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Silver Lake - Aquatic Plant Management Plan

Silver Lake Management District

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Executive Summary

Silver Lake is a natural drainage lake in Kenosha County that provides numerous recreational opportunities for a wide spectrum of users. Being a popular local destination and being within an area which has plentiful lakes and near high population centers, Silver Lake draws a wide array of users from throughout southern Wisconsin and northern Illinois. Some use patterns may be detrimental to the overall health of the lake and bring a higher risk of the introduction of new aquatic invasive species (AIS).

The aquatic plant community in Silver Lake is very diverse, but plants can grow in dense clusters in some locations. Dense aquatic plant growth can impact lake users and hamper navigation, which can be made worse by the presence of AIS. There are multiple AIS present within Silver Lake, including one animal species (zebra mussel). For purposes of this plan, the focus is on invasive aquatic vegetation. Hybrid Eurasian water-milfoil (*Myriophyllum spicatum x sibiricum* – HWM), curly-leaf pondweed (*Potamogeton crispus* – CLP), purple loosestrife (*Lythrum salicaria*), and starry stonewort (*Nitellopsis obtusa*) have been verified as present and are the non-native species of primary concern. Purple loosestrife has had minimal to no impact on Silver Lake. Starry stonewort, a non-native macroalgae, was first identified in Silver Lake during the 2023 aquatic plant survey as part of this plan update.

Spiny naiad (*Najas mariana*) is also present and listed as a potential non-native species. However, spiny naiad is native to the United States, commonly found in nearby waters, and does not pose a known threat to Wisconsin waterbodies. For purposes of this plan, spiny naiad is considered naturalized and non-invasive.

Containing the spread of AIS, managing excessive and dense aquatic plant growth, and maintaining a quality fishery are the main issues of concerns for lake users. The dense aquatic plant growth, primarily HWM, hampers navigation within the lake, limits enjoyment, and causes increased expenditure on actions to alleviate them. Past management has focused on aquatic plant control through targeted chemical treatments of varying size and active ingredients. Continuing to stay ahead of potential issues has caused the need for understanding of what is happening and why. Development of an updated management plan for better management of the lake was needed.

This management plan provides a multi-faceted approach to address issues and recommends management options based on best fit, cost, feasibility, and desires based on direct input from the lake user survey. Many aquatic plant 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 will begin to yield positive results. The basic plan is based on exploration of new aquatic plant management techniques with expanded actions for AIS control, overall aquatic plant community control, and protection of the lake's value to all users. Some of these actions potentially include harvesting, herbicide applications, protection of ecologically sensitive areas, and AIS and boat launch monitoring. It would be recommended the group start with a specific project component or area of the lake to gain early and immediate success and build from that for future projects.

1.0 INTRODUCTION

Silver Lake is natural drainage lake located in the Village of Salem Lakes in south central Kenosha County. Lake data from the WDNR lists the lake at 516-acres with a mean depth of 9.3 feet and maximum of 43 feet. Water quality of Silver Lake rates as mesotrophic and moderately productive. Water clarity is good, averaging 8.8 feet, and provides numerous recreational opportunities. The Silver Lake Management District (SLMD or the District) is the primary organization responsible for management activities on Silver Lake. The SLMD is a group that supports the restoration and management of the lake with an emphasis on conservation and resource management to protect and enhance these opportunities. The District, along with its predecessor the Silver Lake Protection Association, has been active for a decade in a number of lake management activities including aquatic plant management and invasive species sampling, while supporting water quality sampling and overall protection of the lake. The District contracted with Wisconsin Lake & Pond Resource, LLC (WLPR) to develop an aquatic plant management (APM) plan for Silver Lake.

2.0 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 lakeshore residents made available to any interested lake user, and available online for 45+ days. Notification of the survey was sent out as an information postcard with a link to the online survey and an option to request a paper copy. Notification of the survey were also posted on the District's website, sent out via e-mail by the District, and made available at the public boat launch, the post office, and various local businesses with a sign and scannable QR code directly linking interested parties to the survey. In total, 173 postcards were sent to all lakeshore landowners. 99 unique survey responses were submitted with 59 of these verified to be completed by respondents on the mailing list, giving a return rate of 34%. A good portion of the remaining respondents may have been included in the original mailing, but entered "shoreline resident" without an address on the survey. 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 action by the people the lake impacts the most.

In total, 99 respondents completed the survey with a majority (77.3%) being shoreline residents – either year-round or seasonal. The remainder were offshore residents or visitors. This shows that the lake and its health is important to not only riparian owners but to nearby residents. Responses give an opportunity to investigate personal histories with Silver Lake and create an average user profile. Overall, the average user looks like this:

- 63.6% have used the lake for over 10 years
    - Average of 20.7-year history with the lake
    - Median of 15-year history with the lake
- Spend a significant portion of their time on the water, with averages of:
    - 12.6 days per month during open water
    - 4.2 days per month during ice cover
- Nearly all (92%) found their time on the water enjoyable with a variety of activities. Activities enjoyed by users are focused on a variety of different uses, including:
    - Pleasure boating (#1)

- Open water fishing (#2)
- Tubing/Wakeboarding/Water Skiing (#3)
- Swimming (#4)

Many responses indicated a decrease of enjoyment of experiences on the lake over time.

- 30.3% indicated no change
- 17.2% indicated their use has become more enjoyable.
- 52.6% indicated their use has become less enjoyable, due to:
  - Excessive aquatic plant growth
    - 50% of respondents who indicated decreased enjoyment selected this option as a cause
  - Decreased water depth
  - Increased boat traffic

The respondents' primary issues currently with Silver Lake were:

- Invasive species management (#1)
- Boating safety and enforcement (#2)
  - Many respondents indicated increased boat traffic and minimal enforcement of boating traffic and safety laws as a big concern throughout the survey. Though recommendations for boating enforcement or changes to local ordinances are outside the realm of an aquatic plant management plan, it is still important to note the concern.
- Lake levels / outlet dam (#3)

The respondents' main concerns on lake health focused on aquatic invasive species and their impact on the lake and use patterns. The primary concerns were:

- Spread of aquatic invasive species (#1)
- Excessive aquatic plant growth (#2)
  - Negatively affected lake users 78.8% at least some of their time
- Fluctuating lake levels (#3)

This plan will focus on the main two contributing factors – invasive aquatic plant growth and controlling its spread while continuing to educate the residents and lake users. Users were moderately knowledgeable about AIS and potential harm.

- 87.9% believed there are populations of AIS in Silver Lake.
  - 80.9% responded that HWM was present in Silver Lake. This shows continued knowledge of the lake by its residents and users.

- 87.9% of respondents want action to manage aquatic plants, primarily the AIS HWM. Top management options were:
  - Continue to monitor through aquatic plant surveys (#1)
  - Targeted herbicide control of AIS (#2)
  - Manual removal or hand pulling (#3)
  - No action was far and away the least preferred option

- Users chose the following elements as the most needed for this APM Plan:
  - Prevent the introduction of new AIS into Silver Lake (#1 – tie)
  - Seek grant funding for direct management efforts (#1 – tie)
  - Reduce extent and density of AIS infestation (#2)

- Identify and explore new aquatic plant management strategies

The Silver Lake APM Plan includes a review of available lake information, aquatic plant surveys, and the lake user survey 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.

A public meeting to present the initial user survey results, aquatic plant survey data, and further refine the plan outline and over goals was held on December 5, 2023. Review of the draft APM plan was submitted to the District and WDNR for comments prior to finalization. In addition, it was made available online for public comment for 21+ days. The APM plan that follows recommends specific management activities for Silver Lake based on the top management concerns indicated in the questionnaire; spread of AIS and excessive aquatic plant growth. This APM plan will help ensure not only the health of the lake but also its enjoyment by future generations of Lake users.

3.0 LAKE HISTORY & PAST MANAGEMENT

Located in southern Kenosha County in the Village of Salem Lakes, the lake has been an important fixture in the lives of resident and non-resident users. Three public landings provide excellent accessibility with parking for 25 or more vehicles with trailers. Very good water quality and recreation opportunities of Silver Lake along with its proximity to high population centers have led to times of high recreational use. Lake use has always been popular for low-intensity uses such as swimming. However, Silver Lake has seen an increasing volume of high-intensity uses such as water skiing, wakeboarding, and tubing.

Silver Lake is a biologically moderately productive lake with multiple, broad locations of dense aquatic plant growth. Most areas of dense growth are in soft-sediment areas of water depths from 4ft. to10-ft. Clear water allows the sunlight to reach the bottom in much of the lake. Expanding, dense growth of HWM has historically impacted the native plant community of Silver Lake and created a nuisance to lake use throughout a significant portion of the lake. Dense HWM growth has been a continued concern for Silver Lake and has been the driving issue for past management. Historically, lake management has been varied, and is more fully described in past management reports, including *Silver Lake 2016 Aquatic Plant Management Report* or *Silver Lake 2019 Aquatic Plant Survey Report*. An outline of Silver Lake's management is listed below:

- **Silver Lake Protection Association – 1987:** Prior to the District, the Silver Lake Protection Association was founded to protect the lake, deal with management issues, enhance the water quality fishery, and aesthetic values of Silver Lake for future generations. The SLPA was re-energized in 2011-12 due to the increased HWM population that was taking over the lake. From 2012-2022, the SLPA led efforts for lake research, planning, education, and treatment. The SLPA undertook several HWM control actions including successful applications and received multiple WDNR grants.
- **Silver Lake Management District – 2021:** A formal effort to evolve the association into a lake district was started in the summer of 2020 to further enhance lake management efforts. Broad public support for formation of a District was present among residents. The SLMD was created in August 2021, and took over the HWM treatment in 2023 from the SLPA.
- **Aquatic Plant Surveys**: The first documented, in-depth aquatic plant survey of the lake was conducted in 2006 as a whole-lake point intercept survey, identifying 29 different species. Since 2012, annual aquatic plant surveys and monitoring has been completed in the lake, most often as comprehensive, whole-lake point intercept surveys.
- **Aquatic Invasive Species Identified - 1976:** The first AIS found in Silver Lake was curly-leaf pondweed. It wasn't until 1994 that Eurasian water-milfoil was documented, which has since been confirmed as a hybrid water-milfoil in 2012. Populations of HWM have historically shown to be extremely broad and dense, requiring management up to whole-lake scale. Starry stonewort, a new AIS in Wisconsin, was identified in Silver Lake during the 2023 aquatic plant survey.
- **AIS Control Efforts:** After the discovery of EWM in 1994, control efforts have been varied in scale, action, and intensity. Management efforts over the last 10-years include the following:
    - **2013 –** Whole-lake 2,4-D application at 0.350 parts per million (PPM)
        - HWM from Silver Lake was subsequently lab tested and found to be less susceptible to 2,4-D

  - A WDNR grant was applied for and awarded in late 2013 for management of HWM from 2014-2016
- **2015 –** Whole-lake fluridone application at 2.0 – 5.0 parts per billion (PPB)
- **2016 –** small-scale hand harvesting near a public boat access site and a 1.0 acre application with a mixture of fast-acting contacts to an incoming channel near the northwest boat launch. Monitoring and surveying continued.
- **2017** – No active management for HWM, surveying and monitoring only
- **2018** – The first permitted application of ProcellaCOR EC in Wisconsin, a brand new, selective technology for HWM control, was completed to 3.0 acres of HWM. Annual surveying and monitoring for future management.
- **2019** – No active management for HWM, surveying and monitoring only
- **2020** – No active management for HWM, surveying and monitoring only
- **2021** – Application of ProcellaCOR EC to 11.2 acres across two locations for HWM control. Annual surveying and monitoring for future management.
- **2022** – Application of ProcellaCOR EC to 14.0 acres across four locations for HWM control. Annual surveying and monitoring for future management.
- **2023** – Application of a mixture of endothall and diquat to 3.08 acres across two locations for HWM control. A WDNR grant was awarded to update Silver Lake's aquatic plant management plan and covers associated action.

Management actions carried out for aquatic plant growth within the lake have concentrated on invasive species control through targeted, chemical application. Issues with dense HWM growth persisted in varying densities after the whole-lake fluridone application in 2015. This is also evidenced by the concerns raised in the user questionnaire. Continued problems from an increasing population of HWM, both in size and density, drive the desire to continue plant management activities. This action requires an aquatic plant management plan approved by the Wisconsin Department of Natural Resources (WDNR), leading to the creation of this plan.

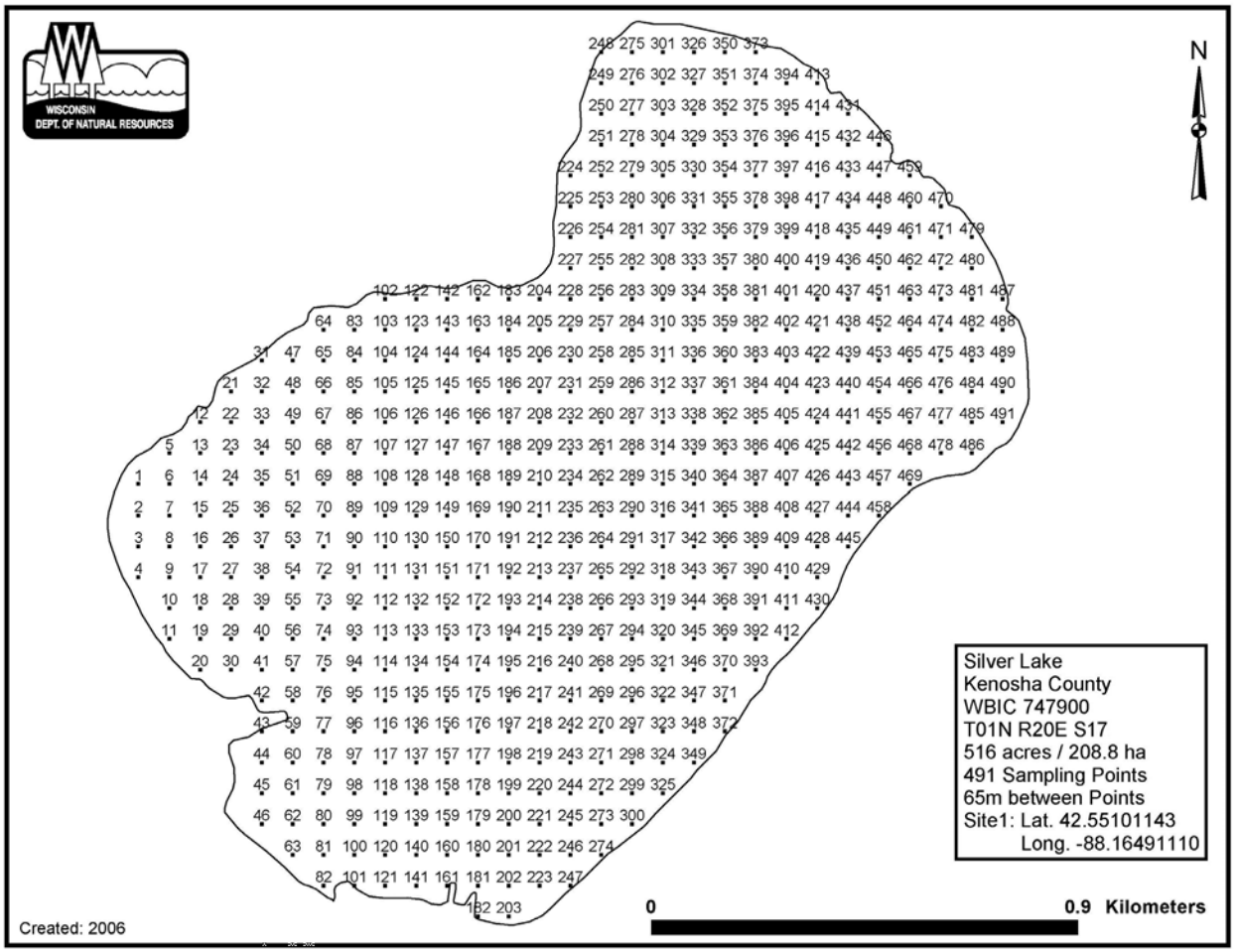
4.0 AQUATIC PLANTS

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 to properly manage a lake ecosystem. Rooted aquatic plants are extremely important for the well-being of a lake community and 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, such as Eurasian water-milfoil, 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 August 22-23, 2023, by staff from Wisconsin Lake & Pond Resource, LLC which followed all WDNR survey protocols. The survey included sampling at 491 pre-determined locations uniformly spaced 65 meters apart to document the following at each site:

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

Each pre-determined location was assigned coordinates and loaded into a GPS unit, which was used to navigate to each point. Data collected at all points was 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. Figure 1 illustrates the location of all sample points.



4.1 2023 POINT INTERCEPT SURVEY

In 2023, the aquatic plant survey identified a diverse community with scattered sections of dense submersed vegetation growth, primarily as low-laying chara/muskgrass – a native plant-like macro-algae. In total, 28 species were identified including three AIS – Hybrid water-milfoil, curly-leaf pondweed, and starry stonewort (Table 1). All remaining species identified are native in Wisconsin and included eight different species of pondweeds, which are vital to fisheries habitat.

Table 1: Taxa Dectected During 2023 Aquatic Plant SUrvey, Silver Lake, Kenosha County, Wisconsin.

Common Name	Genus	Species	Category
Hybrid water-milfoil	*Myriophyllum*	*spicatum x sibiricum*	Invasive
Curly-leaf pondweed	*Potamogeton*	*crispus*	Invasive
Starry Stonewort	*Nitellopsis*	*obtusa*	Invasive
Watershield	*Brasenia*	*scherberi*	Floating-leaf
Coontail	*Ceratophyllum*	*demersum*	Submersed
Muskgrass	*Chara*	*sp.*	Submersed (algal)
Common waterweed	*Elodea*	*canadensis*	Submersed
Water star-grass	*Heteranthera*	*dubia*	Submersed
Slender naiad	*Najas*	*flexilis*	Submersed
Southern naiad	*Najas*	*guadalupensis*	Submersed
Spiny naiad	*Najas*	*mariana*	Submersed
Nitella	*Nitella*	*sp.*	Submersed (algal)
Spatterdock	*Nuphar*	*variegata*	Floating-leaf
White water lily	*Nymphaea*	*odorata*	Floating-leaf
Pickerelweed	*Pontederia*	*cordata*	Emergent
Frie's pondweed	*Potamogeton*	*friesii*	Submersed
Variable pondweed	*Potamogeton*	*gramineus*	Submersed
Illinois pondweed	*Potamogeton*	*illinoensis*	Submersed
Floating-leaf pondweed	*Potamogeton*	*natans*	Floating-leaf
Long-leaf pondweed	*Potamogeton*	*nodosus*	Submersed
White-stem pondweed	*Potamogeton*	*praelognus*	Submersed
Stiff pondweed	*Potamogeton*	*strictifolius*	Submersed
Flat-stem pondweed	*Potamogeton*	*zosertiformis*	Submersed
White water crowfoot	*Ranunculus*	*aquatilus*	Submersed
Sago pondweed	*Stuckenia*	*pectinata*	Submersed
Small purple bladderwort	*Utricularia*	*resupinata*	Submersed
Common bladderwort	*Utricularia*	*vulgaris*	Submersed
Wild celery	*Vallisneria*	*americana*	Submersed

Species sampled in Silver Lake were present in four categories: emergent, near shore species which are rooted below the water's surface with growth extending above the water (Pickerel weed – *Pontederia cordata);* floating-leaf species, which are rooted on the lake bottom but with leaves that float on the water's surface *(*white water lily – *Nymphaea odorata);* algae species, which compromise a wide variety typically only identifiable to species through a microscope and primarily found as planktonic or filamentous algae; and submersed species which root on the lake bottom and remain below the water's surface (common waterweed – *Elodea canadensis*).

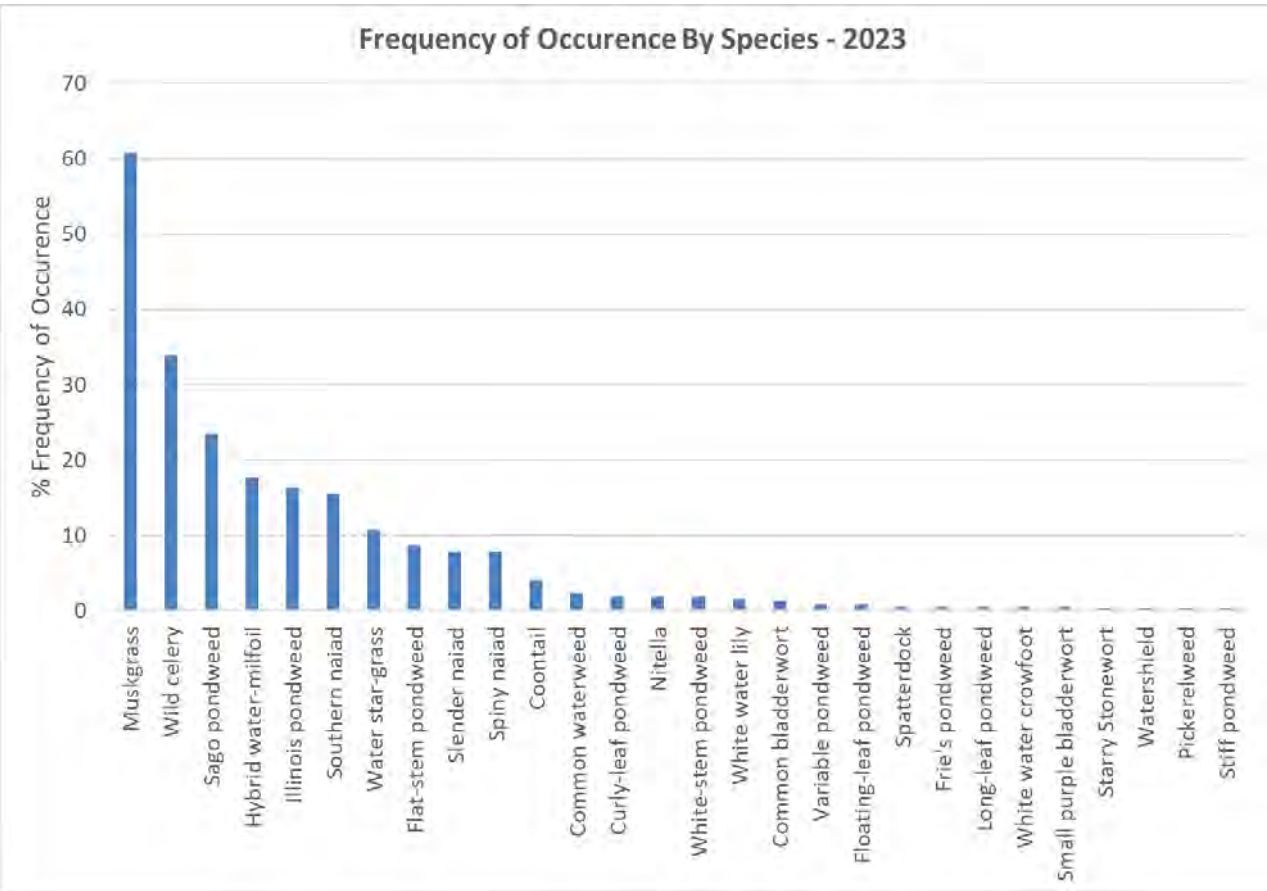


Table 2: Aquatic Plant Community Statistics. Silver Lake, Kenosha County, Wisconsin.

	2023
Number of sites sampled	481
Number of sites with vegetation	348
Number of sites shallower than maximum depth of plants	392
Frequency of occurrence at sites shallower than maximum depth of plants (%)	88.78
Simpson Diversity Index	0.87
Maximum Depth of Plants (Feet)	20
Taxonomic Richness (Number Taxa - includes visuals)	28
Average Number of Species per Site (less than max depth of plant growth)	2.22
Average Number of Species per Site (sites with vegetation)	2.51
Average Number of Native Species per Site (less than max depth of plant growth)	1.95
Average Number of Native Species per Site (sites with vegetation)	2.2
Average Total Rake Fulless	1.54
Floristic Quality Index	31.44
Average Coefficient of Conservatism	6.42

The photic zone, or area of the lake where light penetration can support plant growth, covered a large portion of the lake. Plants were found growing to 20 feet deep. Plant growth was locally dense with 88.8% of this area vegetated and an average rake fullness rating of 1.54. Rake fullness ratings of 2 or 3 were common throughout the lake (Figure 1). Much of the sediment was compromised of muck in deeper areas with sand in near-shore locations. A mixture of sand and organic rich muck sediment was found on large, moderate-depth portions of the lake. This sediment type provides ideal conditions for aquatic plant growth with an excellent nutrient source and solid footing for roots to establish in.

Species richness was above average at 28 and exhibited good diversity per sample point, averaging 2.2 native species per vegetated site. A moderately high, even spread of aquatic plant species was found throughout the system, as exhibited by a Simpson Diversity Index (SDI) of 0.87. An SDI value closer to 1.0 indicates a healthier, more evenly spread plant community. Muskgrass (*Chara sp.*), wild celery (*Vallisneria americana*), and sago pondweed (*Stuckenia pectinata*) were the most dominant species present. Muskgrass is common in many of the hardwater lakes throughout Wisconsin and commonly occupies a wide variety of depths and can grow dense enough to cause navigational nuisance. Wild celery and sago pondweed are an important food sources for waterfowl and found throughout much of Silver Lake, primarily at low to moderate densities. Table 3 displays frequency data by individual species for 2023 along with frequency data from past surveys. Figures 2-10 display the locations of the most common species and any AIS found during sampling.

4.2 NON-NATIVE AQUATIC INVASIVE SPECIES

Three AIS were present in Silver Lake during the 2023 survey: HWM, curly-leaf pondweed, and starry stonewort. Including visual observations, HWM was sampled at 70 locations (Figure 2). HWM has the potential to become an extreme nuisance and detriment to a lake's ecosystem, as witnessed by past survey and management throughout Silver Lake. HWM was the fourth most common species sampled at 17.6% of photic-zone sample sites. However, the density of HWM was largely low, with an average rake fullness of 1.06. Extended efforts to map out beds of HWM were also completed during the point-intercept survey. The following densities were used to further define HWM populations:

1. **Spots** – small locations of individual plants or clumps that were not large enough to map around their perimeter.
2. **Scattered** – locations of HWM that had plants close enough to map as an area, but were still widely scattered. HWM is merely present and not a large component of the biomass.
3. **Low** – HWM identified in distinct beds. While individual plants or clumps may reach the surface, most are lower growing or not as dense. Often mixed with other vegetation.
4. **Moderate** – HWM occupies over half the water column with many plants or clumps at or just below the surface. Few other plant species found.
5. **High** – locations of HWM that were at or near the surface and occupied much of the water column. HWM may be the only plant found growing in these locations.

The 2023 survey found HWM occupying 53.41 acres (Figure 3a). Much like the results of the point-intercept survey, a majority of the HWM population was noted as scattered with individual stems or clumps spaced apart and mixed in with native species. As an invasive species with aggressive growth tendencies, HWM spreads by growing from plant fragments, which can be hastened through increased boating traffic. Acreage of HWM changes annuals and increased from 2022, but significantly below 2021 levels. 2021-22 HWM maps are included in figures 3b – 3c.

Density	Acreage		
	2023	2022	2021
Scattered	38	23.9	28.04
Low	10.94	0.81	114.24
Moderate	2.99	---	21.29
High	1.48	---	8.69
TOTAL	**53.41**	**24.71**	**172.26**

Curly-leaf pondweed has been present in the lake since the 1970s and consistently remained at low, background levels not requiring management. The 2023 survey continued to find CLP at low levels where it was often mixed in with native species (Figure 4).

Starry stonewort is large, plant-like macroalgae and a newly identified AIS in Wisconsin, first found in 2015. Since then, it has been identified in 37 unique waters throughout the State, including in lakes near to Silver Lake such as Camp Lake, Wind Lake, and Lake Geneva. Populations of starry stone wort can outcompete native vegetation and create dense, monotypic stands that reduce the lakes ecosystem quality and negatively impact fish habitat.

During the 2023 survey, one sample location in Silver Lake was found to have starry stonewort (Figure 5). It was found growing in depths of 10-12 feet and at very low densities. A multitude of additional rake samples was completed around the initial sample point which did not indicate a large population. In fact, it was difficult to collect enough plant material for DNR confirmation of the plant. The population of starry stonewort in Silver Lake is likely a pioneer infestation and caught very early.

4.3 FLORISTIC QUALITY INDEX (FQI) AND C VALUES

The calculated FQI for Silver Lake from the 2023 plant survey is 31.44 with an average C value of 6.42 (Table 4).

The FQI is used to compare changes in the plant community over time within Silver Lake and to similar lakes in Wisconsin. FQI provides the ability to compare aquatic plant communities based on species presence. The FQI varies throughout Wisconsin, ranging from 3.0 to 44.6, with a statewide average of 22.2.

Each plant species, except for AIS, is assigned a coefficient of conservatism value (C value). 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.

Not only does FQI allow us to track changes over time within the lake, but it allows for comparison to lakes with similar environmental conditions within a delineated area, called an eco-region. Silver Lake lies within the Southeastern Till Plain Lakes eco-region.

Lakes withing the Southeastern Till Plains eco-region are typically natural lakes that, due to higher population density in this area of the state, have developed shoreline. Increased development around a lake and higher overall use of these lakes leads to more disturbance from an expected natural condition, which leads to lower plant community metrics like FQI and C value. Even with

the presence of multiple AIS, of which HWM can grow very dense in Silver Lake, past management, and heavy recreational use, Silver Lake displays a high-quality plant community for the eco-region. Its total species (28), average C value (6.42), and FQI (31.42) are in the upper quartile for the Southeastern Till Plains eco-region. Silver Lake also ranks highly when compared to other lakes throughout the state as all three Silver Lake parameters are also in the upper quartile (Table 5).

Table 5: FQI and Average Coefficient of Silver Lake Compared to Wisconsin and Southeastern Till Plain lakes.

	Avg. Coefficient of Conservatism			Floristic Quality			Number of Species		
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
Southeastern Till Plain Lakes	5.2	5.6	5.8	17	20.9	24.4	10	14	19
2023	6.42			31.44			28		
2020	6.07			32.13			31		
2019	6.28			31.4			28		
2017	6.24			31.2			28		
2016	6.41			30.06			25		
2015	6.00			23.24			15		
2014	6.24			28.59			23		
2013	6.14			28.78			26		
2012	5.33			26.13			28		
2006	6.35			30.44			29		

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

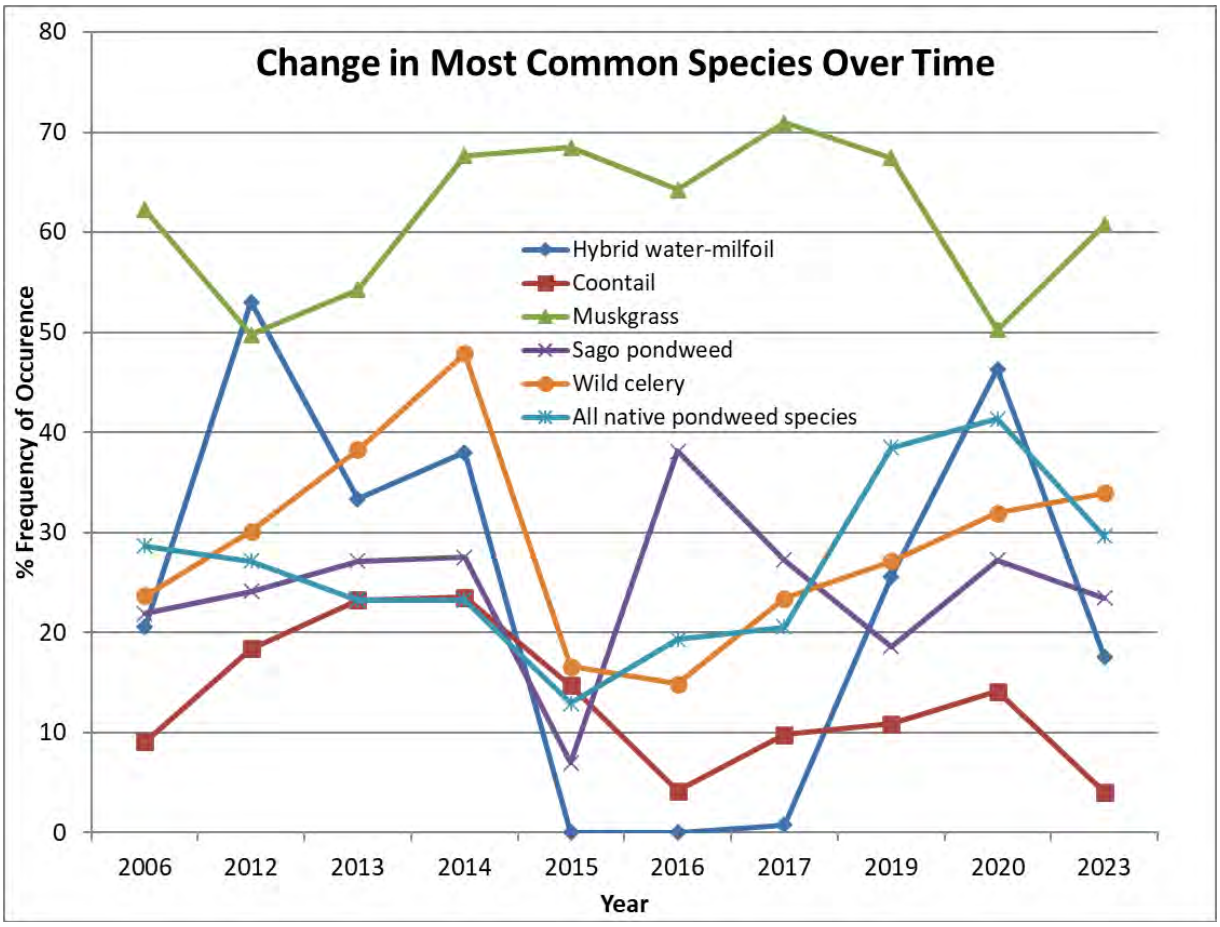
Many other lakes within the eco-region have a more disturbed plant community due to high shoreline development and recreational usage.. Mesotrophic lakes like Silver Lake can be productive for both fisheries and aquatic plant growth, sometimes leading to denser areas of aquatic plant growth. This is true for Silver Lake and worsened by the presence of AIS. 28 native species were found during the 2023 survey with an average of 2.2 native species per sample point with vegetation present. Many sample points had more than the 2.2 average with the highest sample containing up to seven native species present. This native plant community is important and if history can be repeated, will be maintained should continue AIS management be warranted. A healthy native plant population is already established and present to populate areas vacated by AIS due to potential management. Some lakes with AIS growth in region lack a native plant community to do so.

4.4 HISTORICAL COMPARISON

The aquatic plant community has been regularly monitored in Silver Lake over the past 10 years with many annual whole-lake point intercept surveys. This provides an extremely unique opportunity to track changes over time. Aquatic plant sampling protocol recommended by WDNR are point-intercept surveys. These surveys are more repeatable and comparable between years. Full point-intercept surveys were completed in 2012-2017, 2019, 2020, and again in 2023. In years without point-intercept surveys AIS populations were monitored through focused meander surveys to document the spread and density of HWM.

The relative plant community within the lake has fluctuated slightly over time in species composition while remaining stable and high-quality overall. Species diversity, average coefficient of conservatism, and FQI all display the overall stability trend over time and are shown below for all metrics over time when comparing historical survey data (Tables 2-6).

Floristic quality index for Silver Lake has historically been high for the eco-region, falling within the upper quartile. The FQI calculated from the 2023 survey data was 31.44, the second highest recorded value. This value is above the upper quartile values for State wide and eco-region and indicates a tremendously healthy native plant community and continued diversity and recovery HWM management. Table 4 displays the expanded breakdown of FQI by species.



Over the most recent surveys (2020 & 2023) as shown above, the aquatic plant community has seen changes in overall species composition while maintaining many community metrics. Species sampled in 2020, but not identified in 2023 include small duckweed, large-leaf pondweed, leafy pondweed, clasping-leaf pondweed, hardstem bulrush, three-square bulrush, and common watermeal. Lower water levels in 2023 limited access to shallower locations where hardstem and three-square bulrush have been historically sampled. Both species are still present in the lake and were noted during the 2023 survey, but outside direct sample locations.

Conversely, the 2023 survey had three species sampled that were not noted in the past survey; slender naiad, stiff pondweed, and white water crowfoot. Composition of the plant community changes by year and the lack of finding species in 2023 that were present in past surveys and vice versa is not concerning, especially due to the healthy and diverse community found in Silver Lake. Many not found in 2023 have been historically present in low frequencies and likely still present within the lake.

Data comparison between years shows that the lake continually exhibits a dynamic and diverse 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 that noted within the lake is currently not a cause for concern.

To further assess changes between 2023 and past surveys, a statistical analysis was completed using a Chi-square test with a 5% Type-I error rate. This error rate is standard in ecological studies and equals that there is a 5% chance of claiming statistically significant change when no real change occurred. Only those species that display a p-value of 0.05 or lower changed significantly population-wise between years. To calculate these values, the total number of sample locations each species was found at is compared between years. Table 8 displays statistical changes, if any, for each species sampled in 2023 versus the past six surveys, dating back to 2014 – the year before large-scale HWM control efforts.

For a complete review of the lake's aquatic plant community changes from pre-fluridone treatment please see *Silver Lake 2016 Aquatic Plant Management Report* and *Silver Lake 2020 Aquatic Plant Survey Report*. In comparing the most recent 2020 and 2023 survey data statistically significant changes were noted in three species that increased and four that decreased, including HWM. Though the changes may be dynamic, they are not a cause of concern as a lake's plant community changes annually and there was a fair amount of time between surveys. Silver Lake reflects these changes, which should be viewed as natural as no significant lake management activities have taken place. It would be concerning, however, if there were a large group of significant declines without any increases.

Overall, the native aquatic plant community of Silver Lake was in excellent condition during the 2023 survey. Even with moderate HWM populations, the native community has continued to stabilize and become even healthier than before the last large-scale management as noted by increased FQI, average coefficient of conservancy, species diversity, and SDI. In addition, though some species have reduced abundances, the overall evenness of the spread of the most common native species has leveled out. This shows increased diversity and health with an excellent population of native pondweeds present. Pondweed species are vital for the health of a lake and create excellent fisheries habitat.

An aquatic plant community is dynamic and will see changes in species from year to year under natural conditions. In light of the past whole-lake control, a reduction of a few species is outweighed by the increase of native pondweed species distribution, overall species diversity, and increased evenness in distribution of all species present as noted in the increased SDI.

Table 6: Statistical Significance of Species Between Most Recent Sampling Events (2014-2023), Silver Lake, Kenosha County, Wisconsin.

Species	2023 v 2014		2023 v 2015		2023 v 2016		2023 v 2017		2023 v 2019		2023 v 2020	
	Significance	+ / -	Significance	+ / -	Significance	+ / -	Significance	+ / -	Significance	+ / -	Significance	+ / -
Hybrid water-milfoil	***	-	***	+	***	+	***	+	***	-	***	-
Curly-leaf pondweed	**	+	**	+	n.s.	+	n.s.	+	n.s.	+	*	+
Starrt stonewort	n.s.	+	n.s.	+	n.s.	+	n.s.	+	n.s.	+	n.s.	+
Filamentous algae	**	-	n.s.	-	---	---	---	---	---	---	---	---
Watershield	n.s.	+	n.s.	-	n.s.	-	n.s.	-	n.s.	+	n.s.	-
Coontail	***	-	***	-	n.s.	-	**	-	***	-	***	-
Muskgrass	*	-	*	-	n.s.	-	**	-	*	-	**	+
Common waterweed	n.s.	+	**	+	**	+	**	+	**	+	n.s.	+
Water star-grass	*	+	***	+	***	+	n.s.	-	***	-	***	-
Small duckweed	---	---	---	---	---	---	---	---	n.s.	-	n.s.	-
Slender naiad	*	+	***	+	***	+	n.s.	-	n.s.	-	***	+
Southern naiad	n.s.	+	***	+	***	+	***	+	***	+	n.s.	+
Spiny naiad	*	-	***	+	***	-	***	-	n.s.	-	n.s.	+
Nitella	**	+	n.s.	+	*	+	n.s.	+	n.s.	-	n.s.	+
Spatterdock	n.s.	-	n.s.	-	n.s.	-	n.s.	-	n.s.	+	n.s.	-
White water lily	n.s.	-	n.s.	-	n.s.	-	n.s.	+	n.s.	+	n.s.	-
Pickerelweed	n.s.	-	n.s.	-	n.s.	-	n.s.	-	n.s.	-	n.s.	-
Large-leaf pondweed	---	---	---	---	---	---	---	---	---	---	n.s.	-
Leafy pondweed	---	---	---	---	---	---	n.s.	-	---	---	n.s.	-
Frie's pondweed	n.s.	+	n.s.	+	n.s.	-	n.s.	-	***	-	n.s.	-
Variable pondweed	*	-	***	-	***	-	***	-	***	-	n.s.	-
Illinois pondweed	n.s.	-	***	+	***	+	***	+	**	+	***	-
Floating-leaf pondweed	n.s.	+	n.s.	+	n.s.	+	n.s.	+	n.s.	+	n.s.	+
Long-leaf pondweed	n.s.	-	n.s.	+	n.s.	-	n.s.	+	n.s.	-	n.s.	+
White-stem pondweed	n.s.	+	**	+	**	+	n.s.	+	n.s.	+	n.s.	+
Stiff pondweed	n.s.	+	n.s.	+	n.s.	-	n.s.	+	n.s.	+	n.s.	+
Clasping-leaf pondweed	*	-	---	---	---	---	---	---	---	---	n.s.	-
Flat-stem pondweed	***	+	***	+	***	+	***	+	***	+	n.s.	+
White water crowfoot	n.s.	+	n.s.	+	n.s.	+	n.s.	+	n.s.	+	n.s.	+
Rigid arrowhead	---	---	---	---	n.s.	-	n.s.	-	n.s.	-	---	---
Hardstem bulrush	n.s.	-	---	---	n.s.	-	n.s.	-	n.s.	-	n.s.	-
Three-square bulrush	---	---	n.s.	-	---	---	n.s.	-	n.s.	-	n.s.	-
Sago pondweed	n.s.	-	***	+	***	-	n.s.	-	n.s.	+	n.s.	-
Small purple bladderwort	n.s.	-	n.s.	+	n.s.	+	n.s.	+	n.s.	+	n.s.	+
Common bladderwort	n.s.	+	n.s.	-	n.s.	+	*	+	n.s.	+	n.s.	+
Common watermeal	---	---	---	---	---	---	n.s.	-	n.s.	-	n.s.	-
Wild celery	***	-	***	+	***	+	**	+	*	+	n.s.	+
Illinois/Variable/Hybrid combined^	n.s.	-	n.s.	+	n.s.	+	n.s.	-	n.s.	-	***	-

* - somewhat significant change, ** - moderatly significant change, *** - very significant change

n.s. - Change not significant, n.c - no change

--- - Species was not sampled in both comparison years

5.0 AQUATIC PLANT MAINTENANCE ALTERNATIVES

Based on the goals of the stakeholders outlined above, several management alternatives are available for this APM plan. Some general alternatives are discussed below. More information on management alternatives are included in Appendix C. 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.

AQUATIC PLANT MAINTENANCE ALTERNATIVES

A combination of management alternatives may be used on a lake with a healthy native aquatic plant community with 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 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

One AIS was identified within the Project Area during the 2023 full point-intercept survey. To monitor existing populations of current AIS and for new AIS in the future, a consistent and systematic 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 pre- and post-treatment aquatic plant monitoring in any areas that are actively managed for AIS control to evaluate effectiveness. 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 are recommended every year to monitor aquatic plant community changes 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 was the top management priority indicated in the user survey responses. To prevent the spread of AIS from Silver Lake, 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 boaters 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 Silver Lake has not been done. Initiating participation in this program is strongly encouraged, especially when considering the high amount of frequency of HWM and recreational boat traffic, which increases chances for plant fragments to be picked up by boaters.

Scheduling volunteers for CB/CW landing inspection is often difficult due to time constraints for volunteers. The WDNR offers grant assistance through the Surface Waters program to pay for CB/CW landing inspectors. This establishes a set and known schedule for boat landing monitoring,

offering added protection for the Lake. If acquiring CB/CW monitors becomes difficult for Silver Lake and the SLMD it is recommended they apply through this grant to program to hire a dedicated monitor. This is often done in conjunction with County-wide AIS monitoring efforts.

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. Additionally, HWM 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. This can be a potential issue within the lake, as Silver Lake has a large watershed with portions in agricultural use. Good candidates for shoreline 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 shoreline 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 developed, providing potential avenues for increased 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.

The Kenosha County Land & Water Conservation department may be able to help with shoreline restoration projects, rain gardens and/or additional shoreline protection. Interested landowners can contact the Land & Water Conservation department at 262-857-1895 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 pre-application is September 15th with funding of up to $25,000 per group or $1,000 per best management practice on a 75% DNR / 25% applicant cost sharing. Further information can be obtained at: http://healthylakeswi.com

PUBLIC EDUCATION AND INVOLVEMENT

The District should continue to keep abreast of current AIS issues throughout the County and State. The County Land Conservation and Zoning department, WDNR Lakes Coordinator and the UW Extension are good sources of information. Many important materials can be found at the following website: http://www.uwsp.edu/cnr-ap/UWEXlakes

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 D). 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.

Manual removal of aquatic plants can be quite labor intensive and time consuming. This technique is well suited for small areas in shallow water. Hiring laborers to remove aquatic vegetation is an option, but also increases cost. SCUBA divers can be contracted to remove unwanted vegetation in deeper areas. Benefits of manual removal by property owners include low cost compared to chemical control methods, quick containment of pioneering (new) populations of invasive aquatic plants and the ability for a property owner to slowly and consistently work on active management. The drawback of this alternative is that pulling aquatic plants includes the challenge of working in the water, especially deep water, the threat of letting fragments escape and colonize a new area, and the fact that control of any significant sized population is quite labor intensive, and therefore very costly; $1,500 - $2,000 per 5,000 square feet, or $10,000 - $20,000 acre depending on plant densities.

NUISANCE AQUATIC PLANT GROWTH CONTROL – MECHANICAL OR CHEMICAL

Aquatic plants may be mechanically harvested up to five feet below the water surface and one half the depth of the water column without disturbing or contacting the lake bed. Harvesting 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. 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 are that it does cause fragmentation and may facilitate the spread of some plants, including HWM, 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 under NR109 which are renewable every 5 years.

In some areas of excessive plant growth, particularly in shallow water areas that can't be effectively managed using a harvester, contact herbicides can provide effective season long relief. Navigational channels 30' – 50' in width, as described in the section above, can be created using chemical herbicides. Since selectivity is not a concern for navigational treatment, contact herbicides such as diquat or more recently flumioxazin are used for submersed species. They are

typically mixed with a copper-based algaecide for increased efficacy. For floating leaf species, an herbicide such as imazapyr is typically used with a surfactant or sticking agent. A combination of harvesting and treatment is sometimes a wise approach to compare length of control, costs and season long performance. Please note, chemical control requires a separate NR107 permit.

Mechanical harvesting requires significant infrastructure to complete, many times requiring the purchase of a harvester by the group and, unless already being completed, has significant startup costs.

6.0 AQUATIC PLANT MANAGEMENT ALTERNATIVES

6.1 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.

6.1.1 Curly-leaf Pondweed (CLP)

Curly-leaf pondweed is the second most prevalent aquatic invasive plant species targeted for chemical treatment in the state. At present, endothall, a contact herbicide is the most common active ingredient in herbicides used for CLP management in Wisconsin. Imazamox has been used periodically in the last several years. Imazamox has shown promise in that it is a systemic herbicide for CLP control and can potentially have a much lower impact to the native plant community than a contact herbicide and appears to show increased year after treatment control than

endothall. It is not entirely clear as to why this happens but it may be due to the systemic effect on turion production within the plants, resulting in fewer plants the following year.

Granular based formulations are generally more costly and 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. CLP seems to prefer and flourish in mucky or highly flocculent substrate, which is found in most of Silver Lake's sediments. Given the lack locating populations of CLP during the most recent survey and large locations of appropriate substrate its presence was expected to have been more prevalent. Monitoring may be the best option for management.

6.1.2 Eurasian/Hybrid Water-Milfoil

EWM/HWM is the most commonly managed AIS within Wisconsin lakes and HWM is the most prevalent AIS in Silver Lake. HWM is an extremely opportunistic plant and could easily expand within Silver Lake. Should such an event take place again as occurred in 2012, it is prudent to include potential management actions for HWM within this plan, to provide a quick and concise reference for management.

At present, 2,4-D has been 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.

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, a combination of active ingredients, or change of active ingredient in hopes to extend contact time. Recently, the active ingredient florpyrauxifen-benzyl has been approved for EWM and control. This active ingredient requires very limited contact time and has shown to offer excellent control with reduced non-target impacts in comparison to previously used modes of action.

If HWM abundance increases and requires active management in smaller treatment areas (< 2.0 ac), it is recommended to use florpyrauxifen-benzyl, a fast-acting systemic herbicide, at appropriate rates of around 5-20 parts per billion (ppb). 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. Unlike other active ingredients, such as fluridone, florpyrauxifen-benzyl can be successfully used at any scale, from 0.25 acres all the way up to whole-lake volume dosed applications.

The EWM within Silver Lake has been identified as a hybrid (HWM). It is worth noting there are various hybrid strains of EWM being genetically confirmed throughout the state and many of these are showing resistance to typical systemic herbicides. Research projects are currently underway with the WDNR and herbicide manufacturers. For better control, 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) may be more effective on these strains of hybrid EWM. For fluridone applications are most successful on a whole-lake volume basis maintaining a 4-12 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 considered spot treatments and are 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 standpoint to target the "whole" lake for treatment. This typically entails calculating the entire volume of water within the lake, in acre/feet, and applying an herbicide at a low dose at a lake wide rate.

6.1.3 Starry Stonewort

Starry stonewort is a newly-advanced aquatic invasive plant species in the state. As a macroalgae, products with copper algaecides are the most common active ingredient used for starry stonewort management in Wisconsin. These may be mixed with additional active ingredients, such as diquat, mono salt of endothall, or flumioxazin to increase effectiveness. Initial results indicate the long-term control may be difficult due to bulbil accumulation in lake sediments. Multiple years of active management to the same area may be necessary for long-term control.

Current WDNR policy for starry stonewort management is constantly evolving with a preference for monitoring and no active management. If management is warranted, granular based formulations are generally more costly and used for smaller spot type treatments, while liquid formulations are less costly and generally used for larger contiguous treatment areas. To decrease any potential impact to native plants and be as selective as possible for starry stonewort, treatments should be designed with non-target impacts in mind.

6.2 AQUATIC INVASIVE PLANT HARVESTING

MECHANICAL HARVESTING

Aquatic plants may be mechanically harvested up to five feet below the water surface or one half of the water column, whichever is less, and 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 to control nuisance growth from AIS such as curly-leaf pondweed if the plants are.

Harvesting can also be used 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.

Diver Assisted Suction Harvesting (DASH) is another form of mechanical harvesting that can target populations of AIS. DASH uses divers in the water to hand pull the target species. Plant fragments are fed into a suction hose which transports them onto a nearby boat. Here, they are fed into a mesh bag to allow the material to dewater while removing the target AIS from the lake. This practice can be used to selectively remove populations of AIS from individual stems mixed with native species or from denser, monotypic stands. A mechanical harvesting permit is required for DASH.

DASH can be a useful tool for small populations of AIS. This technique is labor intensive and can be slowed by dense stands, poor visibility, and weather conditions. On a cost-per-unit basis DASH is considerably slower and more costly per acre compared to herbicide control. Use of DASH on well-established beds may only offer nuisance reduction instead of AIS control.

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 if the removal is conducted completely by hand without mechanical assistance. 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. This can be a very effective control mechanism for 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. Hand harvesting costs using professionally contracted SCUBA divers are around $2,000 - $3,000 or more, per acre depending on plant densities.

7.0 OVERALL AQUATIC PLANT MANGEMENT GOALS

Silver Lake is a natural drainage lake with good water quality and a healthy and diverse native aquatic plant community. Silver Lake can also see periods of heavy recreational use. A growing concern is the presence of AIS within the lake and its impact on the health and use of Silver Lake. Management actions recommended below are based on the findings of this APM plan and chosen to protect and enhance the conditions present:

- Users of the lake enjoy their time on the water with over 20.7 average years (median of 15 years) of experience, indicating a longevity that is important to generations of families and an increased importance on maintaining conditions for future generations (Section 2.0, pg. 2.1)

- Largely, the aquatic plant community of Silver Lake is of high quality with good diversity and includes 28 native species (Section 4.1, pg. 4.6, & Figures 6-10)

- AIS such as HWM can grow to dense, nuisance levels, requiring active management in the past (Section 3.0, pg. 3.4-3.5)

- Aquatic invasive species are a constant threat to the quality of the lake and are present at annually-varying rates, specifically HWM (Section 4.2, pg. 4.9, & Figures 2-5). Management of AIS should take on many facets. Additional information that is important to guide AIS management includes the following:

    - Populations of HWM have varied year to year and have shown to impact the native plant community and use of the lake (Section 4.2, pg. 4.10)
    - HWM currently covers 53.41 acres or 12.9% of the littoral zone at primarily scattered to low densities (Figure 3a).
    - Curly-leaf pondweed has not historically been dense enough to require active management and remains present at low, background levels (Section 4.2, pg. 4.10, Figure 4)
    - Starry stonewort is a newly found AIS growing in Silver Lake and a potential concern for future lake health and management (Section 4.2, pg. 4.10, Figure 5)

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

- Current management actions and lake uses have shown to have minimal, if any, negative impacts to the native aquatic plant over time (Section 4.4, pg. 4.12).

- Selected management actions below are the most accepted and recommended by lake users to achieve results (Appendix A).

HWM is a potentially aggressive AIS, but its presence in Silver Lake has been reduced through a whole-lake treatment in 2015, followed by highly selective, small to large scale, targeted management. Even though the aquatic plant community in Silver Lake is healthy, HWM could still grow dense and adversely impact recreational use. Dense AIS growth from HWM only worsens

biological and navigational issues throughout the lake and negatively impacted users of the lake 78.8% of the time, with 87.9% of users wanting management actions to reduce non-native aquatic plant issues.

Only those options that will be supported by the users and District 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. The user survey showed a strong desire by the public and lake users to actively control populations of HWM in Silver Lake.

A clear focus of the plan is to prevent the spread of AIS into or out of Silver Lake while reducing the extent and density of AIS (HWM) already established. Management planning will follow Integrated Pest Management (IPM) with an approach that provides a variety of control actions, active ingredients, and monitoring to gauge results. 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.

The size of the infestation tends to dictate the type of treatment. Small treatment areas or beds less than 5 acres are considered spot treatments and are usually targeted with fast acting ingredients. When there are multiple "spot" treatment areas within a lake, it often makes more sense from an economic and efficacy standpoint 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, lake-wide rate. 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 or with a combination of active ingredients in hopes of extending contact time.

Goal: Manage AIS to improve recreation, increase use opportunities, and maintain native plants by reducing AIS abundance and frequency within the littoral zone. For Silver Lake, the littoral zone extends to an approximate depth of 20-ft and covers a significant portion of the lake's 412 acres. Only the deepest part of the central basin is outside the littoral zone. If active AIS management is pursued, the goal should be to treat the presence of the densest locations of the target species over a 3–5-year period. Currently, HWM is the most common AIS present and occupies the following coverage of the littoral zone at the listed densities (Figure 3a):

Density	Acreage	% Littoral Zone
Scattered	38	9.22%
Low	10.94	2.66%
Moderate	2.99	0.73%
High	**1.48**	**0.36%**
TOTAL	**53.41**	**12.96%**

The following levels of AIS can be used to trigger active management of the target species, primarily HWM and starry stonewort:

- 1 – 10% coverage of the littoral zone of areas of moderate density or greater for small scale, spot treatment or control

Or

- Greater than 15% coverage of the littoral zone of low densities or greater for large-scale control at up to whole-lake approaches

Primary Action: Continue monitoring for and mapping of AIS.

- Annual bed-mapping surveys to document spread and density of AIS already present
- Continually monitor for introduction of newly introduced AIS
- If a newly introduced AIS is found, follow the rapid response plan below:
    - Collect a sample and submit to WDNR for confirmation
    - Record spread, density, and location of species – preferably with GPS capable equipment
    - Initiate fast and targeted management, if necessary. This may include any of the following options:
        - Apply for appropriate WDNR permit, if necessary.
        - Hand pulling – does not require a permit if done without mechanical equipment
        - Targeted mechanical harvesting – either through conventional equipment or DASH (permit required)
        - Targeted chemical control – active ingredients, rates, and application methods may vary based on target species (permit required)
        - Pre- and post-treatment monitoring of any active control areas
        - Annual monitoring of any areas of pioneer infestation noted
        - Apply for a WDNR AIS Rapid Response Grant through the Surface Water program for financial assistance

Primary Action: If populations of AIS exceed the above listed triggers pursue active management.

***Small-Scale HWM control Action*:** Small-scale HWM control maintain low populations of HWM may be a necessary step to ensure the health of the lake. This may include a variety approaches and control methods based on the dominance and size of small-scale HWM control areas.

- HWM areas less than 0.25 acres
    - Monitoring only through annual surveys
    - Hand pulling by shoreline residents
    - Diver Assisted Suction Harvesting (DASH) for small, dominant stands

- HWM areas 0.25 – 0.75 acres
    - Monitoring only through annual surveys
    - Hand pulling by shoreline residents
    - DASH for stands up to moderate dominance
    - Fast-acting, selective chemical control for stands of moderate density or more.
        - The active ingredients florpyrauxifen-benzyl, diquat, endothall, and/or flumioxazin may be used at appropriate label rates

- HWM areas greater than 0.75 acres
    - Fast-acting, selective chemical control for stands of moderate density or more

- The active ingredients florpyrauxifen-benzyl, diquat, endothall, and/or flumioxazin may be used at appropriate label rates

***Large Scale HWM Control Action*:** Targeted, whole-lake based control efforts. This may include a variety of active ingredients and be dosed at up to whole-lake volume rates.

- If possible, control should be completed to time application to early/mid spring when plants are young

- Application may be completed using a variety of active ingredients and rates. Consideration should be given to expected longevity and selectivity of control. The following table displays a comparison of potential whole-lake application methods and expected longevity and selectivity:

Active Ingredient(s)	Product	Expected Control	Longevity of Control	Selectivity	Cost
fluridone	Sonar	X	X	O/X	$$$
florpyrauxifen-benzyl	ProcellaCOR EC	X	X	X	$$-$$$
2,4-D	Various	O	-/O	O	$
2,4-D & endothall	2,4-D/Aquathol K	O	O	O	$
X = good, O = OK, - = poor					

- Some recommended active ingredients and application rates are as follows:

  - Active ingredient 2,4-D at 0.25-0.40 PPM. Use of 2,4-D alone is likely a one-time application as EWM has shown to become tolerant of the active ingredient in repeated uses. Use of 2,4-D alone is likely to see shorter-lasting results than options below.

  - Active ingredient 2,4-D at 0.25-0.40 PPM and active ingredient endothall at 0.6-0.80 PPM at whole-lake volume rates. This is likely a one-time Use of this method is likely to see shorter-lasting results than options below.

  - Active ingredient fluridone at 4-16 PPB whole-lake volume rates with follow-up "bump" applications to maintain 6 PPB in water for 120+ days. Target rates may be reduced by product uptake, loss through water flow out of the lake, and loss through natural degradation. Residual sampling of in-water concentrations should be completed approximately every 21 days after the initial application to properly dose and time "bump" applications.

  - Active ingredient florpyrauxifen-benzyl dosed at 5 - 11 PPB within areas of direct application only. Due to the fast-acting nature of florpyrauxifen-benzyl, applications do not need to consider the entire lake's volume for dosing.

- An aquatic invasive species assessment survey should be completed 1-year prior to assess conditions and verify they exceed management triggers above. In addition, the survey should be repeated 1-year post-control activities to gauge results. The assessment survey may be completed as a whole lake point intercept survey or targeted AIS meander survey. Bed locations and dominance should be mapped to accurately assess conditions.

Possible Starry Stonewort Control Action: If populations of starry stonewort exceed the above listed triggers and are negatively impacting navigation or use of the lake, pursue active management.

***Small-Scale control Action*:** Small-scale starry stonewort control to maintain low populations may be a necessary step to ensure the health of the lake. This may include a variety of approaches and control methods based on the dominance and size of small-scale starry stonewort areas. Annual monitoring for starry stonewort should be the main priority at this time.

- Starry stonewort areas less than 0.50 acres of any density and/or dominance
  - Monitoring only through annual surveys
  - Hand pulling by shoreline residents
  - Diver Assisted Suction Harvesting (DASH) for small, high density stands

- Starry stonewort areas greater than 0.5 acres and of any density and/or dominance
  - Monitoring only through annual surveys
  - Hand pulling by shoreline residents
  - Targeted chemical control for stands of moderate dominance or more if causing a navigational nuisance
    - The active ingredients copper, mono-salt of endothall, diquat, or others may be used at appropriate label rates. Mixing of multiple active ingredients is recommended for smaller-scale application to increase control

Goal: Obtain financial assistance for AIS management activities.

Primary Action: Apply for an AIS Established Population Control Grant through the WDNR's Surface Water Grant program for large-scale AIS control projects. The deadline for pre-application is September 15 and can fund up to 75% of eligible project costs.

Goal: Continue comprehensive water quality monitoring within Silver Lake through the WDNR Citizen Lake Monitoring Network and support CB/CW efforts.

Primary Action: Continue monitoring in 2024 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.

Primary Action: Continue participation in the Clean Boats / Clean waters program and commit to a minimum of 50 hours of monitoring per year.

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.

Southeastern Wisconsin Regional Planning Commission
W239 N1812 Rockwood Drive
Waukesha, WI 53187-1607
(262) 547-6721
sewrpc@sewrpc.org

Wisconsin Department of Natural Resources
Craig Helker – Water Resources Management Specialist - Senior
(414) 550-2970
craig.helker@wisconsin.gov

SILVER LAKE -
AQUATIC PLANT MANAGEMENT PLAN
Overall Aquatic Plant Mangement Goals
March 13, 2024

Kenosha County Land & Water Conservation Department
Mark Jenks – County Conservationist
(262) 857-1900
mark.jenks@kenoshacounty.org

8.0 REFERENCES

While not all references are specifically cited, the following resources were used in preparation of this report.

Borman, Susan, Robert Korth, and Jo Temte, *Through the Looking Glass, A Field Guide to Aquatic Plants*, Wisconsin Lakes Partnership, 1997

Carlson, R. E., A trophic state index for lakes. Limnology and Oceanography, 22:361-369, 1977

Fassett, Norman C., *A Manual of Aquatic Plants*, The University of Wisconsin Press, Madison, Wisconsin, 1975

Getsinger, Kurt D., and H.E. Westerdahl, *Aquatic Plant Identification and Herbicide Use Guide, Volume II Aquatic Plants and Susceptibility to Herbicides*, U.S. Bonestroo, Inc. Waterways Experiments Station, Technical Report A-88-9, 1988

Jester, Laura, Bozek, Michael, Helsel, Daniel, and Sheldon, Sallie, *Euhrychiopsis lecontei Distribution, Abundance, and Experimental Augmentation for Eurasian watermilfoil Control in Wisconsin Lakes*, Journal Aquatic Plant Management, 38:88-97

Madsen, John, *Point Intercept and Line Intercept Methods for Aquatic Plant Management, Aquatic Plant Control Technical Note MI-02*, February 1999

Nichols, Stanley A. *Distribution and habitat descriptions of Wisconsin lake plants*, Wisconsin Geological and Natural History Survey Bulletin 96, 1999

North America Lake Management Society of Aquatic Plant Management Society (NALMS), *Aquatic Plant Management in Lakes and Reservoirs,* 1997

Prescott, G.W., *How to Know the Aquatic Plants,* Wm. C. Brown Publishers, Dubuque, Iowa, 1980

United States Department of Agriculture, *Soil Survey of Vilas County, Wisconsin*. 1988

Welsh, Jeff, *Guide to Wisconsin Aquatic Plants,* Wisconsin Department of Natural Resources Publication WR 173, 1992 revised

Wetzel, Robert G., *Limnology*, 1983

Wisconsin Department of Natural Resources, *Aquatic Plant Management in Wisconsin DRAFT,* April 25 2005

Wisconsin Department of Natural Resources, *Wisconsin Lakes,* Publication # PUB-FH-800, 2005

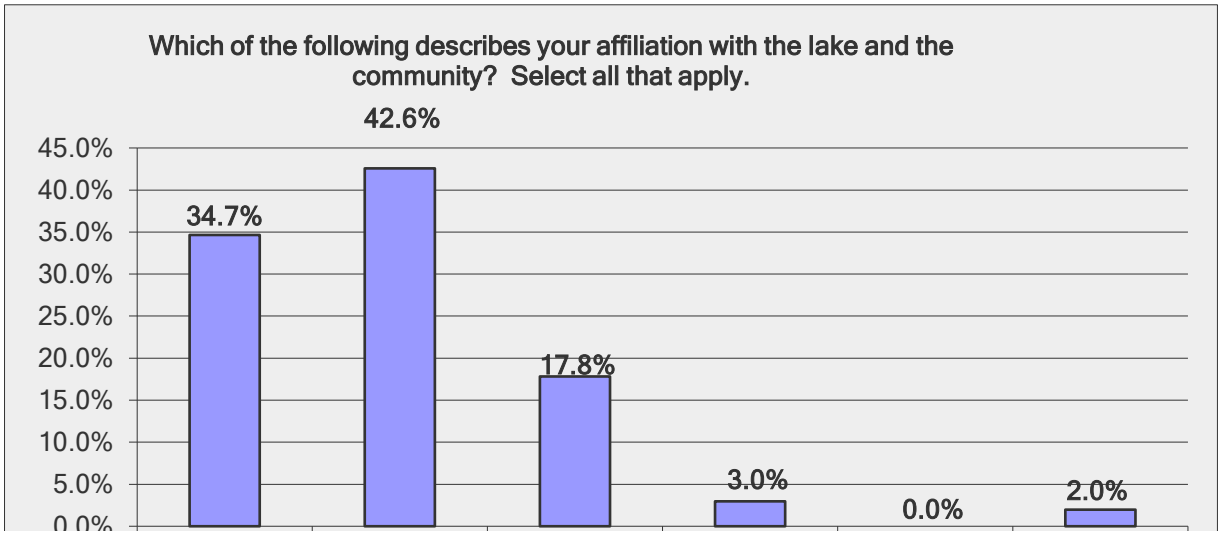
APPENDIX A – PUBLIC SURVEY RESULTS

Which of the following describes your affiliation with the lake and the community? Select all that apply.

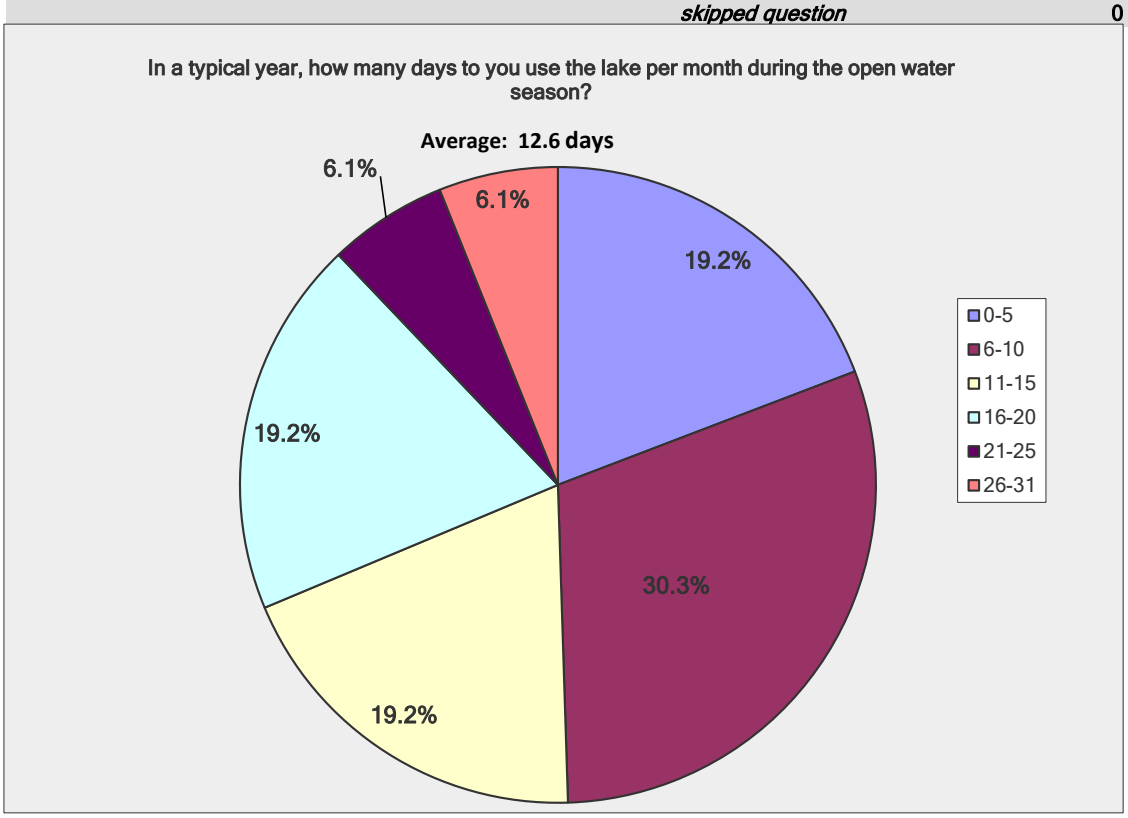
Answer Options	Response Percent	Response Count
Shoreline year round resident	34.7%	35
Shoreline seasonal resident	42.6%	43
Nearby (offshore) resident	17.8%	18
Visitor	3.0%	3
Area business owner	0.0%	0
Other (please specify)	2.0%	2
	answered question	101
	skipped question	0

Other (please specify)

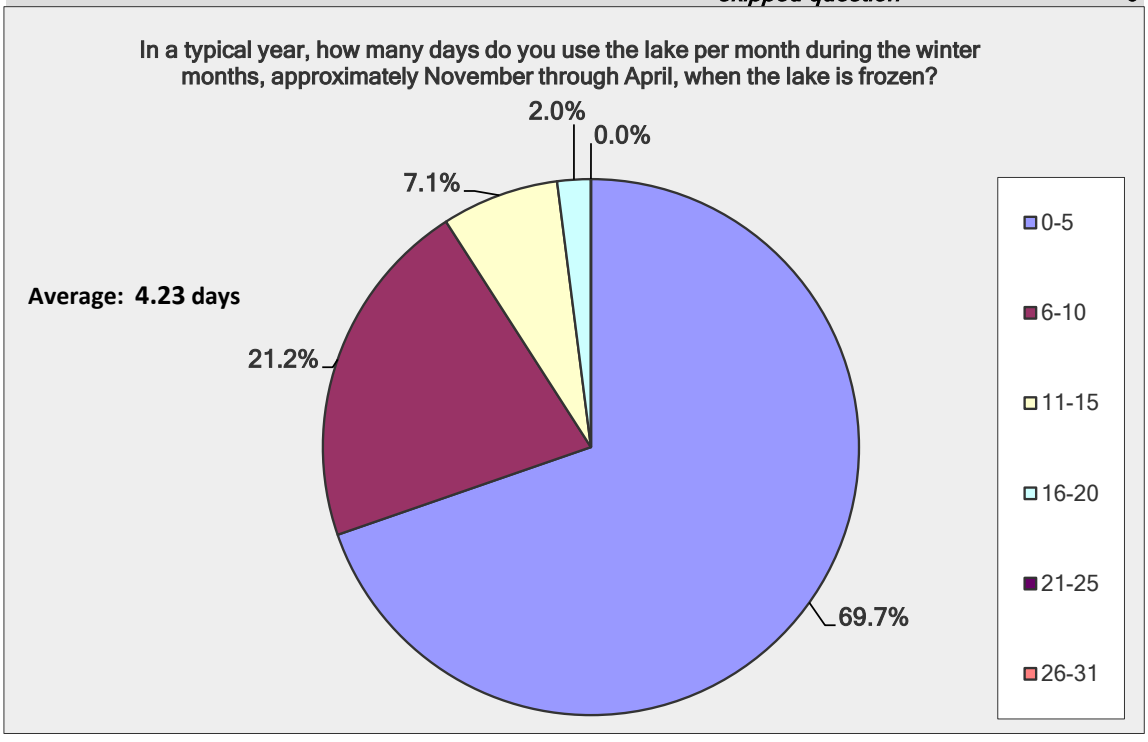
1) Weekend residents
2) subdivision owns property on lake for access



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	2.0%	2
1	1.0%	1
2	2.0%	2
3	4.0%	4
4	5.1%	5
5	5.1%	5
6	5.1%	5
7	3.0%	3
8	8.1%	8
9	3.0%	3
10	11.1%	11
11	1.0%	1
12	9.1%	9
13	0.0%	0
14	3.0%	3
15	6.1%	6
16	1.0%	1
17	2.0%	2
18	4.0%	4
19	0.0%	0
20	12.1%	12
21	1.0%	1
22	0.0%	0
23	0.0%	0
24	1.0%	1
25	4.0%	4
26	0.0%	0
27	1.0%	1
28	0.0%	0
29	0.0%	0
30	5.1%	5
31	0.0%	0
	answered question	99
	skipped question	0



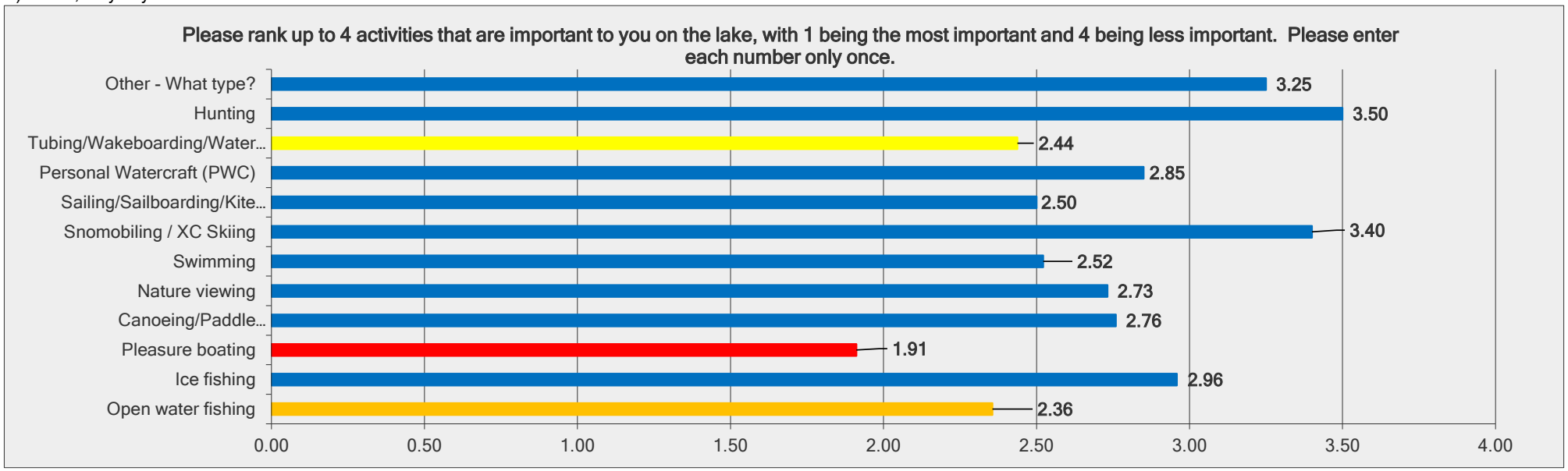
In a typical year, how many days do you use the lake per month during the winter months when the lake is frozen, approximately November through April?		
Answer Options	Response Percent	Response Count
0	27.3%	27
1	11.1%	11
2	12.1%	12
3	10.1%	10
4	1.0%	1
5	8.1%	8
6	4.0%	4
7	2.0%	2
8	3.0%	3
9	2.0%	2
10	10.1%	10
11	2.0%	2
12	1.0%	1
13	0.0%	0
14	0.0%	0
15	4.0%	4
16	1.0%	1
17	0.0%	0
18	0.0%	0
19	0.0%	0
20	1.0%	1
21	0.0%	0
22	0.0%	0
23	0.0%	0
24	0.0%	0
25	0.0%	0
26	0.0%	0
27	0.0%	0
28	0.0%	0
29	0.0%	0
30	0.0%	0
31	0.0%	0
answered question		99
skipped question		0



Please rank up to 4 activities that are important to you on the lake, with 1 being most important and 4 being less important. Please enter each number only once.

Answer Options	1	2	3	4	Rating Average	Response Count
Open water fishing	21	12	10	16	2.36	59
Ice fishing	2	6	7	9	2.96	24
Pleasure boating	36	22	13	8	1.91	79
Canoeing/Paddle Boarding/Kayaing	7	16	14	17	2.76	54
Nature viewing	8	7	14	12	2.73	41
Swimming	11	21	27	10	2.52	69
Snomobiling / XC Skiing	1	1	1	7	3.40	10
Sailing/Sailboarding/Kite Sailing	0	1	1	0	2.50	2
Personal Watercraft (PWC)	1	7	6	6	2.85	20
Tubing/Wakeboarding/Water Skiing	12	5	4	11	2.44	32
Hunting	0	0	1	1	3.50	2
Other - What type?	0	1	1	2	3.25	4
					answered question	99
					skipped question	0

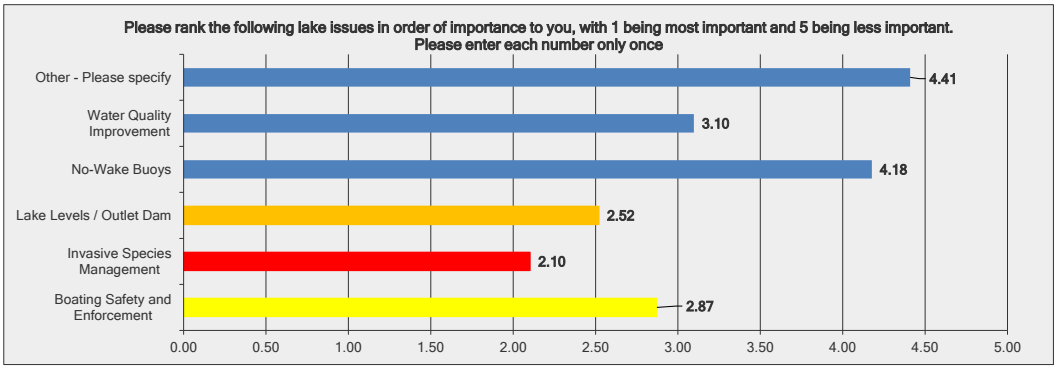
Other - What type?
1) ice hockey
2) None, only kayak



Please rank the following lake issues in order of importance to you, with 1 being most important and 5 being less important. Please enter each number only once.

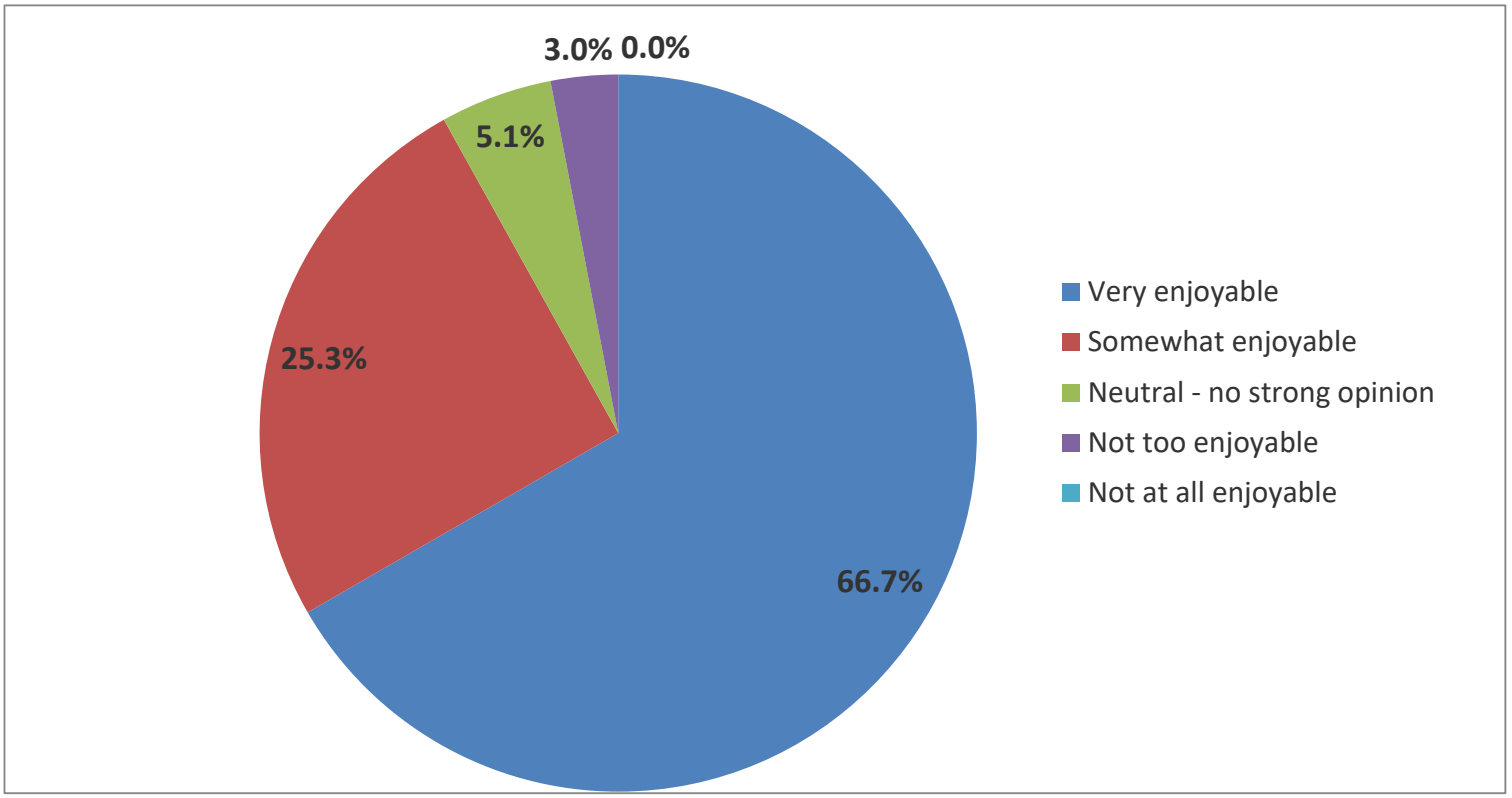
Answer Options	1	2	3	4	5	Rating Average	Response Count
Boating Safety and Enforcement	21	18	19	24	12	2.87	94
Invasive Species Management	37	29	20	6	5	2.10	97
Lake Levels / Outlet Dam	24	31	19	11	11	2.52	96
No-Wake Buoys	0	3	19	23	40	4.18	85
Water Quality Improvement	16	17	17	28	15	3.10	93
Other - Please specify	1	1	2	2	16	4.41	22
						answered question	99
						skipped question	0

Other - Please specify
1) Fish and wildlife stocks
2) WAKEBOAT LIMITATIONS
3) Air B and B rentals
4) The boats park right in front of our piers and block our access to the lake on weekends
5) The small swimming beach area in Silver Lake proper (west site of the lakes) needs attention - weeds and goose dropping in the sand. Both are bad
6) Publi use of boats on lake to limi and charge to access lake
7) Managed with migratory birds and aquatic residents in mind
8) Better regulation of jet skis
9) Non resident use is very high
10) Launch dredging and cleaning stations
11) Fishin Enforement (Quantity and Limits), Marina and Launch quantity limits



Overall, how would you rate the enjoyment of your experiences on Silver Lake?

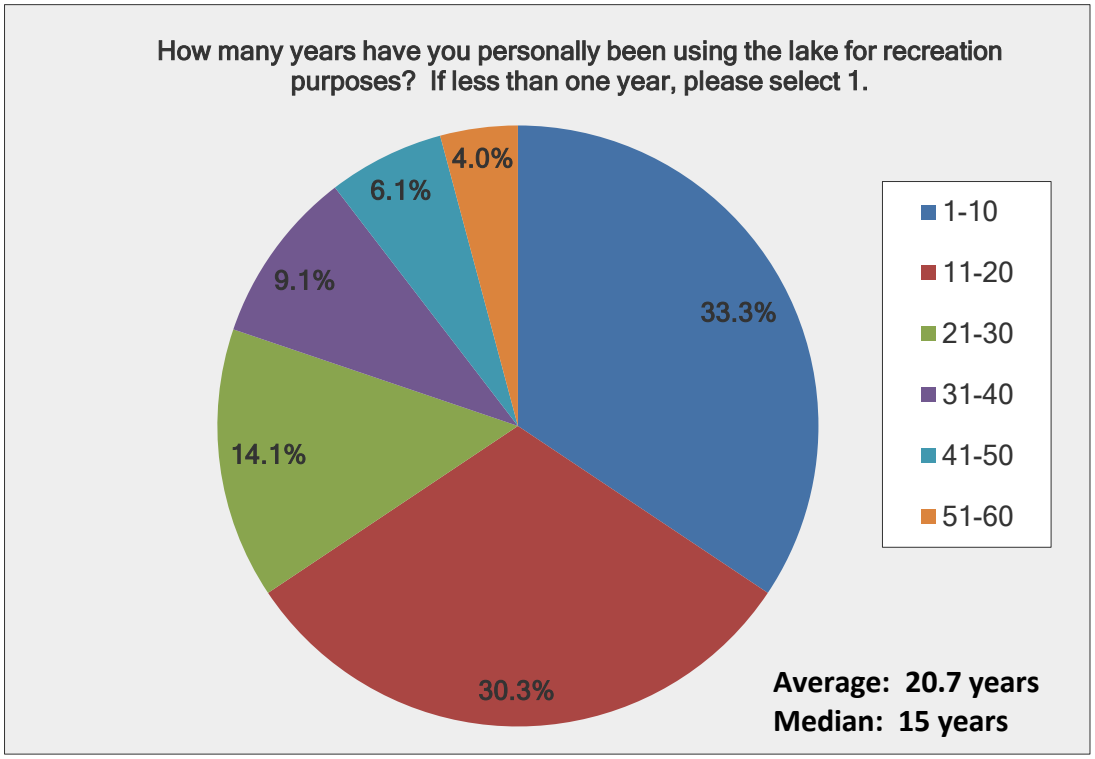
Answer Options	Very enjoyable	Somewhat enjoyable	Neutral - no strong opinion	Not too enjoyable	Not at all enjoyable	Rating Average	Response Count
	66 66.7%	25 25.3%	5 5.1%	3 3.0%	0 0.0%	1.44	99
						answered question	99
						skipped question	0



How many years have you personally been using the lake for recreation purposes? If less than one year, please select 1.		
Answer Options	Response Percent	Response Count
1	2.0%	2
2	4.0%	4
3	4.0%	4
4	3.0%	3
5	6.1%	6
6	4.0%	4
7	4.0%	4
8	2.0%	2
9	1.0%	1
10	3.0%	3
11	3.0%	3
12	4.0%	4
13	4.0%	4
14	2.0%	2
15	7.1%	7
16	0.0%	0
17	2.0%	2
18	0.0%	0
19	1.0%	1
20	7.1%	7
21	1.0%	1
22	1.0%	1
23	1.0%	1
24	1.0%	1
25	2.0%	2
26	0.0%	0
27	1.0%	1
28	0.0%	0
29	1.0%	1
30	6.1%	6
31	1.0%	1
32	0.0%	0
33	1.0%	1
34	1.0%	1
35	3.0%	3
36	0.0%	0
37	0.0%	0
38	1.0%	1
39	0.0%	0
40	2.0%	2
41	0.0%	0
42	0.0%	0
43	0.0%	0
44	0.0%	0
45	2.0%	2
46	1.0%	1
47	0.0%	0
48	0.0%	0
49	0.0%	0

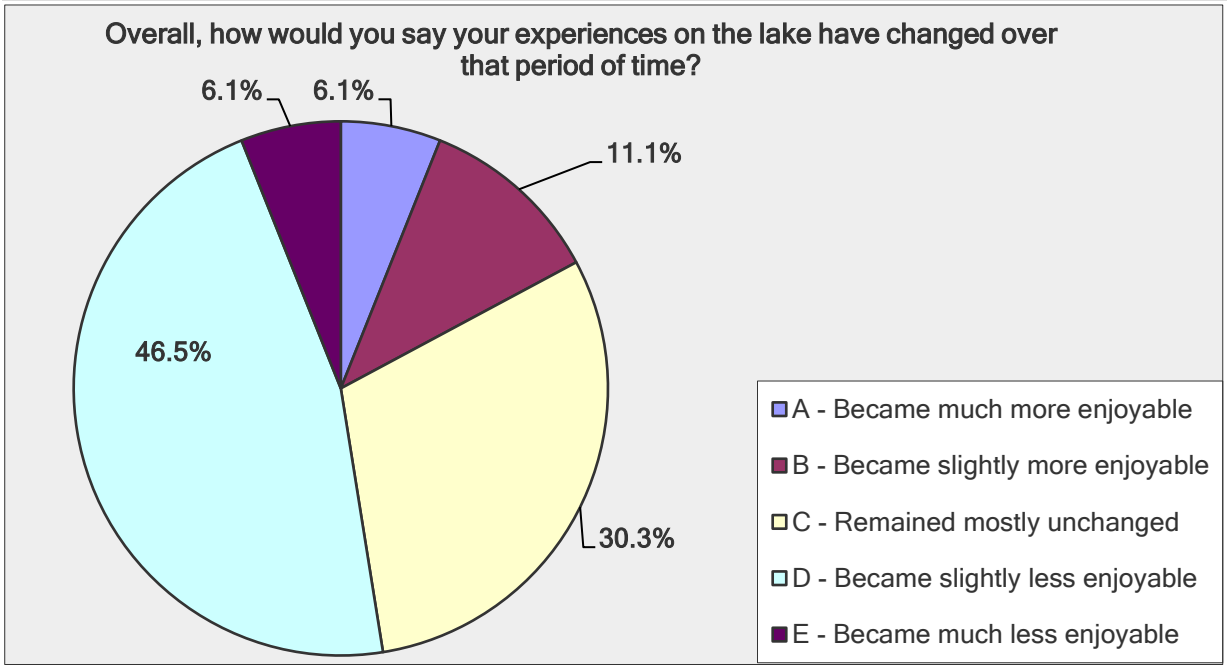
How many years have you personally been using the lake for recreation purposes? If less than one year, please select 1.		
50	3.0%	3
51	0.0%	0
52	0.0%	0
53	1.0%	1
54	0.0%	0
55	0.0%	0
56	0.0%	0
57	0.0%	0
58	0.0%	0
59	0.0%	0
60	3.0%	3
61	0.0%	0
62	0.0%	0
63	1.0%	1
64	0.0%	0
65	0.0%	0
66	1.0%	1
67	0.0%	0
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	1.0%	1
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	99
	skipped question	0

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



Overall, how would you say your experiences on the lake have changed over that period of time? If you select A, B, or C please skip to question 9.

Answer Options	Response Percent	Response Count
A - Became much more enjoyable	6.1%	6
B - Became slightly more enjoyable	11.1%	11
C - Remained mostly unchanged	30.3%	30
D - Became slightly less enjoyable	46.5%	46
E - Became much less enjoyable	6.1%	6
	answered question	99
	skipped question	0

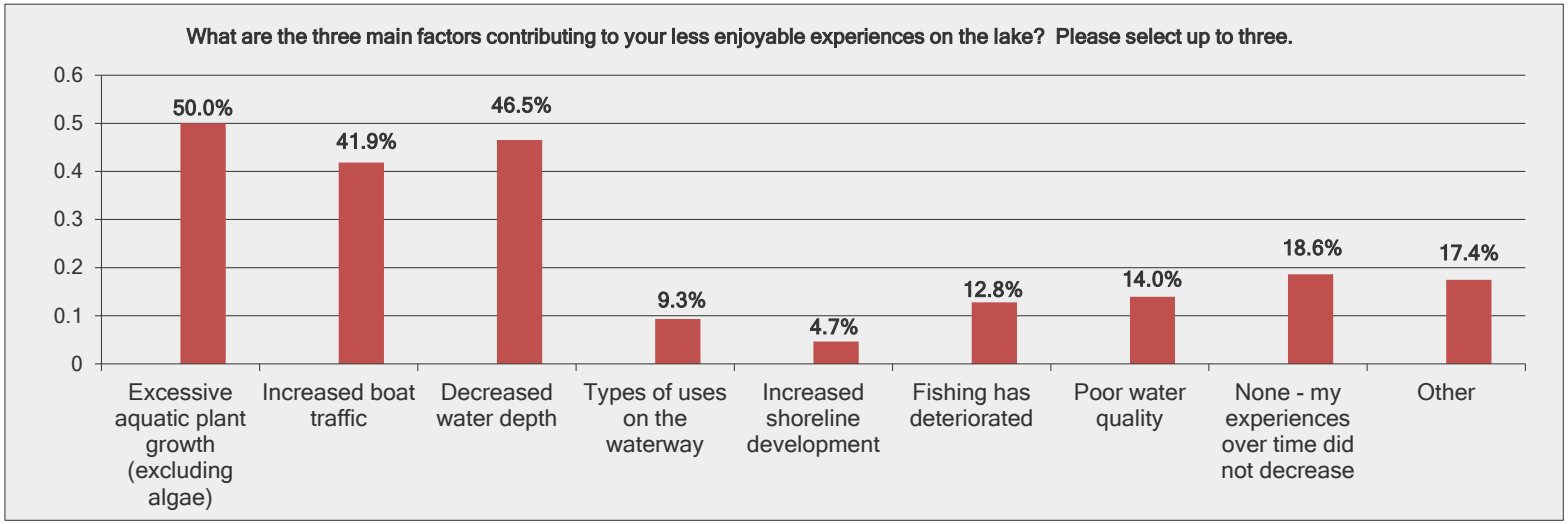


If your experience using the lake over time has become less enjoyable what do you consider the three main factors contributing to your less enjoyable experiences on the lake? Please select up to three.

Answer Options	Response Percent	Response Count
Excessive aquatic plant growth (excluding algae)	50.0%	43
Increased boat traffic	41.9%	36
Decreased water depth	46.5%	40
Types of uses on the waterway	9.3%	8
Increased shoreline development	4.7%	4
Fishing has deteriorated	12.8%	11
Poor water quality	14.0%	12
None - my experiences over time did not decrease	18.6%	16
Other	17.4%	15
	answered question	86
	skipped question	13

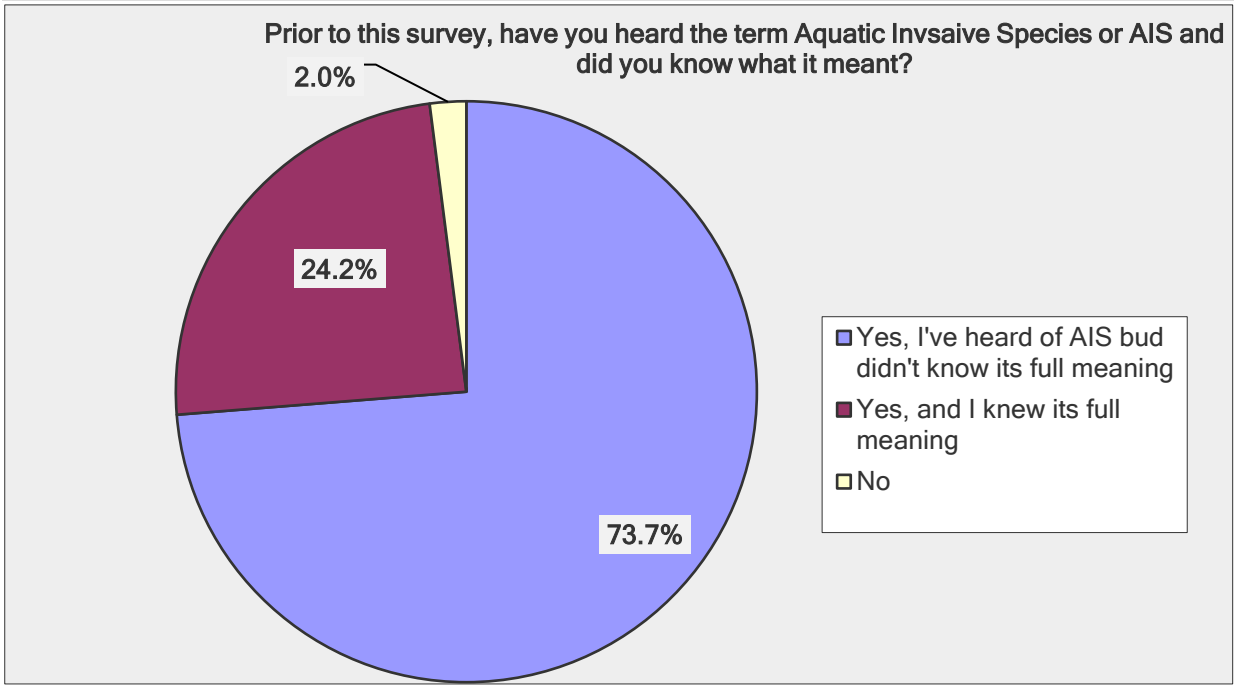
Other (please specify)

1	No-wake hours having a vague sunset rule instead of a specific time
2	Little places to shore fish for public
3	no enforcement of boat traffic and safety laws
4	My health has changed. Hard to get in and out of boat
5	Lake isn't patrolled anymore
6	Less water patrol, less rule enforcement
7	the amount of trash people are leaving in the lake
8	DNR removing fish to transport to other lakes
9	Jet ski usage has increased and they don't follow rules
10	To many jet skies. Stock muskies again
11	FIB's
12	Not enough police patrol
13	algae blooms
14	unsafe boat and PWC drivers on the lake
15	The loss of police patrols has raised the drunk boating and no-wake speeding

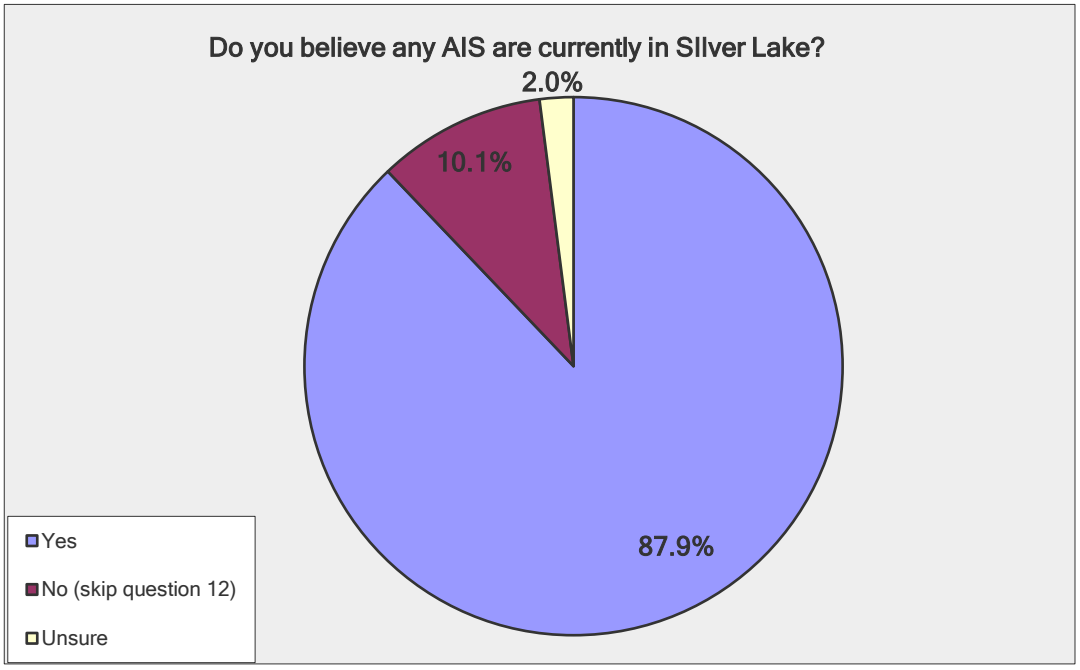


Aquatic Invasive Species (AIS) are non-native plants or animals that can out-compete their native counterparts and can potentially cause many problems within the lake and/or an ecosystem. Prior to this survey, have you heard the term Aquatic Invasive Species or AIS and did you know what it meant?

Answer Options	Response Percent	Response Count
Yes, I've heard of AIS bud didn't know its full meaning	73.7%	73
Yes, and I knew its full meaning	24.2%	24
No	2.0%	2
	answered question	99
	skipped question	0



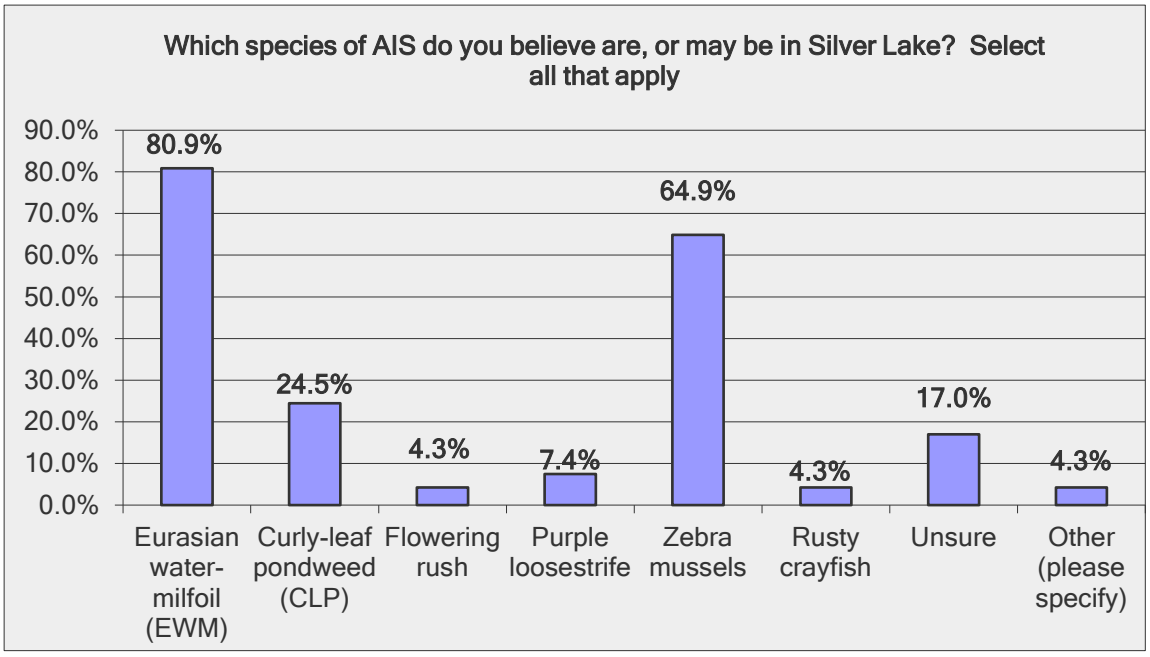
Do you believe any AIS are currently in Silver Lake?		
Answer Options	**Response Percent**	**Response Count**
Yes	87.9%	87
No (skip question 12)	10.1%	10
Unsure	2.0%	2
	answered question	**99**
	skipped question	**0**



Which species of AIS do you believe are, or may be in Silver Lake? Select all that apply		
Answer Options	**Response Percent**	**Response Count**
Eurasian water-milfoil (EWM)	80.9%	76
Curly-leaf pondweed (CLP)	24.5%	23
Flowering rush	4.3%	4
Purple loosestrife	7.4%	7
Zebra mussels	64.9%	61
Rusty crayfish	4.3%	4
Unsure	17.0%	16
Other (please specify)	4.3%	4
	answered question	94
	skipped question	0

Other (please specify)

1) Phragmites australis
2) Canadian Geese (I know, but they are a problem)
3) algae blooms
4) carp

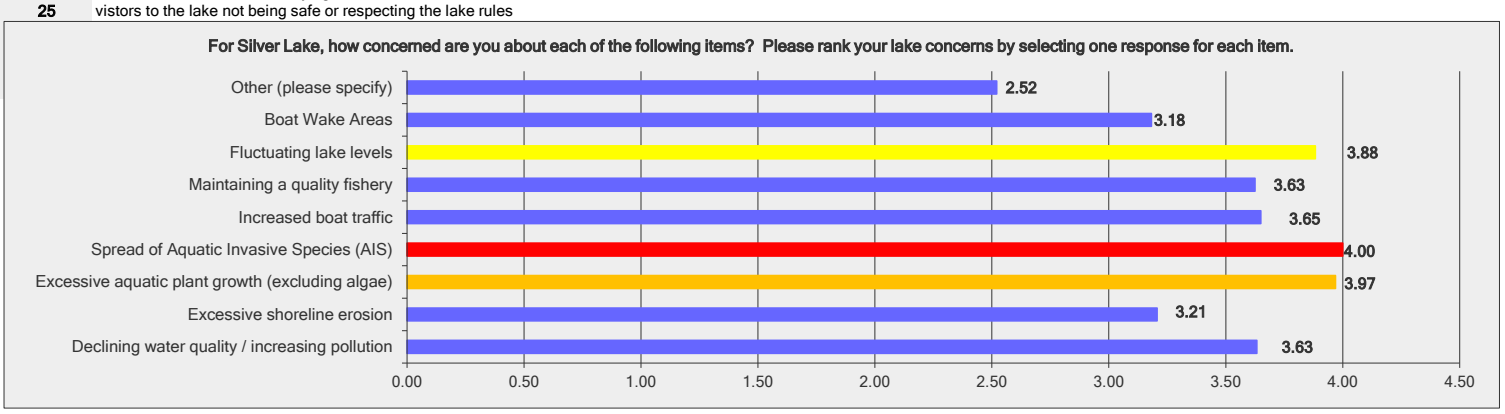


For Silver Lake, how concerned are you about each of the following items? Please rank your lake concerns by selecting one response for each item.

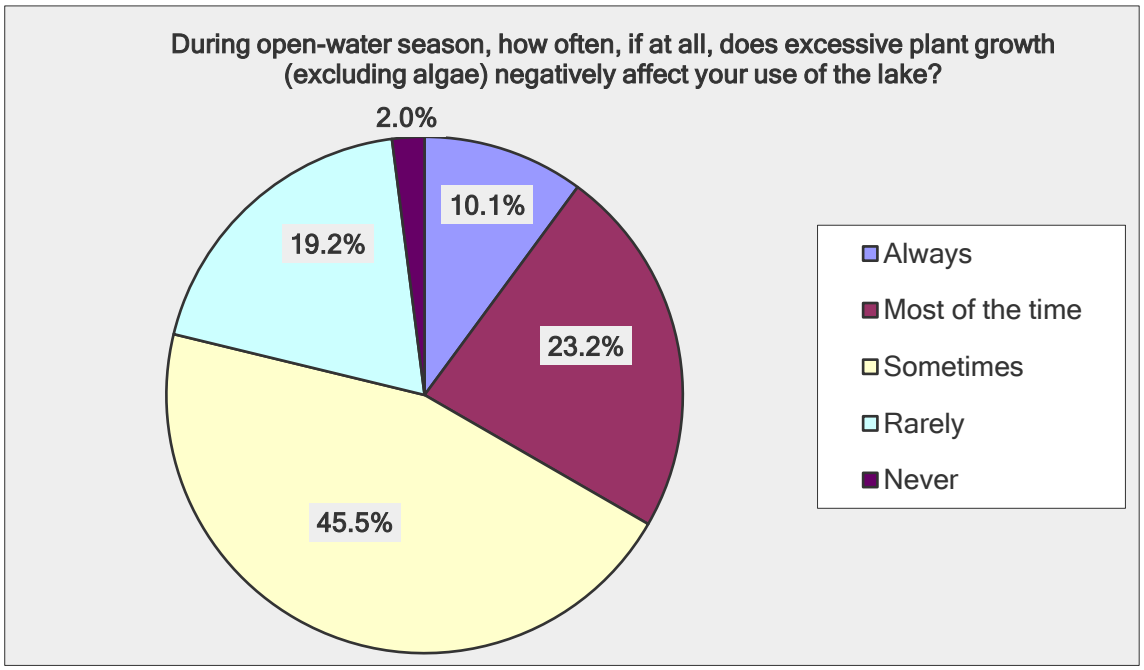
Answer Options	Very Unconcerned	Somewhat Unconcerned	Neutral	Somewhat Concerned	Very Concerned	Unsure - need more information	Rating Average	Response Count
Declining water quality / increasing pollution	8	10	14	44	22	1	3.63	99
Excessive shoreline erosion	9	14	29	29	11	7	3.21	99
Excessive aquatic plant growth (excluding algae)	13	3	5	29	47	2	3.97	99
Spread of Aquatic Invasive Species (AIS)	12	4	6	23	50	4	4.00	99
Increased boat traffic	11	7	17	32	30	2	3.65	99
Maintaining a quality fishery	8	5	25	35	23	3	3.63	99
Fluctuating lake levels	8	7	11	30	38	5	3.88	99
Boat Wake Areas	13	13	34	21	18	0	3.18	99
Other (please specify)	28	3	28	4	10	20	2.52	93
							answered question	99
							skipped question	0

Other (please specify)

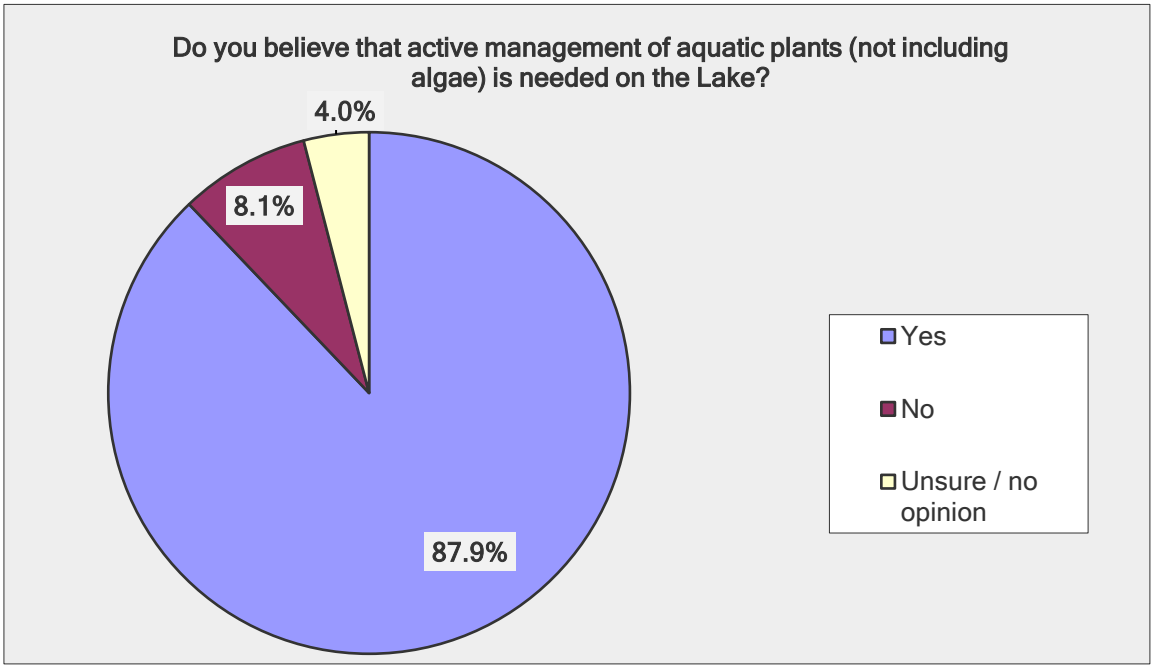
1	You didn't give me an option to leave it blank
2	The spreading of lilies
3	Safety by people piloting watercraft
4	Boaters who are unaware, don't care or purposely disregard safety rules and regulations on watercraft also probably not licensed drivers either
5	Na
6	None
7	E-Colie and Swimmer Itch (Avian problems)
8	survey structure flaw
9	Reparian owners destroying natural shoreline
10	N/A
11	required
12	the shore line next to the city public beach is filled with excessive growth and ecoli
13	NA
14	boat safety
15	Boats parking in front of the piers as mentioned above
16	Needed to click to submit
17	I think the commercial piers need to contribute more financially to the District than their tax assessment part. Basically something like a fee for each rental space they offer which they could pass on to the boaters who rent the slips. I also think their number of slips for rent should be limited
18	reckless jet ski drivers, no patrolling of the lake
19	Beach on Cogswell not maintained
20	No police & dangerous boats speeding in no wake areas even at night
21	Boating rules enforcement, fishing size and limits enforcement
22	SAFETY - lack of water patrol on weekends
23	Muck buildup on bottom from decaying aquatic plants and algae
24	There is no direction and an excessive lack of respect and common sense by many of the water craft users on silver lake. People anchor in the travel paths of the skiers and tubers instead of moving outside the no wake buoys or to the middle of the travel track. The jet skiers are out of control and either need to follow the track or be removed from the lake. The bow fisherman are killing game fish, also their lights should have to be hooded as not to shine horizontally into our homes. Some people dont know the boating regulations, simple things like the person on the right has the right of way. Too many weeds are being killed which is causing the lake temperatures to rise to dangerous levels for the aquatic wild life. They provide shade, cover from predators and Oxygen which helps break down the dead fauna and flora. The lake is dying, I know this because I've seen when it flourished
25	vistors to the lake not being safe or respecting the lake rules



During open-water season, how often, if at all, does excessive plant growth (excluding algae) negatively affect your use of the lake?		
Answer Options	**Response Percent**	**Response Count**
Always	10.1%	10
Most of the time	23.2%	23
Sometimes	45.5%	45
Rarely	19.2%	19
Never	2.0%	2
	answered question	99
	skipped question	0

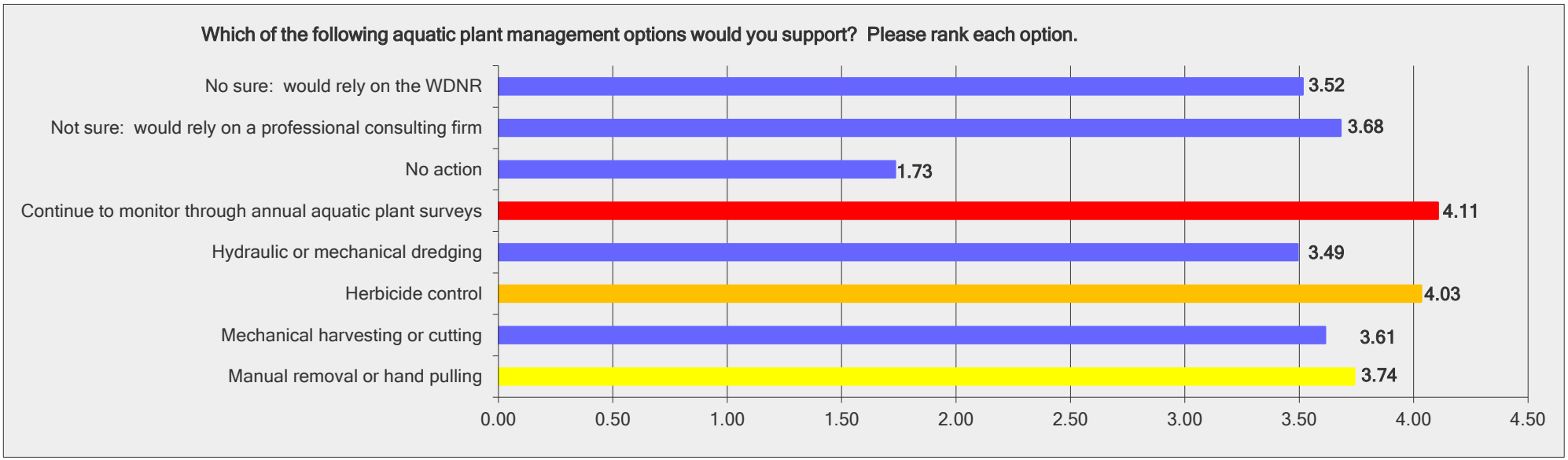


Do you believe that active management of aquatic plants (not including algae) is needed on the Lake? Active management may include any of the following: manual removal, mechanical harvesting, chemical control		
Answer Options	**Response Percent**	**Response Count**
Yes	87.9%	87
No	8.1%	8
Unsure / no opinion	4.0%	4
	answered question	99
	skipped question	0



For each of following aquatic plant and/or algae management options please tell us the extent you would support or oppose each potential option for Silver Lake? Please rank each option.

Answer Options	Strongly Oppose	Oppose	Neutral	Support	Strongly Support	Unsure - need more information	Rating Average	Response Count
Manual removal or hand pulling	3	9	20	28	25	14	3.74	99
Mechanical harvesting or cutting	9	13	10	27	29	11	3.61	99
Herbicide control	3	6	15	27	39	9	4.03	99
Hydraulic or mechanical dredging	6	8	23	28	16	18	3.49	99
Continue to monitor through annual aquatic plant	0	5	19	31	39	5	4.11	99
No action	54	17	18	4	1	5	1.73	99
Not sure: would rely on a professional consulting firm	5	4	30	28	24	8	3.68	99
No sure: would rely on the WDNR	7	5	34	30	19	4	3.52	99
							answered question	99
							skipped question	0

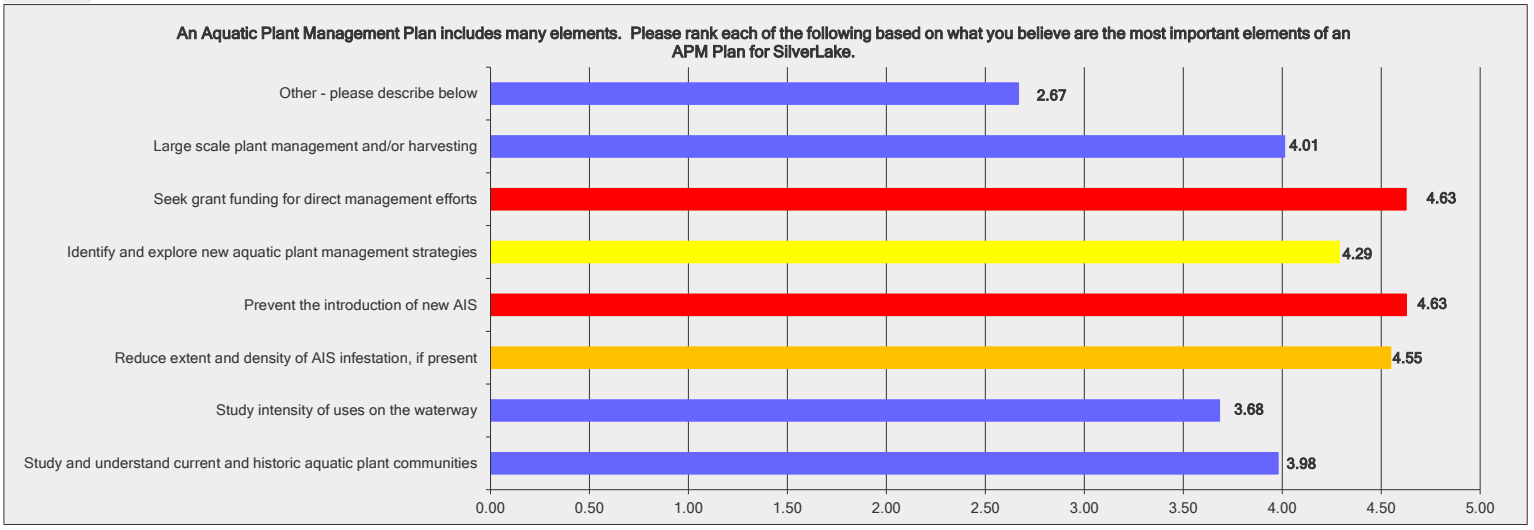


An Aquatic Plant Management Plan includes many elements. For each of the following, please tell us how necessary or unnecessary you believe each element is for Silver Lake.

Answer Options	Definitely not necessary	Somewhat Unnecessary	Neutral	Somewhat Needed	Definitely needed	Unsure - need more information	Rating Average	Response Count
Study and understand current and historic aquatic plant communities	2	9	14	31	36	5	3.98	97
Study intensity of uses on the waterway	2	13	16	37	20	8	3.68	96
Reduce extent and density of AIS infestation, if present	0	1	7	26	61	2	4.55	97
Prevent the introduction of new AIS	0	2	4	20	65	6	4.63	97
Identify and explore new aquatic plant management strategies	0	2	9	38	38	10	4.29	97
Seek grant funding for direct management efforts	1	0	5	19	63	9	4.63	97
Large scale plant management and/or harvesting	5	3	16	26	38	9	4.01	97
Other - please describe below	5	0	7	1	2	9	2.67	24
							answered question	97
							skipped question	2

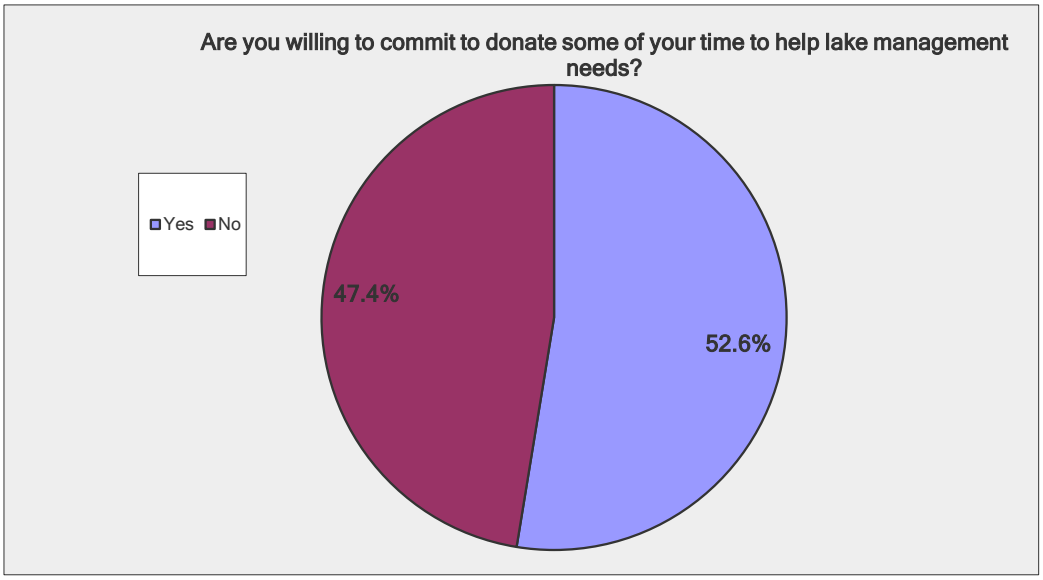
Other (please specify)

1	Wry strongly agree with plant management, however I very strongly disagree with plant harvesting
2	No
3	Police enforement on weekends
4	Investigate the use of natural weed control ie; fish species
5	Limited management of aquatic plants as fas as cutting. Provide a path for the water sports to travel in, mostly necessary on the west and south and dependent on the growth patterns. Education to the boaters by their prespective marinas and or through the official site
6	This section is more nuanced than can be captured in a predefined question
7	none



Are you willing to commit to donate some of your time to help lake management needs? Such as "Clean Boats / Clean Water" inspecitons, lake water sampling, etc.? Please not this not regarded as a formal commitment but will be used to gauge potential participation of area stakeholders.

Answer Options	Response Percent	Response Count
Yes	52.6%	51
No	47.4%	46
If Yes, how many hours per summer are you willing to commit?	9.9 hrs	average
	answered question	97
	skipped question	0



If you have any additional general comments about the Silver Lake Management District, lake planning process, or something that you felt wasn't addressed in this survey please enter them here.

Answer Options	Response Count
	39

Number	Response
1	Not sure our lake should have hunting allowed, based on size, waterfowl moving through, close to people, etc I thought the weeds were really minimal this year, being on the eastern shore I was always cleaning the "haystack" up of milfoil off the shore
2	Management of public boat lunch and private lunch. Not sure of the legality of introducing a fee (i.e like the beach access on the weekends) - If fishing is a real concern introduce a stricter limit during ice fishing season.
3	Contributions were asked for and given last year to kill weeds. The weeds on the west side of the lake are worse than ever, and I have been here for 45 years. In addition, some of the lowest lake levels seem to exacerbate this issue.
4	The shoreline weeds seem to be down quite a bit the last couple years. Thank you for your management. I'm not sure if others on the lake are noticing shoreline erosion but I have not.
5	Thank You!
6	none
7	I believe the main purpose of forming the district was to create a sustainable revenue stream to fund the treatment of invasive aquatic species. I believe that should be the main focus of the district. Once substantial bank is established for a whole like treatment then I would be in favor of allocating money towards work on launches, cleaning stations for boats, maintenance of the dam and funding lake patrol.
8	Maybe a signage of where people can park ((can they park at the grade school) if there is no room at the DNR. and a sign showing where the DNR boat launch is?? ALSO a free rental of life jackets also at this boat launch. MORE signage of RULEs of the lake.
9	The no wake need to be 1 hour before dusk. It's crazy! people on jet skis and water skiing at dusk or after it's to dark they can't see or no one can see them. Someone's gonna get killed.
10	Please keep the lake open to Recreational Boating and don't get over-zealous in police safety inspections / harassments (I don't need one everyday like we use to have). Marina and Bait Shop Slips and other Single Day Boaters Need to Pay their fair share (introduce fees).
11	We really need to have a proper dam installed that actually controls the water.
12	Bowfishing should be stopped.
13	AIS mechanical harvester would be a worthwhile investment; perhaps sharing with Camp/Center lake which has 2.
14	DNR fish stocking and size limits don't make sense. They seem to not have a definite plan and are stuck on some archaic regulations
15	I don't mind the occasional "concerts" on Sunday afternoons, but disike the profanity.
16	THANK YOU FOR ALL YOU DO!
17	None
18	on the weekends due to reckless and irresponsible boaters. Unfortunately, despite having a busy lake, we have seen very little police/sheriff boat presence on the lake to help regulate this. Lake property owers' guests and lake visitors often do not follow the State of Wisconsin boat laws, which in turn, affects the safety of all Silver Lake users. Common problems we have encountered are: 1) boats and PWC not following the "100-foot distance rule" from other watercraft or swimmers. 2) PWC and boats creating a wake before 10am, 3) boats not following the counter clockwise pattern, 4) PWC following the wakes of boats pulling skiers and tubers, 5) boats driving too fast around the swimming area at the park and boats anchored near the park. Possible solutions to consider: 1) Commitment from the county to have a police boat presence each Saturday and Sunday throughout the summer months. 2) Check boater safety licenses at the public boat launches prior to allowing visitor to access the lake. 3) Have visitors review and sign off on safety rules prior to accessing the lake via the public boat launches.
19	Love the lake! Would love to get the plants under control & improve the west side muck!
20	I don't fish, don't have a boat. I walk the path along north side to county park. I am 76 and past the age of wanting to do anything now.
21	enforce people top pay the $7 at the launch by the BP and use these funds to stock the lake with fish - thousands of boats use this all year and nobody pays to launch there boat there
22	Glad you are addressing this now and not when it is too late.
23	Grateful for the efforts to date and for asking for our input.
24	I had a place for 14 years on Paddock Lake where mechanics harvesting was done. There was a lot of floating Eurasian milfoil on the lake as a result of the harvester cutting and machine inadequacies in collecting all the cut milfoil. Made a mess of the lake and likely spread more easily. Was also a nuisance on top of the water when swimming and boating. There was also huge piles that residents had to clean up along the shore. I am strongly opposed to mechanical cutting of any foliage on Silver Lake.
25	Thank you to the SLMD leaders for your time and efforts!!
26	Different marinas for boat slips and limiting how many slips they are allowed and do the owners contribute to lake projects
27	Runoff from highway 50 and settling ponds at business park.
28	Lack of sheriff patrolling of the lake during peak hours. A clear time when the no wake starts in the evening. (There is a specific time when no wake ends in the morning) Sundown is a subjective time. More sheriff enforcement of tubing and jet skiing rules.
29	The cleaning, maintaining and enforcing of rules of the beach on Cogswell. People fish there leaving fishing line/hooks in the water and beach area making it dangerous especially for young children. The seaweed is not moved from the lake edge and the sand not raked frequently.
30	More info and studies need to be provided to the community for understanding. That may lead to greater support.
31	We live silver lake. Glad to see your reaching out to hear what the community has to say!
32	Need police to make it safer & limit number of boat slips & how many boats The Marina allows on
33	Improve/monitor boat launches, hire lake rules enforcement for busy times, build financial reserves to accommodate initial improvement programs and fund new services
34	We need to re-establish water patrol on weekends.
35	We need to try and get more dnr wardens to check bag limits and bow fishermen. Lake Police need to start handing out tickets for direction violations and coming too close to other water craft. There are too many boats on the lake and it's unsafe to the point that people who pay taxes don't want to Boat. The lake is too small for the number of boats and its a matter of time before someone is Killed.

36	So far we are pushing $200,000 spent on chemical treatments to combat Eurasian Water Milfoil (EWM) in Silver Lake and there has been no progress with abatement. Silver Lake has become a perfect environment for EWM. Nutrient run off into the lake, plant and lakebed disturbance from watercraft tip the ecologic balance in the favor of EWM vs. other desirable plants. Many lake districts around the state have thrown a lot of money treating EWM for no improvement. If chemicals worked, conventional farmers wouldn't need to spray their fields each year. Over the many years that EWM has been in Silver Lake, it has produced millions of seeds and cuttings from propellers floating around the lake, which continue the spread. We can't put Pandora back in the box. We think that weeds make the lake unhealthy, but it's the other way around, weeds are the symptom of an unhealthy lake. The plants that grow in the lake define the management of the lake. The only path you have explored has been chemical treatment, not only does it not work, it produces all sorts of unintended consequences that are detrimental to life, including human health. There are 2 other short-term possibilities that you have not explored. One is mowing, that reduces organic and nutrient load as plants get removed from the lake. This is a slow continuous process. The 3rd is adding critters to the water to eat the EWM, This has to be monitored closely and these organisms can move the balance for other species. These short-term solutions don't address the health of the lake, only the symptom and they cost money. To address the health of the lake you have to fix the broken water cycle. The water cycle is how water moves through the environment. It has worked for billions of years. What's changed is that now there are more non-permeable or impermeable surfaces surrounding the lake (homes, roads, driveways commercial buildings). Water can't make its' way back into the ground to be captured, stored, filtered and returned to our underground aquifers. Also modern farming practices of tillage and not having plants in the ground year round produces runoff of nutrients into our waterways and lakes. Nutrient rich water (with phosphorus) enters the lake through culverts that drain into the lake from various points around Silver Lake. This is where most of the weed growth is. These are also the shallow areas of the lake, which get more sunlight for plant photosynthesis. Another source of nutrients is run off into the lake from homeowner's lawns, from fertilizer (phosphorus) and herbicides. Without a buffer these lawns don't capture runoff and nutrients before entering the lake. We need to focus on the health of the lake, not just killing weeds. The focus on killing weeds gets us nowhere but poorer.
37	My main concern is guests and visitors using the lake unsafely. We had several close calls with jet skis in the no wake areas buzzing our anchored boat and also boats and jet skis following too closely while we were towing our kids. Very dangerous! We wish there was more we could do about this. Many boats do not honor the 100 foot rule either. Thanks for all you do for our lake!
38	We need level control first. Our outlet is in a joke and easily manipulated at will by many.

APPENDIX B – SUPPORTING AQUATIC PLANT DOCUMENTATION

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.

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

NR 107.01 Purpose.
NR 107.02 Applicability.
NR 107.03 Definitions.
NR 107.04 Application for permit.
NR 107.05 Issuance of permit.
NR 107.06 Chemical fact sheets.
NR 107.07 Supervision.
NR 107.08 Conditions of the permit.
NR 107.09 Special limitation.
NR 107.10 Field evaluation use permits.
NR 107.11 Exemptions.

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.
NR 109.02 Applicability.
NR 109.03 Definitions.
NR 109.04 Application requirements and fees.
NR 109.05 Permit issuance.
NR 109.06 Waivers.
NR 109.07 Invasive and nonnative aquatic plants.
NR 109.08 Prohibitions.
NR 109.09 Plan specifications and approval.
NR 109.10 Other permits.
NR 109.11 Enforcement.

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.

FIGURES

Fullness Rating	Coverage	Description
1		Only 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 the tines.
3		The rake is completely covered and tines are not visible.

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Total Rake Fullness

Surveyed: August 22-23, 2023

Figure 1
Silver Lake
Kenosha County

Fullness Rating	Coverage	Description
1		Only 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 the tines.
3		The rake is completely covered and tines are not visible.

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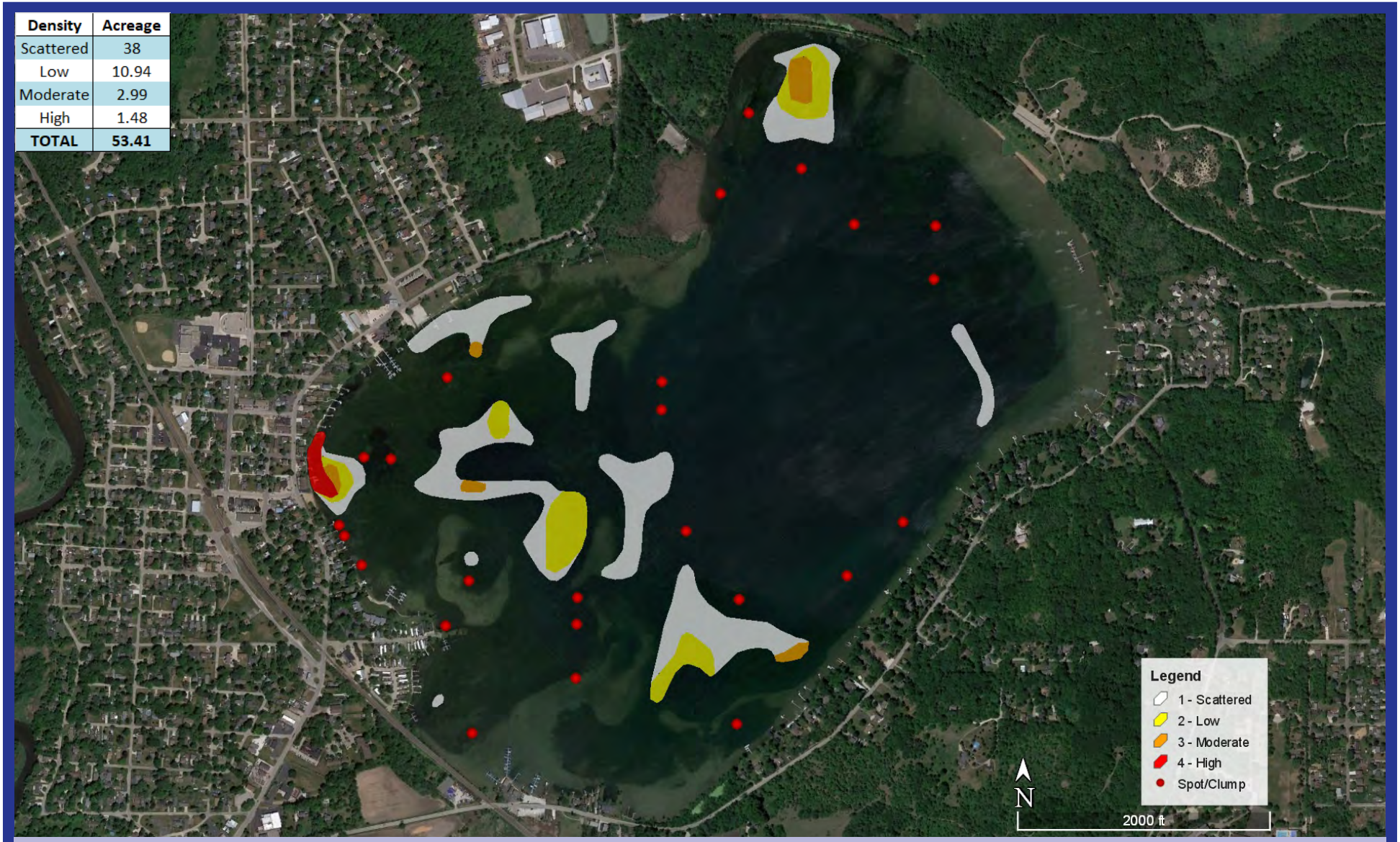
Hybrid Water-milfoil Locations

Surveyed: August 22-23, 2023

Figure 2
Silver Lake
Kenosha County

Density	Acreage
Scattered	38
Low	10.94
Moderate	2.99
High	1.48
TOTAL	**53.41**



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Hybrid Water-milfoil Areas

Surveyed: August 22-23, 2023

Figure 3a
Silver Lake
Kenosha County

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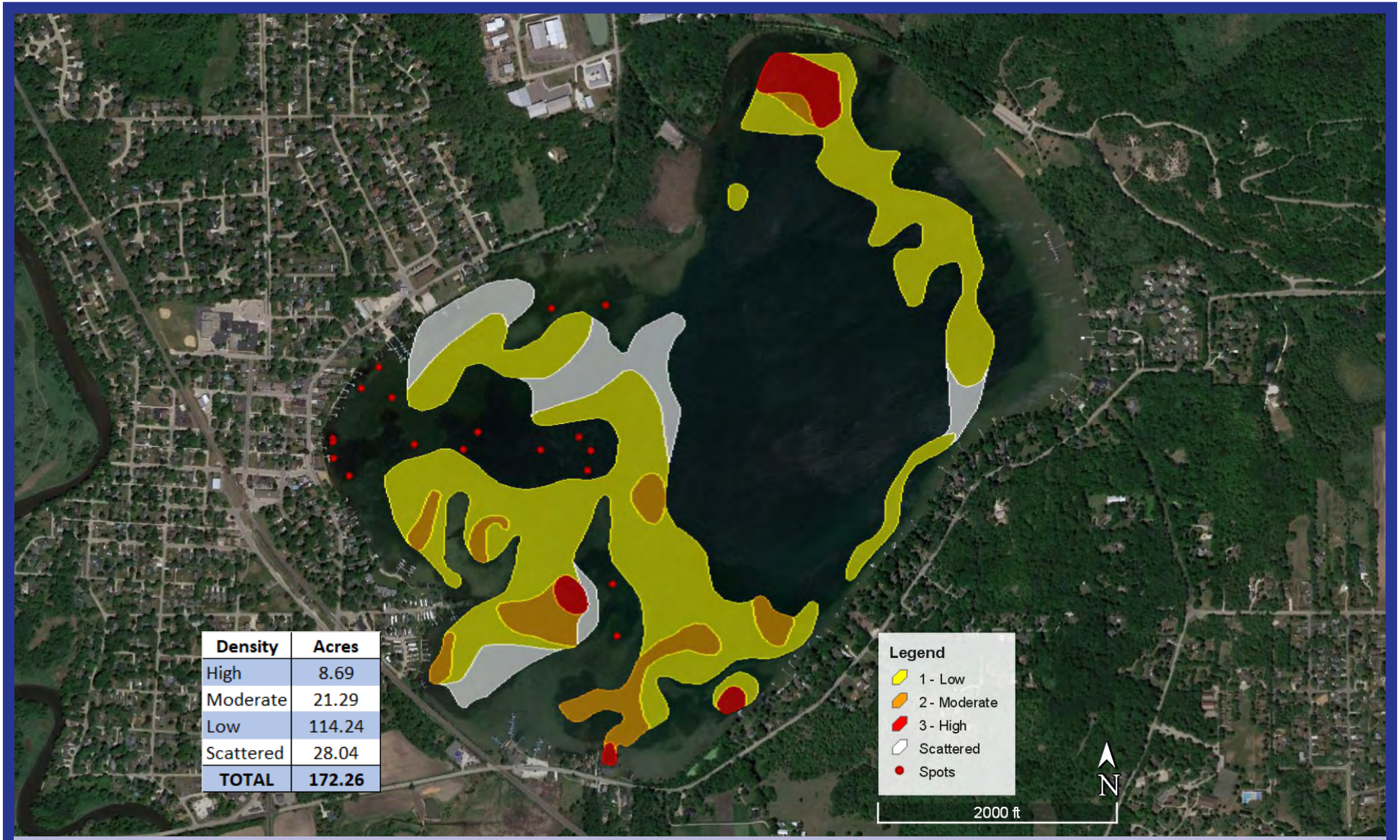
2022 HWM Locations

Figure 3b
Silver Lake, Kenosha County
Surveyed: October 20, 2022



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2021 HWM Locations

Figure 3c
Silver Lake, Kenosha County
Surveyed: Sept. 14 & 16, 2021

Fullness Rating	Coverage	Description
1		Only 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 the tines.
3		The rake is completely covered and tines are not visible.

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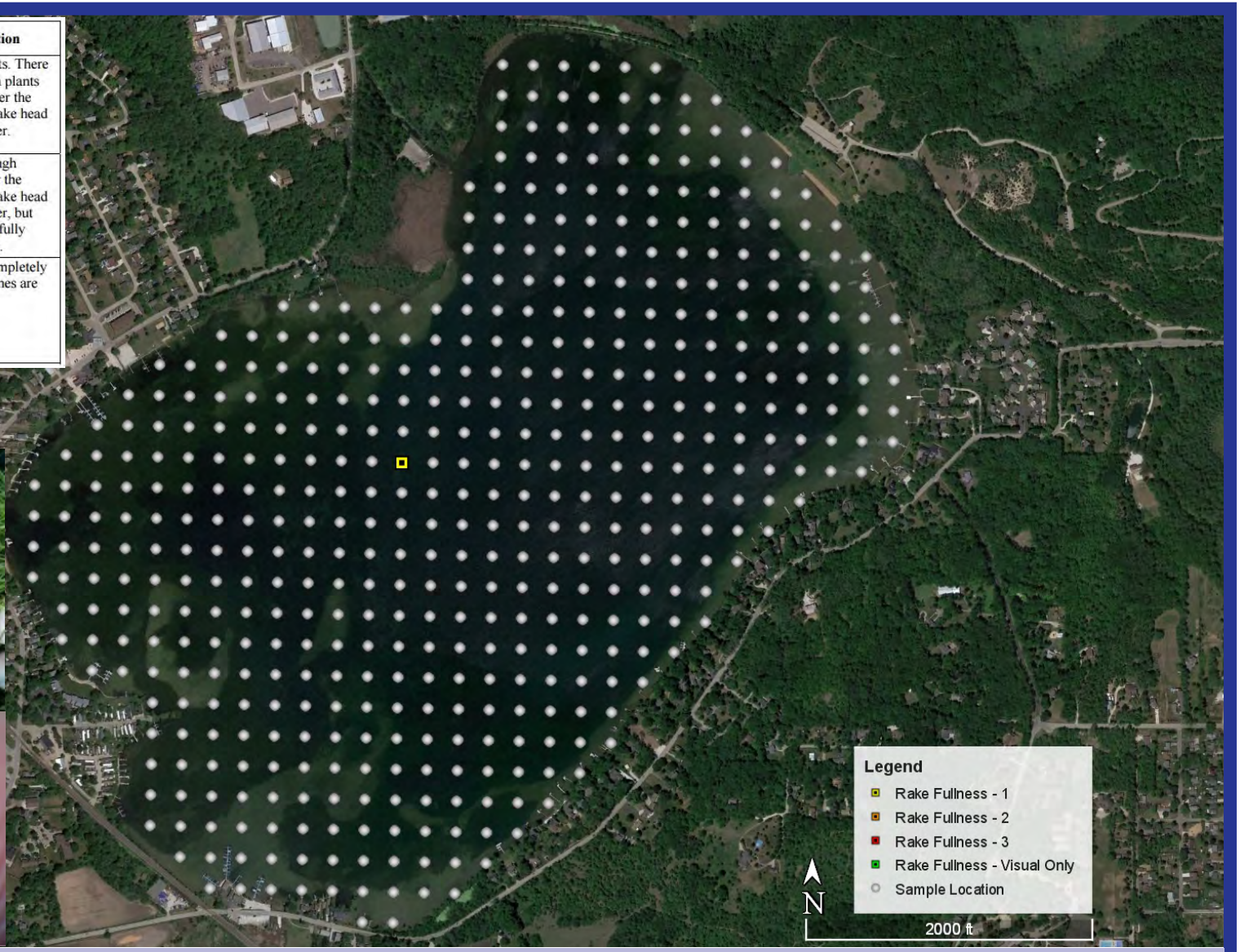
Curly-leaf Pondweed Locations

Surveyed: August 22-23, 2023

Figure 4
Silver Lake
Kenosha County

Fullness Rating	Coverage	Description
1		Only 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 the tines.
3		The rake is completely covered and tines are not visible.



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Starry Stonewort Locations

Surveyed: August 22-23, 2023

Figure 5
Silver Lake
Kenosha County

Fullness Rating	Coverage	Description
1		Only 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 the tines.
3		The rake is completely covered and tines are not visible.

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Chara/Muskgrass Locations

Surveyed: August 22-23, 2023

Figure 6
Silver Lake
Kenosha County

Fullness Rating	Coverage	Description
1		Only 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 the tines.
3		The rake is completely covered and tines are not visible.

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Water Celery Locations

Surveyed: August 22-23, 2023

Figure 7
Silver Lake
Kenosha County

Fullness Rating	Coverage	Description
1		Only 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 the tines.
3		The rake is completely covered and tines are not visible.

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Sago Pondweed Locations

Surveyed: August 22-23, 2023

Figure 8
Silver Lake
Kenosha County

Fullness Rating	Coverage	Description
1		Only 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 the tines.
3		The rake is completely covered and tines are not visible.

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Illinois Pondweed Locations

Surveyed: August 22-23, 2023

Figure 9
Silver Lake
Kenosha County

Fullness Rating	Coverage	Description
1		Only 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 the tines.
3		The rake is completely covered and tines are not visible.

Legend
- Rake Fullness - 1
- Rake Fullness - 2
- Rake Fullness - 3
- Rake Fullness - Visual Only
- Sample Location

N

2000 ft

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Southern Naiad Locations

Surveyed: August 22-23, 2023

Figure 10
Silver Lake
Kenosha County

TABLES

Table 3: Frequency of Occurrence of Aquatic Plant Species by Year, Silver Lake, Kenosha County, Wisconsin.

Species	Frequency of Occurrence by Year									
	2006	2012	2013	2014	2015	2016	2017	2019	2020	2023
Hybrid water-milfoil	20.57	52.99	33.33	37.97	---	---	0.77	25.58	46.34	17.6
Curly-leaf pondweed	1.04	---	0*	---	---	0.78	0.51	0.52	0.26	1.79
Starry Stonewort	---	---	---	---	---	---	---	---	---	0.26
Filamentous algae	21.35	0.25	2.84	2.41	0.52	---	---	---	---	---
Watershield	0.26	---	---	---	0.26	0.26	0.26	---	0.26	0.26
Coontail	9.11	18.41	23.26	23.53	14.73	4.18	9.77	10.85	14.14	4.08
Muskgrass	62.24	49.75	54.26	67.65	68.48	64.23	70.95	67.44	50.26	60.71
Common waterweed	---	0.25	0.26	0.53	---	---	---	---	0.79	2.3
Water star-grass	7.29	7.71	5.43	5.35	2.58	2.61	13.37	22.22	22.51	10.71
Small duckweed	---	0*	---	---	---	---	---	0.52	0.51	---
Purple loosestrife	---	0*	---	---	---	---	---	---	---	---
Northern water-milfoil	7.81	---	---	---	---	---	0.26	---	---	---
Whorled water-milfoil	---	0*	---	---	---	---	---	---	---	---
Slender naiad	10.68	11.91	10.34	4.01	---	2.35	9	9.3	---	7.91
Southern naiad	---	---	16.8	14.97	---	---	---	0.52	14.14	15.56
Spiny naiad	6.25	8.21	16.8	13.37	---	25.07	19.79	8.27	4.97	7.91
Nitella	2.6	1.99	---	---	0.52	0.26	1.03	2.33	0.79	1.79
Spatterdock	0*	0.5	0.26	0.53	0.78	0.78	0.51	0.26	0.79	0.51
White water lily	0.26	0.75	0.78	0.8	1.55	1.57	1.29	0.78	1.31	1.53
Common reed	---	0*	---	---	---	---	---	---	---	---
Pickerelweed	0.26	0.25	0*	0*	0.52	0.52	0.51	0.52	0.52	0.26
Large-leaf pondweed	---	---	---	---	---	---	---	---	0.26	---
Leafy pondweed	0.52	---	---	---	---	---	0.77	---	0.52	---
Frie's pondweed	1.04	1	1.03	0.27	---	1.57	1.29	15.25	1.05	0.51
Variable pondweed	0.26	---	0.78	2.94	12.4	14.62	10.8	9.56	1.57	0.77
Illinois pondweed	24.22	0.75	3.62	16.84	---	0.26	5.91	9.3	29.58	16.33
Floating-leaf pondweed	---	0*	0*	---	---	0.26	0.26	0.52	0.26	0.77
Long-leaf pondweed	0.26	1.99	1.81	0.8	0.26	0.52	0.26	0.52	0.26	0.51
White-stem pondweed	---	1.74	0.26	0.53	---	---	0.51	0.52	1.31	1.79
Small pondweed	1.04	---	---	---	---	---	---	---	---	---
Clasping-leaf pondweed	1.3	---	2.33	1.34	---	---	---	---	0.26	---
Stiff pondweed	---	---	---	---	---	0.52	---	---	---	0.26
Flat-stem pondweed	---	---	0*	0.53	0.26	1.57	0.77	2.8	6.28	8.67
White water crowfoot										0.51
Common arrowhead	---	0*	---	---	---	---	---	---	---	---
Rigid arrowhead	---	---	---	---	---	0.78	0.51	0.26	---	---
Hardstem bulrush	---	---	---	0*	---	0.26	0.26	0*	0*	---
Three-square bulrush	---	---	0.26	---	0.26	---	0.26	0.26	0.26	---
Softstem bulrush	0*	0*	---	---	---	---	---	---	---	---
Sago pondweed	21.88	24.13	27.13	27.54	6.98	38.12	27.25	18.6	27.23	23.47
Narrow-leaved cattail	---	0*	---	---	---	---	---	---	---	---
Small bladderwort	0.26	---	---	---	---	---	---	---	---	---
Small purple bladderwort	1.3	---	0.26	0.53	---	0.26	0.26	0.26	0.26	0.51
Common bladderwort	0.26	0.5	0.52	1.07	1.5	0.78	---	0.26	0.26	1.28
Common watermeal	---	0*	---	---	---	---	0.26	0.26	0.52	---
Wild celery	23.7	30.1	38.24	47.86	16.6	14.88	23.39	27.13	31.94	33.93
Illinois x variable pondweed hybrid	---	21.64	13.44	---	---	---	---	---	---	---
Illinois / Variable / Hybrid data combined^	24.48	22.39	17.84	19.78	12.4	14.88	16.71	18.86	31.15	17.1

* - recorded as visual only

--- - species not sampled

^ - due to difficulty identifying between three species and drastic changes between years data for Illinois, variable, and Illinois x variable hybrid pondweed species is combined

Table 4: Historical Floristic Quality Index, Silver Lake, Kenosha County, WI

	Coefficient of Conservatism									
Common Name	**2006**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2019**	**2020**	**2023**
Watershield	6	---	---	---	6	6	6	---	6	6
Coontail	3	3	3	3	3	3	3	3	3	3
Muskgrass	7	7	7	7	7	7	7	7	7	7
Common waterweed	---	3	3	3	---	---	---	---	3	3
Water star-grass	6	6	6	6	6	6	6	6	6	6
Small duckweed	---	4	---	---	---	---	---	4	4	---
Northern water-milfoil	6	---	---	---	---	---	6	---	---	---
Whorled water-milfoil	---	8	---	---	---	---	---	---	---	---
Slender naiad	6	6	6	6	---	6	6	6	---	6
Southern naiad	---	---	8	8	---	---	---	8	8	8
Nitella	7	7	---	---	7	7	7	7	7	7
Spatterdock	6	6	6	6	6	6	6	6	6	6
White water lily	6	6	6	6	6	6	6	6	6	6
Common reed	---	1	---	---	---	---	---	---	---	---
Pickerelweed	8	8	8	8	8	8	8	8	8	8
Large-leaf pondweed	---	---	---	---	---	---	---	---	7	---
Leafy pondweed	6	---	---	---	---	---	6	---	6	---
Frie's pondweed	8	8	8	8	---	8	8	8	8	8
Variable pondweed	7	---	7	7	7	7	7	7	7	7
Illinois pondweed	6	6	6	6	---	6	6	6	6	6
Floating-leaf pondweed	---	5	5	---	---	5	5	5	5	5
Long-leaf pondweed	7	7	7	7	7	7	7	7	7	7
White-stem pondweed	---	8	8	8	---	---	8	8	8	8
Stiff pondweed	---	---	---	---	---	8	---	---	---	8
Small pondweed	7	---	---	---	---	---	---	---	---	---
Clasping-leaf pondweed	5	---	5	5	---	---	---	---	5	---
Flat-stem pondweed	---	---	6	6	6	6	6	6	6	6
White water crowfoot	---	---	---	---	---	---	---	---	---	8
Common arrowhead	---	3	---	---	---	---	---	---	---	---
Rigid arrowhead	---	---	---	---	---	8	8	8	---	---
Hardstem bulrush	---	---	---	6	---	6	6	6	6	---
Three-square bulrush	---	---	5	---	5	---	5	5	5	---
Softstem bulrush	4	4	---	---	---	---	---	---	---	---
Sago pondweed	3	3	3	3	3	3	3	3	3	3
Narrow-leaved cattail	---	1	---	---	---	---	---	---	---	---
Small bladderwort	10	---	---	---	---	---	---	---	---	---
Small purple bladderwort	9	---	9	9	---	9	9	9	9	9
Common bladderwort	7	7	7	7	7	7	---	7	7	7
Common watermeal	---	5	---	---	---	---	5	5	5	---
Wild celery	6	6	6	6	6	6	6	6	6	6
Total Species	23	24	22	21	15	22	25	25	28	24
Mean C	6.35	5.33	6.14	6.24	6.00	6.41	6.24	6.28	6.07	6.42
Floristic Quality Index (FQI)	**30.44**	**26.13**	**28.78**	**28.59**	**23.24**	**30.06**	**31.20**	**31.40**	**32.13**	**31.44**