# Curly-leaf pondweed (*Potamogeton crispus*) Fall Turion Survey Upper Turtle Lake - WBIC: 2079800 Barron County, Wisconsin

Upper Turtle Lake Aerial Photo (2015)

Tamaracks in fall splendor along Upper Turtle Lake's north bay 10/28/18 (B. Collins)

## Project Initiated by:

The Upper Turtle Lake Association, the Wisconsin Department of Natural Resources, and Lake Education and Planning Services, LLC


Upper Turtle Common Loon in 1st year winter plumage 10/28/18 (B. Collins)

## Survey Conducted by and Report Prepared by:

Endangered Resource Services, LLC
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St. Croix Falls, Wisconsin
October 28, 2018

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## INTRODUCTION:

Upper Turtle Lake (WBIC 2079800) is a 427 acre, stratified, drainage lake located in the Town of Almena in west-central Barron County (T34N R14W S27 NE NW). It reaches a maximum depth of 25ft in the central basin and has an average depth of 14ft (WDNR 2018). The lake is eutrophic in nature with Secchi readings from 1994-2017 averaging 5.8ft; however, in 2017 the summer average was only 2.8 – the lowest value during this span (no data was available for 2018) (WDNR 2018). This poor water clarity produced a littoral zone that reached approximately 14.0ft throughout the 2018 growing season. The lake's bottom substrate is predominantly organic muck in the north, south, and western bays as well as the majority of the main basin with a narrow ring of sand/rock occurring along most of the eastern shore and on scattered exposed points (Figure 1) (Bush et al. 1966).

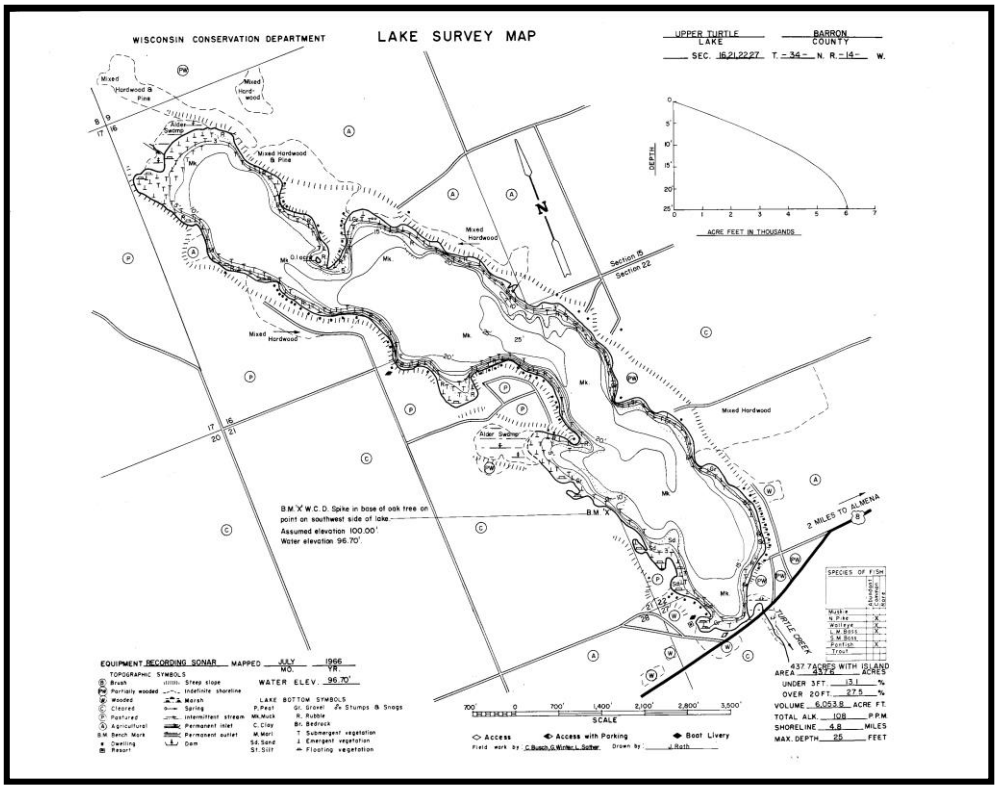


**Figure 1: Upper Turtle Lake Bathymetric Map**

## BACKGROUND AND STUDY RATIONALE:

In 2010, the Upper Turtle Lake Association (UTLA) and the Wisconsin Department of Natural Resources (WDNR) authorized a series of full-lake plant surveys as a prerequisite to developing the lake's initial Aquatic Plant Management Plan (APMP). Although those surveys found that the exotic invasive species Curly-leaf pondweed (*Potamogeton crispus*) (CLP) occurred throughout the lake, it was decided that the generally low growth levels did not justify active management at that time. However, following several years of high CLP density on the lake that resulted in severe navigation impairment for many residents, mats of rotting vegetation, and poor summer water quality (UTLA board, pers. comm), the UTLA decided to authorized follow-up plant surveys in 2017 so they could update their APMP in 2018 and revisit active management.

The spring of 2017 brought near record early ice-out in late March and early April followed by prolonged cool weather that kept lake temperatures in the 40's and 50's through May. These conditions appeared to benefit Curly-leaf pondweed, and we found high levels on many of the lakes we surveyed that spring. On Upper Turtle Lake, CLP formed a nearly continuous canopied mat that ringed the entire lake and covered the north bay. Totaling 132.4 acres (31.0% coverage), it represented a 124.57 acre increase (+1,590%) over the 33 small beds mapped in 2010 that totaled 7.83 acres (1.83% of the lake).

Using the information gained from the 2017 bed-mapping survey, the UTLA, under the direction of Dave Blumer - Lake Education and Planning Services, LLC (LEAPS), decided to conduct a small-scale trial herbicide treatment totaling 9.88 acres (approximately 2.31% of the lake's total surface area) in the thumb bay in the northwest corner of the lake's southern basin in May 2018 (Figure 2). Posttreatment analysis suggested the treatment resulted in a highly significant reduction in CLP within this bay.

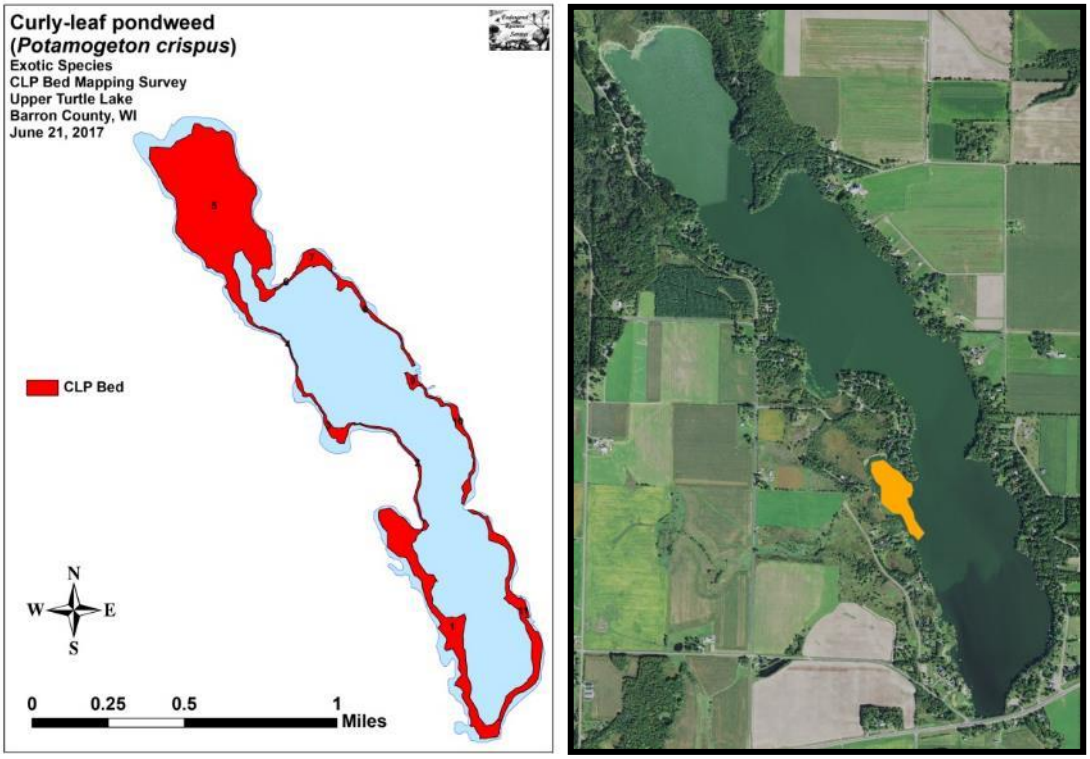


**Figure 2: 2017 June CLP Bed Map and 2018 CLP Treatment Area**

The spring of 2018 brought more extreme weather with near record **late** ice-out followed by a dramatic stretch of warm weather that boosted lake temperatures from frozen to the upper 60's in less than two weeks. These conditions did not appear to favor Curly-leaf pondweed as, although we found CLP throughout the lake in the beds identified in 2017, none of these beds canopied, and we noted that most CLP plants within them were only a few feet tall. By randomly raking within the beds, we also discovered most CLP looked unhealthy as plants were a pale lime green in color and many were dying without setting turions. In an effort to better understand the true nature of the infestation, the UTLA requested a late fall survey to determine the level of latent CLP turions in the lake's substrate. These data will be used to help plan for future management in 2019.

## CLP LIFE HISTORY AND STUDY OBJECTIVES:

Although Curly-leaf pondweed occasionally reproduces by seed, the vast majority of plants resprout from stiff overwintering buds called turions that are normally produced in number by the plants prior to their late June/early July senescence (Figure 3). After the pinecone-like turions germinate in late fall or early winter, plants continue to grow slowly under the ice. Following ice out, growth accelerates, and plants rapidly canopy allowing them a competitive advantage over slower growing native species (Capers 2005).

**Figure 3: Germinating CLP Turion**

Research suggests approximately 50% of turions germinate in a growing season while the rest remain dormant until the following growing season when another 50% will germinate (Johnson 2012). Depending on the level of turions at a given location and knowing that latent turions may be able to survive for over 5 years in the sediment, it may take several years of control to exhaust the "turion bank" (R. Newman – U of M unpublished data).

Following the 2018 summer growing season, we conducted a fall turion survey. The goals of the survey were to determine the level of CLP turions within the lake's historic high density CLP areas; and, if there were any present, to predict whether their numbers suggested there would likely be enough to cause navigation issues in 2019. This report is the summary analysis of that survey conducted on October 28, 2018.

## METHODS:

## Fall Ponar Dredge Turion Survey:

Within the 2017 mapped Curly-leaf pondweed beds, we used Hawth's Analysis Tools Extension to ArcGIS 9.3.1 to create 80 survey points at the rate of approximately 1 point for every 1.65 acres. Although the points were auto-generated as offset regular, we moved points into thin areas of the polygons where there were no points, and tried to spread points uniformly throughout these areas at regular intervals (Figure 4) (Appendix I).

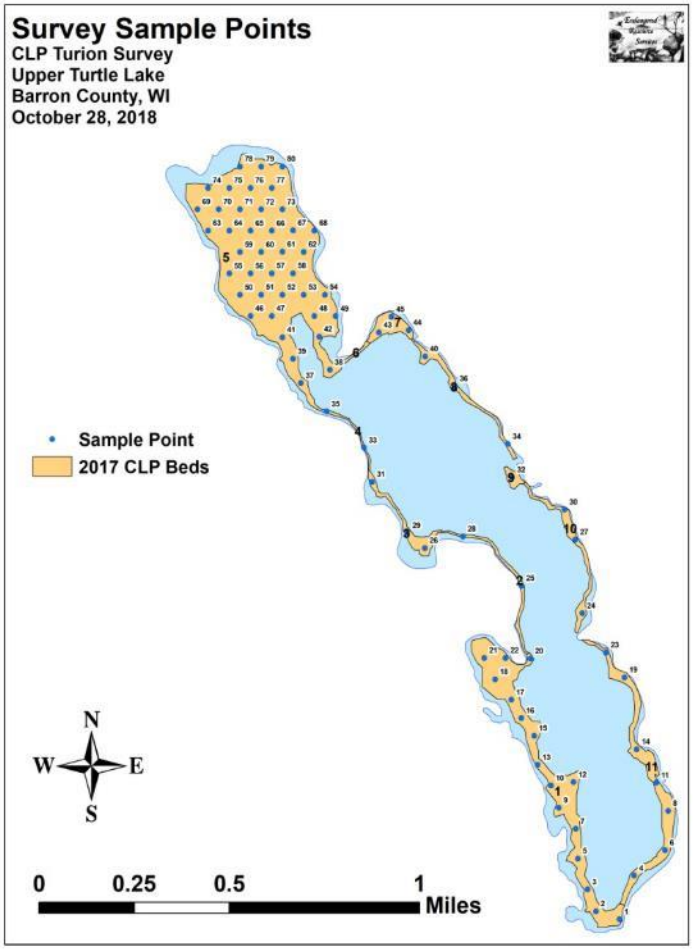


**Figure 4: Turion Survey Sample Points**

During the surveys, we located each point with a handheld mapping GPS unit (Garmin 76CSx) and used a Petite Ponar dredge with a 0.0232$m^2$ (36$in^2$) sample area to take a bottom sediment grab from each side of the boat at each location. These samples were then rinsed in a fine sieve to separate out the sediment (Figure 5). Samples with high numbers of turions or significant amounts of detritus were bagged for later analysis; at which time we discarded all rotten turions, tallied all live turions, and multiplied the combined total live turions from the two samples by 21.53 to estimate turions/$m^2$ at each location. This value gives an idea of how many CLP plants will germinate in an area during the 2019 growing season.


**Figure 5: Ponar Grab and Turion Sieving**

## DATA ANALYSIS:

We entered all data collected into an Excel spreadsheet and used standard formulas in the data analysis tool pack to calculate the following:

**Total number of points sampled:** This value is the total number of points on the lake within each study area. We took **two** Ponar samples at each point.

**Total number of live turions:** This value includes all live turions found at all sites within a study area.

**Total number of points with live turions:** This number includes all survey sites that had at least one turion in **either** of the Ponar samples taken at the site.

**Frequency of occurrence:** The frequency of turions is generally reported as a percentage of occurrences at all sample points. The value is used to extrapolate coverage within the study area. For example, if 20% of all sample sites have turions, it suggests that 20% of the study area will have at least some Curly-leaf pondweed coverage the following year.

**Points at or above nuisance level:** This value gives the number of survey sites within the study area that were above the predicted nuisance threshold (Figure 6). Research suggests that when the turion density is at or above 200/$m^2$, the following year's CLP growth has the potential to at least moderately impair navigation (Johnson 2012).

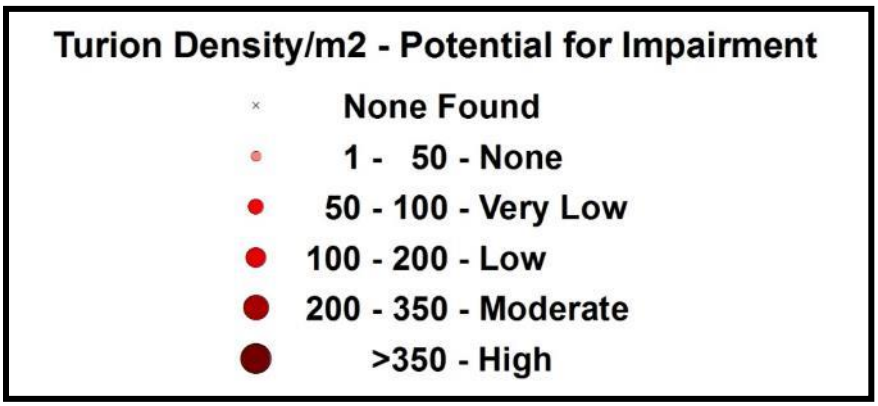


**Figure 6: Predicted Navigation Impairment Based on Turion Density**

**Percent nuisance level:** The percentage of nuisance points divided by the total number of survey points can be extrapolated to determine what percent of the study area has the potential to have at least moderate navigation impairment during the next growing season.

**Mean turions/$m^2$:** This value is the average number of turions/$m^2$ when pooling the data from all survey sites regardless of whether or not they had turions present.

**Standard deviation of turions/$m^2$:** This value tells us how far apart the data is from the mean. A low standard deviation suggests most points have a turion density that was similar to the mean, while a high value suggests there was greater variability in turion density within the sample area (Table 1).

## RESULTS AND DISCUSSION:

We counted a total of 296 CLP turions at 53 of 80 survey points (66.3% coverage) (Table 1). Of these, nine points (11.3% coverage/17.0% of points with turions) exceeded the expected "nuisance level" of 200/$m^2$, and 37 points (46.3% coverage/69.8% of points with turions) topped 50 turions/$m^2$ meaning it is likely there would be at least some potential for navigation impairment (Figure 7) (Appendix II). Despite this, the standard deviation of 112.95 turions/$m^2$ was higher than the overall mean density of 79.65 turions/$m^2$ suggesting there will be significant variability.

Visual analysis of the map showed that most of the 2018 treatment area will likely experience low impairment in 2019, while Beds 3, 7, and 9 around the central basin could experience moderate to high impairment. Somewhat surprisingly, the survey suggested most of Bed 5 in the north bay was likely have little to no impairment away from the immediate shoreline. The only other area on the lake that appeared likely to be an issue in 2019 was the north finger of Bed 11 on the southeastern shoreline.

### Table 1: CLP Turion Survey - Summary Statistics
### Upper Turtle Lake, Barron County
### October 28, 2018

Summary Statistics:

| | |
|---|---|
| Total number of points sampled | 80 |
| Total live turions | 296 |
| Total # of points with live turions | 53 |
| Frequency of occurrence (in percent) | 66.3 |
| Number of points at or above nuisance level (+200/$m^2$) | 9 |
| % nuisance level | 11.3 |
| Maximum turions/$m^2$ | 689 |
| Mean turions/$m^2$ | 79.65 |
| Standard deviation/$m^2$ | 112.95 |

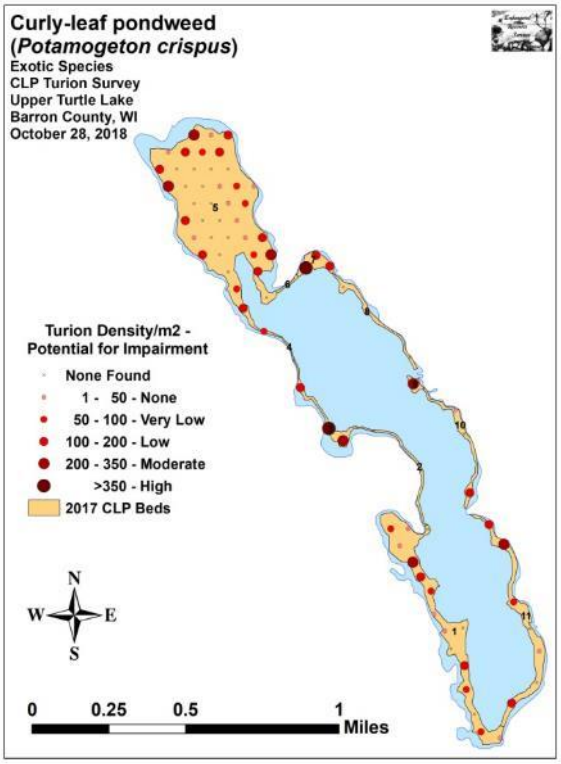


**Figure 7: 2018 Fall CLP Turion Survey Density and Distribution**

## CONSIDERATIONS FOR FUTURE MANAGMENT:

The 2018 turion survey suggested there will again be Curly-leaf pondweed throughout much of Upper Turtle Lake in 2019. Ultimately, the results of the 2019 pretreatment survey coupled with the level of CLP growth the board is comfortable with will determine how much, if any, of the lake is actively managed.

## LITERATURE CITED

Busch, C., G. Winter, L. Sather, and J. Roth. 1966. Upper Turtle Lake Map. Available from http://dnr.wi.gov/lakes/maps/DNR/2079800a.pdf (2018, November).

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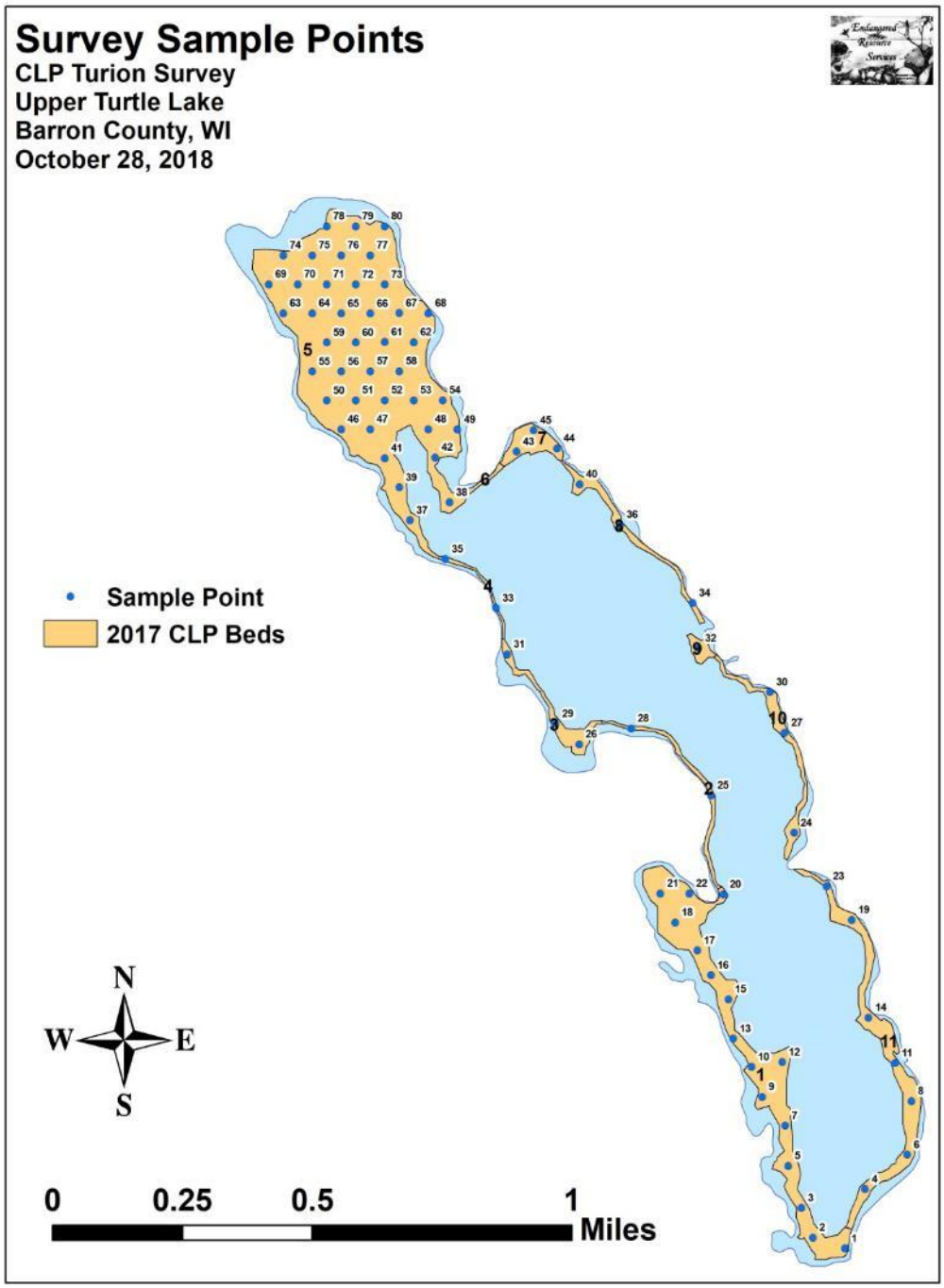
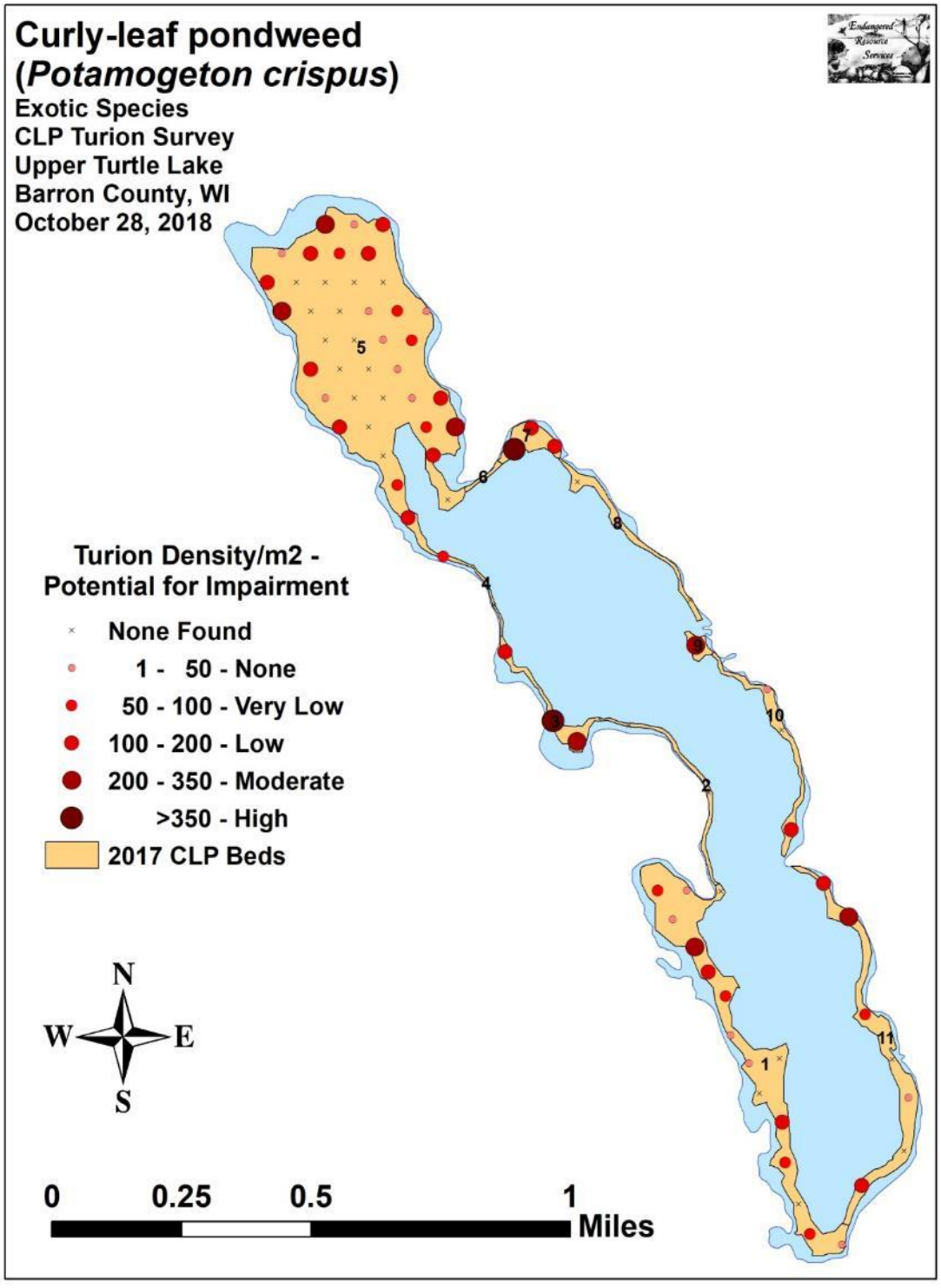
UWEX Lakes Program. [online]. 2010. Pre/Post Herbicide Comparison. Available from http://www.uwsp.edu/cnr-ap/UWEXLakes/Documents/ecology/Aquatic%20Plants/Appendix-D.pdf (2018, November).

WDNR. [online]. 2018. Citizen Lake Monitoring Water Quality Data Report for Upper Turtle Lake. http://dnr.wi.gov/lakes/waterquality/Station.aspx?id=033175 (2018, November)

# Appendix I:  Turion Survey Sample Points


Survey Sample Points
CLP Turion Survey
Upper Turtle Lake
Barron County, WI
October 28, 2018
Sample Point
2017 CLP Beds
N
W
E
S
0
0.25
0.5
1
Miles

## Appendix II:  2018 Fall CLP Turion Density and Distribution


Curly-leaf pondweed
(Potamogeton crispus)
Exotic Species
CLP Turion Survey
Upper Turtle Lake
Barron County, WI
October 28, 2018
Endangered Resource Services
Turion Density/m2 -
Potential for Impairment
None Found
1 - 50 - None
50 - 100 - Very Low
100 - 200 - Low
200 - 350 - Moderate
>350 - High
2017 CLP Beds
N
W
E
S
0
0.25
0.5
1
Miles
5
7
6
8
4
9
10
3
2
11
1