Underwater View of Flatstem Pondweed in Pleasant Lake, Ramsey County, Minnesota, June 27, 2018

Aquatic Plant Delineation for Pleasant Lake, Ramsey County, Minnesota, 2018

Delineation: June 27, 2018
Mechanical Harvesting: July
Assessment: September 4, 2018

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Aquatic Plant Delineation for Pleasant Lake, Ramsey County, Minnesota, 2018

Summary

Aquatic Plant Delineation: Pleasant Lake (MnDNR ID #62-004600) is a 607acre lake located in Ramsey County, Minnesota. An aquatic plant delineation was conducted on June 27, 2018 by Blue Water Science to characterize conditions of the aquatic plants. Results of the delineation on June 27, 2018 found coontail and stringy pondweed were the dominant plants found at 41 out of 201 sites (Table S1). Curlyleaf pondweed was present at 12 sample sites and Eurasian watermilfoil was found at 4 samples sites (Table S1). Both of these species are non-native plants. A total of 7 submerged plant species were observed in June.

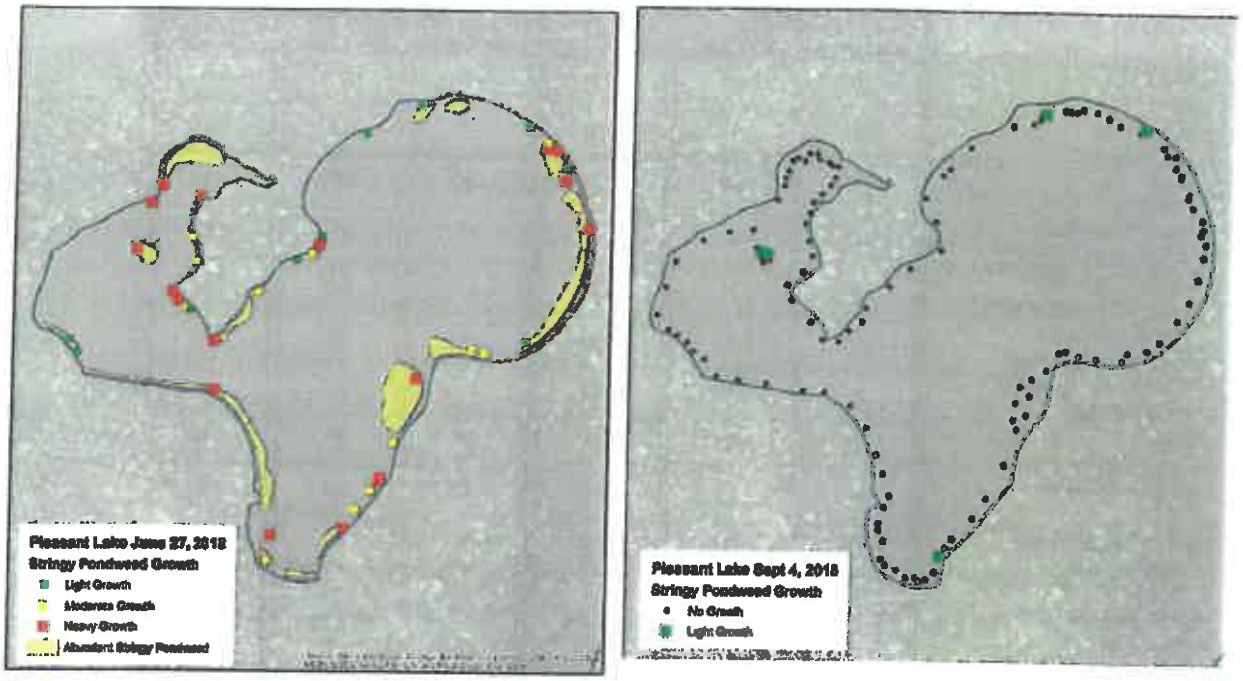
A follow-up aquatic plant assessment was conducted on September 4, 2018 by Blue Water Science to characterize conditions of the aquatic plants and the changes over the course of the summer. Results of the assessment on September 4, 2018 found coontail was the dominant plant present at 94 out of 131 sites (Table S1). Two non-native plant species were sampled in September, Curlyleaf pondweed was present at 2 sample sites and Eurasian watermilfoil was found at 1 sample site (Table S1). A total of 10 submerged plant species were observed in September.

Figure S1. Pleasant Lake nearshore aquatic plant conditions on June 27, 2018. Stringy pondweed was the dominant plant at this time in the summer.

2018 Pleasant Lake Stringy Pondweed Growth Comparison

Pleasant Lake Stringy Pondweed June 27, 2018

Pleasant Lake Stringy Pondweed September 4, 2018



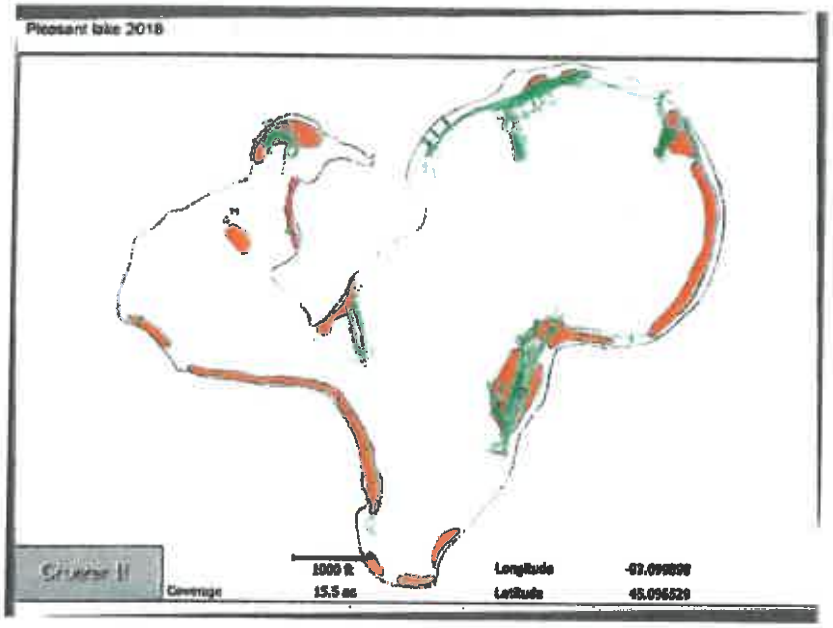


Figure S1. [top-left] Stringy pondweed coverage for Pleasant Lake on June 27, 2018 was widespread.
[top-right] Stringy pondweed coverage for Pleasant Lake on September 4, 2018.
Key: black dots = not plants, green = light growth, yellow = moderate growth, and red = heavy growth.
[bottom] Pleasant Lake treatment area map and treatment tracks for 2018.

Table S1. Pleasant Lake aquatic plant occurrences and densities for the 2018 surveys. Density ratings are 1-3 with 1 being low and 3 being most dense.

	June 27, 2018 All Stations (n=201)			September 4, 2018 All Stations (n=131)		
	Occur	% Occur	Density	Occur	% Occur	Density
Duckweed (*Lemna sp*)	1	1	1.0	–	–	–
White waterlily (*Nymphaea sp*)	4	2	1.3	5	4	1.4
Coontail (*Ceratophyllum demersum*)	41	20	1.4	94	72	2.2
Northern watermilfoil (*Myriophyllum sibiricum*)	–	–	–	1	1	1.0
Eurasian watermilfoil (*Myriophyllum spicatum*)	4	2	1.8	1	1	1.0
Curlyleaf pondweed (*Potamogeton crispus*)	12	6	1.2	2	2	1.0
Claspingleaf pondweed (*P. Richardsonii*)	7	3	1.7	–	–	–
Whitestem (*P. praelongus*)	–	–	–	6	5	1.0
Stringy pondweed (*P. sp*)	41	20	2.2	5	4	1.0
Flatstem pondweed (*P. zosteriformis*)	26	13	1.3	4	3	1.0
Buttercup (*Ranunculus sp*)	–	–	–	1	1	1.0
Water celery (*Vallisneria americana*)	4	2	1.0	28	21	1.3
Water stargrass (*Zosterella dubia*)	–	–	–	6	5	1.3

2018 Findings and Recommendations: Stringy pondweed, a native plant, grew abundantly in June producing heavy growth in some nearshore areas in water depths of 3-6 feet. Stringy pondweed occurrence and abundance was drastically reduced in September by a combination of harvesting and natural dieback. Maps showing a comparison of stringy growth over the season is shown in Figure S1.

In June, coontail, a native plant, was widespread but had a low abundance. However, in September, coontail was the dominant aquatic plant. Coontail produced heavy-matted growth in a number of areas in water depths in the 5 foot to 8 foot range. In future years, mechanical harvesting could continue to be used to remove the top two to three feet of the coontail or stringy pondweed mats. The mechanical harvester cutting bar could be adjusted to go down 3 feet rather than 5 feet. Cutting at a 3-foot depth enables the harvester to cover more area before the cargo area is filled with plant while also leaving the beneficial and stabilizing plants alive.

Non-native Curlyleaf pondweed was observed growing at 7 sites in June at low densities. Eurasian watermilfoil was present at four sites in June and one site in September. Plant control of these non-natives is not necessary at this time as navigation is doesn't appear restricted.

Aquatic Plant Delineation for Pleasant Lake, Ramsey County, Minnesota, 2018

Pleasant Lake, Ramsey County (ID: 62-004600)
Size: 607 acres (MnDNR)
Littoral area: 273 acres (MnDNR)
Maximum depth: 58 ft (MnDNR)

Introduction

An aquatic plant delineation was conducted on June 27, 2018 on 607 acre Pleasant Lake, Ramsey County. The objective of the delineation was to check the distribution and abundance of aquatic plants and delineate areas for harvesting. Harvesting was conducted in July. A follow-up assessment was conducted on September 4, 2018 to evaluate the control of aquatic plants from harvesting and to check the distribution and abundance of aquatic plants and how the composition changes over the growing season.

Methods

The aquatic plant delineation of Pleasant Lake was conducted by Blue Water Science on June 27, 2018 to evaluate non-native curlyleaf pondweed and any other plants growing to nuisance conditions. For the delineation, 201 sites were sampled around Pleasant Lake. Later in the summer, an assessment was conducted on September 4, 2018 and 131 sites were sampled. Sample sites were randomly selected in the littoral zone around Pleasant Lake (Figure 1). At each sample point, a sampling rake was lowered into the water and a plant sample was taken. The plant species were recorded and the density of each species was assigned. Densities were based on the coverage on the teeth of the rake. Density ratings were from 1 to 3 with 1 being sparse and 3 being a nuisance. Based on these sample sites, a plant distribution map was constructed.

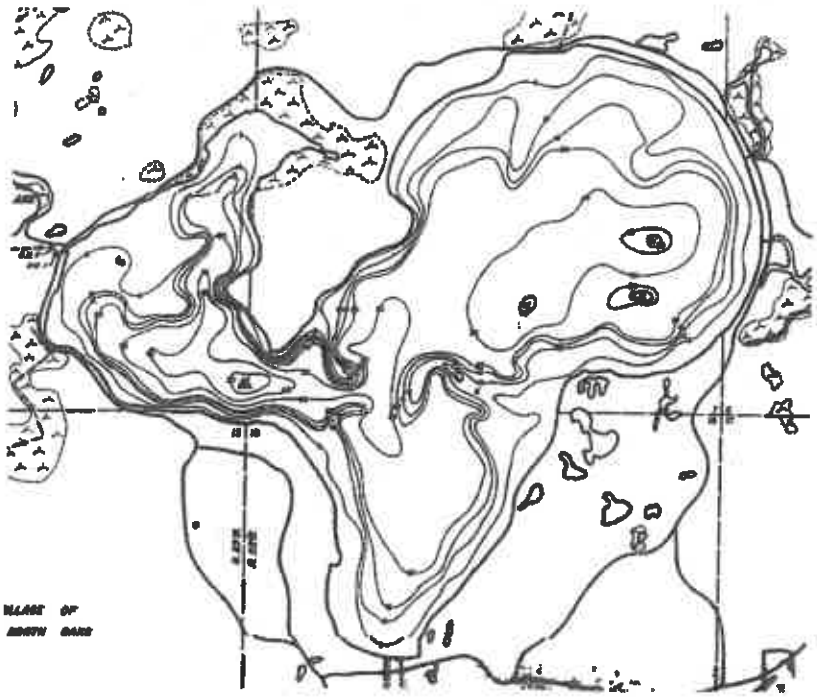


Figure 1. MnDNR contour map of Pleasant Lake. Samples for the delineation and for the assessment were collected within the littoral zone (0-15 feet).

Results for the June 27, 2018 Delineation

Results of the delineation on June 27, 2018 found stringy pondweed was the dominant plant. Coontail was widespread as well but not as abundant as stringy. A total of 15 potential harvesting areas were delineated (Figure 2) and a total of 46 acres were designated for potential harvesting. Curlyleaf pondweed was present at 12 sample sites and Eurasian watermilfoil was found at 4 samples sites (Table 1). Both curlyleaf pondweed and Eurasian Watermilfoil are non-native plants but they were not growing to nuisance levels. A total of 7 submerged plant species were observed on June 27, 2018.

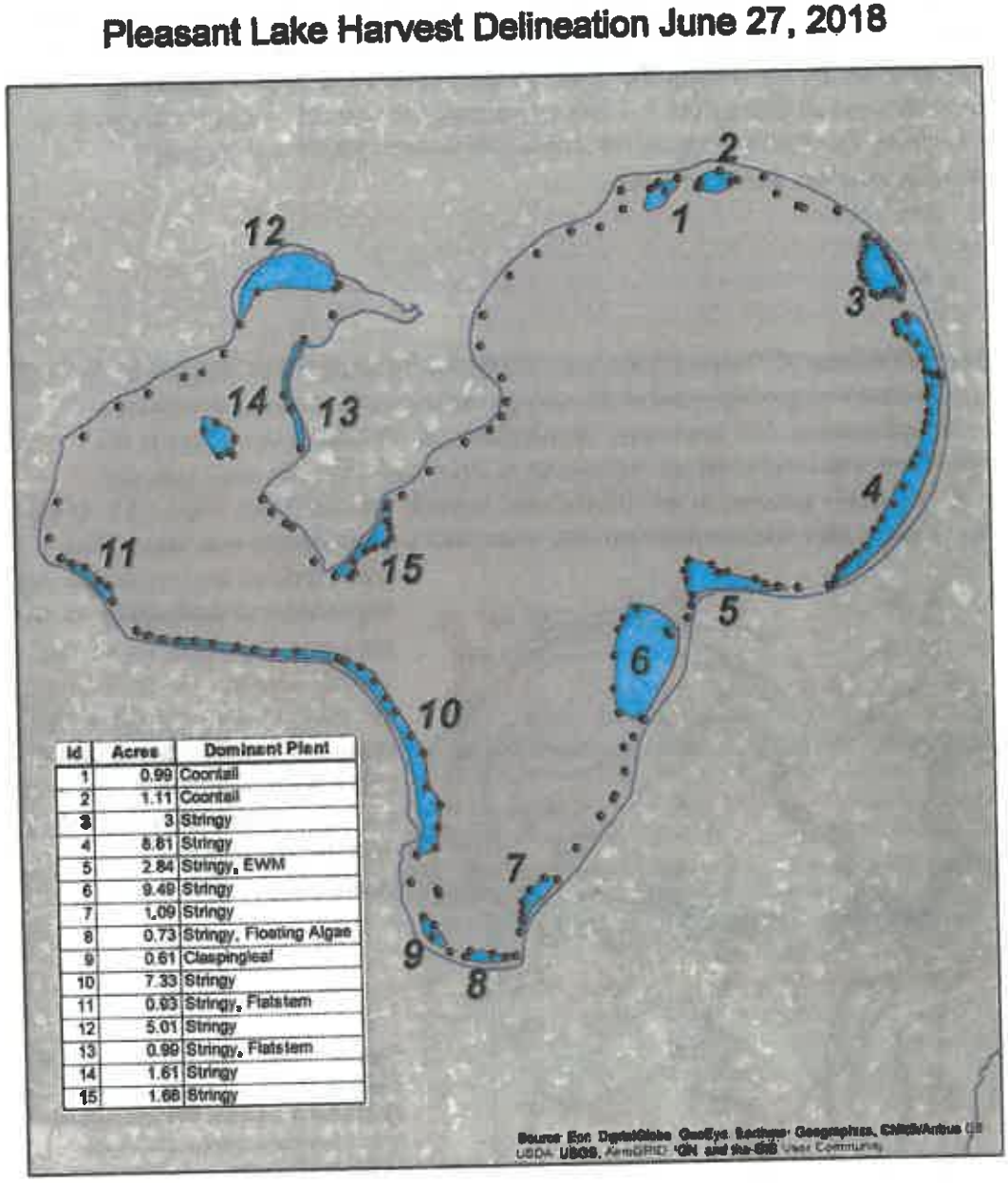


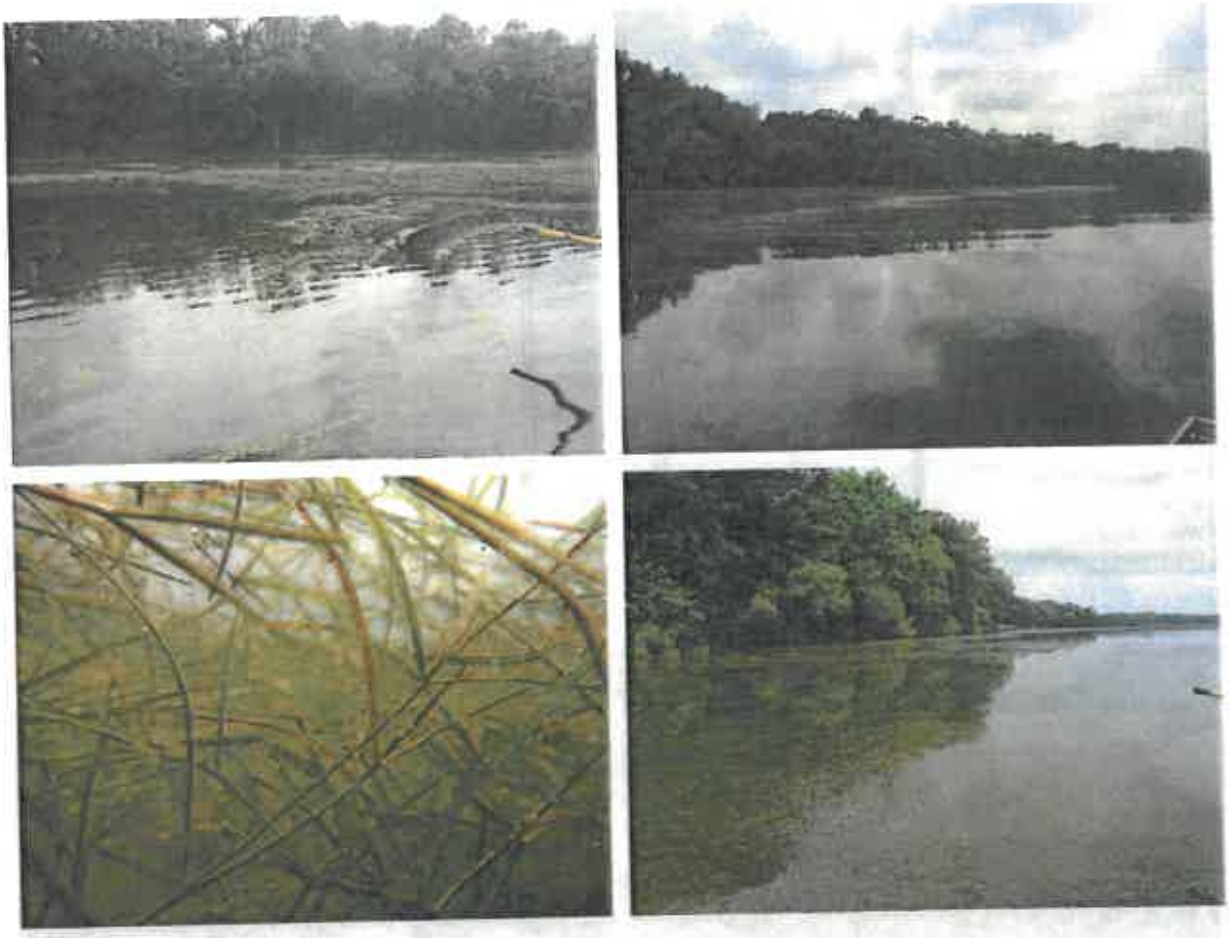
Figure 2. Harvesting map for Pleasant Lake on June 27, 2018.

Table 1. Pleasant Lake aquatic plant occurrences and densities for the June 27, 2018 delineation survey based on 201 sites. Density ratings are 1-3 with 1 being low and 3 being most dense.

	June 27, 2018 All Stations (n=201)		
	Occur	% Occur	Density
Duckweed (*Lemna sp*)	1	1	1.0
White waterlily (*Nymphaee sp*)	4	2	1.3
Coontail (*Ceratophyllum demersum*)	41	20	1.4
Eurasian watermilfoil (*Myriophyllum spicatum*)	4	2	1.8
Curlyleaf pondweed (*Potamogeton crispus*)	12	6	1.2
Claspingleaf pondweed (*P. Richardsonii*)	7	3	1.7
Stringy pondweed (*P. sp*)	41	20	2.2
Flatstem pondweed (*P. zosteriformis*)	26	13	1.3
Water celery (*Vallisneria americana*)	4	2	1.0

Figure 3. Underwater view of aquatic plants in Pleasant Lake on June 27, 2018.

Aquatic Plant Conditions in Pleasant Lake, June 27, 2018



Results for the September 4, 2018 Assessment

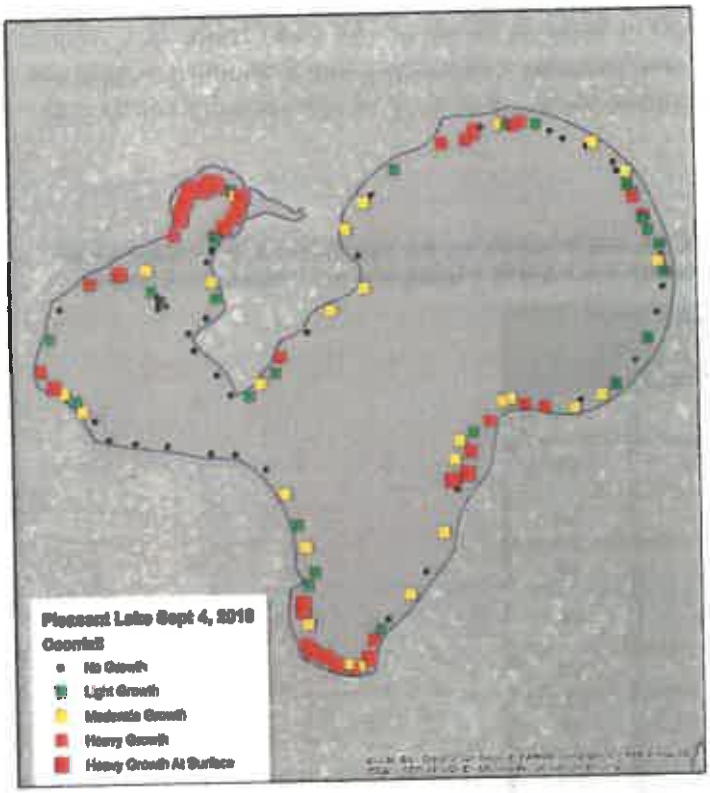
Results of the assessment on September 4, 2018 found that stringy pondweed was no longer a nuisance and coontail was the dominant plant found at 94 out of 131 sites (Table 2). Curlyleaf pondweed was present at 2 sample sites and Eurasian watermilfoil was found at 1 sample site (Table 2). Both of these species are non-native plants. A total of 10 submerged plant species were observed.

Table 2. Pleasant Lake aquatic plant occurrences and densities for the September 4, 2018 assessment survey based on 131 sample sites. Density ratings are 1-3 with 1 being low and 3 being most dense.

	September 4, 2018 All Stations (n=131)		
	Occur	% Occur	Density
White waterlily (*Nymphaea sp*)	5	4	1.4
Coontail (*Ceratophyllum demersum*)	94	72	2.2
Northern watermilfoil (*Myriophyllum sibiricum*)	1	1	1.0
Eurasian watermilfoil (*Myriophyllum spicatum*)	1	1	1.0
Curlyleaf pondweed (*Potamogeton crispus*)	2	2	1.0
Whitestem (*P. praelongus*)	6	5	1.0
Stringy pondweed (*P. sp*)	5	4	1.0
Flatstem pondweed (*P. zosteriformis*)	4	3	1.0
Buttercup (*Ranunculus sp*)	1	1	1.0
Water celery (*Vallisneria americana*)	28	21	1.3
Water stargrass (*Zosterella dubia*)	6	5	1.3

Figure 4. Example of an aquatic plant sample. Here water celery was sampled at a density of a "1" and coontail was sampled at a density of "3".

Pleasant Lake Coontail Growth September 4, 2018



Pleasant Lake Stringy Pondweed September 4, 2018

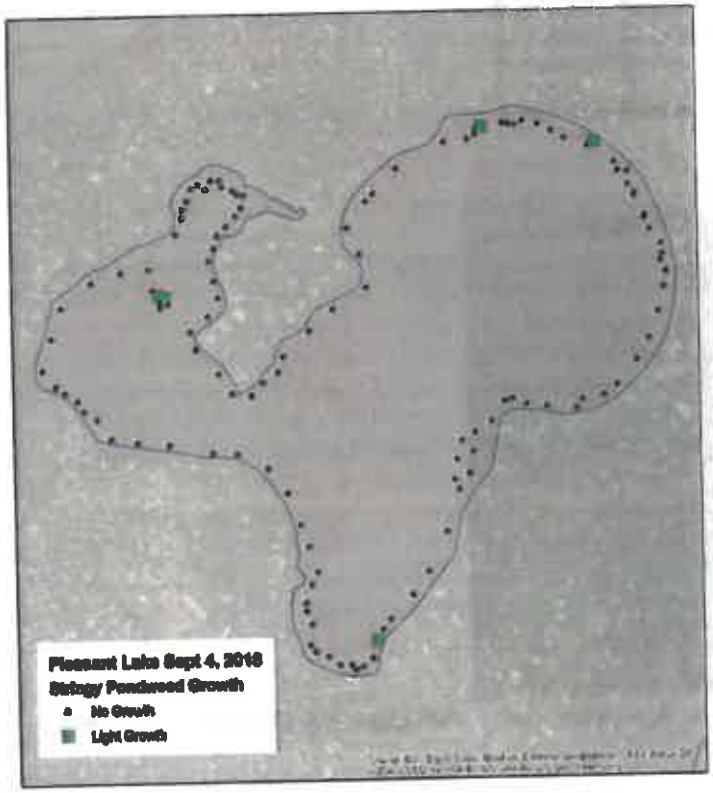
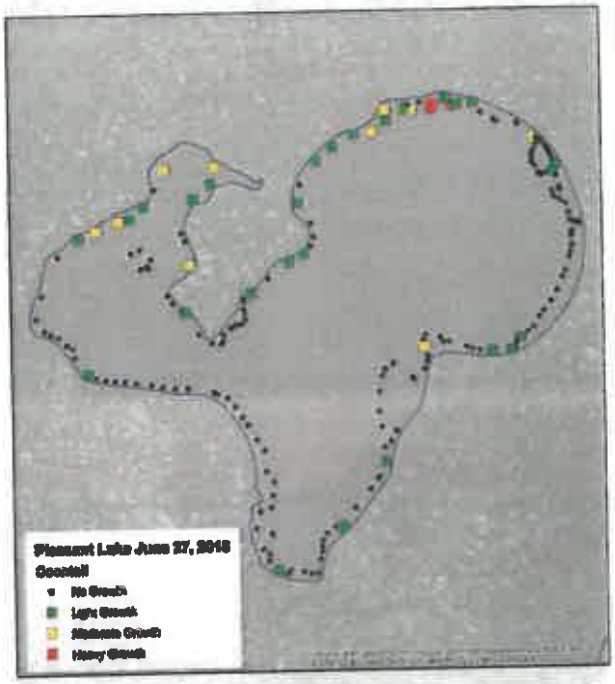


Figure 5. [top] Coontail coverage for Pleasant Lake on September 4, 2018. [bottom] Stringy pondweed coverage for Pleasant Lake on September 4, 2018. Key: green = light growth, yellow = moderate growth, and red = heavy growth.

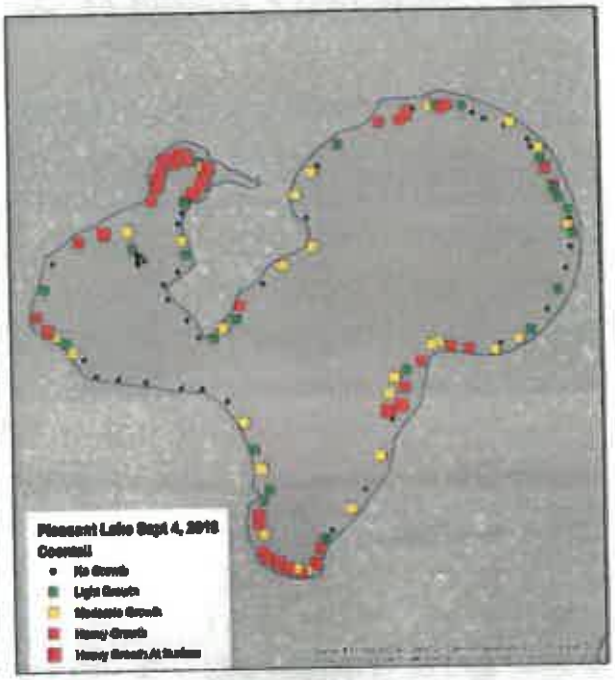
Aquatic Plant Conditions in Pleasant Lake, September 4, 2018. Heavy Growth was Dominated by Coontail.

Aquatic Plant Changes from June to September, 2018

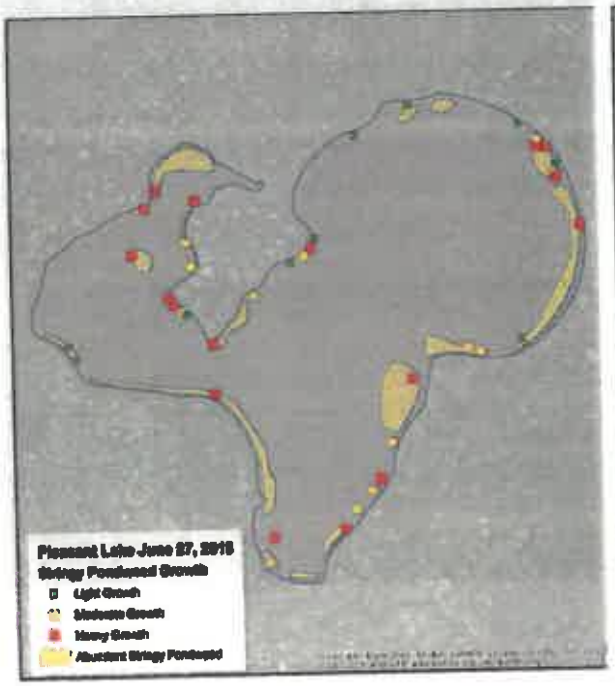
Pleasant Lake Coontail Growth June 27, 2018



Pleasant Lake Coontail Growth September 4, 2018



Pleasant Lake Stringy Pondweed June 27, 2018



Pleasant Lake Stringy Pondweed September 4, 2018

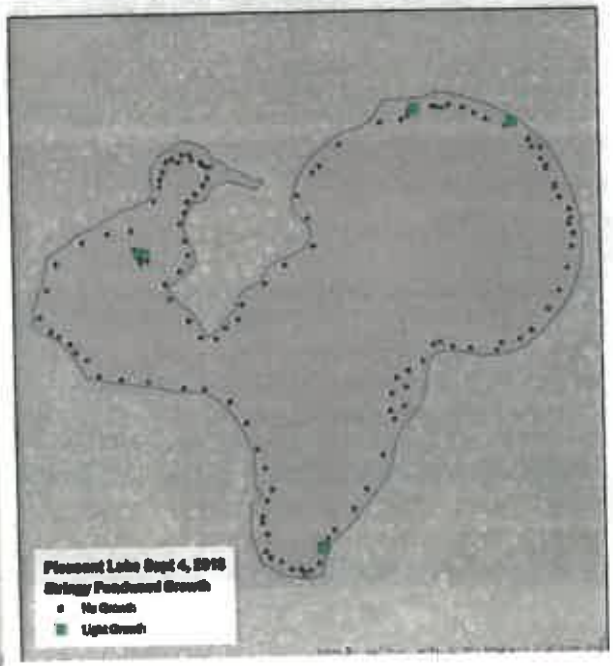


Table 3. Pleasant Lake aquatic plant occurrences and densities for the 2018 surveys. Density ratings are 1-3 with 1 being low and 3 being most dense.

	June 27, 2018 All Stations (n=201)			September 4, 2018 All Stations (n=131)		
	Occur	% Occur	Density	Occur	% Occur	Density
Duckweed (*Lemna sp*)	1	1	1.0	--	--	--
White waterlily (*Nymphaea sp*)	4	2	1.3	5	4	1.4
Coontail (*Ceratophyllum demersum*)	41	20	1.4	94	72	2.2
Northern watermilfoil (*Myriophyllum sibiricum*)	--	--	--	1	1	1.0
Eurasian watermilfoil (*Myriophyllum spicatum*)	4	2	1.8	1	1	1.0
Curlyleaf pondweed (*Potamogeton crispus*)	12	6	1.2	2	2	1.0
Claspingleaf pondweed (*P. Richardsonii*)	7	3	1.7	--	--	--
Whitestem (*P. praelongus*)	--	--	--	6	5	1.0
Stringy pondweed (*P. sp*)	41	20	2.2	5	4	1.0
Flatstem pondweed (*P. zosteriformis*)	26	13	1.3	4	3	1.0
Buttercup (*Ranunculus sp*)	--	--	--	1	1	1.0
Water celery (*Vallisneria americana*)	4	2	1.0	28	21	1.3
Water stargrass (*Zosterella dubia*)	--	--	--	6	5	1.3

Recommendations

2018 Findings and Recommendations: Stringy pondweed, a native plant, grew abundantly in June producing heavy growth in some nearshore areas in water depths of 3-6 feet. Stringy pondweed occurrence and abundance was drastically reduced in September by a combination of harvesting and natural dieback.

Non-native curlyleaf pondweed was observed growing at 7 sites in June at low densities. Eurasian watermilfoil was present at four sites in June and one site in September. Plant control of these non-natives is not necessary at this time as navigation is doesn't appear restricted.

Coontail, a native plant, was the dominant aquatic plant in September. Coontail produced heavy-matted growth in a number of areas in water depths in the 5 foot to 8 foot range. Mechanical harvesting could continue to be used to remove the top two to three feet of the coontail or stringy pondweed mats. The mechanical harvester cutting bar could be adjusted to go down 3 feet rather than 5 feet. Cutting at a 3-foot depth enables the harvester to cover more area before the cargo area is filled with plant while also leaving the beneficial and stabilizing plants alive.

APPENDIX A - 2018 Survey Data

Individual Sample Point Plant Data for June 27, 2018

Moderate plant diversity was found in Pleasant Lake with a total of 7 submerged species observed. Coontail and stringy pondweed were the dominant plants and Eurasian watermilfoil and curlyleaf pondweed were the only non-native aquatic plant species observed on the June 27, 2018 delineation (Table A1).

Table A1. Aquatic plant occurrence and density for individual sample points in Pleasant Lake, June 27, 2018.

Site	Depth (ft)	Coontail	CLP	EWM	Natives	White lilies	Duckweed	Clasping leaf	Flatstem	Stringy	Water celery	Filament Algae	No Plants
1	5		2		1								
2	6	2	1										
3	6									3			
4	6												
5	6												
6	6												
7	6												
8	6												
9	6												
10	6												
11	6												
12	6												
13	4	1								2			
14	4												
15	3	1			1					1			
16	3												
17	3												
18	3												
19	3							3		3			
20	3												
21	3									2			
22	7									3			
23	4												
24	4												
25	4												
26	4												
27	4												
28	4												
29	4												
30	4												
31	4												
32	4												
33	2									3			
34	5												
35	5												
36	5												
37	5												
38	5												
39	5												
40	5												
41	5												
42	5												
43	5												
44	5												
45	5												
46	5												
47	5												
48	7	1								1			

Table A1. Aquatic plant occurrence and density for individual sample points in Pleasant Lake, June 27, 2018.

Site	Depth (ft)	Coontail	CLP	EWM	Natives	White lilies	Duckweed	Claspingleaf	Flatstem	Stringy	Water celery	Filament Algae	No Plants
49	3												
50	3												
51	3												
52	3												
53	3	1	1		1								
54	6	1											
55	6			2						2			
56	6												
57	6			2						2			
58	6												
59	6												
60	6												
61	6												
62	6												
63	6	2											
64	5												
65	5			2									
66	5												
67	5												
68	5		2	1						3			
69	5												
70	5												
71	5												
72	7												
73	7												
74	7												
75	4												
76	4												
77	5									2			
78	5												
79	6	1											
80	5									3			
81	5									3			
82	5									2			
83	6									2			
84	5	1								3			
85	5												
86	5												
87	5												
88	5												
89	5												
90	3												
91	3											3	
92	3											3	
93	4											3	
94	3											3	
95	3											3	
96	4	1						1					
97	4							3		2			
98	4												
99	4												
100	4											3	
101	3					2							
102	5									3			
103	5												
104	5												
105	5												
106	5												
107	5												
108	5												

Table A1. Aquatic plant occurrence and density for individual sample points in Pleasant Lake, June 27, 2018.

Site	Depth (ft)	Coontail	CLP	EWM	Natives	White lilies	Duckweed	Claspingleaf	Flatstem	Stringy	Water celery	Filament Algae	No Plants
109	5												
110	5												
111	5												
112	5												
113	5												
114	5												
115	5								1	3			
116	5												
117	5												
118	5												
119	5												
120	5												
121	5												
122	5												
123	5												
124	5							1	1				
125	6	1							1				
126	5								2	1			
127	5												
128	5							2	1	1			
129	5												
130	5					1			2				
131	4												
132	4					1			1				
133	5							1	1				
134	5												1
135	5	1							1				
136	4	2							1				
137	4	2							1			1	
138	4	1							2			2	
139	4	1							1	3			
140	3					1			1	3		2	
141	5	2							1			2	
142	4												
143	4	2											
144	4	1							1			1	
145	4	1							2	3			
146	4												
147	5								2	2			
148	4	2	1						2	2			
149	10												
150	4												
151	4												
152	4									3			
153	4												
154	4												
155	5								1	3			
156	5								1	3			
157	6									2			
158	5	1	1							1			
159	8												1
160	4		1							3			
161	4												
162	4												
163	4												
164	4												
165	4												
166	4												
167	4												
168	4												

Table A1. Aquatic plant occurrence and density for individual sample points in Pleasant Lake, June 27, 2018.

Site	Depth (ft)	Coontail	CLP	EWM	Natives	White lilies	Duckweed	Clasping-leaf	Flatstem	Stringy	Water celery	Filament Algae	No Plants
169	4												
170	4												
171	4												
172	4	1							2	2			
173	13												1
174	5	1							1	1			
175	5	1	1						1	2			
176	5									3			
177	5									1			
178	15												1
179	4	1											
180	5								1				
181	5	1											
182	6	1											
183	4	1							1	1			
184	5	2											
185	5	1											
186	3	2											
187	3	2											
188		2											
189	3	1											
190	2									1	1		
191	2										1		
192	4	3											
193	5	3											
194	2	1											
195	4	3											
196	5	1											
197	3	1					1				1		
198	8		1										
199	10		1										
200	9		1										
201	5		1					1		1	1		
Average		1.4	1.2	1.8	1.0	1.3	1.0	1.7	1.3	2.2	1.0	2.4	
Occurrence (201 sites)		41	12	4	3	4	1	7	26	41	4	11	4
% occurrence		20	6	2	1	2	0	3	13	20	2	5	

Individual Sample Point Plant Data for September 4, 2018

Moderate plant diversity was found in Pleasant Lake with a total of 13 submerged species observed. Coontail was the dominant plant and Eurasian watermilfoil and curlyleaf pondweed were the only non-native aquatic plant species observed on the July 15, 2015 delineation (Table A2).

Table A2. Aquatic plant occurrence and density for individual sample points in Pleasant Lake, September 4, 2018.

Site	Depth (ft)	White lilies	Butter-cup	Field Coon-tail	MnDNR Coon-tail	CLP	EWM	Flat-stem	NWM	Stringy	Water celery	Water star-grass	White-stem	FA	No Plants	Treat Site	Notes
1	7														1	3	
2	6														1	3	
3	5			2	2											3	
4	5			1	1						1		1			3	
5	5			1	1						2					3	
6	5			3	3						1					3	
7	5			3	3												
8	6			1	1											4	
9	5			1	1											4	
10	5			1	1											4	
11	5															4	
12	6			2	2						1					4	
13	4			1	1						1					4	
14	5										1					4	
15	4											1				4	
16	4			1	1											4	
17	5										1					4	
18	5			1	1											4	
19	6			2	2											4	
20	8														1		
21	5			2	2												
22	4			3	3											5	
23	3			3	3											5	
24	4			2	2				1							5	
25	5			2	2											5	
26	7			3	3												
27	4			1	1	1										6	
28	5			2	2						1					6	
29	7			3	3											6	
30	5			2	2											6	
31	6			4	3											6	
32	5			4	3											6	
33	5										3					6	
34	8			2	2												
35	8														1		
36	6			2	2												
37	5										1					7	
38	4			1	1						2		1			7	
39	5			3	3					1	2	1				7	
40	4			4	3									1		8	
41	3			2	2						2					8	
42	4	2		3	3						2			2		8	
43	4		1	2	2						1			2		8	
44	5			4	3									2		8	
45	5			4	3												
46	4			4	3									2		9	
47	4			3	3											9	
48	4			2	2						1						
49	4			4	3									2			
50	5			4	3												
51	3			1	1						1					10	
52	6			1	1						1					10	

Table A2. Aquatic plant occurrence and density for individual sample points in Pleasant Lake, September 4, 2018.

Site	Depth (ft)	White lilies	Buttercup	Field Coontail	MnDNR Coontail	CLP	EWM	Flatstem	NWM	Stringy	Water celery	Water stargrass	Whitestem	FA	No Plants	Treat Site	Notes
53	4			2	2	1										10	
54	5			1	1						1					10	
55	5			2	2											10	
56	5														1	10	
57	5														1	10	Good
58	5														1	10	Good
59	6														1	10	
60	7														1	10	
61	8														1	10	
62	12														1		
63	4			2	2			1			1					11	
64	4			1	1			1					1			11	
65	4			2	2			1					1			11	Fair
66	4	1		4	3											11	Fair
67	5	2		3	3												
68	5			1	1												
69	4														1		
70	6	1		3	3			1									
71	5			4	3						1						
72	2			1	1							1				14	
73	2									1		1				14	
74	2									1						14	
75	3											2				14	
76	3											2	1			14	
77	3						1						1			14	
78	6			2	2												
79	5			3	3												
80	5			4	3											12	
81	4			4	3											12	
82	6			4	3											12	
83	4			4	3											12	
84	5			4	3											12	Poor
85	5			4	3											12	Poor
86	4			4	3											12	
87	4	1		3	3									1		12	
88	5			3	3									1		12	
89	5			1	1									1		12	
90	5			2	2									1		12	
91	5			4	3									2		12	
92	5			4	3											12	
93	5			4	3									1			
94	5			4	3									1			
95	5			3	3									1		13	
96	5			1	1											13	
97	5														1	13	Good
98	5														1	13	Good
99	5			2	2											13	Good
100	5			1	1											13	Good
101	11														1	13	
102	12														1	13	
103	6														1	13	
104	10														1	13	
105	11														1	13	
106	4			1	1						1					15	
107	4			2	2						1					15	
108	3			1	1						1					15	Fair
109	4			3	3						1					15	Fair
110	9														1	15	
111	7			2	2											15	

Table A2. Aquatic plant occurrence and density for individual sample points in Pleasant Lake, September 4, 2018.

Site	Depth (ft)	White lillies	Butter-cup	Field Coon-tail	MnDNR Coon-tail	CLP	EWM	Flat-stem	NWM	Stringy	Water celery	Water star-grass	White-stem	FA	No Plants	Treat Site	Notes
112	5			2	2											15	
113	7														1	15	
114	5			2	2											15	
115	7			2	2											15	
116	8														1		
117	7			1	1												
118	5			3	3												
119	5			3	3											1	Fair
120	4			3	3											1	Fair
121	4			3	3											1	Fair
122	3									1	2					1	Fair
123	3			2	2											2	Floating mat of coontail
124	5			1	1											2	
125	5			3	3											2	Poor
126	5			3	3						1					2	Poor
127	7			1	1												
128	9														1		
129	10														1		
130	10														1		
131	4			2	2					1	1						
Average		1.4	1.0	2.4	2.2	1.0	1.0	1.0	1.0	1.0	1.3	1.3	1.0	1.4			
Occurrence (131 sites)		5	1	94	94	2	1	4	1	5	28	6	6	14	25		
% occurrence		4	1	72	72	2	1	3	1	4	21	5	5	11			

APPENDIX B - July 15, 2015 Survey Data

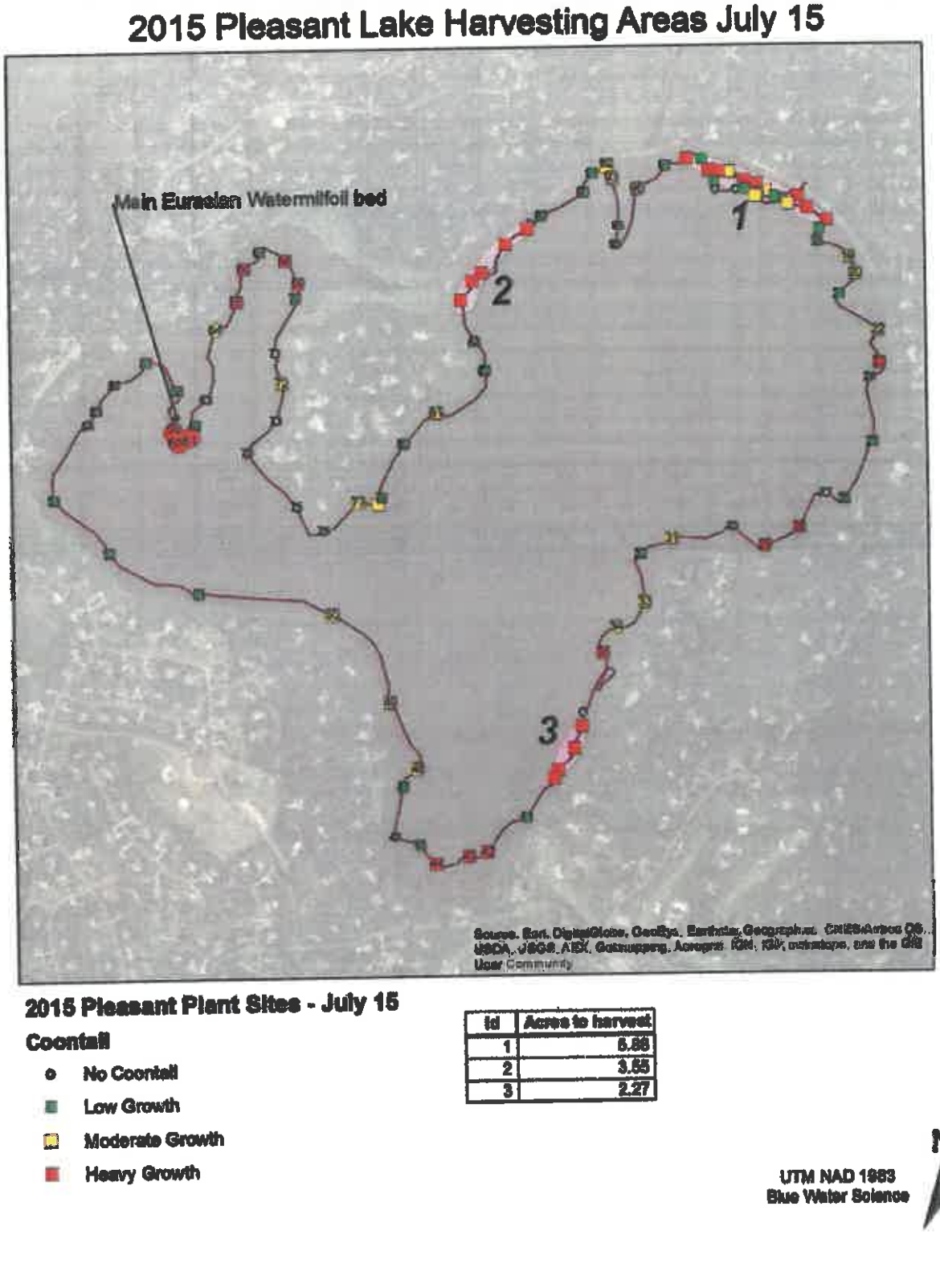


Figure B1. Harvesting map for Pleasant Lake in July, 2015.

Results for the July 15, 2015 Delineation

Table B1. Pleasant Lake aquatic plant occurrences and densities for the July 15, 2015 survey based on 102 sites. Density ratings are 1-5 with 1 being low and 5 being most dense.

	All Stations (n=102)		
	Occur	% Occur	Density
White waterlily (*Nymphaea sp*)	1	1	2.0
Coontail (*Ceratophyllum demersum*)	81	79	2.9
Chara (*Chara sp*)	2	2	1.0
Elodea (*Elodea canadensis*)	13	13	1.2
Northern watermilfoil (*Myriophyllum sibiricum*)	8	8	1.0
Eurasian watermilfoil (*Myriophyllum spicatum*)	11	11	2.2
Curlyleaf pondweed (*Potamogeton crispus*)	12	12	1.4
Claspingleaf pondweed (*P. Richardsonii*)	7	7	1.4
Stringy pondweed (*P. sp*)	4	4	1.3
Flatstem pondweed (*P. zosteriformis*)	1	1	1.0
Buttercup (*Ranunculus sp*)	1	1	1.0
Sago pondweed (*Stuckenia pectinata*)	3	3	1.7
Water celery (*Vallisneria americana*)	9	9	2.4
Water stargrass (*Zosterella dubia*)	22	22	1.4