



Sailing Class in Session on White Bear Lake, June 13, 2019

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## Eurasian Watermilfoil Management Program and Water Quality Summary for White Bear Lake, Washington County, Minnesota, 2019

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**EWM Delineation Conducted on June 13, 2019**

2019 EWM Treatment: July 2, 2019, 56.42 acres

**EWM Assessment Conducted on August 7, 2019**

No Starry Stonewort Observed (August 7, 2019)

Prepared for:  
White Bear Lake  
Conservation District



Prepared by:  
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November 2019

# Eurasian Watermilfoil Management Program and Water Quality Summary for White Bear Lake, Washington County, Minnesota, 2019

## Summary

White Bear Lake (MnDNR ID: 82-0167) is a 2,428 acre lake located in Washington County, Minnesota. An Eurasian watermilfoil delineation was conducted by Blue Water Science on June 13, 2019 (Figure 1). Milfoil was widely distributed in June, ranging from light to heavy growth. 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 56.42 acres. A follow-up Eurasian watermilfoil assessment was conducted on August 7, 2019 to evaluate the status of Eurasian watermilfoil in the treated areas as well as other areas around the lake. The herbicide treatment was generally successful from the perspective that only a few acres of Eurasian watermilfoil had light growth based on the assessment survey. No heavy growth or surface matted conditions were observed.

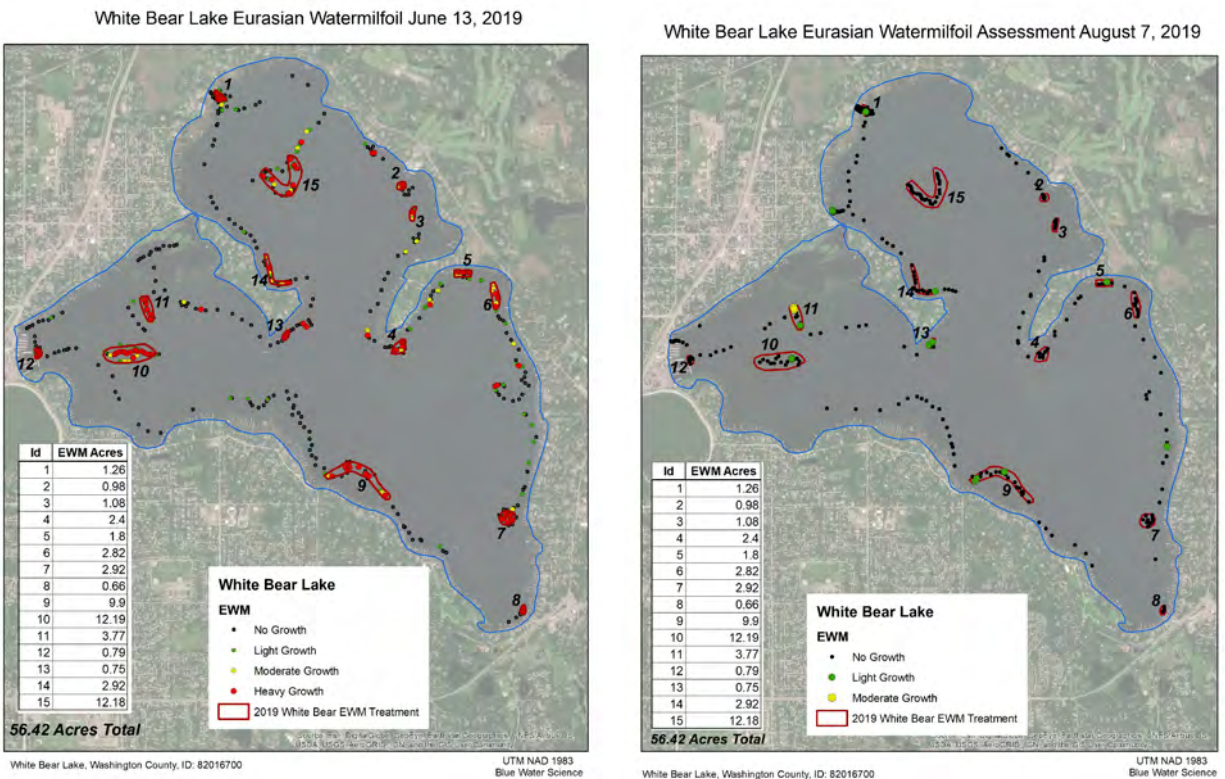
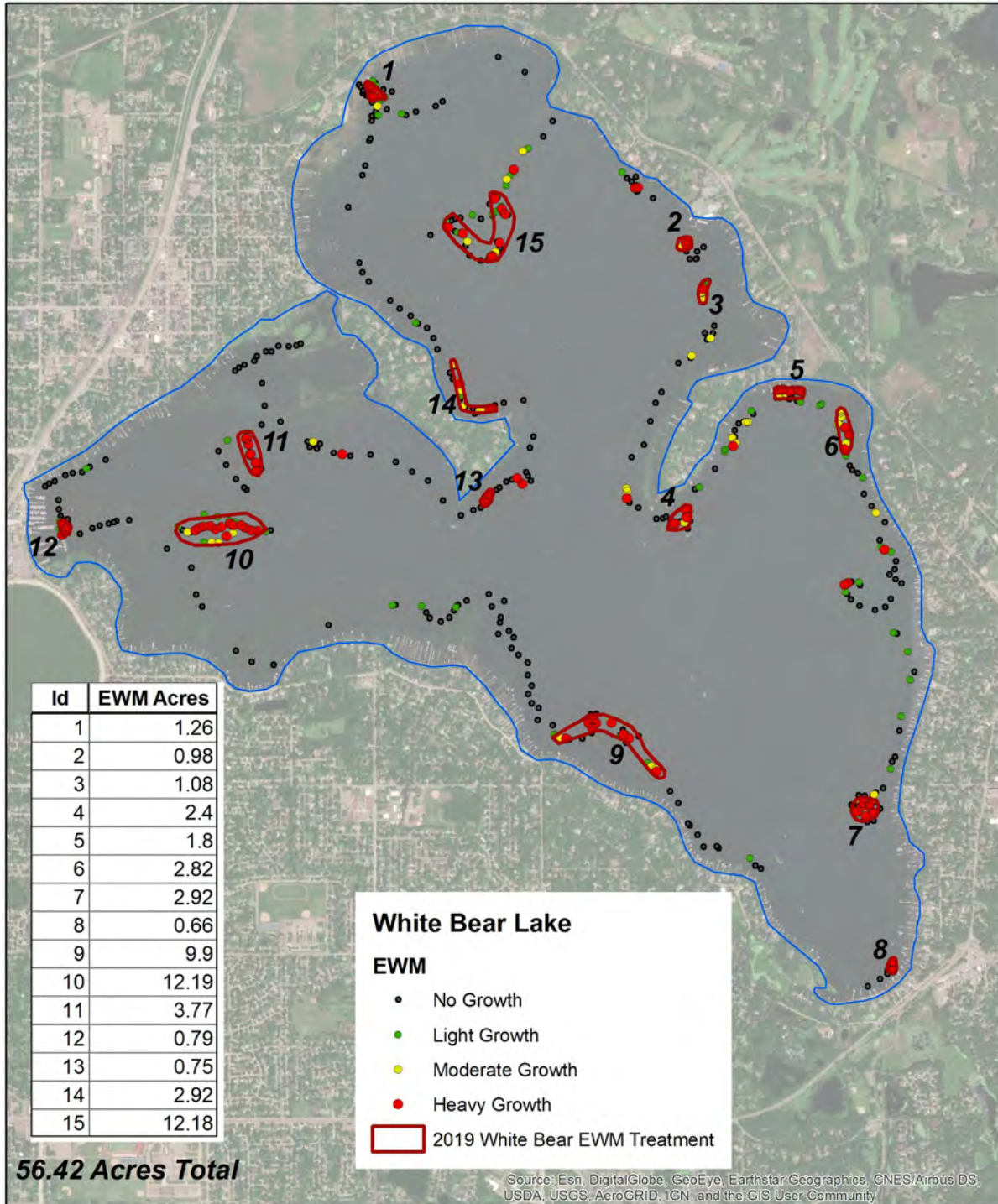


Figure 1. [left] EWM delineation with treatment polygons for June 13, 2019. [right] EWM assessment on August 7, 2019 found mostly light to moderate EWM growth (shown with green dots = light growth, yellow dots = moderate growth, red dots = heavy growth, and black dots = no EWM growth) in the 56.42 acres treated in 2019.

# EWM Delineation on June 13, 2019

## White Bear Lake Eurasian Watermilfoil June 13, 2019



White Bear Lake, Washington County, ID: 82016700

UTM NAD 1983  
Blue Water Science

Figure 2. EWM delineation map with treatment polygons for June 13, 2019.

Key: green dots = light growth, yellow dots = moderate growth, red dots = heavy growth, and black dots = no EWM growth.

## EWM Assessment on August 7, 2019

A total of 56.42 acres were treated and all 15 treatment areas were evaluated (Table 1). EWM control by either 2,4-D or Depth Charge was mostly good to excellent (Table 1 and Figure 4).

**Table 1. Summary of herbicide treatment results for 15 areas totaling 56.42 acres for White Bear Lake in 2019. Density ratings are on a scale from 1 to 3 with 3 the heaviest. Herbicide used was either Depth Charge or 2,4-D at full strength based on label directions.**

Herbicide	Treatment Areas	Acres	Delineation (6.13.19)			Assessment (8.7.19)			EWM Control Results
			% EWM (occurrence within treatment area)		Average EWM Density	% EWM (occurrence within treatment area)		Average EWM Density	
2,4-D	1	1.26	82%	9/11	1.7	6%	1/17	0.1	Good
2,4-D	2	0.98	100%	3/3	2.7	0%	0/6	0	Excellent
2,4-D	3	1.08	83%	5/6	1.5	0%	0/7	0	Excellent
2,4-D	4	2.4	83%	5/6	2.3	0%	0/8	0	Excellent
2,4-D	5	1.8	91%	10/11	2.4	14%	1/7	0.1	Good
2,4-D	6	2.82	100%	11/11	2.0	0%	0/12	0	Excellent
2,4-D	7	2.92	93%	13/14	2.2	0%	0/12	0	Excellent
Depth Charge*	8	0.66	100%	3/3	1.5	0%	0/4	0	Excellent
Depth Charge*	9	9.9	85%	17/20	2.0	14%	3/21	0.1	Good
Depth Charge*	10	12.19	92%	24/26	2.1	10%	2/20	0.1	Good
Depth Charge*	11	3.77	88%	7/8	2.6	30%	3/10	0.5	Fair
Depth Charge*	12	0.79	100%	7/7	2.7	0%	0/8	0	Excellent
Depth Charge*	13	0.75	100%	3/3	3.0	29%	2/7	0.3	Fair
2,4-D	14	2.92	71%	10/14	1.6	6%	1/17	0.1	Good
2,4-D	15	12.18	62%	16/26	1.3	0%	0/30	0	Excellent
	<b>TOTAL</b>	<b>56.4</b>	<b>85%</b>	<b>143/169</b>	<b>2.1</b>	<b>8%</b>	<b>14/186</b>	<b>0.1</b>	

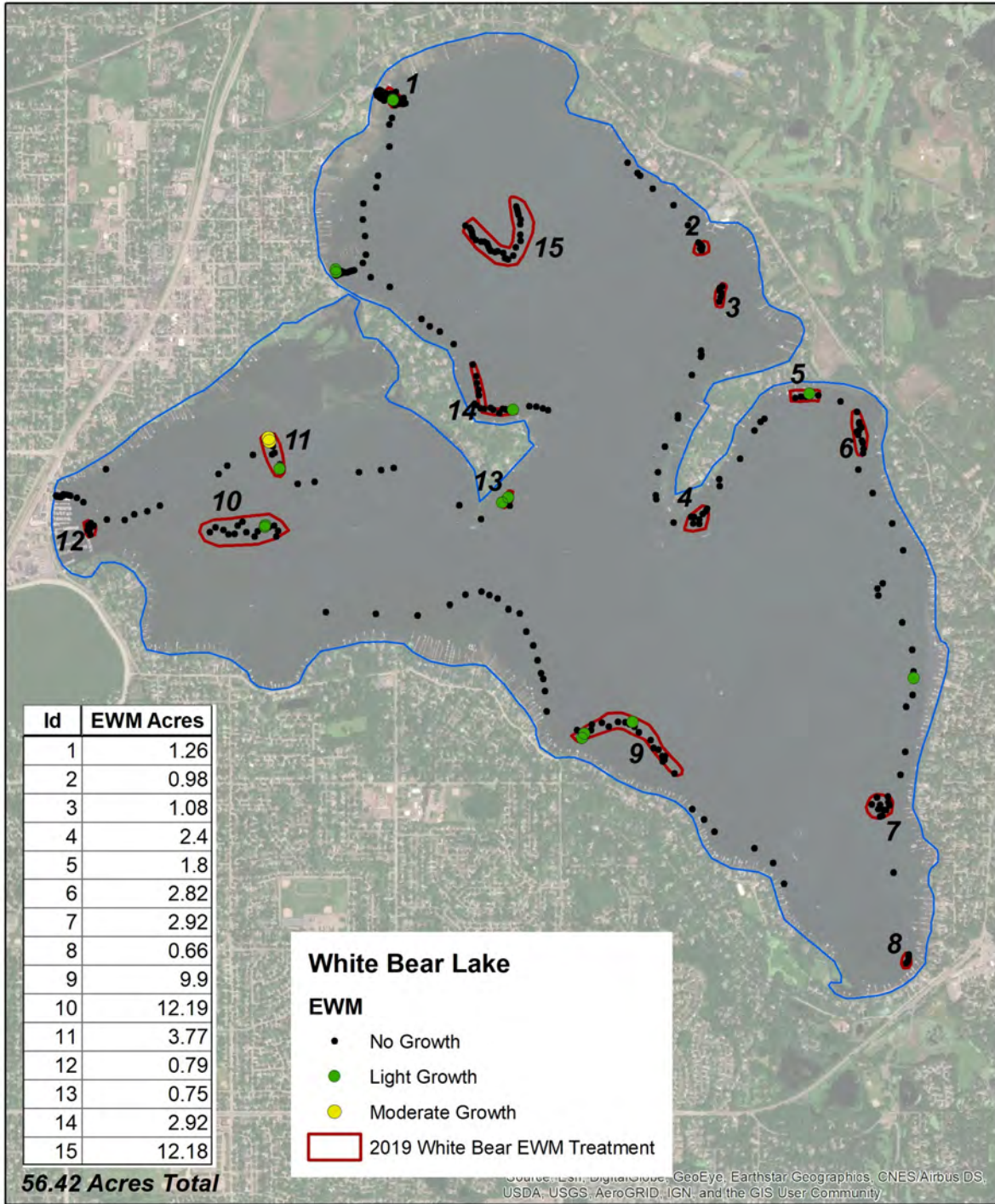
\*Depth Charge herbicide that is a combination of 2,4-D and flumioxazin at 2.0 ppm



**Figure 3. [left] Mike Parenteau, White Bear Lake resident, helped with a survey in 2019. [right] Aquatic plants sampled on August 7, 2019.**

# EWM Assessment on August 7, 2019

## White Bear Lake Eurasian Watermilfoil Assessment August 7, 2019



White Bear Lake, Washington County, ID: 82016700

UTM NAD 1983  
Blue Water Science

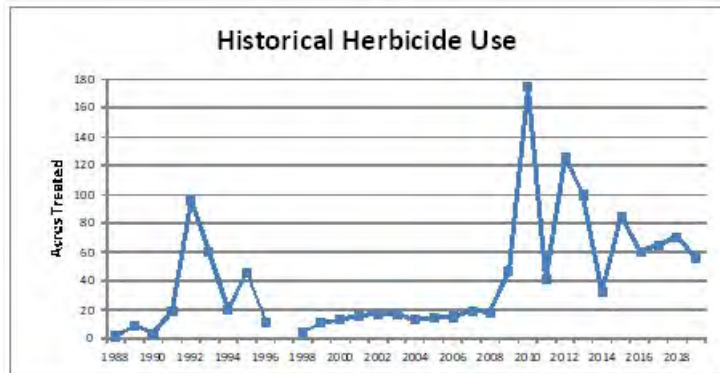
Figure 4. The August 7, 2019 EWM assessment found mostly light to moderate EWM growth (shown with green dots = light growth, yellow dots = moderate growth, red dots = heavy growth, and black dots = no EWM growth) in the 56.42 acres treated in 2019.

# Eurasian Watermilfoil Treatments from 1988-2019

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 2. 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). Since 2009, Eurasian watermilfoil has been more abundant and is reflected in an increase in treatment acreages. A graph of treatment areas from 1988 through 2019 is shown in Figure 5.

**Table 2. 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		



**Figure 5. Historical herbicide use in White Bear Lake from 1988 to 2019.**

# Overlay of Treatment Areas Showing Persistent EWM Growth from 2010 to 2019

White Bear Lake  
EWM Treatments 2012-2019

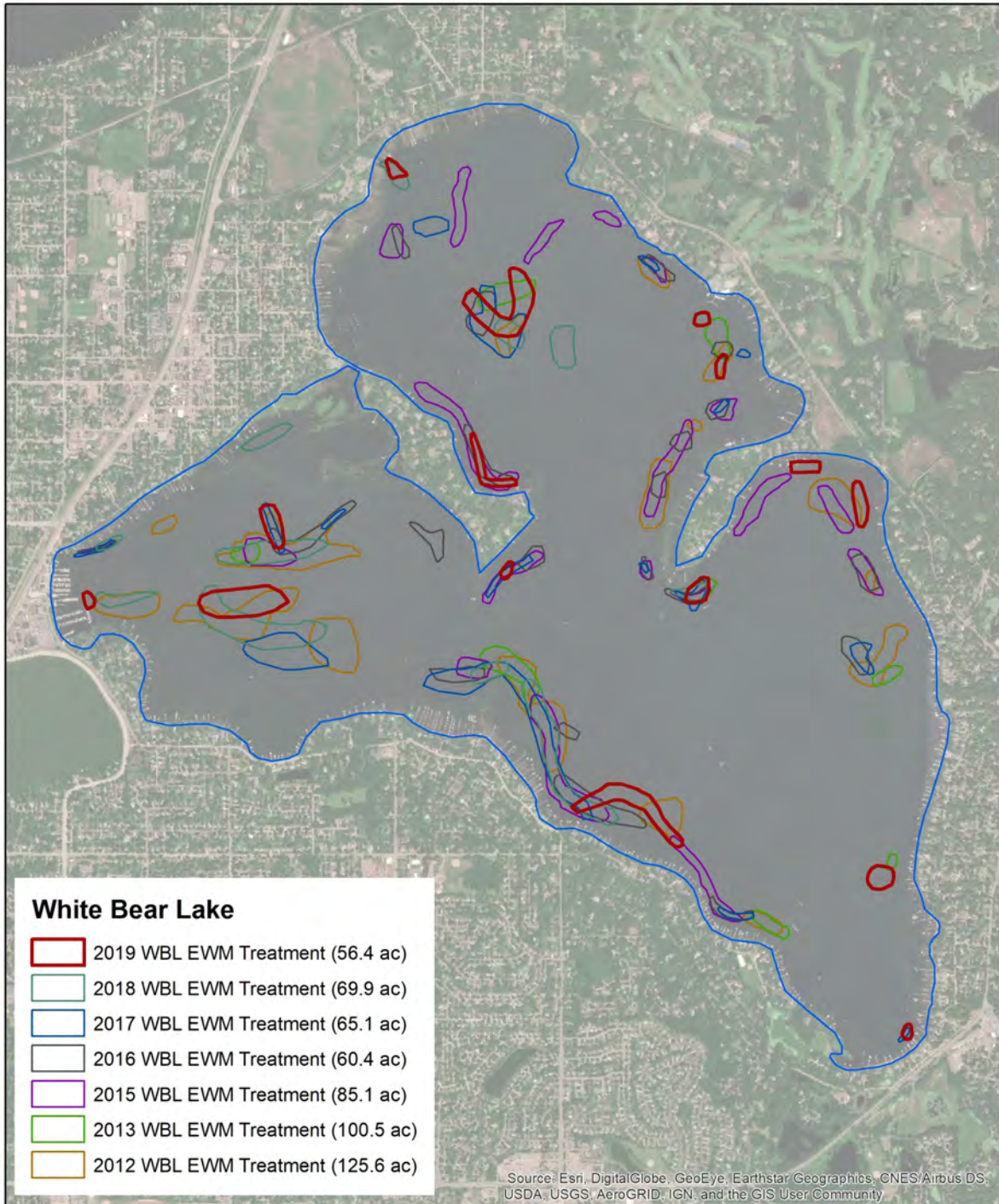


Figure 6. Overlay of treatment polygons from 2012-2019.

# Overlay of 2019 Treatment Areas Compared to the EWM Hotspots

White Bear Lake  
2019 EWM Treatment vs Hot Spot Areas

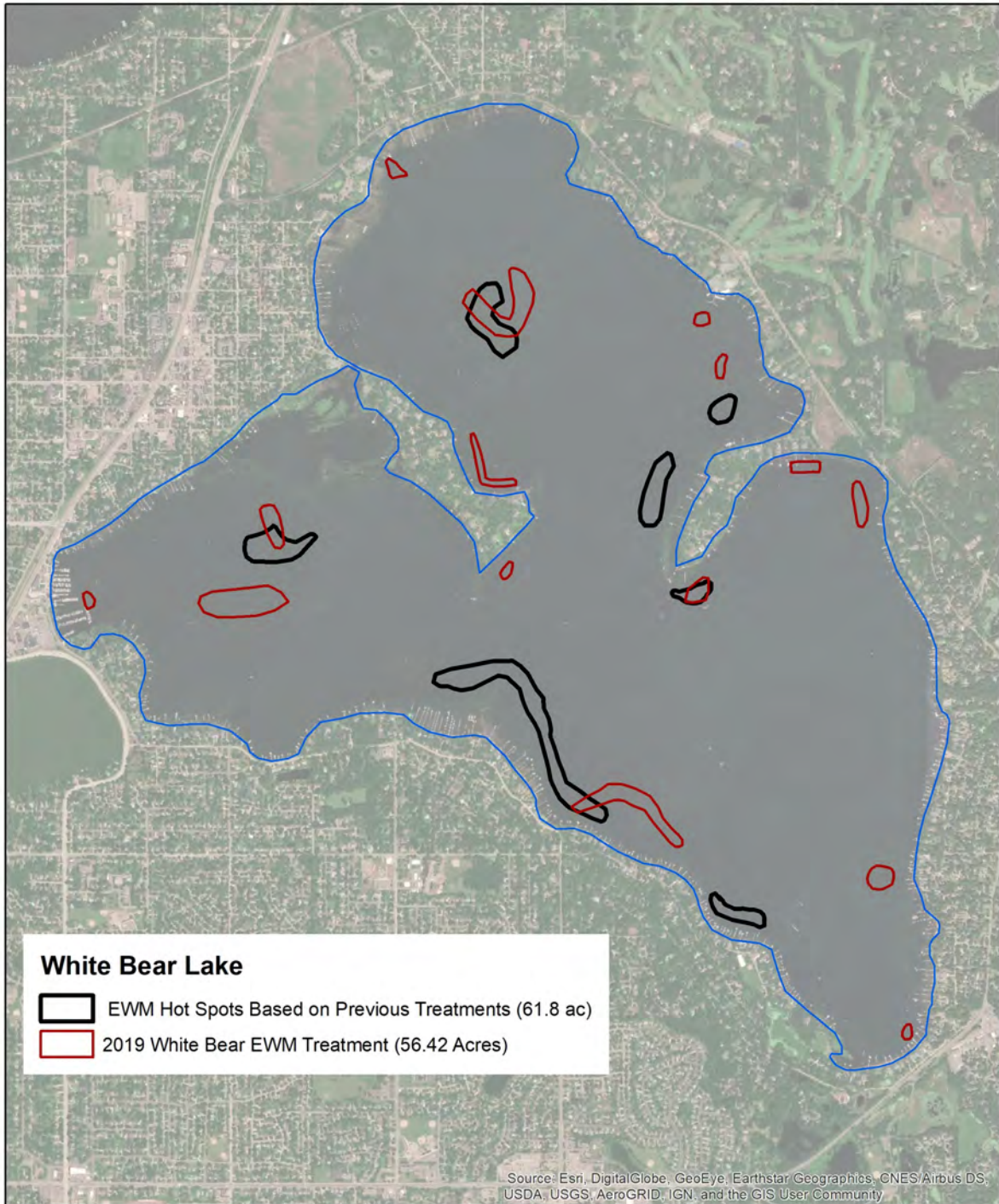


Figure 7. Overlay of 2019 treatment polygons and the treatment hotspots from 2012-2019.



# White Bear Lake Proposed 2020 EWM Treatment Based on Treatments from Previous Years

For EWM control in 2020 it is proposed to treat the persistent heavy growth areas early and then delineate the lake again in June to determine if additional areas of EWM treatment are needed.

Areas of persistent growth and potential treatment are shown in Figure 8. These areas have been treated at least 4 out of the last 7 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 would be a EWM assessment in August or September to assess EWM control.

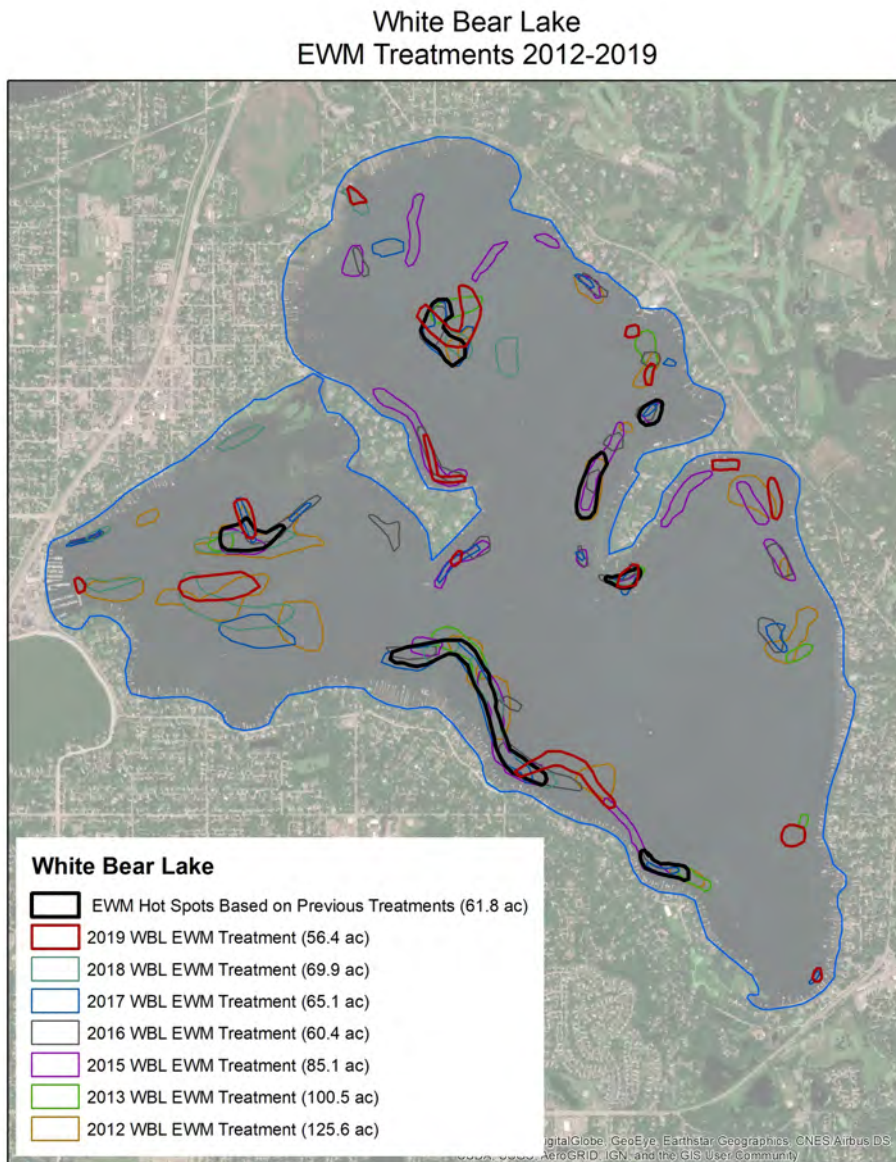


Figure 8. Proposed 2020 EWM treatment.

# White Bear Lake Water Quality Summary

**White Bear Lake Water Clarity and Lake Levels Through 2018:** Secchi disc readings for 1969 through 2018 are shown in Figure 9. From 2007 through 2016, water clarity was not as good compared to the period of 2000 through 2006. Lake water levels have fluctuated over the years (Figure 10).

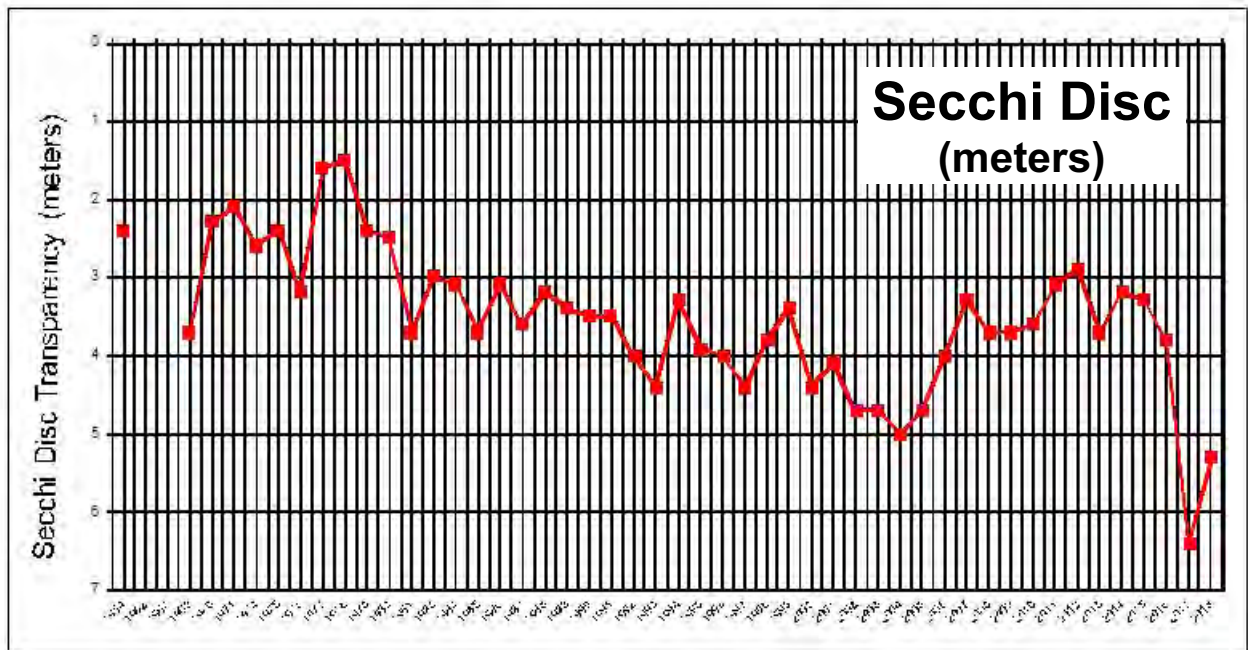


Figure 9. Secchi disc summer averages (from May-September, unless data are lacking) for White Bear Lake (2005-2018 data are from Ramsey County).

## White Bear Lake levels from 1924 - 2019

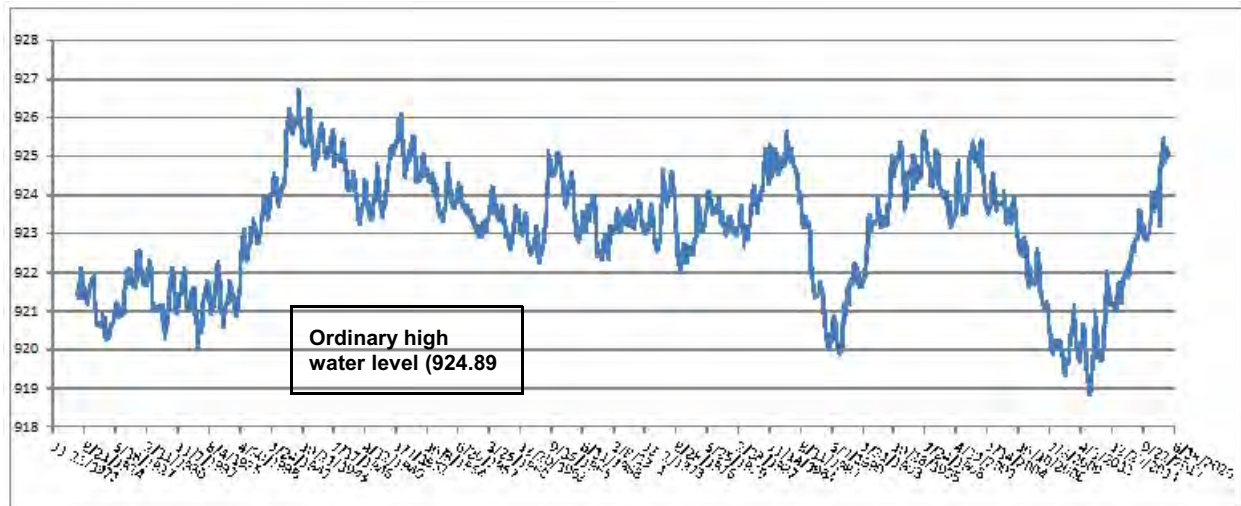


Figure 10. Lake levels for White Bear Lake.

# White Bear Lake: Lake Levels in 1999, 2012, and 2019

*(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**

# White Bear Lake Aquatic Invasive Species Check for Starry Stonewort on August 7, 2019

Three accesses were searched for aquatic invasive species including starry stonewort (Figure 11). No new species were observed on August 7, 2019.



**INVASIVE** Starry stonewort  
*Nitellopsis obtusa*

**KEYS TO ID**

- Long, smooth branchlets are attached in whorls of 5 – 8
- Small, star-shaped bulks form on clear threads at base of plant and may be found above or below the sediment surface
- Small, orange spheres called antheridia may be visible, these are male reproductive structures
- Typical branchlets are long; can be up to twelve inches
- Can form dense mats in water

**LOOKS SIMILAR TO**

- Native Chara (native)
- Native Alivella (native)
- Sago pondweed (native)
- Water stargrass (native)

**WHERE TO LOOK**

- In shallow, still water and near accesses.

**CURRENTLY FOUND**

Actual size of stonewort  
Below: orange antheridia



Figure 11. [top] Locations around White Bear Lake that were searched for new aquatic invasive species on August 7, 2019. [bottom-left] MAISRC starry stonewort id page. [bottom-right] A native plant found in White Bear Lake that looks a lot like starry stonewort.

# Additional Information on the Eurasian Watermilfoil Management Program for White Bear Lake, Washington County, Minnesota, 2019

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 2019 aquatic plant delineation and assessment were to delineate treatment areas of Eurasian watermilfoil and then assess treatment effectiveness in the 56.42 acres that were treated with herbicides.

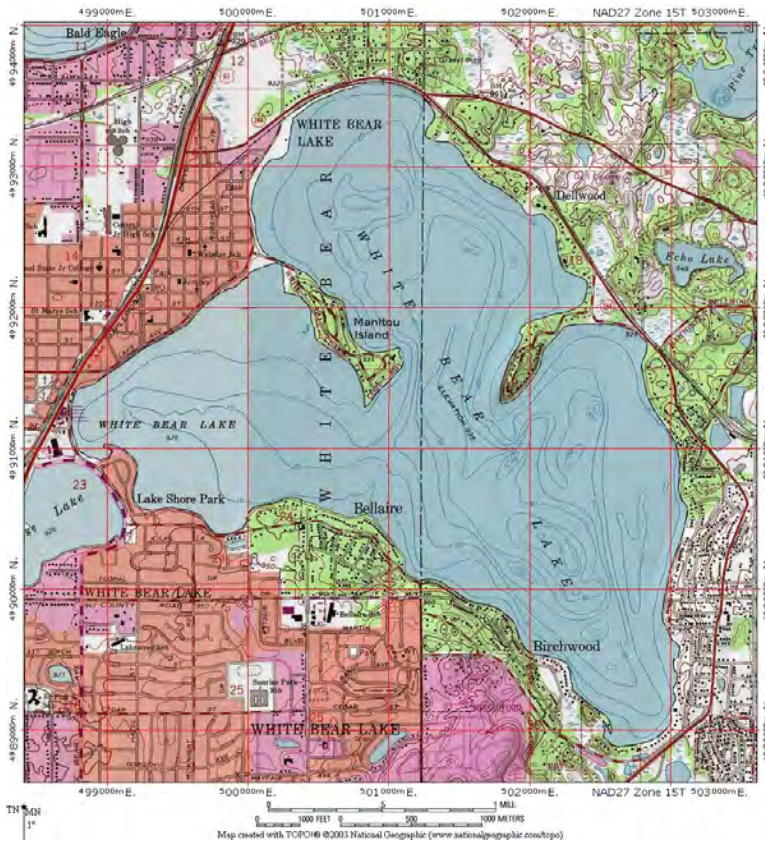


Figure 12. USGS map of White Bear Lake, Washington County, Minnesota.

# Methods

**Eurasian Watermilfoil Delineation and Assessment:** Eurasian watermilfoil delineations were conducted by Blue Water Science with the assistance of Mike Parenteau on June 13, 2019. The delineations involved cruising around the entire lake and observing milfoil growth and sampling aquatic plants with rakes. A total of 512 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 56.42 acres were treated.

A follow-up Eurasian watermilfoil assessment was conducted by Steve McComas, Blue Water Science, on August 7, 2019 to evaluate the effectiveness of the herbicide treatment for Eurasian watermilfoil control. A total of 173 sites were checked on the August 7, 2019 assessment. EWM density ratings used in the June delineation and August assessment are shown in the chart below.

## Chart of EWM Density Ratings for EWM



Figure 13. Eurasian watermilfoil rake density ratings from 1 to 3. Native plants used the same rake fullness rating as well.

# Results - June 13, 2019 EWM Delineation

White Bear Lake Eurasian Watermilfoil June 13, 2019

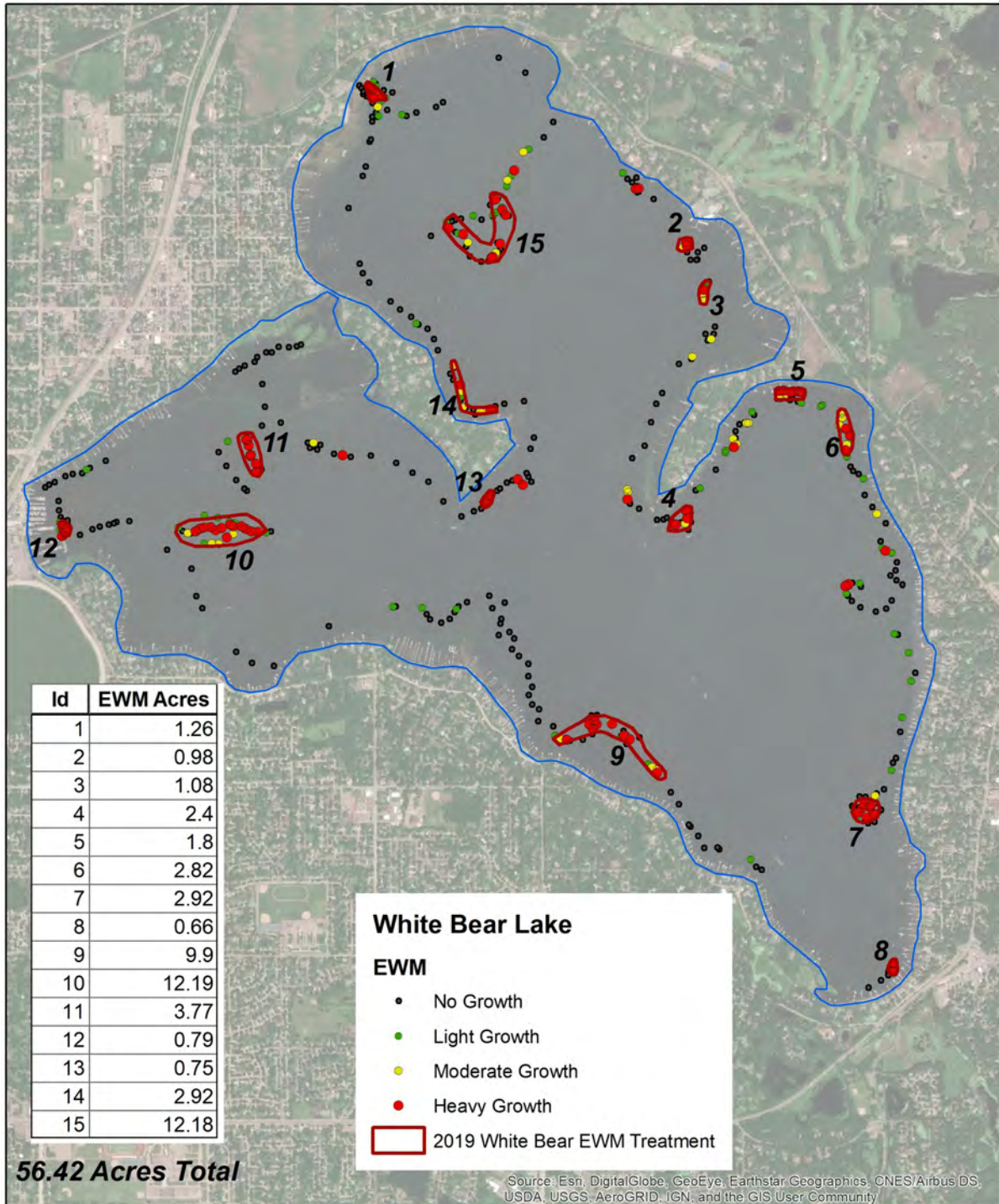


Figure 14. June 13, 2019 delineation map. Fifteen areas were delineated for treatment in 2019.

# EWM and Native Plant Results for Individual Sample Sites

Table 3. EWM delineation on June 4, 2018.

WayPoints	Depth (ft)	EWM	CLP
1			
2			
3			
4			
5			
6	5		2
7	5	1	
8	9	1	
9	9	1	
12	11	1	
13	12	2	
17	12	1	
18	12		1
19	12	1	
20	11	1	
29	13	1	
30	11	2	
31	11	3	
32	11	1	
33	11	2	
34	11	1	
35	11	1	
36	12	3	
39	16	1	
40	20		
41	14	1	
45	12	1	
47	12	3	
49	11	1	
50	12	3	
51	12	2	
56	12	3	
57	11	3	
58	12	2	
60	13		
61	12	3	
65	12	1	
67	12	3	
70	12	3	
71	11	1	
72	11		
73		1	
75			
76	2		
77	13	3	
78	3	3	
79			
91	15	3	
92	12	3	
93		2	
94	12	2	
95		2	
96		3	
97		1	
98		1	
102	12	2	
105	11	2	
113	13	2	
114	14	2	
115		3	
123		3	
124		3	
125			
126		2	
127			
128			
129			
130			
131	10	3	
134	10	3	
136	15	1	
138	14	1	
139		1	
140	14	3	
141	15	2	
143	15	2	
148	16	2	
149	14	2	
151	14	1	
154	7	3	
155	7	3	
156	7	2	
157	7	3	
158	8	3	
159	9	2	
160		2	

WayPoints	Depth (ft)	EWM	CLP
161		2	
162	6	3	
163	6	3	
165	11		
167	11	1	
168	9	1	
169	10	1	
170	8	2	
171		2	
172		2	
173		1	
174		2	
175	10	1	
176	10	3	
177	10	2	
178	10	3	
179		1	
180	10	2	
181	11	3	
182	11	1	
183	11	1	
187	10	1	
190		2	
193	13	1	
194	12	3	
195	12	1	
203	12		
207	13	1	
208	13	3	
209	13	3	
210	13		
211	13	1	
212			
213	12	1	
215	12	1	
217	12	1	
218	12	1	
222	12	1	
225	14	2	
227	14	1	
228	14	2	
229	12	3	
230	13	3	
231	13	2	
232	13	3	
233			
234		1	
235		3	
236	12	1	
240	12	3	
241	13	3	
242	13	2	
243			
250		3	
251			
252	11	3	
253		1	
254	12	3	
255	12	1	
263	14	1	
265			3
266			3
267			3
268			3
269			3
273	15	3	
274	14	2	
275	14	2	
276		1	
278	12	3	
279	13	1	
282	13	3	
283		2	
284			
285			
286	13	3	
287	13	2	
289	13	3	
290	13	3	
291	12	3	
292	13	3	
293			
297	13	3	
298	12	2	
299	12	1	
300	13	1	

WayPoints	Depth (ft)	EWM	CLP
301	14		
321	13	1	
327	12	1	
329	12	1	
345	10	3	
347			
350	9	3	
352	9	3	
354	9	3	
355	9	1	
356	11	1	
365	11	1	
368	11	1	
370	11	2	
372		3	
373		3	
374		3	
375		3	
376		3	
377	10	3	
378	10	3	
379	13	1	
380	10	3	
381	11	2	
382	11	3	
383	11	2	
384	11	2	
385	11	1	
386			
387		1	
388		1	
389		1	
390	12	3	
391	12	3	
392	13	3	
393	13	3	
394	13	1	
401	10	1	
402	10	3	
403	10	3	
404	10	3	
405	11	3	
406	11	3	
407	11	3	
409	12	3	
430	10	2	
431	11		
433	10	3	
443	7	3	
444	12	3	
445	12	3	
451	8	3	
452	12	3	
453	16		
462	12	3	
463	12	1	
464	12	2	
465	12	2	
469	12	2	
471		1	
472	13	2	
473	14	3	
474	12	2	
475			
476	12		
478	12	2	
479	11	1	
484	15	1	
498	11	3	
503	11	2	
505	10	1	
507		1	
508	10	3	
509	9	3	
510	11	3	
511	11	2	
512	12	3	
Average Occur		2.1	7



# White Bear Lake Eurasian Watermilfoil Assessment, August 7, 2019

## White Bear Lake Eurasian Watermilfoil Assessment August 7, 2019

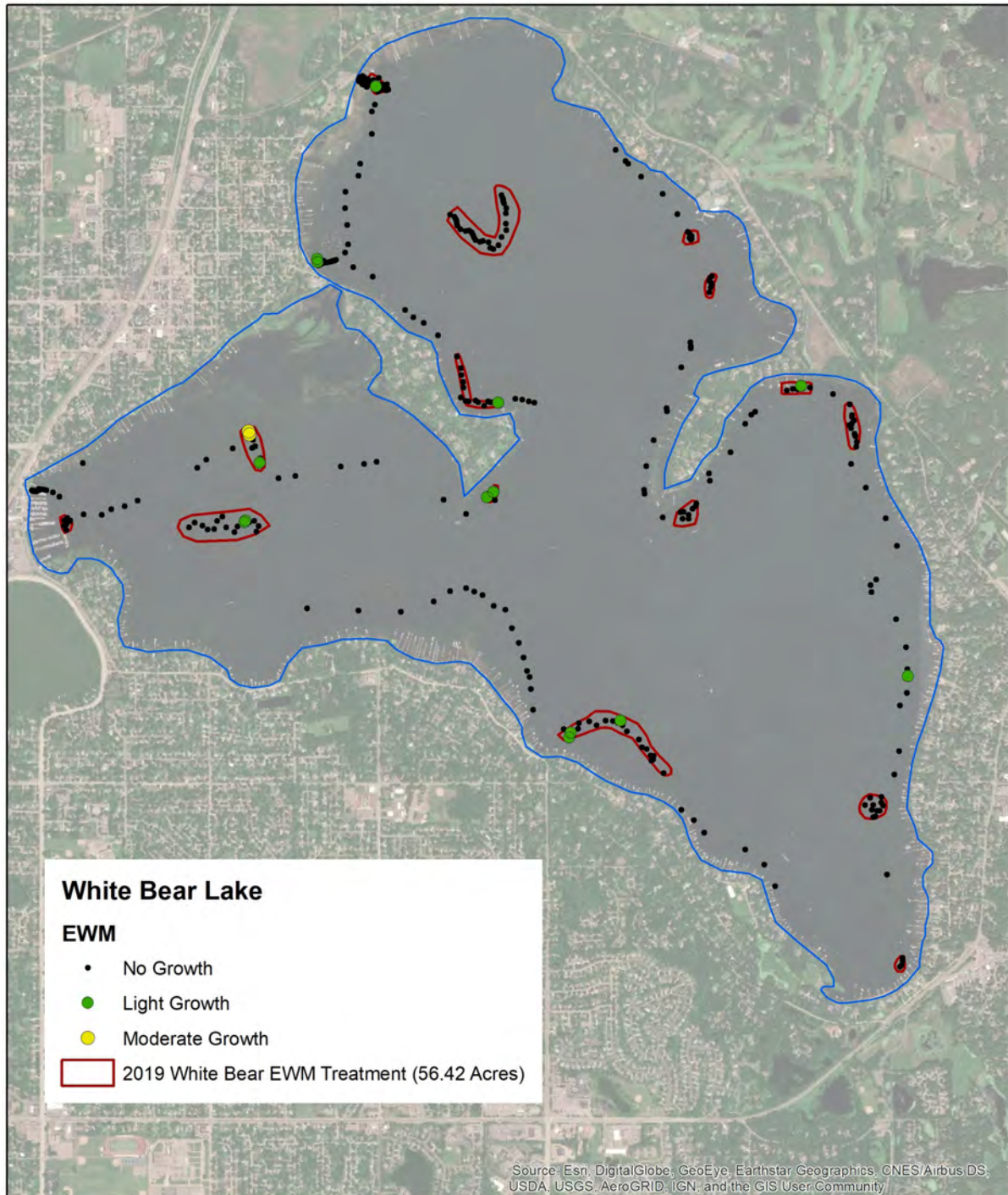


Figure 15. Location of the 15 treatment sites around White Bear Lake on August 7, 2019.

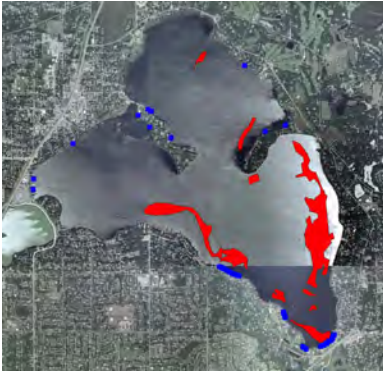
**Table 4. EWM assessment on August 7, 2019.**

WayPoints	Depth (ft)	EWM	Natives	Treat Area
6	5		2 - 3	T1
7			2 - 3	T1
8			2 - 3	T1
9			2 - 3	T1
10			2 - 3	T1
11			2 - 3	T1
12			2 - 3	T1
13			2 - 3	T1
14			2 - 3	T1
15	11	1	2 - 3	T1
16			2 - 3	T1
17			2 - 3	T1
18			2 - 3	T1
19			2 - 3	T1
20			2 - 3	T1
21			2 - 3	T1
22			2 - 3	T1
23	10 - 13		1 - 2	T15
24	10 - 13		1 - 2	T15
25	10 - 13		1 - 2	T15
26	10 - 13		1 - 2	T15
27	10 - 13		1 - 2	T15
28	10 - 13		1 - 2	T15
29	10 - 13		1 - 2	T15
30	10 - 13		1 - 2	T15
31	10 - 13		1 - 2	T15
32	10 - 13		1 - 2	T15
33	10 - 13		1 - 2	T15
34	10 - 13		1 - 2	T15
35	10 - 13		1 - 2	T15
36	10 - 13		1 - 2	T15
37	10 - 13		1 - 2	T15
38	10 - 13		1 - 2	T15
39	10 - 13		1 - 2	T15
40	10 - 13		1 - 2	T15
41	10 - 13		1 - 2	T15
42	10 - 13		1 - 2	T15
43	10 - 13		1 - 2	T15
44	10 - 13		1 - 2	T15
45	10 - 13		1 - 2	T15
46	10 - 13		1 - 2	T15
47	10 - 13		1 - 2	T15
48	10 - 13		1 - 2	T15
49	10 - 13		1 - 2	T15
50	10 - 13		1 - 2	T15
51	10 - 13		1 - 2	T15
52	10 - 13		1 - 2	T15
60	13 - 14		1 - 2	T2
61	13 - 14		1 - 2	T2
62	13 - 14		1 - 2	T2
63	13 - 14		1 - 2	T2
64	13 - 14		1 - 2	T2
65	13 - 14		1 - 2	T2
66	11 - 14		1 - 2	T3
67	11 - 14		1 - 2	T3
68	11 - 14		1 - 2	T3
69	11 - 14		1 - 2	T3
70	11 - 14		1 - 2	T3
71	11 - 14		1 - 2	T3
72	11 - 14		1 - 2	T3
84				T4
85				T4
86				T4
87				T4
88				T4
89				T4
90				T4
91				T4
98	9			T5
99	9			T5
100	9			T5
101	9			T5
102	9	1		T5
103	9			T5
104	9			T5
105	7 - 10			T6
106	7 - 10			T6
107	7 - 10			T6
108	7 - 10			T6
109	7 - 10			T6
110	7 - 10			T6
111	7 - 10			T6
112	7 - 10			T6
113	7 - 10			T6
114	7 - 10			T6
115	7 - 10			T6
116	7 - 10			T6
132	11 - 13			T7
133	11 - 13			T7
134	11 - 13			T7
135	11 - 13			T7

WayPoints	Depth (ft)	EWM	Natives	Treat Area
136	11 - 13			T7
137	11 - 13			T7
138	11 - 13			T7
139	11 - 13			T7
140	11 - 13			T7
141	11 - 13			T7
142	11 - 13			T7
143	11 - 13			T7
144				T8
145				T8
146				T8
147				T8
154	13 - 15			T9
155	13 - 15			T9
156	13 - 15			T9
171	13 - 15			T9
172	13	1		T9
173	13 - 15			T9
174	14	1		T9
192				T10
193				T10
194				T10
195				T10
196	8	1		T10
197				T10
198	8	1		T10
199				T10
200	12	dead		T10
201				T10
202				T10
203				T10
204				T10
205				T10
206	12	dead		T10
207				T10
208				T10
209				T10
210				T10
211				T10
212	12	1		T11
213				T11
214				T11
215				T11
216				T11
217	11	2		T11
218				T11
219	11	2		T11
220				T11
221				T11
230				T12
231				T12
232				T12
233				T12
234	10	dead		T12
235				T12
236				T12
237				T12
266	14	1		T13
267				T13
268				T13
269				T13
270	14	1		T13
271				T13
272				T13
277	12	1		T14
278				T14
279				T14
280				T14
281				T14
282				T14
283		dead		T14
284				T14
285				T14
286				T14
287				T14
288				T14
289				T14
290				T14
291				T14
292				T14
293				T14
Average		1.1		
Occur	173	15	0	

# Eurasian Watermilfoil Treatment Maps for 2010 - 2019

2010 (174 ac)



2011 (41.6 ac)



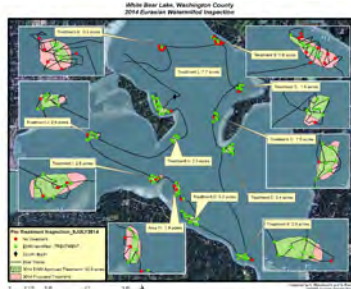
2012 (144 ac)



2013 (100 ac)



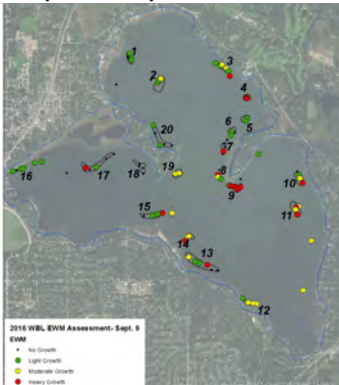
2014 (32.8 ac)



2015 (85 ac)



2016 (60.4 ac)



2017 (65.1 ac)



2018 (69.9 ac)



2019 (56.42 ac)

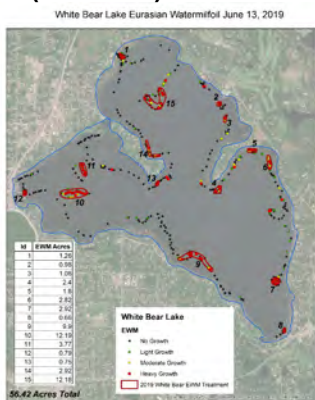


Figure 16. Acres of treated EWM for 2010-2019.

# 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<sub>4</sub> and organic matter (McComas, unpublished), a table and map were prepared that predict what type of milfoil growth could be expected (Table 5 and Figure 17).

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 5. White Bear Lake sediment data and ratings for potential heavy EWM growth.**

Site	Depth		NH <sub>4</sub> Conc (ppm)	Organic Matter (%)	Potential for Heavy EWM Growth
	1998	2009/2010	<10 >10	<0.6 or >20 >0.6 or <20	Light (green) to Moderate (yellow) Heavy (red)
<b>1998 Data</b>					
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

Site	Depth		NH <sub>4</sub> Conc (ppm)	Organic Matter (%)	Potential for Heavy EWM Growth
	1998	2009/2010	<10 >10	<0.6 or >20 >0.6 or <20	Light (green) to Moderate (yellow) Heavy (red)
<b>2009 Data</b>					
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
<b>2010 Data</b>					
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

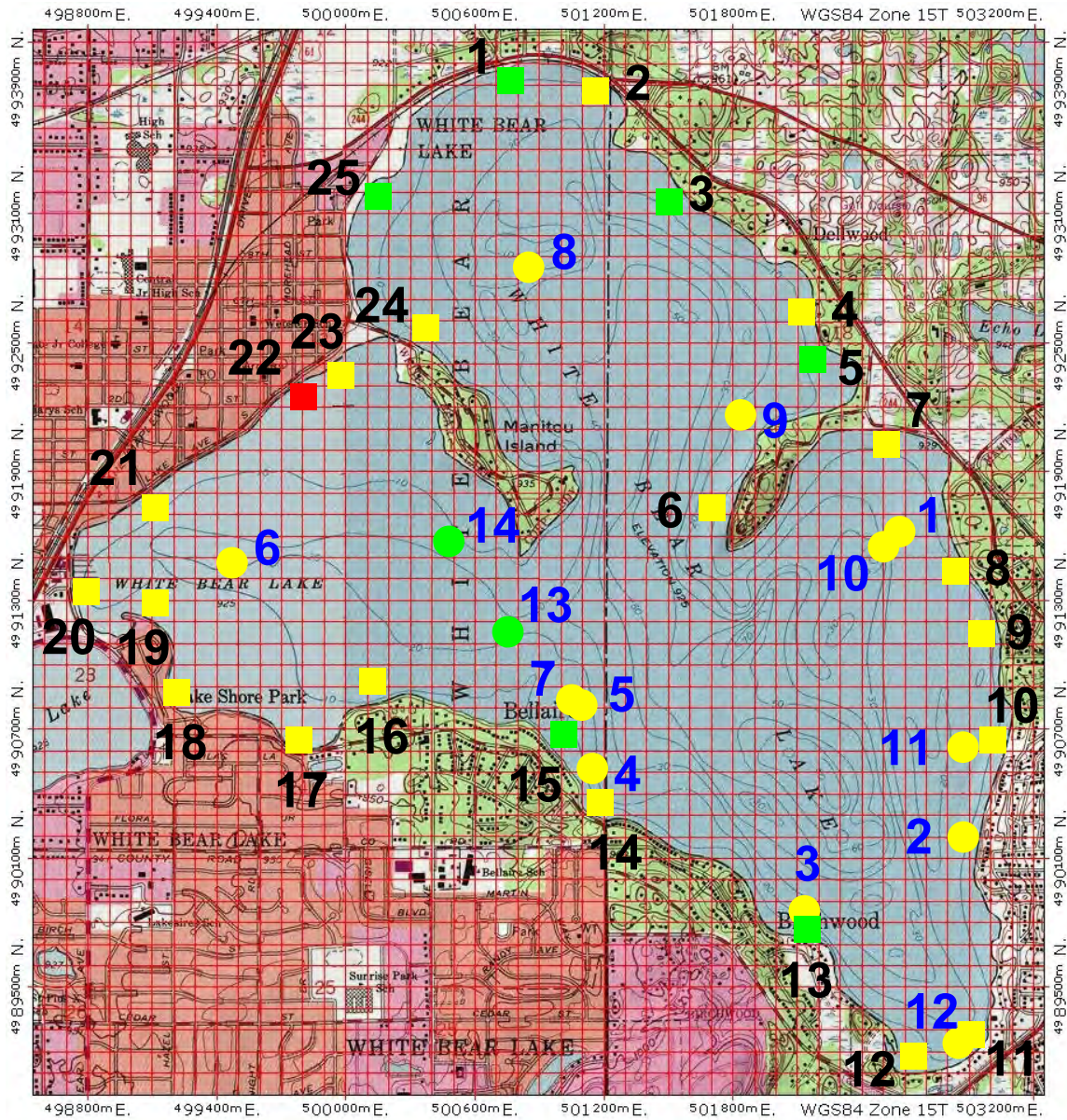


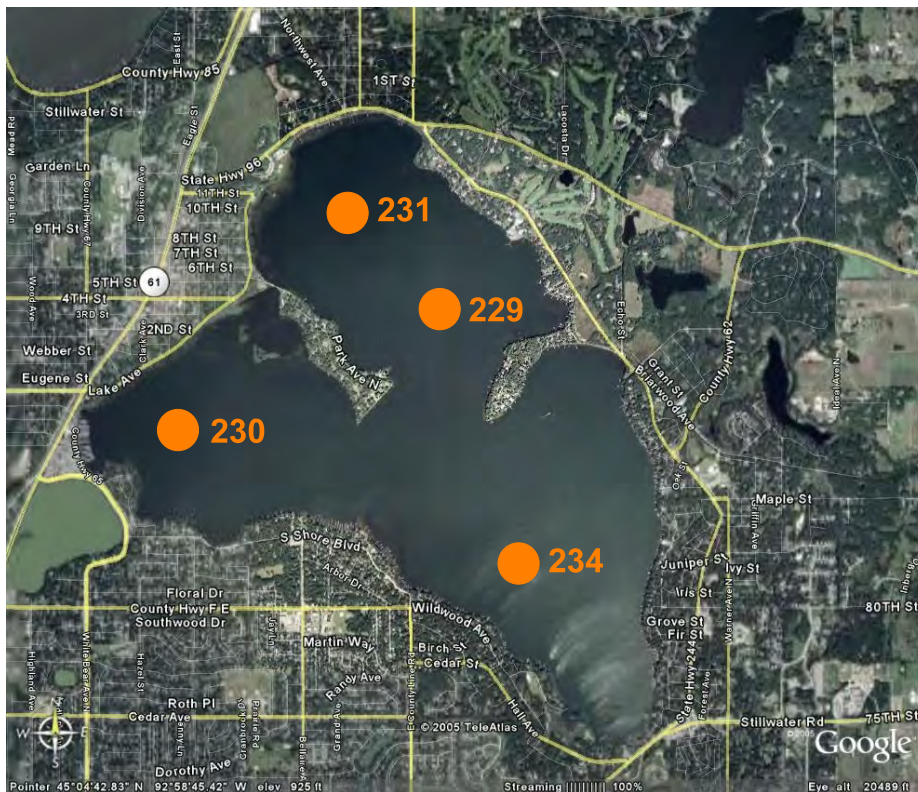
Figure 17. Sediment sample locations are shown with squares (1998 data) and circles (2009 and 2010 data). The color indicates the potential for heavy Eurasian watermilfoil to occur at that site. Key: green = low; yellow = medium; red = high potential.



**White Bear Lake Water Quality from 2005 - 2016:** A summary of seasonal water quality averages from 4 sample sites from 2005 - 2016 is shown in Table 6. The location of the sample sites is shown in Figure 18. Transparency has ranged from 3 to 4 meters at most of the sites from 2005 - 2016. Chlorophyll has ranged from 3 to 7 ug/l over the same period. Total phosphorus appears to have increased starting in 2010 but it has not significantly influenced changes in water clarity or in chlorophyll.

**Table 6. Water quality data for 4 sites around White Bear Lake from 2005 through 2016 (June - September averages). (Source: Ramsey County).**

	Secchi disc (m)					Total phosphorus (ug/l)					Chlorophyll a (ug/l)				
	229	230	231	234	AVE	229	230	231	234	AVE	229	230	231	234	AVE
2005	4.78	4.34	4.66	5.14	4.7	11	10	9	14	11	3.7	2.4	2.7	3.6	3.1
2006	4	4.1	3.8	3.9	4	17	12	12	19	15	7.2	5.1	5.9	6.5	6.2
2007	3.34	3.04	2.97	3.71	3.3	14	11	12	14	13	6.4	5.5	6.5	7	6.4
2008	3.67	3.49	3.67	3.84	3.7	13	13	15	18	15	5.3	3.2	4.9	5.8	4.8
2009	3.95	3.03	3.63	4.2	3.7	14	12	13	17	14	3.5	2.5	3.7	3.3	3.3
2010	3.94	2.8	3.55	4.15	3.6	21	22	21	22	22	5	3.3	4.8	4.6	4.4
2011	3.05	2.91	3	3.41	3.1	21	22	18	22	21	6	4.3	5.5	5.6	5.4
2012	3.39	2.84	2.53	3.01	2.9	22	21	23	21	22	5.7	3.7	6.5	5.9	5.5
2013	3.89	3.28	3.66	3.93	3.7	15	19	17	19	18	4.8	3.5	6.4	5.1	5
2014	3.18	3.03	3.3	3.34	3.2	21	19	16	21	19	4.6	3.6	4	4.8	4.3
2015	3.4	2.5	3.1	3.0	3.0	19	19	18	17	18	5.7	4.3	5.1	6.2	5.3
2016	3.93	3.69	3.85	3.91	3.8	13	12	13	15	13	3.3	2.3	3.3	3.4	3.1



**Figure 18. Water quality sampling sites.**