White Water Lilies in Bone Lake, September 15, 2022

Curlyleaf Pondweed and Eurasian Watermilfoil Delineation, Treatment, and Assessment for Bone Lake, Washington County, Minnesota in 2022

	Delineation	Treatment	Assessment
CLP	May 6, 2022	No treatment	June 10, 2022
EWM	June 10, 2022	No treatment	September 15, 2022

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Summary

Curlyleaf Pondweed Delineation, Treatment, and Assessment: Bone Lake (MnDNR ID #82-0054) is a 221 acre lake located in Washington County, Minnesota. An initial curlyleaf pondweed (CLP) delineation was conducted on May 6, 2022 by Blue Water Science to characterize areas that could be treated. Results of the curlyleaf delineation on May 6, 2022 found CLP present at 9 sample sites. No treatment for curlyleaf pondweed was conducted in 2022.

A CLP assessment was conducted on June 10, 2022, which was the time period of peak CLP growth in area lakes. Curlyleaf was sampled at 40 sites on June 10, 2022 (Figure S1). One area in the southwest corner of the lake had several patches of heavy CLP growth. However, native plant abundance was also heavy in this area. Native plant growth was often more abundant than CLP.

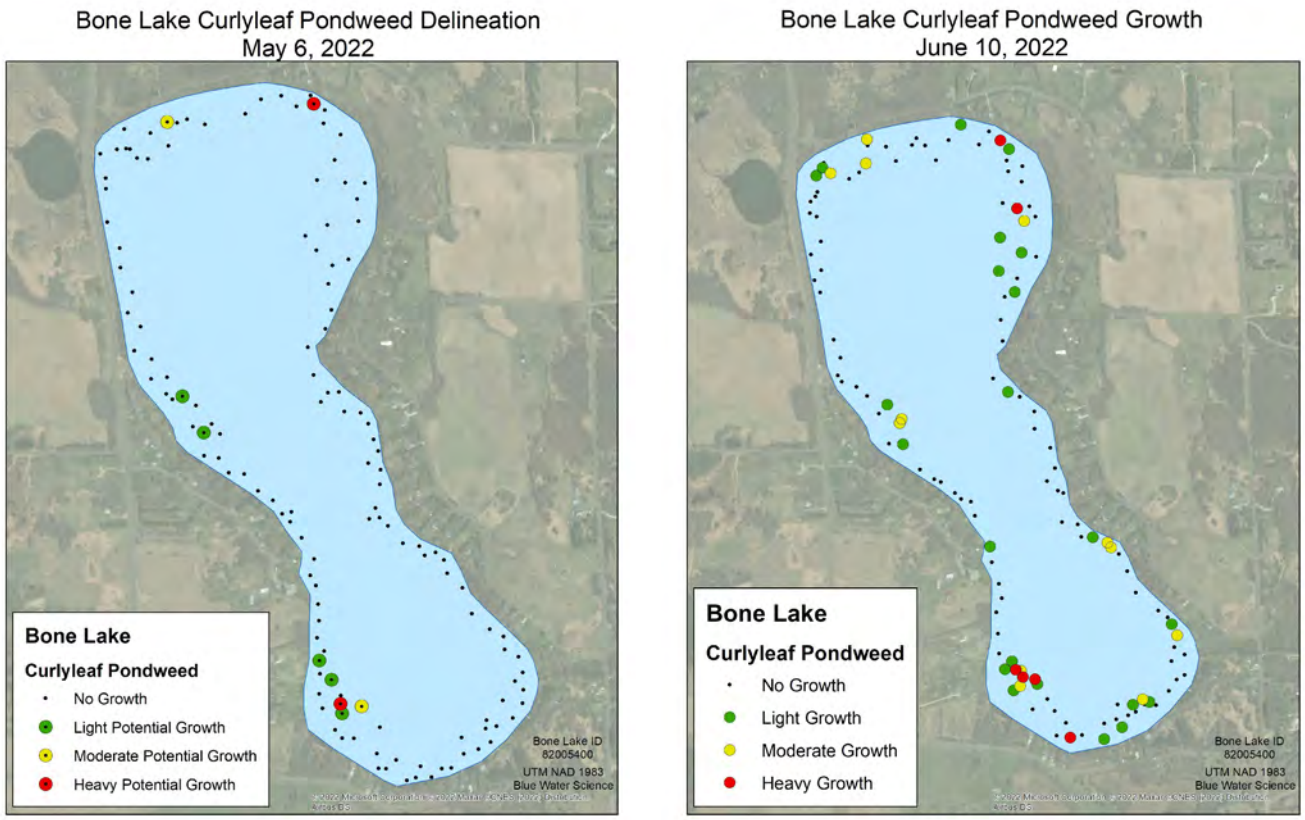


Figure S1. [left] CLP was found at 9 out of 138 sample sites in Bone Lake on May 6, 2022.
[right] CLP was found at 40 out of 132 sample sites on June 10, 2022.
Key: green = light growth potential, yellow = moderate growth potential, red = heavy growth potential.

Eurasian Watermilfoil Delineation, Treatment, and Assessment: Eurasian watermilfoil (EWM) was verified in Bone Lake in 2006. In 2022, an initial early EWM meander survey was conducted on May 6, 2022, and EWM was found at 28 sites out of 138 sites sampled with only light to moderate growth observed. Another EWM delineation meandering survey was conducted on June 10, 2022 and EWM was found at 34 sites out of the 132 sites sampled, with mostly light EWM growth observed (Figure S2). No areas were delineated for EWM treatment in 2022.

A follow-up assessment meander survey was conducted on September 15, 2022. Eurasian watermilfoil had decreased in distribution and was found at 14 sites out of 164 sample locations. EWM density was mostly light in Bone Lake in 2022 (Figure S2).

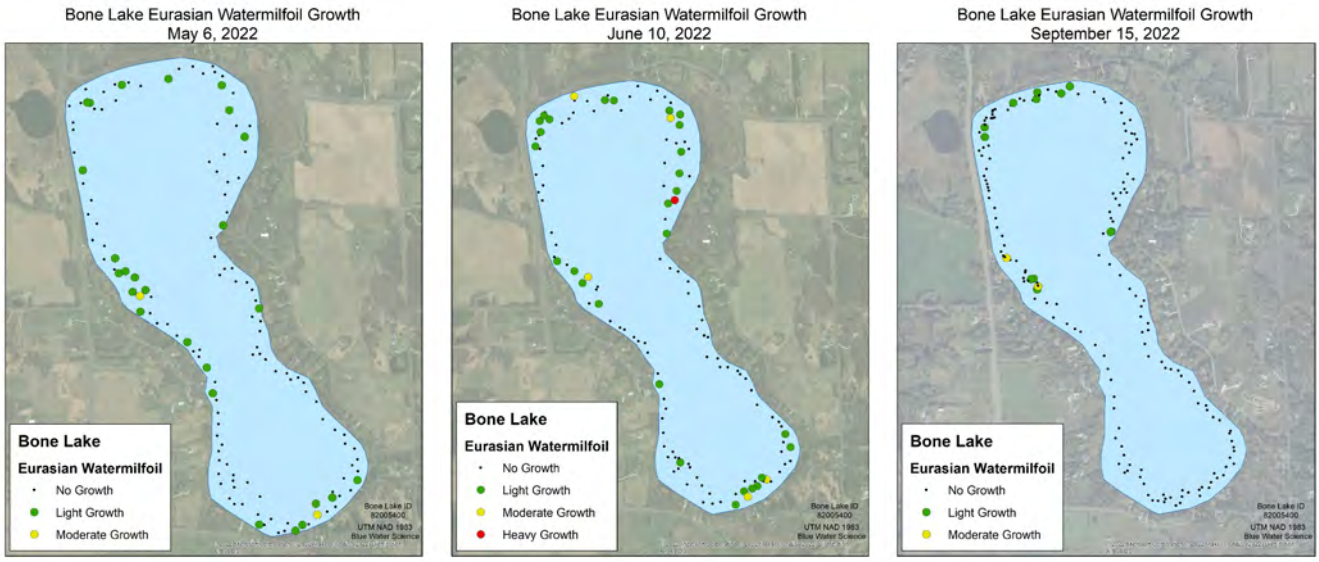
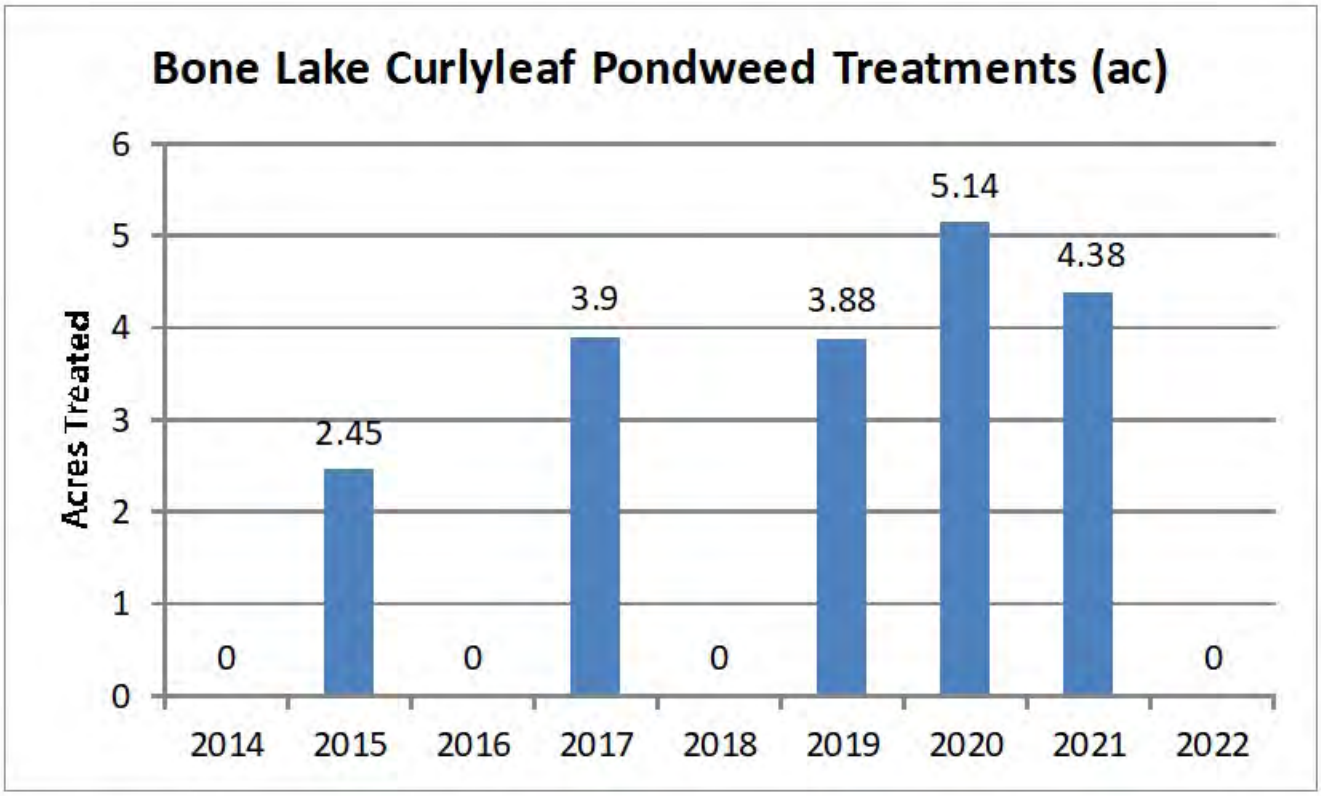


Figure S2. [left] EWM coverage for Bone Lake on May 6, 2022.
[middle] EWM coverage for Bone Lake on June 10, 2022.
[right] EWM coverage on for Bone Lake on September 15, 2022.

Summary of CLP and EWM Bone Lake Treatments: CLP has been treated in 5 out of the last 9 years. EWM has been treated in 3 out of the last 9 years. However, no CLP or EWM was treated tin 2022 (Figure S3).



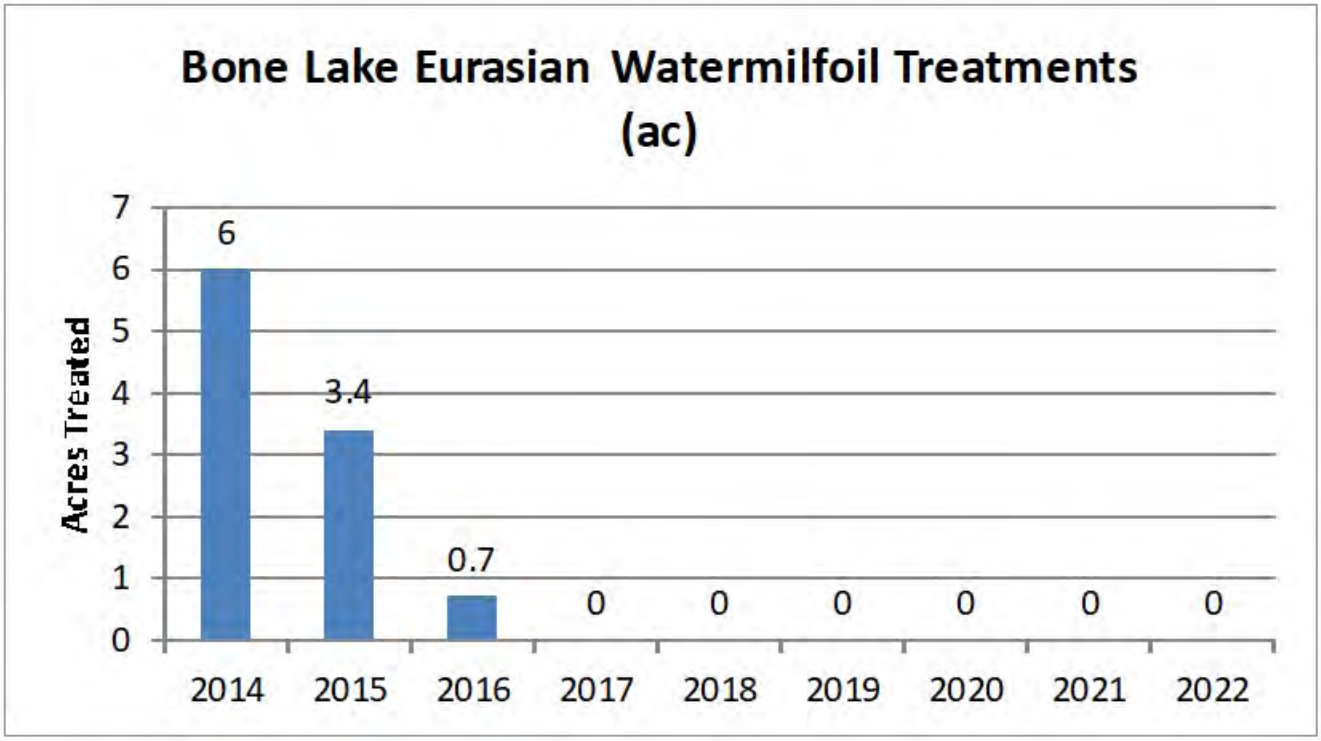


Figure S3. Summary of CLP and EWM treatment acreage for 2014-2022.

Curlyleaf and Milfoil Treatments from 2015-2022: A summary of CLP and EWM treatments from 2015 through 2022 is shown in Figure S4. CLP growth has been variable for the last couple of years. Lake ice, snow cover, and even cloudy days can limit curlyleaf growth. EWM treatment areas have decreased since 2014, but EWM is still present in nearshore areas in Bone Lake.

A hotspot map of sites of CLP and EWM that show moderate and heavy growth for 2015 through 2022 is shown in Figure S4. In the last 5 years CLP and EWM growth has been most evident in the northern and southern ends of Bone Lake where growing conditions are conducive to heavy plant growth. CLP and EWM have typically grown to a water depth of 6 feet or less.

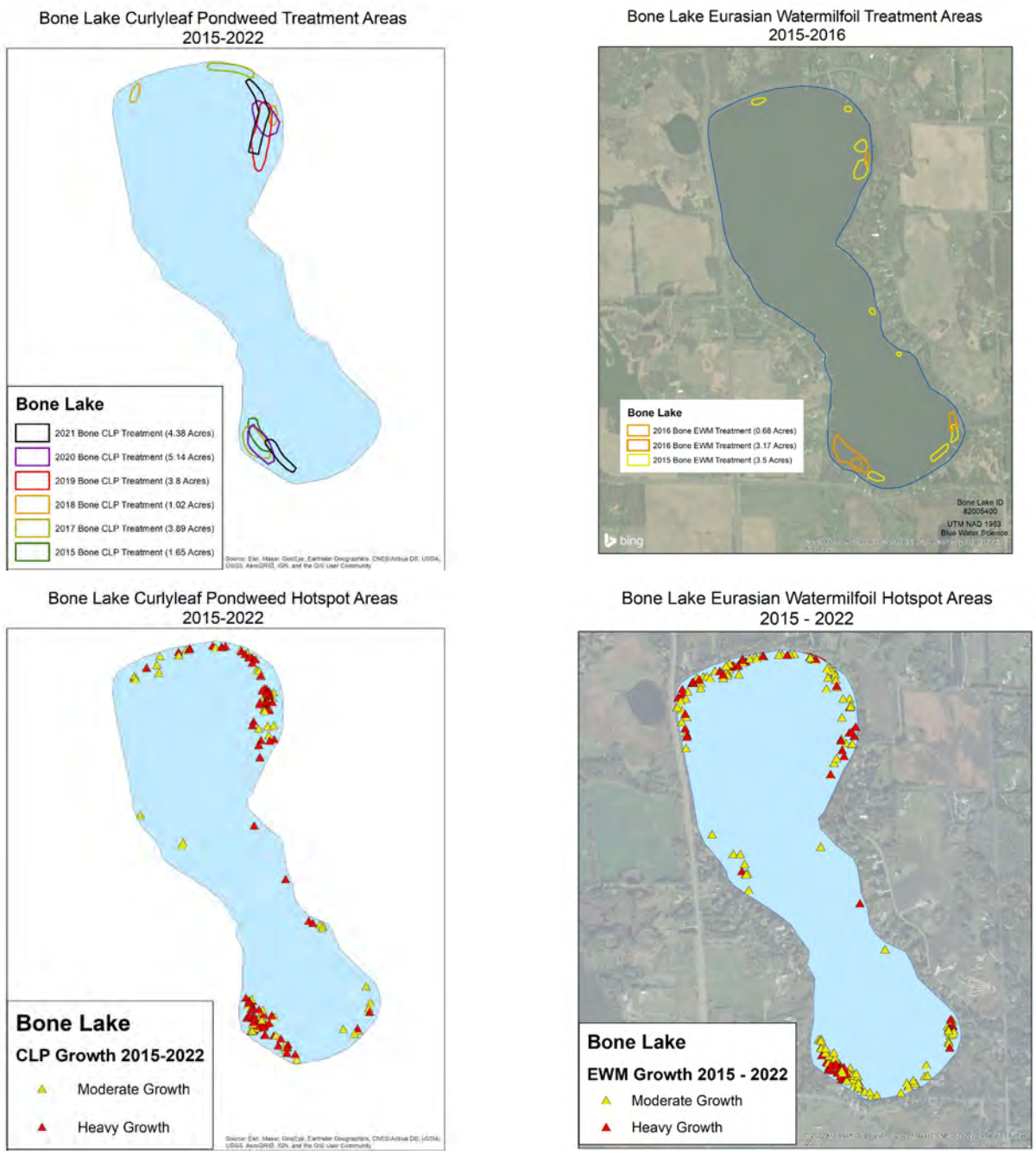


Figure S4. [top-left] Bone Lake CLP treatment map 2015-2022. [top-right] Bone Lake EWM treatment map 2015-2016. [bottom-left] Hotspot map of CLP growth over the years of 2015-2022 placed on a single map. [right] Hotspot map of EWM growth over the years of 2015-2022 placed on a single map Key: yellow = moderate growth, and red = heavy growth.

Curlyleaf Pondweed and Eurasian Watermilfoil Delineation, Treatment, and Assessment for Bone Lake, Washington County, Minnesota in 2022

Bone Lake, Washington County (ID: 82-0054)
Size: 221 acres (MnDNR)
Littoral area: 124 acres (MnDNR)
Maximum depth: 30 ft (MnDNR)

Introduction

Curlyleaf pondweed (CLP) and Eurasian watermilfoil (EWM) are non-native species and both are present in Bone Lake. CLP and EWM delineations were conducted on 221 acre Bone Lake, Washington County in 2022. The objectives of the delineations were to locate areas of nuisance invasive species and recommend areas for potential treatments.

Figure 1. Water lilies in Bone Lake on September 15, 2022.

Methods

Curlyleaf Pondweed Delineation and Assessment Methods: At the time of the spring curlyleaf delineation on May 6 only a fraction of the peak curlyleaf biomass is present compared to what could be present in June, at its peak. For spot treatments, the areas to be treated are delineated prior to curlyleaf developing peak biomass. The CLP delineation survey is conducted using a meandering path around the nearshore area of the entire lake. Curlyleaf is sampled using a fixed 14 tine rakehead on a pole. Curlyleaf stem counts on a rake sampler were used to identify areas that had a potential to produce curlyleaf growth at its June peak. After a short sweep of about 1-foot (which samples about 0.1 m^2), if one or two stems (10-20 stems/m^2) were collected on the rake sweep, it was predicted that this area would produce only future light growth at its peak and was not delineated for treatment. Alternatively, sites where 3 stems (30 stems/m^2) were collected per rake sample future potential growth was considered to be moderate. However if 4 curlyleaf stems (40 stems/m^2) or more per rake sample generally indicated some plants had developed runners and would likely produce heavy growth in the next few weeks and this site would be marked for potential treatment. This survey method used for determining curlyleaf pondweed spot herbicide treatments was similar to the methodology published in a peer reviewed journal (McComas et al, 2015)*.

CLP and EWM Sampling: An initial delineation was conducted on May 6 and 138 sites were sampled. On June 10 the entire perimeter of the lake was checked for CLP and EWM. On June 10, a total of 132 sites were sampled for CLP, EWM, and other aquatic plants. A follow-up EWM assessment was conducted on September 15. A total of 164 sites were sampled for aquatic plants. Curyleaf and EWM were not chemically treated in 2022.

Chart of Aquatic Plant Density Ratings

Figure 2. Aquatic plant density ratings from 1 to 3.

*McComas, S.R., Y.E. Christianson, and U. Singh. 2015. *Effects of curlyleaf pondweed control on water quality and coontail abundance in Gleason Lake, Minnesota. Lake and Reservoir Management, 31:109–114.* https://doi.org10.1080/10402381.2015.1014583

Curlyleaf Pondweed Delineation on May 6, 2022

Results of the delineation conducted on May 6, 2022 found CLP present at 9 sample sites out to a total of 138 sites sampled. Curlyleaf was scattered and treatment was not recommend in 2022 (Figure 3).

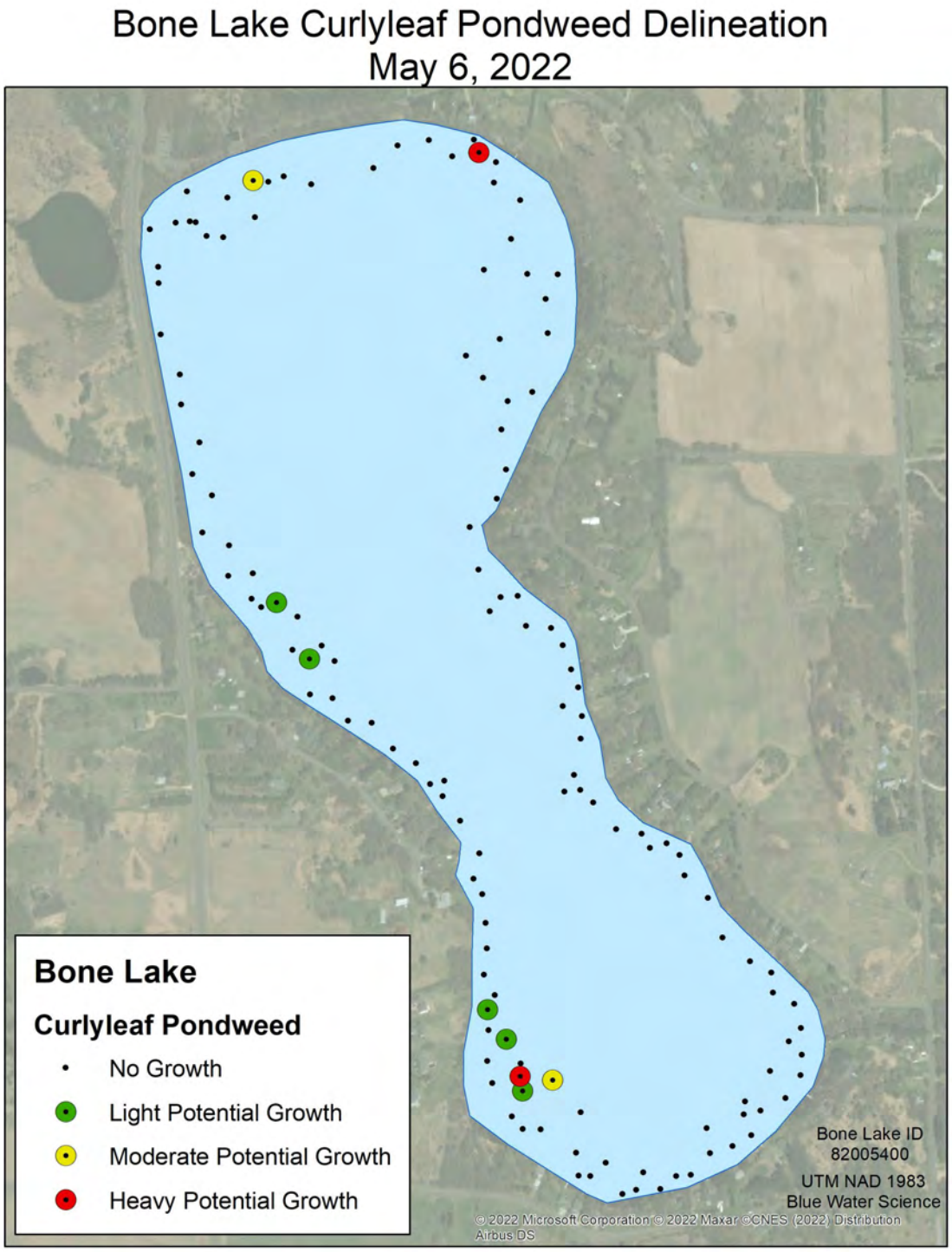


Figure 3. CLP coverage for Bone Lake on May 6, 2022. Key: black dot = no growth, green dots = light growth, yellow dots = moderate growth, and red dots = heavy growth.

Curlyleaf Pondweed Assessment on June 10, 2022

Results of an assessment conducted on June 10, 2022 found that CLP was present at 40 sites out of the 132 locations sampled (Figure 4). CLP had increased in occurrence since April but only several patches in the southwest end of Bone Lake had heavy growth. Native aquatic plant growth was heavy in this area as well.

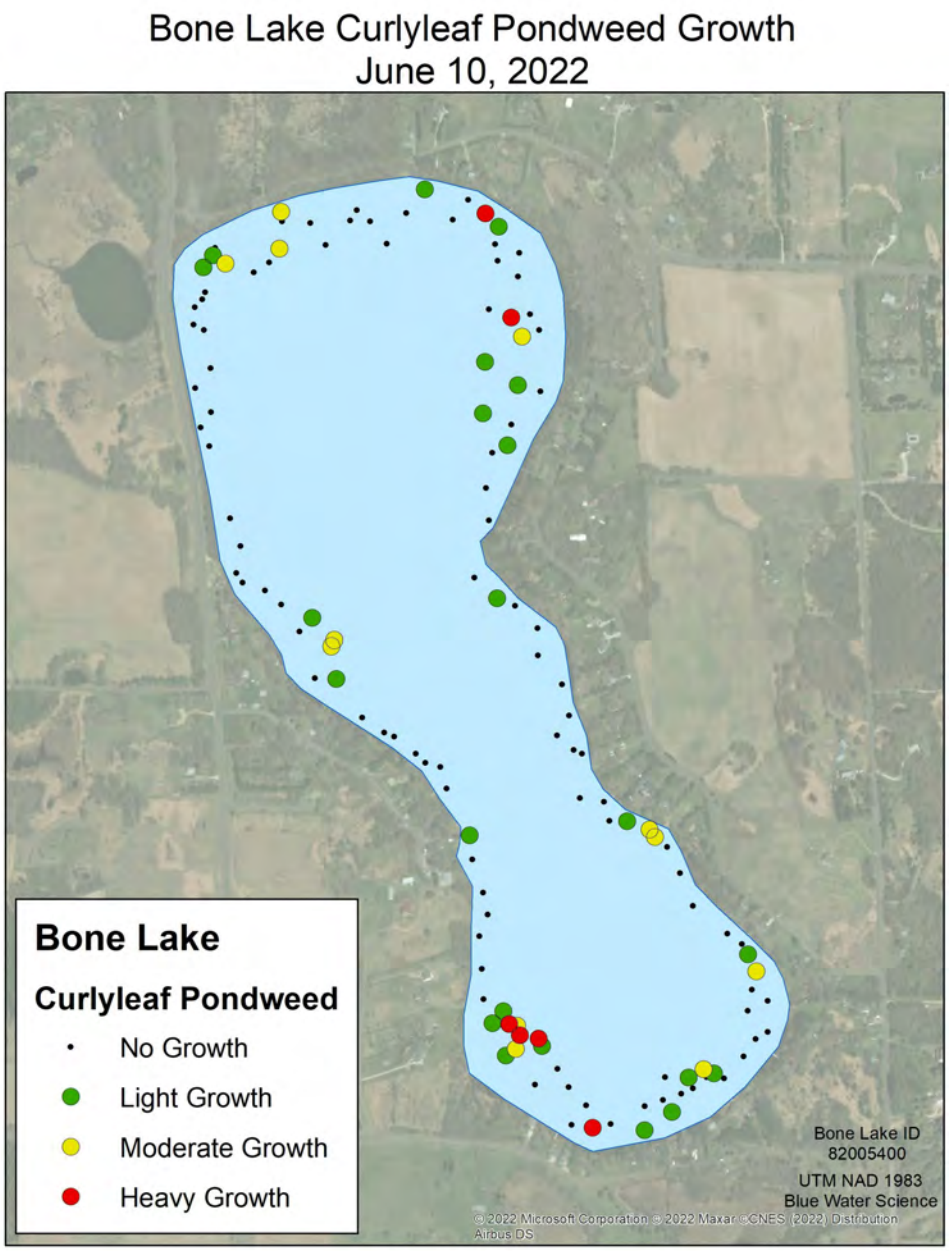


Figure 4. CLP growth in Bone Lake on June 10, 2022.
Key: black dot = no curlyleaf growth, green dot = light growth, yellow dot = moderate growth, and red dot = heavy growth.

Eurasian Watermilfoil Delineations on June 10, 2022

An EWM delineation was conducted on June 10, 2022. EWM was found at 34 sites out of 132 sites sampled (Figure 5). No areas were delineated for treatment (Figure 5).

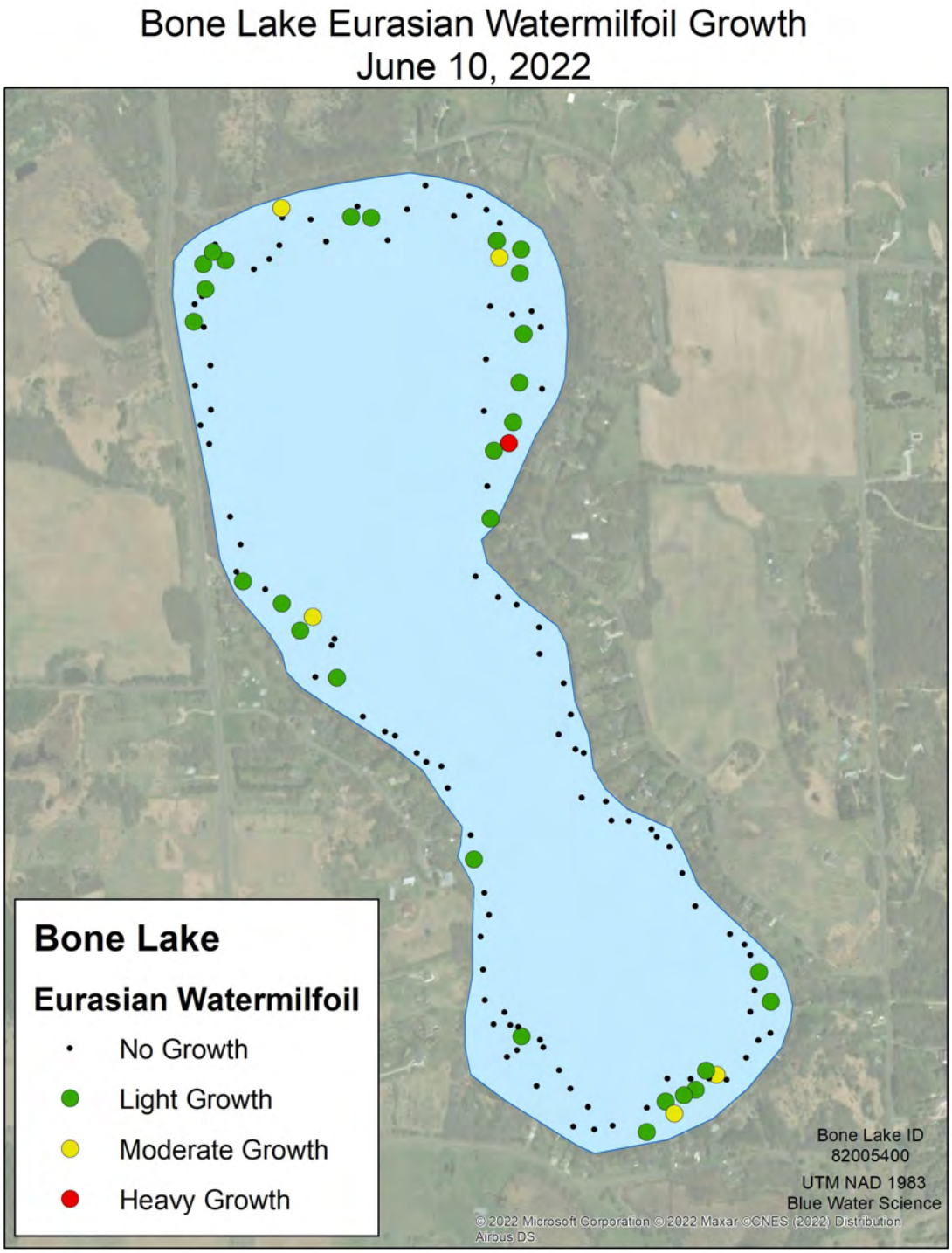


Figure 5. EWM coverage for Bone Lake on June 10, 2022.
Key: black dot = no growth, green dots = light growth, yellow dots = moderate growth, and red dots = heavy growth.

Eurasian Watermilfoil Assessment on September 15, 2022

EWM growth was assessed on September 15, 2022 and 14 occurrences of EWM were observed in Bone Lake (Figure 6). EWM growth was light and only found in the northern nearshore areas.

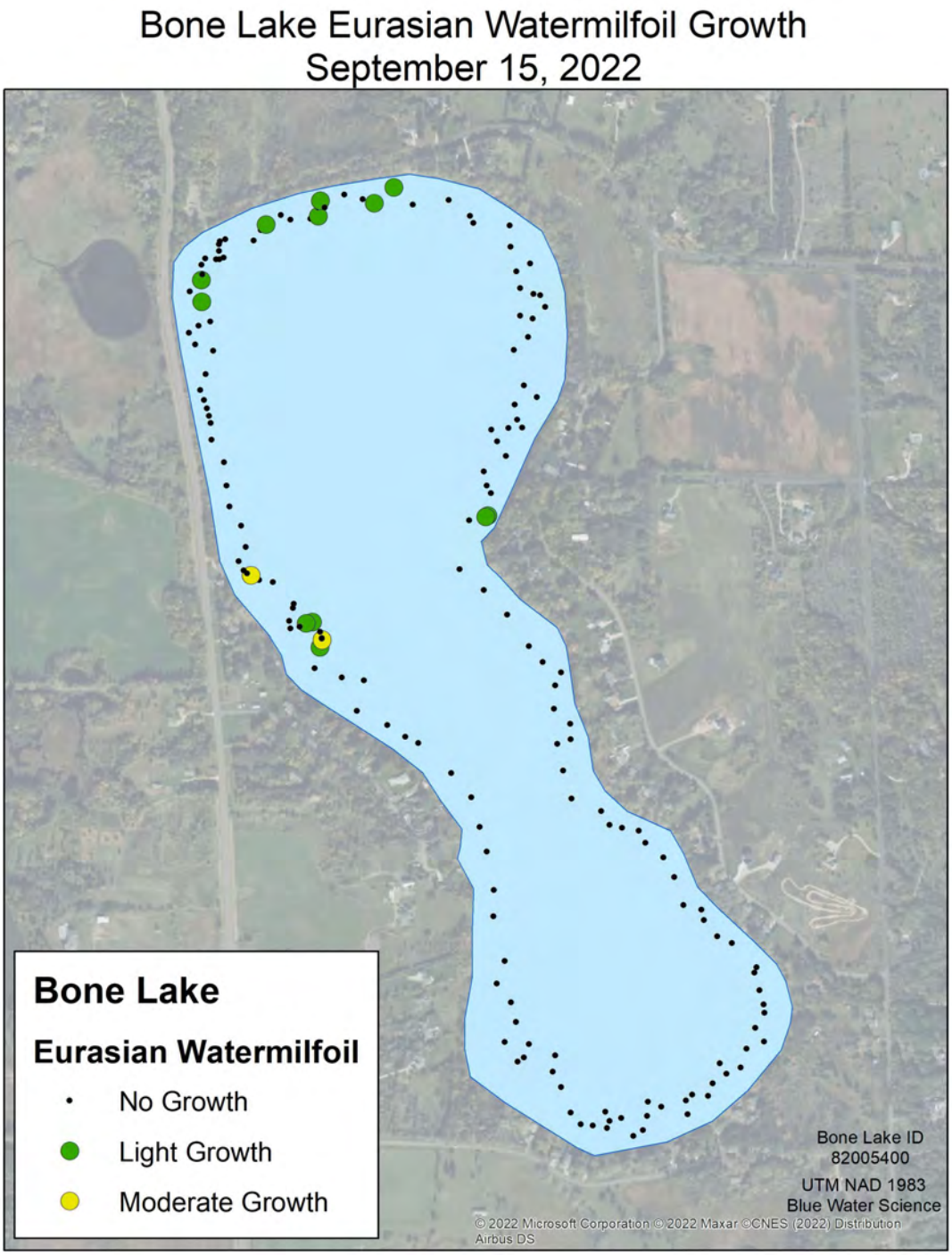


Figure 6. EWM coverage for Bone Lake on September 15, 2022.
Key: black dot = no growth, green dots = light growth, and yellow dots = moderate growth.

Bone Lake Aquatic Plants Found on the September 15, 2022 Meander Survey

APPENDIX

Curlyleaf Pondweed and Eurasian Watermilfoil Assessments from 2014 - 2022

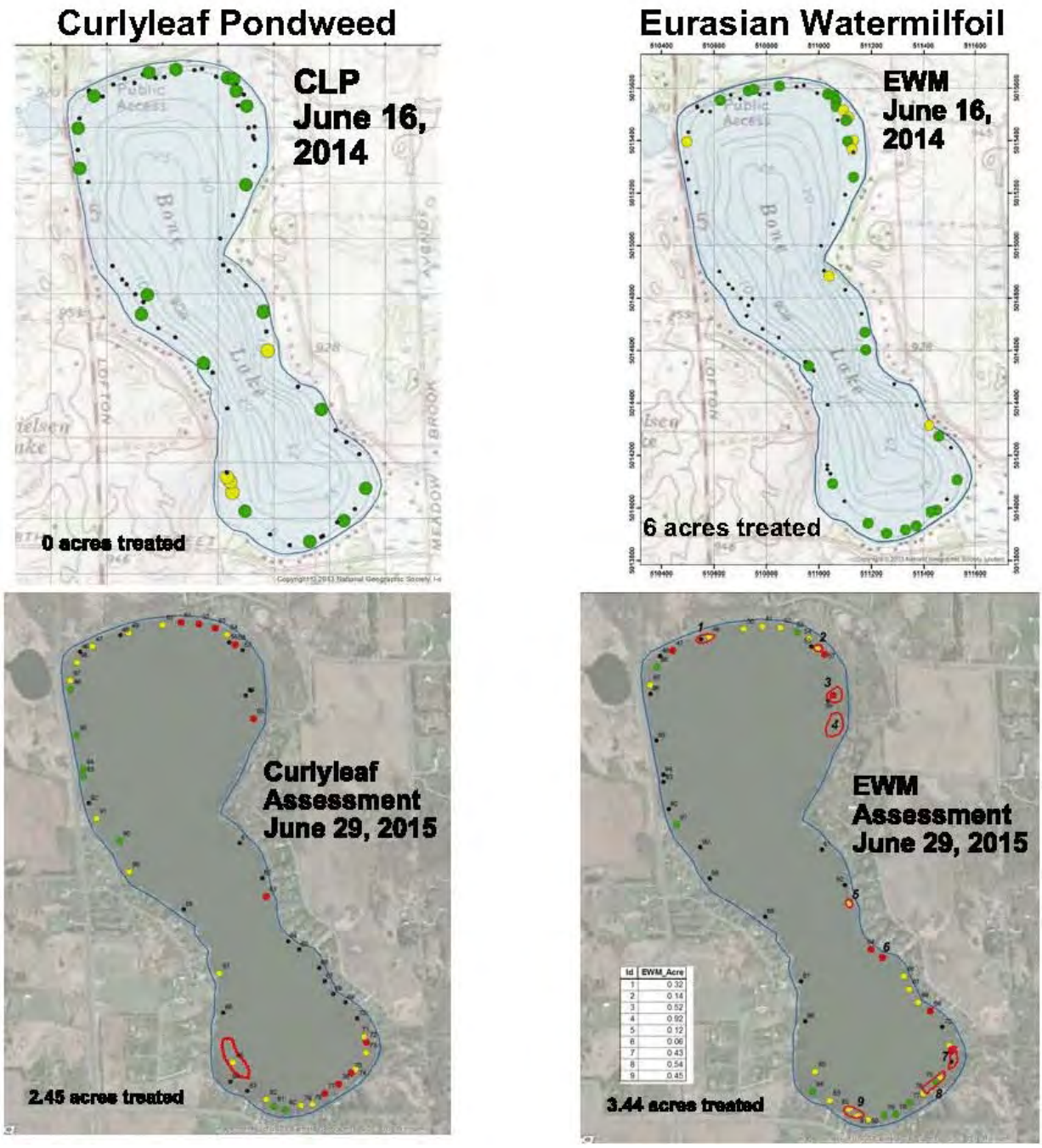


Figure 7. CLP and EWM maps for 2014 through 2022 (continued on the next 2 pages).

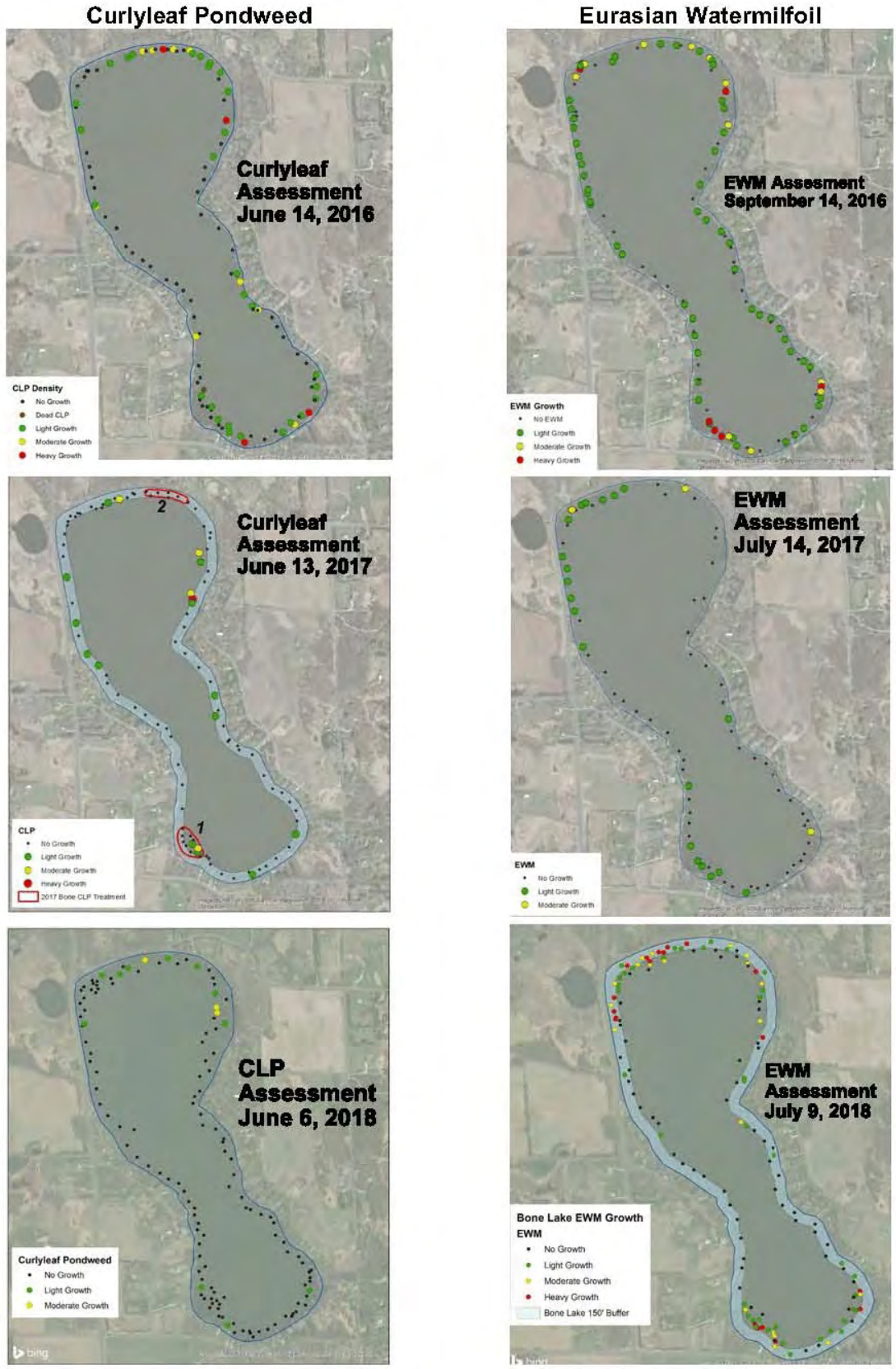


Figure 7. CLP and EWM maps for 2014 through 2022.

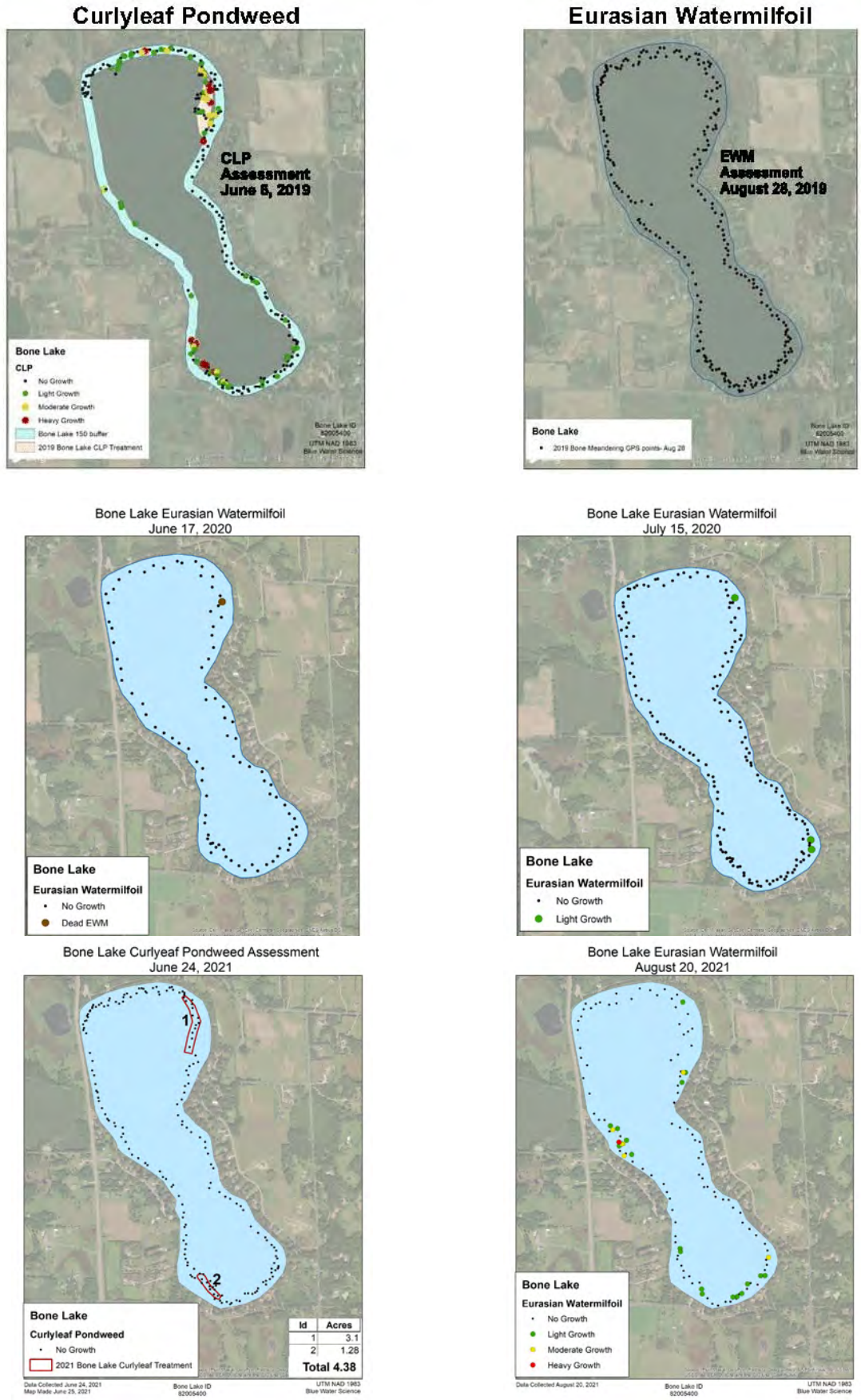
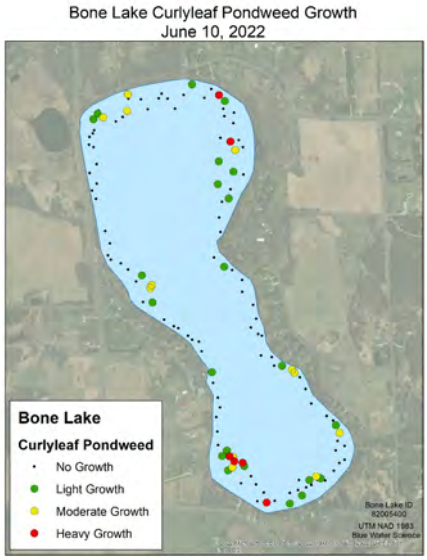


Figure 7. CLP and EWM maps for 2014 through 2022.

Curlyleaf Pondweed



Eurasian Watermilfoil

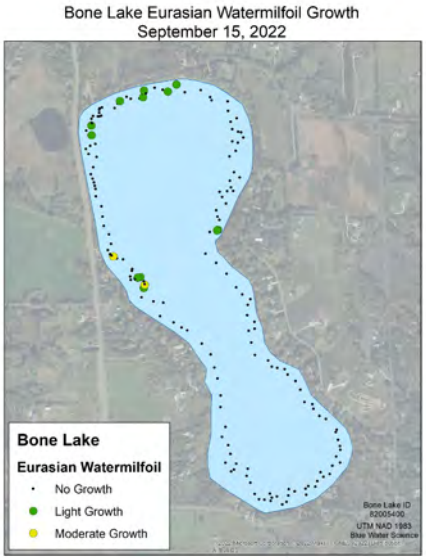
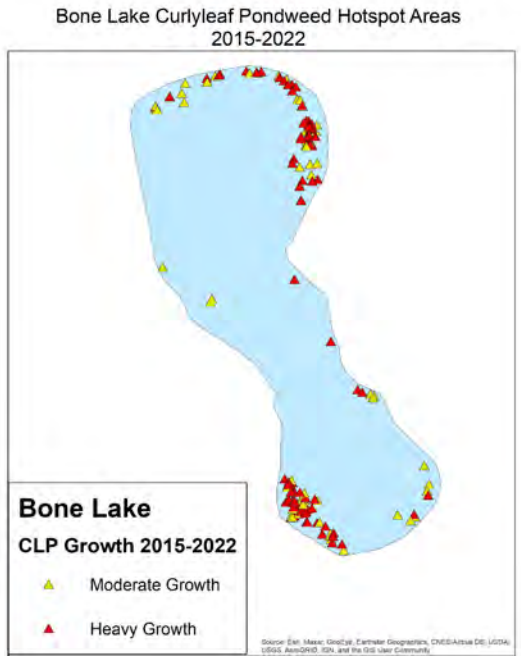
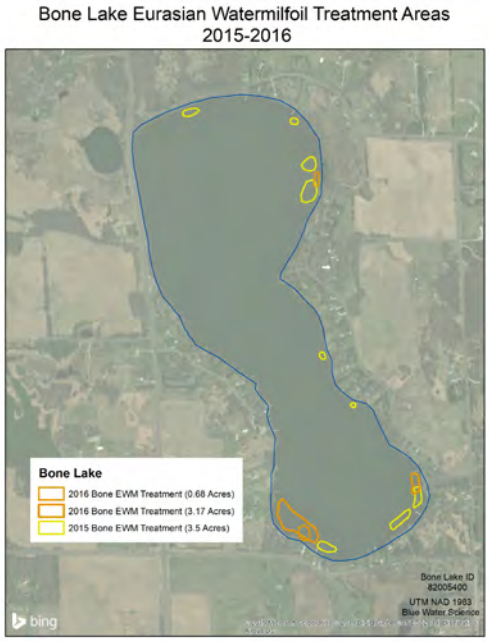


Figure 7. CLP and EWM maps for 2014 through 2022.

Curlyleaf Pondweed from 2015 - 2022

A summary of CLP treatments from 2015 through 2022 is shown in Figure 8. CLP growth has been variable for the last couple of years. Lake ice, snow cover, and even cloudy days can limit curlyleaf growth. A hotspot map of sites of CLP moderate and heavy growth for 2015 through 2022 is shown in Figure 8. In the last 5 years CLP growth has been most evident in the northern and southern ends of Bone Lake where growing conditions are conducive to heavy plant growth. CLP has typically grown to a water depth of 6 feet or less.





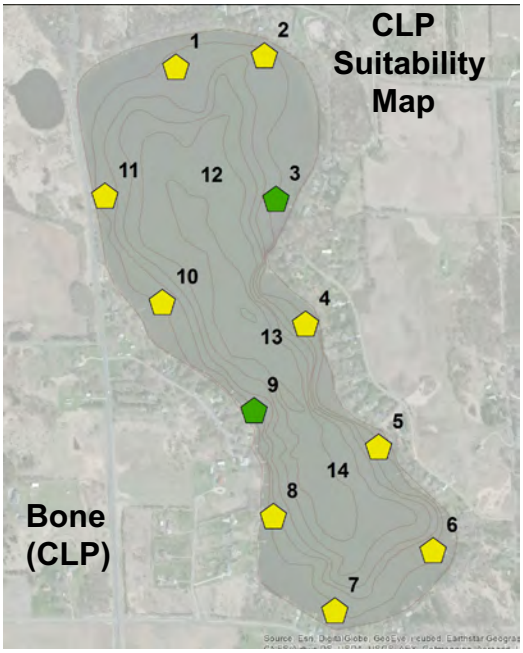


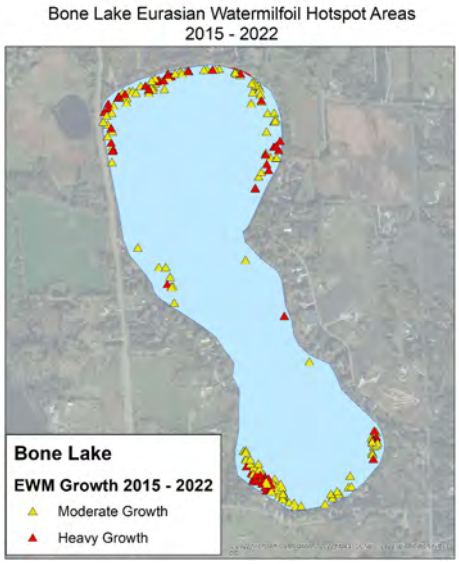
Figure 8. [top-left] Bone Lake CLP hotspot map 2015-2022. [top-right] Treatment map of CLP growth over the years of 2015-2022 placed on a single map. [bottom-left] Curlyleaf pondweed potential growth based on lake sediment analyses for Bone Lake. Key for Potential Growth: green = light growth, yellow = moderate growth, red = heavy growth (shown with octagons).

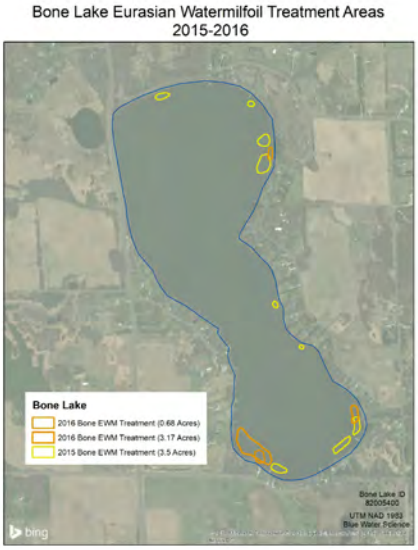
Eurasian Watermilfoil from 2015 - 2022

EWM has been in Bone Lake since 2006. Although control of EWM has been ongoing since 2006, EWM continued to expand around the lake. A map showing the occurrence of moderate to heavy growth of EWM in Bone Lake from 2015 through 2022 is shown in Figure 9. Some nearshore areas in the north and south ends of Bone Lake support consistently significant growth. These “hotspot” areas are shown in Figure 9.

Heavy milfoil growth has been correlated with high sediment nitrogen conditions and from a soils survey conducted in 2014, Bone Lake has at least 1 area with high lake sediment nitrogen conditions. The potential for long term milfoil growth, based on lake sediment sampling, predicts mostly moderate growth with the potential for annual heavy growth limited to the northwest side of Bone Lake.

For Bone Lake, it is estimated the plants have the potential to grow down to at least 7 feet of water depth based on low Secchi transparencies, restricting milfoil growth to nearshore areas. Results of the sediment survey indicate growth would be primarily light on a long term basis.





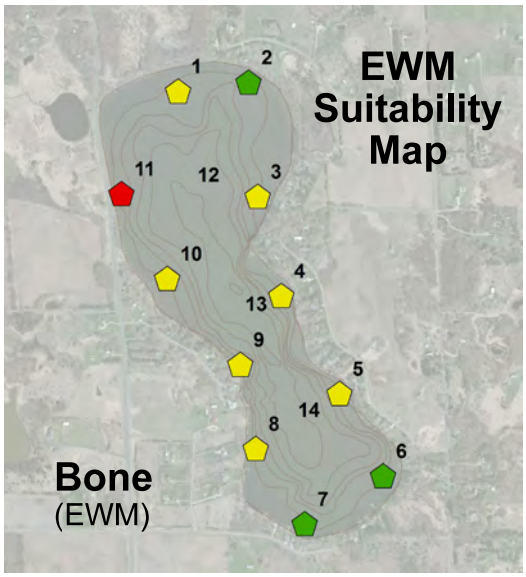


Figure 9. [top-left] Hotspot map of EWM growth over the years of 2015 to 2022 placed on a single map.
[top-right] Treatment map of EWM growth over the years of 2015-2022 placed on a single map.
[bottom-left] Suitability map for EWM growth in Bone Lake.
Key: green = light growth, yellow = moderate growth, and red = heavy growth.