Buck Lake, Scott County (source: Google Earth)

Sediment Survey and Aquatic Plant Survey for Buck Lake, Scott County, Minnesota for 2010

[Sediment Survey Conducted: September 16, 2010]
[Aquatic Plant Survey Conducted: September 16, 2010]

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Introduction

Buck Lake is a 27 acre (open water) lake in Scott county, Minnesota. An aquatic plant survey and sediment survey were completed September 16, 2010. The goals were to:1) characterize lake sediment fertility, 2) monitor the aquatic vegetation in the lake, and 3) assess the sediment suitability for establishment of invasive aquatic plants (mainly curlyleaf pondweed and Eurasian watermilfoil).

Methods

Aquatic Plant Survey: An aquatic plant point-intercept survey of Buck Lake was conducted by Blue Water Science on September 16, 2010. A grid map was prepared by Blue Water Science and a consisted of a total of 60 points that were distributed throughout the lake at 50 meter intervals. 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 matted surface plant growth.

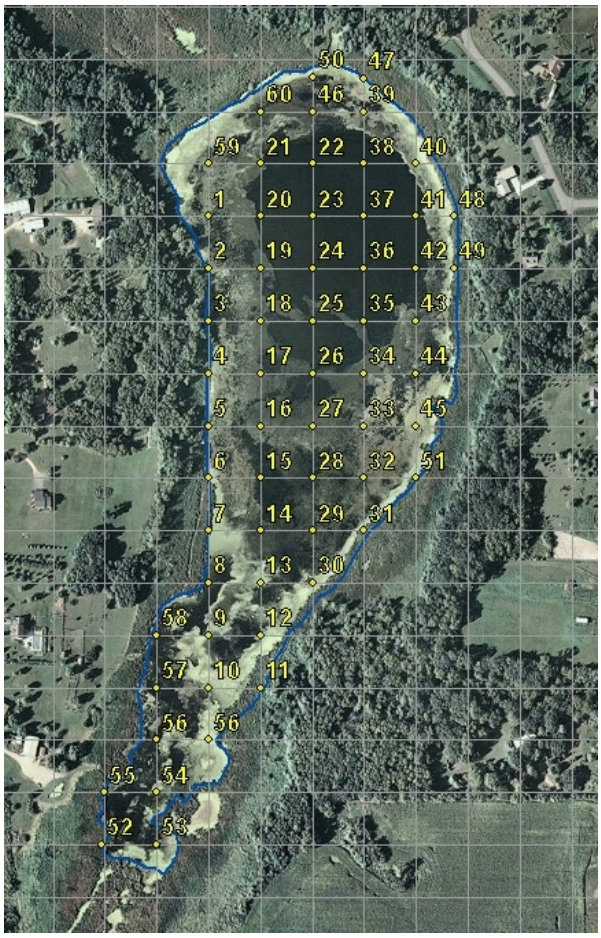

Figure 1. Sample site map used on September 16, 2010.

Sediment Survey: A total of 6 lake sediment samples were collected from depths ranging from 4 to 7 feet in Buck Lake on September 16, 2010. Samples were collected using a modified soil auger, 5.2 inches in diameter (Figure 2). Soils were sampled to a depth of 6 inches. The lake soil from the sampler was transferred to 1-gallon zip-lock bags and delivered to a soil testing laboratory. Sample locations are shown in Figure 3.

At the lab, sediment samples were air dried at room temperature, crushed and sieved through a 2 mm mesh sieve. Sediment samples were analyzed using standard agricultural soil testing methods. Fourteen parameters were tested for each soil sample. A summary of extractants and procedures is shown in Table 1. Routine soil test results are given on a weight per volume basis.

Figure 2. Soil auger used to collect lake sediments.

Table 1. Soil testing extractants used by the University of Minnesota Soil Testing Laboratory. These are standard extractants used for routine soil tests by most Midwestern soil testing laboratories (reference: Western States Laboratory Proficiency Testing Program: Soil and Plant Analytical Methods, 1996-Version 3).

Parameter	Extractant
P-Bray	0.025M HCL in 0.03M NH_4F
P-Olsen	0.5M $NaHCO_3$
NH_4-N	2N KCL
K, Ca, Mg	1N NH_4OA_c (ammonium acetate)
Fe, Mn, Zn, Cu	DTPA (diethylenetriamine pentaacetic acid)
B	Hot water
SO_4-S	$Ca(H_2PO_4)_2$
pH	water
Organic matter	Loss on ignition at 550^o C

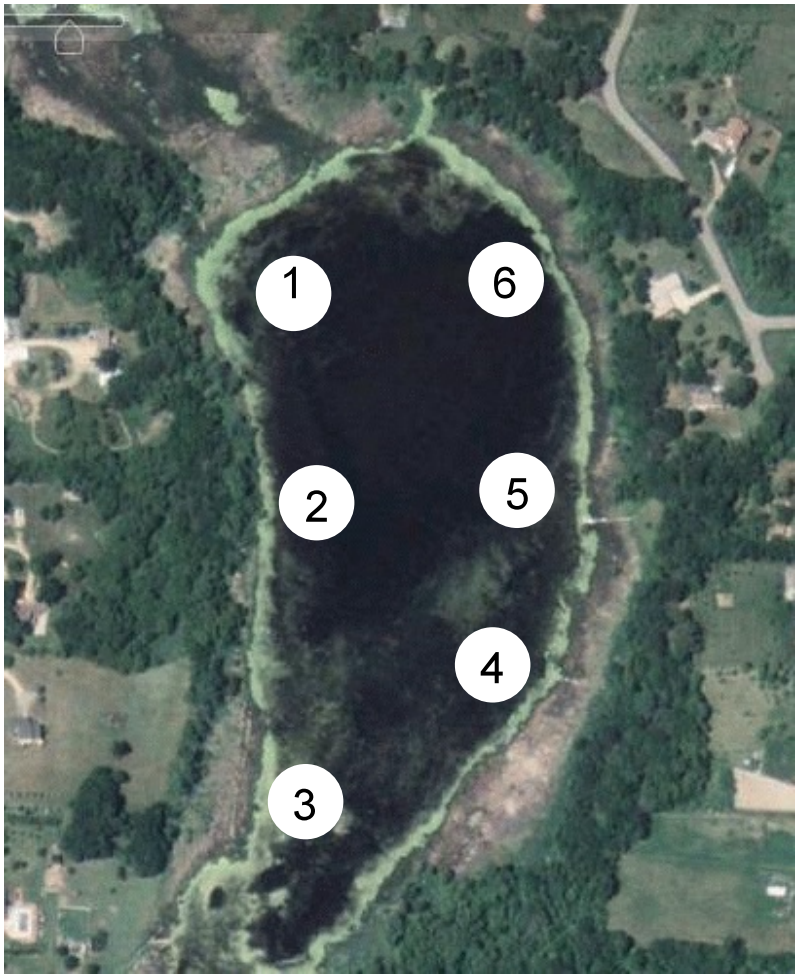

Figure 3. Six sediment samples were collected on September 16, 2010.

Results of the Lake Sediment Survey

Buck Lake sediment results are fairly typical for lake sediments except for a couple of parameters. Sediment pH is a little lower than normal (where normal is 7.7). Both Olsen-phosphorus and ammonia nitrogen were elevated in the sediments (Table 2) and iron was also slightly elevated. With high Olsen-P concentrations, it appears Buck Lake sediments have a potential to release moderate amounts of phosphorus to the water column. Sulfate levels were normal except for Site B6 where there was a high concentration. Organic matter was normal for a shallow lake and results indicated sediments were generally a silty muck.

Table 2. Lake sediment results for six locations.

Sample Number	Bulk Density (wt/8.51)	Water pH	Organic Matter (%)	Bray-P (ppm)	Olsen-P (ppm)	Potassium (ppm)	Zinc (ppm)	Copper (ppm)	Iron (ppm)	Manganese (ppm)	Fe/Mn	Calcium (ppm)	Magnesium (ppm)	Boron (ppm)	Ammmonia Nitrogen (ppm)	Sulfate (ppm)
B1	0.58	7.4	26.1	1	14	65	1.7	1.6	227.8	27.6	8.3	2,790	278	0.8	55.5	45
B2	0.76	7.3	14.9	7	19	147	3.4	3.8	263.3	47.8	5.5	3,285	462	0.9	171.9	39
B3	0.77	7.4	12.4	10	18	122	3.3	3.4	275.1	25.8	10.7	3,122	396	1.2	110.7	23
B4	0.59	7.5	19.5	2	12	69	1.9	1.9	177.1	26.2	6.8	2,712	298	0.9	62.7	61
B5	0.66	7.4	19.2	1	19	90	2.1	2.4	264.3	48.4	5.5	3,151	327	0.7	85.7	70
B6	0.72	7.2	19.0	2	49	100	2.2	2.4	399.6	71.8	5.6	3,647	472	1.1	61.7	215

Figure 4. [left] Coontail was found growing to the surface in some areas of Buck Lake on September 16, 2010.
[right] Buck Lake plant conditions on September 16, 2010. Some plants were growing to the surface.

Results of the Summer Aquatic Plant Survey

Coontail was the dominant plant in Buck Lake in 2010 (Table 3). Other plants present included flatstem pondweed, sago pondweed, and stringy pondweed. Plants grew out to a depth of 5 feet. The lake has a maximum depth of 9 feet although that is a small area in the northern end of the lake (Table 4). Overall plant species diversity is low, but plant abundance, primarily coontail, is high. Submerged plant distribution, which is dominated by coontail, covers about 73% of the lake bottom.

Table 3. Buck Lake aquatic plant occurrence and densities for the September 19, 2010 plant survey based on 60 sampled locations.

Sept. 19, 2010	Buck Lake (60 stations)		
	Occur	% Occur	Density
Cattails	7	12	5.0
Watermeal	32	53	1.8
Duckweed	33	55	2.8
Coontail	44	73	3.5
Flatstem Pondweed	3	5	1.6
Sago Pondweed	3	5	0.8
Star duckweed	8	13	1.0
Stringy Pondweed	3	5	1.0

Figure 5. Coontail was the dominant plant in Buck Lake.

Table 4. Data for point-intercept sample sites from the aquatic plant survey of September 16, 2010 in Buck Lake.

Site	Depth (ft)	Plant Densities							
		Cattails	Watermeal	Duckweed	Coontail	Flatstem	Sago	Star Duckweed	Stringy
1	3.5				4				
2	2		2	5					
3	1.5				1				
4	2		3	5	3				
5	2		4	5	5				
6	2.5		2	2	2				
7	2	5							
8	3				1			1	1
9	3				1				
10	3		1	4	4				
11	1								
12	2								
13	3			1	1				
14	14		1	3	3				
15	4		3	2	5				
16	4.5		2	3	4				
17	4.5				4				
18	5		1	1	4.5				
19	5		1	2	5				
20	5				3				1
21	4.5				2				1
22	8.5								
23	9.5								
24	7								
25	5		1	1	4.5				
26	5		0.5	1	4.5				
27	4.5		0.5	1	4.5			1	
28	4.5		2	2	4				
29	4		3	3	4.5			1	
30	3		4	5	4				
31	3		2	3	5				
32	3.5				4				
33	4				4				
34	4.5		1	1	5		0.5	1	
35	5		1	1	4	1			
36	9								
37	9.5								
38	5			1	3				
39	3								
40	4		1	5	4.5				
41	5				4	2			
42	5			2	5				
43	4.5		2	2	5				
44	4		1	2	5				
45	3		1	5	4			1	
46	4		1	2	4				
47	1	5							
48	1	5							
49	1	5							
50	1								
51	1.5		2	5	3				
52	1.5		4	4	3				
53	2	5							
54	3								
55	2		3	5	3		1		
56	1.5		1	2	3				
57	3		1	3	2	2		1	
58	3			4	3			1	
59	3				1				
60	4				3				

Lake Sediment Conditions and Future Non-Native Plant Growth

The objective of this lake soil fertility survey was to characterize Buck Lake soils in the littoral zone in order to better predict where potential nuisance areas of milfoil and Curlyleaf growth could occur in the future.

Table 5. Sediment survey summary. Based on lake sediment characteristics, curlyleaf pondweed has a low potential for heavy growth and Eurasian watermilfoil has a high potential for heavy growth.

	Depth (ft)	Plants Observed at Sample Site	Curlyleaf Suitability for Heavy Growth	Eurasian watermilfoil Suitability for Heavy Growth
Site 1	5	Coontail "5" Stringy "1"	Moderate	Moderate
Site 2	5	Coontail "4"	Low	High
Site 3	3	--	Low	High
Site 4	4	Coontail "4"	Moderate	High
Site 5	5	Coontail "5" Sago "1"	Low	High
Site 6	8	Coontail "1"	Low	High

Figure 6. Buck Lake has fairly good water clarity, especially in areas with thick coontail growth. Duckweed (shown floating on the water) was common as well.

Potential for Curlyleaf Pondweed Growth

Lake sediment sampling results from 1997 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 and Figure 7.

Curlyleaf pondweed growth is predicted to produce mostly low to moderate nuisance growth (where plants top out) at only several locations (Figure 7).

Table 4. Buck Lake sediment data and ratings for potential nuisance curlyleaf pondweed growth.

Site	pH (su)	Bulk Density (g/cm^3 dry)	Organic Matter (%)	Fe:Mn Ratio	Potential for Curlyleaf Pondweed Growth
Light Growth	**6.8**	**1.04**	**5**	**4.5**	**Light (green)**
Moderate Growth	**6.2**	**0.94**	**11**	**5.9**	**Moderate (yellow)**
Heavy Growth	**>7.7**	**<0.51**	**>20**	**<1.6**	**High (red)**
1	7.4	0.579	26.1	5.3	Moderate
2	7.3	0.756	14.9	5.5	Light
3	7.4	0.766	12.4	10.7	Light
4	7.5	0.591	19.5	6.8	Moderate
5	7.4	0.662	19.2	5.5	Light
6	7.2	0.718	19.0	5.6	Light

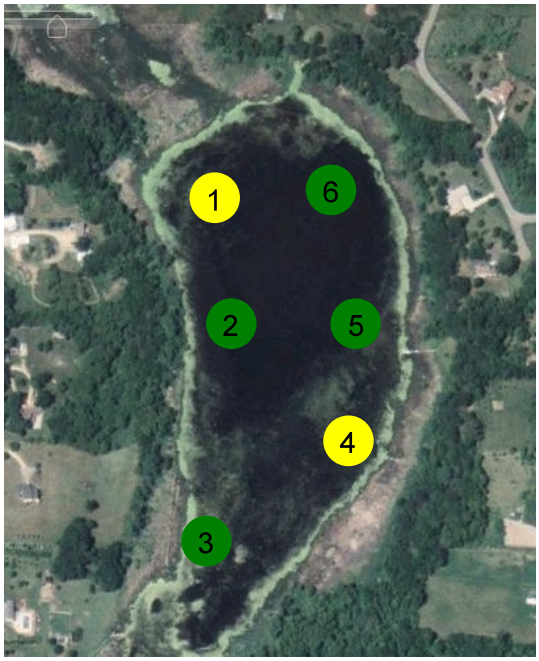

Figure 7. Curlyleaf pondweed growth is predicted to be light to moderate based on lake sediment characteristics. Green circles = light growth and yellow circles = moderate growth.

Potential for Eurasian Watermilfoil Growth

Based on results from other lakes we predict that the combination of high organic matter and high nitrogen values (greater than 10 ppm as exchangeable ammonium) will sustain nuisance milfoil growth on an annual basis unless some other factor limits growth. Limiting factors include things such as milfoil weevils, light penetration, and other unknown variables. When lake bottom areas have moderate fertility (less than 6 ppm of exchangeable nitrogen), we predict there is the potential to support nuisance growth in some years, but not on a continuous basis.

Table 5. Buck Lake sediment data and ratings for potential nuisance Eurasian watermilfoil growth.

Site	NH_4 Conc (ppm)	Organic Matter (%)	Potential for Nuisance EWM Growth
Light Growth	<10	>20	Low (green) to Medium (yellow)
Heavy Growth	>10	<20	High (red)
1	56	26	Medium
2	172	15	High
3	111	12	High
4	63	20	High
5	86	19	High
6	62	19	High

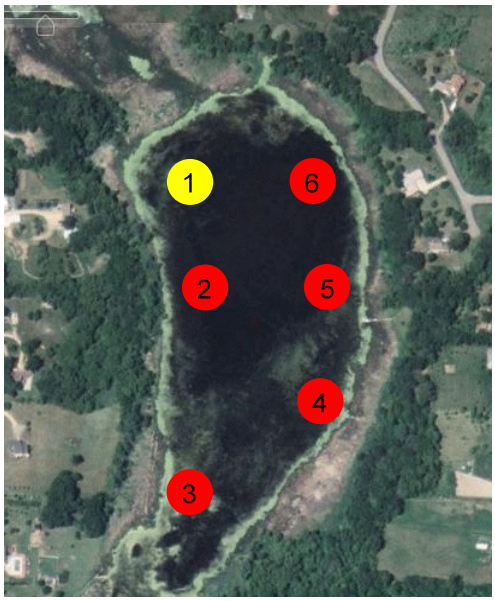

Figure 8. Eurasian watermilfoil growth is predicted to be moderate to heavy. Yellow circle = moderate growth and red circles = heavy growth.

Summary

Lake Sediments: The lake sediments have moderate to heavy fertility, with high Olsen phosphorus and ammonia nitrogen levels. Iron is high while most other parameters for average for typical lake sediments.

Aquatic Plants: No non-native plant species (curlyleaf or milfoil) were observed. Diversity was relatively low and coontail was the dominant plant.

Potential for Future Non-Native Plant Growth: Neither curlyleaf nor Eurasian watermilfoil are observed in Buck Lake at this time. However, if they get introduced, there is a low potential for heavy curlyleaf but there is a high potential for heavy Eurasian watermilfoil growth.

Figure 9. Flatstem pondweed and coontail were both common plants found in Buck Lake in 2010. Coontail was more abundant than flatstem.