# Deer Lake CLP Treatment Report-2009

## Introduction

In May 2009 *Potamogeton crispus* (curly-leaf pondweed akaCLP) was treated in three plots for the 4th consecutive year. This report will evaluate the effectiveness of this treatment. The plots treated are mapped in Figure 1. All of these treatment sites involved an early season treatment in order to better target the AIS plant curly-leaf pondweed . All three plots were remapped in June 2008 with areas remaining relatively the same. Plot 2 was reduced near shore as no CLP was present in the re-mapping survey during June 2008.

In past year analysis, percent coverage was evaluated. This data collection was eliminated this year as the data was very subjective and very difficult to collect due to water clarity variability as well as estimation difficulties.

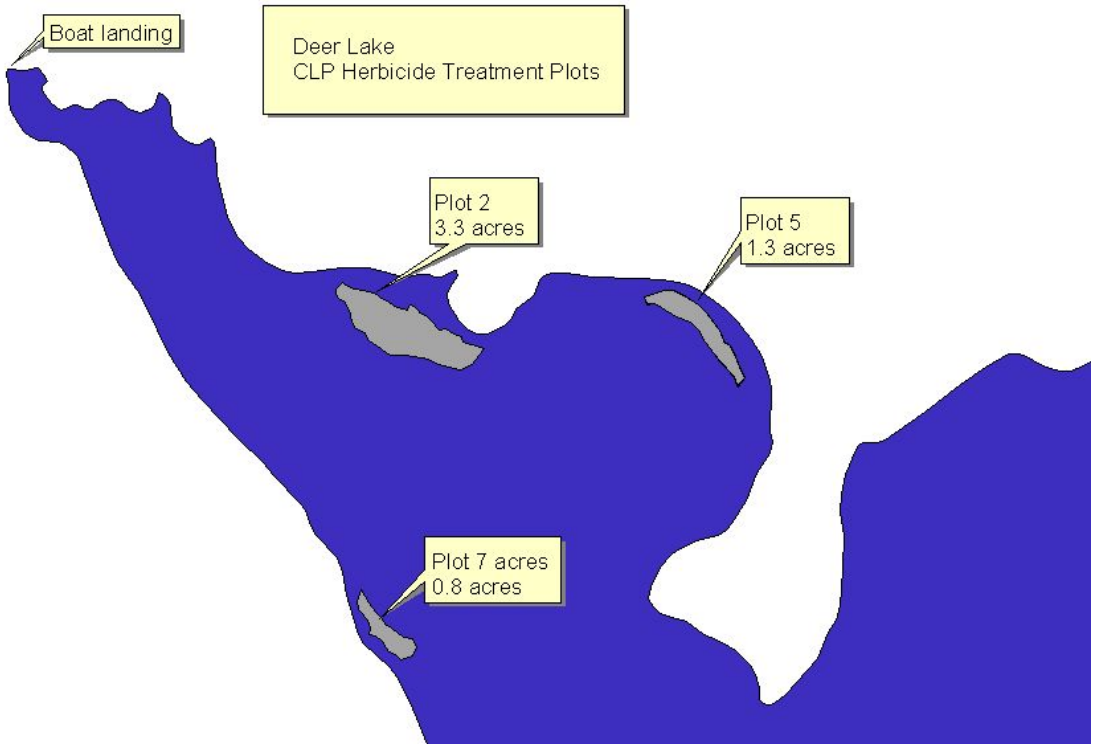



***Figure 1: CLP treatment beds on Deer Lake***

Table 1 summarizes the treatment. This involved the application of endothall in late May with water temperature at XX.

| | |
|---|---|
| Date and time of appication | May 21 |
| Water temperature at application | XXXX |
| Wind speed during application | 18 MPH |
| Herbicide | Endothall |

***Table 1: Summary of treatment conditions.***

**Pre-treatment survey**

A pre-treatment survey was conducted on April 28, 2009. The purpose of a pre-treatment survey is to verify that the AIS target species is indeed present. Any necessary adjustments to the treatment polygons are also done at this time. Figure 2 shows the sample points of each plot, with a presence absence point. White indicates no CLP present and black indicates presence.


***Figure 2: Pre-treatment presence/absence map.***

As can be observed, the all sample points in plots 5 and 7 had CLP present. In plot 2, only two of 34 sample points lacked CLP. Both of these points were on the polygon border and due to such a low number and in opposite borders, no adjustments were made.

To compare pre-treatment early spring density, a statistical analysis of density rating can be conducted. Caution must be used when using early spring density ratings as the plant growth can range quite extensively from year to year. Table 1 shows a density comparison between the first year 2006 and 2008, 2009. The t-test results are also used to statistically compare the early spring density.

| **Plot** | **2006** | **2008** | **2009** |
|---|---|---|---|
| 2 mean density | 4.3 | 2.5 | 4.0 |
| 5 mean density | 5.0 | 3.0 | 3.6 |
| 7 mean density | 4.0 | 1.4 | 3.2 |

***Table 2: Pre-treatment survey mean density by plot.***

| Plot | 2006-2009 P value | Significance | 2008-2009 p Value | Significance |
|---|---|---|---|---|
| 2 | 0.09 | Not significant | 0.02 | Significant (increase) |
| 5 | No change | Not significant | 0.28 | Not significant |
| 7 | 0.13 | Not significant | 0.02 | Significant (increase) |

***Table 3: Pre-treatment survey ttest analysis results.***

**Post-treatment survey**

A post-season treatment survey was conducted on June 24th, approximately 4 weeks after treatment. This was prior to senescence of the CLP and gave the herbicide time to have an effect on the CLP. A rake sample was taken in four directions at the sample point. The CLP was given a density rating of 0-5 and each native was also identified, given a density rating of 0-3. Table 2 summarizes the CLP density of each plot from the June 24th survey.

| Plot | Mean Density 2006 | Mean Density 2008 | Mean Density 2009 |
|---|---|---|---|
| 2 | 3.2 | 3.75 | 3.5 |
| 5 | 3.2 | 3.6 | 4.6 |
| 7 | 3.1 | 3.2 | 2.8 |
| All plots | 3.14 | 3.56 | 3.61 |

***Table 4: Comparison of mean density at each plot 2006, 2008 and 2009(only points that correspond).***

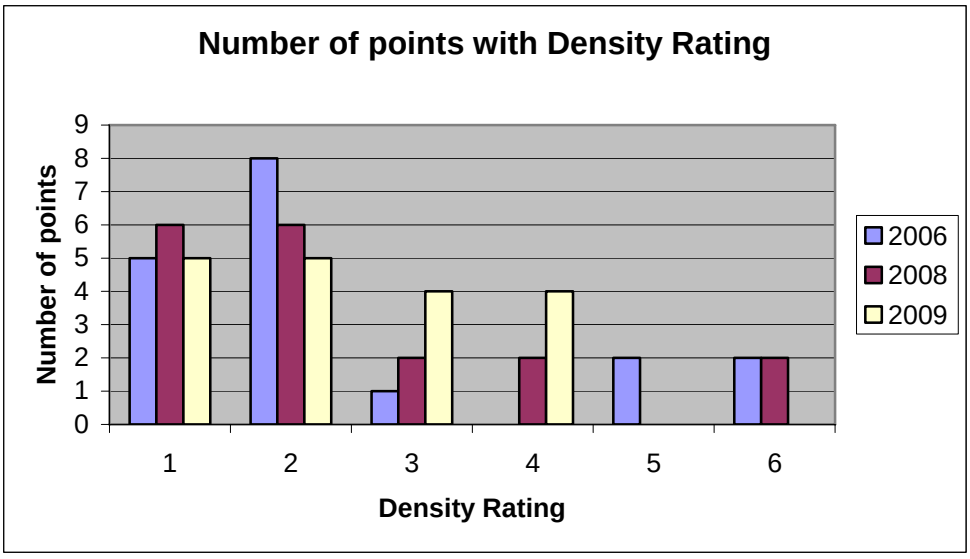



*Figure 3: Graph comparing density ratings by number of sample points 2008-2009.*

During the previous treatment surveys fewer point were evaluated. This year in response to changes in DNR protocol, more sample points were added. The previous years' sample points were retained, with more points simply added to the existing ones. For comparison puposes, only those points that coorrespond are used. However, the added points will be retained for future comparisons.

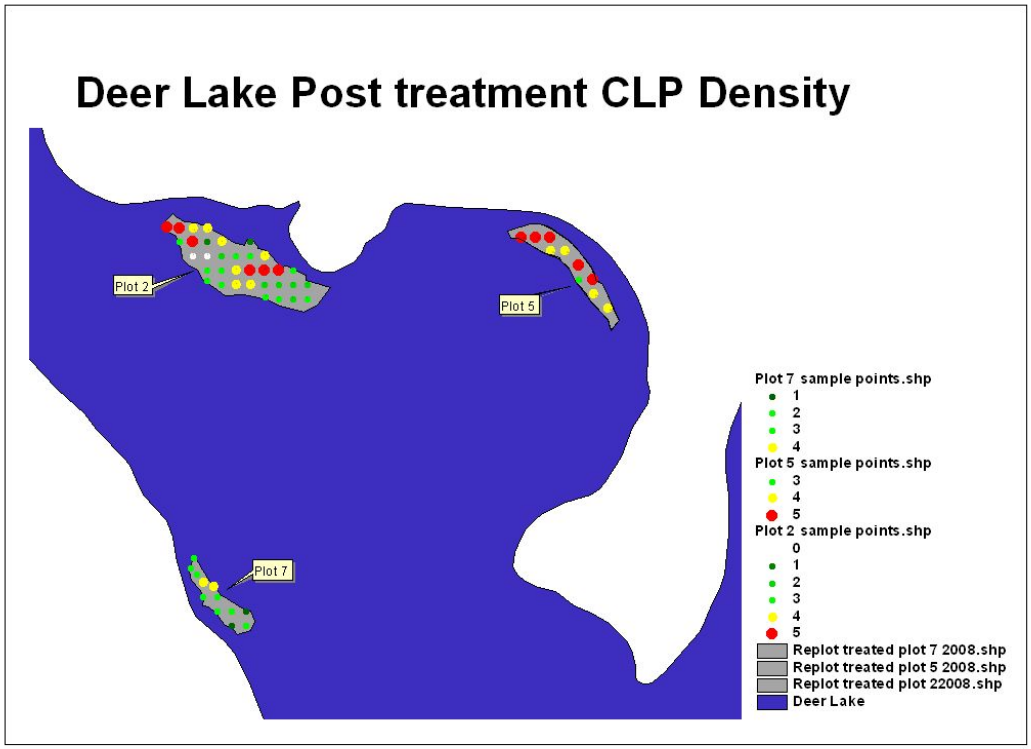



*Figure 4: Post-treatment survey map of densities at each sample point.2009.*

In order to determine if the changes (or lack of) are significant, a statistical analysis of the data is necessary. A t-test will evaluate if the two density data sets (CLP in 08 and CLP in 09) are significantly different. If $P<0.05$, it indicates that the CLP density for 2009 is less than the CLP 2008 in significant amounts and is largely due to the treatment and not chance alone. The comparison is to 2008 and not previous years because the plots were remapped in 2008 based upon density (even though the plots changed little from previous years). Table 3 summarizes the statistical analysis.

| Plot | P value | Significance |
|---|---|---|
| 2 | 0.35 | Not significant |
| 5 | 0.16 | Not significant |
| 7 | 0.34 | Not significant |

***Table 3: t-test results of CLP density changes 2008 to 2009 by plot.***

| Plot | P value | Significance |
|---|---|---|
| 2 | 0.5 | Not significant |
| 5 | 0.15 | Not significant |
| 7 | 0.27 | Not significant |

***Table 4: t-test results of CLP density changes 2006 to 2009 by plot***

*Note*
*Null: No difference in density between the two years compared.*
*P<0.05 can reject null and makes year one < year two significant.*

In addition to analysis of CLP changes, the native plants must be evaluated to determine if the native plants are being adversely affected by the treatement. A chi-square analysis was conducted on the native plant population in all three plots to determine if the native population was adversely affected. Again the comparison was between data in 2008 and 2009.

| Native species | 2008 | 2009 | p value | Significance | Change |
|---|---|---|---|---|---|
| CLP | 16 | 16 | 1.00 | no | No change |
| Stargrass | 1 | 6 | 0.04 | yes | + |
| Forked duckweed | 5 | 9 | 0.17 | no | + |
| Robbin's pondweed | 3 | 0 | 0.07 | no | - |
| Large-leaf pondweed | 5 | 3 | 0.42 | no | - |
| White-stem pondweed | 13 | 13 | 1.00 | no | no change |
| Coontail | 5 | 3 | 0.428 | no | - |
| Northern milfoil | 10 | 8 | 0.50 | no | - |
| Clasping pondweed | 14 | 5 | 0.003 | yes | - |
| Wild celery | 3 | 2 | 0.63 | no | - |
| Filamentous algae | 18 | 17 | 0.31 | no | - |
| Elodea | 0 | 1 | 0.31 | no | + |

***Table 5: chi-square analysis of all plots combined. Emphasis on native plants.***

It does not appear that the treatment had any adverse effect on the native plants. The chi-square analysis shows only two significant changes. One is the positive change (increase in samples points with plant presence) with stargrass (*Heteranthera dubia*). The other is a negative change (reduced sample point presence) with clasping pondweed (*Potamogeton richardsonii*). This may be due to sample point location error or simply a scattered population of clasping pondweed. There is no evidence to suggest it is from herbicide damage as other natives had no significant change.
Also note that the chi-square showed no significant change in the CLP samples.

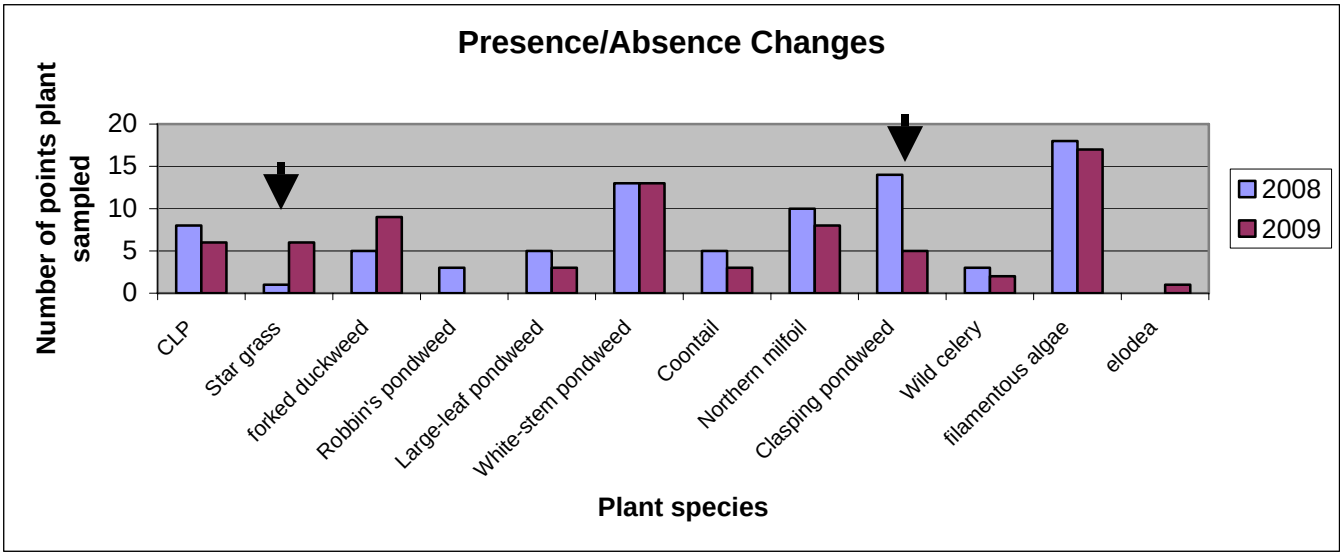



***Figure 5: Number of points plants sampled 2008 and 2009 for native species comparison. Arrows indicate significant change.***

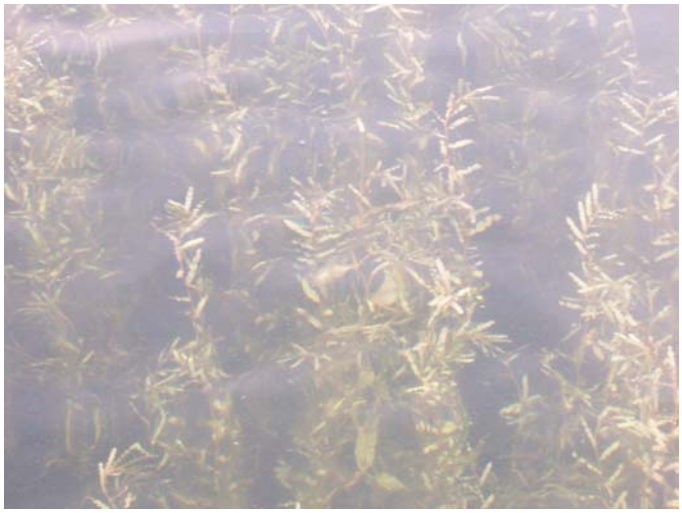
**Summary**

Upon review of the data, it appears that the CLP herbicide treatment was not effective. The density data comparing 2006 and 2008 to 2009 indicates that the difference is insignificant, with actually and increase in CLP density and number of points with CLP present. In the pre-treatment comparison, the statistical analysis indicates a density increase from 2008 to 2009 in plots 2 and 7. In last years analysis, there was no significant change between CLP density in these two plots in the post-treatment analysis. Therefore, this density change may indicate turion germination from previous year's turion production. As stated earlier, early spring density can vary quite a large amount from seasonal variation and must be used with caution.

**Plot 2**

**Plot2**

**Plot 5**



**Plot 7**

***Figure 6: Pictures demonstrating the near surface growth observed during post treatment survey-2009***

When conducting the post treatment analysis, it was observed that the CLP was very dense and with much of the polygon's area (in all three) there were significant portions with the CLP reaching the surface or very near the surface. The data analysis supports this observation indicating that no significant changes in CLP coverage or density occurred.

| 2009 | Pre treat mean density | Post-treat mean density | P Value |
|---|---|---|---|
| Plot 2 | 4.00 | 3.50 | 0.24 (not significant) |
| Plot 3 | 3.60 | 4.60 | 0.003 (increase) |
| Plot 4 | 3.20 | 2.80 | 0.10 (not significant |

***Table 6: Comparion of 2009 pre and post treatment density and ttest results.***

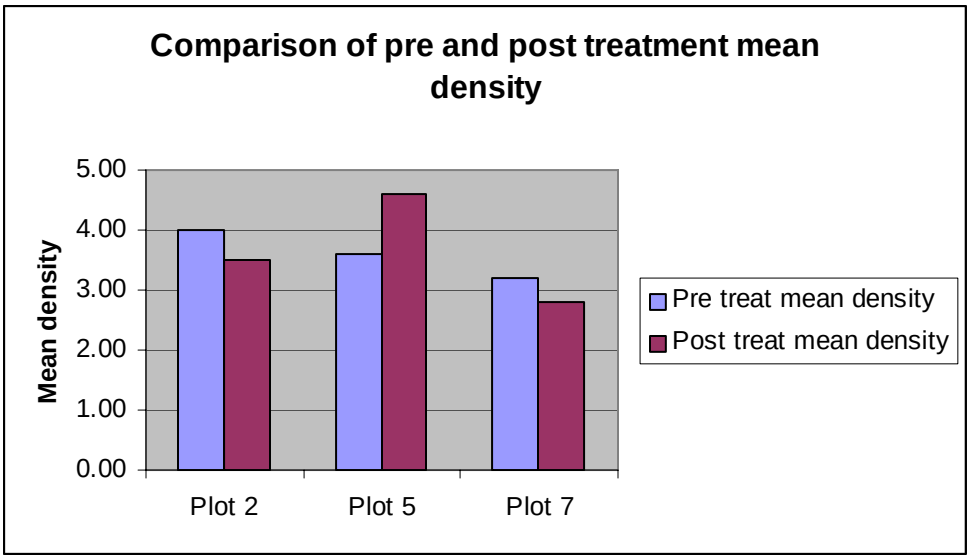



***Figure 7: Graph comparing 2009 pre and post treatment mean density.***

One potential indication of slight effectiveness of treatment for 2009 is comparing the pre-treatment density to the post-treatment mean density in 2009. Because the plants are smaller, density ratings tend to be less than 5 and 0-4 indicate number of samples containing CLP at each sample point. As a result, if the post-treatment density is smaller than the pre-treatment density, it may indicate impact on the CLP bed by breaking it up, causing for less samples at a particular point containing CLP. Although the statistical analysis of comparing pre to post treatment isn't significant (except for plot 5 which indicates an increase as expected), there does appear to be a slight density decrease in plot 2 and plot 7. Again, the statistics don't indicate a significant change, but when one considers how the density data is obtained, there must have been some affect from the herbicide.

When comparing 2008 to 2009 in five control points that were not treated, it appears no changes have occurred in the five points that has caused a change in CLP growth. In both years the CLP density at every point was a "5".

In relationship to native plants, the herbicide application seems to have had no negative impact on the native plants. Only two native plants showed significant change, one being positive and one being negative. The negative (reduced) change was with clasping pondweed but there is no indication this is due to the herbicide, since all others were unchanged.

It is apparent that the herbicide treatments over the last four years have been largely ineffective. This concern has been recently raised and more information will be reviewed to determine what changes can be made to make the treatment more effective. The timing, weather conditions, dose rates and maps used by the applicator should be reviewed and adjusted within the Wisconsin DNR guidelines. All of these could have tremendous impact on treatment success.

**Herbicide Summary and Considerations:**

1. Based upon the DNR analysis protocol, the treatment does not appear effective when comparing between 2006 (initial data collection) and 2009. Nor between 2008 (CLP bed remapping effort) and 2009.
2. Based upon comparison of pre treatment 2009 to post treatment 2009, there is some indication of herbicide impact on CLP in Plot 2 and Plot 7 (although not statistically significant).
3. Based upon these results, and previous year's results, herbicide application procedures should be evaluated.

# Appendix-Data Tables

## Pre-treatment Survey Data-CLP (with post-treatment density included for comparison)

### Plot 2

| Sample point | Pre treat density | Post-treat density |
|---|---|---|
| 201 | 4 | 5 |
| 202 | 4 | 4 |
| 203 | 4 | 5 |
| 204 | 3 | 3 |
| 205 | 0 | 4 |
| 206 | 4 | 1 |
| 207 | 4 | 2 |
| 208 | 4 | 5 |
| 209 | 4 | 4 |
| 210 | 4 | 2 |
| 211 | 4 | 4 |
| 212 | 3 | 3 |
| 213 | 4 | 3 |
| 214 | 4 | 4 |
| 215 | 4 | 4 |
| 216 | 4 | 5 |
| 217 | 4 | 3 |
| 218 | 4 | 5 |
| 219 | 4 | 4 |
| 220 | 4 | 4 |
| 221 | 4 | 5 |
| 222 | 4 | 2 |
| 223 | 4 | 5 |
| 224 | 4 | 2 |
| 225 | 3 | 3 |
| 226 | 4 | 3 |
| 227 | 4 | 2 |
| 228 | 4 | 2 |
| 229 | 3 | 2 |
| 230 | 4 | 3 |
| 231 | 2 | 3 |
| 232 | 2 | 5 |
| 233 | 4 | 3 |
| 234 | 3 | 3 |

## Plot 5

| | Pre treat density | Post treat density |
|---|---|---|
| 501 | 4 | 5 |
| 502 | 4 | 5 |
| 503 | 4 | 5 |
| 504 | 2 | 4 |
| 505 | 4 | 4 |
| 506 | 4 | 5 |
| 507 | 3 | 3 |
| 508 | 4 | 5 |
| 509 | 3 | 4 |
| 510 | 4 | 4 |

## Plot 7

| | Pre treat density | Post treat density |
|---|---|---|
| 701 | 4 | 4 |
| 702 | 1 | 2 |
| 703 | 3 | 3 |
| 704 | 4 | 2 |
| 705 | 4 | 3 |
| 706 | 4 | 1 |
| 707 | 2 | 1 |
| 708 | 4 | 2 |
| 709 | 4 | 2 |
| 710 | 1 | 3 |
| 711 | 4 | 2 |
| 712 | 2 | 4 |

## No treat points

| Point | Pre treat density | Post treat density |
|---|---|---|
| No Treat 1 | 4 | 5 |
| No Treat 2 | 4 | 5 |
| No Treat 3 | 4 | 5 |
| No Treat 4 | 4 | 5 |
| No Treat 5 | 4 | 5 |

**Post treatment Turion data: Fraction of sample points with plant turions present:**

| Turions | 2006 | 2008 | 2009 |
|---|---|---|---|
| Plot 2 | 1.00 | 0.63 | 0.13 |
| Plot 5 | 1.00 | 1.00 | 0.80 |
| Plot 7 | 1.00 | 1.00 | 0.40 |

## Post-treatment Survey Data 2009

| Sample point | CLP post | *Lemna* | *Triscula* | *Elodea canadensis* | *Filamentous algae* | *P. amplifolius* | *Myriophyllum sibiricum* | *P. Praelongus* | *H. dubia* | *P. richardsonii* | *C. demersum* | *V. americana* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 201 | 5 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 202 | 4 | 1 | 0 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 203 | 5 | 1 | 0 | 2 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| 204 | 0 | 1 | 0 | 2 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 205 | 4 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| 206 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| 207 | 0 | 1 | 0 | 2 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| 208 | 5 | 1 | 0 | 3 | 0 | 1 | 1 | 0 | 1 | 0 | 0 |
| 209 | 4 | 1 | 0 | 2 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 210 | 2 | 1 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 211 | 4 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 |
| 212 | 3 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 0 |
| 213 | 3 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 214 | 4 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 0 |
| 215 | 4 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 216 | 5 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 217 | 3 | 0 | 0 | 2 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| 218 | 5 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| 219 | 4 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 |
| 220 | 4 | 1 | 1 | 2 | 0 | 1 | 0 | 0 | 1 | 0 | 0 |
| 221 | 5 | 0 | 0 | 1 v | | 0 | 0 | 0 | 0 | 0 | 0 |
| 222 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 |
| 223 | 5 | 0 | 0 | 1 | 0 | 0 v | | 0 | 0 | 1 | 0 |
| 224 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 225 | 3 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| 226 | 3 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 0 | 0 | 1 |
| 227 | 2 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| 228 | 2 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Sample point | CLP post | *Lemna Triscula* | *Elodea canadensis* | *Filamentous algae* | *P. amplifolius* | *Myriophyllum sibiricum* | *P. Praelongus* | *H. dubia* | *P. richardsonii* | *C. demersum* | *V. americana* |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 229 | 2 | 1 | 0 | 1 v | | 3 | 0 | 0 | 0 | 0 | 0 |
| 230 | 3 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| 231 | 3 | 1 | 0 | 2 | 0 | 3 | 0 | 0 | 2 | 0 | 0 |
| 232 | 5 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 233 | 3 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| 234 | 3 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| 501 | 5 | 1 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 |
| 502 | 5 | 0 | 0 | 1 | 0 v | | 1 | 0 | 0 | 0 | 0 |
| 503 | 5 | 0 | 0 | 1 | 0 v | | 1 | 0 | 1 | 0 | 0 |
| 504 | 4 | 0 | 0 | 1 | 0 | 2 | 1 | 0 | 0 | 1 | 0 |
| 505 | 4 | 0 | 0 | 2 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 506 | 5 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 507 | 3 | 1 | 0 | 1 | 0 | 2 | 1 | 1 | 0 | 0 | 0 |
| 508 | 5 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| 509 | 4 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 | 0 | 0 |
| 510 | 4 | 0 | 0 | 1 | 0 v | | 0 | 1 | 2 | 1 | 0 |
| 701 | 4 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 |
| 702 | 2 | 1 | 0 | 2 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |
| 703 | 3 | 0 | 0 | 2 | 0 | 0 | 2 | 1 | 0 | 0 | 0 |
| 704 | 2 | 0 | 0 | 3 | 0 | 0 | 1 | 1 | 1 | 0 | 1 |
| 705 | 3 | 1 | 0 | 2 | 0 | 0 | 0 | 1 | 0 | 1 | 0 |
| 706 | 1 | 1 | 0 | 2 | 1 | 1 | 0 v | | 1 | 0 | 1 |
| 707 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 2 | 1 |
| 708 | 2 | 1 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 |
| 709 | 2 | 0 | 0 | 1 | 0 | 2 | 0 | 0 | 1 | 1 | 0 |
| 710 | 3 | 0 | 0 | 2 | 0 | 1 | 0 | 1 | 1 | 0 | 0 |
| 711 | 2 | 0 | 0 | 2 | 0 | 1 | 0 | 1 v | | 0 | 0 |
| 712 | 4 | 0 | 0 | 1 | 0 | 2 | 2 | 1 | 0 | 0 | 0 |
| **Freq of occurrence** | **0.96** | **0.50** | **0.125** | **0.93** | **0.125** | **0.57** | **0.43** | **0.30** | **0.41** | **0.16** | **0.09** |

| Sample point | CLP post | *Lemna* | *Triscula* | *Elodea canadensis* | *Filamentous algae* | *P. amplifolius* | *Myriophyllum sibiricum* | *P. Praelongus* | *H. dubia* | *P. richardsonii* | *C. demersum* | *V. americana* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **No Treat 1** | **5** | **0** | **0** | **4** | **0** | **0** | **0** | **2** | **2** | **0** |
| **No Treat 2** | **5** | **0** | **0** | **4** | **0** | **0** | **1** | **2** | **1** | **0** |
| **No Treat 3** | **5** | **0** | **0** | **4** | **0** | **0** | **0** | **1** | **0** | **0** |
| **No Treat 4** | **5** | **0** | **0** | **4** | **3** | **0** | **2** | **2** | **1** | **0** |
| **No Treat 5** | **5** | **0** | **0** | **4** | **2** | **0** | **0** | **0** | **0** | **0** |

## References

Schieffer, Steve. *2008 Deer Lake Pre/Post Curly Leaf Pondweed (CLP)Treatment Summary.* 2008

Brad Morris. *Aquatic Plant/AIS Management Protocols and Reports.* (Microsoft Powerpoint Presentation). Burnett County AIS. 2009

Wisconsin Department of Natural Resources Treatment Monitoring Survey Protocol. April 2008