
Sallie Lake, Becker County, MN 2021 Aquatic Vegetation Management Report



Prepared by:

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Project Details

Lake: Sallie (EQUIS# 03-0359-00-201)

Lake Surface Area: 1,273 acres **Littoral Area:** 577 acres **County:** Becker

Survey Type: Point-intercept aquatic plant surveys (2021)

Date of Survey (most recent): July 22, 2021 – August 2, 2021 (PRWD)

Surveyor[s]: Meagan Powers and Isaac Cuchna

Report Updated: December 2022

Author[s]:

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Report Details

G. L. Kemper. 2022. Sallie Lake, Becker County: 2021 Aquatic Vegetation Management Report. Water Resource Coordinator Pelican River Watershed District, 211 Holmes Street W., Detroit Lakes, MN 56501. 21 pp.

Summary

The purpose of this report is to provide an overview of aquatic plant distribution and the management of invasive aquatic plants in Sallie Lake, Becker County in 2021. 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

Sallie is a small lake with 64 of 69 acres classified as littoral (<15 feet deep). Lake Sallie is a polymictic lake, with 45% of its surface area considered littoral. Lake Sallie is classified as a borderline eutrophic lake vulnerable to nutrient impairment. The Pelican River passes through the lake, entering on the north end from Muskrat Lake, and outlets on the south end to Lake Melissa.

Historically, Lake Sallie has had poor water quality, partly due to the City of Detroit Lakes' use of upstream St. Clair Lake as a discharge point for wastewater. Prior to the construction of the original wastewater treatment facility in 1929, untreated wastewater was discharged into Lake St. Clair, which resulted in phosphorus levels in Lake Sallie to be approximately 54ppb, nearly 3 times that of nearby and similar lakes. In 1979, the facility was upgraded. Sallie responded with a decline in phosphorus levels ranging from 46 to 48ppb. The current facility, upgraded in 2002, further reduced the load to Lake Sallie, resulting in the current mean summer levels between 35 and 37ppb.

While it has greatly improved since the 1970's, moderate to severe algal blooms are common, often continuous in July and August. These appear to be brought on in part by internal nutrient recycling, whereby nutrient rich water from the bottom layers is brought to the oxygen rich upper layers during lake mixing periods, often triggered by a storm event and high winds.

Much of the nutrient load comes from upstream sources, specifically from nutrient rich water from partially drained Lake St. Clair via Becker County Ditch 14. An alum treatment in Lake St. Clair conducted in 1998 reduced internal loading to the lake, and in effect, reduced nutrient loading to downstream Muskrat and Sallie Lakes. Stormwater Best Management Practices in the City of Detroit Lake has also aided in Lake Sallie improvements by reducing stormwater runoff loads to Little Detroit Lake, which outlets to Sallie.

In the fall of 2016, zebra mussels were located at the public access of the lake. By 2017, the infestation had spread lakewide. The District continues to monitor how the infestation impacts water quality. After only three years, the water clarity has increased to a record summer average of 13 ft. (compared to the previous 10-year average of 7 ft.).

A lock and dam system was installed during the depression era by a Civilian Conservation Corp (CCC) crew between Lake Sallie and Muskrat Lake. This structure was removed in 2001 and replaced with a constructed rock rapids outfall at the historic water outlet elevation and no longer allows for any water level manipulation. The Pelican River flows out to Lake Melissa through a culvert under Becker CSAH 22, approximately 200 feet downstream of Lake Sallie. The velocity of flow between the outlet of Sallie and the

culvert suggests that the headwater of the culvert may be slightly lower than the true water level in the Lake. There is also a slight hydraulic restriction that appears to control lake level.

Management History

The lake has two invasive plant species: Curly-leaf Pondweed (*Potamogeton crispus*) (CLP) and Flowering Rush (*Butomus umbellatus*) (FR). Curly-leaf Pondweed and Flowering Rush have both been present since the 1970s. Mechanical harvesting was the primary method used to control CLP and FR, however in the mid-2000s it became clear that harvesting was not an effective control method. After conducting several years of research, the District used herbicides as its primary control method for CLP and FR.

While Curly-leaf Pondweed and Flowering Rush 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. 2021 treatments for Curly-leaf Pondweed was for 13 acres and Flowering Rush was for 88 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.

Table 1 - Curly-leaf Pondweed Management Summary. Characteristics and history of partial lake invasive plant treatments for Sallie, Becker County (EQuIS# 03-0359-00-201), total acres: 1273, Littoral acres: 577, (15% of Littoral acres: 86.6). 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 |
|-------------|----------------|-----------------------|-----------|--------------------------------|
| 5/26/2021 | CLP | 8 | Diquat | PLM & Land Management Corp. |
| 5/26/2021 | CLP | 5 | Endothall | PLM & Land Management Corp. |

Table 2 – Flowering Rush Management Summary. Characteristics and history of partial lake invasive plant treatments for Sallie, Becker County (EQuIS# 03-0359-00-201). 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 | Target Species | Total Acres Permitted | Herbicide | Licensed Commercial Applicator |
|-----------|----------------|-----------------------|-----------|--------------------------------|
| 6/28/2021 | FR | 51 | Diquat | PLM & Land Management Corp. |
| 8/9/2021 | FR | 37 | Diquat | PLM & Land Management Corp. |




Survey Objectives

In 2021, a Point-intercept Survey assessed the distribution of aquatic plants in Sallie Lake. 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 2021 Survey. Points were placed 72 meters apart using a Geographic Information System (GIS), comprising of 150 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 |

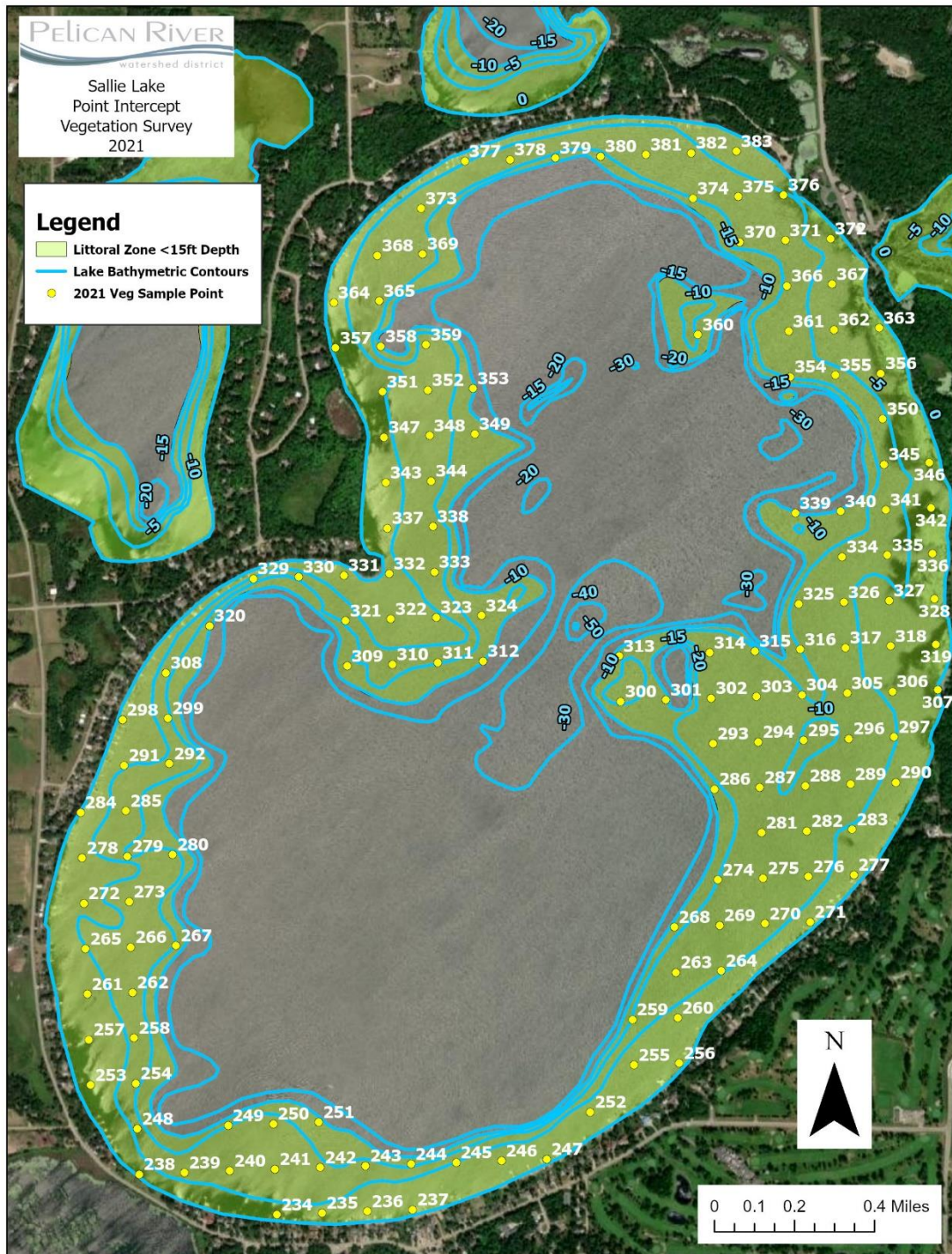


Figure 1 – Point-intercept Survey Grid. Point-intercept survey grid for Sallie Lake, Becker County (EQUIS# 03-0359-00-201). A total of 150 points were surveyed in 2021 at 72 meters apart.

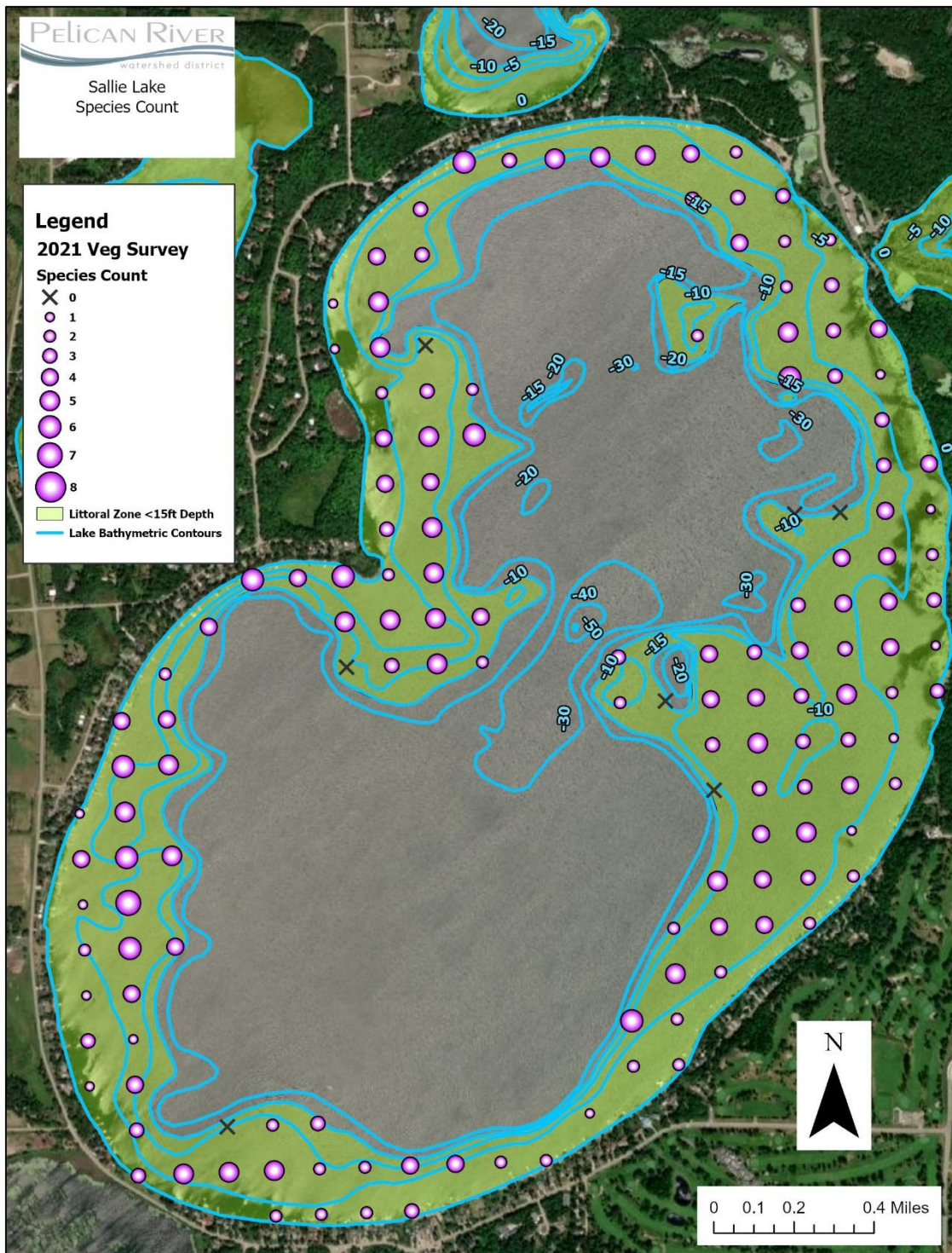


Figure 2 – Species Richness Distribution. Number of species at each site from the 2021 point-intercept survey in Sallie Lake, Becker County (EQuIS# 03-0359-00-201). Densities ranged from 0 to 8 at each point, with a 8 indicating the richness in species presence and 0 indicating no species.

Survey Observations

The vegetation point-intercept survey of Sallie Lake (EQuIS# 03-0359-00-201) conducted by the PRWD occurred between July 22nd and August 8th, 2021. Plants were rooted to a maximum depth (95%) of 15.1 feet, with depths ranging from 0 – 15 feet. However, since 577 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. 93% of the points had submersed native vegetation (Table 4) with a mean submersed native taxa per point of 4.3. Sallie Lake has up to 11 submersed native taxa (Table 5) and one non-native submersed taxa (Curly-leaf Pondweed) and one non-native emergent taxa (Flowering Rush).

Table 4 - Point-intercept Metrics. Summary of PRWD point-intercepts metrics Sallie Lake, Becker County (EQuIS# 03-0359-00-201). Shaded values were calculated from littoral depth range (0-15 feet).

| Metric | JULY – AUGUST 2021 |
|--|--------------------|
| Surveyor | PRWD |
| Total # Points Sampled | 150 |
| 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 | 139 |
| # Points in Littoral (0-15 feet) | 150 |
| % Points w/ Submersed Native Taxa | 93 |
| Mean Submersed Native Taxa/ Point | 4.3 |
| # Submersed Native Taxa | 11 |
| # Submersed Non-Native Taxa | 1 |
| % Points w/ Submersed Non- native Taxa | 0 |

Based on the 2021 point-intercept survey, the submersed native plant community within the littoral area in Sallie Lake was primarily dominated by Northern Watermilfoil (*Myriophyllum sibiricum*) 50%, Macroalgae (*Chara* spp./ *Nitella* spp.) 44%, Illinois Pondweed (*Potamogeton illinoensis*) 30% Flat-stem Pondweed (*Potamogeton zosteriformis*) 24%, Common Water Moss (*Fontinalis* spp.) 24% and Water Celery (*Vallisneria americana*) 23% (3, 4, 5, 6, 7, & 8). These aquatic plants are central to a healthy fish population, offering shelter and providing food and habitat to wildlife. Sallie Lake also has the following floating leaf and emergents: Star Duckweed (*Lemna trisulca*) 66%, Bladderwort (*Utricularia* spp.) 12%, and Bulrush (*Schoenoplectus* sp.) 5%, (Figures 9, 10 and 11) These emergent plants are especially good at preventing shoreline erosion, habitat and providing food sources for waterfowl. Plants also absorb nutrients and reduce algae, thereby improving water quality.

Sallie 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 2021 point-intercept survey.

Table 5 - Plant Frequency Occurrence. Percent frequency of occurrence for observed plant species within the littoral zone (0-15 feet) in Sallie Lake, Becker County (EQulS# 03-0359-00-201).

July 22, 2021 - Aug 2, 2021 *b*

| Taxonomic Name | Common Name | Frequency (%) |
|---|------------------------|---------------|
| SUBMERSED NON-NATIVE | | |
| <i>These plants spread or have been introduced beyond its native range and are either causing harm or have the potential to cause harm.</i> | | |
| | Curly-leaf Pondweed ** | |
| SUBMERSED NATIVE | | |
| <i>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.</i> | | |
| <i>Ceratophyllum demersum</i> | Coontail | 15% |
| <i>Fontinalis spp.</i> | Common Water Moss | 24% |
| <i>Myriophyllum sibiricum</i> | Northern Watermilfoil | 50% |
| <i>potamogeton amphifolius</i> | Large-leaf Pondweed | 1% |
| <i>Potamogeton richardsonii</i> | Richardson's Pondweed | 17% |
| <i>Potamogeton zosteriformis</i> | Flat-stem Pondweed | 24% |
| <i>Vallisneria americana</i> | Water Celery | 23% |
| <i>Najas flexilis</i> | Slender Naiad | 11% |
| <i>Najas guadalupensis</i> | Southern Naiad | 1% |
| <i>Chara spp./ Nitella spp.</i> | Macroalgae | 44% |
| <i>Potamogeton Illinoensis</i> | Illinois Pondweed | 30% |
| FLOATING LEAF | | |
| <i>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.</i> | | |
| <i>Utricularia spp.</i> | Bladderwort | 12% |
| <i>Nymphaeaceae spp.</i> | Water Lilies | 1% |
| EMERGENT | | |
| <i>These plants extend well above the water surface and are usually found in shallow water, near shore.</i> | | |
| <i>Scirpoides Holoschoenus</i> | Bulrush | 5% |
| EMERGENT NON-NATIVE | | |
| <i>These plants spread or have been introduced beyond its native range and are either causing harm or have the potential to cause harm.</i> | | |
| | Flowering Rush ** | |
| FREE FLOATING | | |
| <i>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.</i> | | |
| <i>Lemna trisulca</i> | Star Duckweed | 66% |

b Percent frequency for 2021 (PI Survey Method) calculated for 0-15 feet zone.

** This species is present on the lake but detected through the lake delineation process and is not recorded in the Point intercept process data.

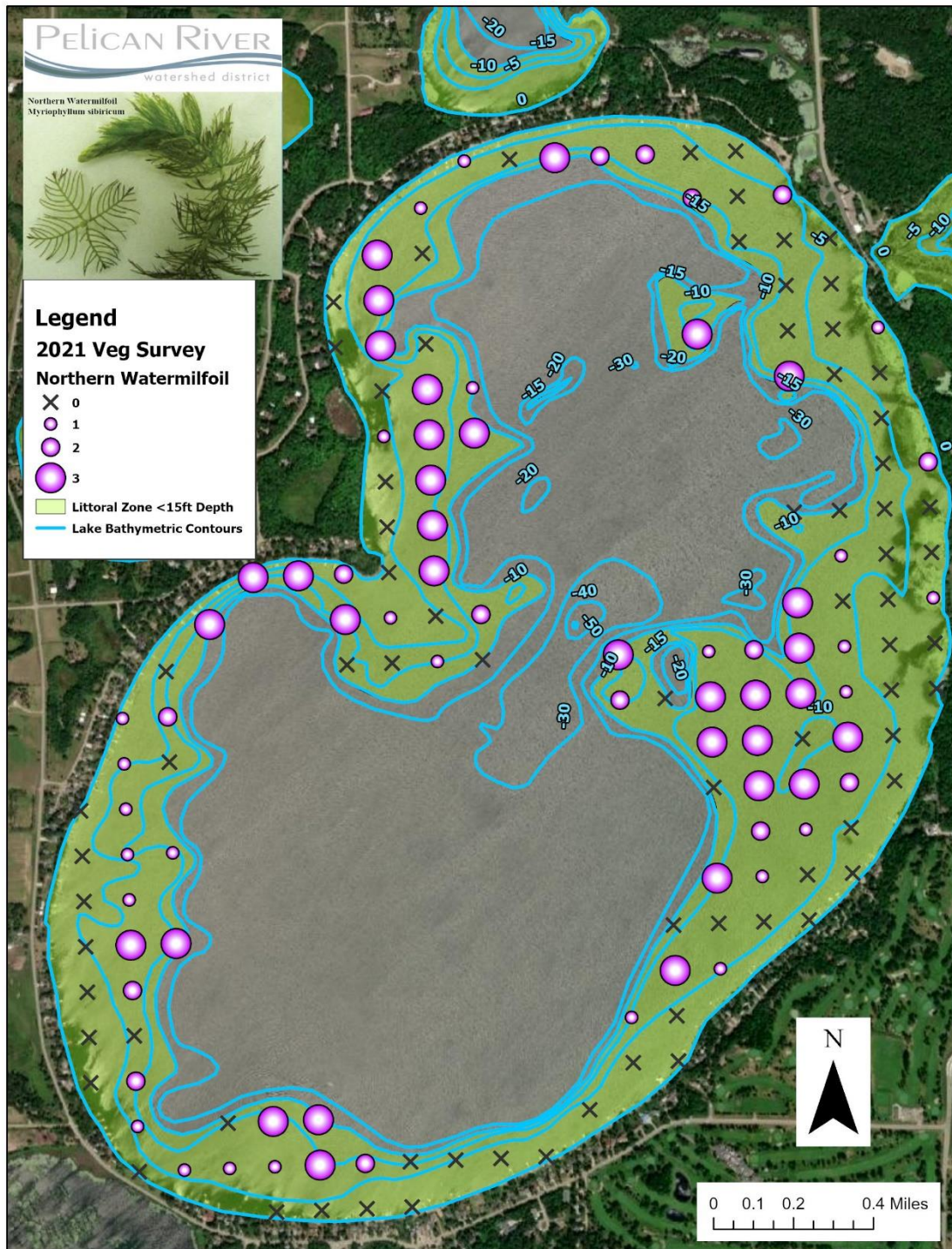


Figure 3 – Northern Watermilfoil Distribution. Plant distribution from the 2021 point-intercept survey for Northern Watermilfoil in Sallie Lake, Becker County (EQuIS# 03-0359-00-201). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

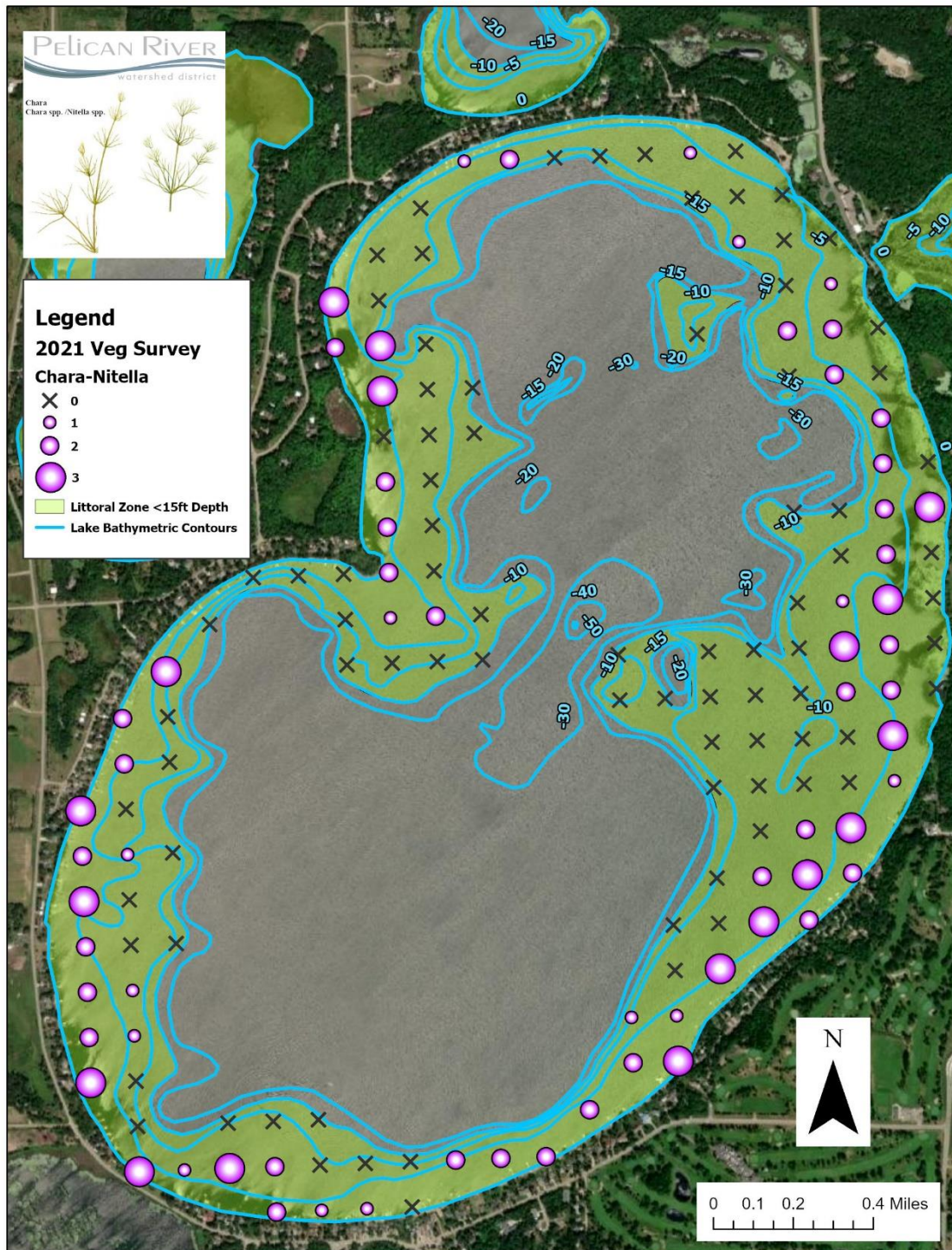


Figure 4 – Chara Distribution. Plant distribution from the 2021 point-intercept survey for Chara in Sallie Lake, Becker County (EQUIS# 03-0359-00-201). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

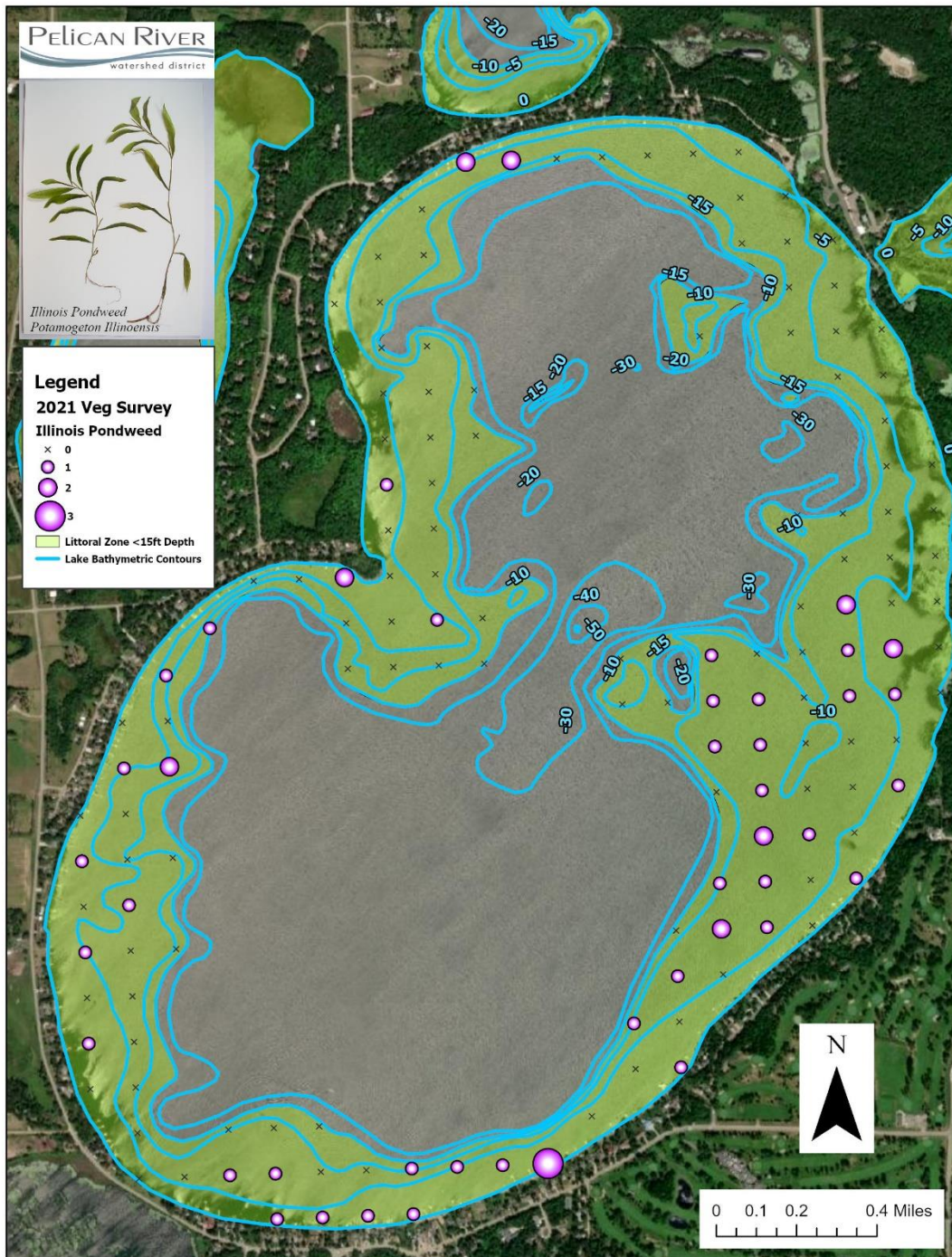


Figure 5 – Illinois Pondweed Distribution. Plant distribution from the 2021 point-intercept survey for Illinois Pondweed in Sallie Lake, Becker County (EQuIS# 03-0359-00-201). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

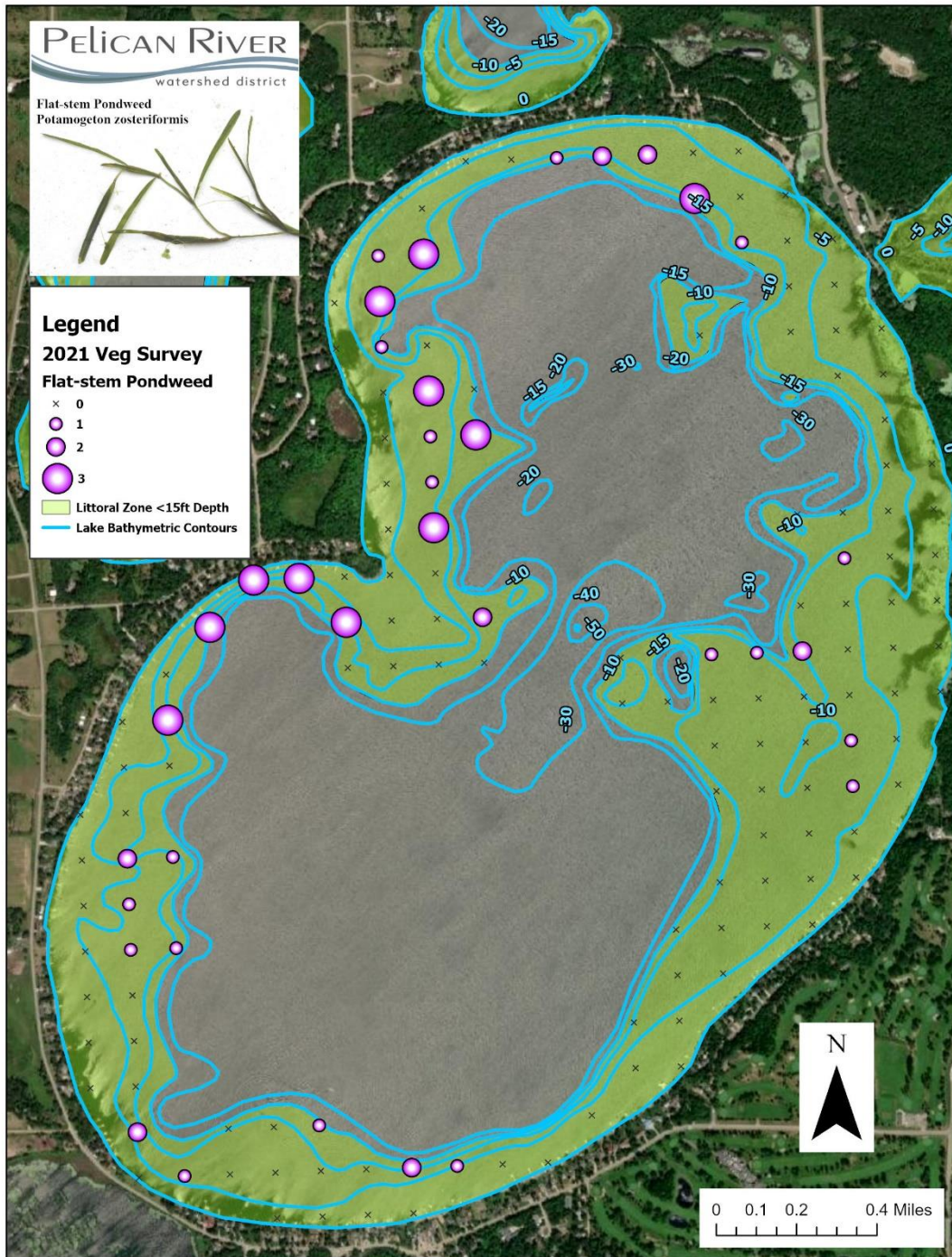


Figure 6 – Flat-stem Pondweed Distribution. Plant distribution from the 2021 point-intercept survey for Flat-stem Pondweed in Sallie Lake, Becker County (EQUIS# 03-0359-00-201). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

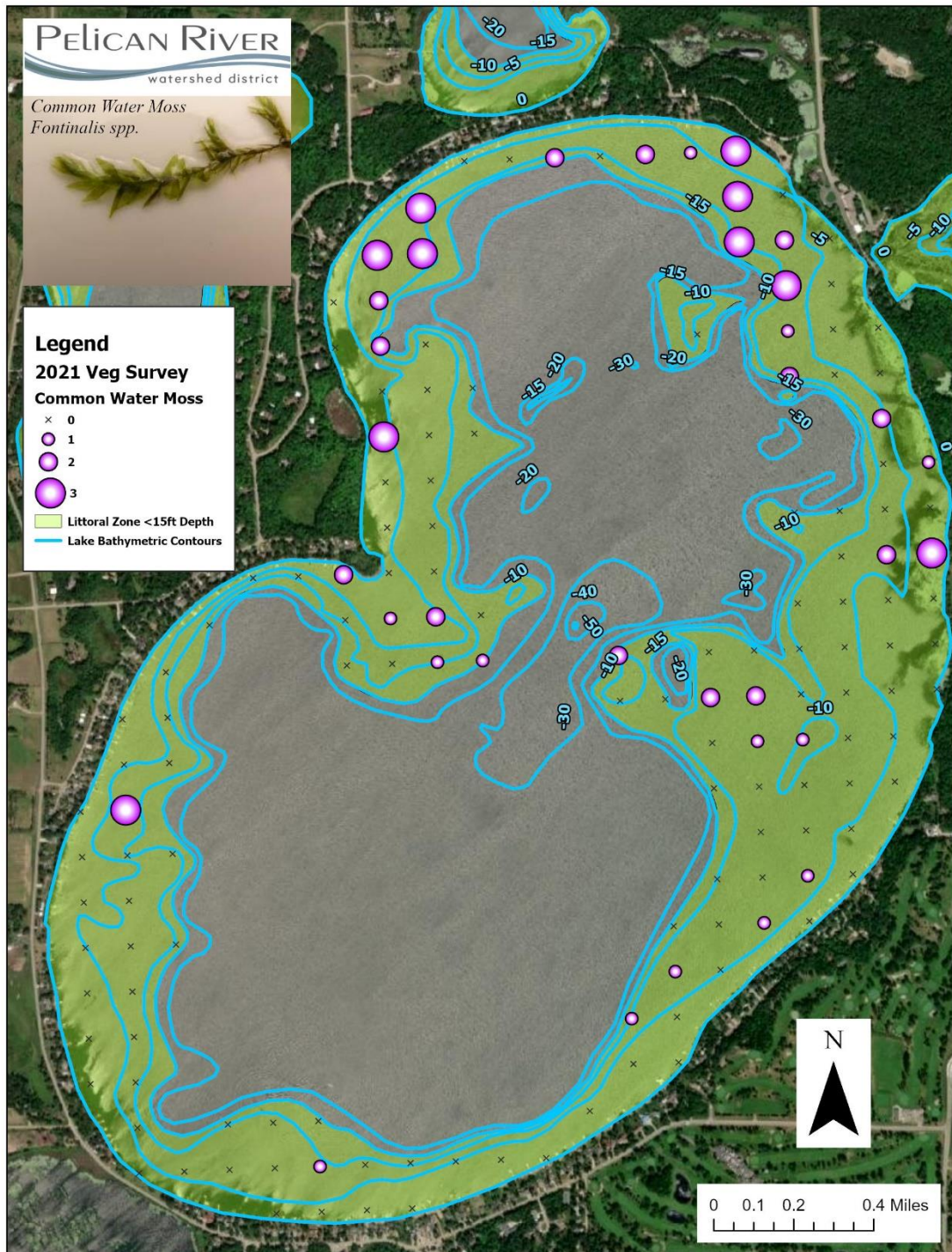


Figure 7 –Common Water Moss Distribution. Plant distribution from the 2021 point-intercept survey for Common Water Moss in Sallie Lake, Becker County (EQuIS# 03-0359-00-201). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

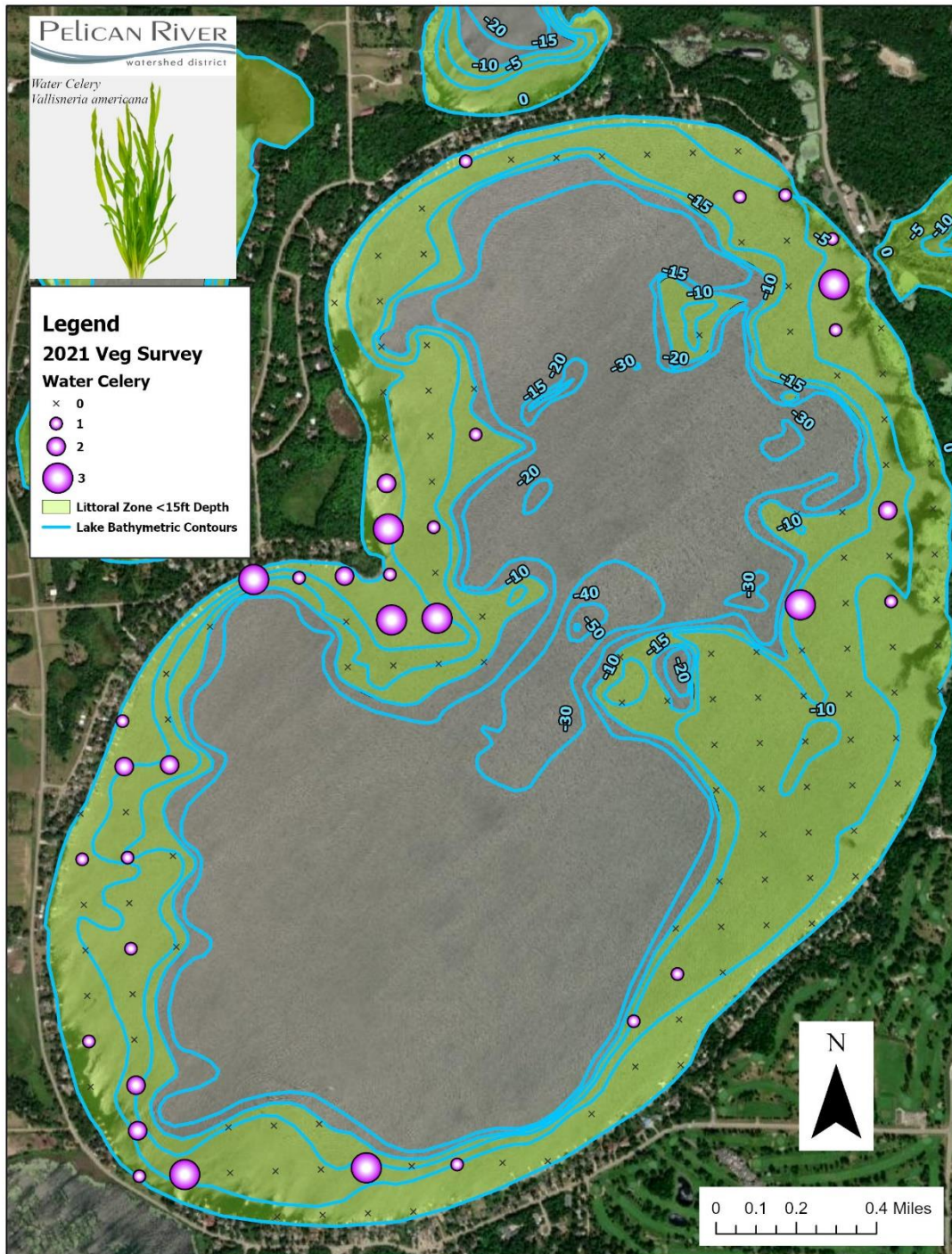


Figure 8 – Water Celery Distribution. Plant distribution from the 2021 point-intercept survey for Water Celery in Sallie Lake, Becker County (EQuIS# 03-0359-00-201). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

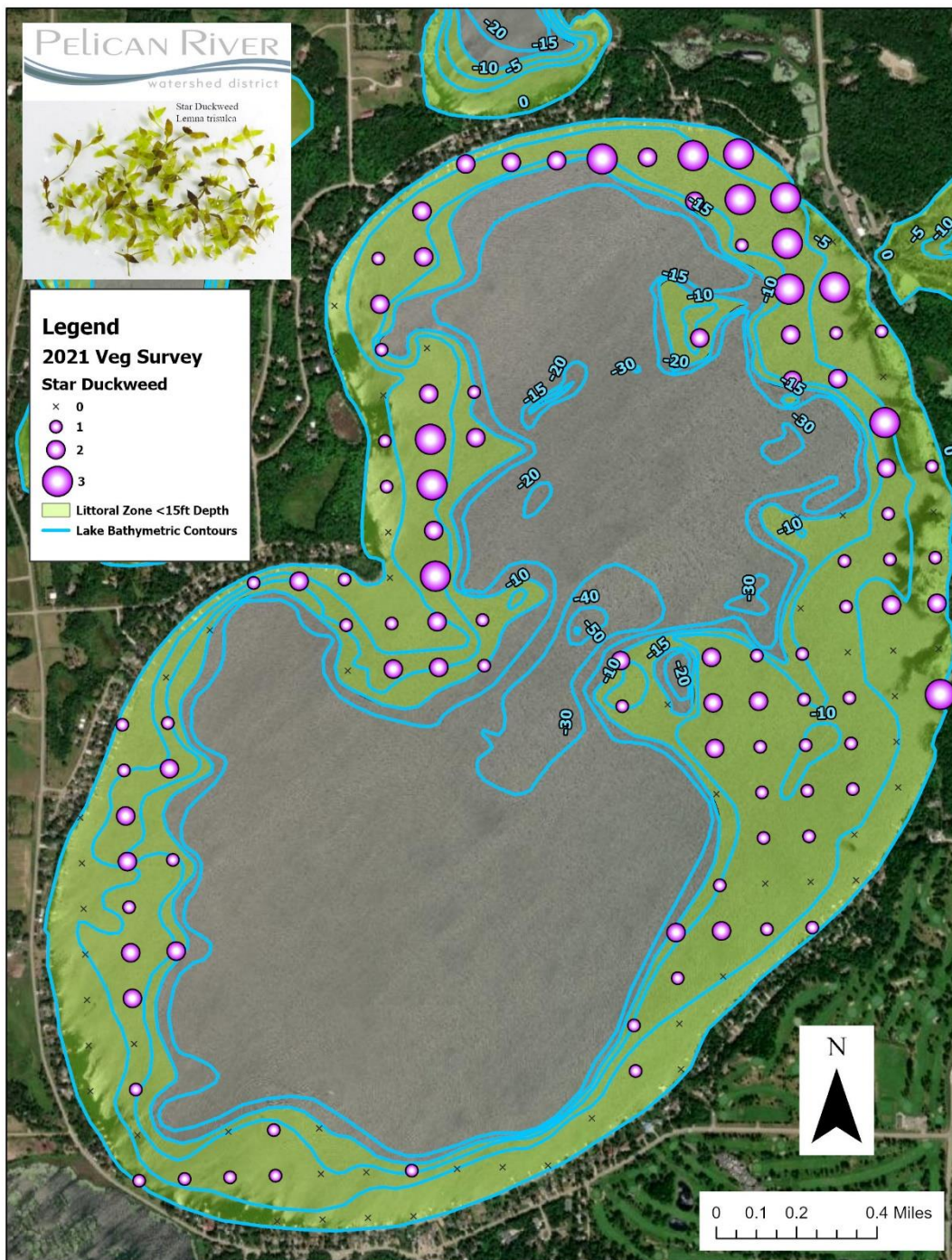


Figure 9 – Star Duckweed Distribution. Plant distribution from the 2021 point-intercept survey for Star Duckweed in Sallie Lake, Becker County (EQuIS# 03-0359-00-201). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

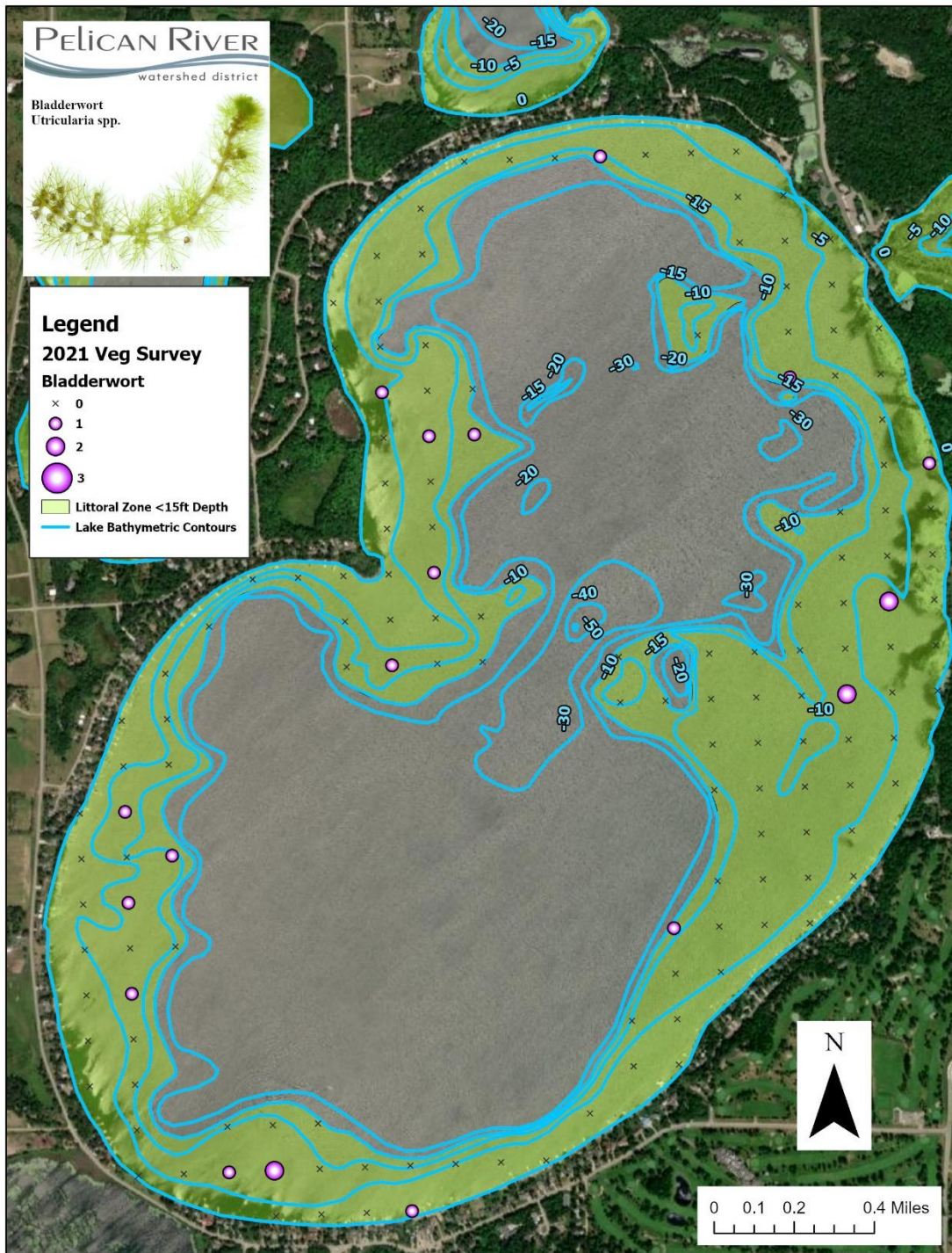


Figure 10 – Bladderwort Distribution. Plant distribution from the 2021 point-intercept survey for Bladderwort in Sallie Lake, Becker County (EQuIS# 03-0359-00-201). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

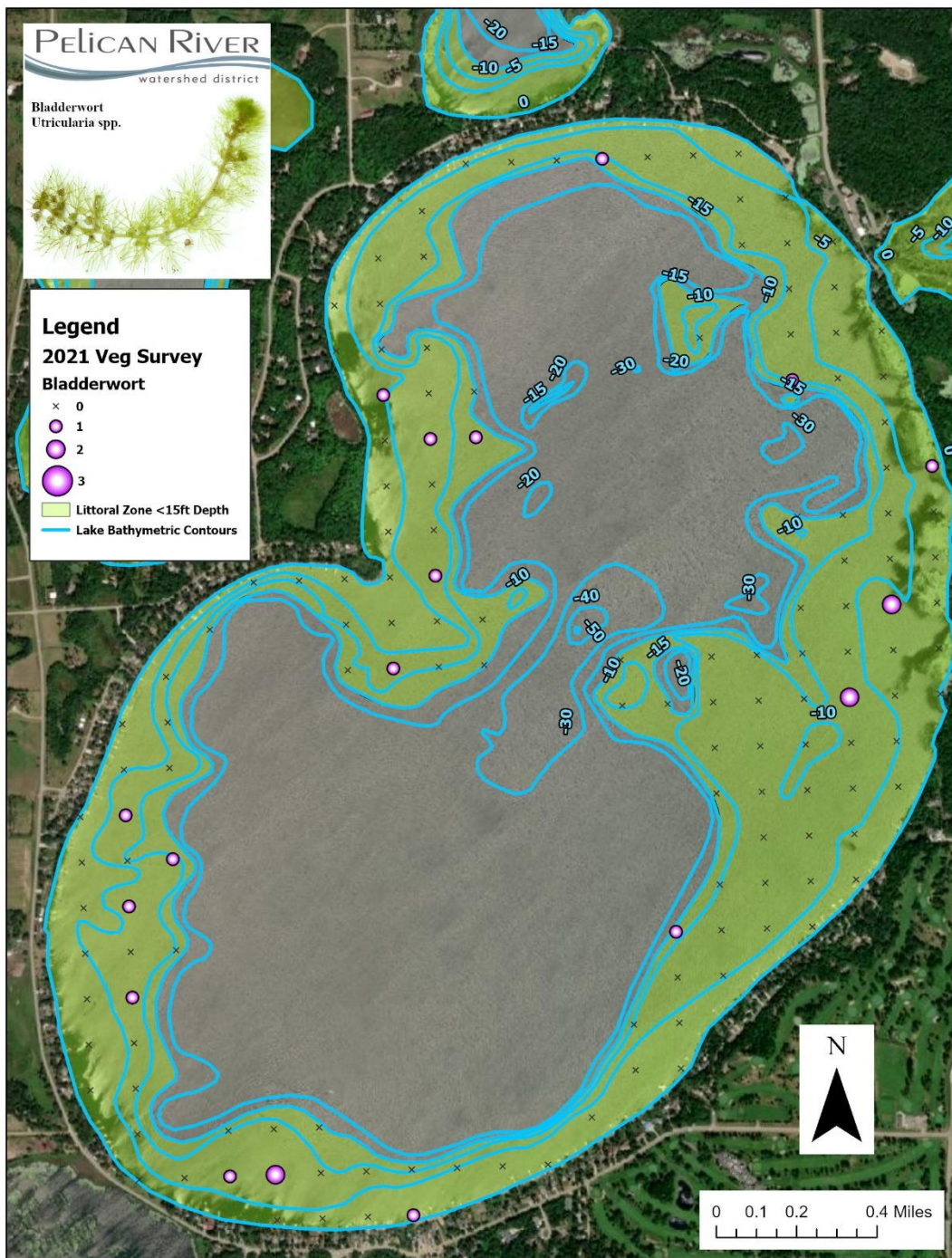


Figure 11 – Bulrush Distribution. Plant distribution from the 2021 point-intercept survey for Bulrush in Sallie Lake, Becker County (EQUIS# 03-0359-00-201). Densities ranged from 0 to 3 at each point, with a 3 indicating dense plant presence and 0 indicating no plants.

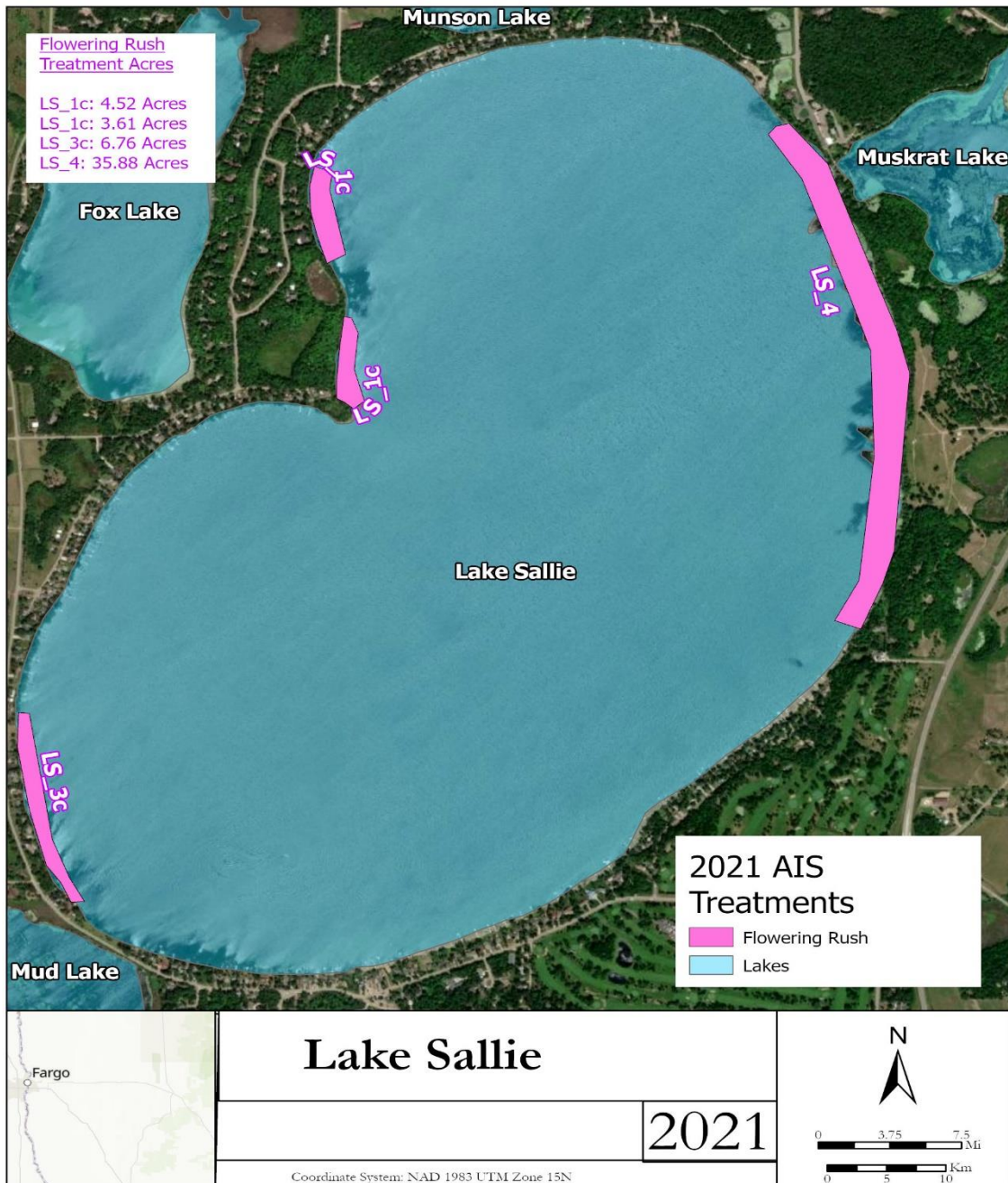


Figure 8 - Flowering Rush Distribution. Pink polygon indicates the presence of Flowering Rush in Sallie Lake, Becker County (EQuIS# 03-0359-00-201) based on the delineation survey in 2021.

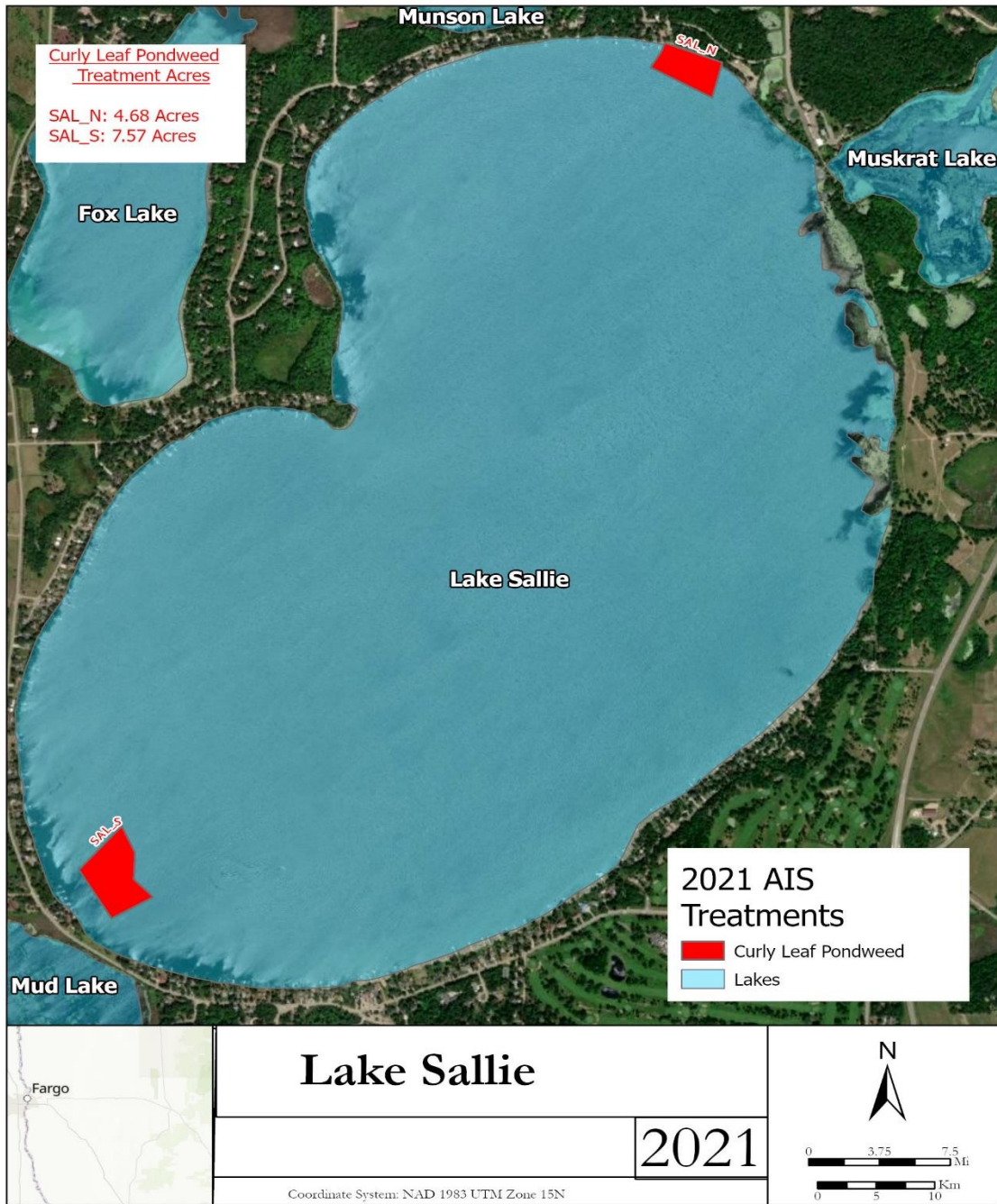


Figure 9 - Curly-leaf Pondweed Distribution. Red polygons indicate the presents of Curly-leaf Pondweed on Sallie Lake, Becker County (EQuIS# 03-0359-00-201) based on delineation surveys in 2021.

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.