Spooner Lake Aquatic Plant Management Plan

WBIC: 268520

November 2012

Sponsored by: Spooner Lake Protection and Rehabilitation District

Prepared by: Harmony Environmental
Ecological Integrity Service

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Introduction

This aquatic plant management plan presents data about the plant community, watershed, and water quality of Spooner Lake. Goals and strategies to coordinate sound management of aquatic plants in the lake are presented based on this data. Aquatic plant management includes preservation of native species, managing nuisance aquatic plants, reducing growth and spread of the invasive curly leaf pondweed, and preventing the establishment of additional aquatic invasive species. This plan updates the 2007 Spooner Lake Aquatic Plant Management Plan to guide the Spooner Lake Protection and Rehabilitation (P&R) District and Wisconsin Department of Natural Resources in plant management through 2017.

A very important theme of this and any other Aquatic Plant Management Plan is to understand the importance of aquatic plants in a lake. Aquatic plants provide immeasurable benefit to the lake ecosystem. They are the base of the food chain and provide the primary habitat for aquatic organisms. Aquatic plants also:

- Provide habitat for invertebrates, fish, and other wildlife.
- Provide important forage areas for fish.
- Provide plants or plant cover for fish reproduction.
- Aerate waters with oxygen release during photosynthesis.
- Reduce wave energy, thereby reducing erosion.
- Stabilize shoreline areas and lake sediments.
- Absorb nutrients that may otherwise be available for algae to bloom.

Public Input

Public input for the development of the 2007 plan included a survey of trustees and visitors and public comment at the 2006 annual meeting and fall meeting. Concerns expressed focused on nuisance plant growth, filamentous algae, curly leaf pondweed and their management.

The 2013 committee to update the Spooner Lake Aquatic Plant Management Plan are listed below. This committee met once to review goals and strategies from the 2007 plan, point intercept and curly leaf pondweed monitoring data, and update concerns regarding plant management. They also provided information, reviewed draft documents, and attended the public meeting for the draft plan.

Plant management committee members are:

- Joe Banick, Board President, Aquatic Plant Committee
- Polly Banick, Citizen Representative
- Ron Boushon, Aquatic Plant Committee, Clean Boats, Clean Waters Lead
- Carol Boushon, Citizen Representative
- Frank Gray, Citizen Representative
- John Meacham, Board Secretary, Aquatic Plant Committee
- Mike Saunders, Board, Aquatic Plant Committee Chair
- Joe Cuskey, Board, Aquatic Plant Committee

Plant management advisors included:

- Lisa Burns, Washburn County Aquatic Invasive Species Coordinator
- Alex Smith, Wisconsin Department of Natural Resources, Lakes Coordinator

Public Review

This plan was available for public review and comment at the Spooner Public Library and on the Spooner Lake District website spoonerlakewi.com. This availability was announced in the Spooner Advocate newspaper. The Lake District held a public meeting to present the plan prior to submitting for approval on November 28, 2012. Committee discussion occurred at this meeting, but no comments were received from the public. The Lake District Board also approved the plan for submittal to the WDNR. The WDNR approved the plan on March 15, 2003.

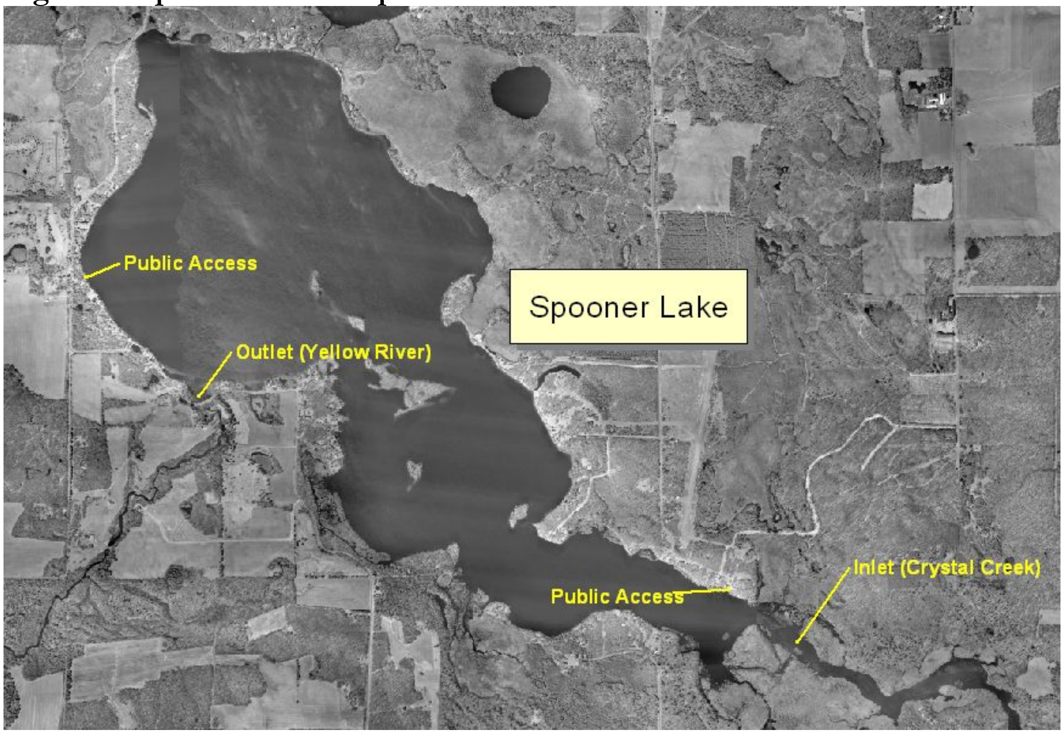
Schedule for Plan Completion

Advisory Committee Meeting	November 2
Revised Implementation Plan for Committee Review	November 5
Comments back from Committee	November 12
Plan for Public Review	November 14
Comments from Public	November 28
Public Meeting	November 28
Plan submitted to DNR	November 30
60 Day Review	
AIS Grant Applications due	February 1

Lake Information

Spooner Lake is a 1,092 acre lake located in Washburn County, Wisconsin in the town of Spooner (T39N R12W S22, 23, 26, 27, 34 and 35); WBIC: 2685200. The lake is a drainage lake with one main inlet, Crystal Brook and an outlet, the Yellow River. The outlet is controlled by a dam. The watershed area is approximately 7,811 acres. The maximum lake depth is 17 feet, and the mean depth is 7 feet.

Figure 1. Spooner Lake Map



Fisheries[1]

Largemouth bass, bluegill, black crappie, and northern pike are the primary sport fish present in Spooner Lake. Other fish species include yellow perch, pumpkinseed, black, brown, and yellow bullhead, rock bass, and white sucker. Some brown trout overwinter in Spooner Lake from Crystal Brook. No walleye were sampled in a 2008 survey, and they are assumed to be either at extremely low levels or absent.

[1] Information from Jamison Wendell, Fisheries Biologist, Wisconsin DNR. Email communication 10/25/12.

Table 1. Fish Spawning Information[2]

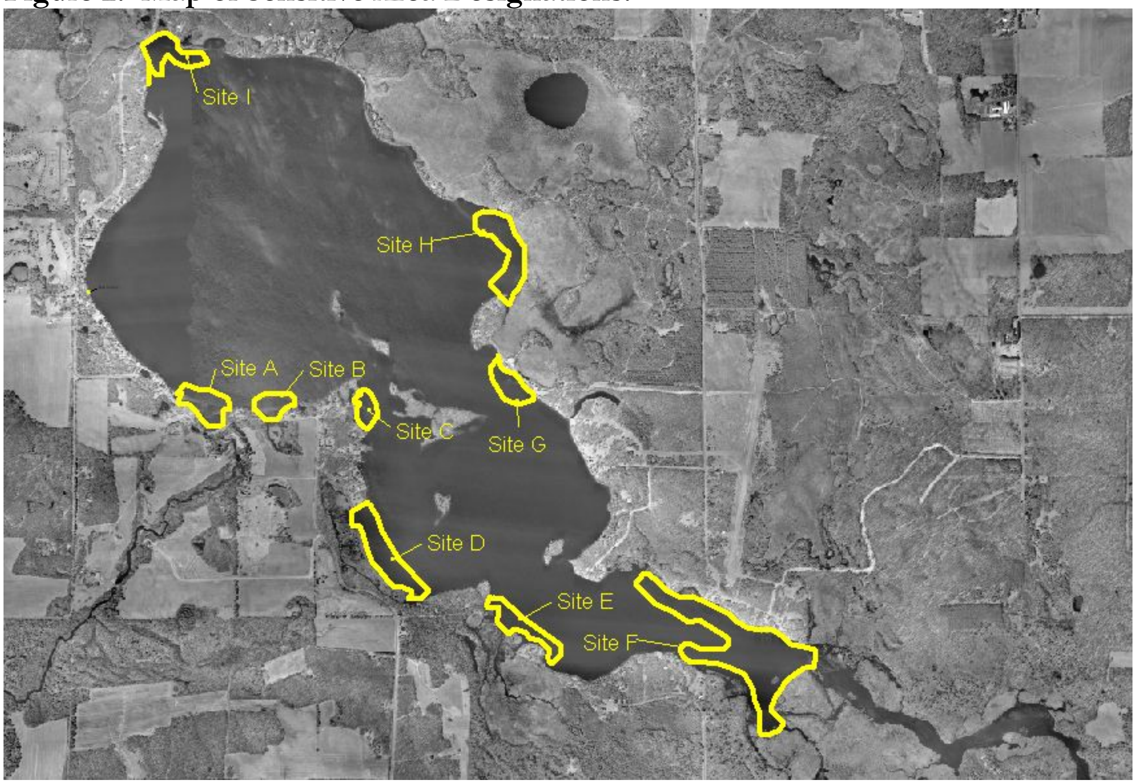
Species	**Spawning Temp in °F**	**Spawning substrate**	**Comments**
Black Crappie	Upper 50's to lower 60's	Nests built in 1-6 feet of water	Build nests
Bluegill/Largemouth Bass and Pumpkinseed	Mid 60's to lower 70's	Nests built in less than 3 feet of water	Build nests
Northern Pike	Upper 30's to mid 40's: soon after ice-out	Emergent vegetation in 6-10 inches of water	Eggs broadcast onto vegetation
Yellow Perch	Mid 40's to lower 50's	Submergent vegetation or large woody debris	Eggs broadcast
Bullheads[3]	70-77	Muddy bottom for blacks, sandy/rocky for browns, and heavy vegetation for yellows	Make nests in bottom and broadcast eggs into nests protected by vegetation and/or woody debris

[2] Information on spawning from Heath Benike, Fish Biologist. Wisconsin DNR.
[3] Information on bullheads from Mecozzi, Maureen. *Bullheads*. Wisconsin DNR Bureau of Fisheries Management. PUBL-FM-706 89. May 1989.

Sensitive Area Survey[4]

The Wisconsin Department of Natural Resources conducted an integrated sensitive area survey in August of 2000. Nine areas were designated as "sensitive" containing very important habitat for fish and wildlife and important plant species. The map below shows the designated areas.

Figure 2. Map of Sensitive Area Designations.



The following management guidelines are encouraged for these aquatic plant sensitive areas:

1. Limit aquatic vegetation removal to navigational channels no greater than 25 feet wide, where necessary. These channels should be kept as short in length as possible and it is recommended that there is not complete elimination of aquatic vegetation with the navigational channel. Remove only what is necessary to prevent fouling of propellers to provide access to open water areas. Chemical treatments should be discouraged and if a navigational channel must be cleared, pulling by hand is preferable over mechanical harvesters, where practical.
2. Prohibit littoral zone alterations covered by Wisconsin Statutes Chapter 30, unless such alterations clearly benefit the lake's ecosystem. Rock riprap permits should not be approved for areas that already have a healthy native plant community stabilizing the shoreline.

[4] *Spooner Lake Sensitive Area Survey and Management Guidelines.* Wisconsin Department of Natural Resources. 2000.

3. Leave large woody debris in the littoral zone to provide habitat for fish, wildlife, and other aquatic organisms.
4. Leave an adequate shoreline buffer of un-mowed natural vegetative cover and keep access corridors as narrow as possible (less than 30 ft or 30% of any developed lot, whichever is less).
5. Prevent erosion, especially at construction sites.
6. Strictly enforce zoning ordinances and support development of new zoning regulations where needed.
7. Eliminate nutrient inputs to the lake caused by lawn fertilizers, failing septic systems, and other sources.
8. Manage for invasive/exotic species.

The sensitive areas provide food and habitat for many fish and other aquatic species as well as some terrestrial species. Protection of these areas is strongly encouraged. Chemical treatments and/or mechanical harvesting are strongly discouraged. Historical chemical treatments and mechanical harvesting should be limited to navigational channels only and other chemical treatments/mechanical harvesting should be scrutinized.

Specific site descriptions from the report are included below:

<u>Value of Site A:</u>
This area provides important habitat for centrarchid (bass and panfish) and sucker species for spawning, feeding, protection and as nursery for young. Esocid (northern pike) will use this area for spawning, feeding, protection and as a nursery for young. This area also provides important habitat for forage species.

Wildlife is also reliant upon this area for habitat. Eagles, loons, herons, waterfowl, songbirds, furbearers, amphibians and reptiles benefit from this valuable habitat.

<u>Value of Site B</u>:
This area provides habitat for large mouth bass and northern pike. These species will use the area for spawning, feeding, protection and as nursery for young. This area also provides important habitat for forage species. Wildlife values same as Site A.

<u>Value of Site C:</u>
This area provides important habitat for centrarchid (panfish) and esocid (northern pike). These species will use this area for spawning, feeding, protection and as nursery for young. This area also provides important habitat for forage species. Wildlife values same as Site A.

<u>Value of Site D:</u>
This sensitive area rates as outstanding for natural scenic beauty.

This area provides important habitat for centrachid (panfish and bass) and esocid (northern pike). Northern pike will use this area for spawning. Small mouth bass and panfish will use this area for feeding and protective cover. This area also provides important habitat for forage species. Wildlife values same as other sites.

Value of Site E:
This sensitive area rates as outstanding for natural scenic beauty.

This area provides important habitat for centrarchid and esocid. Northern pike and panfish will use this area for spawning, feeding, protection, and as nursery for young. Large mouth bass will use this area for feeding, protection and as a nursery for young. Wildlife values same as other sites.

Value of Site F:
This sensitive area has good natural scenic beauty with no development. Fish and wildlife value is very similar to other sites.

Value of Sites G, H and I:
These areas were stated to have average natural scenic beauty.
The fish and wildlife values are very similar to other sites.

Rare and Endangered Species Habitat

The Department of Natural Resources Natural Heritage Inventory documents threatened, endangered, and special concern species in the towns where the lake and watershed are located. The Washburn County map documents that aquatic occurrences include sections where the lake is. Species that occur in the lake and watershed areas are included in a table on the following page.

No state or federally listed threatened, endangered, rare or special concern plant species were found in the lake plant surveys.

Table 2. Spooner Lake Area Natural Heritage Inventory Results

Latin Name	Common Name	Status[5]	T39N R12W (lake)	T39N R11W (watershed)	T38N R12W
Arabis missouriensis var. deamii	Deam's Rockcress (plant)	SC S2	X		
Arethusa bulbosa	Swamp-pink (plant)	SC S3 G4	X		
Artemisia frigida	Prairie Sagebrush (plant)	SC S2 G5	X		
Canis lupus	Gray Wolf	SC/FL LE S2 G4		X	X
Clinostomus elongatus	Redside Dace (fish)	SC/N S3 G3G4			
Emydoidea blandingii	Blanding's Turtle	THR S3 G4	X	X	X
Haliaeetus leucocephalus	Bald Eagle	SC/P S4B,S2N G5	X	X	X
Moxostoma valenciennesi	Greater Redhorse (fish)	THR S3 G4	X		
Ophiogomphus smithi	Sand Snaketail (dragonfly)	SC/N S2 G2G3	X	X	
Pandion haliaetus	Osprey	THR S4B G5			X
Platanthera dilatata	Leafy White Orchis (plant)	SC S3 G5	X		
Platanthera hookeri	Hooker Orchis (plant)	SC S2S3 G4	X		
Poa paludigena	Bog Bluegrass (plant)	THR S3 G3		X	

[5] THR = Threatened, END = endangered, SC/FL = Special Concern (federally protected as endangered or threatened), SC/N = Special Concern (no laws regulating use, possessions, or harvesting), and SC/H = Special Concern (take regulated by establishment of open closed seasons). G3 = Global ranking: vulnerable to extinction, G4 = apparently globally secure, but rare in parts of range, G5 = globally secure, but rare in parts of range.

Water Quality

Water quality is frequently reported by the trophic state or nutrient level of the lake. Nutrient-rich lakes are classified as eutrophic. These lakes tend to have abundant aquatic plant growth and low water clarity due to algae blooms. At the high end of the eutrophic scale blue-green algae dominate and algae scums are present, sometimes throughout the summer. Mesotrophic lakes have intermediate nutrient levels and only occasional algae blooms. Oligotrophic lakes are nutrient-poor with little growth of plants and algae.

Secchi depth readings are one way to assess the trophic state of a lake. The Secchi depth is the depth at which the black and white Secchi disk is no longer visible when it is lowered into the water. Greater Secchi depths occur with greater water clarity. Secchi depth readings, phosphorus concentrations, and chlorophyll measurements can each be used to calculate a Trophic State Index (TSI) for lakes. TSI values range from 0 – 110. Lakes with TSI values greater than 50 are considered eutrophic. Those with values in the 40 to 50 range are mesotrophic. Lakes with TSI values below 40 are considered oligotrophic. Monitoring results place Spooner Lake in the eutrophic to upper mesotrophic range TSI range depending upon the year.

Citizen lake monitoring volunteers have collected data at the deep hole of Spooner Lake sporadically through the years. Results are available from the WDNR website.[6] For better comparison between lakes, only July and August results are summarized and reported in the figures that follow. Figure 3 illustrates the annual summer Secchi depth averages for the lake. Figure 4 graphs the Trophic State Index for Spooner Lake, based upon Secchi depth, and for some years, chlorophyll, dissolved oxygen, and total phosphorus results. Note that some years' results are based on only one sample rather than a series of samples which can be misleading. This is true for 1978, 1984, 1998, and 2005 – some of the years where the best secchi and trophic state results are recorded.

It is important to note that aquatic plants play a critical role in maintaining water quality in Spooner Lake. This is a system with a large watershed, high volume of accumulated sediments, and high nutrient levels. Without aquatic plants present, nutrient-rich sediments will be re-suspended and water clarity can be expected to decrease dramatically. For shallow-water lakes and flowages, an aquatic plant dominated system is highly preferable to a flowage without aquatic plants. In fact, restoration efforts for shallow lakes frequently focus on re-establishing aquatic plants in order to improve water clarity.

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[6] http://dnr.wi.gov/lakes/CLMN

Figure 3. Secchi Depth Summer Averages for Spooner Lake

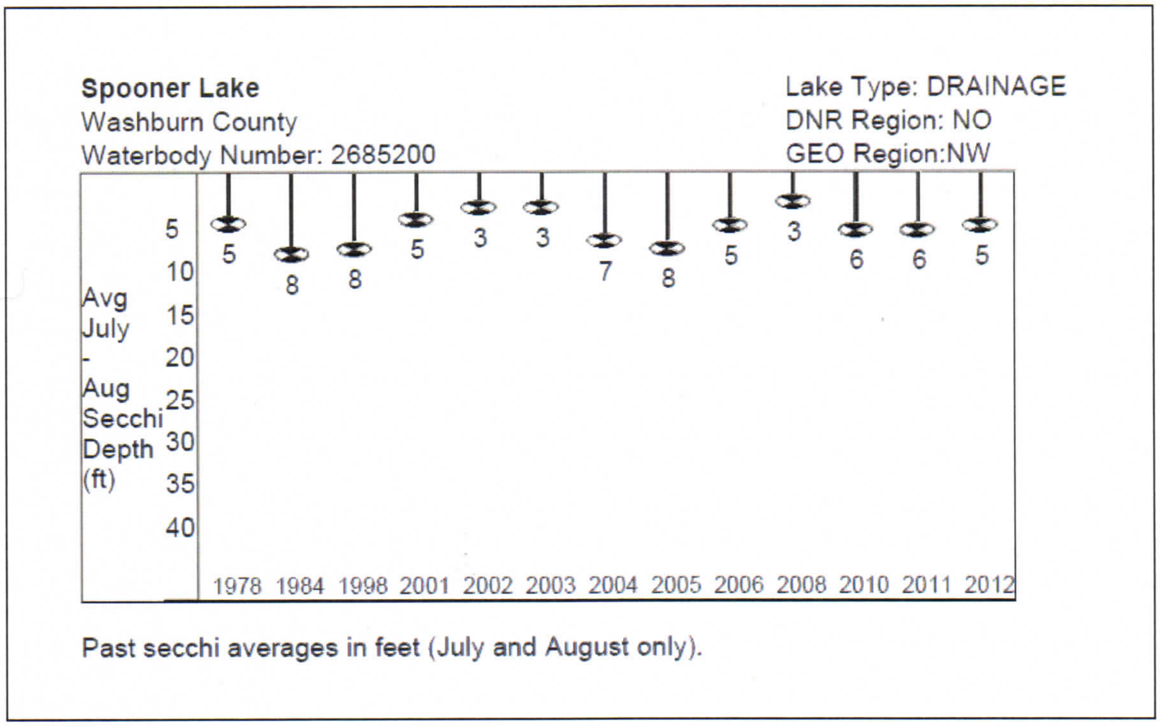
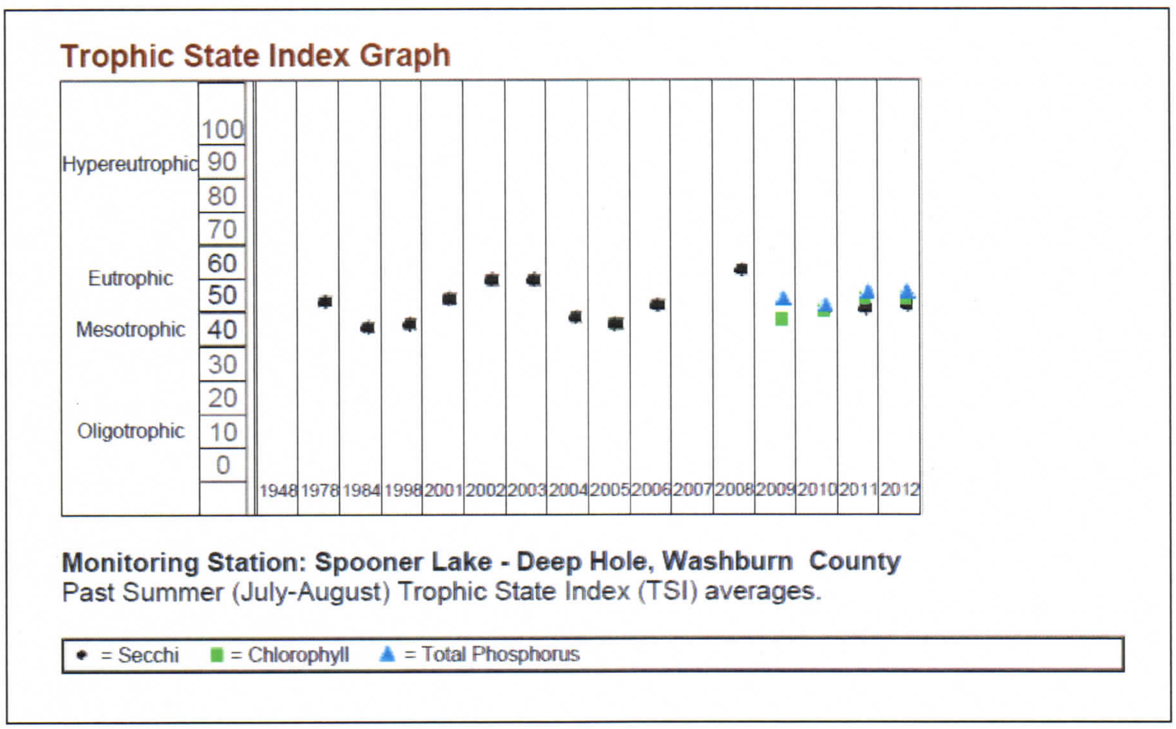


Figure 4. Trophic State Index Graph for Spooner Lake



Limited depth profiles of temperature from 2004 and 2008 show the lake did not stratify during the summer months. Without stratification of water temperature, water can readily mix storms and wind events. In addition, the dissolved oxygen profiles conducted in 2004 indicate that the lake becomes anoxic in the deep hole during a very short period of time in July. This could allow for a small phosphorus release from the sediments. No indication of anoxic conditions was found in 2008.[7]

Watershed Description

The Spooner Lake watershed is part of the Shell Lake and Upper Yellow River watershed in the St. Croix River Basin. The Spooner Lake watershed totals 7,811 acres. The watershed is large, mainly due to the inlet of Crystal Creek, which has a vast watershed area. The lake's watershed extends into the Towns of Beaver Brook, Madge, and Crystal. Crystal Creek is a cold-water stream that flows continuously throughout the entire year.

There is a fair amount of residential development on Spooner Lake. The buildings are indicated on the topographical map as small, black squares (Figures 5 and 6). The percentage of shoreline developed is unknown at this time. Most of the development is on the west shore and on the north and south shore toward the inlet. Much of the east shore is comprised of a large area of wetlands and is undeveloped.

There are two main public access points on the lake. The main landing on the west side of the lake is owned by the Town of Spooner. DNR owns the parking area for the west landing. There is little use of the DNR landing on the east side. Additional use of the lake occurs at the Pine Harbor Resort on Spooner Lake Road on the southwest shore of the lake. The Spooner golf course brings additional visitors to the lake. According to a survey in 2002, most resort visitors travel at least 300 miles to visit the lake. Spooner Lake is also heavily used for fishing tournaments with 25 in 2010.

The lake is located within 115 miles of the Twin Cities of St. Paul and Minneapolis, MN and in close proximity to the city of Spooner. Spooner with a population of 2,706 is the most populated municipality in Washburn County.[8] There are 164 homes on the lake, and approximately 70% of these are seasonal.

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[7] Citizen Lake Monitoring Data. http://dnr.wi.gov/lakes/CLMN. 10/23/12

[8] Wisconsin Demographic Services Center. Final Population Estimates. October 2010.

Figure 5. Topographical Map of Spooner Lake – Northern Portion

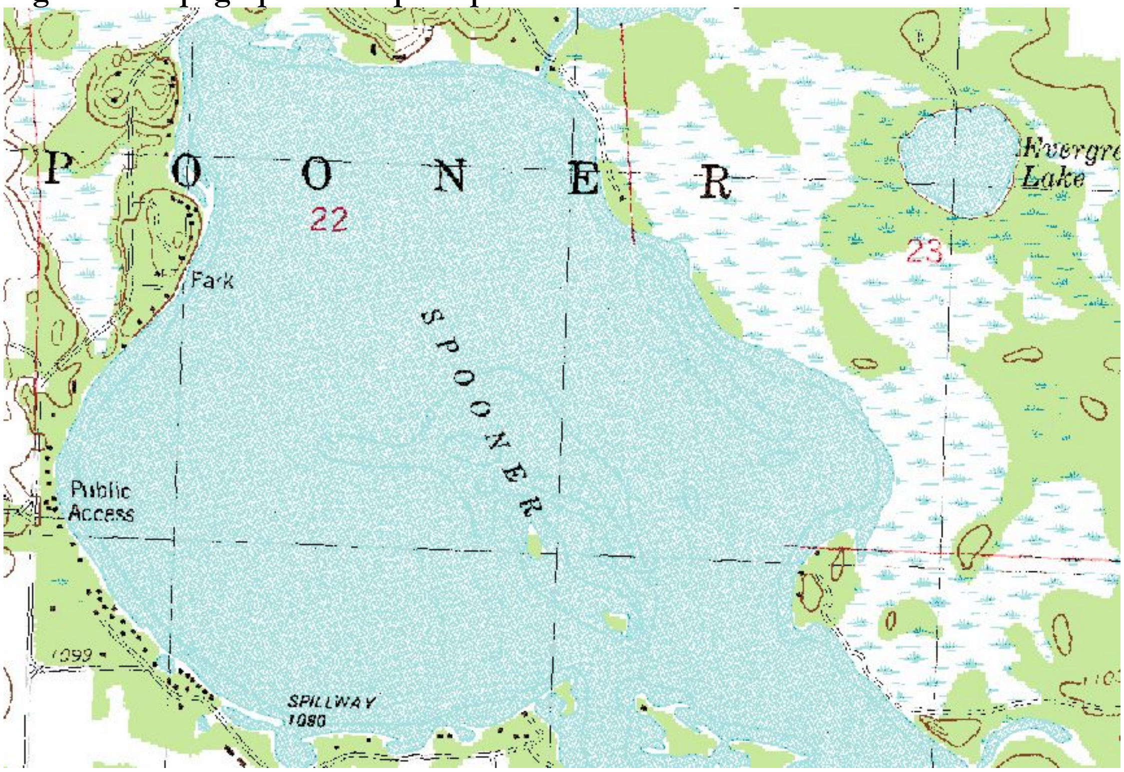
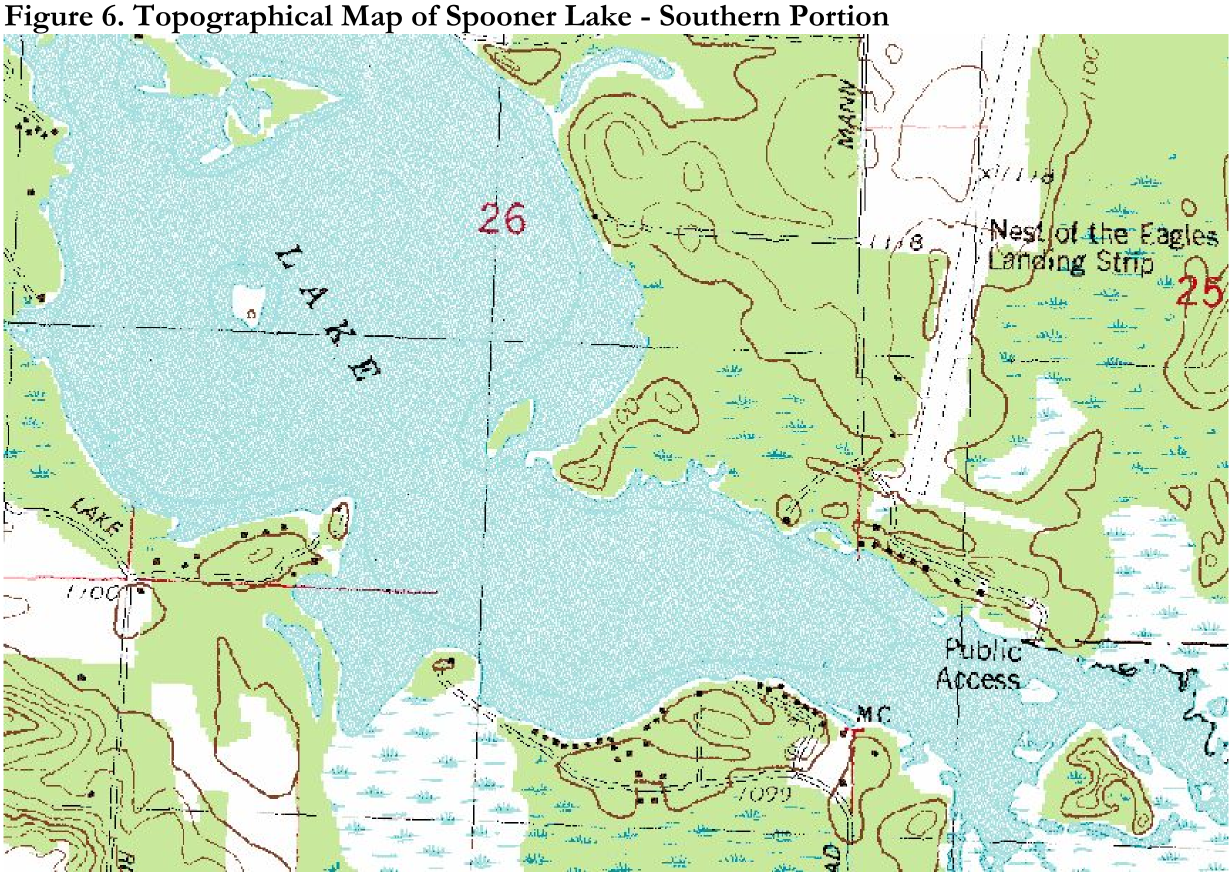


Figure 6. Topographical Map of Spooner Lake - Southern Portion

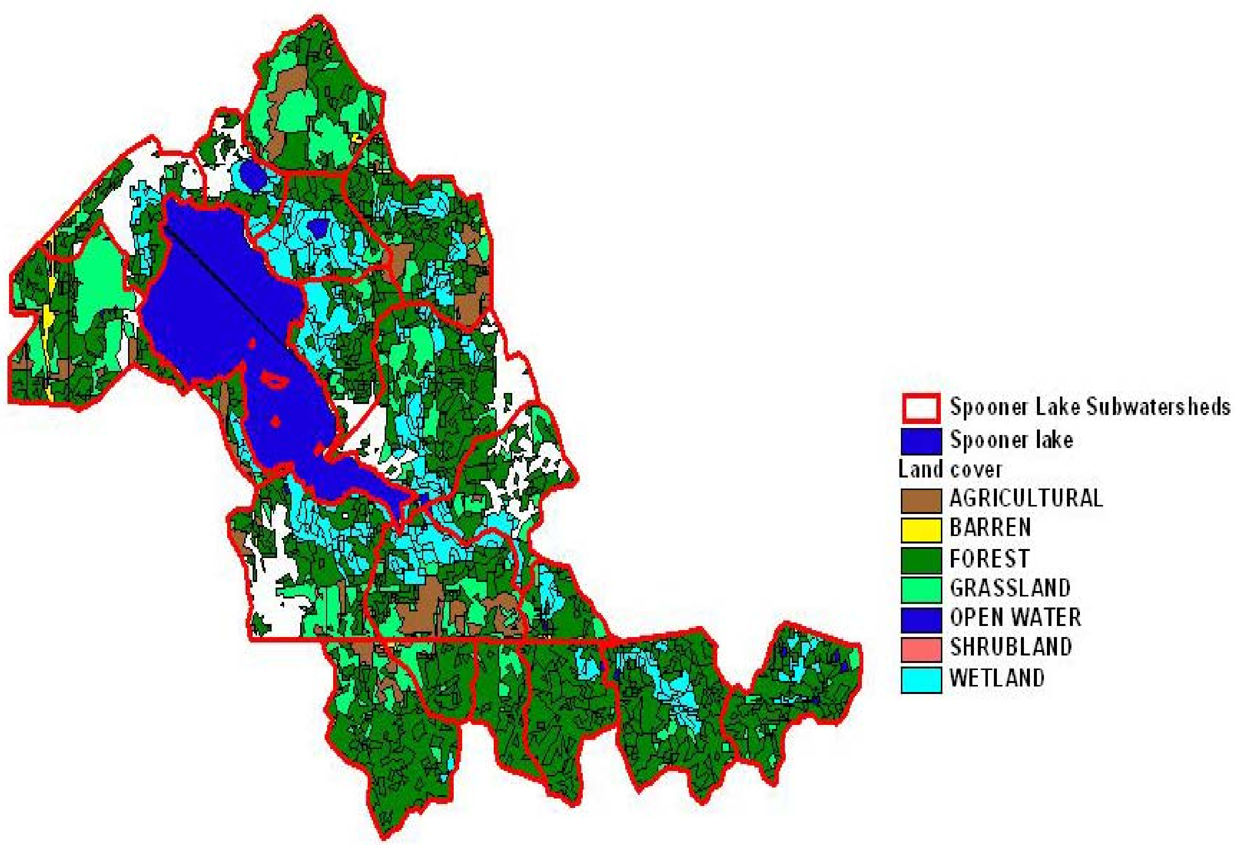


Watershed Land Cover

The dominant land cover category for the Spooner Lake watershed is forest which makes up approximately 54% of the land cover. Grassland is the next most dominant at 15% followed by wetland at 14%. Agriculture makes up about 6% of the land cover. The watershed likely has less impact on the lake than it would if agriculture or urban area made up a greater portion of the land cover. Figure 7 illustrates land cover in the watershed and Table 3 summarizes acres of each land cover type.

The land covers likely to have potentially significant impact on Spooner Lake water quality are agriculture, single family residential, and commercial because of resulting high nutrient and sediment loads. In the future agriculture is predicted to decrease while commercial and single-family residential are predicted to increase significantly.

Figure 7. Watershed Map of Spooner Lake[9]



[9] Map provided by Cedar Corporation, Menomonie, Wisconsin. 2006

Table 3. Current and Predicted Land Cover Acreage[10]

Current	Acres
AGRICULTURAL Total	748.66
COMMERCIAL Total	2.52
FOREST Total	4,457.28
GRASSLAND Total	1,059.45
OPEN WATER Total	59.07
RECREATION Total	136.36
RURAL RESIDENTIAL Total	41.04
SINGLE FAMILY Total	168.70
WETLAND Total	1,138.07
Grand Total	7,811.15

Future	Acres
AGRICULTURAL Total	615.01
COMMERCIAL Total	317.82
FOREST Total	4,135.74
GRASSLAND Total	945.34
OPEN WATER Total	58.77
RECREATION Total	136.36
RURAL RESIDENTIAL Total	68.02
SINGLE FAMILY Total	396.02
WETLAND Total	1,138.07
Grand Total	7,811.15

Table 4 reports calculated increases in phosphorus loads due to the predicted land cover changes. These land cover changes are predicted to result in an increase in over 500 lbs of phosphorus each year - a 39% increase in phosphorus loading. With this large increase, large increases in unicellular algae, filamentous algae, and plant growth are likely to result. These increases can be avoided by reducing potential nutrient loads to the lake through stormwater and runoff management practices.

[10] Data provided by Cedar Corporation, Menomonie, Wisconsin. 2006

Table 4. Modeled Loads of Current and Predicted Watershed Land Cover[11]

Current Land Cover

WATER SHED ID	AREA (Acres)	TSS (lb/yr)	P (lb/yr)	N (lb/yr)
A	388.48	4,931.26	23.18	70.06
B	525.91	5,587.60	31.00	79.38
C	353.82	4,254.39	18.06	60.39
D	199.57	2,720.14	14.87	47.90
E	168.18	10,230.94	19.75	84.93
F	544.15	41,801.87	70.00	332.94
G	664.93	64,935.41	117.87	500.91
H	538.02	109,117.95	153.19	775.71
I	167.76	6,233.29	18.16	55.23
J	416.41	6,107.32	33.93	74.95
K	787.53	28,653.67	84.31	271.28
L	362.15	15,813.87	39.51	139.88
M	104.29	27,240.85	47.41	250.38
N	626.57	159,150.99	199.38	1,243.00
O	378.87	58,009.18	107.85	511.89
P	219.28	3,793.71	16.63	50.76
Q	321.09	7,664.21	74.34	88.49
R	543.68	104,748.69	120.78	750.90
S	500.46	107,922.86	134.82	780.31
TOTALS	1,894.12	768,918.21	1,325.05	6,169.31

Future Land Cover

WATER SHED ID	AREA (Acres)	TSS (lb/yr)	P (lb/yr)	N (lb/yr)
A	388.48	4,931.26	23.18	70.06
B	525.91	5,587.60	31.00	79.38
C	353.82	4,254.39	18.06	60.39
D	199.57	2,720.14	14.87	47.90
E	168.18	10,230.94	19.75	84.93
F	544.15	41,801.87	70.00	332.94
G	664.93	71,255.31	138.07	598.65
H	538.02	109,117.95	153.19	775.71
I	167.76	6,233.29	18.16	55.23
J	416.41	12,560.45	50.64	166.61
K	787.53	34,570.96	102.98	355.32
L	362.15	23,177.00	62.49	244.46
M	104.29	27,553.13	48.40	254.82
N	626.57	190,938.85	497.68	2,341.24
O	378.87	89,135.80	257.31	1,140.10
P	219.28	7,926.06	29.66	109.45
Q	321.09	7,664.21	74.34	88.49
R	543.68	104,748.69	120.78	750.90
S	500.46	107,922.86	134.82	780.31
TOTALS	1,894.12	854,089.92	1,839.38	8,219.84

The Lake Watershed Management Plan for the Spooner Lake District[12] includes the following:

- a general overview of watersheds and lake water quality,
- a description of the physical environment,
- a delineation of lake watersheds and land uses,
- a report of water quality monitoring results,
- a discussion of water quality problems and sources of pollutant loading,
- results of a community survey,
- an overview of regulations and plans, and
- water quality recommendations.

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[11] This data provided by Cedar Corporation, Menomonie, Wisconsin. 2006
[12] Cedar Corporation.

Plant Community

Ecological Integrity Service conducted whole lake aquatic macrophyte surveys in 2006 and 2012. The 2012 survey found a moderately diverse plant community with thirty-three species of aquatic plants sampled on the rake. When viewed species (seen within six feet of sample point) were included, the number of species increased to thirty-nine. Two algae species were sampled: filamentous algae and *Chara sp*.

Figure 8 is a map of the 711 points in the plant survey. Points 698-711 were not sampled because it was too shallow to boat in the southeastern part of the lake. The white dots in Figure 9 indicate the only areas of the lake where plants were not present. Plants grow in areas as deep as 13.7 feet.

Figure 8. Plant Survey Sample Points

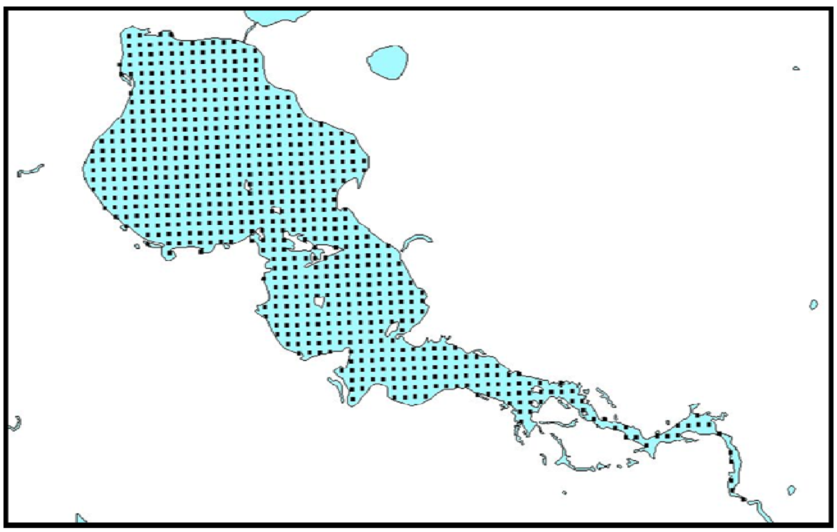


Figure 9. Presence (black dots) and Absence (white dots) of Plants

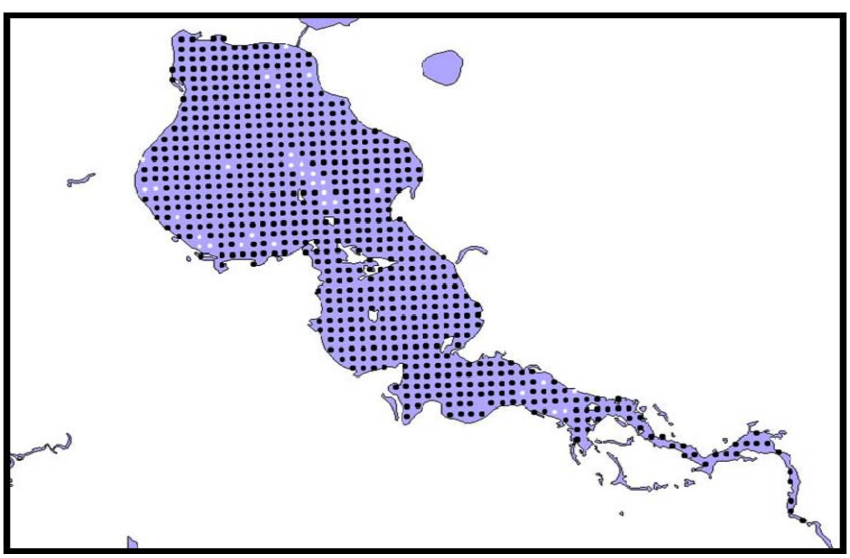


Table 5 lists the species sampled and viewed in the 2012 plant survey. All of the plants sampled on the rake were native species.

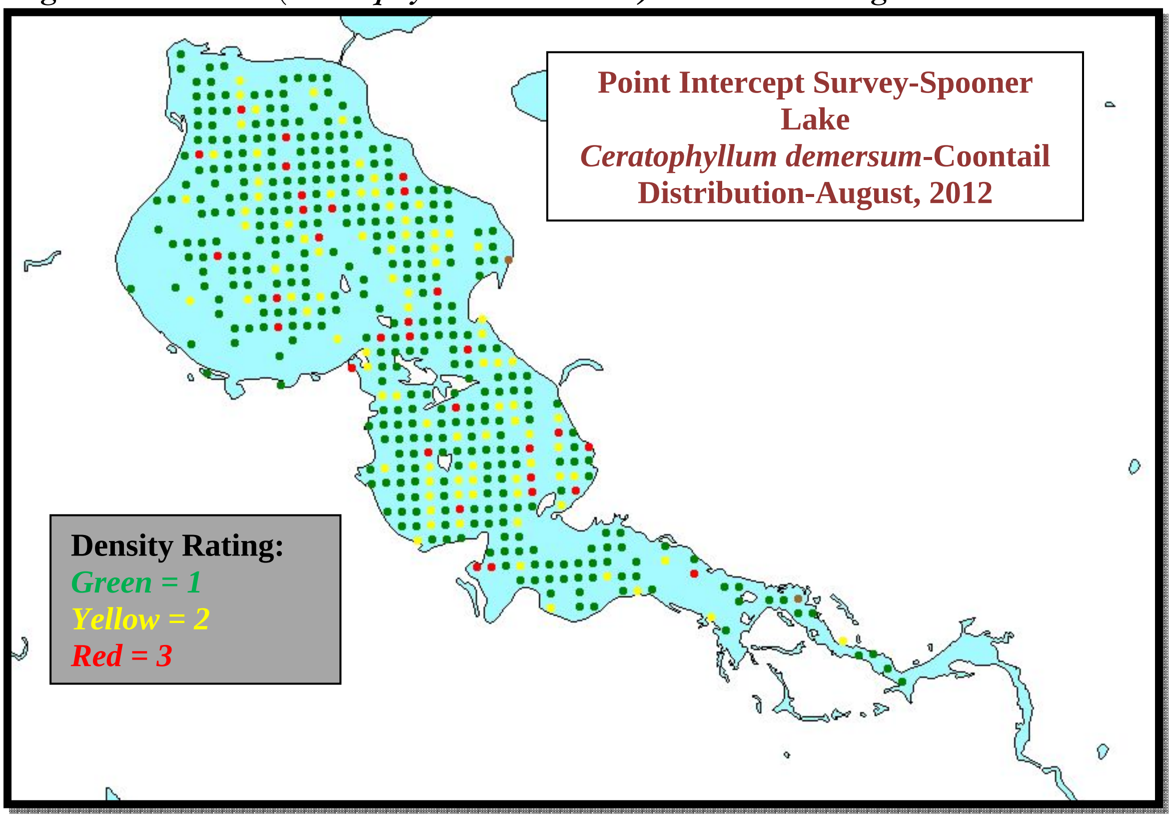
Table 5. Plant Species of Spooner Lake 2012

Species	Freq. of Occurrence	Relative Frequency	No of Pts Sampled	Mean Density
Species Sampled				
Ceratophyllum demersum, Coontail	75.90	32.41	466	1.32
Potamogeton zosteriformis, Flat-stem pondweed	38.60	16.48	237	1.27
Potamogeton robbinsii, Fern pondweed	25.41	10.85	156	1.26
Elodea canadensis, Common waterweed	24.76	10.57	152	1.30
Myriophyllum sibiricum, Northern water milfoil	11.89	5.08	73	1.03
Najas flexilis, Slender naiad	9.28	3.96	57	1.39
Potamogeton richardsonii, Clasping-leaf pondweed	7.17	3.06	44	1.20
Potamogeton praelongus, White-stem pondweed	6.84	2.92	42	1.05
Vallisneria americana, Wild celery	5.86	2.50	36	1.17
Chara sp., Muskgrasses	4.56	1.95	28	1.50
Stuckenia pectinata, Sago pondweed	3.91	1.67	24	1.00
Potamogeton amplifolius, Large-leaf pondweed	3.75	1.60	23	1.00
Heteranthera dubia, Water star-grass	3.09	1.32	19	1.00
Nymphaea odorata, White water lily	2.44	1.04	15	1.07
Lemna minor, Small duckweed	1.95	0.83	12	1.00
Potamogeton friesii, Fries' pondweed	1.30	0.56	8	1.00
Utricularia vulgaris, Common bladderwort	1.14	0.49	7	1.00
Spirodela polyrhiza, Large duckweed	0.98	0.42	6	1.00
Wolffia columbiana, Common watermeal	0.81	0.35	5	1.00
Nuphar variegata, Spatterdock	0.65	0.28	4	1.00
Pontederia cordata, Pickerelweed	0.65	0.28	4	1.00
Sagittaria rigida, Sessile-fruited arrowhead	0.65	0.28	4	1.00
Potamogeton foliosus, Leafy pondweed	0.49	0.21	3	1.00
Potamogeton natans, Floating-leaf pondweed	0.49	0.21	3	1.00
Schoenoplectus acutus, Hardstem bulrush	0.33	0.14	2	1.00
Carex comosa, Bottle brush sedge	0.16	0.07	1	1.00
Eleocharis erythropoda, Bald spikerush	0.16	0.07	1	1.00
Isoetes sp., Quillwort	0.16	0.07	1	1.00
Ranunculus aquatilis, White water crowfoot	0.16	0.07	1	1.00
Sagittaria latifolia, Common arrowhead	0.16	0.07	1	1.00
Schoenoplectus tabernaemontani, Softstem bulrush	0.16	0.07	1	1.00
Typha angustifolia, Narrow-leaved cattail	0.16	0.07	1	1.00
Typha latifolia, Broad-leaf cattail	0.16	0.07	1	1.00
Freshwater sponge	0.49	n/a	3	1.00
Filamentous algae	23.13	n/a	142	1.06

Species Viewed near Sample Points	***Species from Boat Survey***
Calla palustris, Wild calla	*Carex sp,*-Sedge
Decodon verticillatus, Swamp loosestrife	*Phragmites australis*, Giant reed
Eleocharis acicularis, Needle spikerush	*Phalaris arundinacea*, Reed canary grass
Sparganium fluctuans, Floating-leaf bur-reed	*Rumex orbiculatus,* Aquatic dock
Myosotis scirpoides, Aquatic forget me not	*Sagittaria gramineus,* Grass leaved arrowhead
Sagittaria sp. (rosettes)	

Coontail (*Ceratophyllum demersum*) was the most abundant plant surveyed. It had a very high relative frequency of 32.4%. Conditions present in Spooner Lake are allowing coontail to dominate the lake. Coontail commonly dominates lakes with very nutrient-rich conditions. Coontail is a common aquatic plant in Wisconsin lakes and is desirable, although it can sometimes reach nuisance levels. Coontail is not rooted and can live in low light conditions, allowing it to over winter as an evergreen. Most new plants come primarily from stem fragments.

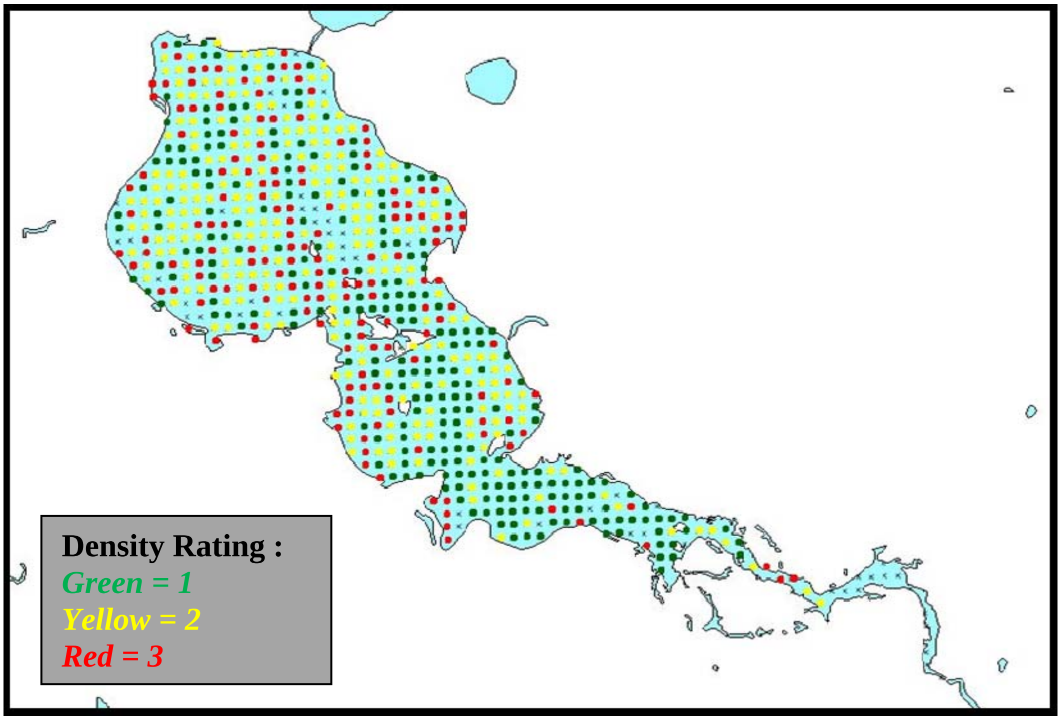
Figure 10. Coontail (*Ceratophyllum demersum)* Distribution August 2012



The second and third most dominant plants are flat-stem pondweed (*Potamogeton zosteriformis*) and Robbin's pondweed (*Potamogeton robbinsii*). Both of these plants are common, desirable aquatic plants in Wisconsin lakes.

Overall plant density is quite high in Spooner Lake. There were numerous sample points with rake fullness ratings of 2 and 3. Figure 11 shows the density ratings of each rake sample.

Figure 11. Rake Sample Plant Density August 2012



Aquatic plants sometimes do reach what could be considered nuisance levels in the southeast region near the inlet. During both the early and late season survey in 2006, it was very difficult to navigate through these areas. The rest of the lake has extensive plant coverage, but this coverage does not seem to impede navigation. Navigability is not necessary related to rake density because plants may not be growing at the surface.

Rake densities were relatively low in the east bay in 2012. However, the plant survey followed an herbicide treatment of the navigation channel in this area.

Figure 12. Nuisance Levels of Growth in the East Bay

Comparison of 2012 and 2006 Aquatic Plant Surveys

Plant survey protocol was the same in both 2012 and 2006. However, the two surveys yielded fairly different results. Table 6 shows the similarities and differences. There were more species of plants sampled in 2012, and yet the number of species per sample was lower in 2012 than in 2006. This may indicate that the species present were more widespread, creating more species on each rake sample.

Table 6. Plant Survey Summary Statistics: 2006 and 2012

Data	2006	2012
Species richness	20	33
Simpson's diversity index[13]	0.86	0.84
Number of species per sample point	3.14	2.34
Maximum depth with plants	16.50 ft	13.70 ft
% of littoral zone with plants	99.56	90.75

<u>2006 most abundant plant species</u>

Potamogeton zosteriformis-flatstem pondweed (23.4%)
Myriophyllum sibiricum-northern water milfoil (17.6%)
Ceratophyllum demersum-coontail (15.2%)

<u>2012 most abundant plant species</u>

Ceratophyllum demersum-coontail (32.4%)
Potamogeton zosteriformis-flatstem pondweed (16.5%)
Potamogeton robbinsii-Robbin's pondweed (10.9%)

Floristic Quality Index

The Floristic Quality Index (FQI) is an index developed by Dr. Stanley Nichols of the University of Wisconsin-Extension. This index is a measure of the plant community response to development and human influence on the lake. It takes into account the species of aquatic plants present and their tolerance for changing water quality and habitat characteristics. A plant's tolerance is expressed as a coefficient of conservatism (C). Native plants in Wisconsin are assigned a conservatism value between 0 and 10. A plant with a high conservatism value has more specialized habitat requirements and is less tolerant of disturbance and/or water quality changes. Those with lower values are more able to adapt to disturbance or changing conditions, and can therefore be found in a

[13] Simpson's diversity index is a measure of the likelihood of pulling up different plant species with each rake sample.

wider range of habitats. The FQI is calculated using the number of species present and these plants' species conservatism values. A higher FQI generally indicates a healthier aquatic plant community.

Spooner Lake had a higher FQI for 2012 than the median for other eco-region lakes. This appears to be due to a higher diversity (more species) rather than more sensitive plants present.

Table 7. Floristic Quality Index Data

FQI Value	Spooner Lake-2012	Spooner Lake - 2006[14]	Median of Ecoregion Lakes[15]
Number of species	33	19	23.5
Mean conservatism	5.76	5.74	6.2
Floristic Quality Index	33.07	25	28.3

Near Shore Vegetation

In areas of development, the near shore vegetation is mostly lawn. In areas without development, the shoreline vegetation is a mostly shrub, leading to a tree layer. There are some large areas of wetlands that border the lake that appear to have a rather diverse collection of wetland plants growing. These include *Typha sp., Sagittaria sp., Schoenoplectus sp.,* and *Phragmites sp.*

[14] The FQI for 2006 was adjusted to match the protocol in place in 2012 (different from 2006 in that the FQI is limited to using only plants sampled on the rake which was not the case in 2006).

[15] Spooner Lake is located in the Northern Lakes and Forest region.

Rationale for Survey Differences
The differences between the two surveys could be due to several factors other than human activity. First, many of the plants sampled on the rake in 2012 were only viewed in the 2006 survey. This may account for the difference in species richness. However, since the plants were viewed in 2006, they were close to the sample points. Chance variation could have resulted in those plants being sampled in 2012. Secondly, aquatic plant species growth can vary greatly from year to year. Annual variation in plant growth could account for difference in frequencies and even plants not being sampled in one survey or the other. Lastly, even though the same GPS coordinates were used, sampling locations are not precise. Plants that were sampled very few times could get missed randomly due to sample location variation.

A 5.11 acre navigational channel was treated with the herbicide diquat in 2012. This herbicide application could have changed the frequency and/or density of the more common plant species in 2012.

Non-native Invasive Species
The Spooner Lake P&R District has managed curly leaf pondweed (CLP) (*Potamogeton crispus*) with herbicide treatments for several years. In addition, the extent of CLP growth varies dramatically naturally from year to year.

Curly leaf pondweed is non-native, cold-water loving plant. It tends to grow in highly nutritive sediments. It reproduces mainly by the production of turions. These turions settle into the sediment in July when the plants tend to die. In late summer to early fall, the turions germinate into new plants. These plants will continue to grow throughout the winter and then grow very quickly in the spring. Sometimes they can reach nuisance levels and reach the surface, appearing to be the only plant present.

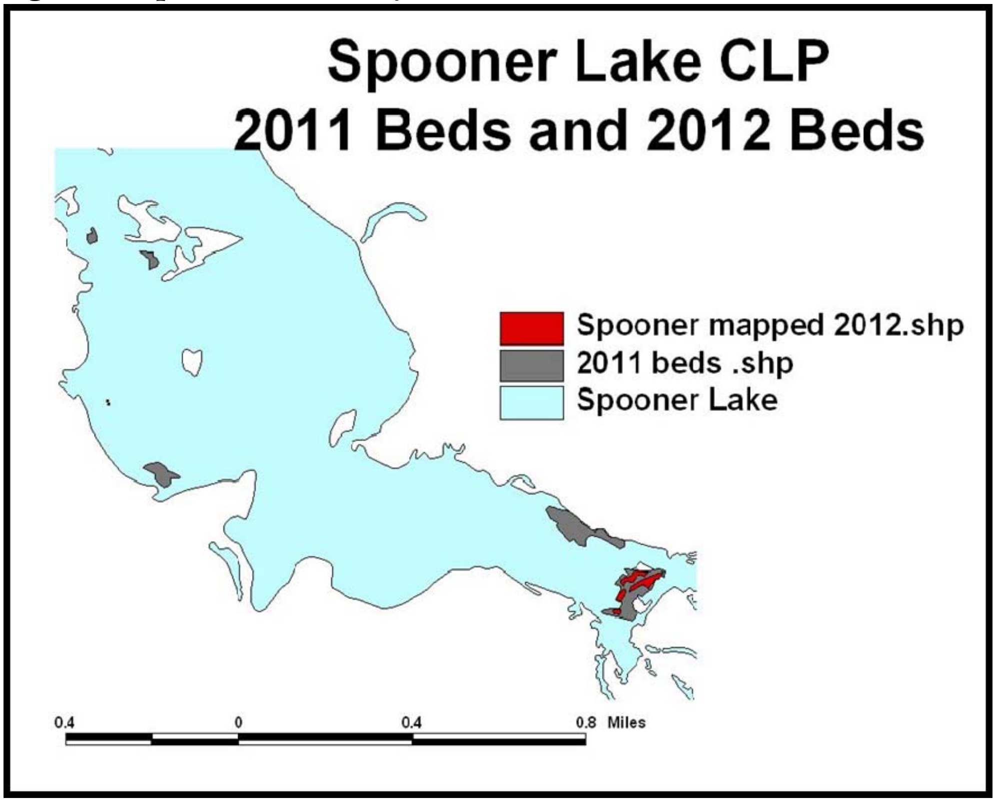
The map of CLP coverage was updated with a June 2011 survey. A June 2012 survey was also conducted. Both years' survey results are shown in Figure 13. The CLP coverage in 2012 was significantly less than in 2011. The areal coverage of CLP in 2011 was 10.3 acres and in 2012 it was about 1 acre. Acreage of CLP in both years is a result decreased because measurements followed herbicide treatments.

Non-native plants observed in the 2012 survey in areas other than the sample point locations include aquatic forget-me-not, reed canary grass, and giant reed.

Washburn County Aquatic Invasive Species staff confirmed the presence of Japanese knotweed near the Town of Spooner (west) boat landing in November 2012.[16] There are likely other locations where this plant is growing around the lake. Lake residents also report the presence of purple loosestrife around the lake.

[16] Personal communication. Lisa Burns. Washburn County Land and Water Conservation Department, November 28, 2012.

Figure 13. Spooner Lake Curly Leaf Pondweed Beds



Invasive Species Information

Curly Leaf Pondweed

Curly leaf pondweed is specifically designated as an invasive aquatic plant (along with Eurasian water milfoil and purple loosestrife) to be the focus of a statewide program to control invasive species in Wisconsin. Invasive species are defined as a "non-indigenous species whose introduction causes or is likely to cause economic or environmental harm or harm to human health (23.22(c)."

The Wisconsin Comprehensive Management Plan for Aquatic Invasive Species describes curly leaf pondweed impacts as follows:

> It is widely distributed throughout Wisconsin lakes, but the actual number of waters infested is not known. Curly-leaf pondweed is native to northern Europe and Asia where it is especially well adapted to surviving in low temperature waters. It can actively grow under the ice while most plants are dormant, giving it a competitive advantage over native aquatic plant species. By June, curly-leaf pondweed can form dense surface mats that interfere with aquatic recreation. By mid-summer, when other aquatic plants are just reaching their peak growth for the year, it dies off. Curly-leaf pondweed provides habitat for fish and invertebrates in the winter and spring when most other plants are reduced to rhizomes and buds, but the mid-summer decay creates a sudden loss of habitat. The die-off of curly-leaf pondweed also releases a surge of nutrients into the water column that can trigger algal blooms and create turbid water conditions. In lakes where curly-leaf pondweed is the dominant plant, the summer die-off can lead to habitat disturbance and degraded water quality. In other waters where there is a diversity of aquatic plants, the breakdown of curly-leaf may not cause a problem.[17]

The state of Minnesota DNR web site explains that curly leaf pondweed often causes problems due to excessive growth. At the same time, the plant provides some cover for fish and some waterfowl species feed on the seeds and winter buds.[18]

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[17] *Wisconsin's Comprehensive Management Plan to Prevent Introductions and Control Existing Populations of Aquatic Invasive Species*. Wisconsin Department of Natural Resource. September 2003.

[18] Information from Minnesota DNR (www.dnr.state.mn.us/aquatic_plants).

The following description is taken from a Great Lakes Indian Fish and Wildlife Commission handout.

Curly Leaf Pondweed (*Potamogeton crispus*)[19]

Identification

Curly leaf pondweed is an invasive aquatic species found in a variety of aquatic habitats, including permanently flooded ditches and pools, rivers, ponds, inland lakes, and even the Great Lakes. Curly leaf pondweed prefers alkaline or high nutrient waters 1 to 3 meters deep. Its leaves are strap-shaped with rounded tips and undulating and finely toothed edges. Leaves are not modified for floating, and are generally alternate on the stem. Stems are somewhat flattened and grow to as long as 2 meters. The stems are dark reddish-green to reddish-brown, with the mid-vein typically tinged with red. Curly leaf pondweed is native to Eurasia, Africa and Australia and is now spread throughout most of the United States and southern Canada.

Characteristics

New plants typically establish in the fall from freed turions (branch tips). The winter form is short, with narrow, flat, relatively limp, bluish-green leaves. This winter form can grow beneath the ice and is highly shade-tolerant. Rapid growth begins with warming water temperatures in early spring – well ahead of native aquatic plants.

Reproduction and Dispersal

Curly leaf pondweed reproduces primarily vegetatively. Numerous turions are produced in the spring. These turions consist of modified, hardened, thorny leaf bases interspersed with a few to several dormant buds. The turions are typically 1.0 – 1.7 cm long and 0.8 to 1.4 cm in diameter. Turions separate from the plant by midsummer, and may be carried in the water column supported by several leaves. Humans and waterfowl may also disperse turions. Stimulated by cooler water temperatures, they germinate in the fall, over-wintering as a small plant. The next summer they mature, producing reproductive tips of their own. Curly leaf pondweed rarely produces flowers.

Ecological Impacts

Rapid early season growth may form large, dense patches at the surface. This canopy overtops most native aquatic plants, shading them and significantly slowing their growth. The canopy lowers water temperature and restricts absorption of atmospheric oxygen into the water. The dense canopy formed often interferes with recreational activities such as swimming and boating.

In late spring, curly leaf pondweed dies back, releasing nutrients that may lead to algae blooms. Resulting high oxygen demand caused by decaying vegetation can adversely affect fish populations. The foliage of curly leaf pondweed is relatively high in alkaloid compounds possibly making it unpalatable to insects and other herbivores.

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[19] Information from GLIFWC Plant Information Center (http://www.glifwc.org/epicenter).

Curly Leaf Pondweed Control:
Small populations of curly leaf pondweed in otherwise un-infested water bodies should be attacked aggressively. Hand pulling, suction dredging, or spot treatments with contact herbicides are recommended. Cutting should be avoided because fragmentation of plants may encourage their re-establishment. In all cases, care should be taken to remove all roots and plant fragments to keep them from re-establishing.

Control of large populations requires a long-term commitment that may not be successful. A prudent strategy includes a multi-year effort aimed at killing the plant before it produces turions, thereby depleting the seed back over time. It is also important to maintain, and perhaps augment, native populations to retard the spread of curly leaf and other invasive plants. Invasive plants will aggressively infest disturbed areas of the lake, such as those where native plant nuisances have been controlled through chemical applications.

Eurasian Water Milfoil[20]
The ecological risks associated with an infestation of Eurasian water milfoil appear to surpass those associated with curly leaf pondweed. This plant is not present in Spooner Lake. However, there is a risk that Eurasian water milfoil may become established in Spooner Lake.

Public boat landings are located at the west side of the lake and the southeast corner of the Lake. Many fishermen travel from the Twin Cities, Minnesota metropolitan area, and access the lake at this boat landing. With Eurasian water milfoil present in many urban Twin Cities lakes, such as White Bear Lake and Lake Minnetonka, the danger of transporting plant fragments on boats and motors is very real. The lake is also situated near a major highway, providing easy access to the Twin Cities. According to the Minnesota Sea Grant Office:

> *Eurasian water milfoil can form dense mats of vegetation and crowd out native aquatic plants, clog boat propellers and make water recreation difficult. Eurasian water milfoil has spread to over 150 lakes [in Minnesota], primarily in the Twin Cities area.*

Department of Natural Resource scientists have also found Eurasian water milfoil in the nearby counties of Burnett (Ham Lake and Round Lake) Washburn (Nancy Lake, Totagatic River and the Minong Flowage), Barron (Beaver Dam, Sand, Kidney, Shallow, Duck, and Echo Lakes), Sawyer (Callahan, Clear, Connors, Little Round, Mud, Osprey, Round Lakes and Lake Chippewa, Raddison flowage) and Polk (Long Trade) in Wisconsin.

The following Eurasian water milfoil information is taken from a Wisconsin DNR fact sheet. Both northern milfoil and coontail, mentioned below as frequently mistaken for Eurasian water milfoil are present in Spooner Lake.

[20] Wisconsin DNR Invasive Species Factsheets from www.dnr.state.wi.us.

Identification

Eurasian water milfoil is a submersed aquatic plant native to Europe, Asia, and northern Africa. It is the only non-native milfoil in Wisconsin. Like the native milfoils, the Eurasian variety has slender stems whorled by submersed feathery leaves and tiny flowers produced above the water surface. The flowers are located in the axils of the floral bracts, and are either four-petaled or without petals. The leaves are threadlike, typically uniform in diameter, and aggregated into a submersed terminal spike. The stem thickens below the inflorescence and doubles its width further down, often curving to lie parallel with the water surface. The fruits are four-jointed nut-like bodies. Without flowers or fruits, Eurasian water milfoil is nearly impossible to distinguish from Northern water milfoil. Eurasian water milfoil has 9-21 pairs of leaflets per leaf, while Northern milfoil typically has 7-11 pairs of leaflets. Coontail is often mistaken for the milfoils, but it does not have individual leaflets.

Characteristics

Eurasian water milfoil grows best in fertile, fine-textured, inorganic sediments. In less productive lakes, it is usually restricted to areas of nutrient-rich sediments. It has a history of becoming dominant in eutrophic, nutrient-rich lakes, although this pattern is not universal. It is an opportunistic species that prefers highly disturbed lakebeds, lakes receiving nitrogen and phosphorous-laden runoff, and heavily used lakes. Optimal growth occurs in alkaline systems with a high concentration of dissolved inorganic carbon. High water temperatures promote multiple periods of flowering and fragmentation.

Reproduction and Dispersal

Unlike many other plants, Eurasian water milfoil does not normally rely on seed for reproduction. Its seeds germinate poorly under natural conditions. It reproduces vegetatively by fragmentation, allowing it to disperse over long distances. The plant produces fragments after fruiting once or twice during the summer. These shoots may then be carried downstream by water currents or inadvertently picked up by boaters. Milfoil is readily dispersed by boats, motors, trailers, bilges, live wells, or bait buckets, and can stay alive for weeks if kept moist.

Once established in an aquatic community, milfoil reproduces from shoot fragments and stolons (runners that creep along the lake bed). As an opportunistic species, Eurasian water milfoil is adapted for rapid growth early in spring.

Ecological Impacts

Eurasian water milfoil's ability to spread rapidly by fragmentation and effectively block out sunlight needed for native plant growth often results in monotypic stands. Monotypic stands of Eurasian milfoil provide only a single habitat, and threaten the integrity of aquatic communities in a number of ways; for example, dense stands disrupt predator-prey relationships by fencing out larger fish, and reducing the number of nutrient-rich native plants available for waterfowl.

Dense stands of Eurasian water milfoil also inhibit recreational uses like swimming, boating, and fishing. Some stands have been dense enough to obstruct industrial and power generation water intakes. The visual impact that greets the lake user on milfoil-dominated lakes is the flat yellow-green of matted vegetation, often prompting the perception that the lake is "infested" or "dead". Cycling of nutrients from sediments to the water column by Eurasian water milfoil may lead to deteriorating water quality and algae blooms of infested lakes.

<u>Control Methods</u>

Preventing a Eurasian water milfoil invasion requires various efforts. The first component is public awareness of the necessity to remove weed fragments at boat landings. Inspection programs should provide physical inspections as well as a direct educational message. Native plant beds must be protected from disturbance caused by boaters and indiscriminate plant control that disturbs these beds. A watershed management program would keep nutrients from reaching the lake and reduce the likelihood that Eurasian milfoil colonies will establish and spread.

Monitoring is also important, so that introduced plants can be controlled immediately. The lake district and lakeshore owners should check for new colonies and control them before they spread. The plants can be hand pulled or raked. It is imperative that all fragments be removed from the water and the shore.

If Eurasian water milfoil is introduced, additional control methods should be considered including mechanical control, chemical control, and biological control. As always, prevention is the best approach to invasive species management.

Because Eurasian water milfoil is found in nearby lakes, it is prudent to provide a contingency plan to be best prepared to control milfoil, should it be found in the lake. A contingency plan including a systematic monitoring program and a fund to provide timely treatments is found in Appendix A.

Information about additional invasive species is found in Appendix C.

Aquatic Plant Management

This section presents aquatic plant management goals for Spooner Lake and the potential management methods available to reach these goals. A recent history of aquatic plant management on Spooner Lake is also reported. The goals were developed by the plant committee and reflect the concerns resulting from public involvement, the lake district board of directors, and suggestions from the Wisconsin Department of Natural Resources.

Goals for Aquatic Plant Management

1. Protect and restore healthy native aquatic plant communities.
2. Preserve and restore native shoreline vegetation.
3. Preserve and/or enhance water quality.
4. Prevent the spread of curly leaf pondweed and restore healthy native plant communities in its place.
5. Reduce nuisance levels of aquatic plants (native and non-native) in East Bay (near inflow) to allow for navigation.
6. Reduce filamentous algae in East Bay while monitoring remaining lake.
7. Prevent introduction of new invasive species such as Eurasian Water Milfoil (EWM).
8. Rapidly respond to eliminate any newly introduced invasive, non-native aquatic plant species.

Discussion of Management Methods

Techniques to control the growth and distribution of aquatic plants are discussed in following text. In most cases, a combination of techniques must be used to reach plan goals. The application, location, timing, and combination of techniques must be considered carefully.

Permitting Requirements

The Wisconsin Department of Natural Resources regulates the removal of aquatic plants when chemicals are used and when plants are removed mechanically, or when plants are removed manually from an area greater than thirty feet in width along the shore. The requirements for chemical plant removal are described in Administrative Rule NR 107-Aquatic Plant Management. A permit is required for any aquatic chemical application in Wisconsin.

The requirements for manual and mechanical plant removal are described in NR 109-Aquatic Plants: Introduction, Manual Removal & Mechanical Control Regulations. A permit is required for manual and mechanical removal except for when a riparian (waterfront) landowner manually removes or gives permission to someone to manually remove plants, (with the exception of wild rice) from his/her shoreline limited to a 30-foot corridor. A riparian landowner may also manually remove the invasive plants Eurasian water milfoil, curly leaf pondweed, and purple loosestrife along his or her shoreline without a permit. Manual removal means the control of aquatic plants by hand or hand-held devices without the use or aid of external or auxiliary power.

Biological Control

Biological control is the purposeful introduction of parasites, predators, and/or pathogenic microorganisms to reduce or suppress populations of plant or animal pests. Biological control counteracts the problems that occur when a species is introduced into a new region of the world without a complex or assemblage of organisms that feed directly upon it, attack its seeds or progeny through predation or parasitism, or cause severe or debilitating diseases (i.e., pathogenic microorganisms). With the introduction of native pests to the target invasive organism, the exotic invasive species may be maintained at lower densities.

While this theory has worked in application for control of some non-native aquatic plants, results have been varied (Madsen, 2000). Beetles are commonly used to control purple loosestrife populations in Wisconsin with good success. Weevils are used as an experimental control for Eurasian water milfoil once the plant is established. In other parts of the county, tilapia and carp are used to control the growth of filamentous algae in ponds. Grass carp, and herbivorous fish are sometimes used to feed on pest plant populations. Grass carp introduction is not allowed in Wisconsin.

There are advantages and disadvantages to the use of biological control as part of an overall aquatic plant management program. Advantages include longer-term control relative to other technologies, lower overall costs, as well as plant-specific control. On the other hand, there are several disadvantages to consider, including control times of years instead of weeks, lack of available agents for particular target species, and relatively strict environmental conditions for success.

Biological control is not without risks; new non-native species introduced to control a pest population may cause problem of its own. Biological control is not proposed as a management tool in Spooner Lake. There are no species present that warrant this method.

Re-vegetation with Native Plants
Another aspect to biological control is native plant restoration. The rationale for re-vegetation is that restoring a native plant community should be the end goal of most aquatic plant management programs (Nichols, 1991; Smart and Doyle, 1995). However, in communities that have only recently been invaded by non-native species, a propagule bank probably exists that will restore the community after non-native plants are controlled (Madsen, Getsinger, and Turner, 1994). Re-vegetation following plant removal is probably not necessary in Spooner Lake because it has a very diverse and healthy plant community present.

Physical Control
In physical management, the environment of the plant is manipulated, which in turn acts upon the plants. Several physical techniques are commonly used: dredging, draw down, benthic (lake bottom) barriers, and shading or light attenuation. Because they involve placing a structure on the bed of a lake and/or affect lake water level, a Chapter 30 or 31 DNR permit is required.

Dredging removes accumulated bottom sediments that support plant growth. Dredging is usually not performed solely for aquatic plant management but to restore lakes that have been filled in with sediments, have excess nutrients, need deepening, or require removal of toxic substances (Peterson, 1982). Dredging is not a viable option for aquatic plant management alone. However, dredging might be considered for navigation improvements from the DNR (east) boat landing to the navigation channel in the future. This might be best completed during a drawdown for dam maintenance.

Drawdown, or significantly decreasing lake water levels can be used to control nuisance plant populations. Essentially, the water body has all water removed to a given depth. It is best if this depth includes the entire depth range of the target species. To be effective, drawdowns need to be at least 1 month long to ensure thorough drying (Cooke 1980a). In northern areas, a drawdown in the winter that will ensure freezing of sediments is also effective. Although drawdown may be effective for control of hydrilla for 1 to 2 years (Ludlow 1995), it is most commonly applied to Eurasian water milfoil (Geiger 1983; Siver et al. 1986) and other milfoils or submersed evergreen perennials (Tarver 1980). Drawdown requires that there be a mechanism to lower water levels.

Although drawdown is expensive and has long-term effects (2 or more years), it also has significant environmental effects and may interfere with use and intended function (e.g., power generation or drinking water supply) of the water body during the drawdown period. Lastly, species respond in very different manners to drawdown and often not in a consistent fashion (Cooke 1980a). Drawdowns may provide an opportunity for the spread of highly weedy or adventive species, particularly annuals.

There have been two drawdowns performed in Spooner Lake. One was for the sole purpose of reducing aquatic plants. The results were viewed as relatively positive on a short-term basis. There is no scientific data to verify the result. Drawdown is not being proposed for Spooner Lake for many reasons. If drawdown were used as a management tool, it would have to occur often. This would make plant management more difficult since it would eventually select species that are resistant to drawdown, making it less effective through time. Another is the fact that drawdown potentially has a very dramatic affect on the lake ecosystem beyond the plant community. When this is weighed against the benefits, other options appear better for Spooner Lake as primary management tools.

In the future, if drawdown is necessary for dam maintenance, it may also be considered for aiding in plant management. This may affect the amount of water level reduction and can be evaluated at that time.

Benthic barriers or other bottom-covering approaches are another physical management technique. The basic idea is that the plants are covered over with a layer of a growth-inhibiting substance. Many materials have been used, including sheets or screens of organic, inorganic and synthetic materials, sediments such as dredge sediment, sand, silt or clay, fly ash, and combinations of the above (Cooke 1980b; Nichols 1974; Perkins 1984; Truelson 1984). The problem with using sediments is that new plants establish on top of the added layer (Engel and Nichols 1984). The problem with synthetic sheeting is that the gasses evolved from decomposition of plants and sediment collects under and lifts the barrier (Gunnison and Barko 1992). Benthic barriers will typically kill plants under them within 1 to 2 months, after which they may be removed (Engel 1984). Sheet color is relatively unimportant; opaque (particularly black) barriers work best, but even clear plastic barriers will work effectively (Carter et al. 1994). Sites from which barriers are removed will be rapidly re-colonized (Eichler et al. 1995). In addition, synthetic barriers may be left in place for multi-year control but will eventually become sediment-covered and will allow colonization by plants. Benthic barriers, effective and fairly low-cost control techniques for limited areas (e.g., <1 acre), may be best suited to high-intensity use areas such as docks, boat launch areas, and swimming areas. However, they are too expensive to use over widespread areas, and heavily affect benthic communities by removing fish and invertebrate habitat. A Department of Natural Resources permit would be required for a benthic barrier.

Although a benthic barrier may be a potential option for riparian owners, there is no plan to use this as a management tool by the Spooner Lake District. Since the main use of management tools will be to create navigational channels, benthic barriers are not prudent as the coverage is too extensive and placement would be costly and labor intensive.

Shading or light attenuation reduces the light plants need to grow. Shading has been achieved by fertilization to produce algal growth, by application of natural or synthetic dyes, shading fabric, or covers, and by establishing shade trees (Dawson 1981, 1986; Dawson and Hallows 1983; Dawson and Kern-Hansen 1978; Jorga et al. 1982; Martin and Martin 1992; Nichols 1974). During natural or cultural eutrophication, algae growth alone can shade aquatic plants (Jones et al. 1983). Although light manipulation techniques may be useful for narrow streams or small ponds, in general these techniques are of only limited applicability. As a result, Spooner Lake will not use this management tool.

Manual Removal

Manual removal involving hand pulling, cutting, or raking plants will remove plants from small areas. It is likely that plant removal will need to be repeated during the growing season. Best timing for hand removal of herbaceous plant species is after flowering but before seed head production. For plants that possess rhizomatous (underground stem) growth, pulling roots is not generally recommended since it may stimulate new shoot production. Hand pulling is a strategy recommended for rapid response to a Eurasian water milfoil infestation. If curly leaf pondweed is present at near shore locations in low density, hand pulling by residents may be effective.

Mechanical Control

Larger-scale control efforts require more mechanization. Mechanical cutting, mechanical harvesting, diver-operated suction harvesting, and rotovating (tilling) are the most common forms available. Department of Natural Resources permits under Chapter NR 109 are required for mechanical plant removal.

Aquatic plant harvesters are floating machines that cut and remove vegetation from the water. The cutter head uses sickles similar to those found on farm equipment, and generally cuts from one to six feet deep. A conveyor belt on the cutter head is always in motion, bringing the clippings onboard the machine for storage. Once full, the harvester travels to shore to discharge the load of weeds off of the vessel.

Harvesters come in a variety of sizes, with cutting swaths ranging from four to twelve feet in width. The onboard storage capacity varies as well, and is measured in both volume and weight. Harvester storage capacities generally range from 100 to 1,000 cubic feet of vegetation by volume, or from one to eight tons. They are usually propelled by two paddle wheels that provide excellent maneuverability and will not foul in dense plant growth.

Because large-scale mechanical control tends to be nonselective and leaves plant fragments in the lake, this method is not recommended for Spooner Lake. Also, this method has been used in the past with variable results on Spooner Lake. Most recently it caused extensive accumulation of uprooted and cut plants in many areas of the lake, leading to many complaints. Also, for curly leaf pondweed control, mechanical harvesting would be largely aesthetic in nature as turions can remain and spreading of the plant is likely thereby reducing plant density for a brief time as the plant dies off in mid summer anyway.

If chemical treatment for a navigational channel should be ineffective upon evaluation, further consideration of mechanical harvesting may be prudent. However, this method would need to be used after curly leaf pondweed has undergone senescence (later in summer). In addition, total control of the harvesting would be necessary for successful implementation including purchasing a harvester.

Diver dredging operations use pump systems to collect plant and root biomass. The pumps are mounted on a barge or pontoon boat. The dredge hoses are from 3 to 5 inches in diameter and are handled by one diver. The hoses normally extend about 50 feet in front of the vessel. Diver dredging is especially effective against pioneering infestations of submersed invasive plant species. When a weed is discovered in a pioneering state, this methodology should be considered. To be effective, the entire plant, including the subsurface portions, should be removed.

Plant fragments can be formed from this type of operation. Fragmentation is not as great a problem when infestations are small. Diver dredging operations can be an ongoing mission. When applied toward a pioneering infestation, control can be complete. However, periodic inspections of the lake should be performed to ensure that all the plants have been found and collected.

Lake substrates can play an important part in the effectiveness of the operation. Soft substrates are very easy to work in. Divers can remove the plant and root crowns with little problem. Hard substrates, however, pose more of a problem. Divers may need hand tools to help dig the root crowns out of hardened sediment. The areas of Spooner Lake that need management are too large for this method.

Rotovation involves using large underwater rototillers to remove plant roots and other plant tissue. Rotovators can reach bottom sediments to depths of 20 feet. Rotovating may significantly affect non-target organisms and water quality as bottom sediments are disturbed. However, the suspended sediments and resulting turbidity produced by rotovation settles fairly rapidly once the tiller has passed. Tilling sediments that are contaminated could possibly release toxins to the water column. If there is any potential of contaminated sediments in the area, further investigation should be performed to determine potential impacts from this type of treatment. Tillers do not operate effectively in areas with many underwater obstructions such as trees and stumps. There may be a need to collect the plant material that is tilled from the bottom. If operations release large amounts of plant material, harvesting equipment should be on hand to collect this material and transport it to shore for disposal.

For Spooner Lake, rotovation would release excessive sediment and plant fragments. Also, potential treatment will likely be aimed at non-native plants. Rotovation is not a good option for non-native plant control, as it could increase spreading of non-native plants from plant fragments.

Herbicide and algaecide treatments

Herbicides are chemicals used to kill plant tissue. Currently, no product can be labeled for aquatic use if it poses more than a one in a million chance of causing significant damage to human health, the environment, or wildlife resources. In addition, it may not show evidence of biomagnification, bioavailability, or persistence in the environment (Joyce, 1991). Thus, there are a limited number of active ingredients that are assured to be safe for aquatic use (when used according to the label) (Madsen, 2000).

An important caveat is that these products are safe when used according to the label. The U.S. Environmental Protection Agency (EPA)-approved label gives guidelines protecting the health of the environment, the humans using that environment, and the applicators of the herbicide. In most states, additional permitting or regulatory restrictions on the use of these herbicides also apply. Most states require these herbicides be applied only by licensed applicators. Wisconsin Department of Natural Resources permits under Chapter NR 107 are required for herbicide application.

Herbicide use will likely be the main management tool for Spooner Lake. Considering the potential treatment areas, costs, location and time of season, this option is most viable.

General descriptions of chemical control are included below.

Contact Herbicides
Contact herbicides act quickly and are generally lethal to all plant cells that they contact. Because of this rapid action, or other physiological reasons, they do not move extensively within the plant and are effective only where they contact plants. For this reason, they are generally more effective on annuals (plants that complete their life cycle in a single year). Perennial plants (plants that persist from year to year) can be defoliated by contact herbicides but they quickly resprout from unaffected plant parts. Submersed aquatic plants that are in contact with sufficient concentrations of the herbicide in the water for long enough periods of time are affected but regrowth occurs from unaffected plant parts, especially plant parts that are protected beneath the sediment. Because the entire plant is not killed by contact herbicides, retreatment is necessary, sometimes two or three times per year. **Endothall, diquat** and **copper** are contact aquatic herbicides.

Systemic Herbicides
Systemic herbicides are absorbed into the living portion of the plant and move within the plant. Different systemic herbicides are absorbed to varying degrees by different plant parts. Systemic herbicides that are absorbed by plant roots are referred to as soil active herbicides and those that are absorbed by leaves are referred to as foliar active herbicides. Some soil active herbicides are absorbed only by plant roots. Other systemic herbicides, such as glyphosate, are only active when applied to and absorbed by the foliage. **2,4-D, dichlobenil, fluridone, and glyphosate** are systemic aquatic herbicides. When applied correctly, systemic herbicides act slowly in comparison to contact herbicides. They must move to the site of action in the plant. Systemic herbicides are generally more effective for controlling perennial and woody plants than contact herbicides. Systemic herbicides also generally have more selectivity than contact herbicides.

Broad Spectrum Herbicides
Broad spectrum (sometimes referred to as nonselective) herbicides are those that are used to control all or most vegetation. This type of herbicide is often used for total vegetation control in areas such as equipment yards and substations where bare ground is preferred. **Glyphosate** is an example of a broad spectrum aquatic herbicide. **Diquat, endothall, and fluridone** are used as broad spectrum aquatic herbicides, but can also be used selectively under certain circumstances. For example, you can use them to selectively kill an individual plant or plants in a limited area such as a swimming zone.

Selective Herbicides
Selective herbicides are those that are used to control certain plants but not others. A good example of selective aquatic herbicide is 2,4-D, which can be used to control Eurasian water milfoil with minimum impact on water celery. Herbicide selectivity is based upon the relative susceptibility or response of a plant to an herbicide. Many related physical and biological

factors can contribute to a plant's susceptibility to an herbicide. Physical factors that contribute to selectivity include herbicide placement, formulation, and rate of application. Biological factors that affect herbicide selectivity include physiological factors, morphological factors, and stage of plant growth.

Environmental Considerations
Aquatic communities consist of aquatic plants including macrophytes (large plants) and phytoplankton (free floating algae), invertebrate animals (such as insects and clams), fish, birds, and mammals (such as muskrats and otters). All of these organisms are interrelated in the community. Organisms in the community require a certain set of physical and chemical conditions to exist such as nutrient requirements, oxygen, light, and space. Aquatic weed control operations can affect one or more of the organisms in the community which can in turn affect other organisms or water chemistry. The effects of aquatic plant control on the aquatic community can be separated into direct or indirect effects of the herbicides.

General descriptions of the breakdown of commonly used aquatic herbicides are included below.[21]

<u>Copper</u>
Copper is a naturally occurring element that is essential at low concentrations for plant growth. It does not break down in the environment, but it forms insoluble compounds with other elements and is bound to charged particles in the water. It rapidly disappears from water after application as an herbicide. Because it is not broken down, it can accumulate in bottom sediments after repeated high application rates. Accumulation rarely reaches levels that are toxic to organisms or significantly above background concentrations in the sediment.

<u>2,4-D</u>
2,4-D photodegrades on leaf surfaces after applied to leaves and is broken down by microbial degradation in water and sediments. Complete decomposition usually takes about 3 weeks in water and can be as short as 1 week. 2,4-D breaks down into naturally occurring compounds.

<u>Diquat</u>
When applied to enclosed ponds for submersed weed control, diquat is rarely found longer than 10 days after application and is often below detection 3 days after application. The most important reason for the disappearance of diquat from water is that it is rapidly taken up by aquatic vegetation and bound tightly to particles in the water and bottom sediments. When bound to certain types of clay particles diquat is not biologically available. When it is bound to organic matter, it can be slowly degraded by microorganisms. When diquat is applied foliarly, it is degraded to some extent on the leaf surfaces by photodegradation, and because it is bound in the plant tissue, a proportion is probably degraded by microorganisms as the plant tissue decays. Diquat or another broad spectrum herbicide will be the chemical of choice for late season navigational channel treatments.

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[21]These descriptions are taken from Hoyer/Canfield: Aquatic Plant Management. North American Lake Management Society. 1997.

Endothall

Like 2,4-D, endothall is rapidly and completely broken down into naturally occurring compounds by microorganisms. The by-products of endothall dissipation are carbon dioxide and water. Complete breakdown usually occurs in about 2 weeks in water and 1 week in bottom sediments. This will be the chemical of choice for early season CLP treatments.

Fluridone

Dissipation of fluridone from water occurs mainly by photodegradation. Metabolism by tolerant organisms and microbial breakdown also occurs, and microbial breakdown is probably the most important method of breakdown in bottom sediments. The rate of breakdown of fluridone is variable and may be related to time of application. Applications made in the fall or winter when the sun's rays are less direct and days are shorter result in longer half-lives. Fluridone usually disappears from pond water after about 3 months but can remain up to 9 months. It may remain in bottom sediment between 4 months and 1 year.

Glyphosate

Glyphosate is not applied directly to water for weed control, but when it does enter the water it is bound tightly to dissolved and suspended particles and to bottom sediments and becomes inactive. Glyphosate is broken down into carbon dioxide, water, nitrogen, and phosphorus over a period of several months.

Algaecide Treatments for Filamentous Algae

Copper-based compounds are generally used to treat filamentous algae. Common chemicals used are copper sulfate and Cutrine Plus, a chelated copper herbicide, has been used on Spooner Lake in the past

Herbicide Use to Manage Invasive Species

Curly Leaf Pondweed

The Army Corps of Engineers Aquatic Plant Information System (APIS) identifies three herbicides for control of curly leaf pondweed: Diquat, Endothall, and Fluridone. Fluridone requires exposure of 30 to 60 days making it infeasible to target a discreet area in a lake system. The other herbicides act more rapidly. Herbicide labels provide water use restriction following treatment. Diquat (Reward) has the following use restrictions: drinking water 1-3 days, swimming and fish consumption 0 days. Endothall (Aquathol K) has the following use restrictions: drinking water 7 – 25 days, swimming 0 days, fish consumption 3 days.

Early season herbicide treatment:[22]

Studies have demonstrated that curly leaf can be controlled with Aquathol K (a formulation of Endothall) in 50 - 60 degree F water, and that treatments of curly leaf this early in its life cycle can prevent turion formation. Several lakes in northwestern Wisconsin use early season treatment with Endothall to control curly leaf pondweed.

[22] Research in Minnesota Control of Curly Leaf Pondweed. Wendy Crowell, Minnesota Department of Natural Resources. Spring 2002.

Because the dosage is at lower rates than dosage recommended on the label, a greater herbicide residence time is necessary. To prevent drift of herbicide and allow greater contact time, application in shallow bays is likely to be most effective. Calm winds are also desirable to maintain herbicide contact in the treatment area. Herbicide applied to a narrow band of vegetation along the shoreline is likely to drift, rapidly decrease in concentration, and be rendered ineffective.[23]

CLP Turion Monitoring

Turions are the reproductive structures from which new CLP plants will germinate in late fall and early spring. CLP turions can live in lake sediments for many years. A primary objective of the CLP herbicide treatment program is to kill CLP plants before they can form turions, thereby depleting the turion bank in the sediments and preventing future CLP growth.

Turion monitoring measures the density of turions in the sediment. Turion sediment monitoring is conducted late in the summer after CLP plants die back. A sediment sampler is used to collect bottom sediment at several randomly selected sample points within the treatment beds. The sample is then filtered with a filter bucket, and the turions are counted. Because the sample collection area is known, the number of turions per square meter of lake bed can be estimated.

Repeated years of turion density measurements provide a means to predict the following year's CLP growth and to evaluate the long term effectiveness of the herbicide treatment program. The data will aid in decisions regarding continuation or suspension of herbicide treatment. Turion monitoring is recommended for Spooner Lake CLP management.

Eurasian water milfoil

The Army Corps of Engineers Aquatic Plant Information System (APIS) identifies the following herbicides for control of Eurasian water milfoil: Complexed Copper, 2,4-D, Diquat, Endothall, Fluridone, and Triclopyr. Herbicide use may be necessary to rapidly respond to an infestation if discovered in Spooner Lake.

[23] Personal communication, Frank Koshere. Wisconsin DNR. March 2005.

Historical Plant Management Practices[24]

Drawdown
In the fall of 1984, Spooner Lake went through a drawdown to attempt to reduce what was recognized as extensive aquatic plant growth that had been occurring for the past 20 years. The lake was refilled in spring 1985. Informal reports from various interested parties were that the drawdown was a success. There is virtually no plant data available pre and post drawdown, therefore, there is no data to validate this claim[25]. The Wisconsin DNR did state that the plant community was largely made up of species susceptible to drawdown techniques and that the plants were growing less the following year. The fisheries did seem to respond positively to the drawdown. It was reported that the largemouth bass fishing was outstanding. A fish survey was conducted in 1989 (five years after drawdown). The report contained the following significant points:

- More large northern pike in 1989 than in 1984.
- Twice as many largemouth bass were sampled in 1989 vs. 1984.
- Walleye appear to be almost gone.
- Pan fish growth is less than the average in lakes of northwest Wisconsin.

In 1995 another drawdown was performed for repairing the dam. Information is sketchy, but it appears it was only a one-foot level reduction. There was no information as to the plant or fisheries response.

In past years, some mechanical harvesting has occurred. One summer, the mechanical harvest was reported as a success, with noticeable reduction in aquatic plants. On another occasion, the harvest was reported as a failure with many plant fragments floating around in the lake. The actual data of these treatments were not available.

[24] From Wisconsin DNR files on Spooner Lake. Viewed January 11, 2007 and via email October 30, 2012.
[25] Larry Dammon, Wisconsin DNR Fish Biologist stated he was unable to locate this information.

Chemical Treatments[26]

Table 8. Chemical Treatment History

Date	Treatment	Acres Treated
7/12	Navigational channel for Spooner Lake P&R District: Tribune (Diquat)	5.11
07	Navigational channel for Spooner Lake P&R District: Tribune	5.11
6/06-8/06	Private riparian owners: Aquathol K, Cultrine Plus, Reward	0.69
6/05	Private riparian owners: chemicals not noted	0.52
6/04	Private riparian owners: Aquathol K, Cutrine Plus, Reward	0.69
6/03	Private riparian owners: Aquathol K, Cultrine Plus, Reward	0.34
7/02	Private riparian owners: Aquathol K, Copper Sulfate, Reward	1.26
7/02	Navigational channel for Spooner Lake P&R District: Copper Sulfate, Reward	5.85
6/01	Navigational channel for Spooner Lake P&R District: Aqualthol K, Copper Sulfate	5.85
7/01	Private riparian owners: Hydrothol Gran, Copper Sulfate, Reward, 2-4 D LVG Ester	3.76
8/01	Navigational channel for Spooner Lake P&R District: Reward	5.85
7/00	Navigational channel for Spooner Lake P&R District: Aquathol K, Reward, Copper Sulfate	6.9
6/00	Navigational channel for Spooner Lake P&R District: Aquathol K, Copper Sulfate, Reward	6.9
6/00	Private riparian owners: Aquathol K, Hydrothol, Copper Sulfate, Reward	2.15
6/00	Private riparian owners: Aquathol K, Hydrothol, Copper Sulfate, Reward	1.47
6/99	Private riparian owners: chemicals not noted	0.64
6/98	Private riparian: owners: Aquathol K, Hydrothol, 2-4 D, Cutrine T, Copper Sulfate, Aquakleen[27]	0.64
7/97	Private riparian owners: chemicals not noted	0.64

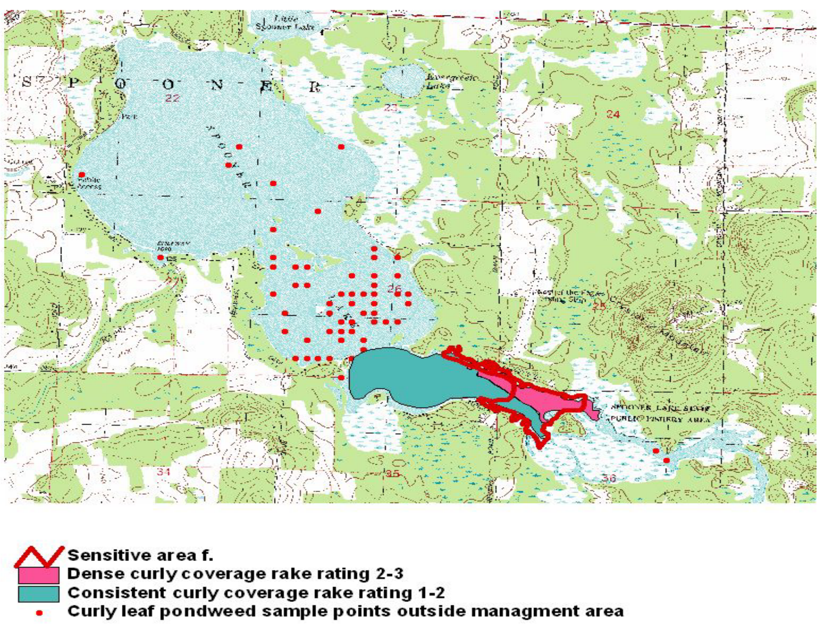
[26] From files provided by Wisconsin DNR, Spooner Office, January 2007.
[27] This chemical was recorded in the treatment files from June 8, 1998 in a hand written note. This chemical name was not very legible and is written here as it appears.

As Table 8 indicates, many chemical treatments were carried out prior to the 2007 aquatic plant management plan. However, treatments were limited in acres, and only the navigational channel was treated by the Spooner Lake P&R District. In addition, the navigational channel has been marked with buoys every year since beginning this management.

Curly Leaf Pondweed Control 2008-2012

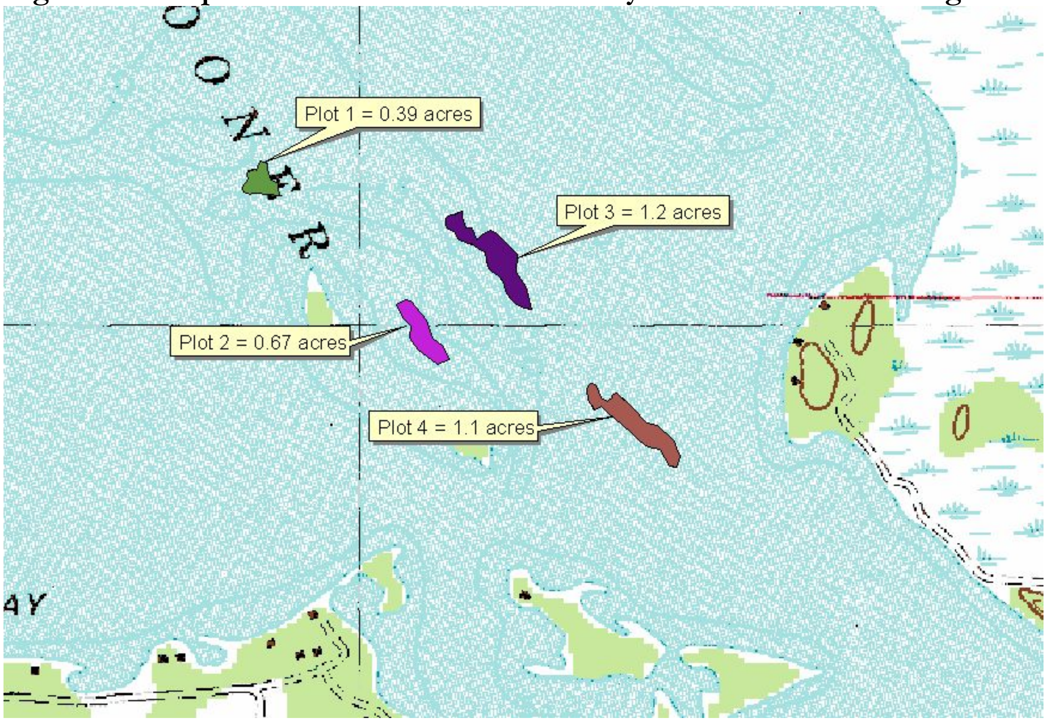
The map in Figure 14 illustrates the coverage of CLP in Spooner Lake in 2006. CLP growth was concentrated near the inlet in the East Bay. Density of CLP decreased in the main basin of the lake. The strategy for CLP control in the 2007 plan was to treat beds that were a nuisance or an area of concern. <u>Nuisance areas</u> were defined as areas of dense growth (rake density of 3, aerial coverage > 80%) with plant growth reaching the surface to impede navigation. <u>Areas of concern</u> were defined as small beds approaching nuisance levels. An early season treatment of Endothall has been used to target CLP and avoid impacts to native plants. The overall objective was to prevent spread into the main basin of the lake. To accomplish this, the objective for the treatment beds was to have a 90% reduction in CLP coverage by area and a mean density rating during a post treatment survey of <1.

Figure 14. Curly Leaf Pondweed (*Potamogeton crispus*) Locations 2006



The stands originally proposed for treatment were small, isolated, dense areas of curly leaf pondweed. These beds were chosen for treatment since they were dominated by CLP and were in the main lake where CLP coverage was limited. The beds shown in Figure 15 below were mapped in 2007. The terms beds and plots are used interchangeably in monitoring reports.

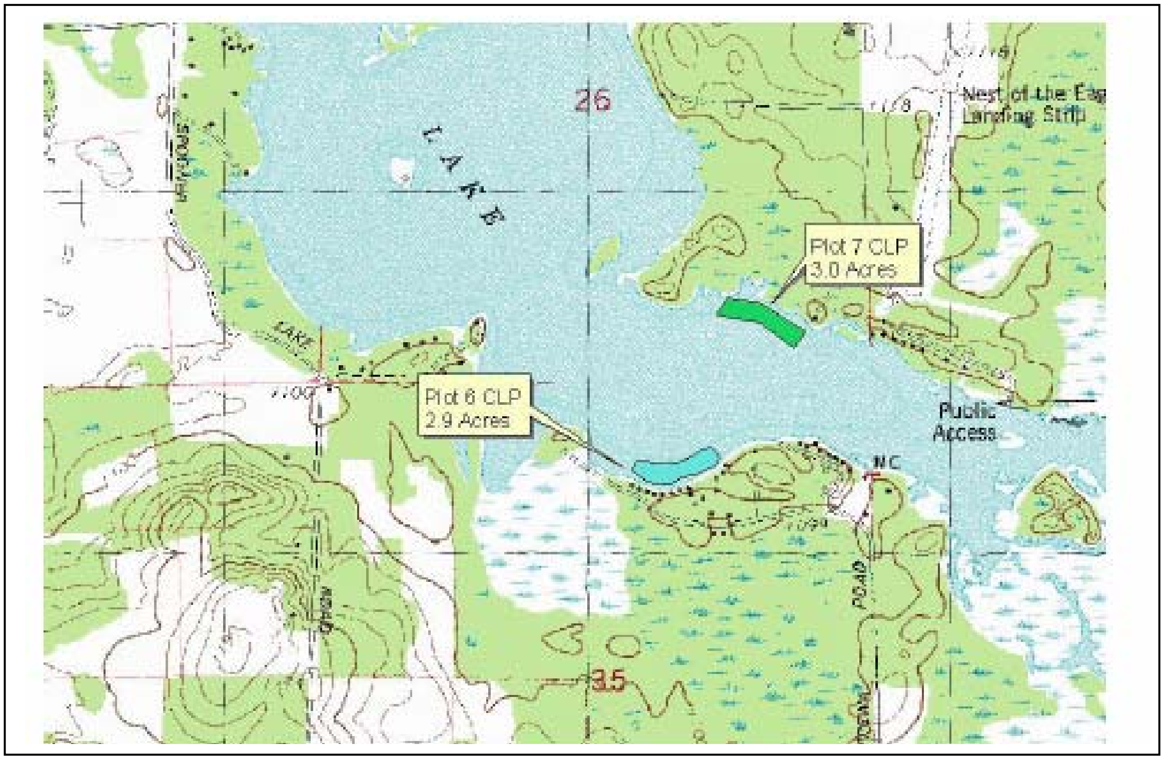
Figure 15. Proposed Sites for Small-scale Curly Leaf Pondweed Management (2007)

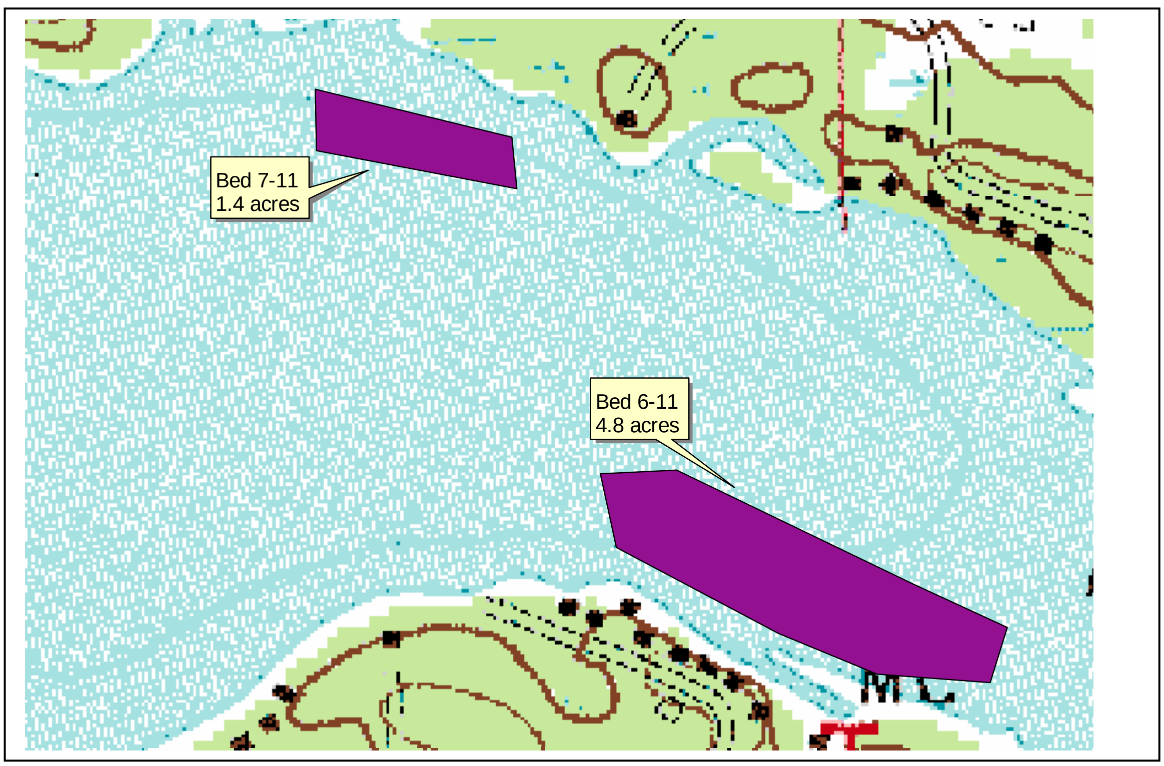


Standard DNR methods were used for pre and post treatment monitoring of curly leaf pondweed. This includes verifying presence of CLP prior to treatment and taking rake density samples within treatment beds following treatment. Native plant rake density measurements were recorded during pre and post treatment to assess impact of treatment.

Curly leaf pondweed management was supported by AIS Control Grant ACEI-045-08 with early season Endothall treatments in May of 2008, 2009, 2010, and 2011. Beds 1-4 were treated each year. Pre and post monitoring occurred in 2009, 2010, 2011, and 2012. Beds 6 and 7 were treated in 2009, 2010, and 2011. Excerpts from the monitoring reports follow. These have been submitted in full to the Department of Natural Resources for grant reporting.

Figure 16. Location of CLP Beds 6 and 7





On May 22, 2009 an early season Endothall application was used to treat curly leaf pondweed in Spooner Lake. There were six different plots totaling 8.66 acres. A pre and post treatment survey was conducted in April and June respectively. A chi square analysis to evaluate the frequency of occurrence and a t-test to evaluate the density changes were conducted. The data suggests that the treatment was effective at reducing the density and the frequency of occurrence in the 4 plots from 2008 to 2009 and in two plots between the pre treatment and the post treatment surveys.

2010, 2011, and 2012 treatments were all successful at reducing seasonal growth of curly leaf pondweed. However, there was not a significant reduction in frequency between 2009 and 2010. Table 9 summarizes CLP treatments from 2008-12.[28]

Table 9. Summary of Treated CLP Beds by Year

Year	Acres Treated	Beds Treated	Sig. Freq. Reduction from Previous Year?	Sig Density Reduction from Previous Year?
2008	3.36	(4) 1, 2, 3, 4	NA	NA
2009	8.66	(6) 1, 2, 3, 4, 6, 7	Yes	Yes
2010	10.3	(6) 1, 2, 3, 4, 6, 7	No	No
2011	8.3	(6) 1, 2, 3, 4, 6, 7	Yes	Yes
2012	9.45	(6) Not the same beds – maybe 1 and 6		

Table 10 summarizes changes in originally targeted beds 1-4 only. Area coverage reduction goal of 90% in these beds has been exceeded.

Table 10. Change in Beds 1-4

	Acres Treated	Post Freq	Change Freq	Change in Acres	
2008	3.36	0.92			
2009	3.36	0.35	-0.57	0	
2010	1.83	0.32	-0.03	-1.52	
2011	2.13	0.05	-0.27	0.3	
2012	0.14	0	-0.05	-1.99	Bed 1 only
overall			0.92	**3.22**	**99% reduction**

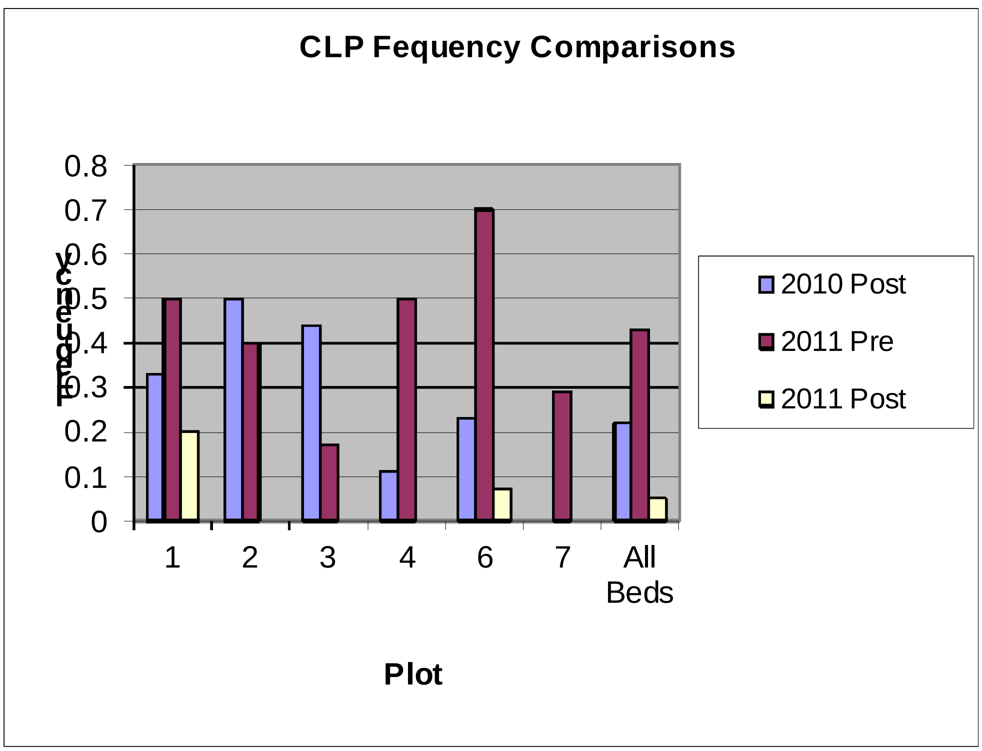
[28] Information in Tables 9 and 10 is from DNR treatment records and annual CLP monitoring reports.

An analysis of reductions in CLP growth in each bed between 2010 and 2011 follows as an example of monitoring reporting. As the data shows, the reduction of CLP was significant in 2011. There were only two samples points that had CLP present in the 2011 post treatment survey (one in Plot 1 and one in Plot 6). When comparing the post treatment frequency in 2010 to the post treatment to 2011 all plots had reductions (except Plot 7 which went from 0 to 0). The pretreatment survey, which reflects new growth from turions, also showed reduction in each bed, including Plot 7. The reduction was statistically significant in both comparisons.

Table 11. 2010 and 2011 Treatment Results

Plot	*2010 Freq*	*2011 Pre*	*2011 Post*	*Change10/11*	*Change Pre/Post*
1	0.33	0.5	0.2	-	-
2	0.5	0.4	0	-	-
3	0.44	0.17	0	-	-
4	0.1	0.5	0	-	-
6	0.23	0.7	0.07	-	-
7	0	0.29	0	**nc**	-
All	0.22	0.43	0.05	-	-
				p=0.02	p=0.0003

Figure 17. Graph of CLP Frequency Comparisons

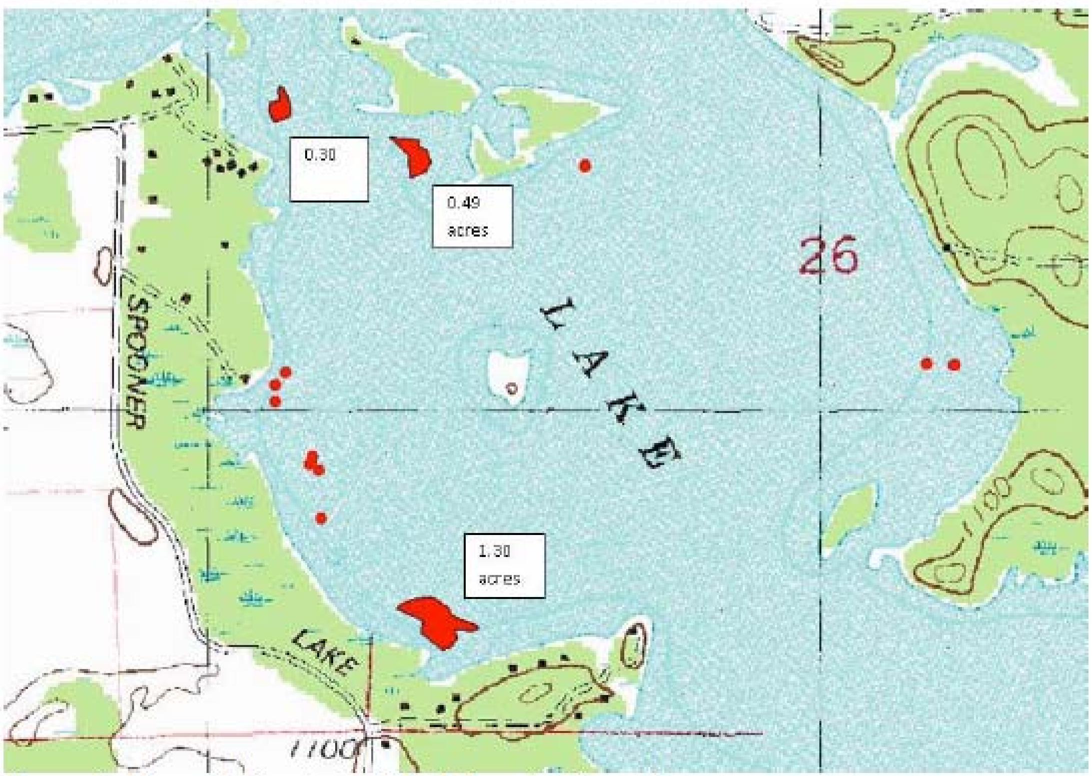


New CLP Treatment Areas 2011

CLP beds were remapped during peak growth of CLP in June 2011. The CLP growth in Spooner Lake has changed significantly since the plant survey in 2007. There is less CLP, and beds are better defined. Figures 18 and 20 indicate where the CLP beds were delineated in Spooner Lake during June 2011. The red dots in Figure 18 are not beds, but locations of single plants or small clumps.

In 2011, A total of 10.3 additional acres of CLP was delineated that would meet the threshold for treatment as outlined in the 2007 Spooner Lake Aquatic Plant Management Plan. This is in addition to the treated areas from the previous year. The largest of these new beds are within sensitive area site F near the public access.

Figure 18. Delineated CLP Beds June 2011 – Northern Map



Treatment of 9.45 acres of CLP occurred without grant funding in 2012. The 2012 report is included as Appendix B. CLP beds mapped following 2012 treatment are shown in red below (Figure 20).

Figure 19. 2012 CLP Treatment Beds

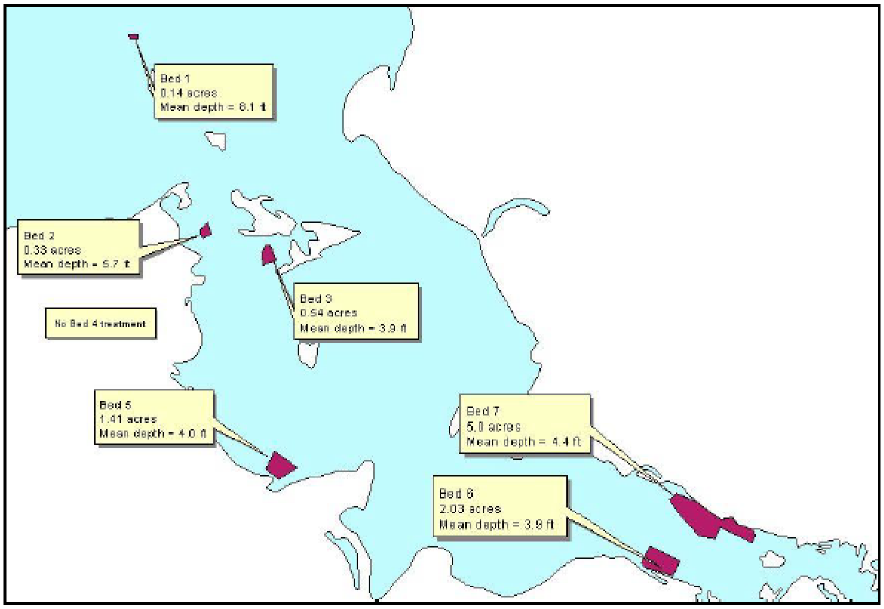
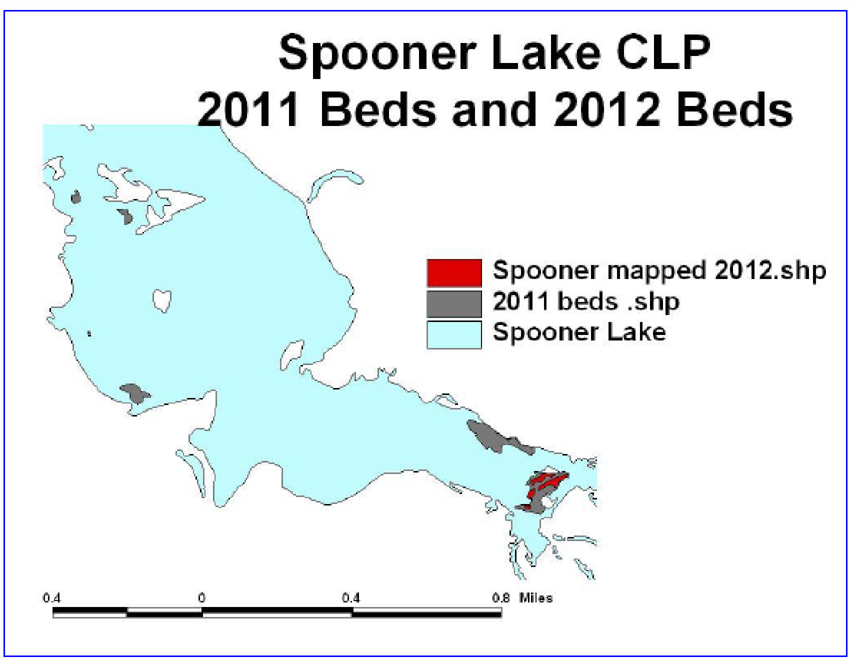


Figure 20. CLP Beds in June 2011 and 2012



Clean Boats Clean Waters

The Clean Boats, Clean Waters monitoring program began on Spooner Lake on Memorial Day weekend 2008. In 2010 the west boat landing was staffed on 10 weekends serving 239 boats and exceeding the minimum grant requirement of 200 staffed hours. In 2011 there were 582.75 hours staffed at the west landing, and 431 of these were paid. In 2012 there were 550.75 hours staffed, and 474.75 of these were paid. In 2012 staffing began the first weekend of May with the fishing opener and continued through Labor Day weekend.

Adults and students staff the landing. Volunteer coordinator, Ron Boushon, provides many of the staffing hours. In addition, he supervises training for new volunteers using the CBCW training video. Signs alerting boaters to take appropriate aquatic invasive species precautions and to identify curly leaf pondweed and Eurasian water milfoil are present at both the main landing and the DNR landing on the southeast side of the lake.

Public Education

Public education about aquatic plant management on Spooner Lake is provided via meetings, semi-annual newsletters, and the web site. District meetings are held each year Memorial Day and Labor Day weekends. The web site will include information about the Clean Boats, Clean Waters monitoring, what owners can do to prevent introduction of invasive species, invasive species identification, and aquatic plant management plan implementation, among other topics. The web site address is spoonerlakewi.com.

Boat Washing Station

A boat washing statement for the main boat landing is under consideration. Washing stations can be added to a watercraft inspection and education program to ensure removal of attached plant material, invertebrates, and other substances from boats and trailers. Signs can direct landing visitors to visit the wash station prior to entry and as leaving the lake. When present, Clean Boats, Clean Waters volunteers can explain the importance of boat washing and direct visitors to the washing station.

The Department of Natural Resources trialed a portable boat washing station at the Town of Spooner (west) Landing on the DNR-owned parking lot in the summer of 2012. This was part of the DNR Water Guard program. The Lake District has considered a boat washing station in this same location in recent years.

Implementation Plan

Educational activities will be critical to reach all of the plan goals. One of the first tasks is to raise awareness about the plan itself. Educational methods for the Spooner Lake District will include meetings, newsletters, printed information, and the web site to reach residents. Educational messages are included for each of the plan goals.

Responsible Parties for Plan Implementation and Monitoring

Spooner Lake Protection and Rehabilitation District Board – elected representatives responsible for oversight of lake management district. Some actions such as hiring a contractor or consultant require a vote of the board.

Aquatic Plant (AP) Committee -

> **Aquatic Plant Management (APM) Lead** – makes day-to-day aquatic plant management decisions and directs contractors in herbicide treatments and related monitoring. The APM Lead may have interns, volunteers, and consultants to assist in these activities. The APM Lead is currently Mike Saunders.
>
> **Aquatic Invasive Species (AIS) Lead** – leads and coordinates volunteer and staffed aquatic invasive species education activities including Clean Boats, Clean Waters monitoring and education at the boat landings. The AIS Lead is currently Ron Boushon.
>
> **AIS Identification (ID) Lead** – is the lead monitor for Eurasian water milfoil (EWM) and the initial contact for suspected EWM identification on the lake. The AIS ID Lead is currently Joe Cuskey.
>
> **AP Committee Members** – assist with aquatic plant management activities including monitoring as needed. Committee membership includes Joe Banick in addition to those listed above.

Herbicide Contractor – the herbicide applicator hired by the Lake District Board to complete herbicide treatment as permitted by the Wisconsin Department of Natural Resources. The herbicide contractor is currently Lake Restoration.

APM Monitor– a consultant hired to complete monitoring under the direction of the APM Lead and the Board. The APM Monitor is currently Steve Schieffer of Ecological Integrity Service.

DNR – Lakes staff will review aquatic plant management plans, grants, and permit applications, enforce permit conditions, and confirm aquatic invasive species identification.

Washburn County LWCD – Staff from the Washburn County Land and Water Conservation Department will assist with education and plant identification.

Goals for Aquatic Plant Management

1. Protect and restore healthy native aquatic plant communities.

2. Preserve and restore native shoreline vegetation.

3. Preserve and/or enhance water quality.

4. Prevent the spread of curly leaf pondweed and restore healthy native plant communities in its place.

5. Reduce nuisance levels of aquatic plants (native and non-native) in East Bay (near inflow) to allow for navigation.

6. Reduce filamentous algae in East Bay while monitoring remaining lake.

7. Prevent introduction of new invasive species such as Eurasian Water Milfoil (EWM).

8. Rapidly respond to eliminate any newly introduced invasive, non-native aquatic plant species.

Aquatic Plant Management Plan Outreach

Educational Message
Spooner Lake residents will be aware of this aquatic plant management plan and its planned actions.

Goal 1. Protect and restore healthy native aquatic plant communities.

The plant community in Spooner Lake is very diverse and extensive. Over 90% of the lake area is covered with aquatic plants. Based on phosphorus levels and the water clarity readings, it is speculated that these plants are helping to keep the water clarity in Spooner Lake much higher than expected.

Resident education is critical to aid in understanding of the importance of native aquatic plant communities, and the following information should be stressed. Aquatic plants in Spooner Lake provide key habitat for a diverse fish population. They also prevent shoreline erosion in some critical areas. Although residents have expressed interest in significantly reducing the plant density in Spooner Lake, it is important to understand that these plants play an important role in the lake ecosystem. If the reduction of aquatic plants should occur, it must be done in a systematic, careful manner. Reducing the plant community too much could lead to very adverse effects in Spooner Lake. These could include algae blooms, reduced fish reproduction, and increased sedimentation.

No-wake Zones
Another important message will be to discourage boating disturbance within 100 feet of the shoreline. Although this is a no-wake zone according to state regulation, many boaters still travel close to the shoreline. This activity is strongly discouraged for the following reasons:

- Boats may uproot native plants and break aquatic plants into fragments
- Bare substrate is more likely to be colonized by non-native species
- Plant fragments contribute phosphorus to the water as they decay
- Curly leaf pondweed fragments broken up by boat propellers may root and encourage further uncontrolled spread of this invasive plant.

Waterfront Activities
Waterfront residences can also negatively affect native plant communities by causing disturbance of existing plant beds and altering sediment characteristics. Regular waterfront use like boating, swimming, and clearing removes native aquatic plants. Healthy native plant populations prevent colonization by invasive plants. Erosion and runoff from waterfront property may alter sediment characteristics encouraging spread of invasive plants.

Educational Messages
1a. Explain the functions and values of native aquatic plants in Spooner Lake to lake residents.
1b. Boat only at no-wake speeds within 100 feet of the shoreline. It is the law in Wisconsin.
1c. Erosion and runoff from waterfront property can alter sediment characteristics and encourage invasive plant growth.
1d. Removal of aquatic plants in front of waterfront residences can increase erosion and encourage invasive species establishment.

Goal 2. Preserve and restore native shoreline vegetation.

Native Shoreline Restoration

Native shoreline vegetation is very important to protecting the lake ecosystem. With fairly dense development and a large number of residences with disturbed shorelines, it is important to work to restore these shoreline areas to native vegetation. Shoreline restoration can be encouraged through education discussing the importance of native vegetation on shorelines and encouraging the implementation of restoration practices. Technical and financial assistance can also be made available.

Plan Action Item
The Spooner Lake District will work with Washburn County to develop a program to provide cost sharing and technical assistance to waterfront owners to restore a maximum number of developed lots. The District may secure financing through grants to help facilitate restoration projects.

Educational Messages
2a. Stress the importance of preserving and restoring native shoreline vegetation. 2b. Provide information regarding available technical and financial assistance for shoreline buffer restoration.

Goal 3. Enhance and/or protect water quality.

Nutrient Loading

Spooner Lake is an impoundment system where flowing water is dammed to create a lake. High nutrient levels are generally an issue in flowages. Nutrient inputs can be high in flowages because of large watershed areas. Nutrients lead to more algae growth when water flow is slowed by a dam. For this reason, it is very important that nutrients from the immediate watershed be held to a minimum. It must also be understood that the large amount of nutrients has, and could continue to, lead to increased plant growth. Decreasing nutrient loading could limit increases in macrophyte density and coverage, including those of the non-native curly leaf pondweed.

Spooner Lake is a nutrient rich or eutrophic lake. However, the water clarity has been fairly high considering the nutrients available in the lake. This might be because extensive aquatic plant growth in the lake is removing substantial nutrients from the water column. Therefore, the plant community may be contributing to this higher than expected water clarity[29]. Furthermore, if natural shoreline vegetation is restored in areas where there are lawns and infiltration practices are implemented, the runoff quantity and nutrient loading can be reduced.

[29] Personal communication with Frank Koshere, October 2006.

For these reasons, it is recommended that the plant community in the main part of Spooner Lake (where there are no nuisance stands of plants) be left intact. In addition, it is recommended that infiltration practices and native shoreline restoration be encouraged. Lastly, the sensitive areas designated include many emergent plant stands that can reduce erosion. These areas should be protected.

Historically Spooner Lake has been part of the Citizen Lake Monitoring program mainly monitoring water clarity with Secchi depth measurements. In 2009 the Spooner Lake District began participation in expanded self-help monitoring. This added phosphorus and chlorophyll-a readings to better evaluate long-term trends.

Plan Action Item
Maintain the present native plant community in the main portion of Spooner Lake. There will be no chemical application or harvesting except for treatment of invasive species in these areas unless nuisance levels occur.

Plan Action Item
Continue expanded self-help monitoring, including measurements of chlorophyll-a, total phosphorus, and Secchi depth during the growing season.

Educational Messages
3a. Provide examples of waterfront infiltration practices.
3b. Encourage riparian owners to leave native aquatic plant stands undisturbed.
3c. Native plant restoration along shorelines and infiltration practices can help to reduce runoff and improve water quality.
3d. Leaving native aquatic plants intact in the main lake helps to improve water quality by taking up nutrients and stabilizing lake sediments.

Goal 4. Prevent the spread of curly leaf pondweed and restore healthy native plant communities in its place.

With successful curly leaf pondweed (CLP) treatments in recent years, a change in the management strategy is recommended. The Lake District will go from a strategy of containment to the East Bay to one of reduction and removal of CLP throughout the lake. Annual CLP bed mapping will track CLP growth and be used to plan the following year's treatment. Pre and post and monitoring according to standard DNR methods and turion monitoring will occur in the treatment areas.

Early season treatment with Endothall will continue. The application will take place when the water temperatures are 50-58 degrees F. This will reduce adverse effects on the native plant community as most of those plants will still be in, or just coming out of, dormancy. This timing is also based on protection of fish spawning activities. However crappies, which are present in Spooner Lake, spawn at target treatment temperatures.

Private owners will be provided with information about curly leaf pondweed identification and will be directed to notify the Aquatic Plant Committee AIS ID Lead if they find CLP. The AIS Lead will confirm this and other CLP locations throughout the lake and record them with GPS points. These locations will be provided to the APM Lead. The APM Lead will provide the information to the APM Monitor prior to the CLP bed mapping. Owners may be directed to pull small areas of CLP.

Plan Action Item
Continue will be early season Endothall treatments to control curly leaf pondweed. Treatments will occur between 50-58 degrees F. Target concentration over the beds is 1.5 ppm for beds of 0.5 – 5 acres. Target concentrations may be adjusted downward for larger beds and upward for smaller beds. Treatment methods may be modified as new information becomes available.

Plan Action Item
Map CLP beds annually. Bed mapping standards will be CLP frequency >50% and mean rake density >2. Treatment acreage will be determined with bed mapping results. Given treatment standards, the range might be about 10-20 acres each year.
Conduct pre and post treatment monitoring according to standard DNR methods.
Measure turion density in sediment of CLP beds following treatment.

Plan Action Item
Monitor herbicide residuals if required as a condition of the Department of Natural Resources permit. Herbicide residuals would be monitored because of Tribal concerns regarding the potential impact to wild rice downstream in the Yellow River.

Educational Messages
4a. Explain CLP management methods to Spooner Lake residents.
4b. Carry out proper notification for herbicide treatments as required by the Wisconsin DNR.

Goal 5. Reduce nuisance levels of macrophytes (native and non-native) in East Bay (near inflow).

Individual Access Corridors
Aquatic plants can create nuisances for residents attempting to swim and boat from the shoreline. It is important that riparian owners are aware of importance of native aquatic plants and know that complete removal can be a high risk. Critical habitat can be lost and the chance of colonization by invasive, non-native species can be increased. Chemical treatment for residential access is highly discouraged. In fact, it is illegal to apply aquatic herbicide without a permit. Instead residents should hand pull or rake to allow access to docks.

Residents should be aware that the only time a permit is <u>not</u> required to control aquatic plants is when a waterfront property owner manually removes (i.e., hand-pulls or hand rakes), or gives permission to someone to manually remove plants (except wild rice) from his/her shoreline in an area that is 30 feet or less in width along the shore and is not within a designated sensitive area. In sensitive areas the opening is limited to 25 feet. The non-native invasive plants (Eurasian water milfoil, curly leaf pondweed, and purple loosestrife) may be manually removed beyond 30 feet without a permit, as long as native plants are not harmed. Wild rice removal always requires a permit.

Educational Messages

5a. Residents may not remove native plants along their shorelines using chemical means on Spooner Lake. Hand removal is limited to a width of 30 feet or less along an owner's shoreline. Hand raking is recommended if native plant removal is needed for navigation.

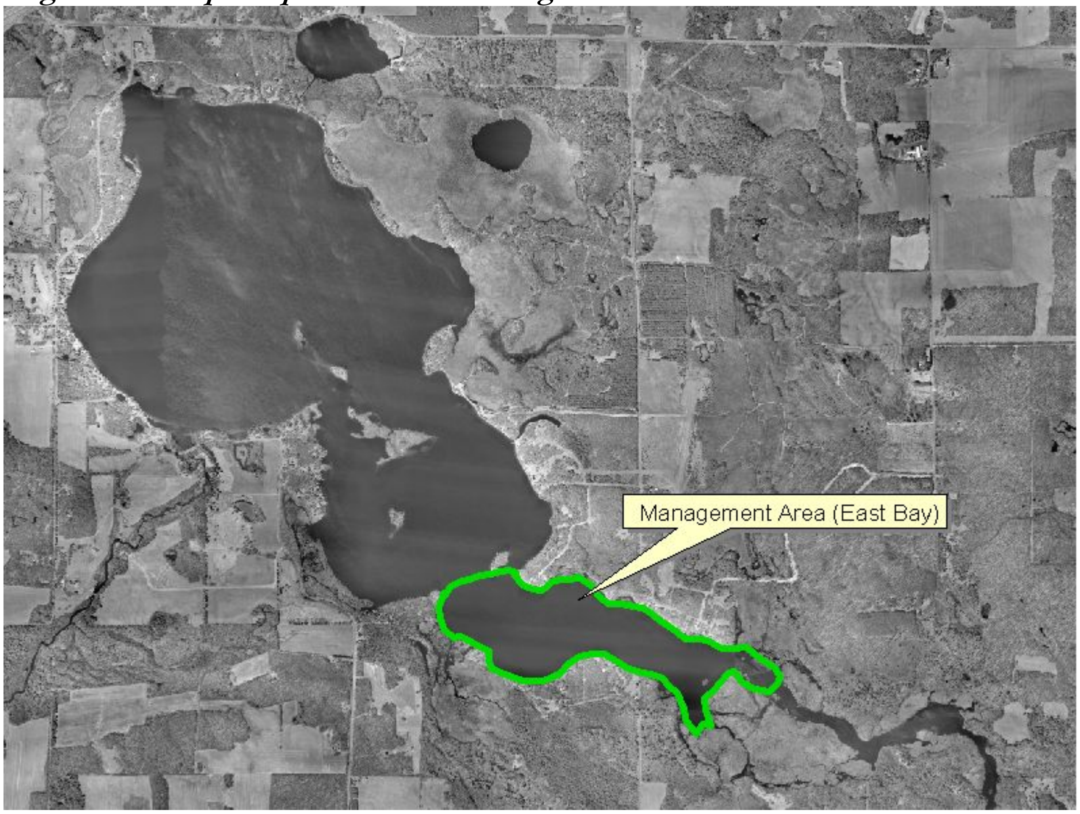
5b. Aquatic plant raking services may be available for hire.

Navigation Channel
A navigation channel may be maintained in the East Bay Management Area as shown in Figure 21 when nuisance conditions arise. Figure 22 shows the navigation channel location. The priority is to maintain the main navigation channel. Branching, secondary channels have not been maintained to date.

Plan Action Item
Inspections and treatment of the navigation channel will be coordinated by the Aquatic Plant Management (APM) Lead following the steps below.

1. The APM lead will inspect the channel on a regular basis and/or in response to complaints.
2. Inspection will measure conditions against treatment standards. These standards include severe navigation impairment, growth of aquatic plants at the surface of the water, and a mean rake density >2. Severe navigation impairment means that it is not possible to boat through the area without backing and potentially removing plant material from boat props. Conditions will be documented with photographs.
3. If treatment standards are met, and the APM Lead judges that herbicide treatment is warranted, the permit process for treatment will be initiated.

Figure 21. Map of Spooner Lake Management Area

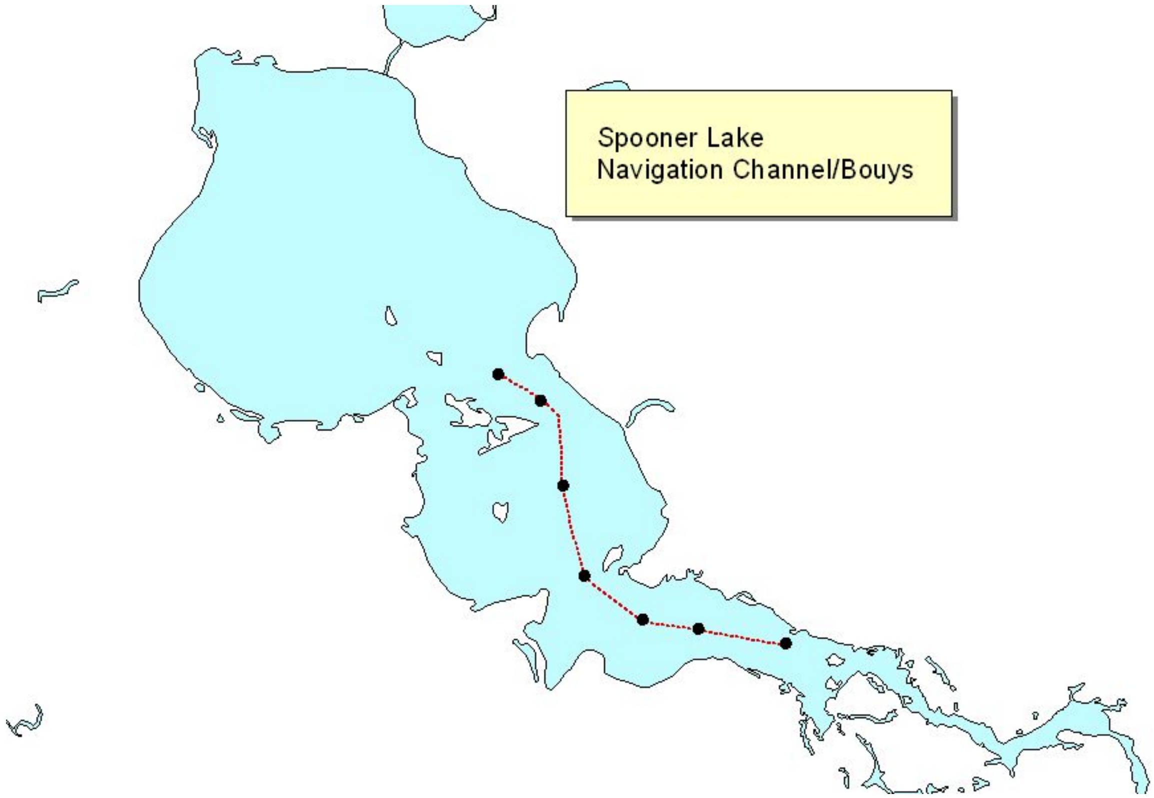


Treatment and Proposed Control Actions
During any given year, the channel may be treated up to two times. Early in the growing season, the non-native aquatic plant curly leaf pondweed may impede navigation. This may provide cause for an early season treatment using standards and procedures established elsewhere in the plan. Because a narrow corridor is treated, higher treatment concentrations might be used.

Navigation impairment from native plants may result in herbicide treatment later in the summer. The chemical for late season navigational channel treatment will be a broad spectrum herbicide such as Diquat. Chemical use will be based on effectiveness, environmental concerns, and biological considerations such as fish species and native plant species present.

All chemical treatments can have adverse affects. In the case of curly leaf pondweed treatment, non-native plants that are not being targeted could be affected, especially those bordering the application plot. All species are targeted within the navigational channel. However, over-spray and drift may cause plant kill in areas somewhat wider than the fifty foot channel. The channel does go near a designated sensitive area. Precaution will be taken to reduce any affect on this area. There is also a period of time after application where fishing warnings will be posted, affecting fishing activities for a short period of time. The amount of chemical application is not likely to affect drinking water supplies.

Figure 22. Navigation Channel Map



Oxygen Monitoring
Pre-treatment dissolved oxygen levels should be monitored prior to potential late season treatments. As the water warms and plants die off, oxygen levels can become depleted. If lake oxygen levels are low, plant decomposition resulting from treatment could possibly reduce oxygen even more. If the dissolved oxygen prior to a late season (July or August) treatment in the navigational channel is lower than 6 mg/L (ppm) in any one of several sample points along the entire channel treatment area, the Wisconsin DNR will be consulted for advice on treatment. The APM Lead or Aquatic Plant Committee volunteers will monitor oxygen levels prior to and following any navigation treatment and twice a month throughout the growing season.

Treatment Evaluation
At the end of the growing season, the effectiveness of navigational channel treatment will be evaluated. If the treatment has been ineffective, the Aquatic Plant Committee will meet and review optional and/or alternative treatments if available.

Plan Action Item
Maintain a navigational channel through the East Bay management area in years of heavy plant growth. The channel may be up to 50 feet wide and may follow established map of a main channel and three secondary channels as shown in Figure 22. Less treatment is an option. Treatment may be done up to two times each summer, depending on status of the channel. The channel will be marked with buoys.

Plan Action Item
Monitor oxygen levels prior to and after treatment.
Monitor dissolved oxygen levels twice each month from May to September to provide a baseline.

Plan Action Item
Evaluate effectiveness and options for navigation channel treatment. APM Lead will evaluate effectiveness following channel treatment based upon treatment standards previously described. The Aquatic Plant Committee will review effectiveness of treatments and consider future options with recommendations from the APM Lead, Department of Natural Resources, and the Herbicide Contractor.

Educational Message
5b. Management of the navigational channel will be clearly communicated to Spooner Lake residents including time of chemical treatment (if used), locations, and the type of chemical used.

Goal 6. Reduce filamentous algae in East Bay and monitor remaining lake.

The long-term strategy for filamentous algae management is to reduce watershed inputs of phosphorus. This presents a challenge considering the size of the Spooner Lake watershed.

Filamentous algae creates nuisance conditions in late summer when it floats on the surface. For this reason, the Lake District may skim or rake the lake surface to remove the algae.

Additional management methods for filamentous algae will be considered if they become available. Chemical treatments of copper sulfate are currently not permitted in Northern Wisconsin.

Plan Action Item
Remove dead/dying filamentous algae from the lake surface by hand with rakes or other means during July and August. This removal will not involve removing any plants/algae below the surface nor will it involve cutting or pulling any plants or plant parts in the lake.

Educational Message
6a. Filamentous algae growth is caused by nutrients – especially phosphorus in the lake. Reducing phosphorus inputs is the best way to reduce filamentous algae growth in the long term.

Goal 7. Prevent introduction of new invasive species such as Eurasian water milfoil (EWM).

Objective: Lake residents and visitors understand the significance of avoiding invasive species introduction to Spooner Lake.

Objective: Lake residents can identify curly leaf pondweed, Eurasian water milfoil, and other common invasive species threats.

Like any other lake in Wisconsin with a public landing, Spooner Lake has a threat of invasion by non-native, invasive species. Lakeshore resident and lake user education reduces the risk of an invasive species introduction. There are many educational materials available from public sources. Eurasian water milfoil prevention and identification signs are in place at the public landings. Local contacts to confirm identification will be added to the signs.

Clean Boats, Clean Waters
The Clean Boats, Clean Waters program is in force at the Town of Spooner boat landing. This program involves education and equipment inspections. The goal is to educate all lake users about the importance of keeping invasive species out of the lake.

Aquatic Invasive Species Monitoring
Volunteers from the Aquatic Plant Committee will be trained to identify Eurasian water milfoil (EWM), purple loosestrife, Japanese knotweed, and other common invasive species. The areas around the two public boat landings will be the focal points for monitoring, as these are the most likely introduction sites. The area near the inflow will be a third focal point as this could be another introduction site. Areas where northern water milfoil has been sampled should also be monitored as Eurasian water milfoil tends to grow in similar habitats. Lake residents will be encouraged to learn to identify Eurasian water milfoil, curly leaf pondweed, and purple loosestrife and establish a contact for verification of identification.

Plan Action Item
Continue a Clean Boats/ Clean Waters program for Spooner Lake. This includes public access education and inspection. Assistance for training will be provided by Washburn County.

Plan Action Item
Monitor for the presence of Eurasian water milfoil and other aquatic invasive species. Volunteers will monitor the boat landings and other areas of likely EWM introduction. Develop a map that identifies areas where introduction is likely as part of a monitoring kit which includes an aquascope, rake, plant ID plates, phone numbers, bags, and GPS equipment.

Plan Action Item
Consider installation of a boat washing station with the following in mind:

- The wash station will be part of an overall watercraft inspection and education program, not simply a substitute for other prevention steps;
- Washing will be voluntary;
- Water will not wash back to the lake;
- The boat washing facility will be portable; it will be operated only when staff or volunteers are on-site;
- Liability will be assumed by the lake district and safety procedures will be identified and followed;
- Boaters will be asked for feedback on boat washing as part of the CBCW interview;
- Washing will be recommended both entering and leaving the lake.

Plan Action Item
Conduct a whole lake macrophyte survey every 5 years. This survey will follow the DNR guidelines and use the point intercept method of data collection.

Educational Messages
7a. Why invasive species introduction is a concern for Spooner Lake.
7b. Methods to prevent Eurasian water milfoil and other invasive species introduction.
7c. How to identify curly leaf pondweed, Eurasian water milfoil, and other invasive aquatic species. Contact Joe Cuskey (AIS ID Lead) or Joe Banick (Plant Committee) if you have questions about invasive species identification.

Goal 8. Establish a rapid response plan to a new introduction of invasive, non-native species.

Objective: Identify invasive species introductions early.

Objective: Rapidly respond to new invasive species introduction.

Plan Action Item

Follow the Rapid Response Plan in Appendix A.

- Train and support lake resident volunteers to identify Eurasian water milfoil and other invasive plants.
- Maintain a non-lapsing contingency fund of at least $10,000 for removal of invasive species.
- Designate board and resident responsibilities for the Rapid Response Plan.

Implementation Tables

Educational Activities – all Aquatic Plant Management Goals				
Actions[30]	**Timeline**	**$ Estimate**	**Vol. Hours**	**Responsible Parties**[31]
Provide information at lake district meetings	Memorial Day Labor Day	$100	20	Lake District Board
Newsletter	2X/Year	$400	40	Lake District Board – or designate position
Website information	Ongoing	$300	20	Lake District Board – or designate position
Distribute publications	Ongoing	$100	10	Lake District Board
SUBTOTAL ED ACTIVITIES		$900	90	

Goal 2. Preserve and restore native shoreline vegetation.				
Actions	**Timeline**	**$ Estimate**	**Vol. Hours**	**Responsible Parties**
Develop a program to provide technical and financial assistance for shoreline restoration	Ongoing	Varies	40	Washburn County LWCD Spooner Lake District

30 Note that educational messages for each goal are included in the body of the plan.
31 Lake District Board = Spooner Lake Protection and Rehabilitation District
LWCD = Washburn County Land and Water Conservation Department
WDNR = Wisconsin Department of Natural Resources

Goal 4. Prevent the spread of curly leaf pondweed and restore healthy native plant communities in its place.				
Actions[32]	**Timeline**	**$ Estimate**	**Vol. Hours**	**Responsible Parties**
Permit application	February	$225-$475	20	APM Lead WDNR
Temperature monitoring	May		10	APM Lead or Lake Volunteer
CLP pre and post monitoring	April/May,	$1,800	0	APM Monitor[33]
CLP herbicide treatment	May	$5,000 - $10,000	0	Herbicide Contractor[34]
CLP bed mapping	June	$1,200	20	AIS ID Lead APM Monitor
CLP turion monitoring	June/July	$600		APM Monitor
Monitor herbicide residue – if required	May	$200	10	AP Committee WDNR
SUBTOTAL GOAL 4		$9,025 - $14,275	60	

[32] See previous pages for action item detail.
[33] The APM Monitor is currently Ecological Integrity Service, LLC.
[34] The Herbicide Contractor is currently Lake Restoration.

Goal 5. Reduce nuisance levels of macrophytes (native and non-native) in East Bay (near inflow).				
Actions[35]	**Timeline**	**$ Estimate**	**Vol. Hours**	**Responsible Parties**[36]
Inspect plant growth in channel	Growing season		10	APM Lead
Apply for permit (if warranted)	June/July	$125	5	APM Lead WDNR
Monitor oxygen levels	June/July		40	AP Committee WDNR
Treat navigation channel (if warranted)	June/July	$3,000 - $3,500		Herbicide Contractor
Evaluate treatment effectiveness	July/July		5	AP Committee
SUBTOTAL GOAL 5		$3,125 - $3,625	60	

[35] Note that educational messages for each goal are included in the body of the plan.
[36]Lake District Board = Spooner Lake Protection and Rehabilitation District
LWCD = Washburn County Land and Water Conservation Department
WDNR = Wisconsin Department of Natural Resources

Goal 6. Reduce filamentous algae in East Bay and monitor remaining lake.				
Actions[37]	Timeline	**$ Estimate (annually)**	**Vol. Hours**	**Responsible Parties**[38]
Remove algae with rakes or skimming	As desired/needed	$?	40	Spooner Lake District

Goal 7. Prevent introduction of new invasive species such as Eurasian water milfoil (EWM).				
Actions[39]	Timeline	**$ Estimate (annually)**	**Vol. Hours**	**Responsible Parties**
Clean Boats, Clean Waters - staffing	May – Sept.	$8,000 (w/paid staff)	40	AIS Lead
Clean Boats, Clean Waters - training	April/May		5	Washburn County LWCD
Clean Boats, Clean Waters – publications	April/May	$100	5	AIS Lead
Provide training for AIS monitors	Growing season		20	Washburn County LWCD
Monitor for AIS using a monitoring kit	Growing season	$300	20	AP Committee
SUBTOTALGOAL 7		$8,400	90	

[37] See previous pages for action item detail.
[38]LWCD = Land and Water Conservation Department
WDNR = Wisconsin Department of Natural Resources
[39] See previous pages for action item detail.

Goal 8. Establish a rapid response plan to a new introduction of invasive, non-native species.				
Actions[40]	**Timeline**	**$ Estimate**	**Vol. Hours**	**Responsible Parties**[41]
Follow the rapid response plan	If needed			Detailed in Appendix A
Maintain a contingency fund		$10,000		Board
Review and update rapid response contacts	Annually		3	Board

[40] Note that educational messages for each goal are included in the body of the plan.
[41]Lake District Board = Spooner Lake Protection and Rehabilitation District
LWCD = Washburn County Land and Water Conservation Department
WDNR = Wisconsin Department of Natural Resources

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Appendix A. Rapid Response for Early Detection of Eurasian Water Milfoil

1. Maintain a contingency fund of at least $10,000 for rapid response to EWM or other invasive species (Spooner Lake District Board).

2. Begin volunteer (Aquatic Plant Committee) monitoring at the public landings, the East Bay inlet, and other likely areas of AIS introduction. A map of likely areas of introduction will be prepared and made available to volunteer monitors. If a suspected plant is found, contact the Aquatic Invasive Species (AIS Lead or Aquatic Plant Committee Member).

3. Direct lake residents and visitors to contact the AIS ID Lead if they see a plant in the lake they suspect might be Eurasian water milfoil (EWM). Signs at the public boat landings, web pages, handouts at annual meeting, and newsletter articles will provide plant photos and descriptions, contact information, and instructions.

4. If plant is likely EWM, the AIS ID Lead will confirm identification with Washburn County LWCD or the WDNR and inform the rest of the Board. Two entire intact rooted adult specimens of the suspect plants will be collected and bagged and delivered to the WDNR, (810 West Maple Street, Spooner, WI 54801). WDNR may confirm identification with the herbarium at the University of Wisconsin – Stevens Point or the University of Wisconsin – Madison.

5. Mark the location of suspected EWM (AIS ID Lead). Use GPS points, if available, or mark the location with a small float.

6. If identification is positive:
    a. Inform the person who reported the EWM and the board (AIS ID Lead), who will then inform Washburn County LWCD and WDNR, and the lake management consultant.

    b. Mark the location of EWM with a more permanent marker. Special EWM buoys are available. (AIS Lead or APM Lead).

    c. Post a notice at the public landing (DNR has these signs available) and include a notice in the next newsletter. Notices will inform residents and visitors of the approximate location of EWM and provide appropriate means to avoid its spread (Board).

7. Hire a consultant to determine the extent of the EWM introduction (APM Lead). A diver may be used if water clarity is high enough. If small amounts of EWM are found during this assessment, the consultant will be directed to identify locations with GPS points and hand pull plants found. All plant fragments will be removed from the lake when hand pulling.

8. Select a control plan in cooperation with the WDNR (Board). The goal of the rapid response control plan will be eradication of the EWM. Additional guidance regarding EWM treatment is found in DNR's *Response for Early Detection of Eurasian Water Milfoil Field Protocol*.

   Control methods may include hand pulling, use of divers to manually or mechanically remove the EWM from the lake bottom, application of herbicides, and/or other effective and approved control methods.

9. Implement the selected control plan including applying for the necessary permits. Regardless of the control plan selected, it will be implemented by persons who are qualified and experienced in the technique(s) selected.

10. Spooner Lake District funds may be used to pay for any reasonable expense incurred during the implementation of the selected control plan, and implementation will not be delayed by waiting for WDNR to approve or fund a grant application.

11. The Board will work with the WDNR to confirm, as soon as possible, a start date for an Early Detection and Rapid Response AIS Control Grant. Thereafter, the Board shall formally apply for the grant.

12. Frequently inspect the area of the EWM to determine the effectiveness of the treatment and whether additional treatment is necessary (Board, APM Monitor).

13. Review the procedures and responsibilities of this rapid response plan on an annual basis. Changes may be made with approval of the Board.

EXHIBIT A[42]

SPOONER LAKE PROTECTION AND REHABILITATION DISTRICT

EWM ID Lead	Joe Cuskey: 715-635-9070 612-227-5748
APM Lead	Mike Saunders: 715-635-9074 303-907-7419
Aquatic Plant Committee	Ron Boushon (CBCW) Joe Banick (Plant ID, Board Chair)

WASHBURN COUNTY LAND AND WATER CONSERVATION DEPARTMENT (LWCD)

AIS Coordinator	Lisa Burns: 715-468-4654

WISCONSIN DEPARTMENT OF NATURAL RESOURCES (WDNR)

Grants and EWM Notice	Pamela Toshner: 715-635-4073
Permits	Mark Sundeen: 715-635-4074
EWM Identification and Notice	Spooner Lakes Team: 715-635-4073

APM MONITORS

Ecological Integrity Services	Steve Schieffer: 715-554-1168

DIVERS

Ecological Integrity Services	Steve Schieffer: 715-554-1168
Endangered Resource Services	Matt Berg: 715-483-2847

[42] This list will be reviewed and updated each year.

Appendix B.

Herbicide Treatment Analysis- *Potamogeton crispus*

Spooner Lake
Washburn County WI
2012

Prepared by: Ecological Integrity Service, LLC
Amery, WI

Spooner Lake Herbicide Treatment Analysis-2012

This report will analyze the effectiveness of herbicide treatment for *Potamogeton crispus*-curly leaf pondweed (CLP). This treatment occurred on May 4-5, 2012. The analysis will review and compare a treatment survey of all plots treated in 2011, to a post treatment survey, which was conducted approximately four weeks after herbicide was applied. It will also analyze the effectiveness in new areas that were treated for the first time in 2012.

There were six beds of CLP treated with herbicide in 2012. They will be referred to as Beds 1,2,3,5,6 and 7. Due to the success of past treatments and an updated CLP map in 2011, treatment beds were reestablished for 2012,

Treatment areas and application conditions

The figure below shows the locations and sizes of each treatment plot.

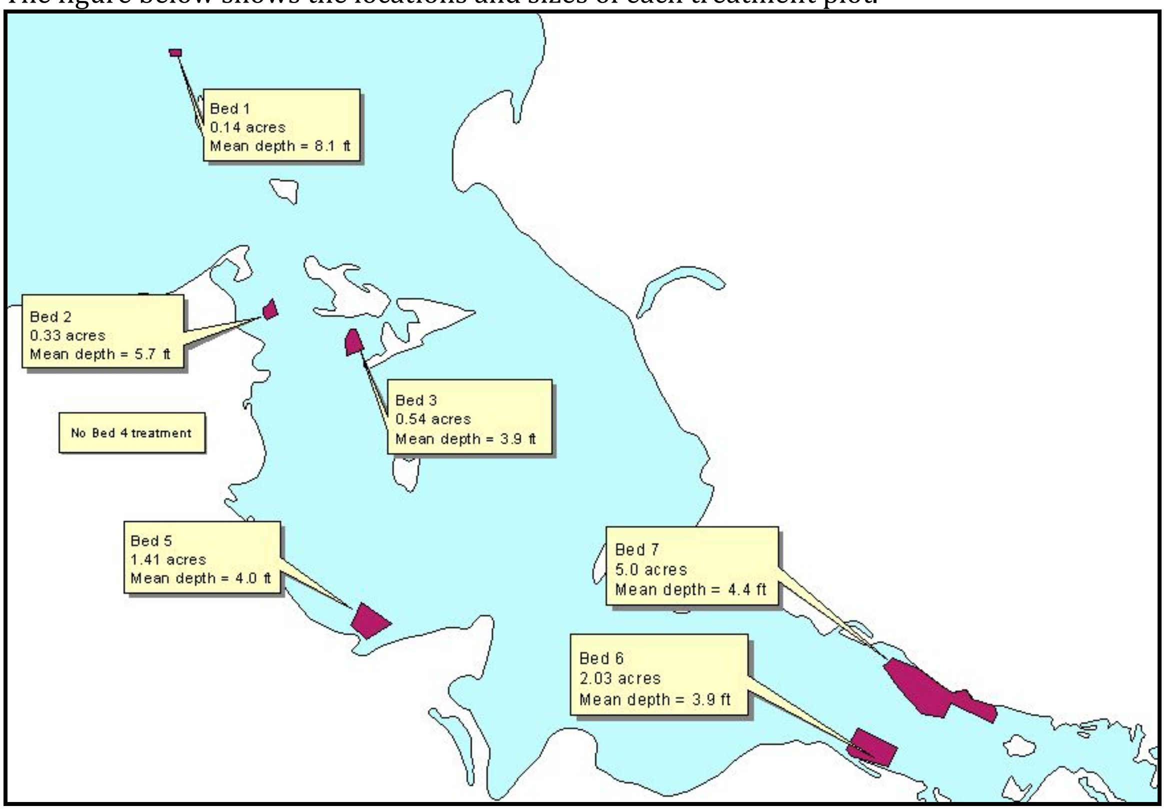


Figure 1: Map of CLP plots treated in 201 (delineated in 2011). Beds 2,3,5 and 7 are new beds for treatment. These new beds were delineated due to a mean density greater than "2".

Treatment conditions are summarized in the table below.

Bed	Date	Area (acres)	Wind velocity	Water temp-F	Herbicide	Rate (gallons)	Target conc. (ppm)
1	5-5-12	0.14	0-4	58.1	Aquathol-K	1.1	1.5
2	5-5-12	0.33	0-4	58.1	Aquathol-K	2.4	1.5
3	5-5-12	0.54	0-4	58.1	Aquathol-K	3.4	1.5
5	5-5-12	1.41	0-4	58.1	Aquathol-K	8.8	1.5
6	5-4-12	2.03	0-7	58.9	Aquathol-K	12.6	1.5
7	5-4-12	5.0	0-7	58.9	Aquathol-K	31.0	1.5

Table 1: Treatment conditions and herbicide information.(from Lake Restoration Inc.)

Pre treatment survey

The early April pre treatment survey is used to verify the presence of the target species, curly-leaf pondweed. If the species is not found consistently, the polygons for treatment can be adjusted. All plots had growth of CLP except Bed 4. As a result, Bed 4 was eliminated for treatment. The treatment beds in figures 1 thru all reflect the results of the pre-treatment survey on April 3, 2012.

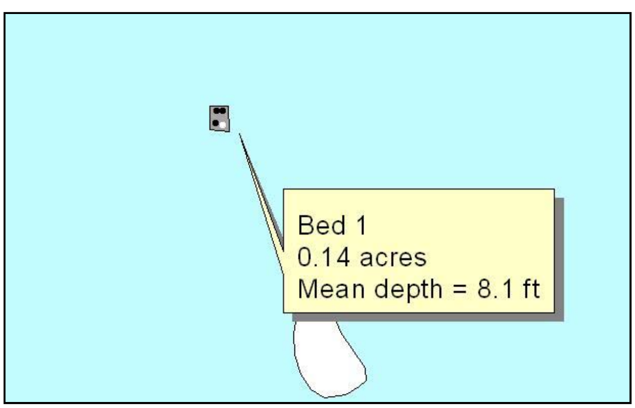


Figure 1: Pretreatment map of bed 1.

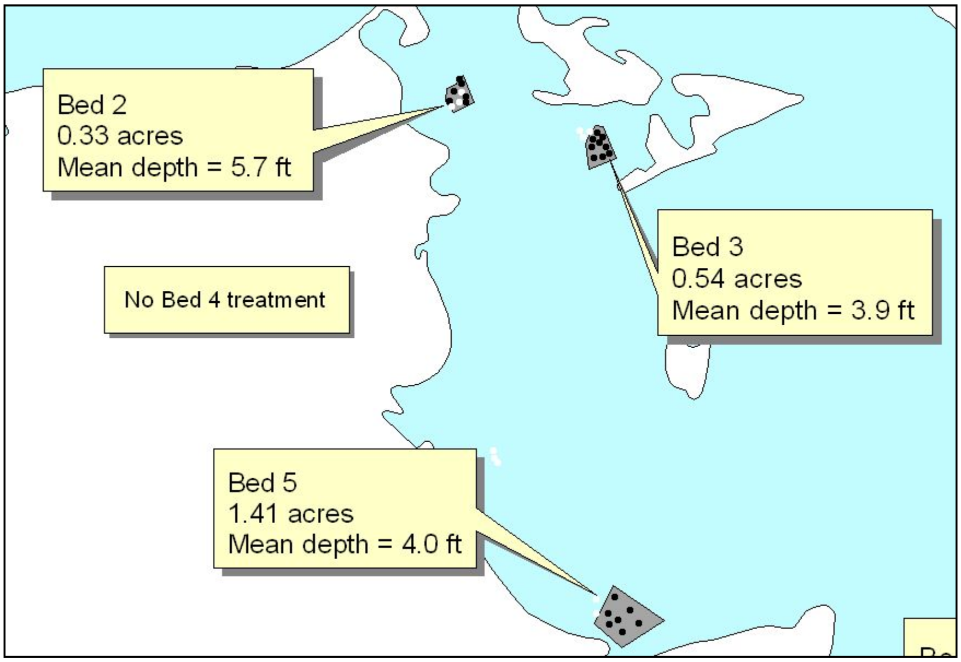


Figure 2: Pretreatment map of beds 2-5.

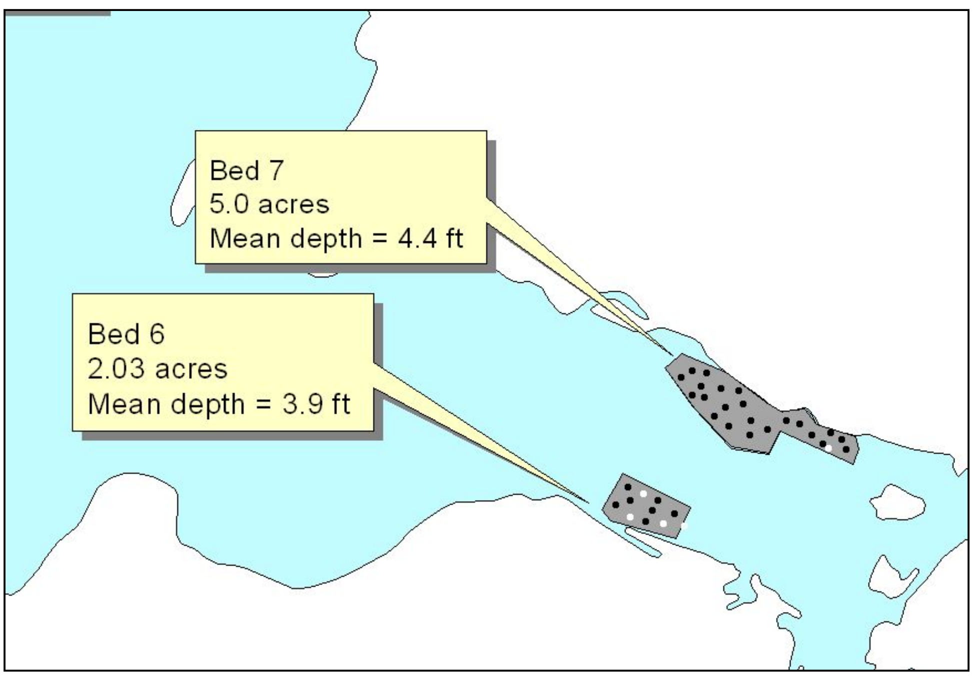


Figure 3: Pretreatment map of beds 6 and 7.

Post treatment Survey

Approximately four weeks after herbicide was applied to the six plots, a post treatment survey was conducted. This survey involves going to each sample point and sampling with a 1-meter rake tow. Each plant, including CLP and native species, is recorded with a density rating ranging from 1-3. A “1” means the plant is present and takes up less than ½ the tine space. A “2” takes up more than ½ the tine space, and a “3” is overflowing the rake.

After the data is collected, the data is statistically analyzed to determine if a reduction in the target species has occurred and if that reduction is significant. The mean density for each plot and for all plots is calculated. In addition, the frequency of occurrence for each species is determined. A chi-square analysis is done to determine if there is a significant change in the CLP and in the native species. A t-test is done to determine if the density changes are significant or not.

Results

The results from the 2011 are mapped as a density per sample point in each plot in Figures 3 thru 5.

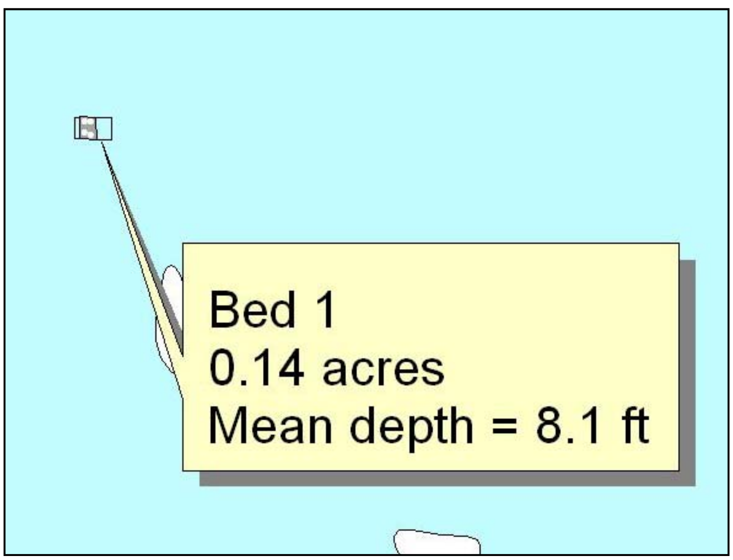


Figure 4: Post treatment map, Bed 1.

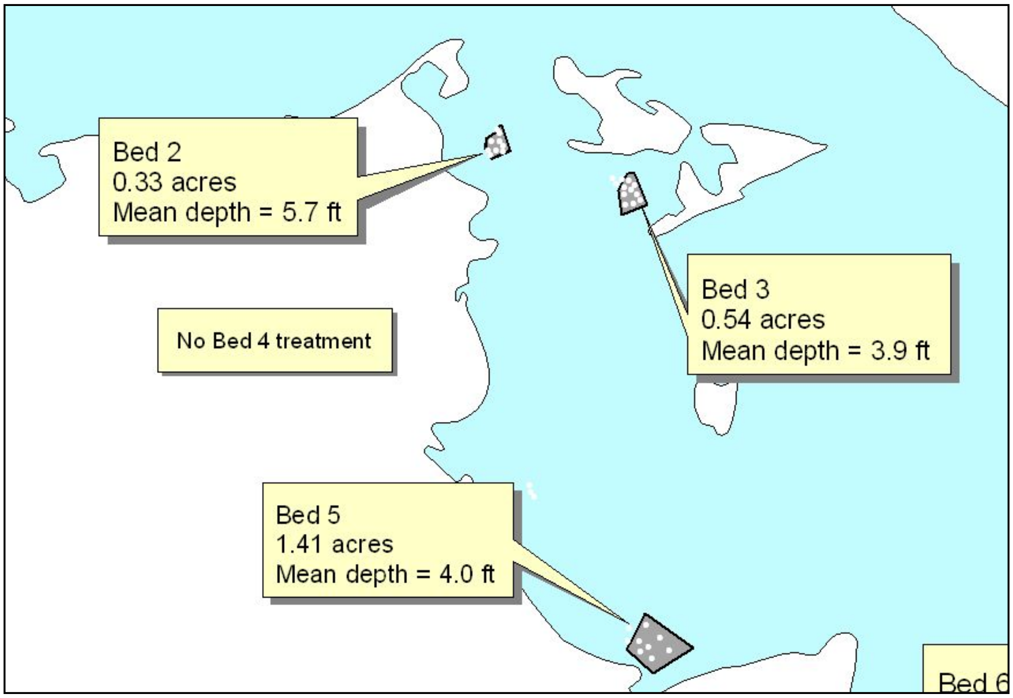


Figure 5: Post treatment map, Beds 2-5.

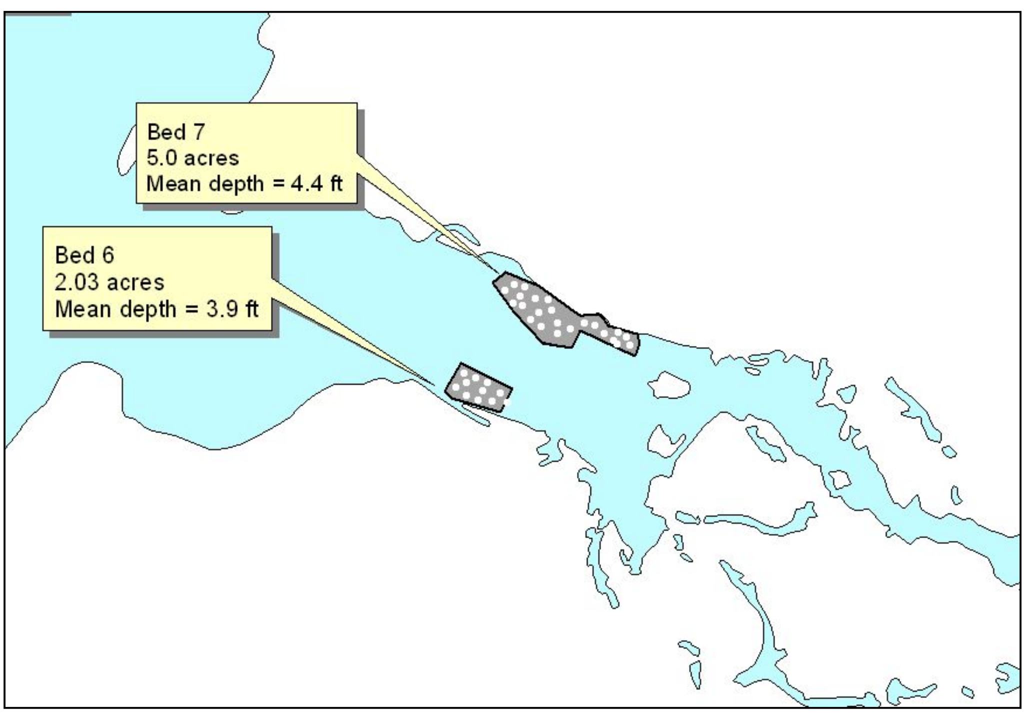
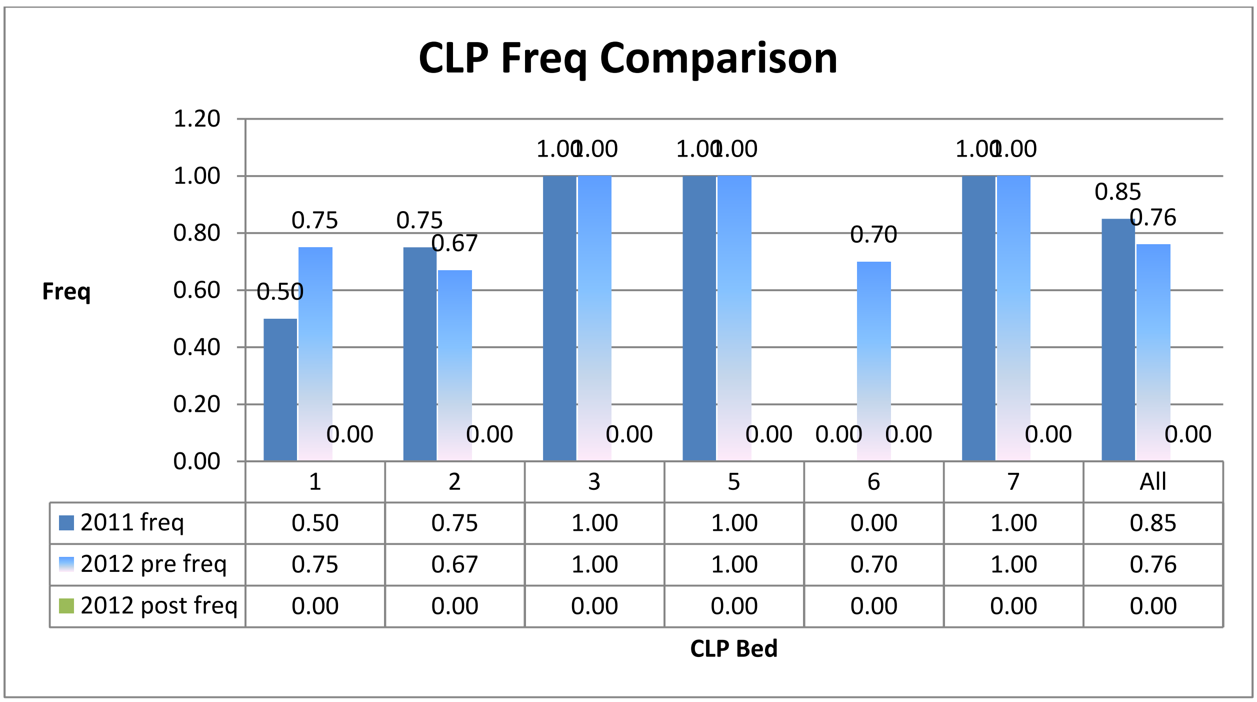


Figure 6: Post treatment map, Beds 6 and 7.

Survey	Freq all beds	Mean density
2011	0.85	1.5(new beds included)
2012 pre	0.76	n/a*
2012 post	0.00	0.00
2011 vs 2012	Significant reduction($p<0.05$)	Significant reduction ($p<0.05$)
2012 pre vs 2012 post	Significant reduction ($p<0.05$)	n/a

Note: density is not measured in the pre-treatment survey due to the plants being so small and would be misleading. A significant reduction indicates that the chi-square analysis resulted in p<0.05 (all beds had no growth). The density is evaluated using a ttest; p<0.05 to establish significant.

Table 2: Summary of post treatment survey data and analysis 2010 and 2011 as well as 2011 pretreatment to 2011 post treatment.



(Note: Beds 2,3,5 and 7 are newly treated for 2012, delineated in 2011)

Figure 6: Graph showing frequency comparisons of CLP.

As the data shows, the reduction on CLP was significant. There were no samples points that had CLP present in the 2012 post treatment survey. When comparing the post treatment frequency in 2011 to the post treatment to 2012 all plots had reductions. Plot 6 (treated in 2011 also) had no growth in 2011, but the pretreatment in 2012 had a frequency of 0.7, showing the turion germination occurred. Only plots 1 and 6 were treated prior to 2012.

Native Species

Another important consideration is the potential adverse affects the herbicide may have on the native plants. An early season application allows the targeting of the invasive species with no ill affects on the native plants. However, this must be monitored.

Most of the 2012 beds that were treated were not treated in 2011 (only 1 and 6 were). Typically the previous year's native species survey data is compared (statistically) to the next year's survey. Since very few survey points were in the same treat beds for 2011 to 2012, this comparison is not possible. When the new beds were delineated in 2011 after the treatment, CLP data was collected but not native species data since it was not known that treatment of any of these beds was to occur. The data is presented in order to make a non-statistical comparison, although it isn't really valid to do so. The data for 2012 is posted so it can be used for the 2013 treatment analysis.

Native species*	2011 Freq	2012 Freq
Elodea canadensis	**0.57**	**0.61**
P. robbinsii	**0.14**	**0.00**
Ceratophyllum demersum	**0.65**	**0.30**
Myriophyllum sibiricum	**0.41**	**0.07**
P. zosteriformis	**0.05**	**0.00**
P. praelongus	**0.05**	**0.00**
P. richardsonii	**0.05**	**0.00**
Filamentous algae	**0.51**	**0.34**
P. friesii	**0.03**	**0.00**

*Note: The native species frequency data from 2012 cannot be statistically compared to the 2011 data since the surveys had very little overlap. Most of the 2012 treatment was in different beds than the 2011 treatment and the native species frequency in the new beds was unknown.

Table 3: Summary of native species data from post treatment survey 2009 and 2010.

Summary

Data from the treatment survey in 2012 shows that the herbicide treatment was effective at reducing the frequency of occurrence of curly leaf pondweed. All plots except plot 6 (which couldn't since it was a 0 in 2011 and 2012) showed a significant frequency reduction and all plots combined had a significant reduction in frequency (when comparing the 2011 post to the 2012 post surveys). No CLP bed had any growth in the post treatment survey.

The treatment of the CLP beds in 2009 was effective and in 2010 it was not. The treatment in 2011 was effective and led to the treatment of new beds in 2012 (dropping treatment in some previous treated areas). The Aquatic Plant Management Plan goals in relationship to CLP control should be evaluated and the future treatment of CLP in all of the treated plots (except for plot 6) should be revisited, based upon this data. The goals of treatment reduction of these areas needs to be determined if they have been met or not (on a year to year basis).

Mapping of CLP Beds-2011and 2012

During peak growth of CLP in June, the beds were remapped. It has been observed that the CLP growth in Spooner Lake has been quite different since the PI plant survey in 2007. As was suspected, the coverage of CLP is much less and it is much easier to define the beds. This could lead to even more significant reduction of CLP in Spooner Lake. The maps below show where the CLP beds were delineated in Spooner Lake during June 2011. The CLP was mapped again in 2012. Since many of the beds were treated in 2012, the amount of coverage significantly decreased. However, the eastern most bed that wasn't treated typically has extensive density within the delineated bed. In 2012, the coverage of CLP was much smaller in area and much less dense. The is further evidence that the CLP in Spooner Lake seems to vary greatly from year to year. The total area of CLP that was mapped in 2011 was approximately 10.3 acres. The area in 2012 was just over 1 acre.

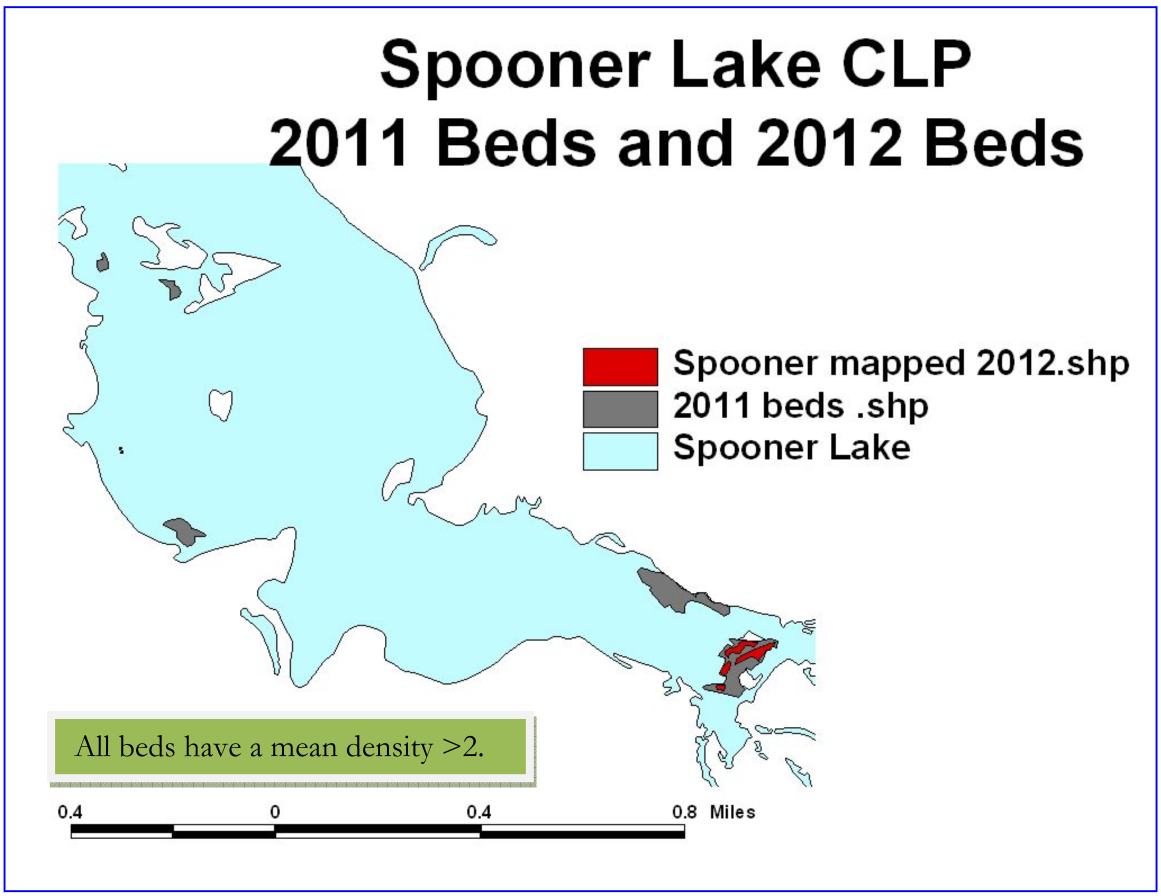


Figure 8: Map of delineated CLP beds June 2011 and June 2012.

Sample point	LATITUDE	LONGITUDE	DEPTH	CLP_POST	CLP_PRE	2011
001	45.84420886	-91.83010206	8.10	0	1	1
002	45.84429226	-91.83009879	8.00	0	1	1
003	45.84429352	-91.83003391	8.30	0	1	1
004	45.84419461	-91.83003559	7.90	0	0	0
005	45.83812544	-91.82682582	5.80	0	1	1
006	45.83793911	-91.82677729	6.30	0	0	0
007	45.83786317	-91.82669783	6.10	0	1	1
008	45.83779595	-91.82684074	5.50	0	0	0
009	45.83780349	-91.82702917	5.10	0	1	1
010	45.83794515	-91.82694275	5.30	0	1	1
011	45.83773443	-91.82698030	5.00	0	0	1
012	45.83806568	-91.82676799	6.10	0	1	1
013	45.83778329	-91.82669842	5.90	0	1	1
014	45.83735196	-91.82432634	3.80	0	0	1
015	45.83733746	-91.82411696	4.30	0	0	1
016	45.83730846	-91.82396164	3.90	0	1	1
017	45.83724618	-91.82384019	3.40	0	1	1
018	45.83716848	-91.82391529	4.10	0	1	2
019	45.83721525	-91.82406021	4.00	0	1	2
020	45.83725741	-91.82425300	4.00	0	0	2
021	45.83710411	-91.82408075	4.10	0	1	1
022	45.83693957	-91.82404286	4.10	0	1	1
023	45.83696874	-91.82386852	4.30	0	1	1
024	45.83709916	-91.82378244	3.30	0	1	1
025	45.83700922	-91.82371471	2.90	0	1	2
026	45.83269900	-91.82621872	4.50	0	0	1
027	45.83258199	-91.82620774	4.60	0	0	1
028	45.83251820	-91.82613985	4.20	0	0	1
029	45.83049573	-91.82411956	3.50	0	0	1
030	45.83029591	-91.82388101	4.10	0	1	1

031	45.83013673	-91.82385427	3.30	0	1	2
032	45.83002484	-91.82360256	3.60	0	1	1
033	45.83014528	-91.82324315	4.40	0	1	2
034	45.83033782	-91.82343358	4.50	0	1	2
035	45.83053353	-91.82374137	4.30	0	1	1
036	45.83019759	-91.82368143	4.00	0	1	1
037	45.83030362	-91.82412903	4.00	0	0	1
038	45.82699821	-91.80658235	3.50	0	1	1
039	45.82682571	-91.80629745	2.90	0	0	1
040	45.82675103	-91.80596821	3.10	0	1	1
041	45.82671926	-91.80560728	3.50	0	0	0
042	45.82686343	-91.80537838	4.50	0	1	1
043	45.82706208	-91.80571793	4.70	0	1	1
044	45.82715412	-91.80602169	4.80	0	0	0
045	45.82725847	-91.80633349	4.20	0	1	1
046	45.82707114	-91.80628270	4.30	0	1	2
047	45.82692060	-91.80583108	3.80	0	1	2
048	45.82667970	-91.80518526	3.80	0	0	0
049	45.82882086	-91.80521015	5.50	0	1	2
050	45.82891993	-91.80496255	4.40	0	1	2
051	45.82888381	-91.80467924	3.60	0	1	2
052	45.82869220	-91.80478603	4.20	0	1	2
053	45.82857066	-91.80498191	5.50	0	1	3
054	45.82852908	-91.80472316	4.80	0	1	3
055	45.82865230	-91.80439082	3.90	0	1	3
056	45.82861542	-91.80403006	4.20	0	1	2
057	45.82842750	-91.80393434	4.00	0	1	2
058	45.82837603	-91.80430641	4.50	0	1	3
059	45.82825298	-91.80452367	5.50	0	1	3
060	45.82810974	-91.80423986	4.90	0	1	2
061	45.82818274	-91.80378808	3.90	0	1	2

062	45.82797186	-91.80379772	5.60	0	1	2
063	45.82805953	-91.80344609	4.40	0	1	2
064	45.82817847	-91.80305768	3.90	0	1	3
065	45.82812977	-91.80276750	3.70	0	1	3
066	45.82797051	-91.80252031	4.90	0	1	3
067	45.82784219	-91.80229350	4.10	0	1	2
068	45.82799231	-91.80215201	3.10	0	1	2
069	45.82789114	-91.80192495	3.60	0	1	1
070	45.82774781	-91.80183191	3.60	0	1	2
071	45.82776533	-91.80219191	3.80	0	0	1
			count	0	54	65
			frequency	0.00	0.76	0.85
			mean density	0.00		1.457143

Appendix C. Invasive Species Information[43]

Japanese knotweed (*Polygonum cuspidatum*)

Description
Japanese knotweed is an herbaceous perennial that forms large colonies of erect, arching stems resembling bamboo. Stems are round, smooth, hollow and reddish-brown. Plants reach up to 10 feet.

Identification
Leaves: Simple, alternate, 3-4" wide and 4-6" long. Leaves are egg shaped to nearly triangular and more heart-shaped on young shoots. They have long petioles that are broad at the base and narrow to a fine point. The upper surface is dark green while the lower surface is pale green.

Flowers: Creamy white or greenish; tiny 0.125" wide; borne in plume-like clusters in upper leaf axils near the end of stems. Bloom August through September.

Fruits & seeds: Seeds are small, triangular, shiny, black produced by female plants; rare since colonies seldom have both male and female plants. The seed is enclosed in a winged calyx that contributes to its buoyancy. The seeds have no dormancy requirement and germinate readily.

Roots: Roots are present along the rhizome and extend deeply into the soil creating a dense impenetrable mat.

Control
Mechanical: Hand pull young plants; dig or till when soil is soft. Plants should be pulled up by the root crown, trying to remove as much of the rhizomes as possible because any rhizomes remaining in the soil will produce new plants at each node. It is possible to eradicate small patches of knotweed with repeated and persistent cutting of the plants.

Chemical: Plants are more susceptible to herbicides if they are cut when 4-5' tall and the regrowth treated around 3' tall. Foliar application of glyphosate with a surfactant, triclopyr formulated for use with water, dicamba, or imazapyr may be effective on large populations. Tests involving large-bore needle injection of glyphosate into the lower nodes of each stem have been successful.

[43] Information taken from http://dnr.wi.gov/topic/Invasives

Purple Loosestrife (Lythrum salicaria)

Description

Purple loosestrife is a non-native plant common in Wisconsin. By law, purple loosestrife is a nuisance species in Wisconsin. It is illegal to sell, distribute, or cultivate the plants or seeds, including any of its cultivars.

Purple loosestrife is a perennial herb 3-7 feet tall with a dense bushy growth of 1-50 stems. The stems, which range from green to purple, die back each year. Showy flowers vary from purple to magenta, possess 5-6 petals aggregated into numerous long spikes, and bloom from July to September. Leaves are opposite, nearly linear, and attached to four-sided stems without stalks. It has a large, woody taproot with fibrous rhizomes (underground stems) that form a dense mat.

Characteristics

Purple loosestrife is a wetland herb that was introduced as a garden perennial from Europe during the 1800's. It is still promoted by some horticulturists for its beauty as a landscape plant, and by beekeepers for its nectar-producing capability. Currently, about 24 states have laws prohibiting its importation or distribution because of its aggressively invasive characteristics. It has since extended its range to include most temperate parts of the United States and Canada. The plant's reproductive success across North America can be attributed to its wide tolerance of physical and chemical conditions characteristic of disturbed habitats, and its ability to reproduce prolifically by both seed dispersal and vegetative propagation. The absence of natural predators, like European species of herbivorous beetles that feed on the plant's roots and leaves, also contributes to its proliferation in North America.

Purple loosestrife was first detected in Wisconsin in the early 1930's, but remained uncommon until the 1970's. It is now widely dispersed in the state, and has been recorded in 70 of Wisconsin's 72 counties. This plant's optimal habitat includes marshes, stream margins, river flood plains, sedge meadows, and wet prairies. It is tolerant of moist soil and shallow water sites such as pastures and meadows, although established plants can tolerate drier conditions. Purple loosestrife has also been planted in lawns and gardens, which is often how it has been introduced to many of our wetlands, lakes, and rivers.

Reproduction and Dispersal

Purple loosestrife spreads mainly by seed, but it can also spread vegetatively from root or stem segments. A single stalk can produce from 100,000 to 300,000 seeds per year. Seed survival is up to 60-70%, resulting in an extensive seed bank. Most of the seeds fall near the parent plant, but water, animals, boats, and humans can transport the seeds long distances. Vegetative spread through local disturbance is also characteristic of loosestrife; clipped, trampled, or buried stems of established plants may produce shoots and roots. It is often very difficult to locate non-flowering plants, so monitoring for new invasions should be done at the beginning of the flowering period in mid-summer.

Any sunny or partly shaded wetland is susceptible to purple loosestrife invasion. Vegetative disturbances such as water drawdown or exposed soil accelerate the process by providing ideal conditions for seed germination. When the right disturbance occurs, loosestrife can spread rapidly, eventually taking over the entire wetland.

Ecological Impacts

Purple loosestrife displaces native wetland vegetation and degrades wildlife habitat. As native vegetation is displaced, rare plants are often the first species to disappear. Eventually, purple loosestrife can overrun wetlands thousands of acres in size, and almost entirely eliminate the open water habitat. The plant can also be detrimental to recreation by choking waterways.

Mechanical Control

Purple loosestrife (PL) can be controlled by cutting, pulling, digging and drowning. Cutting is best done just before plants begin flowering. Cutting too early encourages more flower stems to grow than before. If done too late, seed may have already fallen. Since lower pods can drop seed while upper flowers are still blooming, check for seed. If none, simply bag all cuttings (to prevent them from rooting). If there is seed, cut off each top while carefully holding it upright, then bend it over into a bag to catch any dropping seeds. Dispose of plants/seeds in a capped landfill, or dry and burn them. Composting will not kill the seeds. Keep clothing and equipment seed-free to prevent its spread. Rinse all equipment used in infested areas before moving into uninfested areas, including boats, trailers, clothing, and footwear.

Pulling and digging can be effective, but can also create disturbed bare spots, which are good sites for PL seeds to germinate, or leave behind root fragments that grow into new plants. Use these methods primarily with small plants in loose soils, since they do not usually leave behind large gaps nor root tips, while large plants with multiple stems and brittle roots often do. Dispose of plants as described above.

Mowing has not been effective with loosestrife unless the plants can be mowed to a height where the remaining stems will be covered with water for a full twelve months. Burning has also proven largely ineffective. Mowing and flooding are not encouraged because they can contribute to further dispersal of the species by disseminating seeds and stems.

Follow-up treatments are recommended for at least three years after removal.

Chemical Control

This is usually the best way to eliminate PL quickly, especially with mature plants. The chemicals used have a short soil life. Timing is important. Treat in late July or August, but before flowering to prevent seed set. Always back away from sprayed areas as you go, to prevent getting herbicide on your clothes. The best method is to cut stems and paint the stump tops with herbicide. The herbicide can be applied with a small drip bottle or spray bottle, which can be adjusted to release only a small amount. Try to cover the entire cut portion of the stem, but not let the herbicide drip onto other plants since it is non-selective and can kill any plant it touches.

Glyphosate herbicides: Currently, glyphosate is the most commonly used chemical for killing loosestrife. Roundup and Glyfos are typically used, but if there is any open water in the area use Rodeo, a glyphosate formulated and listed for use over water. Glyphosate must be applied in late July or August to be most effective. Since you must treat at least some stems of each plant and they often grow together in a clump, all stems in the clump should be treated to be sure all plants are treated.

Another method is using very carefully targeted foliar applications of herbicide (NOT broadcast spraying). This may reduce costs for sites with very high densities of PL, since the work should be easier and there will be few other plant species to hit accidentally. Use a glyphosate formulated for use over water. A weak solution of around 1% active ingredient can be used and it is generally necessary to wet only 25% of the foliage to kill the plant.

You must obtain a permit from WDNR before applying any herbicide over water. The process has been streamlined for control of purple loosestrife and there is no cost. Contact your regional Aquatic Plant Management Coordinator for permit information.

Biological Control

Conventional control methods like hand pulling, cutting, flooding, herbicides, and plant competition have only been moderately effective in controlling purple loosestrife. Biocontrol is now considered the most viable option for more complete control for heavy infestations. The WDNR, in cooperation with the U.S. Fish and Wildlife Service, is introducing several natural insect enemies of purple loosestrife from Europe. A species of weevil (*Hylobius transversovittatus*) has been identified that lays eggs in the stem and upper root system of the plant; as larvae develop, they feed on root tissue. In addition, two species of leaf eating beetles (*Galerucella calmariensis* and *G. pusilla*) are being raised and released in the state, and another weevil that feeds on flowers (*Nanophyes marmoratu*s) is being used to stress the plant in multiple ways. Research has shown that most of these insects are almost exclusively dependent upon purple loosestrife and do not threaten native plants, although one species showed some cross-over to native loosestrife. These insects will not eradicate loosestrife, but may significantly reduce the population so cohabitation with native species becomes a possibility.

Zebra Mussels (Dreissena polymorpha)

The zebra mussel is a tiny (1/8-inch to 2-inch) bottom-dwelling clam native to Europe and Asia. Zebra mussels were introduced into the Great Lakes in 1985 or 1986, and have been spreading throughout them since that time. They were most likely brought to North America as larvae in ballast water of ships that traveled from fresh-water Eurasian ports to the Great Lakes. Zebra mussels look like small clams with a yellowish or brownish D-shaped shell, usually with alternating dark- and light-colored stripes. They can be up to two inches long, but most are under an inch. Zebra mussels usually grow in clusters containing numerous individuals.

Zebra mussels were first found in Wisconsin waters of Lake Michigan in 1990. They are now found in a number of inland Wisconsin waters. Zebra mussels are the only freshwater mollusks that can firmly attach themselves to solid objects. They are generally found in shallow (6-30 feet deep), algae-rich water.

Zebra mussels feed by drawing water into their bodies and filtering out most of the suspended microscopic plants, animals, and debris for food. This process can lead to increased water clarity and a depleted food supply for fish and other aquatic organisms. The higher light penetration fosters growth of rooted aquatic plants which, although creating more habitat for small fish, may inhibit the larger, predatory fish from finding their food. This thicker plant growth can also interfere with boaters, anglers, and swimmers. Zebra mussel infestations may also promote the growth of blue-green algae, since zebra mussels avoid consuming this type of algae but not others.

Once zebra mussels are established in a water body, very little can be done to control them. It is therefore crucial to take all possible measures to prevent their introduction in the first place. Be sure to follow the Clean Boats, Clean Waters procedure in preventing the spread of aquatic hitchhikers. In addition to these measures, boaters can take specific precautions in protecting their motors from zebra mussels.

No selective method has been developed that succeeds in controlling zebra mussels in the wild without also harming other aquatic organisms. To a certain extent, ducks and fish will eat small zebra mussels, but not to the point of effectively controlling their populations. As of yet, no practical and effective controls are known, again emphasizing the need for research and prevention.

Appendix D. Funding Sources

Aquatic Invasive Species Monitoring, Planning, etc.

Grant Program: AIS Grant

Wisconsin Department of Natural Resources
Program Goals/Objectives: prevent and control aquatic invasive species
Eligible Applicants: Qualified lake and river management organizations and qualified school districts
Eligible Project Elements: education, prevention, and planning; early detection and response; controlling established infestations
Funding limits and rate: 75% of project costs up to $150,000 for education, prevention, planning; 75% of project costs up to $200,000 for controlling established infestations; and 75% of project costs up to $20,000 for early detection and rapid response
Application Deadline: February 1st and August 1st of each year
Contact: Pamela Toshner 715.635.4073

Grant Program: Lake Planning

Wisconsin Department of Natural Resources
Program Goals/Objectives: collect information in order to manage lakes
Eligible Applicants: Qualified lake and local government organizations; qualified school districts
Eligible Project Elements: Monitoring and education; organization development; studies or assessments.
Funding limits and rate: Small scale-75% state share with a cap of $3000; large scale-up to 67% state share with a cap of $25,000.
Application Deadline: Feb 1st and August 1st of each year.
Contact: Pamela Toshner 715.635.4073

Watershed Practices

Grant Program: Lake Protection

Wisconsin Department of Natural Resources
Program Goals/Objectives: lake protection and restoration
Eligible Applicants: Qualified lake and conservation organizations
Eligible Project Elements: plans and specifications, earth moving and structure removal, native plants and seeds, monitoring costs
Funding Limits and Rates: 75 % of project costs up to $200,000
Application Deadline: May 1st each year
Contact: Pamela Toshner 715.635.4073

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Scott Walker, Governor
Cathy Stepp, Secretary
John Gozdzialski, Regional Director

Northern Region Headquarters
810 W. Maple Street
Spooner, Wisconsin 54801
Telephone 715-635-2101
FAX 715-635-4105
TTY Access via relay - 711

March 15, 2013

Mr. Joe Banick
Spooner Lake P&R District
W5581 Miramar Road
Spooner, Wisconsin 54801

Subject: Spooner Lake Aquatic Plant Management Plan (Plan) Approval Request

Dear Mr. Banick:

Thank you for your efforts to understand and manage Spooner Lake and the local community that depends on it! This letter is to notify you that the DNR has approved the aquatic invasive species recommendations within the Plan. Approved management recommendations specified below are eligible for funding under Lake Management Planning, Lake Protection and Classification, and Aquatic Invasive Species grants subject to the application requirements of those programs.

Management recommendations that are approved include the following:

1. AIS prevention activities, including watercraft inspection and volunteer monitoring.
2. Aquatic plant and water quality monitoring.
3. Educational activities, including AIS workshops, signage, etc.
4. Curlyleaf pondweed control, provided the monitoring warrants it.

Please note grant eligibility does not apply for native aquatic plant management. Furthermore, this activity would need to meet administrative and regulatory requirements for permitting.

Thanks to you and the lake community for your continued efforts. Please contact me (715-635-4073) if you have any questions.

Sincerely yours,

Pamela Toshner
Lake Management Coordinator

cc. Cheryl Clemens, Harmony Environmental
Mark Sundeen, WDNR