Presque Isle Wilderness Waters Program
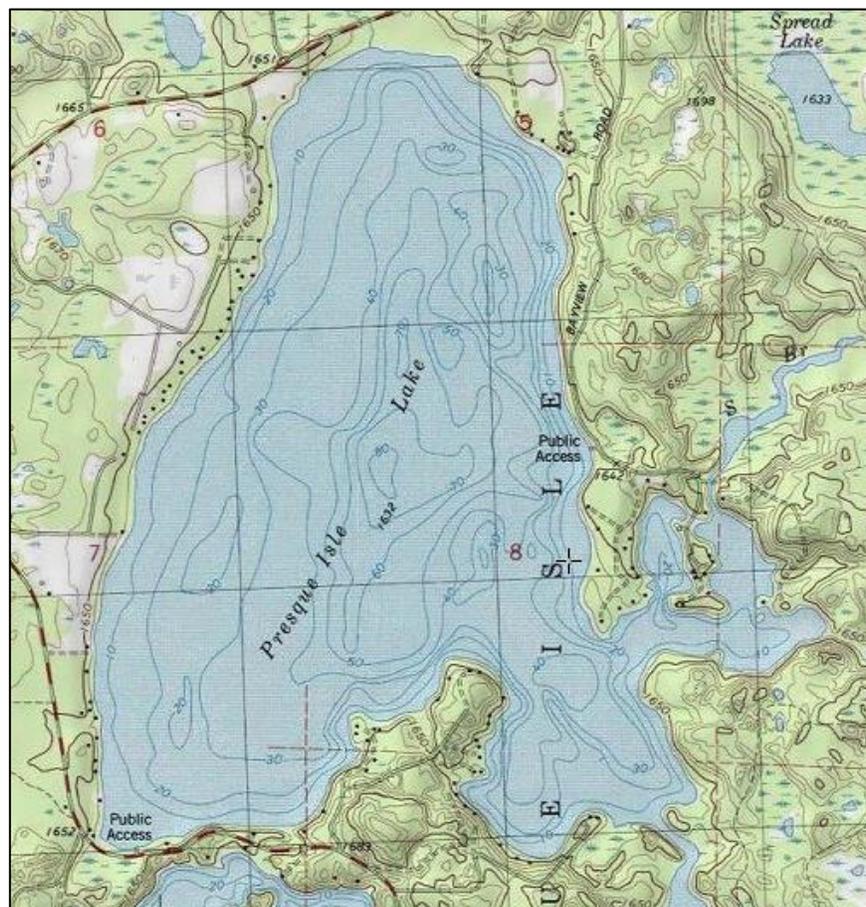
Aquatic Plant Management Plan – Presque Isle Lake

Prepared for:

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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 Presque Isle 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 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 lush 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 humans 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 and water gardens may come to dominate a water body to the exclusion of a healthy diversity of native species. Eurasian water-milfoil (*Myriophyllum spicatum*) is one of the better known examples of these so-called aquatic invasive plant species.

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.

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. 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*.[1]

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

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[1] *http://www4.uwsp.edu/cnr/uwexlakes/ecology/APM/APMguideFull2010.pdf*

- *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, Town Lakes Committee has followed the first five steps in 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 plan. Finally, Chapter 6 presents actions and objectives for implementing the plan. Three appendices complete this document. Appendix A contains literature cited, Appendix B contains tables and figures for the aquatic plant survey, and Appendix C contains a *Review of Presque Isle Lake Water Quality*. Appendix D contains the *Lake Shoreland and Shallows Habitat Monitoring Report*, and Appendix E contains *the Aquatic invasive Species Report*.

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 (Presque Isle Lake) is shown in Exhibit 1 along with other lakes in Presque Isle Township that have had point-intercept aquatic plant surveys conducted. Exhibit 2 is an aerial view of Presque Isle Lake.

Exhibit 1. Presque Isle Township lakes on which point-intercept aquatic plant surveys have been conducted.
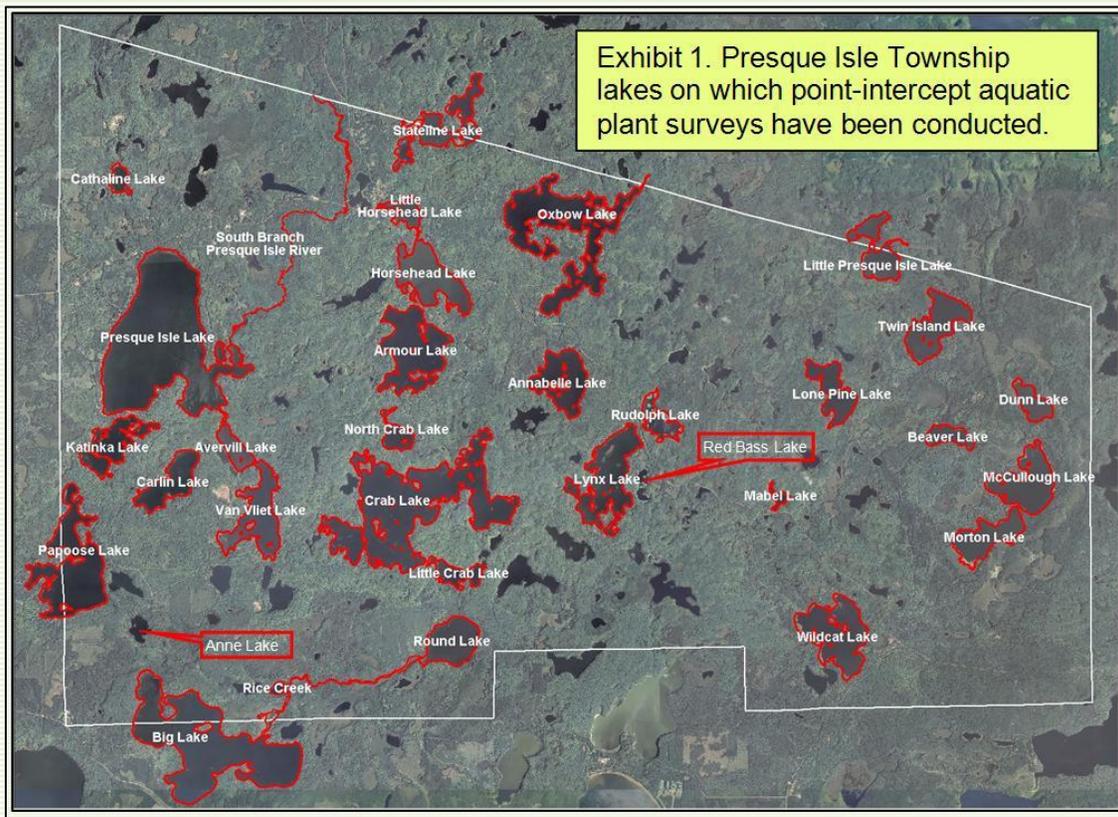
"Almost an island" is the literal translation of the French phrase "Presque Isle." Early French missionaries, perhaps disoriented by the preponderance of water in this north central Wisconsin landscape applied the name, "Presque Isle" to describe an area where the water seemed to dominate the land. The French visitors and Native Americans certainly recognized this landscape as special. Modern ecologists and recreationist 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."
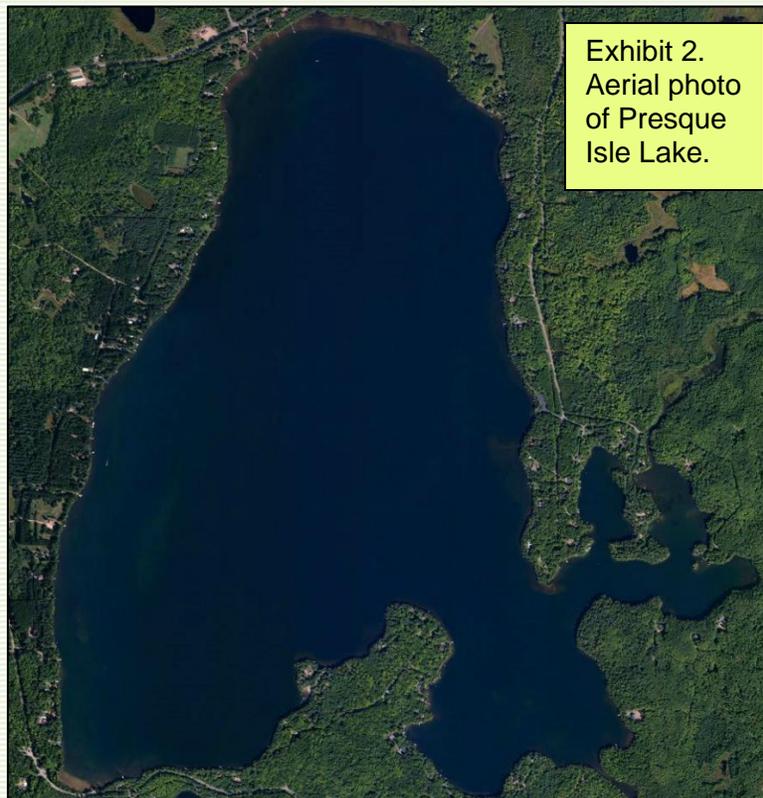

Exhibit 2. Aerial photo of Presque Isle Lake.

Descriptive parameters for Presque Isle Lake are in Exhibit 3. It is a drainage lake of about 1,165 acres and maximum depth of 103 feet. The shoreline development index (SDI) values for

the Wilderness Waters Program lakes surveyed in 2019 and 2020 ranged from 1.3 to 3.7 (average = 2.1). Presque Isle Lake has an SDI just below this average value at 1.8. 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.

Exhibit 3. Water Body Parameters	
Water Body Name	Presque Isle
County	Vilas
Township/Range/Section	T43N-R06E-S5,6,7,8,9,17,18
Water Body Identification Code	2956500
Lake Type	Drainage
Surface Area (acres)	1165
Maximum Depth (feet)	103
Maximum Length (miles)	1.7
Maximum Width (miles)	1.7
Shoreline Length (miles)	8.8
Shoreline Development Index	1.8
Total Number of Piers (2019 Shoreland)	142
Number of Piers / Mile of Shoreline	16.1
Total Number of Homes (2021 aerial)	108
Number of Homes / Mile of Shoreline	12.27

Presque Isle Lake has two public access sites. We observed a total of 142 piers on the shoreline of Presque Isle Lake from the 2019 shoreland survey or about 16.1 piers per mile of shoreline. The riparian area consists of both upland and wetland areas (Exhibit 4).

Exhibit 4.
Topographic Map of
Presque Isle Lake
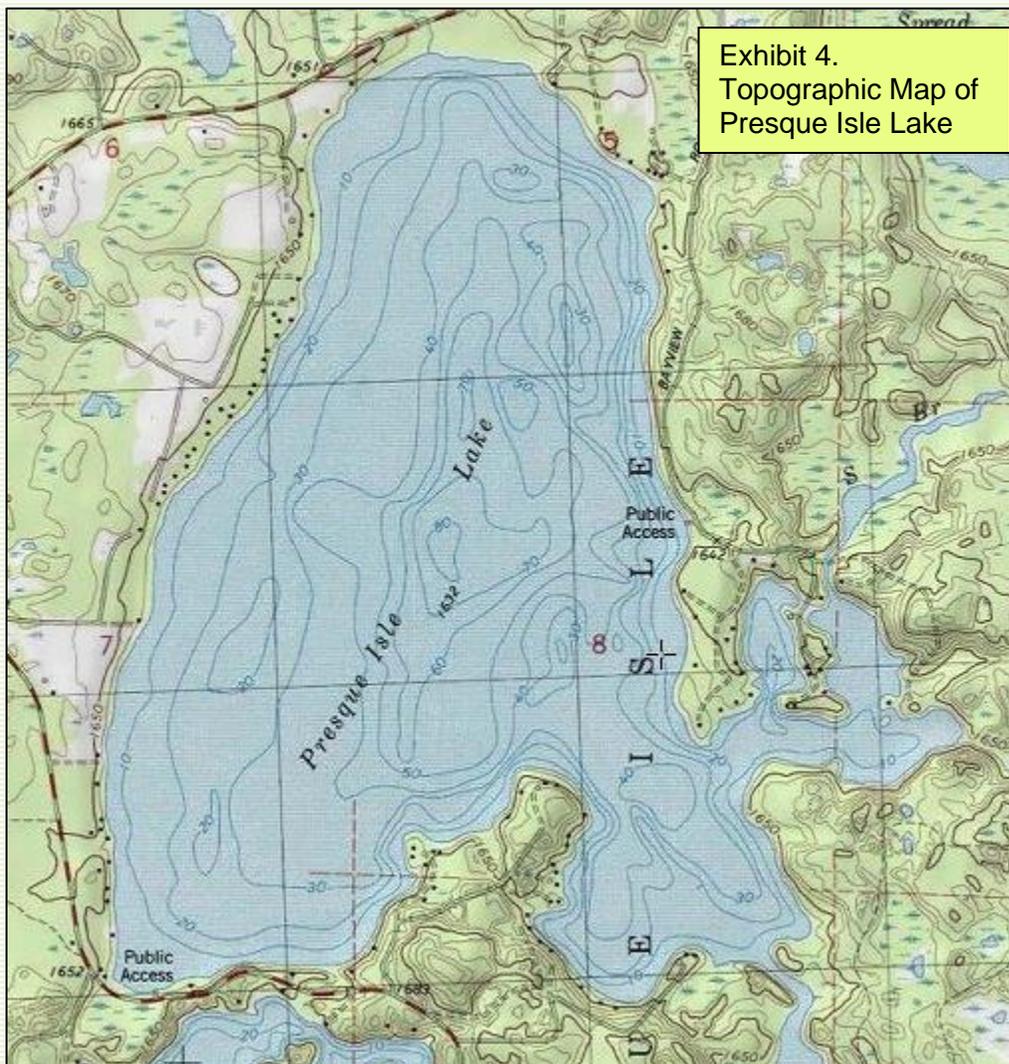
CHAPTER 3   Purpose and Goal Statements

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:

> *Presque Isle Lake has a native aquatic plant community that was documented by a point-intercept aquatic plant survey. 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 maintain the aquatic plant community in its present high quality state.*

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

> *(1) Monitor and protect the native aquatic plant community;*
> *(2) Prevent establishment of AIS and nuisance levels of native plants;*
> *(3) Promote and interpret APM efforts; and*
> *(4) Educate riparian owners and lake users on preventing AIS introduction, reducing nutrient inputs that potentially alter the plant community, and minimizing physical removal of native riparian and littoral zone 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 Presque Isle Lake stewards.

CHAPTER 4   **Information and Analysis**

Our efforts in the Wilderness Waters Program have compiled information about historical and current conditions of the Presque Isle 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.
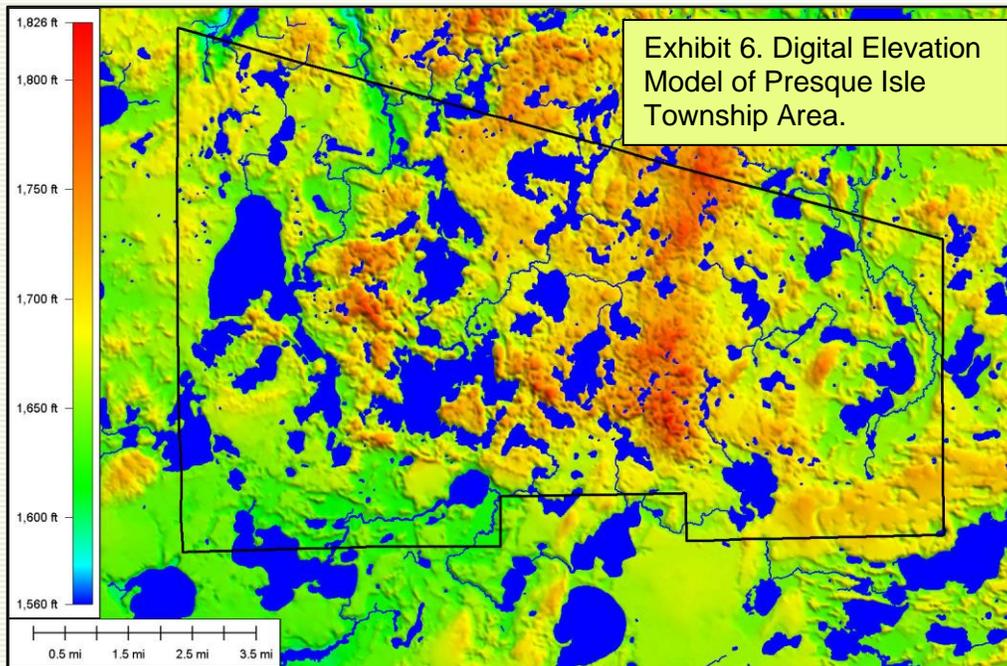
Part 1. Watershed

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 to the Mississippi River and to the Gulf of Mexico. 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). Exhibit 5 illustrates these watersheds and the watersheds of the water bodies subject to the Wilderness Waters Program studies. Presque Isle Lake is contained within the South Branch Presque Isle River sub-watershed (Exhibit 5).

Exhibit 5. Watersheds of Presque Isle Township Area.

Presque Isle Lake

PRESQUE ISLE TWP.

0.0 mi   1.5 mi   3.0 mi
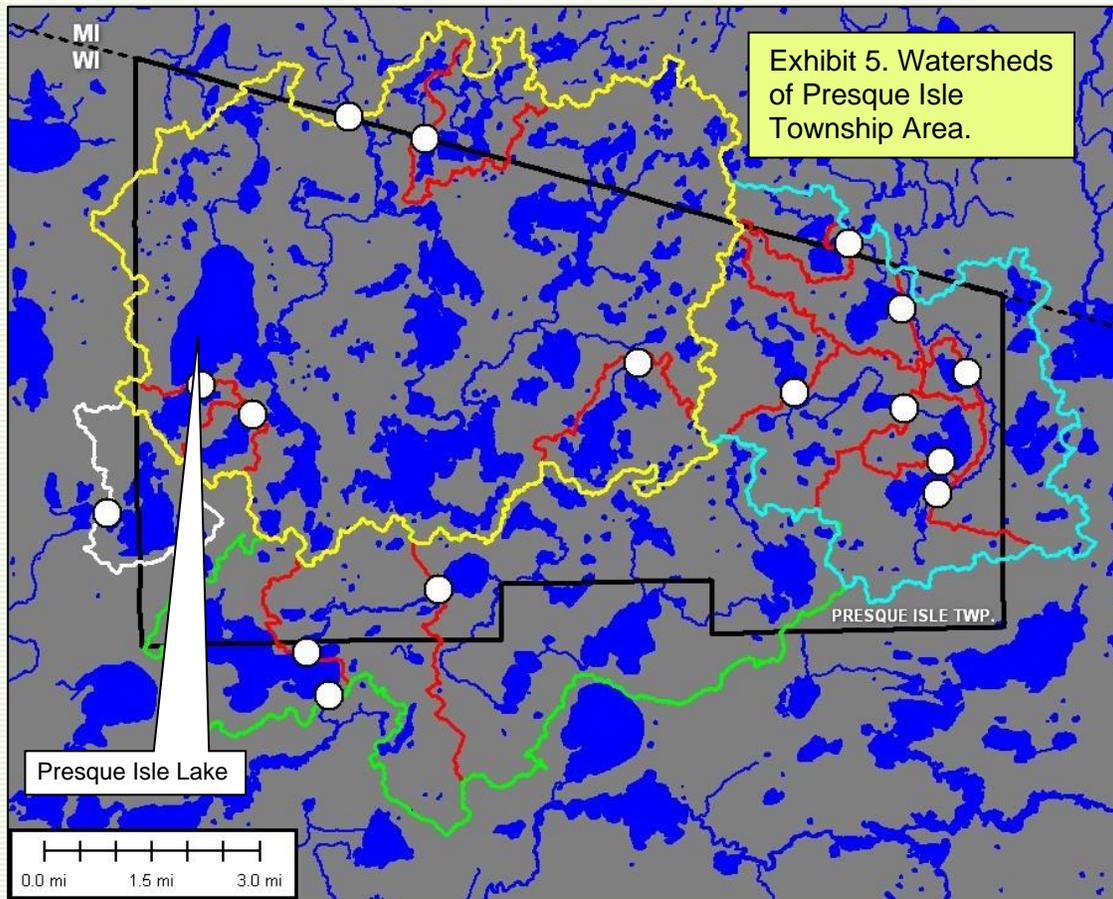
Description: Portions of 3 federal hydrologic sub-watersheds are illustrated: (1) S.Br. Presque Isle River (bounded by yellow), (2) Pomeroy Cr-E.Br. Presque Isle River (bounded by blue and yellow), and (3) Rice Cr. (bounded by green, yellow, and blue). Also shown are the smaller watersheds of individual 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 Exhibit 6 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.

Exhibit 6. 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 Presque Isle Lake watershed is about 8,820 acres. The cover types in the watershed are presented in Exhibit 7. Forest and surface water comprise the largest components. Soil group B is most prevalent, followed by group D, while groups A and C make up a very small percentage of the watershed. Soil group A has the highest infiltration capacity, and the lowest runoff potential. Conversely, soil group D has the lowest infiltration capacity, and the highest runoff potential. The watershed to lake area ratio is about 8:1. 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.

Exhibit 7. Cover Types and Soil Groups of the Presque Isle Lake Watershed.		
Cover Type	Acres	Percent
Agriculture	63.5	0.7
Commercial	0	0
Forest	4548.6	51.6
Grass/Pasture	46.7	0.5
High-density Residential	3.2	0.04
Low-density Residential	529.8	6.0
Water	3630.1	41.1
Total	8821.96	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	588.1	6.7	**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	4902.5	55.6	**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	17.8	0.2	**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	3313.6	37.6	**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.
*(USDA, Natural Resources Conservation Service, 1986)			

Part 2. Aquatic Plant Management History

As far as we can determine, no systematic or large-scale plant management activity has ever taken place in Presque Isle Lake. Over the years, no particular nuisance issues have demanded control action. Comprehensive aquatic plant surveys have been conducted at Presque

Isle Lake in 2007, 2013, and 2019. Findings from these surveys are discussed in the next section (Part 3).

Part 3. Aquatic Plant Community Description

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. 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 (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, which is, in turn, controlled 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 our hypothetical 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.

As mentioned earlier, non-native invasive plant species can reach high densities and wide distribution within a lake. This diminishes the native plant community and the related habitat. At times, even a native plant species can reach nuisance levels with respect to certain kinds of human recreation. These cases may warrant some kind of plant management.

Aquatic plant surveys have been conducted on Presque Isle Lake by aquatic plant specialists in 2007, 2013, and 2019. In each of these surveys, WDNR point-intercept protocol and methodology was followed. This formal survey assesses the plant species composition on a grid of several hundred points distributed evenly over the lake. Using latitude-longitude

coordinates and a handheld GPS unit, scientists navigate to the points and use a rake mounted on a pole or rope to sample plants. Plants are identified, recorded and put into a dedicated spreadsheet for storage and data analysis. Plants not directly captured by the rake are categorized as "visuals" or "boat survey." This systematic survey provides baseline data about the lake.

Because Presque Isle Lake has been surveyed for aquatic plants three times, we are able to identify differences in the plant community that have resulted over the years. 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 3) we provide a report of the findings of the 2019 point-intercept aquatic plant survey. Table 1 displays summary statistics for the survey and Table 2 provides a list of the species encountered, including common and scientific name along with summarizing statistics. We also summarize the aquatic plant findings for the 2007, 2013 and 2019 surveys. Supporting tables and figures for the aquatic plant surveys are provided in Appendix B. Table 3 provides a comparison of statistics from the survey years.

Species richness refers to the total number of species recorded. We recorded 18 species of aquatic plants.[2] Of these, 9 were collected at sampling sites and the others were observed from the boat. The number of species encountered at any given sample point ranged from 0 to 2 and 28 sample points were found to have aquatic vegetation present. The average number of species encountered at these vegetated sites was 1.18. The actual number of species encountered at each of the vegetated sites is graphically displayed on Figure 1. Plant density is estimated by a "rake fullness" metric (3 being the highest possible density). These densities (considering all species) are displayed for each sampling site on Figure 2.

The maximum depth of plant colonization is 10.0 feet (Table 1 and Figure 3). Rooted vegetation was found at 28 of the 155 sample sites with depth ≤ the maximum depth of plant colonization (18.1% of sites). These sites are displayed as a black dot within a circle on Figure 4. This indicates that although availability of appropriate depth may limit 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). Figure 5 presents the substrates encountered during the aquatic plant survey (mud, sand, or rock).

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[2] *If you are interested in learning more about the plant species found in the lake, visit the University of Wisconsin Stevens Point Freckmann Herbarium website at: http://wisplants.uwsp.edu/ or obtain a copy of "Through the Looking Glass (A Field Guide to the Aquatic Plants in Wisconsin)."*

Table 2 provides information about the frequency of occurrence of the plant species recorded in the lake. Several metrics are provided, including total number of sites in which each species was found and frequency of occurrence at sites ≤ the maximum depth of rooted vegetation. This frequency metric is standardized as a "relative frequency" (also shown in 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 descending order on Figure 6 (data for both 2013 and 2019 are included for comparison). This display shows that large-leaf pondweed (*Potamogeton amplifolius)* had the highest relative frequency followed by muckgrass (*Chara sp.)*. The lowest relative frequencies are at the far right of the graph. Figure 7 shows the distribution of floating and emergent plant forms in the lake. As examples of individual species distributions, we show the occurrences of a few of the most frequently and least frequently encountered plants in Figures 8-13.

Species richness (total number of plants recorded at the lake) is a measure of species diversity, but it 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, richness is 10). 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 Presque Isle Lake aquatic plants is 0.80 (Table 1) which indicates a diverse aquatic plant community.

Another measure of floristic 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 (ecoregional) characteristics of the FQI metric. This is useful for considering how the Presque Isle Lake FQI (19.3) compares to other lakes and regions. The statewide medians for number of species and FQI are 13 and 22.2, respectively. Presque Isle Lake values are comparable to 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. Presque Isle Lake is located in the Northern Lakes and Forests lakes group. Nichols (1999) found species numbers for the Northern Lakes and Forests lakes group had a median value of 13. Presque Isle Lake data is consistent than that find. Finally, the Presque Isle Lake FQI (19.3) is slightly below the median value for the Northern Lakes and Forests lakes group (24.3). This analysis means that the Presque Isle Lake plant community in general is comprised of plant species that tolerate disturbance. Plant species that tend to thrive in undisturbed habitats are not present. Nevertheless, the plant community appears to be in a healthy condition.

We observed no aquatic plants in Presque Isle Lake that would be considered a nuisance-level population density/distribution. We found no state or federally listed species.

In the 2013 aquatic plant survey, an average 1.56 species were observed per site[3], while in 2019, the average species per sit was 1.18. The maximum depth of plants was 10 feet for both sample years. In 2013, the frequency of occurrence of plants at sites shallower than the maximum depth of plants was 24.66%. This percentage is higher than what was observed in 2019 (18.06%). This decrease means that fewer sites in 2019 had vegetation than in 2013. Large-leaf pondweed (*Potamogeton amplifolius)* and wild celery (*Vallisnera americana)* had the highest relative frequencies in 2013. In 2019, large-leaf pondweed was still the most common species; however, *Chara sp.* had since become the second most frequent species. The Simpson Diversity Index (SDI), which takes into account both richness and evenness in estimating diversity, was 0.68 (2007), 0.87 (2013), and 0.80 (2019) (see Table 3), meaning the lake has a

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[3] The 2007 aquatic plant statistics included filamentous algae, which, according to WDNR protocol, should not be included. Because of this, species number, average species per site, SDI and relative frequencies will vary.

somewhat fluctuating plant diversity. This is worth monitoring in the future. In 2007, the FQI was 22.5, which is equal to state averages, slightly lower than regional average, and relatively equal to the FQI observed in 2013 (22.7). In 2019 the FQI observed was 19.3. A comparison of 2007, 2013, and 2019 aquatic plant statistics can be viewed in Table 3. This factor is worth monitoring in the future.

Figure 6 displays the relative frequency of plants found in 2013 and 2019. We can see that large-leaf pondweed was the most common plant species in both years. The frequency of large-leaf pondweed has decreased, which is evident from the more evenly distributed plant community. We also see there were new species observed in 2019. This trend is worthy of monitoring with future aquatic plant surveys.

Many factors can be considered as "stressors" to the plant community (some are natural and some are human-caused). For example, Presque Isle Lake water levels fluctuate due to climatic conditions and beaver (both natural causes of water level fluctuation). Presque Isle Lake also has human-influenced stressors on aquatic plants. Rusty crayfish (an aquatic invasive species) has been present in the lake for nearly two decades and this herbivorous and abundant animal can change the plant community. We would consider this a human-influenced stressor, because humans were likely involved with this species' introduction to the lake. Recreational watercraft traffic on Presque Isle Lake also disturbs the plant community with increased turbulence and mechanical disturbance. With the advent of so-called "wake boats," this stressor may have increased in intensity. The effects of some of these disturbances on plants might be revealed in the plant community statistics that have been obtained in 2007, 2013, and 2019 and emphasizes the importance of this sort of scientific monitoring. Even with monitoring data, however, interpreting impacts from stressors is complex. For example, landowner observations indicate a reduction of rusty crayfish in recent years, while at the same time another stressor (recreational traffic) is on the increase.

Part 4. 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 (http://dnr.wi.gov/lakes/lakepages/) indicates that the bottom is comprised of 60% sand, 30% gravel, 5% rock, and 5% muck and that fish species present include musky, panfish, largemouth bass, smallmouth bass, northern pike, and walleye.

Part 5. Water Quality and Trophic Status

Presque Isle Lake is a 1,165 acre drainage lake with a maximum depth of 103 feet. Existing water quality data was retrieved from the Wisconsin DNR SWIMS database from 1979 to 2020. Secchi disk measurements were collected by Citizen Lake Monitoring Network (CLMN) volunteers from 1989 to 2020. The water quality information is briefly summarized in this section, but more fully interpreted in Appendix C.

Temperature and dissolved oxygen showed stratification in Presque Isle Lake at times in the ice-free season. Average water clarity is "very good," and user perception of Presque Isle Lake aesthetic quality is generally regarded as "beautiful, could not be nicer." Turbidity is low. The trophic state is oligotrophic. Water quality would be classified as "very good" with respect to phosphorus concentrations. Chlorophyll *a,* chloride, magnesium, sodium, and potassium are considered low. The pH of Presque Isle Lake is neutral to slightly alkaline.

Part 6. Water Use

Presque Isle Lake has two public access sites, and is used by riparian owners and recreationists for a variety of activities. There is no State of Wisconsin ownership on the lake.

Part 7. Riparian Area

Part 1 (Watershed) describes the larger riparian area context of Presque Isle Lake. The near shore riparian area can be appreciated by viewing Exhibits 2 and 4. The lake is lightly developed with a fairly 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. Our review of 2021 aerial photography reveals 108 houses on the lake. 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. In 2019, the Vilas County Lakes and Rivers Association awarded its Blue Heron Shoreland Stewardship Award for The Town of Presque Isle for the restoration work at Wilderness Park on Presque Isle Lake.

Part 8. 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. In the future, it would be desirable to monitor indicator species of wildlife such as common loons, bald eagles, and osprey. Also of special importance would be monitoring the populations of aquatic invasive animal species that already exist in the lake (rusty crayfish) and monitoring for the presence of currently not present aquatic invasive wildlife species (for example, spiny water flea, or zebra mussel) and fish species (for example, rainbow smelt or common carp).

Presque Isle Lake is currently designated as a *priority navigable water* (PNW) (WI Admin. Code, 2014). Priority Navigable Waters meet any of these standards: navigable waterways, or portions thereof, that are considered OWR/EWR (outstanding/exceptional water resources) or trout streams; lakes less than 50 acres in size; tributaries and rivers connecting to inland lakes containing naturally-reproducing lake sturgeon populations; waters with self-sustaining walleye populations in ceded territories; waters with self-sustaining musky populations; or perennial tributaries to trout streams (WI Admin. Code, 2014). Presque Isle Lake is considered a PNW with self-sustaining musky and walleye populations.

Part 9. Stakeholders

At this juncture in the ongoing aquatic plant management planning process, the Town Lakes Committee has represented the Presque Isle 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 Town Lakes Committee has conducted a township wide lake users' survey that is presented in the overarching ***Wilderness Waters Adaptive Management Plan*** (Stine et al., 2022).

CHAPTER 5

Recommendations, 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) Prevent establishment of AIS and nuisance levels of native plants;

(3) Promote and interpret APM efforts; and

(4) Educate riparian owners and lake users on preventing AIS introduction, reducing nutrient inputs that potentially alter the plant community, and minimizing physical removal of native riparian and littoral zone plants.

Since Presque Isle Lake is a healthy ecosystem, we could simply recommend an alternative of "no action." In other words, Presque Isle Lake continues without any effort or intervention on part of the 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 Presque Isle Lake. No aquatic invasive plant species are known to be present and no native plants exhibit nuisance population size or distribution.

Recommended Actions for the Presque Isle 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 2022.

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 (such as spiny waterfleas or zebra mussels).

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 Presque Isle 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 2022.

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 2024.

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: Ongoing.

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: Anticipated to begin in 2022.

Recommended Actions for the Presque Isle 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: Anticipated to begin in 2022.

Action #12: Monitor the lake watershed for purple loosestrife and Aquatic forget-met not.

Objective: Identify purple loosestrife and Aquatic forget-me-not populations before they reach large size.

Monitoring: The Lake Association and/or Town Lakes Committee oversees activity.

Status: Anticipated in 2022.

Recommended Actions for the Presque Isle Lake APM Plan

Action #13: 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 oversee(s) activity and assesses effectiveness

Status: Anticipated to begin in 2022.

Action #14: Lake leaders should encourage and assist landowners to take on shoreland and 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, impervious surfaces, and lawns) *Vilas County Land and Water Conservation Department* looks for partners in this endeavor and can provide planning and sponsorship of projects. Funding for eligible projects is available from WDNR. Example projects on active lake stewards' properties would serve as valuable demonstration projects and encourage others to participate.

Objective: For high quality areas, maintain this condition through protection. For degraded areas, rehabilitate specific shoreland areas to improve natural functions and values.

Monitoring: Town Lakes Committee oversee(s) activity and assesses effectiveness.

Status: Anticipated to begin in 2022.

Action #15: Investigate WDNR programs such as "Fish Stix" to educate and provide direction and funding for habitat improvements.

Objective: To encourage good shallow water stewardship by lake users and improve the littoral zone quality of the lake in areas where warranted.

Outcome: Monitor by general awareness of landowners and changes to shallow water habitat.

Status: Anticipated to begin in 2022.

Recommended Actions for the Presque Isle Lake APM Plan

Action #16: Monitor the lake for aquatic forget-me- not and work with land owners to remove. This plant is restricted in Wisconsin and it would be good to control its population on the lake.

Objective: Limit the population and distribution of this species on the lake.

Monitoring: The Lake Association or Town Lakes Committee oversees activity and maintains data.

Status: Ongoing.

CHAPTER 6   Contingency Plan for AIS

Unfortunately, sources of aquatic invasive plants and other AIS are numerous in Wisconsin. Some infested lakes are quite close to Presque Isle Township. There is an increasing likelihood of accidental introduction of AIS to Presque Isle Township Lakes through conveyance of life stages by boats, trailers, and other vectors. It is important for the Town Lakes Committee and other lake stewards to be prepared for the contingency of aquatic invasive plant species colonization in a Presque Isle Township water body. As part of this grant an Aquatic Invasive Survey was conducted using the *Aquatic Invasive Species Early Detection Monitoring Standard Operating Procedure* (2014). Further discussion is found in Appendix E.

For riparian owners and users of a lake ecosystem, the discovery of AIS is a tragedy that elicits an immediate desire to "fix the problem." Although strong emotions may be evoked by such a discovery, a deliberate and systematic approach is required to appropriately and effectively address the situation. 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). AIS invade not just a single lake, but an entire region since the new infestation is an outpost from which the AIS can more easily colonize other nearby water bodies. For this reason it is strategic for the Rapid Response Team to include representation from regional stakeholders.

Figure 6 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. In the remainder of this chapter we further describe the approach.

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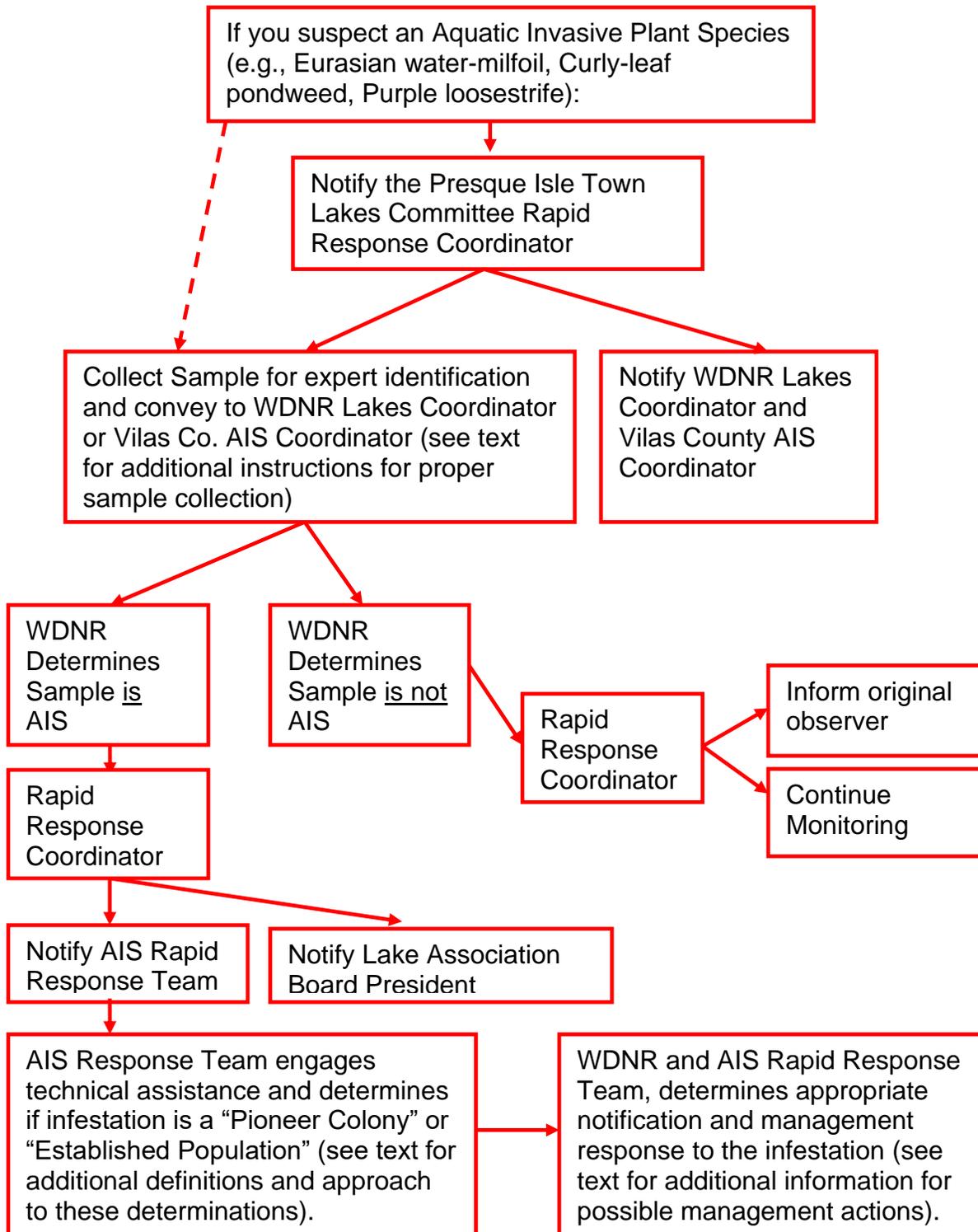
specimen including roots, stems, and flowers (if present). The sample should be placed in a sealable bag with a small amount of water to keep it moist. Place a label in the bag written in pencil with date, time, collector's name, lake name, location, town, and county. Attach a lake map to the bag that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

If the suspect specimen is determined to be an invasive plant species, the next step is to determine the extent and density of the population since the management response will vary accordingly. The Rapid Response Team should conduct (or have its consultant conduct) a survey to define the colony's perimeter and estimate density. If less than five acres (or <5% of the lake surface area), it is designated a "Pioneer Colony." If greater than five acres (or >5% of the lake surface area) then it is designated an "Established Population." Once the infestation is characterized, "at risk" areas should also be determined and marked on a map. For example, nearby boat landing sites and areas of high boat traffic should be indicated.

When "pioneer" or "established" status has been determined, it is time to consult with the WDNR Lakes Coordinator to determine appropriate notifications and management responses to the infestation. Determining whether hand-pulling or chemical treatment will be used is an important and early decision. 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.

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, chemical treatment contractors, and consultant(s).

Exhibit 8. Aquatic Invasive Plant Species Rapid Response

If you suspect an Aquatic Invasive Plant Species (e.g., Eurasian water-milfoil, Curly-leaf pondweed, Purple loosestrife):

Notify the Presque Isle Town Lakes Committee Rapid Response Coordinator

Collect Sample for expert identification and convey to WDNR Lakes Coordinator or Vilas Co. AIS Coordinator (see text for additional instructions for proper sample collection)

Notify WDNR Lakes Coordinator and Vilas County AIS Coordinator

WDNR Determines Sample is AIS

WDNR Determines Sample is not AIS

Rapid Response Coordinator

Inform original observer

Continue Monitoring

Rapid Response Coordinator

Notify AIS Rapid Response Team

Notify Lake Association Board President

AIS Response Team engages technical assistance and determines if infestation is a "Pioneer Colony" or "Established Population" (see text for additional definitions and approach to these determinations).

WDNR and AIS Rapid Response Team, determines appropriate notification and management response to the infestation (see text for additional information for possible management actions).

Appendix A
Literature Cited

LITERATURE CITED

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Appendix B

Aquatic Plant Survey Tables and Figures

Table of Contents

Table 1. Summary statistics for the 2019 point-intercept aquatic plant surveys for Presque Isle Lake.

Summary Statistic	Value	Notes
Total number of sites on grid	1266	Total number of sites on the original grid (not necessarily visited)
Total number of sites visited	244	Total number of sites where the boat stopped, even if much too deep to have plants.
Total number of sites with vegetation	28	Total number of sites where at least one plant was found
Total number of sites shallower than maximum depth of plants	155	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.
Frequency of occurrence at sites shallower than maximum depth of plants	18.06	Number of times a species was seen divided by the total number of sites shallower than maximum depth of plants.
Simpson Diversity Index	0.80	A nonparametric estimator of community heterogeneity. It is based on Relative Frequency and thus is not sensitive to whether all sampled sites (including non-vegetated sites) are included. The closer the Simpson Diversity Index is to 1, the more diverse the community.
Maximum depth of plants (ft.)	10.00	The depth of the deepest site sampled at which vegetation was present.
Number of sites sampled with rake on rope	8	
Number of sites sampled with rake on pole	182	
Average number of all species per site (shallower than max depth)	0.21	
Average number of all species per site (vegetated sites only)	1.18	
Average number of native species per site (shallower than max depth)	0.21	Total number of species collected. Does not include visual sightings.
Average number of native species per site (vegetated sites only)	1.18	Total number of species collected including visual sightings.
Species Richness	9	
Species Richness (including visuals)	18	
Floristic Quality Index (FQI)	19.3	

Table 2. Plant species recorded and distribution statistics for the 2019 Presque Isle Lake aquatic plant survey.

Common name	Scientific name	Frequency of occurrence at sites less than or equal to maximum depth of plants	Frequency of occurrence within vegetated areas (%)	Relative Frequency (%)	Number of sites where species found	Number of sites where species found (including visuals)	Average Rake Fullness
Large-leaf pondweed	*Potamogeton apmplifolius*	7.10	39.29	33.33	11	25	1
Muckgrasses	*Chara sp.*	4.52	25.00	21.21	7	9	1
Softstem bulrush	*Schoenoplectus tabernaemontani*	2.58	14.29	12.12	4	15	1
Wild celery	*Vallisneria americana*	2.58	14.29	12.12	4	7	1
Northern water-milfoil	*Myriophyllum sibiricum*	1.29	7.14	6.06	2	5	1
Nitella	*Nitella sp.*	1.29	7.14	6.06	2	2	1
Slender naiad	*Najas flexilis*	0.65	3.57	3.03	1	2	1
Illinois pondweed	*Potamogeton illinoensis*	0.65	3.57	3.03	1	2	1
Creeping spearwort	*Ranunculus flammula*	0.65	3.57	3.03	1	1	1
Creeping spikerush	*Eleocharis palustris*				Visual	3	
White water lily	*Nymphaea odorata*				Visual	3	
Variable pondweed	*Potamogeton gramineus*				Visual	2	
Water horsetail	*Equisetum fluviatile*				Visual	1	
Brown-fruited rush	*Juncus pelocarpus f. submerses*				Visual	1	
Spatterdock	*Nuphar variegata*				Visual	1	
Pickerelweed	*Pontederia cordata*				Visual	1	
Floating-leaf pondweed	*Potamogeton natans*				Visual	1	
Bur-reed	*Sparganium sp.*				Visual	1	
Water marigold	*Bidens beckii*				Boat survey		
Watershield	*Brasenia schreberi*				Boat survey		
Wild calla	*Calla palustris*				Boat survey		
Cyperus-like sedge	*Carex pseudocyperus*				Boat survey		
Sedge	*Carex sp.*				Boat survey		
Coontail	*Ceratophyllum demersum*				Boat survey		

Frequency of occurrence within vegetated areas (%): Number of times a species was seen in a vegetated area divided by the total number of vegetated sites.

Table 2. Continued.

Common name	Scientific name	Frequency of occurrence at sites less than or equal to maximum depth of plants	Frequency of occurrence within vegetated areas (%)	Relative Frequency (%)	Number of sites where species found	Number of sites where species found (including visuals)	Average Rake Fullness
Bulbet-bearing water hemlock	*Cicuta bulbifera*				Boat survey		
Swamp loosestrife	*Decadon verticillatus*				Boat survey		
Common waterweed	*Elodea canadensis*				Boat survey		
Water star-grass	*Heteranthera dubia*				Boat survey		
	Iris sp.				Boat survey		
Common rush	*Juncus efffusus*				Boat survey		
Aquatic forget-me-not	*Myosotis scorpioides*				Boat survey		
Reed canary grass	*Phalaris arundinacea*				Boat survey		
Crested arrowhead	*Sagittaria cristata*				Boat survey		
Common arrowhead	*Sagittaria latifolia*				Boat survey		
Woolgrass	*Scirpus cyperinus*				Boat survey		
Short-stemmed bur-reed	*Sparganium emersum*				Boat survey		
Sago pondweed	*Stuckenia pectinata*				Boat survey		
Narrow-leaved cattail	*Typha angustifolia*				Boat survey		
Broad-leaved cattail	*Typha latifolia*				Boat survey		

Frequency of occurrence within vegetated areas (%): Number of times a species was seen in a vegetated area divided by the total number of vegetated sites.

Dr. Freckmann (U.W. Stevens Point: Herbarium) confirmed the voucher specimens January, 2020.

Aquatic forget-me-not (Myosotis scorpiodes), reed canary grass (*Phalaris arundinacea*), and the narrow-leaved cattail (*Typha angustifolia*)

are *Restricted* in Wisconsin (control is encouraged but not required).

Table 3. Comparison of summary statistics for 2007, 2013, and 2019 point-intercept aquatic plant surveys in Presque Isle Lake.

Summary Statistic	2007[1]	2013	2019
Total number of sites on grid	1266	1266	1266
Total number of sites visited		336	244
Total number of sites with vegetation		36	28
Total number of sites shallower than maximum depth of plants		146	155
Frequency of occurrence at sites shallower than maximum depth of plants	36.0	24.66	18.06
Simpson Diversity Index	0.68	0.87	0.80
Maximum depth of plants (ft.)	10.0	10.00	10.00
Number of sites sampled with rake on rope		37	8
Number of sites sampled with rake on pole		191	182
Average number of all species per site (shallower than max depth)	0.51	0.38	0.21
Average number of all species per site (vegetated sites only)	1.41	1.56	1.18
Average number of native species per site (shallower than max depth)	0.51	0.38	0.21
Average number of native species per site (vegetated sites only)	1.41	1.56	1.18
Species Richness	13	14	9
Species Richness (including visuals)		17	18
Floristic Quality Index (FQI)	22.5	22.7	19.3

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[1] The 2007 aquatic plant statistics included filamentous algae, which, according to WDNR protocol, should not be included. Because of this, statistics will vary.

Figure 1. Number of plant species recorded at Presque Isle Lake sample sites (2019).

Figure 2. Rake fullness ratings for Presque Isle Lake sample sites (2019).

Figure 3. Maximum Depth of Plant Colonization, Presque Isle Lake, 2019
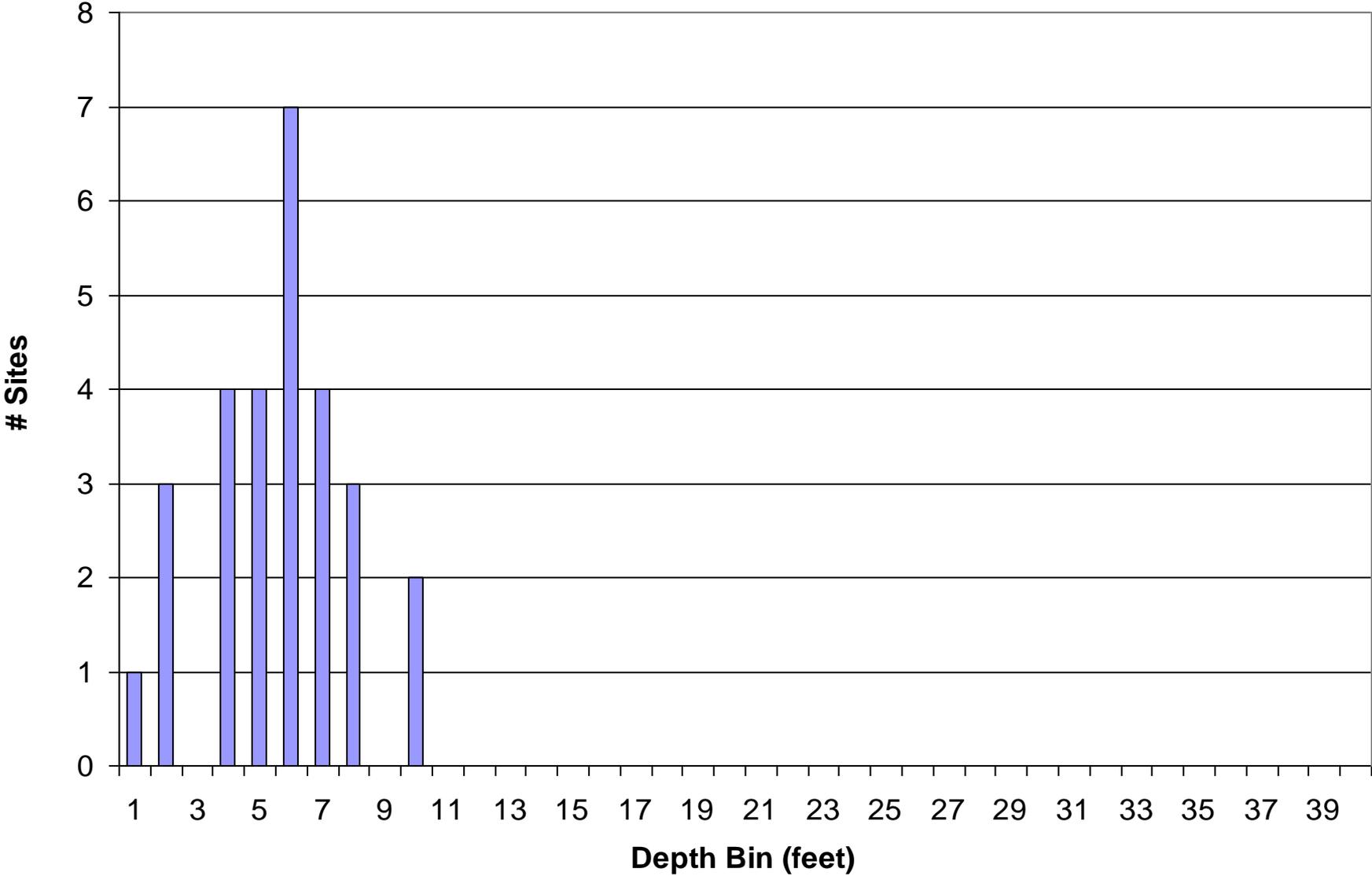
Figure 4. Presque Isle Lake sampling sites less than or equal to maximum depth of rooted vegetation (2019).

Legend:
- Site less than or equal to maximum depth of plant colonization (MDC).
- Plant find(s) at site less than or equal to MDC.

150 m

Figure 5. Presque Isle Lake substrate encountered at point-intercept plant sampling sites (2019).

Figure 6. Presque Isle Lake, Plant Finds in 2013 and 2019.
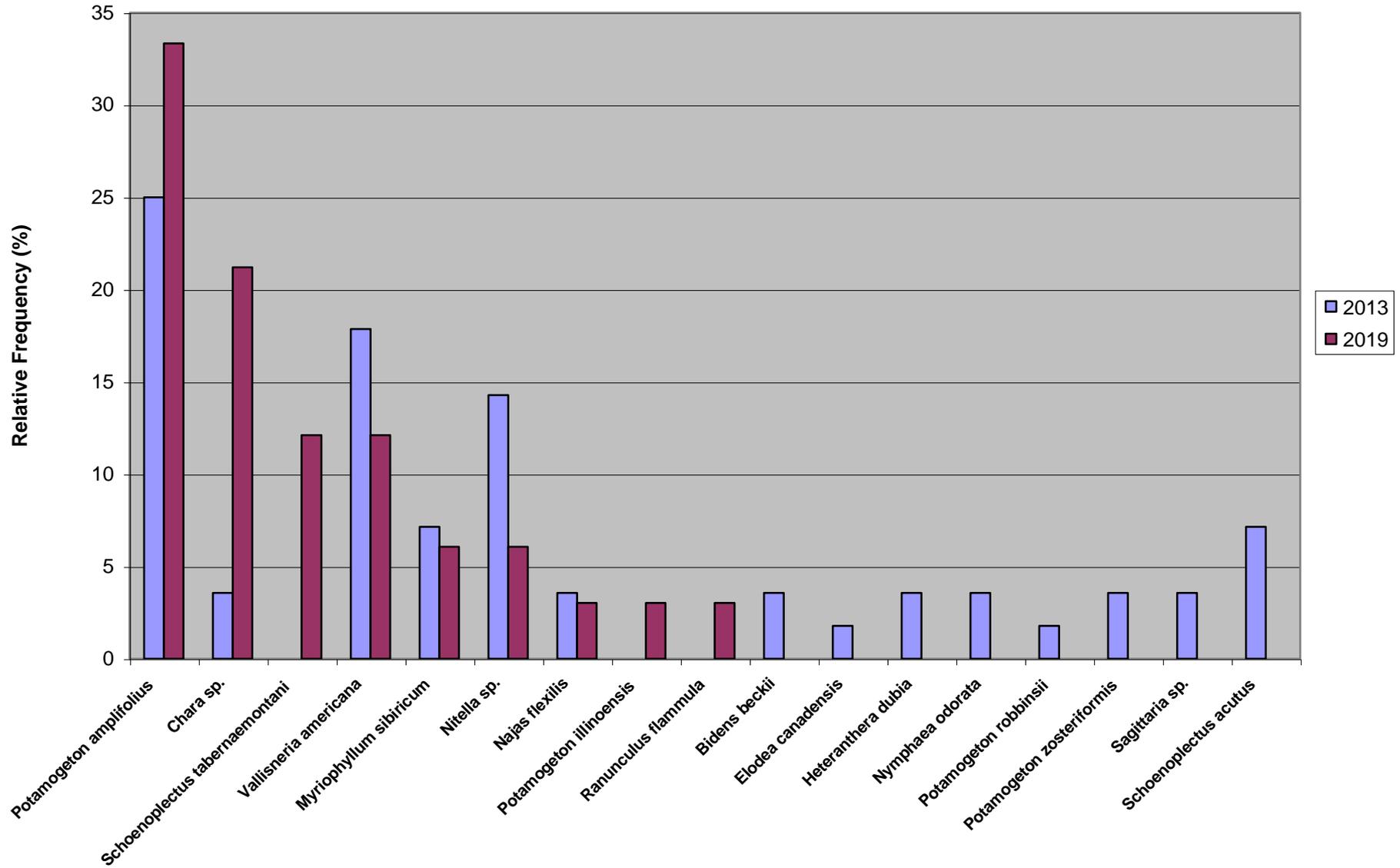
Figure 7. Presque Isle Lake point-intercept plant sampling sites with emergent and floating aquatic plants (2019). Floating plants were not present.
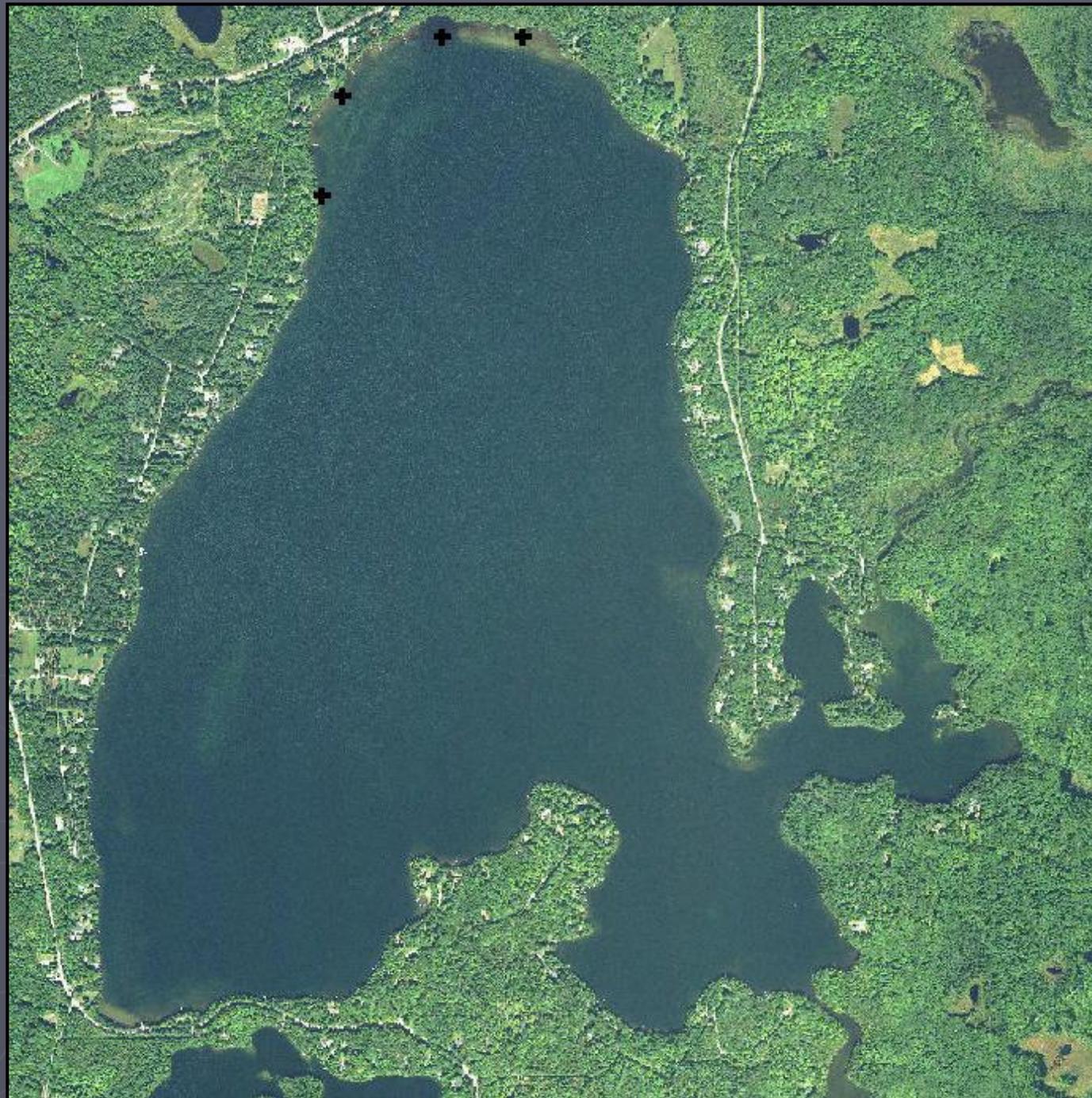
Figure 8. Distribution of plant species, Presque Isle Lake (2019).

Potamogeton amplifolius,
Large-leaf pondweed

- ● 1 (Rake fullness)
- ● 2
- ● 3
- ▼ Visual
- ✕ Not found
- ✕ Unsampled (depth)
- ✕ Non-navigable

N

150 m

Figure 9. Distribution of plant species, Presque Isle Lake (2019).

Legend:
Chara sp., Muskgrasses
- 1 (Rake fullness) — yellow circle
- 2 — orange circle
- 3 — red circle
- Visual — red triangle
- Not found — red X
- Unsampled (depth) — black X
- Non-navigable — white X

N

150 m

Figure 10. Distribution of plant species, Presque Isle Lake (2019).

Schoenoplectus tabernaemontani, Softstem bulrush

- ● 1 (Rake fullness)
- ● 2
- ● 3
- ▼ Visual
- ✕ Not found
- ✕ Unsampled (depth)
- ✕ Non-navigable

N

150 m

Figure 11. Distribution of plant species, Presque Isle Lake (2019).

Vallisneria americana, Wild celery

1 (Rake fullness)
2
3
Visual
Not found
Unsampled (depth)
Non-navigable

150 m

Figure 12. Distribution of plant species, Presque Isle Lake (2019).

Myriophyllum sibiricum, Northern water-milfoil

- 1 (Rake fullness)
- 2
- 3
- Visual
- Not found
- Unsampled (depth)
- Non-navigable

150 m

Figure 13. Distribution of plant species, Presque Isle Lake (2019).

Nitella sp., Nitella

- 🟡 1 (Rake fullness)
- 🟠 2
- 🔴 3
- 🔻 Visual
- ❌ Not found
- ✖ Unsampled (depth)
- ✖ Non-navigable

150 m

Appendix C

Presque Isle Lake Water Quality Report

Appendix C

Review of Lake Water Quality

Table of Contents

Review of Presque Isle Lake Water Quality

Prepared by Angie Stine, B.S., White Water Associates, Inc.

Introduction

Presque Isle Lake is located in Vilas County, Wisconsin. It is a 1,165 acre drainage lake with a maximum depth of 103 feet. The Waterbody Identification Code (WBIC) is 2956500. The purpose of this study was to review and report existing baseline water quality data found in the Wisconsin DNR SWIMS database. Future water quality monitoring data can be compared to this baseline dataset in order to detect and understand long-term changes in water quality. Water quality data was retrieved from the Wisconsin DNR SWIMS database (WDNR, 2021b) from 1979 to 2020. Secchi disk measurements were collected by Citizen Lake Monitoring Network (CLMN) volunteers from 1989 to 2020. Chlorophyll *a* and total phosphorus were also collected in various years by CLMN volunteers.

Comparison of Presque Isle Lake with other datasets

Lillie and Mason's *Limnological Characteristics of Wisconsin Lakes* (1983) is a great source to compare lakes within our region to a subset of lakes that have been sampled in Wisconsin. Wisconsin is divided into five regions of sampling lakes. Presque Isle Lake is in the Northeast Region (Figure 1) and was among 243 lakes randomly selected and analyzed for water quality.

Figure 1. Wisconsin regions in terms of water quality.
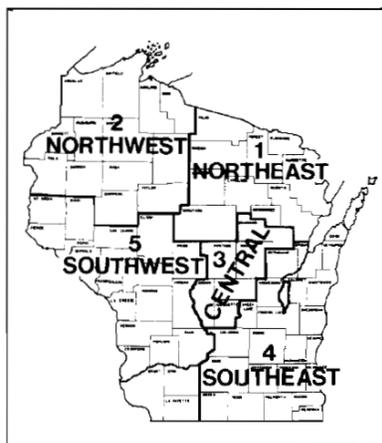
Temperature

Measuring the temperature of a lake at different depths will determine the influence it has on the physical, biological, and chemical aspects of the lake. Lake water temperature influences the rate of decomposition, nutrient recycling, lake stratification, and dissolved oxygen (D.O.) concentration. Temperature can also

affect the distribution of fish species throughout a lake. Figures 2-6 indicate the changes in water temperature from April-October in years sampled. In April and May, the surface temperatures have varied from year to year, showing little stratification (Figure 2). The June temperature levels show stratification (Figure 3). In July and August (Figure 4 and 5), stratification was between 20 and 40 feet. In September, water temperatures were continuing to stratify, however, in October, water temperatures remained the same at all depths (Figure 6). For more information about the influence of lake stratification on a lake's water quality and biota, please refer to *Understanding Lake Data* (Shaw et al., 2004).

Figure 2. Presque Isle Lake temperature profile, April and May.

Figure 3. Presque Isle Lake temperature profile, June.

Figure 4. Presque Isle Lake temperature profile, July.

Legend: 1996, 1997, 2004, 2005, 2006, 2007, 2008, 2011, 2012, 2013, 2014, 2015, 2017, 2018, 2019, 2020, 2014, 2015, 2017, 2018, 2018, 2019

Figure 5. Presque Isle temperature profile, August.

Legend: 1996, 1997, 2003, 2004, 2005, 2006, 2009, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020

Figure 6. Presque Isle Lake temperature profile, September and October.

° F

Depth (feet) vs ° F, legend: 9/1996, 9/1997, 10/1997, 10/2005, 10/2006, 9/2008, 9/2014
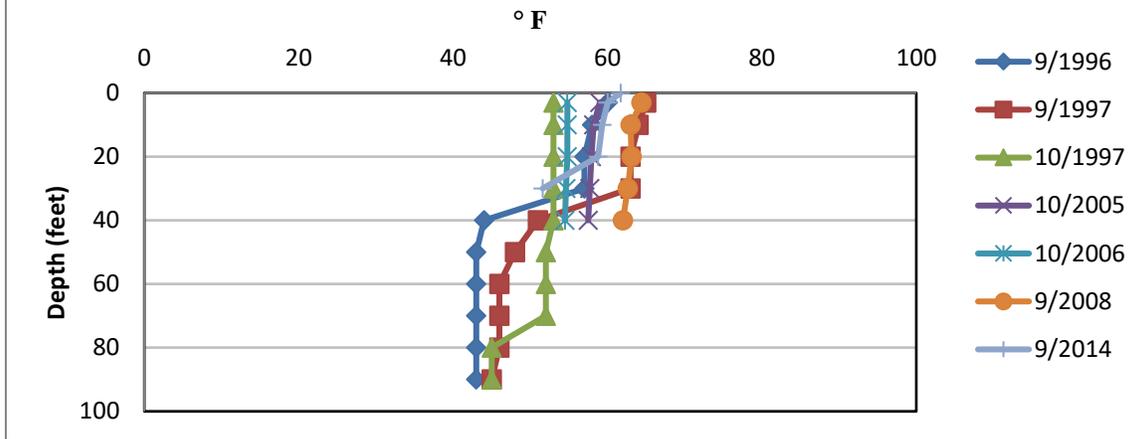
Dissolved Oxygen

The dissolved oxygen (D.O.) content of lake water is vital in determining presence of fish species and other aquatic organisms. Dissolved oxygen also has a strong influence on the chemical and physical conditions of a lake. The amount of dissolved oxygen is dependent on the water temperature, atmospheric pressure, and biological activity. Oxygen levels are increased by aquatic plant photosynthesis, but reduced by respiration of plants, decomposer organisms, fish, and invertebrates. The amount of dissolved oxygen available in a lake, particularly in the deeper parts of a lake, is critical to overall health. Figure 7 displays the D.O. data taken on Presque Isle Lake in various years since 1979. In the months that D.O. data was collected, the concentrations varied at different depths throughout the lake.

Figure 7. Presque Isle Lake dissolved oxygen profiles.

D.O. (mg/L)

Depth (feet) vs D.O. (mg/L), legend: 8/21/1979, 10/22/1995, 7/16/1996, 8/21/1996, 9/24/1996, 6/25/1997, 7/20/1997, 8/24/1997
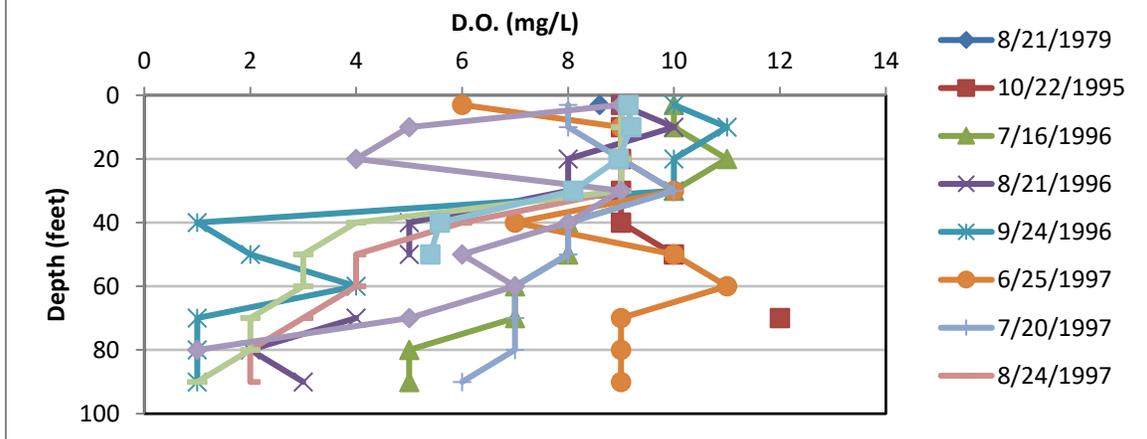
Water Clarity

Water clarity has two main components: turbidity (suspended materials such as algae and silt) and true color (materials dissolved in the water) (Shaw et al., 2004). Water clarity gives an indication of the overall water quality in a lake. Water clarity is typically measured using a Secchi disk (black and white disk) that is lowered into the water column on a tether. In simple terms, the depth at which the disk is no longer visible is recorded as the Secchi depth.

Figure 8 shows the July and August mean Secchi depths from 1989 to 2020, in the Deep Hole (center of Presque Isle Lake). The shallowest mean Secchi depth was 16.6 feet in 1995, and the deepest average depth was 28 feet in 2003. According to Table 1, the 2020 Deep Hole average Secchi depth classifies Presque Isle Lake as "very good," with respect to water clarity. Figure 9 shows the July and August mean min and max Secchi depths from 1989 to 2020 for the Deep Hole of Presque Isle Lake.

Figure 8. Presque Isle Lake (Deep Hole) Secchi depth averages (July and August only).

(WDNR, 2021a)

Table 1. Water clarity index (Shaw et al., 2004).

Water clarity	Secchi depth (ft.)
Very poor	3
Poor	5
Fair	7
Good	10
Very good	20
Excellent	32

Figure 9. Presque Isle Lake's July and August Secchi Data (Deep Hole): Mean, Min, Max, and Secchi Count (1989-2021).

Year	Secchi Mean	Secchi Min	Secchi Max	Secchi Count
1989	27.25	27	27.5	2
1990	26.83	21.75	32	3
1991	24.13	23	25.25	2
1992	23.25	23.25	23.25	1
1993	22	15	39	6
1994	20.13	14	26.5	4
1995	16.56	12.75	19.5	4
1996	19.25	17.5	21	2
1997	20.17	16.5	24.5	3
1998	27.25	27.25	27.25	1
2000	18	18	18	1
2001	20	17	23	2
2002	23.63	18.5	28.75	2
2003	28	23.5	32.5	2
2004	23	19.5	26.5	2
2005	21.83	19.5	24.5	3
2006	21.25	20.5	22	2
2007	21	21	21	2
2008	20.25	18	22.5	2
2009	18.75	17.5	20	2
2010	27	27	27	1
2011	25	25	25	1
2012	23.5	22.5	24	3
2013	18.5	18.5	18.5	2
2014	22.5	22	23	2
2015	24	23.5	24.5	2
2017	23.5	22	24.5	3
2018	27	25	29	2
2019	22.38	20.5	23	4
2020	24.17	23	25.5	3

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(WDNR, 2021a)

Figure 10 shows the average, min and max Secchi depths for Site 2 (center of southeast bay). Here, the shallowest mean Secchi depth was 14 feet in 2007, 2019 and 2020, and the deepest mean depth was 21.1 feet in 2003 (Figure 11). According to Table 1, the 2020 Site 2 Secchi depth was considered "good," with respect to water clarity.

Figure 10. Presque Isle Lake (Site 2) Secchi depth averages (July and August only).

Presque Isle Lake
Vilas County
Waterbody Number: 2956500

Lake Type: DRAINAGE
DNR Region: NO
GEO Region:NE

Avg July-Aug Secchi Depth (ft)

	5
	10
	15
	20
	25
	30
	35
	40

18 · 21 · 16 · 18 · 15 · 14 · 16 · 15 · 20 · 18 · 18 · 18 · 16 · 18 · 17 · 19 · 17 · 17 · 14 · 14

2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020
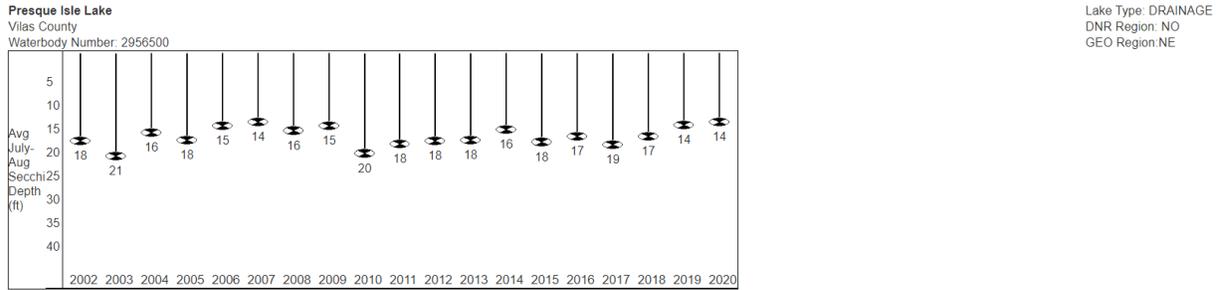
Past secchi averages in feet (July and August only).

(WDNR, 2021a)

Figure 11. Presque Isle Lake's July and August Secchi Data (Site 2): Mean, Min, Max, and Secchi Count (2002-2021).

Year	Secchi Mean	Secchi Min	Secchi Max	Secchi Count
2002	18	17.5	18.5	2
2003	21.1	17	24	5
2004	16.13	14.25	18	2
2005	17.88	15.25	20.5	2
2006	14.88	14	15.75	2
2007	14	14	14	1
2008	15.88	14.25	17.5	2
2009	14.75	14	15.5	2
2010	20.5	17	24	2
2011	18.5	15	22	2
2012	18	18	18	2
2013	17.75	15	20.5	2
2014	15.5	15	16	2
2015	18.13	16.25	20	2
2016	17	16	18	2
2017	18.75	18	19.5	2
2018	17	17	17	2
2019	14.5	14	15	2
2020	14	14	14	1

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(WDNR, 2021a)

Turbidity

Turbidity is another measure of water clarity, but is caused by suspended particulate matter rather than dissolved organic compounds (Shaw et al., 2004). Particles suspended in the water dissipate light and reduce the depth at which the light can penetrate. This affects the depth at which plants can grow. Turbidity also affects the aesthetic quality of water. Water that runs off the watershed into a lake can

increase turbidity by introducing suspended materials. Turbidity caused by algae is the most common reason for low Secchi readings (Shaw et al., 2004). In terms of biological health of a lake ecosystem, measurements less than 10 Nephelometric Turbidity Units (NTU) represent healthy conditions for fish and other organisms. Presque Isle Lake turbidity was measured in August, 1979 and had a value of 1.5 NTU at 3 feet deep. Long term monitoring should be conducted to determine any trends in turbidity.

While checking Secchi depth, the CLMN volunteers also rated the water clarity and describe the water as "clear" or "murky." From 1989 to 2020, 95% of volunteers rated the water in Presque Isle Lake as "clear" (Figure 12).

Figure 12. Presque Isle Lake water appearance, 1989-2020.
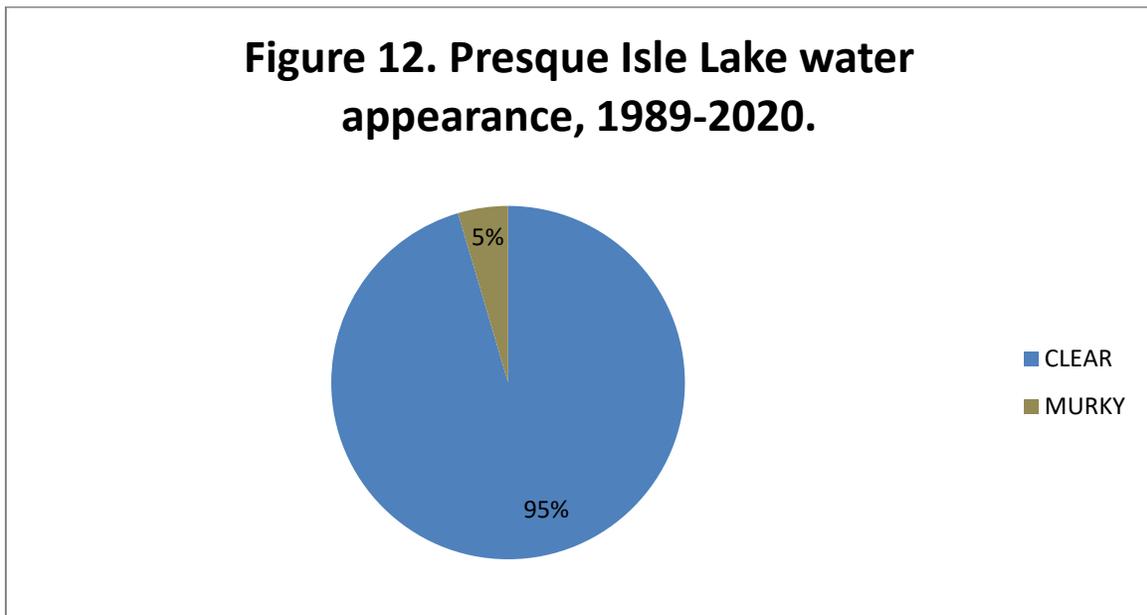
Water Color

Color of lake water is related to the type and amount of dissolved organic chemicals. Its main significance is aesthetics, although it may also influence light penetration and in turn affect aquatic plant and algal growth. Many lakes have naturally occurring color compounds from decomposition of plant material in the watershed (Shaw et al., 2004). Units of color are determined from the platinum-cobalt scale and are therefore recorded as Pt-Co units. Shaw states that a water color between 0 and 40 Pt-Co units is low. Presque Isle Lake color was at a non detection limit for the sample taken 8/7/2019.

The CLMN have recorded their perceptions of water color in Presque Isle Lake. From 1989-2020, 79% of volunteers said the water appeared "blue," while 20% said the water appeared "green" (Figure 13).

Figure 13. Presque Isle Lake CLMN color percentage, 1989-2020.
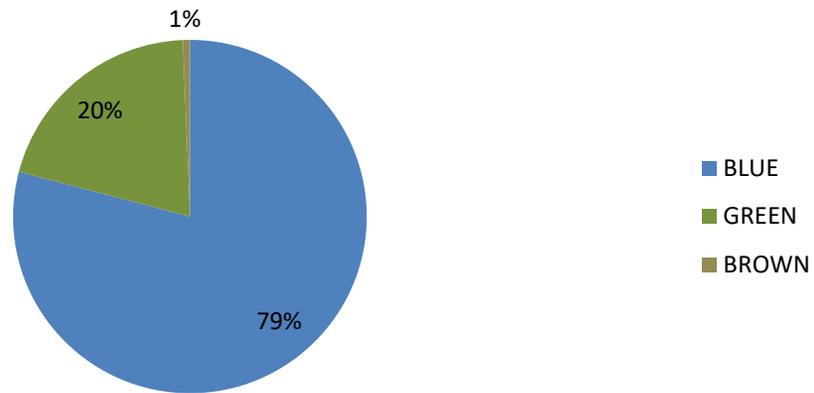
Water Level

CLMN volunteers also recorded their opinions of the lake's level as "high," "normal," or "low." Figure 14 indicates that in 1997, 2000, 2009 and 2012, 100% of CLMN volunteers viewed Presque Isle Lake as "low." In 1995, 2001, 2010, 2011, 2015, 2016, 2017, and 2019 100% of volunteers indicated the lake levels to be "normal." Volunteers viewed the water level to be "high" in in 2020 100% of the time.

Figure 14. Presque Isle Lake water level, 1995-2020.
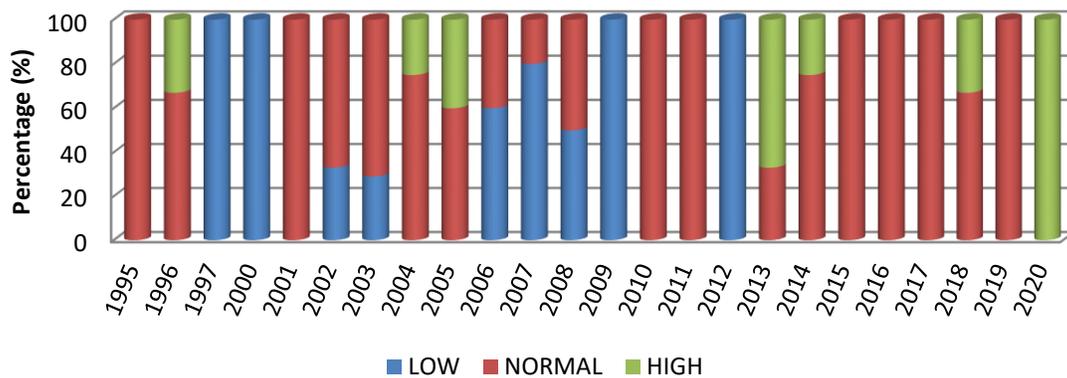
User Perceptions

The CLMN also recorded their perceptions of the water, based on the physical appearance and the recreational suitability. These perceptions can be compared to water quality parameters to see how the lake user would experience the lake at that time. When interpreting the transparency data, we see that when the Secchi depth decreases, the rating of the lake's physical appearance also decreases. These perceptions of recreational suitability are displayed by year in Figure 15. In 1989, 100% of CLMN volunteers recorded Presque Isle Lake to have "very minor aesthetic problems." In 1990-1992, 1995, 1996, 1998, 2000-2002, 2004-2006, 2010 and 2013-2019, 100% of the volunteers recorded the lake to be "beautiful, could not be nicer." Only in 2007, did more than half of the volunteers view Presque Isle Lake as "enjoyment somewhat impaired (algae)."

Figure 15. Presque Isle Lake aesthetic value, 1989-2020.
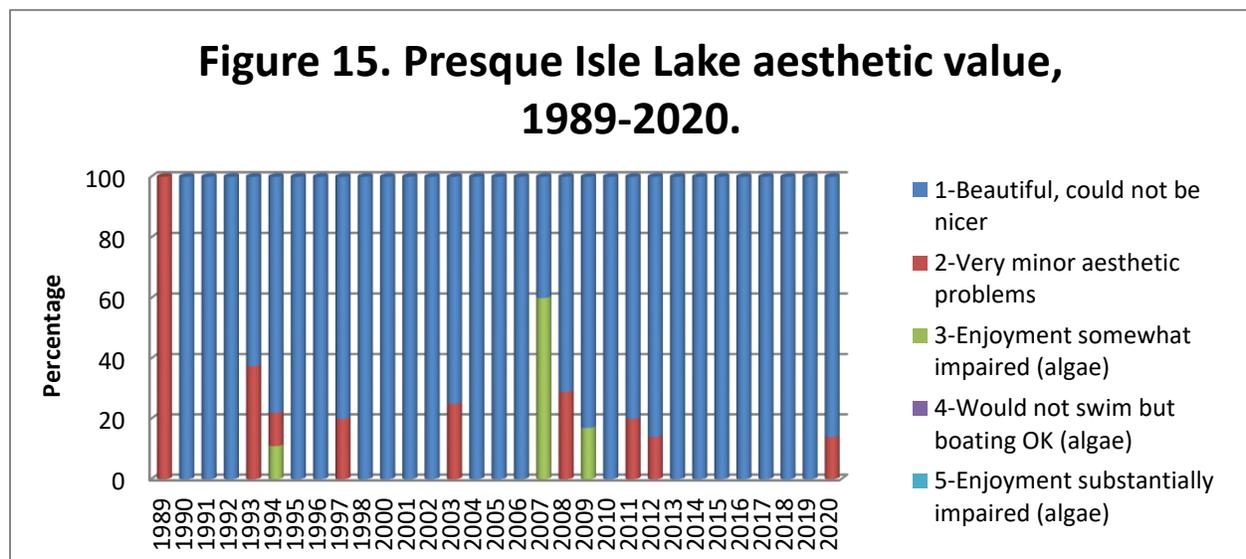
Chlorophyll *a*

Chlorophyll *a* is the photosynthetic pigment that makes plants and algae green. Chlorophyll *a* in lake water is therefore an indicator of the amount of algae. Chlorophyll *a* concentration greater than 10 µg/L are perceived as a mild algae bloom, while concentrations greater than 20 µg/L are perceived as a nuisance. Chlorophyll *a* was analyzed during the growing season (April-May) and summer season (June, July, August) on Presque Isle Lake (Figure 16). Average chlorophyll *a* levels were well below the nuisance threshold and well below the average levels for Wisconsin natural lakes and Northeast Lakes.

Figure 16. Presque Isle Lake chlorophyll *a* .

μg/L (y-axis, 0 to 16)

Categories (x-axis): 1979, 1995, 1996, 1997, 1998, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, All Years, WI Natural Lakes, Northern Lakes

Legend: ■ Growing Season ■ Summer
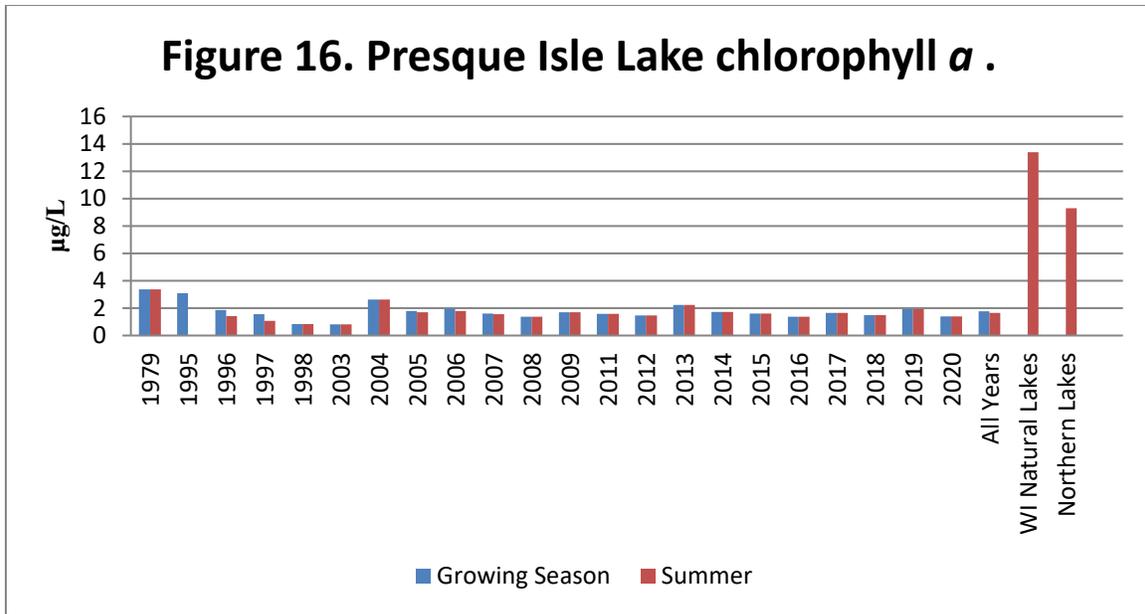
Phosphorus

In more than 80% of Wisconsin's lakes, phosphorus is the key nutrient affecting the amount of algae and plant growth. If phosphorus levels are high, excessive aquatic plant growth can occur.

Phosphorus originates from a variety of sources, many of which are related to human activities. Major sources include human and animal wastes, soil erosion, detergents, septic systems and runoff from farmland or lawns (Shaw et al., 2004). Phosphorus provokes complex reactions in lakes. An analysis of phosphorus often includes both soluble reactive phosphorus and total phosphorus. Soluble reactive phosphorus dissolves in the water and directly influences plant growth (Shaw et al., 2004).   Its concentration varies in most lakes over short periods of time as plants take it up and release it. Total phosphorus is considered a better indicator of a lake's nutrient status than soluble reactive phosphorus because its levels remain more stable (Shaw et al., 2004). Total phosphorus includes soluble phosphorus and the phosphorus in plant and animal fragments suspended in lake water. Ideally, soluble reactive phosphorus concentrations should be 10 µg/L or less at spring turnover to prevent summer algae blooms (Shaw et al., 2004). A concentration of total phosphorus below 20 µg/L for lakes should be maintained to prevent nuisance algal blooms (Shaw et al., 2004).

Presque Isle Lake total phosphorus was collected during the growing season and during summer (Figure 17). The average growing season total phosphorus was approximately 11.5 µg/L and the average summer total phosphorus was 10.6 µg/L. These values are much lower than the nuisance level, however, in 1997, both growing season and summer total phosphorus values were above the threshold. Average total phosphorus values were considered "very good" (Figure 18).

Figure 17. Presque Isle Lake total phosphorus mean values.
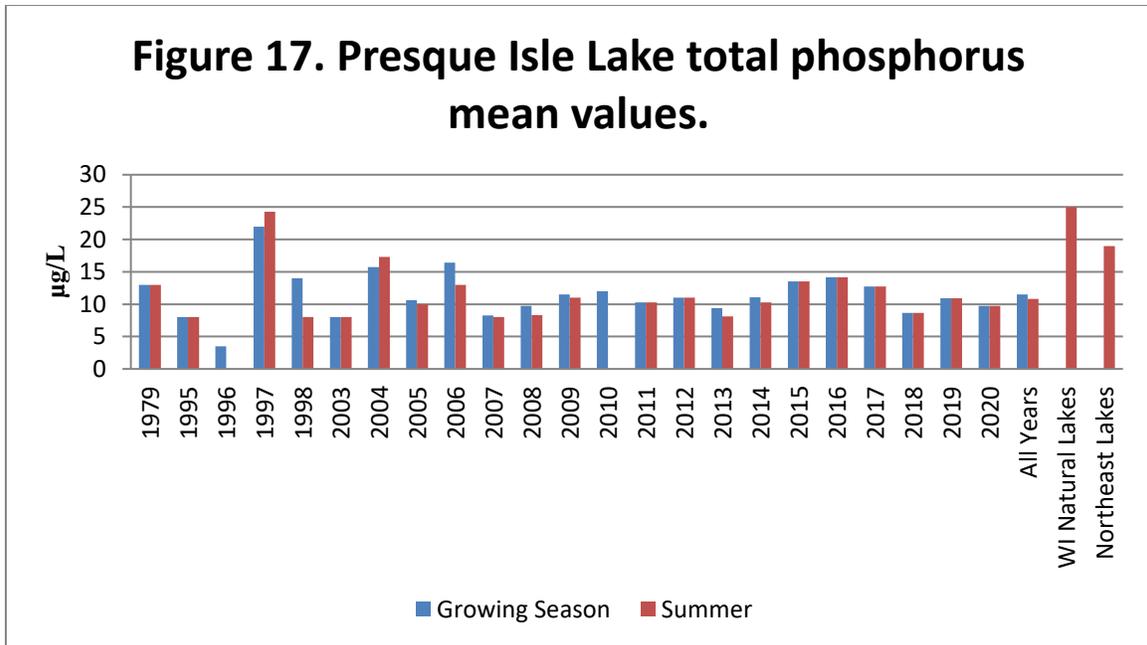
Figure 18. Total phosphorus concentrations for Wisconsin's natural lakes and impoundments (Shaw et al., 2004).
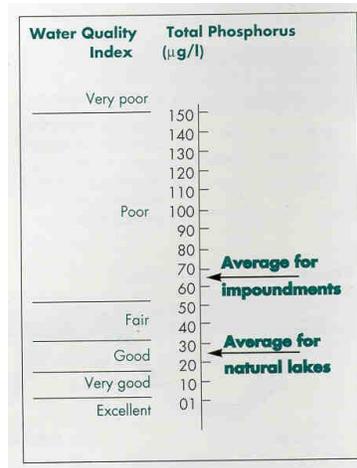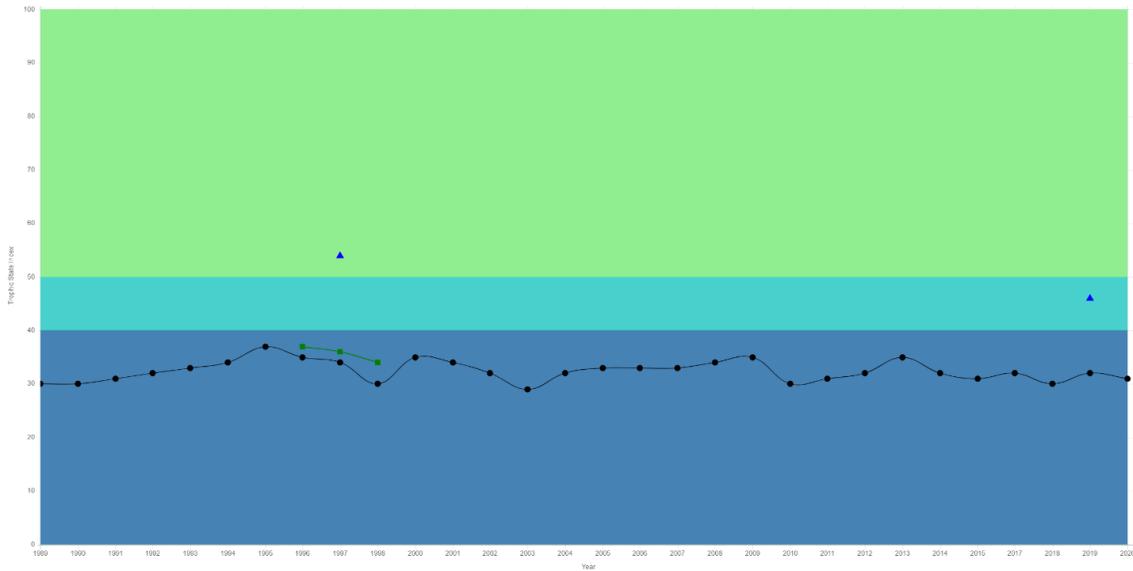

Trophic State

Trophic state is another indicator of water quality (Carlson, 1977). Lakes can be divided into three categories based on trophic state – oligotrophic, mesotrophic, and eutrophic. These categories reflect a lake's nutrient and clarity levels (Shaw et al., 2004).

Trophic State Index (TSI) was calculated by the WDNR using Secchi measurements, chlorophyll *a*, and total phosphorus data collected by the CLMN. The July and August average measurements for Presque Isle Lake, Deep Hole in 2020: Secchi TSI (31.00) and total phosphorus TSI for 2019 (46.0) (Figure 19).

This classifies Presque Isle Lake as "oligotrophic" (Table 2). The July and August average measurements for Presque Isle Lake in 2020, Site 2 (Figure 20) classify the site as "oligotrophic to borderline mesotrophic."

Figure 19. Presque Isle Lake (Deep Hole) Trophic State Index (1989-2020).

(WDNR, 2021a)

Figure 20. Presque Isle Lake (Site 2) Trophic State Index (2002-2020).

(WDNR, 2021a)
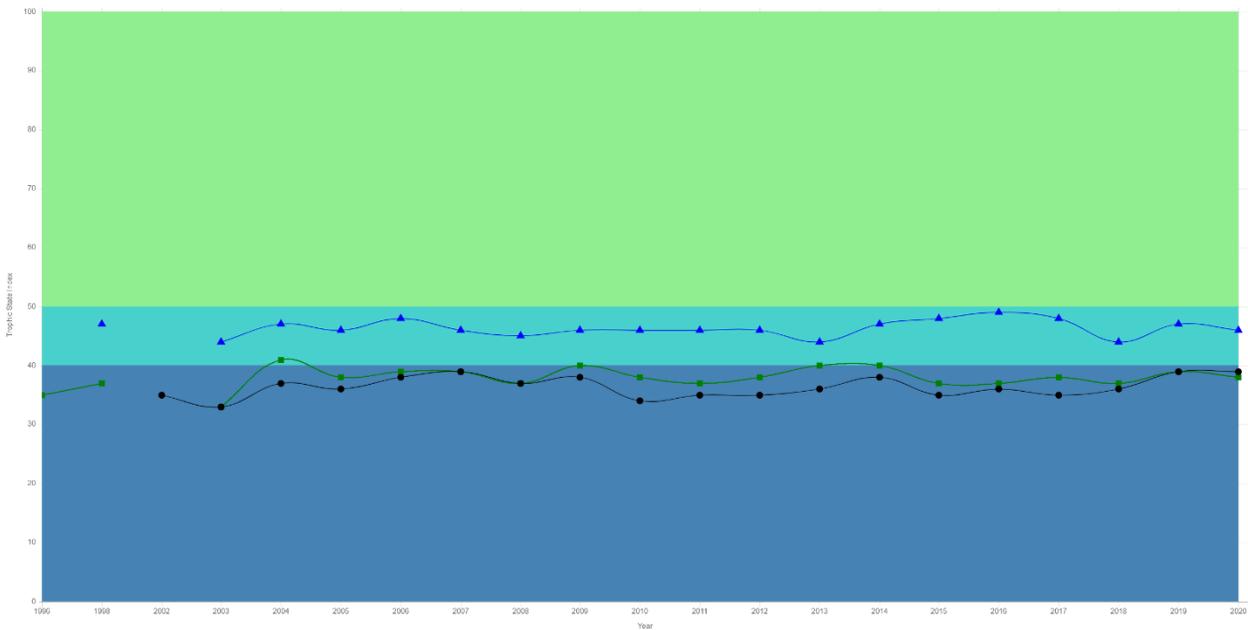
Table 2. Trophic State Index.	
30-40	**Oligotrophic:** clear, deep water; possible oxygen depletion in lower depths; few aquatic plants or algal blooms; low in nutrients; large game fish usual fishery
40-50	**Mesotrophic:** moderately clear water; mixed fishery, esp. panfish; moderate aquatic plant growth and occasional algal blooms; may have low oxygen levels near bottom in summer
50-60	**Mildly Eutrophic:** decreased water clarity; anoxic near bottom; may have heavy algal bloom and plant growth; high in nutrients; shallow eutrophic lakes may have winterkill of fish; rough fish common
60-70	**Eutrophic:** dominated by blue-green algae; algae scums common; prolific aquatic plant growth; high nutrient levels; rough fish common; susceptible to oxygen depletion and winter fishkill
70-80	**Hypereutrophic:** heavy algal blooms through most of summer; dense aquatic plant growth; poor water clarity; high nutrient levels

(WDNR, 2015)

Researchers use various methods to calculate the trophic state of lakes. Common characteristics used to make the determination are: total phosphorus (important for algae growth), chlorophyll *a* concentration (a measure of the amount of algae present), and Secchi disk readings (an indicator of water clarity) (Shaw et al., 2004) (Table 3).

Table 3. Trophic classification of Wisconsin Lakes based on chlorophyll *a*, water clarity measurements, and total phosphorus values (Shaw et al., 2004).

Trophic class	Total phosphorus µg/L	Chlorophyll *a* µg/L	Secchi Disk (ft.)
Oligotrophic	3	2	12
	10	5	8
Mesotrophic	18	8	6
	27	10	6
Eutrophic	30	11	5
	50	15	4

Nitrogen

Nitrogen is second only to phosphorus as an important nutrient for aquatic plant and algae growth (Shaw et al., 2004). Human activities on the landscape greatly influence the amount of nitrogen in a lake. Nitrogen may come from lawn fertilizer, septic systems near the lake, or from agricultural activities in the watershed. Nitrogen may enter a lake from surface runoff or groundwater sources.

Nitrogen exists in lakes in several forms. In August, 1979 Presque Isle Lake was analyzed for total nitrogen (0.36 mg/L), organic nitrogen (0.23 mg/L), ammonium (0.11 mg/L), nitrite nitrogen (0.003 mg/L), and nitrate nitrogen (0.02 mg/L). In August of 2019 Presque Isle Lake was analyzed for total Kjeldahl nitrogen (0.323 mg/L), ammonium (ND), and nitrate/nitrite (ND). Nitrogen is a major component of all organic (plant and animal) matter. Decomposing organic matter releases ammonia, which is converted to nitrate if oxygen if present (Shaw et al., 2004). All inorganic forms of nitrogen can be used by aquatic plants and algae (Shaw et al., 2004). If these inorganic forms of nitrogen exceed 0.3

mg/L (as N) in spring, there is sufficient nitrogen to support summer algae blooms (Shaw et al., 2004). Elevated concentrations of ammonium, nitrate, and nitrite, derived from human activities, can stimulate or enhance the development, maintenance and proliferation of primary producers (phytoplankton, benthic algae, marcrophytes), contributing to the widespread phenomenon of the cultural (human-made) eutrophication of aquatic ecosystems (Camargo et al., 2007). The nutrient enrichment can cause important ecological effects on aquatic communities, since the overproduction of organic matter, and its subsequent decomposition, usually lead to low dissolved oxygen concentrations in bottom waters, and sediments of eutrophic and hypereutrophic aquatic ecosystems with low turnover rates (Camargo et al., 2007). Long term monitoring should be conducted to determine any trends in nitrogen.

Chloride

The presence of chloride (Cl^-) where it does not occur naturally indicates possible water pollution (Shaw et al., 2004). Chloride does not affect plant and algae growth and is not toxic to aquatic organisms at most of the levels found in Wisconsin (Shaw et al., 2004). Presque Isle Lake chloride was 3 mg/L in August, 1979 and 2.35 mg/L August, 2019. Chloride concentrations average 2 mg/L in the Northern Region and 4 mg/L in Wisconsin natural lakes.

Sulfate

Sulfate in lake water is primarily related to the types of minerals found in the watershed, and to acid rain (Shaw et al., 2004). Sulfate concentrations are noted to be less than 10 mg/L in Vilas County (Lillie and Mason, 1983). Presque Isle Lake sulfate was 2.49 mg/L August, 2019.

Conductivity

Conductivity is a measure of the ability of water to conduct an electric current. Conductivity is reported in micromhos per centimeter (µmhos/cm) and is directly related to the total dissolved inorganic chemicals in the water. Usually, values are approximately two times the water hardness, unless the water is receiving high concentrations of human-induced contaminants (Shaw et al., 2004). Presque Isle Lake conductivity levels were sampled in August, 1979 and had a conductance of 131 µmhos/cm. August, 2019 conductivity was 134 µmhos/cm.

pH

The acidity level of a lake's water regulates the solubility of many minerals. A pH level of 7 is considered neutral. The pH level in Wisconsin lakes ranges from 4.5 in acid, bog lakes to 8.4 in hard water, marl lakes (Shaw et al., 2004). Natural rainfall in Wisconsin averages a pH of 5.6. Some minerals become available under low pH (especially aluminum, zinc, and mercury) and can inhibit fish reproduction and/or survival. Mercury and aluminum are not only toxic to many kinds of wildlife, but also to humans (especially those that eat tainted fish). The pH scale is logarithmic, so every 1.0 unit change in pH increases the acidity tenfold. Water with a pH of 6 is 10 times more acidic than water with pH of 7. A lake's pH level is important for the release of potentially harmful substances and affects plant growth, fish reproduction and survival. A lake with neutral or slightly alkaline pH is a good lake for fish

and plant survival. The pH was sampled in Presque Isle Lake in August, 1979 and was 7.3 and the pH was 8.32 in August, 2019, indicating that the lake is almost neutral to alkaline.

Table 4 indicates the effects pH levels less than 6.5 will have on fish. Since Presque Isle Lake is neutral, it is unlikely the pH would negatively affect any fish species. While moderately low pH does not usually harm fish, the metals that become soluble under low pH can be important. In low pH waters, aluminum, zinc, and mercury concentrations increase if they are present in lake sediment or watershed solids (Shaw et al., 2004).

Table 4. Effects of acidity on fish species (Olszyk, 1980).

Water pH	Effects
6.5	Walleye spawning inhibited
5.8	Lake trout spawning inhibited
5.5	Smallmouth bass disappear
5.2	Walleye & lake trout disappear
5	Spawning inhibited in most fish
4.7	Northern pike, sucker, bullhead, pumpkinseed, sunfish & rock bass disappear
4.5	Perch spawning inhibited
3.5	Perch disappear
3	Toxic to all fish

Alkalinity

Alkalinity levels in a lake are affected by the soil minerals, bedrock type in the watershed, and frequency of contact between lake water and these materials (Shaw et al., 2004). Alkalinity is important in a lake to buffer the effects of acidification from the atmosphere. Acid rain has long been a problem with lakes that have low alkalinity levels and high potential sources of acid deposition. Alkalinity was analyzed in August, 1979 and had a value of 59 mg/L and August, 2019 with a value of 62 mg/L. Based on these values, Presque Isle Lake is not sensitive to acid rain (Table 5).

Table 5. Sensitivity of Lakes to Acid Rain (Shaw et al., 2004)	
Sensitivity to acid rain	*Alkalinity value (mg/L or ppm CaCO$_3$)*
High	0-2
Moderate	2-10
Low	10-25
Non-sensitive	>25

Hardness

Hardness levels in a lake are affected by the soil minerals, bedrock type in the watershed, and frequency of contact between lake water and these materials (Shaw et al., 2004). One method of evaluating hardness is to test for calcium carbonate ($CaCO_3$). Presque Isle Lake hardness was 56.4 mg/L in August, 1979 and 64 mg/L in August, 2019. Table 6 indicates Presque Isle Lake (2019) to have "moderately hard water."

Table 6. Categorization of hardness (mg/L of calcium carbonate ($CaCO_3$)) (Shaw et al., 2004).	
Soft water	0-60
Moderately hard water	61-120
Hard water	121-180
Very hard water	>180

Calcium and Magnesium Hardness

The carbonate system provides acid buffering through two alkaline compounds: bicarbonate and carbonate. These compounds are usually found with two hardness ions: calcium and magnesium (Shaw et al., 2004). Calcium is the most abundant cation found in Wisconsin lakes. Its abundance is related to the presence of calcium-bearing minerals in the lake watershed (Shaw et al., 2004). Aquatic organisms such as native mussels use calcium in their shells. The aquatic invasive zebra mussel tends to need calcium levels greater than 20 mg/L to maintain shell growth. Presque Isle Lake had a calcium level of 16 mg/L at in August, 1979 and 19.1 mg/L August, 2019, which is an indication that zebra mussels could flourish. Magnesium was also sampled in 1979 with a value of 4 mg/L and 4.69 mg/L in August, 2019.

Sodium and Potassium

Sodium and potassium are possible indicators of human pollution in a lake, since naturally occurring levels of these ions in soils and water are very low. Sodium is often associated with chloride and gets into lakes from road salting, fertilizations, and human and animal waste (Shaw et al., 2004). Potassium is the key component of commonly-used potash fertilizer, and is abundant in animal waste. Both of these elements are held by soils to a greater extent than is chloride or nitrate; therefore, they are not as useful as indicators of pollution impacts (Shaw et al., 2004). Although not normally toxic themselves, they provide a strong indication of possible contamination by more damaging compounds (Shaw et al., 2004). Presque Isle Lake sodium was 1 mg/L August, 1979 and 2.17 mg/L August, 2019 and potassium was 1.3 mg/L August, 1979 and 0.833 mg/L August, 2019.

Dissolved Organic Carbon

Dissolved Organic Carbon (DOC) is a food supplement, supporting growth of microorganisms, and plays an important role in global carbon cycle through the microbial loop (Kirchman et al., 1991). In general, organic carbon compounds are a result of decomposition processes from dead organic matter such as plants. When water contacts highly organic soils, these components can drain into rivers and lakes as

DOC. DOC is also extremely important in the transport of metals in aquatic systems. Metals form extremely strong complexes with DOC, enhancing metal solubility while also reducing metal bioavailability. Baseflow concentrations of DOC in undisturbed watersheds generally range from 1 to 20 mg/L carbon. Presque Isle Lake DOC was 4 mg/L in August, 2013.

Silica

The earth's crust is abundant with silicates or other compounds of silicon. The water in lakes dissolves the silica and pH can be a key factor in regulating the amount of silica that is dissolved. Silica concentrations are usually within the range of 5 to 25 mg/L. Generally lakes that are fed by groundwater have higher levels of silica. Silica data was not collected for Presque Isle Lake, and future sampling should include this parameter.

Aluminum

Aluminum occurs naturally in soils and sediments. In low pH (acidic) environments aluminum solubility increases greatly. With a low pH and increased aluminum values, fish health can become impaired. This can have impacts on the entire food web. Aluminum also plays an important role in phosphorus cycling in lakes. When aluminum precipitates with phosphorus in lake sediments, the phosphorus will not dissolve back into the water column as readily. Aluminum data was not collected for Presque Isle Lake, and future sampling should include this parameter.

Iron

Iron also forms sediment particles that bind with and store phosphorus when dissolved oxygen is present. When oxygen concentration gets low (for example, in winter or in the deep water near sediments) the iron and phosphorus dissolve in water. This phosphorus is available for algal blooms. Presque Isle Lake iron levels were analyzed in August, 1979 and had a value of 0.08 mg/L.

Manganese

Manganese is a mineral that occurs naturally in rocks and soil. In lakes, manganese is usually in particulate form. When the dissolved oxygen levels decrease, manganese can convert from an insoluble form to soluble ions. A manganese concentration of 0.05 mg/L can cause color and staining problems. Manganese data was taken in Presque Isle Lake in August, 1979 and had a value of 0.03 mg/L in the Deep Hole. At Site 2, the manganese level was 0.012 mg/L.

Sediment

Lake bottom sediments are sometimes analyzed for chemical constituents that they contain. This is especially true for potentially toxic metals such as mercury, chromium, selenium, and others. Lake sediments also tend to record past events as particulates settle down and become part of the sediment. Biological clues for the historic conditions in the lake can be gleaned from sediment samples. Examples include analysis of pollen or diatoms that might help understand past climate or trophic states in the lake. Sediment data was not collected for Presque Isle Lake, and future sampling should include this parameter.

Total Suspended Solids

Total suspended solids are all particles suspended in lake water. Silt, plankton, and wastes are examples of these solids and can come from runoff of agricultural land, erosion, and can be produced by bottom-feeding fish. As the suspended solid levels increase, they absorb heat from sunlight which can increase the water temperature. They can also block the sunlight that plants need for photosynthesis. These events can in turn affect the amount of dissolved oxygen in the lake. Lakes with total suspended solids levels less than 20 mg/L are considered "clear," while levels between 40 and 80 mg/L are "cloudy." Total suspended solids data is unknown for Presque Isle Lake, so future water quality sampling should include this parameter.

Aquatic Invasive Species

Presque Isle Lake has one know aquatic invasive species (AIS): rusty crayfish (*Orconectes rusticus*). Rusty crayfish are native to parts of Ohio, Tennessee, Kentucky and Indiana, and were likely introduced to Wisconsin waters by fishermen using the crayfish as bait (Gunderson, 2015). Rusty crayfish negatively affect other native crayfish species, cause destruction to aquatic plant beds, reduce fish populations by eating eggs, and cause shoreland owners' recreational problems (Gunderson, 2015). It is illegal to possess both live crayfish and angling equipment simultaneously on any inland Wisconsin water (except Mississippi River) (WDNR, 2015). It is also illegal to release crayfish into a water body without a permit (WDNR, 2015).

There have been numerous aquatic invasive surveys conducted on Presque Isle Lake and the information can be found in the SWIMS database. White Water Associates conducted a survey in 2019 and the information can be found in *The Presque Isle Aquatic Invasive Species Report, 2019*. While conducting this survey the Aquatic forget-me-not and reed canary grass were found and verified by Dr. Freckmann, U.W. Steven's Point.

The University of Wisconsin-Madison's Aquatic Invasive Species Smart Prevention program classifies Presque Isle Lake as "Borderline Suitable" for zebra mussels, based on calcium and conductivity levels found in the lake (UW-Madison).

Clean Boats, Clean Waters (CBCW) is a program that inspects boats for aquatic invasive species and in the process educates the public on how to help stop the spread of these species. Figures 21-24 display CBCW statistics. Clean Boats, Clean Waters inspected 65 boats in 2021 and 102 people were contacted. In 2019 there were 35 boats inspected with 46 people contacted. In 2020 there were no boaters contacted. (Figure 21). There were 100 hours spent from 2019-2021 (Figure 22). Figure 23 indicates that 46 people were contacted before by CBCW but 54 responded they hadn't been contacted. Ninety-nine percent of the people contacted were willing to answer questions. Figure 24 indicates that 36 percent of the boaters said they used their boat on another waterbody in the past five days and 79 people said the understood what was being discussed.

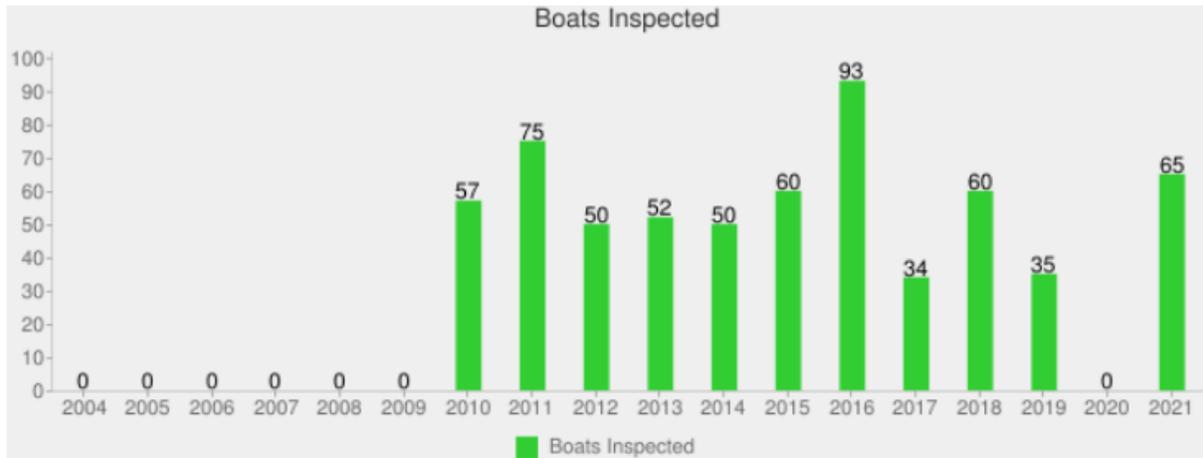**Figure 21. Presque Isle Lake (Wilderness Park off Bayview Rd), CBCW (WDNR, 2021).**
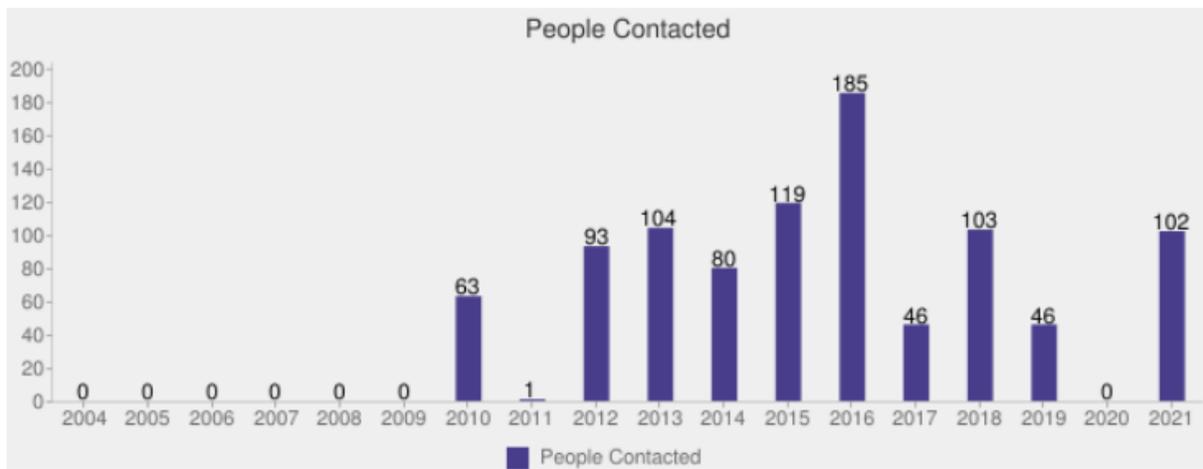
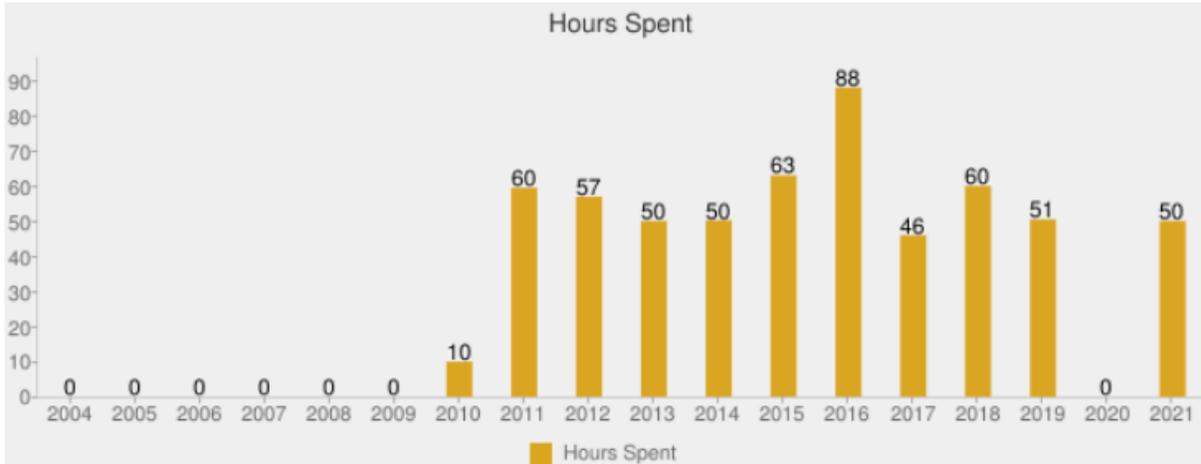**Figure 22. Presque Isle Lake (Wilderness Park off Bayview Rd), CBCW (WDNR, 2021).**

Figure 23. Presque Isle Lake (Wilderness Park off Bayview Rd), CBCW (WDNR, 2021).
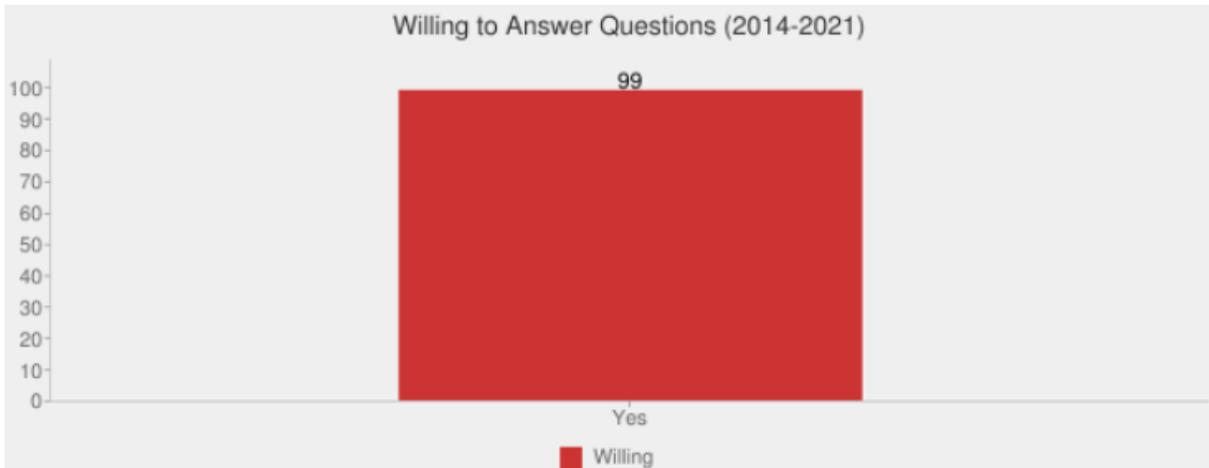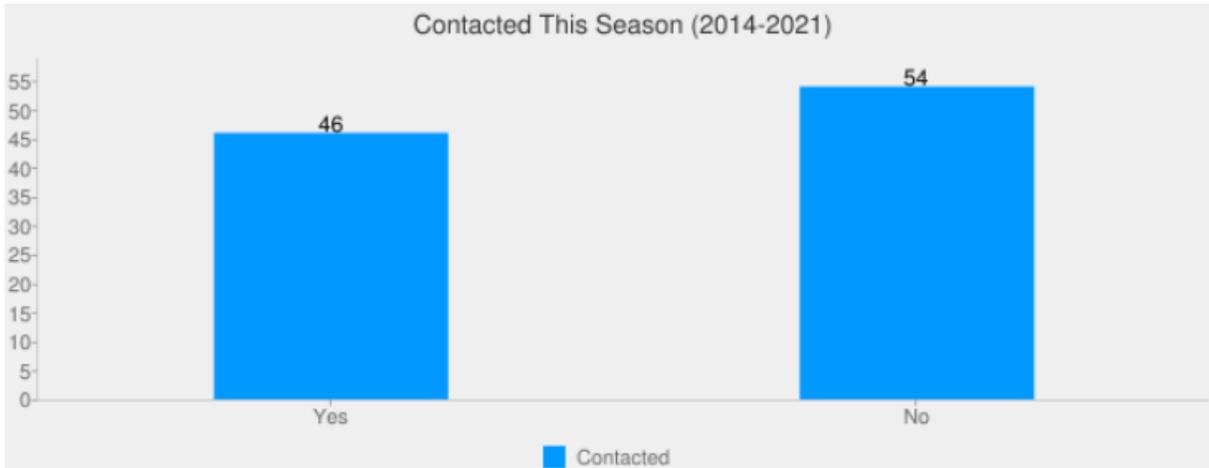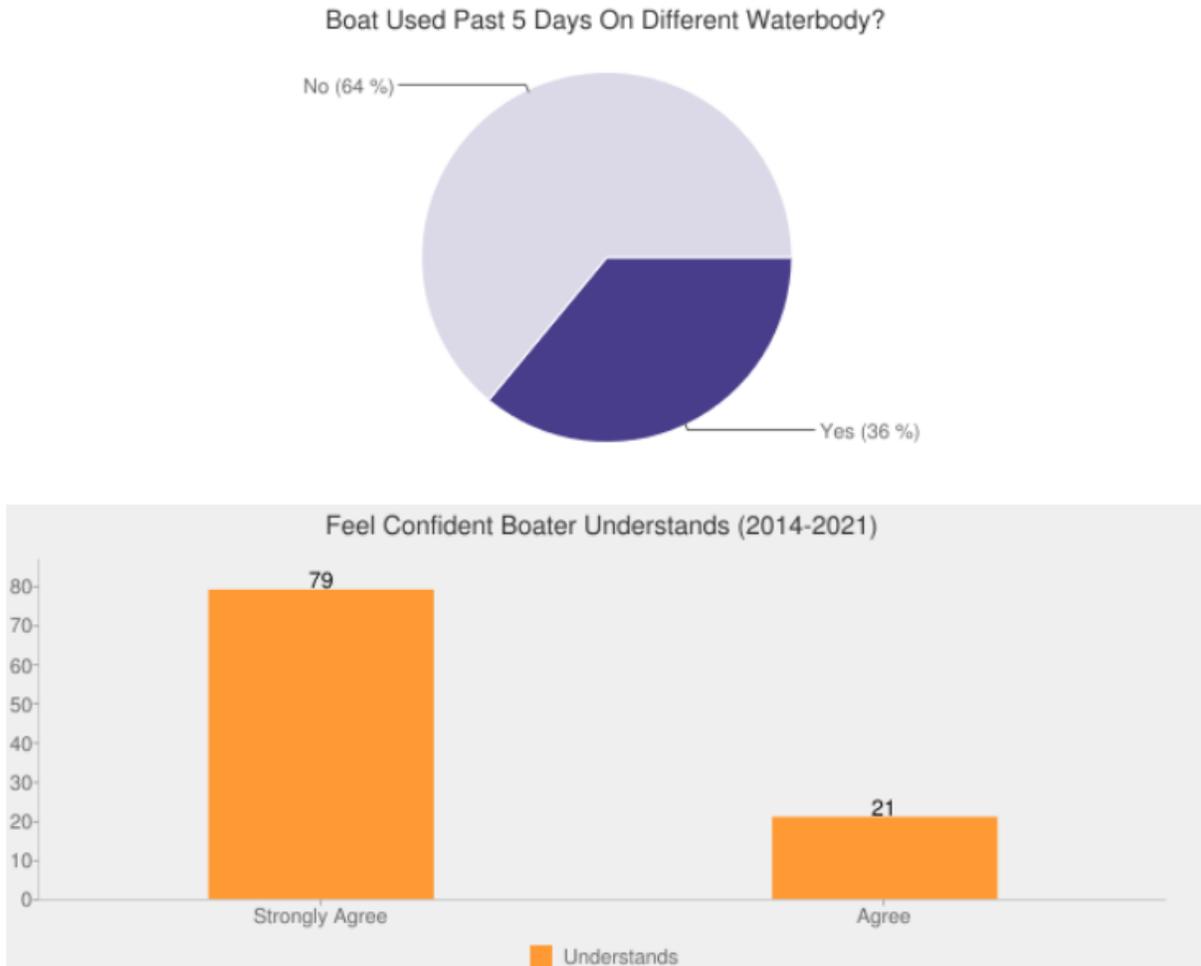
Figure 24. Presque Isle Lake (Wilderness Park off Bayview Rd), CBCW (WDNR, 2021).

Boat Used Past 5 Days On Different Waterbody?

No (64 %)

Yes (36 %)

Feel Confident Boater Understands (2014-2021)

Resources

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Appendix D

Presque Isle Lake Shoreland and Shallows

Habitat Monitoring Report

Presque Isle Lake (Vilas County, Wisconsin)

Shoreland and Shallows Habitat Monitoring Report
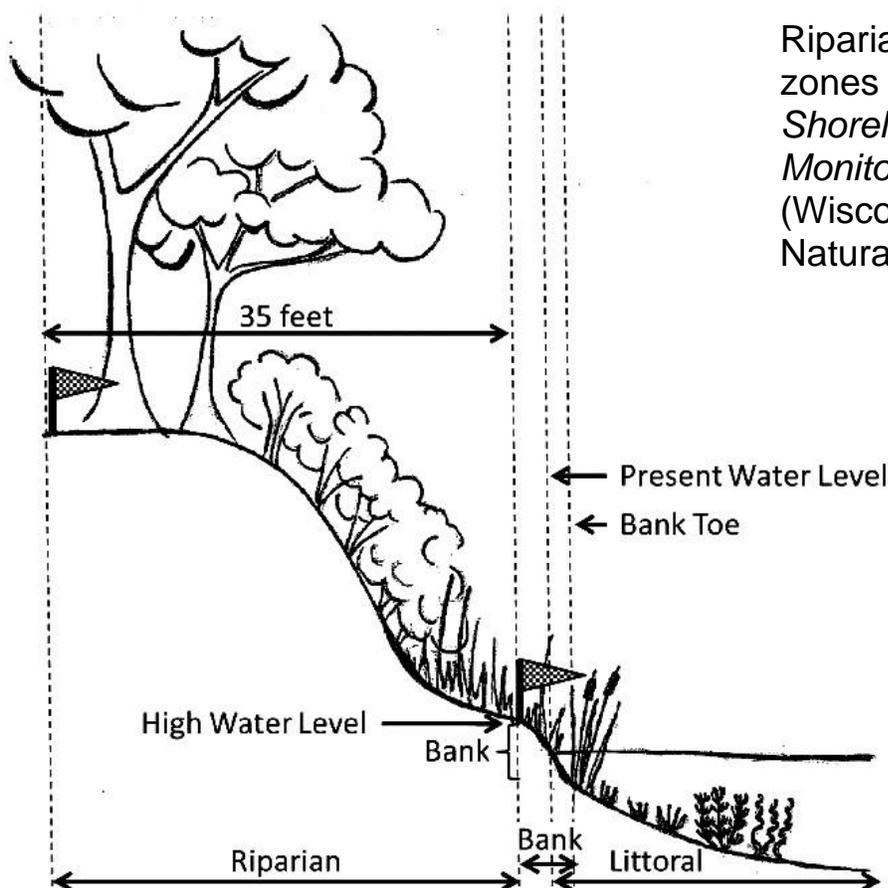
Riparian, bank, and littoral zones covered by the *Shoreland & Shallows Habitat Monitoring Field Protocol* (Wisconsin Department of Natural Resources 2016)

WHITE WATER
ASSOCIATES, INC.

Date: 2019

INTRODUCTION

White Water Associates, Inc. is retained by the Presque Isle Town Lakes Committee (PITLC) as a consultant for the *Presque Isle Wilderness Waters Program.* A recent Wisconsin Department of Natural Resources (WDNR) lake planning grant to the PITLC included an assessment of the shoreland area and shallows habitat for Presque Isle Lake (Vilas County, Wisconsin). The assessment was conducted using the *Lake Shoreland and Shallows Habitat Monitoring Field Protocol* (WDNR 2016)[1]. This protocol provides a standard methodology for surveying, assessing, and mapping habitat in lakeshore areas, including the riparian buffer, bank, and littoral zone (WDNR 2016). This information will be useful to local and regional resource managers, community stakeholders, and others interested in protecting and enhancing Wisconsin's lakes and rivers (WDNR 2016).

METHODS

There are three principal components to the shoreland and shallows habitat monitoring: (1) obtain georeferenced photos of the entire lake shoreline area, (2) assess the riparian, bank, and littoral habitat by ownership parcel, and (3) count and map all pieces of large woody material in water less than 2 feet deep. In this section, we describe each of these components.

The photographic component of the monitoring documented shoreland habitat conditions around the lake at the time of the survey. Results may be referred to in future years (WDNR 2016). Digital photos were taken with the intent to slightly overlap, thus capturing the entire shoreline. The survey crew used the boat to circumnavigate the lake at a distance of approximately 50 feet perpendicular from shore where conditions permitted. This standardized relative position on the lake allowed the photos to include the water's edge and understory vegetation 35 feet inland. A digital camera with an internal GPS was used to capture the photos. An example shoreland photograph is shown on next page. In the laboratory, photos were processed, georeferenced, and provided as part of the data package to the WDNR.

---

[1] Wisconsin Department of Natural Resources. May 27, 2016. *Draft Lake Shoreland & Shallows Habitat Monitoring Field Protocol.* WDNR 2016.

Photo of the water's edge and understory vegetation on Presque Isle Lake (White Water Associates, Inc., 2019)
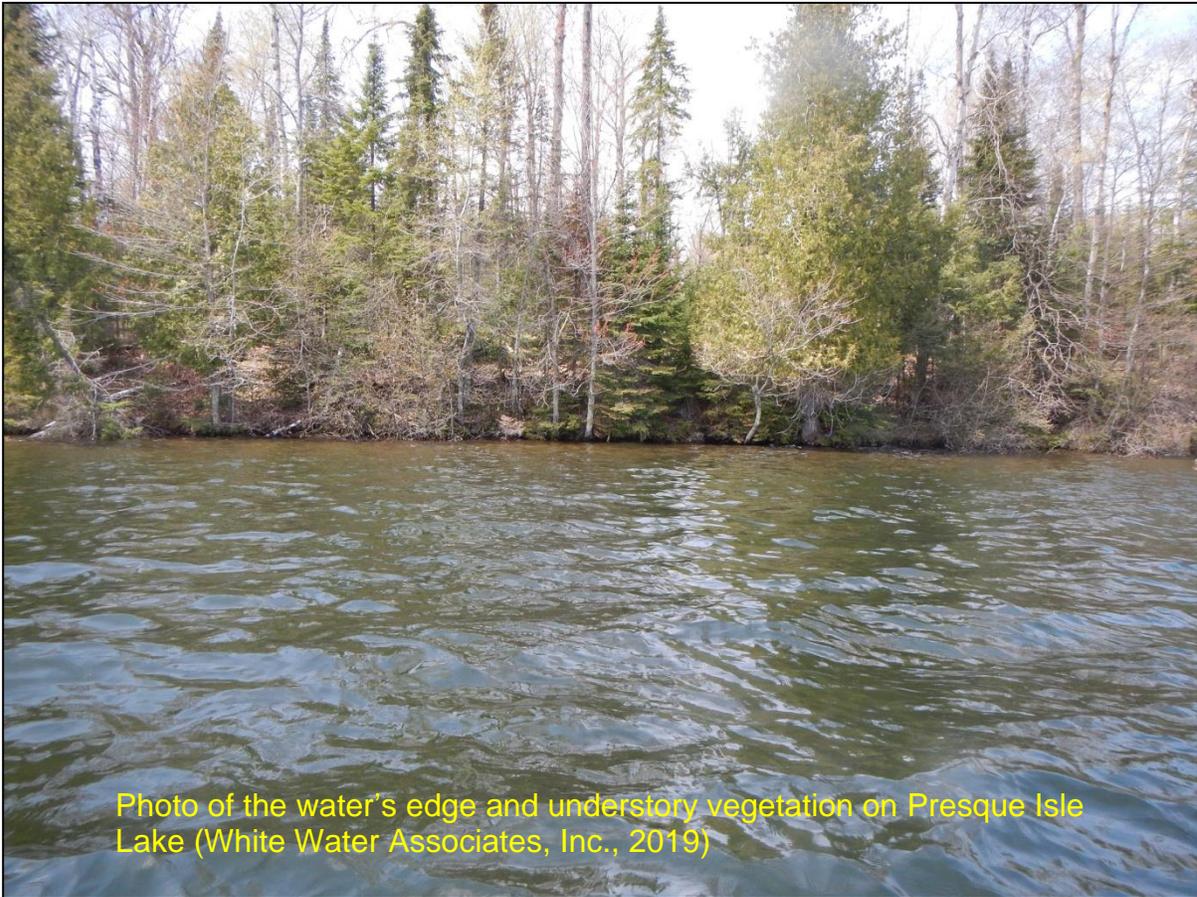
The shoreline habitat assessment was conducted for every ownership parcel on the lake. To facilitate this effort, parcel data was obtained March 2018 via the Wisconsin Statewide Parcel Map, which can be found at https://maps.sco.wisc.edu/Parcels/. Parcel IDs and shoreline lengths were derived from these spatial data files. Parcel IDs and parcel lines, together with a "riparian buffer" line at 35 feet from the shoreline, were layered onto aerial photography maps saved as a georeferenced image file viewed on the Avenza Maps application on an Apple® iPad Pro 9.7 equipped with GPS for offline navigation. The GPS function of the iPad allowed the survey crew to know their position relative to the shoreline and specific parcels. The map is provided as Exhibit 1. Data sheets were prepared that included parcel ID numbers and frontage feet of each parcel (an example data sheet is shown in Exhibit 2). Exhibit 2 also shows the categories that were documented for each parcel. Back in the laboratory, data recorded on field data sheets were input to a Microsoft Office Excel spreadsheet and later conveyed to the WDNR as part of the data package to be included in a publicly available database.

The woody habitat component of the assessment was conducted on a separate circumnavigation of the lake. Before starting, a Secchi depth was measured. The protocol specifies that if the Secchi depth is less than two feet, no woody habitat survey will be conducted due to poor visibility (WDNR 2016). In addition to the Secchi depth, lake water level was documented relative to the lake's *high water level* (HWL). As the lake was circumnavigated, large wood was enumerated. The protocol defines "large wood" as wood greater than 4 inches in diameter somewhere along its length and at least 5 feet long. Eligible large wood was that which was located between the high water level and the 2 foot depth contour and the large wood section must be in the water or below the high water level. Tree "branchiness" ranking was recorded as "0" (no branches), "1" (few branches), or "2" (tree trunk with full crown). Additional details on eligible large wood are provided in the protocol document (WDNR 2016). A GPS was used to document each eligible piece of large wood. A datasheet entry corresponded to each large wood piece. An example datasheet is provided as Exhibit 3.

FINDINGS

The data and photos for the assessment of shoreland area and shallows habitat for Presque Isle Lake have been delivered to the WDNR. Any user can view the results in the Wisconsin Department of Natural Resources Lakes and AIS Mapping Tool found at: https://dnr.wi.gov/lakes/viewer/.   In this section we summarize a few of the data and provide some example maps that illustrate the findings from the assessment.

The assessment was conducted on May 21-22, 2019. At the time of the survey there were 156 ownership parcels on Presque Isle Lake. The shoreline perimeter including islands of Presque Isle Lake is 9.58 miles. Exhibit 4 summarizes some of the Presque Isle Lake data. Exhibits 5 through 13 provide maps of findings on Presque Isle Lake. Any interested party can access the data in the database and create maps of this type or maps specific to detailed areas of shoreland and shallow water habitat. Exhibit 14 provides instructions for navigating the WDNR AIS Mapping Tool.

In general, the assessment shows the shoreland and shallow water habitat of Presque Isle Lake to be of high quality. There is excellent tree canopy coverage as well as shrub and herbaceous coverage. That being said, there is evidence of human influence in the riparian buffer zone and bank zone. The number of large wood pieces per mile of shoreline is average.

It should be noted that this report has summarized only some of the data collected during the assessment in order to exemplify how the data might be investigated. This only hints at the possibilities and interested stakeholders can sort through more shoreland data on the WDNR data base (see Exhibit 14 for instructions).

LAKE STRATEGY

Presque Isle Lake is a high quality lake with good shallow water habitat and intact riparian area. Lake stewardship could primarily be directed toward protection of the current conditions and monitoring to detect changes over time. Although Presque Isle Lake is in a mostly natural state, there are a few parcels that could undertake some restoration to ameliorate possible runoff and erosion issues. These areas can be identified by investigating the 2019 monitoring data in maps and tables in this report as well as in the WDNR database (link given previously). The Healthy Lakes program in Wisconsin provides simple, practical, and inexpensive best practices that improve habitat and water quality on lakeshore property (see https://healthylakeswi.com/ for additional information and guidance on funding projects). Presque Isle Lake large woody habitat is somewhat sparse and could be augmented with the "fish sticks" best practice.

Exhibit 1. Shoreland Parcels (page 1 of 2 – north half of lake)
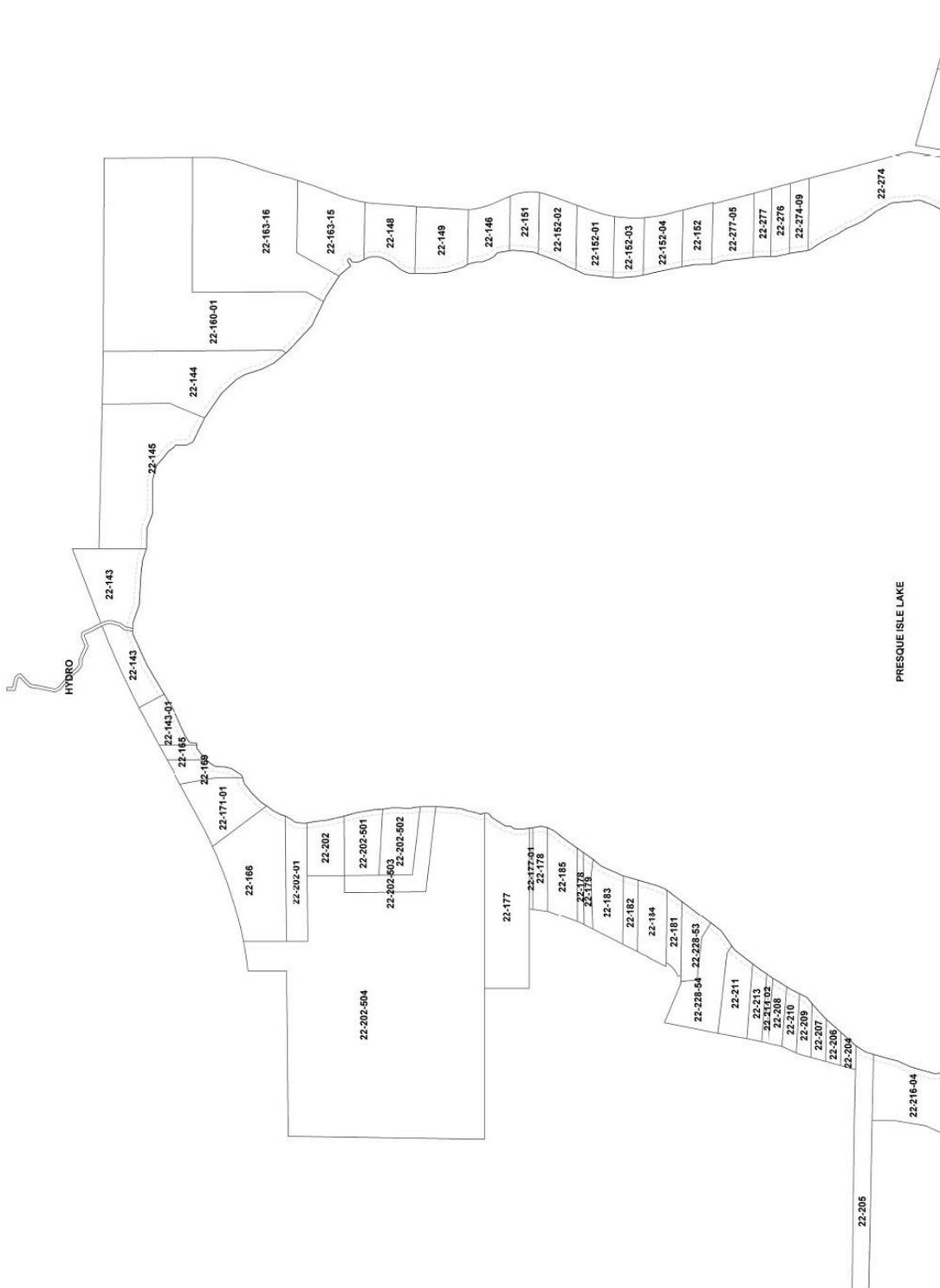
Exhibit 1. Shoreland Parcels (page 2 of 2 – south half of lake)

Habitat Assessment Data Sheet (one per parcel)

Date _____ Lake name _____ WBIC_____
Parcel ID_____ Observers_____

RIPARIAN BUFFER ZONE

Percent Cover	Percent
Canopy	(0-100)
Shrub ☐ Herbaceous ☐	
Shrub/Herbaceous	
Impervious surface	
Manicured lawn	
Agriculture	sum=100
Other (e.g. duff, soil, mulch)	

description:_____

Human Structures	Number
Buildings	
Boats on shore	
Fire pits	
Other	

description:_____

Runoff Concerns **in Riparian or Entire Parcel**	Present in Riparian	Present out of Riparian
Point source	☐	☐
Channelized water flow/gully	☐	☐
Stair/trail/road to lake	☐	☐
Lawn/soil sloping to lake	☐	☐
Bare soil	☐	☐
Sand/silt deposits	☐	☐
Other	☐	☐

description:_____

Notes:

BANK ZONE	Length (ft)
Vertical sea wall	
Rip rap	
Other erosion control structures	
Artificial beach	
Bank erosion > 1 ft face	
Bank erosion < 1 ft face	

LITTORAL ZONE	
Human Structures	Number
Piers	
Boat lifts	
Swim rafts/water trampolines	
Boathouses (over water)	
Marinas	
Other	

description:_____

Aquatic Plants	Present
Emergents	☐
Floating	☐
Plant Removal	☐

If Applicable (low water level):	
EXPOSED LAKE BED ZONE	
Plants	Present
Canopy	☐
Shrubs	☐
Herbaceous	☐
Disturbed	
Plants (mowed or removed)	☐
Sediment (tilled or dug)	☐

Exhibit 2. Example habitat assessment data sheet.

Exhibit 3. Coarse woody habitat inventory data sheet.

Date _____ Lake name _____ WBIC_____
Observers_____
Present water level is ☐ Below ☐ At ☐ Above   the High Water Level   Secchi depth _____ ft

ID	Branch	Touch Shore	In Water	ID	Branch	Touch Shore	In Water	ID	Branch	Touch Shore	In Water	ID	Branch	Touch Shore	In Water
1				26				51				76			
2				27				52				77			
3				28				53				78			
4				29				54				79			
5				30				55				80			
6				31				56				81			
7				32				57				82			
8				33				58				83			
9				34				59				84			
10				35				60				85			
11				36				61				86			
12				37				62				87			
13				38				63				88			
14				39				64				89			
15				40				65				90			
16				41				66				91			
17				42				67				92			
18				43				68				93			
19				44				69				94			
20				45				70				95			
21				46				71				96			
22				47				72				97			
23				48				73				98			
24				49				74				99			
25				50				75				100			

Branch: 0 = no branches, 1 = a few branches, 2 = full tree crown
Touch Shore: 0 = entirely below High Water Level (HWL), 1 = crosses HWL
In Water: 0 = less than 5 ft of log is currently underwater, 1 = at least 5 ft of log is currently underwater

Exhibit 4. Summary of shoreland and shallow water habitat for Presque Isle Lake.

Date of Survey: May 21 and 22, 2019		Miles of shoreline: 9.58	
Number of ownership parcels: 156		Mean parcel frontage feet: 324	
Riparian Buffer Zone		# of parcels	% of parcels
Impervious surfaces		128	82
Manicured lawn		65	42
Agriculture		0	0
Other (duff, soil, mulch)		91	58
Human structures (buildings, boats on shore, fire pit, other)		114	73
Broad runoff concerns (incl. point source; channelized water flow; straight stair, trail, or road to lake; lawn or soil sloping; bare soil;sand/silt deposits; other erosion). Note: Exhibit 10 is less inclusive.		122	78
Bank Zone		# of parcels	% of parcels
Concerns in the bank zone (e.g., vertical sea wall, rip rap, other erosion control structures, artificial beach, active erosion)		21	13
Littoral Zone		# of parcels	% of parcels
Human structures in littoral zone (e.g., piers, boat lifts, swim rafts, water trampolines, boat houses over water, marinas, other)		122	78
Emergent and/or floating aquatic plants		9	6
Evidence of aquatic plant removal		0	0
Large Wood Habitat			
Total Number of large wood pieces		448	
Number of large wood pieces per mile of shoreline		46.8	

Exhibit 5. Presque Isle Lake Riparian Coverage - % Canopy - 2019

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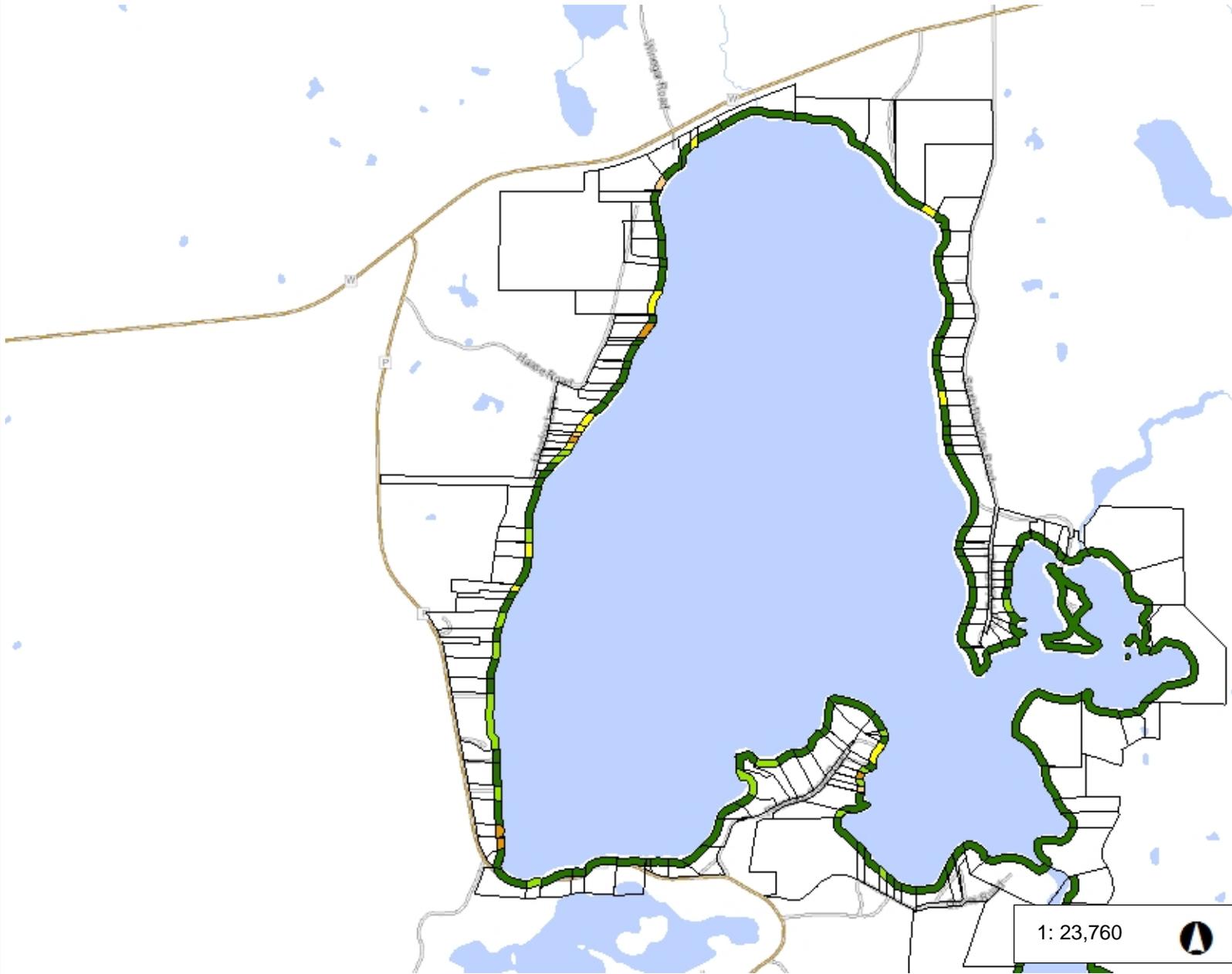
Legend

Percent Canopy

- 0 - 20
- 21 - 40
- 41 - 60
- 61 - 80
- 81 - 100

☐ Shoreland Parcels

☐ County Boundary

☐ Municipality

☐ State Boundaries

☐ County Boundaries

Major Roads

- Interstate Highway
- State Highway
- US Highway

County and Local Roads

- County HWY
- Local Road

+ Railroads

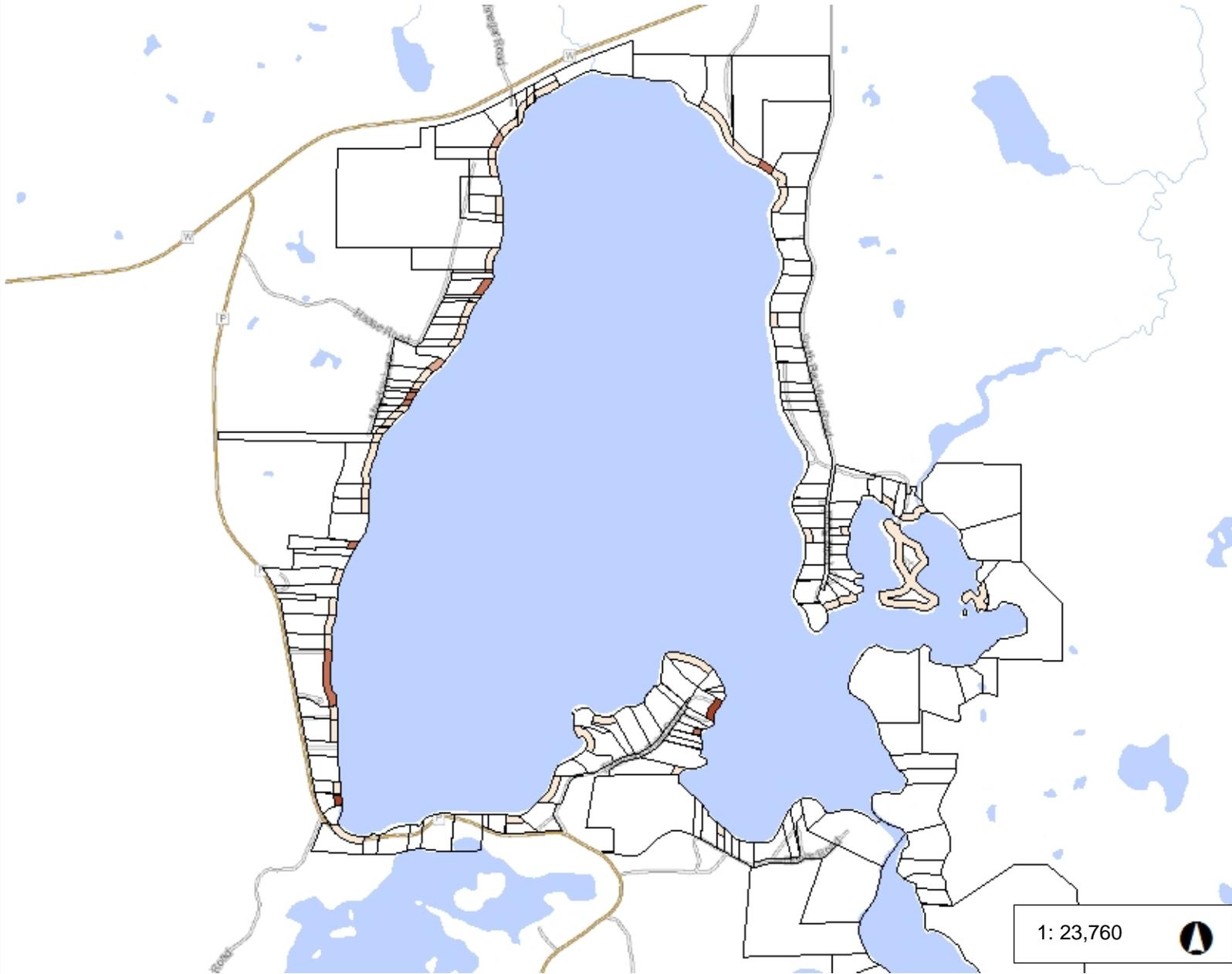☐ Tribal Lands

Rivers and Streams

Intermittent Streams

☐ Open Water

☐ Great Lakes

1: 23,760

Notes

0.8　　　　0　　0.38　　0.8 Miles

NAD_1983_HARN_Wisconsin_TM
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Exhibit 6. Riparian Coverage - % Shrub Herbaceous - 2019
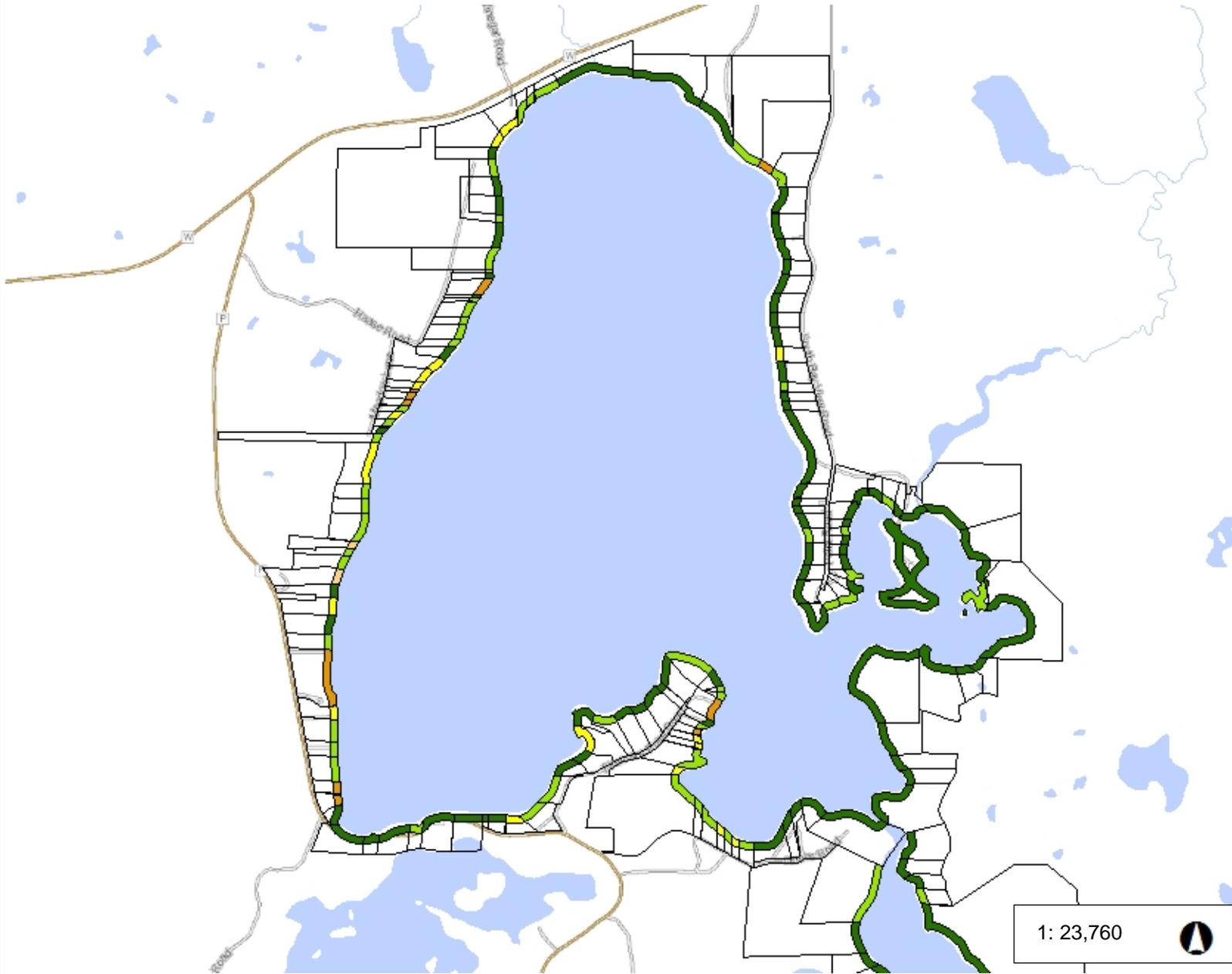
Legend

Percent Shrub Herbaceous
- 0 - 20
- 21 - 40
- 41 - 60
- 61 - 80
- 81 - 100

Shoreland Parcels

County Boundary

Municipality

State Boundaries

County Boundaries

Major Roads
- Interstate Highway
- State Highway
- US Highway

County and Local Roads
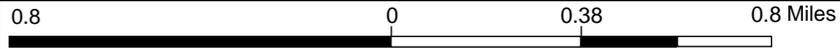- County HWY
- Local Road

Railroads

Tribal Lands

Rivers and Streams

Intermittent Streams

Open Water

Great Lakes

1: 23,760

Notes

Presque Isle Lake

0.8   0   0.38   0.8 Miles

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Exhibit 7. Presque Isle Riparian Coverage - % Impervious - 2019

1: 23,760
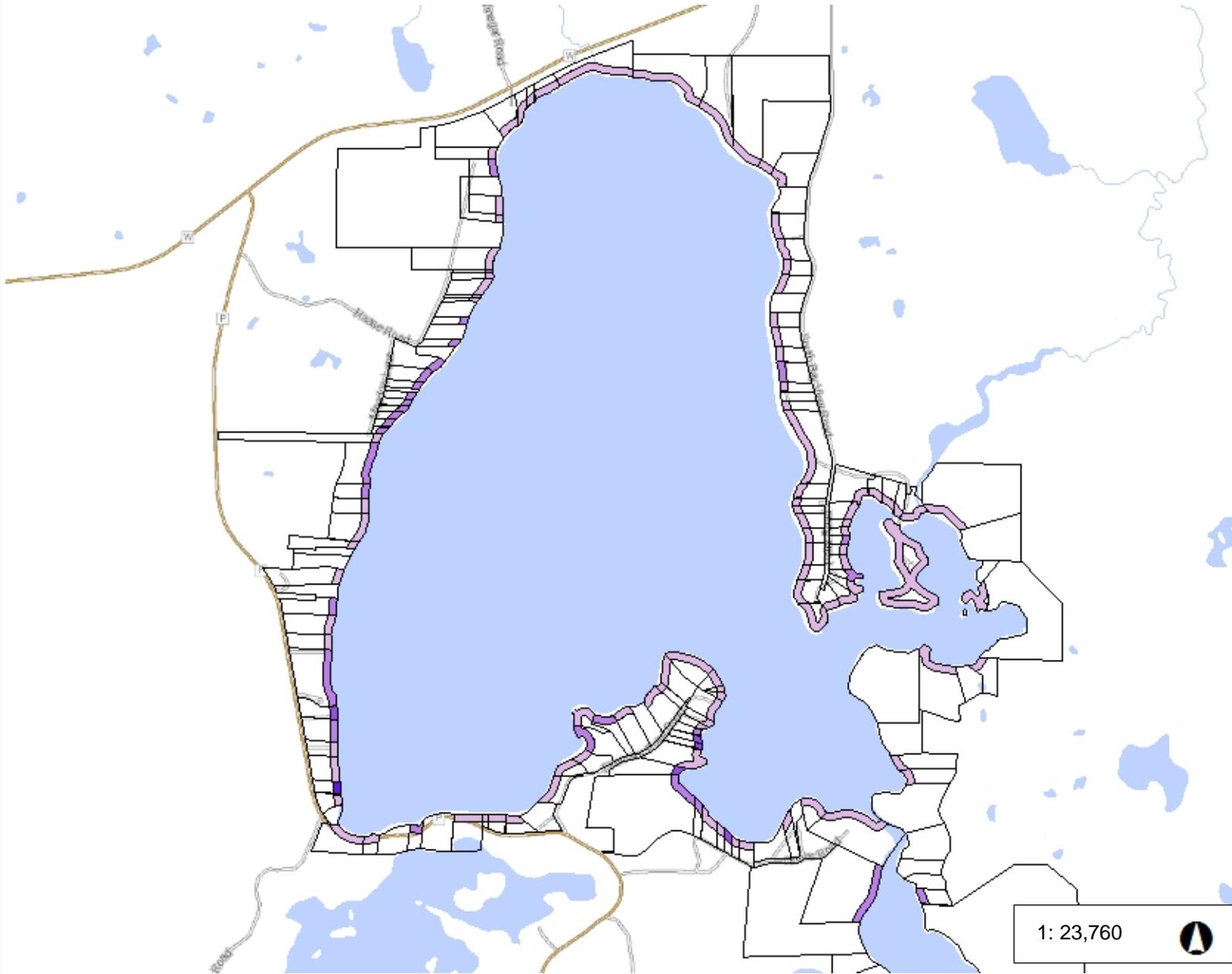
Legend

Percent Impervious
- 1 - 5
- 6 - 15
- 16 - 35
- 36 - 100

- Shoreland Parcels
- County Boundary
- Municipality
- State Boundaries
- County Boundaries

Major Roads
- Interstate Highway
- State Highway
- US Highway

County and Local Roads
- County HWY
- Local Road

- Railroads
- Tribal Lands
- Rivers and Streams
- Intermittent Streams
- Open Water
- Great Lakes

Notes
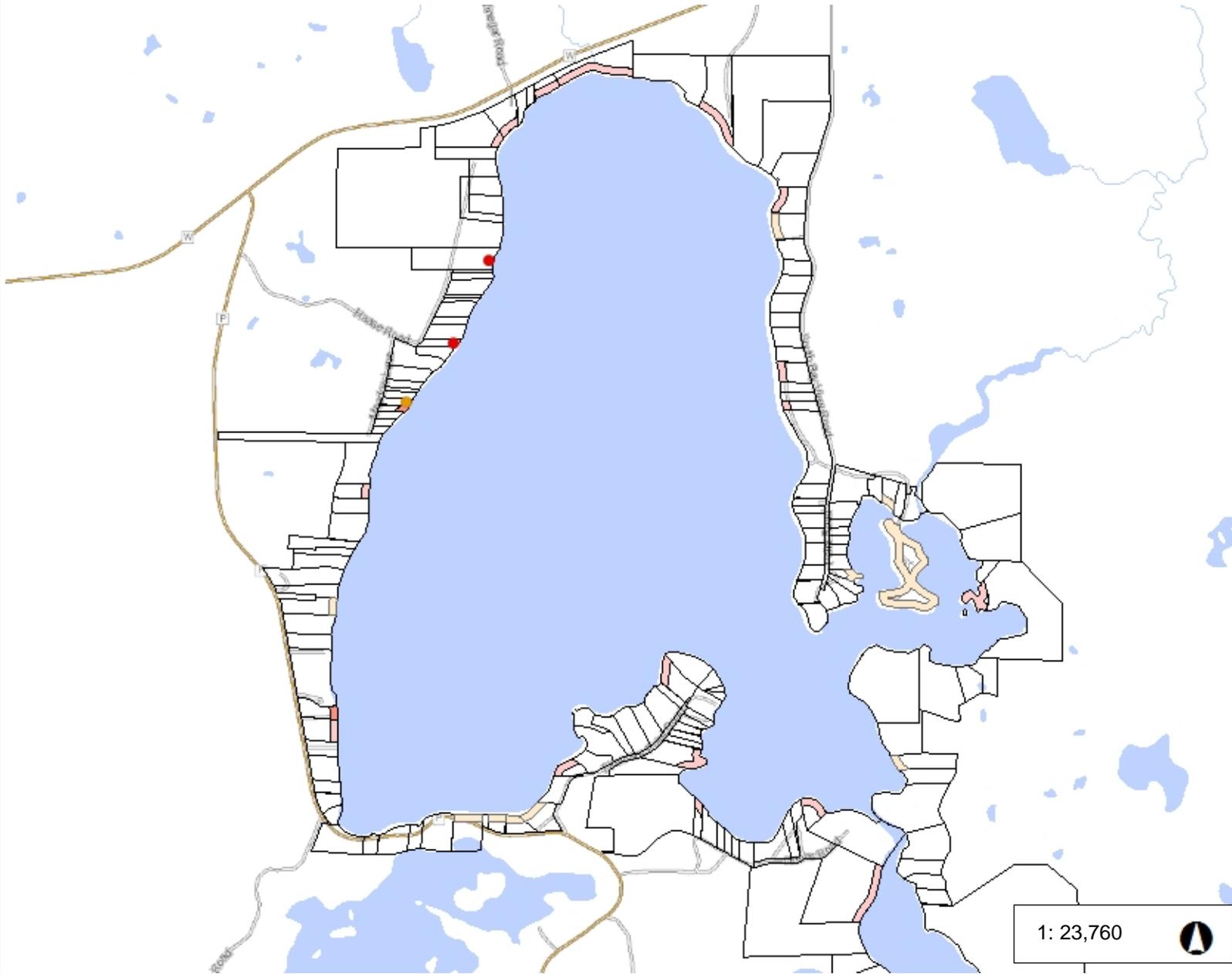
0.8   0   0.38   0.8 Miles

NAD_1983_HARN_Wisconsin_TM
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Exhibit 8. Presque Isle Riparian Coverage - % Manicured Lawn - 2019

Legend

Percent Manicured Lawn
- 1 - 25
- 26 - 50
- 51 - 75
- 76 - 100

- ☐ Shoreland Parcels
- ☐ County Boundary
- ☐ Municipality
- ☐ State Boundaries
- ☐ County Boundaries

Major Roads
- — Interstate Highway
- — State Highway
- — US Highway

County and Local Roads
- — County HWY
- — Local Road

- ─┼─ Railroads
- Tribal Lands
- Rivers and Streams
- Intermittent Streams
- Open Water
- Great Lakes

1: 23,760

Notes

0.8   0   0.38   0.8 Miles

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Exhibit 9. Presque Isle Lake Bank Erosion and Modifications - 2019

Legend

- 🔴 Bank Erosion >1ft
- 🟠 Bank Erosion <1ft

Vertical Sea Wall
- ⬜ 1 - 50 ft
- ⬜ 51 - 100 ft
- ⬜ 101 - 200 ft
- ⬜ 200 + ft

Rip Rap
- ⬜ 1 - 50 ft
- ⬜ 51 - 100 ft
- ⬜ 101 - 200 ft
- ⬜ 200+ ft

Other Bank Modifications
- ⬜ 10 - 50 ft
- ⬜ 51 - 100 ft
- ⬜ 101 - 200 ft
- ⬜ 200+ ft

Artificial Beach
- ⬜ 0 - 50 ft
- ⬜ 51 - 100 ft
- ⬜ 101 - 200 ft
- ⬜ 200+ ft

- ⬜ Shoreland Parcels
- ⬜ County Boundary
- ⬜ Municipality
- ⬜ State Boundaries

1: 23,760

Notes

0.8   0   0.38   0.8 Miles

NAD_1983_HARN_Wisconsin_TM
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Exhibit 10. Presque Isle Lake Runoff Concerns - 2019
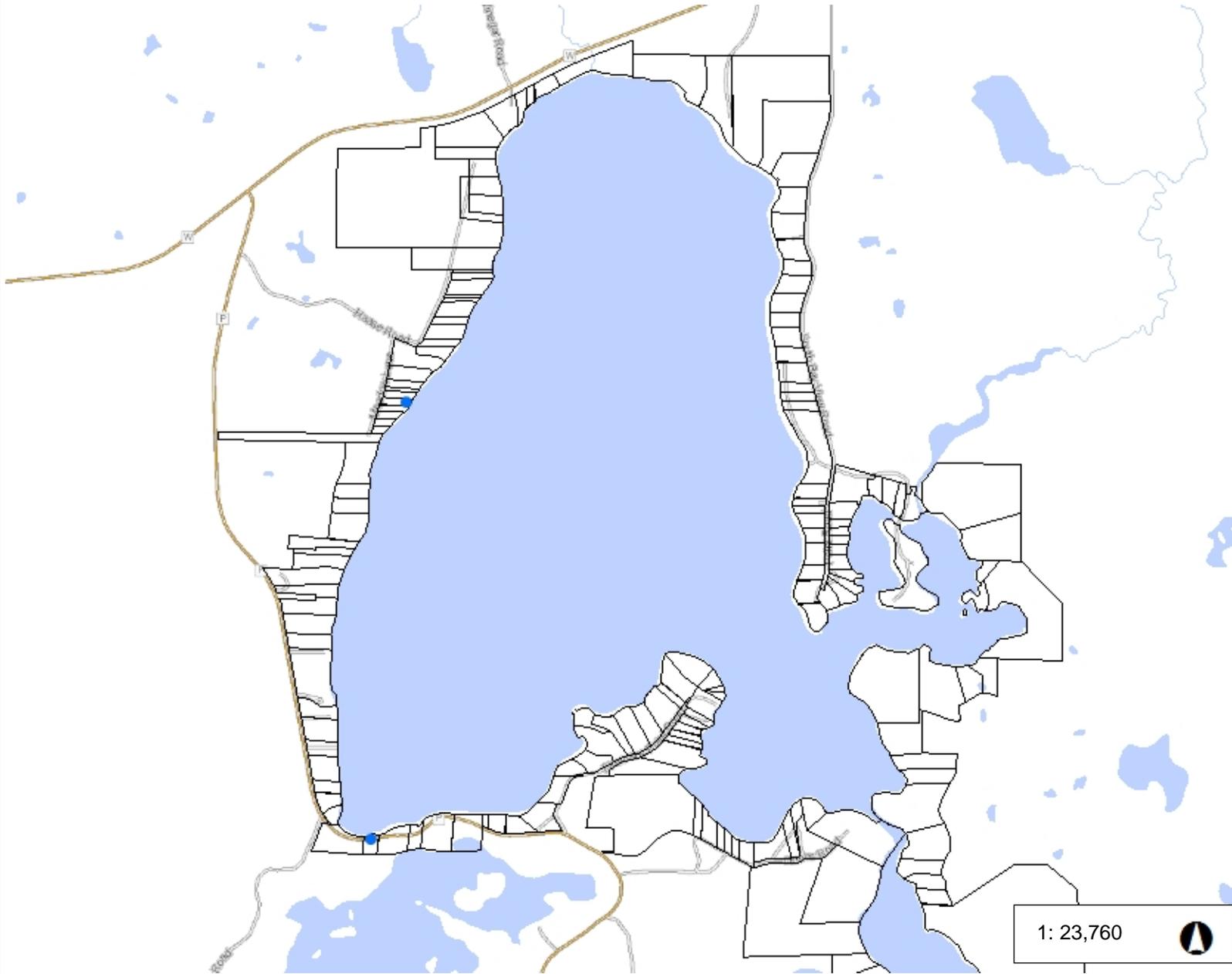
Legend

- ● Channelized Flow
- ● Point Source
- ☐ Shoreland Parcels
- ☐ County Boundary
- ☐ Municipality
- ⊡ State Boundaries
- ⊡ County Boundaries

Major Roads
- ▬ Interstate Highway
- ▬ State Highway
- ▬ US Highway

County and Local Roads
- ▬ County HWY
- ▬ Local Road

- ┼ Railroads
- ▨ Tribal Lands
- ▬ Rivers and Streams
- ▬ Intermittent Streams
- ■ Open Water
- ■ Great Lakes

1: 23,760

Notes

0.8   0   0.38   0.8 Miles

NAD_1983_HARN_Wisconsin_TM
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Exhibit 11. Presque Isle Lake Littoral Zone - Aquatic Plants - 2019
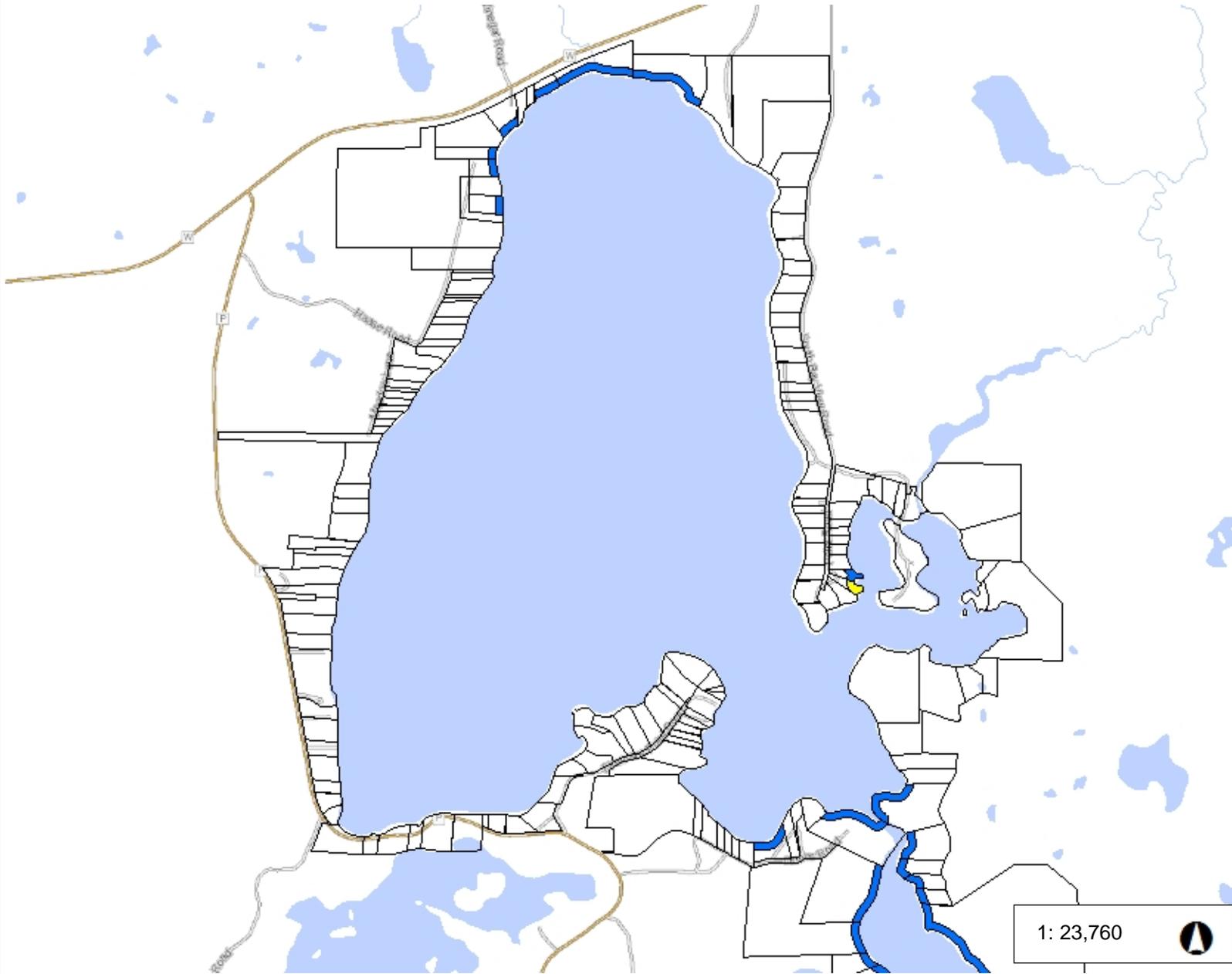
Legend

- Aquatic Plant Removal
- Floating & Emergent Plants
- Emergent Plants
- Floating Plants
- Shoreland Parcels
- County Boundary
- Municipality
- State Boundaries
- County Boundaries
- Major Roads
  - Interstate Highway
  - State Highway
  - US Highway
- County and Local Roads
  - County HWY
  - Local Road
- Railroads
- Tribal Lands
- Rivers and Streams
- Intermittent Streams
- Open Water
- Great Lakes

1: 23,760

Notes

0.8   0   0.38   0.8 Miles

NAD_1983_HARN_Wisconsin_TM
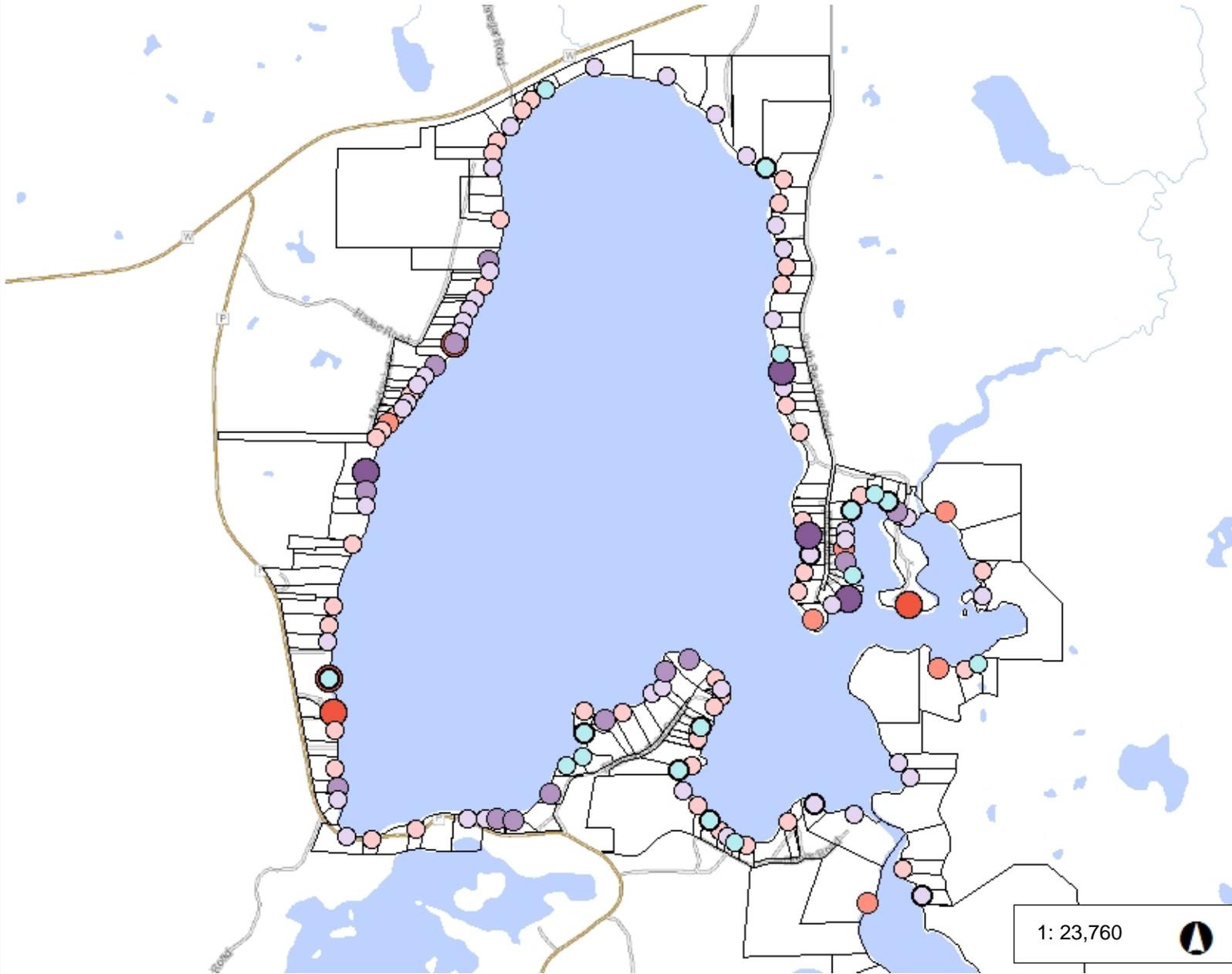© Latitude Geographics Group Ltd.

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Exhibit 12. Presque Isle Lake Littoral Zone - Human Structures - 2019

Legend

Swim Rafts
- 1
- 2
- 3 - 5
- 6+

Boat Lifts
- 1
- 2
- 3 - 5
- 6+

Piers
- 1
- 2
- 3 - 5
- 6+

Boat Houses
- 1
- 2
- 3 - 5
- 6+

Marinas
- 1
- 2
- 3 - 5
- 6+

Shoreland Parcels

1: 23,760

Notes

0.8   0   0.38   0.8 Miles

NAD_1983_HARN_Wisconsin_TM
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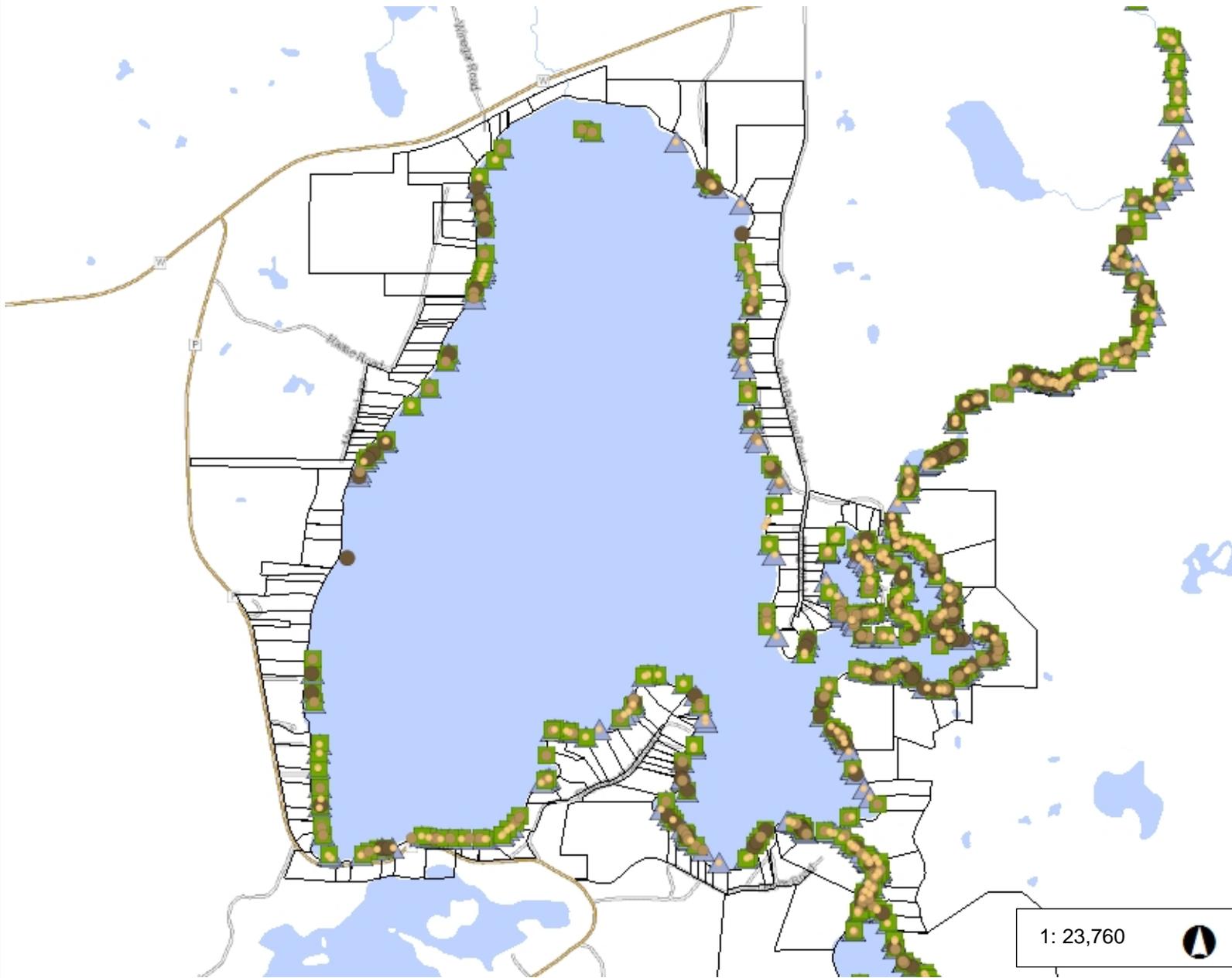
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Exhibit 13. Presque Isle Lake Woody Habitat - 2019

Legend

WH Branchiness
- No branches
- Few branches
- Full tree crown

- WH Touching Shore
- WH In Water
- Shoreland Parcels
- County Boundary
- Municipality
- State Boundaries
- County Boundaries

Major Roads
- Interstate Highway
- State Highway
- US Highway

County and Local Roads
- County HWY
- Local Road

- Railroads
- Tribal Lands
- Rivers and Streams
- Intermittent Streams
- Open Water
- Great Lakes

1: 23,760

0.8   0   0.38   0.8 Miles

Notes

NAD_1983_HARN_Wisconsin_TM
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WISCONSIN DEPT. OF NATURAL RESOURCES

Exhibit 14. Exploring the Wisconsin DNR AIS Mapping Tool for shoreland and shallow water habitat data for specific lakes.

For stakeholders interested in mining the trove of shoreland and shallow water habitat data that has been collected for specific lakes, the Wisconsin DNR AIS Mapping Tool is the portal for entry. The following steps have been outlined to facilitate your experience.

1. https://dnr.wi.gov/lakes/viewer/
2. Click on *Proceed* – it will take a while to load.
3. Click on *I Accept*
4. On top grey menu go to *Find Location*
5. Right below grey menu *Find Locations* click on *Find Locations*
6. Bottom Left – Click on *Lakes and Open Waters* then scroll down click on *Find*
7. Search Type – you can put *Name of Lake* or *WBIC* (Water Body Identification Code)
8. *Value* – put *Lake Name* or *WBIC* then click on *Find*
9. If using *Lake Name* then also select the *County*
10. If you know where your lake is you do not need to use the tool above; you can just go on the map and find your location by holding the left button on your mouse and scrolling to the location you want to view. You can use the Zoom In and Zoom Out on the menu bar or use your mouse.
11. The lake should show up – Then on the white menu bar click on *Show Layers*
12. Under Layers - Uncheck all boxes that have a black check mark except *surface waters* and *basemap*
13. Check (click on) the *Shoreland Habitat Monitoring* box
14. Click on the grey **+** symbol next to it
15. All of the categories that were mapped show up here.
16. Check (click on) the box you want to view. For example, check the box in front of the category *Riparian Coverage*
17. Then check (click on) the sub category *Percent Canopy*. The display will show up on the map to the right.
18. Each Heading there is a + sign on you need to click on the + sign to make it a – sign to see the categories underneath. The Main Sub Heading needs to be checked to see the sub categories. To go onto the next category, you need to uncheck the one you were just on. If there are no colors that show up on the map that would indicate it wasn't indicated on the data sheet and entered. So, if you click on Rip Rap and the map is clear then there is no rip rap by definition of the protocol.
19. If you want to find more info on a certain section on the top menu under basic tools click on *Get Info*. Then go to the parcel you want information on and click once- to the left you will see information on this parcel. You then have to click on the > to find the info and you may have to > again. To close out of the info use the < back arrow. To close out of that click on the X to right of *Identify Results*.
20. You can use your mouse to hold and move the *Lake Map* or use it to scroll in or out to make the map smaller or larger.
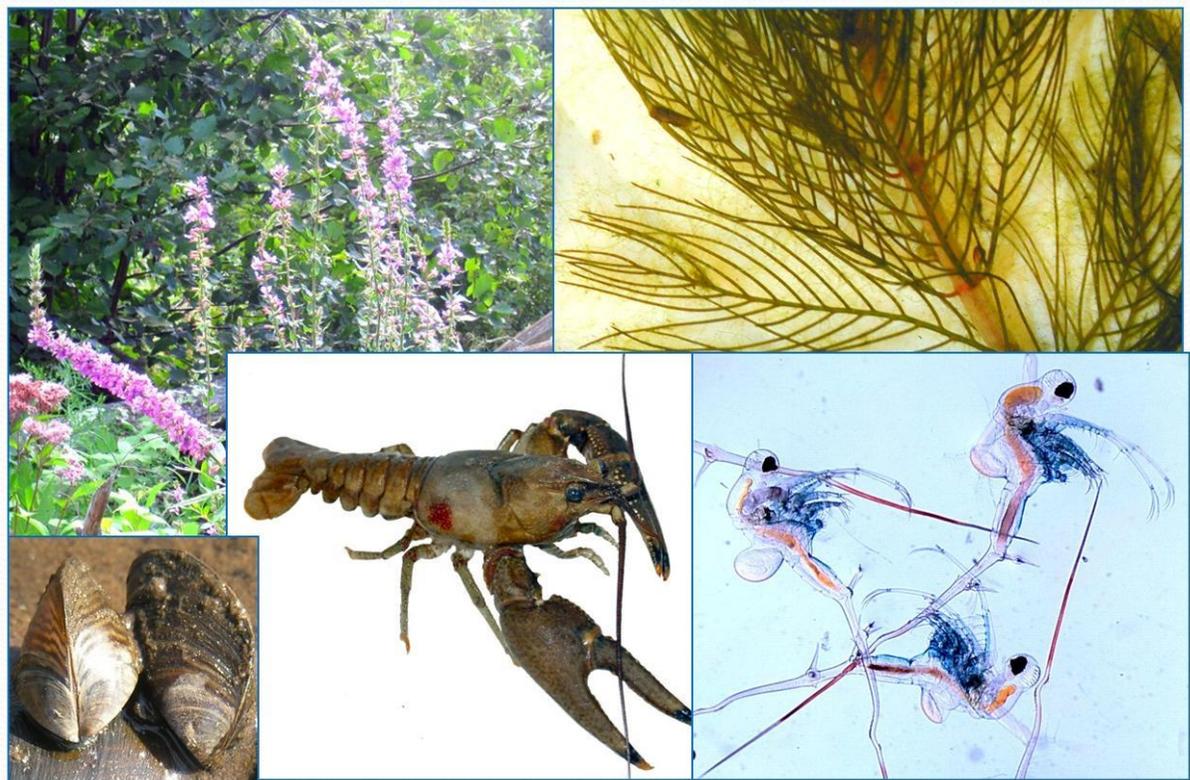
Appendix E

Presque Isle Lake Aquatic Invasive Species Report

Presque Isle Lake (Vilas County, Wisconsin)

Aquatic Invasive Species Report

WHITE WATER
ASSOCIATES, INC.

Date: 2019

INTRODUCTION

White Water Associates, Inc. has been retained by Wilderness Waters: through an Education, Prevention, and Planning Grant on Presque Isle Lake (Vilas County, Wisconsin). Some tasks for this grant focused on aquatic invasive species (AIS). Efforts are intended to increase the understanding of AIS as well as native species in Presque Isle Lake. This work prepares Presque Isle Lake stakeholders to conduct actions that serve lake health. A portion of this project monitored Presque Isle Lake for AIS using Wisconsin Department of Natural Resources (WDNR) protocol. This approach assesses the lake as to its vulnerability to AIS and documents any AIS detected. Findings from the survey were entered into the SWIMS database. A *floating workshop* on lake health, riparian ecology, and AIS was not offered due to Covid-19 concerns in 2020 and 2021.

AQUATIC INVASIVE SPECIES EARLY DETECTION MONITORING

In order to determine if other aquatic invasive species (AIS) were present in study areas, biologists followed the *Aquatic Invasive Species Early Detection Monitoring Standard Operating Procedure* (WDNR, 2014). This procedure outlines several types of monitoring techniques, including: boat landing searches, sample site searches, targeted searches, waterflea tows and/or a Ponar dredge, and a meander search. The Presque Isle Lake Survey took place June 25, 2019.

Five sites around the lake shoreline were thoroughly searched and a meander search was conducted while traveling from one site to another. The public boat landing was surveyed for 30 minutes by checking the dock and walking 200 feet of shoreline. The other four shoreline sites were randomly selected and are identified in Exhibit 1 and Exhibit 2. Snorkeling was not used to search for AIS due to the weather that day. A long rake was used to collect any suspicious aquatic plants for closer inspection and identification. A D-net was used to collect invertebrate animals to look for AIS. Any invasive species observed were recorded. In the event of a new AIS record, specimens are collected for verification.

Spiny water fleas are aquatic invasive zooplankton found in several lakes in Wisconsin. They can be monitored by way of plankton tow nets or by an examination of sediment for dead water flea exoskeleton fragments. In Presque Isle Lake, a Ponar dredge was used to collect a sediment sample in the middle of the lake (Exhibit 1 and Exhibit 3). The sample was brought back to the lab and filtered to look for spiny water flea spines under magnification.

No AIS were found. The WDNR did a plankton tow and a dredge in October 2021 and no spiny water fleas were found.

The rusty crayfish was the only AIS that established in Presque Isle Lake prior to this survey. During the survey there were two new invasive plants that were noted. One was the Aquatic forget-me-not (Exhibit 4) and the other was reed canary grass (*Phalaris arundinacea*) (Exhibit 5). Reed canary grass was noted at Site 1, 2, and 3 and the boat landing. It was also noted on a location in between sites during the meander search. Aquatic forget-me-not was found at the boat landing. These specimens were vouchered and sent to Dr. Freckmann and were confirmed January, 2019. Sites 4 had no AIS present. The narrow-leaf cattail (Typha angustifolia) was found during the aquatic plant survey August, 2019 (46.23731, -089.7841 and 46.23731, -089.7833) and the voucher was verified by Dr. Freckmann.
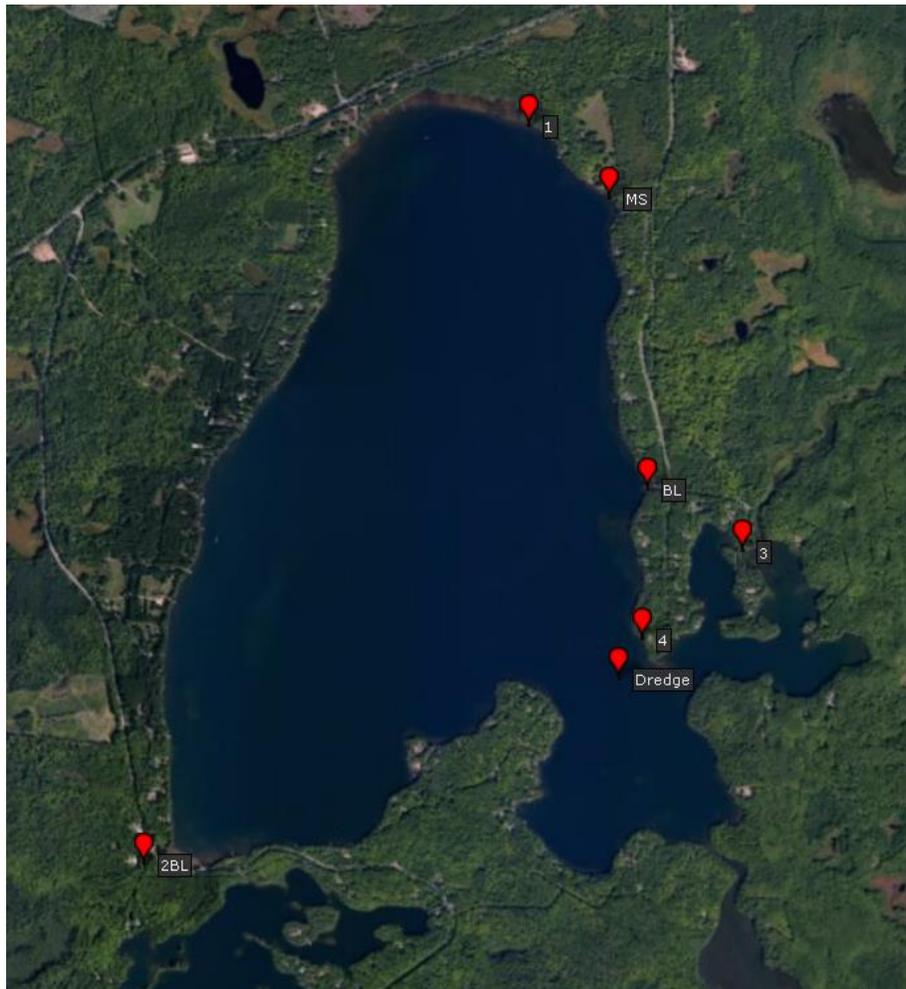

Exhibit 1. Presque Isle Lake AIS survey Sites 1-4, the Boat Landing, meander survey site (MS) and the location of dredge site.

Site	Latitude	Longitude	Species found
Exhibit 2. AIS Survey on Presque Isle Lake 6/25/2019.			
Density (1-5), and live (L) or dead (D). Boat Landing (BL). Meander Survey (MS)			
1	46.23711	-89.77602	Rusty crayfish 1 (D)
2BL	46.21041	-89.79308	Rusty crayfish 3 (L) (D)
3	46.22170	-89.76481	Rusty crayfish 1 (L) (D)
4	46.21854	-89.77008	None
BL	46.22394	-89.769819	Aquatic forget-me-not 2 (L), Reed canary grass 3 (L)
MS	46.23450	-89.77180	Reed canary grass 1 (L)

Date: 6/25/2019	GPS Coordinates		Depth of sample (feet)
Exhibit 3. Spiny Water Flea Sediment Sample from Presque Isle Lake			
Dredge Site	46.21714	-89.77130	19

Rusty crayfish are native to parts of Ohio, Tennessee, Kentucky and Indiana, and were likely introduced to Wisconsin waters by fishermen using the crayfish as bait (Gunderson, 2014). Rusty crayfish negatively affect other native crayfish species, cause destruction to aquatic plant beds, reduce fish populations by eating eggs, and cause shoreland owners recreational problems (Gunderson, 2014). It is illegal to possess both live crayfish and angling equipment simultaneously on any inland Wisconsin water (except Mississippi River) (WDNR, 2015). It is also illegal to release crayfish into a water body without a permit (WDNR, 2015).

Aquatic Forget-me-not (*Myosotis scorpioides*) can quickly crowd out native plant species and is able to form large monocultures, especially in situations where it is in or near a stream (WDNR, 2019). This plant is restricted in Wisconsin.
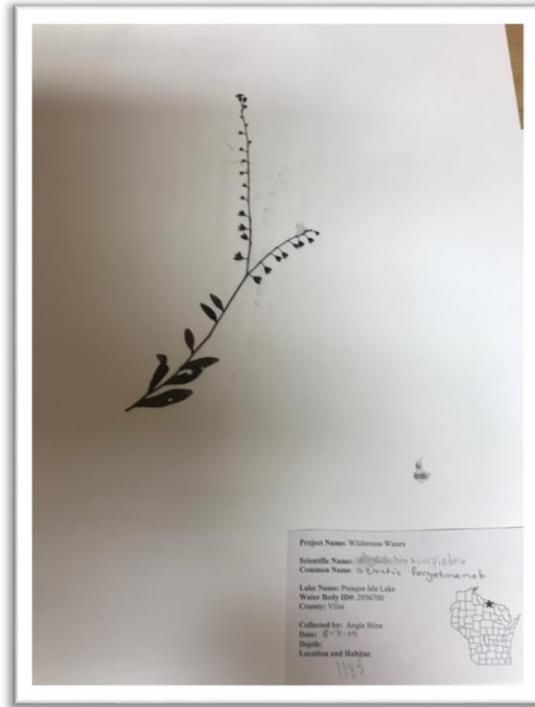
Exhibit 4. Voucher specimen of aquatic forget-me-not sent to Dr. Freckmann (U.W. Steven's Point: Herbarium) for verification, January 2019.

Reed canary grass (*Phalaris arundinacea*) has been found in nearly every county in Wisconsin. It is on the *Restricted* species list. It forms dense, monocultured stands in wetland and riparian areas (Czarapata, 2005). It reproduces by spreading rhizomes, and seeds (Czarapata, 2005). It is one of the first grasses to sprout in the spring, increasing its chances of out-competing other plants.

Narrow-leaved cattail (*Typha angustifolia*) is another perennial wetland plant that can grow very tall. It has a flowering spike of male flowers with another section of female flowers just below it (Czarapata, 2005). It grows along shorelines, roadsides, marshes, and wet meadows. Narrow-leaved cattails form monocultures that push out native plant species and can alter the hydrology and wildlife habitat (Czarapata, 2005).
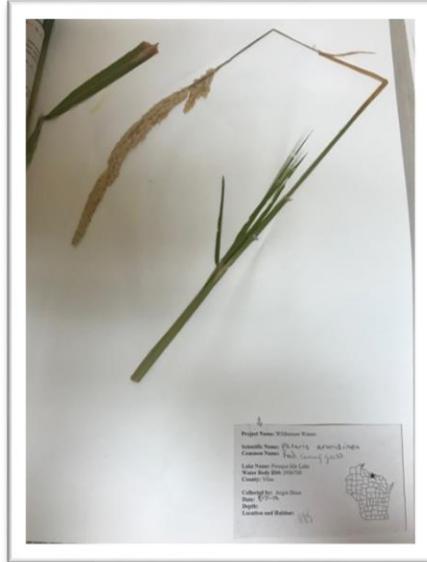
Exhibit 5. Voucher specimen of reed canary grass that was sent to Dr. Freckmann (U.W. Steven's Point: Herbarium) for verification, January, 2019.

The Wisconsin DNR has a very informative website that educates on invasive species. The Presque Isle Lake stakeholders are the ones that frequent the lake and play a big role in protecting the lake. Stopping the spread of AIS and early detection is important when it comes to invasives. Please feel free to take the time to browse through the many links provided: https://dnr.wi.gov/topic/Invasives/.

Literature Cited

Czarapata, Elizabeth. 2005. *Invasive Plants of the Upper Midwest: An Illustrated Guide to Their Identification and Control*. University of Wisconsin Press.

Gunderson, Jeff. 2014. *Rusty Crayfish: A Nasty Invader*. Minnesota Sea Grant. Retrieved 2017. <http://www.seagrant.umn.edu/ais/rustycrayfish_invader>

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