Lake Wawasee, Kosciusko County, Aquatic Vegetation Management Plan Update – 2009 and Vegetation Surveys in Ecozone Areas of Conklin

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FINAL

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Executive Summary

V3 was contracted by the Wawasee Area Conservancy Foundation (WACF) to update the 2006 Lake Wawasee Aquatic Vegetation Management Plan and include results of vegetation surveys in ecozone areas of Conklin and Johnson Bay. Native species provide many benefits which can be diminished by the presence of exotic aquatic vegetative species. The primary submersed aquatic exotic species at Lake Wawasee are Eurasian watermilfoil (*Myriophyllum spicatum*), curlyleaf pondweed (*Potamogeton crispus*), and starry stonewort (*Nitellopsis obtusa*). In addition to disrupting the native vegetative community, exotic species inhibit recreational uses such as swimming, boating and fishing.

Herbicide treatments are an effective management tool for controlling exotic species at Lake Wawasee. Aquatic Weed Control applied liquid 2,4-D (DMA®4 IVM) at a rate of 2.8 gal/A-ft. to 25 acres of Eurasian watermilfoil on July 20, 2009 and treated an additional 25 acres on August 24, 2009. Aquatic Weed control applied liquid Nautique at a rate of 1.0 ppm to 15 acres of starry stonewort within Johnson Bay on August 31, 2009 (Figure 4). The treatment of starry stonewort was done later in the growth season when the star-shaped bulbils are developed and allows for positive identification.

V3 conducted the summer Tier II survey on August 12, 2009 to evaluate the vegetative community and determine the extent of exotic species in Lake Wawasee. The 2009 summer sampling effort had vegetation at 78 of the 100 sampling locations and collected a total of 16 species. The two exotic species collected were Eurasian watermilfoil and curlyleaf pondweed. Chara was the most frequently occurring species within Lake Wawasee (39%). Eurasian watermilfoil was present at 33% of sampling locations and collected from depths ranging from 4 to 23 feet during the 2009 Tier II survey. Curlyleaf pondweed was collected at one sampling location from a depth of 16 feet during the 2009 Tier II survey. Starry stonewort was collected at 4 sampling locations in Johnson Bay with a rake score frequency of 3 (20-100% rake teeth filled). Starry stonewort was collected from depths ranging from 3 to 5 feet (Figure 15).

In addition to the Tier II vegetation survey, V3 conducted ecozone surveys in Johnson Bay, Conklin Bay and North Bay. The ecozone survey of Johnson Bay was conducted on August 10, 2009. Ecozone areas of Conklin Bay and North Bay were surveyed on August 11, 2009. The most common floating-leaf emergent species within Johnson and Conklin Bay are yellow pond lily (*Nuphar variegate*) and white water lily (*Nymphaea oderata*). Fifteen emergent beds were mapped within Johnson Bay's shoreline, which ranged from 0.01 - 2.74 acres in size and totaled 9.75 acres (Figure 13). The 2009 emergent survey results indicate that the buoys within Johnson Bay are protecting the ecozone areas, as emergent beds increased by 1 acre from 2008 to 2009. V3 mapped 9 beds along the shoreline of Conklin Bay. Conklin Bay's emergent beds ranged from 0.09 - 3.44 acres in size and totaled 8.9 acres (Figure 14). Conklin Bay's emergent beds have increased by 0.93 acres since the 2008 emergent survey. Hardstem bulrush (*Scirpus acutus*), floating pondweed (*Potamogeton natans*) and white water lily composed the three emergent clumps in North Bay in 2008 and 2009. North Bay's clumps 1 and 3 expanded in 2009 and clump 2 decreased in size by 0.02 acres (Figure 17).

Eurasian watermilfoil has shown a steady increase in frequency from 2005 to 2009 (12.8% and 33% respectively) which substantiates the need for treatment in 2010. The 2005 survey effort included more sampling locations in the shallow zones of Lake Wawasee which could have resulted in an underestimate of Eurasian watermilfoil's abundance as it can thrive in deeper depth zones. Locations where starry stonewort was retrieved in 2009 remained consistent with the locations starry stonewort was collected in 2008.

The proposed management schedule and budget for 2010 and 2011 are summarized below.

2010

Target Species Distribution Map and Proposed Treatment Area Map	$1,000
Systemic Herbicide Treatment of Eurasian watermilfoil using 2, 4-D (assumed 50 acres)	$20,000
Treatment of Starry Stonewort using Nautique (assumed 20 acres)	$3,700
Late season summer aquatic plant survey (Tier II) and plan update	$8,000

2011

Target Species Distribution Map and Proposed Treatment Area Map	$1,000
Late season summer aquatic plant survey (Tier II) and plan update	$8,000

Any proposed herbicide applications will depend on the results of the vegetation surveys.

A total of 20 acres of starry stonewort will be treated in 2010 within the priority treatment area within Johnson bay using Nautique at a rate of 1.0 ppm (Figure 12). Starry stonewort is anticipated to be treated in late June to early July but may require multiple applications. Priority treatment area and acreage for starry stonewort is described within the Application for Aquatic Vegetation Control Permit located in Appendix II. V3 recommends continued monitoring for starry stonewort throughout Lake Wawasee as it has the potential for spreading through bulbils and negatively impacting native species.

These management activities and plant surveys are proposed to improve Lake Wawasee's ecosystem and facilitate the achievement of the overall goals. These overall goals established by the IDNR for all lakes applying for LARE funding are: 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; and 3) provide reasonable public recreational access while minimizing the negative impacts on plant and wildlife resources.

Acknowledgements

We would like to acknowledge Angela Sturdevant, Rod Edgell and Greg Biberdorf with IDNR's LARE program for providing funding and assistance in the completion of this study. We would like to thank Jed Pearson, IDNR District Fisheries Biologist and Doug Keller of IDNR, for consultation and information. We would like to acknowledge the Wawasee Area Conservancy Foundation as the local sponsor that provided assistance and guidance including: Heather Harwood and Diana Castell. We would like to thank Jim Donahoe of Aquatic Weed Control for mapping, recommendations, and consultation. Finally we would like to acknowledge V3 staff involved in the research, sampling and document preparation including: Scott Brejcha, Nick Vansomeran, and Jessica Dunn.

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Introduction and Background

The Wawasee Area Conservancy Foundation (WACF) received a Lake and River Enhancement (LARE) grant in March, 2009 which was used to fund the vegetation and ecozone study. The LARE grant program is part of the Indiana Department of Natural Resources (IDNR), Division of Fish and Wildlife. V3 was contracted by the WACF to update the 2006 Lake Wawasee Aquatic Vegetation Management Plan and include results of vegetation surveys in identified ecozone areas of Conklin Bay, Johnson Bay and North Bay. Additional funding for this study was provided by the WACF. The purpose of the Aquatic Vegetation Management Plan is to identify aquatic weed problem areas, describe management objectives, prescribe management strategies, and determine funding needs and the sources necessary to control exotic vegetation. This update will serve as a prerequisite to continue future LARE program funding for the control of exotic species within Lake Wawasee. The goal of the ecozone study in Johnson Bay, Conklin Bay, and North Bay is to establish baseline data on the emergent vegetative community, and to monitor changes over time so that these significant aquatic communities, or ecozones, can be protected.

Lake Wawasee is a 3,410-acre lake in Syracuse, Kosciusko County, Indiana. A summer Tier II survey was conducted on August 12, 2009 to evaluate the aquatic vegetative community and provide the data necessary to make scientifically based recommendations for future aquatic vegetation management. Eurasian watermilfoil (*Myriophyllum spicatum*), curlyleaf pondweed (*Potamogeton crispus*) and starry stonewort (*Nitellopsis obtusa)* are the identified exotic species within Lake Wawasee. Exotic vegetative species disrupt lake ecosystems, provide poor habitat for aquatic organisms, and inhibit recreational access. Aquatic vegetation management at Lake Wawasee must have an integrated approach and include stakeholders' concerns for successful implementation. This plan integrates scientific data with public input to provide management recommendations that outline proactive measures to reduce the exotic species within Lake Wawasee.

The overall goal of the LARE program is to ensure the continued viability of public-access lakes and streams by utilizing a watershed approach to reduce non-point source sediment and nutrient pollution of Indiana's and adjacent states' surface waters to a level that meets or surpasses state water quality standards. To accomplish this overall goal, the LARE program provides technical and financial assistance to qualified projects. These include: a) studies, management plans, sediment removal, and design and construction activities involving specific lakes and streams; b) land treatment practices or management plans for designated watersheds; and c) management plans and control of exotic plants and animals in targeted lakes. Funding for the LARE program is provided by an annual fee charged to Indiana boat owners.

Watershed and Water Body Characteristics

Lake Wawasee is Indiana's largest natural lake and has a surface area of 3,410-acres. Lake Wawasee has a maximum depth of 77 feet and an average depth of 22 feet. Lake Wawasee has been the subject of many studies as the improvement and protection of this valuable resource continues to be a focus (Table 1). Projects reports included in Table 1 can be accessed through the LARE Project Report website http://www.in.gov/dnr/fishwild/3303.htm.

Table 1: List of existing LARE Studies on Lake Wawasee and the surrounding watershed.

Project Report Title	Date of Report
Enchanted Hills Watershed Evaluation-Wawasee Watershed	November 1995
Lake Enhancement Diagnostic-Feasibility Study for the Wawasee Area Watershed	March 1996
Lake Wawasee Engineering Feasibility Study	May 2001
Griffith's Island Design Build Report	September 2004
Martin Creek Outlet Design Build Report	November 2004
Dillon Creek Sediment Control Project draft report	November 2005
Lake Wawasee Aquatic Vegetation Management Plan 2005	February 2006
Wawasee Area Watershed Management Plan, Elkhart, Kosciusko and Noble Counties	April 2007
Lake Wawasee Aquatic Plant Management Plan Update 2006	June 2007
Bayshore (Lake Wawasee) Design Report – Kosciusko County	November 2007
Wawasee Turkey Creed Sediment Trap	April 2008
Lake Wawasee, Kosciusko County Emergent Vegetation Survey in Ecozone areas of Johnson and Conklin Bay and Tier II Survey Results – 2008	March 2009

Lake Wawasee supports a productive fishery and provides many recreational opportunities. Major lake uses include fishing, pleasure boating, jet skiing, swimming and water skiing (Figure 1). Lake Wawasee has an excellent fishery as it supports many healthy populations of popular game fish such as largemouth bass (*Micropterus salmoides)*, northern pike (*Esox Lucius*), bluegills (*Lepomis macrochirus)*, crappies *(Poxmois sp.)* and yellow perch (*Perca flavescens*) (Aquatic Weed Control, 2005). Lake Wawasee's large size also attracts bass tournament anglers with popular fishing spots including Johnson's Bay, Conklin Bay and the deeper vegetative beds located throughout the lake. The Lake Wawasee fishery is described in detail in the Lake Wawasee Aquatic Plant Management Plant Update – 2006 (V3, 2006) and can be obtained through the LARE Project Report website. There were no additional fisheries studies conducted since the 2006 vegetation management plan update.

Figure 1: Recreational boating (left) and fishing at Lake Wawasee (right).

Problem Statement

A diverse aquatic vegetative community is vital in promoting a balanced lake ecosystem. Exotic species that have been identified within Lake Wawasee during previous vegetation surveys include Eurasian watermilfoil, curlyleaf pondweed, and starry stonewort. Starry stonewort is a new exotic species to Lake Wawasee that was collected in Johnson Bay during V3's 2008 aquatic vegetation sampling. Starry stonewort originates from Eurasia and is best identified by tiny starry bulbils along the lower parts of the stem (Stewart, 2001). Michigan has reportedly seen starry stonewort spreading rapidly and creating nuisance conditions, but very little information is available on this species. While it is not very clear as to the invasive potential of this plant, the IDNR have elected to keep these populations under control while trying to learn more about this species (Doug Keller, IDNR Great Lakes Panel).

Eurasian watermilfoil is an aggressive, extremely adaptable invasive species that can destroy a diverse native aquatic vegetative community without proactive management. Eurasian watermilfoil requires low light, has a high photosynthetic rate, and can grow over a broad temperature range (Madsen et al., 1991). Eurasian watermilfoil spreads rapidly through fragmentation and forms dense weed beds. Relative to other submersed plants, Eurasian watermilfoil was collected at 33% of sampling locations and was observed near 4 sampling locations during the August 2009 Tier II survey.

Curlyleaf pondweed is another submersed exotic species present in Lake Wawasee and has the ability to create nuisance conditions in the early recreational season. Curlyleaf pondweed typically reaches peak biomass in the late spring or early summer months, forms turions, then declines and remains in a dormant state during the warmer months (Figure 2).

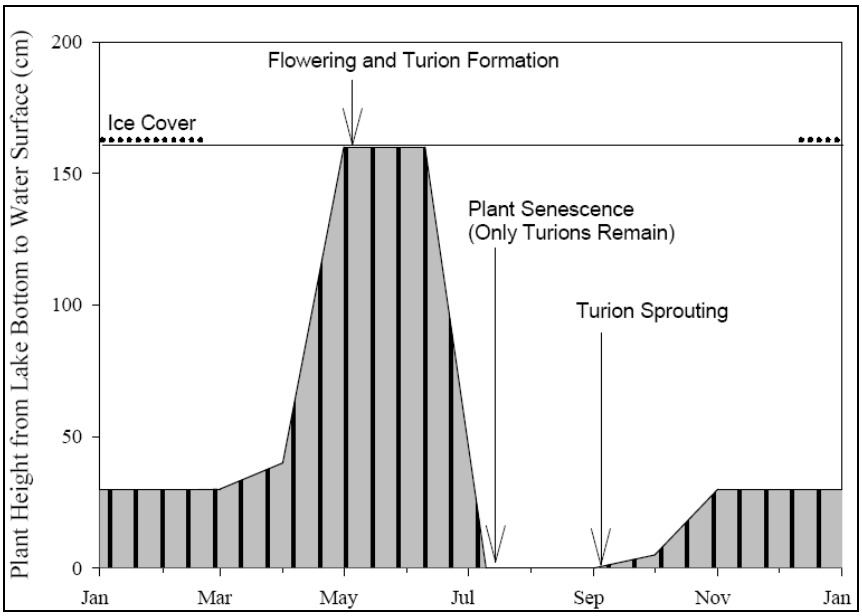


Figure 2: Life history of curlyleaf pondweed. The timing of this cycle varies with location (Wolf and Madsen, 2003)

Long-term management of curlyleaf pondweed at Lake Wawasee will require the reduction or elimination of turions to interrupt its life cycle. Curlyleaf pondweed was collected at one sampling location from a depth of 16 feet during the 2009 Tier II survey. The low frequency of curlyleaf pondweed may be related to the sampling effort being conducted late in the season.

In addition to exotic species management efforts, significant wetland areas located in Johnson Bay, Conklin Bay, North Bay and other areas of Lake Wawasee have been targeted by the IDNR in an attempt to prevent future degradation. Idle speed limits have been enforced near these significant wetland areas to protect them from harm due to wave action and boater impacts. Emergent beds within ecozones have been mapped in 2008 and 2009 in order to understand how emergent areas are responding to protection efforts such as idle speeds and buoys.

Aquatic Vegetation Management Goals and Objectives

The following management goals have been established by the IDNR for all Indiana lakes applying for LARE funding. Any management practices implemented at Lake Wawasee must 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; and

3. Provide reasonable public recreational access while minimizing the negative impacts on plant and wildlife resources.

The WACF identified objectives and specific actions to achieve those goals in the Lake Wawasee, Aquatic Vegetation Management Plan (Aquatic Weed Control, 2005) as well as the 2006 update (V3, 2007). These objectives continue to be a focus for future outreach and management. The main revision to the objectives for Lake Wawasee is the inclusion of starry stonewort management efforts.

Specific objectives are proposed as follows to facilitate achievement of the overall LARE management goals for Lake Wawasee.

1. **Tier II Vegetation Surveys.** Tier II vegetation surveys should be conducted for the next two years to monitor the distribution and abundance of Eurasian watermilfoil, and document any changes in the native plant community of Lake Wawasee. Changes in the plant community will be identified, and the survey results will be used to provide well informed future management strategies. Tier II vegetation survey results will identify if starry stonewort is expanding or spreading to other areas of Lake Wawasee.

2. **Chemical Treatment of Eurasian Watermilfoil.** The results of the 2009 Tier II summer survey demonstrate a significant increase in the population of Eurasian watermilfoil since the 2006 study. Chemical treatment is recommended to be applied to dense monotypic stands of Eurasian watermilfoil and within priority treatment areas. Eurasian watermilfoil should be closely monitored during 2010.

3. **Promote and Maintain the Diversity of Native Aquatic Plant Species.** Tier II vegetation surveys should be conducted for the next two years to monitor the diversity of native aquatic plant species. The significant wetland areas by Johnson Bay, Conklin Bay, North Bay and other areas of the lake should be closely monitored to determine if degradation is occurring and if the idle speed zone enforced by the IDNR is resulting in increased diversity and protection.

Aquatic Species Management Efforts

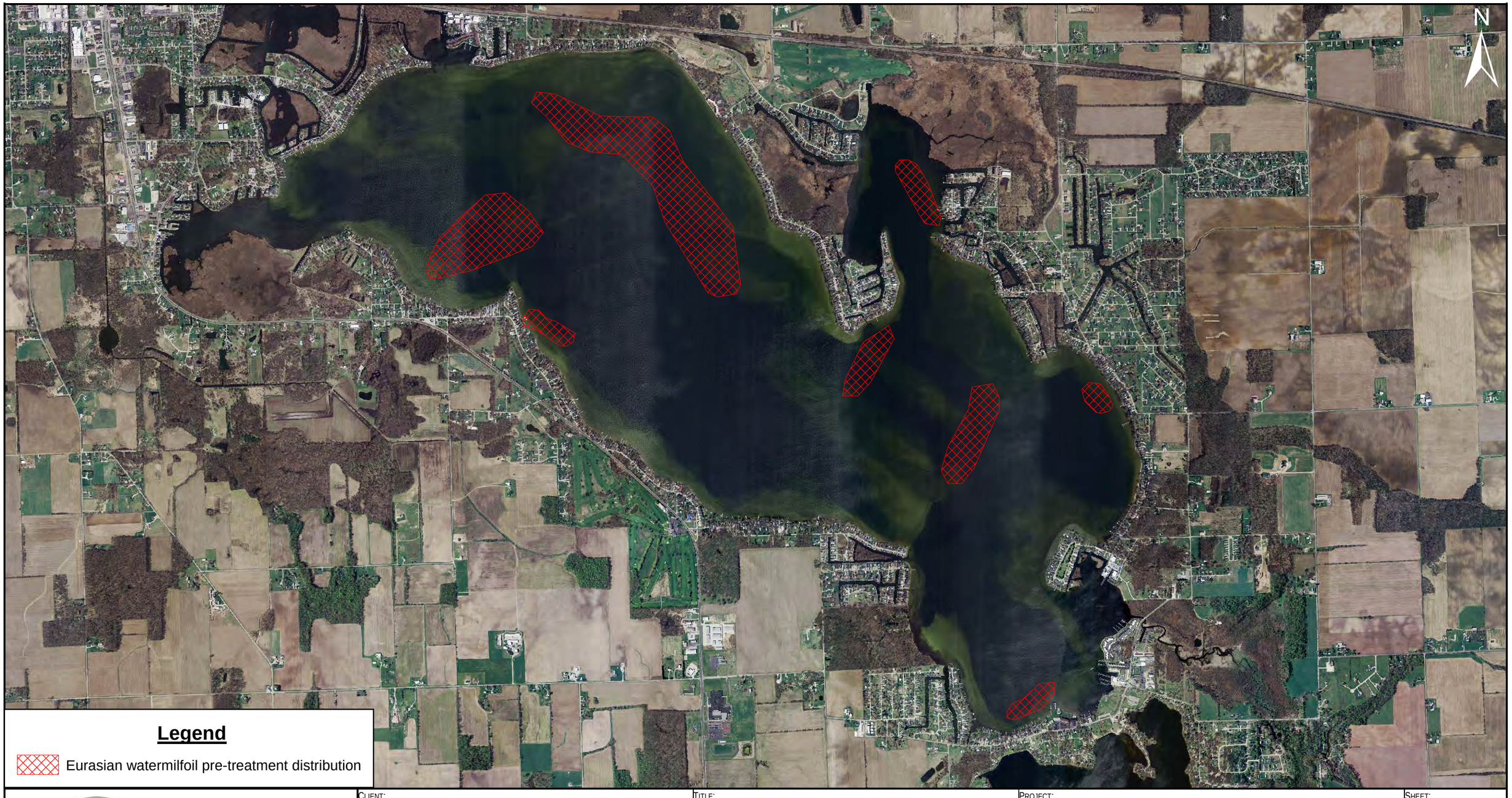
There have been limited chemical treatments on Lake Wawasee over the years as a result of the plant structure and morphology of the lake (Aquatic Weed Control 2005). However, limited amounts of chemical treatments have been applied on individual lots on Lake Wawasee. These limited treatments on the lake accounted for less than 1% of the overall lake's surface area (Aquatic Weed Control 2005). Past chemical treatments for Eurasian watermilfoil, submersed native species, and algae occurred primarily in the channels off Lake Wawasee. Weed growth is abundant in channels due to reduced wave action and increased nutrient runoff and organics in the sediment. Both native and exotic species were targeted during chemical treatments within channels throughout the years at Lake Wawasee. Channel treatments are meant to improve access for boating and fishing, but will not effectively reduce populations of Eurasian watermilfoil within Lake Wawasee.

2009 Eurasian Watermilfoil Control

An invasive species distribution map was created prior to herbicide application based on field surveys (Figure 3). Aquatic Weed Control applied liquid 2,4-D (DMA®4 IVM) at a rate of 2.8 gal/A-ft. to 25-acres of Eurasian watermilfoil on July 20, 2009 and treated an additional 25-acres on August 24, 2009 (Figure 4). V3 conducted the summer Tier II vegetation survey on August 12, 2009 to evaluate the vegetative community at Lake Wawasee and determine the extent of exotic species. The results of the 2009 Tier II vegetation survey had Eurasian watermilfoil present at 33% of sampling locations at depths ranging from 4 to 23 feet. Eurasian watermilfoil was noted as brown or decaying at 11 stations which is indicative of herbicide treatment. Dead or dying plant material that was intact and identifiable was included as outlined by the Tier II Survey Protocol.

2009 Starry Stonewort Control

Starry stonewort is an exotic species that was identified in Johnson Bay during the 2008 emergent survey. Starry stonewort is best identified by tiny starry bulbils along the lower parts of the stem which are more apparent in the late growth season. Aquatic Weed control applied liquid Nautique at a rate of 1.0 ppm to 15 acres of starry stonewort on August 31, 2009 (Figure 4). Starry stonewort was treated late in the growth season when bulbils were present for positive identification prior to treatment as it is morphologically similar to the native species chara. V3 conducted the emergent survey in Johnson Bay on August 10, 2009 and retrieved starry stonewort at four locations at depths ranging from 3 to 5 feet. Locations where starry stonewort was retrieved in 2009 remained consistent with the locations starry stonewort was retrieved in 2008.



Legend

Eurasian watermilfoil pre-treatment distribution

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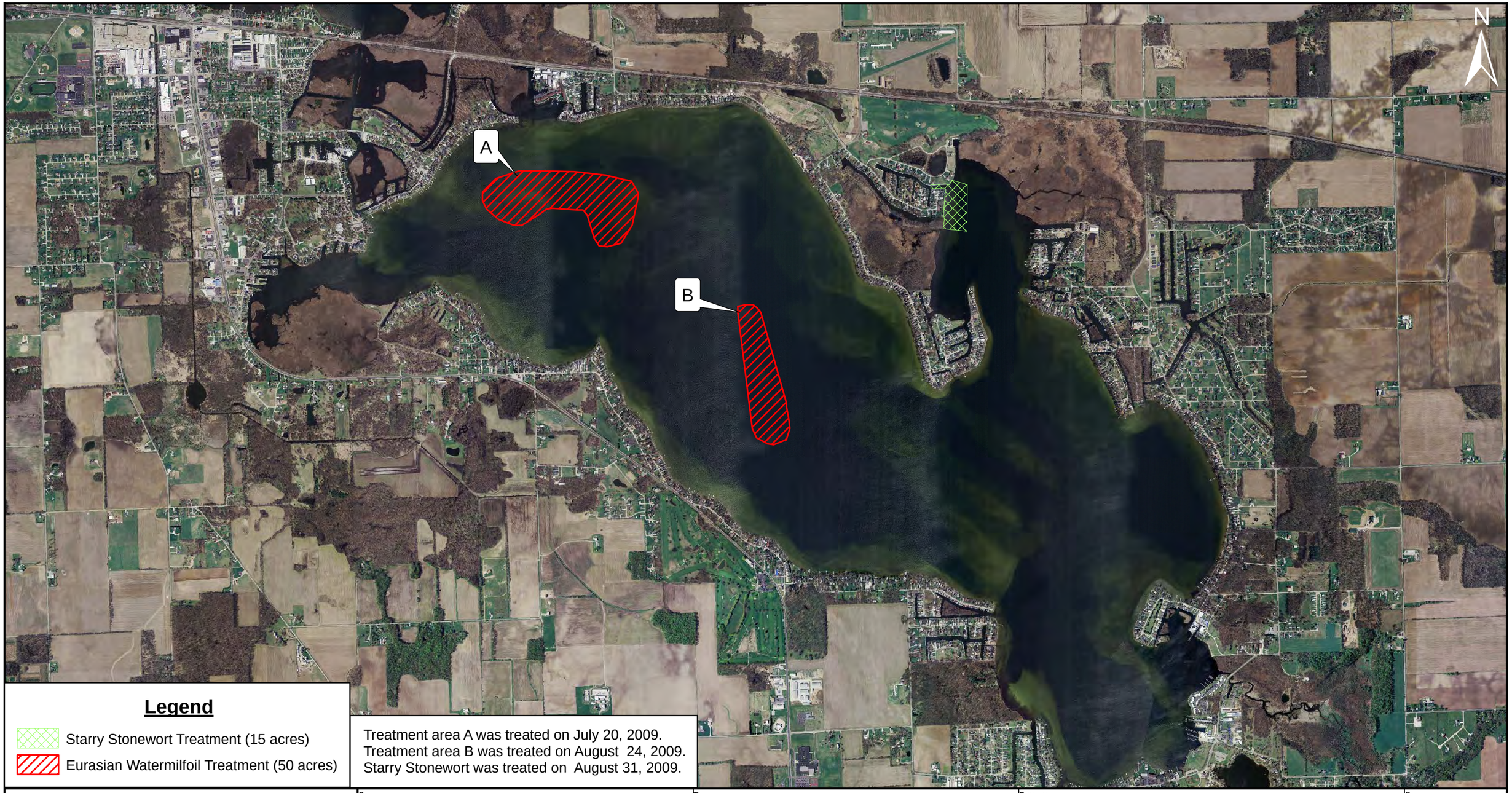
Client:	Title:	Project:	Sheet:
Wawasee Area Conservancy Foundation	**Pre-treatment Invasive Species Distribution Map**	**Lake Wawasee Aquatic Vegetation Management Plan- 2009 Update**	of: 1 1

Address:	Base Layer:	Project No.:	Quadrangle:	Date:	Scale:	Exhibit:
PO BOX 548 Syracuse, IN 46567	Indiana Spatial Data Service 2005 Orthophotography	06037.05	Lake Wawasee	7/13/09	1" = 2000'	3



Legend

Starry Stonewort Treatment (15 acres)

Eurasian Watermilfoil Treatment (50 acres)

Treatment area A was treated on July 20, 2009.
Treatment area B was treated on August 24, 2009.
Starry Stonewort was treated on August 31, 2009.

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Client:	Title:	Project:	Sheet:
Wawasee Area Conservancy Foundation	**Eurasian watermilfoil and Starry Stonewort 2009 Treatment**	**Lake Wawasee Aquatic Vegetation Management Plan- 2009 Update**	of: 1 1

Address:	Base Layer:	Project No.:	Quadrangle:	Date:	Scale:	Exhibit:
PO BOX 548 Syracuse, IN 46567	Indiana Spatial Data Service 2005 Orthophotography	06037.05	Lake Wawasee	7/20/09	1" = 2000'	4

Tier II Sampling Results 2009

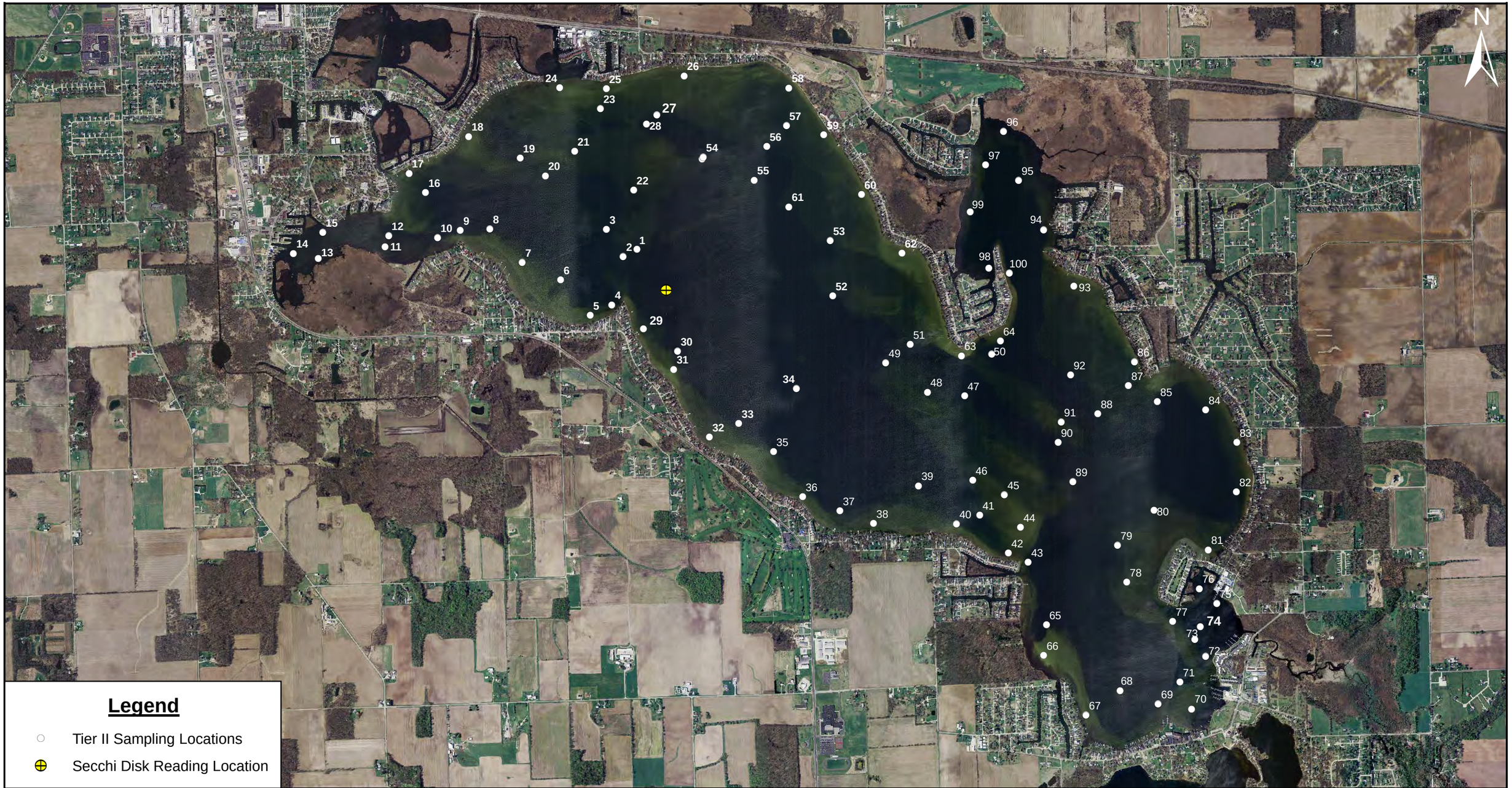
On August 12, 2009 a Tier II vegetation survey was conducted at Lake Wawasee. The Tier II Aquatic Vegetation Survey Protocol, designated by the IDNR, serves as a standardized method to document the distribution and abundance of aquatic vegetation within selected areas at a state-wide scale. The information collected can be used to compare present trends in distribution and abundance of the aquatic vegetative community to past conditions. A table outlining the scientific and common names of species collected in Lake Wawasee is listed below (Table 2). Fourteen native aquatic species and two exotic species were collected during the 2009 Tier II vegetation survey.

Table 2: Species collected in Lake Wawasee during 2009 Tier II sampling.

Scientific Name	Common Name
Chara sp.	Chara
Myriophyllum spicatum	Eurasian watermilfoil*
Ceratophyllum demersum	Coontail
Vallisneria americana	Eel grass
Najas flexilis	Slender naiad
Potamogeton richardsonii	Richardson's pondweed
Stuckenia pectinata	Sago pondweed
Nitella sp.	Nitella
Potamogeton praelongus	White-stemmed pondweed
Myriophyllum heterophyllum	Variable leaved milfoil
Utricularia macrorhiza	Bladderwort
Potamogeton illinoensis	Illinois pondweed
Najas marina	Spiny naiad
Potamogeton crispus	Curlyleaf pondweed*
Potamogeton foliosus	Leafy pondweed
Potamogeton natans	Floating pondweed
** Exotic species collected during 2009 Tier II vegetation survey*	

Sampling Methodology for Summer Tier II Survey

Plant communities typically reach peak diversity between July 15 and August 31. One sampling effort occurred during this time which included a representative sample of the species within Lake Wawasee. According to the IDNR protocol, the number and depth of sampling locations is based on trophic status and acreage. Lake Wawasee is a 3,410-acre Mesotrophic lake that requires 100 sampling locations within the littoral zone. Lake Wawasee has a maximum sampling depth of 25 feet. Sampling locations were located with the GPS unit and remained consistent with the vegetation survey conducted in 2006 (Figure 5). The depth of each sampling location was adjusted based on the need to collect vegetation data in the 20 to 25 foot depth zone and field conditions during Tier II sampling. Variations in sampling location depths are attributed to lake conditions and depth finder readings. Trends in vegetative community and treatment response can be determined by using the same survey locations. Ten additional sampling stations in depths greater than 25 feet were also raked to determine whether plants were present in deeper zones. Vegetation was not collected in depths greater than 25 feet; therefore it is not necessary to extend sampling stations into deeper contours for future surveying efforts. Tier II data sheets and the sampling locations' latitude and longitude can be found in Appendix I. At each station a sampling rake is used for collecting vegetation samples. Once a species is identified, vegetation abundance is scored as a 1 (1-19%), 3 (20-100%), or 5 (+100%) based on the vegetation density on the rake. Species are recorded in the comment section of the data sheet if they are observed within the vicinity of a sampling station but not collected. Secchi disk reading and water quality measurements are taken after completion of the sampling effort (Figure 5).



Legend

- Tier II Sampling Locations
- Secchi Disk Reading Location

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Client: Wawasee Area Conservancy Foundation	Title: **Tier II Sampling Locations and Secchi Disk Reading Location**	Project: **Lake Wawasee Aquatic Vegetation Management Plan- 2009 Update**				Sheet: 1 of: 1
Address: PO BOX 548 Syracuse, IN 46567	Base Layer: Indiana Spatial Data Service 2005 Orthophotography	Project No.: 06037.05	Quadrangle: Lake Wawasee	Date: 8/12/09	Scale: 1" = 2000'	Exhibit: 5

Results of Summer Tier II Survey – August 12, 2009

A total of 16 species were identified up to a maximum depth of 24 feet (Table 3a-3f) during the 2009 Tier II vegetative survey of Lake Wawasee. Emergent species observed during the sampling effort include yellow pond lily *(Nuphar variegate)* and white water lily (*Nymphaea oderata)*. A secchi disk reading was taken after sampling and was found to be at 8.5 feet.

Table 3a: Lake Wawasee's Tier II survey results all depths (0 to 25 feet)

County: Kosciusko	Total Sites: 100	Mean species/site: 1.49		
Date: 8/12/2009	Sites with plants: 78	SE Mean species/site: 0.12		
Secchi (ft): 8.5	Sites with native plants: 71	Mean native species/site: 1.15		
Maximum Plant Depth (ft): 24.0	Number of species: 16	SE Mean natives/site: 0.10		
Trophic Status: Oligotrophic	Number of native species: 14	Species diversity: 0.85		
	Maximum species/site: 5	Native species diversity: 0.83		

All Depths (0 to 25 ft)		Frequency of	Rake score frequency per species				Plant
Species	Common Name	Occurrence (%)	0	1	3	5	Dominance
Chara sp.	Chara	39.0	61.0	32.0	7.0	0.0	10.6
Myriophyllum spicatum	Eurasian watermilfoil	33.0	67.0	18.0	6.0	9.0	16.2
Ceratophyllum demersum	Coontail	18.0	82.0	11.0	7.0	0.0	6.4
Vallisneria americana	Eel grass	14.0	86.0	7.0	7.0	0.0	5.6
Najas flexilis	Slender naiad	7.0	93.0	7.0	0.0	0.0	1.4
Potamogeton richardsonii	Richardson's pondweed	7.0	93.0	6.0	1.0	0.0	1.8
Stuckenia pectinata	Sago Pondweed	6.0	94.0	3.0	3.0	0.0	2.4
Nitella sp.	Nitella	5.0	95.0	4.0	1.0	0.0	1.4
Potamogeton praelongus	White-stemmed pondweed	5.0	95.0	3.0	2.0	0.0	1.8
Myriophyllum heterophyllum	Variable leaved milfoil	4.0	96.0	2.0	2.0	0.0	1.6
Utricularia macrorhiza	Bladderwort	4.0	96.0	3.0	1.0	0.0	1.2
Potamogeton illinoensis	Illinois pondweed	3.0	97.0	2.0	1.0	0.0	1.0
Najas marina	Spiny naiad	1.0	99.0	0.0	1.0	0.0	0.6
Potamogeton crispus	Curlyleaf pondweed	1.0	99.0	1.0	0.0	0.0	0.2
Potamogeton foliosus	Leafy pondweed	1.0	99.0	1.0	0.0	0.0	0.2
Potamogeton natans	Floating pondweed	1.0	99.0	1.0	0.0	0.0	0.2

Table 3b: Lake Wawasee's Tier II survey results 0 – 5 foot depth zone.

County: Kosciusko	Total Sites: 25	Mean species/site: 1.10		
Date: 8/12/2009	Sites with plants: 19	SE Mean species/site: 0.21		
Secchi (ft): 8.5	Sites with native plants: 19	Mean native species/site: 1.07		
Maximum Plant Depth (ft): 24.0	Number of species: 9	SE Mean natives/site: 0.20		
Trophic Status: Oligotrophic	Number of native species: 8	Species diversity: 0.65		
	Maximum species/site: 4	Native diversity: 0.63		

Depth: 0 to 5 ft		Frequency of	Rake score frequency per species				Plant
Species	Common Name	Occurrence (%)	0	1	3	5	Dominance
Chara sp.	Chara	62.1	37.9	62.1	0.0	0.0	12.4
Najas flexilis	Slender naiad	10.3	89.7	10.3	0.0	0.0	2.1
Potamogeton illinoensis	Illinois pondweed	10.3	89.7	6.9	3.4	0.0	3.4
Potamogeton richardsonii	Richardson's pondweed	6.9	93.1	6.9	0.0	0.0	1.4
Vallisneria americana	Eel grass	6.9	93.1	3.4	3.4	0.0	2.8
Ceratophyllum demersum	Coontail	3.4	96.6	3.4	0.0	0.0	0.7
Myriophyllum spicatum	Eurasian watermilfoil	3.4	96.6	3.4	0.0	0.0	0.7
Potamogeton natans	Floating pondweed	3.4	96.6	3.4	0.0	0.0	0.7
Potamogeton foliosus	Leafy pondweed	3.4	96.6	3.4	0.0	0.0	0.7

Table 3c: Lake Wawasee's Tier II survey results 5 – 10 foot depth zone.

County: Kosciusko	Total Sites: 23	Mean species/site: 1.91			
Date: 8/12/2009	Sites with plants: 20	SE Mean species/site: 0.29			
Secchi (ft): 8.5	Sites with native plants: 19	Mean native species/site: 1.64			
Maximum Plant Depth (ft): 24.0	Number of species: 8	SE Mean natives/site: 0.26			
Trophic Status: Oligotrophic	Number of native species: 7	Species diversity: 0.83			
	Maximum species/site: 5	Native diversity: 0.79			

Depth: 5 to 10 ft		Frequency of	Rake score frequency per species				Plant
Species	Common Name	Occurrence (%)	0	1	3	5	Dominance
Chara sp.	Chara	59.1	40.9	45.5	13.6	0.0	17.3
Vallisneria americana	Eel grass	31.8	68.2	18.2	13.6	0.0	11.8
Myriophyllum spicatum	Eurasian watermilfoil	27.3	72.7	13.6	4.5	9.1	14.5
Potamogeton richardsonii	Richardson's pondweed	18.2	81.8	13.6	4.5	0.0	5.5
Utricularia macrorhiza	Bladderwort	18.2	81.8	13.6	4.5	0.0	5.5
Stuckenia pectinata	Sago Pondweed	13.6	86.4	4.5	9.1	0.0	6.4
Potamogeton praelongus	White-stemmed pondweed	13.6	86.4	4.5	9.1	0.0	6.4
Myriophyllum heterophyllum	Variable leaved milfoil	9.1	90.9	4.5	4.5	0.0	3.6

Table 3d: Lake Wawasee's Tier II survey results 10 – 15 foot depth zone.

County: Kosciusko	Total Sites: 22	Mean species/site: 1.80			
Date: 8/12/2009	Sites with plants: 22	SE Mean species/site: 0.23			
Secchi (ft): 8.5	Sites with native plants: 19	Mean native species/site: 1.20			
Maximum Plant Depth (ft): 24.0	Number of species: 11	SE Mean natives/site: 0.19			
Trophic Status: Oligotrophic	Number of native species: 10	Species diversity: 0.82			
	Maximum species/site: 5	Native diversity: 0.85			

Depth: 10 to 15 ft		Frequency of	Rake score frequency per species				Plant
Species	Common Name	Occurrence (%)	0	1	3	5	Dominance
Myriophyllum spicatum	Eurasian watermilfoil	60.0	40.0	36.0	8.0	16.0	28.0
Chara sp.	Chara	28.0	72.0	16.0	12.0	0.0	10.4
Ceratophyllum demersum	Coontail	24.0	76.0	16.0	8.0	0.0	8.0
Vallisneria americana	Eel grass	20.0	80.0	8.0	12.0	0.0	8.8
Najas flexilis	Slender naiad	12.0	88.0	12.0	0.0	0.0	2.4
Stuckenia pectinata	Sago Pondweed	12.0	88.0	8.0	4.0	0.0	4.0
Potamogeton praelongus	White-stemmed pondweed	8.0	92.0	8.0	0.0	0.0	1.6
Myriophyllum heterophyllum	Variable leaved milfoil	4.0	96.0	0.0	4.0	0.0	2.4
Najas marina	Spiny naiad	4.0	96.0	0.0	4.0	0.0	2.4
Nitella sp.	Nitella	4.0	96.0	4.0	0.0	0.0	0.8
Potamogeton richardsonii	Richardson's pondweed	4.0	96.0	4.0	0.0	0.0	0.8

Table 3e: Lake Wawasee's Tier II survey results 15 – 20 foot depth zone.

County:	Kosciusko	Total Sites:	20	Mean species/site:	1.38		
Date:	8/12/2009	Sites with plants:	12	SE Mean species/site:	0.29		
Secchi (ft):	8.5	Sites with native plants:	9	Mean native species/site:	0.81		
Maximum Plant Depth (ft):	24.0	Number of species:	7	SE Mean natives/site:	0.21		
Trophic Status:	Oligotrophic	Number of native species:	5	Species diversity:	0.74		
		Maximum species/site:	4	Native diversity:	0.64		

Depth: 15 to 20 ft		Frequency of	Rake score frequency per species				Plant
Species	Common Name	Occurrence (%)	0	1	3	5	Dominance
Myriophyllum spicatum	Eurasian watermilfoil	50.0	50.0	18.8	12.5	18.8	30.0
Ceratophyllum demersum	Coontail	43.8	56.3	25.0	18.8	0.0	16.3
Nitella sp.	Nitella	18.8	81.3	12.5	6.3	0.0	6.3
Chara sp.	Chara	6.3	93.8	0.0	6.3	0.0	3.8
Myriophyllum heterophyllum	Variable leaved milfoil	6.3	93.8	6.3	0.0	0.0	1.3
Najas flexilis	Slender naiad	6.3	93.8	6.3	0.0	0.0	1.3
Potamogeton crispus	Curlyleaf pondweed	6.3	93.8	6.3	0.0	0.0	1.3

Table 3f: Lake Wawasee's Tier II survey results 20 – 25 foot depth zone.

County:	Kosciusko	Total Sites:	10	Mean species/site:	1.00		
Date:	8/12/2009	Sites with plants:	5	SE Mean species/site:	0.33		
Secchi (ft):	8.5	Sites with native plants:	5	Mean native species/site:	0.63		
Maximum Plant Depth (ft):	24.0	Number of species:	3	SE Mean natives/site:	0.18		
Trophic Status:	Oligotrophic	Number of native species:	2	Species diversity:	0.59		
		Maximum species/site:	2	Native diversity:	0.32		

Depth: 20 to 25 ft		Frequency of	Rake score frequency per species				Plant
Species	Common Name	Occurrence (%)	0	1	3	5	Dominance
Ceratophyllum demersum	Coontail	50.0	50.0	25.0	25.0	0.0	20.0
Myriophyllum spicatum	Eurasian watermilfoil	37.5	62.5	25.0	12.5	0.0	12.5
Nitella sp.	Nitella	12.5	87.5	12.5	0.0	0.0	2.5

Aquatic Vegetation Sampling Results Discussion

The goal of this plan is to reduce nuisance conditions created by exotic aquatic vegetation while still maintaining the abundance of beneficial native vegetative species within Lake Wawasee. A diverse native vegetative community is vital in preventing the establishment of invasive species such as Eurasian watermilfoil.

The summer Tier II survey had vegetation at 78% of sampling locations. The results of the Tier II sampling effort identified chara present at 39% of sampling locations making it the most frequently occurring species within Lake Wawasee (Figure 6). Eurasian watermilfoil was the second most frequently occurring species and had a site frequency of 33% (Figure 7). Coontail and eel grass followed Eurasian watermilfoil in frequency of occurrence at 18% and 14%, respectively. Curlyleaf pondweed had a site frequency of 1% and had a rake score of 1 (1-19% rake teeth filled). Fourteen native species were collected during the summer sampling. The maximum number of species collected at one sampling location was 5 and the average number of species per site was 1.49. Native plants were collected at 71 of the 100 sampling locations.

Nine species were collected within the 0 to 5 foot depth zone. Native species accounted for 8 of the species collected and were represented at 19 of the 25 sampling locations within this depth zone. The maximum number of species at one sampling location was 4. The most dominant species within the 0 to 5 foot depth range was chara algae and occurred at 62.1% of sampling locations. Slender naiad and Illinois pondweed followed in frequency of occurrence (10.3%). Eurasian watermilfoil was collected at 1 sampling location within this depth zone and had a rake score of 1 (1-19% rake teeth filled). Native species collected in this depth zone include Richardson's pondweed, eel grass, coontail, floating pondweed and leafy pondweed.

The 5 to 10 foot depth zone was represented by 7 native species and 1 exotic species. Native vegetation was collected at 19 of the 23 sampling locations in this depth zone. The maximum number of species at one sampling location was 5 and the average number of species per site was 1.91. The top three most frequently occurring species within the 5 to 10 foot depth zone were chara (59.1%), eel grass (31.8%), and Eurasian watermilfoil (27.3%). Chara algae is an important food source for waterfowl and provides fish habitat but can quickly develop to a nuisance level. Chara algae carpets the lake bottom and inhibits the growth of other native species. Chara is typically found in shallow depths and was present in Lake Wawasee in depths up to 12 feet. Native vegetative species collected in this depth zone include Richardson's pondweed, bladderwort, sago pondweed, white-stemmed pondweed, and variable leaved milfoil.

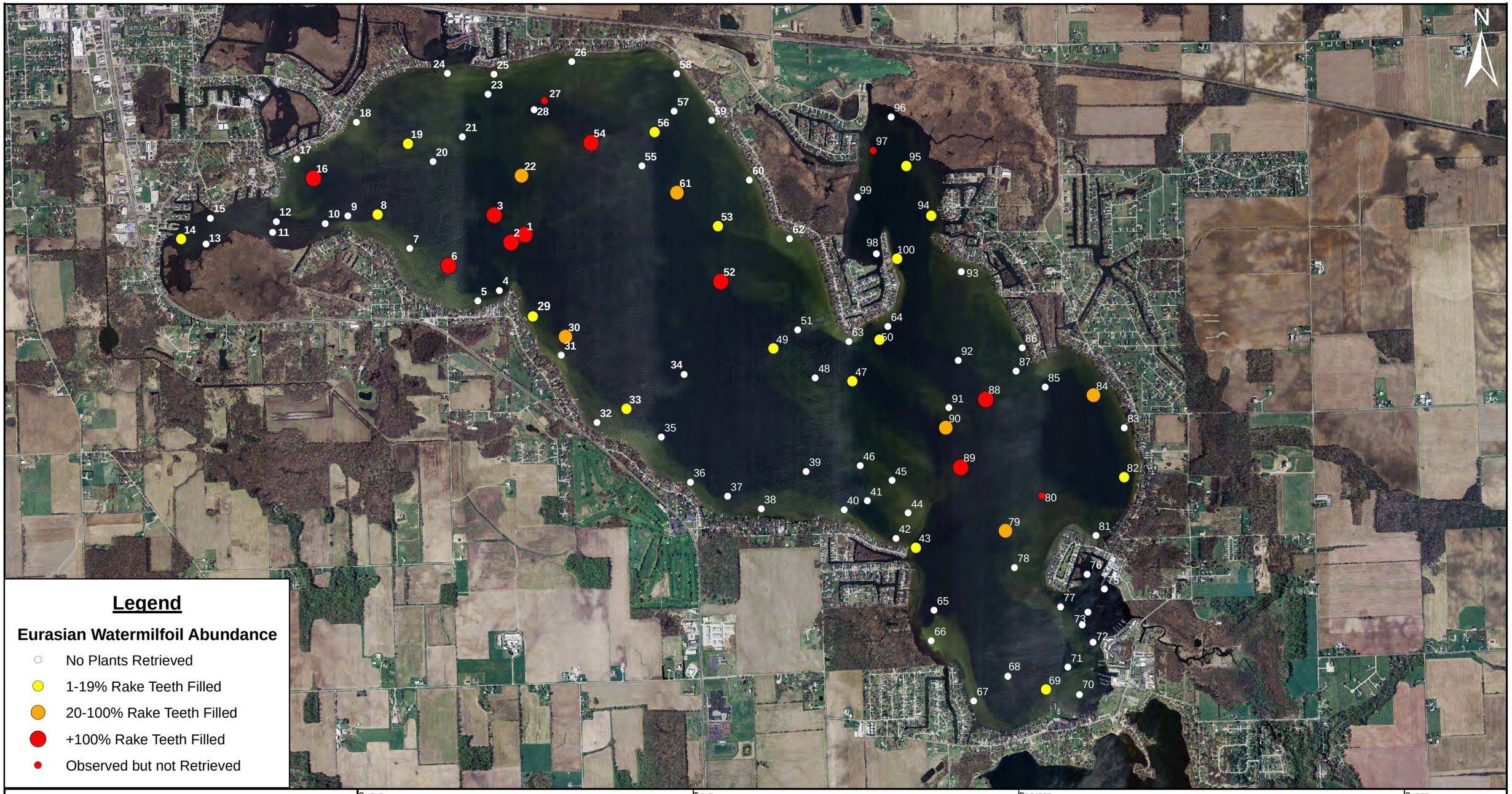
Legend

Chara Abundance

- No Plants Retrieved
- 1-19% Rake Teeth Filled
- 20-100% Rake Teeth Filled

V3 Companies
7325 Janes Avenue
Woodridge, IL 60517
630.724.9200 phone
630.724.9202 fax
www.v3co.com

CLIENT: Wawasee Area Conservancy Foundation	TITLE: **Summer Distribution and Abundance of Chara**	PROJECT: **Lake Wawasee Aquatic Vegetation Management Plan- 2009 Update**				SHEET: OF: 1 1
ADDRESS: PO BOX 548 Syracuse, IN 46567	BASE LAYER: Indiana Spatial Data Service 2005 Orthophotography	PROJECT NO.: 06037.05	QUADRANGLE: Lake Wawasee	DATE: 8/12/09	SCALE: 1" = 2000'	EXHIBIT: 6



Legend

Eurasian Watermilfoil Abundance

- No Plants Retrieved
- 1-19% Rake Teeth Filled
- 20-100% Rake Teeth Filled
- +100% Rake Teeth Filled
- Observed but not Retrieved

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Client:	Title:	Project:	Sheet:
Wawasee Area Conservancy Foundation	**Summer Distribution and Abundance of Eurasian Watermilfoil**	**Lake Wawasee Aquatic Vegetation Management Plan- 2009 Update**	of: 1 1

Address:	Base Layer:	Project No.:	Quadrangle:	Date:	Scale:	Exhibit:
PO BOX 548 Syracuse, IN 46567	Indiana Spatial Data Service 2005 Orthophotography	06037.05	Lake Wawasee	8/12/09	1" = 2000'	7

Eleven species were collected within the 10 to 15 foot depth zone and was the most diverse depth zone. Ten native species and one exotic species were collected in this depth zone. One-hundred percent (100%) of the sampling locations were vegetated within this depth zone. The maximum number of species collected at a single sampling location was 5 with an average of 1.80 species per sampling location. Eurasian watermilfoil was the most frequently occurring species (60%) within the 10 to 15 foot depth zone. The top three most frequently occurring native species within this depth zone include chara (28%), coontail (24%) and eel grass (20%). Despite Eurasian watermilfoil's dominance, native species were present at 19 of the 22 sampling locations. Native vegetative species collected in this depth zone include slender naiad, sago pondweed, white-stemmed pondweed, variable leaved milfoil, spiny naiad, nitella, and Richardson's pondweed.

The 15 to 20 foot depth zone consisted of 20 sampling locations. Twelve of the 20 sampling locations were vegetated. Seven species were collected which includes two exotic species. Eurasian watermilfoil was the most frequently occurring species (50%) followed by coontail (43.8%). Coontail is a native species that offers habitat for aquatic organisms in deeper zones. It is important for coontail to remain dominant in the deeper zones so Eurasian watermilfoil doesn't become the only species represented.

The 20 to 25 foot depth zone had ten sampling locations. Five of the ten sampling locations were vegetated and native species were present at all vegetated locations. Three species were collected which included the exotic species, Eurasian watermilfoil. Coontail had a frequency of occurrence of 50%. Eurasian watermilfoil had a frequency of occurrence of 37.5% followed by nitella which had a frequency of 12.5%.

Threatened and Endangered Species

The Indiana Natural Heritage Data Center database provides information on the presence of rare species, threatened and endangered species, and high quality natural communities and areas. The database serves as a tool for setting management priorities in areas where these species are encountered. There were no encounters with threatened or endangered species during the 2009 Tier II sampling. No voucher specimens were collected during the efforts of this project. There are no anticipated adverse impacts to any state or federally protected threatened or endangered species as it relates to the use of the vegetation control herbicides recommended within this plan.

Comparison of Lake Wawasee's Quantitative Sampling Data

Two Tier II vegetation surveys of aquatic plants were conducted on May 26 and August 10, 2005, by Aquatic Weed Control (2005). It is important to note that the comparisons are not straight forward, as the sampling protocols for 2005 were different from the sampling efforts in 2006 and 2009. The 2005 sampling effort followed a protocol that included more shallow points and had a total of 360 sampling locations. The 2006 and 2009 Tier II results are the most comparable as the sampling locations remained consistent between both surveys (Table 4).

Table 4: Tier II Survey Frequency of Occurrence Results at Lake Wawasee.

	Frequency of Occurrence (%)			
Species	**5/26/05**	**8/10/05**	**7/26/06**	**8/12/09**
Chara	59.7	55.3	49.0	39.0
Northern milfoil	22.2	18.3	37.0	-
Eurasian watermilfoil	12.8	11.1	28.0	33.0
Coontail	10.6	15.3	31.0	18.0
Clasping leaf pondweed	10.3	4.7	-	
Curlyleaf pondweed	10.3	0.6	2.0	1.0
Flat-stemmed pondweed	5.0	2.5	4.0	
Bladderwort	4.7	18.3	9.0	4.0
Whorled milfoil	3.9	7.2	4.0	4.0
Water stargrass	3.3	-	-	
Slender naiad	3.3	18.9	10.0	7.0
Eel grass	2.5	14.7	12.0	14.0
Large-leaf pondweed	2.2	-	2.0	1.0
Sago pondweed	1.9	9.7	8.0	6.0
Nitella	1.7	0.3	8.0	5.0
Elodea	0.8	0.6	-	
Variable Pondweed	-	18.6	9.0	
Southern naiad	-	2.5	-	
Illinois pondweed	-	2.2	7.0	3.0
Brittle naiad	-	0.8	-	
Horned pondweed	-	0.3	-	
Richardson's pondweed	-	-	2.0	7.0
White stemmed pondweed	-	-	-	5.0
Spiny naiad	-	-	-	1.0
Floating pondweed	-	-	-	1.0
Canadian waterweed	-	-	2.0	-
Southern water nymph	-	-	2.0	-
Total Number of Species	**16**	**20**	**18**	**16**

As shown in Table 4, chara remained the most frequently encountered species throughout all the sampling efforts. Chara's lower frequency of occurrence in 2006 and 2009 may be attributed to the change in protocol from the survey conducted in 2005. The 2005 survey effort included more sampling locations in the shallow zones of Lake Wawasee which is where chara is most dominant. Eurasian watermilfoil has shown a steady increase in frequency from 2005 to 2009 (12.8% and 33% respectively) which substantiates the need for treatment in 2010. The frequency of occurrence for coontail in 2009 decreased by 13% from the 2006 study. The decrease in coontail may be attributed to the increase of Eurasian watermilfoil in deeper contours of Lake Wawasee. Eurasian watermilfoil was collected along with coontail at 12 of the 18 sampling locations where coontail was retrieved.

Milfoil Identification

As summarized by Moody and Les (2002), northern watermilfoil and Eurasian watermilfoil are two closely related species that have been confused taxonomically for decades as a result of inconsistent morphological differences, mainly differences in leaf-segment number. Moody and Les (2002) documented that hybrids between northern watermilfoil and Eurasian watermilfoil have intermediate morphology for leaf-segment number. During the 2006 aquatic vegetation study two samples were sent to Dr. Robin Scribailo, Director of the Aquatic Plant Herbarium at Purdue University North Central for species identification. He concluded that the samples appear to be more similar to Eurasian watermilfoil (*M. spicatum*) but he indicated that it is hardly conclusive because of the level of phenotypic plasticity in leaf morphology. Intermediate characteristics of Eurasian watermilfoil and Northern milfoil were noted in 2006 which suggested hybridization.

During the 2009 field effort milfoil plants bared the closest resemblance of vegetative characteristics particularly leaf segment number to Eurasian watermilfoil. The phenotypic plasticity in leaf morphology of Eurasian watermilfoil and Northern milfoil make it difficult to determine whether Eurasian watermilfoil has always been more prevalent than Northern milfoil. From a management perspective, areas dominated by milfoil are concluded to be a mixture of northern watermilfoil, Eurasian watermilfoil and/or a hybrid.

Secchi Disk Depth Measurements at Lake Wawasee

Water quality in Lake Wawasee is considered relatively good when compared to many Indiana lakes (Aquatic Weed Control 2005). A secchi disk is a tool used to obtain data on water clarity. Secchi disk depth measurements are determined by the depth at which a standard black and white disk is no longer visible in the water column. Lake Wawasee participates in the Indiana Clean Lakes Program which is a volunteer program that participates in volunteer lake monitoring. Secchi disk depth measurements in 1994, 2000, and 2003 were available through data collected by volunteers of the Indiana Clean Lakes Program (Figure 8).

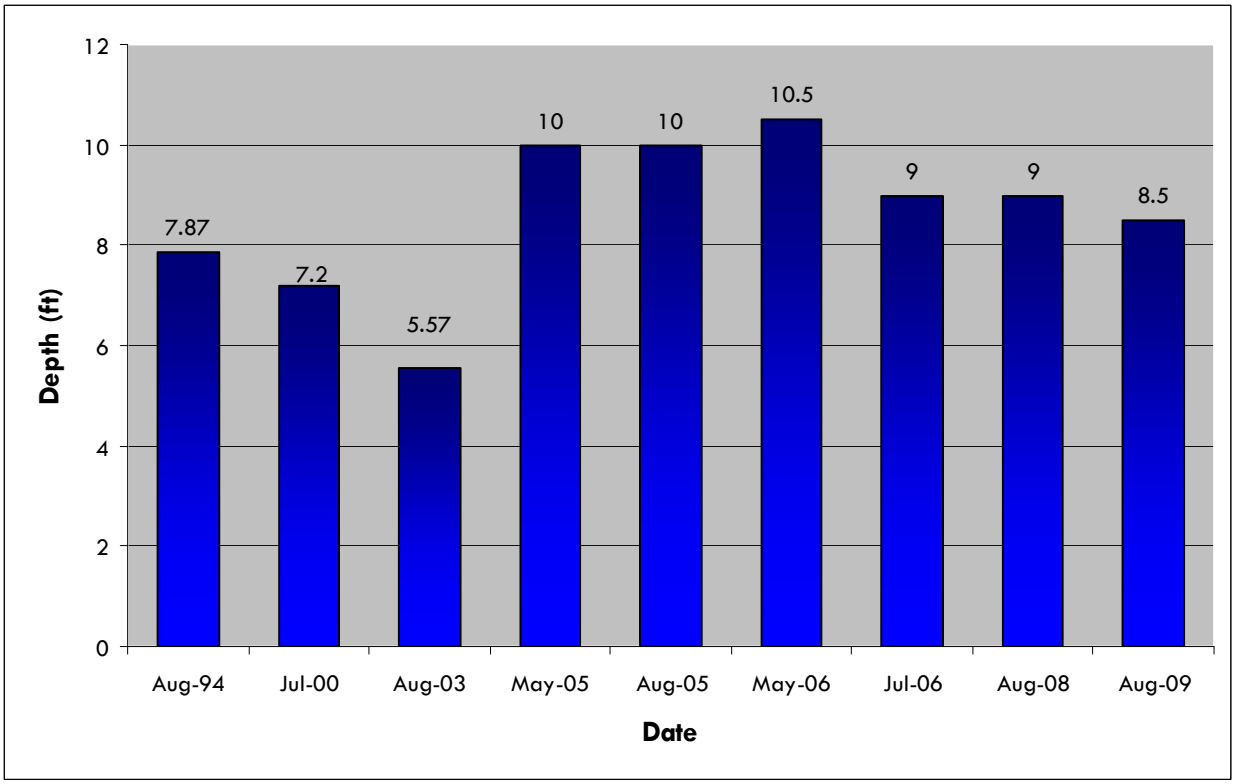


Figure 8: Lake Wawasee secchi disk readings.

Secchi depths have usually been between 10 and 15 feet at Lake Wawasee (Aquatic Weed Control 2005). A contributing factor to higher water clarity in recent years may be the accidental introduction of the filter feeding zebra mussels. Factors that contribute to the turbidity of water include heavy boat traffic, algae growth, and urban runoff. Turbidity is a measure of the degree to which the water loses its transparency due to the presence of suspended particulates. The suspended material may be eroded soil, re-suspended lake sediments, or other organic material. The 2009 secchi disk reading of 8.5 feet was equal to the average secchi disk reading (Figure 8). All of Lake Wawasee's secchi disk depth measurements exceeded the 2003 median depth for "typical northern Indiana lakes" of 5.7 feet as presented in DJ Case & Associates study (2005).

Aquatic Vegetation Management Alternatives

At the present time, the health of Lake Wawasee's aquatic plant communities is fair and requires continued management of exotic species to further promote a healthy native vegetative community. Fourteen native species were collected during the 2009 Tier II survey and were represented in every depth contour sampled. Despite the presence of exotic species such as Eurasian watermilfoil and curly-leaf pondweed, native species diversity is high. Future management efforts to maintain the Eurasian watermilfoil population at a low level is desirable to prevent Eurasian watermilfoil from becoming the dominant species in the lake.

Continued efforts to decrease starry stonewort's abundance and distribution within Johnson Bay is critical as it is a new exotic species and its impacts to the native vegetative community is not fully understood. Starry stonewort was identified at 5 sampling locations within Johnson Bay during the Tier II survey conducted on August 13, 2008 and was the first recording of this species within Lake Wawasee. In 2009, V3 collected starry stonewort at four locations within Johnson Bay with a rake score of 3 (20 – 100% rake teeth filled). Management efforts to prevent starry stonewort from spreading to other areas of Lake Wawasee should continue to be a focus in vegetation management.

Aquatic vegetation management alternatives are described in detail in the Lake Wawasee Aquatic Plant Management Plan Update – 2006 (V3, 2007). This report can be obtained through the LARE project report website at: http://www.in.gov/dnr/fishwild/3303.htm. A management strategy should be chosen based on its selectivity to the target species, its long-term effectiveness, and its potential for detrimental side-effects (i.e., effects on non-target species). The foremost objective is to choose a management strategy that will effectively control the Eurasian watermilfoil population with minimal negative effects on non-target plants or fish species.

Public Involvement

The WACF was formed in 1991 to anticipate, search out, and solve threats to the Wawasee Area Watershed and to its water quality. The Foundation is dedicated to enhancement of the watershed and works hand-in-hand with property owner groups, the State Department of Natural Resources and other governmental and civic organizations that share its concerns (WACF). The WACF has developed an Ecology Committee that is engaged in environmental issues concerning Lake Wawasee and the surrounding watershed. The WACF maintains a website that provides notice of events, provides access to past and present studies, and serves as an educational outreach tool and can be accessed at the following link: http://wacf.com/.

A public meeting was held November 18, 2009, at the WACF Center in Syracuse Indiana. A notice of the public meeting was published in the local newspaper, the WACF newsletter, and provided on the WACF website. Fourteen individuals attended the meeting who collectively represented members of the WACF, home owners, and a representative from the Milford newspaper. The number of people in attendance was similar to the attendance of the 2006 aquatic vegetation public meeting, which had 15 people. V3 discussed the 2009 herbicide treatment, a description of the planning process, LARE grants, statewide aquatic vegetation management goals, results of the Tier II vegetation study, the presence of starry stonewort in Johnson Bay, and the 2010 herbicide treatment approach for Eurasian watermilfoil. A lake use survey form was handed out after the meeting and twelve individuals participated. Summary totals from completed lake use surveys are shown in Figure 9. One hundred percent (100%) of participants were lake property owners that have resided at Lake Wawasee for over 10 years. Questions concerning lake use identified 83% of those surveyed used the lake for swimming and boating, 75% irrigation, and 42% fishing. None of the survey participants used the lake for drinking water. One participant indicated they used the lake for water skiing. Eleven of the participants were aware that LARE funds only apply to the control of invasive exotic species and were in favor of continuing efforts to control vegetation within Lake Wawasee. Eighty-three percent (83%) of participants did not feel that aquatic vegetation interfered with their use or enjoyment of the lake. Four participants identified nuisance quantities of aquatic plants at their shoreline and three participants felt that the level of vegetation in the lake affects their property values. Questions concerning problems at Lake Wawasee identified too many boats accessing the lake as the primary issue among participants (75%). Fifty percent (50%) of participants had issues with jet skis on the lake and felt there is a pier funneling problem. Pier funneling is the use of a single waterfront lot by multiple users. Forty-eight percent (48%) of participants identified overuse by non-residents as an issue and 25% felt there is too much fishing at Lake Wawasee. The need for dredging and a fish population problem was identified by a participant as an issue.

Additional comments provided in the lake use survey form included a desire for boats to be washed before coming into the lake in an effort to reduce the transmission of exotic species. One participant indicated that phosphorus fertilizer needs to be eliminated. Two participants had issues with deep hull boats (wake-boarding boats).

Aquatic Vegetation Management Plan
2009 Lake Use Survey for Lake Wawasee

Are you a lake property owner? Yes 12 No 0

Are you currently a member of your lake association? Yes 11 No 0

How many years have you been at the lake?

2 or less	0
2-5 years	0
5-10 years	0
Over 10 years	12

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

10 Swimming	9 Irrigation
10 Boating	0 Drinking water
5 Fishing	1 Other: skiing

Do you have aquatic plants at your shoreline in nuisance quantities? Yes 4 No 8

Do you currently participate in a weed control project on the lake? Yes 7 No 3

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes 1 No 10

Does the level of vegetation in the lake affect your property values? Yes 3 No 9

Are you in favor of continuing efforts to control vegetation on the lake? Yes 11 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 11 No 0

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

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

Figure 9: Summary totals from completed 2009 Lake Use Survey Forms.

Lake residents play an important role in establishing and maintaining a healthy lake community. The WACF has monthly meetings which provide a forum for issues and goals for the lake to be discussed. The WACF is continually working towards improving the water quality of the lake and continues to be actively involved in vegetation management at Lake Wawasee.

Hydrilla (*Hydrilla verticillata*) was discovered in Lake Manitou (Rochester, Indiana) during a routine aquatic vegetation survey conducted by the Division of Fish and Wildlife in August 2006. Public involvement and educational outreach are critical in keeping Hydrilla from spreading to other Indiana lakes. Hydrilla has many adaptive qualities that allow it to outcompete and greatly diminish populations of native species. It can grow in low-light areas, is very tolerant to varying water flows, and can also grow up to an inch per day. It reproduces through tubers, flowers, fragmentation and turions (cone shaped growths) on its stalks. Hydrilla can be differentiated from the native elodea in that there are typically 3 leaves per whorl on the native elodea and there are as many as 8 leaves per whorl in Hydrilla. Figure 10 (Michigan Sea Grant 2007) demonstrates a means of comparative identification. It is critical if this plant is seen at Lake Wawasee for the state to be notified as soon as possible.

Additional information can be found from the national campaign to *Stop Aquatic Hitchhikers!* at http://www.protectyourwaters.net/

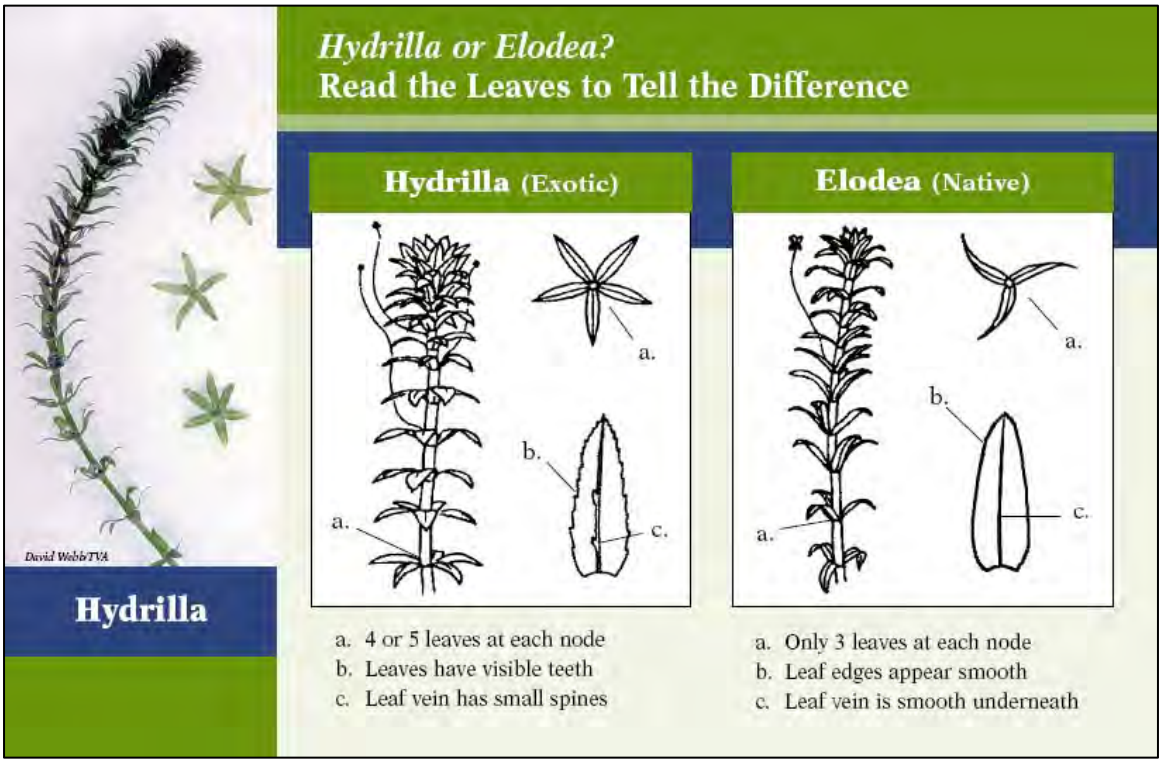


Figure 10: Illustration of Hydrilla compared to native elodea. (Illustrations provided by Michigan Sea Grant)

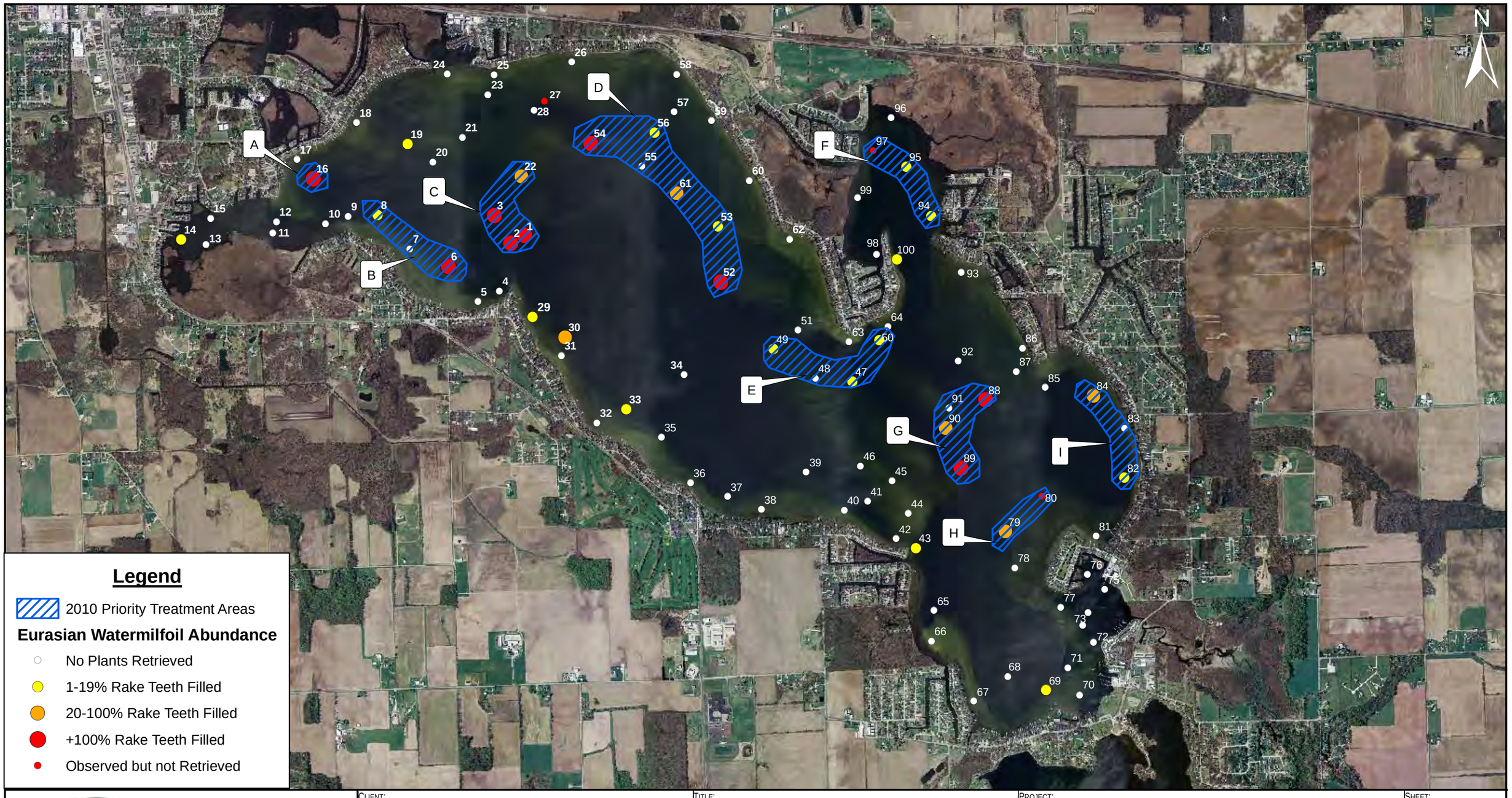
Action Plan

A total of 50 acres of Eurasian watermilfoil will be treated in 2010 within the priority treatment area using 2, 4-D (Figure 11). The selected treatment locations will be determined with priority given to 1) dense, monotypic stands of Eurasian watermilfoil, 2) high potential for milfoil expansion, 3) high traffic locations such as the mouth of a channel, and 4) areas where milfoil stands may be treated in their entirety. Priority treatment area and acreage is described within the Application for Aquatic Vegetation Control Permit located in Appendix II.

Johnson Bay had starry stonewort at four locations with a rake density of 20-100% rake teeth filled. A total of 20 acres of starry stonewort will be treated in 2010 within the priority treatment area within Johnson bay using Nautique at a rate of 1.0 ppm (Figure 12). Starry stonewort is anticipated to be treated in late June to early July but may require multiple applications. Priority treatment area and acreage for starry stonewort is described within the Application for Aquatic Vegetation Control Permit located in Appendix II. V3 recommends continued monitoring for starry stonewort throughout Lake Wawasee as it has the potential for spreading through bulbils and negatively impacting native species.

The 2010 treatment plan is based on results of summer sampling and quantitative sampling data from past vegetative surveys. Treatment maps will be sent to the DNR in the Spring to provide accurate representation of areas requiring treatment. There are no problems anticipated with the vegetation control permit as was discussed at the permit meeting held November 19, 2009. The costs associated with treating exotic species have been accepted by the WACF and lake residents have expressed acceptance and support for continued vegetation management.

As the action plan is implemented, aquatic vegetation surveys will monitor the effectiveness of the management strategy. The abundance and distribution of Eurasian watermilfoil will be recorded using the current IDNR Tier II sampling protocol. After the spring 2010 Target Species Distribution Map is created, the distribution and abundance of Eurasian watermilfoil will be identified and treatment maps will be prepared. The survey will document native species distribution within areas previously occupied by Eurasian watermilfoil. The new data analysis results will be incorporated into the current lake management plan which will provide property owners, applicators, and the IDNR with detailed records describing the changes within the vegetative communities of Lake Wawasee. In years to follow, additional Tier II surveys should be conducted to determine how exotic species and native aquatic species are responding to treatment.



Legend

2010 Priority Treatment Areas

Eurasian Watermilfoil Abundance

- No Plants Retrieved
- 1-19% Rake Teeth Filled
- 20-100% Rake Teeth Filled
- +100% Rake Teeth Filled
- Observed but not Retrieved

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Client:	Title:	Project:	Sheet:
Wawasee Area Conservancy Foundation	**Summer Distribution and Abundance of Eurasian Watermilfoil and 2010 Priority Treatment Areas**	**Lake Wawasee Aquatic Vegetation Management Plan- 2009 Update**	of: 1 1

Address:	Base Layer:	Project No.:	Quadrangle:	Date:	Scale:	Exhibit:
PO BOX 548 Syracuse, IN 46567	Indiana Spatial Data Service 2005 Orthophotography	06037.05	Lake Wawasee	8/12/09	1" = 2000'	11

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TITLE: **Johnson Bay Starry Stonewort Results and 2010 Priority Treatment Area**

PROJECT: **Lake Wawasee Aquatic Vegetation Management Plan- 2009 Update**

BASE LAYER: Indiana Spatial Data Service 2005 Orthophotography

CLIENT: Wawasee Area Conservancy Foundation
PO Box 548
Syracuse, IN 46567

PROJECT NO.	EXHIBIT:	SHEET: 1 OF: 1
06037.05	12	
QUADRANGLE:	DATE:	SCALE:
Lake Wawasee	8/13/09	1"=500'

Implementation of Action Plan

1. Prepare the Spring 2010 Target Species Distribution Map and Proposed Treatment Area Map. The site visit and investigation necessary to create these two maps will allow for the determination of the extent of chemical treatment that will be necessary to treat problematic beds of Eurasian watermilfoil in 2010. The spring 2010 mapping will determine the extent and location of the problematic Eurasian watermilfoil beds.

2. Perform Herbicide Treatment of Eurasian Watermilfoil. A systemic herbicide treatment of 2,4-D is proposed between mid-June and mid-July 2010 to treat 50 acres of Eurasian watermilfoil within the priority treatment areas. The selected treatment locations will be determined with priority given to 1) dense, monotypic stands of Eurasian watermilfoil, 2) high potential for milfoil expansion, 3) high traffic locations such as the mouth of a channel, and 4) areas where milfoil stands may be treated in their entirety.

3. Conduct the Summer 2010 Tier II Aquatic Plant Survey. A Tier II aquatic plant survey should be conducted during the summer 2010 to document the diversity, distribution and abundance of aquatic plants. This data is important to determine if the native vegetative community is being protected, and that the Eurasian watermilfoil population is not drastically increasing.

The management goal for 2010 is to maintain Eurasian watermilfoil below nuisance quantities and low frequency of occurrence (less than 25%). The overall goal for Lake Wawasee is that the 2010 frequency of occurrence of Eurasian watermilfoil is less than the 2009 results and shows continued decrease in milfoil densities. A decrease in Eurasian watermilfoil density and abundance would demonstrate effective herbicide treatment strategy and management.

Project Budget

The following costs are estimated based on lake size, average depth, chemical and application costs, as well as LARE survey requirements. The proposed management schedule and budgets for 2010 and 2011 are summarized below. Budget projections are estimated at maximum values and will fluctuate depending on treatment acreage.

2010

Target Species Distribution Map and Proposed Treatment Area Map	$1,000
Systemic Herbicide Treatment of Eurasian watermilfoil using 2,4-D (assumed 50 acres)	$20,000
Treatment of Starry Stonewort using Nautique (assumed 20 acres)	$3,700
Late season summer aquatic vegetation survey (Tier II) and plan update	$8,000

2011

Target Species Distribution Map and Proposed Treatment Area Map	$1,000
Late season summer aquatic plant survey (Tier II) and plan update	$8,000

Any proposed herbicide applications will depend on the results of the Tier II vegetation surveys.

The WACF is grateful for LARE funding that is used to control invasive exotic species. The WACF supports the cost share strategy and has funds prepared for future cost share.

Timeline for LARE Grant Applications

LARE grants are available on a competitive basis for actions that can address the ecology and management of public lakes and their watersheds. The WACF must comply with IDNR grant deadlines to remain eligible for funding assistance with management of invasive aquatic plants such as Eurasian watermilfoil.

Associations must apply for funding assistance by January 15 and grant application forms can be obtained through the LARE website (www.in.gov/dnr/fishwild/3302.htm). Aquatic vegetation control permits should ideally be completed by January 31st and submitted to DNR Division of Fish and Wildlife commercial license clerk. Award notices are announced in March. If a lake has received funding, a request for proposals that is prepared by LARE staff should ideally be submitted to contractors by the end of March. Contractor qualifications and experience should be thoroughly reviewed before a final selection is made. Contracts for a planning consultant and herbicide treatment contractor should ideally be signed by the month of April to accommodate early spring treatments and pre-treatment surveys if applicable.

Monitoring and Plan Updates

Guideline thresholds regarding unacceptable levels of Eurasian watermilfoil were identified in the 2006 Update and were based on the numerical results of the Tier II survey. The thresholds for Eurasian watermilfoil Tier II results are as follows (V3, 2006):

1. Greater than 20% Site Frequency of Eurasian watermilfoil;
2. Dominance Index of Eurasian watermilfoil greater than 10;
3. If Eurasian watermilfoil is one of the three most dominant species in Lake Wawasee;
4. If Eurasian watermilfoil has an estimated abundance of greater than 20% in Johnson Bay, Conklin Bay, or the bay near Morrison Island or
5. If a dense stand of Eurasian watermilfoil covers more than ten acres in an area less than 8 feet deep.

Based on the 2009 Tier II results aggressive Eurasian watermilfoil treatment in 2010 is warranted as thresholds 1 through 3 have been met. Eurasian watermilfoil had a site frequency of 33% and a dominance index of 16.2 during the August 2009 sampling effort. In years to follow, additional surveys will be conducted to determine how the Eurasian watermilfoil population and the native aquatic plant beds are reacting to treatment regimes. These surveys will provide a basis for evaluation of the management strategy and can be presented to the public should the management strategy need to be modified. They will also serve to keep the public informed about management practices at the lake so that they will be motivated and educated to actively participate in conservation of the Lake Wawasee ecosystem.

Additional Funding Sources

Identifying additional funding sources for improvement at Lake Wawasee is important as State funding is limited. In addition to the LARE Program, there are many other sources of potential funding to help improve the quality of Indiana Lakes such as Lake Wawasee. Many government agencies assist in projects designed to improve environmental quality.

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

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

- Watershed Protection and Flood Prevention Program
- Wetlands Reserve Program
- Grasslands Reserve Program
- Wildlife Habitat Incentive Program
- Small Watershed Rehabilitation Program

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
- Bring Back the Natives Program
- Native Plant Conservation Program

Ecozone Introduction

Ecozones are established to protect shallow water emergent vegetation which are a vital component of lake ecosystems. Aquatic vegetation provides habitat, cover, erosion control, reduces wave action, and is vital in nutrient cycling. Aquatic vegetation has the ability to take in pollutants from contaminated water and utilize nutrients that would otherwise be used by algae, thereby improving water clarity. Emergent vegetation is also very important to many aquatic wildlife species. For proper ecological functioning of a lake to occur, a substantial portion of the lake's shoreline and shallow areas should contain desirable emergent plants. The goal of the ecozone study is to establish baseline data of the vegetative community in ecozone areas of Johnson, Conklin and North Bay in order to monitor changes in the vegetative community so that appropriate measures are taken to protect these significant aquatic communities or ecozones. State or federally protected threatened or endangered species were not present within Lake Wawasee's Johnson Bay, Conklin Bay or North Bay. No voucher specimens were collected during the efforts of this project.

Aquatic plant communities depend on soil type, water depth, water clarity and nutrient availability for their health. Aquatic plant communities are impacted by a number of stressors including: currents, waves, and the activities of animals and humans. Aquatic vegetation and habitat are directly impacted by motorized boating by the cutting of plant material, scouring of substrate with propellers, and uprooting of species by boat hulls. Indirect impacts may result from boat-generated turbidity and increased suspended solids in shallow areas which decreases light penetration. Decreased light intensity can reduce photosynthetic rates and limit rooting depth of submerged macrophytes. Sediment deposition on leaves can inhibit photosynthesis and increased wave exposure generated by boats can affect aquatic plant distribution, species composition and growth rates (IDNR 2007).

Floating-leaf beds were sampled using a technique developed by IDNR fisheries biologists (Pearson 2004), although it was modified to include floating pondweed (*Potomogeton natans*). Ecozone surveys were conducted in 2008 and 2009 in Johnson, Conklin and North Bay. This study outlines the current condition of vegetative communities in these established ecozone areas within Lake Wawasee.

Emergent Surveying Methodology

The 2009 surveying protocol remained consistent with the 2008 surveying technique. GPS technology, mapping programs, and Rangefinders allow for vegetative beds to be mapped at a lower cost than traditional transect surveys while still providing accurate geo-referenced data that can be easily shared. A vegetative bed was defined as a geo-referenced polygon with distinct edges enclosing a contiguous stand of floating-leaf emergent plants (Pearson, 2004). Smaller isolated stands of floating-leaf emergents or individual plants were defined as "clumps". Vegetative bed widths were measured landward at each GPS (Garmin) coordinate with an optical rangefinder. The perimeter of vegetative beds was measured with ArcGIS software based on polygons created through GPS points taken in the field. Bed coverage area was calculated using X-Tools Pro in GIS software.

V3 used Guidelines for sampling floating-leaf emergent plants in Indiana Lakes, Pearson 2004 as the emergent survey protocol. According to DNR protocol (Pearson 2004), "Floating-leaf plants do not include submersed species with leaves that float on the surface or form surface canopies, such as *Potamogeton spp.*" However, V3 deviated from this component of the protocol to accommodate the submersed species that are functionally providing the same role as floating-leaf species within the emergent beds. *Potamogeton spp.* has similar functional roles that emergent species posses, such as, provide include habitat coverage, physical resistance in the form of wave breaking, structure for fish, and sediment stabilization. All other components of the protocol were followed. Jed Pearson did not see this as a problem or a flaw for ecozone monitoring at Lake Wawasee as information regarding floating pondweed (*Potomogeton natans*) could prove useful in terms of monitoring the response to the ecozone.

Protocol for vegetative bed surveying required a two person crew equipped with a GPS unit that would log GPS waypoints while boating counter clockwise along the lakeward edge of vegetative beds. Datasheets were completed for each bed denoting an "S" which symbolized the start of a bed and an "E" symbolizing the end of a bed. The purpose of this sampling method is to locate, delineate, and characterize floating-leaf emergent aquatic vegetative beds in a standardized manner which allows Indiana lakes to be compared at a State-wide scale. Emergent bed datasheets and latitude and longitude locations are provided in Appendix III.

Johnson and Conklin Bay Floating-leaf Emergent 2009 Surveying Results

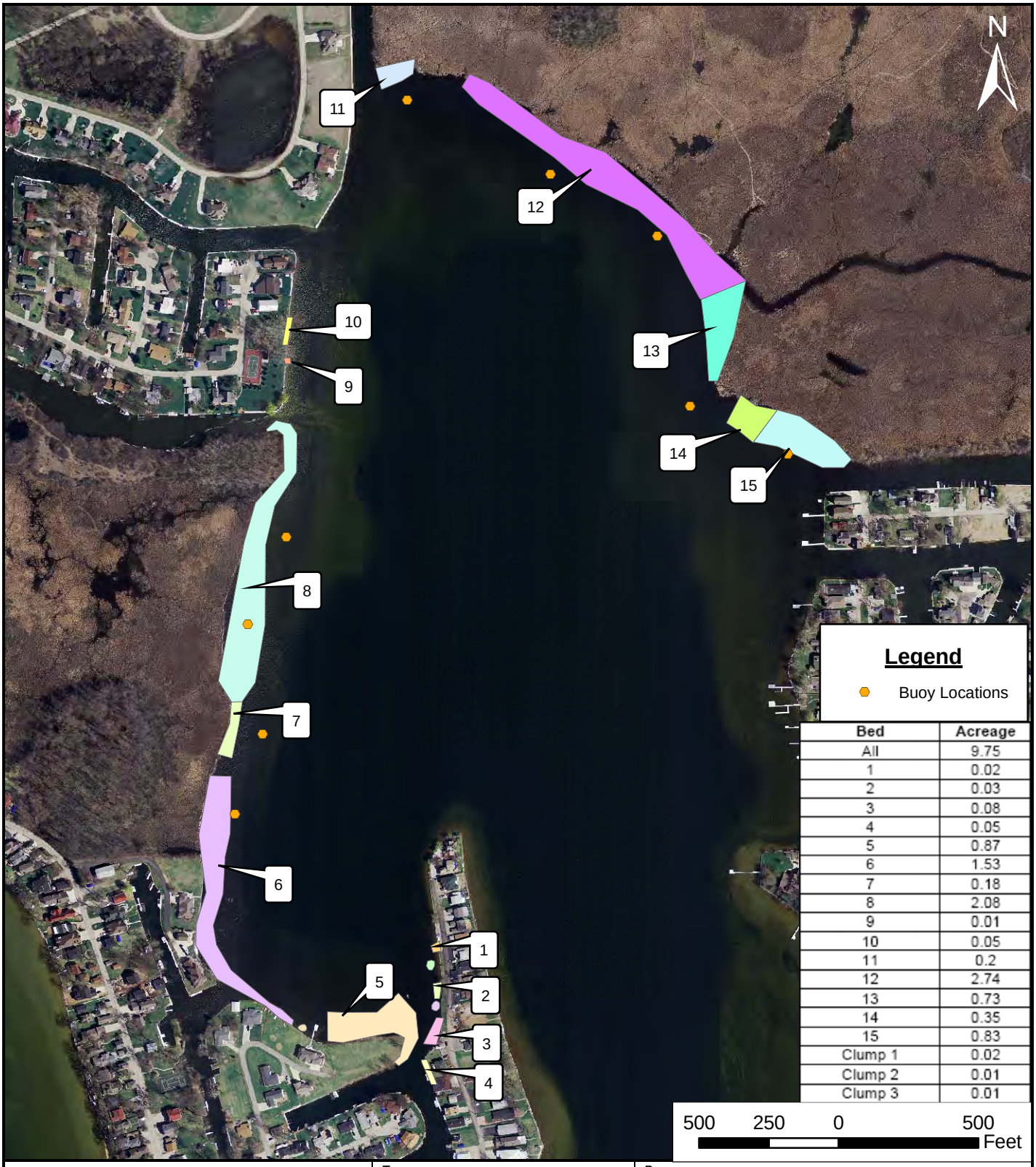
The most common floating-leaf emergent species within Johnson and Conklin Bays are yellow pond lily (*Nuphar variegate)* and white water lily (*Nymphaea oderata)*. Species collected or observed during the emergent surveying in Johnson and Conklin Bays are included in Table 5. V3 mapped 15 beds (62 transects) along Johnson Bay's shoreline. Johnson Bay beds ranged from 0.01-2.74 acres in size and totaled 9.75 acres (Figure 13). There are currently 9 buoys within Johnson Bay. The 2009 emergent survey results indicate that the buoys are protecting the ecozone areas, as emergent beds increased by 1 acre from 2008 to 2009. Emergent species that were present in clumps in 2008 have expanded into emergent beds in 2009. Photographs of Johnson Bay's emergent beds are found in Appendix IV. The legal lake water level for Lake Wawasee is 858.87 feet which is 8.87 feet on the staff gauge. The lake water level on August 10, 2009 and August 11, 2009 was 9.21, which was 0.34 feet above the legal level of the lake.

V3 mapped 9 beds (80 transects) along the shoreline of Conklin Bay. Photographs of Conklin Bay's plant beds are found in Appendix V. Beds ranged from 0.09-3.44 acres in size and totaled 8.9 acres (Figure 14). Conklin Bay's emergent beds have expanded from 2008 to 2009 as substantiated by the total bed acreage increase of 0.93 acres. There were a total of 12 emergent beds in 2008 and 9 emergent beds in 2009. The decrease in the number of beds is due to emergent beds expanding and combining into a larger bed. Vegetative beds were concentrated in the southern portion of Conklin Bay which is attributed to the undeveloped shoreline. The shoreline in the northern portion of Conklin Bay consists largely of concrete sea walls which reflect wave action and make the establishment of vegetation difficult.

Table 5: Species collected or observed in Johnson and Conklin Bay during emergent surveying.

Johnson Bay (8/10/09)	
Scientific Name	**Common Name**
Cephalanthus occidentalis	Button bush
Hibiscus palustris	Swamp rose mallow
Justicia americana	American water willow
*Lythrum salicaria**	Purple loosestrife
Nuphar variegata	Yellow pond lily
Nymphaea odorata	White water lily
Peltandra virginica	Arrow Arum
Pontederia cordata	Pickerelweed
Potamogeton natans	Floating pondweed
Sagittaria latifolia	Broadleaf arrowhead
Scirpus acutus	Hardstem Bulrush
Typha latifolia	Broadleaf cattail
***indicates exotic species**	

Conklin Bay (8/11/09)	
Scientific Name	**Common Name**
Hibiscus palustris	Swamp rose mallow
*Lythrum salicaria**	Purple loosestrife
Nuphar variegata	Yellow pond lily
Nymphaea odorata	White water lily
Peltandra virginica	Arrow Arum
Pontederia cordata	Pickerelweed
Potamogeton natans	Floating pondweed
Sagittaria latifolia	Broadleaf arrowhead
Scirpus acutus	Hardstem Bulrush
Typha latifolia	Broadleaf cattail



Bed	Acreage
All	9.75
1	0.02
2	0.03
3	0.08
4	0.05
5	0.87
6	1.53
7	0.18
8	2.08
9	0.01
10	0.05
11	0.2
12	2.74
13	0.73
14	0.35
15	0.83
Clump 1	0.02
Clump 2	0.01
Clump 3	0.01

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TITLE: **Johnson Bay 2009 Emergent Beds**

PROJECT: **Lake Wawasee 2009 Emergent Plant Survey**

BASE LAYER: Indiana Spatial Data Service 2005 Orthophotography

CLIENT: Wawasee Area Conservancy Foundation PO Box 548 Syracuse, IN 46567

PROJECT NO. 06037.05

EXHIBIT: 13

SHEET: 1 OF: 1

QUADRANGLE: Lake Wawasee

DATE: 8/10/09

SCALE: See Above

Bed	Acreage
All	8.9
1	3.44
2	0.49
3	0.76
4	2.23
5	1.41
6	0.31
7	0.09
8	0.06
9	0.11

Legend

IDNR Placed Buoys

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TITLE:
Conklin Bay 2009 Emergent Beds

PROJECT AND SITE LOCATION:
Lake Wawasee 2009 Emergent Plant Survey

BASE LAYER:
Indiana Spatial Data
Service 2005 Orthophotography

PROJECT NO.:
06037.05

FIGURE:
14

SHEET: 1
OF: 1

CLIENT:
Wawasee Area
Conservancy Foundation
PO Box 548
Syracuse, IN 46567

QUADRANGLE:
Lake Wawasee

DATE:
8/11/09

SCALE:
1" = 550'

Starry Stonewort in Johnson Bay 2009

Johnson Bay was studied in 2009 using the Tier II survey methodology as well as the emergent ecozone survey methodology. In addition to the Tier II sampling locations and boundary of emergent beds, V3 sampled areas of Johnson Bay that contained starry stonewort in the 2008 survey. V3 performed additional rake throws during the 2009 tier II vegetation survey in areas of Lake Wawasee that are highly utilized, such as boat up restaurants, condominium areas, public access site, and marinas, but did not retrieve starry stonewort. Starry stonewort was not found during the 2009 Tier II vegetation survey but was identified during the additional rake throw effort through Johnson Bay.

In 2009, V3 collected starry stonewort at four sampling locations within Johnson Bay (Figure 15). Starry stonewort is a new exotic species to Indiana lakes that has the ability to form a monoculture in deep areas that don't facilitate native species and has been recorded growing at depths up to 20 feet. Starry stonewort reproduces through the star-shaped bulbils that occur on the lower stem nodes (Figure 16). These bulbils stay viable for several years. Starry stonewort will be closely monitored in future surveys to determine its potential impact to the native vegetative community.

Figure 16: Comparison of starry stonewort (left) and chara (right) (left photograph). Starry stonewort collected during emergent survey in Johnson Bay, August 2009 (right photograph).

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TITLE: **Johnson Bay 2009 Starry Stonewort Results**

PROJECT: **Lake Wawasee Aquatic Vegetation Management Plan Update**

BASE LAYER: Indiana Spatial Data Service 2005 Orthophotography

CLIENT: Wawasee Area Conservancy Foundation
PO Box 548
Syracuse, IN 46567

PROJECT NO.	EXHIBIT:	SHEET: 1 OF: 1
06037.05	15	
QUADRANGLE:	DATE:	SCALE:
Lake Wawasee	8/13/09	1"=500'

North Bay Floating-Leaf Emergent Surveying Results

Hardstem bulrush, floating pondweed and white water lily composed the three emergent clumps in North Bay in 2008 and 2009 (Table 6, Figure 17). Floating pondweed was the most dominant species among the clumps present in North Bay. Clump 1 was the most diverse and had all three species present. The sizes of the clumps ranged from 0.02 acres in size to 1.38 acres in size. Clump 1 increased from 1.14 acres in 2008 to 1.38 acres in 2009. Clump 2 decreased from 0.04 acres in 2008 to 0.02 acres in 2009. Clump 3 increased from 0.11 acres in 2008 to 0.17 acres in 2009. The increase acreage in Clump 3 is also apparent by its growth on the west side of North Bay adjacent to the seawall. Floating pondweed is the only species represented in Clump 2 and 3 of North Bay. Photographs of identified clumps within North Bay are included in Appendix VI. Ecozone surveying should continue in North Bay to monitor the size of clumps as clump 2 decreased in size.

Table 6: Species collected or observed in North Bay during ecozone surveying.

North Bay (8/11/09)	
Scientific Name	**Common Name**
Scirpus acutus	Hardstem Bulrush
Potamogeton natans	Floating pondweed
Nymphaea odorata	White water lily

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630.724.9202 fax
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TITLE:
North Bay 2009 Emergent Survey Results

PROJECT:
Lake Wawasee 2009 Emergent Plant Survey

BASE LAYER: Indiana Spatial Data Service 2005 Orthophotography

CLIENT:
Wawasee Area Conservancy Foundation
PO Box 548
Syracuse, IN 46567

PROJECT NO.:	EXHIBIT:	SHEET: OF:
06037.05	17	1 1
QUADRANGLE:	**DATE:**	**SCALE:**
Lake Wawasee	8/11/09	1" = 200'

Ecozone Monitoring Strategy

Baseline data of vegetative composition within ecozone areas of Johnson, Conklin and North Bays was collected through the 2008 and 2009 emergent vegetation surveys. The next ecozone survey should be done no later than 2012 and should follow the floating-leaf emergent plant survey developed by IDNR fisheries biologists (Pearson 2004). In addition to emergent sampling, continued surveys around Lake Wawasee's access sites for the presence of hydrilla should be conducted. If hydrilla is suspected, the location will be identified with GPS coordinates. A comprehensive data analysis should be conducted following the next ecozone survey to determine changes in emergent zone vegetative communities.

The proposed cost estimate for 2012 is summarized below.

2012

Emergent Plant Surveys in Ecozone Areas	$10,000
Publication of the findings of the Emergent Plant Surveys in Ecozone areas within Conklin, Johnson and North Bay	$2,000

References Cited

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APPENDIX I

TIER II DATA SHEETS AND
TIER II LATITUDE/LONGITUDE

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

WATERBODY NAME: Lake Wawasee	**DATE:** 8-12-09
COUNTY: Kosciusko County	**SECCHI DEPTH (FT):**
SITE ID:	**MAX PLANT DEPTH (FT):**
SURVEYING ORGANIZATION: V3 Companies	**WEATHER:** cloudy
CREW LEADER: Ed Belmonte	**COMMENTS (Include voucher codes - V1, V2...):**
RECORDER: Jessica Dunn	
CONTACT INFO: JDunn@V3CO.com	***Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.***

Point #	R/T	Latitude	Longitude	Depth	Species Codes: CHARA	VALAME	MYRSPI	POTRIC	CERDE	UTRVUL	POTILL		Notes
1	R			8			5		1				brown
2	R			17			5						brown MYRSPI
3	R			11			5		1				dying MYRSPI
4	R			7	3	3							
5	R			3	1			1					
6	R			9			5						dying MYRSPI
7	R			4	1								
8	R			9		1	1						dead MYRSPI
9	R			17									NOVEG
10	R			8		1		3					
11	R			4	1						3		
12	R			16					1	3			
13	R			3	1	1		1					NAJVAR-9 NUPODOR-9
14	R			16			1	-	3	1			
15	R			8		3							
16	R			9		1	5	1					noveg
17	R			4									
18	R			6	1								
19	R			7			1						brown
20	R			19					3				
21	R			8	3								
22	R			11			3						NAJFLE (1), POTPUS (1) sago
23	R			7	3								
24	R			4	1								
25	R			3	X								noveg
26	R			3	1								
27	R			12	1		9						NAIMAR (3)
28	R			24						1			
29	R			4	1		1	9					MYRSPI dead
30	R			10			3						dying
31	R			4									NOVEG
32	R			3							1		
33	R			7			1		1				MYRSPI brown/green

Other plant species observed at lake:

SE part of Lake condemn
Bay Point Condo

marinas (east shoreline Marina)
food

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

WATERBODY NAME: Lake Wawasee	**DATE:**
COUNTY: Kosciusko	**SECCHI DEPTH (FT):**
SITE ID:	**MAX PLANT DEPTH (FT):**
SURVEYING ORGANIZATION: V3 Companies	**WEATHER:**
CREW LEADER:	**COMMENTS (Include voucher codes - V1, V2...):**
RECORDER:	
CONTACT INFO:	***Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.***

Point #	R/T	Latitude	Longitude	Depth	Species Codes: POTRIC	CHARA	NITELLA	POTILL	UTRVUL	VALAME	MYRSPI	Notes
34	R			11								No veg
35	R			5	1	1						
36	R			4	9	1						
37	R			9		3						
38	R			3								No veg
39	R			14			1					
40	R			3		1		9				
41	R			11		1						
42	R			4		1						
43	R			8				9		1	1	NAJFLE①, [illegible]
44	R			2								No veg, sandbar
45	R			3								No veg, rocky
46	R			6		1			1			
47	R			18			1				1	
48	R			11		3						
49	R			15			3				1	
50	R			23			3				1	MYRSPI bed adjacent inland
51	R			18								No veg
52	R			13							5	
53	R			11			1				1	POTPE ①,
54	R			19							5	POTPE ⑨
55	R			9					1			POTPE ③
56	R			14			1				1	NAJFLE①
57	R			12	1	1						
58	R	*	treated area	4		1		POTNAT⑨				MYRSPI adjacent to station
59	R			3								No veg
60	R			4								No veg
61	R			18			3				3	dying MYRSPI
62	R			3								No veg
63	R			8								NAJFLE
64	R			6		1						
65	R			24								No veg
66	R			2		1						

Other plant species observed at lake:

Elodea, flatstem pondweed

Eel grass Chara at The Green Frog

Starry Survey:

467 → 3

474 → Chara dying

GPS 472 starry 08 E Johnson

473 → Star ③ no other spec

~~Star~~ 3

turbidity 3.63 temp 25.6
Secchi 8.5ft salinity 0.1
DO 9.32 pH 9.2
Cond. 310.5
specific cond 307.0

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

WATERBODY NAME: Lake Wawasee	**DATE:**
COUNTY: Kosciusko	**SECCHI DEPTH (FT):**
SITE ID:	**MAX PLANT DEPTH (FT):**
SURVEYING ORGANIZATION: V3 Companies	**WEATHER:**
CREW LEADER:	**COMMENTS (Include voucher codes - V1, V2...):**
RECORDER:	
CONTACT INFO:	***Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.***

Point #	R/T	Latitude	Longitude	Depth	Species Codes: CHARA	POTPRA	VALAME	MYRVAR	MYRSPI	POTILL	CERDEM	POTNAT	Notes
67	R			3	1								
68	R			6	1								
69	R			8	1	1	3	3	1				
70	R			4									NOVEG
71	R			20									NOVEG
72	R			4						1			Algae (9)
73	R			14					1		3		
74	R			22									Algae black/NoVeg
75	R			3	1		3				1		
76	R			10									NoVeg
77	R			5	1								NAJFLE (1), POTFOL (1)
78	R			7									NoVeg
79	R			8		1			3		1		MYRBRI DOWN
80	R			9	1	9			9				UTRVU (1)
81	R	POTRIC (1)	spraying?	4	1				1			1	POTNAT missing floating leaves cut up
82	R			12			3		1				1.7ft = MYRSPI
83	R			6	1								NAJFLE (1)
84	R			7	1	3	3	1	3				
85	R			22									NOVEG
86	R			4	1					1			NAJFLE (1)
87	R			8	3	1	1						UTRVU (3), POTPEC (1)
88	R		big MYRSPI	8					5				POTPEC (3)
89	R			13		9			5	X			POTPEC (9)
90	R	adjacent	MYRSPI bed	24					3		1		
91	R			8	1								POTRIC (1)
92	R		POTROB (1)	23							1		
93	R			4									NOVEG
94	R		MYRSPI (9) bed	7			3		1				POTPEC (1)
95	R			16				1	1				POTCRI (1) NAJFLE (1)
96	R			4	1								
97	R			18	3				9				
98	R			3	1								
99	R			6		3	1	3	R				
Other plant species observed at lake:													
100	R			21					1		3		

Lake Wawasee Aquatic Vegetation Management Plan Update - 2009

Tier II Sampling, August 12, 2009

Tier II Sampling Location Number	Latitude	Longitude
1	41.40582	-85.71497
2	41.40538	-85.71607
3	41.40701	-85.71734
4	41.40256	-85.71701
5	41.40196	-85.71871
6	41.40407	-85.72099
7	41.40512	-85.72398
8	41.40713	-85.72647
9	41.40708	-85.72879
10	41.40666	-85.73058
11	41.40618	-85.73471
12	41.40681	-85.7344
13	41.40555	-85.73994
14	41.40586	-85374189
15	41.40707	-85.73956
16	41.40933	-85.73148
17	41.41047	-85.73274
18	41.41259	-85.72802
19	41.41128	-85.72401
20	41.41021	-85.72206
21	41.41163	-85.71973
22	41.40929	-85.71516
23	41.41411	-85.71767
24	41.41538	-85.72084
25	41.41529	-85.71718
26	41.41597	-85.71108
27	41.4137	-85.71326
28	41.41317	-85.71408
29	41.41106	-85.70976
30	41.39977	-85.7119
31	41.3987	-85.71223
32	41.39469	-85.70952
33	41.39547	-85.70721
34	41.39746	-85.70264
35	41.39379	-85.7045
36	41.3911	-85.70227
37	41.39025	-85.69938
38	41.38947	-85.69676
39	41.39164	-85.6932
40	41.38935	-85.69027
41	41.38985	-85.68844
42	41.38761	-85.68624
43	41.38705	-85.6847
44	41.3891	-85.68526
45	41.39103	-85.68648
46	41.39139	-85.68895
47	41.3969	-85.68948
48	41.39714	-85.69238
49	41.3989	-85.69562
50	41.39932	-85.68731
51	41.39999	-85.69368
52	41.40289	-85.69969
53	41.40614	-85.69982
54	41.41117	-85.70968
55	41.40977	-85.70571
56	41.41175	-85.70468
57	41.41295	-85.70311
58	41.41516	-85.70288
59	41.41239	-85.7002
60	41.40883	-85.69731
61	41.40816	-85.70302
62	41.40535	-85.69422
63	41.39926	-85.68969
64	41.40011	-85.68662
65	41.38335	-85.68335
66	41.38155	-85.6836
67	41.37799	-85.68035
68	41.3794	-85.67765
69	41.37858	-85.67469
70	41.37825	-85.67207
71	41.37987	-85.67295
72	41.38133	-85.67092
73	41.38235	-85.67175
74	41.38309	-85.6713
75	41.38444	-85.66998
76	41.38534	-85.67132
77	41.37343	-85.67345
78	41.38579	-85.67700
79	41.38579	-85.67768
80	41.39000	-85.67478
81	41.38761	-85.67058
82	41.39101	-85.66831
83	41.39391	-85.66822
84	41.39586	-85.67062
85	41.39639	-85.67439
86	41.39873	-85.67613
87	41.39736	-85.67664
88	41.39572	-85.67907
89	41.39174	-85.68111
90	41.39408	-85.68222
91	41.39526	-85.68195
92	41.39803	-85.68116
93	41.40325	-85.68081
94	41.40658	-85.68311
95	41.40952	-85.68500
96	41.41242	-85.68612
97	41.41048	-85.68758
98	41.40438	-85.68744
99	41.40773	-85.68884
100	41.40407	-85.68583

APPENDIX II

IDNR 2010 VEGETATION PERMIT

APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT

State Form 26727 (R4 / 2-04)
Approved State Board of Accounts 2004

[ ] 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:
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	Lake Assoc. Name	
Heather Harwood	Wawasee Area Conservancy Foundation	
Rural Route or Street		Phone Number
P.O. Box 548		574 457-4549
City and State		ZIP Code
Syracuse, IN		46567
Certified Applicator (if applicable)	Company or Inc. Name	Certification Number
Rural Route or Street		Phone Number
City and State		ZIP Code

Lake (One application per lake)	Nearest Town	County
Lake Wawasee	Syracuse	Kosciusko
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 #	A (7 acres)	LAT/LONG or UTM's	Lat: 85º 43' 25.13"W Lon: 41º 24' 19.43"N
Total acres to be controlled	sum of 50 acres for lake	Proposed shoreline treatment length (ft)	sum of 13,550 ft
Perpendicular distance from shoreline (ft)	adjacent		
Maximum Depth of Treatment (ft)	25 ft	Expected date(s) of treatment(s)	06/15/10 - 07/17/10

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.

There are nine priority treatment areas for Wawasee in 2010. Within these areas, 50 acres will be selected for herbicide application of 2,4-D in 2010, although the priority treatment areas is larger. The selected treatment locations will be determined with priority given to 1) dense, monotypic stands of Eurasian watermilfoil, 2) high potential for milfoil expansion, 3) high traffic locations such as the mouth of a channel, and 4) milfoil stands treated in their entirety.

Plant survey method: [x] Rake [ ] Visual [ ] Other (specify) Based on Tier II sampling conducted during August 2009

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Chara		39
Eurasian watermilfoil	x	33
coontail		18
eel grass		14
slender naiad		7

Treatment Area #	B (32 acres)	LAT/LONG or UTM's	Lat: 85º 43' 4.92"W Lon: 41º 24' 41.92"N
Total acres to be controlled	sum of 50 acres for lake	Proposed shoreline treatment length (ft)	sum of 13,550 ft
Perpendicular distance from shoreline (ft)	1,078 ft		
Maximum Depth of Treatment (ft)	25 ft	Expected date(s) of treatment(s)	06/15/10 - 07/17/10

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. same as previously stated on page 1

Plant survey method: [X] Rake [ ] Visual [ ] Other (specify) Based on Tier II sampling conducted during August 2009

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Chara		62.1
Slender naiad		10.3
Illinois pondweed		10.3
Richardson's pondweed		6.9
Eel grass		6.9
coontail		3.4
Eurasian watermilfoil	x	3.4

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

Treatment Area #	C (35 acres)	LAT/LONG or UTM's	Lat: 85º 42' 57.19"W Lon: 41º 24' 22.10"N		
Total acres to be controlled	sum of 50 acres for lake	Proposed shoreline treatment length (ft)	sum of 13,550 ft	Perpendicular distance from shoreline (ft)	634 ft
Maximum Depth of Treatment (ft)	25 ft	Expected date(s) of treatment(s)	06/15/10 - 07/17/10		

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. same as previously stated on page 1

Plant survey method: [X] Rake [ ] Visual [ ] Other (specify) Based on Tier II sampling conducted during August 2009

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Chara		59.1
Eel grass		31.8
Eurasian watermilfoil	x	27.3

Treatment Area #	D (96 acres)	LAT/LONG or UTM's	Lat: 85º 42' 15.70"W Lon: 41º 24' 15.99"N		
Total acres to be controlled	sum of 50 acres for lake	Proposed shoreline treatment length (ft)	sum of 13,550 ft	Perpendicular distance from shoreline (ft)	2,377 ft
Maximum Depth of Treatment (ft)	25 ft	Expected date(s) of treatment(s)	06/15/10 - 07/17/10		

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. same as previously stated on page 1

Plant survey method: [X] Rake [ ] Visual [ ] Other (specify) Based on Tier I sampling conducted during August 2009

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Eurasian watermilfoil	x	50
coontail		43.8
nitella		18.8

Treatment Area #	E (44 acres)	LAT/LONG or UTM's	Lat: 85º 42' 9.53"W Lon: 41º 23' 51.33"N		
Total acres to be controlled	sum of 50 acres for lake	Proposed shoreline treatment length (ft)	sum of 13,550 ft	Perpendicular distance from shoreline (ft)	1,605 ft
Maximum Depth of Treatment (ft)	25 ft	Expected date(s) of treatment(s)	06/15/10 - 07/17/10		

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. same as previously stated on page 1

Plant survey method: [X] Rake [ ] Visual [ ] Other (specify) Based on Tier II sampling conducted during August 2009

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
coontail		50
Eurasian watermilfoil	x	37.5
nitella		12.5

Treatment Area #	F (28 acres)	LAT/LONG or UTM's	Lat: 85º 40' 55.48"W Lon: 41º 22' 59.10"N		
Total acres to be controlled	sum of 50 acres for lake	Proposed shoreline treatment length (ft)	sum of 13,550 ft	Perpendicular distance from shoreline (ft)	adjacent
Maximum Depth of Treatment (ft)	25 ft	Expected date(s) of treatment(s)	06/15/10 - 07/17/10		

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. same as previously stated on page 1

Plant survey method: [X] Rake [ ] Visual [ ] Other (specify) Based on Tier II sampling conducted during August 2009

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
chara		39
Eurasian watermifloil	x	33
Coontail		18
Eel Grass		14

Treatment Area # G (39 acres)		LAT/LONG or UTM's Lat: 85º 40' 39.94"W Lon: 41º 22' 45.76"N	
Total acres to be controlled	sum of 50 acres for lake	Proposed shoreline treatment length (ft)	sum of 13,550 ft
Perpendicular distance from shoreline (ft)	961 ft		
Maximum Depth of Treatment (ft)	25 ft	Expected date(s) of treatment(s)	06/15/10 - 07/17/10

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. same as previously stated on page 1

Plant survey method: [X] Rake [ ] Visual [ ] Other (specify) Based on Tier I sampling conducted during August 2009

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

Treatment Area # H (16 acres)		LAT/LONG or UTM's Lat: 85º 40' 10.66"W Lon: 41º 23' 3.75"N	
Total acres to be controlled	sum of 50 acres for lake	Proposed shoreline treatment length (ft)	sum of 13,550 ft
Perpendicular distance from shoreline (ft)	adjacent		
Maximum Depth of Treatment (ft)	sum of 50 acres for lake	Expected date(s) of treatment(s)	06/15/10 - 07/17/10

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. same as previously stated on page 1

Plant survey method: [X] Rake [ ] Visual [ ] Other (specify) Based on Tier II sampling conducted during August 2009

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Eurasian watermilfoil	x	25
chara		25
Canadian waterweed		25
wild celery		25

Treatment Area #	I (28 acres)	LAT/LONG or UTM's	Lat: 85º 40' 39.94"W Lon: 41º 22' 45.76"N
Total acres to be controlled	sum of 50 acres for lake	Proposed shoreline treatment length (ft)	sum of 13,550 ft
Perpendicular distance from shoreline (ft)	961 ft		
Maximum Depth of Treatment (ft)	25 ft	Expected date(s) of treatment(s)	06/15/10 - 07/17/10

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. same as previously stated on page 1

Plant survey method: [X] Rake [ ] Visual [ ] Other (specify) Based on Tier I sampling conducted during August 2010

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Eurasian watermilfoil	x	50
coontail		43.8
nitella		18.8

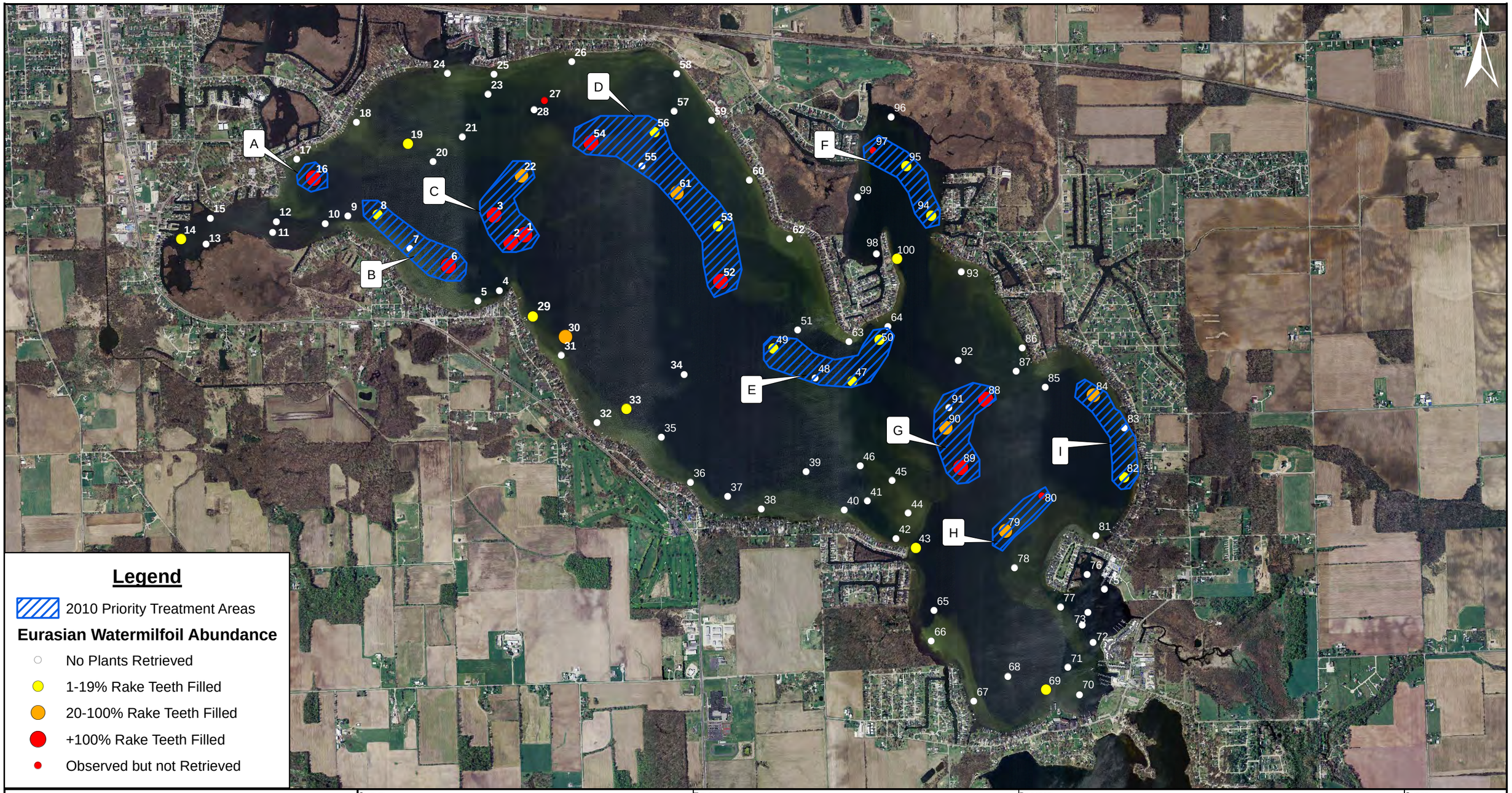
Treatment Area #		LAT/LONG or UTM's	
Total acres to be controlled		Proposed shoreline treatment length (ft)	
Perpendicular distance from shoreline (ft)			
Maximum Depth of Treatment (ft)	sum of 50 acres for lake	Expected date(s) of treatment(s)	

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.

Plant survey method: [ ] Rake [ ] Visual [ ] Other (specify)

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



Legend

2010 Priority Treatment Areas

Eurasian Watermilfoil Abundance

- No Plants Retrieved
- 1-19% Rake Teeth Filled
- 20-100% Rake Teeth Filled
- +100% Rake Teeth Filled
- Observed but not Retrieved

V3 Companies
7325 Janes Avenue
Woodridge, IL 60517
630.724.9200 phone
630.724.9202 fax
www.v3co.com

Client:	Title:	Project:	Sheet:
Wawasee Area Conservancy Foundation	**Post-treatment Distribution and Abundance of Eurasian Watermilfoil and 2010 Priority Treatment Areas**	**Lake Wawasee Aquatic Vegetation Management Plan- 2009 Update**	of: 1 1

Address:	Base Layer:	Project No.:	Quadrangle:	Date:	Scale:	Exhibit:
PO BOX 548 Syracuse, IN 46567	Indiana Spatial Data Service 2005 Orthophotography	06037.05	Lake Wawasee	8/12/09	1" = 2000'	10

APPENDIX III

EMERGENT DATA SHEETS AND EMERGENT BED LATITUDE/LONGITUDE

Aquatic Plant Survey Form

LAKE: Johnson Bay									**SECCHI (ft):**											
COUNTY: Kosciusko County									**MAX PLANT DEPTH (ft):**											
DATE: 8-10-09									**WEATHER:** partly cloudy											
BIOLOGIST: Ed Belmonte, Jessica Dunn									**COMMENTS:**											
UNITS OF MEASURE: Yards									**Rake score (1,3,5), observed (9), algae (p), emergent contact (1), emergent visual (9)**											
	R/T				yds				**Use acronyms/codes for identified species, use V1, V2...for voucher codes**											
Grid# Site	S/E/C	Latitude	Longitude	Dep (est)	Dep/Wid	ALL	NYMOD	SCIACU	tutrsh	PONCOR	NUPVAR	SAGLAT	LOOSE	JUSAME	Pickerel	POTNAT	HIBPAL	Marsh mallai		
895 1	C			12			1													
896 2	E			9			1													
897 3	C			8 x 18 ft		(8)	1	1												
898 4	S			11			1													
899 5	E			6			1		1											
900 6	C			5 x 5 ft		(8)														
901 7	S			8			1			1										
902 8	E			14		1				1	1	1	9							
903 9	S/E			6			1			1	1									
904 10	E			6			1			1	1									
905 11	S			4			1			1	1	1	1	1						
906 12	nickname point in bed			(9)			1			1	1	1	1							
907 13				16			1			1	1	1	1	1						
908 14				33																
909 15				46																
910 16				26																
911 17				34																
912 18	E			33																
913 19	C			10	x 10 ft					1										
914 20	S			6			1	1		1					1					
915 21				8																
916 22				4			1			1	1									
917 23				17			1			1	1									
918 24				23											1	1				
919 25				17																
920 26				19																
921 27				25												1				
922 28				33																
923 29	E			23												1				
24 30	S			15			1				1		1			1	1			
925 31				8													1			
926 32	E		buttonbus Cephalanthus	10		1	1	1	1	1	1				1	1	1			
927 33				41																

Aquatic Plant Survey Form

LAKE: Johnson Bay									SECCHI (ft):													
COUNTY: Kosciusko									MAX PLANT DEPTH (ft):													
DATE:									WEATHER:													
BIOLOGIST:									COMMENTS:													
UNITS OF MEASURE:						Rake score (1,3,5), observed (9), algae (p), emergent contact (1), emergent visual (9)																	
	R/T				yds	Use acronyms/codes for identified species, use V1, V2...for voucher codes																	
Site	S/E/C	Latitude	Longitude	Dep (est)	Dep/Wid	ALL	[illegible]	[illegible]	POTAM	SCIACU	POTGR	NUPVAR	Nymex	Loose	pickerel	SAG LAT	HIB PAL	Buttonbush				
928 34				39																		
929 35				23																		
930 36				21																		
931 37			8	12																		
932 38				12																		
933 39				14																		
934 40	E			12																		
935/936 41	S/E			7							1		1									
937 42	S	10		6																		
938 43	E			6																		
939 44	S			24							1		1	1		1	1	1				
940 45		11		21																		
941 46	E			17																		
942 ~~947~~	S			13			1	9			1	1			1	9						
943 48				26																		
944 49		12		24						1												
945 50				40																		
946 51				28																		
147 52				28																		
948 53				39																		
949 54	E/S			57																		
950 55		13		28			1	1		1					1				1			
951 56	E			9																		
752 57	S			37			1	1							1			1				
53 58		14		34																		
954 59	E/S			47	yellow		1	1			9	1			1			1	1			
955 60				44																		
956 61				34							1		1									
957 62	E			11	Jasmine						1		1									

Aquatic Plant Survey Form

LAKE: Conklin Bay
COUNTY:
DATE: 8-11-09
BIOLOGIST:
UNITS OF MEASURE:

SECCHI (ft):
MAX PLANT DEPTH (ft):
WEATHER:
COMMENTS:

Rake score (1,3,5), observed (9), algae (p), emergent contact (1), emergent visual (9)
Use acronyms/codes for identified species, use V1, V2...for voucher codes

	Site	R/T S/E/C	Latitude	Longitude	Dep (est) yds	Dep/Wid	ALL	Pickerel	Arrow	NYMOD	NYMPVAR	loose	HIBAL	TYPLAT	POTNOD	Spikerush		
993	1	S			8			1	1	1	1	1	1	1	1			
	2				13			1	1	1	1	1	9	1	1			
995	3				23					9								
	4				28								9					
	5				25													
	6				55			9			9		9					
999	7				45			9	1	1	1	1	1	1	1			
	8		1		54			1	1	1			1	9				
	9				49			1	1	1	1	1	1	1	1			
	10				39													
1003	11				42													
1004	12				6													
	13				79				1	(1)	1	9		1	1			
1008	14				81					(1)						1		
1007	15				78											(1)		
	16				58													
1009	17	E/S			50								1	1	1			
	18				14							1	(9 1)	1	1			
	19				25													
	20		2		44								1	1	1			
	21				35										1			
	22				39								1		1			
015	23	E			16									1				
1016	24	S			31									1	1			
	25				34						1			1	1			
018	26			past buoy	39						1	9		1	1			
	27		3		33					1	1	1			1			
1020	28	E			2						1	1	1	1				
1021	29	S			13					1		9		1	1			
	30				10					1				1				
1023	31		4		13				1	1		1	9					
	32				28						1		9	1				
	33				74													

Huntington 13th FR Bluebill Fry

Ecosubcommittee 10:30AM – Wed

Aquatic Plant Survey Form

LAKE:								**SECCHI (ft):**													
COUNTY:								**MAX PLANT DEPTH (ft):**													
DATE:								**WEATHER:**													
BIOLOGIST:								**COMMENTS:**													
UNITS OF MEASURE:					**Rake score (1,3,5), observed (9), algae (p), emergent contact (1), emergent visual (9)**																
	R/T				**Use acronyms/codes for identified species, use V1, V2...for voucher codes**																
Site	**S/E/C**	**Latitude**	**Longitude**	**Dep (est)**	**Dep/Wid**	**ALL**	MYRHAK	THLAT	LOOSE	HIBAL	NYMODR	POTNAT	SUSAME	ARRUM	PICLAN						
1026 34				49			1	1	1	9											
35				44			1	1	1	1	1										
1028 36				50			1	1	9	9											
37		4		2					1	1		no	emergent	growth		concrete slabs present					
1035 38				44			1	1		1											
39				12			1	1	9	9	1	1									
40				20			1	1	1	9											
41	E			8			1	1	1	1											
1034 42	S			17			1	1		1			1								
43				39			9				1		9								
44				23				1	1		1		1								
45		5		2				1			1		9								
1038 46				29			1	1	1												
47				24			1	1	1												
48				18			1	1		1											
1041 49				231																	
50				253			1	1													
1043 51				12																	
52				25										1							
53				9			1	1		1	1			1							
1046 54				18											1						
55				10											1						
56				7																	
1049 57				3																	
58	E			2																	
1051 59	S			10			1			1		1	1							buttonbush	
60				15										1	1						
61		6		18				1	1												
1054 62				7																	
63				11										1							
64				6																	
65				29			1	1													
1058 66				24																buttonbush	
1061 67	E			70																	
1062 68	C			10x10 Arrow Arum																	

Aquatic Plant Survey Form

LAKE: Conklin Bay								**SECCHI (ft):**										
COUNTY:								**MAX PLANT DEPTH (ft):**										
DATE:								**WEATHER:**										
BIOLOGIST:								**COMMENTS:**										
UNITS OF MEASURE:					**Rake score (1,3,5), observed (9), algae (p), emergent contact (1), emergent visual (9)**													
	R/T				**Use acronyms/codes for identified species, use V1, V2...for voucher codes**													
Site	**S/E/C**	**Latitude**	**Longitude**	**Dep (est)**	**Dep/Wid**	**ALL**	POTNAT	ArrowSPOVL										
69	C		3 x 10				1	1										
70	S		13yds				1											2 ayds POTNAT
71				11			1											
72		7		6														
73	E			13			1											
74	S			8			1	1										
75		8		12			1											
76	E			6			1											
77	S			7					1									
78		9		8					1									
79				17														
80	E			9														

• Erosion control fabric

Aquatic Plant Survey Form

SCIACU – Need softstem

LAKE: Lake Wawasee North Bay								**SECCHI (ft):**											
COUNTY:								**MAX PLANT DEPTH (ft):**											
DATE: 8-11-09								**WEATHER:**											
BIOLOGIST: Ed Belmonte								**COMMENTS:**											
UNITS OF MEASURE: Yds								**Rake score (1,3,5), observed (9), algae (p), emergent contact (1), emergent visual (9)**											
	R/T							**Use acronyms/codes for identified species, use V1, V2...for voucher codes**											
Site	**S/E/C**	**Latitude**	**Longitude**	**Dep (est)**	**Dep/Wid**	**ALL**	POTNAT	SCIACU	NYMODOR										
958 1	C						1	1											
959-992		40 Yds outside bay																	
1075 1075-1085		C2					1												
1086-1091		C3				1													

Johnson Bay Emergent Bed Locations

	LAT	LON
Bed 1	41.40463341	-85.68708459
	41.4045793	-85.68705764
Clump 1	41.40443728	-85.68710255
Bed 2	41.40426819	-85.68700374
	41.4041194	-85.68699476
Clump 2	41.40405177	-85.68703968
Bed 3	41.40393002	-85.68703069
	41.40367302	-85.68721035
Bed 4	41.40351746	-85.6872373
	41.40327397	-85.68711154
Bed 5	41.40347011	-85.68754271
	41.40353098	-85.68741695
	41.40373389	-85.68727323
	41.40398413	-85.68730018
	41.40417351	-85.68752475
	41.4039909	-85.68780321
	41.4039909	-85.68826134
	41.40399766	-85.68844997
Clump 3	41.40385563	-85.68879132
Bed 6	41.40392326	-85.68889911
	41.40402471	-85.68906081
	41.40410587	-85.6892225
	41.40443051	-85.68971655
	41.40468752	-85.68990519
	41.40488365	-85.68994112
	41.40518124	-85.68980638
	41.40555321	-85.68977045
	41.40576963	-85.68970757
	41.40632421	-85.68967164
Bed 7	41.40652034	-85.68966265
	41.40684497	-85.68956384
	41.40706139	-85.68951893
Bed 8	41.40726428	-85.68933927
	41.40782561	-85.68920453
	41.40860334	-85.68917758
	41.40899559	-85.68904284
	41.40931344	-85.68877336
	41.40968539	-85.68875539
	41.40977331	-85.68882725
	41.40980036	-85.68899793

	LAT	LON
Bed 9	41.41037519	-85.68880929
	41.41042929	-85.68881827
Bed 10	41.41055779	-85.68884522
	41.41082829	-85.68877336
Bed 11	41.41305993	-85.68756068
	41.41313431	-85.68731814
	41.41320194	-85.68716543
Bed 12	41.41306669	-85.68650071
	41.41290439	-85.6862941
	41.41237692	-85.68534193
	41.41209966	-85.68490177
	41.41184268	-85.68425501
	41.41159247	-85.68387773
	41.41118671	-85.68359926
	41.41095678	-85.68343757
Bed 13	41.41055779	-85.68336571
	41.4101385	-85.68334774
Bed 14	41.40972597	-85.68312317
	41.40965834	-85.68297047
	41.40954338	-85.68278183
Bed 15	41.40948927	-85.68244048
	41.40927963	-85.68188355
	41.40927963	-85.6815961

Conlin Bay Emergent Bed Locations

	LAT	LON
Bed 1	41.40530297	-85.73190876
	41.40541795	-85.73192672
	41.40550587	-85.7319896
	41.40555321	-85.73211536
	41.4055194	-85.7322501
	41.40565466	-85.73247467
	41.40551263	-85.7326723
	41.40552616	-85.73292381
	41.40555321	-85.73322025
	41.40547882	-85.73342685
	41.40559379	-85.73374125
	41.40567495	-85.7340287
	41.40585756	-85.73416344
	41.40589813	-85.73443292
	41.40595224	-85.73468444
	41.40602663	-85.7348641
Bed 2	41.40608074	-85.73509765
	41.40601987	-85.73543002
	41.40610103	-85.73551984
	41.40614837	-85.73565459
	41.40611456	-85.73580729
	41.40616866	-85.73593305
	41.40604016	-85.7360139
Bed 3	41.40626334	-85.73628338
	41.40627011	-85.73640914
	41.40635803	-85.73677744
	41.40640537	-85.73719963
	41.40638508	-85.73759487
Bed 4	41.40641213	-85.73793622
	41.40635127	-85.73806198
	41.40628363	-85.73816977
	41.406216	-85.73838536
	41.4060875	-85.73855603
	41.40591166	-85.73887043
	41.40578316	-85.73924771
	41.40559379	-85.73974176
	41.40551263	-85.73984057
	41.40551263	-85.74004717
	41.40536384	-85.74017293
	41.40526239	-85.74037055
	41.40514742	-85.74037954

	LAT	LON
Bed 5	41.40503921	-85.7404514
	41.40490394	-85.74055021
	41.40474839	-85.740658
	41.40468752	-85.74077478
	41.40483631	-85.74088257
	41.40482955	-85.74115206
	41.4048566	-85.74151137
	41.40497158	-85.74178984
	41.40513389	-85.74200542
	41.40530297	-85.74218508
	41.4055194	-85.74242762
	41.40555321	-85.74265219
	41.40562084	-85.74272405
	41.40558703	-85.74296658
	41.40545176	-85.74320014
	41.40538413	-85.74328996
	41.40527592	-85.7433259
Bed 6	41.40738601	-85.7409724
	41.40731162	-85.74090054
	41.40725752	-85.74081969
	41.40732515	-85.74069394
	41.4074063	-85.7405053
	41.40749422	-85.74038852
	41.40748746	-85.74025378
	41.40750098	-85.74004717
	41.40746041	-85.7398765
	41.40759567	-85.73977769
	41.40771064	-85.73992142
Clump 1	41.40764301	-85.73965193
Clump 2	41.40825167	-85.73720861
Bed 7	41.40821109	-85.73641812
	41.40819757	-85.7362744
	41.4082652	-85.73606779
	41.4082652	-85.73592407
Bed 8	41.40828549	-85.73567255
	41.40824491	-85.73551086
	41.40833959	-85.73528629
Bed 9	41.40821786	-85.73444191
	41.40824491	-85.73425327
	41.40838693	-85.73406463
	41.40852219	-85.7340826

North Bay Emergent Locations

	LAT	LON
Clump 1	41.41601503	-85.71932386
	41.41602179	-85.71939572
	41.41598122	-85.71952148
	41.41603532	-85.71962029
	41.41600151	-85.71973706
	41.41600151	-85.71988079
	41.41598798	-85.7199796
	41.41600151	-85.72010536
	41.41598798	-85.7202401
	41.4159677	-85.72039281
	41.4159677	-85.72053653
	41.41587979	-85.72069822
	41.41579188	-85.72085093
	41.41573778	-85.72090483
	41.41569045	-85.72094076
	41.4156093	-85.72092279
	41.41559578	-85.72079704
	41.41557549	-85.72070721
	41.41550111	-85.72056348
	41.41554168	-85.72040179
	41.41552816	-85.72024908
	41.41550787	-85.71995265
	41.41564988	-85.71978198
	41.41585274	-85.7196652
	41.41584598	-85.71952148
	41.41585274	-85.71932386
	41.41578512	-85.71929691
	41.41569721	-85.71921606
	41.41573102	-85.71897353
	41.41580541	-85.71900048
	41.41581217	-85.71910827
	41.41587303	-85.71908132
	41.41587979	-85.71899149
	41.4159136	-85.71918013
	41.41598122	-85.71927894

	LAT	LON
Clump 2	41.41573778	-85.7222253
	41.41564311	-85.72220733
	41.41568369	-85.72212649
	41.41569721	-85.72204564
	41.41554844	-85.72202768
	41.41563635	-85.72189294
	41.41567016	-85.72174921
	41.41585274	-85.72174921
	41.41578512	-85.72199175
	41.41578512	-85.72207259
	41.41583245	-85.72210852
Clump 3	41.41560254	-85.72134499
	41.41570397	-85.72131804
	41.41572426	-85.72123719
	41.4156634	-85.72122821
	41.4156093	-85.72122821
	41.4156093	-85.72129109

APPENDIX IV

JOHNSON BAY EMERGENT BED PHOTOGRAPHS

Johnson Bay Emergent Plant Bed Photographs

Bed: 1
Size: 0.02 acres
Dominant Species: White water lily
Number of Species: 1

Bed: 2
Size: 0.03 acres
Dominant Species: White water lily
Number of Species: 2

Bed: 3
Size: 0.08 acres
Dominant Species: Yellow pond lily
Number of Species: 5

Bed: 4
Size: 0.05 acres
Dominant Species: White water lily
Number of Species: 3

Bed: 5
Size: 0.87 acres
Dominant Species: Yellow pond lily
Number of Species: 6

Bed: 6
Size: 1.53 acres
Dominant Species: Yellow pond lily
Number of Species: 7

Bed: 7
Size: 0.18 acres
Dominant Species: Mixed
Number of Species: 5

Bed: 8
Size: 2.08 acres
Dominant Species: Yellow pond lily
Number of Species: 7

Bed: 9
Size: 0.01 acres
Dominant Species: Pickerel weed
Number of Species: 1

Bed: 10
Size: 0.05 acres
Dominant Species: Pickerel weed
Number of Species: 1

Bed: 11
Size: 0.2 acres
Dominant Species: Mixed
Number of Species: 6

Bed: 12
Size: 2.74 acres
Dominant Species: Floating pondweed
Number of Species: 7

Bed: 13
Size: 0.73 acres
Dominant Species: Mixed
Number of Species: 5

Bed: 14
Size: 0.35 acres
Dominant Species: Pickerel weed
Number of Species: 6

Bed: 15
Size: 0.83 acres
Dominant Species: Mixed
Number of Species: 8

APPENDIX V

CONKLIN BAY EMERGENT BED PHOTOGRAPHS

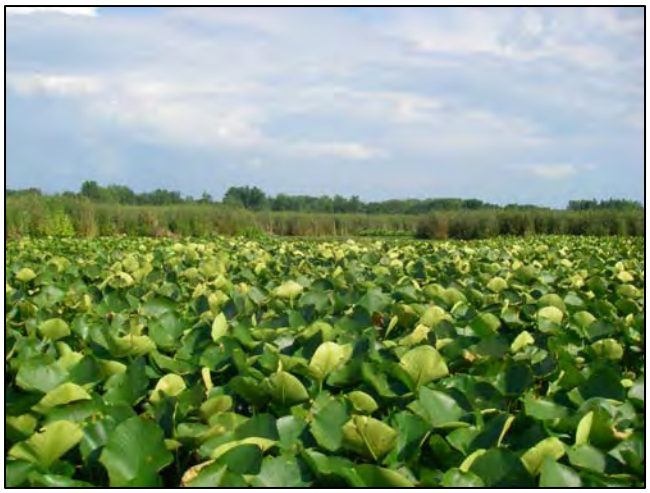
Conklin Bay Emergent Plant Bed Photographs

Bed: 1
Size: 3.44 acres
Dominant Species: Floating pondweed
Number of Species: 8

Bed: 2
Size: 0.49 acres
Dominant Species: Floating pondweed
Number of Species: 4

Bed: 3
Size: 0.76 acres
Dominant Species: Floating pondweed
Number of Species: 5

Bed: 4
Size: 2.23 acres
Dominant Species: Yellow pond lily
Number of Species: 6

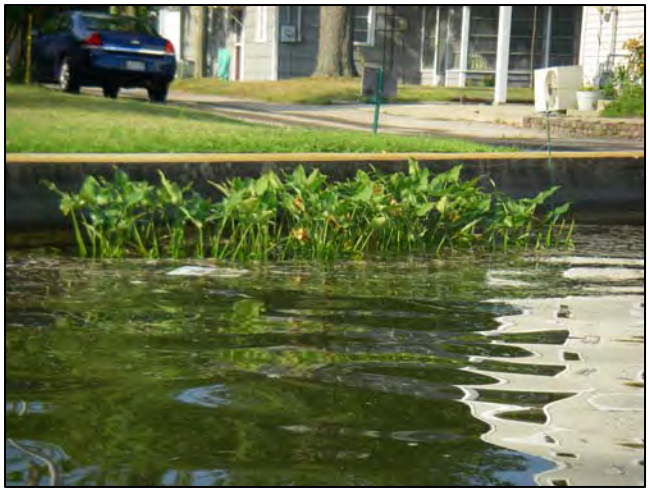


Bed: 5
Size: 1.41 acres
Dominant Species: Yellow pond lily
Number of Species: 8

Bed: 6
Size: 0.31 acres
Dominant Species: Yellow pond lily
Number of Species: 7

Bed: 7
Size: 0.09 acres
Dominant Species: Floating pondweed
Number of Species: 1

Bed: 8
Size: 0.06 acres
Dominant Species: Floating pondweed
Number of Species: 2



Bed: 9
Size: 0.11 acres
Dominant Species: Hardstem bulrush
Number of Species: 1

APPENDIX VI

NORTH BAY EMERGENT BED PHOTOGRAPHS

North Bay Emergent Plant Bed Photographs

Clump 1
Size: 1.38 acres
Dominant Species: Hardstem bulrush
Number of Species: 3

Clump 2
Size: 0.02 acres
Dominant Species: Floating pondweed
Number of Species: 1

Clump 3
Size: 0.18 acres
Dominant Species: Floating pondweed
Number of Species: 1