Carlin Lake

Aquatic Plant Management Plan – 2nd edition

Prepared for:

Presque Isle Town Lake Committee

Contact: Nick Williams

P.O. Box 37

Presque Isle, Wisconsin 54557

Prepared by:

White Water Associates, Inc.

Carole Gabbard, M.S. and Dean Premo Ph.D.

429 River Lane, P.O. Box 27

Amasa, Michigan 49903

Phone: (906) 822-7889; E-mail: dean.premo@white-water-associates.com

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Presque Isle Wilderness Waters Program

Aquatic Plant Management Plan – Carlin Lake

This plan is a product of a WDNR Lake Planning Grant awarded to:

Presque Isle Town Lakes Committee

P.O. Box 37

Presque Isle, Wisconsin 54557

Contact: Nick Williams

Phone: (715) 892-7184; E-mail: thewds@milwpc.com

Submitted to:

Wisconsin Department of Natural Resources

Attention: Kevin Gauthier, Sr., Water Resource Management Specialist

8770 Hwy J

Woodruff, WI 54568

Phone: (715) 365-5211 ext. 214; Email: Kevin.GauthierSr@wisconsin.gov

Prepared by:

White Water Associates, Inc.

Carole Gabbard, M.S. and Dean Premo Ph.D.

429 River Lane, P.O. Box 27

Amasa, Michigan 49903

Phone: (906) 822-7889; E-mail: dean.premo@white-water-associates.com

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Chapter 1. Introduction

The ***Presque Isle Wilderness Waters Program*** results from the efforts of the Presque Isle Town Lakes Committee, an organization that has been active since 2005. The Lakes Committee views stewardship of lakes as an ongoing endeavor that is integrated, coordinated, and administered by the Lakes Committee. This broader perspective accommodates the appropriate range of geographic scales from which to approach lake stewardship: a discrete "lake specific" focus that goes hand-in-hand with waterscape-wide awareness.

This aquatic plant management plan addresses Carlin Lake. Despite this specificity, it maintains the waterscape perspective crucial to effective lake stewardship. This is especially important when it comes to preventing introduction and establishment of aquatic invasive species (AIS). The closely related ***Wilderness Waters Adaptive Management Plan*** (Stine et al., 2022) provides additional overarching waterscape level examination that allows greater opportunity and efficiency in water resource management and education.

A 2025 systematic survey of aquatic plants using the Wisconsin Department of Natural Resources (WDNR) "point-intercept" method was an important underpinning of this aquatic plant management plan. An analysis of the plant data along with water quality and other lake information allowed the preparation of the plan.

Aquatic plants rarely get the respect they merit, although this is slowly changing. We still call an aquatic plant bed a "weed bed." Many aquatic plants have "weed" in their names (e.g., duckweed, pondweed, or musky weed). Likely this term was borrowed from "seaweed" and not intended as derogatory, but in today's use, "weed" connotes an unwanted, aggressively growing plant. Such is not the case for the vast majority of aquatic plants. In fact, aquatic plants are a vital part of a lake ecosystem, recycling nutrients, providing vertical and horizontal structure, and creating habitat for animal life. Invertebrates, including crustaceans and insects, live on or within this "aquatic forest." Fish find food and shelter within aquatic plant beds. Waterfowl eat parts of plants directly as well as feed on invertebrates associated with the plants. Muskrats eat aquatic plants and particularly love cattails and bulrushes. Otter and mink hunt invertebrates and small vertebrates within the shelter of submergent and emergent beds. In shallow water, great blue herons find fishes among the plants.

In lakes that receive an excess of nutrients (particularly from fertilizers or leaking septic tanks), plant growth can become too dense or dominated by only a few species. As these abundant plants die, their decomposition can depress dissolved oxygen levels and diminish suitability for fish. Algae can respond rapidly to nutrient influxes and create nuisance conditions. These phenomena can cause people to view all aquatic plants in a negative light.

On another negative front, non-native plant species, transported on boats and trailers or dumped from home aquariums, private ponds or water gardens may proliferate in a water body and negatively influence the community of native species. Eurasian watermilfoil (*Myriophyllum spicatum*) is one of the invasive plant species capable of this kind of population boom. Fortunately, this kind of rampant growth of aquatic invasive plants does not always occur. On occasion, even a native plant species can exhibit excessive growth and results in a population that is viewed by some as a recreational nuisance. The native Southern Naiad (*Najas guadalupensis*) has exhibited this kind of behavior in some northern Wisconsin lakes.

For most lakes, native aquatic plants are an overwhelmingly positive attribute, greatly enhancing the aesthetics of the lake and providing good opportunities for fishing, boating, swimming, snorkeling, sight-seeing, and hunting. In some water bodies even the presence of an aquatic invasive plant species is not a significantly negative phenomenon.

When it comes to aquatic plant management, it is useful to heed the mantra of the medical profession: "First, do no harm." It is both a social and scientific convention that aquatic plant management is more effective and beneficial when a lake is considered as an entire and integrated ecosystem. Actions taken to curtail a specific plant population (for example, herbicide use to treat Eurasian watermilfoil) will invariably impact other desirable native species. Rare plants, important habitats, or culturally significant plants (such as wild rice) should always be given careful consideration and protection.

Anyone involved in aquatic plant management should be aware that a permit may be required to remove, add, or control aquatic plants. In addition, anyone using Wisconsin's lakes must comply with the "Boat Launch Law" that addresses transport of aquatic plants on boat trailers and other equipment. A good review of the laws, permits, and regulations that affect management and behavior surrounding aquatic plants can be found in the WDNR guidelines called ***Aquatic Plant Management in Wisconsin***.

In preparing this plan, we followed guidelines in ***Aquatic Plant Management in Wisconsin***. The resulting plan is an adaptive plan (Walters, 1986). Simply put, it will be modified as new information becomes available. The WDNR Guidance document outlines three objectives that may influence preparation of an aquatic plant management plan. Currently, the motivation for this plan lies in the first two objectives:

• ***Protection*** - preventing the introduction of nuisance or invasive species into waters where these plants are not currently present;

• ***Maintenance*** - continuing the patterns of recreational use that have developed historically on and around a lake; and

• ***Rehabilitation*** - controlling an imbalance in the aquatic plant community leading to the dominance of a few plant species, frequently associated with the introduction of invasive non-native species.

During projects with the WDNR Planning Grant Program and through past efforts, the Town Lakes Committee has followed the seven-step plan outlined in the Guidance Document for developing an aquatic plant management plan:

1. Goal setting – Getting the effort organized, identifying problems to be addressed, and agreeing on the goals;

2. Inventory – Collecting baseline information to define the past and existing conditions;

3. Analysis – Synthesizing the information, quantifying and comparing the current conditions to desired conditions, researching opportunities and constraints, and setting directions to achieving the goals;

4. Alternatives – Listing possible management alternatives and evaluating their strengths, weaknesses and general feasibility;

5. Recommendations – Prioritizing and selecting preferred management options, setting objectives, drafting the plan;

6. Implementation – Formally adopting the plan, lining up funding, and scheduling activities for taking action to achieve the goals;

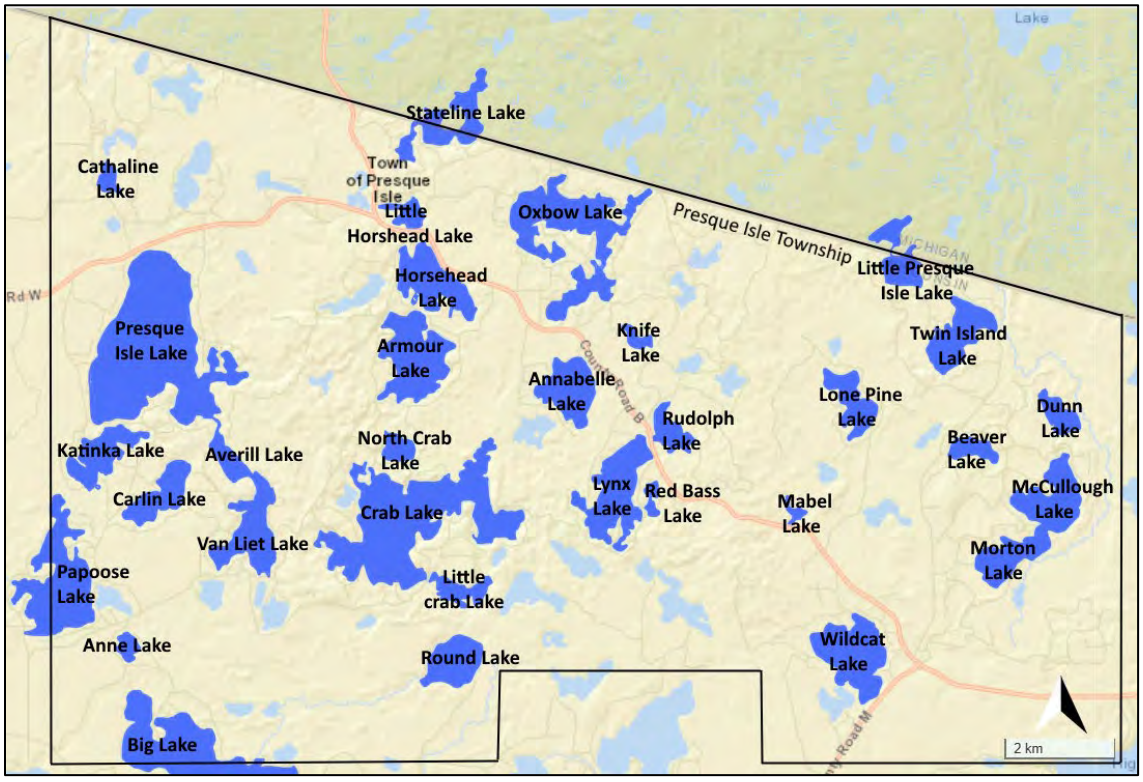
7. Monitor & Modify – Developing a mechanism for tracking activities and adjusting the plan as it evolves.

Besides this introductory chapter, this plan is organized in six Chapters. The study area is described in Chapter 2. Chapter 3 states the purpose and goals for the plan. Chapter 4 presents an inventory and analysis of information that pertain to the plan including the results of the aquatic plant survey. Chapter 5 provides recommendations that support the overall goals and establish the stewardship component of the plan. This chapter also presents actions and objectives for implementing the plan. Finally, Chapter 6 describe the contingency plan for aquatic invasive species. Three appendices complete this document. Appendix 1 contains literature cited, Appendix 2 contains some tables and figures of the aquatic plant survey results, Appendix 3 contains the 2025 Aquatic Invasive Species Report for Carlin Lake.

Chapter 2. Study area

"Almost an island" is the literal translation of the French phrase "Presque Isle." Early French missionaries, perhaps disoriented by the preponderance of water in this north central Wisconsin landscape applied the name, "Presque Isle" to describe an area where the water seemed to dominate the land. The French visitors and Native Americans certainly recognized this landscape as special. Modern ecologists and recreationists share this view. The region that includes the Township of Presque Isle, Wisconsin is an ecological landscape marvelously rich in surface waters. Aerial photography reveals a concentration of lakes and streams that is unique in North America. Presque Isle Township has eighty-four lakes. The Presque Isle area could as easily be termed a "waterscape" as a "landscape."

Presque Isle Township is one of the northern-most townships in Vilas County, Wisconsin. Presque Isle Township's northern border is shared with the State of Michigan. In fact, some of the Presque Township lakes lie on the state border. The location of the subject of this APM Plan (Carlin Lake) is shown in Map 1 along with other lakes in Presque Isle Township that have had point-intercept aquatic plant surveys conducted.



Map 1. Presque Isle Township lakes on which point-intercept aquatic plant surveys have been conducted.



Map 2. Aerial photo of Carlin Lake.

Descriptive parameters for Carlin Lake are in Table 1. It is a seepage lake (no inlet or outlet) of about 155 acres and maximum depth of 36 feet. The shoreline development index for Carlin Lake is 1.6. The shoreline development index is a quantitative expression derived from the shape of the lake. It is defined as the ratio of the shoreline length to the length of the circumference of a circle of the same area as the lake. A perfectly round lake would have an index of 1. Increasing irregularity of shoreline development in the form of bays and projections of the shore is shown by numbers greater than 1. For example, fjord lakes with extremely irregularly shaped shorelines sometimes have SDI's exceeding 5. A higher shoreline development index indicates that a lake has relatively more productive littoral zone habitat.

Table 1. Water body parameters

Water Body Name	Carlin Lake
County	Vilas
Township/Range/Section	T43N-R06E-S17, S19, S20
Water Body Identification Code	2757900
Lake Type	Seepage
Surface Area (acres)	155
Maximum Depth (feet)	36
Maximum Length (miles)	0.9
Maximum Width (miles)	0.4
Shoreline Length (miles)	2.8
Shoreline Development Index	1.6
Total Number of Piers (2026 aerial)	38
Number of Piers / Mile of Shoreline	13.6
Total Number of Homes (2026 aerial)	34
Number of Homes / Mile of Shoreline	12.1

Carlin Lake has no public access site. We observe a total of 38 piers on the shoreline of Carlin Lake from a 2026 aerial photograph or about 13.6 piers per mile of shoreline. The riparian area consists of both upland and wetland areas (Map 3).



Map 3. Topographic map of Carlin Lake.

Chapter 3. Purpose and goal statements

This plan approaches aquatic plant management with a healthy dose of humility. We do not always understand the causes of environmental phenomena or the effects of our actions to manage the environment. With that thought in mind, we have crafted a statement of purpose and goals for this plan:

> ***Carlin Lake has a healthy aquatic plant community that was documented by point-intercept aquatic plant surveys over the years. This plant community is essential to, and part of, a high-quality aquatic ecosystem that benefits the human community with its recreational and aesthetic features. The purpose of this aquatic plant management plan is to provide accurate information about the lake and encourage a lake user culture that values and sustains a healthy native plant community.***

Supporting this purpose, the goals of this aquatic plant management plan are:

> ***(1) Monitor and protect the native aquatic plant community;***
>
> ***(2) Monitor for AIS and prevent establishment of new non-native biota; and***
>
> ***(3) Educate riparian owners and lake users on preventing AIS introduction, reducing nutrient inputs that can alter the plant community, minimizing physical removal of native riparian and littoral zone plants, and living with a lake whose natural healthy state includes aquatic plants.***

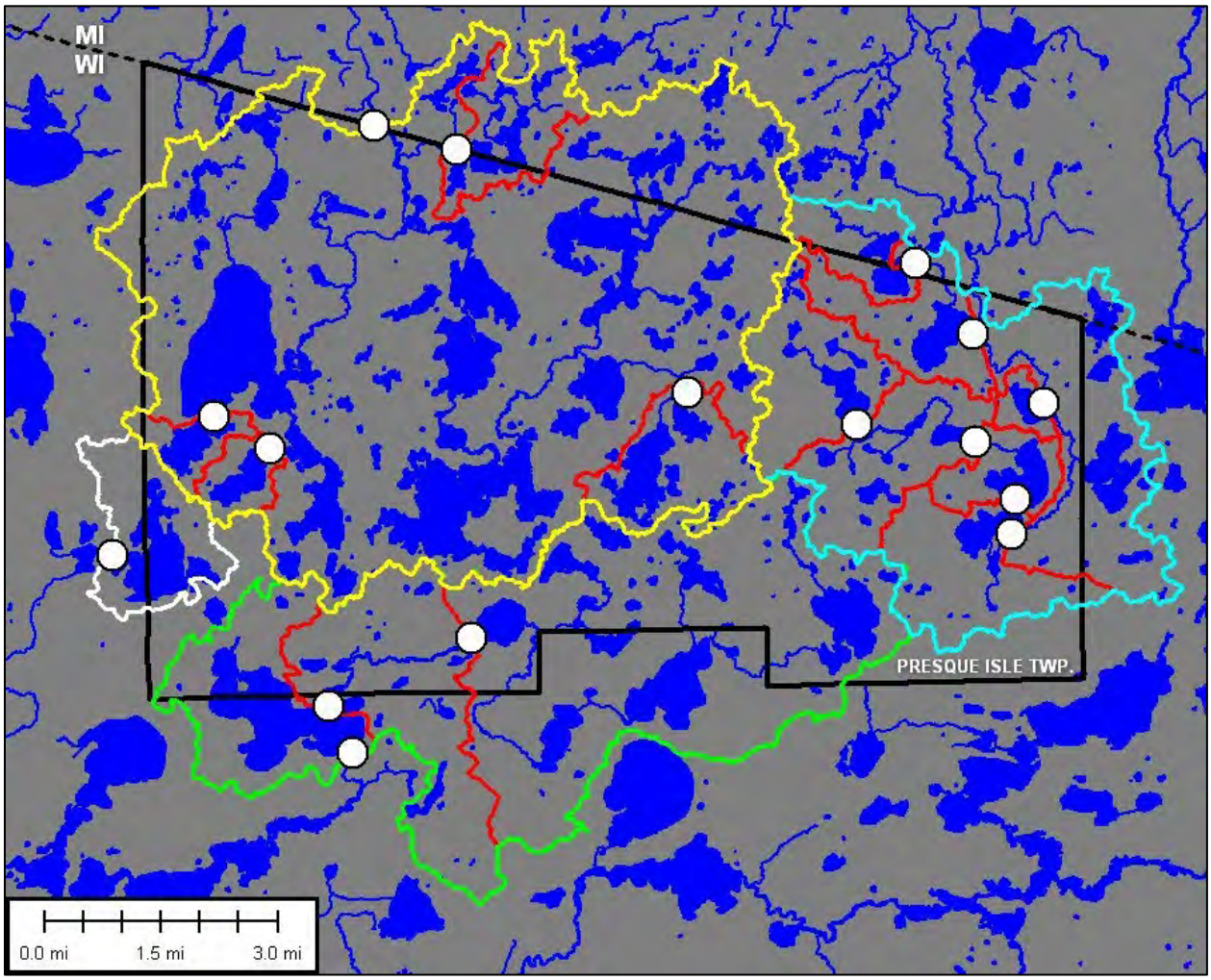
The purpose and goals are the foundation for the aquatic plant management plan presented in this document. They inform the objectives and actions outlined in Chapter 5 and are the principal motivation of Carlin Lake stewards.

Chapter 4. Information and Analysis

Our efforts in the Wilderness Waters Program have compiled information about historical and current conditions of the Carlin Lake ecosystem and its surrounding watershed. Of particular importance to this aquatic plant management plan is the aquatic plant survey that was conducted using the ***WDNR Protocol for Aquatic Plant Survey, Collecting, Mapping, Preserving, and Data Entry*** (Hauxwell et al., 2010). The results of this comprehensive "point-intercept" survey along with relevant components of other information are presented in this chapter under nine respective subheadings: watershed, aquatic plant management history, aquatic plant community description, fish community, water quality and trophic status, water use, riparian area, wildlife, and stakeholders.

Section 1. Watershed

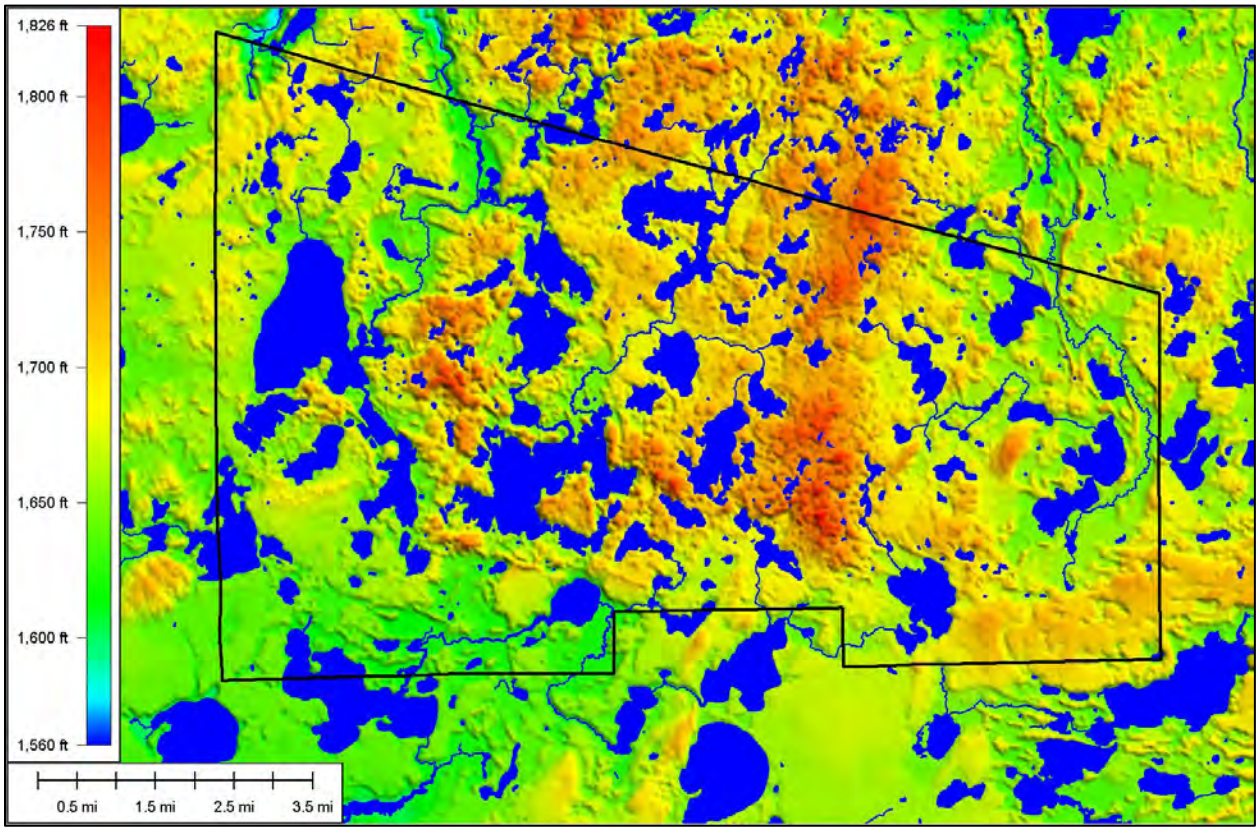
The Presque Isle Township waterscape sits on a large-scale watershed divide. Some of the water drains north through the Presque Isle River system and eventually enters Lake Superior. Some of the water drains into the Flambeau River system and on to the Mississippi River. In fact, there are two federal hydrologic sub-basins (designated by 8-digit HUC codes) that include Presque Isle Township. The Black-Presque Isle Rivers sub-basin (HUC#04020101) drains north to Lake Superior and the Flambeau River sub-basin (HUC#0705002) drains southwesterly to the Mississippi River. The Black-Presque Isle Rivers sub-basin contains two federal hydrologic sub-watersheds within Presque Isle Township: the South Branch Presque Isle River sub-watershed (HUC#040201010303) and the Pomeroy Creek-East Branch Presque Isle River sub-watershed (HUC#040201010301). The Flambeau River sub-basin contains one sub-watershed within Presque Isle Township: the Rice Creek sub-watershed (HUC#07050020103). Map 4 illustrates these watersheds and the watersheds of the water bodies subject to the Wilderness Waters Program studies. Carlin Lake is contained within the South Branch Presque Isle River sub-watershed (Map 4).



Map 4. Watersheds of Presque Isle Township Area.

Description: Portions of 3 federal hydrologic sub-watersheds are illustrated: (1) S.Br. Presque Isle River (bounded by yellow), (2) Pomeroy Cr-E.Br. Presque Isle River (bounded by blue and yellow), and (3) Rice Cr. (bounded by green, yellow, and blue). Also shown are the smaller watersheds of individual water bodies subject to the Wilderness Waters studies (bounded by red and, in the case of Papoose Lake, bounded by white). White dots show outlet points for the smaller watersheds.

The elevation in Presque Isle Township ranges from around 1,550 feet above sea level to 1,750 feet above sea level. A digital elevation model is provided as Map 5 and shows the relative elevations for the area with orange areas of the landscape being the highest elevations and greens and blues being the lowest elevations.



Map 5. Digital elevation model of Presque Isle Township area.

The watershed (drainage basin) is all of the land and water areas that drain toward a particular river or lake. A water body is greatly influenced by its watershed. Watershed size, topography, geology, land use, soil fertility and erodibility, and vegetation are all factors that influence water quality. The Carlin Lake watershed is about 534 acres. The cover types in the watershed are presented in Table 2. Forest and surface water comprise the largest components. Soil groups B and D are present with over half of the total acreage comprising of group B soil. Soil group B has good infiltration capacity whereas D has very low infiltration capacity. The watershed to lake area ratio is 3:1. Water quality often decreases with an increasing ratio of watershed area to lake area. As the watershed to lake area increases there are more sources and amounts of runoff. In larger watersheds, runoff water can leach more minerals and nutrients and

carry them to the lake. The runoff to a lake (such as after a rainstorm or snowmelt) differs greatly among land uses. Forest cover is the most protective as it exports much less soil (through erosion) and nutrients (such as phosphorus and nitrogen) to the lake than agricultural or urban land use.

Table 2. Cover Types and Soil Groups of the Carlin Lake Watershed.

Cover Type	Acres	Percent
Agriculture	0	0
Commercial	0	0
Forest	318.2	59.6
Grass/Pasture	2	0.4
High-density Residential	0	0
Low-density Residential	33.6	6.3
Water	179.7	33.7
Total	533.5	100.0

Soil Group	Acres	Percent	
			Hydrologic Soil Groups - Soils are classified by the Natural Resource Conservation Service into four Hydrologic Soil Groups* based on the soil's runoff potential. The four Hydrologic Soils Groups are A, B, C and D. Where A has the smallest runoff potential and D the greatest.
A	9.9	1.9	**Group A** is sand, loamy sand or sandy loam types of soils. It has low runoff potential and high infiltration rates even when thoroughly wetted. They consist chiefly of deep, well to excessively drained sands or gravels and have a high rate of water transmission.
B	344.8	64.6	**Group B** is silt loam or loam. It has a moderate infiltration rate when thoroughly wetted and consists chiefly or moderately deep to deep, moderately well to well drained soils with moderately fine to moderately coarse textures.
C	0	0	**Group C** soils are sandy clay loam. They have low infiltration rates when thoroughly wetted and consist chiefly of soils with a layer that impedes downward movement of water and soils with moderately fine to fine structure.
D	178.8	33.5	**Group D** soils are clay loam, silty clay loam, sandy clay, silty clay or clay. This soil has the highest runoff potential. They have very low infiltration rates when thoroughly wetted and consist chiefly of clay soils with high swelling potential, soils with a permanent high-water table, soils with a claypan or clay layer at or near the surface and shallow soils over nearly impervious material.

Section 2. Aquatic plant management history

As far as we can determine, no systematic or large-scale plant management activity has ever taken place in Carlin Lake. Over the years, no particular nuisance issues have demanded control action. Systematic aquatic plant surveys have been conducted on Carlin Lake in 2010 and 2025. Findings from the 2010 survey are discussed and compared to the most recent (2025) survey results in Part 2.

Section 3. Basic knowledge on aquatic plants

Why do lakes need aquatic plants? In many ways, they are underwater forests. Aquatic plants provide vertical and horizontal structure in the lake just like the many forms and variety of trees do in a forest. Imagine how diminished a forest's biodiversity becomes in the advent of a clear-cut or a conversion from a hardwood forest to a red pine plantation. Similarly, a lake's biodiversity in large part depends on a diversity of plants.

Aquatic plants are beneficial in many ways. Areas with plants produce more food for fish in the form of insect larvae, snails, and other invertebrates. Aquatic vegetation offers fish shelter and spawning habitat. Many submerged plants provide food for waterfowl and habitat for insects on which some waterfowl feed. Aquatic plants further benefit lakes by producing oxygen and absorbing nutrients (phosphorus and nitrogen) from runoff. Aquatic plants also protect shorelines and lake bottoms by dampening wave action and stabilizing sediments.

The distribution of plants within a lake is generally limited by light availability. Light availability at the lake bottom is affected by water clarity. Aquatic biologists often estimate the depth to which rooted aquatic plants can exist as about two times the average Secchi clarity depth. For example, if the average Secchi depth is eight feet, then it is fairly accurate to estimate that rooted plants might exist in water as deep as sixteen feet. At depths greater than that (in this example), light is insufficient for rooted plants to grow. In addition to available light, the type of substrate influences the distribution of rooted aquatic plants. Plants are more likely to be found in muddy or soft sediments containing organic matter, and less likely to occur where the substrate is sand, gravel, or rock. Finally, water chemistry influences which plants are found in a body of water. Some species prefer alkaline lakes and some prefer more acidic lakes. The presence of nutrients like phosphorous and nitrogen also influence plant community composition. Water

quality information for Carlin Lake can be found in the DNR Water Explorer tool (WEx WDNR - Carlin Lake (Vilas County))

As mentioned earlier, non-native invasive plant species can reach high densities and wide distribution within a lake. This can diminish the native plant community and the related habitat. At times, even a native plant species can reach high population levels and interfere with certain kinds of human recreation. Cases such as these often elicit calls for some kind of plant management. It should be noted, however, that altering aquatic plant communities through hand-pulling, mechanical harvest, herbicides, or other means is expensive (in time and/or money) and by no means permanent. Long-term outcomes of these manipulations are difficult to predict and collateral damage to non-target plant species can be significant. For example, the efficacy and widespread effects of new chemicals developed for plant management are poorly understood. Safety evaluation of these herbicides often does not include their breakdown products that will reside in the lake environment for unknown duration. Management treatments can even exacerbate the perceived problem or create other management challenges. Because of these uncertainties, permits are typically required in cases of aquatic plant management.

Section 4. Carlin Lake aquatic plant community

Aquatic plant surveys have been conducted on Carlin Lake by aquatic plant specialists in 2010 and 2025. In each of these surveys, WDNR point-intercept protocol and methodology[1] was followed. This systematic survey assessed the plant species composition on a grid of 456 points distributed evenly over the lake. Using latitude-longitude coordinates and a handheld GPS unit, scientists navigated to the points and used a rake mounted on a pole or rope to sample plants. These were identified, recorded, and put into a dedicated spreadsheet for storage and data analysis. During the preparation of this plan, the data from the two PI surveys (2010 and 2025) have been analyzed and interpreted to evaluate the composition of the plant community (species present and abundance) and how the plant community has changed over time. The aquatic plant data for Carlin

[1] Wisconsin Standard Method to Collect Aquatic Plant Data

Lake along with data from many Wisconsin Lakes, can be explored in the Wisconsin DNR Aquatic Plant Explorer Tool at Aquatic Plant Explorer .

Because Carlin Lake has been surveyed twice, we are able to study the plant community over time. Changes in a lake environment might manifest as loss of species, change in species abundance or distribution, difference in the relative composition of various plant life forms (emergent, floating leaf, or submergent plants), and/or appearance of an AIS or change in its population size. Monitoring can track changes and provide valuable insight on which to base management decisions. In the remainder of this section (Part 1) we provide a report of the findings of the 2025 point-intercept aquatic plant survey and summarize and compare findings of the 2010 and 2025 surveys in Part 2.

Part 1. Carlin Lake aquatic plants in 2025

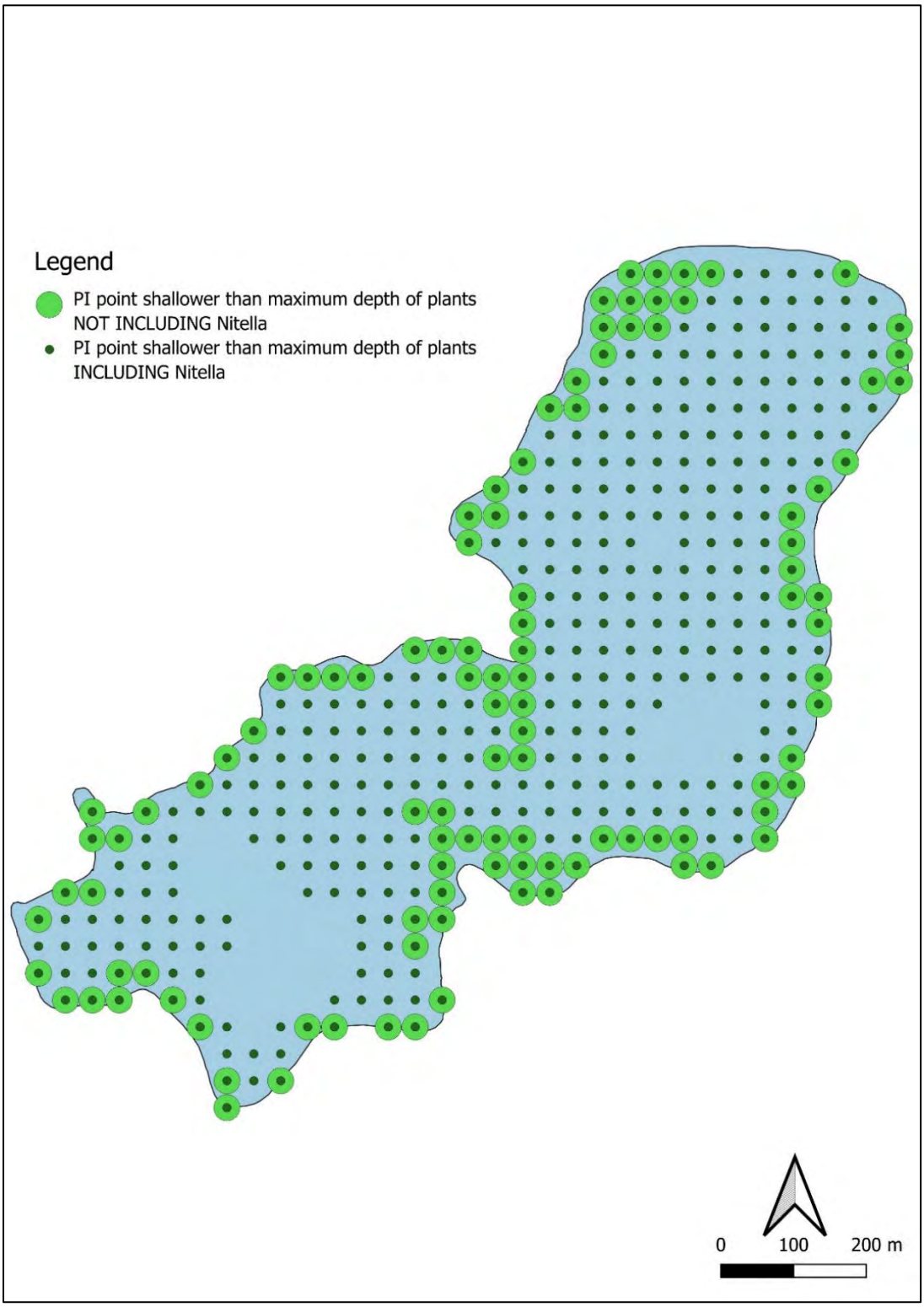
In 2025, a total of 453 of the 456 point-intercept (PI) points were visited. Of these, 416 points were shallower than the maximum depth of plants. The maximum depth of plant colonization was determined during the 2025 survey to be 32.5 feet (Table 3). We point out, however, that the plant life in the deeper areas of the lake is comprised of *Nitella sp*. (an alga that is not rooted). The depth to actual rooted vegetation (that is rooted vascular plants) is 15 feet. Map 6 illustrates the distribution of sample points under these two depth criteria (32.5ft and 15ft). Deeper areas in the lake do not have sufficient light for rooted vegetation to establish. Vegetation (including *Nitella*) was actually found at 267 of the 412 sample points within the littoral zone (64.2% of sites shallower than 32.5ft). Rooted vascular macrophytes were found at 24 sample points. This indicates that although availability of sufficient light limits the distribution of plants, it is not the only habitat factor involved. Substrate is another feature that influences plant distribution (e.g., soft substrate often harbors more plants than hard substrate). Map 7 presents the substrates encountered during the aquatic plant survey (muck, sand, or rock). The substrate types were represented with 53.2% for muck followed by sand with 36.0% and 10.8% of the substrate is rock.

Plant density is estimated by a “rake fullness” metric (scores are assessed as 1, 2, or 3 with 3 being the highest possible density). The average rake fullness for Carlin Lake in 2025 was 1.36 (Table 3). These densities (considering all species) are displayed for each sampling point on Map 8.

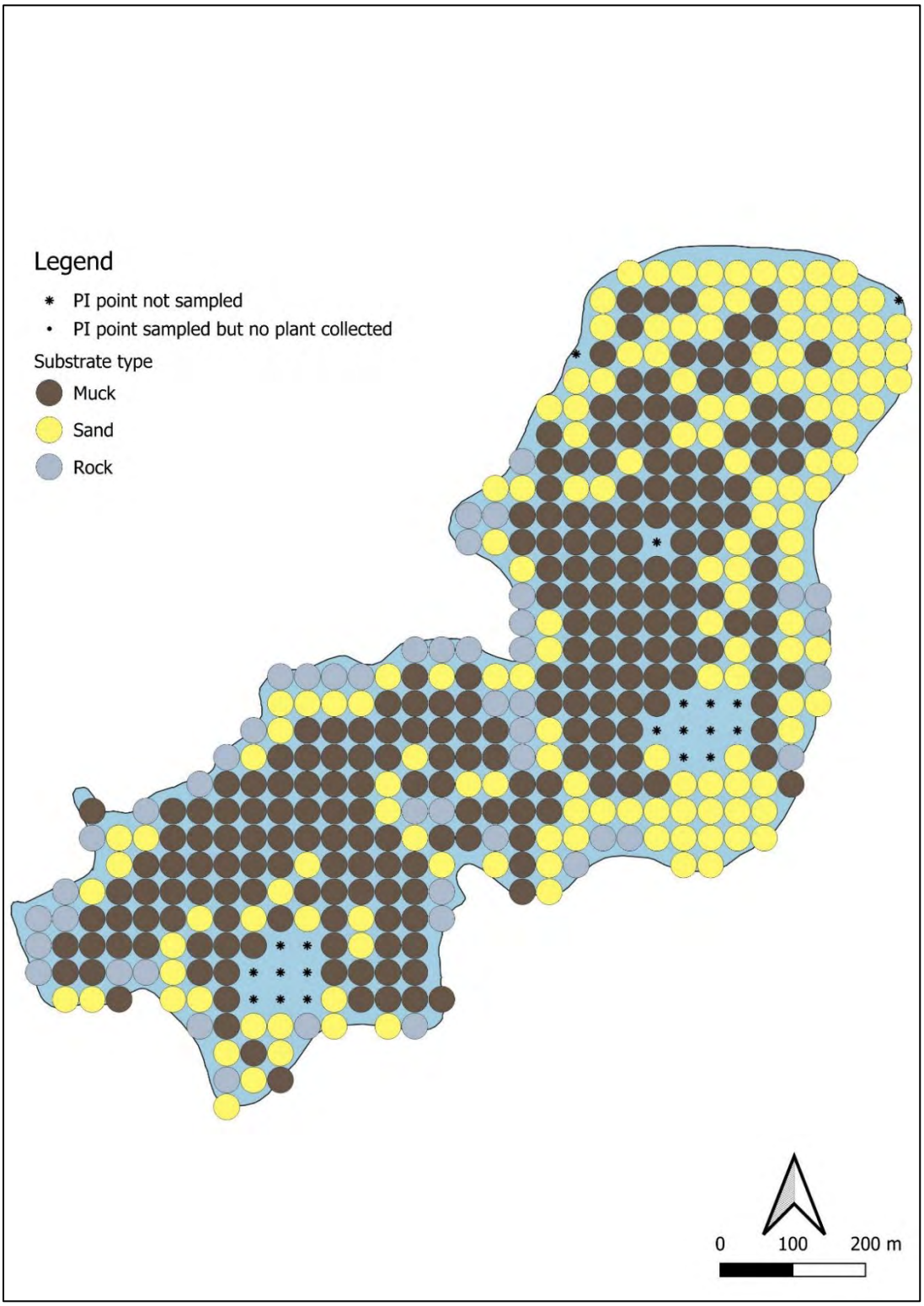
Table 3. Summary statistics for the 2025 PI aquatic plant surveys for Carlin Lake.

General Statistics:	**2025**
Total number of sites on grid - Total number of sites on original grid (not necessarily visited)	456
Total number of sites visited - Total number of sites where the boat stopped to sample.	453
Total number of sites with vegetation - Total sites with at least one plant was found	267
Total number of sites shallower than maximum depth of plants - Number of sites where depth was less than or equal to the maximum depth where plants were found. This value is used for frequency of occurrence at sites shallower than maximum depth of plants.	416
Frequency of occurrence at sites shallower than maximum depth of plants - Not every area of the lake bottom that is shallower than the maximum depth of plants actually has plants living there. Other things (like substrate) can influence where a plant can root. Frequency of occurrence at sites shallower than max depth of plants documents the proportion of sites where rooted plants actually occur within the littoral zone	64.18
Simpson Diversity Index - An index that accounts for richness (number of species) and evenness of distribution in estimating diversity. It is based on a plant's relative frequency. Values range from 0 to 1 with higher values indicating greater diversity.	0.22
Maximum depth of plants (ft) - Since rooted aquatic plants require sunlight at the lake bottom in order to root and grow, water depth and transparency limit where plants can establish. By repeated sampling, we determine the max depth at which plants grow. Plants are absent beyond that depth. The area of the lake where plants can grow is the littoral zone.	32.5
Number of sites sampled using rake on Rope	328
Number of sites sampled using rake on Pole	108
Average number of all species per site (shallower than max depth) - This is the average number of species found at PI points shallower than max depth of rooted plants. Lakes with diverse plant communities tend to have high average number of species per site.	0.68
Average number of all species per site (veg. sites only) - This is the average number of plant species documented at PI sampling points where plants were collected. Lakes with diverse plant communities tend to have high average number of species at each site	1.06

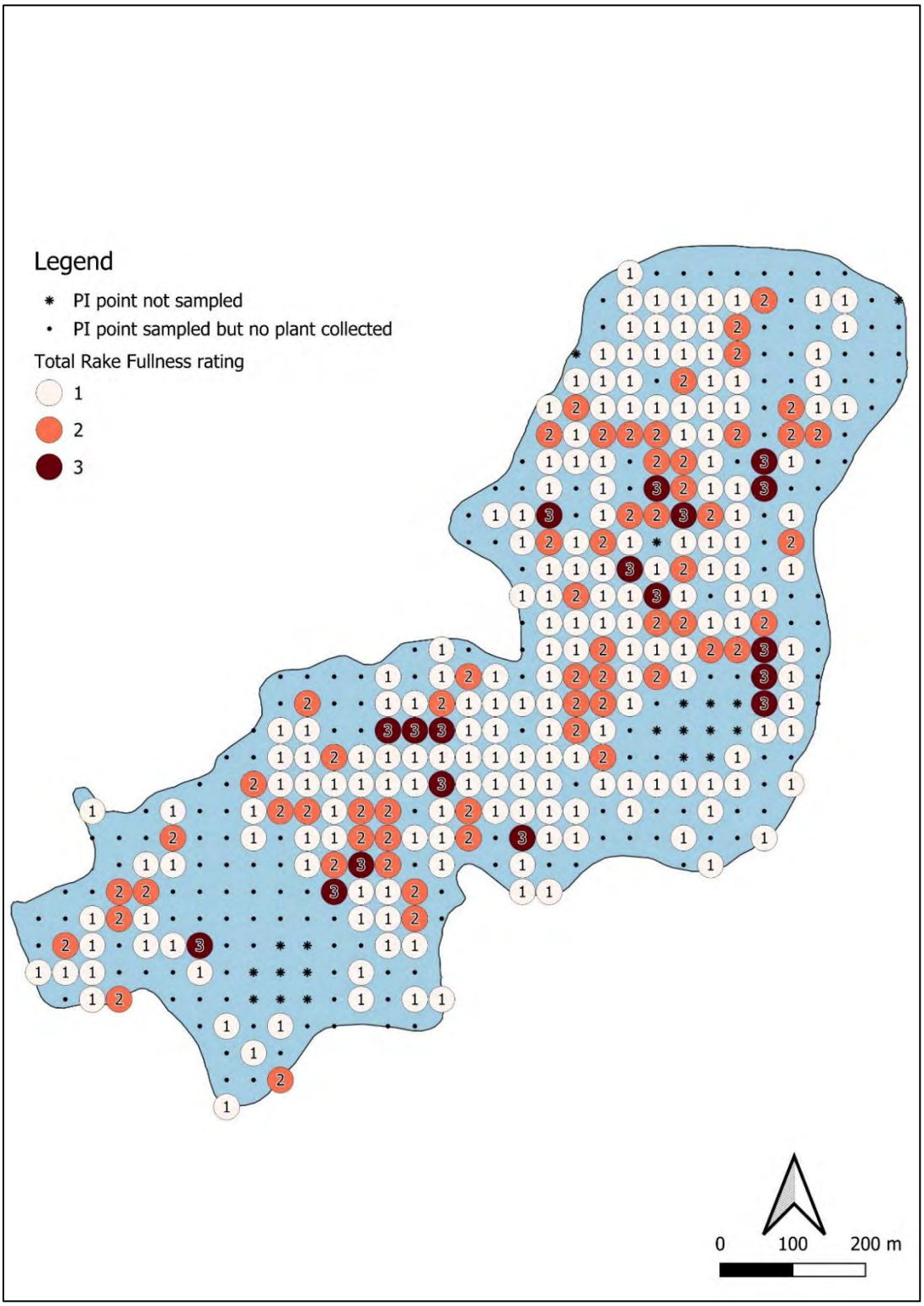
General Statistics:	2025
Average number of native species per site (shallower than max depth) - This metric is the average number of native plant species documented at PI sampling points. Lakes with diverse plant communities tend to have high average number of plant species at each site.	0.68
Average number of native species per site (veg. sites only) - This metric is the average number of native plant species documented at PI points where plants were collected. Lakes with diverse plant communities tend to have high average number of plant species per site.	1.06
Species Richness - This metric is a simple measure of diversity and is a count of the number of species. In the case of a PI survey, it is the number of species collected on the rake for PI points in a given area (an entire lake or a plot). The species richness of a lake would mean the total number of plant species in the entire lake. More species equals higher diversity	10
Species Richness (including visuals) - This metric includes the count of the number of plant species collected on the rake for the point-intercept sampling points in a given area and those observed (but not actually collected with the rake) within 6 feet of the sampling points.	18
FQI – A metric to evaluate the closeness of the flora of an area to that of undisturbed areas.	23.67
Average Rake Fullness - Rake fullness is a rating given to each rake pull on a PI survey that indicates the amount of plant material for each species as well as combined species. There are four ranks: 0 (not present), 1, 2, & 3 (3 is the highest amount of plant material on the rake). Average rake fullness is the mean value for all of the PI points.	1.36



Map 6. 2025 distribution of PI points under two depth criteria (15ft is the maximum depth of plants not including Nitella and 32.5ft is the maximum depth of plants including Nitella).



Map 7. 2025 substrate distribution in Carlin Lake.



Map 8. Carlin Lake total rake fullness per PI point in 2025.

Species richness is an ecological term that refers to the total number of species in a community (Table 3). Eighteen species of aquatic plants were documented on Carlin Lake in 2025. Of these, ten were collected at point-intercept sampling points and the others were observed from the boat while traveling between sampling points. Appendix 2 - Table 2 provides a list of the species encountered, including common and scientific names along with summarizing statistics. The average number of species encountered at the vegetated points was 1.06. The number of species at these vegetated points ranges from one to four. Figure 1 shows the percentages of vegetated PI points with 1-4 species. Sites with only one comprised 95.1% of the sites. The actual number of species encountered at each of the vegetated points is graphically displayed on Map 9.

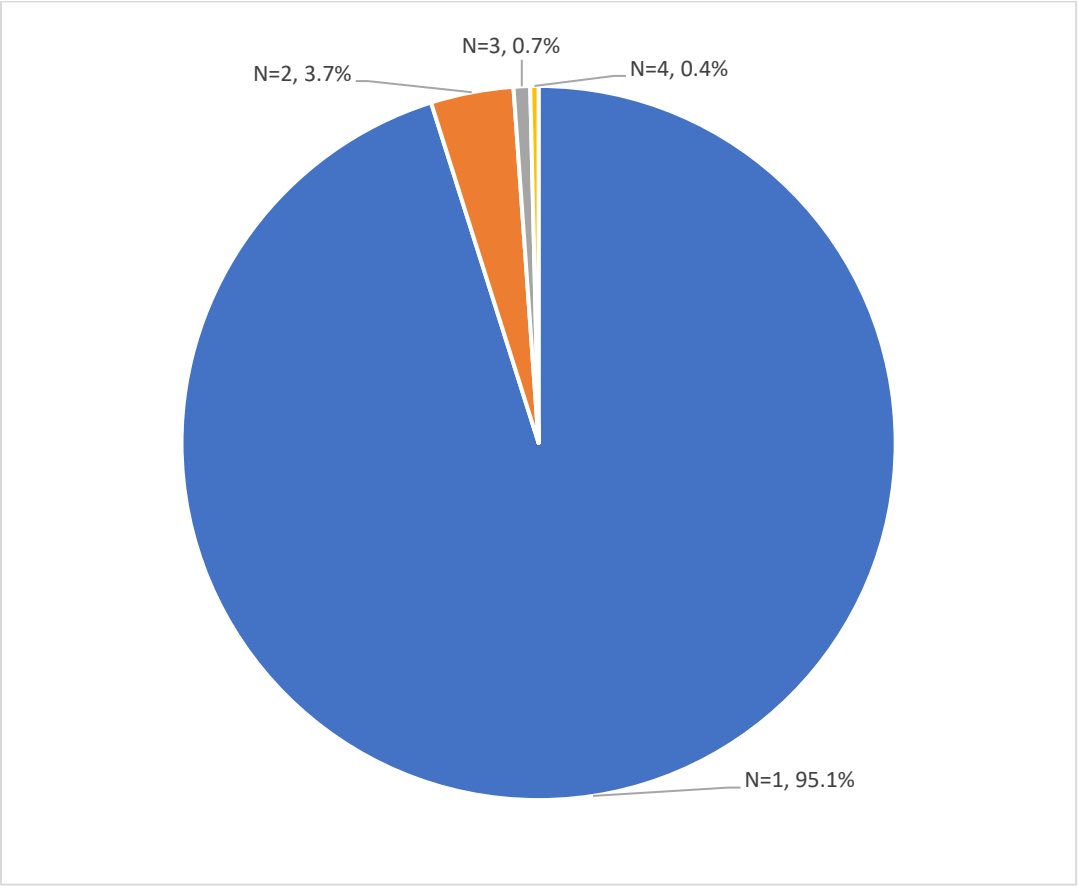
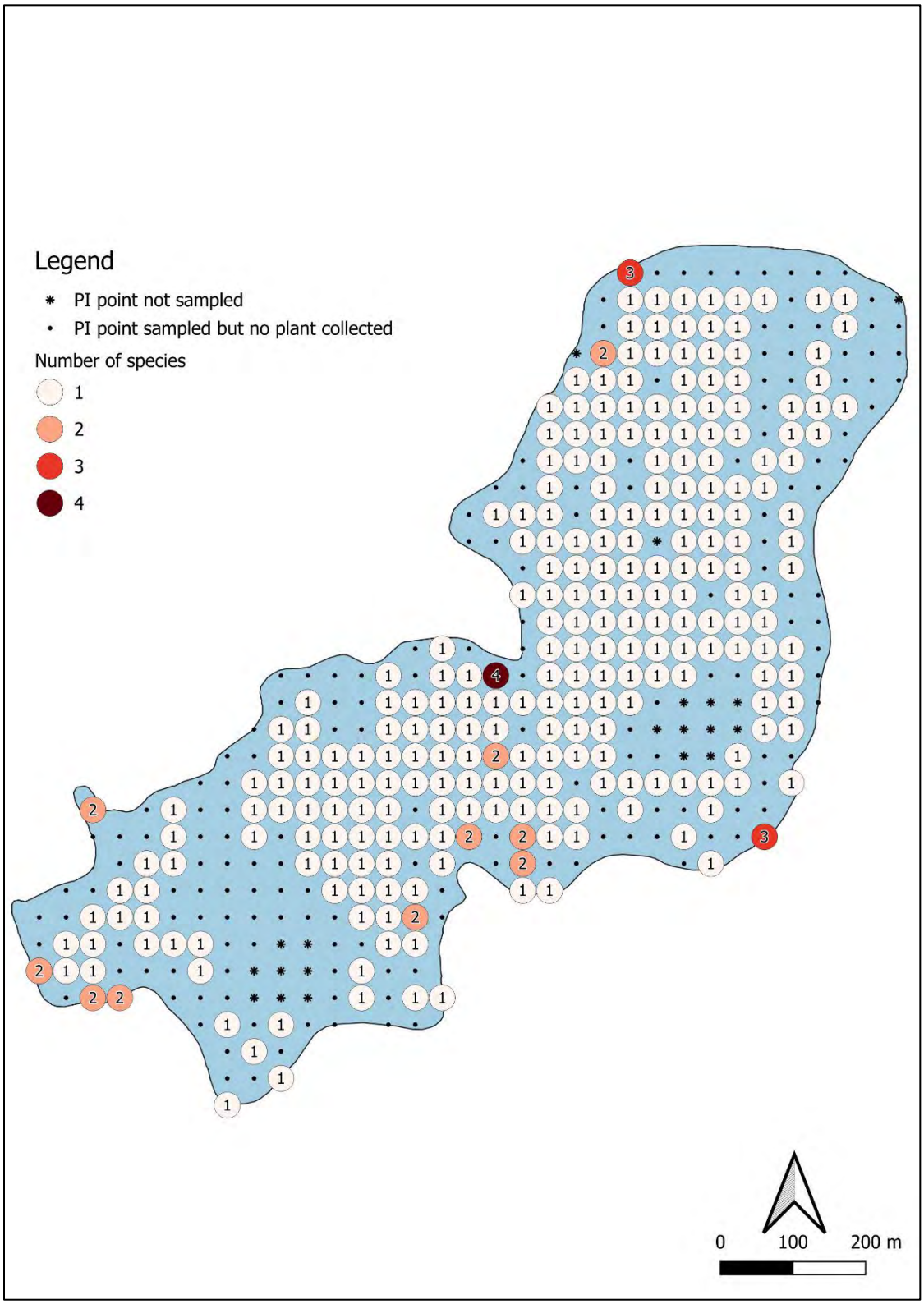


Figure 1. Percentages of PI points with various number of species per point (Note: "N" is the total number of species found at a point).



Map 9. Carlin Lake number of aquatic plant species documented per PI point in 2025.

Appendix 2 - Table 2 provides information about occurrences of the plant species recorded in Carlin Lake in 2025. Several metrics are provided, including total number of points at which each species was found and frequency of occurrence at points within the littoral zone. This frequency metric is also standardized as a "relative frequency" (also shown in Appendix 2 - Table 2) by dividing the frequency of occurrence for a given species by the sum of frequency of occurrence for all plants and multiplying by 100 to form a percentage. The resulting relative frequencies for all species total 100%. The relative frequencies for the plant species collected with a rake are graphically displayed in alphabetic order on Figure 2. This display shows that *Nitella sp.* (nitella) has the highest relative frequency (88.03%) followed by *Juncus pelocarpus f. submersus* (Brown-fruited rush) with 2.82% of relative frequency and *Isoetes lacustris* (Lake quillwort) with 2.11% of relative frequency. A number of species (7 total) have individually a relative frequency under 2% but comprise a total 7.04% of relative frequency.

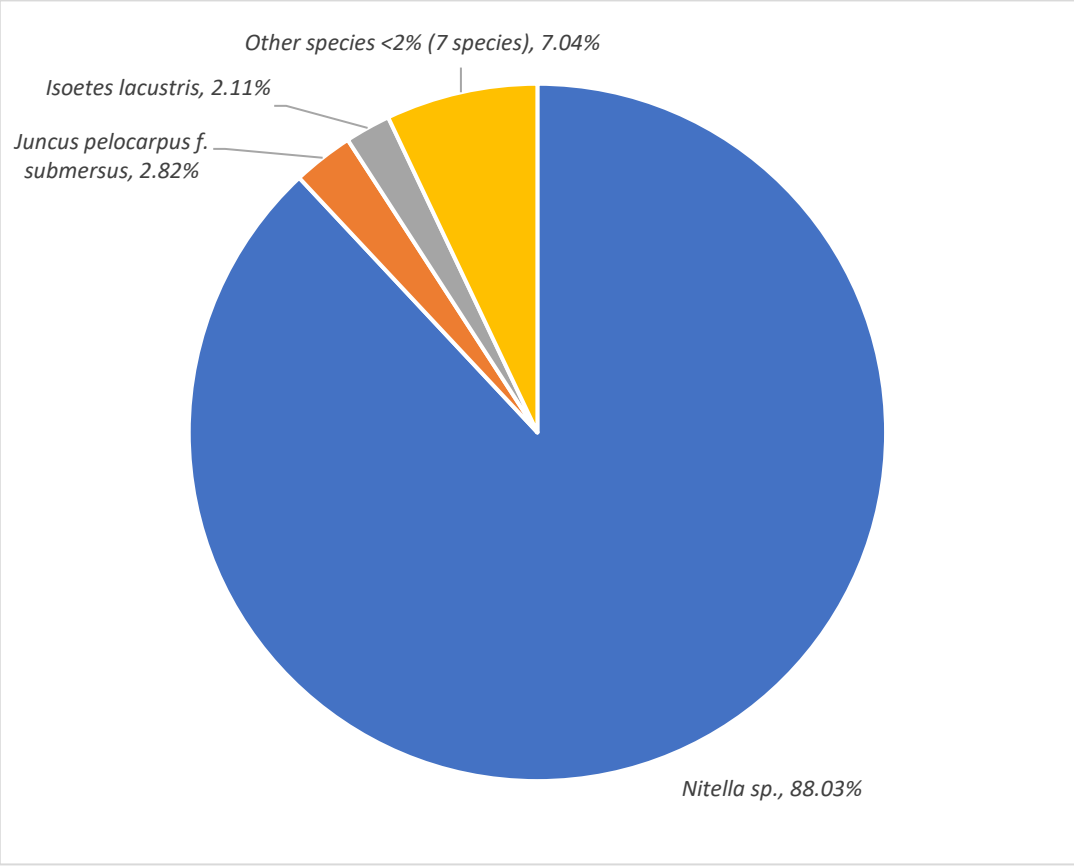


Figure 2. Carlin Lake aquatic plants relative frequency in 2025.

As discussed earlier, “species richness” is the term given to the total number of species in a given area. For example, the total number of plant species in a lake would be its plant species richness. Generally speaking, a high species richness means high biodiversity and this is considered a healthy and desirable condition in an ecosystem. But species richness doesn’t tell the whole story. As an example, consider the plant communities of two hypothetical ponds each with 1,000 individual plants representing ten plant species (in other words, species richness is 10 in both ponds). In the first pond each of the ten species populations is comprised of 100 individuals. In the second pond, Species #1 has a population of 991 individuals and each of the other nine species is represented by one individual plant. Intuitively, we would say that first pond is more diverse because there is more “even” distribution of individual species. The “Simpson Diversity Index” takes into account both richness and evenness in estimating diversity. It is based on a plant’s relative frequency in a lake. The closer the Simpson Diversity Index is to 1, the more diverse the plant community. The Simpson Diversity Index for Carlin Lake aquatic plants was 0.22 in 2025 (Table 3) which indicates a low diversity aquatic plant community. This low value is mainly due to the abundance and wide distribution of *Nitella* in Carlin Lake. In other words, the *Nitella* population reduces the evenness of the plant community. If we exclude *Nitella* in calculating the Simpson Diversity Index, the Carlin Lake value is 0.85 indicating a fairly diverse community.

Another measure of diversity and quality is the Floristic Quality Index (FQI). Floristic quality is an assessment metric designed to evaluate the closeness that the flora of an area is to that of undisturbed conditions (Nichols 1999). Among other applications, it forms a standardized metric that can be used to compare the quality of different lakes (or different locations within a single lake) and monitor long-term changes in a lake’s plant community (an indicator of lake health). The FQI for a lake is determined by using the average coefficient of conservatism times the square root of the number of native plant species present in the lake. Knowledgeable botanists have assigned to each native aquatic plant a coefficient of conservatism representing the probability that a plant is likely to occur in pristine environments (relatively unaltered from presettlement conditions). The coefficients range from 0 to 10, with 10 being assigned to those species most sensitive to disturbance. As more environmental disturbance occurs, the less conservative species become more prevalent.

Nichols (1999) analyzed aquatic plant community data from 554 Wisconsin Lakes to ascertain geographic characteristics of the FQI metric. This is useful for considering how the Carlin Lake FQI (23.67 in 2025) compares to other lakes and regions. The statewide medians for number

of species and FQI are 13 and 22.2, respectively. Carlin Lake values are within these statewide values. Nichols (1999) determined that there are four ecoregional-lake types groups in Wisconsin: (1) Northern Lakes and Forests lakes, (2) Northern Lakes and Forests flowages, (3) North Central Hardwoods and Southeastern Till Plain lakes and flowages, and (4) Driftless Area and Mississippi River Backwater lakes. Carlin Lake is located in the Northern Lakes and Forests lakes group. Nichols (1999) found species numbers (species richness) for the Northern Lakes and Forests lakes group had a median value of 13. Carlin Lake data demonstrates greater median species richness than this value with 18 documented species. Finally, the Carlin Lake FQI (23.67) is within the median value for the Northern Lakes and Forests lakes group (24.3). These findings indicate that the Carlin Lake aquatic plant community reflects one with little disturbance caused by human stressors.

Part 2. Carlin Lake aquatic plant community history

a. General aquatic plant community statistics

Aquatic plant surveys were conducted in Carlin Lake in 2010 and 2025 using the systematic "point-intercept" method. The same grid of 456 sampling points was used for these two surveys and the resulting data sets formed the principal underpinning of this aquatic plant management plan. The summary statistics for the two surveys are provided in Table 4. The 2010 and 2025 surveys were conducted by White Water Associates.

Comparing the 2010 and 2025 aquatic plant surveys, reveals consistency in several of the summary statistics presented in Table 4. In both years, the Simpson Diversity Index and Species Richness statistics indicate an aquatic plant community with low diversity. This is typical of seepage lakes that are oligotrophic (low nutrients and low plant productivity). The Floristic Quality Indices (FQI) for both years are fairly similar and near statewide medians. These FQI values describe an aquatic plant community that is not dramatically affected by human stressors.

We define the littoral zone by the area where the depth is less than or equal to the maximum depth of plants. The maximum depth of plants can change from year to year due to factors such as water clarity, temperature, and lake level. The maximum depth of plants for Carlin Lake is quite high in both the 2010 and 2025 aquatic plant surveys (29 feet and 32.5 feet, respectively). This difference is very small. It is worth noting that this high value for maximum depth of plants is driven by a single taxon (*Nitella sp.*, nitella) as it occurs at dramatically greater depths in Carlin

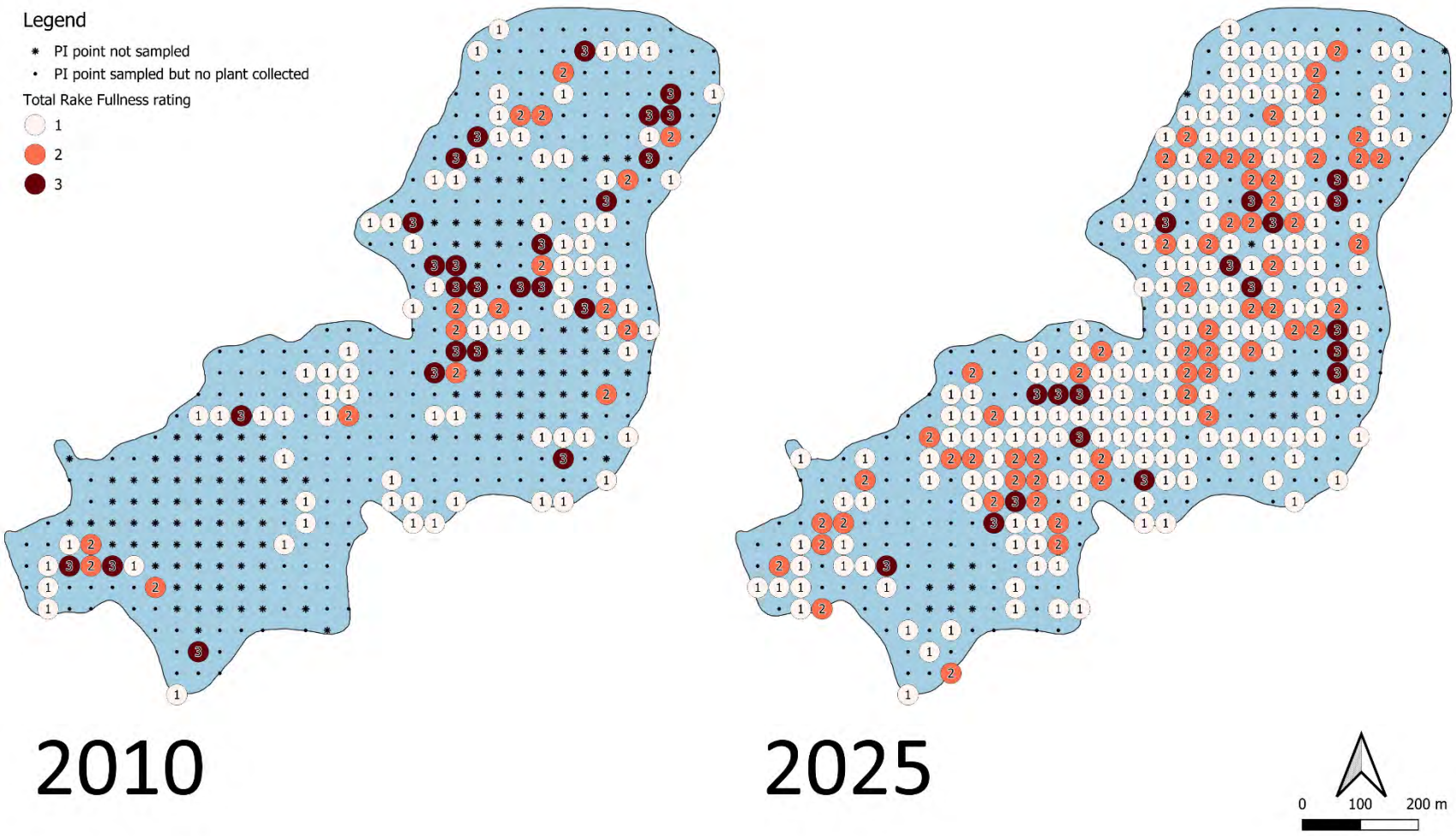
Lake than truly rooted plants (*Isoetes lacustris*, Lake quillwort was the next deepest plant at 15 feet in 2025). *Nitella sp.* is an alga and not a rooted plant.

The average number of species per point-intercept cite (considering vegetated sites only) was nearly identical for the 2010 and 2025 surveys (Table 4). The average rake fullness was also very similar indicating not much change in vegetation density between the two surveys. The total number of sites with vegetation more than doubled in the 2025 survey (110 sites in 2010 and 262 sites in 2025). This difference is accounted for by *Nitella sp*. The distributions of the sites with vegetation found during the 2010 and 2025 aquatic plant surveys are presented in Map 10[2]. There were areas of the lake in the 2025 survey where plants were documented that had no vegetation in the 2010 survey. The frequency of occurrence at sites shallower than maximum depth of plants increased in the 2025 survey (more sites had plants in the recent survey). This increase is also generally due to *Nitella sp*.

[2] Individual maps are presented in Appendix 2 - Maps 1 and 2

Table 4. Summary statistics for the 2010 and 2025 PI aquatic plant surveys for Carlin Lake.

Summary Statistic	2010	2025
Total number of sites on grid	456	456
Total number of sites visited	454	453
Total number of sites with vegetation	110	267
Total number of sites shallower than maximum depth of plants	400	416
Frequency of occurrence at sites shallower than maximum depth of plants	27.50	64.18
Simpson Diversity Index	0.34	0.22
Maximum depth of plants (ft.)	29	32.5
Number of sites sampled with rake on rope	181	328
Number of sites sampled with rake on pole	158	108
Average number of all species per site (shallower than max depth)	0.28	0.68
Average number of all species per site (vegetated sites only)	1.03	1.06
Average number of native species per site (shallower than max depth)	0.28	0.68
Average number of native species per site (vegetated sites only)	1.03	1.06
Species Richness	6	10
Species Richness (including visuals)	12	18
Floristic Quality Index (FQI)	19.60	23.67
Average rake fullness	1.55	1.36



Map 10. 2010 and 2025 total rake fullness distribution in Carlin Lake

b. Analysis of the aquatic plant species composition

The relative frequencies for the plant species collected with a rake for the two point-intercept plant surveys are graphically displayed on Figure 3. Since this graph displays relative frequencies, the total necessarily equals 100%. The graph shows the composition of the plant community in each of the survey years. As one plant increases in relative frequency, others (one or several species) decrease. In the case of Carlin Lake, Figure 3 does not reveal any dramatic trends. The graphs show that *Nitella sp*. dominates the plant community. The relative frequency of *Nitella sp*. was somewhat higher in the 2025 survey. Two new species (*Potamogeton epihydrus*, ribbon-leaf pondweed and *Brasenia schreberi*, watershield) for Carlin Lake were documented in the 2025 survey, but were present in low relative frequencies.

Figure 4 presents the frequency of occurrence within vegetated areas of aquatic plants for the 2010 and 2025 surveys. The frequency of occurrences within vegetated areas is the number of sites at which a species was observed divided by the total number of vegetated sites. The graph shows that three species were first documented in 2025 by collection on the rake (*Potamogeton epihydrus, Brasenia schreberi* and *Sparganium angustifolium*, narrow-leaved bur-reed). Figure 4 also shows that the Carlin Lake plant community in 2010 did not differ appreciably from the 2025 aquatic plant community.

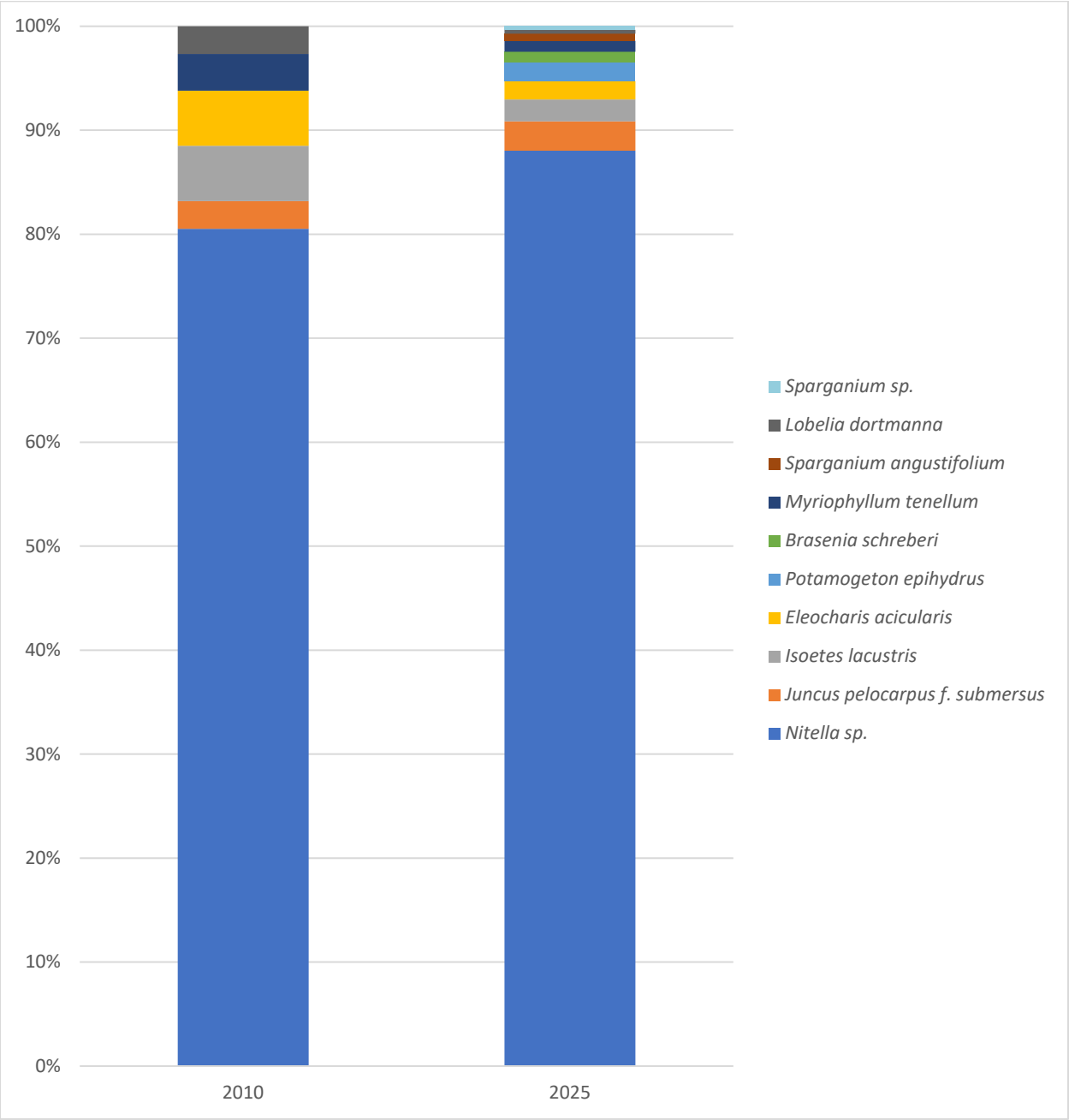


Figure 3. Carlin Lake relative frequencies for the plants collected during the 2010 and 2025 PI aquatic plant surveys.

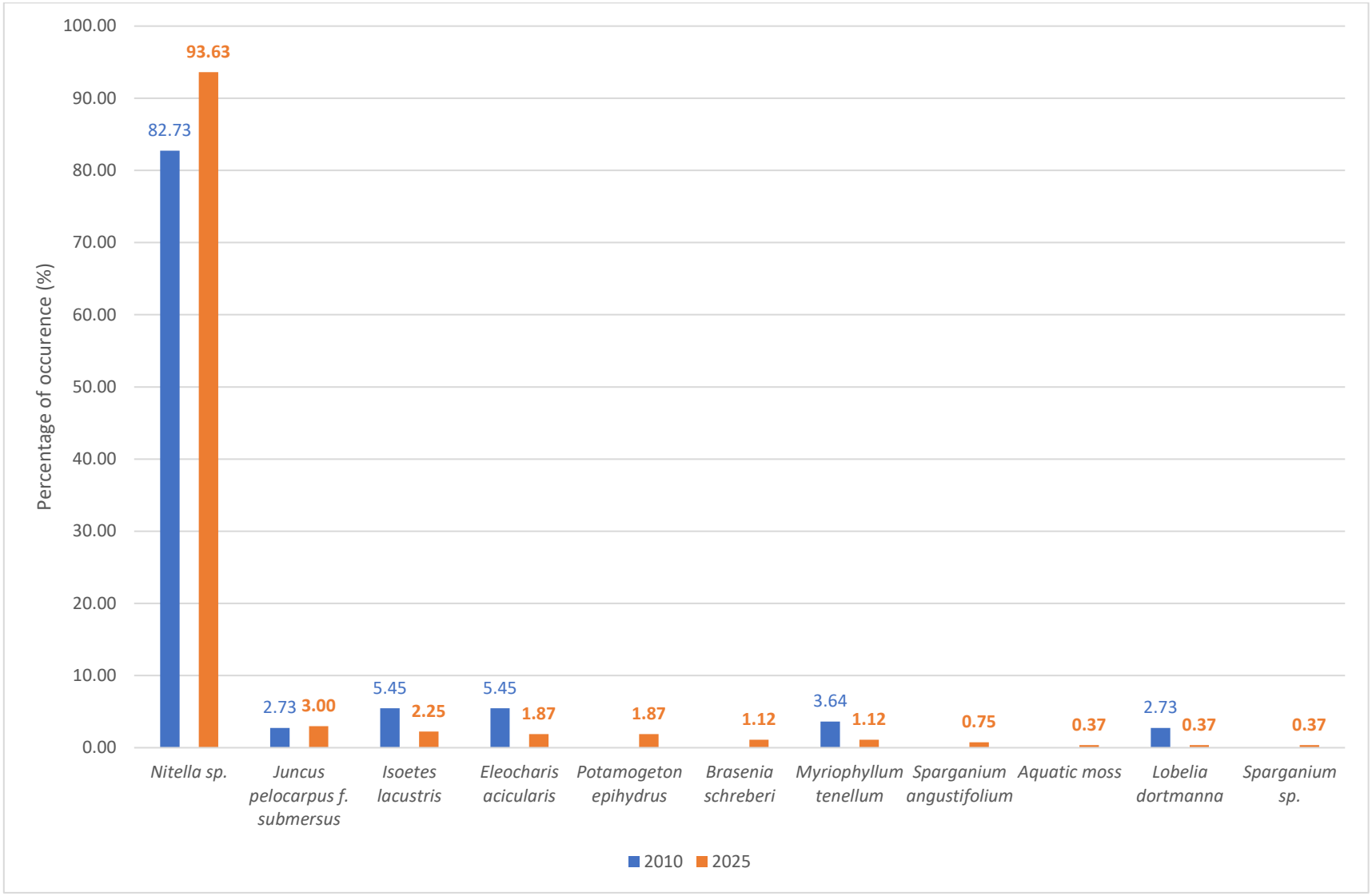


Figure 4. Carlin Lake frequencies of occurrences for the plants collected during the 2010 and 2025 PI aquatic plant surveys.

Part 3. Carlin Lake aquatic plant community highlights

Lake ecosystems tend to be dynamic - change is the norm rather than the exception. Changes in the ecosystem result from numerous direct and indirect factors and this complexity makes it challenging to determine the causal relationships. Analysis of the two aquatic plant data sets (2010 and 2025) available for the Carlin Lake plant community revealed several points:

- The total number of sites with vegetation more than doubled in the 2025 survey.
- The frequency of occurrence at sites shallower than maximum depth of plants more than doubled in the 2025 survey.
- The maximum depth of plants for Carlin Lake was consistent in the two aquatic plant surveys and quite high. The high value was greatly influenced by the alga *Nitella sp*.
- The aquatic plant community diversity has remained consistent and quite low when considering species richness and Simpson Diversity Index. The Floristic Quality Index value for Carlin Lake indicates an aquatic plat community little disturbed by human stressors.
- The number of species per point-intercept vegetate sites was the same for the two surveys.
- The percent relative frequencies for the species found in Carlin Lake during the 2010 and 2025 surveys show dominance by *Nitella sp*. and little change over time with the exception of increasing *Nitella sp*.
- The frequencies of occurrence reflect a stable aquatic plant community.
- The average rake fullness of vegetated sites showed a small decrease in the 2025 survey.
- No aquatic invasive plant species were found in Carlin Lake.
- One wetland invasive species was confirmed in Carlin Lake (Appendix 3).

Section 5. Fish community

It was beyond the scope of the current Wilderness Waters project to characterize the fish community and fish habitat of this water body. The WDNR Lake Pages website (Wisconsin Lakes - Carlin Lake) indicates that the bottom is comprised of 70% sand, 15% gravel, 15% rock, and 0% muck and that fish species present include panfish, largemouth bass, smallmouth bass.

Section 6. Water quality and trophic status

It was beyond the scope of the current Wilderness Waters project to characterize the water quality of Carlin Lake. A record of Carlin Lake water quality data and along with some interpretation can be accessed at the following link: Water Explorer WDNR - Carlin Lake

Section 7. Water use

Carlin Lake has no public access site, but is used by riparian owners and their guests for a variety of recreational activities. There is no State of Wisconsin ownership on the lake.

Section 8. Riparian area

Part 1 (Watershed) describes the larger riparian area context of Carlin Lake. The near shore riparian area can be appreciated by viewing Maps 2 and 3. Our review of recent aerial photography reveals 34 houses on the lake. The lake is lightly developed and has an intact forested riparian zone that extends for hundreds of feet back from the lake. The forest is a mixture of coniferous and deciduous trees and shrubs. This intact riparian area provides numerous important functions and values to the lake. It effectively filters runoff to the lake. It provides excellent habitat for birds and mammals. Trees that fall into the lake from the riparian zone contribute important habitat elements to the lake. Educating riparian owners as to the value of riparian areas is important to the maintenance of these critical areas.

The WDNR drafted in 2016 and formulated a final version in 2020 of a protocol called *Lake Shoreland and Shallows Habitat Monitoring* (WDNR, 2020). It provides a standard methodology for surveying, assessing, and mapping habitat in lakeshore areas, including the Riparian buffer, Bank, and Littoral Zones (WDNR, 2020). This information is useful to local and regional resource managers, community stakeholders, and others interested in protecting and enhancing Wisconsin's lakes and rivers (WDNR, 2020). The shoreland and shallow water data for Carlin Lake was

recorded in 2021 and the results are available online in WDNR website. The WDNR Lakes and AIS Viewer can be used to see all of the different aspects that were measured in the Shoreland Habitat Survey on a map. This tool can be found here: WDNR Lake viewer map . Then you will want to click on the Layers tab and the Shoreland Habitat Monitoring box. The WDNR Shoreland Habitat Disturbance Viewer can be found here: Shoreland Habitat Disturbance Viewer . This link gives both lake wide and property parcel level general statistics on shoreline disturbances and recommendations for improvement.

Section 9. Wildlife

A study of wildlife was beyond the scope of the current study, but would be valuable to study and interpret in future iterations of the plan. This would be especially true of wetland and water-oriented wildlife such as frogs, waterfowl, fish-eating birds, aquatic and semi-aquatic mammals, and invertebrate animals (for example freshwater mussels). Of special importance would be monitoring for the presence of aquatic invasive wildlife species (for example, rusty crayfish, spiny water flea, or zebra mussel) and fish species (for example, rainbow smelt or common carp). Specific surveys for aquatic invasive species have been conducted (Appendix 3).

Section 10. Stakeholders

At this juncture in the ongoing aquatic plant management planning process, the Town Lakes Committee and the Carlin Lake Association has represented the Carlin Lake stakeholders. Additional stakeholders and interested citizens are invited to participate as the plan is refined and updated in order to broaden input, build consensus, and encourage participation in stewardship. No contentious direct plant management actions (for example, harvesting or use of herbicides) are a component of the current plan.

The next chapter requires contributions of actions from the Carlin Lake Association. Examples have been provided below for format and construction.

Chapter 5. Recommendation, actions, and objectives

In this chapter we provide recommendations for specific objectives and associated actions to support the APM Plan's goals stated in Chapter 3 and re-stated here for convenient reference:

(1) Monitor and protect the native aquatic plant community;

(2) Monitor for AIS and prevent establishment of new non-native biota; and

(3) Educate riparian owners and lake users on preventing AIS introduction, reducing nutrient inputs that can alter the plant community, minimizing physical removal of native riparian and littoral zone plants, and living with a lake whose natural healthy state includes aquatic plants.

Since Carlin Lake is a healthy ecosystem, we could simply recommend an alternative of "no action." In other words, Carlin Lake continues without any effort or intervention on part of lake stewards. Nevertheless, we consider the "no action" alternative imprudent. Many forces threaten the quality of the lake and Wilderness Waters Program and Town Lakes Committee feels a great responsibility to minimize the threats. We therefore outline in this section a set of actions and related management objectives that will actively engage lake stewards in the process of management.

The actions are presented in tabular form. Each "action" consists of a set of four statements: (1) a declarative "action" statement that specifies the action (2) a statement of the "objective" that the action serves, (3) a "monitoring" statement that specifies the party responsible for carrying out the action and maintaining data, and (4) a "status" statement that suggests a timeline/calendar and indicates status (not yet started, ongoing, or completed).

At this time, we recommend no direct manipulation of plant populations in Carlin Lake. There are currently no non-native aquatic plants documented for the lake. One wetland invasive plant species was found during the Aquatic Invasive Species Survey (Appendix 3). No native plants exhibit nuisance population size or distribution. Monitoring of the shoreline for wetland invasives should be ongoing and appropriate management employed when needed.

Recommended Actions for the Carlin Lake APM Plan
Action #1: Formally adopt the Aquatic Plant Management Plan. ***Objective:*** To provide foundation for long-term native plant community conservation and stewardship and to be prepared for response to AIS introductions. ***Monitoring:*** The Lake Association and Town Lakes Committee oversee activity and maintains the plan. ***Status:*** Planned for 2027.
Action #2: Monitor water quality. ***Objective***: Continue with collection and analysis of water quality parameters to detect trends in parameters such as nutrients, chlorophyll *a*, and water clarity. ***Monitoring:*** The Lake Association or Town Lakes Committee oversees activity and maintains data. ***Status:*** Ongoing.
Action #3: Monitor the lake for aquatic invasive plant species. ***Objective***: To understand the lake's biotic community, provide for early detection of AIS and continue monitoring any existing populations of AIS. ***Monitoring:*** The Lake Association or Town Lakes Committee oversees activity and maintains data. ***Status:*** Ongoing.
Action #4: Monitor the lake for aquatic invasive animal species. ***Objective***: To understand the lake's biotic community, provide for early detection of AIS and continue monitoring any existing populations of AIS. ***Monitoring:*** The Lake Association or Town Lakes Committee oversees activity and maintains data. ***Status:*** Ongoing.

Recommended Actions for the Carlin Lake APM Plan
Action #5: Form an Aquatic Invasive Species Rapid Response Team and interface with the Town Lakes Committee AIS Rapid Response Coordinator. ***Objective:*** To be prepared for AIS discovery and efficient response. ***Monitoring:*** The Lake Association and/or Town Lakes Committee coordinate activity. ***Status:*** Planned for 2027.
Action #6: Conduct quantitative plant survey every five years using WDNR Point-Intercept Methodology. ***Objective:*** To watch for changes in native species diversity, floristic quality, plant abundance, and plant distribution and to check for the occurrence of non-native, invasive plant species. ***Monitoring:*** Town Lakes Committee (Wilderness Waters Program) oversees and maintains data; copies to WDNR. ***Status:*** Anticipated in 2030.
Action #7: Update the APM plan approximately every five years or as needed to reflect new plant information from plant surveys and monitoring. ***Objective:*** To have current information and management science included in the plan. ***Monitoring:*** Lake Association and/or Town Lakes Committee (Wilderness Waters Program) oversees and maintains data; copies to WDNR. ***Status:*** Anticipated in 2030.
Action #8: Develop a Citizen Lake Monitoring Network to monitor for invasive species and develop strategies including education and monitoring activities (see http://www.uwsp.edu/cnr/uwexlakes/clmn for additional ideas). ***Objective:*** To create a trained volunteer corps to monitor aquatic invasive species and to educate recreational users regarding AIS. ***Monitoring:*** The Lake Association oversees activity and reports instances of possible introductions of AIS. ***Status:*** Ongoing.

Recommended Actions for the Carlin Lake APM Plan
Action #9: Become familiar with and recognize the water quality and habitat values of ordinances and requirements on boating, septic, and property development. ***Objective:*** To protect native aquatic plants, water quality, and riparian habitat. ***Monitoring:*** Lake residents and other stakeholders. ***Status:*** Ongoing.
Action #10: Promote adherence to, and enforcement of, the Town of Presque Isle's 200-foot no-wake ordinances (from shoreline and islands). ***Objective:*** To minimize recreational impacts on the aquatic plant community and shoreline habitats, and promote safe boating. ***Monitoring:*** Town Lakes Committee oversees activity and assesses effectiveness. ***Status:*** Ongoing.
Action #11: Create an education plan for the property owners and other stakeholders that will address issues concerning aquatic and riparian plant communities. ***Objective:*** To educate stakeholders about issues and topics that affect the lake's aquatic and riparian plant communities, including topics such as: (1) the importance of the aquatic plant community; (2) no or minimal mechanical removal of plants along the shoreline is desirable and that any plant removal should conform to Wisconsin regulations; (3) the value of a natural shoreline in protecting the aquatic plant community and lake health; (4) nutrient sources to the lake and the role excess nutrients play in degradation of the aquatic plant community; (5) the importance of reducing or eliminating use of fertilizers on lake front property; (6) the importance of minimizing transfer of AIS to the lake by having dedicated watercraft and cleaning boats that visit the lake. ***Monitoring:*** Town Lakes Committee oversee(s) activity and assesses effectiveness. ***Status:*** Ongoing.

Recommended Actions for the Carlin Lake APM Plan

Action #12: Identify and highlight high quality areas of littoral zone and riparian areas through review of aquatic plant and shoreland assessment data through various reports and online tools.

Objective: To (1) educate lake users on the value of these areas and the importance of good stewardship to their maintenance, (2) recognize landowners who implement good practices (e.g., large percentage of buffer area intact; three vegetative layers intact – herbaceous, shrubs, trees; areas of high native aquatic plant diversity and abundance), and (3) encourage landowners to implement good practices.

Monitoring: Town Lakes Committee and/or lake association promotes and oversees activity.

Status: Ongoing.

Action #13: Lake leaders should encourage and assist landowners to take on lake shore/shallow water improvement projects to rehabilitate areas identified through formal shoreland/shallow water assessments and/or lake user observations (sites might include areas of active erosion, channelized flow, point source pollution, imperious surfaces, and lawns) *Vilas County Land and Water Conservation* looks for partners in this endeavor and can provide planning and sponsorship of projects.

Objective: To rehabilitate specific areas of shoreland to improve natural functions and values.

Monitoring: Lake groups and lake leaders monitor and report progress to Town Lakes Committee.

Status: Ongoing.

Action #14: As part of an education program, encourage commitment from property owners to adopt practices that maintain/improve health of shoreland areas. In many cases, these are "practices" that mean less or no work (e.g., now mowing, no weed-wacking, no leaf blowing, no removing large woody material).

Objective: To engage landowners in simple practices that improve/maintain health of the lake and shoreland.

Monitoring: Each landowner can monitor changes in the shoreland over time by simple means (e.g., annual mid-summer photographs or a catalog of plants and animals seen over time).

Status: Ongoing.

Chapter 6. Contingency plan for AIS

Aquatic Invasive Species (AIS) are aquatic organisms that are introduced into waterbodies outside their natural range. These species include plants, animals, and pathogens (e.g., bacteria, fungi, and viruses). AIS may thrive in new environments because they lack environmental controls (such as natural predators). Waterbodies with AIS pose a risk to unaffected lakes through transportation of life stages by boats, trailers, and other vectors. Lake stewards should be prepared for the possibility of AIS colonization. Vigilant lake users are often the first to report an AIS in a waterbody. Early detection and response to an AIS can be helpful in limiting its success and spread.

For riparian owners and lake users, discovery of an AIS causes concern and an immediate desire to "fix the problem." It is important to base responses to an AIS on scientific understanding of the particular species and the environment that it has colonized. A deliberate and systematic approach is beneficial. In some cases, the only management approach is to monitor how the lake ecosystem responds. For some AIS there is no effective treatment. For some AIS (especially plants) management is helpful, but careful consideration of the approach is essential since undesired outcomes of actions are problematic. An aquatic plant management plan (one including a contingency plan for AIS) is the best tool by which the process can be navigated. In fact, the APM plan is a requirement in Wisconsin for some kinds of aquatic plant management actions. One of the actions outlined in the previous chapter was to establish an Aquatic Invasive Species Rapid Response Team. This team and its coordinator are integral to the management process. It is important for this team to be multi-dimensional (or at least have quick access to the expertise that may be required). Since an AIS in a waterbody forms a source for colonization of other waterbodies, it is strategic for the Rapid Response Team to include representation from regional stakeholders.

Once the Rapid Response Team is organized, one of its first tasks is to develop a list of contacts and associated contact information (phone numbers and email addresses). At a minimum, this contact list should include: the Rapid Response Coordinator, members of the Rapid Response Team, County AIS Coordinator, WDNR Lakes Management Coordinator, Lake Association Presidents (or other points of contact), local WDNR warden, local government official(s), other experts, and contractor(s)/consultant(s). The Rapid Response Team should be prepared to respond to the possibility of any AIS (plant or animal). Since this contingency plan is part of an aquatic plant management plan, the remainder of this chapter focuses on aquatic invasive plant species.

Figure 5 provides a flowchart outlining an appropriate rapid response to the suspected discovery of an aquatic invasive plant species. The response will be most efficient if an AIS Rapid Response Team has already been established and is familiar with the contingency plan.

When a suspect aquatic invasive plant species is found, either the observer or a member of the Rapid Response Team (likely the coordinator) should collect an entire specimen including roots, stems, and flowers (if present). The sample should be placed in a sealable plastic bag with a small amount of water. Place a label in the bag written in pencil with date, time, collector's name, lake name, town, and county. Attach a lake map to the bag that marks the specific location of the suspect AIS and includes GPS coordinates (if available). The plant specimen should be placed in a refrigerator or on ice in a cooler. Deliver the sample to the WDNR Water Resource Management Specialist in the affected county as soon as possible (within three days). The WDNR or their botanical expert(s) will determine the species and confirm whether or not it is an AIS.

If the suspect plant specimen is judged to be an AIS, the next step is to determine the extent and density of the population since this will influence the management response. The Rapid Response Team should conduct (or have its consultant conduct) a survey to understand the distribution of the plant and, if appropriate, determine the perimeter and density for any beds. For rooted aquatic plant species, a "Pioneering Population" is designated when an invasive plant species covers a small area and is typically sparse and has been verified during the preceding 5 years. A "Pioneering Population" will cover an area that is less than three acres in size or has colonized less than 3% of the habitable area of the lake, stream reach, or wetland, whichever is greater. If greater than three acres (or >3% of the lake surface area) then it is designated an "Established Population." Once the infestation is characterized, "at risk" areas should also be marked on a map. For example, nearby boat landing sites and areas of high boat traffic.

When "pioneer" or "established" status is determined, it is time to consult the WDNR Lakes Coordinator to determine appropriate notifications and management responses. Necessary notifications of landowners, governmental officials, and recreationists (at boat landings) will be determined. Whether the population's perimeter needs to be marked with buoys will be decided by the WDNR. Funding sources will be identified and consultants and contractors will be contacted where necessary. The WDNR will determine if a further baseline plant survey is required (depending on type of treatment). A post treatment monitoring plan will be discussed and established to determine the efficacy of the selected treatment.

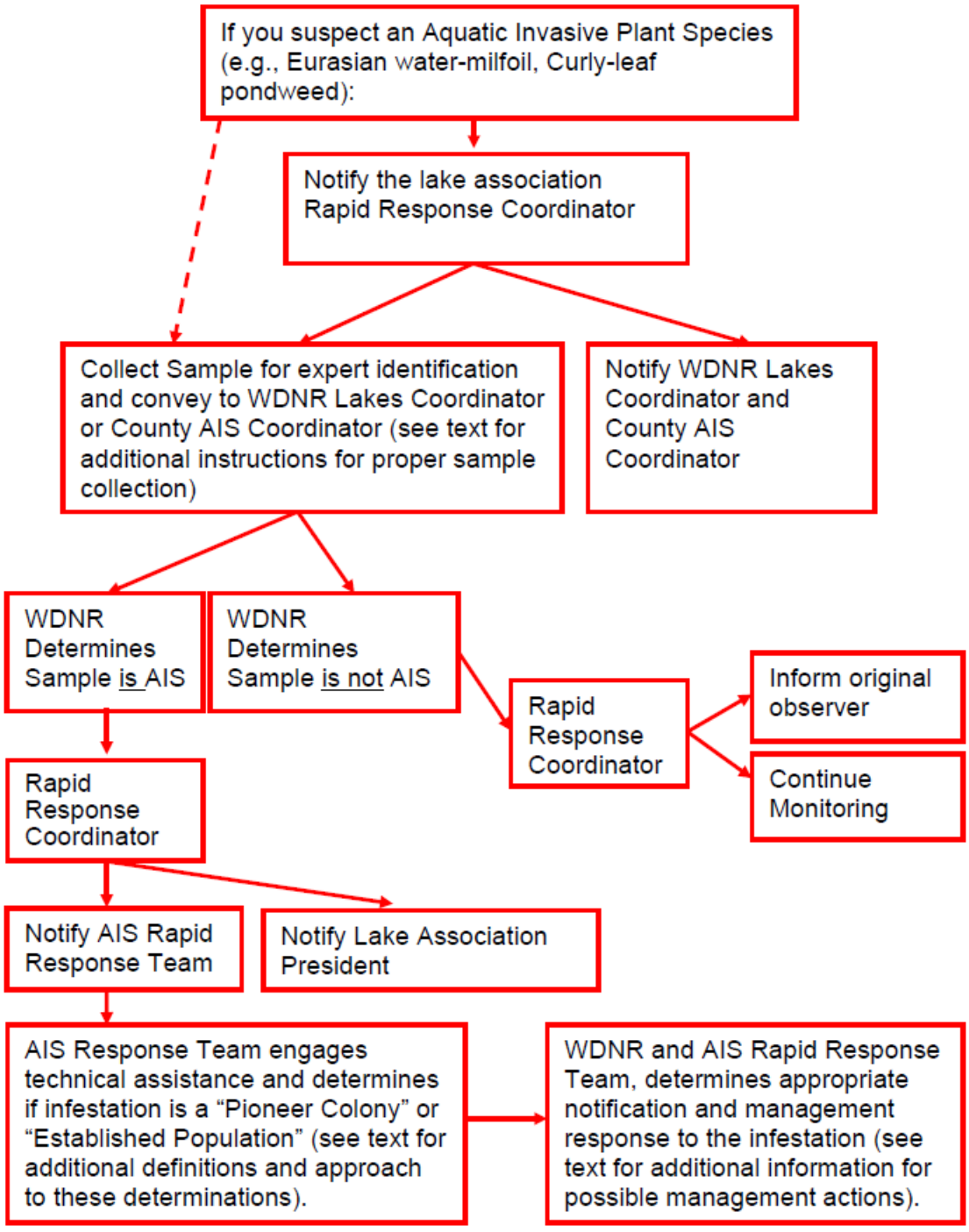


Figure 5. Aquatic Invasive Plant Species Rapid Response Flow Chart

Appendix 1. Literature cited

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Appendix 2. Documents

Appendix 2 - Table 1. Description of the aquatic plant community statistical terms

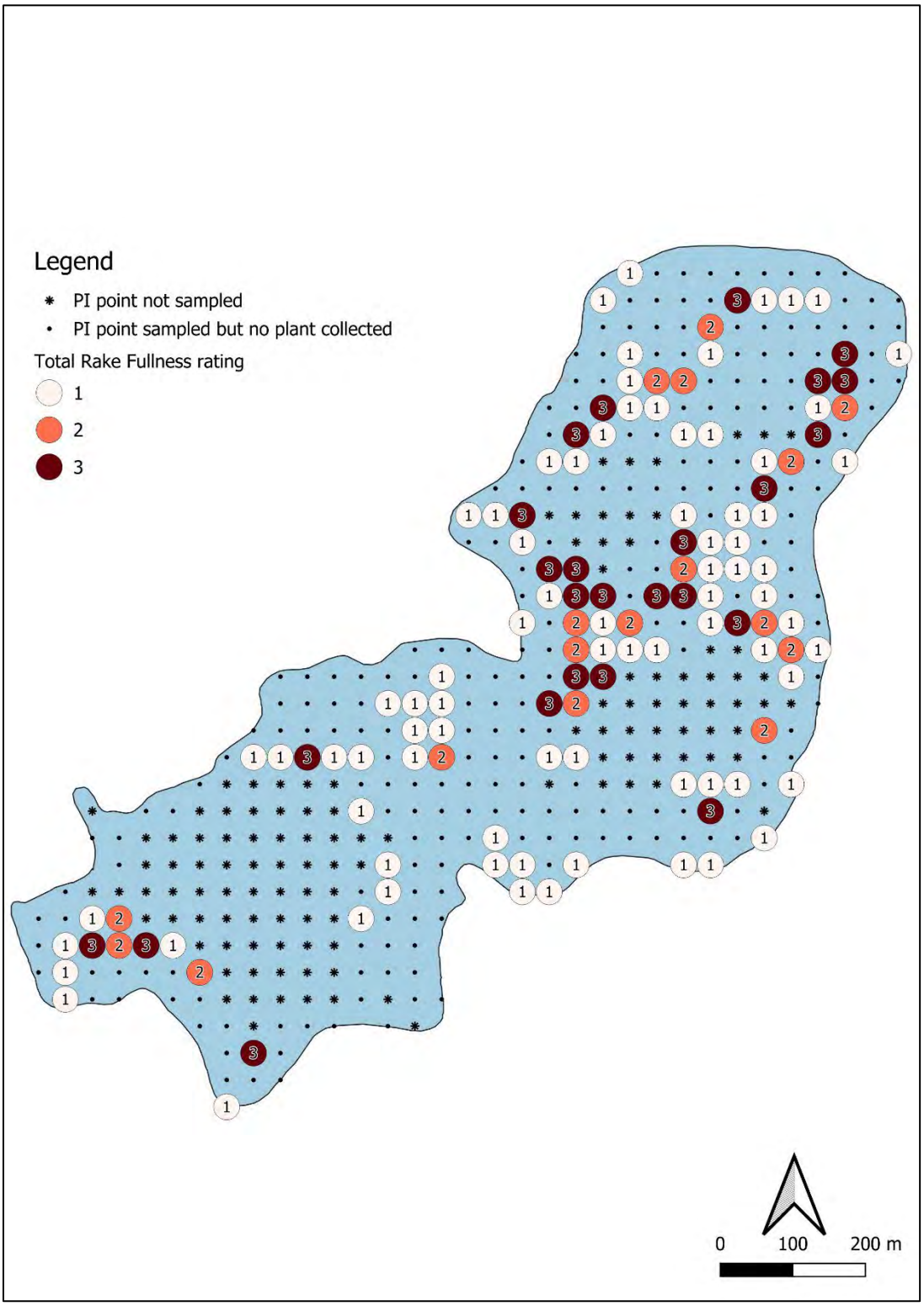
Statistical term	Description
Maximum depth of plants (ft)	Since aquatic rooted aquatic plants require sunlight at the lake bottom in order to root and grow, water depth and transparency ultimately limit where plants can grow. By repeated sampling in a lake, we can determine the maximum depth at which plants grow. By definition this area where plants can grow is called the littoral zone. Beyond that depth plants are absent.
Frequency of occurrence at points within the littoral zone	Not every area of the lake bottom that is shallower than the maximum depth of plants actually has plants living there. Other things like the kind of substrate can influence whether a plant can take root. Frequency of occurrence at sites shallower than maximum depth of plants documents the proportion of sites where rooted plants actually occur within the littoral zone.
Average number of all species per point (vegetative. points only)	This metric is the average of the number of plant species documented at each of the point-intercept sampling points. Lakes with diverse plant communities tend to have higher average number of plant species at each site.
Species richness	This metric is a simple count of the number of species in an area. In the case of the point-intercept survey, this refers to the number of plant species actually collected on the rake for the point-intercept sampling points in a given area (e.g., an entire lake or a sub-PI plot). The species richness of a lake would mean the total number of plant species in the entire lake. Species richness is a simple measure of diversity. More species equals higher diversity.
Species richness (including visuals)	This metric includes the simple count of the number of plant species collected on the rake for the point-intercept sampling points in a given area and those observed (but not actually collected with the rake) within 6 feet of the sampling points.
Simpson diversity Index	This is a more sophisticated measure of biological diversity than species richness. It is an index that takes into account species richness (number of species) as well as evenness. Species evenness is a description of the distribution of abundance across the species in a community. Species evenness is highest when all species in a sample have the same abundance. The most diverse systems have both high number of species and high evenness.

Statistical term	Description
Floristic Quality Index (FQI)	This is an index that tries to capture how "pristine" a plant community is in terms of its species composition. Some plant species are very sensitive to human presence and are less likely to occur in lakes where human influences are strong. At the other end of the spectrum are plants that do very well in the presence of human influence. The FQI attempts to evaluate the mix of sensitive and non-sensitive plants in a lake.
Average rake fullness	Rake fullness is a rating given to each rake pull on a PI survey that indicates the amount of plant material for each species as well as combined species. There are four ranks: 0 (not present), 1, 2, & 3 (3 represents the highest value of plant material on a rake). Average rake fullness is the mean value for all the point-intercept points.

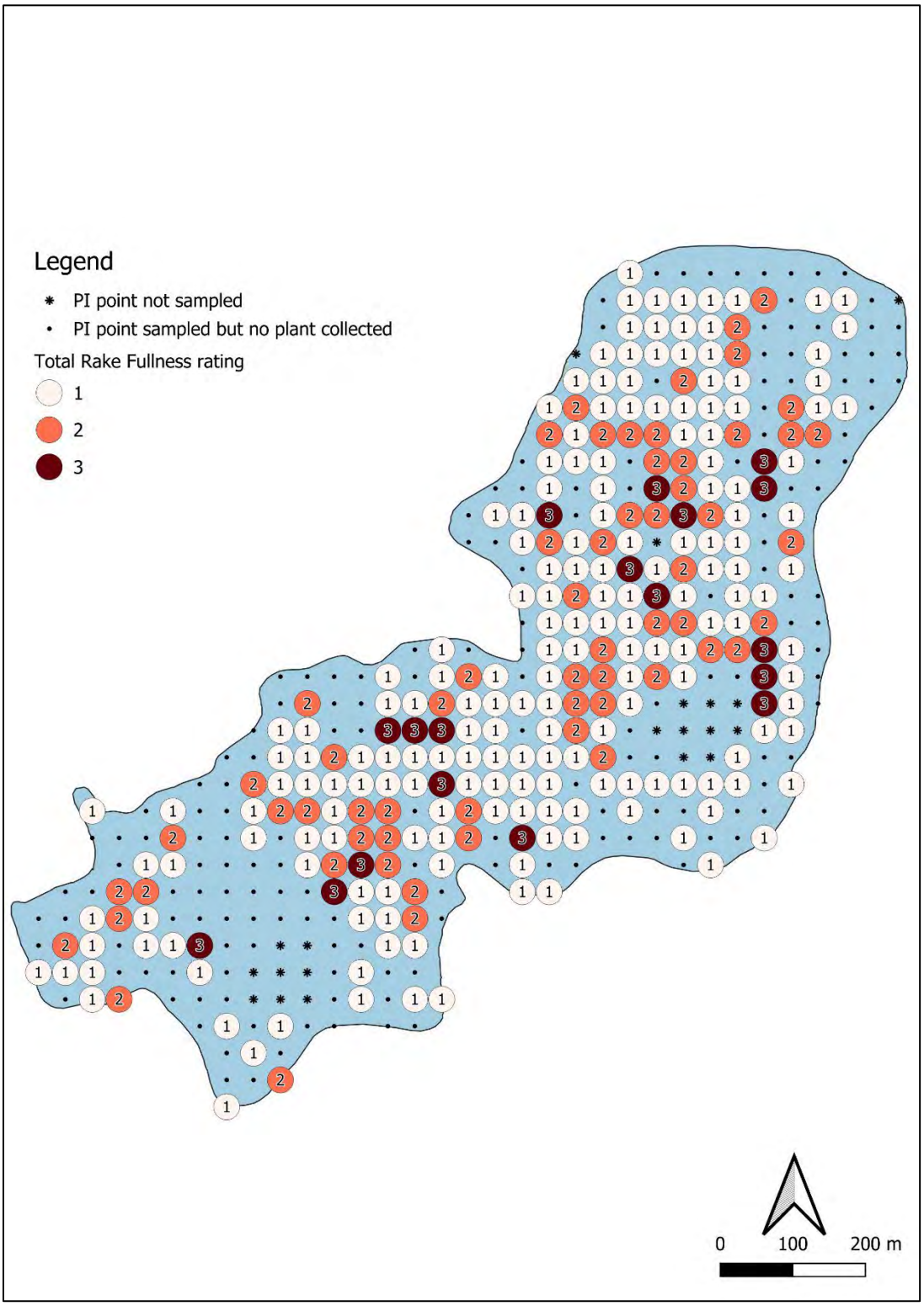
Appendix 2 - Table 2. Plant species recorded and statistics for the 2025 Carlin Lake aquatic plant survey.

Common name	Scientific name	Frequency of occurrence within vegetated areas (%)	Frequency of occurrence at sites shallower than maximum depth of plants	Relative Frequency (%)	Number of sites where species found (including visuals)	Average Rake Fullness
Nitella	*Nitella sp.*	93.63	60.10	88.03	250	1.4
Brown-fruited rush	*Juncus pelocarpus f. submersus*	3.00	1.92	2.82	14	1
Lake quillwort	*Isoetes lacustris*	2.25	1.44	2.11	11	1
Needle spikerush	*Eleocharis acicularis*	1.87	1.20	1.76	5	1
Ribbon-leaf pondweed	*Potamogeton epihydrus*	1.87	1.20	1.76	18	1
Dwarf water-milfoil	*Myriophyllum tenellum*	1.12	0.72	1.06	3	1
Watershield	*Brasenia schreberi*	1.12	0.72	1.06	6	1.6
Narrow-leaved bur-reed	*Sparganium angustifolium*	0.75	0.48	0.70	7	1.5
Aquatic moss		0.37	0.24		1	1
Water lobelia	*Lobelia dortmanna*	0.37	0.24	0.35	5	1
Bur-reed	*Sparganium sp.*	0.37	0.24	0.35	3	1
Pipewort	*Eriocaulon aquaticum*				9	
Waterwort	*Elatine minima*				4	

Common name	Scientific name	Frequency of occurrence within vegetated areas (%)	Frequency of occurrence at sites shallower than maximum depth of plants	Relative Frequency (%)	Number of sites where species found (including visuals)	Average Rake Fullness
Water horsetail	*Equisetum fluviatile*				3	
Aquatic forget-me-not	*Myosotis scorpioides*				2	
Three-way sedge	*Dulichium arundinaceum*				1	
Creeping spikerush	*Eleocharis palustris*				1	
Freshwater sponge					1	
Turion Duckweed	*Lemna turionifera*				1	
Spatterdock	*Nuphar variegata*				1	



Appendix 2 - Map 1. Carlin Lake total rake fullness distribution during the 2010 aquatic plant survey.



Appendix 2 - Map 2. Carlin Lake total rake fullness distribution during the 2025 aquatic plant survey.

Appendix 3. Aquatic Invasive Species Report

Carlin Lake
(Vilas County, Wisconsin)

Aquatic Invasive Species Monitoring Report

Prepared for:

Presque Isle Town Lake Committee
Contact: Nick Williams
P.O. Box 37
Presque Isle, Wisconsin 54557
Phone: (715) 892-7184; E-mail: thewds@milwpc.com

Prepared by:

White Water Associates, Inc.
Contact: Carole Gabbard
429 River Lane, P.O. Box 27
Amasa, Michigan 49903
Phone: (906) 822-7889; Email: carole.gabbard@white-water-associates.com

Cite as: *Gabbard, Carole. 2025. Aquatic Invasive Species Monitoring Report for Carlin Lake (Vilas County, Wisconsin). White Water Associates, Inc.*

WHITE WATER ASSOCIATES, INC.

Date: October 2026

INTRODUCTION

White Water Associates, Inc. (hereafter referred to as White Water) was retained by the Presque Isle Town Lake Committee to conduct an Aquatic Invasive Species (AIS) monitoring in Carlin Lake (Vilas County, Wisconsin) associated with an aquatic plant survey in 2025.

METHODS

For this survey, we conducted a thorough search of likely habitats for aquatic invasive species (AIS) around the entire Carlin Lake shoreline with special focus on the boat landing and other points of most likely AIS introduction or colonization. The field work was conducted on July 30, 2025 by White Water aquatic biologists Carole Gabbard and Jesse Gabbard and field technician Faryn Rice.

The search began at a private boat landing on the west shore of the lake. Using White Water boat, we meander-searched around the entire lake and stopped at five targeted search sites and snorkeled and waded with viewing bucket to look for AIS in the water and near shore. As part of the survey, a Ponar dredge was used to collect a sediment sample at the deep hole location in the lake. This sample was later examined in the laboratory using a stereo microscope to look for spiny water flea body parts. Spiny water fleas (*Bythotrephes longimanus*) are an aquatic invasive zooplankton that is found in a few lakes in Wisconsin. The survey ended by wading and snorkeling at the boat landing area looking for AIS (Figure 1).



Figure 1. Carlin Lake targeted search sites (CL2025-#), sediment sampling site (CL2025-DR) and boat landing locations.

SURVEY RESULTS

During the survey, one wetland invasive plant species was observed: aquatic forget-me-not (*Myosotis scorpioides*). During this survey, vegetative parts of an unknown Iris species were observed. This plant could be the native blue flag (Iris versicolor) or a wetland invasive species known as yellow iris (*Iris pseudacorus*). Each of these invasive species is described in the following paragraphs. The spiny water flea (*Bythotrephes longimanus*) was not found in Carlin Lake sediment sample.

1. ***Yellow iris.*** At the time of the 2025 survey, iris plants were not in flower making definitive species identification impossible. The location of the iris found is shown in the Figure 2. We recommend monitoring the population annually in the spring (June) to confirm the presence of yellow iris by the blossom color. If yellow flag iris (*Iris pseudacorus*) plants are present, they should be removed by digging up the entire plant (including the underground rhizome). To stabilize the resulting disturbed shoreline, we recommend that native blue flag iris (*Iris versicolor*) be planted. This species is available from nurseries.

2. ***Aquatic forget-me-not.*** This invasive species can quickly crowd native plant species and is able to form large monocultures. This, in turn, affects community compositions by reducing the number of native herbs (Wisconsin DNR, 2026). Aquatic forget-me-not is difficult to control due to its mechanisms for spreading (Wisconsin DNR, 2026). The locations of the aquatic forget-me-not found during the 2025 AIS monitoring are shown in the Figure 2.

Table 1. Targeted search site GPS coordinates and their findings.

Targeted search site	Latitude	Longitude	Findings
CL2025-01	46.20432	-89.77303	No AIS Present.
CL2025-02	46.19951	- 89.77938	No AIS Present
CL2025-03	46.19630	-89.78730	No AIS Present
CL2025-04	46.19481	-89.77998	No AIS Present
CL2025-05	46.19666	-89.77499	No AIS Present
Boat Landing	46.20081	-89.77983	No AIS Present
CL2025-DR	46.19794	-89.77571	No AIS Present

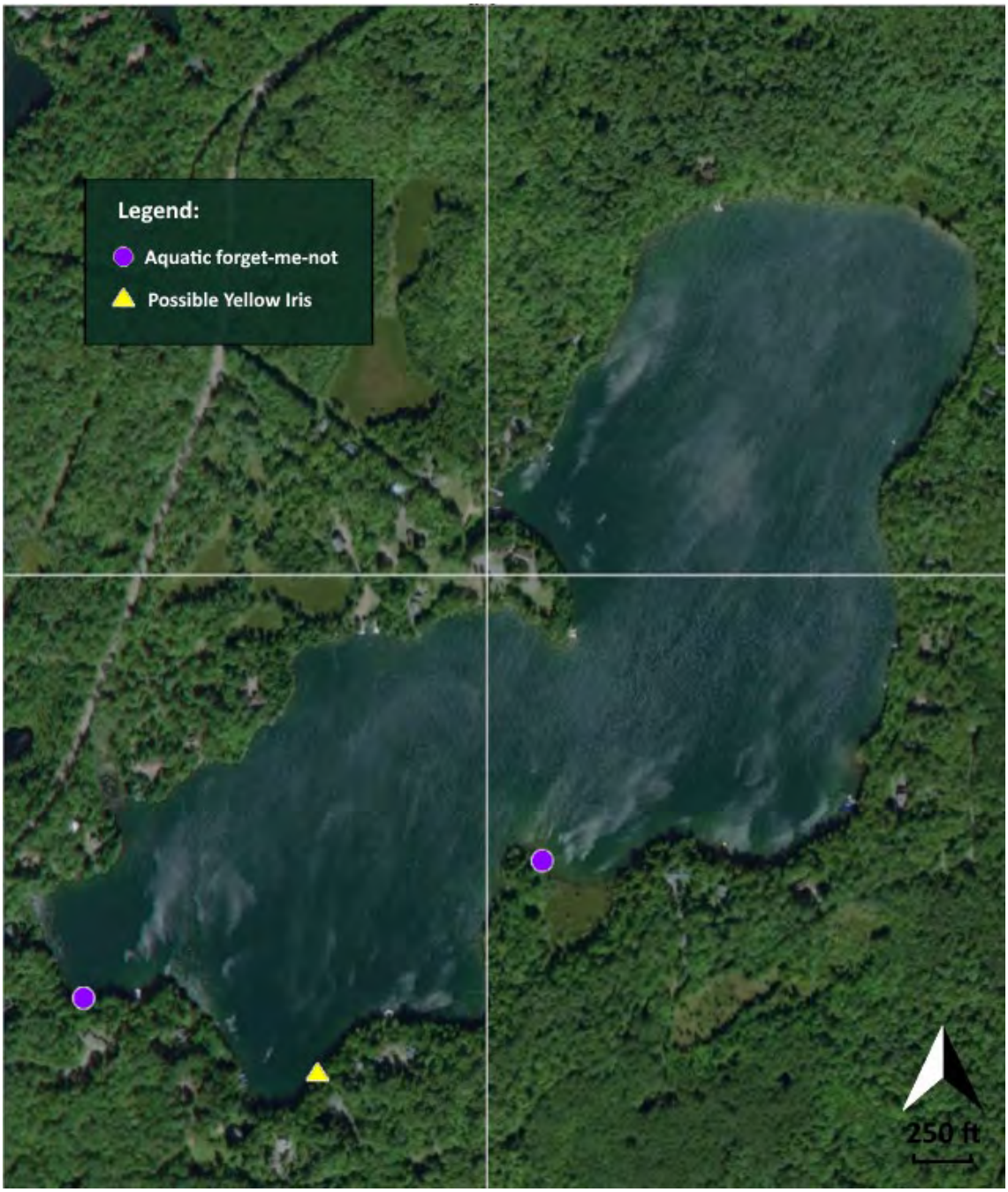


Figure 2. Wetland invasive species found during the 2025 AIS in Carlin Lake.

Literature cited

Wisconsin DNR, 2026. Aquatic Forget-me-not | (Myosotis scorpioides) | Wisconsin DNR

Wisconsin DNR, 2026. Yellow flag iris | (Iris pseudacorus) | Wisconsin DNR