Zebra Mussels in White Bear Lake in August, 2023

Eurasian Watermilfoil Treatment and Starry Stonewort Search for White Bear Lake, Washington County, Minnesota, 2023

EWM Delineation Conducted on June 27, 2023

2023 EWM Treatment: 47.67 acres on July 18, 2023

EWM Assessment Conducted on August 9 and 10, 2023

No Starry Stonewort Observed (August 9 and 10, 2023)

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Eurasian Watermilfoil Treatment and Starry Stonewort Search for White Bear Lake, Washington County, Minnesota, 2023

Overview

White Bear Lake (MnDNR ID: 82-0167) is a 2,428 acre lake located in Washington County, Minnesota. An Eurasian watermilfoil (EWM) delineation was conducted by Blue Water Science on June 27, 2023 with 538 sites sampled and milfoil was fairly widely distributed in 2023 (Figure 1). Abundance was also less compared to previous years. Moderate growth had the potential to produce heavy growth and areas with the potential to produce heavy growth were delineated for treatment. An herbicide application treated a total of 47.67 acres. A follow-up Eurasian watermilfoil assessment was conducted on August 9 and 10, 2023 to evaluate the status of Eurasian watermilfoil in the treated areas as well as other areas around the lake. The herbicide treatments were considered successful, however three areas (6, 9, 10) had partial control of Eurasian watermilfoil (Figure 1).

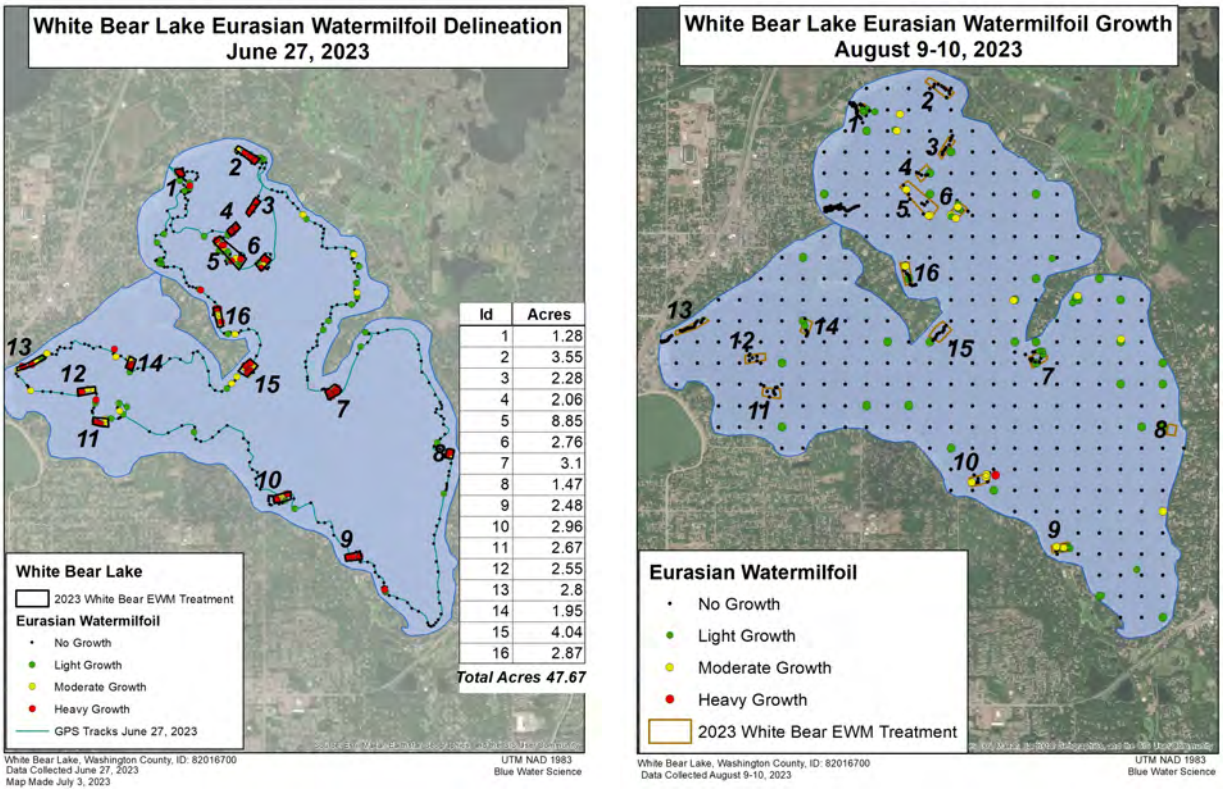


Figure 1. [left] EWM delineation with treatment polygons for June 27, 2023.
[right] EWM assessment on August 9 and 10, 2023 found mostly light to moderate EWM growth.
Key: green dots = light growth, yellow dots = moderate growth, red dots = heavy growth, and black dots = no EWM growth.

EWM Delineation on June 27, 2023

A total of 47.67 acres was delineated for 16 treatment areas (Figure 2).

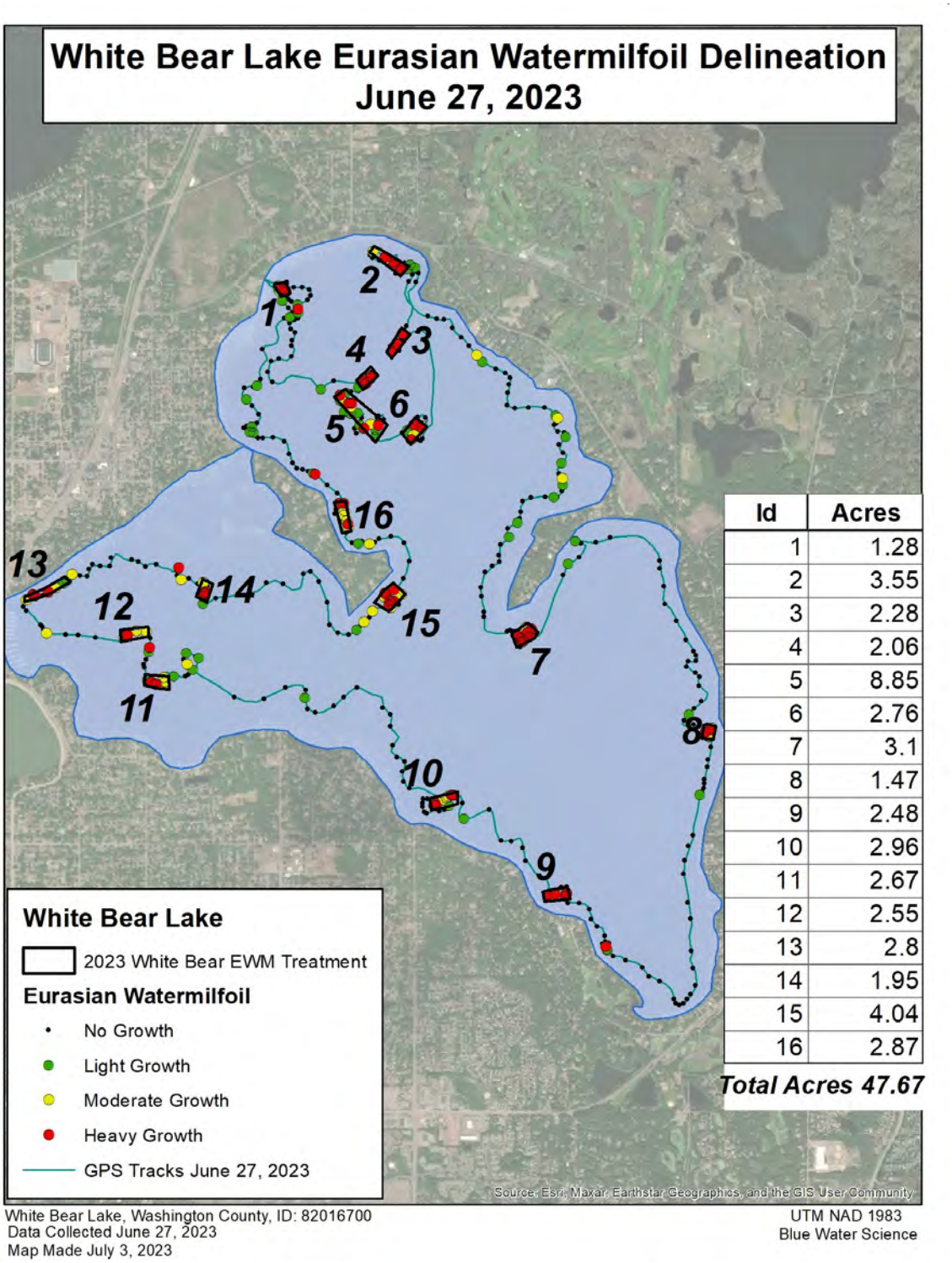


Figure 2. EWM delineation map with treatment polygons for June 27, 2023.
Key: green dots = light growth, yellow dots = moderate growth, red dots = heavy growth, and black dots = no EWM growth.

EWM Assessment on August 9 and 10, 2023

A total of 47.67 acres were treated on July 18, 2023 with trichlopyr at 1.5 ppm and all 16 treatment areas were evaluated. Results of the treatments were mostly good (Figure 3). Some EWM was found in treatment areas in 6, 9, and 10 but at light growth conditions. Scattered EWM was sampled at other sites.

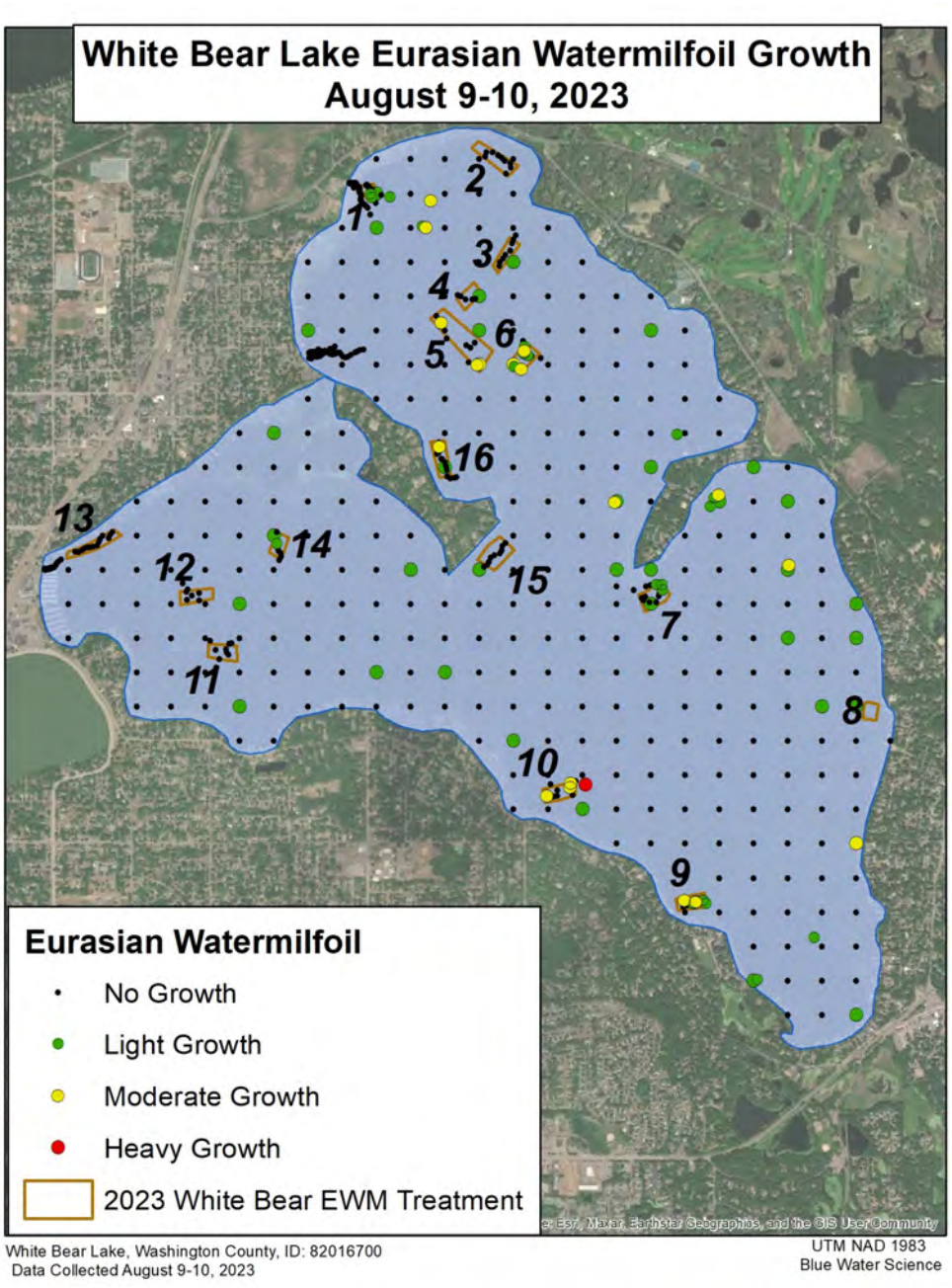


Figure 3. The August 9 and 10, 2023 EWM assessment.
Key: green dots = light growth, yellow dots = moderate growth, red dots = heavy growth, and black dots = no EWM growth.

EWM Treatments from 1988-2023

Eurasian watermilfoil was first observed with a single plant collected near a public dock on the west side of the lake in 1988. A history of Eurasian watermilfoil control measures is shown in Table 1. From 1991 through 1995, an aggressive EWM treatment program was implemented to try to stop the spread of EWM within White Bear Lake. The aggressive treatment approaches were discontinued after 1995. EWM had basically spread around White Bear Lake at mostly light to moderate growth with some patches of heavier growth. After 1995, there was a period of 13 years (1996-2008) where Eurasian watermilfoil treatments were less than 20 acres per year (which includes shoreline treatments). Then from 2009 through 2023, Eurasian watermilfoil was more abundant and is reflected in an increase in treatment acreages. An increase in EWM for a few years (2010-2013) was likely due to low lake levels and clearer water from zebra mussels. In 2020, lake levels were reaching normal and EWM treatments were lower. In 2021, 2022, and 2023 lake levels were at near normal levels. A graph of treatment areas from 1988 through 2023 is shown in Figure 4.

Table 1. Eurasian watermilfoil treatment history in White Bear Lake.

Year	Herbicide (permitted acres)	Mechanical (acres)	Hand-pulling (acres)
1988	2		
1989	8.8		
1990	4		
1991	19.2		12
1992	95.9		3
1993	60.6		3
1994	20.5		
1995	46.0		
1996	11.5		
1997	minimal		
1998	5		
1999	11.0		
2000	13.0		
2001	16.2		
2002	17.2		
2003	16.5		
2004	12.9		
2005	14.7		
2006	15.1		
2007	19.8		
2008	17.8		
2009	12.3	35	
2010	174		
2011	41.6		
2012	126		
2013	100		
2014	32.8		
2015	85		
2016	60.4		
2017	65.1		
2018	69.9		
2019	56.42		
2020	12.17		
2021	50.53		
2022	32.70		
2023	47.67		

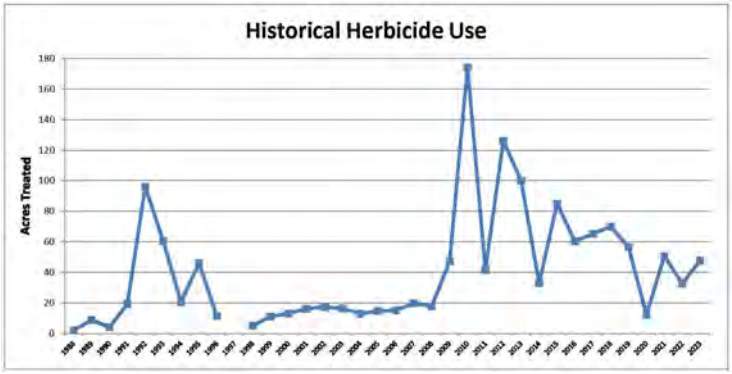


Figure 4. Historical herbicide use in White Bear Lake from 1988 to 2023.

White Bear Lake EWM Hotspots Based on Treatments From Previous Years

For EWM control in 2023 it is proposed to concentrate survey efforts in areas of persistent heavy growth. Areas of persistent growth and potential treatment are shown in Figure 5. These areas have been treated at least 4 out of the last 12 years. A MnDNR permit application for these areas would be submitted in winter. Then EWM would be checked in late May or early June to verify its presence. If it is present in the polygon then that area would be treated.

There should be a EWM assessment in August or September to assess EWM control.

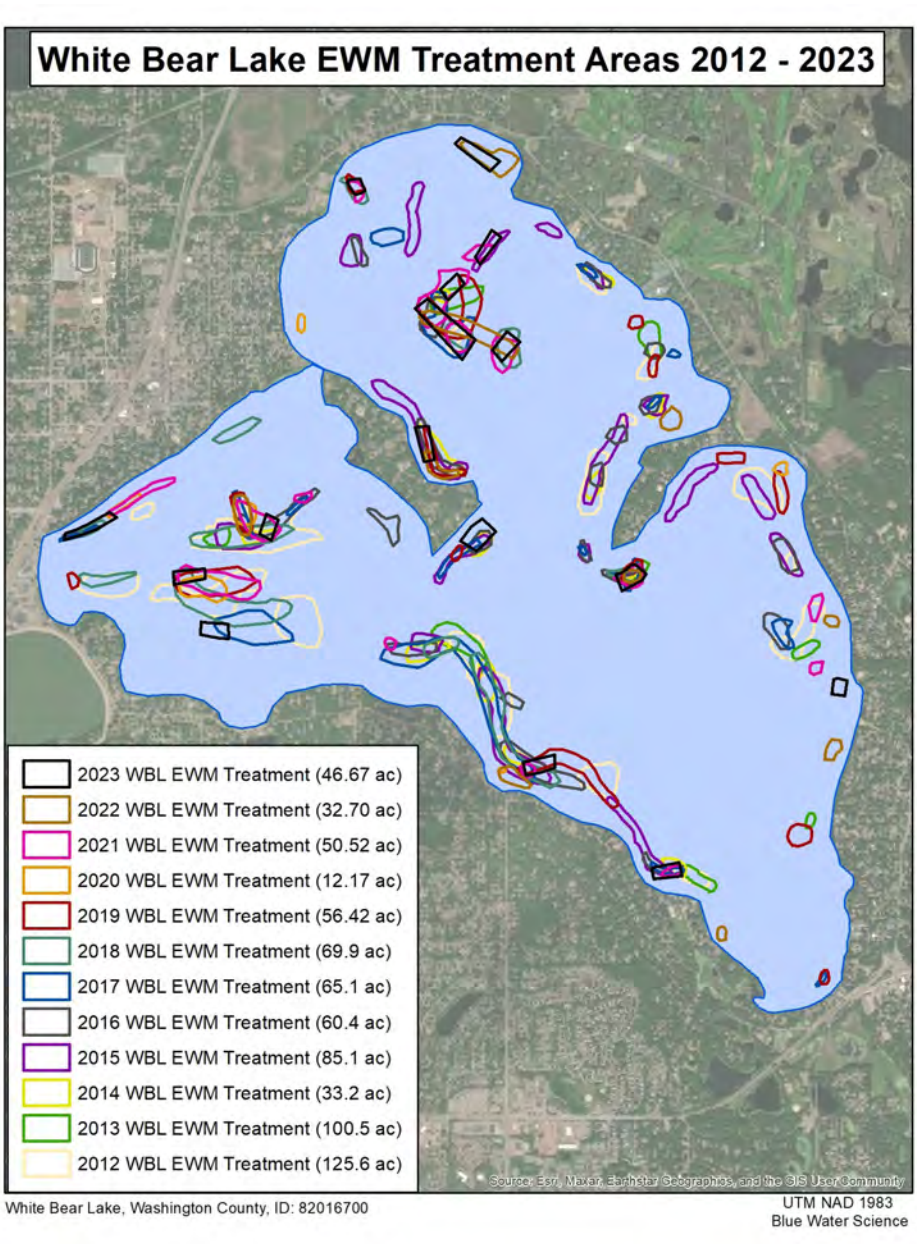


Figure 5. Hotspot map for treatments conducted in 2012-2023. Proposed 2024 EWM treatment would be in the areas that have been treated for multiple years.

White Bear Lake Zebra Mussel Distribution

In the course of a point intercept aquatic plant survey sponsored by the Rice Creek Watershed District, the presence of any zebra mussels on the aquatic plant sample were noted. A map showing the distribution of zebra mussels on aquatic plants is shown in Figure 6. Zebra mussels were distributed throughout most of the White Bear Lake plant growing depths (out to 23 feet of water).

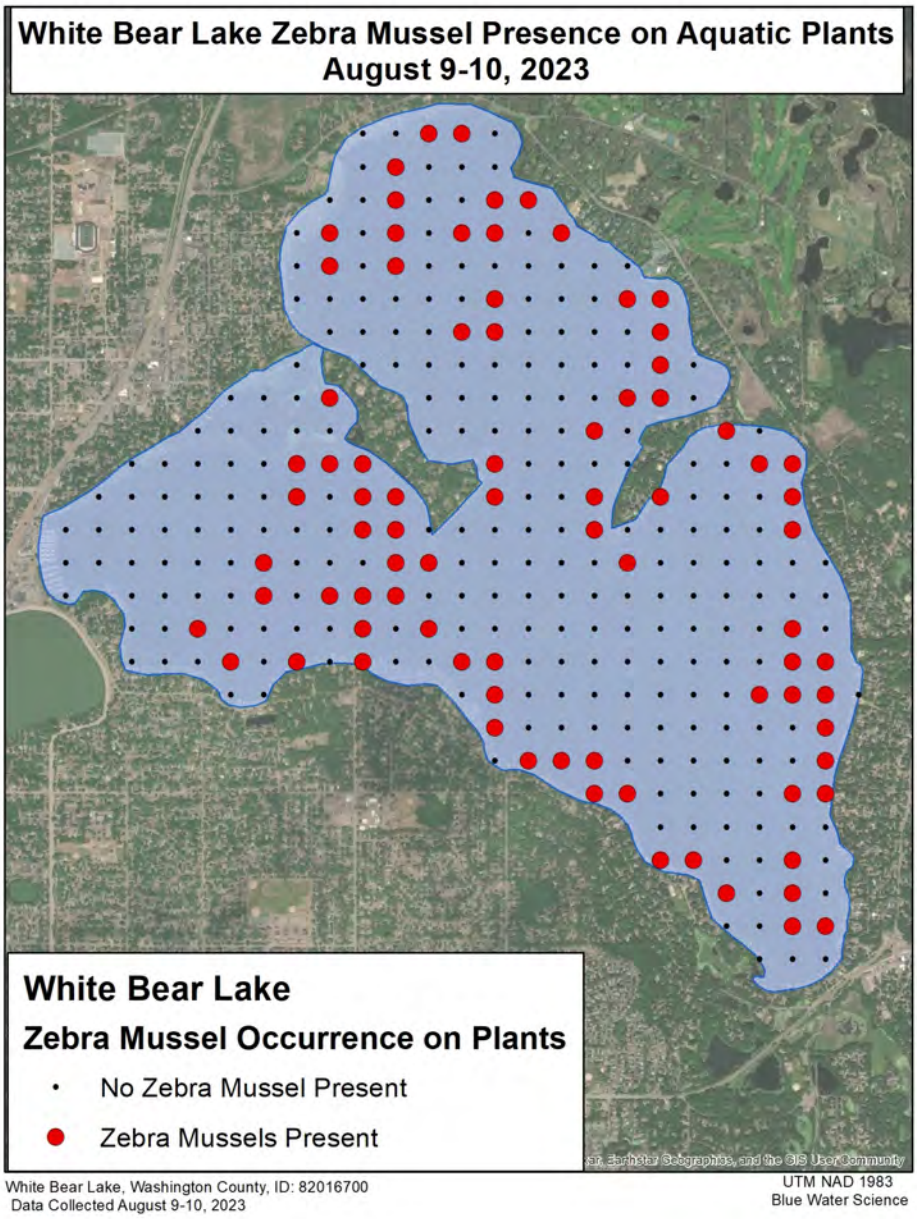
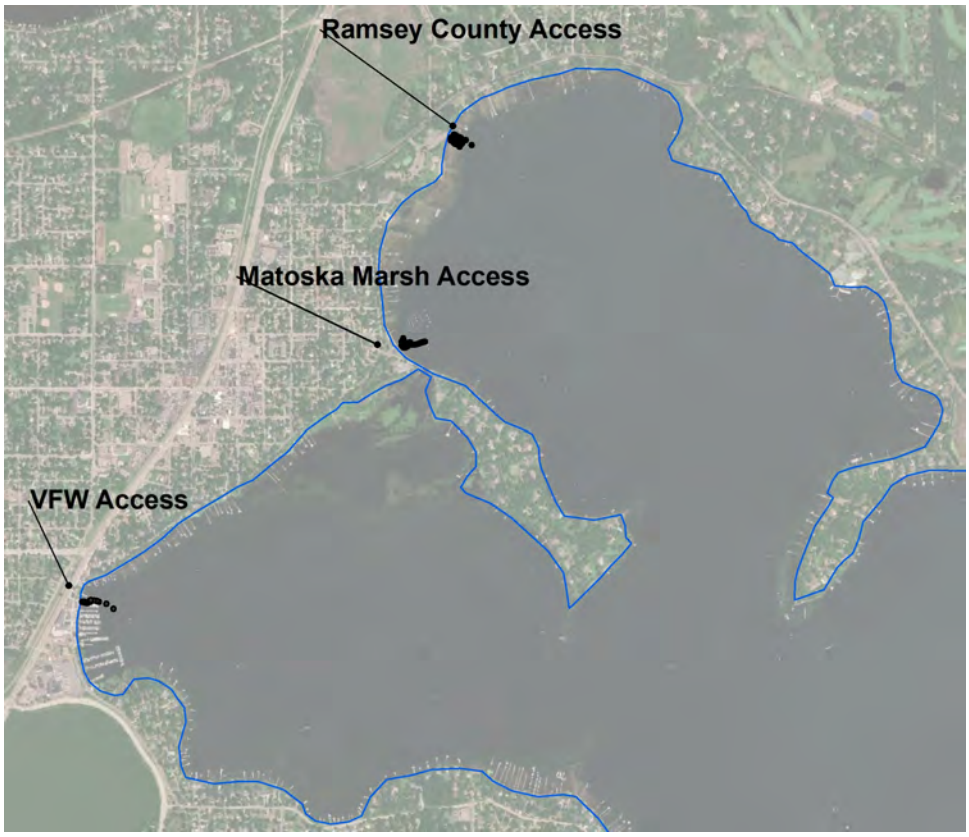


Figure 6. Zebra mussel distribution on aquatic plants was recorded during the point intercept survey that was conducted on August 9 and 10, 2023.

White Bear Lake Aquatic Invasive Species Check for Starry Stonewort on August 10, 2023

Three accesses were searched for aquatic invasive species including starry stonewort (Figure 7). No new species were observed on August 10, 2023.



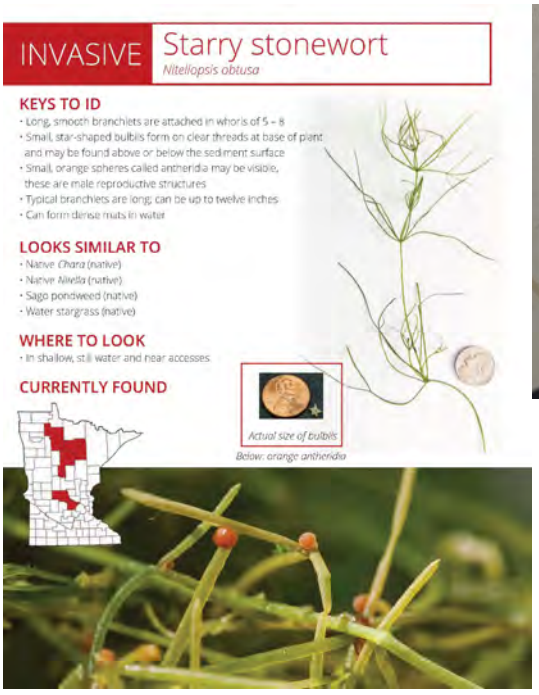


Figure 7. [top] Locations around White Bear Lake that were searched for new aquatic invasive species on August 10, 2023.
[bottom-left] MAISRC starry stonewort id page.
[bottom-right] A native plant found in White Bear Lake that looks a lot like starry stonewort.

White Bear Lake Water Quality Summary

White Bear Lake Water Quality from 2005-2022: A summary of seasonal water quality averages from 4 sample sites from 2005-2022 is shown in Table 2. Transparency has ranged from 3 to 6 meters at most of the sites from 2005-2022. Chlorophyll has ranged from 3 to 6 ug/l over the same period. Total phosphorus appears to have increased starting in 2010 but has decreased slightly in the last few years. Water clarity has been changing in the last few years. Zebra mussels were first confirmed in 2014 and clarity improved for 4 years from 2017 through 2020 and has declined in 2021 and 2022. Its possible zebra mussels have peaked and are declining in White Bear Lake (Figure 8).

Table 2. Water quality data for 4 sites around White Bear Lake from 2005 through 2020 (June - September averages)(Source: Ramsey County). Data for 2021 and 2022 are from MnDNR LakeFinder for sample site 234.

	Secchi disc (m)	Total phosphorus (ug/l)	Chlorophyll a (ug/l)
	AVERAGE	AVERAGE	AVERAGE
2005	4.7	11	3.1
2006	4	15	6.2
2007	3.3	13	6.4
2008	3.7	15	4.8
2009	3.7	14	3.3
2010	3.6	22	4.4
2011	3.1	21	5.4
2012	2.9	22	5.5
2013	3.7	18	5
2014	3.2	19	4.3
2015	3.0	18	5.3
2016	3.8	13	3.1
2017	5.8	16	2.5
2018	6.7	19	3.5
2019	6.3	15	3
2020	6.8	16	3.5
2021	5.5	20	1.9
2022	4.4	17	3.7

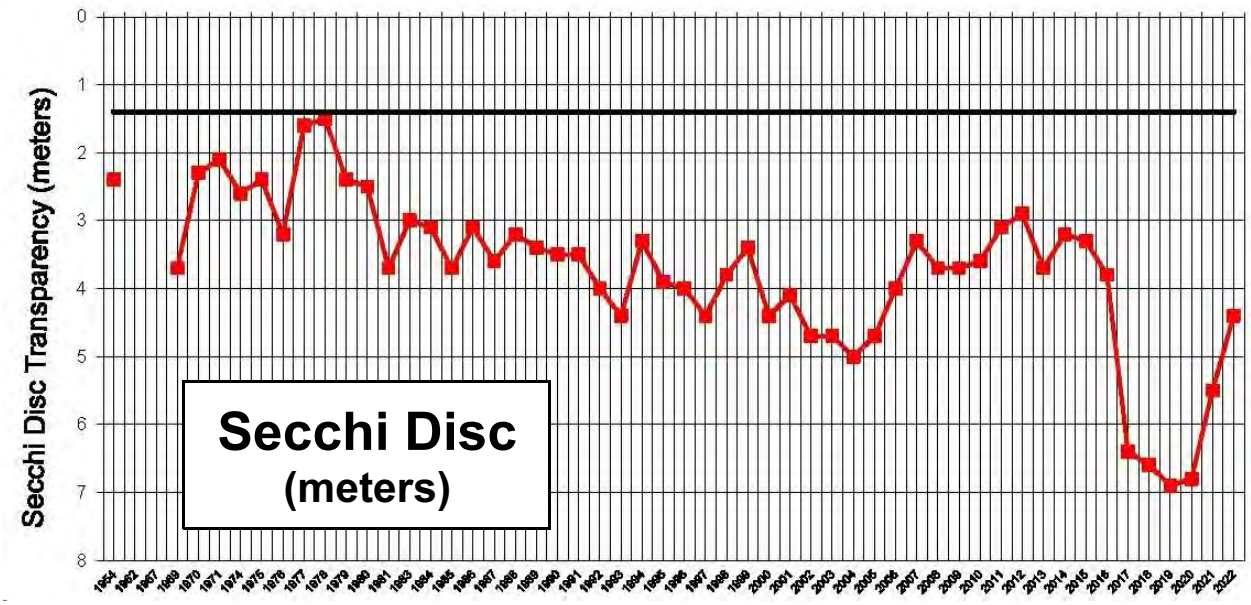


Figure 8. Secchi disc summer averages (from May-September, unless data are lacking) for White Bear Lake (2005-2018 data are from Ramsey County). Data for 2021 and 2022 are from LakeFinder for sample site 234.

White Bear Lake Lake Levels in 1999, 2012, 2019, 2021, 2022, And 2023

(***View: looking down the shoreline from the Ramsey Co Public Access toward the swimming beach***)

August 7, 1999
Lake Level: 924.9

August 17, 2012
Lake Level: 920.3

August 7, 2019
Lake Level: 924.9

July 1, 2021
Lake Level: 924.2

August 22, 2022
Lake Level: 923.26

August 9, 2023
Lake Level: 922.15

White Bear Lake Levels from 1913 - 2023

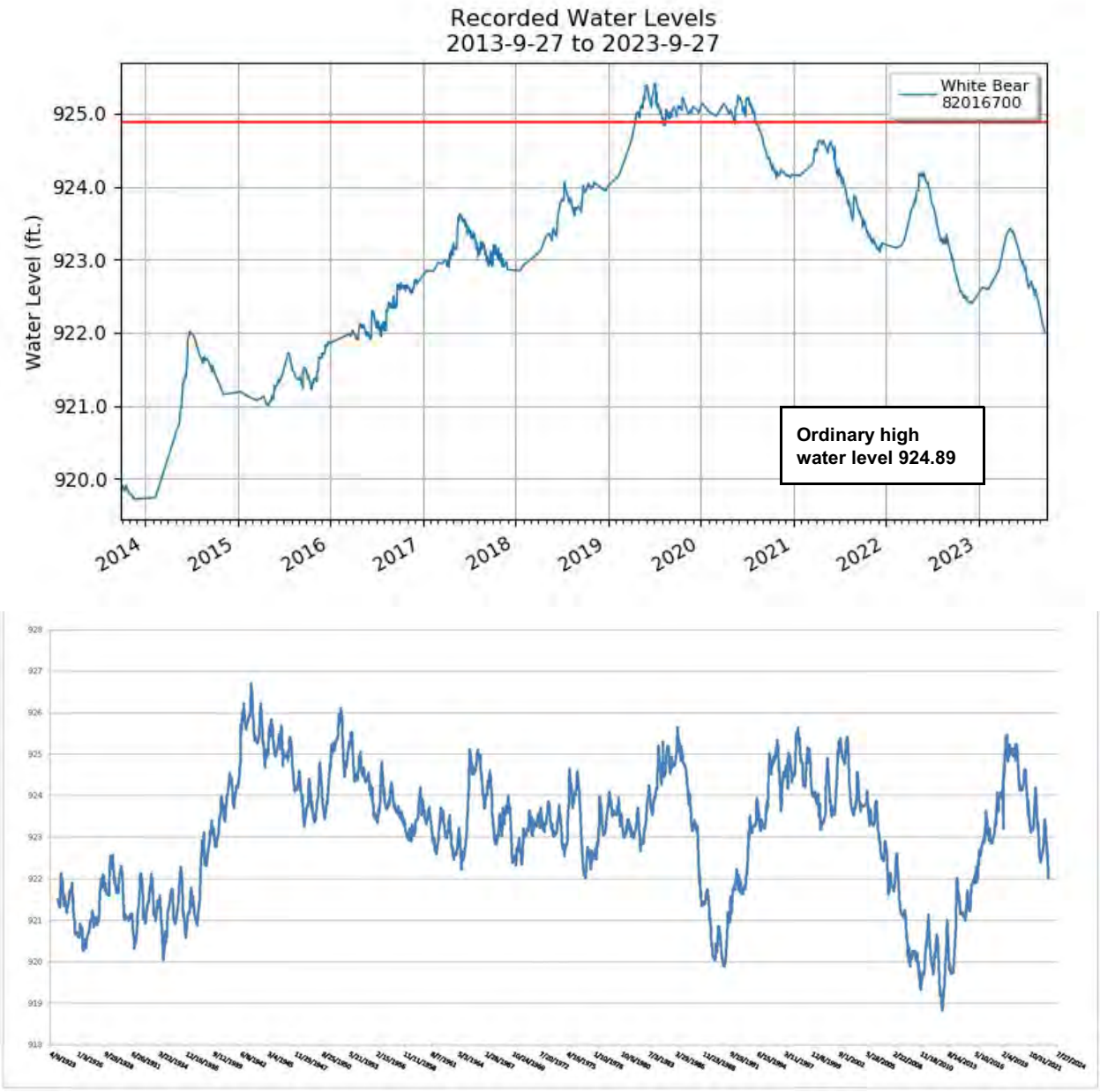


Figure 9. Lake levels for White Bear Lake.

Additional Information on the Eurasian Watermilfoil Management Program for White Bear Lake, Washington County, Minnesota, 2023

White Bear Lake, Washington County (ID: 82-0167)
Lake Area: 2,428 acres (MnDNR)
Littoral Area: 1,314 acres (MnDNR)
Maximum depth: 83 ft (MnDNR)

Project Setting

White Bear Lake has a variety of native and non-native aquatic plants. The objectives of the 2023. aquatic plant delineation and assessment were to delineate treatment areas of Eurasian watermilfoil and then assess treatment effectiveness in the 47.67 acres that were treated with the trichlopyr herbicide.

Figure 10. USGS map of White Bear Lake, Washington County, Minnesota.

Methods

Eurasian Watermilfoil Delineation and Assessment: Eurasian watermilfoil delineations were conducted by Blue Water Science with the assistance of Mike Parenteau on June 27, 2023. The delineations involved cruising around the entire lake and observing milfoil growth and sampling aquatic plants with rakes. A total of 538 sample sites were checked. Areas to be treated were selected based on the growth status of milfoil in late June, the known previous occurrence of milfoil and the importance for navigation and/or recreation in the area.

An herbicide application was conducted by Lake Management Inc and a total of 47.67 acres were treated.

A follow-up Eurasian watermilfoil assessment was conducted by Steve McComas, Blue Water Science, on August 9 and 10, 2023 to evaluate the effectiveness of the herbicide treatment for Eurasian watermilfoil control. A total of 169 sites were checked on the August 9 and 10, 2023 assessment. EWM density ratings used in the July delineation and August assessment are shown in the chart below.

Chart of EWM Density Ratings for EWM

Figure 11. Eurasian watermilfoil rake density ratings from 1 to 3. Native plants used the same rake fullness rating as well.

Eurasian Watermilfoil Treatment Maps for 2010 - 2023

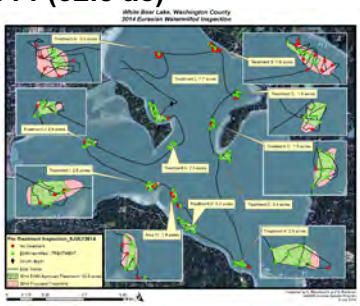
2010 (174 ac)

2011 (41.6 ac)

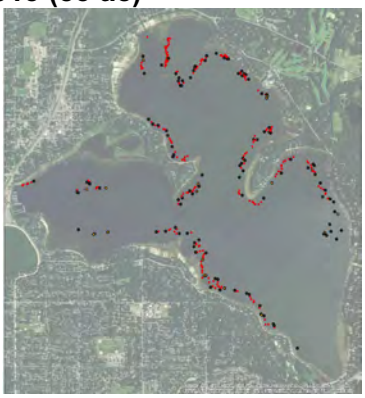
2012 (144 ac)

2013 (100 ac)

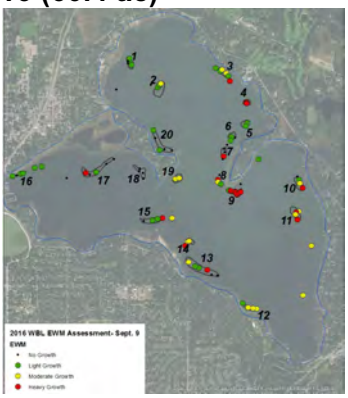
2014 (32.8 ac)



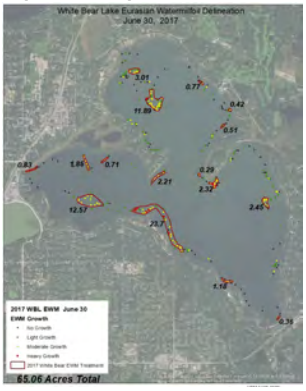
2015 (85 ac)



2016 (60.4 ac)



2017 (65.1 ac)



2018 (69.9 ac)

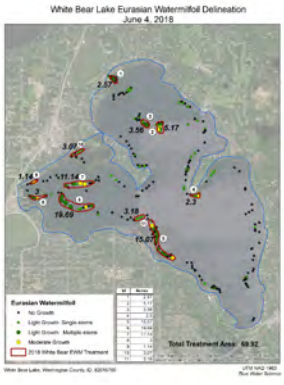
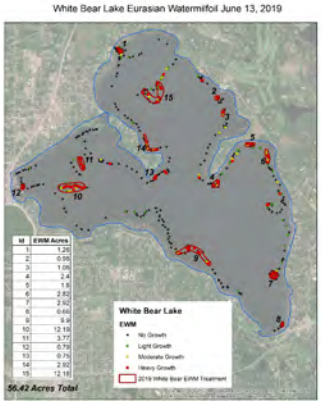
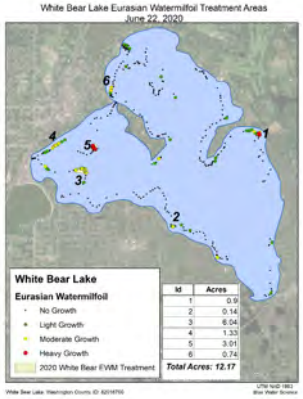


Figure 12. Acres of treated EWM for 2010-2023.

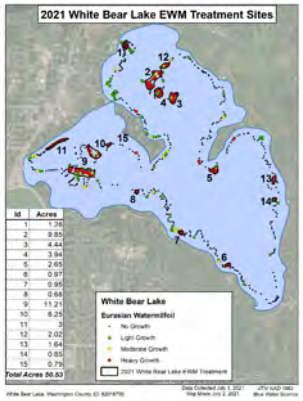
2019 (56.42 ac)



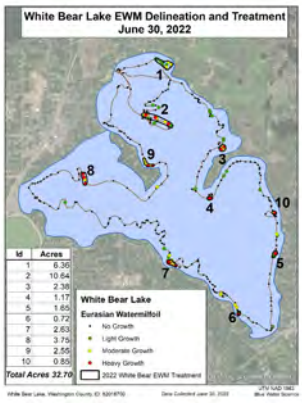
2020 (12.17 ac)



2021 (52.53)



2022 (32.70 ac)



2023 (47.67 ac)

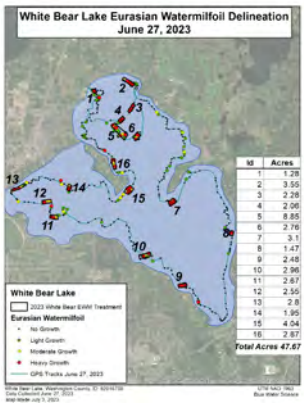


Figure 12 - concluded. Acres of treated EWM for 2010-2023.

Potential Future Growth of Eurasian Watermilfoil in White Bear Lake Based on Lake Sediment Characteristics

Eurasian Watermilfoil Growth Potential in White Bear Lake: Eurasian watermilfoil has been in White Bear Lake since 1988. Lake sediment sampling results from 1998, 2009, and 2010 have been used to predict lake bottom areas that have the potential to support light, moderate, or heavy Eurasian watermilfoil growth in the future. Based on the key sediment parameters of NH_4 and organic matter (McComas, unpublished), a table and map were prepared that predict what type of milfoil growth could be expected (Table 3 and Figure 13).

The sediment nitrogen conditions in White Bear Lake range from low to moderate concentrations with high nitrogen levels found at 3 sites. Sediments over 10 ppm of nitrogen are candidates for heavy milfoil growth. It has also been found that Eurasian watermilfoil does not grow well in sediments with over 20% organic matter. Site 6, sampled in 2009, and Sites 13 and 14, sampled in 2010 have high organic matter and are not predicted to support heavy milfoil growth even though nitrogen is high. Eurasian watermilfoil may grow widely through the littoral area in White Bear Lake but it is predicted that it will not sustain extensive perennial nuisance matting conditions (which are defined as heavy growth conditions) on a long-term basis.

Table 3. White Bear Lake sediment data and ratings for potential heavy EWM growth.

			NH_4 Conc (ppm)	Organic Matter (%)	Potential for Heavy EWM Growth
Site	Depth		<10	<0.6 or >20	Light (green) to Moderate (yellow)
	1998	2009/ 2010	>10	>0.6 or <20	Heavy (red)
1998 Data					
1	4	0	0.8	0.6	Light
2	5	1	0.9	0.7	Moderate
3	6	2	0.7	0.4	Light
4	6	2	0.6	0.5	Low
5	5	1	0.9	0.6	Light
6	5	1	0.6	0.7	Moderate
7	7	3	0.6	0.8	Moderate
8	7	3	0.9	0.8	Moderate
9	7	3	0.8	0.5	Low
10	7	3	0.5	0.5	Low
11	7	3	0.6	0.5	Low
12	6	2	4.2	2.7	Moderate
13	6	2	1.2	0.6	Light
14	4	0	1.1	1.5	Moderate
15	2	0	0.8	0.6	Light
16	4	0	1.3	0.7	Light
17	4	0	1.2	1.3	Moderate
18	5	1	4.4	11.6	Moderate
19	5	1	0.7	1.9	Moderate
20	5	1	5.2	10.8	Moderate
21	6	2	0.2	0.5	Low
22	6	2	48.1	8.7	Heavy
23	5	1	2.7	2.1	Moderate
24	7	3	2.3	2.7	Moderate
25	4	0	1.0	0.6	Light

			NH_4 Conc (ppm)	Organic Matter (%)	Potential for Heavy EWM Growth
Site	Depth		<10	<0.6 or >20	Light (green) to Moderate (yellow)
	1998	2009/ 2010	>10	>0.6 or <20	Heavy (red)
2009 Data					
1	14	10	3.6	0.8	Moderate
2	14	10	3.2	0.9	Moderate
3	14	10	3.1	1.5	Moderate
4	14	10	2.8	1.9	Moderate
5	14	10	5.7	0.7	Moderate
6	13	9	10.1	30.5	Moderate
7	14	10	3.0	0.9	Moderate
2010 Data					
8	14	8.5	3.1	0.9	Moderate
9	14	9.5	3.5	2.0	Moderate
10	14	10	4.3	0.7	Moderate
11	14	11	5.4	0.8	Moderate
12	14	11	8.5	7.1	Moderate
13	13	12	7.2	24.6	Light
14	14	12	10.0	31.9	Light

White Bear Lake Eurasian Watermilfoil Growth Potential Based on Lake Sediments

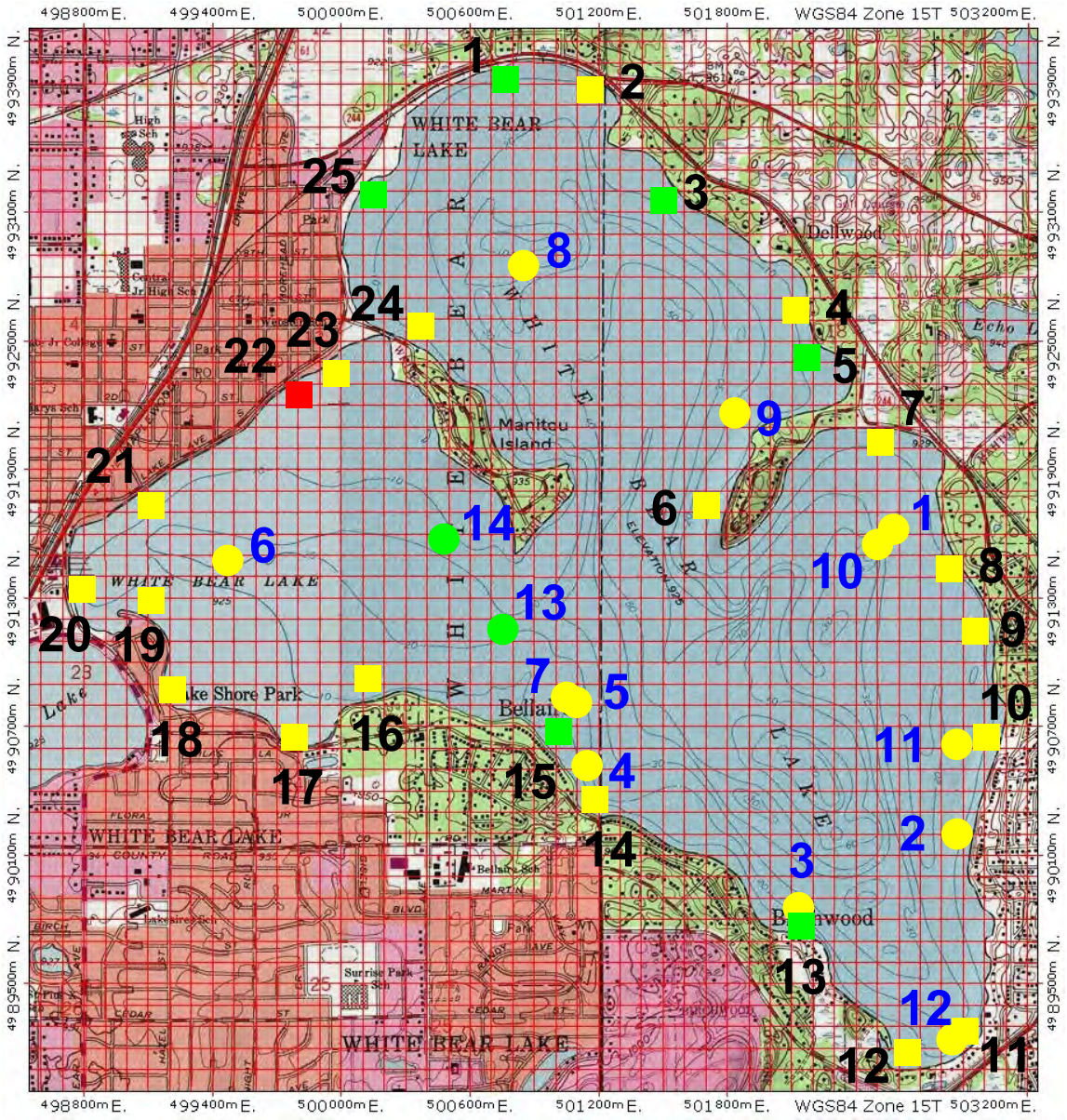


Figure 13. Sediment sample locations are shown with squares (1998 data) and circles (2009 and 2010 data). The color indicates the potential for heavy Eurasian watermilfoil to occur at that site. Key: green = low; yellow = medium; red = high potential.