

## Summary of Pretreatment Survey Results: May 2014

Treatment Plots in Red Cedar Lake & Hemlock Lake (*Barron County, WI*)

Pretreatment Surveys – May 20, 2014



### Surveying, Analysis, and Reporting by:

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**Certified Lake Manager**  
[www.NALMS.org](http://www.NALMS.org)

### Funding Provided by:

*Red Cedar Lake Association (Mikana, WI) with Grant Assistance from the Wisconsin DNR*

## Summary

### Purpose of Surveys

These surveys were conducted to assess the frequency and abundance of invasive curlyleaf pondweed (*Potamogeton crispus*, henceforth referred to as CLP) and native aquatic plants in areas of Red Cedar Lake and Hemlock Lake where endotox treatments are planned to occur in the spring of 2014. The results of these surveys will help to (1) assess the effectiveness of the proposed treatments for controlling CLP, (2) document effects (positive or negative) on native aquatic plants, and (3) guide future vegetation management planning in the lakes.

### Summary of Findings

- 1) During the 2014 pretreatment survey, we found substantially less CLP than in 2013 in both Hemlock (29% vs. 76%) and Red Cedar Lake (9% vs. 82%). Furthermore, the CLP plants in 2014 were generally small (4 to 6 inches in Red Cedar; 6 to 12 inches in Hemlock) with most plants having only flat “winter leaves” (no undulated “summer” leaves). This suggests that the late ice-out and long, cool spring in 2014 delayed CLP growth substantially. This pattern has been seen in lakes throughout WI and MN this spring. Although the 2013 treatment may have reduced curlyleaf in the plots to some degree, past studies have shown that such treatments only reduce turion abundance by 40-50% in the initial year of treatment (Johnson et al. 2012). This strongly suggests that the greatly reduced CLP seen in 2014 is due to the weather, so it is very likely that these treated plots still harbor abundant turions in the sediment. This delay in CLP sprouting and growth may affect the efficacy of treatments this spring, particularly if there is substantial new CLP sprouting after treatment. For this reason, any treatments should be delayed as long as possible to maximize CLP control in 2014.
- 2) Overall, native aquatic plants did not appear to be growing very actively in the proposed plots at the time of the 2014 pretreatment survey:
  - Coontail (*Ceratophyllum demersum*) was common in both lakes and showed some signs of active growth, particularly at shallower sites. Elodea was less common, but was growing very actively. Coontail and Elodea are quite tolerant of endotox, and would likely not be negatively affected by treatments.
  - Flat-stem pondweed (*Potamogeton zosteriformis*) was somewhat common but all observed growth of this plant consisted of very small sprouts (<3 in. tall) emerging from winter buds. Flat-stem is quite sensitive to endotox.
  - Northern watermilfoil (*Myriophyllum sibiricum*) was common in Red Cedar Lake but was only found as small over-wintering fragments (<6 inches tall). These fragments mostly appeared dormant, but some showed early signs of active growth (bright green tips).
  - White-stem pondweed was actively growing from remnant stems left over from last year’s growth (no new sprouting from sediment seen). White-stem is very sensitive to endotox.
  - Robbin’s pondweed (*Potamogeton robbinsii*), was very common in both lakes, but was predominantly old growth from 2013 with very little new growth apparent.
  - Other native plants were present at lower frequency (generally <5%), and none showed signs of active growth beyond a few small shoots.

## Survey & Analysis Methods

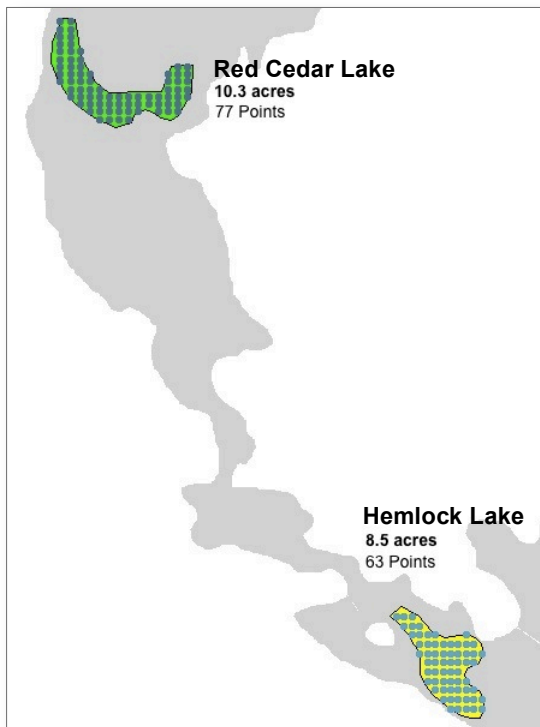
### Pretreatment Point-Intercept Survey

Freshwater Scientific Services, LLC completed pretreatment point-intercept aquatic plant surveys in both of the proposed treatment plots on May 20, 2014 using the point-intercept method described by Madsen (1999). These surveys incorporated assessments at a total of 140 sample points that covered the proposed treatment areas (77 in Red Cedar plot, 63 in Hemlock plot; Figure 1). We generated these sample points using desktop GIS software and the MDNR *Random Sample Generator* extension to project a grid of points over maps of the proposed pretreatment plots and aerial imagery of the lake. We then loaded the selected sample locations onto a handheld GPS unit (Garmin GPSMAP-78) to enable navigation to each point while in the field.




At each designated sample location, we collected plants using a double-headed, 14-tine rake on a pole (for sites <10 ft deep) or a similar rake on a rope (for sites ≥10ft deep). For each rake sample, all of the retrieved plants were piled on top of the rake head and assigned density ratings from 1 to 3 (Figure 2) for all plants collectively, and for each species individually. At each location, we also documented water depth, overall plant height, and curlyleaf pondweed plant height. In addition to the rake samples, we also recorded sonar data for more detailed assessment of water depth and plant height with ciBioBase™.

We calculated the frequency (% occurrence) and mean rake density for each encountered plant species (Table 1), as well as the mean depth, mean CLP density, and mean CLP height within each of the proposed treatment plots (Table 2).

**Figure 1.** Map showing the proposed treatment plots for CLP in 2014 and sampled locations in the Red Cedar Lake and Hemlock Lake plots.



**Figure 2.** Density ratings based upon rake coverage

Density Rating	Rake Coverage	Description
1		Only a few plants retrieved
2		Plants cover full length of rake head, but do not cover the tines completely
3		Plants completely cover rake head and tines

## Results

### Statistical Summary of Findings

**Table 1.** Frequency (% occurrence) and abundance (rake density rating) of plant species found during the pretreatment surveys conducted on May 20, 2014 (Hemlock and Red Cedar Lake). Species roughly listed from most common to least common. % Occurrence calculated using all surveyed points in each plot; Mean density calculated using only points where each species was found.

Plant Species	Common Name	HEMLOCK		RED CEDAR	
		% Occ	Mean Density (rake, 1-3)	% Occ	Mean Density (rake, 1-3)
<i>Potamogeton crispus</i>	Curlyleaf Pondweed	29	1.0	9	1.0
<i>Ceratophyllum demersum</i>	Coontail	48	1.2	69	1.5
<i>Potamogeton robbinsii</i>	Robbins' Pondweed	68	1.5	27	1.3
<i>Myriophyllum sibiricum</i>	Northern Watermilfoil	-	-	25	1.0
<i>Potamogeton zosteriformis</i>	Flat-stem Pondweed	-	-	23	1.0
<i>Lemna trisulca</i>	Star Duckweed	-	-	20	1.0
<i>Potamogeton praelongus</i>	White-stem Pondweed	-	-	16	1.0
<i>Elodea canadensis</i>	Canadian waterweed	22	1.1	8	1.0
<i>Potamogeton amplifolius</i>	Large-leaf Pondweed	2	1.0	4	1.0
<i>Fontinalis antipyretica</i>	Aquatic Moss	16	1.0	3	1.0
<i>Potamogeton pusillus</i>	Small Pondweed	-	-	1	1.0
<i>Nuphar variegata</i>	Bullhead Lily	Present	-	-	-
<b>All Vegetation</b>		<b>98</b>	<b>1.4</b>	<b>81</b>	<b>1.3</b>

**Table 2.** Summary of calculated statistics for each surveyed plot (Hemlock and Red Cedar Lake, May 20, 2014)

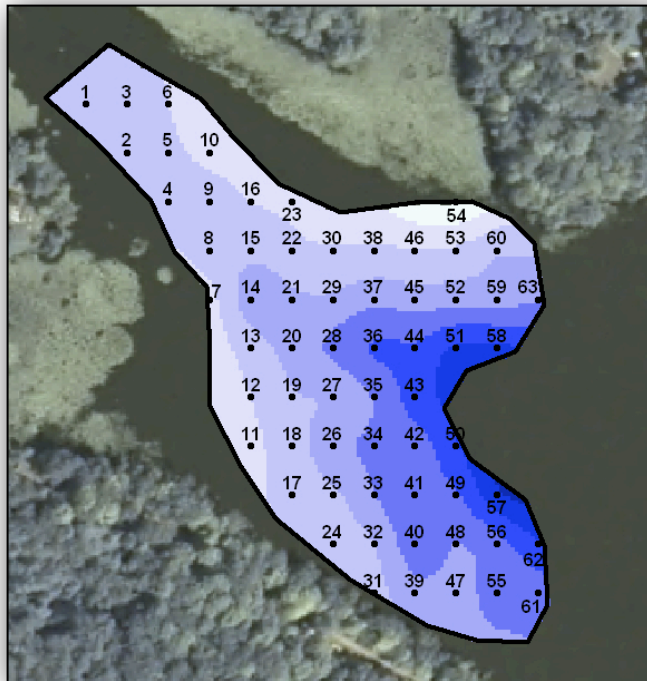
Plot	Area (acres)	Mean Water Depth <sup>1</sup> (ft)	Mean CLP Density (rake, 1-3)	Mean CLP Height (ft)	Native Species per Point
Hemlock	8.5	8.1	0.8	0.6	1.6
Red Cedar	10.3	8.8	1.0	0.4	2.0

<sup>1</sup> Mean water depth reported by CIBioBase ([www.contourinnovations.com](http://www.contourinnovations.com))

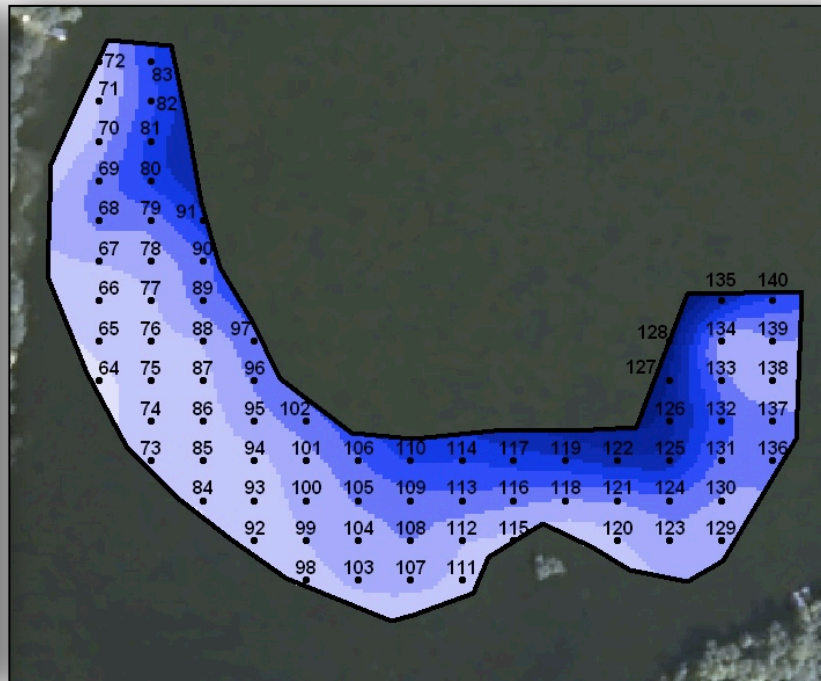
**Red Cedar Lakes**  
**Pretreatment Assessment: May 20, 2014**

**Survey Points & Water Depth**

Hemlock Lake Treatment Plot



Red Cedar Lake Treatment Plot



**Surveyed Locations**

- Surveyed Points

**Water Depth (ft)\***

- 4-5
- 5-6
- 6-7
- 7-8
- 8-9
- 9-10
- 10-11
- 11-12
- 12-13

\*Contours based upon measured depth at surveyed points in 2013; interpolated using IDW method.

Water was ~0.5 to 1.0 ft higher during the May 2014 survey.



0 200 ft

See Table 3 for detailed point descriptions (*by number*)

See page 9 for additional analysis of water depth and volume using sonar data and ciBioBase ([www.contourinnovations.com](http://www.contourinnovations.com))

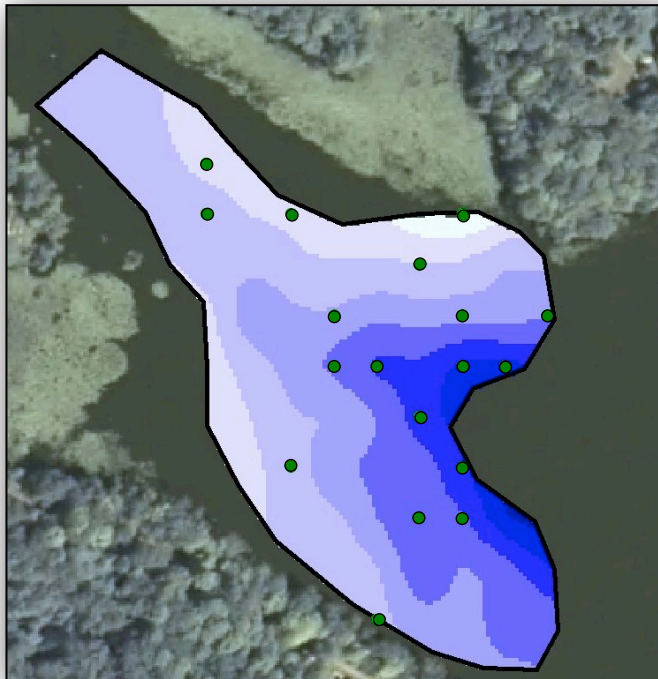
**Surveyed:** May 20, 2014  
**Surveyor:** J.A. Johnson  
**Affiliation:** Freshwater Sci. Serv.  
**Methods:** Rake, Sonar, Depth Rod  
**Analyses by:** J.A. Johnson

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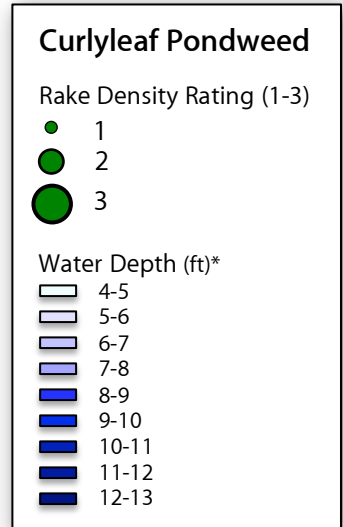
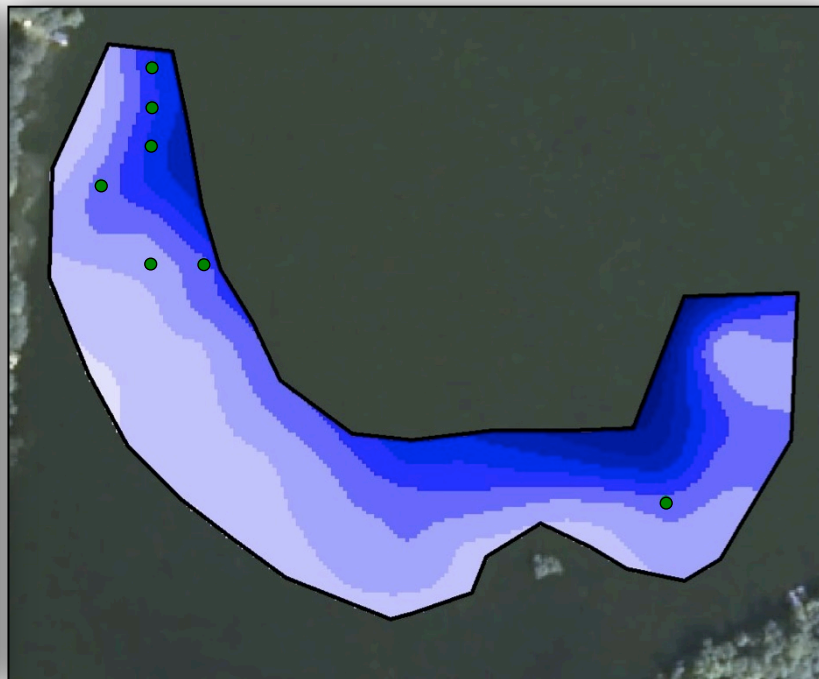
**Red Cedar Lakes**  
**Pretreatment Assessment: May 20, 2014**

**Curlyleaf Pondweed Abundance**

Hemlock Lake Treatment Plot



Red Cedar Lake Treatment Plot



\*Contours based upon measured depth at surveyed points in 2013; interpolated using IDW method.

\*Water was ~0.5 to 1.0 ft higher during the May 2014 survey.

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**Methods:** Rake, Sonar, Depth Rod  
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0 200 ft

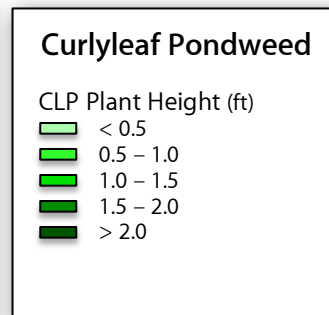
## Red Cedar Lakes Pretreatment Assessment: May 20, 2014

## Curlyleaf Pondweed Plant Height

Hemlock Lake Treatment Plot



Red Cedar Lake Treatment Plot



CLP plant height estimated based upon plants retrieved in rake samples. Plant height data interpolated between points using IDW method.

**Surveyed:** May 20, 2014  
**Surveyor:** J.A. Johnson  
**Affiliation:** Freshwater Sci. Serv.  
**Methods:** Rake, Sonar, Depth Rod  
**Analyses by:** J.A. Johnson



0 200 ft

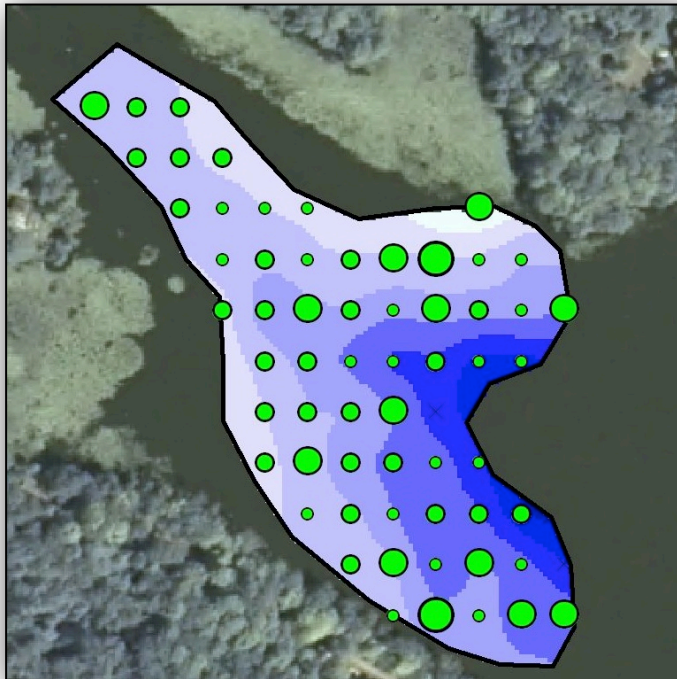
See page 9 for additional analysis of plant height using sonar data and ciBioBase ([www.contourinnovations.com](http://www.contourinnovations.com))

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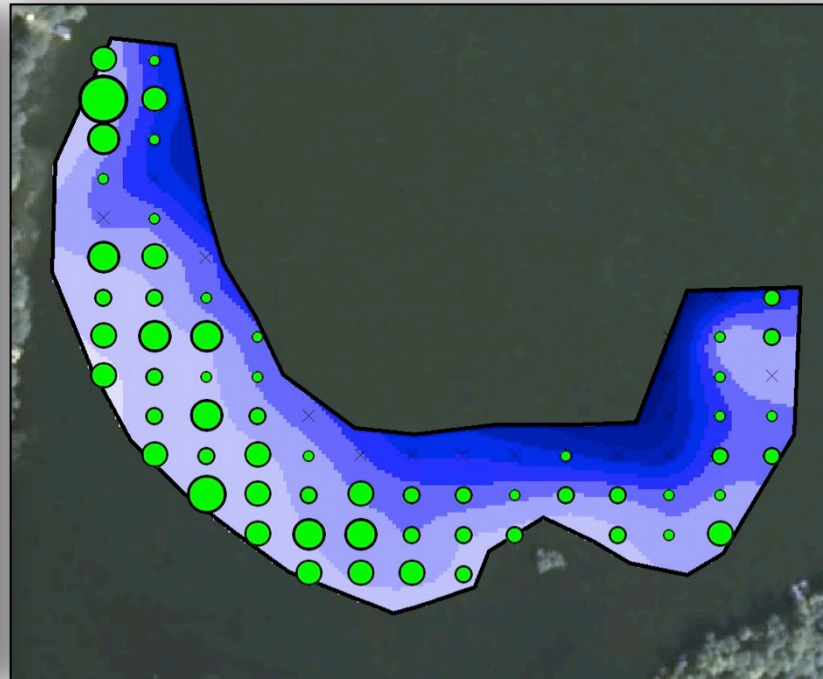
**Red Cedar Lakes**  
**Pretreatment Assessment: May 20, 2014**

**Native Aquatic Plants**

Hemlock Lake Treatment Plot



Red Cedar Lake Treatment Plot



**Native Aquatic Plants**

Native Species per Point

- × 0
- 1
- 2
- 3
- 4
- 5
- 6 or more

\*Contours based upon measured depth at surveyed points in 2013; interpolated using IDW method.

\*Water was ~0.5 to 1.0 ft higher during the May 2014 survey.

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 Surveyor: J.A. Johnson  
 Affiliation: Freshwater Sci. Serv.  
 Methods: Rake, Sonar, Depth Rod  
 Analyses by: J.A. Johnson

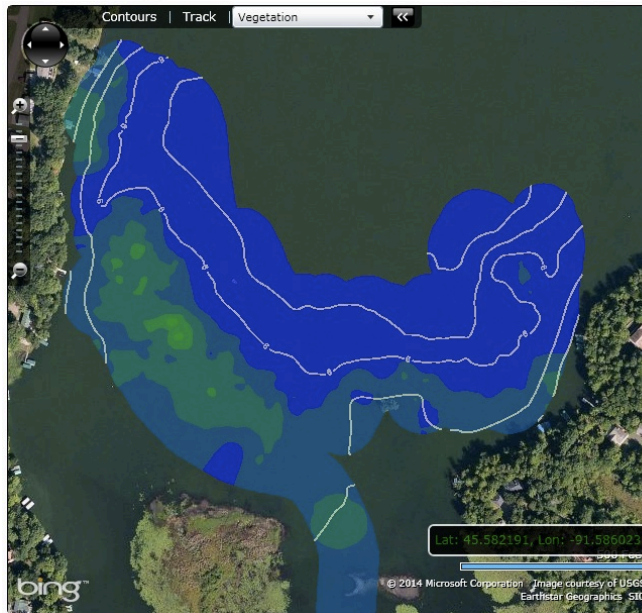
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## Sonar Analysis of Depth and Plant Growth

In addition to collecting data at each sample point, we also recorded sonar data from the plots in Hemlock and Red Cedar Lakes. We uploaded these recorded data to ciBioBase servers for processing. The figures below provide additional analyses of the treatment plots. You can access the ciBioBase report at:

<http://files5.contourinnovations.com/ReportOutput/5738efc8-87bf-446f-b3b7-1e589212c17d/report.htm>



Property	Value
<b>Name</b>	RedCedarPlot
<b>Description</b>	Approximate treatn
<b>Created By</b>	Johnson, James
<b>Volume (cu. m)</b>	141543.86
<b>Volume (acre ft)</b>	114.75
<b>Depth (avg ft)</b>	8.82
<b>Depth (max ft)</b>	15.45
<b>Depth (min ft)</b>	2.66
<b>Surface Acres</b>	12.803
<b>Width (m)</b>	366.024
<b>Height (m)</b>	307.534
<b>Perimeter (m)</b>	1269.307



Property	Value
<b>Name</b>	Hemlock
<b>Description</b>	Approximate treatn
<b>Created By</b>	Johnson, James
<b>Volume (cu. m)</b>	93374.79
<b>Volume (acre ft)</b>	75.7
<b>Depth (avg ft)</b>	8.14
<b>Depth (max ft)</b>	11.49
<b>Depth (min ft)</b>	4.81
<b>Surface Acres</b>	9.129
<b>Width (m)</b>	254.946
<b>Height (m)</b>	283.373
<b>Perimeter (m)</b>	936.43

**Table 3.** GPS coordinates and measurements for surveyed points (Red Cedar Lake and Hemlock Lake; May 20, 2014)

<b>Point ID</b>	<b>Lake</b>	<b>Lat</b>	<b>Long</b>	<b>Water Depth (ft)</b>	<b>CLP Plant Height (ft)</b>	<b>CLP Density (rake, 1-3)</b>
1	Hemlock	45.5678884	-91.5803203	7.9		
2	Hemlock	45.5676615	-91.5800581	8.2		
3	Hemlock	45.5678851	-91.5800525	8.2		
4	Hemlock	45.5674345	-91.5797960	7.9		
5	Hemlock	45.5676581	-91.5797904	7.9		
6	Hemlock	45.5678818	-91.5797848	7.9		
7	Hemlock	45.5669839	-91.5795396	7.5		
8	Hemlock	45.5672075	-91.5795339	8.2		
9	Hemlock	45.5674312	-91.5795283	7.9	0.7	1
10	Hemlock	45.5676548	-91.5795227	7.5	0.3	1
11	Hemlock	45.5663096	-91.5792887	7.5		
12	Hemlock	45.5665333	-91.5792831	7.9		
13	Hemlock	45.5667569	-91.5792775	8.5		
14	Hemlock	45.5669806	-91.5792718	8.9		
15	Hemlock	45.5672042	-91.5792662	7.9		
16	Hemlock	45.5674278	-91.5792605	7.9		
17	Hemlock	45.5660827	-91.5790266	8.2		
18	Hemlock	45.5663063	-91.5790210	8.5	0.3	1
19	Hemlock	45.5665299	-91.5790154	8.9		
20	Hemlock	45.5667536	-91.5790097	9.2		
21	Hemlock	45.5669772	-91.5790041	9.2		
22	Hemlock	45.5672009	-91.5789984	8.2		
23	Hemlock	45.5674245	-91.5789928	7.5	1.0	1
24	Hemlock	45.5658557	-91.5787645	8.5		
25	Hemlock	45.5660793	-91.5787589	8.9		
26	Hemlock	45.5663030	-91.5787532	9.2		
27	Hemlock	45.5665266	-91.5787476	9.2		
28	Hemlock	45.5667502	-91.5787420	9.5	0.3	1
29	Hemlock	45.5669739	-91.5787363	9.2	1.6	1
30	Hemlock	45.5671975	-91.5787307	7.9		
31	Hemlock	45.5656287	-91.5785024	8.2	0.3	1
32	Hemlock	45.5658524	-91.5784968	8.9		
33	Hemlock	45.5660760	-91.5784911	9.2		
34	Hemlock	45.5662996	-91.5784855	9.5		
35	Hemlock	45.5665233	-91.5784799	9.5		
36	Hemlock	45.5667469	-91.5784742	10.8	1.0	1
37	Hemlock	45.5669706	-91.5784686	8.9		
38	Hemlock	45.5671942	-91.5784629	7.9		
39	Hemlock	45.5656254	-91.5782347	8.9		
40	Hemlock	45.5658490	-91.5782291	9.2		
41	Hemlock	45.5660727	-91.5782234	9.5		
42	Hemlock	45.5662963	-91.5782178	11.2		
43	Hemlock	45.5665199	-91.5782121	11.2	0.3	1
44	Hemlock	45.5667436	-91.5782065	11.5		
45	Hemlock	45.5669672	-91.5782008	9.2		
46	Hemlock	45.5671909	-91.5781952	7.9	0.3	1
47	Hemlock	45.5656220	-91.5779670	9.8		
48	Hemlock	45.5658457	-91.5779613	9.5		
49	Hemlock	45.5660693	-91.5779557	10.2	0.7	1

Pretreatment Assessment of Treatment Plots – Red Cedar Lake and Hemlock Lake (Barron Co., WI) – May 2014

Point ID	Lake	Lat	Long	Water Depth (ft)	CLP Plant Height (ft)	CLP Density (rake, 1-3)
50	Hemlock	45.5662930	-91.5779500	11.5	0.7	1
51	Hemlock	45.5667402	-91.5779387	11.2	0.3	1
52	Hemlock	45.5669639	-91.5779331	9.2	0.7	1
53	Hemlock	45.5671875	-91.5779274	7.9		
54	Hemlock	45.5674112	-91.5779218	5.9	0.3	1
55	Hemlock	45.5656187	-91.5776992	9.2		
56	Hemlock	45.5658424	-91.5776936	9.5		
57	Hemlock	45.5660660	-91.5776879	11.5		
58	Hemlock	45.5667369	-91.5776710	11.5	0.3	1
59	Hemlock	45.5669606	-91.5776653	9.5		
60	Hemlock	45.5671842	-91.5776597	7.2		
61	Hemlock	45.5656154	-91.5774315	10.5		
62	Hemlock	45.5658390	-91.5774258	11.2		
63	Hemlock	45.5669572	-91.5773976	9.8	0.1	1
64	Red Cedar	45.5810572	-91.5916250	7.2		
65	Red Cedar	45.5812396	-91.5916205	7.2		
66	Red Cedar	45.5814219	-91.5916159	7.9		
67	Red Cedar	45.5816042	-91.5916113	8.2		
68	Red Cedar	45.5817865	-91.5916068	9.8		
69	Red Cedar	45.5819688	-91.5916022	9.2		
70	Red Cedar	45.5821511	-91.5915977	8.5		
71	Red Cedar	45.5823334	-91.5915931	7.9		
72	Red Cedar	45.5825157	-91.5915885	7.2		
73	Red Cedar	45.5806885	-91.5912964	7.5		
74	Red Cedar	45.5808708	-91.5912918	7.2		
75	Red Cedar	45.5810531	-91.5912872	7.2		
76	Red Cedar	45.5812354	-91.5912827	7.5		
77	Red Cedar	45.5814177	-91.5912781	8.2		
78	Red Cedar	45.5816000	-91.5912736	8.5	0.3	1
79	Red Cedar	45.5817823	-91.5912690	9.5		
80	Red Cedar	45.5819646	-91.5912644	11.5		
81	Red Cedar	45.5821469	-91.5912599	11.2	0.3	1
82	Red Cedar	45.5823292	-91.5912553	11.2	0.3	1
83	Red Cedar	45.5825115	-91.5912508	10.8	0.3	1
84	Red Cedar	45.5805020	-91.5909631	7.5		
85	Red Cedar	45.5806843	-91.5909586	7.9		
86	Red Cedar	45.5808666	-91.5909540	7.9		
87	Red Cedar	45.5810489	-91.5909495	8.2		
88	Red Cedar	45.5812312	-91.5909449	8.9		
89	Red Cedar	45.5814135	-91.5909403	9.8		
90	Red Cedar	45.5815958	-91.5909358	10.8	0.7	1
91	Red Cedar	45.5817781	-91.5909312	11.8		
92	Red Cedar	45.5803155	-91.5906299	7.9		
93	Red Cedar	45.5804978	-91.5906254	7.9		
94	Red Cedar	45.5806801	-91.5906208	8.2		
95	Red Cedar	45.5808624	-91.5906162	8.5		
96	Red Cedar	45.5810447	-91.5906117	9.2		
97	Red Cedar	45.5812271	-91.5906071	9.5		
98	Red Cedar	45.5801291	-91.5902967	7.9		
99	Red Cedar	45.5803114	-91.5902922	7.9		
100	Red Cedar	45.5804937	-91.5902876	8.5		
101	Red Cedar	45.5806760	-91.5902830	9.2		
102	Red Cedar	45.5808583	-91.5902785	10.2		

<b>Point ID</b>	<b>Lake</b>	<b>Lat</b>	<b>Long</b>	<b>Water Depth (ft)</b>	<b>CLP Plant Height (ft)</b>	<b>CLP Density (rake, 1-3)</b>
103	Red Cedar	45.5801249	-91.5899589	8.2		
104	Red Cedar	45.5803072	-91.5899544	9.2		
105	Red Cedar	45.5804895	-91.5899498	9.2		
106	Red Cedar	45.5806718	-91.5899453	10.8		
107	Red Cedar	45.5801207	-91.5896212	8.5		
108	Red Cedar	45.5803030	-91.5896166	9.2		
109	Red Cedar	45.5804853	-91.5896120	9.8		
110	Red Cedar	45.5806676	-91.5896075	11.2		
111	Red Cedar	45.5801166	-91.5892834	7.5		
112	Red Cedar	45.5802989	-91.5892788	8.5		
113	Red Cedar	45.5804812	-91.5892743	9.8		
114	Red Cedar	45.5806635	-91.5892697	11.2		
115	Red Cedar	45.5802947	-91.5889411	7.5		
116	Red Cedar	45.5804770	-91.5889365	9.8		
117	Red Cedar	45.5806593	-91.5889319	11.5		
118	Red Cedar	45.5804728	-91.5885987	8.9		
119	Red Cedar	45.5806551	-91.5885941	11.5		
120	Red Cedar	45.5802863	-91.5882655	7.9		
121	Red Cedar	45.5804686	-91.5882609	9.8		
122	Red Cedar	45.5806509	-91.5882564	12.5		
123	Red Cedar	45.5802822	-91.5879277	8.9		
124	Red Cedar	45.5804645	-91.5879232	9.2	0.3	1
125	Red Cedar	45.5806468	-91.5879186	12.5		
126	Red Cedar	45.5808291	-91.5879140	13.8		
127	Red Cedar	45.5810114	-91.5879095	14.4		
128	Red Cedar	45.5811937	-91.5879049	15.1		
129	Red Cedar	45.5802780	-91.5875900	8.5		
130	Red Cedar	45.5804603	-91.5875854	9.2		
131	Red Cedar	45.5806426	-91.5875808	9.8		
132	Red Cedar	45.5808249	-91.5875762	10.2		
133	Red Cedar	45.5810072	-91.5875717	10.2		
134	Red Cedar	45.5811895	-91.5875671	8.9		
135	Red Cedar	45.5813718	-91.5875625	15.1		
136	Red Cedar	45.5806384	-91.5872430	9.2		
137	Red Cedar	45.5808207	-91.5872385	9.5		
138	Red Cedar	45.5810030	-91.5872339	8.2		
139	Red Cedar	45.5811853	-91.5872293	8.2		
140	Red Cedar	45.5813676	-91.5872248	10.5		