Aquatic Plant Management Plan for Lower McKenzie Lake

McKenzie Lake Association

Burnett County, WI
August 21, 2014

Sponsored By
Lower McKenzie Lake Association

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Prepared By

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Tables

Figures

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Introduction

The Aquatic Plant Management Plan for Lower McKenzie Lake is sponsored by the McKenzie Lake Association (MLA). The planning phase of the project is funded, in part, by the Burnett County Land and Water Conservation Department and the McKenzie Lake Association.

Knowing that Eurasian water milfoil (*Myriophyllum spicatum*) is found in several lakes in Burnett and Washburn County, concerned members of the Lower McKenzie Lake Association authorized an extensive assessment of Lower McKenzie Lake aquatic macrophytes using the Wisconsin Department of Natural Resources statewide guidelines for conducting systematic point intercept macrophyte sampling. This Aquatic Plant Management Plan for Lower McKenzie Lake presents a strategy for managing aquatic plants by protecting native plant populations and preventing the establishment of invasive species. The plan includes data about the plant community, watershed, and water quality, as well as other non plant species. Based on this data and public input, goals and strategies for the sound management of aquatic plants in Lower McKenzie Lake are presented. This plan will guide the Lower McKenzie Lake Association, Burnett County, and the Wisconsin Department of Natural Resources in aquatic plant management for Lower McKenzie Lake over the next five years (from 2014 through 2019).

Public Input for Plan Development

On July 13, 2013, a public meeting was held to discuss the concerns of Lower McKenzie Lake and to establish those concerns as the primary focus of writing the Aquatic Plant Management Plan for the lake. Prior to the meeting date, a Public Notice was advertised for two weeks in the local newspaper. A total of 13 people were present for the meeting. Minutes of the meeting were recorded. A summary of the concerns are listed below:

- Water clarity and algal blooms tied in with the fact that many felt like they could not use the lake for swimming
- Control and prevent nutrient run-off/shoreland preservation/restoration
- Issues concerning the introduction of aquatic invasive species
- Encouraging the growth of native plants and "too much weed growth."
- Mass education on various subjects related to protecting and preserving this natural resource, including wildlife and fish species enhancement
- Boat landing inspections
- Poor fishing

A brief meeting was held immediately after the kick-off meeting to establish a committee. In addition to a public kick-off meeting, a survey was sent out to all riparian land owners. A total of 65 surveys were sent out and a total of 31 were returned. Survey results were discussed during the kick-off meeting and were used to help guide decisions made by the Aquatic Plant Management Committee members. The Lower McKenzie Lake Association announced the availability of the draft Aquatic Plant Management Plan for review by August 31, 2014. Copies will be available at the following locations: Burnett County Government Center Land and Water Conservation Department, Room 21; online at the Burnett County website (www.burnettcounty.com), Washburn County DNR Station in Spooner, WI and from Lower

McKenzie Lake Aquatic Plant Management committee members. Comments and suggestions can be mailed or emailed to the address/addresses below.

Schedule for Plan Completion	October 18, 2014
Comments accepted on the plan through	September 20, 2014
Final draft for DNR and public review by	October 18, 2014

Send comments via mail or email to:

Brad Morris
Burnett County Land and Water Conservation Department
7410 County Road K, #109
Siren, WI 54872
bmorris@burnettcounty.org

Board meeting to review comments	TBD

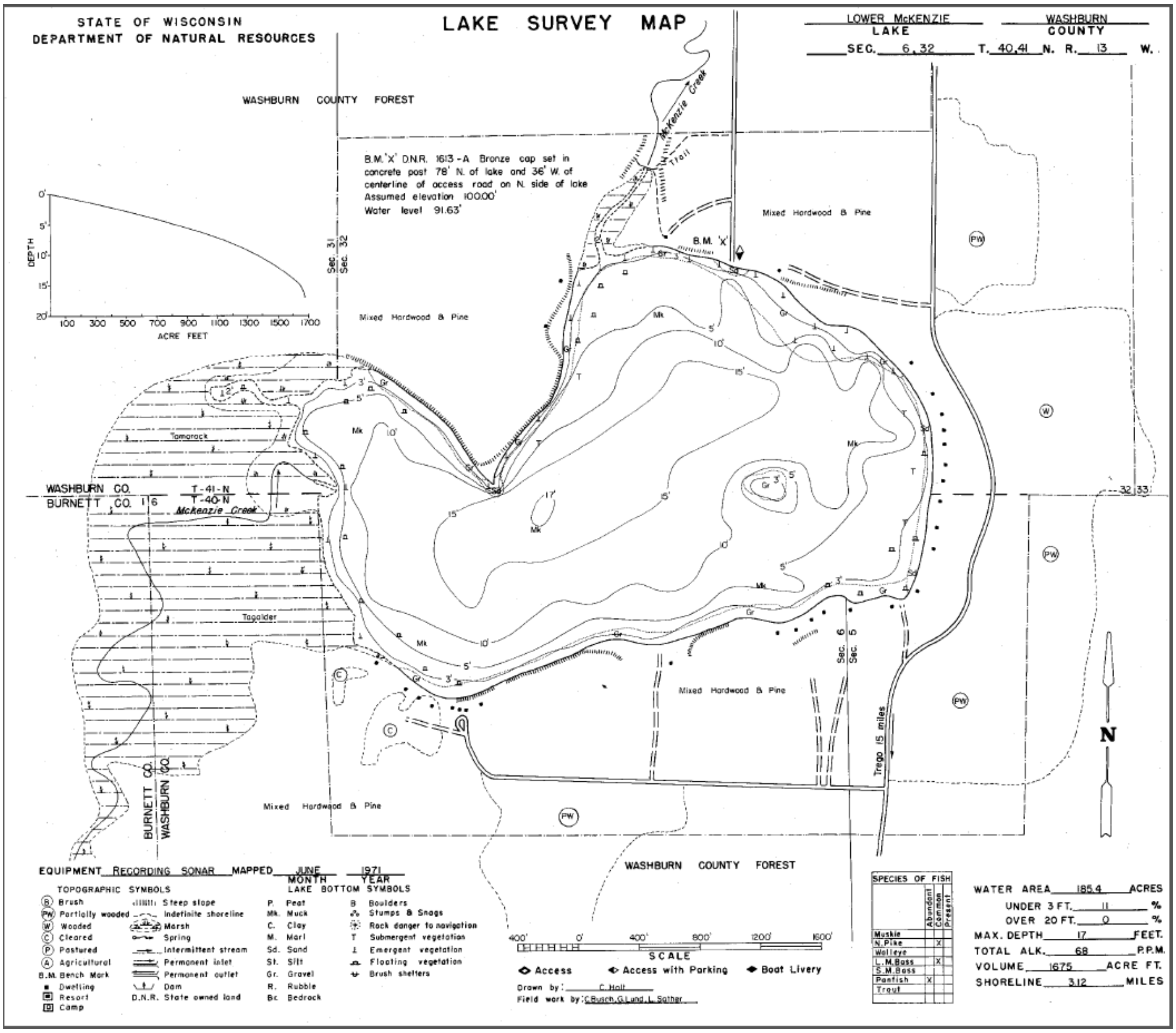
Lake Information

Lower McKenzie Lake (WBIC 2493100) is a 206 acre drainage lake located in Washburn County. It has a maximum depth of 17 feet. The lake is comprised of 12% sand, 50% gravel, 0% rock, 38% muck. Visitors have access to the lake from a public boat landing. Fish include Musky, Panfish, Largemouth Bass, Smallmouth Bass, Northern Pike and Walleye. The lake's water is moderately clear with an average Seechi reading of 11.75 feet in 2013. The moderately clear water created a littoral zone of 15 feet which classifies this lake as Mesotrophic. (1)

Table 1: Lake Information

Lower McKenzie Lake	**WBIC:** 2706300
Size (acres)	206
Mean depth (feet)	9
Maximum depth (feet)	17
Littoral zone depth (feet)	15

A Map of Lower McKenzie Lake can be found below in Figure 1.



(1)

Figure 1: Lower McKenzie Lake Contour Map

Water Quality

Water quality is frequently reported by the trophic state or nutrient level of the lake. Nutrient-rich lakes are classified as eutrophic. These lakes tend to have abundant aquatic plant growth and low water clarity due to algae blooms. Mesotrophic lakes have intermediate nutrient levels and only occasional algae blooms. Oligotrophic lakes are nutrient-poor with little growth of plants and algae.

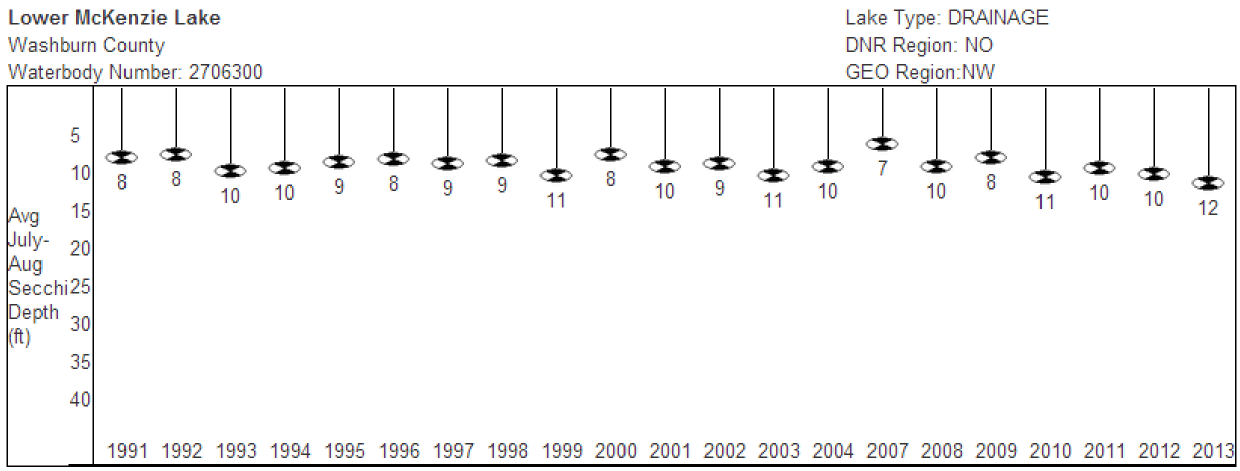
Secchi depth readings are one way to assess the trophic state of a lake. The Secchi depth is the depth at which the black and white Secchi disk is no longer visible when it is lowered into the water. Greater Secchi depths occur with greater water clarity. Secchi depth readings, phosphorus concentrations, and chlorophyll measurements can each be used to calculate a Trophic State Index (TSI) for lakes. TSI values range from 0 – 110. Lakes with TSI values greater than 50 are considered eutrophic. Those with values in the 40 to 50 range are mesotrophic. Lakes with TSI values below 40 are considered oligotrophic.

Citizen lake monitoring volunteers have collected lake data annually since 1990. Below is a summary of the secchi disk reading and chemistry data obtained from the Wisconsin DNR Surface Water Integrated Monitors System data base (1).

The average summer (July-Aug) secchi disk reading for Lower McKenzie Lake - Deep Hole (Washburn County, WBIC: 2706300) was 11.75 feet. The average for the Northwest Georegion was 8.5 feet. Typically the summer (July-Aug) water was reported as ***CLEAR*** *and* ***BLUE****. With this particular lake, it is important to note that the Secchi disc hit the bottom of the lake for 5 of the Secchi readings during the 2013 monitoring season. This indicates that the water clarity was actually greater than the Secchi readings imply.*

Chemistry data was collected on Lower McKenzie Lake - Deep Hole. The average summer Chlorophyll was 3.3 µg/l (compared to a Northwest Georegion summer average of 15.4 µg/l). The summer Total Phosphorus average was 12.6 µg/l. Lakes that have more than 20 µg/l and impoundments that have more than 30 µg/l of total phosphorus may experience noticable algae blooms.

The overall Trophic State Index (based on chlorophyll) for Lower McKenzie Lake - Deep Hole was 44. The TSI suggests that Lower McKenzie Lake - Deep Hole was ***mesotrophic****. Mesotrophic lakes are characterized by moderately clear water, but have a increasing chance of low dissolved oxygen in deep water during the summer.*



Past secchi averages in feet (July and August only).

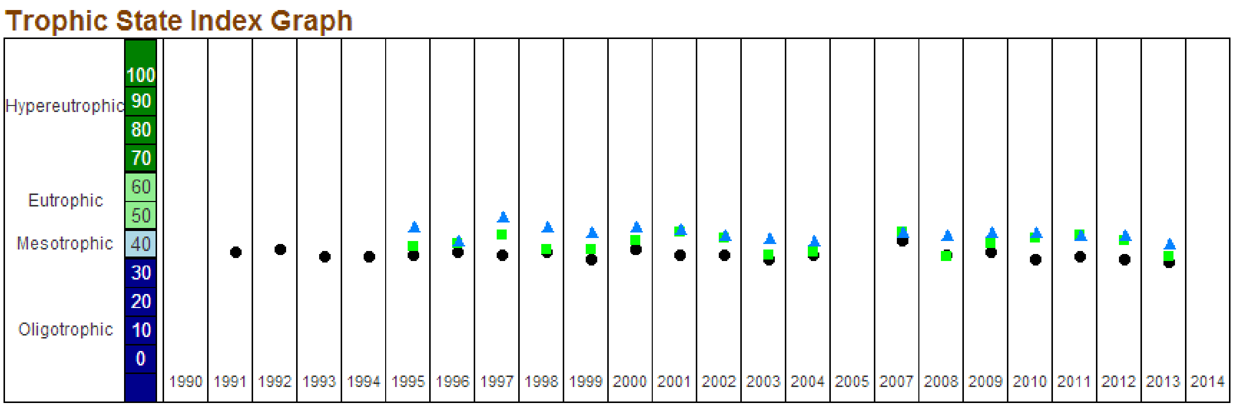
(1)

Figure 2: Secchi Readings of Lower McKenzie Lake

Table 2: Secchi Readings on Lower McKenzie Lake from 1991-2013

Year	Secchi Mean	Secchi Min	Secchi Max	Secchi Count
1991	8.43	7	9.5	7
1992	8	8	8	1
1993	10.17	10	10.5	3
1994	9.71	9	10.25	6
1995	9	8	10.5	6
1996	8.5	8	9	6
1997	9.25	9	9.5	6
1998	8.88	7	10.5	4
1999	10.83	9.5	12	3
2000	8	8	8	3
2001	9.55	9	10.5	10
2002	9.17	8.5	9.5	6
2003	10.8	9	12	5
2004	9.5	9.5	9.5	2
2007	6.6	6.2	7	2
2008	9.5	9.5	9.5	2
2009	8.42	8.25	8.5	3
2010	11	11	11	2
2011	9.75	9	10.5	2
2012	10.5	10	11	2
2013	11.75	11.5	12	2

(1)



Monitoring Station: Lower McKenzie Lake - Deep Hole, Washburn County
Past Summer (July-August) Trophic State Index (TSI) averages.

Figure 3: Trophic State Index for Lower McKenzie Lake Deep Hole

(1)

• = Secchi ■ = Chlorophyll ▲ = Total Phosphorus

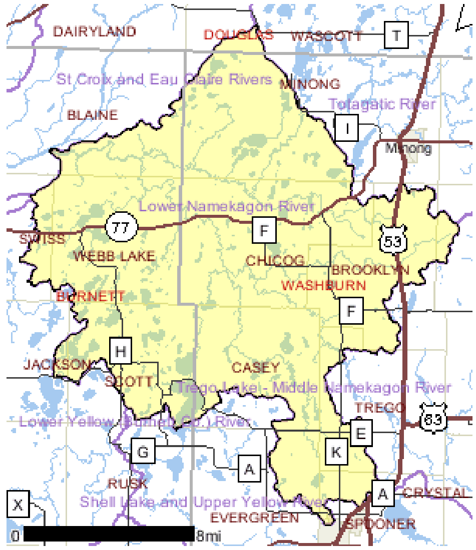
TSI(Chl) = TSI(TP) = TSI(Sec)	It is likely that algae dominate light attenuation.
TSI(Chl) > TSI(Sec)	Large particulates, such as Aphanizomenon flakes dominate
TSI(TP) = TSI(Sec) > TSI(Chl)	Non-algal particulate or color dominate light attenuation
TSI(Sec) = TSI(Chl) >= TSI(TP)	The algae biomass in your lake is limited by phosphorus
TSI(TP) > TSI(Chl) = TSI(Sec)	Zooplankton grazing, nitrogen, or some factor other than phosphorus is limiting algae biomass

TSI	TSI Description
TSI < 30	Classical oligotrophy: clear water, many algal species, oxygen throughout the year in bottom water, cold water, oxygen-sensitive fish species in deep lakes. Excellent water quality.
TSI 30-40	Deeper lakes still oligotrophic, but bottom water of some shallower lakes will become oxygen-depleted during the summer.
TSI 40-50	Water moderately clear, but increasing chance of low dissolved oxygen in deep water during the summer.
TSI 50-60	Lakes becoming eutrophic: decreased clarity, fewer algal species, oxygen-depleted bottom waters during the summer, plant overgrowth evident, warm-water fisheries (pike, perch, bass, etc.) only.
TSI 60-70	Blue-green algae become dominant and algal scums are possible, extensive plant overgrowth problems possible.
TSI 70-80	Becoming very eutrophic. Heavy algal blooms possible throughout summer, dense plant beds, but extent limited by light penetration (blue-green algae block sunlight).
TSI > 80	Algal scums, summer fishkills, few plants, rough fish dominant. Very poor water quality.

(1)

Watershed

The Lower Namekagon River Watershed includes the Namekagon River drainage from below the Trego Lake dam down to the confluence with the St. Croix River except for the Totagatic River drainage. Included in this area is a portion of west central Washburn County and a part of northeastern Burnett County. The watershed is approximately 153,176 acres in size and contains 172 miles of streams and rivers, 12,590 acres of lakes and 21,781 acres of wetlands. The watershed is dominated by forest (63%) and wetlands (14%) and is ranked low for nonpoint source issues affecting groundwater. (2)



(3)

Figure 4: Lower Namekagon River Watershed

Watershed Runoff

Land cover plays a critical role in a watershed. The type of land cover that exists in the watershed determines the amount of phosphorus (and sediment) that runs off the land and eventually makes its way to the lake. The actual amount of pollutants (nutrients, sediment, toxins, etc.) depends greatly on how the land within the watershed is used. Vegetated areas, such as forests, grasslands, and meadows, allow the water to permeate the ground and do not produce much surface runoff. On the other hand, agricultural areas, particularly row crops, along with residential/urban areas, minimize infiltration and increase surface runoff. The increased surface runoff associated with these land cover types leads to increased phosphorus and pollutant loading; which, in turn, can lead to nuisance algal blooms, increased sedimentation, overabundant macrophyte populations, and decreased dissolved oxygen levels. Land that is maintained in a natural, vegetated state is beneficial to soil and water quality.

A 2002 State of the St. Croix River Basin report, identified four key priorities for the basin, all of which are directly associated with water quality: (3)

1. Protection and restoration of shoreland habitat
2. Control of nonpoint source runoff contamination of surface waters
3. Restoration of grasslands, prairies, and wetlands to protect soil and water quality, and to enhance wildlife habitat
4. Implementation of a Northwest Sands Integrated Ecosystem Management Plan

The majority of Burnett County's land cover is made up of forest, while grassland, open water and wetlands make up approximately one-third. Below is a list of Land Cover Classifications and percentages for each found in the St. Croix Basin, followed by a short discussion of the major land cover types.

Table 3: Land Cover Classification found in the St. Croix Basin

Forest	48.01%
Grassland	16.64%
Wetland	14.02%
Agriculture	12.85%
Water	4.55%
Shrubland	3.18%
Urban/Developed	0.43%
Barrens	0.32%

(3)

Aquatic Habitats

Functions and Values of Native Aquatic Plants

Naturally occurring native plants are extremely beneficial to the lake. They provide a diversity of habitats, help maintain water quality, sustain fish populations, and support common lakeshore wildlife such as loons and frogs.

Water Quality

The core of life in all fresh water lakes is cradled in the shallow waters near shore. Much of a lake ecosystem depends on what happens in this shallow water. When parts of the lake, such as plants or wood, are removed from this shallow area, it is like removing a house in the neighborhood. The residents that once lived there can no longer return, and when enough homes are removed, and enough residents lost, the interactions that make the neighborhood a viable community cease, and the community fails. This is similar to what we see with our own human communities due to events like hurricanes or the mortgage crisis. A community of aquatic plants is part of what makes a healthy lake ecosystem. We are beginning to see aquatic plants in a new light, for their beauty and ability to protect and nourish a lake.

These plants are the binding thread in a watery tapestry of life. (UW-Extension)

- *Aquatic plants create a thriving habitat for animals.*
- *Plant roots create networks that stabilize sediments at the water's edge.*
- *Plants are essential to the spawning success of many fish species.*
- *Plants provide refuge for near shore animals.*
- *Plants provide habitat for many non-game fish species that are often "invisible" to most people, but are important to the food chain.*
- *Plants photosynthesize, creating life-giving oxygen to the animals that live in the littoral (shallow water) zone.*
- *Submersed plants absorb phosphorus and nitrogen over their leaf surface and through their roots, making nutrients less available for nuisance algae.*
- *Native aquatic plants can limit aquatic invasive plant growth.*
- *Plants, fruits and tubers provide food for mammals, waterfowl, insects and fish.*
- *Plant beds provide cover and nesting for marsh birds, songbirds and waterfowl.*

Aquatic plants can improve water quality by absorbing phosphorus, nitrogen, and other nutrients from the water that could otherwise fuel nuisance algal growth. Some plants can even filter and break down pollutants. Plant roots and underground stems help to prevent re-suspension of sediments from the lake bottom. Stands of emergent plants (whose stems protrude above the water surface) and floating plants help to blunt wave action and prevent erosion of the shoreline. The shoreline plant populations around Lower McKenzie Lake are particularly important to reducing erosion along the shoreline, but these populations are also vulnerable to the nutrient loading and the resultant algae growth in the lakes.

A natural, undisturbed shoreline provides numerous advantages such as: less algal blooms and protection against invasive plants, which result in higher property values. Freshwater resources are extremely valuable to everyone. We must be dedicated stewards of these resources in order to ensure success of the communities that live there now and for all our future generations.

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 many species of fish. Other fish such as bluegills graze directly on the plants themselves. Plant beds, such as bulrush present on Lower McKenzie Lake, 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. During both the late May and July plant surveys, a very diverse population of bird species was observed on and around the lake, such as loons, bald eagles and great blue herons.

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 they take over openings in the lake bottom where native plants have been removed. Without competition from other plants, these invasive species may successfully become established in the lake. This concept of opportunistic invasion can also be observed on land, in areas where bare soil is quickly taken over by weeds.

Removal of native vegetation not only diminishes the natural qualities of a lake, but it increases the risk of non-native species invasion and establishment. Invasive species can change many of the natural features of a lake and often lead to expensive annual control plans. Allowing native plants to grow may not guarantee protection against invasive plants, but it can discourage their establishment. Native vegetation at times can become problematic, however, more often than not; they do not create a nuisance.

Aquatic Invasive Species Status

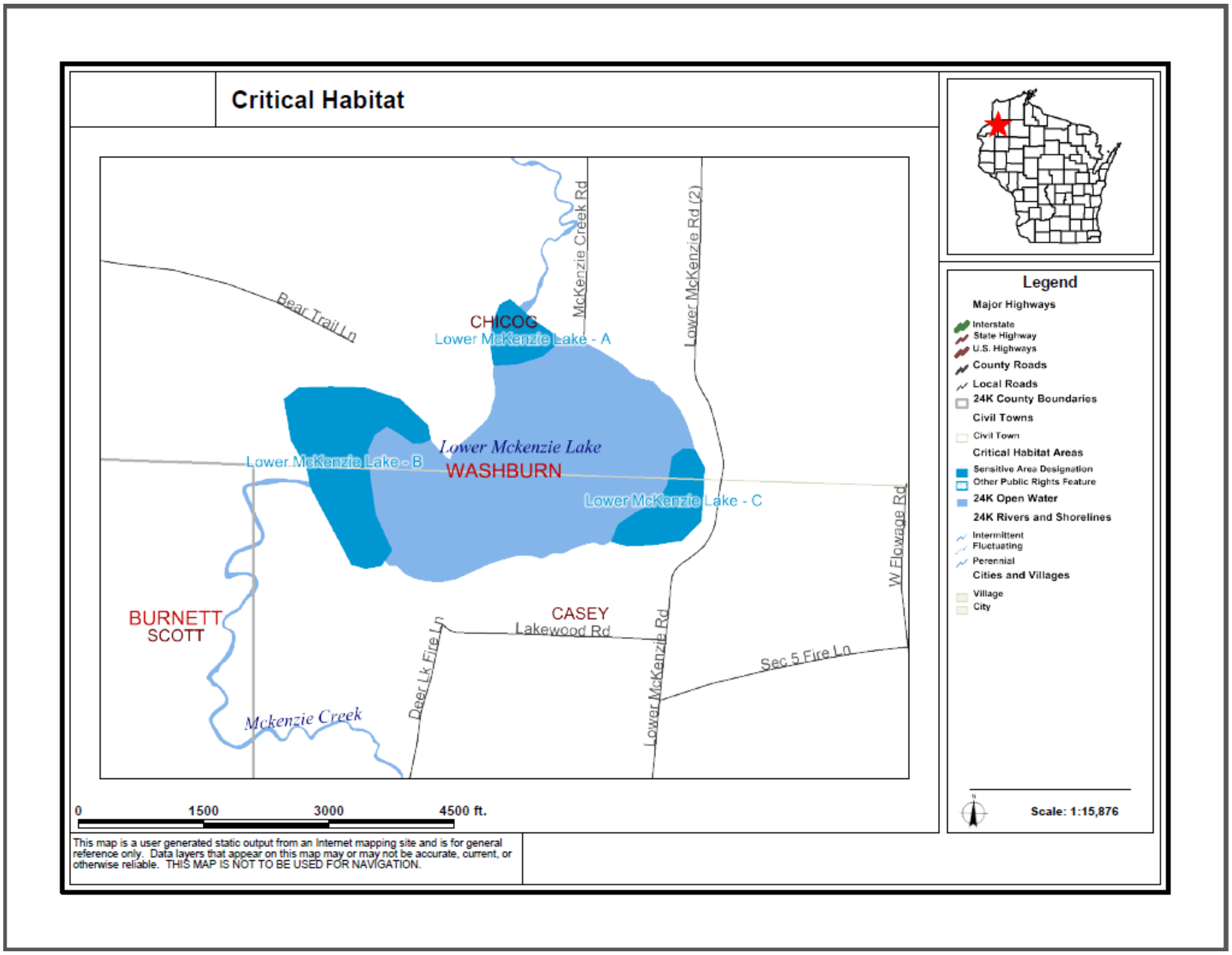
Reed canary grass (Phalaris arundinacea), and curly leaf pondweed (Potamogeton crispus) have been observed on Lower McKenzie Lake. Purple loosestrife is known to exist in both Big and Middle McKenzie, however, during the July macrophyte survey, no purple loosestrife was detected. No Eurasian water milfoil (Myriophyllum spicatum) was found on the lake, but it has been found in four nearby lakes in Burnett County: Ham Lake, Round Lake, Big Trade Lake and Little Trade Lake. The EWM has also been known to exist in the Minong Flowage and Nancy Lake in Washburn County. It is therefore of paramount importance that the Lower McKenzie Lake Association takes measures to avoid the introduction of EWM into the lake.

Sensitive Areas

The Wisconsin Department of Natural Resources has completed sensitive area surveys to designate areas within aquatic plant communities that provide important habitat for game fish, forage fish, macroinvertebrates, and wildlife, as well as important shoreline stabilization functions. The Department of Natural Resources is transitioning to designations of critical habitat areas that include both sensitive areas and public rights features. The critical habitat area designation will provide a holistic approach to ecosystem assessment and protection of those areas within a lake that are most important for preserving the very character and qualities of the lake.

Critical habitat areas include sensitive areas that offer critical or unique fish and wildlife habitat (including seasonal or life stage requirements) or offer water quality or erosion control benefits to the area (Administrative code 107.05(3)(1)(1)). The Wisconsin Department of Natural Resources is given the authority for the identification and protection of sensitive areas of the lakes. 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. The critical habitat area designation will provide a framework for management decisions that impact the ecosystem of the lake.

Lower McKenzie Lake is designated as having critical habitat areas (see Figure 5 below). Also, see Appendix B for a detailed summary of the Critical Habitat Designation Program Rule Summary.



(4)

Figure 5: Critical Habitat Areas of Lower McKenzie Lake

Rare and Endangered Species Habitat

In addition to sensitive areas designated to aquatic plants, the Natural Heritage Inventory has developed a list of species on and around Lower McKenzie Lake that are listed as being endangered, threatened or of special interest (Table 4).

Table 4: Natural Heritage Inventory (NHI) Species Found in Lower McKenzie Lake Area (T.40N. – R.13W. & T.41N. – R.13W)

Common Name	Scientific Name	WI State Status
Purple Wartyback (Mussel)	*Cyclonaias tuberculata*	END
Elktoe (Mussel)	Alasmidonta marginata	SC/P
Blanding's Turtle	*Emydoidea blandingii*	SC/H
Trumpeter Swan	*Cygnus buccinator*	SC/M
Crawling Water Beetle	*Haliplus leopardus*	SC/N
Karner Blue Butterfly	*Lycaeides melissa samuelis*	NA
Bald Eagle	*Haliaeetus leucocephalus*	SC/P
Least Darter (Fish)	*Etheostoma microperca*	SC/N
Kirtland's Warbler	*Setophaga kirtlandii*	END
Lake Sturgeon	*Acipenser fulvescens*	SC/H
Dwarf Milkweed	*Asclepias ovalifolia*	THR
Tiger Beetle	*Cicindela patruela patruela*	SC/N
Wood Turtle	*Glyptemys insculpta*	THR
Gilt Darter (Fish)	*Percina evides*	THR
Prairie Skink (Lizard)	*Plestiodon septentrionalis*	SC/H

(5)

WDNR and federal regulations regarding Special Concern species range from full protection to no protection. The current categories and their respective level of protection are as follows:

Key:
END = endangered
SC/P = fully protected
THR = threatened
SC/N = no laws regulating use, possession, or harvesting
SC = Special Concern
SC/H = take regulated by establishment of open /closed seasons
SC/FL = Federally protected as endangered or threatened, but not so designated by state
SC/M = fully protected by federal and state laws under the Migratory Bird Act

Lower McKenzie Lake Fishery

Table 5: Lower McKenzie Lake Fish Species List

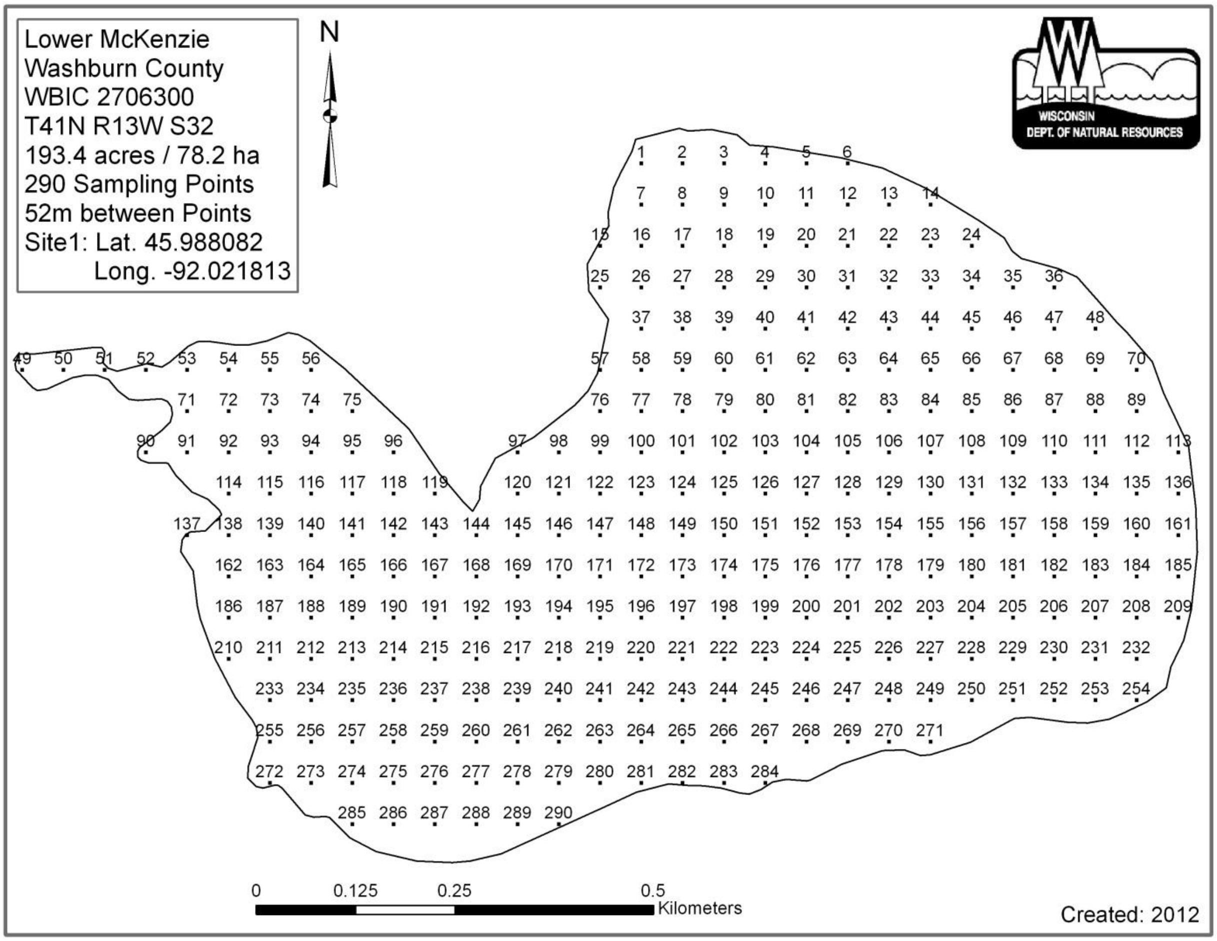
Common Name	*Scientific Name*	Relative Abundance
Gamefish		
Northern pike	*Esox lucius*	Abundant
Largemouth Bass	*Micropterus salmoides*	Abundant
Walleye	*Sander vitreum*	Present
Panfish		
Bluegill	*Lepomis macrochirus*	Abundant
Black crappie	*Pomoxis nigromaculatus*	Abundant
Pumpkinseed	*Lepomis gibbosus*	Common
Rock bass	*Amblopites rupestris*	Common
Yellow perch	*Perca flavecens*	Common
Black bullhead	*Ameiurus melas*	Present
Brown bullhead	*Ictalurus nebulosus*	Present
Yellow bullhead	*Ictalurus natalis*	Present
Forage and other species		
Bowfin	*Amia calva*	Common
White sucker	*Catostomus commersoni*	Common
Golden shiner	*Notemigonus crysoleucas*	Present
Common shiner	*Notropis cornutus*	Present
Spottail shiner	*Notropis hudsonius*	Present
Blacknose shiner	*Notropis heterolepis*	Common
Blackchin shiner	*Notropis heterodon*	Present
Johnny darter	*Etheostoma nigrum*	Present
Iowa darter	*Etheostoma exile*	Present
Brook silverside	*Labidesthes sicculus*	Common
Bluntnose minnow	*Pimephales notatus*	Abundant
Tadpole madtom	*Notorus gyrinus*	Present
Central mudminnow	*Umbra limi*	Common

(6)

Plant Community

METHODS:

Using a standard formula that takes into account the shoreline shape and distance, islands, water clarity, depth and total lake acres, Michelle Nault (WDNR) generated a sampling grid for Lower McKenzie Lake (Figure 6). In June, Burnett County Land and Water Conservation Department conducted a Curly-leaf pondweed survey to check for the presence of this invasive species. During this survey, we went to each of the 290 points on Lower McKenzie Lake. We sampled just for Curly-leaf pondweed at each site. This type of survey should result in both detection and approximate mapping of any infestation that may have occurred. During the May survey, several sites in the littoral zone were discovered. In addition to the several sites with CLP, one small bed was also mapped on the north end of the lake. (See Figure 7)



(7)
Figure 6: Lower McKenzie Lake Sample Grid

During the May survey, a general idea for the lake and plant communities was established and a more detailed summary was done during the July survey. All plants found were identified (Boreman et al. 1997; Chadde 2002; Crow and Hellquist 2006), and two vouchers were pressed and retained for herbarium specimens – one to be retained by the Lower McKenzie Lake Association, and one to be sent to the state for identification confirmation. During the point intercept survey, we located each survey point using a handheld mapping GPS unit (Garmin 76CSx). At each point, we recorded a depth reading with a Hummingbird depth finder unit. After sampling numerous depths at numerous sites, we were able to establish the littoral zone at a maximum of 15 feet. We sampled for plants within the depth range of plant growth. At each of these points, we used a rake (either on a pole or a throw line depending on depth) to sample an approximately 2.5ft. section of the bottom. All plants on the rake, as well as any that were dislodged by the rake were identified, and assigned a rake fullness value of 1-3 as an estimation of abundance (Figure 6). We also recorded visual sightings of plants within six feet of the sample point. Substrate (lake bottom) type was assigned at each site where the bottom was visible or it could be reliably determined using the rake. The substrate is defined as either being sand, muck or rock.

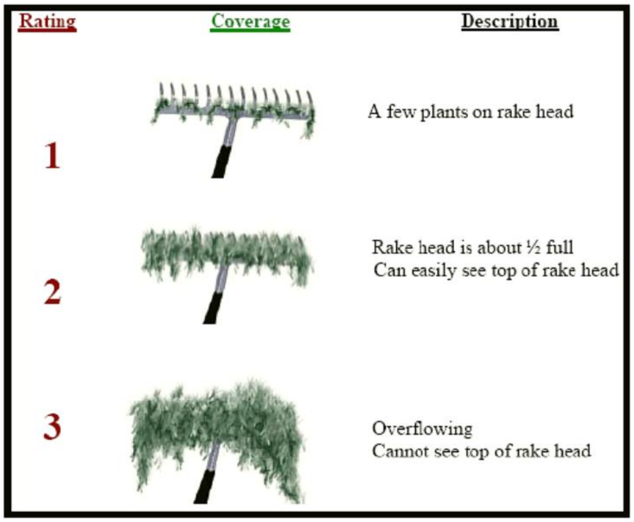


Figure 7: Rake Fullness Ratings (UWEX, 2010)

DATA ANALYSIS:

We entered all data collected into the standard APM spreadsheet (UWEX, 2007). From this, we calculated the following:

<u>Total number of points sampled:</u> This included the total number of points on the lake coverage that were within the littoral zone (0-maximum depth where plants are found) Initially, we continued to sample points whose depth were several feet beyond the littoral zone, but once we established this maximum depth with confidence, most points beyond this depth were not rake sampled.

<u>Total number of sites with vegetation:</u> These included all sites where we found vegetation after doing a rake sample. For example, if 20% of all sample sites have vegetation, it suggests that 20% of the lake has plant coverage.

<u>Total number of sites shallower than the maximum depth of plants:</u> This is the number of sites that are in the littoral zone. Because not all sites that are within the littoral zone actually have vegetation, we use this value to estimate how prevalent vegetation is throughout the littoral zone. For example, if 60% of the sites shallower than the maximum depth of plants have vegetation, then we estimate that 60% of the lake's littoral zone has plants.

Frequency of occurrence: The frequency of all plants (or individual species) is generally reported as a percentage of occurrences at all sample points. It can also be reported as a percentage of occurrences at sample points within the littoral zone.

Frequency of occurrence example:

Plant A is sampled at 70 out of 700 total points = 70/700 = .10 = 10%

This means that Plant A's frequency of occurrence = 10% considering the entire lake sample.

Plant A is sampled at 70 out of 350 total points in the littoral zone = 70/350 = .20 = 20%

This means that Plant A's frequency of occurrence = 20% when only considering the littoral zone.

From these frequencies, we can estimate how common each species was throughout the lake, and how common the species was at depths where plants were able to grow. Note the second value will be greater as not all the points (in this example, only ½) occur at depths shallow enough for plant growth.

Simpson's diversity index: A diversity index allows the entire plant community at one location to be compared to the entire plant community at another location. It also allows the plant community at a single location to be compared over time thus allowing a measure of community degradation or restoration at that site. With Simpson's diversity index, the index value represents the probability that two individuals (randomly selected) will be different species. The index values range from 0 -1 where 0 indicates that all the plants sampled are the same species to 1 where none of the plants sampled are the same species. The greater the index value, the higher the diversity in a given location. Although many natural variables like lake size, depth, dissolved minerals, water clarity, mean temperature, etc. can affect diversity. In general, a more diverse lake indicates a healthier ecosystem. Perhaps most importantly, plant communities with high diversity also tend to be **more resistant** to invasion by exotic species.

Maximum depth of plants: This indicates the deepest point that vegetation was sampled. In clear lakes, plants may be found at depths of over 20ft, while in stained or turbid locations, they may only be found in a few feet of water. While some species can tolerate very low light conditions, others are only found near the surface. In general, the diversity of the plant community decreases with increased depth.

Number of sites sampled using rope/pole rake: This indicates which rake type was used to take a sample. Protocol suggests a 15ft pole rake, and a 25ft rope rake for sampling (Wagoner personal communication).

Average number of species per site: This value is reported using four different considerations. 1) **shallower than maximum depth of plants** indicates the average number of plant species at all sites in the littoral zone. 2) **vegetative sites only** indicate the average number of plants at all sites where plants were found. 3) **native species shallower than maximum depth of plants** and 4) **native species at vegetative sites only** excludes exotic species from consideration.

Species richness: This value indicates the number of different plant species found in and directly adjacent to (on the waterline) the lake. Species richness alone only counts those plants found in the rake survey. The other two values include those seen during the point intercept survey and the initial boat survey.

Mean and median depth of plants: The mean depth of plants indicates the average depth in the water column where plants were sampled. Because a few samples in deep water can skew this data, median depth is also calculated. This tells us that half of the plants sampled were in water shallower than this value, and half were in water deeper than this value.

Relative frequency: This value shows a species' frequency relative to all other species. It is expressed as a percentage, and the total of all species' relative frequency will add up to 100%. Organizing species from highest to lowest relative frequency value gives us an idea of which species are most important within the macrophyte community.

Relative frequency example:

Suppose that we sample 100 points and found 5 species of plants with the following results:

Plant A was located at 70 sites. Its frequency of occurrence is thus 70/100 = 70%
Plant B was located at 50 sites. Its frequency of occurrence is thus 50/100 = 50%
Plant C was located at 20 sites. Its frequency of occurrence is thus 20/100 = 20%
Plant D was located at 10 sites. Its frequency of occurrence is thus 10/100 = 10%
To calculate an individual species' relative frequency, we divide the number of sites a plant is sampled at by the total number of times all plants were sampled. In our example that would be 150 samples (70+50+20+10).

Plant A = 70/150 = .4667 or 46.67%
Plant B = 50/150 = .3333 or 33.33%
Plant C = 20/150 = .1333 or 13.33%
Plant D = 10/150 = .0667 or 6.67%
This value tells us that 46.67% of all plants sampled were Plant A.

Floristic Quality Index (FQI): This index measures the impact of human development on a lake's aquatic plants. Species in the index are assigned a Coefficient of Conservatism (C) which ranges from 1-10. The higher the value assigned, the more likely the plant is to be negatively impacted by human activities relating to water quality or habitat modifications. Plants with low values are tolerant of human habitat modifications, and often exploit these changes to the point where they may crowd out other species. The FQI is calculated by averaging the conservatism value for each species found in the lake. Consequently, a higher index value indicates a healthier macrophyte community. Nichols (1999) identified four eco-regions in Wisconsin: Northern Lakes and Forests, Northern Central Hardwood Forests, Driftless Area and Southeastern Wisconsin Till Plain. He recommended making comparisons of lakes within ecoregions to determine the target lake's relative diversity and health. Lower McKenzie Lake is in the Northern Lakes and Forests Ecoregion.

RESULTS:

Aquatic Plant Survey Results for Lower McKenzie Lake

An aquatic plant survey was completed for Lower McKenzie Lake in 2013. Prior to the whole lake monitoring, a curly leaf pondweed (CLP) survey was conducted to confirm the presence of this aquatic invasive species. Since CLP grows earlier than native species, it typically dies in early July; therefore, the CLP survey is done in May or early June while the plant is still robust. A general boat survey was also conducted prior to the point intercept survey to gain familiarity with the lake and the plant species found on the lake. The results discussed below are taken from these two surveys.

Using a standard formula based on a lake's shoreline shape and distance, islands, water clarity, depth, and size in acres, the Wisconsin Department of Natural Resources (WDNR) generated the sampling point grid of 468 points for Lower McKenzie Lake. Figure 6 above shows the locations of these sampling points.

As mentioned before, Lower McKenzie Lake survey grid is comprised of 290 points of which, 289 sites were sampled. Of these points, we found plants at 209 sites in less than 15 feet of water (Figure 8: littoral zone). Areas that were shallow and had a mucky substrate supported more plants than those with sandy or rocky bottoms. Figure 9 below illustrates the substrate of Lower McKenzie Lake. Plants were found growing on approximately 72% of the entire lake bottom, and in 75% of the littoral zone. Diversity was very high with a Simpson Diversity Index value of 0.93. Species richness was also high with 45 total species found growing in and immediately adjacent to the lake. The majority of aquatic macrophytes were found growing in shallow water with a mean depth of 7.7ft, and a median depth of 6.0ft. These zones of plant growth are extremely important in helping to control algal growth and they support diverse plant beds that provide important underwater habitat. Tables 7, 8 and 9 summarize data from the completed survey.

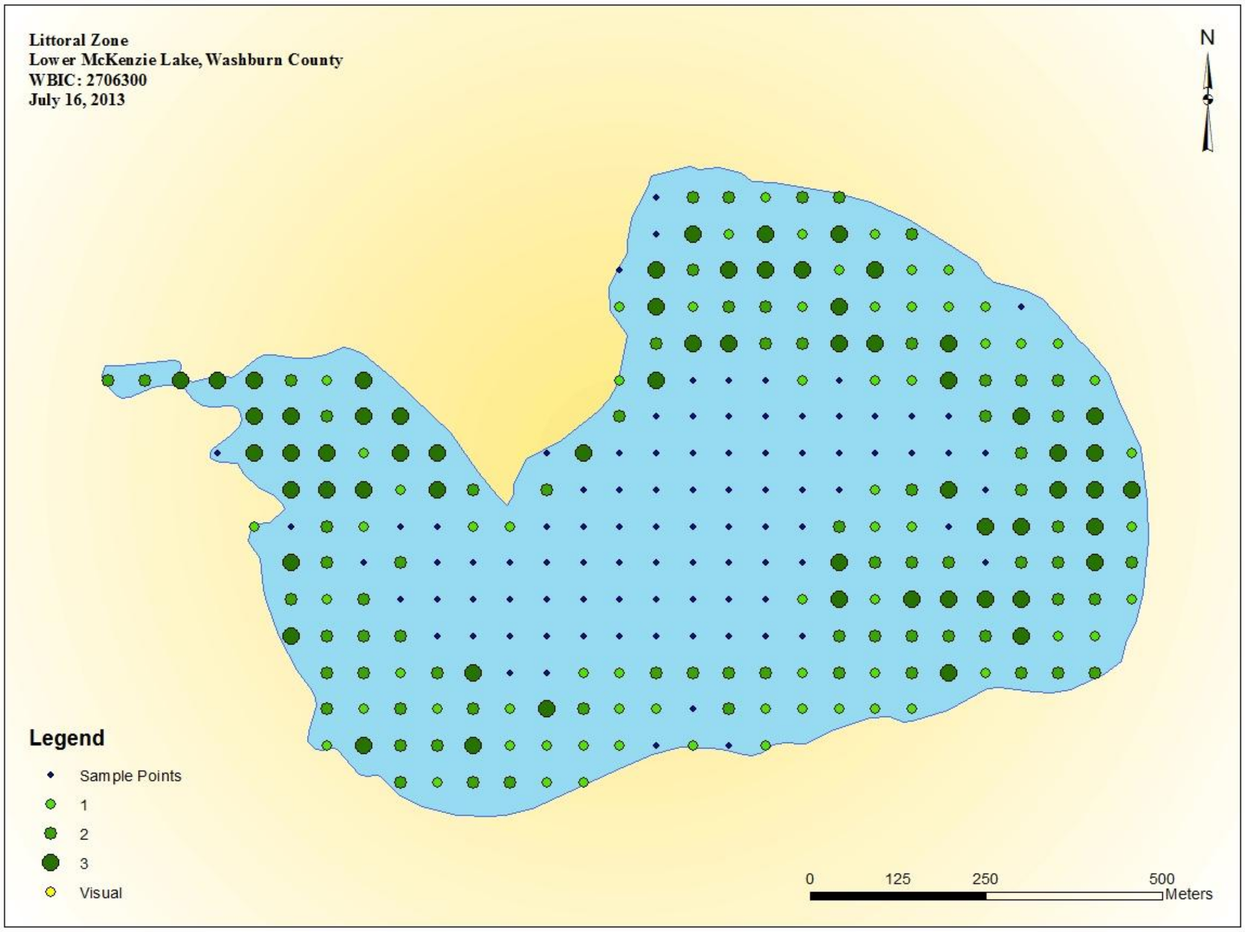


Figure 8: Lower McKenzie Lake Littoral Zone: Region of Plant Growth

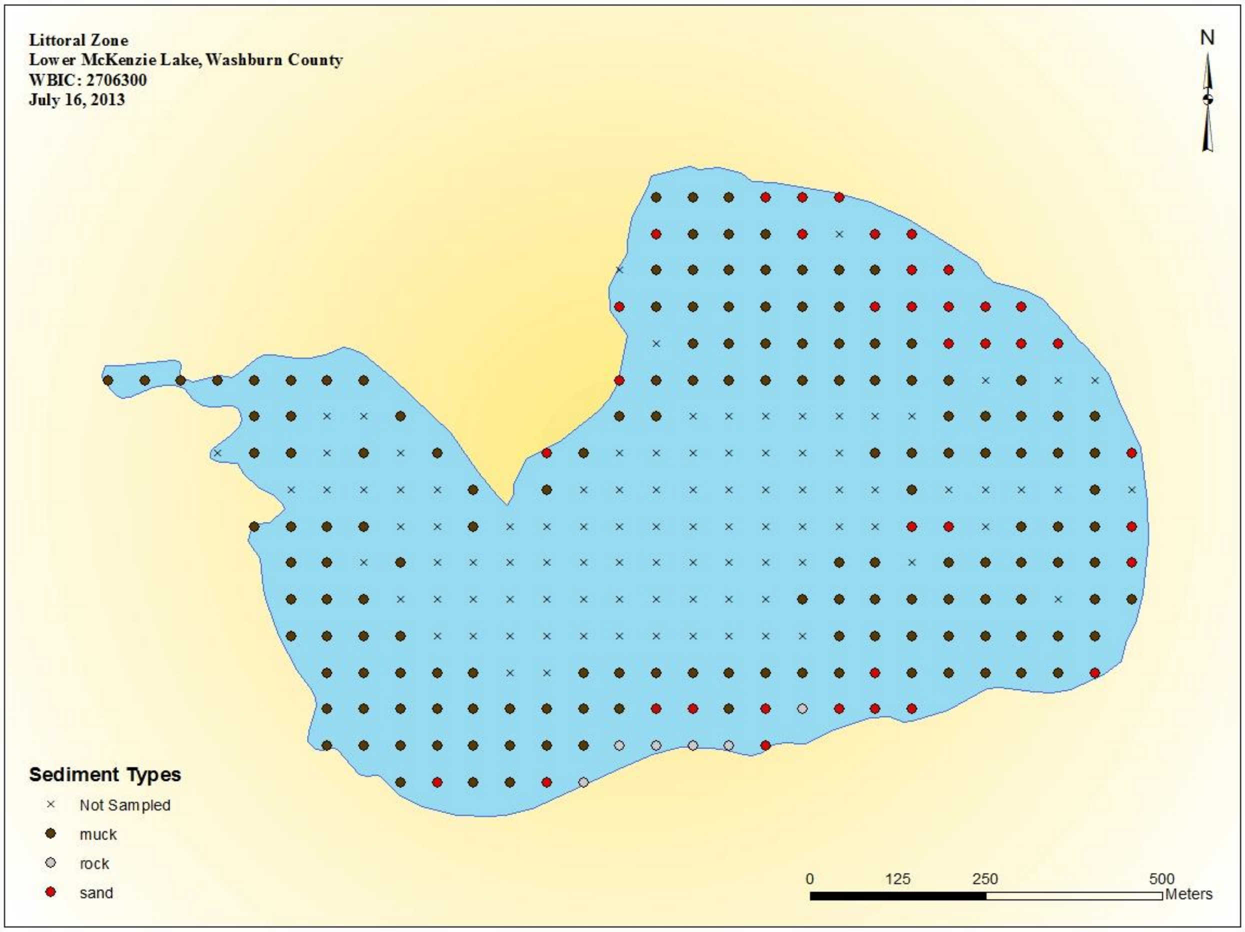
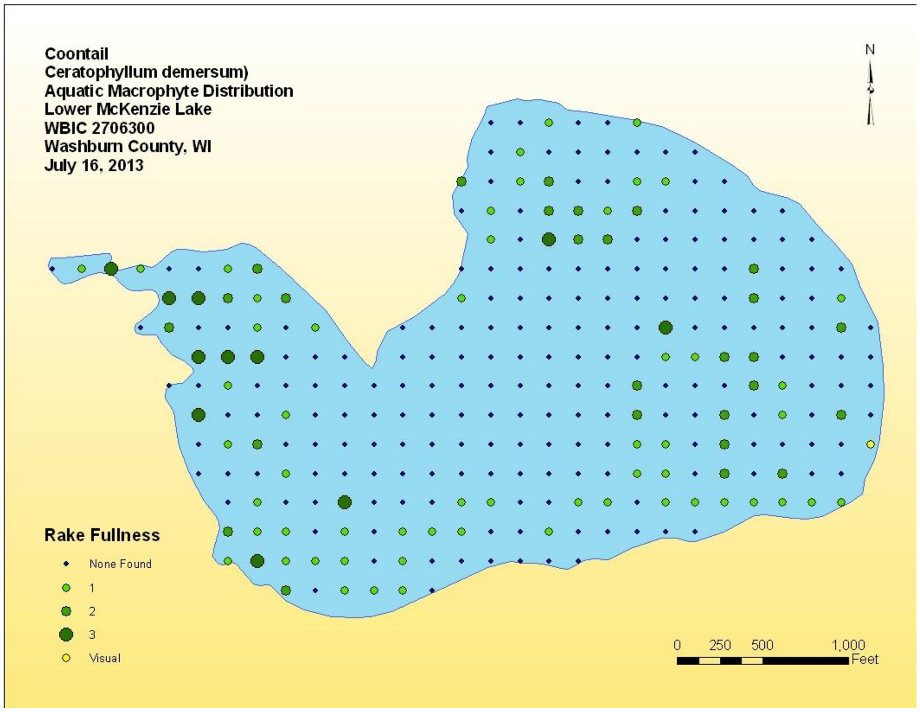


Figure 9: Sediment Types of Lower McKenzie Lake

The following plant species where the most frequently observed on the lake: Coontail (***Ceratophyllum demersum)***, Flat-stem pondweed (***Potamogeton zosteriformis***), Fern pondweed (***Potamogeton robbinsii***), and Common waterweed (***Elodea Canadensis***). See Table 6 for a list of each plant species statistics. The four species were found at 44.98%, 42.11%, 39.23%, and 36.84% of the survey points with vegetation respectively (Figure 10). All five species were widely distributed throughout the lake over muck and sandy bottoms (Figure 9). Although many other species were widely distributed, none were found with a relative frequency over 12%.

During the May and July survey, no Eurasian water-milfoil (*Myriophyllum sibiricum*) was detected. Several sites adjacent to the littoral zone had Reed canary grass, a common invasive species. Although we did not find any Purple loosestrife (PLS) in the littoral zone or adjacent to the littoral zone, PLS had been spotted on both Middle McKenzie and Big McKenzie Lakes. Members of the lake association have been trained in Citizen Lake Monitoring Network aquatic invasive species identification and have been monitoring the lake. More members will be trained in the future to monitor aquatic invasive species and will continue to survey the lake for Purple loosestrife as well as other invasive species.



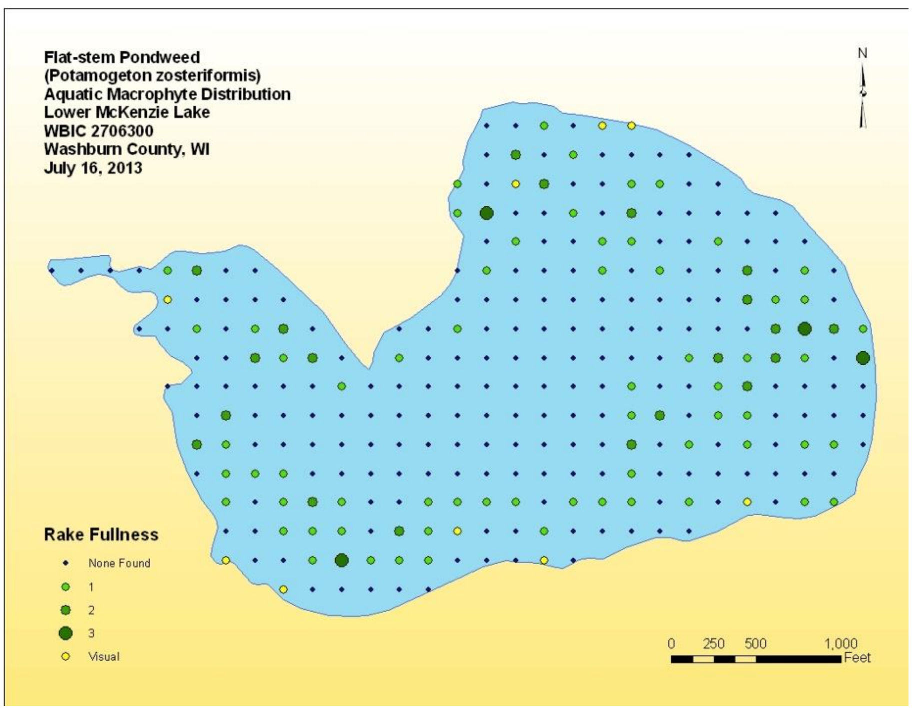
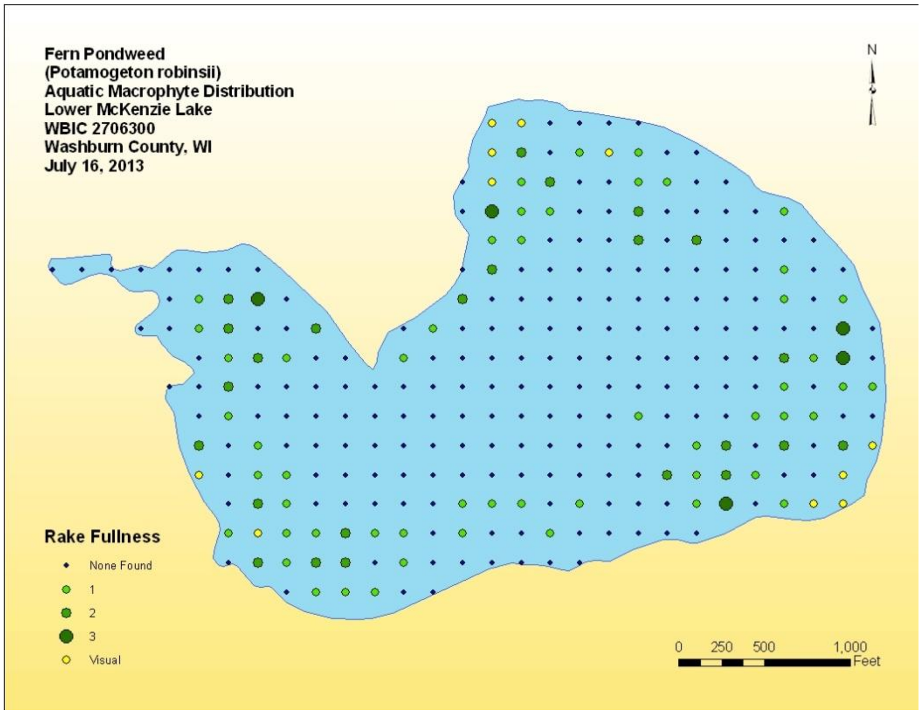


Figure 10: Most Common Aquatic Plant Species Found on Lower McKenzie Lake



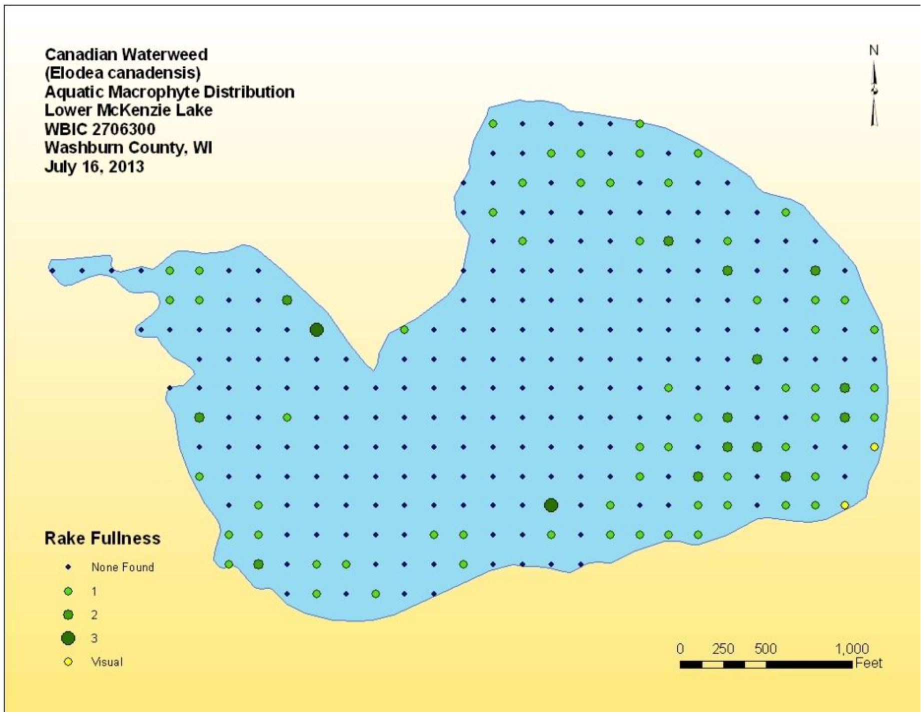


Figure 10: Most Common Aquatic Plant Species Found on Lower McKenzie Lake

Table 6: Lower McKenzie Aquatic Macrophytes Survey Summary Statistics

SUMMARY STATS:	
Total number of sites visited	289
Total number of sites with vegetation	209
Total number of sites shallower than maximum depth of plants	279
Frequency of occurrence at sites shallower than maximum depth of plants	74.91
Simpson Diversity Index	0.93
Maximum depth of plants (ft)**	15.00
Number of sites sampled using rake on Rope (R)	188
Number of sites sampled using rake on Pole (P)	3
Average number of all species per site (shallower than max depth)	2.80
Average number of all species per site (veg. sites only)	3.74
Average number of native species per site (shallower than max depth)	2.80
Average number of native species per site (veg. sites only)	3.74
Species Richness	38
Species Richness (including visuals)	45
Mean Depth of Plants (ft)	7.7
Median Depth of Plants (ft)	6

Table 7: Lower McKenzie FQI Species and Conservatism Values

Species	Common Name	C Value
Bidens beckii	Water marigold	8
Brasenia schreberi	Watershield	6
Ceratophyllum demersum	Coontail	3
Chara	Muskgrasses	7
Eleocharis acicularis	Needle spikerush	5
Elodea canadensis	Common waterweed	3
Glyceria borealis	Northern manna grass	8
Heteranthera dubia	Water star-grass	6
Lemna minor	Small duckweed	4
Lemna trisulca	Forked duckweed	6
Myriophyllum sibiricum	Northern water-milfoil	6
Myriophyllum tenellum	Dwarf water-milfoil	10
Najas flexilis	Slender naiad	6
Nitella	Nitella	7
Nuphar variegata	Spatterdock	6
Nymphaea odorata	White water lily	6
Polygonum amphibium	Water smartweed	5
Pontederia cordata	Pickerelweed	8

Table 7 Continued:		
Potamogeton amplifolius	Large-leaf pondweed	7
Potamogeton friesii	Fries' pondweed	8
Potamogeton gramineus	Variable pondweed	7
Potamogeton illinoensis	Illinois pondweed	6
Potamogeton natans	Floating-leaf pondweed	5
Potamogeton praelongus	White-stem pondweed	8
Potamogeton pusillus	Small pondweed	7
Potamogeton richardsonii	Clasping-leaf pondweed	5
Potamogeton robbinsii	Fern pondweed	8
Potamogeton spirillus	Spiral-fruited pondweed	8
Potamogeton vaseyi	Vasey's pondweed	10
Potamogeton zosteriformis	Flat-stem pondweed	6
Ranunculus aquatilis	White water crowfoot	8
Spirodela polyrhiza	Large duckweed	5
Stuckenia pectinata	Sago pondweed	3
***Typha* sp.**	Cattail	1
Utricularia gibba	Creeping bladderwort	9
Utricularia resupinata	Small purple bladderwort	9
Utricularia vulgaris	Common bladderwort	7
Vallisneria americana	Wild celery	6
N		36
mean C		6.28
FQI		37.67

Table 8: Frequencies and Mean Rake Sample of Aquatic Macrophytes Lower McKenzie Lake, Burnett County August 2013

Scientific Name	Common Name	Number of sites where species found	Relative Frequency (%)	Frequency of occurrence within vegetated areas (%)	Frequency of occurrence at sites shallower than maximum depth of plants	Average Rake Fullness
Ceratophyllum demersum	Coontail	94	12.02	44.98	33.69	1.52
Potamogeton zosteriformis	Flat-stem pondweed	88	11.25	42.11	31.54	1.32
Potamogeton robbinsii	Fern pondweed	82	10.49	39.23	29.39	1.41
Elodea canadensis	Common waterweed	77	9.85	36.84	27.60	1.23
Lemna trisulca	Forked duckweed	47	6.01	22.49	16.85	1.19
Myriophyllum sibiricum	Northern water-milfoil	45	5.75	21.53	16.13	1.29
Chara sp.	Muskgrasses	43	5.50	20.57	15.41	1.09
Potamogeton amplifolius	Large-leaf pondweed	40	5.12	19.14	14.34	1.15
Vallisneria americana	Wild celery	37	4.73	17.70	13.26	1.22
Potamogeton friesii	Fries' pondweed	34	4.35	16.27	12.19	1.18
Potamogeton pusillus	Small pondweed	22	2.81	10.53	7.89	1.05
Najas flexilis	Slender naiad	18	2.30	8.61	6.45	1.00
Potamogeton richardsonii	Clasping-leaf pondweed	18	2.30	8.61	6.45	1.06
Nymphaea odorata	White water lily	17	2.17	8.13	6.09	1.12
Potamogeton gramineus	Variable pondweed	16	2.05	7.66	5.73	1.06
Heteranthera dubia	Water star-grass	12	1.53	5.74	4.30	1.08
Utricularia vulgaris	Common bladderwort	11	1.41	5.26	3.94	1.18
Potamogeton illinoensis	Illinois pondweed	10	1.28	4.78	3.58	1.10
Eleocharis acicularis	Needle spikerush	9	1.15	4.31	3.23	1.22
Stuckenia pectinata	Sago pondweed	8	1.02	3.83	2.87	1.00
Brasenia schreberi	Watershield	6	0.77	2.87	2.15	1.33

Table 8 Continued: Potamogeton praelongus	White-stem pondweed	6	0.77	2.87	2.15	1.00
Bidens beckii	Water marigold	5	0.64	2.39	1.79	1.00
Sagittaria sp.	Arrowhead	5	0.64	2.39	1.79	1.20
Nitella sp.	Nitella	4	0.51	1.91	1.43	1.00
Nuphar variegata	Spatterdock	4	0.51	1.91	1.43	1.50
Potamogeton natans	Floating-leaf pondweed	4	0.51	1.91	1.43	1.00
Myriophyllum tenellum	Dwarf water-milfoil	3	0.38	1.44	1.08	1.33
Lemna minor	Small duckweed	2	0.26	0.96	0.72	1.00
Polygonum amphibium	Water smartweed	2	0.26	0.96	0.72	1.00
Pontederia cordata	Pickerelweed	2	0.26	0.96	0.72	1.00
Potamogeton spirillus	Spiral-fruited pondweed	2	0.26	0.96	0.72	2.00
Ranunculus aquatilis	White water crowfoot	2	0.26	0.96	0.72	1.00
Spirodela polyrhiza	Large duckweed	2	0.26	0.96	0.72	2.00
Utricularia gibba	Creeping bladderwort	2	0.26	0.96	0.72	1.00
Potamogeton vaseyi	Vasey's pondweed	1	0.13	0.48	0.36	1.00
Potamogeton crispus	Curly-leaf pondweed	1	0.13	0.48	0.36	3.00
Typha latifolia	Broad-leaved cattail	1	0.13	0.48	0.36	1.00
Freshwater sponge	Freshwater sponge	3		1.44	1.08	1.00
Decodon verticillatus	Swamp loosestrife	Visual				
Elatine minima	Waterwort	Visual				
Eleocharis palustris	Creeping spikerush	Visual				
Potamogeton epihydrus	Ribbon-leaf pondweed	Visual				
Schoenoplectus acutus	Hardstem bulrush	Visual				
Sparganium sp.	Bur-reed	Visual				
Zizania palustris	Northern wild rice	Visual				

Aquatic Plant Management

This section reviews the potential management methods available, and reports recent management activities on the lakes. The application, location, timing, and combination of techniques must be considered carefully.

Discussion of Management Methods

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 thirty 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. Additional requirements exist when a lake is considered an ASNRI (Area of Special Natural Resource Interest) due to the presence of wild rice.

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 up 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 refers to the control of aquatic plants by hand or hand–held devices without the use or aid of external or auxiliary power (WDNR).

Manual Removal (UW-Extension 2006)

Manual removal—hand pulling, cutting, or raking—will effectively remove plants from small areas. It is likely that plant removal will need to be repeated more than once during the growing season. The best timing for hand removal of herbaceous plant species is after flowering but before seed head production. For plants with 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 20 feet wide.

SCUBA divers may engage in manual removal for invasive species like Eurasian water milfoil. Care must be taken to ensure that all plant fragments are removed from the lake. Manual removal with divers is recommended for shallow areas with sporadic EWM growth.

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. WDNR permits under Chapter NR 109 are required for mechanical plant removal. (APIS, Army Corps of Engineers)

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. 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 1000 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 (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. 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 enjoyed 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 don't 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 as well as 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 to avoid spreading of 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, 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, be sure to inspect the equipment before and after it enters the lake. Since these 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.

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 the pioneering establishment of submersed invasive plant species. When a weed is discovered in a pioneering state, this methodology can be considered. To be effective, the entire plant, including the subsurface portions, should be removed.

Plant fragments can result from this type of operation, but fragmentation is not as great a problem when infestations are small. Diver dredging operations may need to be repeated more than once to be effective. When applied to 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 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 difficulty. Hard substrates, however, pose more of a problem. Divers may need hand tools to help dig the root crowns out of hardened sediment.

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 contaminated sediments could possibly release toxins into the water column. If there is any potential of contaminated sediments in the area, further investigation should be performed to determine the 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 (UW-Extension 2006)

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.

Weevils (WI DNR, 2006)
Weevils have potential for use as a biological control agent against Eurasian water milfoil. There are several documented "natural" declines of EWM infestations. In these cases, EWM was not eliminated but its abundance was reduced enough so that it did not achieve dominance. These declines are attributed to an ample population of native milfoil weevils (Euhrychiopsis lecontei). Weevils feed on native milfoils but will shift preference over to EWM when it is present. Lakes where weevils can become an effective control have an abundance of native Northern water milfoil and fairly extensive natural shoreline where the weevils can over winter. Because native milfoils are susceptible to higher doses of herbicides, any control strategy for EWM that would also harm native milfoil may hinder the ability of this natural bio-control agent. Lakes with large bluegill populations are not good candidates for weevils because bluegills feed on the weevils. The presence and efficacy of stocking weevils in EWM lakes is being evaluated in Wisconsin lakes. So far, stocking does not appear to be effective.

The effectiveness of biocontrol efforts varies widely (Madsen, 2000). Beetles are commonly used to control Purple loosestrife populations in Wisconsin with good success. As mentioned above, 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, but grass carp introduction is not allowed in Wisconsin.

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, and plant-specific control. On the other hand there are several disadvantages to consider, including very long control times (years instead of weeks), a lack of available agents for particular target species, and relatively specific environmental conditions necessary for success.

Biological control is not without risks; new non-native species introduced to control a pest population may cause problems of its own. Biological control is not currently proposed for management of aquatic plants in Lower McKenzie Lake, although it will be considered for Purple loosestrife control.

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 Lower McKenzie Lakes because a healthy, diverse native plant population is present.

Physical Control (UW-Extension 2006)

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 DNR 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. Dredging is not suggested for the Lower McKenzie Lake as part of the aquatic plant management plan.

Benthic barriers or other bottom-covering approaches are another physical management technique. The basic idea is to cover the plants 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 various combinations of the above materials (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 plant and sediment decomposition collect underneath and lift the barrier (Gunnison and Barko 1992). Benthic barriers will typically kill the plants under them within 1 to 2 months, after which time 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, they are too expensive to use over widespread areas, and heavily affect benthic communities by removing fish and invertebrate habitat. A WDNR 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. Physical control is not currently proposed for management of aquatic plants in Lower McKenzie Lake.

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. WDNR permits under Chapter NR 107 are required for herbicide application.

General descriptions of herbicide classes are included below. (US Army Corps, 2005)

Contact herbicides (WI DNR, 2007)

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 directly. 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 species of 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 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.

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, and in turn affect other organisms or weed control operations. These operations can also impact water chemistry which may result in further implications for aquatic organisms.

Copper

Copper is a naturally occurring element that is essential at low concentrations for plant growth. It does not break down in the environment, but it forms insoluble compounds with other elements and is bound to charged particles in the water. It rapidly disappears from water after application as an herbicide. Because it is not broken down, it can accumulate in bottom sediments after repeated or high rates of application. Accumulation rarely reaches levels that are toxic to organisms or significantly above background concentrations in the sediment.

2,4-D

2,4-D photodegrades on leaf surfaces after being applied to leaves, and is broken down by microbial degradation in water and in sediments. Complete decomposition usually takes about 3 weeks in water but 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 levels 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, and 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, but 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.

Copper Compounds

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

Eurasian water milfoil

The Army Corps of Engineers Aquatic Plant Information System (APIS) identifies the following herbicides for control of Eurasian water milfoil: 2,4-D, diquat, endothall, All of these herbicides with the exception of diquat are available in both granular and liquid formulations. It is possible to target invasive species by using the appropriate herbicide and timing. The herbicide 2,4-D is most commonly used to treat EWM in Wisconsin. This herbicide kills dicots including native aquatic species such as northern water milfoil, coontail, water lilies, spatterdock, and watershield. Early season (April to May) treatment of Eurasian water milfoil is recommended to limit the impact on native aquatic plant populations because EWM tends to grow before native aquatic plants.

Granular herbicide formulations are more expensive than liquid formulations (per active ingredient). However, granular formulations release the active ingredient over a longer period of time. Granular formulations, therefore, may be more suited to situations where herbicide exposure time will likely be limited, as is the case in small bands or blocks. In large, shallow lakes with widespread EWM, a whole lake treatment with a low rate of liquid herbicide may be most cost effective because exposure time is greater. Factors that affect exposure time are size and configuration of treatment area, water flow, and wind.

Application rates for liquid and granular formulations are not interchangeable. A rate of 1 to 1.5 mg/L 2,4-D applied as a liquid is a middle rate that will require a contact time of 36 to 48 hours. Application rates recommended for Navigate (granular 2,4-D) are 100 pounds per acre for depths of 0 to 5 feet, 150 pounds per acre for 5 to 10 feet, and 200 pounds per acre for depths greater than 10 feet.

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.

Studies have demonstrated that curly leaf pondweed can be controlled with Aquathol K (a formulation of endothall) in 50 to 60 degree F water, and that treatments of CLP this early in its life cycle can prevent turion formation (WI DNR, 2007). Since curly leaf pondweed is actively growing at these low water temperatures and many native aquatic plants are still dormant, early season treatment selectively targets curly leaf pondweed. Staff from the Minnesota Department of Natural Resources and the U.S Army Engineer Research and Development Center is conducting trials of this method.

Because the dosage is at lower rates than the 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 (Clemens, Harmony Environmental).

Burnett County Land and Water Conservation (Clemens, Harmony Environmental)

Burnett County assists the Lower McKenzie Lake Association in management of aquatic invasive species. They have individuals available to assist with the following tasks:

- Conduct watercraft inspection at public access points.
- Complete in-lake monitoring for EWM and other invasive species.
- Carry out public outreach and education events related to invasive species including lake meetings, fishing tournaments, county fairs, and local festivals.
- Post signs at boat landings and other public lake access points to inform residents of the “do not transport” ordinance.
- Train local lake residents and others to monitor their own boat landings as part of the WDNR “Clean Boats, Clean Waters” (CBCW) program.
- Train lake residents and others in Citizen Lake Monitoring, which includes CBCW, Secchi, Water Chemistry, and Aquatic Invasive Species identification.

- Assist in "rapid response" actions to identify and respond to new invasive species infestations reported by the public.
- Conduct integrated pest management for purple loosestrife control including beetle rearing and release, and offer assistance with clipping and herbicide application for individual infestations.

In-lake monitoring focuses on searching for potential establishment of Eurasian water milfoil and other aquatic invasive species at boat landings and other areas with high public use. Grab samples are taken at regular intervals at these high public use areas and at random locations around the littoral zone. All Burnett County boat landings are monitored each year.

Workshops and trainings include Clean Boats, Clean Waters training, plant identification, and whole lake monitoring workshops. Staff generally travels to local lakes to encourage participation and provide more focused training.

The Rapid Response Plans will involve a team of resource professionals from various agencies who can directly assist the lake organization in managing newly discovered invasive species and develop a plan to restore the native plant community. This Rapid Response SWAT team will assist with identifying appropriate management methods, coordinating and, in some instances, carrying out control measures, grant writing, and completing or hiring consultants to complete aquatic plant surveys and management plans.

Lower McKenzie Lake Aquatic Plant Management Plan Goals & Strategies

Overall Purpose

This section of the plan lists goals for aquatic plant management for Lower McKenzie Lakes. It also presents a detailed strategy of actions that will be used to reach Aquatic Plant Management Plan goals. Educational strategies that outline audience, messages, and methods are included under each goal.

Goals

1. Prevent the introduction and spread of aquatic invasive species.
2. Enhance and maintain the diverse populations of native aquatic plants.
3. Maintain and improve water quality conditions.
4. Educate the Lower McKenzie Lake community regarding aquatic plant management, management strategies found in the plan, erosion control and appropriate plant management actions.

Goal 1: Prevent the introduction and spread of aquatic invasive species

Objectives

A. 100% of boaters inspect, clean, and drain boats, trailers and equipment.

B. 100% enforcement of the State of Wisconsin's Do Not Transport Ordinance.

C. Lower McKenzie Lake is monitored regularly for the spreading of Curly-leaf pondweed and the introduction of new aquatic invasive species.

D. McKenzie Lake Association is ready to rapidly respond to identified AIS in the lake.

Actions

1. Conduct Clean Boats Clean Waters monitoring and education at the boat landing using paid and/or volunteer staff and pursue grants from the DNR for this purpose.

2. Work with the Washburn County Sheriff's Department to encourage increased enforcement and potentially increased fines for the Do Not Transport Ordinance.

3. Monitor boat landings and other areas with high potential for introduction of AIS.

4. Hire a Clean Boats Clean Waters employee to monitor the boat landings.

5. Conduct a Curly-leaf pondweed survey on Lower McKenzie every two years or more frequently as need.

6. Monitor each year through volunteers of CLMN AIS on Lower McKenzie

Goal 2:
Enhance and maintain the diverse populations of native aquatic plants.

Objectives

A. Increase Lower McKenzie Lake community's understanding of the role and importance of aquatic plants and the impact of human activity on them.

B. Prevent removal of native plants using herbicides.

C. Implement strict adherence with treatment standards and monitoring methods prior to and following herbicide treatment.

Actions

1. Highlight how aquatic plants provide habitat for a diverse fish population, protect against shoreline erosion, and prevent colonization by invasive plants. Show the negative effects erosion, runoff, and boating disturbances near shore can have on the Lake Ecosystem and, ultimately, property values.

2. Consider alternative methods for removing native plants, other than using herbicide treatment, for individual access corridors.

3. Conduct a point intercept survey of the lake every five to ten years, or as needed.

4. Update the aquatic plant management plan every five to ten years, or as needed.

Goal 3: Maintain and improve water quality conditions.

Objectives

A. Continue to sample and record both water samples and Secchi readings to ensure water quality.

B. Encourage lake residents to restore and preserve shoreline buffers of native vegetation.

C. Reduce phosphorus and sediment loads from immediate watershed.

D. Encourage riparian landowners to adopt and implement storm water runoff controls for existing structures and all new constructions utilizing the Adaptive Management Approach.

Actions

1. Continue to monitor water quality through WDNR Citizens Lake Monitoring Network advanced water chemistry program and Secchi disk sampling and record data in the Surface Water Integrated Monitoring System (SWIMS) system.

2. Incorporate the Adaptive Management Approach to reduce phosphorus and sediment loads from immediate watershed. This includes addressing sources such as faulty septic systems, the use of phosphorus-containing fertilizers, shoreland areas that are maintained in an unnatural manner, and impervious surfaces.

3. Educate Lower McKenzie Lake community members in the restoration and preservation of shoreland buffers and vegetation (natural recovery, stop mowing, and plant natives). Review Washburn County's requirements and cost-sharing program for restoration of shoreline buffers and highlight good examples of Lower McKenzie neighbors who have participated in the program.

Goal 4: Educate the Lower McKenzie Lake community regarding aquatic plant management, management strategies found in the plan, erosion control and appropriate plant management.

Objectives

A. Communicate to audiences that make up the Lower McKenzie Lake community including lakes residents, business owners, lake users.

B. Provide education and appropriate avenues of communication to reach these audiences, including electronic, written, and live speaker presentations.

C. 100% of Lower McKenzie Lake landowners are aware of, understand, and support the APM plan.

Actions

1. Identify who makes up our audience and how to reach them.
2. Present summary of APM plan at a public meeting in the spring.
3. Conduct CLMN AIS education workshop for all lake users at our Lake Association spring meeting.
4. Improve signage at boat landings.
5. Obtain current and (if necessary) create Lower McKenzie-specific AIS handouts and distribute.
6. Write newsletter articles.
7. Send mailings to lake residents.
8. Include ongoing information, materials and APM plan on website.
9. Initiate Clean Boats, Clean Waters monitoring/education.
10. Recruit volunteers for CBCW and lake monitoring.
11. Underscore how a robust native aquatic plant population and AIS threats correlate to lake health and, consequently, property values.
12. Emphasize the importance and value of native aquatic plants and how to identify native and non-natives alike.

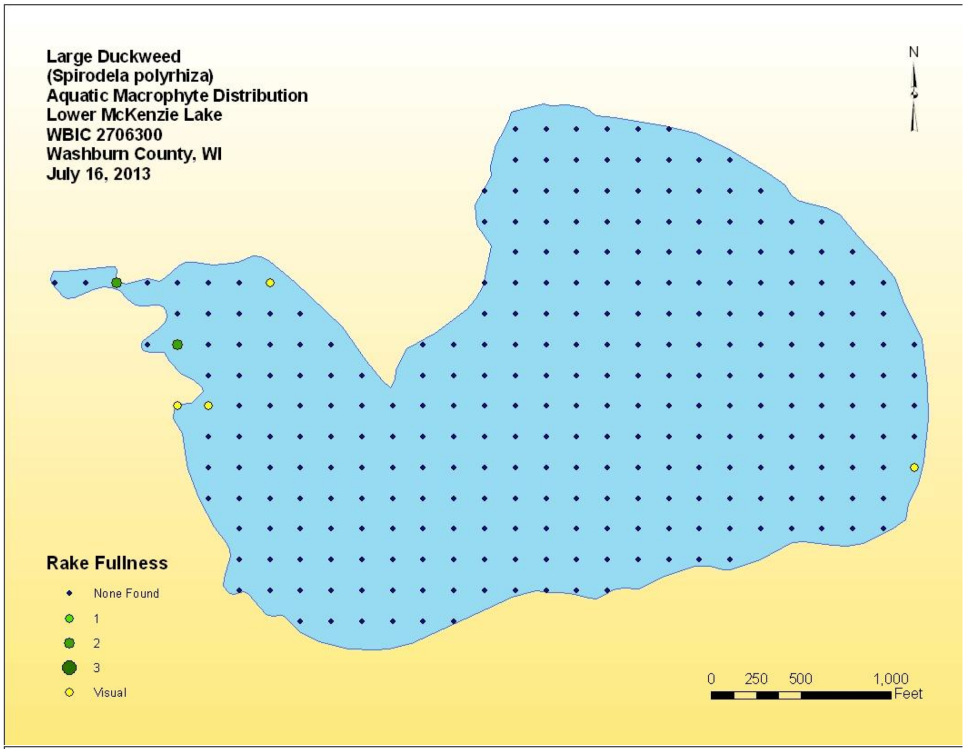
Implementation Plan

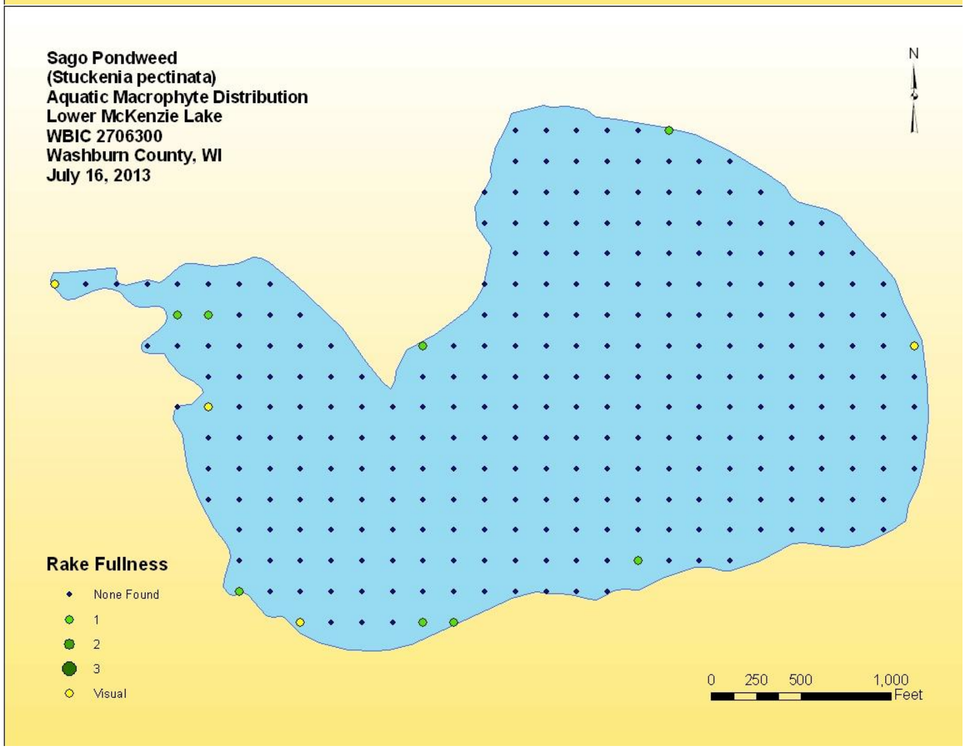
Action Items	Timeline	Cost 2014	Cost 2015	Cost 2016	Responsible Parties
Prevent AIS Introduction					
Identify and organize volunteer workers/employers for CBCW program	Ongoing	15 hours	10 hours	10 hours	MLA President
Conduct CBCW program	Ongoing	20 hours	20 hours	20 hours	MLA President
Increase enforcement of theDo Not Transport Ordinance	Ongoing	4 hours	4 hours	4 hours	MLA, WashburnSheriff Dept. and LWCD
Monitor boat landings	Annually	200 hours	200 hours	200 hours	MLA, Washburn County LWCD
Train Volunteer monitors in CLMN	As needed	10 hours	10 hours	10 hours	BC County LWCD/MLA
Rapid Response plan review	Ongoing	3 hours	3 hours	3 hours	MLA, Burnett County LWCD
Provide Identification information and encourage volunteer monitoring	May - August	20 hours	20 hours	20 hours	MLA AIS Committee
Preserve Native Plants					
Conduct a point intercept survey of the lake	2017-2022	$3000			MLA
Update APM plan	2018-2023	$3000			MLA

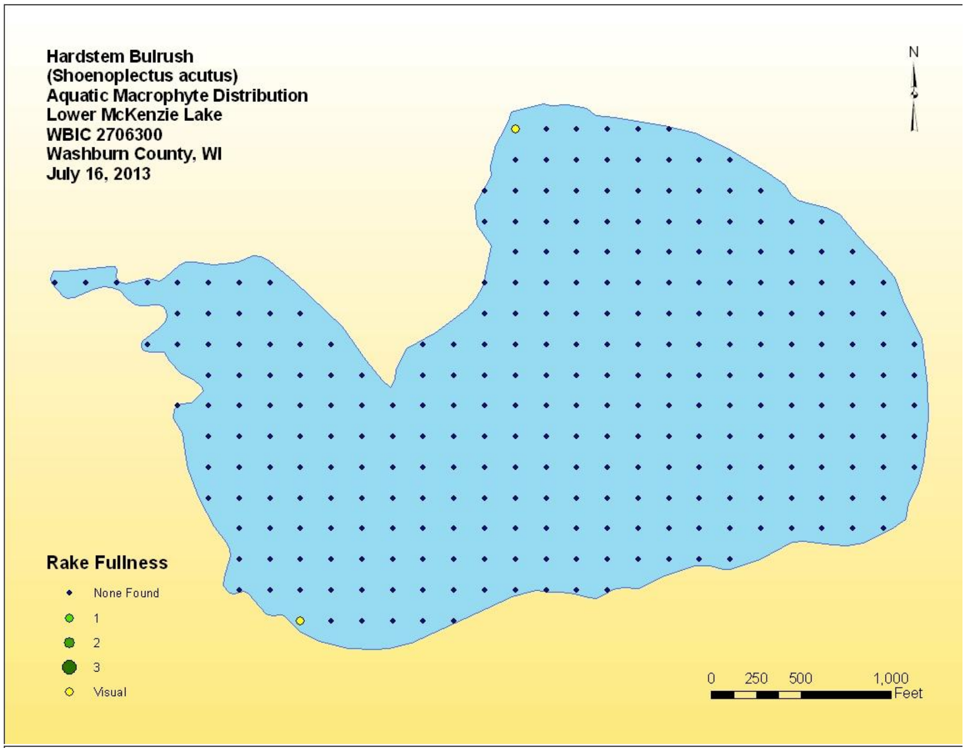
Implementation Plan (Continued)

Action Items	Timeline	Cost 2014	Cost 2015	Cost 2016	Responsible Parties
Water Quality					
Water chemistry and Secchi sampling	ongoing	15 hours	15 hours	15 hours	MLA
Reduce phosphorus and sediment loads from immediate watershed	Ongoing	TBD			MLA, BC LWCD, Washburn County
Educate and assist Lower McKenzie Lake community members in the restoration and preservation of shoreland buffers and shoreland vegetation	Ongoing	TBD			MLA, BC LWCD, Washburn County
Continue implementation of shoreline owners' education program	Ongoing	TBD			MLA, BC LWCD
Educate Lower McKenzie Lake Community					
Recruit employees to conduct CBCW	May	10 hours	10 hours	10 hours	MLA
Recruit volunteers to conduct CLMN	May	10 hours	10 hours	10 hours	MLA, BC LWCD
AIS workshops CBCW & CLMN	Ongoing	$0	$0	$0	BC LWCD
AIS signage	As needed	$0	$0	$0	BC LWCD
Handouts, mailings, door-to door distribution	Ongoing	5 hrs/$150	5 hrs/$150	5 hrs/$150	MLA
MLA newsletter articles	Ongoing	$500	$500	$500	MLA
MLA Website updates	Ongoing	20 hours/Vol	20 hours/Vol	20 hours/Vol	MLA
Annual meeting	Ongoing	$200	$200	$200	MLA

Appendix A: Plants of Lower McKenzie Lake






Hardstem Bulrush
(Shoenoplectus acutus)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
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Visual
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250
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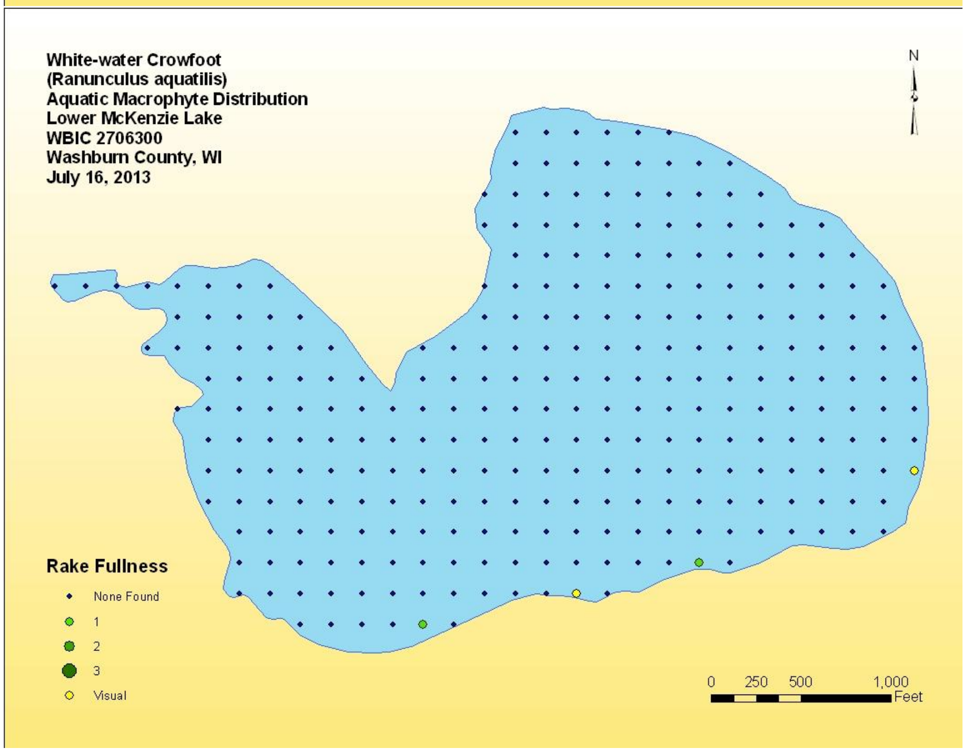
1,000
Feet


White-water Crowfoot
(Ranunculus aquatilis)
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Lower McKenzie Lake
WBIC 2706300
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July 16, 2013
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Visual
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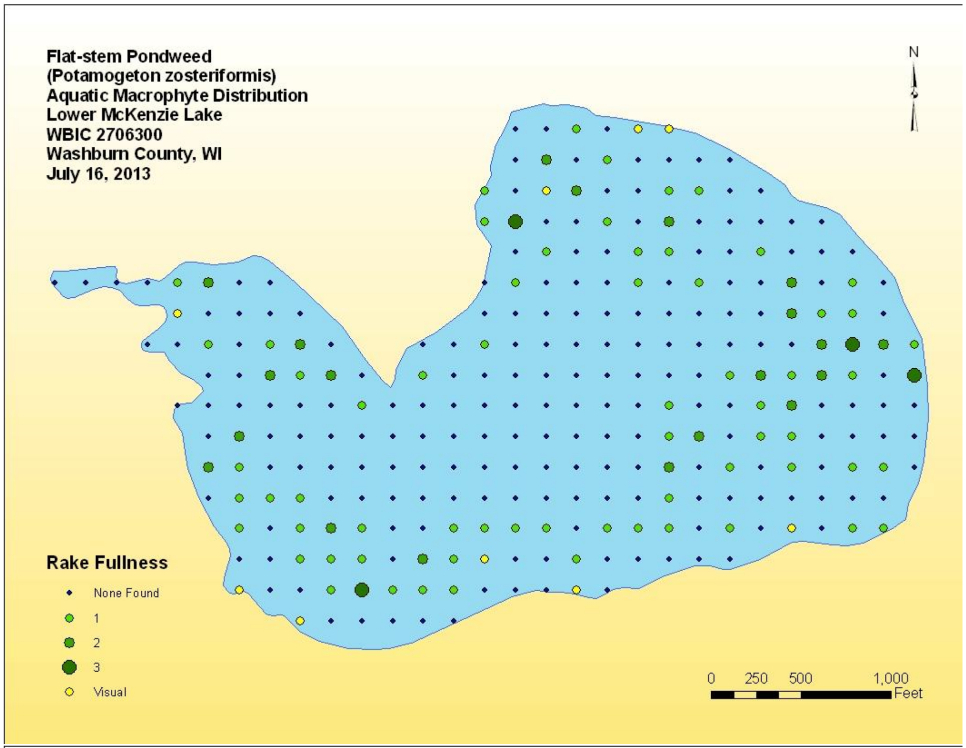
Flat-stem Pondweed
(Potamogeton zosteriformis)
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Feet
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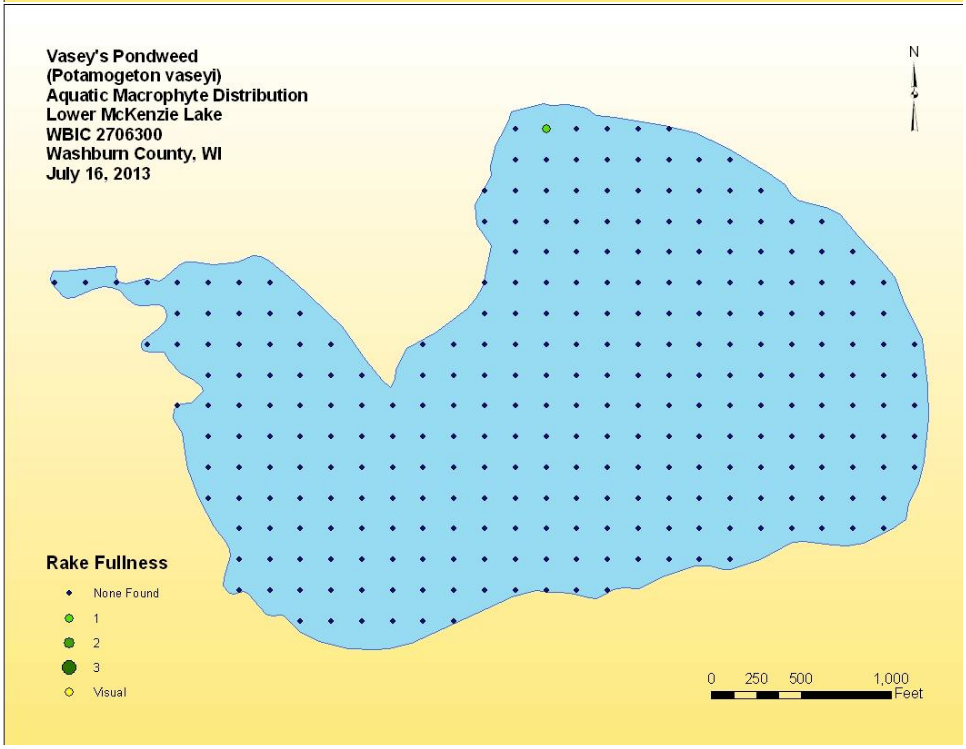
Vasey's Pondweed
(Potamogeton vaseyi)
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Washburn County, WI
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Feet
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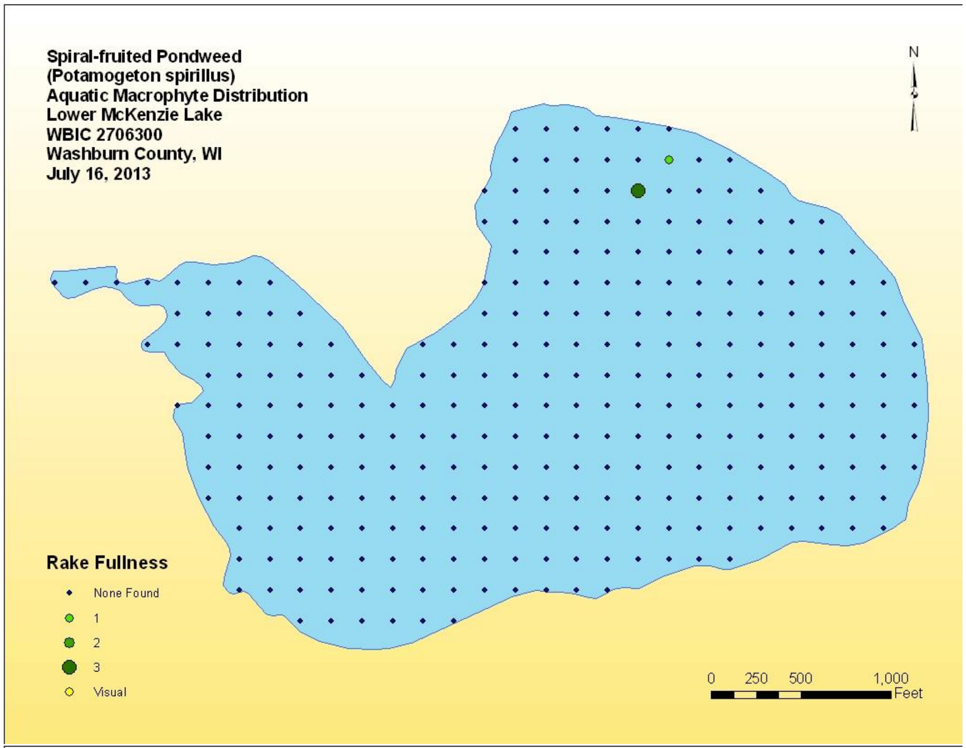
Spiral-fruited Pondweed
(Potamogeton spirillus)
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Washburn County, WI
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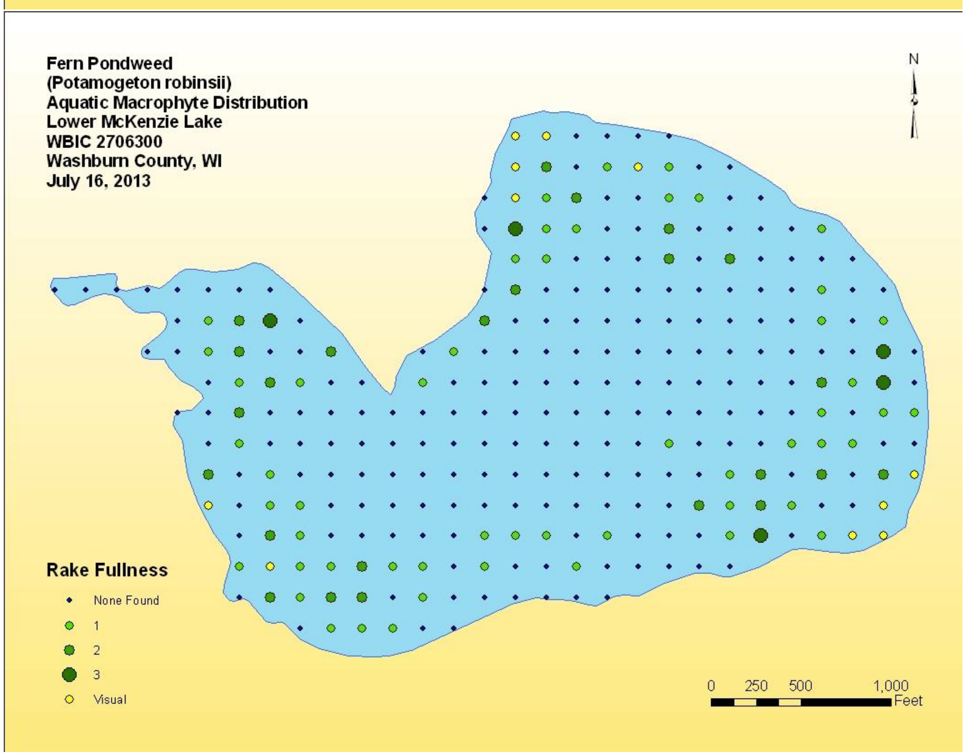
Feet


Fern Pondweed
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Washburn County, WI
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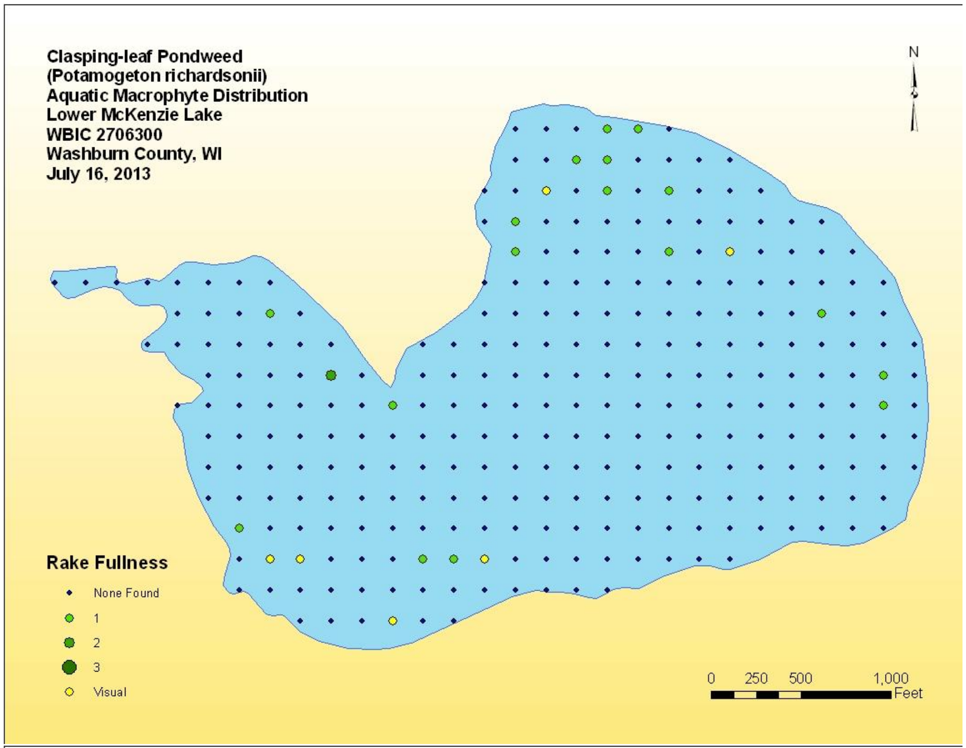
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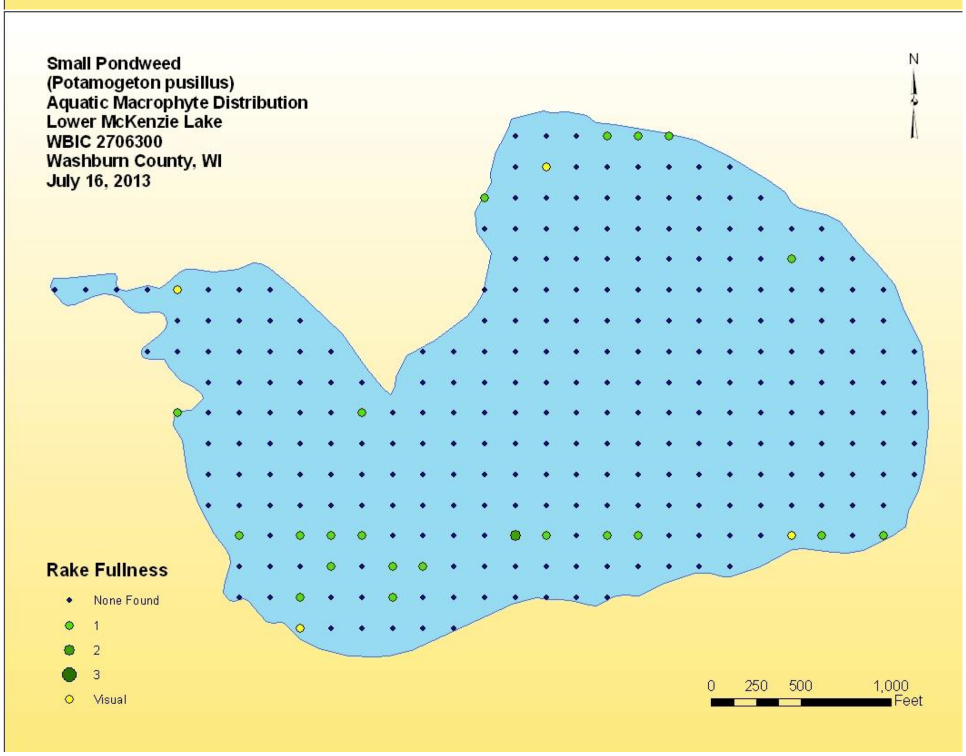
Small Pondweed
(Potamogeton pusillus)
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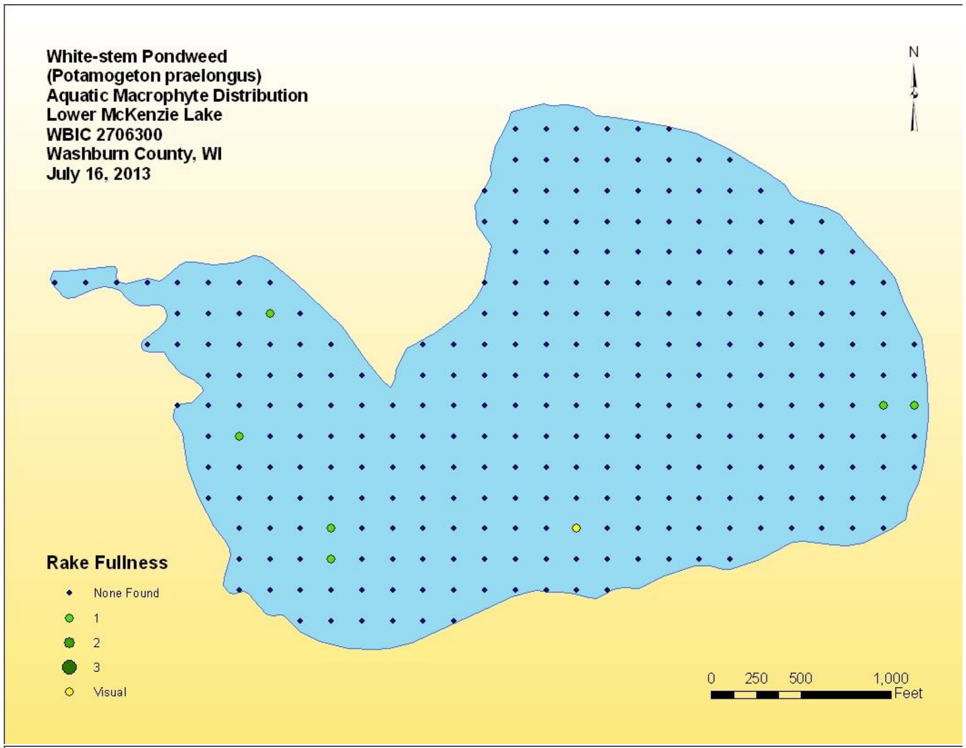
White-stem Pondweed
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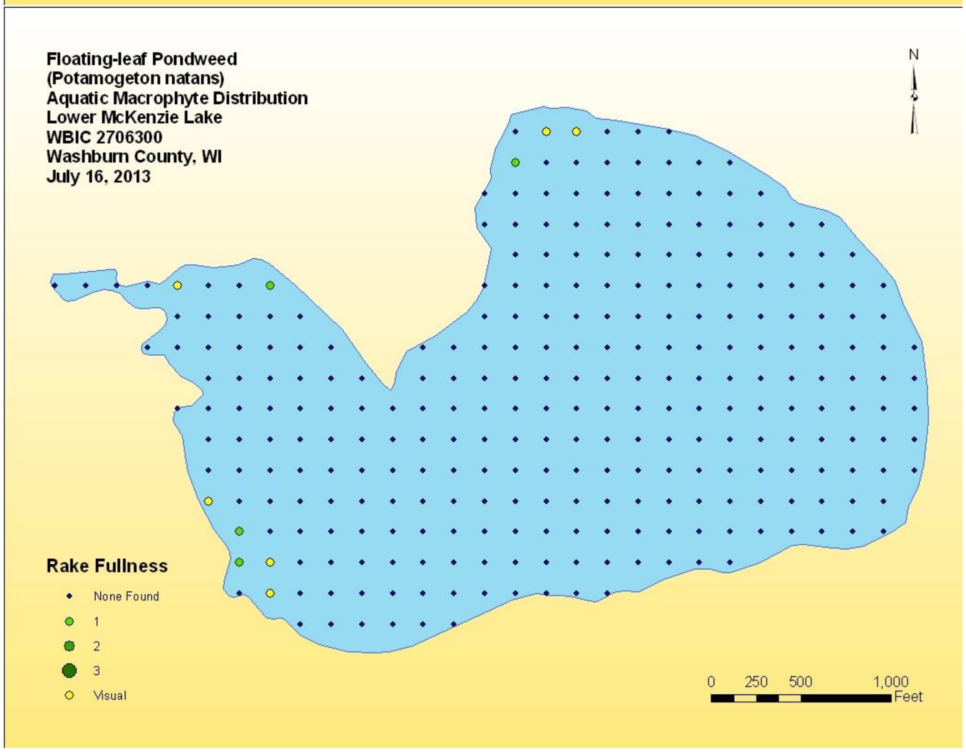
Floating-leaf Pondweed
(Potamogeton natans)
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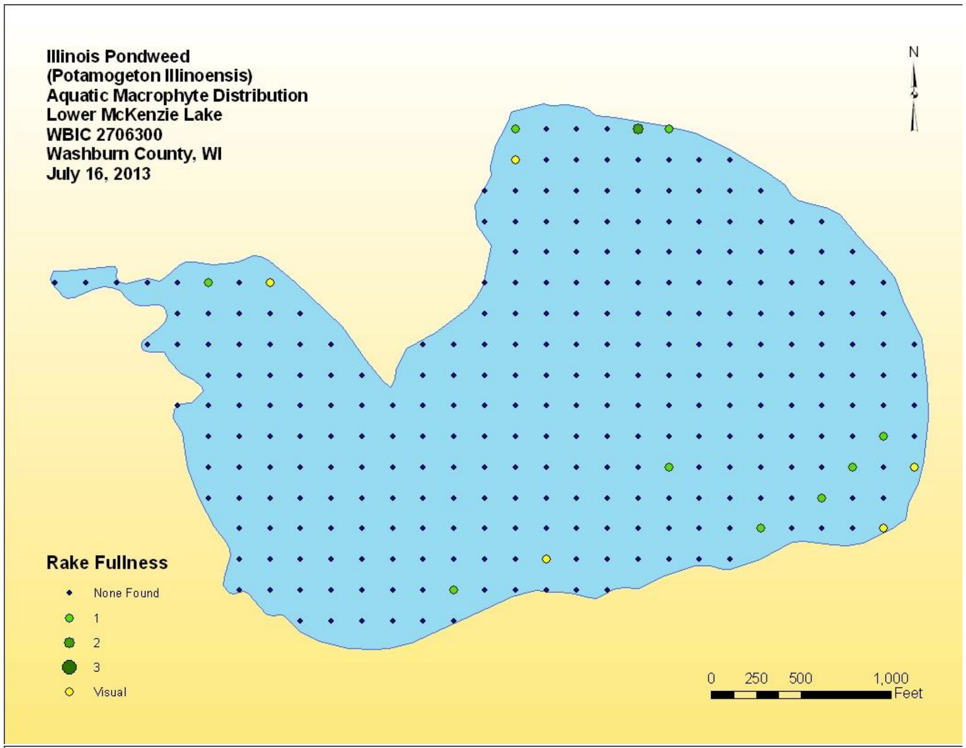
Illinois Pondweed
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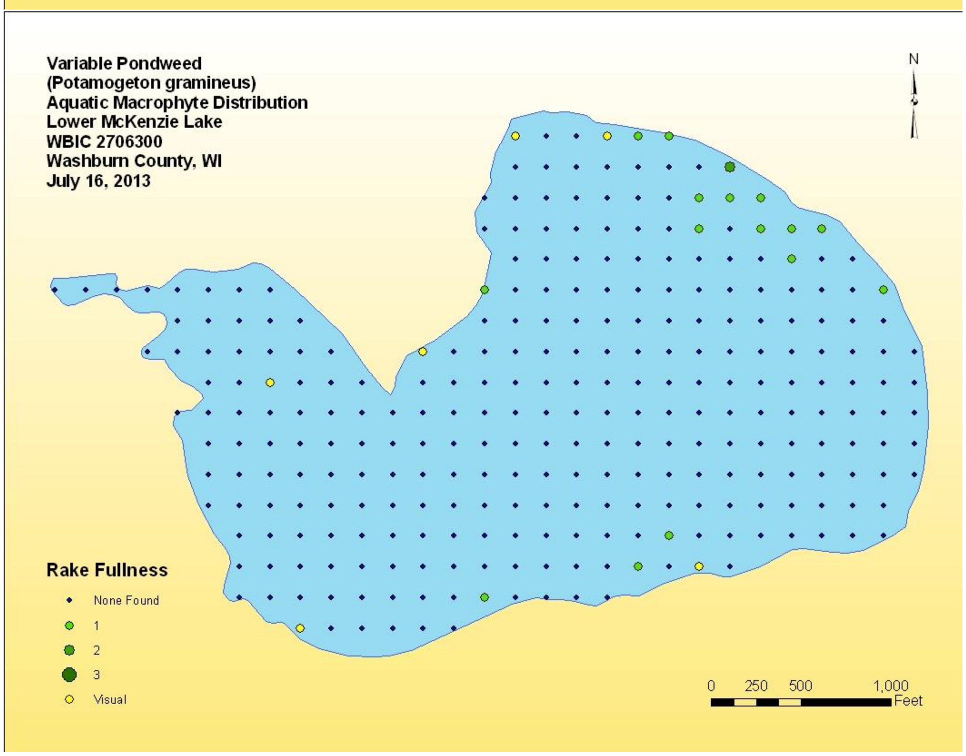
Variable Pondweed
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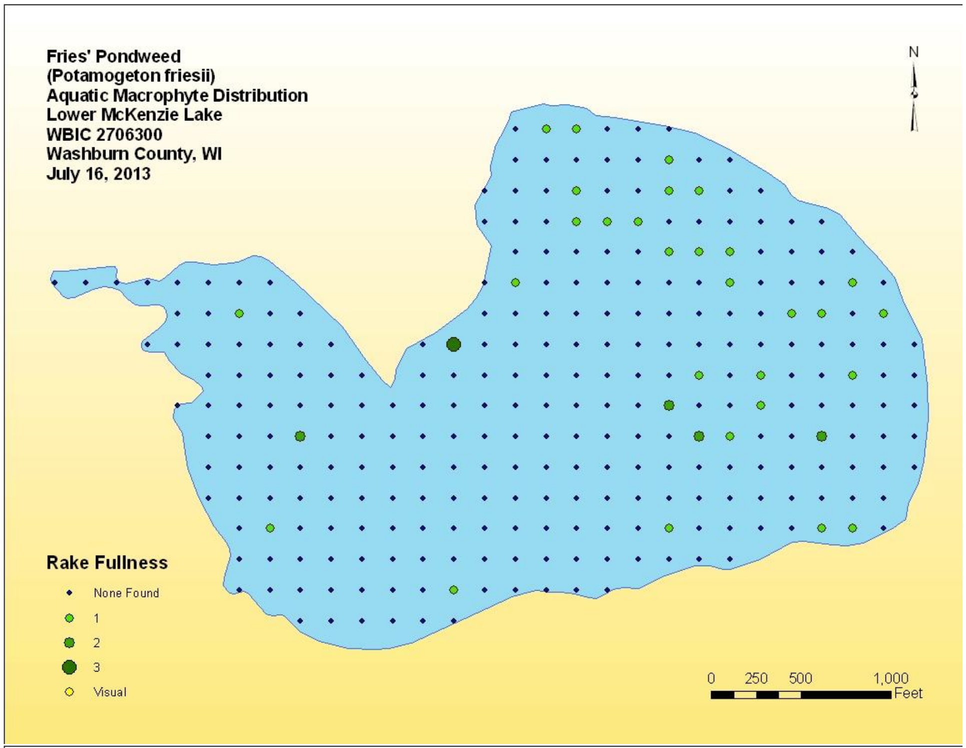
Fries' Pondweed
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WBIC 2706300
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July 16, 2013
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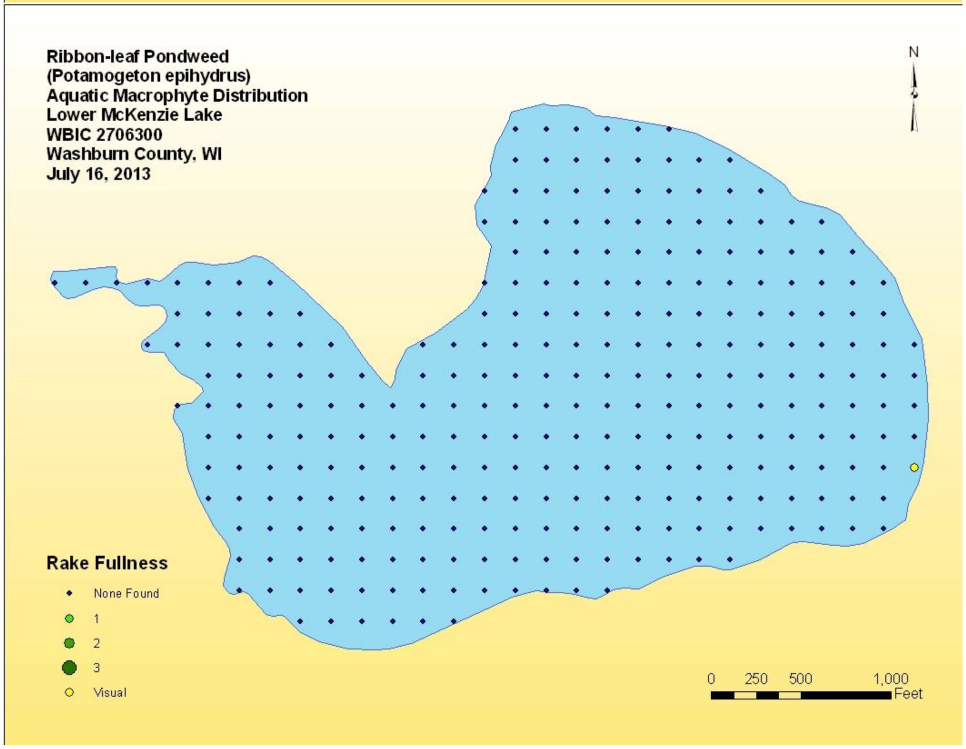
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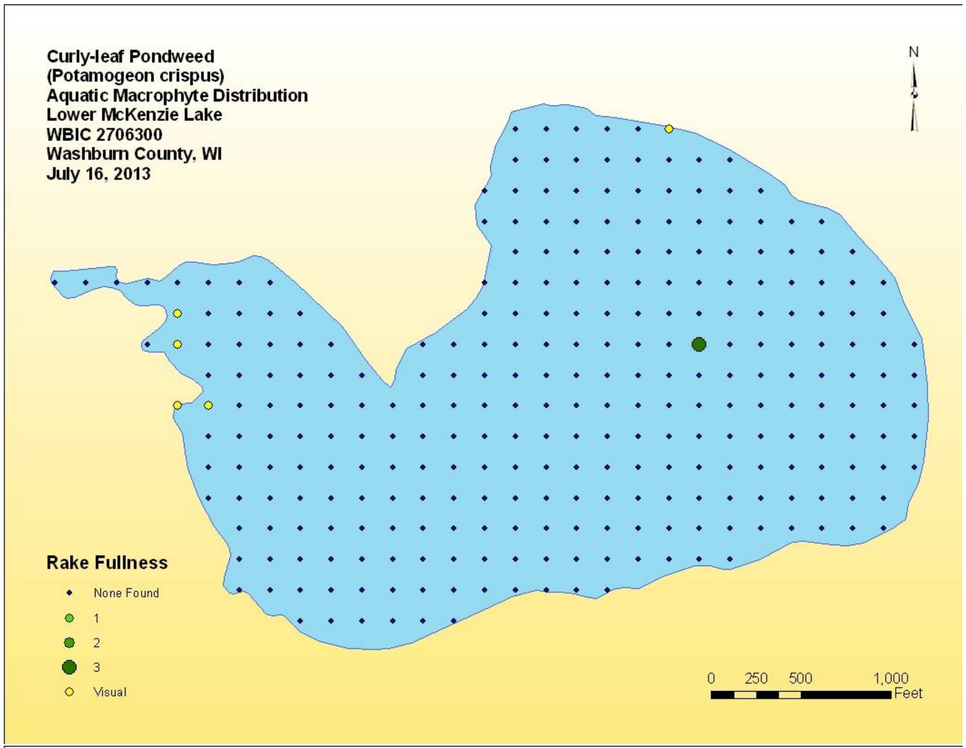
Curly-leaf Pondweed
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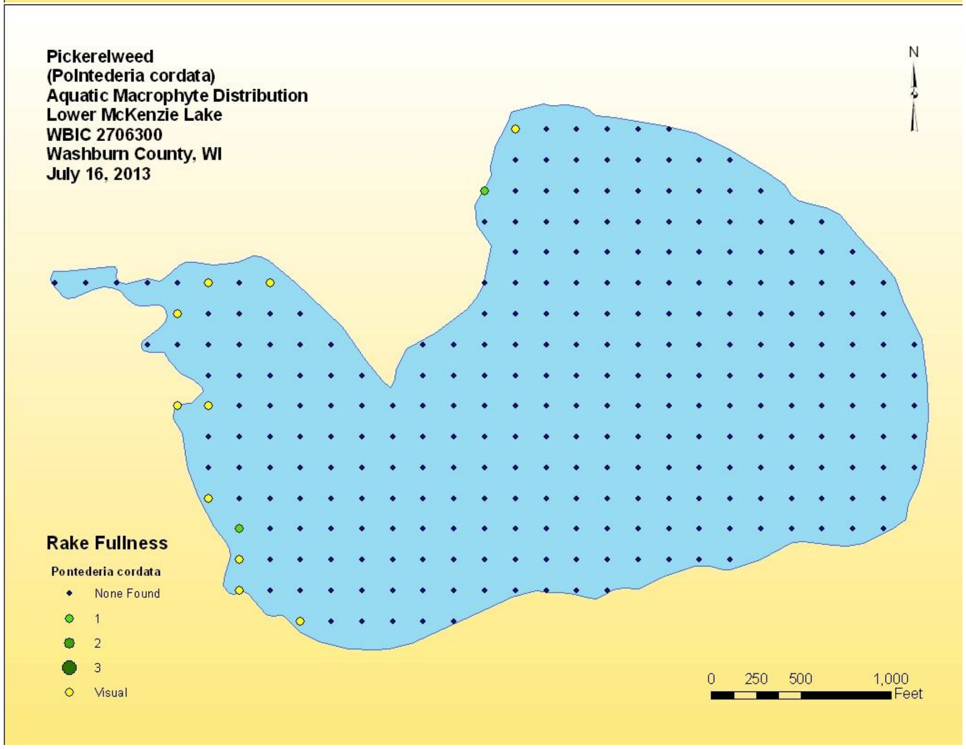
Pickerelweed
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Washburn County, WI
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Rake Fullness
Pontederia cordata
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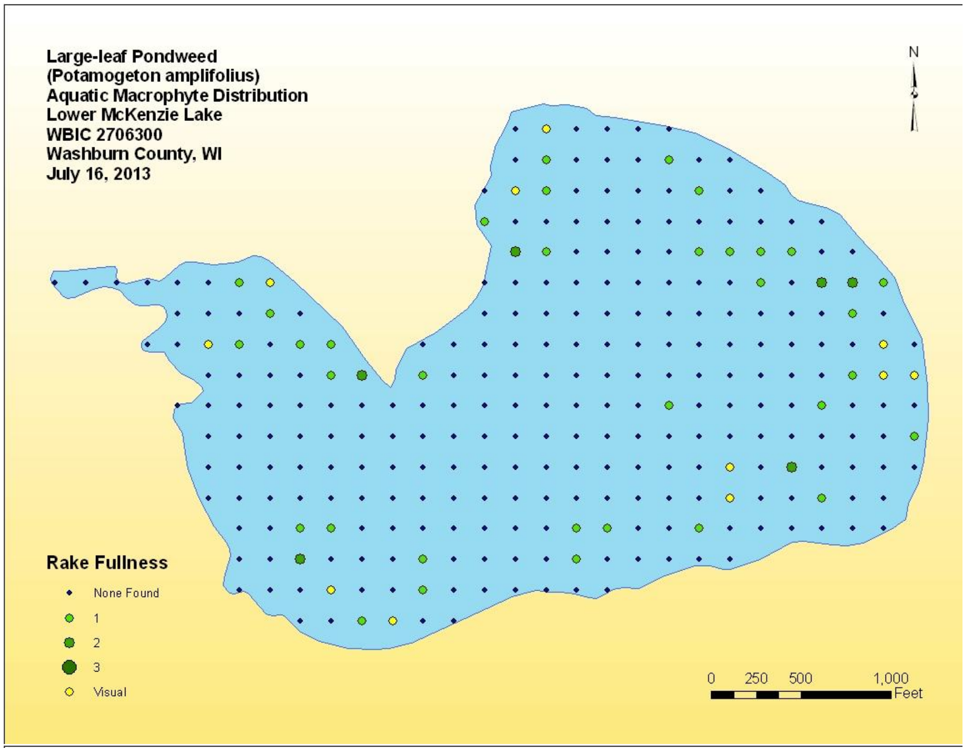
Feet


Large-leaf Pondweed
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Washburn County, WI
July 16, 2013
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Rake Fullness
None Found
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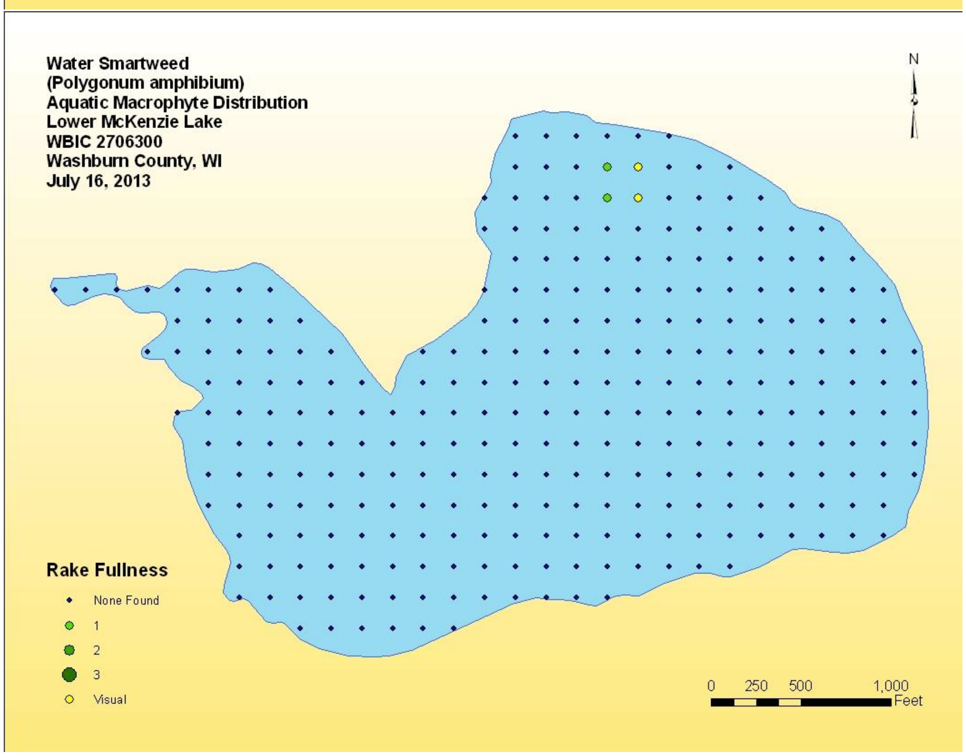
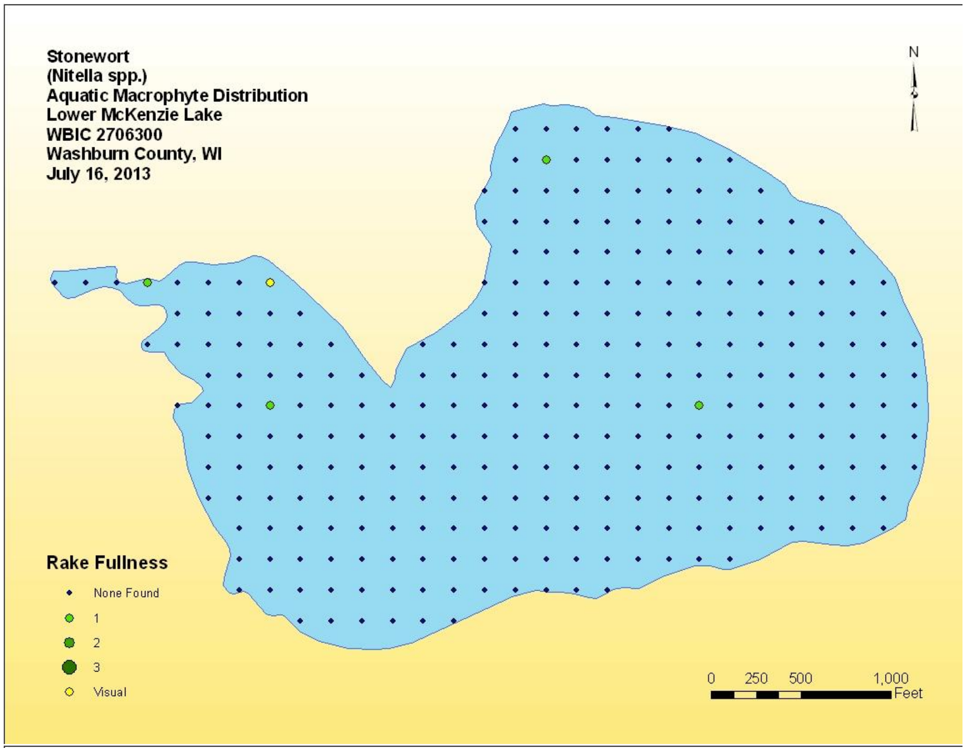
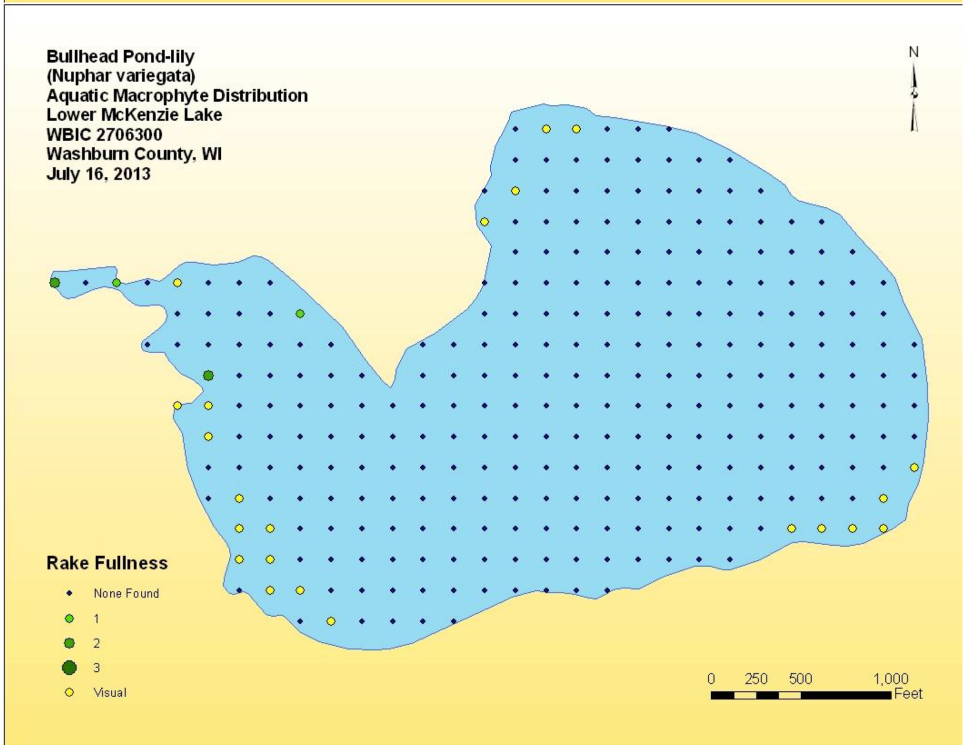
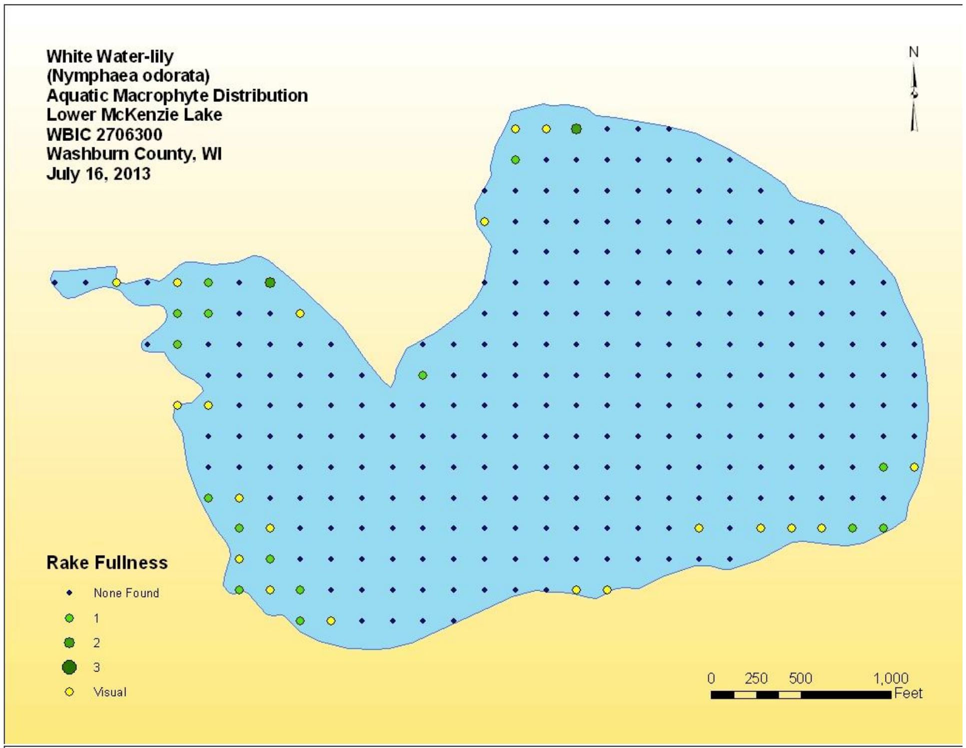
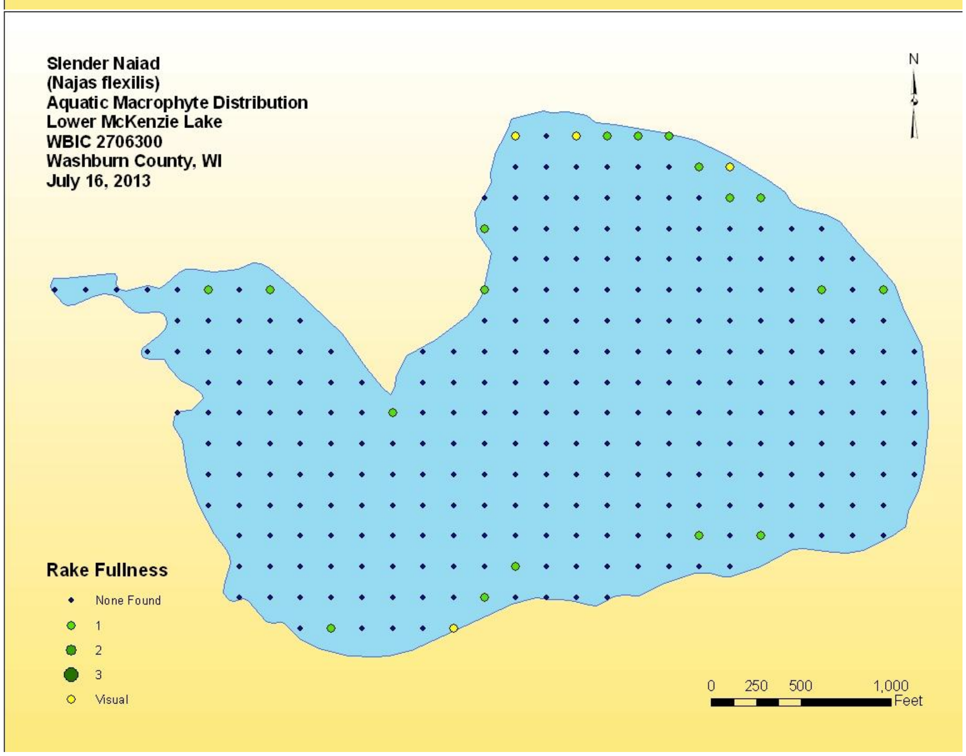
Visual
0 250 500 1,000
Feet

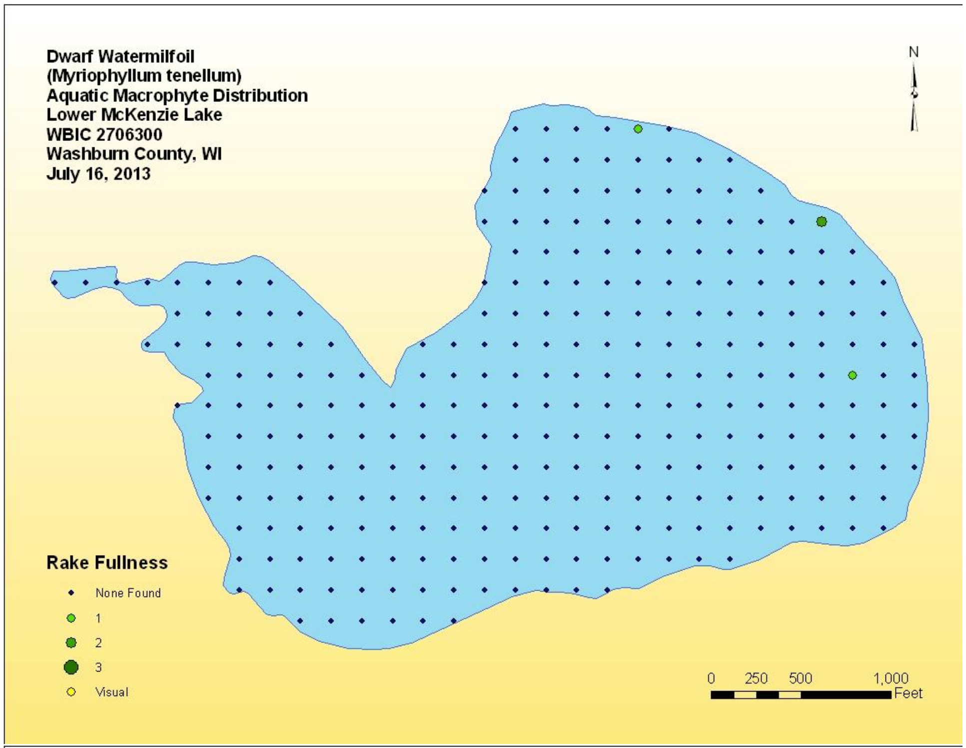

Water Smartweed
(Polygonum amphibium)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet

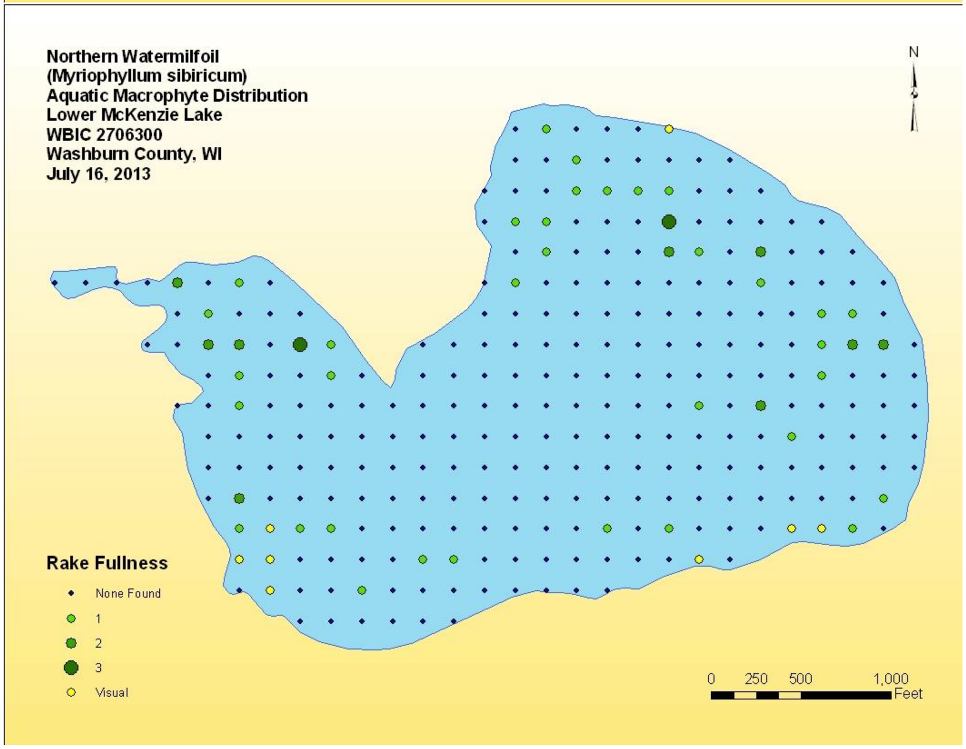

Stonewort
(Nitella spp.)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet

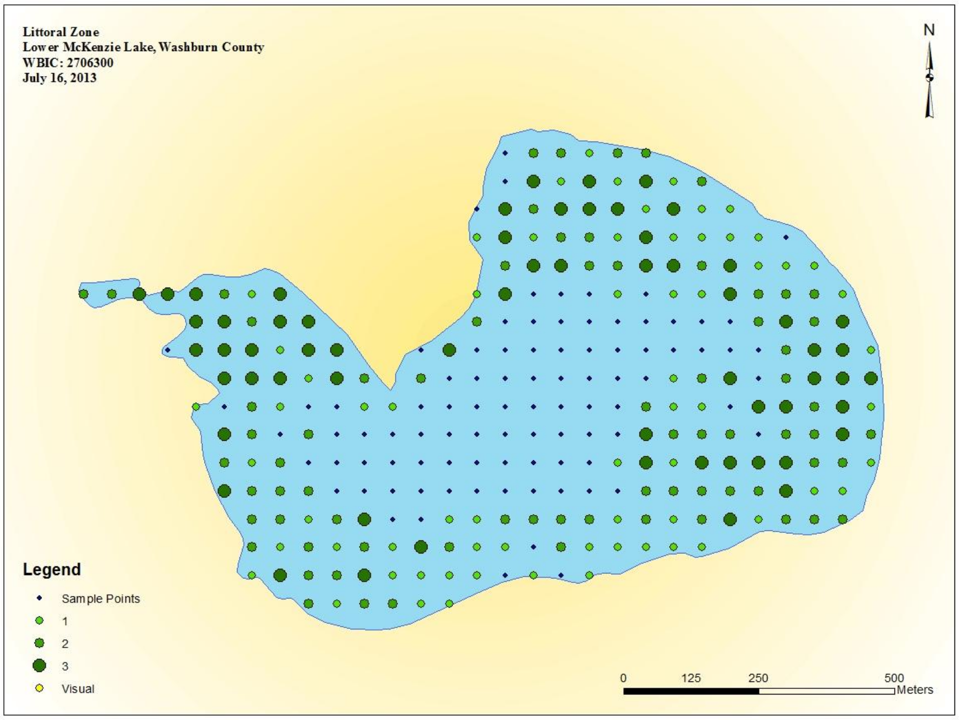

Bullhead Pond-lily
(Nuphar variegata)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet

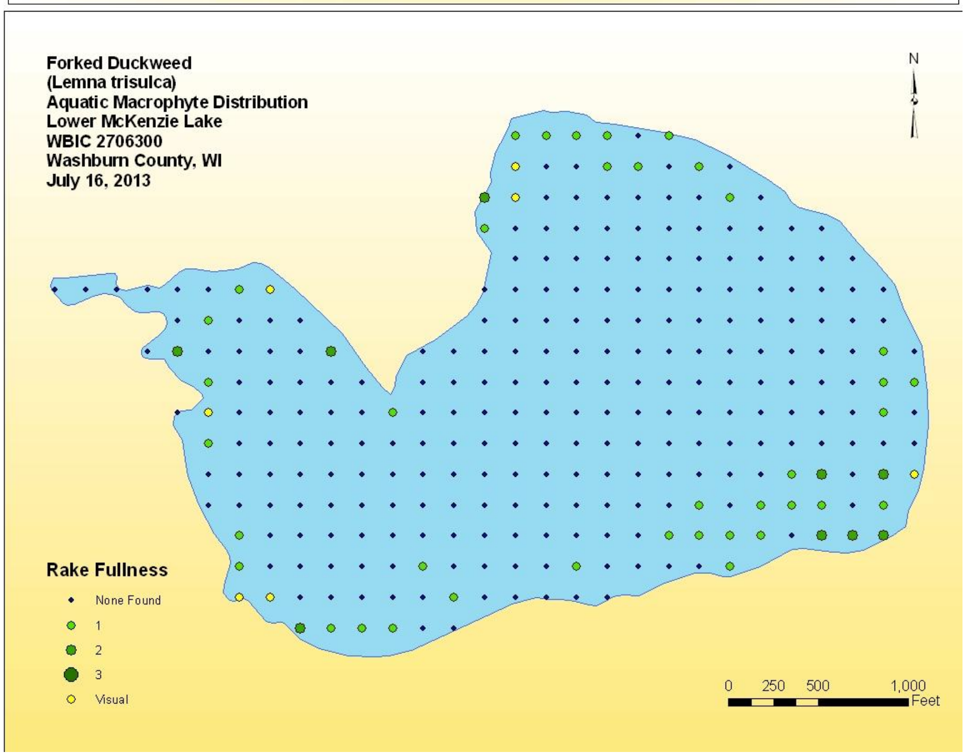

White Water-lily
(Nymphaea odorata)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet

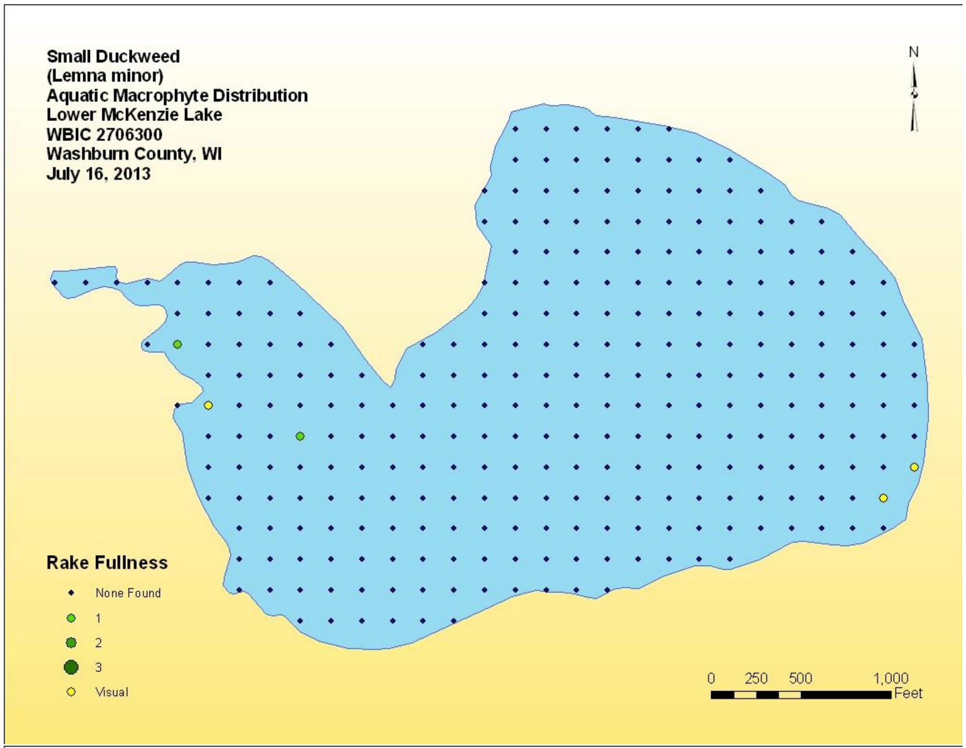

Slender Naiad
(Najas flexilis)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet

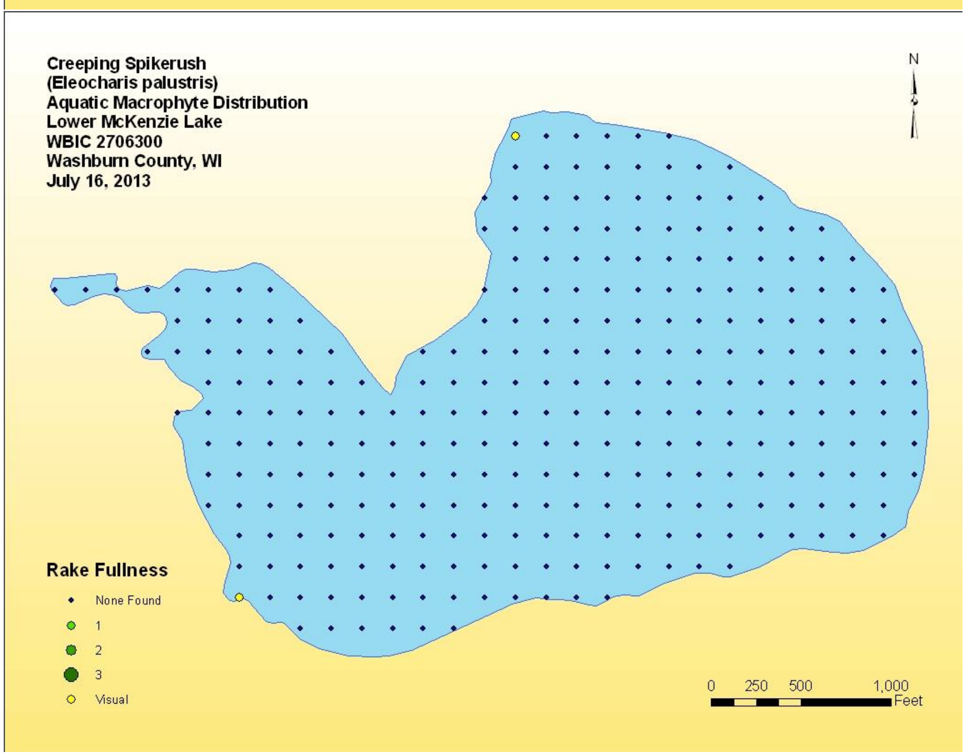

Dwarf Watermilfoil
(Myriophyllum tenellum)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet

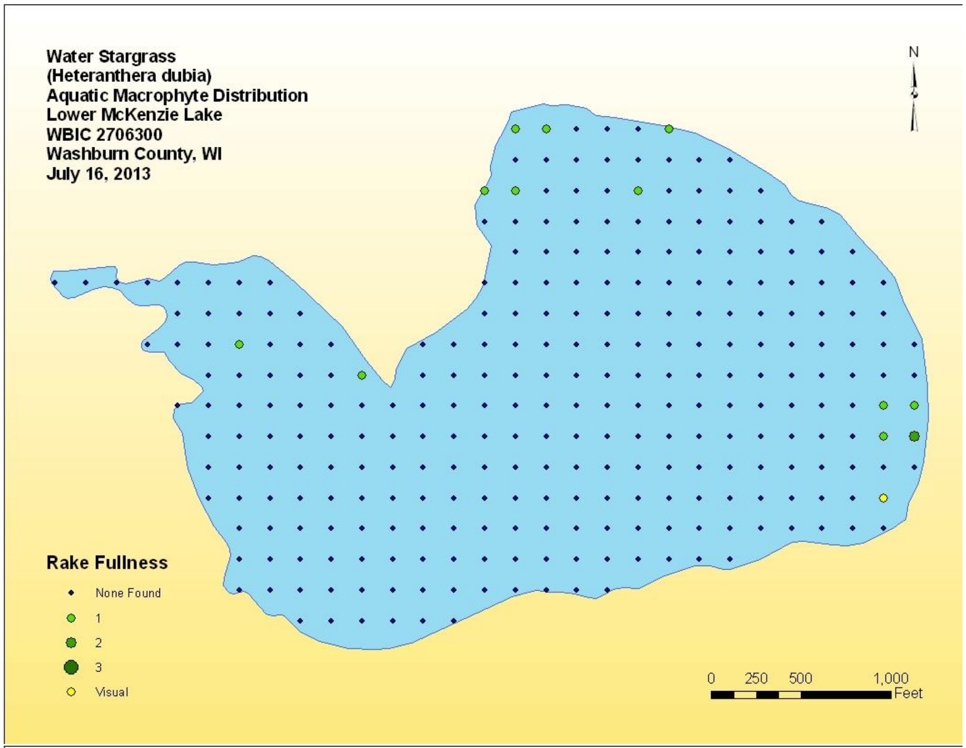

Northern Watermilfoil
(Myriophyllum sibiricum)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet

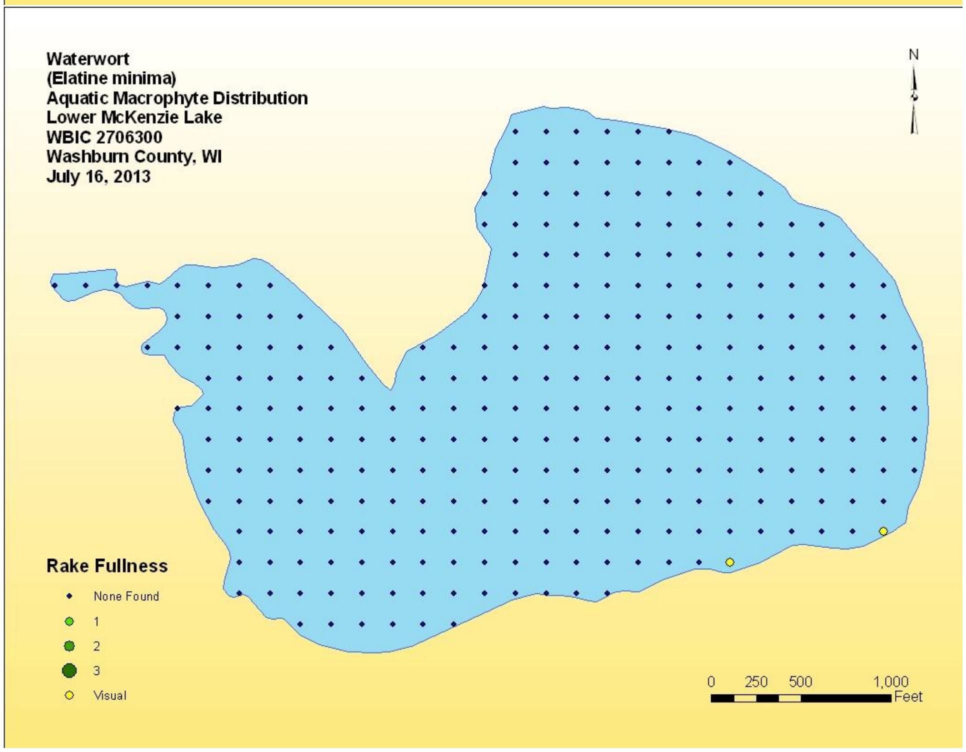

Littoral Zone
Lower McKenzie Lake, Washburn County
WBIC: 2706300
July 16, 2013
N
Legend
Sample Points
1
2
3
Visual
0 125 250 500
Meters

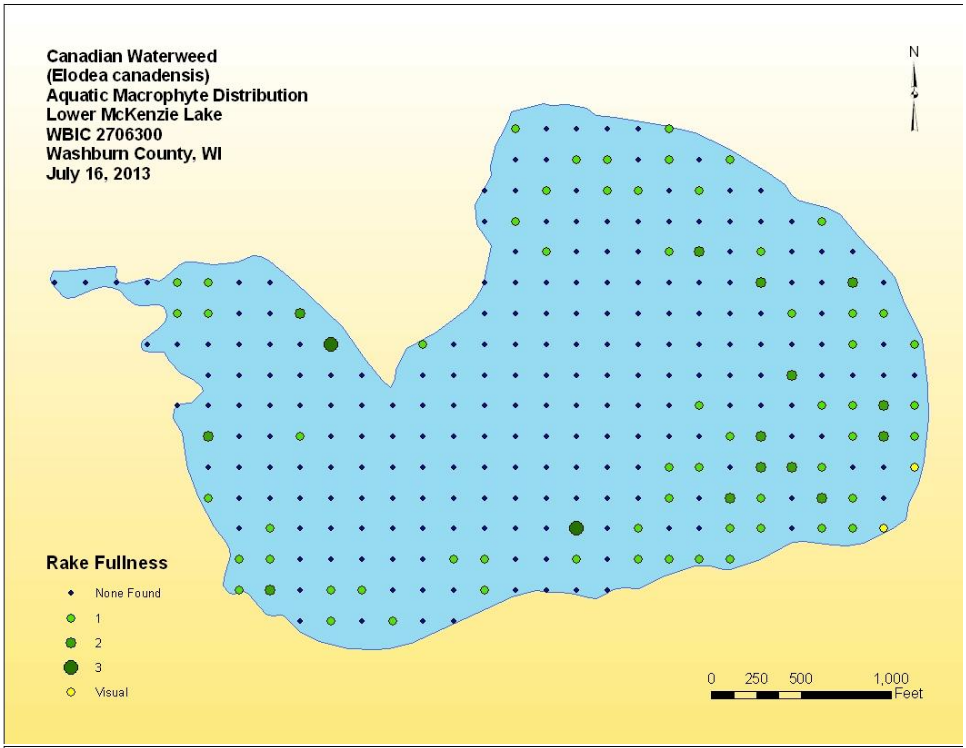

Forked Duckweed
(Lemna trisulca)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet

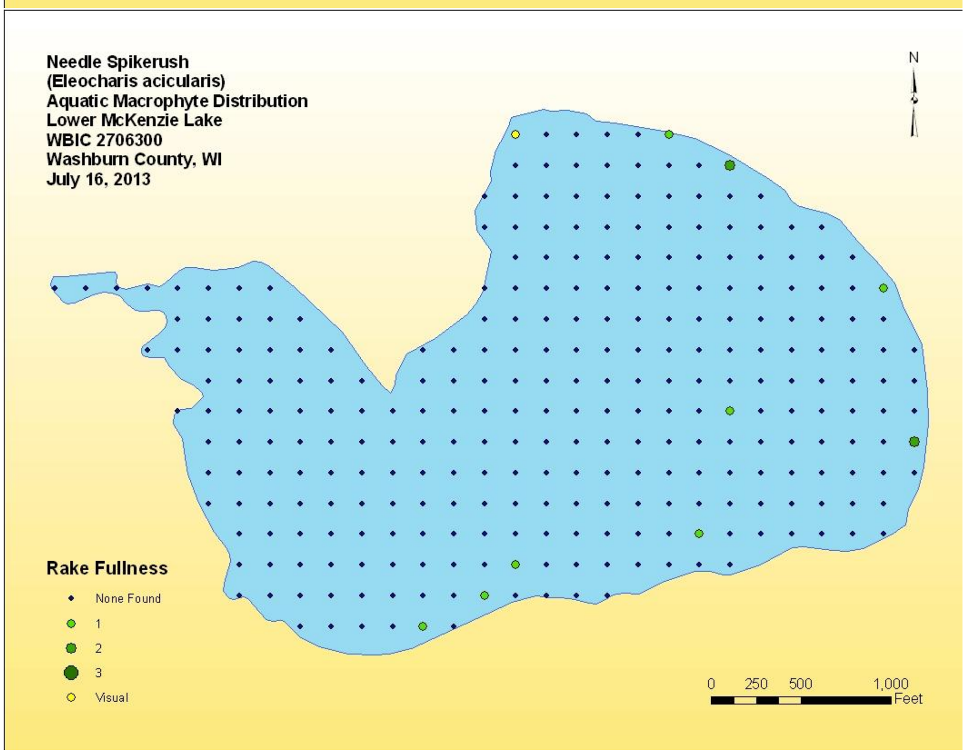

Small Duckweed
(Lemna minor)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet

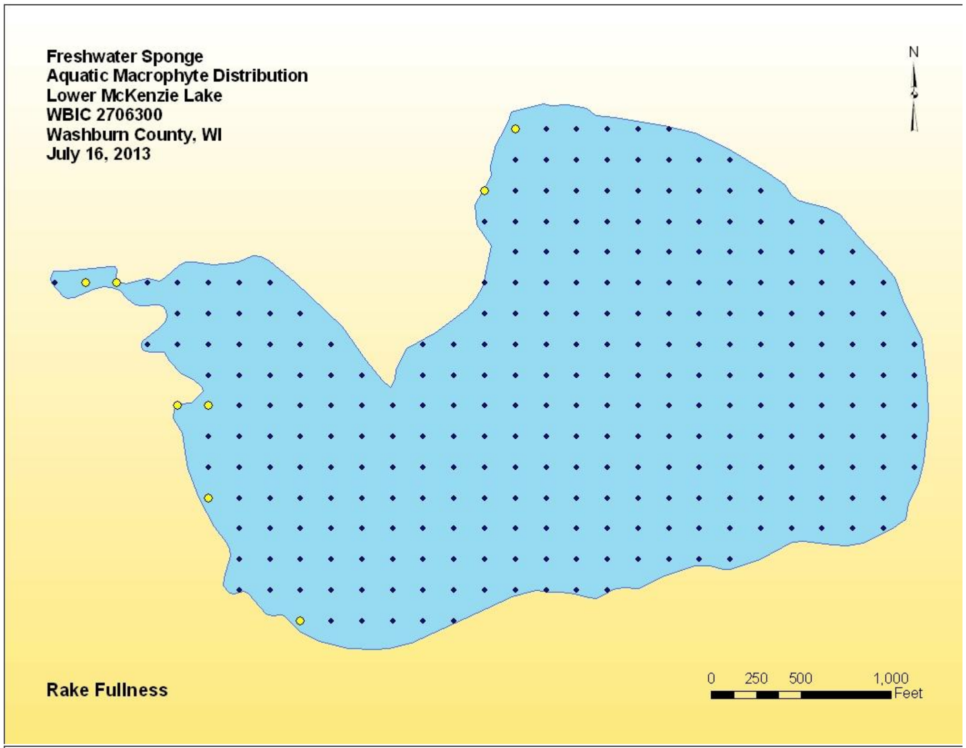

Creeping Spikerush
(Eleocharis palustris)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet

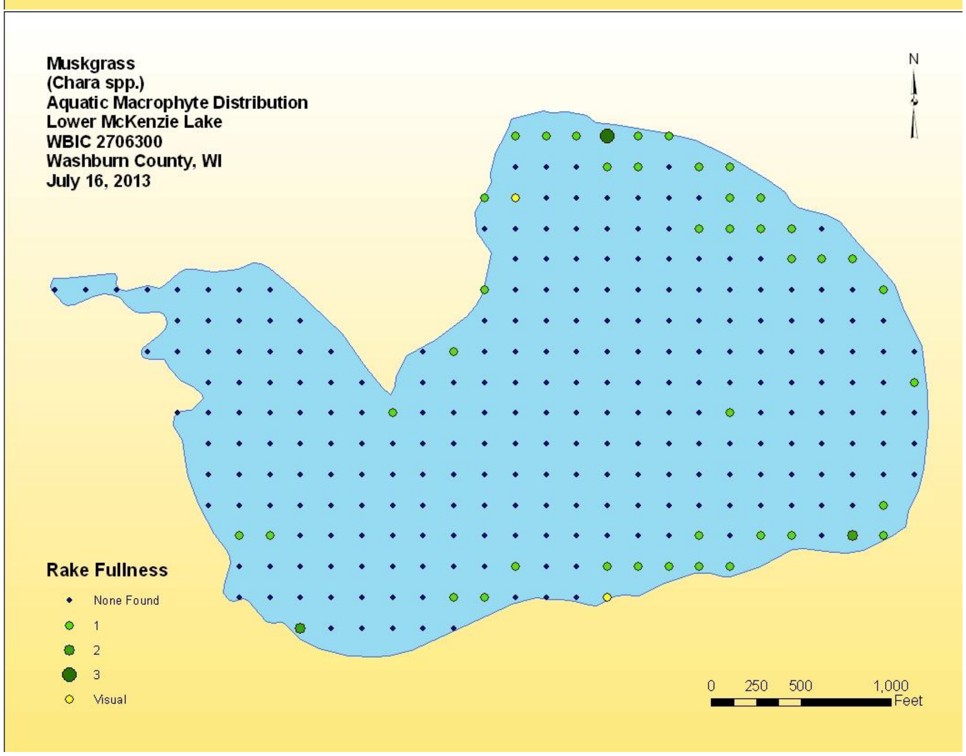

Water Stargrass
(Heteranthera dubia)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0
250
500
1,000
Feet

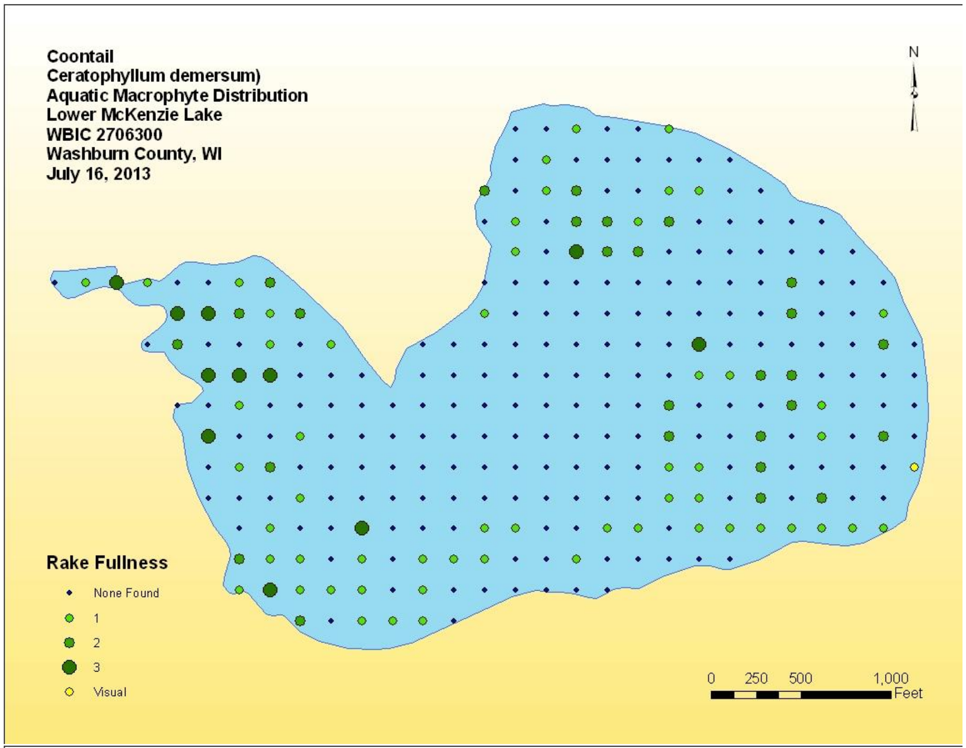

Waterwort
(Elatine minima)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0
250
500
1,000
Feet


Canadian Waterweed
(Elodea canadensis)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet

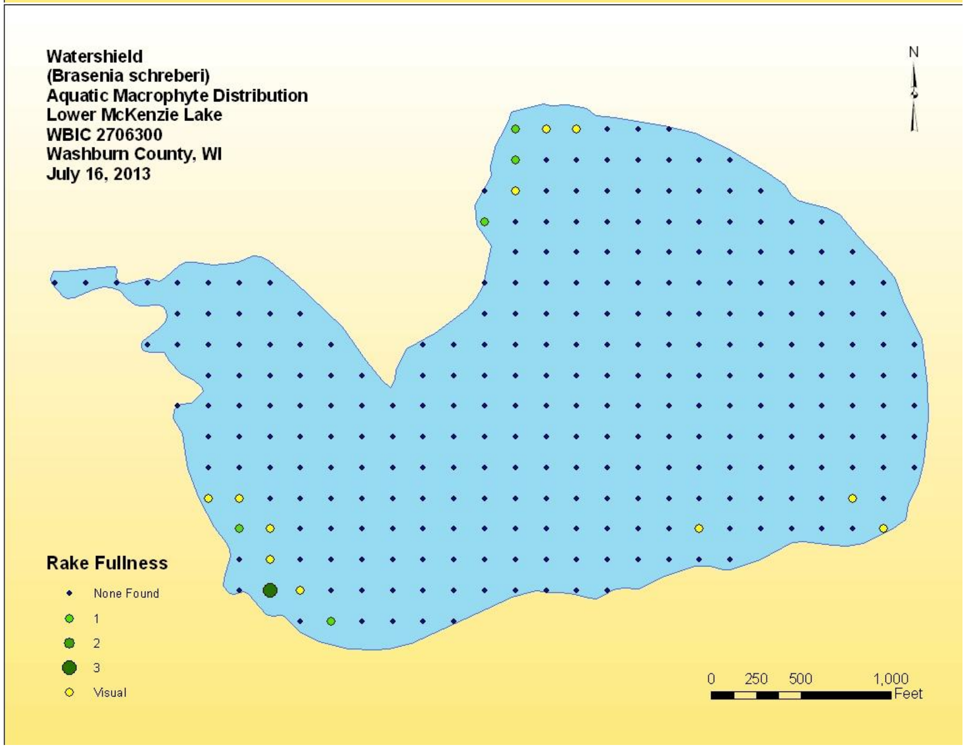

Needle Spikerush
(Eleocharis acicularis)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet


Freshwater Sponge
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
0 250 500 1,000
Feet

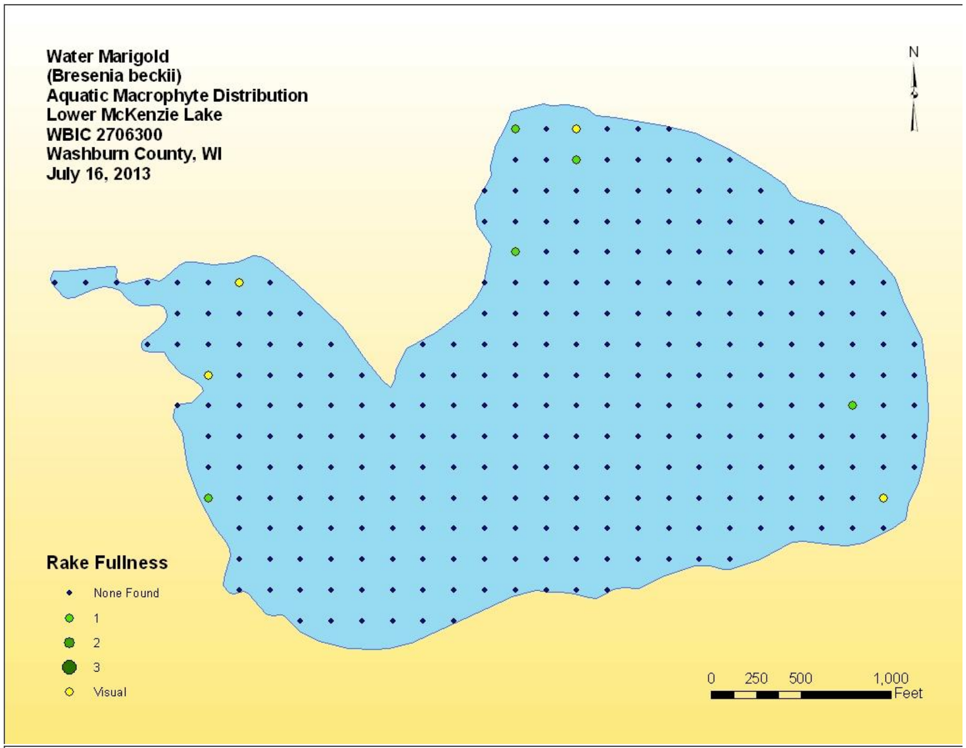

Muskgrass
(Chara spp.)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet

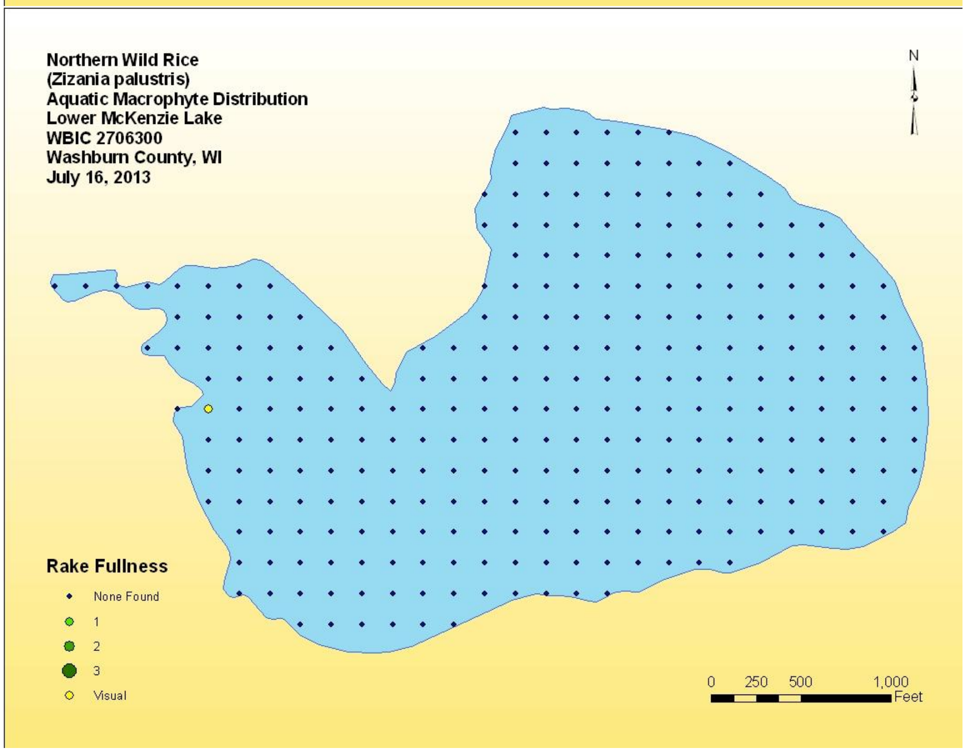


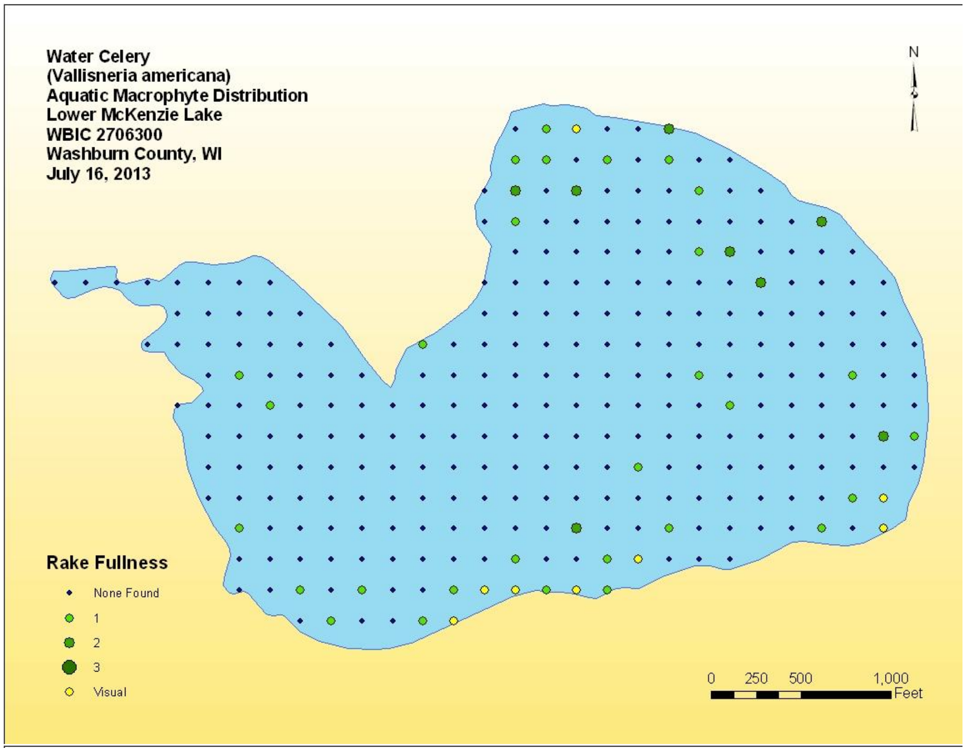
Coontail
Ceratophyllum demersum)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet



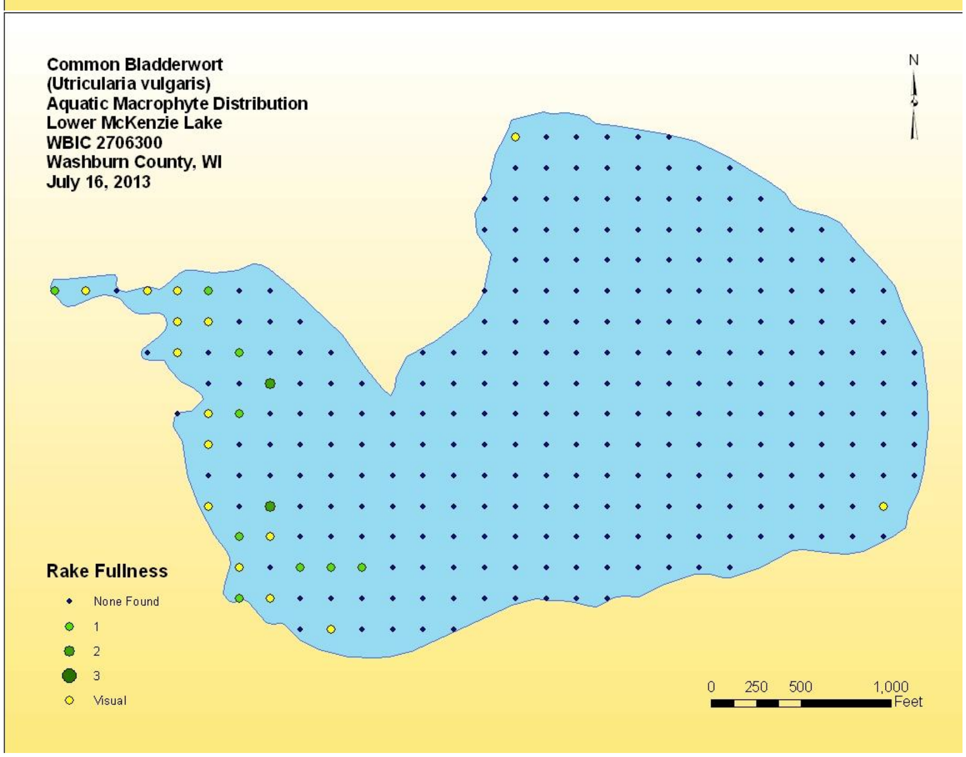
Watershield
(Brasenia schreberi)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet


Water Marigold
(Bresenia beckii)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet

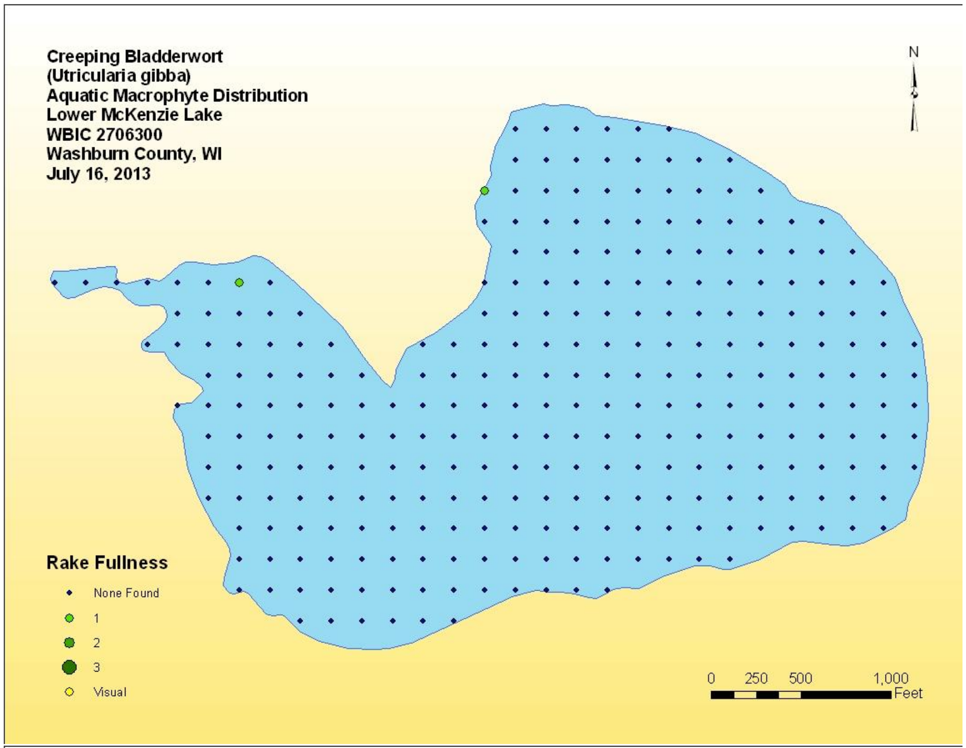

Northern Wild Rice
(Zizania palustris)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet

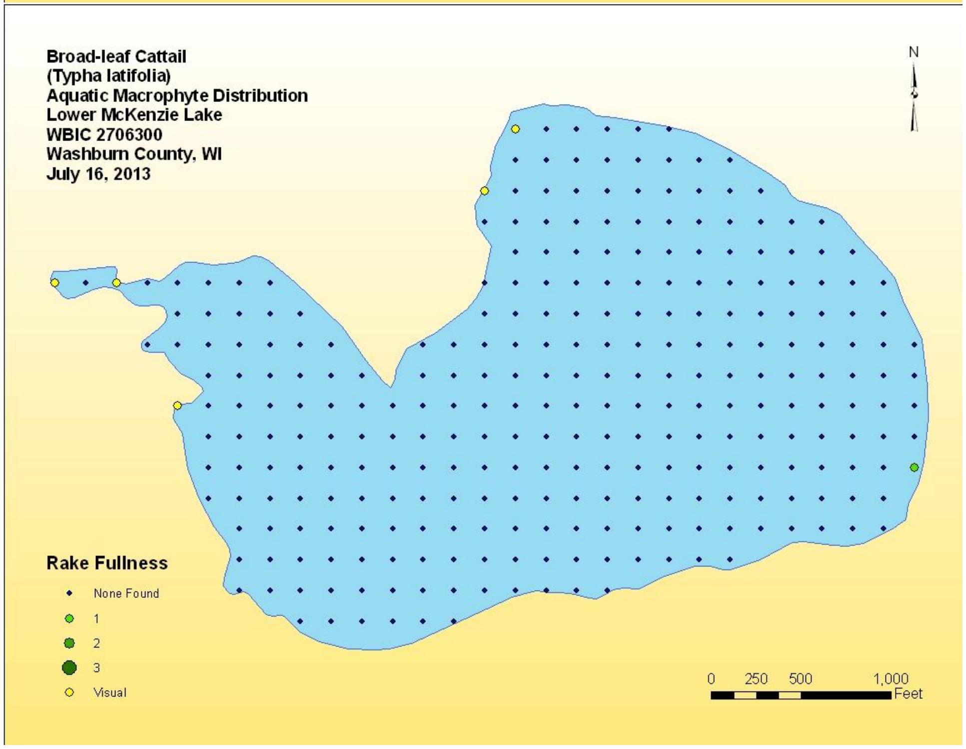


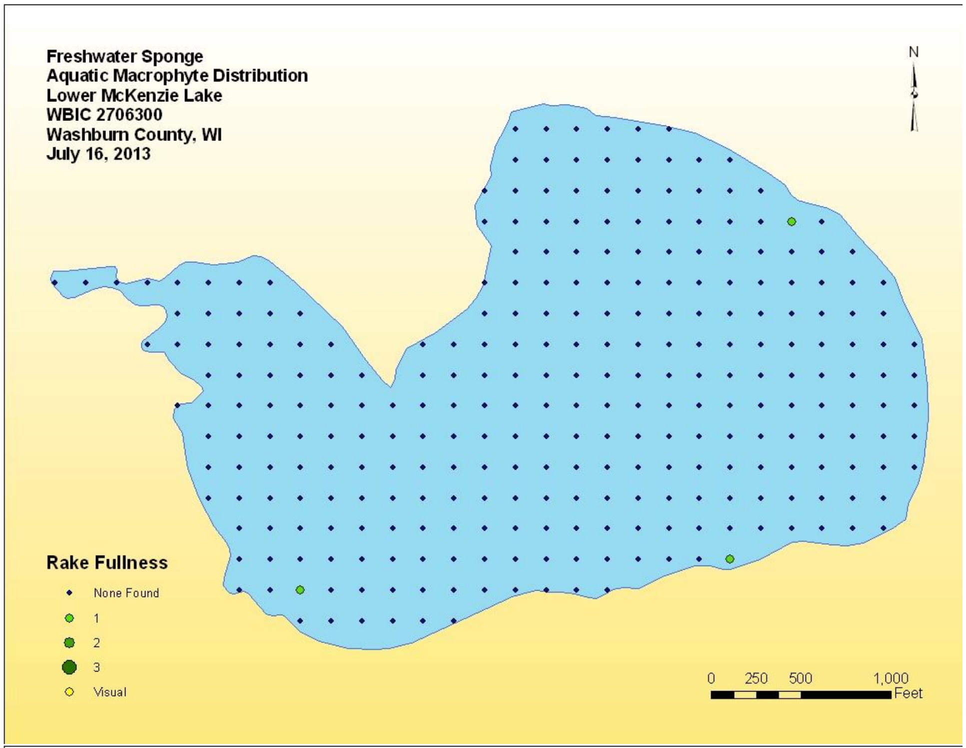
Water Celery
(Vallisneria americana)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet

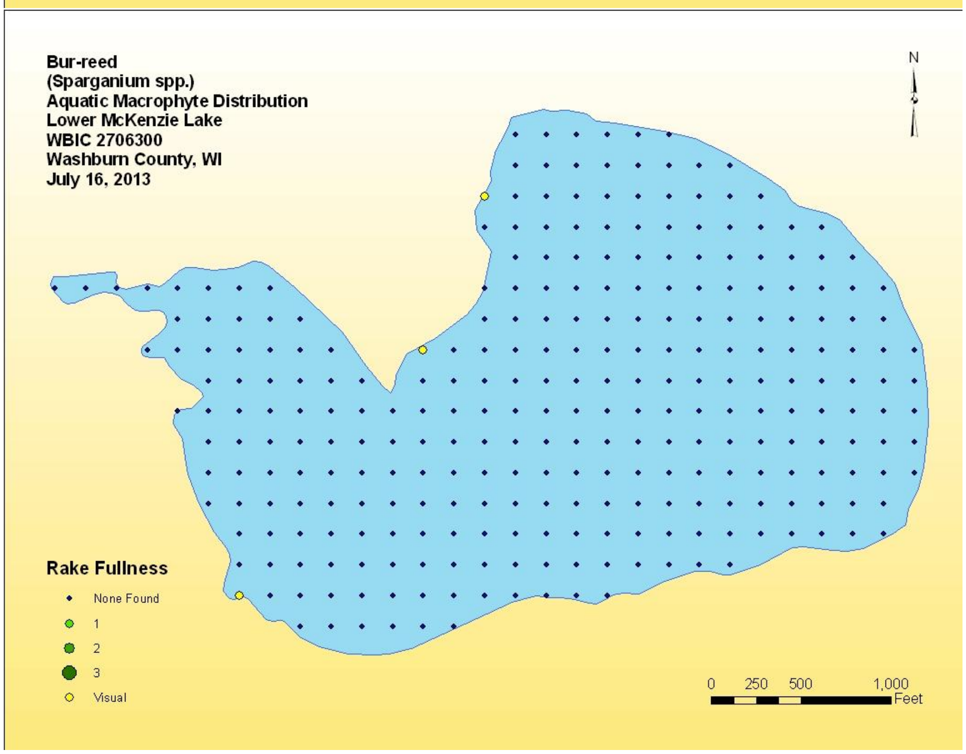


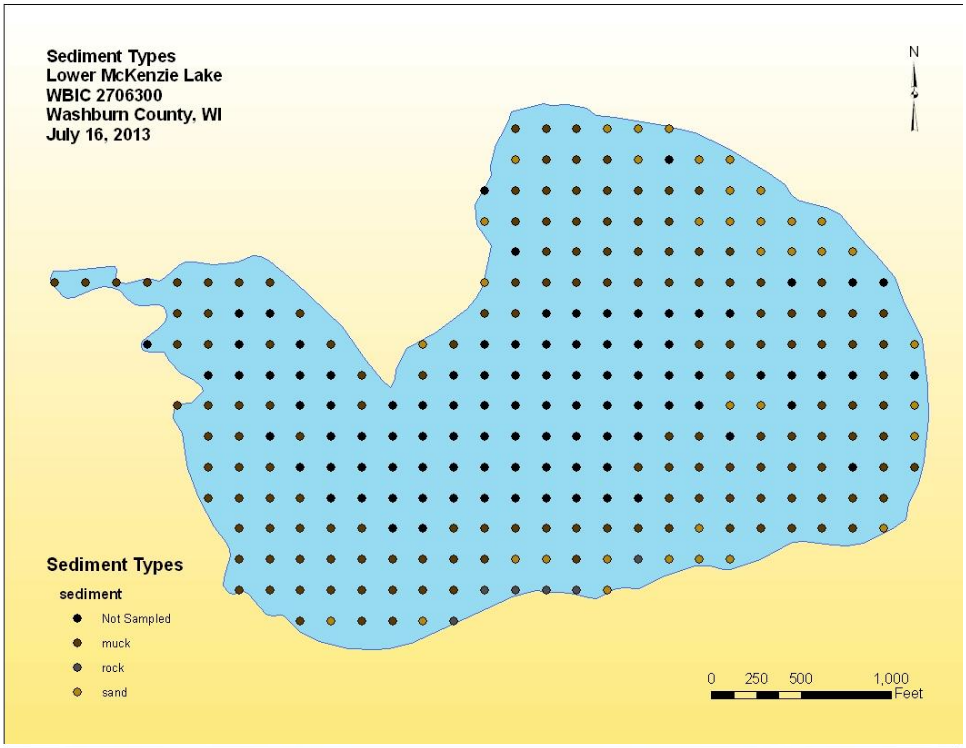
Common Bladderwort
(Utricularia vulgaris)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet

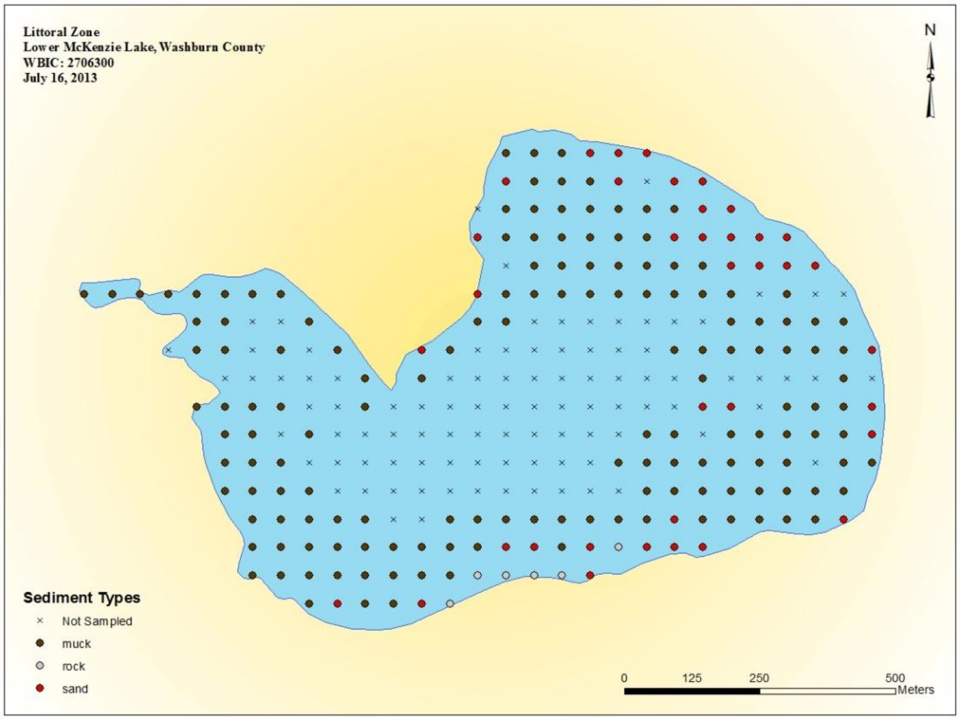

Creeping Bladderwort
(Utricularia gibba)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet

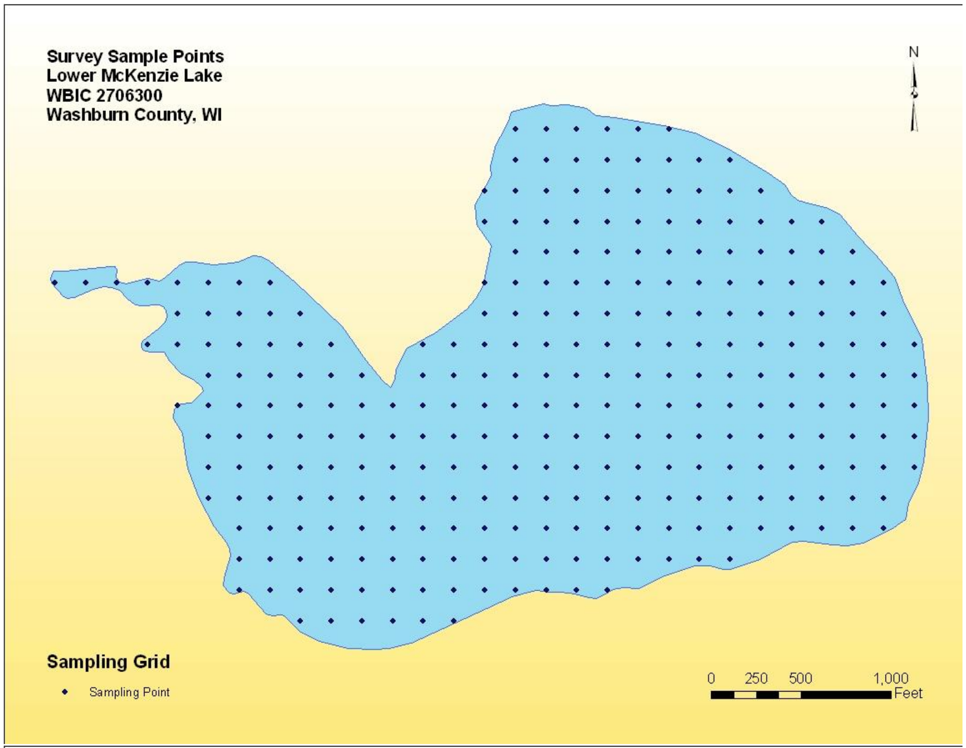

Broad-leaf Cattail
(Typha latifolia)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet

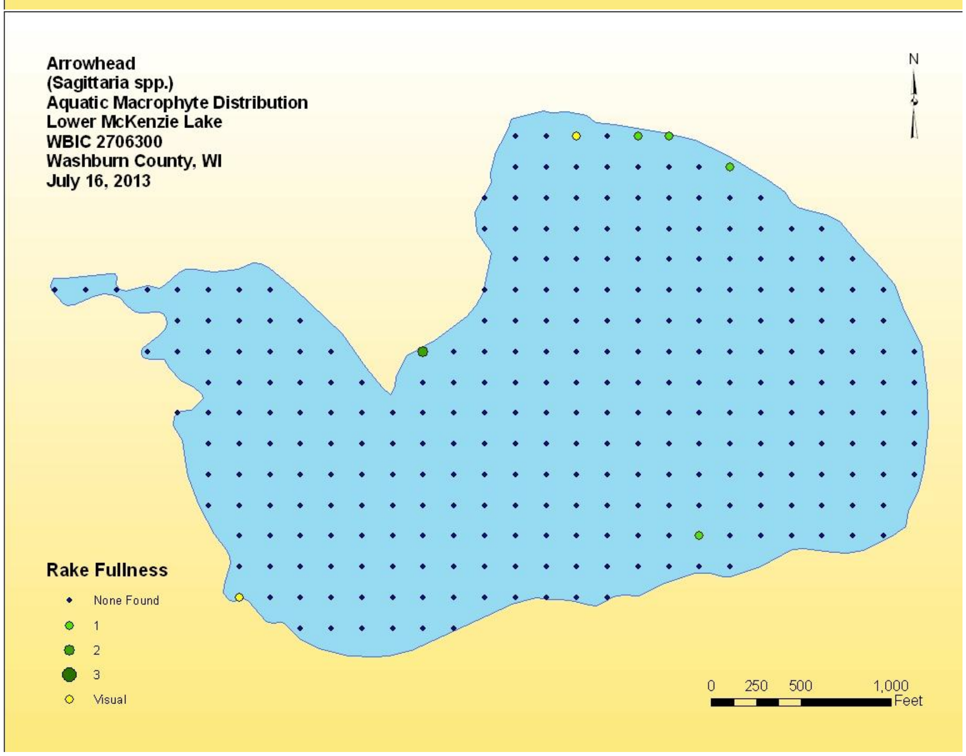

Freshwater Sponge
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0
250
500
1,000
Feet


Bur-reed
(Sparganium spp.)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0
250
500
1,000
Feet


Sediment Types
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Sediment Types
sediment
Not Sampled
muck
rock
sand
0 250 500 1,000
Feet


Littoral Zone
Lower McKenzie Lake, Washburn County
WBIC: 2706300
July 16, 2013
N
Sediment Types
Not Sampled
muck
rock
sand
0 125 250 500
Meters


Survey Sample Points
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
N
Sampling Grid
Sampling Point
0 250 500 1,000
Feet


Arrowhead
(Sagittaria spp.)
Aquatic Macrophyte Distribution
Lower McKenzie Lake
WBIC 2706300
Washburn County, WI
July 16, 2013
N
Rake Fullness
None Found
1
2
3
Visual
0 250 500 1,000
Feet

Appendix B
Critical Habitat Areas

LOWER McKENZIE LAKE SENSITIVE AREA SURVEY REPORT AND MANAGEMENT GUIDELINES

This document is to be used with its companion document "Guidelines for protecting, maintaining, and understanding lake sensitive areas"

Lower McKenzie Lake (Washburn Co.)

Integrated Sensitive Area Survey Report

Date of Survey: 9 September 1999 Number of Sensitive Areas: 3

Site Evaluators: Larry Daman, Fisheries Biologist

Jim Cahow, Water Resources Biologist

Lake Sensitive Area Survey results identified three areas that merit special protection of the aquatic habitat. These areas of aquatic vegetation on Lower McKenzie Lake offer critical or unique fish and wildlife habitat. These habitats provide the necessary seasonal or life stage requirements of the associated fisheries, and the aquatic vegetation offers water quality or erosion control benefits to the body of water.

During this survey there were no documented occurrences of Purple Loosestrife. However, the threat of Purple Loosestrife is always a concern and should be dealt with immediately. Methods for control are to remove the entire plant before it produces seeds or by cutting the flower head and spraying with and approved herbicide. You should contact the Department before any of these methods are implemented.

The reader should consider that any buffer that does not extend back from the waters edge at least 35' is not providing adequate protection for water quality and should be expanded to at least 35'. Local zoning ordinances and lakes classification systems have tried to provide better guidelines pertaining to buffer widths and set backs based on lake type. Landowners are encouraged to go beyond the minimum requirements laid out by zoning and consider extending buffer widths to beyond 35' and integrating other innovative ways to capture and reduce the runoff flowing off from their property while improving critical shoreline habitat. Berms and low head retention areas can greatly increase the effective capture rate from developed portions in addition to that portion captured within the buffer.

Site conditions may dictate that a buffer has to be much wider than 35' to be effective at capturing the sediments and nutrients running off the developed portions of the shoreline. If the shoreline is steeply sloped (>7%slope) greater widths should definitely be used.

No mowing should take place within the buffer area (with the exception of a narrow access trail and small picnic area), and trees and shrubs should not be cut down even when they become old and die; because they provide important woody debris habitat within the buffer zone as well as aquatic habitat when they fall into the lake.

The following is a brief summary of the Lower McKenzie Lake sensitive area sites and the management guidelines. Also, the "Guidelines for Protecting, Maintaining, and Understanding Sensitive Areas" provides management guidelines and considerations for different lake sensitive areas (Attached).

I. Aquatic Plant Sensitive Areas

Sensitive areas A, B and C contain aquatic plant communities, which provide important fish and wildlife habitat as well as important shoreline stabilization functional values. Sensitive areas provide important enough habitat for the Lower McKenzie Lake ecosystem that conservation easements, deed restrictions, or zoning should be used to protect them. Management guidelines for aquatic plant sensitive areas are (unless otherwise specifically stated):

1. Limit aquatic vegetation removal to navigational channels no greater than 25 feet wide where necessary, the narrower the better. These channels should be kept as short in length as possible and it is recommended that people do not completely eliminate aquatic vegetation within the navigation channel; but instead only remove what is necessary to prevent fouling of propellers to provide access to open water areas. Chemical treatments should be discouraged and if a navigational channel must be cleared, pulling by hand is preferable over mechanical harvesters where practical.
2. Prohibit littoral zone alterations covered by Wisconsin Statutes Chapter 30, unless there is clear evidence that such alterations would benefit the lake's ecosystem. Rock riprap permits should not be approved for areas that already have a healthy native plant

community stabilizing the shoreline and property owners should not view riprap as an acceptable alternative in these situations.

3. Leave large woody debris, logs, trees, and stumps, in the littoral zone to provide habitat for fish, wildlife, and other aquatic organisms.
4. Leave an adequate shoreline buffer of un-mowed natural vegetative cover and keep access corridors as narrow as possible (preferable less than 30 feet or 30% of any developed lot which ever is less).
5. Prevent erosion, especially at construction sites. Support the development of effective county erosion control ordinances. The proper use of Best Management Practices (BMP's) will greatly reduce the potential of foreign materials entering the waterway (i.e. silt, nutrients).
6. Strictly enforce zoning ordinances and support development of new zoning regulations where needed.
7. Eliminate nutrient inputs to the lake caused by lawn fertilizers, failing septic systems, and other sources.
8. Control exotic species such as purple loosestrife.

Resource Value of Site A

Sensitive area A consists of approximately 800 feet of shoreline along the northern shore of Lower McKenzie Lake. This area encompasses the mouth of McKenzie Creek. This area provides important habitat for centrarchid (bass and panfish) spawning and nursery areas. This area also provides important habitat for forage species. Wildlife also are reliant upon this area for habitat. Eagles, loons, herons, waterfowl, songbirds, furbearers, turtles, and amphibians benefit from this valuable habitat.

The emergent, floating and submergent plant community structure of Sensitive area A includes: **Emergent**; creeping spike rush (Eleocharis palustris), jewelweed (Impatiens sp.), pickerelweed (Pontederia cordata), water willow (Decon sp.), hardstem bulrush (Scirpus sp.), bur-reed (Sparganium sp.) and narrow leaf cattail (Typha angustifolia). **Floating leafed**; watershield (Brasenia schreberi), spadderdock (Nuphar variegata) and white water lily (Nymphaea odorata). **Submergents;** wild celery (Vallisneria americana), coontail (Ceratophyllum demersum), elodea, water marigold (Megalodonta beckii), northern milfoil (Myriophyllum sibiricum), bushy pondweed (Najas flexilis) large leaf pondweed (Potamogeton amplifolius), white stem pondweed (P. praelongus), clasping leaf pondweed (P. richardsonii), robbin's pondweed (P. robbinsii) and flat stem pondweed (P. zosteriformis).

Chemical treatments and mechanical removal efforts should be limited to navigation channels only.

Resource Value of Site B

Sensitive area B is located along the western shore of Lower McKenzie Lake and covers approximately 3,200 feet of shoreline. This area encompasses the entrance of McKenzie Creek.

This area provides important habitat for centrarchid (bass and panfish) spawning and nursery areas. This area also provides important habitat for forage species. Wildlife also are reliant upon this area for habitat. Eagles, loons, herons, waterfowl, songbirds, furbearers, turtles, and amphibians benefit from this valuable habitat.

The emergent, floating and submergent plant community structure of Sensitive area B includes: **Emergent**; pickerelweed (Pontederia cordata), water willow (Decodon sp.), narrow leaf cattail (Typha angustifolia) and broad leaf cattail (Typha latifolia). **Floating leafed**; watershield (Brasenia schreberi), forked duckweed (Lemna trisulca), spadderdock (Nuphar variegata) and white water lily (Nymphaea odorata). **Submergents;** bladderwort (Utricularia sp.), wild celery (Vallisneria americana), coontail (Ceratophyllum demersum), elodea, water marigold (Megalodonta beckii), northern milfoil (Myriophyllum sibiricum), bushy pondweed (Najas flexilis), stonewort (Nitella sp.), large leaf pondweed (Potamogeton amplifolius), floating leaf pondweed (P. natans), clasping leaf pondweed (P. richardsonii), robbin's pondweed (P. robinsii) and flat stem pondweed (P. zosteriformis).

Chemical treatments and mechanical removal efforts should be limited to navigation channels only.

Resource Value of Site C

Sensitive area C is located along the southeastern shore of Lower McKenzie Lake and covers approximately 1,200 feet of shoreline.

This area provides important habitat for centrarchid (bass and panfish) spawning and nursery areas. This area also provides important habitat for forage species. Wildlife also are reliant upon this area for habitat. Eagles, loons, herons, waterfowl, songbirds, furbearers, turtles, and amphibians benefit from this valuable habitat.

The emergent, floating and submergent plant community structure of Sensitive area C includes: **Emergent**; brown fruited rush (Juncus peleocarpus), pickerelweed (Pontederia cordata), water willow (Decodon sp.), and broad leaf cattail (Typha latifolia). **Floating leafed**; spadderdock (Nuphar variegata) and white water lily (Nymphaea odorata). **Submergents;** buttercup (Ranunculus sp.), wild celery (Vallisneria americana), coontail (Ceratophyllum demersum), elodea, quillwort (Isoetes sp.), water marigold (Megalodonta beckii), northern milfoil (Myriophyllum sibiricum), bushy pondweed (Najas flexilis), large leaf pondweed (Potamogeton amplifolius), variable leaf pondweed (P. gramineus), white stem pondweed (P. praelongus), clasping leaf pondweed (P. richardsonii), robbin's pondweed (P. robinsii) and flat stem pondweed (P. zosteriformis).

Chemical treatments and mechanical removal efforts should be limited to navigation channels only.

Appendix C

AQUATIC PLANT MANAGEMENT STRATEGY

Northern Region WDNR

Summer, 2007

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR

ISSUES

- Protect desirable native aquatic plants.
- Reduce the risk that invasive species replace desirable native aquatic plants.
- Promote "whole lake" management plans
- Limit the number of permits to control native aquatic plants.

BACKGROUND

As a general rule, the Northern Region has historically taken a protective approach to allow removal of native aquatic plants by harvesting or by chemical herbicide treatment. This approach has prevented lakes in the Northern Wisconsin from large-scale loss of native aquatic plants that represent naturally occurring high quality vegetation. Naturally occurring native plants provide a *diversity of habitat* that *helps maintain water quality*, helps *sustain the fishing* quality known for Northern Wisconsin, supports common lakeshore wildlife from loons to frogs, and helps to provide the *aesthetics* that collectively create the "up-north" appeal of the northwoods lake resources.

In Northern Wisconsin lakes, an inventory of aquatic plants may often find 30 different species or more, whereas a similar survey of a Southern Wisconsin lake may often discover less than half that many species. Historically, similar species diversity was present in Southern Wisconsin, but has been lost gradually over time from stresses brought on by cultural land use changes (such as increased development, and intensive agriculture). Another point to note is that while there may be a greater variety of aquatic vegetation in Northern Wisconsin lakes, the vegetation itself is often *less dense*. This is because northern lakes have not suffered as greatly from nutrients and runoff as have many waters in Southern Wisconsin.

The newest threat to native plants in Northern Wisconsin is from invasive species of aquatic plants. The most common include Eurasian Water Milfoil (EWM) and CurlyLeaf Pondweed (CLP). These species are described as *opportunistic invaders*. This means that these "invaders" benefit where an opening occurs from removal of plants, and without competition from other plants 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*. There it may more easily establish itself without the native plants to compete against. This concept is easily observed on land where bared soil is quickly taken over by replacement species (often weeds) that crowd in and establish themselves as new occupants of the site. While not a providing a certain guarantee against invasive plants, protecting and allowing the native plants to remain may reduce the success of an invasive species becoming established on a lake. Once established, the invasive species cause far more inconvenience for all lake users, riparian and others included; 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.

2 To the extent we can maintain the normal growth of native vegetation, Northern Wisconsin lakes can continue to offer the water resource appeal and benefits they've historically provided. A regional position on removal of aquatic plants that carefully recognizes how native aquatic plants benefit lakes in Northern Region can help prevent a gradual decline in the overall quality and recreational benefits that make these lakes attractive to people and still provide abundant fish, wildlife, and northwoods appeal.

GOALS OF STRATEGY:

1. Preserve native species diversity which, in turn, fosters natural habitat for fish and other aquatic species, from frogs to birds.
2. Prevent openings for invasive species to become established in the absence of the native species.
3. Concentrate on a" whole-lake approach" for control of aquatic plants, thereby fostering systematic documentation of conditions and specific targeting of invasive species as they exist.

4. Prohibit removal of wild rice. WDNR – Northern Region will not issue permits to remove wild rice unless a request is subjected to the full consultation process via the Voigt Tribal Task Force. We intend to discourage applications for removal of this ecologically and culturally important native plant.
5. To be consistent with our WDNR Water Division Goals (work reduction/disinvestment), established in 2005, to "not issue permits for chemical or large scale mechanical control of native aquatic plants – develop general permits as appropriate or inform applicants of exempted activities." This process is similar to work done in other WDNR Regions, although not formalized as such.

<u>BASIS OF STRATEGY IN STATE STATUTE AND ADMINISTRATIVE CODE</u>

State Statute 23.24 (2)(c) states:

"The requirements promulgated under par. (a) 4. may specify any of the following:

1. The **quantity** of aquatic plants that may be managed under an aquatic plant management permit.
2. The **species** of aquatic plants that may be managed under an aquatic plant management permit.
3. The **areas** in which aquatic plants may be managed under an aquatic plant management permit.
4. The **methods** that may be used to manage aquatic plants under an aquatic plant management permit.
5. The **times** during which aquatic plants may be managed under an aquatic plant management permit.
6. The **allowable methods** for disposing or using aquatic plants that are removed or controlled under an aquatic plant management permit.
7. The requirements for plans that the department may require under sub. (3) (b). "

State Statute 23.24(3)(b) states:

"The department may require that an application for an aquatic plant management permit contain a plan for the department's approval as to how the aquatic plants will be introduced, removed, or controlled."

Wisconsin Administrative Code NR 109.04(3)(a) states:

"The department may require that an application for an aquatic plant management permit contain an aquatic plant management plan that describes how the aquatic plants will be introduced, controlled, removed or disposed. Requirements for an aquatic plant management plan shall be made in writing stating the reason for the plan requirement. In deciding whether to require a plan, the department shall consider the potential for effects on protection and development of diverse and stable communities of native aquatic plants, for conflict with goals of other written ecological or lake management plans, for cumulative impacts and effect on the ecological values in the body of water, and the long-term sustainability of beneficial water use activities."

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR
APPROACH

1. After January 1, 2009* no individual permits for control of native aquatic plants will be issued. Treatment of native species may be allowed under the auspices of an approved lake management plan, and only if the plan clearly documents "impairment of navigation" and/or "nuisance conditions". Until January 1, 2009, individual permits will be issued to previous permit holders, only with adequate documentation of "impairment of navigation" and/or "nuisance conditions". No new individual permits will be issued during the interim.

2. Control of aquatic plants (if allowed) in documented sensitive areas will follow the conditions specified in the report.

3. Invasive species must be controlled under an approved lake management plan, with two exceptions (these exceptions are designed to allow sufficient time for lake associations to form and subsequently submit an approved lake management plan):

a. Newly-discovered infestations. If found on a lake with an approved lake management plan, the invasive species can be controlled via an amendment to the approved plan. If found on a lake without an approved management plan, the invasive species can be controlled under the WDNR's Rapid Response protocol (see definition), and the lake owners will be encouraged to form a lake association and subsequently submit a lake management plan for WNDR review and approval.

b. Individuals holding past permits for control of *invasive* aquatic plants and/or "mixed stands" of native and invasive species will be allowed to treat via individual permit until January 1, 2009 if "impairment of navigation" and/or "nuisance conditions" is adequately documented, unless there is an approved lake management plan for the lake in question.

4. Control of invasive species or "mixed stands" of invasive and native plants will follow current best management practices approved by the Department and contain an explanation of the strategy to be used. Established stands of invasive plants will generally use a control strategy based on Spring treatment. (typically, a water temperature of less than 60 degrees Fahrenheit, or approximately May 31st, annually).

5. Manual removal (see attached definition) is allowed (Admin. Code NR 109.06).

** Exceptions to the Jan. 1, 2009 deadline will be considered only on a very limited basis and will be intended to address unique situations that do not fall within the intent of this approach.*

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR
DOCUMENTATION OF IMPAIRED NAVIGATION AND/OR NUISANCE CONDITIONS

Navigation channels can be of two types:

- Common use navigation channel. This is a common navigation route for the general lake user. It often is off shore and connects areas that boaters commonly would navigate to or across, and should be of public benefit.

- Individual riparian access lane. This is an access lane to shore that normally is used by an individual riparian shore owner.

  Severe impairment or nuisance will generally mean vegetation grows thickly and forms mats on the water surface. Before issuance of a permit to use a regulated control method, a riparian will be asked to document the problem and show what efforts or adaptations have been made to use the site. (This is currently required in NR 107 and on the application form, but the following helps provide a specific description of what impairments exist from native plants).

Documentation of *impairment of navigation* by native plants must include:

a. Specific locations of navigation routes (preferably with GPS coordinates)
b. Specific dimensions in length, width, and depth
c. Specific times when plants cause the problem and how long the problem persists
d. Adaptations or alternatives that have been considered by the lake shore user to avoid or lessen the problem
e. The species of plant or plants creating the nuisance (documented with samples or a from a Site inspection)

Documentation of the *nuisance* must include:

a. Specific periods of time when plants cause the problem, e.g. when does the problem start and when does it go away.
b. Photos of the nuisance are encouraged to help show what uses are limited and to show the severity of the problem.
c. Examples of specific activities that would normally be done where native plants occur naturally on a site but cannot occur because native plants have become a nuisance.

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR

DEFINITIONS

- Manual removal: Removal by hand or hand-held devices without the use or aid of external or auxiliary power. Manual removal cannot exceed 30 ft. in width and can only be done where the shore is being used for a dock or swim raft. The 30 ft. wide removal zone cannot be moved, relocated, or expanded with the intent to gradually increase the area of plants removed. Wild rice may not be removed under this waiver.
- Native aquatic plants: Aquatic plants that are indigenous to the waters of this state.
- Invasive aquatic plants: Non-indigenous species whose introduction causes or is likely to cause economic or environmental harm or harm to human health.
- Sensitive area: Defined under s. NR 107.05(3)(i) (sensitive areas are areas of aquatic vegetation identified by the department as offering critical or unique fish and wildlife habitat, including seasonal or lifestage requirements, or offering water quality or erosion control benefits to the body of water).
- Rapid Response protocol: This is an internal WDNR document designed to provide guidance for grants awarded under NR 198.30 (Early Detection and Rapid Response Projects). These projects are intended to control pioneer infestations of aquatic invasive species before they become established.

Appendix D: Management Options

Management Options for Aquatic Plants

Updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
No management	N	Do not actively manage plants	Minimizing disturbance can protect native species that provide habitat for aquatic fauna, reduce shoreline erosion, may improve water clarity, and may limit spread of invasive species	May allow small population of invasive plants to become larger, more difficult to control later
			No financial cost	Excessive plant growth can hamper navigation and recreational lake use
			No system disturbance	May require modification of lake users' behavior and perception
			No unintended effects of chemicals	
			Permit not required	
Mechanical Control	May be required under NR 109	Plants reduced by mechanical means	Flexible control	Must be repeated, often more than once per season
		Wide range of techniques, from manual to highly mechanized	Can balance habitat and recreational needs	Can suspend sediments and increase turbidity and nutrient release
a. Handpulling/Manual raking	Y/N	SCUBA divers or snorkelers remove plants by hand or plants are removed with a rake	Little to no damage done to lake or to native plant species	Very labor intensive
		Works best in soft sediments	Can be highly selective	Needs to be carefully monitored
			Can be done by shoreline property owners without permits within an area <30 ft wide OR where selectively removing exotics	Roots, runners, and even fragments of some species, particularly Eurasian watermilfoil (EWM) will start new plants, so all of plant must be removed
			Can be very effective at removing problem plants, particularly following early detection of an invasive exotic species	Small-scale control only

Management Options for Aquatic Plants

Updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
b. Harvesting	Y	Plants are "mowed" at depths of 2-5 ft, collected with a conveyor and off-loaded onto shore	Immediate results	Not selective in species removed
		Harvest invasives only if invasive is already present throughout the lake	EWM removed before it has the opportunity to autofragment, which may create more fragments than created by harvesting	Fragments of vegetation can re-root
			Usually minimal impact to lake ecology	Can remove some small fish and reptiles from lake
			Harvested lanes through dense weed beds can increase growth and survival of some fish	Initial cost of harvester expensive
			Can remove some nutrients from lake	
Biological Control	Y	Living organisms (e.g. insects or fungi) eat or infect plants	Self-sustaining; organism will over-winter, resume eating its host the next year	Effectiveness will vary as control agent's population fluctates
			Lowers density of problem plant to allow growth of natives	Provides moderate control - complete control unlikely
				Control response may be slow
				Must have enough control agent to be effective
a. Weevils on EWM	Y	Native weevil prefers EWM to other native water-milfoil	Native to Wisconsin: weevil cannot "escape" and become a problem	Need to stock large numbers, even if some already present
			Selective control of target species	Need good habitat for overwintering on shore (leaf litter) associated with undeveloped shorelines
			Longer-term control with limited management	Bluegill populations decrease densities through predation

Management Options for Aquatic Plants

Updated Oct 2006

	Option	Permit Needed?	How it Works	PROS	CONS
b.	Pathogens	Y	Fungal, bacterial, or viral pathogen introduced to target species to induce mortalitiy	May be species specific	Largely experimental; effectiveness and longevity unknown
				May provide long-term control	Possible side effects not understood
				Few dangers to humans or animals	
c.	Allelopathy	Y	Aquatic plants release chemical compounds that inhibit other plants from growing	May provide long-term, maintenance-free control	Initial transplanting slow and labor-intensive
				Spikerushes (*Eleocharis* spp.) appear to inhibit Eurasian watermilfoil growth	Spikerushes native to WI, and have not effectively limited EWM growth
					Wave action along shore makes it difficult to establish plants; plants will not grow in deep or turbid water
d.	Native plantings	Y	Diverse native plant community established to compete with invasive species	Native plants provide food and habitat for aquatic fauna	Initial transplanting slow and labor-intensive
				Diverse native community more repellant to invasive species	Nuisance invasive plants may outcompete plantings
					Transplants from another lake or nursery may unintentionally introduce invasive species
					Largely experimental; few well-documented cases

Management Options for Aquatic Plants

Updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
Physical Control	Required under Ch. 30 / NR 107	Plants are reduced by altering variables that affect growth, such as water depth or light levels		
a. Fabrics/ Bottom Barriers	Y	Prevents light from getting to lake bottom	Reduces turbidity in soft-substrate areas	Eliminates all plants, including native plants important for a healthy lake ecosystem
			Useful for small areas	May inhibit spawning by some fish
				Need maintenance or will become covered in sediment and ineffective
				Gas accumulation under blankets can cause them to dislodge from the bottom
				Affects benthic invertebrates
				Anaerobic environment forms that can release excessive nutrients from sediment
b. Drawdown	Y, May require Environmental Assessment	Lake water lowered with siphon or water level control device; plants killed when sediment dries, compacts or freezes	Winter drawdown can be effective at restoration, provided drying and freezing occur. Sediment compaction is possible over winter	Plants with large seed bank or propagules that survive drawdown may become more abundant upon refilling
		Season or duration of drawdown can change effects	Summer drawdown can restore large portions of shoreline and shallow areas as well as provide sediment compaction	May impact attached wetlands and shallow wells near shore
			Emergent plant species often rebound near shore providing fish and wildlife habitat, sediment stabilization, and increased water quality	Species growing in deep water (e.g. EWM) that survive may increase, particularly if desirable native species are reduced
			Success demonstrated for reducing EWM, variable success for curly-leaf pondweed (CLP)	Can affect fish, particularly in shallow lakes if oxygen levels drop or if water levels are not restored before spring spawning
			Restores natural water fluctuation important for all aquatic ecosystems	Winter drawdawn must start in early fall or will kill hibernating reptiles and amphibians
				Navigation and use of lake is limited during drawdown

Management Options for Aquatic Plants

Updated Oct 2006

	Option	Permit Needed?	How it Works	PROS	CONS
c.	Dredging	Y	Plants are removed along with sediment	Increases water depth	Severe impact on lake ecosystem
			Most effective when soft sediments overlay harder substrate	Removes nutrient rich sediments	Increases turbidity and releases nutrients
			For extremely impacted systems	Removes soft bottom sediments that may have high oxygen demand	Exposed sediments may be recolonized by invasive species
			Extensive planning required		Sediment testing may be necessary
					Removes benthic organisms
					Dredged materials must be disposed of
d.	Dyes	Y	Colors water, reducing light and reducing plant and algal growth	Impairs plant growth without increasing turbidity	Appropriate for very small water bodies
				Usually non-toxic, degrades naturally over a few weeks.	Should not be used in pond or lake with outflow
					Impairs aesthetics
					Effects to microscopic organisms unknown
e.	Non-point source nutrient control	N	Runoff of nutrients from the watershed are reduced (e.g. by controlling construction erosion or reducing fertilizer use) thereby providing fewer nutrients available for plant growth	Attempts to correct source of problem, not treat symptoms	Results can take years to be evident due to internal recycling of already-present lake nutrients
				Could improve water clarity and reduce occurrences of algal blooms	Requires landowner cooperation and regulation
				Native plants may be able to better compete with invasive species in low-nutrient conditions	Improved water clarity may increase plant growth

Management Options for Aquatic Plants

Updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
Chemical Control	Required under NR 107	Granules or liquid chemicals kill plants or cease plant growth; some chemicals used primarily for algae	Some flexibility for different situations	Possible toxicity to aquatic animals or humans, especially applicators
		Results usually within 10 days of treatment, but repeat treatments usually needed	Some can be selective if applied correctly	Often affect desirable plant species that are important to lake ecology and compete with invasive species
		Chemicals must be used in accordance with label guidelines and restrictions	Can be used for restoration activities	Treatment set-back requirements from potable water sources and/or drinking water use restrictions after application, usually based on concentration
				May cause severe drop in dissolved oxygen causing fish kill, depends on plant biomass killed, temperatures and lake size and shape
				Often controversial
a. 2,4-D (e.g. Weedar, Navigate)	Y	Systemic[1] herbicide selective to broadleaf[2] plants that inhibits cell division in new tissue	Moderately to highly effective, especially on EWM	May cause oxygen depletion after plants die and decompose
		Applied as liquid or granules during early growth phase	Monocots, such as pondweeds (e.g. CLP) and many other native species not affected.	May affect native dicots such as water lilies and coontail
			Can be used in synergy with endothall for early season CLP and EWM treatments	Cannot be used in combination with copper herbicides (used for algae)
			Can be selective depending on concentration and seasonal timing	Toxic to fish
			Widely used aquatic herbicide	

Management Options for Aquatic Plants

Updated Oct 2006

	Option	Permit Needed?	How it Works	PROS	CONS
b.	Endothall (e.g. Aquathol)	Y	Broad-spectrum[3], contact[4] herbicide that inhibits protein synthesis	Especially effective on CLP and also effective on EWM	Affects many native pondweeds
			Applied as liquid or granules	May be effective in reducing reestablishment of CLP if reapplied several years in a row in early spring	Not as effective in dense plant beds; heavy vegetation requires multiple treatments
				Can be selective depending on concentration and seasonal timing	Not to be used in water supplies; post-treatment restriction on irrigation
				Can be combined with 2,4-D for early season CLP and EWM treatments, or with copper compounds	Toxic to aquatic fauna (to varying degrees)
				Limited off-site drift	
c.	Diquat (e.g. Reward)	Y	Broad-spectrum, contact herbicide that disrupts cellular functioning	Mostly used for water-milfoil and duckweed	May affect non-target plants, especially native pondweeds, coontail, elodea, naiads
			Applied as liquid, can be combined with copper treatment	Rapid action	Toxic to aquatic invertebrates
				Limited direct toxicity on fish and other animals	Must be reapplied several years in a row
					Ineffective in muddy or cold water (<50°F)

Management Options for Aquatic Plants

Updated Oct 2006

	Option	Permit Needed?	How it Works	PROS	CONS
d.	Fluridone (e.g. Sonar or Avast)	Y; special permit and Environmental Assessment may be required	Broad-spectrum, systemic herbicide that inhibits photosynthesis	Effective on EWM for 1 to 4 years with aggressive follow-up treatments	Affects native milfoils, coontails, elodea, and naiads, even at low concentrations
			Must be applied during early growth stage	Some reduction in non-target effects can be achieved by lowering dosage	Requires long contact time: 60-90 days
			Available with a special permit only; chemical applications beyond 150 ft from shore not allowed under NR 107	Slow decomposition of plants may limit decreases in dissolved oxygen	Often decreases water clarity, particularly in shallow eutrophic systems
			Applied at very low concentration at whole lake scale	Low toxicity to aquatic animals	Demonstrated herbicide resistance in hydrilla subjected to repeat treatments
					Unknown effect of repeat whole-lake treatments on lake ecology
e.	Glyphosate (e.g. Rodeo)	Y	Broad-spectrum, systemic herbicide that disrupts enzyme formation and function	Effective on floating and emergent plants	RoundUp is often illegally substituted for Rodeo; surfactants in RoundUp believed to be toxic to reptiles and amphibians
			Usually used for purple loosestrife stems or cattails	Selective if carefully applied to individual plants	Cannot be used near potable water intakes
			Applied as liquid spray or painted on loosestrife stems	Non-toxic to most aquatic animals at recommended dosages	Ineffective in muddy water
				Effective control for 1-5 years	No control of submerged plants

Management Options for Aquatic Plants

Updated Oct 2006

Option	Permit Needed?	How it Works	PROS	CONS
f. Triclopyr (e.g. Renovate)	Y	Systemic herbicide selective to broadleaf plants that disrupts enzyme function	Effective on many emergent and floating plants	Impacts may occur to some native plants at higher doses (e.g. coontail)
		Applied as liquid spray or liquid	Most effective on dicots, such as purple loosestrife; may be more effective than glyphosate	May be toxic to sensitive invertebrates at higher concentrations
			Control of target plants occurs in 3-5 weeks	Retreatment opportunities may be limited due to maximum seasonal rate (2.5 ppm)
			Low toxicity to aquatic animals	Sensitive to UV light; sunlight can break herbicide down prematurely
			No recreational use restrictions following treatment	Relatively new management option for aquatic plants (since 2003)
g. Copper compounds (e.g. Cutrine Plus)	Y	Broad-spectrum, systemic herbicide that prevents photosynthesis	Reduces algal growth and increases water clarity	Elemental copper accumulates and persists in sediments
		Used to control planktonic and filamentous algae	No recreational or agricultural restrictions on water use following treatment	Short-term results
		Wisconsin allows small-scale control only	Herbicidal action on hydrilla, an invasive plant not yet present in Wisconsin	Long-term effects of repeat treatments to benthic organisms unknown
				Toxic to invertebrates, trout and other fish, depending on the hardness of the water
				Clear water may increase plant growth

[1]Systemic herbicide - Must be absorbed by the plant and moved to the site of action. Often slower-acting than contact herbicides.
[2]Broadleaf herbicide - Affects only dicots, one of two groups of plants. Aquatic dicots include waterlilies, bladderworts, watermilfoils, and coontails.
[3]Broad-spectrum herbicide - Affects both monocots and dicots.
[4]Contact herbicide - Unable to move within the plant; kills only plant tissue it contacts directly.

This document is intended to be a guide to available aquatic plant control techniques, and is not necessarily an exhaustive list.
References to registered products are for your convenience and not intended as an endorsement or criticism of that product versus other similar products.
Specific effects of herbicide treatment contingent on usage within label guidelines and in accordance with all applicable laws.
Please contact your local Aquatic Plant Management Specialist when considering a permit.

Appendix E

Rapid Response for Early Detection of Eurasian Water Milfoil

The Lower McKenzie Lake community will be directed to contact the EWM identification (ID) leads (Lisa Kiener-Barnett and Teri deClairville on Lower McKenzie) or the Burnett County AIS Coordinator if they see a plant in the lakes they suspect might be Eurasian water milfoil (EWM). Signs at the public boat landings, web pages, and newsletter articles will provide contact information and instructions.

If plant is likely EWM, the AIS ID lead will confirm identification with Burnett County LWCD and the WDNR and inform the rest of the McKenzie Lake Association Board (MLA). Two entire intact rooted adult specimens of the suspect plants will be collected and bagged and delivered to the WDNR. WDNR may confirm identification with the herbarium at the University of Wisconsin – Stevens Point or the University of Wisconsin – Madison.

Mark the location of suspected EWM (AIS ID Lead). Use GPS points, if available, or mark the location with a small float.

If the suspect plants are determined to be EWM, the location of EWM will be marked with a more permanent marker. Special EWM buoys are available. (AIS ID Lead).

If identification is positive, inform the board, Burnett County LWCD, herbicide applicator, the person who reported the EWM, lake management consultant, any other involved parties and all lake residents. (AIS ID Lead).

If identification is positive, post a notice at the public landing and include a notice in the next newsletter. (DNR has these signs available.) Notices will inform residents and visitors of the approximate location of EWM and provide appropriate means to avoid spread. (MLA board)

Contact Burnett County LWCD to seek assistance in EWM control efforts. The county has a rapid response plan in place that includes assisting lakes where EWM is discovered. Request that the county determine the extent of the EWM introduction and conduct initial removal efforts. If unavailable to assist within two weeks, proceed to step 9.

Hire a consultant to determine the extent of the EWM introduction. A diver may be used. If small amounts of EWM 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.

Select a control plan in cooperation with Burnett County AIS Coordinator and WDNR (MLA board of directors). 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.

The goal of the control plan will be eradication of the EWM.

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.

MLA funds may be used to pay for any reasonable expense incurred in implementing the selected control plan, and implementation will not be delayed by waiting for WDNR to approve or fund a grant application.

The President of the MLA 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 MLA shall formally apply for the grant.

MLA board has the responsibility to raise funds to match the grant. The MLA may develop a rapid response contingency fund with special donations.

Frequently inspect the area of the EWM to determine the effectiveness of the treatment and whether additional treatment is necessary.

Contract for professional monitoring to supplement volunteer monitoring in years following EWM discovery.

EXHIBIT A[1]

McKenzie Lake Association

President	Lisa Kiener-Barnett – 715-635-2355
EWM ID Lead	Teri deClairville – 612-961-9824

Burnett County Land and Water Conservation Department – 715-349-2186

Brad Morris, AIS Coordinator

Dave Ferris, County Conservationist

WISCONSIN DEPARTMENT OF NATURAL RESOURCES

Grants	Pamela Toshner: 715-635-4073
Permits	Mark Sundeen: 715-635-4074
EWM Notice	Kathy Bartilson: 715-635-4053

LAKE MANAGEMENT CONSULTANT

Burnett County Land and Water Conservation Department:

Brad Morris and Dave Ferris: 715-349-2186

DIVERS

Endangered Resource Services	Matt Berg: 715-483-2847

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

Appendix F

Lower McKenzie Lake Survey Results

LOWER MCKENZIE LAKE USER SURVEY

SECTION 1 – Residency
These first few questions will help to determine who is responding to this survey and how those people would like to use Lower McKenzie Lake. If you have more than one property on the lake, please comment on the one property that you have had the longest.

1. What type of property do you have on Lower McKenzie Lake? If you have more than one type of property, please report on only the property you have had the longest. *(please select one)*

3	Permanent Residence		Business
10	Seasonal Residence		undeveloped land
14	Weekend visits	1	other

2. How long have you owned your property on Lower McKenzie Lake? *(If less than 1 year, please write '1' in the space provided. If you own multiple properties, please comment on the one you have owned for the longest period of time.)*

Years owned	
0-10	9
11-20	4
21-30	9
31-40	2
41-50	3
>50	1

3. During a 12-month period (Jan. 1 – Dec. 31) how many days are you, members of your family, or guests at the property indicated in Question 1? *(please provide your best estimate in the space below)*

There are people at the property approximately 104 (average) days a year.

4. On average, about how many people are at the property each time it is being used?
3.5
SECTION 2 – Lake Use
The purpose of this section is to gather information on how Lower McKenzie Lake is used by its residents.
1. From the list below, check all activities on Lower McKenzie Lake that you, your family, or guests participate in.

25	A. fishing from the shore	26	G. viewing wildlife	22	M. canoe/kayak/paddle boat
23	B. fishing from a boat	5	H. speed boating	1	N. other (please list)____________
12	C. pontoon boating	3	I. jet skiing		O. I do not use the lake ☐ Skip to Section 3
25	D. rest/relaxation	0	J. wild rice harvest		
26	E. swimming/wading	1	K. sailing		
12	F. ice fishing	12	L. water skiing/tubing		

2. Which 3 activities from the above list do you or members of your family or guests participate in most often? *(write the letters of the corresponding activities in the spaces below)*

I (We) participate in B most often, E second most often, and D & G third most often.

3. During the open-water (no ice) season, how frequently do you use the lake for the activities listed in Question 1, this section?

5	daily	11	once or twice per month
10	several times per week	0	once or twice per open-water season
1	3 or 4 times per month		

4. What type(s) of watercraft do you own, rent, or use on Lower McKenzie Lake? *(Check all that apply. If you do not use any watercraft on Lower McKenzie Lake, please check the last box.)*

14	motorized boat (0-50hp)	21	canoe or kayak
11	motorized boat (greater than 50hp)	1	sailboat
10	paddle boat	0	other (please specify) ________________________
11	pontoon boat	1	I do not own, rent, or use a boat or other
3	personal watercraft – PWC (jet-ski)	0	watercraft on Lower McKenzie Lake

SECTION 3 – Lake Stewardship

This section of the survey will provide information about the lake stewardship practices of lake property owners and renters.

1. Which of the following do you consider the most desirable shoreline for your property? *(please check one)*

4	mowed/manicured lawn to shoreline	9	managed natural vegetation along shoreline
4	mowed lawn with landscaped shoreline	3	unmanaged natural vegetation along shoreline
6	mowed lawn to sand beach	0	other *(please describe)* ________________________

2. Which of the following water quality/landscaping practices are you familiar with? (*check all that apply)*

8	rain garden	9	natural shoreline restoration

9	shoreline buffers	8	septic system upgrade
8	native prairie restoration	7	runoff reduction practices
23	not fertilizing	10	native flower/tree planting
12	using zero phosphorus fertilizers	0	other *(please describe)* ___________________
6	diversion of surface water runoff away from the lake		
2	not familiar with any of these		

3. Which, if any, of the following water quality/landscaping practices have you have installed or that you follow on your property on Lower McKenzie Lake? (*check all that apply)*

0	rain garden	2	natural shoreline restoration
6	shoreline buffers	3	septic system upgrade
1	native prairie restoration	0	runoff reduction practices
20	not fertilizing	5	native flower/tree planting
10	using zero phosphorus fertilizers	0	other *(please describe)* ___________________
1	diversion of surface water runoff away from the lake	0	I have not installed any of the above water quality/landscaping practices.
5	not familiar with any of these		

4. Which, if any, of the following outcomes do you consider a motivator to install a water quality/landscaping practice on your property? *(check all that apply)*

17	increasing the natural beauty of your property
20	improving the water quality of Lower McKenzie Lake
17	improving the water quality around your property's shoreline
18	providing better habitat for fish
18	providing better habitat for birds and wildlife
6	setting an example for other lake residents
10	less lawn mowing time
9	a property tax rebate
10	financial assistance that pays a portion of the cost/installation
8	technical assistance that would evaluate my property for water quality concerns
8	technical assistance that would identify appropriate practices to install
0	other *(please describe)* ____
4	I have no interest in installing a water quality/landscaping practice on my property

5. What type of septic system do you have on your property? *(select all that apply)*

0	mound system	7	holding tank	3	other *(please list)* /cess pool
1	at-grade system	0	lift pump system		
14	conventional system	1	none *(skip to Section 4)*		

6. How many years ago was your septic system last inspected? *(please provide your best recall)*

17	1-5 years
3	6-10 years
0	11+ years
1	Never
4	Not Sure

7. When was your septic system last ‘pumped’ or ‘sewered’? *(please provide your best recall)*

22	1-5 years
1	6-10 years
0	11+ years
0	Never
1	Not Sure

SECTION 4 – Lake Issues

The questions in this section pertain to various issues in Lower McKenzie Lake including water quality, lake level, and aquatic plant growth.

1. Below are numerous issues that may negatively affect your use of Lower McKenzie Lake. From the list below, please mark all of the issues that are of concern to you.

14	A. poor quality fishing	2	M. not enough wild rice
4	B. too much public use	19	N. introduction of undesirable aquatic
1	C. not enough weed growth		
6	D. poorly maintained boat access	5	O. nuisance wildlife (please specify) / Geese and Muskrats
6	E. low water level in the lake	3	P. other (please specify) / Noise & Swimmer's itch
5	F. foul or offensive odor	0	Q. not concerned about any of these issues
21	G. too much weed growth		
4	H. overdevelopment of the shoreline		
6	I. “icky” or “green” water		
2	J. too much shoreline lighting		
0	K. high water level in the lake		
0	L. too much wild rice		

2. Which three issues from the above list are of the most concern to you? *(write the letters of the corresponding issues in the spaces below)*

I am most concerned about issues G , N , and A .

3. In this survey, clean and clear water is considered *good* water quality while green (algae) water is considered *poor* water quality. In your opinion, the water quality in the summer (June – September) in Lower McKenzie Lake is:

Excellent	good	fair	poor	very poor	I don't know
7	16	3	1	0	1

4. Please check the answer that best completes the following sentence: “In my opinion, the overall level of the lake, given fluctuation with rainfall, seems to be ….”

too high	just right	too low	I don't know
0	19	7	3

5. Has low water ever prevented you from using Lower McKenzie Lake?

yes	no	I don't use the lake
3	24	21

6. Aquatic plants (rooted and floating) are an important part of any healthy lake system. In the time that you have owned/rented the property indicated in Section 1, Question 1, would you say the amount of visible aquatic plant growth in the lake, excluding algae, has:

increased	stayed the same	decreased	unsure
5	0	0	2

7. Aquatic plant growth varies throughout the open water season. Which month(s) of the season do you consider aquatic plant growth, excluding algae, to be problematic in Lower McKenzie Lake? *(check all that apply)*

May	June	July	August	September	October	never a problem	I don't know
1	7	17	21	15	6	0	0

SECTION 5 – Aquatic Invasive Species in Lower McKenzie Lake
This section of the survey seeks to determine how much lake residents know about aquatic invasive species. Aquatic invasive species are plants and animals that are foreign to Lower McKenzie Lake and do not belong there.

Curly-leaf pondweed (CLP)
Curly-leaf pondweed has not been documented in Lower McKenzie Lake but could be a threat in the future. CLP can create nuisance levels of plant growth and negatively impact water quality in a lake.

1. How much do you know about CLP and the problems it can cause in a lake?

a lot	some	very little	Just what I have read here
2	6	12	8

2. Do you think you would recognize CLP in the lake if you saw it?

definitely yes	probably yes	unsure	probably not	definitely not
0	6	7	7	8

Eurasian Watermilfoil (EWM)
Eurasian watermilfoil has not been documented in Lower McKenzie Lake but could be a threat in the future. EWM can form dense beds of vegetation that interfere with many lake uses.

3. How much do you know about EWM and the problems it can cause in a lake?

a lot	some	very little	Just what I have read here
4	13	6	5

4. Do you think you would recognize EWM in the lake if you saw it?

definitely yes	probably yes	unsure	probably not	definitely not
0	12	6	6	4

Purple Loosestrife

Purple loosestrife, an invasive shoreline/wetland plant species, has not been documented in Lower McKenzie Lake but could be a threat in the future. Purple loosestrife can take over shorelines and wetlands displacing more beneficial native plants.

5. How much do you know about purple loosestrife and the problems it can cause in a lake?

a lot	some	very little	Just what I have read here
3	13	4	8

6. Do you think you would recognize purple loosestrife in the lake if you saw it?

definitely yes	probably yes	unsure	probably not	definitely not
0	11	6	6	5

Other Aquatic Invasive Species

7. Below is a list of additional aquatic invasive species. Please check all of those that you have heard of before.

zebra mussels	Chinese Mystery snail	New Zealand mudsnail	Japanese knotweed	Rusty crayfish	Banded mystery snail	Freshwater jellyfish	carp	Spiny waterflea	Hydrilla	Phragmites	I ha hea of t
28	1	1	0	4	1	3	25	4	3	2	0

8. In order to gauge potential interest, would you be willing to take part in a training session to help you identify aquatic invasive species in the lake?

definitely yes	probably yes	unsure	probably not	definitely not
6	10	7	4	1

SECTION 6 – Aquatic Plant Management

Currently aquatic plant growth in Lower McKenzie Lake is not managed. Algae growth is also not managed. A benefit of aquatic plant management strategies is that they can help reduce algae growth. Aquatic plants in a lake can be managed in many different ways. Sometimes no aquatic plant management may be the best option.

1. Do you think that management of aquatic plants in Lower McKenzie Lake is necessary?

definitely yes	probably yes	unsure	probably not	definitely not
9	11	5	2	0

2. Which type(s) of aquatic plants do you think should be managed on Lower McKenzie Lake? *(check all that apply)*

grow below the water's surface	stick out of the water	float on the surface of the water	grow on the shoreline, out of the water	other	comments
18	18	18	8	2	Only invasives and all too much

Common Aquatic Plant Management Methods
If plant management is recommended for Lower McKenzie Lake, what methods might you support? Please assume that the following management methods are safe and legal, and would only be performed by professionals and only be used if approved by the State of Wisconsin. Total removal or eradication of aquatic plants is not possible.

3. Please mark whether you would support, oppose, or need more information about the use of these aquatic plant management methods on Lower McKenzie Lake.

Small-scale (less than 10 acres) mechanical harvesting:

Support	Oppose	Need more info
12	3	10

Large-scale (10 acres or greater) mechanical harvesting:

Support	Oppose	Need more info
12	4	9

Hand-pulling and raking in shallow waters:

Support	Oppose	Need more info
20	2	4

Small-scale (less than 10 acres) of chemical herbicide application:

Support	Oppose	Need more info
7	6	14

Large-scale (10 acres or greater) of chemical herbicide application:

Support	Oppose	Need more info
8	5	13

Biological control (using one live species to control another):

Support	Oppose	Need more info
6	6	14

No Management:

Support	Oppose	Need more info
3	10	10

4. Have you made any attempts to remove or control aquatic plants in Lower McKenzie Lake by your shore property? *(check one)*

no	yes, I did it myself	yes, I hired someone	yes, I did some myself and I hired someone
13	15	0	0

5. What have you done to remove aquatic plants from the lake by your property? *(Check all that apply)*

hire someone to hand-pull or rake	hire someone to apply chemical herbicide	mechanical plant removal with boat and motor or other apparatus	self hand pull or rake	self-application of chemical herbicide	other	Other comments
					1	remove dead leaves
0	0	3	15	0	1	0

SECTION 7 –Community Support

Local, county, state, and federal resources will be sought in addition to Lake Association funds to implement management recommendations for Lower McKenzie Lake. Donations of volunteer time, services, materials, and equipment can be used as match funding for many grant programs reducing the overall financial burden to the Lake Association. The following questions will help to determine your willingness to support future projects involving the implementation of aquatic plant and lake management recommendations.

1. Following are activities that lake residents could participate in. *Please check all those activities you might be willing to volunteer your time if additional assistance is needed. This is not a commitment but rather a measure of possible assistance if needed.*

watercraft inspection at the boat landings	on the water monitoring for aquatic invasive species	shore land monitoring for aquatic invasive species	raising beetles for purple loosestrife control	native aquatic plant monitoring and identification	water quality monitoring	wildlife monitoring	I am not interested in volunteering any time
4	10	9	2	5	11	8	12

2. How much time would you be willing to contribute to support any of the activities in Question 1 above?

a few hours a year	a few days a year	longer periods of time
9	4	2

3. Donated service needs are varied and somewhat unknown, but could include any of the options listed below. Do you think you would be willing to provide any of the services that may be necessary? This is not a commitment but rather a measure of possible assistance if needed. *(check all that apply)*

GPS use	grant writing	printing services	physical labor	sewing	graphic design	legal services	construction service
2	2	0	7	1	0	1	1

gardening /landscaping design	gardening/ landscaping implementation	web development	scuba diving	outdoor sign design	I am not interested or not able to provide assistance	other
2	1	0	1	0	16	1

4. Have you ever attended a McKenzie Lake Association (MLA) meeting?

yes	no
14	10

5. If you answered “no” in Question 4, why haven’t you attended a MLA meeting?

not interested	I don't have time	I never know when they are occurring	other	comments
1				
			1	works Saturdays
			1	Conflicting activities
			1	not at lake during those dates
2	4	3	3	

6. The McKenzie Lake Association annual meeting is generally held in the morning on the Saturday of Memorial Day Weekend. *In the following list of meeting dates and times, please check up to three meeting dates that would work for you.*

The current date and time works for me	Hold the meeting in the afternoon on the Saturday of Memorial Day	Hold the meeting in the evening on the Saturday of Memorial Day	Hold the meeting the Saturday before Memorial Weekend	Hold the meeting the Saturday after Memorial Weekend	Hold the meeting a different day	I am not interested in the McKenzie Lake Association annual meeting	comments
			1	1	1		Not on a Holiday Weekend
					1		any other than memorial day
12	2	3	5	6	2	3	

7. What is your affiliation with the McKenzie Lake Association?

current member	former member	I've never been a member
15	5	6

8. If you are not a member of the MLA, please indicate why. *(check all that apply)*

not interested	dues are too high	I did not know it existed	I do not have enough time	I disagree with what they are doing	I haven't been asked to be a member	I feel there is no benefit for being a member	Other	comments
							1	out of state - hard to make meetings
							1	need to turn in paper work
							1	Lake assoc. want to privatize the lakes
0	0	1	2	0	1	2	3	

9. How satisfied are you with the following aspects of Lake Association activity?

	Very Satisfied	Somewhat Satisfied	Unsure	Somewhat Dissatisfied	Very Dissatisfied
Communication with community	7	6	4	1	1
Meeting frequency					
Meeting atmosphere (parliamentary procedure)	8	5	4	0	1
Executing Lake Association business	8	2	5	0	1
Promoting cooperation to achieve goals and objectives	6	5	7	0	1
Management of Association finances	7	5	7	0	0
Listening to property owners' needs and concerns	7	3	9	0	0

10. How would you prefer to be contacted by the MLA? *(please check one)*

mail	email	phone	in person	I do not want to be contacted
12	13	0	0	1

11. If there are any additional issues you would like the Lake Association to address, please use the space below to explain.

Additional comments
weed control/removal and erosion
noise, large bonfires, too fast boats, loose dogs on the road
More active participation from Lower McKenzie property owners
High property taxes be used for this terrible weed issue
Limited free time - willing to give extra money to the cause
control weeds and lake shore erosion

Appendix G

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