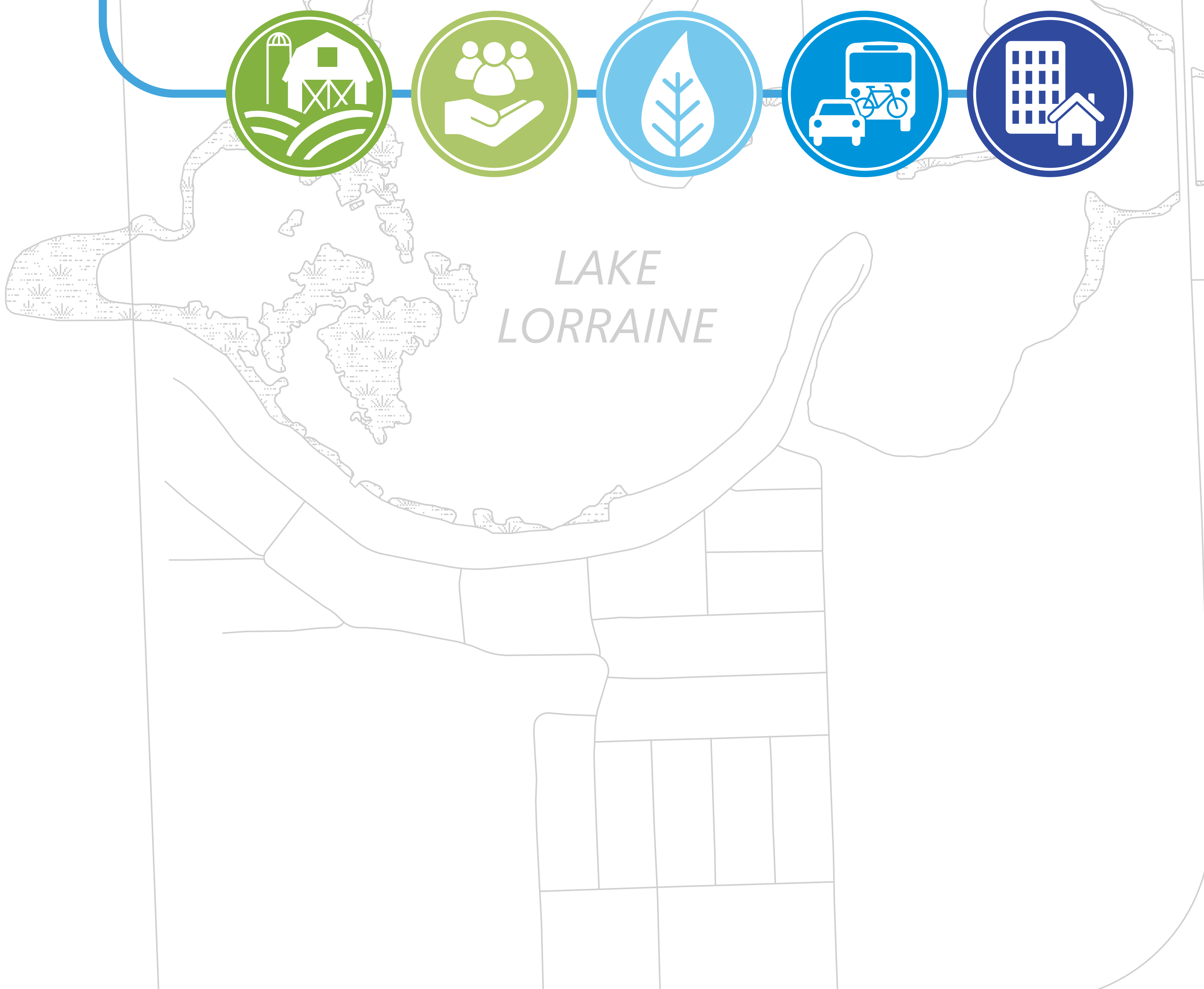
MEMORANDUM REPORT NO. 273

AQUATIC PLANT MANAGEMENT PLAN FOR LAKE LORRAINE

WALWORTH COUNTY, WISCONSIN



SOUTHEASTERN WISCONSIN REGIONAL PLANNING COMMISSION

Special acknowledgement is due to Danielle Matuszak MS, Specialist-Biologist; Hanna Helker, Intern Biologist; Justin Poinsatte, PhD, Principal Specialist-Biologist; Thomas Slawski, PhD, Chief Biologist; and Megan Deau, Principal Graphic Designer, for their contributions to the conduct of this study and the preparation of this report. Acknowledgement is also extended to the lake monitoring volunteers for their time, efforts, and equipment.

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Credit: Commission Staff

The Southeastern Wisconsin Planning Commission (Commission or SEWRPC) completed this aquatic plant inventory and management study of Lake Lorraine (Lake) on behalf of the Lake Lorraine Restoration and Protection Association (Association). This memorandum report is the Commission's first aquatic plant management plan for Lake Lorraine. The Wisconsin Department of Natural Resources (WDNR) will use data and conclusions generated as part of the Commission's study to help evaluate the Lake's aquatic plant community and draft an updated Aquatic Plant Control permit.

1.1 PROJECT SETTING, BACKGROUND, SCOPE, AND INTENT

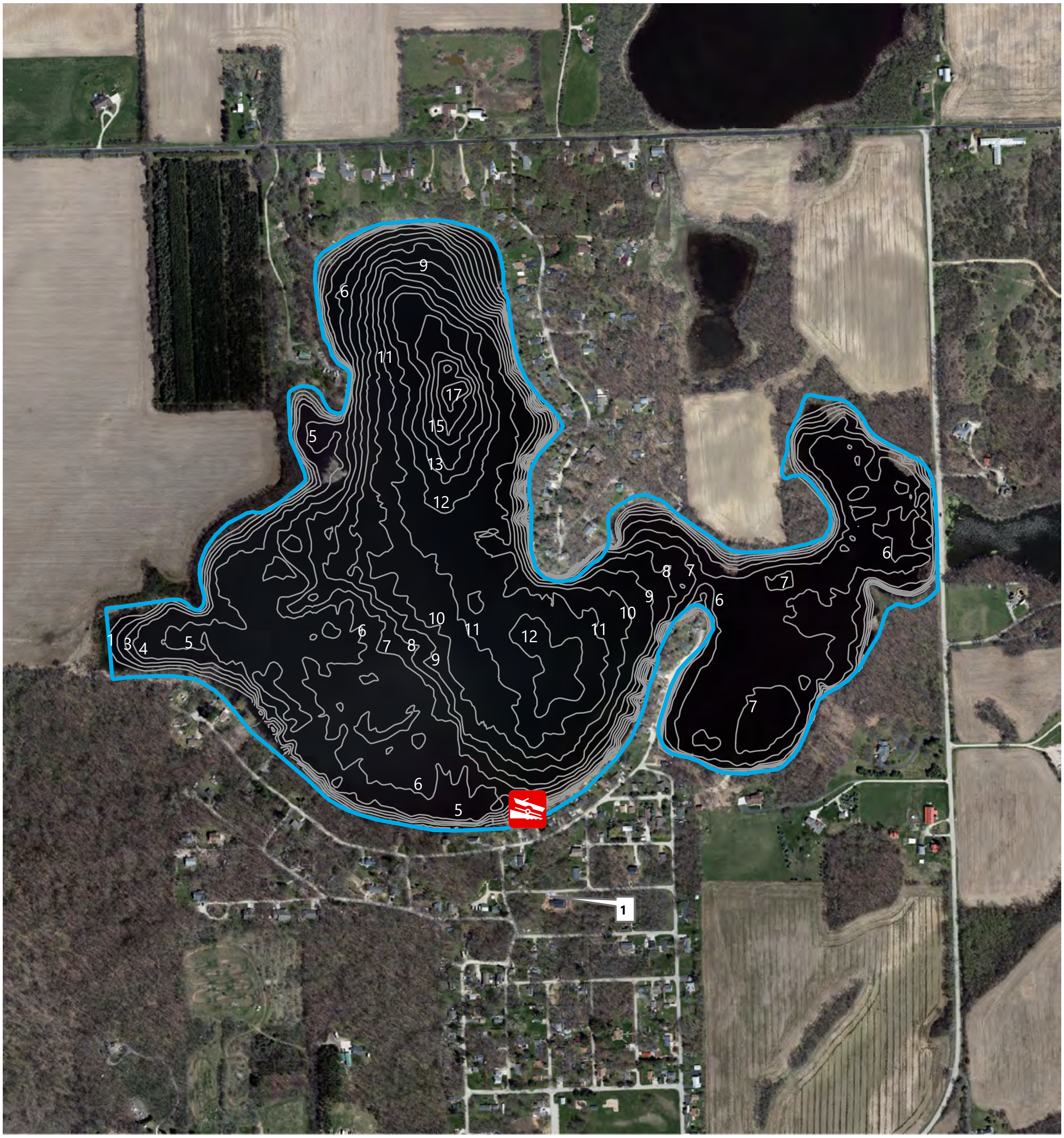
Lake Lorraine is a 155-acre[1] seepage lake located in the Town of Richmond in Walworth County. As a seepage lake, the Lake has no outlet stream, and its water levels can fluctuate substantially during periods of high and low rainfall. Attaining a maximum depth of 18 feet (Map 1.1), the Lake supports aquatic plant growth throughout most of its surface areas. A 2019 survey observed 14 aquatic plant species in the Lake. The aquatic plant survey conducted for this update was performed in July of 2024 where Commission staff utilized the recommended baseline monitoring protocol employed by the WDNR.[2]

The Association manages aquatic plant growth on the Lake to enhance navigation and recreational opportunities, primarily through chemical controls. Aquatic plant management is regulated by the WDNR and requires a permit. The Association is required to reevaluate the aquatic plant community, update the aquatic plant management plan, and renew the aquatic plant management permit every five years. To renew its permits to conduct this management, the Association retained the Commission to reevaluate the Lake's aquatic plant community and update the aquatic plant management plan. This updated plan needs to consider the present status of the aquatic plant community, must identify plant community changes

[1] *The 2015 Aquatic Plant Management Plan for Lake Lorraine, completed by Walworth County staff, reports that the surface area of the lake has been documented as varying sizes including: 146.7 acres, 133 acres, 91 acres, and 83 acres. The most recent lake boundary developed in 2023 reported the area of the lake as 146.7 acres. The WDNR lake page for Lake Lorraine currently lists the lake as having 155 acres.*

[2] *Hauxwell, J., S. Knight, K. Wagner, A. Mikulyuk, M. Nault, M. Porzky and S. Chase,* Recommended Baseline Monitoring of Aquatic Plants in Wisconsin: Sampling Design, Field and Laboratory Procedures, Data Entry and Analysis, and Applications, *Wisconsin Department of Natural Resources Bureau of Science Services, PUB-SS-1068, 2010.*

Map 1.1
Bathymetric Lake Contours on Lake Lorraine: 2019

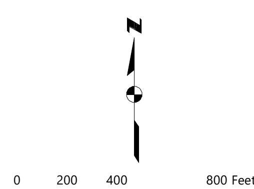


Note: Mapping was completed by Lake and Pond Solutions LLC in April 2019

PUBLIC LAUNCH

DEPTH CONTOURS

LAKE AREA OUTLINE



Source: Lake and Pond Solutions LLC, and SEWRPC that may have occurred, must examine the potential success or lack of success of the current aquatic plant management strategies, must consider current trends and issues that pertain to aquatic plant management issues and techniques, and must describe the methods and procedures associated with the proposed continuation of aquatic plant management in the Lake. These efforts were supported through Wisconsin Department of Natural Resources NR 193 Surface Water Grant AEPP75924.

This updated aquatic plant management (APM) plan summarizes information and recommendations needed best manage the aquatic plant community of the Lake. The plan covers four main topics:

- APM Goals and Objectives
- Aquatic Plant Community Changes and Quality
- Aquatic Plant Control Alternatives
- Recommended Aquatic Plant Management Plan

This memorandum focuses upon approaches to monitor and control actively growing nuisance populations of aquatic plants and presents a range of alternatives that could potentially be used to achieve desired APM goals and provides specific recommendations related to each alternative. These data and suggestions can be valuable resources when developing requisite APM permit applications and implementing future aquatic plant management efforts.

INVENTORY FINDINGS AND RELEVANCE TO RESOURCE MANAGEMENT 2

Credit: Commission Staff

2.1 AQUATIC PLANT MANAGEMENT GOALS AND OBJECTIVES

Aquatic plant management (APM) programs are designed to further a variety of lake user and riparian landowner goals and desires. For example, most APM programs aim to improve lake navigability. However, APM programs must also be sensitive to other lake uses and must maintain or enhance a lake's ecological integrity. Consequently, APM program objectives are commonly developed in close consultation with many interested parties. The Lake Lorraine (Lake) APM plan considered input from the Lake Lorraine Restoration & Protection Association (Association), Wisconsin Department of Natural Resources (WDNR), and the public. Objectives of the Lake Lorraine APM program include the following.

- Effectively control the quantity and density of nuisance aquatic plant growth in well-targeted portions of Lake Lorraine. This objective helps:
    - Enhance water-based recreational opportunities,
    - Improve community-perceived aesthetic values, and
    - Maintain or enhance the Lake's natural resource value.
- Manage the Lake in an environmentally sensitive manner in conformance with *Wisconsin Administrative Code* standards and requirements under Chapters NR 103 *Water Quality Standards for Wetlands*, NR 107 *Aquatic Plant Management*, and NR 109 *Aquatic Plants: Introduction, Manual Removal & Mechanical Control Regulations*. Following these rules helps the Association preserve and enhance the Lake's water quality, biotic communities, habitat value, and essential structure and relative function in relation to adjacent areas.
- Protect and maintain public health and promote public comfort, convenience, and welfare while safeguarding the Lake's ecological health through environmentally sound management of vegetation, wildlife, fish, and other aquatic/semi-aquatic organisms in and around the Lake.

- Promote a high-quality water-based experience for residents and visitors to the Lake consistent with the policies and practices of the WDNR, as described in the regional water quality management plan, as amended.[3]

To meet these objectives, the Association executed an agreement with the Southeastern Wisconsin Regional Planning Commission (Commission or SEWRPC) to investigate the characteristics of the Lake and to develop an aquatic plant management update. As part of this planning process, surveys of the aquatic plant community and comparison of the results of previous surveys were conducted. This chapter presents the results of each of these inventories.

2.2 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. Through photosynthesis, plants utilize energy from sunlight and release the oxygen required by many other aquatic life forms into the water. Aquatic plants also serve several other valuable functions in a lake ecosystem, including:

- Improving water quality by filtering excess nutrients from the water
- Providing habitat for invertebrates and fish
- Stabilizing lake bottom substrates
- Supplying food for waterfowl and various lake-dwelling animals

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 they often support many other beneficial functions. For example, water lilies play a significant role in providing shade, habitat, and food for fish and other important aquatic organisms. They also help prevent damage to the lakeshore by dampening the power of waves that could otherwise erode the shoreline. Additionally, the shade that these plants provide helps reduce the growth of undesirable plants because it limits the amount of sunlight reaching the lake bottom. Given these benefits, large-scale removal of native plants that may be perceived as a nuisance should be avoided when developing plans for aquatic plant management.

Aquatic Plant Surveys

Aquatic plant inventories have been completed in Lake Lorraine in the past to support aquatic plant management.[4] Most recently, Onterra, LLC surveyed the Lake's aquatic plants in 2014, followed by Lake and Pond Solutions Co. in 2019 to establish long-term management goals and permitted management of the Lake. The 2014 and 2019 surveys used the same point-intercept grid and methodology. In this method, sampling sites are based on predetermined global positioning system (GPS) location points that are arranged in a point-intercept (PI) grid pattern across the entire surface of a lake.

Following initial discussion with the Association about updating the aquatic plant management (APM) plan for Lake Lorraine in 2023, Commission staff looked at the previous survey grids for the lake and noted that the survey grid only covered part of the currently open water area of the Lake. The WDNR spatial database where each lake is represented as a polygon currently only shows a 63-acre polygon for Lake Lorraine[5], which is what was used to develop the original PI grid. During the grant application process, WDNR staff, the Association, and Commission staff agreed to expand the PI grid to better represent the open water

[3] *SEWRPC Planning Report No. 30,* A Regional Water Quality Management Plan for Southeastern Wisconsin—2000, Volume One, Inventory Findings*, September 1978,* Volume Two, Alternative Plans*, February 1979,* Volume Three, Recommended Plan*, June 1979, and SEWRPC Memorandum Report No. 93,* A Regional Water Quality Management Plan for Southeastern Wisconsin: An Update and Status Report*, March 1995.*

[4] *Sampling methodology changed from transect-based methods in 2011 to a point-intercept method beginning with the 2019 survey.*

[5] *As of February 2025, the polygon on the WDNR's Surface Water Data Viewer had not been updated to the 147 acre polygon.*

areas of Lake Lorraine. Commission staff requested that WDNR staff create an updated PI grid to better represent the entire Lake, which they complied with and provided (See Figure 2.1). This updated grid was noted in the Association's grant application and the official grid for Lorraine Lake encompasses the entire lake extent.

The equation that WDNR uses to determine the number of survey points within a grid is determined by the lake acreage, the average water depth, and how complex the shoreline is (round lakes have fewer points, lakes with bays have more points). Since the Lake polygon acreage used for the grid increased from 63 to 146 acres, the number of points in the grid increased while the average distance between the points also increased (32 meters between points in old grid, 41 meters between points in new grid). [6,7]

The current grid pattern of Lake Lorraine consists of 351 points (provided by WDNR staff) that allows the types and abundance of aquatic plants to be directly contrasted to prior point-intercept surveys (see Figure 2.2). At each grid point sampling site, a single rake haul is taken and a qualitative assessment of the rake fullness, on a scale of zero to three (see Figure 2.3) is made for each species identified. The same points were sampled using the same techniques on roughly the same dates in 2014 and 2019, with the new grid being used for the 2024 survey.

Commission staff conducted the 2024 survey on July 23rd and 24th with the assistance of volunteers from the Association. Conditions during the survey were adequate, with partly sunny skies and intermittent rain, low wind speeds, and little to no boat traffic. The Lake's water clarity was suitable, which enhanced visual observations of aquatic plant species within six feet of the sampling location. In general, the aquatic plant specimens were mature, and several species were in flower (e.g., white water lily (*Nymphaea odorata*)). In addition to the aquatic plants, Commission staff observed waterfowl, fish, whitetail deer, and turtles during the survey.

While Commission staff strived to survey as much of the Lake as feasible, certain areas of the Lake were not surveyed in 2024. These areas included the central portion of the main Lake body, which was determined to be too deep for vascular aquatic plants to grow. Points in the eastern bay of the Lake were unable to be sampled due to dense lily pads that rendered part of the bay as non-navigable. Other points that were not surveyed were either due to temporary obstacles or points that were deemed to be on shore.

Aquatic Plant Survey Metrics

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 of 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. All other factors being equal, water bodies with a diverse array of habitat variables are more likely to host a diverse aquatic plant community. For similar reasons, some areas of a particular lake may contain plant communities with low diversity, while other areas of the same lake may exhibit higher diversity. Historically, 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. The aforementioned metrics are discussed in further detail below.

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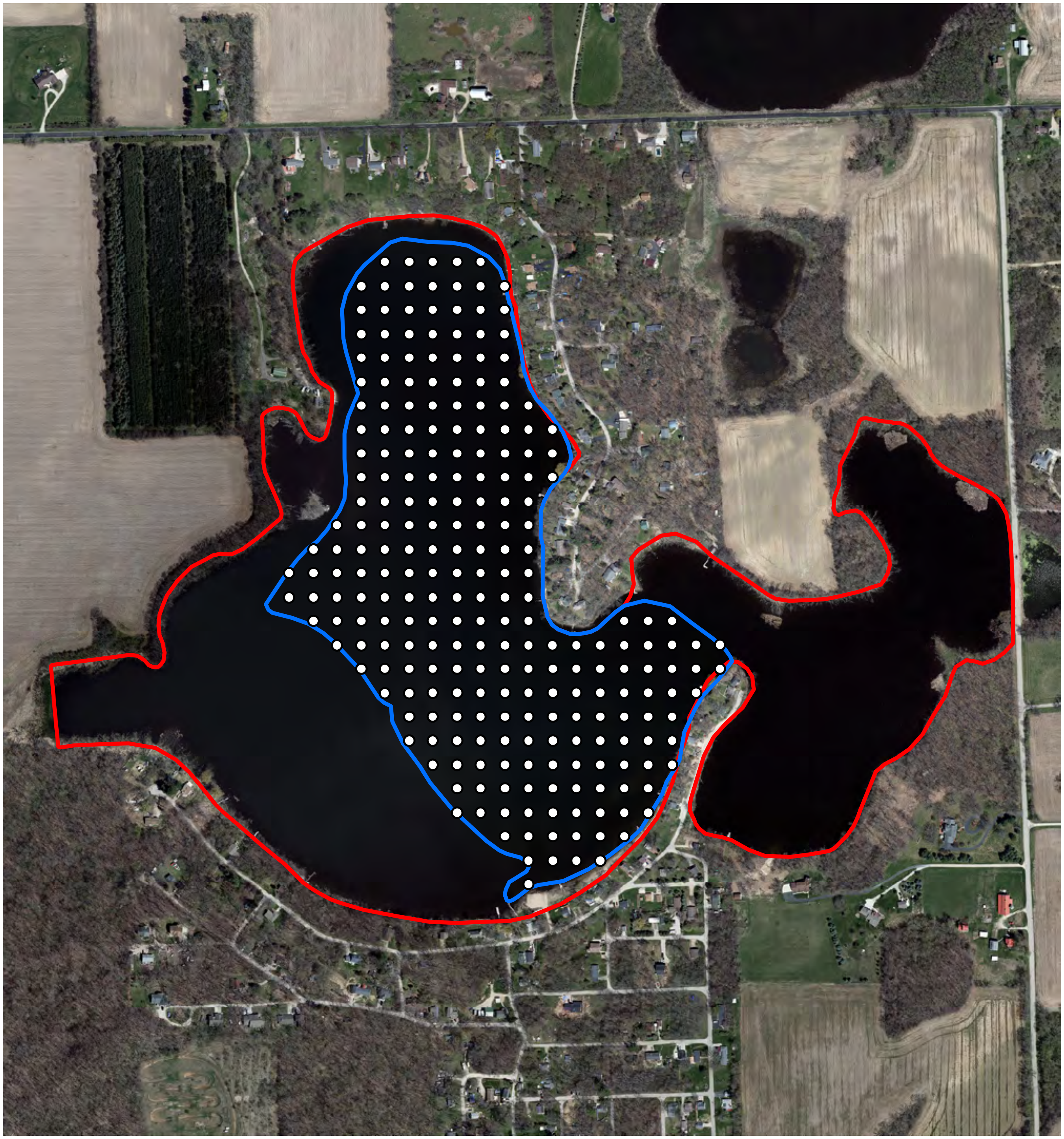
[6] *R. Jesson and R. Lound, Minnesota Department of Conservation,* Game Investigational Report No. 6*,* An Evaluation of a Survey Technique for Submerged Aquatic Plants*, 1962; as refined in the Memo from S. Nichols to J. Bode, J. Leverence, S. Borman, S. Engel, and D. Helsel, entitled "Analysis of Macrophyte Data for Ambient Lakes-Dutch Hollow and Redstone Lakes Example," Wisconsin Geological and Natural History Survey, University of Wisconsin-Extension, February 4, 1994.*

[7] *J. Hauxwell, S. Knight, K. Wagner, A. Mikulyuk, M. Nault, M. Porzky, and S. Chase,* Recommended Baseline Monitoring of Aquatic Plants in Wisconsin: Sampling Design, Field and Laboratory Procedures, Data Entry and Analysis, and Applications*, Wisconsin Department of Natural Resources, Bureau of Science Services, Publication No. PUB-SS-1068 201, March 2010.*

Figure 2.1
Comparison of Old WDNR Lake Lorraine Polygon to 2023 Updated Lake Polygon

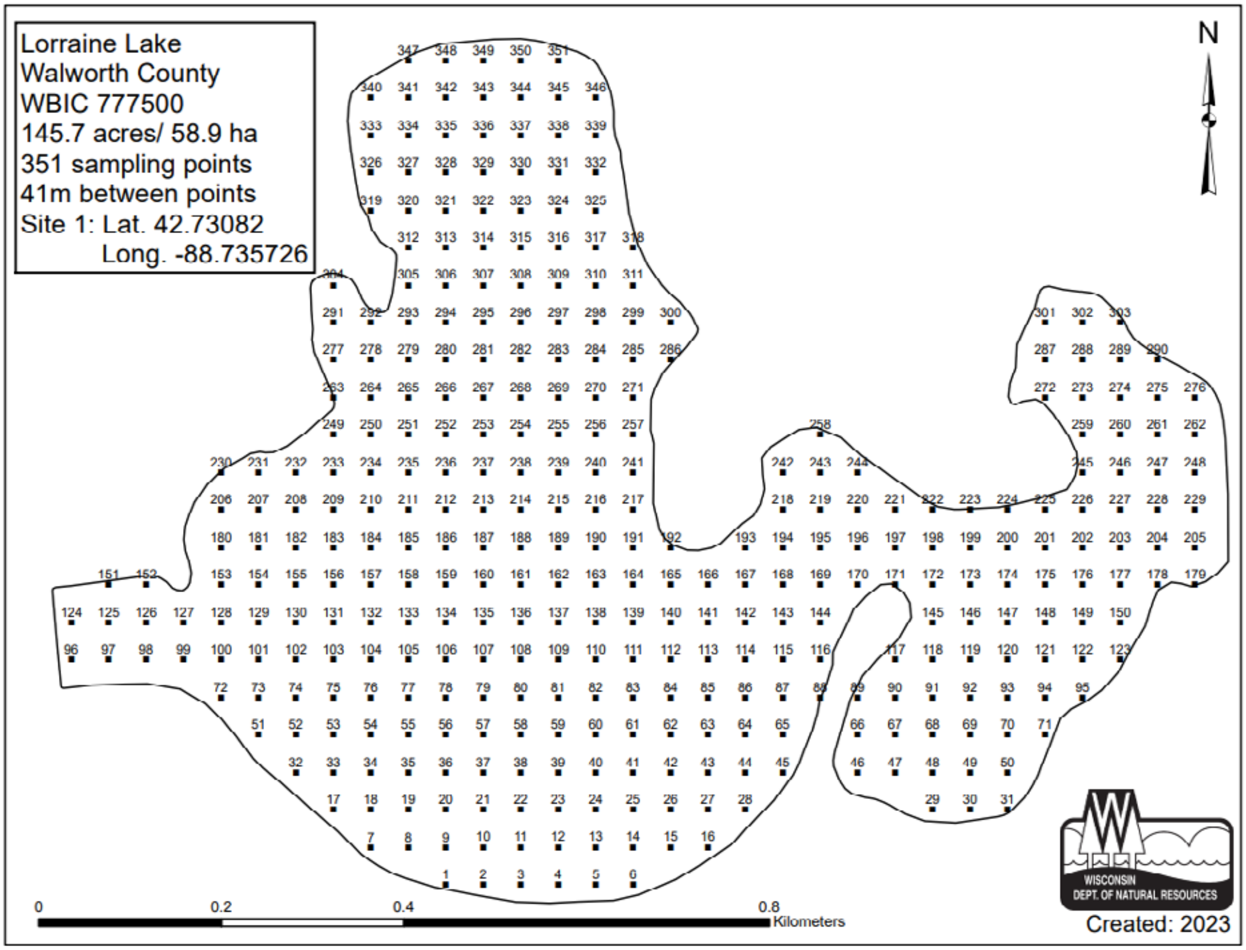


OLD WDNR LAKE POLYGON (63 ACRES)

2023 UPDATED LAKE POLYGON (146 ACRES)

Source: SEWRPC

Figure 2.2
Aquatic Plant Point Intercept Map for Lake Lorraine



Source: WDNR

Total Rake Fullness

As described earlier in this section, Commission staff qualitatively rated the plant abundance at each survey point by how much of the sampling rake was covered by all aquatic plant species.[8] This rating, called total rake fullness, can be a useful metric evaluating general abundance of aquatic plants as part of the point-intercept survey. As shown in Figure 2.4, the average total rake fullness in Lake Lorraine was 1.04 in the 2024 survey. Of the 221 sites visited during the survey, 142 had aquatic plants present.

Maximum Depth of Colonization

Maximum depth of colonization (MDC) can be a useful indicator of water quality, as turbid and/or eutrophic (nutrient-rich) lakes generally have shallower MDC than lakes with clear water.[9] It is important to note that for surveys using the point-intercept protocol, the protocol allows sampling to be discontinued at depths greater than the maximum depth of colonization for vascular plants. However, aquatic moss and macroalgae, such as muskgrass and nitella, frequently colonize deeper than vascular plants and thus may be under-sampled in some lakes. For example, *Chara globularis* and *Nitella flexilis* have been found growing as deep as 37 and 35 feet, respectively, in Silver Lake, in Washington County. In 2024 the MDC was found to be 13 feet, 1.5 feet deeper than it was in 2019 (see Table 2.1). Coontail (*Ceratophyllum demersum*) was the primary plant found at the 13 foot depth.

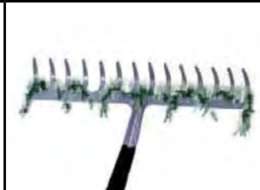
[8] *This method follows the standard WDNR protocol.*

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

Species Richness

The number of distinct types of aquatic plants present in a lake is referred to as the species richness of the lake. Larger lakes with diverse lake basin morphology, less human disturbance, and/or healthier, more resilient lake ecosystems have greater species richness. Aquatic plants provide a wide variety of benefits to lakes, examples of which are briefly described in Table 2.2. Commission staff observed a total of 14 species on the Lake, the same number found in the 2019 survey.

Figure 2.3
WDNR Rake Fullness Rating

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

Source: WDNR

Biodiversity and Species Distribution

Species richness is often incorrectly used as a synonym for biodiversity. The difference in meaning between these terms is both subtle and significant. Biodiversity is based on the number of species present in a habitat along with the abundance of each species. For the purposes of this study, abundance was determined as the percentage of observations of each species compared to the total number of observations made. Aquatic plant biodiversity can be measured with the Simpson Diversity Index (SDI).[10] Using this measure, a community dominated by one or two species would be considered less diverse than one in which several different species have similar abundance. In general, more diverse biological communities are better able to maintain ecological integrity in response to environmental stresses. Promoting biodiversity not only helps sustain an ecosystem but preserves the spectrum of options useful for future management decisions.

Lake Lorraine has an SDI of 0.65, down 0.66 from 2019. Between zero and 8 species, including visuals, were found at a single sampling point across the Lake, with higher species richness being found in the southwestern portion of the main basin (see Figure 2.5). 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.

Sensitive Species

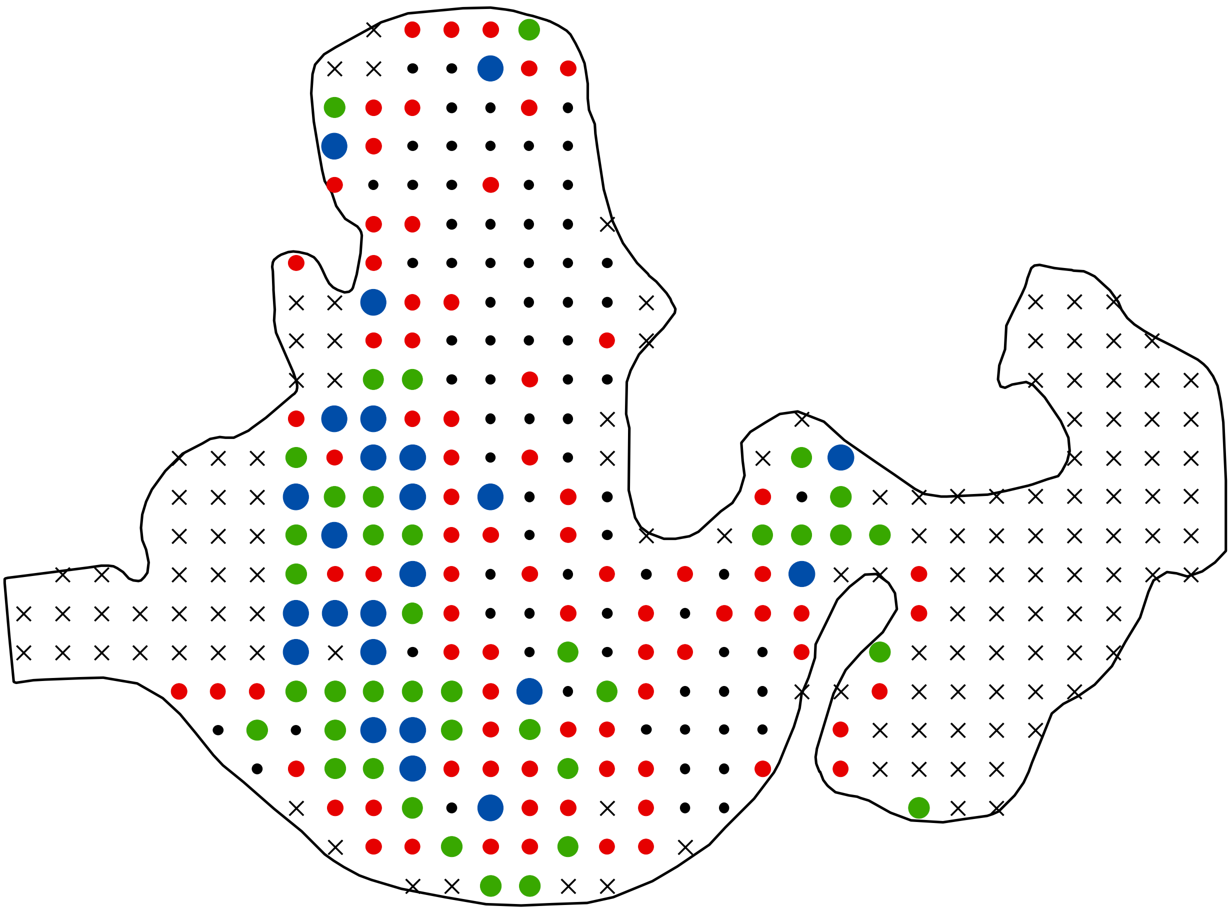
Aquatic plants metrics such as species richness, the floristic quality index (FQI), and disturbance tolerance are often used as indicators of the ecological health of lake due to aquatic plants' varying sensitivity to human activity. In hard water lakes, such as those common in Southeastern Wisconsin, species richness generally increases with water quality and decreases with nutrient enrichment.[11] The FQI is an assessment metric used to evaluate how closely a lake's aquatic plant community matches that of undisturbed, pre-settlement conditions.[12] 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 species richness. The Lake's FQI in 2019 was 18.2 and it was 15.2 in 2024.

[10] *The SDI expresses values on a zero to one scale where 0 equates to no diversity and 1 equates to infinite diversity.*

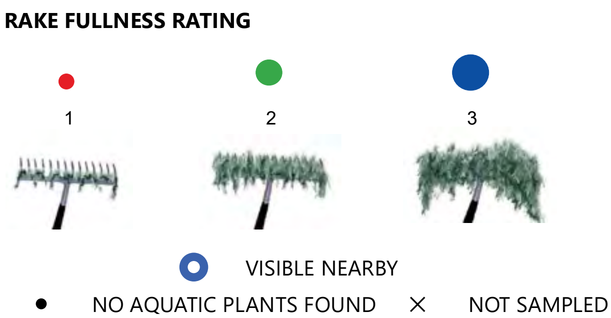
[11] *Vestergaard, O. and Sand-Jensen, K. "Alkalinity and Trophic State Regulate Aquatic Plant Distribution in Danish Lakes,"* Aquatic Botany *67, 2000.*

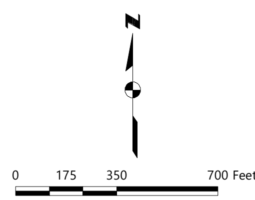
[12S.] *Nichols, "Floristic Quality Assessment of Wisconsin Lake Plant Communities with Example Applications,"* Lake and Reservoir Management *15(2), 1999.*

Figure 2.4
Total Rake Fullness on Lake Lorraine: July 2024



Note: Survey was conducted on Lake Lorraine from July 23rd-24th, 2024.





Source: SEWRPC

In 2017, a new method of tying aquatic plants to lake health was developed that utilized human disturbance variables. This model found that as those variables increased, the abundance of sensitive aquatic plant species decreased, with tolerant species becoming more prevalent.[13] As identified in this model, Lake Lorraine had one sensitive species (*Nitella* sp.) in the 2024 aquatic plant survey. This species was found at only one point on the Lake (see Figure 2.6).

[13] *Mikulyuk A., M. Barton, J. Hauxwell, C. Hein, E. Kujawa, K. Minahan, M. E. Nault, D. L. Oele, and K. I. Wagner, "A Macrophyte Bioassessment Approach Linking Taxon-Specific Tolerance and Abundance in North Temperate Lakes,"* Journal of Environmental Management *199: 172-180, 2017.*

Table 2.1
Aquatic Plants Summary Statistics: PI Survey 2024

Statistic	Value
Total number of sites visited	221
Total number of sites with vegetation	142
Total number of sites shallower than maximum depth of plants	220
Frequency of occurrence at sites shallower than maximum depth of plants	64.55
Simpson Diversity Index	0.65
Maximum depth of plants (feet)	13.00
Number of sites sampled using rake on Rope (R)	212
Number of sites sampled using rake on Pole (P)	9
Average number of all species per site (shallower than max depth)	1.04
Average number of all species per site (vegetation sites only)	1.61
Average number of native species per site (shallower than max depth)	1.03
Average number of native species per site (vegetation sites only)	1.61
Species Richness	11
Species Richness (including visuals)	14

Source: SEWRPC

Table 2.2
Examples of Positive Ecological Qualities Associated with a Subset of the Aquatic Plant Species Present in Lake Lorraine

Aquatic Plant Species Present	Ecological Significance
Ceratophyllum demersum (coontail)	Provides good shelter for young fish; supports insects valuable as food for fish and ducklings; native
Elodea canadensis (common waterweed)	Provides shelter and support for insects which are valuable as fish food; native
Lemna minor (small duckweed)	Can provide up to 90 percent of the dietary needs for ducks and geese; native
Nuphar variegata (spatterdock)	Provide food sources for waterfowl, deer, muskrat, beavers, and porcupines; leaves offer shade and habitat for fish and invertebrates; native
Nymphaea odorata (white water lily	Flower provides seeds for waterfowl; rhizomes ae eaten by moose, beaver, muskrat and porcupine; provides shade and habitat for invertebrates and fish; native
Potamogeton crispus (curly-leaf pondweed)	Adapted to cold water; mid-summer die-off can impair water quality; invasive nonnative
Sparganium sp (bur-reed)	Colonies help anchor sediment and provide nesting areas for shorebirds and waterfowl; fruit is eaten by waterfowl and whole plant is razed by deer and muskrat; native
Utricularia spp. (bladderworts)	Stems provide food and cover for fish; native

Note: Information obtained from A Manual of Aquatic Plants by Norman C. Fassett, University of Wisconsin Press; Guide to Wisconsin Aquatic Plants, Wisconsin Department of Natural Resources; and, Through the Looking Glass: A Field Guide to Aquatic Plants, Wisconsin Lakes Partnership, University of Wisconsin-Extension.

Source: SEWRPC

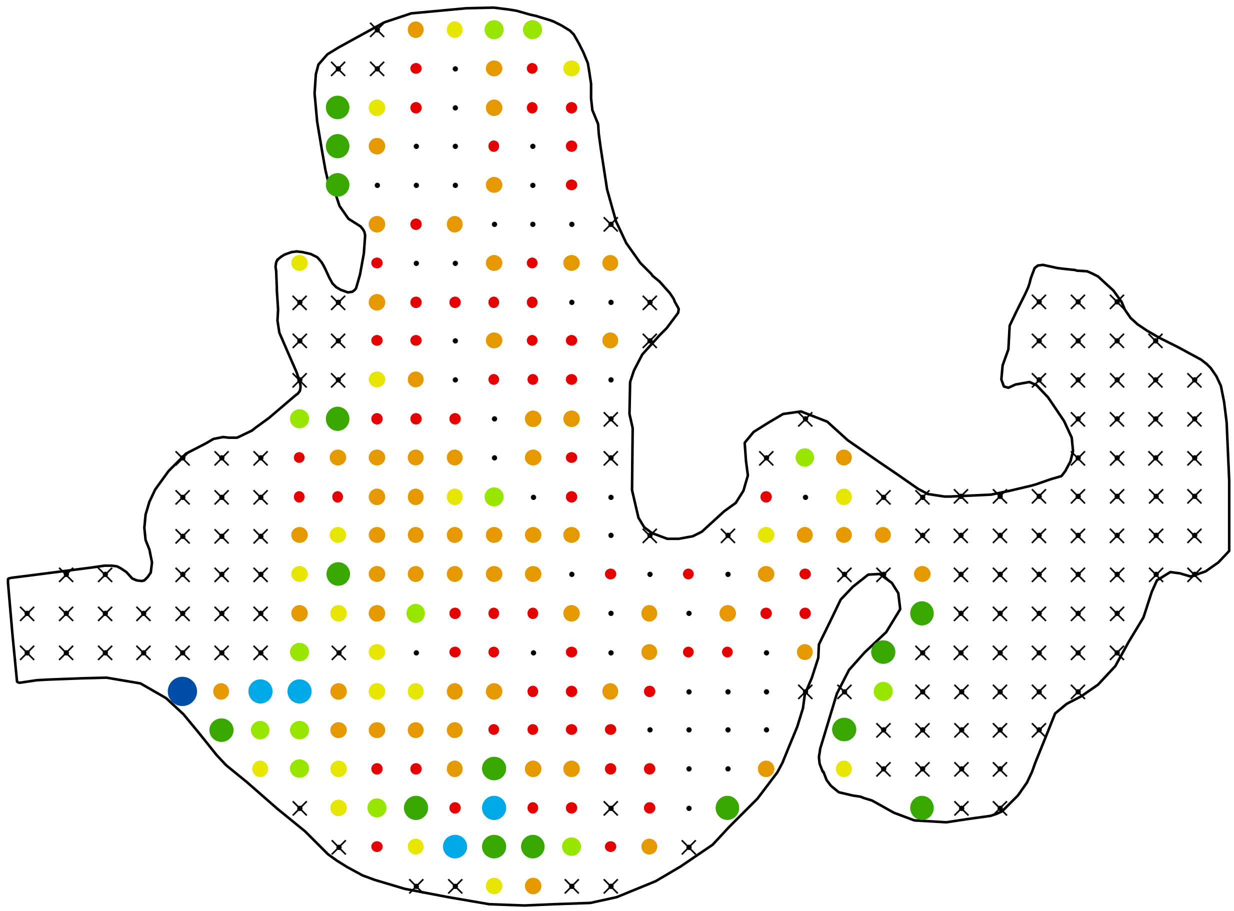
Relative Species Abundance

The five most abundant plants found during the 2024 aquatic plant survey were: 1) Coontail (*Ceratophyllum demersum*, found at or seen near 128 sites), 2) Watermeal (*Wolffia* sp*.*, found at or seen near 59 sites), 3) White water lily (*Nymphaea odorata*, found at or seen near 51 sites), 4) Elodea (*Elodea canadensis*, found at or seen near 51 sites), and 5) Small duckweed (*Lemna minor*, found at or seen near 41 sites) (see Appendix A). In addition to the points where white water lily was documented, almost the entirety of the far eastern bay has thick white water lily growth. That portion of the lake was non-navigable by boat due to the density at which the lilies were growing.

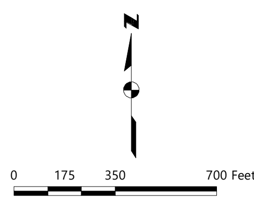
Apparent Changes in Observed Aquatic Plant Communities: 2019 Versus 2024

The 2024 aquatic plant survey identified a total of 15 different plant species including visuals, close to the 14 species found in the 2019 aquatic plant survey (see Table 2.3). There are several species previously found in 2019 in Lake Lorraine that were not found in 2024 including (see Table 2.4): Water smartweed (*Persicaria amphibia),* floating-leaf pondweed *(Potamogeton natans),* stiff pondweed *(Potamogeton strictifolius),* soft-stem bulrush *(Schoenoplectus tabernaemontani),* and creeping bladderwort (*Utricularia gibba).* Some species

Figure 2.5
Species Richness in Lake Lorraine: July 2024



Note: Survey was conducted on Lake Lorraine from July 23rd-24th, 2024.



Source: SEWRPC

SPECIES RICHNESS

- 1
- 2
- 3
- 4
- 5
- 6
- 8
- NOT SAMPLED
- NO AQUATIC PLANTS FOUND

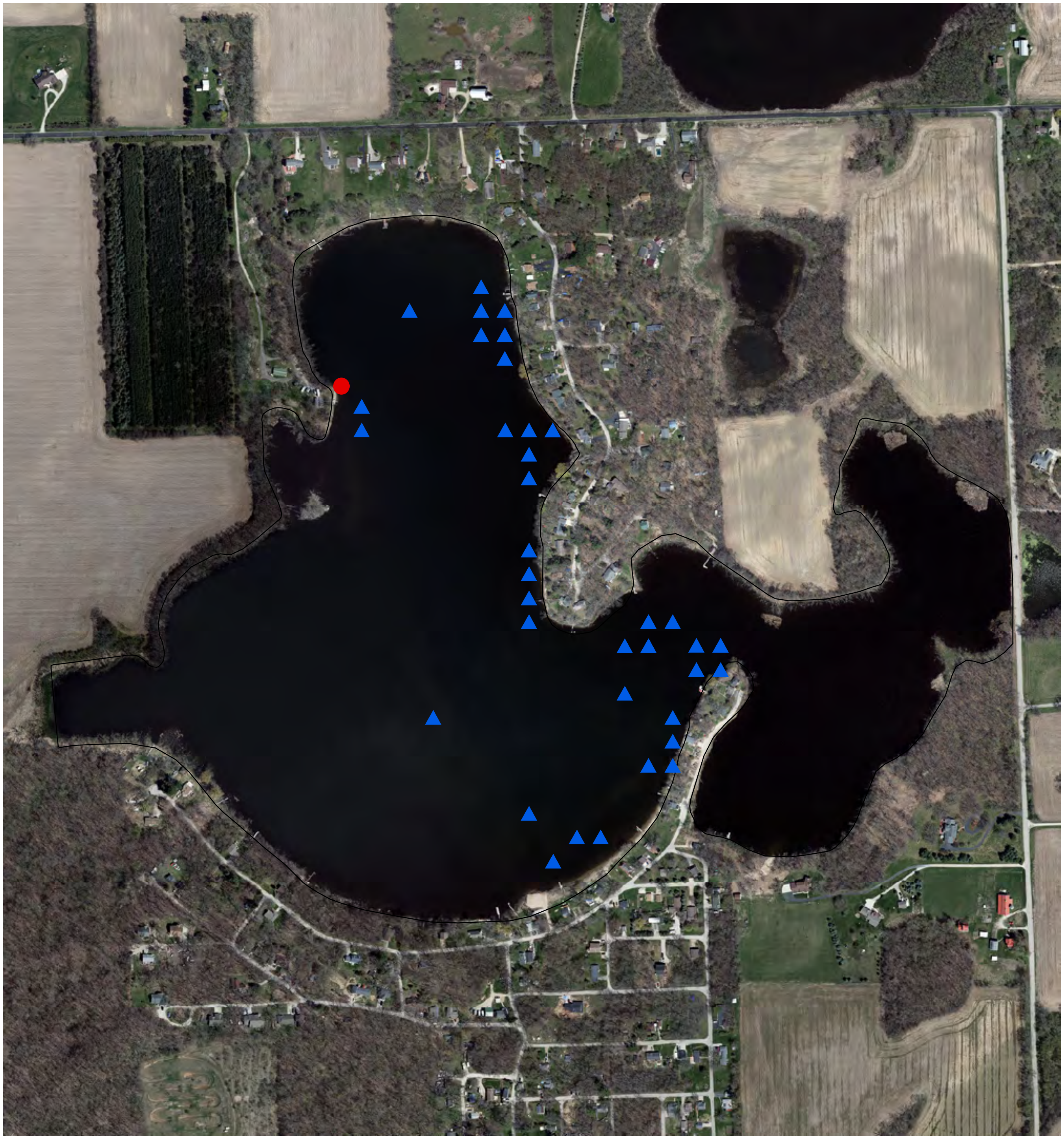
recorded for the first time during a PI survey include: bur-reed (*Sparganium* sp.), arrowhead (*Sagittaria* sp.), and spatterdock (*Nuphar variegata*).

General Trends

In addition to the different type of aquatic plant species detected in the Lake, several other comparisons can be drawn between the 2019 and 2024 aquatic plant survey results, as examined below. When examining these comparisons, it should be noted that the PI grids changed from 2019 to 2024 as described above.

- The total littoral vegetated frequency of occurrence remained moderate but increased slightly from 52 percent in 2019 to 65 percent in 2024, indicating that over half of the shallow Lake bottom continues to have aquatic vegetation present.

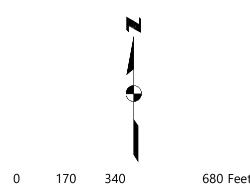
Figure 2.6
Location of Sensitive Aquatic Plant Species 2019-2024 in Lake Lorraine



SENSITIVE SPECIES

2019 SENSITIVE SPECIES LOCATION

2024 SENSTIVE SPECIES LOCATION



Source: SEWRPC

Table 2.3
Aquatic Plant Species Observed in Lake Lorraine: 2004-2024

Aquatic Plant Species	Native or Invasive	June 2004	July 2004	July 2009	August 2014	July 2019	July 2024
Brasenia schreberi	Native	--	--	X	--	--	--
Ceratophyllum demersum	Native	X	X	X	X	X	X
Chara spp.	Native	--	--	X	X	--	X
Eleocharis acicularis	Native	--	--	--	X	--	--
Elodea canadensis	Native	X	X	X	X	X	X
Heteranthera dubia	Native	--	--	--	X	--	X
Lemna minor	Native	X	--	--	--	X	X
Lemna trisulca	Native	X	--	--	--	--	--
Myriophyllum spicatum	Invasive	X	X	X	X	--	--
Najas flexilis	Native	X	X	--	X	--	X
Nitella sp.	Native	--	--	X	--	X	X
Nuphar variegata	Native	--	--	--	--	--	X
Nymphaea odorata	Native	X	X	X	X	X	X
Persicaria amphibia	Native	--	--	X	--	X	--
Potamogeton crispus	Invasive	X	X	X	X	X	X
Potamogeton foliosus	Native	--	--	X	X	--	--
Potamogeton natans	Native	--	--	X	--	X	--
Potamogeton pusillus	Native	--	--	X	--	--	--
Potamogeton strictifolius	Native	--	--	--	X	X	--
Potamogeton zosteriformis	Native	--	X	X	X	--	--
Sparganium sp.	Native	--	--	--	--	--	X
Sagittaria sp.	Native	--	--	--	--	--	X
Schoenoplectus tabernaemontani	Native	--	--	--	X	X	--
Stuckenia pectinata	Native	X	--	X	X	--	--
Typha sp.	Native	--	--	--	X	X	X
Utricularia gibba	Native	--	--	--	--	X	--
Utricularia vulgaris	Native	--	--	X	--	X	X
Wolffia columbiana	Native	--	--	--	--	X	X
Species Total	--	9	7	15	15	14	15

Note: Red text indicates nonnative and/or invasive species. The August 2014 aquatic plant survey data recorded Spiny Coontail (*Ceratophyllum echinatum*), however Commission biologists believe this was a data entry error based on surrounding data and species frequency.

Source: WDNR and SEWRPC

- The MDC slightly increased from 11.5 to 13 feet between 2019 and 2024, indicating that water clarity may have improved during this time as plants are establishing deeper into the lake.

- Eurasian watermilfoil (*Myriophyllum spicatum*) (EWM) was not found at any points in both the 2019 and 2024 surveys, while curly-leaf pondweed (*Potamogeton crispus*) (CLP) was found at two points in 2019 and one in 2024. No new aquatic invasive plant species were found in 2024.

- Several native submerged aquatic plant species have small populations within the Lake. Water stargrass, nitella, arrowhead, and common bladderwort were only observed at a few points in 2024 survey.

- While Commission staff did not survey a portion of the heavily vegetated eastern bay of the Lake, this area was thoroughly covered by white water lilies. Aquatic plants are chemically treated in a single lane along the southeastern side of the bay to allow for navigation.

- The FQI for Lake Lorraine in 2024 was 15.2 as compared to 18.2 in the 2019 survey. The FQI decreased by 2.98, indicating a decrease in the quality of the aquatic plant community. This decrease is due to a lower species richness as the mean C value of the species observed increased incrementally from 2019 (5.25) to 2024 (5.38).

Table 2.4
Lake Lorraine Aquatic Plant Survey Summary: July 2019 Versus July 2024

Aquatic Plant Species	Native or Invasive	Number of Sites Found[a] (2019/2024)	Frequency of Occurrence Within Vegetated Areas[b] (2019/2024)	Average Rake Fullness[c] (2019/2024)	Relative Frequency of Occurrence[d] (2019/2024)	Visual Sightings[e] (2019/2024)
Ceratophyllum demersum (coontail)	Native	66/123	59.46/86.62	1.47/1.50	34.2/53.9	18/5
Chara spp. (muskgrass)	Native	--/31	--/21.83	--/1.29	--/13.6	--/0
Elodea canadensis (waterweed)	Native	86/43	77.48/30.28	1.59/1.16	44.6/18.9	10/8
Heteranthera dubia (water stargrass)	Native	--/1	--/0.70	--/1.00	--/0.4	--/0
Lemna minor (duckweed)	Native	0/3	0/2.11	0/1.00	0/1.3	130/38
Nitella sp. (nitella)	Native	31/1	27.93/0.70	1.35/1.00	16.1/0.4	0/0
Nuphar variegata (spatterdock)	Native	--/0	--/0	--/0	--/0	--/9
Nymphaea odorata (white water lily)	Native	6/15	5.41/0.56	1.00/1.20	3.1/6.6	47/36
Persicaria amphibia (water smartweed)	Native	0/--	0/--	0/--	0/--	7/--
Potamogeton crispus (curly-leaf pondweed)	Invasive	2/1	1.80/0.70	1.00/1.00	1.0/0.4	0/0
Potamogeton natans (floating-leaf pondweed)	Native	0/--	0/--	0/--	0/--	1/--
Potamogeton strictifolius (stiff pondweed)	Native	1/--	0.90/--	1.00/--	0.5/--	0/--
Sagittaria sp. (arrowhead)	Native	--/1	--/0.70	--/1.00	--/0.4	--/0
Schoenoplectus tabernaemontani (soft-stem bulrush)	native	0/--	0/--	0/--	0/--	1/--
Sparganium sp. (bur-reed)	Native	--/0	--/0	--/0	--/0	--/4
Typha sp. (cattail)	Native	0/0	0/0	0/0	0/0	6/3
Utricularia gibba (creeping bladderwort)	Native	1/--	0.90/--	3.00/--	0.5/--	4/--
Utricularia vulgaris (bladderwort)	Native	0/2	0/1.41	0/2.00	0/0.9	5/2
Wolffia columbiana (common watermeal)	Native	0/7	0/4.93	0/1.00	0/3.1	64/52

Note: Sampling grids changed between 2019 and 2024 to add additional points to better represent the extent of the Lake. Red text indicates non-native and/or invasive species.

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

[b] *Frequency of Occurrence, 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 sites 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 sites 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.*

Source: WDNR and SEWRPC

As was described earlier, sensitive aquatic plant species are the most vulnerable to human disturbance. Therefore, changes in sensitive species abundance can indicate the general magnitude of human disturbance derived stress on a waterbody's ecosystem. The location of sensitive species in the Lake during 2019 and 2024 were contrasted (see Figure 2.6). Overall, the sensitive species richness decreased greatly between 2019 and 2024, reflecting a declining plant community. Sensitive species were distributed throughout a large portion of the Lake in 2019, however only one sensitive species was found in 2024 at a single sampling point out of the 213 surveyed points (less than 0.5 percent of points) (see Figure 2.6).

Invasive Species

Eurasian Watermilfoil (EWM)

Eurasian watermilfoil is one of eight milfoil species found in Wisconsin and is the only exotic or nonnative milfoil species. It is identified in Chapter NR 109 of the *Wisconsin Administrative Code* as a nonnative invasive aquatic plant. EWM favors mesotrophic to moderately eutrophic waters, fine organic-rich lake-bottom sediment, warmer water with moderate clarity and high alkalinity, and tolerates a wide range of pH and salinity.[14,15] In Southeastern Wisconsin, EWM can grow rapidly and has few natural enemies to inhibit its growth. Furthermore, it can grow explosively following major environmental disruptions, as small fragments of EWM can grow into entirely new plants.[16] For reasons such as these, EWM can grow to dominate an aquatic plant community in as little as two years.[17,18] In such cases, EWM can displace native plant species and interfere with the aesthetic and recreational use of waterbodies. However, established populations may rapidly decline after approximately ten to 15 years.[19]

Human produced EWM fragments (e.g., created by boating through EWM), as well as fragments generated from natural processes (e.g., wind-induced turbulence, animal feeding/disturbance) readily colonize disturbed sites. contributing to EWM spread. EWM fragments can remain buoyant for two to three days in summer and two to six days in fall, with larger fragments remaining buoyant longer than smaller ones.[20] The fragments can also cling to boats, trailers, motors, and/or bait buckets where they can remain alive for weeks contributing to transfer of milfoil to other lakes. For these reasons, it is especially important to remove all vegetation from boats, trailers, and other equipment after removing them from the water and prior to launching in other waterbodies.

In the 2014 aquatic plant survey, EWM was found at 58 points with 10 additional visual sightings. However, EWM has not been documented to be present in the lake during the last two aquatic plant surveys in 2019 and 2024. This indicates a large decrease in the EWM population. While no EWM was found in 2019 and 2024, EWM could potentially persist in portions of the lake that were not sampled due to dense white water lily growth (see Figure 2.7).

Curly-Leaf Pondweed (CLP)

Curly-leaf pondweed continues to be present in Lake Lorraine, though at low densities. This plant, like EWM, is identified in Chapter NR 109 of the *Wisconsin Administrative Code* as a nonnative invasive aquatic plant. Although survey data suggests it presently is only a relatively minor species in terms of dominance, and, as such, is less likely to interfere with recreational boating activities, the plant can grow dense strands that exclude other high value aquatic plants. For this reason, curly-leaf pondweed should continue to be monitored and managed as an invasive member of the aquatic community. This species often senesces by midsummer and therefore may be underrepresented in the inventory data presented in this report.

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[14] *U.S. Forest Service,* Pacific Islands Ecosystems at Risk (PIER)*, 2019: hear.org/pier/species/myriophyllum_spicatum.htm.*

[15] *S.A. Nichols and B. H. Shaw, "Ecological Life Histories of the Three Aquatic Nuisance Plants: Myriophyllum spicatum, Potamogeton crispus, and Elodea canadensis,"* Hydrobiologia *131(1), 1986*

[16] Ibid.

[17] *S.R. Carpenter, "The Decline of Myriophyllum spicatum in a Eutrophic Wisconsin (USA) Lake,"* Canadian Journal of Botany *58(5), 1980.*

[18] *Les, D. H., and L. J. Mehrhoff, "Introduction of Nonindigenous Vascular Plants in Southern New England: a Historical Perspective,"* Biological Invasions *1: 284-300, 1999*

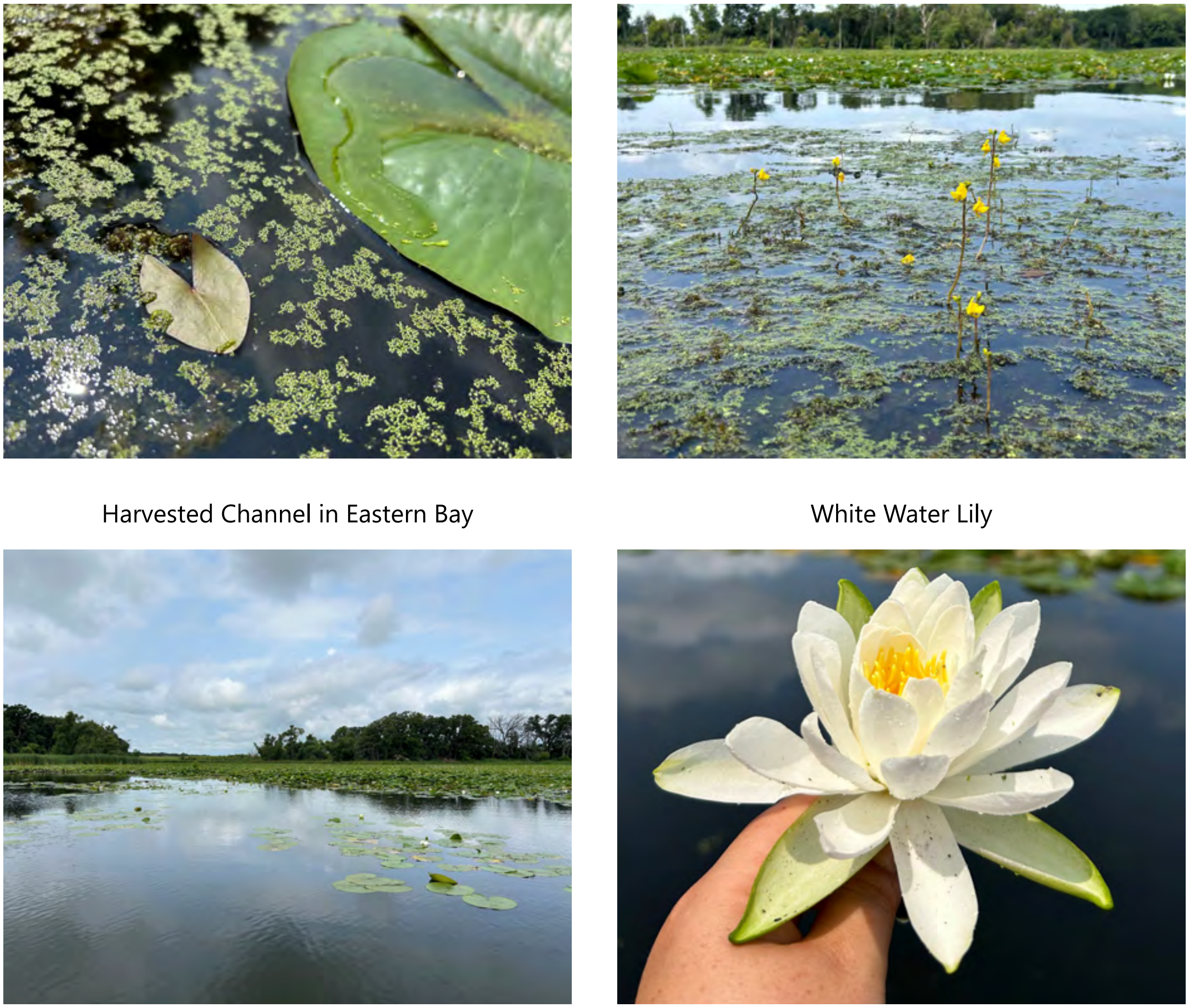
[19] *S.R. Carpenter, 1980,* op. cit.

[20] *J.D. Wood and M. D. Netherland, "How Long Do Shoot Fragments of Hydrilla (Hydrilla verticillata) and Eurasian Watermilfoil (Myriophyllum spicatum) Remain Buoyant?",* Journal of Aquatic Plant Management *55: 76-82, 2017.*

Figure 2.7
Aquatic Plants in Lake Lorraine: July 2024

White Water Lily and Watermeal | Common Bladderwort

Harvested Channel in Eastern Bay | White Water Lily



Source: SEWRPC

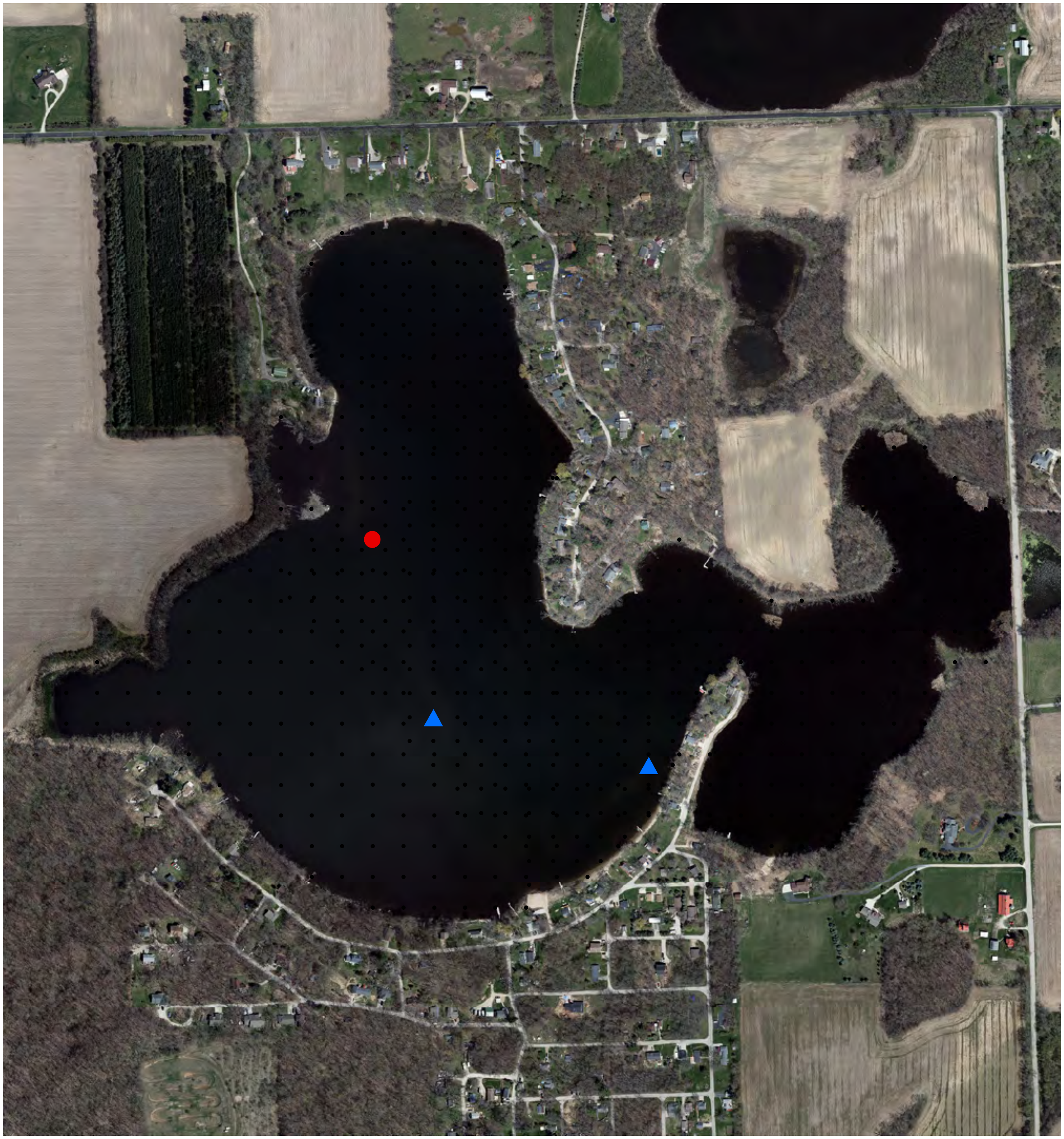
Curly-leaf pondweed was found at only a single sampling point in 2024. The specimen found in 2024 was a single turion, or winter bud, which was not very healthy or robust. In the previous 2019 survey, CLP was only found at two points (see Figure 2.8). In both surveys the average rake fullness for CLP was 1.00.

2.3 PAST AND PRESENT AQUATIC PLANT MANAGEMENT PRACTICES

Lake Lorraine has been subject to a variety of aquatic plant management practices over the last 28 years beginning with its participation in the 1996 Wisconsin Milfoil Weevil Project.[21] In the mid-1990s, a native weevil, *Euhrychiopsis lecontei*, commonly referred to as the milfoil weevil, was reported to be associated with Eurasian water milfoil declines in a number of Vermont Lakes and later associated with EWM decline in Illinois and Wisconsin lakes. As a result, scientists from WDNR and the University of Wisconsin – Stevens Point developed a project to further study this. Lake Lorraine was one of twelve lakes selected as a study site for this project. The project framework consisted of answering the following questions:

[21] *apps.dnr.wi.gov/lakes/grants/project.aspx?project=10099441.*

Figure 2.8
Curly-Leaf Pondweed Distribution in Lake Lorraine 2019-2024

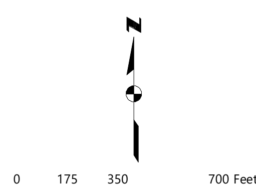


Note: Survey was conducted on Lake Lorraine from July 23rd-24th, 2024.

RAKE FULLNESS RATING

2024 CLP LOCATION

2019 CLP LOCATION



Source: SEWRPC

1. What is the geographic distribution of the milfoil weevil across the State?

2. Are there specific lake characteristics (geography, shoreline, water chemistry, etc.) that are correlated with weevil densities?

3. Can stocking weevils in experimental plots increase natural weevil densities and cause a decrease in Eurasian water milfoil biomass?

Lake Lorraine was stocked with weevils in the summer of 1997 and subsequently monitored for their density as well as their impact on EWM populations. In addition to weevil and EWM monitoring, scientists monitored a variety of water quality parameters as well to search for any correlations. The weevil EWM biocontrol efforts were unsuccessful on Lake Lorriane with weevil densities not maintaining target levels and no noticeable milfoil reduction occurred in the lake as a result.

The Association decided in 2003 to improve their plant management activities on the Lake after aquatic plant growth had reached nuisance levels. The Association contracted with The Limnological Institute to have the Lake's first Aquatic Plant Management Plan completed.[22] After the first plan was completed in 2004, the plan was updated every five years after to ensure that the recommended plant management practices best fit the needs of the Lake and its residents.

From 2009 until 2019 mechanical harvesting was the main management practice employed on the Lake. In the ten years that harvesting was employed on the Lake, 231.1 cubic yards of aquatic plants were removed from (see Table 2.5). However, in 2019 Lake water levels were too high to harvest aquatic plants. Harvesting on the Lake has focused on EWM removal to improve navigation as well as water quality.

The Association utilized herbicide treatment in the past to assist with aquatic plant management (see Table 2.6). Beginning in 2020, mechanical harvesting of aquatic plants was replaced by herbicide usage as the main form of aquatic plant management. Currently, 28.15 acres of Lake Lorraine are permitted for herbicide application. Aquathol has been the main herbicide used on Lake Lorraine; however Rodeo, DMA 4, and 2,4-D have also been utilized. Aquathol is a contact herbicide that primarily kills pondweeds, but does not control other potentially nuisance species, such as EWM. The herbicide 2,4-D is a systemic herbicide that is absorbed by the leaves and translocated to other parts of the plant; it is more selective than the other herbicides listed above and is used to control EWM. However, it can also kill beneficial species, such as water lilies (*Nymphaea* sp. and *Nuphar* sp.).

2.4 POTENTIAL AQUATIC PLANT CONTROL METHODOLOGIES

Aquatic plant management techniques can be classified into six categories.

- *Physical measures* include lake bottom coverings

- *Biological measures* include the use of organisms such as herbivorous insects

- *Manual measures* involve physically removing plants by hand or using hand-held tools such as rakes

- *Mechanical measures* rely on artificial power sources and remove aquatic plants with a machine known as a harvester or by suction harvesting

- *Chemical measures* use aquatic herbicides to kill nuisance and nonnative plants *in-situ*

- *Water level manipulation measures* utilize fluctuations in water levels to reduce aquatic plant abundance and promote growth of specific native species

All aquatic plant control measures are stringently regulated and most require a State of Wisconsin permit.

[22] *apps.dnr.wi.gov/lakes/grants/project.aspx?project=10100415.*

Chemical controls, for example, require a permit and are regulated under *Wisconsin Administrative Code* Chapter NR 107, "Aquatic Plant Management" while placing bottom covers (a physical measure) requires a WDNR permit under Chapter 30 of the *Wisconsin Statutes*. All other aquatic plant management practices are regulated under *Wisconsin Administrative Code* Chapter NR 109, "Aquatic Plants: Introduction, Manual Removal and Mechanical Control Regulations." Furthermore, the aquatic plant management measures described in this plan are consistent with the requirements of Chapter NR 7, "Recreational Boating Facilities Program," and with the public recreational boating access requirements relating to eligibility under the State cost-share grant programs set forth in *Wisconsin Administrative Code* Chapter NR 1, "Natural Resources Board Policies." Water level manipulations require a permit and are regulated under *Wisconsin Statutes* 30.18 and 31.02.[23,24] More details about aquatic plant management are discussed in the following sections while recommendations are provided later in this document.

Table 2.5
Aquatic Plants Harvested in Lake Lorraine Lake: 2009-2024

Year	Plant Material Removed (cubic yards)
2009	31.5
2010	119.0
2011	182.0
2012	259.0
2013	378.0
2014	126.0
2015	406.0
2016	887.0
2017	56.0
2018	98.0
2019*-2024	0.0
Annual Mean	231.1

*Note: Water level was too high in 2019 for harvesting operations to occur.

Source: WDNR

Non-compliance with aquatic plant management permit requirements is an enforceable violation of Wisconsin law and may lead to fines and/or complete permit revocation. The information and recommendations provided in this memorandum can help frame permit requirements. Mechanical permits can cover up to a five-year period.[25] At the end of that period, the aquatic plant management plan must be updated. The updated plan must consider the results of a new aquatic plant survey and should evaluate the success, failure, and effects of earlier plant management activities that have occurred on the lake.[26] These plans and plan execution are reviewed and overseen by the WDNR regional lakes and aquatic invasive species coordinators.[27]

Physical Measures

Lake-bottom covers and light screens provide limited control of rooted plants by creating a physical barrier that reduces or eliminates plant-available sunlight. Various materials such as pea gravel or synthetics like polyethylene, polypropylene, fiberglass, and nylon can be used as covers. The longevity, effectiveness, and overall value of some physical measures is questionable. The WDNR does not permit these kinds of controls. Consequently, lake-bottom covers are not a viable aquatic plant control strategy for the Lake.

Biological Measures

Biological control offers an alternative to direct human intervention to manage nuisance or exotic plants. Biological control techniques traditionally use herbivorous insects that feed upon nuisance plants. This approach has been effective in some southeastern Wisconsin lakes.[28] For example, milfoil weevils (*Eurhychiopsis lecontei)* have been used to control EWM. Milfoil weevils do best in waterbodies with balanced panfish populations,[29] where dense EWM beds reach the surface close to shore, where natural shoreline areas include leaf litter that provides habitat for over-wintering weevils, and where there is comparatively little boat traffic. This technique is not presently commercially available making the use of milfoil weevils non-viable.

[23] *docs.legis.wisconsin.gov/statutes/statutes/30/ii/18.*

[24] *docs.legis.wisconsin.gov/statutes/statutes/31/02.*

[25] *Five-year permits allow a consistent aquatic plant management plan to be implemented over a significant length of time. This process allows the selected aquatic plant management measures to be evaluated at the end of the permit cycle.*

[26] *Aquatic plant harvesters must report harvesting activities as one of the permit requirements.*

[27] *Information on the current aquatic invasive species coordinator is found on the WDNR website.*

[28] *B. Moorman, "A Battle with Purple Loosestrife: A Beginner's Experience with Biological Control,"* LakeLine *17(3): 20-21, 34-37, September 1997; see also, C.B. Huffacker, D.L. Dahlsen, D.H. Janzen, and G.G. Kennedy, Insect Influences in the Regulation of Plant Population and Communities, pp. 659-696, 1984; and C.B. Huffacker and R.L. Rabb, editors,* Ecological Entomology*, John Wiley, New York, New York, USA.*

[29] *Panfish such as bluegill and pumpkinseed are predators of herbivorous insects. High populations of panfish lead to excess predation of milfoil weevils.*

Table 2.6
Chemical Treatments in Lake Lorraine: 2015-2024

Year	Rodeo	Aquathol K	DMA-4	2,4-D	Diquat	Tribune
2015	Utilized	Utilized	Utilized	0	Utilized	0
2016	0	0	Utilized	0	Utilized	0
2017	Utilized	Utilized	Utilized	0	0	Utilized
2018	0	222	84	0	0	0
2019	0	205	108.5	0	0	0
2020	0	306	0	115	0	0
2021	0.5	405	0	400	0	0
2022	0	21.	0	1.5	0	0
2023	0	21.	0	1.5	0	0
2024	0	223.5	0	0	0	0
Total	0.5	1,403.5	192.5	518.0	N/A	N/A

Note: Herbicide values in gallons. Herbicide amounts unavailable for 2015-2017; "Utilized" indicates that the chemical was used but value is unknown.

Source: WDNR and SEWRPC

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 plants 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. Since hand raking and hand pulling are readily allowed by WDNR, and since both are practical methods to control riparian landowner scale problems, these methods are described in more detail in the following paragraphs.

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. Advantages of this method include:

- Tools are inexpensive ($100 to $150 each)
- The method is easy to learn and use
- It may be employed by riparian landowners without a permit if certain conditions are met
- Results are immediately apparent
- Plant material is immediately removed from a lake (including seeds)

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, curly-leaf pondweed) 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. Recommendations regarding hand-pulling, hand-cutting, and raking are discussed later in this document.

Mechanical Measures

Two methods of mechanical harvesting are currently employed in Wisconsin - mechanical harvesting and suction harvesting. Both are regulated by WDNR and require a permit.[30]

[30] *Mechanical control permit conditions depend upon harvesting equipment type and specific equipment specifications.*

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 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 widely employed in Southeastern Wisconsin.

In addition to controlling plant growth, gathering and removing plant material from a lake reduces in-lake nutrient recycling, sedimentation, and targets plant reproductive potential. In other words, harvesting removes plant biomass, which would otherwise decompose and release nutrients, sediment, and seeds or other reproductive structures (e.g., turions, bulbils, plant fragments) into a lake. Mechanical harvesting is particularly effective and popular for large-scale open-water projects. However, small harvesters are also produced that are particularly suited to working around obstacles such as piers and docks in shallow nearshore areas.

An advantage of mechanical harvesting is that the harvester, when properly operated, "mows" aquatic plants and, therefore, typically leaves enough living plant material in place to provide shelter for aquatic wildlife and stabilize lake-bottom sediment. Harvesting, when done properly, does not kill aquatic plants, it simply trims plants back. Aside from residual plant mass remaining because of imperfect treatment strategy execution, none of the other aquatic plant management methods purposely leave living plant material in place after treatment. Aquatic plant harvesting has been shown to allow light to penetrate to the lakebed and stimulate regrowth of suppressed native plants. This is particularly effective when controlling invasive plant species that commonly grow quickly early in the season (e.g., EWM, curly-leaf pondweed) when native plants have not yet emerged or appreciably grown.

A disadvantage of mechanical harvesting is that the harvesting process may fragment plants and thereby unintentionally propagate EWM and curly-leaf pondweed. EWM fragments are particularly successful in establishing themselves in areas where plant roots have been removed. This underscores the need to avoid harvesting or otherwise disrupting native plant roots. Harvesting may also agitate bottom sediments in shallow areas, thereby increasing turbidity and resulting in deleterious effects such as smothering fish breeding habitat and nesting sites. To this end, most WDNR-issued permits do not allow deep-cut harvesting in water less than three feet deep,[31] which limits the utility of this alternative in many littoral and shoal areas. Nevertheless, if employed correctly and carefully under suitable conditions, harvesting can benefit navigation lane maintenance and can reduce regrowth of nuisance plants while maintaining, or even enhancing, native plant communities.

Cut plant fragments commonly escape the harvester's collection system and form mats or accumulate on shorelines. To compensate for this, most harvesting programs include a plant pickup program. Some plant pickup programs use a harvester to gather and collect significant accumulations of floating plant debris as well as sponsor regularly scheduled aquatic plant pick up from lakefront property owner docks. Property owners are encouraged to actively rake plant debris along their shorelines and place these piles on their docks for collection. This kind of program, when applied systematically, can reduce plant propagation from plant fragments and can help alleviate the negative aesthetic consequences of plant debris accumulating on shorelines. Nevertheless, it is important to remember that normal boating activity (particularly during summer weekends) often creates far more plant fragments than generated from mechanical harvesting. Therefore, a plant pickup program is often essential to protect a lake's health and aesthetics, even in areas where harvesting has not recently occurred.

Suction Harvesting and Diver-Assisted Suction Harvesting

Another mechanical plant harvesting method uses suction to remove aquatic plants from a lake. Suction harvesting removes sediment, aquatic plants, plant roots, and anything else from the lake bottom and disposes of this material outside the lake. Since bottom material is removed from the lake, this technique also requires a dredging permit in addition to the aquatic plant management permit.

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[31] *Deep-cut harvesting is harvesting to within one foot of the lake bottom. This is not allowed in shallow water because it is challenging to ensure that the harvester avoids lake-bottom contact in such areas.*

First permitted in 2014, diver-assisted suction harvesting (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 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 potential to release plant fragments when compared to mechanical harvesting, raking, and hand-pulling, thereby reducing spread and growth of invasive plants like EWM; 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.

Given how costly DASH can be, DASH is not considered a viable control option for large-scale management of EWM in the Lake. Nevertheless, DASH can provide focused relief of nuisance native and non-native plants around piers and other critical areas. If individual property owners chose to employ DASH, a NR 109 permit is required.

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. However, many drawbacks are also associated with chemical herbicide aquatic plant control including the following examples.

- **Unknown and/or conflicting evidence about the effects of long-term chemical exposure on fish, fish food sources, and humans.** The U.S. Environmental Protection Agency, the agency responsible for approving aquatic plant treatment chemicals, studies aquatic plant herbicides to evaluate short-term exposure (acute) effects on human and wildlife health. Some studies also examine long-term (chronic) effects of chemical exposure on animals (e.g., the effects of being exposed to these herbicides for many years). However, it is often impossible to conclusively state that no long-term effects exist due to the animal testing protocol, time constraints, and other factors. Furthermore, long-term studies cannot address all potentially affected species.[32] For example, conflicting studies/opinions exist regarding the role of the chemical 2,4-D as a human carcinogen.[33] Some lake property owners judge the risk of using chemicals as being excessive despite legality of use. Consequently, the concerns of lakefront owners should be considered whenever chemical treatments are proposed. Moreover, if chemicals are used, they should be applied as early in the season as practical. This helps assure that the applied chemical decomposes before swimming, water skiing, and other active body-contact lake uses begin.[34] Early season application also is generally the best time to treat EWM and curly-leaf pondweed for a variety of technical reasons explained in more detail as part of the "loss of native aquatic plants and related reduction or loss of desirable aquatic organisms" bullet below.

- **Reduced water clarity and increased risk of algal blooms.** Water-borne nutrients promote growth of both aquatic plants and algae. If rooted aquatic plant populations are depressed, demand for dissolved nutrients will be lessened. In such cases, algae tend to become more abundant, a situation reducing water clarity. For this reason, lake managers must avoid needlessly eradicating native plants and excessive chemical use. Lake managers must strive to maintain balance between rooted aquatic plants and algae - when the population of one declines, the other may increase in abundance to nuisance levels. In addition to upsetting the nutrient balance between rooted aquatic plants and

[32] *U.S. Environmental Protection Agency,* 2,4-D RED Facts*, EPA-738-F-05-002, June 2005.*

[33] *M.A. Ibrahim et al., "Weight of the Evidence on the Human Carcinogenicity of 2,4-D,"* Environmental Health Perspectives *96: 213-222, December 1991.*

[34] *Though the manufacturers indicate that swimming in 2,4-D-treated lakes is allowable after 24 hours, it is possible that some swimmers may want more of a wait time to lessen chemical exposure. Consequently, allowing extra wait time is recommended to help lake residents and l users can feel comfortable that they are not being unduly exposed to aquatic plant control chemicals.*

algae, dead chemically treated aquatic plants decompose and contribute nutrients to lake water, a condition that may exacerbate water clarity concerns and algal blooms.

- **Reduced dissolved oxygen/oxygen depletion.** When chemicals are used to control large mats of aquatic plants, the dead plant material settles to the bottom of a lake and decomposes. Plant decomposition uses oxygen dissolved in lake water, the same oxygen that supports fish and many other vital beneficial lake functions. In severe cases, decomposition processes can deplete oxygen concentrations to a point where desirable biological conditions are no longer supported.[35] Ice covered lakes, and the deep portions of stratified lakes, are particularly vulnerable to oxygen depletion. Excessive oxygen loss can inhibit a lake's ability to support certain fish and can trigger processes that release phosphorus from bottom sediment, further enriching lake nutrient levels. These concerns emphasize the need to limit chemical control and apply chemicals in *early* spring, when EWM and curly-leaf pondweed have not yet formed dense mats.

- **Increased organic sediment deposition.** Dead aquatic plants settle to a lake's bottom, and, because of limited oxygen and/or rapid accumulation, may not fully decompose. Accumulation of this material can create flocculent organic-rich sediment and ultimately reduce water depth. Care should be taken to avoid creating conditions leading to rapid thick accumulations of dead aquatic plants to promote more complete decomposition of dead plant material.

- **Loss of native aquatic plants and related reduction or loss of desirable aquatic organisms.** EWM and other invasive plants often grow in complexly intermingled beds. Additionally, EWM is physically similar to, and hybridizes with, native milfoil species. Native plants, such as pondweeds, provide food and spawning habitat for fish and other wildlife. A robust and diverse native plant community forms the foundation of a healthy lake, and the conditions needed to provide and host desirable gamefish. Fish, and the organisms fish eat, require aquatic plants for food, shelter, and oxygen. If native plants are lost due to insensitive herbicide application, fish and wildlife populations often suffer. For this reason, if chemical herbicides are applied to the Lake, these chemicals must target EWM or curly-leaf pondweed and therefore should be applied in early spring when native plants have not yet emerged. Early spring application has the additional advantage of being more effective due to colder water temperatures, a condition enhancing herbicidal effects and reducing the dosing needed for effective treatment. Early spring treatment also reduces human exposure concerns (e.g., swimming is not particularly popular in early spring).

- **Need for repeated treatments.** Chemical herbicides are not a one-time silver-bullet solution—instead, treatments need to be regularly repeated to maintain effectiveness. Treated plants are not actively removed from the Lake, a situation increasing the potential for viable seeds/fragments to remain after treatment, allowing target species resurgence in subsequent years. Additionally, leaving large expanses of lakebed devoid of plants (both native and invasive) creates a disturbed area without an established plant community. EWM thrives in disturbed areas. In summary, applying chemical herbicides to large areas can provide opportunities for exotic species reinfestation and new colonization which in turn necessitates repeated and potentially expanded herbicide applications.

- **Hybrid watermilfoil's resistance to chemical treatment.** The presence of hybrid watermilfoil complicates chemical treatment programs. Research suggests that certain hybrid strains may be more tolerant to commonly utilized aquatic herbicides such as 2,4-D and Endothall.[36,37] Consequently, further research regarding hybrid watermilfoil treatment efficacy is required to apply appropriate herbicide doses. This increases the time needed to acquire permits and increases application program costs.

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[35] *The WDNR's water quality standard to support healthy fish communities is 5 mg/L for warmwater fish communities and 7 mg/L for coldwater fish communities.*

[36] *L.M. Glomski and M.D. Netherland, "Response of Eurasian and Hybrid Watermilfoil to Low Use Rates and Extended Exposures of 2,4-D and Triclpyr,"* Journal of Aquatic Plant Management *48: 12-14, 2010.*

[37] *E.A. LaRue et al., "Hybrid Watermilfoil Lineages are More Invasive and Less Sensitive to a Commonly Used Herbicide than Their Exotic Parent (Eurasian Watermilfoil),"* Evolutionary Applications *6: 462-471, 2013.*

- **Effectiveness of small-scale chemical treatments.** Small-scale EWM treatments using 2,4-D have yielded highly variable results. A study completed in 2015 concluded that less than half of 98 treatment areas were effective or had more than a 50 percent EWM reduction.[38] For a treatment to be effective, a target herbicide concentration must be maintained for a prescribed exposure time. However, wind, wave, and other mixing actions can dissipate herbicide doses, which decrease their effectiveness in the target area and negatively impact non-target areas and species. Therefore, when deciding to implement small-scale chemical treatments, the variability in results and treatment cost of treatment should be examined and contrasted.

Considering the potential for EWM in the eastern portion of the Lake, should EWM be discovered in high densities, a large spot treatment in that basin may be utilized.[39] In addition, small spot treatments enclosed with a barrier (e.g., turbidity barrier) could be a viable alternative for treating shoreline areas and navigation lanes if determined feasible by the Association. Whatever the case, monitoring should continue to ensure that EWM does not become problematic. If further monitoring suggests a dramatic change in these invasive species populations, management recommendations should be reviewed.

Water Level Manipulation Measures

Manipulating water levels can also be an effective method for controlling aquatic plant growth and restoring native aquatic plant species, particularly emergent species such as bulrush and wild rice.[40] In Wisconsin, water level manipulation is considered to be most effective by using winter lake drawdowns, which expose lake sediment to freezing temperatures while avoiding conflict with summer recreational uses. One to two months of lake sediment exposure can damage or kill aquatic plant roots, seeds, and turions through freezing and/or desiccation. As large areas of lake sediment need to remain exposed for extended periods, water level manipulation is most cost effective in lakes with operable dam gates that can provide fine levels of control of water elevations within the lake. In lakes without dams, high capacity water pumping can be used to reduce lake levels at much greater cost. Given that Lake Lorraine is a seepage lake and does not have an outlet dam, water level manipulation is not considered a viable form of aquatic plant management on the lake.

[38] *M. Nault et al., "Control of Invasive Aquatic Plants on a Small Scale,"* Lakeline *35-39, 2015.*

[39] *WDNR has been studying the efficacy of spot treatments versus whole lake treatments for the control of Eurasian watermilfoil and it has been found that spot treatments are not an effective measure for reducing Eurasian watermilfoil populations, while whole lake treatments have proven effective depending on conditions.*

[40] *For detailed literature reviews on water level manipulation as an aquatic plant control measure, see C. Blanke, A. Mikulyuk, M. Nault, et al.,* Strategic Analysis of Aquatic Plant Management in Wisconsin*, Wisconsin Department of Natural Resources, pp. 167-171, 2019 as well as J.R. Carmignani and A.H. Roy, "Ecological Impacts of Winter Water Level Drawdowns on Lake Littoral Zones: A Review,"* Aquatic Sciences *79: 803-824, 2017.*

MANAGEMENT RECOMMENDATIONS AND PLAN IMPLEMENTATION 3

Credit: Commission Staff

This Chapter summarizes the information and recommendations needed to manage aquatic plants in Lake Lorraine, particularly the nonnative species of Eurasian watermilfoil (EWM) and curly-leaf pondweed (CLP). Accordingly, it presents a range of alternatives that could potentially be used, and provides specific recommendations related to each alternative. The measures discussed focus on those that can be implemented by the Lake Lorraine Restoration and Protection Association (Association) in collaboration with the Wisconsin Department of Natural Resources (WDNR) and Lake residents. The aquatic plant management recommendations contained in this chapter are limited to approaches that monitor and control nuisance level aquatic plant growth in the Lake after the growth has already occurred.

The individual recommendations presented below, and which collectively constitute the recommended aquatic plant management plan, balance three major goals:

- Improving navigational access within the Lake
- Protecting the native aquatic plant community
- Controlling CLP and EWM populations

Plan provisions also ensure that current recreational uses of the Lake (e.g., swimming, boating, fishing) are maintained or promoted. The plan recommendations described below consider common, State-approved, aquatic plant management alternatives including manual, biological, physical, chemical, and mechanical measures.

3.1 RECOMMENDED AQUATIC PLANT MANAGEMENT PLAN

The most effective plans to manage nuisance and invasive aquatic plant growth rely on a combination of methods and techniques as well as consideration of when and where these techniques should be applied. Table 3.1 describes the benefits and considerations of common aquatic plant management approaches. The recommended aquatic plant management plan is presented in Figures 3.1 and 3.2[41] and briefly summarized in the following paragraphs. These management techniques were discussed with both the Association and the WDNR.[42]

Aquatic Plant Management Recommendations

The most effective plans to manage nuisance and invasive aquatic plant growth rely on a *combination* of methods and techniques. A "silver bullet" single-minded strategy rarely produces the most efficient, most reliable, or best overall result. This plan recommends three primary aquatic plant management techniques: mechanical harvesting, chemical treatment, and invasive species prevention. Each of these techniques have custom adaptations for the conditions present in certain portions of the Lake. Figure 3.1 illustrates the overall aquatic plant recommendations for Lake Lorraine. The elements described below are combined to form the recommended Lake Lorraine aquatic plant management program.

1. **Mechanically harvest invasive and nuisance aquatic plants.** Mechanical harvesting is recommended to be the primary means to manage invasive and nuisance aquatic plants on Lake Lorraine. Harvesting must avoid, or must be substantially restricted, in certain areas of the Lake. This includes areas of greater ecological value, areas that provide unique habitat, areas that are difficult to harvest due to lake morphology (e.g., excessively shallow water depth), and where boat access is not desired or necessary (e.g., marshland areas).

2. **Manually remove nearshore invasive and nuisance plant growth.** Manual removal involves controlling aquatic plants by hand or using hand-held non-powered tools. Manual removal does not require a permit if riparian landowners remove only invasive plants without injuring native plants or remove nuisance native aquatic plants along 30 or less feet of shoreline (inclusive of dock, pier, and other lake access areas) and generally not more than 100 feet into the lake.

3. **Limit chemical use.** As described in Chapter 2 of this plan, large-scale chemical treatment has been the primary part of the Association's aquatic plant management strategies for the last seven years. However, while previously effective, this method of aquatic plant control has several drawbacks (e.g., water quality, comparatively nonselective, chemical side effects, and more) and should only be considered under exceptional circumstances going forward. Recent surveys have shown that the invasive and nuisance species are well under control and that the plant community has shifted to be mainly elodea and coontail. Thus, chemical usage as the main practice to manage EWM and CLP are not recommended at this time. Limited chemical use in areas where harvesting is not feasible, is recommended and described in further detail below.

4. **Invasive species plant control.** While the 2024 aquatic plant survey did not reveal a need to actively control Eurasian water milfoil or curly-leaf pondweed, these plants should still be monitored. As aquatic plant community species change, the need for management changes. Populations should be controlled with top-cut harvesting and early spring chemical treatments. This recommendation should be considered a high priority.

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[41] *Much of the area designated by WDNR as "wetlands" in Figure 3.2 are classified as aquatic wetlands and have had that designation for many years. The boundary between "lake" and "aquatic wetland" is a grey area as aquatic wetlands can have 4+ feet of water in them at any given time. Considering that Lake Lorraine is a seepage lake and can have large fluctuations in water levels, it may be that at the time these were delineated the water levels were lower. Some of the areas marked as wetlands historically had bog, which were removed in sections in 2016-2018. Thus, the historical wetland inventory may not perfectly represent the current state of that area of the lake due to the wetland boundaries having not been updated since 2015.*

[42] *Commission staff met with the Association and WDNR to discuss the aquatic plant management plan on February 21st, 2025. The Association indicated that they had approved the plan in April 7th, 2025 email correspondence.*

Table 3.1
Pros and Cons to Aquatic Plant Management Practices for Lake Lorraine 2025-2029

Aquatic Plant Management Practice	Pros	Cons	Recommendation Status
Mechanical Harvesting	Can remove the need for chemical treatment in lakes; minimal long term effects on aquatic plant communities	Risk of by-catches of aquatic organisms; can cause floating plant debris in wind-blown areas of lakes, can only be utilized in 4-foot or greater water depths	High Priority
Suction Harvesting or Diver-Assisted Suction Harvesting	Good for small areas or targeted removal of aquatic plants	Can be costly for larger removals	Low Priority
Chemical Spot Treatment	Good for treating areas hard to reach with harvesting; effective in treating smaller populations of nuisance aquatic plants	Can affect non-target species in treatment area	Medium Priority
Whole Lake Chemical Treatments	Effective in large-scale management of CLP and EWM	Can negatively affect native plant species, particularly sensitive species; can increase nutrient loading in the lake	Not Recommended

Source: SEWRPC

5. **Begin participation in the Clean Boats Clean Waters program at the public launch.** Participation in this program proactively encourages lake users to clean boats and equipment before launching and using them in Lake Lorraine.[43] This will help lower the probability of invasive species entering and leaving the lakes.

6. **Stay abreast of best management practices to address invasive species**. The Association should regularly communicate with Walworth County and WDNR staff about the most effective treatment options for invasive species as novel techniques and/or chemical products that may more effectively target these species become available.

Mechanical Harvesting

Aquatic plant harvesting to create access lanes should be considered a high priority. As can be seen on Figure 3.1, harvesting is recommended to create *access channels* in areas of the Lake that host dense aquatic plant growth, impeding boat access to and within the main body of the Lake.[44] The lanes should extend into open water (about 10 feet in water depth). Harvesting along the Main Loop should be limited to a 30-foot wide channel at a depth that ensures a minimum of 1-foot of plant growth on the lake bottom. The East Lane, Fishing Lane, and West Lane should be limited to a 30-foot wide channel at a depth that ensures a minimum of 1-foot of plant growth on the lake bottom. as well. All harvesting should be done in water depths greater than 4 feet to ensure the harvester is not disturbing the lake bottom. During low-water periods when the East Lane is too shallow for harvesting, use of chemical treatment should be considered to create an access lane as necessary. 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.

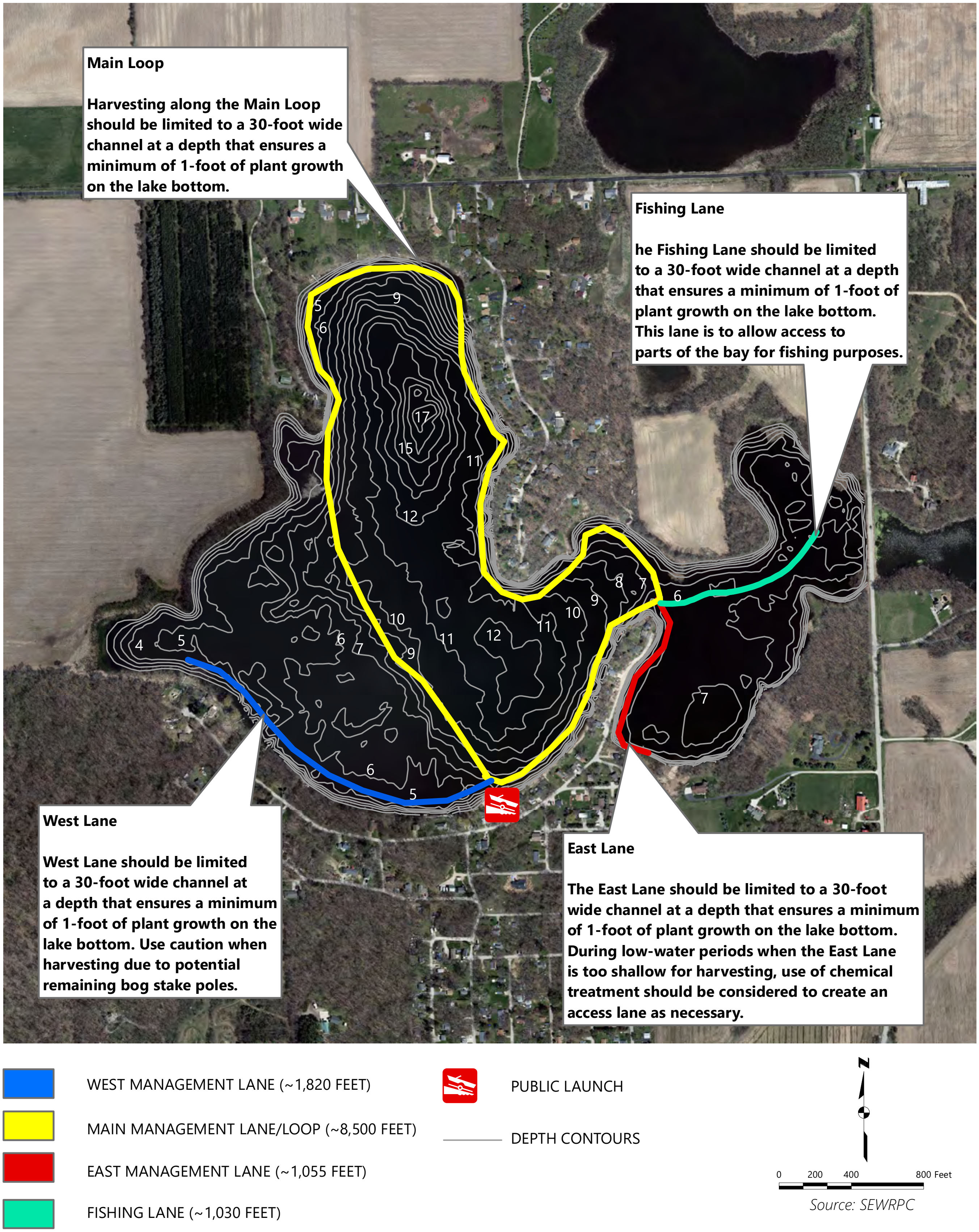
To ensure sustainable recreational use and the long-term health of the Lake, the following conditions must be added to all aquatic plant harvesting practices:

1. **Maintain at least 12 inches of living plant material after harvesting.** Harvesting equipment operators must not intentionally denude the lakebed. Instead, the goal of harvesting is to maintain and promote healthy native aquatic plant growth. Harvesting invasive aquatic plants can promote native plant regrowth since many invasive aquatic plants grow early in the season depriving later emerging native plants of light and growing room.

[43] *Further information about Clean Boats Clean Waters can be found on the WDNR website at: dnr.wi.gov/lakes/cbcw.*

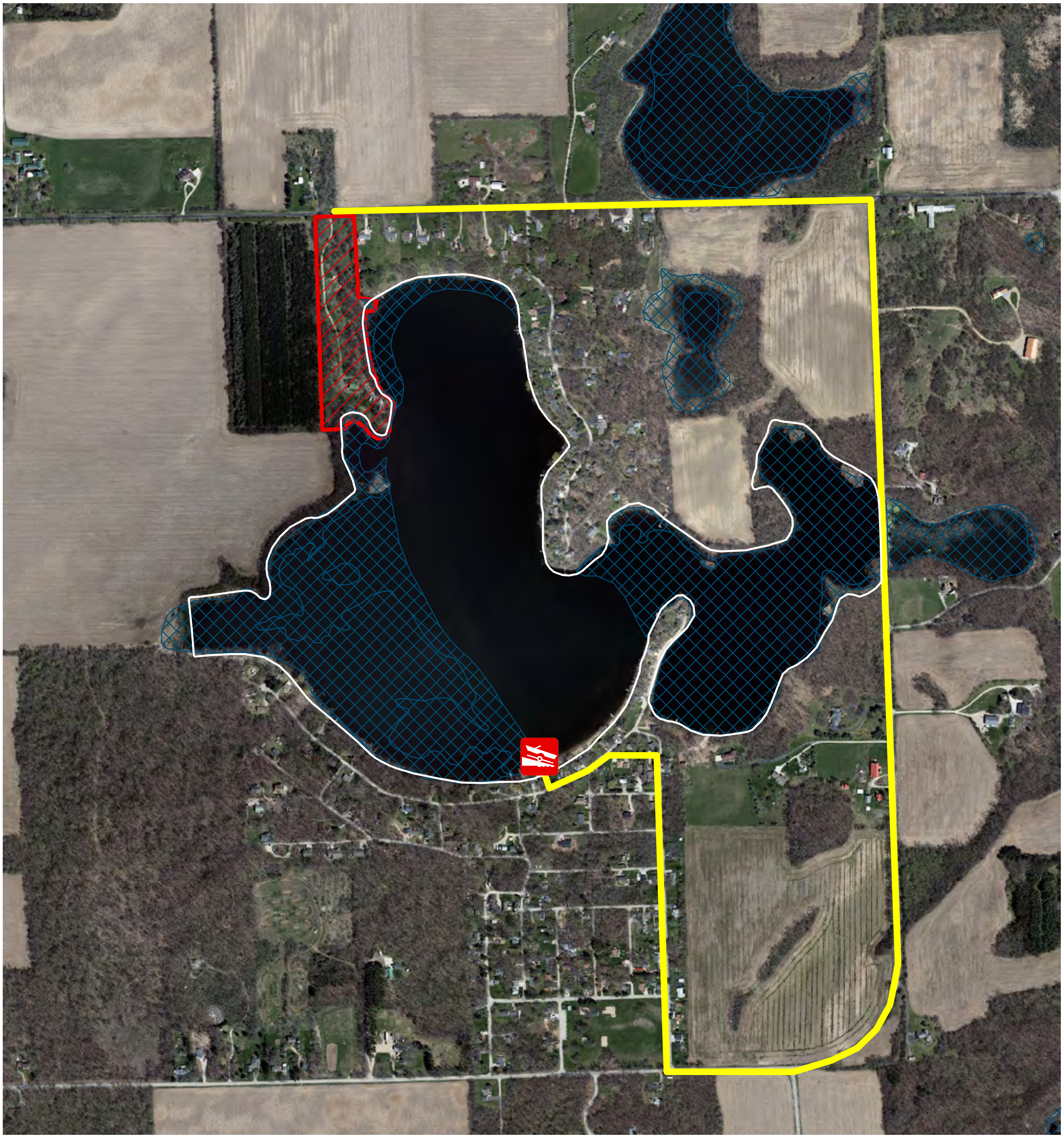
[44] *Line width and locations are not scaled and only illustrate overall concept. The actual size, orientation, and depth of plant management activities depend upon area restrictions and permit conditions and site-specific factors. Site-specific factors include the composition of the plant community, water depth, shoreline configuration and obstacles, and other factors.*

Figure 3.1
Aquatic Plant Management on Lake Lorraine: 2025-2029



Source: SEWRPC

Figure 3.2
Aquatic Plant Harvesting Disposal Route ad Location: 2025-2029



Note: Wetland extent is from prior to removal of bogs from Lake Lorraine and may overrepresent area of the Lake that is a wetland. Areas considered aquatic wetlands are still considered part of the main body of Lake Lorraine.

HARVESTING DISPOSAL SITE

PUBLIC BOAT LAUNCH

WDNR DESIGNATED WETLANDS

HARVESTING DISPOSAL ROUTE

N

0 237.5 475 950 Feet

Source: SEWRPC

2. **Harvesting native pondweeds (*Potamogeton* spp.) and muskgrasses (*Chara* spp.) outside of the designated harvesting lanes is prohibited.** These plants provide habitat for young fish, reptiles, and insects in the Lake.

3. **Inspect all cut plants for live animals. Immediately return live animals to the water.** A second staff person equipped with a net should accompany and assist the harvester operator. Animals can be caught in the harvester and harvested plants, particularly when cutting larger plant mats. Consequently, carefully examine cut materials to avoid inadvertent harvest of fish, crustaceans, amphibians, turtles, and other animals.

4. **Harvesting should not occur in the early spring** to avoid disturbing fish spawning. Studies suggest that harvesting activities can significantly disturb the many fish species that spawn in early spring. Thus, avoiding harvesting during this time can benefit the Lake's fishery.

5. **All harvester operators should adhere to the harvesting specifications and practices as described in the harvesting permit.** Harvester operators should 1) understand "deep-cut" versus "shallow-cut" techniques and when to employ each in accordance with this plan, 2) review of the aquatic plant management plan and associated permits with special emphasis focused on the need to restrict cutting in shallow areas, and 3) have plant identification skills to encourage preservation of native plant communities. Additionally, all harvester operators are obligated to record their work for inclusion in annual reports that are required under harvesting permits.

6. **Harvesting can fragment plants.** Plant fragments may float in the Lake, accumulate on shorelines, and help spread undesirable plants. The harvesting program should include a comprehensive plant pickup program that all residents can use. This helps ensure that harvesting does not create a nuisance for Lake residents. The program typically includes residents raking plants, placing them in a convenient location accessible to the harvester (e.g., the end of a pier), and regularly scheduled pickup of cut plants by the harvester operators. This effort should be as collaborative as practical.

7. **Proper disposal of aquatic plants is required.** All plant debris collected from harvesting activities must be collected and disposed at the designated disposal sites using the designated disposal route, as shown on Figure 3.2. No aquatic plant material may be deposited within identified floodplain and wetland areas.

Early Spring Chemical Treatment

Studies have shown that repeated large-scale herbicide treatments can shift the plant community from diverse to being primarily dominated by a few highly tolerant plants.[45] Large-scale treatments also can have unintended side effects such are the reduction of native pondweeds and sensitive plant species[46], as is the case in Lake Lorraine. As discussed in Chapter 2 of this plan, Lake Lorraine's sensitive species occurrence decreased from 36 points in 2019 to a single point in 2024. The Lake also saw a shift in plant dominance to elodea and coontail as the primary species. In addition to shift plant community dominance, large-scale treatment in more eutrophic lakes can lead to increases in algae in the lake as well as reduction in the water quality and clarity.[47,48,49]

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[45] *Mikulyuk, A., J. Hauxwell, P. Rasmussen, S. Knight, K. Wagner, M.E. Nault, D. Ridgely, "Testing a Methodology for Assessing Aquatic Plant Communities in Temperate Inland Lakes,"* Lake and Reservoir Management *26:54-62, 2010*.

[46] Ibid.

[47] *O'Dell, K.M., J. VanArman, B.H. Welch, S.D. Hill, "Changes in Water Chemistry in a Macrophyte-dominated Lake Before and After Herbicide Treatment,"* Lake and Reservoir Management *11:311-316, 1995*.

[48] *Crowell, W.J., N.A. Proulx, C.H. Welling, "Effects of Repeated Fluridone Treatments Over Nine Years to Control Eurasian Watermilfoil in a Mesotrophic Lake,"* Journal of Aquatic Plant Management *44: 133-136, 2006*.

[49] *Valley, R. D., W. Crowell, C. H. Welling, N. Proulx, "Effects of a Low-dose Fluridone Treatment on Submersed Aquatic Vegetation in a Eutrophic Minnesota Lake Dominated by Eurasian Watermilfoil and Coontail,"* Journal of Aquatic Plant Management *44:19-25, 2006*.

If chemical treatment is used in the eastern bay along the East Lane, it should only occur in the early spring when human contact and risks to native plants are most limited, and not after July 1st. A WDNR permit and WDNR staff supervision are required to implement this alternative. Lakeshore property owners must be notified of planned chemical treatment schedules and permit conditions before chemicals are applied to the lake. This recommendation should be considered a low priority.

While large-scale chemical treatment on Lake Lorriane is not currently recommended, the aquatic plant community may change in the future which would warrant re-evaluation of the currently recommended management practices. A return to large-scale and whole-lake chemical treatments may be warranted should the aquatic invasive species of CLP and EWM reach a lake coverage level of 50% of the total lake or greater. In addition, if chemical treatments are resumed, it is recommended to use a variety of different chemical compound to limit the herbicide resistance of plants in the Lake.

Future Funding

Current efforts pursued by the Association have been effective at suppressing aquatic invasive species populations. The Association should continue to utilize WDNR Surface Water Grants to further their efforts in monitoring the Lake, inspecting watercraft at boat launches, and targeting areas for management. Key WDNR 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 invasive species, and reporting invasive species to the WDNR.[50]

- **Aquatic Invasive Species Prevention** – this grant program covers up to 75 percent of either $4,000 or $24,000 for projects that help prevent the spread of AIS species. Eligible costs include the acquisition of decontamination equipment at public boat launches as well as targeted management at boat launches or other access points. All lakes are eligible for at least $4,000 in funding but lakes that are designated as high priorities for AIS spread statewide, due to large amounts of boat traffic and/or the presence of particular invasive species, are eligible for $24,000.

- **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 CLP within the lakes, the small-scale project is more appropriate at this time. The large-scale projects should be considered if the populations of these species increase or a novel invasive species, such as starry stonewort, is observed within the lake. 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 and only approved recommendations from the plan are eligible projects for funding through this program.

- **Recreational Boating Facilities** – this grant program covers up to 50 percent of up to $250,000 for projects that enhance navigational access. Eligible costs include aquatic plant harvesting equipment as well as boat ramps, navigational aids, and dredging projects near public launches.[51]

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

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[50] *For more information on the Surface Water Grant program, which includes the Clean Boats, Clean Waters; Aquatic Invasive Species Prevention; and Aquatic Invasive Species Control grants, see the following link: dnr.wisconsin.gov/aid/SurfaceWater.html.*

[51] *For more information on this grant program, see the following link: dnr.wisconsin.gov/aid/RBF.html.*

3.2 SUMMARY AND CONCLUSIONS

As requested by the Association, the Commission worked with the Association to develop a scope of work and secure funding to provide information needed to renew the Association's aquatic plant management permit. This report, which documents the findings and recommendations of the study, examines existing and anticipated conditions, potential aquatic plant management problems, and lake use. Conformant with the study's intent, the plan includes recommended actions and management measures as well as options for future funding. Figures 3.1 summarizes and locates where aquatic plant management recommendations should be implemented.

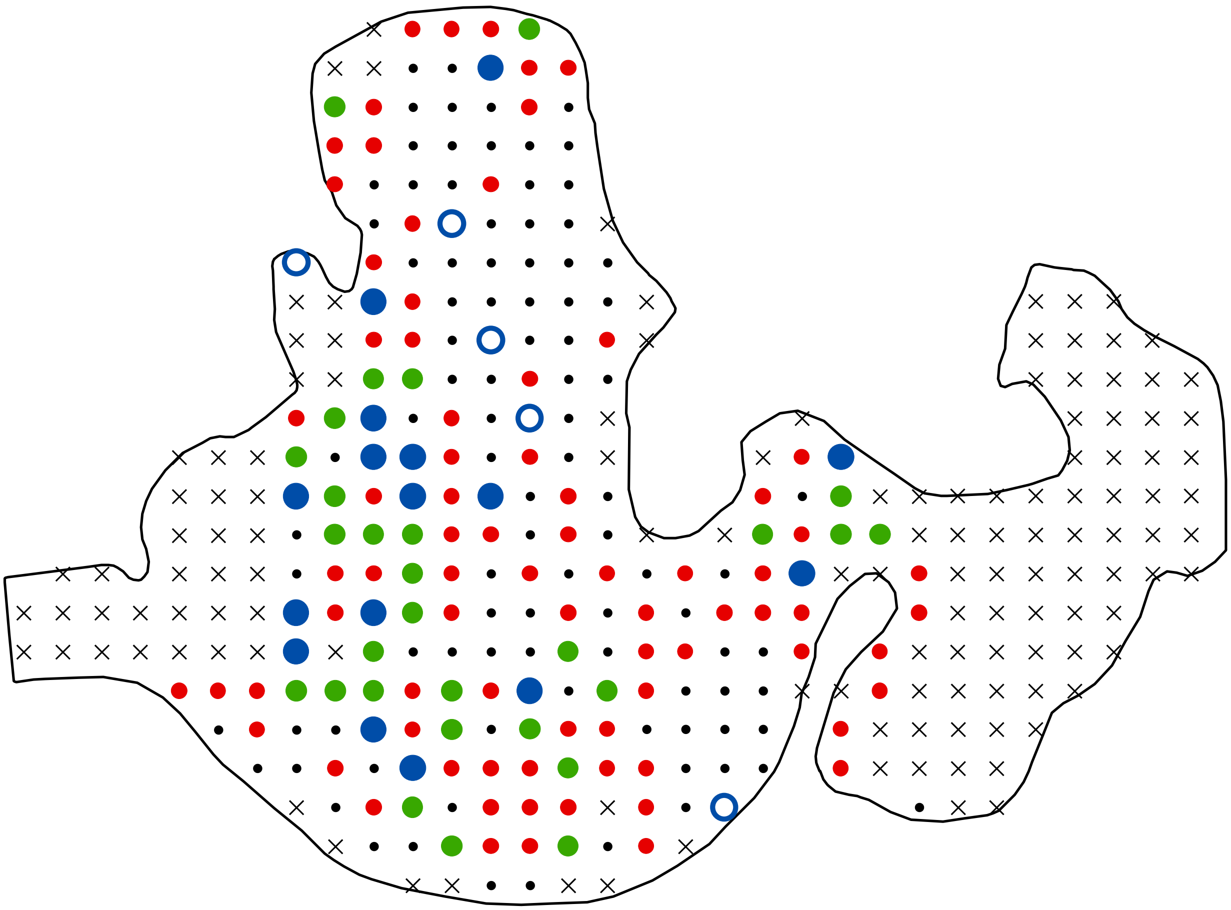
Successfully implementing this plan will require cooperation engagement from the Association, State and regional agencies, Walworth County, municipalities, and residents/users of the Lake. The recommended measures help foster conditions sustaining and enhancing the natural beauty and ambience of Lake Lorraine while promoting a wide array of water-based recreational activities suitable for the Lake's intrinsic characteristics.

APPENDICES

APPENDIX A

2024 RAKE FULLNESS OF AQUATIC PLANT SPECIES IN LAKE LORRAINE

Figure A.1
Coontail Rake Fullness in Lake Lorraine: July 2024



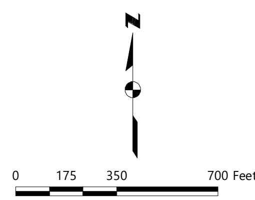
Note: Survey was conducted on Lake Lorraine from July 23rd-24th, 2024.

RAKE FULLNESS RATING

VISIBLE NEARBY

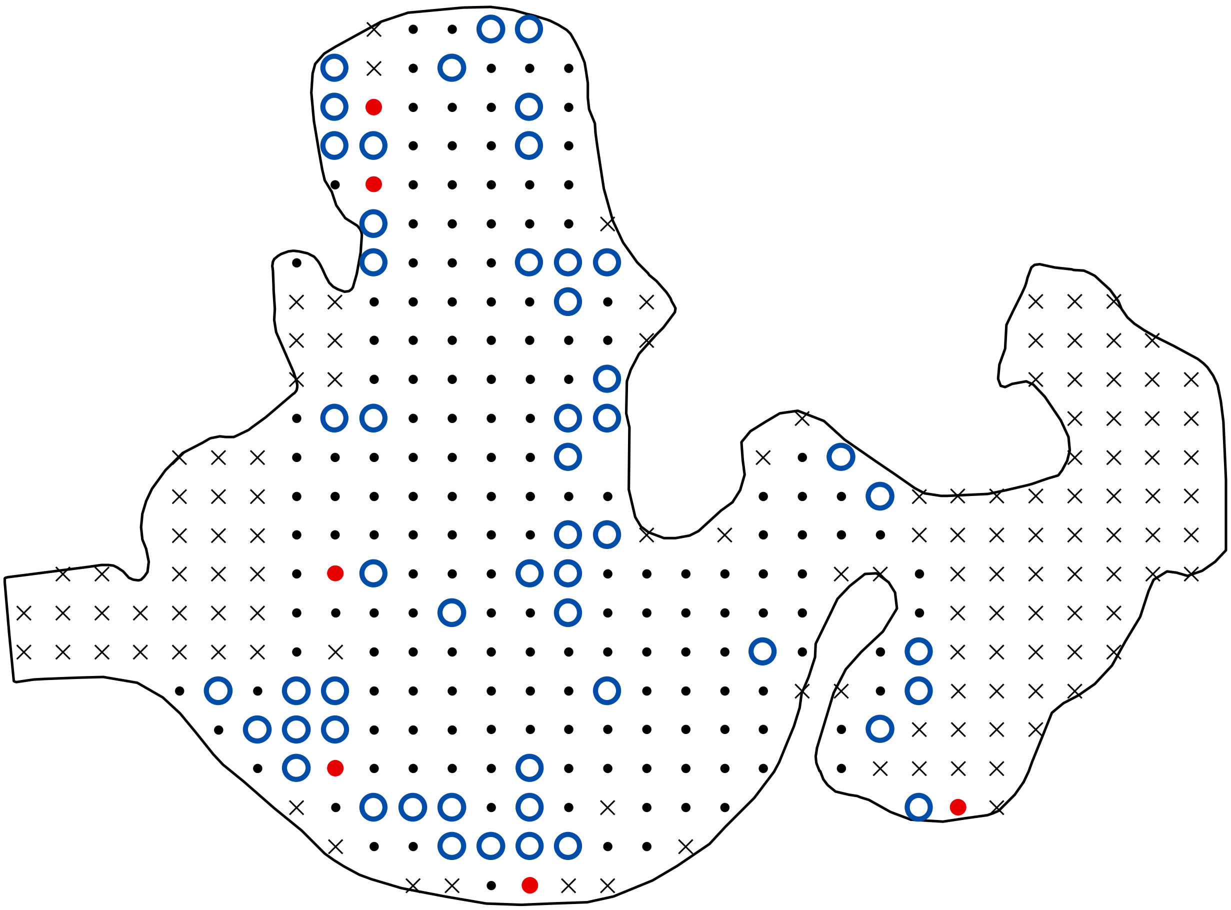
NO AQUATIC PLANTS FOUND

NOT SAMPLED

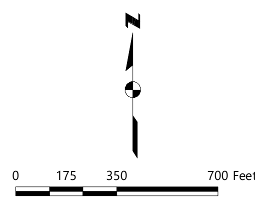


Source: SEWRPC

Figure A.2
Watermeal Total Rake Fullness in Lake Lorraine: July 2024



Note: Survey was conducted on Lake Lorraine from July 23rd-24th, 2024.



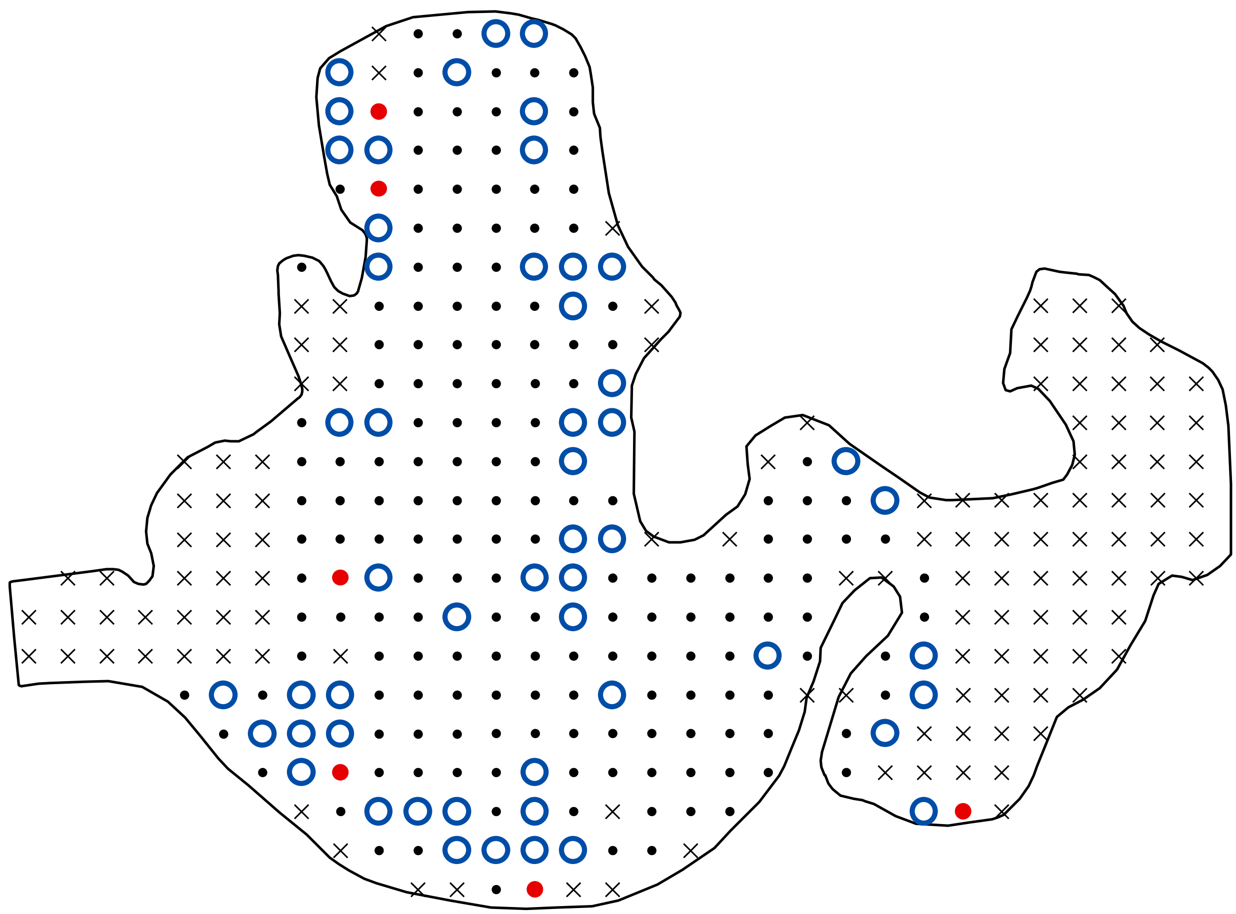
Source: SEWRPC

RAKE FULLNESS RATING

VISIBLE NEARBY

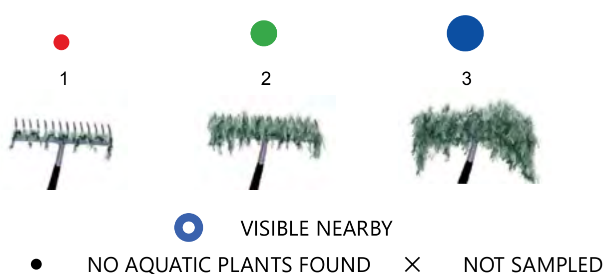
NO AQUATIC PLANTS FOUND   NOT SAMPLED

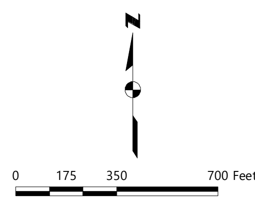
Figure A.3
White Water Lily Total Rake Fullness in Lake Lorraine: July 2024



Note: Survey was conducted on Lake Lorraine from July 23rd-24th, 2024.

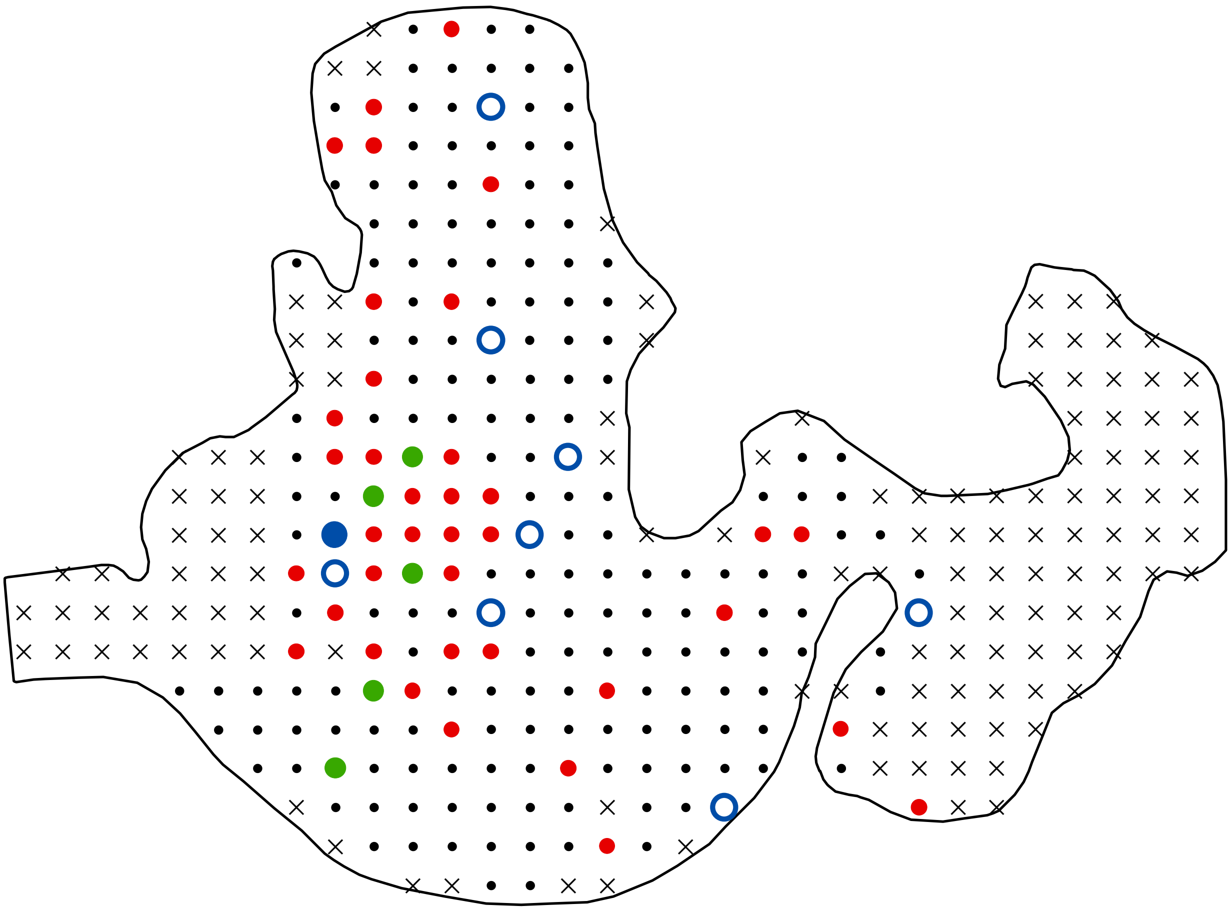
RAKE FULLNESS RATING



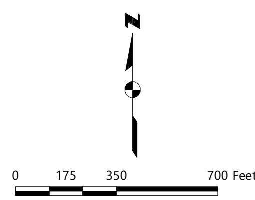


Source: SEWRPC

Figure A.4
Elodea Total Rake Fullness in Lake Lorraine: July 2024



Note: Survey was conducted on Lake Lorraine from July 23rd-24th, 2024.



Source: SEWRPC

RAKE FULLNESS RATING

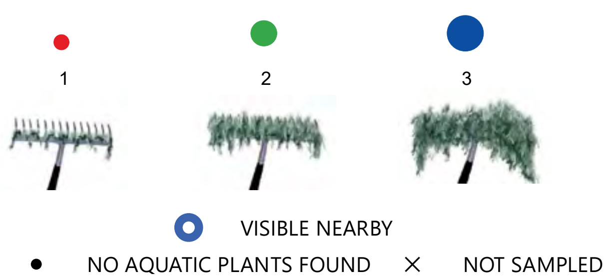
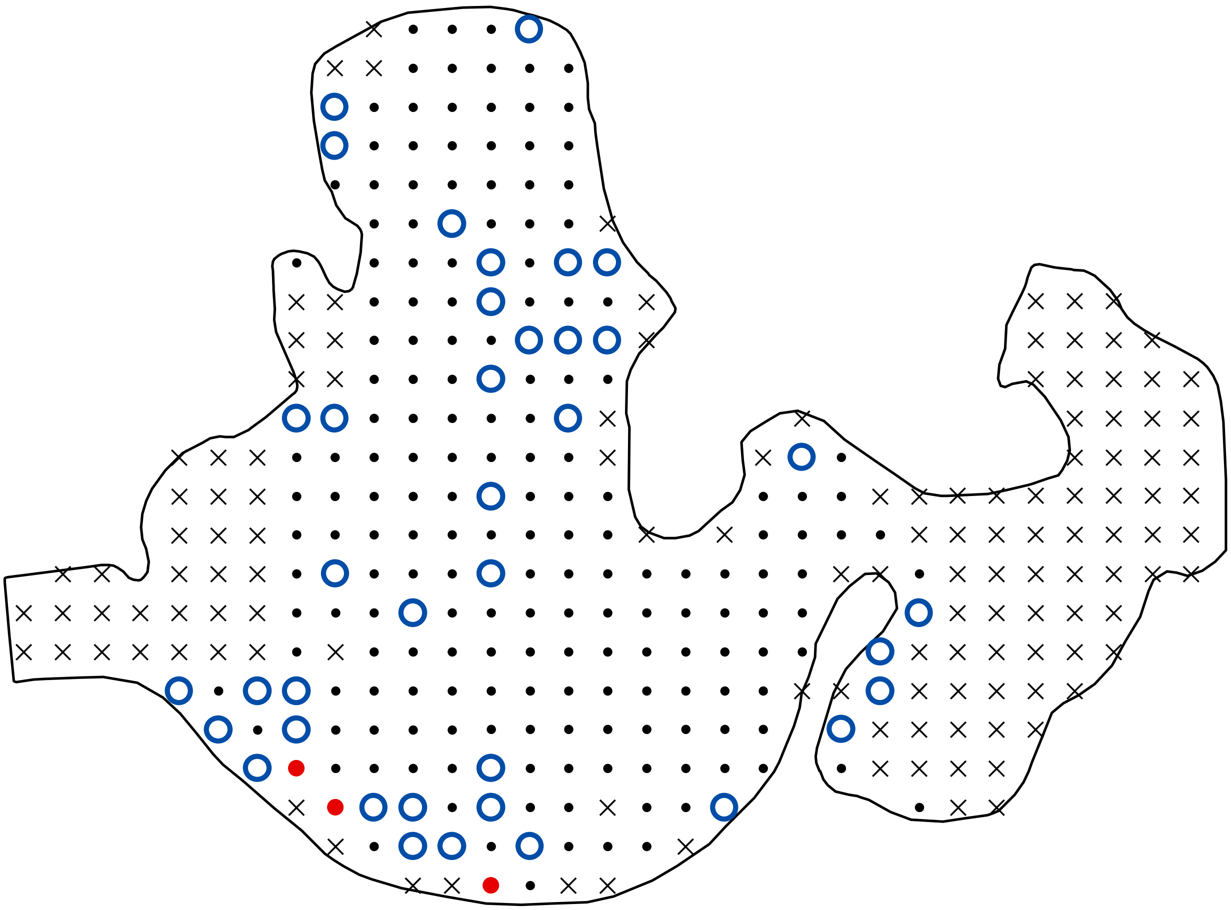
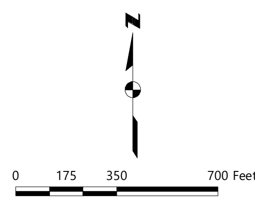


Figure A.5
Small Duckweed Total Rake Fullness in Lake Lorraine: July 2024



Note: Survey was conducted on Lake Lorraine from July 23rd-24th, 2024.



Source: SEWRPC

RAKE FULLNESS RATING

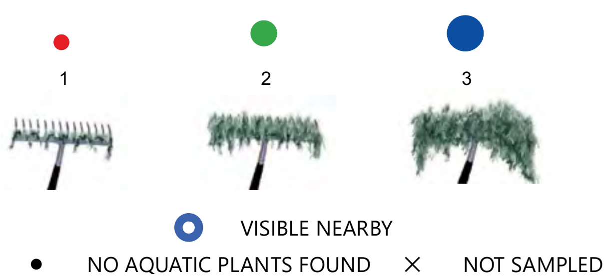
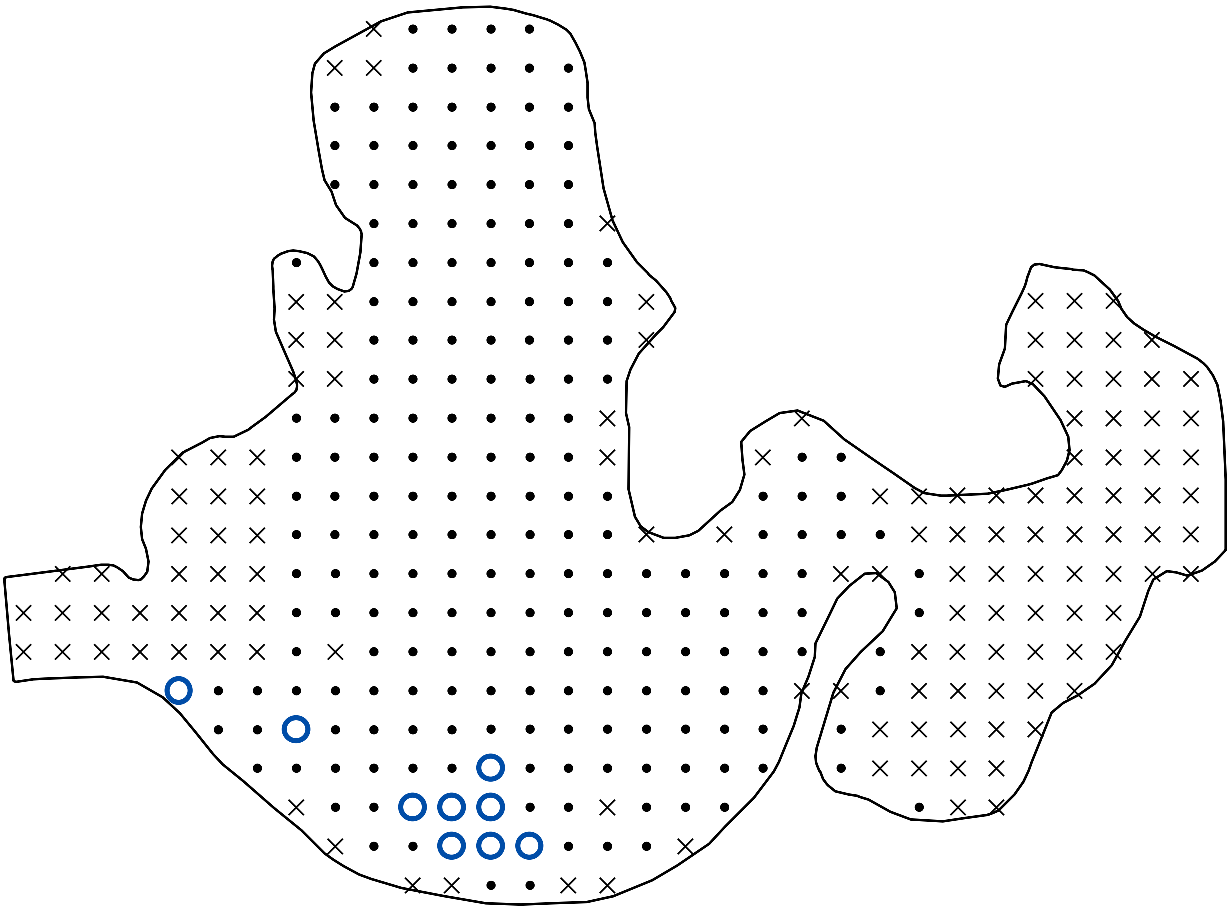
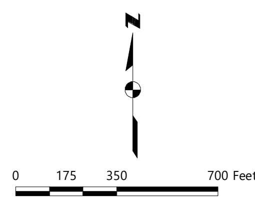


Figure A.6
Spatterdock Rake Fullness in Lake Lorraine: July 2024



Note: Survey was conducted on Lake Lorraine from July 23rd-24th, 2024.

RAKE FULLNESS RATING



Source: SEWRPC