

**Curly-leaf Pondweed P/I and Bed Mapping Surveys  
Apple River Flowage -WBIC: 2624200  
Polk County, Wisconsin  
May 16-18, and June 6, 8, 2011**



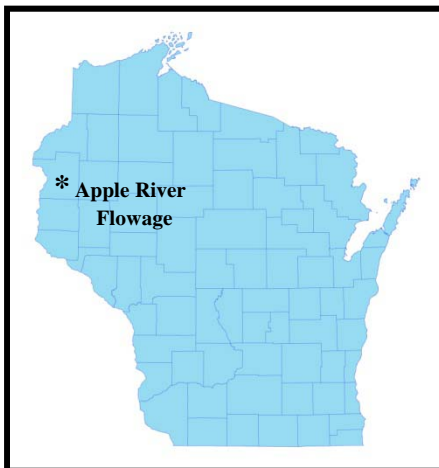
Typical Canopied CLP Bed on the Apple River Flowage (Berg, 2011)



Aerial Photo of the Apple River Flowage

**Project Initiated by:**

Apple River Flowage Protection and Rehabilitation District,  
Wisconsin Department of Natural Resources, and the  
Polk County Land and Water Conservation Department



River Channel Through CLP Looking Towards the Dam (Berg, 2011)

**Survey Conducted by and Report Prepared by:**

Endangered Resource Services, LLC  
Matthew S. Berg, Research Biologist  
572 North Day Road  
St. Croix Falls, Wisconsin 54024

# TABLE OF CONTENTS

	Page #
LIST OF FIGURES AND TABLES.....	ii
INTRODUCTION .....	1
METHODS .....	2
RESULTS AND DISCUSSION.....	3
Curly-leaf pondweed Density Survey.....	3
CLP Bed Mapping Survey.....	5
Description of Beds and High Density Areas with CLP.....	7
LITERATURE CITED.....	11
APPENDIX.....	12
I: Apple River Flowage Map with Survey Sample Points.....	12
II: Vegetative Survey Data Sheet.....	14
III: Apple River Flowage CLP Distribution and Density.....	16
IV: Apple River Flowage CLP Bed Maps.....	18

**LIST OF FIGURES AND TABLES**

Page #

Figure 1: Aerial Photo of the Apple River Flowage..... 1

Figure 2: Rake Fullness Ratings ..... 2

Figure 3: Apple River Flowage CLP Distribution and Density.... 4

Table 1: CLP Bed Summary Apple River Flowage, Polk Co. June 6, 8, 2011..... 5

Table 2: High Density CLP Areas Summary Apple River Flowage,  
Polk Co. June 6, 8, 2011..... 5

Figure 4: CLP Bed and High CLP Density Areas Map..... 6

Figure 5: City of Amery – CLP Beds 1-2..... 7

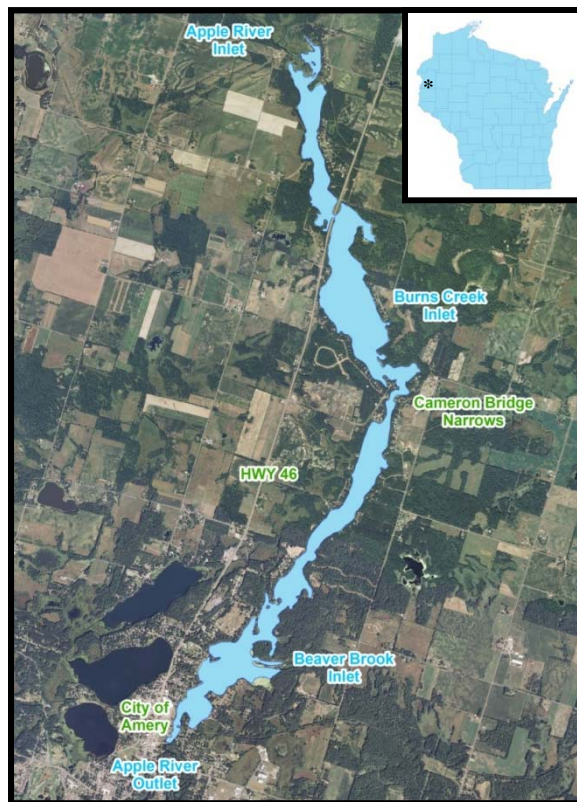
Figure 6: The Narrows – CLP Beds 3-8..... 8

Figure 7: The “Lake” South of the HWY 46 Bridge – CLP Beds 9-12..... 9

Figure 8: The River Inlet North of the HWY 46 Bridge – CLP Bed 13..... 10

## INTRODUCTION:

The Apple River Flowage (WBIC 2624200) is located in central Polk County, Wisconsin in the Towns of Lincoln and Apple River as well as the City of Amery (T33N R18W S33 NE NW). The 639-acre waterbody is created by an 8ft high dam near Central Avenue in Amery (Figure 1). The Wisconsin Department of Natural Resources' (WDNR) lakes data website reported a maximum depth of 18ft in the main "lake" area of the flowage just downstream of the HWY 46 Bridge. The flowage has an overall average depth of approximately 6ft. The bottom is predominately thick organic muck with the exception of a few sandy areas on exposed points and the original river channel which remains scoured rock. Water clarity is very poor with summer Secchi values averaging 3.5ft in 2010. This reading extends a steady decline from summer averages in the 6.5-7.5ft range during the late 90's and early 2000's and indicates the flowage is eutrophic trending towards hypereutrophic (WDNR 2010).



**Figure 1: Aerial Photo of the Apple River Flowage**

The shallow, nutrient rich waters of the flowage promote abundant plant growth. Curly-leaf pondweed (*Potamogeton crispus*), an exotic invasive species, dominates the flowage in early summer before being replaced by dense mats of Coontail (*Ceratophyllum demersum*) later in the growing season. In the past, this dense plant growth has lead the Apple River Flowage Protection and Rehabilitation District (ARFPRD) to sanction mechanical and chemical control of macrophytes to allow individual land owners to access the main body of water as well as to open navigation channels throughout the flowage. However, in 2010, the ARFPRD was denied a chemical treatment permit because they had not completed an Aquatic Plant Management Plan (APMP). The




development of an APMP is now required by the WDNR prior to any active plant management to guarantee that all stakeholders in the flowage have a say in developing the plan and to ensure transparency before, during, and after any agreed upon management. Because the first step in developing a plan is to understand plant species richness, density and distribution throughout the waterbody, the ARFPRD, the Polk County Land and Water Conservation Department (PCLWC) and the WDNR authorized a survey of the flowage’s macrophyte community in the summer of 2010 with follow up CLP density and bed mapping surveys in the spring of 2011.

Using the WDNR statewide guidelines for conducting systematic point intercept macrophyte surveys, we sampled the flowage’s Curly-leaf pondweed on May 16-18, and mapped the flowage’s CLP beds on June 6, 8, 2011. This report represents the summary analysis of the data collected during these surveys, and will be used by Harmony Environmental to help develop an appropriate APMP with and for the ARFPRD as they work to manage their resource moving forward.

**METHODS:**

**Curly-leaf pondweed Density Survey:**

Using a standard formula that takes into account the shoreline shape and distance, islands, water clarity, depth and total acreage, Michelle Nault (WDNR) generated a 672 point sampling grid for the Apple River Flowage (Appendix I). Using this grid, we completed a density survey where we recorded the level of CLP at each point in the flowage’s littoral zone. We located each survey point using a handheld mapping GPS unit (Garmin 76CSx), and used a rake to sample an approximately 2.5ft section of the bottom. CLP was assigned a rake fullness value of 1-3 as an estimation of abundance (Figure 2). We also recorded visual sightings of CLP within six feet of the sample point.

<u>Rating</u>	<u>Coverage</u>	<u>Description</u>
1		A few plants on rake head
2		Rake head is about ½ full Can easily see top of rake head
3		Overflowing Cannot see top of rake head

**Figure 2: Rake Fullness Ratings (UWEX, 2010)**

### **CLP Bed Mapping Survey:**

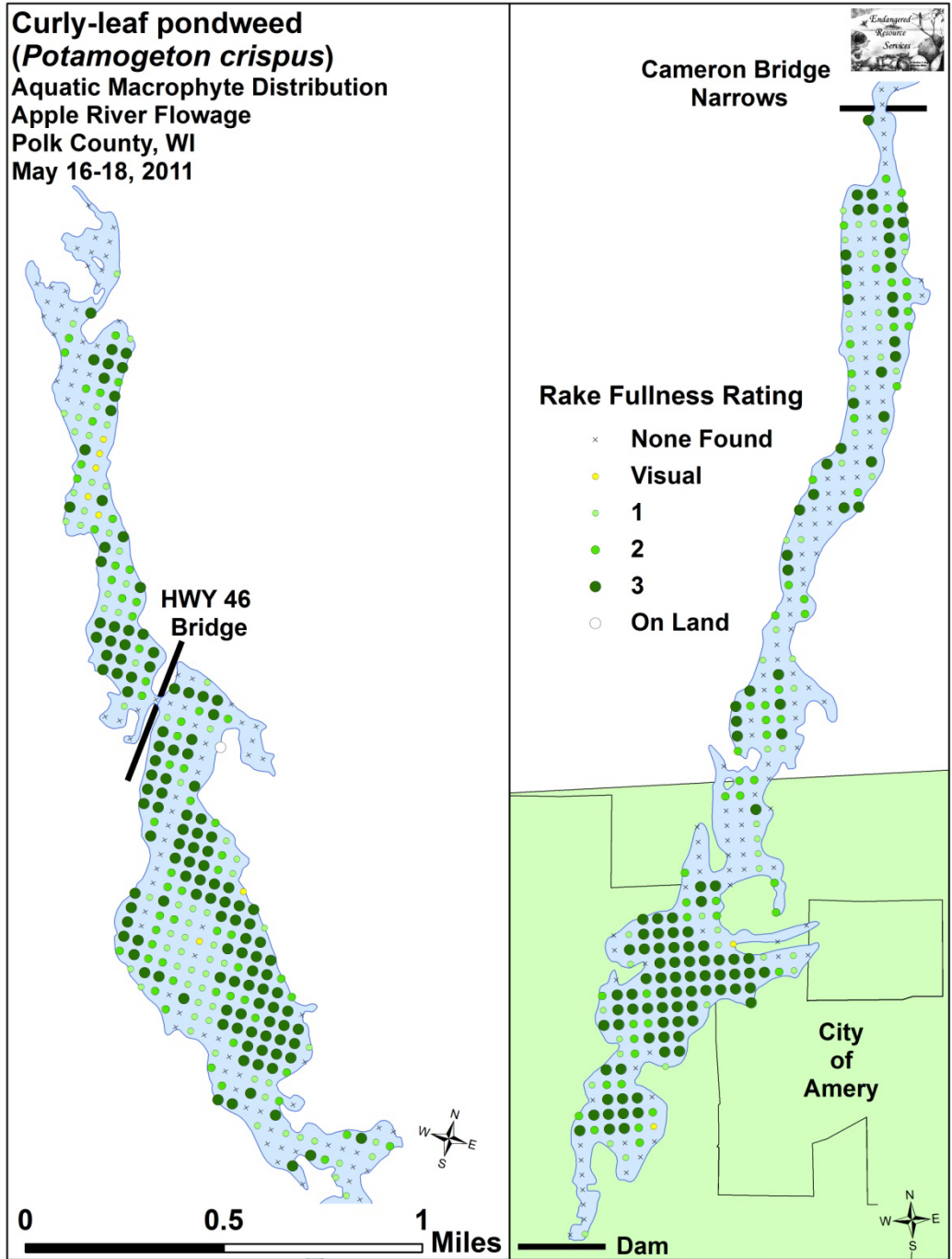
Following the density survey, we used the resulting map coupled with a meandering shoreline survey to locate and map all significant beds of CLP on Apple River Flowage. We defined a bed based on the following two criteria: CLP plants made up greater than 50% of all aquatic plants in the area, and the CLP had canopied at the surface or was close enough to the surface that it would likely interfere with normal boat traffic. Areas that had a high amount of CLP, but were not canopied or were not dense enough to meet the “bed” criteria, were also mapped and identified as “high density CLP areas”. Although not beds in 2011, these areas have the potential to form beds in the future.

Using a GPS unit, we recorded a string of waypoints that circled around the edges of the beds. We then uploaded these points into ArcMap 9.3.1, created bed shapefiles, and determined the total acreage and perimeter of the bed to the nearest hundredth of an acre and meter respectively.

## **RESULTS AND DISCUSSION:**

### **Curly-leaf pondweed Density Survey:**

We surveyed all 671 accessible points as essentially the entire flowage either falls in or is adjacent to the littoral zone (1 point was terrestrial). We found CLP present in the rake sample at 465 locations and it was recorded as a visual at an additional 9 points (Figure 3) (Appendix III). This extrapolated to CLP being present in approximately 69% of the flowage. Of these points, 232 had a rake fullness rating of 3 and another 116 rated a 2 indicating 52% of the flowage had a significant infestation. Although found throughout the littoral zone, CLP achieved its greatest densities in sheltered bays with muck bottoms in water 3-7ft deep. In general, the only place CLP wasn't found was in the deepest parts of the river channel, in water <1ft deep where Coontail filled the entire water column, and in most of the shallow Northern wild rice (*Zizania palustris*) areas surrounding the Apple River Inlet.



**Figure 3: Apple River Flowage CLP Distribution and Density**

### CLP Bed Mapping Survey:

We located and mapped a total of 13 beds on the Apple River Flowage ranging in size from 0.15 acre (Bed 6) to 93.62 acres (Bed 1) (Figure 4) (Appendix IV). All combined, these beds covered a total of 344.65 acres or 54% of the lake's 639 total acres (Table 1). This was similar to the results of the point intercept survey that suggested 52% of the flowage had a significant infestation.

Although many additional areas of the lake had CLP, either it was not invasive to the point of excluding natives (density <50%) or the beds were located well below the surface and thus would not interfere with watercraft. We did, however, map five additional areas totaling 26.51 acres (Table 2) that had significant amounts of CLP. Although CLP was discontinuous in these areas in 2011, we felt that, under different annual growing conditions, these areas had the potential to form canopied beds and thus deserved to be identified.

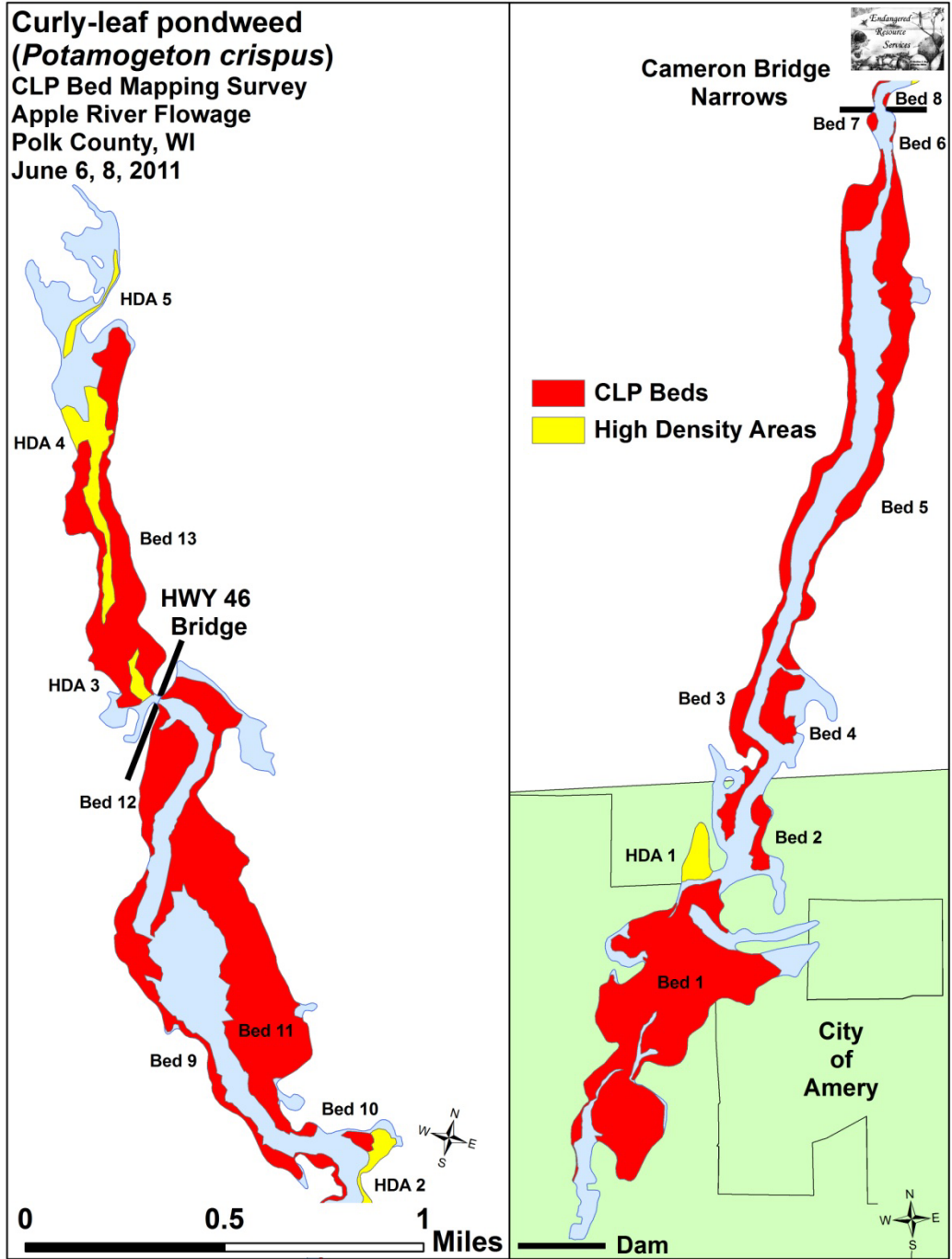
**Table 1: CLP Bed Summary  
Apple River Flowage, Polk Co. June 6, 8, 2011**

<b>Bed Number</b>	<b>Acreage</b>	<b>Perimeter (m)</b>
1	93.62	6,601
2	3.97	775
3	33.14	6,548
4	7.71	933
5	33.9	4,830
6	0.15	189
7	0.60	193
8	0.22	151
9	21.31	4,542
10	1.53	354
11	84.89	5,614
12	16.3	1,557
13	47.31	5,778
<b>Total Acres</b>	344.65	

**Table 2: High Density CLP Areas Summary  
Apple River Flowage, Polk Co. June 6, 8, 2011**

<b>HDA Number</b>	<b>Acreage</b>	<b>Perimeter (m)</b>
1	4.64	620
2	3.62	921
3	2.04	529
4	13.89	2,475
5	2.32	1,053
<b>Total Acres</b>	26.51	





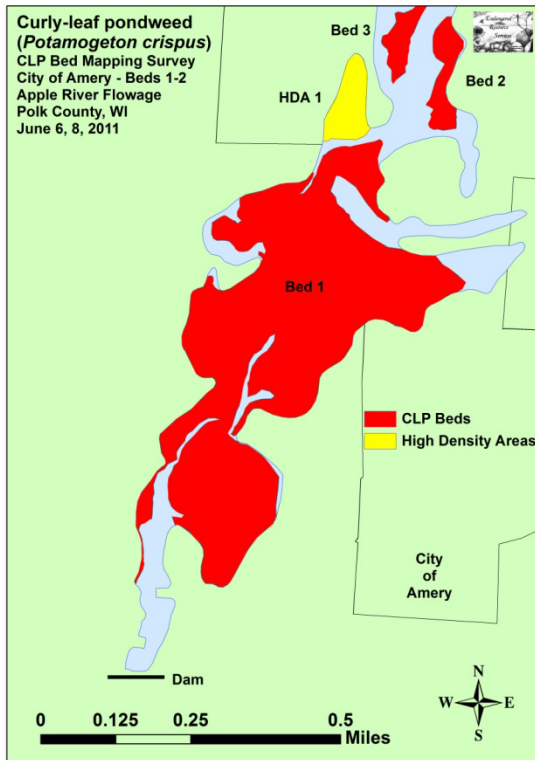
**Figure 4: CLP Bed and High CLP Density Areas Map**

**Description of Beds and High Density Areas with CLP:**

**Bed 1** – The biggest bed on the Flowage, Bed 1 was dense, canopied, nearly monotypic throughout, and a major obstacle to any kind of recreation. The channel allowed travel through the area in May, but, by June, the only trails through were those that had been made by repeated boat travel by locals trying to access the channel. Most people appeared to avoid the area altogether as we observed numerous pontoons and boats turning around once they reached the north end of the bed. The only open water was nearest the dam, in a few deep areas over 8ft, and near the Beaver Brook Inlet where sand bottom areas proved unsuitable for CLP (Figure 5).

**High Density Area 1** – This bay had little CLP during the Point Intercept Survey in May, but many 10m<sup>2</sup> clusters had appeared by June. Although not filled in to form a technical “bed”, CLP was common throughout; especially near the south entrance to the bay. Coontail was especially thick on the north end, and this, coupled with numerous stumps, made navigation of any sort difficult.

**Bed 2** – This area barely qualified as a bed as there were native plants mixed in, and the CLP was only intermittently canopied. Average rake fullness varied widely from 1-3; especially on the west side of the bed. The river channel provided navigation through the area and the shoreline was largely undeveloped likely making this a lower priority for control.



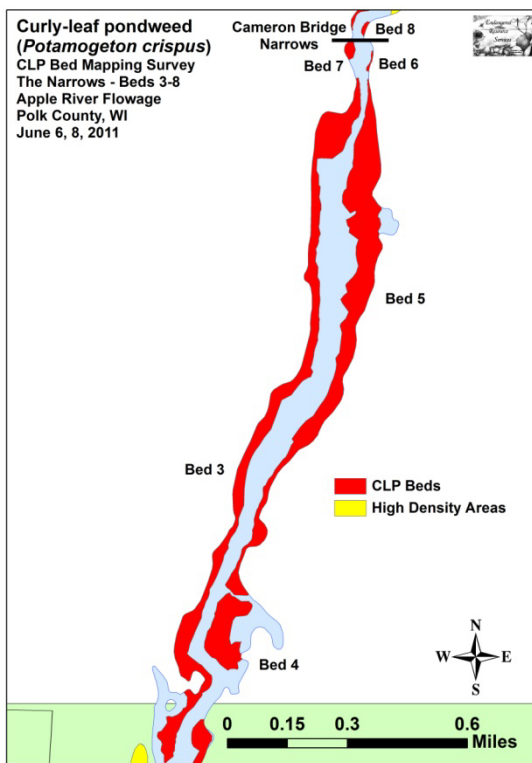
**Figure 5: City of Amery – CLP Beds 1 – 2**

**Bed 3** – Running the entire length of the western shoreline of the Narrows, the bed was dense, monotypic and canopied out to 8ft of water. We noted that, with the exception of Coontail, native plants were almost entirely excluded from the area. The bed was generally <50m wide making it an inconvenience to access the channel, but crossing it could be done after clearing the prop 1-2 times. Notable exceptions to this were the extreme north and south bays where we had a hard time imagining how the float plane based there would be able to escape for takeoff (Figure 6).

**Bed 4** – This bed was also dense, but we found that it had numbers and diversity of native plants mix in on the eastern border where it wrapped around the small stump islands. The shoreline adjacent to this bed is undeveloped and the area is littered with stumps resulting in the bed likely being avoided by most people.

**Bed 5** – Similar to Bed 3, Bed 5 runs the length of the Narrows. Although more fragmented on the south where it mixes with native species, the CLP becomes continuously denser and more monotypic until becoming a solid bed that stretches over 100m from shore in many places on the northern end. Navigation through the area is extremely difficult and repeated motor clearing is required to transect the bed which likely makes it a major inconvenience for the many residences along this shoreline.

**Beds 6 – 8** – These three small beds were located in front of residences just off the channel in the Cameron Bridge area. Although monotypic and dense, the short distance between them and the navigational channel likely made them only a minor inconvenience.



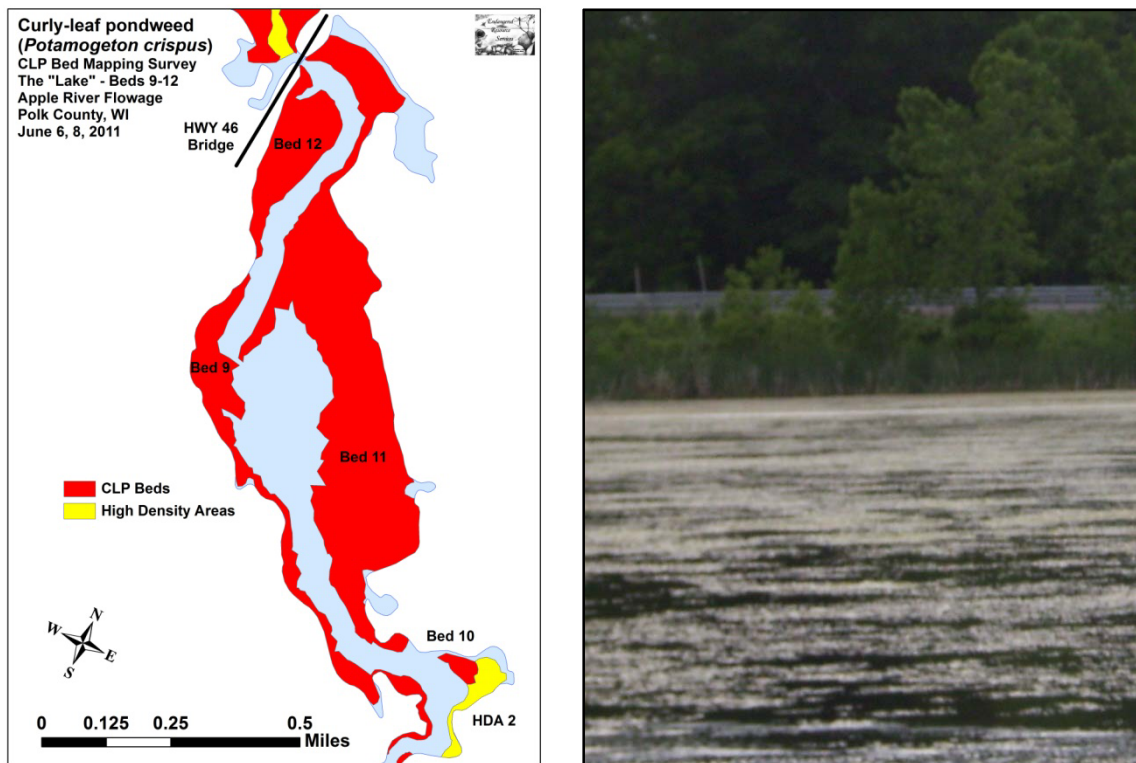
**Figure 6: The Narrows – CLP Beds 3-8**

**Bed 9** – Running along most of the western shoreline before ending on a rocky point, the bed was dense, monotypic and canopied out to 8ft of water on the north end, but became more fragmented and mixed with natives on the southern end where the flowage narrowed north of the Cameron Narrows Bridge. While many areas on the northern end of the bed extended over 125m from shore making access to the channel a significant challenge, on the southern end, the bed was generally <50m wide making it crossable with 1-2 prop clearings. We noted that residences formed a continuous string along this shoreline which likely means this bed is impacting a large number of people (Figure 7).

**Bed 10 and High Density Area 2**– This small bed occurred on the northwest end of the small stump filled bay northeast of the Cameron Bridge Narrows. CLP was canopied, but the bed was fragmented and was downgraded to a high density area as native species became >50% on the south and east ends of the bed. While Coontail constituted the majority of other plants, we also noted numbers of native pondweeds (*Potamogeton* sp.) and Lilypads (*Nuphar variegata* and *Nymphaea odorata*) provided habitat for spawning panfish in this area.

**Bed 11** – Next to Bed 1, this was the biggest and densest bed on the flowage. It dominated the eastern shoreline in the “lake” area and travel through it was impossible without continuously clearing the prop. The stump filled bay areas in the bed would make harvesting a challenge, but these areas are largely uninhabited by people.

**Bed 12** – Although not large in size, Bed 12 was extremely dense and travel through it was also impossible without continuously clearing the motor. CLP was monotypic and canopied from the shoreline to the edge of the channel (Figure 7).

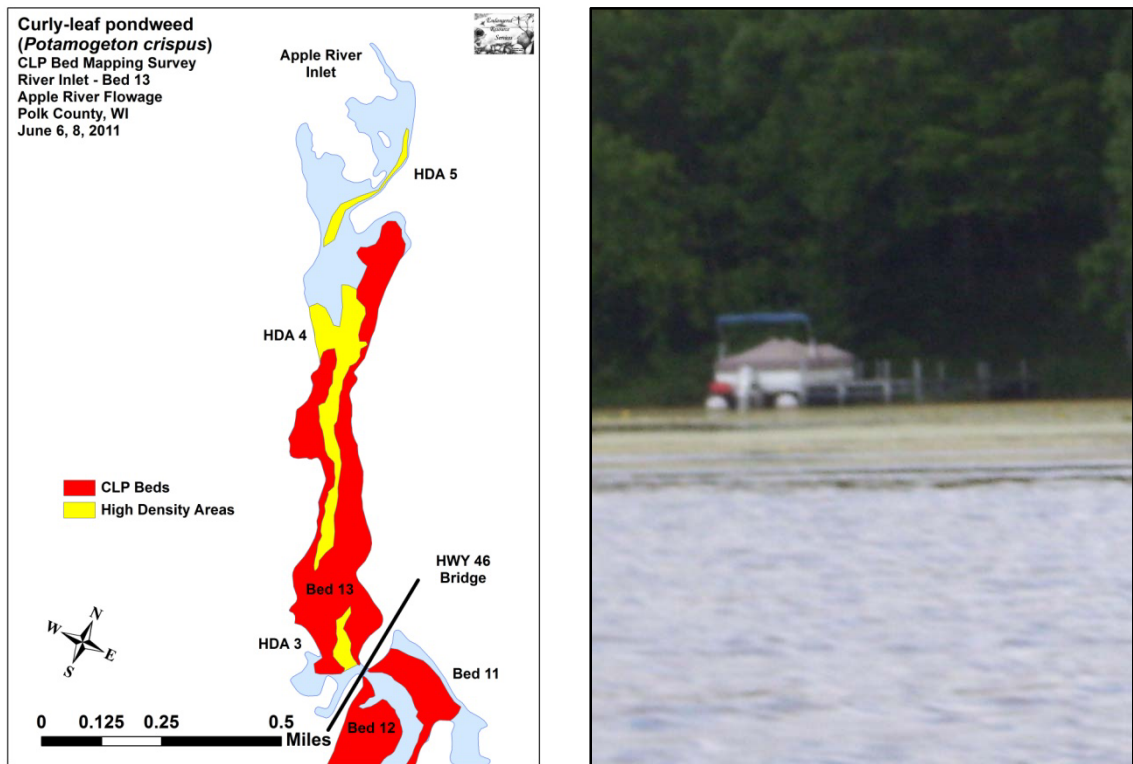


**Figure 7: The “Lake” South of the HWY 46 Bridge – CLP Beds 9-12**

**Bed 13** – CLP dominated the area, and, within the bed, Coontail seemed to be the only other species present. Canopied throughout, residents along the bed likely had a difficult time accessing the narrow channel through the area that was primarily kept open by boat props clipping the CLP (Figure 8).

**High Density Areas 3 and 4**– In these areas, we found that the CLP bed became fragmented, and large numbers of high quality native species like Large-leaf pondweed (*Potamogeton amplifolius*) and White-stem pondweed (*Potamogeton praelongus*) were more common. Although CLP has a strong presence here, navigation is possible without difficulty due to extended areas of open water. Aggressive management in these areas could damage some of the best native plant beds on the flowage.

**High Density Area 5** – In the river inlet, we found CLP scattered in clusters directly along the channel in 1-3ft of water. Northern wild rice was growing directly west of these areas, and, other than canoeists or hunters in johnboats, it is unlikely anyone could or would access this area making management unlikely if not impossible due to a lack of access.



**Figure 8: The River Inlet North of the HWY 46 Bridge – CLP Bed 13**

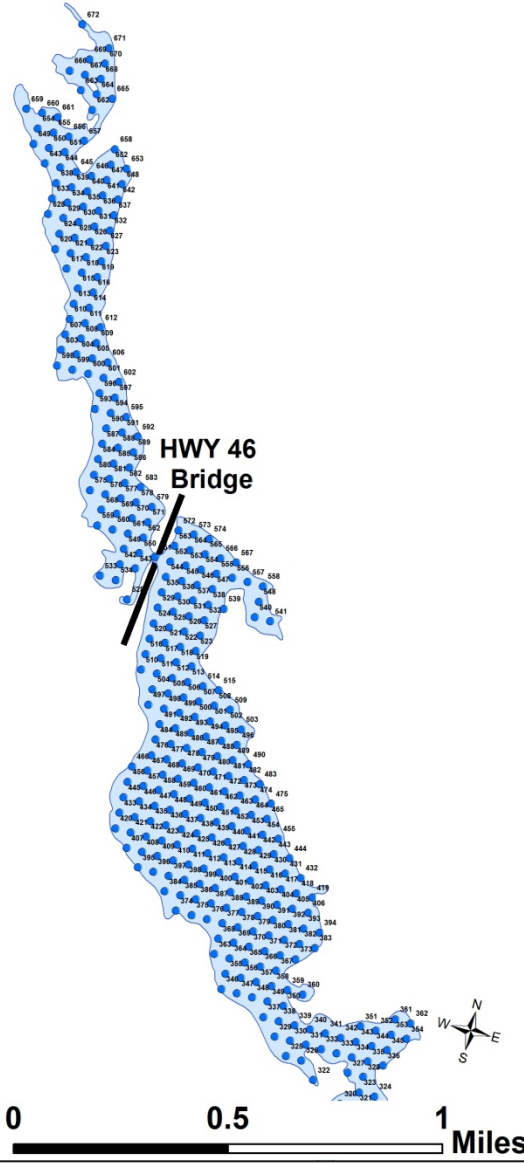
## LITERATURE CITED

UWEX Lakes Program. [online]. 2010. Aquatic Plant Management in Wisconsin. Available from <http://www.uwsp.edu/cnr/uwexlakes/ecology/APMguide.asp> (2010, October).

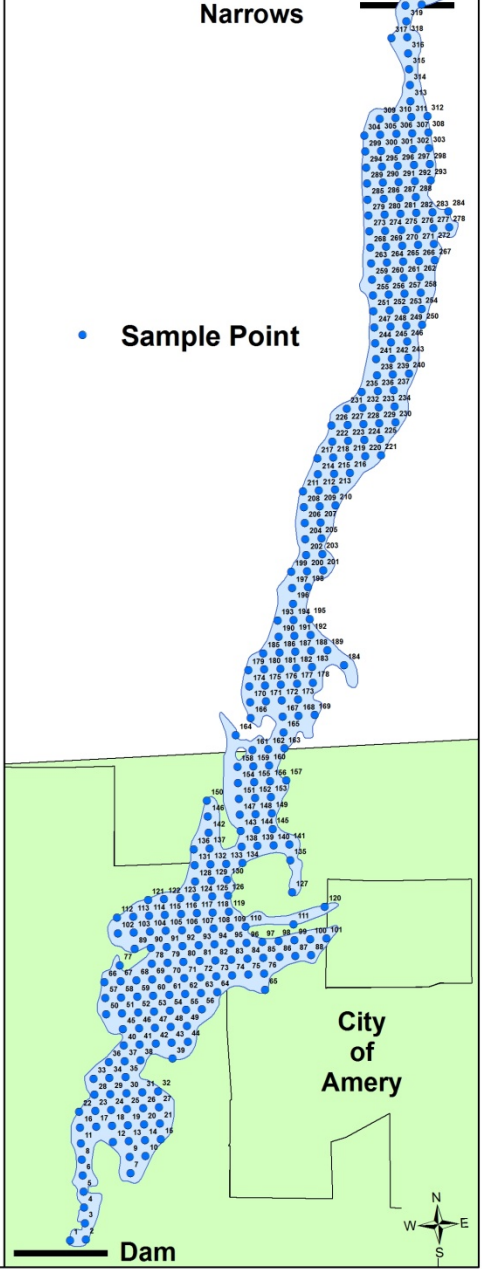
WDNR. [online]. 2010. Citizen Monitoring Lake Water Quality Database. Available from <http://dnr.wi.gov/lakes/clmn/reportsanddata/station.asp?folder=clmn&stationid=493104> (2010, October).

**Appendix I: Apple River Flowage Map with Survey Sample Points**

**Survey Sample Points**  
**Apple River Flowage**  
**Polk County, WI**  
**July 10-12, 2010**



**Cameron Bridge Narrows**



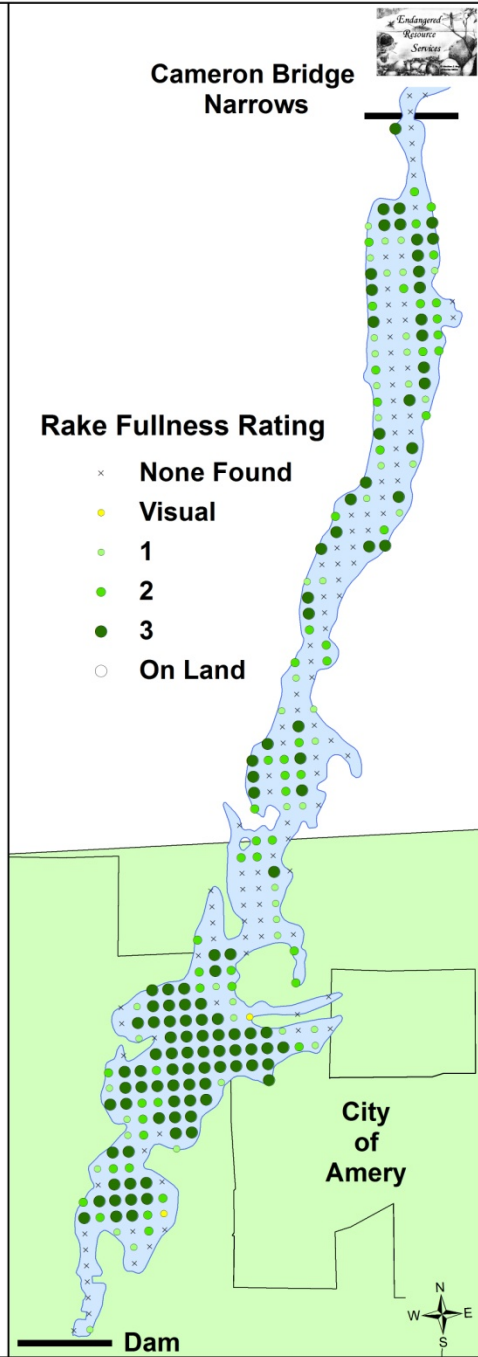
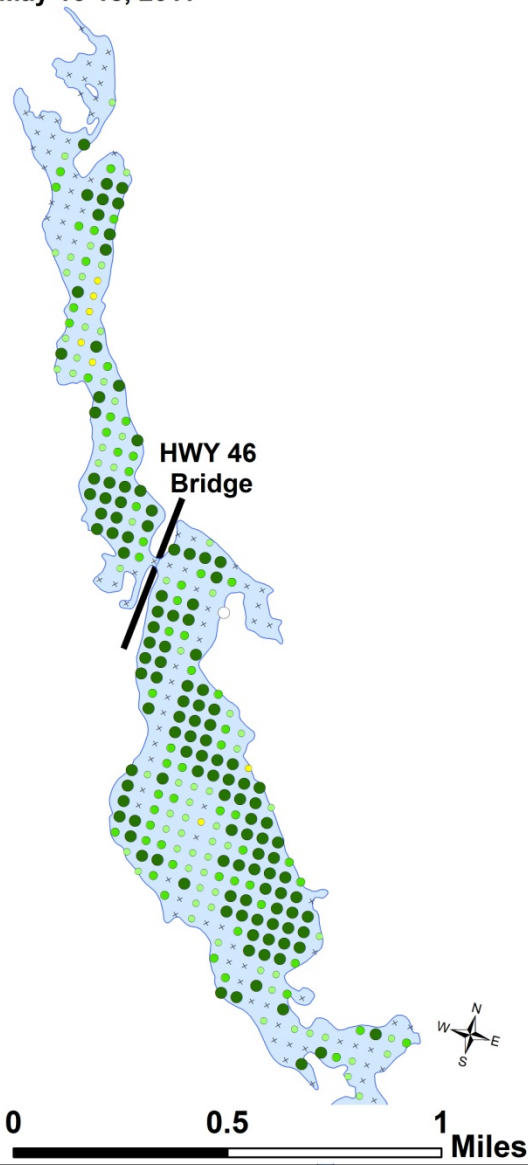


**Appendix II: Vegetative Survey Data Sheet**

Observers for this lake: names and hours worked by each:																										
Lake:		WBIC										County					Date:									
Site #	Depth (ft)	Muck (M), Sand (S), Rock (R)	Rake pole (P) or rake rope (R)	Total Rake Fullness	EWM	CLP	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	
1																										
2																										
3																										
4																										
5																										
6																										
7																										
8																										
9																										
10																										
11																										
12																										
13																										
14																										
15																										
16																										
17																										
18																										
19																										
20																										

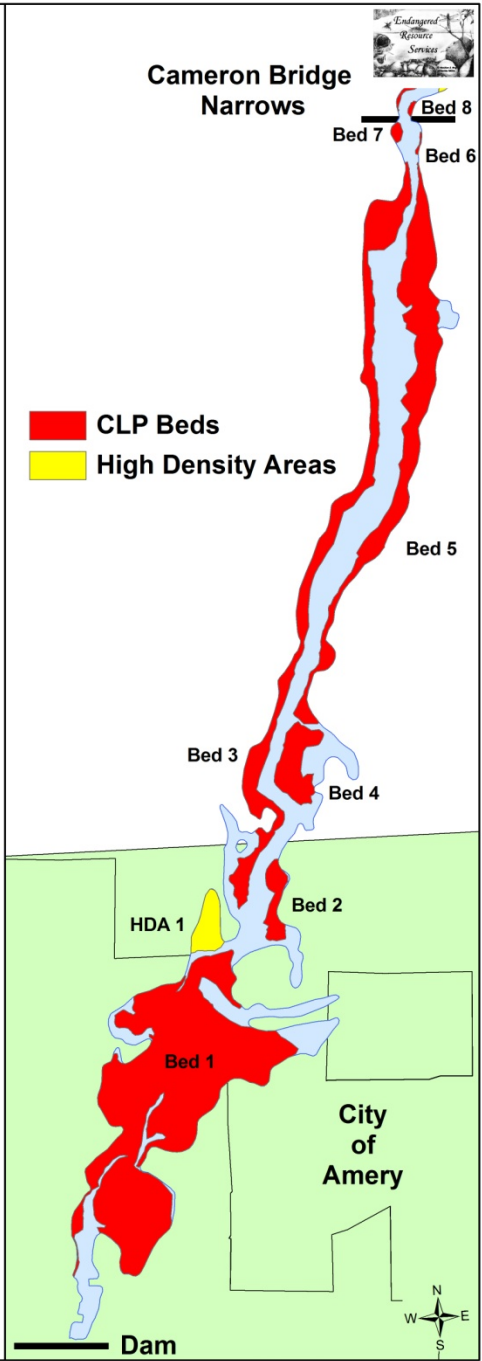
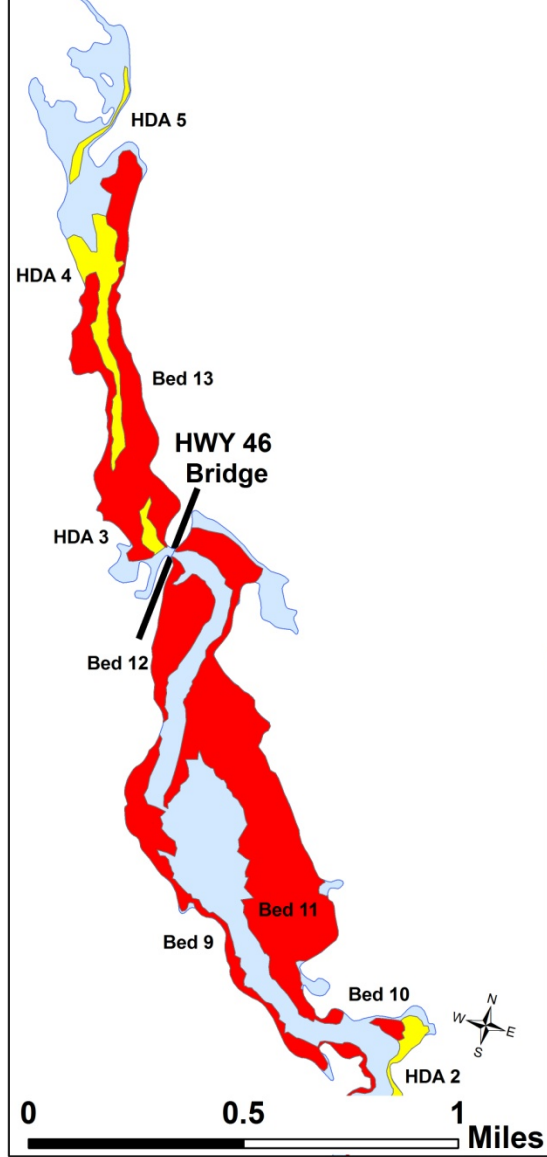
### **Appendix III: Apple River Flowage CLP Distribution and Density**

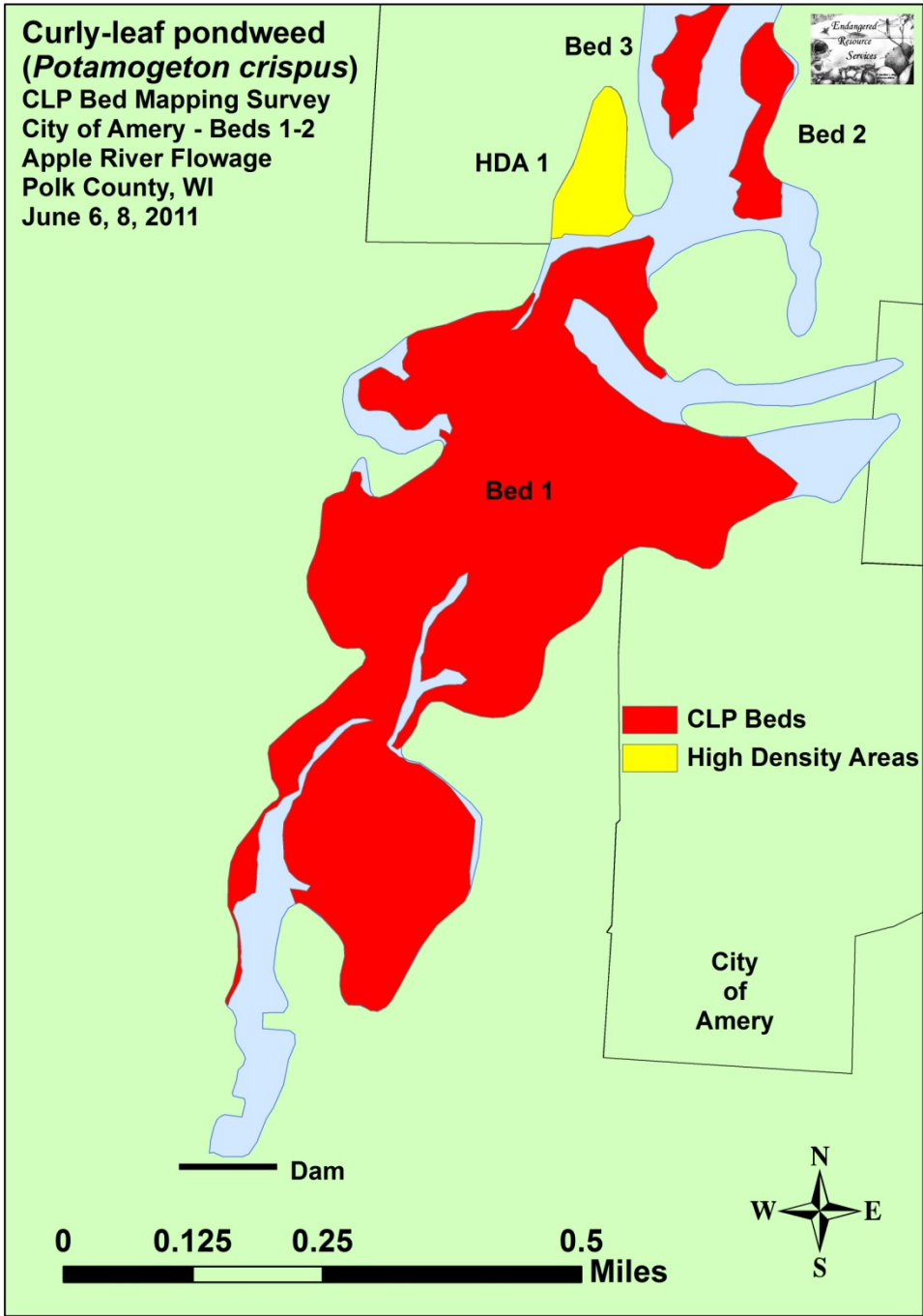
**Curly-leaf pondweed  
(*Potamogeton crispus*)  
Aquatic Macrophyte Distribution  
Apple River Flowage  
Polk County, WI  
May 16-18, 2011**

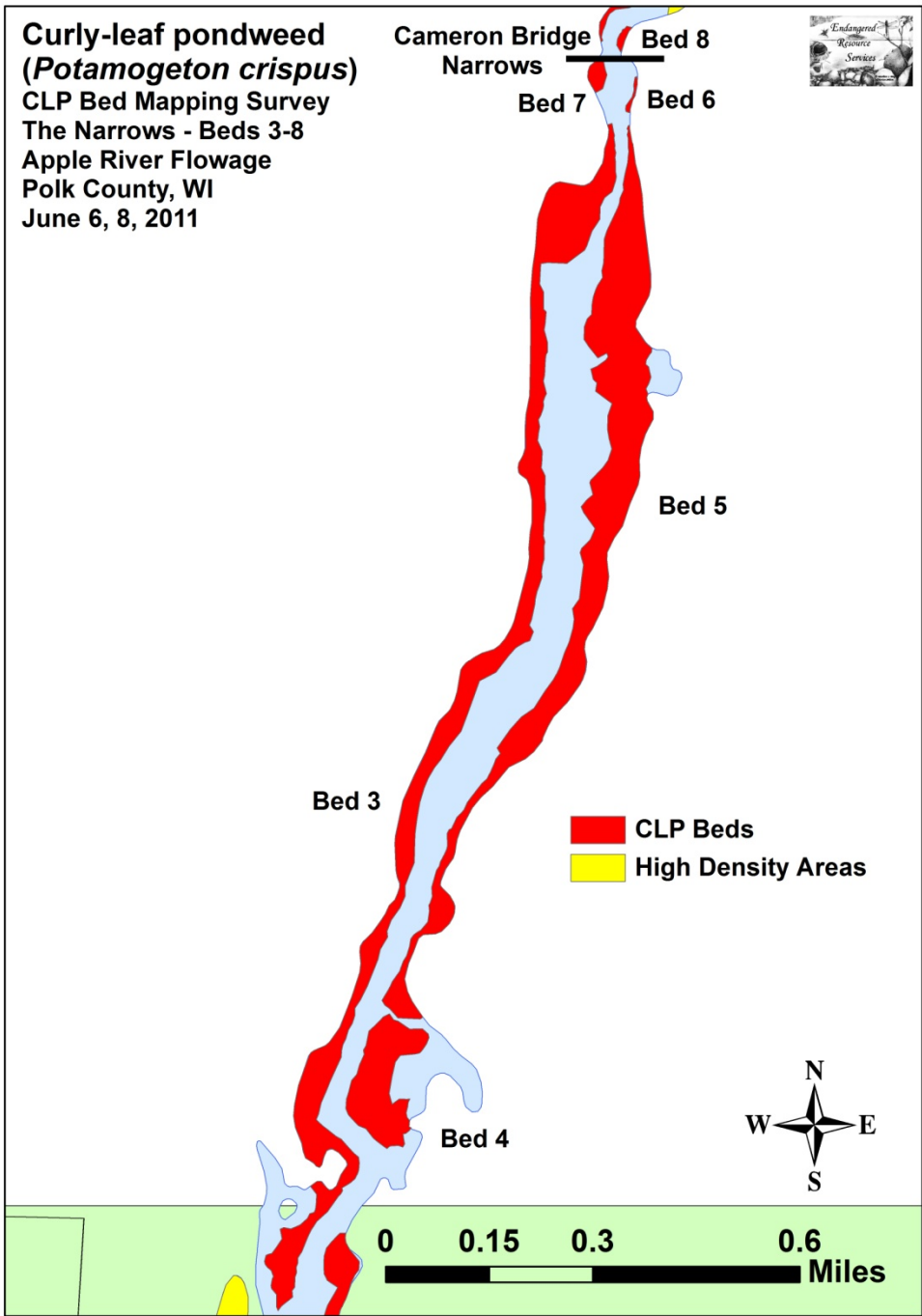


**Appendix IV: Apple River Flowage CLP Bed Maps**

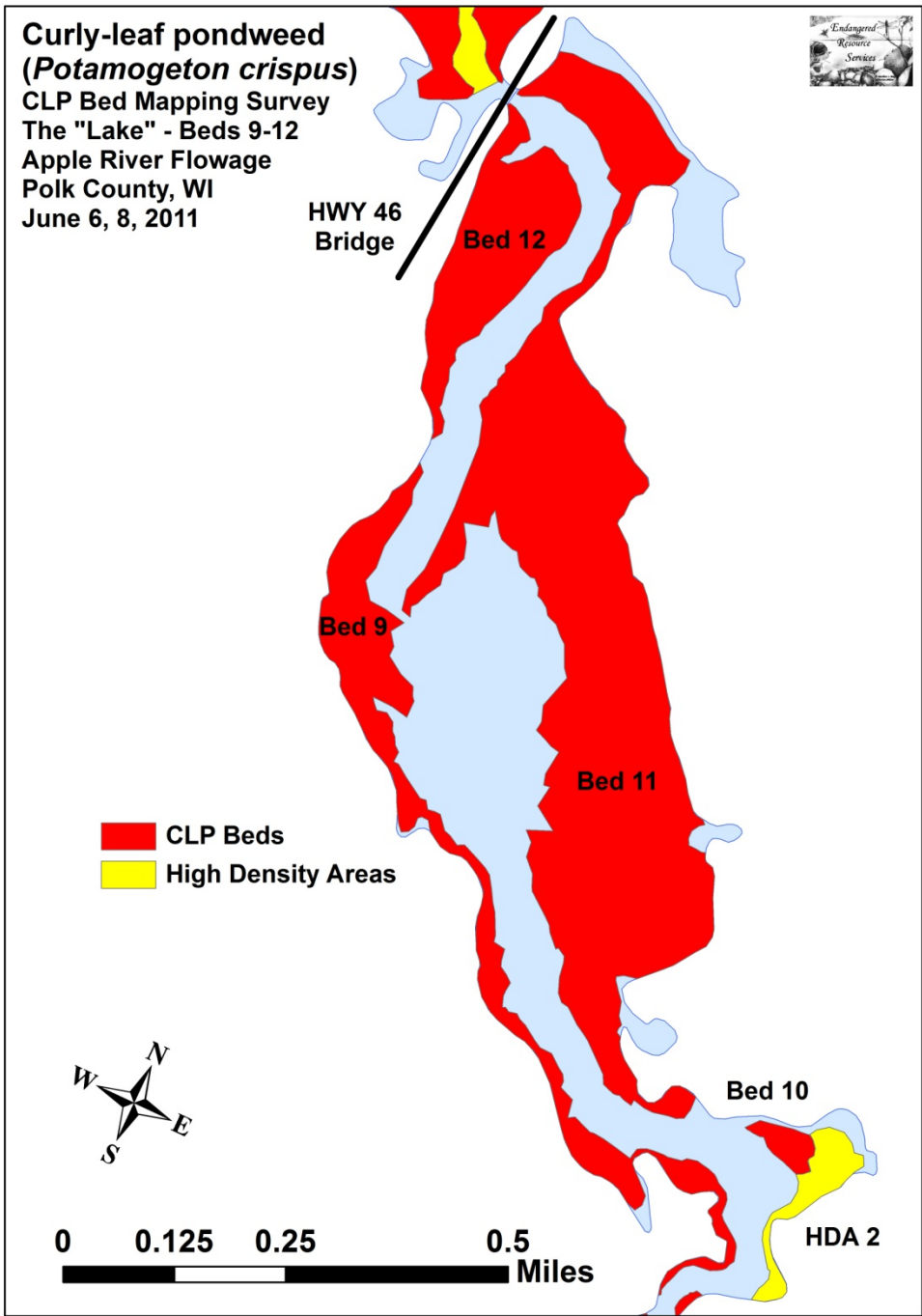
**Curly-leaf pondweed  
(*Potamogeton crispus*)  
CLP Bed Mapping Survey  
Apple River Flowage  
Polk County, WI  
June 6, 8, 2011**











**Curly-leaf pondweed  
(*Potamogeton crispus*)**  
CLP Bed Mapping Survey  
River Inlet - Bed 13  
Apple River Flowage  
Polk County, WI  
June 6, 8, 2011

