Whole Lake Point-Intercept Survey on Lake Ripley, Jefferson County, Wisconsin

Lake Ripley during the first day of the crew's survey.

By: Lianna Spencer, Lake Manager, Lake Ripley Management District

Contributors: Colton Hutchinson (Water Resources Specialist, Jefferson County Land and Water Conservation Department), Paul Skawinski (Statewide Educator, UW-Extension).

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Summary

In lake ecosystems, the aquatic plant community serves as critical habitat and nursery for fish and other animals, a source of oxygen for all organisms, a refuge for prey as well as a foraging area for predators, a buffer against erosion and sediment resuspension from both waves and shoreline inputs, and can significantly contribute to overall lake primary productivity.

Historically, Lake Ripley has had a diverse and abundant native plant population. The two most common invasive species in Wisconsin, Eurasian watermilfoil and curly-leaf pondweed, invaded Lake Ripley in the 1990s which prompted the Lake Ripley Management District (herein referred to as the District) to form. Controlling and monitoring these invasive plants has continued to be a priority of the District's, and requires continued studies of their composition, distribution and abundance.

A full-lake aquatic plant survey using the point-intercept (PI) method developed by the Wisconsin DNR was conducted on Lake Ripley, Jefferson County, Wisconsin during the week of July 28th, 2025. This survey will help the District update our Aquatic Plant Management plan (APM).

The WDNR recommends a point-intercept survey is completed every five years while following their quantitative monitoring protocol. Standardized, quantitative data are an essential part of strategic lake management. This data allows us to better understand our lake, directs us towards appropriate management activities and can identify trends and refine our understanding of our aquatic plant population in Lake Ripley.

Introduction

The composition of plants in Lake Ripley has been studied for over 50 years! A thriving and diverse native plant community is the foundation of a healthy and high-functioning lake ecosystem. Aquatic plants are vital for maintaining ideal water quality and habitat conditions. The relative abundance, distribution and types of rooted aquatic plants can be used as an indicator of lake quality. Ideally, healthy lakes will have at least moderate levels of native plant growth that are characterized by high species diversity.

An absence of vegetation and associated habitat can lead to declines in native fish and wildlife, while favoring more tolerant "rough fish" like carp. It can also lead to increased algal blooms and higher turbidity, resulting in a loss of water clarity that is likely to further suppress plant growth. A different set of problems occurs when invasive aquatic plants gain dominance and become overly abundant. This situation can create single-species monocultures of low habitat value, impede recreational use of the water, stunt fish growth, and contribute to dramatic fluctuations in dissolved oxygen levels that can stress aquatic life.

In 2006 the DNR revised their protocols for aquatic plant surveys and since then, Lake Ripley has conducted their surveys according to these updated protocols. Full point-intercept surveys were conducted in 2006, 2011, 2015, 2020 and 2025.

Methods

The point-intercept (PI) survey is to be completed on Lake Ripley every five years in order to track the aquatic plant population. The point-intercept method as described in the "Recommended Baseline Monitoring of Aquatic Plants in Wisconsin: Sampling Design, Field and Laboratory Procedures, Data Entry, and Analysis, and Applications" (WDNR PUB-SS-1068 2010) has been used to complete the last four PI surveys on Lake Ripley. This monitoring protocol was designed to quantitatively assess the distribution and abundance of aquatic plants in lake ecosystems. This protocol employs a point-intercept sampling design, with sites located on a geo-referenced sampling grid placed over the entire lake (Hauxwell, et. al., 2010). Any new species found would be vouchered and sent to the UW-Madison Herbarium.

All biologists that helped to complete the point-intercept survey for the Lake Ripley Management District have previous experience conducting PI surveys. The surveyors employed the point-intercept sampling method in accordance with protocols approved by the Wisconsin Department of Natural Resources (WDNR) and used on Lake Ripley in surveys conducted in 2011 2015, 2020 and 2025. The data in 2006 was collected using similar protocols, but ones that had not yet been approved by the DNR. Based on parameters specific to Lake Ripley, the DNR has mapped a 725-point sampling grid over the entire lake. Of the 725 points, 374 were sampled during the 2025 survey. Using GPS, the field crew navigated to each of the predetermined grid points. The biologists locate the sample points using a hand-held GPS. This continuity of sampling and recording style is hoped to lead to an increased correlation between the studies.

A metal rake is used to sample a site where the water is shallower than 15 feet. In order to record depth with this rake, the rake's handle is marked in one-foot increments with electrical tape. When researchers arrive at a sampling point by boat, the metal rake is lowered straight through the water column to rest slightly on the bottom. The rake is then twisted around twice, and pulled straight out of the water. This sampling technique allows the biologists to collect a plant sample, measure the water depth (to the nearest half-foot) and determine the

Picture 1: The metal rake that was used during the 2025 survey.

sediment composition of the lake's bottom all at the same time.

In water deeper than 15 feet, the rope rake is used. A rope rake is similar to the metal rake, with a double-sided rake attached to a 40-foot-long rope. The rope is dropped straight into the water column alongside the boat and is then dragged along the sediment surface for approximately one foot and then pulled to the surface. This technique allows the surveyors to collect a full, thorough sample of plants.

At each site, after pulling the rake from the water the overall rake fullness is recorded with a rating that best estimates the total coverage of plants on the rake. Each species is then identified and assigned a density rating based on the amount of that specific plant found on the rake. Plants that are in close proximity (<1ft from sample point) to the sample point but not collected on the rake are recorded as "visual" sightings.

The data collected are later analyzed and used for statistical analysis. The analyses are used for determining trends within the lake's aquatic plant community, monitoring and managing any invasive species found.

The 2025 survey was completed during the week of July 28-August 1, with sampling dates occurring consecutively. Lianna Spencer (Lake Manager, LRMD), Colton Hutchinson (Land and Water Conservation – Water Resources Specialist, Jefferson County), and Paul Skawinski (Statewide CLMN Educator, UW-Extension) performed the plant inventory survey. Lianna Spencer took the lead on preparing for and conducting the survey, specimen preparation and data analysis.

Picture 2: Colton, one of the biologists, navigating to the next sampling site.

Results

The 2025 survey was completed during the week of July 28 – August 1, providing a snapshot of plant conditions during the lake's season. As curly-leaf pondweed peaks before July, an early-season meander survey was done to gain a better understanding of its current population (see Curly-Leaf Pondweed Meander Survey of Lake Ripley report, 2025).

The total number of plant species found using both the point-intercept and visual survey methods was 30. Of these, 27 species were found using the point-intercept method. The remaining three species, which included cattail species, forked duckweed and floating-leaf pondweed, were recorded as visuals. Plants were found growing in water as deep as 16 feet, and as shallow as less than 1 foot deep. The six most dominant plant species from most to least documented were: sago pondweed (*Stuckenia pectinata*), water celery (*Valisneria americana*), common stonewort (*Chara contraria*), coontail (*Ceratophyllum demersum*) and Fries' pondweed (*Potamogeton friesii*).

Three of the tables within this report show a variety of different statistics from the 2025 survey. The other three show statistics from the four previous surveys as well as the data from the 2025 surveys. These tables allow you to compare the data over time.

New Species

Four new plants species were found and documented during the 2025 plant survey! Specimens of all four new species were collected, pressed, and sent to the UW-Madison Herbarium for verification. The four species were: globular stonewort, Braun's stonewort, leafy pondweed and a hybrid of white-stem pondweed X curly-leaf pondweed.

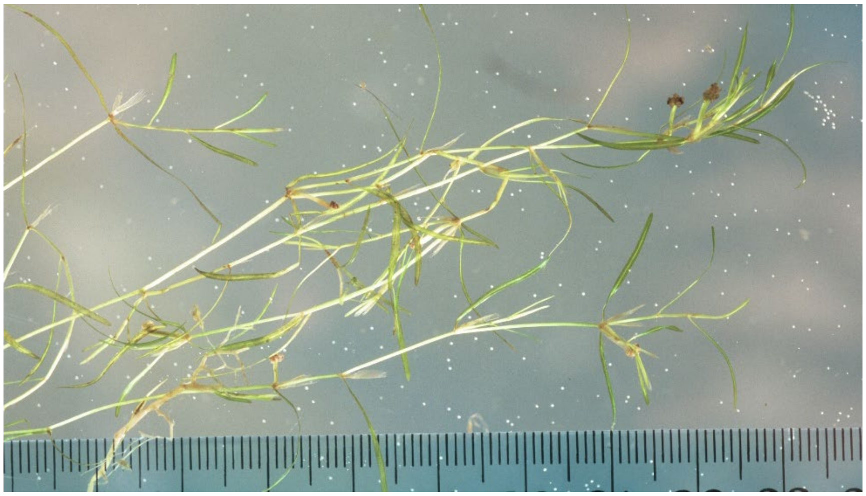
Globular stonewort, *Chara globularius*, was predominantly found on the northwest side of Lake Ripley, with some plants scattered along the north and south side of the lake. Chara species are an unusual type of algae that resembles a higher plant (Borman, et. al., 2014). Sometimes referred to as muskgrass, this species is usually found in hard waters, preferring muddy or sandy substrate. Chara is a favorite food for waterfowl! It is also considered valuable fish habitat. Beds of *Chara* offer cover and habitat for fish and macroinvertebrates and are excellent producers of food for these animals.

Braun's stonewort, *Chara braunii*, is another species of *Chara* that was found for the first time in Lake Ripley this year. This species was only found on the west side of East Bay, within Critical Habitat Designation #1. Chara species are good at absorbing excess nutrients like phosphorus and nitrogen, which can limit the growth of other algae. Their presence serves as a reliable indicator of healthy water conditions.

Picture 3: The specimen out in the field!

Picture 4: The oogonia are some of the distinguishable features of this plant (seen here). They look like black circles within the whirls of the leaflets.

Leafy pondweed, *Potamogeton foliosus*, looks very similar to other small pondweeds. It can be identified from other pondweeds as there are no glands present at the leaf nodes. The fruit that this plant produces can be a locally important food source for geese and a variety of ducks (Borman, et.al., 2014). It is particularly useful because it matures before



Picture 5 : Leafy pondweed. Photo by Paul Skawinski.

many other aquatic fruits. The bushy form of this pondweed offers good surface area for invertebrates and cover for juvenile fish (Borman, et.al., 2014).

The fourth new plant found was a suspected hybrid between curly-leaf pondweed and white-stem pondweed, *Potamogeton praelongus* X *Potamogeton crispus*. This plant had zig-zagged stems with wavy, serrated-looking leaf edges. Being unable to identify it in the field, the surveyors collected a specimen to press and send to the UW-Herbarium for identification.

Invasive Species

Lake Ripley has been battling Eurasian watermilfoil (*Myriophyllum spicatum*) since the early 1990s. Since then, it has hybridized with northern watermilfoil (*Myriophyllum sibiricum*) creating a hybrid watermilfoil (*Myriophyllum spicatum X sibiricum*). This hybrid shares visual features of Eurasian watermilfoil (EWM) and northern watermilfoil. For example, some of the hybrid stems have the whitish or tan hue of the native but with 10-14 leaflets per leaf, compared to 12-20 leaflets per leaf on EWM. It is impossible to differentiate between hybrid watermilfoil (HWM) and EWM out in the field as it requires genetic analysis to determine which species is which. Therefore, EWM and HWM were combined in the survey data.

Curly-leaf pondweed (CLP) is the second invasive aquatic plant species found in Lake Ripley. Typically, CLP isn't represented well during mid-summer PI surveys due to their early-season life cycle. This invasive actively grows during the winter months, reaching its maximum density in late spring and dying back by mid-summer (Curly-leaf Pondweed, Notre Dame). As curly-leaf pondweed peaks before July, an early-season meander survey was done to gain a better understanding of its current population (see Curly-Leaf Pondweed Meander Survey of Lake Ripley report, 2025).

Overview of 2025 Results

During the 2025 survey 374 points were sampled throughout Lake Ripley, which was four less than the 2020 survey. The total number of plants species documented in the lake for the last ten years can be seen in Table 2. The fluctuation of sampled points could be due to an obstacle in the way of the crew getting to the sampling point, the site is no longer accessible, or another field variable. Seasonal variability is expected from season to season; the number of plants has remained fairly consistent over the last ten years, only fluctuating by a few each year. However, compared to the previous survey's data, five additional plants were recorded by being sampled or visually seen including the four species that were discovered this year!

The floristic quality index (FQI) increased slightly, to a value of 26.16. This value helps us assess the overall ecosystem's health and changes over time and will help inform our decisions for management and planning. In general, a higher FQI indicates higher floristic quality and biological integrity and a lower level of disturbance impacts (Bernthal, 2003). In other words, it means that the habitat quality is improving, indicating successful restoration or reduced disturbance, as it reflects an increase in native, conservative (those sensitive to change) plant species.

Over the last five years, the District has been altering our weed-harvesting map to target areas with EWM/CLP while also maintaining recreational navigational lanes. These changes may be one of the reasons why our FQI is increasing. Another reason for an increasing FQI may be due to the eight different Critical Habitat Areas that were designated by the DNR in 2024. These areas are not harvested and have been discussed at a broad level with our residents about their importance.

The mean coefficient of conservatism (Mean C) is the average C-value (conservation value) for all plants found in the survey. This is used in Floristic Quality Assessments to measure habitat health. The species are assigned a value (0-10) representing tolerance to disturbance. The 'Mean C' is calculated by adding all individual species' C-values and dividing by the number of species, indicating a site's quality. A higher 'Mean C' suggests higher integrity in the plant community. The Mean C for 2025 is 5.91, slightly higher than 2020's 5.89 rating.

Summary of the Plant Inventory Survey Results 2025	
[a]Total Number of Points Sampled	374
[b]Number of Points Sampled within Depth Range of Potential Plant Growth (0-16')	372
[c]Number of Points with Vegetation	351
[d]Maximum Depth of Plant Growth	16
[e]Number of Species in Lake	30
[f]Frequency of Occurrence of Vegetation within Range of Plant Growth (0-16')	94.35
[g]Simpson Diversity Index	0.86
[h]Species Richness	27
[i]Species Richness + Visuals	30
[j]Floristic Quality Index (FQI)	26.161995
[k]Mean Coefficient of Conservatism (C)	5.91
Average Number of Species Sampled Per Site (0-16')	2.28
Average Number of Species Sampled Per Site (Veg. Sites Only)	2.44
Average Number of Native Species Sampled Per Site (0-16')	2.21
Average Number of Native Species Sampled Per Site (Veg. Sites Only)	2.38

[a]Does not include sample points in depths beyond 17 ft. where plant growth could not be documented
[b]Includes all sample points within the 0-17-ft. littoral zone that was shown to support plant growth
[c]Includes all sample points where vegetation was found after taking a rake sample
[d]Represents deepest point where vegetation was sampled. This depth will fluctuate from year to year depending on changes in water clarity conditions. Plants may be found at depths of over 20 ft. in clear lakes, but only in a few feet of water in stained or turbid lakes. While some species can tolerate very low light conditions, others are only found near the surface. In general, the diversity of the plant community decreases with increased depth.
[e]Includes plant species documented in the lake and along the zero-depth shoreline margin using both the point-intercept method and a general boat survey.

[f]Percentage of occurrence that vegetation would be sampled within the 0-17-ft. littoral zone
[g]Simpson Diversity Index: One minus the sum of each of the relative frequencies squared ($SDI = 1 - \sum(RFREQ^2)$). The closer the SDI value is to one, the greater the diversity is between communities being compared. The index allows the plant community at one location to be compared to the plant community at another location. It also allows a single location's plant community to be compared over time. The index value (on a scale of 0-1) represents the probability that two individuals (randomly selected) will be different species. The greater the index value, the higher the diversity in a given location. Plant communities with high diversity are usually representative of healthier lakes, and also tend to be more resistant to invasion by exotic species.
[h]Indicates the number of different plant species found in and directly adjacent to the lake (on the waterline). Species richness only counts those plants documented as part of the point-intercept data. It includes filamentous algae, freshwater sponge, and unidentified *Myriophyllum* and *Najas* species. This number does not include the species found during general boat surveys (GS).
[i]Indicates the number of different plant species found in and directly adjacent to the lake (on the waterline). This species richness count includes visuals found in the point-intercept survey. This number does not include the species found during general boat surveys (GS).
[j]Measures the impact of human development on a lake's aquatic plant community. Species in the index are assigned a Coefficient of Conservatism (C), which ranges from 3.0 to 44.6 in Wisconsin. The higher the value, the more likely the plant is negatively influenced by human activities that affect water quality or habitat. Plants with low values are tolerant of human disturbances, and often exploit these impacts to the point where they may crowd out other species. The FQI is calculated by averaging the conservatism value for each species found in the lake, and then multiplying that value by the square root of the number of species ($FQI = meanC\sqrt{N}$). Consequently, a higher index value indicates a healthier macrophyte community.
[k]Mean Coefficient of Conservatism (C) among species documented during point-intercept survey. Does not include species observed during the follow-up boat survey.

Table 1: Statistical descriptions based on all plants inventoried (2025)

This year, plants were found at a maximum depth of 16 feet. The most common depth that plants were found at was 4 feet deep, with 72 different sites being vegetated at 4 feet. The second most common depth was 5 feet deep, followed by 6 feet deep. These results are very similar to the 2020 data.

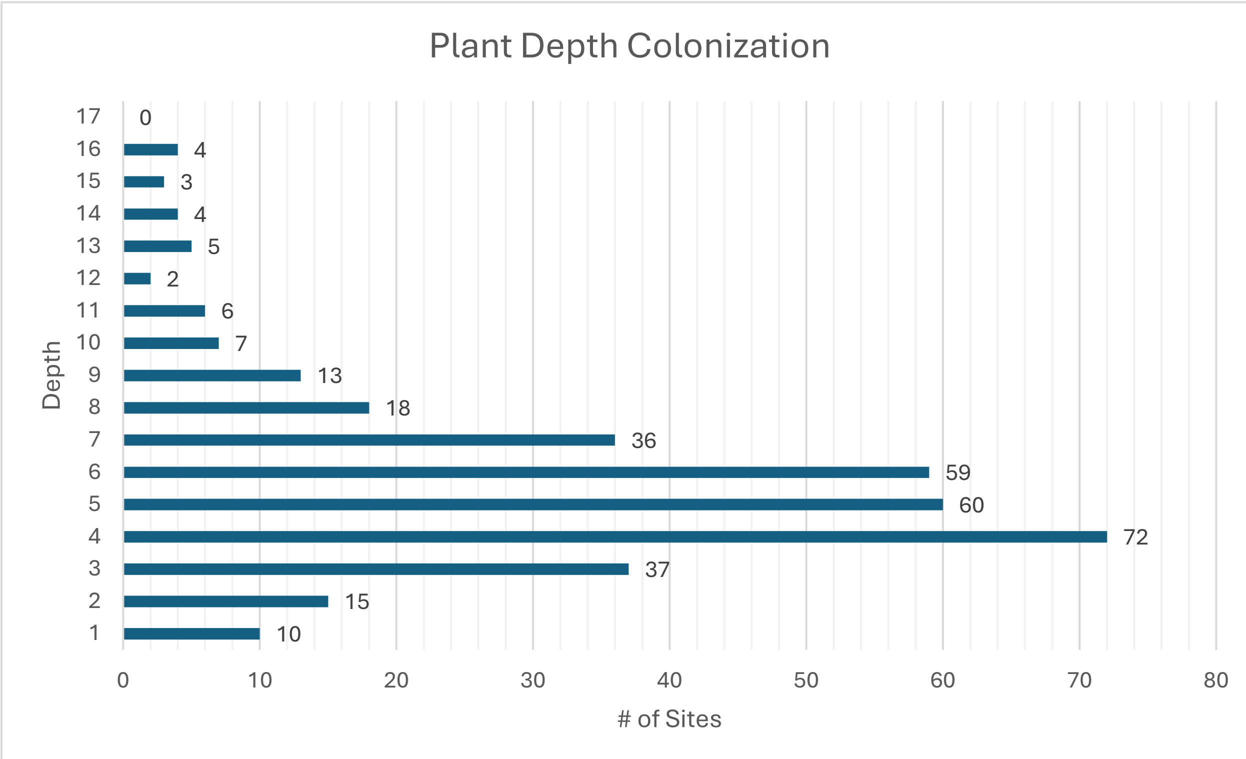


Figure 1: Chart depicting plant depth colonization during the 2025 plant inventory survey.

Lake Ripley has a large littoral zone that is dominated by aquatic plants (Figure 2). These plants are crucial for many ecosystem services including filtering water, stabilizing shorelines and providing habitat for fish, macroinvertebrates and other animals. Residents should expect to encounter plants while boating in the littoral zone. Since most of the plants found in the lake are native, management will focus on maintaining navigational lanes and targeting invasive species.

Aquatic Plant Survey

Lake Ripley – Jefferson County – July 2025

Rake Fullness Rating for All Species

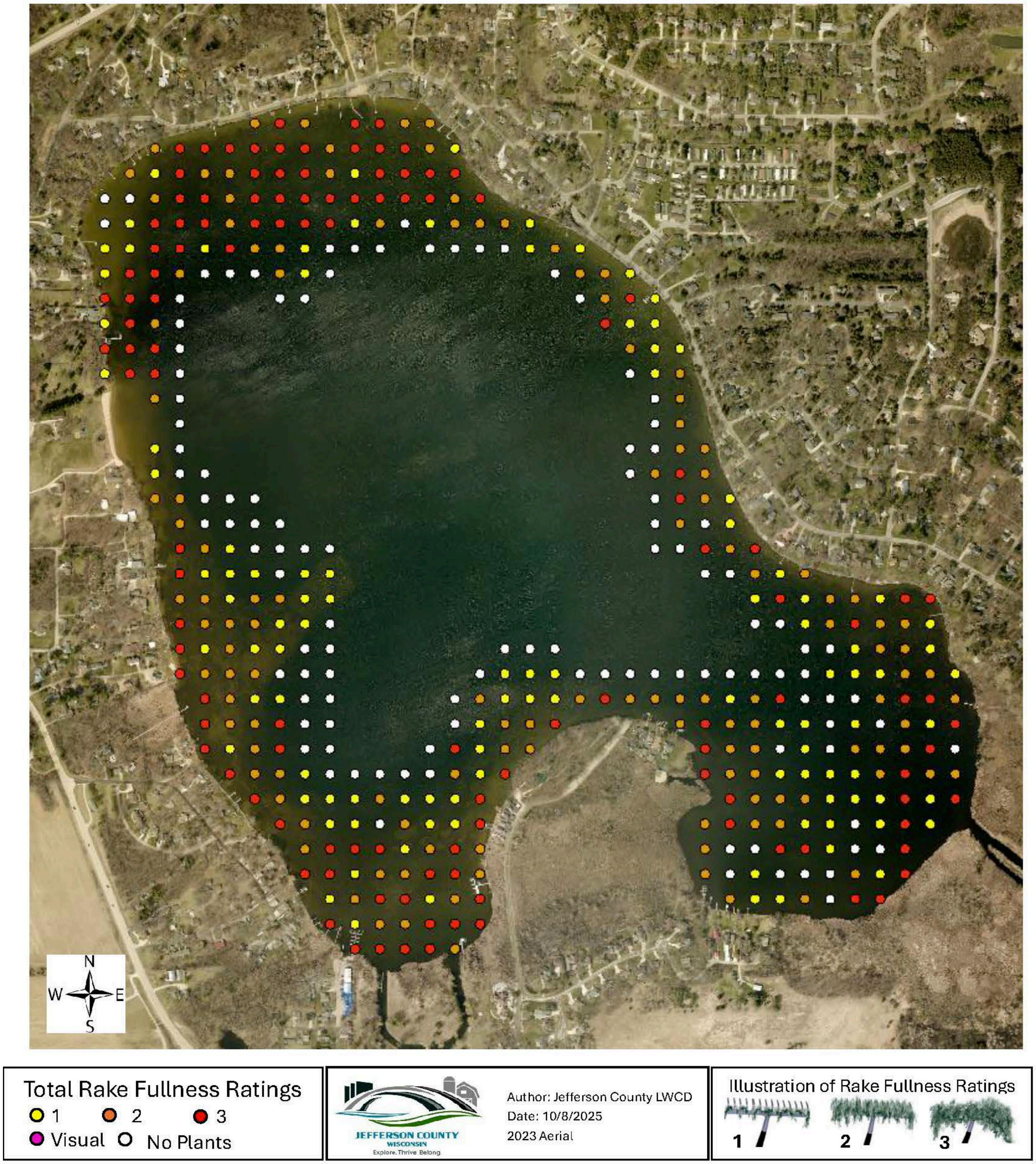


Figure 2: Rake fullness rating for all species found during 2025 plant inventory survey.

Table 2 allows us to compare the statistics collected during each survey. There is some variability, which is common, but overall, there are no drastic changes that cause concern.

Summary of Past and Current PI Surveys					
Species	**Year**				
	2006	**2011**	**2015**	**2020**	**2025**
Total Number of Points Sampled	398	421	369	378	374
Number of Points Sampled Shallower than Maximum Depth of Plants	369	407	359	376	372
Number of Points with Vegetation	318	366	330	362	351
Maximum Depth of Plant Growth	17 ft	21 ft	15 ft	16 ft	16ft
Total Number of Species in Lake (includes visuals and boat survey)	31	28	34	26	30
[a]Species Documented on the Rake	20	21	24	24	27
Frequency of Occurrence at sites shallower than maximum depth of plants	86	90	91	96.28	94.35
Average Rake fullness for all vegetation	--	1.61	2.36	2.10	2.04
Simpson Diversity Index	0.85	0.89	0.86	0.90	0.86
Floristic Quality Index (FQI)	22.75	23.77	25.92	25.47	26.16
Mean Coefficient of Conservatism (C)	5.69	5.76	5.95	5.8	5.91
Average Number of Species Sampled Per Site	1.76	2.33	2.19	2.58	2.28
Average Number of Species Sampled at Sites with Vegetation	2.05	2.60	2.39	2.69	2.44
Average Number of Native Species Sampled Per Site	1.52	2.02	1.79	2.30	2.21
Average Number of Native Species Sampled at Sites with Vegetation	2.00	2.34	1.97	2.41	2.38

[a]Does not include plants seen visually.

Table 2: Statistics for the 2006, 2011, 2015, 2020 and 2025 plant surveys

Table 3 shows the frequency of occurrence, average density, relative frequency and the importance value data for the 2025 survey (seen in alphabetical order). This table does not include visually observed plant species. The most dominant plant, sago pondweed, had a frequency of occurrence (FOO) of 61.82%, an average density of 1.70, and a relative frequency of (RF) of 25.3%. The second most dominant plant, water celery, had a FOO of 35.90%, an average density of 1.70, and an RF of 14.7%. The third most dominant plant, common stonewort, had a FOO 34.47%, an average density of 1.75, and an RF of 14.1%. The fourth most dominant plant, coontail, had a FOO of 34.19%, an average density of 1.44, and an RF of 14.0%. And the fifth most common plant, Fries' pondweed, had a FOO of 28.21%, an average density of 1.08, and an RF of 11.5%.

The total plant density within the lake is recorded using the average rake fullness value. In 2025 the average rake fullness value measured 2.04, compared to 2.10 in 2020 and 2.36 in

2015. Average rake fullness can fluctuate based on a variety of local pressures including annual variability and shoreland development.

2025 Plant Inventory Survey Data			
Aquatic Plant Species	**Frequency of Occurrence (%)**	**Average Density** (1-3 scale)**	**Relative Frequency**
Stuckenia pectinata (Sago pondweed)	61.82	1.70	25.3
Vallisneria americana (Water celery)	35.90	1.33	14.7
Chara contraria (Common stonewort)	34.47	1.75	14.1
Ceratophyllum demersum (Coontail)	34.19	1.44	14.0
Potamogeton friesii (Fries' pondweed)	28.21	1.08	11.5
Potamogeton gramineus (Variable pondweed)	5.70	1.10	2.3
Chara globularis (Globular stonewort)	5.13	1.00	2.1
Potamogeton praelongus (White-stem pondweed)	5.13	1.56	2.1
Heteranthera dubia (Water star grass)	4.27	1.53	1.7
Lemna minor (Small duckweed)	4.27	1.07	1.7
Najas marina (Spiny naiad)	3.99	1.00	1.6
**Myriophyllum spicatum* (Eurasian watermilfoil)	3.13	1.27	1.3
Nuphar variegata (Spatterdock)	3.13	2.55	1.3
Nymphaea odorata (White water lily)	2.28	2.25	0.9
Najas flexilis (Slender naiad)	1.99	1.00	0.8
Utricularia vulgaris (Common bladderwort)	1.99	1.00	0.8

Potamogeton foliosus (Leafy pondweed)	1.42	1.00	0.6
Potamogeton illinoensis (Illinois pondweed)	1.42	1.00	0.6
Wolffia columbiana (Common watermeal)	1.42	1.00	0.6
Elodea canadensis (Waterweed)	1.14	1.5	0.5
Potamogeton zosteriformis (Flat-stem pondweed)	1.14	1.00	0.5
Ranunculus aquatilis (White water crowfoot)	0.57	1.00	0.2
**Potamogeton crispus* (Curly-leaf pondweed) X *Potamogeton praelongus* (White-stem pondweed) – Hybrid	0.57	1.00	0.2
Chara braunii (Braun's stonewort)	0.28	1.22	0.1
Myriophyllum sibiricum (Northern watermilfoil)	0.28	1.00	0.1
**Potamogeton crispus* (Curly-leaf pondweed)	0.28	1.00	0.1

* = Species not native to Wisconsin
** = Average Densities and corresponding Importance Values are based on a 1-3 rake-fullness scale.
Frequency of Occurrence is the number of sites at which a species was observed divided by the total number of vegetated sites. Frequency of occurrence is sensitive to the number of sample sites included. Including non-vegetated sites will lower the frequency of occurrence.
Average density is the mean rake fullness ratings for each species, ranging from 1-3.
Relative frequency is a proportional value that reflects the degree to which an individual species contributes to the sum total of all species observations. The sum of the relative frequencies of all species is 100%. Relative frequency is not sensitive to whether all sampled sites, including non-vegetated sites, are included. Relative frequency does not take into account aquatic moss, freshwater sponges, filamentous algae, or liverworts.

Table 3: 2025 plant inventory survey data (sorted in descending order to show most common to least common)

Table 4 is similar to Table 3, with a few additional data points (in alphabetical order). This table includes number of sites the species was found at, frequency of occurrence where plants were collected, importance values of species, and coefficient of conservatism.

These comparisons allow us to make educated management decisions regarding our aquatic plant population.

2025 Plant Inventory Survey Data							
Aquatic Plant Species	**Number of Sites Found**	**FREQ[a] [0-16'] (%)**	**FREQ[b] [Veg. Sites] (%)**	**RFREQ[c] (%)**	**ADEN[d] (1-3 scale)**	**IV[e]**	**C[f]**
Ceratophyllum demersum (Coontail)	120	34.19	32.26	14.0	1.44	20.16	3
Chara contraria (Common stonewort)	121	34.47	32.53	14.1	1.75	24.67	7
Chara braunii (Braun's stonewort)	1	1.42	1.34	0.6	1.00	0.6	7
Chara globularis (Globular stonewort)	18	5.13	4.84	2.1	1.22	2.56	7
Elodea canadensis (Waterweed)	4	1.14	1.08	0.5	1.50	0.75	3
Heteranthera dubia (Water star grass)	15	4.27	4.03	1.7	1.53	2.6	6
Lemna minor (Small duckweed)	15	4.27	4.03	1.7	1.07	1.82	4
Myriophyllum sibiricum (Northern watermilfoil)	1	0.28	0.27	0.1	1.00	0.1	6
**Myriophyllum spicatum* (Eurasian watermilfoil)	11	3.13	2.96	1.3	1.27	1.65	N/A
Najas flexilis (Slender naiad)	7	1.99	1.88	0.8	1.00	0.8	6
Najas marina (Spiny naiad)	14	3.99	3.76	1.6	1.00	1.6	N/A
Nuphar variegata (Spatterdock)	11	3.13	2.96	1.3	2.55	3.32	6
Nymphaea odorata (White water lily)	8	2.28	2.15	0.9	2.25	2.03	6
**Potamogeton crispus* (Curly-leaf pondweed)	1	0.28	0.27	0.1	1.00	0.1	N/A
Potamogeton foliosus (Leafy pondweed)	5	1.42	1.34	0.6	1.00	0.6	6
Potamogeton friesii (Fries' pondweed)	20	5.70	5.38	2.3	1.10	2.53	8
Potamogeton gramineus (Variable pondweed)	20	5.70	5.38	2.3	1.10	2.53	7
Potamogeton illinoensis (Illinois pondweed)	5	1.42	1.34	0.6	1.00	0.6	6

Potamogeton praelongus (White-stem pondweed)	18	5.13	4.84	2.1	1.56	3.28	8
Potamogeton zosteriformis (Flat-stem pondweed)	4	1.14	1.08	0.5	1.00	0.5	6
Ranunculus aquatilis (White water crowfoot)	2	0.57	0.54	0.2	1.00	0.2	8
Spirodela polyrhiza (Large duckweed)	1	0.28	0.27	0.1	1.00	0.1	5
Stuckenia pectinata (Sago pondweed)	217	61.82	58.33	25.3	1.70	43.01	3
Utricularia vulgaris (Common bladderwort)	7	1.99	1.88	0.8	1.00	0.8	7
Vallisneria americana (Water celery)	126	35.90	33.87	14.7	1.33	19.55	6
Wolffia columbiana (Common watermeal)	5	1.42	1.34	0.6	1.00	0.6	5
**Potamogeton crispus* (Curly-leaf pondweed) X *Potamogeton praelongus* (White-stem pondweed) – Hybrid	2	0.57	0.54	0.2	1.00	0.2	N/A

[a]FREQ [0-16'] = Frequency of Occurrence within depth zone defining extent of plant growth. The number of occurrences of a species divided by the number of sampling points in the 0-16' depth range.
[b]FREQ [Veg. Sites] = Frequency of Occurrence within sites where plants were collected. The number of occurrences of a species divided by the number of sampling points with documented plant growth.
[c]RFREQ = Relative Frequency of Occurrence.
[d]ADEN = Average Density. The sum of the density ratings for a species (1-3 rake fullness scale) divided by the number of sampling points with vegetation.
[e]IV = Importance Value. The product of the relative frequency (RFREQ) and the average density, expressed as a percentage.
[f]C = Coefficient of Conservatism. Used to compute Floristic Quality Index. Values range from 0-10, with higher values indicative of plant species intolerant of habitat modification or water quality impairment caused by human disturbance.

Table 4: Statistical summary for all plant species documented in the 2025 inventory

Table 5 details what species were found via the rope rake, pole rake or by visual observation during the plant inventory surveys. Fifteen different plants were found in each survey. Those plants include: stonewort species, common waterweed, coontail, curly-leaf pondweed, Eurasian watermilfoil, Frie's pondweed, Illinois pondweed, northern watermilfoil, sago pondweed, small duckweed, spatterdock, spiny naiad, water celery, water stargrass and white water lily.

Species Documented on Lake Ripley 2006-2025 (Number of Sites Where Species were Found on Pole/Rope Rake)					
	Years				
Species	**2006**	**2011**	**2015**	**2020**	**2025**
Arum-leaved arrowhead	--	--	V	--	--
Cattail	--	--	--	V	V
Chara sp.	196	--	--	--	--
Braun’s stonewort	--	--	--	--	1
Common stonewort	--	202	155	144	121
Common bladderwort	--	11	6	27	7
Common watermeal	--	V	--	3	5
Common waterweed	3	40	2	7	4
Coontail	44	103	98	153	120
*Curly-leaf pondweed	5	36	5	30	1
*Eurasian watermilfoil	25	15	12	65	11
Flat-stem pondweed	--	--	1	--	4
Floating-leaf pondweed	--	V	2	--	V
Forked duckweed	1	--	--	--	V
Fries’ pondweed	27	82	20	136	99
Globular stonewort**	--	--	21	115	18
Hardstem Bulrush	--	--	V	--	--
Horned pondweed	--	1	1	--	--
Hybrid watermilfoil	--	50	10	--	N/A
Illinois pondweed	18	30	3	3	5
Large duckweed	--	--	--	1	1
Leafy pondweed	3	--	--	--	5
Naiad sp.	--	--	--	--	--
Needle spikerush	--	--	--	1	--
Northern watermilfoil	14	100	26	4	1
Potamogeton sp.(Hybrid)	--	--	10	--	1
Sago pondweed	62	133	174	58	217
Softstem bulrush	--	--	--	V	--
Slender naiad	4	8	25	--	7
Small duckweed	4	1	V	3	15
Small pondweed	1	2	3	59	--
Spatterdock	7	7	5	12	11
Spiny naiad	123	76	127	11	14
Stiff pondweed	--	--	1	13	--
Variable pondweed	--	1	4	23	20
Water bulrush	--	--	--	--	--
Water celery	11	43	79	72	126
Water stargrass	16	4	5	14	15
White-stem pondweed	--	--	--	--	18
White water crowfoot	--	--	--	10	2
White water lily	6	5	3	9	8

Total Number of Species Documented:	19	23	28	24	30

*Indicates an invasive species
** Does not include visual sightings
Table 5: Number of littoral-zone sample sites where each species was found (2006-2025)

Frequency of Occurrence (%)

In Table 6 we compare the plants' frequency of occurrence (FOO%) results over the last five surveys. The frequency of occurrence is the number of sites at which a species was observed, divided by the total number of vegetated sites. Frequency of occurrence is sensitive to the number of sample sites included. Including non-vegetated sites in this calculation would lower the frequency of occurrence. Since 2020, 13 species saw an increase in the frequency of occurrence while 16 species saw a decrease.

Without including any of the Chara species, the largest decreases from 2020 to 2025 were 1) Eurasian watermilfoil, 2) Fries' pondweed, 3) coontail, 4) Curly-leaf pondweed, and 5) common bladderwort. The largest increases were: 1) sago pondweed, 2) water celery, 3) white-stem pondweed, 4) small duckweed and 5) Illinois pondweed. Most of the other species saw a small variability in their FOO.

The stoneworts saw the largest differences between species, as we were able to have a Chara species expert on the boat with us during one of the survey days. Paul Skawinski, a statewide educator with UW-Extension, was able to differentiate between the three Chara species found in Lake Ripley: common, Braun's and globular. He was able to identify key features on the plants to show the other biologists, who could then identify it later in the survey. The Chara data prior to 2020 may be slightly off, due to not being able to identify it to the exact species during the previous surveys.

Percent Frequency of Occurrence of Aquatic Plant Species (2006-2025)					
	Years				
Species	**2006**	**2011**	**2015**	**2020**	**2025**
Braun's stonewort	--	--	--	--	0.28
Chara sp.	53.1	49.6	43.2	39.8	--
Common bladderwort	--	2.7	1.7	7.5	1.99
Common stonewort	--	--	--	--	34.47
Common watermeal	--	--	--	0.8	1.42
Common waterweed	0.8	9.8	0.6	1.9	1.14
Coontail	12.2	25.3	27.3	42.3	34.19

*Curly-leaf pondweed	1.4	8.9	1.4	8.3	0.28
*Eurasian watermilfoil	6.8	3.7	3.3	17.9	3.13
Flat-stem pondweed	--	--	0.3	--	1.14
Floating-leaf pondweed	--	--	0.6	--	--
Forked duckweed	0.3	--	--	--	--
Fries' pondweed	7.3	20.1	5.6	37.6	28.21
Globular stonewort	--	--	5.9	31.8	5.13
Horned pondweed	--	0.2	0.3	--	--
Hybrid watermilfoil	4.6	12.3	2.8	--	--
Illinois pondweed	--	7.4	0.8	0.8	1.42
Large duckweed	--	--	--	--	0.28
Leafy pondweed	0.8	--	--	--	1.42
Naiad sp.	--	--	--	--	--
Needle spikerush	--	--	--	0.3	--
Northern watermilfoil	3.8	24.6	7.2	1.1	0.28
Potamogeton sp.	--	--	2.8	--	--
Pondweed hybrid (White-stem X Curly-leaf)	--	--	--	--	0.57
Sago pondweed	16.8	32.7	48.5	16.0	61.82
Slender naiad	1.1	2.0	7.0	--	1.99
Small duckweed	1.1	0.2	V	0.8	4.27
Small pondweed	0.3	0.5	0.8	16.3	--
Spatterdock	1.9	1.7	1.4	3.3	3.13
Spiny naiad	33.3	18.7	35.4	3.0	3.99
Stiff pondweed	--	--	0.3	3.6	--
Variable pondweed	--	0.2	1.1	6.4	5.70
Water bulrush	--	--	--	--	--
Water celery	3.0	10.6	22.0	19.9	35.90
Water star grass	4.3	1.0	1.4	3.9	4.27
White-stem pondweed	--	--	--	--	5.13

White water crowfoot	--	--	--	2.8	0.57
White water lily	1.6	1.2	0.8	2.5	2.28

* = Species nonnative to Wisconsin
-- = Species not found during that year's survey

Table 6: Percent frequency of occurrence of aquatic plant species (2006-2025)

Both invasives saw large declines in their frequency of occurrence. The FOO for EWM in 2025 was 3.3%, down 14.6% compared to the 2020 results! The frequency of occurrence for EWM in Lake Ripley has been steadily declining since 2011, with one anomaly in 2020.

We believe one of the reasons EWM is steadily declining is due in part to the District's weed harvesting permit program. Since our 2020 survey, we have altered the harvesting map to better encompass areas of the lake with high EWM (and CLP) populations. We target areas of EWM and harvest late into the season to harvest any seeds – potentially preventing them from starting new colonies. Between the 2015 and 2020 surveys, scientists discovered that EWM and hybrid watermilfoil could not be distinguished from one another during a field survey. Therefore, those two species are recorded together as EWM.

In 2020, the FOO for curly-leaf pondweed was 8.29%. During the 2025 survey, that number dropped to 0.28% - an 8.01% decrease! This decrease could have been due to the timing of the survey as well as a reduction in its population. Looking at the data, CLP has been experiencing a 'boom-bust dynamic' – rapid population explosions (booms) followed by

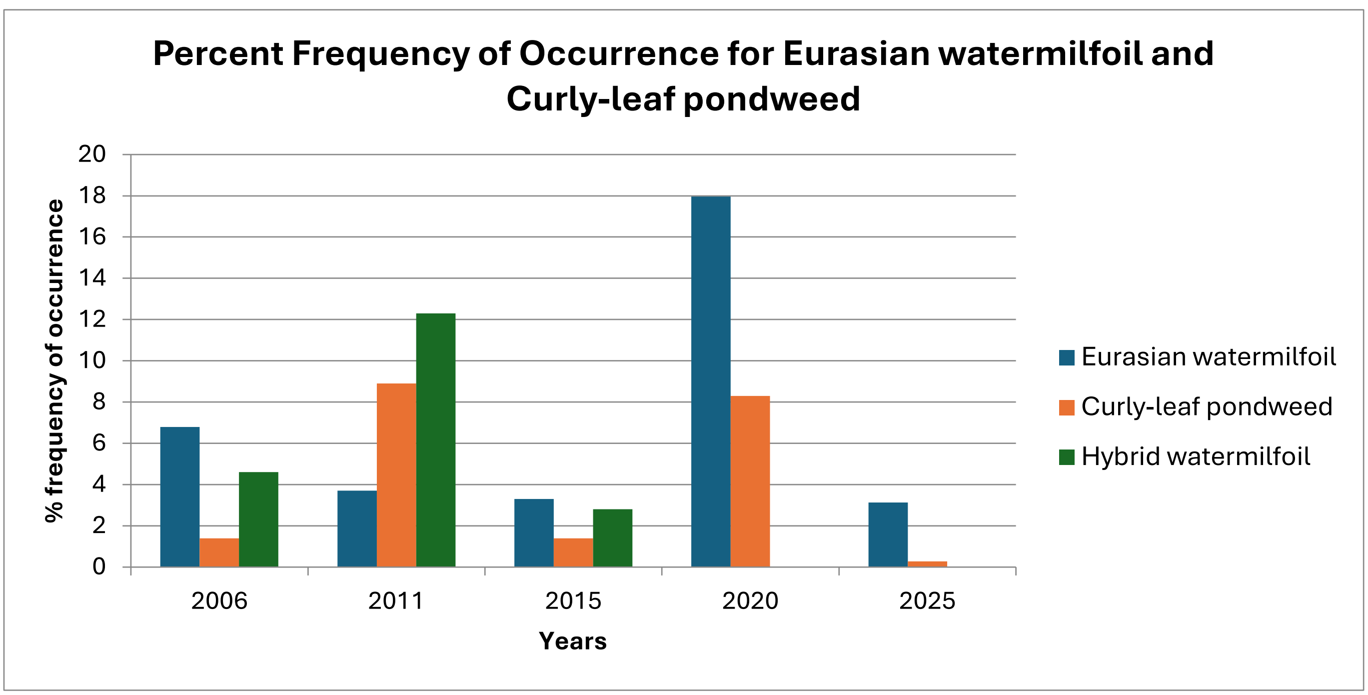


Figure 3: Frequency of Occurrence for Non-Native Aquatic Plant Species Found Among Littoral-Zone Sample Sites (2006-2025).

sharp declines (busts), driven by factors such as rainfall, nutrient cycles or management changes that can lead to cycles of overgrowth and collapse. This dynamic often occurs in invasive species populations.

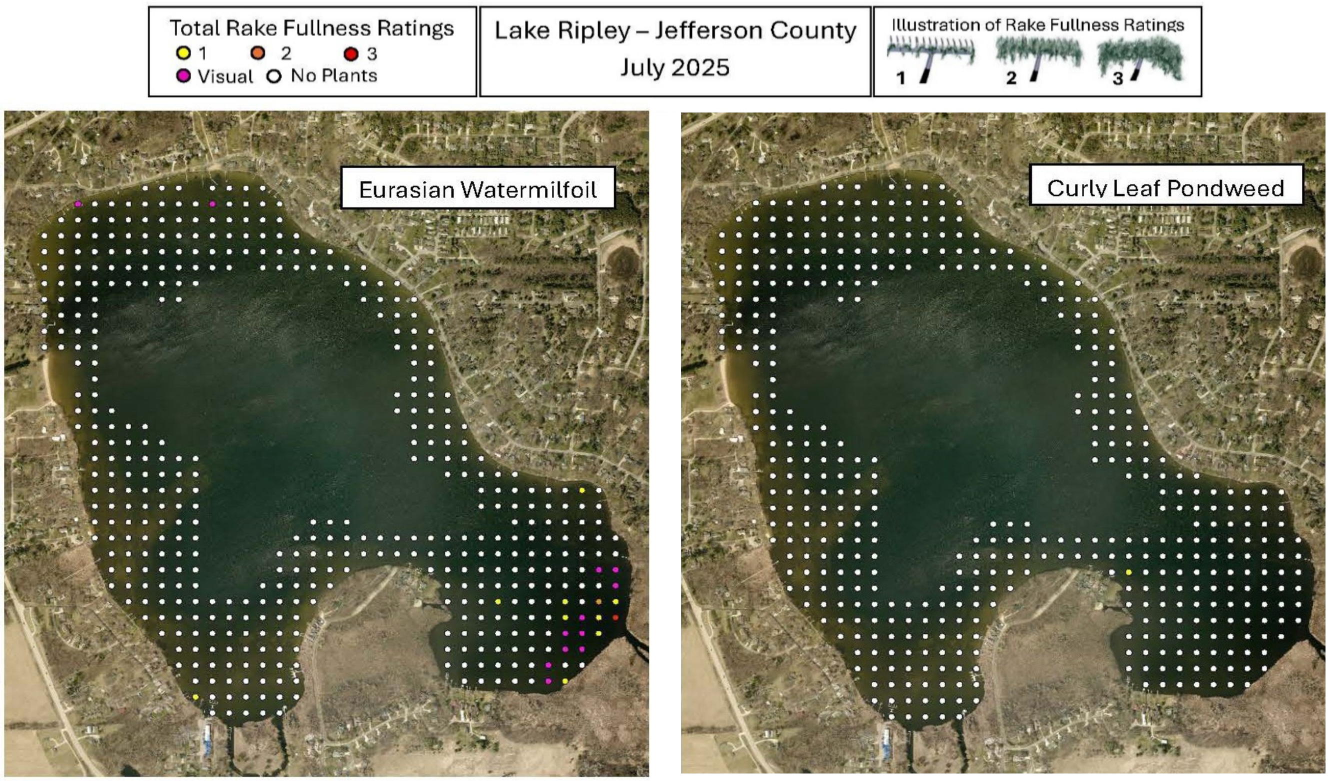


Figure 4: Total rake fullness for CLP and EWM.

Discussion

The 2025 plant inventory survey data XX. There was a decrease in 1) number of points sampled, 2) number of points sampled within depth range of potential plant growth, 3) number of points with vegetation, 4) frequency of occurrence of vegetation within range of plant growth, 5) the Simpson Diversity Index, 6) the average number of species sampled per site, 7) average number of native species sampled per site, and 8) the average number of native species sampled per (vegetated sites only).

The number of points with vegetation recorded has decreased since 2020 by eleven sites. Over time this number has fluctuated and likely has to do with lake conditions during the time of the surveys. The frequency of occurrence (FOO) decreased slightly from 2020 by 1.93%. This decrease is not concerning, as it is such a small decrease. This metric means that of the number of vegetated site sampled, there was vegetation found at 94% of those sites. This indicates that there is a healthy littoral zone on Lake Ripley that is dominated by mostly native aquatic plants.

The Simpson Diversity Index (SDI) is a measure of biodiversity that takes into account the species richness (total number of species) and relative abundance of each species. The value of Simpson's Index ranges between 0 and 1, with 0 representing no biodiversity and 1 representing infinite biodiversity. A higher value indicates higher biodiversity, while a value closer to 0 indicates a community dominated by one or a few species. Lake Ripley's SDI decreased by 0.04%, which is not alarming. The SDI for Wisconsin lakes generally ranges from 0.80 to 0.90, indicating a high plant species diversity (UWSP). Over the last twenty years the SDI has fluctuated, averaging at 0.87 over five different PI surveys. This number represents a healthy, native plant population in Lake Ripley.

The floristic quality index (FQI) is the highest it has ever been! This is due to the crew finding four new species in the lake this year. Four new species were found in the lake in 2025, increasing the floristic quality index (FQI) to a value of 26.16! Three species are native to Wisconsin, with one of the species being a suspected hybrid. Globular stonewort has likely been in the lake for decades, but wasn't being identified correctly. This year, we had an expert join us that was able to identify between the different Chara species. Leafy pondweed was also found this year, a native that increased helped to increase the FQI.

The Mean Coefficient of Conservatism (Mean C) measures the ecological quality of a plant community, ranging from 0 to 10. High values indicate undisturbed, high-quality habitats. Each plant species is assigned a value (0-10) based on its tolerance to disturbance and fidelity to specific habitats (Bernthal, 2002). The Mean C did increase slightly compared to the 2020 result, due to the four species found in 2025.

The average number of species sampled per site, and at sites with vegetation, respectively, have both decreased. These results indicate that some of the plant species found in the lake are more dominant than others. The result for average number of species sampled at sites with vegetation for 2025 is 2.44; that means 2.44 different plant species are found on an average rake pull. The average number of native species sampled at sites with vegetation was only slightly lower, at 2.38.

The plant composition has changed slightly since 2020, with sago pondweed replacing coontail as the most dominant plant. Sago pondweed dominates Lake Ripley, with an FOO of 61.82%. In 2020, sago pondweed was only at 16.02%, increasing by a whopping 45.8%! Coontail went from 42.27% in 2020 to 34.19% in 2025. Both of these native plants have a coefficient of conservatism of 3, having the same ecological quality.

Water celery was another species that saw a large increase; measuring at 19.89% in 2020 and 35.90% in 2025 – a 16% increase! Fries' pondweed and common stonewort both stayed in the top five plants, decreasing by 9.5% and 5% respectively from the 2020 data.

The two invasives found on the lake both saw decreases in their FOO this year. Eurasian watermilfoil decreased from 17.9% to 3.13%, a 14.7% decrease! Curly-leaf pondweed decreased from 8.29% to 0.28%. This drastic decline in curly-leaf pondweed was likely due to the timing of this survey, but also due to the slow decline of this species in Lake Ripley over time. During the spring a crew went out on the lake to conduct a meander survey looking specifically for curly-leaf pondweed. What was found during the survey was that curly-leaf pondweed was getting a head start on all other macrophytes, and wherever it was growing it was most often the dominant species. The continued decline of the two invasive species on Lake Ripley is good news!

Unfortunately, the remaining patch of soft stem bulrush has seen significant changes. It has gotten smaller over the last 5 years, and in late 2025 the patch had seemingly been harmed by what look like a boat motor or some type of trimming tool. The District reached out to the homeowner nearest the bulrush and educated them on what this plant species was, the benefits it provides to the lake, and ways they could protect it.

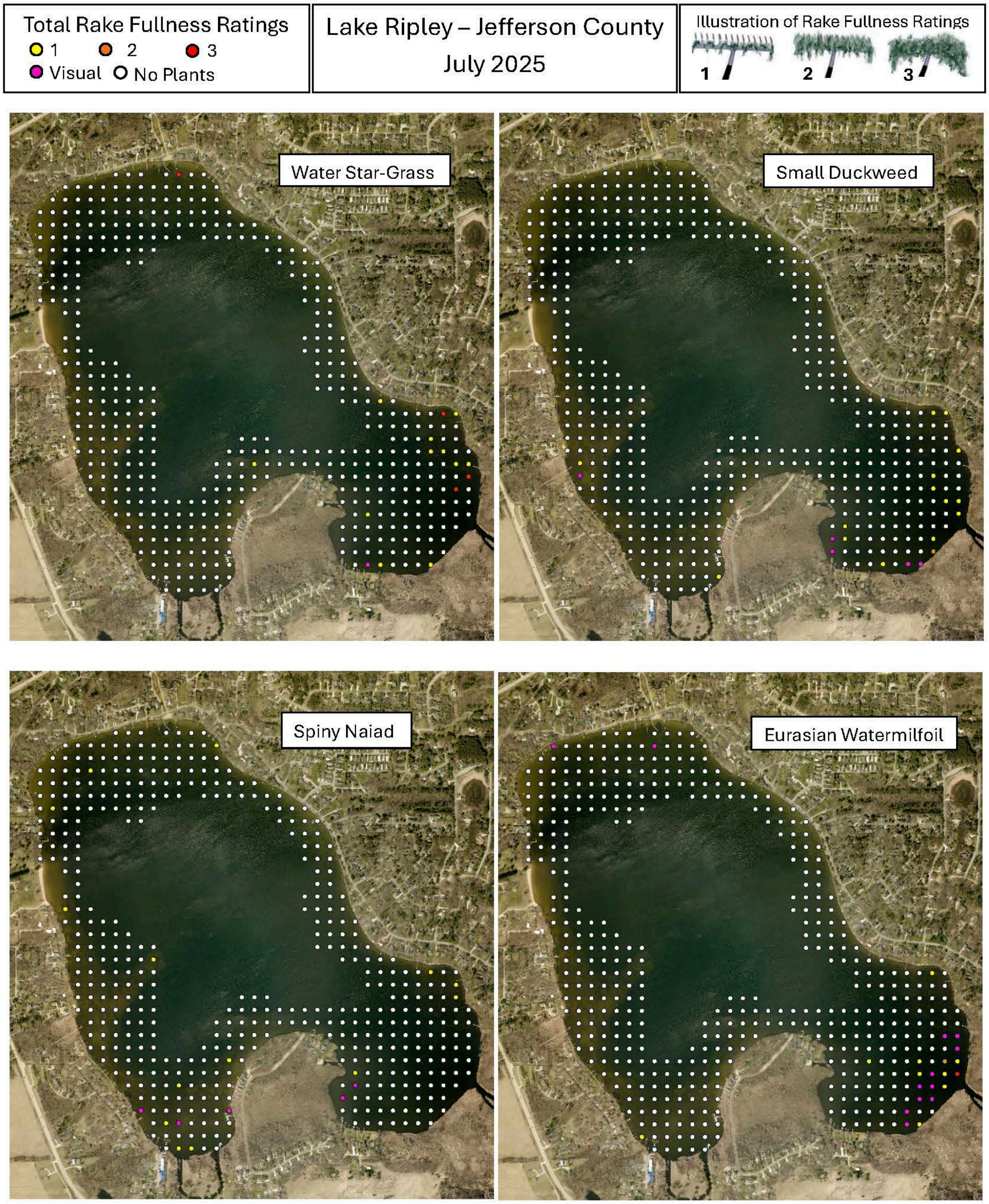
The plant composition has changed, but not in a negative way. Sago pondweed dominates the north and west shores of the lake, with the heaviest densities found in the northern part of the lake. Water celery has spread more towards Lake Ripley Marina since 2020. Common stonewort was found in high densities in Marina Bay, along the southwest shore and along the northwest shore of the lake, similar to the 2020 data. These areas of the lake are high in marl, and most of this area's lakebed is dominated by sand. Globular stonewort was found in the same areas as common stonewort, but with less density. However, neither stonewort species were found in Milwaukee Bay, where the lakebed substrate is muck-dominated.

White-stem pondweed was only found in Milwaukee Bay. Fries' pondweed, variable pondweed and Illinois pondweed distributions were similar to their 2020 data. Fries' pondweed was found consistently all over Lake Ripley, while variable and Illinois pondweeds were more scattered.

In conclusion, these results show us that the plant community in Lake Ripley experiences seasonal changes over the years. Invasive species are declining in the lake and are being replaced by native aquatic plant species.

The District recommends continuing to repeat the whole lake point-intercept survey every five years to compare results. This will help guide the District in future management decisions. It is important to have this data, especially since the District has a harvesting program.

Appendix A

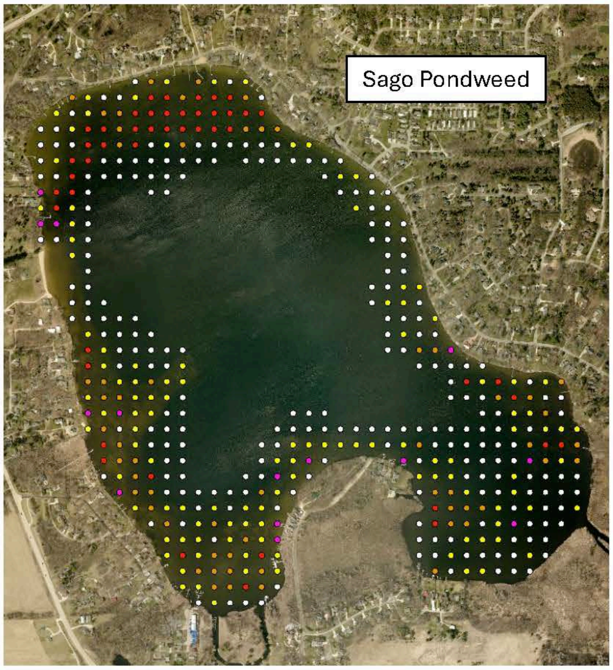


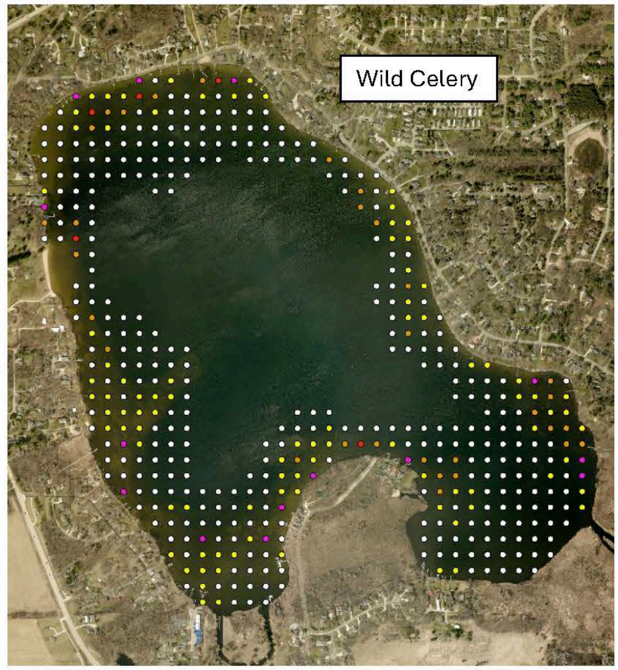
Total Rake Fullness Ratings
1
2
3
Visual
No Plants
Lake Ripley – Jefferson County
July 2025
Illustration of Rake Fullness Ratings
1
2
3
Water Star-Grass
Small Duckweed
Spiny Naiad
Eurasian Watermilfoil

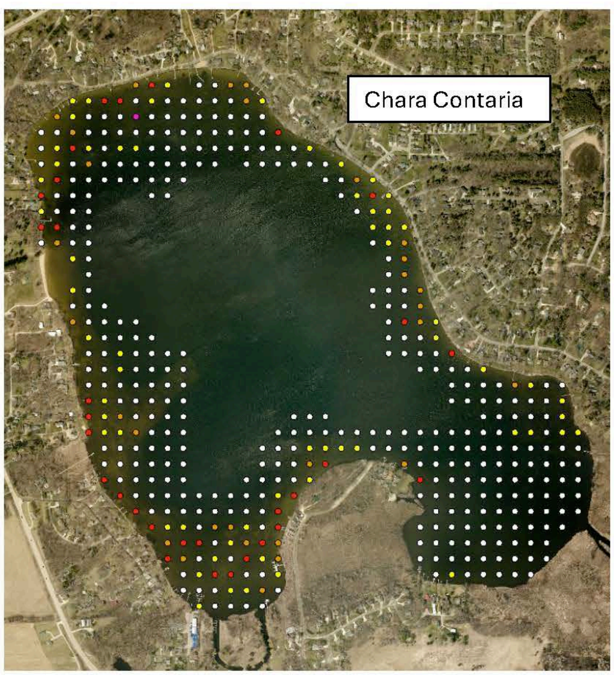
Total Rake Fullness Ratings
1 2 3
Visual No Plants

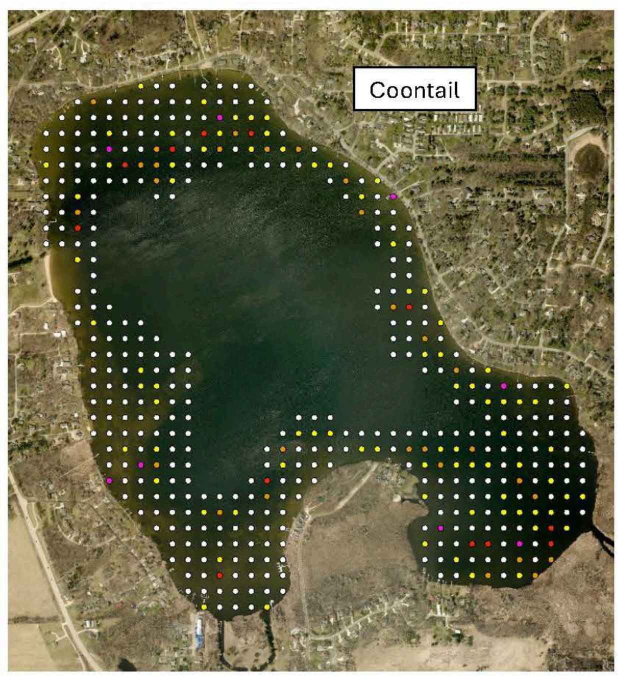
Lake Ripley – Jefferson County
July 2025

Illustration of Rake Fullness Ratings





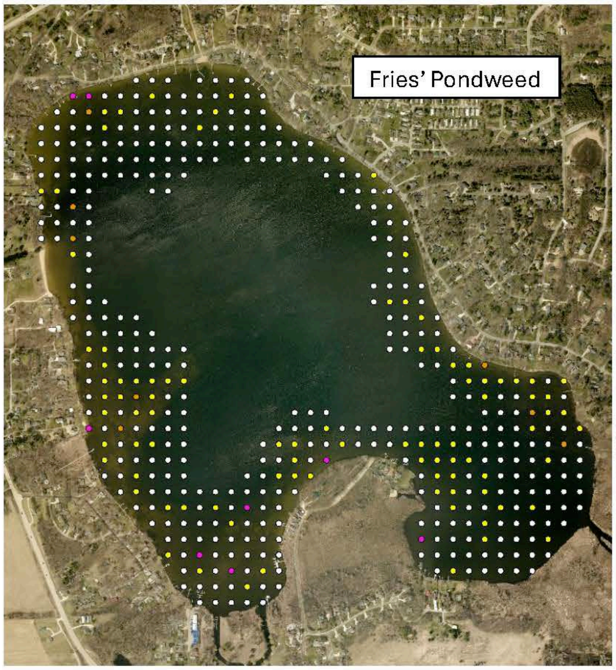


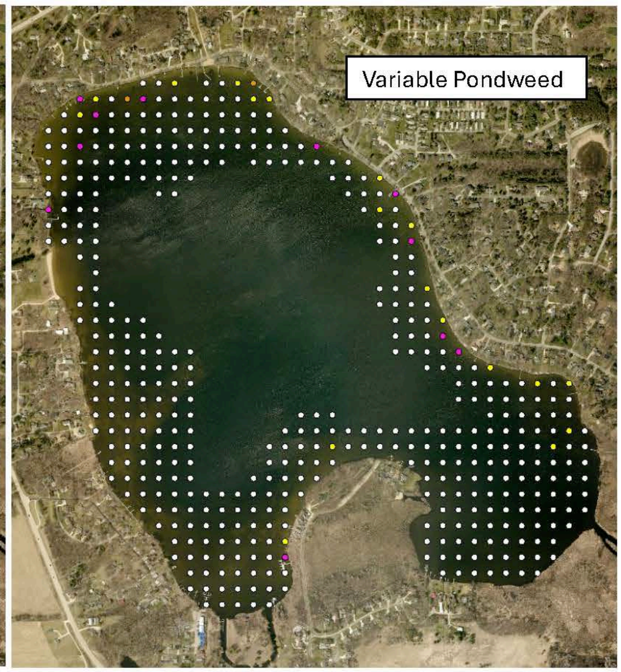


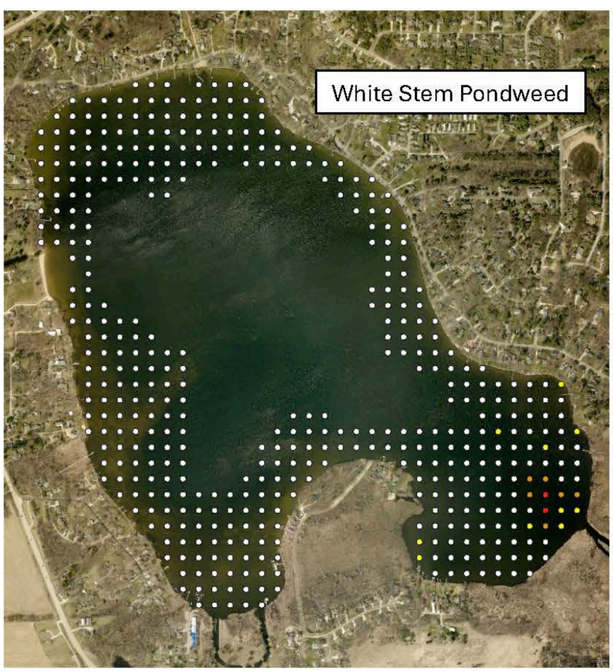
Total Rake Fullness Ratings
1 2 3
Visual No Plants

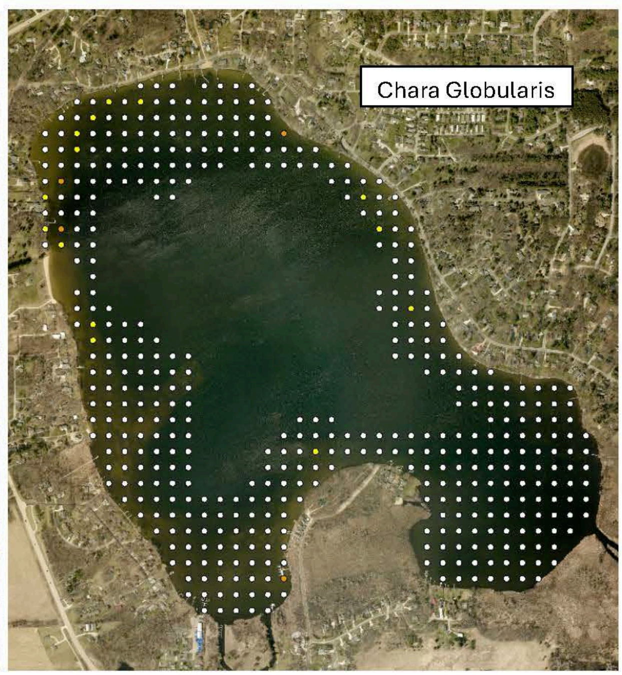
Lake Ripley – Jefferson County
July 2025

Illustration of Rake Fullness Ratings





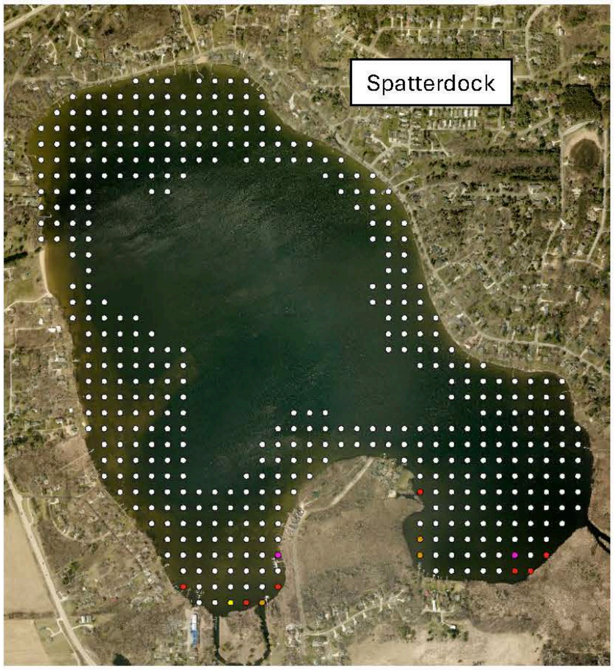


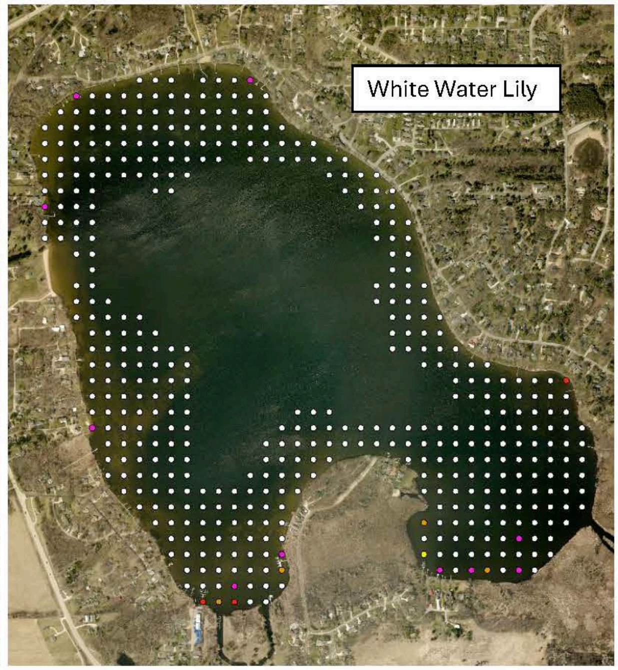


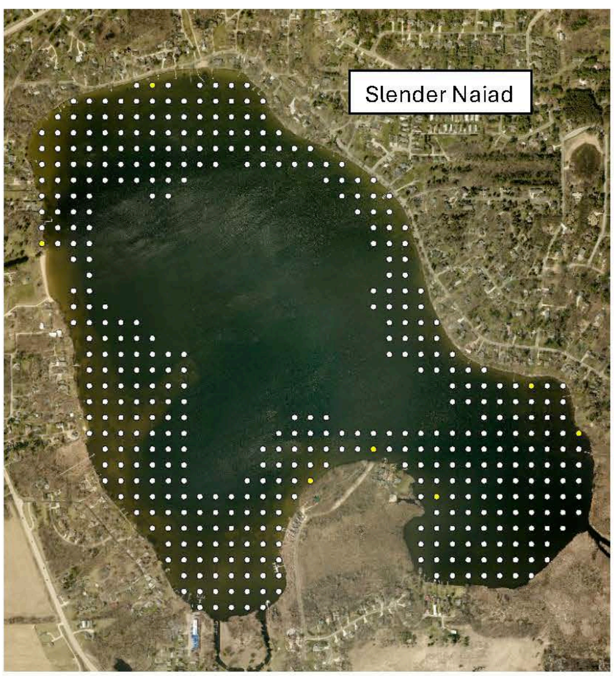
Total Rake Fullness Ratings
1 2 3
Visual No Plants

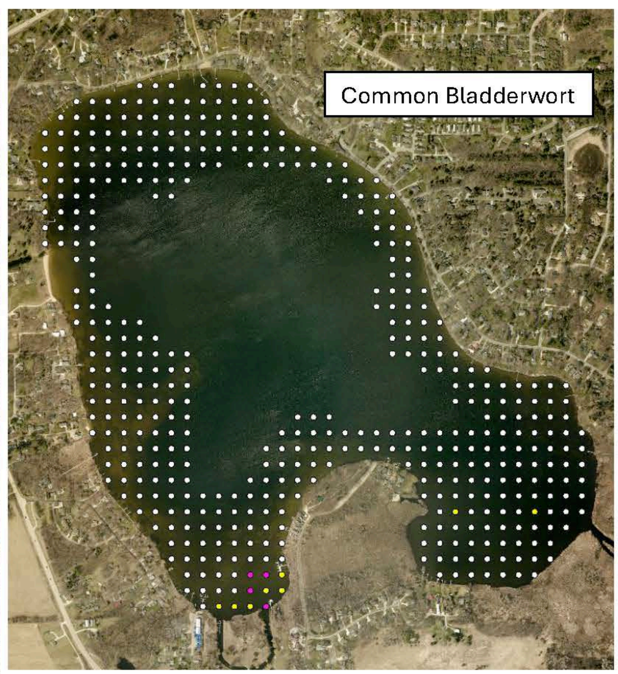
Lake Ripley – Jefferson County
July 2025

Illustration of Rake Fullness Ratings





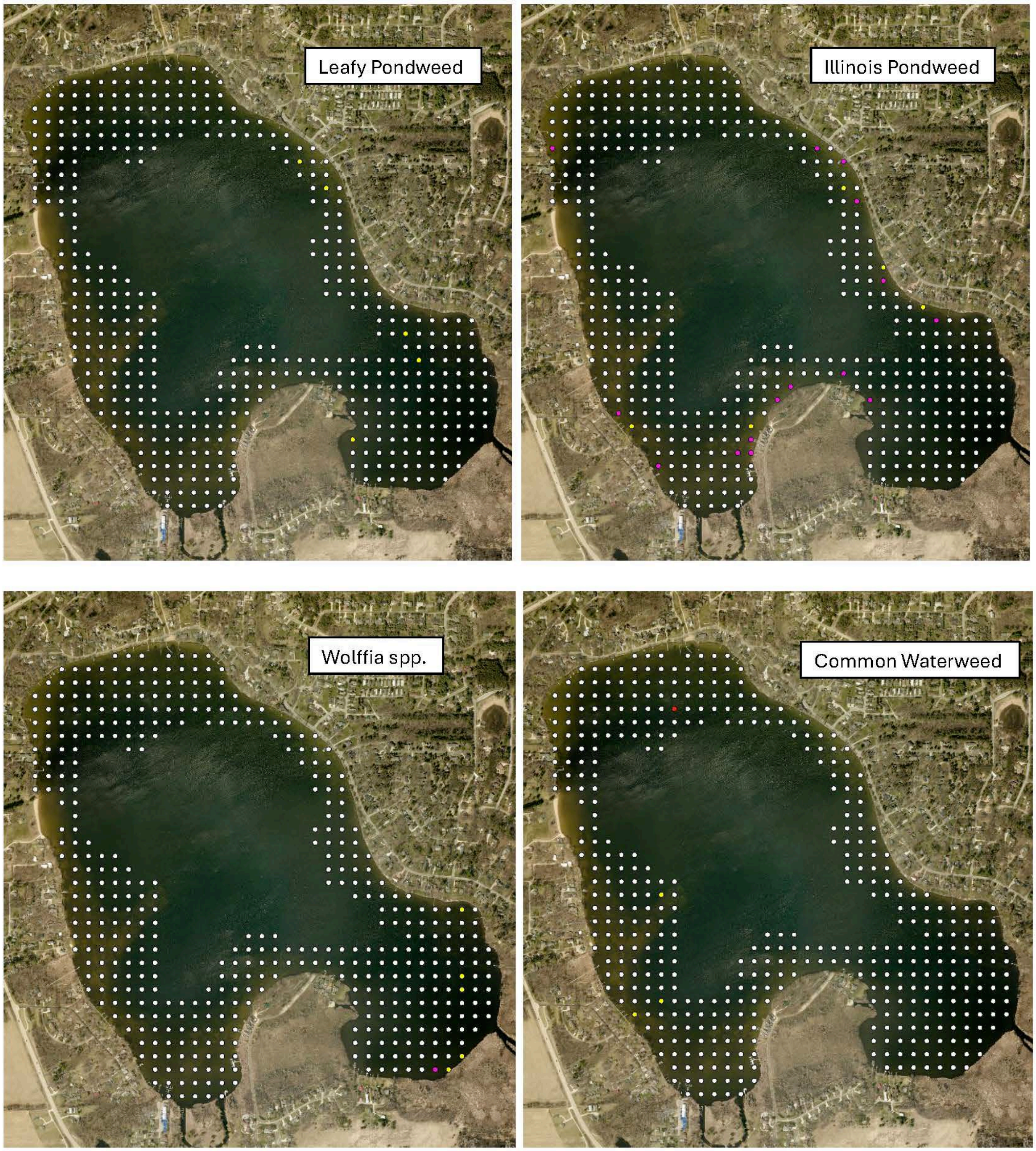




Total Rake Fullness Ratings
1 2 3
Visual No Plants

Lake Ripley – Jefferson County
July 2025

Illustration of Rake Fullness Ratings



Total Rake Fullness Ratings

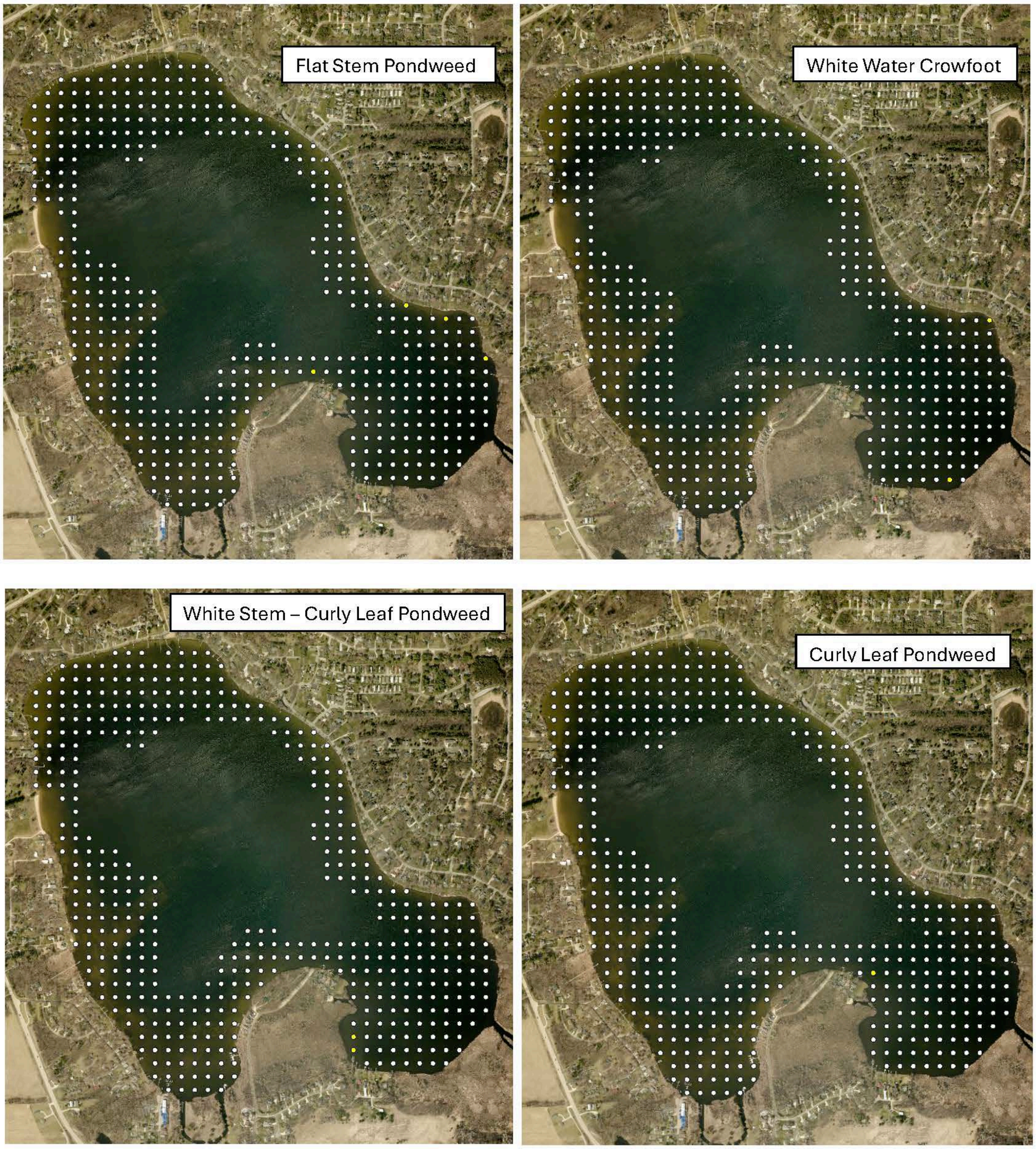
1 2 3

Visual No Plants

Lake Ripley – Jefferson County

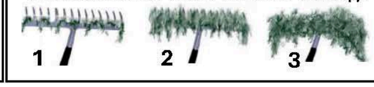
July 2025

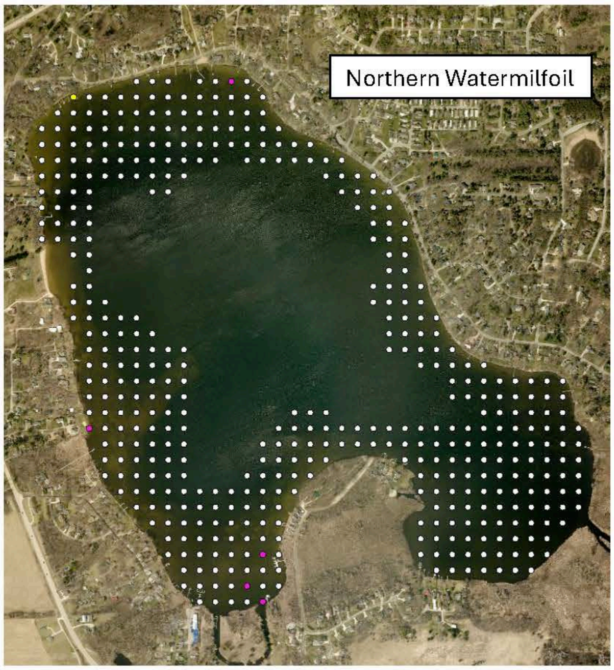
Illustration of Rake Fullness Ratings

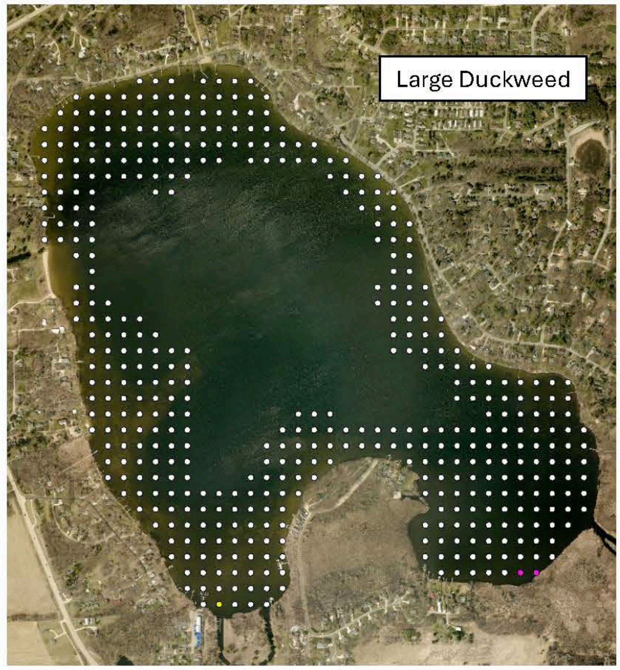


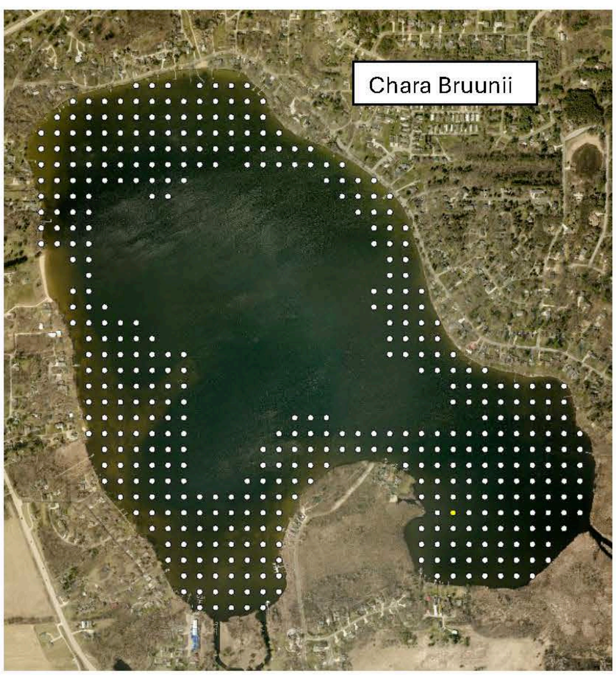
Total Rake Fullness Ratings
1 2 3
Visual No Plants

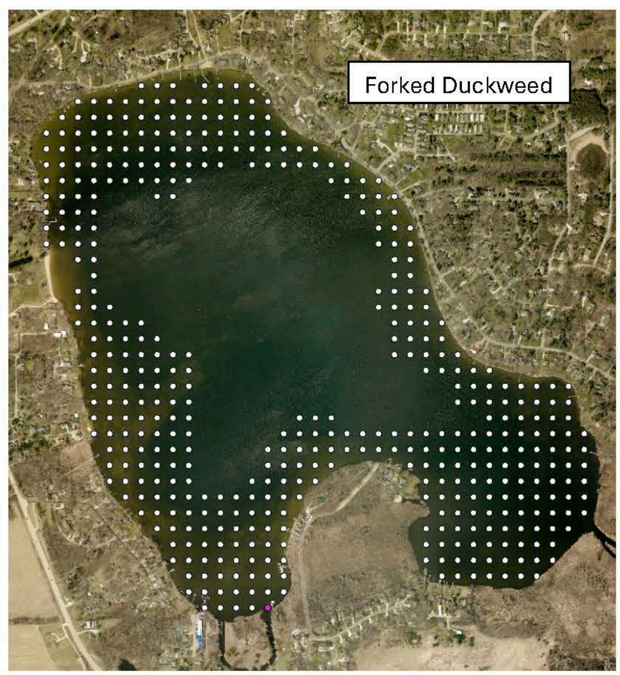
Lake Ripley – Jefferson County
July 2025

Illustration of Rake Fullness Ratings






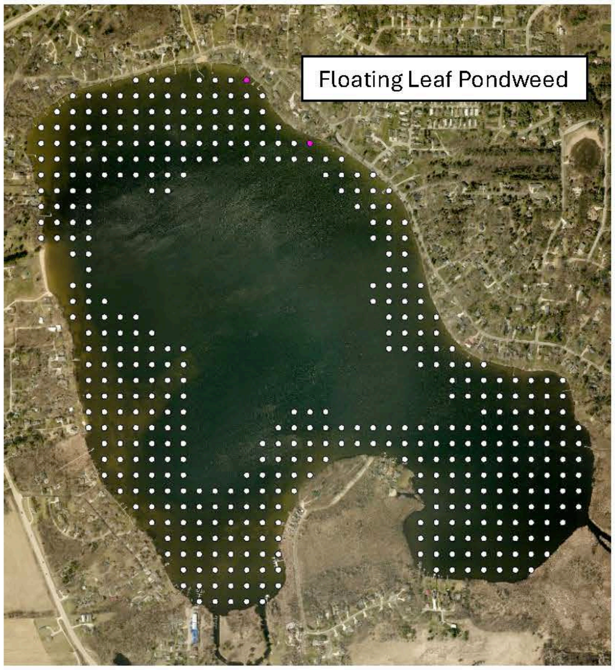


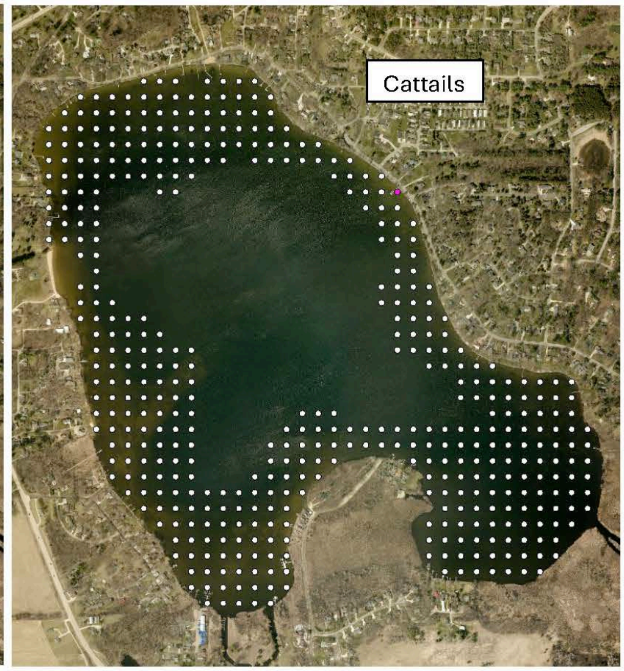


Total Rake Fullness Ratings
1 2 3
Visual No Plants

Lake Ripley – Jefferson County
July 2025

Illustration of Rake Fullness Ratings





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