Curlyleaf Pondweed Growth on June 19, 2014 on Prior Lake

Curlyleaf Pondweed Delineation and Assessment Surveys for Upper and Lower Prior Lake, Scott County, 2014

Delineation: May 13, 2014
Herbicide Treatment: May 20, 2014 (29.3 ac, 123.19 gallons)
Assessment Date: June 19, 2014

Prepared for:
Prior Lake/Spring Lake Watershed District
Prior Lake, Minnesota

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December 16, 2014

Curlyleaf Pondweed Delineation and Assessment Surveys for Upper and Lower Prior Lake, Scott County, 2014

Summary

Curlyleaf pondweed (CLP) distribution and abundance were delineated on May 13, 2014. Based on the curlyleaf pondweed densities on both Upper and Lower Prior, several areas were delineated as having the potential for heavy curlyleaf growth by June (Figure S1).

Curlyleaf was fairly widespread in May (Figure S2) and although the density was mostly light in May, there was the potential for heavy curlyleaf growth in some areas. Curlyleaf areas delineated on May 13, 2014 totaled 29.3 acres.

The curlyleaf pondweed treatment was conducted on May 20, 2014 and a total of about 29 acres were treated including 23.73 acres in Upper Prior and 5.56 acres in Lower Prior (Figure S3). PLM conducted the treatment.

A follow-up curlyleaf assessment was conducted on June 19, 2014. The June 19 curlyleaf assessment found, in the treated areas, the distribution and abundance of CLP was mostly controlled (Figure S4).

Figure S1. Curlyleaf pondweed was sampled in Prior Lake on May 13, 2014. Here curlyleaf pondweed is sampled at a density of a 1. This site was not treated.

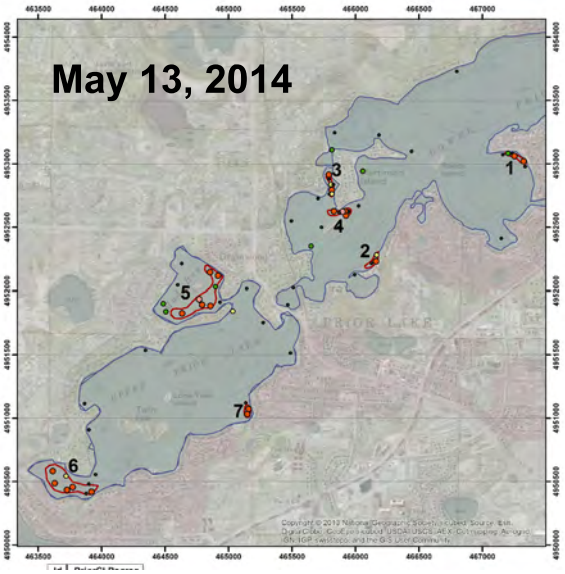


Figure S2. DELINEATION: Map of curlyleaf pondweed delineation sites for May 13, 2014 totaling about 29.3 acres. Key: Green dots = light growth, yellow dots = moderate growth, and red dots = heavy growth. Red outlined area = proposed CLP treatment areas. (Treatment acreages are shown below).

Site	Acres
1	1.22
2	1.32
3	1.2
4	1.82
5	11.45
6	11.33
7	0.95

Figure S3. TREATMENT: Prior Lake curlyleaf pondweed treatment areas May 20, 2014. A total of 29 acres were treated using about 123 gallons of Aquathol K.

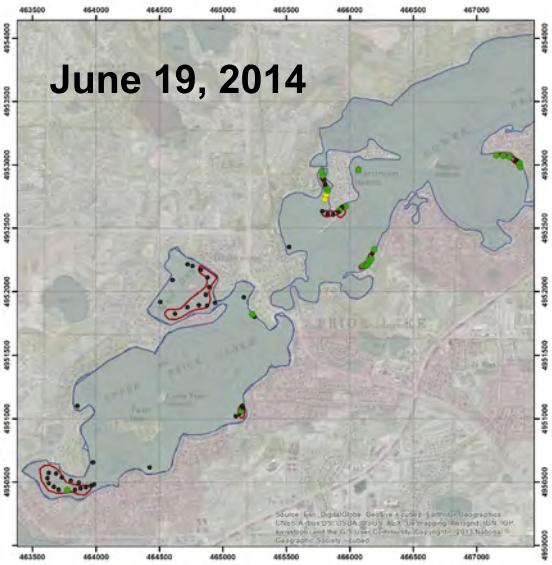


Figure S4. ASSESSMENT: Map of curlyleaf pondweed assessment sites for June 19, 2014. Colored sample areas indicate the growth in June , 2014 for curlyleaf pondweed. Key: Green = light growth, yellow = moderate growth and red = heavy growth. Black = no CLP.

Summary (concluded)

Curlyleaf Planning for 2015: Treating heavy growth of curlyleaf pondweed based on early season curlyleaf distribution is a challenge. Curlyleaf in April and May has just started to go into a rapid growth phase. However, not all early season curlyleaf growth will result in heavy curlyleaf growth in late May and June. It appears there are factors that limit curlyleaf growth and significant variables are associated with sediment conditions. The question is how to best delineate areas to treat what could be heavy growth in June but not overtreat areas where growth wouldn't be a nuisance for the season.

Currently, for Upper and Lower Prior Lake, the method has been to use past CLP growth history combined with early season scouting. Then if curlyleaf growth has indications of producing potential heavy growth, those areas are delineated and treatment is considered. That is the approach to be considered for 2015.

Example of light growth of curlyleaf pondweed in Prior Lake on June 19, 2014.

Example of moderate growth of curlyleaf pondweed in Prior Lake on June 19, 2014.

Curlyleaf Pondweed Delineation and Assessment Surveys for Upper and Lower Prior Lake, Scott County, 2014

Introduction

Upper and Lower Prior Lakes combined have an area of 1,343 acres with a total littoral area of 732 acres (MnDNR). An initial curlyleaf pondweed delineation was conducted on May 13, 2014 and a follow-up curlyleaf pondweed assessment was conducted on June 19, 2014 to characterize the status of curlyleaf pondweed at it's peak growing period. Sample sites in the delineation survey are shown in Figure 1. Sample sites were selected based on areas where curlyleaf had been found over the years. A chart showing examples of curlyleaf growth conditions are shown on the next page.

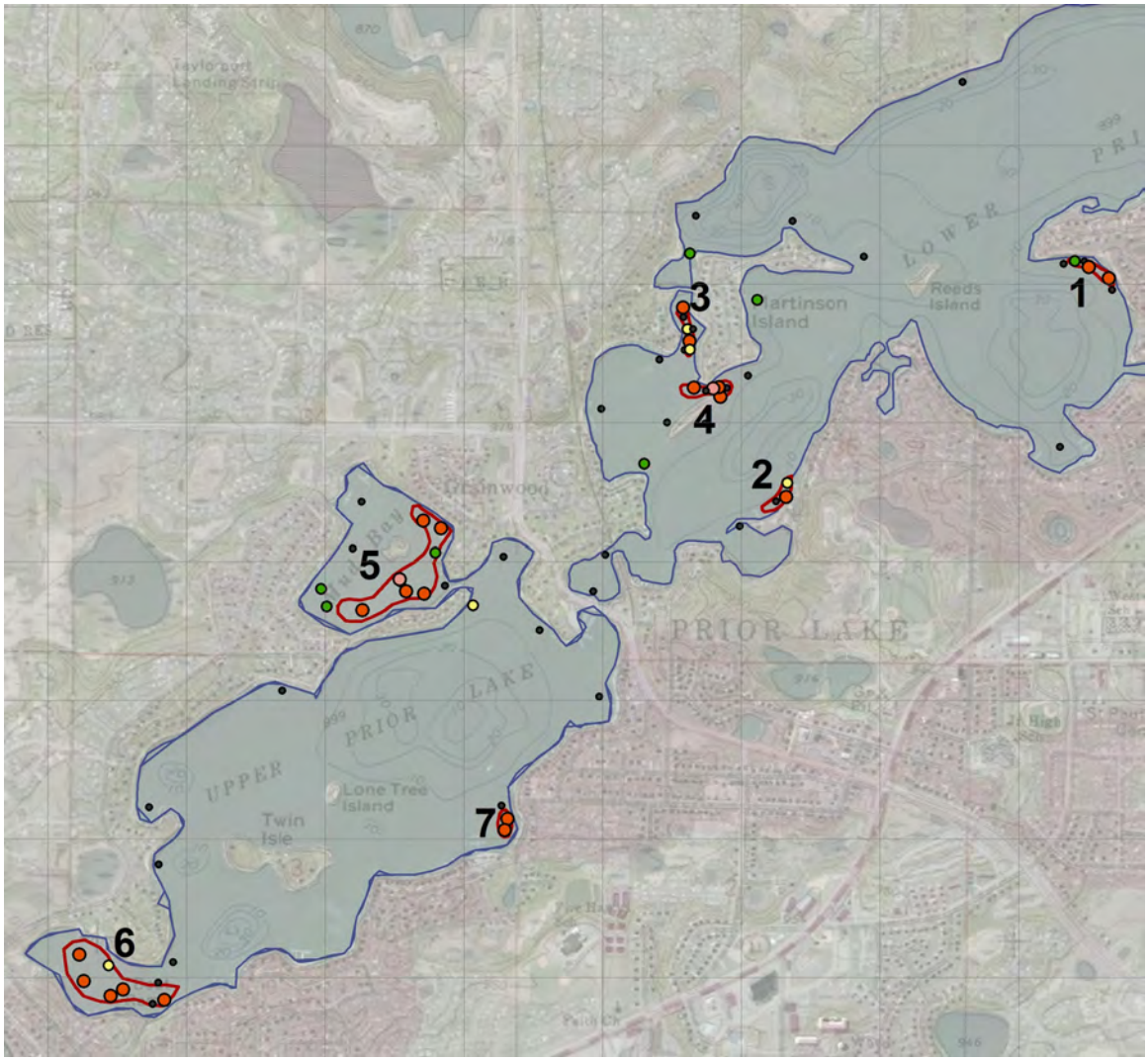
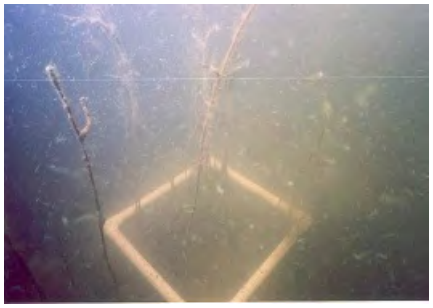


Figure 1. Sites of curlyleaf sampling for a delineation on May 13, 2014.

Methods: Curlyleaf pondweed densities are represented on a scale of 1 to 5 with 5 being densest.

Light Growth Conditions



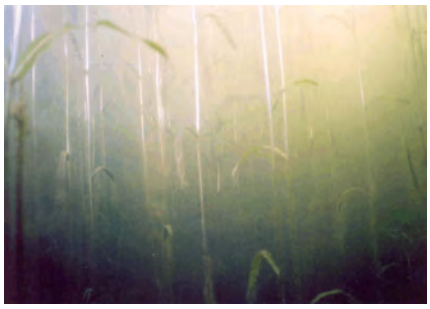
Plants rarely reach the surface.

Navigation and recreational activities are not generally hindered.

Stem density: 0 - 160 stems/m^2
Biomass: 0 - 50 g-dry wt/m^2
Estimated TP loading: <1.7 lbs/ac

MnDNR rake sample density equivalent for light growth conditions: 1, 2, or 3.

Moderate Growth Conditions



Broken surface canopy conditions.

Navigation and recreational activities may be hindered.

Lake users may opt for control.

Stem density: 100 - 280 stems/m^2
Biomass: 50 - 85 g-dry wt/m^2
Estimated TP loading: 2.2 - 3.8 lbs/ac

MnDNR rake sample density equivalent for moderate growth conditions: 2, 3 or sometimes, 4.

Heavy Growth Conditions

Solid or near solid surface canopy conditions.

Navigation and recreational activities are severely limited.

Control is necessary for navigation and/or recreation.

Stem density: 400+ stems/m^2
Biomass: >300 g-dry wt/m^2
Estimated TP loading: >6.7 lbs/ac

MnDNR rake sample density has a scale from 1 to 4. For certain growth conditions where plants top out at the surface, the scale has been extended: 4.5 is equivalent to a near solid surface canopy and a 5 is equivalent to a solid surface canopy. Heavy growth conditions have rake densities of a 4 (early to mid-season with the potential to reach the surface), 4.5, or 5.

Curlyleaf Pondweed Delineation on May 13, 2014 in Upper and Lower Prior Lake

A total of 72 sample sites around Upper and Lower Prior Lake were monitored with rake sampling on May 13, 2014. Curlyleaf was found at low to moderate densities at 49 out of 72 smple sites. A total of 29.3 acres of curlyleaf at 7 treatment areas were delineated as having the potential to develop moderate to heavy growth conditions by June (Table 1 and Figure 2).

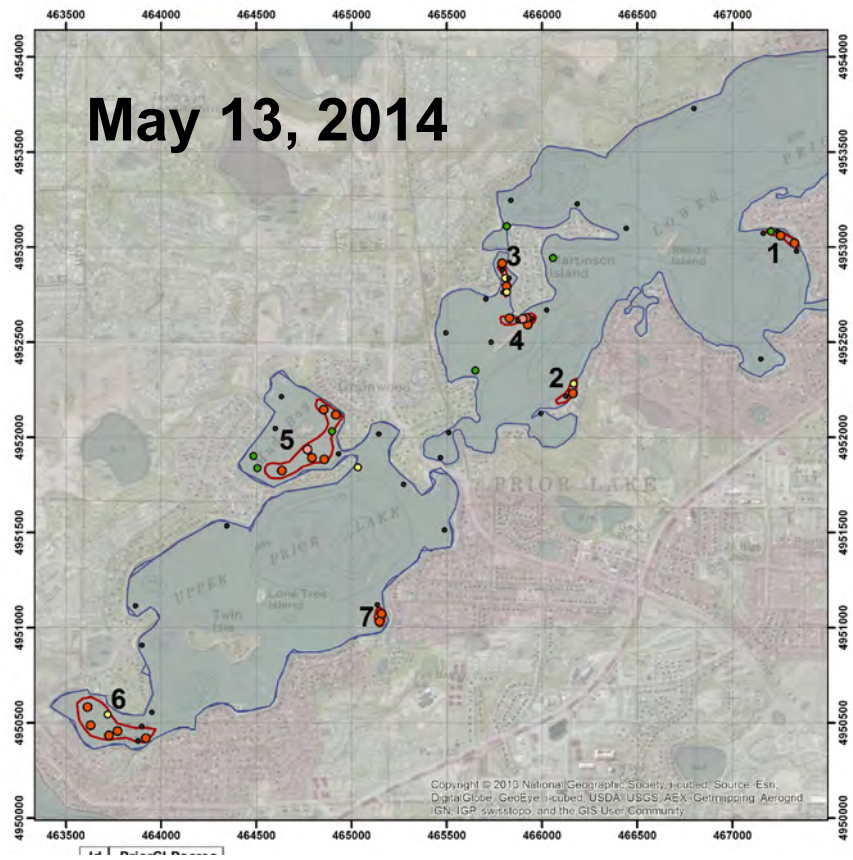


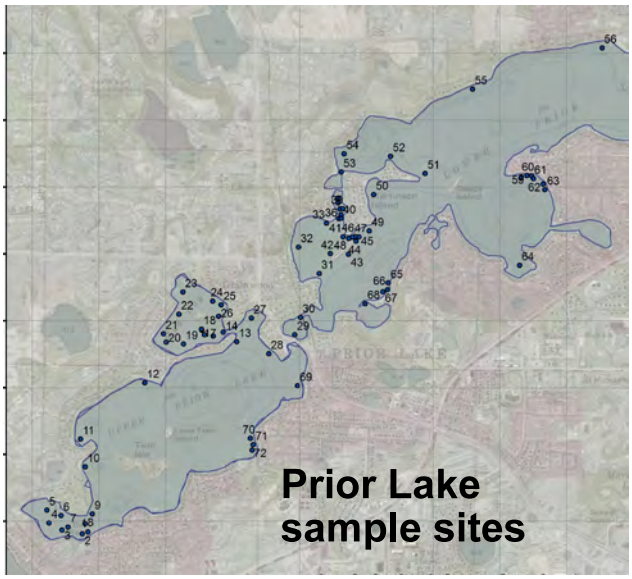
Figure 2. Curlyleaf delineation in Lower and Upper Prior Lake on May 13, 2014. Green circles = light density, yellow circles = moderate density, and red circles = heavy density. Red lines = proposed treatment areas. For Upper Prior: total CLP acres: 23.7 acres. For Lower Prior: total CLP acres: 5.6 acres.

Curlyleaf pondweed density on May 13, 2014 that was high enough to be treated.

Curlyleaf pondweed density on May 13, 2014 at another site that was high enough to be treated.

Table 1. Aquatic plant densities based on rake sampling for May 13, 2014 . Densities are based on a scale from 1 to 3 with 3 being the densest. Curlyleaf stems per rake sample were also noted. Areas with green shading have light growth and areas with yellow shading have moderate curlyleaf growth. Treatment was generally considered for a site when a site had 4 or more CLP stems.

Treatment Area	Sample Site	Depth (ft)	Curlyleaf Density	Curlyleaf Stems
6	1	6		0
			3	3
			4	18
	2	6		0
	3	8	4	9
	4	8	4	7
	5	7	1	1
			4	12
	6	8	3	3
			4	8
	7	8	4	5
			4	10
	8	8		0
				0
	9	9		0
				0
	10	11		0
				0
	11	10		0
				0
	12	13		0
	13	12		0
			3	3
	14	7		0
5	15	7	4	8
	16	7	4	5
	17	7		0
			3	3
	18	4	3	4
	19	7	4	6
	20	7		0
			1	1
	21	7	2	2
	22	7		0
				0
	23	6		0
				0
5	24	7	4	5
	25	7	4	7
	26	7		0
			1	1
	27	10		0
				0
	28	12		0
	29	11		0
	30	10		0
	31	11		0
			2, 0	2, 0
	32	12		0
	33	12		0
	34	11		0
3	35	12	4	6
	36	9	3	3
	37	9		0
	38	9	4	5
	39	9		0
	40	12	1	1
			3	3



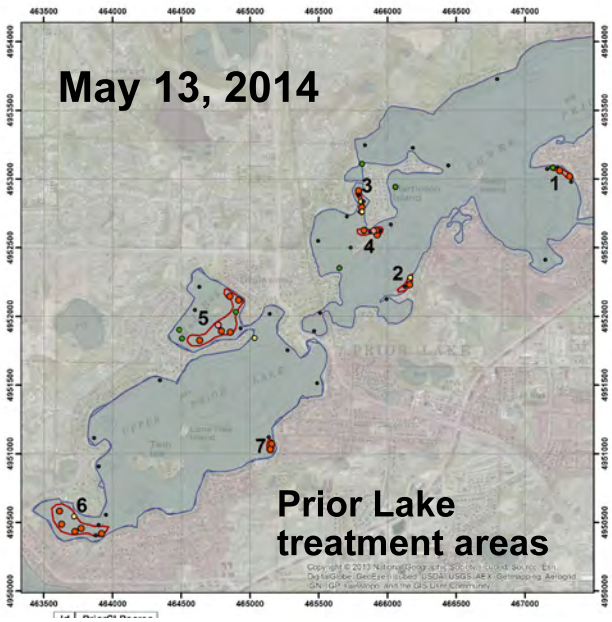
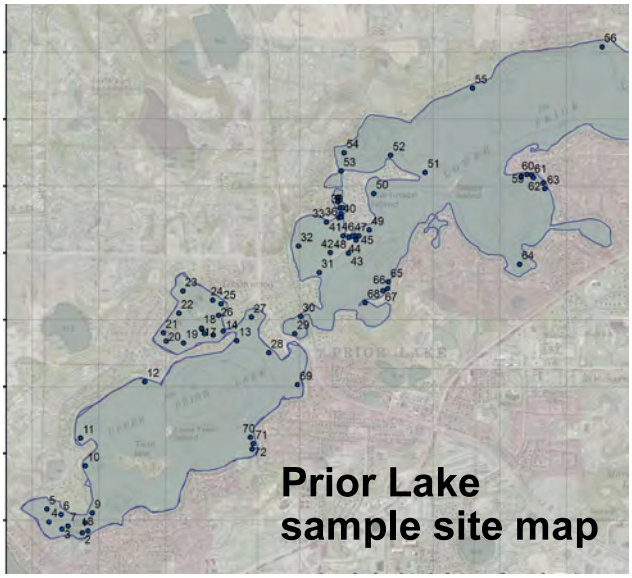
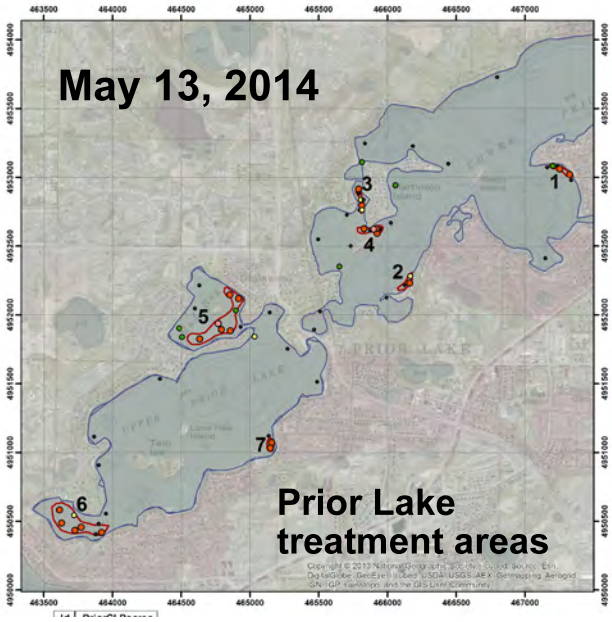


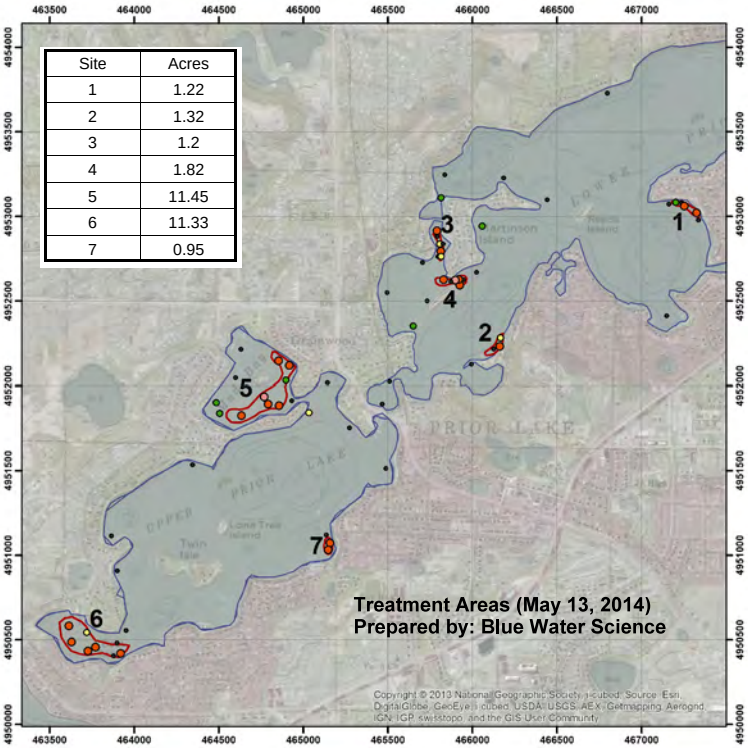
Table 1. Aquatic plant densities based on rake sampling for May 13, 2014 . Densities are based on a scale from 1 to 3 with 3 being the densest. Curlyleaf stems per rake sample were also noted. Areas with green shading have light growth and areas with yellow shading have moderate curlyleaf growth. Treatment was generally considered for a site when a site had 4 or more CLP stems.

Treatment Area	Sample Site	Depth (ft)	Curlyleaf Density	Curlyleaf Stems
4	41	8		0
			4, 0	6, 0
	42	12		0
	43	13		0
	44	10	4	6
	45	14		0
	46	7	4	8
	47	7	3	4
	48	7		0
	49	18		0
	50	9		0
			1	1
	51	7		0
	52	10		0
	53	8		0
			1, 0	1, 0
	54	16		0
	55	15		0
	56	14		0
	57	13		0
	58	12		0
	59	10	2	2
	60	9		0
1	61	10	4	5
	62	10	4	5
	63	10		0
				0
	64	18		0
2	65	9	3	3
	66	9	4	10
	67	9		0
	68	5		0
	69	11		0
	70	12		0
7	71	10		0
			0, 4	5
	72	10	4	8
Average			2.7	5.1
occurrence (95 sample sites)			40	40
Percent occurrence			42	42





Curlyleaf Pondweed Treatment Areas on May 20, 2014



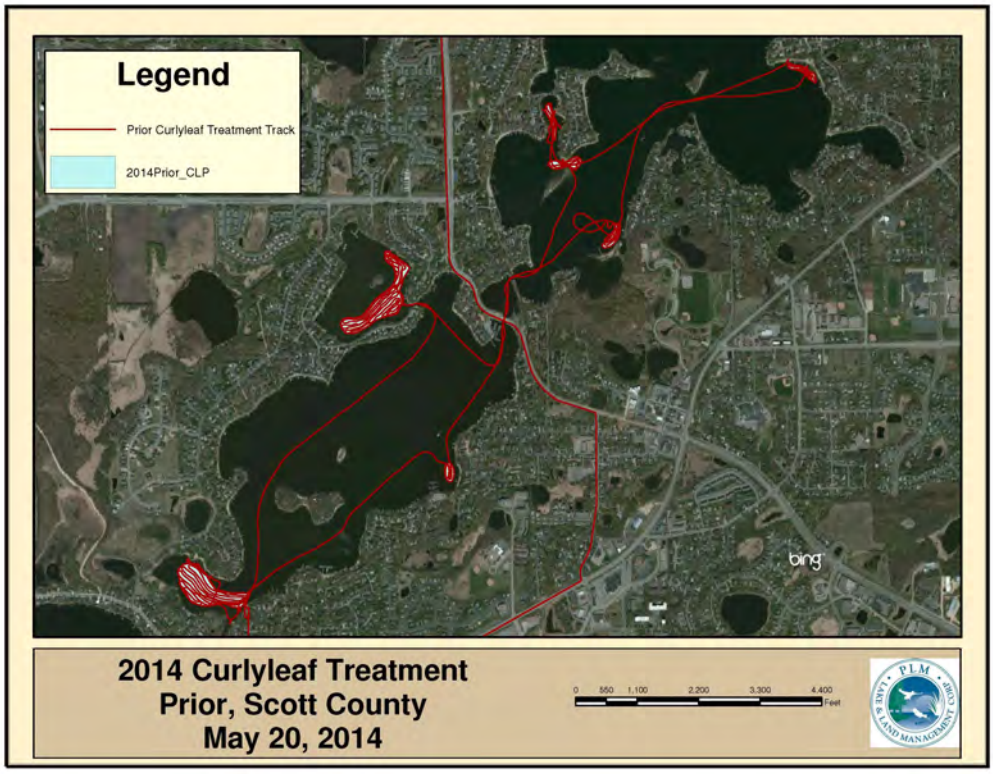


Figure 3. [top] Curlyleaf pondweed delineation and recommended treatment areas totaling 29.3 acres (based on Blue Water Science survey).
[bottom] Curlyleaf pondweed treatment areas for May 20, 2014 (source: PLM).

Curlyleaf Pondweed Assessment on June 19, 2014 in Upper and Lower Prior Lake

A total of 29 acres of curlyleaf was treated on May 20, 2014 (Table 2 and Figure 4). A total of 70 sites around Upper and Lower Prior Lake were resampled with rake sampling on June 19, 2014 to assess curlyleaf treatment areas and other untreated areas. Curlyleaf was found at low densities at 24 out of 70 sites.

The overall curlyleaf treatment was good, and overall curlyleaf growth at other untreated sites was mostly light.

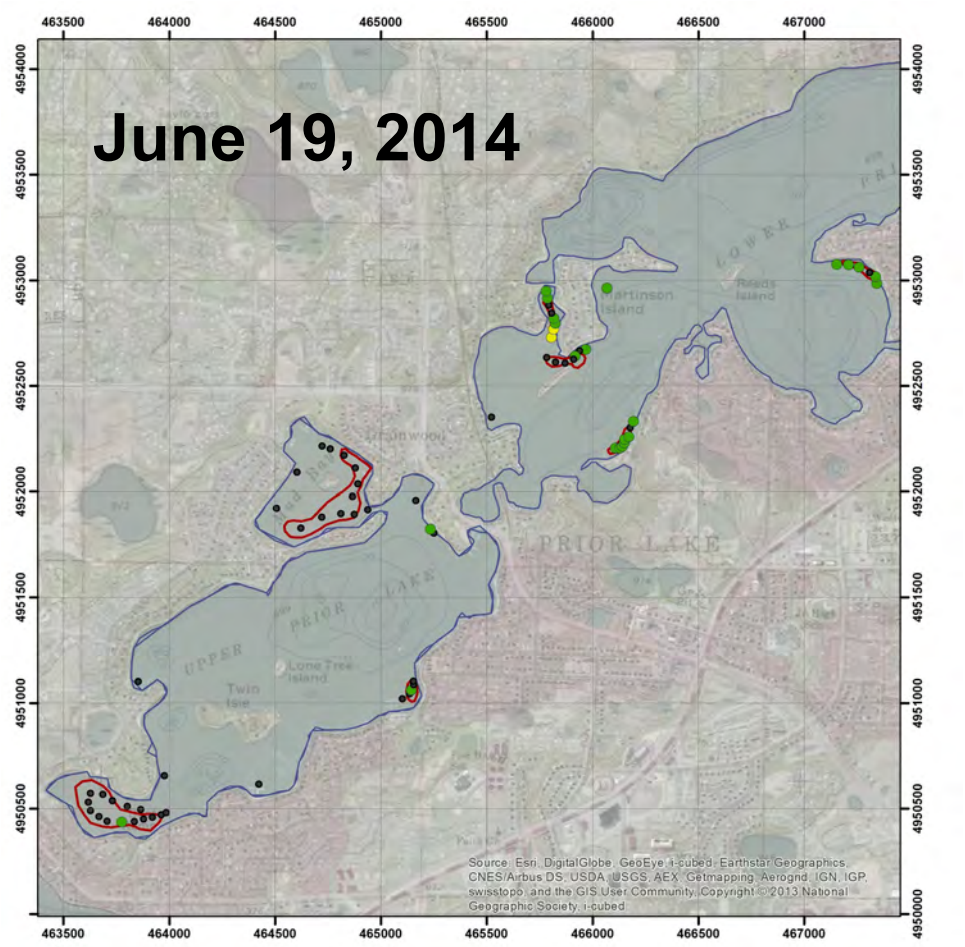


Figure 4. Curlyleaf density on June 19, 2014.
Key: Green = light growth, yellow = moderate growth, yellow = moderate growth, and black = no growth.

Table 2. Aquatic plant densities based on rake sampling for June 19, 2014. Densities are based on a scale from 1 to 5 with 5 being the densest. Areas with green shading had light growth at the peak of the curlyleaf growth cycle. Areas with yellow shading had moderate growth and areas with red shading had heavy curlyleaf growth. In the curlyleaf stem column D = dead.

Treatment Site	Sample	Depth (ft)	Cabbage	Coontail	Curlyleaf - density	Curlyleaf - stems	Claspingleaf pondweed	EWM	Stringy pondweed	No Plants
7	1	12								1
	2	10								1
	3	10								1
	4	9			1	2				
	5	11								1
	6	12								1
2	7	11			1	2				
	8	10			2	5				
	9	9			1	1				
	10	10			1	3				
	11	12			1	4				
	12	12			2	8				
	13	14		2						1
	14	12		2	1	2		1		
1	15	11		1	2	10			2	
	16	8			1	2		1		
	17	11	1					1		1
	18	11			1	1		2		
	19	13			2	7		3		
	20	14	1	1	2	6				
	21	11			1	2				
	22	12			1	3				
4	23	10								1
	24	9			1	1				
	25	7					3			1
	26	6					3			1
	27	9				30+ - D				
	28	13				15 - D				
	29	14			3	20				
	30	12			3	15				
3	31	11			1	4				
	32	11			2	10				
	33	10								1
	34	10								1
	35	10			1	2				
	36	9			2	5				
	37	15				1 - D				
	38	9								1
	39	9			1	1				
	40	12								1
	41	10								1
5	42	8								1
	43	9								1
	44	8								1
	45	8								1
	46	8								1
	47	8								1
	48	9								1
	49	9								1
	50	8								1
5	51	8								1
	52	8								1
	53	8								1
	54	12								1
	55	9								1
6	56	10				15 - D				
	57	9				20 - D				
	58	8				15 - D				
	59	9				1 - D				
	60	9				1 - D				
	61	9				15 - D				
	62	10				1 - D				
	63	9				1 - D				
	64	9				4 - D				
	65	8				4				
	66	7								1
	67	8								1
	68	9				4 - D				
	69	11								1
	70	11								1
	Average		**1.0**	**1.5**	**1.3**		**3.0**	**1.6**	**2.0**	
	occurrence (70 sites)		2	4	24		2	5	1	33
	% occurrence		3	6	51		3	7	1	

Comparison of Early Season to Late Season Curlyleaf Growth

Mostly light growth of curlyleaf pondweed was found in the May 13 delineation for treatment areas (Table 3). A curlyleaf assessment on June 19, 2014 found curlyleaf to be growing at a range of densities, from light to moderate. In areas where herbicides were applied, control was generally good (Figure 5).

Table 3. Comparison of curlyleaf pondweed stem densities based on rake sampling for May 13 and June 19, 2014. Densities are based on a scale from 1 to 5 with 5 being the densest.

Treatment Area	May 13, 2014 - Delineation		June 19, 2014 - Assessment	
	Sample Sites	Range of stem densities (stems/0.1 m^2)	Sample Sites	Average CLP density at maximum growth potential (range is 0 - 5)
1	61 - 62	0 - 5	15-20	1.3
2	65 - 66	0 - 10	7-14	1.1
3	35 - 40	0 - 6	31-36	1.3
4	41 - 47	0 - 8	23-28	0.9
5	15 - 19 & 24 - 25	0 - 7	42-45 & 51-53	0
6	1 - 7	0 - 18	56-70	0.7
7	71 - 72	0 - 8	2-6	0.2

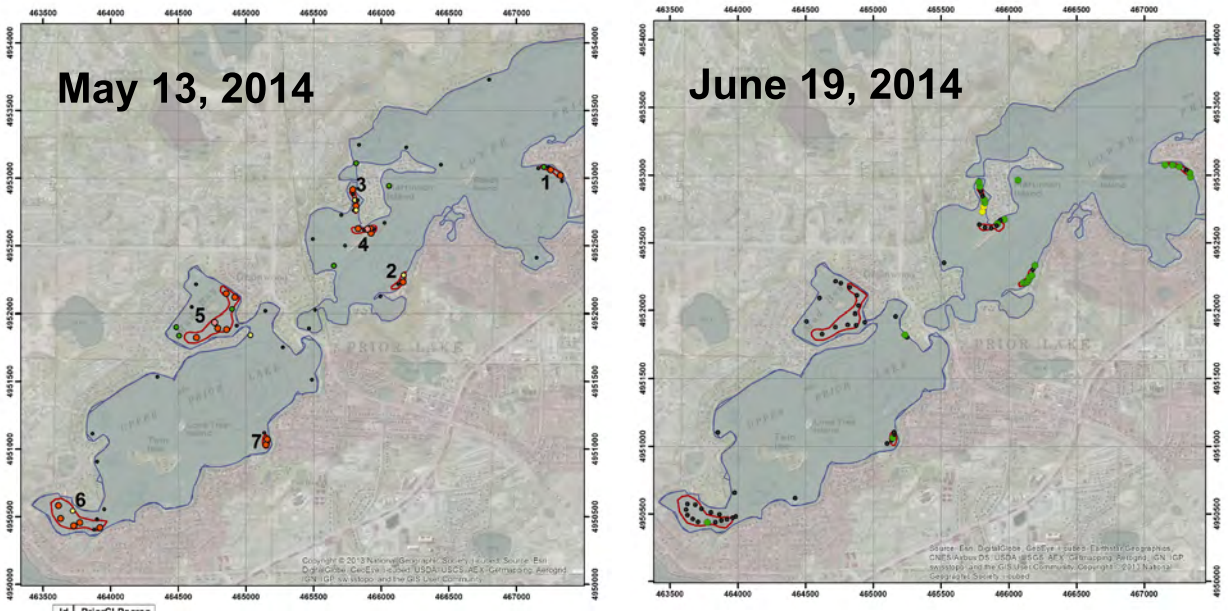


Figure 5. Map of curlyleaf pondweed delineation is shown on the left (May 13, 2014) and the curlyleaf assessment is shown on the right (June 19, 2014).

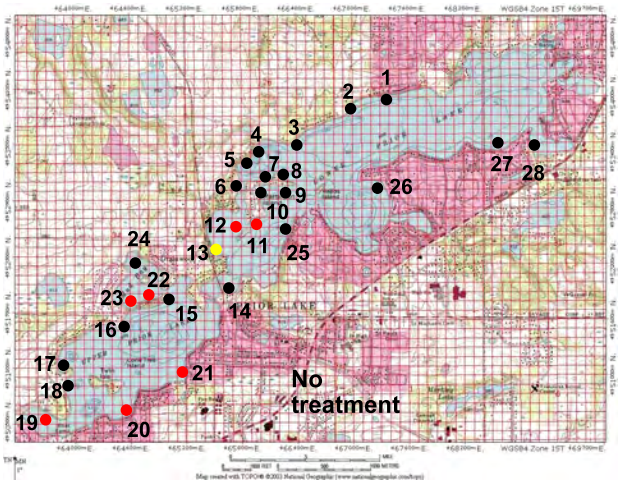
Curlyleaf Planning for 2015: Treating heavy growth of curlyleaf pondweed based on early season curlyleaf distribution is a challenge. Curlyleaf in April and May has just started to go into a rapid growth phase. However, not all early season curlyleaf growth will result in heavy curlyleaf growth in late May and June. It appears there are factors that limit curlyleaf growth and significant variables are associated with sediment conditions. The question is how to best delineate areas to treat what could be heavy growth in June but not overtreat areas where growth wouldn't be a nuisance for the season.

Currently, for Upper and Lower Prior Lake, the method has been to use past CLP growth history combined with early season scouting. Then if curlyleaf growth has indications of producing potential heavy growth, those areas are delineated and treatment is considered. That is the approach to be considered for 2015.

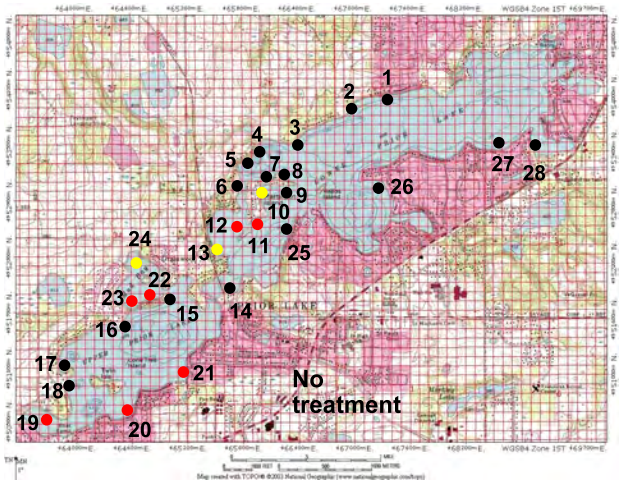
Example of light growth of curlyleaf pondweed in Prior Lake on June 19, 2014.

Example of moderate growth of curlyleaf pondweed in Prior Lake on June 19, 2014.

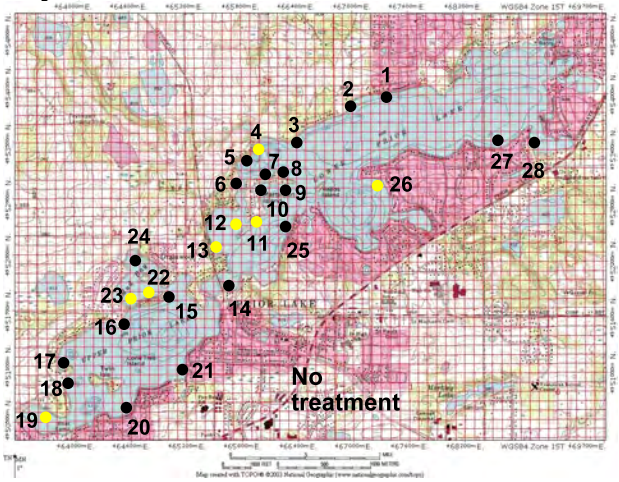
Previous Herbicide Treatments from 2009 - 2014



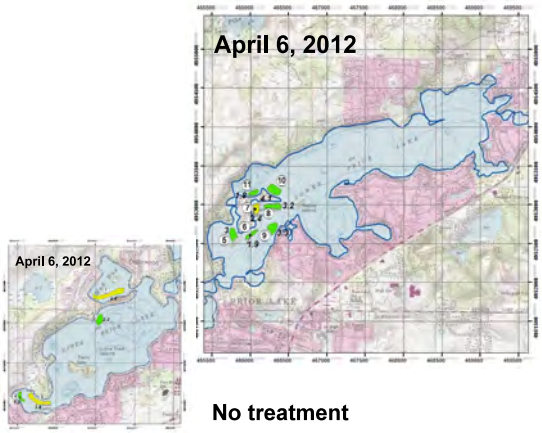
May 5, 2009



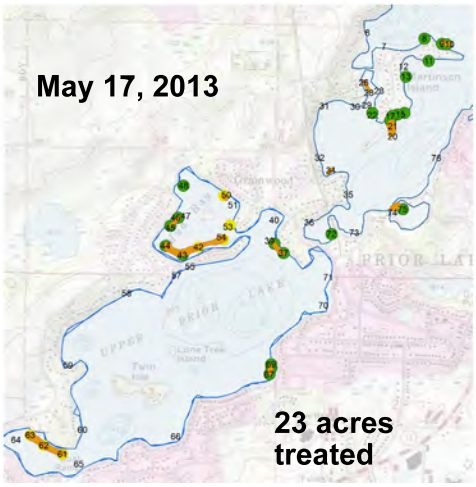
April 27, 2010



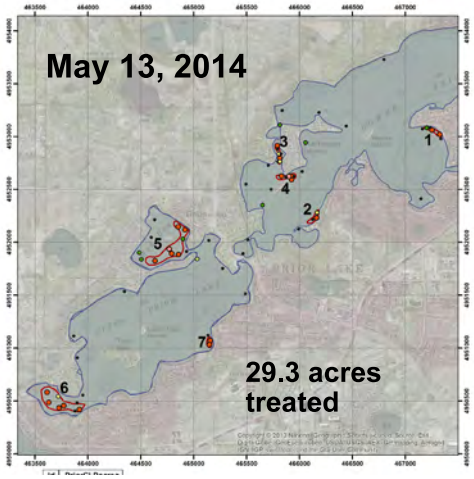
May 10, 2011



April 6, 2012



May 17, 2013



May 13, 2014