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Staff Memorandum

AQUATIC PLANT MANAGEMENT PLAN FOR LOWER NEMAHBIN LAKE, WAUKESHA COUNTY, WISCONSIN

February 29, 2024

Following an April 7th, 2023, phone call between Jim Keller, former President of the Lower Nemahbin Lake Association ("Association") and Southeastern Wisconsin Regional Planning Commission ("Commission") staff, the Commission prepared a scope of work and an agreement to evaluate recent aquatic plant surveys on Lower Nemahbin Lake ("Lake") and ongoing efforts to manage invasive starry stonewort ("SSW") (*Nitellopsis obtusa*) and Eurasian watermilfoil ("EWM") (*Myriophyllum spicatum*) as part of an aquatic plant management plan for the Lake. This agreement was executed by the Association on May 23rd, 2023. This memorandum inventories recently aquatic plant survey information for the Lake and provides recommendations for long-term aquatic plant management in fulfillment of that agreement.

BACKGROUND INFORMATION

Lower Nemahbin Lake is a 239-acre drainage lake located entirely within the Village of Summit in Waukesha County. The Lake is immediately downstream of Upper Nemahbin Lake, with which it shares a public boat landing, and about one mile upstream of Crooked Lake.[1] The Bark River, which flows into the Lake from Upper Nemahbin Lake, is the Lake's largest tributary and its outlet. The Lake is impounded by a weir near CTH P. Previous aquatic plant surveys in 2006, 2019, 2020, and 2022 have observed several beneficial native species, including muskgrass (*Chara* spp.) and many varieties of sensitive pondweeds (*Potamogeton* spp.). Invasive aquatic plant species, including SSW, EWM, spiny naiad (*Najas marina*), and curly-leaf pondweed ("CLP") (*Potamogeton crispus*), have also been observed in the Lake; EWM and SSW populations are a focus of monitoring and management efforts by the Lower Nemahbin Lake Association and the Wisconsin Department of Natural Resources ("WDNR").

Eurasian watermilfoil was first verified on the Lake in 1978 and has been a focus of aquatic plant management.[2] The Association received a WDNR permit to chemically treat EWM populations on the Lake in 2020 and 2021. Since 2020, the EWM population has decreased notably with few to no areas of surface matting.[3]

Starry stonewort was first observed on Lower Nemahbin Lake near the public boat launch in August 2019.[4] With funding from WDNR Early Detection and Response grants, the Association and the WDNR have monitored this population and utilized hand-pulling and Diver Assisted Suction Harvesting (DASH) treatments to reduce its size and spread. As part of this monitoring, WDNR conducted aquatic plant surveys

[1] *The Lake also has a separate carry-in launch on its western shore.*

[2] *See dnr.wi.gov/lakes/lakepages/LakeDetail.aspx?wbic=827000&page=invasive.*

[3] *Personal communication between Commission staff (Justin Poinsatte) and Jim Keller, President of the Lower Nemahbin Lake Association, on April 7th, 2023.*

[4] Ibid.

in 2019, 2020, and 2022. While the population remained limited to its original establishment area from 2019 to 2021, a 2022 survey indicated spread of SSW to a new area of the Lake.

This aquatic plant management plan is intended to present the status of the aquatic plant community, identify plant community changes that have occurred, examine the efficacy of the current aquatic plant management strategies, and recommend a long-term aquatic plant management plan for the Lake.

AQUATIC PLANT COMMUNITY COMPOSITION, CHANGE, AND QUALITY

All healthy lakes have plants and native aquatic plants form a foundational part of a lake ecosystem. Aquatic plants form an integral part of the aquatic food web, converting sediments and inorganic nutrients present in the water into organic compounds that are directly available as food to other aquatic organisms. Plants also provide habitat to many aquatic organisms, enhance water quality, and stabilize lake shorelines and bottom sediments. Even though aquatic plants may hinder human use and/or access to a lake, aquatic plants should not necessarily be eliminated or even significantly reduced in abundance because of these important functions. Large-scale removal of native plants that may be perceived as a nuisance should be avoided when developing plans for aquatic plant management.

Each aquatic plant species has preferred habitat conditions in which that species thrives as well as conditions that limit or completely inhibit its growth. For example, water conditions (e.g., depth, clarity, source, alkalinity, and nutrient concentrations), substrate composition, the presence or absence of water movement, and pressure from herbivory and/or competition all can influence the type of aquatic plants found in a water body. Human manipulation has often favored certain plants and reduced biological diversity (biodiversity). Thoughtful aquatic plant management can help maintain or even enhance aquatic plant biodiversity.

Several metrics are useful to describe aquatic plant community condition and design management strategies. These metrics include total rake fullness, maximum depth of colonization, species richness, biodiversity, evaluation of sensitive species, and relative species abundance. Metrics derived from the 2020 and 2022 point-intercept surveys are described below.

Maximum Depth of Colonization

The maximum depth to which aquatic plants grow in a lake, known as the maximum depth of colonization (MDC), is a useful indicator of water quality, as turbid and/or eutrophic (nutrient-rich) lakes generally have shallower MDC than lakes with clear water.[5] The MDC of Lower Nemahbin Lake was generally 20 feet below the water surface during 2020 and 2022, indicating generally high water clarity.

Biodiversity and Species Distribution

Data collected during 2022 reveal Lower Nemahbin Lake's Simpson Diversity Index (SDI) was 0.82, a very slight decrease from 0.85 measured during 2020. The number of native species found in Lower Nemahbin Lake has remained stable at approximately 20 species. Actions that conserve and promote aquatic plant biodiversity are critical to the long-term health of the Lake. Such actions not only help sustain and increase the robustness and resilience of the existing ecosystem, but also promote efficient and effective future aquatic plant management. Figure 1 shows species richness across the Lake in 2022.

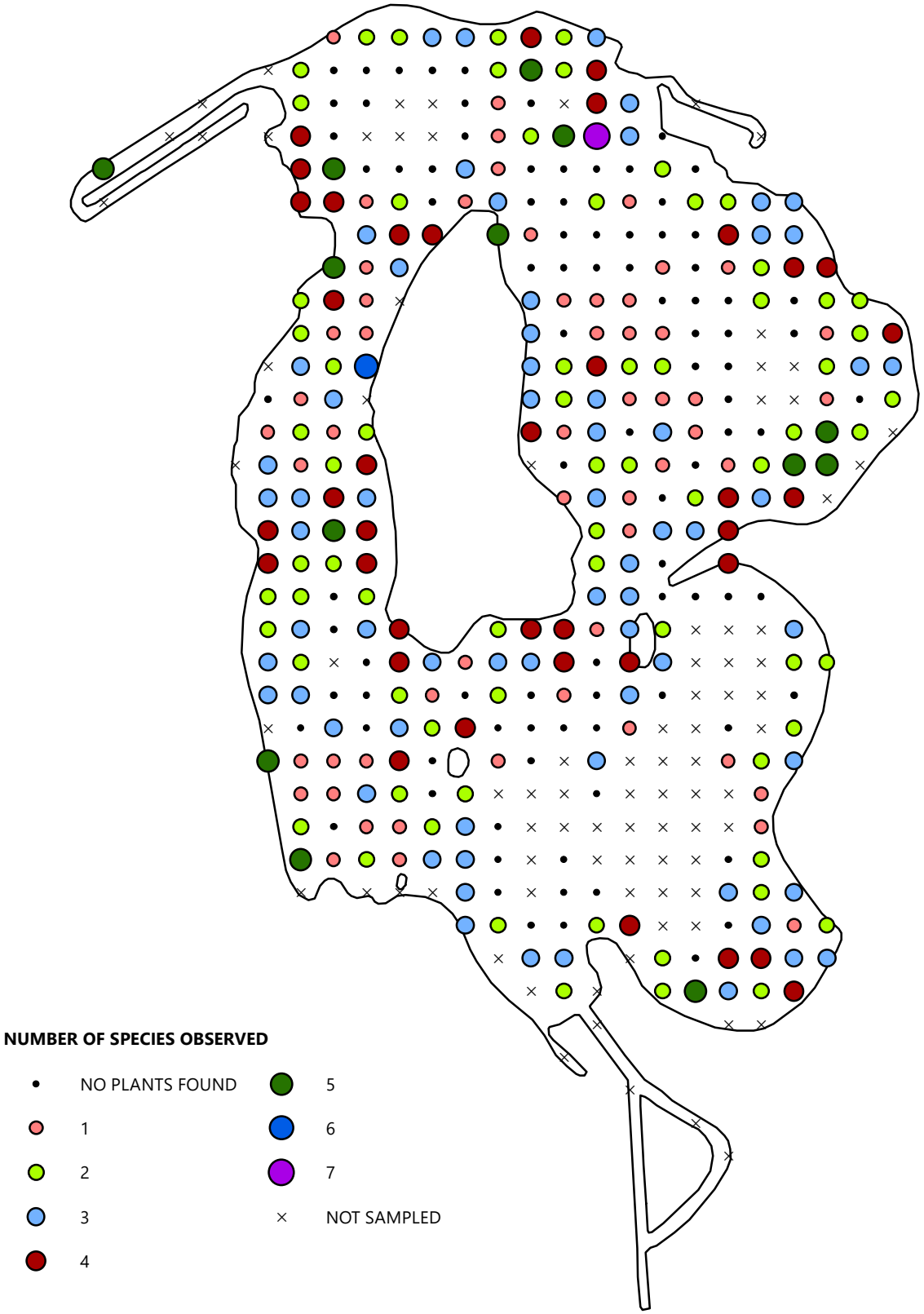
Sensitive Species

Aquatic plant metrics, such as species richness and the floristic quality index (FQI), can be useful for evaluating lake health. In hard water lakes, such as those common in Southeastern Wisconsin, species richness generally increases with water clarity and decreases with nutrient enrichment.[6] The FQI is an assessment metric used to evaluate how closely a lake's aquatic plant community matches that of undisturbed, pre-settlement

[5] *D.E. Canfield Jr, L. Langeland, W.T. and Haller, "Relations Between Water Transparency and Maximum Depth of Macrophyte Colonization in Lakes,"* Journal of Aquatic Plant Management*, 23, 1985.*

[6] O. Vestergaard and K. Sand-Jensen, "Alkalinity and Trophic State Regulate Aquatic Plant Distribution in Danish lakes," Aquatic Botany 67, 2000.

Figure 1
Aquatic Plant Species Richness, Lower Nemahbin Lake: September 2022



Note: Samples were collected in Lower Nemahbin Lake between September 6, and September 7, 2022.

Source: Wisconsin Department of Natural Resources and SEWRPC

conditions.[7] To formulate this metric, Wisconsin aquatic plant species were assigned conservatism (C) values on a scale from zero to ten that reflect the likelihood that each species occurs in undisturbed habitat. These values were assigned based on the species substrate preference, tolerance of water turbidity, water drawdown tolerance, rooting strength, and primary reproductive means. Native "sensitive" species that are intolerant of ecological disturbance receive high C values, while natives that are disturbance tolerant receive low C values. Invasive species are assigned a C value of 0. A lake's FQI is calculated as the average C value of species identified in the lake, divided by the square root of the lake's species richness. The FQI decreased in Lower Nemahbin Lake from 20.5 in 2020 to 18.9 in 2022. Plant communities naturally fluctuate based on many different factors and slight changes in FQI may be reflective of these fluctuations rather than a persistent trend in the aquatic plant community. Both surveys had FQI values that are comparable to the average for the Southeastern Wisconsin Till Plains ecoregion of 20.0, indicating that this Lake has a stable and healthy aquatic plant community. Changes in sensitive species presence are shown in Figure 2.

Apparent Changes in Observed Aquatic Plant Communities: 2020 versus 2022

Based on the 2022 point-intercept survey, the five most abundant native submerged aquatic plant species in Lower Nemahbin Lake were, in decreasing order of abundance: 1) common stonewort (*Chara contraria*), 2) water celery (*Vallisneria americana*), 3) Sago pondweed (*Stuckenia pectinata*), 4) spiny naiad (*Najas marina*), and 5) slender naiad (*Najas flexilis*) (see Table 1). Invasive species abundance in decreasing order was 1) spiny naiad, 2) SSW, 3) EWM, and 4) CLP. The distribution of these aquatic plant species identified as part of the 2022 survey is mapped in Appendix A.

In addition to the number of different aquatic plant species detected in the Lake, several other comparisons can be drawn between the 2020 and 2022 aquatic plant survey results, as examined below.

General Trends

- Common stonewort, a *Chara* species, was the most common species found in the Lake in both 2020 and 2022. This is a critical species to protect, as *Chara* species have several unique environmental preferences as well as beneficial functions in lakes. These species are nearly always associated with hard water lakes, particularly those with significant groundwater seepage and springs. This species has been found to promote marl formation and induce dissolved phosphorus to be precipitated to the lake bottom, reducing phosphorus concentrations in the water column, and thus improving water clarity.[8] Additionally, *Chara* species help stabilize lake-bottom sediment, as they have been observed to grow deeper than most vascular plants.

- EWM is not widespread in Lower Nemahbin Lake, occurring sporadically throughout the basin. EWM was observed at 6 points out of 420 points during both the 2020 and 2022 surveys (see Figure 3). In addition, EWM average rake fullness remained minimal between 2020 and 2022.

- Pondweed (*Potamogeton* spp.) presence has remained stable between 2006 and 2022 (see Table 2). Species types have altered through the years, however, that shows natural fluctuation in species presence. Pondweed is a food source for waterfowl, muskrat, deer, and beaver. It also provides food and protection for fish.

- Small SSW populations were found along the northern and eastern lobes of the Lake in the 2022 survey. Average rake fullness was very low. SSW was found at the boat launch between Upper and Lower Nemahbin Lakes in 2019 but was not observed at any point-intercept survey points. WDNR staff did not observe SSW during a 2020 point-intercept survey, although SSW was observed and removed as part of ongoing hand-pulling efforts near the boat launch and the channel between Upper and Lower Nemahbin Lakes.[9]

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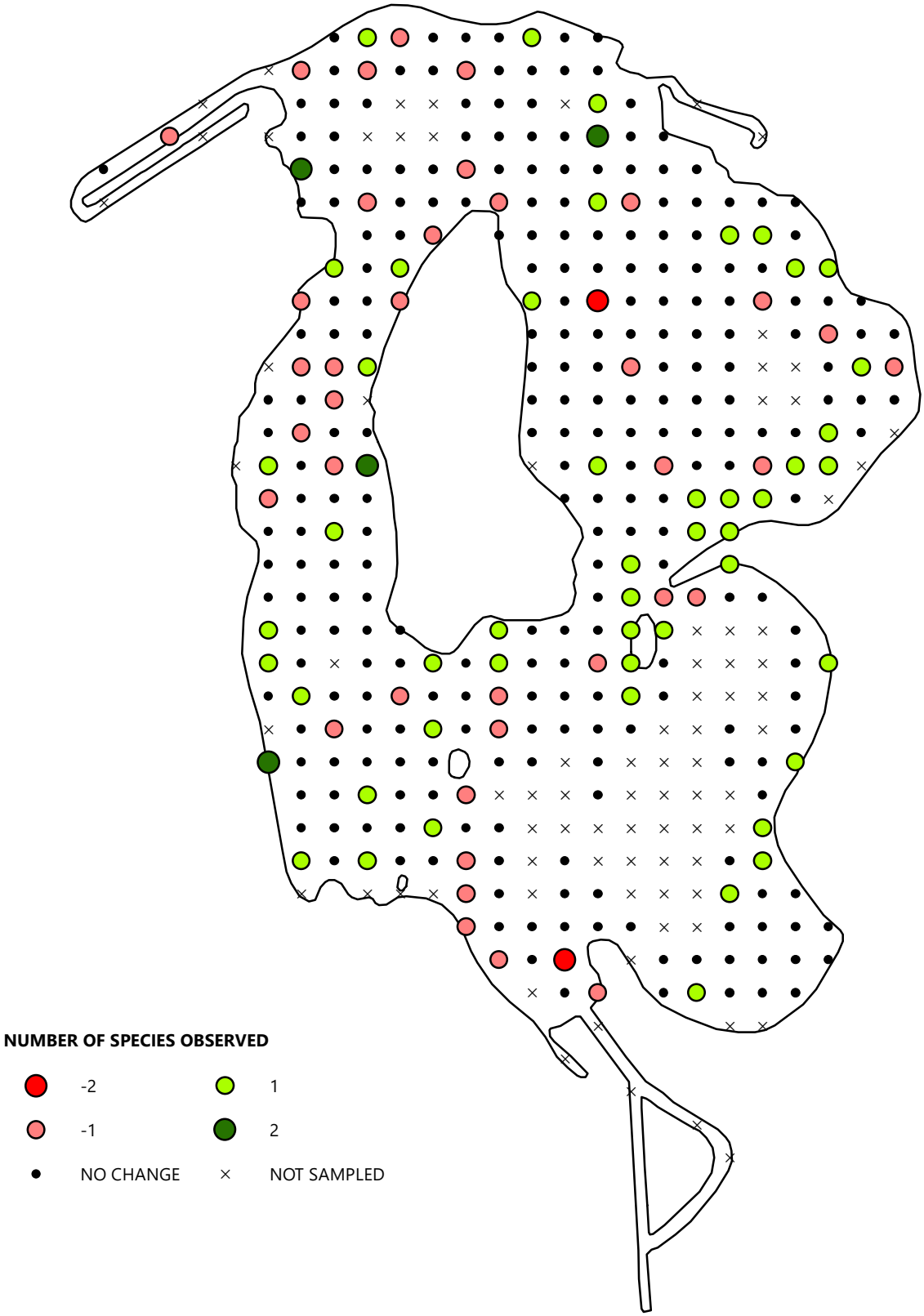
[7] S. Nichols, "Floristic Quality Assessment of Wisconsin Lake Plant Communities with Example Applications," Lake and Reservoir Management, 15(2), 1999.

[8] *M. Scheffer, and E.H. van Ness, "Shallow Lakes Theory Revisited: Various Alternative Regimes Driven by Climate, Nutrient, Depth, and Lake Size,"* Hydrobiologia*, 584, 2007*.

[9] *Eco Waterway Services, LLC,* 2020 Annual Summary Report – DASH Harvesting Permit #SE-2020-68-7744M*, October 2020*.

Figure 2
Change in Sensitive Species Richness, Lower Nemahbin Lake: 2020 Versus 2022



Note: Samples were collected in Lower Nemahbin Lake between September 6, and September 7, 2022.

Source: Wisconsin Department of Natural Resources and SEWRPC

Table 1
Aquatic Plant Abundance, Lower Nemahbin Lake: September 2020 Versus September 2022

Aquatic Plant Species	Native or Invasive	Number of Points Found[a] (2020/2022)	Frequency of Occurrence Within Vegetated Areas[b] (2020/2022)	Average Rake Fullness[c] (2020/2022)	Relative Frequency of Occurrence[d] (2020/2022)	Visual Sightings[e] (2020/2022)
Myriophyllum spicatum (Eurasian watermilfoil)	Invasive	6/6	2.6/2.7	1.0/1.0	1.0/1.2	1/2
Najas marina (spiny naiad)	Invasive	59/57	25.4/25.2	1.1/1.3	10.1/11.5	0/1
Nitellopsis obtusa (starry stonewort)	Invasive	0/7	0.0/3.1	0.0/1.1	0.0/1.4	0/0
Potamogeton crispus (curly-leaf pondweed)	Invasive	3/2	1.3/0.9	1.0/1.0	0.5/0.4	0/0
Ceratophyllum demersum (coontail)	Native	21/5	9.1/2.2	1.7/1.2	3.6/1.0	1/1
Chara braunii (Braun's stonewort)*	Native	0/2	0.0/0.9	0.0/1.0	0.0/0.4	0/0
Chara contraria (common stonewort)*	Native	163/172	70.3/76.1	1.3/1.1	27.8/34.6	1/14
Chara haitensis (leafy stonewort)	Native	6/0	2.6/0.0	1.0/0.0	1.0/0.0	0/0
Elodea canadensis (common waterweed)	Native	2/1	0.9/0.4	1.5/1.0	0.3/0.2	0/0
Heteranthera dubia (water stargrass)	Native	2/3	0.9/1.3	1.5/1.7	0.3/0.6	1/1
*Lemna minor, (*small duckweed)	Native	0/0	0.0/0.0	0.0/0.0	0.0/0.0	1/0
Najas flexilis (slender naiad)	Native	67/53	28.9/23.5	1.0/1.0	11.4/10.7	0/3
Najas guadalupensis (Southern naiad)*	Native	8/0	3.4/0.0	1.0/0.0	1.4/0.0	0/0
Nitella flexilis (slender nitella)	Native	5/2	2.2/0.9	1.0/0.4	0.9/0.4	0/0
Nuphar variegata (spatterdock)	Native	1/1	0.4/0.4	2.0/1.0	0.2/0.2	4/2
Nymphaea odorata (white water lily)	Native	8/5	3.4/2.2	1.5/1.2	1.4/1.0	7/13
Potamogeton friesii (Fries' pondweed)*	Native	0/2	0.0/0.9	0.0/1.0	0.0/0.4	0/0
Potamogeton illinoensis (Illinois pondweed)	Native	19/2	8.2/0.9	1.1/1.0	3.2/0.4	1/2
Potamogeton gramineus (variable pondweed)*	Native	43/34	18.5/15.0	1.2/1.0	7.3/6.8	2/27
Potamogeton natans (floating-leaf pondweed)	Native	0/0	0.0/0.0	0.0/0.0	0.0/0.0	2/1
Potamogeton richardsonii (clasping-leaf pondweed)	Native	2/8	0.9/3.5	1.5/1.1	0.3/1.6	0/2
Stuckenia pectinata (Sago pondweed)[f]	Native	79/62	34.1/27.4	1.2/1.0	13.5/12.5	2/1
Spongillina (freshwater sponge)	Native	2/4	0.9/1.8	1.0/1.0	0.2/0.5	0/0
Utricularia intermedia (flat-stem bladderwort)*	Native	1/0	0.4/0.0	1.0/0.0	0.2/0.0	0/0
Utricularia vulgaris (common bladderwort)*	Native	9/10	3.9/4.4	1.2/1.0	1.5/2.0	0/5
Vallisneria americana (eelgrass/water celery)[f]	Native	88/63	37.9/27.9	1.21.0	15.0/12.7	0/24

Table continued on next page.

Table 1 (Continued)

Notes:

- During the 2020 survey, sampling occurred at 338 sampling points between September 8 and 9, 2020. Of the sampling points visited, 232 were vegetated. During the 2022 survey, sampling occurred at 335 sampling points between September 6 and 7, 2022. Of the sampling points visited, 226 had vegetation.
- Red text indicates non-native and/or invasive species.
- An asterisk (*) next to a species name indicates that the species is considered "sensitive," with a coefficient of conservatism C value of seven or greater.
- See Appendix A for distribution maps and identifying features of the invasive and five most dominant species.

[a] Number of Points *refers to the number of points at which the species was retrieved and identified on the rake during sampling.*

[b] Frequency of Occurrence Within Vegetated Areas, *expressed as a percent, is the percentage of times a particular species occurred when there was aquatic vegetation present at the sampling site.*

[c] Average Rake Fullness is the average amount, *on a scale of 0 to 3, of a particular species at each site where that species was retrieved by the rake.*

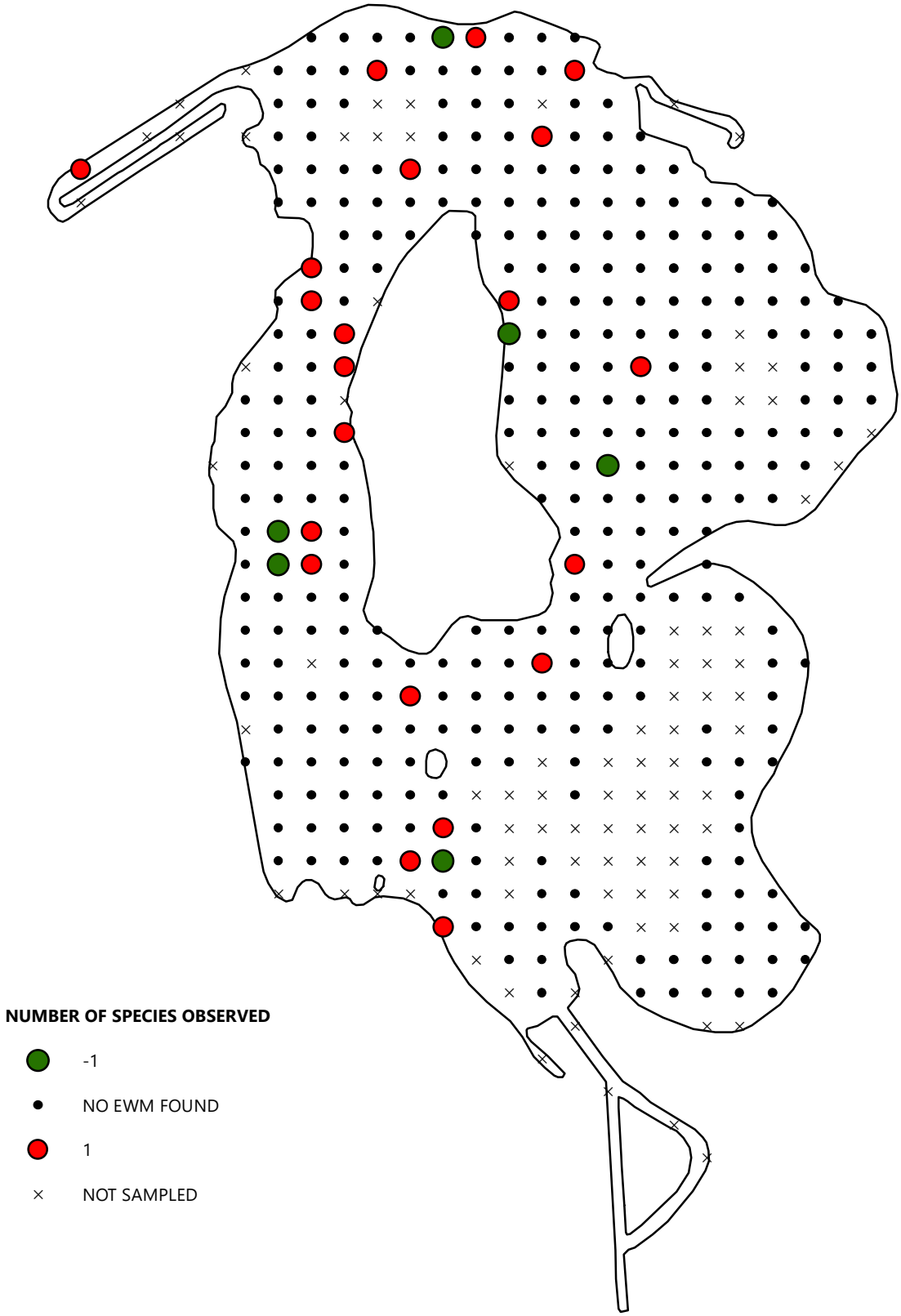
[d] Relative Frequency of Occurrence, *expressed as a percent, is the frequency of that particular species compared to the frequencies of all species present.*

[e] Visual Sightings *is the number of points where that particular species was visually observed within six feet of the actual rake haul location but was not actually retrieved on the rake and was not, therefore assigned a rake fullness measurement for that site. At points where this occurred, the species was simply marked as "present" at that site. Recording the number of visual sightings helps give a better picture of species distribution throughout the lake. (It is likely that visual sightings were not taken in 2011*).

[f] *Considered a high-value aquatic plant species known to offer important values in specific aquatic ecosystems under Section NR 107.08 (4) of the* Wisconsin Administrative Code.

Source: Wisconsin Department of Natural Resources and SEWRPC

Figure 3
Change in Eurasian Watermilfoil, Lower Nemahbin Lake: 2020 Versus 2022



Note: Samples were collected in Lower Nemahbin Lake between September 6, and September 7, 2022.

Source: Wisconsin Department of Natural Resources and SEWRPC

Table 2
Submerged Aquatic Plant Species Observed in Lower Nemahbin Lake: 2006-2022

Aquatic Plant Species	2006	2019	2020	2022
Invasive				
Myriophyllum spicatum (Eurasian watermilfoil)	X	X	X	X
Najas marina (Spiny naiad)	X	X	X	X
Nitellopsis obtusa (Starry stonewort)	--	X	--	X
Potamogeton crispus (Curly-leaf pondweed)	X	X	X	X
Total Invasive Species Observed	3	4	3	4
Native				
Ceratophyllum demersum (Coontail)	X	X	X	X
Chara spp. (Muskgrasses)	X	X	X	X
Elodea canadensis (Common waterweed)	X	X	X	X
Heteranthera dubia (Water stargrass)	--	X	X	X
Lemna minor (Small duckweed)	X	X	X	--
Myriophyllum sibiricum (Northern watermilfoil)	X	--	--	--
Najas flexilis (Slender naiad)	X	X	X	X
Najas guadalupensis (Southern naiad)	--	X	X	--
Nitella flexilis (Slender stonewort)	X	X	X	X
Nuphar variegata (Spatterdock)	X	X	X	X
Nymphaea odorata (White water lily)	X	X	X	X
Potamogeton friesii (Fries' pondweed)	X	--	--	X
Potamogeton gramineus (Variable pondweed)	X	X	X	X
Potamogeton illinoensis (Illinois pondweed)	X	X	X	X
Potamogeton natans (Floating-leaf pondweed)	X	X	X	X
Potamogeton pusillus (Small pondweed)	X	--	--	--
Potamogeton richardsonii (Clasping-leaf pondweed)	--	X	X	X
Potamogeton zosteriformis (Flat-stem pondweed)	--	X	--	--
Spirodela polyrhiza (Large duckweed)	--	X	--	--
Spongillina, (Freshwater sponge)	X	X	X	X
Stuckenia pectinata (Sago pondweed)	X	X	X	X
Utricularia intermedia (Flat-leaf bladderwort)	--	--	X	--
Utricularia minor (Small bladderwort)	--	X	--	--
Utricularia vulgaris (Common bladderwort)	X	X	X	X
Vallisneria americana (Wild celery)	X	X	X	X
Wollfia spp. (Watermeal)	--	X	--	--
Total Native Species Observed	18	22	19	17
Total Species Observed	21	26	22	21

Source: Wisconsin Department of Natural Resources and SEWRPC

- Curly-leaf pondweed was very sparse in both 2020 and 2022. However, since these surveys were conducted in September, the population may not be properly represented as CLP senesces during the summer. However, the general population of invasive species continues to be low.

- Freshwater sponges have been identified in Lower Nemahbin Lake between 2006 and 2022. Freshwater sponges are a sensitive species and their presence can indicate high water quality.

Overall, the aquatic plant community within Lower Nemahbin Lake shows consistent diversity, a low number of invasives species, and a healthy abundance of important native species. The aquatic plant community has exhibited no major changes and remains diverse and at non-nuisance levels.

AQUATIC PLANT MANAGEMENT ON LOWER NEMAHBIN

The most effective plans to manage nuisance and invasive aquatic plant growth rely on a combination of methods and techniques as well as a long-term strategy to fund these management techniques. Therefore, to enhance lake access, recreational use, and lake health, this plan recommends a combination of several aquatic plant management techniques as well as grant opportunities to fund long-term monitoring and management.

The aquatic plant management strategy that the Commission is presenting in this management plan focuses on minimizing spread of invasive species to other waterbodies and targeted management that addresses concerning and/or nuisance invasive species populations. Commission staff selected this strategy because the native plant community within the Lake appears healthy, robust, and capable of minimizing AIS spread through competition for habitat and resources. Disturbance to this native community from intensive management techniques could facilitate the spread of AIS within the Lake. Combining this approach with targeted monitoring at access points as well as communication with nearby lake districts, lake associations, the Waukesha County AIS Coordinator, and WDNR is recommended.

Monitoring

Commission staff recommend that targeted, frequent monitoring occur near the boat launch, the carry-in launch, and any other access points (e.g., near the outlet dam). The Association should consider conducting sub-point-intercept surveys ("sub-PIs") in the channel between Upper and Lower Nemahbin Lakes at least annually to monitor the existing population. Pre- and post-treatment sub-PIs would be ideal for evaluating the effects of the treatment on SSW, EWM, and non-target species. Frequently conducting meander surveys or spot checks near the outlet dam, carry-in launch, and other access points can allow more rapid detection and response before SSW can spread from these locations. A point-intercept survey of the entire Lake should be conducted at least every two years to evaluate the status of SSW, EWM, and other species within the Lake. If surveyors find that SSW spread within the lake is limited, then these surveys could be conducted at least every five years instead.

Watercraft Inspection

The Clean Boats, Clean Waters watercraft inspection program is an opportunity to take a front-line defense against the spread of aquatic invasive species. Through the Clean Boats, Clean Waters program, inspectors are trained to organize and conduct a boater education program in their community. Adults and youth teams educate/inform boaters on how and where invasive species are most likely to hitch a ride into waterbodies. Inspectors perform boat and trailer checks for invasive species, distribute informational brochures, and collect and report any new AIS presence in waterbodies. Commission staff recommend that the Association maintain its Clean Boats, Clean Waters program annually to negate the introduction of other invasive species and to reduce the chances of spreading invasive species present in the Lake to other lakes in the area. Continuing this program is also a requirement for some grant programs, as discussed in the "Future Funding" subsection.

Communication

The Association should maintain regular communication with the lake districts and associations of nearby waterbodies, particularly the Upper Nemahbin Lake Management District and the Crooked Lake Association. These organizations represent residents who live on waterbodies directly upstream and downstream of Lower Nemahbin Lake. Starry stonewort has not yet been observed in either Crooked Lake or Upper Nemahbin Lake, but these waterbodies are also the most likely to receive SSW spread from Lower Nemahbin Lake. Commission staff recommend that the Association should share findings with these organizations as well as with the Waukesha County AIS Coordinator and the WDNR.

Management Methods

The following subsection provides an overview of several commonly used aquatic plant management methods on Southeastern Wisconsin lakes as well as recommendations on whether these management methods are currently suitable for Lower Nemahbin Lake.

Manual Measures

Manually removing specific types of vegetation is a highly selective means of controlling nuisance aquatic plant growth, including invasive species such as EWM. Two commonly employed methods include hand raking and hand pulling. Both physically remove target plants from a lake. Since plant stems, leaves, roots, and seeds are actively removed from the lake, the reproductive potential and nutrients contained by pulled/raked plant material is also removed. These plants, seeds, and nutrients would otherwise re-enter the lake's water column or be deposited on the lake bottom. Hence, this aquatic plant management technique helps incrementally maintain water depth, improves water quality, and can help decrease the spread of nuisance/exotic plants. Hand raking and hand pulling are readily allowed by WDNR and are practical methods to control riparian landowner scale problems.

Raking with specially designed hand tools is particularly useful in shallow nearshore areas. This method allows nonnative plants to be removed and provides a safe and convenient aquatic plant control method in deeper nearshore waters around piers and docks.

The second manual control method, hand-pulling whole plants (stems, roots, leaves, seeds) where they occur in isolated stands, is a simple means to control nuisance and invasive plants in shallow nearshore areas that may not support large-scale initiatives. This method is particularly helpful when attempting to target nonnative plants (e.g., EWM, CLP) during the high growth season when native and nonnative species often comingle. Hand pulling is more selective than raking, mechanical removal, and chemical treatments, and, if carefully applied, is less damaging to native plant communities.

The Association contracted Eco Waterway Services, LLC to remove SSW via hand-pulling in 2020 through 2023 with treatments occurring over one day in July and another in August (see Table 3 and Appendix B). The WDNR has permitted these efforts and provided funding through an Early Detection and Response grant. Over this period, Eco Waterway Services has increased the acreage harvested to 0.135 acres, expanding to the entire lower length of the channel and into the northernmost portions of Lower Nemahbin Lake. The amount of SSW removed has also increased from an estimated 997 lbs. in 2020 to an estimated 4,475 lbs. in 2023.[10] It is unclear whether this increase is due to the hand-pulling team becoming more proficient at identifying and removing SSW or whether SSW had become more abundant within the treatment area, particularly since no sub-PIs have been conducted in the channel.[11,12] Based on narrative post-treatment reports, SSW was not observed during the second day in areas where it had been removed during the first day of treatment.[13,14] Areas where Eco Waterway Services, LLC had removed sediment along with SSW in 2019 were stated to be largely devoid of SSW while areas with only hand-pulling or minimal treatment had dense patches of SSW in 2021.[15] New SSW outbreaks were observed in disturbed areas, such as ruts created by boat propellors, indicating the importance of maintaining dense cover by native species to avoid further SSW spread within the Lake.[16]

Despite the impact within the channel, SSW has not been observed in either Upper Nemahbin Lake upstream or Crooked Lake downstream of Lower Nemahbin Lake at the time of this writing. Additionally, populations of EWM and SSW elsewhere in the Lake are sparse. Consequently, the current management strategy of using hand-pulling predominantly near the boat launch and otherwise letting native species compete with other populations seems to have been effective in reducing SSW spread. Therefore, continuing hand-pulling is considered a viable long-term control option for managing SSW and EWM populations within the Lake.

Suction Harvesting and DASH

An alternative aquatic plant suction harvesting method has emerged called Diver-Assisted Suction Harvesting ("DASH"). First permitted in 2014, DASH is a mechanical process where divers identify and pull select aquatic plants and roots from the lakebed and then insert the entire plant into a suction hose that transports the plant to the surface for collection and disposal. The process is essentially a mechanically assisted method for hand-pulling aquatic plants. Such labor-intensive work by skilled professional divers is, at present, a costly undertaking and long-term monitoring will need to evaluate the efficacy of the technique. Nevertheless, many apparent advantages are associated with this method including: 1) lower

[10] *Commission staff estimated this amount by multiplying the weighted percent of SSW in the total amount removed by the total amount removed for each year. The weighted percent of SSW in the total amount increased each year from 2020 to 2022.*

[11] *Personal communication between Patrick Siwula, WDNR Southeast Region Aquatic Invasive Species Coordinator and Commission staff (Justin Poinsatte) on August 11th, 2023.*

[12] *The harvesting treatment summary reports indicate that the area remains predominantly covered by SSW with some cover by muskgrass.*

[13] *Eco Waterway Services, LLC, 2020,* op. cit.

[14] *Eco Waterway Services, LLC,* 2021 Annual Summary Report – DASH Harvesting Permit #SE-2021-68 10822M*, September 2021.*

[15] Ibid.

[16] *Eco Waterway Services, LLC, 2020,* op. cit.

Table 3
Summary of Starry Stonewort (*Nitellopsis obtusa*) Treatments on Lower Nemahbin Lake

Year	Treated Acreage	Total Plants Removed (lbs.)	Percent SSW in Removed Plants (%)	SSW Removed (lbs.)	Other Reported Species Removed
2020	0.06	1,295	77	997	Muskgrass
2021	0.06	3,550	81	2,876	Muskgrass, eelgrass
2022	0.135	4,500	93	4,185	Muskgrass
2023	0.135	5,400	83	4,475	Muskgrass

Source: WDNR; Lower Nemahbin Lake Association; Eco Waterway Service, LLC; and SEWRPC

potential to release plant fragments when compared to mechanical harvesting, raking, and hand-pulling, thereby reducing spread and growth of invasive plants like EWM and SSW; 2) increased selectivity of plant removal when compared to mechanical techniques and hand raking which in turn reduces native plant loss; and 3) lower potential for disturbing fish habitat. DASH can provide focused relief of nuisance native and non-native plants around piers, near boat launches, and other critical areas. A WDNR permit is required to use DASH within a waterbody.

In 2019, the Association contracted Eco Waterway Services, LLC to remove SSW via DASH from a shallow 0.06-acre area near the boat launch and within the channel between Upper Nemahbin and Lower Nemahbin Lakes (see Appendix B). Since 2019, Eco Waterway Services, LLC has utilized hand-pulling efforts instead of DASH. In 2021, Eco Waterway Services, LLC reported that areas where DASH was utilized in 2019 to remove SSW and sediment were still clear of SSW while areas where only hand-pulling was used in 2020 had dense patches of SSW.[17] Based on that report, it would appear that DASH was more effective than hand-pulling for maintaining areas without SSW; however, the 2022 report did not contain a narrative section describing whether the areas initially treated with DASH were still clear of SSW so the continued effectiveness of that DASH effort cannot be discerned.[18] Further monitoring of the area initially treated with DASH should be conducted to determine if that area is still clear of SSW; if so, then utilizing DASH more widely in the channel would be recommended. A NR 109 permit is also required for any private landowner that chooses to employ DASH.

Mechanical Harvesting

Aquatic plants can be mechanically gathered using specialized equipment commonly referred to as harvesters. Harvesters use an adjustable depth cutting apparatus that can cut and remove plants from the water surface to up to about five feet below the water surface. The harvester gathers cut plants with a conveyor, basket, or other device. Mechanical harvesting is often a very practical and efficient means to control nuisance plant growth and is the primary method utilized in many lakes within Wisconsin. However, plant growth is generally not dense in Lower Nemahbin Lake and invasive species populations are sparse. Consequently, maintaining a regular aquatic plant harvesting program is not currently recommended.

If invasive populations become larger or other species become a nuisance through excessive plant growth, utilizing a harvester may be pursued as an option for controlling growth and maintaining recreational opportunities while also maintaining species diversity. If the Association is unwilling or unable to acquire its own harvester, then the Association could consider contracting a local private harvesting firm if harvesting within the Lake is permitted through WDNR.

Chemical Measures

Aquatic chemical herbicide use is stringently regulated. A WDNR permit and direct WDNR staff oversight is required during application. Chemical herbicide treatment is used for short time periods to temporarily control excessive nuisance aquatic plant growth. Chemicals are applied to growing plants in either liquid or granular form. Advantages of chemical herbicides aquatic plant growth control include low cost as well as the ease, speed, and convenience of application.

[17] *Eco Waterway Services, LLC, 2021,* op. cit.

[18] *Eco Waterway Services, LLC,* 2022 Annual Summary Report – DASH Harvesting Permit #SE-2022-68 13571M*, August 2022.*

The Association received WDNR chemical control permits in 2020 and 2021 to treat two acres of the northeastern portion of the Lake for EWM and hybrid watermilfoil (*Myriophyllum sibiricum X spicatum)* through a contract with Marine Biochemists.[19,20] WDNR staff observed EWM at substantially fewer points in 2020 and 2022 point-intercept surveys than in a 2019 point-intercept survey (6, 6, and 55 points, respectively), with no EWM observed at points within the treated area in 2022. However, this EWM reduction also occurred in other areas across the Lake outside of the treatment area, so it does not appear that this treatment alone was the cause.

Considering the sparse distribution of EWM in the Lake, spot chemical treatments can be used to maintain or reduce the EWM population. These treatments should be carefully applied so that the native plant community is not needlessly disturbed by this application. Current research indicates that chemical treatments are not an effective control method for SSW. Consequently, Commission staff do not currently recommend utilizing chemical treatments to attempt to control SSW populations as this may instead facilitate its spread by disturbing the native species in the treated area.

If monitoring suggests a dramatic change in these or other invasive species populations, management recommendations should be reviewed. Additionally, the Association should communicate with the Waukesha County AIS Coordinator and WDNR staff about the most effective treatment options as novel chemical products that may more effectively target these species become available.

Future Funding

Current efforts pursued by the Association have been exhibiting effectiveness at maintaining a healthy and diverse aquatic plant community while suppressing aquatic invasive species communities. The Association should continue to utilize WDNR Surface Water Grants to further their efforts with monitoring in the Lake, watercraft inspection efforts at the boat launch, and targeted management within the Lake. Key grant programs to fund these efforts are as follows:

- **Clean Boats, Clean Waters** – this grant program covers up to 75 percent of up to $24,000 to conduct watercraft inspections, collect data, educate boaters about AIS, and reporting AIS to the WDNR.

- **Aquatic Invasive Species Supplemental Prevention** – this grant program provides supplemental funding for waterbodies that are high priorities for AIS spread statewide, due to large amounts of boat traffic and/or the presence of particular invasive species. Lower Nemahbin Lake is an eligible waterbody for this program, which covers up to 75 percent of up to $4,000 that can fund the acquisition of decontamination equipment at the boat launches as well as targeted management at the boat launch or other access points. The Association must continue to participate in the Clean Boats, Clean Waters program to maintain eligibility for this grant program.

- **Aquatic Invasive Species Control** – this grant program covers up to 75 percent of up to $50,000 for small-scale projects and $150,000 for large-scale projects that suppress or reduce an AIS population within a lake. Given the current limited spread of EWM and SSW within the Lake, the small-scale project is more appropriate at this time. Aquatic Invasive Species Control grants fund projects that utilize integrated pest management and are designed to cause multi-season suppression of the target species. An approved aquatic plant management plan is a requirement to participate in this program, which this staff memo satisfies, and only approved recommendations from the plan are eligible projects for funding through this program.

The Association should consider applying for these grant programs whenever possible to support the monitoring, communication, watercraft inspection, and targeted management recommended in this aquatic plant management plan.

[19] *WDNR,* Chemical Aquatic Control Permit SE-2020-68-5922*, April 2020*.

[20] *WDNR,* Chemical Aquatic Control Permit SE-2021-68-10567*, April 2021*.

PUBLIC COMMENTS

The draft aquatic plant management plan was posted on the Commission's website with a comment box to receive public comments on the plan between February 1st, 2024 and February 23rd, 2024. The Association posted a notification on their website with a link to the Commission's website encouraging the public to leave comments on the plan. Commission staff notified WDNR staff of the opening and closing of the public comment period. Only one comment, which is provided in Appendix C, was received during the public comment period.

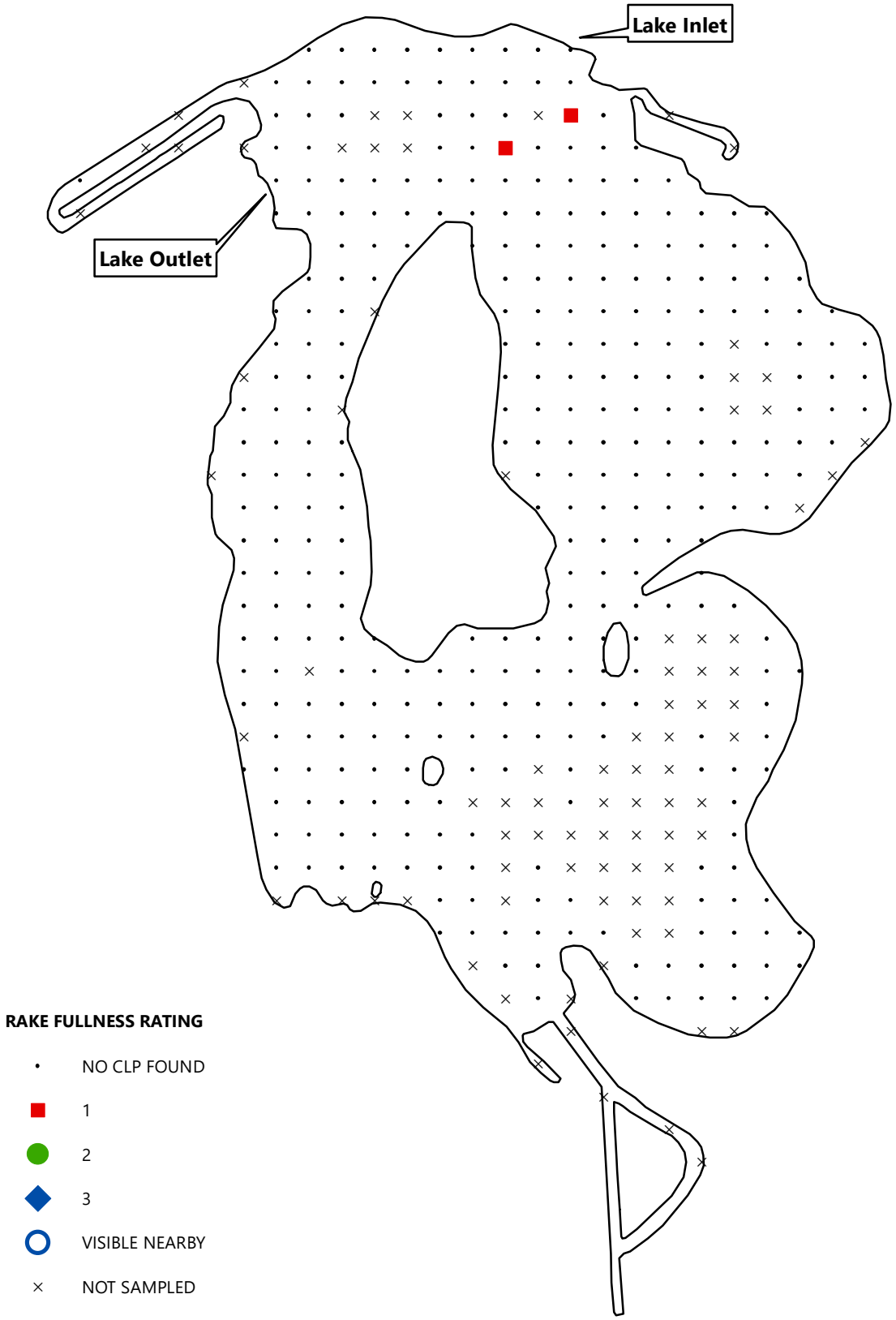
The public comment asked whether mechanical harvesting would be a good option for lake management considering the greater removal of SSW each year. The aquatic plant management plan does not currently recommend mechanical harvesting due to the overall lack of nuisance aquatic plant populations in the lake, the shallow area that the SSW population occupies would be challenging to use a mechanical harvester in, and that the harvester could further fragment and spread the SSW population. However, the plan does recommend considering the use of a mechanical harvester if the aquatic plant conditions drastically change to warrant this use.

APPENDICES

LAKE AQUATIC PLANT SPECIES MAPS

APPENDIX A

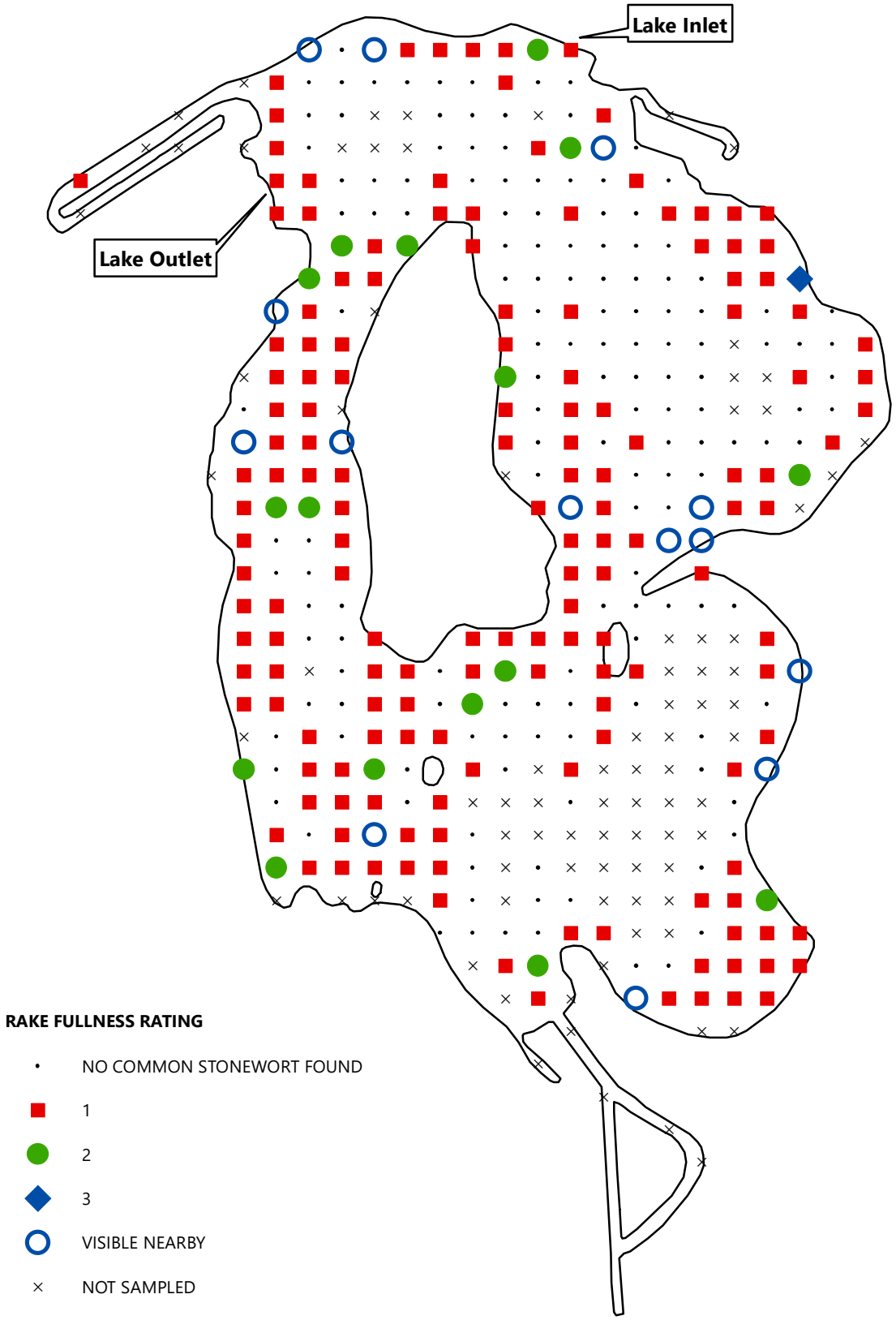
Figure A.1
Presence of Curly-Leaf Pondweed, Lower Nemahbin Lake: 2022



Note: Samples were collected in Lower Nemahbin Lake between September 6, and September 7, 2022.

Source: Wisconsin Department of Natural Resources and SEWRPC

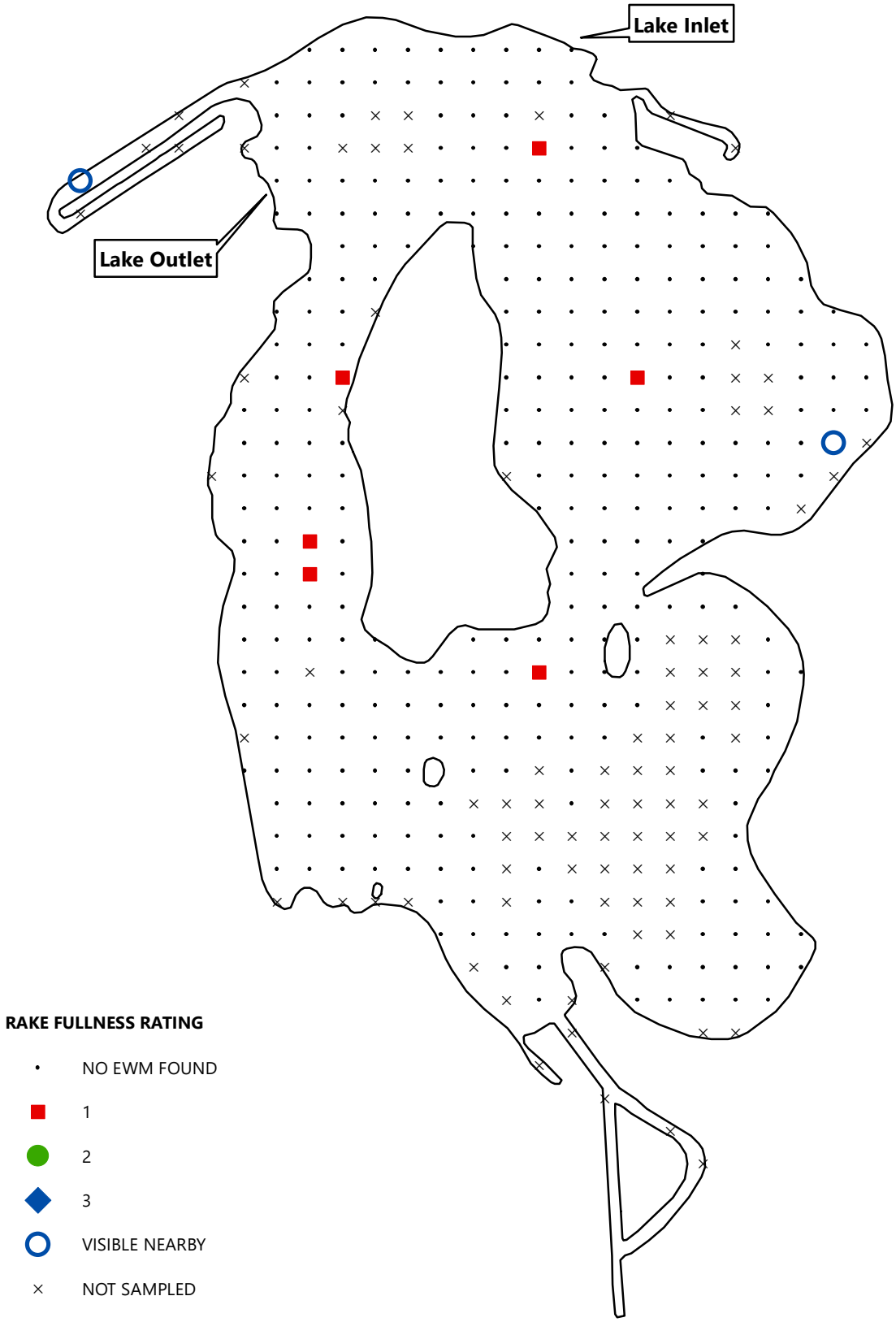
Figure A.2
Presence of Common Stonewort, Lower Nemahbin Lake: 2022



Note: Samples were collected in Lower Nemahbin Lake between September 6, and September 7, 2022.

Source: Wisconsin Department of Natural Resources and SEWRPC

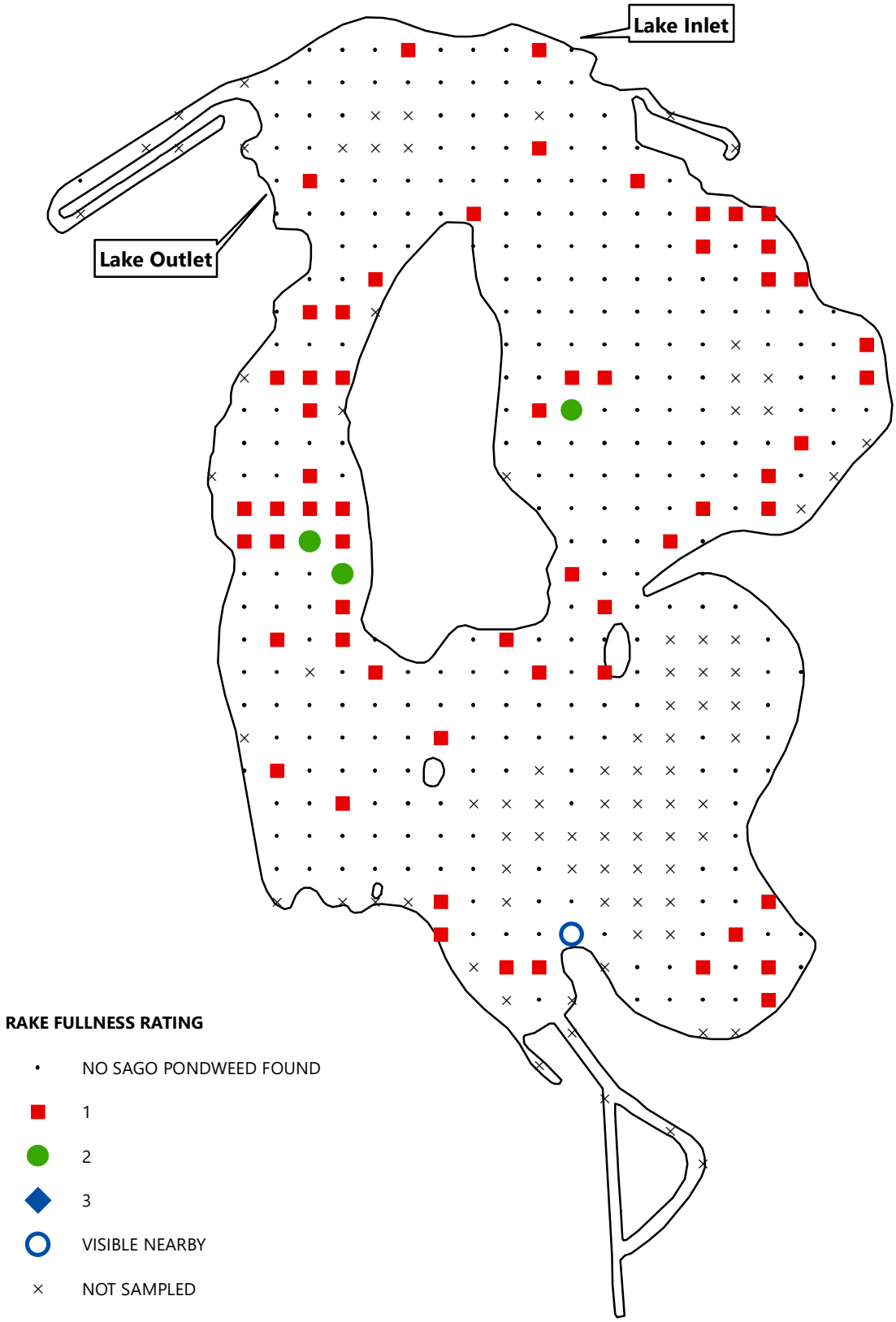
Figure A.3
Presence of Eurasian Watermilfoil, Lower Nemahbin Lake: 2022



Note: Samples were collected in Lower Nemahbin Lake between September 6, and September 7, 2022.

Source: Wisconsin Department of Natural Resources and SEWRPC

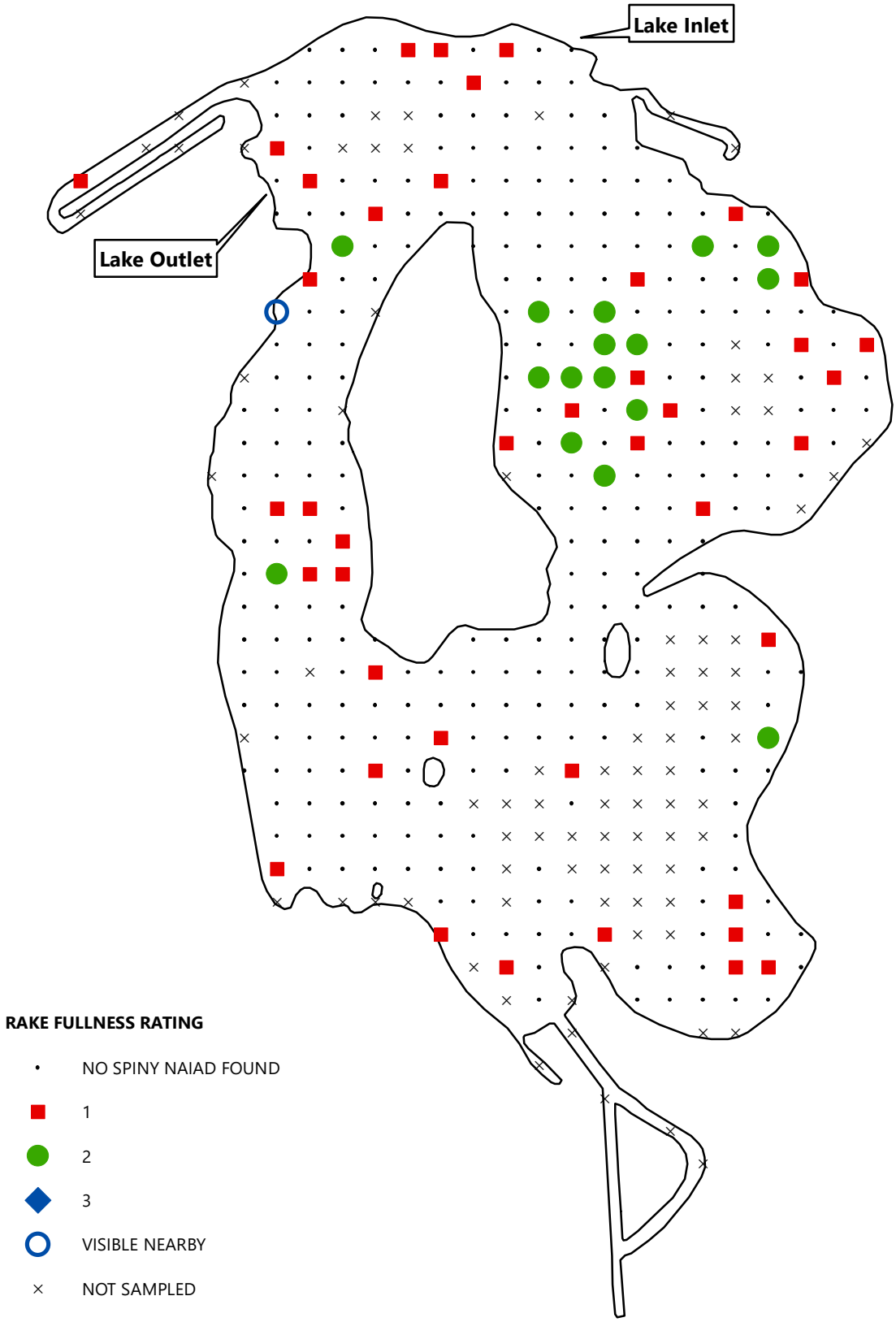
Figure A.4
Presence of Sago Pondweed, Lower Nemahbin Lake: 2022



Note: Samples were collected in Lower Nemahbin Lake between September 6, and September 7, 2022.

Source: Wisconsin Department of Natural Resources and SEWRPC

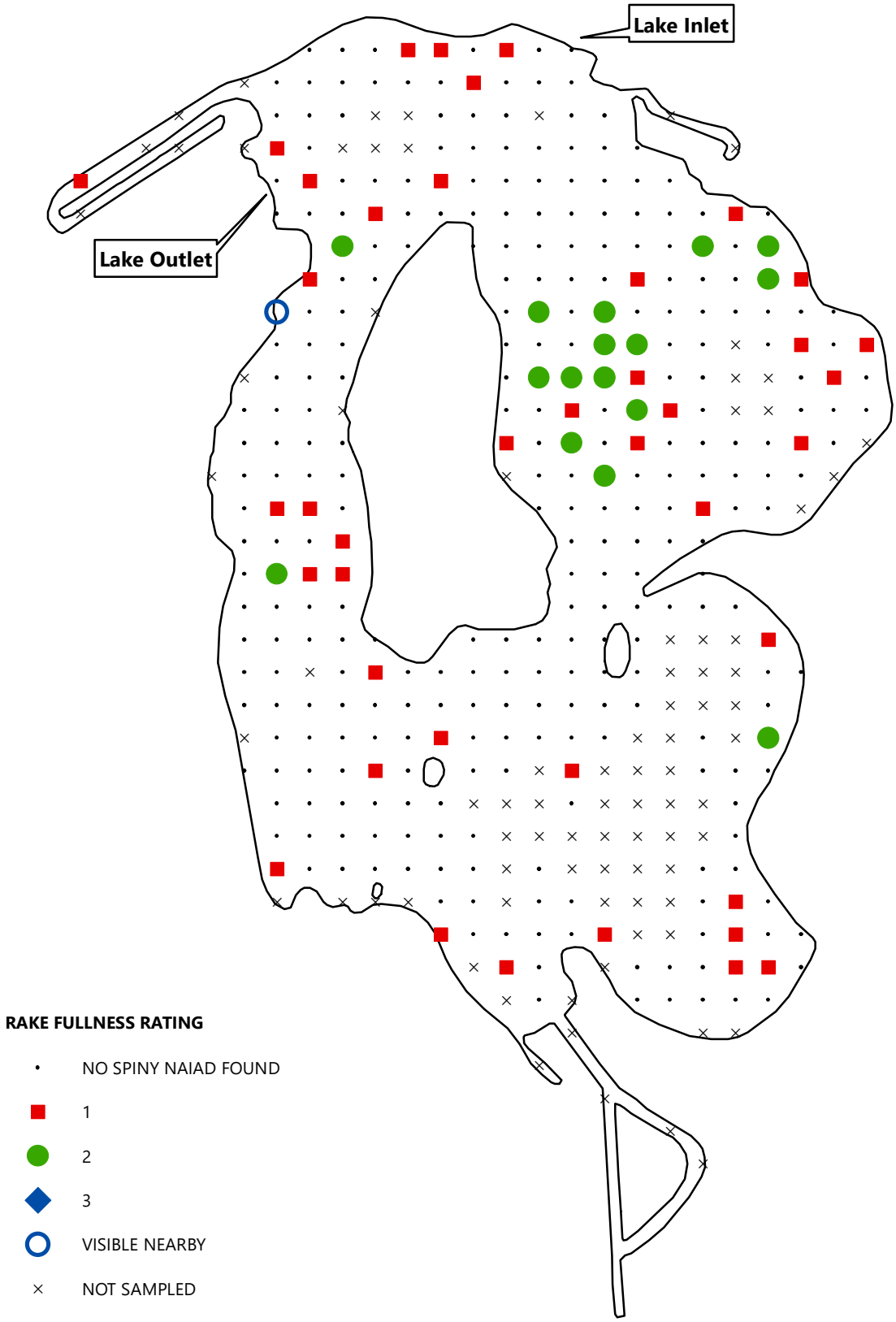
Figure A.5
Presence of Slender Naiad, Lower Nemahbin Lake: 2022



Note: Samples were collected in Lower Nemahbin Lake between September 6, and September 7, 2022.

Source: Wisconsin Department of Natural Resources and SEWRPC

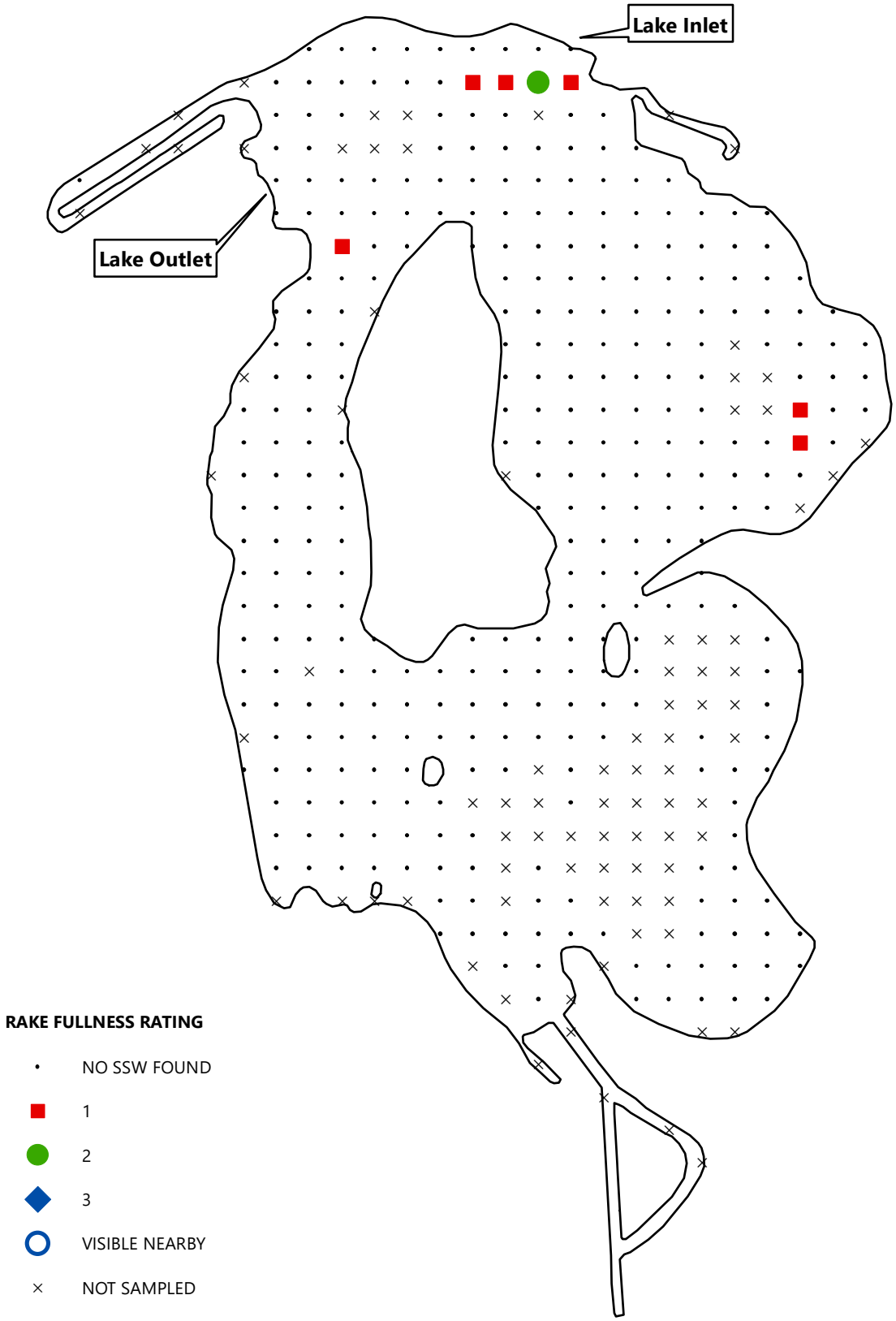
Figure A.6
Presence of Spiny Naiad, Lower Nemahbin Lake: 2022



Note: Samples were collected in Lower Nemahbin Lake between September 6, and September 7, 2022.

Source: Wisconsin Department of Natural Resources and SEWRPC

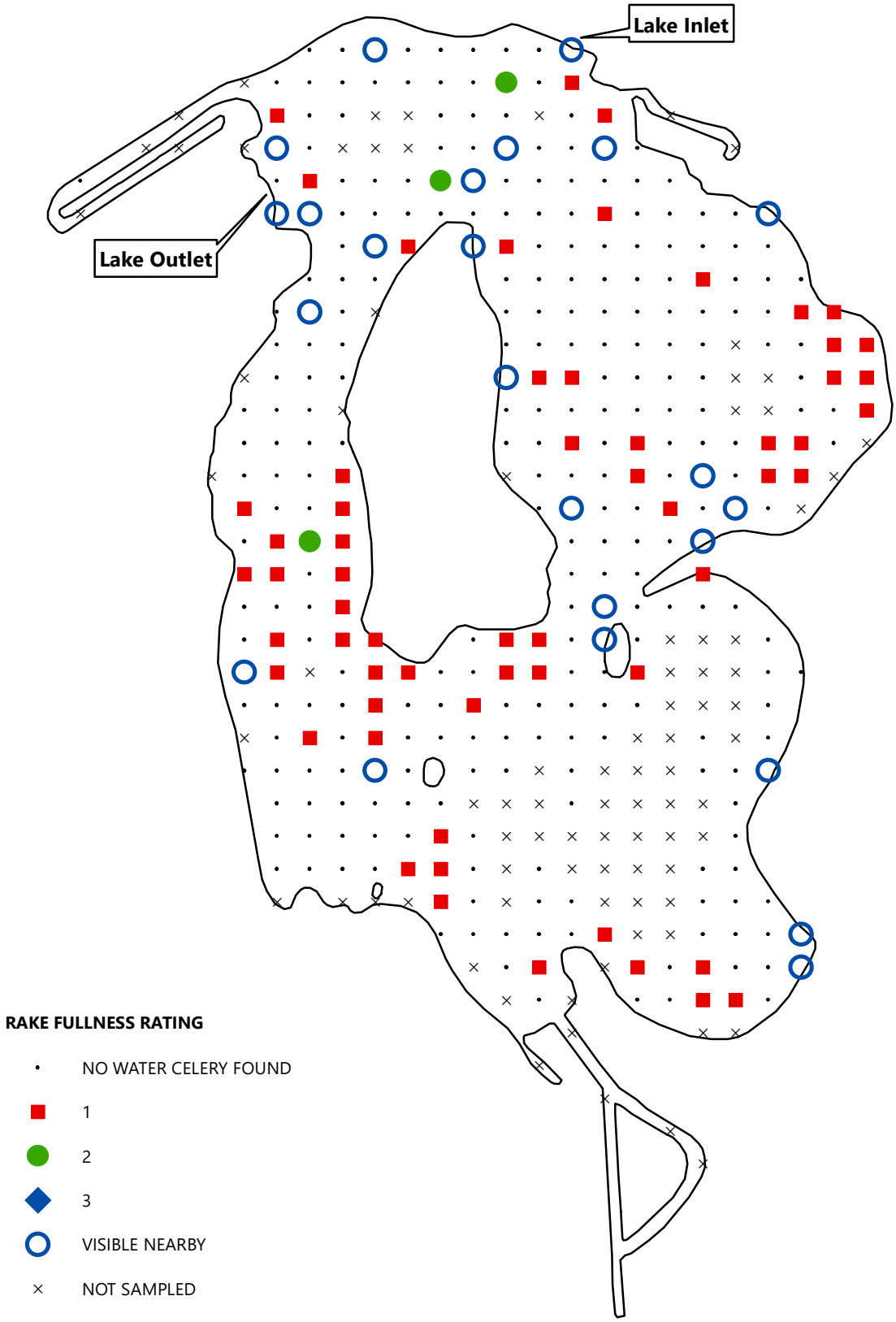
Figure A.7
Presence of Starry Stonewort, Lower Nemahbin Lake: 2022



Note: Samples were collected in Lower Nemahbin Lake between September 6, and September 7, 2022. Starry stonewort was found and identified at the boat launch in 2019 but was not reported during the 2020 point-intercept survey of the Lake.

Source: Wisconsin Department of Natural Resources and SEWRPC

Figure A.8
Presence of Water Celery, Lower Nemahbin Lake: 2022



Note: Samples were collected in Lower Nemahbin Lake between September 6, and September 7, 2022.

Source: Wisconsin Department of Natural Resources and SEWRPC

STARRY STONEWORT TREATMENT REPORTS

APPENDIX B

October 02, 2020

State of Wisconsin
Department of Natural Resources
Water Permit Central Intake
Mechanical Aquatic Plant Control Permit
PO Box 7185
Madison, WI 53707

Annual Summary Report - DASH HARVESTING
Permit # SE-2020-68-7744M
Holder: Lower Nemahbin Lake Association
C/O Jim Keller
1227 N. Jenkins Drive
Oconomowoc, WI 53066
Lake: Lower Nemahbin Lake

Starting and Ending Dates of Project:
Starry Stonewort DASH Hand Harvesting – 7/27/20 and 8/31/20

Harvest Hours: 12 hours
Map of the area harvested: Attached

Total Acreage of the lake harvested:
Approximately 2500 sq feet area
0.06 acres harvested area of lake
Total amount of plant material removed:
7/27/20 – 32 bags, 1120lbs
8/31/20 – 5 bags, 175lbs

Types of plants harvested by area: Selectively harvesting Starry Stonewort to try to control spread. 1st treatment was 75% Starry/25% native, primarily Chara. 2nd treatment was 90% Starry/10% Chara due to selectively harvesting clusters of Starry plants only. Aquatic plants present in general area were Starry Stonewort 10%, Chara 60% Water Celery 10%, Elodea 10%, Other 10%.

Weather Conditions
7/2/20 – 79 degrees, Humid, mostly cloudy, occasional rain, WNW winds 10mph am/gusts to 24 in pm
8/31/20 - 74 degrees, mostly cloudy, occasional rain, South winds 10mph

Submitted by: Pat Dalman
Eco Waterway Services, LLC
W346 S4109 Virgin Forest Drive
Dousman, WI 53118

Lower Nemahbin STARRY STONEWORT DASH TREATMENT - 2020

Eco Waterway Services (ECO) was engaged in 2020 to do follow up hand harvesting treatments to remove an outbreak of the invasive species, Starry Stonewort (SS), found at the Lower Nemahbin boat launch area. We performed this service at two different times during the summer season for one day each treatment. The first treatment was done on 7/27/20 and the second treatment was done on 8/31/20. The SS removal process is specialized as the divers need to carefully place their hands in the sediment and "roll up" the bulbils and algae material. Material is than collected in bags and disposed of. This method is considered hand harvesting.

7/27/20 Treatment – While the amount of SS was significantly decreased in certain areas from the outbreak in 2019, there were still some moderately dense areas within the boat launch area and on the outside of the South I94 overpass bridge. Most of the outbreak was in specific patches and not in an overall area. A map is attached of the service from this hand harvesting treatment. We collected 32 bags or 1120lbs of plant material. 75% of the material was SS and 25% native plants of primarily Chara. Based on DNR direction and in consideration of allowed treatment time and budget, some SS was left on the East side of the boat launch. This area was considered a non-traffic area with less exposure for migration.

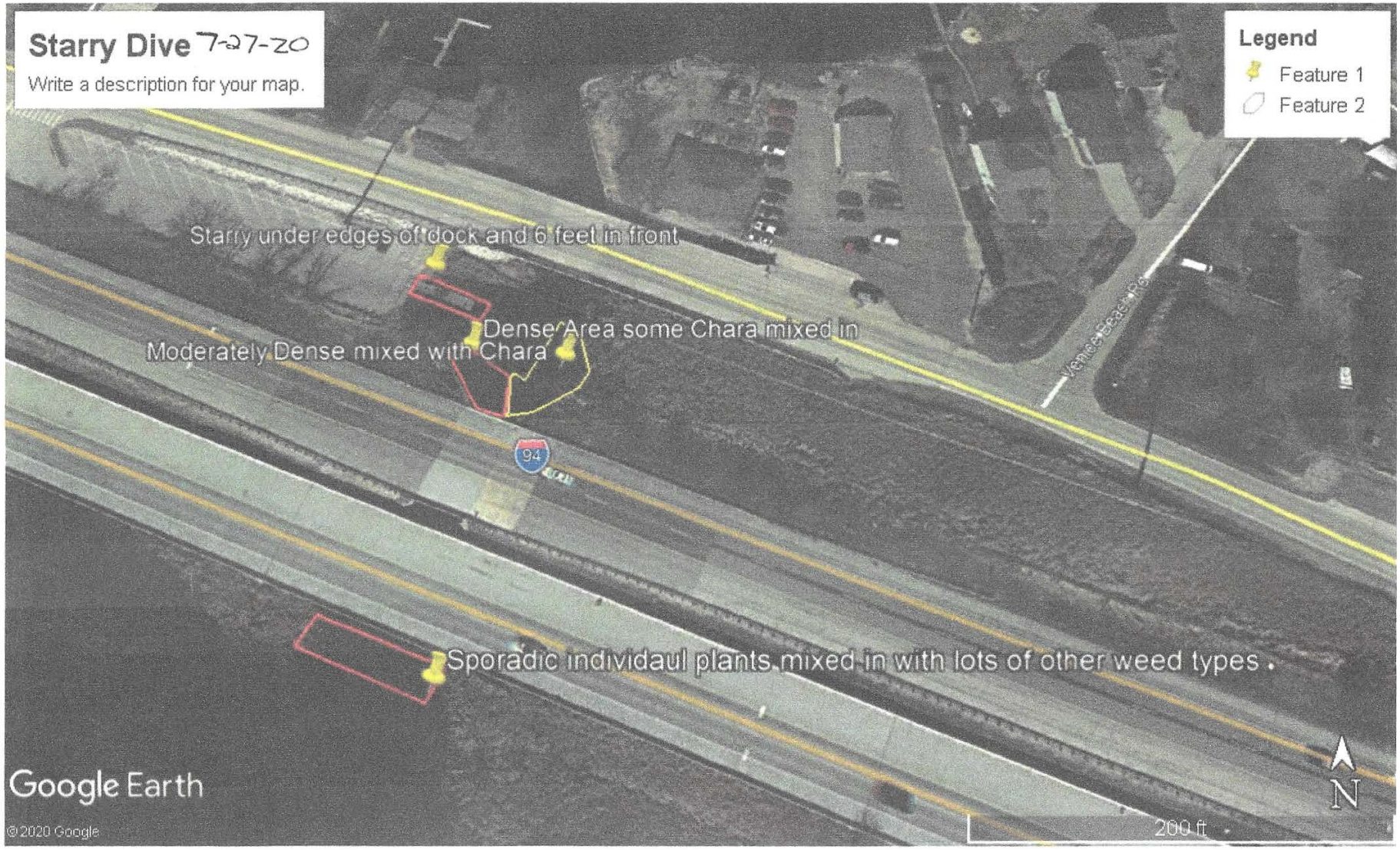
8/31/20 Treatment – A follow up hand harvesting treatment was completed. There was little to no SS plant material in the areas treated in July. There were a few small patches that were found within the boat launch area and removed. Divers concentrated more on Lower Nemahbin, South of the I94 overpass bridge. New outbreak areas were found where there was prop rutting. SS was growing within the bare areas of the prop ruts. Divers removed these plants and determined the entire original treatment area, except the previously excluded area on the East side of the boat launch was clean. There were some sporadic SS plants intermingled with other native plants, primarily CHARA. The native plant environment seemed to be overtaking the SS growth areas. Primary plant was CHARA. Amy Kruetlow, DNR, was present at treatment time and observed the results of treatments. We collected 5 bags or 175lbs of plant material. 90% of the material was SS and 10% native Chara. A map is attached of the service from this hand harvesting treatment.

A plant survey was planned to be performed in September to determine if there are any other outbreaks of Starry Stonewort in Lower Nemahbin.

Sincerely,

Pat Dalman
Eco Waterway Services

W346S4109 Virgin Forest Drive, Dousman WI, 53118, (262)468-6510 www.ecowaterwayservices.com


Starry Dive 7-27-20
Write a description for your map.
Legend
Feature 1
Feature 2
Starry under edges of dock and 6 feet in front
Dense Area some Chara mixed in
Moderately Dense mixed with Chara
94
Sporadic individaul plants mixed in with lots of other weed types .
Google Earth
© 2020 Google
200 ft
N


Starry Divers 8-31-20
Write a description for your map.
Legend
Delafield Rd
Venice Beach Rd
Sporadic Individual Plants
94
Sporadic indivdual plants mixed with Chara and other natives
Google Earth
© 2020 Google
300 ft
N

August 26, 2022

State of Wisconsin
Department of Natural Resources
PO Box 7185
Madison WI 53707-7185

Annual Summary Report – DASH HARVESTING

Permit # SE-2022-68-13571M

Holder: James Keller
34448 Delafield Rd
Oconomowoc, WI 53066

Site Address: 34448 Delafield Rd
Oconomowoc, WI 53066

Lake: Lower Nemahbin

Starting and Ending Dates of Project:
Starry Stonewort DASH Hand Harvesting 7/18/22 and 8/8/22
Harvest Hours: 12

Total Acreage of the lake harvested:
239 Acres lake surface area
.135 Acres harvested area of lake

Total amount of plant material removed:
7/18/22 - 37 – 19" x 32" onion bags at 50 lbs each or 1,850 lbs. of weeds
8/08/21 - 53 – 19" x 32" onion bags at 50 lbs each or 2,650 lbs. of weeds

Type of plants harvested by area:
Selectively harvesting Starry Stonewort to help control spread. 1st treatment was 90% SS/10% native (Chara). 2nd treatment was 95% SS/ 5% Chara.

Weather Conditions:
7/18 – 84 degrees, sunny, 11 mph W winds
8/08 – 70 degrees, cloudy, 11 mph NW winds

Submitted by: Kelly Csizmadia
Eco Waterway Services, LLC
111 Wilmont Dr. Unit L
Waukesha, WI 53189

September 13, 2021

State of Wisconsin
Department of Natural Resources
PO Box 7185
Madison WI 53707-7185

Annual Summary Report – DASH HARVESTING

Permit #SE-2021-68-10822M

Holder: Lower Nemahbin Lake Association
C/O Jim Keller
1227 N. Jenkins Drive
Oconomowoc, WI 53066

Lake: Lower Nemahbin Lake

Starting and Ending Dates of Project:
Starry Stonewort DASH Hand Harvesting – 7/12/21 and 8/25/21

Harvest Hours: 12 hours
Map of the area harvested: Attached

Total Acreage of the lake harvested:
.06 acres harvested area of lake

Total amount of plant material removed:
7/12/21 - 62 – 19" x 32" onion bags at 50 lbs each or 3,100 lbs. of weeds
8/25/21 - 9 – 19" x 32" onion bags at 50 lbs each or 450 lbs. of weeds

Type of plants harvested by area:
Selectively harvesting Starry Stonewort to help control spread. 1st treatment was 80% SS/20% native (Chara & Water Celery). 2nd treatment was 90% SS/10% Chara.

Weather Conditions:
7/12/21 – 67 degrees, cloudy, 9mph wind speeds E/NE
8/25/21 – 88 degrees, partly cloudy, 12 mph wind speeds W/NW, up to 23 mph gusts

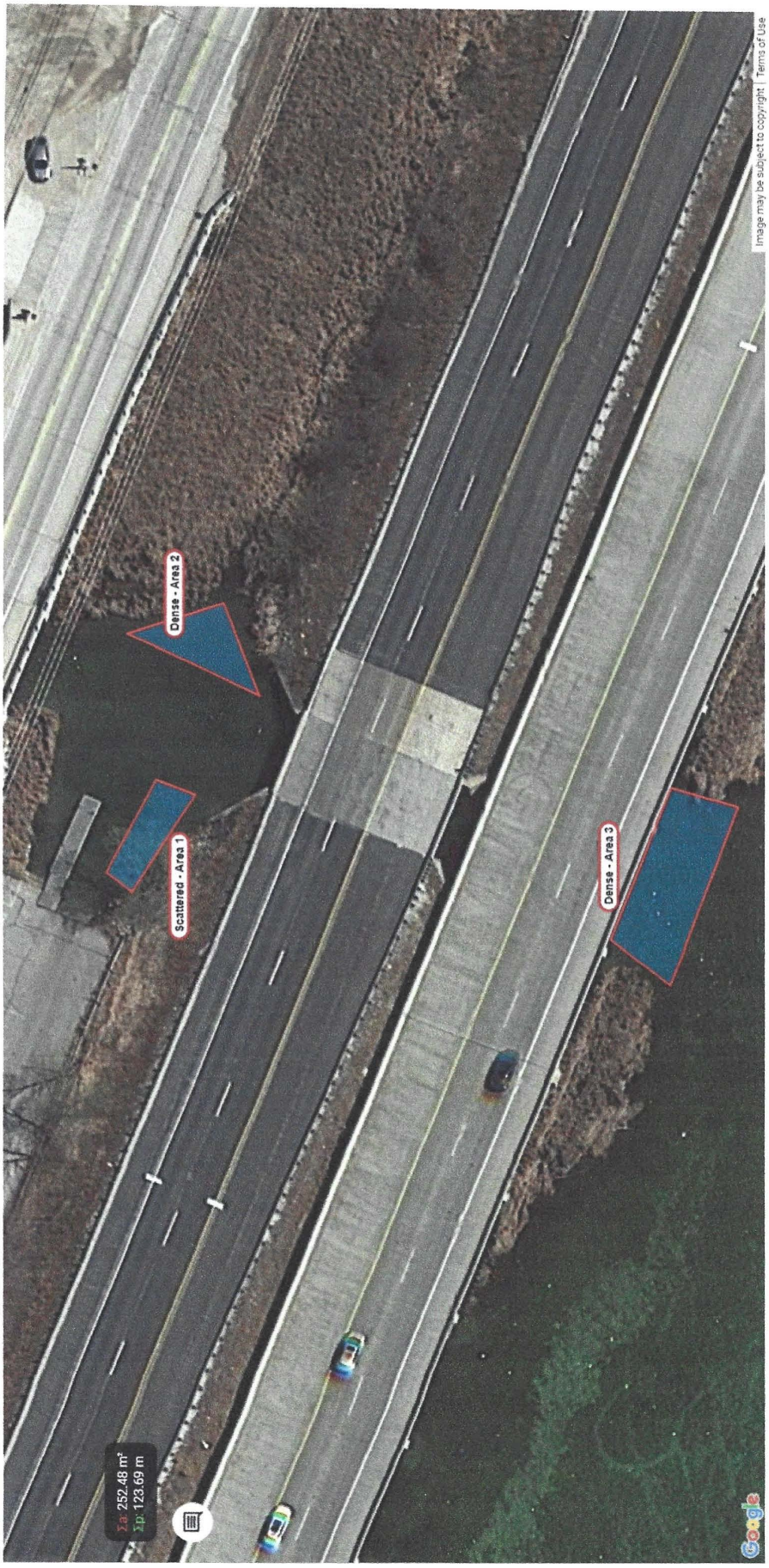
Submitted by: Pat Dalman
Eco Waterway Services, LLC
111 Wilmont Dr. Unit L
Waukesha, WI 53189

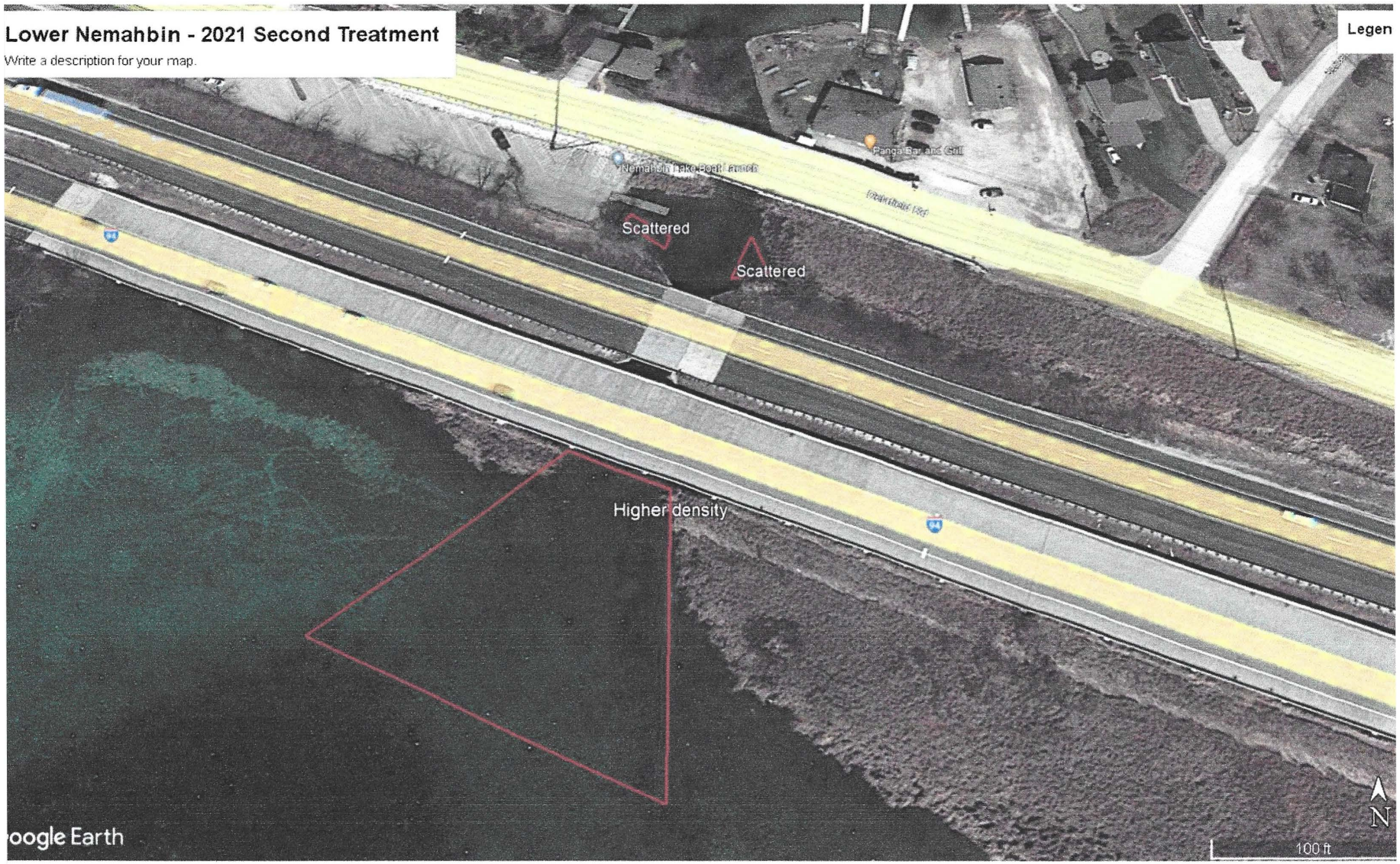
Lower Nemahbin STARRY STONEWORT DASH TREATMENT – 2021

Eco Waterway Services (ECO) was engaged in 2021 to do follow up hand harvesting treatments to remove an outbreak of the invasive species, Starry Stonewort (SS), found at the Lower Nemahbin boat launch area. We will perform this service at two different times during the summer season for one day each treatment. The first treatment was done on 7/12/21 and the second treatment was completed on 8/25/21. The SS removal process is specialized as the divers need to carefully place their hands in the sediment and "roll up" the bulbils and algae material. Material is than collected in bags and disposed of. This method is considered hand harvesting.

7/12/21 Treatment – A review of the area shows that areas harvested in 2019 when we used geo textile bags and collected some sediment along with plant material was still relatively clear of SS. This includes directly in and under the docking area and the south side of the docking area, and along the middle channel. There consistently seems to be small outbreaks of scattered plants which is being controlled by hand pulling. The areas where we did not remove much sediment in 2019 but have been hand pulling along the east side of the boat launch and on the south side of the bridge leading into Lower Namahbin had dense patches of SS. Both in 2019 and 2020, we limited the harvesting on the east side of the boat launch due to it being considered a non-traffic area. This is the area which now is abundant with SS and moving into the main channel area. Eco spent a majority of time in this area. The area on the south side of the bridge also had a higher density of SS then in 2020. Eco collected 62 bags of SS on 7/12/21. Last year at the first treatment Eco collected 32 bags. The 2nd treatment for 2021 will concentrate first on the East side of the boat launch again and harvesting further out on the south side of the bridge, looking for sporadic outbreaks. Other Native plants of chara and water celery were present around harvesting areas.

8/25/21 Treatment – A follow up treatment was completed. We found significantly less SS around the boat launch area treated in July. Most of the SS was near the Lily Pads and against the wall of the I94 bridge on the south of the boat launch area. We collected 9 bags of plant material. Last year during the second treatment Eco collected 5 bags.


Dense - Area 2
Scattered - Area 1
Dense - Area 3
Σa: 252.48 m²
Σp: 123.69 m
Image may be subject to copyright | Terms of Use
Google


Lower Nemahbin - 2021 Second Treatment
Write a description for your map.
Legen
Panga Bar and Grill
Scattered
Scattered
Higher density
94
94
oogle Earth
N
100 ft

August 29, 2023

State of Wisconsin
Department of Natural Resources
PO Box 7185
Madison WI 53707-7185

Annual Summary Report – DASH HARVESTING

Permit # SE-2022-68-13571M Renewal

Holder: James Keller
34448 Delafield Rd
Oconomowoc, WI 53066

Site Address: 34448 Delafield Rd
Oconomowoc, WI 53066

Lake: Lower Nemahbin

Starting and Ending Dates of Project:
Starry Stonewort DASH Hand Harvesting 7/13/23 and 8/21/23
Harvest Hours: 12

Total Acreage of the lake harvested:
239 Acres lake surface area
.135 Acres harvested area of lake

Total amount of plant material removed:
7/13/23 - 77 – 19" x 32" onion bags at 50 lbs each or 3,850 lbs. of weeds
8/21/23 - 31 – 19" x 32" onion bags at 50 lbs each or 1,550 lbs. of weeds

Type of plants harvested by area:
Selectively harvesting Starry Stonewort to help control spread. 1st treatment was 80% SS/20% native (Chara). 2nd treatment was 90% SS/ 10% Chara.

Weather Conditions:
7/13 – 73 degrees, scattered clouds, 6 mph WNW winds
8/21 – 79 degrees, sunny, 7 mph ENE winds

Submitted by: Kelly Csizmadia
Eco Waterway Services, LLC
111 Wilmont Dr. Unit L
Waukesha, WI 53189

APPENDIX C

PUBLIC COMMENTS RECEIVED

FirstName1:	Cindy
LastName1:	Rentsch
Email:	XXXXXXXXXX
Organization1:	Lower Lake Nemahbin
MailingAddress1:	1414 North Breezeland Road
City1:	Oconomowoc
State1:	Wisconsin
Zipcode1:	53066
comments:	With the increase in amount of weed removal that has occurred over the years , would mechanical harvesting become a better option ?