Muskrat Lake, Becker County, MN
2022 Aquatic Vegetation Management Report

Prepared by:
Gina L. Kemper
Water Resource Coordinator
Pelican River Watershed District

Project Details

Lake: Muskrat (EQuIS# 03-0360-00-201)

Lake Surface Area: 69 acres **Littoral Area:** 64 acres **County:** Becker

Survey Type: Point-intercept aquatic plant surveys (2022)

Date of Survey (most recent): July 25, 2022 (PRWD)

Surveyor[s]: Beatrice Jaszczak & Blaine Henderson

Report Updated: December 2022

Author[s]:

Gina L. Kemper, Water Resource Coordinator (PRWD), prwdmonitor@arvig.net, 218-846-0436

Report Details

G. L. Kemper. 2022. Muskrat Lake, Becker County: 2022 Aquatic Vegetation Management Report. Water Resource Coordinator Pelican River Watershed District, 211 Holmes Street W., Detroit Lakes, MN 56501. 17 pp.

Summary

The purpose of this report is to provide an overview of aquatic plant distribution and the management of invasive aquatic plants in Muskrat Lake, Becker County in 2022. Historical data on water quality, invasive aquatic plant management permits and point-intercept surveys are all summarized in this report. This summary will guide future invasive aquatic plant control projects and can evaluate changes in native plant communities.

Lake Description

Muskrat is a small lake with 64 of 69 acres classified as littoral (<15 feet deep). Muskrat lake is located within the Lake Sallie drainage area with the Pelican River flowing through it. The river is navigable from Detroit Lake, which has influenced increased development considerably from what is typically observed on similar lakes in this area. A tram was constructed to allow the movement of watercraft from Muskrat to Lake Sallie, which would otherwise not be possible due to a constructed rapid between the two lakes. The shallow lake is fertile with aquatic plants that grow to the surface in the deepest region of the lake.

A lock and dam system was removed and replaced with a constructed rapid. The primary goal of the barrier removal was to allow for fish passage from Sallie to Muskrat (and Detroit via the Pelican River). The rapid has become a valuable asset for the MN DNR, which has a fisheries facility located in the area. Annual walleye netting is conducted for egg takes, which are grown and released back into area lakes which are not capable of sustaining a high enough rate of natural reproduction. The passage has also aided in the Muskie fishery by allowing the passage between the lakes.

Water quality in Muskrat Lake is variable and highly influenced by the nutrient load from discharge from Detroit Lake via the Pelican River and from St. Clair Lake (impaired for excessive nutrients) via Judicial Ditch 14. The lake is classified as mesotrophic; however, it tends to exhibit some eutrophic tendencies (lake wide algal blooms and dense macrophyte growth) during warmer summer months. It should be noted that beginning in 2018, the City of Detroit Lake began to upgrade the Wastewater Treatment Facility which discharges effluent wastewater into St. Clair Lake. While the water will be low in nutrients, the volume will increase by about 2 million gallons per day, which was previously land applied during summer months. This may increase the nutrient load discharge from the ditched wetland which Ditch 14 flows through.

Management History

The lake has two invasive plant species: Curly-leaf Pondweed (*Potamogeton crispus*) and Flowering Rush *(Butomus umbellatus)*. Curly-leaf Pondweed and Flowering Rush have both been present since at least 2018. Using herbicides, invasive aquatic plant management in Muskrat Lake has focused on Curly-leaf Pondweed and Flowering Rush since 2018. Curly- leaf treatments occurred in 2018, 2020 and 2021.

While Curly-leaf Pondweed can be delineated in large areas, MN DNR only allows up to 15% of the Littoral area to be treated with herbicide without a variance. The most recent treatment was for Curly- leaf Pondweed in 2021 for 8.9 acres and the last treatment for Flowering Rush was in 2018 for 0.4 acres. Management of invasive aquatic plants is summarized in Tables 1 and 2. Over time, the invasive aquatic plant community has fluctuated based in annual field delineations. In 2022, no Curly-leaf Pondweed or Flowering rush plants were treated due to little, or no plant growth found.

Table 1 - Curly-leaf Pondweed Management Summary. Characteristics and history of partial lake invasive plant treatments for Muskrat, Becker County (EQuIS# 03-0360-00-201), total acres: 69, Littoral acres: 64, (15% of Littoral acres: 9.6). CLP is an abbreviation for curly-leaf pondweed. Total acres permitted does not reflect areas actually treated or delineated. The total acres were rounded to the nearest whole number.

Date (year)	Target Species	Total Acres Permitted	Herbicide	Licensed Commercial Applicator
2018	CLP	5	Endothall	PLM & Land Management Corp.
2020	CLP	3	Endothall	PLM & Land Management Corp.
2021	CLP	9	Endothall	PLM & Land Management Corp.

Table 2 – Flowering Rush Management Summary. Characteristics and history of partial lake invasive plant treatments for Muskrat, Becker County (EQuIS# 03-0360-00-201). FR is an abbreviation for Flowering Rush. Total acres permitted does not reflect areas actually treated or delineated. The total acres are rounded to the nearest whole number.

Date (year)	Target Species	Total Acres Permitted	Herbicide	Licensed Commercial Applicator
2018	FR	1	Diquat	PLM & Land Management Corp.

Survey Objectives

In 2022, a Point-intercept Survey assessed the distribution of aquatic plants in Muskrat Lake, last conducted in 1966 by the MN DNR. The primary purpose for this type of survey is to 1) develop baseline knowledge of the current plant community in a lake, and over time, 2) compare year to year plant variation (in plant presence and spatial location) and 3) track invasive aquatic plants. Moreover, this survey will help the PRWD and our partners to monitor native plant communities and evaluate possible responses to invasive aquatic plant management via herbicide control. It is important to note that distributions and occurrences of aquatic plants may vary from year to year due to natural variations (water clarity, snow cover, water temperatures, and natural fluctuation in plant species) or human induced alterations, such as, herbicide and shoreline management activities.

Survey Methods

PRWD surveyors used a point-intercept survey method developed by John Madsen in "Aquatic Plant Control Technical Note MI-02, 1999" during the 2022 Survey. Points were placed 72 meters apart using a Geographic Information System (GIS), comprising of 102 points on a grid (Figure 1). Plant samples were collected by throwing and dragging a double-sided rake along the lake bottom at each point. All plant taxa (submerged, floating-leaf, emergent and free floating) were recorded to species or genera during the survey following Skawinski (2018). Plant samples were assessed on the boat to determine species presence/absence and abundance. The abundance rake rating are as follows: 1: sparse, 2: common/ frequent/ occasional, and 3: abundant/matted (Table 3). Frequencies of occurrence percentages (i.e., how often a plant species was sampled in the lake) were calculated based on the littoral zone.

Table 3. Quantitative rake abundance ranking (0-3) used to estimate plant abundance for each species based on rake coverage and/or visual observation (PRWD). A zero (0) ranking indicates no target plants were retrieved or observed in a sample.

Abundance Ranking	Rake Coverage	Description
1		Sparse; plants covering <25% of the rake head
2		Common; plants covering 25%-75% of the rake head
3		Abundant; plants covering >75% of the rake head

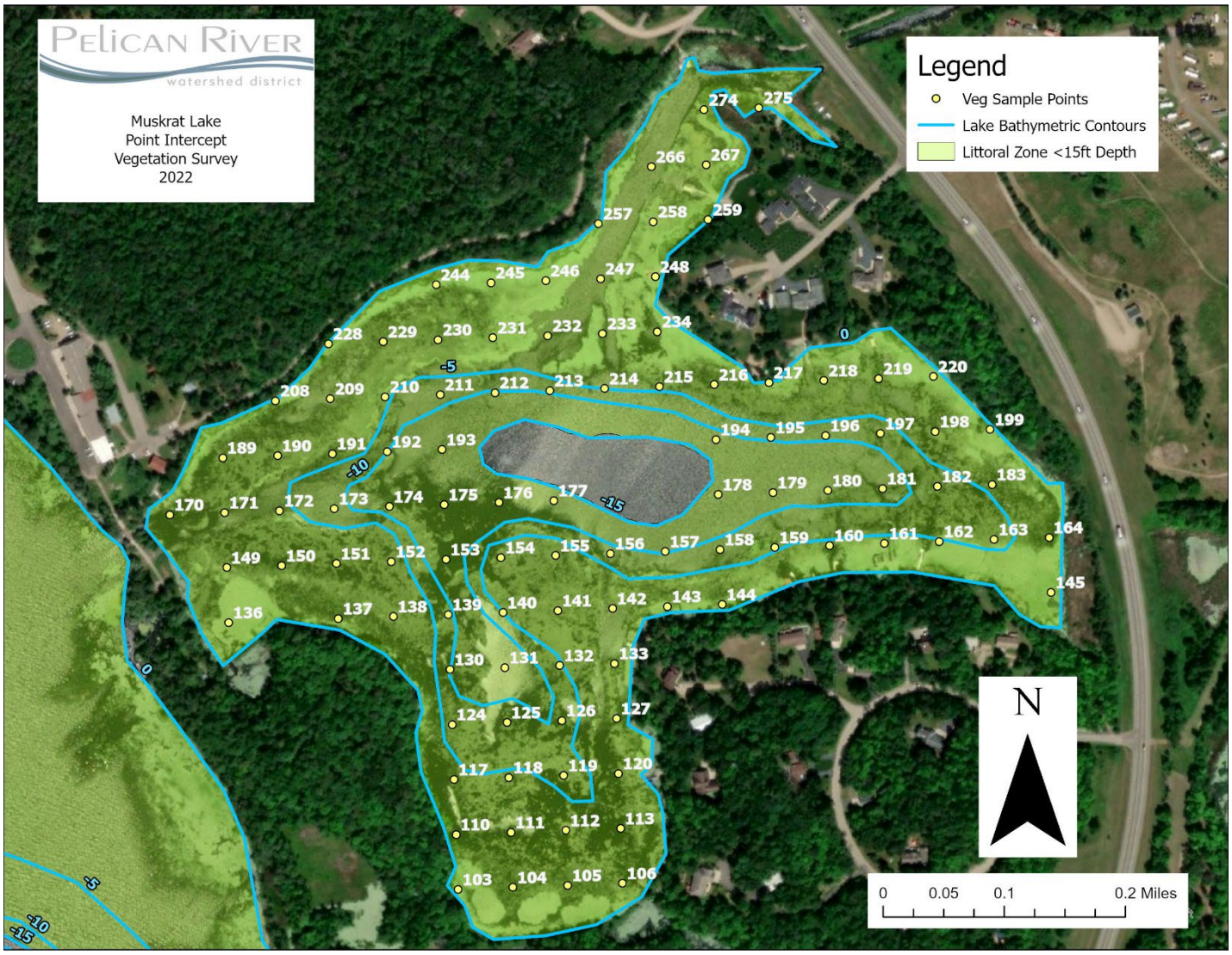

Figure 1 – Point-intercept Survey Grid. Point-intercept survey grid for Muskrat Lake, Becker County (EQuIS# 03-0360-00-201). A total of 102 points were surveyed in 2022 at 72 meters apart.

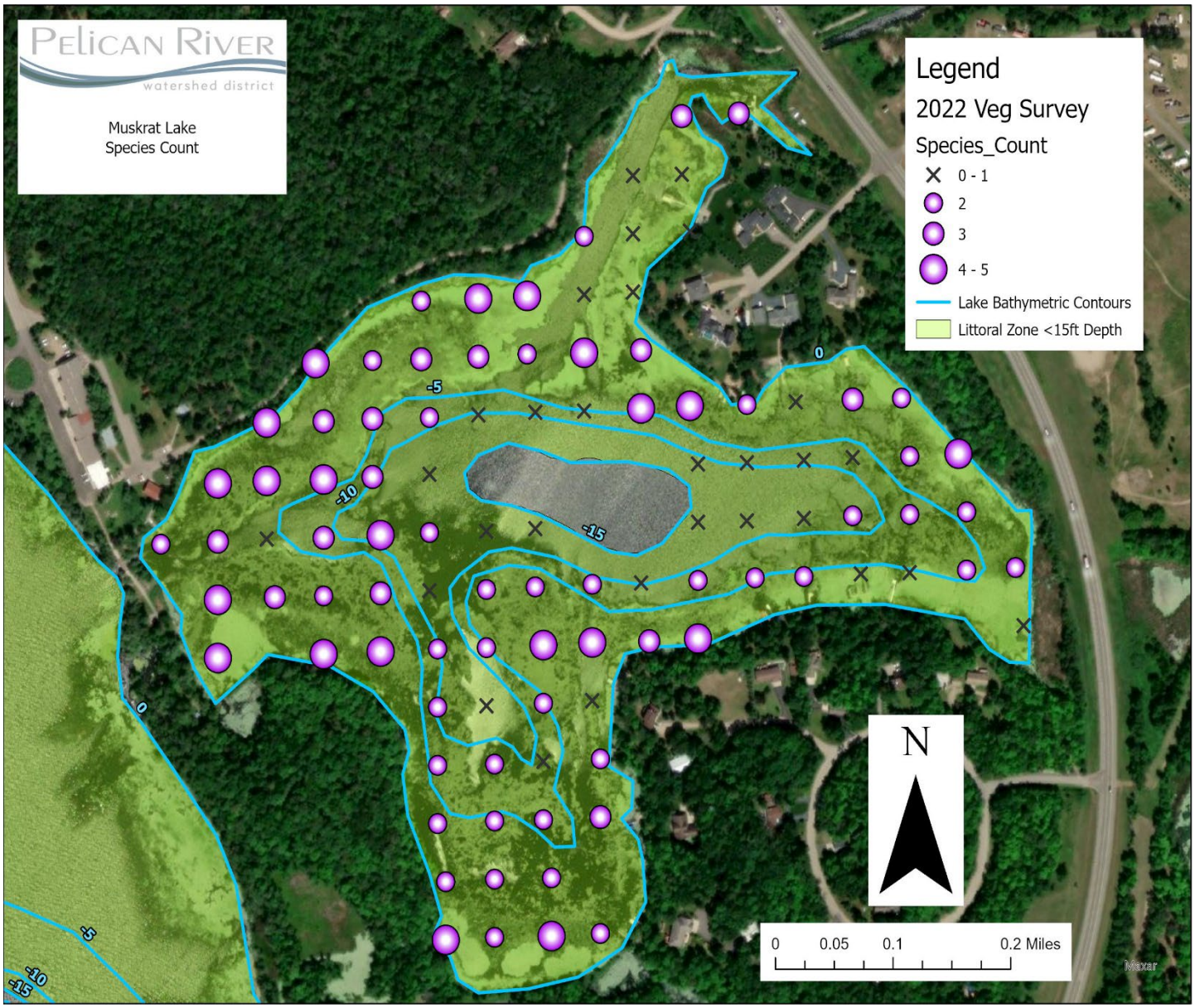

Figure 2 – Species Richness Distribution. Number of species at each site from the 2022 point-intercept survey in Muskrat Lake, Becker County (EQuIS# 03-0360-00-201). Densities ranged from 0 to 5 at each point, with a 5 indicating the richness in species presence and 0 indicating no species.

Survey Observations

The first vegetation point-intercept survey of Muskrat Lake (EQuIS# 03-0360-00-201) conducted by the PRWD occurred on July 25th, 2022. Plants were rooted to a maximum depth (95%) of 15.1 feet, with depths ranging from 0 – 18 feet. However, since 64 acres is considered the littoral zone (< 15 feet deep and where aquatic plants are likely to be found) it was very rare to find any rooted plants deeper than 15 feet. 84% of the points had submersed native vegetation (Table 4) with a mean submersed native taxa per point of 2.1. Muskrat Lake has up to 6 submersed native taxa (Table 5) and one non-native submerged taxa (Curly-leaf Pondweed) and one non- native emergent taxa (Flowering Rush). However, there were little to no non-native plants detected during the 2022 point-intercept survey.

Table 4 - Point-intercept Metrics. Summary of PRWD point-intercepts metrics Muskrat Lake, Becker County (EQuIS# 03-0360-00-201). Shaded values were calculated from littoral depth range (0-15 feet).

Metric	JULY 2022
Surveyor	PRWD
Total # Points Sampled	102
Max depth of growth	15
Depth Range of Rooted Veg (ft.)	0.0 – 15.0
Max Depth of Growth (95%) (ft.)	15
# of Vegetated Points in Max Depth Range	88
# Points in Littoral (0-15 feet)	102
% Points w/ Submersed Native Taxa	84
Mean Submersed Native Taxa/ Point	2.1
# Submersed Native Taxa	5
# Submersed Non-Native Taxa	0
% Points w/ Submersed Non- native Taxa	0

Based on the 2022 point-intercept survey, the native plant community within the littoral area in Muskrat Lake was primarily dominated by Coontail (*Ceratophyllum demersum*) 64%, Flat-stem Pondweed (*Potamogeton zosteriformis*) 61%, Star Duckweed (Lemna trisulca) 40%, Northern Watermilfoil (*Myriophyllum sibiricum)* 26% , and Sago Pondweed (Stuckenia pectinate) 15% (3, 4, 5, 6 and 7). These aquatic plants are central to a healthy fish population, offering shelter and providing food and habitat to wildlife. Flowering Rush and Curly-leaf Pondweed (Aquatic Invasive Species) have been present in the lake, although not found during the 2022 survey. The District will continue to monitor annually for AIS.

Muskrat Lake has an average of two species per sampling site. Figure 2 displays the spatial distribution and species richness (# of species per sample point) of all native submersed species from the 2022 point-intercept survey.

Table 5 - Plant Frequency Occurrence. Percent frequency of occurrence for observed plant species within the littoral zone (0-15 feet) in Muskrat Lake, Becker County (EQuIS# 03-0360-00-201).

		July 2022 *b*
Taxonomic Name	**Common Name**	**Frequency (%)**
SUBMERSED NON-NATIVE		
These plants spread or have been introduced beyond its native range and are either causing harm or have the potential to cause harm.		
Potamogeton crispus	Curly-leaf Pondweed	0% **
SUBMERSED NATIVE		
These plants are rooted plants with flaccid or limp stems and most of their vegetative mass is below the water surface, although small portions may stick above the water.		
Ceratophyllum demersum	Coontail	64%
	Northern Watermilfoil	26%
Potamogeton praelongus	Whitestem Pondweed	8%
SUBMERSED NATIVE		
These plants are rooted plants with flaccid or limp stems and most of their vegetative mass is below the water surface, although small portions may stick above the water.		
Potamogeton zosteriformis	Flat-stem Pondweed	61%
Stuckenia pectinata	Sago Pondweed	15%
FLOATING LEAF *These plants are rooted in the lake bottom and have leaves that float on the water surface. Many have colorful flowers that extend above the water.*		
Nymphaeaceae spp.	Water Lilies	5%
EMERGENT *These plants extend well above the water surface and are usually found in shallow water, near shore.*		
	None observed	
EMERGENT NON-NATIVE		
These plants spread or have been introduced beyond its native range and are either causing harm or have the potential to cause harm.		
Butomus umbellatus	Flowering Rush	0% **
FREE FLOATING *These plants float freely on the water surface. The entire plant is suspended on the water, allowing the plant to be moved around the pond by wind and water currents.*		
Lemna trisulca	Star Duckweed	40%

b *Percent frequency for 2022 (PI Survey Method) calculated for 0-15 feet zone.*

** *Found during lake delineation process in past years (2018, 2020, and 2021).*

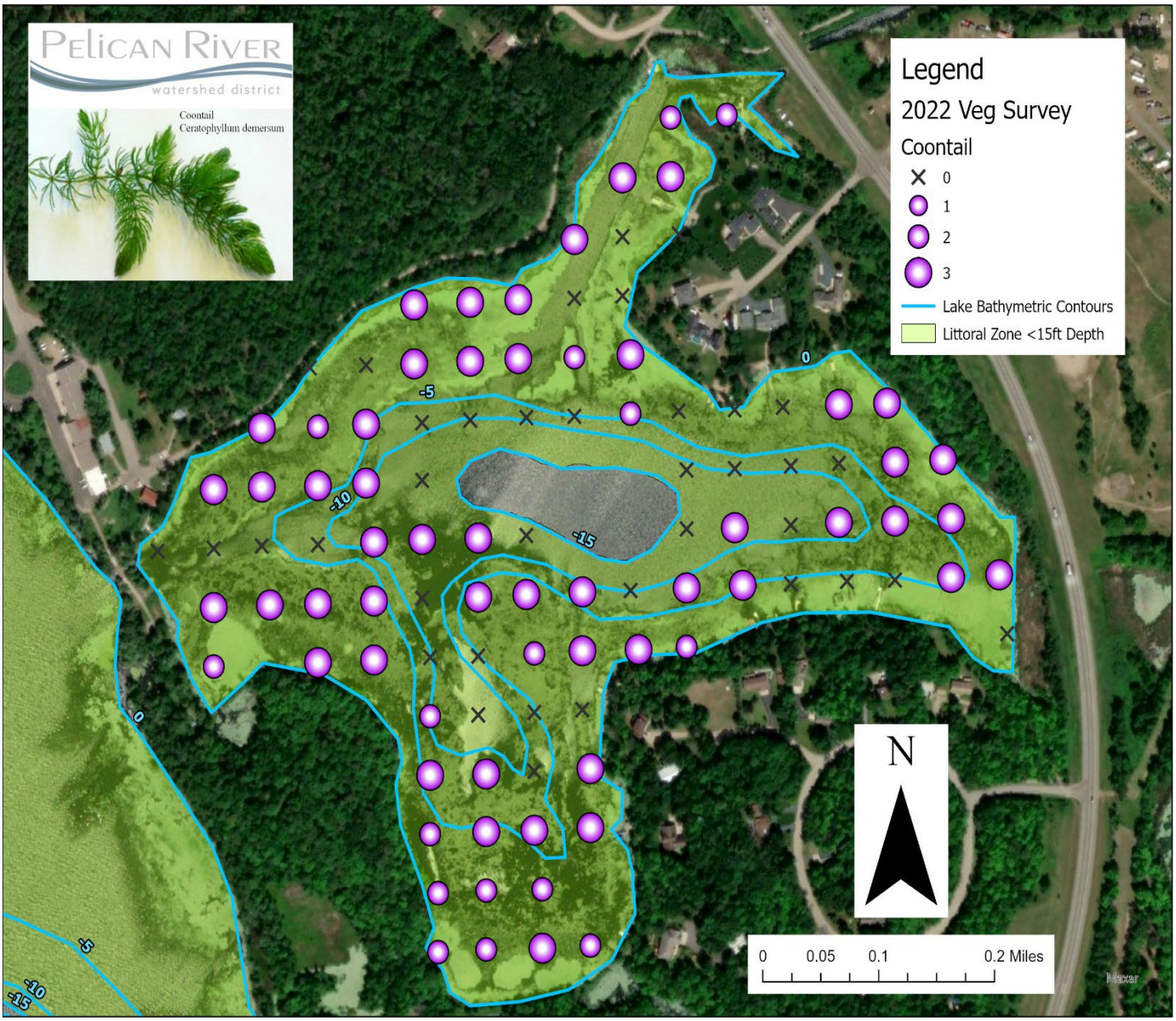

Figure 3 –Coontail Distribution. Plant distribution from the 2022 point-intercept survey for Coontail in Muskrat Lake, Becker County (EQuIS# 03-0360-00-201). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

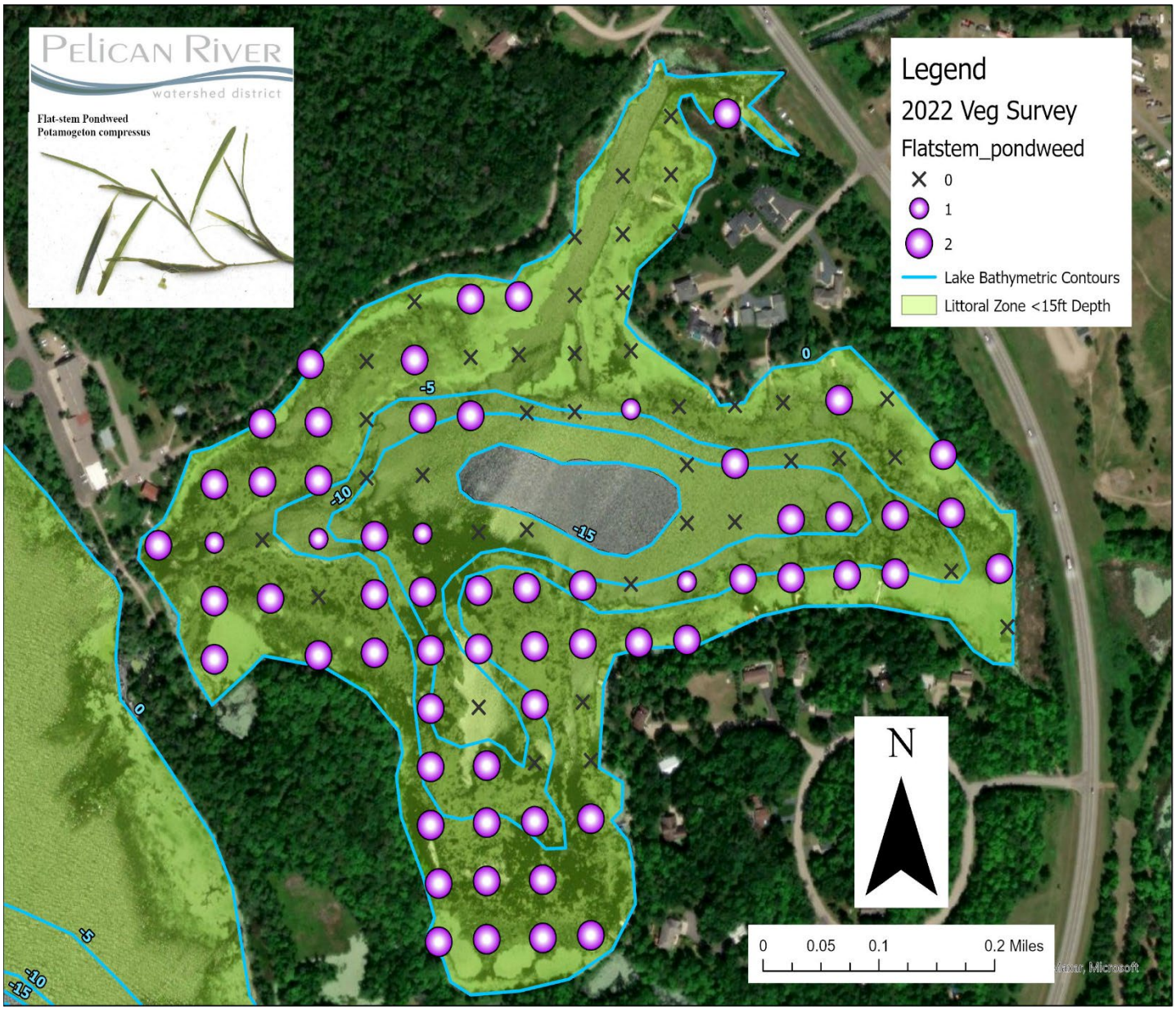

Figure 4 – Flat-stem Pondweed Distribution. Plant distribution from the 2022 point-intercept survey for Flat-stem Pondweed in Muskrat Lake, Becker County (EQuIS# 03-0360-00-201). Densities ranged from 0 to 2 at each point, with a 2 indicating dense plant presence and 0 indicating no plants.

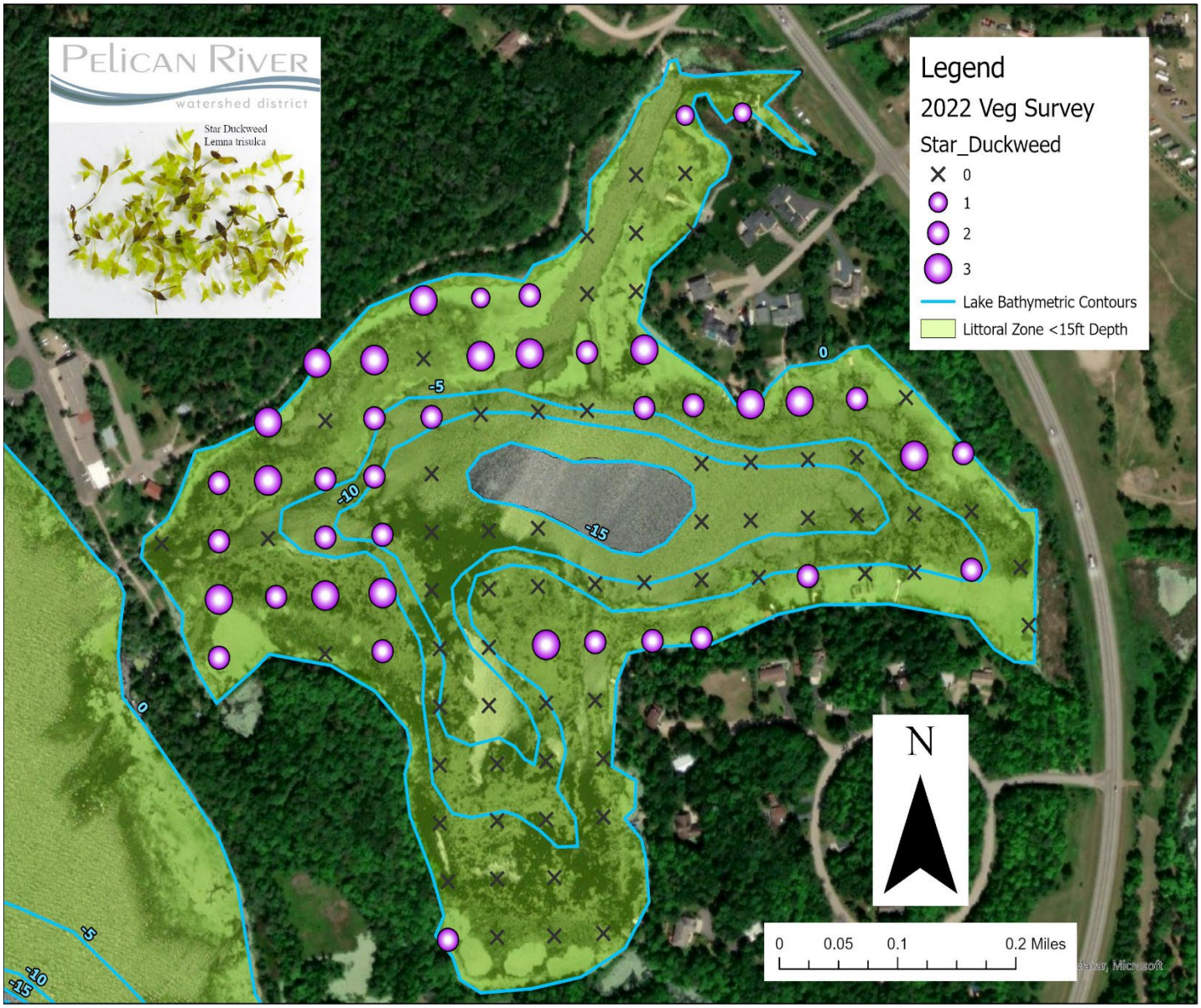

Figure 5 – Star Duckweed Distribution. Plant distribution from the 2022 point-intercept survey for Star Duckweed in Muskrat Lake, Becker County (EQuIS# 03-0360-00-201). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

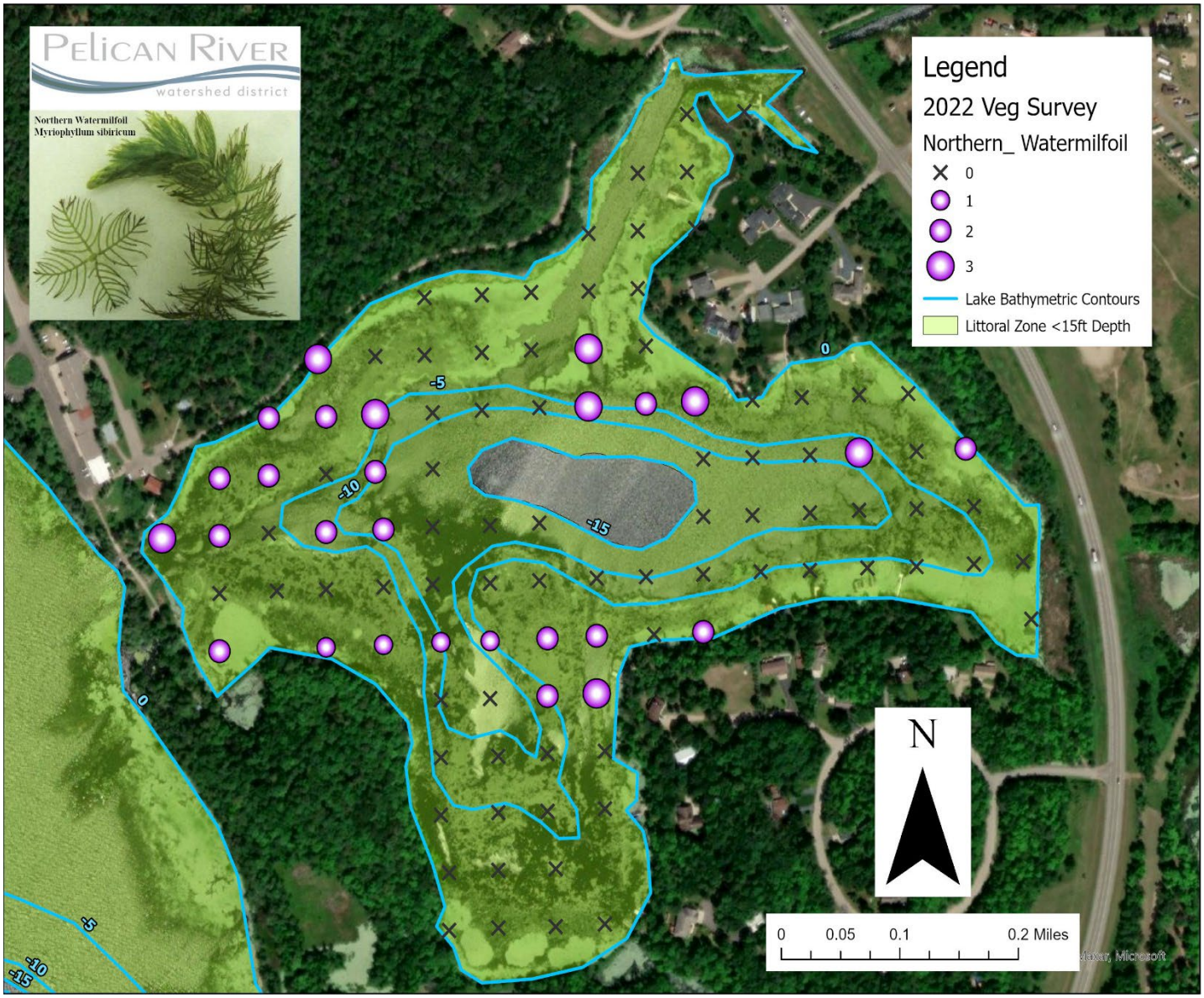

Figure 6 – Northern Watermilfoil Distribution. Plant distribution from the 2022 point-intercept survey for Northern Watermilfoil in Muskrat Lake, Becker County (EQuIS# 03-0360-00-201). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

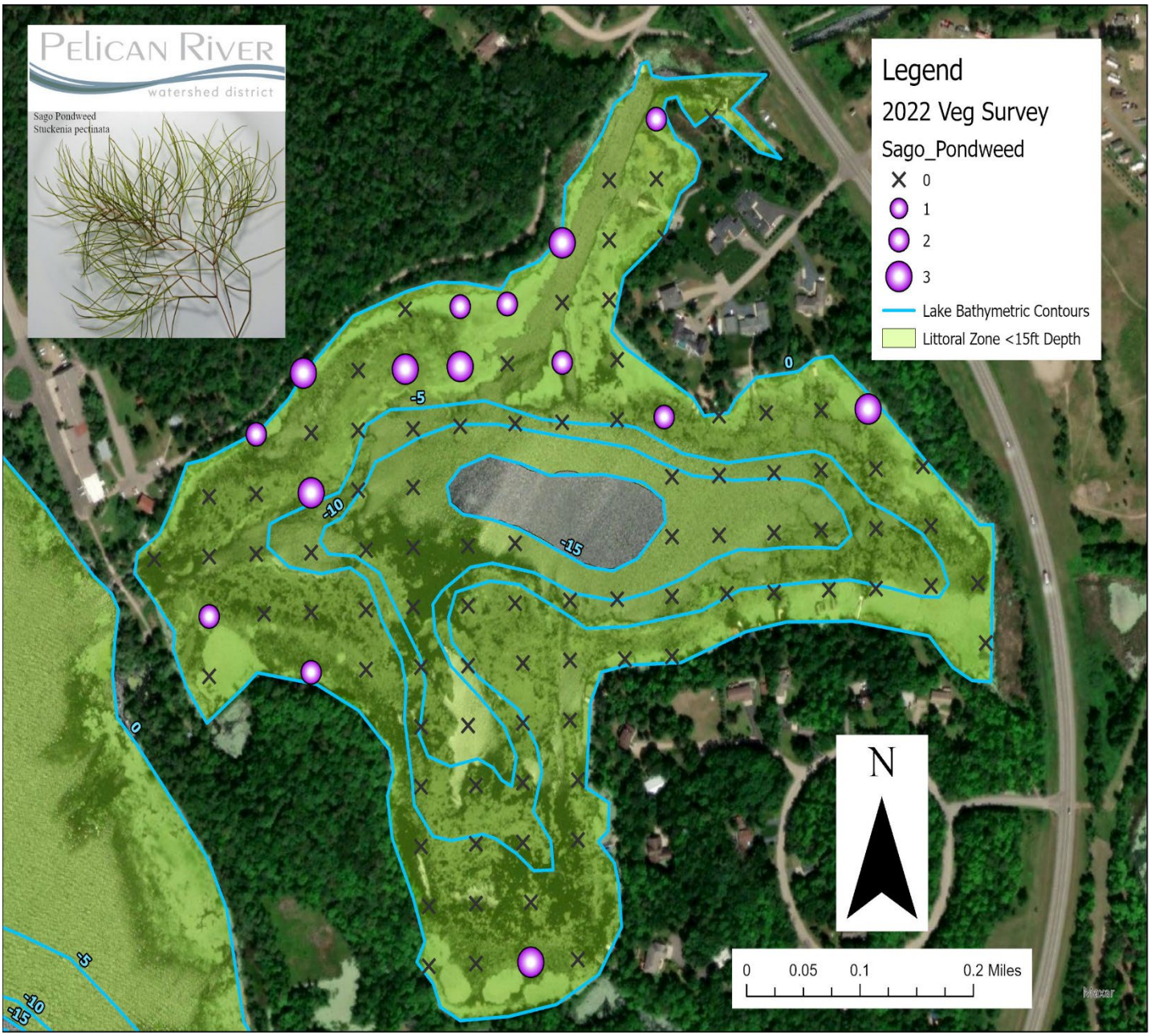

Figure 7 –Sago Pondweed Distribution. Plant distribution from the 2022 point-intercept survey for Sago Pondweed in Muskrat Lake, Becker County (EQuIS# 03-0360-00-201). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

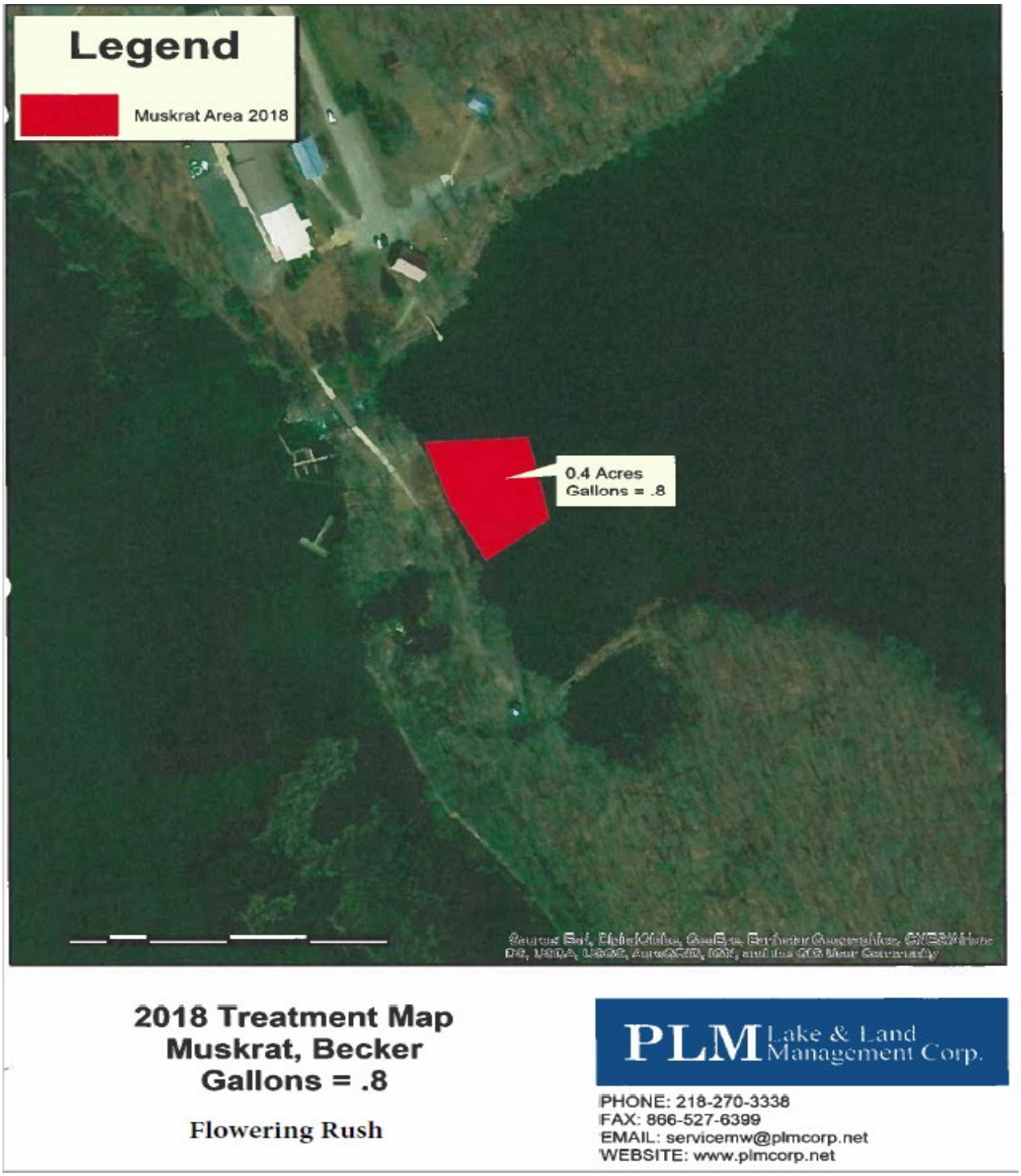

Figure 8 - Flowering Rush Distribution among Years. *Red polygon* indicates the presence of Flowering Rush in Muskrat Lake, Becker County (EQuIS# 03-0360-00-201) based on the delineation survey in 2018.

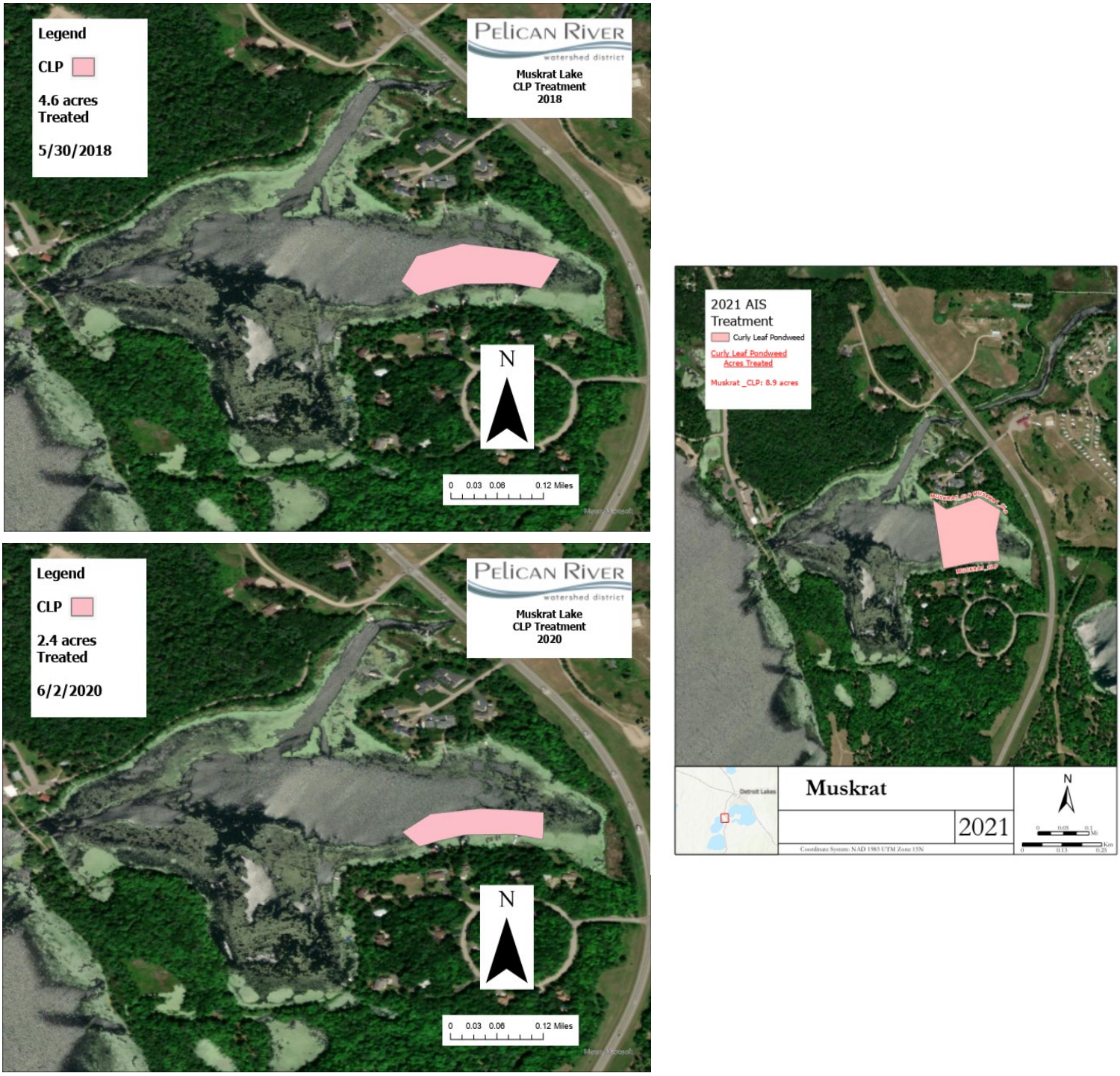

Figure 9 - Curly-leaf Pondweed Distribution among Years. *Pink polygons* indicate the presents of Curly-leaf Pondweed on Muskrat Lake, Becker County (EQuIS# 03-0360-00-201) based on delineation surveys between 2018 and 2022.

Literature Cited

Skawinski, Paul M. (2018). *Aquatic Plants of the Upper Midwest*. (Third Edition). Wisconsin: Paul M. Skawinski.

Madsen, J. (1999). *Point-intercept and line intercept methods for aquatic macrophytes management.* APCRP Technical Notes Collection (TN APCRP-M1-02). Vicksburg, MS: U.S. Army Engineer Research and Development Center.