Pretty Lake Aquatic Vegetation Management Plan

2016 Update

LaGrange County, Indiana

Prepared for:

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Executive Summary

Pretty Lake, located in LaGrange County, Indiana has 184 surface acres with a maximum depth of 82 feet and an average depth of 25.6 feet. The following report summarizes Eurasian watermilfoil (EWM) control practices implemented on Pretty Lake in 2013 through 2016 as part of the Lake and River Enhancement Program (LARE). It also outlines a future management strategy for the continued control of invasive species.

The Pretty Lake Conservation Club helped to fund a lake-wide aquatic vegetation management plan (AVMP) which was completed in 2008 by J.F. New and Associates. As part of the integrated management strategy for Pretty Lake, J.F. New estimated that EWM was present in approximately 16 acres of Pretty Lake. It was recommended that treatment was not immediately necessary but that the EWM population should be monitored closely in future years for any significant increase in abundance. No widespread EWM treatments were conducted between 2008 and 2012. However, since 2008, lake residents had noticed an apparent increase in EWM acreage and abundance in Pretty Lake. In fall of 2012, Aquatic Weed Control conducted a visual survey of Pretty Lake with the help and input of Rod Bergstedt. Handheld GPS units were used to identify EWM beds in Pretty Lake. This survey found an estimated 27.85 acres of EWM infestation. This survey indicated that the perceived increase in EWM abundance since 2008 was most likely accurate. The Pretty Lake Conservation Club applied for and received LARE funding to treat all areas of EWM infestation in the spring of 2013.

All areas of known EWM infestation were treated each spring in 2013, through 2015. These treatments used diquat herbicide at a rate of 2.0 gallons per acre along with copper sulfate at 1.0 parts per million. The major goal of this treatment was to control EWM early in the spring before native plants began to grow. In theory, this should protect native plants and provide annual control of EWM. This treatment is also being evaluated to see if the total acreage of EWM can be reduced from year to year through aggressive, repetitive early season diquat treatments.

It was decided that in 2016, a less aggressive treatment approach should be taken in order to evaluate both native and invasive plant abundance after 3 years of aggressive early season treatments. A visual survey was conducted on May 24, 2016 and found 3.9 acres of EWM. All of these areas were treated selectively with 2, 4-D at a rate of 2.0 parts per million on June 2, 2016.

A tier II plant survey was conducted on July 26, and found 7.02 acres of EWM in the area around Job's Hole. The IDNR decided not to treat this area citing abundant native plants and the concern that some of the milfoil could actually be native.

The annual "permit meeting" was held on September 19, 2016. It was decided at this meeting that the 2017 EWM treatment strategy will remain much the same as 2016. Areas of dense EWM in spring of 2017 will be treated with 2, 4-D pending LARE and IDNR approval. A summer tier II survey should be conducted to evaluate both the invasive and native plant communities.

The 2017 2, 4-D treatments would likely receive a 50% cost share from LARE with the association being responsible for 50% of the cost as well. The AVMP could be updated, or the association may have the option to do a survey only, without a full AVMP update. It is likely that LARE would pay for 80% of planning and survey costs, with the association being responsible for 20% of the AVMP costs.

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Problem Statement

Eurasian watermilfoil (EWM) is impacting the use and ecology of Pretty Lake. The milfoil forms dense mats in shallow areas, which can inhibit fishing, swimming, and boating. Dense milfoil beds may also prevent the growth of beneficial native species which often provide less recreational interference and more desirable fish habitat.

Objectives:

The following specific, quantifiable objectives are recommended to evaluate the success of EWM management activities on Pretty Lake. These objectives differ from those presented in the original 2008 AVMP as EWM abundance appears to have changed substantially.

1. Limit EWM abundance to less than 10% site frequency each summer in tier II surveys.

2. Maintain at least 12 native species collected each summer in tier II surveys. (IDNR, 2014)

3. Maintain a native species diversity of no less than 0.84 each summer in tier II surveys. (IDNR, 2014)

4. Reduce the abundance of EWM to less than 10% site frequency in a spring tier II survey by 2016. (IDNR, 2014) Note: After discussion at the fall 2015 permit meeting it was decided that a spring 2016 visual/GPS survey for EWM acreage was sufficient.

Treating EWM is not likely to eradicate it from Pretty Lake. However, if these objectives are met each year, the indication would be that EWM is being controlled effectively on a seasonal basis, without causing damage to the native plant community.

The native plant objectives set by the DNR in 2014 have not been met since aggressive EWM treatments began in 2013 with the exception that 12 native species were collected in 2014. The native diversity goal of 0.84 was established in January of 2014. At that time the most recent tier II survey (summer 2013) had recorded a native diversity of 0.76. The objectives established in 2014 were based on averages calculated from surveys completed in 2007, 2010 and 2013. These objectives are very optimistic, which is good, but maintaining current diversity appears much more likely than increasing it so significantly in 2017. In 2016, native diversity was 0.79 which is its highest value since 2010.

Aquatic Vegetation Management History

Prior to 2013, no widespread treatment strategy had been implemented on Pretty Lake. Some small private treatments in the past had been permitted with a maximum total acreage of 1.34 acres per year (J.F. New, 2008). Herbicides permitted for use in these areas include Reward, Aquathol K, Hydrothol 191, Komeen, and copper sulfate. The first LARE funded herbicide treatment took place in the spring of 2013. Table 1 summarizes recent herbicide treatments on Pretty Lake.

Table 1: Pretty Lake Herbicide Treatment History

Year	Target Species	Acreage	Herbicide	Rate
2005-2012	EWM,CLP	Up to 1.34	Various contacts	NA
May 2, 2013*	EWM	27.85	Diquat, Copper Sulfate	2 gal/ acre, 1.0 ppm
August 1,2013*	EWM re-growth	0.25	Navigate	2.0 ppm
May 12, 2014*	EWM	27.85	Diquat, Copper Sulfate	2 gal/acre, 1.0 ppm
August 7, 2014*	EWM re-growth	3.19	Diquat, Copper Sulfate	2 gal/acre, 1.0 ppm
April 30, 2015*	EWM	28.02	Diquat, Copper Sulfate	2 gal/acre, 1.0 ppm
August 3, 2015*	EWM re-growth	3.84	2, 4-D	2.0 ppm
June 2, 2016*	EWM	3.9	2, 4-D	2.0 ppm

*LARE funded

2015 Vegetation Treatments

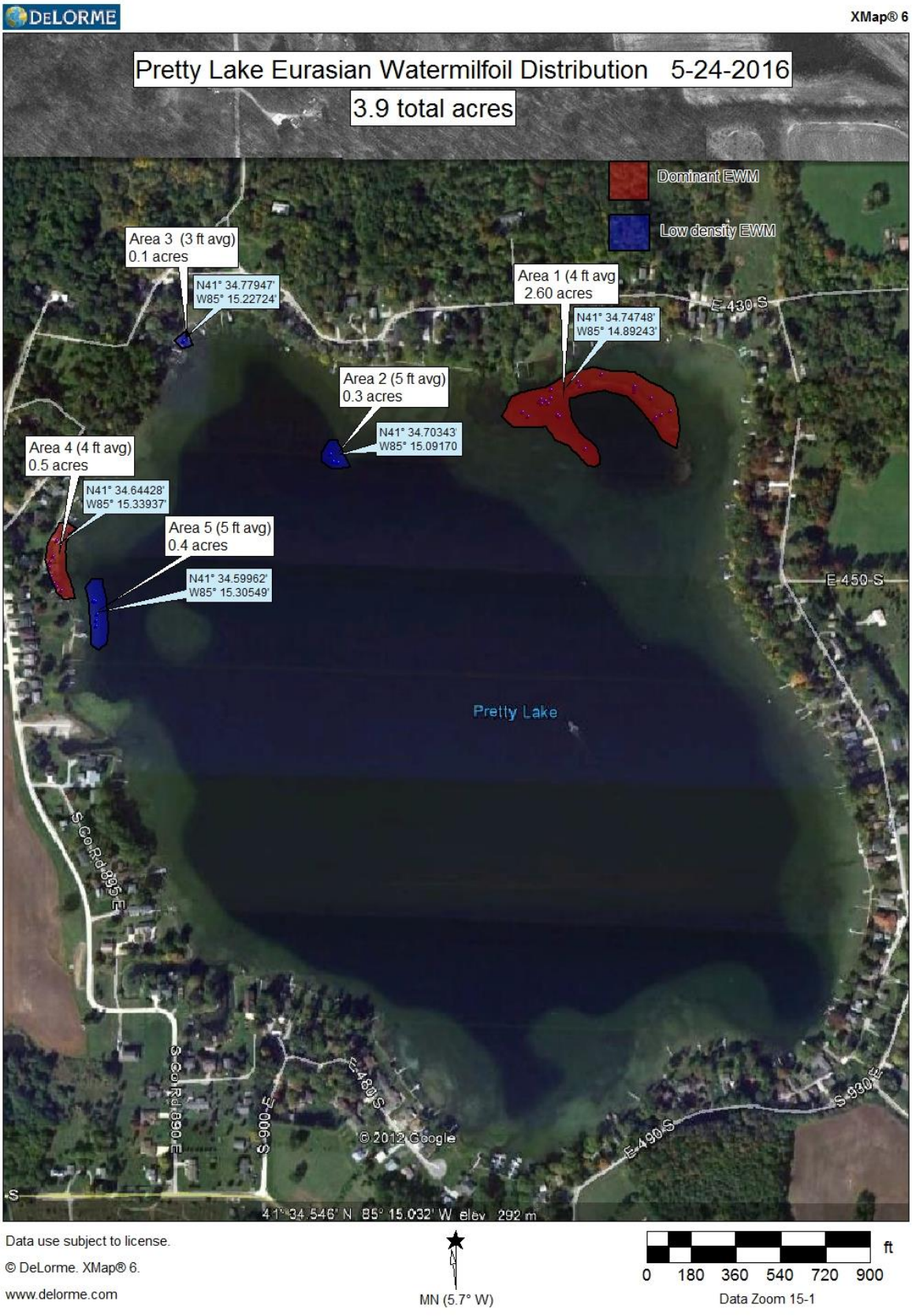
It was decided that in 2016, a less aggressive treatment approach should be taken in order to evaluate both native and invasive plant abundance after 3 years of aggressive early season treatments. A visual survey was conducted on May 24, 2016 and found 3.9 acres of EWM. All of these areas were treated selectively with 2, 4-D at a rate of 2.0 parts per million on June 2, 2016. A tier II plant survey was conducted on July 26, and found 7.02 acres of EWM in the area around Job's Hole. The IDNR decided not to treat this area citing abundant native plants and the concern that some of the milfoil could actually be native. The areas treated on June 2, 2016 are described in Figure 1. Both the red and blues areas on this map were treated for EWM.

Table 1 shows the acreage, average depth, the herbicide, and concentration used for each treatment area in 2016 and corresponds to Figure 1.

Table 2: Pretty Lake 2016 EWM Treatment Area Details

Area	Date	Acreage	Avg. Depth (ft.)	Herbicide	Rate
1	June 2	2.6	4	2, 4-D	2.0 ppm
2	June 2	0.3	5	2, 4-D	2.0 ppm
3	June 2	0.1	3	2, 4-D	2.0 ppm
4	June 2	0.5	4	2, 4-D	2.0 ppm
5	June 2	0.4	5	2, 4-D	2.0 ppm

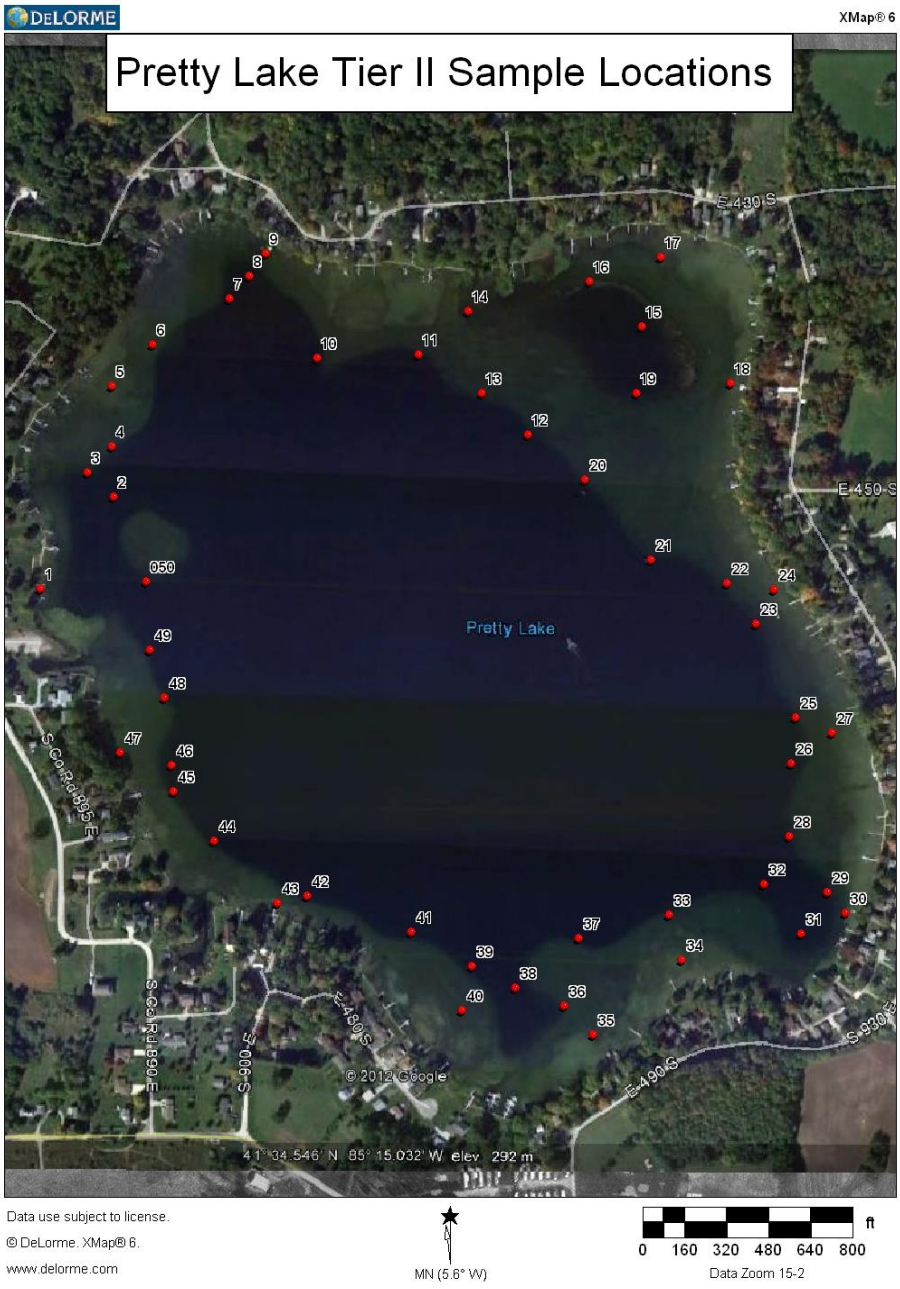
Figure 1: Pretty Lake 2016 Eurasian Watermilfoil Treatment Areas



Tier II Survey Results

Aquatic plant sampling methods used for surveys on Pretty Lake are outlined in the Tier II Aquatic Vegetation Survey Protocol (IDNR 2014). The current sample locations are the same locations that have been used by IDNR fisheries biologists in recent years. This was done to help ensure consistency in data between different surveyors on Pretty Lake. These same locations will continue to be used in the future to help maintain consistency in tier II data from year to year. Common and scientific names mentioned in the tier II results are consistent with those mentioned in the original AVMP in 2008, and a list of common and scientific plant names is included in the appendix to this report. Figure 2 shows rake sample locations for the Pretty Lake tier II surveys. Fifty sample sites are spaced throughout the lake.

Figure 2: Pretty Lake Tier II Sample Locations

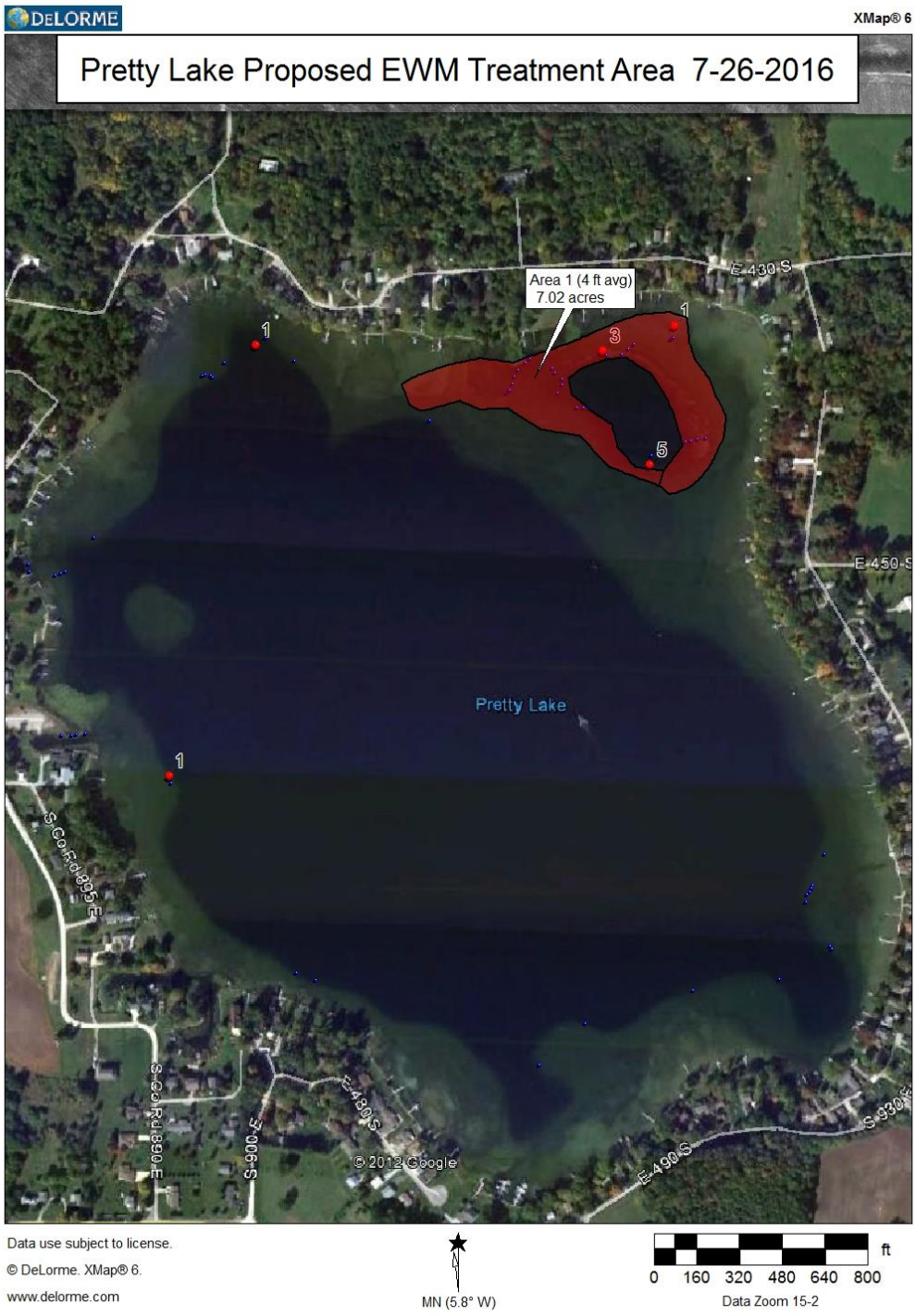


Exotic Plant Distribution

EWM

In the summer 2016 tier II survey, Eurasian watermilfoil was found at 10 percent of the sample locations. These sample locations are shown as labeled red dots in Figure 3. This figure also shows visual EWM sightings as small blue dots. The area that was recommended for treatment is shown in red and totaled 7.02 acres.

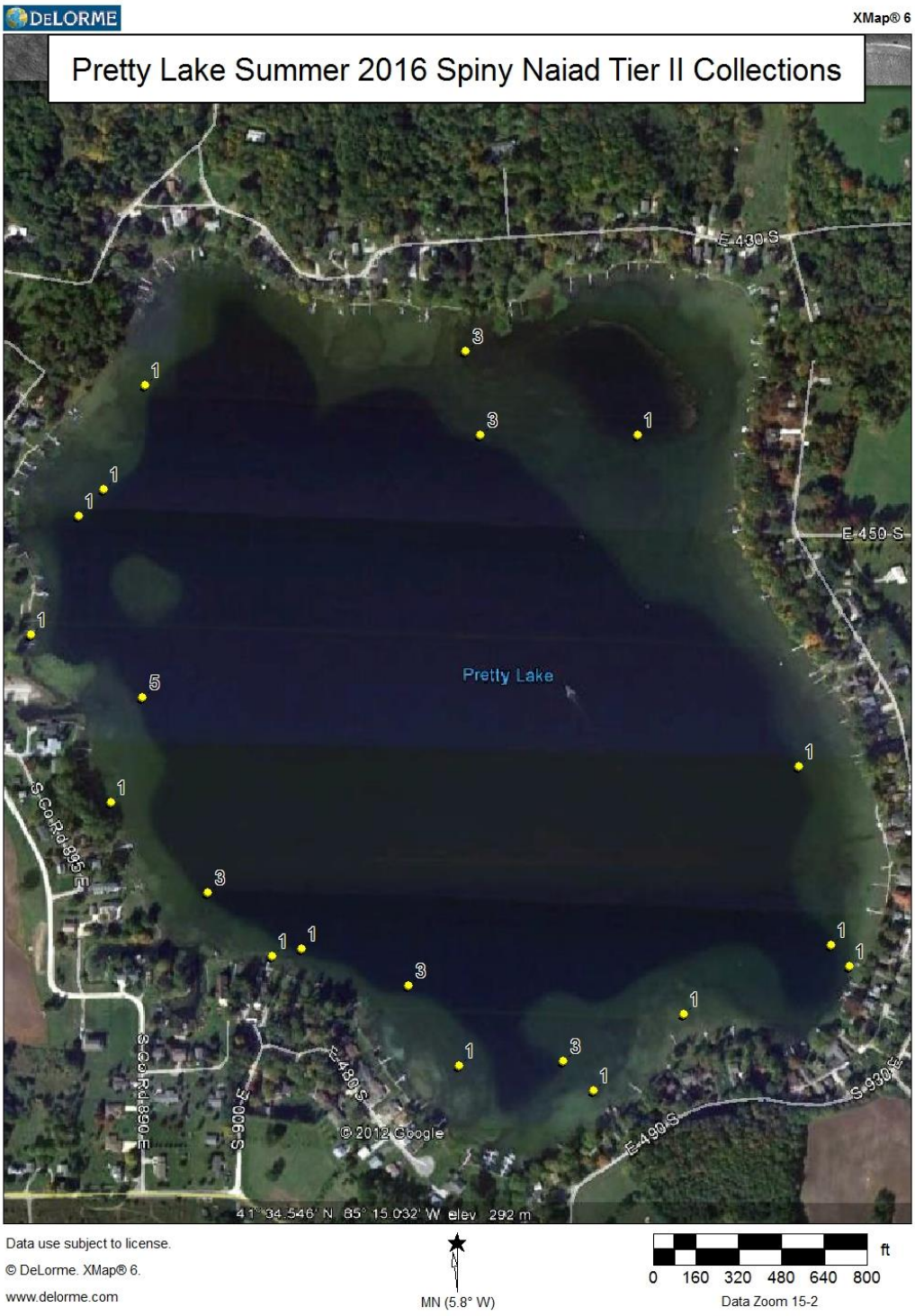
Figure 3: Pretty Lake Summer 2016 Eurasian Watermilfoil Distribution



Spiny Naiad

Spiny naiad (*Najas marina*) is another exotic species that is very common in Pretty Lake. In the summer 2016 tier II survey, spiny naiad was the second most collected species in the entire lake with a 40.0 percent site frequency. This is up from 32.0 percent in 2015. However, data from past tier II surveys indicates that spiny naiad does not appear to be increasing significantly in abundance in Pretty Lake. Spiny naiad does not appear to be causing any major use impairment in Pretty Lake.

Figure 4: Pretty Lake Summer 2016 Spiny Naiad Distribution



Tier II Data

Results from the July 26, 2016 tier II survey on Pretty Lake are summarized in Table 1. Site frequency, dominance, diversity, and other metrics are shown for the entire survey (overall) and also for each 5 foot depth contour where plants were present. In this survey no plants were found deeper than 20.0 feet.

Table 3: Pretty Lake Summer 2016 Tier II Data Analysis

Occurrence and Abundance of Submersed Aquatic Plants in Pretty Lake.

County:	LaGrange	Secchi (ft):	13.5	Mean species/site:	2.44
Date:	7/26/2016	Sites with plants:	48	SE Mean species/site:	0.21
Littoral Depth (ft):	20.0	Sites with native plants:	48	Mean native species/site:	1.86
Littoral Sites:	50	Number of species:	13	SE Mean natives/site:	0.15
Total Sites:	50	Number of native species:	10	Species diversity:	0.85
		Maximum species/site:	7	Native species diversity:	0.79

All Depths	Frequency of	Rake score frequency per species				Plant
Species	Occurrence	0	1	3	5	Dominance
Chara	70.0	30.0	22.0	34.0	14.0	38.8
Spiny naiad	40.0	60.0	28.0	10.0	2.0	13.6
Illinios pondweed	34.0	66.0	30.0	4.0	0.0	8.4
Eel grass	24.0	76.0	16.0	8.0	0.0	8.0
Nitella	18.0	82.0	6.0	10.0	2.0	9.2
Coontail	12.0	88.0	6.0	6.0	0.0	4.8
Sago pondweed	12.0	88.0	4.0	6.0	2.0	6.4
Eurasian watermilfoil	10.0	90.0	6.0	2.0	2.0	4.4
Curly-leaf pondweed	8.0	92.0	8.0	0.0	0.0	1.6
Flat-stemmed pondweed	6.0	94.0	6.0	0.0	0.0	1.2
Slender naiad	6.0	94.0	0.0	6.0	0.0	3.6
Richardson's pondweed	2.0	98.0	2.0	0.0	0.0	0.4
Small pondweed	2.0	98.0	2.0	0.0	0.0	0.4
Filamentous Algae	2.0					

Occurrence and Abundance of Submersed Aquatic Plants in Pretty Lake.

County:	LaGrange	Secchi (ft):	13.5	Mean species/site:	3.21
Date:	7/26/2016	Sites with plants:	14	SE Mean species/site:	0.38
Littoral Depth (ft):	20.0	Sites with native plants:	14	Mean native species/site:	2.50
Littoral Sites:	14	Number of species:	10	SE Mean natives/site:	0.25
Total Sites:	14	Number of native species:	7	Species diversity:	0.79
		Maximum species/site:	7	Native species diversity:	0.70

Depths: 0 to 5 ft	Frequency of	Rake score frequency per species				Plant
Species	Occurrence	0	1	3	5	Dominance
Chara	100.0	0.0	7.1	64.3	28.6	68.6
Illinios pondweed	85.7	14.3	71.4	14.3	0.0	22.9
Spiny naiad	57.1	42.9	50.0	7.1	0.0	14.3
Eel grass	28.6	71.4	21.4	7.1	0.0	8.6
Slender naiad	14.3	85.7	0.0	14.3	0.0	8.6
Coontail	7.1	92.9	7.1	0.0	0.0	1.4
Curly-leaf pondweed	7.1	92.9	7.1	0.0	0.0	1.4
Eurasian watermilfoil	7.1	92.9	7.1	0.0	0.0	1.4
Flat-stemmed pondweed	7.1	92.9	7.1	0.0	0.0	1.4
Sago pondweed	7.1	92.9	0.0	0.0	7.1	7.1

Occurrence and Abundance of Submersed Aquatic Plants in Pretty Lake.

County:	LaGrange	Secchi (ft):	13.5	Mean species/site:	2.86
Date:	7/26/2016	Sites with plants:	14	SE Mean species/site:	0.36
Littoral Depth (ft):	20.0	Sites with native plants:	14	Mean native species/site:	1.93
Littoral Sites:	14	Number of species:	9	SE Mean natives/site:	0.27
Total Sites:	14	Number of native species:	6	Species diversity:	0.79
		Maximum species/site:	5	Native species diversity:	0.67

Depths: 5 to 10 ft	Frequency of	Rake score frequency per species				Plant
Species	Occurrence	0	1	3	5	Dominance
Chara	100.0	0.0	28.6	50.0	21.4	57.1
Spiny naiad	64.3	35.7	35.7	28.6	0.0	24.3
Sago pondweed	35.7	64.3	14.3	21.4	0.0	15.7
Eel grass	21.4	78.6	21.4	0.0	0.0	4.3
Eurasian watermilfoil	21.4	78.6	7.1	7.1	7.1	12.9
Illinios pondweed	21.4	78.6	21.4	0.0	0.0	4.3
Coontail	7.1	92.9	0.0	7.1	0.0	4.3
Curly-leaf pondweed	7.1	92.9	7.1	0.0	0.0	1.4
Flat-stemmed pondweed	7.1	92.9	7.1	0.0	0.0	1.4
Filamentous Algae	7.1					

Table 3 continued

Occurrence and Abundance of Submersed Aquatic Plants in Pretty Lake.

County:	LaGrange	Secchi (ft):	13.5	Mean species/site:	2.25
Date:	7/26/2016	Sites with plants:	12	SE Mean species/site:	0.37
Littoral Depth (ft):	20.0	Sites with native plants:	12	Mean native species/site:	1.75
Littoral Sites:	12	Number of species:	12	SE Mean natives/site:	0.28
Total Sites:	12	Number of native species:	9	Species diversity:	0.88
		Maximum species/site:	5	Native species diversity:	0.83

Depths: 10 to 15 ft	Frequency of	Rake score frequency per species				Plant
Species	Occurrence	0	1	3	5	Dominance
Chara	50.0	50.0	41.7	8.3	0.0	13.3
Eel grass	33.3	66.7	8.3	25.0	0.0	16.7
Nitella	25.0	75.0	8.3	8.3	8.3	15.0
Spiny naiad	25.0	75.0	16.7	0.0	8.3	11.7
Coontail	16.7	83.3	8.3	8.3	0.0	6.7
Curly-leaf pondweed	16.7	83.3	16.7	0.0	0.0	3.3
Illinios pondweed	16.7	83.3	16.7	0.0	0.0	3.3
Eurasian watermilfoil	8.3	91.7	8.3	0.0	0.0	1.7
Flat-stemmed pondweed	8.3	91.7	8.3	0.0	0.0	1.7
Richardson's pondweed	8.3	91.7	8.3	0.0	0.0	1.7
Slender naiad	8.3	91.7	0.0	8.3	0.0	5.0
Small pondweed	8.3	91.7	8.3	0.0	0.0	1.7

Occurrence and Abundance of Submersed Aquatic Plants in Pretty Lake.

County:	LaGrange	Secchi (ft):	13.5	Mean species/site:	1.00
Date:	7/26/2016	Sites with plants:	8	SE Mean species/site:	0.21
Littoral Depth (ft):	20.0	Sites with native plants:	8	Mean native species/site:	1.00
Littoral Sites:	10	Number of species:	4	SE Mean natives/site:	0.21
Total Sites:	10	Number of native species:	4	Species diversity:	0.58
		Maximum species/site:	2	Native species diversity:	0.58

Depths: 15 to 20 ft	Frequency of	Rake score frequency per species				Plant
Species	Occurrence	0	1	3	5	Dominance
Nitella	60.0	40.0	20.0	40.0	0.0	28.0
Coontail	20.0	80.0	10.0	10.0	0.0	8.0
Chara	10.0	90.0	10.0	0.0	0.0	2.0
Eel grass	10.0	90.0	10.0	0.0	0.0	2.0

Multi-Year Data Presentation

Data from recent tier II surveys of Pretty Lake is summarized in Table 4. This summary helps track plant trends from year to year. As more data is added each year, it should help to give a better picture of long term changes in the plant population in Pretty Lake.

Table 4: Pretty Lake Historical Tier II Data

Pretty Lake Multi-Year Tier II Data Presentation							
Date:	5/30/2007	7/30/2007	8/18/2010	7/26/2013	7/30/2014	7/29/2015	7/26/2016
Total Sites:	59	59	50	50	50	50	50
Secchi (ft):	12.7	15.5	15.0	26.0	18.2	12.9	13.5
Number of Species:	15	14	14	13	14	10	13
Number of Native Species:	13	12	13	11	12	8	10
Sites with Plants	51	55	48	47	40	43	48
Sites with Native Plants	51	55	48	45	38	39	48
Maximum Plant Depth (ft)	18	25	20	20	19	20	20
Species Diversity:	0.88	0.89	0.9	0.81	0.8	0.79	0.85
Native Species Diversity:	0.87	0.88	0.88	0.76	0.74	0.72	0.79
Mean Native Species/Site:	2.2	2.5	2.2	1.5	1.18	1.3	1.86
Surveying Organization	J.F. NEW	J.F. NEW	IDNR	AWC	AWC	AWC	AWC
Species Frequency of Occurrence - All Depths							
Chara	55.9	50.9	36.7	64.0	54.0	60.0	70.0
Spiny naiad	0.0	30.5	36.7	36.0	32.0	32.0	40.0
Illinois pondweed	11.9	20.3	14.3	24.0	18.0	18.0	34.0
Nitella	27.1	27.1	14.3	16.0	6.0	8.0	18.0
Coontail	23.7	25.4	14.3	12.0	6.0	6.0	12.0
Eel grass	11.9	27.1	28.6	12.0	16.0	24.0	24.0
Flat-stemmed pondweed	10.2	3.4	4.1	8.0	4.0	0.0	6.0
Canada waterweed	0.0	0.0	0.0	4.0	2.0	0.0	0.0
Richardson's pondweed	0.0	0.0	2.0	4.0	4.0	4.0	2.0
Eurasian watermilfoil	11.9	15.3	24.5	2.0	2.0	2.0	10.0
Sago pondweed	27.1	23.7	34.7	2.0	2.0	0.0	12.0
Slender naiad	8.5	0.0	14.3	2.0	2.0	8.0	6.0
Small pondweed	0.0	0.0	0.0	2.0	2.0	0.0	2.0
Variable pondweed	22.0	27.1	14.3	0.0	0.0	0.0	0.0
Northern watermilfoil	8.5	10.2	6.1	0.0	0.0	0.0	0.0
Large-leaved pondweed	3.4	6.8	2.0	0.0	2.0	2.0	0.0
Southern naiad	10.2	0.0	0.0	0.0	0.0	0.0	0.0
Curly-leaf pondweed	5.1	0.0	0.0	0.0	0.0	0.0	8.0
Water stargrass	1.7	0.0	0.0	0.0	0.0	0.0	0.0
Long-leaf pondweed	0.0	3.4	0.0	0.0	0.0	0.0	0.0
Various-leaved watermilfoil	0.0	1.7	0.0	0.0	0.0	0.0	0.0
Species Frequency of Occurrence - 0 to 5 ft							
Chara	100.0	100.0	78.6	92.9	92.9	92.9	100.0
Illinois pondweed	25.0	37.5	28.6	42.9	35.7	42.9	85.7
Spiny naiad	0.0	56.3	14.3	28.6	28.6	14.3	57.1
Eel grass	18.8	43.8	7.1	14.3	14.3	28.6	28.6
Coontail	31.3	12.5	0.0	7.1	7.1	7.1	7.1
Flat-stemmed pondweed	6.3	0.0	7.1	7.1	0.0	0.0	7.1
Small pondweed	0.0	0.0	0.0	7.1	0.0	0.0	0.0
Variable pondweed	50.0	50.0	42.9	0.0	0.0	0.0	0.0
Northern watermilfoil	0.0	12.5	0.0	0.0	0.0	0.0	0.0
Large-leaved pondweed	0.0	12.5	0.0	0.0	7.1	7.1	0.0
Richardson's pondweed	0.0	0.0	0.0	0.0	7.1	7.1	0.0
Sago pondweed	50.0	18.8	14.3	0.0	7.1	0.0	7.1
Slender naiad	0.0	0.0	14.3	0.0	7.1	28.6	0.0
Eurasian watermilfoil	12.5	12.5	7.1	0.0	0.0	0.0	7.1
Curly-leaf pondweed	0.0	0.0	0.0	0.0	0.0	0.0	7.1
Long-leaf pondweed	0.0	6.3	0.0	0.0	0.0	0.0	0.0

Table 4 continued

Species Frequency of Occurrence - 5 to 10 ft							
Chara	55.6	69.2	35.7	92.9	78.6	78.6	100.0
Spiny naiad	0.0	38.5	71.4	57.1	50.0	71.4	64.3
Illinois pondweed	11.1	38.5	21.4	28.6	28.6	14.3	21.4
Eel grass	16.7	61.5	42.9	21.4	21.4	28.6	21.4
Coontail	33.3	46.2	21.4	14.3	7.1	0.0	7.1
Eurasian watermilfoil	22.2	46.2	35.7	7.1	0.0	7.1	21.4
Flat-stemmed pondweed	22.2	0.0	0.0	7.1	7.1	0.0	7.1
Richardson's pondweed	0.0	0.0	0.0	7.1	0.0	0.0	0.0
Small pondweed	0.0	0.0	0.0	0.0	7.1	0.0	0.0
Sago pondweed	33.3	46.2	92.9	7.1	0.0	0.0	35.7
Slender naiad	5.6	0.0	7.1	7.1	0.0	0.0	0.0
Large-leaved pondweed	5.6	15.4	7.1	0.0	0.0	0.0	0.0
Northern watermilfoil	27.8	23.1	7.1	0.0	0.0	0.0	0.0
Variable pondweed	27.8	53.9	0.0	0.0	0.0	0.0	0.0
Curly-leaf pondweed	11.1	0.0	0.0	0.0	0.0	0.0	7.1
Nitella	16.7	0.0	0.0	0.0	0.0	0.0	0.0
Southern naiad	11.1	0.0	0.0	0.0	0.0	0.0	0.0
Water stargrass	5.6	0.0	0.0	0.0	0.0	0.0	0.0
Long-leaf pondweed	0.0	7.7	0.0	0.0	0.0	0.0	0.0
Species Frequency of Occurrence - 10 to 15 ft							
Spiny naiad	0.0	25.0	50.0	41.7	41.7	25.0	25.0
Chara	35.3	62.5	16.7	41.7	25.0	50.0	50.0
Coontail	17.7	37.5	16.7	16.7	0.0	0.0	16.7
Flat-stemmed pondweed	5.9	12.5	8.3	16.7	0.0	0.0	8.3
Illinois pondweed	5.9	12.5	0.0	16.7	0.0	8.3	16.7
Nitella	47.1	12.5	8.3	16.7	8.3	0.0	25.0
Eel grass	5.9	12.5	50.0	8.3	25.0	33.3	33.3
Canada waterweed	0.0	0.0	0.0	8.3	0.0	0.0	0.0
Richardson's pondweed	0.0	0.0	8.3	8.3	8.3	8.3	8.3
Eurasian watermilfoil	5.9	12.5	41.7	0.0	8.3	0.0	8.3
Slender naiad	23.5	0.0	25.0	0.0	0.0	0.0	8.3
Northern watermilfoil	0.0	0.0	16.7	0.0	0.0	0.0	8.3
Sago pondweed	11.8	50.0	16.7	0.0	0.0	0.0	0.0
Southern naiad	23.5	0.0	0.0	0.0	0.0	0.0	0.0
Curly-leaf pondweed	5.9	0.0	0.0	0.0	0.0	0.0	16.7
Large-leaved pondweed	5.9	0.0	0.0	0.0	0.0	0.0	0.0
Variable pondweed	0.0	12.5	0.0	0.0	0.0	0.0	0.0
Species Frequency of Occurrence - 15 to 20 ft							
Nitella	62.5	57.2	66.7	60.0	20.0	40.0	60.0
Spiny naiad	0.0	14.3	0.0	10.0	0.0	10.0	0.0
Chara	12.5	0.0	0.0	10.0	0.0	0.0	10.0
Coontail	0.0	28.6	22.2	10.0	10.0	20.0	20.0
Canada waterweed	0.0	0.0	0.0	10.0	10.0	0.0	0.0
Slender naiad	0.0	0.0	11.1	0.0	0.0	0.0	0.0
Eel grass	0.0	0.0	11.1	0.0	0.0	0.0	10.0
EWM	0.0	0.0	11.1	0.0	0.0	0.0	0.0
Flat-stemmed pondweed	0.0	7.1	0.0	0.0	10.0	0.0	0.0
Sago pondweed	0.0	7.1	0.0	0.0	0.0	0.0	0.0
Various-leaved watermilfoil	0.0	7.1	0.0	0.0	0.0	0.0	0.0
Northern watermilfoil	0.0	7.1	0.0	0.0	0.0	0.0	0.0
Species Frequency of Occurrence - 20 to 25 ft							
Nitella	62.5	100.0	NA	NA	NA	NA	NA

Water Clarity and Water Quality

Table 5 summarizes the Secchi readings taken in each tier II survey since 2007 at Pretty Lake. Although water clarity can fluctuate greatly based on weather, rain events, and algal blooms, it appears that water clarity in Pretty Lake is excellent.

Table 5: Pretty Lake Secchi History

Date	5/30/2007	7/30/2007	8/18/2010	7/26/2013	7/30/2014	7/29/2015	7/26/2016
Secchi Depth (ft.)	12.7	15.5	15.0	26.0	18.2	12.9	13.5

During the summer 2016 tier II survey, Aquatic Weed Control collected data to construct dissolved oxygen and temperature profiles for Pretty Lake. These profiles are described in Figure 5 and Figure 6. Dissolved oxygen in Pretty Lake is excellent, with adequate oxygen to support fish life down to at least 18 feet. Oxygen dropped to 3.5 ppm around 21 feet but then rose back to over 4 ppm at depths of 30 to 40 feet. The Data from the temperature profile indicates a large amount of cool, oxygenated water which should foster good fish habitat and general good health for the biological community in Pretty Lake. The surface temperature was 85.8 degrees and dropped to 46.5 degrees at a depth of 45 feet.

Figure 5: Pretty Lake 2016 Dissolved Oxygen Profile

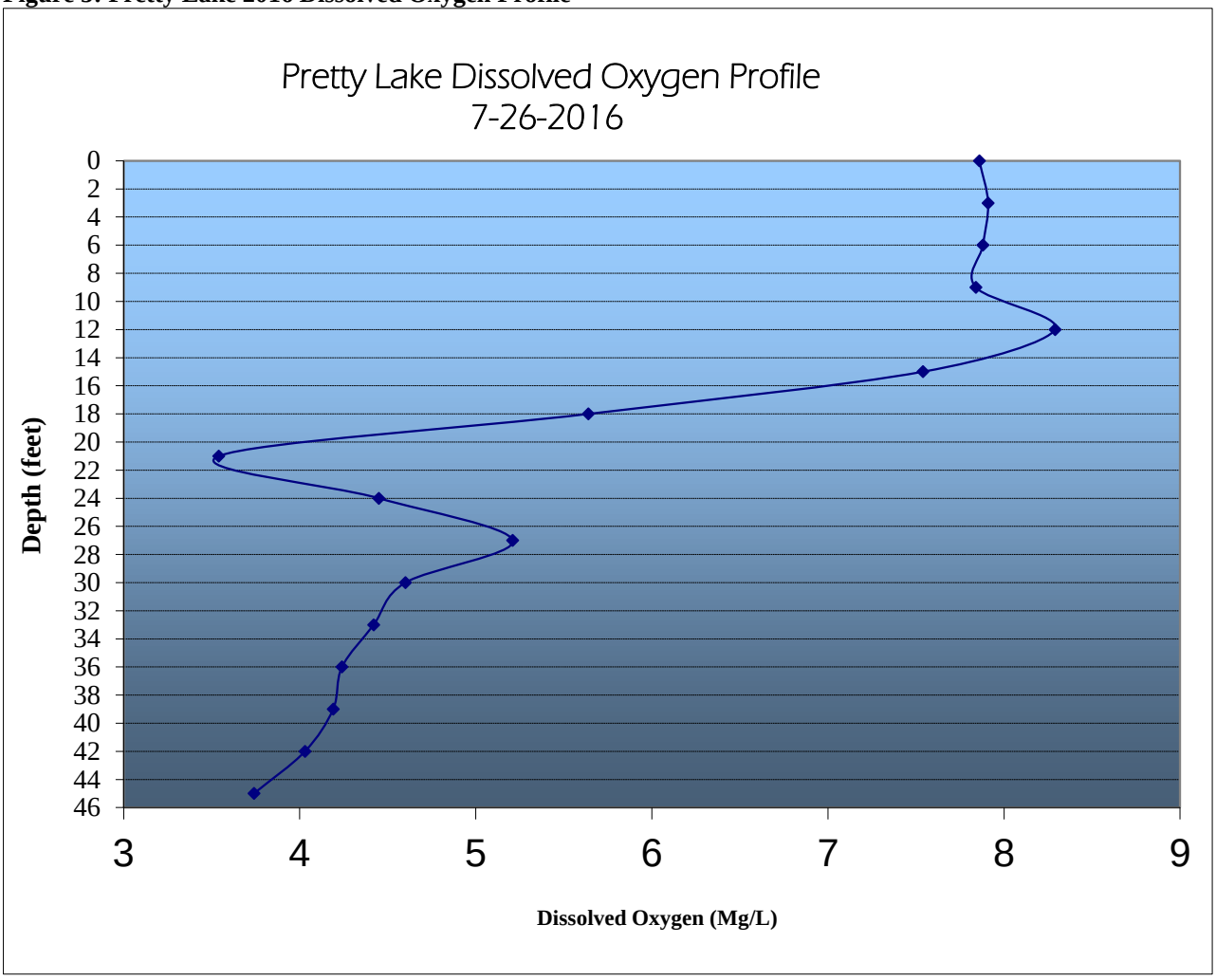
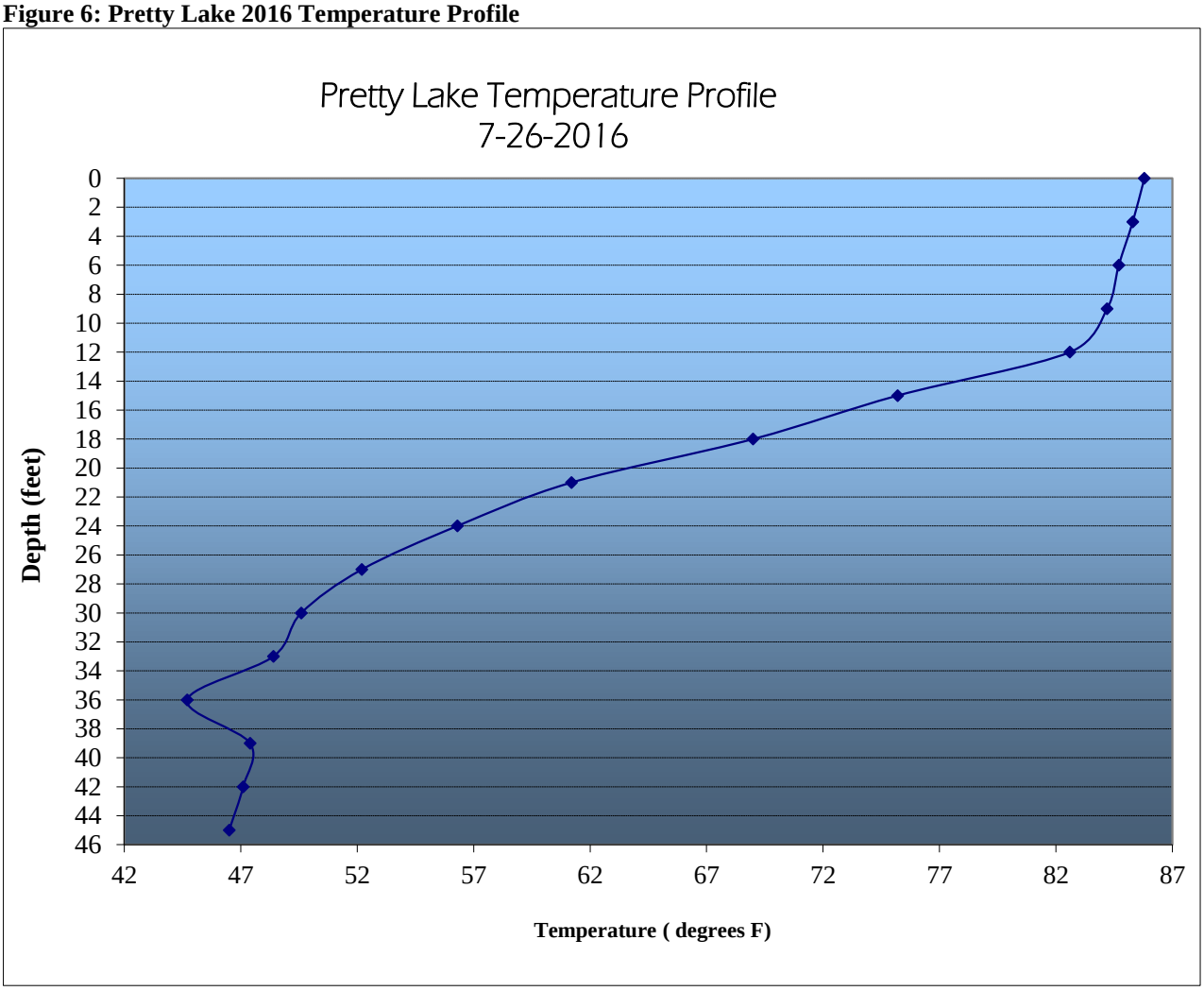


Figure 6: Pretty Lake 2016 Temperature Profile



Fisheries Update

The most recent fisheries reports for Pretty Lake are available online at the links below.
http://www.in.gov/dnr/fishwild/files/fw-Pretty_Lake_Walleye_Evaluation_2010.pdf
http://www.in.gov/dnr/fishwild/files/fw-Pretty_Lake_Walleye_Evaluation_2009.pdf
http://www.in.gov/dnr/fishwild/files/fw-Pretty_Lake_Walleye_2008.pdf

Tier II Discussion

Tier II surveys on Pretty Lake have found 8 to 14 native plant species per survey since 2007. The IDNR has set native species richness and diversity targets of 12 species and 0.84 respectively (IDNR 2014).

In 2016, native diversity was 0.79 and native species richness was 10 species. These values are greater than 2015 but did not meet the target objectives proposed by the IDNR. Native species diversity should continue to be monitored for any significant changes in future years. Based on results from the past four years, it appears unlikely that the native diversity target of 0.84 will be met in 2017. This could be due to weather patterns or herbicide impacts, but this was an aggressive goal based on data averaged from surveys completed in 2007, 2010 and 2013. It appears the plant community has changed since then and one major factor might be the increased abundance of EWM. It is encouraging that native diversity and sites with native plants in 2016 were the highest they had been since 2010. In addition the frequency of most plants stayed the same or increased when compared to data collected in 2014 and 2015.

Eurasian watermilfoil has been collected in each tier II survey since 2007. It reached a maximum site frequency (24.5%) in the summer of 2010 when no widespread EWM treatments were being conducted. In the summer of 2013 through summer 2015, EWM frequency was just 2.0 percent (1 site). This might indicate that the early season treatment strategy was effective at reducing EWM abundance from spring to summer. In 2016, without the large-scale, aggressive treatments EWM frequency was 10.0 percent.

Curly-leaf pondweed (*Potamogeton crispus*) (CLP) had a site frequency of 8.0 percent in summer of 2016. This is the highest site frequency for CLP recorded at Pretty Lake. The CLP population should continue to be monitored for any further increase. CLP does not seem to be causing any major recreation impairment in Pretty Lake.

Spiny naiad is another abundant exotic species in Pretty Lake. It was collected at 40.0 percent of sample locations in the summer 2016 tier II survey. Even though it is somewhat abundant in Pretty Lake, spiny naiad is generally not present in nuisance quantities. It does not appear that spiny naiad is causing any lake use problems in Pretty Lake. Looking back at tier II data from 2007 and 2010, it does not appear that spiny naiad is increasing. At this time it is not believed that any management of spiny naiad is needed.

Action Plan

Given the increase in native plants observed in 2016, for 2017 the treatment strategy is likely to be much the same. Areas of dense EWM in spring of 2017 will be treated with 2, 4-D at a rate of 2.0 parts per million pending LARE and IDNR approval. The IDNR is hopeful that this plan will keep EWM at or below 10% frequency while allowing native plants to thrive. A summer tier II survey should be conducted to evaluate both the invasive and native plant communities.

It is unknown what the treatment areas and acreages will be in 2017. However it is very likely that all areas in shown in Figure 2 of this report will need EWM treatment. Other areas may need treatment as well as EWM recovers from the aggressive treatment program.

In fall of 2017 a native plant called sago pondweed became very dense in several areas of the lake. Although the treatment of this plant would not be eligible for LARE funding, if it causes significant recreational impairment of the lake, a request could be made to have the district fisheries biologist

inspect the lake. Any native treatments would need approval from the district biologist and be completed with private funds.

The 2017 2, 4-D treatments would likely receive a 50% cost share from LARE with the association being responsible for 50% of the cost as well. The AVMP could be updated, or the association may have the option to do a survey only, without a full AVMP update. It is likely that LARE would pay for 80% of planning and survey costs, with the association being responsible for 20% of the AVMP costs.

Surveys and Planning

A visual survey should be sufficient in spring of 2017 to use a GPS to map EWM beds. This visual survey will be used to develop a potential treatment map for 2017.

A summer tier II survey should be conducted after treatment in 2017. The main purposes of this survey will be to evaluate treatment success, identify any areas of EWM re-growth, and to monitor both exotic and native plant populations. Quantifiable data from this survey will be used for comparison to past surveys and can help to identify any long term plant trends in Pretty Lake.

An AVMP is optional for 2017 for Pretty Lake. This update would summarize 2017 management activities, evaluate treatment success, and further outline future management strategies for the control of exotic plant species in Pretty Lake.

2017 Budget Estimates

Treat up to 30 acres of EWM with liquid 2, 4-D at 2.0 ppm	up to $ 9,800
Spring visual survey, summer Tier II survey with optional plan update	up to $ 5,000
(The cost to do a survey only is estimated at $2500 dolllars)	
Total cost estimate	up to $ 14,800
LARE share (50% of treatment and 80% of plan/survey-subject to availability)	up to $ 8,900
Assocaitions share (50% of treatment, 20% of plan/survey)	up to $ 5,900

Public Involvement

Parties interested in the improvement of Pretty Lake include members of the Pretty Lake Conservation Club as well as others who access the lake at the IDNR owned access site. The most common and often most effective methods for keeping the public informed about aquatic vegetation management practices are lake association meetings as well as periodical newsletters sent out by the associations. It is recommended that association members encourage neighbors and other lake users to attend lake association meetings so that interested parties are well informed about the LARE program. Making sure that meetings are well advertised and planned well in advance of the meeting dates are ways to help ensure good attendance. Carry-in dinners, door prizes, contests, guest speakers, and discussion panels are all excellent ways to boost attendance, encourage involvement, and keep association members informed about lake management activities.

The Pretty Lake Property Owners Association held a public meeting on July 16, 2016 to discuss issues related to the LARE program. Attendance was excellent with 43 lake use surveys being returned. Jim Donahoe of Aquatic Weed Control attended this meeting to summarize LARE activities on the lake. Forty of the 43 association members were in favor of continuing treatments for invasive plant species. Responses from all returned lake use surveys are summarized in Figure 7. Please note that not every person answers every question in pubic surveys, so the sum of responses for each question may not equal the total number of surveys returned.

Figure 7: Pretty Lake 2016 Public Questionnaire

Lake Use Survey Lake name Pretty Lake

Are you a lake property owner? Yes 43 No 0

Are you currently a member of your lake association? Yes 43 No 0

How many years have you been at the lake? 2 or less 1
2 – 5 years 7
5-10 years 5
Over 10 years 28

How do you use the lake (mark all that apply)

40 Swimming
42 Boating
34 Fishing
7 Irrigation
Drinking water
1 Other Scuba

Do you have aquatic plants at your shoreline in nuisance quantities? Yes 16 No 26

Do you currently participate in a weed control project on the lake? Yes 36 No 7

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes 9 No 33

Does the level of vegetation in the lake affect your property values? Yes 13 No 26

Are you in favor of continuing efforts to control vegetation on the lake? Yes 40 No 3

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes 42 No 1

Mark any of these you think are problems on your lake:

3 Too many boats access the lake
0 Use of jet skis on the lake
2 Too much fishing
3 Fish population problem
1 Dredging needed
3 Overuse by nonresidents
3 Too many aquatic plants
1 Not enough aquatic plants
1 Poor water quality
3 Pier/funneling problem

Please add any comments:

Fishing too close to our pier.
Too many people using lake for personal hygiene.
Appreciate efforts to keep Pretty Lake a beautiful place.
~~We have many good aquatic plants in our lake. Care needs to be taken to not harm these!!~~
Continue to control invasive species.
I am very pleased with the results of the weed program done on Pretty Lake.
We appreciate the efforts to control the weeds. It made a big difference throughout the lake and in front of our cottage.
On north side of lake- it was dredged and the weeds are very dense and unbearable.
Smallmouth population is increasing but largemouth is low.
Good job this year on having some weeds for fishing.

References Cited

J.F. New Inc. (C/O Sara Peel). 2008. Pretty Lake Aquatic Vegetation Management Plan 2007-2011. 708 Roosevelt Road, Walkerton IN, 46574.

IDNR. 2014. Tier II Aquatic Vegetation Survey Protocol. IN Department of Natural Resources. Indianapolis, Indiana.

Aquatic Weed Control. 2014. Pretty Lake Aquatic Vegetation Management Plan Update 2013. P.O. Box 325 Syracuse, IN 46567.

Appendix

Common and Scientific names of aquatic plants mentioned in this report.

Common Name	Scientific Name
Chara	*Chara sp.*
Coontail	*Ceratophyllum demersum*
Curly-leaf pondweed	*Potamogeton crispus*
Eel grass	*Vallisneria americana*
Canada waterweed	*Elodea canadensis*
Eurasian watermilfoil	*Myriophyllum spicatum*
Flat-stemmed pondweed	*Potamogeton zosteriformis*
Illinois pondweed	*Potamogeton illinoensis*
Large-leaved pondweed	*Potamogeton amplifolius*
Leafy pondweed	*Potamogeton foliosus*
Long-leaf pondweed	*Potamogeton nodosus*
Nitella	*Nitella sp.*
Northern watermilfoil	*Myriophyllum sibiricum*
Richardson's pondweed	*Potamogeton richardsonii*
Sago pondweed	*Stuckenia pectinata*
Slender naiad	*Najas flexilis*
Small pondweed	*Potamogeton pusillus*
Southern naiad	*Najas guadalupensis*
Spiny naiad	*Najas* marina
Variable pondweed	*Potamogeton gramineus*
Various-leaved watermilfoil	*Myriophyllum heterophyllum*
Water stargrass	*Heteranthera dubia*
White-stemmed pondweed	*Potamogeton praelongus*
Whorled watermilfoil	*Myriophyllum verticillatum*

Pretty Lake	7/26/2016			Secchi: 13.5'													
Latitude	Longitude	Depth	Site	Eurasian watermilfoil	Spiny naiad	Curly-leaf pondweed	chara	Illinios pondweed	Eel grass	Slender naiad	Richardson's pondweed	Nitella	Coontail	Sago pondweed	Flat-stemmed pondweed	Small pondweed	algae
41.57598	-85.25547	3	1		1		5	1									
41.57694	-85.25446	19	2									3	1				
41.57720	-85.25482	7	3		1		3	1						1			
41.57747	-85.25448	11	4		1			1	3		1						
41.57810	-85.25448	2	5				3	1									
41.57853	-85.25391	7	6		1		1	1	1								
41.57901	-85.25285	19	7														
41.57925	-85.25257	14	8	1			1										
41.57948	-85.25234	3	9				5	1									
41.57839	-85.25163	7	10				3										
41.57843	-85.25022	15	11				3		3								
41.57759	-85.24870	18	12														
41.57802	-85.24934	8	13		3		3							1			
41.57888	-85.24953	3	14		3	1	1		3	3				5	1		
41.57872	-85.24712	14	15										3				
41.57919	-85.24784	8	16	3		1	1						3				
41.57944	-85.24685	3	17	1			3	1					1				
41.57813	-85.24588	3	18				3	3									
41.57802	-85.24719	9	19	5	1		1								1		p
41.57712	-85.24791	13	20			1						1	1				
41.57628	-85.24699	18	21									3					
41.57604	-85.24593	7	22				3										
41.57562	-85.24553	14	23					1	1								
41.57597	-85.24528	3	24				3	1									
41.57464	-85.24498	7	25		1		3							3			
41.57416	-85.24504	18	26				1										
41.57448	-85.24447	3	27				3	1									
41.57340	-85.24507	13	28									5					
41.57281	-85.24454	8	29		1		3		1					3			
41.57260	-85.24429	3	30		1		3	1	1	3							
41.57238	-85.24490	16	31									3	3				
41.57290	-85.24542	12	32				1										
41.57258	-85.24674	7	33				5										
41.57211	-85.24656	2	34		1		3	1									
41.57133	-85.24779	3	35		1		3	3									
41.57163	-85.24820	9	36		3		5										
41.57233	-85.24799	13	37			1	1									1	
41.57182	-85.24887	19	38									3					
41.57204	-85.24948	14	39									3					
41.57158	-85.24962	3	40		1		5	1	1								
41.57240	-85.25032	10	41		3		3										
41.57278	-85.25177	11	42		1		1		3	3					1		
41.57270	-85.25218	2	43		1		5	1									
41.57335	-85.25306	6	44		3		1	1	1					3			
41.57387	-85.25362	16	45						1								
41.57414	-85.25365	20	46									1					
41.57427	-85.25437	3	47		1		3		1								
41.57485	-85.25375	8	48	1			5										
41.57534	-85.25395	11	49		5		1										
41.576059	-85.254	17	50									1					

Tier II GPS Coordinates

Latitude	Longitude	Depth	WPT
41.57598	-85.25547	3	1
41.57694	-85.25446	19	2
41.57720	-85.25482	7	3
41.57747	-85.25448	11	4
41.57810	-85.25448	2	5
41.57853	-85.25391	7	6
41.57901	-85.25285	19	7
41.57925	-85.25257	14	8
41.57948	-85.25234	3	9
41.57839	-85.25163	7	10
41.57843	-85.25022	15	11
41.57759	-85.24870	18	12
41.57802	-85.24934	8	13
41.57888	-85.24953	3	14
41.57872	-85.24712	14	15
41.57919	-85.24784	8	16
41.57944	-85.24685	3	17
41.57813	-85.24588	3	18
41.57802	-85.24719	9	19
41.57712	-85.24791	13	20
41.57628	-85.24699	18	21
41.57604	-85.24593	7	22
41.57562	-85.24553	14	23
41.57597	-85.24528	3	24
41.57464	-85.24498	7	25
41.57416	-85.24504	18	26
41.57448	-85.24447	3	27
41.57340	-85.24507	13	28
41.57281	-85.24454	8	29
41.57260	-85.24429	3	30
41.57238	-85.24490	16	31
41.57290	-85.24542	12	32
41.57258	-85.24674	7	33
41.57211	-85.24656	2	34
41.57133	-85.24779	3	35
41.57163	-85.24820	9	36
41.57233	-85.24799	13	37
41.57182	-85.24887	19	38
41.57204	-85.24948	14	39
41.57158	-85.24962	3	40
41.57240	-85.25032	10	41
41.57278	-85.25177	11	42
41.57270	-85.25218	2	43
41.57335	-85.25306	6	44
41.57387	-85.25362	16	45
41.57414	-85.25365	20	46
41.57427	-85.25437	3	47
41.57485	-85.25375	8	48
41.57534	-85.25395	11	49
41.57606	-85.254	17	50

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Aquatic Vegetation Control Permit

Page 1 of ____

APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT
State Form 26727 (R5 / 9-13)
Approved by State Board of Accounts, 2013

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
ATTN: COMMERCIAL LICENSE CLERK
402 W. Washington Street, Rm W273
Indianapolis, IN 46204
Telephone Number: (317) 232-4102
Fax Number: (317) 232-8150

FEE $5.00

Check type of permit:
☐ Whole Lake ☒ Multiple Treatment Areas

INSTRUCTIONS: 1. *Please print or type information.*
2. *Applicant must sign the application and is the only signature required. If applicant is also the certified chemical applicator that will be performing the treatment(s), he/she will also sign as the Certified Applicator.*

Applicant Name	Lake Association Name	
Pretty Lake Conservation Club	Pretty Lake Conservation Club	
Street or Rural Route		Telephone Number
City and State		ZIP Code
Certified Applicator Name	Company or Corporation Name	Certification Number
Street or Rural Route		Telephone Number
City and State		ZIP Code
Water Body Name (One application per water body)	Nearest Town	County
Is the body of water a water supply or does it flow into a water supply?	☐ Yes	☒ No

Please complete one section for *EACH* treatment area. Attach lake map showing treatment area and denote location of any water supply intake.

Treatment area number:	Latitude / Longitude or Universal Transverse Mercator (UTM):	Total acres to be controlled:	Proposed shoreline treatment length (ft):	Perpendicular distance from shoreline (ft):
1	see map- exact areas to be determined by 2016 survey	up to 28	see map	see map

Maximum depth of treatment (ft):	Expected date(s) of treatment(s):	Treatment method:				
10	late may or early june	☒ Chemical	☐ Physical	☐ Biological Control	☐ Mechanical	

Based on treatment method, describe chemical to be used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. 2, 4-D

Plant survey method: ☐ Rake ☒ Visual ☐ Other (*specify*) _____

Aquatic Plant Name	Check if Target Species	% Relative Abundance of Community	Aquatic Plant Name	Check if Target Species	% Relative Abundance of Community
Eurasian watermilfoil	✓	30			
chara		30			
spiny naiad		20			
illinois pondweed		10			
sago pondweed		10			
map will be submitted for approval					
prior to treatment					

Aquatic Weed Control

Page ____ of ____

Treatment area number:	Latitude / Longitude or Universal Transverse Mercator (UTM):	Total acres to be controlled:	Proposed shoreline treatment length (ft):	Perpendicular distance from shoreline (ft):

Maximum depth of treatment (ft):	Expected date(s) of treatment(s):	Treatment method: ☐ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical to be used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. _____

Plant survey method: ☐ Rake ☐ Visual ☐ Other (*specify*) _____

Aquatic Plant Name	Check if Target Species	% Relative Abundance of Community	Aquatic Plant Name	Check if Target Species	% Relative Abundance of Community
	☐			☐	
	☐			☐	
	☐			☐	
	☐			☐	
	☐			☐	

Treatment area number:	Latitude / Longitude or Universal Transverse Mercator (UTM):	Total acres to be controlled:	Proposed shoreline treatment length (ft):	Perpendicular distance from shoreline (ft):

Maximum depth of treatment (ft):	Expected date(s) of treatment(s):	Treatment method: ☐ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical to be used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. _____

Plant survey method: ☐ Rake ☐ Visual ☐ Other (*specify*) _____

Aquatic Plant Name	Check if Target Species	% Relative Abundance of Community	Aquatic Plant Name	Check if Target Species	% Relative Abundance of Community
	☐			☐	
	☐			☐	
	☐			☐	
	☐			☐	
	☐			☐	

AGREEMENT

I have read and understand the Indiana Aquatic Vegetation Control Permit Laws and agree to abide by them. Under the penalties of perjury (IC 35-44-2-1), I affirm the information supplied by me is true and correct to the best of my knowledge.

Signature of Applicant _____ Date (*month, day, year*) _____

Signature of Certified Applicator _____ Date (*month, day, year*) _____

Make check or money order payable to DNR - Division of Fish and Wildlife in the amount of $5.00
Return completed application with the $5.00 permit fee to the address shown on page 1.

OFFICE USE ONLY

Permit Number	Check Number	Other

☐ Denied ☐ Approved ☐ Approved w/Conditions	Fisheries Section Approval

Permit Map- final treatment areas will be determined in the spring of 2017. A map will be submitted for approval prior to any treatment. The map below shows the full extent of EWM in past years. These are the areas most likely to contain EWM and be targeted for treatment.