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Halsey Lake - Comprehensive Lake Management Plan

Halsey Lake Association

WDNR Lake Planning Grant
LPL-1564-15

Prepared by:
Wisconsin Lake & Pond Resource

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Executive Summary

Halsey Lake is the largest lake in Florence County and provides numerous recreation opportunities for a wide spectrum of users. Halsey Lake is very shallow with a 2 foot mean depth with seasonally fluctuating water levels a concern, as the lake is a drainage lake. Given the extreme overall shallow depth of the lake, during dry years this can have a greater impact on important habitat for fish and wildlife, as well as recreational use of the lake. There have been both natural and man-made structures placed (illegally) at the outlet in an effort to help stabilize water levels. Shallow water and sometimes very dense aquatic plant growth have impacted navigation and recreational opportunities for lake users, including significant impact to the fishery due to winter die off from low oxygen levels. These issues could potentially be worsened if there was an introduction of aquatic invasive species (AIS), specifically vegetation including Eurasian water-milfoil (*Myriophyllum spicatum* – EWM) or curly-leaf pondweed (*Potamogeton crispus* – CLP).

Currently, no management plan exists to deal with any of these potential issues or response actions. The threat of an AIS being introduced into the lake is great, with 13 other lakes within the County having EWM infestations, 12 established since 2000 and six since 2010. Development of a comprehensive lake management plan for better management of the Lake is needed. Though the association is not required to complete or implement a comprehensive lake management (CLM) plan, one is essential to address these issues while being proactive to protect the lake for future generations.

This management plan provides a multi-faceted approach to address issues and recommend management options based on best fit, cost, feasibility, and desires constructed from direct input from the lake user survey questions. Many management options are evaluated and, while there is not one silver bullet, it is likely a combination of techniques over a period of several years that will begin to yield positive results. The basic plan is based on exploration of new aquatic plant management techniques with expanded actions for protection of the Lake from AIS, water quality maintenance, and a stabilization of water levels. Some of these actions potentially include aeration system installation, addressing point and non-point source nutrient loading, protection of ecologically sensitive areas, and AIS and boat landing monitoring. It would be recommended the group start small with a specific project component or area of the lake to gain early and immediate success and build off of that for future projects.

1.0 INTRODUCTION

Halsey Lake (the Lake) is a natural, shallow drainage lake located in western Florence County in the Town of Long Lake and provides ample year-round recreational opportunities. The Lake has a maximum depth of 10 feet, mean depth of 2.1 feet, and 3.65 miles of shoreline. The shoreline provides public access to over 50% of it as follows: Nicolet National Forest – 0.73 miles, State of Wisconsin - 0.74 miles, and open managed forest land – 0.37 miles.

Halsey Lake is classified as a shallow lowland drainage lake. Shallow lowland lakes do not stratify during summer months and have watersheds greater than 4 square miles in area. As a shallow lake, Halsey Lake is dominated by large expanses of flocculent muck or marl bottom, with many areas 1 ft or less in depth. Drainage lakes like Halsey Lake are dependent on precipitation to maintain water levels. In drier years, water levels have historically fluctuated and have caused difficulty in navigation to shallow areas of the lake. Water quality of Halsey Lake is considered mesotrophic and mildly productive with good water clarity.

The Halsey Lake Association (HLA) was founded in 1975 and is a group of over 40 members who support the restoration and management of the Lake, with a strong tradition in conservation and resource management to protect and enhance these opportunities. The HLA has been active in a number of lake management activities on Halsey Lake including: aquatic plant management, water quality sampling and monitoring, and fisheries management through stocking. The HLA received a grant from WDNR and contracted with Stantec, which was then mutually assigned to Wisconsin Lake & Pond Resource (WLPR) to help develop a comprehensive lake management (CLM) plan for Halsey Lake.

2.0 OVERALL LAKE MANAGEMENT GOALS

Halsey Lake is a natural drainage lake with very good water quality, an aquatic plant community without AIS present, and high quality fishery. Management actions recommended below are based on the findings of this CLM plan and chosen to protect and enhance the conditions present:

- User of the lake enjoy their time on the water with over 26 average years of experience, indicating a longevity that is important to generations of families and an increased importance on maintaining conditions for future generations (Section 3.0, pg 3.5)

- Water quality is good, with clarity averaging 7.2 ft and low frequency of algae blooms (Section 6.1, pg 5.17)

- Good water clarity, nutrient rich sediment, and shallow depths allow for aquatic plants to occasionally grow dense enough becoming a navigational nuisance. Though limited in diversity, the aquatic plant community of Halsey Lake is of high quality without an AIS present and 11 native species (Section 5.1, pg 45.12, & Figures 1.1-1.3)

- Aquatic invasive species are a constant threat to the quality of the lake and are present in numerous nearby lakes (Executive Summary, pg i)

- The watershed draining into the lake is largely undeveloped forest and wetland with large portions in the Nicolet National Forest and protects the lake from excessive nutrient inputs (Section 6.2, pg 6.22, Figure 4)

- Water levels have fluctuated historically and led to contentious relationships with individual property owners (Section 7.0, pg 7.27).

- A public user survey was conducted to gauge the perception of the lake and formulate management options that are not only viable for Halsey Lake, but also desired by its users and able to be successful (Appendix A)

- Current management has been extremely limited due to no direct need for intensive action and are the most accepted and recommended by lake users (Appendix A)

Though the aquatic plant community in Halsey Lake is healthy, it can grow dense and impact recreational use on the water. Dense aquatic plant growth only worsens navigational issues from shallow water throughout the lake, but only negatively impacted users of the lake 27.1% of the time.

Only those options that will be supported by the users and HLA with high likelihood of subsequent approval from the WDNR will be selected to help accomplish management goals. However, not all desired management options are viable or feasible for each situation. All options are discussed further in Appendix C. Based on the above, the following recommended action plan includes a combination of management actions to achieve desired results.

Goal: Prevent the introduction of an Aquatic Invasive Species into Halsey Lake

Primary Action: Initiate and conduct annual AIS surveys in cooperation with WRISC (Section 8.4, pg 8.32).

Secondary Action: If suspected AIS are found at any time in Halsey Lake follow proper notification and documentation procedure:

- Take a digital photo(s) of the location and area where it was found and of the plant itself.
- Collect a sample of 5-10 specimens, if possible, and place in a zip-loc baggie for submission and identification to WDNR.
- Note location of finding using GPS, if possible, or on a map of the Lake.
- Contact WDNR and Wild Rivers Invasive Species Coalition (WRISC) of finding (contact information at end of this section)
- Complete WDNR form 3200-125 and submit specimen and form to the regional WDNR Invasive Species Coordinator. Form 3200-125 can be found at this web address: http://prodoasint.dnr.wi.gov/swims/downloadDocument.do?id=34913498

Secondary Action: If an AIS ever becomes established in Halsey Lake and warrants active management, the follow should be used to decide actions:

- For scattered populations or individual beds totaling 1.0 acres or less in size utilize DASH for removal of the target species (Section 9.2, pg 9.37)
- For more prevalent populations greater than 1.0 acres in size utilize targeted herbicide application early season to control the target species and limit non-target impact to native species (Section 9.1, pg 9.35)
- All activities should be completed under appropriate permitting and under approval from the WDNR.
- Each year direct AIS management is to take place, continue to complete aquatic plant surveys to monitor AIS and native plant responses to the management and plan for the future. AIS should be surveyed and mapped before and after treatment, according to DNR protocol, to evaluate effectiveness. Comparison of data between years allows calculating reduction of targeted species in relation to established frequency

Primary Action: Limit active management of native aquatic plants only to locations where riparian access is impeded and only by manual hand harvesting (Section 8.4, pg 8.33).

Goal: Reduce threat of fishery winter kill due to low dissolved oxygen

Primary Action: Purchase a dissolved oxygen meter by the winter of 2018/2019.

Secondary Action: Begin monitoring in-lake dissolved oxygen levels during ice-on periods in the deepest portion of the lake annually.

Primary Action: Install, operate, and maintain an approved aeration system to oxygenate the lake by the winter of 2018/2019 (Section 8.1, pg 8.29, fig 6).

Secondary Action: Turn on aeration system by early October annually to ensure proper aeration and maintain an open area during ice cover.

Secondary Action: Properly flag off open area when ice levels are adequate for human traffic with posts, warning signs, and warning flagging. Install warning sign indicating active aeration and location at Halsey Lake boat landing.

Primary Action: Apply for funds from the U.S. Forest Service and/or WDNR to assist in project installation.

Goal: Continue comprehensive water quality monitoring within Halsey Lake through the WDNR Citizen Lake Monitoring Network.

Primary Action: Continue monitoring in 2018 and beyond for water quality through secchi readings, chlorophyll-a, and total phosphorus. Samples should be taken once monthly between May – September or at least 3 times a year spaced 30 days apart, or at a bare minimum once a year mid-summer.

Goal: **Initiate use of the Clean Boats / Clean Water program in cooperation with the Wild Rivers Invasive Species Coalition campaign (Section 8.4, pg 8.43).**

Primary Action: Commit up to four members of the HLA to attend CB/CW training in 2018.

Primary Action: Assist the WRISC's CB/CW campaign in 2018 and beyond by committing to at least 50 inspection hours at the Halsey Lake boat landing annually.

There are multiple resources and organizations able to help achieve plan goals and related actions. Contacts for those referenced in the plan and additional groups are included as follows.

Wild River Invasive Species Coalition
420 N Hooper St.
Kingsford, MI 49802
(906) 774-1550 x102
wildiverscwma@gmail.com

Wisconsin Department of Natural Resources
Kevin Gauthier Sr – Water Resources Management Specialist
(715) 356-5211
kevin.gautheirsr@wisconsin.gov

Joseph Cunningham – Aquatic Invasive Species Regional Coordinator
(715) 637-6860
Joseph.Cunningham@wisconsin.gov

Florence County Land Department
Rich Wolosyn – Land Conservation Administrator
Po Box 410
Florence, WI 54121
(715) 528-3430
rwolosyn@co.florence.wi.us

University of Wisconsin – Extension Lakes
(715) 346-2116
uwexlakes@uwsp.edu

3.0 LAKE USER SURVEY AND PRIMARY CONCERNS

Any management plan can only be successful if accepted by the lake users it impacts the most. If options are laid out that are not needed or feasible, a plan is set to fail due to lack of support and this management plan is no different. Prior to drafting this plan, a questionnaire was sent out to all members of the HLA and residents with property bordering Halsey Lake, totaling 67 properties that received a mailing with a response rate of 60% (40 of 67). In addition, it was and made available to any interested lake user, as this is the direct audience, and was available online for 60 days. Results of the questionnaire are included in Appendix A. This questionnaire gives us a unique look at all lake users and a better understanding of issues to guide development of a plan that will not only strive to improve current lake conditions, but be successfully implemented and supported by lake users through direct response actions by the people the lake impacts the most.

In total, 48 respondents completed the survey across an array of users with a majority (83%) residing on the water, showing that the lake and its health are important to riparian owners. Responses give an opportunity to look into personal histories with Halsey Lake and to create an average user profile. Overall, the average user is as follows:

- 83% have used the lake for over 10 years
    - Average of 26+ year history with the lake
- Spend an average time on the water of
    - 13.8 days per month during open water
    - 5.25 days per month during ice cover
- 98% find their time enjoyable with low impact activities as their top choice, including:
    - Open water fishing (#1)
    - Canoeing or kayaking (#2)
    - Nature viewing (#3)

Many responses indicated enjoyable experiences on the lake which have largely remained the same, even increasing over time. 24.5% indicated no change

- 55% indicated no change
- 15.8% indicated their use has become more enjoyable.
- 30% indicated their use has become less enjoyable, due to:
    - Fishing has deteriorated (#1)
    - Decreased water depth (#2)
    - Increased sedimentation (#3)
- Main concerns on lake health
    - Quality Fishery (#1)
    - Sedimentation (#2)
    - Decreased Water Depth (#3 – tie)
        - 47% believe the lake has become shallower during certain portions of the year, at minimum
        - Has negatively impacted navigability to 78% of respondents
    - Aquatic Invasive Species (#3 – tie)

HALSEY LAKE -
COMPREHENSIVE LAKE MANAGEMENT PLAN
Lake User Survey and Primary Concerns
September 14, 2018

This plan will focus on the main contributing factors and concerns for lake management and threats to Halsey Lake: protection or enhancement of the fishery and monitoring for and prevention of the introduction of AIS.

- Users are very knowledgeable about AIS and potential harm, 75% responded in kind
- Majority of respondents did not feel active management of aquatic plants was warranted with top concerns being protection of what's currently in place, including:
    - Monitoring through plant surveys
    - Prevent the introduction of new AIS
    - Rely on outside recommendations from WDNR and/or professional consulting firm
- Increased sedimentation and water level fluctuation were noted as main concerns throughout the questionnaire
    - No evidence that sedimentation has increased
    - Sediment present is extremely flocculent and varying water levels impact navigation drastically in large portions of the lake, leading to an appearance of increased sedimentation
    - Water levels maintained by a natural dam-like outlet
    - Illegal structures placed at times to increase water levels

The Halsey Lake CLM Plan includes a review of available information, an aquatic plant survey, watershed assessment, and water quality evaluation to determine the most appropriate management alternatives (physical, mechanical, biological or chemical) for protection and health of the Lake. Though not all activities desired for management by lake users may be viable or appropriate, their input above provides a strong base to form this plan. The CLM plan that follows recommends specific management activities for Halsey Lake based on the top management concerns indicated in the questionnaire, dense aquatic plant growth and sedimentation, to ensure not only the health of the Lake but also the enjoyment by future generations of Lake users.

In preparation of this plan, multiple meetings on the main topics were held to refine and guide the plan.

- January 25, 2017 – meeting to discuss the water level control and unauthorized dam. Those present included the property owner of where the dam is located, Bill Sturtevant and Miles Winkler of the WDNR, and representatives of WLPR.
- February 14, 2017 – teleconference to discuss need and initial planning for an aeration system in Halsey Lake. Those present included Bill Newhouse of the HLA, WDNR fisheries biologist for Florence County Greg Matzke, and representatives of WLPR.
- August 5, 2017 (HLA Annual Meeting) - A project update meeting to present the user survey results, collected lake and water quality data, and management recommendations to further refine the plan and review desired goals. Approximately 50 HLA members and nearby residents were in attendance.

Review of the draft CLM plan was submitted to the HLA and WDNR for comments prior to finalization. The CLM plan that follows recommends specific management activities for Halsey Lake based on the top management concerns indicated in the questionnaire, to ensure not only the health of the lake but also the enjoyment of the lake by future generations of Lake users.

4.0 LAKE HISTORY & PAST MANAGEMENT

Located in western Florence County, in the Town of Long Lake, the Lake has been an important fixture in the lives of resident and non-resident users. A public landing on the eastern shore provides watercraft accessibility with a gravel launch lane. Additional lake access is provided by a large area of publicly accessible shoreline.

Halsey Lake is a productive and popular fishing lake, both open water and through the ice. Problems with shallow, fluctuating water levels and occasionally dense aquatic plant growth have caused nuisance issues with users and contributed to occasional low oxygen conditions under ice cover leading to winter fish kills. Past history and management has been limited on Halsey Lake and focused on protection of the current status.

- **Halsey Lake Association – 1975**: Was formed to deal with lake management issues while protecting and enhancing the lake for future generations. Past projects completed by the HLA include:
    - Fish stocking for over 20 years
    - Enhancement of fishery habitat by constructing and installing 15-20 fish cribs
    - First initial aquatic plant inventory in 2002
    - Initiation of a long-term management plan prior to this CLM plan in 2012
    - Lake water quality monitoring through self-help citizen lake monitoring

Varying water levels have been a main concern for lake users throughout their history on Halsey Lake. As a drainage lake, Halsey Lake has both an inlet and outlet and relies primarily on precipitation to maintain water levels. In periods of dry weather the lake levels fall, while they rise during wetter periods. The Halsey Lake outlet occurs at a pinch point and flows through a low spot in a natural land bridge. During conversations with residents, issues with water levels have dated back to the 1960s and likely earlier.

Past management actions have been extremely limited and focused on fisheries habitat and stocking only. No past management has been carried out for aquatic plant growth within the Lake. Issues intermittently arise in due to water level variation, dense aquatic plant growth and low dissolved oxygen, as evidenced by the concerns raised in the user questionnaire and led to creation of this CLM plan.

4.1 FISHERIES SUMMARY

As evidenced by the survey results, the fishery of Halsey Lake is a popular recreational pursuit, both open water and ice fishing, and an important aspect for management activities. Comprehensive fishery studies for Halsey Lake have been completed in 1998 and 2013. This plan will only summarize past and current conditions of Halsey Lake's fishery, as management recommendations are already completed by WDNR staff.

Halsey Lake's fisheries management history dates back to the first study in 1951, conducted to determine fishing pressure. At that time, only one cottage was on the lake with no boat access and not enough pressure was present to justify a fisheries survey. By the 1960s the lake's shoreline had become more developed, with 12 cottages and a boat landing completed by 1969. Past surveys focused on electrofishing from 1976 – 2013 and was used to monitor the fish populations. Due to Halsey Lake's shallow nature, winterkill from low oxygen levels has been a concern and has been noted to occur sporadically, as seen in 1987-88, 2003-2004, and 2013-14, the most recent having major impacts to a number of fish species.

From the 2013 comprehensive survey, three sportfish species were present: walleye, northern pike, and largemouth bass. Past surveys found populations of smallmouth bass, but none were sampled in 2013. Only largemouth bass and northern pike are able to maintain their populations through natural reproduction. Halsey Lake's fisheries habitat is largely soft, flocculent sediment with locations of dense aquatic vegetation. Hard bottom areas of gravel, rock, or sand are preferred for smallmouth bass and walleye spawning and are limited in location on Halsey Lake. Presence of these species is largely maintained by supplemental stocking.

Angling for panfish continues to be the largest draw for fishermen. Five panfish species were captured during the 2013 survey: yellow perch, bluegill, pumpkinseed, black crappie, and hybrid sunfish. Yellow perch were the most abundant species noted followed by bluegill with considerably less frequency of remaining panfish species. Though bluegills were the second most abundant species sampled, their relative abundance was low, with a larger size structure when compared to nearby lakes.

Fish stocking in Halsey Lake is used to maintain walleye populations, while bolstering populations of other species. The Halsey Lake Association has contributed to stocking other species in years of winterkill and to maintaining panfish populations. WDNR stocking records show the following stocking amounts for northern pike and walleye:

Fish Stocking Within Halsey Lake					
Year	**Walleye - fingerling**	**Northern Pike - fingerling**	**Year**	**Walleye - fingerling**	**Northern Pike - fingerling**
1972	12700	---	1999	9018	---
1974	25000	---	2003	25600	---
1976	25000	---	2004	6888	---
1978	10000	---	2005	458	---
1989	---	1000	2006	5119	---
1990	---	2000	2007	16398	---
1991	---	2500	2009	17918	---
1992	---	1006	2011	17918	---
1993	---	1000	2013	---	2545
1994	---	1000	2014	2528	--
1995	4042	---	2016	2523	---

Halsey Lake contains a significant forage base, especially of white suckers, which contributes to above average growth rates for walleye and northern pike. Additionally, all panfish species sampled showed above average growth rates. As a highly pressured lake, angler harvest was noted to impact the top end size of most species sampled and management recommendations from the 2013 comprehensive survey were focused on maintaining the high quality fishery present, as follows:

- **Northern pike** – bolster abundance by continued stocking of large fingerlings and transferring of adult pike from nearby Fay Lake into Halsey Lake. Re-evaluate size limit regulation after the Fay Lake transfer effect is known.
- **Walleye** – continue stocking of large fingerlings at up to 5 walleye per acre on an every other year basis to maintain an adult population of 1.25 or greater per acre. Current minimum length limits are appropriate for Halsey Lake as a put-and-take fishery.
- **Largemouth Bass** – current population is weighted towards younger fish due to high recruitment years; >95% in 2013 were below the current 14" minimum length limit. To curb future issues of a high largemouth bass population, it was recommended to change to no minimum length limit, with a 14-18" protected slot and daily bag limit of 3 fish, only one of which may be >18".
- **Panfish** – angler exploitation is currently curbing populations and removing larger fish from the system. All species show tremendous growth rates. To reduce angler impact and allow the fishery to reach its potential, a reduction in the daily bag limit of 25 fish to 10 fish was recommended.

Since the 2013 comprehensive survey fishing regulations for largemouth bass and panfish have been updated to reflect the recommendations above as follows:

- **Largemouth Bass** – Only fish less than 14" may be kept, except one fish over 18" may be kept
- **Panfish** – 25 panfish may be kept, but no more than 10 of one species

For all remaining species the Statewide regulations apply. Please refer to *Guide to Wisconsin Hook and Line Fishing Regulations, 2017-2018 (WDNR)* for current regulations.

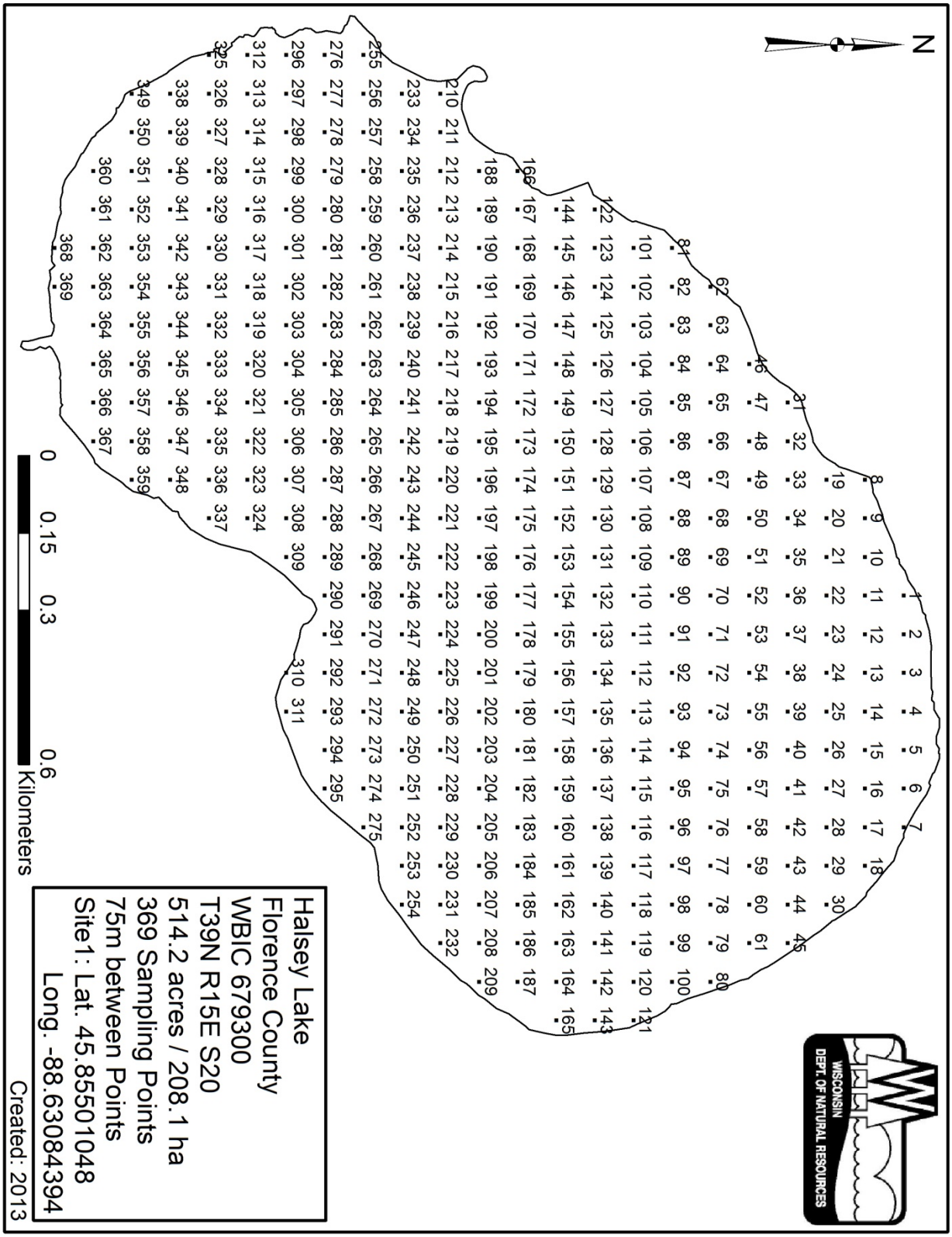
5.0 AQUATIC PLANTS

Aquatic plants are vital to the health of a water body. Unfortunately, they are often negatively referred to as "weeds". The misconceptions this type of attitude brings must be overcome in order to properly manage a lake ecosystem. Rooted aquatic plants are extremely important for the well-being of a lake community and they possess many positive attributes. Despite their importance, they sometimes grow to nuisance levels that hamper recreational activities and are common in degraded ecosystems. The introduction of AIS often can increase nuisance conditions, particularly when they successfully out-compete native vegetation and occupy large portions of a lake.

To assess the state of the current plant community, a full point-intercept survey was completed on September 1, 2015 following all WDNR survey protocol. The survey included sampling at 369 pre-determined locations uniformly spaced 75 meters apart to document the following at each site:

- Individual species present and their density
- Water depth
- Bottom substrate

Each location was assigned coordinates and loaded into a GPS unit, which was used to navigate to each point. Data collected at each point was then entered into a WDNR spreadsheet, which outputs various aquatic plant community indexes and data, allowing for a comparison to past data to monitor changes over time. Information on methods and all referenced tables or charts is included in Appendix B.


N
WISCONSIN
DEPT. OF NATURAL RESOURCES
0
0.15
0.3
0.6
Kilometers
Halsey Lake
Florence County
WBIC 679300
T39N R15E S20
514.2 acres / 208.1 ha
369 Sampling Points
75m between Points
Site1: Lat. 45.8550104
Long. -88.6308439
Created: 2013

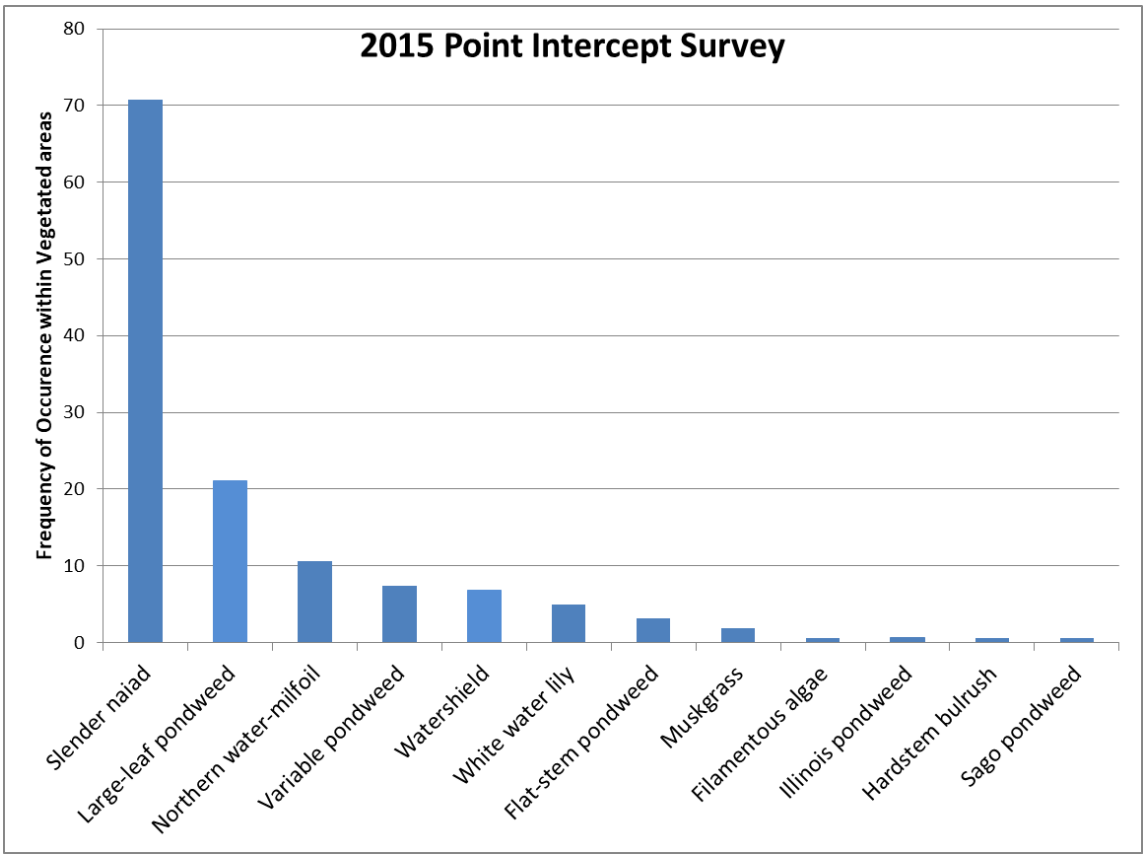
5.1 2015 POINT INTERCEPT SURVEY

In 2015, the aquatic plant survey identified a minimally diverse, but healthy community with scattered sections of dense vegetation growth. In total, 11 species were identified, with no AIS observed or sampled (Table 1, Appendix B). All species identified are common of such systems in Wisconsin and included four different species of pondweeds, which are vital to fisheries habitat.

Table 2: 2015 Aquatic Plant Community Statistics,Halsey Lake, Florence County, WI

Aquatic Plant Community Statistics	2015
F.o.o. at sites shallower than maximum depth of plants	46.26
Simpson Diversity Index	0.65
Maximum depth of plants	5
Avergage number of all species per site	0.59
Average number of all species per vegetated site	1.29
Average Number of native species per site	0.59
Average Number of native species per vegetated site	1.29
Species Richness	11

Species sampled in Halsey Lake were present in three categories: floating-leaf plants (white water lily – *Nymphaea odorata*) which root in the sediment and produce leaves that float on the water's surface; emergent, near shore species which are rooted below the water's surface with growth extending above the water (hardstem bulrush – *Schoenoplectus acutus);* and submersed species which root on the Lake bottom and remain below the water's surface (common waterweed – *Elodea canadensis*).



The photic zone, or area of the lake where light penetration is able to support plant growth, covered most of lake, with plants found growing up to 5 feet deep. Plant growth was sporadic, but was locally dense with 46.3% of this area vegetated. A majority of the sediment was comprised of a soupy muck and marl mixture, which provides poor rooting for aquatic vegetation. In many of these areas of muck the loose sediment allows plants to easily uproot by wave or boat action and float to the surface, creating an additional nuisance to lake users.

Species richness was below average at 11 and exhibited moderate diversity per sample point, averaging 1.29 species per vegetated site with a poor distribution spread throughout the system, as exhibited by a Simpson Diversity Index (SDI) of 0.65. An SDI value closer to 1.0 indicates a healthier, more evenly spread plant community. Slender naiad (*Najas flexilis*) and large-leaf pondweed (*Potamogeton amplifolius*) were the most dominant species present. Table 3, Appendix B displays frequency data by individual species. Figures 1.1-1.3 display the locations of all species found during sampling. No AIS were sampled or noted growing during the survey.

Point-intercept surveys can under-sample vegetation growing adjacent to the lake or in shallow, near-shore habitats due to the layout of the sampling grid. In conjunction with the point-intercept survey, a near-shore visual survey of emergent and wetland plant species was completed at the same time. Much of the shoreline of Halsey Lake is undeveloped with adjacent wetlands and provides a rich diversity of near-shore emergent vegetation. Species commonly found during the near-shore survey included multiple sedge, bur-reed, and arrowhead species, hardstem bulrush, wild rice, and wetland shrubs. Locations and distribution of these communities is indicated on Figure 2.

5.2 FLORISTIC QUALITY INDEX

To compare changes in the plant community over time within Halsey Lake and to similar lakes in Wisconsin, the floristic quality index (FQI) can be used. FQI provides the ability to compare aquatic plant communities based on species presence. This value varies throughout Wisconsin, ranging from 3.0 to 44.6 with a statewide average of 22.2. To achieve this, each plant species, except for AIS, is assigned a coefficient of conservatism value (C values). A plant's C value relates to a plant species' ability to tolerate disturbance. Low C values (0-3) indicate that a species is very tolerant of disturbance, while high C values (7-10) indicate species with a low tolerance of disturbance and are typically found in systems of higher water quality. Intermediate C values (4-6) indicate plant species that can tolerate moderate disturbance.

Table 4: 2015 Floristic Quality Index, Halsey Lake, Florence County, WI

Common Name	Coefficient of Conservatism C
Watershield	6
Muskgrass	7
Northern water-milfoil	6
Slender naiad	6
White water lily	6
Large-leaf pondweed	7
Variable pondweed	7
Illinois pondweed	6
Flat-stem pondweeed	6
Hardstem bulrush	6
Sago pondweed	3
Total Species	11
Mean C	6.00
Floristic Quality Index (FQI)	**19.90**

Not only does this track changes over time within the Lake, but allows for comparison of the Lake to lakes with similar environmental conditions within a delineated area, called an eco-region, to be compared. Halsey Lake is located within the Northern Lakes and Forests eco-region. Lakes within the Northern Lakes and Forest region are typically natural lakes created by glaciation.

Halsey Lake is found near the northern border of the ecoregion in Wisconsin, within the Brule and Paint River Drumlins. Lakes density within this area is lower than the sub regions to the west in Forest and Vilas counties and is composed of mainly large glacial, seepage and drainage lakes that can have fluctuating water levels, especially during dry years. Land use within the region is primarily undeveloped forest or wetland, with most lakes having low to moderate development along the shoreline, which leads to higher aquatic plant community metrics like FQI and coefficient of conservatism. The average coefficient of conservatism is above the average for all Wisconsin lakes due to limited comparative disturbance (Table 5).

Table 5: FQI and Average Coefficient of Halsey Lake Compared to Wisconsin and Northern Lakes and Forests Ecoregion.

	Average Coefficient			Floristic Quality			Species Diversity		
Quartile*	Lower	Mean	Upper	Lower	Mean	Upper	Lower	Mean	Upper
Wisconsin Lakes	5.5	6	6.9	16.9	22.2	27.5	8	13	20
Northern Lakes & Forests	6.1	6.7	7.7	17.8	24.3	30.2	7	13	20
2015	6			19.9			11		

* - Values indicate highest value of the lowest quartile, mean, and lowest value of the upper quartile

11 native species were found during the 2015 survey, with an average of 1.29 native species per sample point where vegetation was present. This native plant community is important should any AIS become established since they are already established and present to compete with and prevent a quick expansion of AIS.

The FQI calculated from the 2015 aquatic plant survey data was 19.9 with an average C of 6.0. These values, when compared to the Northern Lakes and Forests Eco-region averages of 24.9 and 6.7, respectively, are below average for both. However, this does not indicate a depressed or poor aquatic plant community. Many areas of Halsey Lake have a soupy sediment which is poor rooting substrate, limiting the species that are able to grow in those conditions. Instead the aquatic plant community of Halsey Lake should be considered healthy and representative of the conditions present for aquatic plant growth.

5.3 HISTORICAL COMPARISON

The aquatic plant community of Halsey Lake has been surveyed only once prior to 2015, in 2002, as a visual only presence / absence survey. The relative plant community of true aquatic species within the lake has fluctuated little over this time. Three species noted in 2002 were not directly sampled during the 2015 survey, including: floating-leaf pondweed, nitella, and various-leaved water-milfoil. Conversely, four species sampled in 2015 were not present in 2002: flat-stem pondweed, muskgrass, slender naiad, and variable pondweed (Table 6).

Table 6: Species surveyed by year, Halsey Lake, Florence County, WI.

	In-lake True Aquatic Species		Near-shore Wetland Species*	
	2002*	2015	2002*	2015*^
Floating-leaf species				
Spatterdock	X			X
Watershield	X	X		
White water lily	X	X		X
Emergent Species				
Bottle-brush sedge			X	
Broad-leaved cattail				X
Bur-reed species			X	X
Cala lily			X	
Common arrowhead			X	
Grass-leaved arrowhead			X	
Hardstem bulrush		X		X
Lake sedge				X
Northern blue-flag iris				X
Sedge species				X
Softstem bulrush			X	
Turtle head			X	
Tussock sedge				X
Wild Rice			X	X
Submersed Species				
Filamentous algae		X		
Flat-stem pondweed		X		
Floating-leaf pondweed	X			
Illinois pondweed	X	X		
Large-leaf pondweed	X	X		
Muskgrass		X		
Nitella	X			
Northern water-milfoil	X	X		
Sago pondweed	X	X		
Slender naiad		X		
Variable pondweed		X		
Various-leaved water-milfoil	X			

* - Species noted visualy only and not directly sampled
^ - Figure 2

Comparison between years shows that the Lake exhibits a stable aquatic plant community. Dominant species will vary year to year depending on many factors including weather patterns,

community composition in year's prior, water levels and more. Some conditions may be favorable for certain species during one growing year but not others, and vice versa. This is common and indicative of a healthy lake. Variance is normal and is currently not a cause for concern.

5.4 POTENTIALLY ENVIRONMENTALY SENSITIVE AREAS

Environmentally sensitive areas are locations within a lake that offer critical and/or unique fisheries or wildlife habitat areas or areas that offer water quality and erosion control benefits. Such areas play important roles within the lake's ecosystem such as offering fisheries spawning, nursery, feeding or cover areas, areas of rare species occurrence or habitat, or erosion and nutrient buffer locations. During the aquatic plant survey, special note was taken to inventory and delineate such potential areas on Halsey Lake, as none currently exist. These have been mapped (Figure 3) and are described in detail below.

- **Sensitive Area #1**: Area #1 is a broad expanse of extremely flocculent sediment and plants present are prone to uprooting from wave or boat wake. This possible location encompasses much of the western portion of Halsey Lake and is adjacent to a large bog wetland complex with excellent plant diversity. In this location, the only beds of bur-reed and wild rice on the lake were found.

- **Sensitive Area #2**: Potentially sensitive area #2 is a small, mid-lake hump of gravel with occasional boulders and covered in hardstem bulrush. Hard bottom habitat is extremely limited in Halsey Lake. An area like this is potentially important for fisheries and is entirely unique within the Lake.

Only the WDNR can officially designate sensitive areas and those outlined above are submitted as recommendations for further assessment by the State of Wisconsin.

6.0 WATER QUALITY & WATERSHED

The water quality within a lake and its surrounding watershed are tied directly to each other. Runoff from rainfall on the watershed contributes nutrients and sediment to the waterbody, with each affected directly by land use within the watershed. Varying land uses yield differing amounts of nutrient and sediment loads in the form of surface water runoff. Areas of agriculture or with large amounts of paved and impermeable surfaces (industrial, commercial and high density residential) contribute more loading than natural areas, such as wetlands and forests, which may act as sponges, more readily able to soak up precipitation and slow down runoff.

As the land use affects the quality of surface water runoff, that runoff then has an effect on the overall water quality of a lake. When high nutrient loads are contributed by land use that disturbs or impacts more surface area, the water quality of the lake usually suffers. High nutrient loads lead to increased plant and algae growth, with an excess of nutrients leading to potential algae blooms, which can than lead to reduced water clarity, ultimately culminating in reduced overall water quality.

To assess water quality, water samples were taken according to WDNR protocol and tested for various parameters at a certified lab. The watershed was delineated, with each land use type mapped and tallied. All of this data was then used within a modeling program from the WDNR to calculate impact to the lake by land use, compare current water quality to predicted water quality (using land use within the watershed), and predict what future changes may do to nutrient input into Halsey Lake. Information on methods and all referenced tables or charts is included in Appendix C.

6.1 WATER QUALITY

Halsey Lake is a drainage lake relying mainly on input from precipitation into the system to maintain water levels. Water quality within the Lake depends primarily on annual rainfall and amount of nutrient runoff. In years of high rainfall, water quality is expected to decrease and may take a year or longer to return to normal due to residence time; while years of drought show an increase in water quality parameters due to less runoff.

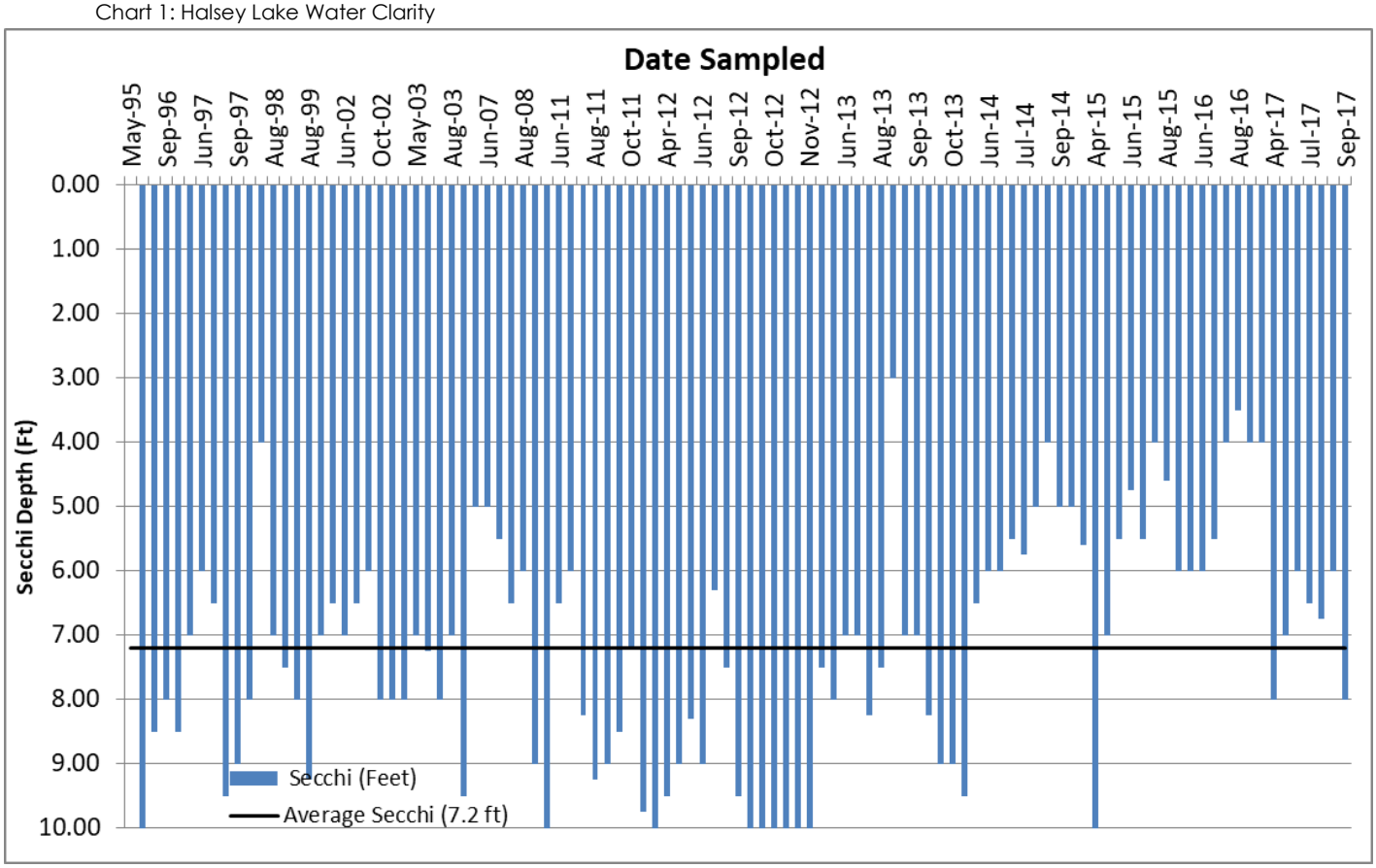
Halsey Lake water quality data has been collected regularly since 1995, including:

- Water clarity (Secchi depth) – 1995-1999, 2001-2003, & 2007-2017
- Total phosphorus – 1995-1999, 2001-2003, & 2007-2017
- Chlorophyll *a* – 1995-1999, 2001-2003, & 2007-2017

All three parameters were again collected and tested for during this project period (2015) by HLA members.

Higher **secchi depth** (water clarity) readings indicate clearer water and deeper light penetration, allowing plants to grow in deeper areas of the Lake. Historical water clarity for the Lake is 7.2 feet (Chart 1), indicating marginal clarity when compared to the average for all lakes in Wisconsin (10ft), but still quite good and reached 10 ft on multiple occasions. However, the secchi reading reached bottom on multiple occasions, indicating clarity was only limited by the depth of the lake. Since the secchi reached bottom during many sample dates, water clarity of Halsey Lake is better than indicated by its overall average.

Chart 1: Halsey Lake Water Clarity



Nutrients within the water play an important part in the productivity of the water, leading to impacts on water quality. These include total phosphorus, nitrogen and chlorophyll *a*. **Phosphorus** is the key nutrient or food source influencing plant growth in waterbodies. Phosphorus promotes excessive aquatic plant growth and originates from a variety of sources, many of which are related to human activities. Major sources include human and animal wastes, soil erosion, wastewater treatment plants, detergents, septic systems and runoff from farmland or lawns. Soluble reactive phosphorus is the amount of phosphorus in solution that is available to plants. Total phosphorus includes the amount of phosphorus in solution (reactive) and in particulate form. For natural lakes, the average total phosphorus should be between 0.016 and 0.030 milligrams per liter (mg/L). The below table outlines average phosphorus readings and their respective water quality:

Water quality vs. Total Phosphorus

Water Quality Index	Total Phosphorus (mg/L)	
Very Poor	0.150+	
Poor	0.053 – 0.149	
Fair	0.031 – 0.052	
Good	0.016 – 0.030	← Halsey Lake
Very Good	0.002 – 0.015	
Excellent	0.001 or less	

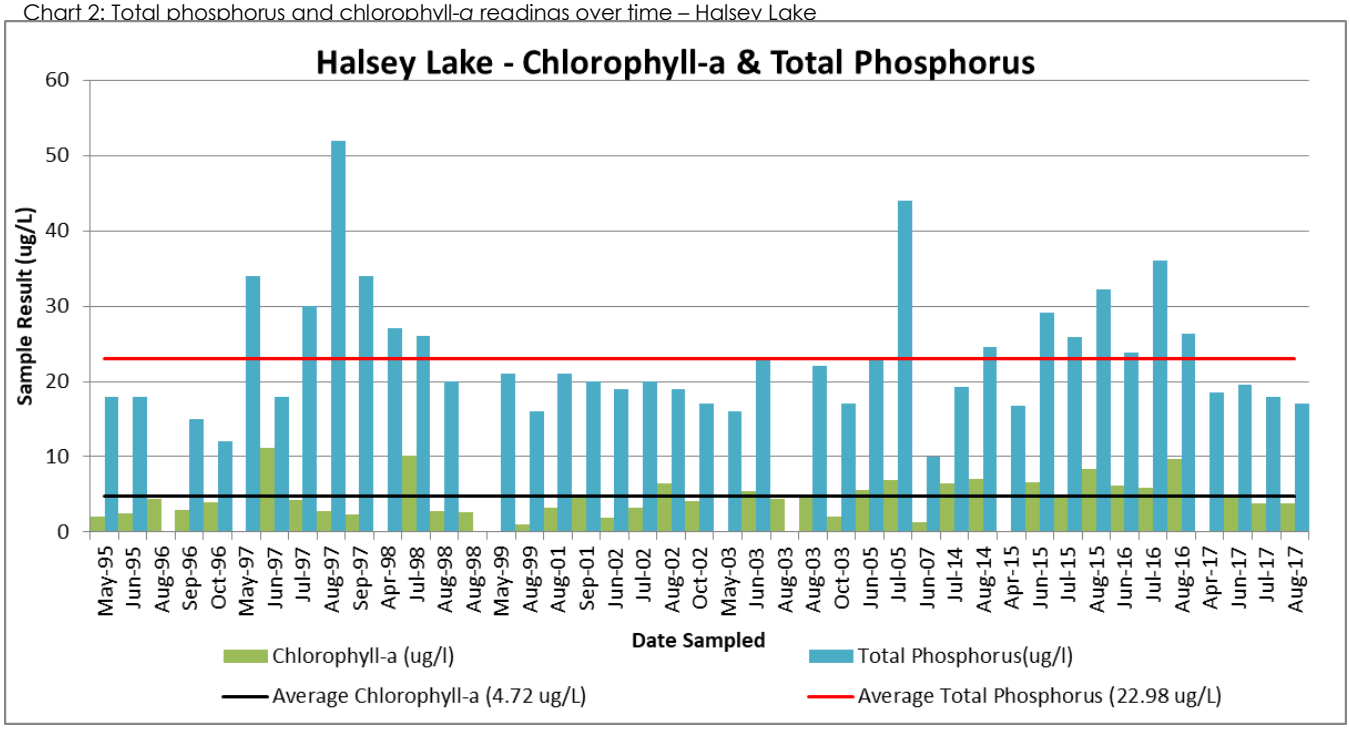
Adapted from: *Understanding Lake Data*, 2004.

All samples averaged 0.02298 mg/L (22.98 ug/L) for total phosphorus, indicating good water quality and moderate availability of nutrients (Chart 2) and were right in line with Wisconsin lakes on average.

Chlorophyll *a* is a green pigment present in all plant life and necessary for photosynthesis. The amount present in surface water depends on the amount of algae, and is used as a common indicator of water quality. Higher chlorophyll a values indicate lower water clarity. Values of 10 ug/L and higher are associated with algal blooms while values between 5 and 10 ug/L indicate good water quality.

In natural lakes, these values cycle annually during the open water period. They begin low after ice out and increase throughout the year as the water warms and algae growth increases, sometimes spiking and creating a bloom condition (>10 ug/L). However, only one reading over 10 ug/L was noted in Halsey Lake (June, 1997), indicating fairly stable planktonic algae populations. Though the amount of phosphorus present may fuel potential algae blooms, the algae is limited by other nutrients, such as nitrogen, or by zooplankton grazing in Halsey Lake. Zooplanktons are tiny, living organisms in the water column and are important food sources for small panfish and minnows.

Chart 2: Total phosphorus and chlorophyll-a readings over time – Halsey Lake



Nitrogen is the second most important nutrient for plant and algae growth. A waterbody's nitrogen sources vary widely. In most cases, the amount of nitrogen in lake water is related to local land use. Nitrogen may come from fertilizer and animal wastes on agricultural lands, human waste from sewage treatment plants or septic systems, and lawn fertilizers used on lakeshore property. Nitrogen may enter a lake from surface runoff or groundwater sources. Organic nitrogen is a measure of the nutrient not readily available for plant or organism use, typically locked into plant matter. All inorganic forms of nitrogen (nitrate, nitrite and ammonia) can be

used by aquatic plants and algae. If these inorganic forms of nitrogen are available in high amounts they could support summer algae blooms and the growth of AIS has been correlated with such fertilization of the sediment.

Nitrogen levels on their own are typically not tracked in comparison to other nutrients, such as with phosphorus above. Instead, they are compared with the phosphorus concentration of the lake to establish a ration between nitrogen and total phosphorus present to describe the water quality. If the ratio of nitrogen to phosphorus is less than 10:1, nitrogen is the limiting nutrient. Waters with a ratio between 10:1 and 15:1 are considered transitional with little or no limitations, while lakes with ratios greater than 15:1 are limited by phosphorus. No sampling for nitrogen has been completed for Halsey Lake. Based on similar impoundments within the region, it is expected that the Lake would fall into the phosphorus-limited category. This is common for most lakes in Wisconsin.

Trophic State

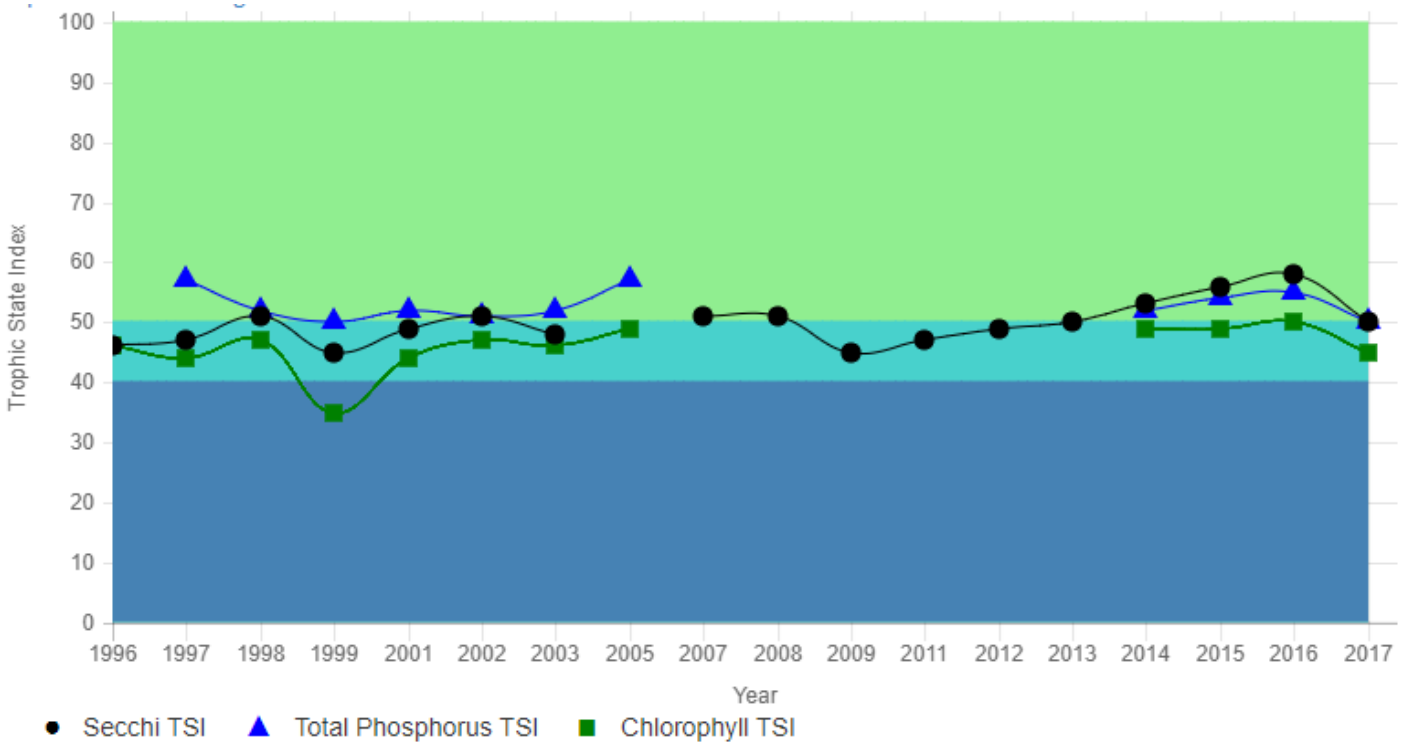
Water quality is a component of three factors: Water clarity (secchi), total phosphorus and chlorophyll *a*. All factors are linked to each other and as one changes so do the others. For example, if nutrient loads, such as phosphorus or nitrogen, increase, that increases available resources for algae (chlorophyll a), which can cause an increase in this reading, all while leading to a decrease in water clarity. Data is collected over time and averaged, allowing these factors to be used to assess the Trophic State Index (TSI) for a lake. TSI values are assigned to a lake based on all three values and are a measure of a lakes' biological productivity during the summer or growing season months of May – September only. Lakes with higher TSI values are more biologically productive, but have lower water clarity, increased nutrient input and the potential for frequent algae blooms. On the opposite end, lakes with low nutrient input and very clear water are typically less productive, having lower TSI values.

Historical water clarity, total phosphorus and chlorophyll *a* show a relatively stable trend over time with minor annual variances. Secchi TSI values historically have been higher than *chlorophyll a* values and at or near total phosphorus values. This type of relationship indicates that particulates other than algae are the main factor for water clarity and that algae blooms are limited. The overall TSI average indicates the Halsey Lake is a mesotrophic lake with a rating of 49.25.

Category	TSI	Lake Characteristics	Total P *(ug/l)*	Chlorophyll a *(ug/l)*	Water Clarity *(feet)*
Oligotrophic	1-40	Clear water; oxygen rich at all depths, except if close to mesotrophic border; then may have low or no oxygen; cold-water fish likely in deeper lakes.	< 12	<2.6	>13
Mesotrophic	41-50	Moderately clear; increasing probability of low to no oxygen in bottom waters.	12 to 24	2.6 to 7.3	13 to 6.5
Eutrophic	51-70	Decreased water clarity; probably no oxygen in bottom waters during summer; warm-water fisheries only; blue-green algae likely in summer in upper range; plants also excessive.	> 24	>7.3	<6.5
Halsey Lake	**49.25**	**Eutrophic**	**22.98**	**4.72**	**7.2**

Adopted from Carlson 1977, Lillie and Mason, 1983, and Shaw 1994 et al

Chart 3: TSI of Halsey Lake over time and is adapted from WDNR data.



6.2 WATERSHED

All above factors are impacted by the lake's watershed. To gauge the watershed's effect on the water quality of Halsey Lake, Wisconsin Lake Modeling Suite (WiLMS), a WDNR computer program, was used to model lake water quality based on watershed land use and current water quality data. WiLMS can be used as a planning tool to assist in management recommendations or procedures within a watershed to ensure stable or increased water quality. Using WiLMS, a lake total phosphorous prediction model and a lake eutrophication analysis procedure (LEAP) model was developed for Halsey Lake. Information on methods and all referenced tables or charts and direct model outputs is included in Appendix D.

LEAP is a program within WiLMS that predicts lake trophic status indices based on watershed area, lake depth and lake eco-region. Halsey Lake is a drainage lake with both an inlet and outlet. The Halsey Lake Slough is an inlet on the Lake's southern and western shore that begins in a large wetland bog complex and flows north approximately 1.75 miles before emptying into the Lake. The outflow, or Halsey Lake Outlet, empties into Fay Lake and eventually to the Pine River, which flows east to the Menominee River on the Wisconsin / Michigan border.

Halsey Lake is the only lake in the watershed and, without the lake itself; ***the watershed encompasses 2733.74 acres, or 4.27 square miles*** terminating at the Halsey Lake outlet. This gives a watershed-to-lake ratio of 5.3:1, meaning for every 5.3 acres of watershed there is one acre of lake. A lake and its water quality is a representation of the watershed around it, specifically its land use, soils, topography, vegetation, and geology. All of these factor directly into the nutrient loading to the lake. The small watershed-to-lake ratio for Halsey Lake can indicate minimal nutrient loading relative to the lake size. The Lake has a mean depth of 2 feet and total surface area of 513 acres within the watershed and it belongs in the North Central Hardwoods Forests ecoregion (Figure 4).

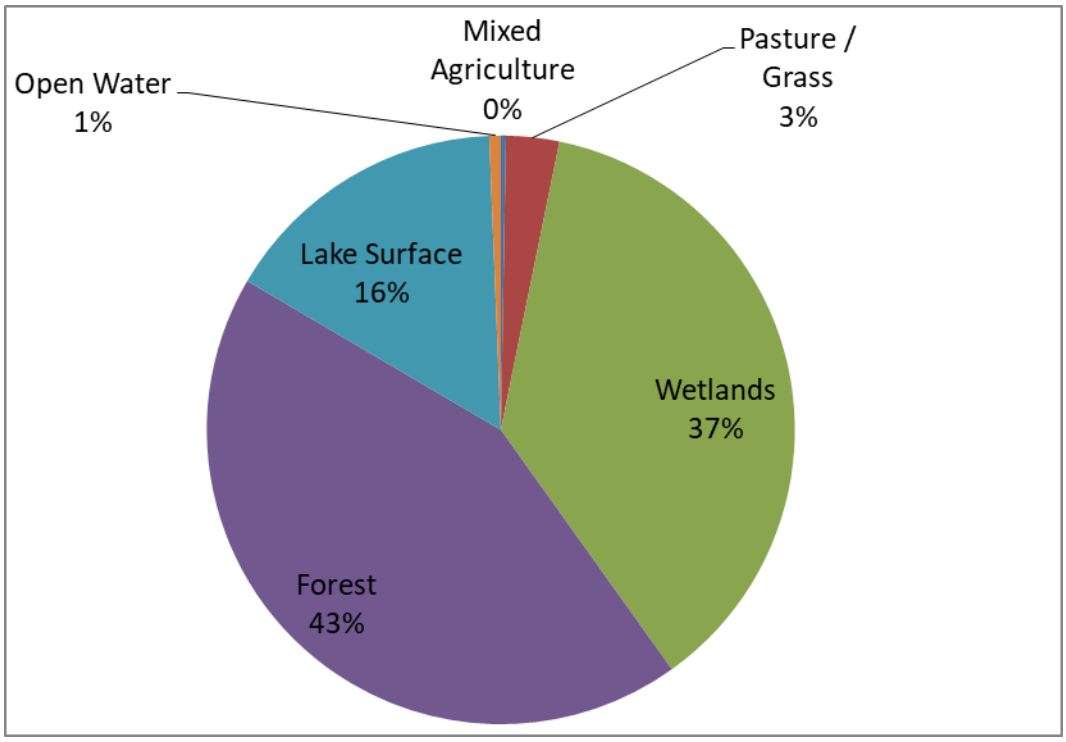
In order to complete WiLMS modeling, land use within the watershed first had to be calculated. Land use was calculated using data from the National Land Cover Database – 2011 (NLCD). Aerial and satellite imagery was used to assess and assign land cover to areas within the watershed across 14 types. WiLMS modeling, however, uses simplified land cover with less cover types, eight in this instance. To best fit the NLCD data for the WiLMS model, some cover types were combined into areas of best fit – i.e. Mixed, deciduous, and evergreen forests under NLCD were all combined to Forest for WiLMS. Land cover breakdown for WiLMS and associated NLCD cover types are as follows:

Table 7: Land cover within Halsey Lake Watershed.

WiLMS**	NLCD - 2011*	Acres
Mixed Agriculture	Cultivated Crops	9.08
Pasture / Grass	Developed, Open Space	45.85
	Herbaceous	6.00
	Shrub / Scrub	43.23
Wetlands	Woody Wetlands	1070.03
	Emergent Herbaceous Wetlands	130.32
Forest	Mixed Forest	106.39
	Deciduous Forest	1274.32
	Evergreen Forest	28.12
Lake Surface	Halsey Lake	513.00
Open Water	Open Water	20.40
	TOTAL	**3246.74**

* - National Land Cover Database - 2011
** - Wisconsin Lake Modeling Suite

Chart 4: Halsey Lake Watershed Components



A vast majority of Halsey Lake's watershed remains in natural land use patterns, specifically forests and wetlands. These land cover types are well protected against runoff and nutrient loss and contribute very little phosphorus loading to the Lake.

After collecting the above data, LEAP then takes into account the current, collected water quality data of phosphorus, chlorophyll *a*, and secchi depth and statistically compares these values against predicted values to screen for any potential problems.

LEAP was also used to predict the possibility of nuisance algae blooms within the Lake. This occurs when excess nutrients are available for planktonic algae, causing an explosion in growth, or "bloom," and is typically associated with chlorophyll *a* reading of >20.0 ug/L. This excess growth leads to soupy, green colored water with reduced water clarity and recreational value. Based on current conditions of the Lake and its watershed, the chance that these levels meet or exceed the nuisance threshold at any one time annually are extremely low, approximately 2%, and remain very low extrapolated out to multiple years. The prediction matches recorded data taken for chlorophyll *a* as no samples have exceeded the 20 ug/L threshold and only one ever having exceeded 10 ug/L. This indicates the lake is well protected by its largely natural land use watershed.

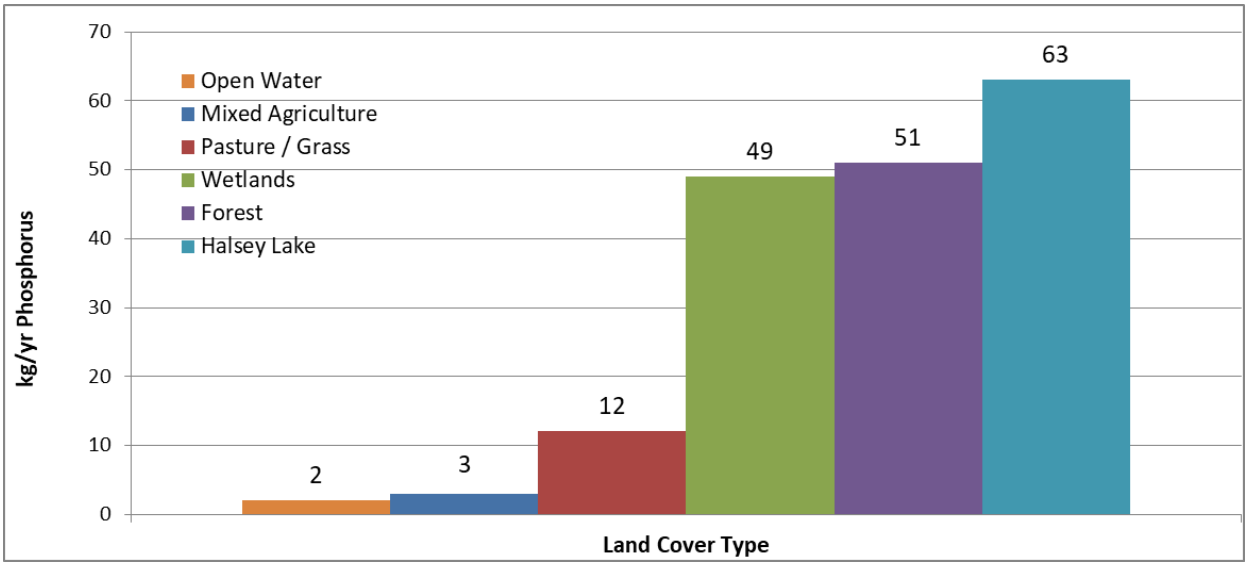
Using WiLMS, a Lake Total Phosphorous Prediction (LTPP) model was used to predict the amount of phosphorus loading into the Lake within its watershed through point and non-point sources. This is important because in many lakes, phosphorus is the limiting nutrient for plant growth. An increase in phosphorus levels will allow for increased plant growth and possibly cause problematic algae blooms if phosphorus loading becomes too high. There are no point sources for phosphorus introduction to Halsey Lake.

The LTPP predicted a total phosphorous amount of 180 kg per year being added to the waterbody through non-point sources. The amount of phosphorous put into the watershed through each land use is different (Table 8 and Chart 5). Though forested land encompasses the largest amount of the watershed, it is only the second highest calculated input of phosphorus annually at approximately 51 kg/year. Phosphorus listed as an "open water" source accounts for natural deposits into the lake, such as from leaves falling off trees, and a small portion of recycling that already in the Lake. This accounts for the most annual phosphorus input at 63 kg of the lake's budget per year based on the model.

Table 8: Phosphorus input by land use type. Halsey Lake, Florence County, WI

		Phosphorus Loading	
Land Use	**Acres**	**kg / year**	**Average kg / acre / year**
Mixed Agriculture	9.08	3	0.33
Pasture / Grass	95.08	12	0.13
Wetlands	1200.35	49	0.04
Forest	1408.83	51	0.04
Halsey Lake	513	63	0.12
Open Water	20.4	2	0.10
OVERALL	**3246.74**	**180**	**0.06**

Chart 5: Watershed Phosphorus Input by Source

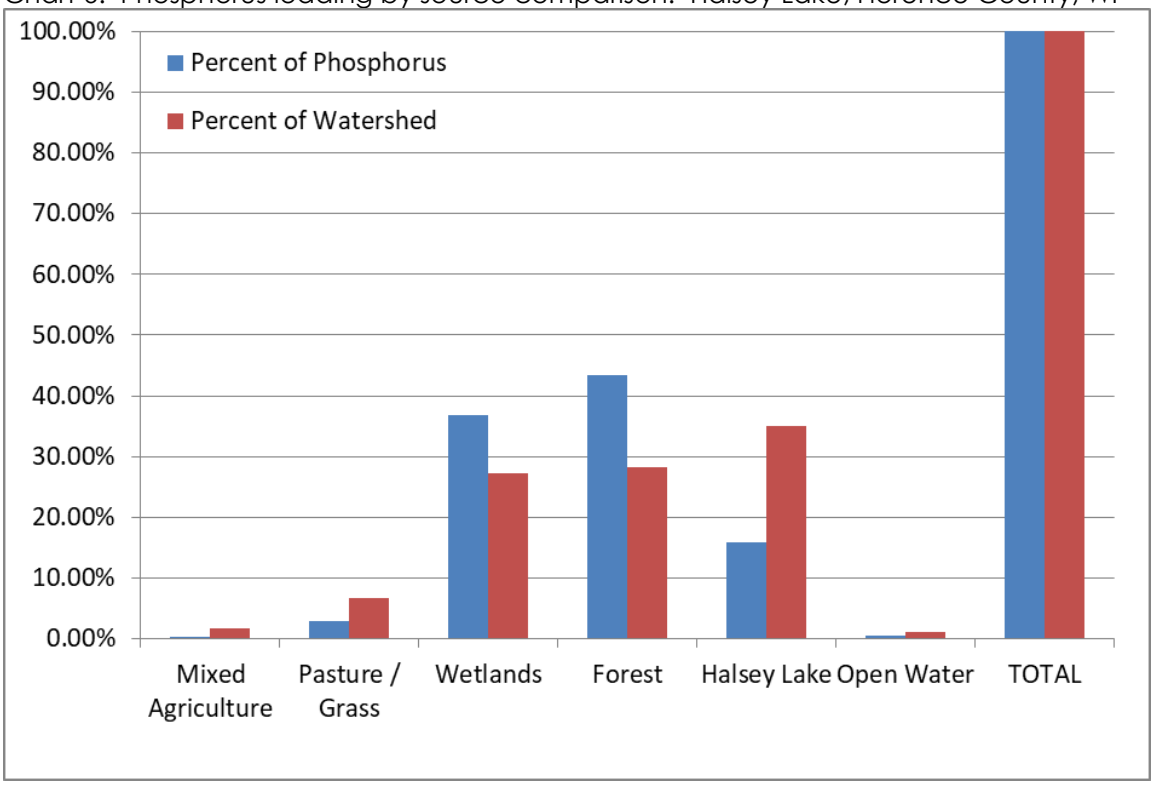


Areas of natural land cover, such as forests and wetlands, have reduced runoff and release lower rates of phosphorus into the lakes compared to developed areas with higher amounts of impervious surfaces, such as roads and buildings. Meaning, though forests may occupy the largest percent of land cover, they do not contribute the largest percent of phosphorus loading into the Lake. Halsey Lake, though only 41.8% of the total watershed, attributes 78.5% of the annual phosphorus load into the lake (Table 9 and Chart 6).

Table 9: Percent phosphorus loading by source. Halsey Lake, Florence County, WI

Land Use	Acres	Percent of Watershed	Percent of Phosphorus Loading
Mixed Agriculture	9.08	0.28%	1.67%
Pasture / Grass	95.08	2.93%	6.67%
Wetlands	1200.35	36.97%	27.22%
Forest	1408.83	43.39%	28.33%
Halsey Lake	513	15.80%	35.00%
Open Water	20.4	0.63%	1.11%
TOTAL	**3246.74**	**100.00%**	**100.00%**

Chart 6: Phosphorus loading by source comparison. Halsey Lake, Florence County, WI



Halsey Lake TSI - Observed vs Model Predicted Values

Parameter	Observed	Predicted
Total Phosphorus (ug/L)	22.98	17
Chlorophyll-a (ug/L)	4.72	4.2
Secchi (m)	2.3	3.3

Currently, water quality is moderately good within the Lake, and nearly in-line when compared to that predicted by the model data. Chlorophyll-a is slightly above predicted values for its ecoregion, but not significantly so. However, the observed total phosphorus and secchi are both more eutrophic than predicted. Measurement of water clarity, or secchi, on Halsey Lake is limited by the shallow depth of the lake and readings often are visible to the bottom. If the lake were deeper, water clarity would be greater. Therefore, the difference between the observed and predicted values is not a concern.

Observed total phosphorus is statistically higher than predicted values. Much of Halsey Lake's watershed is well protected as natural land cover types of forest or wetlands dominate the area. Original land cover was assessed using NLCD and included 11 land cover types. However, WiLMS and LEAP modeling only allow for more generalized land cover types to be input, which reduced it to six types. It is possible that some of the 11 NLCD types may be inputting more phosphorus per acre than their assessed WiLMS types, such as developed open land.

It is, however, more likely that internal loading and recycling of phosphorus attributes a greater amount than what is predicted. The soft sediments of Halsey Lake are rich in nutrients and the lake experiences occasionally dense growth of aquatic vegetation, which decays and is recycled into the lake. Furthermore, the predominantly forested land surrounding the lake attributes additional phosphorus input other than surface water runoff, such as leaf and plant material deposits into the lake, namely during fall.

	Phosphorus in sediment (mg/kg)		
Sample Site	Mobile	Residual	Total
1	65	323	489
2	22	268	290
AVERAGE	43.5	295.5	389.5

Two sediment samples were taken to be analyzed for phosphorus amounts in the lake sediments. Site 1 was collected at the mouth of the Halsey Lake Slough and Site 2 along the north shore, with both in soft, mucky sediments. The samples were tested for amount of mobile and residual phosphorus. Mobile phosphorus is readily available for biological use, such as for plant growth. Residual phosphorus is chemically bound in lake sediments and locked up, unavailable for biological use. Residual phosphorus may be able to be released and biologically available under certain conditions, such as during periods of low dissolved oxygen.

The samples averaged 43.5 mg/kg of phosphorus with the highest reading near the inlet. Sediment recorded during the point-intercept survey showed that 91% of the lake bottom is classified as muck. The predominantly muck sediments attribute towards a large portion of the internal loading, or recycling, of phosphorus and helps drive the in-water readings above model predicted values.

The watershed draining to Halsey Lake continues to be well protected and a beneficial factor, improving water quality within the lake. Actual management recommendations within this plan should remain status quo on a large scale. Much of the land is protected from further development as wetlands and location with State and National forests. Individual landowners immediately adjacent to Halsey Lake should continue to limit disturbance and impervious surface runoff into the Lake. It is recommended residents interested in such projects work with the County Land and Water Conservation Department for assistance.

7.0 WATER LEVEL CONCERNS

Halsey Lake, as a drainage lake dependent on precipitation, has a history of fluctuating water levels. Much of the lake is shallow, less than 2', and reductions of water level even as small as a few inches can expose large areas of sediment and limit navigation by lake users. Residents and lake users alike have shown concern for maintaining water elevation as high as possible to benefit all users. This concern was also the 2nd most common concern among survey respondents and has caused internal issues between residents.

A bathymetric map was created using data recorded during the point-intercept survey to calculate volumetric data. At full pool, Halsey Lake is 513 acres in size with a total volume of 1043 ac-ft and surface water elevation at 1499 ft above sea level (ASML). A reduction of elevation by 1 foot (1498 ft ASML) reduces the surface area of the Lake to 406 acres and volume by 43.5% to 589 ac-ft, exposing 107 acres of lake sediment (Figure 5).

A small stream, Halsey Lake Slough, flows into the lake through a large wetland bog complex before emptying into the lake at a broad, diffuse mouth. Halsey Lake is drained by the Halsey Lake Outlet through a natural pinch point in a low spot between two peninsulas of land. The natural topography makes the outlet an ideal location to control water levels.

A site visit was performed on August 31, 2016 to assess condition of the outlet and gather flow and elevation data. Water level at this time appeared normal. Though inflow from the Halsey Lake Slough was occurring it was over too broad and shallow of an area at to slow of a rate to gather accurate flow data. Water flow out of the Lake was calculated at a cross section in the Outlet and gave a base flow of 3.31 cubic feet per second (Table 10).

Table 10: Cross Section 40-ft downstream from outlet, Halsey Lake.

Station	Width (ft)	Depth (ft)	Velocity (ft/s)	Flow (cfs)
1	2.2	0.2	0	0
2	2.2	0.4	2.1	1.848
3	2.2	0.2	1.9	0.836
4	2.2	0.3	0.8	0.528
5	2.4	0.2	0.2	0.096
TOTAL	11.2		**TOTAL**	3.308

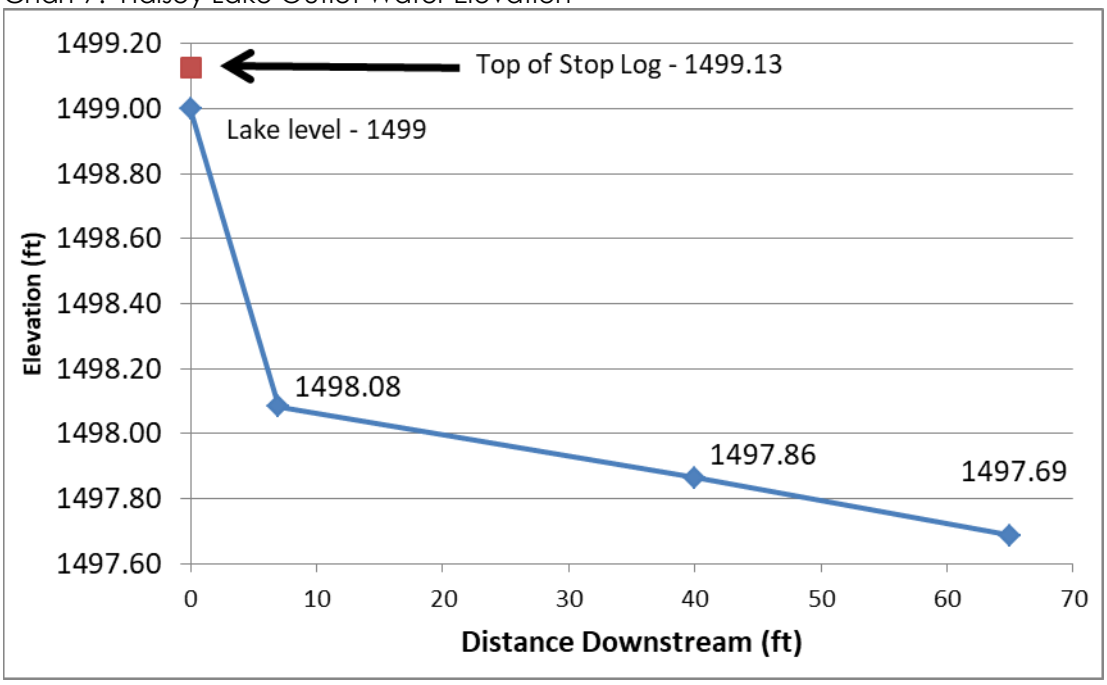
The outlet structure appeared representative of what is normally present. A sawn log approximately 8" square was seen across the stream, anchored by several rebar driven through it, and backed by naturally occurring large rocks and boulders. Water at the time of the site visit was not flowing over the log but rather under and around it. Elevation data collected shows the top of the log was 1.5" above static lake surface and impounded up to 6" water. After leaving the lake, water elevation decreased by 1' 3.75" at 65-ft downstream, most (11") being lost in the first 7 ft downstream (Table 11) and Chart 7).

Table 11: Halsey Lake Outlet Water Elevation.

Station	Field Height (ft)	Adjusted Elevation (ft)*	Change from Lake Level (ft)
Lake Level	1.9375	1499.00	---
Top of Dam	1.8125	1499.13	0.13
7-ft downstream from dam	2.8542	1498.08	-0.92
40-ft downstream from dam	3.0729	1497.86	-1.14
65-ft downstream from dam	3.2500	1497.69	-1.31

*Lake elevation from WDNR Topography Data

Chart 7: Halsey Lake Outlet Water Elevation



Water level elevation of Halsey Lake has been a contentious issue between the property owner where the outlet is located and individuals who desire maintaining a higher elevation. During periods of low water, extra rocks, logs, and material have been illegally placed by individuals trying to increase water elevation. This has resulted in erosion damage to the private property where the outlet is located and fines levied against those placing debris or fill. The actions of individuals to raise water levels, though completed by people who may have been an HLA member, were not completed at the direction or discretion of the HLA.

To facilitate water level discussion and clarify the issue with the outlet, the HLA requested a meeting was held on February 6, 2017 between the WDNR, property owner, and WLPR (on behalf of the HLA). Present at the meeting were:

- Miles Winkler – WDNR, northeast region water regulations and zoning engineer
- William Sturtevant – WDNR, State dam safety engineer
- Dan Dickinson – property owner
- Diane Skewes – property owner, sister of Dan
- Mark Kordus & James Scharl – Wisconsin Lake & Pond Resource, LLC.

The current structure in place has been classified as an unauthorized structure and, in order to remain, would require ownership and regulation as a dam. WDNR representatives explained regulatory requirement of owning a dam. After discussion of history, contentions with the HLA, and concerns over ownership, responsibility, and liability, Dan stated he did not wish to own a dam. Upon this conclusion the DNR would issue an order to remove the log that is classified as the illegal structure.

As of the August, 2017 HLA meeting the log was still in place. Changes in the Lake's elevation upon removal are not known at this time. During the 2016 site visit, water was flowing under and around the log, with actual amount held back by the log indeterminate. Boulders and rocks already naturally in place may continue to retain water at current elevations.

8.0 IN-LAKE RESTORATION OPTIONS

Halsey Lake is in a largely natural condition without the presence of AIS. Management recommendations should be focused on protecting this condition with targeted improvement, where necessary. Consider using one or more of these techniques only after consulting a WDNR water management specialist for permitting and other requirements. Some may not be feasible due to a wide variety of reasons but all are none the less presented below.

This provides an overview of some common in-lake treatment techniques. Please refer to the third edition of *Restoration and Management of Lakes and Reservoirs*; by G. Dennis Cooke, Eugene B. Welch, Spencer A. Peterson and Stanley A. Nichols, 2005, for a comprehensive and scientific discussion of these and other lake management methods.

8.1 OVER WINTER AERATION

Artificial circulation provides increased aeration and oxygen to a lake by circulating the water to expose more of it to the atmosphere. Aeration systems are generally used in shallow water bodies. A number of artificial circulation systems can provide aeration including surface spray (fountains), paddlewheels and air diffusers. Artificial circulation disrupts or prevents stratification and increases aerobic habitat, but this can also disturb sediments which can cause problems for fish and other macro invertebrates. Aeration can also be used in conjunction with additional microbial metabolism to aid more in aerobic "digestion". Internal loading of phosphorous may also decline if sediments remain oxygenated. When lake sediments lack oxygen, conditions exist to release phosphorus into the water.

Halsey Lake has experience winter fish kills due to low oxygen levels in the past. WDNR fisheries staff fully support installation of an aeration stem in Halsey Lake. Without one in place management of the fisher will be extremely hard for species beyond yellow perch and northern pike. Protection of the Lake's fishery was the highest concern among lake users and an aeration system will alleviate concerns of over winter low oxygen impact. Much of Halsey Lake is extremely shallow (less than 2 feet) and freezes nearly to the bottom with one deeper hole where the fish population overwinters.

The deepest area of Halsey Lake is located immediately adjacent to the southern shore, making this the ideal location for aeration as it is also centrally located and near electricity. To be effective, the system must be appropriately sized to maintain dissolved oxygen levels in the affected area. The target area is approximately the 3 foot contour of the bathymetric map and encompasses 63 acres, average depth of 5 ft, and a volume of 315 ac-ft along the southern shore (Figure 6).

Sizing and placement of the system as follows is based on Diffused-Air Aeration System Guidelines (Skip Sommerfeldt, WDNR, updated 2001).

1. **Air requirement**: 0.5 CFM (cubic feet per minute per acre of water – 31.5 CFM
2. **Maintain at least 1.5% of the target 63 acre area as open water**: 1.0 acre
3. **Pressure requirement**: need sufficient air pressure to overcome water pressure and friction loss through the pipes.
    a. 33 feet of water = 1 atmosphere of pressure = 14.7 psi
    b. Diffusers will be placed in water depth of 9'
    c. Anticipated loss of 2 psi from friction.
    d. Calculated requirement of 6 psi

The main goal of an aeration system is to keep an area of open water throughout winter. To achieve this there are multiple options in the type of air delivery, blower or compressor, and air diffusion under water, perforated pipe or micro-pore membrane diffuser. In general blower systems work best with longer pipe runs and multiple diffusers, but shallower water depths. Compressor systems allow for aeration to deeper water, but on shorter pipe runs and overall smaller areas. Perforated pipe allows runs at lower pressures and delivers larger overall air bubble sizes while micro-pore membrane diffusers can operate at a wider range of pressures and delivers much smaller bubble size. Smaller bubble sizes allow for better contact and oxygenation with the water. Because of the relatively shallow water, short pipe runs, and need to maintain oxygenation a blower system utilizing micro-pore membrane diffusers is recommended.

8.2 POTENTIAL SEDIMENTATION ISSUES

Increased sedimentation, leading to decreased water depth and impacting navigation throughout the lake was noted as a main concern by questionnaire respondents. During the 2015 and 2016 site visits, no direct areas of increased sediment input were noted. Halsey Lake is a very shallow lake with fluctuating water levels. Periods of lower precipitation and overall water depth may give the appearance that sediment levels in the lakes have increased due to the large shallow flats that may become exposed.

The Halsey Lake watershed is well protected, with a majority being in natural forest and wetland conditions. This limits the amount of runoff and sedimentation into the lake by slowing runoff and allowing particulates to drop out naturally before entering the lake. The concern over sedimentation is likely due to perceived increase in lake sediments during periods of low water level. Though dredging can increase lake depth it is an extremely expensive and intensive action and potentially harmful to Halsey Lake's ecosystem. At this time no action on removing sediment is recommended or warranted due to the potential harm to Halsey Lake and lack of evidence to support and increase in incoming sediments.

8.3 WATER LEVEL CONTROL

Halsey Lake is a shallow drainage lake reliant on annual precipitation to maintain water levels. A natural pinch point at the Halsey Lake Outlet acts as naturally occurring dam. This also creates an ideal location to install structures or place material to increase water levels. Illegal placement of materials has occurred in the past, damaging the property adjacent to the outlet and creating friction between the adjacent property owners, individuals placing the material, and the HLA. Additionally, a pre-existing log structure in place is classified by the DNR as an unauthorized structure.

Though the public questionnaire results indicate a desire for a water level control structure the land owner does not want to own a dam and removal of the unauthorized structure has been required. Concern of water levels on Halsey Lake was a major point indicated in the user survey. During periods of low precipitation all users are affected. Removal of the unauthorized structure may have little to no effect on the overall water level of Halsey Lake as a natural stone and boulder barrier exists behind it. The lake will continue to fluctuate in water levels depending on annual precipitation. However, Halsey Lake will not disappear entirely and all users, HLA members, and the property owner adjacent to the outlet benefit from the Lake. If a water control structure is proposed or a change to leave the current one in place a permit application is required. The application should include appropriate supporting information including engineering design, flowage easements, and additional documentation as required. Once complete, the permit should be submitted to the DNR jointly by the property owner and HLA.

The desire for higher water levels is largely a social issue and can be detrimental to the lake health. With or without the structure, Halsey Lake may experience fluctuation in water elevation. These are natural in occurrence and not unique to Halsey Lake alone and the lake will not disappear, even in periods of low water. It is often for social reasons that users desire opportunities that are not feasibly supported on lakes like Halsey Lake. Though there has been contention in the past between the Halsey Lake Association and Dan Dickinson, it must be noted that both parties have common ground in protecting Halsey Lake. The water levels as noted in 2016 were agreeable to both parties. No active action for water level control is recommended.

8.4 AQUATIC PLANT MAINTENANCE ALTERNATIVES

Based on the goals of the stakeholders outlined above, several management alternatives focusing on maintenance of the current aquatic plant community and prevention of AIS are available for this CLM plan. Some general alternatives are discussed below. More information on management alternatives are included in Appendix E. The following management alternatives are based on historical aquatic plant management approaches and incorporate needs established by the questionnaire and recommendations of Wisconsin Lake & Pond Resource.

A combination of management alternatives may be used on a lake with a healthy native aquatic plant community wth invasive or non-native plant species present. Maintenance alternatives tend to be more protection-oriented because no significant plant problems exist or the issues are at levels that are generally acceptable to lake user groups with no active manipulation is required. These alternatives can include an educational plan to inform lake shore owners of the value of a natural shoreline and encourage the protection of the lake water quality and the native aquatic plant community.

AQUATIC INVASIVE SPECIES MONITORING

No AIS were identified within the Project Area during the 2015 full point-intercept survey. In order to monitor existing populations of aquatic vegetation and for newly introduced AIS in the future, a consistent and systematic Halsey Lake monitoring program that conducts surveys for AIS is highly recommended. In some lake systems, native aquatic plants "hold their own" and AIS never grow to nuisance levels; however, in others active management is required. The spread of AIS can be caused by several factors, including water quality.

It is recommended to complete annual monitoring for AIS within Halsey Lake in cooperation with Wild Rivers Invasive Specie Coalition efforts. Surveys can be completed in many varieties and informally throughout the year. At minimum the entire near-shore of the lake should be assessed through a visual drive survey. Periodic samples of vegetation too deep or immediately unable to identify are recommended. Aquatic plant communities may undergo changes for a variety of reasons, including varying water levels, water clarity, nutrient levels and aquatic plant management actions. In general, lake-wide aquatic plant surveys, such as that completed in 2015, are recommended every year to monitor changes in the overall aquatic plant community during large-scale treatments and then again every 5 years, once small scale maintenance treatments take place, to monitor the effects of the aquatic plant management activities.

CLEAN BOATS/CLEAN WATERS CAMPAIGN

Prevention of the introduction of new AIS to the Lake and spread of existing AIS from the Lake should be a priority. To prevent the spread of AIS into Halsey Lake from nearby lakes, a monitoring program such as Clean Boats/Clean Waters (CB/CW) is a good choice. This program is carried out by trained volunteers who inspect incoming and outgoing boats at launches. Boat landing signage also accompanies the use of CB/CW to inform lake users of proper identification of AIS and boat inspection procedures. Education of Association members about inspecting watercraft for AIS before launching a boat or leaving access sites on other lakes could help prevent new AIS infestations.

CB/CW use on Halsey Lake has not been completed and participation in this program is strongly encouraged. Currently Wild Rivers Invasive Species Coalition currently operates a CB/CW for Florence County with assistance from various volunteers of monitored lakes. Joint participation of this program is recommended and should be promoted within the HLA.

AQUATIC PLANT PROTECTION AND SHORELINE MANAGEMENT

Protection of the native aquatic plant community is needed to slow the spread of AIS from lake to lake and within a lake once established. Therefore, riparian landowners should refrain from removing native vegetation. Due to the very flocculant sediment in Halsey Lake aquatic plants may be easily uprooted by wake action from boating activities or wind. A slow-no-wake speed on Halsey Lake may provide additional protection to the plant community. Enactment of this ruling would need to first be accepted by lake users and initiated at the local governmental level. Additionally, EWM and CLP can thrive in nutrient (phosphorus and nitrogen) enriched waters or where nutrient rich sediments occur. Two relatively simple actions can prevent excessive nutrients and sediments from reaching the lake.

The first activity is the restoration of natural shorelines, which act as a buffer for runoff containing nutrients and sediments. Good candidates for shoreland restorations include areas that are mowed to the lake's edge, or that have structures directly adjacent to the lake edge. Establishing natural shoreline vegetation can sometimes be as easy as not mowing to the water's edge. Native plants can also be purchased from nurseries for restoration efforts. Shoreline restoration has the added benefits of providing wildlife habitat and erosion prevention. Or many times, a simple "no mow" buffer strip 35'–50' back from the water's edge can provide effective and

economical restoration for shoreland property owners. A vegetated buffer area can also prevent surface water runoff from roads, parking areas and lawns from carrying nutrients to the lake. Currently, much of the Lake's shoreline is undeveloped, providing excellent protection for impacts from runoff.

The second easy nutrient prevention effort is to use lawn fertilizers only when a soil test shows a lack of nutrients. Importantly, fertilizers containing phosphorus, though readily available to the consumer, are illegal for use in Wisconsin, unless a soil test shows a deficiency in phosphorus. The fertilizers commonly used for lawns and gardens have three major plant macronutrients: Nitrogen, Phosphorus and Potassium. These are summarized on the fertilizer package by three numbers. The middle number represents the amount of phosphorus. Since most Wisconsin lakes are "Phosphorus limited", meaning additions of phosphorus can cause increased aquatic plant or algae growth, preventing phosphorus from reaching the Lake is a good practice. Local retailers and lawn care companies can provide soil test kits to determine a lawn's nutrient needs. Of course, properties with an intact natural buffer require very little maintenance, and no fertilizers.

Another possible source of nutrients to a lake is the septic systems surrounding it. Septic systems should be properly installed and maintained in order to prevent nutrient laden wastewater from reaching the lake. A professional inspector can assess septic systems to determine if they are adding undue nutrients to the Lake. Many times the age and type of septic system is a likely indication as to the current functionality of the system and would not require an on-site visit, which at times can be controversial. The local County Zoning Department or Health Department can many times assist in this regard.

The Florence County Land and Water Conservation Department may be able to offer assistance with shoreland restoration projects, rain gardens and soil testing to determine nutrients needs for lawns and gardens. Interested landowners can contact the Land Conservation Department at (715) 528-3430 to request additional information.

An additional option is the DNR Healthy Lakes grant program. This program provides initiative for lakeshore owners to improve their shoreline through simple and inexpensive best management practices. Deadline for application is February 1st with funding of up to $25,000 per group or $1,000 per individual on a 75% DNR / 25% applicant cost sharing. Further information can be obtained at: http:// http://healthylakeswi.com

PUBLIC EDUCATION AND INVOLVEMENT

The HLA should continue to keep abreast of current AIS issues throughout the County and State. The County Land Conservation Department, WDNR Lakes Coordinator and the UW Extension are good sources of information. Many important materials can be ordered at the following website: http://www.uwsp.edu/cnr/uwexlakes/publications/

If the above hyperlink to web address becomes inactive, please contact WDNR for appropriate program and contact information.

MANUAL (HAND) REMOVAL

Native plants may be found at nuisance levels in scattered locales throughout the waterway. Manual removal efforts, including hand raking or hand pulling unwanted native plants (except wild rice in the northern region), is allowed under Wisconsin law, to a maximum width of 30 feet (recreational zone) per riparian property. The intent is to provide pier, boatlift or swimming raft access in the recreation zone. A permit is not required for hand pulling or raking if the maximum width cleared does not exceed this 30-foot recreation zone (manual removal of any native aquatic vegetation beyond the 30-foot area would require a permit from the WDNR that satisfies the requirements of Chapter NR 109, Wisconsin Administrative Code, see Appendix E). However,

manual removal is not recommended because it could open a niche for non-native invasive aquatic plants to occupy. Removal of native plants also destroys habitat for fish and wildlife.

MECHANICAL HARVESTING / NUISANCE AQUATIC PLANT GROWTH

Aquatic plants may be mechanically harvested up to six feet below the water surface and can be a practical and efficient means of controlling plant growth as it generally removes the plant biomass from the lake. It can also be effective in control AIS such as curly-leaf pondweed if the plants are cut prior to the start of turion production. Harvesting can be an effective measure to control large-scale nuisance growth of aquatic plants.

The advantages of harvesting are that the harvester typically leaves enough plant material in the lake to provide shelter for fish and to stabilize the lake bottom. Navigation lanes cut by harvesting also allow predator fish, such as bass or pike, better ambush opportunities. Many times, prey like minnows or panfish, are able to hide in thick vegetation lacking predation and potentially causing stunting to the population due to too many prey individuals and not being thinned out by predators. The disadvantages of the harvesting is that it does cause fragmentation and may facilitate the spread of some plants, including EWM, and may disturb sediment in shallow water increasing water turbidity and suspended sediment issues. Another disadvantage is harvesters are limited in depths to which they can effectively operate; typically, it must be greater than 2' – 3' of water. Aquatic plant harvesting is subject to State permitting requirements which are renewable every 5 years.

As stated above, mechanical harvesting requires significant investment in equipment. No harvesting is currently ongoing for Halsey Lake and at this time is not recommended. Its use would be detrimental to the native condition present on Halsey Lake and be cost prohibitive for HLA.

9.0 INVASIVE PLANT MANAGEMENT ALTERNATIVES

Currently no AIS are present in Halsey Lake. In the event that populations are found or become established in the future, the following actions may be used for control. All actions should be approved with WDNR personnel prior to initiating.

9.1 AQUATIC INVASIVE SPECIES HERBICIDE TREATMENT

An aquatic herbicide treatment may be an appropriate way to treat larger areas of AIS and to conduct restoration of native plants. When using chemicals to control AIS, it is a good idea to reevaluate the lake's plant community and the extent of the AIS conditions before, during and after chemical treatment. The chosen herbicide may impact native plant communities including coontail, common waterweed, naiad species and others, especially during whole-lake applications and/or extended periods of herbicide exposure. The WDNR may require another aquatic plant survey and may require an AIS survey prior to approving a permit for treatment. Surveys should be included for all aquatic plant treatments and is typically a WDNR requirement.

The science regarding what chemicals are most effective, dosages, timing and how they should be applied is constantly evolving and being updated. Current WDNR and Army Corps of Engineer research has shown that herbicide applied to water diffuses off site due to a variety of environmental and physical conditions including wind, waves, water depth, and treatment area relative to lake volume. Due to these actions, as treatment areas decrease, herbicide retention time needed for impact is lessened due to diffusion off site because of the small amount of area treated and herbicide applied relative to the entire water volume. To combat this, it is recommended to apply at higher rates when compared to a whole-lake rate and typically with a granular herbicide with a combination of active ingredients in hopes to extend contact time.

Chemical treatment is usually a long term commitment and requires a specific plan with a goal set for "tolerable" levels of the relevant AIS. One such landmark might be 10% or less of the littoral area being occupied by aquatic invasive plants. WDNR recommends conducting a whole-lake point-intercept survey on a five year basis. Such a survey may reveal new AIS and at the very least would provide good trend data to see how the aquatic plant community is evolving.

Herbicides provide the opportunity for broader control over a larger area than hand pulling, and unlike harvesters, allow for a true restoration effort. Disadvantages include negative public perception of chemicals in natural lakes, the potential to affect non-target plant species (if not applied at an appropriate application rate and/or time of year), and the fact that water use restrictions may be necessary after application.

9.1.1 Curly-leaf Pondweed

Curly-leaf pondweed is the second most prevalent aquatic invasive plant species targeted for chemical treatment in the State. At present, endothall is the most common active ingredient in herbicides used for CLP management in Wisconsin when, although imazamox has been used periodically in the last several years. Imazamox has shown promise in that it is a systemic herbicide for CLP control.

Granular based formulations are generally costlier and more used for smaller spot type treatments, while liquid formulations are less costly and generally used for larger contiguous treatment areas or whole-lake type treatments. In order to decrease any potential impact to native plants and

be as selective as possible for CLP, treatments are completed in the spring when native plant growth is minimal, typically prior to 60˚ water temperatures, but perhaps most importantly prior to the start of turion production. Approximate rates can vary, but endothall applications at >1.5 PPM are most effective for smaller areas. In cases of large, expansive populations lower rates can be used. CLP seems to prefer and flourish in mucky or highly flocculent substrate, which is present throughout most of Halsey Lake. Given the presence of large areas of appropriate substrate CLP may become quickly established if introduced.

9.1.2 Eurasian Water-milfoil

EWM is the most commonly managed AIS within Wisconsin lakes. EWM is an extremely opportunistic plant and could easily become established within Halsey Lake. Should such an event take place, it is prudent to include potential management actions for EWM within this plan to provide a quick and concise reference for management.

At present, 2,4-D is the most common active ingredient for selective systemic herbicides used for EWM management in Wisconsin, although triclopyr use is increasing and has been commonly used in Minnesota for well over a decade. Granular based formulations are typically more costly and used for smaller spot type treatments, while liquid formulations tend to be less costly and used for larger contiguous treatment areas or whole-lake type treatments. In order to maximize effectiveness and decrease any potential impact to native plants to the greatest extent possible, treatments should be completed in the spring when native plant growth is minimal, typically prior to 65˚ water temperatures.

Current WDNR and Army Corps of Engineer research has shown that herbicide applied to water diffuses off site due to a variety of environmental and physical conditions including wind, waves, water depth, and treatment area relative to lake volume. Due to these actions, as treatment areas decrease, herbicide retention time needed for impact is lessened due to diffusion off site because of the small amount of area treated and herbicide applied relative to the entire water volume. To combat this, it is recommended to apply at higher rates when compared to a whole-lake rate and or with a combination of active ingredients in hopes to extend contact time. As EWM abundance lessens within a lake and smaller areas (>2.0 ac) are mapped, it is recommended to use DASH hand management (Section 9.2) or either 2,4-D or a 2,4-D/triclopyr combination herbicide applied between 3.0 – 4.0 parts per million (ppm), depending on water depth and volume of the treatment area. This approach has shown to be an effective management tool in various lakes throughout Wisconsin and is continuing to be researched for efficacy and long-term control.

It is worth noting there are various hybrid strains of EWM being genetically confirmed throughout the State and many of these are showing tolerance to typical systemic herbicides, such as 2,4-D Research projects are currently underway with the WDNR and herbicide manufacturers' testing various combination herbicides (systemic, such as 2,4-D & contact, such as endothall) at 1:2 or 1:3 ratio as well other modes of action like pigment bleaching herbicides (fluridone) in the field and lab that may be more effective on these strains of hybrid EWM, in particular on a whole lake basis maintaining a 2-4 PPB residual for 90+ days.

Fluridone is also available in different pelletized slow release formations that are designed to release off the carrier over extended periods of time; from several weeks to several months. These may be useful in a flowing water situation as the pellets can be placed upstream and the herbicide allowed to be carried downstream by the current as it is released off the pellet.

The size of the infestation tends to dictate the type of the treatment. Small treatment areas or beds less than 5 acres are many times consider spot treatments and usually targeted with granular type herbicides, or fast acting contact liquid herbicides. When there are multiple "spot" treatment areas within a lake, it most often makes more sense from economic and efficacy standpoints to target the "whole" lake for treatment. This typically entails calculating the entire volume of water within the lake, in acre/feet, and applying a liquid herbicide, such as 2,4-D, at a low dose at a lake wide rate of typically between 250 – 350 parts per billion (PPB).

9.2 AQUATIC INVASIVE PLANT HARVESTING

MECHANICAL HARVESTING

Aquatic plants may be mechanically harvested up to six feet below the water surface and can be a practical and efficient means of controlling plant growth as it generally removes the plant biomass from the lake. It can also be effective in controlling AIS such as curly-leaf pondweed if the plants are cut prior to the start of turion production, and continually cut throughout the season to prevent turion production until the plant dies on its own in mid to late summer. Harvesting can be an effective measure to control large-scale nuisance growth of invasive aquatic plants.

Harvesting can also be used as a means to facilitate native aquatic plant growth by "top cutting" AIS growth that has canopied out. This is done by removing a canopy of AIS that shades out native, lower growing species, such as pondweed species. Use of a top cut only in areas of dense AIS growth, can provide additional sunlight for growth, increasing diversity and available fisheries habitat quality. As stated above, mechanical harvesting requires significant investment in equipment. No harvesting is currently ongoing for Halsey Lake and at this time and would be cost prohibitive for HLA.

MANUAL (HAND) REMOVAL

If a small isolated stand of AIS is present, hand pulling may be a viable option. No permit is required to remove non-native invasive aquatic vegetation, as long as the removal is conducted completely by hand with no mechanical assistance of any kind. All aquatic plant material must be removed from the water to minimize dispersion and re-germination of unwanted aquatic plants. Portions of the roots may remain in the sediments, so removal may need to be repeated periodically throughout the growing season.

Manual hand removal can be a very effective control mechanism for small or pioneer infestations of EWM if the entire plant mass and root structure is completely removed. The drawback of this alternative is that pulling aquatic plants includes the challenge of working in the water, especially deep water, threat of letting fragments escape and colonize a new area, and control of any significant sized population is quite labor intensive and very costly.

Diver Assisted Suction Harvesting (DASH) has shown to effectively control or reduce populations of EWM. DASH utilizes divers operating from a central boat, or barge, on a hookah system to swim to the bottom and pull target EWM plants. Pulled EWM plants are then sucked onboard the boat, bagged, and dewatered with collected plants removed from the lake disposed of. In shallow water locations divers may not dive at all and simply operate by wading.

Use of DASH is best completed in clear water and limiting disturbance of bottom sediments to reduce impact to visibility. Since Halsey Lake is largely very flocculent, muck based sediment the plants will pull easily, but visibility may be hampered. Hand harvesting costs using professionally contracted SCUBA divers are around $1,500 - $2,000 per 5,000 square feet, or $10,000 - $20,000 acre depending on plant densities. Many DASH units are mobile and able to operate on different lakes throughout the year. If a population of EWM ever becomes established in Halsey Lake the DASH system is highly recommended as first management option to control the population.

10.0 REFERENCES

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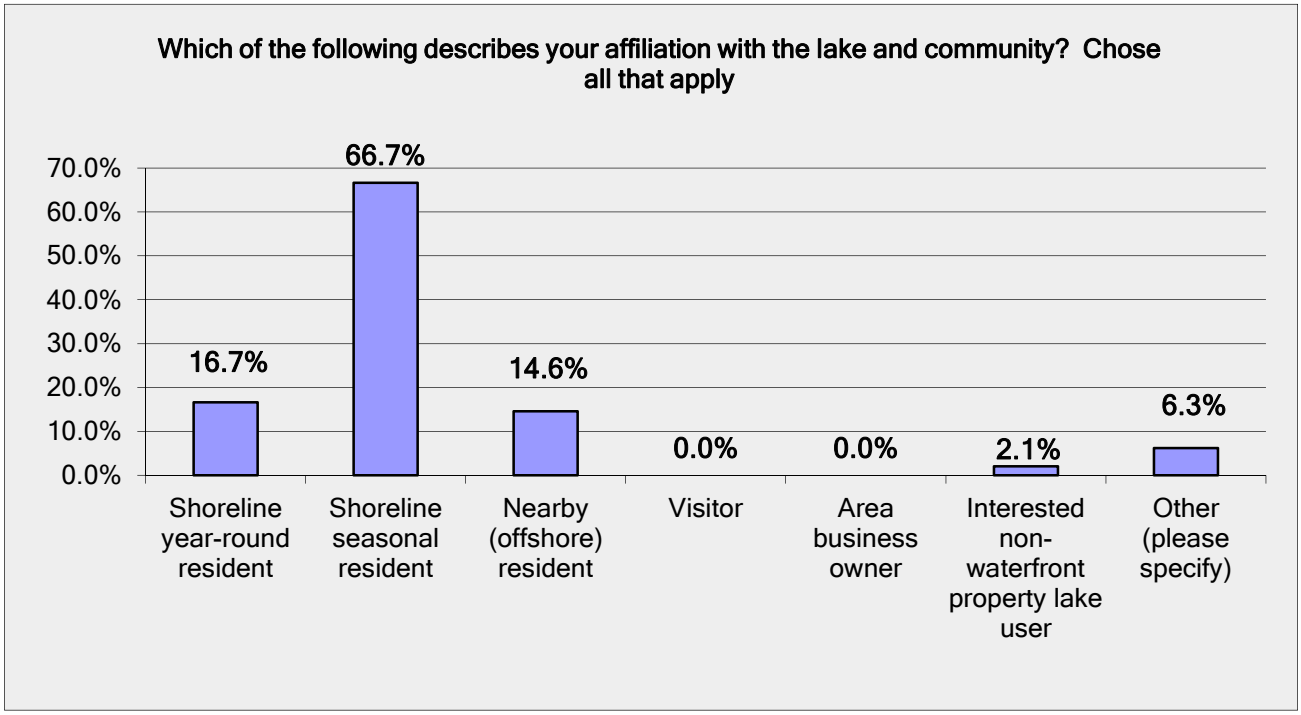
APPENDIX A – PUBLIC SURVEY RESULTS

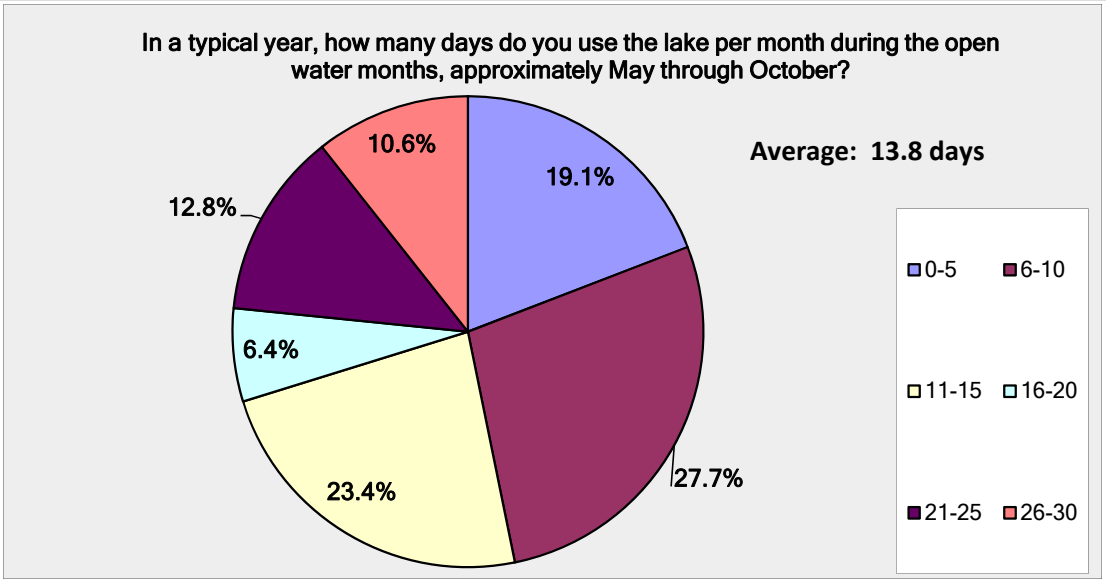
Question 1: Which of the following describes your affiliation with the lake and community? Chose all that apply		
Answer Options	**Response Percent**	**Response Count**
Shoreline year-round resident	16.7%	8
Shoreline seasonal resident	66.7%	32
Nearby (offshore) resident	14.6%	7
Visitor	0.0%	0
Area business owner	0.0%	0
Interested non-waterfront property lake user	2.1%	1
Other (please specify)	6.3%	3
	answered question	48
	skipped question	0

Comments

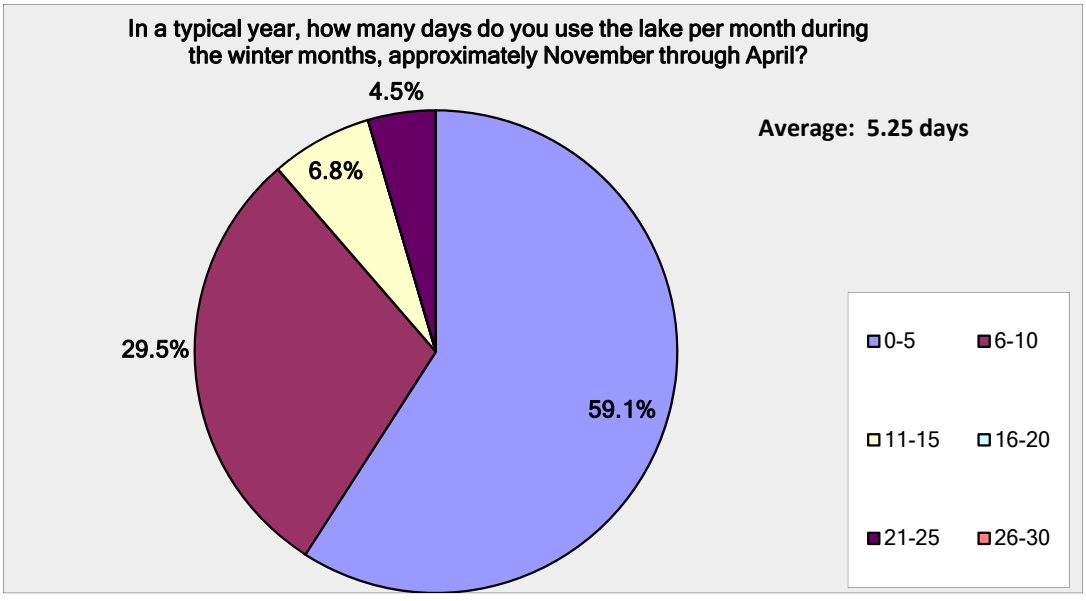
1 Son of owner. Visit several times a year. Property on lake.
2 Out of state property owner
3 Year round cottage on Halsey Lake



Question 2: In a typical year, how many days do you use the lake per month during the open water months, approximately May through October?		
Answer Options	Response Percent	Response Count
0	0.0%	0
1	4.3%	2
2	4.3%	2
3	4.3%	2
4	2.1%	1
5	4.3%	2
6	2.1%	1
7	2.1%	1
8	2.1%	1
9	0.0%	0
10	21.3%	10
11	0.0%	0
12	8.5%	4
13	0.0%	0
14	2.1%	1
15	12.8%	6
16	0.0%	0
17	0.0%	0
18	0.0%	0
19	0.0%	0
20	6.4%	3
21	2.1%	1
22	0.0%	0
23	0.0%	0
24	8.5%	4
25	2.1%	1
26	2.1%	1
27	0.0%	0
28	0.0%	0
29	0.0%	0
30	8.5%	4
answered question		47
skipped question		1

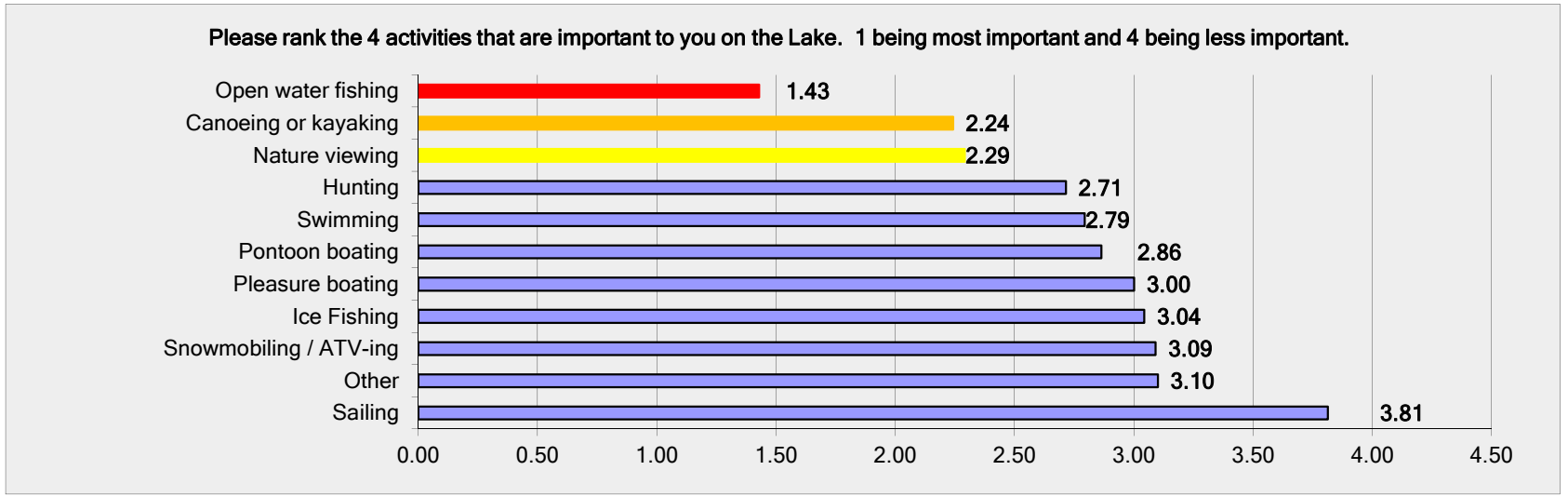


Question 3: In a typical year, how many days do you use the lake per month during the winter months, approximately November through April?		
Answer Options	**Response Percent**	**Response Count**
0	27.3%	12
1	11.4%	5
2	9.1%	4
3	4.5%	2
4	2.3%	1
5	4.5%	2
6	11.4%	5
7	2.3%	1
8	0.0%	0
9	0.0%	0
10	15.9%	7
11	0.0%	0
12	0.0%	0
13	0.0%	0
14	2.3%	1
15	4.5%	2
16	0.0%	0
17	0.0%	0
18	0.0%	0
19	0.0%	0
20	0.0%	0
21	0.0%	0
22	2.3%	1
23	0.0%	0
24	0.0%	0
25	2.3%	1
26	0.0%	0
27	0.0%	0
28	0.0%	0
29	0.0%	0
30	0.0%	0
	answered question	**44**
	skipped question	**4**



Question 4: Please rank the activities that are important to you on the Lake. 1 being most important and 4 being less important.

Answer Options	1	2	3	4	Rating Average	Response Count
Sailing	1	0	0	15	3.81	16
Other	3	0	0	7	3.10	10
Snowmobiling / ATV-ing	5	5	3	11	3.09	22
Ice Fishing	6	3	10	7	3.04	23
Pleasure boating	6	4	7	10	3.00	25
Pontoon boating	6	6	3	9	2.86	22
Swimming	11	6	10	7	2.79	29
Hunting	8	5	5	6	2.71	21
Nature viewing	18	9	5	5	2.29	31
Canoeing or kayaking	12	5	5	7	2.24	29
Open water fishing	30	8	2	2	1.43	42
Other (please specify)						3
					answered question	48
					skipped question	0

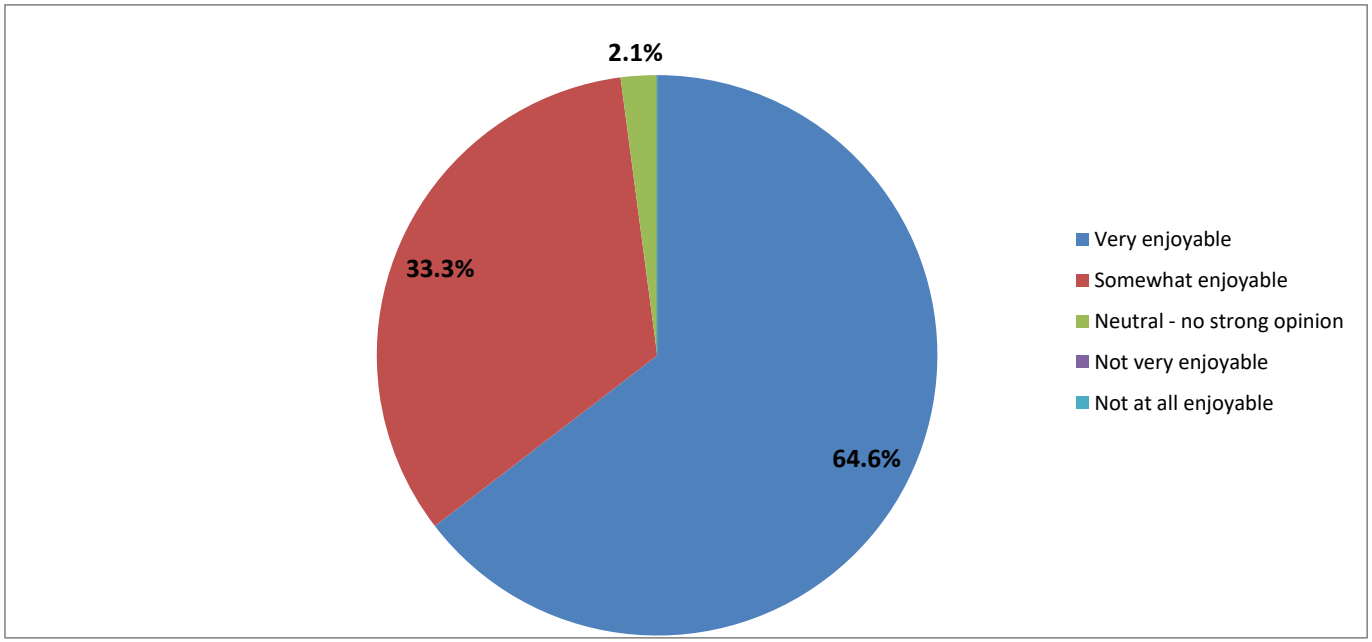


Other (please specify)

1 Skating, sledding, hiking
2 Following the laws and rules of the State by the owners and visitors of the lake and area.
3 Paddle board

Question 5: Overall, how would you rate the enjoyment of your experiences on Halsey Lake?

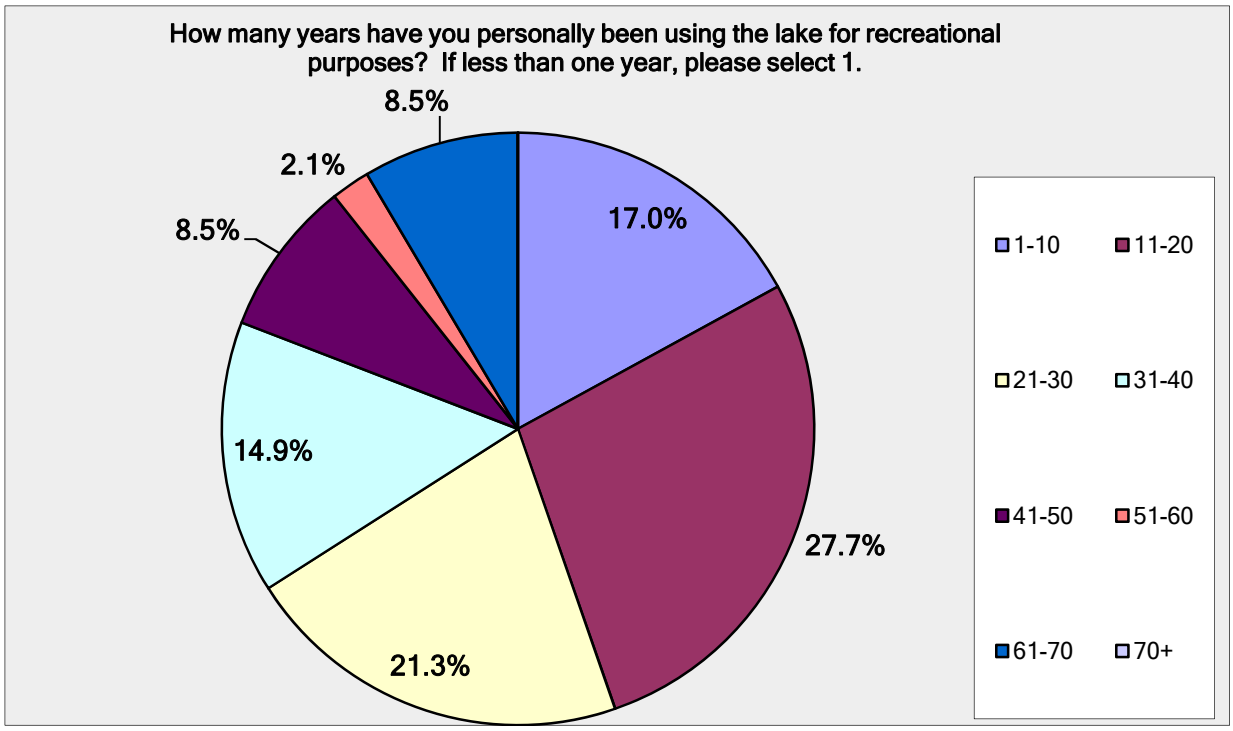
Answer Options	Very enjoyable	Somewhat enjoyable	Neutral - no strong opinion	Not very enjoyable	Not at all enjoyable	Rating Average	Response Count
Select only one	31 64.6%	16 33.3%	1 2.1%	0 0.0%	0 0.0%	1.38	48
						answered question	48
						skipped question	0



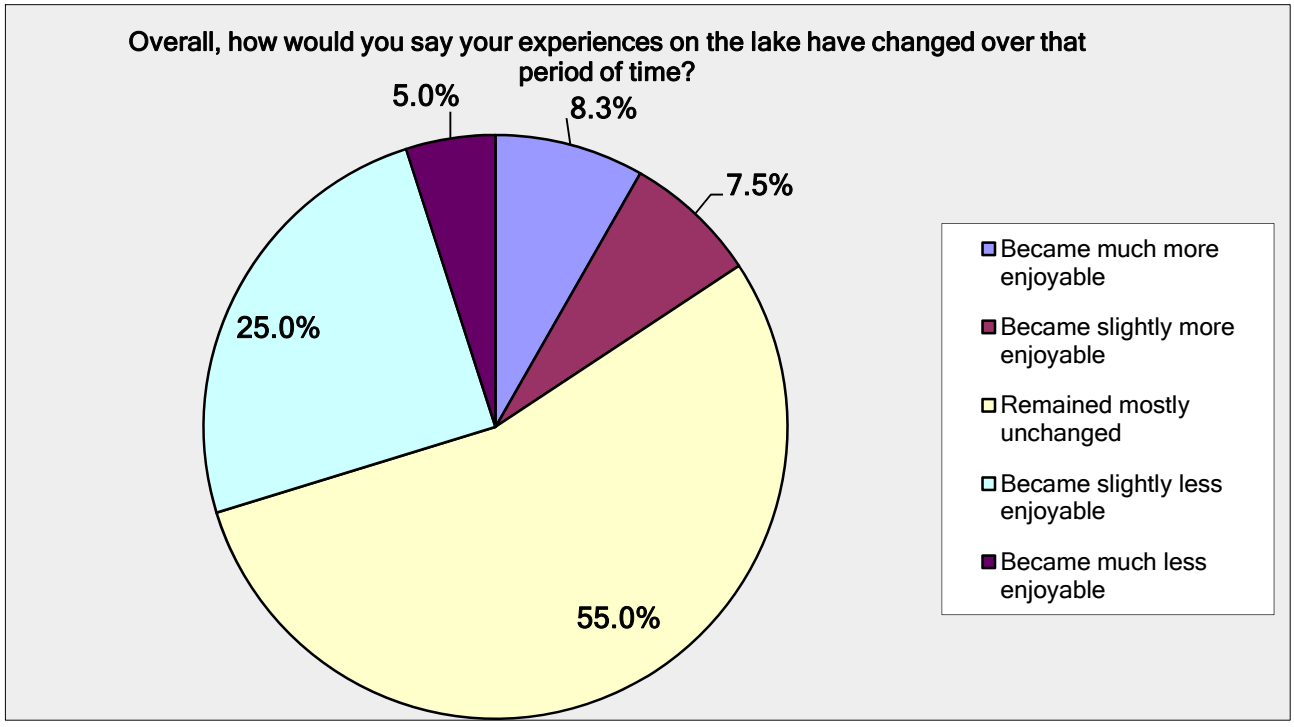
Question 6: How many years have you personally been using the lake for recreational purposes? If less than one year, please select 1.		
Answer Options	Response Percent	Response Count
1	0.0%	0
2	0.0%	0
3	2.1%	1
4	0.0%	0
5	0.0%	0
6	4.3%	2
7	0.0%	0
8	0.0%	0
9	4.3%	2
10	6.4%	3
11	2.1%	1
12	4.3%	2
13	2.1%	1
14	4.3%	2
15	6.4%	3
16	2.1%	1
17	0.0%	0
18	2.1%	1
19	0.0%	0
20	4.3%	2
21	0.0%	0
22	2.1%	1
23	8.5%	4
24	0.0%	0
25	0.0%	0
26	0.0%	0
27	0.0%	0
28	2.1%	1
29	2.1%	1
30	6.4%	3
31	2.1%	1
32	0.0%	0
33	2.1%	1
34	2.1%	1
35	2.1%	1
36	2.1%	1
37	2.1%	1
38	0.0%	0
39	0.0%	0
40	2.1%	1
41	0.0%	0
42	2.1%	1
43	2.1%	1
44	0.0%	0
45	2.1%	1
46	2.1%	1
47	0.0%	0
48	0.0%	0
49	0.0%	0
50	0.0%	0

Question 6: How many years have you personally been using the lake for recreational purposes? If less than one year, please select 1.		
51	0.0%	0
52	0.0%	0
53	0.0%	0
54	0.0%	0
55	0.0%	0
56	0.0%	0
57	2.1%	1
58	0.0%	0
59	0.0%	0
60	0.0%	0
61	0.0%	0
62	6.4%	3
63	2.1%	1
64	0.0%	0
65	0.0%	0
66	0.0%	0
67	0.0%	0
68	0.0%	0
69	0.0%	0
70	0.0%	0
71	0.0%	0
72	0.0%	0
73	0.0%	0
74	0.0%	0
75	0.0%	0
76	0.0%	0
77	0.0%	0
78	0.0%	0
79	0.0%	0
80	0.0%	0
81	0.0%	0
82	0.0%	0
83	0.0%	0
84	0.0%	0
85	0.0%	0
86	0.0%	0
87	0.0%	0
88	0.0%	0
89	0.0%	0
90	0.0%	0
91	0.0%	0
92	0.0%	0
93	0.0%	0
94	0.0%	0
95	0.0%	0
96	0.0%	0
97	0.0%	0
98	0.0%	0
99	0.0%	0
100	0.0%	0
	answered question	47
	skipped question	1

Question 6: How many years have you personally been using the lake for recreational purposes? If less than one year, please select 1.

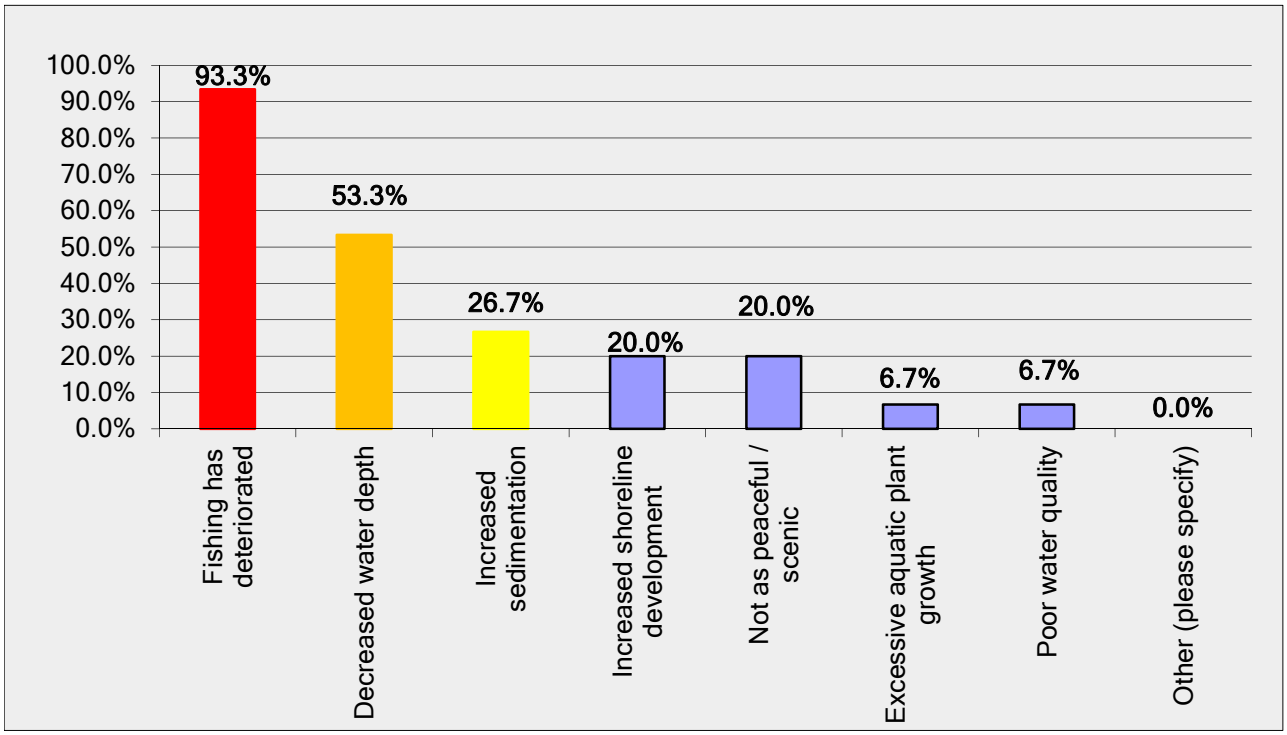


Question 7: Overall, how would you say your experiences on the lake have changed over that period of time?		
Answer Options	**Response Percent**	**Response Count**
Became much more enjoyable	8.3%	4
Became slightly more enjoyable	7.5%	4
Remained mostly unchanged	55.0%	25
Became slightly less enjoyable	25.0%	13
Became much less enjoyable	5.0%	2
	answered question	48
	skipped question	0



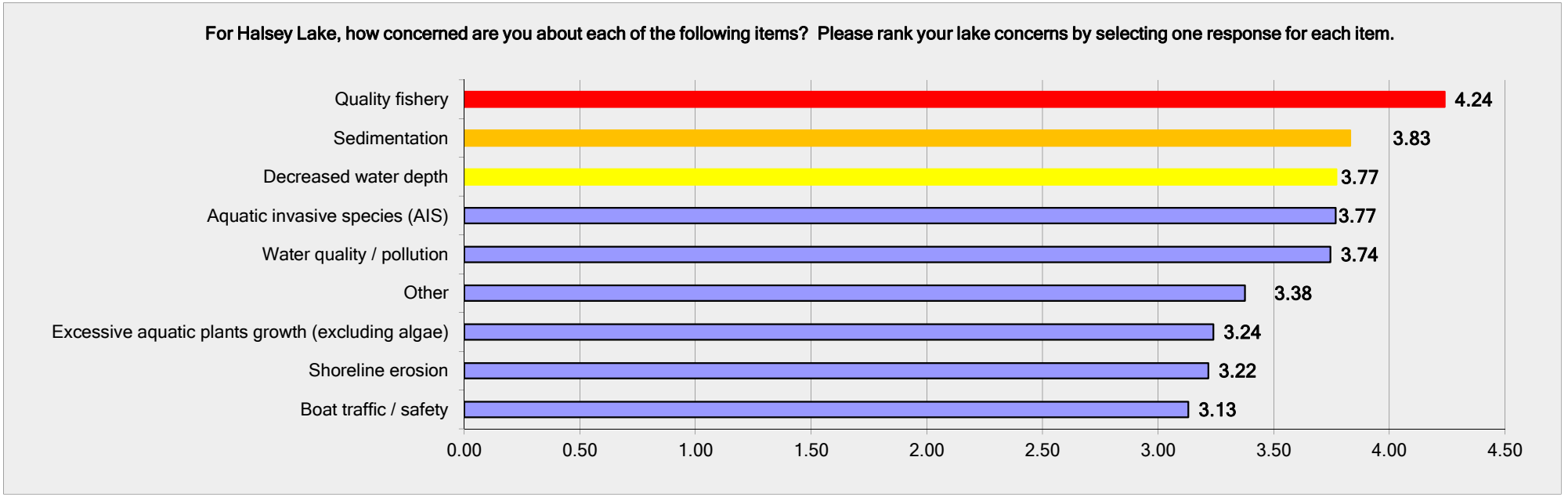
Question 8: If your experience using the lake over time has become less enjoyable what do you consider the two main factors contributing to your less enjoyable experiences on the lake? (Please select up to two from the list below)

Answer Options	Response Percent	Response Count
Fishing has deteriorated	93.3%	14
Decreased water depth	53.3%	8
Increased sedimentation	26.7%	4
Increased shoreline development	20.0%	3
Not as peaceful / scenic	20.0%	3
Excessive aquatic plant growth	6.7%	1
Poor water quality	6.7%	1
Other (please specify)	0.0%	0
	answered question	15
	skipped question	33



Question 9: For Halsey Lake, how concerned are you about each of the following items? Please rank your lake concerns by selecting one response for each item.

Answer Options	Not concerned	Moderately unconcerned	Neutral	Moderately concerned	Very concerned	Unsure - need more information	Rating Average	Response Count
Boat traffic / safety	8	7	11	11	9	1	3.13	39
Shoreline erosion	10	2	14	8	12	1	3.22	39
Excessive aquatic plants growth (excluding algae)	6	4	15	15	6	2	3.24	40
Other	1	1	3	0	3	2	3.38	10
Water quality / pollution	5	2	11	11	18	1	3.74	48
Aquatic invasive species (AIS)	5	1	9	12	16	4	3.77	39
Decreased water depth	8	1	9	6	24	0	3.77	40
Sedimentation	3	4	11	9	20	1	3.83	40
Quality fishery	2	1	6	12	25	2	4.24	40
Other (please specify)								3
							answered question	48
							skipped question	0



Other (please specify)

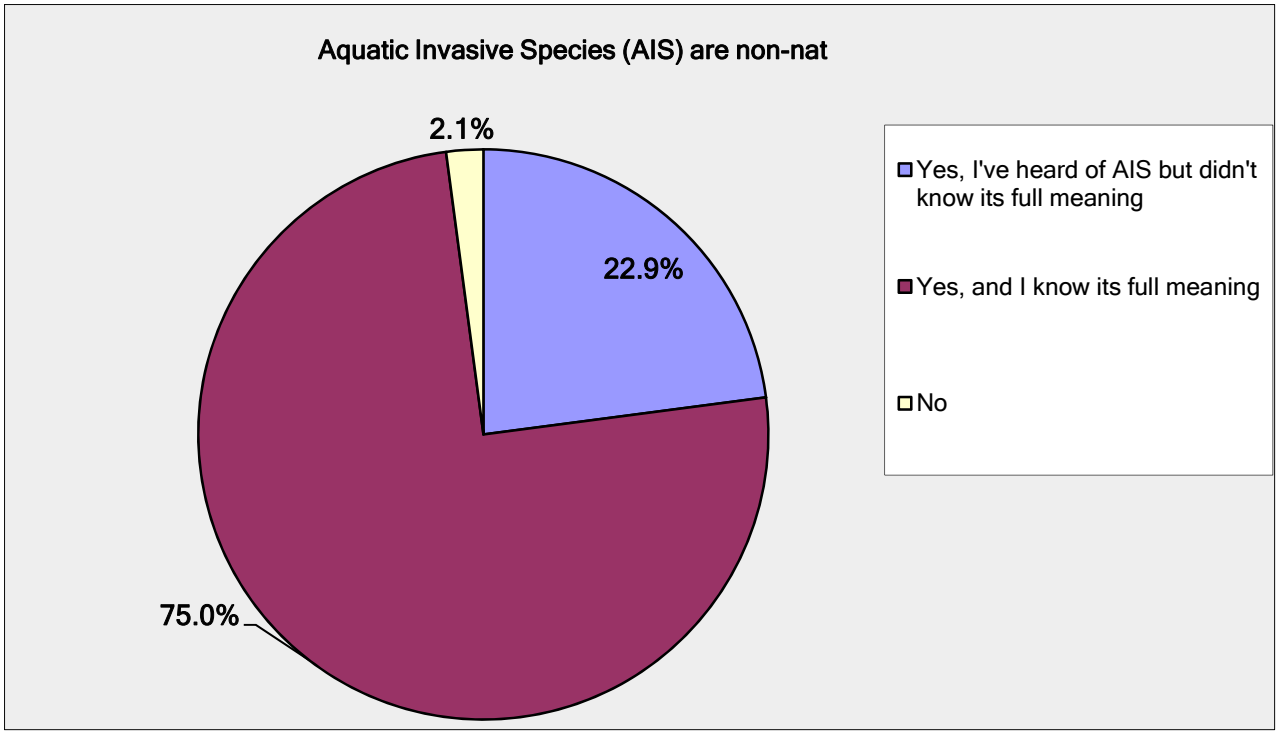
1 Lack of walleye reproduction, over fishing of perch when they finally start showing signs of good size, overall sediment in lake spreading and choking off the lake, lake association funds used to plant fish while the boat landing is wide open at know cost to reap the benifits of the members efforts.

2 "outsiders" exceeding panfish bag limit; people fishing out the perch population

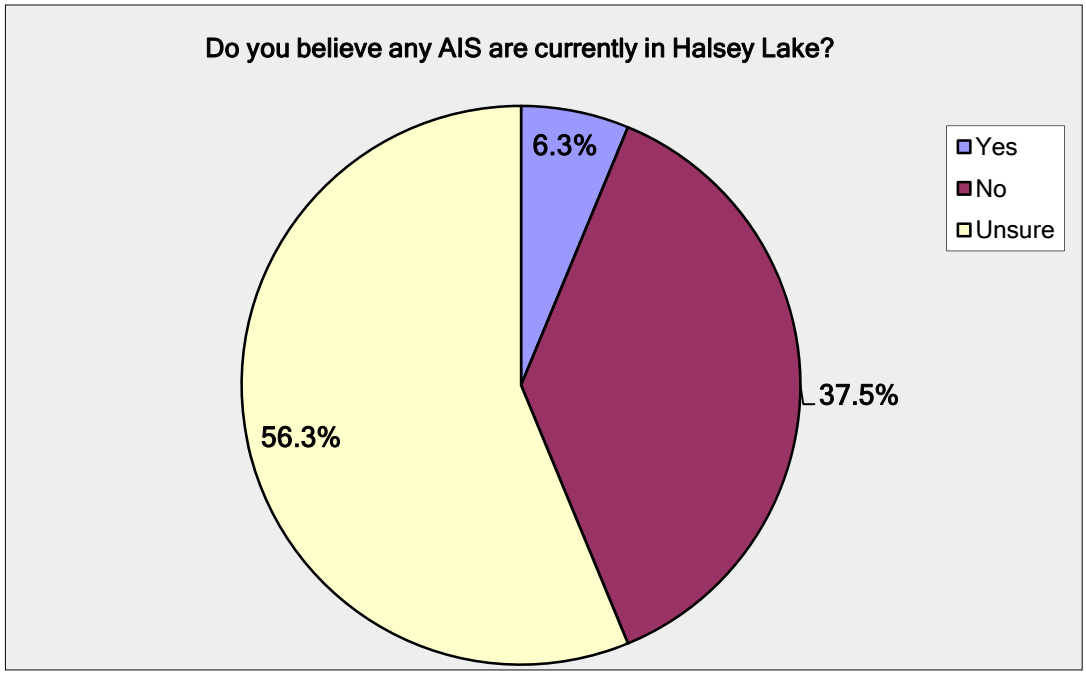
3 The deeper the water the better the water. An owner on the west shore blows the beaver dams, causing the level to drop a foot. How can we prevent that?

Question 10: Aquatic Invasive Species (AIS) are non-native plants or animals that can out-compete their native counterparts and can potentially cause many problems within the lake and/or an ecosystem. Prior to this survey, have you heard the term Aquatic Invasive Species or AIS and did you know what it meant?

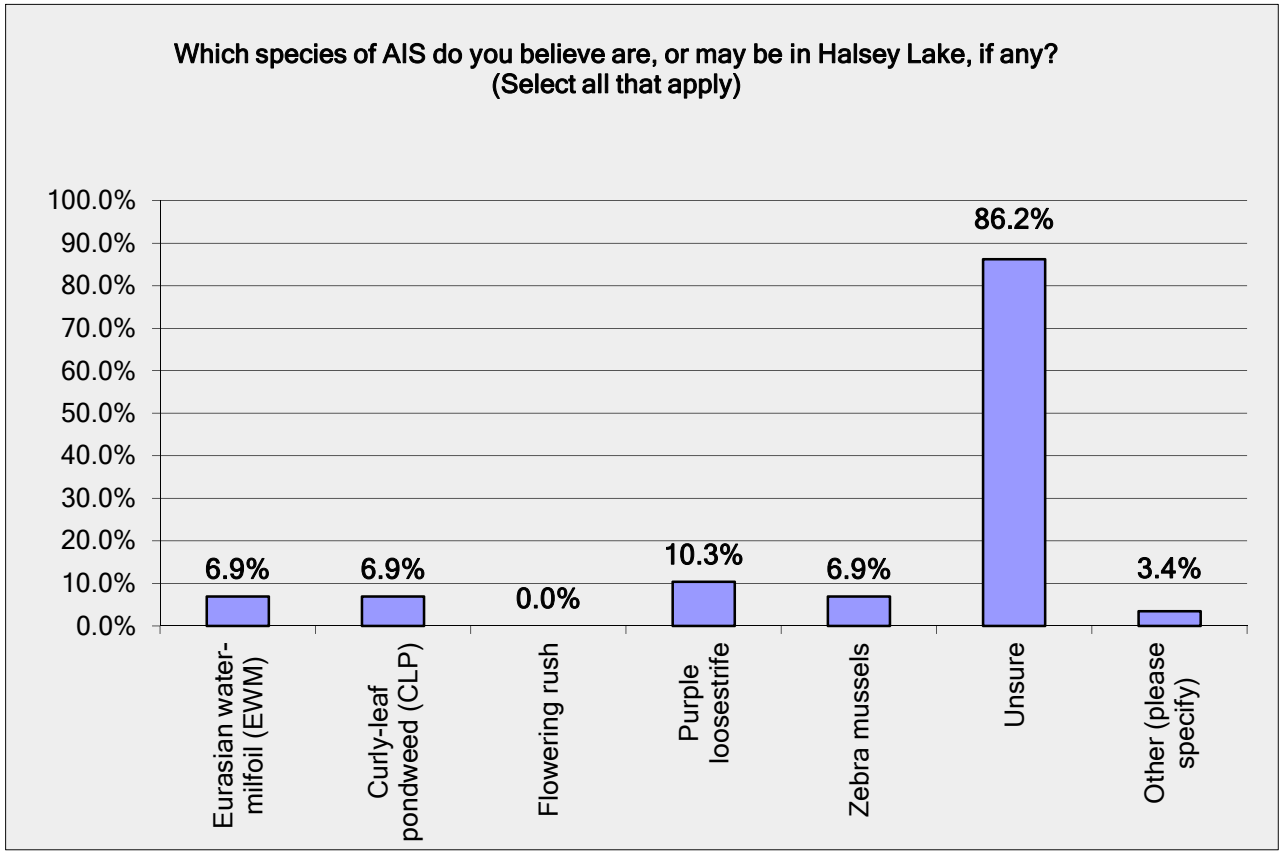
Answer Options	Response Percent	Response Count
Yes, I've heard of AIS but didn't know its full meaning	22.9%	11
Yes, and I know its full meaning	75.0%	36
No	2.1%	1
	answered question	48
	skipped question	0



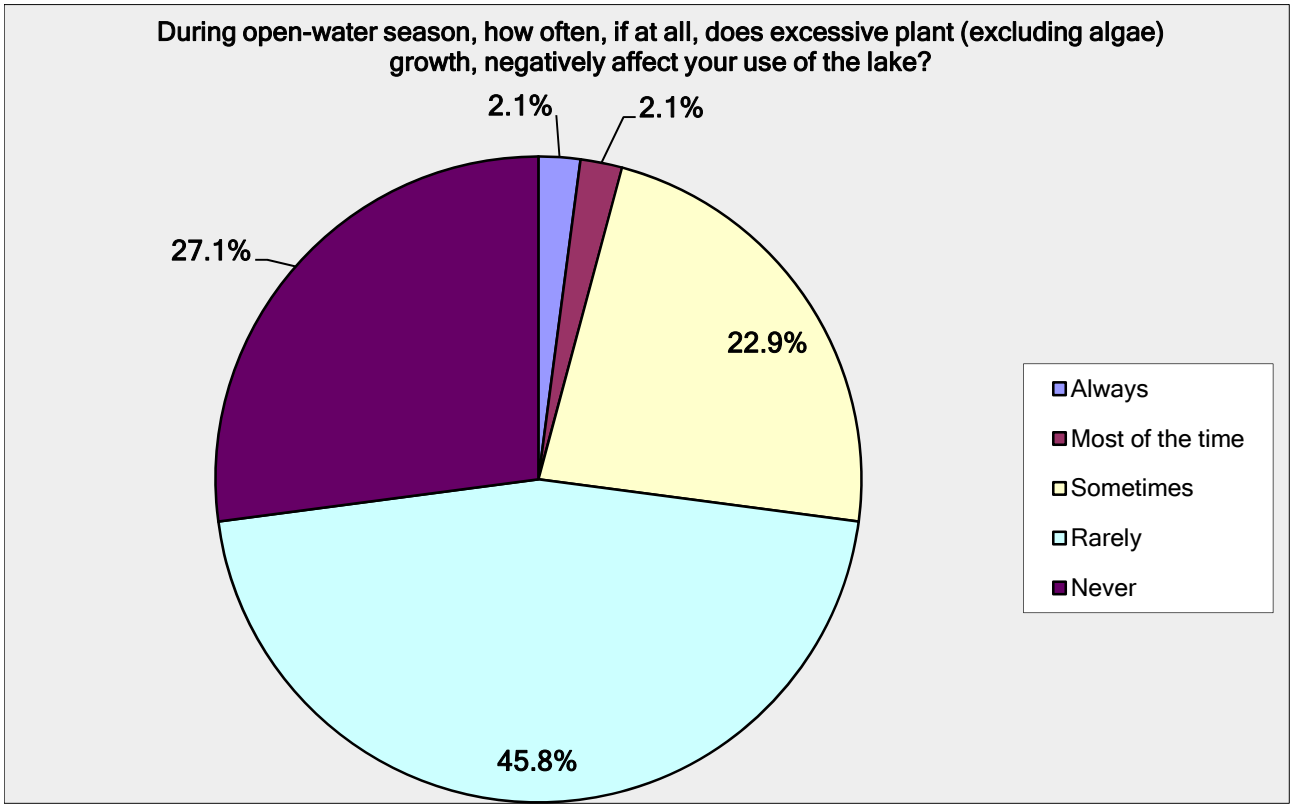
Question 11: Do you believe any AIS are currently in Halsey Lake?		
Answer Options	**Response Percent**	**Response Count**
Yes	6.3%	3
No	37.5%	18
Unsure	56.3%	27
	answered question	**48**
	skipped question	**0**



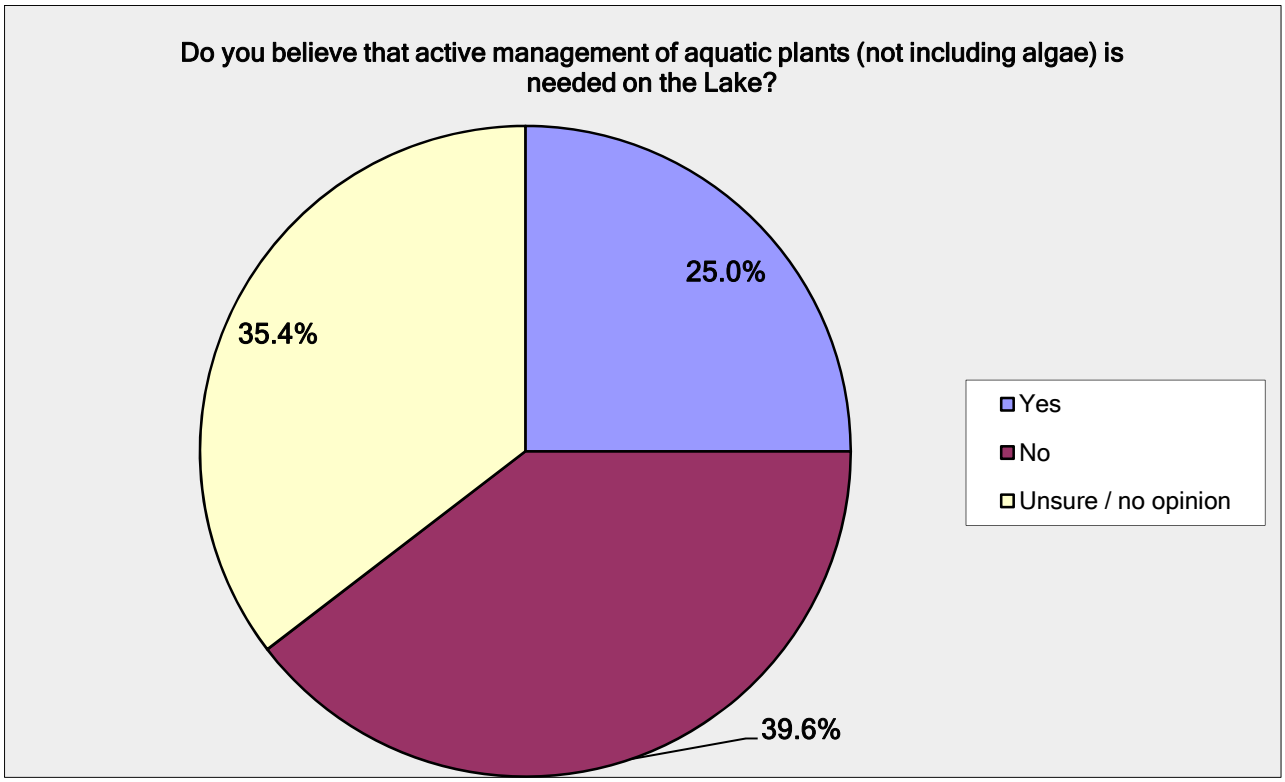
Question 12: Which species of AIS do you believe are, or may be in Halsey Lake, if any? (Select all that apply)		
Answer Options	**Response Percent**	**Response Count**
Eurasian water-milfoil (EWM)	6.9%	2
Curly-leaf pondweed (CLP)	6.9%	2
Flowering rush	0.0%	0
Purple loosestrife	10.3%	3
Zebra mussels	6.9%	2
Unsure	86.2%	25
Other (please specify)	3.4%	1
	answered question	29
	skipped question	19



Question 13: During open-water season, how often, if at all, does excessive plant (excluding algae) growth, negatively affect your use of the lake?		
Answer Options	**Response Percent**	**Response Count**
Always	2.1%	1
Most of the time	2.1%	1
Sometimes	22.9%	11
Rarely	45.8%	22
Never	27.1%	13
	answered question	48
	skipped question	0

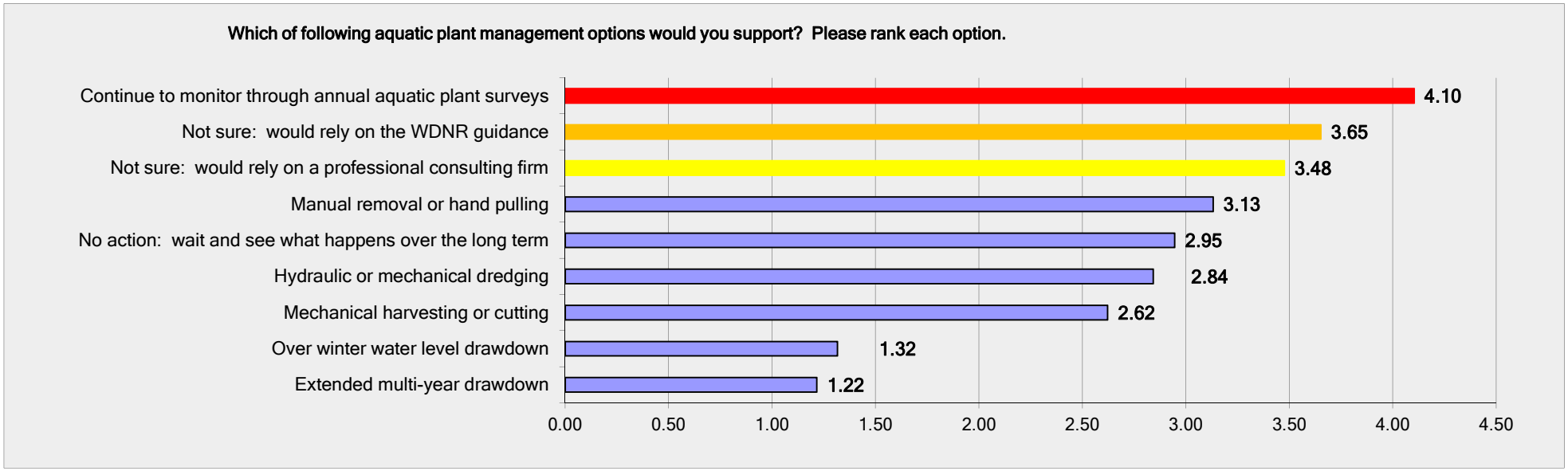


Question 14: Do you believe that active management of aquatic plants (not including algae) is needed on the Lake?		
Answer Options	**Response Percent**	**Response Count**
Yes	25.0%	12
No	39.6%	19
Unsure / no opinion	35.4%	17
	answered question	48
	skipped question	0

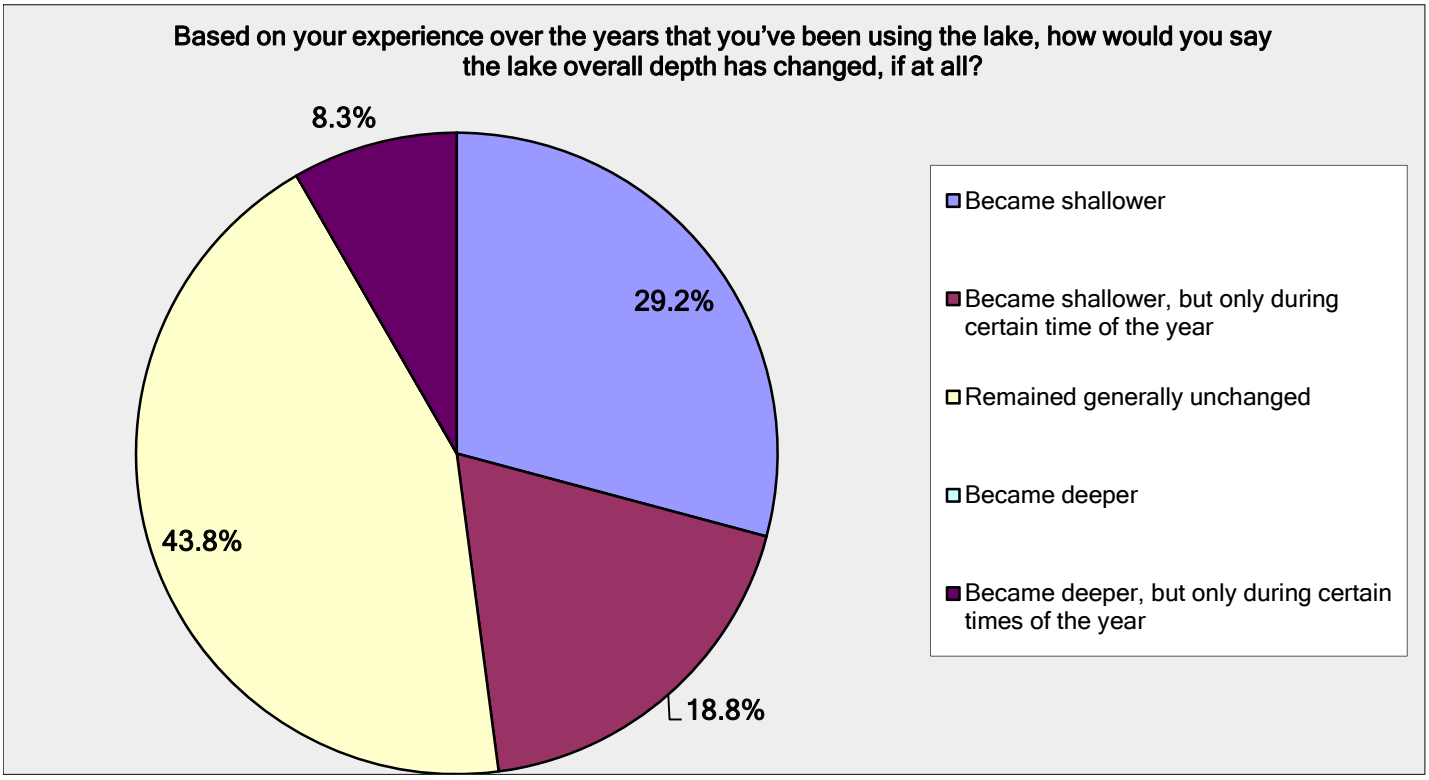


Question 15: Which of following aquatic plant management options would you support? Please rank each option.

Answer Options	Not supportive	Moderately unsupportive	Neutral	Moderately supportive	Highly supportive	Unsure - need more information	Rating Average	Response Count
Extended multi-year drawdown	33	0	4	0	0	6	1.22	43
Over winter water level drawdown	31	2	5	0	0	5	1.32	43
Mechanical harvesting or cutting	12	4	9	10	2	5	2.62	42
Hydraulic or mechanical dredging	15	1	7	5	10	4	2.84	42
No action: wait and see what happens over the long term	9	2	14	6	6	5	2.95	42
Manual removal or hand pulling	9	2	11	7	9	3	3.13	41
Not sure: would rely on a professional consulting firm	6	1	11	12	10	4	3.48	44
Not sure: would rely on the WDNR guidance	3	1	14	15	10	3	3.65	46
Continue to monitor through annual aquatic plant surveys	1	0	10	11	17	4	4.10	43
							answered question	48
							skipped question	0



Quetsion 16: Based on your experience over the years that you've been using the lake, how would you say the lake overall depth has changed, if at all?		
Answer Options	**Response Percent**	**Response Count**
Became shallower	29.2%	14
Became shallower, but only during certain time of the year	18.8%	9
Remained generally unchanged	43.8%	21
Became deeper	0.0%	0
Became deeper, but only during certain times of the year	8.3%	4
	answered question	48
	skipped question	0

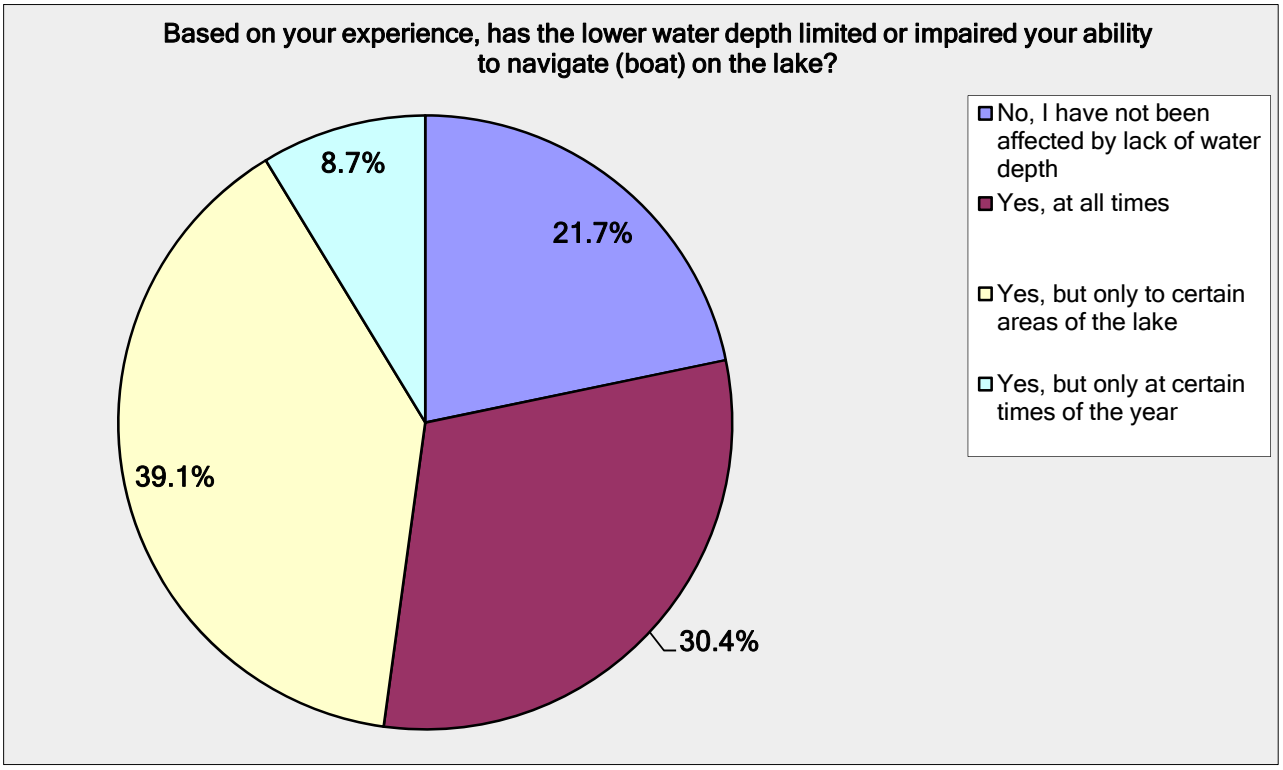


Question 17: Based on your experience, has the lower water depth limited or impaired your ability to navigate (boat) on the lake?

Answer Options	Response Percent	Response Count
No, I have not been affected by lack of water depth	21.7%	5
Yes, at all times	30.4%	7
Yes, but only to certain areas of the lake	39.1%	9
Yes, but only at certain times of the year	8.7%	2
	answered question	23
	skipped question	25

Comments

1 With our small engine & boat it's no problem, but larger boats / motors may have difficulty when level is low

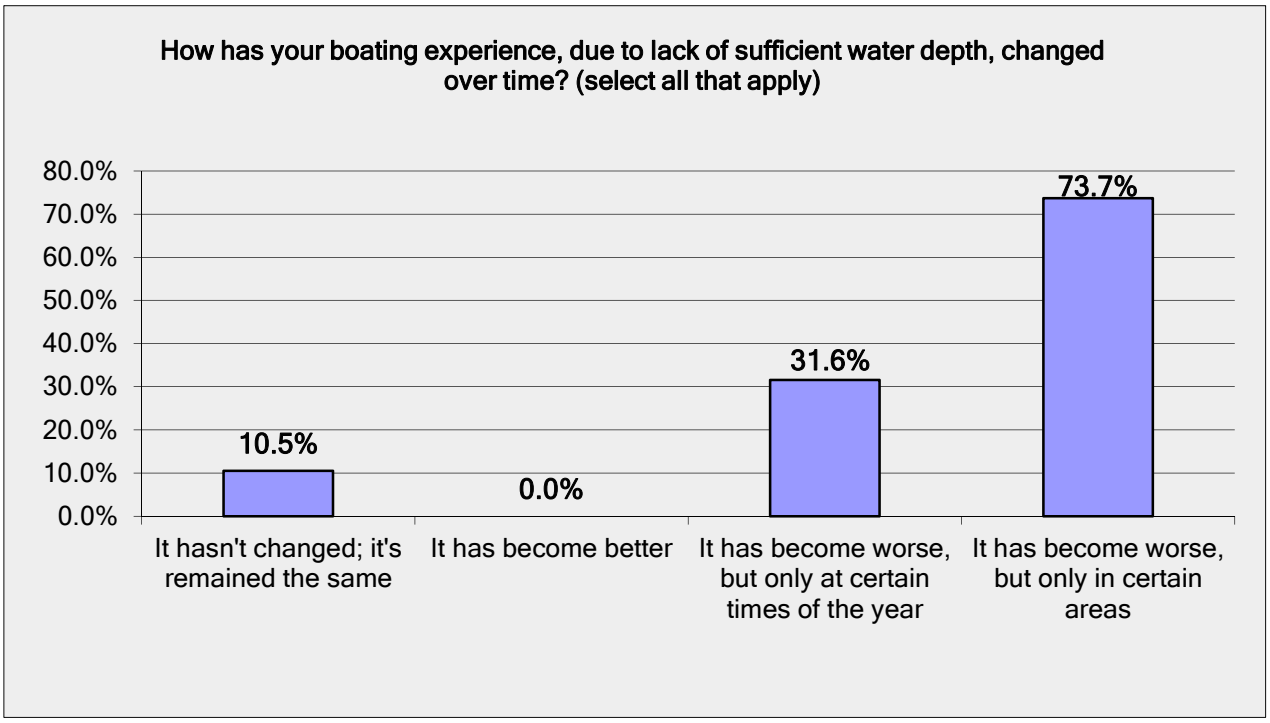


Question 18: How has your boating experience, due to lack of sufficient water depth, changed over time? (select all that apply)

Answer Options	Response Percent	Response Count
It hasn't changed; it's remained the same	10.5%	2
It has become better	0.0%	0
It has become worse, but only at certain times of the year	31.6%	6
It has become worse, but only in certain areas	73.7%	14
	answered question	19
	skipped question	29

Comments

1 We have a small boat so it hasn't affected us, but some have trouble launching their boats at the landing when water is low

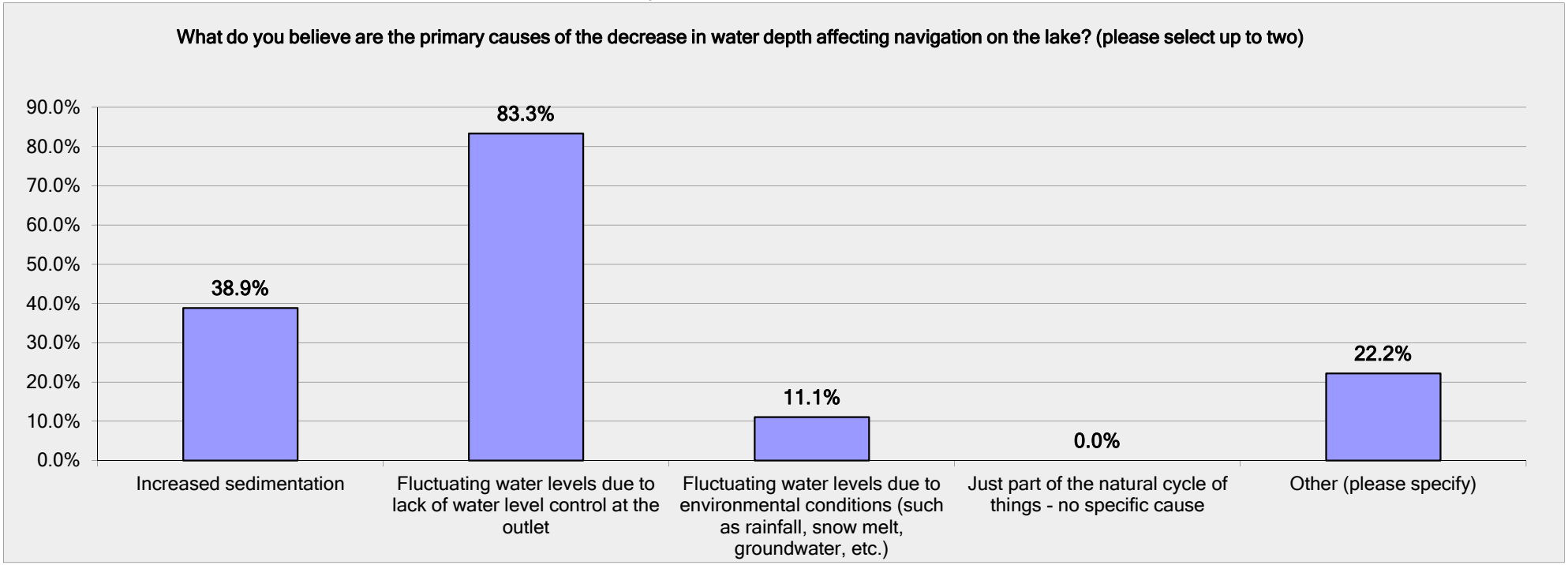


Question 19: What do you believe are the primary causes of the decrease in water depth affecting navigation on the lake? (please select up to two)

Answer Options	Response Percent	Response Count
Increased sedimentation	38.9%	7
Fluctuating water levels due to lack of water level control at the outlet	83.3%	15
Fluctuating water levels due to environmental conditions (such as rainfall, snow melt, groundwater, etc.)	11.1%	2
Just part of the natural cycle of things - no specific cause	0.0%	0
Other (please specify)	22.2%	4
	answered question	18
	skipped question	30

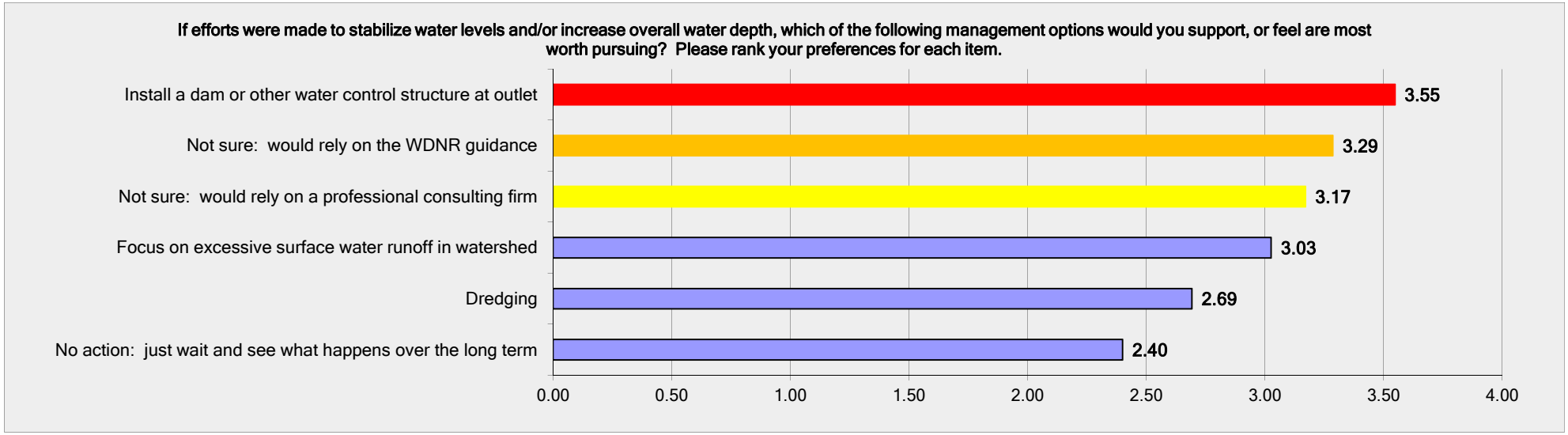
Other (comments)

1 Lowering the outlet level
2 A structure that used to be the outlet was removed in 1995 that held back about 11/2 feet of water
3 A west shore owner removes beaver dams, causing the level to drop a foot. Year after year. If the nadtural water level were to hold, property values and fishing would increase.
4 Elimination of the dam at the lake outlet. The level is constantly low because of the lack of a dam.



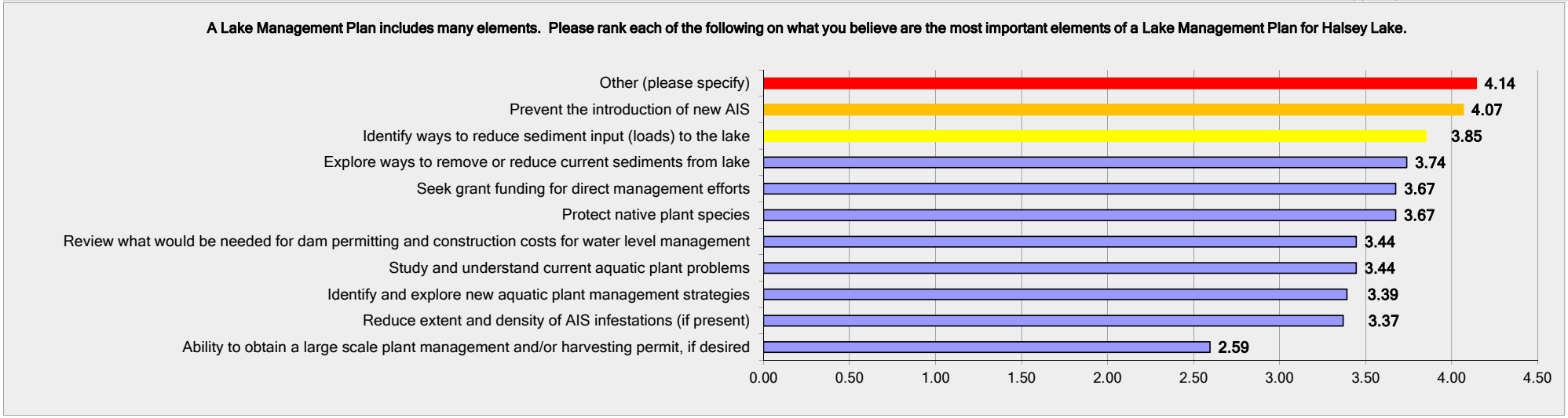
Quesiton 20: If efforts were made to stabilize water levels and/or increase overall water depth, which of the following management options would you support, or feel are most worth pursuing? Please rank your preferences for each item.

Answer Options	Not supportive	Moderately unsupportive	Neutral	Moderately supportive	Highly supportive	Unsure - need more information	Rating Average	Response Count
No action: just wait and see what happens over the long term	15	6	12	2	5	3	2.40	43
Dredging	15	3	8	5	8	6	2.69	45
Focus on excessive surface water runoff in watershed	7	2	19	5	6	5	3.03	44
Not sure: would rely on a professional consulting firm	7	3	16	6	9	3	3.17	44
Not sure: would rely on the WDNR guidance	6	5	12	9	10	2	3.29	44
Install a dam or other water control structure at outlet	12	3	0	4	23	3	3.55	45
							answered question	48
							skipped question	0



Question 21: A Lake Management Plan includes many elements. Please rank each of the following on what you believe are the most important elements of a Lake Management Plan for Halsey Lake.

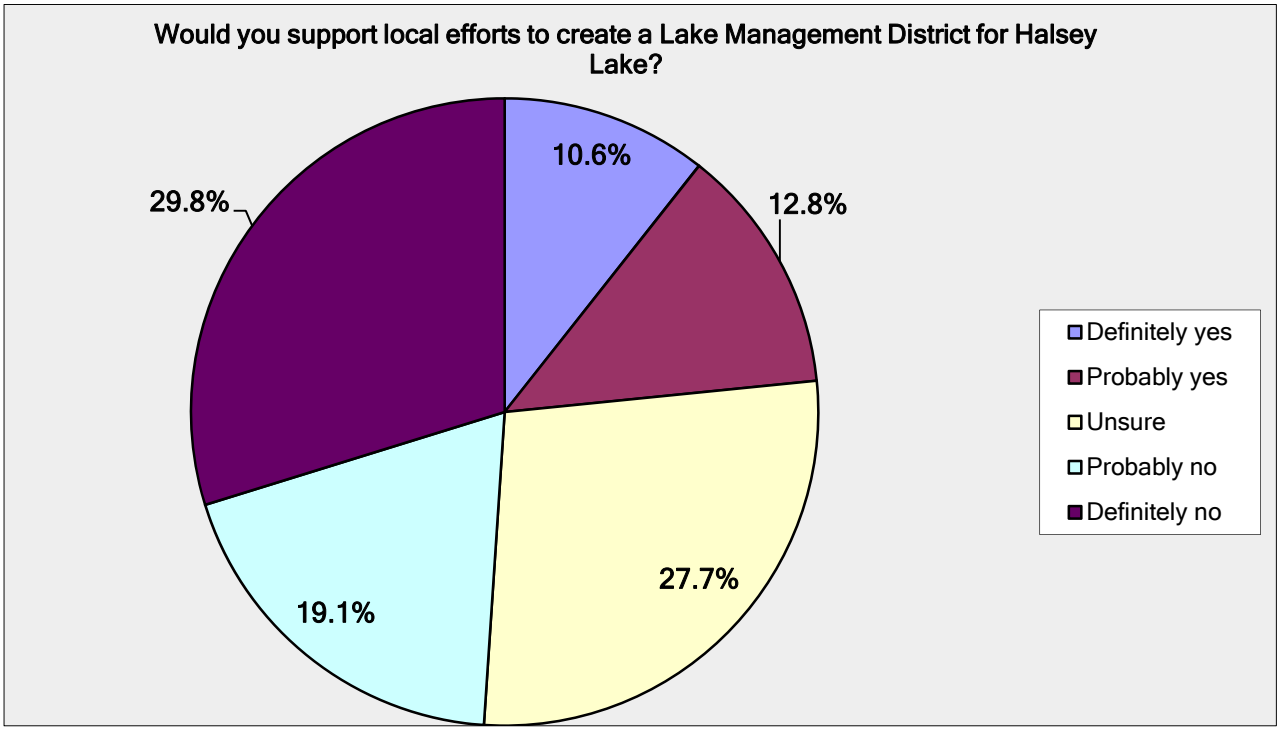
Answer Options	Definitely not needed	Likely not needed	Neutral	Likely needed	Definitely needed	Unsure - need more information	Rating Average	Response Count
Ability to obtain a large scale plant management and/or harvesting permit, if desired	9	7	13	6	2	8	2.59	45
Reduce extent and density of AIS infestations (if present)	4	8	6	10	10	7	3.37	45
Identify and explore new aquatic plant management strategies	4	4	11	16	6	4	3.39	45
Study and understand current aquatic plant problems	4	6	9	18	8	1	3.44	46
Review what would be needed for dam permitting and construction costs for water level	10	5	4	7	19	2	3.44	47
Protect native plant species	3	6	7	17	13	0	3.67	46
Seek grant funding for direct management efforts	7	3	6	8	19	2	3.67	45
Explore ways to remove or reduce current sediments from lake	5	3	7	10	17	4	3.74	46
Identify ways to reduce sediment input (loads) to the lake	4	2	7	10	17	6	3.85	46
Prevent the introduction of new AIS	1	3	5	19	17	0	4.07	45
Other (please specify)	0	0	3	0	4	3	4.14	10
Other (please specify)								6
							answered question	48
							skipped question	0



Other (please specify)

1 State of WI & US Forest Service Need To Fund Watershed Remediation Due To Beaver Damage On THEIR PROPERTY over many decades. (Inlet located entirely on public land; See Sections 29 &32; T39N-R15E)
2 Restocking fish is my number one concern and priority after the winter kill
3 Keep updating and adding structure, for example, fish cribs
4 The water level is most important.
5 Test continually water quality and fish population.
6 Dam it Baby, dam it!

Question 22: Would you support local efforts to create a Lake Management District for Halsey Lake?		
Answer Options	**Response Percent**	**Response Count**
Definitely yes	10.6%	5
Probably yes	12.8%	6
Unsure	27.7%	13
Probably no	19.1%	9
Definitely no	29.8%	14
	answered question	**47**
	skipped question	**1**



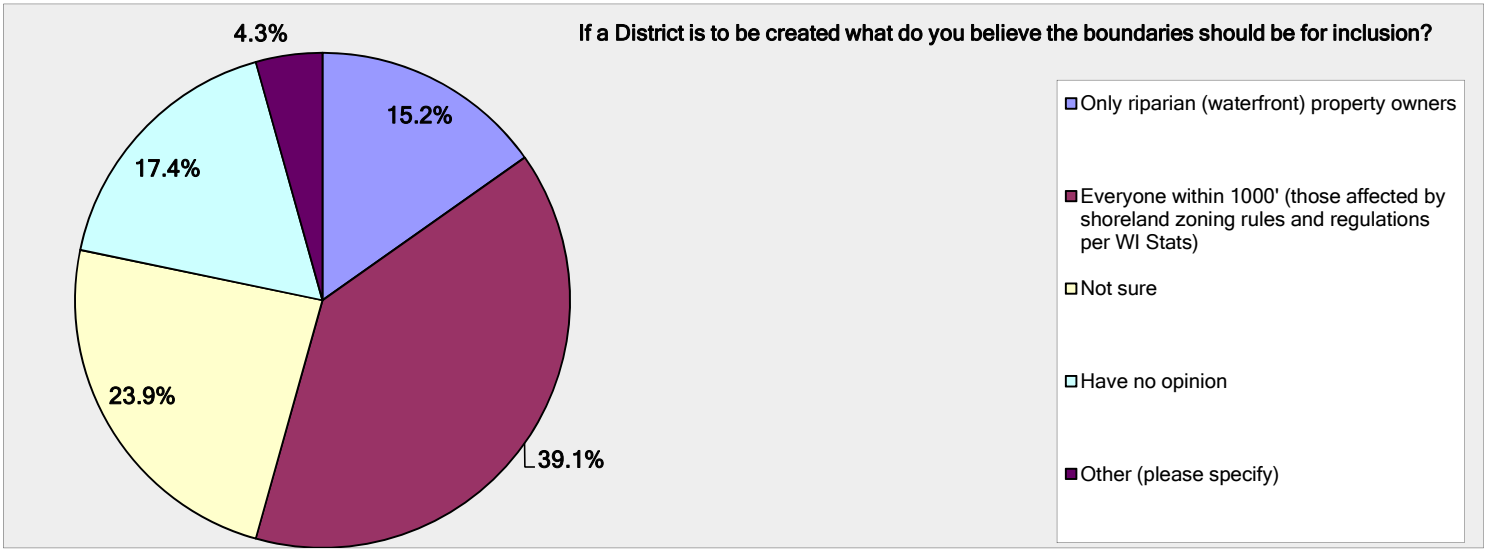
Question 23: If a District is to be created what do you believe the boundaries should be for inclusion?

Answer Options	Response Percent	Response Count
Only riparian (waterfront) property owners	15.2%	7
Everyone within 1000' (those affected by shoreland zoning rules and regulations per WI Stats)	39.1%	18
Not sure	23.9%	11
Have no opinion	17.4%	8
Other (please specify)	4.3%	2
	answered question	46
	skipped question	2

Other (please specify)

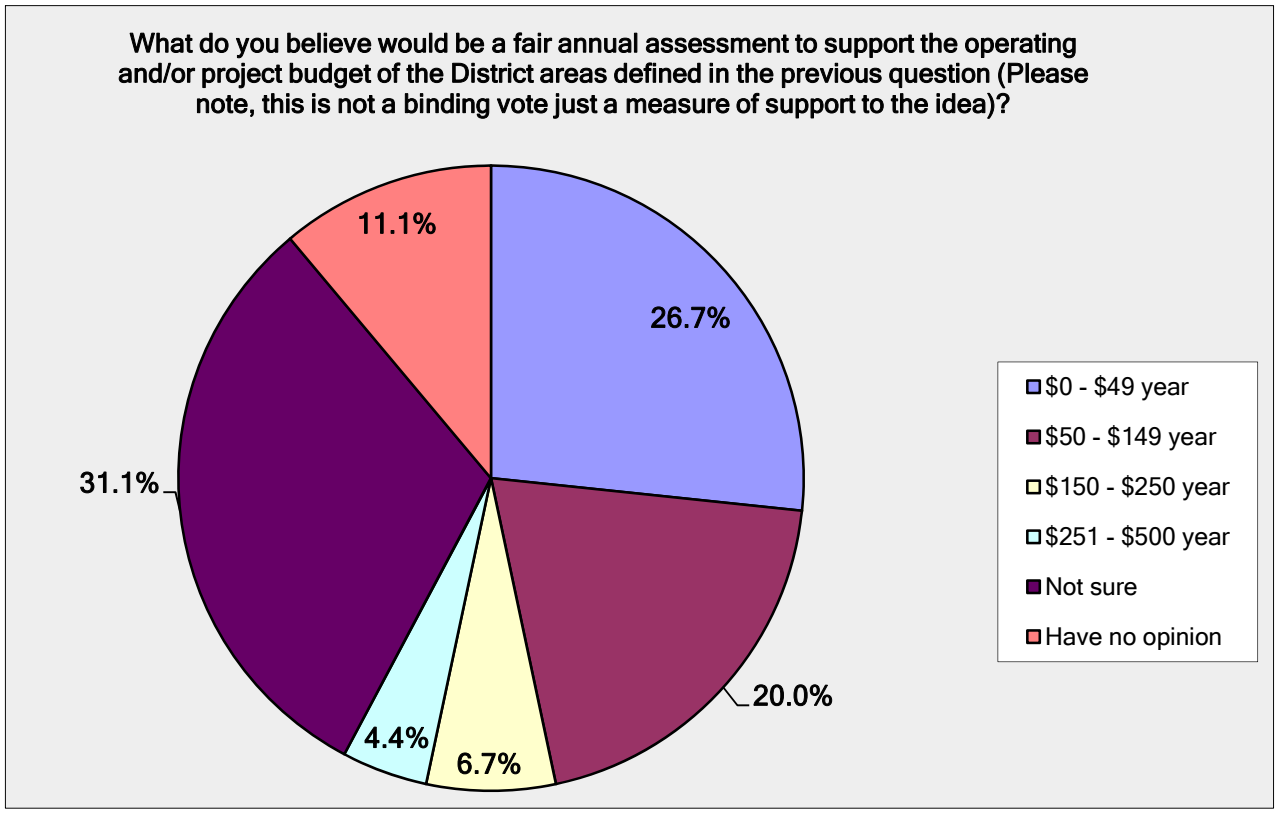
1 Per WIDNR 2015-2025 Beaver Management Plan (Page 56): Property owners with beaver dams are responsible for the damages to the lands of another.

2 I don't believe one needs to be created



Question 24: What do you believe would be a fair annual assessment to support the operating and/or project budget of the District areas defined in the previous question (Please note, this is not a binding vote just a measure of support to the idea)?

Answer Options	Response Percent	Response Count
$0 - $49 year	26.7%	12
$50 - $149 year	20.0%	9
$150 - $250 year	6.7%	3
$251 - $500 year	4.4%	2
Not sure	31.1%	14
Have no opinion	11.1%	5
	answered question	45
	skipped question	3



Question 25: If you have any additional comments or concerns about Halsey Lake or the lake planning process please enter them here.

Answer Options	Response Count
	22
answered question	22
skipped question	25

	Comments
1	Property owners should not be held responsible for any costs. Public access!
2	The present structure which controls the water level near the outlet is insufficient, but the landowner in this area is not willing to permit the Association or other entities ton construct anything on his property which is both sides of the outlet. Without his cooperation the up/down level of the lake will probably continue the way it has been. When we get a lot of rain, the lake level is high, when we have dry periods the level is down. But it would be nice to see it mor constantly at the higher end.
3	Water level control is what is the primary thing to accomplish on Halsey Lake. Other problems will take care of themselves with guidance from porperty owners.
4	Keep the lake level up. Keep big motor boats out of sediment areas (shallows)
5	Thanks to everyone on the lake who contributed to this effort. The State of WI & US Forest Service are the largest riparian owners on this lake. They need to develop and fund a multi-decade remediation plan; "not our problem". The guys that found the stimulus money to tear down acres of National Forest and further fragment the forest with their "shovel-ready" project called ATV trails can fix this lake.
6	Water level is being controlled by property owner at the outlet. Go and see for yourselves! Is this legal? Ethical?
7	As I understand it, Halsey lake is a marl lake. The deposits are calcium. They start out as dissolved calcium in the spring water and are precipitated out when they reach the lake. Nothing can be done to stop this from happening. Other lakes have been dredged and the marl used as fertilizer for farm fields. This sounds like our best option.
8	Want $, install a toll booth at the landing. Not interested in any of these projects. Waste of money. Short term answers.
9	Installation of a water level control device is not realistic. Raising water levels will make shoreline erosion worse than it currently is. Re -opening the toilet at the boat landing is necessary and should be pursued.
10	There are only a limited amount of owners around the lake. The majority have very limited financial resources. The volunteer rate among the owners is very low. My opinion is, very few will voluntarily offer time or money to any effort, even though they would want the benefit of any improvement. Any improvements would most likely have to come from grants or other means. We can't get 100% participation to the Lake Acc. with a $25.00 annual dues fee.
11	The dam will cause problems to area dry lands. What are the other side affects of a dam
12	Leave the lake alone. Halsey lake is not a resort lake.
13	the outlet is the biggest problem concerning the water level problem when the structure was taken out it caused very areas to be unusable. The structure was in place since the late 60's or early 70's
14	Jan Dickinson will assist with AIS monitoring. Is trained and currently doing this on Tichigan Lake.
15	Keep forging ahead with the lake study and actions to enhance the "health" of Halsey Lake
16	Again,. if your agency can give us a way to hold the lake level that is created by the beaver dams, that level will have a huge impact on the lake.
17	None-well covert.
18	Development of a management plan for Halsey Lake requires knowledge of its history, which includes the intentional elimination of a dam and the resulting reduction in water level. The lake association has been discussing issues for many years and planting hundreds of thousands of fish. The most important step forward that requires the least amount of study and discussion is the replacement of the old dam. PERIOD. Let's stop flapping our jaws and move forward! Dam it Baby, dam it!
19	This lake has seen sedimentation increasing steadily over the past 14 years since we've been here. Something needs to be done to reverse this process. Also a water level control structure (dam) needs to be in place. The water level affects ALL property owners around the lake as well as recreational users of the lake. One household should not be able to determine the level of the largest body of water in Florence County. This is the largest tax base in the county - it should be governed and put to best use for ALL!
20	I wish more updates on the project would be emailed to me
21	My opinion is the lake levels go down and up periodically with the amount of rain etc It is the normal cycle of things.
22	I don't think we have an issue with AIS but will be interested to see what the study says. Lake depth is always the concern of the shoreland owners. This is a shallow lake so any loss of depth creates mud flats and problems getting boats to docks. I hope some of these issues are discussed in the study.

APPENDIX B – SUPPORTING AQUATIC PLANT DOCUMENTATION & TABLES

Appendix B – Supporting Aquatic Plant Documentation

The point intercept method was used to evaluate the existing emergent, submergent, floating-leaf and free-floating aquatic plants. If a species was not collected at a specific point, the space on the datasheet was left blank. For the survey, the data for each sample point was entered into the WDNR "Worksheets" (i.e., a data-processing spreadsheet) to calculate the following statistics:

Taxonomic richness (the total number of taxa detected)

- **Maximum depth of plant growth**
- **Community frequency of occurrence** (number of intercept points where aquatic plants were detected divided by the number of intercept points shallower than the maximum depth of plant growth)
- **Mean intercept point taxonomic richness** (the average number of taxa per intercept point)
- **Mean intercept point native taxonomic richness** (the average number of native taxa per intercept point)
- **Taxonomic frequency of occurrence within vegetated areas** (the number of intercept points where a particular taxon (e.g., genus, species, etc.) was detected divided by the total number of intercept points where vegetation was present)
- **Taxonomic frequency of occurrence at sites within the photic zone** (the number of intercept points where a particular taxon (e.g., genus, species, etc.) was detected divided by the total number of intercept points which are equal to or shallower than the maximum depth of plant growth)
- **Relative taxonomic frequency of occurrence** (the number of intercept points where a particular taxon (e.g., genus, species, etc.) was detected divided by the sum of all species' occurrences)
- **Mean density** (the sum of the density values for a particular species divided by the number of sampling sites)
- **Simpson Diversity Index (SDI)** is an indicator of aquatic plant community diversity. SDI is calculated by taking one minus the sum of the relative frequencies squared for each species present. Based upon the index of community diversity, the closer the SDI is to one, the greater the diversity within the population.

Floristic Quality Index (FQI) (This method uses a predetermined Coefficient of Conservatism (C), that has been assigned to each native plant species in Wisconsin, based on that species' tolerance for disturbance. Non-native plants are not assigned conservatism coefficients. The aggregate conservatism of all the plants inhabiting a site determines its floristic quality. The mean C value for a given lake is the arithmetic mean of the coefficients of all native vascular plant species occurring on the entire site, without regard to dominance or frequency. The FQI value is the mean C times the square root of the total number of native species. This formula combines the conservatism of the species present with a measure of the species richness of the site.

Table 1: Taxa Detected During 2015 Aquatic Plant Survey, Halsey Lake, Florence County, WI

Genus	Species	Common Name	Category
Algae	*sp.*	Filamentous algae	Algal
Brasenia	*schreberi*	Watershield	Floating-leaf
Chara	*sp.*	Muskgrass	Submersed [algal]
Myriophyllum	*sibiricum*	Northern water-milfoil	Submersed
Najas	*flexilis*	Slender naiad	Submersed
Nymphaea	*odorata*	White water lily	Floating-leaf
Potamogeton	*amplifolius*	Large-leaf pondweed	Submersed
Potamogeton	*gramineus*	Variable pondweed	Submersed
Potamogeton	*illinoensis*	Illinois pondweed	Submersed
Potamogeton	*zosteriformis*	Flat-stem pondweed	Submersed
Schoenoplectus	*acutus*	Hardstem bulrush	Emergent
Stuckenia	*pectinata*	Sago pondweed	Submersed

Table 3: 2015 Aquatic Plant Taxa-Specific Statistics, Halsey Lake, Florence County, WI

Common Name	Percent Frequency of Occurrence within vegetated areas	Percent Frequency of Occurrence at sites shallower than max depth of plants	Percent Relative Frequency of Occurrence	Number of Intercept Points Where Detected	Average Density
Filamentous algae	0.62	0.29	---	1	1.00
Watershield	6.83	3.16	5.30	11	1.00
Muskgrass	1.86	0.86	1.40	3	1.00
Northern water-milfoil	10.56	4.89	8.20	17	1.00
Slender naiad	70.81	32.76	55.10	114	1.01
White water lily	4.97	2.30	3.90	8	1.12
Large-leaf pondweed	21.12	9.77	16.40	34	1.00
Variable pondweed	7.45	3.45	5.80	12	1.00
Illinois pondweed	0.62	0.29	0.50	1	1.00
Flat-stem pondweed	3.11	1.44	2.40	5	1.60
Hardstem bulrush	0.62	0.29	0.50	1	1.00
Sago pondweed	0.62	0.29	0.50	1	1.00

APPENDIX C – ADDITIONAL MANAGEMENT OPTIONS

Management Options for Aquatic Plants

Option	Permit Needed	How it Works	Pros	Cons
No Management	No	No active plant management	Possible protects native species that can enhance water quality and provide habitat for aquatic fauna: • No financial cost • No system disturbance • No harmful effects of chemicals • Permit not required	May allow small populations of invasive plants to become larger and more difficult to control later • Requires intensive monitoring
Mechanical Control	Required under NR 109	Plants reduced by mechanical means	Flexible control	Must be repeated, often more than once per season, sometimes weekly
		Wide range of techniques from manual to mechanized	Can balance habitat and recreational needs	Can suspend sediments and increase highly turbidity and nutrient release
a. Handpulling/ Manual raking	Yes/No	Scuba divers or snorkelers remove plants are removed with a rake	Little to no damage done to lake or to native plant species	Very labor intensive and costly by hand or plants
		Works best in soft sediments	Can be highly selective Can be done by shoreline property owners within an area <30 ft wide or removing EWM or CLP Can be very effective at removing problems particularly following early detection of an invasive specie	Needs to be carefully monitored Roots, runners and even fragments of some without permits species (including EWM) will start new where selectively planted, so all of plant must be removed Small scale control only plants Can be very costly if subcontracted
b. Harvesting	Yes	Plants are “mowed” at depths of 2-5 ft., collected with a conveyor and off loaded onto shore	Immediate results	Not selective in species removed
		Harvest invasives only if invasive is already present throughout the lake	Good for CLP management if cut prior to turion production and is then cut to be kept in check through its growth cycle Usually minimal impact to the lake Harvested lanes through dense weed beds can increase growth and forage ability of some fish Can remove some nutrients from the lake	Fragments of EWM can re-root Difficulty in finding disposal sites Can remove some small fish and reptiles from lake Initial cost of harvester expensive High transport, maintenance and operational costs Liability if owned
Biological Control	Yes	Living organisms (e.g. insects or fungi) eat or infect plants	Self sustaining organism will over winter resume eating its host the next year Lowers density of problem plant to allow growth of natives	Effectiveness will vary as control agent’s population fluctuates Provides moderate control – complete control unlikely Control response may be slow. Must have enough control agent to be effective

Management Options for Aquatic Plants

a. Weevils on EWM	Yes	Native weevil prefers EWM to other native water milfoil	Native to Wisconsin: Weevil cannot "escape" and become a problem Selective control of target species Longer term control with limited management	Excessive cost need to stock large numbers, even if some already present and are costly **$1.00/each** Need good habitat for over wintering on shore (leaf litter) associated with undeveloped shorelines High Panfish populations decrease densities through predation
b. Pathogens	Yes	Fungal/bacterial/viral pathogen introduced to target species to induce mortality	May be species specific May provide long term control Few dangers to humans or animals	Largely experimental; effectiveness and longevity unknown Possible side effects not understood
c. Allelopathy	Yes	Aquatic plants release chemical compounds that inhibit other plants from growing	May provide long term, maintenance free control Spikerushes (*Eleocharis* spp.) appear to inhibit Eurasian watermill foil growth	Initial transplanting slow and labor intensive Spikerushes native to Wisconsin and have not effectively limited EWM growth Wave action along shore makes it difficult to establish plants; plants will not grow in deep or turbid water
d. Restoration of native plants	Possibly, strongly recommend plan and consultation with DNR	Diverse native plant community established to help repel invasive species	Native plants provide food and habitat for aquatic fauna Diverse native community more repellant to invasive species Supplements removal techniques	Initial transplanting slow and labor intensive Nuisance invasive plants may outcompete plantings Largely experimental; few well documented successful cases and very costly
Physical Control	Required under Ch. 30/NR 107	Plants are reduced by altering variables that affect growth, such as water depth or light levels		
a. Drawdown	Yes, may require Environmental Assessment	Lake water lowered; plants killed when sediment dries, compacts or freezes	Can be effective for EWM, especially when done over winter, provided drying and freezing occur. Sediment compaction is possible over winter.	Plants with large seed bank or propagules that survive drawdown may become more abundant upon refilling
		Must have a water level control or device or siphon	Summer drawdown can restore large portions of shoreline and shallow areas as well as provide sediment compaction	Species growing in deep water (e.g. EWM) that survive may increase, particularly if desired native species are reduced
		Season or duration of drawdown can change effects	Emergent plant species often rebound near shore providing fish and wildlife habitat, sediment stabilization and increased water quality Successful for EWM	May impact attached wetlands and shallow wells near shore Not a good control measure for CLP

Management Options for Aquatic Plants

			Low cost if not a hydroelectric dam Restores natural water fluctuation important for all aquatic ecosystems	Can affect fish, particularly in shallow lakes if oxygen levels drop or if water levels are not restored before spring spawning Winter drawdown must start in early fall or will kill hibernating reptiles and amphibians Controversial
b. Dredging	Yes	Plants are removed along with sediment	Increases water depth	Expensive
		Most effective when soft sediments overlay harder substrate	Removes nutrient rich sediments	Increases turbidity and releases nutrients
		For extremely impacted systems	Removes soft bottom sediments that may have high oxygen demand	Exposed sediments may be recolonized by invasive species
		Extensive planning and permitting required		Sediment testing is expensive Removes benthic organisms Dredged materials must be disposed if Severe impact on lake ecosystem
c. Dyes	Yes	Colors water, reducing light and reducing plant and algal growth	Impairs plant growth without increasing turbidity Usually non-toxic, degrades naturally over a few weeks	Appropriate for very slam water bodies Should not be used in pond or lake with outflow Impairs aesthetics Affects to microscopic organisms unknown
d. Mechanical circulation (Solarbees)	Yes	Water is circulated and oxygenated	Reduces blue green algae	Method is experimental; no published studies have been done
		Oxygenation of water decreases ammonium-nitrogen, which is a preferred nutrient source of EWM, theoretically limiting EWM growth (has not been demonstrated scientifically)	May reduce levels of ammonium-nitrogen in the water and at the sediment interface, which could reduce EWM growth Oxygenated water may reduce phosphorus release from sediments if mixing is complete Reduces chance of fish kills by aerating water	Although EWM prefers ammonium-nitrogen to nitrate, it will uptake nitrate efficiently, so EWM growth may not be affected Units are aesthetically unpleasing Units could be a navigational hazard
e. Non-point source nutrient control	No	Runoff of nutrients from the watershed are reduced (e.g. by controlling construction erosion or reducing fertilizer use)	Attempts to correct source of problem, not treat symptoms Could improve water clarity and reduce occurrences of algal blooms	Results can take years to be evident due to internal recycling of already resent lake nutrients Expensive

Management Options for Aquatic Plants

			Native plants may be able to compete invasive species better in low nutrient conditions	Requires landowner cooperation and regulation Improved water clarity may increase plant growth
Chemical Control	Required under NR 107	Granules or liquid chemicals kill plants or cease plant growth; some chemicals used primarily for algae	Some flexibility for different situations	Possible toxicity to aquatic animals or humans, especially applicators
		Results usually within 10 days of treatment, but repeat treatments usually needed	Some can be selective if applied correctly Can be used for restoration activities	May kill desirable plant species, e.g. native water milfoil or native pondweeds Treatment set back requirements from potable water sources and/or drinking water use restrictions after application, usually based on concentration May cause severe drop in dissolved oxygen causing fish kill, depends on plant biomass killed, temperatures and lake size and shape Controversial
a. 2,4-D (DMA-4; Sculpin	Yes	Systemic[1] herbicide selective to broadleaf[2] plants that inhibit cell division in new tissue	Moderately to highly effective; especially on EWM	May cause oxygen depletion after plants die and decompose
		Applied as liquid or granules during early growth phase	Monocots, such as pondweeds (e.g. CLP) and many other native species not affected Can be used in synergy with endotholl for early season CLP and EWM treatments Widely used aquatic herbicides	Cannot be used in combination with copper herbicides (used for algae) Toxic to fish
b. Endothall (Aquathol)	Yes	Broad-spectrum[3], contact [4] herbicide that inhibits protein synthesis	Especially effective on CLP and also effective on EWM	Kills many native pondweeks
		Applied as liquid or granules	May be effective in reducing reestablishment of CLP if reapplied several years in a row in early spring Can be selective depending on concentration and seasonal timing Can be combined with 2,4-D for early season CLP and EWM treatments, or with copper compounds	Not as effective in dense plant beds Not to be used in water supplies Toxic to aquatic fauna (to varying degrees)
c. Diquat (Reward)	Yes	Broad-spectrum, contact herbicide that disrupts cellular functioning	Mostly used for water-milfoil and duckweed	May impact non-target plants, especially native pondweeds, coontail, elodea, naiads
		Applied as liquid, can be combined with copper treatment	Rapid action Limited direct toxicity on fish and other animals	Toxic to aquatic invertebrates Needs to be reapplied several years in a row

Management Options for Aquatic Plants

				Ineffective in muddy or cold water (<50°F)
d. Fluridone (Sonar)	Yes	Broad-spectrum, systemic pigment bleaching herbicide that inhibits photosynthesis, some reduction in non target effects can be achieved by lowering dosage	Effective on EWM for 2 to 4+ years Applied at very low concentration typically on lake wide basis of less than 8 PPB Specific granular formulation release over extended periods of time 30 – 60 days eliminating peaks and lessening impacts to non targets (natives)	Affects some non-target plants, particularly native milfoils, coontails, elodea and naiads, even at low concentrations. These plants are important to combat invasive species Requires long contact time: 60-90 + days Requires residual monitoring
			Slow decomposition of plants may limit decreases in dissolved oxygen Low toxicity to aquatic animals	Demonstrated herbicide resistance in hydrilla subjected to repeat treatments Unknown effect of repeat whole lake treatments on lake ecology
e. Glyphosate (Rodeo)	Yes	Broad spectrum, systemic herbicide that disrupts enzyme formation and function	Effective on floating and emergent plants such as purple loosestrife	Effective control for 1-5 years
		Usually used for purple loosestrife stems or cattails	Selective if carefully applied to individual plants	Ineffective in muddy water
		Applied as liquid spray or painted on loosestrife stems	Non-toxic to most aquatic animals at recommended dosages	Cannot be used near potable water intakes No control of submerged plants
f. Triclopyr (Renovate)	Yes	Systemic herbicide selective to broadleaf plants that disrupts enzyme function	Effective on many emergent and floating plants	Impacts may occur to some native plants at higher does (e.g. coontail)
		Applied as liquid spray or liquid	More effective on dicots, such as purple loosestrife; may be more effective than glyphosate Results in 3-5 weeks Low toxicity to aquatic animals No recreational use restrictions following treatment	May be toxic to sensitive invertebrates at higher concentrations Retreatment opportunities may be limited due to maximum seasonal rate (2.5 ppm) Sensitive to UV light; sunlight can break herbicide down prematurely Relatively new management option for aquatic plants (since 2003)
g. Copper compounds (Cutrine, Captain)	Yes	Broad-spectrum, systemic herbicide that prevents photosynthesis	Reduces algal growth and increases water clarity	Elemental copper accumulates and persists in sediments
		Used to control planktonic and filamentous algae	No recreational or agricultural restrictions on water use following treatment Herbicidal action on hydrilla, an invasive plant not yet present in Wisconsin	Short term results Small-scale control only, because algae are easily windblown

Management Options for Aquatic Plants

					Toxic to invertebrates, trout and other fish, depending on the hardness of the water Long-term effects of repeat treatments to benthic organism unknown Clear water may increase plant growth
h.	**Lime slurry**	Yes	Applications of lime temporarily raise water pH, which limits the availability of inorganic carbon to plants, preventing growth	Appears to be particularly effective against EWM and CLP Prevents release of sediment phosphorus, which reduces algal growth Increases growth of native plants beneficial as fish habitat	Relatively new technique, so effective dosage levels and exposure requirements are not yet known Short-term increase in turbidity due to suspended lime particles High pH detrimental to aquatic invertebrates May restrict growth of some native plants
i.	**Alum (aluminum sulfate)**	Yes	Remove phosphorus from water column and creates barrier on sediment to prevent internal loading of phosphorus	Most often used against algal problems Lasts up to 5 years	Most not eat fish for 30 days from treatment area
			Dosage must consider pH, hardness and water volume	Improves water clarity	Minimal effect on aquatic plants, or increased light penetration may increase aquatic plants Potential ecosystem toxicity issues for aquatic animals, including fish at some concentrations
j.	**Phoslock**	yes	Remove/sequesters phosphorus from water column and creates barrier on sediment to prevent internal loading of phosphorus	Most often used against algal problems/blooms Improves water quality	Higher cost than Alum
			Dosing based on water quality parameters and volumes	Lasts up to 5 years Made from natural materials/carriers and tends to be more environmentally friendly than alum	

***EWM** - Eurasian water-milfoil
***CLP** - Curly-leaf pondweed

[1]**Systemic herbicide -** Must be absorbed by the plant and moved to the site of action. Often slower-acting than contact herbicides.

[2]**Broadleaf herbicide -** Affects only dicots, one of two groups of plants. Aquatic dicots include waterlilies, bladderworts, watermilfoils, and coontails.

[3]**Broad-spectrum herbicide -** Affects both monocots and dicots.

[4]**Contact herbicide -** Unable to move within the plant; kills only plant tissue it contacts directly

Techniques for Aquatic Plant Control Not Allowed in Wisconsin

Option	How it Works	Pros	Cons
Biological Control			
a. Carp	Plants eaten by stocked carp	Effective at removing aquatic plants Involves species already present in Madison lakes	Illegal to transport or stock carp in Wisconsin Carp cause resuspension of sediments, increased water temperature, lower dissolved oxygen levels and reduction of light penetration Widespread plant removal deteriorates habitat for other fish and aquatic organisms Complete alteration of fish assemblage possible Dislodging of plants such as EWM or CLP turions can lead to accelerated spreading of plants
b. Crayfish	Plants eaten by stocked crayfish	Reduces macrophyte biomass	Illegal to transport or stock crayfish in Wisconsin Control not selective and may decimate plant community Not successful in productive, soft-bottom lakes with many fish predators Complete alteration of fish assemblage possible
Mechanical Control			
a. Cutting (no removal)	Plants are “mowed” with underwater cutter	Creates open water areas rapidly Works in water up to 25 ft	Root system remains for regrowth Fragments of vegetation can re-root and spread infestation throughout the lake Nutrient release can cause increased algae and bacteria and be a nuisance to riparian property owners Not selective in species removed small-scale control only
b. Rototilling	Sediment is tilled to uproot plant roots and stems	Decreases stem density, can affect entire plant	Creates turbidity
	Works in deep water (up to 17 ft)	Small scale control May provide long-term control	Not selective in species removed Fragments of vegetation can re-root Complete elimination of fish habitat

Techniques for Aquatic Plant Control Not Allowed in Wisconsin

			Releases nutrients Increased likelihood of invasive species recolonization
c. Hydroraking	Mechanical rake removes plants from lake Works in deep water (14 ft)	Creates open water areas rapidly	Fragments of vegetation can re-root May impact lake fauna Creates turbidity Plants regrown quickly Requires plant disposal
Physical Control			
a. Fabrics/Bottom Barriers	Prevents light from getting to lake bottom	Reduces turbidity in soft substrate areas Useful for small areas	Eliminates all plants, including native plants important for a healthy lake ecosystem May inhibit spawning by some fish Need maintenance or will become covered in sediment and ineffective Gas accumulation under blankets can cause them to dislodge from the bottom Affects benthic invertebrates Anaerobic environment forms that can release excessive nutrients from sediment

APPENDIX D – WI ADMIN CODES NR 107 & NR 109

Chapter NR 107

AQUATIC PLANT MANAGEMENT

Note: Chapter NR 107 as it existed on February 28, 1989 was repealed and a new Chapter NR 107 was created effective March 1, 1989.

NR 107.01 Purpose. The purpose of this chapter is to establish procedures for the management of aquatic plants and control of other aquatic organisms pursuant to s. 227.11 (2) (a), Stats., and interpreting s. 281.17 (2), Stats. A balanced aquatic plant community is recognized to be a vital and necessary component of a healthy aquatic ecosystem. The department may allow the management of nuisance–causing aquatic plants with chemicals registered and labeled by the U.S. environmental protection agency and labeled and registered by firms licensed as pesticide manufacturers and labelers with the Wisconsin department of agriculture, trade and consumer protection. Chemical management shall be allowed in a manner consistent with sound ecosystem management and shall minimize the loss of ecological values in the water body.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; **correction made under s. 13.93 (2m) (b) 7., Stats., Register, December, 2000, No. 540.**

NR 107.02 Applicability. Any person sponsoring or conducting chemical treatment for the management of aquatic plants or control of other aquatic organisms in waters of the state shall obtain a permit from the department. Waters of the state include those portions of Lake Michigan and Lake Superior, and all lakes, bays, rivers, streams, springs, ponds, wells, impounding reservoirs, marshes, watercourses, drainage systems and other ground or surface water, natural or artificial, public or private, within the state or its jurisdiction as specified in s. 281.01 (18), Stats.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; **correction made under s. 13.93 (2m) (b) 7., Stats., Register, December, 2000, No. 540.**

NR 107.03 Definitions. (1) "Applicator" means the person physically applying the chemicals to the treatment site.

(2) "Chemical fact sheet" means a summary of information on a specific chemical written by the department including general aquatic community and human safety considerations applicable to Wisconsin sites.

(3) "Department" means the department of natural resources.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 107.04 Application for permit. (1) Permit applications shall be made on forms provided by the department and shall be submitted to the district director for the district in which the project is located. Any amendment or revision to an application shall be treated by the department as a new application, except as provided in s. NR 107.04 (3) (g).

Note: The DNR district headquarters are located at:

1. Southern — 3911 Fish Hatchery Road, Fitchburg 53711
2. Southeast — 2300 N. Dr. Martin Luther King Jr. Dr., Box 12436, Milwaukee 53212
3. Lake Michigan — 1125 N. Military Ave., Box 10448, Green Bay 54307
4. North Central — 107 Sutliff Ave., Box 818, Rhinelander 54501
5. Western — 1300 W. Clairemont Ave., Call Box 4001, Eau Claire 54702
6. Northwest — Hwy 70 West, Box 309, Spooner 54801

(2) The application shall be accompanied by:

(a) A nonrefundable permit application fee of $20, and, for proposed treatments larger than 0.25 acres, an additional refundable acreage fee of $25.00 per acre, rounded up to the nearest whole acre, applied to a maximum of 50.0 acres.

1. The acreage fee shall be refunded in whole if the entire permit is denied or if no treatment occurs on any part of the permitted treatment area. Refunds will not be prorated for partial treatments.

2. If the permit is issued with the proposed treatment area partially denied, a refund of acreage fees shall be given for the area denied.

(b) A legal description of the body of water proposed for treatment including township, range and section number;

(c) One copy of a detailed map or sketch of the body of water with the proposed treatment area dimensions clearly shown and with pertinent information necessary to locate those properties, by name of owner, riparian to the treatment area, which may include street address, local telephone number, block, lot and fire number where available. If a local address is not available, the home address and phone number of the property owner may be included;

(d) A description of the uses being impaired by plants or aquatic organisms and reason for treatment;

(e) A description of the plant community or other aquatic organisms causing the use impairment;

(f) The product names of chemicals proposed for use and the method of application;

(g) The name of the person or commercial applicator, and applicator certification number, when required by s. NR 107.08 (5), of the person conducting the treatment;

(h) A comparison of alternative control methods and their feasibility for use on the proposed treatment site.

(3) In addition to the information required under sub. (2), when the proposed treatment is a large–scale treatment exceeding 10.0 acres in size or 10% of the area of the water body that is 10 feet or less in depth, the application shall be accompanied by:

(a) A map showing the size and boundaries of the water body and its watershed.

(b) A map and list identifying known or suspected land use practices contributing to plant–related water quality problems in the watershed.

(c) A summary of conditions contributing to undesirable plant growth on the water body.

(d) A general description of the fish and wildlife uses occurring within the proposed treatment site.

(e) A summary of recreational uses of the proposed treatment site.

(f) Evidence that a public notice of the proposed application has been made, and that a public informational meeting, if required, has been conducted.

1. Notice shall be given in 2 inch x 4 inch advertising format in the newspaper which has the largest circulation in the area affected by the application.

2. The notice shall state the size of the proposed treatment, the approximate treatment dates, and that the public may request within 5 days of the notice that the applicant hold a public informational meeting on the proposed application.

a. The applicant will conduct a public informational meeting in a location near the water body when a combination of 5 or more individuals, organizations, special units of government, or local units of government request the meeting in writing to the applicant

with a copy to the department within 5 days after the notice is made. The person or entity requesting the meeting shall state a specific agenda of topics including problems and alternatives to be discussed.

b. The meeting shall be given a minimum of one week advance notice, both in writing to the requestors, and advertised in the format of subd. 1.

(g) The provisions of pars. (a) to (e) shall be repeated once every 5 years and shall include new information. Annual modifications of the proposed treatment within the 5–year period which do not expand the treatment area more than 10% and cover a similar location and target organisms may be accepted as an amendment to the original application. The acreage fee submitted under sub. (2) (a) shall be adjusted in accordance with any proposed amendments.

(4) The applicant shall certify to the department that a copy of the application has been provided to any affected property owners' association, inland lake district, and, in the case of chemical applications for rooted aquatic plants, to any riparian property owners adjacent to and within the treatment area.

(5) A notice of the proposed treatment shall be provided by the department to any person or organization indicating annually in writing a desire to receive such notification.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 107.05 Issuance of permit. (1) The department shall issue or deny issuance of the requested permit between 10 and 15 working days after receipt of an acceptable application, unless:

(a) An environmental impact report or statement is required under s. 1.11, Stats. Notification to the applicant shall be in writing within 10 working days of receipt of the application and no action may be taken until the report or statement has been completed; or

(b) A public hearing has been granted under s. 227.42, Stats.

(2) If a request for a public hearing is received after the permit is issued but prior to the actual treatment allowed by the permit, the department is not required to, but may, suspend the permit because of the request for public hearing.

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

(a) The proposed chemical is not labeled and registered for the intended use by the United States environmental protection agency and both labeled and registered by a firm licensed as a pesticide manufacturer and labeler with the Wisconsin department of agriculture, trade and consumer protection;

(b) The proposed chemical does not have a current department aquatic chemical fact sheet;

(c) The department determines the proposed treatment will not provide nuisance relief, or will place unreasonable restrictions on existing water uses;

(d) The department determines the proposed treatment will result in a hazard to humans, animals or other nontarget organisms;

(e) The department determines the proposed treatment will result in a significant adverse effect on the body of water;

(f) The proposed chemical application is for waters beyond 150 feet from shore except where approval is given by the department to maintain navigation channels, piers or other facilities used by organizations or the public including commercial facilities;

(g) The proposed chemical applications, other than those conducted by the department pursuant to ss. 29.421 and 29.424, Stats., will significantly injure fish, fish eggs, fish larvae, essential fish food organisms or wildlife, either directly or through habitat destruction;

(h) The proposed chemical application is in a location known to have endangered or threatened species as specified pursuant to s. 29.604, Stats., and as determined by the department;

(i) The proposed chemical application is in locations identified by the department as sensitive areas, except when the applicant demonstrates to the satisfaction of the department that treatments can be conducted in a manner that will not alter the ecological character or reduce the ecological value of the area.

1. 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.

2. The department shall notify any affected property owners' association, inland lake district, and riparian property owner of locations identified as sensitive areas.

(4) New applications will be reviewed with consideration given to the cumulative effect of applications already approved for the body of water.

(5) The department may approve the application in whole or in part consistent with the provisions of subs. (3) (a) through (i) and (4). Denials shall be in writing stating reasons for the denial.

(6) Permits may be issued for one treatment season only.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; **corrections in (3) (g) and (h) made under s. 13.93 (2m) (b) 7., Stats., Register, December, 2000, No. 540.**

NR 107.06 Chemical fact sheets. (1) The department shall develop a chemical fact sheet for each of the chemicals in present use for aquatic nuisance control in Wisconsin.

(1m) Chemical fact sheets for chemicals not previously used in Wisconsin shall be developed within 180 days after the department has received notice of intended use of the chemical.

(2) The applicant or permit holder shall provide copies of the applicable chemical fact sheets to any affected property owners' association and inland lake district.

(3) The department shall make chemical fact sheets available upon request.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 107.07 Supervision. (1) The permit holder shall notify the district office 4 working days in advance of each anticipated treatment with the date, time, location, and proposed size of treatment. At the discretion of the department, the advance notification requirement may be waived.

(2) Supervision by a department representative may be required for any aquatic nuisance control project involving chemicals. Supervision may include inspection of the proposed treatment area, chemicals, and application equipment before, during or after treatment. The inspection may result in the determination that treatment is unnecessary or unwarranted in all or part of the proposed area, or that the equipment will not control the proper dosage.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 107.08 Conditions of the permit. (1) The department may stop or limit the application of chemicals to a body of water if at any time it determines that chemical treatment will be ineffective, or will result in unreasonable restrictions on current water uses, or will produce unnecessary adverse side effects on nontarget organisms. Upon request, the department shall state the reason for such action in writing to the applicant.

(2) Chemical treatments shall be performed in accordance with label directions, existing pesticide use laws, and permit conditions.

(3) Chemical applications on lakes and impoundments are limited to waters along developed shoreline including public parks except where approval is given by the department for projects of public benefit.

(4) Treatment of areas containing high value species of aquatic plants shall be done in a manner which will not result in adverse long–term or permanent changes to a plant community in a specific aquatic ecosystem. High value species are individual species of aquatic plants known to offer important values in spe-

cific aquatic ecosystems, including *Potamogeton amplifolius, Potamogeton Richardsonii, Potamogeton praelongus, Potamogeton pectinatus, Potamogeton illinoensis, Potamogeton robbinsii, Eleocharis spp., Scirpus spp., Valisneria spp., Zizania aquatica, Zannichellia palustris* and *Brasenia schreberi.*

(5) Treatment shall be performed by an applicator currently certified by the Wisconsin department of agriculture, trade and consumer protection in the aquatic nuisance control category whenever:

(a) Treatment is to be performed for compensation by an applicator acting as an independent contractor for hire;

(b) The area to be treated is greater than 0.25 acres;

(c) The product to be used is classified as a "restricted use pesticide"; or

(d) Liquid chemicals are to be used.

(6) Power equipment used to apply liquid chemicals shall include the following:

(a) Containers used to mix and hold chemicals shall be constructed of watertight materials and be of sufficient size and strength to safely contain the chemical. Measuring containers and scales for the purpose of measuring solids and liquids shall be provided by the applicator;

(b) Suction hose used to deliver the chemical to the pump venturi assembly shall be fitted with an on–off ball–type valve. The system shall also be designed to prevent clogging from chemicals and aquatic vegetation;

(c) Suction hose used to deliver surface water to the pump shall be fitted with a check valve to prevent back siphoning into the surface water should the pump stop;

(d) Suction hose used to deliver a premixed solution shall be fitted with an on–off ball–type valve to regulate the discharge rate;

(e) Pressure hose used to discharge chemicals to the surface water shall be provided with an on–off ball–type valve. This valve will be fitted at the base of the hose nozzle or as part of the nozzle assembly;

(f) All pressure and suction hoses and mechanical fittings shall be watertight;

(g) Equipment shall be calibrated by the applicator. Evidence of calibration shall be provided at the request of the department supervisor.

(h) Other equipment designs may be acceptable if capable of equivalent performance.

(7) The permit holder shall be responsible for posting those areas of use in accordance with water use restrictions stated on the chemical label, but in all cases for a minimum of one day, and with the following conditions:

(a) Posting signs shall be brilliant yellow and conspicuous to the nonriparian public intending to use the treated water from both the water and shore, and shall state applicable label water use restrictions of the chemical being used, the name of the chemical and date of treatment. For tank mixes, the label requirements of the most restrictive chemical will be posted;

(b) Minimum sign dimensions used for posting shall be 11 inches by 11 inches or consistent with s. ATCP 29.15. The department will provide up to 6 signs to meet posting requirements. Additional signs may be purchased from the department;

(c) Signs shall be posted at the beginning of each treatment by the permit holder or representing agent. Posting prior to treatment may be required as a permit condition when the department determines that such posting is in the best interest of the public;

(d) Posting signs shall be placed along contiguous treated shoreline and at strategic locations to adequately inform the public. Posting of untreated shoreline located adjacent to treated shoreline and noncontiguous shoreline shall be at the discretion of the department;

(e) Posting signs shall be made of durable material to remain up and legible for the time period stated on the pesticide label for water use restrictions, after which the permit holder or representing agent is responsible for sign removal.

(8) After conducting a treatment, the permit holder shall complete and submit within 30 days an aquatic nuisance control report on a form supplied by the department. Required information will include the quantity and type of chemical, and the specific size and location of each treatment area. In the event of any unusual circumstances associated with a treatment, or at the request of the department, the report shall be provided immediately. If treatment did not occur, the form shall be submitted with appropriate comment by October 1.

(9) Failure to comply with the conditions of the permit may result in cancellation of the permit and loss of permit privileges for the subsequent treatment season. A notice of cancellation or loss of permit privileges shall be provided by the department to the permit holder accompanied by a statement of appeal rights.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89**;** correction in (7) (b) made under s. 13.93 (2m) (b) 7., Stats., Register, September, 1995, No. 477.

NR 107.09 Special limitation. Due to the significant risk of environmental damage from copper accumulation in sediments, swimmer's itch treatments performed with copper sulfate products at a rate greater than 10 pounds of copper sulfate per acre are prohibited.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 107.10 Field evaluation use permits. When a chemical product is considered for aquatic nuisance control and does not have a federal label for such use, the applicant shall apply to the administrator of the United States environmental protection agency for an experimental use permit under section 5 of the federal insecticide, fungicide and rodenticide act as amended (7 USC 136 et seq.). Upon receiving a permit, the permit holder shall obtain a field evaluation use permit from the department and be subject to the requirements of this chapter. Department field evaluation use permits shall be issued for the purpose of evaluating product effectiveness and safety under field conditions and will require in addition to the conditions of the permit specified in s. NR 107.08 (1) through (9), the following:

(1) Treatment shall be limited to an area specified by the department.

(2) The permit holder shall submit to the department a summary of treatment results at the end of the treatment season. The summary shall include:

(a) Total chemical used and distribution pattern, including chemical trade name, formulation, percent active ingredient, and dosage rate in the treated water in parts per million of active ingredient;

(b) Description of treatment areas including the character and the extent of the nuisance present;

(c) Effectiveness of the application and when applicable, a summary comparison of the results obtained from past experiments using the same chemical formulation;

(d) Other pertinent information required by the department; and

(e) Conclusions and recommendations for future use.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 107.11 Exemptions. (1) Under any of the following conditions, the permit application fee in s. NR 107.04 (2) (a) will be limited to the basic application fee:

(a) The treatment is made for the control of bacteria on swimming beaches with chlorine or chlorinated lime;

(b) The treatment is intended to control algae or other aquatic nuisances that interfere with the use of the water for potable purposes;

(c) The treatment is necessary for the protection of public health, such as the control of disease carrying organisms in sanitary sewers, storm sewers, or marshes, and the treatment is sponsored by a governmental agency.

(2) The treatment of purple loosestrife is exempt from ss. NR 107.04 (2) (a) and (3), and 107.08 (5).

(3) The use of chemicals in private ponds is exempt from the provisions of this chapter except for ss. NR 107.04 (1), (2), (4) and (5), 107.05, 107.07, 107.08 (1), (2), (8) and (9), and 107.10.

(a) A private pond is a body of water located entirely on the land of an applicant, with no surface water discharge or a discharge that can be controlled to prevent chemical loss, and without access by the public.

(b) The permit application fee will be limited to the non–refundable $20 application fee.

(4) The use of chemicals in accordance with label instructions is exempt from the provisions of this chapter, when used in:

(a) Water tanks used for potable water supplies;

(b) Swimming pools;

(c) Treatment of public or private wells;

(d) Private fish hatcheries licensed under s. 95.60, Stats.;

(e) Treatment of emergent vegetation in drainage ditches or rights–of–way where the department determines that fish and wildlife resources are insignificant; or

(f) Waste treatment facilities which have received s. 281.41, Stats., plan approval or are utilized to meet effluent limitations set forth in permits issued under s. 283.31, Stats.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; **corrections in (4) (d) and (f) made under s. 13.93 (2m) (b) 7., Stats., Register, December, 2000, No. 540.**

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 30.715, 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.

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 E – PLAN REVIEW COMMENTS AND EDITS

WLPR comments / edits in BLUE. Change applied with no comment necessary if listed as "X"

Kevin Gauthier & Scott Van Egeren – WDNR lake management comments/questions:

1. Page 2.3 – How does lake level influence the goal to reduce threat of low DO or the proposed action, if at all? Lake level should have no impact on threat of low DO. Past water levels have fluctuated from high to low and have experience winter kill at all. Biggest impact is winter severity. No action taken in plan.
2. Page 3.6 – January 25, 2017 meeting was with "Bill" (not "Dill") Sturtevant. X
3. Pg. 5.12 – I know that nearby Long and Fay Lake have very abundant populations of southern naiad (*N. guadalupensis*). I am wondering if there is a possibility that the slender naiad is a typo or mistaken id for southern naiad? It's possible, but am leaving it as N. flexilis – growth wise it was dissimilar from my experience with *N. guadalupensis* – much more compact, smaller plants.
4. p. 5.13 and Figure 2 (Halsey Figures): wild rice present – already in writeup & on map
5. Emergent species list very different 2002 to 2015. Surprising? Maybe shorelands need to be examined?
    - I wouldn't say any surprise from my end. The 2002 data was simply a list of plants observed during a shoreline survey from Laura Herman – likely got in closer than we did for the PI. Softstem from 2002 likely was hardstem.

    b. Submersed species list not as different except for dominance of *Najas flexilis* in 2015, compared to 2002. No comment – najas not noted in 2002

6. p. 5.13 "However, this does not indicate a depressed or poor aquatic plant community. Many areas of Halsey Lake have a soupy sediment which is poor rooting substrate, limiting the species that are able to grow in those conditions. Instead the aquatic plant community of Halsey Lake should be considered healthy and representative of the conditions present for aquatic plant growth."

    a. That the low number of species does not indicate a depressed or poor plant community is an opinion. I agree it ***might*** not be a human-caused depressed plant community, but that is not known. Since there was substantial change in species composition from 2002 to 2015, it is possible these changes were due to human impacts. The two surveys ('02 & '15) were completed as two different types and for two different reasons: '02 as a visual presence/absence to look for AIS and to create a general list with '15 using the PI system as a complete survey. A substantial change between the two is also an opinion & hard to quantify – I personally wouldn't say the change was substantial. Communities adapt to the ecosystem they develop in and, I feel, that found in Halsey is adapted to the conditions present. No change applied.

    b. The most common species in 2015 was *Najas flexilis*, but this species was not found in 2002. This is an annual species, commonly considered a pioneer species, and often showing up following a disturbance. It is possible the lake suffered a disturbance, leading to a different species composition, including being dominated by *Najas*. It's possible that Najas was present in 2002, or any time before or after that date as well. But, with the different survey techniques, this is again hard to quantify. No change applied.

    c. p.5.13 "Much of the sediment was comprised of a soupy muck and marl mixture, which provides poor rooting for aquatic vegetation." X

    d. Lake Halsey characteristics include: 1. a "soupy" and "marly" substrate not being conducive to plant rooting 2. a big change in the plant community from 2002 to 2015, with current dominance by a pioneer species, *Najas flexilis*, and 3. a low species diversity. Together, these characteristics suggest the plant community is likely unstable, and possibly the entire aquatic plant community is precarious. This lake may be especially vulnerable to flipping from an aquatic plant-dominated system to an algae-dominated system (commonly considered a "regime shift" (Carpenter 2003). Since the entire lake is littoral (average depth 2' and judging from the distribution of *Najas*), I think the lake association should consider slow-no-wake rulings, and other accommodations to carefully protect the plant community.

    Slow-no-wake option noted and included on pg 8.32 Again, a big change from 2002 to 2015 is subjective and cannot be quantified. Natural impact from wind would still be present.

7. Pg. 5.14 – first paragraph – Only the average coefficient of conservatism, but not the FQI is above the average for all Wisconsin lakes. X
8. Pg. 6.18 – Where is the water quality table from? Please include a citation with the table. It isn't critical for this plan, but if it is easy I would suggest using the similar table from the DNR WisCALM document (on pg. 18). Please use WisCALM for future plans as the table from WisCALM has already placed current phosphorus values in lakes in the context of historical phosphorus values (for that type of lake). The most recent version of WisCALM can be found here: http://dnr.wi.gov/topic/surfacewater/assessments.html
Citation noted & added.
9. Pg. 6.24 – first paragraph – The phosphorus export coefficient for the lake area (Halsey Lake in Table 8) does not indicate internal loading, but mostly atmospheric deposition onto the surface of the lake from dirt, leaves, etc. This doesn't mean that there couldn't be some internal loading occurring from a number of sources, but the P export coefficient isn't meant to signify recycling of in-lake phosphorus. Updated as noted here.
10. Pg. 6.26 – the phosphorus export coefficient (from WiLMs) for forest land cover is essentially equal to the groundwater that would flow from a forested landscape into a nearby waterbody. The additional deposits from the forest that are discussed in the second paragraph would be covered in the Halsey Lake portion of the watershed that is discussed in the comment above. X- noted & addressed in comment 9 above.
11. Page 7.27, 8.29 (and throughout) – Volume units should be acre-feet (ac-ft) not acre per foot (ac/ft). X
12. Figure 5 – What elevations do the red and yellow contours correspond to? -1 (red) and -1.5 below current water level elevation of 1499 ASML. – added to report, page 7.27
13. Page 7.27 – Can I interpret that the 8-inch square log was impounding ~6 inches of water even though water was flowing around and beneath it at the time of the survey?I Yes, this is about right. Noted on 7.27.
14. Page 7.27 – What is the benchmark description, location and elevation used to collect survey data at outlet? Lake elevation as listed on WDNR topography data & noted below table 11.
15. Page 7.28 – The plan states that the DNR was to issue an order to remove the unauthorized structure; no order has been issued to date. No order is needed for the property owner to remove the log from the outlet stream located through his property. No change applied – information listed was as given during the 2/6/17 meeting.
16. Page 7.28 – The plan states that changes in lake elevation upon removal are unknown. I agree with this statement; in short, one could estimate that the lake level could be lower by 0-8 inches and would depend on the current water level and natural fluctuations. Given the amount of forest and wetland in the watershed, combined with interannual precipitation variability, it would be difficult for an engineering model to precisely and accurately predict how water levels would fluctuate or the effect with the unauthorized structure removed. Noted – no changes necessary.
17. Page 8.29 – Remove extra period at the end of the second to last paragraph. X
18. Page 8.31 – Add period after first sentence in second paragraph. X
19. Page 8.31 – While no active action for water level control is recommended by the plan, the 8-inch log still needs to be removed or authorized. Many of the additional comments in Appendix A support the presence of a water control structure. The plan should include text to state that if a water control structure is proposed a permit application including supporting information (engineering documentation, flowage easements from all riparian owners, etc.) should be submitted to the DNR by the property owner and Lake Association for review. Updated as noted above.
20. Pg. 8.32 – last paragraph, second sentence – Much of the watershed is not in agricultural use. Removed
21. Pg. 9.35 – last paragraph – Please include citations of studies that show that Imazamox has a lower impact to native plant community and shows increased control the year after treatment than endothall. These could be case studies, but it would be best to at least cite this information. Based on personal projects – removed.
22. Pg. 9.36 – first paragraph – I would suggest switching the third sentence to say that the endothall herbicide label recommends higher concentrations (>1.5 ppm) for effective treatment of smaller areas, but that the manufacturer doesn't recommend treating areas less than five acres in size due to rapid herbicide movement off-site. Changed to indicate >1.5 PPM, left out comment on treating area <5.0 ac in size as this is not listed on the label and highly subject to many different in-field variables such as total lake size, treatment area location, etc.

Greg Matzke – WDNR Fishery comments:

1. In section 4.1, There was a major winterkill in 2013-14 which had major impacts to a number of fish species present. Updated to include
2. In the section with fish management recommendations under walleye: The WDNR has been stocking Halsey at a rate of 5 large fingerling walleye on an every other year basis, so the benchmark for success should be 1.25 adult walleye per acre. Updated to include
3. In regards to aeration: Fisheries fully support an aeration system for Halsey Lake. Without an aeration system creating a refuge it will be extremely hard to manage the lake for more than yellow perch and northern pike, as

winterkill events can potentially eliminate entire populations of many fish species (as was seen during the 2013-14 winterkill). The areas suitable for an aeration system in this report are accurate. Added to section 8.1, pg 8.29

4. Pg. 8.30 – The most important element of an aeration system (for the purpose it is being proposed) is to keep the area of open water. Although smaller bubbles may provide somewhat more oxygen to the water, than larger bubbles, this difference is likely small compared to the amount of oxygen that could be provided by an open water area of one acre. Noted & updated to include open water comment.
5. Another fishery/aeration comment/question - The fisheries professionals should assess the risks and benefits of the aeration proposal, though two winterkill years in the last 30-40 years seems like a low risk. However, it would be nice to see an assessment of how aeration in such a flocculent lake would change other lake variables (clarity, nutrient availability). Maybe there will be little impact since the aeration will be in winter, but a comparison with similar lakes would be helpful. Taken into consideration, but no edits directly applied to the plan.

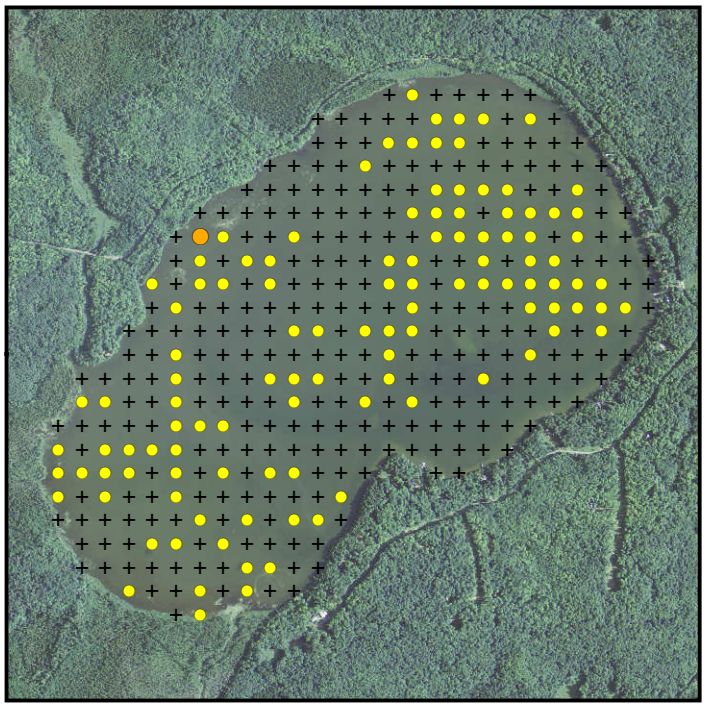
Jordan Petchenik – WDNR social sciences questionnaire comments

My primary observation/concern is with the reporting that total responses to the survey was 48. That number is meaningless without context. While they cannot provide context regarding the online opportunity for input, they can provide context for how many HLA members and how many waterfront residents received the questionnaire. If 48 returns is lower than 60%, they need to acknowledge the limitations of the data – that the results may not reflect the opinions of nor the behavior of those populations. And if 48 returns is *really low*, then they should acknowledge what more they could have done to encourage participation.

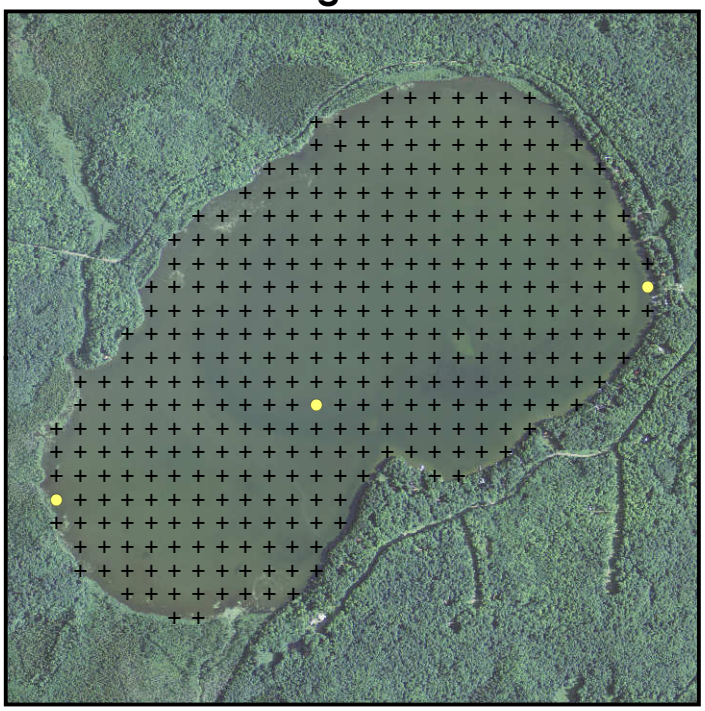
Added that survey was mailed to 67 property owners along Halsey Lake. Going by results, 40 of 48 respondents were property owners (seasonal or full-time), giving a return rate of 60% for riparian owners (40/67).

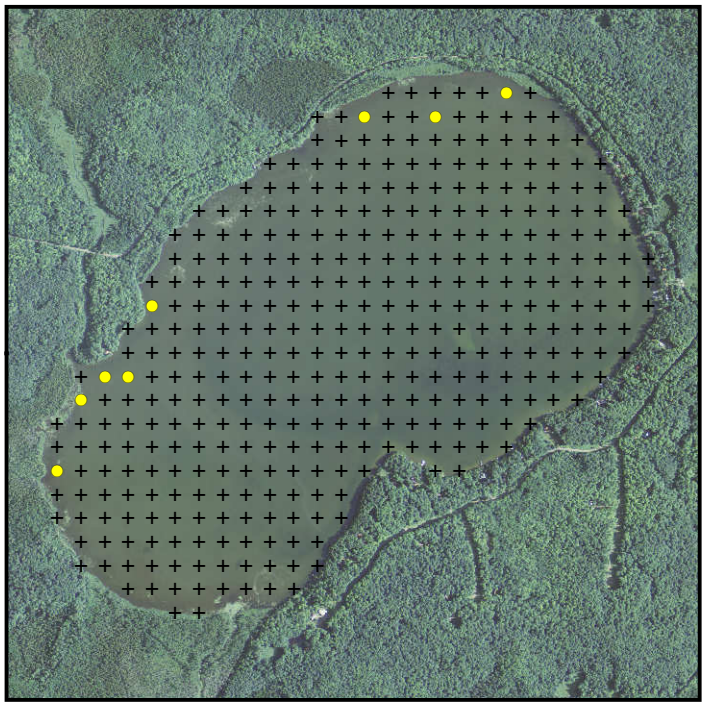
FIGURES

Slender Naiad



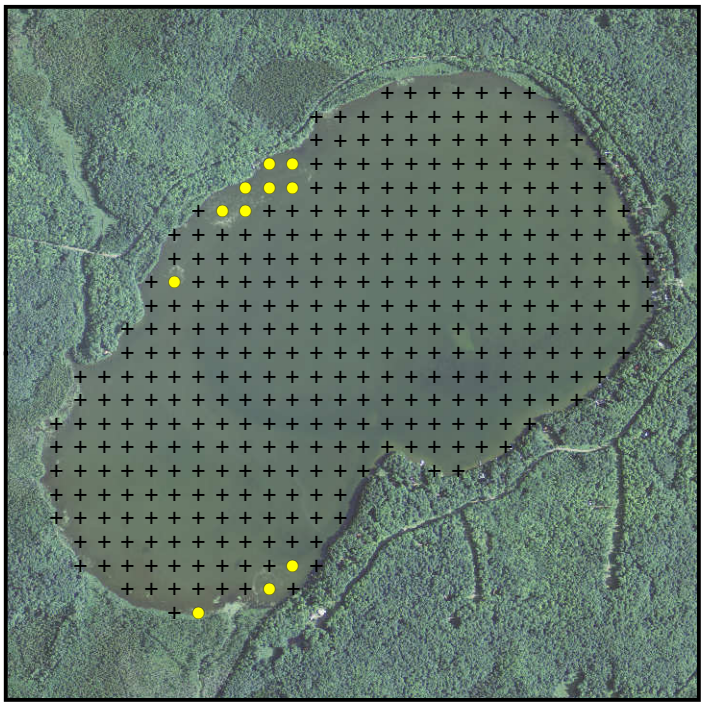
Muskgrass

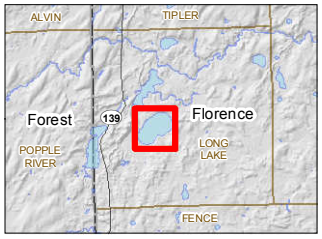




White Water Lily

Watershield





Legend

- \+ GPS Sample Points*
- Fullness Rating 1
- Fullness Rating 2

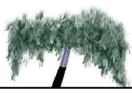
Fullness Rating	Coverage	Description
1		Few plants. There are not enough plants to entirely cover the length of the rake head in a single layer.
2		There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover tines.
3		The rake is completely covered and tines are not visible.

Figure No.
1.1

Title
2015 Point-Intercept Survey
Halsey Lake

Client/Project
Halsey Lake Association
Lake Management

Project Location
T. of Long Lake,
Florence Co., WI

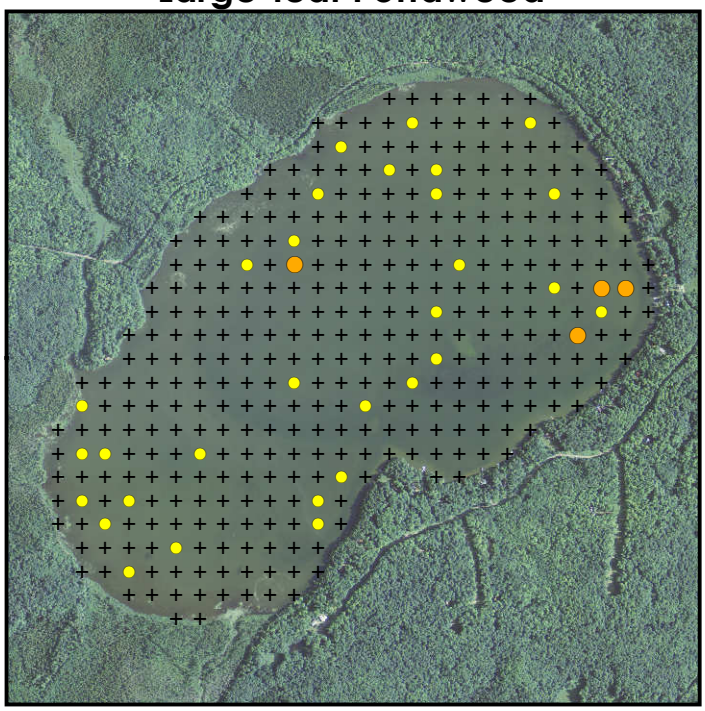
0 1,000 2,000 Feet
1:24,000 (at original document size of 8.5x11)

N

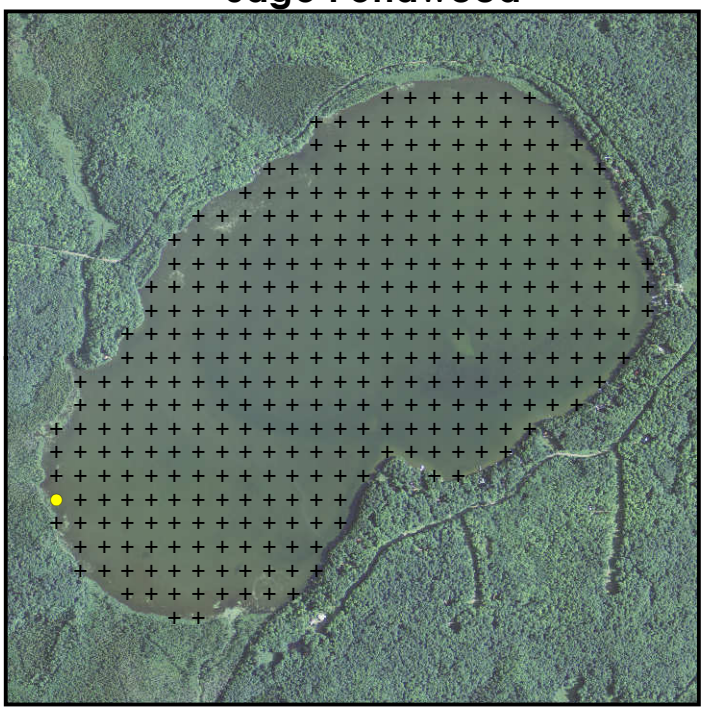
Notes
1. Coordinate System: NAD 1983 StatePlane Wisconsin North FIPS 4801 Feet
2. Data Sources Include: Stantec, WDNR, WDOT
3. Orthophotography: 2013 NAIP

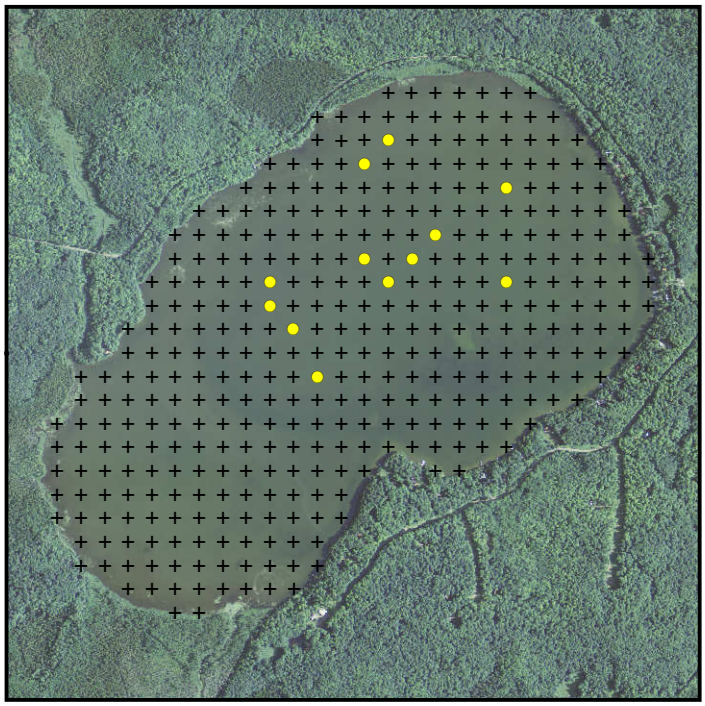
*Survey completed on 09/01/2015

Large-leaf Pondweed

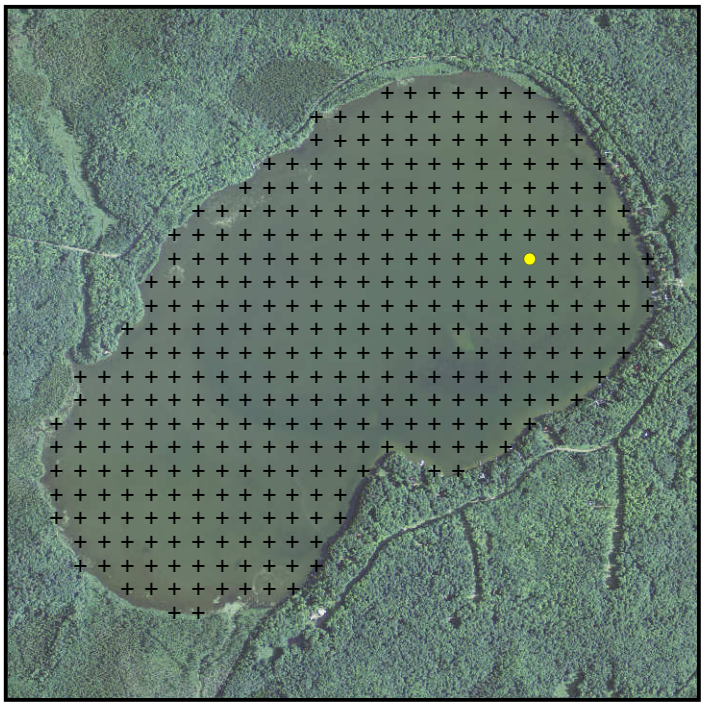


Sago Pondweed

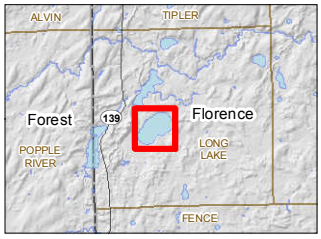




Variable Pondweed



Illinois Pondweed

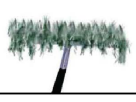


Notes

1. Coordinate System: NAD 1983 StatePlane Wisconsin North FIPS 4801 Feet
2. Data Sources Include: Stantec, WDNR, WDOT
3. Orthophotography: 2013 NAIP

Legend

- \+ GPS Sample Points*
- Fullness Rating 1
- Fullness Rating 2

Fullness Rating	Coverage	Description
1		Few plants. There are not enough plants to entirely cover the length of the rake head in a single layer.
2		There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover tines.
3		The rake is completely covered and tines are not visible.

*Survey completed on 09/01/2015

Figure No.
1.2

Title
2015 Point-Intercept Survey
Halsey Lake

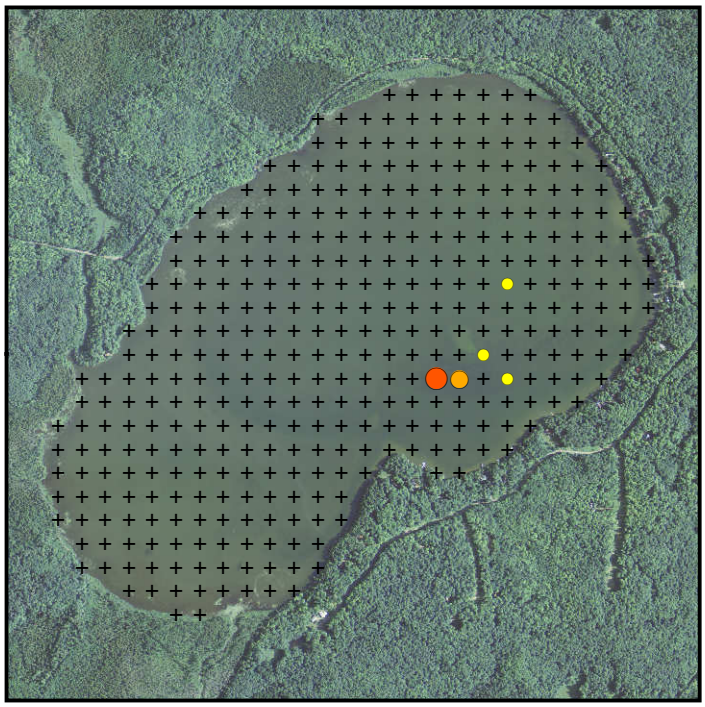
Client/Project
Halsey Lake Association
Lake Management

Project Location
T. of Long Lake,
Florence Co., WI

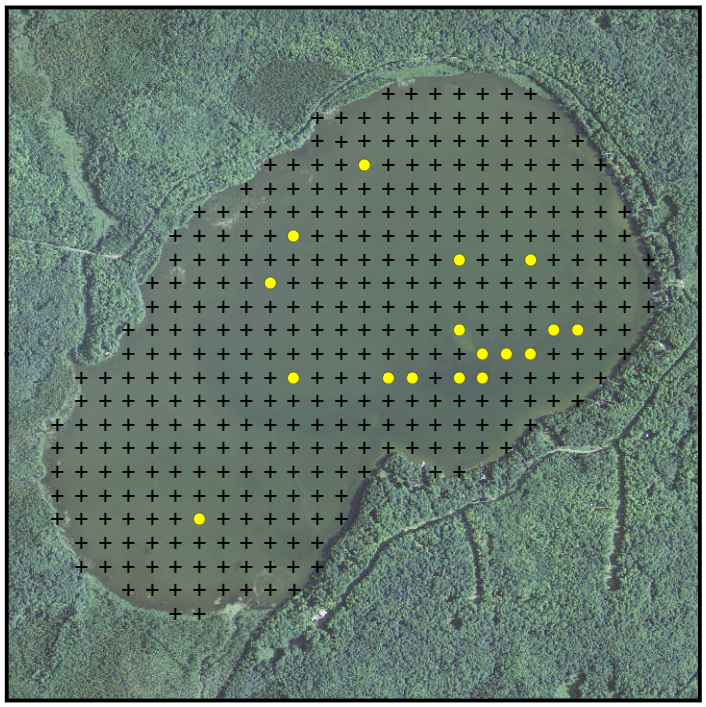
0 1,000 2,000 Feet
1:24,000 (at original document size of 8.5x11)

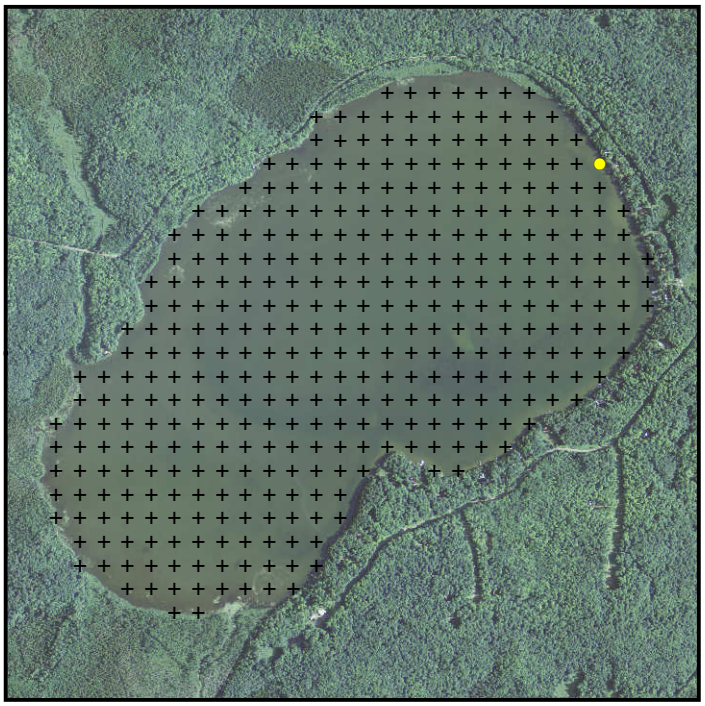
N

Flat Stem Pondweed

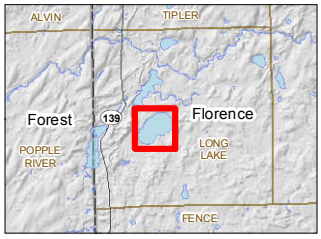


Northern Water-Milfoil





Hardstem Bulrush



Notes

1. Coordinate System: NAD 1983 StatePlane Wisconsin North FIPS 4801 Feet
2. Data Sources Include: Stantec, WDNR, WDOT
3. Orthophotography: 2013 NAIP

Legend

- \+ GPS Sample Points*
- Fullness Rating 1
- Fullness Rating 2
- Fullness Rating 3

Fullness Rating	Coverage	Description
1		Few plants. There are not enough plants to entirely cover the length of the rake head in a single layer.
2		There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover tines.
3		The rake is completely covered and tines are not visible.

*Survey completed on 09/01/2015

Figure No.
1.3

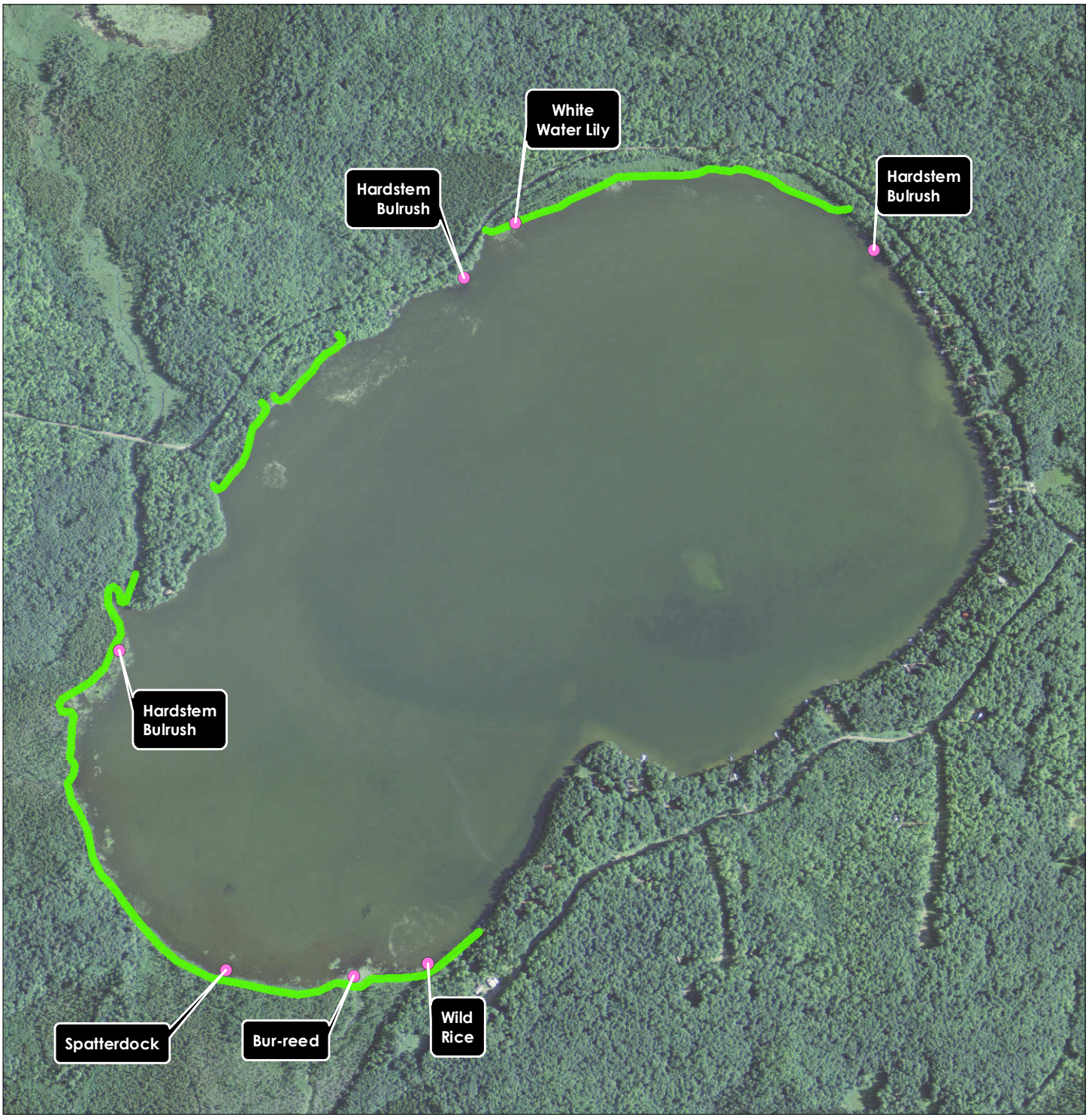
Title
2015 Point-Intercept Survey
Halsey Lake

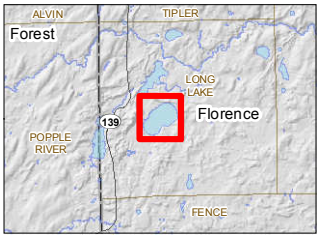
Client/Project
Halsey Lake Association
Lake Management

Project Location
T. of Long Lake,
Florence Co., WI

0 1,000 2,000 Feet
1:24,000 (at original document size of 8.5x11)

N





Notes

1. Coordinate System: NAD 1983 StatePlane Wisconsin North FIPS 4801 Feet
2. Data Sources Include: Stantec, WDNR, WDOT
3. Orthophotography: 2013 NAIP

Legend

- Special Veg Points
- Shoreline Wetland Habitat

Species Observed	
Sweet Gale	Curlydock
Marsh Milkweed	Broad-leaved Cattail
Tussock Sedge	Lake Sedge
Canada Bluejoint	Tag Alder
Button Cotton Grass	Black Spruce
Northern Blue-flag Iris	White Cedar

Figure No.
2

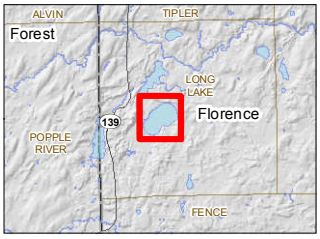
Title
Halsey Lake
Shoreline Wetland Assessment

Client/Project
Halsey Lake Association
Lake Management

Project Location
T. of Long Lake,
Florence Co., WI

0 500 1,000 Feet
1:12,000 (at original document size of 8.5x11)

N



Legend

- Sensitive Area 1
- Sensitive Area 2

Figure No.
3

Title
Halsey Lake
Potential Sensitive Areas

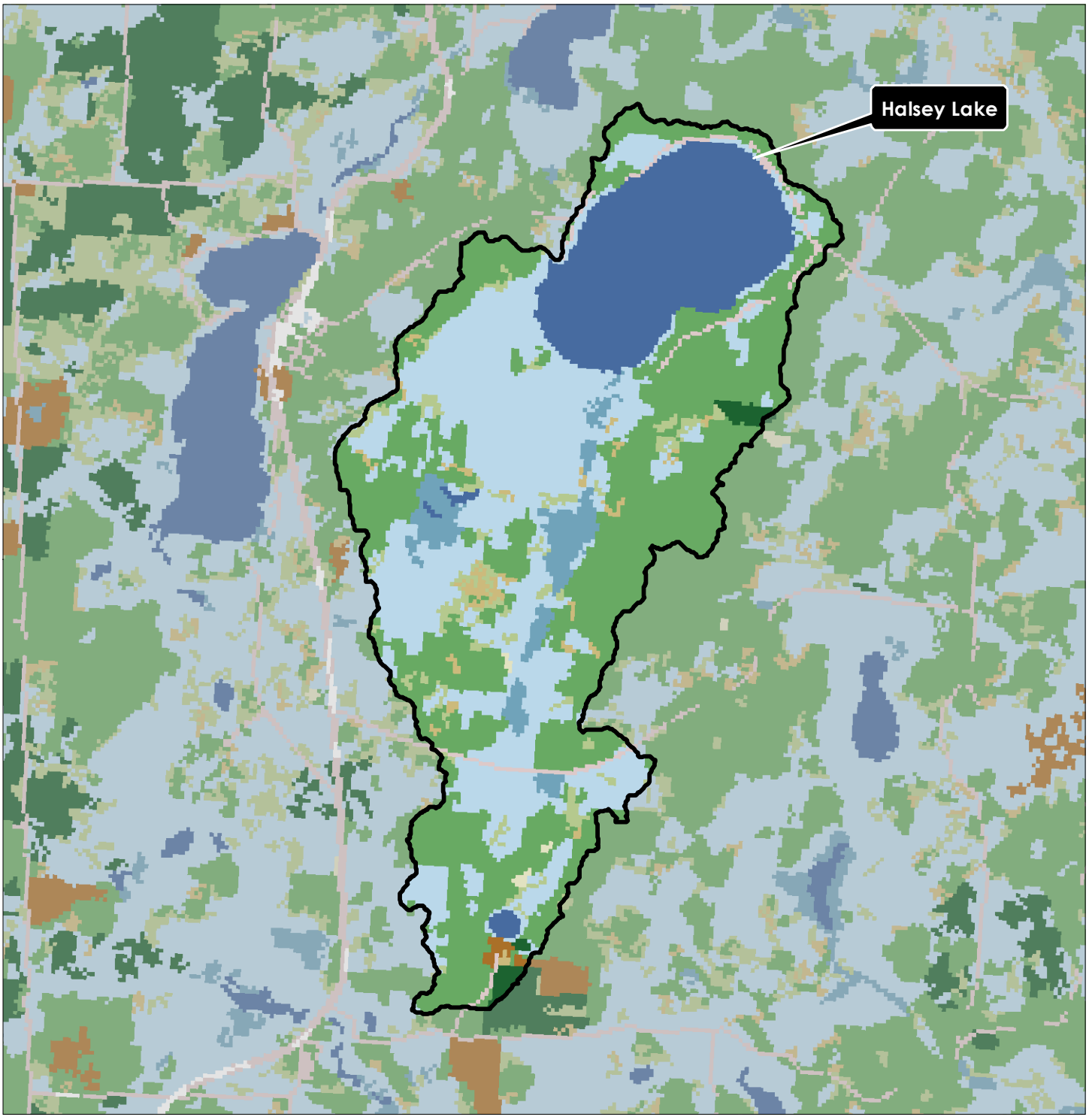
Client/Project
Halsey Lake Association
Lake Management

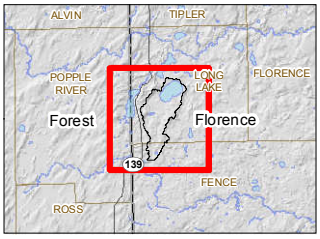
Project Location
T. of Long Lake,
Florence Co., WI

0 500 1,000 Feet
1:12,000 (at original document size of 8.5x11)

N

Notes
1. Coordinate System: NAD 1983 StatePlane Wisconsin North FIPS 4801 Feet
2. Data Sources Include: Stantec, WDNR, WDOT
3. Orthophotography: 2013 NAIP





Notes

1. Coordinate System: NAD 1983 StatePlane Wisconsin North FIPS 4801 Feet
2. Data Sources Include: Stantec, WDNR, WDOT, NLCD
3. Background: NLCD 2011

Legend

- Watershed

NLCD 2011

- Woody Wetlands (1070.03 ac)
- Shrub/ Scrub (43.23 ac)
- Open Water (538.42 ac)
- Mixed Forest (106.39 ac)
- Herbaceuous (6.00 ac)
- Evergreen Forest (28.12 ac)
- Emergent Herbaceous Wetlands (130.32 ac)
- Developed, Open Space (45.85ac)
- Deciduous Forest (1,274.32 ac)
- Cultivated Crops (9.08 ac)

Figure No.
4

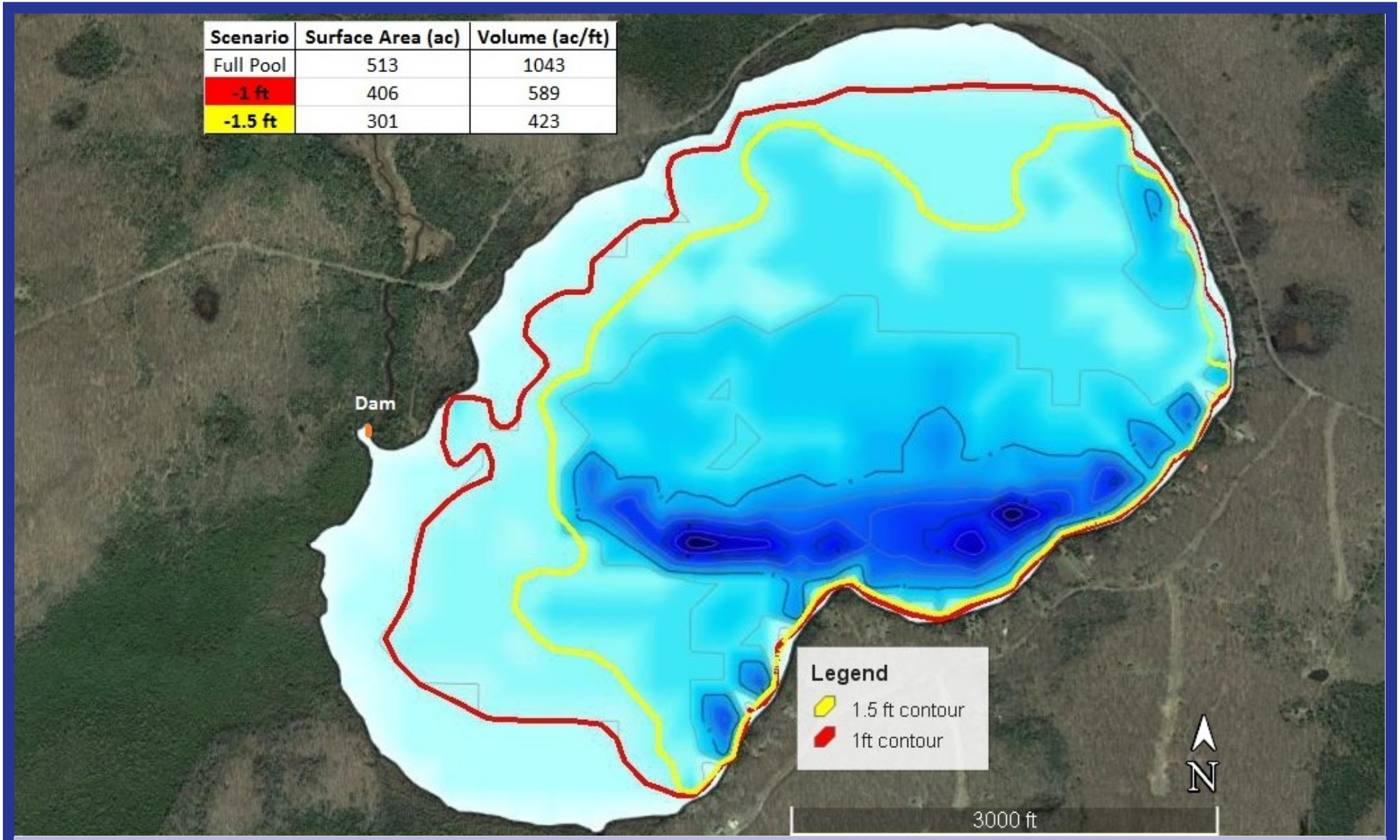
Title
Halsey Lake
National Land Cover Dataset

Client/Project
Halsey Lake Association
Lake Management

Project Location
T. of Long Lake,
Florence Co., WI

0 1,800 3,600 Feet
1:43,200 (at original document size of 8.5x11)

N



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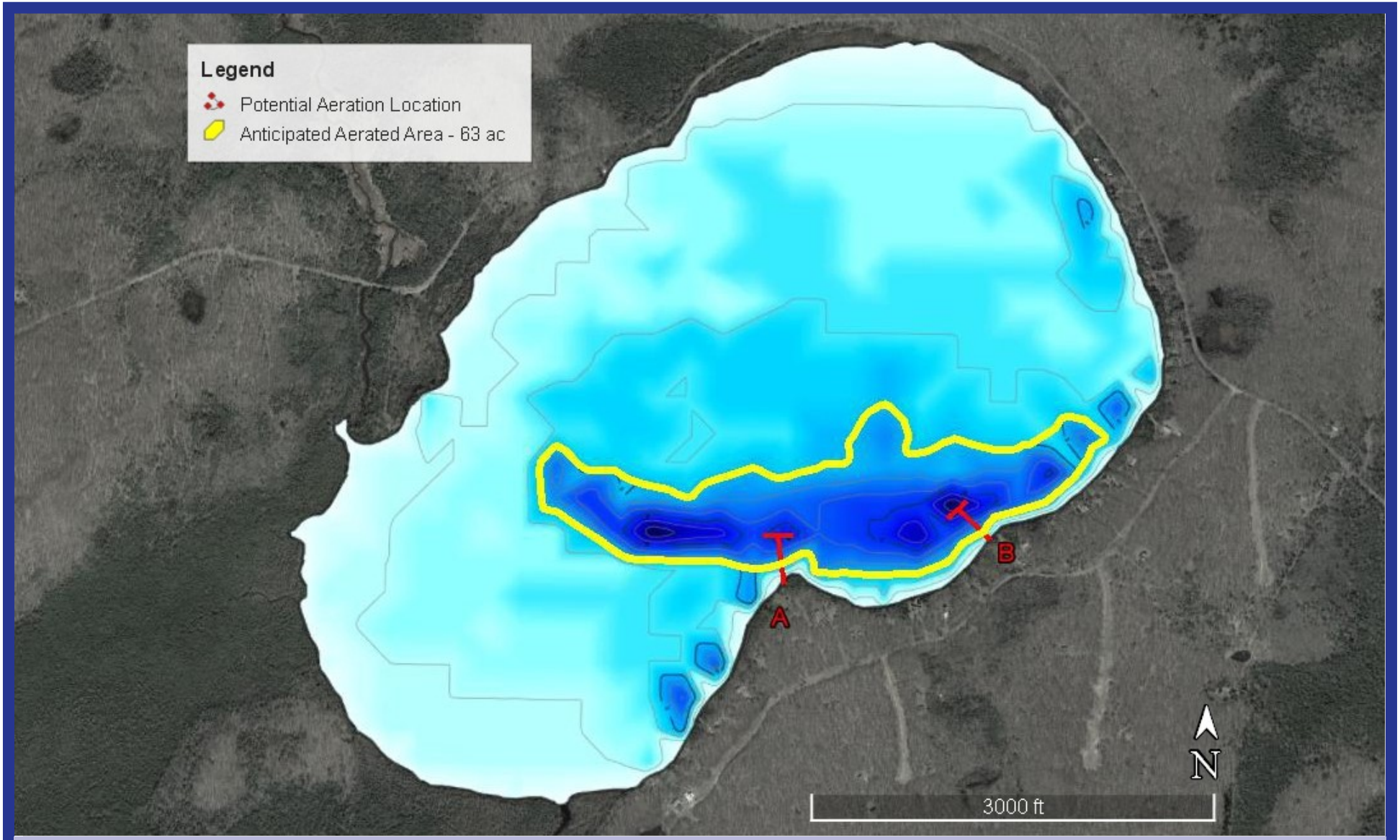
www.WisconsinLPR.com (920) 872-2032

Bathymetry and Water Level Comparison

Halsey Lake, Florence County

Based on 2016 Point-Intercept Depth data

Figure 5



Potential Aeration System Area and Locations

Halsey Lake, Florence County

Bathymetry Based on 2016 Point-Intercept Depth data

Figure 6

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