Bush Lake, Bloomington, Minnesota (Google Earth)

Aquatic Plant Point Intercept Survey for Bush Lake, Bloomington, Minnesota, 2011

Eurasian Watermilfoil Assessment: June 28, 2011
Full Survey Conducted on: August 25 and 29, 2011

Prepared for:
City of Bloomington

Prepared by:
Steve McComas
Blue Water Science
St. Paul, MN 55116

November 2011

Aquatic Plant Point Intercept Survey for Bush Lake, Bloomington, Minnesota, 2011

Summary

Bush Lake (MnDNR ID: 27-0047) is a 186 acre lake located in Bloomington, Minnesota. An Eurasian watermilfoil assessment was conducted on June 28, 2011 and a point-intercept aquatic plant survey was conducted on August 25 and 29, 2011.

In the Eurasian watermilfoil assessment, milfoil was widely distributed, but at light to moderate growth. No open water herbicide treatments were conducted in June or July of 2011. In the point-intercept survey in August, 211 sites were sampled. Native plants were abundant with seventeen submerged plant species identified. The dominant plant in Bush Lake was coontail followed by naiads and then Eurasian watermilfoil (Table S-1). The non-native Eurasian watermilfoil was observed at 86 sites (Table S-1) and although it was widespread, heavy growth was observed at only 6 sites. Plants grew out to a water depth of 16 feet and the estimated plant coverage was 125 acres out of the 186 acre lake (67% coverage) (Figure S-2). A rare floatingleaf plant, American Lotus, was observed in the south end of Bush Lake.

American lotus, a water lily, was found in Bush Lake on August 25 and 29, 2011.

Table S-1. Summary of the occurrence of plant species for aquatic plant survey for 2011. Number in parenthesis represents the percent occurrence of the plant. A total of 211 sites were monitored.

	2011
Emergent	10 (5%)
Bulrush (*Scirpus sp*)	2 (1%)
Cattails (*Typha sp*)	4 (2%)
American lotus (*Nelumbo lutea*)	3 (1%)
White waterlily (*Nymphaea sp*)	37 (18%)
Coontail (*Ceratophyllum demersum*)	128 (61%)
Chara (*Chara sp*)	4 (2%)
Elodea (*Elodea canadensis*)	5 (2%)
Star duckweed (*Lemna trisulca*)	1 (1%)
Northern watermilfoil (*Myriophyllum. sibiricum*)	15 (7%)
Eurasian watermilfoil (*M. spicatum*)	86 (41%)
Naiads (*Najas sp*)	100 (47%)
Cabbage (*Potamogeton amplifolius*)	4 (2%)
Illinois pondweed (*P. illinoensis*)	3 (1%)
Floatingleaf pondweed (*P. natans*)	19 (9%)
Whitestem pondweed (*P. praelongus*)	1 (1%)
Flatstem pondweed (*P. zosteriformis*)	3 (1%)
Stringy pondweed (*P. sp*)	1 (1%)
Buttercup (*Ranunculus sp*)	2 (1%)
Sago pondweed (*Stuckenia. pectinata*)	10 (5%)
Water celery (*Vallisneria americana*)	29 (14%)
Water stargrass (*Zosterella dubia*)	10 (5%)
Filamentous algae floating	2 (1%)
Number of Submerged Species	17

Coontail was the dominant plant found in Bush Lake in August of 2011.

Naiads were the second most common aquatic plant found in Bush Lake on August 25, 2011.

Eurasian Watermilfoil in Bush Lake in 2011: On June 28, 2011 an Eurasian watermilfoil (EWM) assessment was conducted which involved a near-shore cruise around the entire lake. Eleven sites were sampled with observations made between sites. EWM was found at low to moderate abundance at all eleven sites (Figure S-1). In August of 2011, 211 sites were sampled in water up to 16 feet deep. EWM was found at 86 out of 211 sites. Milfoil distribution was similar to the June distribution, but abundance increased slightly from June to August (Figure S-1). In August, heavy milfoil growth was observed at six out of 86 sites where it was present. Milfoil was widespread in the north and south ends of Bush Lake.

EWM Assessment **Point-Intercept Plant Survey**

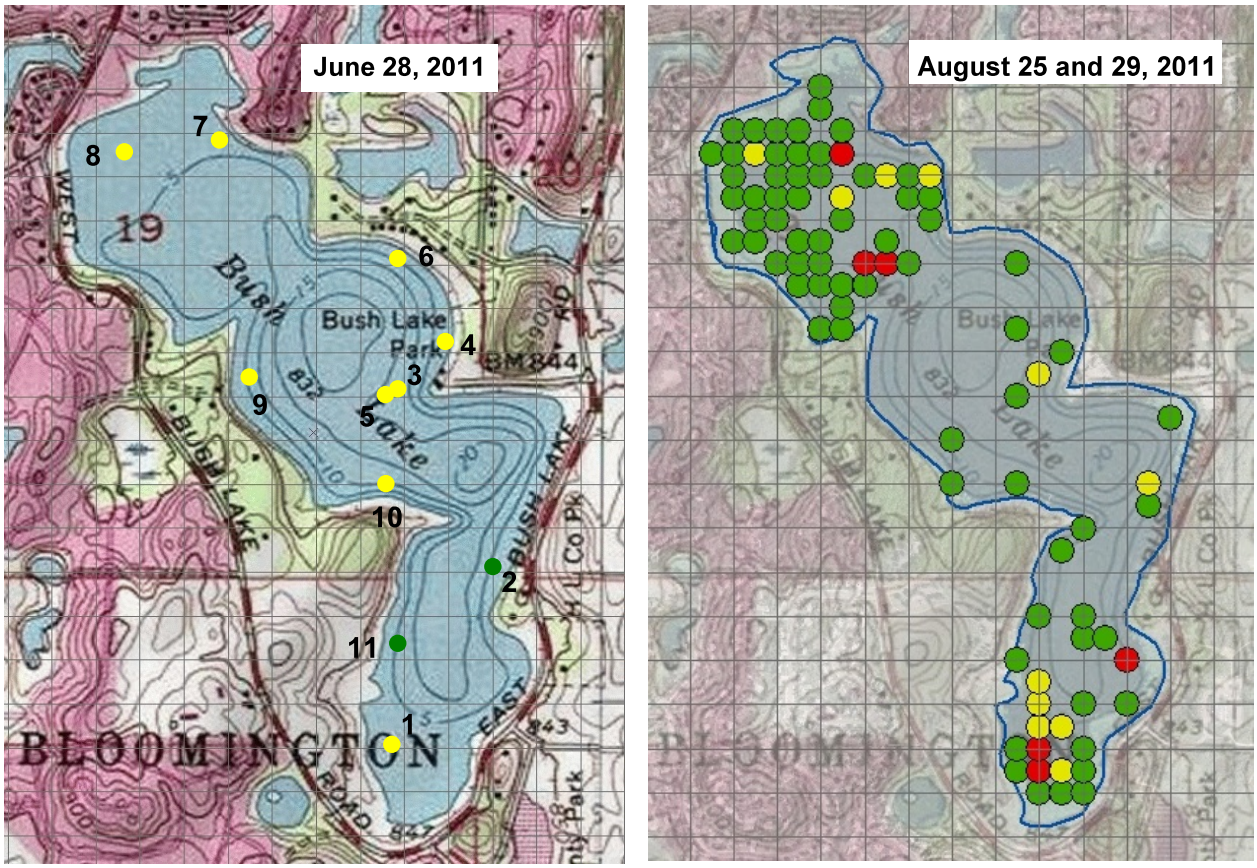


Figure S-1. [left] Locations of Eurasian watermilfoil from the assessment on June 28, 2011. Green dots = light growth and yellow dots = moderate growth.
[right] Coverage of Eurasian watermilfoil from the point-intercept aquatic plant survey on August 25 and 29, 2011. Green dots = light growth, yellow dots = moderate growth, and red dots = heavy growth.

Bush Lake, Minneapolis (ID: 27-0047)

Lake Area: 186 acres (MnDNR)
Littoral Area: 110 acres (MnDNR)
Maximum depth: 28 ft (MnDNR)

Introduction

Bush Lake has a variety of native and non-native aquatic plants. The objective of the 2011 plant evaluations were to assess the early season status of Eurasian watermilfoil and to characterize the summer aquatic plant community of Bush Lake using a point-intercept plant survey. This survey can serve as a reference point to determine if aquatic plants are increasing or decreasing in the future.

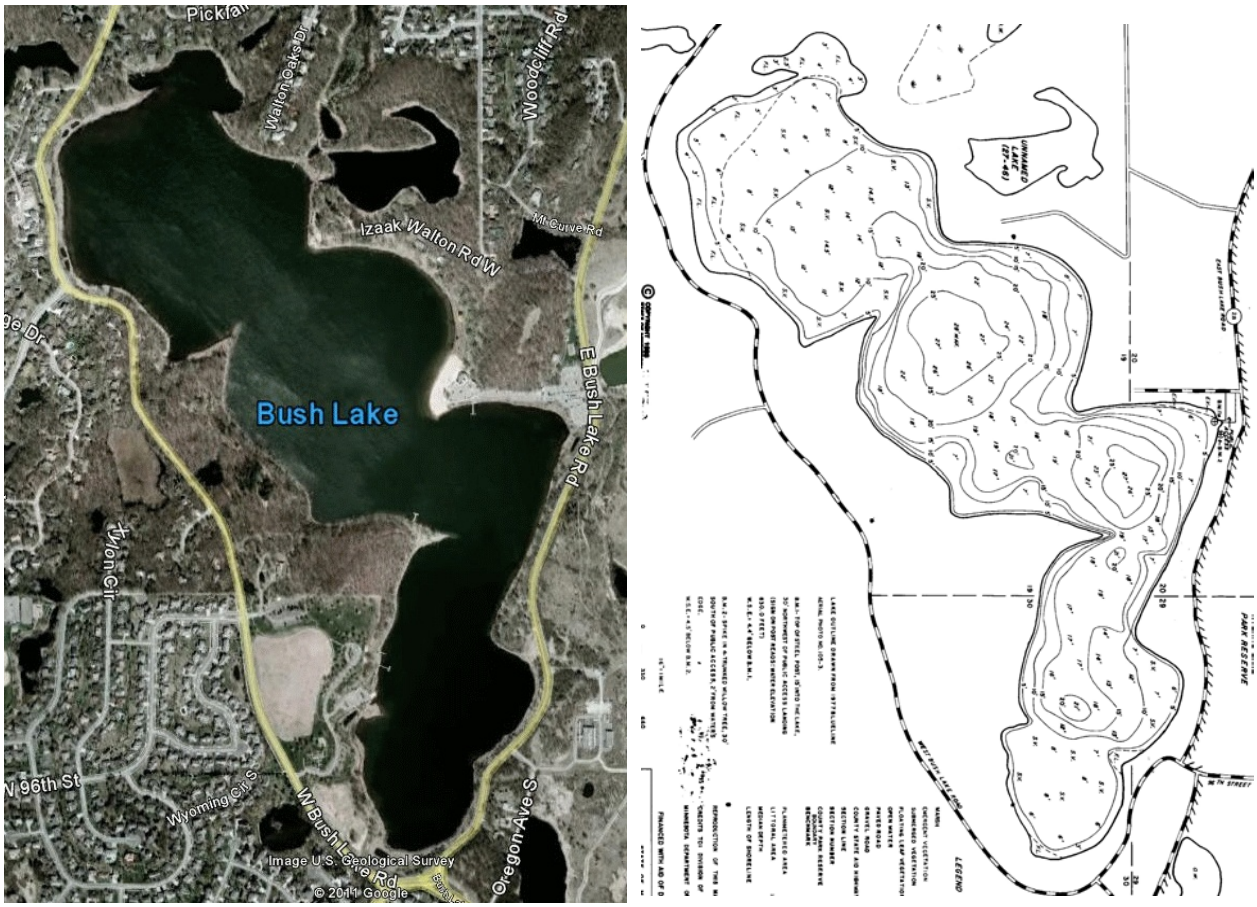


Figure 1. [left] Aerial view of Bush Lake, Bloomington, Minnesota (source: Google Earth). [right] MnDNR contour map.

Methods

Eurasian Watermilfoil Assessment: An Eurasian watermilfoil assessment was conducted on Bush Lake on June 28, 2011. The assessment involved cruising the nearshore area around the entire lake and observing milfoil growth. At eleven sites, rake samples of plants were collected to estimate a density of milfoil on a scale from 1 to 4 with 4 being the highest. The eleven sites were selected based on the known previous occurrence of milfoil, sediment data, and the importance for navigation and/or recreation in the area.

Point Intercept Survey: An aquatic plant survey of Bush Lake was conducted by Blue Water Science in 2011. The late season survey was conducted on August 25 and 29, 2011. The survey used a point-intercept survey method. A grid map was prepared by Blue Water Science and a consisted of a total of 292 points that were distributed throughout the lake (Figure 2). Points were spaced 50 meters apart and each point represented an average of 0.6 acres of lake surface area (186 acres ÷ 292 points = 0.6 ac/pt). GPS coordinates used a UTM WGS84 datum. At each sample point, plants were sampled with a rake sampler. A MnDNR plant density rating was assigned to each plant species on a scale from 1 to 4. A 4.5 or 5 rating indicated matting surface plant growth.

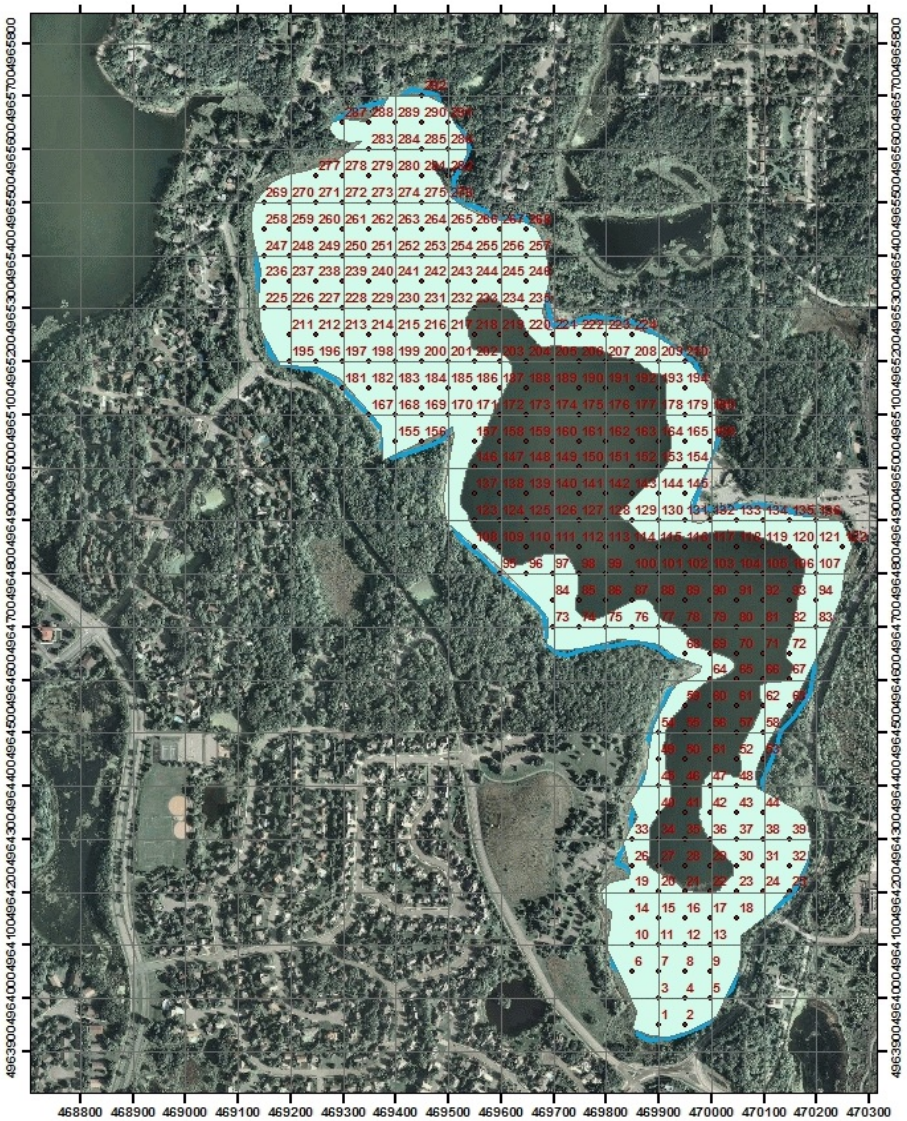


Figure 2. Point locations for the aquatic plant surveys are shown on the lake map with UTM coordinates using the WGS84 datum. The grid consisted of a total of 292 points. The light shading represents the littoral zone of Bush Lake defined as water depths of 15 feet or less.

Results of the June 28, 2011 Eurasian Watermilfoil Assessment

On June 28, 2011, the entire nearshore area of Bush Lake was assessed to characterize Eurasian watermilfoil (EWM) growth conditions. EWM was present at a number of areas in Bush Lake ranging from light to moderate growth (based on rake densities)(Table 1 and Figure 3). In late June, EWM was found primarily in patches in sizes ranging from 0.1 acre or less to about one acre. Because growth was light to moderate, with no large areas of heavy growth, milfoil control with herbicides was not employed in 2011. A full plant survey was to be conducted in August to determine the full extent of milfoil coverage and abundance. Curlyleaf pondweed, another non-native plant species was found at one site in six feet of water on the June 28, 2011 assessment.

Table 1. Bush Lake aquatic plant assessment on June 28, 2011.

Site	Depth (ft)	Non-Native Plant Density (Scale 1 - 4)		Comments
		Curlyleaf Pondweed	Eurasian Watermilfoil	
1 69861E 64102N	5-7		3	Plants will likely top out over a couple of acres. 50% of stems are branching.
2 70095E 64150N	4-9		1-2	Patchy EWM. Stringy pondweed is present.
3 69885E 64935N	8-9		2-3	EWM is 2 feet from surface, patchy area is 200 ft from shore.
4 69981E 65043N	6		3	Biggest bed is 0.1 acre outside of swimming area.
5 69875E 64924N	9		2-3	Bed is about 1.0 acre, next to Site 3, about 300 feet from shore.
6 69878E 65203N	8-10		2-3	Bed is about 1.0 acre. 20-30% of stems are branching. EWM stops at 11-ft drop-off to deeper water.
7 69491E 65483N	9		2-3	Bed is less 0.5 acre, 100 feet from shore (in front of private property).
8 69259E 65468N	6	1-2	2-3	Patchy bed about 1.0 acre. CLP is scattered, no turions observed.
9 69550E 64950N	6		2-3	Bed is about 0.1 acre.
10 69860E 64700N	5		3	Bed is less than 0.1 acre.
11 69870E 64350N	8-10		--	By fishing pier. No EWM observed.

Chart of EWM Density Ratings

Typical Eurasian watermilfoil growth pattern on June 28, 2011. Heaviest milfoil growth was 1-2 feet below the lake surface.

Sample Site Locations for the EWM Assessment on June 28, 2011

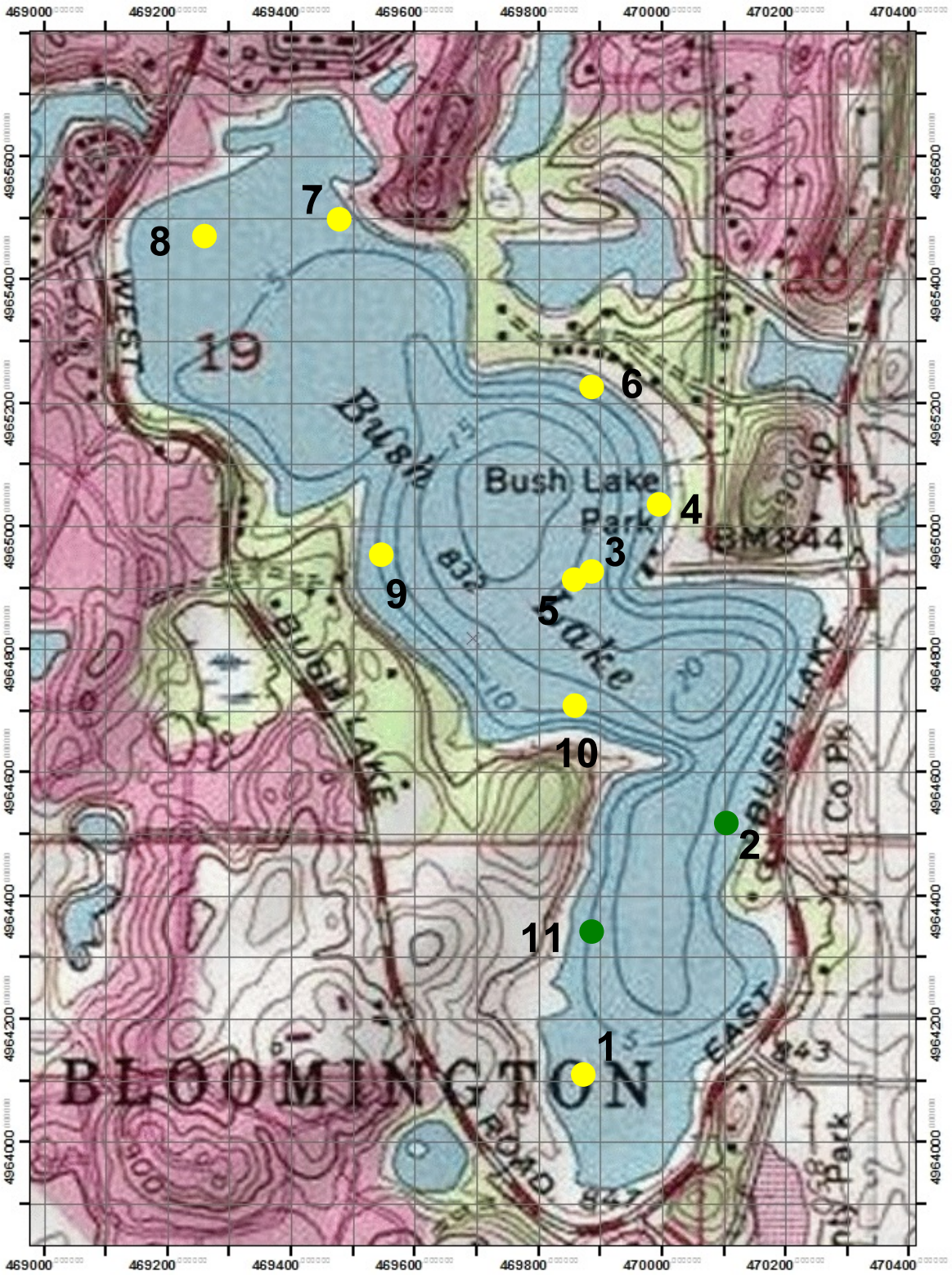


Figure 3. Monitoring areas of the EWM assessment on June 28, 2011. Green dots = light milfoil growth and yellow dots = moderate milfoil growth.

Results of the August 25 and 29, 2011 Point-Intercept Survey

Results of the point intercept aquatic plant survey conducted on August 25 & 29, 2011 found seventeen submerged aquatic plant species in Bush Lake (Table 2). A total of 211 sites were sampled out to depth of 16 feet (results for individual sites are shown in the Appendix). The location of native aquatic plants in Bush Lake is shown in Figure 4. The coverage of aquatic plants was estimated at 125 acres out of 186 acre lake (67% coverage).

Table 2. Summary of the occurrence of plant species for aquatic plant survey for 2011. Number in parenthesis represents the percent occurrence of the plant.

	2011
Emergent	**10 (5%)**
Bulrush (*Scirpus sp*)	**2 (1%)**
Cattails (*Typha sp*)	**4 (2%)**
American lotus (*Nelumbo lutea*)	**3 (1%)**
White waterlily (*Nymphaea sp*)	**37 (18%)**
Coontail (*Ceratophyllum demersum*)	**128 (61%)**
Chara (*Chara sp*)	**4 (2%)**
Elodea (*Elodea canadensis*)	**5 (2%)**
Star duckweed (*Lemna trisulca*)	**1 (1%)**
Northern watermilfoil (*Myriophyllum. sibiricum*)	**15 (7%)**
Eurasian watermilfoil (*M. spicatum*)	**86 (41%)**
Naiads (*Najas sp*)	**100 (47%)**
Cabbage (*Potamogeton amplifolius*)	**4 (2%)**
Illinois pondweed (*P. illinoensis*)	**3 (1%)**
Floatingleaf pondweed (*P. natans*)	**19 (9%)**
Whitestem pondweed (*P. praelongus*)	**1 (1%)**
Flatstem pondweed (*P. zosteriformis*)	**3 (1%)**
Stringy pondweed (*P. sp*)	**1 (1%)**
Buttercup (*Ranunculus sp*)	**2 (1%)**
Sago pondweed (*Stuckenia. pectinata*)	**10 (5%)**
Water celery (*Vallisneria americana*)	**29 (14%)**
Water stargrass (*Zosterella dubia*)	**10 (5%)**
Filamentous algae floating	**2 (1%)**
Number of Submerged Species	**17**

Representative native plant conditions in Bush Lake. [top] Illinois pondweed was surfacing off a point on the west side. [bottom] Floatingleaf pondweed was mixed in with Eurasian watermilfoil.

Native Aquatic Plants: The distribution and abundance of native plants in Bush Lake is shown in Figure 4. The dominant native plant was coontail followed by naiads. Emergent plants were abundant in the north and south ends of the lake. Native plant abundance ranged from light to heavy with heavy growth observed at 62 sites or approximately 37 acres.

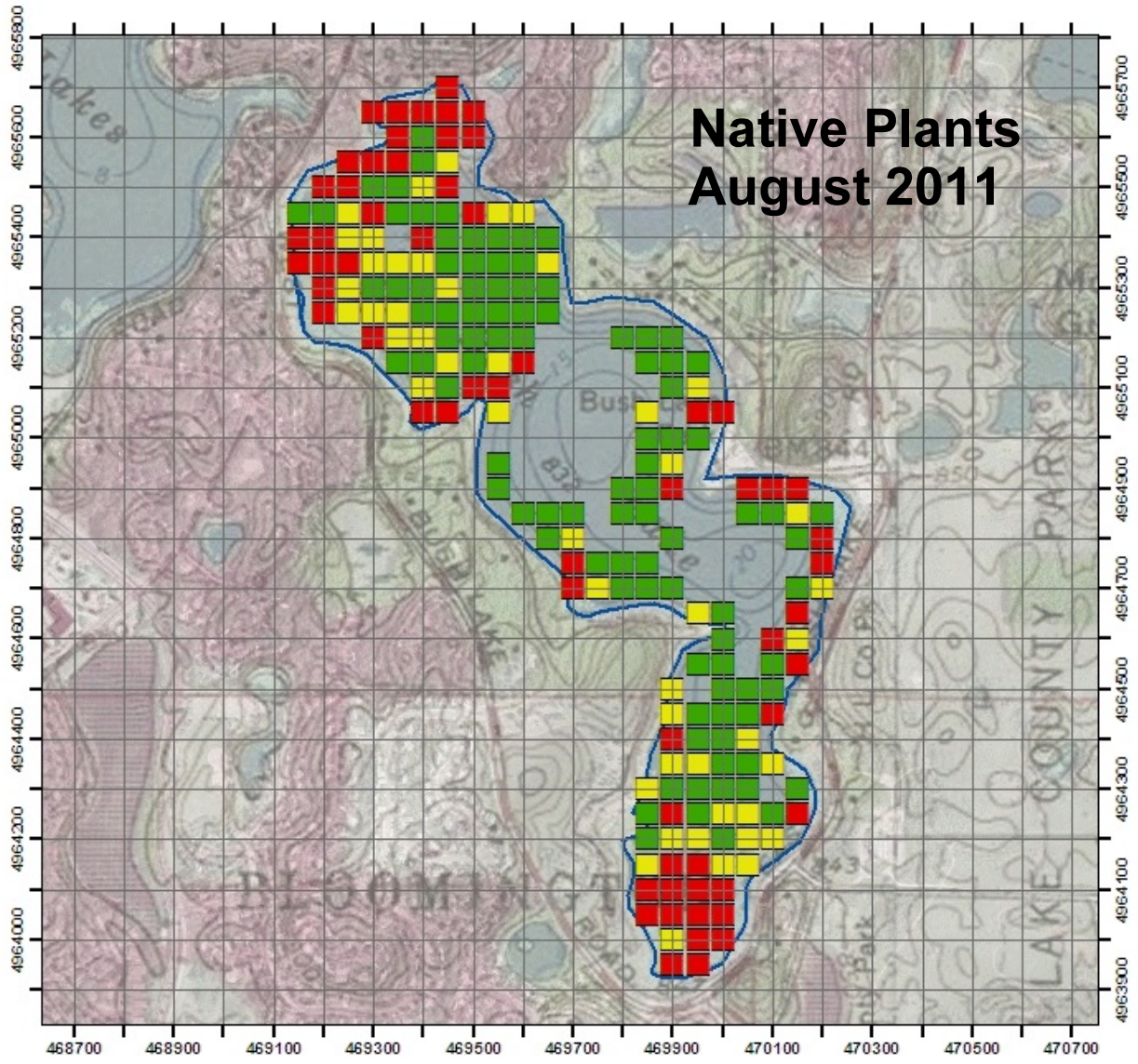


Figure 4. Native aquatic plant coverage for August 25 and 29, 2011. Green squares = light growth, yellow squares = moderate growth, and red squares = heavy growth.

Eurasian Watermilfoil: The distribution and abundance of Eurasian watermilfoil (EWM) in August of 2011 is shown in Figure 5. Although EWM was found at 86 sites (approximately 52 acres), heavy growth was observed at only six sites (roughly 4 acres) with stems reaching the water surface in additional scattered areas.

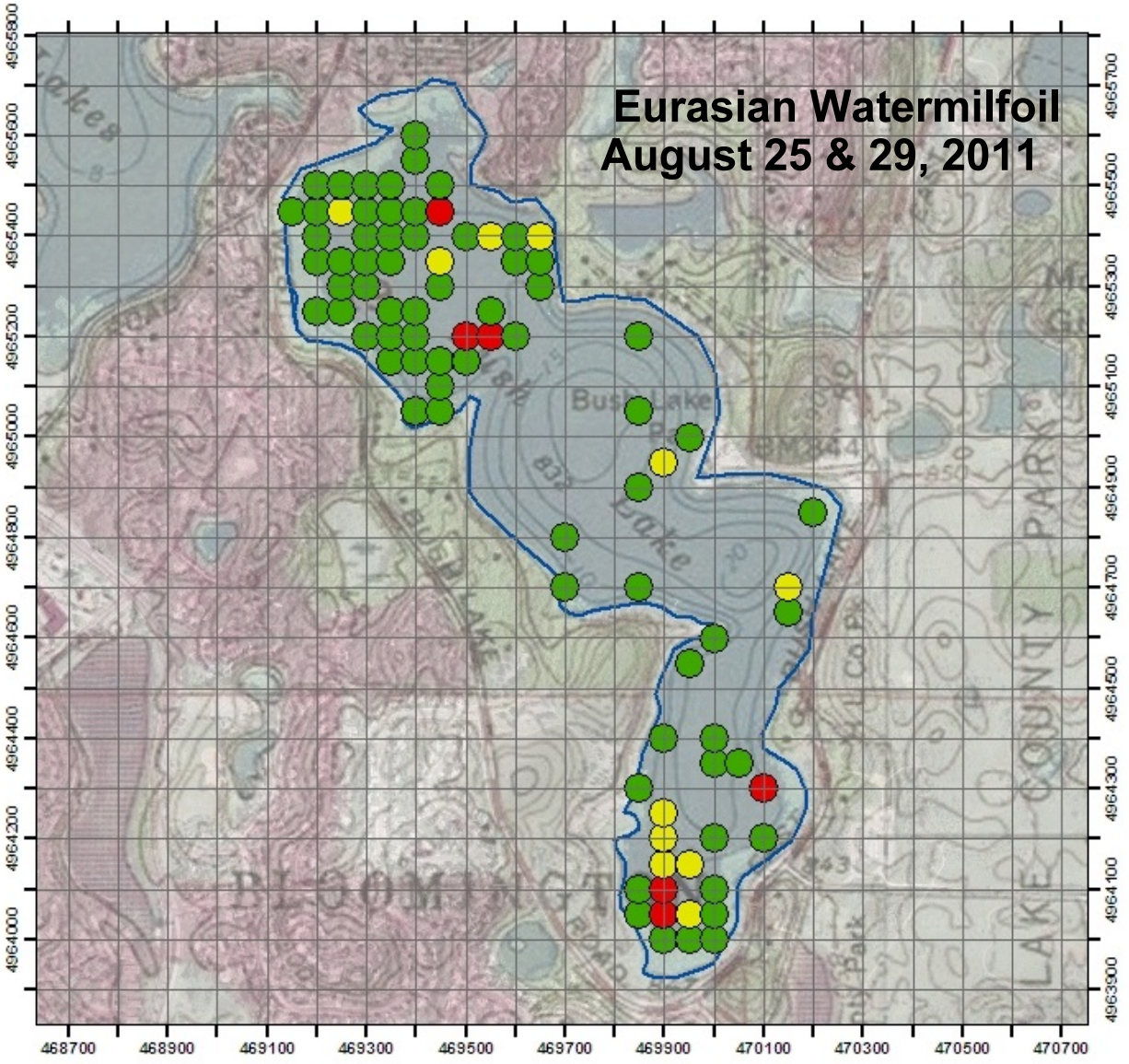


Figure 5. Eurasian watermilfoil coverage for August 25 and 29, 2011. Green dots = light growth, yellow dots = moderate growth, and red dots = heavy growth.

Eurasian Watermilfoil in Bush Lake in 2011: On June 28, 2011 an Eurasian watermilfoil (EWM) assessment was conducted which involved a near-shore cruise around the entire lake. Eleven sites were sampled with observations made between sites. EWM was found at low to moderate abundance at all eleven sites (Figure 6). In August of 2011, 211 sites were sampled in water up to 16 feet deep. EWM was found at 86 out of 211 sites. Milfoil distribution was similar to the June distribution, but abundance increased slightly from June to August (Figure 6). In August, heavy milfoil growth was observed at six out of 86 sites where it was present. Milfoil was widespread in the north and south ends of Bush Lake.

EWM Assessment **Point-Intercept Plant Survey**

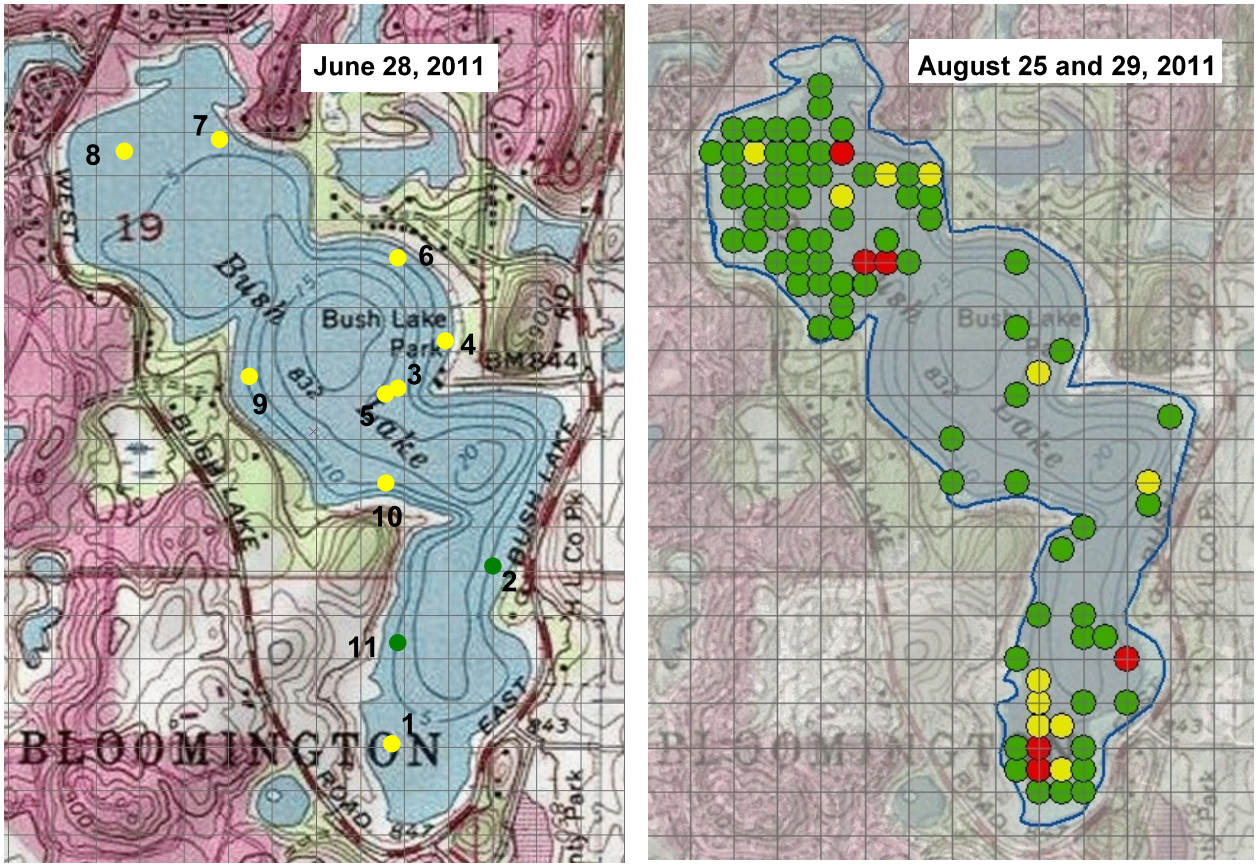


Figure 6. [left] Locations of Eurasian watermilfoil from the assessment on June 28, 2011. Green dots = light growth and yellow dots = moderate growth.
[right] Coverage of Eurasian watermilfoil from the point-intercept aquatic plant survey on August 25 and 29, 2011. Green dots = light growth, yellow dots = moderate growth, and red dots = heavy growth.

Native Plant and Eurasian Watermilfoil Distribution and Abundance: In August of 2011, aquatic plant growth was found to cover 67% of the lake area. Although the non-native Eurasian watermilfoil and curlyleaf pondweed are found in Bush Lake, native plant growth is more widespread and more abundant (Figures 7 and 8).

Native Plants

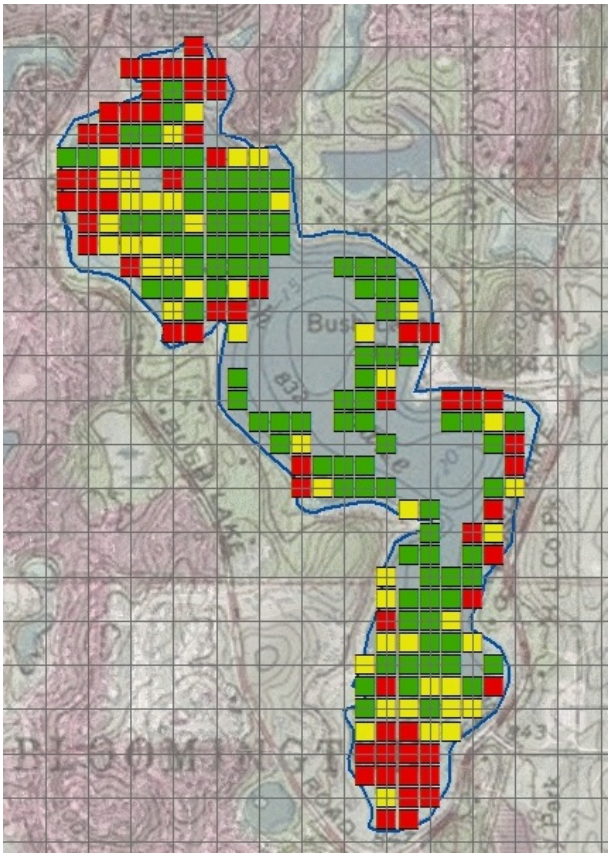


Figure 7. Native plants coverage. Green squares = light growth, yellow squares = moderate growth, and red squares = heavy growth.

Eurasian Watermilfoil

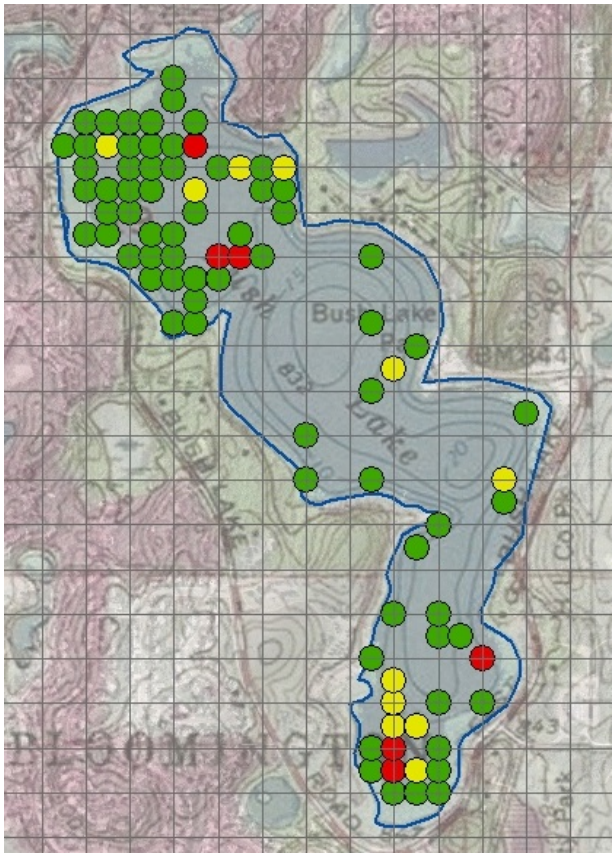


Figure 8. Eurasian watermilfoil coverage. Green circles = light growth, yellow circles = moderate growth, and red circles = heavy growth.

Previous Aquatic Plant Surveys in Bush Lake: Bush Lake was part of a study conducted by the U.S. Army Engineer Research and Development Center (ERDC) in 2003 and 2004 to evaluate early spring applications of low doses of endothal combined with 2,4-D to selectively control curlyleaf pondweed and Eurasian watermilfoil. Pre-treatment point-intercept surveys with 50m spacing between points were conducted in June and August in 2003 and in April 2004. Herbicide was applied on April 23, 2004 and Bush Lake was surveyed again in June and August of 2004. Areas that were treated in 2004 are shown in Figure 9.

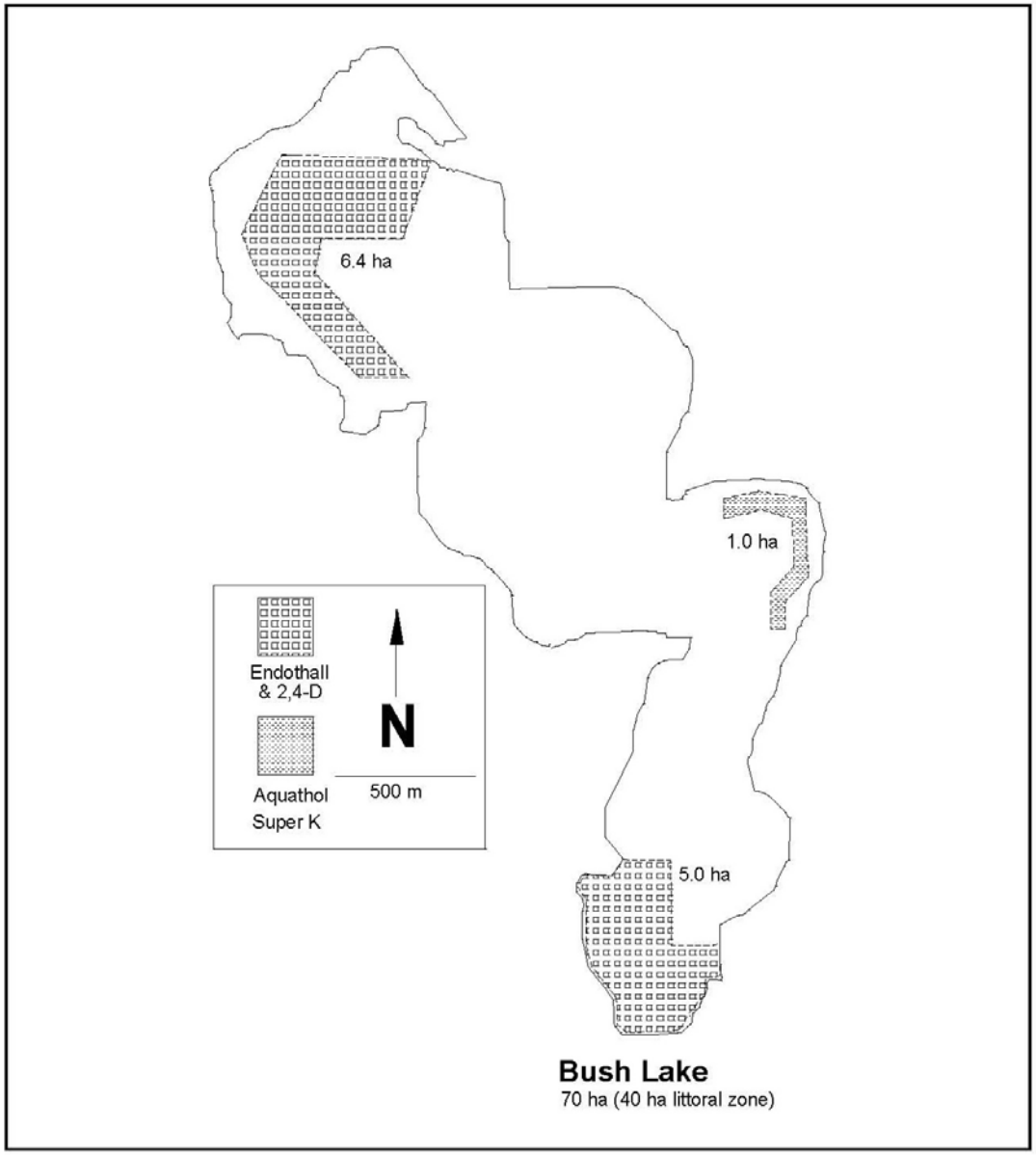


Figure 9. Areas in Bush Lake that were treated on April 23, 2004 (from Skogerboe and Getsinger 2006, reference on next page).

The herbicide treatment in April of 2004 reduced Eurasian watermilfoil and curlyleaf pondweed occurrence in the June and August surveys of 2004. The pre-treatment survey in August of 2003 is probably the most comparable of the 2003-2004 surveys to the August 2011 survey (Table 3). The Eurasian watermilfoil occurrence in 2003 was similar to the occurrence in 2011. Native plant occurrence was also similar.

It appears the aquatic plant community of Bush Lake has been fairly stable with typical annual variations from 2003 through 2011.

Table 3. Percent occurrence of point-intercept aquatic plant surveys conducted by Skogerboe and Getsinger 2006* in 2003-2004 and by Blue Water Science in 2011.

	2003 June Pre-Treatment	2003 August Pre-Treatment	2004 April Pre-Treatment	2004 June Post Treatment	2004 August Post Treatment	2011 August
% Native Plants	91	90	73	88	93	98
% EWM	36	37	21	4	18	41
% CLP	24	0	15	3	8	0
All Species	93	91	80	88	93	98
Number of Native Species	22	19	10	19	20	21

---

*Skogerboe, J.G. and K.D. Getsinger. 2006. Selective control of Eurasian watermilfoil and curlyleaf pondweed using low doses of endothall combined with 2,4-D. APCRP Technical Notes Collection. US Army Engineer Research and Development Center, Vicksburg, MS.

Potential Future Growth of Curlyleaf Pondweed and Eurasian Watermilfoil in Bush Lake Based on Lake Sediment Characteristics

Curlyleaf Pondweed Growth Potential: Lake sediment sampling results in Bush Lake from 2010 have been used to predict lake bottom areas that have the potential to support nuisance curlyleaf pondweed plant growth. Based on the key sediment parameters of pH, sediment bulk density, organic matter, and the Fe:Mn ratio (McComas, unpublished), the predicted growth characteristics of curlyleaf pondweed are shown in Table 4.

Table 4. Bush Lake sediment data and ratings for potential heavy curlyleaf pondweed growth.

Site	Depth (ft)	pH (su)	Organic Matter (%)	Fe:Mn Ratio	Potential for Curlyleaf Pondweed Growth
Light Growth		6.8	5	4.6	Light (green)
Moderate Growth		6.2	11	5.9	Moderate (yellow)
Heavy growth		>7.7	>20	<1.6	Heavy (red)
1	6	7.5	11.3	14.1	Moderate
2	6	7.6	7.3	14.2	Moderate
3	6	7.8	6.9	13.1	Moderate
4	6	7.7	11.9	19.8	Moderate
5	7	7.6	18.1	14.4	Moderate
6	5	7.6	11.2	20.4	Moderate
7	7.5	7.2	33.9	11.0	Light
8	7.5	7.0	33.9	12.7	Light
9	6	7.3	9.5	17.4	Light
10	6	7.8	14.5	10.9	Moderate
11	6	7.4	7.6	10.6	Moderate
12	6	7.0	1.0	6.9	Light
13	5	7.2	5.9	9.4	Light
14	5	7.3	2.1	8.0	Light
15	5.5	7.2	4.6	6.7	Light
16	5.5	7.6	11.3	8.8	Moderate
17	5	7.6	22.3	10.3	Moderate
18	3.5	7.5	23.1	17.7	Moderate
19	6	6.9	39.5	19.9	Light
20	6.5	6.9	43.9	14.4	Light
21	7.0	7.0	41.4	7.6	Light
22	12	7.0	36.8	2.2	Moderate
23	6	7.8	21.2	7.7	Heavy
24	6	7.7	12.7	6.5	Moderate
25	5	7.8	13.3	6.5	Moderate
26	5	8.0	9.9	9.7	Moderate
27	4	8.0	1.6	4.4	Moderate
28	27	7.4	19.5	7.8	--
29	27	7.1	20.8	6.3	--
30	18	7.4	16.6	12.5	--
31	29	7.2	15.8	8.6	--

Curlyleaf Growth Predictions and 2010 Conditions: Based on lake sediment analyses, results indicate curlyleaf pondweed has the potential for light to moderate growth in Bush Lake (Figure 10a). This type of growth was actually observed in an aquatic plant survey conducted on June 2, 2010 where curlyleaf growth was light to moderate (Figure 10b). This type of future growth pattern would be expected to occur based on lake sediment characteristics.

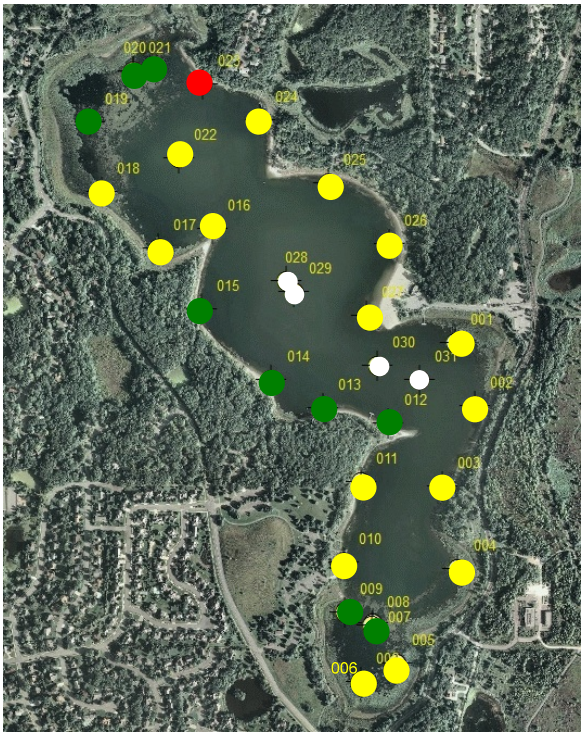


Figure 10a. Predicted curlyleaf pondweed growth characteristics based on 2010 lake sediment survey. Green = light growth, yellow - moderate growth, and red = heavy growth.

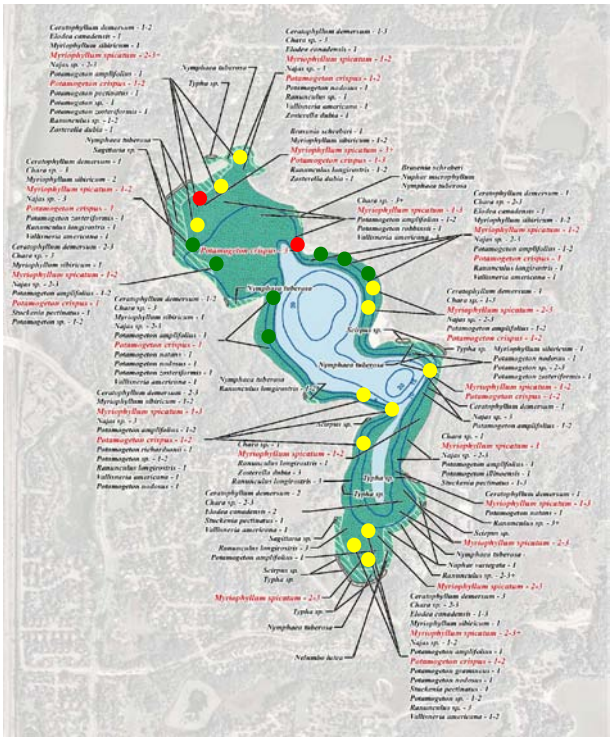


Figure 10b. Actual curlyleaf distribution in Bush Lake on June 2, 2010. Green dots = density of 1, yellow dots = density of 1-2, and red dots = density of 1-3 (source: Barr Engineering).

Eurasian Watermilfoil Growth Potential: Lake sediment sampling results in Bush Lake from 2010 have been used to predict lake bottom areas that have the potential to support heavy EWM growth. Eurasian watermilfoil was first observed in Bush Lake in 1990. 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 growth could be expected for milfoil growth in Bush Lake (Table 5).

Table 5. Bush Lake sediment data and ratings for potential EWM growth.

Site	Depth (ft)	NH_4 Conc (ppm)	Organic Matter (%)	Potential for Eurasian Watermilfoil Growth
Light Growth		<10	>20	Light (green) to Moderate (yellow)
Heavy Growth		>10	<20	Heavy (red)
1	6	15	11.3	Heavy
2	6	12.3	7.3	Heavy
3	6	42.3	6.9	Heavy
4	6	94.2	11.9	Heavy
5	7	98.7	18.1	Heavy
6	5	120.1	11.2	Heavy
7	7.5	37.9	33.9	Light
8	7.5	30.6	33.9	Light
9	6	95.5	9.5	Heavy
10	6	33.1	14.5	Heavy
11	6	7.6	7.6	Moderate
12	6	3.7	1.0	Light
13	5	7.0	5.9	Moderate
14	5	6.7	2.1	Moderate
15	5.5	3.7	4.6	Moderate
16	5.5	4.5	11.3	Moderate
17	5	37.4	22.3	Moderate
18	3.5	6.6	23.1	Moderate
19	6	34.6	39.5	Light
20	6.5	33.0	43.9	Light
21	7.0	11.7	22.3	Moderate
22	12	21.0	36.8	Light
23	6	16.6	21.2	Moderate
24	6	20.0	12.7	Heavy
25	5	5.5	13.3	Moderate
26	5	6.6	9.9	Moderate
27	4	6.5	1.6	Moderate
28	27	67.2	19.5	--
29	27	34.7	20.8	--
30	18	35.7	16.6	--
31	29	111.0	15.8	--

Eurasian Watermilfoil Growth Predictions and Conditions in 2010 and 2011:

The sediment nitrogen conditions in Bush Lake are moderate to high. Eurasian watermilfoil may grow in a number of locations in Bush Lake and is predicted to produce perennial matting conditions (which are defined as heavy nuisance condition) in several areas primarily in the south and southeastern parts of Bush Lake (Figure 11a). Milfoil growth was moderate to heavy in 2010 with heavy growth reported in the north end of the lake as well (Figure 11b). In 2011, milfoil growth was light to heavy (Figure 11c). Sediment parameters indicate that heavy milfoil growth should not be sustained in the north end of Bush Lake. Light to moderate growth is predicted for most years through most of the littoral zone in the future.

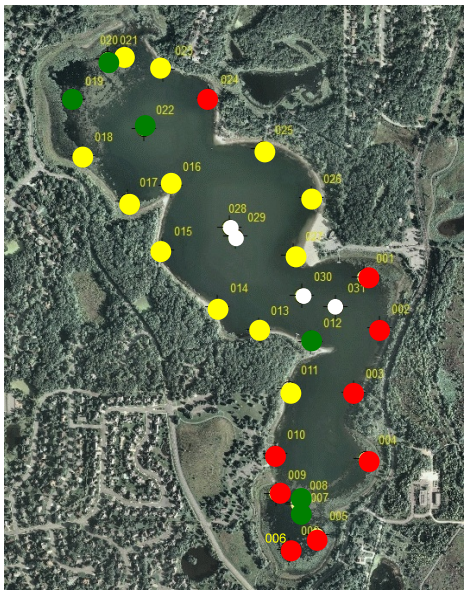


Figure 11a. Predicted Eurasian watermilfoil growth characteristics based on 2010 lake sediment survey. Green = light growth, yellow = moderate growth, and red = heavy growth.

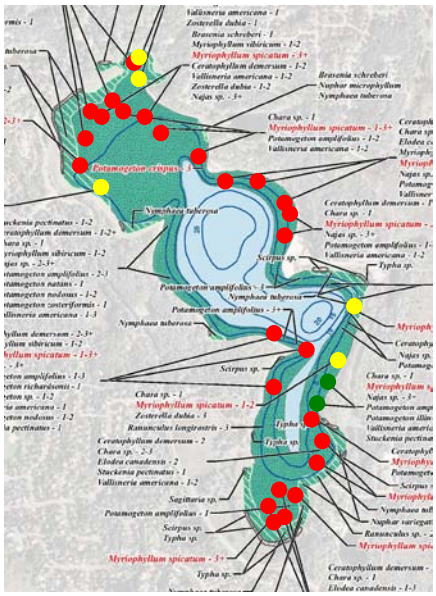


Figure 11b. Actual Eurasian watermilfoil distribution in Bush Lake on August 17, 2010. Green dots = density of 1, yellow dots = density of 1-2, and red dots = density of 1-3 (source: Barr Engineering).

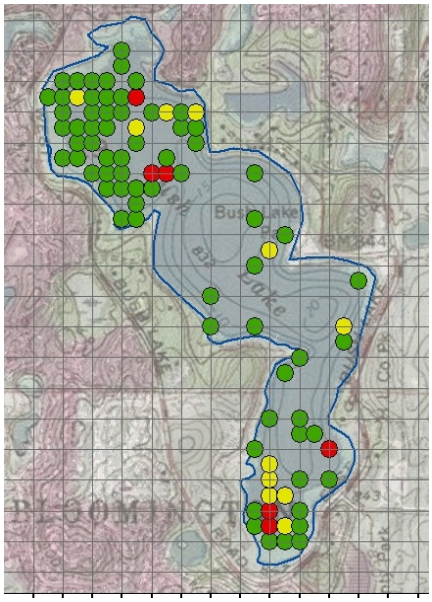
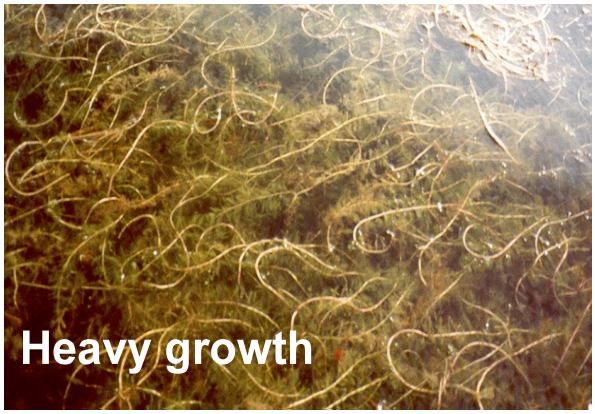


Figure 11c. Actual Eurasian watermilfoil distribution in Bush Lake on August 25 & 29, 2011. Green dots = density of 1-2, yellow dots = density of 3, and red dots = density of 4-5).



Interesting Sites on Bush Lake in 2011

When a stem of Eurasian watermilfoil breaks off, it can produce roots at each node on the stem. This is one way milfoil can propagate and expand in distribution in the lake.

Waterfowl were present on Bush Lake in the August survey.

An underwater pipe was observed at site 284 in the August survey.

APPENDIX

Point-Intercept Aquatic Plant Survey

American Lotus in Bush Lake

Table 1. Aquatic plant densities for sample points for the August 25 and 29, 2011 survey. Plant density was assigned based on a scale from 1 - 5 with 5 the densest.

site	depth (ft)	Bul-rush	Cat-tails	Emergents	Amer. lotus	White water-lily	Butter-cup	Cabb-age	Chara	Coon-tail	Elodea	Eura. water-milfoil	Flat-stem pond-weed	Float-ing-leaf	Illinois pond-weed	Naiad	North water-milfoil	Sago pond-weed	Star duck-weed	Stringy pond-weed	Water celery	Water star-grass	White-stem pond-weed	FA float
1	2		5																					
2	2		5																					
3	5					2				3		1												1
4	6					5				4.5	1	1												
5	5					4				3		1												
6	5					4				2		1												
7	7									4		4.5												
8	7					2				4		3												
9	5				4	4				3		1						1						
10	7					4				4		1												
11	7									4		4.5												
12	8									4														
13	7				5					3		1												
14	7									3						3						2		
15	8							1		4		3				1								
16	8									4	1	3												
17	5					3	1			2														
18	4	2				3																		
19	6															2	2				1			
20	8									3		3				1								
21	9									1						3								
22	10				1					2		1								1		1		
23	8									2						3	2							
24	5					3	1			2		2									1			
26	5					2			1							2					1			
27	12					4				1		3				1								
28	13									2														
29	15									3														
30	15									3														
31	12									2						1								
32	5					4				2											1			
33	5											1				3		1			2			
34	15									2														
35	15									1														
36	15									1						1								
37	13									2														
38	9											4												
39	4					2				2									1		1			
40	12															3								
41	15									3														
42	14									2		1				1								
43	13									2		2				1								
44	4					1					1			1		3	1							
45	9											1				4								
46	16									1.5														
47	12									1		2				2								
48	9									2						3								
49	6														1	3		1						
50	15									2														
51	15									2						1								
52	15									2														
53	5															4		1			1			
54	5									2				3		2					2			
55	16																							
56	15									2														
57	16									2														
58	6					2										2							2	
59	9									1		1				2								
60	16									2														
62	14									2														
63	2	5	5																					
64	14									1		1				1								
65	18																							

Table 1. Aquatic plant densities for sample points for the August 25 and 29, 2011 survey. Plant density was assigned based on a scale from 1 - 5 with 5 the densest.

site	depth (ft)	Bul-rush	Cat-tails	Emerg ents	Amer. lotus	White water-lily	Butter-cup	Cabb-age	Chara	Coon-tail	Elodea	Eura. water-milfoil	Flat-stem pond-weed	Float-ing-leaf	Illinois pond-weed	Naiad	North water-milfoil	Sago pond-weed	Star duck-weed	Stringy pond-weed	Water celery	Water star-grass	White-stem pond-weed	FA float
66	9															4								
67	4								3															
68	6														3	3					2			
69	15									2						1								
71	18																							
72	9											1				4								
73	6					1						1				4					2			
74	9															3								
75	10															2								
76	9											1				2					1			
77	13									2						1								
78	18																							
79	18																							
82	9									2		3									2			
83	4					3										3					1			
84	8															4								
85	16									2														
86	16									1														
87	16									1														
88	18																							
93	18																							
94	5					1							1		4.5									
96	7															2		2			2			
97	10											2				3	1							
101	16									1														
106	16									2														
107	6														5	2		1			2			
109	10															2								
110	16									2														
111	16									2														
113	16									1														
114	16									1														
118	15									1														
119	15									2														
120	7									2					3									
121	5					4				2		1												
123	13															1								
124	18																							
128	14															2								
129	12											1				1								
130	8														4.5									
133	6					2										4								
134	4					5				1						2								
135	3					5				1						2								
137	15									2														
143	15															1								
144	11									3		3												
146	18																							
152	14									1														
153	14															1								
154	7									2		2									1			
155	3					5				1		1									1			
156	2					4				2		1									1			
157	12									1						3								
163	16									3		1				2								
164	16																							
165	8														1	4	2							
166	5														4	2	1							
168	7							3								3								
169	8									2		1			2		1					1		
170	6														5	1	2							
171	5														5	1	1							
178	14									1						0.5								

Table 1. Aquatic plant densities for sample points for the August 25 and 29, 2011 survey. Plant density was assigned based on a scale from 1 - 5 with 5 the densest.

site	depth (ft)	Bul-rush	Cat-tails	Emerg ents	Amer. lotus	White water-lily	Butter-cup	Cabb-age	Chara	Coon-tail	Elodea	Eura. water-milfoil	Flat-stem pond-weed	Float-ing-leaf	Illinois pond-weed	Naiad	North water-milfoil	Sago pond-weed	Star duck-weed	Stringy pond-weed	Water celery	Water star-grass	White-stem pond-weed	FA float
179	8									1						3	1							
182	7					1						2				2		1			1			
183	11									2		2												
184	11									2		1				3								
185	10											2				2								
186	8									2					3	1								
187	8															4								
192	16									1														
193	14									1														
194	7														1	2	1				2			
197	3					5				1		2												
198	10									1		1				3								
199	13									3		1												
200	13									2														
201	12									1		4												
202	11									1		4												
203	14									2		2												
204	18																							
206	17																							
207	15									2														
208	11									1		2												
209	8									1							1				2	1		
211	2					5				1		1												
212	4					3				1		1	1											
213	6												2		3	2					1			
214	11											2				3								
215	13									1		1				2								
216	14									2														
217	14									2														
218	14									2		1												
219	16									1														
220	5									1							2				2			
226	4					4				1						3	1							
227	5											1			3	3					1	1		
228	9											2			2	2								
229	13									2						1								
230	13									2						1								
231	13									3		1												
232	14									2														
233	14									0.5						0.5								
234	15									1														
235	7									1		1												
236	2		5																					
237	5					4				2		1				1					1			
238	6											2				4		1						
239	8									2		2				3						1		
240	10									2		2				3								
241	12															3								
242	12									2		3												
243	14									2						1								
244	13									2														
245	13									1		1												
246	8								3			1												
247	4					5									1	3						1		
248	5											2				4					1			
249	7									3	3				3									
250	8									3		1												
251	9											2												
252	9											2				4								
253	11										1					2								
254	14									2		1				1								
255	13									1		3												
256	12								2			1				1								

Table 1. Aquatic plant densities for sample points for the August 25 and 29, 2011 survey. Plant density was assigned based on a scale from 1 - 5 with 5 the densest.

site	depth (ft)	Bul-rush	Cat-tails	Emerg ents	Amer. lotus	White water-lily	Butter-cup	Cabb-age	Chara	Coon-tail	Elodea	Eura. water-milfoil	Flat-stem pond-weed	Float-ing-leaf	Illinois pond-weed	Naiad	North water-milfoil	Sago pond-weed	Star duck-weed	Stringy pond-weed	Water celery	Water star-grass	White-stem pond-weed	FA float
257	7											3				1					1	1		
258	3					5						1				2								2
259	6									2		2										1		
260	7									2		3				3								
261	8									2		2				4						1		
262	8									2		2												
263	8											1				1		1						
264	9									1		4.5												
265	10															4								
266	10							3																
267	6													1		3	1				2			
270	3					5						2				2								
271	7					4				3		1				3								
272	4									1		1			1									
273	8									2		1						2						
274	8									3						1								
275	7											1				4								
277	3			4																				
278	3			4																				
279	6					4		1								3								
280	8									2		1												
281	4															3								
283	2			4																				
284	2											1				1								
285	2					4										2					1			
286	2			4																				
287	2			4																				
288	2			4																				
289	2			4																				
290	2			4																				
291	2			4																				
292	2			4																				
Average		**3.5**	**5.0**	**4.0**	**3.3**	**3.5**	**1.0**	**2.0**	**2.3**	**1.9**	**1.4**	**1.8**	**1.3**	**1.7**	**2.9**	**2.3**	**1.3**	**1.2**	**1.0**	**1.0**	**1.4**	**1.1**	**2.0**	**1.5**
occur out to 16 feet of depth (211 sites)		2	4	10	3	37	2	4	4	128	5	86	3	3	19	100	15	10	1	1	29	10	1	2
% occurrence		1	2	5	1	18	1	2	2	61	2	41	1	1	9	47	7	5	1	1	14	5	1	1