Bear Lake Aquatic Plant Management Plan

AIS Education, Prevention, and Planning

Barron and Washburn Counties, Wisconsin

DNR Project No. AEPP-377-13
SEH No. BEARL 123341

December 2014

SEH
Building a Better World for All of Us®
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September 24, 2015

RE: AIS Education, Prevention, and Planning
Bear Lake Aquatic Plant Management Plan
Barron and Washburn Counties, Wisconsin
DNR Project No. AEPP-377-13
SEH No. BEARL 123341

Mr. Douglas Peterson
Bear Lake Association, Inc.
1330 St. Paul Avenue #108
St. Paul, MN 55116

Dear Mr. Peterson:

Short Elliott Hendrickson Inc. (SEH®) is pleased to be sending you a copy of the Bear Lake Aquatic Plant Management Plan. This report was completed for the Bear Lake Association, Inc. with financial assistance from the Wisconsin Department of Natural Resources Lakes Grant Program. It addresses the aquatic plant issues in Bear Lake.

The Aquatic Plant Management Plan uses a holistic set of management alternatives for Bear Lake and can be used to assist local decision making to enhance and maintain the quality of Bear Lake. The Aquatic Plant Management Plan includes analysis, discussion of management alternatives and implications, recommendations, and an implementation road map. The plan will serve and guide decision makers in implementing long-term solutions that are good for the lake and the community.

SEH would like to thank the Bear Lake Association for using our services in developing this plan.

Sincerely,

Jacob A. Macholl
Certified Lake Manager

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Bear Lake Aquatic Plant Management Plan

AIS Education, Prevention, and Planning
Barron and Washburn Counties, Wisconsin

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Distribution List

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6	Douglas Peterson Bear Lake Association, Inc. 1330 St. Paul Avenue #108 St. Paul, MN 55116

Executive Summary

INTRODUCTION

Bear Lake is a 1,348-acre drainage lake in the Town of Bear Lake (T36N R12W Sections 1, 2, 3, 11, and 12) in Barron County and the Town of Sarona (T37N R12W Sections 33 and 34) in Washburn County. The Bear Lakes watershed covers (36 square miles) and is predominantly forests and wetlands which cover 84% of the landscape.

Most residents on Bear Lake feel that there has been an increase in aquatic plant and algae growth on the lake. Some residents feel aquatic plants have reached nuisance levels and inhibit boat navigation in portions of the lake. There is also concern about the status of curly-leaf pondweed and if new aquatic invasive species have made their way into the lake since the last extensive monitoring in 2006. To address these and other concerns, the Bear Lake Association pursued and was awarded a grant for this project to complete a new aquatic plant survey and develop this aquatic plant management plan.

This plan represents an ongoing commitment of the Bear Lake Association (Association) and residents of the lake to complete sound planning and management of the lake. The elements of this plan conform to the requirements of Wisconsin Administrative Codes and the plan includes activities which are eligible for funding under the Wisconsin Department of Natural Resources (WDNR) Lake Grants program.

STUDY COMPONENTS

Public Participation and Input

- A 14-page public input survey was mailed to the 134 property owners on Bear Lake and 54 completed surveys were returned for a 40.3% return rate. The survey garnered information on topics including lake use and expectations, lake stewardship, knowledge of aquatic invasive species, and supported plant management activities.
- More than half the respondents feel that the amount of rooted near-shore vegetation, green scum on the water, and algae in the water has increased since they have been on the lake.
- The majority of respondents would support hand-pulling and biological control measures to control aquatic invasive plant species. The use of physical removal (hand pulling and raking), biological controls, and small-scale (covering less than 10 acres) mechanical harvesting are the most supported options while doing nothing and large-scale use (covering more than 10 acres) of chemical herbicides are least supported.
- In general, respondents had some knowledge of various aquatic invasive species, and the majority knew that purple loosestrife and curly-leaf pondweed are present in the lake. The survey also found that the majority of respondents believe the WDNR and the Association are responsible for managing aquatic plant growth in the lake and WDNR, the Association, and individual property owners are responsible for managing the water quality of the lake.

Lake and Watershed Description

- Bear Lake is a drainage lake, meaning it has an outlet leading to a river or stream (in this case, Bear Creek) and receives a higher proportion of water from surface water than direct precipitation or groundwater.
- The lake has a surface area of 1,348 acres with a maximum depth of 87 feet, a mean depth of 20 feet, and a volume of approximately 27,254 acre-feet. The lake has one island, Dubsky's Island, which is covers about 15 acres and is located in the southern part of the lake.
- The land cover in the 23,040-acre (36 square miles) Bear Lake watershed is predominantly forests (63%) open water and wetlands (21%), pastures and grassland (9%), agriculture (4%) and residential (2%). The Bear Lake watershed is situated within the larger Brill-Red Cedar watershed, which has an area of 190,720 acres (298 square miles).

Executive Summary (Continued)

Water Quality

- Water quality data have been collected from Bear Lake by volunteers since 1986 from the Deep Hole monitoring station (SWIMS site ID 33139).
- Water clarity, as measured using a Secchi disc, averaged about 7.5 feet for the period from 1986 through 2013 and was 6.5 feet in 2013. Annual summer averages varied between 5.2 feet and 9.7 feet during this period and no trends (increasing or decreasing) are evident in the data. The water clarity in Bear Lake is usually higher than found in other lakes in northwest Wisconsin, which average about 6.9 feet.
- The mean summer total phosphorus ranged from 18 micrograms per liter (µg/L) to 29 µg/L from 1993 to 2013 and averaged 21.5 µg/L over the entire period with no increasing or decreasing trends evident. The average total phosphorus found in northwest Wisconsin lakes is about 28 µg/L.
- Phosphorus is likely the nutrient limiting plant and algae growth in Bear Lake. Slight increases in phosphorus could lead to increased algae growth and nuisance macrophyte growth.
- Summer chlorophyll *a* concentrations in Bear Lake averaged about 9.7 µg/L from 1996 through 2013. The chlorophyll *a* levels equate to an average trophic state index of 52, which categorizes indicating the lake is eutrophic (nutrient rich with high production). Chlorophyll *a* levels in Bear Lake are less than the average for northwestern Wisconsin lakes of 12.4 µg/L .

Aquatic Vegetation

- The littoral zone, or the maximum depth to which plants can grow in a lake, was found to extend to depths up to 18 feet in Bear Lake with muck and sand as the primary sediments.
- The 2013 point-intercept plant survey documented 49 native aquatic plant species. Plant diversity was high with flat-stem pondweed (*Potamogeton zosteriformis*), coontail (*Ceratophyllum demersum*), fern pondweed (*P. robbinsii*), and forked duckweed (*Lemna trisulca*) the most common aquatic plant species found in Bear Lake.
- A number of high value aquatic plant species listed in NR 107 are found in Bear Lake including: *Potamogeton amplifolius, P. illinoensis, P. praelongus, P. richardsonii, P. robbinsii, Eleocharis spp., Scirpus spp.* (also known as *Schoenoplectus spp.*)*, Vallisneria americana* and *Brasenia schreberi*.
- Bear Lake is designated as an Area of Special Natural Resource Interest by the Wisconsin Department of Natural Resources because of the presence of wild rice (*Zizania palustris*).

Non-native Aquatic Invasive Species and Potential Threats

- The lake has established colonies of curly-leaf pondweed (*Potamogeton crispus*), purple loosestrife (*Lythrum salicaria*), and banded and Chinese mystery snails (*Viviparus georgianus* and *Bellamya chinensis*). The common reed found in the lake has been identified as the native subspecies (*Phragmites australis ssp. americanus*) and is not a threat to the lake ecosystem.
- Eurasian watermilfoil (*Myriophyllum spicatum*) was not found in Bear Lake during extensive surveying in 2013, but its introduction remains a concern because of its presence in other nearby lakes such as Shallow Lake, which is approximately 9 miles west of Bear Lake.
- Chinese mystery snails and banded mystery snails are non-native species found in Bear Lake. Little is yet known of their impact to the ecosystem. Management options for these snails are limited, primarily consisting of landowner removal and disposal of snails and empty shells that wash onto shore.

Fishery and Wildlife

- A comprehensive fish survey completed in 2000 by the WDNR identified 18 fish species in Bear Lake. Northern pike are the most common species and there are modest populations of walleye and largemouth bass, and a low population of smallmouth bass.

- Approximately 4,571,000 walleye have been stocked in Bear Lake since 1973.
- Two species listed as Threatened and eight species of Special Concern are located in the vicinity of Bear Lake. No species of Special concern were documented during the 2013 aquatic plant survey.

EVALUATION OF AQUATIC PLANT MANAGEMENT ALTERNATIVES

Alternative aquatic plant management measures were evaluated in *Section 3.0* for use in Bear Lake and where requested additional information was included, such as for aquatic herbicides and harvesting. Feasible alternatives were identified and applied in the recommended strategic plan (*Section 4.0*) and implementation roadmap (*Section 5.0*) of this plan.

Plant management alternatives that are appropriate for use in Bear Lake and meet community expectations include:

- Physical removal of the plants via hand-pulling, raking, or diving.
- The use of biological controls, particularly Galerucella beetles for controlling purple loosestrife. (Note: there are currently no approved biological controls for curly-leaf pondweed).
- Small-scale mechanical harvesting (small-scale defined as the management activity is undertaken in less than 10 acres annually)
- Suction dredging to vacuum out plants uprooted manually by SCUBA divers.
- Active use of boating lanes to disrupt plant growth. (Note: purposefully navigating a boat in circles to clear large areas is potentially illegal and can be deleterious to water quality).
- Implementing best management practices in the near-shore area and watershed to reduce the nutrients available for plant growth in the lake.

IMPLEMENTATION ROADMAP

The goal of plant management in Bear Lake is to *protect the existing native aquatic plant resource from degradation by maximizing prevention of new invasions and through the containment and control of existing aquatic invasive species.* The efforts to attain this goal are summarized in the following management objectives:

- **Preservation and Restoration**. Protect the native plant species community in and around the lake to decrease susceptibility to the introduction of new aquatic invasive species and to improve water quality. Restore shoreland areas susceptible to erosion and work with landowners to promote natural shorelines.
- **Prevention**. Prevent the introduction and establishment of new aquatic invasive species through early detection and rapid response.
- **Management**. Limit the manual removal of native aquatic plants around docks unless it is essential for navigation. Reduce existing curly-leaf pondweed growth in Bear Lake through containment and control.
- **Education and Awareness**. Continue public outreach and education programs on aquatic plants and aquatic invasive species.
- **Research and Monitoring**. Develop a better understanding of the lakes and the factors affecting lake water quality through continued and expanded monitoring efforts.
- **Adaptive Management**. Follow an adaptive management approach that measures and analyzes the effectiveness of control activities and modify the management plan as necessary to meet goals and objectives.

Executive Summary (Continued)

A five-year timeline for implementation and a listing of potential funding sources has also been developed as part of this plan. This plan should serve as a guide for achieving these objectives in a technically sound and community-supported manner.

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Bear Lake Aquatic Plant Management Plan

AIS Education, Prevention, and Planning

Prepared for the Bear Lake Association, Inc.

1.0 Introduction and Background

Bear Lake is a 1,348 acre drainage lake in Barron and Washburn Counties, Wisconsin (Figure 1). The lake is situated in the Town of Bear Lake in Barron County (T36N R12W Sections 1, 2, 3, 11, and 12) and the Town of Sarona in Washburn County (T37N R12W Sections 33 and 34). Bear Lake has 14.9 miles of shoreline with a mean depth of 20 feet and maximum depth of 87 feet. The lake has established colonies of curly-leaf pondweed (*Potamogeton crispus*), purple loosestrife (*Lythrum salicaria*), and banded and Chinese mystery snails (*Viviparus georgianus* and *Bellamya chinensis*). Common reed (*Phragmites australis*) is present, but it is the native subspecies and therefore not a concern. Bear Lake is designated as an Area of Special Natural Resource Interest by the Wisconsin Department of Natural Resources (WDNR) due to the presence of wild rice (*Zizania palustris*).

The Bear Lake Association (Association) has been active in protecting and managing the lake since it was founded in 1970. The Association has been involved in aquatic invasive species control, fish stocking, water quality monitoring, and has provided newsletters with educational information to its membership. In 1991, the Association received a WDNR lake planning grant to determine the water quality and survey the aquatic plants in the lake. A community survey was also conducted to determine the opinions of residents and landowners regarding the present feelings of the lake and what they envision for the lake.

A lake study was conducted in 2006 to characterize existing conditions in the lake and evaluate changes since the early 1990s. The project led to the development of a Comprehensive Lake Management Plan designed to protect, maintain, and enhance the water quality of Bear Lake, which included an outstanding lake history compiled from numerous property owners with information dating back to the 1600s. The plan provided a curly-leaf evaluation program and also presented a method for determining curly-leaf nuisance conditions and a proposed control program. Volunteer curly-leaf mapping efforts were also conducted and included in the plan. A watershed assessment and a number of suggested activities for maintaining and improving water quality were given in the plan.

Most residents on Bear Lake feel that there has been an increase in aquatic plant and algae growth on the lake. Some residents feel aquatic plants have reached nuisance levels and inhibit boat navigation in portions of the lake. There is also concern about the status of curly-leaf pondweed and if new aquatic invasive species have made their way into the lake since the last extensive monitoring in 2006. The Association pursued and was awarded a grant for this project to complete a new aquatic plant survey and develop a plant management plan for Bear Lake. This plan provides realistic expectations and management objectives to support effective management strategies suited to Bear Lake and the surrounding lake community.

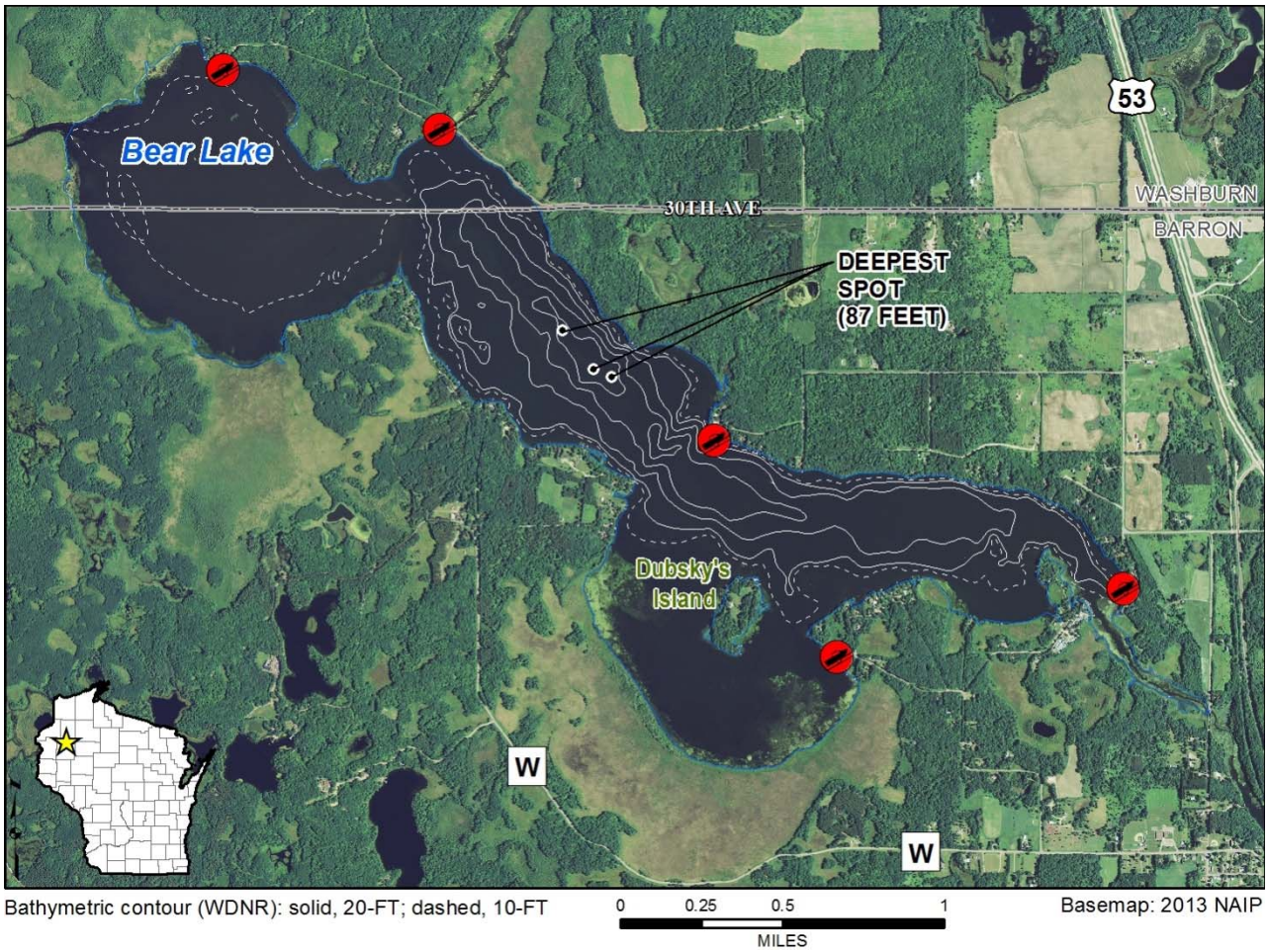


Figure 1 – Bear Lake and Vicinity

1.1 Documentation of Problems and Need for Management

1.1.1 Aquatic Invasive Species

Curly-leaf pondweed was first documented in Bear Lake during a transect-based aquatic plant survey in 1992 conducted by Aron & Associates (1). Curly-leaf was found at only one transect during that survey at a depth of 6 feet in the far eastern part of the lake near the Bear Creek outlet. The survey was completed in late July and it is possible that curly-leaf was present in other parts of the lake, but had since senesced (died-off) at the time of the survey. An early season survey conducted in 2013 as part of this project found twelve beds of curly-leaf pondweed covering a total of 8.9 acres. These curly-leaf pondweed beds create a navigation nuisance to adjacent property owners, particularly in the southeastern part of the lake. The impact of curly-leaf on wild rice growth in the lake is not known at this time.

Although purple loosestrife is documented near and around Bear Lake (2), this aquatic invasive species was not found during a 2013 aquatic plant survey (3). The plant does not appear to be problematic at this time because of biological control efforts completed by the Association in partnership with Barron County and others since the late 1990s. Volunteer monitoring of the purple loosestrife distribution will be continued.

Bear Lake is at risk for the introduction of new AIS including Eurasian watermilfoil. Although Eurasian watermilfoil was not found during the 2013 aquatic plant survey work completed as a part of this project, it remains a concern because of its presence in other lakes such as Shallow Lake, which is approximately 9 miles west of Bear Lake. Eurasian watermilfoil can be transported via boat traffic from infested lakes. Watercraft inspection, in-lake AIS monitoring, and educational and outreach efforts are necessary to prevent the introduction and establishment of Eurasian watermilfoil and other AIS in the lakes.

1.1.2 Navigation

An important aspect of this management plan is protecting the native plants in and near the lake while maintaining recreational uses. The northwest region, especially near the Boyer Creek inlet harbors dense native aquatic plants and some curly-leaf pondweed which collectively interfere with navigation. The same is true for the southern-most portion of the lake surrounding Dubsky's Island. The native aquatic plants in these regions of the lake are at a nuisance level and some management may be required to provide navigation relief.

1.1.3 Wild Rice

Bear Lake is designated as an Area of Special Natural Resource Interest by the WDNR due to the presence of wild rice (*Zizania palustris*), which has a high coefficient of conservatism value (8 out of 10) due to its sensitivity to human disturbance. Wild rice was found during the 2013 aquatic plant survey near the Boyer Creek inlet and to the west and southeast of Dubsky's Island (3). Wild rice occurred at 45 sample points (out of 916 points total or 617 points that were littoral) during the 2013 aquatic plant survey (3). Due to its ecological and cultural significance, wild rice has a strong influence on aquatic plant management in Wisconsin lakes.

1.1.4 Water Quality

Bear Lake was assessed during the 2014 Impaired Waters listing cycle as part of the Clean Water Act Section 303(d) (4). Total phosphorus and chlorophyll *a* were found to exceed threshold limits for the Recreation use and Fish and Aquatic Life use. The lake was recommended for inclusion on the Impaired Waters list by the WDNR for impacts to its Recreation use due to eutrophication and excess algal growth. A decision on the listing is anticipated on April 1, 2014.

According to the 2013 public input survey, which is discussed in further detail below, the majority of respondents feel there has been an increase in rooted plant growth, surface scum, and algae growth on the lake. Each of these changes is an indicator of high nutrient concentrations. Water quality data collected in the lake indicates an increase in total phosphorus and chlorophyll *a* in recent years; however, there isn't enough supporting data to determine the cause or determine if this is a trend or normal annual variation.

1.2 Aquatic Plant Management Strategy

The WDNR aquatic plant management guidelines and the Northern Region Aquatic Plant Management Strategy (Appendix A) formed the framework for the development of this APM plan. All existing and new APM plans and the associated management permits (chemical or harvesting) are reviewed by the WDNR. APM plans developed for northern Wisconsin lakes are evaluated according to the Northern Region APM Strategy goals that went into effect in 2007. Additional review may be completed by the Voigt Intertribal Task Force (VITF) in cooperation with the Great Lakes Indian Fish and Wildlife Commission (GLIFWC).

The VITF is composed of nine tribal members and a chairperson. The VITF recommends policy regarding inland harvest seasons, resource management issues, and budgetary matters to the Board of Commissioners. The VITF addresses matters that affect the treaty rights of the member tribes in the 1837 and 1842 Treaty ceded territories. The VITF recommends harvest seasons and regulations for each inland season. Those recommendations are then taken to the respective tribal councils for ratification prior to becoming an ordinance.

GLIFWC is an agency of eleven Ojibwe member tribes from Minnesota, Wisconsin, and Michigan, who retain off-reservation treaty rights to hunt, fish, and gather in treaty-ceded lands. GLIFWC exercises powers delegated by its member tribes and assists member bands in implementing off-reservation treaty seasons and in the protection of treaty rights and natural resources. GLIFWC provides natural resource management expertise, conservation enforcement, legal and policy analysis, and public information services. All member tribes retained hunting, fishing and gathering rights in treaties with the U.S. government, including the 1836, 1837, 1842, and 1854 Treaties.

This Aquatic Plant Management Plan supports sustainable practices to protect, maintain and improve the native aquatic plant community, the fishery, and the recreational and aesthetic values of the lake. This plan also lays out a strategy to prevent the introduction of new AIS not currently known to be in Bear Lake, which includes a monitoring program to aid in early detection of any new AIS. This five-year plan is intended to be a living document to be evaluated on an annual basis and revised as needed to ensure goals and community expectations are being met.

1.3 The Importance of Aquatic Plants in the Lake Ecosystem

A healthy lake is dependent on a healthy lake ecosystem. Native aquatic plants and animals, the wetland fringe, and fallen trees help to maintain and protect a healthy overall lake ecosystem. When management is recommended for a lake, care must be taken to protect, maintain, and if possible enhance the overall ecosystem. Aquatic plants, also known as macrophytes, are a natural part of most lake communities and provide many benefits to fish, wildlife, and people. Plants have many important functions and values in the lake ecosystem. They are the primary producers in the aquatic food chain, converting the basic chemical nutrients in the water and soil into plant matter, which becomes food for all other life.

Aquatic plants provide valuable fish and wildlife habitat. More food for fish is produced in areas of aquatic vegetation than in areas where there are no plants. Insect larvae, snails, and freshwater shrimp thrive in plant beds. Panfish eat aquatic plants in addition to aquatic insects and crustaceans. Plants also provide shelter for young fish. Northern pike spawn in marshy and flooded areas in early spring and bass, sunfish, and yellow perch usually nest in areas where vegetation is growing.

Many submerged plants produce seeds and tubers (large roots) which are eaten by waterfowl. Bulrushes, sago pondweed, wild celery, and wild rice are especially important duck foods. Submerged plants also provide habitat to a number of insect species and other invertebrates that are, in turn, important foods for brooding hens and migrating waterfowl.

The lake aesthetic valued by so many is enhanced by the aquatic plant community. The visual appeal of a lakeshore often includes aquatic plants, which are a natural, critical part of a lake community. Plants such as water lilies, arrowhead, and pickerelweed have flowers or leaves that many people enjoy.

Aquatic plants improve water clarity and water quality. Certain plants, like bulrushes, can absorb and break down polluting chemicals. Nutrients used by aquatic plants for growth are not available to algae, thus reducing algae abundance and improving water clarity. Algae, which thrive on dissolved nutrients, can become a nuisance when too many submerged water plants are destroyed. Aquatic plants also maintain water clarity by preventing the re-suspension of bottom sediments. Aquatic plants, especially rushes and cattails, dampen the force of waves and help prevent shoreline erosion. Submerged aquatic plants also weaken wave action and help stabilize bottom sediment.

Native aquatic plant communities also offer protection from non-native aquatic invasive species. Current scientific literature generally accepts the concept that invasions of exotic plants are encouraged, and in some cases induced, by the disruption of natural plant communities. Curly-leaf pondweed, which is present in Bear Lake, is an opportunistic plant. Much like lawn and agricultural weeds that germinate in newly disturbed soil, curly-leaf pondweed is more likely to invade areas in which the native plant community has been disturbed or removed. Removing the natural competition from native plants may also open up the door to new invasive species and less desirable plant communities

As a natural component of lakes, aquatic plants support the economic value of all lake activities. Wisconsin's $13 billion tourism industry is anchored by 15,081 lakes and 12,600 rivers and streams which draw residents and tourists to hunt, fish, camp, and watch wildlife on and around lakes. According to the WDNR, the world class fishery lures more than 1.4 million licensed anglers each year, supports more than 30,000 jobs, generates a $2.75 billion annual economic impact, and $200 million in tax revenues for state and local governments.

2.0 Study Components

2.1 Public Participation and Input

The Association provided input, support and review of draft documents during the development of this aquatic plant management plan. Further public input was collected through a public input survey conducted in 2013. The survey was developed by Aquatic Plant and Habitat Services LLC with input from WDNR and SEH.

2.1.1 Public Input Survey

The Association provided input, support and review of draft documents during the development of this aquatic plant management plan. Further public input was collected through a public input survey developed by Aquatic Plant and Habitat Services LLC with input from WDNR and SEH. The survey (Appendix B) and a cover letter were distributed by SEH on August 15, 2013 with a return request for completed surveys by September 15, 2013. Surveys were mailed to the 134 property owners on Bear Lake and 54 completed surveys were returned (40.3% return rate). The majority of respondents (35%) own cabins on Bear Lake that are not intended for long term residency while second home owners and permanent residents accounted for 26% and 24% of respondents, respectively. The remaining 15% owned undeveloped land, a resort/campground, or a recreational vehicle campsite.

Bear Lake residents reported using the lake primarily for rest and relaxation (87%), fishing (76%), wildlife viewing (76%), and swimming (74%). Other popular uses include canoe/kayak/paddle boating (65%) and pontoon boating (59%). Some lake residents reported using the lake for water skiing/tubing (46%), speed boating (30%), and jet skiing (11%), but these uses were in the minority. According to these responses, Bear Lake would appear to be used primarily for what are considered “silent sports.” Nearly all respondents knew that wild rice could be found in the lake and the nearly half felt the amount of wild rice in the lake is just right.

When asked which lake characteristics have changed (improved, stayed the same, worsened, or not sure), most respondents indicated that quality of living, aesthetic quality, quality of motorized and non-motorized recreation, quality of swimming/wading, and diversity of wildlife have all stayed the same. About one-third of respondents feel that the quality of fishing has worsened and nearly half the respondents feel walleye fishing in particular has worsened. Lake residents value the general quality of living on the lake, the quality of fishing, and the aesthetic quality of the lake the most. When asked how various lake characteristics and uses have changed, respondents indicated that the use of motorized boats and personal watercraft has increased with public use of the lake.

More than half the respondents feel that the amount of rooted near-shore vegetation, green scum on the water, and algae in the water has increased since they have been on the lake. Of the nearly half who have removed aquatic plants from near their property, all have hand-pulled or raked the plants out and only a handful have used chemical or mechanical means of removal in the past. The majority of respondents would support hand-pulling and biological control measures to control aquatic invasive plant species. Hand-pulling and raking is the method supported the most, followed by biological controls, then small scale (less than 10 acres) harvesting. More information on mechanical harvesting and chemical herbicides was needed by many before making a decision; information on those control measures are included in *Section 3.0* of this plan.

In general, respondents had some knowledge of various aquatic invasive species, and the majority knew that purple loosestrife and curly-leaf pondweed are present in the lake. The survey also found that the majority of respondents believe the WDNR and Association are responsible for managing aquatic plant growth in the lake, whereas the WDNR, the Association, and individual property owners are responsible for managing the water quality of the lake.

Property owners on Bear Lake support the implementation of aquatic plant management actions. The use of physical removal, biological controls, and mechanical harvesting are the most supported options while doing nothing and large-scale use of chemical herbicides are least supported. Results from the survey indicate education and outreach are needed in order to implement community supported aquatic plant management alternatives.

2.1.2 Public Review and Comment Period

The Draft Bear Lake Aquatic Plant management plan was released to the public for a one-month public review and comment period. Individuals could also request digital copies of the draft plan by contacting the Association by phone or email. The WDNR completed its review and preliminary approval of the plan in December 2014.

2.2 Lake and Watershed Characteristics

Identifying appropriate aquatic plant management recommendations for Bear Lake requires a basic understanding of chemical, physical, and biological characteristics including morphology (size, structure, and depth), the fish and wildlife, water quality (temperature, clarity, oxygen, phosphorus, and chlorophyll *a*), land use, soils, and lake sediment. All of these factors have the potential to influence aquatic plant growth and vice versa. Water quality and plant survey data provide the necessary information for evaluating the effects of aquatic plant management as well as other management activities.

2.2.1 Lake Morphology

Bear Lake is a drainage lake, meaning it has an outlet leading to a river or stream (in this case, Bear Creek) and receives a higher proportion of water from surface water than direct precipitation or groundwater. Boyer Creek flows into Bear Lake at the northwest end and Bear Creek flows into the lake along the northern shore. The lake has a surface area of 1,348 acres with a maximum depth of 87 feet, a mean depth of 20 feet, and a volume of approximately 27,254 acre-feet (5). The lake has an irregular shape with a shoreline distance of 14.9 miles. There is one island covering 15.6 acres, known as Dubsky's Island, located in the southern embayment. According to data collected from Bear Lake's 916 survey points during the 2013 aquatic plant survey, the entire northwest basin is less than 18 feet deep with a muck bottom near the shoreline and sandy sediment in the center (3). The littoral zone during the 2013 aquatic plant survey was determined based on the maximum depth of vegetation, which was 18 feet (Figure 2). Therefore, any survey points less than 18 feet in depth were considered littoral zone while any points 18 feet or deeper were considered limnetic, or the open water region beyond the littoral zone.

It is important to consider the significant differences between deep and shallow lake systems. Shallow lakes are those with a maximum depth of less than 20 feet or with an average depth of less than 10 feet(6). Using these criteria, Bear Lake is classified as a deep system. The water quality of a deep lake is generally driven by external nutrient sources whereas the water quality of a shallow lake is driven by internal processes with aquatic plants playing an important role.

Table 1
Physical Characteristics of Bear Lake

Area (acres)	Volume (acre-feet)	Shoreline (miles)	Maximum depth (feet)	Average depth (ft)
1,348	27,254	14.9	87	20

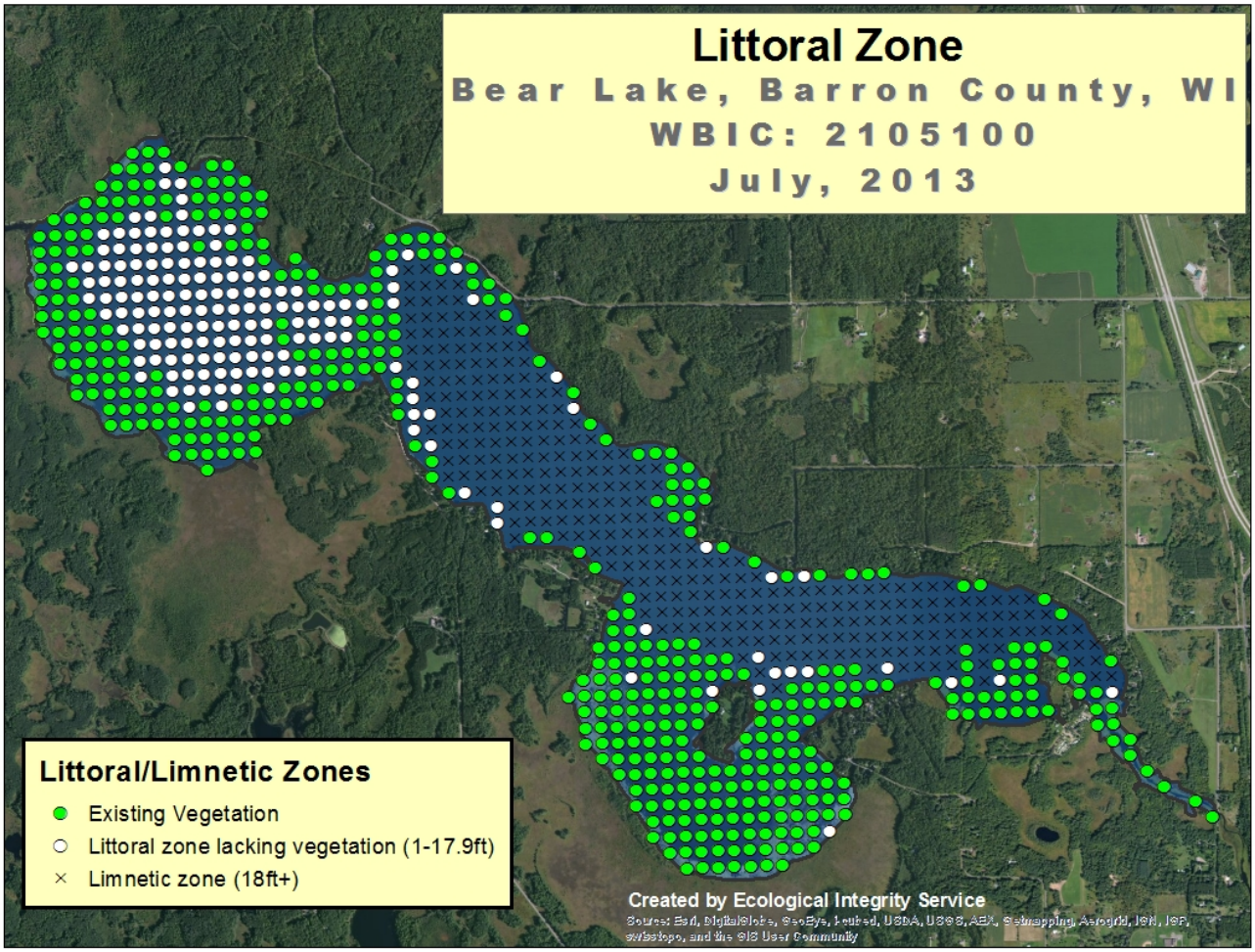


Figure 2 – Bear Lake Littoral Zone

2.2.2 Lake Sediment

During the 2013 aquatic plant surveys, sediment types were documented in Bear Lake where possible. Sediment type was determined at survey points shallow enough (approximately 18 feet or less) to allow for sampling with a rake and pole. The survey crew determined the sediment type based on how the sediment "feels" when in contact with the rake head (mucky, sandy, or rocky). Deeper survey points required the use of a rake head tied to a rope, thus not allowing the survey crew to "feel" the sediment at deeper sites. Most survey points were either muck or sand with a few rocky sites. Muck dominated sites in the southern basin west and south of Dubsky's Island, along shore in the northwest basin, and at survey points near the outlet. Sandy sediment was found in the central area of the northwest basin and survey points with a steeper slope in the narrower central basin.

2.2.3 Soils and Land Use

A watershed is an area of land from which water drains to a common surface water feature, such as a lake, stream, or wetland. A lake is a reflection of its watershed's size, topography, soils, land use and vegetation. The Bear Lakes watershed covers 23,040.6 acres (36 square miles) (Figure 3). The land cover in the watershed is predominantly forests which covers 63% of the landscape, followed by water/wetlands covering 21% of the landscape (Table 2). Grass/pasture only covers 9%, agriculture 4%, and residential covers only about 2% of the land. The Bear Lake watershed is situated within the larger Brill-Red Cedar watershed, which has an area of 190,720 acres (298 square miles) (7).

The majority of soils (64%) in the watershed belong to Hydrologic Soils Group B, which are mostly sand and some clay with moderate infiltration. Twenty-one percent (21%) of soils in the watershed belong to Group D, which consist chiefly of clay and have very slow infiltration rates and high run-off potential. The soils in the watershed are rated "Very Limited" for septic tank absorption fields (8). Therefore, the soil has one or more features that are unfavorable for the specified use and poor performance and high maintenance can be expected. The limitations generally cannot be overcome without major soil reclamation, special design (for example, tertiary systems), or expensive installation procedures. Because of the soil characteristics, it is important to have regular septic system inspections to ensure the systems are functioning properly to prevent excessive nutrient loading to lakes.

Table 2
Land Use and Land Cover in the Bear Lake Watershed

Land Use	Square Miles	Acres	Percent of Total
Agriculture	1.32	844.1	4%
Forest	22.83	14616.8	63%
Grass/Pasture	3.33	2129.6	9%
HD-Residential	0.13	84.0	0%
LD-Residential	0.87	554.3	2%
Commercial	0.02	11.8	0%
Water/Wetland	7.50	4800.0	21%
TOTAL	36.00	23040.6	

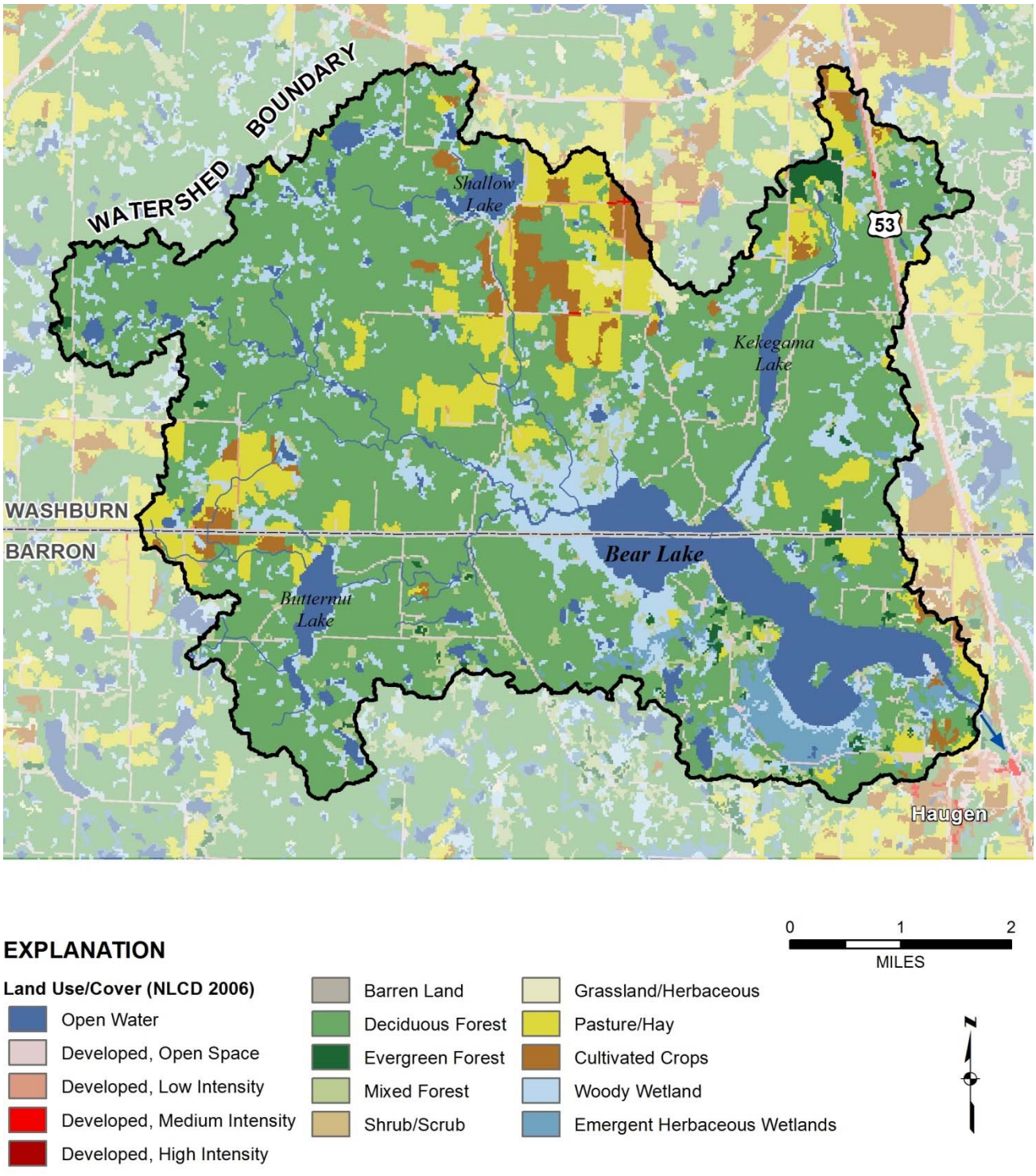


Figure 3 – Bear Lake Watershed Land Use and Land Cover

2.2.4 Wetlands

In Wisconsin, a wetland is defined as an area where water is at, near, or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation, and which has soils indicative of wet conditions (Wisconsin Statue 23.32(1)). Wetlands contain a unique combination of terrestrial and aquatic life and physical and chemical processes. Wetlands are protected under the Clean Water Act and state law and in some places by local regulations or ordinances. Landowners and developers are required to avoid wetlands with their projects whenever possible; if the wetlands can't be avoided, they must seek the appropriate permits to allow them to impact wetlands (for example, fill, drain or disturb soils).

According to the National Wetland Inventory, emergent and forested/shrub wetlands are present in the Bear Lake watershed. Forested/shrub and emergent wetlands make up a large portion of shoreline for the northwest basin and south of Dubsky's Island, which includes the Bear Lake Sedge Meadow State Natural Area. Emergent wetlands are wetlands with saturated soil and are dominated by grasses such as redtop and reed canary grass, and by forbs such as giant goldenrod. Forested/shrub wetlands are wetlands dominated by mature conifers and lowland hardwood trees and are important for stormwater and floodwater retention and provide habitat for various wildlife.

Wetlands serve many functions that benefit the ecosystem surrounding Bear Lake. Wetlands support a great variety of native plants and are more likely to support regionally scarce plants and plant communities. Wetlands provide fish and wildlife habitat for feeding, breeding, resting, nesting, escape cover, travel corridors, spawning grounds for fish, and nurseries for mammals and waterfowl. Contrary to popular belief, healthy wetlands reduce mosquito populations; natural enemies of mosquitoes (dragonflies, damselflies, backswimmers, and predacious diving beetles) need proper habitat (that is, healthy wetlands) to survive.

Wetlands provide flood protection within the landscape by retaining stormwater from rain and melting snow and capturing floodwater from rising streams. This flood protection minimizes impacts to downstream areas. Wetlands provide groundwater recharge and discharge by allowing the surface water to move into and out of the groundwater system. The filtering capacity of wetland plants and substrates help protect groundwater quality. Wetlands can also stabilize and maintain stream flows, especially during dry months.

Wetland plants and soils provide water quality protection by storing and filtering pollutants ranging from pesticides to animal wastes. Wetlands also provide shoreline protection by acting as buffers between the land and water. Wetland plants protect against erosion by absorbing the force of waves and currents and by anchoring sediments. This is important in waterways where high boat traffic, water currents, and wave action may cause substantial damage to the shore.

Although some small (two acres or less) wetlands may not appear to provide significant functional values when assessed individually, they may be very important components of a larger natural system. Not only do small wetlands provide habitat functions, they also store phosphorus and nitrogen and trap pollutants such as heavy metals and pesticides. Draining these small wetlands, which often do not appear on maps, not only requires the proper permits, but can also release the once-stored pollutants and nutrients into lakes and streams.

2.3 Water Quality

The water quality of a lake influences the aquatic plant community and vice versa. The water quality measures used to determine the productivity, or trophic status, of a lake are water clarity, total phosphorus, and chlorophyll *a*. The Carlson Trophic State Index (TSI) is frequently used to estimate the trophic state of an aquatic system. The trophic state of a lake is defined as the total weight of living biological material (or biomass) in a lake at a specific location and time. Eutrophication is the movement of the trophic state in the direction of more plant nutrients and often more plant biomass. Eutrophic lakes tend to have abundant aquatic plant growth, high nutrient concentrations, and low water clarity due to algae blooms. Oligotrophic lakes, on the other end of the spectrum, are nutrient poor and have little plant and algae growth. Mesotrophic lakes have intermediate nutrient levels and only occasional algae blooms.

Water quality data have been collected from Bear Lake by volunteers since 1986 from the Deep Hole monitoring station (SWIMS site 33139) shown in Figure 4 (2). Four additional monitoring stations exist in Bear Lake, but these are access points or boat landings and data collected from these sites is from watercraft inspections administered by volunteers or paid inspectors (Figure 4 and Table 3).

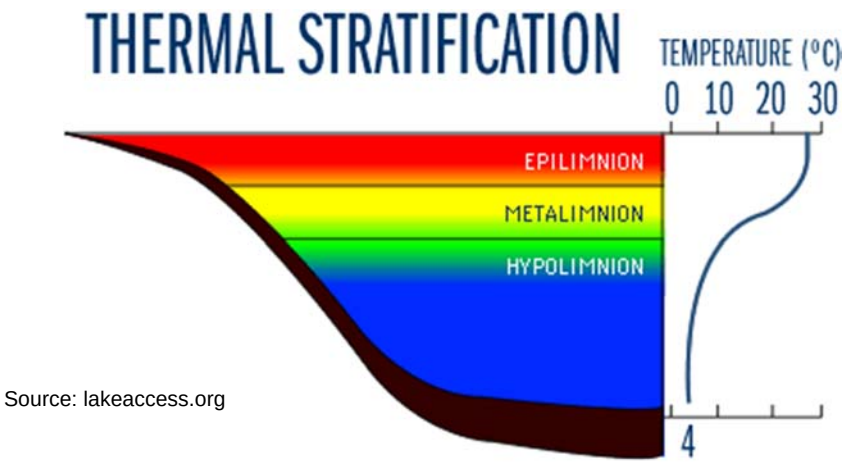
Figure 4 – Bear Lake Monitoring Stations

Table 3
Bear Lake Monitoring Station Descriptions

Monitoring Station Number	Monitoring Station Name	First Field Work Event Date	Last Field Work Event Date
10018547	Access NW Lake	Not Available	Not Available
33139	Deep Hole	6/10/1986	8/31/2012
10018516	Access	8/1/2010	8/1/2010
10018515	Access	7/30/2009	7/27/2012
10018537	Access E Lake, End of 18th St.	7/27/2012	8/29/2012

2.3.1 Temperature and Dissolved Oxygen

Temperature and dissolved oxygen are important factors that influence aquatic organisms and nutrient availability in lakes. As temperature increases during the summer in deeper lakes, the colder water sinks to the bottom and the lake develops three distinct layers as shown in Figure 5. This process, called stratification, prevents mixing between the layers due to density differences, which then limits the transport of nutrients and dissolved oxygen between the upper and lower layers. Most lakes in Wisconsin that undergo stratification mix in the spring and fall when the water temperature is about 39°F, a process called overturn. Overturn begins when the surface temperatures become colder and therefore denser and begin to sink. Below about 39°F, colder water becomes less dense and begins to rise (which is why ice floats) and inverse stratification (warmer water on bottom) occurs throughout the winter.



Source: lakeaccess.org

Figure 5 – Schematic of Summer Thermal Stratification

During the summer months, the upper warm layer, called the epilimnion, remains well oxygenated due to wind and wave action and photosynthesis. The middle layer, called the metalimnion or thermocline, is where changes in temperature and dissolved oxygen are greatest. This middle layer acts as a barrier that prevents the warmer and oxygenated waters in the upper layer from mixing with colder, deeper waters. It is common for dissolved oxygen levels to be depleted in the lower layer, called the hypolimnion, as there is no source of new oxygen and the decomposition of organic matter consumes oxygen.

Dissolved oxygen levels below 5 mg/L stresses many fish species. A low dissolved oxygen level of 2 mg/L or less, called hypoxia, is an important criterion of sediment phosphorus release. When near-bottom dissolved oxygen is at 2 mg/L or less, the sediment-water interface is likely anoxic (no oxygen) and therefore releasing phosphorus. If the phosphorus released from sediments reaches the upper part of the lake (for example, during overturn in spring and fall), it can provide a significant internal load of phosphorus to fuel algae blooms.

Bear Lake is classified as dimictic because the deep areas stratify in the summer and mix in the fall and summer. Volunteers monitored the deepest spot of the lake in 1993, 1996, 2005, 2006, and 2013 for both dissolved oxygen and temperature. Temperature was also monitored from 2007 through 2009. Monitoring in 2013 found the entire water column to be well-oxygenated down to 85 feet at which point dissolved oxygen levels were still 3.63 mg/L through early June. By late June, hypoxia (less than 2 mg/L dissolved oxygen) occurred at 60 feet and deeper. By August 2013, hypoxia occurred at 20 feet and persisted at that depth until monitoring again in October demonstrated that hypoxia was occurring at depths of 35 feet and greater. Although the lake is considered dimictic, it is likely that the entire northwest basin stays mixed throughout the year due to its shallow depth of 10 feet or less. An additional monitoring station established in the center of the northwest basin and consistent volunteer monitoring would provide data that would be helpful for management in Bear Lake.

2.3.2 Water Clarity

The depth to which light can penetrate is a factor that limits aquatic macrophyte growth. Water clarity is measured by lowering a black and white Secchi disk in the water and recording the depth of disappearance. The disk is then lowered further and slowly raised until the reappears. The Secchi depth is the mid-point between the depth of disappearance and the depth of reappearance. Because light penetration is usually associated with nutrient levels and algae growth, a lake is considered eutrophic when Secchi depths are less than 6.5 feet. Secchi depths vary throughout the year, with shallower readings in summer when algae concentrations increase, thus limiting light penetration. Conversely, deeper readings occur in spring and late fall when algae growth is limited.

Some lakes are “stained” due to dissolved organic substances that cause the water to appear brown or tea-colored. These lakes are known as dystrophic, which refers strictly to water color and not nutrient content that causes algal growth. Dystrophic lakes will have a lower water clarity than non-dystrophic lakes with the same nutrient concentrations and algae growth. Bear Lake is not dystrophic but it is important to bear this in mind when comparing water clarity among dystrophic and non-dystrophic systems.

Secchi data for Bear Lake was collected from monitoring station 33139 (Deep Hole) consistently from 1986 through 2013 (Figure 6). Mean summer (June-August) Secchi depths range from 5.2 feet to 9.7 feet with an overall average of 7.5 feet. The overall mean summer Secchi depths classify Bear Lake as a mesotrophic system. However, the WDNR classifies the lake as a eutrophic system, which is consistent with chlorophyll-*a* trophic state index values.

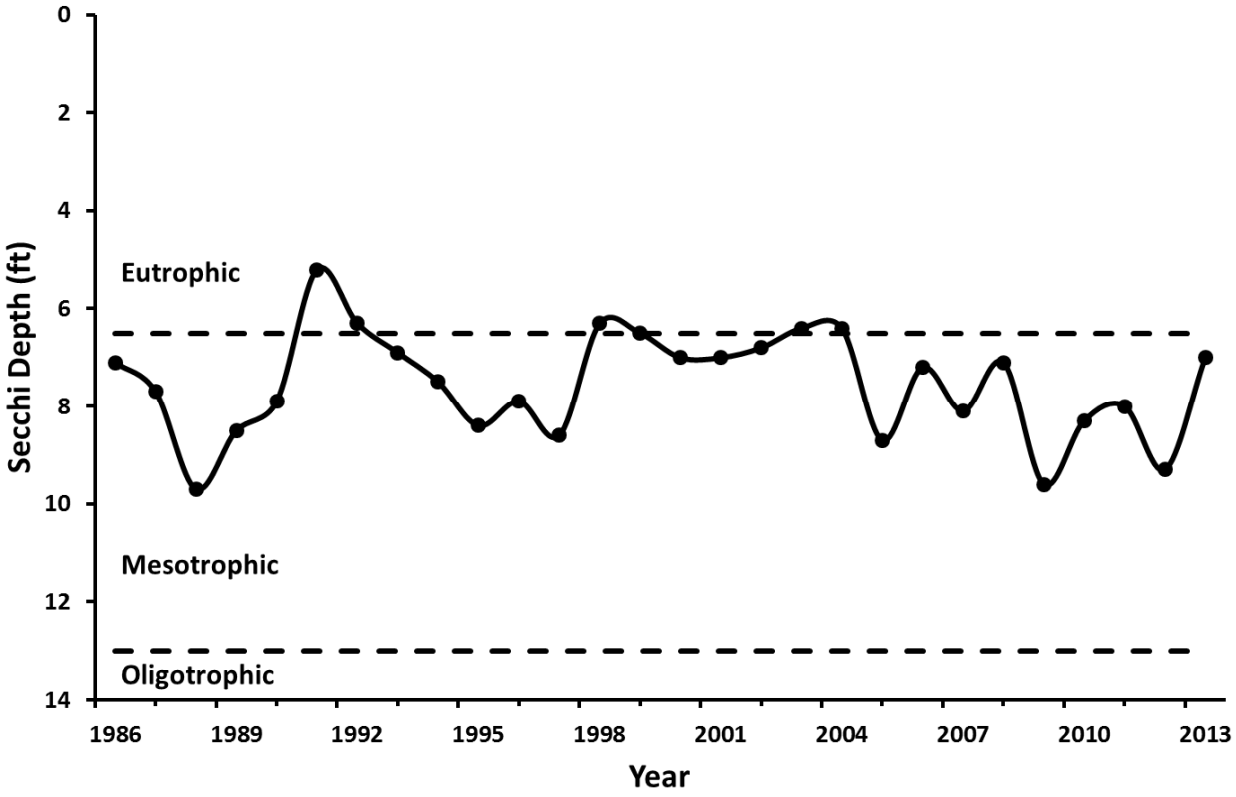


Figure 6 – Mean Summer (June-August) Water Clarity in Bear Lake

2.3.3 Phosphorus

Phosphorus is an important nutrient for plant growth and is commonly the nutrient limiting plant production in Wisconsin lakes. As a limiting factor, addition of small quantities of phosphorus to a lake can cause dramatic increases in plant and algae growth. Deep lakes are more responsive to reductions of external phosphorus inputs, whereas shallow lakes are likely to be more responsive to biomanipulation (alteration of an ecosystem by adding or removing species) (6). Phosphorus can be monitored at various depths, especially in deep lakes, because when a lake is thermally stratified, higher levels of phosphorus are found in deeper waters. This is due to decomposition and sinking of zooplankton and algae, thereby causing a build-up of nutrients in deeper waters that do not readily mix during thermal stratification. Also due to the lack of mixing in summer, the oxygen levels in deeper waters fall. When oxygen is depleted, chemical changes at the sediment-water interface allow phosphorus that was trapped in the sediment to be re-suspended into the water column.

Total phosphorus was monitored in Bear Lake at monitoring station 33139 (Deep Hole) in 1993, 1996, and from 2005 through 2013. The mean summer (June through August) phosphorus levels near the water surface (0 to 6 feet) ranged from 18 micrograms per liter (µg/L, also called parts per billion) to 29 µg/L with an overall average of 21.5 µg/L. The mean phosphorus level classifies Bear Lake as a mesotrophic system; however, the WDNR classifies the lake as a eutrophic, which is consistent with chlorophyll *a* trophic state index values.

The 2007 Lake Management Plan estimates an annual load of 2,993 pounds of phosphorus based on the measured total phosphorus levels in the lake (23 µg/L) and watershed size of 30,464 acres. The major source of phosphorus is identified as natural watershed runoff; however, the method for calculating this annual load was not provided in the plan (9).

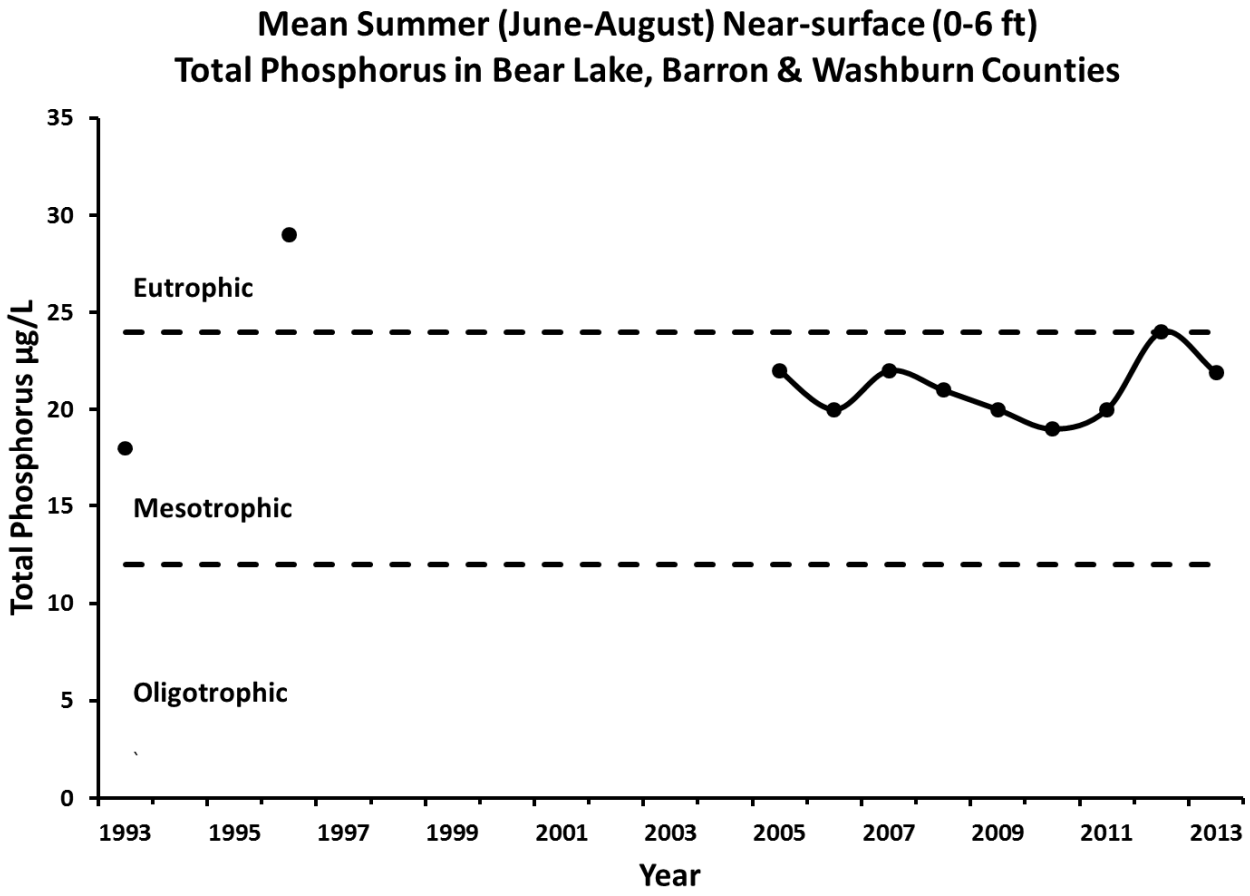


Figure 7 – Mean Summer (June-August) Phosphorus in Bear Lake

2.3.4 Chlorophyll *a*

Chlorophyll *a* is the green pigment found in plants and algae. The concentration of chlorophyll *a* is used as a measure of the algal population in a lake. Concentrations greater than about 10 µg/L are considered indicative of eutrophic conditions and concentrations of 20 µg/L or higher are associated with algal blooms. For trophic state classification, preference is given to the chlorophyll *a* trophic state index (TSI_{CHL}) because it is the most accurate at predicting algal biomass.

Chlorophyll-*a* data is available for Bear Lake monitoring station 33139 (Deep Hole) from 1996 and 2005 through 2013. Mean near-surface (0-6 feet) chlorophyll *a* data in units of micrograms per liter (µg/L) were transformed into Trophic State Index (TSI) values using a calculation from Carlson & Simpson, 1996 (10). TSI values for summer months (June through August) range from 51 (7.96 µg/L) through 56 (12.99 µg/L) with an overall average of 53 (9.65 µg/L) (Figure 8). These values classify Bear Lake as a eutrophic system. The TSI value in 1996 was 52 (8.77 µg/L) but is not depicted in Figure 8.

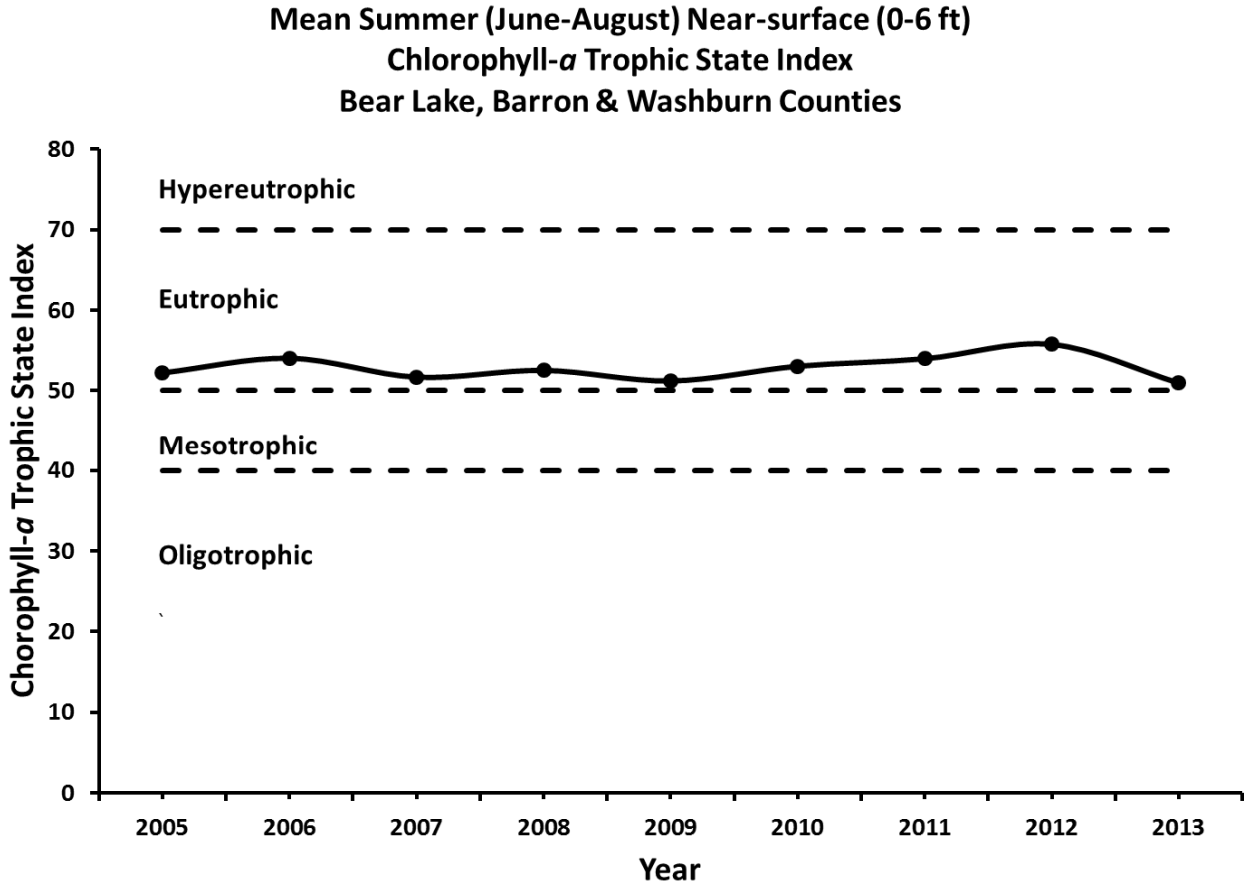


Figure 8 – Mean Summer (June-August) Chlorophyll *a* Trophic State Index for Bear Lake

2.3.5 Water Quality Discussion

Since volunteer monitoring began on Bear Lake in 1986 at Station 33139, mean water clarity and mean phosphorus values classify the lake as mesotrophic while the mean TSI_{CHL} of 53 classifies the lake as eutrophic. For trophic state classification, preference is given to the TSI_{CHL} because it is the most accurate at predicting algal biomass. Linear trends for Secchi depth and total phosphorus were not significant, although annual variation is evident. The TSI_{CHL} linear trend line is nearly horizontal but again the trend is not significant. Since none of the trend lines are significant, it cannot be inferred that the water quality is indeed moving toward a more oligotrophic (low nutrient, clear water) state or more eutrophic (high nutrient, turbid water) state.

Phosphorus is likely the limiting factor for plant and algae growth in Bear Lake. Slight increases in phosphorus could lead to increased algae growth and nuisance macrophyte growth. Due to the undeveloped nature of the watershed, the largest source of phosphorus to the system is likely runoff from development along shore and potentially internal nutrient loading. Because mean TSI_{CHL} is on the lower end of the eutrophic scale, even slight phosphorus increases could push Bear Lake toward a more eutrophic (higher nutrient, decrease water clarity) state.

Table 4
The Trophic State Index and Commonly Associated Conditions

TSI	Trophic State	Description of Associated Conditions
<30	Oligotrophic	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.
30 - 40		Deeper lakes still oligotrophic, but bottom water of some shallower lakes will become oxygen-depleted during the summer.
40 - 50	Mesotrophic	Water moderately clear, but increasing chance of low dissolved oxygen in deep water during the summer.
50 - 60	Eutrophic	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.
60 - 70		Blue-green algae become dominant and algal scums are possible, extensive plant overgrowth problems possible.
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).
>80		Algal scums, summer fishkills, few plants, rough fish dominant. Very poor water quality.

Bear Lake (53)

2.4 Aquatic Vegetation

Aquatic plants play an important role in lakes. They anchor sediments, buffer wave action, oxygenate water, and provide valuable habitat for aquatic animals. The amount and type of plants in a lake can greatly affect nutrient cycling, water clarity, and food web interactions. Furthermore, plants are very important for fish reproduction, survival, and growth, and can greatly impact the type and size of fish in a lake.

Unfortunately, healthy aquatic plant communities are often degraded by poor water clarity, excessive plant control activities, and the invasion on non-native nuisance plants (11). These disruptive forces alter the diversity and abundance of aquatic plants in lakes and can lead to undesirable changes in many other aspects of a lake's ecology (9). Consequently, it is very important that lake managers find a balance between controlling nuisance plant growth and maintaining a healthy, diverse plant community.

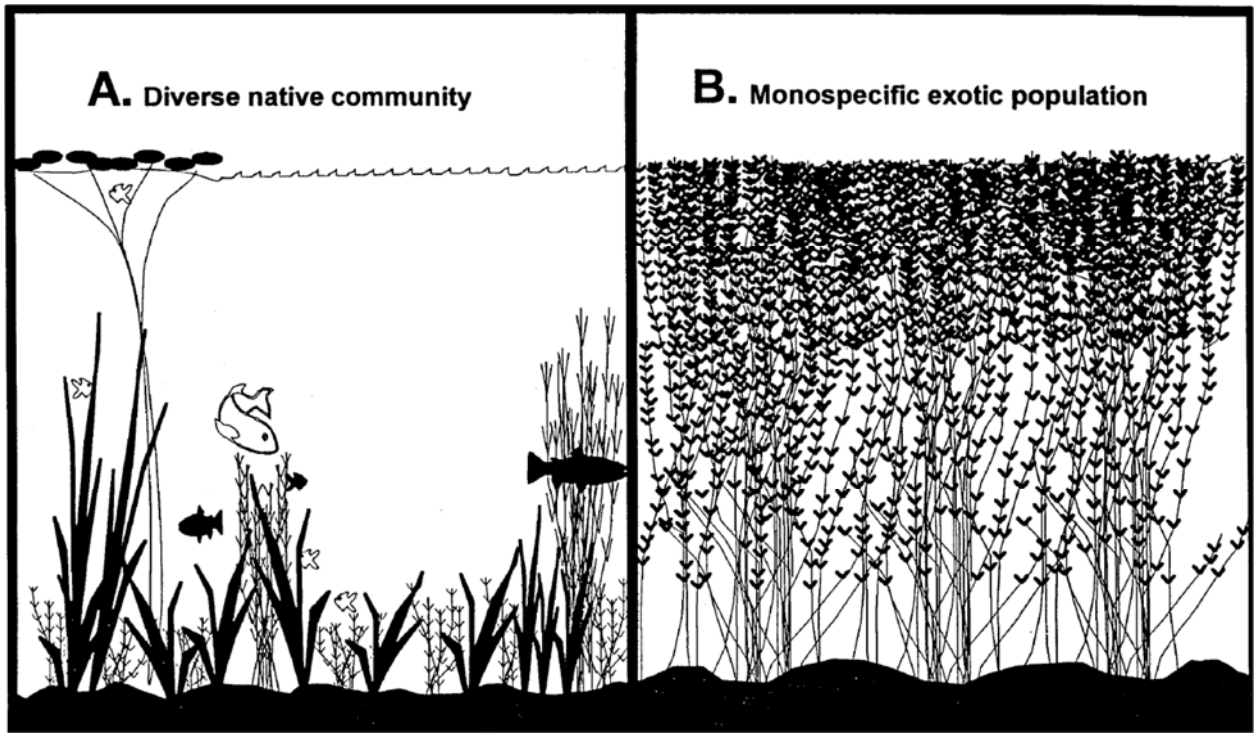


Figure 9 – Submersed Aquatic Plant Communities

An aquatic plant survey was completed late spring and summer of 2013 by Ecological Integrity Service, LLC (EIS) (Amery, Wis.) with the objectives of establishing baseline information and identifying any issues of concern such as the presence of non-native AIS. Bear Lake was found to support a diverse and healthy native aquatic plant community of 52 species occurring in light to moderate density. Although curly-leaf pondweed had already been documented during a plant survey in 1992(1) and again in 2006 by volunteers, this survey formally recorded the location and density of curly-leaf beds. The 2013 EIS investigations, which are the most recent and extensive plant surveys, were used to develop this plan and are summarized below.

EIS conducted two lake-wide plant surveys on Bear Lake in 2013. The first investigation was an early-season curly-leaf distribution and bed mapping survey completed in June and the second a whole-lake point intercept survey in August. The surveys provide detailed statistical assessments of the aquatic plant community in Bear Lake and establish a baseline for evaluating any changes in the plant community over the coming years which will help guide responsible aquatic plant management planning. A detailed report of the 2013 survey and voucher specimens of plants found in the lake were provided to the Association and its partners by EIS.

The Simpson Diversity Index was calculated using the results of the August aquatic plant survey. The Simpson Diversity Index is a value that 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. The index value represents the probability that two individual plants (randomly selected) will be different species. The index values range from 0 to 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 (for example, lake size, depth, dissolved minerals, and water clarity) can affect diversity, in general, a more diverse lake indicates a healthier ecosystem. Plant communities with high diversity also tend to be more resistant to invasion by exotic species

The Floristic Quality Index, or FQI is a measure of the impact of human development on a lake's aquatic plants. The FQI was computed using results from the August plant survey. There are 124 species in the index; each assigned a Coefficient of Conservatism, or C value, which ranges from 1 to 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 they often exploit these changes to the point where they may crowd out other species.

2.4.1 Aquatic Plants in Bear Lake

The Bear Lake ecosystem is home to a rich and diverse plant community, including five extremely high value/sensitive species. A total of 916 survey points were generated by the WDNR but only 617 of those points were shallower than the maximum depth of plants, which was 18 feet. Aquatic plants were found growing at 440 sites, or 48% of the entire lake bottom and in 71% of the littoral zone. At those 440 vegetated sites, there was an average of 3.26 native species found per site.

Overall diversity was high with a Simpson Diversity Index value of 0.91. Species richness was also high with a total of 50 species documented during the point intercept survey (49 species were native while the non-native plant was curly-leaf pondweed). An additional three native species were documented, but were not found at any survey points and thus not used in any plant survey statistics. Plant growth was slightly skewed to shallow water as the mean depth of plant growth was 4.75 feet. Aquatic plant density was high in the northwest basin near Boyer Creek and in the southern basin surrounding Dubsky's Island. Many survey points yielded a rake fullness rating of 3 in those areas.

Flat-stem pondweed (*Potamogeton zosteriformis*), Coontail (*Ceratophyllum demersum*), Fern pondweed (*P. robbinsii*), and Forked duckweed (*Lemna trisulca*) were the most common macrophyte species found at 19.64% , 17%, 6.28%, and 5.26% of survey points with vegetation respectively. Together, they combined for 48.2% of the total relative frequency, which indicates evenness in the plant community (often, the top four species in a lake are

greater than 50%). Northern watermilfoil *(Myriophyllum sibiricum)* (5.13%), large-leaf pondweed *(P. amplifolius)* (4.32%), and wild celery *(Vallisneria americana)* (4.05%) were the only other species with relative frequencies over 4.0%.

A total of 48 native FQI plants were found on the rake during the point intercept survey. They produced a mean Coefficient of Conservatism of 6.13 and a Floristic Quality Index of 42.43. An average mean C for the North Central Hardwoods and Southeastern Till Lakes and Flowages Region is 5.6 (12) putting Bear Lake above average for this part of the state. The FQI was, however, well above the mean FQI of 20.9 for the Region (12). Specifically, the lake supported five extremely high value/sensitive species including Dwarf watermilfoil (*M. tenellum*) (C = 10), Grass-leaved arrowhead (*Sagittaria graminea*) (C = 9), Creeping bladderwort (*Utricularia gibba*) (C = 9), Flat-leaf bladderwort (*U. intermedia*) (C = 9), and Small bladderwort (*U. minor*) (C = 10). Northern wild rice (*Zizania palustris*), a plant of significant wildlife and cultural value, was found in Bear Lake and is described in further detail below.

No evidence of Eurasian water-milfoil was found in Bear Lake. Curly-leaf pondweed was present at 53 of the pre-determined survey points provided by the WDNR in June. Curly-leaf pondweed and other invasive species documented in Bear Lake are described further detail in *Section 2.5* of this plan. More information about the aquatic plant community in Bear Lake can be found in the 2013 Bear Lake Aquatic Plant Survey Report completed by EIS (3).

2.4.2 Wild Rice (*Zizania palustris*)

Northern wild rice (*Zizania palustris*) was found in Bear Lake in the southern bay and along the shoreline of the western basin near Boyer Creek during the 2013 aquatic plant survey (Figure 10 and Figure 11). Wild rice was found in the rake at 45 points. Of these, two had a rake fullness value of 3, eleven were a 2, and the remaining points had a rake fullness of 1. Rice was also recorded as a visual at ten additional points. The Association currently partners with the WDNR for placing buoys and maintaining a no-wake program in areas populated with wild rice.

Wild rice is afforded numerous protections due to its ecological and cultural significance. Management is therefore focused on harvest goals and protection of the resource rather than removal. Any activity included in a comprehensive lake or aquatic plant management plan that could potentially impact the growth of wild rice in any body of water that has in the past, currently has, or potentially could have wild rice in the future requires consultation with the Tribal Nations. This consultation is usually completed by the WDNR in cooperation with GLIFWC during their review of lake management documents.

Wild rice is an annual aquatic grass that produces seed that is a nutritious source of food for wildlife and people. As a native food crop, it has a tremendous amount of cultural significance to the Wisconsin and Minnesota Native American Nations. Wild rice pulls large amounts of nutrients from the sediment in a single year and the stalks provide a place for filamentous algae and other small macrophytes to attach and grow. These small macrophytes pull phosphorous in its dissolved state directly from the water. Wild rice can benefit water quality, provide habitat for wildlife, and help minimize substrate re-suspension and shoreland erosion.

In Wisconsin, wild rice has historically ranged throughout the state. Declines in historic wild rice beds have occurred statewide due to many factors, including dams, pollution, large boat wakes, and invasive plant and animal species. Renewed interest in the wild rice community has led to large-scale restoration efforts to reintroduce wild rice in Wisconsin's landscape. Extensive information is available on wild rice from GLIFWC and the WDNR.

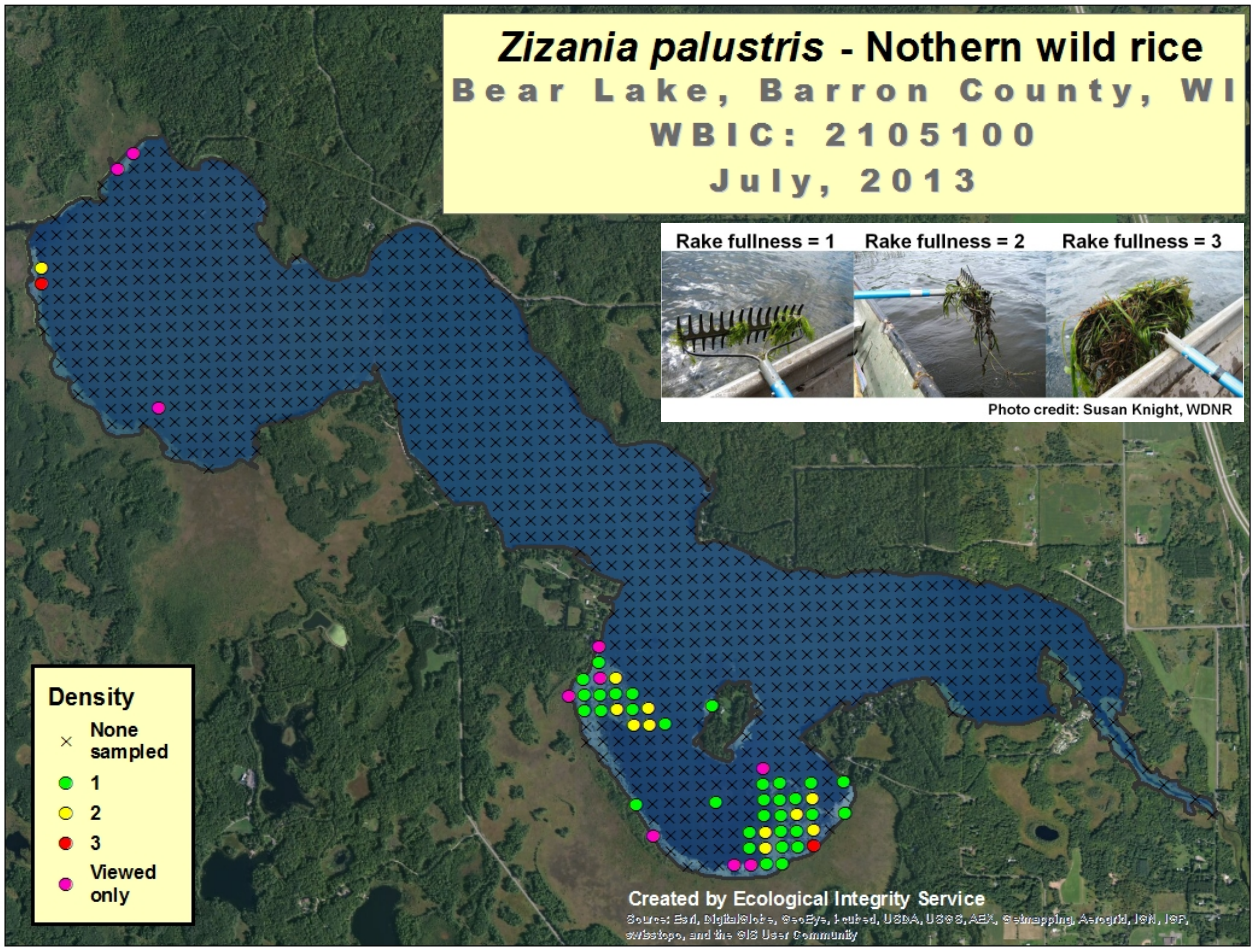


Figure 10 – 2013 Wild Rice Distribution in Bear Lake

Figure 11 – Dense Wild Rice Bed in the South Basin of Bear Lake, 2013

2.5 Non-native Aquatic Invasive Plant Species

In 2009, Bear Lake was monitored for the 8 aquatic invasive species (AIS) shown in Table 5 (13). Purple loosestrife was found at five different sites in 2009, one of which spanned 150 yards of shore and one of which spanned 200 yards of shoreline.

Table 5
Aquatic Invasive Species Monitoring Efforts in Bear Lake

Aquatic Invasive Species	Year(s) monitored	Year(s) found
Curly-leaf pondweed	1992, 2006, 2007, 2009	1992
Purple Loosestrife	2009	2009
Eurasian water-milfoil	2009	--
Zebra mussels	2005, 2009	--
Spiny water flea	2009	--
Banded mystery snail	2009	2009
Chinese mystery snail	2009	2009
Rusty Crayfish	2009	--

One non-native species were found in Bear Lake during the 2013 plant surveys. Twelve beds of curly-leaf pondweed (*Potamogeton crispus*) were found and mapped. More information on these findings can be found below. Purple loosestrife (*Lythrum salicaria)* was historically documented around Bear Lake according to the WDNR SWIMS database, but it was not found (or noted) during the 2013 aquatic plant survey.

2.5.1 Curly-leaf Pondweed (*Potamogeton crispus*)

Curly-leaf was first documented in Bear Lake during a 1992 aquatic plant survey (1). Monitoring for curly-leaf was done in 2006 and 2007 by Blue Water Science and citizen volunteers. A substantial increase in curly-leaf distribution was noted between the 2006 and 2007 monitoring efforts (9). The June 2013 survey found curly-leaf at 104 locations, 53 of which were predetermined survey points provided by the WDNR (Figure 12). Given the number of predetermined survey points in the littoral zone (617), the curly-leaf pondweed frequency of occurrence in 2013 was about 8.6%.

The majority of the curly-leaf growth was found in the far northwest and southeast sections of Bear Lake while low densities of curly-leaf were scattered in other areas. Beds with a definable border that were greater than 200 square feet in size with curly-leaf growing at or near the surface at rake fullness values of at least 1 were delineated during the 2013 survey The locations of the curly-leaf beds are shown in Figure 13 and Figure 14. Twelve such beds were identified in Bear Lake ranging from 0.014 acres (Bed D) to 5.172 acres (Bed C). All twelve beds had a total surface area of 8.9 acres or 0.7% of the total lake surface area (1,348 acres). Beds A through G were in the northwest section of the lake while Beds H through L were in the southeast section of the lake (Figure 14).

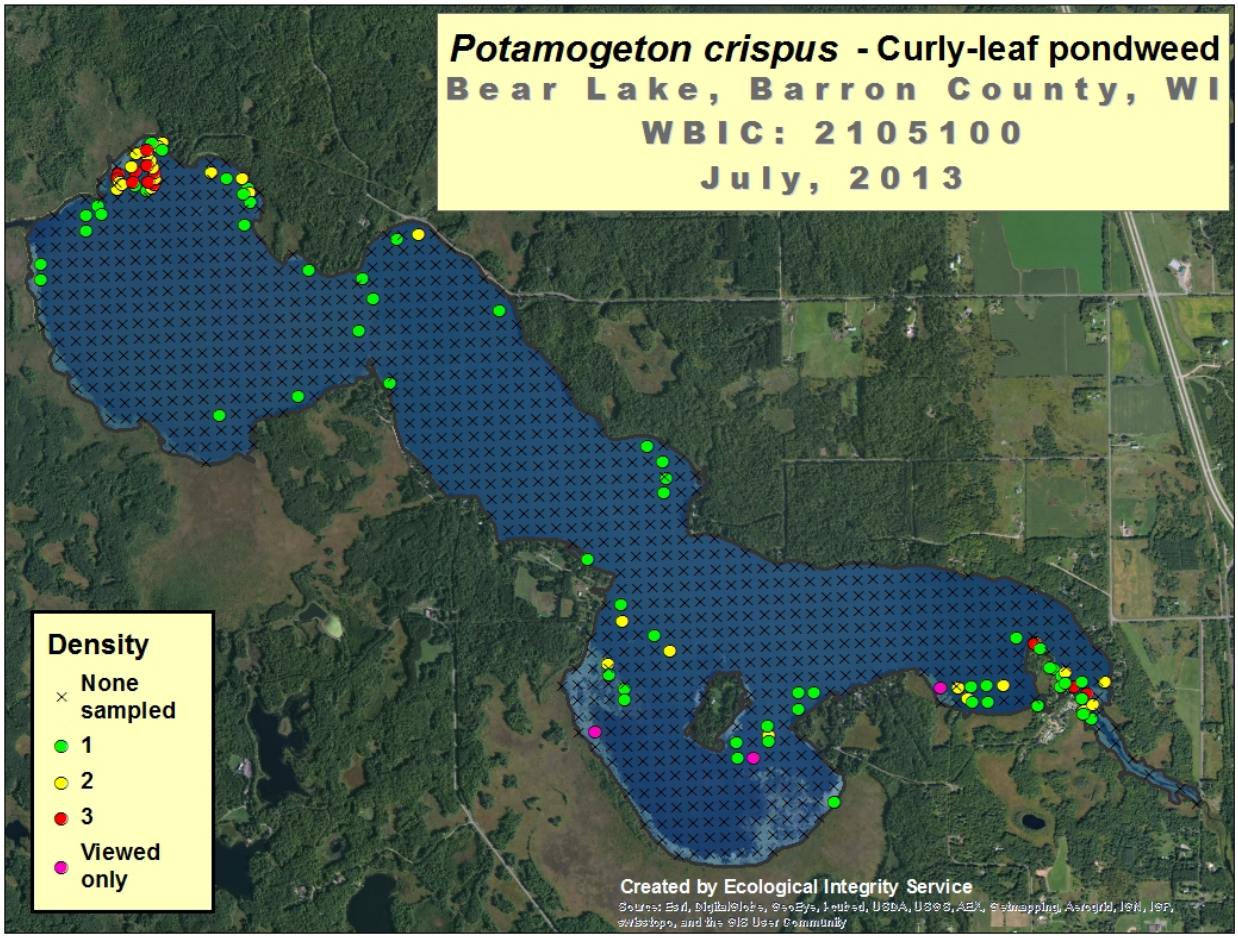


Figure 12 – 2013 Curly-leaf Pondweed Distribution in Bear Lake

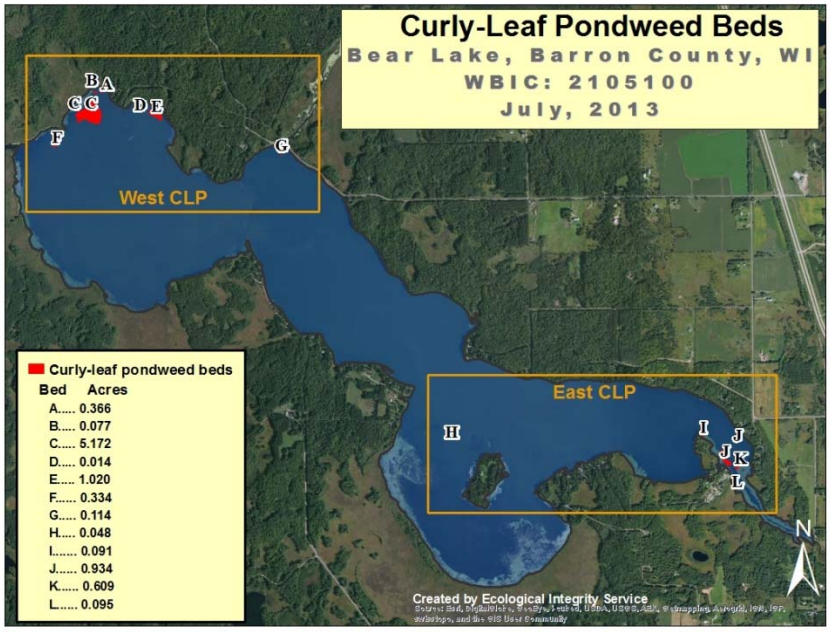


Figure 13 – 2013 Curly-leaf Pondweed Bed Locations

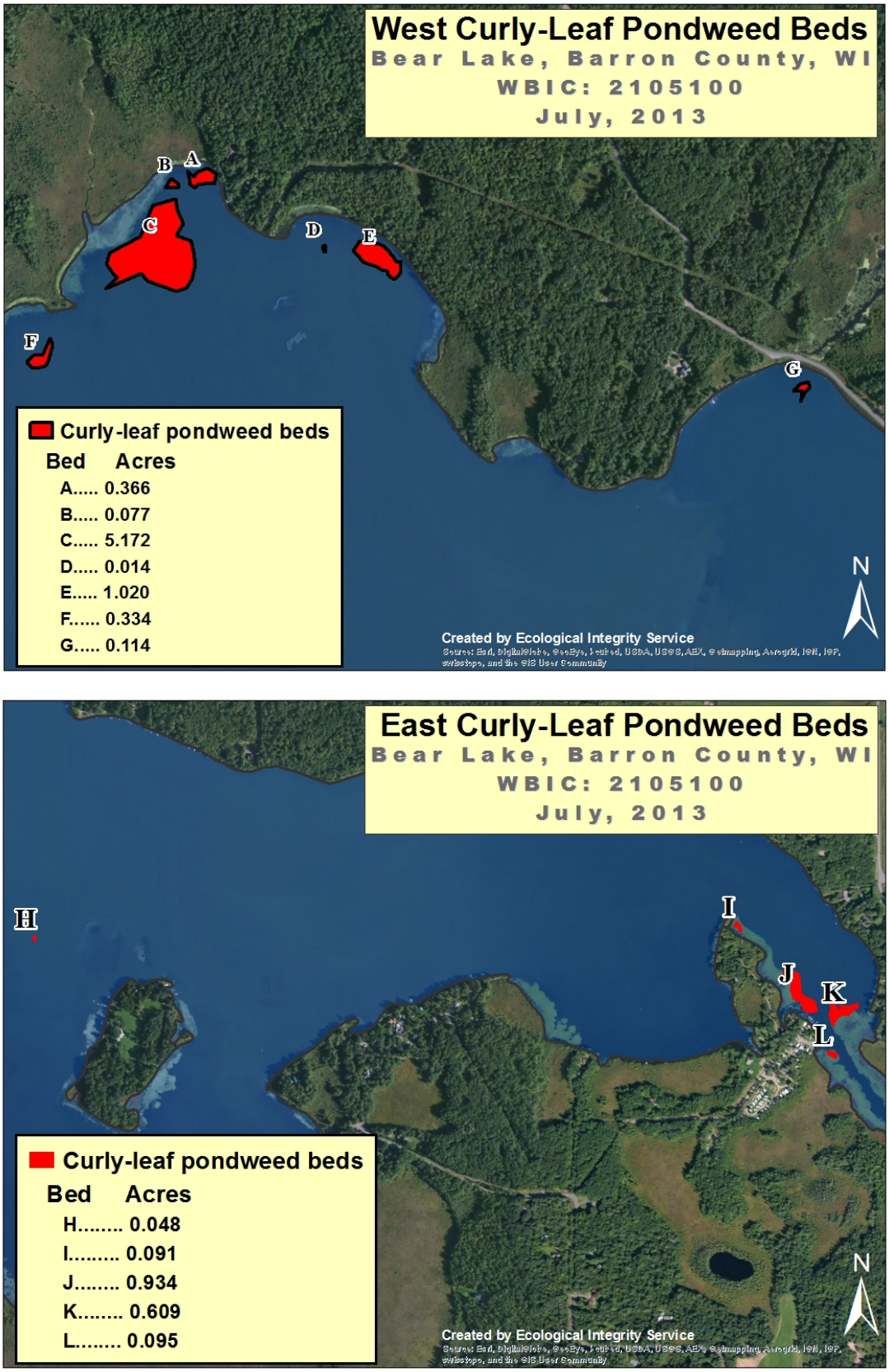


Figure 14 – West and East Curly-leaf Pondweed Bed Areas in Bear Lake

2.5.2 History and Life Cycle of Curly-leaf Pondweed

Curly-leaf pondweed is a submerged aquatic perennial that is native to Eurasia, Africa, and Australia. It was introduced to United States waters in the mid-1880s by hobbyists who used it as an aquarium plant and was planted in Michigan lakes as a food source for ducks. Curly-leaf pondweed has been documented throughout the U.S. In some lakes, curly-leaf pondweed coexists with native plants and does not cause significant problems; in other lakes, it becomes the dominant plant and causes significant problems (14). Dense growth can interfere with late spring and early summer recreation. Furthermore, the nature of curly-leaf is such that it senesces (dies back) during the height of the summer growing season thereby releasing nutrients that can fuel algal blooms. Phosphorus release rates from the senescence of monotypic curly-leaf beds have been reported as high as nearly 10 pounds per acre and averages about 5 pounds per acre (15) (16) (17).

The leaves of curly-leaf pondweed are reddish-green, oblong, and about 3 inches long, with distinct wavy edges that are finely toothed (Figure 15). The stem of the plant is flat, reddish-brown and grows from 1 to 3 feet long. Curly-leaf is commonly found in alkaline and high nutrient waters, preferring soft substrate and shallow water depths. It tolerates low light and low water temperatures.

Figure 15 – Curly-leaf Pondweed

Curly-leaf pondweed spreads through burr-like winter buds called turions which are shown in Figure 16 along with a depiction of the curly-leaf life cycle. These plants can also reproduce by seed, but this plays a relatively small role compared to the vegetative reproduction through turions. New plants form under the ice in winter, making curly-leaf one of the first nuisance aquatic plants to emerge in the spring, often starting to grow late in the fall and staying green under the ice. Growth is accelerated in spring when light and temperature conditions are best suited for growth. Turions begin to grow in June and by late June and early July, the warm water conditions cause curly-leaf to senesce, dropping turions to the sediment while the rest of the plant decays.

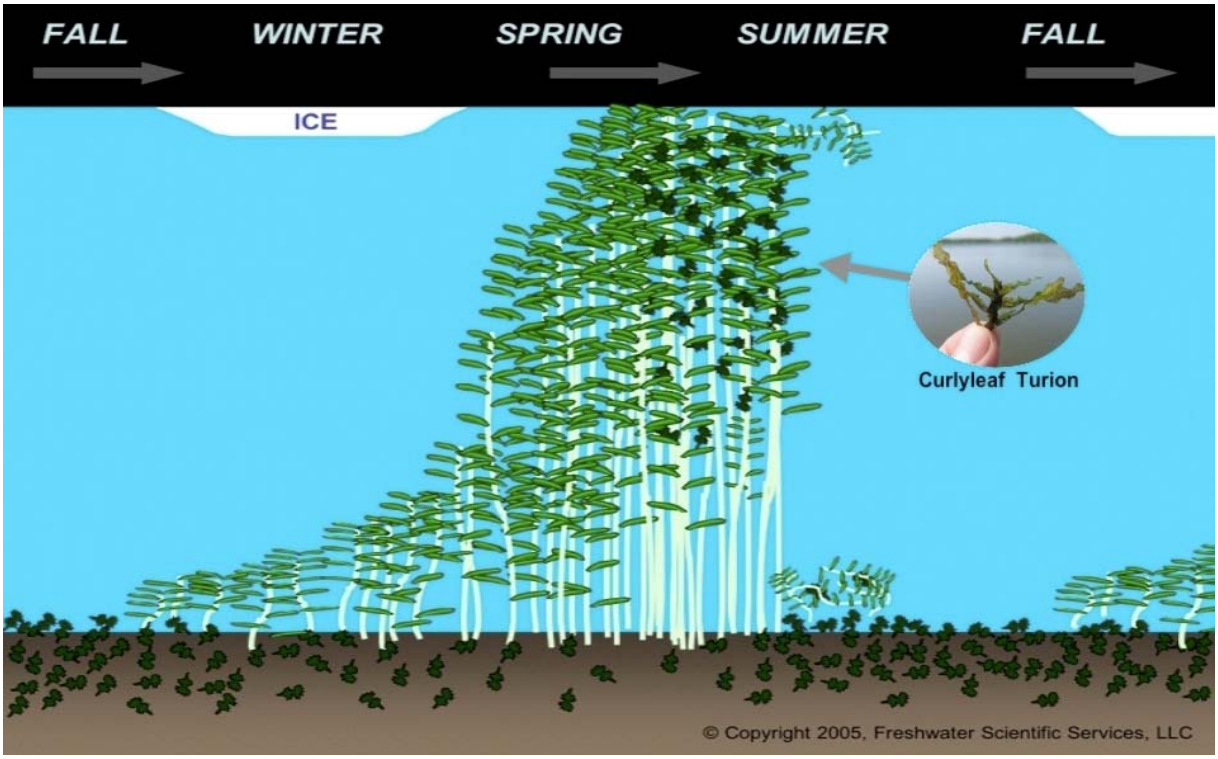


Figure 16 – The Curly-leaf Pondweed Life Cycle

2.5.3 Purple Loosestrife (*Lythrum salicaria*)

During the 2013 aquatic plant survey in Bear Lake, purple loosestrife was not documented at any survey points nor was it recorded during the visual boat survey. However, the WDNR SWIMS database reveals records of purple loosestrife found at five different sites in 2009, one of which spanned 150 yards of shore and another site spanned 200 yards of shoreline (2). Biological control using *Galerucella sp.* beetles has been implemented on the lake since 1998, including a large-scale beetle rearing station in 2013. Regular volunteer monitoring and physical removal has also been implemented. Although it does not appear to be a concern for Bear Lake at present, continued volunteer monitoring for purple loosestrife is recommended.

Purple loosestrife is a perennial herb 3 to 7 feet tall with a dense bushy growth of 1 to 50 stems. The stems range from green to purple and die back each year. Flowers are purple to magenta and possess 5 to 6 petals aggregated into numerous long spikes, which bloom from July to September. It is easiest to distinguish in late July and August as it has a distinctive flowering head. Leaves are opposite, nearly linear, and attached without stalks to four-sided stems. It has a large, woody taproot with fibrous rhizomes that form a dense mat (Figure 17).

The reproductive success of purple loosestrife across North America can be attributed to its wide tolerance of physical and chemical conditions characteristic of disturbed habitats, and its ability to reproduce prolifically by both seed dispersal and vegetative propagation. The absence of natural predators, like European species of herbivorous beetles that feed on the plant's roots and leaves, also contributes to its proliferation in North America. This plant's optimal habitat includes marshes, stream margins, alluvial flood plains, sedge meadows, and

wet prairies. It is tolerant of moist soil and shallow water sites such as pastures and meadows, although established plants can tolerate drier conditions.

Purple loosestrife has also been planted in lawns and gardens, which is often how it has been introduced to many wetlands, lakes, and rivers. By law, purple loosestrife is a nuisance species in Wisconsin. It is illegal to sell, distribute, or cultivate the plants or seeds, including any of its cultivars.

Figure 17 – Purple Loosestrife Flower Head and Stem Mass

2.6 Potential Aquatic Invasive Species Threats

Introduction of new aquatic invasive species is a constant threat to lakes and rivers. The non-native species of most concern are Eurasian watermilfoil, zebra and quagga mussels, spiny water flea, New Zealand mudsnails, and hydrilla. Preventing infestation is the best and least costly alternative, but if a new AIS infestation occurs, early detection is helpful for keeping the species in check.

2.6.1 Eurasian Watermilfoil (*Myriophyllum spicatum*)

Eurasian watermilfoil is a submerged aquatic plant native to Europe, Asia, and northern Africa (Figure 1). Although Eurasian watermilfoil was not found in Bear Lake during extensive surveying in 2013, its introduction remains a concern because of its presence in other lakes such as Shallow Lake, which is approximately 9 miles west of Bear Lake (13).

Figure 1 – Eurasian Watermilfoil

Eurasian watermilfoil first arrived in Wisconsin during the 1960s and is the only non-native milfoil in the state. During the 1980s it began to move from several counties in southern Wisconsin to lakes and waterways in the northern half of the state. Eurasian watermilfoil grows best in alkaline systems with a high concentration of dissolved inorganic carbon and fertile, fine-textured, inorganic sediments. In less productive lakes, Eurasian watermilfoil is restricted to areas of nutrient-rich sediments. It has a history of becoming dominant in eutrophic, nutrient-rich lakes, although this pattern is not universal. It is an opportunistic species that prefers highly disturbed lake beds, lakes receiving nutrient-laden runoff, and heavy-use lakes.

Unlike many other plants, Eurasian watermilfoil is not dependent on seed for reproduction. In fact, its seeds germinate poorly under natural conditions. Eurasian watermilfoil reproduces by fragmentation, allowing it to disperse over long distances by currents and inadvertently by boats, motors, and trailers. The fragments, which are produced after the plant fruits once or twice during the summer and by destruction of the plant (for example by propellers), can stay alive for weeks if kept moist.

Once established in an aquatic community, Eurasian watermilfoil reproduces from shoot fragments and stolons (runners that creep along the lake bed). Stolons, lower stems, and roots persist over winter and store the carbohydrates that help the plant claim the water column early in spring. The rapid growth can form a dense leaf canopy that shades out native aquatic plants. Its ability to spread rapidly by fragmentation and effectively block the sunlight needed for native plant growth often results in monotypic stands.

Monotypic stands of Eurasian watermilfoil provide only a single habitat, and threaten the integrity of aquatic communities in a number of ways. For example, dense stands disrupt predator-prey relationships by fencing out larger fish and reduce the number of nutrient-rich native plants available for waterfowl. Dense stands of Eurasian watermilfoil also inhibit recreational uses like swimming, boating, and fishing. Some stands have been dense enough to obstruct industrial and power generation water intakes. The visual impact that greets the lake user on Eurasian watermilfoil-dominated lakes is the flat yellow-green of matted vegetation, often prompting the perception that the lake is "infested" or "dead". Desiccation of high density Eurasian watermilfoil beds may lead to release of nutrients and subsequent water quality degredation and algae blooms in infested lakes.

Eurasian watermilfoil may or may not thrive in Bear Lake; northern watermilfoil (*Myriophyllum sibiricum*), a native macrophyte and close relative to Eurasian watermilfoil was found in Bear Lake at 76 sites (12% of 617 littoral sites) (3). Illinois pondweed (*Potamogeton illinoensis*), a common associate of Eurasian watermilfoil, was found at 23 sites (4% of 617 littoral sites) (3). The well distributed, healthy native plant community in Bear Lake will help protect that lake from the introduction and subsequent establishment of Eurasian watermilfoil. Research has shown that the abundance of Eurasian watermilfoil in a lake is inversely related to cumulative native plant cover (18). For this reason it is important to maintain healthy and diverse native stands of vegetation (19)

2.7 Fishery and Wildlife

Comprehensive fish surveys done by WDNR in May and August of 2000 found 18 fish species in Bear Lake which are shown in Table 6. Northern Pike are the most common species in Bear Lake with an estimated population of 4.8 adults per acre. The lake has modest populations of walleye (1.2 adults per acre), largemouth bass (1.5 adults per acre) while smallmouth bass populations are low (9). Black crappie, bluegill, and pumpkinseed were abundant in fish surveys with fair (bluegills) to good (crappie and pumpkinseed) size distributions and above average growth rates (9). Overharvest is not a concern; however, consideration of a slot length limit to protect mid-sized northern pike was mentioned in the 2007 Lake Management plan.

Bear Lake is classified as a two-story fishery under the Wisconsin Consolidated Assessment and Listing Methodology, the assessment process used to classify waters for 303(d) status. Two-story lakes are often more than 50 feet deep and are stratified in the summer. These lakes have the potential for an oxygenated hypolimnion during stratification and therefore the potential for coldwater fish species in the hypolimnion. The total phosphorus impairment threshold (nutrient limit) is lower for two-story lakes; the limit is 15 µg/L in two-story lakes as opposed to the 60 µg/L limit for other deep lakes.

Approximately 4,571,000 walleye have been stocked in Bear Lake since 1973 (5) (Table 7). Some natural reproduction of walleye does occur (9). Walleye in north temperate lakes spawn in near-shore, shallow water sites comprised mainly of non-embedded gravel and cobble substrate (20) (21). Protection of such sites may be beneficial to promote continued natural walleye recruitment. There were also 204,000 northern pike fry stocked in 1985. The fry had an average length of one inch (5).

Table 6
Fish Species Found in Bear Lake

Common Name	Scientific Name
Northern Pike	*Esox lucius*
Walleye	*Sander vitreus*
Bluegill	*Lepomis macrochirus*
Black Crappie	*Pomoxis nigromaculatus*
Pumpkinseed	*Lepomis gibbosus*
Yellow Perch	*Perca flavescens*
Smallmouth	*Micropterus dolomieu*
Largemouth	*Micropterus salmoides*
Rock Bass	*Ambloplites rupestris*
Bluntnose minnow	*Pimephales notatus*
Johnny Darter	*Etheostoma nigrum*
Fantail Darter	*Etheostoma flabellare*
Iowa Darter	*Etheostoma exile*
Blackchin Shiner	*Notropis heterodon*
Bowfin	*Amia calva*
Brown Bullhead	*Ameiurus nebulosus*
Yellow Bullhead	*Ameiurus natalis*
White Sucker	*Catostomus commersonii*

Table 7
Walleye Stocking Records for Bear Lake

Year	Age Class	Number Stocked	Average Fish Length (in)
2012	Large Fingerling	13,579	7.47
2010	Large Fingerling	13,573	7.30
2008	Small Fingerling	47,526	1.40
2006	Large Fingerling	13,578	6.95
2004	Fry	525,000	0.20
2004	Small Fingerling	102,326	1.10
2003	Small Fingerling	101,825	2.00
2001	Small Fingerling	101,850	1.70
1999	Small Fingerling	89,005	1.60
1998	Large Fingerling	12,845	3.33
1997	Small Fingerling	67,900	1.70
1995	Fingerling	67,900	2.00
1993	Fingerling	67,900	2.00
1991	Fingerling	68,593	3.00
1989	Fingerling	67,894	3.00
1989	Fry	1,358,000	3.00
1988	Fingerling	36,701	3.80
1988	Fry	1,358,000	1.00
1986	Fingerling	68,064	3.00
1984	Fingerling	67,323	3.00
1982	Fingerling	68,340	3.00
1980	Fingerling	64,492	3.00
1978	Fingerling	67,908	3.00
1976	Fingerling	67,920	3.00
1975	Fingerling	20,090	3.50
1974	Fingerling	20,056	3.00
1973	Fingerling	13,124	3.00
Stocking Records from WDNR Lake Pages (5)			

2.7.1 Critical Habitat

Every body of water has areas of aquatic vegetation or other features that offer critical or unique aquatic plant, fish and wildlife habitat. Such areas can be mapped by the WDNR and designated as Critical Habitat. Critical Habitat areas include important fish and wildlife habitat, natural shorelines, physical features important for water quality (for example, springs) and navigation thoroughfares. These areas, which can be located within or adjacent to the lake, are selected because they are particularly valuable to the ecosystem or would be significantly and negatively impacted by most human induced disturbances or development. Critical Habitat areas include both Sensitive Areas and Public Rights Features. Sensitive Areas offer critical or unique fish and wildlife habitat, are important for seasonal or life-stage requirements of various animals, or offer water quality or erosion control benefits.

The critical habitat areas in Bear Lake were designated in 1998 according to the WDNR Critical Habitat webpage http://dnr.wi.gov/lakes/criticalhabitat/ (last accessed 2014-03-12). A map of the designated areas was found in the 2007 Bear Lake Management Plan (9) and is presented below as Figure 18. The yellow areas in Figure 18 show aquatic plant communities and the red areas outline gravel and cobble sites suited for walleye spawning.

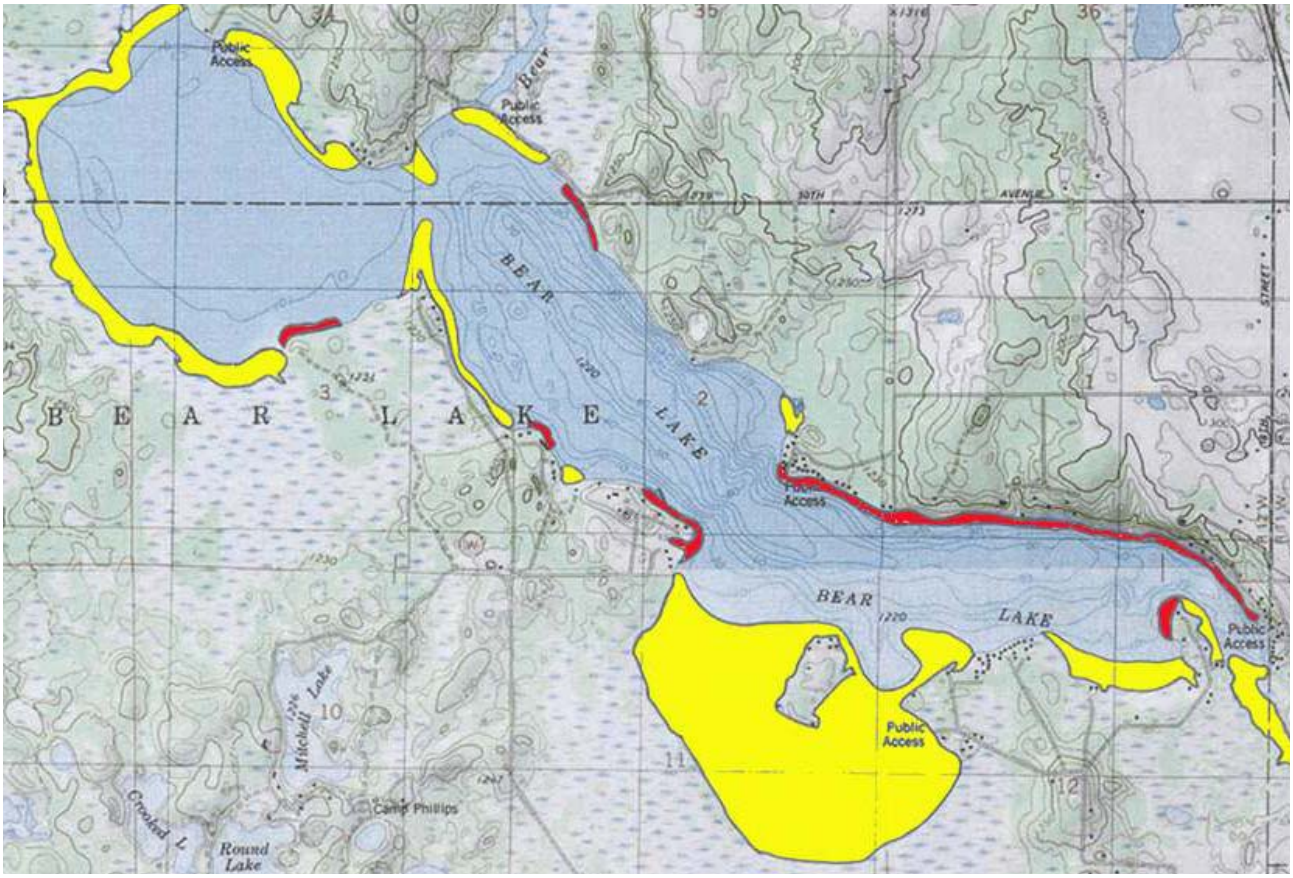


Figure 18 – Critical Habitat Areas in Bear Lake

2.7.2 Rare and Endangered Species and Habitat

The Wisconsin Natural Heritage Inventory (NHI) program is part of an international network of programs that focus on rare plants and animals, natural communities, and other rare elements of nature. Each species has a state status including Special Concern, Threatened, or Endangered. Species are listed by township: Bear Lake is located in the Town of Bear Lake in Barron County (T36 R12W Sections 1, 2, 3, 11, and 12) and the Town of Sarona in Washburn County (T37N R12W Sections 33 and 34). It is important for lake managers to consider impacts to these valuable species, nearly all of which can be directly affected by aquatic plant management. Choosing the proper management techniques and the proper timing of management activities can greatly reduce or prevent negative impacts.

One Threatened species (yellow rail, *Coturnicops noveboracensis*) and seven Species of Special Concern are listed for the Town of Bear Lake in Barron County (T36 R12W) (the bald eagle, *Haliaeetus leucocephalus,* the American bittern, *Botaurus lentiginosus,* LeConte's sparrow, *Ammodramus Leconteii,* trumpeter swan, *Cygnus buccinator,* weed shiner, *Notropis texanus,* sand snaketail, *Ophiogomphus smithi,* and Wilson's phalarope, *Phalaropus tricolor*). One threatened (pugnose shiner, *Notropis anogenus*) and five Special Concern species are listed for T37N R12W in the Town of Sarona in Washburn County (the bald eagle, LeConte's sparrow, trumpeter swan, weed shiner, and least darter). Descriptions of these species can be found at:

http://dnr.wi.gov/topic/EndangeredResources/biodiversity.html/ (last accessed 2014-03-14).

During the 2013 aquatic plant survey, no Wisconsin Species of Special Concern were documented in Bear Lake.

The Natural Heritage Inventory Program tracks examples of all types of Wisconsin's natural communities that are deemed significant because of their undisturbed condition, size, what occurs around them, or for other reasons. Natural communities listed for the Town of Bear Lake in Barron County include: northern sedge meadow, open bog, poor fen, and tamarack swamp. The natural community listed for the Town of Sarona in Washburn County includes the northern sedge meadow. Full descriptions of these communities including current threats can be found on the WDNR website at:

http://dnr.wi.gov/topic/endangeredresources/communities.asp (last accessed 2014-03-14).

A number of high value aquatic plant species listed in NR 107 including *Potamogeton amplifolius, P. illinoensis, P. praelongus, P. richardsonii, P. robbinsii, Eleocharis spp., Scirpus spp.* (also known as *Schoenoplectus spp.*), *Vallisneria americana* and *Brasenia schreberi* were found in Bear Lake. These plant species are known to offer important value to the aquatic ecosystem. Any plant control activities in areas containing these high value species is to be done in a manner which will not result in long-term or permanent changes to the plant community

2.7.3 Chinese and Banded Mystery Snails

Little is known about the ecological impact of Chinese mystery snails and banded mystery snails, non-native species which can be found in Bear Lake. Large die-offs cause a particularly offensive smell and impair lake aesthetics. Management is limited and basically consists of landowner removal and disposal of snails and empty shells washed up on shore. The banded mystery snail and the Chinese mystery snail are shown with a brown mystery snail, a native look-a-like in Figure 19 below. Non-native mystery snails may compete with some native snails, but a study of 44 infested Wisconsin lakes by the UW Center for Limnology found no drastic changes in native snail assemblages after introduction of mystery snails.

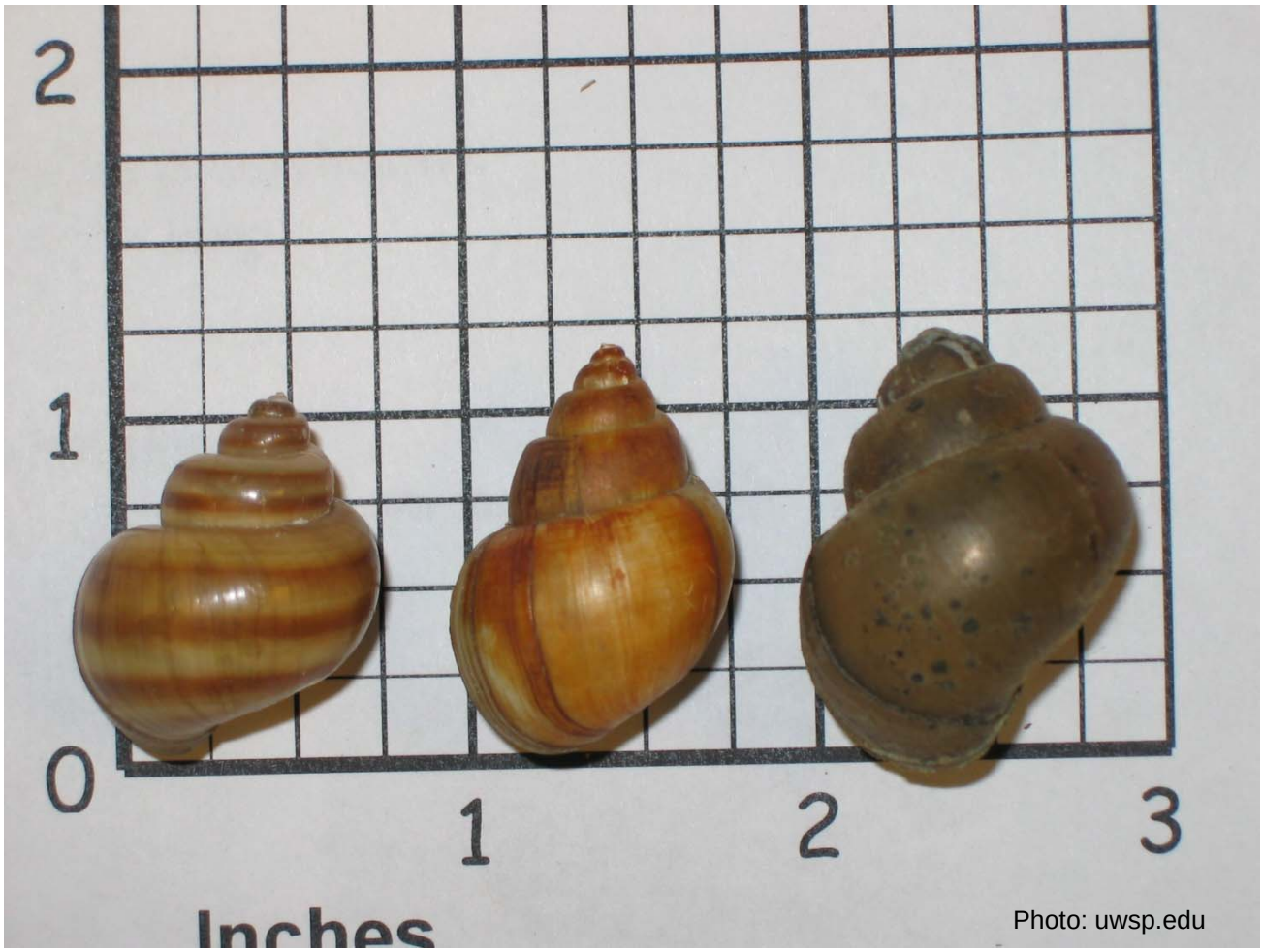


Figure 19 – Banded, Brown (Native), and Chinese Mystery Snails

3.0 Aquatic Plant Management Alternatives Evaluation

Nuisance aquatic plants can be managed a variety of ways in Wisconsin. The best management strategy will be different for each lake and depends on which nuisance species needs to be controlled, how widespread the problem is and the other plants and wildlife in the lake. In many cases, an integrated approach to aquatic plant management that utilizes a number of control methods is necessary.

Control methods for nuisance aquatic plants can be grouped into four broad categories:

- **manual and mechanical control**, which include harvesting, hand-pulling, and raking plants;
- **biological control**, which includes the use of organisms such as herbivorous insects, parasitic organisms, and planting aquatic plants;
- **physical habitat alteration**, which includes dredging, drawdown, lake bottom covers, and non-point source nutrient controls; and
- **chemical control**, which involves the use of herbicides.

Each of the above control categories are regulated by the WDNR and most activities require a permit from the State. Most control methods are regulated under Chapter NR 109 (Appendix C) except for chemical control which is regulated under Chapter NR 107. Installing bottom covers, which is not a commonly accepted practice, also requires a Chapter 30 permit.

Regardless of the target plant species, native or non-native, sometimes no active management of the aquatic plant community is the best option. Plant management activities can be disruptive to native plant species and their ecological functions, and may open up areas for new invasive species to colonize. Other benefits of no management include no financial cost, no system disturbance, and no unintended effects of chemicals. Not managing aquatic invasive species, however, may allow small populations of a plant to become larger and more difficult to control.

The benefits and limitations of a number of management techniques are described below. Although many of the available control methods are currently not applicable for Bear Lake, aquatic plant management options requires an understanding of plant management alternatives and how appropriate and acceptable each alternative is for a given lake.

3.1 No Manipulation

No manipulation of the aquatic plant community is often the easiest, cheapest, and in some cases most effective aquatic plant management alternative, even for non-native invasive species like curly-leaf pondweed. Not actively managing aquatic plants in Bear Lake is recommended in areas where excess aquatic plant growth does not impact lake uses, where the benefit of management is far out-weighed by the cost of management, where water quality or other lake characteristics limit nuisance growth conditions, and where highly valued native plants or habitat would be negatively impacted (for example, areas with wild rice).

3.2 Manual and Mechanical Controls

Except for wild rice, manual removal of aquatic plants by means of a hand-held rake or by pulling the plants from the lake bottom by hand is allowed within a 30-foot-wide corridor along a 100-foot length of shoreline without a permit (as shown in Figure 20) provided the plant material is removed from the lake. Plant fragments can be composted or added directly to a garden.

Even though up to 30 feet of shore can be cleared of aquatic plants, removal should only be done to the extent necessary. Clearing large swaths of aquatic plants disrupts lake habitats, disturbs lake sediment, and creates open areas for non-native species to establish. If an aquatic invasive species such as curly-leaf pondweed is the target species, then removal by this means is unrestricted as long as native plants are not damaged or eliminated.

Manual removal can be effective at controlling individual plants or small areas of plant growth. It limits disturbance to the lake bottom, is inexpensive, and can be practiced by many lake residents. Manual removal is most effective in shallow, hard bottom areas of a lake. Pulling aquatic invasive species while snorkeling or scuba diving in deeper water can be done without a permit and can be effective at slowing the spread of a new aquatic invasive species infestation within a lake when done properly. When harvesting curly-leaf pondweed it is important that all material is removed as free-floating curly-leaf fragments can remain viable and produce turions for up to two weeks. Manual removal is a be a viable management option for certain areas in Bear Lake.

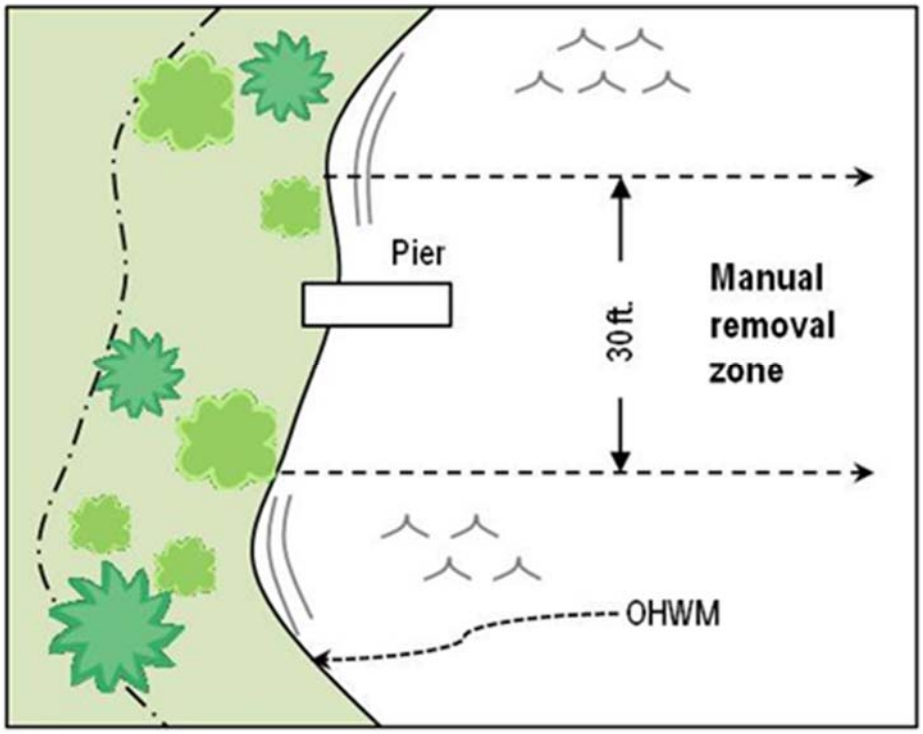


Figure 20 – Aquatic Vegetation Manual Removal Zone

3.2.1 Large-scale Manual Removal

Hand-pulling by wading or SCUBA diving is typically used when an aquatic invasive species exists as single plants or isolated beds, as in new infestations. Large-scale hand or diver removal projects have successfully reduced or controlled established aquatic invasive species populations (22).

One such effort is underway on Red Cedar Lake. In 2011, the Red Cedar Lakes Association performed diver removal on a dense, isolated one-acre bed of curly-leaf pondweed in Red Cedar Lake. This large-scale effort was conducted by a group of local high school students (members of the Conservation Club) and a Red Cedar Lake Association representative. Water depths and inexperience made removal difficult; however, the effort was fairly successful and the divers were able to remove a large boat load of curly-leaf pondweed.

Following the 2012 during early-summer curly-leaf bed mapping survey, it was determined, based on experience the previous year, that hand harvesting was a viable management route. In mid-summer, volunteers re-visited sites and removed on average 83% of the curly-leaf in 14 different beds.

Several lake organizations use large-scale manual removal to manage Eurasian watermilfoil. Horseshoe Lake in Barron County uses diver removal on small or isolated areas of Eurasian watermilfoil, and uses chemical herbicides on larger, more expansive sites. Early in the management phase, Sand Lake in Barron County participated in diver removal, but stopped using divers when the Eurasian watermilfoil expanded too rapidly for the divers to keep up. For several years the St Croix Flowage in Douglas County attempted to control the spread of Eurasian watermilfoil by diver removal. While successful in the first couple of years, the use of small-scale herbicide application has been added to the control regime.

A number of lakes in central Wisconsin are achieving greater success with volunteer-driven Eurasian-watermilfoil manual removal projects. This is primarily due to extensive outreach, training, and program development offered by Paul Skawinski, AIS Education Specialist, and Chris Hamerla, Regional AIS Coordinator and aggressive and prompt response to new invasions in lakes. A video is available online demonstrating the proper way to control a Eurasian watermilfoil population by manual removal efforts at: https://www.youtube.com/watch?v=CfsEDyAwQP4

Overall costs of contracted diver removal of Eurasian watermilfoil have been found to range from a high of $796 per hectare of Eurasian watermilfoil removed during a three-year intensive management effort followed by about $300 per hectare during the subsequent three-year maintenance period (22). This six-year effort successfully reduced the overall distribution of Eurasian watermilfoil in the lake from 16% of the littoral zone to 3%.

3.2.2 Mechanical Control

Mechanical control methods use motorized accessories to assist in vegetation removal. Mechanical control can be used for both small- and large-scale control efforts and require WDNR permits regardless of the size of the area to be managed. As with manual control, plant fragments must be removed from the water to the extent practical.

The most common form of mechanical control is the use of large-scale mechanical harvesters on the lake. The harvesters are generally driven by modified paddle wheels and include a cutter that can be raised and lowered to different depths, a conveyor system to capture and store the cuttings, and the ability to off-load the cuttings. Harvesters operate at depths ranging from skimming the surface to removing vegetation up to five feet below the surface.

Harvesters can remove thousands of pounds of vegetation in a relatively short period of time. By removing the plant biomass, harvesting also removes nutrients from a lake. Everything in the path of the harvester will be removed including the target species, other plants, macro-invertebrates, semi-aquatic vertebrates, forage fishes, young-of-the-year fishes, and even adult game fish found in the littoral zone (23). An advantage of mechanical aquatic plant harvesting is that the harvester typically leaves enough plant material in the lake to provide shelter for fish and other aquatic organisms, and to stabilize the lake bottom sediments (24). Large-scale plant harvesting in a lake is similar to mowing the lawn. Plants are cut at a designated depth, but the root of the plant is often not disturbed. Plant composition can be modified by cutting away dense cover which may increase sunlight penetration enough to stimulate growth of underlying species (Figure 21) (24). Cut plants will usually grow back

after time, just like the lawn grass. Re-cutting during the growing season is often required to provide adequate annual control (25). Harvesting activities in shallow water can re-suspend bottom sediments into the water column releasing nutrients and other accumulated compounds (25). Some research indicates that after cutting, reduction in available plant cover causes declines in fish growth and zooplankton densities. Other research finds that creating deep lake channels by harvesting increases the growth rates of some age classes of bluegill and largemouth bass (26).

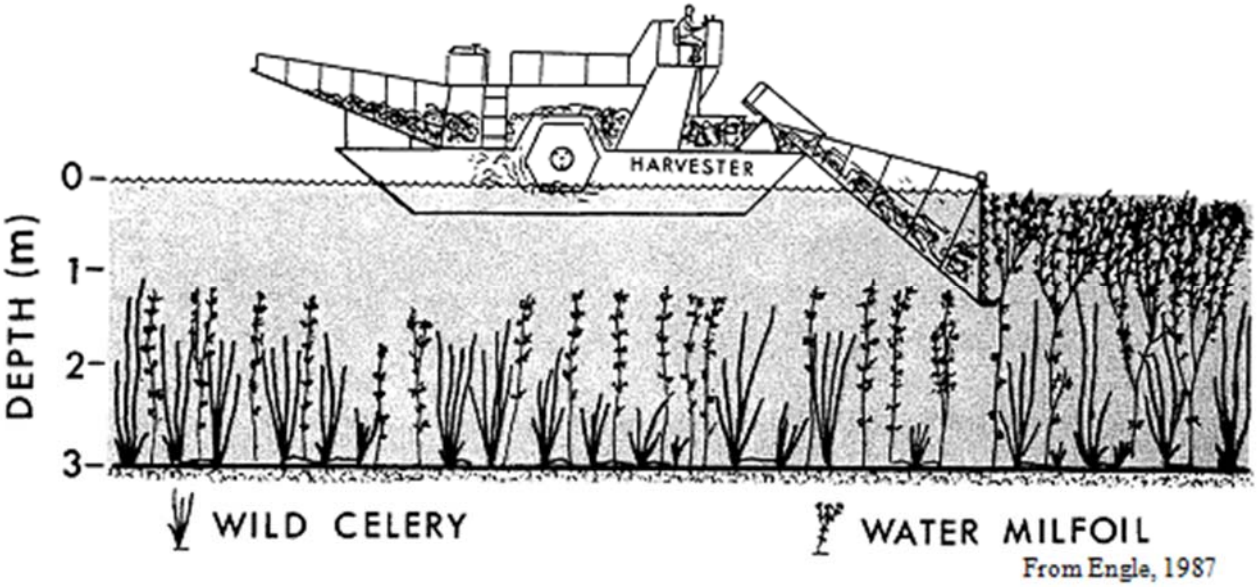


Figure 21 – Harvesting Surface Growth to Maintain Habitat and Simulate Basal Plant Growth

Recent cost per acre for contracting harvesting services average $410 per acre whereas costs for purchasing, operating, and maintaining a harvester average $567 per acre (27). In general, the cost of harvesting decreased with increasing total acreage harvested, from about $500 per acre at 40 acre sites to about $250 per acre at 160 acre sites (27). The Rice Lake Protection and Rehabilitation District in Barron County, Wisconsin owns and operates three harvesters at a cost of approximately $420 per acre harvesting a total of approximately 220 acres. The costs supporting a harvesting program administered by a given lake group may be reduced by purchasing smaller or used equipment, determining a local, low cost disposal site, increasing the amount of acreage harvested, and through other cost analyses. Large-scale plant harvesting of areas with dense CLP growth is an option for aquatic plant management in Bear Lake.

There are a wide range of small-scale mechanical management techniques, most of which involve the use of boat mounted rakes, scythes, and electric cutters. As with large-scale mechanical harvesting, removing the cut plants is required and often accomplished with a rake. Commercial rakes and cutters range in prices from $100 for rakes and cutters that can be thrown from the shore or attached to a boat to around $3000 for electric cutters with a wide range of sizes and capacities. Small-scale mechanical management may be an option for Bear Lake.

One of the best ways for riparian property owners to gain navigation relief near their docks is to actively use their watercraft to create open channels. Although not truly considered mechanical management, plant disruption by normal boat traffic is a legal method of management. Most macrophytes do not grow well in an area actively used for boating and swimming. It should be noted that purposefully navigating a boat in circles to clear large areas is not only potentially illegal, but it can also re-suspend sediments, clear paths for aquatic invasive species growth and cause ecological disruptions.

3.2.3 Suction Dredging

Suction dredging is a form of mechanical harvesting where diver-operated suction tubes connected to barge- or pontoon-mounted pumps and strainer devices are used to vacuum plants uprooted manually by SCUBA divers. This management technique is considered harvesting and not dredging because sediments are not removed from the system. Suction dredging is mostly used for control of isolated, new infestations of aquatic invasive species. Suction dredging requires good visibility for the SCUBA divers (i.e., high water clarity), would probably work best at sites with at least 10 feet of depth or more for divers to control buoyancy, and would also work best where sediment suspension would not cloud diver's vision as plants are uprooted. Furthermore, purchase and assembly of pumps and strainer devices on a pontoon would be required. If there is a committed volunteer base of SCUBA divers and means to secure equipment, suction dredging of CLP is a viable option in Bear Lake.

3.2.4 Other Mechanical Management

The mechanical aquatic plant control methods described below are not recommended for use in Bear Lake because they are often extremely disruptive to aquatic ecosystems. These methods are, however, used in other states or inappropriately employed in Wisconsin and are therefore discussed.

Cutting without plant removal, grinding and returning the vegetation to the water body, and rotovating (tilling) are also methods employed to control nuisance plant growth in some lakes. Cutting is just like harvesting except the plants are left in the lake. Grinding incorporates cutting and then grinding to minimize the biomass returned to the lake. Smaller particles disperse quicker and decay more rapidly. Rotovating works up bottom sediments dislodging and destroying plant root crowns and bottom growth.

Bottom rollers and surface sweepers are devices usually attached to the end of a dock or pier and sweep through an area adjacent to the dock. Continued disruption of the bottom area causes plants to disappear and light sediments to be swept out. The use of rollers may disturb bottom dwelling organisms and spawning fish. Plant fragmentation of nuisance weeds may also occur. In soft bottom areas, sediment disturbance can be significant. These devices are generally not permitted in Wisconsin. A permit under Section 30.12(3) is required which governs the placement of structures in navigable waters.

Another common method for removing aquatic plants from a beach or dock area is for riparian owners to hook a bed spring, sickle mower blade, or other contraption to the back of a boat, lawn mower, or ATV and drag it back and forth across the bottom. This is a type of mechanical management that is illegal to perform in Wisconsin without a permit, and it is usually not permitted by the WDNR.

3.3 Biological Controls

Biological control for aquatic plant management involves using animals, fungi, insects, or pathogens as a means to control nuisance plants. The goal of bio-control is to develop a predator-prey relationship where the growth of nuisance plants is reduced, but not eliminated. A special permit is required in Wisconsin before any biological control measure can be introduced into a new area.

Specific biological controls of curly-leaf pondweed are not known at this time. Ongoing research on naturalized and native herbivores and pathogens that impact nuisance aquatic and wetland plants is increasing the number of potential biological control agents that could be incorporated into invasive plant management programs (28).

The grass carp (*Ctenopharyngodon idella*), which feeds on aquatic plants and has been used as a biological tool to control nuisance aquatic plant growth in other states, is not permitted in Wisconsin. These fish can severely disrupt the aquatic ecosystem and have been known to nearly wipe out all aquatic vegetation in the lakes they inhabit.

The *Galerucella* beetle (*G. calmariensis* and *G. pusilla*) has proven to be extremely effective for control of purple loosestrife. These beetles have been used across North America to manage purple loosestrife, including around Bear Lake. Use of *Galerucella* beetles for purple loosestrife management should be continued.

The milfoil weevil (*Euhrychiopsis lecontei*) is a native aquatic weevil that feeds on aquatic milfoils. Their host plant is typically northern watermilfoil, but they prefer Eurasian watermilfoil when it is available. Utilizing the milfoil weevil for Eurasian watermilfoil control has resulted in variable levels of control, with little control achieved on lakes with extensive motorized boat traffic. Researchers in Wisconsin have been developing a protocol for citizen rearing of the milfoil weevil.

Plant fungi and pathogens are currently still in the research phase. Certain species for control of hydrilla and Eurasian watermilfoil have shown promise, but only laboratory tests in aquariums and small ponds have been conducted. Methods are not available for widespread application. Whether these agents will be successful in flowing waters or large-scale applications remains to be tested (29).

Selectively planting native aquatic plants to encourage or stimulate growth of desired plant species is another form of biological control. Introducing native plants is uncommon as it is often difficult and costly and requires a fairly large source of new plants and substantial short-term labor for collecting, planting, and maintaining the stock. Maintenance of plantings may require protection from fish and birds and temporary stabilization and protection of sediment in the planting area from wind and waves. Allowing the natural re-growth of native plants in cleared areas can prevent curly-leaf and other non-native invasive plant species from establishing in those sites.

3.4 Physical Habitat Alteration

Reducing nutrient loading from the watershed (for example, reducing fertilizer use or controlling construction erosion) provides fewer nutrients available for plant growth. Runoff from development in the near-shore area and from other parts of the watershed can increase the amount of phosphorus available for plant and algae growth. Decreased light penetration due to increased algae in the water produces a favorable environment for plants that have adapted to low-light conditions, such as curly-leaf pondweed. Higher nutrient concentrations also favor other non-native plants such as Eurasian watermilfoil and native plants that can grow to nuisance levels, such as coontail.

Research has shown that as shoreline development increases, the amount of aquatic plant growth near that lake shore decreases. In a Minnesota study of 44 lakes with varying amounts of developed shoreline, the average loss of aquatic plants in developed areas was 66% (30). On a lake wide basis, this loss of aquatic plant growth can lead to higher levels of phosphorus and an increase in the growth of algae, including filamentous algae that may attach to structures within the littoral zone or form surface mats. Reducing nutrient loading from the watershed (for example, reducing fertilizer use, controlling construction erosion, or shoreland restoration and buffers) is a viable option for Bear Lake.

Dredging is usually not performed solely for aquatic plant management but to restore lakes that have been filled in with sediments, have excess nutrients, have inadequate pelagic and hypolimnetic zones, need deepening for navigation, or require removal of toxic substances. A WDNR permit is required to perform any dredging in a waterbody or wetland. This method can be detrimental to desired plants, as all macrophytes would be prevented from growing for many years. This high level of disturbance may also create favorable conditions for the invasion of other invasive species. Dredging is not recommended for aquatic plant management Bear Lake.

Benthic barriers or other bottom-covering approaches are another possible physical management technique. Plants are covered with a layer of a growth-inhibiting substance such as sheets or screens of natural or synthetic materials, sediments such as dredge sediment, sand, silt or clay, fly ash, and combinations of the above. WDNR approval is required and screens must be removed each fall and reinstalled in the spring to be effective over the long term. Benthic barriers are not recommended for aquatic plant management in Bear Lake.

Lowering the lake level to allow for the desiccation, aeration, and freezing of lake sediments can be an effective aquatic plant management technique. Repeated winter drawdowns that last for 4 to 6 months and include a freezing period are sometimes effective for control of certain aquatic plants, such as Eurasian watermilfoil. The lowered lake levels may negatively affect native plants, provides an opportunity for adventitious species such as annuals to expand, often reduces the recreational value of a waterbody (less lake area, more exposed flats), and can impact the fishery if spawning areas are affected. The cost of a drawdown is dependent on the outlet of the lake; if no control structure is present, pumping of the lake can be cost prohibitive whereas costs can be minimal if the lake can be lowered by opening a gate. Raising water levels to flood out aquatic plants is uncommon and has a number of negative effects including the potential for shoreland flooding, shoreland erosion, and nutrient loading. Lake level alterations are not recommended for aquatic plant management in Bear Lake.

3.5 Chemical Control

Aquatic herbicides liquid or granular chemicals specifically formulated for use in water to kill plants or cease plant growth. Herbicides approved for aquatic use by the U.S. Environmental Protection Agency are considered compatible with the aquatic environment when used according to label directions. Some individual states, including Wisconsin, also impose additional constraints on herbicide use. There are a number of aquatic herbicides registered for use in Wisconsin. Factsheets for each can be found on the WDNR website at http://dnr.wi.gov/lakes/plants/factsheets/ (last accessed November 2013).

A WDNR permit is required to use chemical herbicides in aquatic environments and a certified pesticide applicator is required for application on most lakes. The WDNR requires aquatic plant surveys before and after chemical application when introducing new treatments to lakes where the treatment size is greater than 10 acres or greater than 10% of the lake littoral area and more than 150 feet from shore. The pre- and post-treatment survey protocol can be found at: http://www4.uwsp.edu/cnr/uwexlakes/ecology/APM/Appendix-D.pdf (last accessed November 2013).

The advantages of using chemical herbicides for control of aquatic plant growth are the speed, ease and convenience of application, the relatively low cost, and the ability to somewhat selectively control particular plant types with certain herbicides. Disadvantages of using chemical herbicides include possible toxicity to aquatic animals or humans, oxygen depletion after plants die and decompose which can cause fishkills, a risk of increased algal blooms as nutrients are released into the water by the decaying plants, adverse effects on desirable aquatic plants, loss of fish habitat and food sources, water use restrictions, and a need to repeat treatments due to existing seed/turion banks and plant fragments. Chemical herbicide use can also create conditions favorable for non-native aquatic invasive species to outcompete native plants (for example, areas of stressed native plants or devoid of plants).

When properly applied, the possible negative impacts of chemical herbicide use can be minimized. Early spring to early summer applications are preferred because exotic species are actively growing and many native plants are dormant, thus limiting the loss of desirable plant species; plant biomass is relatively low minimizing the impacts of de-oxygenation and contribution of organic matter to the sediments; and recreational use is generally low limiting human contact. The concentration and amount of herbicides can be reduced because colder water temperatures enhance the herbicidal effects. Selectivity of herbicides can be increased with careful selection of application rates and seasonal timing (31). Lake hydrodynamics must also be considered; steep drop-offs, inflowing waters, lake currents and wind can dilute chemical herbicides or increase herbicide drift and off-target injury. This is an especially important consideration when using herbicides near environmentally sensitive areas or where there may be conflicts with various water users in the treatment vicinity.

4.0 Strategic Plan (Management Goal, Objectives and Action Items)

Bear Lake contains a diverse aquatic plant community. The overall goal of aquatic plant management in Bear Lake is to protect the existing native aquatic plant resource from degradation by maximizing prevention of new invasions and through the containment and control of existing aquatic invasive species.

The objectives for this plan include:

- **Preservation and Restoration**. Protect the native plant species community in and around the lake to decrease susceptibility to the introduction of new aquatic invasive species and to improve water quality. Restore shoreland areas susceptible to erosion and work with landowners to promote natural shorelines.
- **Prevention**. Prevent the introduction and establishment of new aquatic invasive species through early detection and rapid response.
- **Management**. Limit the manual removal of native aquatic plants around docks unless it is essential for navigation. Reduce existing curly-leaf pondweed in Bear Lake through containment and control.
- **Education and Awareness**. Continue public outreach and education programs on aquatic invasive species.
- **Research and Monitoring**. Develop a better understanding of the lake and the factors affecting lake water quality through continued and expanded monitoring efforts.
- **Adaptive Management**. Follow an adaptive management approach that measures and analyzes the effectiveness of control activities and modify the management plan as necessary to meet goals and objectives.

Each objective and associated action items are discussed in more detail below.

4.1 Preservation and Restoration

Eighty percent of the plants and animals on the Wisconsin Endangered and Threatened Species List spend all or part of their life cycle within the near-shore zone and as many as ninety percent of the living things in lakes and rivers are found along the shallow margins and shores. Activities along a lakeshore and in the immediate shoreland area can have major impacts on overall lake quality.

Shoreland buffers provide non-point source nutrient control by slowing runoff and utilizing nutrients (and contaminants) before they reach the lake. Curly-leaf pondweed can grow in more turbid waters than many native plants, so maintaining the high water clarity of Bear Lake helps native plants compete more effectively with curly-leaf. Lakeshore residents are encouraged to allow plant growth along shore that will act as a buffer.

Preserving and restoring native shoreland plant communities can reduce erosion, increase and improve native habitat, reduce shoreland runoff, improve water quality, and compliment the lake aesthetic. The re-establishment of emergent aquatic plants in the shallow waters adjacent to the shore, such as rushes, sedges, pickerel weed, and wild rice help anchor sediments, fend off the invasion of non-native species, buffer against shoreland erosion, and improve fish and wildlife habitat. For these reasons, lakeshore residents are encouraged to allow the re-growth of native plants in cleared, shallow-water areas.

To maintain or improve the lake ecosystem, the Association will provide riparian owners with educational materials on shoreland improvement and sponsor shoreland restoration training events. Often, the main barrier preventing lake residents from implementing a shoreland restoration project is not knowing where to begin. General information on shoreland restoration will be provided to all members in a newsletter, on a webpage, and during public events.

Recent research has revealed that riparian property owners evaluate their own shorelines significantly more natural than biologists' evaluations (32). It is recommended that a shoreline evaluation be performed by resource professionals or trained volunteers. The information collected will provide baseline data on the status Bear Lake's shoreline and will allow for focused education and outreach efforts.

The Association may further encourage riparian property owners to diversify the shoreland environment by recognizing riparian owners who implement shoreland restoration and habitat improvement projects. Recognition can be in a number of ways, for example, by displaying a special sign on the shoreline or posting a notice on the webpage.

4.2 Prevention

Early detection and rapid response efforts increase the likelihood that a new aquatic invasive species will be addressed successfully while the population is still localized and levels are not beyond that which can be contained and eradicated. Once an aquatic invasive species becomes widely established in a lake, all that might be possible is the partial control of negative impacts. The costs of early detection and rapid response efforts are typically far less than those of long-term invasive species management programs.

The Association will develop a proactive and consistent aquatic invasive species monitoring program that includes both casual observers and trained monitors. At least three times during the open water season, trained volunteers will patrol the shoreline and littoral zone looking for curly-leaf pondweed, Eurasian watermilfoil, purple loosestrife, Chinese and Banded mystery snails, zebra mussels, and other invasive species.

Monitoring will be completed as a part of the UW-Extension Lakes/WDNR Citizen Lake Monitoring Network Aquatic Invasive Species Monitoring Program. Training is available through the Wisconsin Citizen Lake Monitoring Network (different from Clean Boat Clean Waters monitoring) and the WDNR provides an excellent guide for monitoring called *Aquatic Invasive Species, A Guide for Proactive & Reactive Management* which can be found online at http://dnr.wi.gov/Aid/documents/AIS/AISguide06.pdf (last accessed November, 2013). Volunteers can select AIS of interest; learn when, how and where to monitor; and find out how to report a new AIS infestation. Many new Eurasian watermilfoil and other invasive species finds have been from volunteers who know their lake. All monitoring data will be recorded annually and submitted to the WDNR SWIMS database.

Property owners will be encouraged to monitor their shoreline and open water areas for new growths of aquatic invasive species. These casual observers can undergo more simplified training than the trained monitors via meeting presentations or from more technically trained monitors. If a suspect aquatic invasive species is found, it will be reported to the Association, County Conservation Departments , and the WDNR. Note: the contacts found in the Rapid Response Plan (Appendix D) pertain to all aquatic invasive species.

Aquatic invasive species can be transported via a number of vectors, but most invasions are associated with human activity. Monitoring of the high traffic boat launches on Bear Lake by volunteer and paid inspectors will continue and monitoring will follow WDNR/UW-Extension Clean Boats, Clean Waters guidelines. All watercraft inspection data collected should be submitted to the WDNR SWIMS database. The Association will participate in the Fourth of July Landing Blitz, an outreach effort to warn boaters of the dangers of transporting invasive species that takes place on the Fourth of July, a high-boat traffic day. The Association will also continue to maintain and update signage at the boat launches as necessary.

Preventing the introduction of invasive species is the first line of defense against invasions, but even the best prevention efforts may not stop all invasive species introductions. A Eurasian Watermilfoil Rapid Response Plan has been created for the Bear Lake and included as Appendix D of this plan. The Rapid Response Plan contains information on what to do if a potential aquatic invasive species is found including contacts for authoritative verification and what should be done if a positive identification is made.

4.3 Management

Aquatic plant management in Bear Lake will follow an integrated management approach that relies on a combination of methods and techniques, specifically manual and biological control methods. Chemical herbicides will not be used to control curly-leaf pondweed in Bear Lake because of potential negative impacts to wild rice, often found interspersed with the curly-leaf. Should the need arise, this plan provides guidelines for mechanical harvesting of curly-leaf pondweed and nuisance native plant growth.

Manual harvesting will be done to control both native and non-native and nuisance plant growth around docks, in navigation channels, and in beds of curly-leaf pondweed. Manual removal of aquatic plants may be completed at any time following the guidelines and regulations set forth in NR 109, which can be found in Appendix C. Native plant removal should be limited to the amount needed to access open water areas.

Coarse woody habitat (tree falls, logs, etc.) should be left in the water. Coarse woody habitat is a critical feature of lakes that influences fish behavior, spawning, predator-prey interactions, growth, and species diversity. For example, research has shown that the growth of largemouth bass and bluegill are positively correlated with coarse woody habitat in lakes and a whole lake removal of coarse woody habitat led to the collapse of a yellow perch population (33).

Management practices that protect water quality should be implemented by property owners. For example, property owners should avoid mowing down to the lakeshore and reduce grass clippings, runoff, fertilizer applications, pet waste, ash from fire pits, and other sources of nutrients near the lakeshore. Good water quality is important for maintaining a healthy native aquatic plant community and many of the native plants that can grow to nuisance levels, such as coontail, prefer high-nutrient waters. Property owners on Bear Lake should also be encouraged to have regular septic system inspections to protect water quality.

4.3.1 Native Aquatic Plants

Management of native aquatic plants should only be implemented when plant density reaches nuisance levels, or impedes property owner access to open water. A method for determining and documenting nuisance native plant growth and impaired navigation caused by native plants, alternatives to plant removal, and management options can be found in Appendix E. The preferred methods of native aquatic plant management are physical removal (hand-pulling and raking) and via normal boat traffic to keep navigation channels

open. Physical removal will be implemented by individual property owners by themselves or by an appointee and must follow guidelines in NR109.

The objective of wild rice management is to protect and enhance the waters where wild rice is currently present and allow only management activities that will maintain or increase the amount of wild rice in the lake. Bear Lake is considered an Area of Special Natural Resource Interest because of the presence of wild rice throughout the lake. With this designation, certain management activities are limited and those that are allowed require special reviews and permits. For example, the removal of wild rice plants is prohibited unless a request is subject to the full consultation process via the Voigt Tribal Task Force. The removal of wild rice plants is strongly discouraged because of its ecologic and cultural significance.

The Association will partner with the WDNR, UW-Extension, and GLIFWC to provide education and information related to the value of wild rice as a resource found in the lakes. An example is to invite a resource professional to present on wild rice, or to set up a demonstration of wild rice harvesting techniques. The Association will also continue the current buoy and no wake zone protection program in partnership with the WDNR.

4.3.2 Curly-leaf Pondweed

The target level of curly-leaf pondweed growth in Bear Lake is distribution and density levels equal to or less than the growth found during the 2013 curly-leaf survey. Curly-leaf pondweed was first officially documented in Bear Lake in 1992 (1). The June 2013 survey found curly-leaf at 104 locations, 53 of which were predetermined survey points provided by the WDNR. Given the number of predetermined survey points in the littoral zone (617), the curly-leaf pondweed frequency of occurrence was approximately 8.6%. The majority of curly-leaf was found in the far northwest and southeast sections of the lake while low densities were scattered in other areas. Twelve beds of curly-leaf were delineated and ranged from 0.014 acres to 5.172 acres. All twelve beds had a total surface area of 8.9 acres or 0.7% of the lake's 1,348 acres.

Physical (manual) and mechanical controls of curly-leaf pondweed are recommended for management. Chemical control (herbicide) is not recommended because the beds of curly-leaf are established near beds of wild rice, which is protected due to its ecological and cultural significance.

The sparse occurrences of curly-leaf outside the delineated beds and the curly-leaf found near docks should be manually harvested (removed by hand, rake, or diver) and the areas monitored for expansion into monotypic beds. Pioneer populations of curly-leaf less than 0.25 acres with a rake fullness rating of 3 should also be manually controlled. The Association will evaluate available training for curly-leaf identification and removal methods in 2014. If the interest and capacity is available, the Association will coordinate physical removal education and larger scale removal efforts, either by assigning these responsibilities to a committee or by forming a new committee. The committee will teach members m and other interested parties on how to remove individual plants and small clusters of curly-leaf in shallow, easily accessible areas of the lakes. Instructional materials and training will be provided to aid riparian owners in the identification and removal of curly-leaf. The Association will also sponsor an annual Curly-leaf Removal Day in early to mid-summer during which volunteers will employ a vigorous removal program.

The purchase of a mechanical harvester by the Association is an option for long term management of curly-leaf pondweed and it can also be used to maintain navigation channels near the Bear Creek outlet and other areas of nuisance aquatic plant growth. Channels up to

20 feet wide, which will allow for safe boat passing, are recommended in areas where property owner access to open water is impaired by nuisance aquatic plant growth. Harvesting of These channels should be perpendicular to shore and link directly with the main boating channel or nearest open water. No harvesting should occur in water less than three feet deep and cutting depth cannot exceed two-thirds of the total water depth.

In the event that navigation and open water access channels are needed, the location and dimensions will be pre-determined. See Appendix E for the steps in determining and documenting nuisance native plant growth conditions and navigation impairment caused by native plants. Spring harvesting of curly-leaf pondweed for navigation and open water access channels should be completed between May 15 and June 15. Summer harvesting may be required at least once to maintain boating channels. The Association will refrain from harvesting native plants unless absolutely necessary to avoid colonization in harvested areas by curly-leaf pondweed or other AIS.

The Association will identify volunteers or hire a resource professional to complete annual curly-leaf pondweed bed mapping and density monitoring. A resource professional is suggested to ensure accurate comparisons between surveys and to identify areas that are candidates or targets for control activities. Monitoring should be completed in early May to identify new colonies and in mid-June when curly-leaf is near its peak growth before senescence. Density will be measured using rake sampling following current WDNR aquatic plant monitoring guidelines (that is, the 0 to 3 rake fullness density measurement). New growth areas and beds with a rake density rating of 3 will be priority control areas. A bed is defined as an area where curly-leaf pondweed comprises greater than 50% of the plant biomass in the area with clearly defined borders.

4.3.3 Purple Loosestrife

Purple loosestrife control will be continued to prevent it from becoming monotypic stands along the shoreline and in adjacent wetlands. Success will be measured by keeping this plant at levels equal to or below current levels. Appropriate management alternatives for purple loosestrife control include hand-pulling and digging and biological control (*Galerucella* beetles). Monitoring for new purple loosestrife plants will be completed by volunteers in July and August when the plant is flowering and readily visible. The Association will offer training and support materials to the volunteers. Physical removal will be used to control individual plants or isolated pioneering sites.

4.4 Education and Awareness

Providing education and outreach opportunities and materials to the lake community will improve the general knowledge base and likely increase participation in lake protection and restoration activities. To allow for greater and easier distribution, the Association will condense the Executive Summary, Strategic Plan, Implementation Roadmap, Rapid Response Plan (Appendix D), and any other portions of this report deemed necessary into a summary report available to the membership.

The Association will continue to cultivate a lake community that is aware of aquatic invasive species and has enough knowledge to aid in the detection, planning, and implementation of management alternatives. The Association should also foster a greater understanding and appreciation of the entire aquatic ecosystem and the important role plants, animals and people play in that system. Three to four members of the Association should attend the Wisconsin Lakes Partnership Convention and the Northwest Wisconsin Lakes Conference each year to network and learn from resources professionals and other lake groups.

It is important for the lake community and lake users to know how their activities impact the aquatic plants and water quality of the lake. The Association will distribute educational materials and provide educational opportunities on aquatic invasive species and other factors that impact Bear Lake. Educational and information pamphlets and brochures are available for the WDNR, the UW-Extension, County offices and Federal agencies. The brochures could be provided via direct distribution, Association or lake-oriented meetings, area library displays, and incorporated in newsletters.

At least one annual activity (for example, lake fair, public workshop, guest speaker) will be sponsored and promoted by the Association that focuses on aquatic invasive species. Maintaining signs and continuing active inspections of watercraft at public launches will educate boaters about what they can do to prevent the spread of aquatic invasive species. Results of water quality monitoring should be shared with the lake community at the annual meeting or at another public event to promote a greater understanding of the lake ecosystem which may increase participation in planning and management.

The Association will provide educational materials and information related to wildlife and wildlife monitoring programs during public events or meetings, in newsletters, or on a webpage. Other wildlife monitoring programs sponsored by the Citizen-based Monitoring Network of Wisconsin (http://wiatri.net/cbm/) will be promoted by the Association and member participation will be encouraged. The Association will help make arrangements for training opportunities for these and other wildlife monitoring and appreciation events.

It is important for board members and other interested parties to remain abreast of current developments and management strategies. There are a number of publications, conventions, and seminars available through governmental and educational agencies in both Wisconsin and Minnesota. The Wisconsin Lakes Partnership and the UW-Extension publishes *Lake Tides* which includes information on learning events and recent developments in lake management. *Lake Tides* is available by mail or online at http://www4.uwsp.edu/cnr/uwexlakes/laketides/.

4.4.1 Comprehensive Lake Management Planning

To further understand those factors affecting Bear Lake and where to focus lake protection and management efforts, the Association will evaluate the need to update the 2007 Bear Lake Comprehensive Lake Management Plan within the next two years. Comprehensive Lake Management Plans typically address five key components: water quality, aquatic plants, fisheries, the watershed, and public involvement. Based on results of the 2013 public input survey, the community still has concerns about each component; this plan focuses on aquatic plants, and therefore an evaluation of what has been done and what needs to be done with the Comprehensive Plan is in order.

The majority of respondents of the 2013 public input survey felt faulty septic systems, agricultural and lawn runoff and inflow from streams are the primary causes of water quality deterioration in Bear Lake. Future research and education efforts should first focus on these nutrient sources to meet community expectations.

4.5 Research and Monitoring

The purpose of this objective is to develop a better understanding of the lake and the factors affecting lake water quality through continued and expanded monitoring efforts.

4.5.1 Water Quality

Participation in the Citizen Lake Monitoring Network (CLMN) Water Quality Monitoring Program will continue. At a minimum, water clarity, temperature, dissolved oxygen, total phosphorus, and chlorophyll *a* monitoring should be continued at the Deep Hole monitoring site. Monitoring will be performed on a monthly basis as long as no major aquatic plant management activities or changes to the watershed (for example, large scale development) occur.

An additional monitoring site in the center of the northwest basin is recommended to provide insight of water quality in the shallow basin. Given the large size of the northwest basin and its shallow depth (10 feet maximum), the water quality conditions will likely differ from the Deep Hole monitoring site which has a maximum depth of 87 feet. Secchi depth measurements along with temperature and dissolved oxygen profiles (at one-foot intervals) are recommended to be completed until the feasibility of nutrient monitoring (cost, volunteer base) at the site is evaluated by the Association.

Continuing to collect temperature and dissolved oxygen profiles will help identify the factors leading to changes to water quality, such as aquatic plant management activities, changes in the watershed land use, and the response of the lakes to environmental changes. Determining if stratification occurs in the northwest basin, at what depths, and at what levels will provide valuable information for determining internal nutrient loading and identifying fishery habitat conditions. The background information and trends provided by these data can prove invaluable for comprehensive lake management planning. If large-scale management (ten acres or more) of curly-leaf pondweed or any other aquatic plant species is conducted, the water quality monitoring efforts will be re-evaluated and potentially expanded in order to monitor any effects of management activities on water quality in the lake.

A water quality model, such as BATHTUB, should be developed and used to evaluate the capacity of the lake to assimilate the total phosphorus load and what changes to water quality can be expected following the implementation of different nutrient reduction options. The Association should consider applying for a lake planning grant to complete such a model, the results of which can be incorporated into their comprehensive lake management strategy.

Techniques known as precision conservation have been developed in Minnesota that utilize high-resolution elevation data, or LiDAR (Light Detection and Ranging), that targets where on the landscape best management practices will be most effective. Applications of such techniques are underway in Wisconsin. LiDAR data exists for Barron County with some overlap (about one mile) into Washburn County. These data cover about one-half of the Bear Lake watershed. Barron County does not currently have the resources to fully utilize this valuable data for terrain analyses that help water restoration and protection projects target critical areas of the landscape. Identifying where the projects will be the most effective in meeting water quality goals will allow time, energy and dollars to be used with the greatest payback. The Association should partner with the Barron County Land and Water Resources Department to develop a strategy for employing the LiDAR data. Such a strategy may entail a lake protection grant application in partnership with other lake management groups also interested in utilizing such data, and University and Government agencies or private consultants to complete the data analysis.

4.5.2 Water Quantity

Long-term lake level monitoring can provide information on how much water levels vary in a normal year (or longer time period). This information can be used to identify processes that drive lake levels and processes behind anomalies so management or adaptation can begin.

Lake levels can also be used for comprehensive planning when determining hydrologic and nutrient budgets. Lake levels can be recorded by reading a staff gauge that is installed on a permanent structure in the lake or placed in reference to a permanent and unchanging structure on the shore. To facilitate daily readings, the staff gauge should be installed at the property of a volunteer who is a permanent resident on the lake.

A new bathymetric survey is recommended particularly if plant management is to be implemented. Lake depths and the volume of water in the lake at a given time play in important role in determining planning appropriate management activities. The bathymetric map is used to identify plant and other benthic organism habitat, fishery habitat (live, feed, and breed), as a guide for navigating the lake, to identify changes to lake over time due to sedimentation and erosion, and for determining impacts of drawdown and drought on the lake. The early transect mapping techniques which were used to develop the present bathymetric map relied significantly on map-based measurement skills and interpretation and therefore have a lack of precision not found in the GPS-based maps of today. A new map can be quickly updated using GIS and can incorporate other information collected by the data loggers such as aquatic plant density and height.

In Wisconsin, recent bathymetric mapping services are have been provided by:

- Sean Hartnett of the UW-Eau Claire geography department (www.uwec.edu/hartnesg/hartnett/SeanWeb/BATHtech.html),
- The Center for Watershed Science and education at UW-Stevens Point (www.uwsp.edu/cnr-ap/watershed), and
- ciBiobase (www.cibiobase.com) who also offers cloud-based storage, access, and updating of bathymetric data.

5.0 Implementation Roadmap

A roadmap for the community to follow in implementing the management plan is an important component to a successful plan. Steps and possible funding alternatives to implement the management recommendations are included below.

5.1 Adaptive Management

This Aquatic Plant Management Plan is intended to be a working document guiding management actions on Bear Lake over the next five years (2014-2018). This plan will follow an adaptive management approach by evaluating results and adjusting actions on the basis of what has been learned. This plan is therefore a living document, successively evolving and improving to meet environmental, social, and economic goals, to increase scientific knowledge, and to reduce tensions among stakeholders. Annual and end of project assessment reports are necessary to monitor progress and justify changes to the management strategy. Project reporting will meet the requirements of all stakeholders, gain proper approval, allow for timely reimbursement of expenses, and provide the appropriate data for continued management success. Success will be measured by the efficiency and ease in which these actions are completed

The Association will compile, analyze, and summarize management operations, public education efforts, and other pertinent data into an annual report each year. The information will be presented to members of the Association, Barron and Washburn County and the WDNR and made available online, such as in SWIMS database or on a website developed by the Association. These reports will serve as a vehicle to propose future management recommendations and will therefore be completed prior to implementing following year management actions (approximately March 31 annually). At the end of this five-year project, successes and failures of all management efforts and related activities will be summarized in a report to be used for revising the Aquatic Plant Management Plan.

Whole-lake point intercept aquatic plant surveys will be completed at three- to five-year intervals. At a minimum, a survey will be completed in 2018 and the results compared to the 2013 survey to determine the impacts of management activities on both target and non-target aquatic plants.

5.2 Funding Sources

Funding for all eligible management activities including but not limited to shoreline restoration planning and implementation, aquatic invasive species monitoring and control, and education and outreach programs is available through the WDNR Lake Grant program. Funding for other activities such as maintaining a webpage and developing the newsletter will be generated through Association funds, donations, and volunteer efforts. Local conservation groups and clubs are also a potential source of funds and manpower and may provide suggestions for fundraising events. A WDNR Recreational Boating Facilities Grant can be pursued for assisting with a purchase of a mechanical harvester.

If Bear Lake remains on the Wisconsin Impaired Waters List and update of the Comprehensive Lake Management Plan is suggested. Implementation of recommended actions to improve water quality in the updated plan may be supported by the Environmental Protection Agency's Total Maximum Daily Load (TMDL) program administered through the WDNR. Bear Lake and its watershed are already included in the TMDL for Tainter and Menomin Lakes which addresses the entire Red Cedar River Watershed. More information on this TMDL can be found at: naturalresources.uwex.edu/redcedar/publications.html.

Section 5.3 Activities Timeline for the Bear Lake Aquatic Plant Management Plan

	Objectives/Activities	AIS Grant Eligibility	LPL Grant Eligibility	Implementers	2014	2015	2016	2017	2018
1.	**Preservation and Restoration**								
1	Baseline shoreland evaluation	×	×	BLA, WDNR, UW-Ex, Riparians	×				
2	Shoreland restoration training event	×	×	BLA, CO, WDNR, UW-Ex, Riparians		×		×	
3	Recognize residents that implement shoreland restoration		×	BLA, Riparians, CO, WDNR, UW-EX	×	×	×	×	×
4	Continue signage near wild rice	×	×	BLA, CO, WDNR, GLIFWC	×	×	×	×	×
5	Limit native plant disruption	×	×	BLA, Riparians, UW-Ex	×	×	×	×	×
2.	**Prevention**								
1	AIS training for volunteers	×		BLA, CO, CLMN, Riparians, CBM	×	×	×	×	×
2	AIS monitoring by volunteers	×		BLA, Riparians	×	×	×	×	×
3	Watercraft inspections, including participation in Fourth of July Landing Blitz	×		BLA, Riparians, UW-Ex, CLMN	×	×	×	×	×
4	Maintain and update signage at landings as necessary			BLA	×	×	×	×	×
5	Update contact information in Rapid Response Plan	×		BLA, Riparians	×	×	×	×	×
3.	**Management**								
1	Promote septic system inspections (deliver message as part of ongoing education and outreach efforts		×	BLA, CO, UW-Ex, Riparians	×	×	×	×	×
2	Raise awareness of the importance and status of wild rice and its influence on management activities; offer plant ID info		×	BLA, UW-Ex, WDNR, GLIFWC	×	×	×	×	×
3	Mangement of native aquatic plants for nusiance and navigation relief								
	a) Physical removal in shallow areas according to NR 109 guidelines			BLA, Riparians	×	×	×	×	×
	b) Appoint BLA representative for navigation impairment/nuisance plant growth determinations			BLA	×	×	×	×	×
4	Control Curly-leaf pondweed								
	a) Form BLA committee to support physical removal efforts undertaken by Riparians (offer training, supplies)								
	b) Coordinate & execute lake-wide coordinated hand, rake, and/or diver removal efforts of existing and pioneer populations	×		BLA, WDNR, CO, Riparians	×	×	×	×	×
	c) Evaluate need for mechanical harvesting of larger curly-leaf growth areas	×		BLA		?	?	?	?
	d) Conduct annual curly-leaf distribution and density mapping (utilize professional resource)	×		BLA, RP	×	×	×	×	×
5	Cost-benefit analysis to buy/rent harvesting equipment for AIS control and nuisance/navigation relief	×		BLA	×				
	a) If purchase beneficial, apply for WDNR Recreation Boating Facilities Grant (up to 40% of cost covered)	×		BLA	×				
6	Continue purple loosestrife monitoring and control	×		BLA, UW-Ex, CLMN, Riparians	×	×	×	×	×

Section 5.3 (continued) Activities Timeline for the Bear Lake Aquatic Plant Management Plan

	Objectives/Activities	AIS Grant Eligibility	LPL Grant Eligibility	Implementers	2014	2015	2016	2017	2018
4. Education and Awareness									
1	Summarize and distribute Aquatic Plant Management Plan	×	×	BLA, RP	×				
2	Distribute AIS materials (website, newsletter, gatherings)	×		BLA, CLMN, UW-Ex, Riparians	×	×	×	×	×
3	Provide AIS public education opportunity (Lake Fair, workshop, guest speakers)	×		BLA, CLMN, UW-Ex, Riparians	×	×	×	×	×
4	Develop webpage and newsletter	×	×	BLA, RP, CO, UW-Ex	×	×	×	×	×
5	Update and maintain AIS signage at access points	×		BLA, Riparians, CO	×	×	×	×	×
6	Present water quality information at public event(s) (for example, annual meeting, Lake Fair)	×	×	BLA, CLMN, Riparians		×		×	
7	Support wildlife monitoring via information distribution and educational opportunities	×	×	BLA, UW-Ex, SOEI	×	×		×	
8	Use 2013 survey results to target outreach and education efforts			BLA	×	×	×		
9	Evaluate status of 2007 Comprehensive Lake Management Plan, update if needed		×	BLA, RP	×	×		×	
5. Research and Monitoring									
1	Continue monthly Secchi, chemistry, temp and D.O. monitoring at Deep Hole site to develop long-term dataset for trend analysis			BLA, Riparians, CLMN, WDNR	×	×	×	×	×
2	Evaluate ability to expland CLMN water quality to include northwest basin (Secchi, chemistry, temp and D.O.)		×	BLA, Riparians, CLMN, WDNR	×	×	?	?	?
	a) If feasible, implement expanded monitoring in northwest basin along with continued Deep Hole monitoring		×	BLA, Riparians	×	×	×	×	×
3	Purchase and install staff gauge to monitor lake levels (water quanity)	×	×	BLA, Riparians	×	×	×	×	×
6. Adaptive Management									
1	Annual reports (summary of events/activities, suggested strategy revisions, future management plans)	×	×	BLA, RP	×	×	×	×	×
2	Whole-lake point intercept aquatic plant survey	×	×	BLA, RP, WDNR					×
3	End of project report (review successes/failures, revise APM plan)	×	×	BLA, RP					×

Implementers: BLA, Bear Lake Association; RP, resource professionals/consultant; CO, County AIS Coordinator/LWCD; GLIFWC, Great Lakes Indian Fish & Wildlife Commission; Riparian, waterfront property owner or appointee; UW-Ex, UW-Extension, WDNR, Wis. Department of Natural Resources; CLMN, Citizen Lake Monitoring Network program; CBM, Wis. Citizen-based Monitoring Network; SOEI, Sigurd Olson Env. Institute;

Note: Implementer list is not exhaustive and may change

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Appendix A

WDNR Northern Region Aquatic Plant Management Strategy

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.

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.

BASIS OF STRATEGY IN STATE STATUTE AND ADMINISTRATIVE CODE

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).

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* *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 can not 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 B

Public Input Survey and Results

BEAR LAKE USER SURVEY

SURVEY TALLY

As a part of an Aquatic Invasive Species grant awarded to the Bear Lake Association (BLA), a survey of residents from Bear Lake is being conducted to determine how to better protect and enhance the quality of the lake. Your participation in this survey is very important and all information will be used for development of an Aquatic Plant Management Plan and future lake management planning for BLA. Thank you for your time.

Red numbers are the count of responses.

SECTION 1 - Residency

These first few question will help determine who is responding to the survey.

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

13 ○ Permanent residence
4 ○ Undeveloped land
2 ○ Resort/campground
2 ○ Recreational vehicle campsite
14 ○ Second home
19 ○ Cabin (not for long term residency)
0 ○ Business (other than a resort/campground)
0 ○ Other (please specify)_____

2. How long have you owned or rented your property on Bear Lake? (If you have owned/rented the property for 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. If the property has been in your family for longer than your ownership, please indicate the number of years the property has been in your family.)

I have owned/rented the property for ___ year(s).

Minimum: 3
Average: 31.9
Maximum: 105

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 _____ days a year.

Minimum: 0
Average: 139.6
Maximum: 365

4. On average, about how many people are at the property each time it is being used? _____

Minimum: 0
Average: 4.9
Maximum: 100

SECTION 2 – Lake Use

The purpose of this section is to gather information on how Bear Lake is used by residents. Please answer the questions as they pertain to the property indicated in Section 1, Question 1.

1. Which activities from the list below do you or your family participate in between Memorial Day and Labor Day on Bear Lake? (Please check all that apply. If you do not participate in any activities, please select the last response.)

41 ○ Fishing
25 ○ Water skiing/tubing
16 ○ Speed boating
32 ○ Pontoon boating
6 ○ Jet Skiing
8 ○ Sailing
47 ○ Rest/relaxation
35 ○ Canoe/kayak/paddle boat
40 ○ Swimming/wading
41 ○ Wildlife viewing
2 ○ Wild rice harvest
6 ○ Other (please list)_____
1 ○ I / We do not participate in any activities on the lake → Skip to Question 3

Other: slow boating, hunting ducks, maple syrup, entertain friends, lots of work, family reunions

2. Between Memorial Day and Labor Day, about how many days per month do you or your family use the lake for the activities you selected in Question 1?

I/We use the lake an average of _____ days per month.

Minimum: 0
Average: 14.2
Maximum: 30

3. In your opinion, have the following characteristics of the lake improved, remained the same, or worsened since you've owned or rented the property indicated in Section 1, Question 1? (Please place a check mark under one column only for each characteristic.)

Characteristic	Improved	No Change	Worsened	Not sure
a) Quality of living on the lake	9 ○	35 ○	8 ○	2 ○
b) Quality of fishing in the lake	5 ○	15 ○	19 ○	15 ○
c) Scenic/aesthetic quality of the lake	5 ○	39 ○	9 ○	1 ○
d) Quality of motorized recreation (other than fishing)	4 ○	35 ○	10 ○	5 ○
e) Quality of non-motorized recreation (canoe, kayak, sailing)	8 ○	38 ○	1 ○	7 ○
f) Quality of swimming and wading	4 ○	24 ○	21 ○	5 ○
g) Diversity of wildlife	16 ○	29 ○	4 ○	5 ○

4. From the list in Question 3, which three characteristics are of greatest importance to you? (Please place the letters of the three characteristics that are most important to you in the spaces below.)

Most Selected

_____ _____ _____

A (40) B (33) C (31)

Rank (responses)
1. A (40)
2. B (33)
3. C (31)
4. F (24)
5. G (21)
6. D (7)
7. E (5)

5. In your opinion, have the following characteristics of the lake increased, remained the same, or decreased since you've owned or rented the property indicated in Section 1, Question 1? (Please place a check mark under one column only for each characteristic.)

Characteristic	Increased	No Change	Decreased	Not sure
a) Amount of waterskiing/tubing on the lake	19 ○	22 ○	9 ○	3 ○
b) Use of non-motorized watercraft on the lake	16 ○	27 ○	8 ○	2 ○
c) Use of motorized boats on the lake	27 ○	24 ○	0 ○	2 ○
d) Use of jet skis/personal watercraft on the lake	30 ○	17 ○	4 ○	2 ○
e) Public use on the lake	23 ○	18 ○	3 ○	9 ○
f) Garbage in the lake	5 ○	33 ○	6 ○	9 ○
g) Noise pollution on the lake	17 ○	30 ○	2 ○	3 ○

6. From the list in Question 5, which three characteristics are of greatest concern to you? (Please place the letters of the three characteristics that most concern you in the spaces below.)

Most Selected

_____ _____ _____

F (36) D (28) E (17)
G (36)

Rank (responses)
1T. F (36)
1T. G (36)
3. D (28)
4. E (17)
5. C (11)
6T. A (4)
6T. B (4)

SECTION 3 - Fishing and Habitat

Game fish species found in Bear Lake include panfish, largemouth bass, northern pike, walleye, and smallmouth bass. Stocking of walleye has occurred at least once every two years since 1973. This section of the survey will provide information about angling practices of property owners and perceptions of the fishery and fish habitat.

1. Since owning or renting the property in Section 1, Question 1, have you fished Bear Lake?

48 ○ yes 5 ○ no → skip to Question 4

2. Have you fished Bear Lake in the past three years?

39 ○ yes 9 ○ no → skip to Question 4

3. Which fish species do you pursue while fishing on Bear Lake? (Please check all species that you pursue while fishing on Bear Lake.)

21 ○ Smallmouth Bass
26 ○ Largemouth Bass
28 ○ Walleye
21 ○ Northern Pike
37 ○ Panfish (please list type) _____
2 ○ Other (please list) *Bullheads (1)*

Panfish Type:
Bluegills (5)
Crappie (8)
Crappie, bluegill (10)
Sunfish (2)

4. In your opinion, how would you rate the overall fishery in Bear Lake?

0 ○ Excellent
17 ○ Good
22 ○ Fair
6 ○ Poor
0 ○ Very poor
7 ○ Not sure

5. In your opinion, have the following fishing conditions improved, remained the same, or worsened since you've owned or rented the property indicated in Section 1, Question 1? (Please place a check mark under one column only for each condition.)

Fishing Condition	Improved	No Change	Worsened	Not sure
a) Quality of panfishing (bluegill, crappie, perch, etc.)	4 ○	20 ○	14 ○	14 ○
b) Quality of walleye fishing	2 ○	7 ○	25 ○	18 ○
c) Quality of smallmouth bass fishing	5 ○	19 ○	7 ○	19 ○
d) Quality of largemouth bass fishing	16 ○	15 ○	3 ○	16 ○
e) Quality of northern pike fishing	2 ○	22 ○	7 ○	19 ○

6. Trees that fall into the near-shore areas of the lake provide one type of habitat known as coarse woody structure. In your opinion, how important is this type of habitat to a healthy fishery?

23 ○ Very important
23 ○ Somewhat important
3 ○ Not important
4 ○ Not sure

7. Would you be willing to install coarse woody structure in near-shore areas of your property on Bear Lake?

9 ○ definitely yes
18 ○ probably yes
12 ○ unsure
9 ○ probably not
4 ○ definitely not

8. In your opinion, which of the following items do you believe hold the greatest potential for negatively impacting the fishery in Bear Lake? (Please choose up to **three** responses or check the last response if you do not believe any hold potential for negatively impacting the fishery.)

15 ○ Over harvest of fish during ice fishing season
15 ○ Over harvest of fish during open water season
23 ○ Too much vegetation in the lake
6 ○ Too little vegetation in the lake
19 ○ Too little coarse woody structure
22 ○ Impaired water quality
12 ○ Setting angler bag limits too high
6 ○ Setting fish size limits too small
9 ○ Other (please specify) _____
4 ○ I do not believe any of these hold potential for negatively impacting the fishery

Other:
Native American spearing (5)
Needs a slot (1)
Not enough stocking (1)
Wrong vegetation in lake (1)
Don't know (1)

SECTION 4 – Lake Stewardship

Lake stewardship is an attitude that recognizes the vulnerability of lakes and the need for citizens, both individually and collectively, to assume responsibility for their care. This section of the survey will provide information about the lake stewardship practices of lake property owners. Please answer the questions as they pertain to the property indicated in Section 1, Question 1.

1. The following are landscaping practices used to protect and improve lake water quality. Which ones have you heard of? (Check all that apply.)

25 ○ A) Rain garden
43 ○ B) Shoreline buffers
32 ○ C) Native prairie restoration
37 ○ D) Native flower/tree planting
40 ○ E) Natural shoreline restoration
41 ○ F) Runoff reduction practices
43 ○ G) No mow area
2 ○ H) Other (please describe) *Rip rap wetland (1)*
3 ○ I have not heard of any of these water quality/ landscaping practices → Skip to Question 3

2. Which, if any, of the landscaping practices from Question 1 have been implemented on your property on Bear Lake? (Please write the letters in the space below or check a response.)

A: 4
B: 25
C: 2
D: 11
E: 15
F: 18
G: 30
H: 1 (unknown practice)

_____ 2 ○ None 5 ○ I'm unsure

3. Which, if any, of the landscaping practices from Question 1 might you be interested in implementing on your property? (Please write the letters in the space or check a response.)

A: 5
B: 6
C: 5
D: 16
E: 10
F: 3
G: 7

_____ 6 ○ None 19 ○ I'm unsure

4. Which, if any, of the following might influence you to implement a landscaping for water quality practice on your property? (Check all that apply.)

19 ○ More information about landscaping for water quality practices
13 ○ Training to learn how to install a landscaping for water quality practice
24 ○ Increasing the natural beauty of your property
28 ○ Improving the water quality of the lake
25 ○ Improving the water quality around your property's shoreline
30 ○ Providing better habitat for fish
24 ○ Providing better habitat for birds and wildlife
20 ○ Setting an example for other lake residents
16 ○ Less lawn mowing time
29 ○ A property tax rebate
19 ○ Financial assistance that pays a portion of the cost of installation
25 ○ No cost technical assistance that would identify appropriate practices to install
3 ○ Other (please describe) *Currently wild and natural state (2), Have done all that I can (1)*
5 ○ I have no interest in implementing a landscaping for water quality practice on my property

SECTION 5 – Knowledge of Aquatic Invasive Species

This section of the survey seeks to determine how much lake residents know about aquatic invasive species (AIS). Aquatic invasive species are plants and animals that are foreign to the waters of Bear Lake and do not belong there.

Curly-leaf pondweed

Curly-leaf pondweed (CLP) has been documented in Bear Lake. CLP can create nuisance conditions by forming dense beds of vegetation that interfere with many lake uses.

1. On a scale of 1 to 7, where 7 is extensive knowledge of CLP, and 1 is no knowledge of CLP please indicate your level of knowledge about this aquatic invasive species prior to reading the above statement.

1	2	3	4	5	6	7
no knowledge			some knowledge			extensive knowledge

Min: 1
Lower Quartile: 1
Median: 3
Upper Quartile: 4
Max: 7
Average: 3.1

2. Before responding to this survey, did you know that CLP is present in Bear Lake?

33 ○ Yes 17 ○ No 3 ○ I heard but was not sure

Purple Loosestrife

Purple loosestrife, a shoreline and wetland flowering invasive, has been found along the shore of Bear Lake. Purple loosestrife (PL) can take over areas of the shoreline and adjacent wetlands displacing more beneficial native plants.

3. On a scale of 1 to 7, where 7 is extensive knowledge of Purple Loosestrife, and 1 is no knowledge of PL please indicate your level of knowledge about this invasive species prior to reading the above statement.

1	2	3	4	5	6	7
no knowledge			some knowledge			extensive knowledge

Min: 1
Lower Quartile: 2
Median: 5
Upper Quartile: 6
Max: 7
Average: 4.1

4. Before responding to this survey, did you know that Purple Loosestrife is present along the shore of Bear Lake?

39 ○ Yes 9 ○ No 5 ○ I heard but was not sure

Chinese Mystery Snails and Banded Mystery Snails

Chinese Mystery Snails (CMS) and Banded Mystery Snails (BMS) may compete with the native snails and fish for food and habitat. Both species of snails have been documented in Bear Lake. Large die-offs are possible and can be aesthetically displeasing.

5. On a scale of 1 to 7, where 7 is extensive knowledge of these invasive snails, and 1 is no knowledge of the snails please indicate your level of knowledge about these invasive species prior to reading the above statement.

1	2	3	4	5	6	7
no knowledge			some knowledge			extensive knowledge

Min: 1
Lower Quartile: 1
Median: 2
Upper Quartile: 4
Max: 7
Average: 2.8

6. Before responding to this survey, did you know that Chinese Mystery Snails and Banded Mystery Snails were present in Bear Lake?

29 ○ Yes 23 ○ No 1 ○ I heard but was not sure

Eurasian Water Milfoil

Eurasian water milfoil (EWM) has not been documented in Bear Lake but an infestation exists within 10 miles of the lake. In some lakes EWM is not a nuisance. In other lakes it can form dense beds of vegetation that can interfere with many lake uses.

7. On a scale of 1 to 7, where 7 is extensive knowledge of EWM, and 1 is no knowledge of EWM please indicate your level of knowledge about this aquatic invasive species prior to reading the above statement.

1	2	3	4	5	6	7
no knowledge			some knowledge			extensive knowledge

Min: 1
Lower Quartile: 2
Median: 4
Upper Quartile: 5
Max: 7
Average: 3.8

Zebra Mussels

Zebra Mussels can clog water intake pipes and damage equipment by attaching to boat motors and other hard surfaces. They can compete with small fish for food and smother native mussels and crayfish. The shells of Zebra Mussels are sharp and can be a nuisance for swimming and other water recreation. Zebra Mussels have not been documented in Bear Lake.

8. On a scale of 1 to 7, where 7 is extensive knowledge of Zebra Mussels, and 1 is no knowledge of Zebra Mussels please indicate your level of knowledge about this invasive species prior to reading the above statement.

1	2	3	4	5	6	7
no knowledge			some knowledge			extensive knowledge

Min: 1
Lower Quartile: 2
Median: 4
Upper Quartile: 5
Max: 7
Average: 3.9

Rusty Crayfish

Rusty crayfish have not been documented in Bear Lake but infestations exist within 10 miles of the lake. The most serious impact they can cause is destruction of aquatic plant beds. They can also displace native crayfish, decrease the amount and variety of smaller water bugs and reduce some fish populations.

9. On a scale of 1 to 7, where 7 is extensive knowledge of rusty crayfish, and 1 is no knowledge of rusty crayfish please indicate your level of knowledge about this invasive species prior to reading the above statement.

1 2 3 4 5 6 7

no knowledge some knowledge extensive knowledge

Min: 1
Lower Quartile: 1
Median: 2
Upper Quartile: 4
Max: 7
Average: 2.4

Swimmer's Itch

Swimmer's itch is and itchy rash caused by certain parasites that normally live in snails and sometimes on waterfowl. Symptoms include a red, raised, itcy rash and that appears within an hour or two after being in the water.

10. Have you or relatives/friends using the property indicated in Section 1, Question 1 ever gotten what might be considered swimmer's itch?

23 ○ Yes 26 ○ No 4 ○ Not sure

11. Which of the following aquatic invasive species, if any, do you think you would recognize if you saw them? (Please place a check mark under one column only for each AIS.)

Aquatic Invasive Species	Definitely yes	Probably yes	Unsure	Probably not	Definitely not
a) Curly-leaf Pondweed	8 ○	17 ○	8 ○	8 ○	11 ○
b) Eurasian Water Milfoil	9 ○	14 ○	9 ○	11 ○	8 ○
c) Purple Loosestrife	21 ○	14 ○	5 ○	6 ○	7 ○
d) Chinese Mystery Snail	10 ○	8 ○	10 ○	12 ○	13 ○
e) Banded Mystery Snail	6 ○	7 ○	13 ○	13 ○	12 ○
f) Zebra Mussel	10 ○	19 ○	5 ○	10 ○	7 ○
g) Rusty Crayfish	2 ○	9 ○	13 ○	14 ○	13 ○

12. In order to gauge potential community interest, would you be willing to take part in a training session to help you identify AIS in the lake?

12 ○ definitely yes 6 ○ unsure 10 ○ probably not
23 ○ probably yes 0 ○ definitely not

SECTION 6 - Water Quality

Water quality in a lake is measured by the clarity of the water, the amount of algae in the water, and the concentration of nutrients in the water. High water clarity and low levels of algae and nutrients usually indicate good or excellent water quality. Low water clarity and high levels of algae and nutrients usually indicate poor water quality.

1. In your opinion, how would you rate the water quality in the summer (June-September) in Bear Lake?

4 ○ Excellent	15 ○ Fair	0 ○ Very poor
29 ○ Good	3 ○ Poor	1 ○ Not sure

2. In your opinion, how has the water quality changed in Bear Lake since you have owned or rented the property?

17 ○ Hasn't changed	27 ○ Gotten worse	5 ○ Gotten better	4 ○ Not sure

3. Who do you feel should be responsible for managing water quality in Bear Lake? (Please choose up to **two** responses.)

36 ○ Wisconsin DNR	1 ○ "Mother Nature" (i.e. No management)
3 ○ Local township government	21 ○ Bear Lake Association
4 ○ County government	4 ○ Not sure
22 ○ Individual lake shore property owners	1 ○ Other (please specify) *All work together*

4. In your opinion, which of the following items do you believe hold the greatest potential for contributing to poor water quality in Bear Lake? (Please check all that apply or check the last response if you do not believe any hold potential for contributing to poor water quality.)

17 ○ A) Stirring up bottom sediments by boat use	15 ○ H) Shoreline erosion
5 ○ B) Stirring up bottom sediments by wind/waves	32 ○ I) Inflow from stream/rivers
38 ○ C) Faulty septic systems	19 ○ J) Runoff from hard surfaces (roof tops, driveways)
43 ○ D) Agricultural (farm) runoff	4 ○ K) Other (please specify)_____
16 ○ E) Dead and dying vegetation in the lake	2 ○ L) None of these hold potential for contributing to poor water quality
40 ○ F) Runoff from fertilized lawns	*Other:*
17 ○ G) Construction runoff	*High water (1), Low water (1),*
	Guest boaters (1), Probably all listed (1)

5. From the list in Question 4, which three items hold the greatest potential for contributing to poor water quality? (Please place the letters of the three items in the spaces below or "L" only if you believe none hold potential for contributing to poor water quality.)

Most Selected

D (35)	F (32)	C (30)

Rank (responses)

1. D (35)	*8. E (9)*
2. F (32)	*9T. G(3)*
3. C (30)	*9T. K (3)*
4. A (12)	*11. B (1)*
5. I (11)	
6T. H (10)	
6T. J (10)	

6. As a member of the lake community, which activities would you approve of to help improve water quality in Bear Lake? (Check all that apply.)

29 ○ The creation of no-wake zones in shallow water areas
21 ○ Monetary incentives to change farming practices that negatively affect the lake
39 ○ Removing non-native invasive plant species from the lake
12 ○ More restrictive shore land and building ordinances for the lake
24 ○ Incentives for individual landowners to make improvements to their property
11 ○ Implementing launch fees to raise funding for water quality improvement projects
1 ○ None of the above
3 ○ Other (please specify) *Not sure (1), Lower the lake level (1)*

Written Comment: Please remove no wake buoys by wild rice.

SECTION 7 - Aquatic Plant Management in Bear Lake

Aquatic plants in a lake, whether native or non-native, can be managed in many different ways. In most cases management is ongoing and long-term. Sometimes no aquatic plant management may be the best option.

1. In your opinion, have the following aquatic plant characteristics of the lake increased, remained the same, or decreased since you've owned or rented the property indicated in Section 1, Question 1? (Please place a check mark under one column only for each characteristic.)

Characteristic	Increased	No Change	Decreased	Not sure
Amount of rooted vegetation near shore	27 ○	11 ○	5 ○	10 ○
Amount of green scum on the water surface	28 ○	19 ○	3 ○	3 ○
Amount of algae in the water	32 ○	13 ○	3 ○	5 ○

2. Since you have owned or rented the property indicated in Section 1, Question 1, have any attempts been made to remove or control aquatic plants by your shore land property?

22 ○ yes 30 ○ no → skip to Question 3

3. What has been done to remove aquatic plants from the lake by your property? (Check all that apply.)

0 ○ someone hired to apply chemical herbicide
1 ○ someone hired to hand pull or rake
3 ○ self apply chemical herbicide
23 ○ self hand pull or rake
2 ○ mechanical plant removal with boat and motor or other apparatus
5 ○ other (please specify) *Beetles (3), Nothing (2)*

4. If management of an aquatic invasive plant species like curly-leaf pondweed is recommended for Bear Lake, what alternatives might you support? Please assume that the following management alternatives are safe and legal, and would only be used if approved by the State of Wisconsin and the Bear Lake Association. Please mark if you would support, oppose, or if you need more information about each method. (Mark only one option per alternative.)

Aquatic Plant Management Alternative	Support	Oppose	Need more information
a) Small-scale (less than 10 acres) mechanical harvesting	19 ○	6 ○	25 ○
b) Large-scale (10 acres or more) mechanical harvesting	14 ○	8 ○	27 ○
c) Hand pulling and raking in shallow water	39 ○	1 ○	9 ○
d) Small-scale (less than 10 acres) chemical herbicide	18 ○	8 ○	23 ○
e) Large-scale (10 acres or greater) chemical herbicide	12 ○	10 ○	27 ○
f) Biological control (using one live species to control another)	27 ○	6 ○	19 ○
g) No management (the lakes are what they are, leave them be)	1 ○	25 ○	13 ○

5. Of the management alternatives presented in Question 3, which two would you most support; and which two would you least support? (Please place the letters corresponding to your choices in the spaces provided.)

Most Support: C (25) and F (18) A(15) B(12) E(9) D(7) G(2)
Least Support: E (29) and G (17) D(14) B(11) F(8) A(7) C(2)

6. Who do you feel should be responsible for managing aquatic plant growth, excluding algae, in Bear Lake? (Please choose up to **two** responses.)

38 ○ Wisconsin DNR
3 ○ local township government
11 ○ individual lake shore property owners
6 ○ county government
0 ○ "Mother Nature" (i.e. no management)
27 ○ Bear Lake Association
6 ○ Not sure
0 ○ other (please specify) _____

SECTION 8 - Wild Rice

Wild rice is an aquatic grass that produces a nutritious seed, which is a valuable food source for people and wildlife. Wild rice is protected in Wisconsin and requires a permit for harvest. Given its value and protected status, wild rice will impact management decisions. Wild rice is present in Bear Lake.

1. On a scale of 1 to 7, where 7 is extensive knowledge of wild rice, and 1 is no knowledge of wild rice please indicate your level of knowledge about this aquatic plant prior to reading the above statement.

1 2 3 4 5 6 7

no knowledge some knowledge extensive knowledge

Min: 1
Lower Quartile: 3
Median: 4
Upper Quartile: 6
Max: 7
Average: 4.3

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

25 ○ definitely yes
21 ○ probably yes
5 ○ not sure
3 ○ probably not
0 ○ definitely not

3. Before responding to this survey, did you know that wild rice is present in Bear Lake?

50 ○ Yes
2 ○ No → Skip to Section 9
2 ○ I heard but was not sure → Skip to Section 9

4. How do you feel about the amount of wild rice in Bear Lake?

2 ○ There is too much wild rice in the lake
8 ○ There is too little wild rice in the lake
26 ○ The wild rice in the lake is just right
14 ○ Not sure

SECTION 9 – Public Participation and Community Support

Local, county, state, and federal resources will be sought in addition to Bear Lake Association funds to implement management recommendations for Bear 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 Bear Lake Association.

1. Professional services or special skills are sometimes needed to accomplish goals set by the Bear Lake Association. Do you have any special skills or services that you might be willing to provide if appropriate? Please check all services that you might be willing to donate to help manage Bear Lake. This is not a commitment but rather a measure of possible assistance if needed.

6 ○ GPS use
0 ○ graphic design
1 ○ web development
1 ○ grant writing
0 ○ legal services
2 ○ scuba diving
0 ○ printing services
2 ○ construction services
1 ○ outdoor sign design
22 ○ physical labor
8 ○ snorkeling
1 ○ sewing
12 ○ gardening/landscaping
6 ○ other (please specify)
_____
17 ○ I am not interested in or not able to provide any professional services

Other:
Habitat improvement (1)
E-mail (1)
Dam operation (1)
Donation (1)
Willing to help (1)
Create volunteer list (1)

2. The following are activities for which lake residents could volunteer. Please check all those activities you might be willing to volunteer your time if assistance is needed. This is not a commitment but rather a measure of possible assistance. (Check all that apply.)

11 ○ watercraft inspection at the boat landings
21 ○ lake monitoring for aquatic invasive species (AIS)
2 ○ organizing fund raising events
19 ○ water quality monitoring
16 ○ shore land monitoring for AIS
7 ○ raising beetles that eat purple loosestrife
13 ○ photography to document lake conditions and improvements
10 ○ native aquatic plant monitoring and identification
15 ○ wildlife monitoring (ex. frogs, turtles, loons, other waterfowl, mussels & clams)
6 ○ helping lakeshore property owners with planting projects related to shore land buffers, restoration projects, and rain gardens
13 ○ I am not interested in volunteering any time → Skip to question 4

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

15 ○ few hours a year 20 ○ few days a year 4 ○ longer periods of time

4. Prior to receiving this survey, did you know that there was Bear Lake Association (BLA)?

51 ○ Yes 0 ○ no → Skip to Section 10

5. Have you ever attended a BLA meeting?

36 ○ Yes → Skip to question 7 15 ○ no

6. If you answered "no" in Question 5, what prevents you from attending a BLA meeting?

0 ○ not interested
6 ○ I don't have time
1 ○ I never know when they are occurring
9 ○ other (please explain) _____

Other:
Live too far away (5)
Not in area on meeting days (2)

7. How satisfied are you with the following aspects of BLA activity? (Please place a check mark under one column only for each activity.)

BLA Activity	Very Satisfied	Somewhat Satisfied	Unsure	Somewhat Dissatisfied	Very Dissatisfied
BLA communication within the community	○ 20	○ 21	○ 7	○ 2	○ 0
BLA meeting frequency	○ 18	○ 13	○ 16	○ 2	○ 1
BLA meeting atmosphere (parliamentary procedure)	○ 19	○ 12	○ 18	○ 0	○ 1
Getting things done	○ 8	○ 23	○ 16	○ 1	○ 2
Promoting community cooperation to achieve goals and objectives	○ 11	○ 19	○ 16	○ 1	○ 2
Management of BLA finances	○ 18	○ 13	○ 18	○ 1	○ 0
Listening to/addressing property owners' concerns	○ 11	○ 15	○ 20	○ 2	○ 3

SECTION 10 - Final Comments

1. If there are any additional issues you would like the BLA to address, or comments you would like to make, please use the space below.

_____

(Attached)

_____

_____

2. Thank you for your time and your answers! Providing your contact information is optional, but if you wish to, please do! Contact information will be used for follow up if needed.

Name: _____(Provided to Bear Lake Association in digital format)_____
Addres_____
City: _____ State: _____ Zip: _____
Phone number: _____Email address:_____

Surveys Sent: 134
Surveys Returned: 54
Returned partially completed: 25
Average number of questions unanswered: 8
Most unanswered question: Section 7 Number 5
Note: All returned surveys were included in the response tally.

Section 10 - Comments
Bear Lake Assoc. has been pro active to keep the lake quality, fishing, and shoreline healthy over the past 20+ years we have been there.
First, thank you for asking and this survey. BL is large in comparison to people available to make a difference. Believe with BLA guidance it will occur. Please keep efforts going. Thanks!
I like to see activity on the lake We are blessd on bear lake that the activity is not over whelming
I wish we could put to rest the lake level controversy. Its impossible
Im really tired about all the mis information about the lake level-Bull [explitive] from Larry Mofle
It is a beautiful lake that is being destroyed by weeds
Lake depth fluctuations
Lake to high- Major source of organic matter is from shoreline erosion. Boats and storms remove the shoreline. Lower the lake. We own 1 mile of shoreline on the NW part of the lake. Both my wife and I are PhD Biological Scientists.
Local history is my hobby. I have photographs and postcards on Bear Lake from 1895-present. The changes in the lake can be seen over the years. Give me a call if you want to see them.
Please do something about the weed growth. Especially on the north end of the lake. We continue to do study after study. When is there action!? The north end of the lake continues to get choked by weeds and now we have snails that cause swimmers itch.
Property bought by my father in 1943. We built in 1950 with addition and improvements over the years another generation is now enjoying our cabin on Bear Lake.
Property is in the process of changing hands from my parents to myself and four other siblings. Our knowledge of Bear Lake Association is limited
The basic problem with BLA is that only a few members do all the work. You get burned out after a while. I was on the board for 6 years and set up for the annual meeting and picnic for seven or eight years. Trying to get a new board members and volunteers seemed to fall on deaf ears.
The low lake level in the past few years. We no longer have lake frontage but swamp frontage.
The work of BLA is done by very few people/members. How can we encourage more widespread participation?
Urbanization around the lakes = increased sedimentation over time.
Water levels as maintained the past 10-15 years have been too high. Lake shore erosion and damage has occurred primarily along the east side of the lake.
Weeds are choking out the rice. DNR could poison the weeds and give the rice a chance
Weeds have taken over in the big North Bay, around the island and by poor folks and SW end bay. Why cant most be removed?
would help with email and web based stuff for BLA.
You could just post a sign for no wake zone by the boat launch and campground. Save lots of money compared to putting in and taking out buoys. BLA-Until they remove the buoys by the rice or reduce the number of them, I don’t want anything to do with the BLA. A few tree huggers pushed that through. Im the only one that harvests it. I use to catch huge numbers of walleyes but last 10 years downhill, same with small mouths. Reduce the largemouth bass. Ok, explain why we are getting patches of rice north side of the lake and its in a high wake area?

Appendix C

NR 109

Chapter NR 109

AQUATIC PLANTS: INTRODUCTION, MANUAL REMOVAL AND MECHANICAL CONTROL REGULATIONS

NR 109.01 Purpose. The purpose of this chapter is to establish procedures and requirements for the protection and regulation of aquatic plants pursuant to ss. 23.24 and 30.07, Stats. Diverse and stable communities of native aquatic plants are recognized to be a vital and necessary component of a healthy aquatic ecosystem. This chapter establishes procedures and requirements for issuing aquatic plant management permits for introduction of aquatic plants or control of aquatic plants by manual removal, burning, use of mechanical means or plant inhibitors. This chapter identifies other permits issued by the department for aquatic plant management that contain the appropriate conditions as required under this chapter for aquatic plant management, and for which no separate permit is required under this chapter. Introduction and control of aquatic plants shall be allowed in a manner consistent with sound ecosystem management, shall consider cumulative impacts, and shall minimize the loss of ecological values in the body of water. The purpose of this chapter is also to prevent the spread of invasive and non−native aquatic organisms by prohibiting the launching of watercraft or equipment that has any aquatic plants or zebra mussels attached.

History: CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03; **correction made under s. 13.92 (4) (b) 7., Stats., Register March 2011 No. 663.**

NR 109.02 Applicability. A person sponsoring or conducting manual removal, burning or using mechanical means or aquatic plant inhibitors to control aquatic plants in navigable waters, or introducing non−native aquatic plants to waters of this state shall obtain an aquatic plant management permit from the department under this chapter.

History: CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03.

NR 109.03 Definitions. In this chapter:

(1) "Aquatic community" means lake or river biological resources.

(2) "Beneficial water use activities" mean angling, boating, swimming or other navigational or recreational water use activity.

(3) "Body of water" means any lake, river or wetland that is a water of this state.

(4) "Complete application" means a completed and signed application form, the information specified in s. NR 109.04 and any other information which may reasonably be required from an applicant and which the department needs to make a decision under applicable provisions of law.

(5) "Department" means the Wisconsin department of natural resources.

(6) "Manual removal" means the control of aquatic plants by hand or hand−held devices without the use or aid of external or auxiliary power.

(7) "Navigable waters" means those waters defined as navigable under s. 30.10, Stats.

(8) "Permit" means aquatic plant management permit.

(9) "Plan" means aquatic plant management plan.

(10) "Wetlands" means an area where water is at, near or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation and which has soils indicative of wet conditions.

History: CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03.

NR 109.04 Application requirements and fees. **(1)** Permit applications shall be made on forms provided by the department and shall be submitted to the regional director or designee for the region in which the project is located. Permit applications for licensed aquatic nursery growers may be submitted to the department of agriculture, trade and consumer protection.

Note: Applications may be obtained from the department's regional headquarters or service centers. DATCP has agreed to send application forms and instructions provided by the department to aquatic nursery growers along with license renewal forms. DATCP will forward all applications to the department for processing.

(2) The application shall be accompanied by all of the following unless the application is made by licensed aquatic nursery growers for selective harvesting of aquatic plants for nursery stock. Applications made by licensed aquatic nursery growers for harvest of nursery stock do not have to include the information required by par. (d), (e), (h), (i) or (j).

(a) A nonrefundable application fee. The application fee for an aquatic plant management permit is:

1. $30 for a proposed project to manage aquatic plants on less than one acre.

2. $30 per acre to a maximum of $300 for a proposed project to manage aquatic plants on one acre or larger. Partial acres shall be rounded up to the next full acre for fee determination. An annual renewal of this permit may be requested with an additional application fee of one−half the original application fee, but not less than $30.

(b) A legal description of the body of water including township, range and section number.

(c) One copy of a detailed map of the body of water with the proposed introduction or control area dimensions clearly shown. Private individuals doing plant introduction or control shall provide the name of the owner riparian to the management area, which includes the street address or block, lot and fire number where available and local telephone number or other pertinent information necessary to locate the property.

(d) One copy of any existing aquatic management plan for the body of water, or detailed reference to the plan, citing the plan references to the proposed introduction or control area, and a description of how the proposed introduction or control of aquatic plants is compatible with any existing plan.

(e) A description of the impairments to water use caused by the aquatic plants to be managed.

(f) A description of the aquatic plants to be controlled or removed.

(g) The type of equipment and methods to be used for introduction, control or removal.

(h) A description of other introduction or control methods considered and the justification for the method selected.

(i) A description of any other method being used or intended for use for plant management by the applicant or on the area abutting the proposed management area.

(j) The area used for removal, reuse or disposal of aquatic plants.

(k) The name of any person or commercial provider of control or removal services.

(3) (a) 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.

(b) Within 30 days of receipt of the plan, the department shall notify the applicant of any additional information or modifications to the plan that are required. If the applicant does not submit the additional information or modify the plan as requested by the department, the department may dismiss the aquatic plant management permit application.

(c) The department shall approve the aquatic plant management plan before an application may be considered complete.

(4) The permit sponsor may request an annual renewal in writing from the department under s. NR 109.05 if there is no change proposed in the conditions of the original permit issued.

History: CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03.

NR 109.05 Permit issuance. (1) The department shall issue or deny issuance of the requested permit within 15 working days after receipt of a completed application and approved plan as required under s. NR 109.04 (3).

(2) The department may specify any of the following as conditions of the permit:

(a) The quantity of aquatic plants that may be introduced or controlled.

(b) The species of aquatic plants that may be introduced or controlled.

(c) The areas in which aquatic plants may be introduced or controlled.

(d) The methods that may be used to introduce or control aquatic plants.

(e) The times during which aquatic plants may be introduced or controlled.

(f) The allowable methods used for disposing of or using aquatic plants that are removed or controlled.

(g) Annual or other reporting requirements to the department that may include information related to pars. (a) to (f).

(3) The department may deny issuance of the requested permit if the department determines any of the following:

(a) Aquatic plants are not causing significant impairment of beneficial water use activities.

(b) The proposed introduction or control will not remedy the water use impairments caused by aquatic plants as identified as a part of the application in s. NR 109.04 (2) (e).

(c) The proposed introduction or control will result in a hazard to humans.

(d) The proposed introduction or control will cause significant adverse impacts to threatened or endangered resources.

(e) The proposed introduction or control will result in a significant adverse effect on water quality, aquatic habitat or the aquatic community including the native aquatic plant community.

(f) The proposed introduction or control is in locations identified by the department as sensitive areas, under s. NR 107.05 (3) (i) 1., except when the applicant demonstrates to the satisfaction of the department that the project can be conducted in a manner that will not alter the ecological character or reduce the ecological value of the area.

(g) The proposed management will result in significant adverse long−term or permanent changes to a plant community or a high value species in a specific aquatic ecosystem. High value species are individual species of aquatic plants known to offer important values in specific aquatic ecosystems, including Potamogeton amplifolius, Potamogeton Richardsonii, Potamogeton praelongus, Stuckenia pectinata (Potamogeton pectinatus), Potamogeton illinoensis, Potamogeton robbinsii, Eleocharis spp., Scirpus spp., Valisneria spp., Zizania spp., Zannichellia palustris and Brasenia schreberi.

(h) If wild rice is involved, the stipulations incorporated by *Lac Courte Oreilles v. Wisconsin*, 775 F. Supp. 321 (W.D. Wis. 1991) shall be complied with.

(i) The proposed introduction or control will interfere with the rights of riparian owners.

(j) The proposed management is inconsistent with a department approved aquatic plant management plan for the body of water.

(4) The department may approve the application in whole or in part consistent with the provisions of sub. (3). A denial shall be in writing stating the reasons for the denial.

(5) (a) The department may issue an aquatic plant management permit on less than one acre in a single riparian area for a 3−year term.

(b) The department may issue an aquatic plant management permit for a one−year term for more than one acre or more than one riparian area. The permit may be renewed annually for up to a total of 3 years in succession at the written request of the permit holder, provided no modifications or changes are made from the original permit.

(c) The department may issue an aquatic plant management permit containing a department−approved plan for a 3 to 5 year term.

(d) The department may issue an aquatic plant management permit to a licensed nursery grower for a 3−year term for the harvesting of aquatic plants from a publicly owned lake bed or for a 5−year term for harvesting of aquatic plants from privately owned beds with the permission of the property owner.

(6) The approval of an aquatic plant management permit does not represent an endorsement of the permitted activity, but represents that the applicant has complied with all criteria of this chapter.

History: CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03; reprinted to restore dropped language from rule order, Register October 2003 No. 574.

NR 109.06 Waivers. The department waives the permit requirements under this chapter for any of the following:

(1) Manual removal or use of mechanical devices to control or remove aquatic plants from a body of water 10 acres or less that is entirely confined on the property of one person with the permission of that property owner.

Note: A person who introduces native aquatic plants or removes aquatic plants by manual or mechanical means in the course of operating an aquatic nursery as authorized under s. 94.10, Stats., on privately owned non−navigable waters of the state is not required to obtain a permit for the activities.

(2) A riparian owner who manually removes aquatic plants from a body of water or uses mechanical devices designed for cutting or mowing vegetation to control plants on an exposed lake bed that abuts the owner's property provided that the removal meets all of the following:

(a) 1. Removal of native plants is limited to a single area with a maximum width of no more than 30 feet measured along the shoreline provided that any piers, boatlifts, swimrafts and other recreational and water use devices are located within that 30−foot wide zone and may not be in a new area or additional to an area where plants are controlled by another method; or

2. Removal of nonnative or invasive aquatic plants as designated under s. NR 109.07 when performed in a manner that does not harm the native aquatic plant community; or

3. Removal of dislodged aquatic plants that drift on−shore and accumulate along the waterfront.

(b) Is not located in a sensitive area as defined by the department under s. NR 107.05 (3) (i) 1., or in an area known to contain threatened or endangered resources or floating bogs.

(c) Does not interfere with the rights of other riparian owners.

(d) If wild rice is involved, the procedures of s. NR 19.09 (1) shall be followed.

(4) Control of purple loosestrife by manual removal or use of mechanical devices when performed in a manner that does not harm the native aquatic plant community or result in or encourage re−growth of purple loosestrife or other nonnative vegetation.

(5) Any aquatic plant management activity that is conducted by the department and is consistent with the purposes of this chapter.

(6) Manual removal and collection of native aquatic plants for lake study or scientific research when performed in a manner that does not harm the native aquatic plant community.

Note: Scientific collectors permit requirements are still applicable.

(7) Incidental cutting, removal or destroying of aquatic plants when engaged in beneficial water use activities.

History: CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03.

NR 109.07 Invasive and nonnative aquatic plants. (1) The department may designate any aquatic plant as an invasive aquatic plant for a water body or a group of water bodies if it has the ability to cause significant adverse change to desirable aquatic habitat, to significantly displace desirable aquatic vegetation, or to reduce the yield of products produced by aquaculture.

(2) The following aquatic plants are designated as invasive aquatic plants statewide: Eurasian water milfoil, curly leaf pondweed and purple loosestrife.

(3) Native and nonnative aquatic plants of Wisconsin shall be determined by using scientifically valid publications and findings by the department.

History: CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03.

NR 109.08 Prohibitions. (1) No person may distribute an invasive aquatic plant, under s. NR 109.07.

(2) No person may intentionally introduce Eurasian water milfoil, curly leaf pondweed or purple loosestrife into waters of this state without the permission of the department.

(3) No person may intentionally cut aquatic plants in public/navigable waters without removing cut vegetation from the body of water.

(4) (a) No person may place equipment used in aquatic plant management in a navigable water if the person has reason to believe that the equipment has any aquatic plants or zebra mussels attached.

(b) This subsection does not apply to equipment used in aquatic plant management when re−launched on the same body of water without having visited different waters, provided the re−launching will not introduce or encourage the spread of existing aquatic species within that body of water.

History: CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03.

NR 109.09 Plan specifications and approval. (1) Applicants required to submit an aquatic plant management plan, under s. NR 109.04 (3), shall develop and submit the plan in a format specified by the department.

(2) The plan shall present and discuss each of the following items:

(a) The goals and objectives of the aquatic plant management and protection activities.

(b) A physical, chemical and biological description of the waterbody.

(c) The intensity of water use.

(d) The location of aquatic plant management activities.

(e) An evaluation of chemical, mechanical, biological and physical aquatic plant control methods.

(f) Recommendations for an integrated aquatic plant management strategy utilizing some or all of the methods evaluated in par. (e).

(g) An education and information strategy.

(h) A strategy for evaluating the efficacy and environmental impacts of the aquatic plant management activities.

(i) The involvement of local units of government and any lake organizations in the development of the plan.

(3) The approval of an aquatic plant management plan does not represent an endorsement for plant management, but represents that adequate considerations in planning the actions have been made.

History: CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03.

NR 109.10 Other permits. Permits issued under s. 30.12, 30.20, 31.02 or 281.36, Stats., or under ch. NR 107 may contain provisions which provide for aquatic plant management. If a permit issued under one of these authorities contains the appropriate conditions as required under this chapter for aquatic plant management, a separate permit is not required under this chapter. The permit shall explicitly state that it is intended to comply with the substantive requirements of this chapter.

History: CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03.

NR 109.11 Enforcement. (1) Violations of this chapter may be prosecuted by the department under chs. 23, 30 and 31, Stats.

(2) Failure to comply with the conditions of a permit issued under or in accordance with this chapter may result in cancellation of the permit and loss of permit privileges for the subsequent year. Notice of cancellation or loss of permit privileges shall be provided by the department to the permit holder.

History: CR 02−061: cr. Register May 2003 No. 569, eff. 6−1−03.

Appendix D

Eurasian Watermilfoil (and Other AIS) Rapid Response Plan

Eurasian Watermilfoil Rapid Response Plan for Bear Lake, Barron and Washburn Counties, Wisconsin

Monitoring

Continuous monitoring of the lakes and the public access points for the presence of Eurasian watermilfoil (EWM) will be completed by trained Bear Lake Association (Association) volunteers, Citizen Lake Monitoring Network (CLMN) volunteers, watercraft inspectors, and others. Volunteers will patrol the shoreline of Bear Lake at least three times annually from May through October. In-lake inspection at all boat access sites will be completed at least once a month from May through October by the Association, CLMN, and other lake volunteers. Volunteers completing any monitoring will collect suspicious plants and document where they were found. Suspicious plants will be submitted to designated Association, County, or WDNR representatives for verification and vouchering.

Specimen Vouchering

Volunteers are asked to collect at least two samples of the suspicious plant including roots if possible and place them in a zip-lock bag marked with the date, time, and location in the lake where it was found. The samples should be kept refrigerated until they can be submitted to one of the following appropriate personnel:

Bear Lake Association	
Douglas Peterson	651.334.5508
CONTACT 2	PHONE NUMBER
CONTACT 3	PHONE NUMBER
County Resources	
Tyler Gruetzmacher, Barron County Conservationist	715.537.6135
Lisa Burns, Washburn County AIS Coordinator	715.468.4654
Wisconsin Department of Natural Resources	
Pamela Toshner, Lake Management Coordinator - Spooner	715.635.4073
Alex Smith, Lake Management Coordinator – Spooner	715.635.4124
Kris Larsen, AIS Specialist - Spooner	715.635.4072

Positive Identification

If EWM is positively identified in Bear Lake, the WDNR, County Resources, and/or Association volunteers will install EWM warning signs at public access points. Aquatic plant management, if any is occurring in the area where EWM was identified, will immediately cease until arrangements can be made for the completion of an intensive search for EWM in the immediate and nearby area in which it was first identified. If a sizable area of EWM is identified, EWM buoy markers will be placed in the lake to keep boaters out of the infested area until management can be undertaken.

APM Plan Modification

If EWM is identified in the lakes, the existing plant management plan will need to be modified to include the treatment of EWM. An evaluation will be completed to determine and implement the most effective short-term management option. If necessary, a WDNR AIS Early Detection and Response grant will be applied for to help implement recommendations made in the modified plan. Either in the same year or the year immediately following the new identification, a whole-lake plant survey will be completed to again look for EWM. A complete EWM control plan will be added to the next revision of the existing APM Plan.

AIS Activity Funding

To cover the cost of an EWM treatment program, the Association will seek donations from its members and benefactors, undertake fundraisers and apply for an AIS Rapid Response and Early Detection grant to obtain appropriate funds. AIS Rapid Response and Early Detection grants can be applied for at any time as they are not subject to pre-determined application dates. Up to $20,000.00 is available for management implementation and planning activities.

Volunteer AIS Monitoring Timetable. Life stages of some invasive plant and animal species and the best times of the open water season to monitor for them.

	April	May	June	July	August	September
Eurasian watermilfoil						
Sprout						
Growth						
Bloom						
Die Back						
Curly-leaf pondweed						
Sprout	→					
Growth	→					
Bloom						
Die Back						
Purple Loosestrife						
Sprout						
Growth						
Bloom						
Die Back						
Zebra mussel						
Rusty crayfish						
Spiny water flea						

Source: Scholl, C., 2006. Aquatic Invasive Species: A Guide for Proactive and Reactive Management. Wisconsin Department of Natural Resources Project No. ASPL-001-04. Available at: http://dnr.wi.gov/Aid/documents/AIS/AISguide06.pdf (last accessed 2014-03-13).

Appendix E

Navigation Impairment/Nuisance Determination and Management Options

Navigation Impairment/Nuisance Determination and Management Options

1.0 Identification of Common Navigation Areas of Concern

1. Residents will notify a designee of the Bear Lake Association about an area of potential concern prior to June 30 each year
2. Area of concern is inspected by the Bear Lake Associaiton or its retainer
3. If navigation impairment is confirmed, it will be documented as described below.

2.0 Documenting Navigation Impairment

1. Provide examples of specific impairment of navigation caused by the presence of aquatic plants
2. Indicate when plants cause problems and how long problems persist
3. List the species of plants causing the nuisance
4. List adaptations or alternatives considered/used to lessen problem. Some examples include:
    a. Physical or hand removal
    b. Increasing general use by watercraft
    c. Mechanical removal
    d. Altering the chosen navigation route
5. Locate suggested navigation routes with GPS coordinates
6. Provide dimensions of suggested navigation routes (length, width, and depth)
    a. Note: mechanical harvesting is limited to waters at least 3-ft deep
7. Include photos of navigation impairments
8. Provide a record of historical management at the site if it has been managed previously

3.0 Documenting Nuisance Conditions

1. Provide examples of specific activities that are limited because of presence of nuisance aquatic plants
2. Indicate when plants cause problems and how long problems persist
3. List the species of plants causing the nuisance
4. List adaptations or alternatives consider/used to lessen problem (some examples include)
    a. Physical or hand removal
    b. Increasing general use
    c. Extending the dock to a greater depth or moving the dock
    d. Altering the route to and from the dock

5. Provide dimensions (length, width, and depth)
    a. Note: mechanical harvesting is limited to waters at least 3 feet deep
6. Include photos of navigation impairments
7. Provide a record of historical management at the site if it has been managed previously

4.0 Management Actions

1. If navigation impairment or nuisance condition is confirmed, a control method consistent with the Aquatic Plant Management Plan will be recommended and, if necessary, the area added to an existing or new permit application.

5.0 Selecting Appropriate Control Method

1. Physical removal (hand-pulling, rakes, or scythes) will be the first choice for control
2. Mechanical harvesting will be the alternative management action when:
    a. water depth or sediment type (e.g. muck) prohibits physical removal
    b. the area of concern is sized or shaped such that physical removal methods cannot be achieved in a timely fashion