (underground stems) that form a dense mat.

Characteristics

Purple loosestrife is a wetland herb that was introduced as a garden perennial from Europe during the 1800s. It is still promoted by some horticulturists for its beauty as a landscape plant and by beekeepers for its nectar-producing capability. Currently, about 24 states have laws prohibiting its importation or distribution because of its aggressively invasive characteristics. It has since extended its range to include most temperate parts of the United States and Canada. The plant's reproductive success across North America can be attributed to its wide tolerance of physical and chemical conditions characteristic of disturbed habitats and its ability to reproduce prolifically by both seed dispersal and vegetative propagation. The absence of natural predators,

[19] Information from GLIFWC Plant Information Center (http://www.glifwc.org/epicenter).

[20] Wisconsin DNR Invasive Species Factsheets from http:/dnr.wi.gov/invasives.

like European species of herbivorous beetles that feed on the plant's roots and leaves, also contributes to its proliferation in North America.

Purple loosestrife was first detected in Wisconsin in the early 1930s but remained uncommon until the 1970s. It is now widely dispersed in the state and has been recorded in 70 of Wisconsin's 72 counties. This plant's optimal habitat includes marshes, stream margins, river flood plains, sedge meadows, and wet prairies. It is tolerant of moist soil and shallow water sites such as pastures and meadows, although established plants can tolerate drier conditions. Purple loosestrife has also been planted in lawns and gardens, which is often how it has been introduced to many of our wetlands, lakes, and rivers.

Reproduction and Dispersal

Purple loosestrife spreads mainly by seed, but it can also spread vegetatively from root or stem segments. A single stalk can produce from 100,000 to 300,000 seeds per year. Seed survival is up to 60-70%, resulting in an extensive seed bank. Most of the seeds fall near the parent plant, but water, animals, boats, and humans can transport the seeds long distances. Vegetative spread through local disturbance is also characteristic of loosestrife; clipped, trampled, or buried stems of established plants may produce shoots and roots. It is often very difficult to locate non-flowering plants, so monitoring for new invasions should be done at the beginning of the flowering period in mid-summer.

Any sunny or partly shaded wetland is susceptible to purple loosestrife invasion. Vegetative disturbances, such as water drawdown or exposed soil, accelerate the process by providing ideal conditions for seed germination. When the right disturbance occurs, loosestrife can spread rapidly, eventually taking over the entire wetland.

Ecological Impacts

Purple loosestrife displaces native wetland vegetation and degrades wildlife habitat. As native vegetation is displaced, rare plants are often the first species to disappear. Eventually, purple loosestrife can overrun wetlands thousands of acres in size and almost entirely eliminate the open water habitat. The plant can also be detrimental to recreation by choking waterways.

Mechanical Control

Purple loosestrife can be controlled by cutting, pulling, digging, and drowning. Cutting is best done just before plants begin flowering. Cutting too early encourages more flower stems to grow than before. If done too late, seed may have already fallen. Since lower pods can drop seed while upper flowers are still blooming, check for seed. If none, simply bag all cuttings (to prevent them from rooting). If there is seed, cut off each top while carefully holding it upright, then bend it over into a bag to catch any dropping seeds. Dispose of plants/seeds in a capped landfill, or dry and burn them. Composting will not kill the seeds. Keep clothing and equipment seed-free to prevent its spread. Rinse all equipment used in infested areas before moving into uninfested areas, including boats, trailers, clothing, and footwear.

Pulling and digging can be effective but can also create disturbed bare spots, which are good sites for PL seeds to germinate, or leave behind root fragments that grow into new plants. Use these methods primarily with small plants in loose soils, since they do not usually leave behind large gaps, nor root tips. Large plants with multiple stems and brittle roots often do. Dispose of plants as described above.

Mowing has not been effective with loosestrife unless the plants can be mowed to a height where the remaining stems will be covered with water for a full 12 months. Burning has also proven largely ineffective. Mowing and flooding are not encouraged because they can contribute to further dispersal of the species by disseminating seeds and stems.

Follow-up treatments are recommended for at least three years after removal.

Chemical Control
This is usually the best way to eliminate PL quickly, especially with mature plants. Chemicals used have a short soil life. Timing is important: treat in late July or August but before flowering to prevent seed set. Always back away from sprayed areas as you go to prevent getting herbicide on your clothes. Generally, the formula designed for use on wet sites should be used. The best method is to cut stems and paint the stump tops with herbicide. The herbicide can be applied with a small drip bottle or spray bottle, which can be adjusted to release only a small amount. Try to cover the entire cut portion of the stem but not let the herbicide drip onto other plants since it is non-selective and can kill any plant it touches.

Glyphosate herbicides: Roundup and Glyfos are typically used, but if there is any open water in the area use Rodeo, a glyphosate formulated and listed for use over water. Currently, glyphosate is the most commonly used chemical for killing loosestrife. Glyphosate must be applied in late July or August to be most effective. Since you must treat at least some stems of each plant and they often grow together in a clump, all stems in the clump should be treated to be sure all plants are treated.

Another method is using very carefully targeted foliar applications of herbicide (NOT broadcast spraying). This may reduce costs for sites with very high densities of PL, since the work should be easier, and there will be few other plant species to hit accidentally. Use a glyphosate formulated for use over water. A weak solution of around 1% active ingredient can be used, and it is generally necessary to wet only 25% of the foliage to kill the plant.

You must obtain a permit from WDNR before applying any herbicide over water. The process has been streamlined for control of purple loosestrife, and there is no cost. Contact your regional Aquatic Plant Management Coordinator for a permit. He will want to know about your site, may make control suggestions, and will issue the permit.

Biological Control
Conventional control methods like hand pulling, cutting, flooding, herbicides, and plant competition have only been moderately effective in controlling purple loosestrife. Biocontrol is now considered the most viable option for more complete control for heavy infestations. The WDNR, in cooperation with the U.S. Fish and Wildlife Service, is introducing several natural insect enemies of purple loosestrife from Europe. A species of weevil (*Hylobius transversovittatus*) has been identified that lays eggs in the stem and upper root system of the plant; as larvae develop, they feed on root tissue. In addition, two species of leaf eating beetles

(*Galerucella calmariensis* and *G. pusilla*) are being raised and released in the state, and another weevil that feeds on flowers (*Nanophyes marmoratus*) is being used to stress the plant in multiple ways. Research has shown that most of these insects are almost exclusively dependent upon purple loosestrife and do not threaten native plants, although one species showed some cross-over to native loosestrife. These insects will not eradicate loosestrife but may significantly reduce the population, so cohabitation with native species becomes a possibility.

Eurasian Water Milfoil[21]

The following Eurasian water milfoil information is taken from a Wisconsin DNR fact sheet.

Identification
Eurasian water milfoil is a submersed aquatic plant native to Europe, Asia, and northern Africa. It is the only non-native milfoil in Wisconsin. Like the native milfoils, the Eurasian variety has slender stems whorled by submersed feathery leaves and tiny flowers produced above the water surface. The flowers are located in the axils of the floral bracts and are either four-petaled or without petals. The leaves are threadlike, typically uniform in diameter, and aggregated into a submersed terminal spike. The stem thickens below the inflorescence and doubles its width further down, often curving to lie parallel with the water surface. The fruits are four-jointed, nut-like bodies. Without flowers or fruits, Eurasian water milfoil is nearly impossible to distinguish from northern water milfoil. Eurasian water milfoil has 9-21 pairs of leaflets per leaf, while Northern milfoil typically has 7-11 pairs of leaflets. Coontail is often mistaken for the milfoils, but does not have individual leaflets.

Characteristics
Eurasian water milfoil grows best in fertile, fine-textured, inorganic sediments. In less productive lakes, it is restricted to areas of nutrient-rich sediments. It has a history of becoming dominant in eutrophic, nutrient-rich lakes, although this pattern is not universal. It is an opportunistic species that prefers highly disturbed lakebeds, lakes receiving nitrogen and phosphorous-laden runoff, and heavily used lakes. Optimal growth occurs in alkaline systems with a high concentration of dissolved inorganic carbon. High water temperatures promote multiple periods of flowering and fragmentation.

Reproduction and Dispersal
Unlike many other plants, Eurasian water milfoil does not rely on seed for reproduction. Its seeds germinate poorly under natural conditions. It reproduces vegetatively by fragmentation, allowing it to disperse over long distances. The plant produces fragments after fruiting once or twice during the summer. These shoots may then be carried downstream by water currents or inadvertently picked up by boaters. Milfoil is readily spread attached to boats, motors, trailers, bilges, live wells, and bait buckets. It can stay alive for weeks if kept moist.

Once established in an aquatic community, milfoil reproduces from shoot fragments and stolons (runners that creep along the lake bed). As an opportunistic species, Eurasian water milfoil is adapted for rapid growth early in spring.

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[21] Wisconsin DNR Invasive Species Factsheets from http:/dnr.wi.gov/invasives. Photo by Elizabeth Czarapata.

Ecological Impacts
Eurasian water milfoil's ability to spread rapidly by fragmentation and effectively block out sunlight needed for native plant growth often results in monotypic stands. Monotypic stands of Eurasian milfoil provide only a single habitat and threaten the integrity of aquatic communities in a number of ways. For example, dense stands disrupt predator-prey relationships by fencing out larger fish and reducing the number of nutrient-rich native plants available for waterfowl.

Dense stands of Eurasian water milfoil also inhibit recreational uses like swimming, boating, and fishing. Some stands have been dense enough to obstruct industrial and power generation water intakes. The visual impact that greets the lake user on milfoil-dominated lakes is the flat yellow-green of matted vegetation, often prompting the perception that the lake is "infested" or "dead". Cycling of nutrients from sediments to the water column by Eurasian water milfoil may lead to deteriorating water quality and algae blooms in infested lakes.

Control Methods
Preventing a Eurasian water milfoil invasion requires various efforts. The first component is public awareness of the necessity to remove weed fragments at boat landings. Inspection programs should provide physical inspections as well as a direct educational message. Native plant beds must be protected from disturbance caused by boaters and indiscriminate plant control that disturbs these beds. A watershed management program should decrease nutrients reaching the lake and reduce the likelihood that Eurasian milfoil colonies will establish and spread.

Monitoring is also important so introduced plants can be controlled immediately. The lake district and lakeshore owners should check for new colonies and control them before they spread. The plants can be hand pulled or raked. It is imperative that all fragments be removed from the water and the shore.

A good strategy for a systematic monitoring program is to target areas where the native northern water milfoil (*Myriophyllum sibiricum)* is found. This plant is often confused with Eurasian water milfoil, which looks somewhat similar. Unlike Eurasian water milfoil (EWM), northern water milfoil is native and a desirable plant to have in the lake. It has very fine leaves that provide habitat for small planktonic organisms, which make up an important part of the food chain. From a management perspective, the location of northern water milfoil can be important, because EWM and northern water milfoil grow in similar conditions.

Appendix E. Aquatic Plant Management Methods

Discussion of Management Methods

Techniques to control the growth and distribution of aquatic plants are discussed in the following text. The application, location, timing, and combination of techniques must be considered carefully.

Permitting Requirements

The Department of Natural Resources regulates the removal of aquatic plants when chemicals are used, when plants are removed mechanically, and when plants are removed manually from an area greater than 30 feet in width along the shore. The requirements for chemical plant removal are described in Administrative Rule NR 107 – Aquatic Plant Management. A permit is required for any aquatic chemical application in Wisconsin. This includes granular herbicides available through mail order and internet purchase. A Department of Agriculture, Trade, and Consumer Protection pesticide applicator certification (aquatic nuisance control category) is required to apply liquid chemicals in the water.

Specific pre and post herbicide treatment mapping and monitoring protocol are required when invasive species treatment is permitted in Wisconsin.

The requirements for manual and mechanical plant removal are described in NR 109 – Aquatic Plants: Introduction, Manual Removal & Mechanical Control Regulations. A permit is required for manual and mechanical removal except for when a riparian (waterfront) landowner manually removes or gives permission to someone to manually remove plants (with the exception of wild rice) from his/her shoreline limited to a 30-foot corridor. A riparian landowner may also manually remove the invasive plants Eurasian water milfoil, curly leaf pondweed, and purple loosestrife along his or her shoreline without a permit. Manual removal means the control of aquatic plants by hand or hand–held devices without the use or aid of external or auxiliary power.[22]

Manual Removal[23]

Manual removal involving hand pulling, cutting, or raking plants will effectively remove plants from small areas. It is likely that plant removal will need to be repeated during the growing season. The best timing for hand removal of herbaceous plant species is after flowering but before seedhead production. For plants that possess rhizomatous (underground stem) growth, pulling roots is not generally recommended since it may stimulate new shoot production. Hand pulling is a strategy recommended for rapid response to a Eurasian water milfoil establishment and for private landowners who wish to remove small areas of curly leaf pondweed growth. Raking is recommended to clear nuisance growth in riparian area corridors up to 30 feet wide.

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[22] More information regarding DNR permit requirements and aquatic plant management contacts is found on the DNR web site www.dnr.wi.gov.

[23] Information from APIS (Aquatic Plant Information System) U.S. Army Corps of Engineers. 2005.

Mechanical Control

Larger-scale control efforts require more mechanization. Mechanical cutting, mechanical harvesting, diver-operated suction harvesting, and rotovating (tilling) are the most common forms of mechanical control available. Department of Natural Resources permits under Chapter NR 109 are required for mechanical plant removal.

Aquatic plant harvesters are floating machines that cut and remove vegetation from the water. The cutter head uses sickles similar to those found on farm equipment, and generally cut to depths from one to six feet. A conveyor belt on the cutter head brings the clippings onboard the machine for storage. A harvester can also be used to gather dislodged, free-floating plant fragments such as from coontail or wild celery. Once full, the harvester travels to shore to discharge the load of weeds off of the vessel.

The size and consequently the harvesting capabilities of these machines vary greatly. As they move, harvesters cut a swath of aquatic plants that is between 4 and 20 feet wide, and can be up to 10 feet deep. The on-board storage capacity of a harvester ranges from 100 to 1,000 cubic feet (by volume) or 1 to 8 tons (by weight).

In some cases, the plants are transported to shore by the harvester itself for disposal, while in other cases, a barge is used to store and transport the plants in order to increase the efficiency of the cutting process. The plants are deposited on shore where they can be transported to a local farm to be used as compost (the nutrient content of composted aquatic plants is comparable to that of cow manure) or to an upland landfill for proper disposal. Most harvesters can cut between 2 and 8 acres of aquatic vegetation per day, and the average lifetime of a mechanical harvester is 10 years.

Mechanical harvesting of aquatic plants presents both positive and negative consequences to any lake. Its results—open water and accessible boat lanes—are immediate and can be enjoyed without the restrictions on lake use which follow herbicide treatments. In addition to the human use benefits, the clearing of thick aquatic plant beds may also increase the growth and survival of some fish. By eliminating the upper canopy, harvesting reduces the shading caused by aquatic plants. The nutrients stored in the plants are also removed from the lake, and the sedimentation that would normally occur as a result of the decaying of this plant matter is prevented. Additionally, repeated treatments may result in thinner, more scattered growth.

Aside from the obvious effort and expense of harvesting aquatic plants, there are many environmentally-detrimental consequences to consider. The removal of aquatic species during harvesting is non-selective. Native and invasive species alike are removed from the target area. This loss of plants results in a subsequent loss of the functions they perform including sediment stabilization and wave absorption. Sediment suspension and shoreline erosion may therefore increase. Other organisms such as fish, reptiles, and insects are often displaced or removed from the lake in the harvesting process. This may have adverse effects on these organisms' populations as well as the lake ecosystem as a whole.

While the results of harvesting aquatic plants may be short term, the negative consequences are not so short lived. Much like mowing a lawn, harvesting must be conducted numerous times throughout the growing season. Although the harvester collects most of the plants that it cuts, some plant fragments inevitably persist in the water. This may allow the invasive plant species to propagate and colonize in new, previously unaffected areas of the lake. Harvesting may also result in re-suspension of contaminated sediments and the excess nutrients they contain.

Disposal sites are a key component when considering the mechanical harvesting of aquatic plants. The sites must be on shore and upland to make sure the plants and their reproductive structures do not make their way back into the lake or to other lakes. The number of available disposal sites and their distance from the targeted harvesting areas will determine the efficiency of the operation, in terms of time and cost.

Timing is also important. The ideal time to harvest, in order to maximize the efficiency of the harvester, is just before the aquatic plants break the surface of the lake. For curly leaf pondweed, it should also be before the plants form turions (reproductive structures) to avoid spreading the turions within the lake. If the harvesting is conducted too early, the plants will not be close enough to the surface, and the cutting will not do much damage to them. If too late, turions may have formed and may be spread, and there may be too much plant matter on the surface of the lake for the harvester to cut effectively.

If the harvesting work is contracted, the equipment should be inspected before and after it enters the lake. Since contracted machines travel from lake to lake, they may carry plant fragments with them, and facilitate the spread of aquatic invasive species from one body of water to another. One must also consider prevailing winds, since cut vegetation can be blown into open areas of the lake or along shorelines.

The 2007/08 Aquatic Plant Management Committee discussed harvesting as an option for clearing navigation channels. However, native plant growth has not reached a threshold where management has been necessary. Harvesting is not a proven successful method for CLP management. Harvesting is not recommended for native plant management at this time because of the lack of demand and likely small acreage of navigation impairment.

Diver dredging operations use pump systems to collect plant and root biomass. The pumps are mounted on a barge or pontoon boat. The dredge hoses are from 3 to 5 inches in diameter and are handled by one diver. The hoses normally extend about 50 feet in front of the vessel. Diver dredging is especially effective against pioneering establishment of submersed invasive plant species. When a weed is discovered in a pioneering state, this methodology should be considered. To be effective, the entire plant including the subsurface portions should be removed.

Plant fragments can be formed from this type of operation. Fragmentation is not as great a problem when infestations are small. Diver dredging operations may need to be repeated to be effective. When applied toward a pioneering infestation, control can be complete. However, periodic inspections of the lake should be performed to ensure that all the plants have been found and collected.

Lake substrates can play an important part in the effectiveness of a diver dredging operation. Soft substrates are very easy to work in. Divers can remove the plant and root crowns with little problem. Hard substrates, however, pose more of a problem. Divers may need hand tools to help dig the root crowns out of hardened sediment.

Mechanically Assisted Manual Harvesting - Hydraulic Conveyor System[24]

The Hydraulic Conveyor System (HCS) is an automated system that removes, filters, and bags harvested EWM after it has been hand harvested from the lake bed by divers. The system includes a floating chassis, a "jet pump" water system, a three tiered separation system, and a Hookah diver air supply system. These systems are also commonly referred to as D.A.S.H. (diver assisted suction harvesting). Because of the mechanical elements of the system, a WDNR aquatic plant management harvesting permit is required.

Figure 23. TLA Hydraulic Conveyor System (Greedy)

Rotovation involves using large underwater rototillers to remove plant roots and other plant tissue. Rotovators can reach bottom sediments to depths of 20 feet. Rotovating may significantly affect non-target organisms and water quality as bottom sediments are disturbed. However, the suspended sediments and resulting turbidity produced by rotovation settles fairly rapidly once the tiller has passed. Tilling sediments that are contaminated could possibly release toxins to the

[24] From a Lakes Convention presentation, TLA Hydraulic Conveyor System. Ned Greedy, 2014.

water column. If there is any potential of contaminated sediments in the area, further investigation should be performed to determine potential impacts from this type of treatment. Tillers do not operate effectively in areas with many underwater obstructions such as trees and stumps. If operations are releasing large amounts of plant material, harvesting equipment should be on hand to collect this material and transport it to shore for disposal.

Biological Control[25]

Biological control is the purposeful introduction of parasites, predators, and/or pathogenic microorganisms to reduce or suppress populations of plant or animal pests. Biological control counteracts the problems that occur when a species is introduced into a new region of the world without a complex or assemblage of organisms that feed directly upon it, attack its seeds or progeny through predation or parasitism, or cause severe or debilitating diseases. With the introduction of native pests to the target invasive organism, the exotic invasive species may be maintained at lower densities.

There are advantages and disadvantages to the use of biological control as part of an overall aquatic plant management program. Advantages include longer-term control relative to other technologies, lower overall costs, as well as plant-specific control. On the other hand, there are several disadvantages to consider, including very long control times of years instead of weeks, lack of available agents for particular target species, and relatively narrow environmental conditions for success.

While this theory has worked in practice for control of some nonnative aquatic plants, results have been varied (Madsen, 2000). Beetles are commonly used to control purple loosestrife populations in Wisconsin with good success. Weevils are used as an experimental control for Eurasian water milfoil once the plant is established. Tilapia and carp are used to control the growth of filamentous algae in ponds. Grass carp, an herbivorous fish, is sometimes used to feed on pest plant populations. Grass carp introduction is not allowed in Wisconsin.

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[25] Information from APIS (Aquatic Plant Information System) U.S. Army Corps of Engineers. 2005 except as otherwise noted.

Eurasian Water Milfoil Biocontrol
According to the company which provides the weevils for Eurasian Water Milfoil biocontrol, it is an effective management option. *The milfoil weevil (Euhrychiopsis lecontel) is native to North America and has been augmented in many inland lakes and rivers to suppress the growth of Eurasian Water Milfoil. This weevil damages the plant in multiple ways. The most significant impact is caused by the weevil larva as it damages the growing tip and burrows through the stem. Nutrient flow in the plant is disrupted and the stem loses buoyance, collapsing in the water column.* (EnviroScience, 2011) EnviroScience is no longer raising weevils because it is not cost effective.[26]

The Minocqua and Kawaguesaga Lakes Protection Association experimented with a weevil program for six areas infested with Eurasian Water Milfoil beginning in 2008. The weevils showed little effect on EWM growth when monitored in 2010. Herbicide treatment began in one of the six beds because of concern for EWM expansion. In 2011 the weevil augmentation results were showing some positive results with small decreases in both frequency and in density. However, a second bed was switched to herbicide treatment for 2012 because of expansion of EWM growth. Then in 2012, both frequency and density were back to levels seen in 2010 (density) and prior to 2010 (frequency). Beginning in 2012, any bed that met the criteria for herbicide treatment was treated and reliance on the weevil program was essentially discontinued. (Schieffer, 2012).

The results report for Minocqua and Kawaguesaga Lakes are consistent with DNR research that indicates weevils are not an effective solution in Northern Wisconsin.[27]

Purple Loosestrife Biocontrol[28]
Biocontrol may be the most viable long term control method for purple loosestrife control. The DNR and University of Wisconsin-Extension (UWEX), along with hundreds of citizen cooperators, have been introducing natural insect enemies of purple loosestrife, from its home in Europe to infested wetlands in the state since 1994. Careful research has shown that these insects are dependent on purple loosestrife and are not a threat to other plants. Insect releases monitored in Wisconsin and elsewhere have shown that these insects can effectively decrease purple loosestrife's size and seed output, thus letting native plants reduce its numbers naturally through enhanced competition.

A suite of four different insect species has been released as biological control organisms for purple loosestrife in North America and Wisconsin. Two leaf beetle species called "Cella" beetles that feed primarily on shoots and leaves were the first control insects to be released in Wisconsin, and are the insects available from DNR for citizens to propagate and release into their local wetlands. A root-mining weevil species and a type of flower-eating weevil have also been released and are slowly spreading naturally. The Purple Loosestrife Biocontrol Program offers cooperative support, including free equipment and starter beetles from DNR and UWEX, to all state citizens who wish to use these insects to reduce their local purple loosestrife.

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[26] Susan Knight, Personal Communication with Noah Lottig.
[27] Susan Knight, Personal Communication with Noah Lottig.
[28] http://dnr.wi.gov/topic/Invasives/loosestrife.html

The length of time required for effective biological control of purple loosestrife in any particular wetland ranges from one to several years depending on such factors as site size and loosestrife densities. The process offers effective and environmentally sound control of the plant, not elimination, in most cases. It is also typically best done in some combination with occasional use of more traditional control methods such as digging and herbicide use.

Re-vegetation with Native Plants
Another aspect to biological control is native aquatic plant restoration. The rationale for re-vegetation is that restoring a native plant community should be the end goal of most aquatic plant management programs (Nichols 1991; Smart and Doyle 1995). However, in communities that have only recently been invaded by nonnative species, a propagule (seed) bank probably exists that will restore the community after nonnative plants are controlled (Madsen, Getsinger, and Turner, 1994). Re-vegetation following plant removal is probably not necessary on the Big Round Lake because a healthy, diverse native plant population is present.

Physical Control[29]

In physical management, the environment of the plants is manipulated, which in turn acts upon the plants. Several physical techniques are commonly used: dredging, drawdown, benthic (lake bottom) barriers, and shading or light attenuation. Because they involve placing a structure on the bed of a lake and/or affect lake water level, a Chapter 30 or 31 WDNR permit would be required.

Dredging removes accumulated bottom sediments that support plant growth. Dredging is usually not performed solely for aquatic plant management but to restore lakes that have been filled in with sediments, have excess nutrients, need deepening, or require removal of toxic substances (Peterson 1982). Lakes that are very shallow due to sedimentation tend to have excess plant growth. Dredging can form an area of the lake too deep for plants to grow, thus creating an area for open water use (Nichols 1984). By opening more diverse habitats and creating depth gradients, dredging may also create more diversity in the plant community (Nichols 1984). Results of dredging can be very long term. However, due to the cost, environmental impacts, and the problem of disposal, dredging should not be performed for aquatic plant management alone. It is best used as a lake remediation technique.

Drawdown, or significantly decreasing lake water levels, can be used to control nuisance plant populations. With drawdown, the water body has water removed to a given depth. It is best if this depth includes the entire depth range of the target species. Drawdowns need to be at least one month long to ensure thorough drying and effective removal of target plants (Cooke 1980a). In northern areas, a drawdown in the winter that will ensure freezing of sediments is also effective. Although drawdown may be effective for control of hydrilla for one to two years (Ludlow 1995), it is most commonly applied to Eurasian water milfoil (Geiger 1983; Siver et al. 1986) and other milfoils or submersed evergreen perennials (Tarver 1980). Drawdown requires a mechanism to lower water levels.

[29] Information from APIS (Aquatic Plant Information System) U.S. Army Corps of Engineers. 2005.

Although drawdown is inexpensive and has long-term effects (2 or more years), it also has significant environmental effects and may interfere with use and intended function (e.g., power generation or drinking water supply) of the water body during the drawdown period. Lastly, species respond in very different manners to drawdown and often not in a consistent fashion (Cooke 1980a). Drawdowns may provide an opportunity for the spread of highly weedy species, particularly annuals.

Benthic Barriers, or other bottom-covering approaches, are another physical management technique. The basic idea is that the plants are covered over with a layer of a growth-inhibiting substance. Many materials have been used, including sheets or screens of organic, inorganic, and synthetic materials; sediments such as dredge sediment, sand, silt or clay; fly ash; and combinations of the above (Cooke 1980b; Nichols 1974; Perkins 1984; Truelson 1984). The problem with using sediments is that new plants establish on top of the added layer (Engel and Nichols 1984). The problem with synthetic sheeting is that the gasses evolved from decomposition of plants and sediment decomposition collect under and lift the barrier (Gunnison and Barko 1992). Benthic barriers will typically kill plants under them within 1 to 2 months, after which they may be removed (Engel 1984). Sheet color is relatively unimportant; opaque (particularly black) barriers work best, but even clear plastic barriers will work effectively (Carter et al. 1994). Sites from which barriers are removed will be rapidly re-colonized (Eichler et al. 1995). Synthetic barriers, if left in place for multi-year control, will eventually become sediment-covered and will allow colonization by plants. Benthic barriers may be best suited to small, high-intensity use areas such as docks, boat launch areas, and swimming areas. However, benthic barriers are too expensive to use over widespread areas, and they heavily affect benthic communities by removing fish and invertebrate habitat. A Department of Natural Resources permit would be required for a benthic barrier.

Shading or light attenuation reduces the light plants need to grow. Shading has been achieved by fertilization to produce algal growth, by application of natural or synthetic dyes, shading fabric, or covers, and by establishing shade trees (Dawson 1981, 1986; Dawson and Hallows 1983; Dawson and Kern-Hansen 1978; Jorga et al. 1982; Martin and Martin 1992; Nichols 1974). During natural or cultural eutrophication, algae growth alone can shade aquatic plants (Jones et al. 1983). Although light manipulation techniques may be useful for narrow streams or small ponds, in general, these techniques are of only limited applicability.

Herbicide and Algaecide Treatments

Herbicides are chemicals used to kill plant tissue. Currently, no product can be labeled for aquatic use if it poses more than a one in a million chance of causing significant damage to human health, the environment, or wildlife resources. In addition, it may not show evidence of biomagnification, bioavailability, or persistence in the environment (Joyce, 1991). Thus, there are a limited number of active ingredients that are assured to be safe for aquatic use (Madsen, 2000).

An important caveat is that these products are considered safe when used according to the label. The U.S. Environmental Protection Agency (EPA)-approved label gives guidelines protecting the health of the environment, the humans using that environment, and the applicators of the herbicide. Wisconsin Department of Natural Resources permits under Chapter NR 107 are required for herbicide application. **Aquatic herbicides must be applied only by licensed applicators.**

General descriptions of herbicide classes are included below.[30]

Contact Herbicides
Contact herbicides act quickly and are generally lethal to all plant cells that they contact. Because of this rapid action, or other physiological reasons, they do not move extensively within the plant and are effective only where they contact plants. They are generally more effective on annuals (plants that complete their life cycle in a single year). Perennial plants (plants that persist from year to year) can be defoliated by contact herbicides, but they quickly resprout from unaffected plant parts. Submersed aquatic plants that are in contact with sufficient concentrations of the herbicide in the water for long enough periods of time are affected, but regrowth occurs from unaffected plant parts, especially plant parts that are protected beneath the sediment. Because the entire plant is not killed by contact herbicides, retreatment is necessary, sometimes two or three times per year. **Endothall, diquat,** and **copper** are contact aquatic herbicides.

Systemic Herbicides
Systemic herbicides are absorbed into the living portion of the plant and move within the plant. Different systemic herbicides are absorbed to varying degrees by different plant parts. Systemic herbicides that are absorbed by plant roots are referred to as soil active herbicides, and those that are absorbed by leaves are referred to as foliar active herbicides. **2,4-D, dichlobenil, fluridone, and glyphosate** are systemic aquatic herbicides. When applied correctly, systemic herbicides act slowly in comparison to contact herbicides. They must move to the part of the plant where their site of action is. Systemic herbicides are generally more effective for controlling perennial and woody plants than contact herbicides. Systemic herbicides also generally have more selectivity than contact herbicides.

Broad Spectrum Herbicides
Broad spectrum (sometimes referred to as nonselective) herbicides are those that are used to control all or most vegetation. This type of herbicide is often used for total vegetation control in areas such as equipment yards and substations where bare ground is preferred. **Glyphosate** is an example of a broad spectrum aquatic herbicide. **Diquat, endothall, and fluridone** are used as broad spectrum aquatic herbicides, but they can also be used selectively under certain circumstances.

Selective Herbicides
Selective herbicides are those that are used to control certain plants but not others. Herbicide selectivity is based upon the relative susceptibility or response of a plant to an herbicide. Many related physical and biological factors can contribute to a plant's susceptibility to an herbicide. Physical factors that contribute to selectivity include herbicide placement, formulation, timing, and rate of application. Biological factors that affect herbicide selectivity include physiological factors, morphological factors, and stage of plant growth.

[30] This discussion is taken directly from: Managing Lakes and Reservoirs. North American Lake Management Society.

Environmental Considerations
Aquatic communities consist of aquatic plants including macrophytes (large plants) and phytoplankton (free floating algae), invertebrate animals (such as insects and clams), fish, birds, and mammals (such as muskrats and otters). All of these organisms are interrelated in the community. Organisms in the community require a certain set of physical and chemical conditions to exist such as nutrient requirements, oxygen, light, and space. Aquatic weed control operations can affect one or more of the organisms in the community that can, in turn, affect other organisms. Or, weed control operations can affect water chemistry that, in turn, affects organisms.

General descriptions of the breakdown of commonly used aquatic herbicides are included below.[31] Chemicals commonly used in Wisconsin lakes are listed and described in Table 18 below.

Table 18. Herbicides Used to Manage Aquatic Plants in Wisconsin

Brand Name(s)	Chemical	Target Plants
Captain, Nautique, Cutrine Plus	Copper compounds	Free floating and filamentous algae, also coontail, curly leaf pondweed, water celery, pondweeds
Aquathol K, Hydrothal	Endothall	Curly leaf pondweed also other submergent plants: coontail, milfoil, pondweed, water celery
Reward	Diquat	Pondweeds, coontail, Eurasian water milfoil
Aquakleen, Navigate	2,4-D	Eurasian and other milfoils

Copper[32]
Copper is an essential trace element that tends to accumulate in sediments and can be toxic to aquatic life at elevated concentrations (United States Environmental Protection Agency, June 2008).

A study completed by MacDonald et al. (2000) developed consensus based numerical sediment quality guidelines for metals in freshwater ecosystems. This study provides guidelines for metals in freshwater ecosystems that reflect threshold effect concentrations (TECs, below which harmful effects are unlikely to be observed) and probable effect concentrations (PECs, above which harmful effects are likely to be observed). The consensus based TEC for copper is 31.6 mg/kg and the consensus based PEC for copper is 149 mg/kg.

31 These descriptions are taken from Hoyer/Canfield: Aquatic Plant Management. North American Lake Management Society. 1997.
32 Copper background information is from the Long Lake Management Plan prepared by the Polk County Land and Water Resources Department March 2013.

2,4-D
2,4-D photodegrades on leaf surfaces after applied to leaves and is broken down by microbial degradation in water and sediments. Complete decomposition usually takes about 3 weeks in water and can be as short as 1 week. 2,4-D breaks down into naturally occurring compounds.

Diquat
When applied to enclosed ponds for submersed weed control, diquat is rarely found longer than 10 days after application and is often below detection 3 days after application. The most important reason for the rapid disappearance of diquat from water is that it is rapidly taken up by aquatic vegetation and bound tightly to particles in the water and bottom sediments. When bound to certain types of clay particles, diquat is not biologically available. When diquat is bound to organic matter, it can be slowly degraded by microorganisms. When diquat is applied foliarly, it is degraded to some extent on the leaf surfaces by photodegradation. Because it is bound in the plant tissue, a proportion is probably degraded by microorganisms as the plant tissue decays.

Endothall
Like 2,4-D, endothall is rapidly and completely broken down into naturally occurring compounds by microorganisms. The by-products of endothall dissipation are carbon dioxide and water. Complete breakdown usually occurs in about 2 weeks in water and 1 week in bottom sediments.

Fluridone
Dissipation of fluridone from water occurs mainly by photodegradation. Metabolism by tolerant organisms and microbial breakdown also occurs. Microbial breakdown is probably the most important method of breakdown in bottom sediments. The rate of breakdown of fluridone is variable and may be related to time of application. Applications made in the fall or winter when the sun's rays are less direct and days are shorter result in longer half-lives. Fluridone usually disappears from pondwater after about 3 months but can remain up to 9 months. It may remain in bottom sediment between 4 months and 1 year.

Glyphosate
Glyphosate is not applied directly to water for weed control. However, when it does enter the water, it is bound tightly to dissolved and suspended particles and to bottom sediments and becomes inactive. Glyphosate is broken down into carbon dioxide, water, nitrogen, and phosphorus over a period of several months.

Algaecide Treatments for Filamentous Algae
Copper-based compounds are generally used to treat filamentous algae. Common chemicals used are copper sulfate and Cutrine Plus, a chelated copper algaecide.

Herbicide Use to Manage Invasive Species

Curly Leaf Pondweed
The Army Corps of Engineers Aquatic Plant Information System (APIS) identifies three herbicides for control of curly leaf pondweed: diquat, endothall, and fluridone. Fluridone requires exposure of 30 to 60 days making it infeasible to target a discreet area in a lake system.

The other herbicides act more rapidly. Herbicide labels provide water use restriction following treatment. Diquat (Reward) has the following use restrictions: drinking water 1-3 days, swimming and fish consumption 0 days. Endothall (Aquathol K) has the following use restrictions: drinking water 7 – 25 days, swimming 0 days, fish consumption 3 days.

Early season herbicide treatment:[33]
Studies have demonstrated that curly leaf can be controlled with Aquathol K (a formulation of endothall) in 50 - 60 degree F water, and treatments of curly leaf this early in its life cycle can prevent turion formation. Since curly leaf pondweed is actively growing at these low water temperatures and many native aquatic plants are yet dormant, this early season treatment selectively targets curly leaf pondweed.

Because the dosage is at lower rates than dosage recommended on the label, a greater herbicide residence time is necessary. To prevent drift of herbicide and allow greater contact time, application in shallow bays is likely to be most effective. Herbicide applied to a narrow band of vegetation along the shoreline is likely to drift, rapidly decrease in concentration, and be rendered ineffective.[34]

Eurasian Water Milfoil
The Army Corps of Engineers Aquatic Plant Information System (APIS) identifies the following herbicides for control of Eurasian water milfoil: complexed copper, 2,4-D, diquat, endothall, fluridone, and triclopyr. Early season treatment of Eurasian water milfoil is also recommended by the Department of Natural Resources to limit the impact on native aquatic plant populations.

Native Plant Aquatic Plant Management
The WDNR Northern Region released an Aquatic Plant Management Strategy in the summer of 2007 to protect the important functions aquatic plants provide in lakes. As part of this strategy, the WDNR prohibited management of native aquatic plants in front of individual lake properties after 2008 unless management is designated in an approved aquatic plant management plan.[35] Permits for waterfront corridors were issued in 2008 only for formerly permitted sites where impairment of navigation and/or nuisance conditions were demonstrated. Because of the importance of the native plant population for habitat, protection against erosion, and as a guard against invasive species infestation, plant removal with herbicides as an option for individual property owners is carefully reviewed. The WDNR has not allowed removal after January 1, 2009 unless the “impairment of navigation” and/or “nuisance” conditions are clearly documented.

The WDNR recommends (and may require) that residents who wish to maintain an opening for boating and swimming use rakes or other hand methods.

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[33] Research in Minnesota on Control of Curly Leaf Pondweed. Minnesota Wendy Crowell, Minnesota Department of Natural Resources. Spring 2002.
[34] Personal communication, Frank Koshere. March 2005.
[35] Aquatic Plant Management Strategy. DNR Northern Region. Summer 2007.

Appendix F. Related Plans, Regulations, and Ordinances

As described previously, knowledge of and involvement in development and implementation of local plans and ordinances can assist the Big Round Lake Protection and Rehabilitation District in achieving the goals of this Lake Management Plan.

Comprehensive Land Use Planning

The Polk County Comprehensive Land Use Plan was adopted in 2009. The plan includes an analysis of population, economy, housing, transportation, recreation, and land use trends. It also reports the physical features of Polk County. The purpose of the land use plan is to provide general guidance to achieve the desired future development of the county and direction for development decisions. The lakes classification outlines restriction on development according to lake features. Plan information is available online at http://www.co.polk.wi.us/landinfo/PlanningCompPlan.asp

Town, City and Village Comprehensive Plans are available at: http://www.co.polk.wi.us/landinfo/PlanningCompPlans.asp

Smart growth is a state mandated planning requirement to guide land use decisions and facilitate communication between municipalities. Wisconsin's Comprehensive Planning Law (Statute 66.1001, Wis. Stats.) was passed as part of the 1999 Budget Act. The law requires that if a local government engages in zoning, subdivision regulations, or official mapping, those local land use regulations must be consistent with that unit of local government's comprehensive plan beginning on January 1, 2010. The law defines a comprehensive plan as having at least the following nine elements:

- ✓ Issues and opportunities
- ✓ Housing
- ✓ Transportation
- ✓ Utilities and community facilities
- ✓ Agricultural, natural, and cultural resources
- ✓ Economic development
- ✓ Intergovernmental cooperation
- ✓ Land use
- ✓ Implementation
- ✓ Polk County added "Energy and Sustainability"

Polk County Comprehensive Land Use Ordinance

The Polk County Comprehensive Land Use Ordinance**,** more commonly known as the Zoning Ordinance, is currently being updated due to the passage of the Comprehensive Plan. Seventeen of Polk County's 24 Towns have adopted county zoning, including: the Towns of Alden, Apple River, Beaver, Black Brook, Clam Falls, Clayton, Clear Lake, Eureka, Georgetown, Johnstown, Lincoln, Lorain, Luck, McKinley, Milltown, Osceola, and West Sweden. The Towns of Farmington, Garfield, and St. Croix Falls have adopted Town Zoning and the Towns of Balsam Lake, Bone Lake, Laketown, and Sterling have no town or county zoning other than the state-

mandated shoreland zoning. Land use regulations in the zoning ordinance include building height requirements, lot sizes, permitted uses, and setbacks among other provisions. The current Comprehensive Zoning Ordinance is available at:
http://www.co.polk.wi.us/landinfo/pdfs/Ordinances/ComprehensiveLandUse.pdf

Shoreland Protection Zoning Ordinance

The State of Wisconsin's Administrative Rule NR 115 dictates that counties must regulate lands within 1,000 feet of a lake, pond or flowage and 300 feet of a river or stream. The Shoreland Protection Zoning Ordinance is also currently being rewritten due to the Comprehensive Plan and the State of Wisconsin passing a new version of NR 115 in 2010. Polk County passed an update of the current Shoreland Ordinance in 2002 and again in 2008. These updates put in place standards for impervious surfaces, a phosphorus fertilizer ban for shoreland property, and lakes classification and setback standards. The current ordinance is available online at:
http://www.co.polk.wi.us/landinfo/pdfs/Ordinances/ShorelandOrdinance.pdf

Updates to the Shoreland Protection Ordinance and the Comprehensive Land Use Ordinance were completed in 2015. The old and new version of the ordinances are available at: http://www.co.polk.wi.us/landinfo/ordinances.asp. Recent changes in local authority to implement shoreland ordinances in the 2015 Wisconsin Budget Bill put this update in question.

Subdivision Ordinance

The subdivision ordinance, adopted in 1996 and updated in 2005, requires a recorded certified survey map for any parcel less than 19 acres. The ordinance requires most new plats to incorporate storm water management practices with no net increase in runoff from development. The ordinance is available online at:
http://www.co.polk.wi.us/landinfo/PDFs/Ordinances/Subdivision%20Ordinance%202005-07-01.pdf

Animal Waste

The Polk County Manure and Water Quality Management Ordinance was revised in January 2000. A policy manual established minimum standards and specifications for animal waste storage facilities, feedlots, degraded pastures, and active livestock operations greater than 300 animal units for livestock producers regulated by the ordinances. The Land and Water Resource Department's objective was to have countywide compliance with the ordinance by 2006. The ordinance is available online at: http://www.co.polk.wi.us/landwater/MANUR21A.htm.

Storm Water and Erosion Control

The ordinance, passed in December 2005, establishes planning and permitting requirements for erosion control on disturbed sites greater than 3,000 square feet, where more than 400 cubic yards of material is cut or filled, or where channels are used for 300 feet more of utility installation (with some exceptions). Storm water plans and implementation of best management practices are required for subdivisions, survey plats, and roads where more than ½ acre of impervious surface will result. The Polk County Land and Water Resources Department administers the ordinance. The ordinance is a local mechanism to implement the Wisconsin Non-agricultural Runoff Performance Standards found in NR 151.

WI Non-Agricultural Performance Standards (NR 151)

Construction Sites >1 acre – must control 80% of sediment load from sites

Storm water management plans (>1 acre)

- Total Suspended Solids
- Peak Discharge Rate
- Infiltration
- Buffers around water

Developed urban areas (>1000 persons/square mile)

- Public education
- Yard waste management
- Nutrient management
- Reduction of suspended solids

Polk County Land and Water Resources Management Plan

The Polk County Land and Water Resources Management Plan describes the strategy the Land and Water Resources Department (LWRD) will employ from 2010-2018 to address agriculture and non-agriculture runoff management, stormwater discharge, shoreline management, soil conservation, invasive species, and other environmental degradation that affects the natural resources of Polk County. The plan specifies how the LWRD will implement NR 151 (Runoff Management). It involves identifying critical sites, offering cost-share and other programs, identifying BMP's monitoring and evaluating projects for compliance, conducting enforcement activities, tracking progress, and providing information and education.

Polk County has local shoreland protection, zoning, subdivision, animal waste, and non-metallic mining ordinances. Enforcing these rules and assisting other agencies with programs are part of LWRD's ongoing activities. Other activities to implement the NR 151 Standards include information and education strategies, write nutrient management plans, provide technical assistance to landowners and lakeshore owners, perform lake studies, collaborate with other agencies, work on a rivers classification system, set up demonstration sites of proper BMP's, control invasive species, and revise ordinances to offer better protection of resources.

WI Agricultural Performance Standards (NR 151)

For farmers who grow agricultural crops

- Meet "T" on cropped fields
- Starting in 2005 for high priority areas such as impaired or exceptional waters, and 2008 for all other areas, follow a nutrient management plan designed to limit entry of nutrients into waters of the state

For farmers who raise, feed, or house livestock

- No direct runoff from feedlots or stored manure into state waters
- No unlimited livestock access to waters of the state where high concentrations of animals prevent the maintenance of adequate or self sustaining sod cover
- Starting in 2005 for high priority areas, and 2008 for all other areas, follow a nutrient management plan when applying or contracting to apply manure to limit entry of nutrients into waters of the state

For farmers who have or plan to build a manure storage structure

- Maintain a structure to prevent overflow, leakage, and structural failure
- Repair or upgrade a failing or leaking structure that poses an imminent health threat or violates groundwater standards
- Close a structure according to accepted standards
- Meet technical standards for a newly constructed or substantially-altered structure

For farmers with land in a water quality management area (defined as 300 feet from a stream, or 1,000 feet from a lake or areas susceptible to groundwater contamination)

- Do not stack manure in unconfined piles
- Divert clean water away from feedlots, manure storage areas, and barnyards located within this area

Appendix G. References

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Shoreline Restoration Resources

Grant Funding

Healthy Lakes Initiative

http://dnrmedia.wi.gov/main/Play/6d4492741a11405dbf922c64947aef1e1d#!

Surface Water Grants: Lake Planning and Lake Protection including Healthy Lakes

http://dnr.wi.gov/Aid/SurfaceWater.html

Program Information

Amery Clean Lakes

http://amerywisconsin.org/?112260

Balsam Lake

http://blprd.com/BalsamLakeWaterfrontRunoffProgram/index.php

Bone Lake

http://bonelakewi.com/

Burnett County

http://wi-burnettcounty.civicplus.com/index.aspx?NID=543

Deer Lake Conservancy

http://deerlakewi.com/Conservancy.html

Shoreland Habitat Protection Social Marketing Strategies

http://www.uwsp.edu/cnr-ap/UWEXLakes/Documents/resources/healthylakes/Burnett-CBSM-final-report-12-9-13.pdf

Appendix H. Big Round Lake CLMP WORK PLAN (2016-20)

GOAL: The Big Round Lake community is knowledgeable about and engaged in lake stewardship.

Actions[1]	**Timeline** (each year if not indicated)	**Board/Committee Assignment**	**$ Estimate (annually)**	**Vol. Hours (annually)**	**Funding Sources**	**Partners**
Web site is maintained and promoted	Ongoing	Board Chair	$45	2	Lake District	Jim Mertens
Mailings	Ongoing	Secretary	$300	2	Lake District	
Volunteer coordination and training	Ongoing	Board Chair		8	Lake District	Polk County WDNR
Annual meeting presentations/workshops	June each year	Board Chair	$100	40	Lake District	Polk County WDNR
Training/conferences for board members	April each year	Board	$1,500	60	Lake District	WI Lakes PCALR
Tribal meeting	January each year	Tribal Liaison	$150	40	Lake District	Tribe, WNDR, Polk County, Consultants

[1] See CLMP implementation strategy for action item detail. Estimates are for annual budgets once implementation begins.

Big Round Lake CLMP WORK PLAN (2016-20)

GOAL: Prevent the introduction and spread of aquatic invasive species.

Actions[2]	**Timeline (each year if not indicated)**	**Board/Committee Assignment**	**$ Estimate (annually)**	**Vol. Hours (annually)**	**Funding Sources**[3]	**Partners**
Clean Boats, Clean Waters Program	May to Sept. each year	CBCW Coordinator (vacant)	$0	200	CBCW grant Lake District	Volunteers
ILIDS Cameras and Video Review	May to Sept. each year	Vice-Chair	$4,580	2	Lake District	Environmental Sentry Protection
Consultant AIS Prevention Surveys including CLP surveys	June and August each year	Vice-Chair	$4,900	8	Lake District AEPP grant	Blue Water Science
Volunteer AIS Prevention Surveys	Beginning Spring 2016	Board Chair	$200	20	Lake District AEPP grant	Volunteers Polk County
Rapid Response Contingency Fund	Annual meetings	Board Chair	$5,000		Lake District	Polk County WDNR Blue Water Science
Whole Lake Point Intercept Survey	2018	Board	$2,800		Lake District AEPP grant	Polk County LWRD
Write grants to support AIS prevention	December 10 2015		$1,000		Lake District	Consultants

[2] See previous pages for action item detail. Estimates are for annual budgets once implementation begins.

[3] CBCW grants are WDNR grants for Clean Boats, Clean Waters staffing.
AEPP grants are WDNR grants for Aquatic Invasive Species Education, Prevention, and Planning.

Big Round Lake CLMP WORK PLAN (2016-2020)

GOAL: Understand water quality to potentially reduce the severity of algae blooms.

Actions[4]	Timeline (each year if not indicated)	Board/Committee Assignment	$ Estimate (annually)	Vol. Hours (annually)	Funding Sources	Partners
Initiate study to develop a lake phosphorus budget	2017/2018	Vice Chair	$?	$?	Lake District WDNR Lake Planning Grant	Polk County LWRD Consultants
Consider lake management activities to address phosphorus inputs	2019	Board	$?	$?	Lake District WDNR Lake Protection Grant	Polk County LWRD Consultants
Monitor lake water quality, temp. , and O2 profiles	Ongoing	Volunteer Monitor	$2,500 (equip. in 2016)	8	Lake District WDNR	Polk County LWRD
Update sediment core results using new diatom training set	2016	Board	$500		Lake District WDNR Lake Planning Grant	Polk County LWRD Science Museum of MN
Gather and study new sediment core for algae pigments	2018	Board	$2,500		Lake District WDNR Lake Planning Grant	Polk County LWRD Science Museum of MN
Measure current algae abundance and biomass	2016				Lake District WNDR Lake Planning Grant	Polk County LWRD
Write grants for lake management planning	December 2016		$1,000		Lake District	Consultants

[4] See CLMP implementation strategy for action item detail. Estimates are for annual budgets once implementation begins.

Big Round Lake CLMP WORK PLAN (2016-2020)

GOAL: Preserve and enhance great fishing on Big Round Lake.

Actions[5]	Timeline (each year if not indicated)	Board/Committee Assignment	$ Estimate (annually)	Vol. Hours (annually)	Funding Sources	Partners[6]
Education to encourage natural shorelines	Ongoing		$200	20	Lake District WDNR Small Scale Planning Grant	Polk County LWRD
Provide input to WDNR and tribal fish management	Ongoing/ January mtg.	Fisheries Manager	$0	20	Lake District	WDNR St. Croix Tribe

[5] See CLMP implementation strategy for action item detail. Estimates are for annual budgets once implementation begins.

Appendix I. Glossary

Aeration — To add air (oxygen) to the water supply. Generally used in lake management to reduce the release of phosphorus from lake sediments or to prevent fish kills.

Algae — Small aquatic plants without roots that contain chlorophyll and occur as single cells or multi-celled colonies. Algae form the base of the food chain in aquatic environments.

Algal bloom — Heavy growth of algae in and on a body of water resulting from high nutrient concentrations.

Alluvium — Clay, silt, sand, gravel, or similar detrital material deposited by running water.

Alkalinity — The acid combining capacity of a (carbonate) solution, also describes its buffering capacity.

Animal waste management — A group of practices including barnyard runoff management, nutrient management, and manure storage facilities designed to minimize the effects of animal manure on surface and groundwater resources.

Aquatic plant survey — A systematic mapping of types and location of aquatic plants in a water body, usually conducted in a boat. Survey information is presented on an aquatic plant map.

Aquifer — A water-bearing stratum of permeable rock, sand, or gravel.

BMP's (Best Management Practices) — Practices or methods used to prevent or reduce amounts of nutrients, sediments, chemicals or other pollutants from entering water bodies from human activities. BMP's have been developed for agricultural, silvicultural, construction, and urban activities.

Bathymetric map — A map showing depth contours in a water body. Bottom contours are usually presented as lines of equal depth in meters or feet.

Benchmark — A mark of reference indicating elevation or water level.

Benthal — Bottom area of the lake (Gr. *benthos* depth).

Biocontrol — Management using biological organisms, such as fish, insects, or micro-organisms like fungus.

Biomass — The total organic matter present (Gr. *bios* life).

Bottom barriers — Synthetic or natural fiber sheets of material used to cover and kill plants growing on the bottom of a water body; also called sediment covers.

Buffer strips - Strips of grass, shrubs, trees, and other vegetation between disturbed areas and a stream, lake, or wetland.

Cluster development - Grouping homes on part of a property while maintaining a large amount of open space on the remaining land.

Chlorophyll — The green pigments of plants (Gr. *chloros* green, *phyllon* leaf).

Conservation easement — A legal document that restricts the use of land to farming, open space, or wildlife habitat. A landowner may sell or donate an easement to a government agency or a private land trust.

Consumers — Organisms that nourish themselves on particulate organic matter (Lat. *consumere* to take wholly).

Contact herbicide — An herbicide that causes localized injury or death to plant tissues it contacts. Contact herbicides do not kill the entire plant.

Cost effective — A level of treatment or management with the greatest incremental benefit for the money spent.

Decomposers — Organisms, mostly bacteria or fungi, that break down complex organic material into its inorganic constituents.

Detritus — Settleable material suspended in the water. Organic detritus comes from the decomposition of the broken down remains of organisms. Inorganic detritus comes from settleable mineral materials.

Dissolved oxygen — A measure of the amount of oxygen gas dissolved in water and available for use by microorganisms and fish.

Drainage basin — The area drained by, or contributing to, a stream, lake, or other water body (see watershed).

Drawdown — Decreasing the level of standing water in a water body to expose bottom sediments and rooted plants. Water level drawdown can be accomplished by physically releasing a volume of water through a controlled outlet structure or by preventing recharge of a system from a primary external source.

Dredging — Physical methods of digging into the bottom of a water body to remove sediment, plants, or other material. Dredging can be performed using mechanical or hydraulic equipment.

Ecology — Scientific study of relationships between organisms and their surroundings (environment).

Ecosystems — The interacting system of a biological community and its nonliving surroundings.

Emergent plants — Aquatic plants that are rooted or anchored in the sediment around shorelines, but have stems and leaves extending well above the water surface. Cattails and bulrushes are examples of emergent plants.

Endothall — The active chemical ingredient of the aquatic contact herbicide Aquathol®.

Environmental corridors — Elongated areas in the landscape that encompass most of the best remaining woodland, wetlands, prairie, wildlife habitat, and surface water and attendant floodlands and shorelands, together with many related historic, scenic, and recreational sites. It is recommended that these corridors be preserved in essentially natural, open uses.

Environmental Protection Agency — The federal agency responsible for enforcing federal environmental regulations. The Environmental Protection Agency delegates some of its responsibilities for water, air, and solid waste pollution control to state agencies.

Epilimnion — The uppermost, warm, well-mixed layer of a lake (Gr. *epi* on, *limne* lake).

Eradication — Complete removal of a specific organism from a specified location, usually refers to a noxious, invasive species. Under most circumstances, eradication of a population is very difficult to achieve.

Erosion — The wearing away of the land surface by wind or water.

Eutrophic — Refers to a nutrient-rich lake. Large amounts of algae and weeds characterize a eutrophic lake (see also "Oligotrophic" and "Mesotrophic").

Eutrophication — The process of nutrient enrichment of a lake leading to increased production of aquatic organisms. Eutrophication can be accelerated by human activity such as agriculture and improper waste disposal.

Exotic — Refers to species of plants or animals that are not native to a particular region into which they have moved or invaded. Eurasian watermilfoil is an exotic plant invader.

Fecal coliform — A group of bacteria used to indicate the presence of other bacteria that cause disease. The number of coliform is particularly important when water is used for drinking and swimming.

Floating-leafed plant — Plants with oval or circular leaves floating on the water surface, but are rooted or attached to sediments by long, flexible stems. Waterlilies are examples of rooted floating-leafed plants.

Fluridone — The active chemical ingredient of the systemic aquatic herbicide SONAR®.

Flushing rate — Term describing rate of water volume replacement of a water body, usually expressed as basin volume per unit time needed to replace the water body volume with inflowing water. The inverse of the flushing rate is the (hydraulic) detention time. A lake with a flushing rate of 1 lake volume per year has a detention time of 1 year.

Food chain — A sequence of organisms where each uses the next as a food source.

Freely-floating plants — Plants that float on or under the water surface, unattached by roots to the bottom. Some have small root systems that simply hang beneath the plant. Water hyacinth and tiny duckweed are examples of freely-floating plants.

Glyphosate — The active chemical ingredient of the systemic herbicide RODEO®.

Ground-truthing — Close or on-the-ground observation used to test the validity of observations made at a distance as in aerial or satellite photography

Groundwater — Underground water-bearing areas generally within the boundaries of a watershed, which fill internal passageways of porous geologic formations (aquifers) with water that flows in response to gravity and pressure. Often used as the source of water for communities and industries.

Habitat — The place or type of site where a plant or animal naturally lives and grows.

Herbicide — A chemical used to suppress the growth of or kill plants.

Habitat — The physical place where an organism lives.

Hydraulic detention time — The period of detention of water in a basin. The inverse of detention time is flushing rate. A lake with a detention time of one year has a flushing rate of 1 lake volume per year.

Hypolimnion — The cold, deepest layer of a lake that is removed from surface influences (Gr. *hypo* under, *limne* lake).

Integrated aquatic plant management — Management using a combination of plant control methods that maximizes beneficial uses, minimizes environmental impacts and optimizes overall costs.

Limiting nutrient — Essential nutrient needed for growth of plant organism which is the most scarce in the environment. Oftentimes, in freshwater systems, either phosphorus or nitrogen may be the limiting nutrient for plant growth.

Limnology — The study of inland waters (Gr. *limne* lake).

Littoral — The region of a body of water extending from shoreline outward to the greatest depth occupied by rooted aquatic plants.

Loam — A soil consisting of varying proportions of sand, clay, and silt, generally well-suited for agriculture.

Loess — A loamy soil deposited by wind.

Macrophyte — Large, rooted or floating aquatic plants that may bear flowers and seeds. Some plants, like duckweed and coontail, are free-floating and are not attached to the bottom. Occasionally, filamentous algae like *Nitella* sp. can form large, extensive populations and be an important member of the aquatic macrophyte community.

Mesotrophic — Refers to a moderately fertile nutrient level of a lake between the oligotrophic and eutrophic levels. (See also "Eutrophic" and "Oligotrohpic.")

Milligrams per liter (mg/l) — A measure of the concentration of substance in water. For most pollution measurements this is the equivalent of "parts per million" (ppm).

Mitigation — The effort to lessen the damages from a particular project through modifying a project, providing alternatives, compensating for losses, or replacing lost values.

Morphology — Study of shape, configuration, or form.

Navigable waters — A water body with a bed and a bank that can float a watercraft at any point in the year.

Niche — The position or role of an organism within its community and ecosystem.

Nitrogen — A chemical constituent (nutrient) essential for life. Nitrogen is a primary nutrient necessary for plant growth.

Nonpoint source pollution (NSP) — Pollution whose sources cannot be traced to a single point such as a municipal or industrial wastewater treatment plant discharge pipe. Nonpoint sources include eroding farmland and construction sites, urban streets, and barnyards. Pollutants from these sources reach water bodies in runoff. They can best be controlled by proper land management.

Non-target species — A species not intentionally targeted for control by a pesticide or herbicide.

Nutrient — Any chemical element, ion, or compound required by an organism for the continuation of growth, reproduction, and other life processes.

Nutrient management plan — A guidance document that provides fertilizer and manure spreading recommendations for crop fields based upon soil test results and crop needs. Plans are sometimes referred to as NRCS 590 plans for the Natural Resources Conservation Service Standard that guides their preparation.

Oligotrophic — Refers to an unproductive and nutrient-poor lake. Such lakes typically have very clear water. (See also "Eutrophic" and "Mesotrophic.")

Ordinary high water mark — The point on the bank or shore up to which the water leaves a distinct mark on the shore or bank from its presence, wave action, or flow. The mark may be indicated by erosion, destruction of or change in vegetation, or another easily recognizable characteristic.

Oxidation — A chemical process that can occur in the uptake of oxygen.

pH — The negative logarithm of the hydrogen ion activity. pH values range from 1-10 (low pH values are acidic and high pH levels are alkaline).

Peat — Soil material formed by partial decomposition of plant material.

Pesticide — Any chemical agent used to control specific organisms, such as insecticides, herbicides, fungicides, etc.

Phosphorus — A chemical constituent (nutrient) essential for life. Phosphorus is a primary nutrient necessary for plant growth. When phosphorus reaches lakes in excess amounts, it can lead to over-fertile conditions and algae blooms.

Photosynthesis — Production of organic matter (carbohydrate) from inorganic carbon and water in the presence of light (Gr. *phos*, *photos* light, *synthesis* placing together).

Phytoplankton — Free floating microscopic plants (algae).

Point (pollutant) source — A source of pollutants or contaminants that discharges through a pipe or culvert. Point sources, such as an industrial or sewage outfall, are usually readily identified.

Pollution — The presence of materials or energy whose nature, location, or quantity produces undesired environmental effects. Pollutants can be chemicals, disease-producing organisms, silt, toxic metals, oxygen-demanding materials, to name a few.

Primary environmental corridors — Concentrations of significant natural resources at least 400 acres in area, at least two miles in length, and at least 200 feet in width.

Primary production — The rate of formation of organic matter or sugars in plant cells from light, water, and carbon dioxide (Lat. *primus* first, *producere* to bring forward). Algae are primary producers.

Priority watershed — A drainage area selected to receive state money to help pay the cost of controlling nonpoint source pollution.

Problem statement — A written description of important uses of a water body that are being affected by the presence of problem aquatic plants.

Producers — Organisms able to build up their body substance from inorganic materials.

Productivity — A measure of the amount of living matter which is supported by an environment over a specific period of time. Often described in terms of algae production for a lake.

Public Awareness/Outreach — Programs designed to share technical information and data on a particular topic, usually associated with activities on or around a water body.

Recruitment — The process of adding new individuals to a population.

Residence time — The average length of time that water or a chemical constituent remains in a lake.

Riparian — Belonging or relating to the bank of a lake, river, or stream.

Riprap — Broken rock, cobbles, or boulders placed on the bank of a stream to protect it against erosion.

Rotovation — A mechanical control method of tilling lake or river sediments to physically dislodge rooted plants. Also known as bottom tillage or derooting.

Runoff — Water from rain, snowmelt, or irrigation that flows over the ground surface and returns to streams and lakes. Runoff can collect pollutants from air or land and carry them to receiving waters.

Secchi depth — A measure of transparency of water (the ability of light to penetrate water) obtained by lowering a secchi disc into the water until it is no longer visible. Measured in units of meters or feet.

Secchi disc — A 20-cm (8-inch) diameter disc painted white and black in alternating quadrants. It is used to measure light transparency in lakes.

Secondary environmental corridors — Concentrations of significant natural resources at least 100 acres in area and at least one mile in length.

Sediment — Soil particles suspended in and carried by water as a result of erosion.

Sensitive areas — Plant communities and other elements that provide important fish and wildlife habitat as designated by the Wisconsin Department of Natural Resources.

Septic system — Sewage treatment and disposal for homes not connected to sewer lines usually with a tank and drain field. Solids settle to the bottom of the tank. Liquid percolates through the drain field.

Standing crop — The biomass present in a body of water at a particular time.

Storm sewers — A system of sewers that collect and transport rain and snow runoff. In areas that have separated sewers, such stormwater is not mixed with sanitary sewage.

Stratification — Horizontal layering of water in a lake caused by temperature-related differences in density. A thermally stratified lake is generally divided into the epilimnion (uppermost, warm, mixed layer), metalimnion (middle layer of rapid change in temperature and density) and hypolimnion (lowest, cool, least mixed layer).

Submersed plants — An aquatic plant that grows with all or most of its stems and leaves below the water surface. Submersed plants usually grow rooted in the bottom and have thin, flexible stems supported by the water. Common submersed plants are milfoil and pondweeds.

Susceptibility — The sensitivity or level of injury demonstrated by a plant to effects of an herbicide.

Suspended solids (SS) — Small particles of solid pollutants suspended in water.

Systemic herbicide — An herbicide in which the active chemicals are absorbed and translocated within the entire plant system, including roots. Depending on the active ingredient, systemic herbicides affect certain biochemical reactions in the plant and can cause plant death. SONAR® and RODEO® are systemic herbicides.

Thermal stratification — Horizontal layering of water in a lake caused by temperature-related differences in density. A thermally stratified lake is generally divided into the epilimnion (uppermost, warm, mixed layer), metalimnion (middle layer of rapid change in temperature and density), and hypolimnion (lowest, cool, least mixed layer).

Thermocline — (Gr. *therme* heat, *klinein* to slope.) Zone (horizontal layer) in water body in which there is a rapid rate of temperature decrease with depth. Also called metalimnion, it lies below the epilimnion.

Tolerable soil loss — The tolerable soil loss rate, commonly referred to as “T,” is the maximum average annual rate of soil erosion for each soil type that will permit a high level of crop productivity to be sustained economically and indefinitely (ATCP 50.01(16)).

Topographic map — A map showing elevation of the landscape in contours of equal height (elevation) above sea level. This can be used to identify boundaries of a watershed.

Total maximum daily loads — The maximum amount of a pollutant that can be discharged into a stream without causing a violation of water quality standards.

Transect lines — Straight lines extending across an area to be surveyed.

Tributaries — Rivers, streams, or other channels that flow into a water body.

Trophic state — The level of growth or productivity of a lake as measured by phosphorus content, algae abundance, and depth of light penetration. Lakes are classified as oligotrophic (low productivity, "good" water quality), mesotrophic (moderate productivity), or eutrophic (high productivity; "poor" water quality).

Turbid — Lack of water clarity. Turbidity is closely related to the amount of suspended materials in water.

Uniform dwelling code — A statewide building code specifying requirements for electrical, heating, ventilation, fire, structural, plumbing, construction site erosion, and other construction related practices.

University of Wisconsin Extension (UWEX) — A special outreach and education branch of the state university system.

Vascular plant— A vascular plant possesses specialized cells that conduct fluids and nutrients throughout the plant. The xylem conducts water, and the phloem transports food.

Variance — Government permission for a delay or exception in the application of a given law, ordinance, or regulation. Also, see water quality standard variance.

Waste — Unwanted materials left over from manufacturing processes; refuse from places of human or animal habitation.

Water body usage map — A map of a water body showing important human use areas or zones (such as swimming, boating, fishing) and habitat areas for fish, wildlife and waterfowl.

Water quality criteria — A measure of the physical, chemical, or biological characteristics of a water body necessary to protect and maintain different water uses (fish and aquatic life, swimming, etc.).

Water quality standards — The legal basis and determination of the use of a water body and the water quality criteria; physical, chemical, or biological characteristics of a water body, that must be met to make it suitable for the specified use.

Water quality management area (WQMA) — The area within 1,000 feet from the ordinary high water mark of navigable waters that consists of a lake, pond or flowage; the area within 300 feet from the ordinary high water mark of navigable waters that consist of a river or stream; and a site that is susceptible to groundwater contamination, or that has the potential to be a direct conduit for contamination to reach groundwater. (NR 151.015(24))

Water quality standard variance — When natural conditions of a water body preclude meeting all conditions necessary to maintain full fish and aquatic life and swimming, a variance may be granted.

Watershed — The entire surface landscape that contributes water to a lake or river.

Watershed management — The management of the natural resources of a drainage basin for the production and protection of water supplies and water-based resources.

Wetland — Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support a variety of vegetative or aquatic life. Wetland vegetation requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas.

Wisconsin administrative code — The set of rules written and used by state agencies to implement state statutes. Administrative codes are subject to public hearing and have the force of law.

Zooplankton — Microscopic animal plankton in water (Gr. *zoion* animal). *Daphnia* sp. or water fleas are freshwater zooplankton.

Glossary sources: Washington State Department of Ecology; Maribeth Gibbons Jr.; Wisconsin priority watershed planning guidance; and Southeastern Wisconsin Regional Planning Commission.

Appendix J. Rapid Response for Early Detection of Aquatic Invasive Species

<u>Definition: Aquatic Invasive Species (AIS)</u> are non-native plant species that can out-compete and overtake native plant species damaging native lake habitat and sometimes creating nuisance conditions. AIS currently in Big Round Lake = curly leaf pondweed (CLP). Additional AIS threaten the lakes and will be monitored by professional monitors or volunteers when species are added to the training program.

1. Maintain a contingency fund for rapid response to EWM or other invasive species (Lake District Board).

2. Conduct volunteer (Clean Boats, Clean Waters Crew) and professional monitoring (APM Monitor) at designated public boat landings and other likely areas of AIS introduction. If a suspected plant is found, contact the AIS ID Volunteers.

3. Direct lake residents and visitors to contact the AIS ID Volunteers if they see a plant in the lakes they suspect might be an aquatic invasive species such as Eurasian water milfoil (EWM). Signs at the public boat landings, web pages, and handouts at annual meeting will provide plant photos and descriptions, contact information, and instructions.

   If plant is likely AIS, AIS ID Volunteers will confirm identification with Polk County LWCD and the WDNR and inform the rest of the Lake District Board.

   a. Take a digital photo of the plant in the setting where it was found (if possible). Then collect 5 – 10 intact specimens. Try to get the root system, and all leaves as well as seed heads and flowers when present. Place in a zip lock bag with no water. Place on ice and transport to refrigerator.

   b. Fill out plant incident form http://dnr.wi.gov/lakes/forms/3200-125-plantincident.pdf

   c. Contact WDNR staff, then deliver collected plants to the WDNR (810 West Maple Street, Spooner, WI 54801) as soon as possible to the location they specify. WDNR may confirm identification with the herbarium at the University of Wisconsin – Stevens Point or the University of Wisconsin – Madison.

4. Mark the location of suspected AIS (AIS ID Volunteers). Use GPS points (in decimal degrees and WGS 84 datum), if available, or mark the location with a small float.

5. If identification is positive:[1]

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[1] [1] **If it is an animal other than a fish**

- Be sure the suspected invasive species has not been previously found on the waterbody
- Take a digital photo of the animal in the setting where it was found (if possible). Then collect up to five specimens. Place in a jar with water; put on ice and transport to refrigerator. Transfer specimen to a jar filled with rubbing alcohol (except for Jellyfish – leave in water).
- Fill out form 3200-126 – Aquatic Invasive Animal Incident Report
- Contact DNR staff

a. Inform the person who reported the AIS and the board (AIS ID Volunteers), who will then inform Polk County LWRD, herbicide contractor, and lake management consultant.

b. Mark the location of AIS with a more permanent marker. Special EWM buoys are available. (AIS ID Volunteers).

c. Post a notice at the public landing (DNR has these signs available) and include a notice on the website. Notices will inform residents and visitors of the approximate location of AIS and provide appropriate means to avoid its spread (Lake District Board).

6. Hire a consultant to determine the extent of the AIS introduction (Lake District Board). A diver may be used. If small amounts of AIS are found during this assessment, the consultant will be directed to identify locations with GPS points and hand pull plants found. All plant fragments will be removed from the lake when hand pulling.

7. Select a control plan in cooperation with the WDNR (Lake District Board). The goal of the rapid response control plan will be eradication of the AIS. Additional guidance regarding EWM treatment is found in DNR's *Response for Early Detection of Eurasian Water Milfoil Field Protocol*.

   Control methods may include hand pulling, use of divers to manually or mechanically remove the EWM from the lake bottom, application of herbicides, and/or other effective and approved control methods.

8. Implement the selected control plan including applying for the necessary permits. Regardless of the control plan selected, it will be implemented by persons who are qualified and experienced in the technique(s) selected.

9. Lake District funds may be used to pay for any reasonable expense incurred during the implementation of the selected control plan, and implementation will not be delayed by waiting for WDNR to approve or fund a grant application.

10. The Lake District Board will work with the WDNR to confirm, as soon as possible, a start date for an Early Detection and Rapid Response AIS Control Grant. Thereafter, the Lake District shall formally apply for the grant.

11. Frequently inspect the area of the AIS to determine the effectiveness of the treatment and whether additional treatment is necessary (Lake District Board, APM Monitor).

12. Review the procedures and responsibilities of this rapid response plan on an annual basis. Changes may be made with approval of the Lake District Board.

EXHIBIT A[2]

BIG ROUND LAKE PROTECTION AND REHABILITATION DISTRICT

EWM ID Volunteers and Board Contacts	Doug Jaeger:	612-868-2658	dejaeger23@gmail.com
	Gordon Kill:	651-714-9146	gtkill@aol.com
	Dan Bergeron:	612-419-4193	bergeron@lakeland.ws

POLK COUNTY LAND AND WATER RESOURCES DEPARTMENT

AIS Coordinator	Jeremy Williamson: 715-485-8639
Director	Tim Ritten: 715-485-8631

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Grants and EWM Notice	Alex Smith: 715-635-4124
Permits	Mark Sundeen: 715-635-4074
EWM Identification and Notice	Spooner Lakes Team: 715-635-4124

APM MONITOR

Blue Water Science	Steve McComas:	651-690-9602 mccomas@pclink.com

DIVERS

Blue Water Science	Steve McComas:	651-690-9602 mccomas@pclink.com

[2] This list will be reviewed and updated each year.