Shipshewana Lake Aquatic Vegetation Management Plan 2009 Update

Lagrange County, Indiana

http://129.79.145.7/arcims/statewide%5Fmxd/viewer.htm

Prepared for:

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Executive Summary

Shipshewana Lake is currently in the third year of a whole lake treatment program designed to reduce the abundance of an invasive aquatic plant species called Eurasian watermilfoil (*Myriophyllum spicatum*). On May 3, 2007 Shipshewana Lake was treated for control of Eurasian watermilfoil (EWM) with an herbicide called Sonar (fluridone) at a rate of 6 parts per billion. This was the first time Sonar had been applied in Shipshewana Lake. The Shipshewana Community Lake Improvement Association privately funded the addition of 2 parts per billion of Sonar to prevent coontail (*Ceratophyllum demersum*) (a native species) from increasing dramatically in 2007 once the Eurasian watermilfoil was removed. This made the overall target rate for the application 8 parts per billion. Since the whole lake Sonar treatment in 2007, no herbicide treatments of any kind have been conducted.

Two aquatic vegetation surveys were conducted during 2007 to monitor changes in the plant community as a result of this treatment. The first survey was conducted prior to treatment on May 3, 2007, and the second was conducted on August 17, 2007 (post treatment). The August 2007 vegetation survey found that Eurasian watermilfoil had been reduced to the point that it was undetectable in Shipshewana Lake. The coontail population was reduced from a site frequency of 73.3% on May 3 to 36.7% on August 17, 2007.

In 2008, visual inspections of Shipshewana Lake were unable to detect any Eurasian watermilfoil re-growth. Because no re-growth was found, no spot treatments for Eurasian watermilfoil were conducted during summer of 2008. A Tier II aquatic vegetation survey was conducted on Shipshewana Lake on July 24, 2008. This survey confirmed that Eurasian watermilfoil was still undetectable in Shipshewana Lake in summer of 2008. Coontail site frequency was reduced from 36.7% in August of 2007 to 8.3% on July 24, 2008. Only two other plant species were collected during the July 2008 Tier II survey. Sago pondweed was collected at 6.7% of the sample sites, down from 11.7% in August of 2007. Chara, which had not previously been collected in Shipshewana Lake, had a site frequency of just 1.7%.

In spring 2009, visual inspections were still unable to detect any Eurasian watermilfoil, so no herbicide treatments were conducted. A late season Tier II survey was conducted on July 23, 2009. No Eurasian watermilfoil was collected in this survey. One Eurasian watermilfoil plant was observed, harvested, and destroyed. Sago pondweed was collected with a frequency of 8.3%. Coontail and waterstargrass were both collected with a site frequency of only 1.7%.

Heavy planktonic algae blooms have historically been a problem on Shipshewana Lake and will likely continue to be a problem. No fish kills have been observed since the whole lake Sonar treatment. The possibility of a fish kill as a result of heavy algal blooms was a concern before the Sonar treatment. The possibility of a fish kill at Shipshewana Lake is still a concern, but no fish kills have been observed thus far.

As outlined in the 2006 management plan, poor water quality will unlikely prevent many native plants from colonizing areas previously infested by Eurasian watermilfoil. Coontail a native plant which does very well in nutrient rich water, will likely continue to be the most dominant plant in Shipshewana Lake. Coontail frequency was expected to increase in 2009, but it did not. This is likely due to the heavy planktonic algal blooms.

No herbicide treatments for native species will be allowed on Shipshewana Lake in 2010. This will continue to give native plants a chance to re-establish themselves. Based on results from other whole lake Sonar treatments, much more re-growth of Eurasian watermilfoil is expected in 2010. Spot treatments using liquid DMA4 (2, 4-D) will be used to manage any areas of Eurasian watermilfoil re-growth. Funding should be set aside to treat these areas. Likely areas of infestation will be in the northeast section of the lake where the single milfoil plant was observed in 2010. The exact acreage of re-infestation cannot be known until summer of 2010.

It is recommended that $7,400 be set aside to treat up to 20 acres of Eurasian watermilfoil re-growth in 2010. Original estimates called for treating 5 acres of re-growth in both 2008 and 2009. These treatments were not needed. Since no significant re-growth was observed in 2008 or 2009, it is difficult to estimate exact Eurasian watermilfoil acreage for 2010. Up to $4,700 dollars should also be set aside for survey and planning costs.

2010 Proposed Budget

1. Chemically treat any areas of Eurasian milfoil re-growth
   A. Treat up to 20 acres for Eurasian milfoil with 2, 4-D up to $7,400

2. Conduct a spring visual survey for EWM and a late season Tier II vegetation survey to monitor both Eurasian milfoil and native plant populations.
   A. Aquatic Vegetation Survey and Plan Update Up to $4,700

Total Cost Estimates

2,4-D spot treatments for Eurasian watermilfoil	$7,400
Surveys and AVMP update	$4,700
Total cost	$12,100
Lake and River Enhancement Share	$10,890
Association's Share	$1,210

Acknowledgements

Aquatic vegetation surveys conducted on Shipshewana Lake were made possible by funding from the Shipshewana Community Lake Improvement Association and the Indiana Department of Natural Resources through the Lake and River Enhancement Program (LARE). Aquatic Weed Control would like to extend special thanks to Indiana Department of Natural Resources (IDNR) District 3 biologist Jed Pearson for providing procedural training for both Tier I and Tier II aquatic vegetation surveys. Angela Sturdevant, an aquatic biologist for the LARE program, provided valuable consultation regarding the requirements and objectives of this lake management plan. Gwen White, a former LARE biologist, provided consultation for this plan as well. District 2 Fisheries Biologists, Neil Ledet and Larry Koza, also provided valuable input and consultation regarding management strategies at Shipshewana Lake. Aquatic Weed Control would also like to thank the members of the Shipshewana Community Lake Improvement Association for their commitment to improving this lake and for valuable discussion and input brought forward at the informational meeting held on June 20, 2009.

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1.0 Introduction

The first aquatic vegetation survey conducted by Aquatic Weed Control on Shipshewana Lake took place on May 17, 2006. In summer of 2006, approximately 15 acres of Shipshewana Lake were treated with 2, 4-D to try to alleviate severe matting of Eurasian watermilfoil (EWM) and coontail in the south end of Shipshewana Lake. In 2006, Shipshewana Lake did not have a completed vegetation management plan, and no funding was available for a whole lake treatment. Based on 2006 survey results, a whole lake Sonar treatment was proposed by Aquatic Weed Control and accepted by IDNR biologists.

On May 3, 2007, the entire lake was treated with Sonar to control Eurasian watermilfoil (EWM) and reduce the coontail population. After the Sonar treatment, EWM was not found in the late season plant survey of 2007.

In 2008, no herbicide treatments were conducted for native species in Shipshewana Lake. No EWM was found in Shipshewana Lake in 2008 by visual inspection or by the late season Tier II survey, so no spot treatments using 2, 4-D were conducted.

In 2009 no herbicide treatments of any kind were conducted. Eurasian watermilfoil was not found in spring visual inspections. No Eurasian watermilfoil was collected on the rake in the late season Tier II survey. One EWM plant was observed, harvested, and destroyed.

It is unknown how many acres of EWM will be present in 2010. Based on past whole lake Sonar treatments, much more re-growth is expected. Table 1 summarizes all LARE funded activities on Shipshewana Lake.

Table 1: Shipshewana Lake LARE History

Year	Action	Date	Funding Source
2006	Spring and Late Season Aquatic Vegetation Surveys 15 acres treated for EWM with 2, 4-D Management Plan Development	Spring Survey May 17, 2006 July 12, 2006 Late Season Survey August 2, 2006	Lake and River Enhancement Shipshewana Community Lake Improvement Association
2007	Whole Lake Sonar Treatment Aquatic Vegetation Surveys and Management Plan Update	Spring Survey May 3, 2007 Sonar Treatment Mary 3, 2007 Late Season Survey August 17, 2007	Lake and River Enhancement Shipshewana Community Lake Improvement Association
2008	Spring visual inspection for EWM re-growth Late Season Tier II aquatic vegetation survey and plan update	Visual inspection June 2008 Late Season Survey July 24, 2008	Lake and River Enhancement Shipshewana Community Lake Improvement Association
2009	Spring visual inspection for EWM re-growth Late Season Tier II Survey	June 18, 2009 July 23, 2009	Lake and River Enhancement Shipshewana Community Lake Improvement Association

Table 2 is provided for reference regarding plant names commonly used in this document.

Table 2: Common and Scientific Plant Names

Scientific Name	Common Name
Myriophyllum spicatum	Eurasian Watermilfoil
Ceratophyllym demersum	Coontail
Potamogeton pectinatus	Sago Pondweed
Potamogeton foliosus	Leafy Pondweed
Chara sp.	Chara

2.0 Watershed and Lake Characteristics Update

Shipshewana Lake is located in western Lagrange County, near the town of Shipshewana, Indiana. It has 202 surface acres with a maximum depth of 14 feet and an average depth of 7 feet (Tyllia, 2000). Cotton Lake Ditch is the lake's major inlet entering from the south (Koza, 2002). The lakes outlet is Page Ditch which exits the lake along the east shore and flows into Taylor Lake and the Pigeon River.

In 2009, planktonic algae blooms were common and heavy, as they have been in the past on Shipshewana Lake. Figure 1 shows planktonic algae photographed in the spring 2009 visual survey. Secchi depth in July of 2009 was recorded at 1.1 feet, which is most likely due to the planktonic algae.

Figure 1: Shipshewana Lake Algae: June 18, 2009

The possibility of a fish kill as a result of algal die-off has long been a concern at Shipshewana Lake. The fact that the treatment of EWM at Shipshewana Lake could free up more nutrients for algae was a concern while developing the treatment strategy. Fortunately, no fish kills have been observed at Shipshewana Lake since the Sonar treatment in 2007. Algal growth remains heavy. A dissolved oxygen profile and a temperature profile were constructed using data collected at the time of the 2009 Tier II survey. Figure 2shows the dissolved oxygen profile while Figure 3 shows the temperature profile in Shipshewana Lake. Adequate oxygen was present to support fish down to almost 10 feet, which was encouraging, even though an algal crash could change oxygen levels very quickly. The temperature profile showed that no distinct thermocline existed at the time of this survey, which may be attributed the lake being relatively shallow.

Figure 2: Shipshewana Lake Dissolved Oxygen Profile

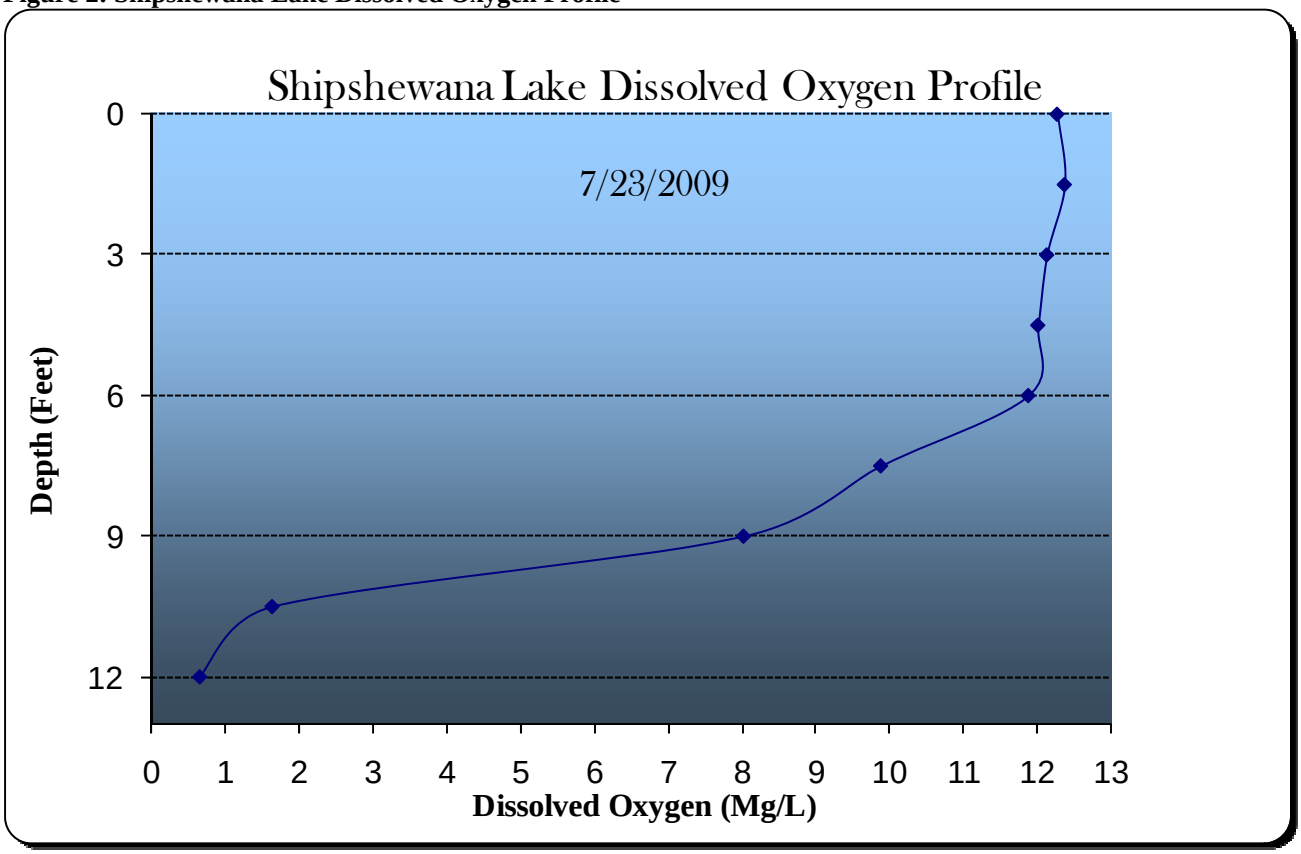
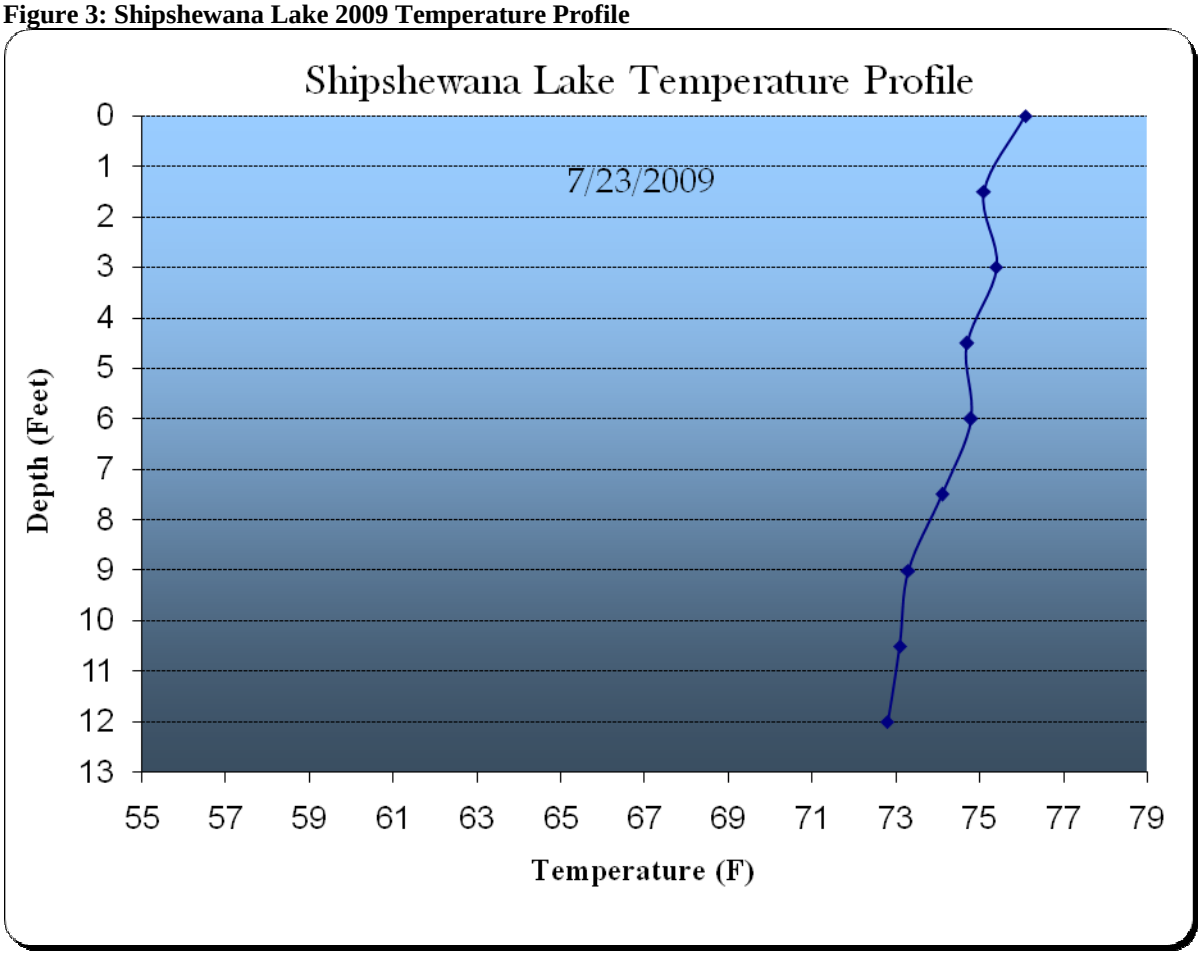


Figure 3: Shipshewana Lake 2009 Temperature Profile



At the public meeting held on June 20, 2009, the issue of a new lake wide sewer system was discussed at length. Residents were very concerned with the costs associated with hooking up to the new system. The addition of this sewer system could help reduce nutrient inputs to Shipshewana Lake. This would have a very positive long term effect on nutrient loading for Shipshewana Lake. Currently, additional funding sources are being explored by the lake association to help reduce cost of this sewer system for lake residents.

3.0 Lake Uses Update

Shipshewana Lake has 2 public access points. One DNR public access site is located on the south shore of the lake and has very limited parking. A newer boat ramp has been constructed on the west shore of the lake with a larger parking area. The new boat ramp increases public access to Shipshewana Lake.

In 2009, multiple fishing boats were observed during each of the surveys conducted on Shipshewana Lake, indicating that it is still a popular fishing destination, especially for large-mouth bass. Figure 4 shows boating regulations posted at the public access site on the west side of Shipshewana Lake.

Figure 4: Shipshewana Lake Boating Regulations

4.0 Fisheries

District 2 Fisheries Biologist, Neil Ledet and Assistant Fisheries Biologist Larry Koza were contacted to determine the most recent fisheries survey data for Shipshewana Lake. Six fisheries surveys have been conducted on Shipshewana Lake with the most recent fisheries survey taking place on June 3-7 of 2002. These surveys are discussed in detail in the 2007 Shipshewana AVMP update. No new fisheries data has been collected in 2008.

5.0 Problem Statement

Eurasian watermilfoil will likely be starting its return to Shipshewana Lake in 2010. Exact EWM acreages for 2010 cannot yet be determined. Based on past Sonar treatments in other northern Indiana lakes, much more re-growth is expected for 2010 since it will be the fourth year of this treatment program. The challenge for 2010 will be to identify areas of EWM re-growth through proper vegetation survey techniques and manage them effectively with herbicide treatments. Spot treatments should be used to manage these smaller areas, as opposed to a whole lake treatment. Spot treatments will use DMA-4 (2, 4-D) herbicide to control Eurasian watermilfoil.

6.0 Vegetation Management Goals and Objectives

The following management goals have been established by the IDNR for all Indiana lakes, including those applying for LARE funding. Any management practices implemented on Shipshewana Lake are to directly facilitate the achievement of these three goals:

1. Develop or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality and is resistant to minor habitat disturbances and invasive species.
2. Direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species.
3. Provide reasonable public recreational access while minimizing the negative impacts on plant and wildlife resources.

Specific Objectives

One measurable goal for 2010 would be that no more than 20 acres of Eurasian watermilfoil would need treatment in Shipshewana Lake. This is about 26% of the littoral zone which is estimated at 75 acres. Re-growth is expected over time, and no significant re-growth has been observed in the past 3 years. EWM control from the Sonar treatment was more complete than expected and lasted longer than expected. Planktonic algae may be slowing EWM's return to Shipshewana Lake.

The major objective for Shipshewana Lake has changed from a large scale treatment effort to reduce the dominant milfoil population, to smaller scale treatments in areas where re-growth is observed in the future. These areas of re-growth will be treated with liquid DMA4 (2, 4-D) herbicide.

7.0 Past Management Efforts

District 2 Fisheries Biologist, Neil Ledet, was contacted to determine any significant changes to vegetation control permits on Shipshewana Lake. No herbicide treatments of any kind have been conducted on Shipshewana Lake in 2009. Control of native vegetation has been stopped to allow native plants to re-establish themselves. No significant EWM re-growth has been found since the Sonar treatment, so no spot treatments using liquid DMA4 (2, 4-D) have been conducted since 2006.

On July 12, 2006, approximately 15 acres of Shipshewana Lake were treated with liquid DMA-4 to alleviate severe matting of Eurasian watermilfoil and coontail in the south end of Shipshewana Lake. This treatment area was located inside the problem plant area outlined in yellow in Figure 5. This dense plant bed was nearly cutting the lake in half, making it extremely difficult for a boat to travel from the public access site to the north end of the lake. This treatment was sponsored by the LARE program and the lake association to provide some temporary relief until a larger management strategy could be developed. Even after this treatment, matted vegetation still impeded boat traffic. This area is outlined in Figure 5.

Figure 5: 2006 2, 4-D Treatment Area

Even though the bed in Figure 5 was very problematic, it was not the only plant bed where Eurasian watermilfoil was found. Eurasian watermilfoil was present throughout the lake.

Sediment and Nutrients

In addition to the dredging project and herbicide treatments, two small ponds have been constructed on the ditch that enters Shipshewana Lake on its south side. These ponds act as a catch basin for nutrients and sediment coming through this ditch. These ponds were found to be infested with Eurasian watermilfoil and were treated with Sonar to prevent rapid re-infestation after the whole lake Sonar treatment.

Several other studies have been conducted on Shipshewana Lake Since 1989. They contain useful information on management activities that have taken place in the past on Shipshewana Lake. Some of these studies are listed below. These studies can be found on the LARE program website at the following address: http://www.in.gov/dnr/fishwild/lare/lare_reports.html

Shipshewana Lake Restoration Feasibility Study. March 1989. International Science and Technology Inc. 11260 Roger Bacon Drive Suite 201. Reston Virginia 22090
Shipshewana Lake Pre-Design Report. January 1996. F.X. Browne Inc. 220 South Broad Street. Lausdale, PA. 19446

Shipshewana Lake Shoreline Stabilization Report. January 1996. F.X. Browne Inc. 220 South Broad Street. Lausdale, PA. 19446

Contract Documents and Specifications for the Construction of Shipshewana Lake Restoration Project: Two Constructed Wetlands. March 1998. F.X. Browne Inc. 220 South Broad Street. Lausdale, PA. 19446

Shipshewana Lake Dredging Project. April 1998. F.X. Browne Inc. 220 South Broad Street. Lausdale, PA. 19446

2007 Sonar Application

On May 3, 2007, the entire lake was treated with Sonar A.S. at a target rate of 8 parts per billion (ppb). The LARE program helped to fund a rate of 6ppb to control Eurasian watermilfoil and gave approval for the lake association to privately fund the addition of 2 ppb to help reduce the coontail population. The herbicide was applied using underwater injection systems from 2 of Aquatic Weed Control's application boats. It was applied in a zigzag pattern over the entire lake. Sonar was also applied in the small pond that flows into Shipshewana Lake's south end to protect against re-infestation. FasTESTS were taken approximately 3 weeks after treatment and found that Sonar rates in Shipshewana Lake ranged from 6 to 12 parts per billion. The average of these tests was 9.05 which is about 1 part per billion higher than expected, based on the size and depth data available for Shipshewana Lake. Because the results were slightly higher than anticipated, SePRO advised Aquatic Weed Control not to bump the concentration but to take another FasTEST later to ensure that the herbicide was remaining in the water column. A second round of FasTESTs were collected on June 8 and still showed Sonar concentrations from 1.3 to 3.1 parts per billion, so a bump was not recommended.

Table 3: Shipshewana Lake 2007 FasTest Results

May 17, 2007	June 8, 2007
6.0 ppb	3.1
12.1 ppb	2.4
	1.3
Average - 9.05	Average - 2.27

Sonar works by prohibiting the plant from making chlorophyll, which in turn prevents the plant from making food. This whitening of plant material due to a lack of chlorophyll is called chlorosis. Figure 6 shows coontail collected from Shipshewana Lake approximately 3 weeks after treatment. This coontail was exhibiting Sonar damage, as indicated by the whitening of the leaves.

Figure 6: Coontail Showing Chlorosis from Sonar

Before the whole lake Sonar treatment, herbicide applications were limited to contact herbicides applied along lake frontages at the request of property owners. These treatments have been very limited. One area treated on a regular basis is the beach area for the Brethren Camp on Shipshewana Lake. Other treatments are very sporadic and usually only involve 50-100 feet of frontage.

8.0 Aquatic Plant Community Characterization

Survey and data analysis techniques have not changed since the completion of the 2007 Aquatic Vegetation Management Plan Update. EWM was not collected in the 2009 Tier II survey but was observed in one location. This one EWM plant was the only invasive species found in Shipshewana Lake in 2009. Its location is shown in Figure 7.

Figure 7: Shipshewana Lake 2009 Invasive Plant Distribution

8.1 Methods Update

The Tier II survey protocol was last updated by the IDNR in 2007. These changes are outlined in Section 8.1 of the 2007 Shipshewana Lake Aquatic Vegetation Management Plan Update.

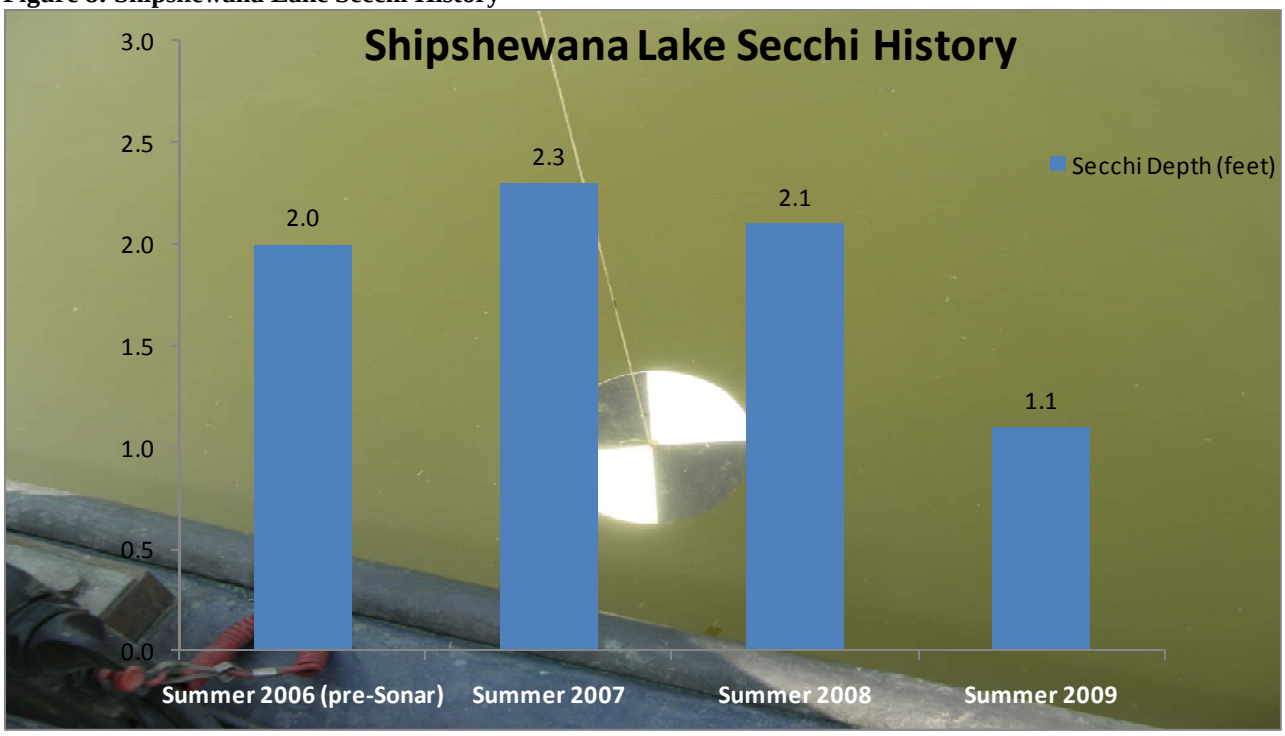
Shipshewana Lake is classified as hypereutriophic by the IDNR and has 202 acres. Based on these characteristics, 60 sites are divided between the 0 – 5 foot and the 5 – 10 foot depth contours of the lake, with 50 of these sites being taken between 0 and 5 feet deep. It is recommended that this sampling protocol be continued in future years.

8.2 Results

8.2.1 Tier II Results

One Tier II survey was conducted on Shipshewana Lake in 2009. This was a late season Tier II survey conducted on July 23, 2009. Secchi disk measurements were recorded at 1.1 feet which is down from 2.1 feet in July 2008 and 2.3 feet in August 2007 (Figure 8). Maximum plant depth was approximately 5 feet in both 2008 and 2009 which was also down slightly from 6 feet in 2007.

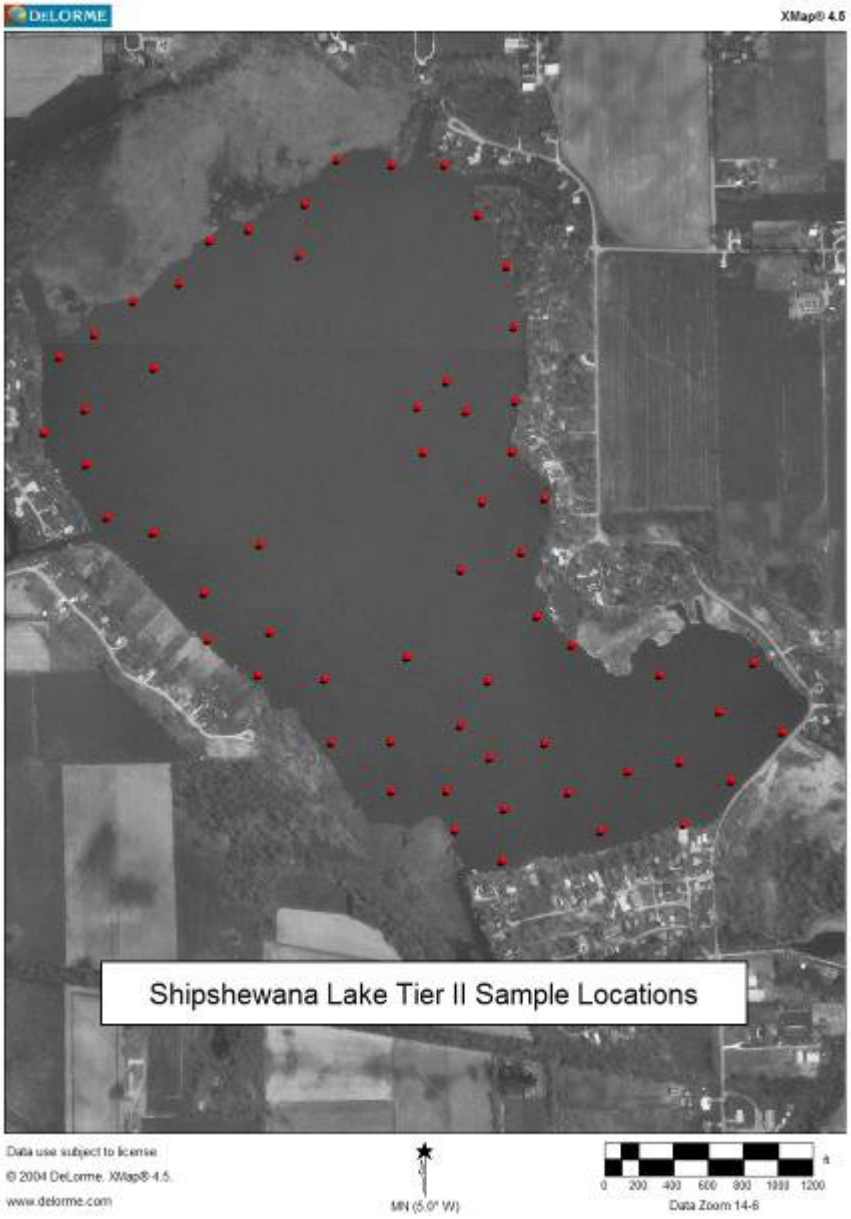
Figure 8: Shipshewana Lake Secchi History



In 2007, 2008, and 2009 sixty rake samples were distributed throughout each 5 foot depth contour of the littoral zone. A total of 3 species of submersed aquatic plants (coontail, sago pondweed, and chara) were collected during the 2008 Tier II survey, which is up slightly from the 2 species that were found in the late season survey in 2007. In 2009, 3 plant species (coontail, sago pondweed, and waterstargrass) were collected in the Tier II survey.

Figure 9 shows the 60 locations of all sample sites for all Tier II surveys.

Figure 9: Shipshewana Lake Rake Sample Locations



2009 Tier II Data Analysis

The following table summarizes data for the July 23, 2009 Tier II aquatic vegetation survey. This table helps to describe the plant community and will help identify any changes that take place in the years to come. This table includes all sample sites at Shipshewana Lake. No plants were found in depths greater than 5 feet, so 5-10 foot contour data is not included.

Table 4: Shipshewana Lake 2009 Tier II Data Analysis

Occurrence and Abundance of Submersed Aquatic Plants in Shipshewana Lake					
County:	Lagrange	Total Sites:	60	Mean species/site:	0.12
Date:	7/23/2009	Sites with plants:	7	SE Mean species/site:	0.04
Secchi (ft):	1.1	Sites with native plants:	7	Mean native species/site:	0.12
Maximum Plant Depth (ft):	5.0	Number of species:	3	SE Mean natives/site:	0.04
Trophic Status:	Hypereutrophic	Number of native species:	3	Species diversity:	0.45
		Maximum species/site:	1	Native species diversity:	0.45

All Depths (0 to 5 ft)	Frequency of	Rake score frequency per species				Plant
Species	Occurrence	0	1	3	5	Dominance
Sago Pondweed	8.3	91.7	6.7	1.7	0.0	2.3
Coontail	1.7	98.3	0.0	1.7	0.0	1.0
Waterstargrass	1.7	98.3	1.7	0.0	0.0	0.3
Filamentous Algae	11.7					
No Plants were found in depths greater than 5 feet						

Site Frequency

Site frequency is a measure of how often a species was collected during the Tier II survey. It can be calculated by the following equation:

$$\text{Site Frequency} = \frac{\text{(\# of sites where the species was collected)}}{\text{Total \# of littoral sample sites}} \times 100$$

Figure 10 shows site frequencies for every plant collected in between fall 2006 and fall 2009. The Sonar treatment took place after the spring 2007 survey. Fall 2006 data shows frequencies prior to the whole lake Sonar treatment on May 3, 2007.

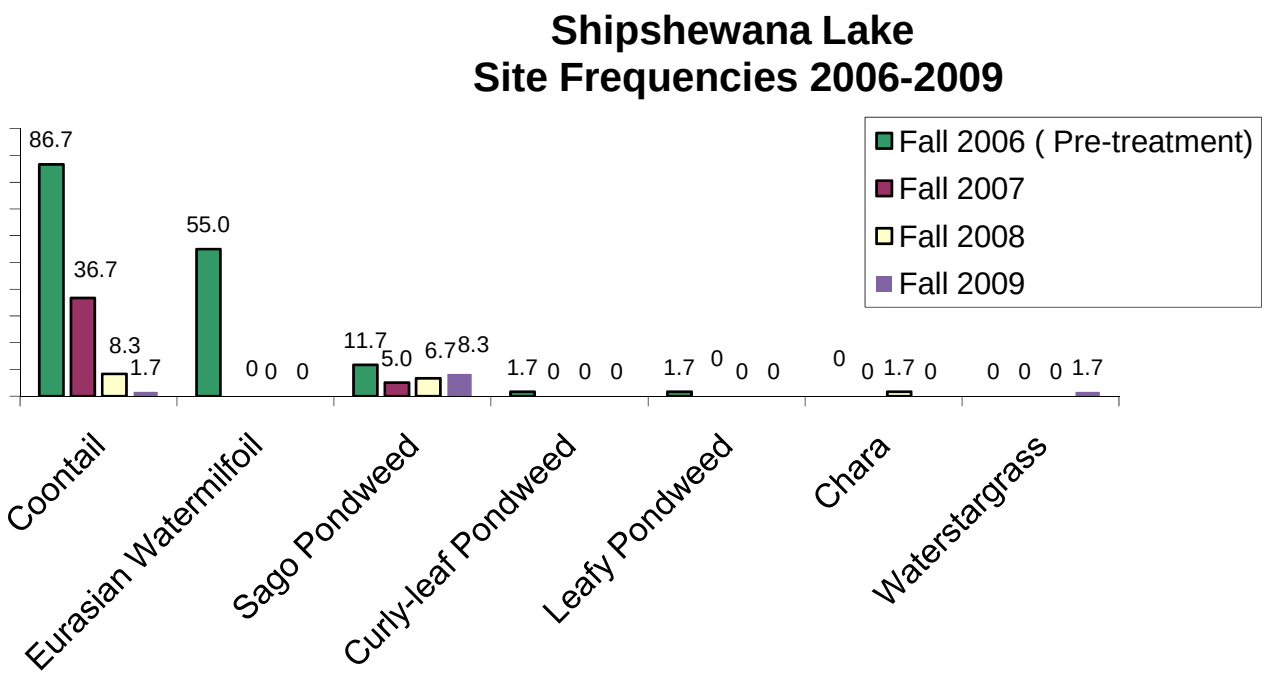
Coontail was the most commonly collected plant in 2006 through 2008. Its site frequency has dropped over the past four years. It is likely that planktonic alga is inhibiting coontail's return to Shipshewana Lake.

Sago pondweed has been collected in each Tier II survey at low levels. Its frequency is currently very similar to pre-treatment levels.

Eurasian watermilfoil site frequency dropped from 55.0 in fall of 2006 to 0 in fall of 2007 and was not collected in 2008 or 2009.

Curly leaf pondweed, leafy pondweed, chara, and waterstargrass have all been found in very low abundance at different times in the past four years.

Figure 10: Shipshewana Lake Site Frequency Histories



Species Diversity

The species diversity indices listed in the data analysis tables help to describe the overall plant community. A species diversity index is actually measured as a value of uncertainty. If a species is chosen at random from a collection containing a certain number of species, the diversity index is the probability that a chosen species will be different from the previous random selection. The diversity index will always be between 0 and 1. The higher the diversity value, the more likely it is that the next species chosen from the collection at random will be different from the previous selection (Smith, 2001). This index is dependent upon species richness and species evenness, meaning that species diversity is a function of how many different species are present and how evenly they are spread throughout the ecosystem.

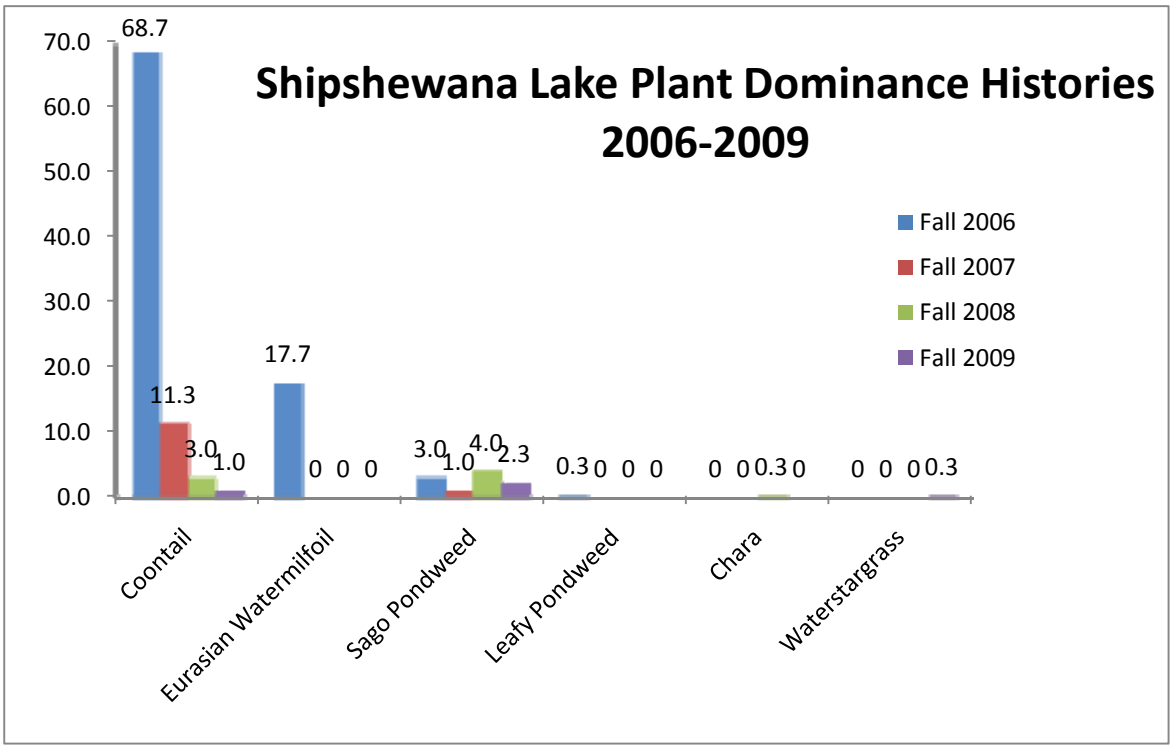
The overall species diversity index for Shipshewana Lake on July 23, 2009 was 0.45 which is down from 0.58 in 2008. These values are both higher than the diversity index of 0.21 in August 2007. Diversity in 2006 before treatment was 0.56. These values are low when compared to other Indiana lakes (Pearson 2004). No invasive plants were collected in July of 2008 or 2009 so native diversities for these years are the same as the overall diversity. Native plant diversities in 2008 and 2009 were actually greater than August of 2007 (0.21) and August of 2006 (0.24).

Species Dominance

Species dominance is dependent upon how many times a species occurs and its relative coverage area or biomass within the system. In this survey, the abundance rating given to each species at each sample site was used to determine dominance. The dominance of a particular species in this Tier II survey increases as its site frequency and relative abundance increase.

Figure 11 tracks dominance values for each plant collected at Shipshewana Lake during the fall 2006, 2007, 2008, and 2009 surveys. Trends are similar to sight frequency, with coontail and EWM dominance dropping sharply after the sonar treatment in 2007. Eurasian watermilfoil dominance dropped to 0 after treatment in 2007 and was not present in 2008 or 2009. Sago pondweed dominance has remained at low levels throughout this time period. Other plant species have been found only sporadically.

Figure 11: Shipshewana Lake Plant Dominance Histories



Coontail

Coontail was present in nuisance levels before the Sonar treatment in 2007. As previously stated, 2 parts per billion of Sonar were added to the whole lake treatment at the expense of the lake association. At the time of the initial plan, there was a concern that coontail could expand if control efforts only targeted EMW. Following the treatment, late season coontail frequency frequency dropped from 86.7% in 2006 to 36.7% after treatment in 2007. In 2008, coontail frequency declined to 8.3% and again to1.7% in 2009. This gradual decline in the coontail population may be linked to heavy planktonic algal blooms. Coontail should continue to be monitored closely in 2010. Figure 12, Figure 13, Figure 14, and Figure 15 show the recent history of coontail abundance in Shipshewana Lake.

Figure 12: 2006 Coontail Locations

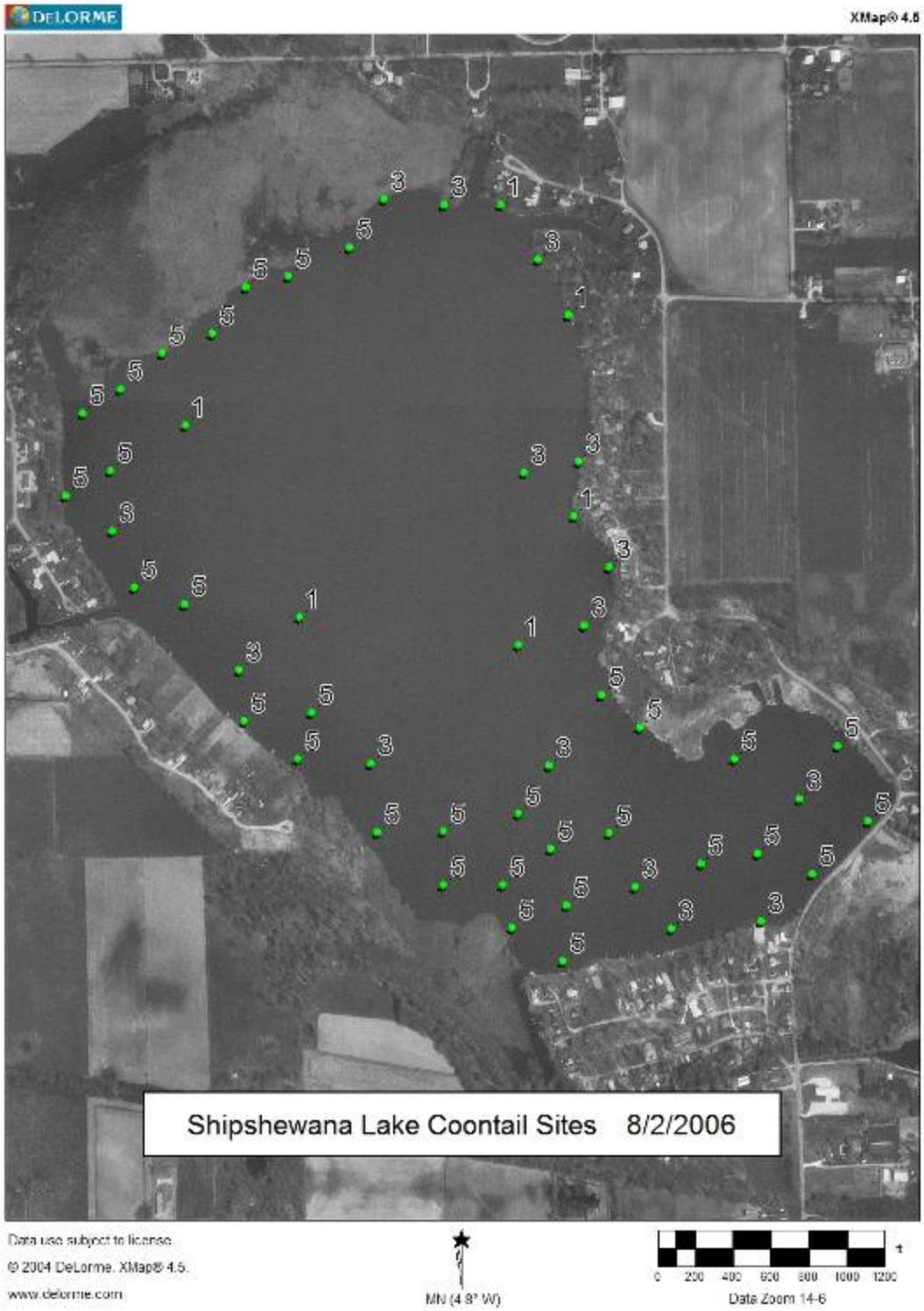


Figure 13: 2007 Post Treatment Coontail Locations

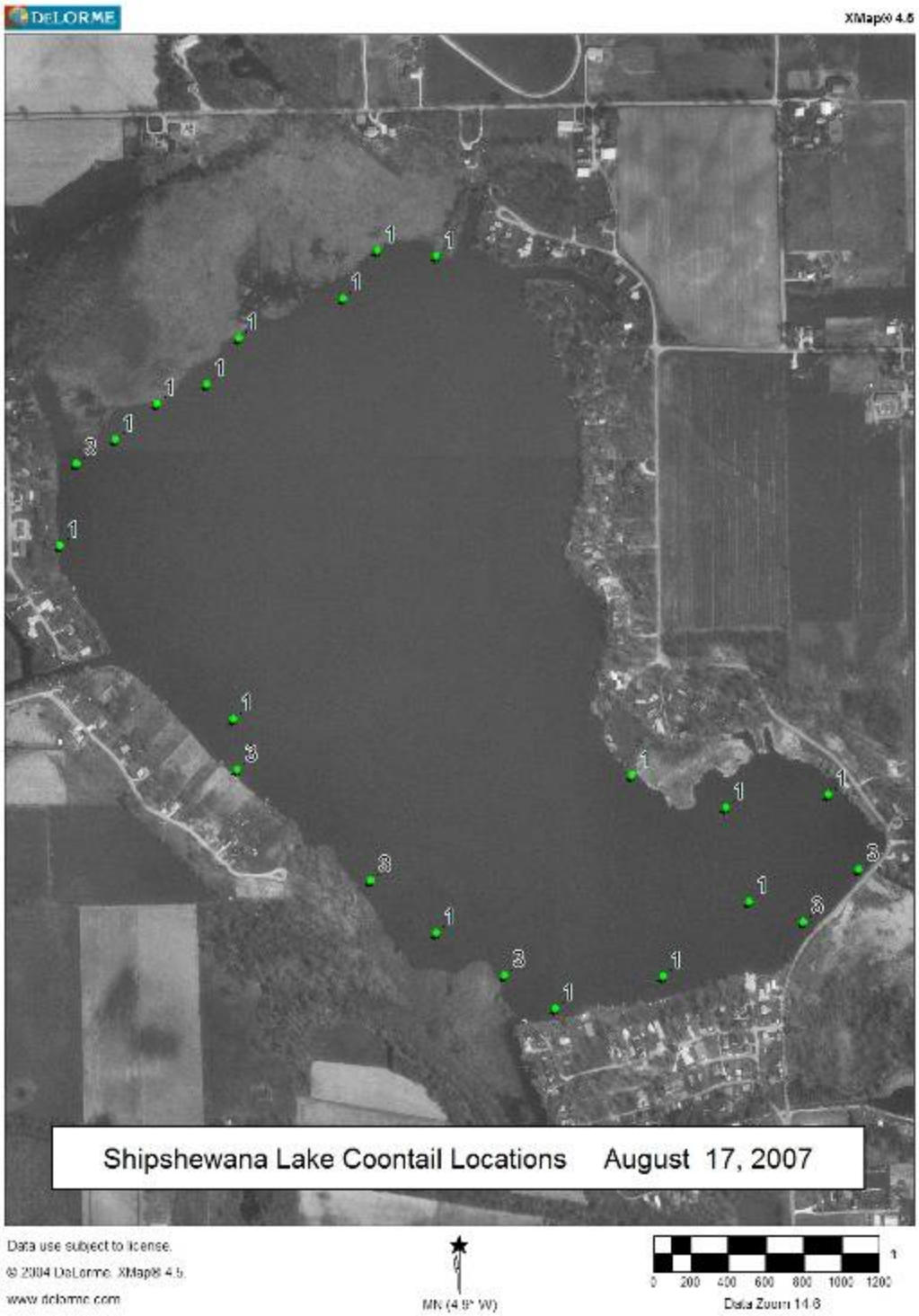


Figure 14: 2008 Coontail Locations

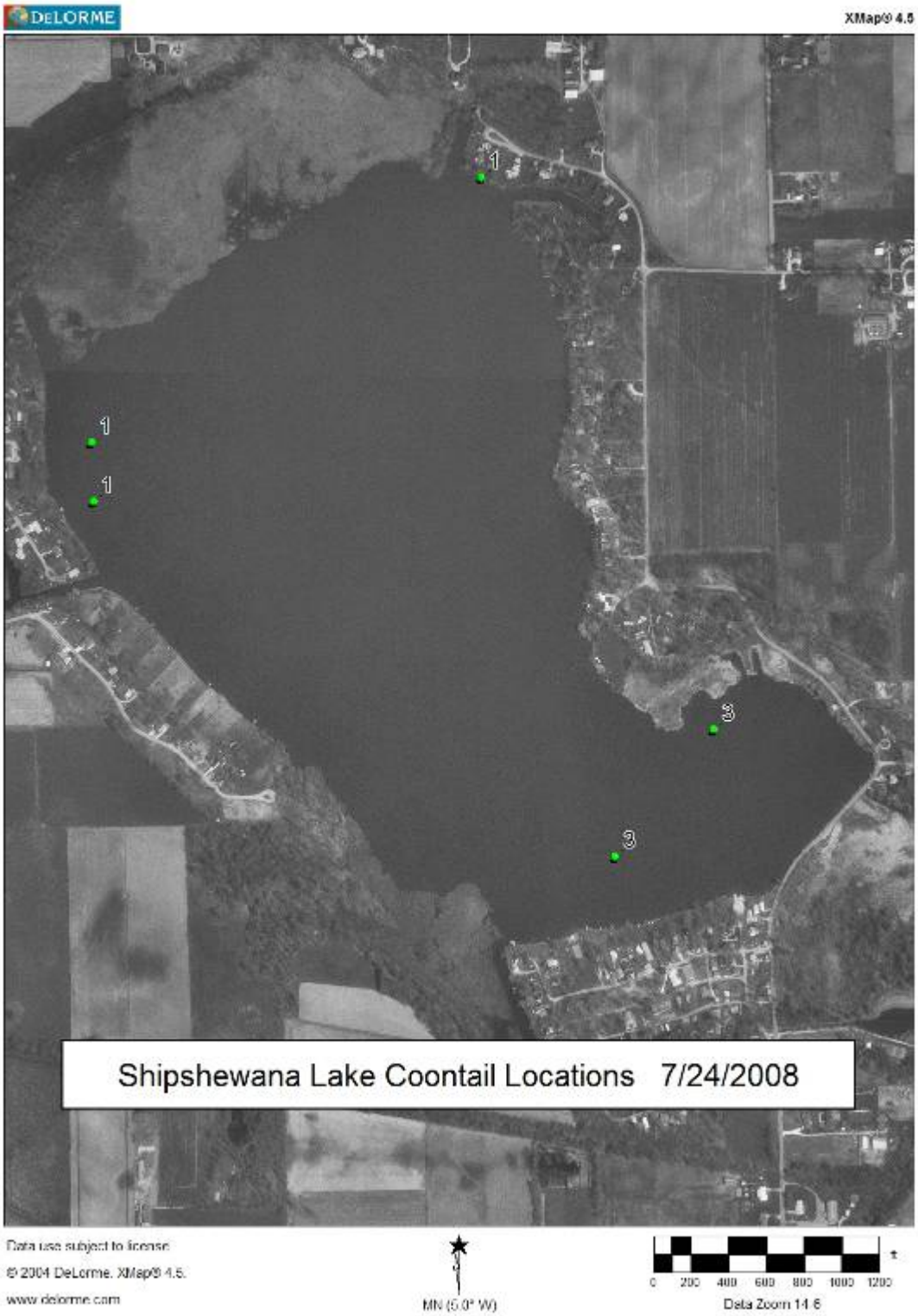
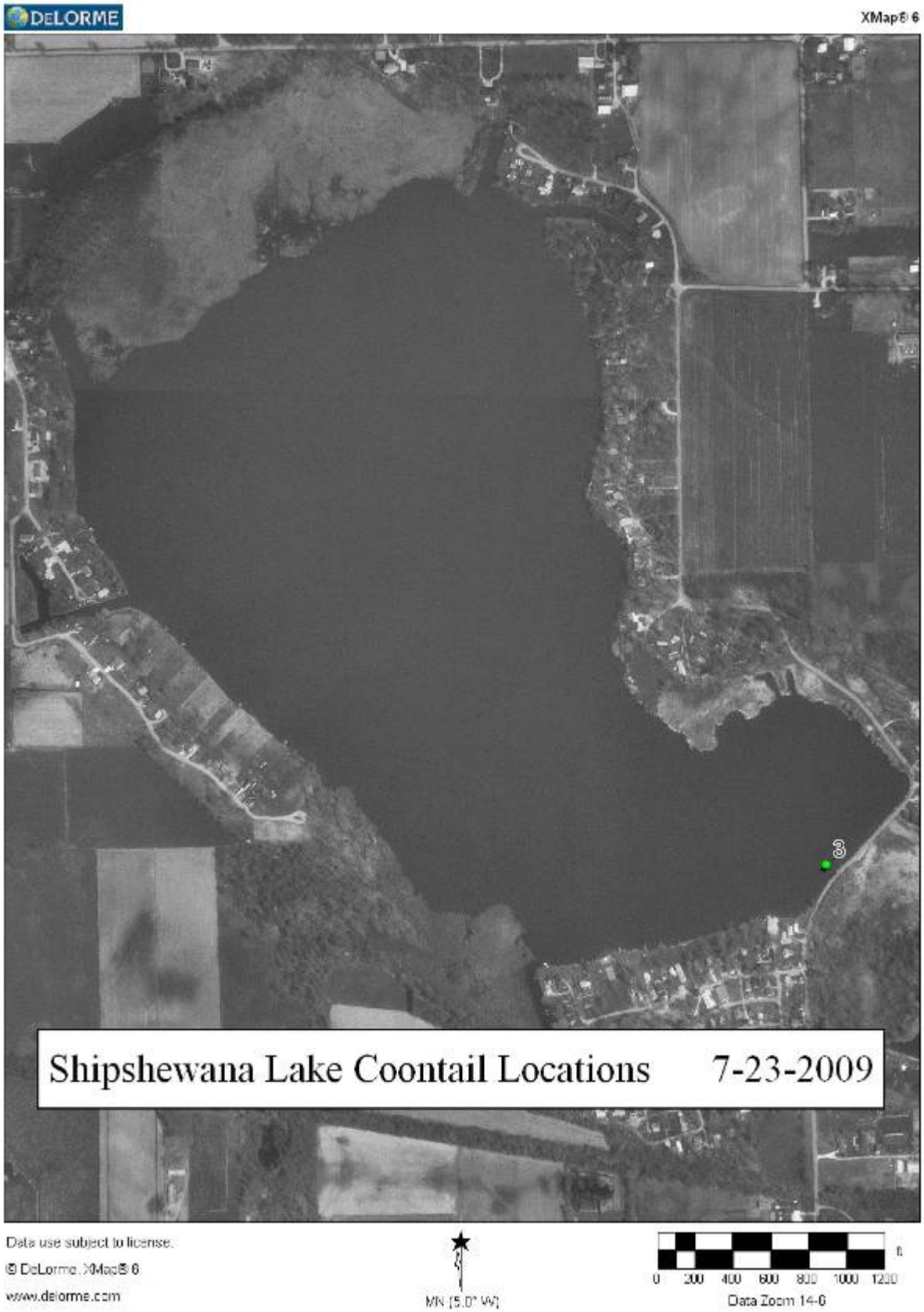


Figure 15: 2009 Coontail Locations



Species Distribution Maps

In addition to coontail, sago pondweed and waterstargrass were both collected in the 2009 Tier II survey. Figure 16 and Figure 17 show 2009 distributions for these two species.

Figure 16: 2009 Sago Pondweed Locations

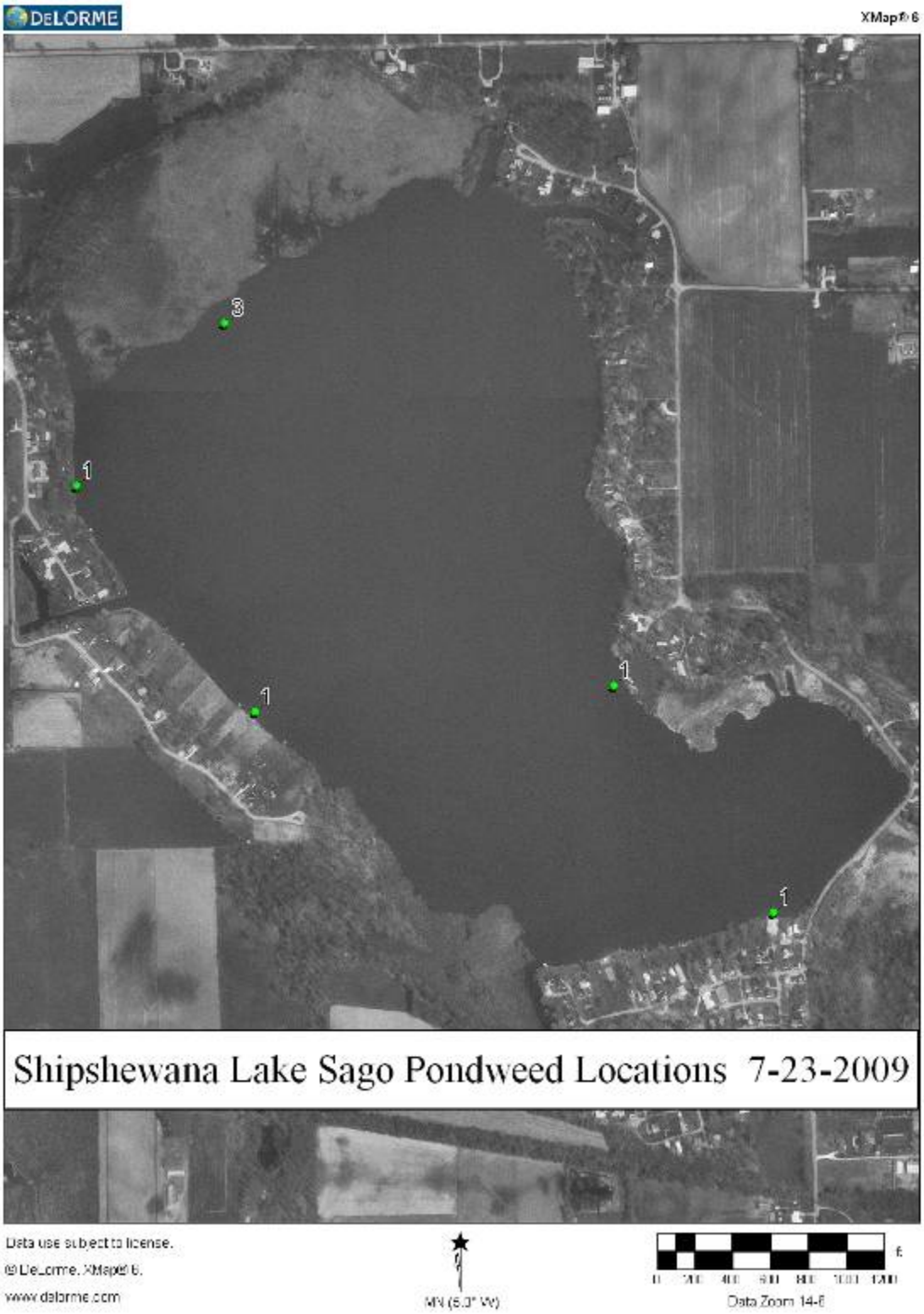
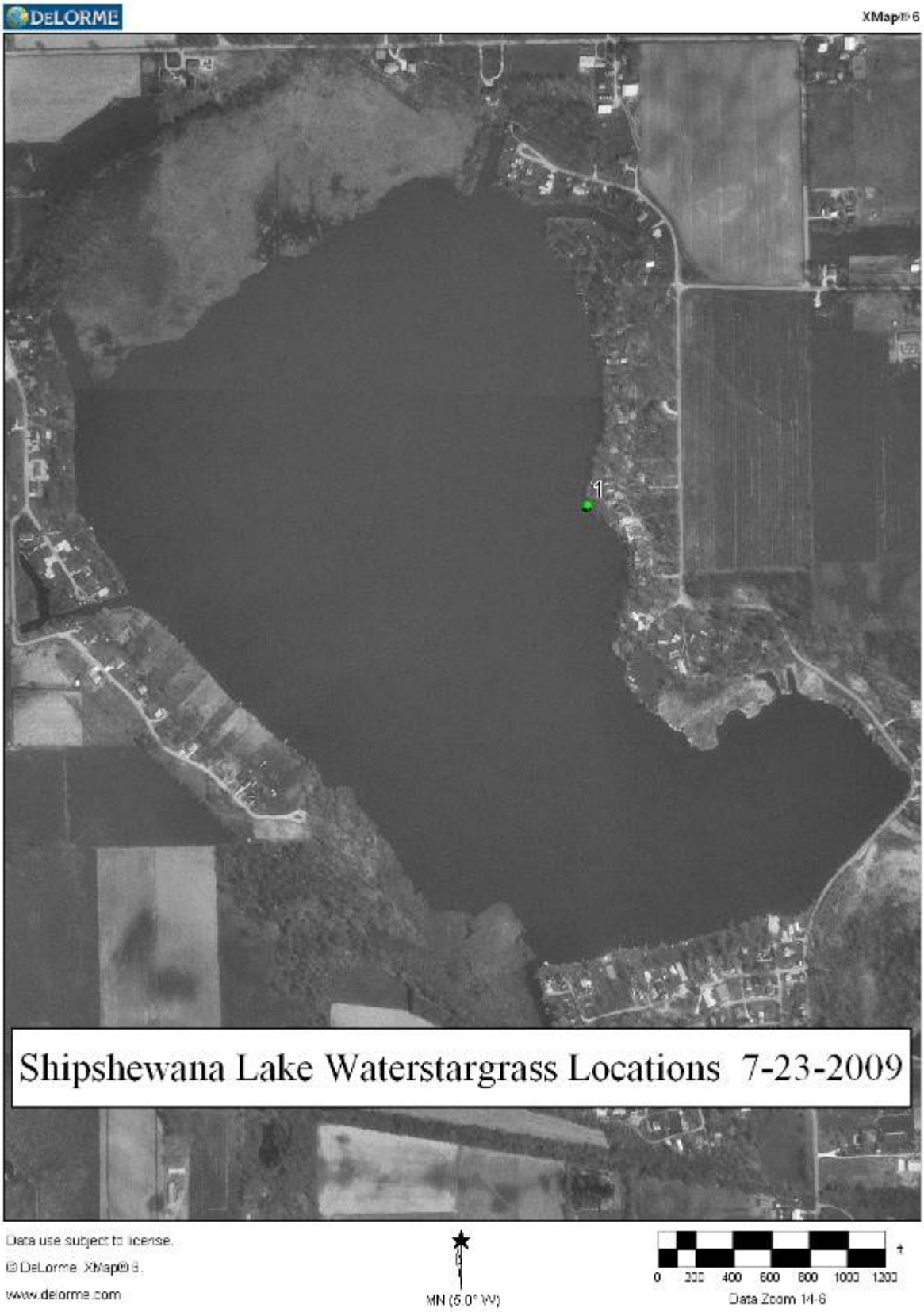


Figure 17: 2009 Waterstargrass Locations



8.3 Macrophyte Inventory Discussion

The whole lake Sonar treatment was very effective in reducing the EWM population. In 2009, only one EWM plant was observed the entire year. Eurasian watermilfoil covered an estimated 40 acres of Shipshewana Lake prior to the Sonar treatment on May 3, 2007. Up to 5 acres of re-growth were expected in both 2008 and 2009, but no significant EWM re-growth was found by visual inspection or in the late season Tier II surveys.

Control of coontail has been longer lasting than expected. In 2009, coontail was only found at one sample location. Coontail abundance has declined from 86.7% site frequency before the Sonar treatment to just an 8.3% site frequency in 2008 and 1.7% in 2009. It was expected that both coontail and EWM would be found in much greater abundance in 2009, which is the third year of the Sonar treatment program. It is very likely that heavy blooms of planktonic algae are preventing both plants from quickly re-establishing themselves in Shipshewana Lake.

Sago pondweed has been present in low abundance in each of the late season Tier II surveys since 2006. Based on data from other whole lake sonar treatments, sago pondweed may be expected to increase in Shipshewana Lake. So far its site frequency level has remained relatively constant.

Leafy pondweed, waterstargrass, and chara are other species that have been collected in Shipshewana Lake, but very sparingly. It is unclear whether these species may increase to an abundance that may be collected more regularly. In other northern Indiana lakes, these species have done very well after Sonar treatments. It is hoped that native species might become dominant in areas where EWM was prevalent. However, a quick re-colonization of the lake by beneficial native plants has not been observed and should not be expected. Low water clarity and heavy algal blooms are likely the cause for slow re-colonization of all plants.

Shipshewana Lake continues to have a very low diversity (0.45) of submersed aquatic plants when compared with many area lakes. Three native plant species were found in July of 2008 and 3 species were found in July 2009. Water clarity is very low with a Secchi depth of 1.1 feet being measured in July 2009. Planktonic algal blooms have historically occurred each summer and will likely continue, giving the water lime green coloration. It is difficult to determine how the plant community in Shipshewana Lake will respond in the years to come. Water quality and clarity issues at Shipshewana Lake complicate future planning and make plant distribution unpredictable. A responsible approach for the future will include careful and consistent monitoring as well as implementing a treatment strategy and budget that is adequate if EWM suddenly begins to proliferate.

Threatened and Endangered Species

The Indiana Natural Heritage Data Center has compiled a list of Indiana plant species that are federally or state listed as endangered, threatened, or rare. The following is an excerpt taken directly from the Indiana Natural Heritage Database website. Link: Indiana Natural Heritage Data Center.

"The Indiana Natural Heritage Data Center, set up in 1978, represents a comprehensive attempt to determine the state's most significant natural areas through an intensive statewide inventory. The Indiana Natural Heritage Data Center is part of the Natural Heritage Network, a worldwide system of Heritage Programs. This program is designed to provide information about Indiana's diversity of natural ecosystems, species, landscape features, and outdoor amenities, and to assure adequate methods for evaluating this information and setting sound land protection priorities. The inventory is a continuous process, becoming an increasingly valuable tool for decision makers and scientists as it progresses."

No state or federally listed plant species were found in Shipshewana Lake in 2009. No vouchers were taken in 2009 that were suspected to be threatened or endangered.

9.0 Aquatic Plant Management Alternatives

Management practices for the control of EWM have not changed significantly since the 2006 lake management plan.

As outlined in the treatment strategy, liquid DMA4 (2, 4-D) will be used to treat areas of Eurasian watermilfoil re-growth in 2010. Plants in Shipshewana Lake can grow to a depth of at least 6 feet. Using 2, 4-D should provide very similar control to Renovate herbicide, while greatly reducing cost, especially in the deeper treatment areas. Currently, it is not anticipated that any circumstances at Shipshewana Lake would warrant the extra cost of using triclopyr in place of 2, 4-D for EWM control.

The Shipshewana Community Lake Improvement Association has helped to co-sponsor many sediment and nutrient removal activities on the lake and has participated in a volunteer monitoring program in the early 1990's.

Sediment and nutrient control is very important for Shipshewana Lake. There are two ponds designed to act as a sediment trap on the inlet on the south side of the lake near the IDNR public access site. This sediment trap was infested with Eurasian watermilfoil as well and was treated with Sonar in 2007 to prevent re-infestation in Shipshewana Lake.

No Treatment

Since no significant re-growth of EWM has been found, the effect of taking no action in 2010 is unknown as well. It is possible that no treatment may be necessary, although based on results from other Sonar treatments, EWM is expected to return to the lake in much greater abundance in 2010.

Native Plant Growth

Native plant growth is currently minimal in Shipshewana Lake. Growth of coontail will likely increase with time, as it usually grows well in turbid water. The growth of other native plants will likely not improve unless water quality increases. Practices to reduce nutrient loading and improve water quality include: using low phosphorus or no phosphorus fertilizers, ensure proper sewer hookup for homes around the lake, vegetated filter strips in highly erodible agricultural areas, sediment removal, preservation of wetland areas, and many other activities.

10.0 Public Involvement

A LARE open house was held on November 19, 2009 at the IDNR's Northeast Regional Office in Columbia City, Indiana. This open house was designed for biologists and consultants to meet together and discuss issues pertaining to the LARE program and develop future management plans for area lakes. District Fisheries Biologists, Aquatic Weed Control staff, and LARE staff were all present at this open house.

The Shipshewana public meeting was held on June 20, 2009. These meetings are the main avenue for lake residents to remain informed about plant management practices. Twenty-two people filled out public questionnaires. The biggest concern at the public meeting was the costs associated with connecting to a new sewer system. Residents were happy with the longer than expected Eurasian milfoil control but very concerned about water quality and heavy planktonic algae blooms which have historically been a problem in Shipshewana Lake. They were also concerned about the need for future dredging. Figure 18 shows responses to the public questionnaire.

Figure 18: Shipshewana Lake 2009 Public Questionnaire

Total: 22

Lake Use Survey — Lake name Shipshewana Lake

Are you a lake property owner? Yes 22 No 0

Are you currently a member of your lake association? Yes 20 No 2

How many years have you been at the lake? 2 or less
2 – 5 years - 6
5-10 years - 6
Over 10 years - 10

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

8 Swimming	0 Irrigation
16 Boating	2 Drinking water
18 Fishing	0 Other _____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes 11 No 10

Do you currently participate in a weed control project on the lake? Yes 11 No 8

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes 10 No 9

Does the level of vegetation in the lake affect your property values? Yes 13 No 9

Are you in favor of continuing efforts to control vegetation on the lake? Yes 21 No 0

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 15 No 5

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

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

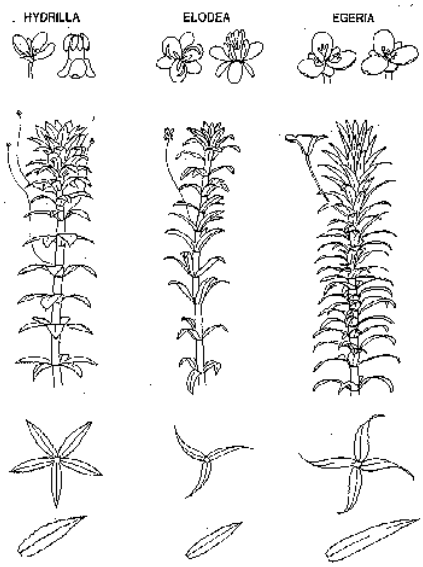
Please add any comments:
dredging need in channel; dredging needed in channel at sw corner of lake!; what can be done to improve water quality!!?; algae problem; poor water quality - big, big problem; geese control; green water that looks like diarrhea; dredging that was done was not adequate;

11.0 Public Education

The Shipshewana Lake association is active and holds two meetings per year with good attendance (~50 %). More information on stopping the spread of invasive aquatic organisms can be found at http://www.protectyourwaters.net/. These items include thoroughly cleaning equipment after use in a lake and removing all water from bilges, livewells, etc.

Hydrilla

Hydrilla (*Hydrilla verticillata*) is an invasive aquatic plant species common throughout the southern United States. It is federally listed as a noxious weed and causes severe ecological and recreational problems wherever it grows. It is considered to be much more destructive than other invasives like Eurasian watermilfoil and curly leaf pondweed because of its reproductive adaptations. It grows by fragmentation, as does Eurasian watermilfoil, but it also produces turions which can remain dormant in the sediment for 4 years or more (Van and Steward, 1990). It produces tubers at its root tips which can also reproduce after multiple years of dormancy. It can grow 1 inch each day, and it quickly out-competes native plants. It forms dense beds that eliminate native plants, stunt fish populations, impede recreation, and cause a drastic decrease in biodiversity (Colle and Shireman, 1980). Millions of dollars are spent for hydrilla maintenance each year in Florida alone. Eradication is unlikely once a population has been well established, although eradication has been achieved in newly infested waters using a herbicide called Sonar. Sonar is applied at a rate of 6 parts per billion, and this concentration is maintained in the water for 180 days. Early detection can be crucial to an effective eradication program, and all lake residents and users are encouraged to be on the look-out for this invader.



In fall of 2006, this plant was found in Lake Manitou, in Rochester, Indiana. This is the first instance of hydrilla in the upper Midwest. Prior to its appearance in Lake Manitou, The closest infestations of hydrilla were in Tennessee and Pennsylvania.

Hydrilla can easily be confused with native elodea. The major difference is that elodea has sets of leaves on the stem in whorls of three, while hydrilla usually has whorls of 5 leaves, although 4 to 9 leaves per whorl are possible with hydrilla. Hydrilla will also have small serrations on the leaf edges. More information on hydrilla can be found at the University of Florida's Center for Aquatic Invasive Plants (http://plants.ifas.ufl.edu/). More general information on aquatic invaders can be found at www.protectyourwaters.net.

12.0 Integrated Treatment Action Strategy

Eurasian watermilfoil has not been collected on the sampling rake in any Tier II survey since the whole lake Sonar treatment in 2007. This was longer lasting, more complete control than expected and makes estimating EWM acreage in 2010 very challenging. One EWM plant was observed (and destroyed) in July of 2009. This would seem to indicate that EWM is just starting to re-grow in Shipshewana Lake. Based on results from other whole lake Sonar treatments, EWM would be expected to show much more re-growth in 2010 since it will be the fourth year of the treatment program. Any areas of Eurasian watermilfoil re-growth should be identified and treated with liquid DMA4 (2, 4-D) herbicide. 2, 4-D and Renovate (triclopyr) are the most common herbicides used for spot treatments of Eurasian watermilfoil. Both herbicides provide effective control, but using 2, 4-D will greatly reduce costs to the lake association members.

A vegetation control permit will be submitted in 2010 listing possible areas of EWM re-growth as one treatment area, and possible areas of heavy coontail infestation as a separate treatment area. The permit will request treatment of up to 20 acres of Eurasian watermilfoil. Exact locations of treatment areas are not yet known, as no significant EWM re-growth has been observed to this point and coontail abundance is currently very low. The lake association is prepared for this cost share and has been supportive of the approach to EWM control in Shipshewana Lake.

Maintenance of the Eurasian watermilfoil population should be the highest priority. Spot herbicide treatments should be limited to areas of Eurasian watermilfoil infestation to protect the native species that are re-colonizing the lake. Treatment of native plants along shorelines of the main lake could possibly be requested in 2010 on a case by case basis but is not recommended unless coontail is severely inhibiting recreation.

In addition to herbicide treatments, all stakeholders in the Shipshewana Lake watershed are encouraged to take actions to reduce nutrient flow into Shipshewana Lake. Those living near the lake should try to minimize runoff of nutrients into the lake from their property. Using low phosphorus fertilizer and ensuring proper septic maintenance are small steps that could help improve water quality. Farmers within the watershed may want to take advantage of financial assistance from the Indiana Conservation Reserve Program. Cost shares and yearly payments are available for the construction of sod waterways and warm season grass plantings that can help reduce agricultural runoff to Shipshewana Lake.

LARE funding may be severely limited in 2010 as funds may encumbered for state budget purposes. Also, costs associated with controlling hydrilla may also impact funding availability.

Herbicide Specifications

In treatment areas on Shipshewana Lake 2, 4-D should be applied at a rate of 1.76 parts per million to achieve adequate control of Eurasian Watermilfoil.

Lake and River Enhancement Deadlines

December 15 – Rough drafts of LARE AMVPs and AVMP updates due to LARE staff

January 15 – Grant application due to LARE Staff

February 15 – Revisions of AVMPs and updates due back to contractors

March 1 – Final drafts of AVMPs and AVMP updates due to LARE Staff

March 15 – LARE funding decisions announced

13.0 Project Budget

It is recommended that $7,400 be set aside to treat up to 20 acres of Eurasian watermilfoil re-growth with liquid DMA-4 in 2010. The original budget called for treating 5 acres of re-growth in both 2008 and 2009, but these treatments were not necessary. Since no significant re-growth has been observed, it is very hard to predict how much re-growth will appear in 2010. Based on other whole lake sonar treatments in Northern Indiana, much more re-growth is expected in Shipshewana Lake in 2010, since it will be the fourth year of the treatment program. Up to $4,700 dollars should also be set aside for survey and planning costs.

2010 Proposed Budget

1. Chemically treat any areas of Eurasian milfoil re-growth
   Treat up to 20 acres for Eurasian milfoil with 2, 4-D up to $7,400

2. Conduct a spring visual survey for EWM and a late season Tier II vegetation survey to monitor both Eurasian milfoil and native plant populations.
   Aquatic Vegetation Surveys and AVMP Update up to $4,700

Total Cost Estimates

2,4-D spot treatments for 20 acres of EWM		$7,400
Surveys and AVMP update		$4,700
	Total cost	$12,100
Lake and River Enhancement Share	up to	$10,890
Association's Share	up to	$1,210

14.0 Monitoring and Plan Update Procedures

In 2010, a spring visual survey will be conducted to search for any areas of Eurasian watermilfoil re-growth. Should any Eurasian watermilfoil be found, a treatment map will be submitted to the IDNR prior to treatment if the area is greater than 20 acres. Herbicide treatment would follow the approval of the treatment map.

A late season Tier II vegetation survey is recommended for Shipshewana Lake in 2010. This survey will help describe how the plant community is responding to the whole lake treatment.

In the years that follow, additional surveys should be conducted to determine how the Eurasian milfoil population is reacting to the management strategy over a long period of time. These surveys will provide a basis for evaluation of the management strategy and can be presented to the public should the need arise to modify the management strategy. They will also serve to keep the public interested and informed about management practices at the lake so they will be motivated and equipped to actively participate in the conservation of the Shipshewana Lake ecosystem. The intensity and frequency of vegetation surveys may change from year to year. Survey and planning needs should be re-evaluated each year to reduce unnecessary cost to the lake association while still providing adequate data to characterize the plant community.

15.0 References

Blessing, Arlene. 2004. Fundamentals of Pesticide Use: Indiana Pesticide Applicator Core Training Manual. Purdue University. West Lafayette, Indiana 106 pp.

Cunningham, Willam P., and Saigo, Barwbara W. 2001. Environmental Science: a Global Concern. McGraw Hill Inc. Boston, Massachusetts 646.

Dow Agrosciences Invasive Species Management. 1998-2007. Dow Agrosciences LLC. http://www.dowagro.com/ivm/invasive/prod/dma.htm

Getsinger, Kurt Ph.D. 2005. Aquatic Plant Management: Best Management Practices in Support of Fish and Wildlife Habitat. The Aquatic Ecosystem Restoration Foundation. 78 pp.

IDNR. 2004. Procedure Manual for Surveying Aquatic Vegetation: Tier II Reconnaissance Surveys. IN Department of Natural Resources, Division of Soil Conservation.

IDNR 2004. Procedure manual for surveying Aquatic Vegetation: Tier I and Tier II, Indiana Department of Natural Resources, Indianapolis, Indiana.

Kalff, Jacob. 2002. Limnology: Inland Water Ecosystems. Prentice Hall. Upper Saddle River, New Jersey. 592 pp.

Kannenburg, James R., and Schmidt, James C. 1998. How to Identify and Control Water Weeds and Algae: 5th edition. Applied Biochemists. Milwaukee, Wisconsin. 128pp.

Lembi, Carole 1997. Aquatic Pest Control: Category 5. Department of Botany and Plant Pathology: Purdue University. West Lafayette, Indiana. 58pp.

Pearson, Jed. 2004. A Proposed Sampling Method to Assess Occurrence, Abundance and Distribution of Submersed Aquatic Plants in Indiana Lakes. IN Department of Natural Resources. Division of Fish & Wildlife. Indianapolis, Indiana 37 pp.

Pullman, Douglas G. 1998. The Lake Association Leaders Aquatic Vegetation Management Guidance Manual.

Renovate 3 Specimen Label. 2003. SePRO Corporation. www.sepro.com

Scribailo, Robin W. Ph.D. & Alix, Mitchell S. 2003. Final Report on the Weevil Release Study for Indiana Lakes. Department of Botany and Plant Pathology. Purdue University. West Lafayette, IN.

Smith, Robert Leo and Smith, Thomas M. 2001. Ecology and Field Biology. Addison Wesley Longman, Inc. San Francisco, California. 771 pp.

Stern, Kinsingly R. 2000. Introductory Plant Biology. McGraw Hill. Madison, Wisconsin. 557 pp.

Tyllia, J. 2000. Northeastern Indiana Fishing Map Guide. Superior, Wisconsin. 184 pp.

16.0 Appendices

16.1 Calculations

Fluridone Calculations:
The following paragraph is taken directly from the Sonar A.S. label. It outlines the specific procedures for calculating the amount of Fluridone needed to treat a body of water.

Application Rate Calculation - Ponds, Lakes and Reservoirs

The amount of Sonar A.S. to be applied to provide the desired ppb concentration of active ingredient in treated water may be calculated as follows:
Quarts of Sonar A.S. required per treated surface acre = Average water depth of treatment site (feet)
x Desired ppb concentration of active ingredient
x 0.0027
For example, the quarts per acre of Sonar A.S. required to provide a concentration of 25 ppb of active ingredient in water with an average depth of 5 feet is calculated as follows:
5 **x** 25 **x** 0.0027 = 0.33 quarts per treated surface acre
When measuring quantities of Sonar A.S., quarts may be converted to fluid ounces by multiplying quarts to be measured **x** 32. For example, 0.33 quarts **x** 32 = 10.5 fluid ounces.
Note: Calculated rates should not exceed the maximum allowable rate in quarts per treated surface acre for the water depth listed in the application rate table for the site to be treated.

The following chart outlines rate calculations for DMA – 4 IVM Herbicide. It was taken directly from the DMA – 4 IVM specimen label on Dow AgroSciences website. http://www.dowagro.com/ivm/invasive/prod/dma.htm

Submerged Aquatic Weeds: Including Eurasian Water Milfoil *(Myriophyllum spicatum)*

Treatment Site	Maximum Application Rate [1]	Specific Use Directions
Aquatic Weed Control in Ponds, Lakes, Reservoirs, Marshes, Bayous, Drainage Ditches, Canals, Rivers and Streams that are Quiescent or Slow Moving, Including Programs of the Tennessee Valley Authority	2.84 gallons (10.8 lb of acid equivalent) per acre foot	**Application Timing:** For best results, apply in spring or early summer when aquatic weeds appear. Check for weed growth in areas heavily infested the previous year. A second application may be needed when weeds show signs of recovery, but no later than mid-August in most areas. **Subsurface Application:** Apply DMA 4 IVM undiluted directly to the water through a boat mounted distribution system. Shoreline areas should be treated by subsurface injection application by boat to avoid aerial drift. **Surface Application:** Use power operated boat mounted boom sprayer. If rate is less than 5 gallons per acre, dilute to a minimum spray volume of 5 gallons per surface acre. **Aerial Application:** Use drift control spray equipment or thickening agents mixed with sprays to reduce drift. Apply through standard boom systems in a minimum spray volume of 5 gallons per surface acre. For Microfoil® drift control spray systems, apply DMA 4 IVM in a total spray volume of 12 to 15 gallons per acre. Apply to attain a concentration of 2 to 4 ppm (see table below).

[1] DMA 4 IVM contains 3.8 lb of acid equivalent per gallon of product.

Amount to Apply to Attain a Concentration of 2 to 4 ppm			
Surface Area	**Average Depth (ft)**	**2,4-D Acid Equivalent to Apply (lb/acre)**	**Amount of DMA 4 IVM to Apply (gal/acre)**
1 acre	1	5.4 to 10.8	1.42 to 2.84
	2	10.8 to 21.6	2.84 to 5.68
	3	16.2 to 32.4	4.26 to 8.53
	4	21.6 to 43.2	5.68 to 11.37
	5	27.0 to 54.0	7.10 to 14.21

The following table outlines rate calculations for Renovate 3 herbicide based on desired PPM and average depth of treatment area. It is taken directly from the Renovate 3 specimen label on SePRO Corporation's website: www.sepro.com

Concentration of Triclopyr Acid in Water (ppm ae)					
	Gallons of Renovate 3 per surface acre at specified depth				
Water Depth (feet)	0.75 ppm	1.0 ppm	1.5 ppm	2.0 ppm	2.5 ppm
1	0.7	0.9	1.4	1.8	2.3
2	1.4	1.8	3.3	3.6	4.6
3	2.1	2.9	4.1	5.4	6.8
4	2.7	3.6	5.4	7.2	9.1
5	3.4	4.5	6.8	9.0	11.3
6	4.1	5.4	8.1	10.9	13.6
7	4.8	6.3	9.5	12.7	15.8
8	5.5	7.2	10.9	14.5	18.1
9	6.1	8.1	12.2	16.3	20.4
10	6.8	9.0	13.6	18.1	22.6
15	10.2	13.6	20.4	27.2	33.9
20	13.6	18.1	27.2	36.2	45.3

16.2 Common Aquatic Plants of Indiana

(See 2006 Management Plan)

16.3 Pesticide Use Restrictions Summary:

The following table was produced by Purdue University and included in the Professional Aquatic Applicators Training Manual. It gives a summary of water use restrictions on all major chemicals available for use in the aquatics market.

Table 5: Pesticide Use Restrictions

Table 1. Aquatic Herbicides and Their Use Restrictions. Always check the label because these restrictions are subject to change.

	Human			Animal	Irrigation		
	Drinking	Swimming	Fish Consumption	Drinking	Turf	Forage	Food Crops
	waiting period, in days						
Copper Chelate	0	0[a]	0	0	0	0	0
Copper Sulfate	0	0[a]	0	0	0	0	0
Diquat	1–3	0[a]	0	1	1–3	1–3	5
Endothall (granular)[b]	7	0[a]	3	0	7	7	7
Endothall (liquid)[b]	7–25	0[a]	3	7–25	7–25[d]	7–25	7–25
Endothall 191 (granular)[c]	7–25	0[a]	3	7–25	7–25	7–25	7–25
Endothall 191 (liquid)[c]	7–25	0[a]	3	7–25	7–25	7–25	7–25
Fluridone	0[e]	0[a]	0	0	7–30	7–30	7–30
Glyphosate	0[e]	0[a]	0	0	0	0	0
2,4-D (granular)	*	0[a]	0	*	*	*	*

[a]Although this compound has no waiting period for swimming, it is always advisable to wait 24 hours before permitting swimming in the direct area of treatment.

[b]Trade name is Aquathol®.

[c]Trade name is Hydrothol®.

[d]May be used for sprinkling bent grass immediately.

[e]Do not apply this product within 1/4 (fluridone) to 1/2 (glyphosate) mile upstream of potable water intakes.

*Do not use treated water for domestic purposes, livestock watering (2,4-D, dairy animals only), or irrigation.

16.4 Resources for Aquatic Management

In addition to the LARE Program, there are many other sources of potential funding to help improve the quality of Indiana Lakes. Many government agencies assist in projects designed to improve environmental quality.

The USDA has many programs to assist environmental improvement. More information on the following programs can be found at www.usda.gov.

Watershed Protection and Flood Prevention Program (USDA

Conservation Reserve Program (USDA)

Wetlands Reserve Program (USDA)

Grassland Reserve Program (USDA)

Wildlife Habitat Incentive Program (USDA)

Small Watershed Rehabilitation Program (USDA)

The following programs are offered by the U.S. Fish and Wildlife Service. More information about the Fish and Wildlife service can be found at www.fws.gov

Partners for Fish and Wildlife Program (U.S. Fish and Wildlife Service)

Bring Back the Natives Program (U.S. Fish and Wildlife Service)

Native Plant Conservation Program (U.S. Fish and Wildlife Service)

The Environmental Protection Agency, the Indiana Department of Environmental Management, and the U.S. Forest Service also have numerous programs for funding. A few of these are listed below. More information can be found at www.in.gov/idem and www.fs.fed.us/

U.S. Environmental Protection Agency Environmental Education Program (EPA)

NPDES Related State Program Grants (IDEM)

Community Forestry Grant Program (U.S. Forest Service)

16.5 State Regulations for Aquatic Plant Management

The following information is found on the IDNR website and outlines general regulations for the management of aquatic plants in public waters.

AQUATIC PLANT CONTROL PERMIT REGULATIONS
Indiana Department of Natural Resources

Note: In addition to a permit from IDNR, public water supplies cannot be treated without prior written approval from the IDEM Drinking Water Section. **Amended state statute adds biological and mechanical control (use of weed harvesters) to the permit requirements, reduces the area allowed for treatment without a permit to 625 sq ft, and updates the reference to IDEM.** *These changes become effective on July 1, 2002.*

Chapter 9. Regulation of Fishing
IC 14-22-9-10

Sec. 10. (a) This section does not apply to the following:
(1) A privately owned lake, farm pond, or public or private drainage ditch.
(2) A landowner or tenant adjacent to public waters or boundary waters of the state, who chemically, mechanically, or physically controls aquatic vegetation in the immediate vicinity of a boat landing or bathing beach on or adjacent to the real property of the landowner or tenant if the following conditions exist:
(A) The area where vegetation is to be controlled does not exceed:
(i) twenty-five (25) feet along the legally established, average, or normal shoreline;
(ii) a water depth of six (6) feet; and
(iii) a total surface area of six hundred twenty-five (625) square feet.
(B) Control of vegetation does not occur in a public waterway of the state.
(b) A person may not chemically, mechanically, physically, or biologically control aquatic vegetation in the public waters or boundary waters of the state without a permit issued by the department. All procedures to control aquatic vegetation under this section shall be conducted in accordance with rules adopted by the department under IC 4-22-2.
(c) Upon receipt of an application for a permit to control aquatic vegetation and the payment of a fee of five dollars ($5), the department may issue a permit to the applicant. However, if the aquatic vegetation proposed to be controlled is present in a public water supply, the department may not, without prior written approval from the department of environmental management, approve a permit for control of the aquatic vegetation.
(d) This section does not do any of the following:
(1) Act as a bar to a suit or cause of action by a person or governmental agency.
(2) Relieve the permittee from liability, rules, restrictions, or permits that may be required of the permittee by any other governmental agency.
(3) Affect water pollution control laws (as defined in IC 13-11-2-261) and the rules adopted under water pollution control laws (as defined in IC 13-11-2-261).
As added by P.L.1-1995, SEC.15. Amended by P.L.1-1996, SEC.64.

312 IAC 9-10-3 Aquatic vegetation control permits
Authority: IC 14-22-2-6; IC 14-22-9-10
Affected: IC 14-22-9-10
Sec. 3. (a) Except as provided under IC 14-22-9-10(a), a person shall obtain a permit under this section before applying a substance to waters of this state to seek aquatic vegetation control.
(b) An application for an aquatic vegetation control permit shall be made on a departmental form and must include the following information:
(1) The common name of the plants to be controlled.
(2) The acreage to be treated.
(3) The maximum depth of the water where plants are to be treated.
(4) The name and amount of the chemical to be used.
(c) A permit issued under this section is limited to the terms of the application and to conditions imposed on the permit by the department.

(d) Five (5) days before the application of a substance permitted under this section, the permit holder must post clearly, visible signs at the treatment area indicating the substance that will be applied and what precautions should be taken.
(e) A permit issued under this section is void if the waters to be treated are supplied to the public by a private company or governmental agency. *(Natural Resources Commission; 312*

16.6 Data Sheets

Figure 19: Shipshewana Lake 2009 Data Cover Sheet

Aquatic Vegetation Random Sampling (Tier 2)

Waterbody Cover Sheet

Surveying Organization: Aquatic Weed Control

Contact Information: 574-533-2597

Waterbody Name: Shipshewana Lake

Lake ID: Ship

County(s): LaGrange County

Date: July 23, 2009

Habitat Stratum: IL

Avg. Lake Depth (ft): 7

Lake Level: AUG

Crew Leader: Dave Keister

GPS Metadata

Datum: NAD83

Zone: 16

Accuracy: 30ft

Recorder: Dave Keister

Method: WAAS Enabled GPS

Secchi Depth (ft): 1.1

Total # of Points Surveyed: 60

Total # of Species: 3

Littoral Zone Size (acres): 75

- ☐ Measured
- ☒ Estimated

Littoral Zone Max. Depth (ft): 5ft max Plant Depth

- ☐ Measured
- ☐ Estimate (historical Secchi)
- ☐ Estimated (current Secchi)

Notable Conditions:

Figure 20: Shipshewana Lake 2009 Data Sheet 1

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

Page 1 of 2

WATERBODY NAME: Shipshewana Lake	DATE: 7-23-09
COUNTY: LaGrange	SECCHI DEPTH (FT): 1.1 water temp 75.7°
SITE ID: Shipshewana Lake	MAX PLANT DEPTH (FT): 5 ft
SURVEYING ORGANIZATION: Aquatic Weed Control	WEATHER: Sunny, Calm
CREW LEADER: Dave Keister	COMMENTS (Include voucher codes - V1, V2...):
RECORDER: Dave Keister	
CONTACT INFO: 574-533-2597	*Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.*

Species Codes: Sago, Coontail, [illegible], STAR

Point #	R/T	Latitude	Longitude	Depth	Sago	Coontail		STAR					Notes
1	R	GPS	Points	2	1								
2	↓	↓	↓	3	—								A
3				4		3							A
4				4	—								
5				3	—								
6				2	—								
7				3	1								
8				4	—								
9				3	—								
10				4				1					
11				3	—								
12				7	—								
13				5	—								
14				4	—								
15				2	—								
EWM obs 16				2	—								
17				3	—								
18				4	—								
19				4	—								
20				6	—								
21				4	—								
22				2	—								A
23				5	3								
24				3	—								
25				7	—								
26				5	—								
27				4	—								
28				5	—								
29				5	1								A
30				4	—								
31				4	—								
32				5	—								
33				7	—								

Other plant species observed at lake:

DO Profile:

0	12.27	76.1	1.5	12.37	75.1
3	12.13	75.4	4.5	12.01	74.7
6	11.88	74.8	7.5	9.88	74.1
9	8.02	73.3	10.5	1.63	73.1
12	0.65	72.8			

Figure 21: Shipshewana Lake 2009 Data Sheet 2

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

Page 2 of 2

WATERBODY NAME: Shipshewana Lake	DATE: 7-23-09
COUNTY: LaGrange County	SECCHI DEPTH (FT): 1.1 Water Temp 75.2
SITE ID: Shipshewana	MAX PLANT DEPTH (FT): 5 ft
SURVEYING ORGANIZATION: Aquatic Weed Control	WEATHER: Sunny, calm
CREW LEADER: Dave Keister	COMMENTS (Include voucher codes - V1, V2...):
RECORDER: Dave Keister	
CONTACT INFO: 574-533-2597	*Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.*

Point #	R/T	Latitude	Longitude	Depth	Species Codes: Sago								Notes
34				4	—								
35	R	GPS	Points	4	—								
36	↓			5	—								
37	↓	↓	↓	4	—								A
38				5	—								
39				8	—								
40				5	—								A
41				5	—								
42				5	—								
43				5	—								A
44				5	—								
45				6	—								
46				5	—								
47				3	—								
48				5	—								
49				3	—								
50				4	—								
51				5	—								
52				4	—								
53				4	—								
54				6	—								
55				5	—								
56				7	—								
57				8	—								
58				5	—								
59				9	—								
60				5	—								

Other plant species observed at lake:

Aquatic Weed Control

Tier II Rake Sample GPS Coordinates

Table 6: GPS Coordinates for Rake Samples

Site	Latitude	Longitude
1	41.68165	-85.601
2	41.68233	-85.6
3	41.6831	-85.5989
4	41.68419	-85.5995
5	41.684	-85.6015
6	41.68447	-85.6033
7	41.68493	-85.6041
8	41.68594	-85.6044
9	41.68679	-85.6039
10	41.68753	-85.6046
11	41.68831	-85.6045
12	41.68862	-85.606
13	41.68949	-85.6045
14	41.69044	-85.6047
15	41.69124	-85.6053
16	41.69203	-85.606
17	41.69204	-85.6071
18	41.69212	-85.6083
19	41.69142	-85.6089
20	41.69061	-85.6091
21	41.69101	-85.6101
22	41.69084	-85.611
23	41.69017	-85.6116
24	41.68989	-85.6126
25	41.68884	-85.6121
26	41.68937	-85.6134
27	41.68901	-85.6141
28	41.68818	-85.6136
29	41.68782	-85.6145
30	41.68731	-85.6135
31	41.68649	-85.6131
32	41.68625	-85.6122
33	41.68606	-85.6099
34	41.6853	-85.6111
35	41.68456	-85.611
36	41.68468	-85.6097
37	41.68401	-85.6099
38	41.68394	-85.6085
39	41.68428	-85.6068
40	41.68294	-85.6084
41	41.68295	-85.6071
42	41.68218	-85.6071
43	41.68218	-85.606
44	41.68321	-85.6057
45	41.68391	-85.6051
46	41.6827	-85.605
47	41.68156	-85.6058
48	41.68189	-85.6047
49	41.68107	-85.6048
50	41.68293	-85.6039
51	41.68215	-85.6034
52	41.68154	-85.6027
53	41.68248	-85.6021
54	41.68264	-85.601
55	41.68342	-85.6002
56	41.68566	-85.6057
57	41.68673	-85.6052
58	41.68751	-85.6064
59	41.68822	-85.6066
60	41.68816	-85.6056

16.7 IDNR Aquatic Vegetation Control Permit

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APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT

State Form 26727 (R / 11-03)
Approved State Board of Accounts 1987

[ ] Whole Lake [X] Multiple Treatment Areas
Check type of permit

INSTRUCTIONS: Please print or type information

FOR OFFICE USE ONLY
License No.
Date Issued
Lake County

Return to: Page **1** of ___

DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
Commercial License Clerk
402 West Washington Street, Room W273
Indianapolis, IN 46204

FEE: $5.00

Applicant's Name: Steven Weiderman	Lake Assoc. Name: Shipshewana Lake Association	
Rural Route or Street: 3560 North 920 West		Phone Number: 260-768-9137
City and State: Shipshewana		ZIP Code: 46565
Certified Applicator (if applicable): Jim Donahoe	Company or Inc. Name: Aquatic Weed Control	Certification Number: F-19215
Rural Route or Street: P. O. Box 325		Phone Number: 574-533-2597
City and State: Syracuse IN		ZIP Code: 46567

Lake (One application per lake): Shipshewana	Nearest Town: Shipshewana	County: Lagrange
Does water flow into a water supply		[ ] Yes [X] 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 # 1	LAT/LONG or UTM's N41degrees 41.041 W85 degrees 30.952		
Total acres to be controlled 20	Proposed shoreline treatment length (ft) Bay	Perpendicular distance from shoreline (ft) Bay	
Maximum Depth of Treatment (ft) 5	Expected date(s) of treatment(s) late june		

Treatment method: [X] Chemical [ ] Physical [ ] Biological Control [ ] Mechanical

Based on treatment method, describe chemical 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: [X] Rake [ ] Visual [ ] Other (specify) ___

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Eurasian Milfoil	X	50
Coontail		40
Algae	X	10

Aquatic Weed Control

Treatment Area #	LAT/LONG or UTM's	
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 used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Reward, Aquathal K, Copper sulfate, 2-4D, renovate, Nautique

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

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

INSTRUCTIONS: Whoever treats the lake fills in "Applicant's Signature" unless they are a professional. If they are a professional company who specializes in lake treatment, they should sign on the "Certified Applicant" line.

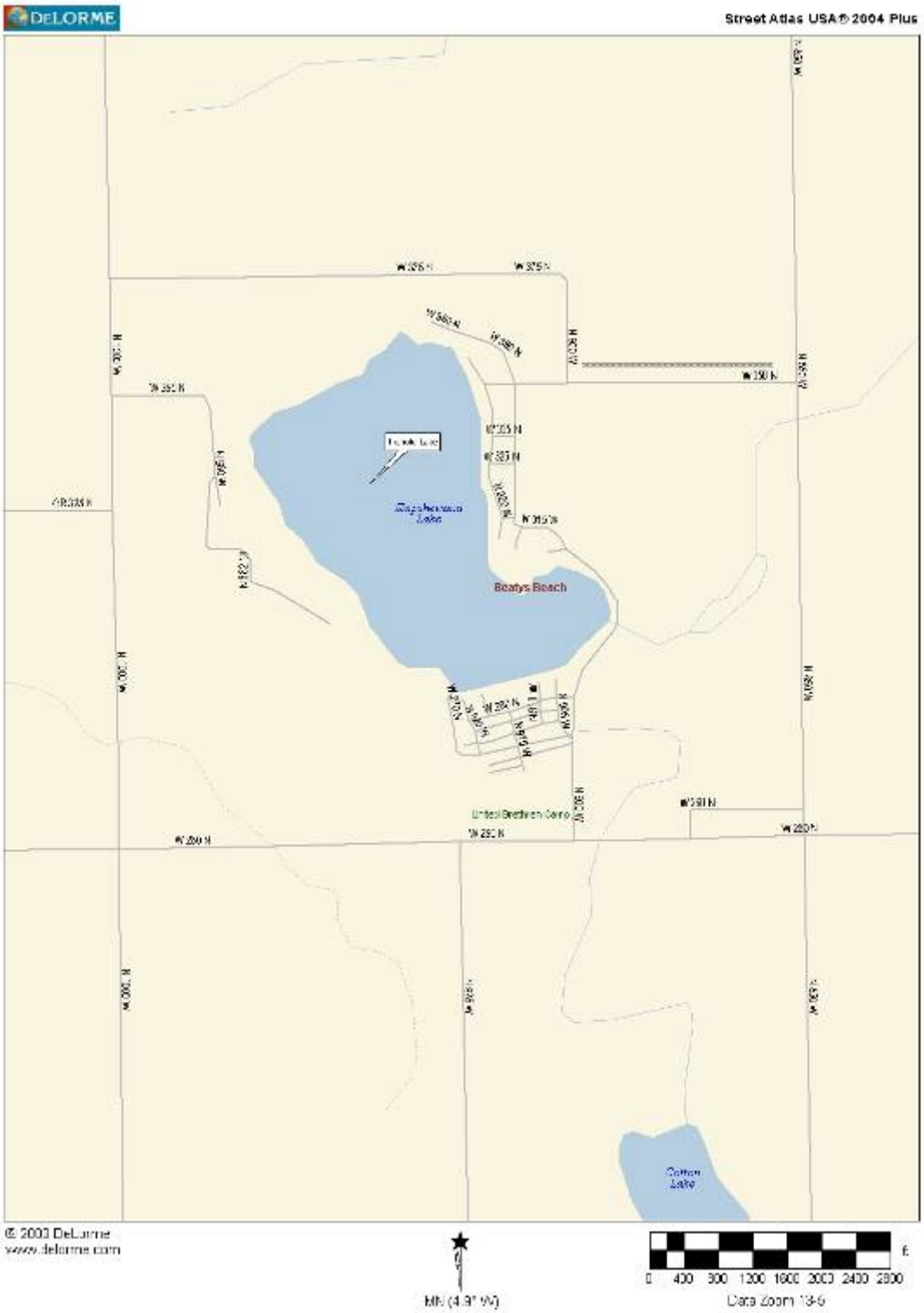
Applicant Signature	Date
Certified Applicant's Signature	Date

FOR OFFICE ONLY

☐ Approved ☐ Disapproved	Fisheries Staff Specialist
☐ Approved ☐ Disapproved	Environmental Staff Specialist

Mail check or money order in the amount of $5.00 to:

DEPARTMENT OF NATURAL RESOURCES
DIVISION OF FISH AND WILDLIFE
COMMERCIAL LICENSE CLERK
402 WEST WASHINGTON STREET ROOM W273
INDIANAPOLIS, IN 46204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