Aquatic Plant Management Plan

for

Lake Hayward
Sawyer County, Wisconsin

2023-2028

Plan approved April 26, 2023

Prepared for the Lake Hayward Property Owners Association

Funded in part by WDNR Surface Water Planning Grant AEPP67322

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Aquatic plant survey assistance provided by AEM Aquatic Consulting

All Photos from Cover Page were taken during the aquatic plant survey in 2021: 1) Shallow bay area with abundant spatterdock and bur-reed was surveyed by kayak, which was kindly provided by Heidi Martens. 2) Common bur-reed was found growing in many near-shore areas of the lake. 3) Sample rake full of submersed aquatic plants, mainly water celery. 4) Dragonfly nymph found among submersed aquatic plants on sample rake. 5) Eurasian / hybrid watermilfoil from Lake Hayward.

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Executive Summary

Lake Hayward is in the City of Hayward, Sawyer County, Wisconsin. Lake Hayward is 191 acres with brown-stained but clear (non-turbid) water, a maximum depth of 17 feet, and abundant vegetation. Lake Hayward is an impoundment of the Namekagon River and therefore lies along the upper portion or the St. Croix National Scenic Riverway. There is one public boat landing and the lake is popular for fishing. Lake Hayward is also the location for the annual Lumberjack World Championship and the ending segment of the annual American Birkebeiner, Kortelopet, and Prince Haakon ski races. As such, many partners have a stake in Lake Hayward and aquatic plant management. Partners include, but aren't limited to, Lake Hayward Property Owners Association (LHPOA), Sawyer County, Wisconsin Department of Natural Resources (WDNR), National Park Service, Xcel Energy (dam owner), City of Hayward, Lumberjack World Championships Foundation, and the American Birkebeiner Ski Foundation.

Eurasian watermilfoil (EWM) was first documented in Lake Hayward in 2011 and hybrid watermilfoil (HWM) was verified in 2012. Curly-leaf pondweed was documented in 2006. There was one 2,4-D herbicide treatment of 23 acres to control EWM & HWM in 2013. Herbicide monitoring results in 2013 suggested that 2,4-D did not reach target concentrations, which was likely due to natural flow of water through the impoundment. Even though there was no EWM control since 2013, the EWM/HWM was not found to be the species causing beneficial use impairment during an aquatic plant survey in 2021 (funded by LHPOA). There was, however, significant submersed native vegetation in near-shore areas of some bays.

Prompted by the beneficial use impairment issue, LHPOA partnered with Aquatic Plant & Habitat Services LLC to apply for a Planning Grant through the WDNR. The grant provided funding assistance for a public planning meeting in June 2022, a follow-up planning meeting in August 2022, and update to the aquatic plant management plan for Lake Hayward. A large component of this plan addresses the impairment issue currently associated with native plant species.

This management plan provides background information on Lake Hayward, identifies issues and need for management, reviews past management activities and presents management options. All these components contributed to a strategy that includes the goals listed below and in Section 5.0. The WDNR provides guidance and regulations for managing aquatic ecosystems. This management plan adheres to DNR guidance (specifically Chapters NR107, NR109, NR40 and Chapter 30/31) and proposed actions will be implemented in compliance with state laws and regulations.

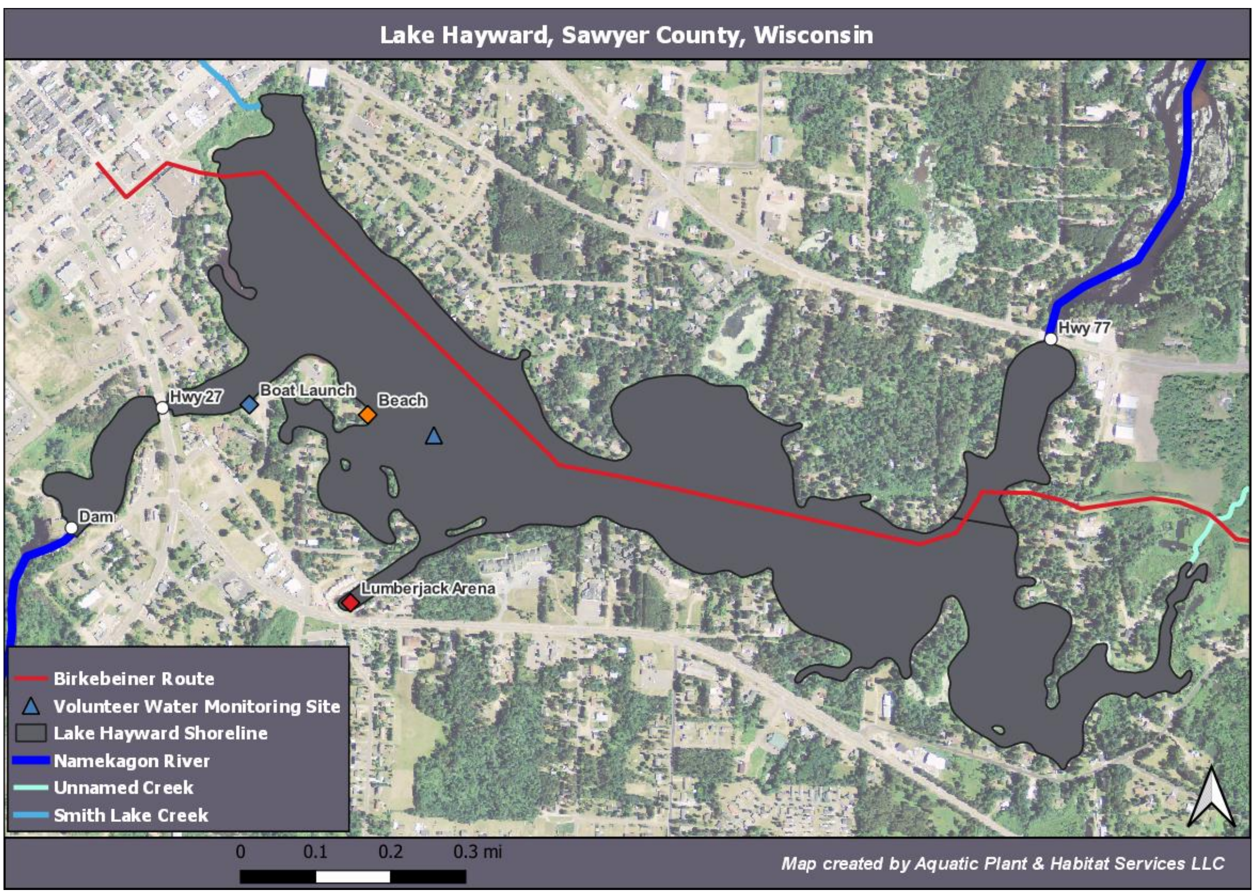
Goal 1 – Provide educational opportunities pertaining to aquatic plants and aquatic invasive species.
Goal 2 – Reduce beneficial use impairment caused by aquatic plants.
Goal 3 – Protect native aquatic plants, organisms, and associated native mammal and fish populations.
Goal 4 – Protect water quality.
Goal 5 - Prevent the introduction of additional aquatic invasive species.

1.0 Lake Hayward Background Information

1.1 Study Site

Lake Hayward (WBIC 2725500) is in the City of Hayward, Sawyer County. The lake has a surface area of 191 acres and maximum depth of 17 feet and mean depth of 5 feet. The lake is classified by the WDNR as a shallow lake meaning its maximum depth is less than 18 feet and does not thermally stratify. Lake Hayward is an impoundment of the Namekagon River formed by a dam at the far western shore. The dam is owned and operated by Xcel Energy as part of the Hayward Hydroelectric Project, which includes a powerhouse generator and spillway. The waters are tannin-stained, which impacts water clarity, but the overall water quality is considered “good” from a nutrient standpoint. More on this is described in Section 1.4. The lake is generally abundant in vegetation in near shore areas and in some areas up to 9 feet deep.

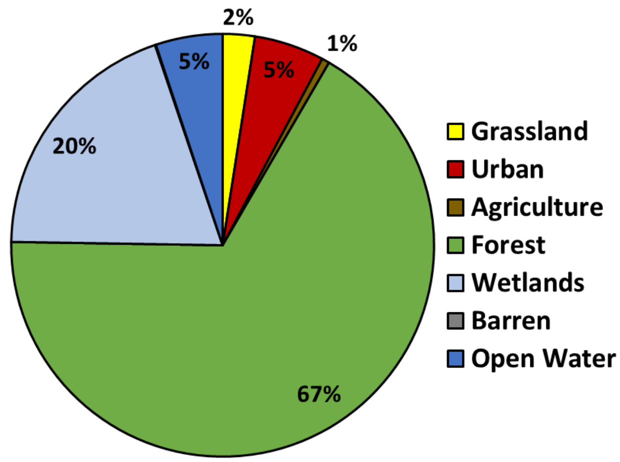
Figure 1 – Lake Hayward, Stream Inlets, & Points of Interest



1.2 Watershed

Lake Hayward lies at the bottom of the Upper Namekagon watershed, which is 205 square miles and extends north into Bayfield County and slightly west into Washburn County (Figure 3). The most common land cover is forest at 137 sq. mi. (67%) followed by wetland at 40 sq.mi. (20%). The remaining land cover is urban, open water, grassland, and agriculture. Barren land cover is less than 1%.

Figure 2 – Upper Namekagon Watershed Land Cover Chart



Data source CropScape nassgeodata.gmu.edu/CropScape

Figure 3 – Upper Namekagon Watershed Map

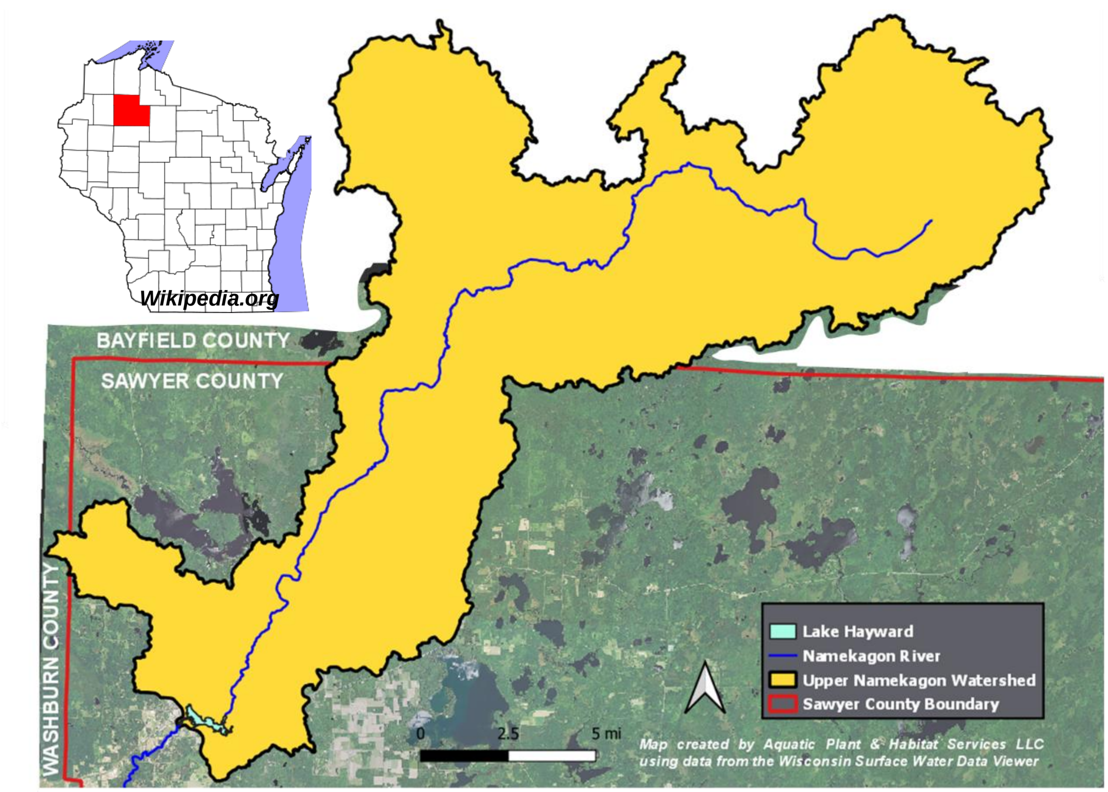
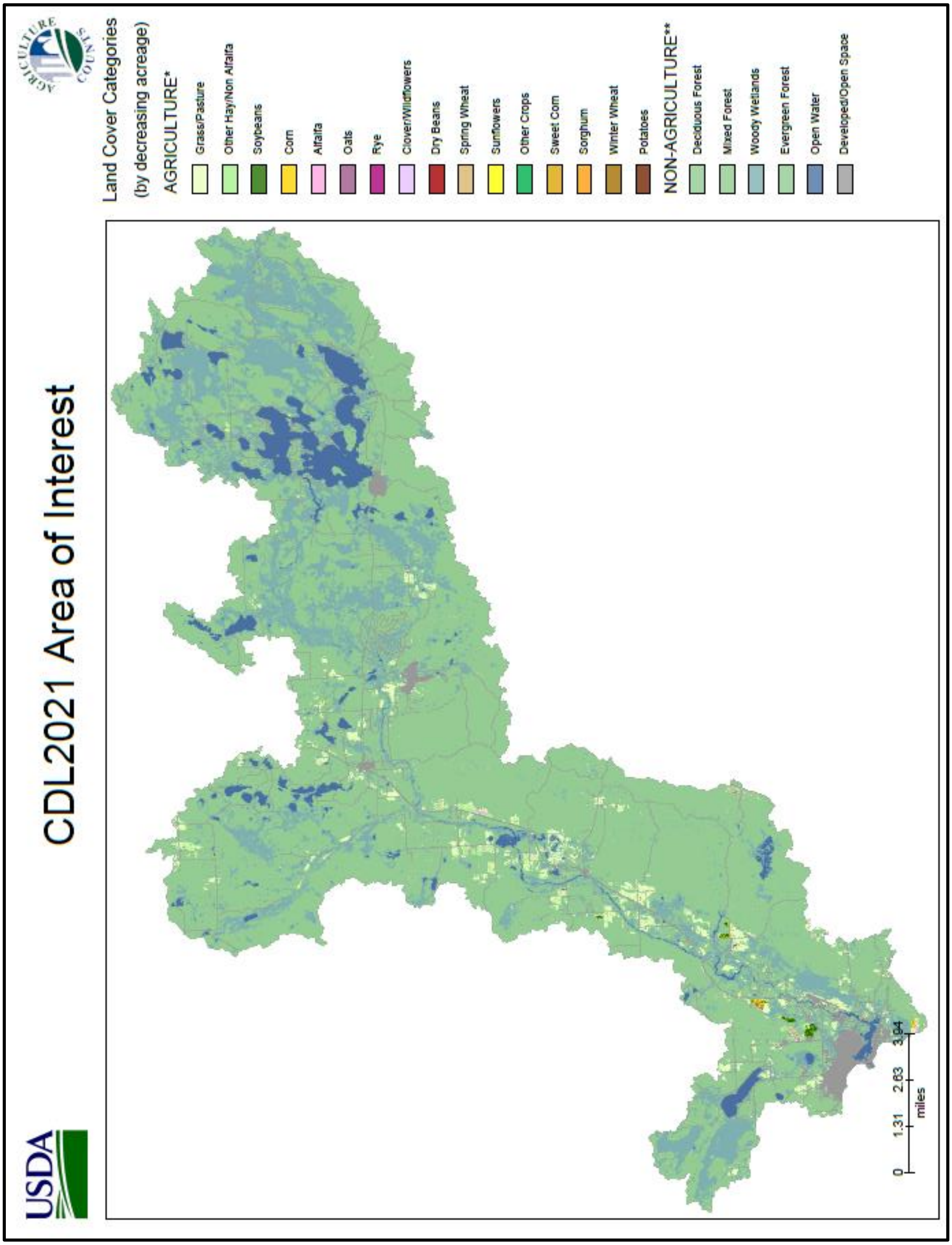


Figure 4 – Upper Namekagon Watershed Land Cover Map



1.3 Shorelands & Water Quality Implications

The water quality of a lake, stream, or river is directly impacted by its watershed, which includes land that is directly adjacent to a lake. When waterfront land changes from forest-covered to a house, driveway, deck, garage, septic systems, lawns and sandy beaches, the water quality will be directly affected. It is the cumulative land cover change of many waterfront properties that leads to a decline in water quality.

Lake property owners are the last line of defense in protecting water quality from the impacts of human development.

For example, the amount of phosphorus entering a lake typically increases as land use changes from forested to residential (Panuska & Lillie, 1995 and Jeffrey, 1985). A developed site with a lawn will allow more runoff volume carrying phosphorus and nitrogen than a forested site (Graczyk et. al. 2003). Phosphorus is generally the key nutrient that leads to algae and nuisance aquatic plant growth. Phosphorus sources include human waste (failing septic systems), animal waste (farm runoff), soil erosion, detergents, and lawn fertilizers (Shaw et al. 2004). Detergents and lawn fertilizer are presumed less of an issue with recent laws. Developed sites have more impervious surface that does not allow precipitation to infiltrate into the soils. This precipitation becomes surface water runoff at warmer temperatures than at non-developed sites (Galli, 1988). The warmer water that flows into the lake can lead to increased lake water temperatures, and as water temperatures increase the amount of dissolved oxygen it can “hold” will decrease.

The combined impacts of increased water temperatures, lower dissolved oxygen, and higher phosphorus can all result from shoreland development.

1.4 Trophic State & Water Quality

Trophic state and water quality are often used interchangeably and while the two are related, they are not the same. Trophic state describes the biological condition of a lake using a scale that is based on measurable and objective criteria. Water quality is an objective descriptor of a lake's condition based on the observer's use of the lake. For example, clear-water lakes are often described as having "good" or "excellent" water quality, which may be true for swimmers or SCUBA divers. The same ultra-clear system may have low productivity and thus a limited fishery leading to an "average" water quality classification by an angler. This section describes the trophic state of Lake Hayward using Carlson's Trophic State Index (1996).

Water clarity, total phosphorus, and chlorophyll-*a* are variables used to determine the productivity or trophic state of a lake. The Carlson Trophic State Index (TSI) is frequently used to determine biomass in aquatic systems. The trophic state of a lake is defined as the total weight of living biological material (or biomass) in a lake at a specific location and time. Eutrophication is the movement of a lake's trophic state in the direction of more plant biomass. Eutrophic lakes tend to have abundant aquatic plant growth, high nutrient concentrations, and low water clarity due to algae blooms. Oligotrophic lakes, on the other end of the spectrum, are nutrient poor and have little plant and algae growth. Mesotrophic lakes have intermediate nutrient levels and only occasional algae blooms (Red ovals in Figure 5 represent ranges in Lake Hayward).

Figure 5 – Trophic State Gradient adapted from Simpson & Carlson (1996)

TSI	Chlorophyll-a (ug/L)	Secchi Depth (ft)	Total Phosphorus (ug/L)	Attributes	Fisheries & Recreation
<30	<0.95	>26	<6	Oligotrophic: Clear water, oxygen throughout the year in the hypolimnion	Salmonid fisheries dominate
30-40	0.95 - 2.6	13 - 26	6 - 12	Oligotrophic: Hypolimnia of shallower lakes may become anoxic	Salmonid fisheries in deep lakes only
40-50	2.6 - 7.3	6.5 - 13	12 - 24	Mesotrophic: Water moderately clear; increasing probability of hypolimnetic anoxia during summer	Hypolimnetic anoxia results in loss of salmonids. Walleye may predominate
50-60	7.3 - 20	3 – 6.5	24 - 48	Eutrophic: Anoxic hypolimnia, macrophyte problems possible	Warm-water fisheries only. Bass may dominate.
60-70	20 - 56	1.5 - 3	48 - 96	Eutrophic: Blue-green algae dominate, algal scums and macrophyte problems	Nuisance macrophytes, algal scums, and low transparency may discourage swimming and boating.
70-80	56 - 155	0.75 – 1.5	96 - 192	Hypereutrophic: (light limited productivity). Dense algae and macrophytes	Rough fish dominate; summer fish kills possible
>80	>155	<0.75	192 - 384	Algal scums, few macrophytes	

1.4.1 Water Clarity

Figure 6 – Secchi Disk

The depth to which light can penetrate, or water clarity, is a factor that limits aquatic plant growth. Water clarity is measured by lowering a black and white Secchi disk (8 inches diameter) in the water and recording the depth of disappearance. The disk is then lowered further and slowly raised until it reappears. The Secchi depth is the mid-point between the depth of disappearance and the depth of reappearance. Because light penetration is usually associated with nutrient levels and algae growth, a lake is considered eutrophic when Secchi depths are less than 6.5 feet. Secchi depths vary throughout the year, with shallower readings in summer when algae concentrations increase, thus limiting light penetration. Conversely, deeper readings occur in spring and late fall when algae growth is less. Although the Secchi disk is a useful, inexpensive, and widely used way to assess water clarity, it has limitations in lakes with tannin-stained water because the water color will affect the Secchi disk reading. Lake Hayward has water that is clear but brown due to tannins, or stain from decaying organic matter. This staining is natural and can be differentiated from suspended sediment because the water is brown but clear, similar to dark tea. Since tannins decrease light penetration in the water column, they can also be helpful in keeping algal growth at lower levels.

Lake Hayward was monitored in July & August in 1999 and 2014 at the deepest area of the lake illustrated in Figure 1. The average summer (July & August) Secchi depth in those two years was 6.5 feet, therefore classifying Lake Hayward as borderline **MESOTROPHIC-EUTROPHIC** system from a water clarity standpoint (Figure 5 & Figure 7).

1.4.2 Phosphorus

Phosphorus is an important nutrient for plant growth and is often the limiting nutrient for plant production in Wisconsin lakes. Therefore, adding small quantities of phosphorus to a lake can cause dramatic increases in plant and algae growth and should therefore be the focus of management efforts to protect or improve water quality.

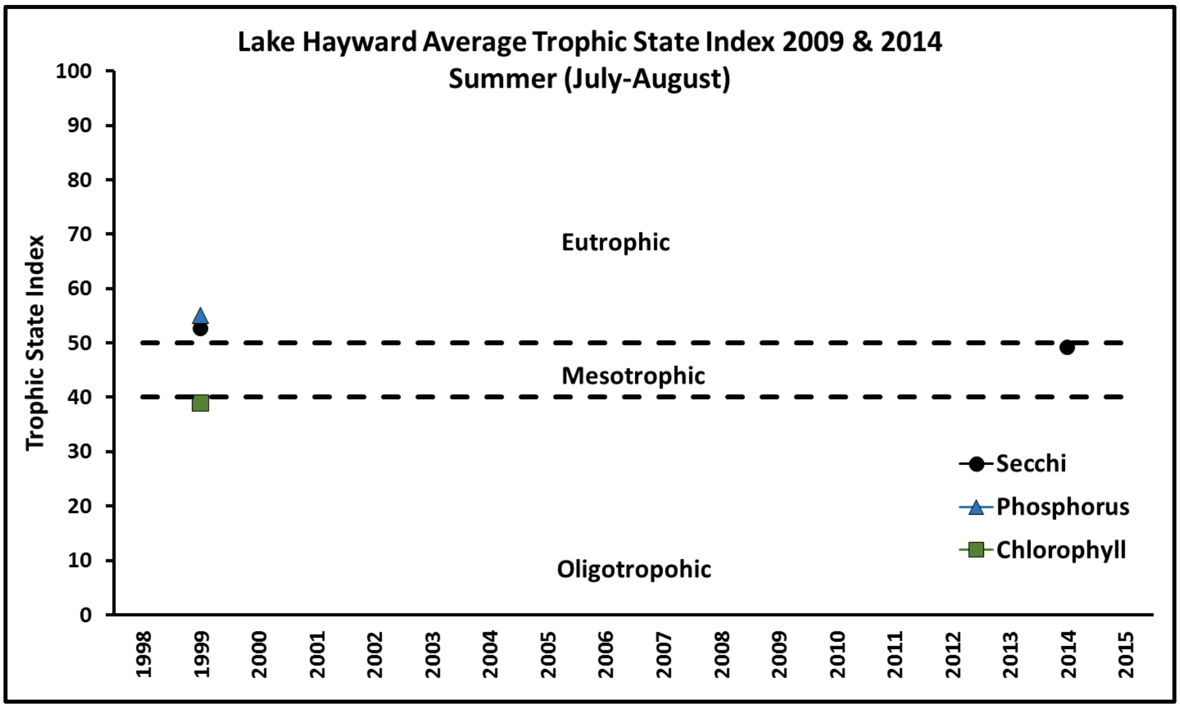
Total phosphorus was monitored in Lake Hayward twice in summer (July & August) 1999 using water samples from the surface (0-6 feet) at the citizen lake monitoring site illustrated in Figure 1. The average total phosphorus was 33µg/l, therefore classifying Lake Hayward as a **EUTROPHIC** system from a nutrient standpoint (Figure 5 & Figure 7).

1.4.3 Chlorophyll-a

Chlorophyll-*a* is the green pigment found in plants and algae. The concentration of chlorophyll-*a* is used as a measure of the algal population in a lake. For trophic state classification, preference is given to the chlorophyll-*a* trophic state index (TSI_{CHL}) because it is the most accurate at predicting algal biomass. The equations for calculating TSI are based on Carlson & Simpson (1996).

Chlorophyll-*a* was monitored in Lake Hayward twice in summer (July & August) 1999 using water samples from the surface (0-6 feet) at the citizen lake monitoring site illustrated in Figure 1. The average TSI_{CHL} was 39 therefore classifying Lake Hayward as a borderline **OLIGOTROPHIC-MESOTROPHIC** system from a biomass standpoint (Figure 5 & Figure 7).

Figure 7 - Trophic State Index Graph



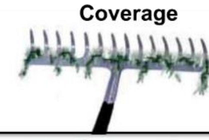
Data collected by volunteers and retrieved from the WDNR Lake Hayward webpage.
Graphs created by Aquatic Plant & Habitat Services LLC.

1.5 Aquatic Plants

1.5.1 2021 Survey Methods

An aquatic plant survey of Lake Hayward was completed by Aquatic Plant and Habitat Services LLC July 27-29th, 2021 using the statewide standard protocol developed by Hauxwell et al. (2010). In Lake Hayward, the survey points were spaced 42 meters (~138 ft.) apart and there were 482 points total (Map in Appendix A). Plants were surveyed from a boat using a double-sided rake head on a telescopic pole or rope, depending on depth. Rake fullness was determined using guidelines in Figure 8.

Figure 8 – Total Rake Fullness Illustration

Rating	Coverage	Description
1		Few plants
2		Plants cover length of the rake but not tines
3		Rake completely covered, tines not visible

Rake illustrations from Hauxwell et al. 2010

1.5.2 2021 Survey Results

The maximum rooting depth of plants was 15 feet and there were 432 sample points shallower than the maximum rooting depth. Most of those sites (344 or 80%) had vegetation present (Table 1, Figure 9). Diversity was high with a species richness of 45 species found on the rake (not including filamentous algae or freshwater sponge), another 5 species within 6ft of survey points but not on the rake (considered "visual"), and another 3 species found greater than 6ft from survey points. The Simpson Diversity Index was high with a value of 0.92 out of a maximum possible value of 1.00. The Floristic Quality Index was 38.4, which is higher than the average value of 28.3 for other impoundments in the same ecoregion. Overall, the aquatic plant community of Lake Hayward is diverse, heterogeneous, and indicative of low disturbance.

<u>Most Frequent Species</u>

Common waterweed, coontail, and flat-stem pondweed were the three most common species found in 2021 with littoral frequencies of 37%, 36%, and 28%, respectively (Table 2). Together, they accounted for 39% of the total relative frequency, which further supports the concept that Lake Hayward has a heterogeneous plant community. Maps of individual species are in Appendix B.

<u>"New" Characeae</u>

Aquatic plant biologists in Wisconsin are paying closer attention in recent years to a family of native macroalgae known as Characeae. Species in this family were likely present in Lake Hayward during past surveys, but were identified to genus level (i.e., Chara sp. And Nitella sp.) as was standard at the time. When possible, identification of Characeae was done at the species level in 2021. Mucronate nitella, Braun's stonewort, and globular stonewort were first listed in Lake Hayward in 2021. Due to uncertain identification, specimens of mucronate nitella were sent to the New York Botanical Garden for verification and determined to be correct identification based on morphology. Genetic analysis of the mucronate nitella will provide more information but results were not available at the time of finalizing this plan.

Table 1 – Aquatic Plant Survey Results for Lake Hayward 2013 & 2021

<table>
<tr><th colspan="3">Summary Statistic</th><th>June 2013</th><th rowspan="17">Herbicide treatment of 23 acres, July 2, 2013</th><th>July 2013</th><th>July 2021</th></tr>
<tr><td>1</td><td colspan="2">Total # of sites visited</td><td>478</td><td>478</td><td>454</td></tr>
<tr><td>2</td><td colspan="2">Total # of sites with vegetation</td><td>349</td><td>341</td><td>344</td></tr>
<tr><td>3</td><td colspan="2">Max. depth of plants (feet)</td><td>13.5</td><td>12.5</td><td>15.0</td></tr>
<tr><td>4</td><td colspan="2">Total # of sites shallower than max. depth of plants</td><td>439</td><td>423</td><td>432</td></tr>
<tr><td>5</td><td colspan="2">Frequency of occurrence at sites shallower than max. depth of plants (Littoral FOO)</td><td>79.50</td><td>80.61</td><td>79.63</td></tr>
<tr><td rowspan="4">6</td><td rowspan="4">Average # of species per site</td><td>a) Shallower than max. depth</td><td>2.56</td><td>3.37</td><td>2.60</td></tr>
<tr><td>b) Vegetated sites only</td><td>3.21</td><td>4.18</td><td>3.27</td></tr>
<tr><td>c) Native shallower than max. depth</td><td>2.10</td><td>3.21</td><td>2.50</td></tr>
<tr><td>d) Native species at vegetated sites only</td><td>2.84</td><td>4.08</td><td>3.14</td></tr>
<tr><td rowspan="2">7</td><td rowspan="2">Species Richness</td><td>a) Total # species on rake at all sites</td><td>46</td><td>50</td><td>45</td></tr>
<tr><td>b) Including visuals</td><td>46</td><td>55</td><td>50</td></tr>
<tr><td>8</td><td colspan="2">Simpson's Diversity Index</td><td>0.92</td><td>0.93</td><td>0.92</td></tr>
<tr><td>9</td><td colspan="2">Mean Coefficient of Conservatism</td><td>6.3</td><td>6.4</td><td>6.2</td></tr>
<tr><td>10</td><td colspan="2">Floristic Quality Index</td><td>39.5</td><td>42.5</td><td>38.4</td></tr>
<tr><td>11</td><td colspan="2">Eurasian/Hybrid Watermilfoil Littoral Frequency of Occurrence</td><td>12.3</td><td>12.5</td><td>9.5</td></tr>
<tr><td>12</td><td colspan="2">Curly-leaf Pondweed Littoral Frequency of Occurrence</td><td>32.6</td><td>2.1</td><td>0.9</td></tr>
<tr><td colspan="7">2013 – Surveys completed by Endangered Resource Services LLC
2021 – Survey completed by Aquatic Plant & Habitat Services LLC</td></tr>
</table>

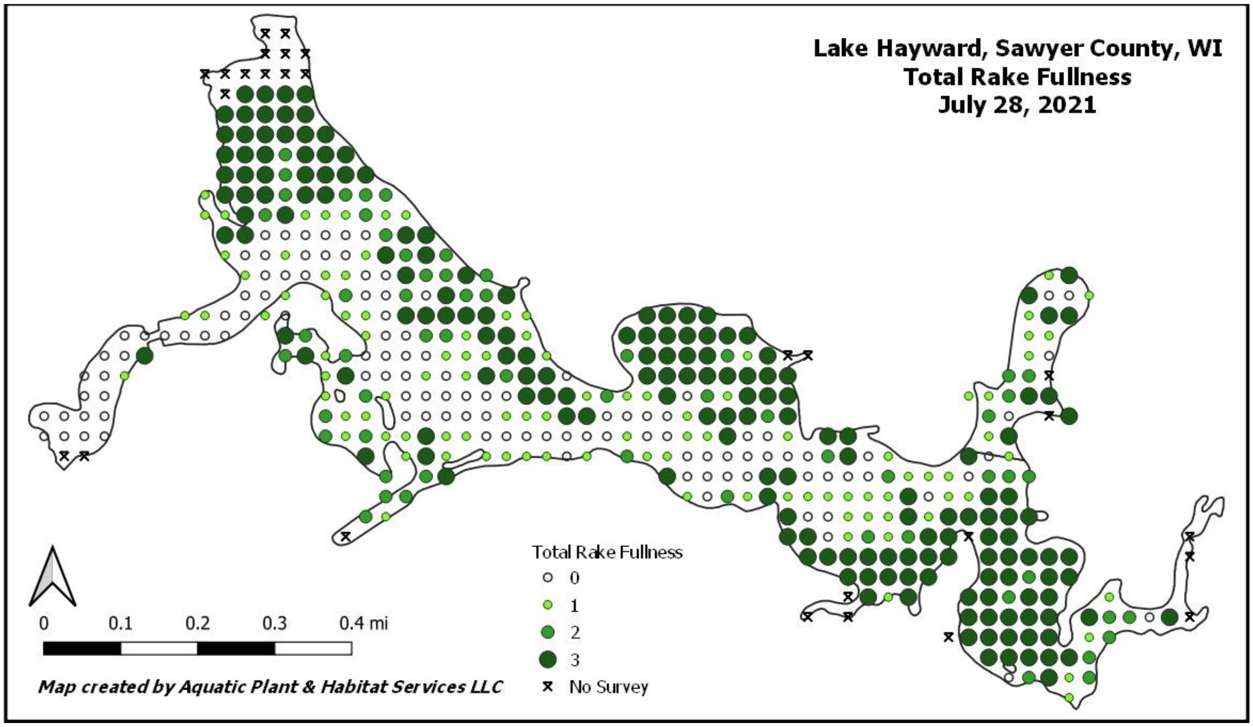
High Conservatism Species

There were three species found in 2021 with a high conservatism (C) value of 9 or 10, including blunt-leaf pondweed, small bladderwort, and wild calla (Table 2, Figure 9). The C value estimates the likelihood of that plant species occurring in an environment that is relatively unaltered from pre-settlement conditions. As human disturbance occurs, species with a low C value are more likely to dominate a lake. No species of special concern were found during the survey. Species of special concern are those believed to be of low abundance in Wisconsin and therefore listed in an advisory capacity before they become threatened or endangered. Maps of individual species are in Appendix B.

Eurasian / Hybrid Watermilfoil

Eurasian (EWM) or hybrid watermilfoil (HWM, hereafter implied as EWM) was found at 41 sites (9.5 littoral frequency) in 2021. This occurrence of EWM is lower than 2013 (Table 1). No beneficial use impairment caused specifically by EWM was apparent during the 2021 aquatic plant survey. EWM was found scattered throughout the lake (Figure 12) and most often accompanied by native species with much higher rake fullness ratings.

Figure 9 – Lake Hayward Total Rake Fullness Species Richness Maps, 2021



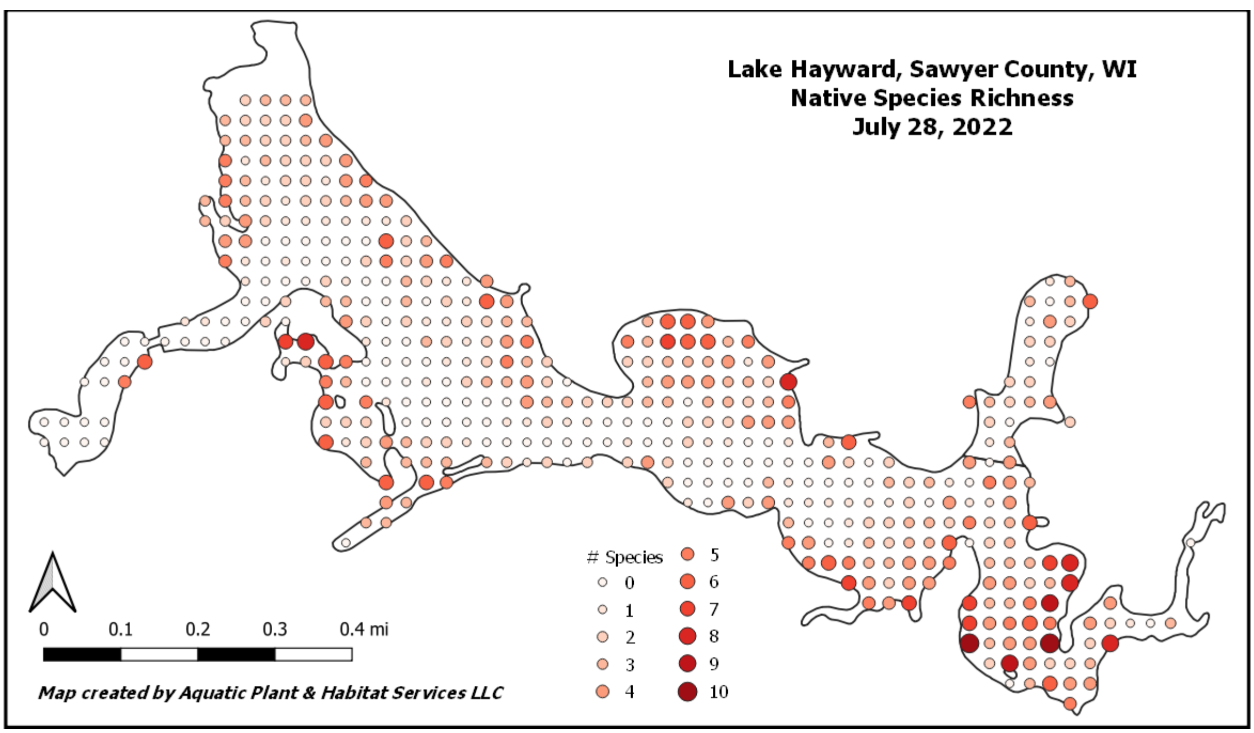


Table 2 – Lake Hayward Individual Species Statistics, 2021

Common Name	Scientific Name	Frequency at Veg. sites (%)	Littoral Frequency (%)	Relative frequency (%)	# Sites where found	Avg. rake fullness	# Visual sites
Common waterweed	*Elodea canadensis*	46.80	37.27	14.32	161	1.58	2
Coontail	*Ceratophyllum demersum*	45.06	35.88	13.79	155	1.57	1
Flat-stem pondweed	*Potamogeton zosteriformis*	35.47	28.24	10.85	122	1.33	3
Wild celery	*Vallisneria americana*	33.72	26.85	10.32	116	1.59	1
Forked duckweed	*Lemna trisulca*	29.94	23.84	9.16	103	1.01	1
Fern pondweed	*Potamogeton robbinsii*	29.07	23.15	8.90	100	1.71	1
Filamentous algae		18.02	14.35	-	62	1.08	1
Eurasian water milfoil	*Myriophyllum spicatum*	11.92	9.49	3.65	41	1.17	0
White water lily	*Nymphaea odorata*	9.01	7.18	2.76	31	1.68	22
Small duckweed	*Lemna minor*	8.43	6.71	2.58	29	1.00	23
Large duckweed	*Spirodela polyrhiza*	7.27	5.79	2.22	25	1.00	17
Spatterdock	*Nuphar variegata*	6.98	5.56	2.14	24	1.79	10
Water star-grass	*Heteranthera dubia*	6.69	5.32	2.05	23	1.09	0
Common watermeal	*Wolffia columbiana*	6.10	4.86	1.87	21	1.00	11
Slender naiad	*Najas flexilis*	5.52	4.40	1.69	19	1.05	1
Nitella	*Nitella sp.*	4.94	3.94	1.51	17	1.12	0
Freshwater sponge		4.94	3.94	-	17	1.00	0
Small pondweed	*Potamogeton pusillus*	4.65	3.70	1.42	16	1.00	0
Mucronate nitella	*Nitella mucronata*	4.36	3.47	1.33	15	2.07	0
Water marigold	*Bidens beckii*	3.78	3.01	1.16	13	1.23	0
Clasping-leaf pondweed	*Potamogeton richardsonii*	3.78	3.01	1.16	13	1.08	1
Large-leaf pondweed	*Potamogeton amplifolius*	2.91	2.31	0.89	10	1.60	3
Braun's stonewort	*Chara braunii*	2.03	1.62	0.62	7	1.29	0
Muskgrasses	*Chara sp.*	1.45	1.16	0.44	5	1.00	0
Ribbon-leaf pondweed	*Potamogeton epihydrus*	1.45	1.16	0.44	5	1.20	0
Fries' pondweed	*Potamogeton friesii*	1.45	1.16	0.44	5	1.00	0
Bur-reed	*Sparganium sp.*	1.45	1.16	0.44	5	1.00	10
Sago pondweed	*Stuckenia pectinata*	1.45	1.16	0.44	5	1.00	2
Curly-leaf pondweed	*Potamogeton crispus*	1.16	0.93	0.36	4	1.00	0
Variable pondweed	*Potamogeton gramineus*	1.16	0.93	0.36	4	1.00	0
White-stem pondweed	*Potamogeton praelongus*	1.16	0.93	0.36	4	1.25	0
Arrowhead	*Sagittaria sp.*	1.16	0.93	0.36	4	1.00	1
Illinois pondweed	*Potamogeton illinoensis*	0.87	0.69	0.27	3	1.00	0
Needle spikerush	*Eleocharis acicularis*	0.58	0.46	0.18	2	1.00	0
Northern water-milfoil	*Myriophyllum sibiricum*	0.58	0.46	0.18	2	1.00	0
Leafy pondweed	*Potamogeton foliosus*	0.58	0.46	0.18	2	1.00	0
White water crowfoot	*Ranunculus aquatilis*	0.58	0.46	0.18	2	1.00	1
Sessile-fruited arrowhead	*Sagittaria rigida*	0.58	0.46	0.18	2	1.00	1
Watershield	*Brasenia schreberi*	0.29	0.23	0.09	1	3.00	2
Floating-leaf pondweed	*Potamogeton natans*	0.29	0.23	0.09	1	1.00	0
Blunt-leaf pondweed	*Potamogeton obtusifolius*	0.29	0.23	0.09	1	1.00	1
Spiral-fruited pondweed	*Potamogeton spirillus*	0.29	0.23	0.09	1	1.00	0
Common arrowhead	*Sagittaria latifolia*	0.29	0.23	0.09	1	1.00	0
Common bur-reed	*Sparganium eurycarpum*	0.29	0.23	0.09	1	1.00	1
Small bladderwort	*Utricularia minor*	0.29	0.23	0.09	1	1.00	0
Common bladderwort	*Utricularia vulgaris*	0.29	0.23	0.09	1	2.00	1
Globular stonewort	*Chara globularis*	0.29	0.23	0.09	1	1.00	0
Wild calla	*Calla palustris*	-	-	-	0	-	3
Water horsetail	*Equisetum fluviatile*	-	-	-	0	-	1
American bur-reed	*Sparganium americanum*	-	-	-	0	-	1
Branched bur-reed	*Sparganium androcladum*	-	-	-	0	-	1
Northern wild rice	*Zizania palustris*	-	-	-	0	-	1
Purple loosestrife	*Lythrum salicaria*	*	*	*	*	*	*
Purple iris	*Iris versicolor*	*	*	*	*	*	*
Softstem bulrush	*Schoenoplectus tabernaemontani*	*	*	*	*	*	*

** Not found at or near any sample points, but observed in Lake Hayward during the survey*

Non-native, invasive species (red) | Species with a high coefficient of conservatism (9 or 10) (green)

1.6 Fishery

The text in this section is copied from the 2022 Spring Fisheries Survey Summary by WDNR Fisheries Biologist, Max Wolter.

The Wisconsin Department of Natural Resources (WDNR) Hayward Fisheries Management Team conducted a fyke netting survey on Lake Hayward from April 17-19, 2022. The primary targets were northern pike and walleye, but useful data were also gathered on black crappie and yellow perch. Up to eight nets were set overnight for two total nights, which resulted in 16 total net-nights of effort. An electrofishing survey was conducted on June 1, 2022 to target largemouth bass and bluegill, and included two and a half miles of shoreline. Quality, preferred and memorable sizes referenced in this summary are based on standard proportions of world record lengths developed for each species by the American Fisheries Society.

The netting survey was well-timed for Walleye and Northern Pike, capturing the start of spawning activity for each species. Nets were set immediately after ice out and covered a variety of habitat types. Water temperature was below the ideal range for capturing Black Crappie and Yellow Perch, but results are still included in this report. Lake Hayward is a "Complex-Riverine" lake, based on the DNR Fisheries lake class system. "Complex" refers to the number of gamefish present in the fish community. Riverine systems present challenges for both surveying and managing populations since fish can move from lake to river habitats.

Northern Pike

Northern Pike catch rates (15 per net night) were exceptionally high in comparison to lakes in the same class as Lake Hayward. Pike were generally small (75% were under 21 inches), but top-end size was excellent. A 40-inch pike was captured in the survey, along with several others over 35 inches. Pike anglers in Lake Hayward should expect action from a lot of smaller pike, with a chance for a true trophy. There is no minimum length limit for Northern Pike and anglers may harvest up to five per day. Harvest of smaller pike is encouraged.

Walleye

Only two Walleye were captured in this survey, indicating low abundance of the species. This matches previous surveys of Lake Hayward. The Walleye population is supported almost exclusively through stocking, very little natural reproduction has been observed. However, stocked Walleye may not stay in Lake Hayward. Walleye have opportunities to leave Lake Hayward both upstream into Namekagon River and downstream over the dam. The Walleye regulation on Lake Hayward is a 15-inch minimum length limit, a 20-24-inch protected slot with only one fish over 24 inches, and a three daily bag limit.

Muskellunge

Muskellunge are present in Lake Hayward, and trophy-sized fish have been caught in past surveys and local Muskellunge tournaments. No Muskellunge were captured during this survey. Muskellunge may not have been shallow enough to be captured due to very cold water temperatures at the time of the survey. Future efforts will try to document the status of this population. Muskellunge are stocked periodically into Lake Hayward, but like Walleye, may move into the river.

Black Crappie

Black Crappie catch rate was below average when compared to lakes in the same class. Survey timing may have played a minor role in the catch rate, and higher rates may have been observed with a later netting survey. Still, Black Crappie in Lake Hayward have nice size, with about 1 in 3 being over 10 inches. The daily bag limit for panfish on Lake Hayward is 25 (all panfish species combined).

Yellow Perch

Yellow Perch catch rate was about average when compared to other lakes in this class. Yellow Perch in Lake Hayward have good size, with a large percentage of the survey catch being over 8 inches. The daily bag limit for panfish on Lake Hayward is 25 (all panfish species combined).

Largemouth Bass

Catch rate for Largemouth Bass in Lake Hayward was close to average when compared to lakes of the same class. Half of the Largemouth Bass captured in the survey were over 15 inches, offering a quality bass fishing opportunity for anglers focused more on size than catch rate. There is a 14-inch minimum length limit for bass and a 5-daily bag limit. Smallmouth Bass are present in Lake Hayward, but none were captured in this survey. Smallmouth Bass likely prefer the riverine areas upstream from Lake Hayward more than the lake itself.

Bluegill

Bluegill catch rate was above average when compared to other lakes in this class. Despite being relatively abundant, size of Bluegill was excellent. More than 10% of Bluegill captured were over 8 inches long. Lake Hayward has a strong reputation as a Bluegill fishery, both during open water and through the ice. The daily bag limit for panfish on Lake Hayward is 25 (all panfish species combined).

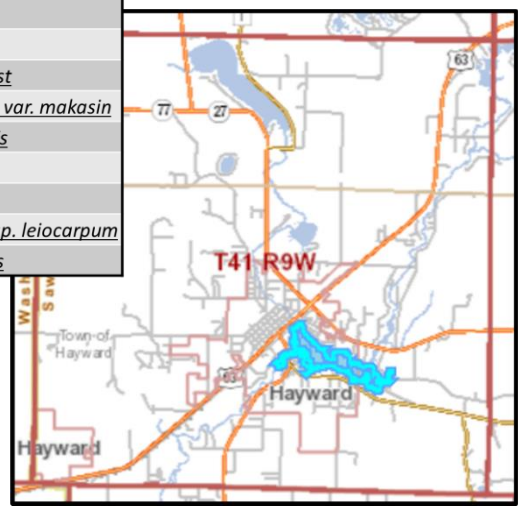
Other species present include: White Sucker, Northern Hogsucker, Pumpkinseed Sunfish, Rock Bass, several species of redhorse, Brown Trout, and various minnow species.

1.7 Wildlife

The Wisconsin Natural Heritage Inventory (NHI) lists species and natural communities that are known or suspected to be rare in Wisconsin. The species are legally designated as endangered or threatened or they may be listed in an advisory capacity of special concern. The NHI lists species according to township and range, which includes T41N 9W for Lake Hayward. There are 11 NHI species in the same township and range as Lake Hayward.

Table 3 – Rare Plant & Animal Species in the Area

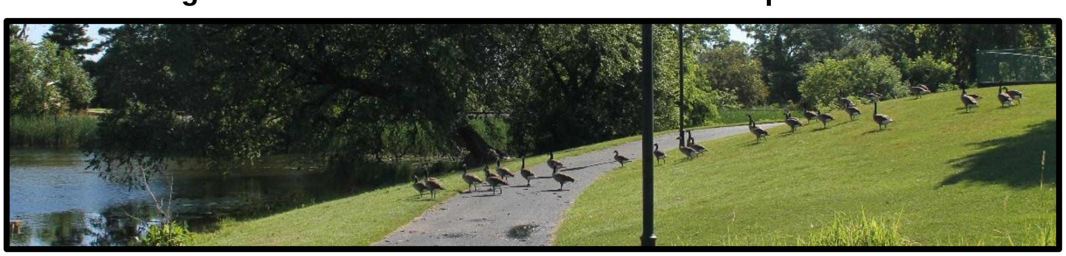
Common Name	Scientific Name
Blanding's Turtle	*Emydoidea blandingii*
Downy Willow-herb	*Epilobium strictum*
Elktoe	*Alasmidonta marginata*
Northern Flying Squirrel	*Glaucomys sabrinus*
Northern Wet-mesic Forest	*Northern wet-mesic forest*
Northern Yellow Lady's-slipper	*Cypripedium parviflorum var. makasin*
Prairie Skink	*Plestiodon septentrionalis*
Pugnose Shiner	*Notropis anogenus*
Round-leaved Orchis	*Amerorchis rotundifolia*
Russet Cotton-grass	*Eriophorum russeolum ssp. leiocarpum*
Bald Eagle	*Haliaeetus leucocephalus*



Wildlife Habitat

The zone within 100 feet of the lakeshore and into the shallows of the lake is a critical area for mammals, birds, reptiles, amphibians, and fish. Leaving trees, shrubs, and vegetation is one way to protect existing habitat. If a lakeshore has already been cleared and developed, habitat restoration can be as simple as mowing less area and/or planting native plants and landscaping. Protecting and restoring lakeshore buffers and natural shoreline also prevents issues with Canada geese that show preference for manicured lawns. Geese are attracted to a mowed lawns because of the visibility it affords. Geese avoid areas with taller plants to elude predators. The addition of taller native plantings along the lakeshore can help deter geese.

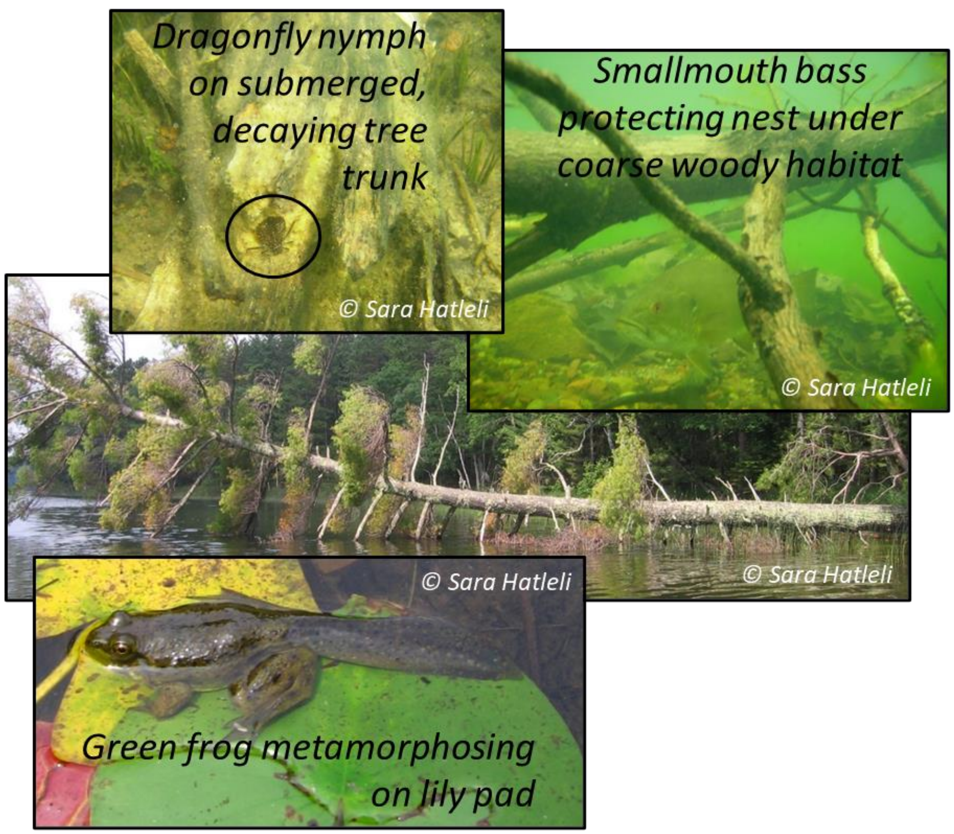
Figure 10 – Photo of Mowed Lawn and Multiple Geese



Near shore vegetation in the lake creates habitat for frogs, turtles, furbearers, and waterfowl. Minimal clearing in this area will maintain critical habitat for these animals and important areas for fish spawning and development. Fallen trees along the lakeshore also provide structural habitat for wildlife and fish. Examples include turtles basking on these fallen trees and wood ducks and mallards loafing on them as well. Anglers often target fallen trees in lakes because they serve as structure for fish (Figure 11). There are grant funds and programs that promote placement of trees back in the water, but it is much easier to leave trees where they fall naturally whenever possible.

Moving away from the lakeshore and further upland, we know that land use impacts water quality and thus impacts which species of animals can thrive in and around the lake. And although this is important, the more critical concept is for lakeshore residents to be conscious of their practices near the lake.

Figure 11 – Near Shore Habitat Photos



2.0 Issues and Need for Management

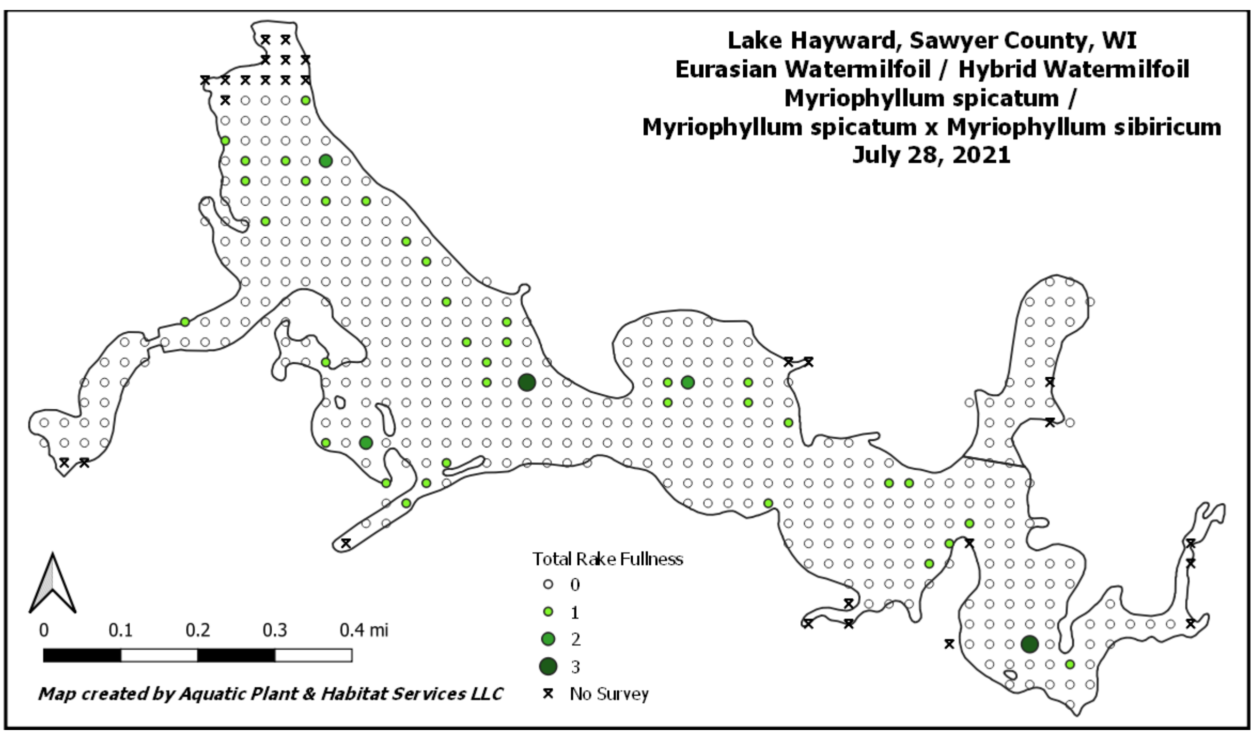
2.1 Aquatic Invasive Species

Aquatic invasive species (AIS) are defined by their tendency to out-compete native species thereby threatening the diversity and balance of plants and animals that are native to a particular system. The aquatic invasive plants of greatest concern in Lake Hayward are Eurasian & hybrid watermilfoil (*Myriophyllum spicatum & M. spicatum X sibiricum*) and curly-leaf pondweed (*Potamogeton crispus)*. Other non-native species in the lake include the Chinese mystery snail and purple loosestrife, which are not currently reportedly a serious threat to the lake ecosystem or recreation.

2.1.1 Lake Hayward Eurasian Watermilfoil / Hybrid Watermilfoil 2021

Hybrid watermilfoil (HWM) was verified in 2012 and Eurasian watermilfoil verified in 2011. Because the two species are only distinguishable from each other using genetic analysis, the reference to “EWM” throughout this management plan refers to both species. EWM had low-to-moderate littoral frequency from a lake-wide perspective during point-intercept (PI) survey in 2021 (9.5%) and only slightly higher occurrence in 2013 at 12.3% in June and then after 23 acres of herbicide treatment there was 12.5% in July 2013. EWM occurrence in 2021 was lower than 6 native species and it was spread throughout the lake. Although EWM is considered an aquatic invasive plant, its occurrence in 2021 was more like just another plant species in the lake. As such, there were no “beds” of dominant or highly dominant EWM in the lake.

Figure 12 – EWM Map, 2021

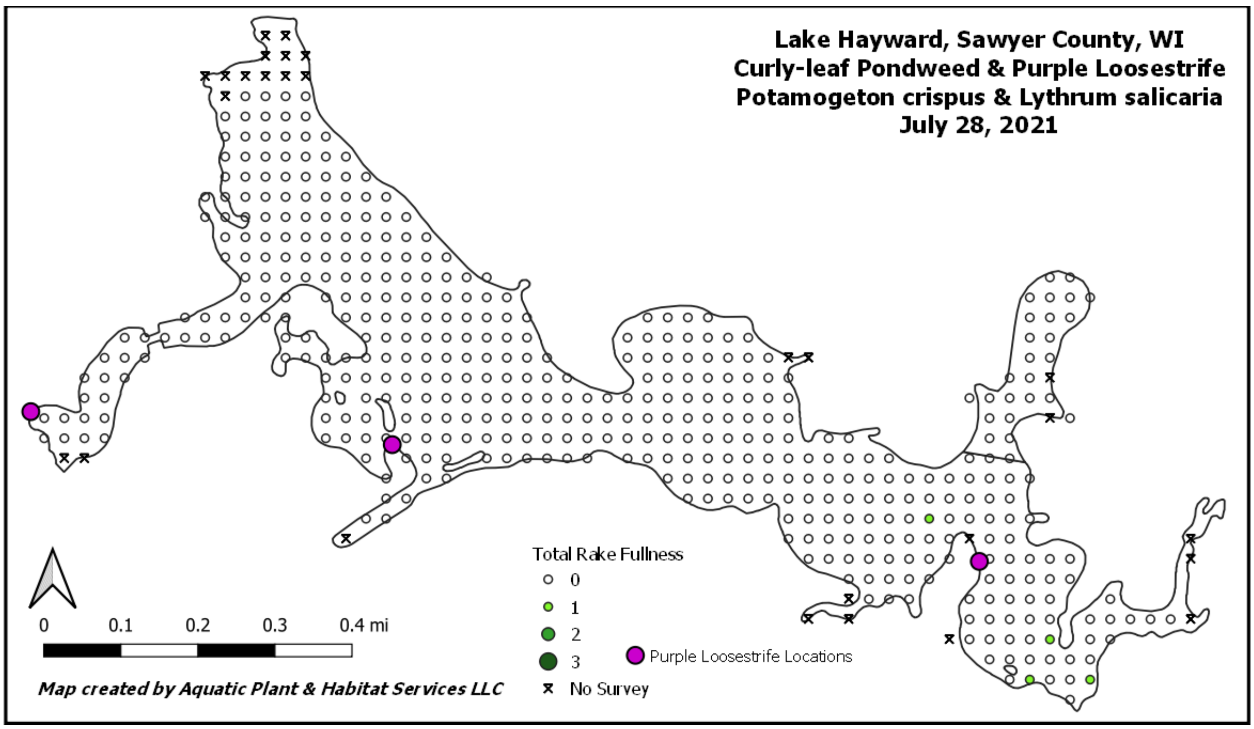


2.1.2 Lake Hayward Curly-leaf Pondweed & Purple Loosestrife 2021

Curly-leaf pondweed (CLP) was found at only 1% of littoral sites in July 2021 but this low occurrence is likely due to the early senescence of CLP in mid-summer. An early-season survey of CLP would be a better indication of occurrence, as was done in June 2013 when CLP was found at 33% of littoral sites.

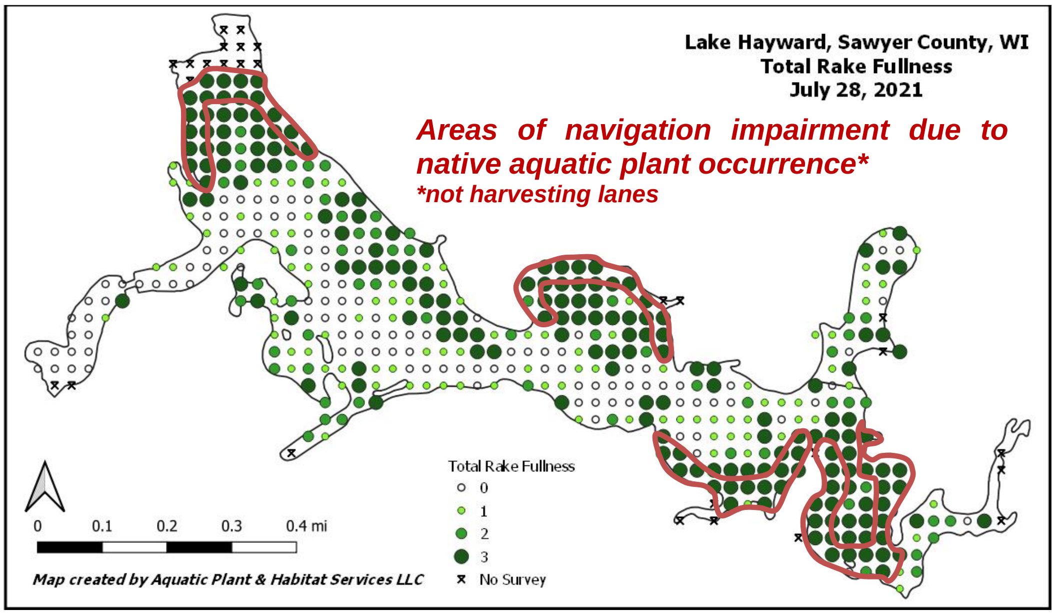
Purple loosestrife was found at 3 locations near sample sites. Although purple loosestrife can become highly invasive and outcompete native species in wetlands, it was found in only a few locations and not causing impairment. Anytime it is found, however, it should be removed with care so as not to spread seeds when the plant is flowering.

Figure 13 – Curly-leaf Pondweed & Purple Loosestrife Map, 2021



2.2 Navigation Impairment

Results from the 2021 aquatic plant survey illustrate that Lake Hayward has a high abundance of native aquatic plants, especially at locations shallower than 10 feet deep. During the survey, there were some areas where navigation was difficult due to abundant emergent (bur-reed), floating-leaf (water lily, spatterdock), or submersed species (coontail, elodea). Although some of these areas are quiet back bay areas that do not require navigation, other areas of abundant plant growth hinder lake residents' ability to access the lake. These areas include the far northwest reach, Echo Bay along the north central shore, the bay along the south-central shore, and Barts Bay along the southeast shore.



2.3 Public Input & Planning

2.3.1 Public Meeting

A public meeting was held June 18, 2022 at the Weiss Public Library in Hayward to gather public input regarding aquatic plant management in Lake Hayward. There were approximately 25 people in attendance including presenters/natural resource professionals (Sara Hatleli, Aquatic Plant & Habitat Services LLC; Natalie Erler, Sawyer County). Information was presented on the 2021 aquatic plant survey results, aquatic invasive species occurrence, comparisons to previous year plant surveys, and management options. Also during the meeting, participants provided written comments about their concerns on a poster-sized map of Lake Hayward, an exercise that yielded the following 5 comments (Figure 14):

1. Algae bloom, excessive weeds, but lots of turtles & frogs. (placed in Echo Bay)
2. Bays are the biggest issue on the lake and need to start in those areas (Echo Bay)
3. Concerns regarding Lake Hayward Pond area (Echo Bay) which has been blocked from the lake by beavers and the destruction made (nothing more written)
4. Weeds so can kayak & motor craft (Echo Bay)
5. Navigable waters to fish (southeast area)

Figure 14 – Public Meeting & Map Photos

<u>Management Options</u>

The main issue and reason for updating the APMP is due to the abundance of vegetation causing navigation impairment, especially in bays, of Lake Hayward. Although EWM and CLP are present, these invasive species were not abundant during the survey in 2021. As management options for alleviating navigation impairment were presented, participants were invited to weigh in on feasibility from social, economic, biological, and organizational capacity perspectives now (2022) or later (post-2022). The most feasible management options were manual removal near docks, mechanical harvest, herbicide treatment of AIS if they become problematic, and nutrient input control in riparian areas.

2.3.2 Follow-up Planning Meeting

A virtual meeting was held on August 18th from 2:00-4:00. Public input results were compiled and used to develop draft goals and objectives that were presented during this meeting. LHPOA committee members in attendance included Heidi Martens and Paul Van Natta. Sara Hatleli (APHS), Scott VanEgeren (WDNR), Andrew Zabel (WDNR), Natalie Erler (Sawyer County), Kristi Maki (American Birkebeiner & Lumberjack World Championships Foundation), and Caitlin Nagorka were also in attendance. Goals and objectives based on the public input meeting and this follow-up meeting are reflected in Section 5.0.

2.3.3 APMP Review and Comment

A first draft of this management plan was available to the LHPOA Aquatic Plant Committee December 28, 2022 through January 15, 2023. Only minor editorial changes were requested.

A second draft of the plan was sent to the WDNR, Sawyer County, National Park Service, Xcel Energy, American Birkebeiner Ski Foundation, Lumberjack World Championships Foundation, and the City of Hayward for another round of review. NPS made some inquiries about permit requirements for mechanical harvest due to the multi-jurisdictional status of Lake Hayward as an impoundment of the St. Croix National Scenic Riverway. The consultant confirmed with the US Army Corps of Engineers in Hayward WI on January 23, 2023 via email correspondence that USACE does not regulate mechanical harvest of aquatic vegetation.

<u>Public Review and Comment</u>

A third draft of the plan was available for public review and comment February 15 – March 8, 2023. A public notice was placed in the local Sawyer County Record on February 15th. A hard copy of the APMP was mailed to the Weiss Public Library in Hayward WI. No comments were received during the public review period.

<u>Adoption by the Lake Hayward Property Owners Association</u>

The LHPOA officers and Aquatic Plant Management Committee voted to adopt the plan via email on March 16th, 2023. LHPOA officers are Todd Martens, Heidi Martens, Lee Neuschwander, and James Miller. Aquatic Plant Management Committee members are Heidi Martens, Paul VanAtta, Paul Adler, and Allen Heinkel.

<u>Approval by the DNR</u>

The APMP was provided to the DNR on March 20, 2023 with the request for official approval. The wildlife biologist and fisheries biologist did not have concerns about the goals and objectives presented. The Northwest Region Ecologist also did not have any main concerns but provided a worthy suggestion that stormwater runoff from the city into Lake Hayward be considered. Stormwater carries nutrients which then help fertilize aquatic vegetation. If stormwater management could be explored during the next update of the APMP, it would provide useful management information. The reality of this initiative would depend on the LHPOA's organizational capacity to pursue stormwater analysis and work with the City of Hayward toward mitigation. The plan was officially approved by Scott Van Egeren, Water Resources Management Specialist, WDNR, on April 26, 2023 by email (see Appendix D).

3.0 Past Aquatic Plant Management Activities

3.1 Chemical Treatment

Chemical treatment of EWM in Lake Hayward at 0.5 acres was conducted July 13, 2011 and 23 acres on July 2, 2013. Pre-treatment and post-treatment aquatic plant surveys were done in 2013 to gauge the efficacy of the herbicide treatment and impact to native species. Herbicide concentration was also monitored after the July 2013 treatment to quantify exposure times.

3.1.1 2013 Pre-Post Treatment Surveys

Endangered Resource Services (ERS) LLC completed a pre-treatment aquatic plant survey in Lake Hayward on June 16-18, 2013. EWM was present at 54 points or 11.3% of the lake during the pretreatment survey with 13 points rating a total rakeness of “3” and 11 points rating a “2”. Herbicide treatment was completed July 2, 2013. ERS then completed a post-treatment survey on July 26-28, 2013 and found EWM was still present at 53 points or 11.1% (Figure 16). Although EWM plants showed evidence of chemical burn, many plants were not killed and changes in total plants nor individual rake fullness ratings were significant.

3.1.2 2013 Herbicide Treatment & Monitoring

During the 23-acre treatment on July 2nd, 2013, 2,4-D (DMA 4 IVM) was applied with a target concentration of 3500 ug/L. There were 7 locations in the lake that were monitored for herbicide concentrations. Samples were collected from those 7 sites at time intervals of 3, 7, 24, 72, and 120 hours after treatment. Peak concentrations of 2,4-D from sites HY1, HY2, HY3, and HY4 ranged from 48 to 1496 ug/L, which is lower than the target concentration for control of 3500 ug/L. Sites HY5, HY6, and HY7 also had herbicide concentrations much lower than the target 3500 ug/L for the duration of sampling (Figure 15).

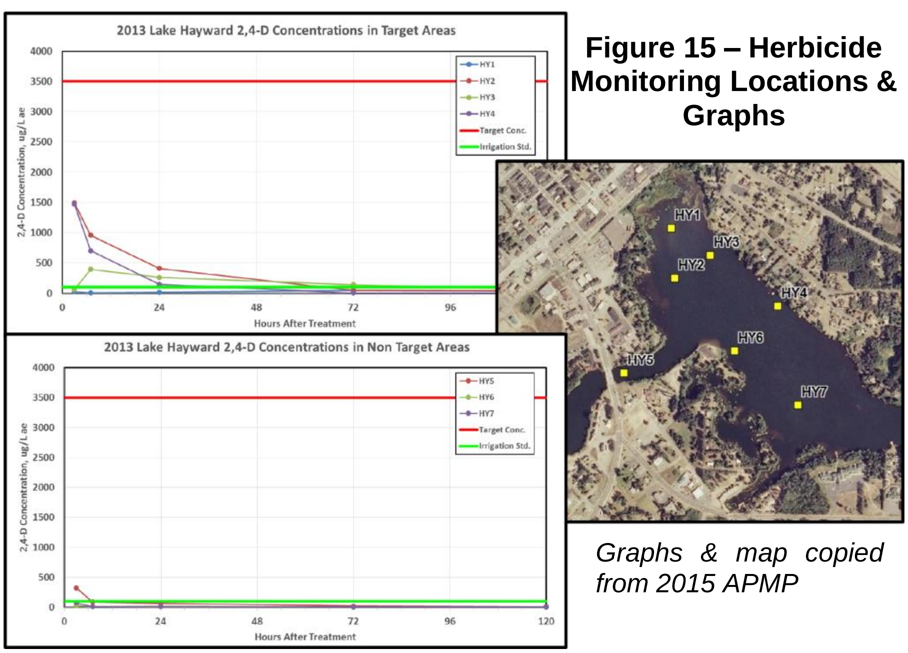
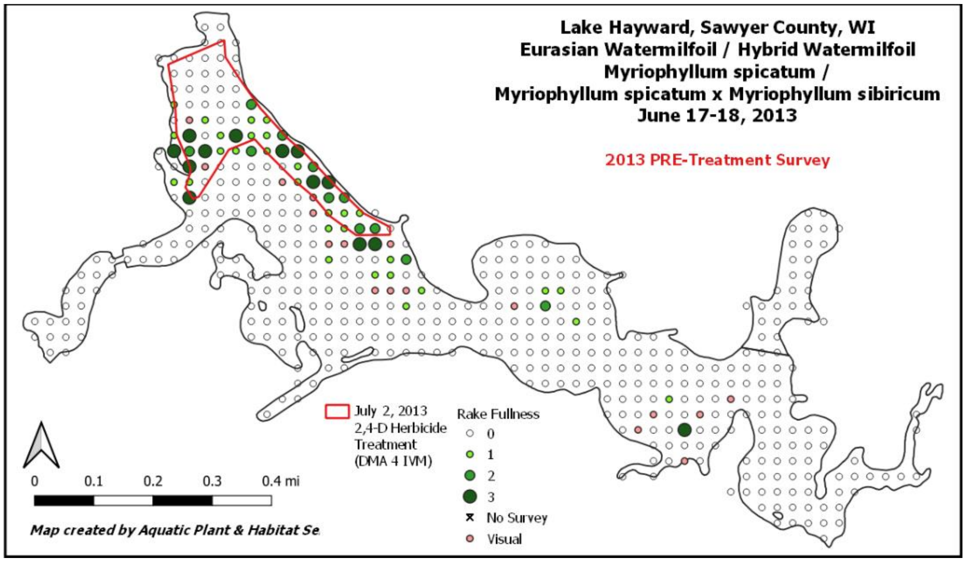
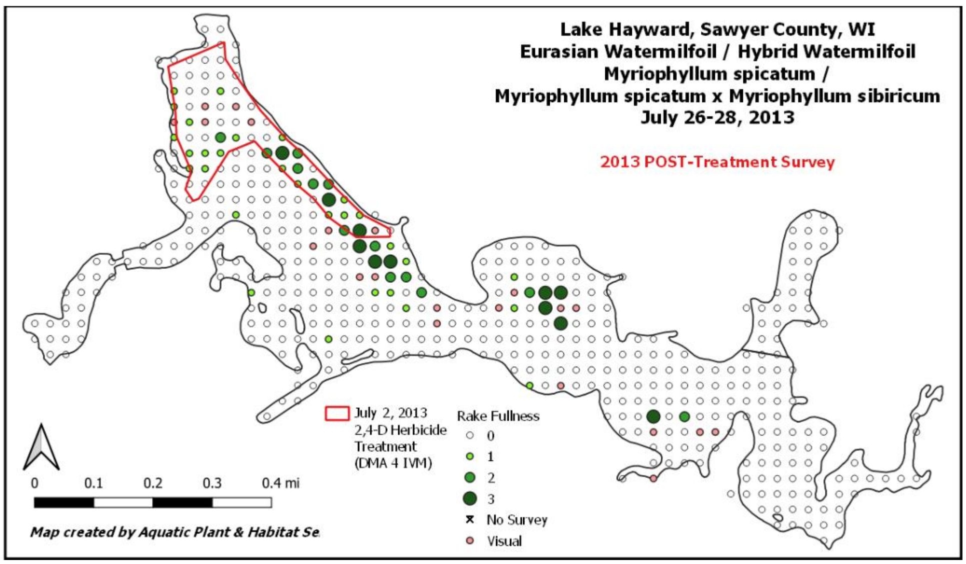


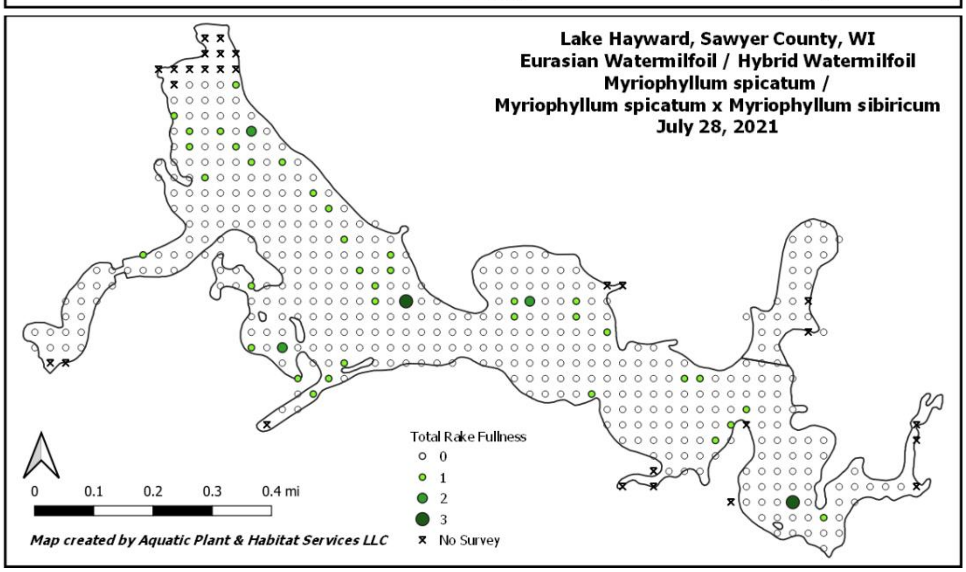
Figure 15 – Herbicide Monitoring Locations & Graphs

Graphs & map copied from 2015 APMP

Figure 16 – EWM/HWM Maps Pre-post Treatment 2013 & 2021







3.2 2021 Aquatic Plant Survey

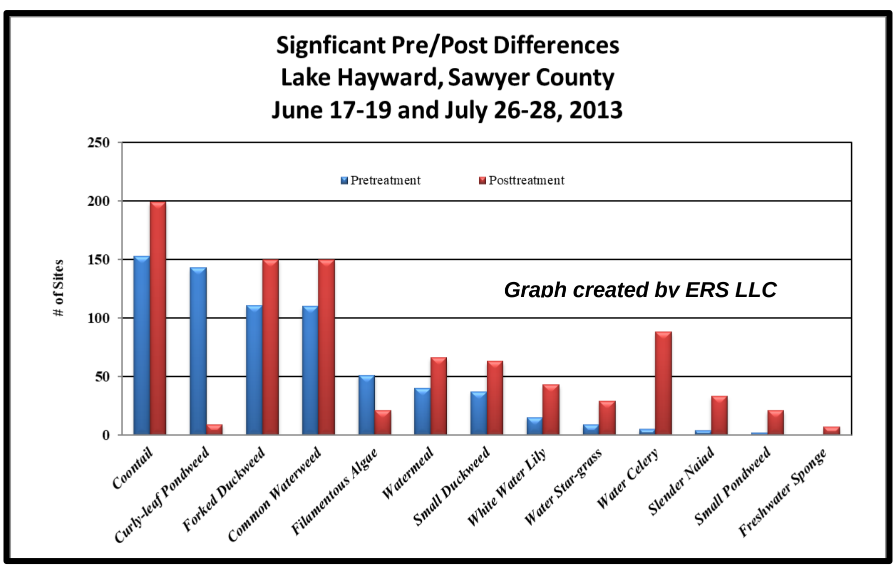
Aquatic Plant & Habitat Services (APHS) LLC completed an aquatic plant survey in Lake Hayward July 27-29, 2021. EWM was found at 41 sites or 9.5% frequency of occurrence with 35 of those sites having rake fullness rating of “1”. EWM was found spread throughout the lake and mainly in no greater frequency or density than native species. Therefore, it was concluded in 2021 that EWM was not a species that was *alone* causing beneficial use impairment (Figure 16).

3.3 Chi-square Tests

ERS completed a chi-squared test of plant occurrence to compare plant species before and after herbicide treatment in 2013. The statistical test helps determine whether there is a significant difference between two data sets by comparing the number of sites a particular plant species was found in two different years. The alpha, or Type I error rate was set at 0.05, meaning there is a 5% chance of claiming there is a significant change when no real change has occurred.

The following results are from Endangered Resource Services LLC. *When considering only the lake’s native vegetation before and after herbicide treatment in 2013, coontail, forked duckweed, common waterweed, and fern pondweed were the most common species before and after herbicide treatment with no significant changes in their occurrence. Curly-leaf pondweed (non-native) was the only species with a significant decline after herbicide treatment, which would have been due to natural senescence and not the herbicide treatment. White water lily, water star-grass, wild celery, slender naiad, and small pondweed all showed highly significant increases; and coontail, forked duckweed, common waterweed, common watermeal, small duckweed, and freshwater sponges moderately significant increases. These gains were likely the result of normal growing season expansion as most of these plants are later growing species that germinate from seeds, annually regrow from overwintering buds, or reproduce by vegetative budding/cloning.*

Figure 17 – Pre-Post Herbicide Treatment Graph



4.0 Plant Management Options

4.1 Options List

The best way to manage aquatic plants will be different for each lake and depends on the plant community, the species that require control, whether AIS are present, the level and type of human use of the system, and various other background information presented in this management plan. Aquatic plant management rules can be found in Wisconsin Administrative Codes, Chapters NR107 (chemical), NR109 (manual/mechanical), NR40 (invasive species) and Chapter 30/31 (waterways). Many management activities require a permit.

There are five broad categories for aquatic plant management:

- **No active management,** which means nothing is done to control plant growth, but a strong monitoring and education component may be included.
- **Manual & mechanical removal of plants**, which includes hand pulling, raking, using plant harvesters, and diver assisted suction harvest.
- **Chemical treatment**, which is the use of herbicide to kill aquatic plants.
- **Physical habitat alteration,** which means plants are reduced by altering variables that affect growth such as sediment, light availability, or depth.
- **Biological control**, which includes the use of living organisms, such as insects, to control plant growth.

4.2 Feasibility Factors

In order for a control method to be appropriate, it must be feasible from a biological, social, financial, and organizational capacity perspective. Biological feasibility infers the control action will not cause significant harm to other aspects of lake ecology. Socially feasible actions are those that have support from project partners, meet regulatory requirements, and will likely be permitted by regulatory agencies. Financial feasibility simply implies that any control action is affordable for the LHPOA and partners providing cost share. Organizational capacity refers to LHPOA's ability to carry out proposed goals and objectives. Some actions are accompanied by risks and potential impact to non-target aspects of a lake, but the benefits must outweigh those risks and potential detriments.

4.3 No Active Management

Sometimes the best course of management is to take no immediate action. There are many benefits including the lack of disturbance to desirable native species and the lake system, there is no financial cost (aside from possibly survey costs), there are no unintended consequences active control, and no permit is required. Disadvantages to this approach include the potential for existing issues to become larger and more challenging to control later. This approach often includes a strong monitoring and educational component.

Refraining from active management is not realistic at this time. The impetus for updating this APMP resides in LHPOA's interest in addressing navigation impairment caused by aquatic plants.

4.4 Manual & Mechanical Control

Manual and mechanical control includes pulling plants by hand or by using harvesting machines or devices. Permits are required for some activities and there are a variety of options under this type of control. Mechanical control is regulated under Chapter NR 109[1].

4.4.1 Manual Plant Removal

Figure 18 – Manual Removal Photo

Shore land property owners are allowed to manually remove a 30-foot-wide section of native aquatic plants parallel to their shoreline without a permit. This can only occur in a single area and there must be piers, boatlifts, swim rafts, or other recreational or other water use devices within that 30-foot zone. This method can only be employed where other plant control methods are not being used and cannot be used in designated sensitive areas. At present there are no designated sensitive areas on Lake Hayward. Property owners considering this method for recreational purposes are encouraged to contact their local WDNR Lakes Coordinator[2] if they have any questions or need clarification on native plant removal at their particular site. There are no limits on raking loose plant material that accumulates along the shoreline. AIS can be selectively removed by manual means anywhere along shore or in open water area without a permit. Regulations require that the native plant community is not harmed during manual removal of AIS. Benefits of these techniques include little damage to the lake and plant community, the removal can be highly selective, and can be very effective in a small bed of AIS. On the other hand, this method can be very labor intensive. Furthermore, EWM that fragments during removal can root and grow elsewhere, so all of the plant must be removed.

Manual removal of EWM or native plants in a 30-ft wide section parallel to shore is feasible for small-scale control as a way for lake residents to keep EWM occurrence low in front of their property and to allow watercraft travel to/from shallow docking areas.

[1] Chapter NR 109 https://docs.legis.wisconsin.gov/code/admin_code/nr/100/109.pdf.
[2] At the time of writing, the appropriate contact is Scott Van Egeren, 715-471-0007, scott.vanegeren@wisconsin.gov

4.4.2 Diver Assisted Suction Harvest (DASH)

Figure 19 – DASH Photo

This form of mechanical control involves the use of suction tubes connected to pumps mounted on a barge or pontoon. The suction tubes reach to the bottom of the lake and SCUBA divers manually uproot EWM to be sucked through the tubes, up to the barge, and strained. Vegetation fragments from harvesting can grow new plants in the lake and it is therefore important for DASH workers to minimize fragmentation as much as possible. DASH is also selective toward EWM so it can help in protecting native and low frequency species and can be highly effective. DASH is labor intensive and costly at $2,500 per day and removal rate depends on the density of EWM on-site, the height of EWM, and the number of different locations that need to be targeted for removal. Construction of a DASH unit costs range from $9,000 if purchasing used components up to $25,000 for new construction. Annual operating costs for two divers over 13 weeks, insurance, fuel, permits, and materials are approximately $31,000 (Greedy, 2016). It is difficult to generalize results across different lakes and results may be lake-specific or even site-specific (Gajewski, 2016).

Using DASH for EWM control in Lake Hayward is not a realistic approach based on 2021 aquatic plant survey results. This method is best employed at small & dense infestation sites, possibly after herbicide treatment as a way to keep EWM occurrence low.

4.4.3 Mechanical Harvest

This method includes “mowing” of aquatic plants down to depths of 5 feet and then collecting the plants and removing them from the lake. Mechanical harvest is only permitted in water depths of 3 feet or greater to prevent the harvester paddle wheels from scouring the lake bottom and/or resuspending sediment. Harvesting is most appropriate for lake systems with large-scale or whole-lake aquatic plant issues. Mechanical harvesters provide immediate results and usually cause minimal impact to lake ecology while removing some, albeit likely minimal, nutrients from the lake via plant biomass reduction. Harvesting lanes in dense plants beds can improve growth and survival of some fish species. A disposal site for harvested plants is a necessary part of a harvesting plan. Hiring a mechanical harvester to work on the lake would cost $2,500 per day. The purchase of a brand new harvester is highly variable and depends on the type of harvester purchased. Cutting harvesters begin at $100,000. With a cutting harvester, a shore conveyor (starting at $35,000) is needed to offload the plants into a truck or dumpster for transport to a disposal site. A Recreational Boating Facilities Grant may help pay for up to 50% of eligible costs associated with purchasing harvesting equipment. Annual costs include paying an operator, storage of the harvester, insurance, and maintenance. As an example, Blake Lake’s (Polk County) 2018 harvesting budget was $27,700[3].

It is feasible for LHPOA to hire a mechanical harvester to open navigation channels in bays where aquatic plants are causing navigation impairment and water depth is 3 feet or greater. If pursued, harvested areas should be monitored to ensure there is no increase in EWM growth in the harvested lanes.

Figure 20 – Mechanical Harvester Photos

[3] 2018 Annual Harvesting Budget Blake Lake: $2,500 APM Coordinator, $1,500 Lakes Convention, $475 Dues, $8,500 Harvester Labor & Expenses, $4,500 Insurance, $4,525 Administration, $5,700 Lake Management Plan.

4.5 Chemical Control

Chemical control is regulated under Wisconsin Administrative Code Chapter NR 107[4]. The amount of time required to control plants depends upon the specific product, whether it is a systemic or contact herbicide, formulation (granular or liquid) and concentration used. Herbicides must be applied in accordance with label guidelines and restrictions. Contact herbicides such as endothall or diquat do not circulate within the plant, kill plant tissue on contact, and are therefore not selective for certain types of plants. Systemic herbicides such as 2,4-D, fluoridone, and the newer ProcellaCOR must be absorbed by the plant tissue, take longer than contact herbicide for control action, and can be selective depending on the herbicide type.

For EWM control, an herbicide generally known as 2,4-D is often used because it is supposed to be selective to broadleaf plants such as EWM. The benefits of using 2,4-D are its effectiveness in controlling EWM, impact to monocots and other native species are supposed to be minimal, altering concentrations and timing allow it to be more selective in killing EWM, and it is widely used. On the other hand, 2,4-D can impact native dicots (such as water lilies, coontail, and bladderworts). The ester formulation of 2,4-D is toxic to fish and invertebrates such as water fleas (*Daphnia sp.)* (WDNR, 2012). Dehnert (2020) found the amine formulation of 2,4-D to impact the embryonic and/or larval stages of walleye, perch, fathead minnow, white sucker, northern pike, white crappie, and largemouth bass.

Herbicide treatment history is discussed in Section 3.1. Aquatic plant survey results and herbicide monitoring from 2013 suggest that herbicide concentrations did not reach target levels and therefore did not result in EWM reduction. This could have been due to the nature of Lake Hayward as an impoundment and the natural flow of water through the lake system may have diluted the herbicide shortly after application.

Impacts to native aquatic plants are an important factor when deciding whether to use chemical control. If the native plants are reduced by repeated chemical control, there is more area for EWM to grow. There were no statistically significant reductions in native plant species after treatment. Even so, if the duration of EWM or CLP control only lasts for one or two growing seasons, it is important to weigh the financial costs combined with impacts to native plants versus the relatively short-lived control. ***Although herbicide treatment may be a feasible option for EWM or CLP control in the future, it is not an appropriate control tool at this time. It is also important to consider the possibility of herbicide dilution before effective control can take place. Following up any herbicide treatment with other forms of EWM control is highly recommended.***

Figure 21 – Chemical Treatment Photo

[4] Chapter NR 107 is available at *https://docs.legis.wisconsin.gov/code/admin_code/nr/100/107.pdf*.

4.6 Physical Habitat Alteration

Various physical habitat alterations exist and most are not appropriate for consideration in Lake Hayward. Many of these alterations require a Chapter 30 permit.

4.6.1 Bottom Barriers

Bottom barriers prevent light from reaching aquatic plants, but kill all plants, and some allow for gas accumulation under the barrier and subsequent dislodging, they can impact fish spawning and food sources, and an anaerobic environment below the barrier could cause nutrient release from the sediment. Bottom barriers are appropriate for public swimming areas near beaches, but not recommended in front of private properties for EWM or native plant control in Lake Hayward.

4.6.2 Dredging

Dredging includes the removal of plants along with sediment and is most appropriate for systems that are extremely impacted with sediment deposition and nuisance plant growth. Impoundments are often faced with issues associated with sedimentation, especially in shallow bays. This is a normal process for a river or stream to carry sediment in faster moving water until the river channel widens, sediment then settles, and overtime reduces water depth. Although Lake Hayward is an impoundment, the use of dredging to control aquatic plants would not be appropriate. There may be a time when dredging is explored to address sedimentation, but this activity would be beyond the scope of an APMP. In any case, dredging is not currently recommended.

4.6.3 Dyes

The use of dyes is for reducing water clarity thereby reducing light availability to aquatic plants. This is only appropriate for very small water bodies with no outflow and is therefore not recommended for Lake Hayward.

4.6.4 Non-point Source Nutrient Control

No permit is required for this type of nutrient management, which reduces the runoff of nutrients from the watershed. As a result, fewer nutrients enter the lake and are therefore not available for plant growth. This approach is beneficial because it attempts to correct the source of a nutrient problem and not just treat the symptoms. Controlling non-point source pollution is always recommended as are continued communications that encourage lake residents to reduce surface water runoff into Lake Hayward.

4.6.5 Drawdown

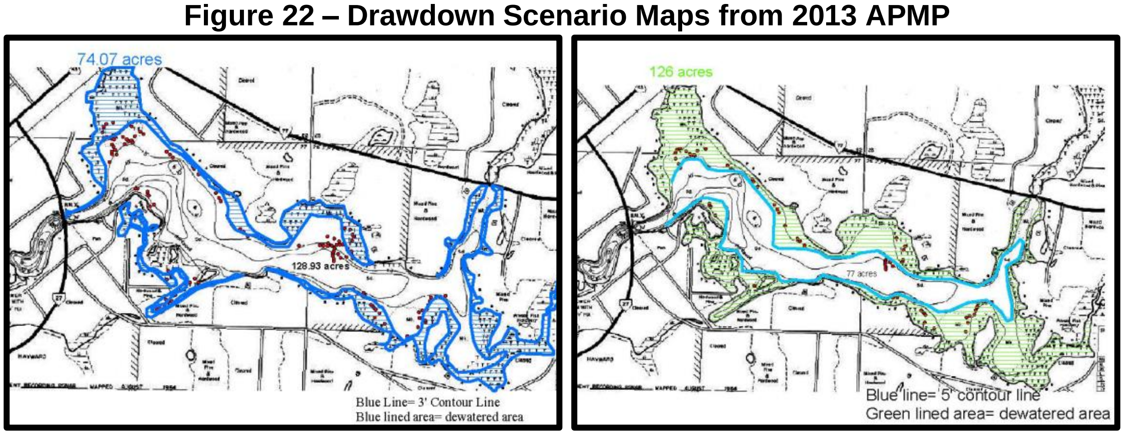
This control technique involves the lowering of water levels and with the existence of the dam and powerhouse, Lake Hayward could potentially be drawn down to control aquatic plant growth. If this method where pursued, a drawdown would lower the water elevation to a pre-determined level in the late summer/early fall and allow exposed sediments dry and freeze during the winter. This would in turn freeze plant root structures, effectively killing the plants. Snowfall before a hard freeze may insulate the sediment thus not exposing the roots and rhizomes to harsh freezing conditions.

Long before a drawdown would occur, there would be considerable planning required and the development of a drawdown management plan (DMP), which would require information listed below and approval by Federal Energy Regulatory Commission (FERC).

- Drawdown need
- Rate of water level decrease
- Schedule & depth of drawdown
- Required minimum downstream flows and pond level elevation
- Impacts to fish, reptiles, amphibians, insects, crayfish, mussels, and other animals in the lake that overwinter in the lake bed sediments
- Meetings with partners (Xcel Energy, National Park Service, U.S. Fish and Wildlife Service, WI Department of Natural Resources, American Birkebeiner Ski Foundation, Lumberjack World Championships Foundation, City of Hayward, snowmobiling clubs, LHPOA, Sawyer County
- Environmental / recreational concerns & protective measures
- Public notification

A 3' drawdown was done in April of 2004 for maintenance purposes. According to the 2013 APMP for Lake Hayward, a drawdown at this level would allow for adequate water to flow through the dam and downstream (8 cubic feet per second required to go through the dam and downstream). A drawdown of 3' would not cause any icing concerns to the dam structure or cause a shutdown of the power generating equipment.

Figure 22 – Drawdown Scenario Maps from 2013 APMP



Images copied from 2013 APMP

4.7 Biological Control

4.7.1 Insects

A native insect commonly known as the milfoil weevil (*Euhrychiopsis lecontei*) is a reasonable biological control agent for EWM. The native weevils lay eggs in the tips of milfoil plants. When the larvae hatch, they feed on the tips of the stem and burrow into the stem. Furthermore, adult weevils feed on leaves of milfoil plants. The weevils are native to Wisconsin and normally feed on northern watermilfoil (*Myriophyllum sibiricum*) but have demonstrated preference for EWM, even when native milfoil species are present (Solarz & Newman, 2001). It is not known whether native populations of weevils already exist in Lake Hayward. Stocking weevils has been done on other lakes, but whether they effectively control EWM depends on the ability for the weevil to survive in the introduced lake. They require natural shorelines for overwintering and seem to survive best in shallow milfoil beds (Jester, 1999). Furthermore, predation can be a major limiting factor in weevil survival, especially when high populations of sunfish (*Lepomis sp.,* including bluegill) are present (Ward & Newman, 2006). The 2021 electrofishing survey suggest that bluegill are relatively abundant and of good size with more than 10% over 8 inches long. Lake Hayward has a strong reputation as a bluegill fishery. Even so, it is entirely possible that native weevils are already present in the lake. If that is true, they may have been the reason for the fall in EWM density between 2013 and 2021. ***Using weevils to control EWM/HWM in Lake Hayward is possible. The first step would be to determine whether the native weevils are naturally present.***

Figure 23 – Milfoil Weevil

5.0 Management Strategy 2023-2027

5.1 Goal 1 – Provide educational opportunities pertaining to aquatic plants and aquatic invasive species.

Objective 1a: Organize two educational sessions that focus on AIS identification, manual removal, and/or APM in Lake Hayward.

- Include funding for educational events if grant applications are pursued for other activities. The grant funding request would need to occur the year before the education session.
- Work with Sawyer County AIS Coordinator, WDNR, and/or private consultant to provide instruction and presentations.

Objective 1b: Use the LHPOA website to disseminate information.

- Recruit a volunteer from LHPOA to serve as webmaster for the website.
- Post the updated APMP on the website.
- Include announcements pertaining to educational events and meetings.
- Post information about manual removal of aquatic plants. See language from Obj. 2a, which pertains to manual removal.

Table 4 – Goal 1 Implementation

Implementation of Goal #1								
Goals, Objectives, and Action Items		Entities Involved	2023	2024	2025	2026	2027	Surface Water Grant Eligible
1. Provide educational opportunities pertaining to aquatic plants and aquatic invasive species.								
1a	**Organize two educational sessions that focus on AIS identification, prevention, manual removal, and/or APM in Lake Hayward.**							Grant application costs not grant eligible. Costs for educational activities are grant eligible.
	Include funding for educational events as needed.	LHPOA, RP	X	X				
	Work with resource professional to provide instruction and presentations.	LHPOA, RP		X	X	X	X	Yes
1b	**Use the LHPOA website to disseminate information.**							Yes, volunteer time can be used as match.
	Recruit a volunteer from LHPOA to serve as webmaster.	LHPOA	X	X	X	X	X	
	Post updated APMP, announcements, & information about manual removal of plants.	LHPOA	X	X	X	X	X	Yes, volunteer time can be used as match.

LHPOA = Lake Hayward Property Owners Association. RP = Resource Professional. WDNR = Wisconsin Dept. of Natural Resources.

5.2 Goal 2 – Reduce beneficial use impairment caused by aquatic plants.

Although EWM was not causing beneficial use impairment in 2021, it was an issue in the past. Currently, beneficial use impairment is caused by native aquatic plants, mainly coontail and elodea.

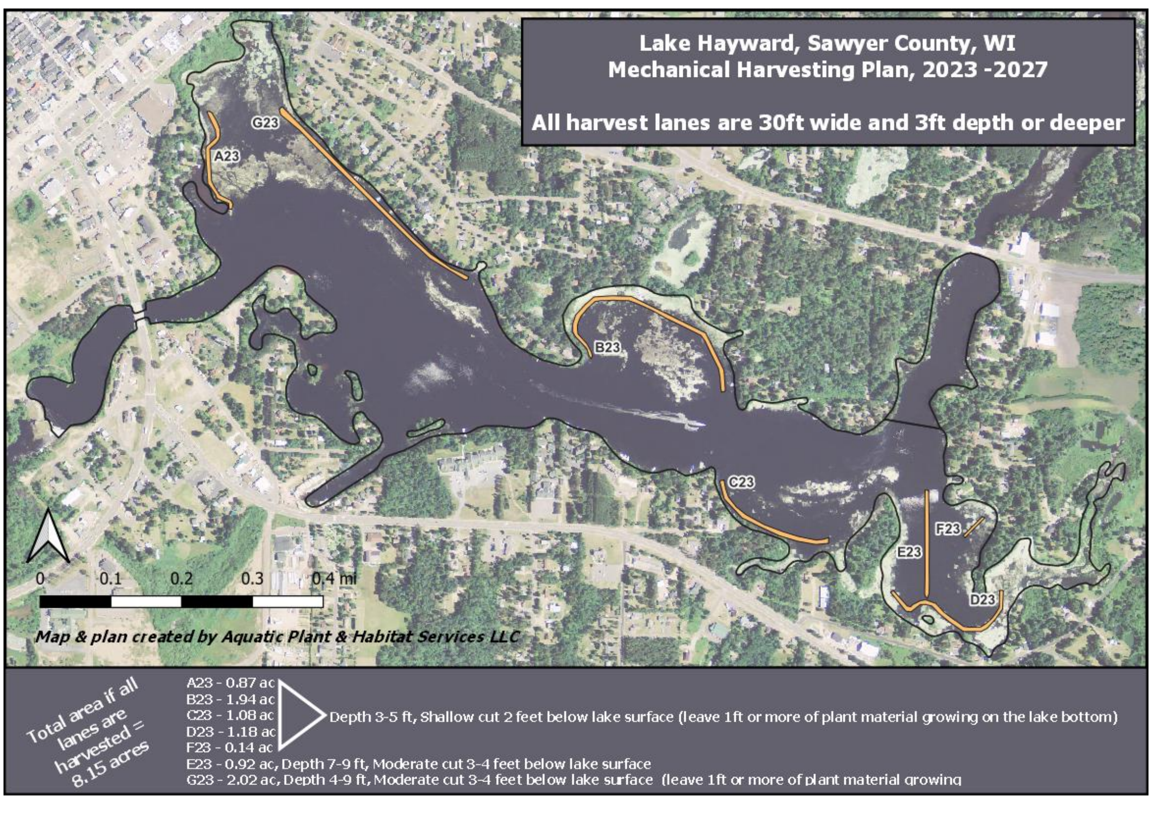
Objective 2a: Balance the manual removal of aquatic plants around docks with the goal of protecting the native plant community (Goal 3).

- Per Chapter NR109, native plant removal is allowed without a permit but limited to a single area with a maximum width of no more than 30 feet measured along the shoreline. All installed piers, boatlifts, swim rafts, and/or other recreational devices must be located within that 30-foot area. Property owners may remove the plants manually (not mechanically or chemically). This should only be done at a minimal level to meet the goal of protecting native plant species while also allowing for recreational use around docks (fishing, swimming, navigation). See Appendix C for tips on manual removal.

Objective 2b: Use mechanical harvest to open channels in bays with navigation impairment.

- Contact harvesting company to coordinate dates and contract details.
- Apply for a mechanical harvest permit from the WDNR in spring 2023. The harvesting company will assist or complete this task. The harvesting permit application must include, nonrefundable application fee $30 per acre up to $300 (to be paid by LHPOA), map of waterbody and control area (Figure 24), aquatic plant management plan, description of impairments caused by plants that are going to be harvested, description of plants to be removed, type of

Figure 24 – Mechanical Harvest Map



equipment and methods for removal, why harvesting was chosen, location of plant disposal, and name of harvesting company hired. Once a *completed* permit application is submitted, the WDNR has 15 days to decide on the permit application.

- Confirm navigation impairment in the harvest lanes mapped in Figure 24. This can be done by a LHPOA volunteer or resource professional. This step ensures LHPOA is only paying for harvesting in areas where it is truly needed.
- After permit approval, conduct harvesting during the summer of 2023.
- Disposal of plants will occur at the Town of Hayward shop building located at 15460W State Road 77E, Hayward, WI 54843. The main contact for questions or concerns is the Town of Hayward Road Supervisor.[5]
- Trained volunteer or resource professional should survey harvest areas for EWM occurrence.
- Mechanical harvest in 2023 should be considered a pilot project. If the following criteria are met after the 2023 harvesting pilot, the process can be considered for future years as needed (another possibly multi-year permit would be necessary).
    - Navigation impairment was alleviated for the summer.
    - Inspection by trained volunteers or natural resource professional suggests there is no increase in EWM growth in the harvested lanes.

Objective 2c: Consider the use of herbicide treatment if aquatic invasive plant occurrence is high and causing navigation impairment. Herbicide treatment is not an option for controlling native plants.

- This objective is activated ***only*** if EWM (or CLP) are causing beneficial use impairment. Determination of beneficial use impairment would occur with a bed survey of EWM and using criteria in Figure 25. Impairment by CLP is less likely and the survey would occur in late spring or early summer.
- Late August / early September EWM bed mapping survey would identify location, density, average depth, and surface area of EWM beds.
- LHPOA would coordinate a planning meeting in winter to identify which beds, if any, should be treated based on results of the bed mapping survey, which herbicide should be used, and strategy to prevent herbicide dispersal and dilution that occurred in 2013 (see Section 3.1.2). Partners would be invited.
- Apply for herbicide treatment permit if appropriate based on the meeting.
- Pre-treatment sub point-intercept survey of beds to be treated would occur within a week before treatment.
- Herbicide treatment would likely occur in late spring.
- Post-treatment sub point-intercept survey to measure efficacy of treatment would occur in late summer or early fall.

[5] At the time of writing this plan, the contact is Brett Briggs, tohroadsup@cheqnet.net, 715-634-5410.

Figure 25 – Eurasian Watermilfoil Control Guidance

Criteria for Prioritizing Eurasian Watermilfoil Control

SIZE	DENSITY	TRAFFIC	IMPAIRMENT	HABITAT	SURVEY DATA
•Is the bed size >0.25 acres (10,890 sq ft)?	•Is EWM considered dominant or highly dominant? •Is EWM rake fullness >2 on average?	•Is the EWM in an area of high boat traffic where fragmentation of the EWM is a concern?	•Is this bed of EWM causing beneficial use impairment? (aquatic plants prevent activities such as angling, boating, swimming, or other navigation /recreation)	•Is EWM the dominant species to the detriment of native plant species? •Would the proposed treatment have limited impact on native plants.	•Has an EWM bed survey been completed to document location, size, density, and height? •Are pre-post treatments planned? •Is herbicide monitoring planned?

HOW TO USE THESE CRITERIA – Answer the 6 questions for a particular bed of EWM or the entire lake depending on EWM occurrence. If the answer is "yes" for most questions (ideally 4 or more), then that bed of EWM may be considered high priority for control actions. For beds of EWM with fewer "yes" answers, control actions can still be considered but perhaps that area is not the highest priority. This graphic is meant to help the LHPOA prioritize where control actions should take place in any given year. Areas that do not receive attention in a given year may be considered higher priority the following year.

Objective 2d - The LHPOA will coordinate a planning meeting each winter relating to plant control and monitoring.

- Because the harvesting of native aquatic plants is a new activity for Lake Hayward, the LHPOA will meet annually, ideally in winter, to determine monitoring and control efforts needed for the next growing season based on results of monitoring and control efforts from the last growing season. This meeting can be virtual.
- Partners will be invited to the annual meeting. (WDNR, Sawyer Co., City of Hayward, American Birkebeiner Ski Foundation, Lumberjack World Championships Foundation, Xcel Energy, and National Park Service).
- Annual monitoring of harvested lanes by trained volunteers or natural resource professionals will help guide future management efforts. If there is greater EWM growth in harvested lanes, continued use of mechanical harvest should be reevaluated.

Objective 2e – Plan for future surveys.

- Whole-lake aquatic plant surveys are recommended every five years. The next survey would be in 2026. The plant survey cost in 2021 was $4,355.
- If there are issues related to curly-leaf pondweed causing navigation impairment in late spring or early summer, an early-season whole-lake survey would be needed to plan for management of CLP which could include mechanical harvest and possibly herbicide treatment although the latter is less likely.
- For the aquatic plant survey in 2026, allocate funding to look for native weevil occurrence (likely $500 or less). If native EWM weevils are present, it might help explain the natural decline of EWM density that occurred between 2013 and 2021. Furthermore, protecting native weevils and their habitat would be recommended as a no-cost and lasting control method for EWM.

Table 5 – Goal 2 Implementation

Implementation of Goal #2								
	Goals, Objectives, and Action Items	Entities Involved	2023	2024	2025	2026	2027	Surface Water Grant Eligible
2. Reduce beneficial use impairment caused by aquatic plants.								
2a	**Balance the manual removal of aquatic plants around docks with the goal of protecting the native plant community.**							Manual removal of native aquatic plants not eligible for surface water grants.
	Manually remove aquatic plants at a minimal level to allow for recreation around docks but also protect native plant species.	LHPOA	X	X	X	X	X	
2b	**Use mechanical harvest to open channels in bays with navigation impairment.**							Mechanical harvest of native aquatic plants not eligible for surface water grants. Cost of survey is grant eligible. Volunteer time can be used as match.
	Contact harvesting company and apply for harvesting permit.	LHPOA, HC	X	X	X	X	X	
	Confirm navigation impairment exists in areas planned for mechanical harvest.	LHPOA	X	X	X	X	X	
	Resource professional or trained volunteer survey harvested areas for increased EWM growth.	LHPOA, RP	X	X	X	X	X	
	Continue mechanical harvest after 2023 if navigation impairment is alleviated and EWM does not increase in harvested lanes.	LHPOA or RP		X	X	X	X	
2c	**Consider the use of herbicide treatment if EWM is in high occurrence and causing navigation impairment.**							
	Confirm beneficial use impairment is being caused primarily by EWM.	RP, WDNR, or CO	Years when EWM is thought to be the primary cause of impairment.					Any monitoring and planning activities contracted out will be grant eligible. Control activities may be grant eligible depending on the type of activity.
	Late summer EWM bed mapping survey.	RP, WDNR, or CO						
	Coordinate planning meeting in winter.	LHPOA (invite partners)						
	Apply for herbicide treatment permit if appropriate.	LHPOA						
	Complete pre-post treatment surveys and herbicide treatment.	RP						
2d	**The LHPOA will coordinate an annual planning meeting relating to plant control and monitoring.**							
	Meet annually to evaluate mechanical harvest activities that summer. Invite partners.	LHPOA	X	X	X	X	X	Yes
2e	**Plan for and conduct future surveys.**							
	Plan for a whole-lake aquatic plant survey in 2026 and look for native weevil occurrence during that survey.	LHPOA, RP	X	X	X	X	X	Yes

LHPOA = Lake Hayward Property Owners Association. RP = Resource Professional. HC = Harvesting Company. WDNR = Wisconsin Dept. of Natural Resources. CO = Sawyer County

5.3 Goal 3 – Protect native aquatic plants, organisms, and associated native mammal and fish populations.

Objective 3a: Avoid impacts to native plants when controlling AIS.

- Follow the herbicide label for concentration if herbicide control is used. A licensed herbicide applicator is required and will understand these guidelines.
- Work closely with the WDNR to target treatment timing that will be least impactful to native aquatic plant species and fish, particularly fish in the embryonic and larval life stages.
- Do not treat an area more than once every 2+ years. Repeat treatments in the same site exacerbate the threat to non-target native plants and organisms and therefore should not be considered.

Objective 3b: Minimize the manual removal of native plants for navigation and recreation.

In some instances, native aquatic plants can hinder recreational activities along shore. Property owners can remove some native plants but there are restrictions under Wisconsin Administrative Code, Chapter NR109 and more detail on this code is described in Section 4.4.1 and Objective 2a.

- This should only be done at a minimal level to meet the goal of protecting native plant species while also allowing for recreational use around docks (fishing, swimming, navigation). See tips on manual removal in Appendix C.

Table 6 – Goal 3 Implementation

<table>
<tr><th colspan="9">Implementation of Goal #3</th></tr>
<tr><th colspan="2">Goals, Objectives, and Action Items</th><th>Entities Involved</th><th>2023</th><th>2024</th><th>2025</th><th>2026</th><th>2027</th><th>Surface Water Grant Eligible</th></tr>
<tr><td colspan="9">3. Protect native aquatic plants, organisms, and associated native mammal and fish populations.</td></tr>
<tr><td>3a</td><td colspan="7">Avoid impacts to native plants when controlling AIS.</td><td rowspan="2">NA</td></tr>
<tr><td></td><td>Follow the herbicide label guidelines for concentration.</td><td>RP</td><td colspan="5" rowspan="3">If herbicide is ever used to control EWM</td></tr>
<tr><td></td><td>Use herbicides when they are least impactful to native aquatic plants and fish in the embryonic and larval life stages.</td><td>HLPOA, RP, WDNR</td><td>NA</td></tr>
<tr><td></td><td>Do not treat an area more than once every 2+ years.</td><td>HLPOA, RP, WDNR</td><td>NA</td></tr>
<tr><td>3b</td><td colspan="7">Minimize the manual removal of native plants for navigation and recreation.</td><td rowspan="2">NA</td></tr>
<tr><td></td><td>Property owners may remove the plants manually (not mechanically or chemically) at a minimal level to meet the goal of protecting native plant species.</td><td>Riparians</td><td colspan="5">As needed</td></tr>
</table>

LHPOA = Lake Hayward Property Owners Association. RP = Resource Professional. WDNR = Wisconsin Dept. of Natural Resources.

5.4 Goal 4 – Protect water quality.

Trophic state and water quality are used interchangeably and while the two are related, they are not the same. Trophic state describes the biological condition of a lake using a scale that is based on measurable criteria. Water quality is a more subjective descriptor of a lake's condition based on the observer's use of the lake (see Section 1.4 for more detail). The clear, brown-stained, water is a result of low-to-moderate nutrient levels in the lake and maintaining this level is important.

Objective 4a: Launch citizen-based water quality monitoring.

There are only 2 years of water quality monitoring (1999 and 2014). Ongoing water quality monitoring is needed.

- LHPOA recruit a volunteer to become trained with the Citizen Lake Monitoring Network of Wisconsin. This volunteer will measure water clarity and take water samples for phosphorus and chlorophyll three or more times each year.

Objective 4b: Promote riparian practices that protect water quality.

Lake water quality/clarity can be linked to property values. Water clarity is directly impacted by surface water runoff of lakeshore properties (see Section 1.3 for more information).

- Educate lakeshore residents about shoreland practices that protect the lake and about Healthy Lakes grant opportunities. Post a link to the Healthy Lakes program on the LHPOA website.
- The LHPOA will aim to recruit 5 lake residents to install Healthy Lakes Practices on their property. Practices could include allowing a 10- foot vegetative buffer to grow along the shoreline, a 350 square-foot native plant shoreline buffer, water diversion, rock infiltration, or rain garden. Detailed fact sheets and technical guidance at https://healthylakeswi.com/best-practices/.

Table 7 – Goal 4 Implementation

Implementation of Goal #4								
	Goals, Objectives, and Action Items	Entities Involved	2023	2024	2025	2026	2027	Surface Water Grant Eligible
4. Launch Citizen-based Monitoring in Lake Hayward.								
4a	**Launch citizen-based water quality monitoring.**							NA
	Recruit a volunteer to become trained and active in the Citizen Lake Monitoring Network.	LHPOA	X	X	X	X	X	
4b	**Promote riparian practices that protect water quality.**							Yes
	Educate lakeshore residents about shoreland practices that protect the lake and about Healthy Lakes grant opportunities to help fund these projects.	LHPOA	X	X	X	X	X	
	Aim to have lakeshore residents complete restoration practices on their shoreline.	LHPOA	X	X	X	X	X	Yes

LHPOA = Lake Hayward Property Owners Association.

5.5 Goal 5 – Prevent the introduction of additional aquatic invasive species.

Objective 5a. Conduct watercraft inspections.

- Apply for grant funds annually to hire watercraft inspectors.
- Participate in the Drain Campaign around Memorial Day weekend. Watercraft inspectors share the message with anglers to drain livewells and ice their catch, which helps prevent the spread of invasive species. Transporting water can contribute to the spread of invasive species because some disease, animals and plants can get caught in motors, livewells and buckets. The WDNR offers education materials to help share the message.
- Participate in the Landing Blitz, which is a statewide effort every fourth-of-July weekend to remind boaters to stop the spread of aquatic invasive species.

Objective 5b: Install and maintain a decontamination station to support the Sawyer County Decontamination Ordinance.

- Apply for grant funds to install a decontamination station at the boat landing. A decontamination station means a device provided at a public or private lake access to remove all potential invasive species. It may consist of high temperature water applied with a pressure washer, a recommended chemical solution applied with a low-pressure washer, or other techniques or devices. The primary reason for decontamination is to reduce the risk of transporting the zebra mussel larvae.
- Recruit a volunteer to maintain the station with bleach solution.

Table 8 – Goal 5 Implementation

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Implementation of Goal #5								
Goals, Objectives, and Action Items		Entities Involved	2023	2024	2025	2026	2027	Surface Water Grant Eligible
5. Prevent the introduction of additional aquatic invasive species.								
5a	**Conduct watercraft inspections.**							LHPOA pays for grant application if contracted out.
	Apply for Clean Boats Clean Waters grant.	LHPOA	X	X	X	X	X	
	Workers/volunteers become trained for watercraft inspections.	LHPOA, CO						
	Participate in the Drain Campaign and Landing Blitz.	LHPOA	X	X	X	X	X	Yes
5b	**Install and maintain a decontamination station to support the Sawyer County Decontamination Ordinance.**							
	Apply for grant funds to install a decontamination station at the boat landing.	LHPOA	X	X				LHPOA pays for grant application if contracted out.
	Recruit a volunteer to maintain the station.	LHPOA	X	X	X	X	X	Volunteer time can be used as grant match.

LHPOA = Lake Hayward Property Owners Association. CO = Sawyer County

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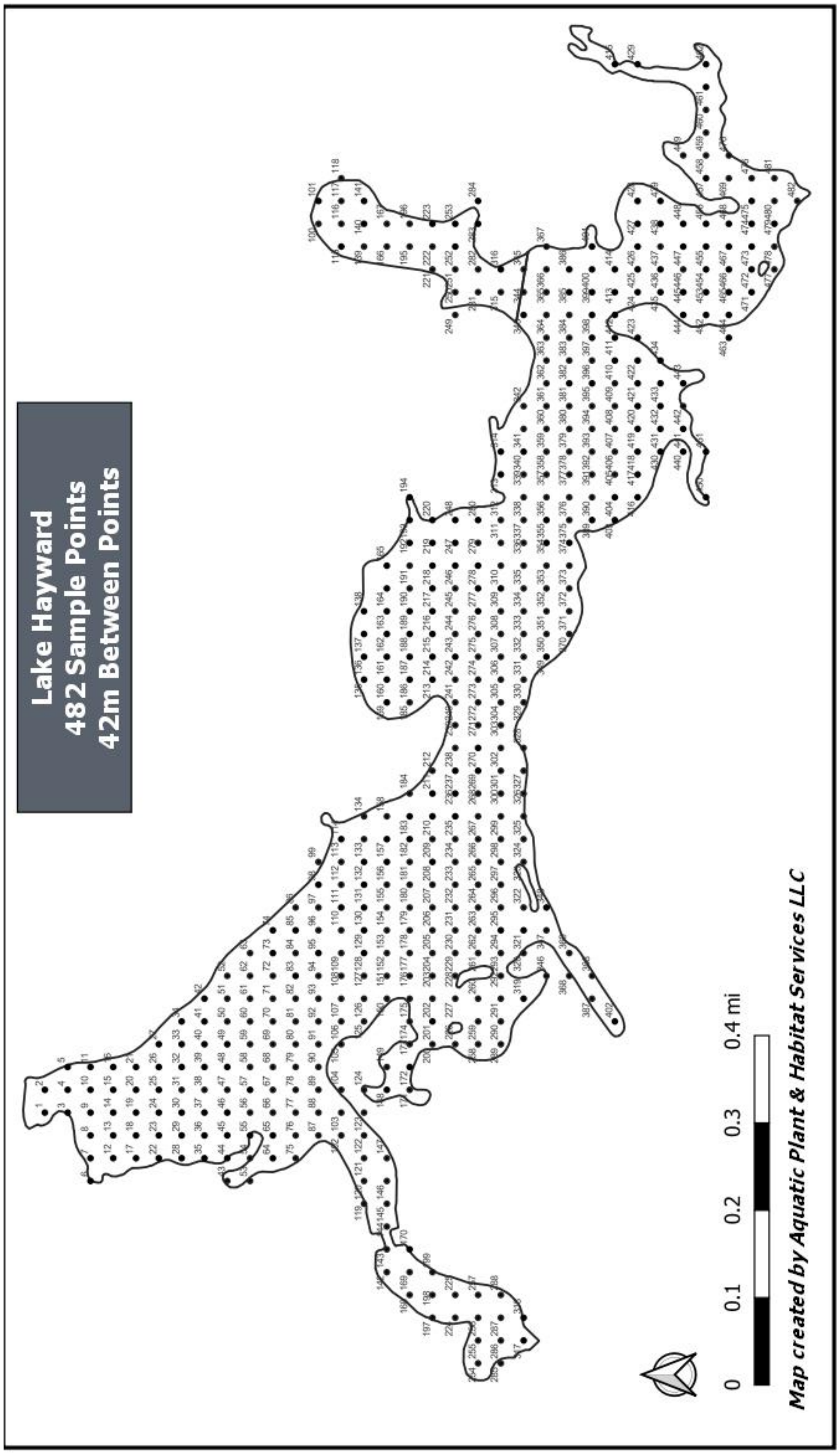
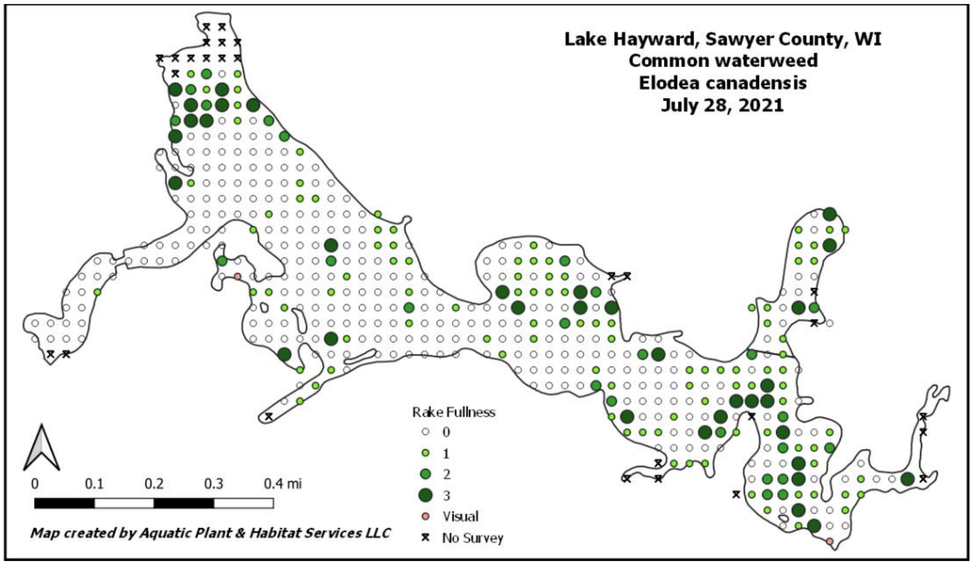
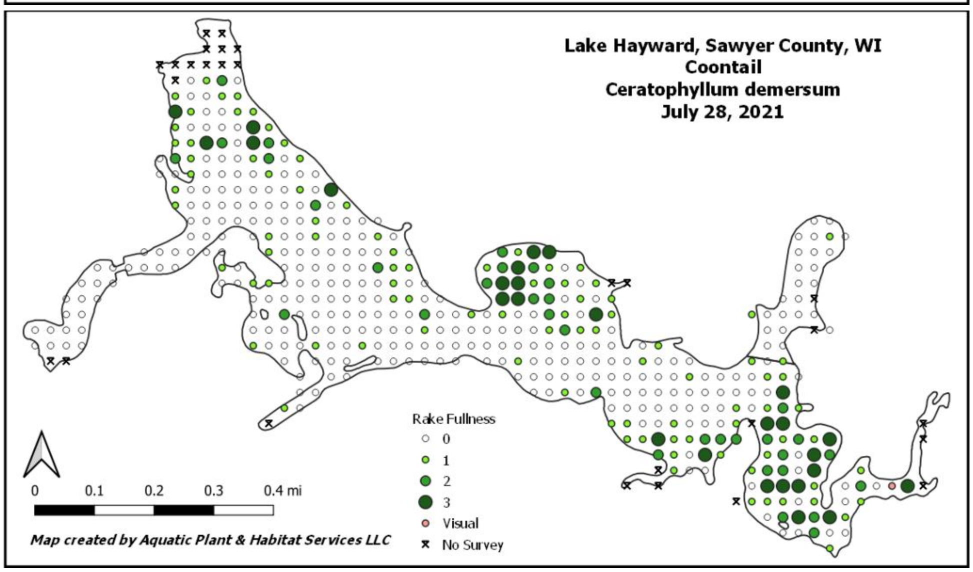
7.0 Appendix

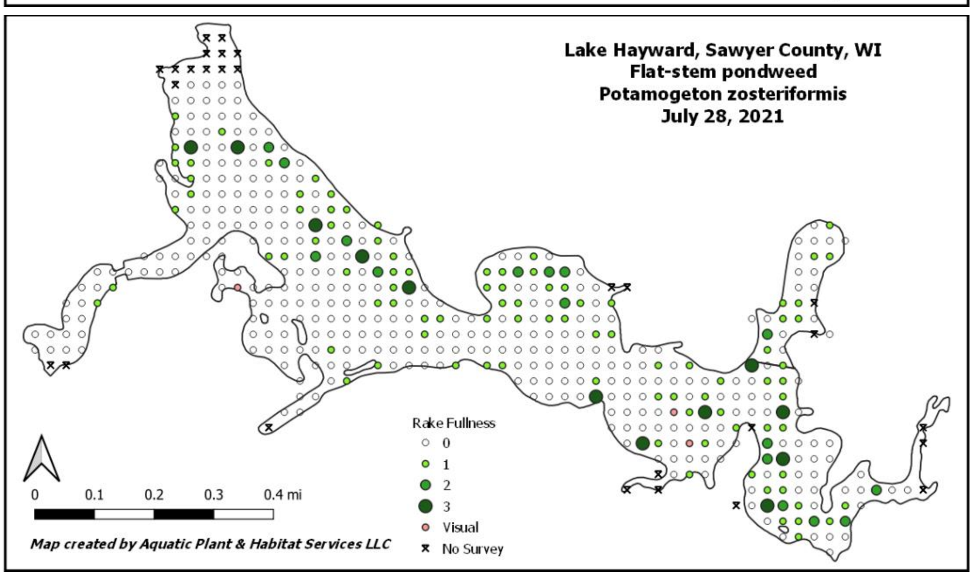
7.1 Appendix A – Lake Hayward Aquatic Plant Survey Grid

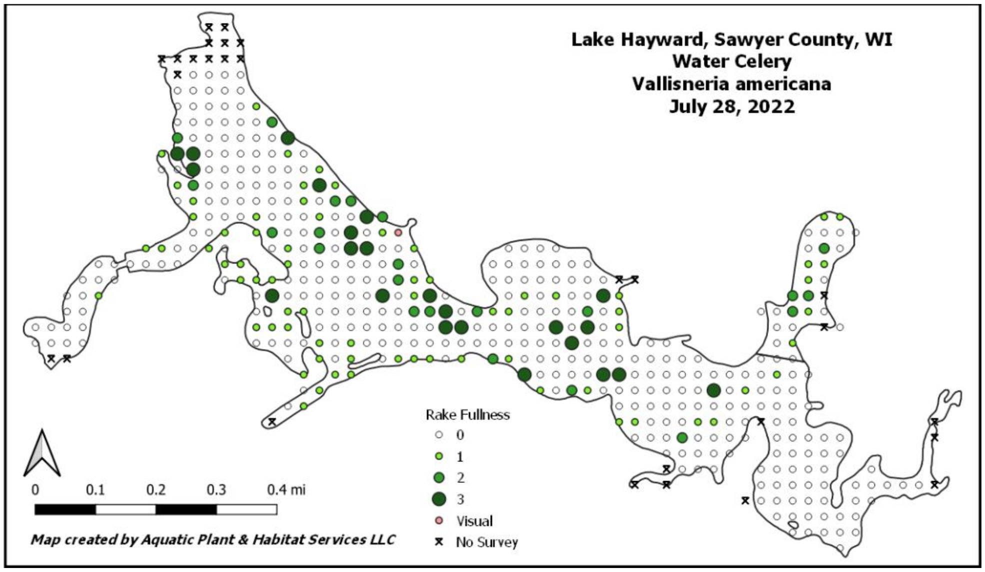


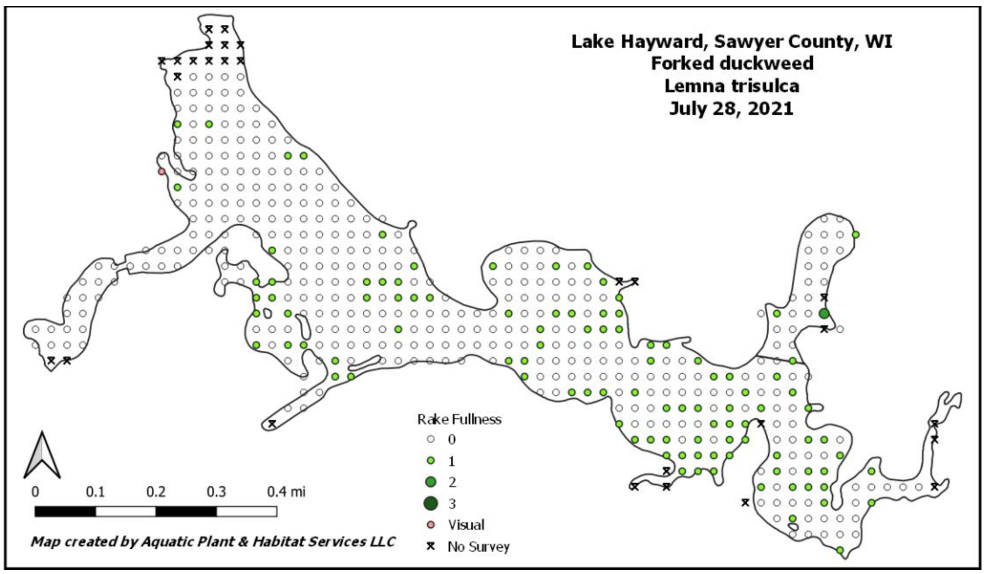
7.2 Appendix B – Lake Hayward Aquatic Plant Species Maps

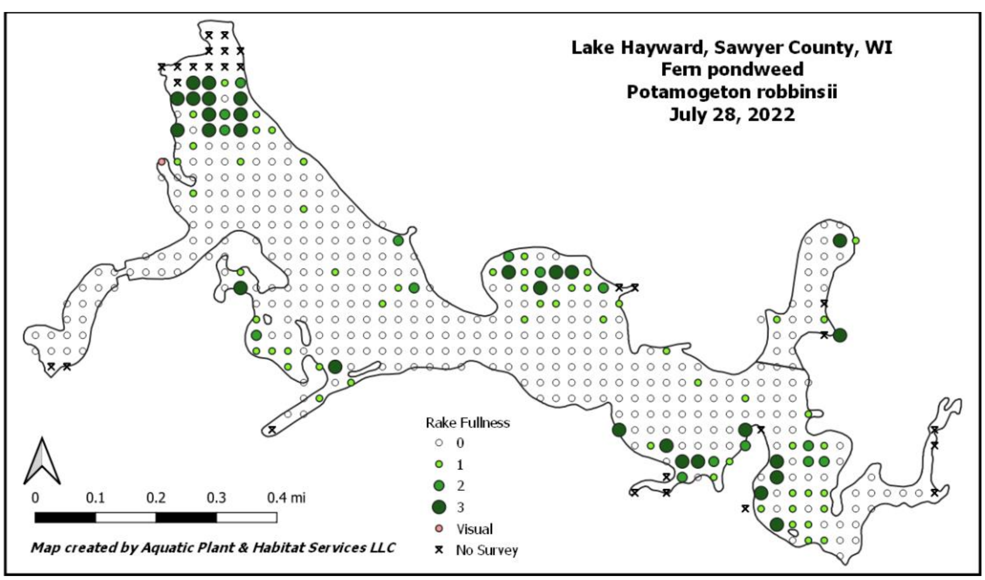


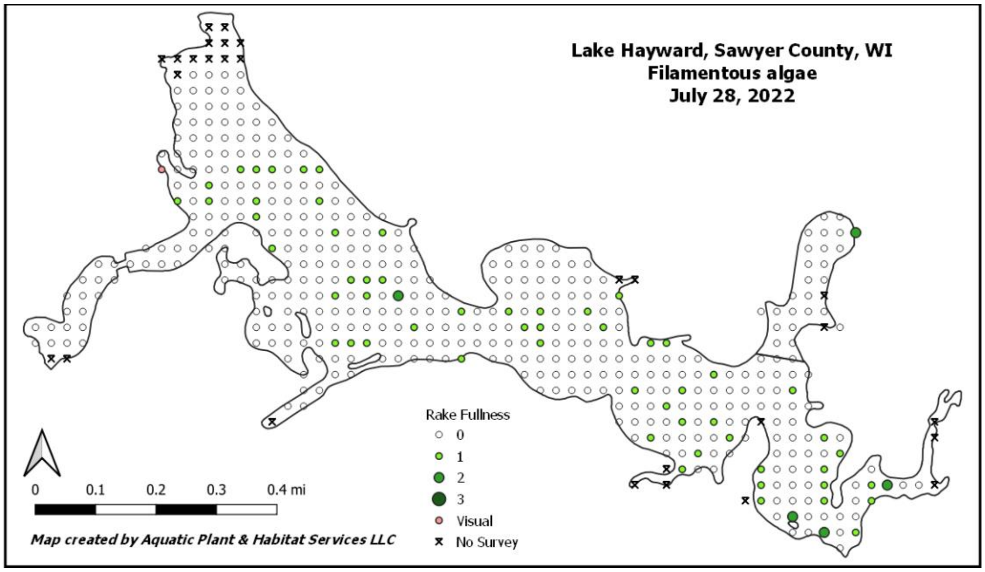


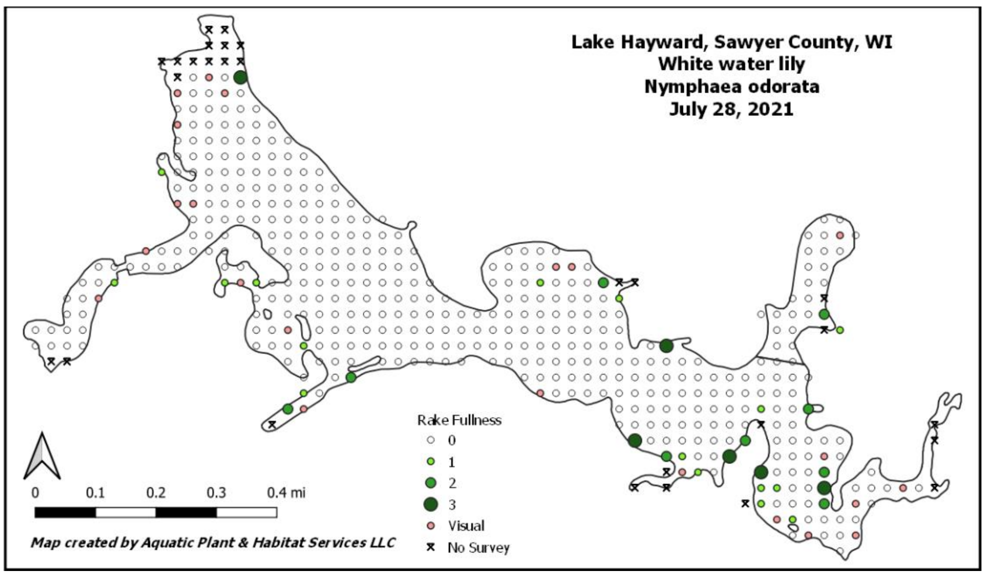


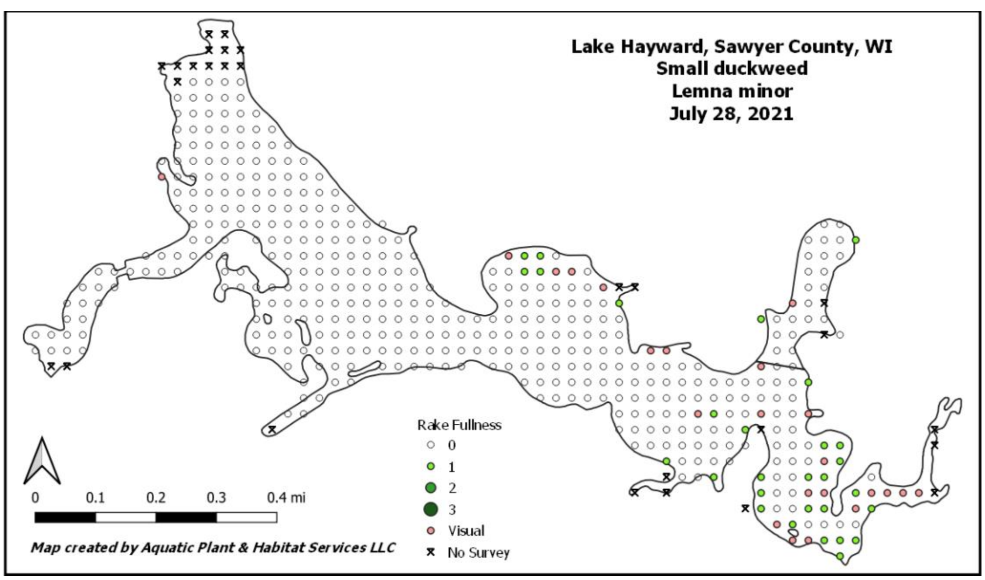

Lake Hayward, Sawyer County, WI
Water Celery
Vallisneria americana
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0
0.1
0.2
0.3
0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

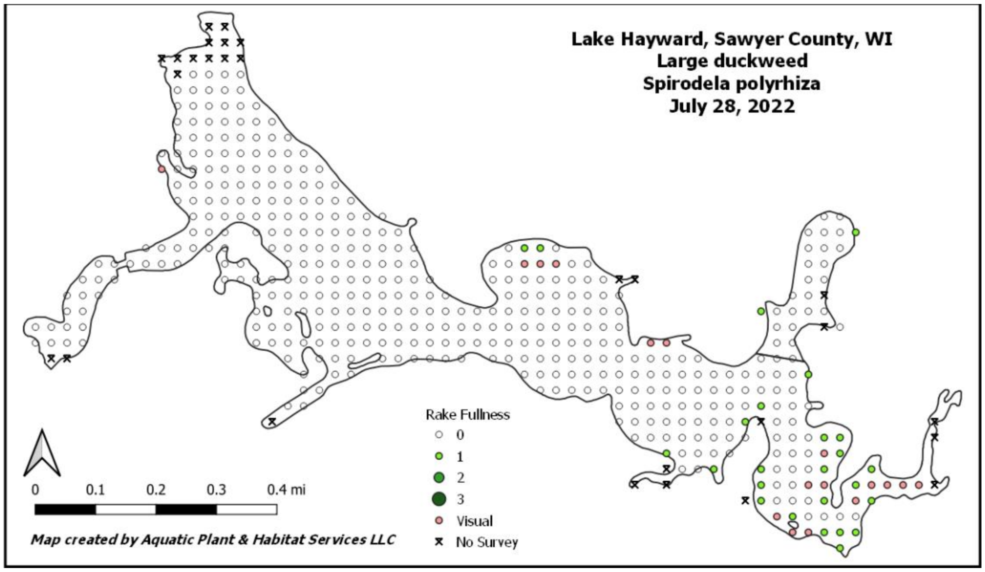

Lake Hayward, Sawyer County, WI
Forked duckweed
Lemna trisulca
July 28, 2021
Rake Fullness
0
1
2
3
Visual
No Survey
0
0.1
0.2
0.3
0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

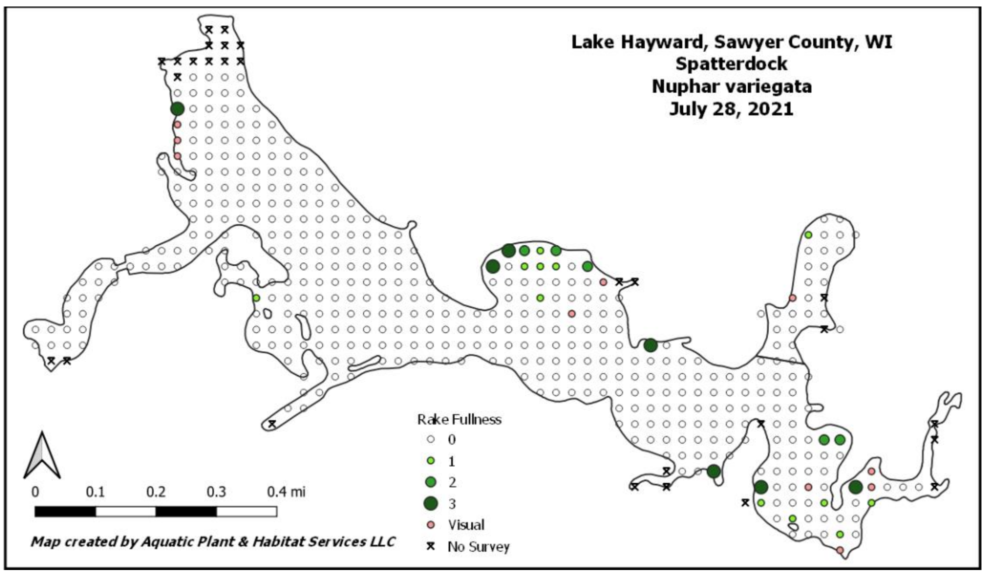

Lake Hayward, Sawyer County, WI
Fern pondweed
Potamogeton robbinsii
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0
0.1
0.2
0.3
0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

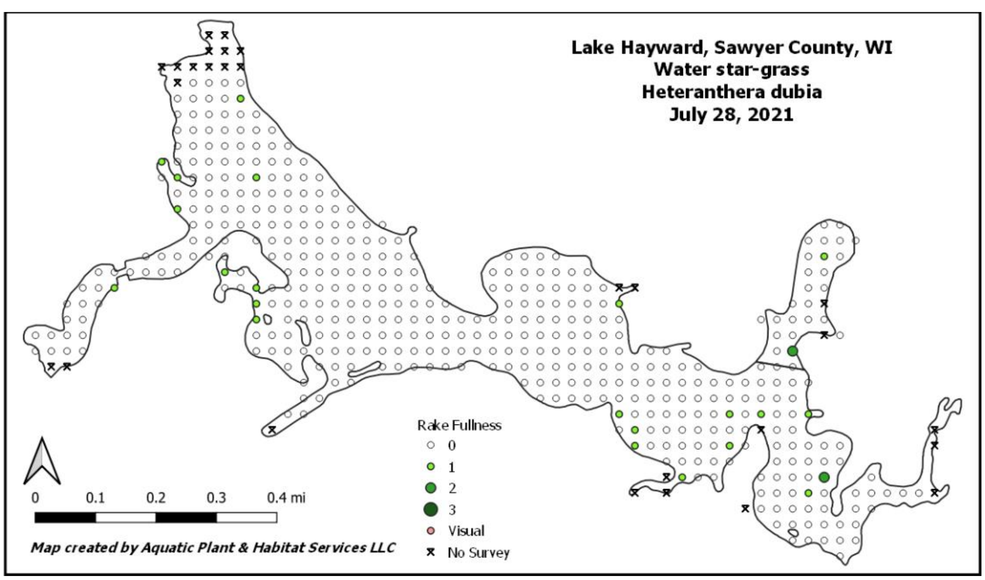

Lake Hayward, Sawyer County, WI
Filamentous algae
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

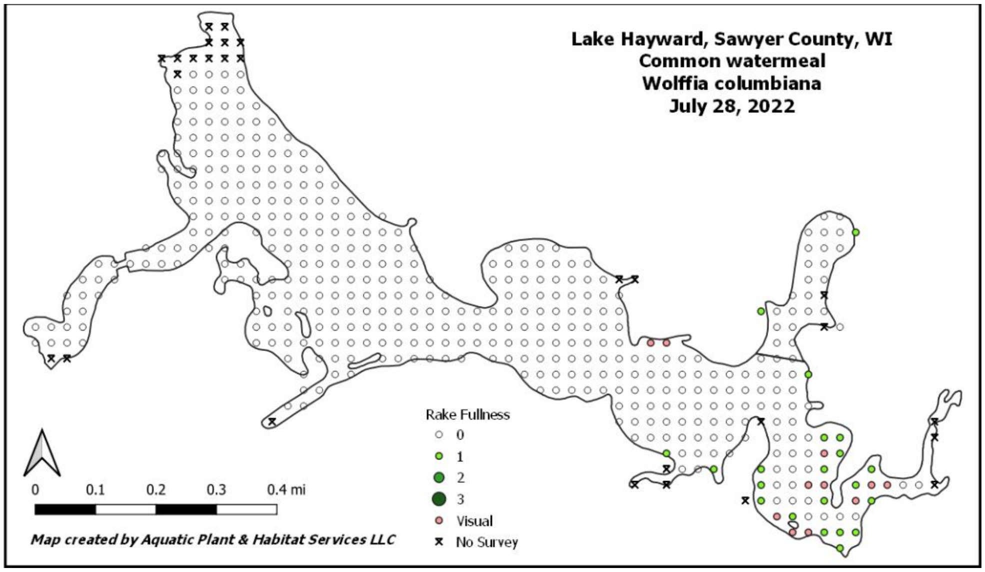

Lake Hayward, Sawyer County, WI
White water lily
Nymphaea odorata
July 28, 2021
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC


Lake Hayward, Sawyer County, WI
Small duckweed
Lemna minor
July 28, 2021
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

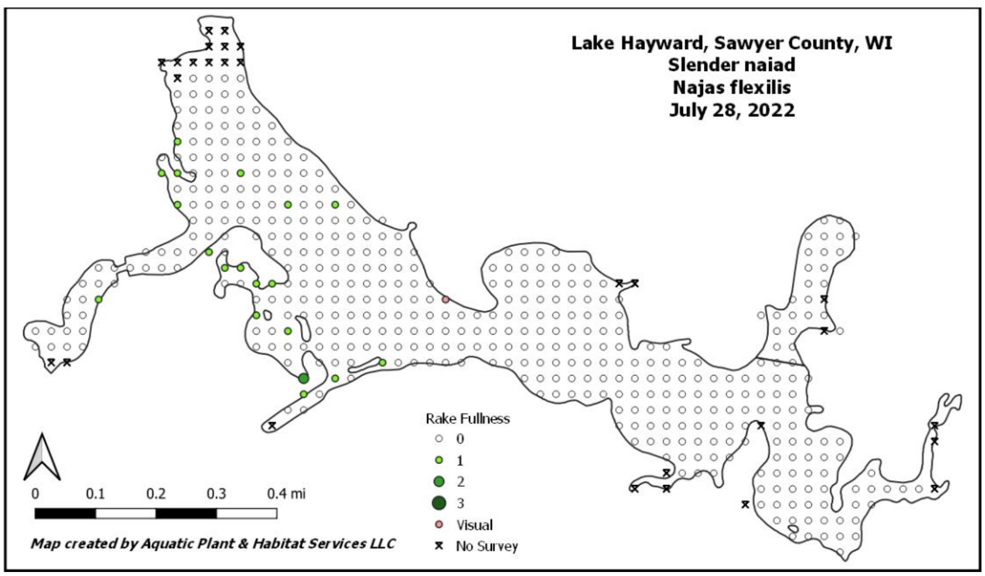

Lake Hayward, Sawyer County, WI
Large duckweed
Spirodela polyrhiza
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC


Lake Hayward, Sawyer County, WI
Spatterdock
Nuphar variegata
July 28, 2021
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

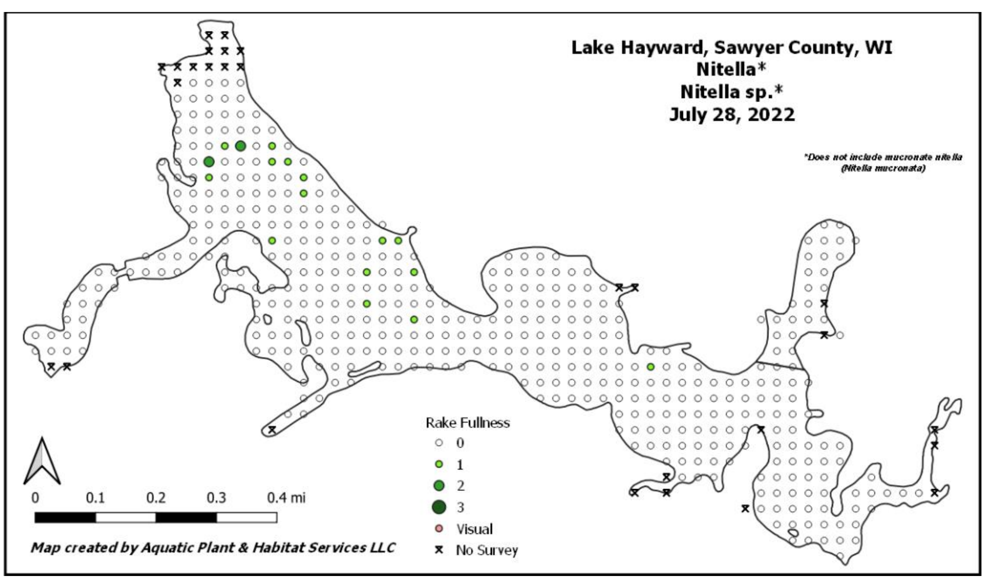

Lake Hayward, Sawyer County, WI
Water star-grass
Heteranthera dubia
July 28, 2021
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC



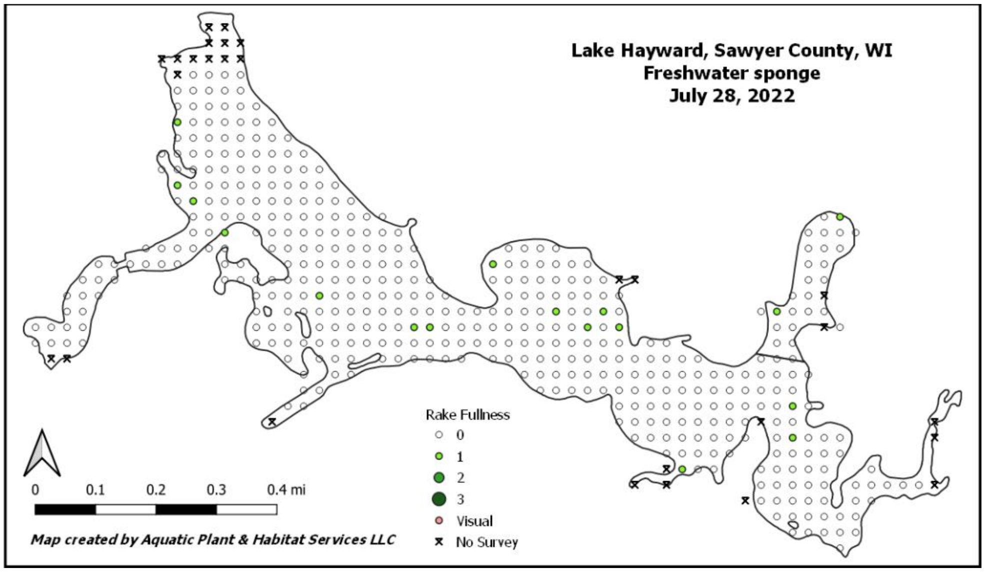
Lake Hayward, Sawyer County, WI
Common watermeal
Wolffia columbiana
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

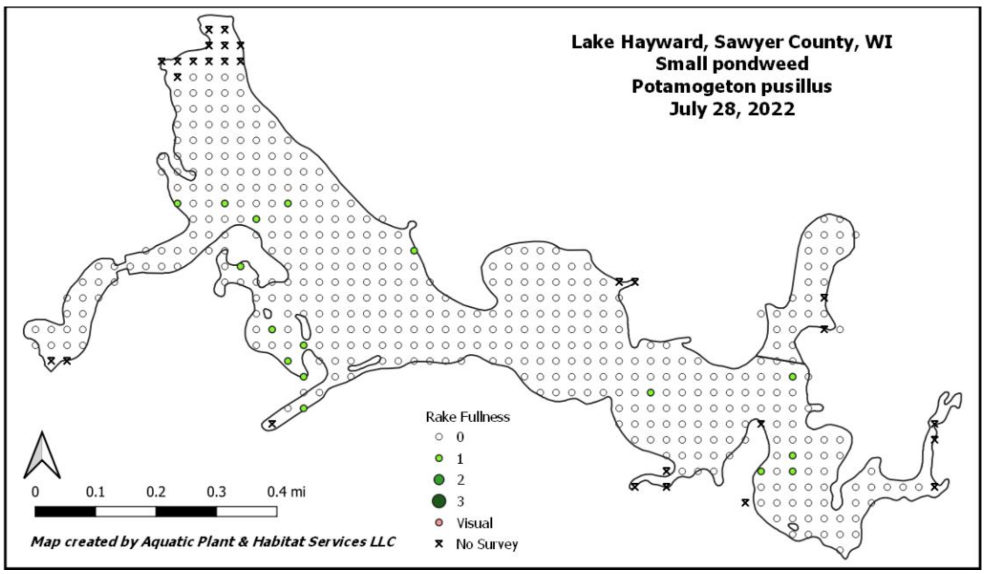


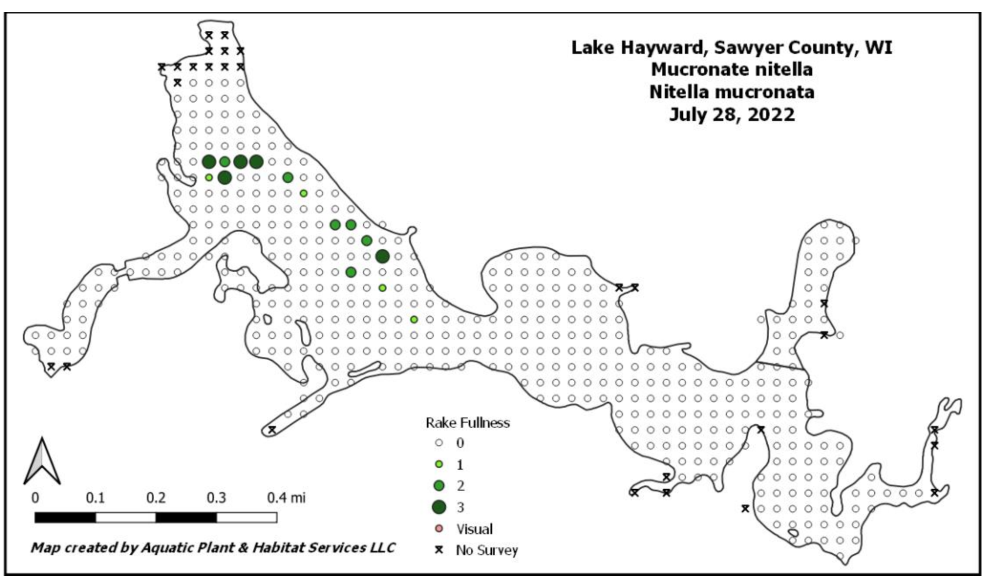
Lake Hayward, Sawyer County, WI
Slender naiad
Najas flexilis
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

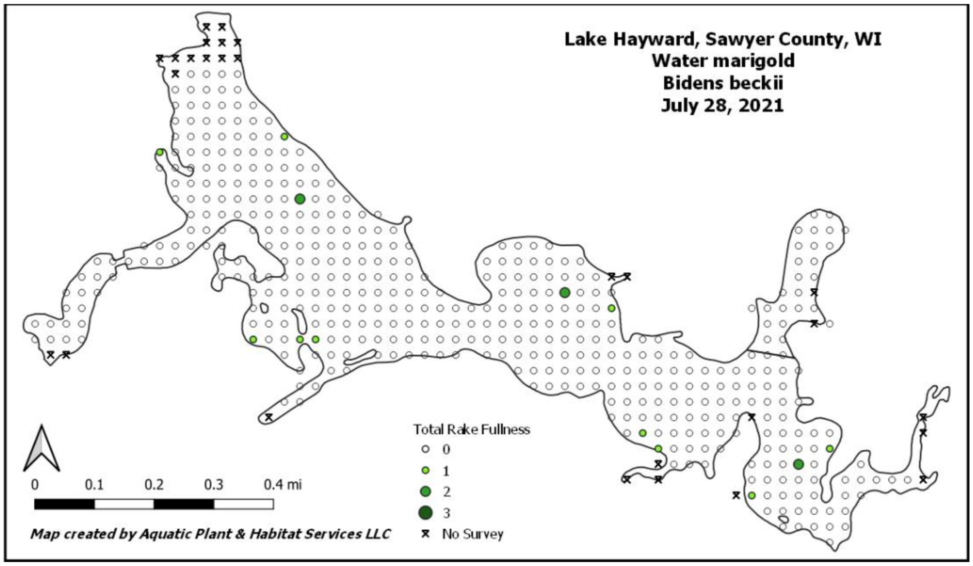


Lake Hayward, Sawyer County, WI
Nitella*
Nitella sp.*
July 28, 2022
*Does not include mucronate nitella (Nitella mucronata)
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

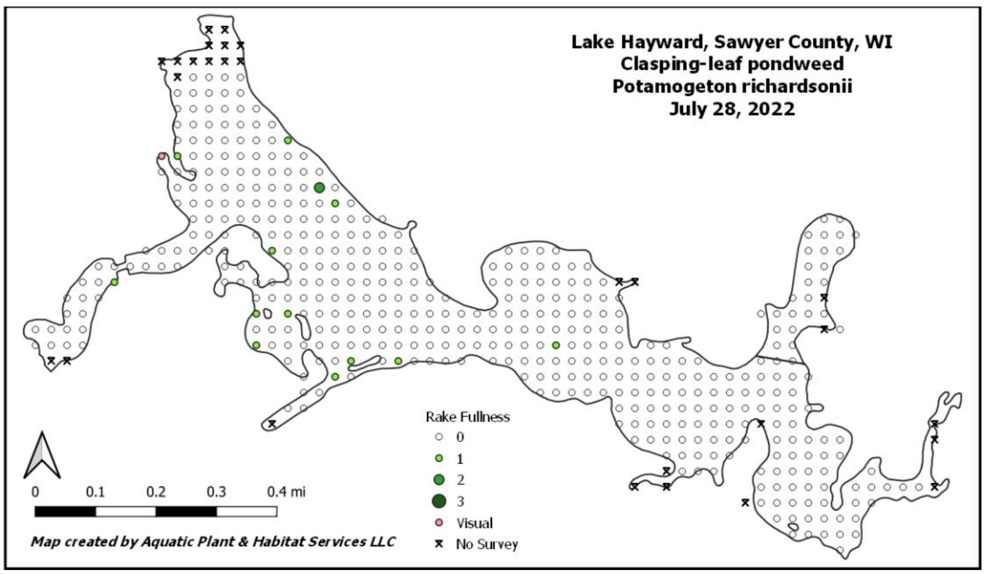

Lake Hayward, Sawyer County, WI
Freshwater sponge
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0
0.1
0.2
0.3
0.4 mi
Map created by Aquatic Plant & Habitat Services LLC


Lake Hayward, Sawyer County, WI
Small pondweed
Potamogeton pusillus
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0
0.1
0.2
0.3
0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

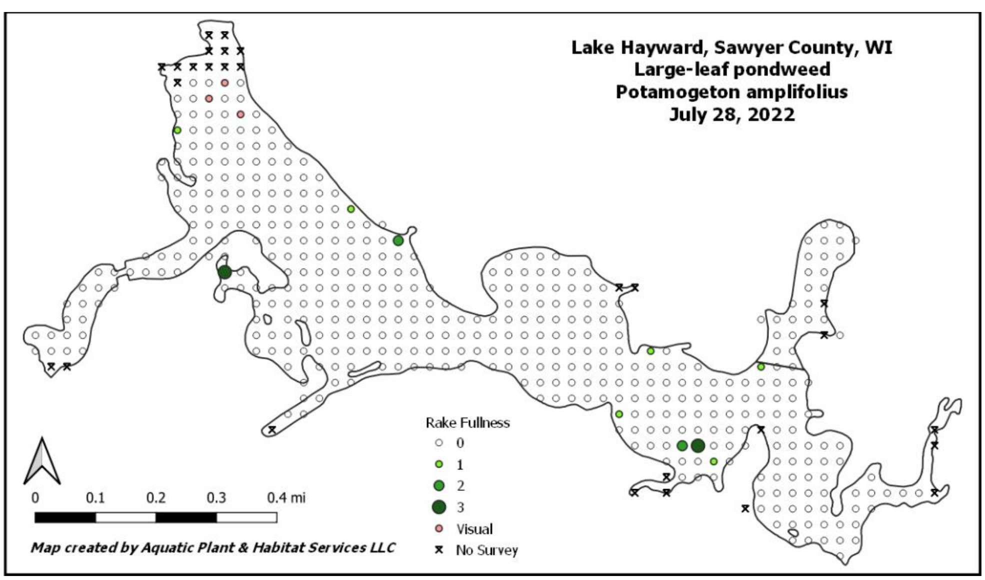

Lake Hayward, Sawyer County, WI
Mucronate nitella
Nitella mucronata
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0
0.1
0.2
0.3
0.4 mi
Map created by Aquatic Plant & Habitat Services LLC



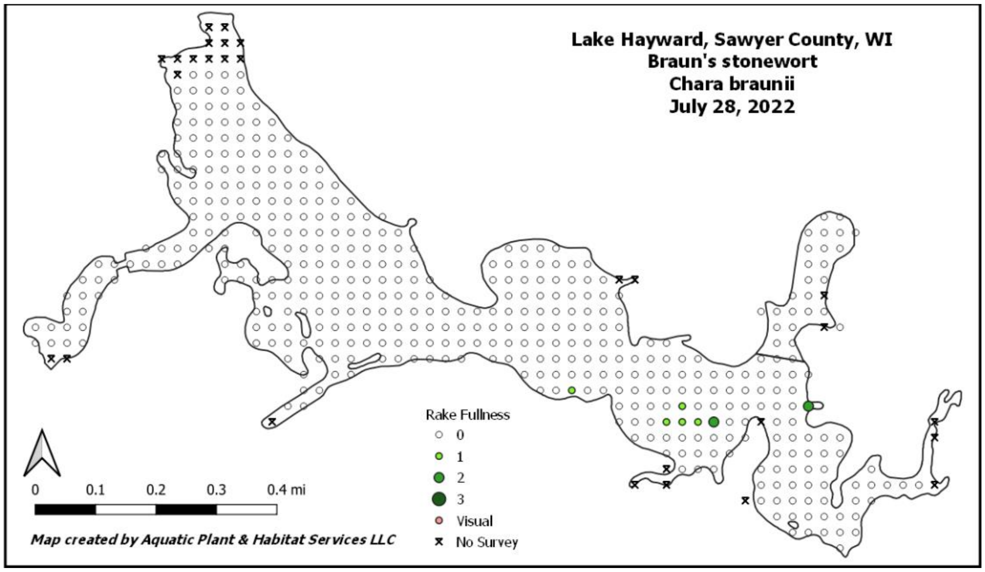
Lake Hayward, Sawyer County, WI
Water marigold
Bidens beckii
July 28, 2021
Total Rake Fullness
0
1
2
3
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC



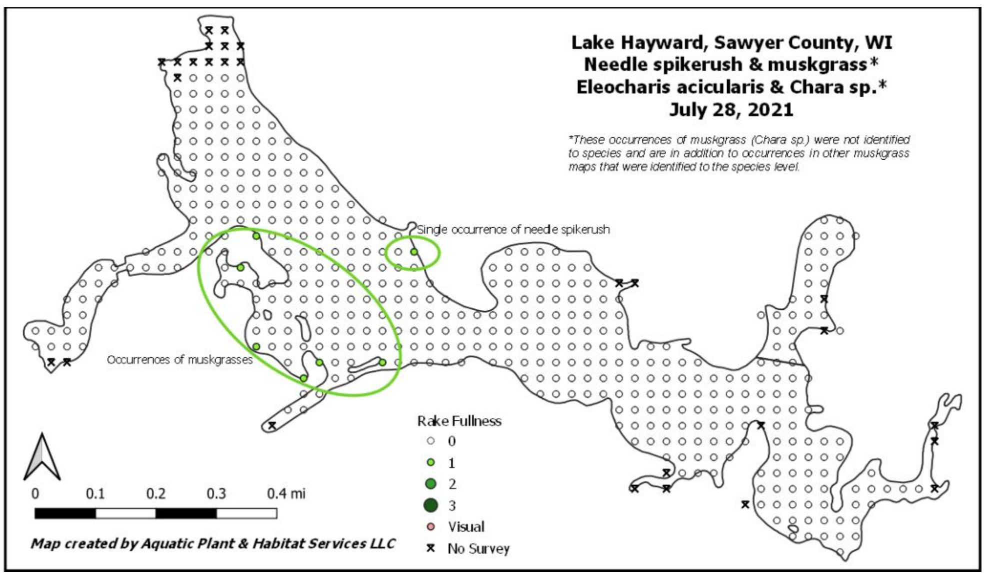
Lake Hayward, Sawyer County, WI
Clasping-leaf pondweed
Potamogeton richardsonii
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC



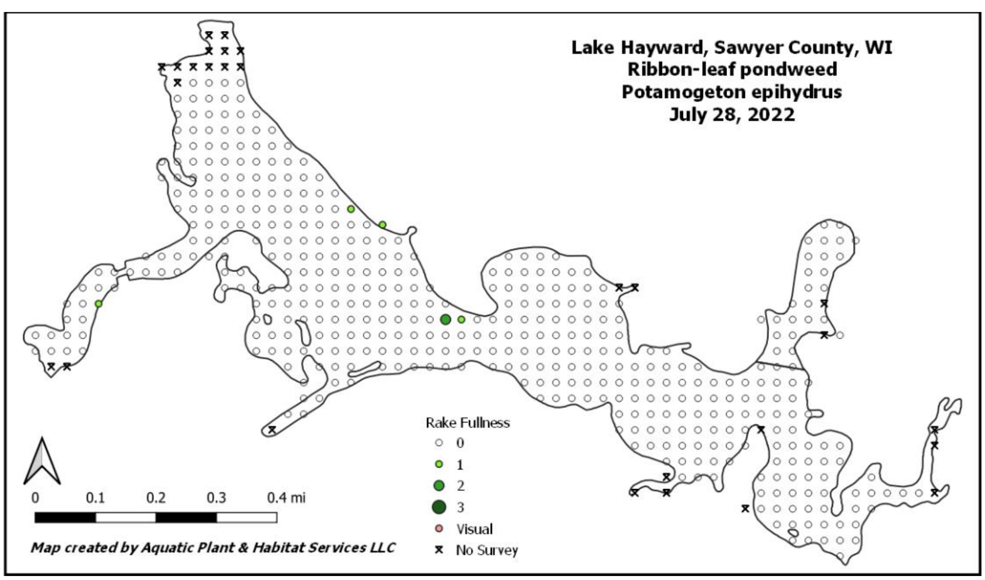
Lake Hayward, Sawyer County, WI
Large-leaf pondweed
Potamogeton amplifolius
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC



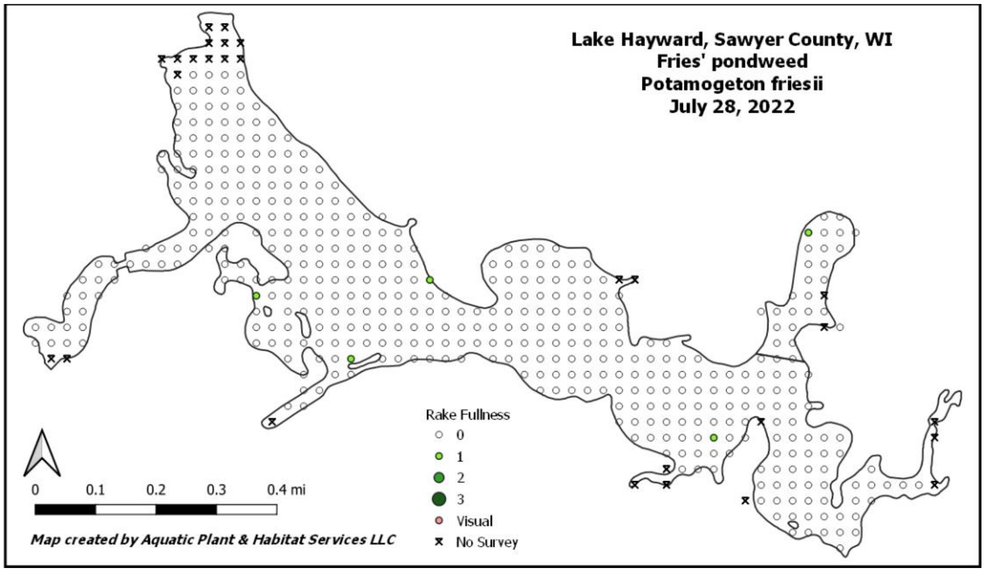
Lake Hayward, Sawyer County, WI
Braun's stonewort
Chara braunii
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

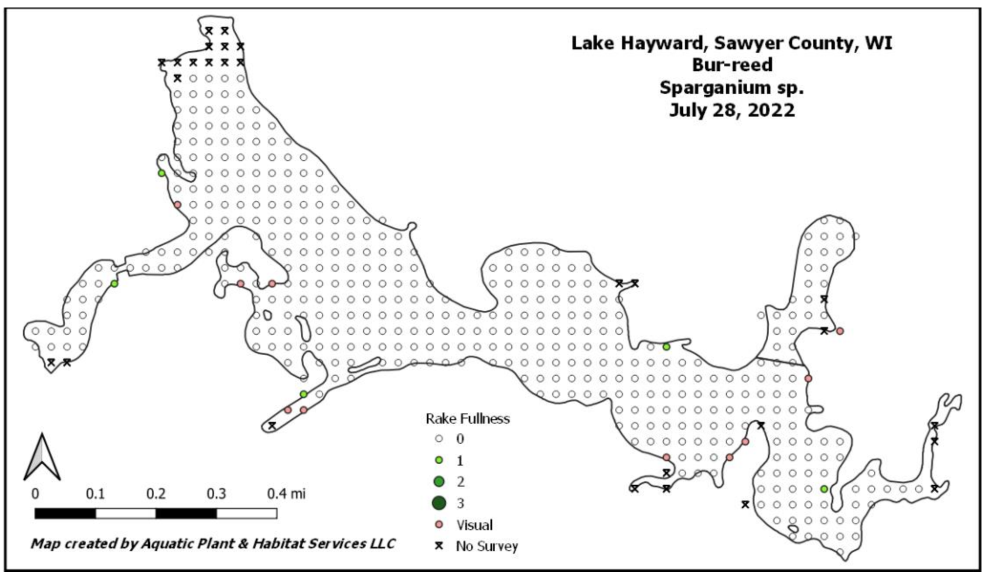


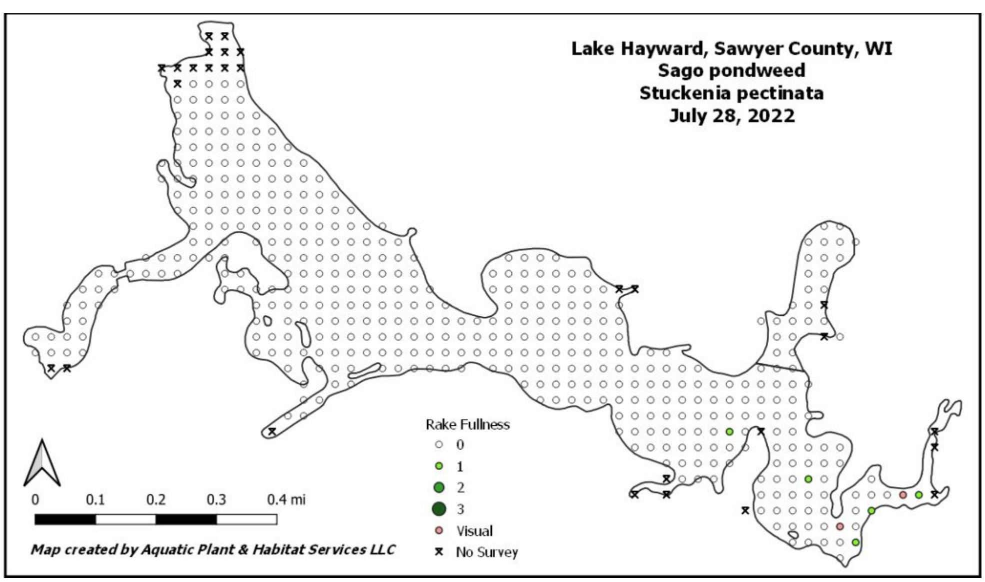
Lake Hayward, Sawyer County, WI
Needle spikerush & muskgrass*
Eleocharis acicularis & Chara sp.*
July 28, 2021
*These occurrences of muskgrass (Chara sp.) were not identified to species and are in addition to occurrences in other muskgrass maps that were identified to the species level.
Single occurrence of needle spikerush
Occurrences of muskgrasses
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

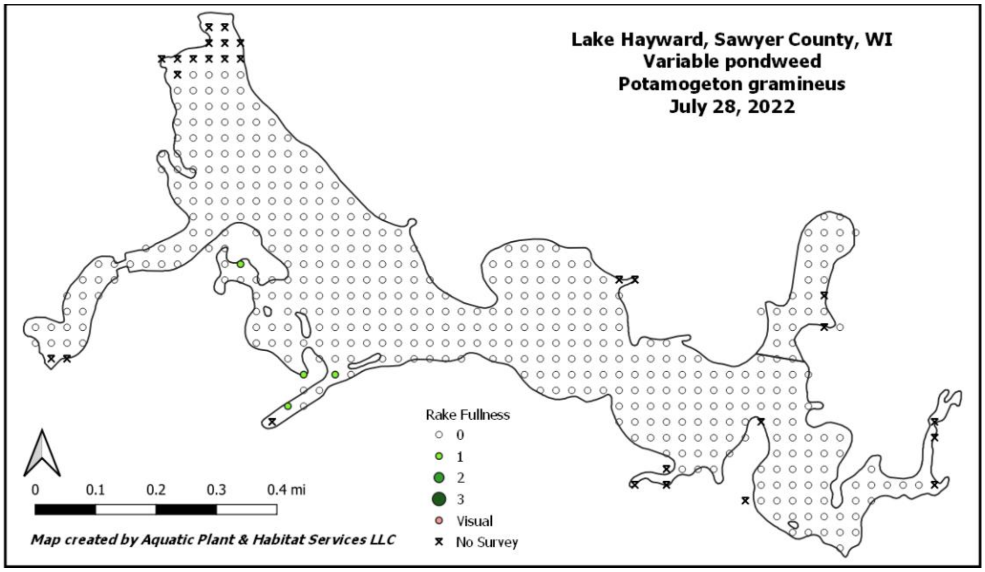


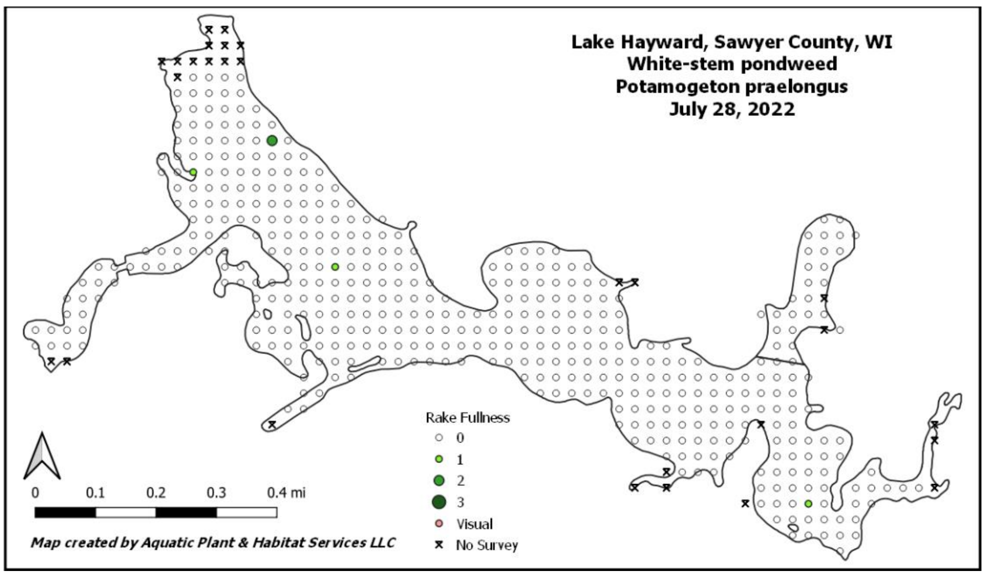
Lake Hayward, Sawyer County, WI
Ribbon-leaf pondweed
Potamogeton epihydrus
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

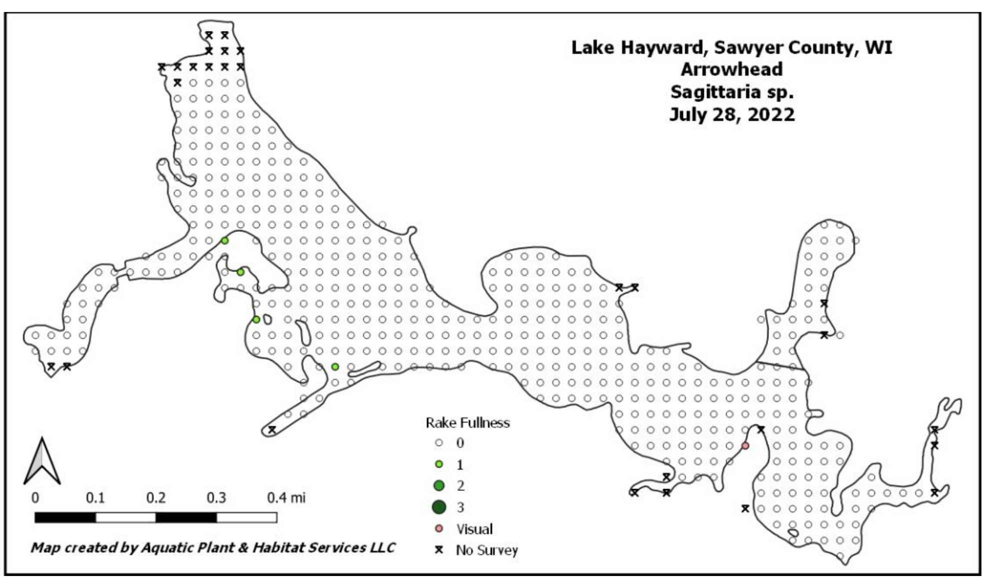

Lake Hayward, Sawyer County, WI
Fries' pondweed
Potamogeton friesii
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

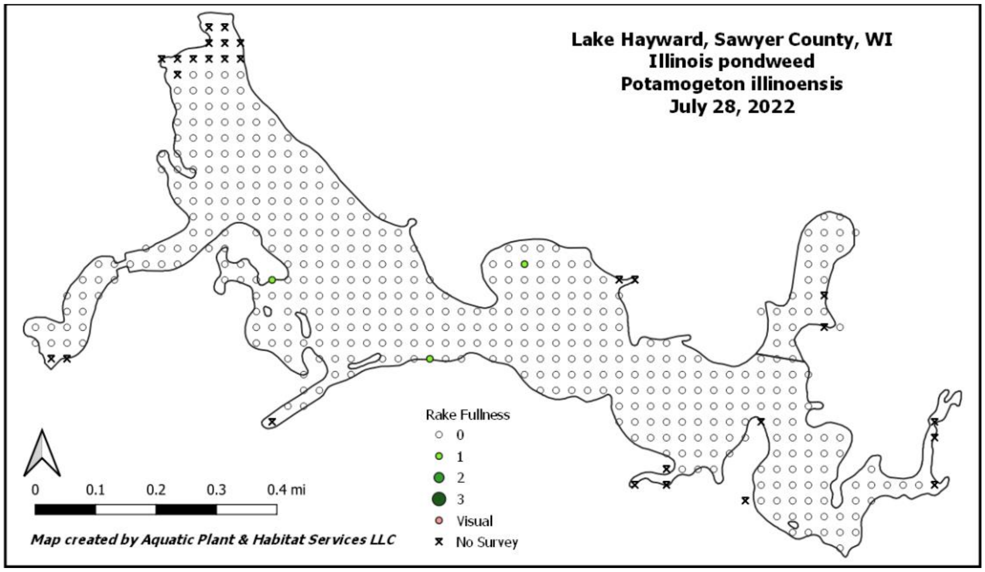

Lake Hayward, Sawyer County, WI
Bur-reed
Sparganium sp.
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

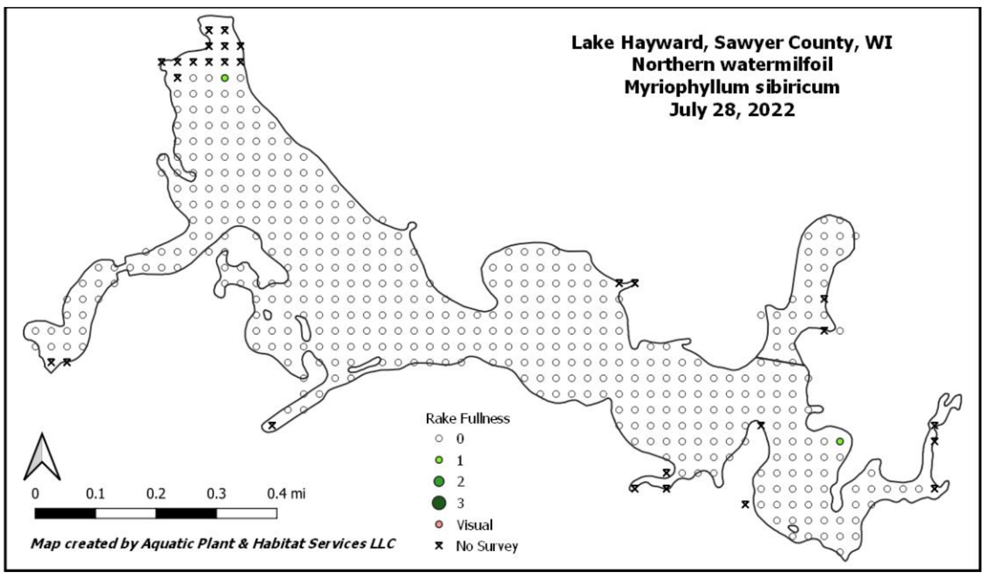

Lake Hayward, Sawyer County, WI
Sago pondweed
Stuckenia pectinata
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

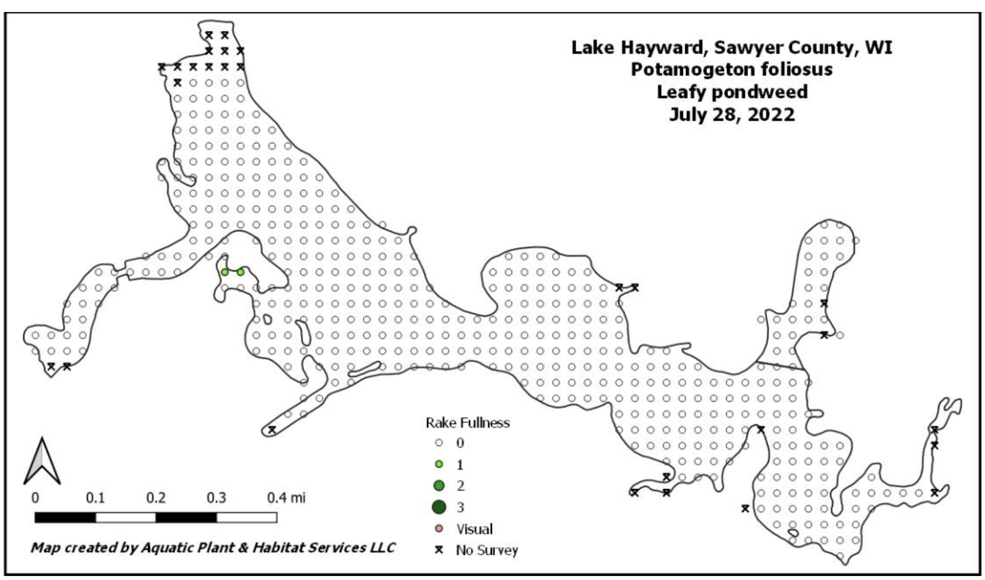

Lake Hayward, Sawyer County, WI
Variable pondweed
Potamogeton gramineus
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0
0.1
0.2
0.3
0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

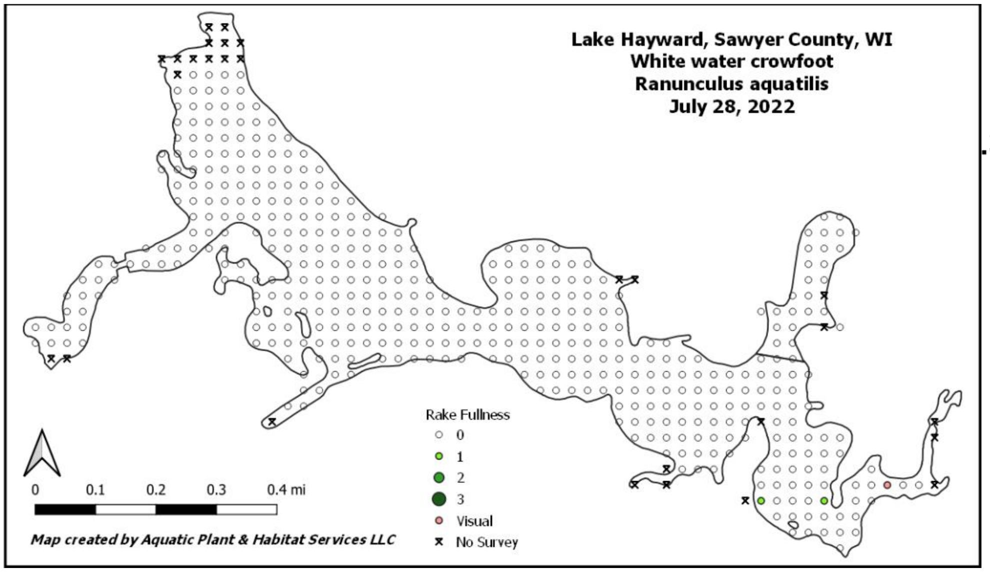

Lake Hayward, Sawyer County, WI
White-stem pondweed
Potamogeton praelongus
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0
0.1
0.2
0.3
0.4 mi
Map created by Aquatic Plant & Habitat Services LLC


Lake Hayward, Sawyer County, WI
Arrowhead
Sagittaria sp.
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0
0.1
0.2
0.3
0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

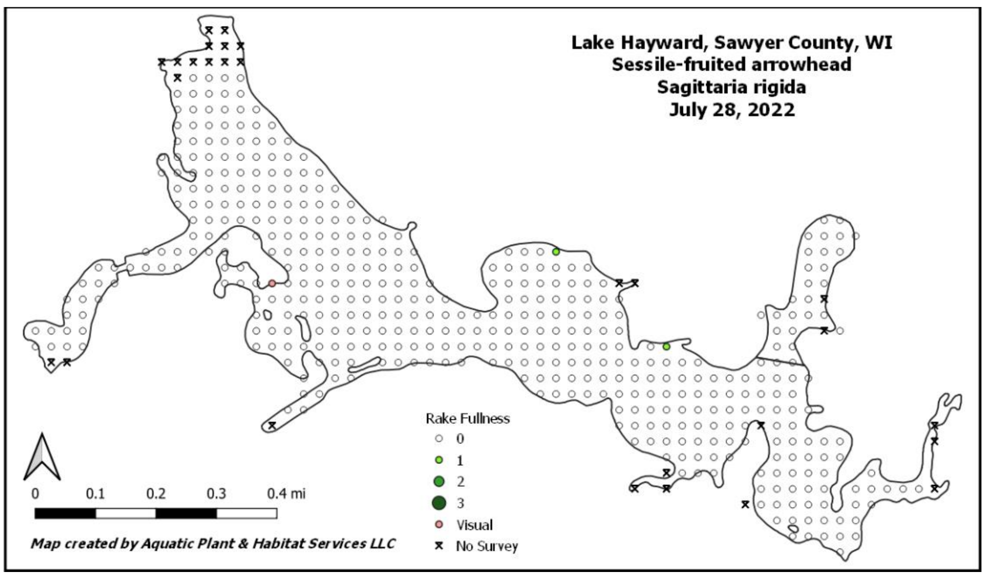

Lake Hayward, Sawyer County, WI
Illinois pondweed
Potamogeton illinoensis
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0
0.1
0.2
0.3
0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

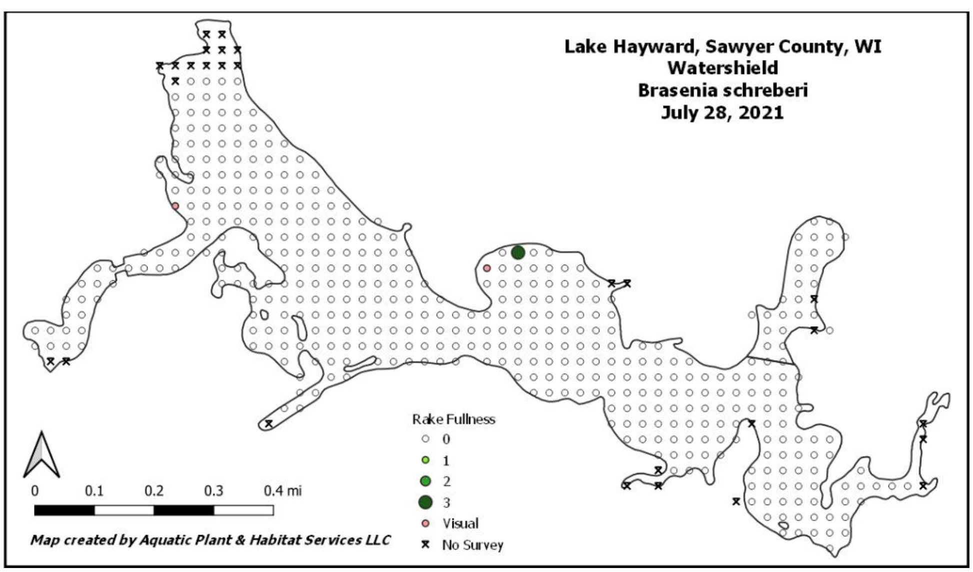

Lake Hayward, Sawyer County, WI
Northern watermilfoil
Myriophyllum sibiricum
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0
0.1
0.2
0.3
0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

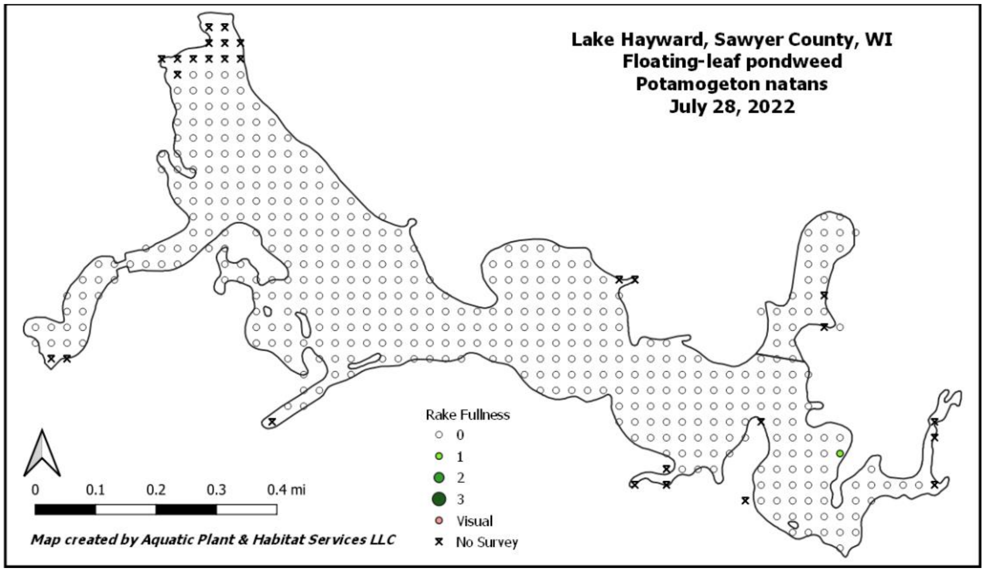

Lake Hayward, Sawyer County, WI
Potamogeton foliosus
Leafy pondweed
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0
0.1
0.2
0.3
0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

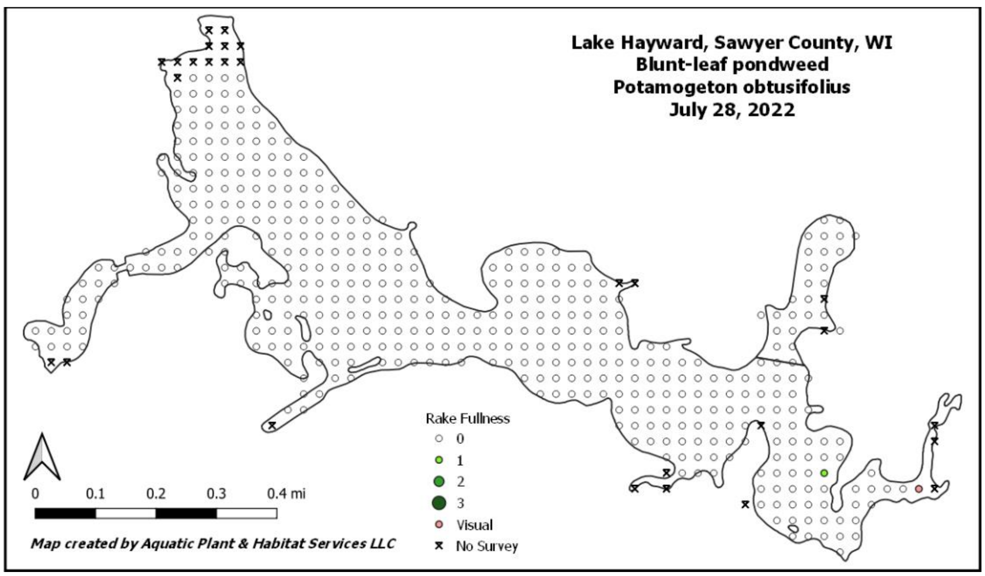

Lake Hayward, Sawyer County, WI
White water crowfoot
Ranunculus aquatilis
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

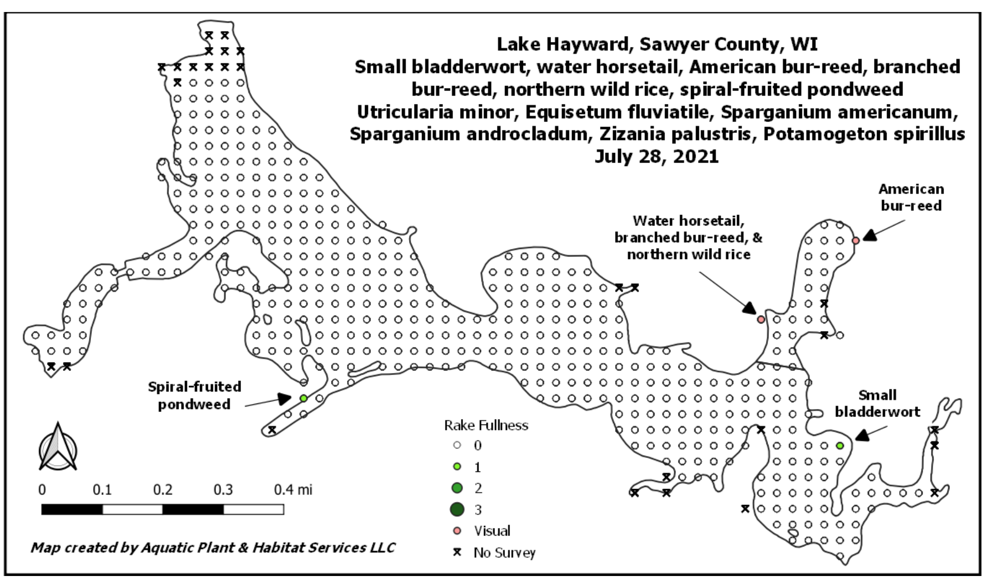
.3

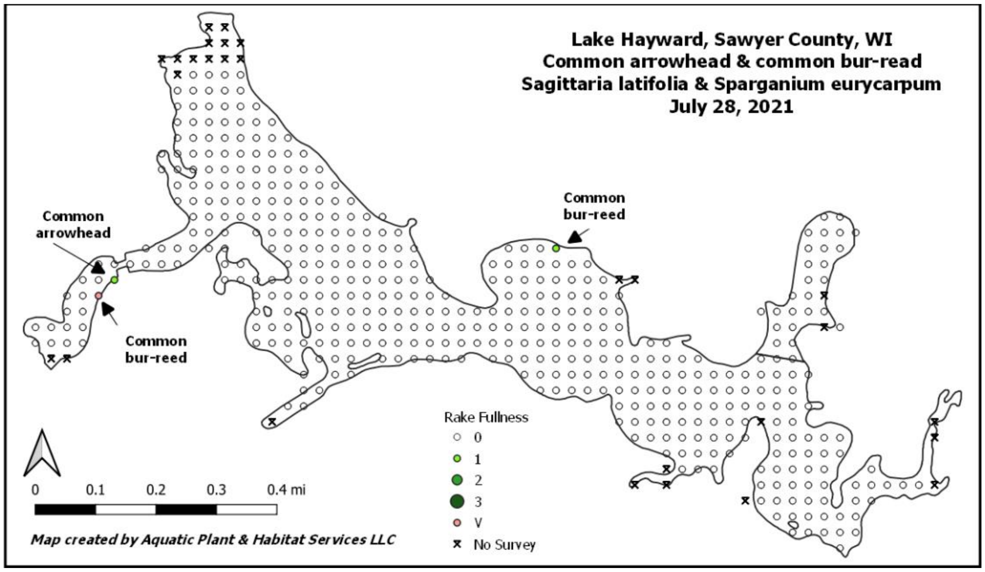

Lake Hayward, Sawyer County, WI
Sessile-fruited arrowhead
Sagittaria rigida
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

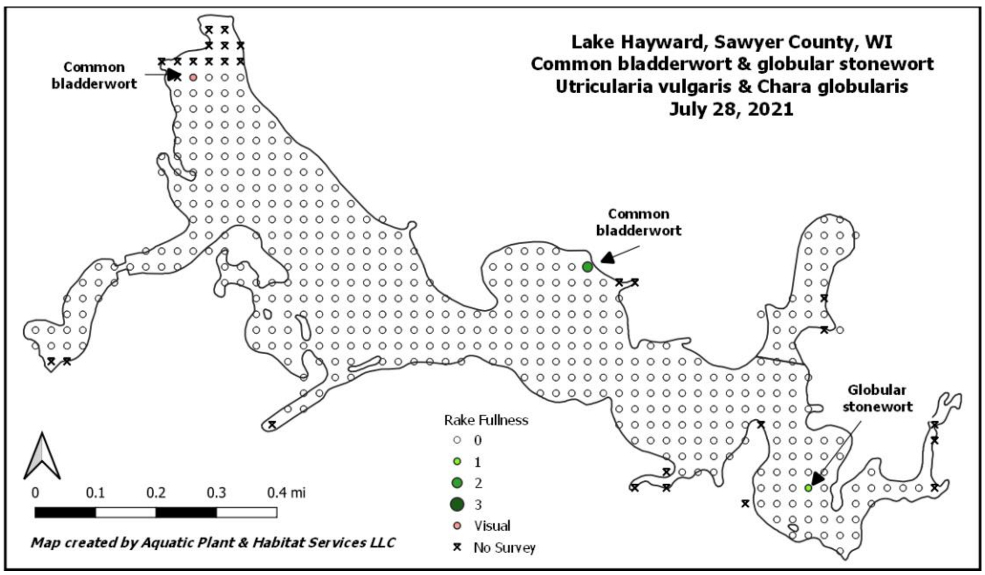

Lake Hayward, Sawyer County, WI
Watershield
Brasenia schreberi
July 28, 2021
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

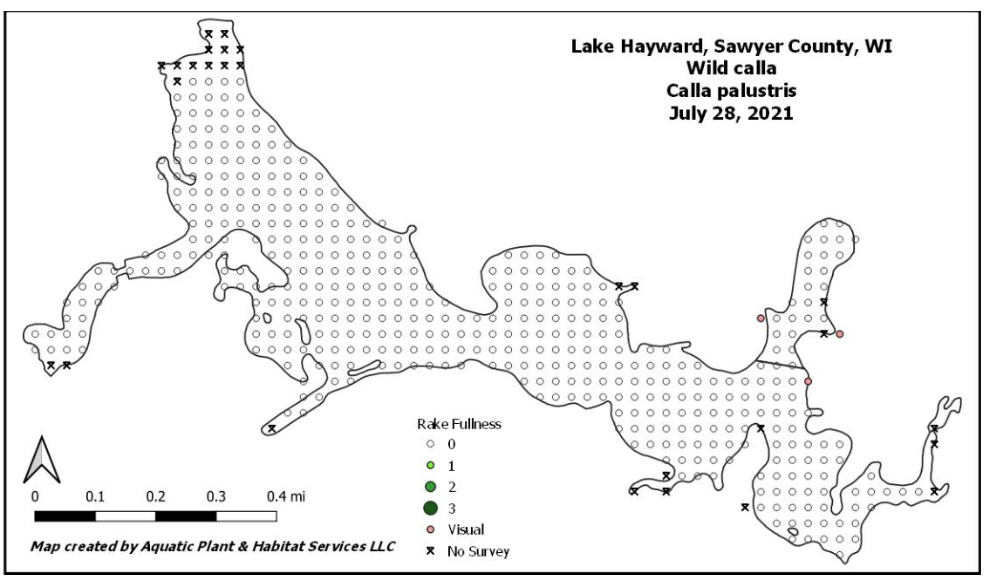

Lake Hayward, Sawyer County, WI
Floating-leaf pondweed
Potamogeton natans
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC


Lake Hayward, Sawyer County, WI
Blunt-leaf pondweed
Potamogeton obtusifolius
July 28, 2022
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC


Lake Hayward, Sawyer County, WI
Small bladderwort, water horsetail, American bur-reed, branched bur-reed, northern wild rice, spiral-fruited pondweed
Utricularia minor, Equisetum fluviatile, Sparganium americanum, Sparganium androcladum, Zizania palustris, Potamogeton spirillus
July 28, 2021
American bur-reed
Water horsetail, branched bur-reed, & northern wild rice
Spiral-fruited pondweed
Small bladderwort
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC


Lake Hayward, Sawyer County, WI
Common arrowhead & common bur-read
Sagittaria latifolia & Sparganium eurycarpum
July 28, 2021
Common arrowhead
Common bur-reed
Common bur-reed
Rake Fullness
0
1
2
3
V
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC


Lake Hayward, Sawyer County, WI
Common bladderwort & globular stonewort
Utricularia vulgaris & Chara globularis
July 28, 2021
Common bladderwort
Common bladderwort
Globular stonewort
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC


Lake Hayward, Sawyer County, WI
Wild calla
Calla palustris
July 28, 2021
Rake Fullness
0
1
2
3
Visual
No Survey
0 0.1 0.2 0.3 0.4 mi
Map created by Aquatic Plant & Habitat Services LLC

Appendix C – EWM Manual Removal Brochure

Frequently asked questions

What do I do if I find EWM?

Collect a sample and mark the location where the specimen was found. Contact your local DNR and/or AIS Coordinator to assist in verifying the EWM, and offer advice before any action is taken. They can also inform you of other experts that are available.

How do I preserve the specimen?

Place the specimen in a zipper-style bag with a moist paper towel. Keep the specimen refrigerated until it is delivered or mailed to your local DNR Water Resource Specialist or AIS Coordinator.

What is manual removal? Is it legal? Do I need a permit?

Manual removal is pulling by hand or with hand-held devices that do not use external or auxiliary power sources (e.g. small rakes). It is legal if the native plant population is not excessively harmed. No permit is needed when following these guidelines. Contact with the local DNR is always recommended before starting.

What if EWM is mixed in with native plants, what should I do?

Try to target only the EWM. If native plants are accidently removed, dispose of them with the EWM. This prevents losing any EWM fragments that might be mixed in with the native plant material. The more native plants you can leave, the better chance they will spread and help prevent any EWM from becoming reestablished in that area.

Where do I dispose of EWM?

Contacting your local DNR Water Resources Specialist prior to the project is always recommended for the latest approved procedures. Transport the material away from the water body so that no parts escape, and dispose of it in a manner that prevents the establishment, introduction, or spread of the plants. All pulled EWM must be disposed of above the ordinary high water mark, preferably in a flat, vegetated area so the EWM fragments cannot wash back into a nearby water body. Compost piles, farm fields, gardens, and landfills are good places.

What kind of equipment do I need?

- (Optional) snorkeling gear: mask, fins, snorkel (a dive flag is needed if more than 150 feet from shore)
- Small rake, trowel or similar tools
- Container to put harvested EWM for transport & disposal (have a predetermined disposal place)
- Bag made with small mesh or burlap to put collected EWM while working away from the watercraft
- Watercraft to work out of & place harvested EWM
- Long-handled, small-mesh net for catching fragments
- Wetsuits aren't necessary but do keep divers warmer & allows them to work longer with more comfort
- Trailer or truck to haul the harvested EWM to a disposal site
- Record progress & what works best so information can be shared. Record time & people working for future reference & to document needed volunteer hours towards grant match funds.

EWM Collection

Making EWM Collection Bags

Materials:

- Mesh bags and/or burlap sacks
- 10 - 12 inch zip ties (amount varies on size of bag)
- Foam water noodles (wacky noodles)

Directions:

- Cut the foam water noodle to the diameter of the bag or sack being used.
- Making a circle with the foam, place the foam inside the bag at the open end and attach with the zip ties to create a floating lip at the opening of the bag (see above pictures). You now have a floating collection bag for the EWM that lets the water strain out when it is time to dispose of the EWM.

Eurasian Water Milfoil

Manual Removal

- ***What Is It?***
- ***How To Do It***
- ***Helpful Tips***

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Sponsored by Lumberjack Resource Conservation & Development (RC&D) Council, Inc. & Golden Sands RC&D Council, Inc.
With assistance from the WDNR AIS Grants Program and UW Extension Lakes Program
Photos by Chris Hamerla, Paul Skawinski, Russ Robinson, & Tiffany Lyden

Identify and responding quickly to EWM is essential. On new, small colonies and scattered plants, hand removal can be a simple, effective way to control EWM. EWM is distinguished from northern water milfoil by having 12 to 21 pairs of leaflets on each leaf (see milfoil leaf pictures far right). Typically, EWM also has limp, pinkish stems, while northern water milfoil tends to have whitish stems, and leaves with 4 to 12 pairs of leaflets.

Manage EWM in spring. Generally, EWM will grow quicker than native plants so it is easier to locate and remove. At this time, most native plants are still dormant, so the EWM is more visible. Also, the plants are younger and stronger, so they don't break apart as easily as later in the season. Eliminating fragmentation is a top priority.

Mark EWM locations after finding it from a boat or by snorkeling so it can be found again quickly for removal. A GPS unit works great, as does a map of the lake marked with EWM locations. Mapping also helps for future reference to see if EWM is showing up in different places and how effective past removal efforts have been. This map can also assist a lake consultant brought in to perform more in-depth surveying.

Remove EWM carefully. All portions of the plant, including roots and pieces that break off, need to be removed. Grabbing numerous stems on the same plant reduces breaking from the roots. Bigger plants or firmer sediment require the person to work their fingers/hands into the sediment to help loosen the plant. Slowly remove the plant from the sediment and gently shake it to reduce sediments clouding the water. Carefully wind the plant around a hand to help eliminate lost fragments, and make for easier transition to the container.

In shallow water, a stable watercraft can be used to work from and minimize sediment disruption, especially when dealing with soft substrates like silt, mud, or marl. The removed plants can be transferred right into the watercraft or other container.

Snorkeling is a good option in shallow water. Using a watercraft is still helpful as it gives the diver a place to deposit removed EWM and to rest. The people in the watercraft can point out plants to the diver and help retrieve fragments (long-handled nets with a fine mesh work well).

The diver can put plants into a mesh or burlap bag that keeps fragments from escaping, or bring the plants directly to the watercraft. To maximize the time spent harvesting EWM, a bag or similar floating container should stay with the diver for depositing plants. Once it is full, it can be taken to the watercraft to be emptied. The watercraft needs to remain at a safe distance to give the diver room to work. Non-motorized watercraft work well since they aren't as likely to disrupt the sediment, and there isn't the danger from the propeller.

Calm, sunny days offer the best working conditions regardless of the removal technique. Visibility is greater, plus boat positioning and control is much easier.

Disposal of harvested plants should be planned in advance. Gardens, flower beds, and farm fields are great places, as aquatic plants make good fertilizer. Care needs to be taken to prevent escape and introduction of fragments into new areas. Drain excess water to reduce weight during transport.

Eurasian water milfoil

Watercraft assistants

Making a difference!

Eurasian water milfoil (left)
Northern water milfoil (right)

Additional Information:

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Wisconsin Department of Natural Resources
www.dnr.wi.gov/invasives

UW Extension Lakes Program
www.uwsp.edu/cnr/uwexlakes/

7.4 Appendix D – WDNR APMP Approval Email 4/26/23

Lake Hayward Grant Deliverables Approval and Future Grant and Permit Application Eligibility

Hello Heidi and Sara,

I have reviewed the final draft of your Aquatic Plant Management Plan for Lake Hayward and all deliverables have been met for Surface Water Planning Grant AEPP67322. You have done a nice job on the plan. We can close out the grant and will make the final reimbursement. In addition I have determined that some of the education, monitoring, and management activities identified in the Management Strategy 2023-2027 section are eligible for Surface Water Grants funding subject to the eligibility and application requirements of the Surface Water Grants program and specifically to the comments below.

At this time Goal 2, Objective 2a and 2b are not eligible for Surface Water Grant funding as the only funding allowed for aquatic plant management is for aquatic invasive species. As pointed out in the management plan, the plants that are currently causing navigational nuisance are not non-indigenous invasive species.

I would note that under Goal 2, Objective 2c, related to management of aquatic invasive plants, that the approval of a specific AIS control proposal for grant eligibility and permitting will depend on DNR review of and discussions with the Lake Hayward Property Owners Association about the annual control and monitoring strategy. DNR and LHPOA should consider the need for management, likelihood of effective management, and also any unintended, non-target impacts. Consideration of your EWM control consideration criteria (Figure 25, page 41) and an annual meeting to discuss the control and monitoring strategy for the coming year will facilitate DNR decisions on annual EWM control plans, however DNR cannot guarantee that a treatment proposal will always be approved for grant funding and/or permitted.

The Department will consider an aquatic plant management permit application for the mechanical harvest of aquatic plants in Lake Hayward given that you have provided us with the required aquatic plant management plan.

Finally, if you would like to apply for a Surface Water grant in the future you will need to submit a grant pre-application and associated eligibility determination by September 15 (or 60 days before the final grant application deadline) or earlier during the year of application. You can contact me for instructions on how to do so or you can find this information in the Surface Water Grant Applicant Guide linked here: https://dnr.wi.gov/files/pdf/pubs/cf/cf0002.pdf

Please let me know if you have questions about any of this. Feel free to give me a call at the number below to discuss.

Thank you for your continuing efforts to protect Lake Hayward!

Sincerely,

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