



Aquatic Plants in Fish Lake, Scott County, MN, on May 23, 2013

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## Fish Lake, Scott County, Curlyleaf Pondweed Assessment for 2013

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Assessment Dates: May 23 and June 13, 2013

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



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January 2014

# Fish Lake, Scott County, Curlyleaf Pondweed Assessment for 2013

**Overview:** Two curlyleaf pondweed (CLP) assessments were conducted in Fish Lake within the 15.5 acre area that was treated with an endothall herbicide from 2005-2008 (shaded dark blue in Figure S-1). The first assessment was on May 23 and the second was on June 13, 2013. In the first assessment on May 23, 2013 curlyleaf pondweed was found at 5 out of the 11 sites monitored. However, CLP growth was light and no herbicide treatments were conducted. On the second assessment, curlyleaf abundance did not significantly increase, but rather remained about the same as in the May survey. Overall curlyleaf growth has been mostly light to moderate in the last few years and that was also the case for 2013. No herbicides have been used in the 15.5 acre area from 2009 through 2013.

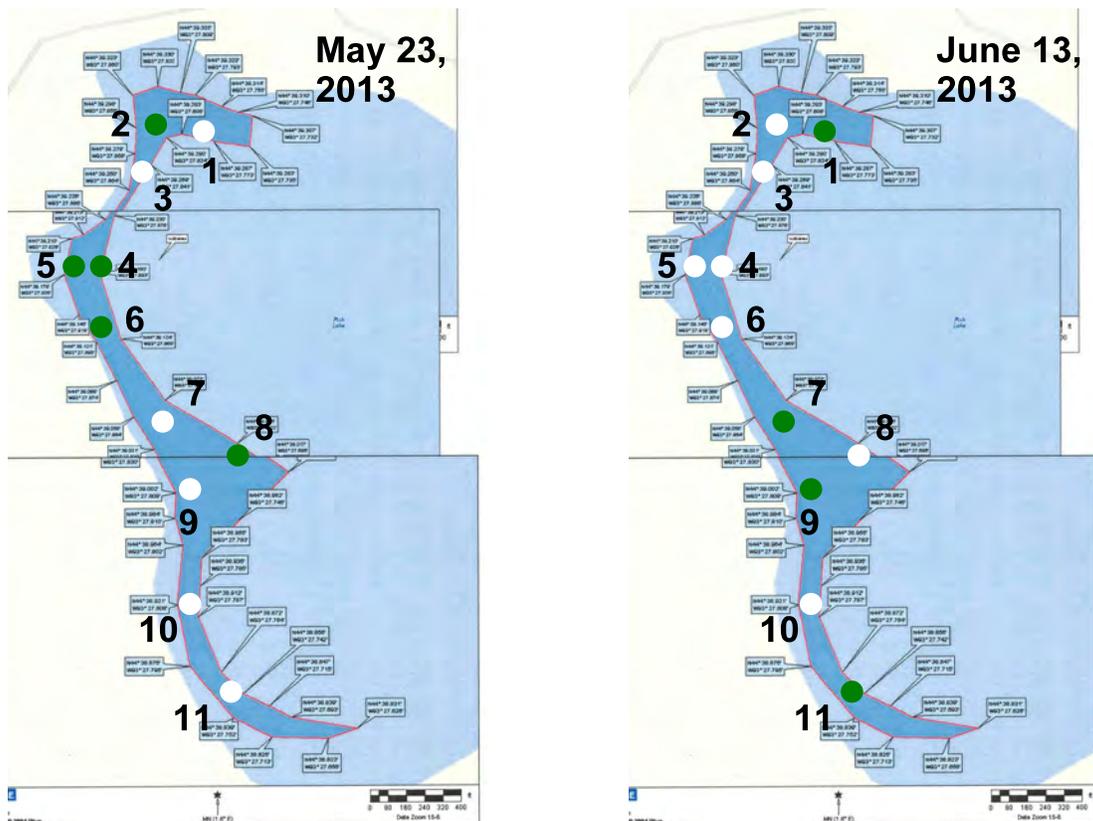
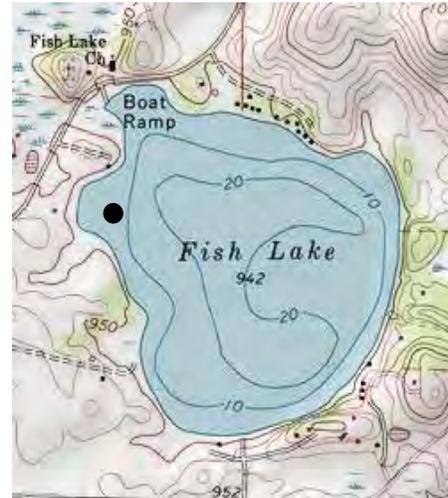


Figure S-1. [left] Eleven sites within an area that was treated from 2005-2008 (dark blue shading) were monitored on May 23, 2013 and curlyleaf was detected at five sites at low densities (green dots). White dots indicate no curlyleaf pondweed observed. [right] In June, the same sites were monitored and curlyleaf was detected at four sites. Green dots indicates were curlyleaf pondweed was observed.

**Curlyleaf Pondweed Density at Site 4 in 2013:** Curlyleaf density on May 23, 2013 was light, with a density of 1 or 2 at 5 out of 10 sites with the number of stems per m<sup>2</sup> ranging from 0 to 60 (Table S-1). On June 13, 2013 the same 10 sites were checked again. Curlyleaf had increased in density but the average was still below nuisance densities which are arbitrarily set at 150 stems/m<sup>2</sup> (Table S-1 and Figure S-2). Although curlyleaf was fairly widely distributed, its density was mostly light to moderate in June.

**Table S-1. Curlyleaf density on a scale from 1 to 5 with 5 the highest and the number of stems collected on the sample rake. Curlyleaf growth was light in May and more abundant in June, but not excessive. Sample depths ranged from 4 to 7 feet.**

Site	May 23, 2103		June 13, 2013	
	Density	Stems/m <sup>2</sup>	Density	Stems/m <sup>2</sup>
1	1	30	1	10
2	1	40	1	20
3	1	30	1	20
4	--	0	2	230
5	--	0	1	40
6	--	0	2	210
7	--	0	--	0
8	2	60	1	80
9	--	0	1	10
10	1	30	--	0
<b>Average</b>	<b>0.6</b>	<b>19</b>	<b>1.0</b>	<b>62</b>



**Underwater monitoring site (shown with a black dot).**

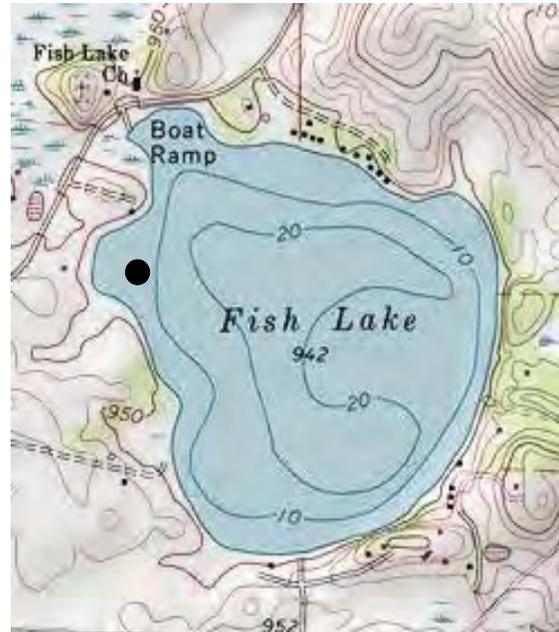


**Figure S-2. Aquatic plants on a sample rake on May 23, 2013.**

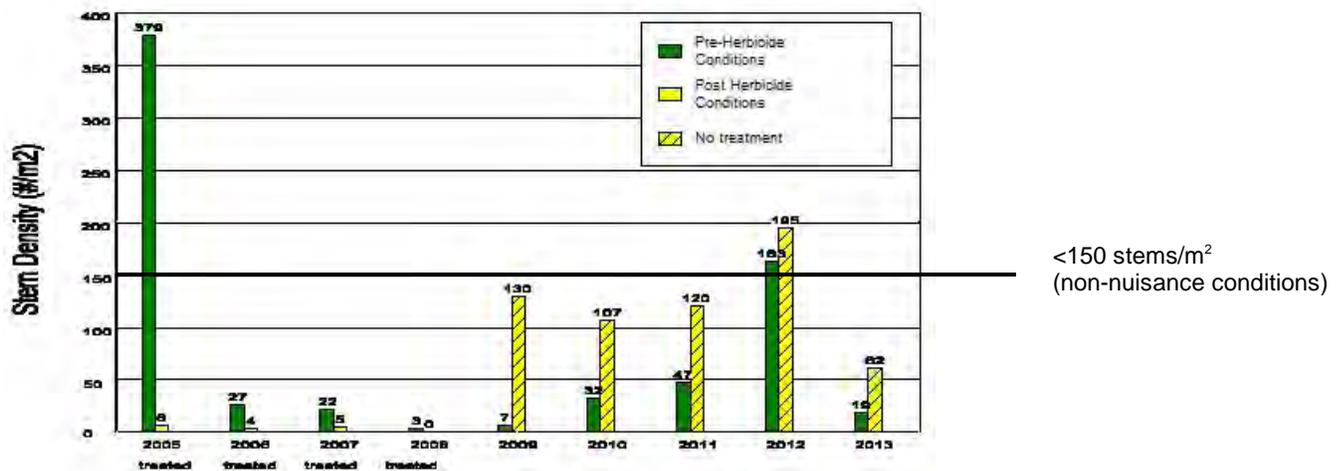
**Curlyleaf Pondweed Stem Densities at Site 4 from 2005 - 2013:** Curlyleaf has been monitored at the same site on early and late season dates from 2005 through 2013 (Figure S-3). Curlyleaf stem densities were initially high on April 18, 2005. Curlyleaf was treated within this site for four years (2005-2008). No herbicide was used in 2009 through 2013. The early season stem density was 19 stems/m<sup>2</sup> on May 23, 2013, which was lower compared to Years 2009-2012. The next sample date on June 13, 2013, curlyleaf stem density increased to 62 stems/m<sup>2</sup> (Table S-2 and Figure S-4).

**Table S-2. Summary of curlyleaf pondweed stem densities for both pre and post herbicide conditions in Fish Lake.**

	Stem Density (#/m <sup>2</sup> )	
	Pre-Herbicide Conditions	Late Spring Conditions
<b>2005 (treated)</b>	<b>379</b> (n=10) (April 18)	<b>6</b> (n=10) (May 23)
<b>2006 (treated)</b>	<b>27</b> (n=10) (April 25)	<b>4</b> (n=10) (June 2)
<b>2007 (treated)</b>	<b>22</b> (n=10) (April 16)	<b>5</b> (n=10) (June 5)
<b>2008 (treated)</b>	<b>3</b> (n=10) (April 29)	<b>0</b> (n=10) (June 13)
<b>2009</b>	<b>7</b> (n=10) (April 23)	<b>130</b> (n=10) (June 10)
<b>2010</b>	<b>32</b> (n=10) (April 27)	<b>107</b> (n=10) (June 2)
<b>2011</b>	<b>47</b> (n=10) (May 12)	<b>120</b> (n=10) (June 13)
<b>2012</b>	<b>163</b> (n=10) (April 17)	<b>195</b> (n=10) (June 5)
<b>2013</b>	<b>19</b> (n=10) (May 23)	<b>62</b> (n=10) (June 13)



**Figure S-3. Underwater monitoring site (shown with a black dot).**



**Figure S-4. Average of Fish Lake curlyleaf pondweed stem densities for early season and late season conditions in 2005 through 2013 at a 6.0-foot water depth at the monitoring site shown in Figure S-3.**

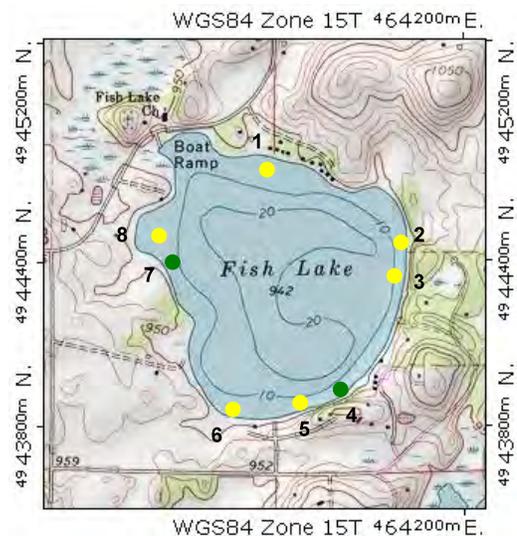
## Fish Lake Curlyleaf Pondweed Growth Potential Based on Lake

**Sediment Characteristics:** Lake sediment sampling results from 2006 have been used to predict lake bottom areas that have the potential to support nuisance curlyleaf pondweed plant growth in Fish Lake. Based on the key sediment parameters of pH, organic matter, and the Fe:Mn ratio (McComas, unpublished), the predicted growth characteristics of curlyleaf pondweed are shown in Table S-3 and Figure S-5.

Without herbicide applications in Fish Lake, curlyleaf pondweed growth is predicted to produce mostly light to moderate growth (where plants occasionally top out) for a number of locations around Fish Lake (Figure S-5).

**Table S-3. Fish Lake sediment data and ratings for potential curlyleaf pondweed growth. Sediment collected in 2006.**

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	5	7.6	3.5	2.38	Moderate
2	5	7.7	2.5	4.39	Moderate
3	5	7.7	5.1	3.12	Moderate
4	5	7.6	6.4	4.13	Light
5	5	8.1	0.9	13.33	Moderate
6	5	7.6	3.7	2.56	Moderate
7	5	7.5	2.2	3.32	Light
8	5	7.5	35.7	2.74	Moderate



**Figure S-5. Sediment sample locations are shown with a circle. The circle color indicates the potential for nuisance curlyleaf pondweed to occur at that site. Key: green = light; yellow = moderate;**

Light to moderate growth typically is a non-nuisance condition. Non-nuisance growth refers to curlyleaf growth that is mostly below the surface and is not a recreational nor an ecological problem. Heavy growth refers to nuisance matting curlyleaf pondweed. This is the kind of nuisance growth predicted by high sediment pH and a low iron to manganese ratio. A chart showing the three types of growth conditions is shown on the next page.

# Examples of Curlyleaf Pondweed Growth Characteristics

## Light Growth Conditions

Plants rarely reach the surface.

Navigation and recreational activities are not generally hindered.

Stem density: 0 - 160 stems/m<sup>2</sup>

Biomass: 0 - 50 g-dry wt/m<sup>2</sup>

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.

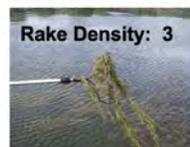
Lake users may opt for control.

Stem density: 100 - 280 stems/m<sup>2</sup>

Biomass: 50 - 85 g-dry wt/m<sup>2</sup>

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<sup>2</sup>

Biomass: >300 g-dry wt/m<sup>2</sup>

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 Density and Abundance in Fish Lake, Scott County, 2013

## Introduction

After four years of herbicide applications (2005-2008), no herbicide treatments with Aquathol K (active ingredient is an endothal salt) were conducted in Fish Lake (171 acres) in 2009 through 2013.

The short term objective for herbicide treatments was to reduce, to the greatest extent possible, the occurrence of heavy growth of the non-native plant, curlyleaf pondweed. The long-term objective was to reduce the standing crop of curlyleaf pondweed to non-nuisance conditions.

This report summarizes the curlyleaf abundance after four years of annual herbicide treatment (from 2005-2008). Curlyleaf density was sampled at one site on Fish Lake at a 6-foot depth and was assessed at 11 sites within a 15.5-acre treatment area.



**Figure 1. Herbicides were applied to a 15-acre area from 2005 through 2008. No herbicides were applied in 2009 through 2013.**

## Methods

After four years of herbicide treatments on 15.5 acres (from 2005-2008), no Aquathol K has been applied to Fish Lake in 2009 through 2013. Two types of surveys, curlyleaf distribution and curlyleaf stem densities were conducted on two dates in 2013. In 2013, an early season delineation was conducted on May 23, 2013 when curlyleaf was starting to grow. A follow-up assessment was conducted on June 13, 2013, when curlyleaf was at its peak biomass. Locations of the sample sites are shown in Figure 2.

**Aquatic Plant Distribution Surveys:** In 2013, eleven sites within a former treatment area were monitored with a rake sampler. At each sampling site, water depth, plant species, and abundance of the plant species were recorded (Figure 2).

**Curlyleaf Stem Density Methods:** In 2013, one site (4-7 feet) was sampled on two sample dates. At the site, a total of ten curlyleaf stem density samples were taken sampling an area of a 0.10 m<sup>2</sup> (Figure 3). The stem density samples were randomly collected along a 50 meter transect line that ran parallel to the shoreline at each station. Other plant species were also counted if present.

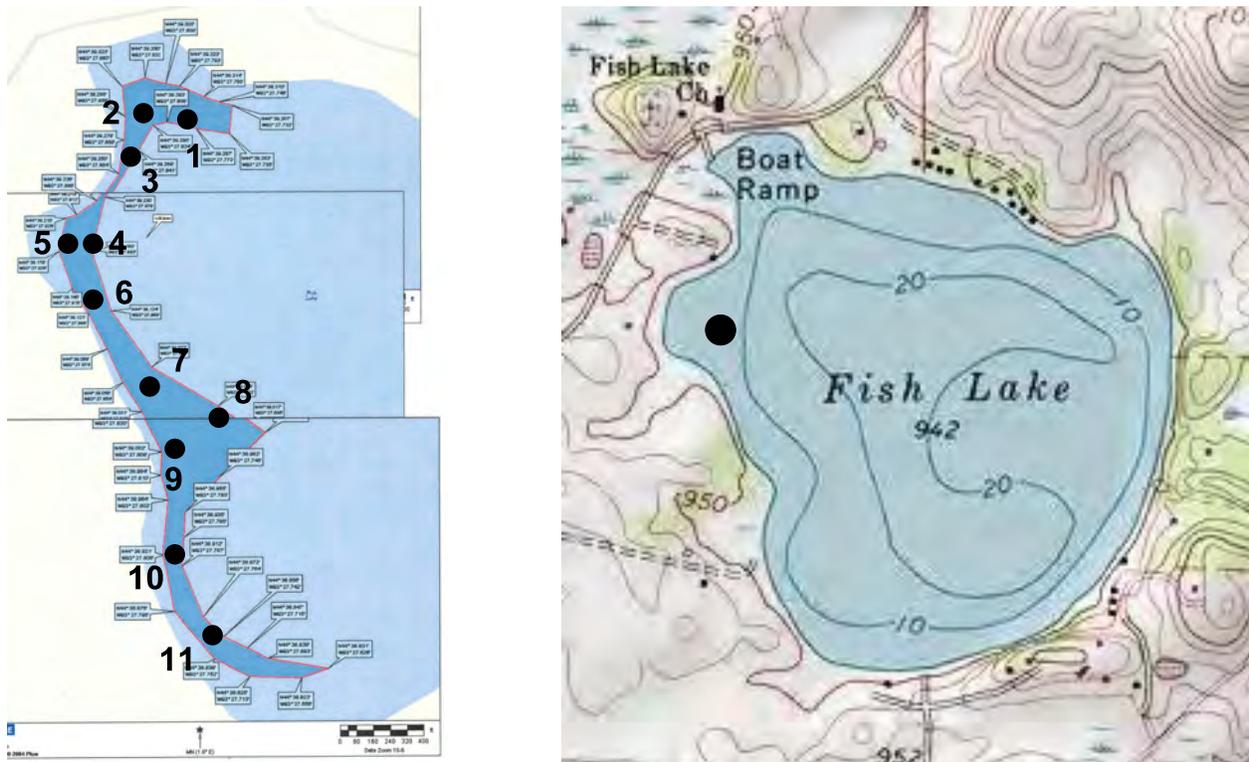


Figure 2. [left] The area treated from 2005-2008 is shown in dark blue is shown on the map to the left. The black dots shows the individual sample sites in the treatment area. Eleven sites were samples on May 23 and June 13, 2013

[right] Stem density determinations (10 samples) were collected from one site within an area treated from 2005-2013. Stem densities were determined using scuba diving and a 0.1 m<sup>2</sup> quadrat.

## Early Spring Curlyleaf Pondweed Delineation in Fish Lake

A total of 11 sites were monitored with rake sampling on May 23, 2013 in areas that previously had been treated for four consecutive years with an endothal herbicide (Figure 4). Curlyleaf was found at 5 sample sites out of the 11 that were monitored (Table 1). In May, curlyleaf was present in the treated area but was sparse in density and in distribution. No herbicide treatments were conducted.

**Table 1. Aquatic plant densities based on rake sampling for May 23, 2013. Densities are based on a scale from 1 to 5 with 5 being the densest. Curlyleaf stems per rake sample were also noted. Areas with green shading are predicted to have light to moderate growth at the peak of the curlyleaf growth cycle. Areas with yellow shading are predicted to have moderate to heavy curlyleaf growth.**

Sample Site	Depth (ft)	Curlyleaf pondweed	Curlyleaf stems on the rake sampler	Curlyleaf stem lengths (inches)	TREAT	Coontail
1	4					3
	4					2
2	5	1	1		N	1
3	5					2
	8					3
4	7	2	6	18	N	
	7	1	1		N	2
	7					0
	7	1	3		N	2
	7	1	3	8	N	3
	8					3
	8					1
	8					
5	4					3
	4					2
	4					
	4					3
	4	1	4		N	
	5	1	3	6	N	
6	5	1	3	6	N	3
	4	1	1	8	N	2
	5	1	1			2
	5	2	8	10	N	2
7	5	2	5	6	N	
	7					2
8	7	1	2	6	N	2
	9	1	3		N	2
9	7					2
10	8					2
11	6					3
	7					2



Curlyleaf pondweed density of 1.



Curlyleaf pondweed density of 2.

# Curlyleaf Conditions in Fish Lake, May 23, 2013

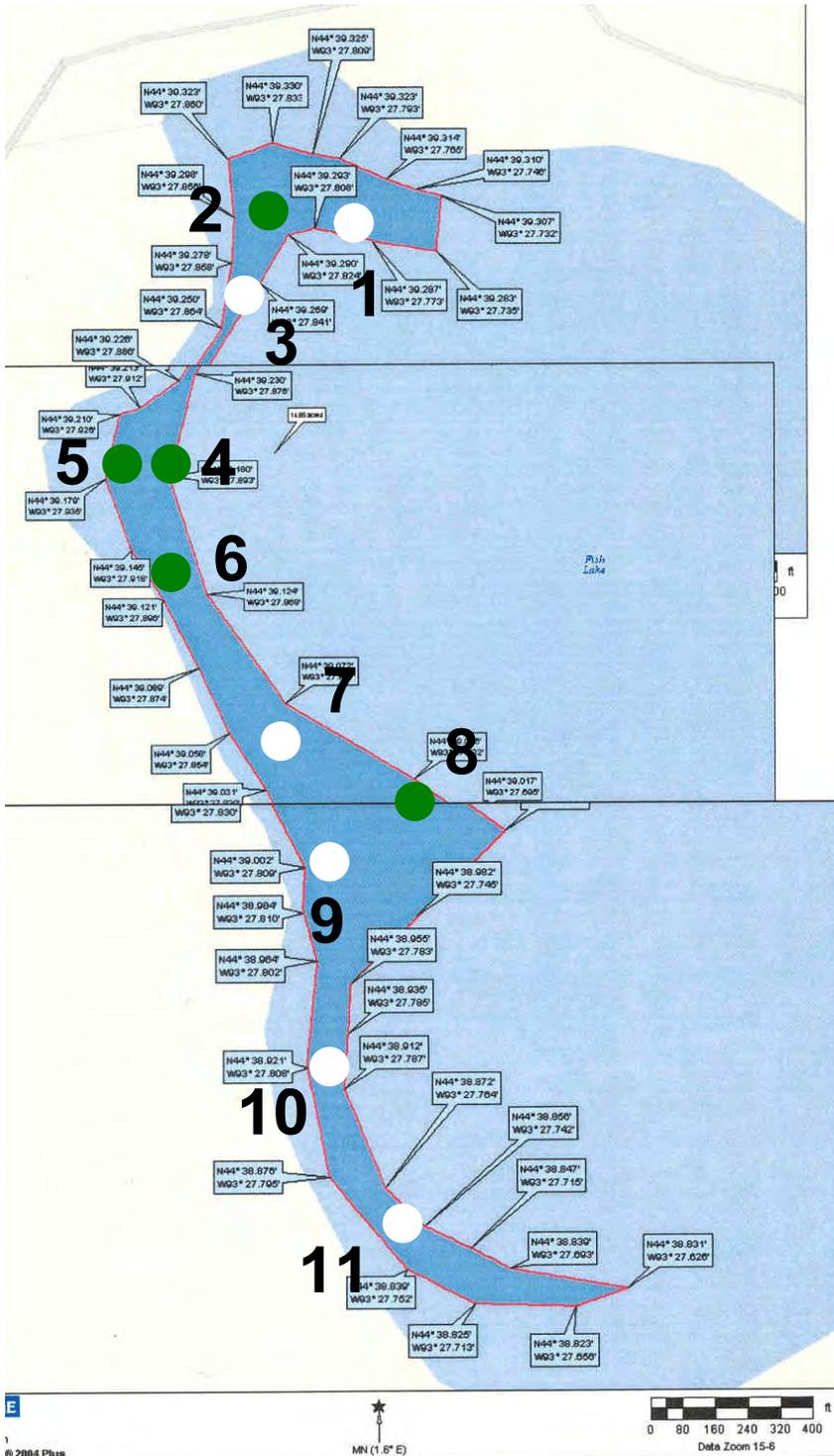


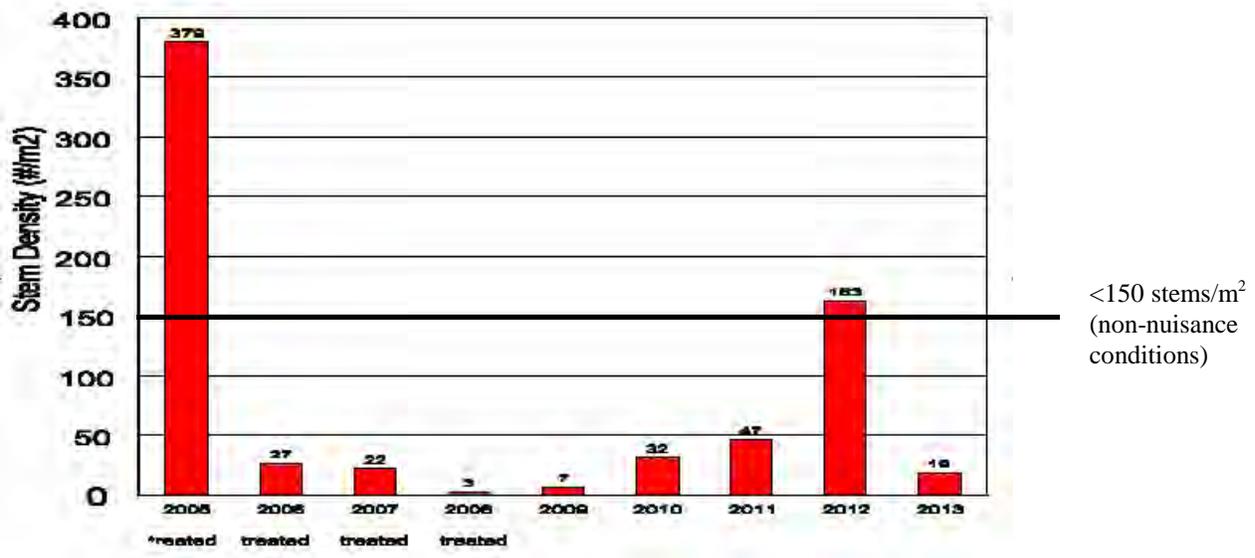
Figure 4. Curlyleaf delineation in Fish Lake on May 23, 2013. White dots = no curlyleaf pondweed and green dots = light growth. The darker blue shading in the nearshore area represents the 15.5 acre area that was treated with herbicides from 2005 through 2008. No herbicides were applied in 2009 through 2013.

## Curlyleaf Stem Densities at One Location, May 23, 2013

Curlyleaf stem densities were determined at a location between sample sites 4-5 (location is shown in Figure 1). Ten quadrat samples were taken at this location. The results for 2013 show curlyleaf was found at light to moderate stem densities (Table 2). CLP stem densities were less in 2013 compared to 2012 (Figure 5).

**Table 2. Curlyleaf pondweed stem densities found on May 23, 2013 at Site 5.**

Sample	Site 5 (4-7 feet)
	(stems/m <sup>2</sup> )
1	30
2	40
3	30
4	0
5	0
6	0
7	0
8	60
9	0
10	30
<b>Average</b>	<b>19</b>



**Figure 5. Curlyleaf stem densities for early season monitoring for 2005-2013.**

## Late Spring Curlyleaf Pondweed Assessment in Fish Lake

A total of 11 sites were re-sampled with rake sampling on June 13, 2013 in the area that previously had been treated for four consecutive years in 2005-2008 with an endothall herbicide. There was no herbicide use in 2013. Curlyleaf was found at 4 out of 11 sample sites. Coontail was found at 11 out of 11 sample sites.

**Table 3. Aquatic plant densities based on rake sampling for June 13, 2013. Densities are based on a scale from 1 to 5 with 5 being the densest. Curlyleaf stems per rake sample were also noted. Areas with green shading are predicted to have light to moderate growth at the peak of the curlyleaf growth cycle. Areas with yellow shading are predicted to have moderate to heavy curlyleaf growth.**

Site	Depth	CLP	Coontail	Filamentous algae
1	6	1	1	2
2	5		2	2
3	7		3	
4	8		2	
5	5		3	
6	7		3	
7	6	1	3	
8	9		2	
9	7	1	3	
10	6		3	
11	7	2	2	
<b>Average</b>		<b>1.3</b>	<b>2.5</b>	<b>2.0</b>
<b>occurrence (11 sites)</b>		4	11	2
<b>% occurrence</b>		36	100	18



**Figure 6. [left] Coontail on a sample rake at a density of a “3”. [right] Filamentous algae sampled at a density of a “2”.**

## Curlyleaf Conditions in Fish Lake, June 13, 2013

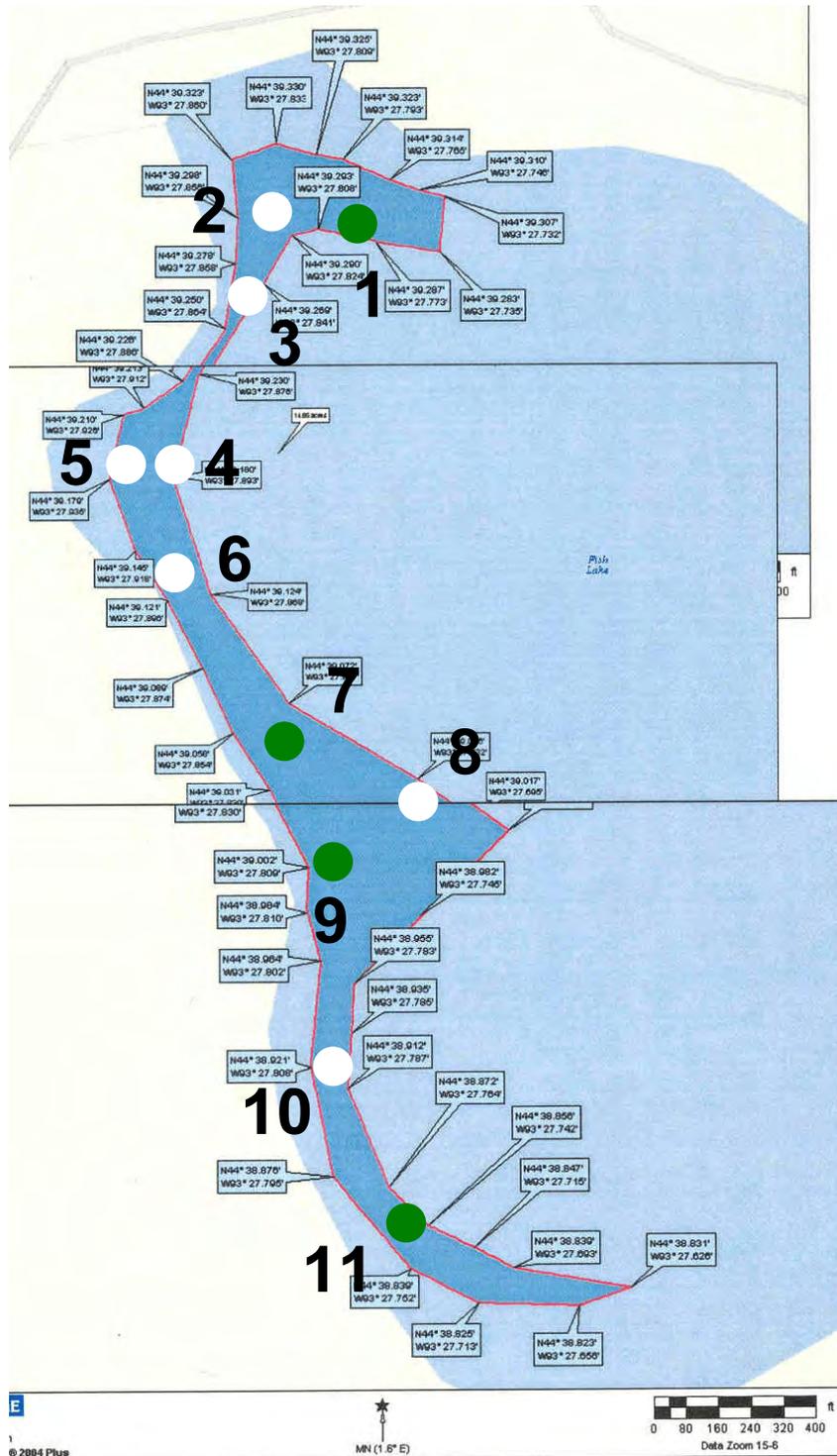


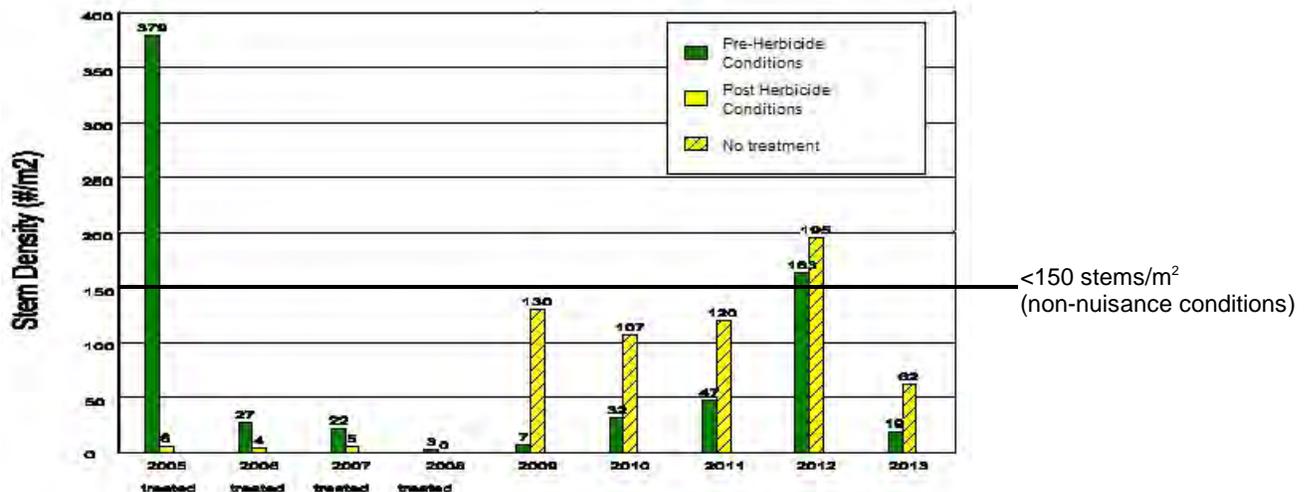
Figure 7. Curlyleaf delineation in Fish Lake on June 13, 2013. White dots = no curlyleaf pondweed and green dots = light growth. The darker blue shading in the nearshore area represents the 15.5 acre area that was treated with herbicides from 2005 through 2008. No herbicides were applied in 2009 through 2013.

## Curlyleaf Stem Densities at One Location, June 13, 2013

Curlyleaf stem densities were determined by scuba diving at a location between sample sites 4-5 (Figure 1). Ten quadrat samples were taken at this location. The results for 2013 show curlyleaf was found at low stem densities (Table 4).

**Table 4. Curlyleaf pondweed stem densities for June 13, 2013. Samples collected at the 6 to 7 foot depth.**

Scuba Diving - June 13, 2013	
Site 4 - 5 Quadrat	Curlyleaf (stems/m <sup>2</sup> )
1	10
2	20
3	20
4	230
5	40
6	210
7	0
8	80
9	10
10	0
<b>Ave</b>	<b>62</b>



**Figure 8. Average of Fish Lake curlyleaf pondweed stem densities for early season and late season conditions in 2005 through 2013 at a 6.0-foot water depth at the monitoring site shown in Figure S-3.**

## Results for 2005-2013

**Curlyleaf Pondweed Stem Densities at Site 4:** Curlyleaf has been monitored at the same site on early and late season dates from 2005 through 2013. Curlyleaf stem densities were initially high on April 18, 2005. Curlyleaf was treated within this site for four years (2005-2008). No herbicide was used in 2009 through 2013. The early season stem density was 19 stems/m<sup>2</sup> on May 23, 2013, which was lower compared to Years 2009-2012. The next sample date on June 13, 2013, curlyleaf stem density increased to 60 stems/m<sup>2</sup> (Table 5).

**Table 5. Summary of curlyleaf pondweed stem densities prior to the effects of herbicide treatment and after the herbicide treatment.**

Site	Stem Density (stems/m <sup>2</sup> )								
	Spring Status								
	5 - 6 foot Depth								
	2005 (Apr 18) (n=10)	2006 (Apr 25) (n=10)	2007 (Apr 16) (n=10)	2008 (Apr 29) (n=10)	2009 (Apr 23) (n=10)	2010 (Apr 27) (n=10)	2011 (May 12) (n=10)	2012 (Apr 17) (n=10)	2013 (May 23) (n=10)
1	290	50	0	10	10	20	60	120	30
2	460	0	0	20	10	60	70	180	40
3	270	0	0	0	20	60	100	90	30
4	260	10	0	0	0	80	50	220	0
5	480	20	30	0	30	0	60	90	0
6	250	80	40	0	0	40	30	240	0
7	540	60	30	0	0	40	30	30	0
8	370	20	80	0	0	20	50	280	60
9	270	30	20	0	0	0	20	360	0
10	600	30	20	0	0	0	20	20	30
<b>Ave</b>	<b>379</b>	<b>27</b>	<b>22</b>	<b>3</b>	<b>7</b>	<b>32</b>	<b>47</b>	<b>163</b>	<b>19</b>

Site	Stem Density (stems/m <sup>2</sup> )								
	Early Summer Status								
	5 - 6 foot Depth								
	2005 (May 23) (n=10)	2006 (June 2) (n=10)	2007 (June 5) (n=10)	2008 (June 13) (n=10)	2009 (June 10) (n=10)	2010 (June 2) (n=10)	2011 (June 13) (n=10)	2012 (June 5) (n=10)	2013 (June 13) (n=10)
	treated	treated	treated	treated					
1	10	10	0	0	50	70	200	60	10
2	20	10	0	0	50	120	160	240	20
3	30	10	0	0	220	20	40	290	20
4	0	10	10	0	130	20	240	320	230
5	0	0	30	0	90	10	100	190	40
6	0	0	10	0	50	360	60	170	210
7	0	0	0	0	100	140	110	320	0
8	0	0	0	0	150	90	120	250	80
9	0	0	0	0	110	230	60	50	10
10	0	0	0	0	320	10	100	60	0
<b>Ave</b>	<b>6</b>	<b>4</b>	<b>5</b>	<b>0</b>	<b>130</b>	<b>107</b>	<b>119</b>	<b>195</b>	<b>62</b>

**Conclusions:** Two curlyleaf pondweed (CLP) assessments were conducted in Fish Lake within the 15.5 acre area that was treated with an endothall herbicide from 2005-2008 (shaded dark blue in Figure 9). The first assessment was on May 23 and the second one was on June 13, 2013. In the first assessment in 2013 curlyleaf pondweed was found at 5 out of the 11 sites monitored. However, CLP growth was light and no herbicide treatments were conducted. On the second assessment, curlyleaf abundance had remain about the same as in the May survey. Overall curlyleaf growth has been mostly light to moderate in the last few years and that was also the case for 2013. No herbicides have been used in the 15.5 acre area in 2009 through 2013.

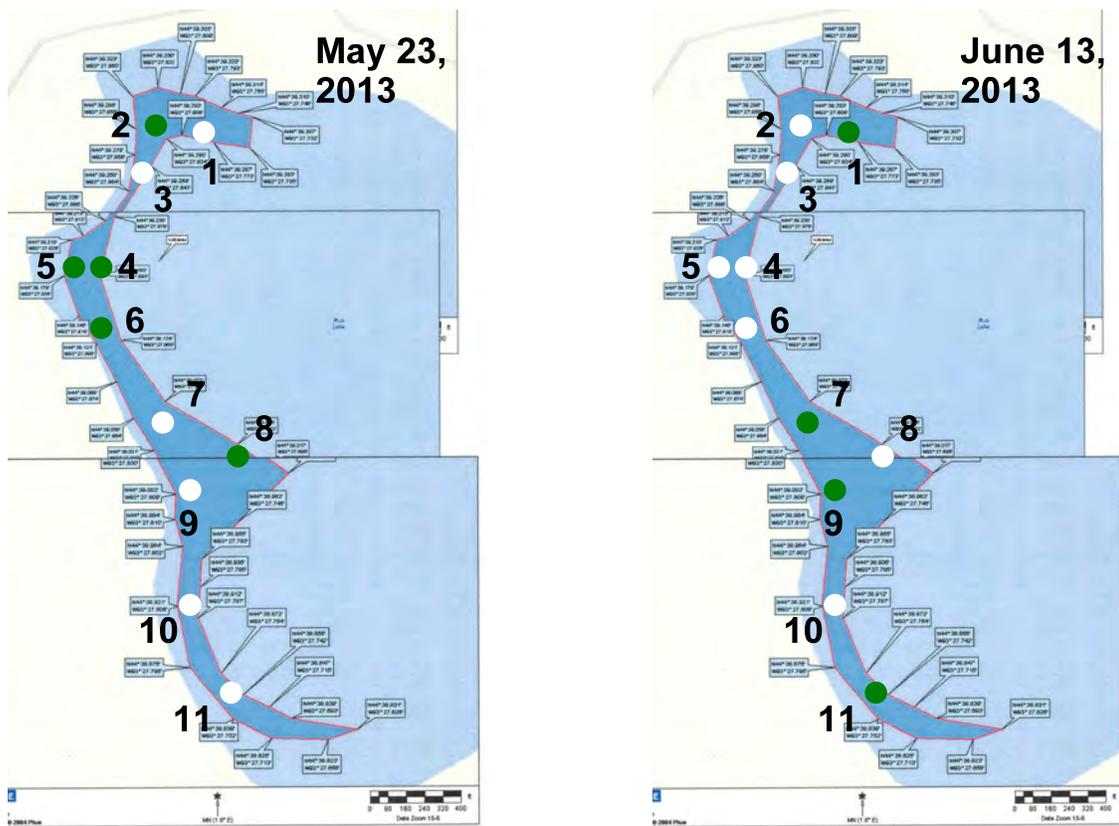


Figure 9. [left] Eleven sites within an area that was treated from 2005-2008 (dark blue shading) were monitored on May 23, 2013 and curlyleaf was detected at five sites at low densities (green dots). White dots indicate no curlyleaf pondweed observed. [right] In June, the same sites were monitored and curlyleaf was detected at four sites. Green dots indicates were curlyleaf pondweed was observed.

# APPENDIX

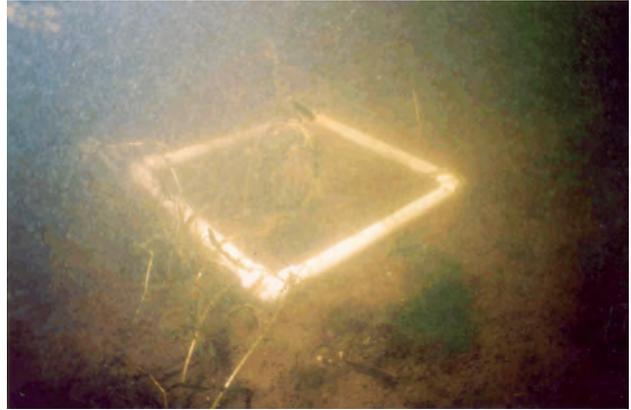
## Subsurface Curlyleaf Pondweed Conditions in Fish Lake in 2005 Through 2012. Herbicides Were Used in 2005-2008.

### Pre-Herbicide (Early) Conditions

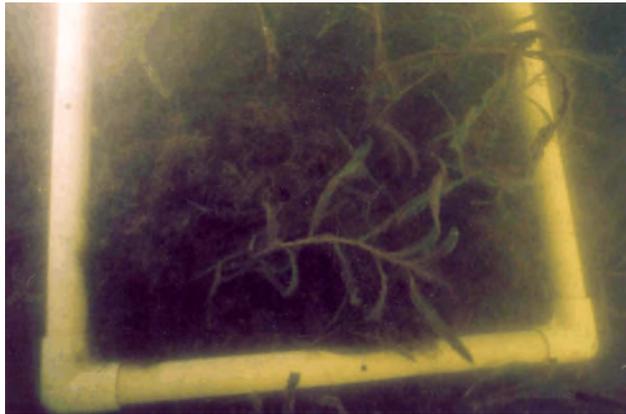


April 18, 2005

### Post Herbicide (Late) Conditions



May 23, 2005



April 25, 2006



June 2, 2006



April 16, 2007



June 5, 2007

**Pre-Herbicide (Early) Conditions**

**Post Herbicide (Late) Conditions**



**April 29, 2008**



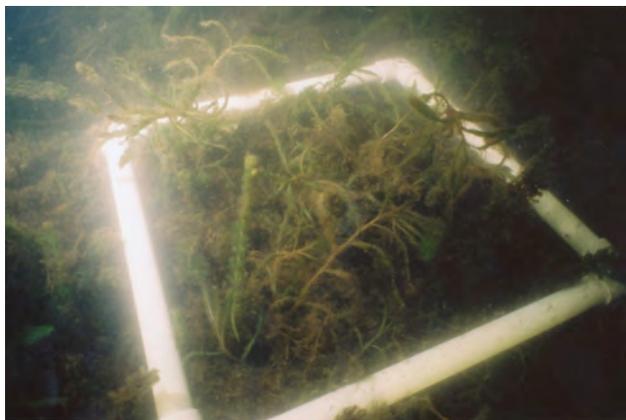
**June 13, 2008**



**April 23, 2009**



**June 10, 2009**



**April 27, 2010**



**June 2, 2010**

**Pre-Herbicide (Early) Conditions**



**May 12, 2011**

**Post Herbicide (Late) Conditions**



**June 13, 2011**



**April 17, 2012**



**June 5, 2012**

# Curlyleaf Pondweed Conditions in early June in 2003 and 2005-2013



2003



2005



2006



2007



2008



2009

# Curlyleaf Pondweed Conditions in early June in 2003 and 2005-2013



2010



2011



2012



2013

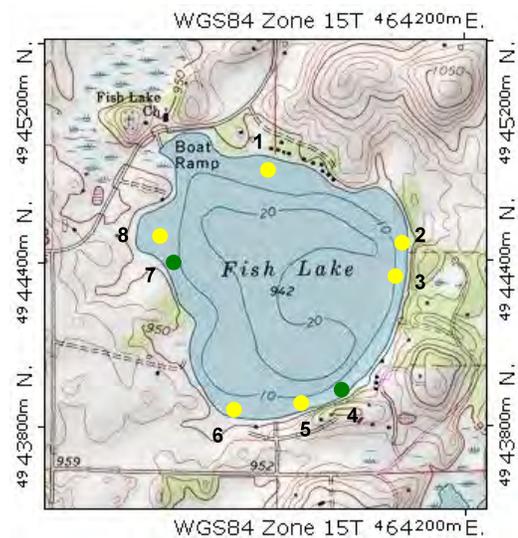
# Predicted Curlyleaf Pondweed Growth Based on Lake Sediment Characteristics

Lake sediment sampling results from 2006 have been used to predict lake bottom areas that have the potential to support nuisance curlyleaf pondweed plant growth in Fish Lake. Based on the key sediment parameters of pH, organic matter, and the Fe:Mn ratio (McComas, unpublished), the predicted growth characteristics of curlyleaf pondweed are shown in Table A-1 and Figure A-1.

If herbicide applications were to stop in Fish Lake, curlyleaf pondweed growth is predicted to produce mostly light nuisance growth (where plants occasionally top out) for a number of locations around Fish Lake (Figure A-1).

**Table A-1. Fish Lake sediment data and ratings for potential curlyleaf pondweed growth. Sediment collected in 2006.**

Site	Depth (ft)	pH (su)	Organic Matter (%)	Fe:Mn Ratio	Potential for Heavy Curlyleaf Pondweed Growth
Light Growth		6.8	5	4.6	Low (green)
Moderate Growth		6.2	11	5.9	Medium (yellow)
Heavy Growth		>7.7	>20	<1.6	High (red)
1	5	7.6	3.5	2.38	
2	5	7.7	2.5	4.39	
3	5	7.7	5.1	3.12	
4	5	7.6	6.4	4.13	
5	5	8.1	0.9	13.33	
6	5	7.6	3.7	2.56	
7	5	7.5	2.2	3.32	
8	5	7.5	35.7	2.74	



**Figure A-1. Sediment sample locations are shown with a circle. The circle color indicates the potential for nuisance curlyleaf pondweed to occur at that site. Key: green = low; yellow = medium; red =**

Light nuisance growth has intermediate growth characteristics between non- nuisance and nuisance growth. Non-nuisance growth refers to curlyleaf growth that is mostly below the surface and is not a recreational nor an ecological problem. Heavy growth refers to nuisance matting curlyleaf pondweed. This is the kind of nuisance growth predicted by high sediment pH and a low iron to manganese ratio. A chart showing the three types of growth conditions is shown on the next page.

# Examples of Curlyleaf Pondweed Growth Characteristics

## Light Growth Conditions

Plants rarely reach the surface.

Navigation and recreational activities are not generally hindered.

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

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



## Moderate Growth Conditions

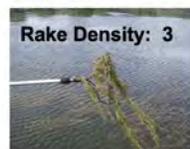
Broken surface canopy conditions.

Navigation and recreational activities may be hindered.

Lake users may opt for control.

Stem density: 100 - 280 stems/m<sup>2</sup>  
Biomass: 50 - 85 g-dry wt/m<sup>2</sup>  
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<sup>2</sup>  
Biomass: >300 g-dry wt/m<sup>2</sup>  
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.*

