

# Lake Puckaway

## Adaptive Aquatic Plant Management Plan



**Cason**  
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LAKES · PONDS · WETLANDS  
PRAIRIES · FORESTS · STREAMS



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# INTRODUCTION

Lake Puckaway is located within Green Lake and Marquette Counties, Wisconsin. It is a 5,013-acre lake with a mean depth of 3 feet, maximum depth of 5 feet (**Figure 1**), and 27.6 miles of shoreline. Lake Puckaway is classified as a drainage lake that contains one outlet on the northeast corner of the lake. A majority of the shoreline consists of natural (undeveloped) or wetland habitat. There are developed shorelines on the north-central, northwestern, and southwestern shores, in particular. The proposed Aquatic Lake Management Plan/Lake Management Plan for Lake Puckaway has been designed at the request of the operators of Lake Puckaway Protection and Rehabilitation District (LPPRD). The LPPRD represents the interests of riparian property owners, business owners, and other users of Lake Puckaway. The need for an Aquatic Plant Management Plan is in response to the explosion of Eurasian/Hybrid watermilfoil (EWM/HWM) since the most recent Comprehensive Lake Management Plan was completed in 2017. Since EWM/HWM is a pioneering invasive species that forms dense beds throughout the littoral zones of lakes it can displace native plants, cause navigational and recreational impairments, impact fisheries, reduce the aesthetics of a lake, and generally decrease riparian property values as a result. This plan will focus on addressing many of the concerns regarding Lake Puckaway’s aquatic plant community and recommend the best course of action for future lake management activities. Without an appropriate aquatic plant management program, it is expected that the lake would continue to become more and more dominated by EWM/HWM to the detriment of the lake’s ecology and to the displeasure of all lake users and riparian property owners.

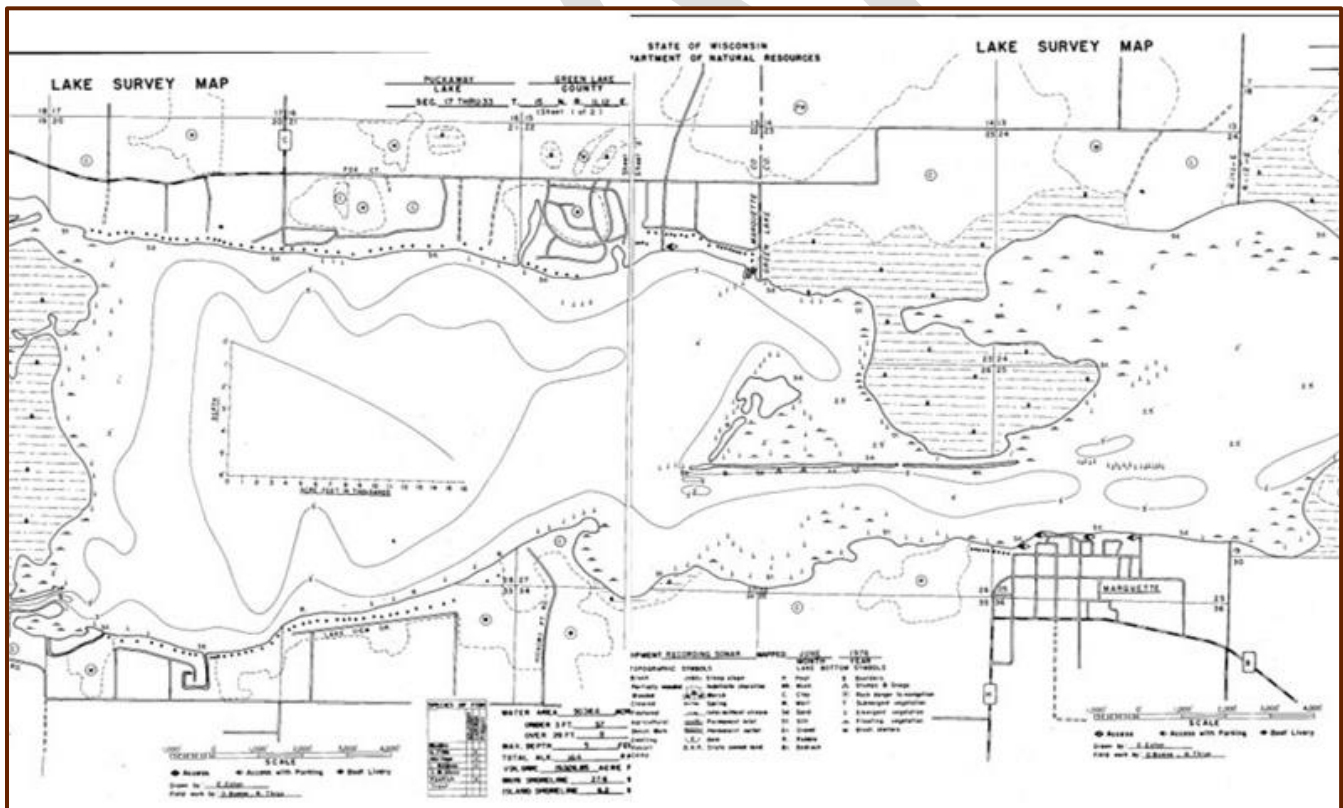


Figure 1. Lake Puckaway Contour map provided by the WDNR.

## EURASIAN WATERMILFOIL

Eurasian watermilfoil is an exotic invasive species in Wisconsin and can be found in many parts of the United States. Due to its aggressive growth and rapid dispersal, it is a significant threat to both the ecological and recreational value of Wisconsin's lakes. It has been shown to successfully hybridize with Northern watermilfoil, creating what is known as hybrid watermilfoil. Hybrid strains of watermilfoil as well as pure strain EWM have been observed within the Lake Puckaway system previously. Both pure strain as well as hybrid watermilfoil can grow very quickly, outcompeting many native aquatic plant species that would typically be found in Wisconsin lakes. In addition to growing rapidly, it also forms dense canopies that block out sunlight from other native plants and cause tremendous navigational and recreational barriers to lake users. Infestations of EWM have been linked to declines in fishery quality, water quality, and invertebrate abundance (Pullman, 1993).

While most lake users consider the colloquial term 'water quality' to mean how nice the lake's waters are for their recreational purposes, aquatic biologists and ecologists generally refer to the term 'water quality' in terms of the chemical and physical properties of the water itself. For example, waterbodies with high nutrient levels (i.e. phosphorus, nitrogen, potassium) can be said to be impaired because abundances of those nutrients can often lead to algal blooms and rapid aquatic plant growth which can result in negative effects to the lake from a human's perspective. Generally, laypeople tend to place much of their assessment and value of the aquatic resource on whether or not it is suitable for recreational activities, provides great fishery opportunities, has navigational access, does not 'look gross to swim in', smell poorly due to decomposing plant material, cause reductions in property values, reduce economic opportunities, etc.

In the case, of Lake Puckaway's explosive growth of EWM and other native plants such as coontail, the lake had accumulated tons of nutrients from many years and seems to have finally reached an ecological turning point whereby nutrients that had been sequestered in sediments and rendered largely unusable to aquatic plants have now become more available to plants, likely coinciding with increased water clarity. Now that water clarity is at an all-time high, sunlight penetration into the shallow waters of lake Puckaway coupled with decades of nutrient accumulation is causing a rapid shift in the ecological composition of Lake Puckaway and EWM happens to be the most adaptive early invader of these newly available ecological niches within the lake.

## GOALS AND ASSESSMENT STRATEGIES

The purpose of this aquatic plant management plan is to guide all management activities and assessments pertaining to aquatic plants within Lake Puckaway. As an adaptive plan, this plan is designed to adapt to new research, understandings of plant communities, assessments of past management activities, and changes in focus to align the plan with the goals of the LPPRD on an annual basis.

Beginning in 2023, the goals of the Lake Puckaway Aquatic Plant Management Plan are to:

- Dramatically reduce the extent to which Aquatic Invasive Species (AIS), particularly EWM/HWM are impacting the lake.

- Ensure navigational and recreational use of Lake Puckaway is possible and reduce impairment issues caused by EWM/HWM.
- Maintain and promote native aquatic plant biodiversity via the use of a selective aquatic herbicide to specifically target invasive EWM/HWM and allow native aquatic species to flourish in its' absence.
- Mechanically harvest navigation lanes along the Southwest shore of Lake Puckaway.

To accomplish these goals, all current and future management activities will be assessed annually based on how each activity impacts the use and health of the system. This will be accomplished by assessing the most current AIS surveys and targeted sub-polygon Point-Intercept survey data of treatment areas each year for 3 years post-treatment. This will be in addition to whole lake Point-Intercept surveys every 5 years, as has become standard practice for the monitoring of aquatic plant diversity in lakes throughout Wisconsin.

### **STAKEHOLDER PARTICIPATION**

On February 6th, 2023, the Lake Puckaway Protection Rehabilitation District (LPPRD) Board of Commissioners held a meeting with Cason Land & Water Management, LLC, and WI DNR personnel. The purpose of this meeting was to discuss the Aquatic Plant Management Planning of Lake Puckaway. General timelines for the planning process were discussed and agreed upon. It was agreed that stakeholder participation in the process needed to be held to high standards and the best way to involve as many stakeholders as possible was going to be to update the previous stakeholder survey and widely distribute it to get as much feedback as possible from the public. Therefore, much of this meeting was spent going over the relevancy of specific questions, developing new questions for stakeholders, identifying priority issues around the lake's management, and discussion of the logistics for various platforms and survey distribution options. At this meeting it was agreed upon by the Board of Commissioners that Cason Land & Water Management, LLC would spearhead the development of a survey, consult with Qualtrics on appropriate survey software options, and work with WI DNR's social scientist, Lauren Bradshaw to review and refine the appropriate survey verbiage to use.

The anonymous stakeholder survey link was published on March 25th, 2023, on the LPPRD website as well as on their social media. A postcard was also sent out to the LPPRD mailing list which totaled 643 addresses and another 100 un-addressed postcards were provided to the LPPRD for manual distribution at sites in the areas that seemed appropriate for lake users to gain access to the survey. The survey period ended on May 10<sup>th</sup>, 2023.

A public notice regarding the 50-acre trial treatment of ProcellaCOR on the west end of Lake Puckaway was issued in the May 11<sup>th</sup> issue of the Ripon Commonwealth Press.

On June 12<sup>th</sup>, 2023, Cason Land & Water Management, LLC was invited to the LPPRD membership meeting and provided a brief re-cap of some of the initial stakeholder survey responses that we received. Cason Land & Water Management, LLC also provided an update to members on how the trial application was performed, how it will be monitored for impacts to native plant species (based on the



plan that was developed in consultation with the WI DNR) and answered additional questions from the public regarding the aquatic herbicide treatment.

**Three Lake Management Planning Meetings were held on the following dates:**

- 1. Sat. July 8<sup>th</sup>, 2023** – Kickoff Lake Management Plan (LMP) planning meeting at the Montello Service Center Building
  - At this meeting, Lance Paden and Brandon Oberleitner from Cason Land & Water Management, LLC presented a PowerPoint presentation to the LPPRD membership outlining basic issues related to the Aquatic Plant Management of Lake Puckaway. Considerable time was also spent reviewing the entire stakeholder survey results and addressing related questions. Anonymous Public Question Comment sheets were passed out to all present and attendees were invited to write down any questions that they felt were not already addressed in the presentation. Those questions will be answered in writing by Cason Land & Water Management, LLC and reviewed (along with those questions collected at the July 22<sup>nd</sup> meeting) at the final LMP planning meeting on Sat. August 5<sup>th</sup>, 2023.
- 2. Sat. July 22<sup>nd</sup>, 2023** – LMP planning meeting at the Marquette Village Hall
  - At this meeting, Lance Paden from Cason Land & Water Management, LLC presented a PowerPoint presentation to the LPPRD membership outlining basic issues related to the Aquatic Plant Management of Lake Puckaway, an abbreviated review of the stakeholder survey results (for anyone not in attendance at the July 8<sup>th</sup> meeting), point-intercept survey data analyses, and presented an outline of the Lake Management Plan and notified the LPPRD that a draft of the APMP/LMP would be available for review by the August 5<sup>th</sup> meeting.
  - Anonymous Public Question Comment sheets were again passed out to all present and attendees were invited to write down any questions that they felt were not already addressed in the presentation.
  - Cason Land & Water Management, LLC also presented a proposal with monitoring services and costs to the LPPRD Board of Commissioners for review.
- 3. Sat. August 5<sup>th</sup>, 2023** – Final LMP planning meeting.
  - At this meeting, Lance Paden from Cason Land & Water Management, LLC presented the final APMP/LMP to the LPPRD membership for review for approval to submit it to WI DNR for their feedback and any plan finalization revisions that may be requested. Additionally considerable time was spent reviewing the written comments that had been received during the first and second planning meetings. They also provided additional written comments/questions and we answered additional questions from members.

## HISTORICAL AQUATIC PLANT CONDITIONS

Historically, Lake Puckaway has been very nutrient rich and was characterized by having low water clarity and high turbidity, this characterization is also known as being hypereutrophic. High turbidity has historically limited the amount of sunlight that is able to penetrate the water column which in turn limits where aquatic plants are capable of colonizing. As of 2015, Aquatic plant studies indicated that Lake Puckaway was sparsely vegetated. In 2015, at the time of adopting the most recent Comprehensive Lake Management Plan, increasing the plant population within the lake was thought to likely result in the most significant improvements to Lake Puckaway's health.

By historically having a largely turbid lake system, the lake was therefore experiencing limited distributions of all forms of aquatic plants. This is critical to the understanding of how the lake has changed rather rapidly over the last several years to its current state of being overwhelmed with AIS like EWM/HWM.

In past years, the limited aquatic plant community of Lake Puckaway resulted in:

- Abundant nutrient availability for fueling algal blooms.
- Reduced aesthetics caused by highly turbid water and algal blooms.
- Limited habitat availability for waterfowl and shorebirds.
- Lake sediments were easily resuspended due to wind and wave action.
- Reduced habitat for species which comprise the base of the ecological food chain in the lake (i.e. zooplankton, aquatic invertebrates, and aquatic macroinvertebrates).

As the lake shifted into having more and more aquatic plants growing in its' shallow areas each year, water clarity also increased because of the nutrients being up taken into those plants and sediments being held in place rather than resuspended easily. This process eventually reached the point where sunlight penetration into the water and nutrient availability within the lakes' sediments created sufficiently ample conditions for optimal aquatic plant growth.

## HISTORICAL PLANT MANAGEMENT

### Chemical Treatment

According to the 2015 Aquatic Plant Management Plan, Lake Puckaway P&R District has not previously needed large-scale chemical treatments to control aquatic plants, invasive or native. Smaller more limited dockside treatments have been used around the lake in some cases, however.

Photo 1: Eurasian Watermilfoil (Invasive Species)



Photo 2: Curly-Leaf Pondweed (Invasive Species)



## Mechanical Harvesting

Lake Puckaway tried the use of a harvester in 2022 to attempt to maintain navigational lanes in the western basin. Historically the turbidity of Lake Puckaway naturally reduced light penetration within the lake, thus reducing the frequency of occurrence of aquatic plants throughout the lake. Harvesting in 2022 had minimal success as noted by the lake residents. This is most likely due to not starting harvesting operations until plant growth was already well established, making it very difficult for the harvester to keep up with plant growth as intended.

## GOALS

LPPRD's goals are to preserve and enhance the lake. This includes its water quality, ecology, fisheries, and wildlife. They plan to do this by targeting invasive and nuisance macrophytes while minimizing the impacts to native species and to preserve and maintain safe recreational use of Lake Puckaway. To achieve these goals, the district has commissioned this Adaptive Aquatic Plant Management Plan as an update to their 2015 Comprehensive Lake Management Plan.

The LPPRD generally desires to:

- Control exotic and nuisance species by:
  - Using selective herbicides to reduce EWM/HWM in the densest areas to create navigational opportunities.
  - Utilizing non-selective herbicide mixtures in nearshore and dockside applications where water depth prevents mechanical harvesting as a viable option.
  - Promote native aquatic plant biodiversity by reducing AIS species within the lake.
  - Utilize mechanical harvesting in combination with aquatic herbicides to maintain a system of navigation lanes in both nearshore and offshore areas along the south end of the western basin in 2024.
- Preserve and enhance the natural lake environment by:
  - Educate landowners and lake users about healthy lake ecology.
  - Working with local governments to develop and enforce ordinances to protect Lake Puckaway.
  - Encourage homeowners to restore native shorelines, where possible.
  - Continuing to improve the watershed to protect Lake Puckaway.
- Conduct in-lake integrated pest management activities with the long-range goal of minimizing management to the greatest extent possible by:
  - Conducting annual AIS meandering surveys to track changes in distribution.
  - Conduct system-wide point-intercept surveys every five years to track plant community diversity.
  - Track progress of treatment efficacy via sub-polygon point-intercept surveys to help refine drift potential and dosage rates for best results.

- Continue water quality monitoring to assist in documenting the results of management strategies.
- Identify and expand local educational efforts to improve the public's understanding of lake issues by:
  - Distributing LPPRD updates and maintaining publicly available information on their website.
  - Encouraging community participation in lake management activities.

**Specific Goals and Metrics of success for Aquatic herbicide use:**

- *ProcellaCOR treatment areas*: Year-of-treatment success will be determined if the EWM/HWM is reduced below nuisance levels within the treatment areas. Nuisance levels will be defined as the invasive watermilfoil occupying greater than 50% of the water column in 1 contiguous acre or greater than 10% of the Management Area. This is the terminology used for the Extended Control Contract on qualifying treatment areas.
  - Treatment Areas will also be monitored using sub-polygon Point-Intercept methods to provide more quantitative data for statistical analysis of aquatic plant diversity. The gradient of success versus failure from those surveys will be determined by the Frequency of Occurrence of EWM/HWM showing statistically significant decreases and statistically significant increases for native aquatic plant species. Failure would be indicated by eradication of native aquatic plant species in the second and third years of monitoring following ProcellaCOR treatment and/or no effect on the abundance of EWM/HWM within the treatment area.
- *Non-selective aquatic herbicide navigation lane treatments*: These treatments utilize non-selective aquatic herbicides to target all nuisance aquatic plants within specifically defined navigation lanes or dock-treatments, these types of treatments would only be used in near-shore areas too shallow for the mechanical harvesters to reach effectively. Success would be evident by the ability of lake users to navigate through those lanes without aquatic vegetation impairments. Failed treatments would be those where the plants do not die back following treatment. However, these types of treatments are only intended to provide short-term relief and an aggressive growing season could necessitate multiple applications to maintain navigability.




**Specific Goals and Metrics of success for Aquatic Harvester use:**

- The success of an aquatic harvesting program will be evident by lake users' ability to navigate through the specifically defined navigation lanes that the harvester is maintaining throughout the season. Failure of an aquatic harvesting program would be the inability of the harvester to maintain operations and keep the designated navigation lanes free of aquatic vegetation impairments. The most likely reasons for failure will be over-ambitious control areas and that will be difficult to predict based on logistics until we see how the first harvester operates in the 2024 season. Additional harvesters, operators, truck drivers, and maintenance mechanics will most likely be necessary to maintain all navigation lanes the LPPRD desires to operate in future years.

## METHODS

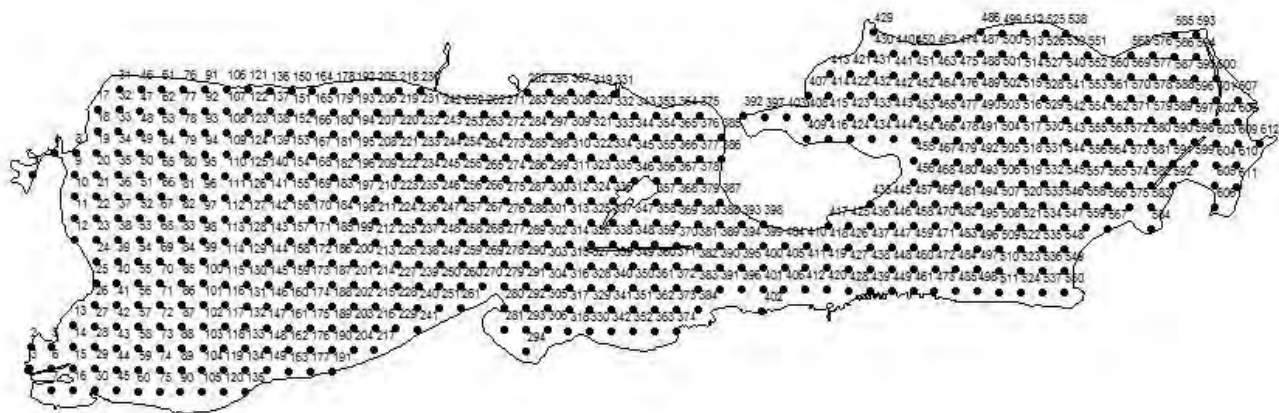
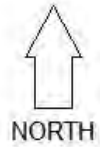
### Point-Intercept Aquatic Plant Surveys

In July of 2022, a Point-Intercept aquatic plant survey was conducted by Onterra, LLC on Lake Puckaway utilizing methods developed by the WDNR. The WDNR develops point-intercept plant survey for Aquatic Plant Management Plans with a series of grid points mapped across the lake (**Figure 2**). At each point on the map, a single rake tow will be used to collect aquatic plants. The rake head will consist of two standard bow rakes welded together. At depths of 15 feet or less, a double rake head attached to a pole was used to collect a sample; a double rake head on a rope was used for depths greater than 15 feet. An overall rake fullness rating was recorded that best estimates the total coverage of plants on the rake using the criteria established by the WDNR: 1 - few, 2 - moderate, 3 – abundant (**Figure 3**). All plants collected were identified to genus and species whenever possible and recorded. An abundance rating was given for each species collected as well (**Figure 3**). Plant species adjacent to the boat (within six feet), but not found on the rake were recorded as *visual* observations. In addition, water depth and dominant sediment type were recorded at each site. Data collected was then used to determine species composition and diversity, percent frequency and floristic quality. Distribution maps were also developed from this data for Eurasian watermilfoil and the top seven native aquatic plants found in the lake.

Rake Fullness Rating	Coverage	Description
1		Only few plants. There are not enough plants to entirely cover the length of the rake head in a single layer.
2		There are enough plants to cover the length of the rake head in a single layer, but not enough to fully cover the tines.
3		The rake is completely covered, and tines are not visible.

**Figure 2. Plant abundance rating criteria used in submergent aquatic plant point-intercept surveys developed by the Wisconsin Department of Natural Resources.**

Sampling maps created using the 24K hydro layer available from the WDNR in spring 2015. We suggest checking these maps against the most recent aerial imagery or by field verification. If major discrepancies exist, please notify DNR Baseline Aquatic Plants Survey at DNRBASELINEAQUATICPLANTS@wisconsin.gov.



Puckaway Lake  
Green Lake County  
WBIC 158700  
5013.4 Acres  
612 Sampling Points  
182m between points

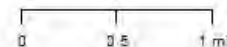


Figure 3. Point-Intercept survey grid provided by WDNR.

### **Aquatic Invasive Species Distribution Mapping (Meandering)**

It is important to survey annually for invasive species which can cause harm to a lake's ecosystem. Eurasian watermilfoil (*Myriophyllum spicatum*, EWM) has been verified and vouchered in Lake Puckaway since 1984 and is still present currently. Hybrid Eurasian/Northern watermilfoil was verified and vouchered in 2015 in Lake Puckaway and is also still present currently. To best manage aquatic invasive species in Lake Puckaway like EWM/HWM, current detailed mapping surveys are needed each year to track the spread of this aggressive invasive species. Eurasian watermilfoil and its' hybrids continue to grow throughout the mid-late season. Late summer/fall surveys are the best time to locate and map this species. Another invasive species, Curly-leaf pondweed (*Potamogeton crispus*, CLP) has been verified in Lake Puckaway since 1995. CLP grows early in the spring and typically dies off during the summer (accounting for low frequencies of occurrence during summer PI Surveys. As a result, it will be important to conduct invasive species mapping surveys each spring for CLP as well. Once found during the survey, the locations, plant densities, acreage, and water depths of invasive plant beds are recorded.

### **AIS Herbicide Treatments**

Once target areas are identified from aquatic plant survey data for treatment, a treatment plan is developed in conjunction with the LPPRD, Wisconsin DNR, and a licensed and insured aquatic applicator such as Cason Land & Water Management, LLC. The preferred method of developing a treatment plan is to identify the distribution and density of AIS for treatment. This is typically done using AIS Distribution Mapping (or Meandering) survey data. These surveys map the extent of defined beds more accurately than Point-Intercept surveys when PI sampling points are very far apart on large lakes. Cason Land & Water Management, LLC can then use GIS software such as ArcGIS Pro to calculate surface acres and volumetric calculations required for herbicide treatment planning. Additionally for large-scale treatments, geo-referenced application transect routes are also generated to apply the chosen aquatic herbicide at a specific application rate across the entire treatment area. The aquatic herbicide is applied using an advanced treatment boat equipped with a 125gl tank, pumps, and injection hoses (**Appendix G**). The injection hoses allow the applicator to apply the herbicide below the surface of the water, reducing the risk of aerial drift that could be a concern when aquatic herbicides are applied using more traditional spray hoses.

### **Water Quality Monitoring**

Water clarity, measured with a Secchi disc, is not a chemical property of water. However, it is a physical parameter used as an indicator of water quality. Secchi disc readings are taken on the downwind, shaded side of the boat. The disc is lowered until it disappears, then is raised until it is just visible. This process was repeated three times, and the average deepest visible depth of the Secchi disk is then recorded. As depth readings can be affected by waves, angle of the sun and cloud cover, an effort is made to take readings only on calm sunny days. Water samples are also collected and sent off to a laboratory for analysis of Chlorophyll a, Total Phosphorus,

All water quality data available for Lake Puckaway can be accessed via the WDNR's Surface Water Data Viewer. The Wisconsin Lake Modeling Suite (WiLMS) is used to predict the trophic state of Lake Puckaway given its area, the watershed area, mean depth, and eco-region.

## RESULTS & DISCUSSION

### 2022 POINT-INTERCEPT SURVEY

In July 2022, Onterra conducted a Point-Intercept (PI) survey of Lake Puckaway. During this survey, 25 species were identified (**Table 1**). The 2020 PI survey identified 39 species and the 2015 PI survey identified 26 species. When comparing the species abundance observed from 2022, to these two other most recent PI surveys of Lake Puckaway, there appears to have been a decline of 14 species from 2020 to 2022. This drastic decline seems unlikely, so this difference is likely due to differences in observer sampling bias.

When comparing statistical variation from survey year to survey year, we compared the 2022 PI survey results to that of the 2015 results (**Table 2**) and results from the 2020 PI survey (**Table 3**). The Percent Frequency of EWM/HWM increased from 5.5% in 2015 to 18.8% in 2022 (**Table 2**). During the same period two native aquatic plants increased in statistically significant ways, Common Waterweed and Southern Naiad. Conversely, American Lotus and White-Water Lily statistically decreased from 2015 to 2022 on Lake Puckaway (**Table 2**). The Percent Frequency of EWM/HWM increased from 7% in 2020 to 18.8% in 2022, indicating a rapid change in AIS abundance within Lake Puckaway (**Table 3**). Small Pondweed was the only native aquatic plant species to statistically increase in Percent Frequency from 2020 to 2022 (**Table 3**).

Additionally, it is noteworthy that Curly-leaf Pondweed (CLP), which was not observed during the 2015 survey has now been observed in both the 2020 and 2022 surveys, albeit at low frequencies of occurrence in the summer months when the PI surveys are conducted. This is important to note because CLP is another extremely aggressive AIS species that flourishes early in the year and it will be important to monitor in the future.



**Table 1. Aquatic Plant Species Present during the 2022, 2020, and 2015 Point-Intercept Surveys of Lake Puckaway (X = Present).**

<b>Scientific Name</b>	<b>Common Name</b>	<b>2022</b>	<b>2020</b>	<b>2015</b>
<i>Bulboschoenus fluviatilis</i>	River bulrush		X	
<i>Ceratophyllum demersum</i>	Coontail	X	X	X
<i>Chara sp.</i>	Muskgrasses	X	X	X
<i>Eleocharis acicularis</i>	Hardstem Bulrush			X
<i>Elodea canadensis</i>	Elodea	X	X	X
<i>Elodea nuttalli</i>	Free-flowered Waterweed	X	X	
<i>Heteranthera dubia</i>	Water Star-grass	X	X	X
<i>Lemna minor</i>	Small Duckweed	X	X	X
<i>Lemna triscula</i>	Forked Duckweed	X	X	X
<i>Lemna Turionifera</i>	Turion duckweed	X	X	
<b><i>M. Spicatum</i></b>	<b>Eurasian Watermilfoil</b>	<b>X</b>	<b>X</b>	<b>X</b>
<i>Myriophyllum sibiricum</i>	Northern Watermilfoil	X	X	X
<i>Najas flexilis</i>	Slender Naiad	X	X	X
<i>Najas guadalupensis</i>	Southern Naiad	X	X	X
<i>Najas marina</i>	Spiny Naiad			
<i>Najas minor</i>	Brittle Naiad		X	X
<i>Nelumbo lutea</i>	American Lotus	X	X	X
<i>Nitella sp.</i>	Nitella			
<i>Nuphar sp.</i>	Bullhead water lily			
<i>Nuphar variagata</i>	Spatterdock	X	X	X
<i>Nymphaea odorata</i>	White water lily		X	X
<i>P. bertoldii</i>	Slender pondweed		X	
<i>Persicaria amphibia</i>	Water smartweed		X	
<i>Phragmites australis australis</i>	Common reed		X	
<i>Potamogeton amplifolius</i>	Large-leaf pondweed			
<b><i>Potamogeton crispus</i></b>	<b>Curly-leaf pondweed</b>	<b>X</b>	<b>X</b>	
<i>Potamogeton foliosus</i>	Leafy pondweed		X	
<i>Potamogeton friesii</i>	Fries pondweed		X	
<i>Potamogeton gramineus</i>	Variable pondweed		X	
<i>Potamogeton illinoensis</i>	Illinois pondweed			
<i>Potamogeton natans</i>	Floating-leaf pondweed			X
<i>Potamogeton nodosus</i>	Long-leaf pondweed	X	X	
<i>Potamogeton praelongus</i>	White-stem pondweed			
<i>Potamogeton pusillus</i>	Small pondweed	X	X	X
<i>Potamogeton richardsonii</i>	Clasping-leaf pondweed	X	X	
<i>Potamogeton robbinsii</i>	Fern pondweed			

<i>Potamogeton strictifolius</i>	Stiff pondweed	X	X	X
<i>Potamogeton zosterformis</i>	Flat-stem pondweed	X	X	
<i>Ranunculus aquatilis</i>	White water crowfoot	X		
<i>Sagittaria rigida</i>	Arrowhead		X	X
<i>Schoenoplectus acutus</i>	Hardstem Bulrush		X	X
<i>Schoenoplectus pungens</i>	Three-square rush		X	
<i>Scirpus sp.</i>	Bulrush			
<i>Sparganium sp.</i>	Common Bur-reed		X	
<i>Spirodela polyrhiza</i>	Large duckweed	X	X	X
<i>Stuckenia pectinata</i>	Sago pondweed	X	X	X
<i>Typha sp.</i>	Cattail		X	
<i>Utricularia vulgaris</i>	Great Bladderwort			X
<i>Vallisneria americana</i>	Water celery	X	X	x
<i>Wolffia spp.</i>	Watermeal	X	X	X
<i>Zannichellia palustris</i>	Horned pondweed		X	X
<i>Zizania sp.</i>	Wild rice		X	
<i>Zosterella dubia</i>	Water star grass			
	Filamentous algae	X	X	X
	Freshwater sponge			X

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**Table 2. Results of point-intercept surveys conducted by Onterra in July 2015, and July 2022 for Lake Puckaway. Plants are organized by 2022 percent frequency, with the highest frequency first. Green rows indicate a significant increase and red rows indicate a significant decrease in plant occurrence from 2015-2022. Invasive plants are indicated with red text.**

Common Name	Scientific Name	Percent Frequency		Significant Change	Increase (I) or Decrease (D)
		2015	2022		
Common Waterweed	<i>Elodea canadensis</i>	10.3	23.2	**	I
<b>Eurasian watermilfoil</b>	<b><i>Myriophyllum spicatum</i></b>	<b>5.5</b>	<b>18.8</b>	<b>***</b>	<b>I</b>
Coontail	<i>Ceratophyllum demersum</i>	17.9	15.3	n.s.	I
Southern Naiad	<i>Najas guadalupensis</i>	1.7	10.5	**	I
Forked duckweed	<i>Lemna triscula</i>	4.1	6.1	n.s.	I
Slender Naiad	<i>Najas flexilis</i>	5.8	6	n.s.	I
Wild celery	<i>Vallisneria americana</i>	10	5.2	n.s.	D
Small Pondweed	<i>Potamogeton pusillus</i>	3.4	3.6	n.s.	I
Sago Pondweed	<i>Stuckenia pectinata</i>	5.8	3.6	n.s.	D
Filamentous algae		0.3	2.6	n.s.	I
Water Star-Grass	<i>Heteranthera dubia</i>	4.1	1.6	n.s.	D
Turion duckweed	<i>Lemna turionifera</i>		1.2	n.s.	I
Free-flowered Waterweed	<i>Elodea nuttalli</i>		0.9	n.s.	I
Watermeal	<i>Wolffia</i> spp.	0.7	0.8	n.s.	I
Lesser duckweed	<i>Lemna minor</i>	1	0.6	n.s.	D
Flatstem Pondweed	<i>Potamogeton zosteriformis</i>		0.6	n.s.	I
Northern watermilfoil	<i>Myriophyllum sibiricum</i>	0.7	0.4	n.s.	D
Muskgrasses	<i>Chara</i>	1.7	0.4	n.s.	D
<b>Curly-leaf Pondweed</b>	<b><i>Potamogeton crispus</i></b>		<b>0.4</b>	<b>n.s.</b>	<b>I</b>
American lotus	<i>Nelumbo lutea</i>	8.9	0.3	*	D
Stiff Pondweed	<i>Potamogeton strictifolius</i>	0.7	0.2	n.s.	D
Clasping-leaf Pondweed	<i>Potamogeton richardsonii</i>		0.2	n.s.	I
Greater duckweed	<i>Spirodela polyrhiza</i>	1	0.1	n.s.	D
Spatterdock	<i>Nuphar variegata</i>	2.1	0.1	n.s.	D
Long-leaf Pondweed	<i>Potamogeton nodosus</i>		0.1	n.s.	I
White Water-Crowfoot	<i>Ranunculus aquatilis</i>		0.1	n.s.	I
Floating-leaf Pondweed	<i>Potamogeton natans</i>	0.3		n.s.	D
Hardstem Bulrush	<i>Schoenoplectus acutus</i>	0.3		n.s.	D
Freshwater sponge		0.3		n.s.	D
Needle Spikerush	<i>Eleocharis acicularis</i>	0.7		n.s.	D
Common Bladderwort	<i>Utricularia vulgaris</i>	0.7		n.s.	D
Stiff Arrowhead	<i>Sagittaria rigida</i>	1.4		n.s.	D
Horned Pondweed	<i>Zannichellia paulustris</i>	2.1		n.s.	D
<b>Brittle Naiad</b>	<b><i>Najas minor</i></b>	<b>3.1</b>		<b>n.s.</b>	<b>D</b>
White Water Lily	<i>Nymphaea odorata</i>	5.8		*	D

**Table 3. Results of point-intercept surveys conducted by Onterra in July 2020, and July 2022 for Lake Puckaway. Plants are organized by 2022 percent frequency, with the highest frequency first. Green rows indicate a significant increase and red rows indicate a significant decrease in plant occurrence from 2020-2022. Invasive plants are indicated with red text.**

Common Name	Scientific Name	Percent Frequency		Significant Change	Increase (I) or Decrease (D)
		2020	2022		
Common Waterweed	<i>Elodea canadensis</i>	18.7	23.2	n.s.	I
<b>Eurasian watermilfoil</b>	<b><i>Myriophyllum spicatum</i></b>	<b>7</b>	<b>18.8</b>	<b>**</b>	<b>I</b>
Coontail	<i>Ceratophyllum demersum</i>	17.4	15.3	n.s.	I
Southern Naiad	<i>Najas guadalupensis</i>	7	10.5	n.s.	I
Forked duckweed	<i>Lemna triscula</i>	4.1	6.1	n.s.	I
Slender Naiad	<i>Najas flexilis</i>	3.2	6	n.s.	I
Wild celery	<i>Vallisneria americana</i>	6.3	5.2	n.s.	I
Small Pondweed	<i>Potamogeton pusillus</i>	0.4	3.6	*	I
Sago Pondweed	<i>Stuckenia pectinata</i>	3.2	3.6	n.s.	I
Filamentous algae		0.5	2.6	n.s.	I
Water Star-Grass	<i>Heteranthera dubia</i>	4.6	1.6	n.s.	D
Turion duckweed	<i>Lemna turionifera</i>		1.2	n.s.	I
Free-flowered Waterweed	<i>Elodea nuttalli</i>	4	0.9	n.s.	D
Watermeal	<i>Wolffia</i> spp.	5.8	0.8	n.s.	D
Lesser duckweed	<i>Lemna minor</i>	0.8	0.6	n.s.	I
Flatstem Pondweed	<i>Potamogeton zosteriformis</i>	2.2	0.6	n.s.	D
Northern watermilfoil	<i>Myriophyllum sibiricum</i>	0.6	0.4	n.s.	D
Muskgrasses	<i>Chara</i>	0.4	0.4	n.s.	I
<b>Curly-leaf Pondweed</b>	<b><i>Potamogeton crispus</i></b>	<b>0.5</b>	<b>0.4</b>	<b>n.s.</b>	<b>I</b>
American lotus	<i>Nelumbo lutea</i>	1.4	0.3	n.s.	D
Stiff Pondweed	<i>Potamogeton strictifolius</i>	3.4	0.2	n.s.	D
Clasping-leaf Pondweed	<i>Potamogeton richardsonii</i>	0.2	0.2	n.s.	I
Greater duckweed	<i>Spirodela polyrhiza</i>	1.4	0.1	n.s.	D
Spatterdock	<i>Nuphar variegata</i>	0.7	0.1	n.s.	D
Long-leaf Pondweed	<i>Potamogeton nodosus</i>	0.2	0.1	n.s.	D
White Water-Crowfoot	<i>Ranunculus aquatilis</i>		0.1	n.s.	I
Hardstem Bulrush	<i>Schoenoplectus acutus</i>	0.2		n.s.	D
Horned Pondweed	<i>Zannichellia paulustris</i>	0.1		n.s.	D
<b>Brittle Naiad</b>	<b><i>Najas minor</i></b>	<b>0.1</b>		<b>n.s.</b>	<b>D</b>
White Water Lily	<i>Nymphaea odorata</i>	0.5		n.s.	D
Common bur-reed	<i>Sparganium</i> sp.	0.1		n.s.	D
Cattail spp.	<i>Typha</i>	0.1		n.s.	D
River bulrush	<i>Bolboschoenus fluviatilis</i>	0.1		n.s.	D
Common reed	<i>Phragmites australis australis</i>	0.2		n.s.	D
Water smartweed	<i>Persicaria amphibia</i>	0.1		n.s.	D
Slender Pondweed	<i>Potamogeton bertoldii</i>	2.9		n.s.	D
Leafy Pondweed	<i>Potamogeton foliosus</i>	0.8		n.s.	D
Fries' Pondweed	<i>Potamogeton friesii</i>	0.4		n.s.	D
Variable-leaved Pondweed	<i>Potamogeton gramineus</i>	0.1		n.s.	D
Three-square rush	<i>Schoenoplectus pungens</i>	0.1		n.s.	D
Wild rice	<i>Zizania</i> sp.	0.1		n.s.	D
Stiff arrowhead	<i>Sagittaria rigida</i>	0.3		n.s.	D

## 2022 FALL AQUATIC INVASIVE SPECIES SURVEY

On September 15-16, 2022, Onterra, LLC conducted an Aquatic Plant Survey on Lake Puckaway. During the survey, Eurasian watermilfoil and its' hybrids (hereafter referred to just as EWM) were mapped out. In the table below, EWM acreages found during that survey are listed by density:

**Table 4. Eurasian watermilfoil acreage by density (2022 Fall AIS Survey).**

Densities	EWM Surveyed (Acres)
Scattered	1672
Dominant	1142.6
Highly Dominant	294.5
Surface Matted	308.5
<b>Total Acreage:</b>	<b>3417.6</b>

A high percentage of Lake Puckaway is relatively shallow and clear, this provides ample habitat for aquatic plants to grow, especially EWM (**Table 4**). They observed EWM in ~68% of Lake Puckaway (**Appendix B**).

## 2023 FALL AQUATIC INVASIVE SPECIES SURVEY

On August 15-16, 2023, Cason Land & Water Management, LLC conducted an Aquatic Plant Survey on Lake Puckaway. During the survey, Eurasian watermilfoil, and its' hybrids (hereafter referred to just as EWM) were mapped out. In the table below, EWM acreages found during that survey are listed by density:

**Table 5. Eurasian watermilfoil acreage by density (2023 Fall AIS Survey).**

Densities	EWM/HWM Acres
Dense	1,302.7
Moderately Dense	861.1
Scattered	1,453.5
Highly Scattered	1,210.9
<b>Total EWM/HWM Acreage:</b>	<b>4,828.2</b>

EWM was observed at varying densities throughout much of Lake Puckaway during the survey. EWM has expanded its' distribution dramatically since the 2022 survey was conducted. We identified EWM of varying density across 4,828.2 acres of the lakes' total area (5,013 acres; **Table 5**). We found dense beds have now expanded to 1,302.7 acres. Dense beds are those EWM/HWM beds which have either reached the surface in a dense mass or are dominating the aquatic plant community while remaining subsurface. An additional 861.1 acres of Moderately Dense EWM/HWM beds were identified. The Scattered (1,453.5 acres) and Highly Scattered (1,210.9 acres) categories comprise the rest of the EWM/HWM that was mapped across the lake in this survey. EWM was observed to be present in ~96% of Lake Puckaway (**Appendix L**).

We also closely assessed the distribution of EWM within the 2023 trial ProcellaCOR treatment area and surrounding 300ft buffer area. The treatment appeared to have been very successful within the treatment area itself at greatly reducing EWM. On the south and southwest side of the treatment polygon we did not see total control within a couple small areas of the treatment area. However, we observed substantial drift effects of the treatment, wherein EWM particularly to the north and northeast of the treatment area appeared to have impacted the EWM as far away as 570ft from the edge of the treatment area. This resulted in the 50-acre trial treatment providing obvious control of EWM across at least 91.25 acres (**Fig. 2-Appendix L**). In other words, the treatment provided 82.5% more control than intended due to drift effects. Based on how dense the EWM growth was already by the time of treatment, we can likely expect even better results in subsequent years using ProcellaCOR and targeting a treatment date that is several weeks earlier in the year.

### **2023 SUB-POLYGON POINT-INTERCEPT SURVEY**

On August 7th, 2023, Cason Land & Water Management, LLC. conducted a sub-polygon point-intercept survey on Lake Puckaway. This aquatic plant survey was developed in coordination with the Wisconsin DNR to better understand the effects of treating Eurasian/Hybrid watermilfoil in a large shallow lake system using the selective aquatic herbicide, ProcellaCOR. A trial treatment of 50 acres of EWM was performed on June 8th, 2023, and this survey serves as the first of 3 consecutive annual sub-polygon point-intercept surveys to be conducted within this treatment area. The goal of this survey is to quantify the extent to which EWM was impacted post-treatment in the initial treatment year. It will be important to continue to monitor this same location for the 2024 and 2025 seasons as well to monitor the response of native species to ProcellaCOR treatments on Lake Puckaway.

**Table 1-Appendix L.) All aquatic plant species observed during the 2023 Lake Puckaway sub-polygon PI survey, including BOTH the ProcellaCOR treatment area and a 300ft buffer zone surrounding the treatment area. (111 total sampling sites)**

Species	Scientific Name	Plant type: floating leaf, free floating, submergent, emergent	% Relative Frequency of Occurrence	Sites Found
Coontail	<i>Ceratophyllum demersum</i>	Submergent	45.8	77
Common waterweed	<i>Elodea canadensis</i>	Submergent	11.3	19
White water lily	<i>Nymphaea odorata</i>	Floating Leaf	0.6	1
Curly-leaf pondweed	<i>Potamogeton crispus</i>	Submergent	1.2	2
Eurasian watermilfoil	<i>Myriophyllum spicatum</i>	Submergent	28.6	48
Wild celery	<i>Vallisneria americana</i>	Submergent	2.4	4
Slender naiad	<i>Najas flexilis</i>	Submergent	8.3	14
Sago pondweed	<i>Stuckenia pectinata</i>	Submergent	Visuals Only	10
Variable pondweed	<i>Potamogeton gramineus</i>	Submergent	0.6	1
Forked duckweed	<i>Lemna trisulca</i>	Free Floating	0.6	1
Fries' pondweed	<i>Potamogeton friesii</i>	Submergent	0.6	1

Species Richness: 10

Species Richness (with visuals): 11

Simpson Diversity Index (D): 0.69

Floristic Quality Index (FQI): 15.9

Avg. Coefficient of Conservatism (C): 5.63

**Table 4-Appendix L.) A comparison of species observed during the 2023 Lake Puckaway sub-polygon PI survey, ONLY WITHIN the ProcellaCOR treatment area as compared to species observed in the same area during the 2022 whole lake PI survey.**

Species	Scientific Name	Treatment Area (Post Treatment; sub-polygon; 40 sample PI points)	Treatment Area (Pre-Treatment whole-lake; 7 sample PI Points)
		2023	2022
Coontail	<i>Ceratophyllum demersum</i>	Yes	Yes
Common waterweed	<i>Elodea canadensis</i>	Yes	No
Forked duckweed	<i>Lemna trisulca</i>	No	Yes
Eurasian Watermilfoil	<i>Myriophyllum spicatum</i>	Yes	Yes
Slender Naiad	<i>Najas flexilis</i>	Yes	No
White Water Lily	<i>Nymphaea odorata</i>	No	No
Curly-leaf Pondweed	<i>Potamogeton crispus</i>	No	No
Fries' Pondweed	<i>Potamogeton friesii</i>	No	No
Variable Pondweed	<i>Potamogeton gramineus</i>	No	No
Sago Pondweed	<i>Stuckenia pectinata</i>	Yes	No
Water Celery	<i>Vallisneria americana</i>	No	No
Watermeal	<i>Wolffia spp.</i>	No	Yes
<b>Total # Species Observed:</b>		<b>5</b>	<b>4</b>

**Table 5-Appendix L.) A comparison of species observed during the 2023 Lake Puckaway sub-polygon PI survey, within the 300ft buffer zone surrounding the treatment area, as compared to species observed in the same area during the 2022 whole lake PI survey.**

Species	Scientific Name	300ft Buffer Area (Post Treatment; sub-polygon; 71 sample PI points)	300ft Buffer Area (Pre-Treatment; whole-lake; 19 sample PI Points)
		2023	2022
Coontail	<i>Ceratophyllum demersum</i>	Yes	Yes
Common waterweed	<i>Elodea canadensis</i>	Yes	No
Forked duckweed	<i>Lemna trisulca</i>	Yes	Yes
Eurasian Watermilfoil	<i>Myriophyllum spicatum</i>	Yes	Yes
Slender Naiad	<i>Najas flexilis</i>	Yes	No
White Water Lily	<i>Nymphaea odorata</i>	Yes	No
Curly-leaf Pondweed	<i>Potamogeton crispus</i>	Yes	No
Fries' Pondweed	<i>Potamogeton friesii</i>	Yes	No
Variable Pondweed	<i>Potamogeton gramineus</i>	Yes	No
Sago Pondweed	<i>Stuckenia pectinata</i>	Yes	No
Water Celery	<i>Vallisneria americana</i>	Yes	No
Watermeal	<i>Wolffia spp.</i>	No	Yes
<b>Total # Species Observed:</b>		<b>11</b>	<b>4</b>



When considering aquatic plant sampling locations only within the ProcellaCOR treatment area, we observed a total of 5 submergent aquatic plant species at 39 sampling locations (**Table 4-Appendix L**). To determine the extent to which the ProcellaCOR treatment impacted the aquatic plant community outside of the treatment area, we examined a 300ft buffer zone surrounding the treatment area. Within this buffer zone, we observed 11 species in total, including the two major AIS: EWM and CLP.

While a valid direct statistical comparison of the pre-treatment plant community from the 2022 whole-lake PI survey to the present sub-polygon PI survey cannot be made (due to so few sample locations because of the greater PI spacing interval on the whole-lake PI survey), we can report on some general observations. During the 2023 sub-polygon PI survey of the treatment area, a total of 5 species were observed versus 4 observed in the 2022 whole-lake PI survey (**Table 4-Appendix L**). Also, a total of 11 species were observed within the 300ft buffer area surrounding the treatment area versus just 4 species observed there during the 2022 whole-lake PI survey (**Table 5-Appendix L**).

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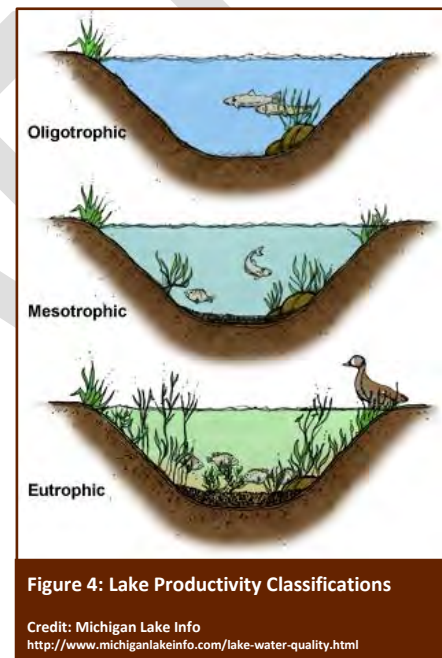
## WATER QUALITY MONITORING -

From 2020-2023, several of the best secchi depth readings ever taken since 1996 have been recorded each year at a depth of 6' or deeper (**Figure 11; Appendix E**). Additionally, in the last several years some of the lowest phosphorus and chlorophyll readings were also recorded, which are used to calculate numerical values for a lakes' trophic state index based on each parameter (**Figure 12, Appendix E**). Total phosphorus readings from the deep hole of the west basin of Lake Puckaway were also trending lower and lower each year (**Figures 13 & 14; Appendix E**).

As Lake Puckaway becomes more reestablished with aquatic plants, we can expect the excess nutrients in the lake to either be reduced from the water column due to being up taken by the aquatic plant community or sequestered in the sediments of the lake due in part to plants' root structures holding sediments in place better than bare lake bottoms thus preventing resuspension of nutrients by wave action and other water movements.

## TROPHIC STATE INDEX

Trophic State Index (TSI) is a measure of a lake's productivity (**Figure 4**). Trophic state takes into consideration water quality parameters such as total phosphorus, chlorophyll  $\alpha$ , and water clarity. A high TSI value means a highly productive lake and poor water quality, whereas a low TSI value is characteristic of a lake with low productivity and good water quality. A desired TSI value for good water quality in lakes is below 50. As calculated from the Deep Hole in the West Basin, Lake Puckaway had an average TSI value of 51.6 in 2022. The TSI suggests that Lake Puckaway was mesotrophic. Mesotrophic lakes are generally characterized by moderately clear water but have an increased chance of low dissolved oxygen in deep water during the summer. This represents a change in TSI from the previous hypereutrophic status that Lake Puckaway had been in prior to the reestablishment of many aquatic plant species within the lake.



## SUMMARY

- The frequency of occurrence of EWM/HWM in vegetated areas of the lake has increased by more than 44% between 2015 and 2022.
- EWM/HWM has become extremely widespread throughout the lake and continues to worsen each year.
- EWM/HWM is becoming a competitive threat to the native plant community and to the general health of the ecosystem.
- Yearly meandering surveys of the entire lake should be conducted in the spring and fall each year to monitor AIS populations carefully.
- Sub-polygon Point-Intercept surveys should be utilized to monitor treatment areas and help further refine each years' treatment plans in an adaptive approach, using the most recent data available to base decisions on.

## AQUATIC PLANT MANAGEMENT OPTIONS

### Herbicide Control

Herbicides have been the one of the most widely used and often successful tools for controlling aquatic macrophytes. Herbicide treatments require WDNR permitting, and herbicides must be applied by a licensed applicator (Cason Land & Water Management, LLC). The efficacy of herbicides is contingent upon timing, formulations and application rates, water flow, lake type and target and non-target species (Nault et al. 2012). The two most important variables to consider in determining herbicide effectiveness are the concentration and exposure time. Product can dissipate throughout the waterbody due to water flow, water depth, wind, and volume. The herbicide also degrades, or breaks down, over time and from microbial processes. Sunlight can also degrade herbicide into its components. There is a broad spectrum of herbicide formulations available to target invasive aquatic plants such as Eurasian watermilfoil and curly-leaf pondweed. These include 2, 4-D products (Navigate<sup>®</sup>, Sculpin G<sup>®</sup>, and Weedar<sup>®</sup>); diquat and endothall products (AquaStrike<sup>®</sup>, Aquathol K<sup>®</sup>, and Tribune<sup>®</sup>); fluridone products (Sonar<sup>®</sup>); and triclopyr products (Renovate<sup>®</sup>). A more recent addition to the aquatic herbicide toolbox in Wisconsin is a selective herbicide known as ProcellaCOR EC. In recent years, ProcellaCOR has become the tool of choice to selectively target submersed plants such as watermilfoil, hydrilla, and parrotfeather. ProcellaCOR is a Floryprauxifen-benzyl product produced by SePRO which has achieved an EPA registration classification as being a Reduced Risk product with very few water use restrictions compared to earlier generations of aquatic herbicides (**Appendix M**). The Wisconsin DNR has compiled a fact sheet that also has a lot of answers to commonly asked questions about ProcellaCOR as well (**Appendix N**).

Eurasian watermilfoil and curly-leaf pondweed are not the only plant species sensitive to herbicide applications. Some non-target species may experience statistically significant declines following an herbicide treatment (Nault et al. 2014). As a result of the potential for all herbicides to impact non-target species, herbicide treatment effectiveness can be bolstered if applied during the appropriate season. Exotic species typically emerge prior to native vegetation. At earlier stages of growth, plants are more actively absorbing nutrients, and therefore, are more vulnerable to herbicide. Since most native plants are still dormant, native plants are less likely to be affected by the treatment. Since water temperatures are cooler, microbial degradation is slower and exposure time is extended. In the spring, plant biomass is also lower, which mitigates the possibility of detrimental effects from the decomposition of large amounts of organic matter, namely, low dissolved oxygen, release of nutrients and subsequent algae blooms.

### Manual Vegetation Removal

Manual removal options include raking, hand-pulling, Diver Assisted Suction Harvesting (DASH), and aquatic mechanical harvesters. Individuals can remove aquatic vegetation in front of their homes, however, there are limitations as to where plants can be raked/hand-pulled and how much can be removed. In most instances, control of native aquatic plants is discouraged and is limited to areas next to piers and docks and in navigational lanes. When aquatic vegetation is manually removed by homeowners, it is restricted to an area that is 30 feet or less in width along the shore. Aquatic invasive species (Eurasian watermilfoil, curly-leaf pondweed, etc.) may be manually removed beyond 30 feet

without a permit if native plants are not harmed. Manual removal of native plants beyond the 30-foot area would require an NR 109 permit. Raking or hand-pulling aquatic plants is labor intensive, and fragmentation may lead to further spread of some species such as Eurasian watermilfoil.

DASH involves a diver or snorkeler removing plants from the sediment and using a suction device to feed the plant into a harvester or other container. As with other similar activities, removal of the entire plant, including the stems and roots, is critical to eliminate the possibility of further spread and regrowth. There are firms in the state that specialize in DASH. As an alternative, some lake organizations have built their own DASH units and operate the units throughout the season. Variables to consider when planning DASH activities and selecting areas to harvest include plant bed size and density, water clarity, sediment type, native plant abundance, obstructions such as docks or fallen trees, financial resources, and time restraints. These variables determine the speed at which progress is made. DASH is a small-scale tool and should not be expected to greatly reduce Eurasian watermilfoil densities in areas of widespread growth. DASH operations should primarily focus on areas of scattered Eurasian watermilfoil not slated for chemical treatment or as a touch-up for regrowth in previously treated areas. However, DASH can be highly effective in managing and reducing curly-leaf pondweed as the plant is much more robust and does not reproduce via fragmentation, but through turions. If the curly-leaf pondweed can be removed prior to turion development and release, populations can achieve long-term controlled.

Mechanical aquatic harvesters, also known as aquatic weed cutters, are specially designed machines that remove aquatic vegetation from water bodies. They can play a useful role in aquatic plant management of water bodies where an Integrated Pest Management approach is desired. While variable, their primary functions typically include the following: Cutting blades or similar mechanism, debris collection mechanism to gather cut plants, and a conveyor belt with a storage hopper onboard. Mechanical harvesters such as this, can be used to clear navigation lanes, or cut the tops off of aquatic plants that grow up towards the surface of the water. Some of the pros to aquatic harvesters include: selectively targeted cutting (in areas of aquatic monocultures), immediate results, minimal ecological impact outside of the area of use, and that some models are customizable for various target species. Some of the cons associated with the use of aquatic harvesters include: the high cost of initial purchase and maintenance, limited reach (especially in areas with low water levels), the need for educated and skilled operators to avoid damaging the machine or causing non-target removal of native plants due to improper use, the requirement for on-shore conveyors to unload the collected debris, the need for haul trucks or tractors to remove the debris (as well as their associated costs), an appropriate debris disposal site, non-target by-catch impacts on fish, turtles, aquatic invertebrates, etc., and the potential for furthering the dispersal of aquatic plants which disperse by fragmentation such as EWM/HWM.

Additionally, when considering the use of aquatic harvesters, their effectiveness at control measures is directly related to the size of the area being harvested and the rate of aquatic vegetation growth. For example, immediately upriver, Buffalo Lake is utilizing a team of 4 harvesters to harvest 284 acres (per DNR comm.). Therefore, achieving success with aquatic harvesters on Lake Puckaway will require an adaptive management approach to determining what is the maximum area that a single harvester can maintain throughout the year and adjusting areas for harvesting accordingly for the next upcoming season. Early season harvesting will also help to stay on top of harvesting lanes versus trying to cut new lanes in established plant beds later in the active season.

Since the aquatic plants growing in Lake Puckaway have largely reached a level where they are causing navigational impediments to lake users in some areas of the lake (beyond just AIS nuisance issues), an aquatic harvester can be utilized to maintain some standardized navigation lanes throughout highly trafficked parts of the lake. For this reason, Cason Land & Water Management, LLC has developed some tentative navigation lane routes for Lake Puckaway should the LPPRD decide to invest in an aquatic harvester to help maintain some navigation lanes throughout the active season (**Appendix D**). The use of top-cutting EWM in certain off-shore areas of the lake, where desired, may provide additional help increasing treatment efficacy of aquatic herbicides, this remains to be seen if such an option will be viable on a large scale in Lake Puckaway. The primary goal of the aquatic harvester will be to maintain 100ft wide channels in the offshore areas of the lake. Narrower 25ft navigation lanes closer to shore can be maintained using non-selective aquatic herbicide mixes in the areas delineated as such in **Appendix D** maps.

## CONCLUSIONS AND RECOMMENDATIONS

### Aquatic Invasive Species

Lake Puckaway is a shallow, productive lake that creates ideal conditions for aquatic plant growth. A relatively recent explosion in abundance of EWM/HWM within the last several years on Lake Puckaway is causing significant issues for both the aquatic ecosystem as well as navigational and recreational problems for lake users. The current largest issue (besides generally low-water levels due to a drought year) is EWM/HWM rapidly expanding its' footprint within the lake.

With over 2,100 acres of combined Dense and Moderately Dense EWM/HWM beds mapped during the fall 2023 meandering survey, and another 2,600+ acres of Scattered and Highly Scattered EWM/HWM, there is no doubt that without substantial intervention, this problem will worsen and be around for the foreseeable future.

Lake Puckaway has been naturally trending towards becoming a more highly vegetated flowage rather than a turbid lake with low aquatic plant abundance. As a result, water clarity is steadily increasing as seen by Secchi disk readings (**Appendix E**). It is our opinion that the best way to deal with the EWM/HWM explosion is to selectively control it and subsequently allow the native aquatic plants to move in and replace the ecological niche that the EWM is currently outcompeting the native plants in.

Such a strategy will require a multi-year approach to strategically reduce the amount of EWM by using the selective aquatic herbicide, ProcellaCOR to treat the worst areas of the lake based on the most recent meandering survey's data. By starting out with a trial treatment of 50 acres in 2023 (in part of the worst bed of EWM on the lake), we aim to learn how effective ProcellaCOR is on EWM in this shallow lake, how the native plants respond over the next three years, and how much herbicide drift effects we get within the Lake Puckaway system. All this information will be critical to strategically reclaiming the lake from this aggressive aquatic invasive species.

In addition to treating large swaths of AIS on Lake Puckaway, it will be necessary to maintain navigation lanes throughout the lake for lake users to utilize. This can be achieved by a combined approach of

nearshore aquatic herbicide spraying of 20-ft wide navigation lanes and further offshore navigation lanes with sufficient depth and up to 100-ft wide, can be maintained using an aquatic plant harvester. The goal for 2024 is to mechanically harvest 51 acres along the south shore of the western basin. Also, dockside aquatic herbicide spraying can be utilized as requested in up to 30-ft wide swaths around docks.

In considering this an Adaptive Aquatic Plant Management Plan, we will conduct both annual sub-polygon Point-Intercept surveys of treated areas, as well as annual full lake meandering surveys to provide the most up to date data to base the next years' treatment areas and strategy on. The survey data combined with lake user needs will be utilized to create a treatment plan for the following year. Treatments will be considered effective when treatment polygons keep Eurasian watermilfoil below nuisance levels for 2 seasons after treatment. Nuisance level is when the invasive watermilfoil occupies more than 50% of the water column in >50% of the original treatment polygon. The overall effectiveness of treatments is dependent on maintaining adequate application rates and prescriptions provided by the technical specialists for the product(s) being used. The longevity of herbicide treatments may be reduced by the influx of EWM fragmentation of nearby mechanical harvesting efforts and boat traffic.

The 2024 herbicide treatment areas and proposed navigation lanes for harvesting were developed following both the sub-polygon Point-Intercept survey and the Meandering survey in August of 2023.

### **Clean Boats, Clean Waters**

A key component to controlling Aquatic Invasive Species (AIS) is education and prevention. The WDNR, in cooperation with the UW-Extension Lakes Program, has developed this volunteer watercraft inspection program designed to educate motivated lake organizations in preventing the spread of exotic plant and animal species among Wisconsin lakes. This program would be particularly useful for Lake Puckaway during the summer months when lake usage increases.

In 2008, the LPPRD began participating somewhat sporadically in the WDNR's Clean Boats, Clean Waters program (CBCW) each year. Since then, a total of 574 Boats have been inspected, 1,082 People have been contacted about the program on Lake Puckaway, and 441 hours have been spent on the program to date (**Appendix J**). The purpose of this program is to inspect boats and trailers entering and leaving participating waterbodies, to educate boaters on how to prevent spreading AIS, and distribute educational materials as applicable. Since 2020, no hours have been logged as a part of this program. Appendix J (**Figures 20-27**) depicts the total number of boats inspected, the total number of people contacted, and the total number of hours spent on the Clean Boats, Clean Waters program from its inception to 2023.

The LPPRD should once again train volunteers to monitor and stop the spread of invasive plants and animals. Not only does this program help reduce the likelihood of new invasive species being introduced to Lake Puckaway, but it also helps prevent the spread of invasive species from this lake to other waterbodies. Since education plays a big part in the CBCW program. LPPRD should make it a priority to include exotic species education during all normally scheduled meetings whenever possible. In addition, special meetings should be sponsored to train volunteers for this program.

Native northern watermilfoil is also present in Lake Puckaway. Native northern watermilfoil is known to hybridize with Eurasian watermilfoil; being aware of hybrid watermilfoil characteristics is necessary to properly differentiate between species. In addition to Eurasian watermilfoil and curly-leaf pondweed, it would be beneficial for LPPRD members to become familiar with the identification of other exotic species that pose a threat to Wisconsin lakes as well. Additional information and education materials are available through the WDNR and the local UW-Extension office.

### **Water Quality Management**

Lake Puckaway is impacted by non-point source pollution from nearby agricultural and urban land use practices within its watershed. The first step in managing nutrients in a lake is to control external sources of nutrients. Individual property owners should be encouraged by LPPRD to utilize shoreline improvement and nutrient management practices through presentations at meetings and in newsletters. However, since Lake Puckaway is known to have a high rate of internal nutrient cycling this is not the sole water quality issue to manage. Promoting better agricultural practices among farmers within the watershed would be a great starting point to reduce further large-scale nutrient inputs into the lake.

With a large amount of internal nutrients that have built up within the Lake Puckaway basin and increased water clarity due to lots of aquatic plants present, the best course of action is to promote the native plants through the reduction of AIS in order for those native plants to take up available nutrients rather than invasive plants such as EWM/HWM and CLP.

### **Lawn Care Practices**

Individuals are important in reducing sedimentation and nutrient inputs from local sources. Mowed grass up to the water's edge is detrimental for the well-being of a lake. A mowed lawn can cause seven times the amount of phosphorus and 18 times the amount of sediment to enter a waterbody than a natural shoreline (Korth, Dudiak, & Dudiak 2003). Lawn grasses also tend to have shallow root systems that cannot protect the shoreline from erosion as well as deeper-rooted native vegetation (Henderson, Dindorf, & Rozumalski 1998). Property owners should take care to keep leaves and grass clippings out of the lake whenever possible, as they contain nitrogen and phosphorus. The best disposal for organic matter, such as leaves and grass clippings, is composting.

Fertilizers that enter the lake will further encourage an increase in plant and algae biomass. Fertilizers contain nutrients that can wash directly into the lake. While elevated levels of phosphorus can cause unsightly algal blooms, nitrogen inputs have been shown to increase plant growth. Increases in plant biomass will lead to further sedimentation and navigational issues. Landowners are encouraged to perform a soil test before fertilizing. A soil test will help determine if a yard needs to be fertilized. For assistance in having soil tested, contact the local county UW-Extension office. Most lawns in Wisconsin do not need additional phosphorus. The numbers on a bag of fertilizer are the percentages of available nitrogen, phosphorus and potassium found in the bag. Phosphorus-free fertilizers will have a 0 for the middle number (e.g. 10-0-3). Since April 1, 2010, fertilizers containing phosphorus cannot be applied to

lawns or turf in Wisconsin. This change in the state's statutes is intended to provide protection to Wisconsin's water resources from phosphorus run-off.

### **Vegetated Buffer Zones**

There are beneficial alternatives to the traditional mowed lawn. When possible, it is best to leave the natural shoreline undisturbed, but if clearing is necessary to access or view the lake, consider selective vegetation removal. If the natural shoreline has been disturbed or removed, restoring the natural areas to the greatest extent practical would have a positive impact on the lake's overall health.

Shoreline vegetation serves as an important filter against nutrient loading, traps loose sediment and plays a key role in bank stabilization. Additionally, a vegetated buffer zone provides excellent fish and wildlife habitat, including nesting sites for birds, and spawning habitat for fish (Jennings et al. 1999). A buffer zone consists of a mixture of native trees, shrubs and other upland and aquatic plants that may extend from 25 to 100 feet or more from the water's edge onto land, and 25 to 50 feet into the water. Often a buffer to this extent is not feasible, either physically or economically. In these cases, a smaller or narrower buffer can still provide the same benefits of a more extensive buffer on a smaller scale. The goal for a buffer zone should be to cover between 50% and 75% of the shoreline frontage. In most cases, this 50% and 75% would leave space for a dock, swimming area and lawn. Providing complex shoreline habitats can result in significant increases in fish diversity and numbers, as well as increasing lake health.

Several resources are available to assist property owners in creating beneficial buffer zones. These include the WDNR, local UW-Extension office and the County Land and Water Conservation Department. These organizations can provide descriptions of beneficial native plant species and listings of aquatic nurseries in the state. Kenosha County and the WDNR have grant programs that can be utilized for funding sources. Cason & Associates provides native plantings as one of our many services. Contact us for quotes.

The WDNR offers grant funds through the Healthy Lakes Program. Healthy Lakes practices focus on simple ways to improve fish habitat, integrate native plantings, divert and clean runoff water and promote natural beauty. Options include fish sticks, native plantings, diversion, rain garden, and rock infiltration practices. Fish sticks and native plantings help create habitat for fish and wildlife and provide pleasing aesthetics. Diversion, rain garden and rock infiltration practices capture and redirect runoff and reduce soil erosion. A total of one thousand dollars can be awarded per practice. A recognized lake district or association can sponsor the grant for participating individual property owners.

The Lake Puckaway Protection and Rehabilitation District should encourage all lakefront residents to improve their shorelines by installing vegetated buffers (**photos 5 & 6**), rain gardens and water diversions to improve the water quality of Lake Puckaway.

### **Erosion Control**

Although erosion is a natural process, erosion should be controlled and slowed as much as possible, both for the health of the lake and the benefit of the landowner. Sediment transport into the lake causes nutrient pollution, turbid water conditions, degrades fish spawning habitat and increases eutrophication.



Shoreline owners are encouraged to leave existing vegetation undisturbed to stabilize the shore. The placement of logs, brush mats and rock riprap are also options against erosion. Desirable shrubs and aquatic plants should be planted within riprap, which will serve as nutrient filters and habitat. Before any shoreline stabilization project is initiated, property owners need to contact the local WDNR office for project approval and to obtain any necessary permits.

### **Reduced Impacts from Boating**

Boat traffic can increase suspended solids, especially in shallow areas of lakes (Hill 2004). Maximum turbidity occurs between 2 and 24 hours following boating activities. Effects of boating depend upon propeller size, boat speed, draft, and sediment characteristics (Asplund & Cook 1999). Silty sediments have the highest susceptibility to resuspension and the highest potential for the reintroduction of nutrients into the water column. No significant changes in algae (chlorophyll *a*) concentrations have been reported following boating activity. This is due primarily to an indeterminate time lag which occurs between the release of nutrients and the subsequent increase in algal growth (Asplund 1996).

Mechanical fragmentation and disturbances to the native plant communities from watercrafts can accelerate the spread of opportunistic exotic plant species. Wisconsin statutes require boaters to maintain no-wake speeds within 100 feet of shorelines, other boats, or fixed structures, including boat docks and swimming platforms. However, it is difficult to enforce such regulations, and even slow boat traffic can have a negative impact on sediments and plant communities in shallow areas. Operating in shallow areas not only has a negative impact on the lake, but shallow conditions can also damage boat propellers and motors. Education is vital to reducing the impacts from boat traffic.

### **Septic System Maintenance**

Septic systems are known to contribute nutrients to a lake. It is the responsibility of lakeshore property owners to ensure that septic systems are properly functioning. A failing septic system can contaminate both surface and ground water. Many counties in Wisconsin are currently taking inventory of septic systems and enrolling the systems in a three-year maintenance program. Property owners should avoid flushing toxic chemicals into septic systems, which can harm important bacteria that live in the tank and naturally break down wastes. Owners should also avoid planting trees, compacting soil or directing additional surface runoff on top of the drain field.

### **Wisconsin Citizen Lake Monitoring Network**

The LPPRD should once again assign some willing volunteers from their membership to participate in this program. This is a great way to get riparian owners and other interested volunteers engaged in active lake management activities. The program teaches volunteers to collect water quality samples, conduct secchi disk readings, and generally collect data used in reporting on the status of the lake and comparing how a particular lake is doing by looking at data collected from other nearby lakes in the same region.

## MANAGEMENT ACTIVITIES IMPLEMENTATION PLAN

The following management activities are/have been recommended for implementation beginning in 2023. As part of an adaptive management plan, we intend to conduct extensive monitoring of the aquatic plant community each year via meandering surveys and targeted sub-polygon surveys of treatment areas in order to guide each successive years' management strategy. It is expected that achieving EWM/HWM control goals will require a stepwise process of yearly selective EWM treatments and mechanical harvesting of navigation lanes meet this objective in the lake without destroying Lake Pickaway's native plant community.

### 2023 Treatment

- Eurasian/hybrid watermilfoil (EWM/HWM) trial treatment of 50 acres (identified as priority areas from Fall 2022 meandering survey) in June 2023 using ProcellaCOR®
  - *Timeline for implementation:* Spring 2023 (Once EWM/HWM active growth is confirmed and permit conditions are met.) **COMPLETED**

### Aquatic Plant Surveys

- Sub-polygon Point-Intercept Survey of 2023 treatment area and 300' surrounding buffer zone
  - The first of 3 consecutive years of sub-polygon point-intercept surveys is to be conducted on the spring 2023 EWM/HWM treatment area to determine treatment efficacy and native plant impacts approximately three months after the initial treatment.
    - *Timeline for implementation:* August 2023 **COMPLETED**
- A system-wide AIS survey for EWM/HWM should be conducted to identify and map areas of EWM/HWM growth.
  - The results of this survey will be used to guide 2024 management activities and identify priority areas for treatment. A proposed 2024 treatment area and plan will be developed directly from this data. (We typically recommend scheduling this survey later in the season so more accurate EWM/HWM acreages and densities are observed due to continued growth of EWM/HWM into the fall, however to keep things progressing with the grant timeline and proposed 2024 activities, we will be conducting this survey several weeks earlier than would be recommended in a typical year for management activities the following year.)
    - *Timeline for implementation:* August 2023 **COMPLETED**

### Grant Applications

- Develop and submit a pre-application for a AIS Large-Scale Population Management grant through the DNR Surface Water Grant Program.
  - *Deadline:* September 15<sup>th</sup>, 2024
- Work with DNR APM Coordinator to finalize the grant application materials.
  - *Deadline:* November 15<sup>th</sup>, 2024

### Aquatic Plant Harvesting

- Purchase an Aquatic plant harvester and shore-based conveyor
  - *Timeline for implementation:* Fall 2023 **COMPLETED**
- Identify appropriate Harvester offloading site on the south Shore for 2024 harvesting needs
  - *Timeline for implementation:* Winter 2023/2024 **COMPLETED**
- Identify nearby farmers to accept harvested plant material for 2024 harvesting needs
  - *Timeline for implementation:* Winter 2023/2024 **COMPLETED**, [David & Jodi Kohn deposition coordinates: 43.7424211, -89.1473241]
- Hire operator(s)
  - *Timeline for implementation:* Winter/early Spring 2024 **IN PROGRESS**
- Begin Harvesting main channels of navigation lanes
  - *Timeline for implementation:* Spring 2024

### 2024 Treatment and Harvesting-

#### (Potential Treatment areas based on 2023 EWM survey data and available budget, Appendix L)

- Eurasian/hybrid watermilfoil (EWM/HWM) treatment of ~100-200 acres (identified as priority areas from Fall 2023 meandering survey) in May 2024 using ProcellaCOR®, exact 2024 treatment areas will focus on the southwest shore primarily with additional treatment areas in dependent on available LPPRD funds. In 2024 and following years, the priority areas are classified as the areas where EWM/HWM is the densest and/or causes the most recreational impediments (this will be determined by survey results). The Western end of Lake Puckaway will be the initial target of large-scale treatments to maintain an open area in the center of the lake with the purpose of providing adequate space for recreational watercraft activities. The treatment of the recreational area will be shifted yearly to provide the most usable space for boaters and avoid treating the same areas of the lake multiple years in a row. This approach follows the ProcellaCOR product label as well as recommendations from SePRO technical specialists.
  - *Timeline for implementation:* Spring 2024 (Once EWM/HWM active growth is confirmed, and permit conditions are met, approximately May)
- Use of the aquatic plant harvester in 2024 will focus efforts on the southwestern shoreline navigation lanes, totaling approximately 51 acres of control area. The LPPRD will be experimenting with early season harvesting to attempt to stay ahead of plant growth. The LPPRD expects to have one harvester, 2 conveyers on the shore, and a dump truck available for use. Harvesting will require a 2-man team for each day of harvesting and there will likely be 4 operators running the operation 4-5 days per week.
- Near-shore non-selective aquatic herbicide navigation lane treatments may be required dependent on mid- to late-season plant growth and water levels that might restrict the reach of the aquatic harvester. The need for these in the 2024 season will be determined by the LPPRD board and harvester operators. These may be coupled with non-selective dock treatments as well. Based on the Fall 2023 Meandering survey, a nearshore ProcellaCOR treatment may be sufficient to not require any treatments such as these in 2024 due to the density of EWM/HWM that was observed along the southwest shore.

**Water Quality Monitoring**

- The LPPRD volunteers and Wisconsin DNR personnel to continue collecting and recording data for water clarity (Secchi disk depth), dissolved oxygen, Total Phosphorus, Chlorophyll *a* and temperature Lake Puckaway.
  - *Timeline for implementation:* 2023 & 2024

**2024 Annual Update to Adaptive APMP**

- As part of an adaptive strategy for the Adaptive APMP of Lake Puckaway, an update will be developed based on 2024 treatment efficacy, monitoring surveys, and other relevant factors in order to maximize the effectiveness of the 2025 strategy.
  - *Timeline for implementation:* Winter 2024/2025

**Future Aquatic Plant Management (beyond 2024)**

- Each year's treatment strategy will be revised annually using an adaptive management approach to increase the efficacy of the next years' management strategies and consider new data and published science as it becomes available. Since lakes and their conditions are constantly changing it makes the most sense to be as adaptive as possible each year. Within 3yrs of the implementation of this plan, we anticipate resolving all nearshore EWM navigation impairments on Lake Puckaway and have implemented a harvesting program sufficient to maintain major navigation routes.
- Based on each years' meandering surveys, sub-polygon point-intercept surveys, budgets, and the desires of the LPPRD and lake users, the next year's treatment areas and harvesting regime can be adjusted accordingly.
- Total eradication of EWM in Lake Puckaway is unrealistic. A goal of reducing navigational and recreational impairments particularly in the densest patches of EWM around the lake each year, is however a very realistic starting goal for actively managing AIS in Lake Puckaway. The densest areas (based on the 2023 EWM mapping survey) are currently predominantly in the western and mid basins of the lake.
- The LPPRD intends to acquire 2 additional aquatic harvesters and supporting equipment within the next 10yrs to begin a long-term navigation lane harvesting program. These will be purchased using an appropriate combination of the LPPRD General Fund, tax levy increases, loan(s) from the Commission of Public Lands Funds, and Wisconsin DNR grants (if awarded) as deemed necessary by the LPPRD Board.
  - *Timeline for implementation:* Winter 2025/2026 to Fall 2028

**General Management Activities Timeline for next 5yrs of Adaptive Plant Management on Lake Puckaway.**

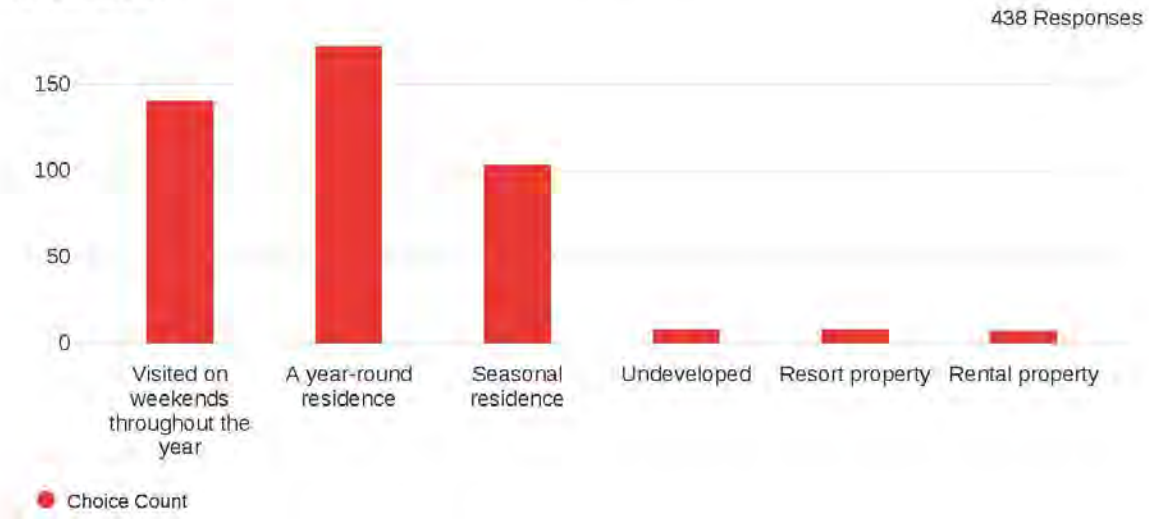
	2024	2025	2026	2027	2028
<b>Winter</b>	Prior Years' Data Analyses, Annual APM Report Update, Adaptive APM Planning, Permitting	Prior Years' Data Analyses, Annual APM Report Update, Adaptive APM Planning, Permitting	Prior Years' Data Analyses, Annual APM Report Update, Adaptive APM Planning, Permitting	Prior Years' Data Analyses, Annual APM Report Update, Adaptive APM Planning, Permitting	Prior Years' Data Analyses, Annual APM Report Update, Adaptive APM Planning, Permitting
<b>Spring</b>	Conduct Permitted EWM Treatment(s), Harvesting Begins	Conduct Permitted EWM Treatment(s), Harvesting Begins	Conduct Permitted EWM Treatment(s), Harvesting Begins	Conduct Permitted EWM Treatment(s), Harvesting Begins	Conduct Permitted EWM Treatment(s), Harvesting Begins
<b>Summer</b>	Sub-polygon PI Survey of '23 (2 <sup>nd</sup> year of monitoring) Treatment Area and '24 Year of Treatment Sub-PI Surveys, Harvesting Continues, Near-shore Navigation Lane Treatments as needed	Sub-polygon PI Survey of '23 (3 <sup>rd</sup> year of monitoring) and '24 (2 <sup>nd</sup> year of monitoring) Treatment Areas, Harvesting Continues, Near-shore Navigation Lane Treatments as needed	Sub-polygon PI Survey of '24 (3 <sup>rd</sup> year of monitoring) Treatment Areas, Harvesting Continues, Near-shore Navigation Lane Treatments as needed	Whole-lake Point Intercept Survey, Harvesting Continues, Near-shore Navigation Lane Treatments as needed	Harvesting Continues, Near-shore Navigation Lane Treatments as needed
<b>Fall</b>	EWM Meandering Survey, Harvesting Continues	EWM Meandering Survey, Harvesting Continues	EWM Meandering Survey, Harvesting Continues	EWM Meandering Survey, Harvesting Continues	EWM Meandering Survey, Harvesting Continues

The above table represents the major activities for each season for the next 5-years. We expect to modify and update this table on an as-needed basis each Winter using the most recent data available at the time to make modifications to the proposed treatment plans and harvesting areas. Additional tasks may be added as deemed necessary or required by Wisconsin DNR.

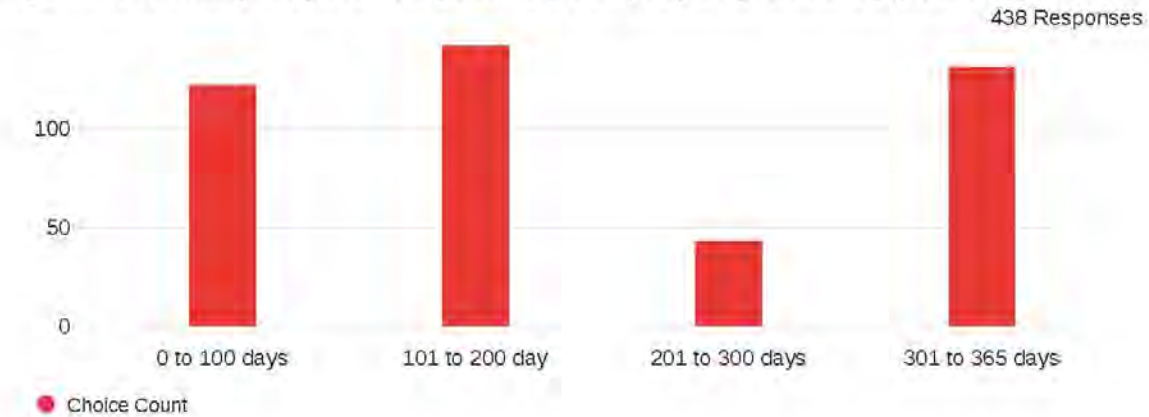
## APPENDIX A

### 2023 Lake User Survey Results

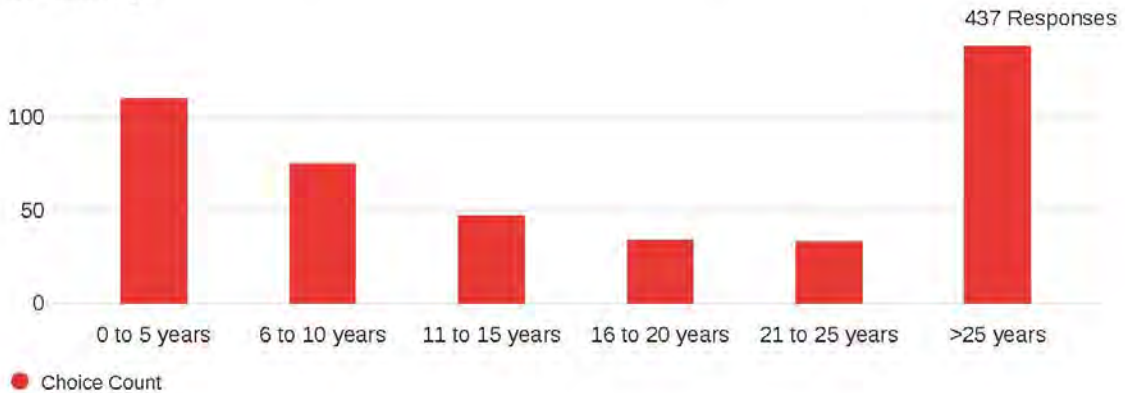
### Q1 - What best describes how your property on or near Lake Puckaway is utilized?



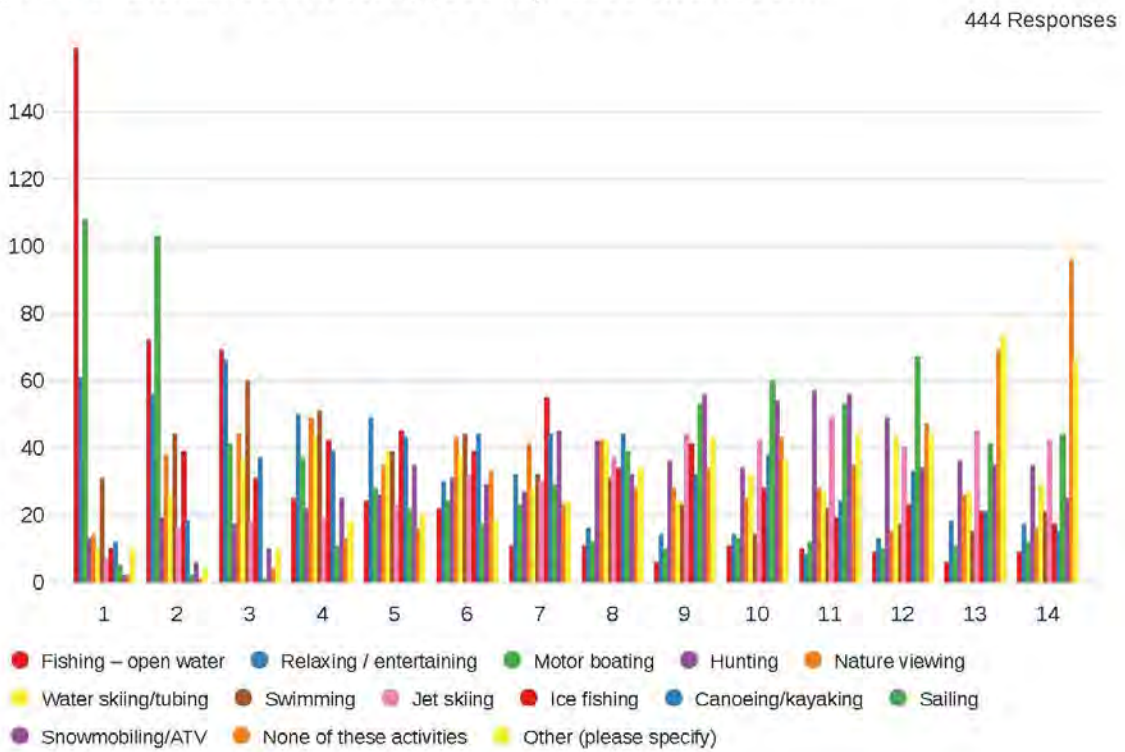
### Q2 - How many days each year is your property used by you or others?



### Q3 - How long have you owned or rented your property on Lake Puckaway?



### Q4 - For the list below, rank your top three activities...





## Q4\_TEXT - Other (please specify)

Other (please specify) - Text

Farming pastures

You

Leave the lake alone!!!!!!!

Homestead/Family History/Heart/Everything

I work at an establishment on the lake, so it is very important to me

Family time

Boating

the community areas

pontoon boating

The beach area

Boating

Pontooning

Ability to boat to the restaurants on the lake

Peace and quiet

Pontooning/Friends

Paddle board

Fishing - open water

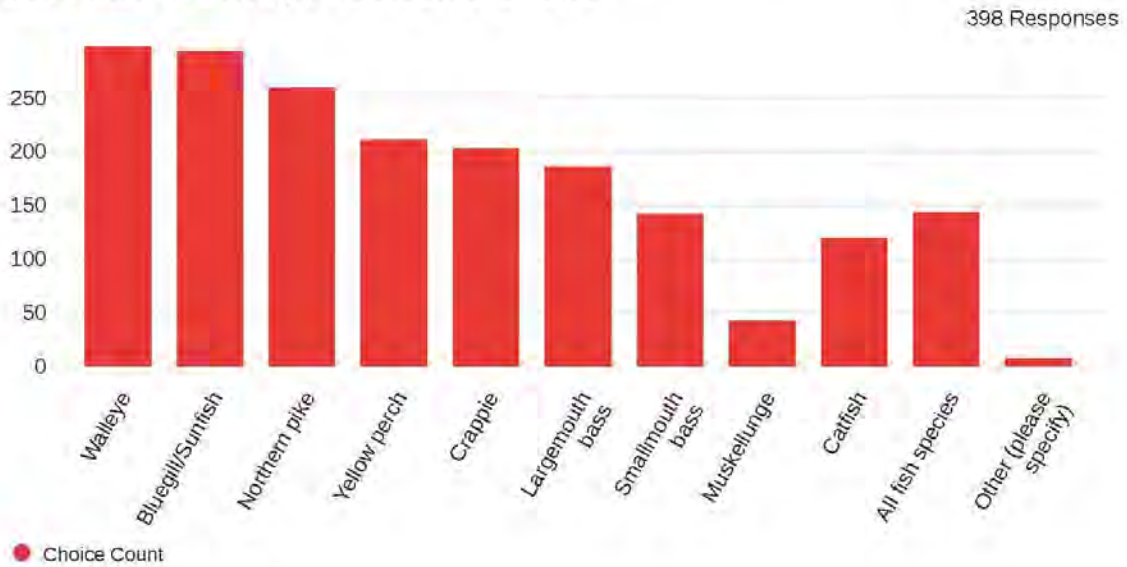
sense of well being

Waterfowl management

### Q5 - Have you fished on Lake Puckaway in the last 5 years?



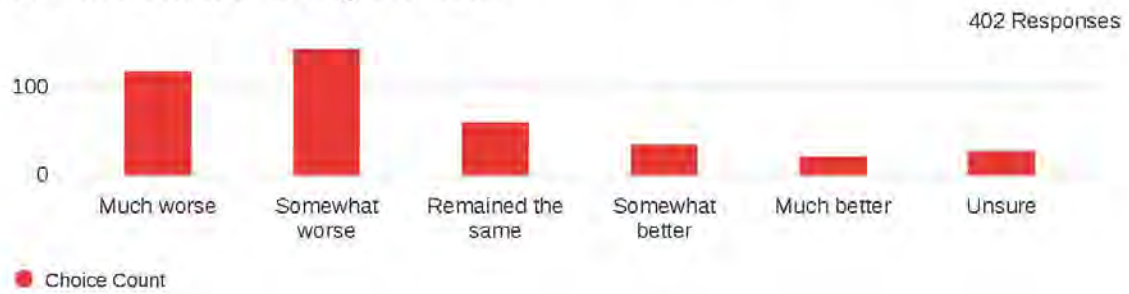
### Q6 - What species of fish do you like to catch on Lake Puckaway? (Select all that apply) - Selected Choice



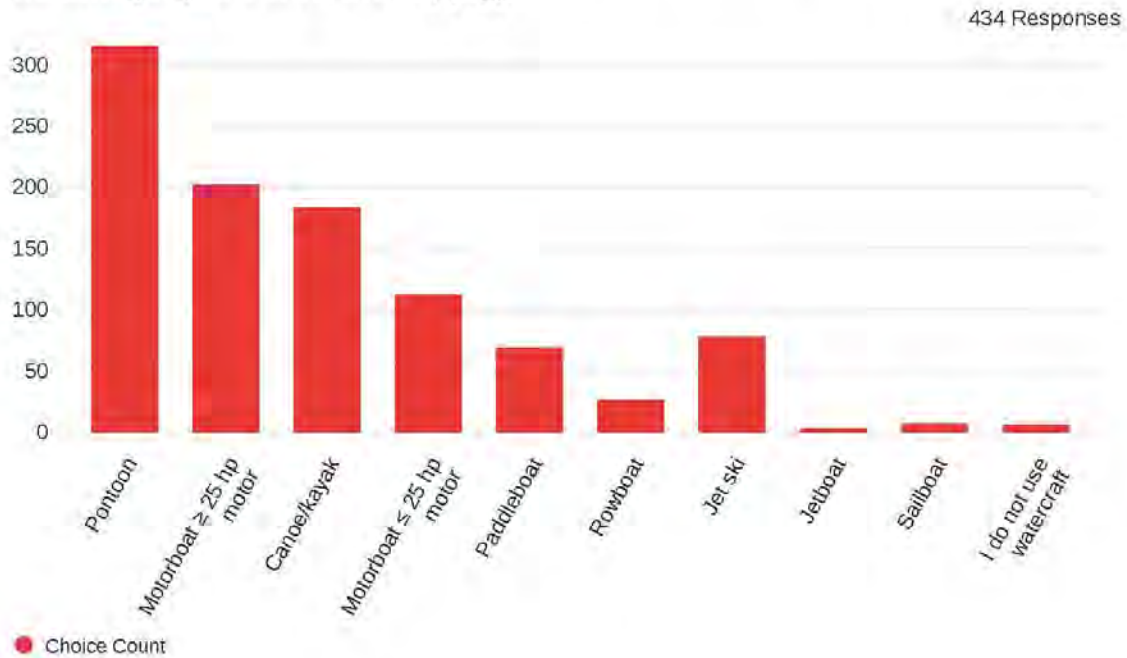
### Q7 - How would you describe the current quality of fishing on Lake Puckaway?



### Q8 - How has the quality of fishing on Lake Puckaway changed since you have started fishing the lake?



Q9 - What types of watercraft, if any, do you currently use on Lake Puckaway? (Select all that apply)



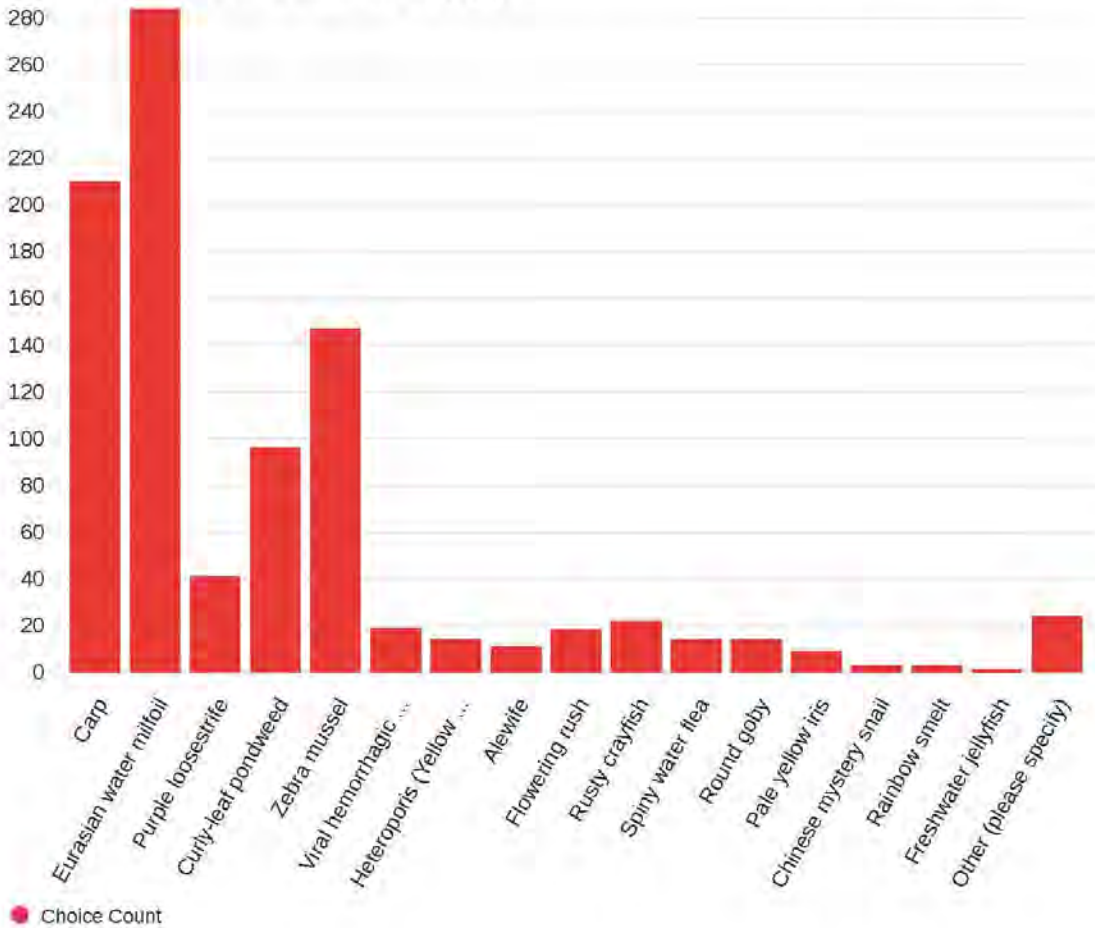
Q10 - Aquatic Invasive Species (AIS) are non-native plants or animals that can out-compete their native counterparts and can potentially cause many problems within the lake and/or an ecosystem. Prior to receiving this survey, had you heard of the term Aquatic Invasive Species?



Q11 - Do you believe aquatic invasive species are present within Lake Puckaway?



Q12 - Which aquatic invasive species do you believe are in Lake Puckaway? (Select all that apply)



### Q12\_21\_TEXT - Other (please specify)

Other (please specify) - Text

Duck weed

other but unsure of names

Water Lillie's

Reed. Canary grass

Not sure what it is. The lake is horrible with weeds

Weeds a lot

Not sure

Brittle Waternymph,Hybrid Eurasian / Northern Water-Milfoil

Narrow leaf cattail; phragmites

Celery

seaweed or whatever the tall weeds are have OVER GROWN our lake.

Not sure but the weeds are terrible and will no longer use our boat on it! Destroyed our motor

The weeds that are growing

Milfold

Highbred Eurasian northern water milfoil

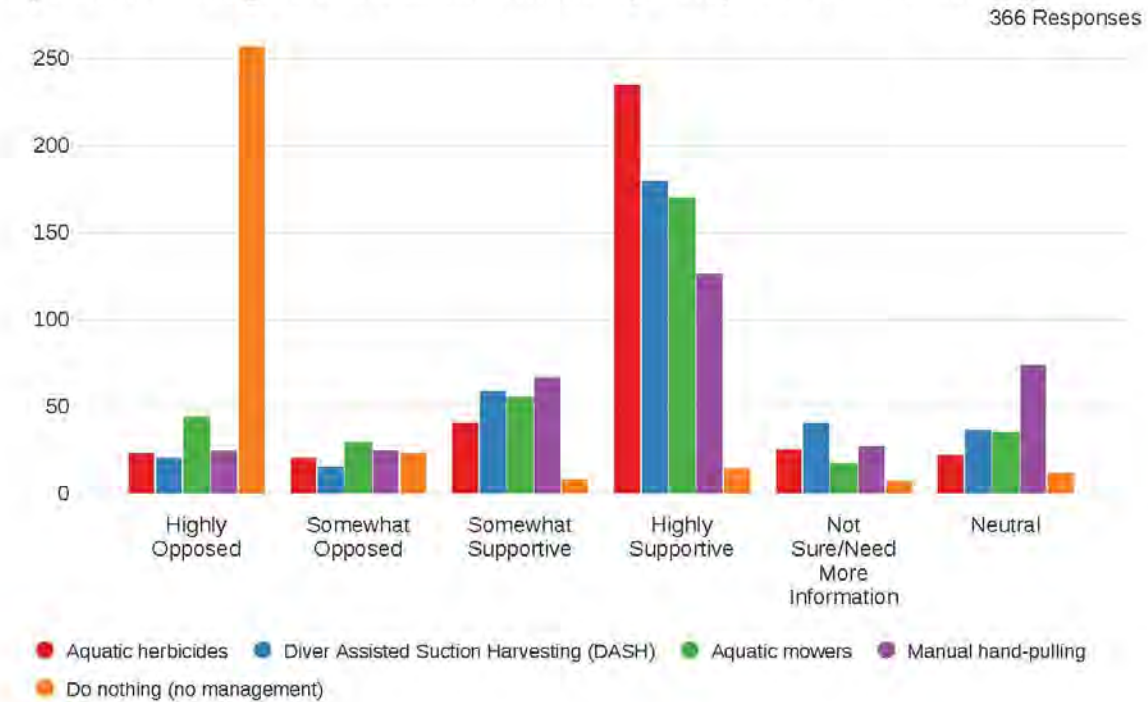
Phragmites

Not sure of all plant changes but recreational activities now suck

Not sure if fish are?

Unfamiliar with all these spieces

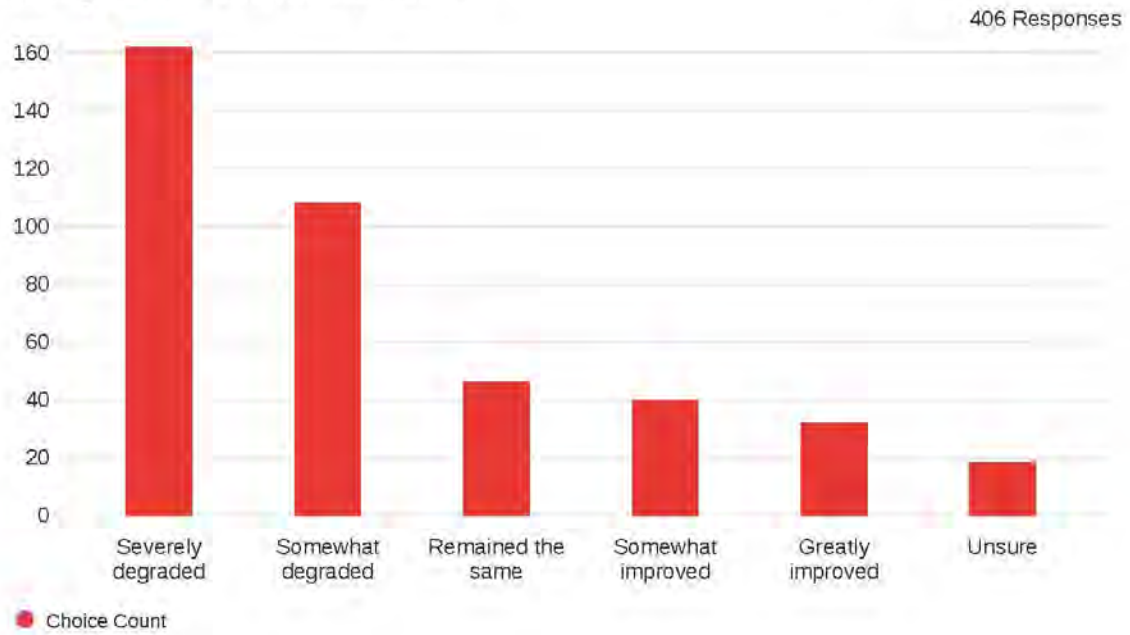
Q13 - For each of the following aquatic plant management options, please indicate the extent to which you would oppose or support the option to manage Eurasian watermilfoil (EWM) on Lake Puckaway.



Q14 - How would you describe the current water quality of Lake Puckaway?



### Q15 - How has the current water quality changed in Lake Puckaway since you first visited the lake?

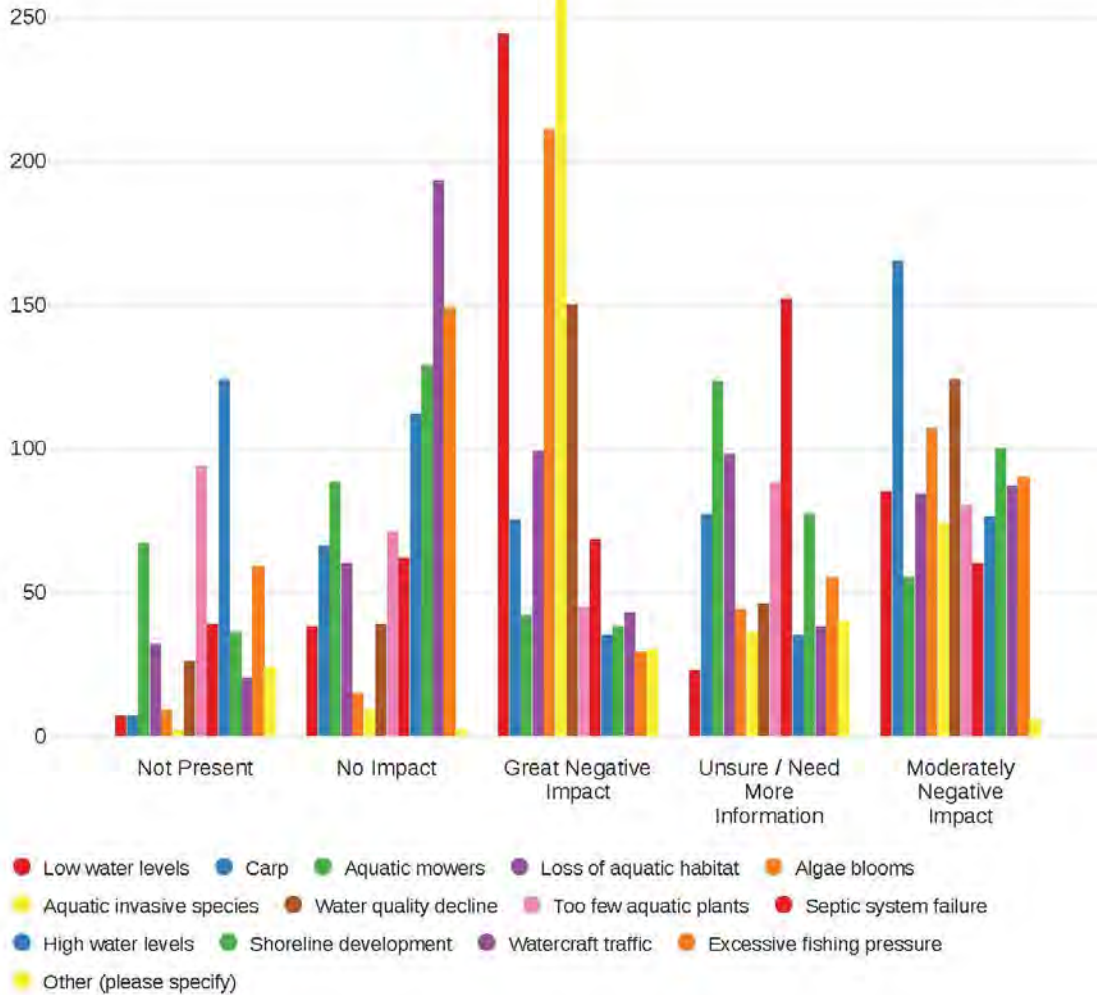


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Q16 - To what level do you believe each of the following factors may currently be...

405 Responses



## Q16\_15\_TEXT - Other (please specify) - Text

Other (please specify) - Text

High water

Mowing without harvesting

Should have No fishing midnight to 4 am

To many weeds

Leave the lake alone

Agricultural and residential run-off

The water level of s being kept low and the lake is being taken over by the plant life( weeds or whatever is overgrown). Can't even fish the plant life is above the water and the algae was terrible last year. Could hardly use the lake. Put more water in our LAKE !!

Lake too low

the new dam

To many weeds

Puckaway people Facebook page

Underwater structure

Water level consistency

local runoff causing heavy sediment intrusion effecting water quality and excess nitrogen over time

Can't get boat out do to weeds

Social media-facebook negative comments

To many weeds

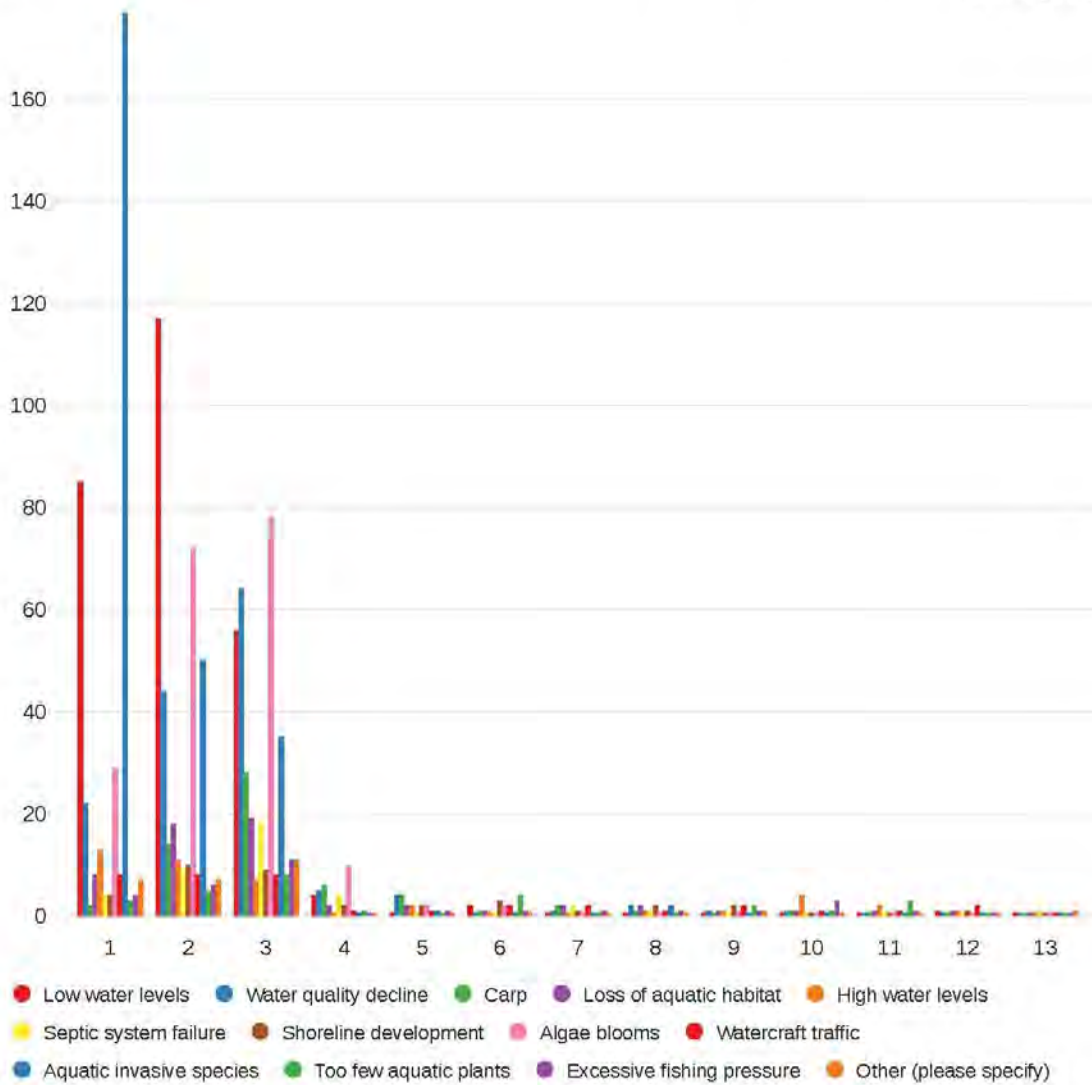
Too many weeds. Cant use lake anymore

Milfoil overtake. Higher water level for boat/fishing, carp to eat bad plants when young

Excessive weeds have choked out our ability to. Use the lake for most any activities.

### Q17 - From the list below, please rank your top three concerns...

357 Responses



## Q17\_13\_TEXT - Other (please specify)

Other (please specify) - Text

It's a river not a lake

To many weeds

weeds

To much weeds

alot of weeds

bow fisherman at night

Weeds

To many weeds!!

Stupid rich people and real estate agents whom think a wetland flowage can be green lake. If thier neighbors give them enough money.

Weeds

Too many weeds

Narrow focus of Lake District Board

Weed density

Inability to get pontoon off lift

Whoever you have running the gates needs to be more qualified and have to answers to somebody higher up and must have a reason or the facts to save that that would improve the quality of the lake because I believe 100% that the low water level in the months of April May and June brought on this whole weed harvest thing.

Weeds

Weeds! Cannot swim or boat

The weeds are biggest concern

To many weeds

Birds

### Q18 - Do you believe the management of Buffalo Lake impacts various aspects of the Lake Puckaway ecosystem?



### Q19 - If you responded “yes” to the previous question, indicate below what aspects you believe are impacted. (Select all that apply) - Selected Choice

If you responded “yes” to the previous question, indicate below what aspects you believe are impacted. (Select all that apply) - Selected Choice

Water levels, Aquatic plant abundance

Water levels, Water quality, Aquatic invasive species, Aquatic plant abundance

Water levels, Aquatic plant abundance

Other (please specify)

Water quality, Aquatic invasive species, Aquatic plant abundance, Shoreline erosion

Other (please specify)

Water levels, Water quality, Aquatic invasive species, Aquatic plant abundance, Shoreline erosion

Water quality, Aquatic invasive species, Aquatic plant abundance

Water levels

Water levels, Water quality, Aquatic invasive species, Aquatic plant abundance, Shoreline erosion

Water quality, Aquatic invasive species, Aquatic plant abundance

Water quality, Aquatic invasive species, Aquatic plant abundance

Water quality, Aquatic invasive species

Water quality, Aquatic invasive species, Aquatic plant abundance, Shoreline erosion

- Aquatic plant abundance
- Water levels, Aquatic invasive species
- Water levels, Water quality, Aquatic invasive species, Aquatic plant abundance
- Aquatic plant abundance
- Water levels, Aquatic invasive species
- Water levels, Water quality, Aquatic invasive species

### Q20 - Do you believe the management of Lake Puckaway impacts various aspects of the Fox River downstream of Lake Puckaway?



### Q21 - If you responded "yes" to the previous question, indicate below what aspects you believe are impacted. (Select all that apply) - Selected Choice

If you responded "yes" to the previous question, indicate below what aspects you believe are impacted. (Select all that apply) - Selected Choice

- Water levels, Water quality, Aquatic plant abundance
- Water levels, Water quality, Aquatic invasive species, Aquatic plant abundance, Shoreline erosion
- Water levels
- Water levels, Water quality, Aquatic invasive species
- Water quality, Aquatic invasive species, Shoreline erosion

Water levels

Water levels, Water quality, Aquatic invasive species, Aquatic plant abundance, Shoreline erosion

Water levels, Water quality, Aquatic invasive species, Aquatic plant abundance, Shoreline erosion

Water levels

Water quality, Aquatic invasive species, Aquatic plant abundance

Water levels, Water quality, Aquatic invasive species, Aquatic plant abundance, Shoreline erosion

Water quality, Aquatic invasive species

Water levels, Aquatic invasive species, Aquatic plant abundance

Water levels, Water quality, Aquatic invasive species, Aquatic plant abundance

Water quality

Water quality

Water levels, Water quality, Aquatic invasive species, Shoreline erosion

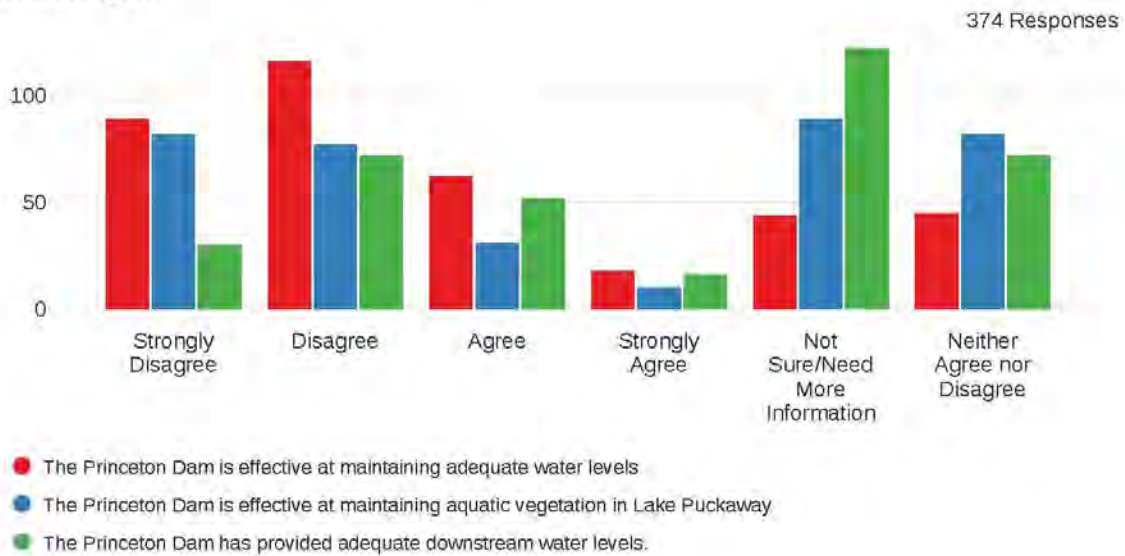
Water quality, Aquatic invasive species, Other (please specify)

Water levels

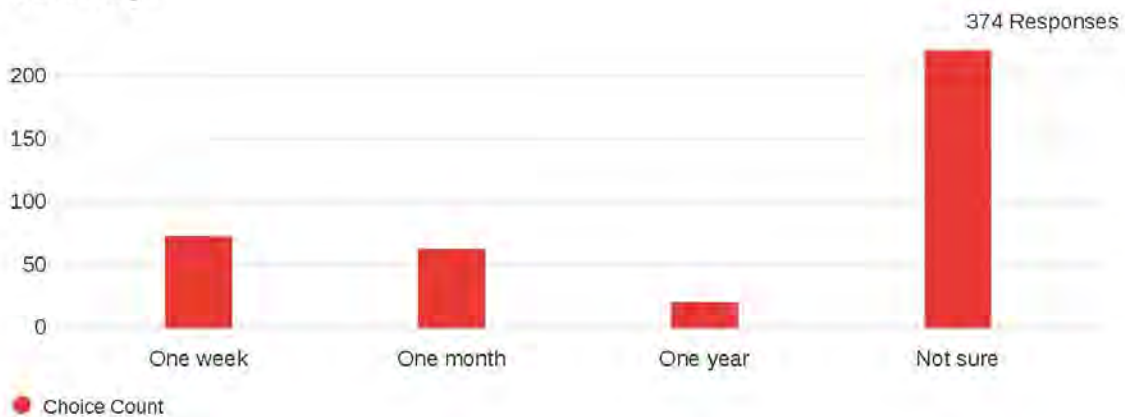
Water levels, Aquatic invasive species, Aquatic plant abundance



Q22 - Please tell us the extent you agree or disagree with each of the following...

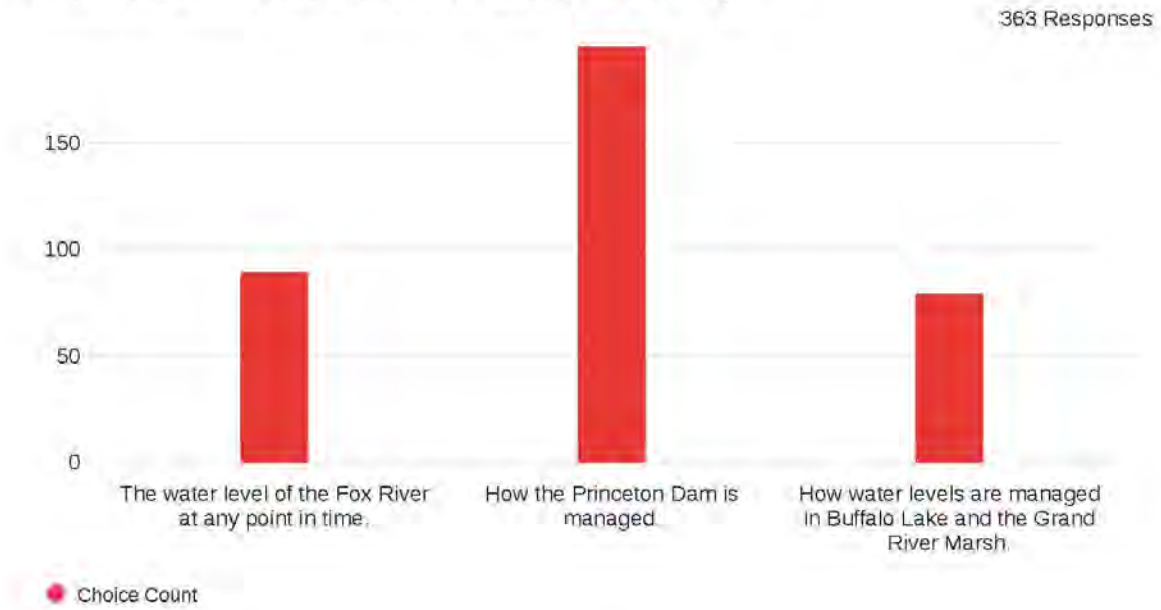


Q23 - Hydrologic residence time (HRT) is defined as how long a given volume of water spends in a lake prior to being completely replaced by new inputs of water. How long do you think the HRT is for Lake Puckaway?



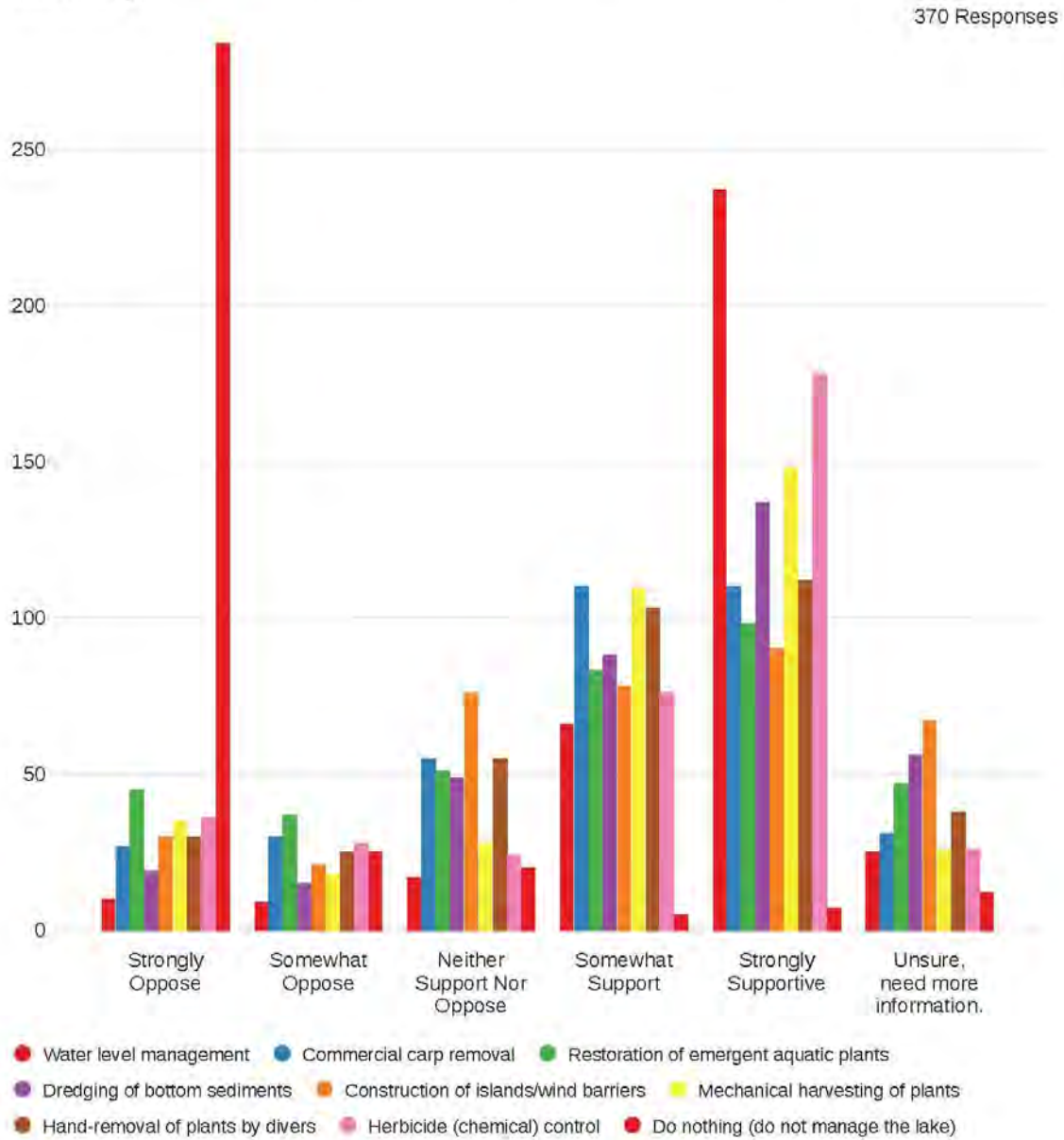


Q24 - Which of the following do you believe has the GREATEST influence over water levels on Lake Puckaway?

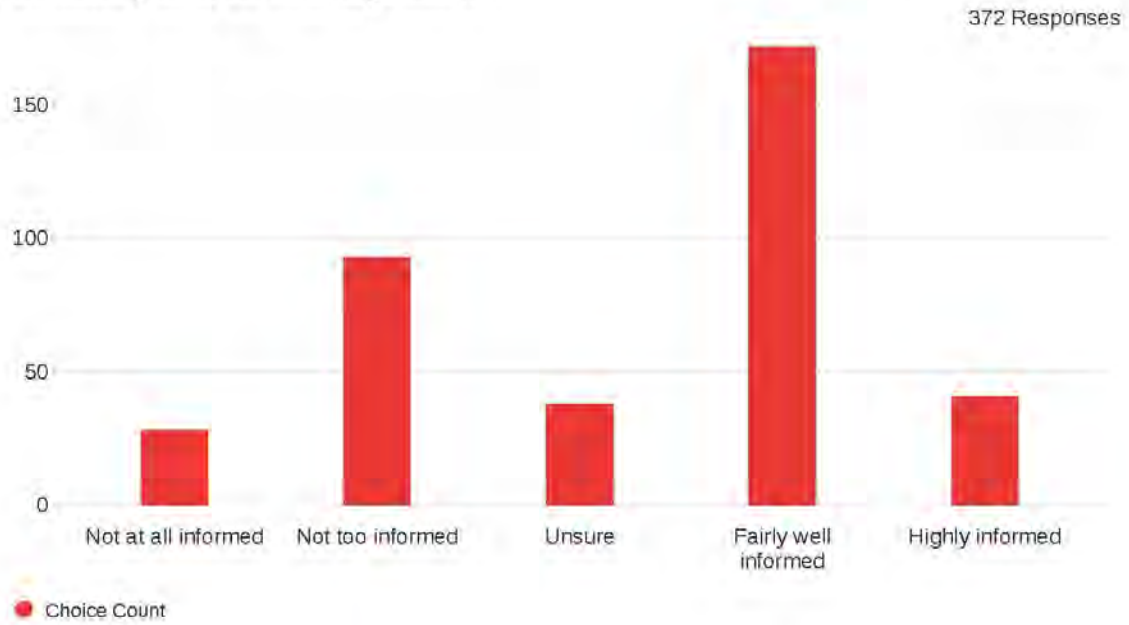


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Q25 - There are many techniques that can be used to manage aspects of a lake. Please indicate your level of support for the following techniques that could be used to increase the ecological health of Lake Puckaway.



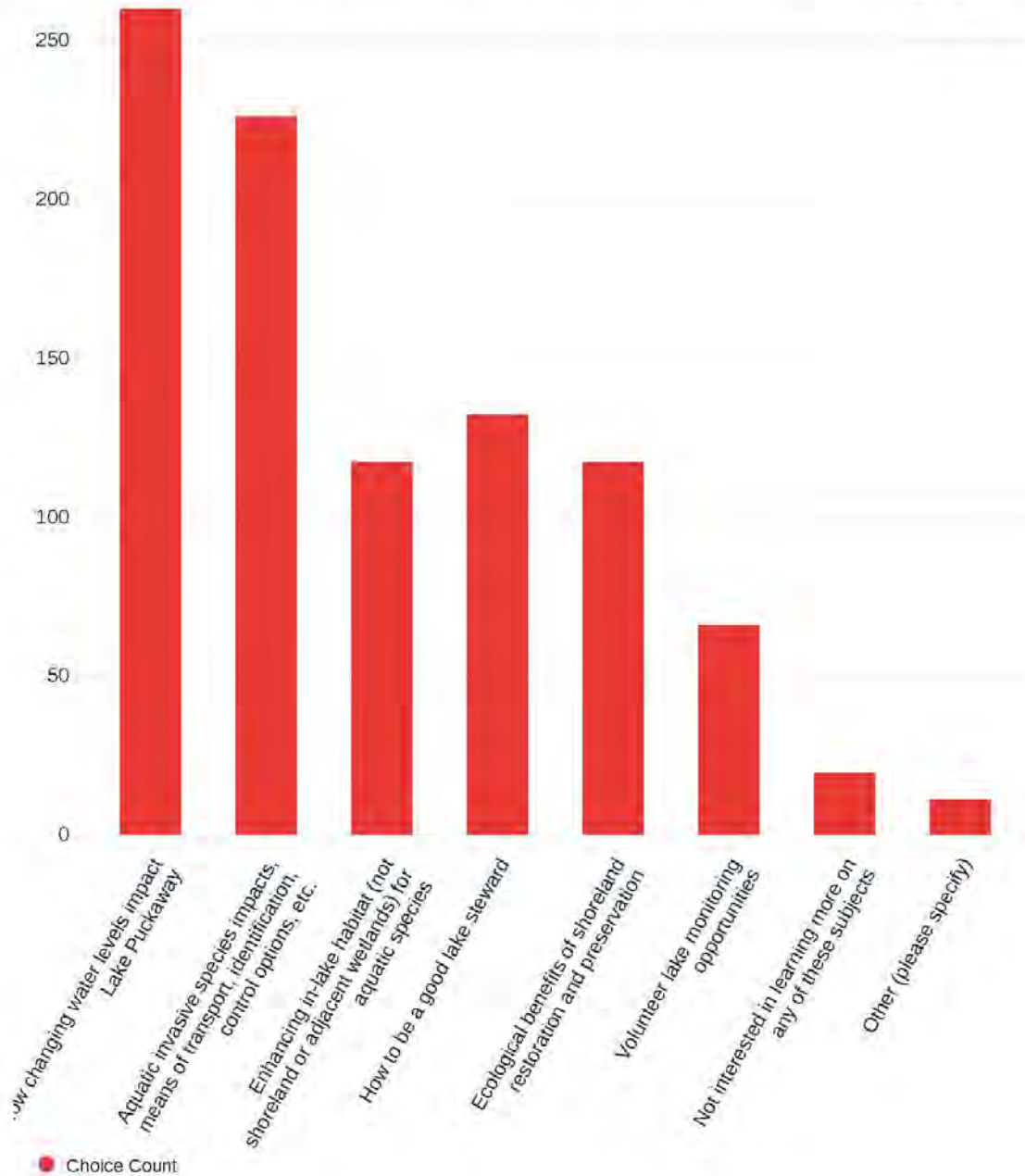
Q26 - How informed has the Lake Puckaway Protection and Rehabilitation District (LPPRD) kept you regarding issues with Lake Puckaway and its management?



DRAFT

Q27 - Stakeholder education is an important component of every lake management planning effort. Which of these subjects would you like to learn more about from LPPRD? (Select all that apply)

345 Responses



## Q27\_28\_TEXT - Other (please specify) - Text

Other (please specify) - Text

The lake chairman Essleman in a tyrant determined to destroy our lake destroying emergent vegetation impacting water quality. Leave the lake alone

Lake Dredging!

Maintaining a constant lake level without opening the Grand River dam.

Dreg the lake! Our motor gets stuck in the mud

First the LPPRD Ned's to be educated, there are too many arm chair quarter back who think they know it all because they live on the lake. Eg, just because I drive a car does not make me a mechanic.

Monitoring of the fish population and quality of fishing

History of Lake and lake management efforts

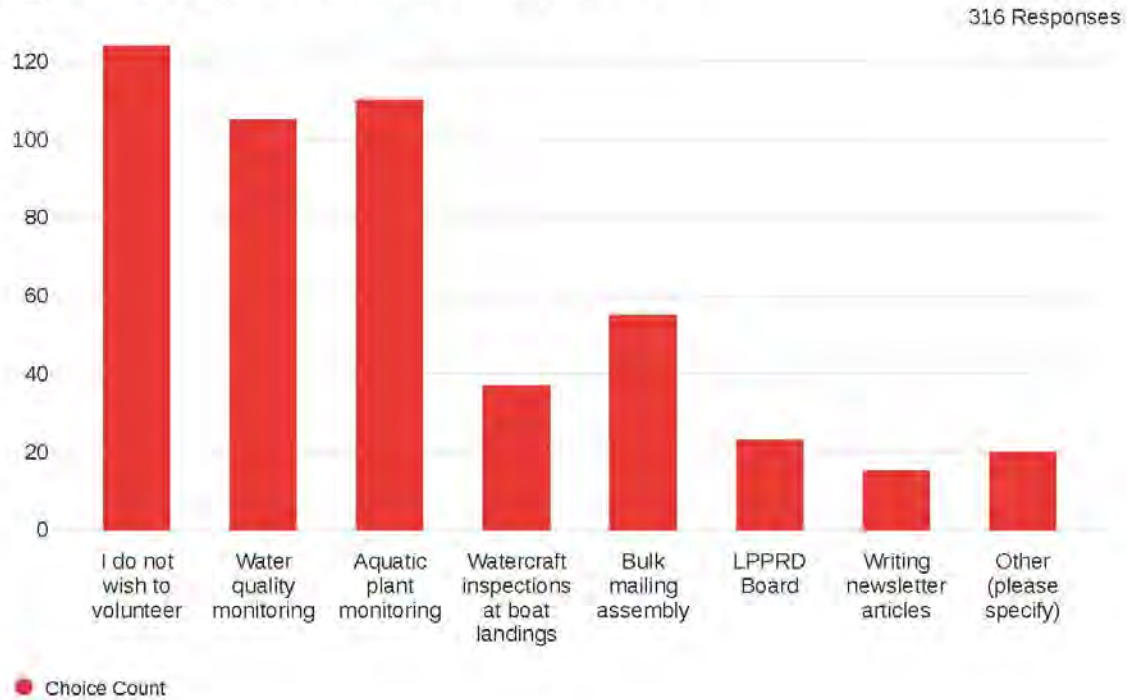
How challenges with the quality of lakes can have an impact on human and animal (such as dogs') health and why it is important that we do our part in keeping the lake healthy to keep our families healthy as well.

Returning native weeds, trees to hold shorelines and the success of the weevil used in Minnesota on the eurasian millfoil. Also, an increased lake access fee for non property owners who boat/ fish in on the lake system

Engaging younger lake users to volunteer. And accept their offers. We use to volunteer and only called on once to help. Now we are in our mid 70s and it is hard to volunteer.



Q28 - Please indicate the activities you would be willing to participate in if the LPPRD requires additional assistance. (Select all that apply)  
Please note that because this survey is anonymous, your answer to this question will not be regarded as a commitment to participate, but instead will be used to gauge potential participation of stakeholders in the LPPRD. The effective management of your lake will require the cooperative efforts of numerous volunteers.



### Q28\_28\_TEXT - Other (please specify)

Other (please specify) - Text

Walleye hatchery and River system bouy maintenance

I don't live there so to volunteer would be hard as of now

helping to cleN up small beach areas

hatchery; tern rafts

buoys, tern rafts, hatchery

there are also many other volunteer postions not mentioned here that many people are involved in fish hatchery,turn rafts,fund raisers,attending meetings and expressing there opinion

Grant writing

Fund raising events

fund raising

At my age I don't know how much help I could be on

it is hard for me to commit to ongoing volunteering but one time type activties I could possibly help with

Helping to educate new property owners on hos destructive fertilizer and chemicals applied to lake front property is. Understanding water tables and the seepage of those chemicals into our lake.

Any administrative assistance

Diver related tasks

Not much that I can do 80 years old would try any thing ,or be a partner with some .

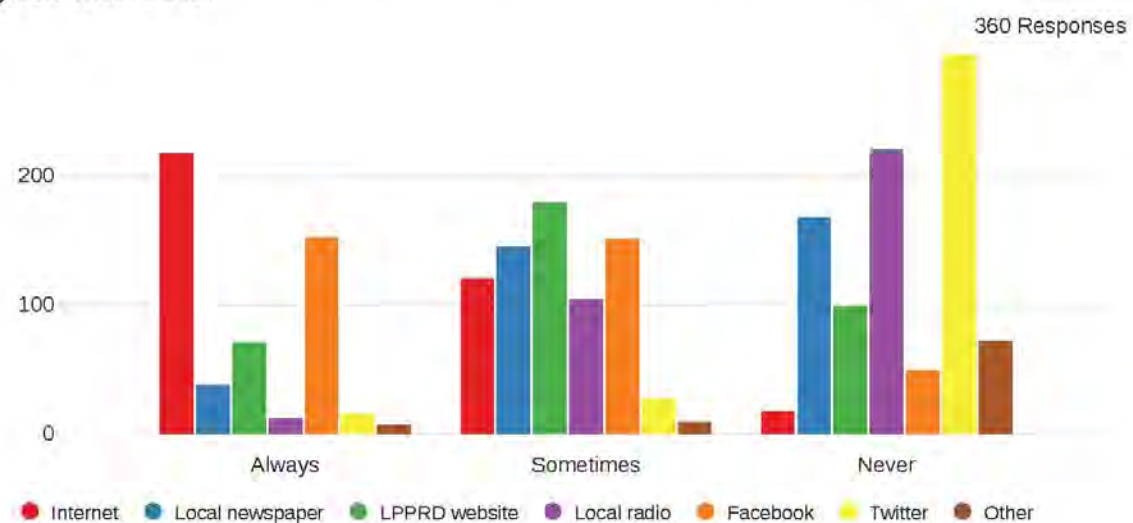
Fundraising events

too old now

Fish Hatchery Walleye Wagon

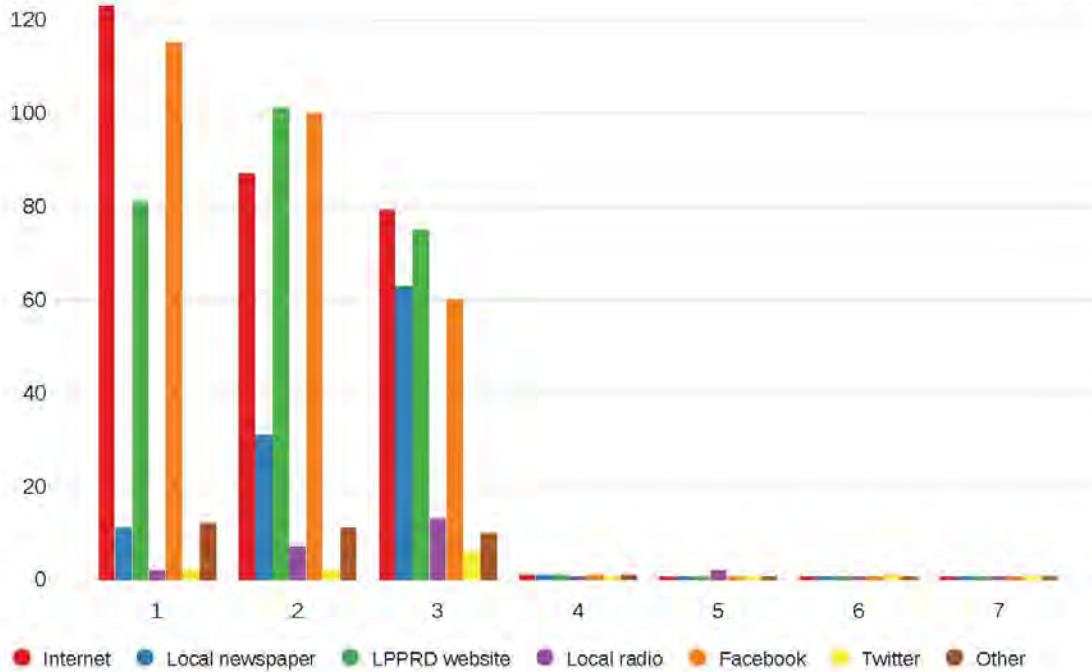
Volunteer at specific events

Q29 - Please indicate how frequently you use the following media sources to stay current on local or non-local news, current events, and your interests.



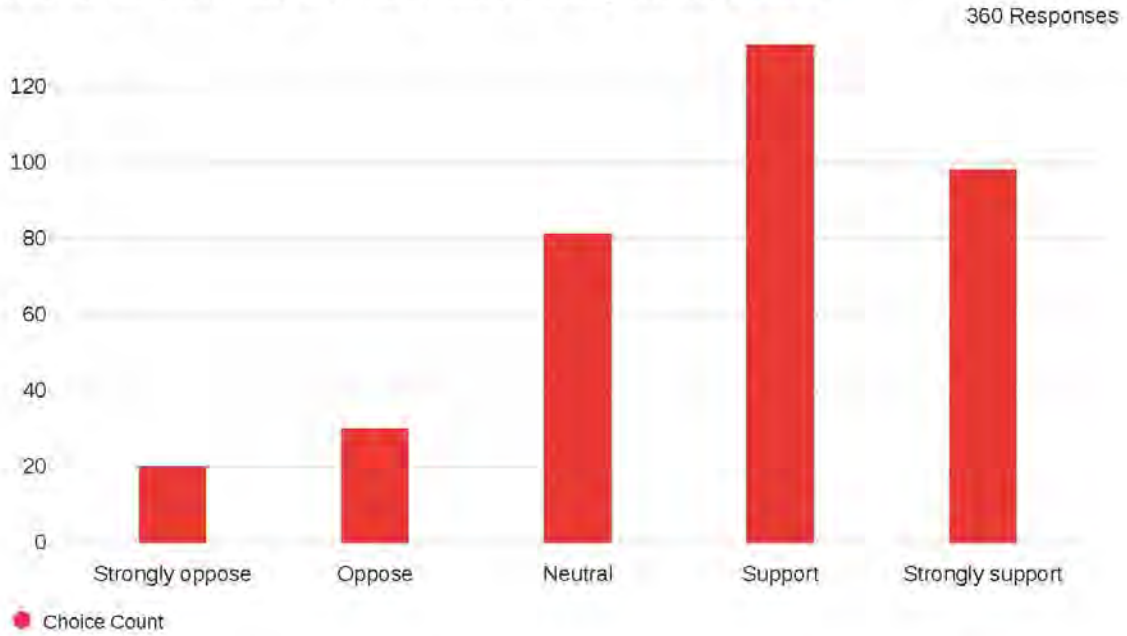
Q30 - Brief updates on the Lake Puckaway management planning project, aspects of the lake's ecology and lake water level management information could be provided through several media sources. Please indicate your top three sources that you would follow to receive more information about Lake Puckaway. (Type 1 for your top choice, 2 for your middle choice, and 3 for your third choice).

346 Responses



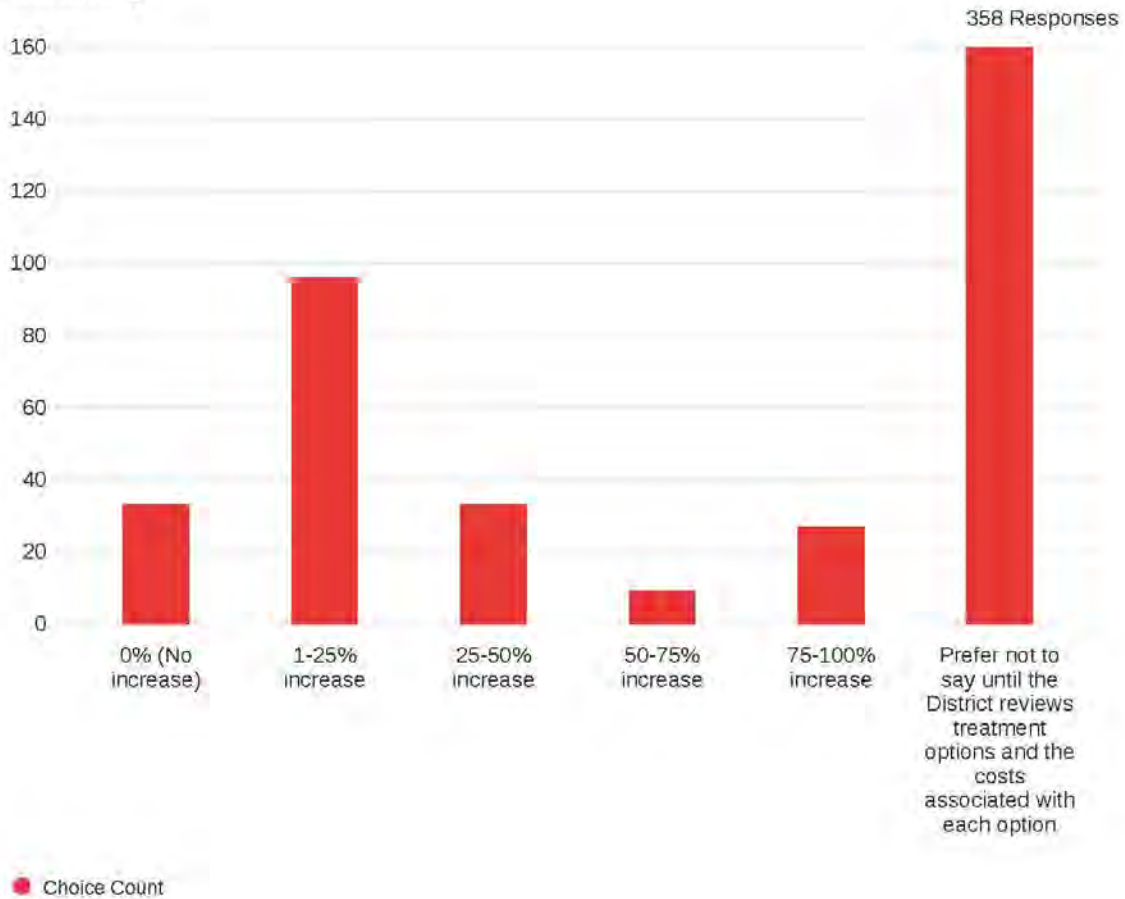


Q31 - To what extent would you support or oppose a fee increase of any amount in Lake Puckaway Protection and Rehabilitation District dues in order to accomplish aquatic plant management goals?



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Q32 - Some additional funding might be required to accomplish aquatic plant management activities. How much would you be willing to contribute each year for additional for Lake Puckaway Protection District dues to pay for aquatic plant management activities? This will not be regarded as a commitment but rather to gauge willingness to contribute and the limitations that may place on treatment options for Lake Puckaway.



## Q33 - Please feel free to provide written comments concerning Lake Puckaway, its current and/or historic condition and its management.

Please feel free to provide written comments concerning Lake Puckaway, its current and/or historic condition and its management.

Having a home here on lake puckaway, it concerns me that the weeds last few years keep getting worse. Some Home owners boats could not leave their docks last year. That is incredibly frustrating when you buy a lake home and cannot enjoy the lake. The low water is also a concern for home owners and well all boaters on puckaway! There has to be something we can do to keep a good balance for all, but still allow home owners and visitors to continue to enjoy lake puckaway.

Please communicate on District website or District Facebook. Puckaway People is not a good source of reliable information.

Essleman has got to go. He does things improperly violates the law has his own agenda. He will ruin our lake and destroy our weeds ,wildlife and the eco system. Essleman has got to go!!!!

We need to let science guide us. If, as property owners, we need to stop using various products...or update our septic systems...or redo our lake-banks / shorelines...or stop using motor-boats...or WHATEVER...then I am all-in. I love Lake Puckaway. People need to be educated about all of the human-created changes that have negatively impacted / hurt Lake Puckaway. There were vast rice-fields, where we now water-ski. I doubt that the climate changes can ever let the Puckaway area be what it was, but we gotta do what is right for the environment. I know that many people don't read and that is unfortunate, because in knowing the long-view timeline of Puckaway, really helps people to understand how "people's choices and wants and greed" really screwed-up Lake Puckaway...and many other parts of the connected waterways. I wanna do what is right for the earth. To hell with "property values." If it's not native, then let's get rid of it, including those miserable carp! We have to learn about and care about what is happening up-stream and down-stream.

This milfoil problem should have been taken care of when the first spot showed up outside mouth of river that was maybe 30by30yards. Instead lots of boats were driving through it some getting stuck and then spreading it!! Should not have had weed choppers out because that also spreads it! Have read from other lake associations about draining the entire lake before winter to let the ground freeze to kill milfoil. Is this possible?? If not would like to see procellacor be used

We need to spend the money to test methods of removing the invasive weeds to see what works best. Then focus on lanes and ultimately more of the lake.

fees for non lake residents should somehow be implemented maybe at the landings to help with lake management costs...some of the landings have been getting destroyed by heavier equipment used for ice fishing

Please do something about the weeds cannot get through very well in a boat

It seems like the board is interested in raising the overall level for portions of the year. I really hope they fully think this through. Increase flooding will lead to lawsuits like it has with other systems in the state.

The lake is dying quickly and something needs to be done. The additional fees in comparison to loss of property value and other quality of life issues is well worth the investment. Cutting is only a short term band aid and it will likely require a huge investment in chemical treatments. Your efforts to enlist state grants and other possible resources is greatly appreciated.

Immediate attention towards addressing the invasive aquatic weed problem is critical.

It doesn't seem right for local home owners to bear the brunt of expenses to maintain the lake when people from all over the state can use it for free! Boat launches around the lake should be upgraded, launch fees & permits sold to maintain landing sites. Permits for duck hunting on the lake could also be sold. Basically a user fee for anyone using the lake that don't live on and maintain the lake.

Return flow and management to the original aspects of the lake. Return flow to dead river.

Please resolve quicker than you did w/the damn replacement (20 +years) you waste time and \$ on surveys!

I feel I pay ENOUGH in taxes that should be properly allocated for the aquatic management.

I would like to see this survey done in July when weeds take over lake and can't get boats out

Last year I went down to the little beach near us it was terrible dirty and over hrown with weeds it is the only little spot for swimming on our side of the lake I am on lotus Dr its not a big beach the kids have fun there

Recommend the board. research the history of the lake and what the previous boards were working on for the betterment of the lake. Also the intent of the previous projects and the goals for them. Would also recommend that the board use their own social media and not that of Puckaway People to correspond lake news. It appears that comments from PP are used as factual and used to guide the Lake District Board in some of their actions. Best of luck to the Lake District Board Board in the upcoming year.

Residents need to be educated much more before making decisions for the lake. Is there a way to weekly or monthly update and inform residents? The once a year newsletter is not enough.

The lake levels and weed levels need to be addressed. It's the worst I've seen in over 30 years and something needs to be done before we lose a valuable asset to our communities!!



## APPENDIX B

### 2022 Fall AIS Meandering Survey Map

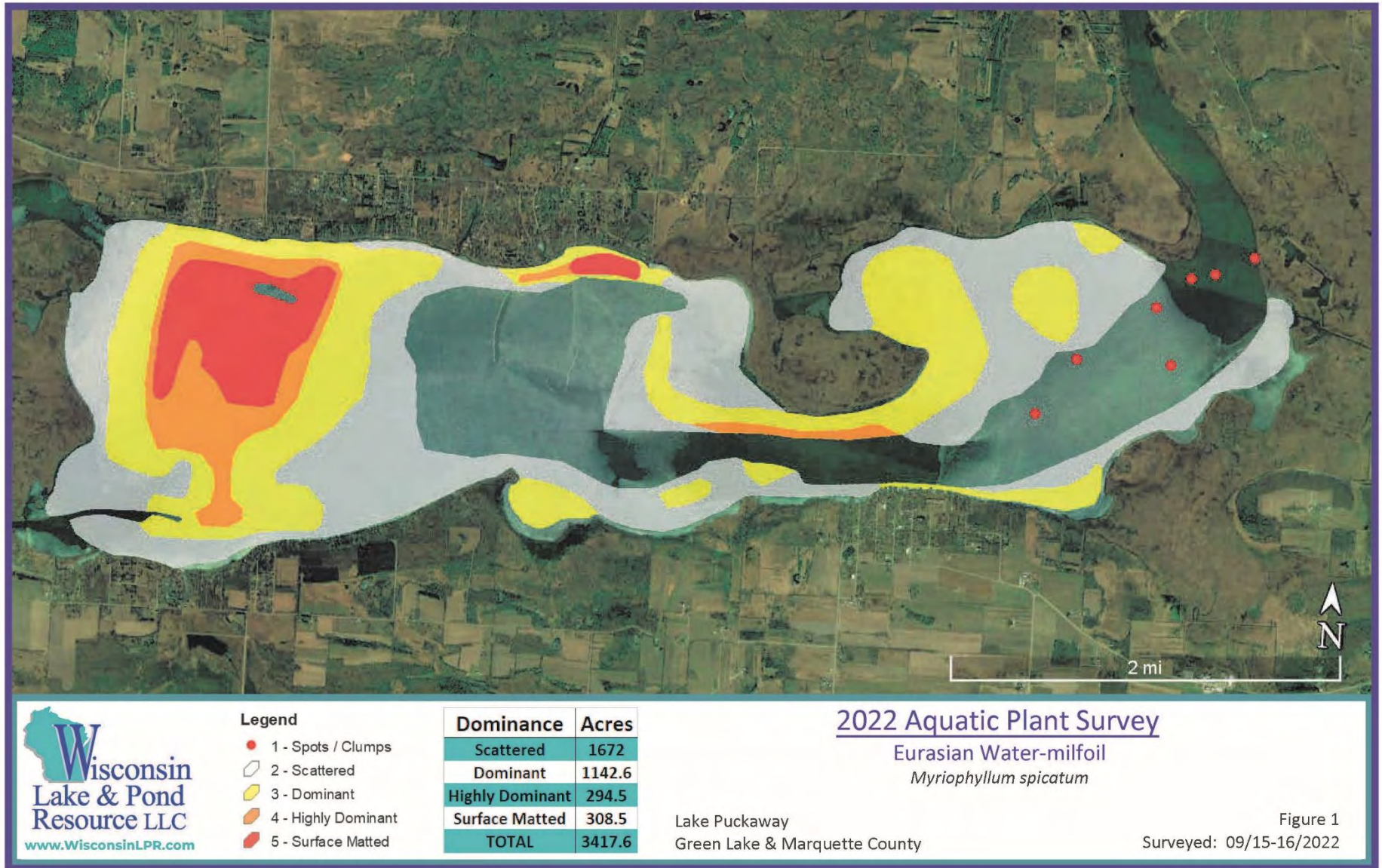


Figure 5. Meandering AIS survey map of Eurasian watermilfoil density observed on Lake Puckaway by Wisconsin Lake & Pond Resource, LLC staff during their September 15-16<sup>th</sup>, 2022 survey.

## APPENDIX C

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### 2022 Aquatic Plant Harvesting Plan Map

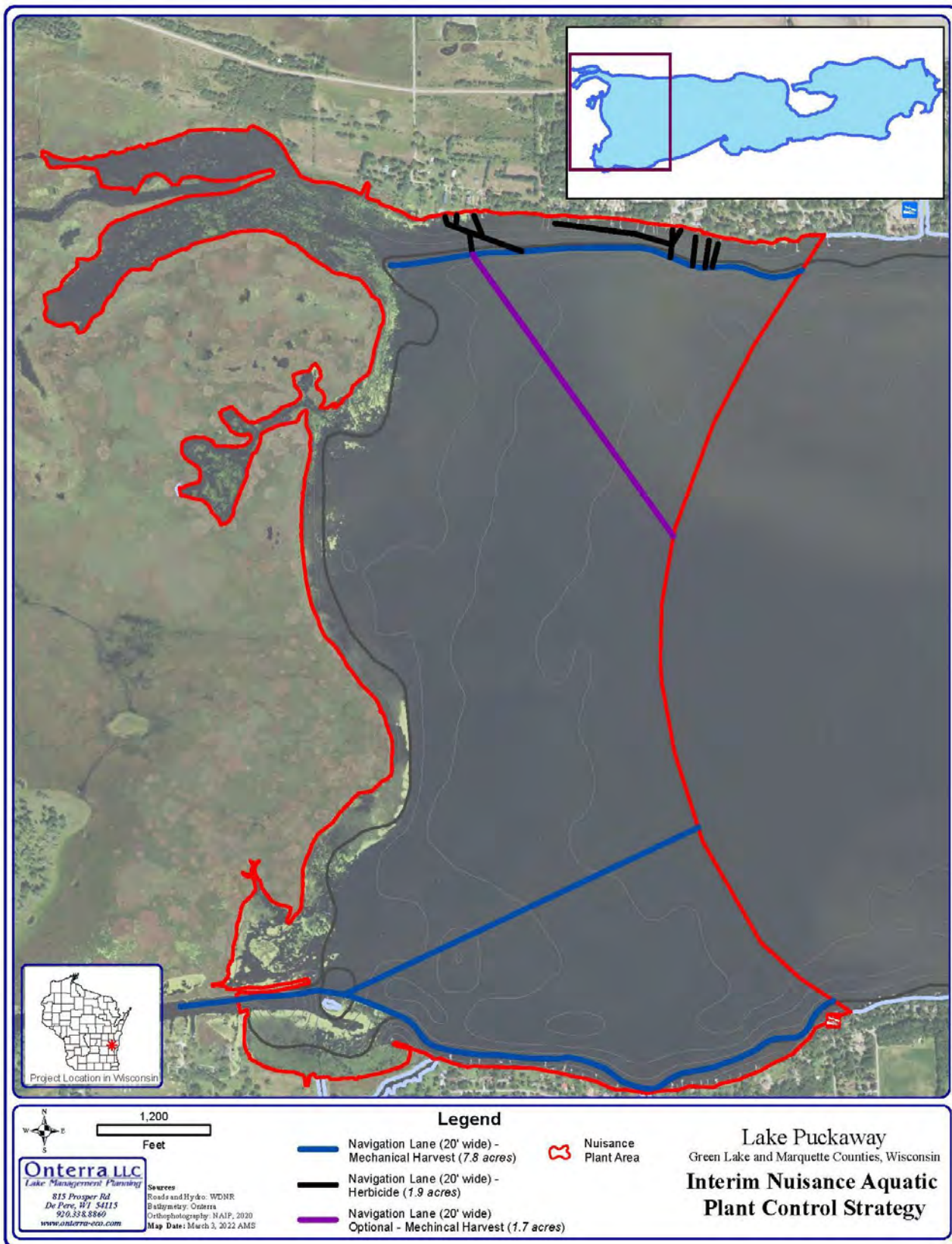


Figure 6. 2022 Nuisance aquatic plant harvesting map developed by Onterra, LLC for the west end of Lake Puckaway.



## APPENDIX D

### Proposed Aquatic Plant Harvesting Plan Maps

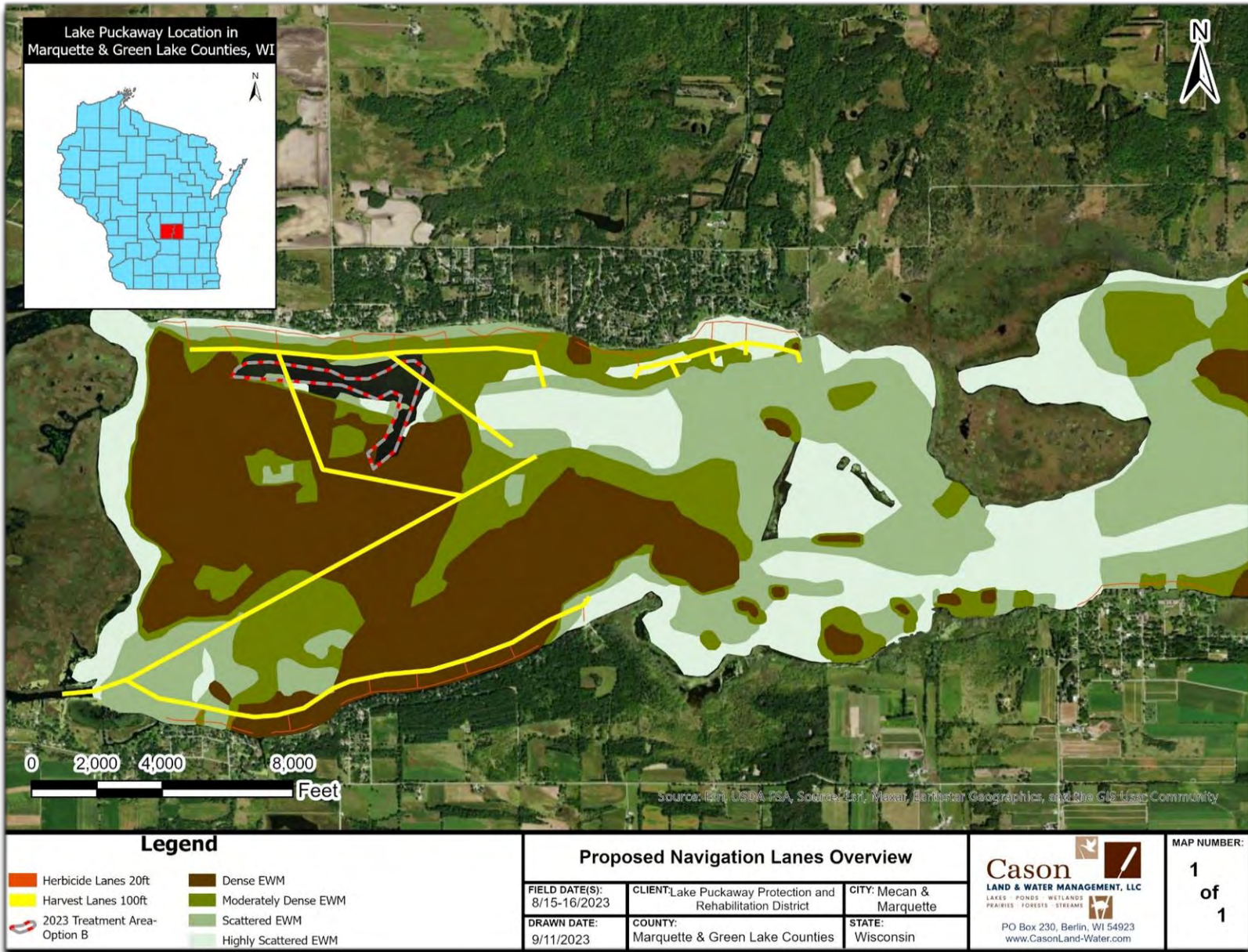


Figure 7. Proposed Aquatic Plant Harvesting Lane Map for Lake Puckaway, overview extent.

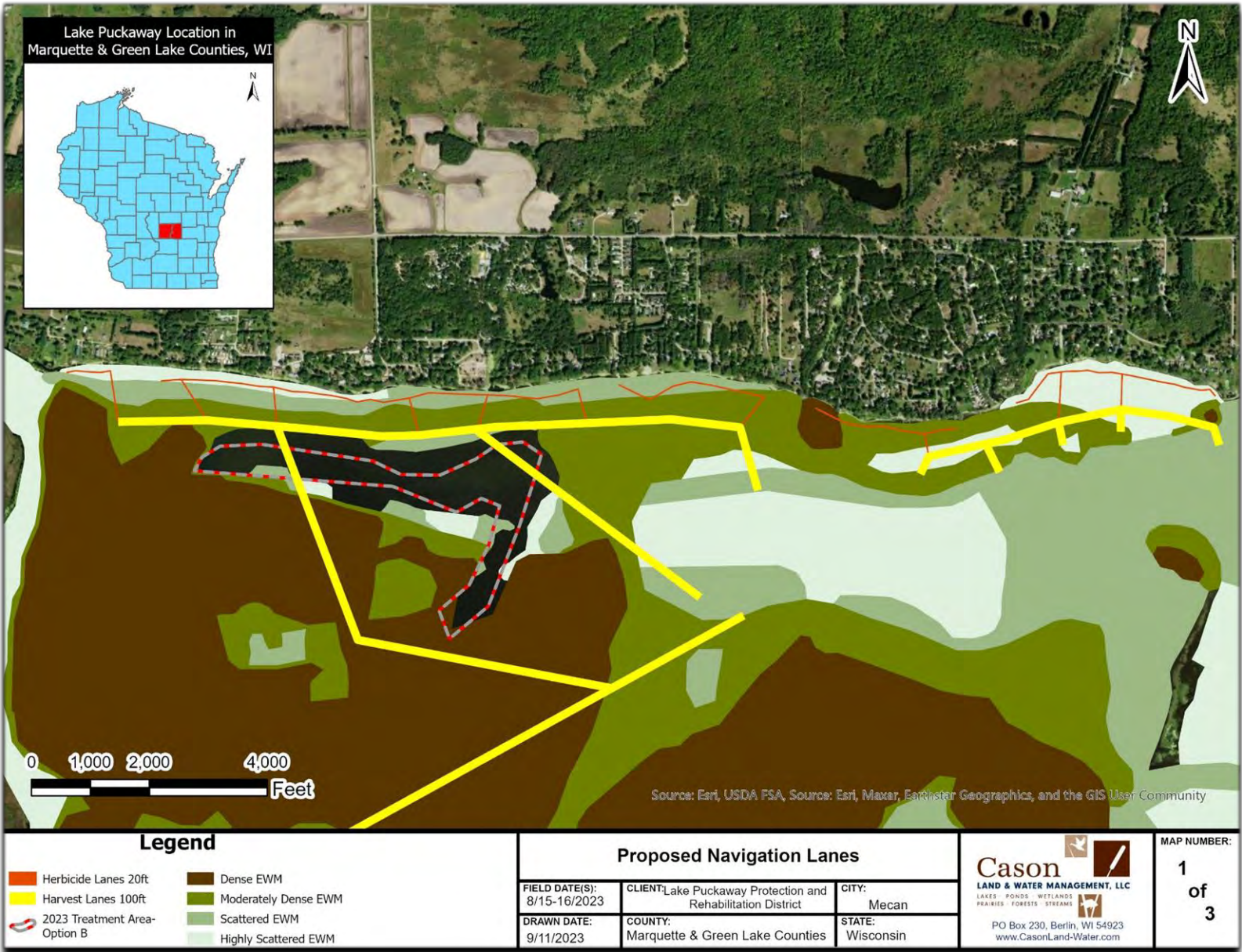


Figure 8. Proposed Aquatic Plant Harvesting Lane Map for Lake Puckaway, northern extent.

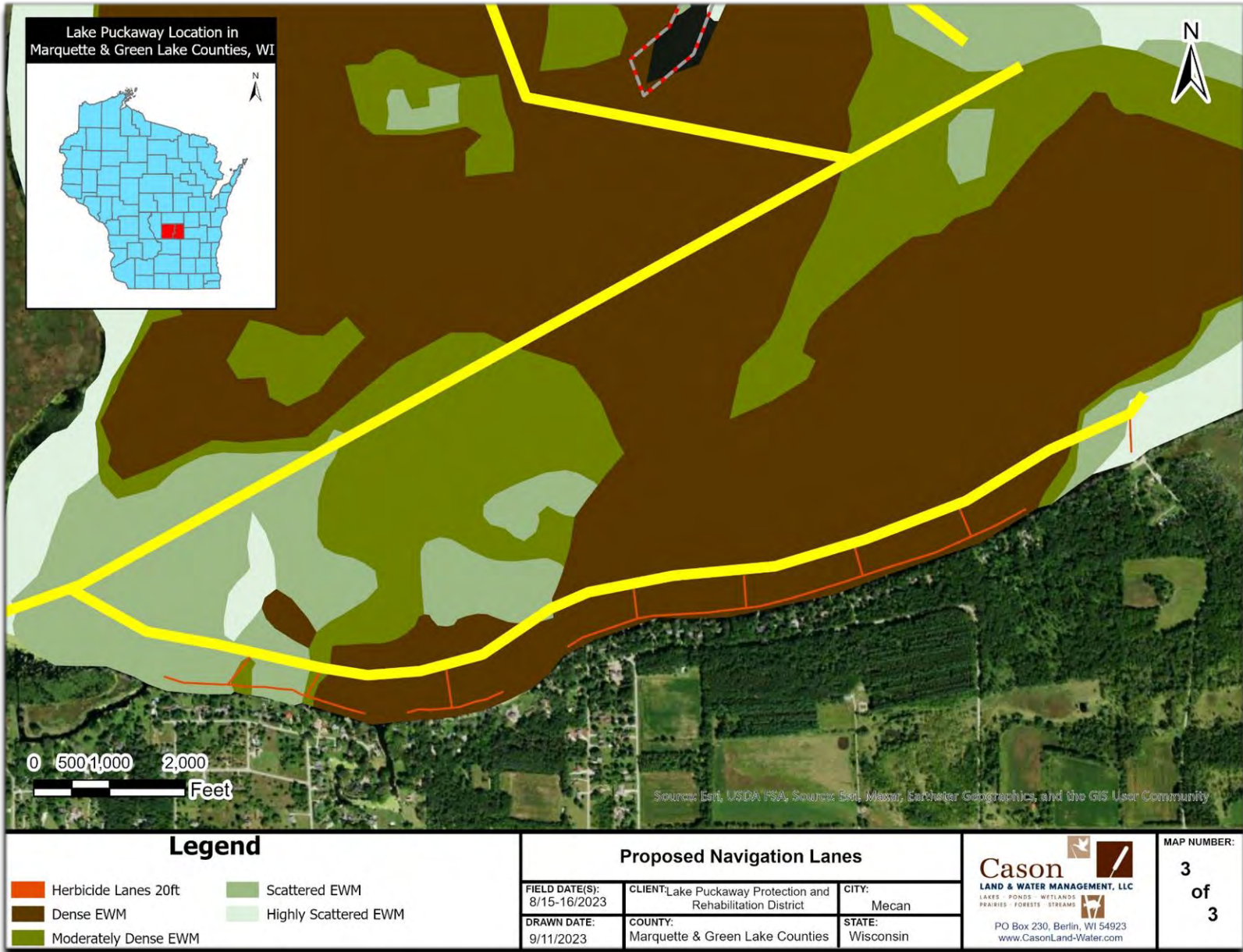


Figure 9. Proposed Aquatic Plant Harvesting Lane Map for Lake Puckaway, southwestern extent.

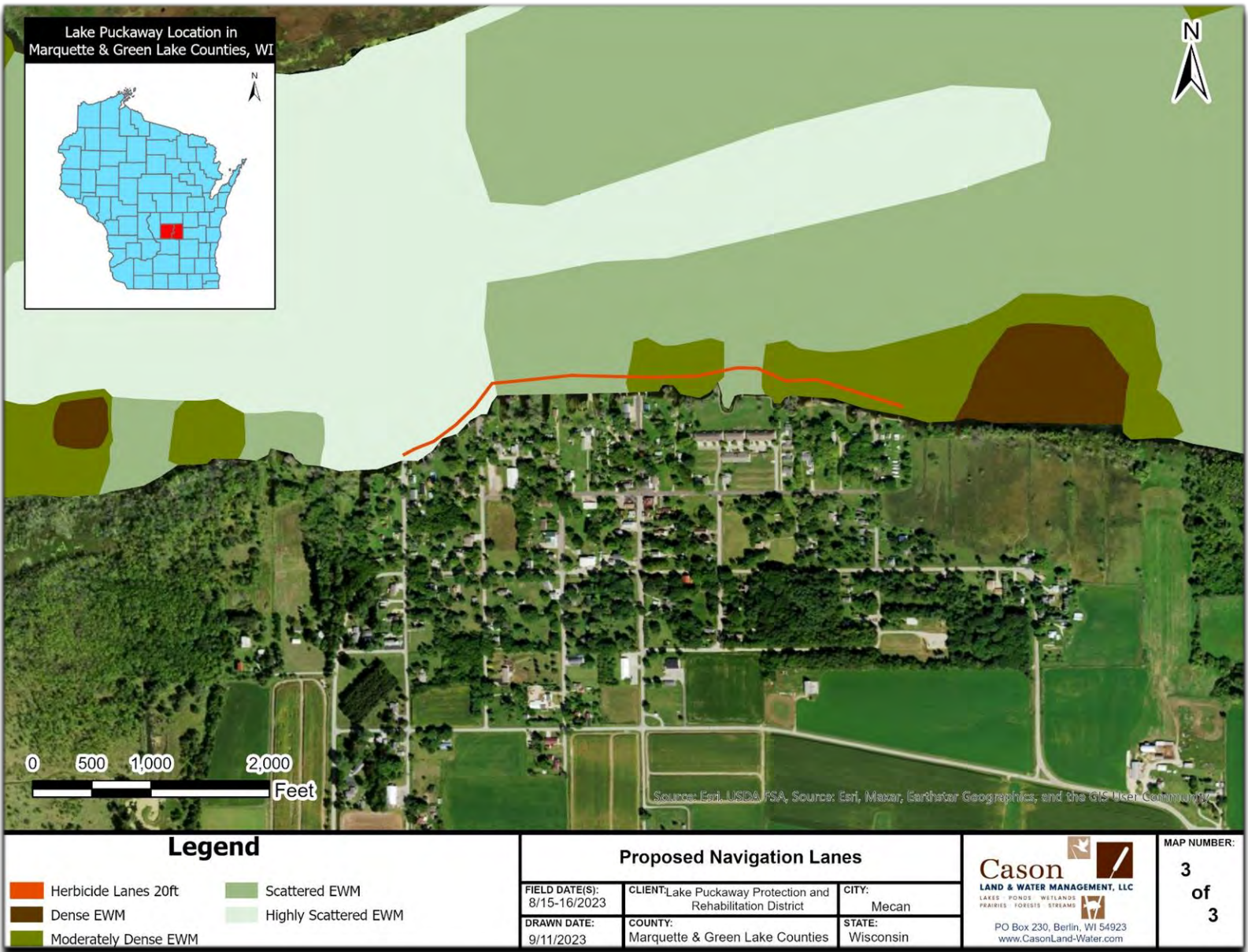


Figure 10. Proposed Aquatic Plant Harvesting Lane Map for Lake Puckaway, southeastern extent.

## APPENDIX E

### Water Quality Data

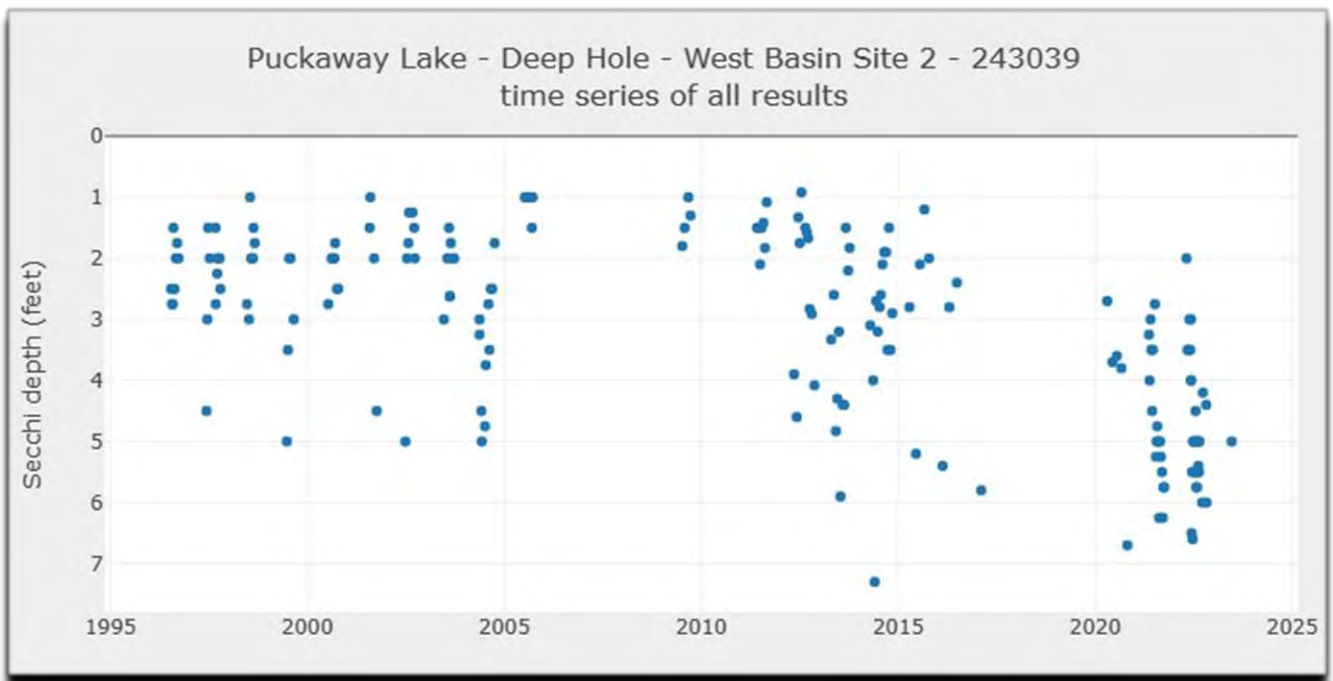


Figure 11. Secchi depth readings for Lake Puckaway Deep Hole West Basin from 1996-2023.

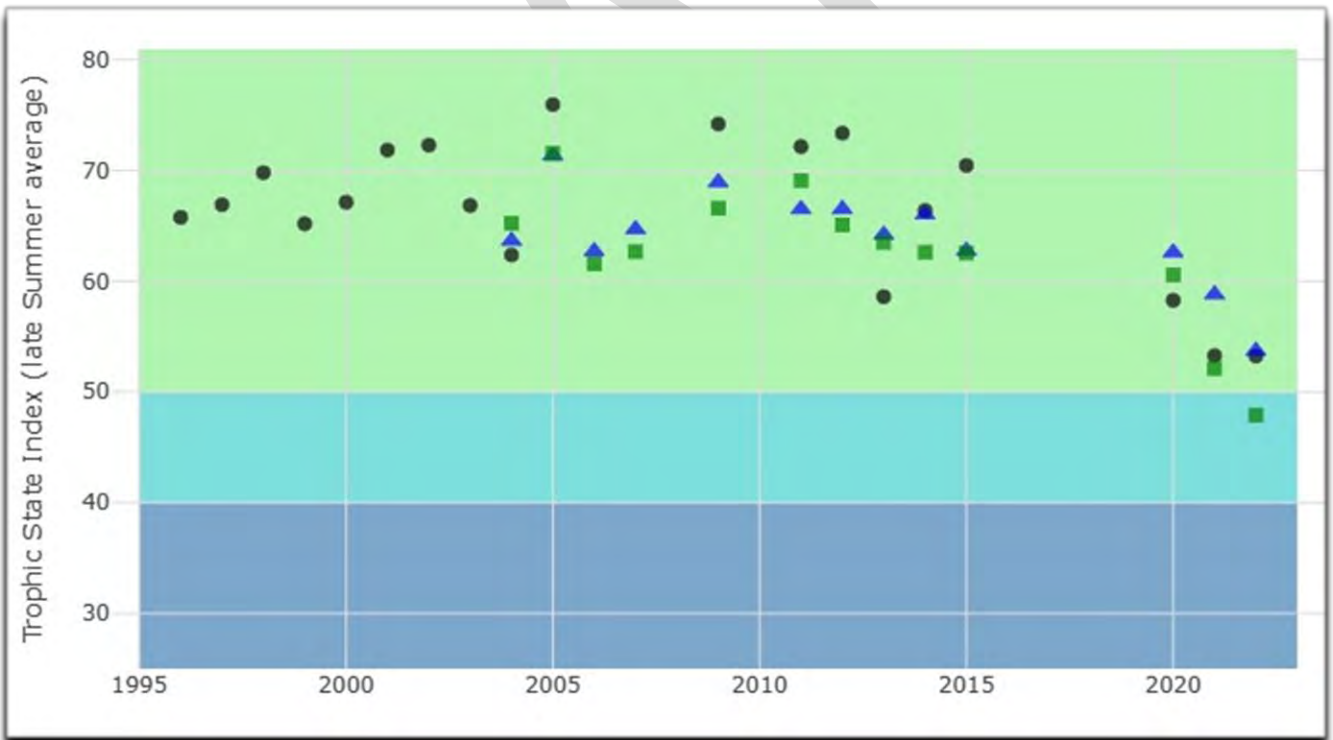


Figure 12. Trophic State Index graph for Lake Puckaway Deep Hole West Basin from 1996-2022.

- Secchi TSI ▲ Total Phosphorus TSI ■ Chlorophyll TSI

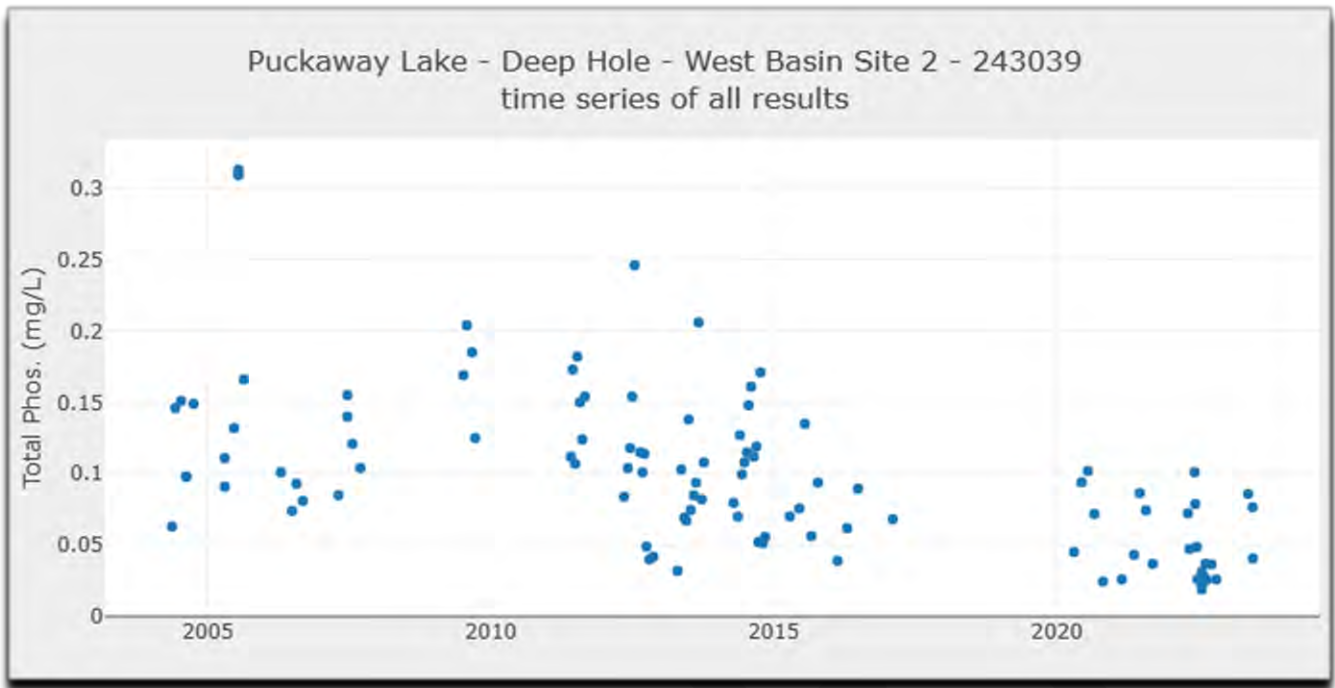


Figure 13. Total Phosphorus readings for Lake Puckaway Deep Hole West Basin from 2004-2023.

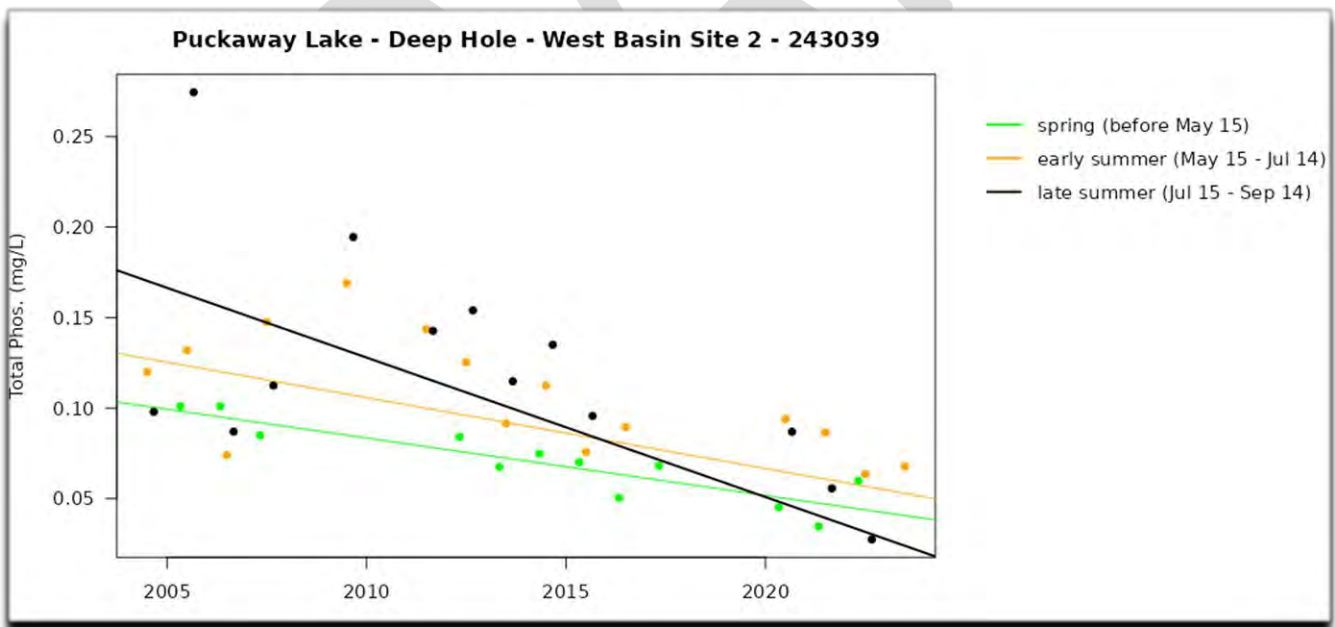


Figure 14. Trends in total Phosphorus readings for Lake Puckaway Deep Hole West Basin from 2004-2023. Dotted lines show non-significant trends ( $p > 0.05$ ), solid lines show significant trends ( $p < 0.05$ ), and points represent seasonal averages.



## APPENDIX F

### 2023 Trial ProcellaCOR Treatment & EWM Monitoring Strategy

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Proposal for  
**2023 Eurasian Watermilfoil  
Treatment & Monitoring Plan**  
for Lake Puckaway, Green Lake & Marquette  
Counties, Wisconsin

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*Prepared for:*

Lake Puckaway Protection  
and Rehabilitation District

*Prepared by:*

P.O. Box 230  
Berlin, WI 54923-0230  
920-361-4088  
April 28th, 2023



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## Introduction

Lake Puckaway is a 5,013 acre lake spanning Green Lake & Marquette counties, Wisconsin. It has a maximum depth of 5 feet and an average depth of 3 feet. Lake Puckaway is classified as a drainage lake with one outlet on the northeast end of the lake. The proposed Lake Management Plan Update and Aquatic Plant Management Plan has been developed at the request of the Lake Puckaway Protection and Rehabilitation District to address recent changes to the lake's aquatic ecosystem. Invasive Eurasian watermilfoil and hybrid watermilfoil (EWM/HWM) have greatly expanded their distribution and density throughout the lake, causing a variety of problems for lake users.

In fact, upon review of Point-Intercept data recently provided to Cason Land & Water Management, LLC by the LPPRD, the EWM/HWM has increased in Frequency of Occurrence in Vegetated Areas by more 44% since 2015. This increase is evident despite 26% fewer potential sampling locations were sampled during the recent 2022 PI survey. A reduction in sampled PI locations further indicate that aquatic vegetation such as EWM/HWM is impairing accessibility throughout large swaths of Lake Puckaway. Additionally, in 2015, EWM/HWM was the 7<sup>th</sup> most abundant aquatic plant species in the lake, based on Relative Frequency, whereas it is now the second most abundant species in Lake Puckaway according to the 2022 PI survey data provided. The combination of lake services that we can provide, will scientifically and responsibly address these and other concerns about Lake Puckaway's degrading aquatic plant community while helping to meet the goals of riparians who wish to utilize the lake as the valuable aquatic resource that it is.

## Statement of Qualifications

Due to the extensive AIS problem on Lake Puckaway, reclaiming the lake from this invasive species will require a sustained multi-year effort. Cason Land & Water Management, LLC. is uniquely qualified to conduct this work based on our extensive history of managing lakes of all sizes throughout Wisconsin for over 17 years. Our company's professional experience and expertise will be essential to our success when working on behalf of the Lake Puckaway Protection and Rehabilitation District to improve access to the lake and simultaneously benefit the native aquatic ecosystem.

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## Project Goals

- 1) Conduct an aquatic herbicide treatment of EWM in the western basin of Lake Puckaway using the selective herbicide, ProcellaCOR EC in spring 2023.
- 2) Conduct post-treatment aquatic plant surveys for three consecutive years using DNR's Point-Intercept survey methodology to monitor the effectiveness of the treatment on EWM as well as any native plant species.
- 3) Analyze data from repeated Point-Intercept Surveys to guide future EWM management activities on Lake Puckaway.
- 4) Collect and provide information needed to make informed decisions regarding the future management of the lake both ecologically and sociologically.

## Methods

Through consultation with Wisconsin DNR personelle, the Lake Puckaway Protection and Rehabilitation District board, and Cason Land & Water Management, LLC staff, a 50 acre site was selected for an aquatic herbicide treatment in 2023. This site was chosen based distributions of EWM mapped out for the LPPRD during the September 2022 Aquatic Plant Survey (conducted by Wisconsin Lake & Pond Resource, LLC). This site is located along the northern edge of the densest patch of EWM in the western basin of lake Puckaway.

This site will be treated in late spring 2023 as EWM begins to grow aggresively but before native plants become fully established for the active season in an effort to reduce impacts to those species. The treatment area will be treated using the selective aquatic herbicide ProcellaCOR EC using subsurface injection hoses mounted from booms on our professionally outfitted lake treatment boat. Because of the known tendency of ProcellaCOR to disperse relatively quickly within lakes, we will attempt to target a treatment day when the water is relatively calm with a northwind to ideally improve the effectiveness of the treatment at controlling both EWM within the treatment area but also hopefully provide some additional control south of the treatment area.

In late summer/early fall 2023 we will conduct a sub-polygon Point-Intercept survey of the treatment area as well as a 300-foot buffer area surrounding the treatment area. Survey points (111 total) were developed in ArcGIS Pro using 100m spacing between grid points. This survey will provide post-treatment plant community data with which to compare to the whole-lake Point-Intercept survey that was conducted in 2022. Additionally, it will be impotant to continue to monitor this same location for the 2024 and 2025 seasons as well to monitor the response of native species to ProcellaCOR treatments on Lake Puckaway.

A report of summary statistics and comparative statistics for the sub-polygon Point-Intercept survey will be developed from the data collected following each survey. This data will then be used to determine effectiveness of the treatment on EWM, identify impacts to native species present, and provide insights into how best to utilize selective aquatic herbicides to effectively manage EWM within Lake Puckaway in future years.

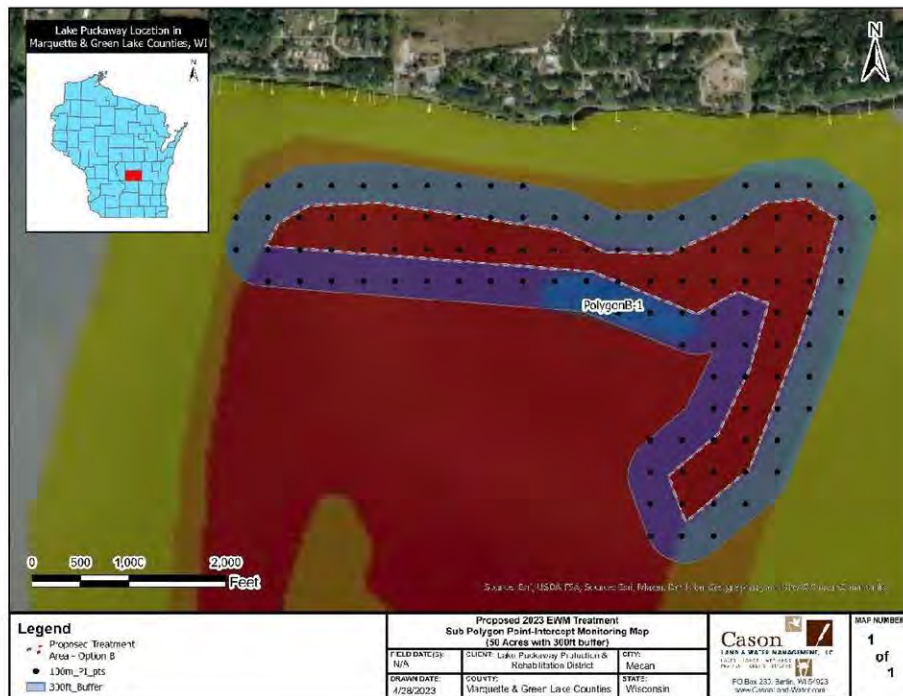


Figure 1. Site of the 50-acre 2023 EWM ProcellaCOR EC treatment area (red & white border). A 300-foot buffer area outside of the treatment area is also shown in blue. A total of 111 Point-Intercept Survey points are shown as black dots for monitoring locations.

---

## Project Deliverables

- Treatment of a 50 acre site of Eurasian Watermilfoil to gauge the effectiveness of using ProcellaCOR within Lake Puckaway for future larger-scale control options
- Point-intercept sub-polygon aquatic plant survey data
- A report comprising a proposed adaptive management strategy for the future management of Lake Puckaway based on the most current plant diversity, distribution, and abundance data available following each survey.

## Project Timeframe

Fieldwork will be conducted during Spring, Summer/Fall 2023. Data analysis of the AIS Mapping survey data and survey report preparation will take place over Fall and Winter 2023/2024. The various project elements are listed in the table below.

Timeframe	Activity
Spring 2023	EWM Treatment using ProcellaCOR
Late summer/early fall 2023, 2024, 2025	Sub-polygon Point-Intercept Survey for EWM/HWM
Fall/Winter 2023, 2024, 2025	Data Analyses, Survey report, and Lake Management Recommendations based on current data

## APPENDIX G

### 2023 Trial ProcellaCOR Treatment Record, Treatment Area Transect Maps, & Treatment Photos

### Treatment Record - Client Copy

*This treatment record is being supplied to the client for informational purposes only. No further action is required.*



PO Box 230  
Berlin, WI 54923  
920-361-4088

Client Name: <u>Lake Puckaway Protection &amp; Rehabilitation Dist.</u>					County: <u>Menominee &amp; Green Lake</u>
Treatment Date: <u>6/8/23</u>	Starting Time: <u>10:45</u>	Ending Time: <u>6:45</u>	Surface Area: <u>50ac</u>	Expected duration: <u>1 day</u>	

**For DNR Permits:**

Submit Online Treatment Record:  
 Yes\*\*    N/A

WI DNR/DATCP Staff Onsite:  
 Yes    N/A

If Yes, name of DNR/DATCP agent:

Individual who made or directly supervised the pesticide application:			
Last Name	First	Certification #	License #
Cason	Charles	95-058843	147029-CA
Cason	Samuel	95-103353	324346-CA
Gantner	Amanda	93-102533	506113-CA
<input checked="" type="checkbox"/> Hetcher	Gus	93-112711	493194-CA
Jacob	Taggart	93-111447	500518-CA
Oberleitner	Brandon	93-112145	505504-CA
<input checked="" type="checkbox"/> Paden	Lance	93-112146	505028-CA
Yacks	Noah	93-112710	500916-CA

Commercial Pesticide Application Business License: 93-017940-013932

\*\*Only EPA registered products reported on DNR forms.

Product	Quantity Used	Treated Acreage	Product	Quantity Used	Treated Acreage
Adjuvant/Non-Ionic Surfactant			Naturalake Aquasticker		
Aquashade Dye, 33068-1			Naturalake Cattzilla		
Aquashadow Dye			Naturalake Pondzilla		
Aquathol K, 70506-176			Navigate, 228-378-8959		
Aquathol Super K, 70506-191			Orb-3 Professional Enzymes		
Aquastrike, 70506-302			Orb-3 Professional Enzymes & Bacteria		
Calcis			Orb-3 Phosphorus Reducing Agent		
Clipper, 59639-161			Phycomycin, 8959-60		
Concentrated Dye: Black/Blue/Midnight			PhosLock		
Citrine Plus, 8959-10			Polyan		
Citrine Ultra, 8959-53			Procellacor, 67690-80	1,000 PBU	50ac
Citrine Granular, 8959-12			Propeller, 81927-68		
F-30 27588-2			Reward, 100-1091		
Glyphosate 5.4 81927-8			Rodeo, 62719-324		
Hydrothol 191 Granular, 70506-175			Sculpin G, 67690-49		
Hydrothol Liquid, 70506-175			SeClear, 67690-55		
Komeen, 67690-25			ShoreKlear, 228-365-8959		
Naturalake Dry Bacteria			Tribune, 100-1390		
Naturalake MuckBiotics			Weedar 64, 71368-1		

Treatment Targeted:  
 Algae    Submersed Plants    Invasive Plants    Shoreline Plants  

Herbicide Treatment and Water Use Restrictions Signs Posted in Accordance with NR 107:    Yes    N/A

Water Temp: 76F   Air Temp: 72   Windspeed & Direction: 3-5mph E, NE  
 Mixing and Loading Site: in boat at treatment area  
 Description of where pesticides applied: in treatment area  
 Observations: great conditions, sunny with light breeze out of the E + NE, EWM in many areas not matted last fall already

List Target Species & Site (TS)*:	<u>EWM</u>				
List Species Present & Site (SP)*:	<u>EWM</u>	<u>CLP</u>	<u>Coontail</u>		

\* Please attach additional pages, if necessary  
**Applicator shall provide client with a free copy of each pesticide label used (if requested).**

**Figure 15. Treatment Record for the 50-acre 2023 trial ProcellaCOR treatment of Eurasian watermilfoil on Lake Puckaway (Approved DNR to replace this version once available on DNR website).**



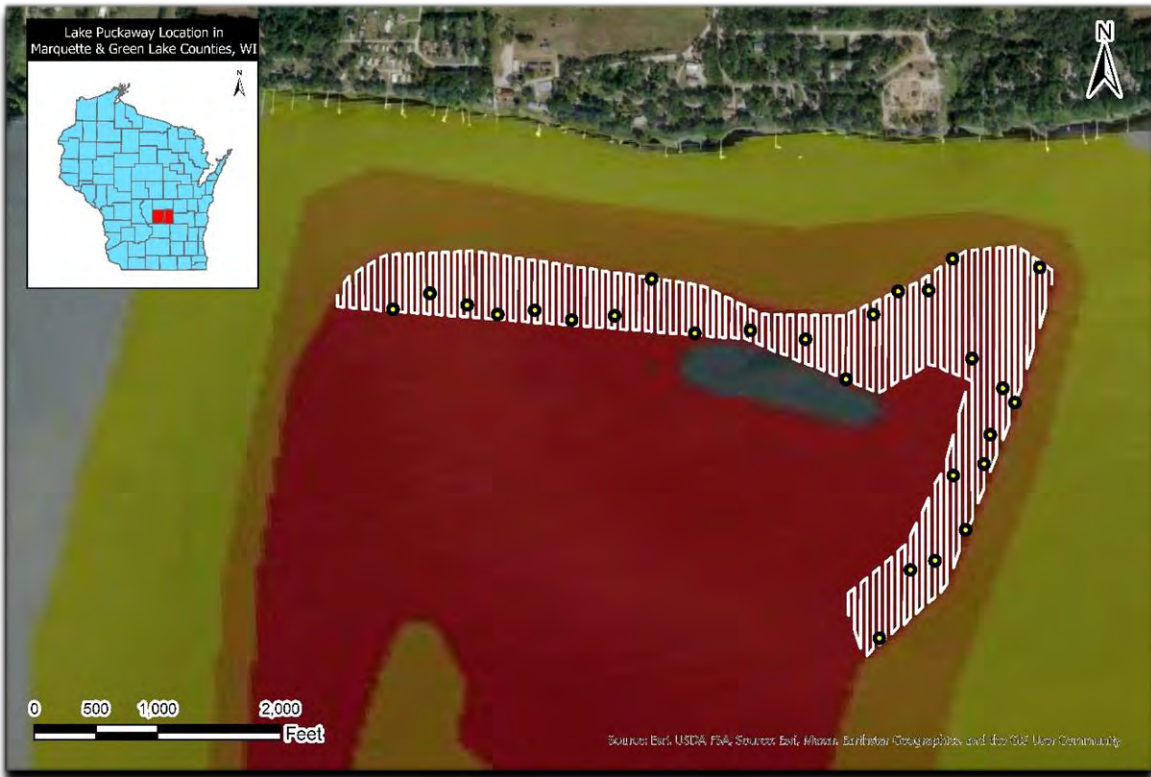


Figure 16. The 50-acre 2023 trial ProcellaCOR treatment area “Option B” transect lines (Full Extent of Treatment Area).

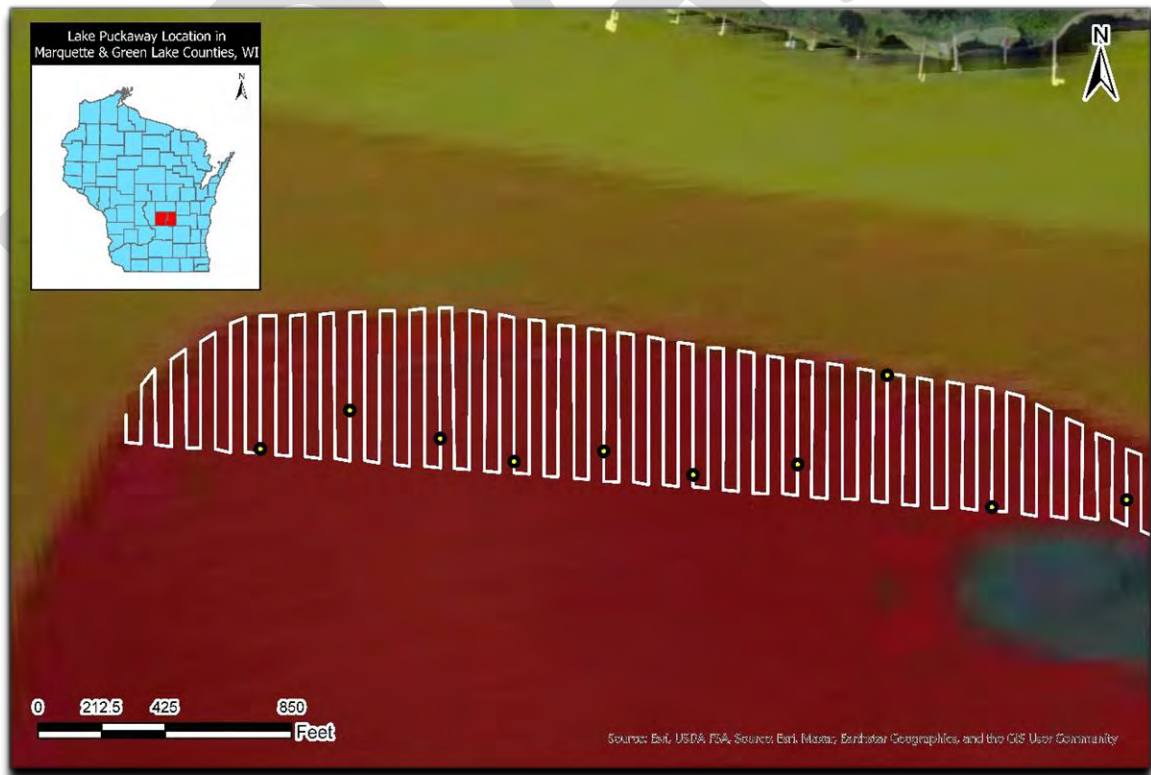


Figure 17. The 50-acre 2023 trial ProcellaCOR treatment area “Option B” transect lines (West).

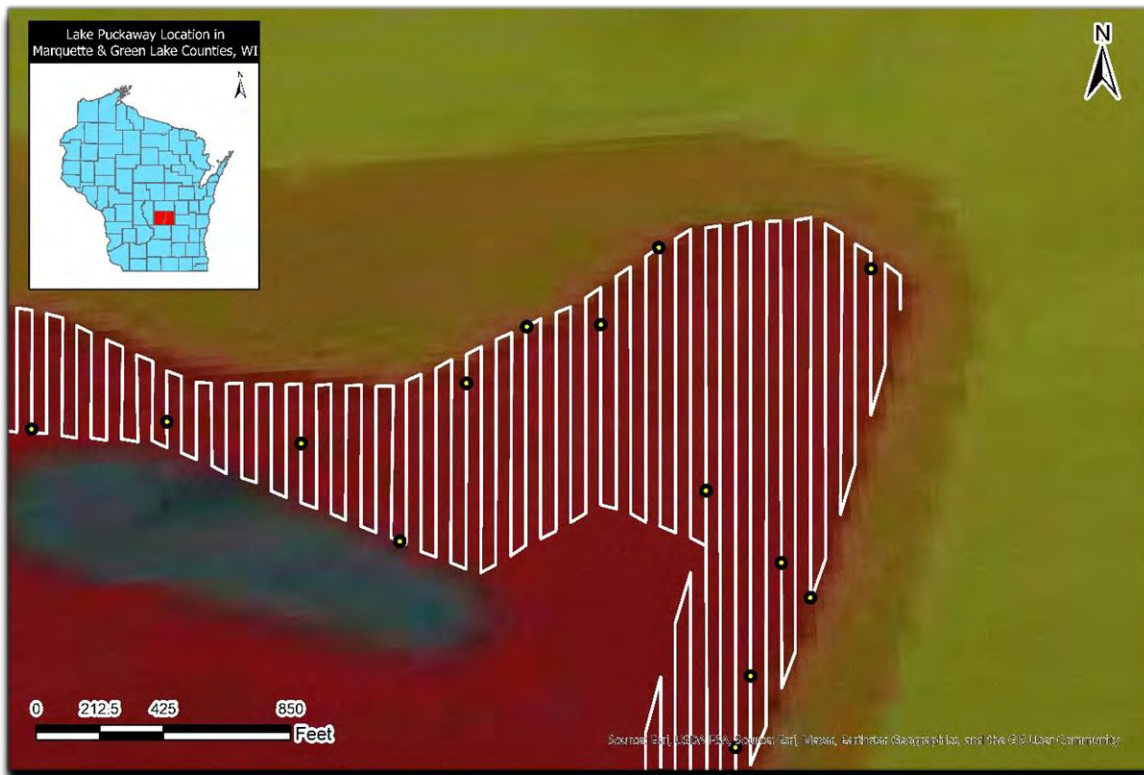


Figure 18. The 50-acre 2023 trial ProcellaCOR treatment area “Option B” transect lines (Northeast).

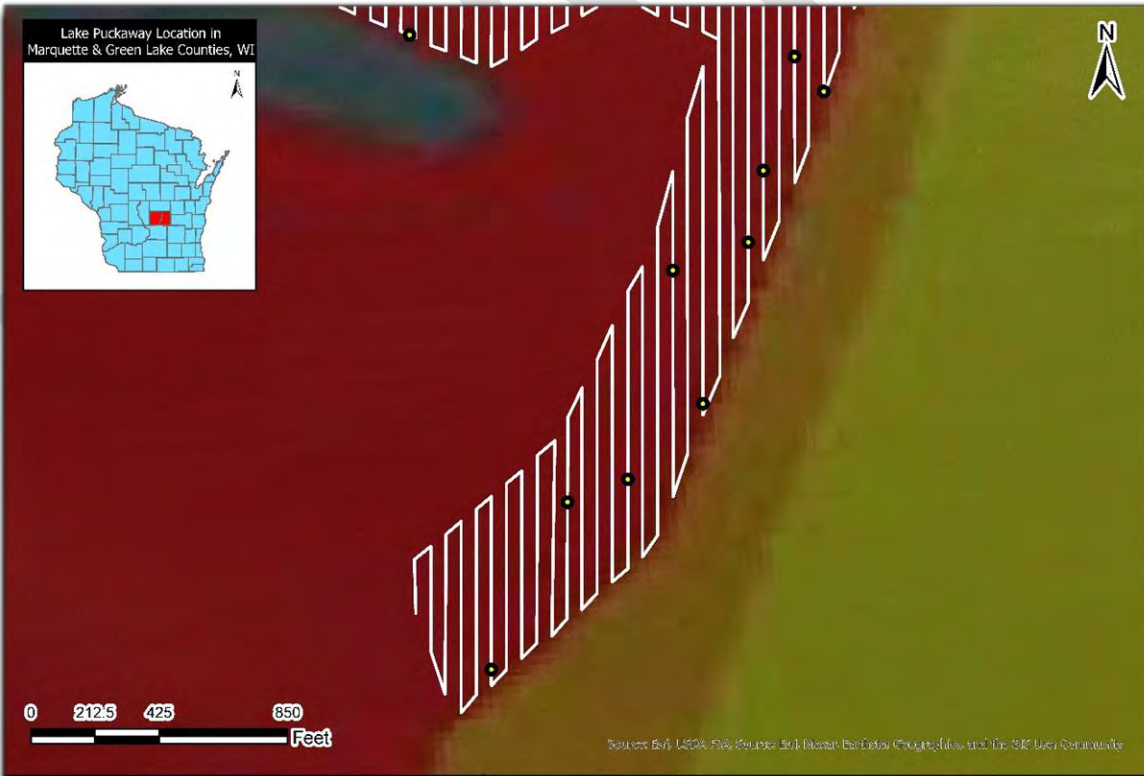


Figure 19. The 50-acre 2023 trial ProcellaCOR treatment area “Option B” transect lines (Southeast).



**Photo 3. At the 50-acre 2023 trial ProcellaCOR treatment area, day of treatment June 8<sup>th</sup>, 2023.**



**Photo 4. Closeup of Eurasian/Hybrid watermilfoil within the 2023 trial ProcellaCOR treatment area, day of treatment June 8<sup>th</sup>, 2023.**



**Photo 5. ProcellaCOR and application equipment used for the 2023 trial ProcellaCOR treatment.**



**Photo 6. Sub-surface injection of ProcellaCOR within the trial treatment area, day of treatment June 8<sup>th</sup>, 2023.**



**Photo 7. Navigational impediment of the treatment boat prop by Eurasian/Hybrid watermilfoil during the treatment; June 8<sup>th</sup>, 2023.**



**Photo 8. Clearing the treatment boat prop of Eurasian/Hybrid watermilfoil during the treatment; June 8<sup>th</sup>, 2023.**

## APPENDIX H

# Princeton Dam Operation Plan: May 2023 – June 2026

Published May-11-2023

## PRINCETON DAM OPERATION PLAN – MAY 2023 THROUGH JUNE 2026

Published 5-11-2023

### A. BACKGROUND

Dams are part of a dynamic system comprised of the river, the dam itself, and precipitation across the contributing watershed. In general, dam operators need to monitor flow conditions and precipitation rates and operate the dam accordingly. Under certain conditions some dam owners will need to notify downstream dams of changes in operation.

The Princeton Dam does not have ordered pool levels established under Ch. 31.02, Stats. From 1960 to 2018, water levels had historically been seasonally adjusted by placement of flashboards across the long crest of the dam in the spring, and their removal in the fall. Due to the construction of a permanent concrete cap on the crest of the dam that replaced the board system, water levels can only be manipulated by operating the gates in the old lock channel.

Due to the presence of the long, ungated overflow crest, the Princeton Dam has very limited ability to manage levels during periods of high flows, and elevations may fluctuate significantly following rain events. However, levels can be reasonably managed during periods of normal, steady flows.

Water level readings are based on the staff gage mounted on the left (north) end of the gated lock channel section near the Public Access and Fishery area at the end of Lock Road south of State Highway 23 east of Princeton, WI. For reference:

- The crest of the dam is at an elevation of 7.23' on the staff gage. At this level there would be no flow over the dam, and 6" of flow in the fish ladder.
- The North American Vertical Datum of 1988 (NAVD88) can be obtained by adding 754.64 to the staff gage reading. The crest of the dam is elevation 761.87 in this datum.

In the interest of navigation and recreation, it is desirable to have higher lake levels maintained in the summer. In the interest of shoreline stability, water quality, wetland conservation, and agricultural uses, it is desirable to have lower lake levels maintained in the winter. In the interest of fish passage through the dam it is desirable to have an adequate amount of flow through the fish ladder and/or through the lock channel gates at all times. In the interest of protecting hibernating herptile species, it is desirable to begin seasonal transitions to targets before overnight freeze conditions are common.

### B. SEASONAL SETTINGS

To meet the general goals presented above, the following settings during specified date ranges for the Princeton Dam will be used:

- **LATE FALL SEASON: October 1 to November 1**
  - Preliminary seasonal gate openings may occur, if water level readings are above 8.1'. This may involve incrementally opening one or more gates to move the level toward a reading of 8.1'.
- **WINTER SEASON: November 1 to March 1**
  - Dam will be set to three gates open during this time period, and will not be adjusted unless the following situations occur:
    - If the staff gage reading at the dam would be below 7.3' if three gates remained open, one or more gates will be closed to maintain a level no lower than 7.3'.
    - If the staff gage reading at the dam would be above 8.1' if only three gates were open, additional gate(s) will be opened to maintain a level no higher than 8.1'.
- **SPRING SEASON: March 1 to the week before Memorial Day**
  - Dam will be set to all five gates open during this time period, and will not be adjusted unless the following situation occurs:
    - If the staff gage reading at the dam would be below 7.3' if all gates remained open, one or more gates will be closed to maintain a level no lower than 7.3'.
- **TRANSITION FROM SPRING TO SUMMER: Week before Memorial Day to Third Week in June**
  - Early in the week prior to Memorial Day: Adjust to 4 gates open, if not already at this setting
  - Right after Memorial Day: Adjust to 3 gates open, " "
  - Early in the 1st full week of June: Adjust to 2 gates open, " "
  - Early in the 2nd full week of June: Adjust to 1 gate open, " "
  - Early in the 3rd full week of June: Closed for Summer Season
- **SUMMER/EARLY FALL SEASON: Third Week in June to October 1**
  - All gates closed, no adjustment.

### C. GATE ADJUSTMENT PROCEDURE

Procedures for operating gates is described in the paragraphs below. Visitation by DNR staff is anticipated to occur infrequently, as it is expected that monitoring via the USGS gage will be effective and flows generally do not vary rapidly.

To determine the appropriate gate setting, use the following procedure:

- Read the current river flow rate from the USGS gage at Princeton:  
[https://waterdata.usgs.gov/nwis/uv/?site\\_no=04073365&agency\\_cd=USGS](https://waterdata.usgs.gov/nwis/uv/?site_no=04073365&agency_cd=USGS)
- Using the rating curve developed for this dam, find the flowrate along the horizontal axis. From that flow rate, follow a vertical line up to the curved line representing the number of gates currently open at the dam.
- At the intersection of flow rate and gate setting, follow a horizontal line over to the left-hand axis. This represents an estimate of the staff gage reading for a given flow rate and gate setting.



- If the estimated staff gage reading is near the bounds established by the seasonal levels described above, DNR staff should plan a visit to the dam to obtain an actual reading. If elevation is out of range, open or close gates as necessary.
- Open Gate #3 (middle) first, Gates #2 and #4 next, and Gates #1 (southerly end) & #5 (northerly end) last. Closures should follow the reverse order. Gates #1 and #5 should be opened last and closed first, in order to avoid turbulence along the lock channel walls.
- To avoid sudden downstream depth changes, avoid closing more than one gate per day and avoid opening more than two gates per day. If greater adjustment is needed, allow three days for the river to come to equilibrium and complete the additional adjustment in a separate visit.

## APPENDIX I

### Anonymous Public Questions & Comments Received

## ANONYMOUS PUBLIC QUESTIONS & COMMENTS RECEIVED AS OF 7/22/2023

1. **Please! Help us get the lake back. It hurts so much to see it die foot by foot by foot.**

*Thank you for caring about your lake! We certainly hope to continue working with the LPPRD to greatly improve the AIS situation on the lake, and thereby improve navigation, recreational activities, economic value, and aesthetics of the lake to generally help you all take back the valuable aquatic resource that is Lake Puckaway!*

2. **What evidence/survey's/of algae blooms on Lake Puckaway that was stated. There was significant bloom happened before the current condition of watermilfoil-invasives, AIS?**

*There have been Secchi disk readings taken on Lake Puckaway multiple times per year since 1996 (**Appendix E**). Water clarity (i.e. decreased turbidity/Chlorophyll a) has steadily improved in the last 3 years. This is likely attributable to the increase in overall aquatic plant biomass not solely AIS. However, AIS are taking up nutrients from the water column that could otherwise be used by algae to fuel algae blooms. To lower the risk of larger Harmful Algal Blooms (HABs) on Lake Puckaway, we recommend the strategic use of selective herbicides to systematically reduce the AIS biomass within the lake and progressively allow the native aquatic plants to replace those invasive species without causing detrimental HABs on the lake.*

3. **Who holds the warranty? SePro or Applicator? Why ProcellaCOR? Other Herbicides? Options.**

*Cason Land & Water Management, LLC holds the ProcellaCOR Extended Control Contract with SePro for the Lake Puckaway herbicide application. This is because the warranty is only available to SePro certified Stewards of Water applicators, which Cason Land & Water Management, LLC is certified in. ProcellaCOR was chosen because out of all the available EWM aquatic herbicides, it is the most selective product on the market, it is extremely effective against EWM/HWM, is comparable in price to broad spectrum herbicides, includes the option of a 3-yr Extended Control Contract which further sets it apart from all other available herbicide options registered for use in Wisconsin. Other herbicide options such as 2,4-D formulations could be considered but the combination of decreased selectivity compared to ProcellaCOR, the need for large scale control on Puckaway in a systematic approach, and the potential for creating herbicide resistant EWM/HWM within Lake Puckaway without causing a massive HAB are all considerations that need to be taken into account when selecting the best option for the lake.*

4. **I thought that the original idea was to let the rice grow more on the lake?**

*Wild Rice would not be impacted by this proposed Lake Management Plan.*

5. **If People stop fertilizing there lawns will it help kill the invasive plants?**

*At this point in the infestation of EWM/HWM on the lake, combined with the internal nutrient availability within the lake basin, and additional nutrient inputs flowing into the lake, even if everyone around the lake stopped fertilizing their lawns, the AIS would not disappear from the lake. However, that said, it is always a great idea to not fertilize lakeside lawns to help reduce the input of nutrients flowing into the lake. This would be especially useful to stop doing once Lake Puckaway got the AIS problem under control.*

6. **So did this have anything to do with the lake levels?**

*While lower water levels generally help to increase the depth that sunlight can penetrate the water and further aquatic plant growth, low lake levels did not introduce this invasive species to the lake. Additionally, with increased water clarity, the entirety of Lake Puckaway is now essentially a littoral zone where aquatic plants could potentially grow.*

7. **Concern of size limit of Northern Pike. Has the size limit had a detrimental effect on perch and bluegill/ panfish. A huge decrease in the number and size of perch/panfish due to the push for “Trophy size pike”. Please bring back perch and panfish/lower the northern pike size limit.**

*Aquatic plant density, especially AIS such as EWM/HWM, can cause a great decrease in the overall size class structure of prey species like perch and panfish within a lake. This is largely since AIS tend to form large monocultures that are extremely dense structure where larger fish like bass and northern pike are not able to hunt as effectively. Reducing the extent of EWM/HWM on the lake will open up more of those areas to predation pressure from Northern Pike. Your DNR fisheries representative will be able to better assess the fishery condition of the lake and provide an explanation of current size limits and discuss any potential needs to adjust those given the rapidly changing aquatic habitat in the lake.*

8. **I am concerned about falling property values due to the low water levels. Assessed value for tax purposes will not match actual property sale value due to lake water levels.**

*This is absolutely a legitimate concern and one of the main reasons people opt to get involved in managing AIS that find their way into their lake. The impacts of invasive species such as EWM/HWM can have significant ecological, recreational, aesthetic, and economic impacts to riparian communities. The best way to reduce these impacts is to have an effective lake management strategy to maintain the benefits of living on a lake and having lakeshore property.*

9. **What is Buffalo lake doing for EMF remediation?**  
*Buffalo Lake has a published management plan that is publicly available. They do utilize mechanical harvesters to maintain navigation lanes throughout the summer months.*
10. **Has there been success using ProcellaCOR on other lakes?**  
*Yes, ProcellaCOR has been used on hundreds of lakes throughout Wisconsin specifically and far more throughout other parts of the US.*
11. **What does the DNR recommend and/or approve?**  
*The Wisconsin DNR has an approved list of aquatic herbicides allowed for use in Wisconsin. However, each region's Aquatic Plant Management Coordinator is allowed the final say in which products can be utilized for a particular application on public lakes. So close cooperation with appropriate DNR personnel is essential for developing a successful management plan for a particular lakes' situation.*
12. **How much does the higher levels of nitrogen and phosphorous contribute to the EMF growth?**  
*Phosphorus is typically the limiting nutrient within lakes in Wisconsin. Available phosphorus has been decreasing steadily within the lake in the last several years. This is most likely due to all aquatic plants taking up Phosphorus, not just AIS. However, since AIS make a large percentage of aquatic plant biomass within Lake Puckaway, they are certainly benefiting from the phosphorus that was and is available within the lake currently.*
13. **What is your opinion on using weevils for control?**  
*It is our opinion that weevils have not been shown to be a viable or economical option for control of EWM/HWM on lakes of this size. Weevils are native to this area so if they were going to knock the EWM/HWM back by any noticeable amount on the lake, they currently have the opportunity to do so.*
14. **Once and effective herbicide is chosen how often must it be reapplied to maintain control?**  
*This is highly variable from lake to lake and there is no straightforward answer that any applicator could give you to that question reliably. With the case of ProcellaCOR, and our recommended strategy to retake control of Lake Puckaway. This will be a multi-year process that is dependent on how much can be treated in a single year, multiple years in a row. I can say that for a given treatment area, the Extended Control Contract will warranty treatment areas that meet the minimum qualifications for the warranted treatment, for 3 years following the original treatment. This warranty would cover the*

*cost of the herbicide itself (excluding applicable application labor and setup charges) required to re-treat any area that qualifies.*

15. **What can we do as concerned property owners to help the weed issues?**

*Attend the LPPRD meetings and voice your concerns. Additionally, you could assist the LPPRD with fundraising efforts for any Aquatic Plant Management initiatives, lobby local governments for funding opportunities, contact your local DNR Aquatic Plant Management coordinator to voice your concerns, and manually remove EWM along your 30' wide swath of shoreline.*

16. **Are there grants that we can apply for to help?**

*Yes, there is a DNR Surface Water Grant program that could be applied for AIS Control that could help to offset some of the costs associated with aquatic plant management activities. Additionally, there are grants to assist with the purchasing of new aquatic plant harvesters to be used for maintaining navigation lanes throughout the lake, leading to open water areas.*

DRAFT

## APPENDIX J

### Clean Boats, Clean Waters

# Apuckawa Park Access

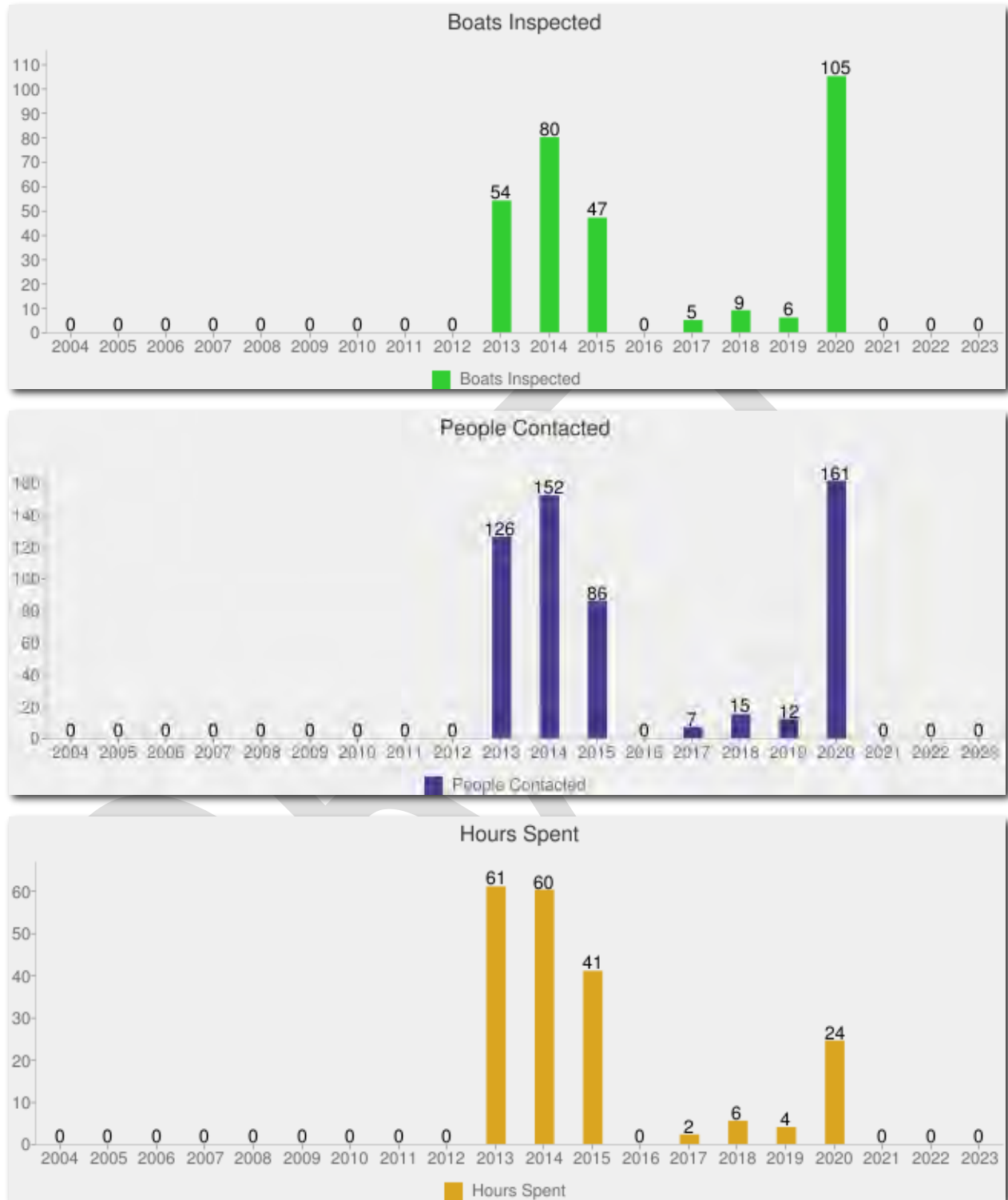


Figure 20. Clean Boats Clean Waters data for the Apuckawa Park Access from 2004 to 2023.



# Arrowhead Road Launch

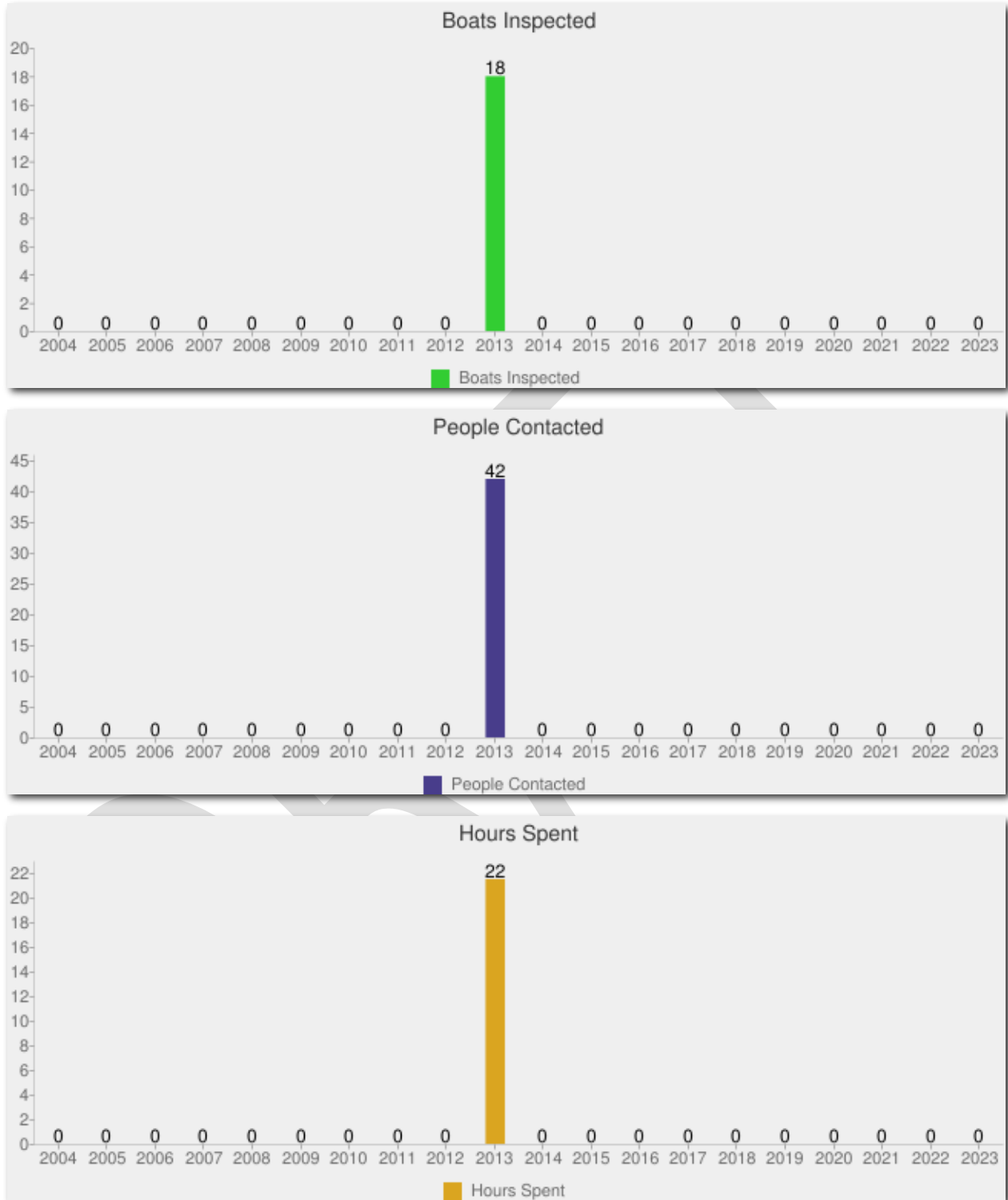


Figure 21. Clean Boats Clean Waters data for the Arrowhead Road Launch from 2004 to 2023.

# Charlevoix Street Launch

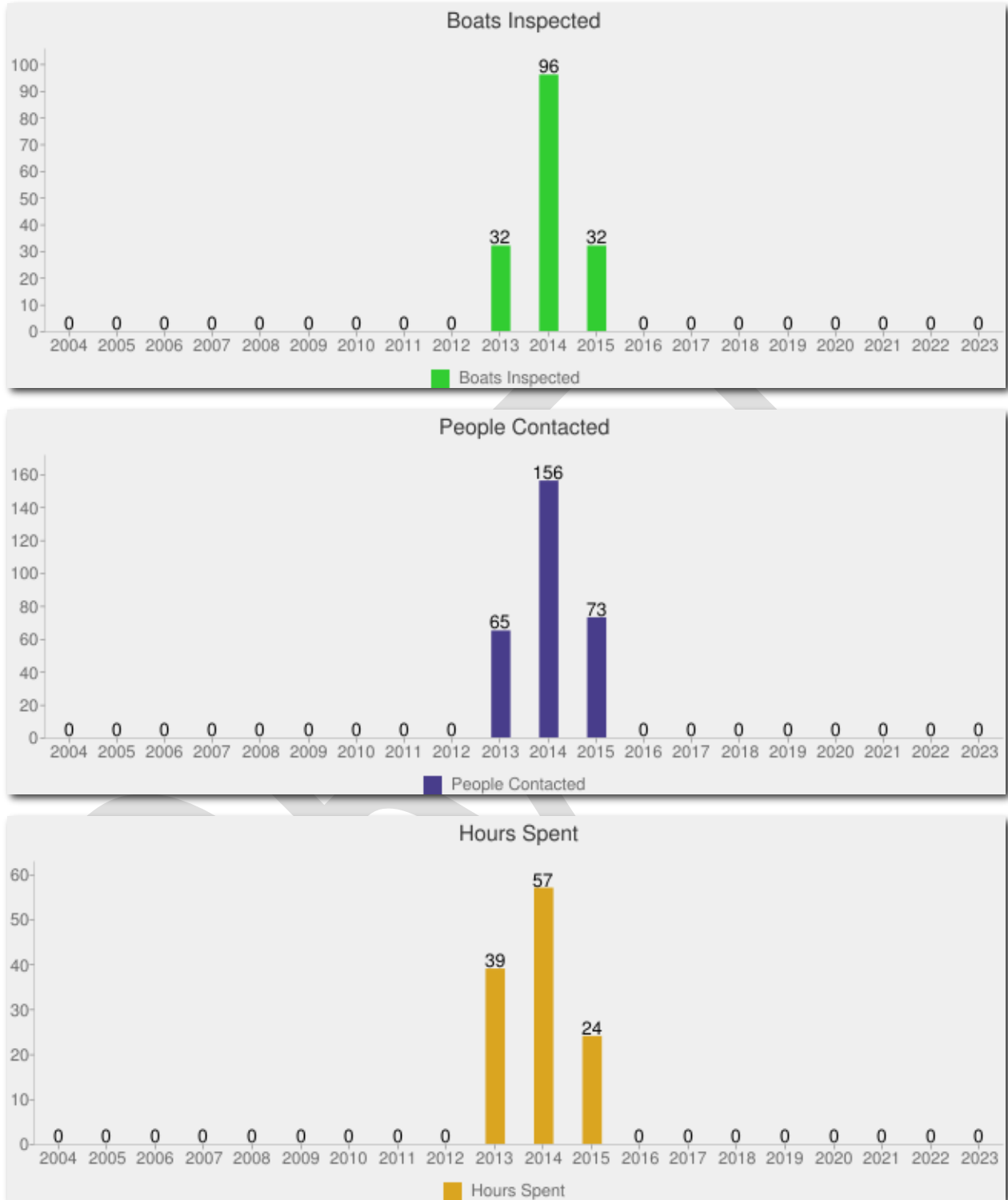


Figure 22. Clean Boats Clean Waters data for the Charlevoix Street Launch from 2004 to 2023.

# Lotus Drive Launch

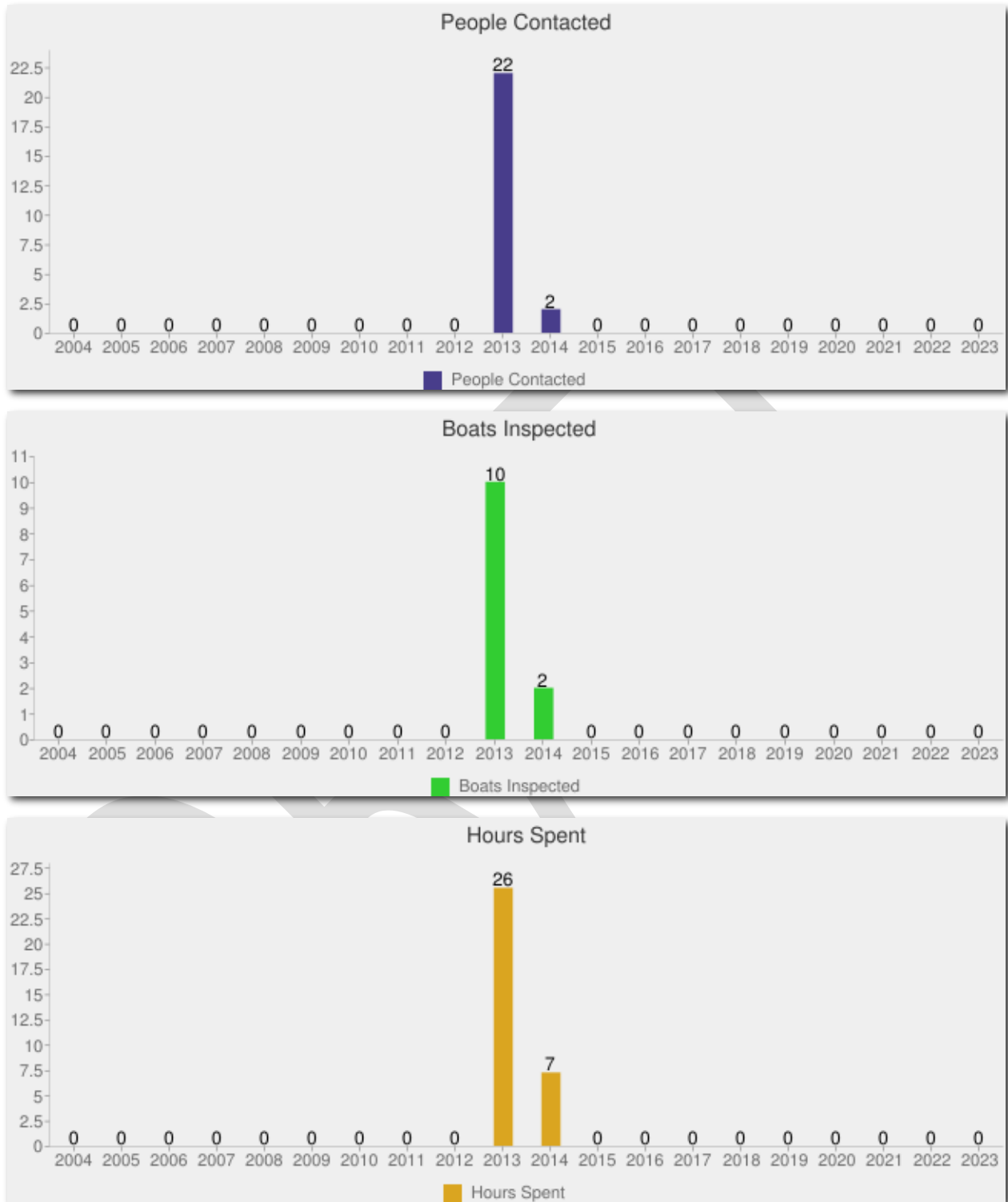


Figure 23. Clean Boats Clean Waters data for the Lotus Drive Launch from 2004 to 2023.

# Lyons Street Launch

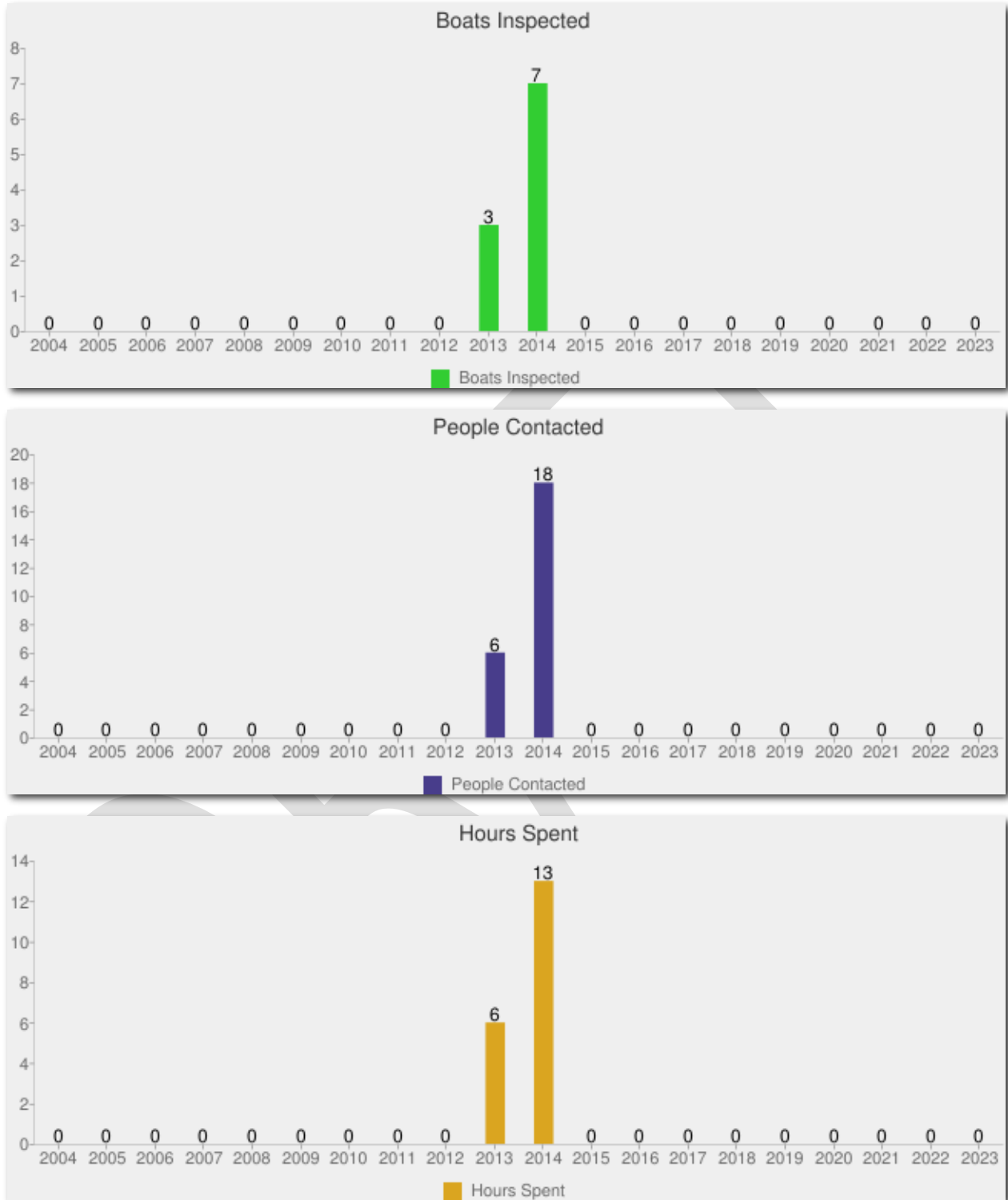


Figure 24. Clean Boats Clean Waters data for the Lyons Street Launch from 2004 to 2023.

## Oak Road & Lake View Drive N. Launch

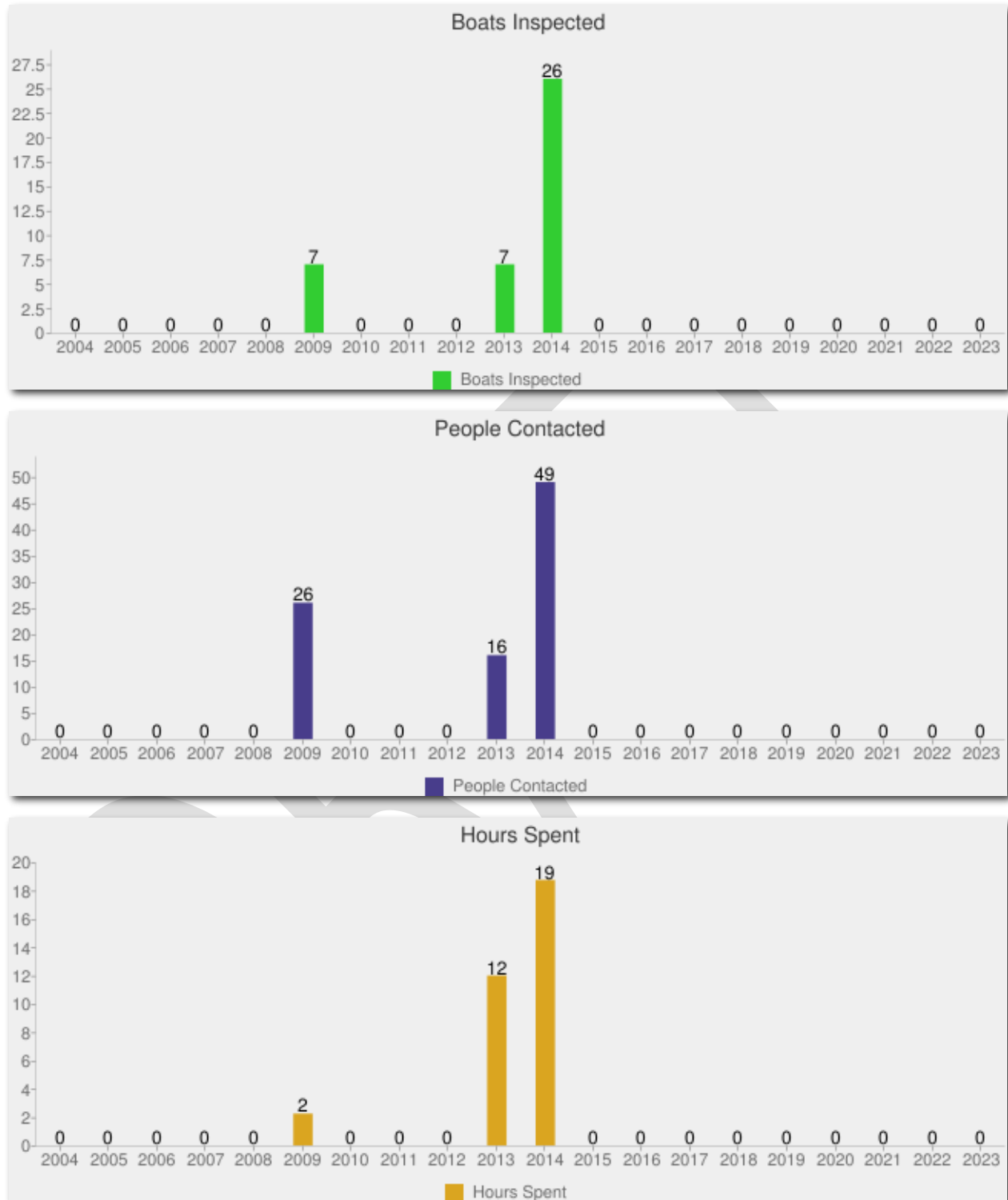


Figure 25. Clean Boats Clean Waters data for the Oak Road & Lake View Drive N. Launch from 2004 to 2023.

# Sherman Avenue Launch

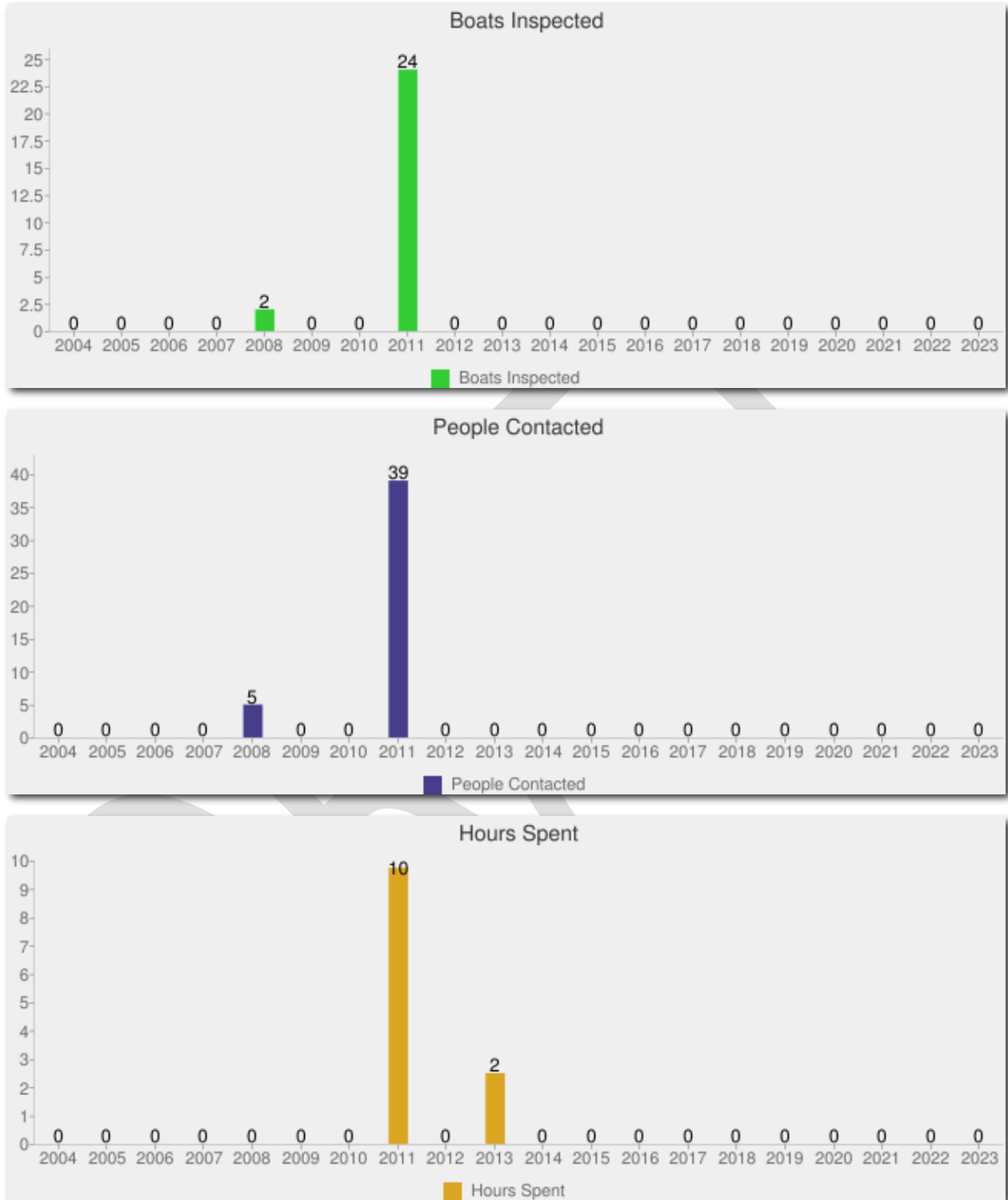


Figure 26. Clean Boats Clean Waters data for the Sherman Avenue Launch from 2004 to 2023.

# W. Northshore Drive Launch

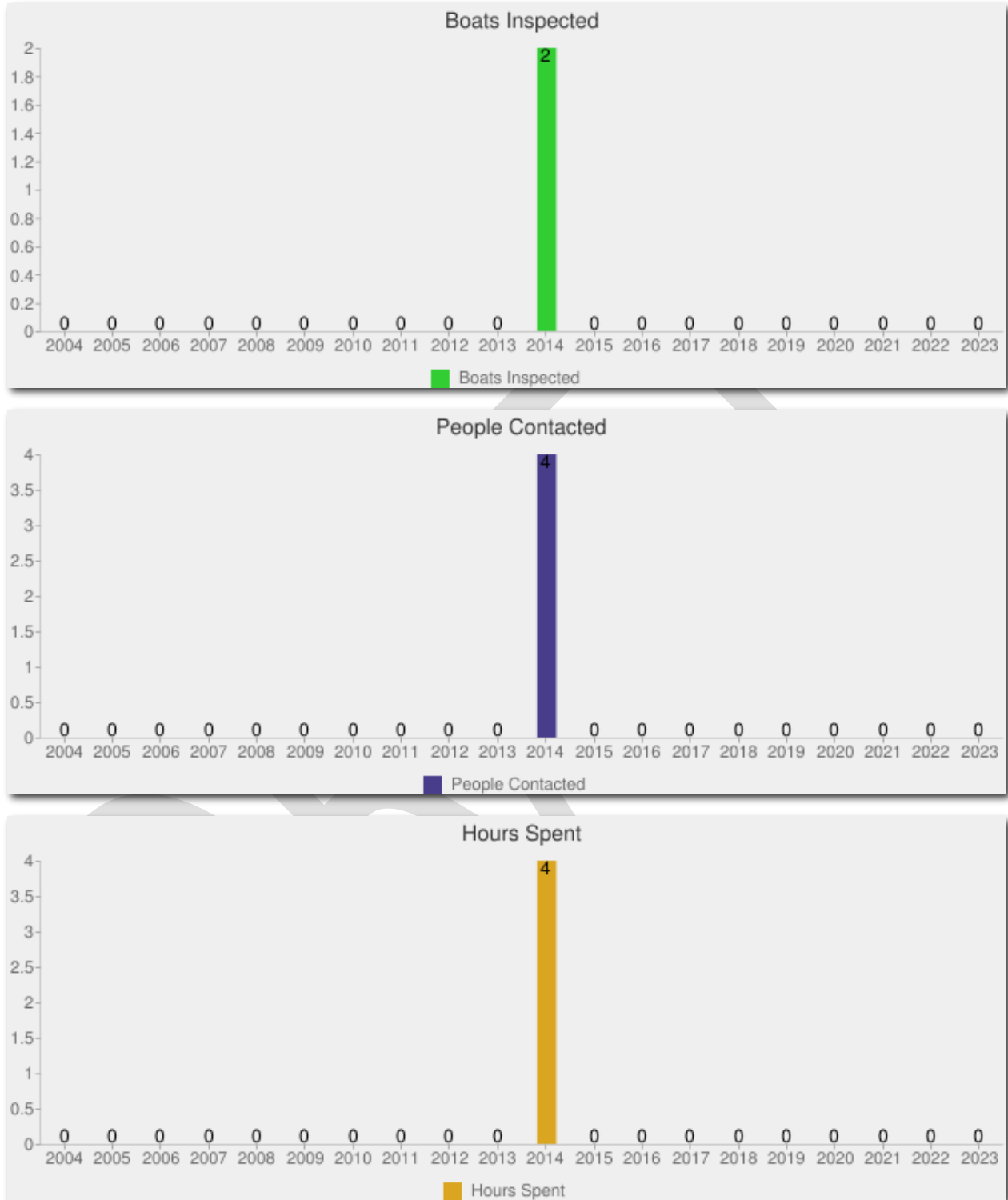


Figure 27. Clean Boats Clean Waters data for the W. Northshore Drive Launch from 2004 to 2023.

## APPENDIX K

### 2023 Sub-polygon Point-Intercept Survey Summary Report



## Lake Puckaway 2023 Sub-polygon Point-Intercept Survey Summary Report

### Introduction

On August 7<sup>th</sup>, 2023, Cason Land & Water Management, LLC. conducted a sub-polygon point-intercept survey on Lake Puckaway. This aquatic plant survey was developed in coordination with the Wisconsin DNR in order to better understand the effects of treating Eurasian/Hybrid watermilfoil in a large shallow lake system using the selective aquatic herbicide, ProcellaCOR. A trial treatment of 50 acres of EWM/HWM was performed on June 8<sup>th</sup>, 2023, and this survey serves as the first of 3 consecutive annual sub-polygon point-intercept surveys to be conducted within this treatment area. The goal of this survey is to quantify the extent to which EWM/HWM was impacted post-treatment in the initial treatment year. It will be important to continue to monitor this same location for the 2024 and 2025 seasons as well to monitor the response of native species to ProcellaCOR treatments on Lake Puckaway.

### Methods

Through consultation with Wisconsin DNR personnel, the Lake Puckaway Protection and Rehabilitation District board, and Cason Land & Water Management, LLC staff, a 50-acre site was selected for an aquatic herbicide treatment in 2023 (Fig. 1). This site was chosen based on distributions of EWM mapped out for the LPPRD during the September 2022 Aquatic Plant Survey (conducted by Wisconsin Lake & Pond Resource, LLC). This site is located along the northern edge of the densest patch of EWM in the western basin of Lake Puckaway.

This site was treated with ProcellaCOR on June 8<sup>th</sup>, 2023, once EWM was growing aggressively but before native plants become fully established for the active season. This was done to reduce impacts to those native aquatic plant species within the lake. The treatment utilized subsurface injection hoses mounted from booms on a professionally outfitted lake treatment boat.

A sub-polygon Point-Intercept survey of the treatment area as well as a 300-foot buffer area surrounding the treatment area was developed by Cason Land & Water Management, LLC staff through conversations with Wisconsin DNR. A survey map with a total of 111 sampling points was developed in ArcGIS Pro using 100m spacing between grid points. Aquatic plant samples were collected from a boat with a single rake pull from a double rake head attached to a pole. Plant samples collected were identified to genus and species whenever possible, and the information was recorded. An abundance rating was also given for each species collected using criteria established by the WDNR. Water depths were also recorded for each location. Data collected was used to determine species composition, percent frequency and relative abundance.

This survey will provide post-treatment plant community data with which to compare to the whole-lake Point-Intercept survey that was conducted in 2022. While there would not be enough sampling points from the 2022 whole-lake PI survey to conduct valid statistical tests, we can qualitatively compare presence and absence data for plants within the treatment area as well as the 300ft buffer area surrounding the treatment area. Going forward, in the second- and third-years post-treatment, we will be

able to use statistical analyses to quantify the response of native plants as well as the impact on EWM/HWM following this ProcellaCOR treatment.

Summary statistics and comparative statistics for the sub-polygon Point-Intercept survey and the most recent whole-lake PI survey of the treatment area and buffer region were developed from the data collected following the survey. These results were then used to illustrate the effectiveness of the treatment on EWM, identify impacts to native species present, and provide insights into how best to utilize selective aquatic herbicides like ProcellaCOR to manage EWM within Lake Puckaway in future years.

#### I. Simpson Diversity Index

To estimate the diversity of the aquatic plant community, the Simpson Diversity Index considers both the number of species identified (richness) and the distribution or relative abundance of each species. With the Simpson Diversity Index ( $D$ ), 1 represents infinite diversity and 0 represents no diversity. That is, the bigger the value of  $D$ , the higher the diversity.

#### II. Assessment of Floristic Quality Resources

The plant data collected for Lake Puckaway was used to assess the *floristic quality* of the lake. The method used, assigns a value to each native plant species called a *Coefficient of Conservatism*. Coefficient values range from 0-10 and reflect a particular species' likelihood of occurring in a relatively undisturbed landscape. Species with low coefficient values, such as sago pondweed (*Stuckenia pectinata*) ( $C=3$ ), are likely to be found in a variety of habitat types and can tolerate high levels of human disturbance. On the other hand, species with higher coefficient values, such as white-stem pondweed (*Potamogeton praelongus*) ( $C=8$ ), are much more likely to be restricted to high quality natural areas. By averaging the coefficient values available for the submergent and emergent species found in the lake, a value was assigned to the lake. The average *Coefficient of Conservatism* value for lakes in Wisconsin is 6.0, Lake Puckaway's average was found to be 5.69 in the 2022 whole-lake PI survey.

By utilizing the Coefficients of Conservatism for the plant species of Lake Puckaway, further assessment of floristic quality of the sub-polygon survey area was made. By multiplying the average coefficient values for the sub-polygon PI survey area by the square root of the number of plant species found, a Floristic Quality Index (FQI) was calculated to be 15.9. The average for Wisconsin lakes is 22.2. According to the U.S. Fish and Wildlife Service "The FQI is an indication of native vegetative quality for an area: generally, 1-19 indicates low vegetative quality; 20-35 indicates high vegetative quality and above 35 indicates "Natural Area" quality. Wetlands with a FQI of 20 or greater are considered high quality aquatic resources."

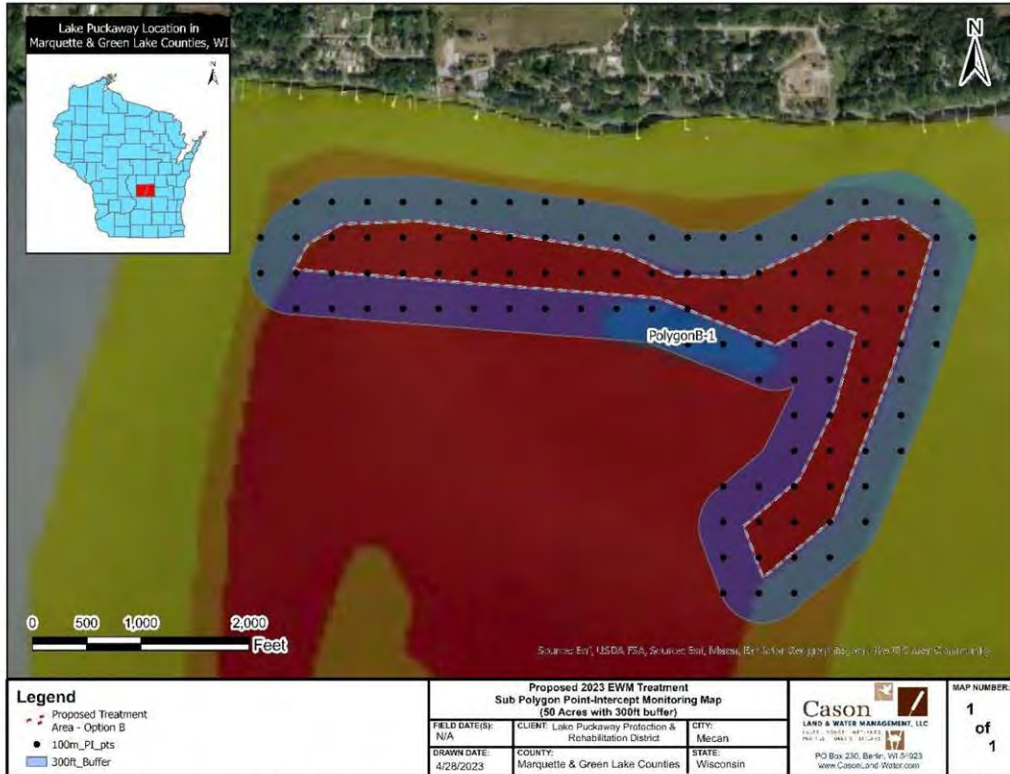


Figure 1. Site of the 50-acre 2023 EWM ProcellaCOR EC treatment area (red & white border). A 300-foot buffer area outside of the treatment area is also shown in blue. A total of 111 Point-Intercept Survey points are shown as black dots for monitoring locations.

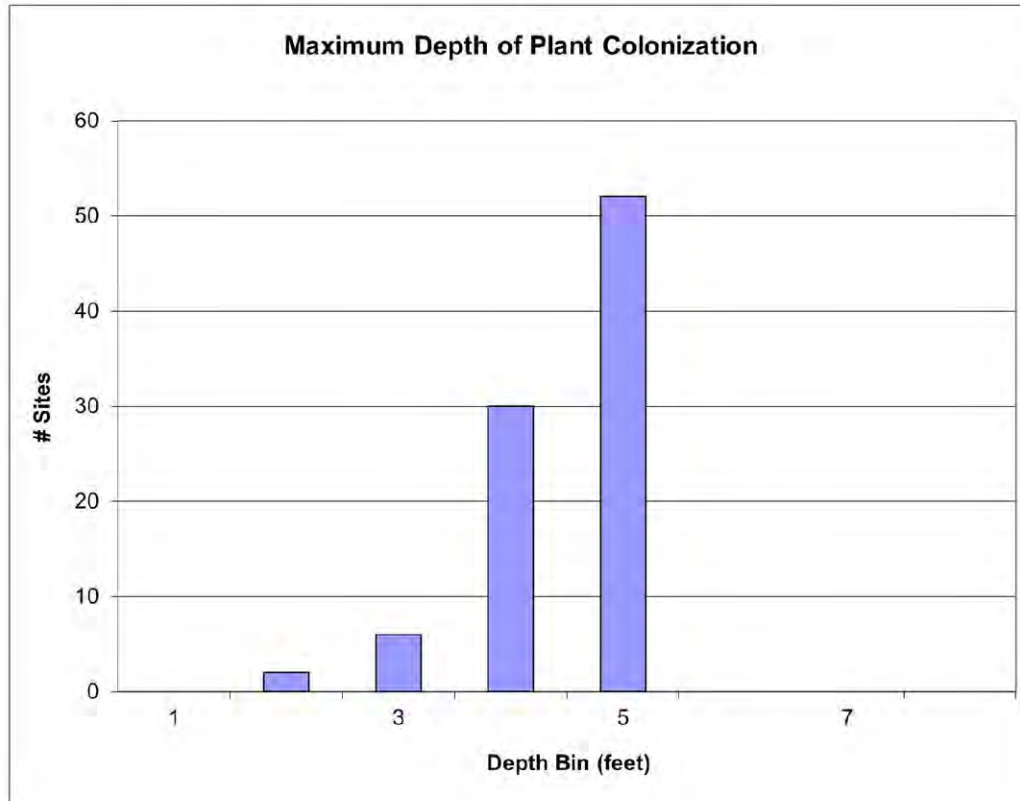
## Results

During the 2023 post-treatment sub-polygon point-intercept survey of both the treatment area and a surrounding 300ft buffer zone, 11 aquatic plant species were observed across 111 sampling sites (Table 1). This includes species that were sampled via a rake pull as well as Sago pondweed which was only visually observed within this area but not sampled via rake pulls. Being that Lake Puckaway is a very shallow lake, all sample sites in this area were at a depth of less than 6ft and Fig. 2 illustrates the distribution of plant colonization depths recorded in this monitoring area.

**Table 1. All aquatic plant species observed during the 2023 Lake Puckaway sub-polygon PI survey, including BOTH the ProcellaCOR treatment area and a 300ft buffer zone surrounding the treatment area. (111 total sampling sites)**

Species	Scientific Name	Plant type: floating leaf, free floating, submergent, emergent	% Relative Frequency of Occurrence	Sites Found
Coontail	<i>Ceratophyllum demersum</i>	Submergent	45.8	77
Common waterweed	<i>Elodea canadensis</i>	Submergent	11.3	19
White water lily	<i>Nymphaea odorata</i>	Floating Leaf	0.6	1
Curly-leaf pondweed	<i>Potamogeton crispus</i>	Submergent	1.2	2
Eurasian water milfoil	<i>Myriophyllum spicatum</i>	Submergent	28.6	48
Wild celery	<i>Vallisneria americana</i>	Submergent	2.4	4
Slender naiad	<i>Najas flexilis</i>	Submergent	8.3	14
Sago pondweed	<i>Stuckenia pectinata</i>	Submergent	Visuals Only	10
Variable pondweed	<i>Potamogeton gramineus</i>	Submergent	0.6	1
Forked duckweed	<i>Lemna trisulca</i>	Free Floating	0.6	1
Fries' pondweed	<i>Potamogeton friesii</i>	Submergent	0.6	1

Species Richness: 10  
Species Richness (with visuals): 11  
Simpson Diversity Index (D): 0.69  
Floristic Quality Index (FQI): 15.9  
Avg. Coefficient of Conservatism (C): 5.63



**Figure 2.** The maximum depth of plant colonization that was observed during the 2023 sub-polygon point-intercept survey. Since Lake Puckaway is shallow throughout, and this survey only targeted one small area, all sample locations were in less than 6 feet of water.

When considering aquatic plant sampling locations only within the ProcellaCOR treatment area, we observed a total of 5 submergent aquatic plant species at 39 sampling locations (**Table 2**). In particular, Coontail (*Ceratophyllum demersum*), a native aquatic plant which was stated as a top native species to avoid impacts to by DNR personnel, was observed at a relative frequency of occurrence of 57.5%. Meanwhile, EWM was highly reduced throughout the northern and northeastern portion of the treatment area, with less reduction on the southernmost extent of the treatment area. This resulted in a 17.5 % relative frequency of occurrence of EWM in the treatment area.

**Table 2. All aquatic plant species observed during the 2023 Lake Puckaway sub-polygon PI survey, ONLY WITHIN the ProcellaCOR treatment area. (39 total sampling sites)**

Species	Scientific Name	Plant type: floating leaf, free floating, submergent, emergent	% Relative Frequency of Occurrence	Sites Found
Coontail	<i>Ceratophyllum demersum</i>	Submergent	57.5	23
Common waterweed	<i>Elodea canadensis</i>	Submergent	15.0	6
Eurasian water milfoil	<i>Myriophyllum spicatum</i>	Submergent	17.5	7
Slender naiad	<i>Najas flexilis</i>	Submergent	10.0	4
Sago pondweed	<i>Stuckenia pectinata</i>	Submergent	Visuals only	4

*Species Richness: 4*  
*Species Richness (with visuals): 5*  
*Simpson Diversity Index (D): 0.61*  
*Floristic Quality Index (FQI): 6.93*  
*Avg. Coefficient of Conservatism (C): 4*

To determine the extent to which the ProcellaCOR treatment impacted the aquatic plant community outside of the treatment area, we examined a 300ft buffer zone surrounding the treatment area. Within this buffer zone, we observed 11 species total, including the two major AIS, EWM and CLP (**Table 3**). Interestingly, in the buffer zone, where EWM had the highest relative frequency of occurrence at 32%, Coontail was found to be at a lower frequency of occurrence here versus in the actual treatment area itself where EWM was much more impacted by the ProcellaCOR treatment.

**Table 3. All aquatic plant species observed during the 2023 Lake Puckaway sub-polygon PI survey, ONLY WITHIN the 300ft buffer zone surrounding the treatment area. (72 total sampling sites)**

Species	Scientific Name	Plant type: floating leaf, free floating, submergent, emergent	% Relative Frequency of Occurrence	Sites Found
Coontail	<i>Ceratophyllum demersum</i>	Submergent	42.2	54
Common waterweed	<i>Elodea canadensis</i>	Submergent	10.2	13
White water lily	<i>Nymphaea odorata</i>	Floating Leaf	0.8	1
Curly-leaf pondweed	<i>Potamogeton crispus</i>	Submergent	1.6	2
Eurasian water milfoil	<i>Myriophyllum spicatum</i>	Submergent	32	41
Wild celery	<i>Vallisneria americana</i>	Submergent	3.1	4
Slender naiad	<i>Najas flexilis</i>	Submergent	7.8	10
Sago pondweed	<i>Stuckenia pectinata</i>	Submergent	Visuals Only	6
Variable pondweed	<i>Potamogeton gramineus</i>	Submergent	0.8	1
Forked duckweed	<i>Lemna trisulca</i>	Free Floating	0.8	1
Fries' pondweed	<i>Potamogeton friesii</i>	Submergent	0.8	1

Species Richness: 10  
 Species Richness (with visuals): 11  
 Simpson Diversity Index (D): 0.70  
 Floristic Quality Index (FQI): 15.9  
 Avg. Coefficient of Conservatism (C): 5.63

While a valid direct statistical comparison of the pre-treatment plant community from the 2022 whole-lake PI survey to the present sub-polygon PI survey cannot be made (due to so few sample locations because of the greater PI spacing interval on the whole-lake PI survey), we can report on some general observations. During the 2023 sub-polygon PI survey of the treatment area, a total of 5 species were observed versus 4 observed in the 2022 whole-lake PI survey (**Table 4**).

**Table 4. A comparison of species observed during the 2023 Lake Puckaway sub-polygon PI survey, ONLY WITHIN the ProcellaCOR treatment area as compared to species observed in the same area during the 2022 whole lake PI survey.**

Species	Scientific Name	Treatment Area (Post Treatment; sub-polygon; 40 sample PI points)	Treatment Area (Pre-Treatment whole-lake; 7 sample PI Points)
		2023	2022
Coontail	<i>Ceratophyllum demersum</i>	Yes	Yes
Common waterweed	<i>Elodea canadensis</i>	Yes	No
Forked duckweed	<i>Lemna trisulca</i>	No	Yes
Eurasian Watermilfoil	<i>Myriophyllum spicatum</i>	Yes	Yes
Slender Naiad	<i>Najas flexilis</i>	Yes	No
White Water Lily	<i>Nymphaea odorata</i>	No	No
Curly-leaf Pondweed	<i>Potamogeton crispus</i>	No	No
Fries' Pondweed	<i>Potamogeton friesii</i>	No	No
Variable Pondweed	<i>Potamogeton gramineus</i>	No	No
Sago Pondweed	<i>Stuckenia pectinata</i>	Yes	No
Water Celery	<i>Vallisneria americana</i>	No	No
Watermeal	<i>Wolffia spp.</i>	No	Yes
<b>Total # Species Observed:</b>		<b>5</b>	<b>4</b>



Again, since a valid direct statistical comparison of the pre-treatment plant community from the 2022 whole-lake PI survey to the present sub-polygon PI survey cannot be made (due to so few sample locations because of the greater PI spacing interval on the whole-lake PI survey), we report on some general observations. During the 2023 sub-polygon PI survey of the 300ft buffer area around the treatment area, a total of 11 species were observed versus 4 observed in the 2022 whole-lake PI survey (Table 5).

**Table 5. A comparison of species observed during the 2023 Lake Puckaway sub-polygon PI survey, within the 300ft buffer zone surrounding the treatment area, as compared to species observed in the same area during the 2022 whole lake PI survey.**

Species	Scientific Name	300ft Buffer Area (Post Treatment; sub-polygon; 71 sample PI points)	300ft Buffer Area (Pre-Treatment; whole-lake; 19 sample PI Points)
		2023	2022
Coontail	<i>Ceratophyllum demersum</i>	Yes	Yes
Common waterweed	<i>Elodea canadensis</i>	Yes	No
Forked duckweed	<i>Lemna trisulca</i>	Yes	Yes
Eurasian Watermilfoil	<i>Myriophyllum spicatum</i>	Yes	Yes
Slender Naiad	<i>Najas flexilis</i>	Yes	No
White Water Lily	<i>Nymphaea odorata</i>	Yes	No
Curly-leaf Pondweed	<i>Potamogeton crispus</i>	Yes	No
Fries' Pondweed	<i>Potamogeton friesii</i>	Yes	No
Variable Pondweed	<i>Potamogeton gramineus</i>	Yes	No
Sago Pondweed	<i>Stuckenia pectinata</i>	Yes	No
Water Celery	<i>Vallisneria americana</i>	Yes	No
Watermeal	<i>Wolffia spp.</i>	No	Yes
<b>Total # Species Observed:</b>		<b>11</b>	<b>4</b>

The distribution of Total Rake Fullness is a proxy metric for aquatic plant density at a particular site. When all the sample locations are mapped out in both the treatment area and the surrounding 300ft buffer zone, we can begin to see general impacts of aquatic plant abundance. So in 2023, the year-of-treatment, we observed lower rake fullness within the treatment area itself and more impacts to aquatic plant abundance to the north and east of the treatment area with less noticeable impacts to plant abundance to the south and west of the treatment area (Fig. 3). With EWM specifically we saw dramatic reduction in the occurrence of EWM both within the treatment area and impacts to the north and east of the treatment area (Fig. 4). We observed, few CLP plants during this survey (Fig. 5) which can likely be attributed to that species already having senesced for the year due to the warm water temperature. The most abundant native aquatic plant species we observed during the survey was that of Coontail (*Ceratophyllum demersum*) (Fig. 6). Locations of all other aquatic plants observed during the sub-polygon PI survey are illustrated in Figures 7-14.

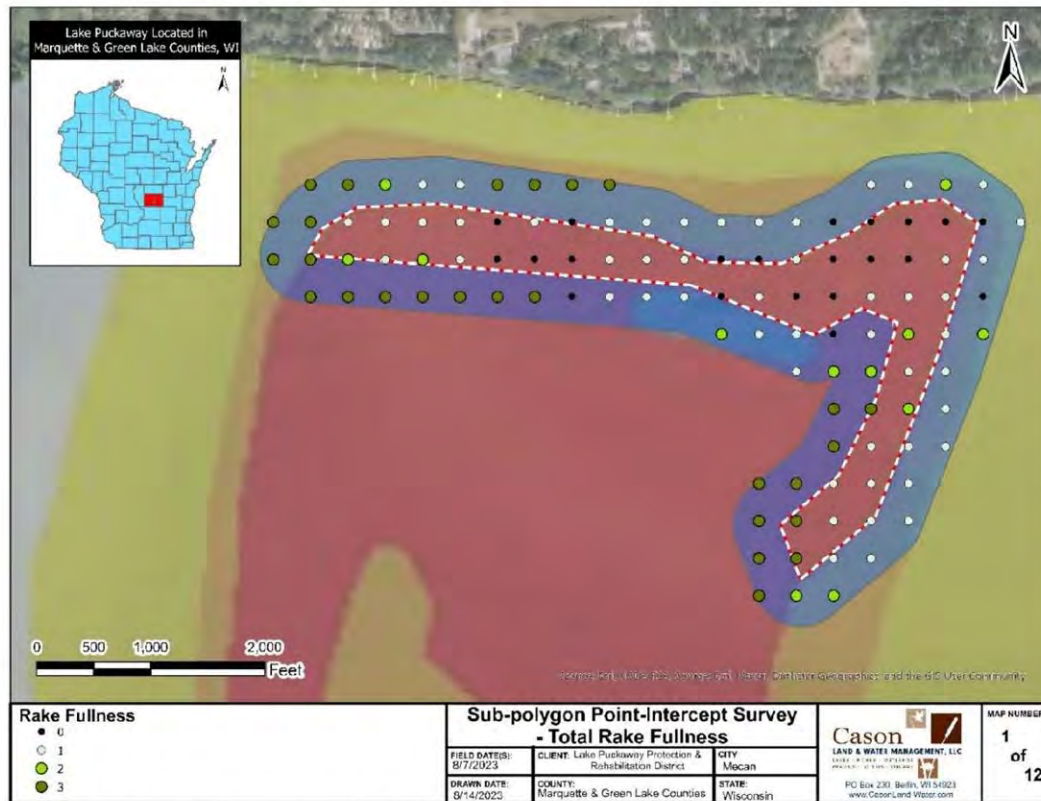


Figure 3. Distribution of Total Rake Fullness across the 2023 sub-polygon point-intercept survey monitoring area.

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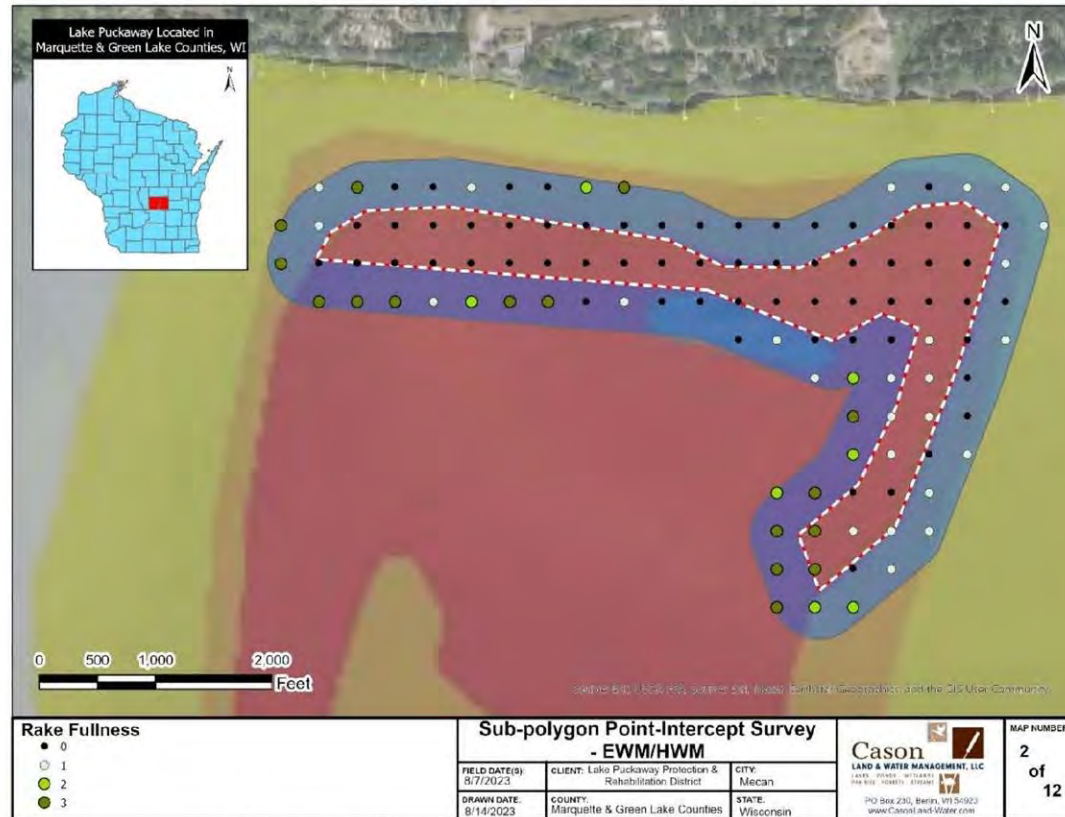


Figure 4. Distribution of Eurasian/Hybrid Watermilfoil (EWM/HWM) across the 2023 sub-polygon point-intercept survey monitoring area.

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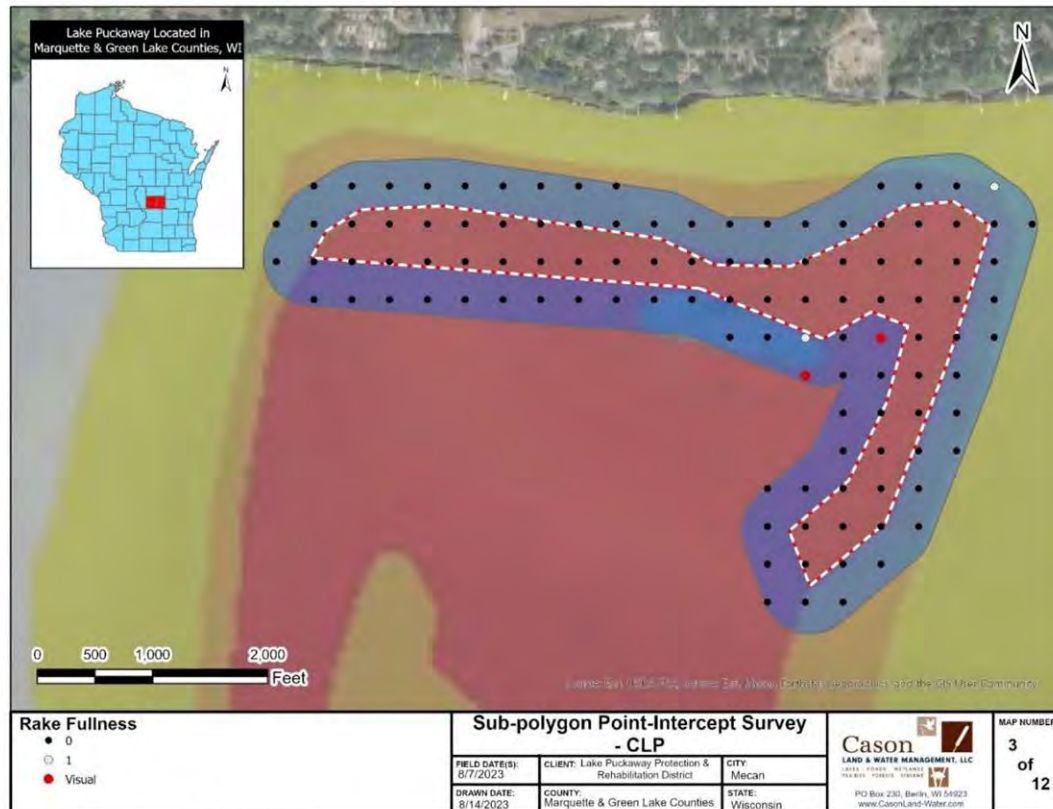


Figure 5. Distribution of the invasive Curly-leaf Pondweed (CLP) across the 2023 sub-polygon point-intercept survey monitoring area.

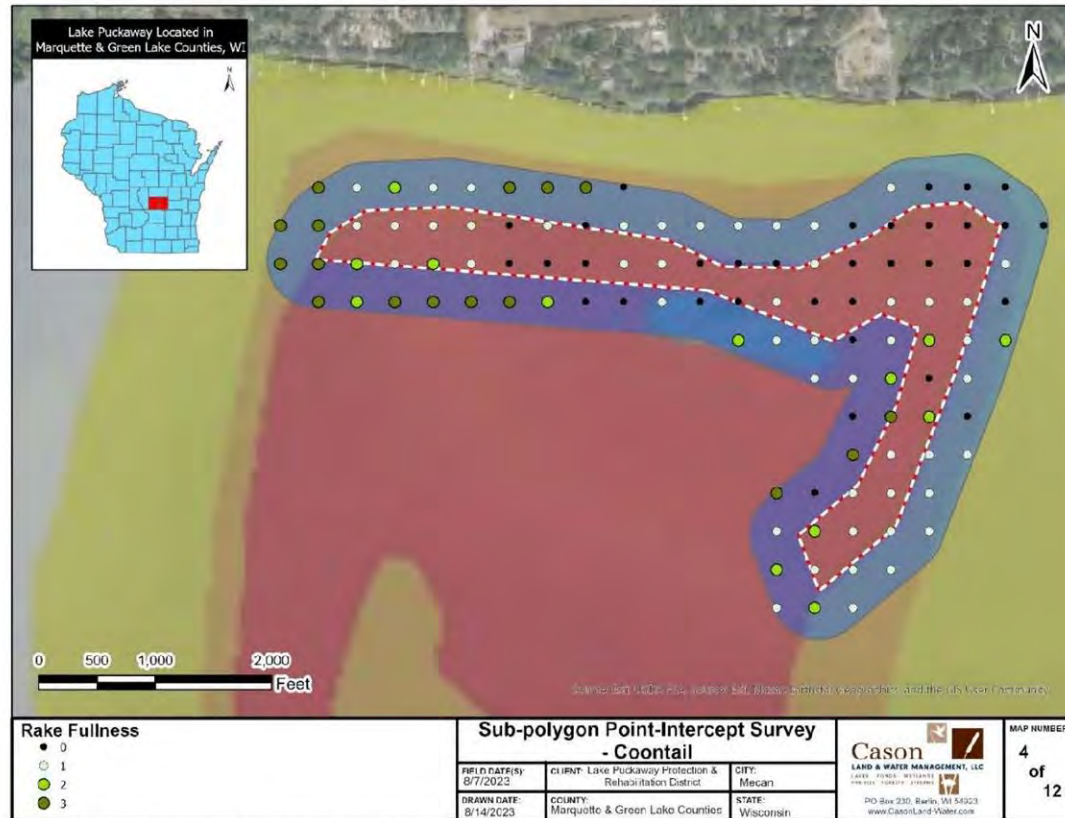


Figure 6. Distribution of Coontail across the 2023 sub-polygon point-intercept survey monitoring area.

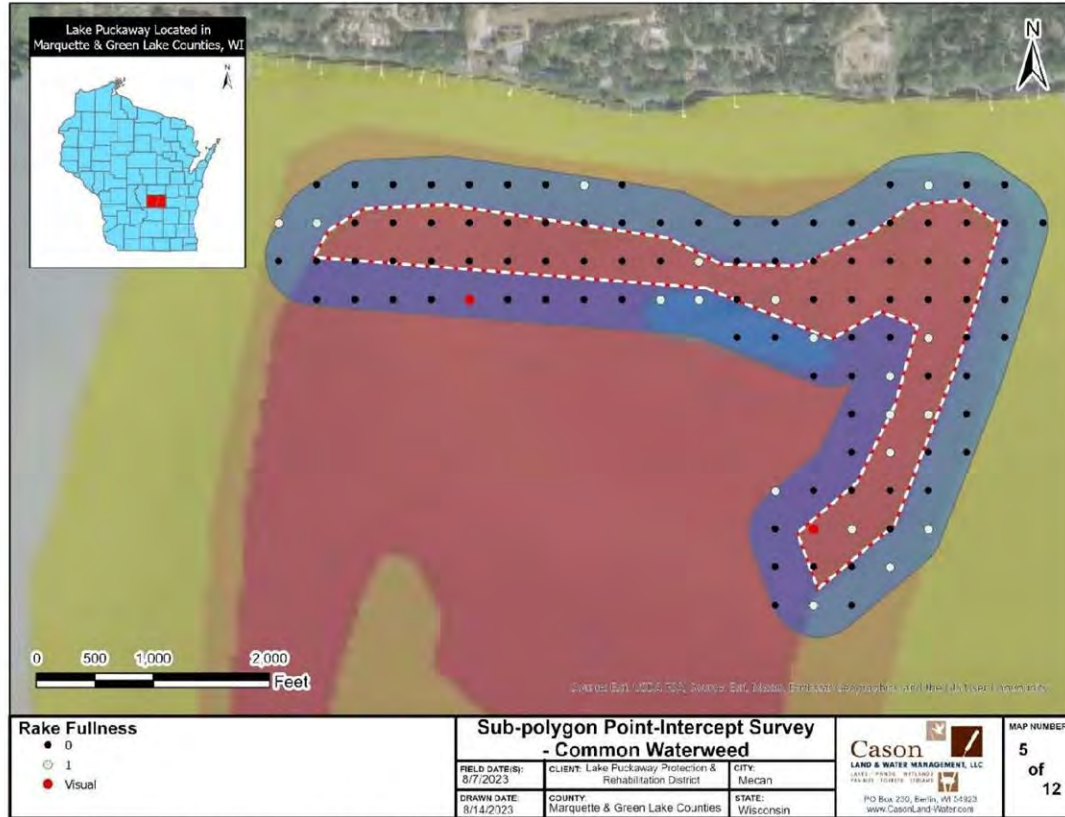


Figure 7. Distribution of Common Waterweed across the 2023 sub-polygon point-intercept survey monitoring area.

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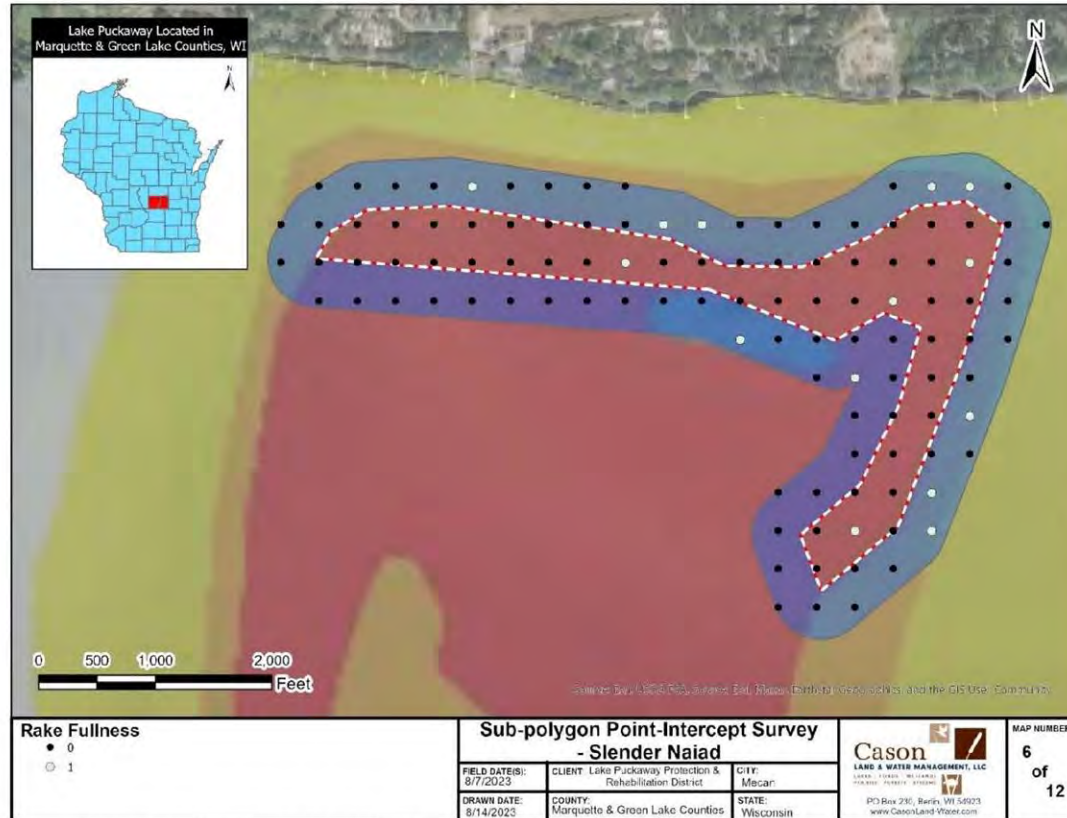


Figure 8. Distribution of Slender Naiad across the 2023 sub-polygon point-intercept survey monitoring area.

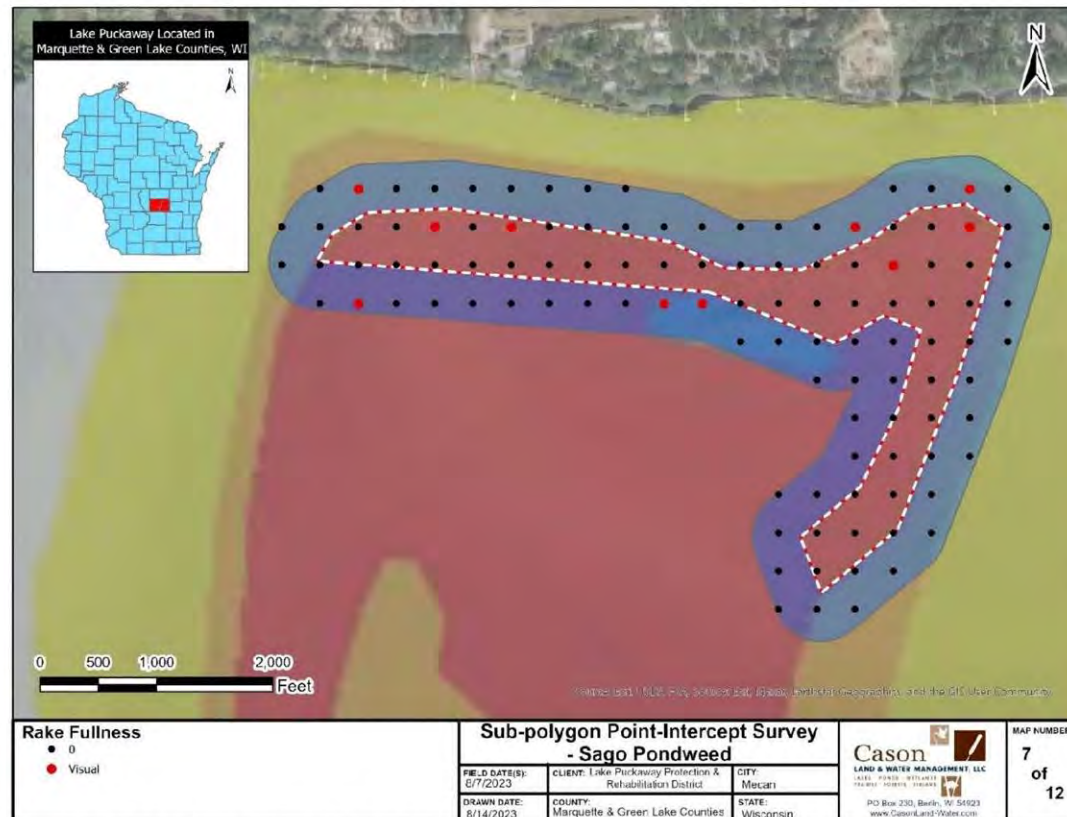


Figure 9. Distribution of Sago Pondweed across the 2023 sub-polygon point-intercept survey monitoring area.

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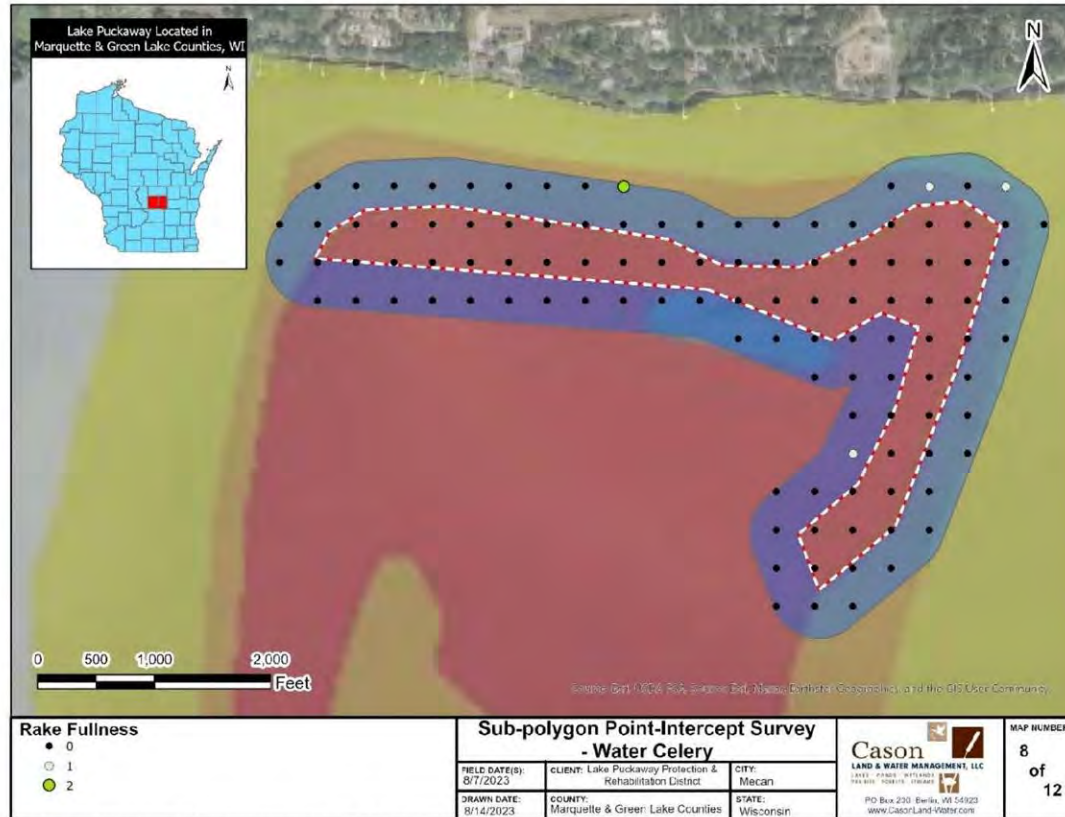


Figure 10. Distribution of Water Celery across the 2023 sub-polygon point-intercept survey monitoring area.

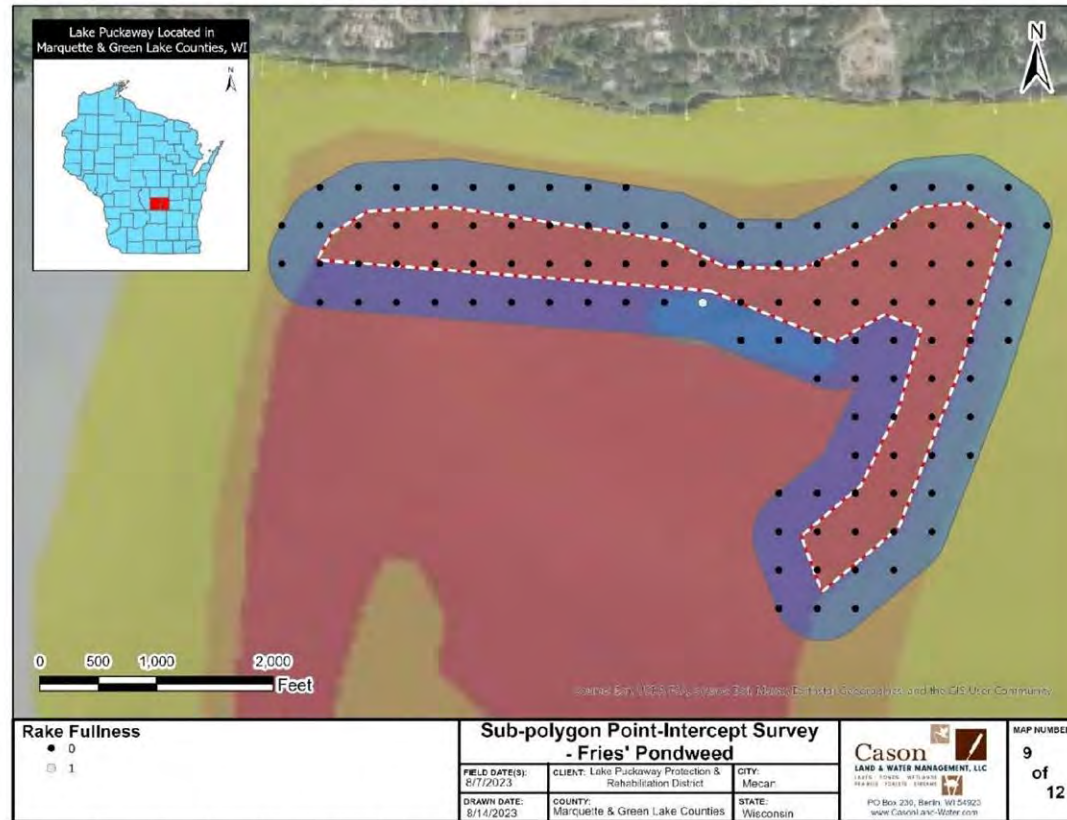


Figure 11. Distribution of Fries' Pondweed across the 2023 sub-polygon point-intercept survey monitoring area.

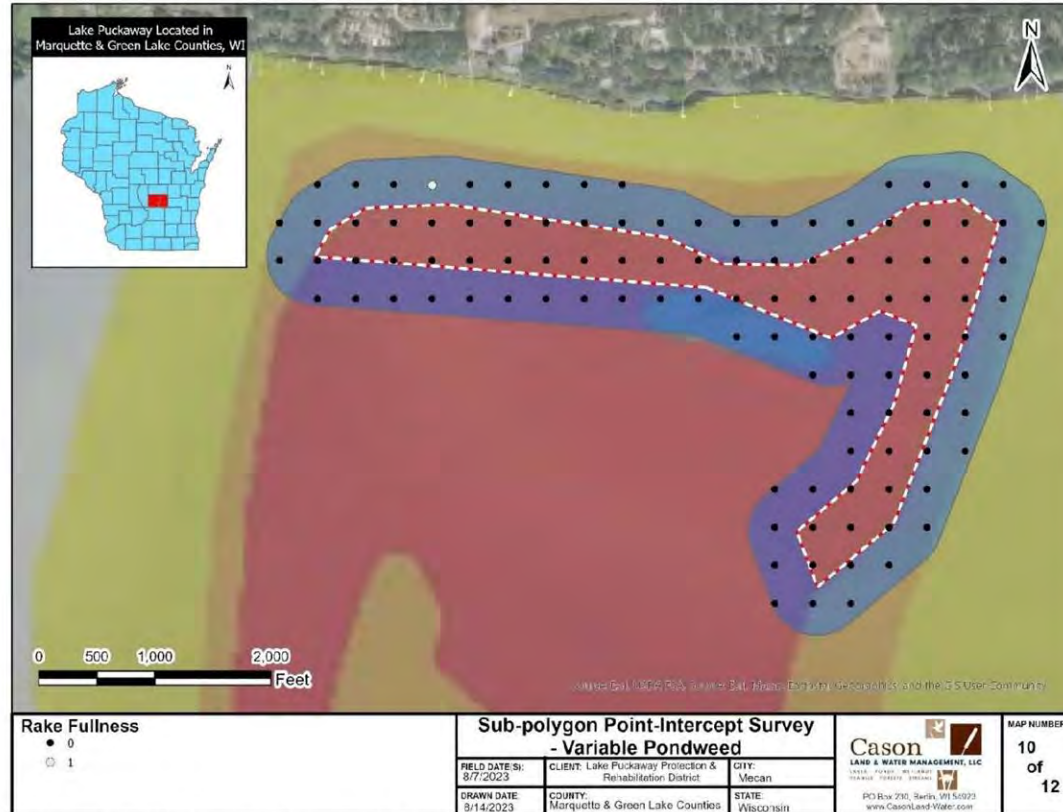


Figure 12. Distribution of Variable Pondweed across the 2023 sub-polygon point-intercept survey monitoring area.

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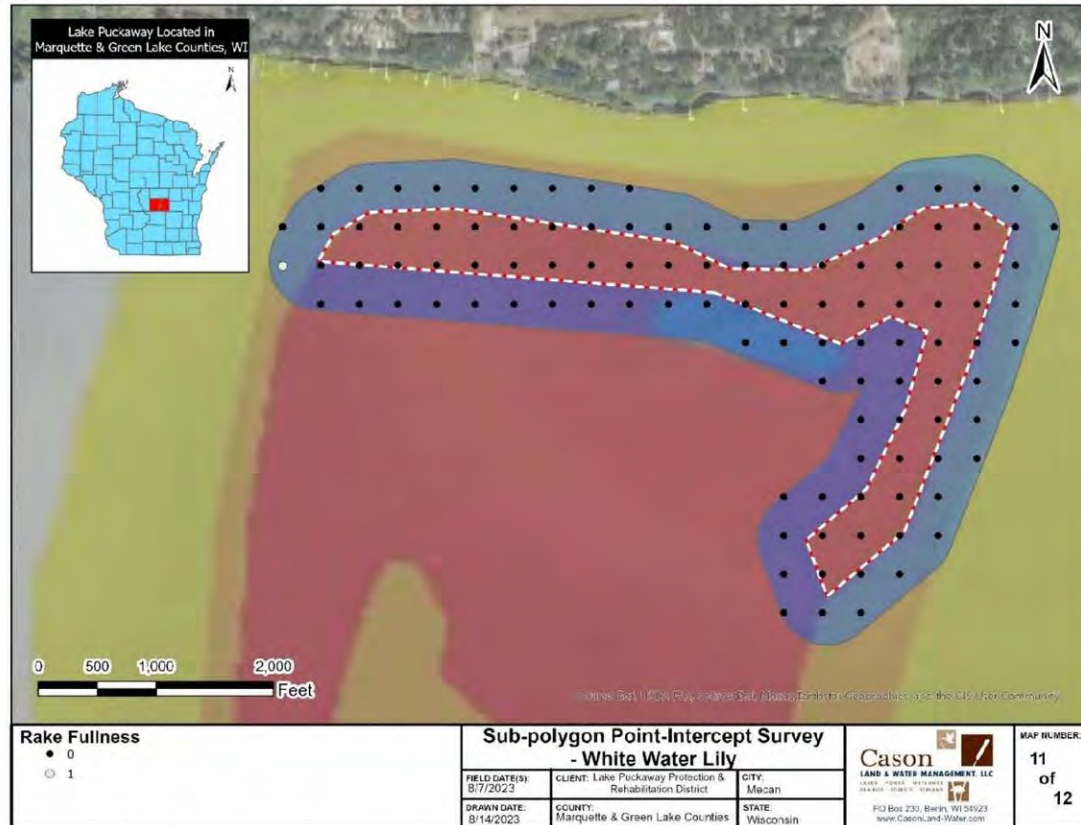
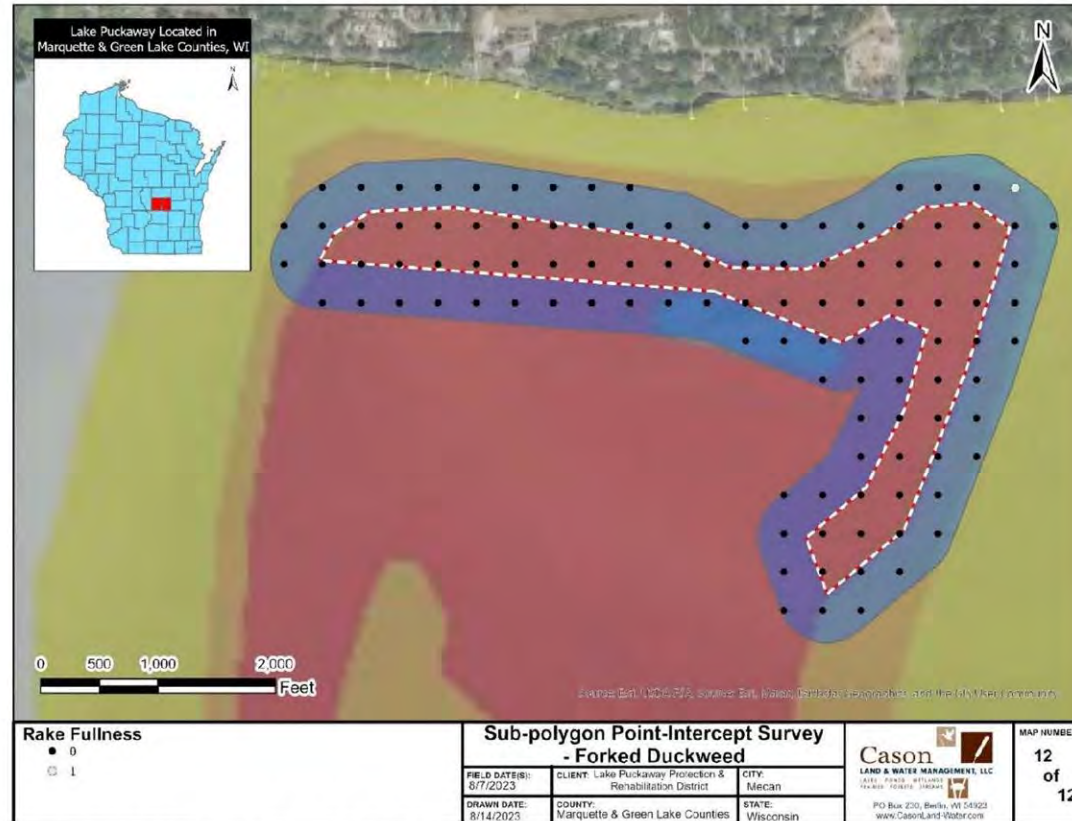


Figure 13. Distribution of White-Water Lily across the 2023 sub-polygon point-intercept survey monitoring area.

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**Figure 14. Distribution of Forked Duckweed across the 2023 sub-polygon point-intercept survey monitoring area.**

## Discussion

The 2023 sub-polygon Point-Intercept survey that we conducted will be critical for making continued year-by-year comparisons of the aquatic plant community in and surrounding the first ProcellaCOR treatment area on Lake Puckaway. While we cannot make statistically valid claims about the pre- and post-treatment aquatic plant assemblage in the treatment area, this qualitative comparison of survey results from this area at two points in time, provides a valuable basis for utilizing a more selective aquatic herbicide like ProcellaCOR to address the rapidly expanding problem of EWM/HWM on Lake Puckaway. These sub-polygon PI survey results showed that the most abundant native aquatic plant species in this part of the lake, Coontail, is minimally impacted by ProcellaCOR, even in the year of treatment.

It will be important to continue to monitor this treatment area in 2024 as well as 2025 to collect valuable data for statistical comparisons year-over-year at this location. After the 2024 sub-polygon PI survey at this site is conducted, we will have the first opportunity to see if the intended goal of EWM control is continuing for multiple seasons in a shallow water lake such as Lake Puckaway with such a massive infestation of EWM. The fact that 11 species were identified in the post-treatment survey versus the 2022 “pre-treatment” whole-lake PI survey shows that the native species continue to persist in this area and should hopefully be able to take advantage of reduced competition with the removal of a large amount of EWM biomass in this area during the next growing season. When comparing the average coefficient of conservatism values of aquatic plant species found in the lake, Floristic Quality Index (FQI) was calculated to be 15.9. The average for Wisconsin lakes is 22.2. Since the FQI is an indication of native vegetative quality for an area and generally, values from 1-19 indicate low vegetative quality, there is still ample room to improve the native aquatic vegetation composition of Lake Puckaway. However, with a widespread AIS outcompeting many of the native species, this will be unlikely to occur without anthropogenic management activities targeting the reduction of AIS biomass in the lake.

Our own anecdotal observation of greatly improved navigability within the treatment area as well as a substantial portion of the 300ft buffer zone, likely corroborates the observations of many other lake users this year in this area. We believe that the results of this study to date represent a generally very positive outcome when compared to the low diversity of native plants using this part of the lake prior to the ProcellaCOR treatment. Additionally, it should be noted that we were able to easily sample every location within the treatment area post-treatment, but it was very difficult to navigate through the area during the treatment just due to the dense beds of EWM which have now been largely eliminated and effects were observed in the buffer zone as well, representing a positive result of herbicide drift in the control of AIS. We believe that moving forward, we can increase the effectiveness of the treatment by receiving the appropriate permits earlier in the growing season and subsequently conducting the treatment several weeks earlier when there is even less early-season growth. This would likely further lessen the impacts that any of the native aquatic plants may experience as well.

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**Resources**

Wilhelm, G. and L. Rerich. 2017. Flora of the Chicago Region. A Floristic and Ecological Synthesis. Indiana Academy of Science, Indianapolis. 1392 pp.

Herman, B., Sliwinski, R. and S. Whitaker. 2017. Chicago Region FQA (Floristic Quality Assessment) Calculator. U.S. Army Corps of Engineers, Chicago, IL.

Nichols, SA. 1999. Floristic Quality Assessment of Wisconsin Lake Plant Communities with Example Applications. Journal of Lake and Reservoir Management, 15(2):133-141.

University of Wisconsin-Madison, 2001. Wisconsin Floristic Quality Assessment (WFQA). Retrieved October 27, 2009 from: <http://www.botany.wisc.edu/WFQA.asp>

## APPENDIX L

### 2023 Fall AIS Meandering Survey Summary Report



## Lake Puckaway 2023 Aquatic Invasive Species Survey Summary

On August 15<sup>th</sup> – 16<sup>th</sup>, 2023, Cason Land & Water Management, LLC conducted an Aquatic Invasive Species survey on Lake Puckaway. The objective of this survey was to map out the distribution of the invasive Eurasian/Hybrid Watermilfoil (EWM/HWM) that is rapidly becoming a major issue that Lake Puckaway is facing.

In the table below, EWM/HWM acreages throughout the lake are listed by density:

Densities	EWM/HWM Acres
Dense	1,302.7
Moderately Dense	861.1
Scattered	1,453.5
Highly Scattered	1,210.9
<b>Total EWM/HWM Acreage:</b>	<b>4,828.2</b>

We observed EWM/HWM at varying densities throughout much of Lake Puckaway during the mapping survey. EWM/HWM has expanded its' distribution dramatically since the 2022 survey was conducted. We identified EWM/HWM of varying density across 4,828.2 acres of the lakes' total area (5,013acres; Fig. 1). We found dense beds have now expanded to 1,302.7acres. Dense beds are those EWM/HWM beds which have either reached the surface in a dense mass or are dominating the aquatic plant community while remaining subsurface. An additional 861.1 acres of Moderately Dense EWM/HWM beds were identified. The Scattered (1,453.5acres) and Highly Scattered (1,210.9acres) categories comprise the rest of the EWM/HWM that was mapped across the lake in this survey.

In addition, to the lake-wide meandering survey, we closely assessed the distribution of EWM/HWM within the 2023 trial ProcellaCOR treatment area and surrounding area. The treatment appears to have been very successful within the treatment area itself. On the south and southwest side of the treatment polygon we did not see total control within a couple small areas of the treatment area. However, we observed substantial drift effects of the treatment, wherein EWM/HWM particularly to the north and northeast of the treatment area appeared to have impacted the EWM/HWM as far away as 570ft from the edge of the treatment area. This resulted in the 50-acre trial treatment providing obvious control of EWM/HWM across at least 91.25 acres (Fig. 2). In other words, the treatment provided 82.5% more control than intended due to drift effects. Based on how dense the EWM/HWM growth was already by the time of treatment, we can likely expect even better results in subsequent years using ProcellaCOR and targeting a treatment date that is several weeks earlier in the year. Ideally, the LPPRD will be able to decide on treatment options earlier in the year and get their approved DNR treatment permit issued much earlier in the year than was possible this first trial treatment year.

Based on the results of this survey, we have attached a map with five potential treatment areas identified for potential treatment in 2024 (**Fig. 3.**). These areas were selected based on their proximity to the greatest number of lake residences, most dense beds of EWM, and likelihood of impacting much larger portions of the lake when treated with ProcellaCOR due to the drift potential. Additional treatment area options may be developed in conjunction with LPPRD and DNR consultation. Treatment cost estimators can be provided as well upon request. To take back the lake from this aggressive AIS, and slowly transition it to a native plant dominated lake, will require strategically targeting large portions of the lake for selective aquatic herbicide treatments for several consecutive years. Each year, following mapping surveys, we can propose targeting different areas of the lake, and methods of maximizing the potential for the treatments to be as successful as possible based on the ecological, biological, and physical properties that affect aquatic herbicide treatments.

The following deliverables are attached to this survey summary:

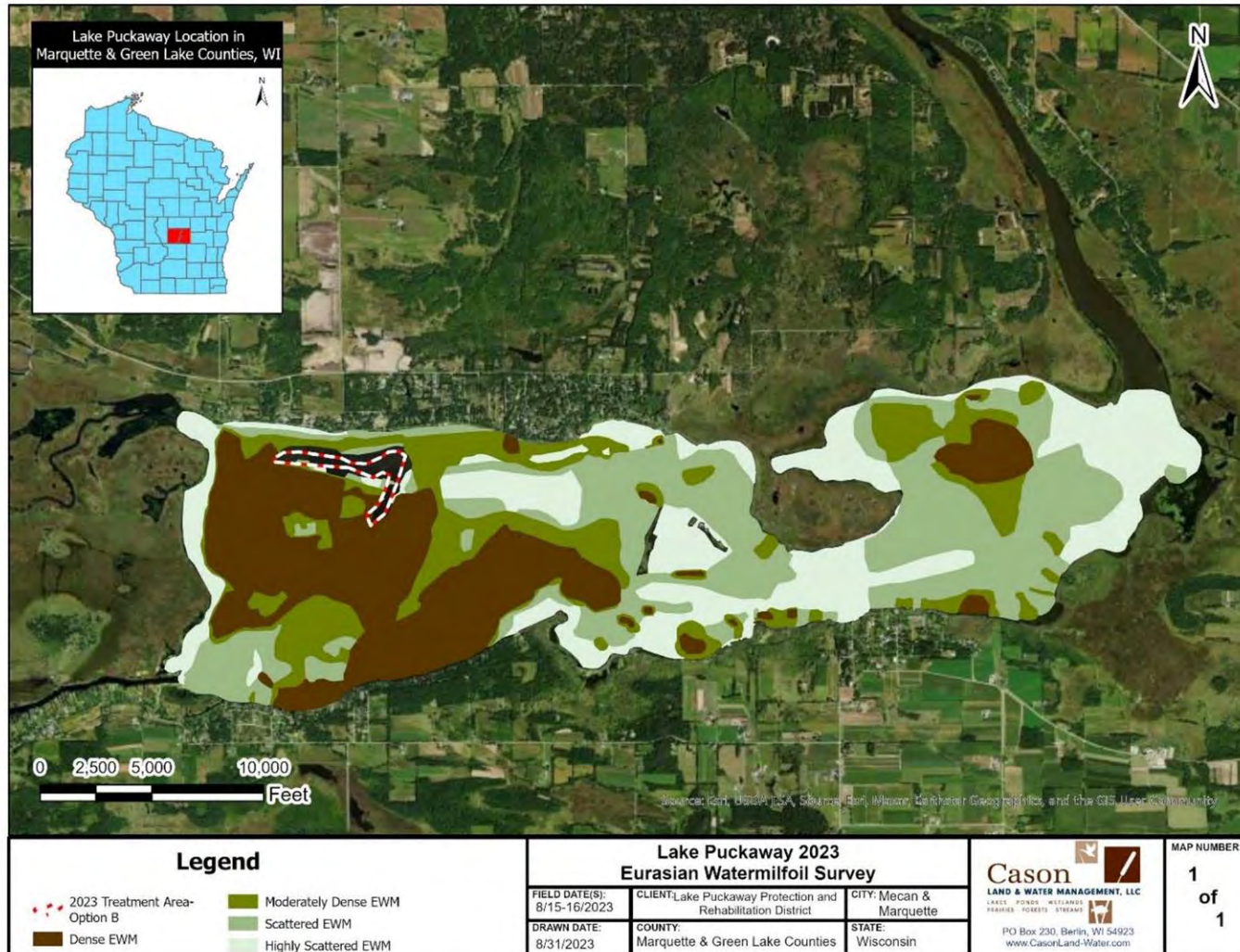
1. EWM/HWM Aquatic Invasive Species Survey Map (Figure 1)
2. 2023 Treatment Area Impact on EWM/HWM (Figure 2)
3. Proposed Treatment Areas for 2024

Thank you for your business and for allowing us to perform this service for your district. If you have any questions, please contact me at 920-290-6810 or at [lancepaden@casonland-water.com](mailto:lancepaden@casonland-water.com)

Sincerely,

Lance Paden

**Figure 1.** The current distributions of invasive EWM/HWM throughout Lake Puckaway as observed during the 2023 mapping survey.



**Figure 2.** The impact on EWM/HWM at the 2023 ProcellaCOR treatment area and surrounding area. The yellow and black hatched line outlines the area where the EWM/HWM was obviously greatly affected by the treatment. The 300ft buffer zone around the treatment area (in red and white) is denoted in blue.

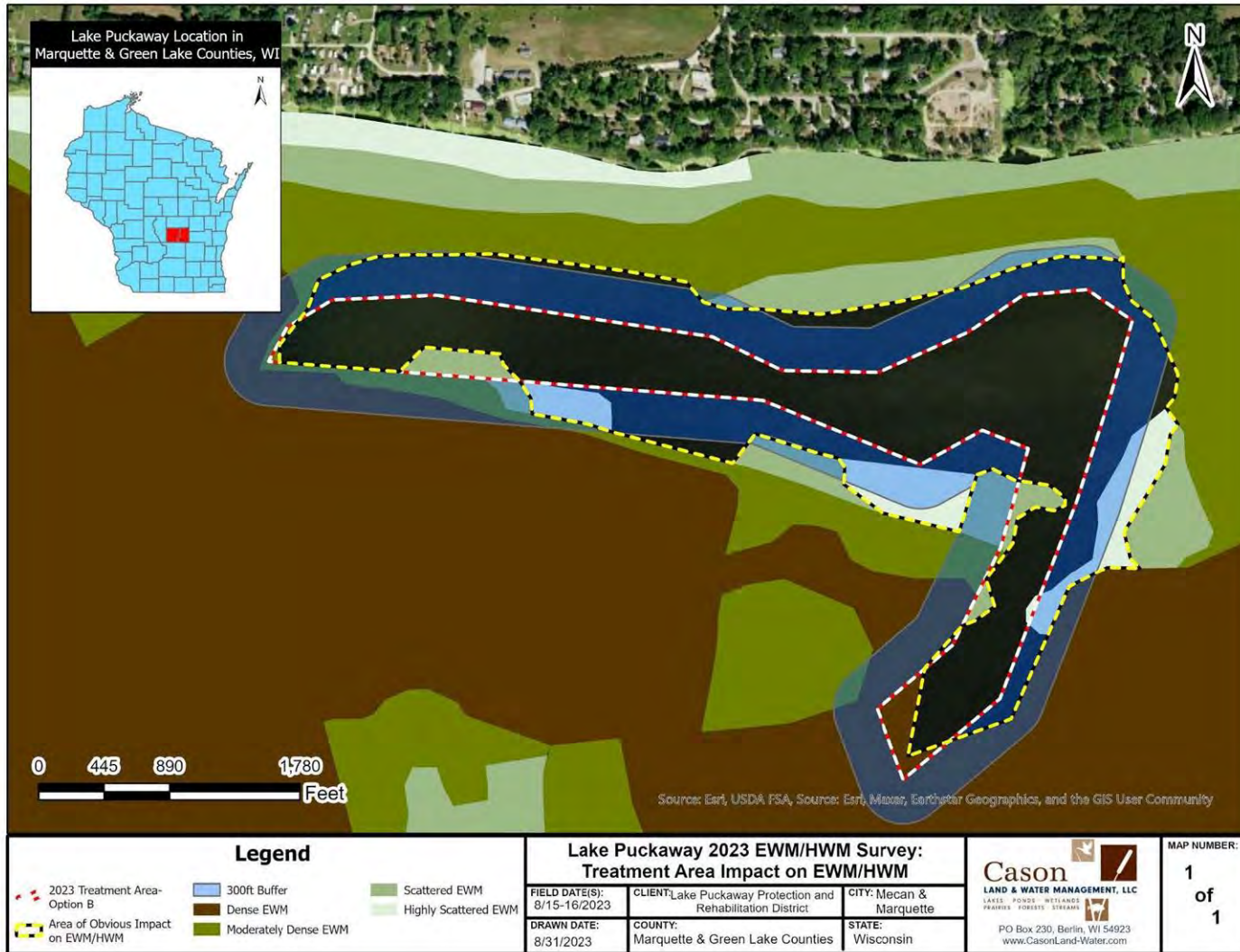
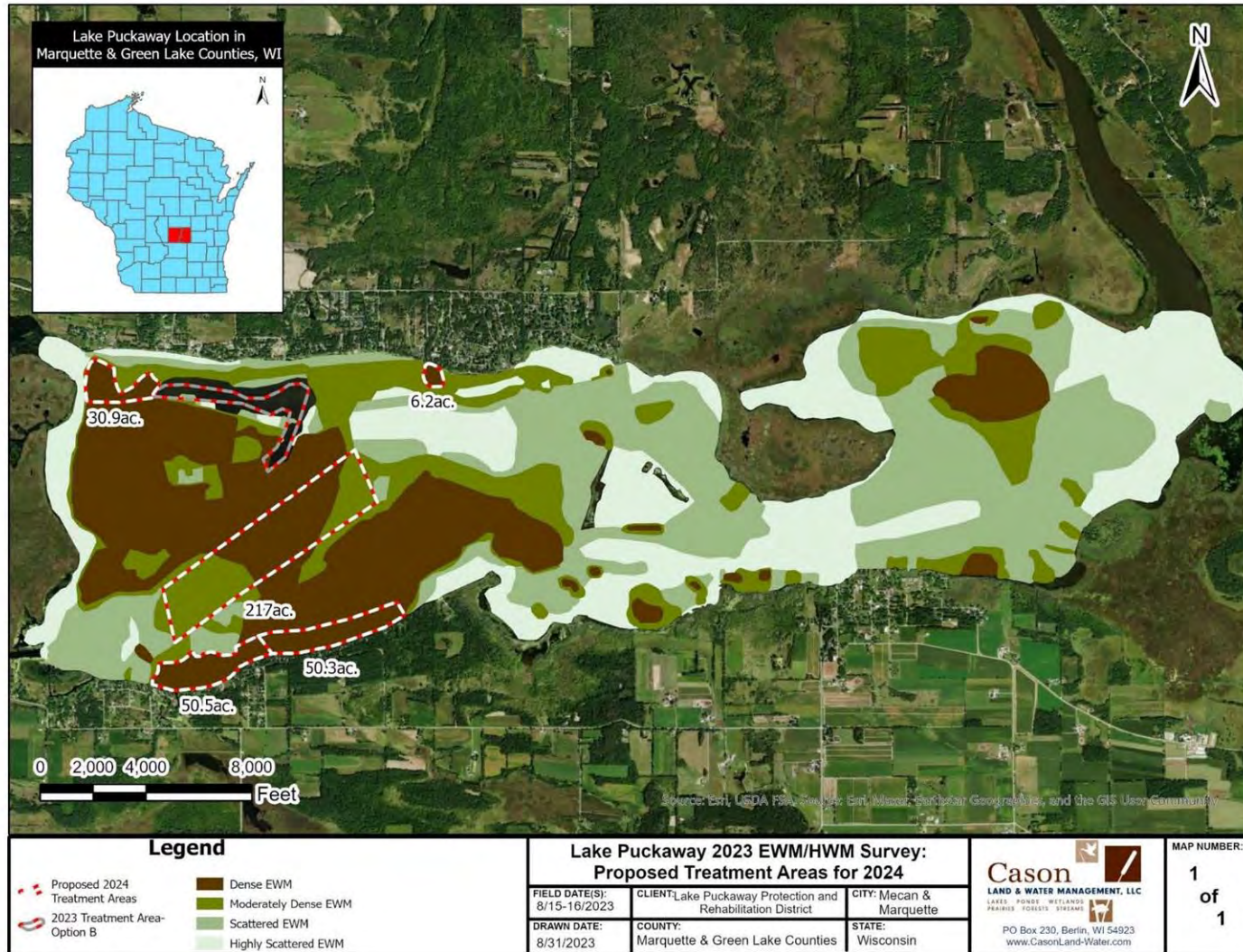


Figure 3. Proposed 2024 ProcellaCOR Treatment Areas based on the 2023 EWM/HWM mapping survey results.



## APPENDIX M

### SePro's ProcellaCOR EC Product Label

## SPECIMEN LABEL

# ProcellaCOR™ EC

A selective systemic herbicide for management of freshwater aquatic vegetation in slow-moving/quiescent waters with little or no continuous outflow: ponds, lakes, reservoirs, freshwater marshes, wetlands, bayous, drainage ditches, and non-irrigation canals, including shoreline and riparian areas in or adjacent to these sites. Also for management of invasive freshwater aquatic vegetation in slow-moving/quiescent areas of rivers (coves, oxbows or similar sites).

FLORPYRAUXIFEN-BENZYL	GROUP	4	HERBICIDE
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Produced for:  
SePRO Corporation  
11550 North Meridian Street, Suite 600  
Carmel, IN 46032, U.S.A.  
ProcellaCOR, Prescription Dose Unit, and PDU  
are trademarks of SePRO Corporation

EPA Reg. No. 67630-40  
FPL20160226

### Active Ingredient:

Florpyrauxifen-benzyl: 2-pyridinecarboxylic acid, 4-amino-3-chloro-6-(4-chloro-2-fluoro-3-methoxy-phenyl)-5-fluoro-, phenyl methyl ester ..... 2.7%

Other Ingredients..... 97.3%  
TOTAL..... 100.0%

Contains 0.0052 lb florpyrauxifen-benzyl per Prescription Dose Unit™ (PDU™) or 0.21 lb florpyrauxifen-benzyl/gallon. 1 PDU is equal to 3.2 fl. oz. of product.

## Keep Out of Reach of Children

# CAUTION

Refer to the inside of label booklet for additional precautionary information including directions for use.

**Notice:** Read the entire label before using. Use only according to label directions. Before buying or using this product, read *Warranty Disclaimer* and *Misuse* statements inside label booklet. If terms are not acceptable, return at once unopened.

**Agricultural Chemical:** Do not ship or store with food, feeds, drugs or clothing.

### PRECAUTIONARY STATEMENTS

#### HAZARDS TO HUMANS AND DOMESTIC ANIMALS

**CAUTION.** Causes moderate eye irritation. Avoid contact with eyes or clothing. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco or using the toilet. Remove and wash contaminated clothing before reuse.

#### PERSONAL PROTECTIVE EQUIPMENT (PPE)

##### Applicators and other handlers **must** wear:

- Long-sleeved shirt and long pants;
- Shoes plus socks;
- Protective eyewear; and
- Waterproof gloves.

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry.

**Engineering Controls:** When handlers use closed systems or enclosed cabs in a manner that meets the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(5)], the handler PPE requirements may be reduced or modified as specified in the WPS.

#### User Safety Recommendations

##### Users should:

- Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.
- Remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

#### FIRST AID

<b>If in eyes</b>	<ul style="list-style-type: none"><li>• Hold eye open and rinse slowly and gently with water for 15 to 20 minutes.</li><li>• Remove contact lenses, if present, after the first 5 minutes; then continue rinsing eye.</li><li>• Call a poison control center or doctor for treatment advice.</li></ul>
-------------------	--

#### HOTLINE NUMBER

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. In case of emergency endangering health or the environment involving this product, call **INFOTRAC** at **1-800-535-5053**.

#### Environmental Hazards

Under certain conditions, treatment of aquatic weeds can result in oxygen depletion or loss due to decomposition of dead plants, which may cause fish suffocation. Water bodies containing very high plant density should be treated in sections to prevent the potential suffocation of fish. Consult with the State agency for fish and game before applying to public waters to determine if a permit is needed.

#### DIRECTIONS FOR USE

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling. Read all Directions for Use carefully before applying.

Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the agency responsible for pesticide regulation.

Shake well before using.

#### PRODUCT INFORMATION

ProcellaCOR EC is a selective systemic herbicide for management of freshwater aquatic vegetation in slow-moving/quiescent waters with little or no continuous outflow: ponds, lakes, reservoirs, freshwater marshes, wetlands, bayous, drainage ditches, and non-irrigation canals, including shoreline and riparian areas in or adjacent to these sites. Also for management of invasive freshwater aquatic vegetation in slow-moving/quiescent areas of rivers (coves, oxbows or similar sites).

Apply ProcellaCOR EC directly into water or spray onto emergent foliage of aquatic plants. Depending upon method of application and target plant, ProcellaCOR EC is absorbed by aquatic vascular plants through emergent or floating leaves and from water through submersed plant shoots and leaves. In-water treatments are effective in spot and partial treatment designs with relatively short exposure times (hours to several days). Species susceptibility to ProcellaCOR EC may vary depending upon time of year, stage of growth, and water movement. For best results, apply to actively growing plants. However, effective control can be achieved over a broad range of growth stages and environmental conditions. Application to mature target plants may require higher application rates and longer exposure periods to achieve control.

#### Resistance Management

ProcellaCOR EC is classified as a WSSA Group 4 Herbicide (HRAC Group O). Weed populations may contain or develop biotypes that are resistant to ProcellaCOR EC and other Group 4 herbicides. If herbicides with the same mode of action are used repeatedly at the same site, resistant biotypes may eventually dominate the weed population and may not be controlled by these products. Unless ProcellaCOR EC is used as part of an eradication program or in a plant management system where weed escapes are aggressively controlled, do not use ProcellaCOR EC alone in the same treatment area for submersed and emergent plant control for more than 2 consecutive years, unless used in combination or rotated with an herbicide with an alternate mode of action.

To further delay herbicide resistance consider taking one or more of the following steps:

- Use tank mixtures with herbicides from a different group if such use is permitted; Consult your local extension service or SePRO Corporation if you are unsure as to which active ingredient is currently less prone to resistance.
- Adopt an integrated weed-management program for herbicide use that includes scouting and uses historical information related to herbicide use, and that considers other management practices.
- Scout after herbicide application to monitor weed populations for early signs of resistance development. Indicators of possible herbicide resistance include: (1) failure to control a weed species normally controlled by the herbicide at the dose applied, especially if control is achieved on adjacent weeds; (2) a spreading patch of non-controlled plants of a particular weed species; (3) surviving plants mixed with controlled individuals of the same species. If resistance is suspected, prevent weed seed production in the affected area by using an alternative herbicide from a different group or by a mechanical method that minimizes plant fragmentation.
- If a weed pest population continues to progress after treatment with this product, switch to another management strategy or herbicide with a different mode of action, if available.
- Contact your local extension specialist or SePRO Corporation for additional pesticide resistance-management and/or integrated weed-management recommendations for specific weed biotypes.

**Stewardship Guidelines For Use**

Apply this product in compliance with Best Management Practices (BMP) that include site assessment, prescription, and implementation. BMP have been developed to ensure accurate applications, minimize risk of resistance development, and monitor concentrations in water to document levels needed for optimal performance and manage potential irrigation use. SePRO Corporation will work with applicators and resource managers to implement BMP for application and monitoring to meet management objectives and ensure compatibility with potential water uses.

**Use Precautions**

- There are no restrictions for recreational purposes, including swimming and fishing.

**Use Restrictions**

- **Obtain Required Permits:** Consult with appropriate state or local water authorities before applying this product to public waters. State or local public agencies may require permits.
- **Chemigation:** Do not apply this product through any type of irrigation system.
- For in-water applications, the maximum single application rate is 25.0 Prescription Dose Units (PDU) per acre-foot of water with a limit of three applications per year.
- For aquatic foliar applications, do not exceed 10.0 PDU per acre for a single application, and do not apply more than 20.0 PDU total per acre per year.
- To minimize potential exposure in compost, do not allow livestock to drink treated water.
- Do not compost any plant material from treated area.
- Allow 14 days or greater between applications.
- Do not use water containing this product for hydroponic farming.
- Do not use treated water for any form of irrigation, except as described in the Application to Water Used for Irrigation on Turf and Landscape Vegetation section.
- Do not use for greenhouse or nursery irrigation.
- Make applications in a minimum of 10 gallons per acre (GPA) for ground and a minimum of 15 gallons per acre (GPA) for aerial applications.
- Do not apply to salt/brackish water.
- Do not apply ProcellaCOR EC directly to, or otherwise permit ProcellaCOR EC to come into contact during an application, with carrots, soybeans, grapes, tobacco, vegetable crops, flowers, ornamental shrubs or trees, or other desirable broadleaf plants, as serious injury may occur. Do not permit spray mists containing ProcellaCOR EC to drift onto desirable broadleaf plants. Further information on spray drift management is provided in the Spray Drift Management section of this label.
- For treatments out of water, do not permit spray mists containing this product to drift onto desirable broadleaf plants as injury may occur. Further information on spray drift management is provided in the Spray Drift Management section of this label.
- Do not allow tank mixes of ProcellaCOR EC to sit overnight. See additional tank mix restrictions below.
- Do not use organosilicone surfactants in spray mixtures of this product.
- Do not tank mix this product with malathion or methyl parathion.
- Do not make an application of malathion or methyl parathion within 7 days of an application of this product. See additional tank mix restrictions below.

**Application to Water Used for Irrigation on Turf and Landscape Vegetation**

To reduce the potential for injury to sensitive vegetation, follow the waiting periods (between application and irrigation) and restrictions below, and inform those who irrigate with water from the treated area. Follow local and state requirements for informing those who irrigate.

When monitoring ProcellaCOR EC concentrations, analyze water samples using an appropriate analytical method for both the active ingredient and the acid form. Use of HPLC (High-Performance Liquid Chromatography), which is also referenced as FastEST™, is recommended.

**Applications to invasive freshwater aquatic vegetation in slow-moving/quiescent areas of rivers (coves, oxbows or similar sites).**

- Users must be aware of relevant downstream use of water for irrigation that may be affected by the treatment and must ensure all label restrictions are followed. All potential downstream water intakes with irrigation practices that may be affected by the treatment must be documented and affected irrigation users notified of the restrictions associated with such treatment.

**Residential and other Non-Agricultural Irrigation** (such as shoreline property use including irrigation of residential landscape plants and homeowner gardens, golf course irrigation, and non-residential property irrigation around business or industrial properties. Excludes greenhouse or nursery irrigation).

- Turf Irrigation: Turf may be irrigated immediately after treatment.
- For irrigation of landscape vegetation or other forms of non-agricultural irrigation not excluded above, conduct one of the following:
  - o analytically verify that water contains less than 2 ppb (SePRO recommends use of FastEST); or
  - o if treated area(s) have the potential to dilute with untreated water, follow the precautionary waiting periods described in the tables 1 and 2 below for in-water or foliar application.

**TABLE 1: Non-agricultural irrigation following in-water application**

Waiting Period (Days) for Irrigation at Specific Target Treatment Rates (PDU per acre-foot)						
Percent Area of Waterbody Treated*	1-3 PDU	>3-5 PDU	>5.0 to 10.0 PDU	>10.0 to 15.0 PDU	>15.0 to 20.0 PDU	>20.0 to 25.0 PDU
2% or less	6 hours	1 day	1 day	2 days	2 days	3 days
3 - 10%	1 day	3 days	5 days	7 days	10 days	14 days
11 - 20%	3 days	7 days	10 days	10 days	14 days	21 days
21 - 30%	5 days	10 days	14 days	21 days	28 days	35 days
>30%	7 days	14 days	21 days	28 days	35 days	35 days

\* Assumes treated area(s) have the potential to dilute with untreated water. If the treated area is not projected to dilute rapidly (example: confined cove area), utilize FastEST to confirm below 2 ppb or verify vegetation tolerance before irrigation use. Consult a SePRO Aquatic Specialist for additional site-specific recommendations.

**TABLE 2: Non-agricultural irrigation following foliar application**

Waiting Period (days) for Irrigation at Specific Target Treatment Rates		
Percent Area of Waterbody Treated*	5.0 PDU / acre	>5.0 to 10.0 PDU / acre
10% or less	0.5 day	1 day
11 - 20%	1 day	2 days
>20%	2 days	3 days

\* Assumes treated area(s) have the potential to dilute with untreated water. If the treated area is not projected to dilute rapidly (example: confined cove area), utilize FastEST to confirm below 2 ppb or verify vegetation tolerance before irrigation use. Consult a SePRO Aquatic Specialist for additional site-specific recommendations.

**Susceptible Plants**

Do not apply where spray drift may occur to food, forage, or other plantings that might be damaged. Spray drift may damage or render crops unfit for sale, use or consumption. Small amounts of spray drift that may not be visible may injure susceptible broadleaf plants. **Before making a foliar or surface spray application, please refer to your state's sensitive crop registry (if available) to identify any commercial specialty or certified organic crops that may be located nearby. At the time of a foliar or surface spray application, the wind cannot be blowing toward adjacent cotton, carrots, soybeans, corn, grain sorghum, wheat, grapes, tobacco, vegetable crops, flowers, ornamental shrubs or trees, or other desirable broadleaf plants.**



### Spray Drift Management

Avoiding spray drift at the application site is the responsibility of the applicator. The interaction of many equipment- and weather-related factors determines the potential for spray drift. The applicator is responsible for considering all these factors when making decisions.

The following drift management requirements must be followed to limit off-target drift movement from aerial applications:

#### Aerial Application:

- Aerial applicators must use a minimum finished spray volume of 15 gallons per acre.
- Drift potential is lowest between wind speeds of 2 to 10 mph. Do not apply below 2 mph due to variable wind direction and high potential for temperature inversion. Do not apply in wind speeds greater than 10 mph.
- To minimize spray drift from aerial application, apply with a nozzle class that ensures coarse or coarser spray (according to ASABE S572) at spray boom pressure no greater than 30 psi.
- The distance of the outer most operating nozzles on the boom must not exceed 70% of wingspan or 80% of rotor diameter.
- Nozzles must always point backward parallel with the air stream and never be pointed downwards more than 45 degrees.
- Do not apply under conditions of a low-level air temperature inversion.
- The maximum release height must be 10 feet from the top of the weed canopy, unless a greater application height is required for pilot safety.

Evaluate spray pattern and droplet size distribution by applying sprays containing a water-soluble dye marker or appropriate drift control agents over a paper tape (adding machine tape). Mechanical flagging devices may also be used. Do not apply under conditions of a low-level air temperature inversion. A temperature inversion is characterized by little or no wind and lower air temperature near the ground than at higher levels. The behavior of smoke generated by an aircraft-mounted device or continuous smoke column released at or near site of application will indicate the direction and velocity of air movement. A temperature inversion is indicated by layering of smoke at some level above the ground and little or no lateral movement.

#### Ground Application

- Ground applicators must use a minimum finished spray volume of 10 gallons per acre.
- To minimize spray drift from ground application, apply with a nozzle class that ensures coarse or coarser spray (according to ASABE S572).
- For boom spraying, the maximum release height is 36 inches from the soil for ground applications.
- Where states have more stringent regulations, they must be observed.

The applicator should be familiar with, and take into account the information covered in the following Aerial Drift Reduction Advisory (this information is advisory in nature and does not supersede mandatory label requirements.)

#### Aerial Drift Reduction Advisory

**Information on Droplet Size:** The most effective way to reduce drift potential is to apply large droplets. The best drift management strategy is to apply the largest droplets that provide sufficient coverage and control. Applying larger droplets reduces drift potential, but will not prevent drift if applications are made improperly, or under unfavorable environmental conditions (see Wind, Temperature and Humidity, and Temperature Inversions).

#### Controlling Droplet Size:

- **Volume** - Use high flow rate nozzles to apply the highest practical spray volume. Nozzles with higher rated flows produce larger droplets.
- **Pressure** - Do not exceed the nozzle manufacturer's specified pressures. For many nozzle types, lower pressure produces larger droplets. When higher flow rates are needed, use higher flow rate nozzles instead of increasing pressure.
- **Number of Nozzles** - Use the minimum number of nozzles that provide uniform coverage.
- **Nozzle Orientation** - Orienting nozzles so that the spray is released parallel to the air stream produces larger droplets than other orientations. Significant deflection from horizontal will reduce droplet size and increase drift potential.
- **Nozzle Type** - Use a nozzle type that is designed for the intended application. With most nozzle types, narrower spray angles produce larger droplets. Consider using low-drift nozzles. Solid stream nozzles oriented straight back produce the largest droplets and the lowest drift.

**Boom Length:** To further reduce drift without reducing swath width, boom must not exceed 70% of wingspan or 80% of rotor diameter.

**Application Height:** Do not make applications at a height greater than 10 feet above the top of the largest plants unless a greater height is required for aircraft safety. Making applications at the lowest height that is safe reduces exposure of droplets to evaporation and wind.

**Swath Adjustment:** When applications are made with a crosswind, the swath will be displaced downwind. Therefore, on the up and downwind edges of the field, the applicator must compensate for this displacement by adjusting the path of the aircraft upwind. Swath adjustment distance should increase with increasing drift potential (higher wind, smaller drops, etc.).

**Wind:** Drift potential is lowest between wind speeds of 2 to 10 mph. However, many factors, including droplet size and equipment type, determine drift potential at any given speed. Do not make applications below 2 mph due to variable wind direction and high inversion potential. Do not apply in wind speeds greater than 10 mph. Local terrain can influence wind patterns. Every applicator should be familiar with local wind patterns and how they affect spray drift.

**Temperature and Humidity:** When making applications in low relative humidity, set up equipment to produce larger droplets to compensate for evaporation. Droplet evaporation is most severe when conditions are both hot and dry.

**Temperature Inversions:** Do not apply during a local, low level temperature inversion because drift potential is high. Temperature inversions restrict vertical air mixing, which causes small suspended droplets to remain in a concentrated cloud. This cloud can move in unpredictable directions due to the light variable winds common during inversions. Temperature inversions are characterized by increasing temperatures with altitude and are common on nights with limited cloud cover and light to no wind. They begin to form as the sun sets and often continue into the morning. Their presence can be indicated by ground fog; however, if fog is not present, inversions can also be identified by the movement of the smoke from a ground source or an aircraft smoke generator. Smoke that layers and moves laterally in a concentrated cloud (under low wind conditions) indicates an inversion, while smoke that moves upward and rapidly dissipates indicates good vertical air mixing.

#### USE DIRECTIONS

ProcellaCOR EC performance and selectivity may depend on dosage, time of year, stage of growth, method of application, and water movement.

#### Aquatic Plants Controlled: In-Water Application

Table 3 lists the expected susceptible species under favorable treatment conditions for aquatic plant control. Use of lower rates will increase selectivity on some species listed. Consultation with SePRO Corporation is recommended before applying ProcellaCOR EC to determine best in-water treatment protocols for given target vegetation.

TABLE 3. Vascular aquatic plant control with in-water application

Vascular Aquatic Plants Controlled: In-Water Application	
Common name	Scientific name
<b>Floating Plants</b>	
Mosquito fern	<i>Azolla</i> spp.
Water hyacinth	<i>Eichhornia crassipes</i>
<b>Emerald Plants</b>	
Alligatorweed	<i>Aiternanthera philoxeroides</i>
American lotus	<i>Nelumbo lutea</i>
Floating heart	<i>Nymphoides</i> spp.
Water pennywort	<i>Hydrocotyle umbellata</i>
Water primrose	<i>Ludwigia</i> spp.
Watershield	<i>Brasenia schreberi</i>
<b>Submersed Plants</b>	
Bacopa	<i>Bacopa</i> spp.
Coontail <sup>1</sup>	<i>Ceratophyllum demersum</i>
Hydrilla <sup>1</sup>	<i>Hydrilla verticillata</i>
Parrotfeather	<i>Myriophyllum aquaticum</i>
Water chestnut	<i>Trapa</i> spp.
Watermilfoil, Eurasian	<i>Myriophyllum spicatum</i>
Watermilfoil, Hybrid Eurasian	<i>Myriophyllum spicatum</i> X <i>M.</i> spp.
Watermilfoil, Variable	<i>Myriophyllum heterophyllum</i>

<sup>1</sup> Higher-rate applications within the specified range may be required to control less-sensitive weeds.

#### Aquatic Plants Controlled: Foliar Application

Table 4 lists the expected susceptible species using labeled foliar rates (5.0 – 10.0 PDU per acre) under favorable treatment conditions for aquatic plant control. Use higher rates in the rate range on more established, dense vegetation. Consultation with SePRO Corporation is recommended before applying ProcellaCOR EC to determine best foliar treatment protocols for given target vegetation.

**TABLE 4. Vascular aquatic plant control with foliar application**

Vascular Aquatic Plants Controlled: Foliar Application	
Common name	Scientific name
<b>Floating Plants</b>	
Mosquito fern	<i>Azolla</i> spp.
Water hyacinth	<i>Eichhornia crassipes</i>
<b>Emerged Plants</b>	
Alligatorweed	<i>Alternanthera philoxeroides</i>
American lotus	<i>Nelumbo lutea</i>
Floating heart	<i>Nymphoides</i> spp.
Parrotfeather (emersed)	<i>Myriophyllum aquaticum</i>
Water pennywort	<i>Hydrocotyle umbellata</i>
Water primrose	<i>Ludwigia</i> spp.
Watershield	<i>Brasenia schreberi</i>

**APPLICATION INFORMATION**

**Mixing Instructions**

**In-Water Application to Submersed or Floating Aquatic Weeds**

ProcellaCOR EC can be applied undiluted or diluted with water for in-water applications. To dilute with water, it is recommended to fill the spray tank to one-half full with water. Start agitation. Add correct quantity of ProcellaCOR EC. Continue agitation while filling spray tank to required volume and during application.

**Foliar Application to Floating and Emergent Weeds**

Dilute ProcellaCOR EC with water to achieve proper coverage of treated plants. To dilute with water, it is recommended to fill spray tank to one-half full with water. Start agitation. A surfactant must be used with all post-emergent foliar applications. Use only surfactants that are approved or appropriate for aquatic use. For best performance, a methylated seed oil (MSO) surfactant is recommended. Read and follow all use directions and precautions on aquatic surfactant label. After adding ProcellaCOR EC and surfactant, continue agitation while filling spray tank to required volume and during application.

**TANK-CLEANOUT INSTRUCTIONS**

ProcellaCOR EC should be fully cleaned from application equipment prior to use for other applications. Contact a SePRO Aquatic Specialist for guidance on methods for thorough cleaning of application equipment after use of the product.

**APPLICATION METHODS**

**In-Water Application to Submersed or Floating Aquatic Weeds**

ProcellaCOR EC can be applied via trailing hose, by sub-surface injection, or surface spray as an in-water application to control weeds such as hydrilla, floating heart, water hyacinth, and other susceptible weed species. This product has relatively short exposure requirements for in-water treatments (hours to days), but treatments with high exchange and short exposure periods should be carefully planned to achieve best results. Where greater plant selectivity is desired - such as when controlling hydrilla or other more susceptible species, choose a lower dose in the specified range. A SePRO Aquatic Specialist can provide site-specific prescriptions for optimal control based on target weed, management objectives, and site conditions.

Apply ProcellaCOR EC to the treatment area at a prescription dose unit (PDU) to achieve appropriate concentrations. A PDU is a unit of measure that facilitates the calculation of the amount of product required to control target plants in 1 acre-foot of water or 1 acre for foliar applications. Per Table 5 below, 1-25 PDU are needed to treat 1 acre-foot of water, depending on target species and the percent of waterbody to be treated.

Use Table 5 to select the dose needed to treat 1 acre-foot of water.

**TABLE 5: Prescription Dose Units (PDU\*\*) per acre-foot of water\***

Percent Area of Waterbody Treated	Target Species			
	Eurasian Watermilfoil	Hybrid Watermilfoil	Variable Leaf Watermilfoil	Other
≤ 2%	3 - 4	4 - 5	3 - 5	3 - 25
>2 - 10%	2 - 3	3 - 5	3 - 4	3 - 20
>10 - 20%	1 - 3	3 - 4	2 - 4	3 - 15
>20 - 30%	1 - 2	2 - 3	2 - 3	2 - 10
>30%	1 - 2	2 - 3	1 - 2	1 - 5

\* In all cases, user may apply up to the maximum of 25 PDU per acre-foot. Consult your SePRO Aquatics Specialist for site-specific recommendations.  
 \*\* 1 PDU contains 3.17 fl. oz. of product.

To calculate the amount of product needed in fluid ounces, use the formula below:

Number of acres X average depth (feet) X PDU\* X 3.17 = fluid ounces  
 \*: from Table 5

Example Calculation:

To control hybrid watermilfoil in 2 acres of a 5-acre lake (>30% treated) with an average depth of 2 feet:  
 2 acres X 2 feet X 3 PDU X 3.17 = 38.04 fl. oz.

For in-water applications, the maximum single application is 25.0 PDU / acre-foot, with a limit of three applications per year. Allow 14 days or greater between applications. Product may be applied as a concentrate or diluted with water prior to or during the application process. Use an appropriate application method that ensures sufficiently uniform application to the treated area.

**Foliar Application to Floating and Emergent Weeds**

Apply ProcellaCOR EC as a foliar application to control weeds such as water hyacinth, water primrose, and other susceptible floating and emergent species. Use an application method that maximizes spray interception by target weeds while minimizing the amount of overspray that inadvertently enters the water.

For all foliar applications, apply ProcellaCOR EC at 5.0 to 10.0 PDU per acre. Use of a surfactant is required for all foliar applications of ProcellaCOR EC. Use only surfactants that are approved or appropriate for aquatic use. Methylated seed oil (MSO) is a recommended surfactant and is typically applied at 1.0% volume/volume. Refer to the surfactant label for use directions. For best results, apply to actively growing weeds. ProcellaCOR EC may be applied more than once per growing season to meet management objectives. Do not exceed 10.0 PDU per acre during any individual application or 20.0 PDU total per acre, per year from all combined treatments.

**Foliar Spot Treatment**

To prepare the spray solutions, thoroughly mix ProcellaCOR EC in water at a ratio of 5.0 to 10.0 PDU per 100 gallons (0.12 to 0.24% product) plus an adjuvant. For best results, a methylated seed oil at 1% volume/volume is the recommended spray adjuvant. When making spot application, ensure spray coverage is sufficient to wet the leaves of the target vegetation but not to the point of runoff.

**Aerial Foliar Application to Floating and Emergent Weeds**

Apply ProcellaCOR EC in a spray volume of 15 gallons per acre (GPA) or more when making a post-emergence application by air. Apply with coarse to coarser droplet category per S-572 ASABE standard; see NAAA, USDA or nozzle manufacturer guidelines. Follow guidelines and restrictions in the *Spray Drift Management and Aerial Drift Reduction Advisory* sections to minimize potential drift to off-target vegetation. Aircraft should be patterned per Operation Safe/PAASS program for calibration and uniformity to provide sufficient coverage and control.

**Boat or Ground Foliar Application to Floating and Emergent Weeds**

When applying ProcellaCOR EC by boat or with ground equipment to emergent or floating-leaved vegetation, use boom-type, backpack or hydraulic handgun equipment. Apply ProcellaCOR EC in a sufficient spray volume (e.g. 20 to 100 gpa) to provide accurate and uniform distribution of spray particles over the treated vegetation while minimizing runoff. Use higher spray volumes for medium to high density vegetation. For boom spraying, use coarse or coarser nozzle spray quality per S-572 ASABE standard; see USDA literature or nozzle manufacturer guidelines. Follow nozzle manufacturer's recommendations for nozzle pressure, spacing and boom height to provide a uniform spray pattern. Follow appropriate spray drift management information where drift potential is a concern.

**TANK MIXES WITH OTHER AQUATIC HERBICIDES**

DO NOT TANK MIX ANY PESTICIDE PRODUCT WITH THIS PRODUCT without first referring to the following website for the specific product: [www.3206tankmix.com](http://www.3206tankmix.com). This website contains a list of active ingredients that are currently prohibited from use in tank mixture with this product.

Only use products in tank mixture with this product that: 1) are registered for the intended use site, application method and timing; 2) are not prohibited for tank mixing by the label of the tank mix product; and 3) do not contain one of the prohibited active ingredients listed on [www.3206tankmix.com](http://www.3206tankmix.com) website.

Applicators and other handlers (mixers) who plan to tank-mix must access the website within one week prior to application in order to comply with the most up-to-date information on tank mix partners.

Do not exceed specified application rates for respective products or maximum allowable application rates for any active ingredient in the tank mix.

Read carefully and follow all applicable use directions, precautions, and limitations on the respective product labels. It is the pesticide user's

responsibility to ensure that all products in the mixtures are registered for the intended use. Users must follow the most restrictive directions for use and precautionary statements of each product in the tank mixture.

Always perform a (jar) test to ensure the compatibility of products to be used in tank mixture.

#### STORAGE AND DISPOSAL

Do not contaminate water, food, or feed by storage or disposal.

**Pesticide Storage:** Store in original container only. Keep container closed when not in use. Do not store near food or feed. In case of spill or leak on floor or paved surfaces, soak up with vermiculite, earth, or synthetic absorbent.

**Pesticide Disposal:** Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency or the Hazardous Waste Representative at the nearest EPA Regional Office for guidance.

#### Container Handling

**Non-refillable Container. DO NOT reuse or refill this container.** Triple rinse or pressure rinse container (or equivalent) promptly after emptying; then offer for recycling, if available, or reconditioning, if appropriate, or puncture and dispose of in a sanitary landfill, or by incineration, or by other procedures approved by state and local authorities.

**Triple rinse containers small enough to shake (capacity ≤ 5 gallons) as follows:** Empty the remaining contents into application equipment or a mix tank and drain for 10 seconds after the flow begins to drip. Fill the container ¼ full with water and recap. Shake for 10 seconds. Pour rinsate into application equipment or a mix tank, or store rinsate for later use or disposal. Drain for 10 seconds after the flow begins to drip. Repeat this procedure two more times.

**Triple rinse containers too large to shake (capacity > 5 gallons) as follows:** Empty the remaining contents into application equipment or a mix tank. Fill the container ¼ full with water. Replace and tighten closures. Tip container on its side and roll it back and forth, ensuring at least one complete revolution, for 30 seconds. Stand the container on its end and tip it back and forth several times. Turn the container over onto its other end and tip it back and forth several times. Empty the rinsate into application equipment or a mix tank, or store rinsate for later use or disposal. Repeat this procedure two more times.

**Pressure rinse as follows:** Empty the remaining contents into application equipment or mix tank and continue to drain for 10 seconds after the flow begins to drip. Hold container upside down over application equipment or mix tank, or collect rinsate for later use or disposal. Insert pressure rinsing nozzle in the side of the container and rinse at about 40 PSI for at least 30 seconds. Drain for 10 seconds after the flow begins to drip.

**Warranty Disclaimer:** SePRO Corporation warrants that this product conforms to the chemical description on the product label. Testing and research have also determined that this product is reasonably fit for the uses described on the product label. To the extent consistent with applicable law, SePRO Corporation makes no other express or implied warranty of fitness or merchantability nor any other express or implied warranty and any such warranties are expressly disclaimed.

**Misuse:** Federal law prohibits the use of this product in a manner inconsistent with its label directions. To the extent consistent with applicable law, the buyer assumes responsibility for any adverse consequences if this product is not used according to its label directions. In no case shall SePRO Corporation be liable for any losses or damages resulting from the use, handling or application of this product in a manner inconsistent with its label.

For additional important labeling information regarding SePRO Corporation's Terms and Conditions of Use, Inherent Risks of Use and Limitation of Remedies, please visit <http://seprolabels.com/terms> or scan the image below.



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## APPENDIX N

# Wisconsin DNR's Florpyrauxifen-benzyl (ProcellaCOR's Active Ingredient) Chemical Fact Sheet

# FLORPYRAUXIFEN-BENZYL CHEMICAL FACT SHEET

## Formulations

Florpyrauxifen-benzyl is a relatively new herbicide that was first registered with the U.S. EPA in 2017. The active ingredient is 4-amino-3-chloro-6-(4-chloro-2-fluoro-3-methoxyphenyl)-5-fluoro-pyridine-2-benzyl ester, also identified as florpyrauxifen-benzyl. Florpyrauxifen-benzyl is labeled for control of submerged, floating and emergent aquatic plants using surface, subsurface or foliar application in slow-moving and quiescent waters. Commercial formulations approved for aquatic use in Wisconsin include ProcellaCOR™\*.

## Aquatic Use and Considerations

Florpyrauxifen-benzyl is a systemic herbicide (i.e., it moves throughout the plant tissue). It is a WSSA Group 4 herbicide, meaning that the mechanism of action is by mimicking the plant growth hormone auxin and causing excessive elongation of plant cells, ultimately killing the plant. Affected plants may show atypical growth patterns (e.g., large and/or twisted leaves, stem elongation), and leaf and shoot tissue may become fragile. While initial effects will become apparent within a few days after treatment, it will take two to three weeks for the full plant decomposition process to occur. Florpyrauxifen-benzyl should be applied to plants that are actively growing; mature plants may require a higher concentration of herbicide and a longer contact time compared to smaller, less established plants.

It is important to note that repeated use of herbicides in the same WSSA group (i.e., with the same mechanism of action) can lead to herbicide-resistant plants, even in aquatic

environments. In order to reduce the risk of developing resistant genotypes, avoid using the same type of herbicides year after year, and utilize effective integrated pest management strategies as part of any long-term control program.

Florpyrauxifen-benzyl has relatively short contact exposure time (CET) requirements (typically 12 to 24 hours). The short CET may be advantageous for localized treatments of submersed aquatic plants, however, the target species efficacy compared to the size of the treatment area is not yet known. In some Wisconsin lakes impacts to target and non-target plants have been observed in areas beyond the targeted treatment areas, and research is ongoing to better understand the herbicide's dissipation and degradation patterns across various lake types.

Florpyrauxifen-benzyl is labeled for control of invasive Eurasian watermilfoil (*Myriophyllum spicatum*), hybrid watermilfoil (*M. spicatum x sibiricum*) and yellow floating heart (*Nymphoides peltata*)<sup>†</sup>. Native species listed on the product label as susceptible to florpyrauxifen-benzyl include coontail (*Ceratophyllum demersum*), variable-leaf watermilfoil (*Myriophyllum heterophyllum*), watershield (*Brasenia schreberi*), pickerelweed (*Pontederia cordata*) and American lotus (*Nelumbo lutea*)<sup>†</sup>.

Preliminary results from pre- and post-treatment monitoring conducted on a subset of Wisconsin lakes observed negative impacts to dicot species such as northern watermilfoil (*Myriophyllum sibiricum*), white water crowfoot (*Ranunculus aquatilis*), water marigold (*Bidens beckii*), & coontail following treatment.

\* Product names are provided solely for your reference and should not be considered exhaustive nor endorsements.

<sup>†</sup> May vary by formulation, application rate, and/or product. Every product label must be carefully reviewed and followed by the user.

The Wisconsin Department of Natural Resources (DNR) is committed to promoting diversity, fairness, equity and the principles of environmental justice. We ensure that we do not discriminate in employment, programs, decisions, actions or delivery of services. If you have questions or to request information in an alternative format (large print, Braille, audio tape, etc.), please contact us at 888-936-7463 or <https://dnr.wisconsin.gov/About/Nondiscrimination>.

### Post-Treatment Water Use Restrictions

There are no drinking water or recreational use restrictions, including swimming and fishing, and no restrictions on irrigating turf. There is a short waiting period (dependent on application rate) for other non-agricultural irrigation purposes. Treated water should not be used for livestock drinking water or for agricultural irrigation without analytical monitoring to confirm dissipation<sup>7</sup>.

### Herbicide Degradation, Persistence and Trace Contaminants

Florpyrauxifen-benzyl is short-lived, with a half-life (the time it takes for half of the active ingredient to degrade) of four to six days in aerobic aquatic environments and two days in anaerobic aquatic environments.

Florpyrauxifen-benzyl in water is subject to rapid breakdown by light (photolysis), with a reported photolytic half-life of approximately two hours in surface water when exposed to sunlight. In addition, the herbicide can convert partially to an acid form via breakdown by water (hydrolysis) at high pH (greater than 9) and higher water temperatures (greater than 25°C). Microbial activity in the water and sediment can also enhance degradation.

Florpyrauxifen-benzyl breaks down into five major degradation products. These materials are generally more persistent in water than the active herbicide (with a half-life of up to three weeks), but four of the five products are minor metabolites detected at less than 5% of applied active ingredient.

Florpyrauxifen-benzyl has a high soil adsorption coefficient (KOC) and low volatility, which allows for rapid plant uptake resulting in short exposure time requirements.

Florpyrauxifen-benzyl degrades quickly (two to 15 days) in sediment. Few studies have yet been completed for groundwater, but based on known environmental properties, florpyrauxifen-benzyl is not expected to be associated with potential environmental impacts in groundwater.

### Impacts on Fish and Other Aquatic Organisms

Florpyrauxifen-benzyl is practically nontoxic to freshwater fish and invertebrates, birds, bees, reptiles, amphibians and mammals. Florpyrauxifen-benzyl will temporarily bioaccumulate (the process by which chemicals in the environment or in a food source are taken up by plants or animals) in freshwater organisms but is expelled and/or metabolized within one to three days after exposure to high (greater than 150 parts per billion) concentrations.

### Human Health

There are no risks of concern to human health since no adverse short- or long-term effects, including a lack of carcinogenicity or mutagenicity, were observed in the submitted toxicological studies for florpyrauxifen-benzyl regardless of the route of exposure. Drinking water exposures to florpyrauxifen-benzyl also do not pose a significant human health risk. Additionally, there is no hazard concern for metabolites and/or degradants of florpyrauxifen-benzyl that may be found in drinking water, plants and livestock.

### For Additional Information

U.S. Environmental Protection Agency (EPA)  
Office of Pesticide Programs  
[epa.gov/pesticides](http://epa.gov/pesticides)

Wisconsin Department of Agriculture, Trade,  
and Consumer Protection  
[datcp.wi.gov/Pages/Programs\\_Services/ACMOVerview.aspx](http://datcp.wi.gov/Pages/Programs_Services/ACMOVerview.aspx)

Wisconsin Department of Natural Resources  
608-266-2621  
[dnr.wi.gov/lakes/plants](http://dnr.wi.gov/lakes/plants)

National Pesticide Information Center  
1-800-858-7378  
[npic.orst.edu](http://npic.orst.edu)

Washington State Department of Ecology. 2017.  
[fortress.wa.gov/ecy/publications/documents/1710020.pdf](http://fortress.wa.gov/ecy/publications/documents/1710020.pdf)



Wisconsin Department of Natural Resources  
PO Box 7921  
Madison, WI 53707-7921

EGAD # 3200-2022-23

## APPENDIX O

### NR 107- Aquatic Plant Management Regulations

## Chapter NR 107

### AQUATIC PLANT MANAGEMENT

NR 107.01	Purpose.
NR 107.02	Applicability.
NR 107.03	Definitions.
NR 107.04	Application for permit.
NR 107.05	Issuance of permit.
NR 107.06	Chemical fact sheets.

NR 107.07	Supervision.
NR 107.08	Conditions of the permit.
NR 107.09	Special limitation.
NR 107.10	Field evaluation use permits.
NR 107.11	Exemptions.

Note: Chapter NR 107 as it existed on February 28, 1989 was repealed and a new Chapter NR 107 was created effective March 1, 1989.

**NR 107.01 Purpose.** The purpose of this chapter is to establish procedures for the management of aquatic plants and control of other aquatic organisms pursuant to s. 227.11 (2) (a), Stats., and interpreting s. 281.17 (2), Stats. A balanced aquatic plant community is recognized to be a vital and necessary component of a healthy aquatic ecosystem. The department may allow the management of nuisance-causing aquatic plants with chemicals registered and labeled by the U.S. environmental protection agency and labeled and registered by firms licensed as pesticide manufacturers and labelers with the Wisconsin department of agriculture, trade and consumer protection. Chemical management shall be allowed in a manner consistent with sound ecosystem management and shall minimize the loss of ecological values in the water body.

History: Cr. Register, February, 1989, No. 398, eff. 3-1-89; correction made under s. 13.93 (2m) (b) 7., Stats., Register, December, 2000, No. 540.

**NR 107.02 Applicability.** Any person sponsoring or conducting chemical treatment for the management of aquatic plants or control of other aquatic organisms in waters of the state shall obtain a permit from the department. Waters of the state include those portions of Lake Michigan and Lake Superior, and all lakes, bays, rivers, streams, springs, ponds, wells, impounding reservoirs, marshes, watercourses, drainage systems and other ground or surface water, natural or artificial, public or private, within the state or its jurisdiction as specified in s. 281.01 (18), Stats.

History: Cr. Register, February, 1989, No. 398, eff. 3-1-89; correction made under s. 13.93 (2m) (b) 7., Stats., Register, December, 2000, No. 540.

**NR 107.03 Definitions.** (1) "Applicator" means the person physically applying the chemicals to the treatment site.

(2) "Chemical fact sheet" means a summary of information on a specific chemical written by the department including general aquatic community and human safety considerations applicable to Wisconsin sites.

(3) "Department" means the department of natural resources.

History: Cr. Register, February, 1989, No. 398, eff. 3-1-89.

**NR 107.04 Application for permit.** (1) Permit applications shall be made on forms provided by the department and shall be submitted to the district director for the district in which the project is located. Any amendment or revision to an application shall be treated by the department as a new application, except as provided in s. NR 107.04 (3) (g).

Note: The DNR district headquarters are located at:

1. Southern — 3911 Fish Hatchery Road, Fitchburg 53711
2. Southeast — 2300 N. Dr. Martin Luther King Jr. Dr., Box 12436, Milwaukee 53212
3. Lake Michigan — 1125 N. Military Ave., Box 10448, Green Bay 54307
4. North Central — 107 Suttiff Ave., Box 818, Rhinelander 54501
5. Western — 1300 W. Clairmont Ave., Call Box 4001, Eau Claire 54702
6. Northwest — Hwy 70 West, Box 309, Spooner 54801

(2) The application shall be accompanied by:

(a) A nonrefundable permit application fee of \$20, and, for proposed treatments larger than 0.25 acres, an additional refundable acreage fee of \$25.00 per acre, rounded up to the nearest whole acre, applied to a maximum of 50.0 acres.

1. The acreage fee shall be refunded in whole if the entire permit is denied or if no treatment occurs on any part of the permitted treatment area. Refunds will not be prorated for partial treatments.

2. If the permit is issued with the proposed treatment area partially denied, a refund of acreage fees shall be given for the area denied.

(b) A legal description of the body of water proposed for treatment including township, range and section number;

(c) One copy of a detailed map or sketch of the body of water with the proposed treatment area dimensions clearly shown and with pertinent information necessary to locate those properties, by name of owner, riparian to the treatment area, which may include street address, local telephone number, block, lot and fire number where available. If a local address is not available, the home address and phone number of the property owner may be included;

(d) A description of the uses being impaired by plants or aquatic organisms and reason for treatment;

(e) A description of the plant community or other aquatic organisms causing the use impairment;

(f) The product names of chemicals proposed for use and the method of application;

(g) The name of the person or commercial applicator, and applicator certification number, when required by s. NR 107.08 (5), of the person conducting the treatment;

(h) A comparison of alternative control methods and their feasibility for use on the proposed treatment site.

(3) In addition to the information required under sub. (2), when the proposed treatment is a large-scale treatment exceeding 10.0 acres in size or 10% of the area of the water body that is 10 feet or less in depth, the application shall be accompanied by:

(a) A map showing the size and boundaries of the water body and its watershed.

(b) A map and list identifying known or suspected land use practices contributing to plant-related water quality problems in the watershed.

(c) A summary of conditions contributing to undesirable plant growth on the water body.

(d) A general description of the fish and wildlife uses occurring within the proposed treatment site.

(e) A summary of recreational uses of the proposed treatment site.

(f) Evidence that a public notice of the proposed application has been made, and that a public informational meeting, if required, has been conducted.

1. Notice shall be given in 2 inch x 4 inch advertising format in the newspaper which has the largest circulation in the area affected by the application.

2. The notice shall state the size of the proposed treatment, the approximate treatment dates, and that the public may request within 5 days of the notice that the applicant hold a public informational meeting on the proposed application.

a. The applicant will conduct a public informational meeting in a location near the water body when a combination of 5 or more individuals, organizations, special units of government, or local units of government request the meeting in writing to the applicant

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Register, December, 2000, No. 540



with a copy to the department within 5 days after the notice is made. The person or entity requesting the meeting shall state a specific agenda of topics including problems and alternatives to be discussed.

b. The meeting shall be given a minimum of one week advance notice, both in writing to the requestors, and advertised in the format of subd. 1.

(g) The provisions of pars. (a) to (c) shall be repeated once every 5 years and shall include new information. Annual modifications of the proposed treatment within the 5-year period which do not expand the treatment area more than 10% and cover a similar location and target organisms may be accepted as an amendment to the original application. The acreage fee submitted under sub. (2) (a) shall be adjusted in accordance with any proposed amendments.

(4) The applicant shall certify to the department that a copy of the application has been provided to any affected property owners' association, inland lake district, and, in the case of chemical applications for rooted aquatic plants, to any riparian property owners adjacent to and within the treatment area.

(5) A notice of the proposed treatment shall be provided by the department to any person or organization indicating annually in writing a desire to receive such notification.

*History:* Cr. Register, February, 1989, No. 398, eff. 3-1-89.

**NR 107.05 Issuance of permit.** (1) The department shall issue or deny issuance of the requested permit between 10 and 15 working days after receipt of an acceptable application, unless:

(a) An environmental impact report or statement is required under s. 1.11, Stats. Notification to the applicant shall be in writing within 10 working days of receipt of the application and no action may be taken until the report or statement has been completed; or

(b) A public hearing has been granted under s. 227.42, Stats.

(2) If a request for a public hearing is received after the permit is issued but prior to the actual treatment allowed by the permit, the department is not required to, but may, suspend the permit because of the request for public hearing.

(3) The department may deny issuance of the requested permit if:

(a) The proposed chemical is not labeled and registered for the intended use by the United States environmental protection agency and both labeled and registered by a firm licensed as a pesticide manufacturer and labeler with the Wisconsin department of agriculture, trade and consumer protection;

(b) The proposed chemical does not have a current department aquatic chemical fact sheet;

(c) The department determines the proposed treatment will not provide nuisance relief, or will place unreasonable restrictions on existing water uses;

(d) The department determines the proposed treatment will result in a hazard to humans, animals or other nontarget organisms;

(e) The department determines the proposed treatment will result in a significant adverse effect on the body of water;

(f) The proposed chemical application is for waters beyond 150 feet from shore except where approval is given by the department to maintain navigation channels, piers or other facilities used by organizations or the public including commercial facilities;

(g) The proposed chemical applications, other than those conducted by the department pursuant to ss. 29.421 and 29.424, Stats., will significantly injure fish, fish eggs, fish larvae, essential fish food organisms or wildlife, either directly or through habitat destruction;

(h) The proposed chemical application is in a location known to have endangered or threatened species as specified pursuant to s. 29.604, Stats., and as determined by the department;

(i) The proposed chemical application is in locations identified by the department as sensitive areas, except when the applicant demonstrates to the satisfaction of the department that treatments can be conducted in a manner that will not alter the ecological character or reduce the ecological value of the area.

1. Sensitive areas are areas of aquatic vegetation identified by the department as offering critical or unique fish and wildlife habitat, including seasonal or lifestage requirements, or offering water quality or erosion control benefits to the body of water.

2. The department shall notify any affected property owners' association, inland lake district, and riparian property owner of locations identified as sensitive areas.

(4) New applications will be reviewed with consideration given to the cumulative effect of applications already approved for the body of water.

(5) The department may approve the application in whole or in part consistent with the provisions of subs. (3) (a) through (i) and (4). Denials shall be in writing stating reasons for the denial.

(6) Permits may be issued for one treatment season only.

*History:* Cr. Register, February, 1989, No. 398, eff. 3-1-89; corrections in (3) (g) and (h) made under s. 13.93 (2m) (b) 7., Stats., Register, December, 2000, No. 540.

**NR 107.06 Chemical fact sheets.** (1) The department shall develop a chemical fact sheet for each of the chemicals in present use for aquatic nuisance control in Wisconsin.

(1m) Chemical fact sheets for chemicals not previously used in Wisconsin shall be developed within 180 days after the department has received notice of intended use of the chemical.

(2) The applicant or permit holder shall provide copies of the applicable chemical fact sheets to any affected property owners' association and inland lake district.

(3) The department shall make chemical fact sheets available upon request.

*History:* Cr. Register, February, 1989, No. 398, eff. 3-1-89.

**NR 107.07 Supervision.** (1) The permit holder shall notify the district office 4 working days in advance of each anticipated treatment with the date, time, location, and proposed size of treatment. At the discretion of the department, the advance notification requirement may be waived.

(2) Supervision by a department representative may be required for any aquatic nuisance control project involving chemicals. Supervision may include inspection of the proposed treatment area, chemicals, and application equipment before, during or after treatment. The inspection may result in the determination that treatment is unnecessary or unwarranted in all or part of the proposed area, or that the equipment will not control the proper dosage.

*History:* Cr. Register, February, 1989, No. 398, eff. 3-1-89.

**NR 107.08 Conditions of the permit.** (1) The department may stop or limit the application of chemicals to a body of water if at any time it determines that chemical treatment will be ineffective, or will result in unreasonable restrictions on current water uses, or will produce unnecessary adverse side effects on nontarget organisms. Upon request, the department shall state the reason for such action in writing to the applicant.

(2) Chemical treatments shall be performed in accordance with label directions, existing pesticide use laws, and permit conditions.

(3) Chemical applications on lakes and impoundments are limited to waters along developed shoreline including public parks except where approval is given by the department for projects of public benefit.

(4) Treatment of areas containing high value species of aquatic plants shall be done in a manner which will not result in adverse long-term or permanent changes to a plant community in a specific aquatic ecosystem. High value species are individual species of aquatic plants known to offer important values in spe-

cific aquatic ecosystems, including *Potamogeton amplifolius*, *Potamogeton Richardsonii*, *Potamogeton praelongus*, *Potamogeton pectinatus*, *Potamogeton illinoensis*, *Potamogeton robbinsii*, *Eleocharis spp.*, *Scirpus spp.*, *Valisneria spp.*, *Zizania aquatica*, *Zannichellia palustris* and *Brasenia schreberi*.

(5) Treatment shall be performed by an applicator currently certified by the Wisconsin department of agriculture, trade and consumer protection in the aquatic nuisance control category whenever:

(a) Treatment is to be performed for compensation by an applicator acting as an independent contractor for hire;

(b) The area to be treated is greater than 0.25 acres;

(c) The product to be used is classified as a "restricted use pesticide"; or

(d) Liquid chemicals are to be used.

(6) Power equipment used to apply liquid chemicals shall include the following:

(a) Containers used to mix and hold chemicals shall be constructed of watertight materials and be of sufficient size and strength to safely contain the chemical. Measuring containers and scales for the purpose of measuring solids and liquids shall be provided by the applicator;

(b) Suction hose used to deliver the chemical to the pump venturi assembly shall be fitted with an on-off ball-type valve. The system shall also be designed to prevent clogging from chemicals and aquatic vegetation;

(c) Suction hose used to deliver surface water to the pump shall be fitted with a check valve to prevent back siphoning into the surface water should the pump stop;

(d) Suction hose used to deliver a premixed solution shall be fitted with an on-off ball-type valve to regulate the discharge rate;

(e) Pressure hose used to discharge chemicals to the surface water shall be provided with an on-off ball-type valve. This valve will be fitted at the base of the hose nozzle or as part of the nozzle assembly;

(f) All pressure and suction hoses and mechanical fittings shall be watertight;

(g) Equipment shall be calibrated by the applicator. Evidence of calibration shall be provided at the request of the department supervisor.

(h) Other equipment designs may be acceptable if capable of equivalent performance.

(7) The permit holder shall be responsible for posting those areas of use in accordance with water use restrictions stated on the chemical label, but in all cases for a minimum of one day, and with the following conditions:

(a) Posting signs shall be brilliant yellow and conspicuous to the nonriparian public intending to use the treated water from both the water and shore, and shall state applicable label water use restrictions of the chemical being used, the name of the chemical and date of treatment. For tank mixes, the label requirements of the most restrictive chemical will be posted;

(b) Minimum sign dimensions used for posting shall be 11 inches by 11 inches or consistent with s. ATCP 29.15. The department will provide up to 6 signs to meet posting requirements. Additional signs may be purchased from the department;

(c) Signs shall be posted at the beginning of each treatment by the permit holder or representing agent. Posting prior to treatment may be required as a permit condition when the department determines that such posting is in the best interest of the public;

(d) Posting signs shall be placed along contiguous treated shoreline and at strategic locations to adequately inform the public. Posting of untreated shoreline located adjacent to treated shoreline and noncontiguous shoreline shall be at the discretion of the department;

(e) Posting signs shall be made of durable material to remain up and legible for the time period stated on the pesticide label for water use restrictions, after which the permit holder or representing agent is responsible for sign removal.

(8) After conducting a treatment, the permit holder shall complete and submit within 30 days an aquatic nuisance control report on a form supplied by the department. Required information will include the quantity and type of chemical, and the specific size and location of each treatment area. In the event of any unusual circumstances associated with a treatment, or at the request of the department, the report shall be provided immediately. If treatment did not occur, the form shall be submitted with appropriate comment by October 1.

(9) Failure to comply with the conditions of the permit may result in cancellation of the permit and loss of permit privileges for the subsequent treatment season. A notice of cancellation or loss of permit privileges shall be provided by the department to the permit holder accompanied by a statement of appeal rights.

**History:** Cr. Register, February, 1989, No. 398, eff. 3-1-89; correction in (7) (b) made under s. 13.93 (2m) (b) 7., Stats., Register, September, 1995, No. 477.

**NR 107.09 Special limitation.** Due to the significant risk of environmental damage from copper accumulation in sediments, swimmer's itch treatments performed with copper sulfate products at a rate greater than 10 pounds of copper sulfate per acre are prohibited.

**History:** Cr. Register, February, 1989, No. 398, eff. 3-1-89.

**NR 107.10 Field evaluation use permits.** When a chemical product is considered for aquatic nuisance control and does not have a federal label for such use, the applicant shall apply to the administrator of the United States environmental protection agency for an experimental use permit under section 5 of the federal insecticide, fungicide and rodenticide act as amended (7 USC 136 et seq.). Upon receiving a permit, the permit holder shall obtain a field evaluation use permit from the department and be subject to the requirements of this chapter. Department field evaluation use permits shall be issued for the purpose of evaluating product effectiveness and safety under field conditions and will require in addition to the conditions of the permit specified in s. NR 107.08 (1) through (9), the following:

(1) Treatment shall be limited to an area specified by the department.

(2) The permit holder shall submit to the department a summary of treatment results at the end of the treatment season. The summary shall include:

(a) Total chemical used and distribution pattern, including chemical trade name, formulation, percent active ingredient, and dosage rate in the treated water in parts per million of active ingredient;

(b) Description of treatment areas including the character and the extent of the nuisance present;

(c) Effectiveness of the application and when applicable, a summary comparison of the results obtained from past experiments using the same chemical formulation;

(d) Other pertinent information required by the department; and

(e) Conclusions and recommendations for future use.

**History:** Cr. Register, February, 1989, No. 398, eff. 3-1-89.

**NR 107.11 Exemptions.** (1) Under any of the following conditions, the permit application fee in s. NR 107.04 (2) (a) will be limited to the basic application fee:

(a) The treatment is made for the control of bacteria on swimming beaches with chlorine or chlorinated lime;

(b) The treatment is intended to control algae or other aquatic nuisances that interfere with the use of the water for potable purposes;

(c) The treatment is necessary for the protection of public health, such as the control of disease carrying organisms in sanitary sewers, storm sewers, or marshes, and the treatment is sponsored by a governmental agency.

(2) The treatment of purple loosestrife is exempt from ss. NR 107.04 (2) (a) and (3), and 107.08 (5).

(3) The use of chemicals in private ponds is exempt from the provisions of this chapter except for ss. NR 107.04 (1), (2), (4) and (5), 107.05, 107.07, 107.08 (1), (2), (8) and (9), and 107.10.

(a) A private pond is a body of water located entirely on the land of an applicant, with no surface water discharge or a discharge that can be controlled to prevent chemical loss, and without access by the public.

(b) The permit application fee will be limited to the non-refundable \$20 application fee.

(4) The use of chemicals in accordance with label instructions is exempt from the provisions of this chapter, when used in:

(a) Water tanks used for potable water supplies;

(b) Swimming pools;

(c) Treatment of public or private wells;

(d) Private fish hatcheries licensed under s. 95.60, Stats.;

(e) Treatment of emergent vegetation in drainage ditches or rights-of-way where the department determines that fish and wildlife resources are insignificant; or

(f) Waste treatment facilities which have received s. 281.41, Stats., plan approval or are utilized to meet effluent limitations set forth in permits issued under s. 283.31, Stats.

**History:** Cr. Register, February, 1989, No. 398, eff. 3-1-89; corrections in (4) (d) and (f) made under s. 13.93 (2m) (b) 7., Stats., Register, December, 2000, No. 540.

## APPENDIX P

# NR 109- Aquatic Plant Manual Removal and Mechanical Control Regulations

## Chapter NR 109

## AQUATIC PLANTS: INTRODUCTION, MANUAL REMOVAL AND MECHANICAL CONTROL REGULATIONS

NR 109.01	Purpose.
NR 109.02	Applicability.
NR 109.03	Definitions.
NR 109.04	Application requirements and fees.
NR 109.05	Permit issuance.
NR 109.06	Waivers.

NR 109.07	Invasive and nonnative aquatic plants.
NR 109.08	Prohibitions.
NR 109.09	Plan specifications and approval.
NR 109.10	Other permits.
NR 109.11	Enforcement.

**NR 109.01 Purpose.** The purpose of this chapter is to establish procedures and requirements for the protection and regulation of aquatic plants pursuant to ss. 23.24 and 30.07, Stats. Diverse and stable communities of native aquatic plants are recognized to be a vital and necessary component of a healthy aquatic ecosystem. This chapter establishes procedures and requirements for issuing aquatic plant management permits for introduction of aquatic plants or control of aquatic plants by manual removal, burning, use of mechanical means or plant inhibitors. This chapter identifies other permits issued by the department for aquatic plant management that contain the appropriate conditions as required under this chapter for aquatic plant management, and for which no separate permit is required under this chapter. Introduction and control of aquatic plants shall be allowed in a manner consistent with sound ecosystem management, shall consider cumulative impacts, and shall minimize the loss of ecological values in the body of water. The purpose of this chapter is also to prevent the spread of invasive and non-native aquatic organisms by prohibiting the launching of watercraft or equipment that has any aquatic plants or zebra mussels attached.

**History:** CR 02-061: cr. Register May 2003 No. 569, eff. 6-1-03; correction made under s. 13.92 (4) (b) 7, Stats., Register March 2011 No. 663.

**NR 109.02 Applicability.** A person sponsoring or conducting manual removal, burning or using mechanical means or aquatic plant inhibitors to control aquatic plants in navigable waters, or introducing non-native aquatic plants to waters of this state shall obtain an aquatic plant management permit from the department under this chapter.

**History:** CR 02-061: cr. Register May 2003 No. 569, eff. 6-1-03.

**NR 109.03 Definitions.** In this chapter:

(1) "Aquatic community" means lake or river biological resources.

(2) "Beneficial water use activities" mean angling, boating, swimming or other navigational or recreational water use activity.

(3) "Body of water" means any lake, river or wetland that is a water of this state.

(4) "Complete application" means a completed and signed application form, the information specified in s. NR 109.04 and any other information which may reasonably be required from an applicant and which the department needs to make a decision under applicable provisions of law.

(5) "Department" means the Wisconsin department of natural resources.

(6) "Manual removal" means the control of aquatic plants by hand or hand-held devices without the use or aid of external or auxiliary power.

(7) "Navigable waters" means those waters defined as navigable under s. 30.10, Stats.

(8) "Permit" means aquatic plant management permit.

(9) "Plan" means aquatic plant management plan.

(10) "Wetlands" means an area where water is at, near or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation and which has soils indicative of wet conditions.

**History:** CR 02-061: cr. Register May 2003 No. 569, eff. 6-1-03.

**NR 109.04 Application requirements and fees.**

(1) Permit applications shall be made on forms provided by the department and shall be submitted to the regional director or designee for the region in which the project is located. Permit applications for licensed aquatic nursery growers may be submitted to the department of agriculture, trade and consumer protection.

**Note:** Applications may be obtained from the department's regional headquarters or service centers. DATCP has agreed to send application forms and instructions provided by the department to aquatic nursery growers along with license renewal forms. DATCP will forward all applications to the department for processing.

(2) The application shall be accompanied by all of the following unless the application is made by licensed aquatic nursery growers for selective harvesting of aquatic plants for nursery stock. Applications made by licensed aquatic nursery growers for harvest of nursery stock do not have to include the information required by par. (d), (e), (h), (i) or (j).

(a) A nonrefundable application fee. The application fee for an aquatic plant management permit is:

1. \$30 for a proposed project to manage aquatic plants on less than one acre.

2. \$30 per acre to a maximum of \$300 for a proposed project to manage aquatic plants on one acre or larger. Partial acres shall be rounded up to the next full acre for fee determination. An annual renewal of this permit may be requested with an additional application fee of one-half the original application fee, but not less than \$30.

(b) A legal description of the body of water including township, range and section number.

(c) One copy of a detailed map of the body of water with the proposed introduction or control area dimensions clearly shown. Private individuals doing plant introduction or control shall provide the name of the owner riparian to the management area, which includes the street address or block, lot and fire number where available and local telephone number or other pertinent information necessary to locate the property.

(d) One copy of any existing aquatic management plan for the body of water, or detailed reference to the plan, citing the plan references to the proposed introduction or control area, and a description of how the proposed introduction or control of aquatic plants is compatible with any existing plan.

(e) A description of the impairments to water use caused by the aquatic plants to be managed.

(f) A description of the aquatic plants to be controlled or removed.

(g) The type of equipment and methods to be used for introduction, control or removal.

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(h) A description of other introduction or control methods considered and the justification for the method selected.

(i) A description of any other method being used or intended for use for plant management by the applicant or on the area abutting the proposed management area.

(j) The area used for removal, reuse or disposal of aquatic plants.

(k) The name of any person or commercial provider of control or removal services.

(3) (a) The department may require that an application for an aquatic plant management permit contain an aquatic plant management plan that describes how the aquatic plants will be introduced, controlled, removed or disposed. Requirements for an aquatic plant management plan shall be made in writing stating the reason for the plan requirement. In deciding whether to require a plan, the department shall consider the potential for effects on protection and development of diverse and stable communities of native aquatic plants, for conflict with goals of other written ecological or lake management plans, for cumulative impacts and effect on the ecological values in the body of water, and the long-term sustainability of beneficial water use activities.

(b) Within 30 days of receipt of the plan, the department shall notify the applicant of any additional information or modifications to the plan that are required. If the applicant does not submit the additional information or modify the plan as requested by the department, the department may dismiss the aquatic plant management permit application.

(c) The department shall approve the aquatic plant management plan before an application may be considered complete.

(4) The permit sponsor may request an annual renewal in writing from the department under s. NR 109.05 if there is no change proposed in the conditions of the original permit issued.

*History:* CR 02-061; cr. Register May 2003 No. 569, eff. 6-1-03.

**NR 109.05 Permit Issuance.** (1) The department shall issue or deny issuance of the requested permit within 15 working days after receipt of a completed application and approved plan as required under s. NR 109.04 (3).

(2) The department may specify any of the following as conditions of the permit:

(a) The quantity of aquatic plants that may be introduced or controlled.

(b) The species of aquatic plants that may be introduced or controlled.

(c) The areas in which aquatic plants may be introduced or controlled.

(d) The methods that may be used to introduce or control aquatic plants.

(e) The times during which aquatic plants may be introduced or controlled.

(f) The allowable methods used for disposing of or using aquatic plants that are removed or controlled.

(g) Annual or other reporting requirements to the department that may include information related to pars. (a) to (f).

(3) The department may deny issuance of the requested permit if the department determines any of the following:

(a) Aquatic plants are not causing significant impairment of beneficial water use activities.

(b) The proposed introduction or control will not remedy the water use impairments caused by aquatic plants as identified as a part of the application in s. NR 109.04 (2) (e).

(c) The proposed introduction or control will result in a hazard to humans.

(d) The proposed introduction or control will cause significant adverse impacts to threatened or endangered resources.

(e) The proposed introduction or control will result in a significant adverse effect on water quality, aquatic habitat or the aquatic community including the native aquatic plant community.

(f) The proposed introduction or control is in locations identified by the department as sensitive areas, under s. NR 107.05 (3) (i) 1., except when the applicant demonstrates to the satisfaction of the department that the project can be conducted in a manner that will not alter the ecological character or reduce the ecological value of the area.

(g) The proposed management will result in significant adverse long-term or permanent changes to a plant community or a high value species in a specific aquatic ecosystem. High value species are individual species of aquatic plants known to offer important values in specific aquatic ecosystems, including *Potamogeton amplifolius*, *Potamogeton Richardsonii*, *Potamogeton praelongus*, *Stuckenia pectinata* (*Potamogeton pectinatus*), *Potamogeton illinoensis*, *Potamogeton robbinsii*, *Eleocharis* spp., *Scirpus* spp., *Valisneria* spp., *Zizania* spp., *Zannichellia palustris* and *Brasenia schreberi*.

(h) If wild rice is involved, the stipulations incorporated by *Lac Courte Oreilles v. Wisconsin*, 775 F. Supp. 321 (W.D. Wis. 1991) shall be complied with.

(i) The proposed introduction or control will interfere with the rights of riparian owners.

(j) The proposed management is inconsistent with a department approved aquatic plant management plan for the body of water.

(4) The department may approve the application in whole or in part consistent with the provisions of sub. (3). A denial shall be in writing stating the reasons for the denial.

(5) (a) The department may issue an aquatic plant management permit on less than one acre in a single riparian area for a 3-year term.

(b) The department may issue an aquatic plant management permit for a one-year term for more than one acre or more than one riparian area. The permit may be renewed annually for up to a total of 3 years in succession at the written request of the permit holder, provided no modifications or changes are made from the original permit.

(c) The department may issue an aquatic plant management permit containing a department-approved plan for a 3 to 5 year term.

(d) The department may issue an aquatic plant management permit to a licensed nursery grower for a 3-year term for the harvesting of aquatic plants from a publicly owned lake bed or for a 5-year term for harvesting of aquatic plants from privately owned beds with the permission of the property owner.

(6) The approval of an aquatic plant management permit does not represent an endorsement of the permitted activity, but represents that the applicant has complied with all criteria of this chapter.

*History:* CR 02-061; cr. Register May 2003 No. 569, eff. 6-1-03; reprinted to restore dropped language from rule order, Register October 2003 No. 574.

**NR 109.06 Waivers.** The department waives the permit requirements under this chapter for any of the following:

(1) Manual removal or use of mechanical devices to control or remove aquatic plants from a body of water 10 acres or less that is entirely confined on the property of one person with the permission of that property owner.

*Note:* A person who introduces native aquatic plants or removes aquatic plants by manual or mechanical means in the course of operating an aquatic nursery as authorized under s. 94.10, Stats., on privately owned non-navigable waters of the state is not required to obtain a permit for the activities.

(2) A riparian owner who manually removes aquatic plants from a body of water or uses mechanical devices designed for cutting or mowing vegetation to control plants on an exposed lake bed that abuts the owner's property provided that the removal meets all of the following:

(a) 1. Removal of native plants is limited to a single area with a maximum width of no more than 30 feet measured along the shoreline provided that any piers, boatlifts, swimrafts and other recreational and water use devices are located within that 30-foot wide zone and may not be in a new area or additional to an area where plants are controlled by another method; or

2. Removal of nonnative or invasive aquatic plants as designated under s. NR 109.07 when performed in a manner that does not harm the native aquatic plant community; or

3. Removal of dislodged aquatic plants that drift on-shore and accumulate along the waterfront.

(b) Is not located in a sensitive area as defined by the department under s. NR 107.05 (3) (i) 1., or in an area known to contain threatened or endangered resources or floating bogs.

(c) Does not interfere with the rights of other riparian owners.

(d) If wild rice is involved, the procedures of s. NR 19.09 (1) shall be followed.

(4) Control of purple loosestrife by manual removal or use of mechanical devices when performed in a manner that does not harm the native aquatic plant community or result in or encourage re-growth of purple loosestrife or other nonnative vegetation.

(5) Any aquatic plant management activity that is conducted by the department and is consistent with the purposes of this chapter.

(6) Manual removal and collection of native aquatic plants for lake study or scientific research when performed in a manner that does not harm the native aquatic plant community.

Note: Scientific collectors permit requirements are still applicable.

(7) Incidental cutting, removal or destroying of aquatic plants when engaged in beneficial water use activities.

History: CR 02-061: cr. Register May 2003 No. 569, eff. 6-1-03.

#### NR 109.07 Invasive and nonnative aquatic plants.

(1) The department may designate any aquatic plant as an invasive aquatic plant for a water body or a group of water bodies if it has the ability to cause significant adverse change to desirable aquatic habitat, to significantly displace desirable aquatic vegetation, or to reduce the yield of products produced by aquaculture.

(2) The following aquatic plants are designated as invasive aquatic plants statewide: Eurasian water milfoil, curly leaf pondweed and purple loosestrife.

(3) Native and nonnative aquatic plants of Wisconsin shall be determined by using scientifically valid publications and findings by the department.

History: CR 02-061: cr. Register May 2003 No. 569, eff. 6-1-03.

**NR 109.08 Prohibitions.** (1) No person may distribute an invasive aquatic plant, under s. NR 109.07.

(2) No person may intentionally introduce Eurasian water milfoil, curly leaf pondweed or purple loosestrife into waters of this state without the permission of the department.

(3) No person may intentionally cut aquatic plants in public/navigable waters without removing cut vegetation from the body of water.

(4) (a) No person may place equipment used in aquatic plant management in a navigable water if the person has reason to

believe that the equipment has any aquatic plants or zebra mussels attached.

(b) This subsection does not apply to equipment used in aquatic plant management when re-launched on the same body of water without having visited different waters, provided the re-launching will not introduce or encourage the spread of existing aquatic species within that body of water.

History: CR 02-061: cr. Register May 2003 No. 569, eff. 6-1-03.

#### NR 109.09 Plan specifications and approval.

(1) Applicants required to submit an aquatic plant management plan, under s. NR 109.04 (3), shall develop and submit the plan in a format specified by the department.

(2) The plan shall present and discuss each of the following items:

(a) The goals and objectives of the aquatic plant management and protection activities.

(b) A physical, chemical and biological description of the waterbody.

(c) The intensity of water use.

(d) The location of aquatic plant management activities.

(e) An evaluation of chemical, mechanical, biological and physical aquatic plant control methods.

(f) Recommendations for an integrated aquatic plant management strategy utilizing some or all of the methods evaluated in par. (e).

(g) An education and information strategy.

(h) A strategy for evaluating the efficacy and environmental impacts of the aquatic plant management activities.

(i) The involvement of local units of government and any lake organizations in the development of the plan.

(3) The approval of an aquatic plant management plan does not represent an endorsement for plant management, but represents that adequate considerations in planning the actions have been made.

History: CR 02-061: cr. Register May 2003 No. 569, eff. 6-1-03.

**NR 109.10 Other permits.** Permits issued under s. 30.12, 30.20, 31.02 or 281.36, Stats., or under ch. NR 107 may contain provisions which provide for aquatic plant management. If a permit issued under one of these authorities contains the appropriate conditions as required under this chapter for aquatic plant management, a separate permit is not required under this chapter. The permit shall explicitly state that it is intended to comply with the substantive requirements of this chapter.

History: CR 02-061: cr. Register May 2003 No. 569, eff. 6-1-03.

**NR 109.11 Enforcement.** (1) Violations of this chapter may be prosecuted by the department under chs. 23, 30 and 31, Stats.

(2) Failure to comply with the conditions of a permit issued under or in accordance with this chapter may result in cancellation of the permit and loss of permit privileges for the subsequent year. Notice of cancellation or loss of permit privileges shall be provided by the department to the permit holder.

History: CR 02-061: cr. Register May 2003 No. 569, eff. 6-1-03.

## GLOSSARY

**Adaptive Management:** A strategy that involves adjusting management practices based on ongoing monitoring and evaluation to achieve desired outcomes.

**Aquatic Harvester:** A specialized machine used for mechanically removing aquatic plants from water bodies to maintain navigable waterways.

**Aquatic Herbicide:** Chemical substances used to control or manage the growth of aquatic plants.

**Aquatic Invasive Species (AIS):** Non-native organisms that invade aquatic ecosystems, disrupting native species and habitats.

**Aquatic Plant Management:** Strategies and methods for controlling the growth of plants in bodies of water, often to maintain ecological balance and/or human activities like boating, fishing, etc...

**Buffer Zone:** A strip of natural vegetation along the shoreline that acts as a filter for pollutants, provides habitat for wildlife, and prevents erosion.

**Chlorophyll a:** A pigment found in algae and plants that is used as an indicator of algal biomass in water bodies.

**Clean Boats, Clean Waters (CBCW):** A program aimed at educating and preventing the spread of invasive species by inspecting boats and trailers entering and leaving water bodies.



**Density:** The concentration or number of organisms within a specific area, often used to describe the thickness of plant beds or populations.

**Drainage Lake:** A type of lake that has an outlet through which water flows out, typically located at the lowest point of the lake.

**Diver Assisted Suction Harvesting (DASH):** A method whereby divers use a suction device to remove plants from underwater and collect them on a boat for removal.

**Eradication:** The complete removal or elimination of a particular species.

**Eurasian Watermilfoil (EWM):** An invasive aquatic plant species that grows rapidly, forming dense mats and disrupting native plant communities.

**Exotic Species:** Species that are not native to an area and can cause harm to ecosystems.

**Fragmentation:** a form of asexual reproduction or cloning, where an organism is split into fragments. Each of these fragments develop into mature, fully grown individuals that are clones of the original organism.

**Hybrid Watermilfoil (HWM):** A hybrid species resulting from the crossbreeding of Eurasian watermilfoil with the Wisconsin native, northern watermilfoil.

**Hypereutrophic:** A term describing a waterbody with extremely high nutrient levels, leading to excessive plant growth and reduced water clarity.

**Integrated Pest Management:** A holistic approach to pest control that combines various strategies, such as monitoring, prevention, and intervention, to minimize environmental impact.

**Maximum Depth:** The deepest point in the lake.

**Mean Depth:** The average depth of the lake.

**Mechanical Harvesting:** The process of physically removing aquatic plants using machinery, often to clear navigation paths.

**Mesotrophic:** A moderate level of productivity in a lake, suggesting fairly clear water but potential oxygen issues in deeper parts during summer.

**Native Aquatic Plant Biodiversity:** The variety of native plant species living in the lake's ecosystem.

**Native Species:** Species that naturally occur and belong to a particular ecosystem or region.

**Navigation Lanes:** Specific pathways designated for boats to navigate through, often cleared of aquatic vegetation to ensure safe and easy passage.

**Non-point Source Pollution:** Pollution that comes from diffuse sources, such as agricultural and urban runoff, rather than from specific, identifiable points like factories or sewage treatment plants.

**Nuisance Levels:** When the presence of a plant or organism becomes problematic due to its abundance.

**Nutrients:** Substances like nitrogen and phosphorus that promote the growth of plants and algae in water bodies.

**Phosphorus:** A nutrient that can cause excessive plant and algal growth in water.

**Point-Intercept Survey:** A methodology for assessing aquatic plant diversity and distribution by collecting data at predefined points or locations within a water body.

**Riparian Property Owners:** People who own property along the shoreline of the lake.

**Secchi Depth:** A measure of water clarity or how far down you can see in the water.

**Secchi Disc:** A tool used to measure water clarity by determining the depth at which a black-and-white disk disappears from view when lowered into the water.

**Selective Aquatic Herbicide:** Herbicides designed to target specific species of aquatic plants while minimizing harm to non-target organisms, often used for precise control in sensitive ecosystems.

**Sedimentation:** The process by which soil and other particles settle at the bottom of a water body, often carrying nutrients and pollutants with them.

**Septic System:** A private sewage treatment system used by homes and businesses that is responsible for treating and disposing of wastewater on-site.

**Shoreline Improvement:** Practices aimed at enhancing the natural vegetation and structures along the edge of a lake to reduce erosion and filter pollutants.

**Species Abundance:** The number of individuals of a particular species present in a given area.

**Total Phosphorus:** A measure of the concentration of phosphorus compounds in water, which can contribute to eutrophication and algal blooms.

**Trophic State:** The relative nutrient richness and biological productivity of a body of water, often classified as oligotrophic (low nutrients) to eutrophic (high nutrients).

**Trophic State Index (TSI):** A measure of how productive a lake is, which indicates its water quality based on factors like clarity, nutrients, and algae levels.

**Turbidity:** The cloudiness or haziness of water caused by suspended particles, affecting light penetration and aquatic plant growth.

**Water Clarity:** The degree to which objects underwater can be seen, affected by factors like sediment and algae levels.

**Water Quality Monitoring:** Regular assessment of various parameters such as clarity, chemical composition, and biological indicators to gauge the health of water bodies.

**Watershed:** The area of land where all the water that falls within it drains into a common outlet, such as a lake or river.

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