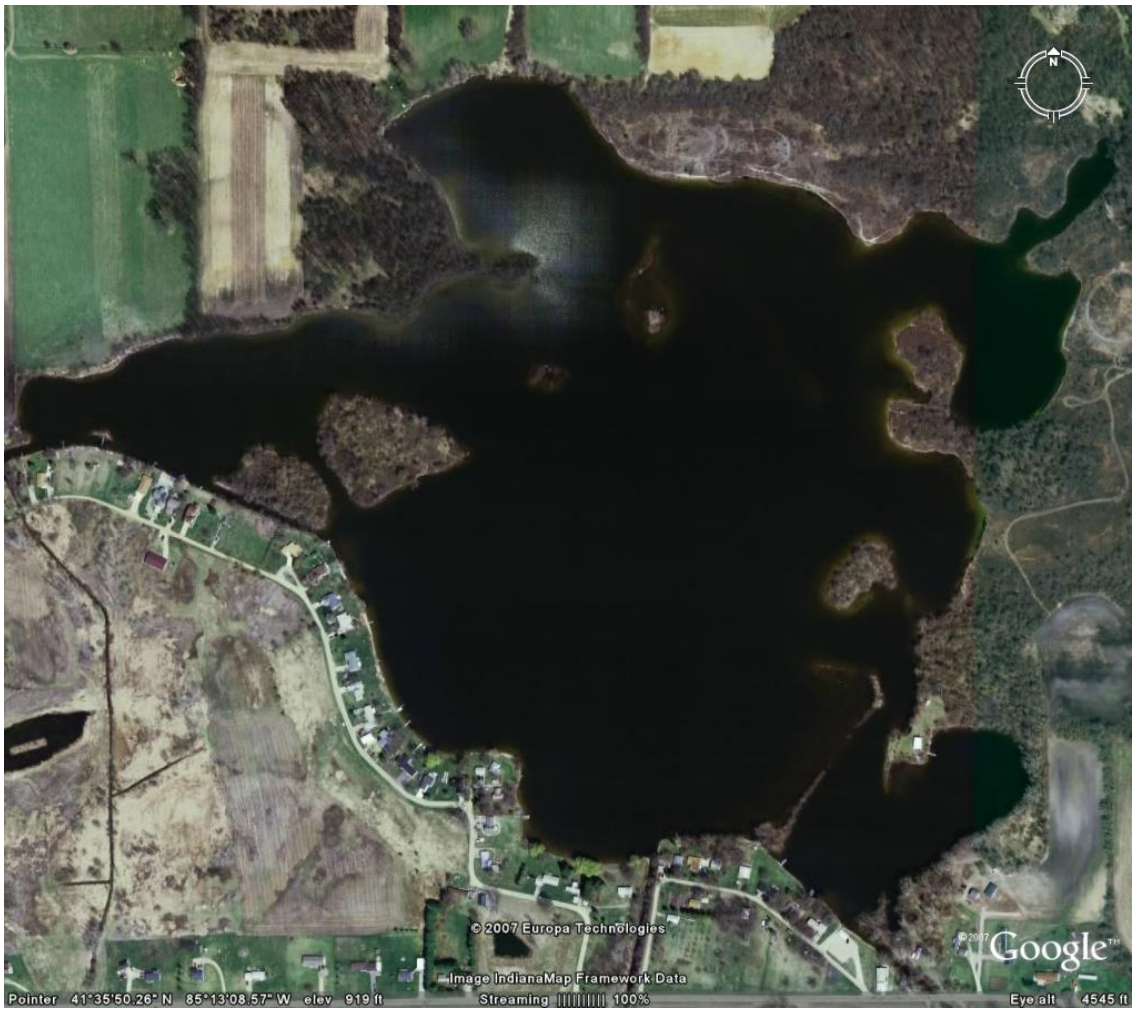
Little Turkey Lake Aquatic Vegetation Management Plan

LaGrange County, Indiana

2007 – 2011



Prepared for:

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March 1, 2008

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Executive Summary

The following report outlines a long-term aquatic plant management strategy for Little Turkey Lake. Aquatic Weed Control was contracted by the Little Turkey Lake Association to conduct aquatic vegetation surveys and propose a vegetation management plan based on the results of these surveys. Funding for this plan was provided by the Little Turkey Lake Association and the Indiana Department of Natural Resources (IDNR) through the Lake and River Enhancement (LARE) program.

In 2007, Aquatic Weed Control conducted two aquatic vegetation surveys to characterize the plant community of Little Turkey Lake. An early season quantitative survey (Tier II) was conducted on June 14, 2007 and a late season Tier II survey was conducted on August 1, 2007. Each survey followed protocol established by the IDNR to evaluate the health of aquatic plant community

Based on the results of these surveys, as well as interaction with association members, lake users, and IDNR biologists, a management plan was constructed to help reach the three major management goals established by the IDNR for all Indiana public lakes, including those applying for LARE funding. These three goals are listed below.

1. Develop or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality and is resistant to minor habitat disturbances and invasive species.

2. Direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species.

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

The late season 2007 vegetation survey of Little Turkey Lake found a plant community with above average species diversity (0.85) when compared to area lakes. Eleven different plant species were collected in Little Turkey Lake in the August 2007. Three invasive plant species, Eurasian watermilfoil (*Myriophyllum spicatum*), curly leaf pondweed (*Potamogeton crispus*) and brittle naiad *(Najas minor*) were present in Little Turkey Lake in 2007. Eurasian watermilfoil is of special concern in Little Turkey Lake. This plant species provides poor fish habitat, crowds out beneficial native plant species, and can impair recreation when present in great abundance.

Funding may be awarded by the LARE program in 2008 for herbicide treatments in areas of Eurasian watermilfoil infestation. Chemical treatment options for selective, root control of Eurasian watermilfoil include the following herbicides: Sonar (active ingredient: fluridone), Renovate (active ingredient: triclopyr), and 2, 4-D. Based on past experience, Sonar treatments generally provide the most complete control of Eurasian watermilfoil and can also provide multiple years of control. Renovate and 2, 4-D, while very effective, are normally applied to the same areas on a yearly basis to provide control.

Aquatic Weed Control recommends the use of Sonar to treat Eurasian watermilfoil in Little Turkey Lake because of its widespread distribution. A fluridone treatment has numerous ecological advantages over other herbicides for Eurasian milfoil control. Fluridone will not only kill Eurasian watermilfoil plants as other herbicides would, but it will also kill its root systems,

reducing the chance for rapid re-growth. One extremely important advantage of using fluridone is that it can selectively kill Eurasian milfoil plants while causing little if any long term harm to native plants. This can allow native plants to re-establish themselves as the Eurasian watermilfoil population declines.

It is important to note that Eurasian watermilfoil will be the only plant species specifically targeted in this project, as LARE funds will only be awarded for the control of invasive plant species. The goal is not to eliminate vegetation in Little Turkey Lake, but to improve the health of the plant community. Native vegetation will still be abundant in shallow areas after treatment, and control of these natives must be privately funded. The goal will be to reduce the Eurasian watermilfoil population and allow for the recovery of native plant species that will provide better fish habitat, foster good water quality and pose less interference to recreational use of the lake.

Treatment Specifications

Hydraulic retention time in Little Turkey Lake has been measured in the past as 17 days (Harza Engineering, 1990). This means that Little Turkey Lake has a high flushing rate, especially in times of heavy rain. This could potentially cause herbicide to flush out of the lake in a heavy rain event. To avoid a potential treatment failure in Little Turkey Lake, SePRO (manufacturers of Sonar) have recommended that a combination of Sonar A.S. (liquid) and Sonar PR (precision release pellets) be used to treat the Eurasian watermilfoil. Adding a timed release, granular pellet to the treatment strategy will ensure that Sonar will always be present in the water column, even if a heavy rain event was to occur in the days following treatment.

Multiple treatments (called "bumps") will likely be used to maintain herbicide concentrations of 2-5 parts per billion in Little Turkey Lake. A minimum of two treatments and a maximum of four treatments will take place, depending upon Sonar concentrations. Sonar concentrations will be monitored every two to three weeks depending upon rainfall. In the weeks that follow the treatment, water samples called FasTESTs will be collected in the lake and sent to SePRO Corporation to determine the concentration of Sonar remaining in the water column. The results of these tests will determine the amount of herbicide that should be added to the lake in each bump to achieve the target concentration of 2-5 parts per billion.

In the years following the Sonar treatment, 2, 4-D would be used to treat areas of Eurasian watermilfoil re-growth. Renovate and 2, 4-D are both good options for spot treatments of Eurasian watermilfoil. They both provide adequate control, but 2, 4-D will be less expensive.

Cost estimates for the whole lake Sonar treatment are included below. These figures are estimates only and are subject to change pending future chemical pricing.

Project	2008	2009	2010	3 Year Cost Totals
Whole Lake Fluridone Treatment: 2-5 parts per billion	$61,000	$0	$0	$61,000
Follow Up Spot Treatments using 2, 4-D	$0	$5,400 **If needed**	$5,400	$10,800
Survey and Plan Update Costs	$4,000	$4,000	$4,000	$12,000
Total Estimated Costs	$65,000	$9,400	$ 9,400	**$83,800**
LARE Share – subject to availability	$58,500	$8,460	$ 8,460	**$75,420**
Association's Share	$6,500	$ 940	$940	**$8,380**

The alternative to a whole lake treatment would be to treat large areas of Little Turkey Lake with 2, 4-D or Renovate herbicide for the control of Eurasian watermilfoil. These treatments are effective, but they would not provide the level of control on a lake wide basis that Sonar would provide. Renovate and 2, 4-D treatments usually do not provide multiple years of control, whereas Sonar can provide multiple years of Eurasian watermilfoil control. Renovate and 2, 4-D treatments would likely have to take place in the same areas year after year to maintain control of Eurasian watermilfoil. Cost estimates for this treatment plan are listed below.

Project	2008	2009	2010	3 Year Cost Totals
Treat up to 45 acres with 2, 4-D	$16,200	$16,200	$16,200	$48,600
Survey and Plan Update Costs	$4,000	$4,000	$4,000	$12,000
Total Estimated Costs	$20,200	$20,200	$20,200	**$60,600**
Total LARE share – subject to availability	$18,180	$18,180	$18,180	**$54,540**
Total Association's Share	$2,020	$2,020	$2,020	**$6,060**

Acknowledgements

Aquatic vegetation surveys conducted on Little Turkey Lake were made possible by funding from the Little Turkey Lake Association and the Indiana Department of Natural Resources through the Lake and River Enhancement Program. Aquatic Weed Control would like to extend special thanks to Indiana Department of Natural Resources (IDNR) District 3 biologist Jed Pearson for providing procedural training for Tier II aquatic vegetation surveys. Gwen White and Angela Sturdevant, aquatic biologists for the IDNR Division of Fish and Wildlife provided valuable consultation regarding the requirements and objectives of this lake management plan. District 2 Fisheries Biologists Neil Ledet and Larry Koza provided consultation for this plan and also provided IDNR survey data. Aquatic Weed Control would also like to thank the members of the Little Turkey Lake Association for their commitment to improving this lake and for valuable discussion and input brought forward at the informational meeting held on June 30, 2007.

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1.0 Introduction

Aquatic Weed Control was contracted by the Little Turkey Lake Association to develop a long-term aquatic vegetation management plan. Funding for this report was provided by the Little Turkey Lake Association and the Department of Natural Resources through the Lake and River Enhancement (LARE) program.

When a person registers a boat within the state of Indiana a lake enhancement fee is included in the cost of registry. Two thirds of the total proceeds collected from this fee are then used to fund projects designed to improve the quality of Indiana lakes. One third of the total proceeds is set aside for invasive plant control, while one third is set aside for sediment removal and construction projects that benefit Indiana lakes.

The aquatic vegetation surveys included in this report, as well as the management plan, are required by the state to receive funding for the treatment of exotic aquatic vegetation. Should a lake be selected for LARE funding, up to 100,000 dollars can be awarded for a whole lake treatment. Following a whole lake treatment up to 20,000 dollars per year can be awarded for up to 3 years for the maintenance of aquatic invasive plant species. If the whole lake is not treated, up to 20,000 dollars can be available annually for up to three years. Requests for funding are reviewed by the LARE office and funds will be distributed at the discretion of the director of the DNR.

The Little Turkey Lake Association has contracted with Aquatic Weed Control for LARE activities starting in 2007. Prior to this time, no aquatic vegetation management plan had been fully developed. The first LARE funded aquatic vegetation survey conducted by Aquatic Weed Control took place on June 14, 2007. A late season Tier II aquatic vegetation survey was also conducted on August 1, 2007. The following chart summarizes all 2007 LARE funded activities on Little Turkey Lake.

Table 1: Little Turkey Lake LARE History

Year	Action	Date	Funding Source
2007	Spring and Late Season Aquatic Vegetation Surveys as well 2, 4-D application and Management Plan Update	Spring Tier II Survey June 14, 2007 Late Season Tier II Survey August 1, 2007	Lake and River Enhancement Little Turkey Lake Association

Table 2 was compiled by the IDNR and gives both common and scientific names of many plants mentioned in this report. It also gives species codes which may be referenced on some data sheets.

Table 2: Common and Scientific Plant Names

Species Code	Scientific Name	Common Name	Vegetation Type
ALGA	Any species of filamentous alga (incl. *Spyrogyra, Cladophora, Hydrodictyon*)	algae	N
AZO001	*Azolla* sp.	A mosquito fern species	N
AZOCAR	*Azolla caroliniana*	Carolina mosquito fern	N
AZOMEX	*Azolla mexicana*	Mexican mosquito fern	N
CERDEM	*Ceratophyllum demersum*	coontail	S
CHARA	*Chara* sp.	A chara species	S
EGEDEN	*EGERIA DENSA*	BRAZILIAN ELODEA	S
ELOCAN	*Elodea Canadensis*	Canada waterweed	S
ELONUT	*Elodea nuttallii*	western waterweed	S
HYIVER	*HYDRILLA VERTICILLATA*	HYDRILLA	S
LEM001	*Lemna* sp.	duckweeds (species within Lemnaceae)	N
LEMMIO	*Lemna minor*	small or common duckweed	N
LEMTRI	*Lemna trisulca*	star duckweed	N
LUDDEC	*Ludwigia decurrens*	primrose-willow	F
MYRSIB	*Myriophyllum sibiricum*	northern watermilfoil	S
MYRSPI	*MYRIOPHYLLUM SPICATUM*	EURASIAN WATERMILFOIL	S
MYR001	*Myriophyllum* sp.	a watermilfoil species	S
NAJFLE	*Najas flexilis*	slender naiad	S
NAJGRA	*Najas gracillima*	Northern naiad	S
NAJGUA	*Najas guadalupensis*	Southern naiad	S
NAJMIN	*NAJAS MINOR*	BRITTLE WATERNYMPH	S
NELLUT	*Nelumbo lutea*	American lotus	F
NITELL	*Nitella* sp.	a nitella species	S
NOAQVG		no aquatic vegetation at site	N
NUPADV	*Nuphar advena*	spatterdock	F
NUPVAR	*Nuphar variegata* (formerly *N. luteum*)	bullhead lily (yellow pond lily)	F
NYMODT	*Nymphaea oderata subsp. tuberosa*	white water lily (fragrant water lily)	F

POTCRI	*POTAMOGETON CRISPUS*	CURLY-LEAF PONDWEED	S
POTEPI	*Potamogeton epihydrus*	ribbon-leaf pondweed	S
POTFOF	*Potamogeton foliosus*	leafy pondweed	S
POTGRA	*Potamogeton gramineus*	variable pondweed	S
POTILL	*Potamogeton illinoensis*	Illinois pondweed	S
POTNLV	*Potamogeton foliosus*, *P. pusillus*, or other unidentified narrow-leaved pondweeds	narrow-leaved pondweeds	S
POTNOD	*Potamogeton nodosus* (formerly *P. americanus*)	American pondweed	S
POTPRA	*Potamogeton praelongus*	white-stemmed pondweed	S
POTPUP	*Potamogeton pusillus*	small pondweed	S
POTRIC	*Potamogeton richardsonii*	Richardson's pondweed	S
POTZOS	*Potamogeton zosteriformis*	flat-stemmed pondweed	S
RANFLA	*Ranunculus flabellaris*	yellow water crowfoot (yellow water buttercup)	S
RANLON	*Ranunculus longirostris* (incl. *R. trichophyllus*)	white water crowfoot (rigid white water crowfoot)	S
RICCIA	*Riccia* sp., *Ricciocarpus* sp.	A liverwort species	N
SPIPOL	*Spirodela polyrhiza*	greater duckweed	N
STUPEC	*Stuckenia pectinata*	sago pondweed	S
UNKN01		Unknown specimen No. 1	
UNKN02		Unknown specimen No. 2	
UTRMAC	*Utricularia macrorhiza* (also known as *U. vulgaris*)	common bladderwort	S
VALAME	*Vallisneria americana*	wild celery or eel grass	S
WOA001	*Wolffia* sp.	A watermeal species	N
WOACOL	*Wolffia columbiana*	watermeal	N
ZANPAL	*Zannichellia palustris*	horned pondweed	S
ZOSDUB	*Zosterella dubia* (also known as *Heteranthera dubia*)	water stargrass	S

Note: The scientific and common names of EXOTIC species are shown in ALL CAPITAL LETTERS.

Key to Vegetation Types:
F = floating-leaved, rooted vegetation
N = non-rooted floating vegetation
S = submersed vegetation

2.0 Watershed and Lake Characteristics

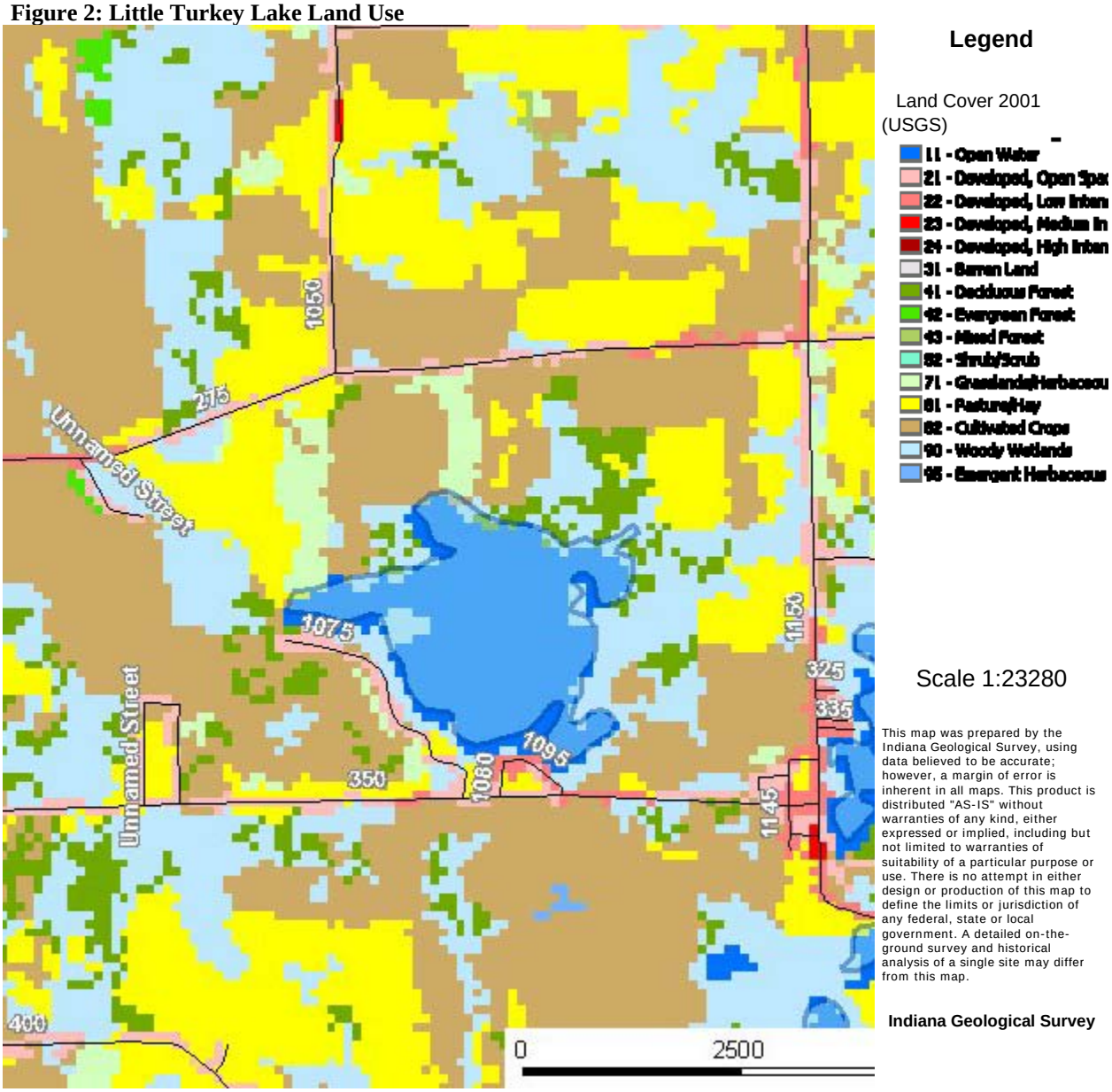
A feasibility study called the "Big Turkey and Little Turkey Lakes Enhancement Feasibility Study" was completed in 1990 and is an excellent source of information for these lakes. This project was completed by Harza Engineering Company in Chicago, Illinois. It was completed with the help of LARE funding and can be found at the following website: http://www.in.gov/dnr/fishwild/lare/lare_reports.html

Little Turkey Lake, located in southeastern LaGrange County, has 135 surface acres with a maximum depth of 36 feet and an average depth of 11.5 feet. According to Harza Engineering Hydraulic Retention time is approximately 17 days. Little Turkey Lake was created in the early 1900's when a cement manufacturer dredged marl from a wetland which is now the lake (Harza, 2003). This dredging could account for the rugged, uneven shoreline in many areas of the lake (Figure 1).

Figure 1: Little Turkey Lake Shoreline - 2007

Little Turkey Lake lies on Turkey Creek, which drains into the Pigeon River. Little Turkey Lake's watershed has an area of 32, 282 acres. In 1990, it was estimated that 20, 831 of these acres were used for crop production. Figure 2 shows 2001 Land Uses around Little Turkey Lake.

Figure 2: Little Turkey Lake Land Use



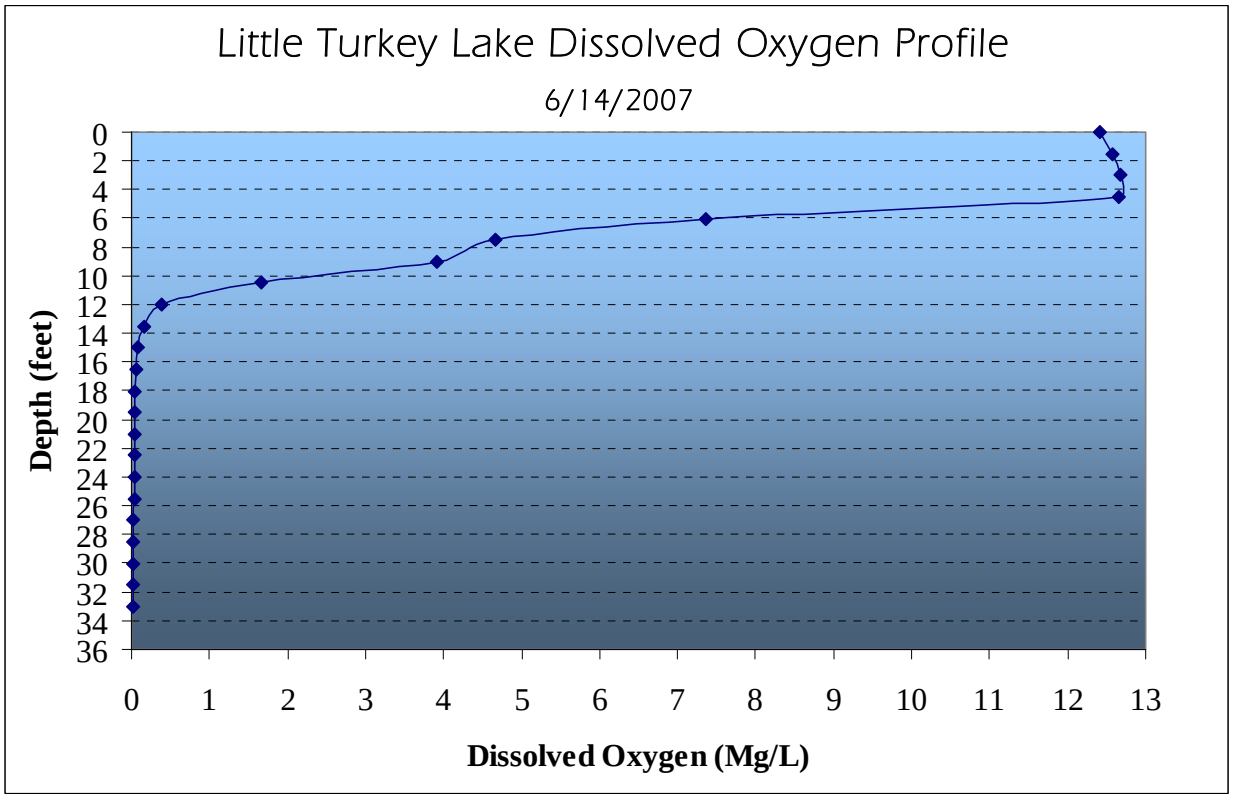
Secchi disk readings were taken in both surveys by Aquatic Weed Control in 2007. Secchi depth was measured at 3.2 feet in both June and August. Based on these measurements, water clarity is low when compared to many area lakes.

On June 14, 2007 Aquatic Weed Control measured dissolved oxygen and temperature throughout the water column in Little Turkey Lake. This data was used to construct dissolved oxygen and temperature profiles.

Dissolved oxygen requirements to maintain healthy fish populations of warm-water species are at least 2-5 mg of oxygen per liter of water, while cold-water fish species require 5-9 mg of oxygen per liter of water (Kalff, 2002, p237).

In June, Little Turkey Lake already showed strong stratification. Oxygen levels remained constant down to a depth of only 5 feet. After 5 feet, dissolved oxygen dropped rapidly, with almost no oxygen being present in the water column at a depth of 12 feet (Figure 3).

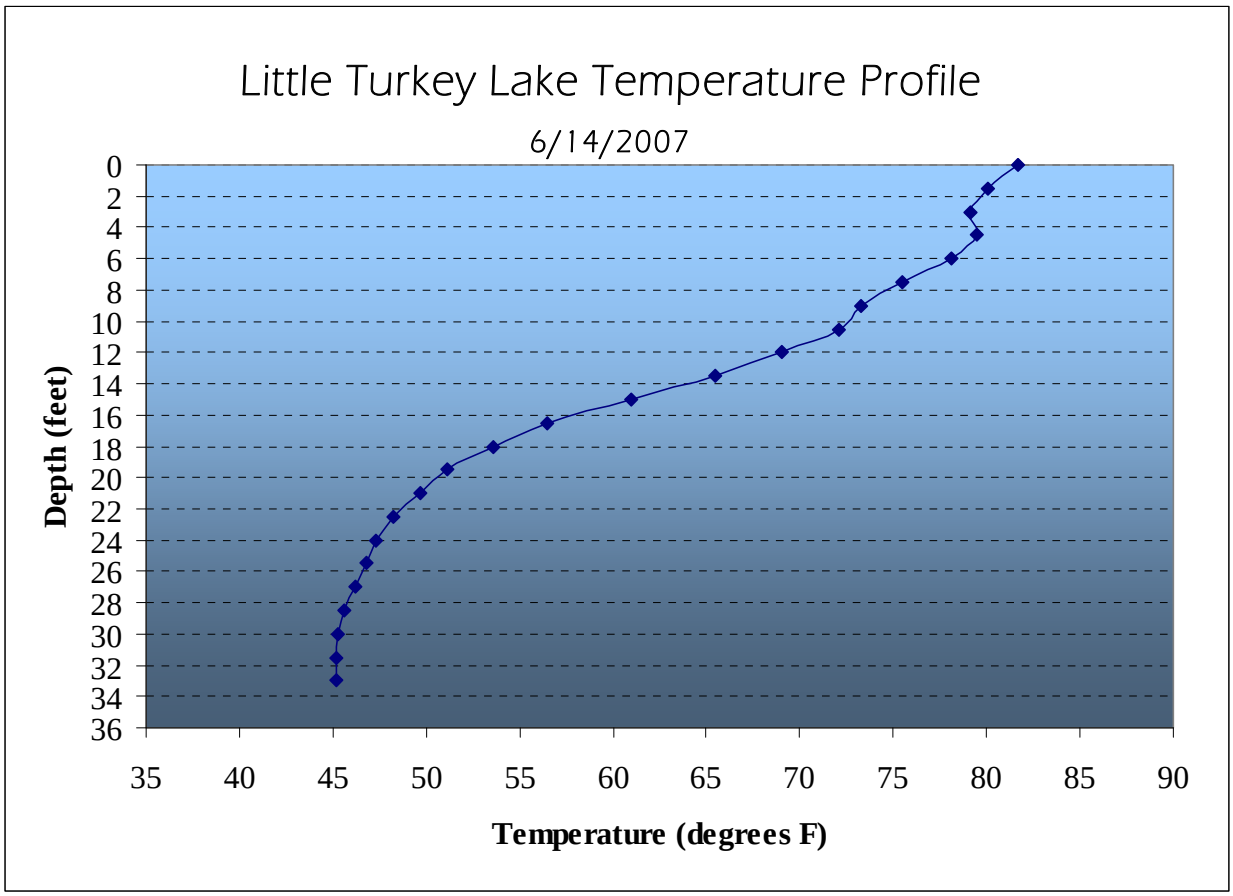
Figure 3: Little Turkey Lake Dissolved Oxygen Profile



The metalimnion is the transition zone between the surface water and the deep water. It is usually accompanied by rapid changes in dissolved oxygen and temperature. The metalimnion in Little Turkey Lake was between 6 and 18 feet, characterized by a loss of dissolved oxygen and a decrease in temperature.

The thermocline is a rapid temperature change associated with the transition from surface water to deep water. In Little Turkey Lake water temperature remains stable from the surface down to 6 feet. Temperature then drops rapidly with depth. This indicates a thermocline beginning at 6 feet (Figure 4).

Figure 4: Little Turkey Lake Temperature Profile



3.0 Lake Uses

Little Turkey Lake receives moderate high levels of public use during the summer months. Little Turkey Lake has an IDNR public access site located on the south shore of the lake just off of county road 350 South. This access site has limited parking (7-9 vehicles) but also adds to the number of boats using the lake. Figure 5 shows the Little Turkey Lake public access site.

Figure 5: Little Turkey Lake Public Access Site

Little Turkey Lake has a 10 mile per hour speed limit, which helps limit excessive boat traffic and excessive speeds. The lake is unique in that only about a third of the lake is developed. The lake has several small islands, and a large section of wooded shoreline, especially in the northeast corner of the lake. These attributes, along with the lake's speed limit make it a very peaceful location for fishing and wildlife viewing. Figure 6 shows a portion of the wooded shoreline of Little Turkey Lake.

Figure 6: Little Turkey Lake Wooded Shoreline

Figure 7 shows features and some lake uses for Little Turkey Lake.

Figure 7: Little Turkey Lake Uses

4.0 Fisheries Update

District 2 Fisheries biologists Neil Ledet and Larry Koza provided the most recent fisheries survey information for Little Turkey Lake. Fisheries surveys have been conducted on Little Turkey Lake in 1977, 1985, 1993, and 2003. Table 2 summarizes fish sampling for each of these fisheries surveys.

Table 3: Fisheries Capture History
Historic capture summary for Little Turkey Lake

Species	1977	1985	1993	2003
Bluegill	412	658	807	338
Pumpkinseed	166	63	192	141
Bullheads	72	60	28	12
Largemouth bass	57	137	91	129
Warmouth	47	16	16	28
Redear	26	0	23	0
Bowfin	20	3	0	2
Black crappie	17	21	70	62
Lake chubsucker	10	10	3	0
Northern pike	6	2	1	0
Golden shiner	6	0	149	8
Yellow perch	6	9	63	47
Spotted gar	5	13	29	21
Green sunfish	5	3	4	0
White sucker	2	11	67	22
Golden redhorse	2	2	13	4
Carp	0	4	14	3
Other	4	4	19	13
Total	863	1016	1589	830
Sampling effort				
Electrofishing hrs.	1.75	1	0.75	0.75
Gill net lifts	9	9	9	6
Trap net lifts	0	0	6	3

Bluegill				
3 - 5.5 in.	249	378	499	175
6 - 6.5 in.	137	224	142	33
7 - 7.5 in.	14	23	92	39
>= 8 in.	0	0	0	5

Largemouth bass				
8 - 9.5 in.	16	57	14	35
10 - 11.5 in.	4	15	29	39
12 - 13.5 in.	1	15	7	29
14 - 17.5 in.	0	7	5	4
>=18 in.	0	1	0	2

Table 4 summarizes data from the most recent fisheries survey conducted in 2003. Bluegills were the most common species collected in this survey, followed by pumpkinseeds and largemouth bass. Two walleyes were also found in this survey which is likely the result of private stockings.

Table 4: 2003 Fisheries Survey Summary

SPECIES AND RELATIVE ABUNDANCE OF FISHES COLLECTED BY NUMBER AND WEIGHT					
*COMMON NAME OF FISH	NUMBER	PERCENT	LENGTH RANGE (inches)	WEIGHT (pounds)	PERCENT
Bluegill	338	40.7	1.4 - 8.3	25.08	9.9
Pumpkinseed	141	17.0	2.6 - 7.3	17.71	7.0
Largemouth bass	129	15.5	4.8 - 19.0	74.49	29.5
Black crappie	62	7.5	5.3 - 12.5	21.14	8.4
Yellow perch	47	5.7	4.9 - 10.2	9.50	3.8
Warmouth	28	3.4	3.1 - 8.1	6.15	2.4
White sucker	22	2.6	7.0 - 18.2	31.03	12.3
Spotted gar	21	2.5	16.8 - 31.2	28.67	11.3
Yellow bullhead	11	1.3	9.0 - 11.2	6.28	2.5
Hybrid sunfish	10	1.2	3.3 - 7.2	1.45	0.6
Golden shiner	8	1.0	6.3 - 9.2	1.41	0.6
Golden redhorse	4	0.5	12.1 - 17.2	5.03	2.0
Common carp	3	0.4	10.7 - 25.7	9.95	3.9
Bowfin	2	0.2	18.8 - 26.8	8.74	3.5
Walleye	2	0.2	16.9 - 21.2	4.52	1.8
Brown bullhead	1	0.1	13.5	1.03	0.4
Log perch	1	0.1	4.3	0.03	**
Rock bass	1	0.1	8.6	0.40	0.2
Brook silversides	present				
Total (19 Species)	831			252.61	

The following is an excerpt from the 2003 IDNR fisheries report. This is only an excerpt and not the entire report. It summarizes the fish community at Little Turkey Lake. Aquatic Weed Control would like to thank District 2 fisheries biologists Neil Ledet and Larry Koza for providing this information.

"Little Turkey Lake continues to support a satisfactory sport fishery. Bluegill, largemouth bass, black crappie and yellow perch represent the best angling opportunities. Combined these species comprised approximately 78% of the sample by number and 52% by weight. Although bluegill is the dominant species in the lake, the percentage of harvestable size bluegill in the population continues to decline. Only 22.8% of the bluegill collected this year were harvestable size. Largemouth bass numbers appear to have changed very little although the percentage of harvestable size fish has declined from the previous two surveys. Black crappie and yellow perch are not present in large numbers but do contribute to the fishery.

The aquatic plant community at Little Turkey Lake is very diverse. Eurasian water milfoil continues to be a problem in a large portion of the lake. Milfoil weevil was introduced into the lake several years ago in an attempt to determine it's effectiveness in controlling nuisance milfoil. The study is still ongoing and it is unknown when the final results will be available. However, milfoil densities in late July when DFW biologists conducted the plant survey on the lake were lower than those observed in June when the fish survey was conducted.

There is some erosion along the marl banks on the north shore of the lake. This is the only location on the lake where erosion appears to be prevalent.

No fish diseases or parasites were observed during the survey.

No additional fish management is recommended at this time."

5.0 Problem Statement

Eurasian watermilfoil, curly leaf pondweed and brittle naiad are all exotic species found in Little Turkey Lake. Of these three species Eurasian watermilfoil is many times considered a highest priority when considering funding requests because of its aggressive growth and detrimental effects to the plant community.

In lakes where Eurasian milfoil is left unchecked, well-diversified plant communities can be decimated, although in some lakes native plants compete well with Eurasian watermilfoil. Eurasian milfoil has the ability to "overwinter," giving it a distinct growth advantage over many native plants. The milfoil lies dormant during the winter months instead of dying back completely, as do many natives. As spring arrives, the dormant milfoil plants have a head start on many native plants and reach the surface faster, shading out the natives. Eurasian milfoil grows profusely, provides poor fish habitat, inhibits boat navigation, and causes annoyances and even recreational hazards to skiers, swimmers, and other members of the public wishing to enjoy the lake.

In Little Turkey Lake, Eurasian watermilfoil is found throughout the lake. Site frequency was 36.0% in June of 2007, and 24.0% in August of 2007. The heaviest areas of infestation are near shore, as plants were only found to a depth of 8 to 9 feet in 2007. Eurasian watermilfoil forms very dense beds in many areas of Little Turkey Lake. Figure 8 shows a dense Eurasian watermilfoil bed in Little Turkey Lake.

Figure 8: Little Turkey Lake Eurasian Watermilfoil Bed

6.0 Management Goals and Objectives

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

1. Develop or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality and is resistant to minor habitat disturbances and invasive species.

2. Direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species.

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

Specific Objectives:

Should a Sonar treatment be conducted, one specific measurable goal would be to reduce Eurasian watermilfoil to the point that it is undetectable in the year of treatment. This is not a guarantee but an ideal outcome of the Sonar treatment.

Specific objectives are needed to ensure that the fundamental goals of the LARE program are met. The following steps are recommended to help achieve LARE management goals for Little Turkey Lake.

1. **Areas infested with Eurasian watermilfoil should be treated with herbicides.** Aquatic Weed Control recommends that the whole lake be treated with Sonar using a “6 bump 6” program. This is explained in more detail in the integrated treatment strategy.

2. **Vegetation surveys should be conducted to evaluate the plant community both before and after treatment in 2008.** A visual vegetation survey will be conducted in spring of 2008 to develop a Eurasian watermilfoil treatment map. A late season Tier II vegetation survey should be conducted after any herbicide treatments to evaluate the plant community.

7.0 Plant Management History

Eurasian watermilfoil weevils were stocked in Little Turkey Lake in 2000. The following press release was issued by the IDNR and summarizes this project.

For immediate release: June 6, 2000

Native insects employed to attack invasive plant

Lagrange, Whitley and Monroe county lakes to benefit from test

Tiny aquatic insects - weevils - will be stocked in two test lakes in northern Indiana and in one southern Indiana reservoir to control Eurasian watermilfoil, a plant that is an overwhelming nuisance in some Indiana lakes. The State Soil Conservation Board recently approved a grant of up to $43,650 for a demonstration project using aquatic insects to control Eurasian watermilfoil (Myriophyllum spicatum), which is an exotic plant not originally from North America.

This aquatic plant looks like a green bottlebrush, but invades lakes by rooting in soft soil and growing rapidly to form dense mats at the surface of the water. Eurasian watermilfoil crowds out desirable native plants, does not provide food for waterfowl or wildlife, and can make waterways unsuitable for boating, fishing, and swimming. The plant was first detected in Washington, D.C. in 1942. Eurasian watermilfoil is currently reported in 175 Indiana lakes and reservoirs. This summer, tiny milfoil eating weevils will be stocked in two test lakes in northern Indiana, Little Turkey Lake (Lagrange County) and Round Lake (Whitley County), and in one southern Indiana reservoir, Griffy Lake (Monroe County).

Lake associations and the City of Bloomington Parks and Recreation Department are providing local funds and cooperation to match the state grant for stocking and monitoring the weevils. These insects burrow into and destroy pest plants, but do not attach to swimmers or animals in the water. A supplier in Ohio (EnviroScience, Inc.) cultures and markets the weevils under the trade name MiddFoil(r). The company will stock several thousand of the insects on plant beds around the three demonstration lakes in Indiana. Another contractor will monitor the project to determine the success of the weevil treatment. Over the course of the project, Dr. Robin Scribailo, a professor of botany at Purdue University North Central and consultant for Aquatic Restoration Systems, LLC, will be measuring the extent of the milfoil, numbers of weevils, effects on other plants, and potential as a control agent in Indiana lakes.

Control of this plant can be very difficult. Mechanical harvesting actually spreads milfoil. As the harvester chops the plants, the broken pieces can drift to other areas, take root in the lake soil, and form new plant beds. Herbicides that are effective against milfoil are also very expensive and may have damaging effects on other plants or animals in the water. Control by these methods is usually temporary due to repeated introduction of the plants as boat trailers bring fragments from other infected lakes.

Biological control (introducing a specific predator or plant disease) can provide long-term management of a pest plant without harming beneficial plants, animals or humans. Once established, the control agent can maintain itself, reducing the need for repeated treatments.

Research at lakes in Minnesota, Vermont, Illinois, and Ohio shows that a North American weevil (Euhrychiopsis lecontei) prefers nesting in the exotic species of milfoil instead of native plants. The weevil lays its eggs on the tips of the milfoil plant. When the young hatch, they burrow down the stem, eat their way through the plant, and slow plant growth by shearing the top of the plant below the water surface. In test lakes, weevil stocking dramatically decreased large mats of Eurasian watermilfoil over a period of three to five years to a level that did not create a nuisance. The weevil occurs naturally in Minnesota, Wisconsin, and Illinois, and was recently discovered in northern Indiana at Saugany Lake in LaPorte County.

District 2 Fisheries biologists were contacted to determine vegetation control permit records for Little Turkey Lake. Private herbicide treatments are not widespread on Little Turkey Lake. The majority of shoreline is not developed. Coontail and Eurasian watermilfoil are the major problem plants along the developed south and southwest shore of the lake.

8.0 Aquatic Plant Community Characterization Update

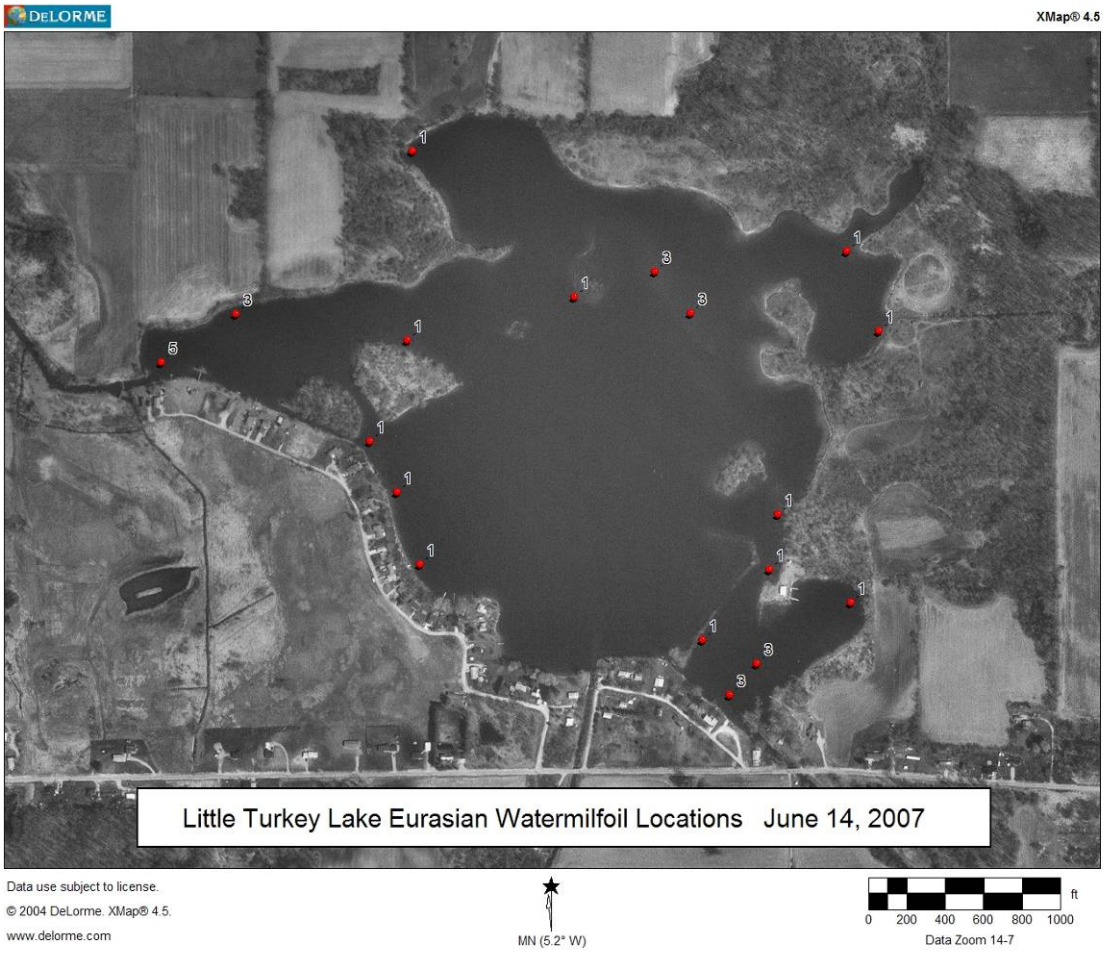
All lake management plans submitted for LARE funding must be accompanied by lake-wide aquatic vegetation surveys. These surveys are used to ensure that the plant community of the entire lake is adequately characterized. They provide information about the overall structure of the plant community, and describe species distribution and abundance in detail.

Two surveys are conducted on each lake in the first year it is involved in the LARE program. One survey is conducted in the spring and another is conducted later in the summer. This two-survey process is essential in providing an accurate representation of all plant species in a lake. Some species such as eel grass (*Vallisneria americana*) are not prevalent until summer and may be under-represented if only one survey was conducted in the spring. Other species such as curly-leaf pondweed (*Potamogeton crispus*) are prevalent in the spring and die off in the summer. This species would be under-represented if only one survey was conducted in the summer. Because of the diverse life cycles of different plants, multiple surveys increase the chance of accurately representing all of the species in a lake

Tier II survey protocols have been established by the IDNR to ensure that each lake is surveyed in the same manner. These surveys reduce subjectivity and provide a consistent basis for the evaluation of a lake's plant community from year to year, as well as a basis for comparing the plant communities of different lakes. They provide quantifiable results that are vital for monitoring the success of management programs. In short, these vegetation surveys are the foundation for describing an aquatic plant community and proposing an effective management strategy.

Figure 9 shows Eurasian watermilfoil distribution in Little Turkey Lake in June of 2007.

Figure 9: June 2007 Eurasian Watermilfoil Distribution



8.1 Methods

This section provides an overview of the purpose and procedures behind the Tier II vegetation surveys. The common goal of these surveys is to accurately describe the aquatic plant community of any particular lake. Standard procedures are established to ensure that:

1. The same survey procedures are used for each lake applying for funding.

2. Subjectivity is kept to a minimum to maintain scientific integrity.

3. The sample size for each survey adequately describes the plant community.

4. All data from each lake is recorded and analyzed in the same format.

In short, procedural and analytical consistency makes data from different surveys suitable for comparison and evaluation, while increasing its reliability and overall utility for evaluating the health of a plant community.

The Tier II survey involves using a specially designed rake to collect plants from numerous sites throughout the entire lake. At each site, each species found is recorded, and given an abundance rating based on the amount collected.

8.1.2 Tier II

The purpose of Tier II surveys is to document the distribution and abundance of submersed and floating-leaved aquatic vegetation throughout a lake (IDNR, 2004). A specific number of sample sites are selected based on the amount of surface acreage the lake possessed. Once sample sites are determined, sampling is accomplished using an aquatic vegetation sampling rake constructed according to the guidelines of the 2007 Tier II random sampling procedure manual.

Aquatic vegetation collected at each sample site is sorted according to species, and given a value to represent its abundance at that site. These values are recorded on data sheets distributed by the IDNR. These records are used for data analysis that served to characterize the aquatic vegetation community of a lake.

Random Sampling:

The Tier II survey protocol was updated by the IDNR in 2007. New LARE Tier II protocol requires that sample sites be stratified by depth contour, and that data analysis be provided for each depth contour. Rake scores for plant species are recorded as 1, 3, or 5, as opposed to the original scoring system of 1, 2, 3, 4, or 5.

The number of sample sites needed for a Tier II survey still is based on both lake size and trophic state, as it was in 2006. Trophic state describes the productivity of a lake and is correlated with plant growth, secchi disk, and nutrient availability. There are 4 different trophic states listed by the IDNR: Oligotrophic, Mesotrophic, Eutrophic, and Hypereutrophic. Oligotrophic lakes usually have clear water and few nutrients, while Hypereutrophic lakes usually have deeply stained water and are nutrient rich. Table 5 is taken from the IDNR 2006 Tier II protocol and shows the maximum depth that must be sampled for a lake in each trophic state. In oligotrophic lakes, where water is clear, plants may be able to grow in up to 25 feet of water because sunlight may still reach the lake bottom in deep water. In hypereutrophic lakes where water is turbid, lack of sunlight will prevent plants from growing in deep water, so the maximum sampling depth is only 10 feet.

Table 5: Sample Depth by Trophic State

Trophic State	Maximum Depth of Sampling (ft)
Hypereutrophic	10
Eutrophic	15
Mesotrophic	20
Oligotrophic	25

Table 6 is used to calculate the number of sample sites need in each depth contour by using lake size and trophic status. The new protocol attempts to more accurately describe the entire littoral zone of a lake and provide more detailed data analysis by separating the littoral zone into 5 foot depth segments.

Table 6: Sample Sites by Lake Size and Trophic State

Tier II Sampling 3

Table 3. Sample size requirements as determined by lake size, trophic state, and apportioned by depth class.

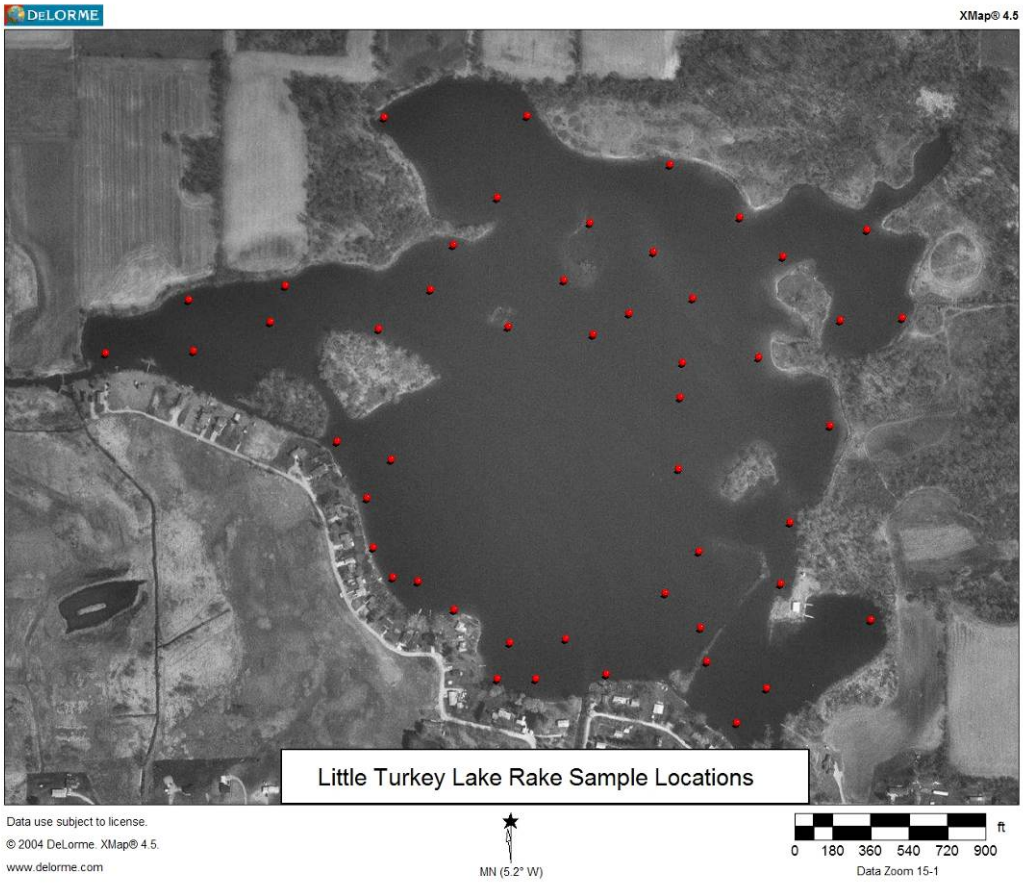
		Hypereutrophic		Eutrophic			Mesotrophic				Oligotrophic				
Lake Acres	Total # of Sites	0-5 foot contour	5-10 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	15-20 foot contour	0-5 foot contour	5-10 foot contour	10-15 foot contour	15-20 foot contour	20-25 foot contour
<10	20	10	10	10	7	3	10	5	3	2	10	4	3	2	1
10-49	30	20	10	10	10	10	10	10	7	3	10	10	5	3	2
50-99	40	30	10	17	13	10	10	10	10	10	10	10	10	7	3
100-199	50	40	10	23	17	10	14	14	12	10	10	10	10	10	10
200-299	60	50	10	30	20	10	18	16	16	10	14	12	12	12	10
300-399	70	60	10	37	23	10	22	20	18	10	17	15	14	14	10
400-499	80	70	10	43	27	10	25	23	22	10	19	18	17	16	10
500-799	90	80	10	50	30	10	29	27	24	10	22	21	19	18	10
>=800	100	90	10	57	33	10	33	31	26	10	25	23	22	20	10

Little Turkey Lake is classified by the IDNR as eutrophic with 135 surface acres. Based on these characteristics 50 sample sites were taken by Aquatic Weed Control. These sites were divided between each 5 foot depth contour of the littoral zone.

8.2 Tier II Results

Two Tier II surveys were conducted by Aquatic Weed Control on Little Turkey Lake in 2007. The first survey took place on June 14, 2007 and the second took place on August 1, 2007. Secchi depth was measured at 3.2 in both the June and the August survey. Nine plant species were collected in June, while 11 plant species were collected in the August survey. Figure 10 shows all rake sample locations for the 2007 Tier II surveys on Little Turkey Lake.

Figure 10: Little Turkey Lake Rake Sample Locations



Tier II Data Analysis

The following tables are data summaries for the 2007 Tier II aquatic vegetation surveys. These tables help to describe the plant community, and will help identify any changes that take place in the years to come. Tables labeled "Overall" include every sample site in the survey, while the other tables describe each five foot depth contour of the lake's littoral zone (0-5 feet, 5-10 feet, etc). Calculations for these tables include null values for each sample site where no plants were collected.

June 2007 Data Analysis

Table 7: June 2007 Data Analysis - Overall

Occurrence and Abundance of Submersed Aquatic Plants - Overall

Lake:	Little Turkey	Secchi:	3.2	SE Mean Species/site:	0.2
Date:	6/14/07	Littoral sites with plants:	34	Mean natives/site:	1.10
Littoral depth (ft):	9.0	Number of species:	9	SE Mean natives/site:	0.15
Littoral sites:	40	Maximum species/site:	5	Species diversity:	0.79
Total sites:	50	Mean number species/site:	1.52	Native diversity:	0.71

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Coontail	40.0	8.0	28.0	4.0	22.4
Eurasian Watermilfoil	36.0	24.0	10.0	2.0	12.8
Chara	34.0	26.0	4.0	4.0	11.6
Sago Pondweed	26.0	16.0	10.0	0.0	9.2
Brittle Naiad	4.0	4.0	0.0	0.0	0.8
Whorled Watermilfoil	4.0	4.0	0.0	0.0	0.8
Elodea	2.0	0.0	2.0	0.0	1.2
Bladderwort	2.0	2.0	0.0	0.0	0.4
Curly-leaf Pondweed	2.0	2.0	0.0	0.0	0.4
Small Pondweed	2.0	2.0	0.0	0.0	0.4

Table 8: June 2007 Data Analysis 0 - 5 Feet

Occurrence and Abundance of Submersed Aquatic Plants 0-5 Feet

Lake:	Little Turkey	Secchi:	3.2	SE Mean Species/site:	0.27
Date:	6/14/07	Littoral sites with plants:	21	Mean natives/site:	1.52
Littoral depth (ft):	9.0	Number of species:	8	SE Mean natives/site:	0.21
Littoral sites:	23	Maximum species/site:	5	Species diversity:	0.80
Total sites:	23	Mean number species/site:	1.96	Native diversity:	0.72

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Chara	52.2	34.8	8.7	8.7	20.9
Coontail	47.8	8.7	34.8	4.3	27.0
Sago Pondweed	39.1	21.7	17.4	0.0	14.8
Eurasian Watermilfoil	34.8	26.1	8.7	0.0	10.4
Elodea	4.3	0.0	4.3	0.0	2.6
Brittle Naiad	4.3	4.3	0.0	0.0	0.9
Curly-leaf Pondweed	4.3	4.3	0.0	0.0	0.9
Small Pondweed	4.3	4.3	0.0	0.0	0.9
Whorled Watermilfoil	4.3	4.3	0.0	0.0	0.9

Table 9: June 2007 Data Analysis 5 - 10 Feet

Occurrence and Abundance of Submersed Aquatic Plants 5-10 Feet					
Lake:	Little Turkey	Secchi:	3.2	SE Mean Species/site:	0.36
Date:	6/14/07	Littoral sites with plants:	13	Mean natives/site:	1.18
Littoral depth (ft):	9.0	Number of species:	6	SE Mean natives/site:	0.27
Littoral sites:	17	Maximum species/site:	5	Species diversity:	0.77
Total sites:	17	Mean number species/site:	1.82	Native diversity:	0.69

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Eurasian Watermilfoil	58.8	35.3	17.6	5.9	23.5
Coontail	52.9	11.8	35.3	5.9	29.4
Chara	29.4	29.4	0.0	0.0	5.9
Sago Pondweed	23.5	17.6	5.9	0.0	7.1
Bladderwort	5.9	5.9	0.0	0.0	1.2
Brittle Naiad	5.9	5.9	0.0	0.0	1.2
Whorled Watermilfoil	5.9	5.9	0.0	0.0	1.2

August 2007 Data Analysis

Table 10: August 2007 Data Analysis - Overall

Occurrence and Abundance of Submersed Aquatic Plants - Overall					
Lake:	Little Turkey	Secchi:	3.2	SE Mean Species/site:	0.23
Date:	8/1/07	Littoral sites with plants:	32	Mean natives/site:	1.16
Littoral depth (ft):	8.0	Number of species:	11	SE Mean natives/site:	0.18
Littoral sites:	39	Maximum species/site:	5	Species diversity:	0.85
Total sites:	50	Mean number species/site:	1.68	Native diversity:	0.77

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Coontail	36.0	14.0	1.0	12.0	20.8
Sago Pondweed	32.0	24.0	8.0	0.0	9.6
Brittle Naiad	26.0	12.0	10.0	4.0	12.4
Eurasian Watermilfoil	24.0	18.0	4.0	2.0	8.0
Chara	24.0	22.0	2.0	0.0	5.6
Illinois Pondweed	12.0	4.0	6.0	2.0	6.4
Slender Naiad	4.0	2.0	2.0	0.0	1.6
Bladderwort	2.0	0.0	2.0	0.0	1.2
Curly-leaf Pondweed	2.0	2.0	0.0	0.0	0.4
Elodea	2.0	2.0	0.0	0.0	0.4
Flat-stemmed Pondweed	2.0	2.0	0.0	0.0	0.4
Small Pondweed	2.0	2.0	0.0	0.0	0.4
Filamentous Algae	8.0				

Table 11: August 2007 Data Analysis 0 - 5 Feet

Occurrence and Abundance of Submersed Aquatic Plants 0-5 Feet

Lake:	Little Turkey	Secchi:	3.2	SE Mean Species/site:	0.27
Date:	8/1/07	Littoral sites with plants:	22	Mean natives/site:	1.83
Littoral depth (ft):	8.0	Number of species:	10	SE Mean natives/site:	0.25
Littoral sites:	23	Maximum species/site:	5	Species diversity:	0.85
Total sites:	23	Mean number species/site:	2.52	Native diversity:	0.78

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Coontail	56.5	30.4	8.7	17.4	28.7
Sago Pondweed	47.8	30.4	17.4	0.0	16.5
Eurasian Watermilfoil	34.8	26.1	8.7	0.0	10.4
Chara	34.8	30.4	4.3	0.0	8.7
Brittle Naiad	30.4	17.4	13.0	0.0	11.3
Illinois Pondweed	21.7	8.7	8.7	4.3	11.3
Slender Naiad	8.7	4.3	4.3	0.0	3.5
Bladderwort	4.3	0.0	4.3	0.0	2.6
Curly-leaf Pondweed	4.3	4.3	0.0	0.0	0.9
Elodea	4.3	4.3	0.0	0.0	0.9
Small Pondweed	4.3	4.3	0.0	0.0	0.9
Filamentous Algae	17.4				

Table 12: August 2007 Data Analysis 5 - 10 Feet

Occurrence and Abundance of Submersed Aquatic Plants 5-10 Feet

Lake:	Little Turkey	Secchi:	3.2	SE Mean Species/site:	0.39
Date:	8/1/07	Littoral sites with plants:	10	Mean natives/site:	0.94
Littoral depth (ft):	8.0	Number of species:	7	SE Mean natives/site:	0.28
Littoral sites:	16	Maximum species/site:	5	Species diversity:	0.80
Total sites:	17	Mean number species/site:	1.53	Native diversity:	0.73

			Score Frequency		
Common Name	**Site Frequency**	**1**	**3**	**5**	**Dominance**
Brittle Naiad	35.3	11.8	11.8	11.8	21.2
Coontail	29.4	0.0	17.6	11.8	22.4
Sago Pondweed	29.4	29.4	0.0	0.0	5.9
Eurasian Watermilfoil	23.5	17.6	0.0	5.9	9.4
Chara	23.5	23.5	0.0	0.0	4.7
Illinois Pondweed	5.9	0.0	5.9	0.0	3.5
Flat-stemmed Pondweed	5.9	5.9	0.0	0.0	1.2
Filamentous Algae	0.0				

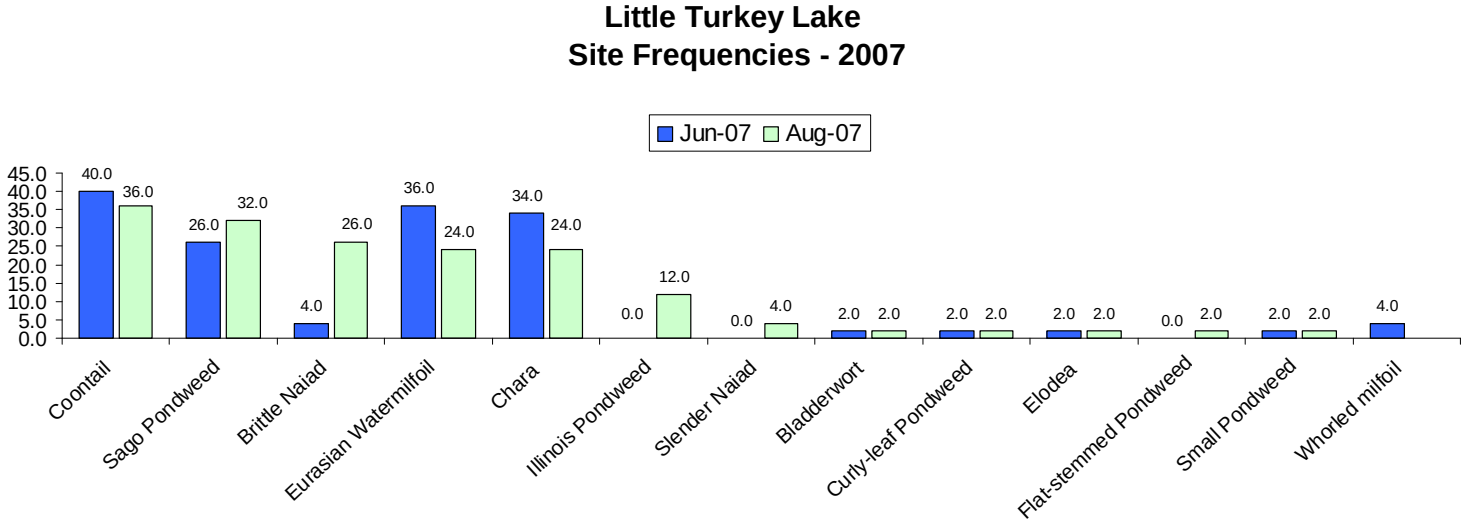
Site Frequency

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

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

Table 13 shows site frequencies for every plant collected in the 2007 Tier II surveys. Coontail was the most frequently collected plant in both surveys in 2007. Eurasian watermilfoil was the second most frequently collected plant in spring, and appeared to show a small amount of natural die off as the year progressed. Chara and sago pondweed, two native species were also collected frequently in both surveys.

Table 13: 2007 Site Frequencies



Species Diversity

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

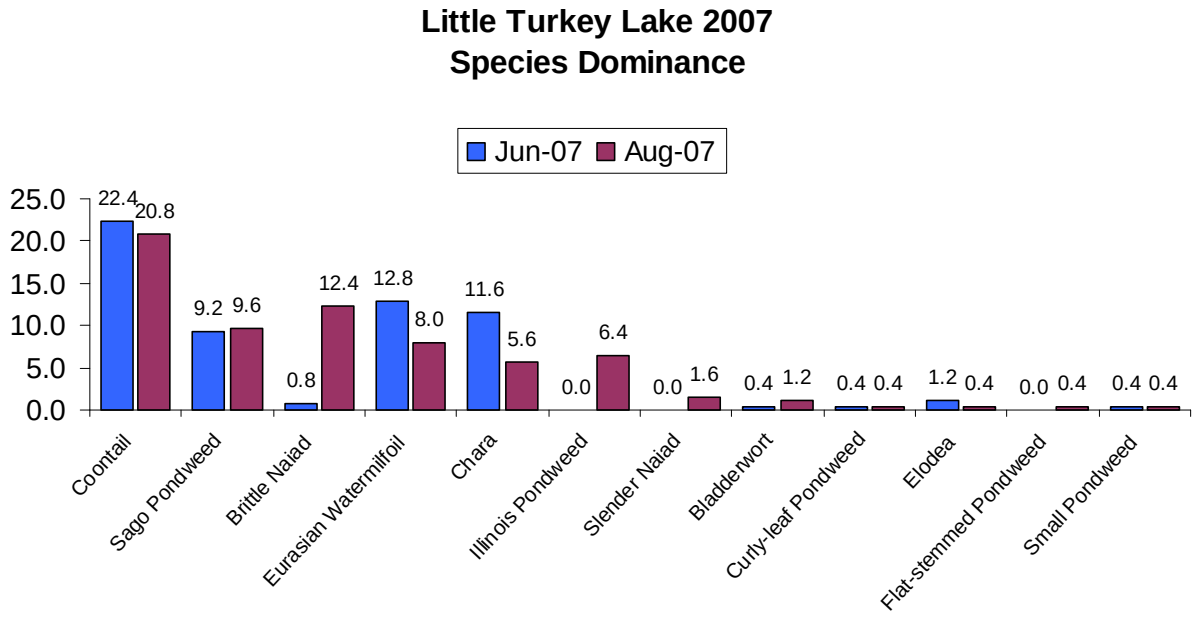
The species diversity index for Little Turkey Lake in June of 2007 was 0.79 which is above average when compared with Pearson's study of area lakes. Species diversity in August of 2007 was 0.85. Native species diversity scores were slightly lower, at 0.71 in June and 0.77 in August. This means that exotic species account for some of the diversity in Little Turkey Lake.

Species Dominance

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

Table 14 tracks dominance values for each plant collected at Little Turkey Lake in 2007. Trends are similar to site frequency, with coontail being the most dominant plant in both 2007 surveys. Eurasian watermilfoil was the second most dominant plant in both surveys. Illinois pondweed, which was not collected in June of 2007, had a dominance score of 6.4 in August.

Table 14: 2007 Species Dominance



Since Little Turkey Lake has not been intensely surveyed in recent years, it is recommended that the sampling protocol remain the same for 2008. Plants were only found in depths of up to 9 feet in 2007, while rake samples were taken to a depth of 15 feet. If no plants are found in depths of over 9 feet in 2008, the sampling protocol may be modified.

Little Turkey Lake has historically had low water clarity, as indicated by past fisheries survey data. Coontail and Eurasian watermilfoil have both been abundant in the lake for sometime. Four fisheries surveys have been conducted since 1977, but a specific mention of plant depth has not been found in the fisheries summary. For these reasons it is recommended that sampling depth remain at 15 feet in 2008.

8.3 Macrophyte Inventory Discussion

Based upon 2007 survey data, Little Turkey Lake has a submersed aquatic plant community with relatively high diversity when compared with many area lakes, although 6 six species had very low site frequency. Species richness in Little Turkey Lake was 9 species in June of 2007 and 11 species in August of 2007. The plant community is dominated by coontail and Eurasian watermilfoil. Coontail had site frequencies of 40% and 36% in the 2007 surveys. Eurasian watermilfoil had site frequencies of 36% and 24% in 2007.

It is unknown if weevil stockings are still having any effect on the Eurasian watermilfoil population in Little Turkey Lake. It is interesting that there was a slight decrease in Eurasian watermilfoil frequency from June to August (36% to 24%). No obvious damage to milfoil plants was observed in the August survey, although this is not to say that weevils could not have contributed to the decline in sight frequency. Declines in Eurasian watermilfoil sight frequency have also been observed in lakes where no weevil stockings have taken place (Big Lake in Noble County, Lake of the Woods in Marshall County). These lakes also have low water clarity similar to Little Turkey Lake.

The large portion of undeveloped shoreline on the northeast section of the lake is definitely a beneficial area that should be protected. Lilies and bulrushes are common along the edge of this section of lake. Residents boating in this area should use caution to disturb these plant beds as little as possible. Figure 11 shows one such bed of bulrushes on little Turkey Lake.

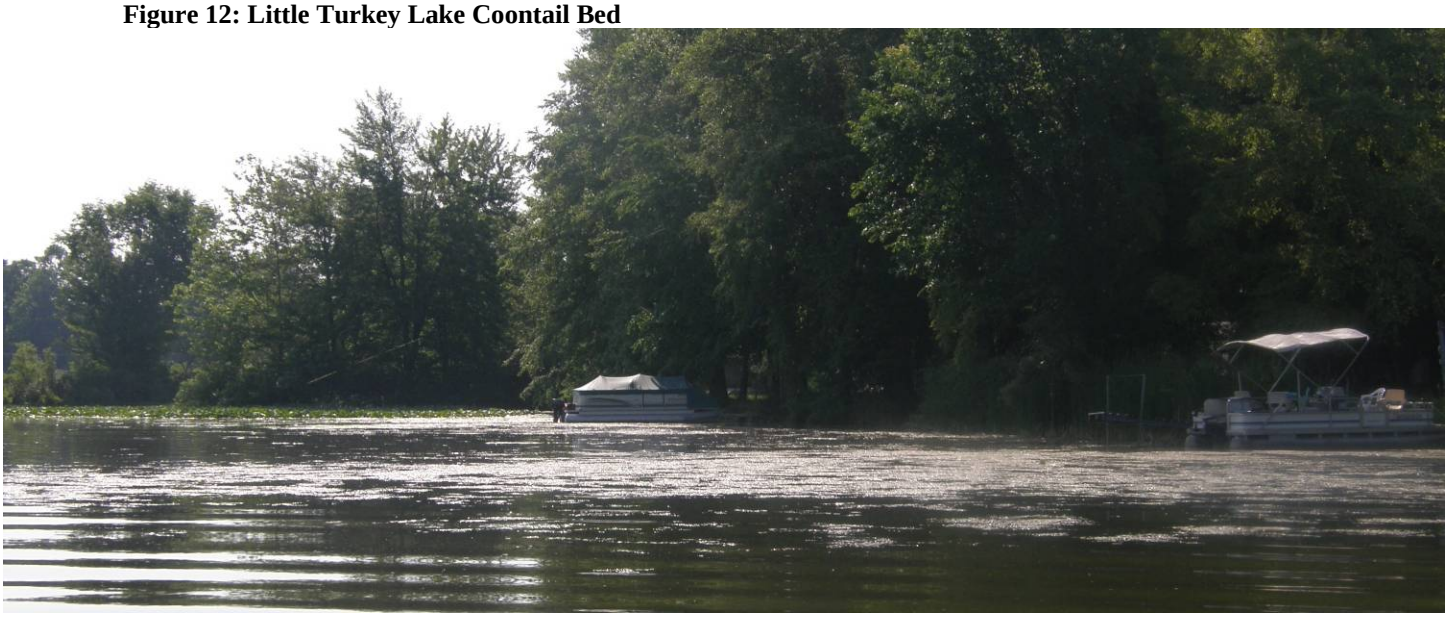
Figure 11: Little Turkey Lake Bulrush Bed

Plants in Little Turkey Lake were not collected in depths greater than 9 feet in 2007. This is likely due to low water clarity. Secchi depth readings were low at 3.2 feet in both surveys.

Eurasian watermilfoil showed some decline from June to August. This is likely a natural die off, as herbicide treatments on Little Turkey Lake are limited. This slight decline could be caused by low water clarity or high water temperatures in summer, or even milfoil weevils which were introduced in the lake in 2007. A similar trend has been noted in other northern Indiana lakes (Big Lake, Shipshewana Lake) with low water clarity.

Based on 2007 survey results, Eurasian watermilfoil is the main management concern in Little Turkey Lake. Coontail is also very abundant in Little Turkey Lake, but LARE funds will not be awarded for its control since it is a native plant. No matter what LARE treatment strategy is adopted for Little Turkey Lake, coontail will likely continue to cause recreational problems along piers and docks. It is important for lake residents to know that recreational problems from excessive vegetation will still be present after LARE herbicide treatments, and that coontail treatments must be privately funded. Figure 12 shows a dense plant bed dominated by coontail.

Figure 12: Little Turkey Lake Coontail Bed



In summary, Little Turkey Lake is characterized by a submersed plant community with high diversity (0.79 – 0.85), low water clarity (secchi depth 3.2 ft.) and abundant dense beds of Eurasian watermilfoil and coontail.

Threatened and Endangered Species

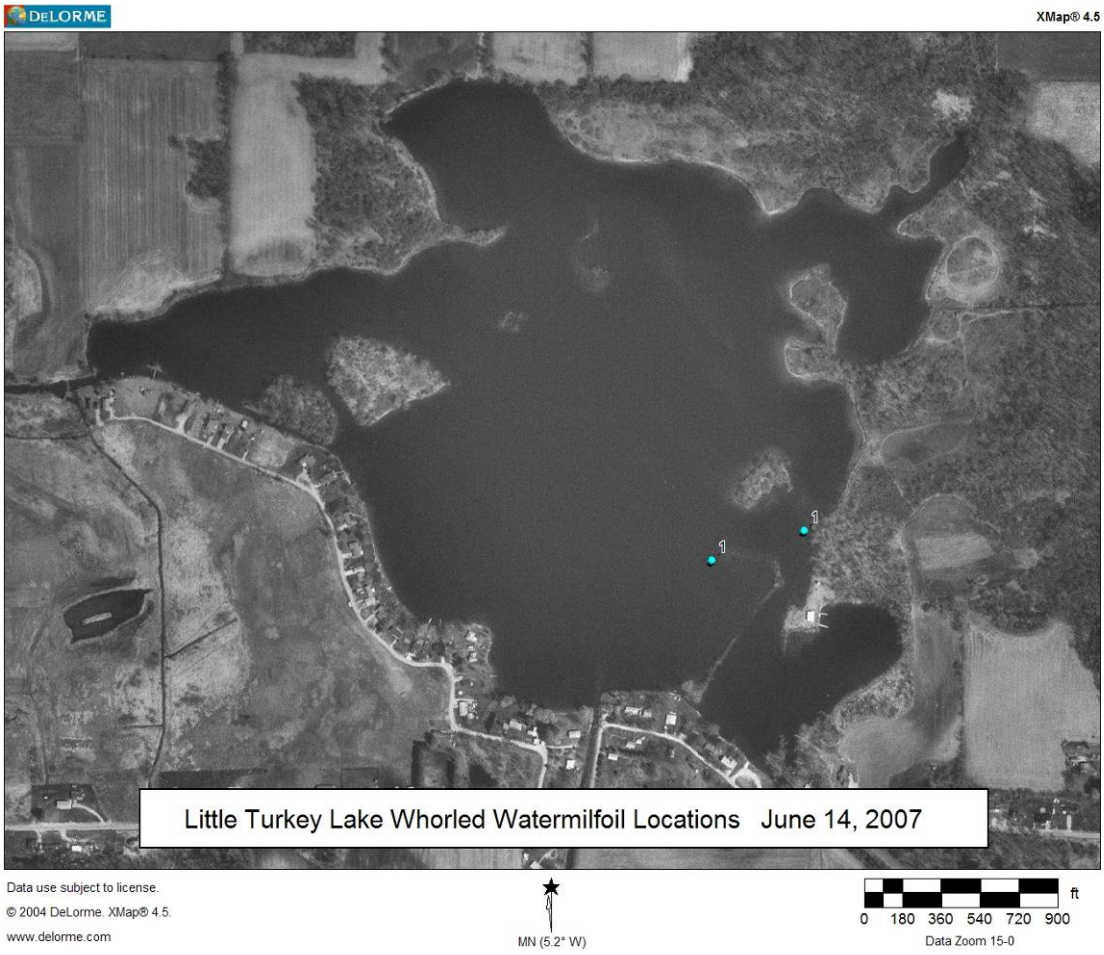
The Indiana Natural Heritage Data Center has compiled a list of Indiana plant species that are federally or state listed as endangered, threatened or rare. The following is an excerpt taken directly from the Indiana Natural Heritage Database website. Link: Indiana Natural Heritage Data Center.

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

One state listed species was found in Little Turkey Lake. Whorled watermilfoil is listed as widespread throughout the U.S. but rare in Indiana. Whorled watermilfoil is common in many

lakes in extreme northeast Indiana. Figure 13 shows its distribution in Little Turkey Lake. It was found at 2 sample sites in the spring but it was not found in the August survey in 2007.

Figure 13: Whorled Watermilfoil Locations



9.0 Aquatic Plant Management Alternatives

Little Turkey Lake currently has Eurasian watermilfoil distributed throughout the lake. Eurasian milfoil is believed to have arrived in North America in the mid 1940's and has spread throughout the east coast to northern Florida and the Midwest. Eurasian milfoil spreads by fragmentation and seed dispersal, and it has the ability to over-winter from year to year. Once it is in a lake it can become the dominant plant species because it forms dense canopies which shade out the native, more beneficial plant species below. There is also increasing evidence that mat forming species like Eurasian milfoil and curly leaf pondweed exert significant negative impacts on a broad range of aquatic organisms (Pullman, 1998)

Many management strategies have been used to control Eurasian milfoil in Indiana lakes. A management strategy should be chosen based on its selectivity of the pest in question, its long term effectiveness, and its environmental risks, The main goal of this plan is to choose a management option that can effectively control the Eurasian milfoil with little or no environmental risk, while causing no harm to native plant or fish species.

9.1 No Action

If no action is taken, the Eurasian milfoil abundance may increase from year to year. Eurasian milfoil grows by fragmentation, meaning that if the plant is cut, the fragment has the ability to form an entirely new plant. Eurasian milfoil also over-winters as an adult plant so new generations are created in each growing season. These reproductive characteristics cause milfoil beds to become more dense over time, which can create a monoculture as it may eliminate more and more native species from a lake.

9.2 Institutional-Protection of Beneficial Vegetation

Lake users can play an important role in the protection of beneficial aquatic vegetation. Aquatic invasive species often gain a foothold in an ecosystem in areas disturbed by human activity or natural processes. In many cases, boating may be restricted in certain areas of a lake to prevent harm to native plants, especially many emergent species. Boating lanes may be established through areas of emergent vegetation, and protected ecological zones may be created to prevent erosion of shoreline vegetation. Shallow areas of a lake may also be marked with buoys to prevent injury to boaters and water skiers. It is important to obey boating restrictions to protect beneficial plant species and even prevent personal injury.

A healthy aquatic plant community is absolutely essential for the maintenance of a stable, diverse ecosystem. Aquatic plants provide habitat for plankton, insects, crustaceans, fish, and amphibians. They take nutrients like phosphorus and nitrogen out of the water column, increase water clarity, prevent harmful algal blooms, produce oxygen and provide food for waterfowl. Aquatic plants can even remove pollutants from contaminated water, and prevent the suspension of particulate matter by stabilizing sediment and preventing erosion from wave action or current.

The LARE aquatic vegetation management program recognizes the importance of beneficial aquatic vegetation and its protection is a top priority. The most basic goal for the LARE aquatic vegetation program is to maintain healthy aquatic ecosystems by maintaining or improving biodiversity in Indiana lakes. The purpose of conducting aquatic vegetation surveys is to document the overall health of plant communities and identify any ecosystem whose stability is threatened by invasive plant species.

Once a problem area is identified, a management strategy must be formulated that directly impacts the aquatic plant community in a positive way. While eradicating invasive plants is a major component of many management strategies, it is important to note the ultimate goal is not to eradicate aquatic vegetation, but to protect beneficial vegetation and protect lake ecosystems.

9.3 Environmental Manipulation

9.3.1 Water Level Manipulation

Draw down of the lake water level is one option that may help the Eurasian milfoil problem. Lower water levels expose the Eurasian milfoil roots to freezing and thawing, which may kill may kill milfoil root systems. However, a lake draw down will not only kill Eurasian milfoil, but native plants as well. Also, reducing the lake level would make new areas of the lake available for vegetative growth, and Eurasian milfoil may have an advantage in the colonization of these new areas if it is not eradicated prior to the lake draw down.

Water level manipulation is probably not feasible for Little Turkey Lake since it has no structure that can raise or lower the water level.

9.3.2 Nutrient Reduction

Limiting factors for plant growth include light, lake morphometry and depth, substrate and the availability of nutrients like phosphorus and nitrogen. While lake morphometry is most highly correlated with plant biomass, the availability of phosphorus and nitrogen have a tremendous impact on the amount of plant growth in a body of water. If the vast majority of phosphorus in a system is tied up in plant matter, it may be difficult for an invasive species to gain a foothold and spread rapidly in the lake. If phosphorus is constantly being added to the system and is readily available in the water, then invasive species will have an unlimited food supply should a disturbance create the opportunity for them to proliferate in a body of water.

Phosphorus and nitrogen are added to aquatic systems by many natural sources, such as the decomposition of plant material, and animal waste, but human activity is often responsible for excessive phosphorus loading that contributes to blue-green algal blooms, overabundant vegetation growth and a general decline in water quality. Major contributions of excess phosphorus come from sources such as septic system inputs, agricultural runoff, storm water drainage, lawn fertilizer applications, , and improper disposal of grass clippings and tree leaves. Owners of lake front property can significantly reduce the amount of phosphorus entering the lake by taking actions outlined in the public education section.

www.epa.gov

9.4 Mechanical Controls

9.4.1 Mechanical Cutting and Harvesting

Mechanical harvesting uses a large machine to cut and collect unwanted aquatic plants. These machines pick up the cut weeds but will still leave small fragments that will have the ability to re-grow. Also, after an area is harvested the Eurasian milfoil generally re-grows first causing the native plants to be shaded out again. Mechanical harvesting is also not selective in its control. The harvesting will cut the native plant species as well as the exotics if both are present in the same area. For these reasons, mechanical harvesting is not recommended. Harvesting can be accomplished by individual owners around their dock areas. A lake property owner can

www.cleanlake.com

legally harvest a 625 square foot area. (25 feet by 25 feet).

9.5 Manual Controls

9.5.1 Hand Pulling, Cutting, Raking


www.ecy.wa.gov

Manual controls such as hand pulling, cutting and raking can be effective ways to control unwanted plants in certain situations. In very shallow clear water, small areas of vegetation can identified and cleared effectively by hand. Large areas of vegetation, especially those in deeper water can be extremely difficult to control using these methods. Many of the harvested weeds will break apart, leaving the root system in the lake bottom. Failure to remove root structures will result in re-growth.

Plants that possess the ability to reproduce through fragmentation can seldom be effectively controlled by these methods if they are distributed throughout a lake. Identifying every area of infestation would be difficult, as would harvesting the plants without causing fragmentation of individual plants. Any plant fragments not removed from the water can form new plants, meaning that hand pulling and cutting can facilitate the spread of the unwanted plant species.

9.5.2 Bottom Barriers

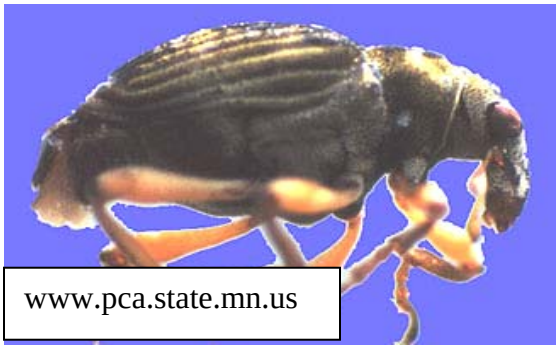
Bottom Barriers prevent the growth of aquatic plants by lining the bottom of a lake or pond with a material that prohibits light from reaching the lake bottom and that is difficult for plants to penetrate. Many times, plastic or concrete barriers are used to prevent the growth of aquatic vegetation during construction of a lake or pond. This from of control is best implemented during construction of a new pond, and placing a bottom barrier in an existing lake would involve significant challenges and be extremely expensive. A draw down of the lake may be necessary install the barrier, and if the lake level is not regulated by control structures, this can be almost impossible. For a large lake, material costs alone would be enormous.


www.ecy.wa.gov

Once in place, the barrier would prevent not only invasive plant growth, but native plant growth as well, destabilizing the lake ecosystem and having a negative impact on insect and fish communities. Sediment would gradually accumulate on top of the barrier, and aquatic plant growth would return as plants begin to take root in the sediment on top of the barrier. An IDNR permit is required for the placement of a bottom Barrier.

9.6 Biological Controls

9.6.1 Water Milfoil Weevil



www.pca.state.mn.us

The watermilfoil weevil is a native North American insect that consumes Eurasian milfoil and northern milfoil. The weevil was discovered after a decline in the Eurasian milfoil population was observed in Brownington Pond, Vermont (Creed and Sheldon, 1993). The milfoil weevil burrows down into the stem of the plant and consumes the tissue of the plant. Holes in the milfoil stem bored by weevil larvae allow disease to enter the plant. These same holes also cause a release of the plants' gases which reduces buoyancy and causes the plant to sink (Creed et. Al. 1992).

Studies conducted to evaluate the effectiveness of the water milfoil weevil have not yielded consistent results. Factors influencing the weevil's success or failure in a body of water are not well documented. In 2003, Scribailo and Alix conducted a weevil test on Round Lake in Indiana and found no conclusive evidence that the Eurasian milfoil populations were reduced. An IDNR permit is required for the stocking of the watermilfoil weevil.

9.6.2 Grass Carp

The Asian grass carp or white amur (*Ctenopharyngodon idella*) is an herbivorous fish that is native to eastern Russia and China. This fish has been introduced into the U.S. to help control aquatic vegetation. To prevent their uncontrolled proliferation, all fish stocked in Indiana must be triploid, meaning that they cannot reproduce. Stocking is restricted to privately owned bodies of water, and suppliers must obtain a special permit from the IDNR. Grass carp are completely vegetarian, feeding on many species of submersed plants, along with some floating plants such as duckweed. Hydrilla, a highly invasive plant found in many southern states is a preferred food of grass carp and efforts to control hydrilla with grass carp have been successful.

www.tpwd.state.tx.us

According to the Aquatic Ecosystem Restoration Foundation, grass carp avoid Eurasian milfoil, and show strong preferences for many native plants along with hydrilla. The success of grass carp stockings is highly dependent upon the food sources available to the fish. When Eurasian milfoil occurs along with native plant populations, grass carp are not recommended. Grass carp are not currently permitted for stocking in pubic waters.

9.7 Chemical Controls

9.7.1 Aquatic Herbicides

There are two major categories of aquatic herbicides: contact and systemic herbicides. Contact herbicides are used best to control the majority of the weeds close to shore, around piers and in man-made channels. Examples of contact herbicides are Reward (active ingredient: diquat), and Aquathal (active ingredient: endothal).

Contact herbicides would not be a wise choice for a whole lake treatment because of their lack of selectivity and their inability to eliminate the root systems of treated plants. These characteristics could result in unnecessary damage to native species, as well as greater potential for the re-infestation of Eurasian milfoil.

Systemic herbicides are absorbed by the plant and transported to the root systems where they eliminate both the roots and the plant. Examples of systemic herbicides are Sonar and Avast (active ingredient: fluridone), Navigate, Aqua Kleen, DMA4 (active ingredient 2, 4-D) and Renovate (active ingredient: triclopyr). All of these chemicals effectively kill Eurasian milfoil plants and roots. Based on the author's experience and other lake managers in the Midwest, whole lake treatments using fluridone are the most effective way to control Eurasian water milfoil in lakes that have become severely infested. Fluridone can be applied at low rates to control the Eurasian milfoil while causing little or no harm to the majority of the native weed species present in the lake.

2, 4-D and Renovate (active ingredient: triclopyr) are both root control herbicides which can to be used for spot treatments in small areas of Eurasian milfoil infestation, while the whole lake must be treated if Sonar (fluridone) is used. The major difference between 2, 4-D and triclopyr is that triclopyr may have the ability to control the Eurasian milfoil longer than 2, 4-D. Renovate (triclopyr) has only been available for use for the past three seasons, and the ability of Renovate to provide more long term control of Eurasian milfoil than 2,4-D in spot treatment situations is still being documented. 2, 4-D is less expensive to use but if triclopyr shows better long term control in treated areas it may become the most cost effective long term investment. Water depth in treatment areas of Little Turkey Lake would make Renovate much more expensive than 2, 4-D, especially in depths of over 5 feet. Milfoil in Little Turkey Lake grows to a depth of 8 to 9 feet.

The public's primary concern with the use of aquatic herbicides is safety. Every chemical registered for aquatic applications has undergone extensive testing prior to becoming available for use. These tests demonstrate that when these herbicides are applied properly at labeled rates, they are safe for humans and will not directly cause any adverse environmental effects.

One plant in Little Turkey Lake that could potentially be affected by a whole lake Sonar treatment would be whorled watermilfoil. Aquatic Weed Control's past experience indicates that whorled watermilfoil is extremely resistant to even high rates of Sonar. However, whorled watermilfoil abundance is so low in Little Turkey that it may be adversely affected by Sonar. It was found at only 2 sample locations in June of 2007 and was not even present in the August 2007 survey. Based on this data it would be very hard to make any conclusions about the effects of Sonar on whorled watermilfoil in Little Turkey Lake.

10.0 Public Involvement

A LARE meeting was held on November 8, 2007 to discuss issues pertaining to Little Turkey Lake. District 2 Fisheries biologists Neil Ledet and Larry Koza, Aquatic Weed Control and LARE Aquatic biologists Angela Sturdevant and Gwen White were all present and discussed the plant community of Little Turkey Lake. Discussion at this meeting helped to develop the 2008 management strategy.

A public lake meeting was held for Little Turkey Lake on June 30, 2007. Jim Donahoe of Aquatic Weed Control summarized LARE management activities and outlined the treatment options to help contain the Eurasian watermilfoil population in the lake. Sixteen people were in attendance at this meeting. All 16 people indicated that they owned property around Little Turkey Lake.

Public questionnaires were handed out at the public lake association meeting. Residents were concerned about Eurasian watermilfoil and about possible assistance to help control it. Table 15 is a summary of the 2007 public questionnaires.

Table 15: Public Questionnaire

Lake Use Survey (16 total) Lake name Little Turkey Lake

Are you a lake property owner? Yes 16 No 0

Are you currently a member of your lake association? Yes 16 No 0

How many years have you been at the lake?
2 or less - 3
2 – 5 years - 5
5-10 years - 4
Over 10 years - 4

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

10 Swimming	0 Irrigation
13 Boating	0 Drinking water
14 Fishing	2 Other _____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes 11 No 5

Do you currently participate in a weed control project on the lake? Yes 3 No 10

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes 12 No 4

Does the level of vegetation in the lake affect your property values? Yes 5 No 3

Are you in favor of continuing efforts to control vegetation on the lake? Yes 15 No 1

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 14 No 2

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

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

Please add any comments:
Currently the lake is very green because there are not enough weeds to uptake dissolved nutrients; bass club speeding and ill manners concerning lake owners' property; lake too small for bass tournaments that happens once a weekend (mon. or weekend) No one has room to fish when the bass tournaments are here. would like to eliminate them.

11.0 Public Education

Lake residents play an important role in establishing and maintaining a healthy lake community. The Little Turkey Lake Association has at least one meeting annually, usually at a private residence. Attendance is usually good, at an estimated 25% of lake property owners attending the meetings.

Lake association meetings and newsletters are excellent avenues through which this information about management practices on Little Turkey Lake can be distributed. These meetings can also help to inform the public about practical steps that they can take to improve Little Turkey Lake. The following information is designed to give practical suggestions on ways that lake residents can reduce nutrient loading and improve the Little Turkey Lake ecosystem.

1. **Ensure that existing homes be connected to a properly maintained lake wide sewer system if possible.** Many older homes possess septic systems without proper filter beds. Some systems may have significant leaks, while some may drain into the lake. Sewage leaks add tremendous amounts of nutrients to the water, along with harmful bacteria. If a lake does not have a sewer system, the proper maintenance of septic tanks and filter beds can help reduce nutrient loading.

2. **Limit lawn fertilizer use in areas where runoff will enter the lake.** If a fertilizer application must be applied, avoid spreading fertilizer directly into the lake, on sidewalks, or sea walls where it will wash into the lake. Try to avoid applying fertilizer within 30 feet of the shoreline. If fertilizer must be used, low phosphorus or no phosphorus fertilizer is preferred for use.

3. **Work with farmers within the lake catchment to increase proper filtration and drainage of agricultural land before runoff reaches the lake.** The Indiana state government offers incentives for farmers to address soil and water concerns through the U.S. Department of Agriculture. The Indiana Conservation Reserve Program (CRP) provides technical and financial aid to reduce soil erosion, reduce sediment in lakes and streams, and improve overall water quality. Farmers owning highly erodible land or property adjacent to tributary streams or lakes may be eligible for funding that can increase water quality significantly. Further information can be found at www.in.nrcs.usda.gov/programs/CRP/crphomepage.html or by contacting the following address.

   Indiana NRCS
   6013 Lakeside Boulevard
   Indianapolis, Indiana 46278-2933
   Phone: (317) 290-3200
   FAX: (317) 290-3225

4. **Avoid blowing grass clippings and tree leaves into the lake**. Many pond owners know that grass clippings blown into a pond can turn into a floating mat of algae in only a few days. This occurs because cut and decaying vegetation rapidly releases nutrients into the water.

5. **Prevent or reduce urban and industrial runoff flowing directly into the lake.** Urban runoff can be one of the most detrimental factors influencing water quality. Not only are nutrients and sediment carried to lakes through storm sewers, but harmful contaminants as well. Oil, antifreeze, gasoline, road salt, and other pollutants are washed from pavement and can all end up harming a lake ecosystem.

The following are practical steps recommended by the United States Environmental Protection Agency to reduce urban runoff:

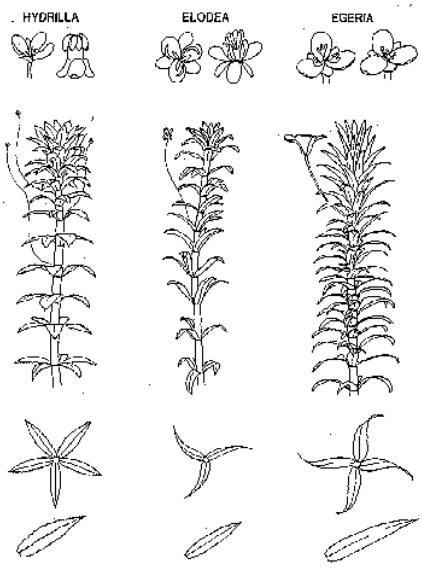
a) Protect areas that provide important water quality benefits or are particularly susceptible to erosion or sediment loss.
b) Limit land disturbance such as clearing and grading and cut fill to reduce erosion and sediment loss.
c) Limit disturbance of natural drainage features and vegetation.
d) Place bridge structures so that sensitive and valuable aquatic ecosystems are protected.
e) Prepare and implement an approved erosion control plan.
f) Ensure proper storage and disposal of toxic material.
g) Incorporate pollution prevention into operation and maintenance procedures to reduce pollutant loadings to surface runoff.
h) Develop and implement runoff pollution controls for existing road systems to reduce pollutant concentrations and volumes.

Further information about urban runoff in Indiana can be obtained by contacting the EPA Region 5 National Pollution Discharge Elimination System Storm Water Coordinator by calling (312) 886-6100.

6. **Establish ecological zones to protect existing wetlands and emergent vegetation from turbulence caused by boats.** Wetlands not only filter water, but they also stabilize shoreline areas that would otherwise be highly erodible. Submersed and emergent vegetation can be eliminated by heavy wave action, which destabilizes the shoreline and reduces the lake's natural defense against sediment and nutrient loading. It is extremely important to make sure that existing wetlands remain intact to aid in the natural water purification process. If possible, lake associations should identify significant wetland areas and work with the IDNR to protect them from drainage and disruption.

Hydrilla

Hydrilla (*Hydrilla verticillata*) is an invasive aquatic plant species common throughout the southern United States. It federally listed as a noxious weed and causes severe ecological and recreational problems wherever it grows. It is considered to be much more destructive than other invasives like Eurasian watermilfoil and curly leaf pondweed because of its reproductive adaptations. It grows by fragmentation, as does Eurasian watermilfoil, but it also produces turions which can remain dormant in the sediment for 4 years or more (Van and Steward, 1990). It produces tubers at its root tips which can also reproduce after multiple years of dormancy. It can grow 1 inch each day and it quickly out-competes native plants. It forms dense beds that eliminate native plants, stunt fish populations, impede recreation and cause a drastic decrease in biodiversity (Colle and Shireman, 1980). Millions of dollars are spent each year for hydrilla maintenance each year in Florida alone. Eradication is unlikely once a population has been well established, although eradication has been achieved in newly infested waters using a herbicide called Sonar. Sonar is applied at a rate of 6 parts per billion and this concentration is maintained in the water for 180 days. Early detection can be crucial to an effective eradication program, and all lake residents and users are encouraged to be on the look-out for this invader. In August of 2006, this plant was found in Lake Manitou, in Rochester, Indiana. This is the first instance of hydrilla in the upper Midwest. Prior to its appearance in Lake Manitou, The closest infestations of hydrilla were in Tennessee and Pennsylvania.



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

12.0 Integrated Management Action Strategy

Funding may be awarded by the LARE program in 2008 for herbicide treatments in areas of Eurasian watermilfoil infestation. Chemical treatment options for selective, root control of Eurasian watermilfoil include the following herbicides: Sonar (active ingredient: fluridone), Renovate (active ingredient: triclopyr), and 2, 4-D. Based on past experience, Sonar treatments generally provide the most complete control of Eurasian watermilfoil and can also provide multiple years of control. Renovate and 2, 4-D, while very effective, are normally applied to the same areas on a yearly basis to provide control.

Aquatic Weed Control recommends the use of Sonar to treat Eurasian watermilfoil in Little Turkey Lake because of its widespread distribution. A fluridone treatment has numerous ecological advantages over other herbicides for Eurasian milfoil control. Fluridone will not only kill Eurasian watermilfoil plants as other herbicides would, but it will also kill its root systems, reducing the chance for rapid re-growth. One extremely important advantage of using fluridone is that it can selectively kill Eurasian milfoil plants while causing little if any long term harm to native plants. This can allow native plants to re-establish themselves as the Eurasian watermilfoil population declines.

It is important to note that Eurasian watermilfoil will be the only plant species specifically targeted in this project, as LARE funds will only be awarded for the control of invasive plant species. The goal is not to eliminate vegetation in Little Turkey Lake, but to improve the health of the plant community. Native vegetation will still be abundant in shallow areas after treatment, and control of these natives must be privately funded. The goal will be to reduce the Eurasian watermilfoil population and allow for the recovery of native plant species that will provide better fish habitat, foster good water quality and pose less interference to recreational use of the lake.

Treatment Specifications

Hydraulic retention time in Little Turkey Lake has been measured in the past as 17 days (Harza Engineering, 1990). This means that Little Turkey Lake has a high flushing rate, especially in times of heavy rain. This could potentially cause herbicide to flush out of the lake in a heavy rain event. To avoid a potential treatment failure in Little Turkey Lake, SePRO (manufacturers of Sonar) have recommended that a combination of Sonar A.S. (liquid) and Sonar PR (precision release pellets) be used to treat the Eurasian watermilfoil. Adding a timed release, granular pellet to the treatment strategy will ensure that Sonar will always be present in the water column, even if a heavy rain event was to occur in the days following treatment.

Multiple treatments (called “bumps”) will likely be used to maintain herbicide concentrations of 2-5 parts per billion in Little Turkey Lake. A minimum of two treatments and a maximum of four treatments will take place, depending upon Sonar concentrations. Sonar concentrations will be monitored every two to three weeks depending upon rainfall. In the weeks that follow the treatment, water samples called FasTESTs will be collected in the lake and sent to SePRO Corporation to determine the concentration of Sonar remaining in the water column. The results of these tests will determine the amount of herbicide that should be added to the lake in each bump to achieve the target concentration of 2-5 parts per billion.

In the years following the Sonar treatment, 2, 4-D would be used to treat areas of Eurasian watermilfoil re-growth. Renovate and 2, 4-D are both good options for spot treatments of Eurasian watermilfoil. They both provide adequate control, but 2, 4-D will be less expensive.

13.0 Project Budget

Cost estimates for whole lake Sonar treatment are included in Table 16. These figures are estimates only and are subject to change pending future chemical pricing.

Table 16: Project Cost Estimates

Project	2008	2009	2010	3 Year Cost Totals
Whole Lake Fluridone Treatment: 2-5 parts per billion	$61,000	$0	$0	$61,000
Follow Up Spot Treatments using 2, 4-D	$0	$5,400 **If needed**	$5,400	$10,800
Survey and Plan Update Costs	$4,000	$4,000	$4,000	$12,000
Total Estimated Costs	$65,000	$9,400	$ 9,400	**$83,800**
LARE Share – subject to availability	$58,500	$8,460	$ 8,460	**$75,420**
Association's Share	$6,500	$ 940	$940	**$8,380**

The alternative to a whole lake treatment would be to treat large areas of Little Turkey Lake with 2, 4-D on Renovate herbicide for the control of Eurasian watermilfoil. These treatments are effective, but they would not provide the level of control on a lake wide basis that Sonar would provide. Renovate and 2, 4-D treatments usually do not provide multiple years of control, whereas Sonar can provide multiple years of Eurasian watermilfoil control. Renovate and 2, 4-D treatments would likely have to take place in the same areas year after year to maintain control of Eurasian watermilfoil. 2, 4-D is being recommended over Renovate because it provides similar control and is much less expensive than Renovate. Cost estimates for this treatment plan are listed in Table 17.

Table 17: Alternative Project Costs

Project	2008	2009	2010	3 Year Cost Totals
Treat up to 45 acres with 2, 4-D	$16,200	$16,200	$16,200	$48,600
Survey and Plan Update Costs	$4,000	$4,000	$4,000	$12,000
Total Estimated Costs	$20,200	$20,200	$20,200	**$60,600**
Total LARE share – subject to availability	$18,180	$18,180	$18,180	**$54,540**
Total Association's Share	$2,020	$2,020	$2,020	**$6,060**

Survey and Planning Costs

Current survey and planning costs for 2008 are estimated at $4,000 and are included in Table 17. This cost is subject to a 90% cost share with the LARE program. LARE would pay $2,600 and the lake association would be responsible to pay $400 toward this cost.

14.0 Monitoring and Plan Update Procedures

A visual inspection should be used in spring of 2008 to confirm Eurasian watermilfoil abundance in Little Turkey Lake. This visual survey will be used to develop a Eurasian watermilfoil treatment map which will be submitted to the IDNR for approval. Should the proposed treatment areas be approved, the LARE funded herbicide treatment will then take place.

A late season Tier II quantitative vegetation survey will also be conducted in 2008. This survey will take place after the LARE funded herbicide treatment, and will be used to evaluate populations of both native and invasive plants in Little Turkey Lake.

15.0 References

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

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

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

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

Harza Engineering. 1990. Big Turkey and Little Turkey Lake Enhancement Feasibility Study. Chicago, Illinois.

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

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

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

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

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

Ledet, Neil and Koza, Larry. 2003. Little Turkey Lake Fish Management Report. IN Department of Natural Resources. Division of Fish & Wildlife. Indianapolis, Indiana

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

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

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

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

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

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

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

16.0 Appendices

16.1 Calculations

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

Application Rate Calculation - Ponds, Lakes and Reservoirs

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

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

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

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

†DMA 4 IVM contains 3.8 lb of acid equivalent per gallon of product.

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

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

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

16.2 Common Aquatic Plants of Indiana

The following appendix was compiled using information found in the 5th edition of How to Identify Water Weeds and Algae, edited by James C. Schmidt and James R. Kannenberg. Some Pictures were taken by Aquatic Weed Control while others are from the Category 5 Aquatic Pest Control Management Manual, written by Dr. Carole Lembi, Head of the Department of Botany and Plant Pathology at Purdue University.

American Pondweed

Scientific name: *Potamogeton americanus*
Classification: Native to Indiana
Distribution: Common throughout the U.S.

Description: American pondweed can be identified by its oval shaped leaves floating on the top of the water. The base of each leaf tapers to a very long petiole that connects the leaf with the stem of the plant. Plant leaves are arranged alternately on the stem and leaves are usually sparsely scattered.

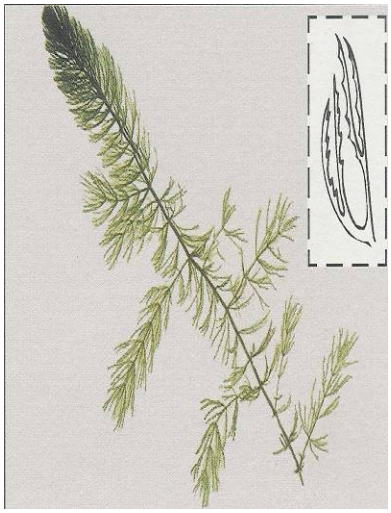
Chara

Scientific name: *Chara sp*.
Classification: Native to Indiana
Distribution: Extremely common worldwide. Usually found in hard water.

Description: Chara is often mistaken for a vascular plant, but it is actually an advanced form of algae. It can be gray, green or yellow in color and is usually forms extremely dense beds that may cover an entire lake. It can be identified by its distinct musky odor and calcium deposits on the algae's surface make

it feel bristly to the touch. It possesses leaf-like structures that are whorled around the hollow stem, and it attaches itself to the lake bottom, although it has no actual roots. It usually grows in shallow, clear water.

Coontail



Scientific name: *Ceratophyllum demersum*

Classification: Native to Indiana

Distribution: Common throughout the U.S., usually in hard water.

Description: Coontail plants are submersed and have no roots, though they appear to be attached to the lake bottom when viewed from above the surface of the water. The free-floating nature of coontail allows it to colonize new areas of a lake quickly, and it often times forms extremely dense weed beds where sufficient light and nutrients are available. Coontail has dark green leaves arranged in whorls around the stem and usually grows in long, bushy strands resembling evergreen trees beneath the surface of the water. Coontail's structure is very similar to Eurasian milfoil but coontail has forked leaves, which distinguishes it from the feather-like projections of milfoil leaves.

Curly Leaf Pondweed

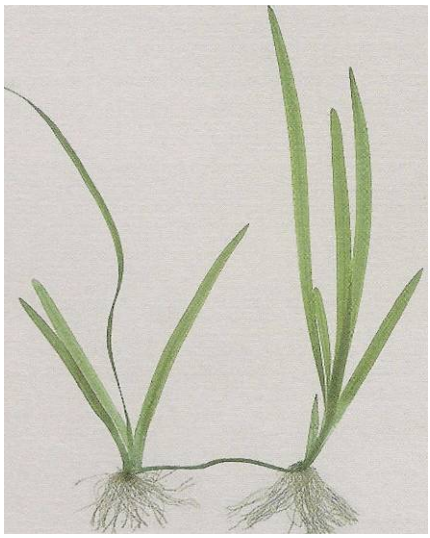
Scientific name: *Potamogeton crispus*

Classification: Exotic to Indiana

Distribution: Found throughout the U.S. in fresh and brackish water.

Description: Curly leaf pondweed usually grows and spreads rapidly in early spring and begins to dies out by midsummer as water temperatures approach 70 degrees Fahrenheit. Curly leaf has extremely thin, membranous leaves arranged alternately on the stem with small teeth-like projections visible along the edge of each leaf. A reproductive spike may be seen protruding from the surface of the water. Curly leaf pondweed may also leave small reproductive structures called turions in the sediment on the lake bottom that can lie dormant throughout the winter and then sprout when spring arrives.

Eel Grass (Wild Celery)



Scientific name: *Vallisneria Americana*

Classification: Native to Indiana

Distribution: Found from the Great Plains to the East Coast of the U.S.

Description: Eel grass has tufts of ribbon-like leaves with a horizontal stem embedded in the sediment connecting each tuft. This native plant grows thick weed beds anchored in the mud by roots. These dense beds often shade out other forms of weeds and provide excellent escape cover for small fish. The flowers of this plant are visible in late summer and sit on the top of a coiled structure protruding to the surface. This plant is found in both lakes and river, but is seldom found in stagnant systems. It is considered an extremely valuable plant to aquatic ecosystems.

Elodea

Scientific Name: *Elodea Canadensis*

Classification: Native to Indiana

Distribution: Common throughout the north and north central united states. Its ranges extends as far south as northern Tennessee.

Description: Elodea grows in long strands resembling milfoil, but its leaves are broad and oval shaped. Leaves are arranged in whorls with three leaves usually occurring at each node. Leaves near the tip of the plant are closely packed together, with the distance between nodes increasing further down the stem.

Eurasian Milfoil

Scientific Name: *Microphyllum spicatum*

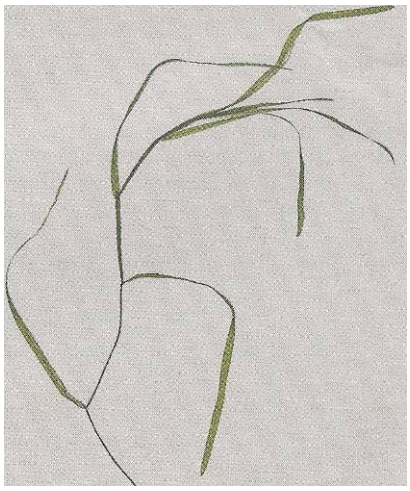
Classification: Exotic in Indiana

Distribution: Common in the Midwest and Eastern U.S. Also spreading along the Pacific coast

Description: This extremely aggressive and extremely destructive plant has leaves in whorls of 4 around a reddish stalk. This plant grows rapidly and can reach lengths of over 10 feet. This plant has the ability to over winter, meaning it can lie dormant during the winter months instead of dying out completely each year. This gives it a distinct advantage over many native species, as it competes for sunlight in early spring. The dormant milfoil plants reach the surface much faster than the native plants sprouting from the lake bottom. This enables the Eurasian milfoil to shade out other plants and form the dense beds that choke the littoral zone of many lakes.

A reproductive process called fragmentation aids the rapid dispersion of Eurasian milfoil. If a milfoil plant is damaged and some fragments are removed from the macrophyte, each small piece of the plant has the ability to grow roots and create a new milfoil plant. Eurasian milfoil is considered one of the most dangerous aquatic nuisance species because of its ability to rapidly disrupt and destroy lake ecosystems.

Flat-stemmed Pondweed



Scientific Name: *Potamogeton zosteriformis*

Classification: Native to Indiana

Distribution: Common throughout the northern half of the U.S.

Description: the most noticeable characteristic is the large, very flat stem. It cannot be rolled between the fingers easily. The ribbon-like leaves extend from the stem toward the surface of the water.

Illinois Pondweed

Scientific name: *Potamogeton illinoensis*

Classification: Native to Indiana

Distribution: Very widespread and very common throughout the upper Midwest and the U.S

Description: Illinois pondweed is common in Indiana, especially in the northern third of the state. This leafy weed has leaves with very broad bases that extend three-fourths of the way around the stem. The upper part of its slender stem is usually branched and very leafy.

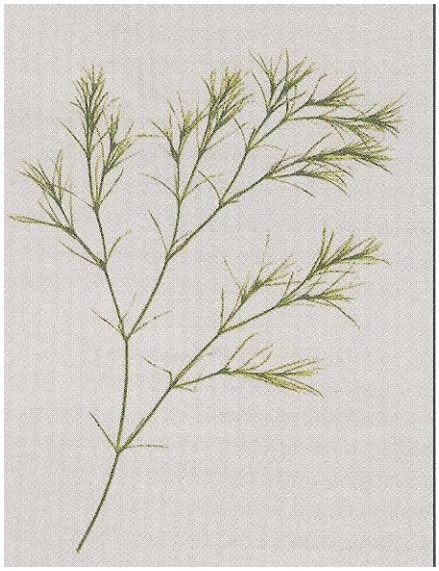
www.wvu.edu

Large Leaf Pondweed

Scientific name*:* *Potamogeton amplifolius*
Classification: Native to Indiana
Distribution: Common throughout the upper Midwest and the northern United States in hard water.

Description: This plant has both submersed and floating leaves. The floating leaves are oval shaped and are similar to those of American pondweed. Submersed leaves are arranged alternately with each leaf becoming extremely narrow as it nears the stem of the plant. Mineral deposits on its leaves often give large leaf pondweed a dark brown appearance.

Naiad



Scientific name: *Najas minor* (brittle naiad)

Classification: Native to Indiana

Distribution: Common throughout the U.S.

Description: The leaves of naiad plants are usually widest at the base and gradually become thinner near the tip of the leaf. Plants are extremely leafy and appear bush-like when viewed from above the surface of the water. Many species of naiad are very common in this area. Plant structure often resembles chara, but the absence of calcium deposits on the surface of the plant help in identification. The leaves of brittle naiad have multiple spines along the margins that are visible to the naked eye.

Nitella

Scientific name: *Nitella sp.*

Classification: Native to Indiana

Distribution: Found worldwide, usually in hard water.

Description: Nitella is very similar to chara, and it is also an advanced form of algae. It has leaf-like projections that are whorled around the stem. It is often found growing in very thick patches, usually in shallow, clear water.

Northern Milfoil

Scientific name: *Myriophyllum sibericum*

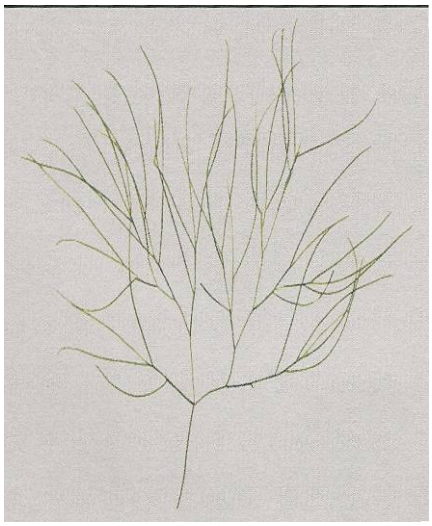
Classification: Native to Indiana

Distribution: Found throughout the northern half of the U.S. and also in Europe and Western Asia

www.io.uwinnipeg.ca

Description: Northern milfoil has submersed, feather-like, whorled leaves that closely resemble the leaves of Eurasian milfoil. Distinguishing the native northern milfoil from Eurasian milfoil can be difficult. The leaflet pairs of northern milfoil are generally fewer and more widely spaced than those of Eurasian milfoil. This plant is known to hybridize with Eurasian milfoil, and at times, chemical analysis is necessary to distinguish between the two plants.

Sago Pondweed



Scientific name: *Potemogeton pectinatus*

Classification: Native to Indiana

Distribution: Found throughout the U.S., Common in the northern 2/3 of Indiana.

Description: Sago Pondweed has a bushy appearance with narrow, thread-like leaves that spread out to resemble a fan. Leaves are usually 1/16 of an inch wide and 1 to 6 inches long. Nutlets are formed on a string-like structure and protrude from the surface of the water. While sago pondweed can form dense beds, many times it is found in sparse, loosely distributed arrangements.

16.3 Pesticide Use Restrictions Summary:

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

Table 18: Pesticide Use Restrictions

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

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

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

[b]Trade name is Aquathol®.

[c]Trade name is Hydrothol®.

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

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

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

16.4 Resources for Aquatic Management

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

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

Watershed Protection and Flood Prevention Program (USDA

Conservation Reserve Program (USDA)

Wetlands Reserve Program (USDA)

Grassland Reserve Program (USDA)

Wildlife Habitat Incentive Program (USDA)

Small Watershed Rehabilitation Program (USDA)

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

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

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

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

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

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

NPDES Related State Program Grants (IDEM)

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

16.5 State Regulations for Aquatic Plant Management

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

AQUATIC PLANT CONTROL PERMIT REGULATIONS
Indiana Department of Natural Resources

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

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

Sec. 10. (a) This section does not apply to the following:

(1) A privately owned lake, farm pond, or public or private drainage ditch.

(2) A landowner or tenant adjacent to public waters or boundary waters of the state, who chemically, mechanically, or physically controls aquatic vegetation in the immediate vicinity of a boat landing or bathing beach on or adjacent to the real property of the landowner or tenant if the following conditions exist:

(A) The area where vegetation is to be controlled does not exceed:

(i) twenty-five (25) feet along the legally established, average, or normal shoreline;

(ii) a water depth of six (6) feet; and

(iii) a total surface area of six hundred twenty-five (625) square feet.

(B) Control of vegetation does not occur in a public waterway of the state.

(b) A person may not chemically, mechanically, physically, or biologically control aquatic vegetation in the public waters or boundary waters of the state without a permit issued by the department. All procedures to control aquatic vegetation under this section shall be conducted in accordance with rules adopted by the department under IC 4-22-2.

(c) Upon receipt of an application for a permit to control aquatic vegetation and the payment of a fee of five dollars ($5), the department may issue a permit to the applicant. However, if the aquatic vegetation proposed to be controlled is present in a public water supply, the department may not, without prior written approval from the department of environmental management, approve a permit for control of the aquatic vegetation.

(d) This section does not do any of the following:

(1) Act as a bar to a suit or cause of action by a person or governmental agency.

(2) Relieve the permittee from liability, rules, restrictions, or permits that may be required of the permittee by any other governmental agency.

(3) Affect water pollution control laws (as defined in IC 13-11-2-261) and the rules adopted under water pollution control laws (as defined in IC 13-11-2-261).

As added by P.L.1-1995, SEC.15. Amended by P.L.1-1996, SEC.64.

312 IAC 9-10-3 Aquatic vegetation control permits

Authority: IC 14-22-2-6; IC 14-22-9-10
Affected: IC 14-22-9-10

Sec. 3. (a) Except as provided under IC 14-22-9-10(a), a person shall obtain a permit under this section before applying a substance to waters of this state to seek aquatic vegetation control.

(b) An application for an aquatic vegetation control permit shall be made on a departmental form and must include the following information:

(1) The common name of the plants to be controlled.

(2) The acreage to be treated.

(3) The maximum depth of the water where plants are to be treated.

(4) The name and amount of the chemical to be used.

(c) A permit issued under this section is limited to the terms of the application and to conditions imposed on the permit by the department.

(d) Five (5) days before the application of a substance permitted under this section, the permit holder must post clearly, visible signs at the treatment area indicating the substance that will be applied and what precautions should be taken.

(e) A permit issued under this section is void if the waters to be treated are supplied to the public by a private company or governmental agency. *(Natural Resources Commission; 312*

16.6 Public Questionnaire

Lake Use Survey (16 total) Lake name Little Turkey Lake

Are you a lake property owner? Yes 16 No 0

Are you currently a member of your lake association? Yes 16 No 0

How many years have you been at the lake?
2 or less - 3
2 – 5 years - 5
5-10 years - 4
Over 10 years - 4

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

10 Swimming	0 Irrigation
13 Boating	0 Drinking water
14 Fishing	2 Other _____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes 11 No 5

Do you currently participate in a weed control project on the lake? Yes 3 No 10

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes 12 No 4

Does the level of vegetation in the lake affect your property values? Yes 5 No 3

Are you in favor of continuing efforts to control vegetation on the lake? Yes 15 No 1

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 14 No 2

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

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

Please add any comments:
Currently the lake is very green because there are not enough weeds to uptake dissolved nutrients; bass club speeding and ill manners concerning lake owners' property; lake too small for bass tournaments that happens once a weekend (mon. or weekend) No one has room to fish when the bass tournaments are here. would like to eliminate them.

16.7 Species Distribution Maps

Figure 14: 2007 Rake Sample Locations

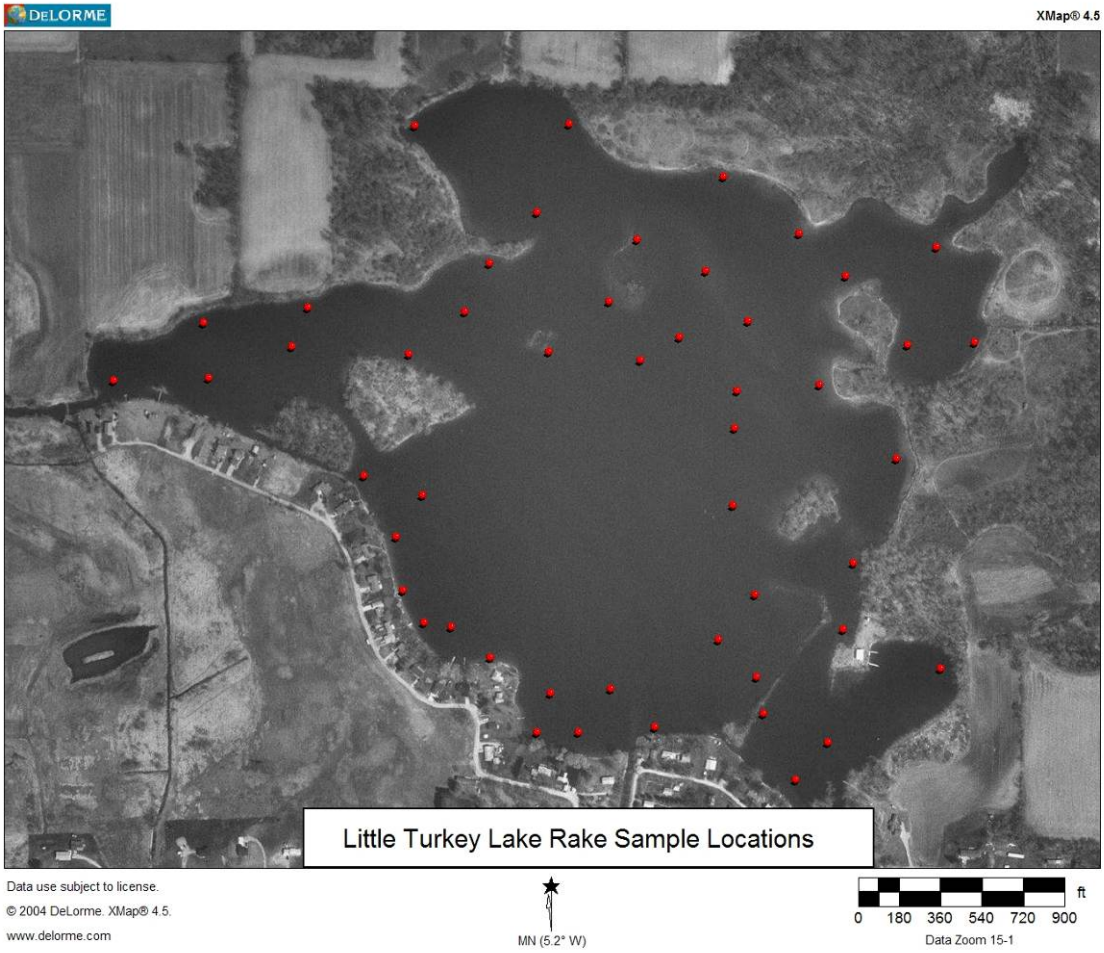


Figure 15: June 2007 Bladderwort Locations

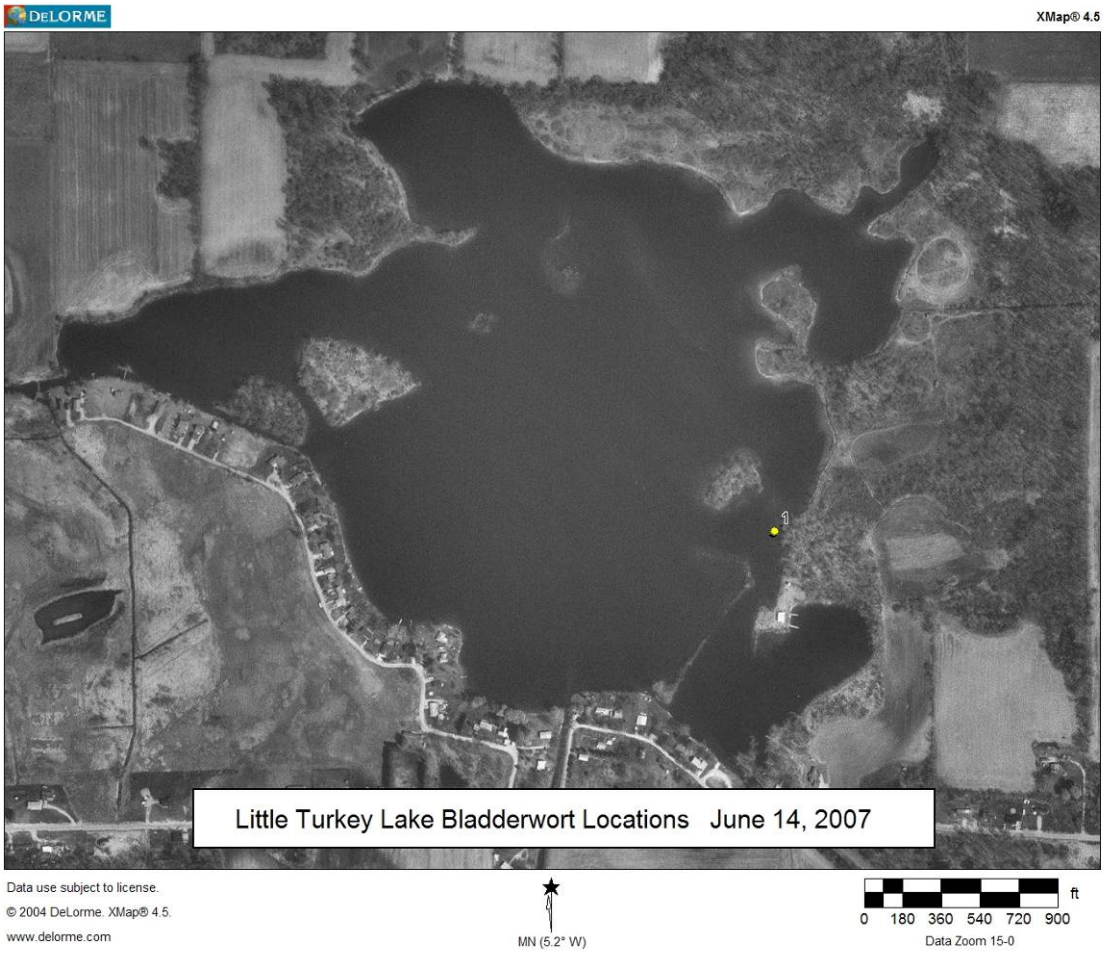


Figure 16: June 2007 Brittle Naiad Locations

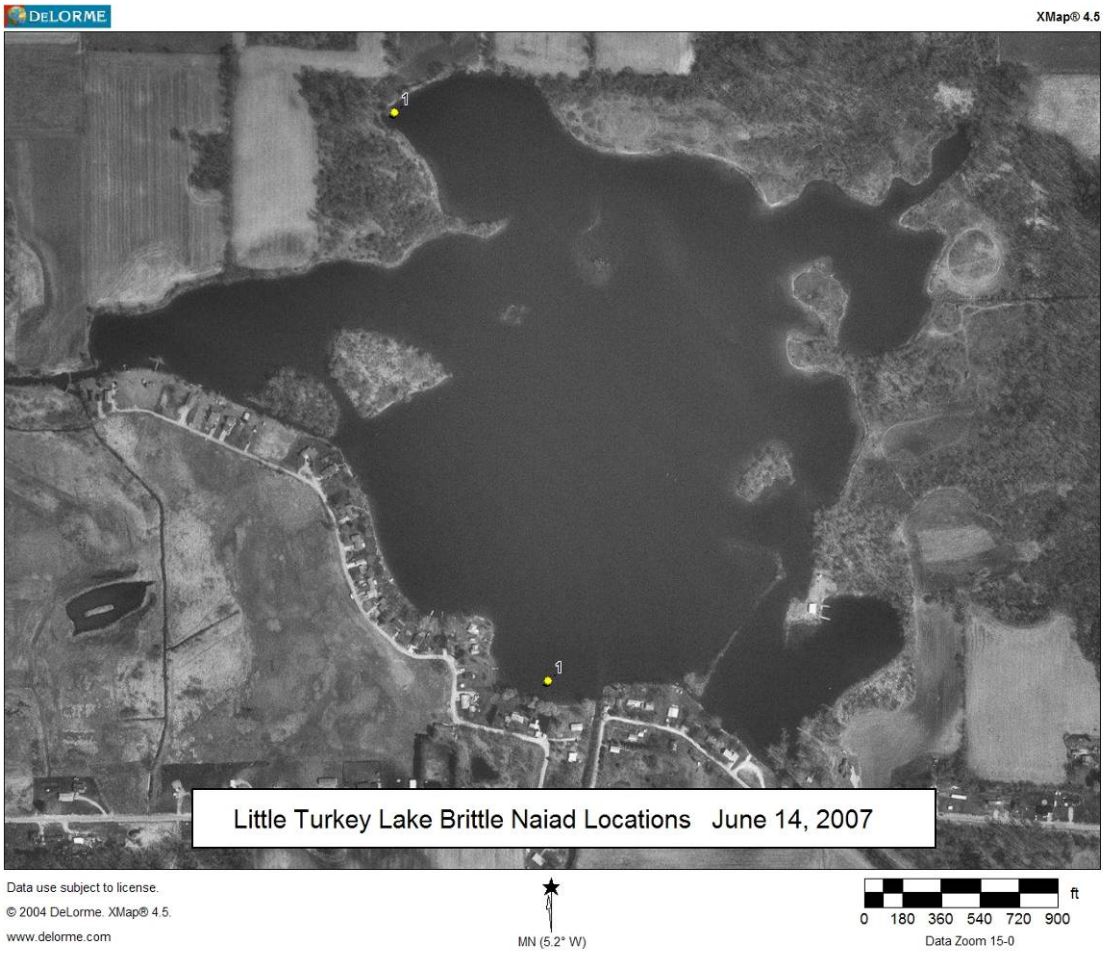


Figure 17: June 2007 Chara Locations

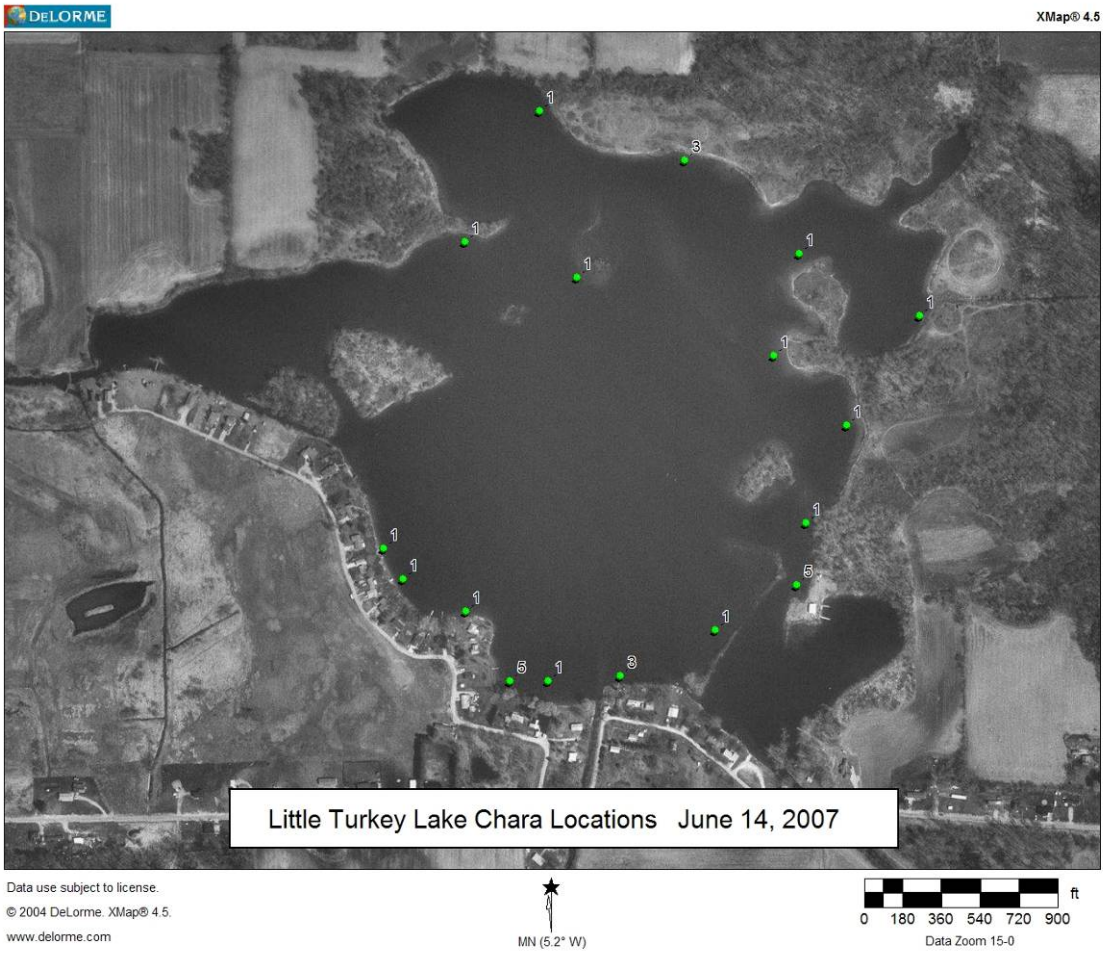


Figure 18: June 2007 Coontail Locations

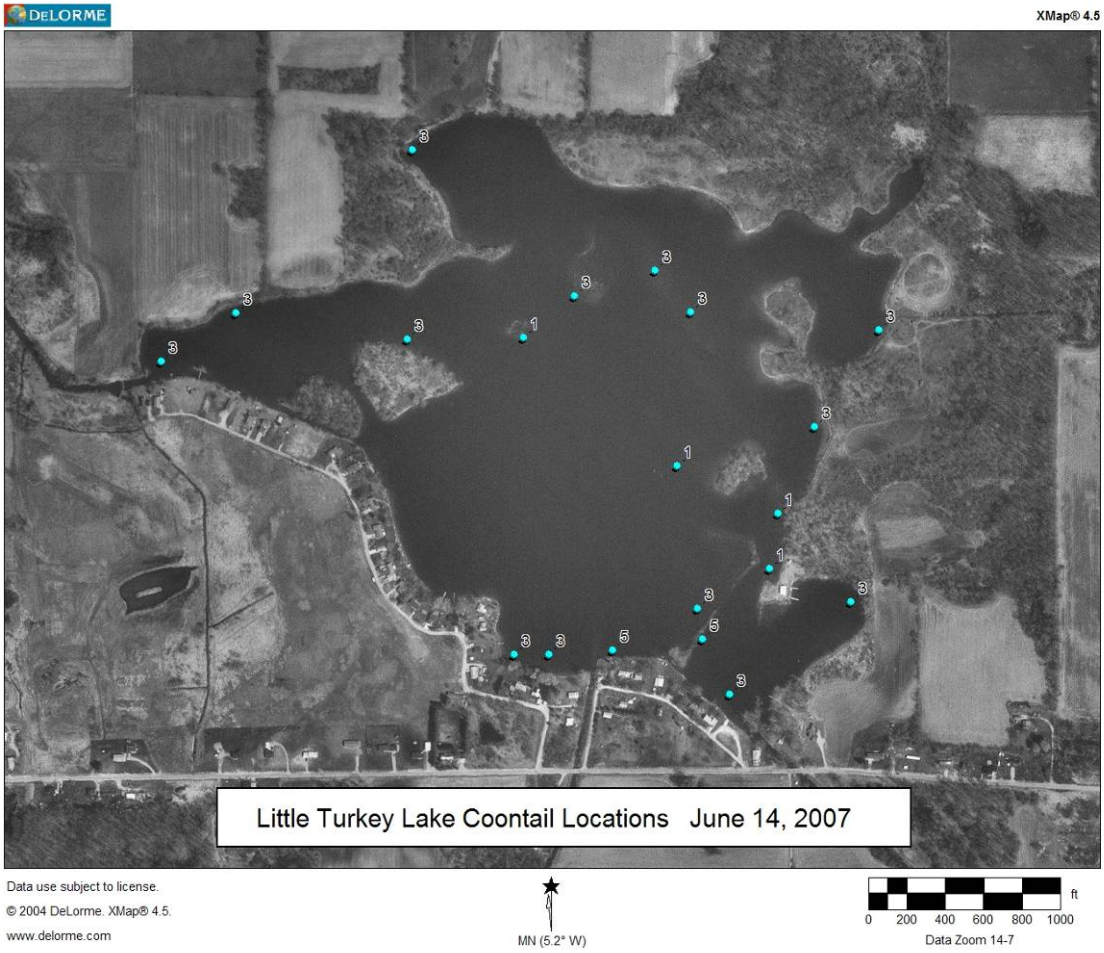


Figure 19: June 2007 Curly Leaf Pondweed Locations

Figure 20: June 2007 Elodea Locations

Figure 21: June 2007 Eurasian Watermilfoil Locations

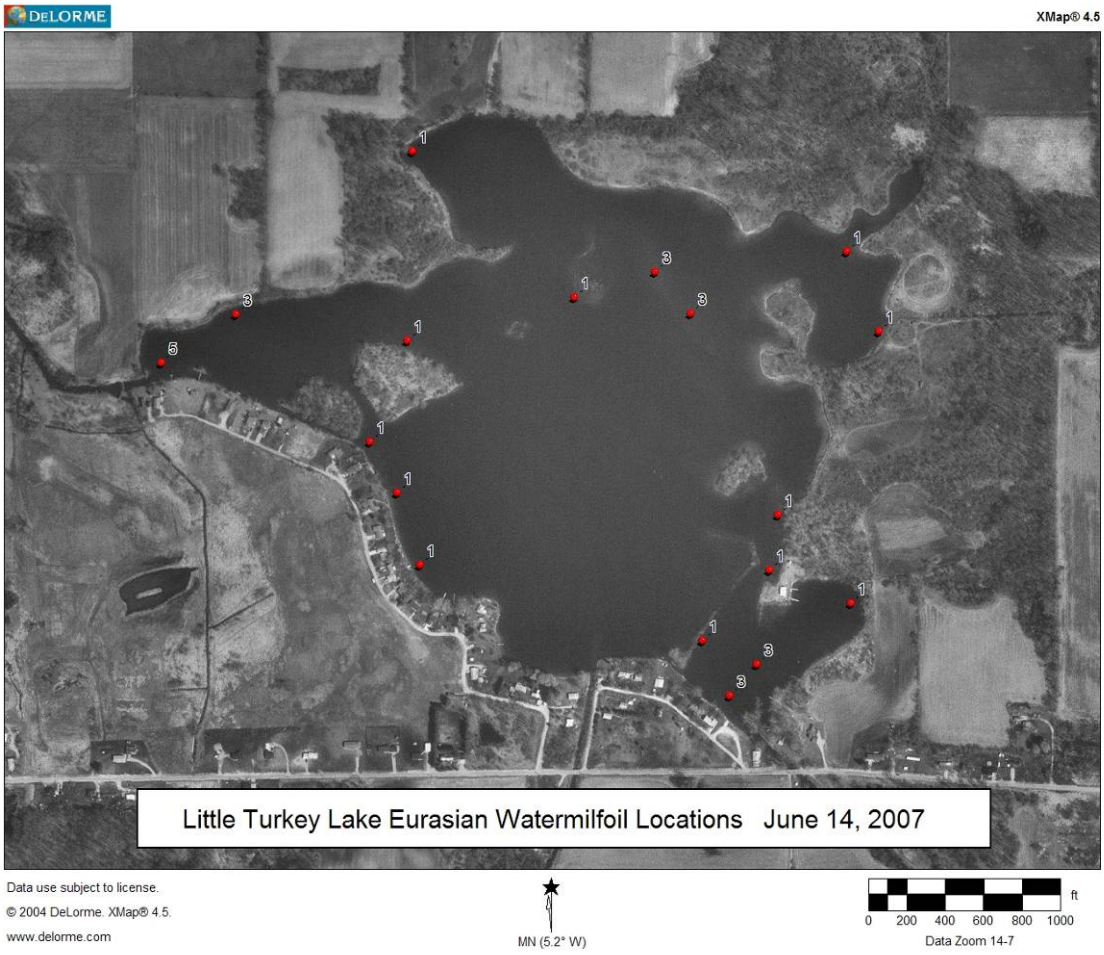


Figure 22: June 2007 Sago Pondweed Locations

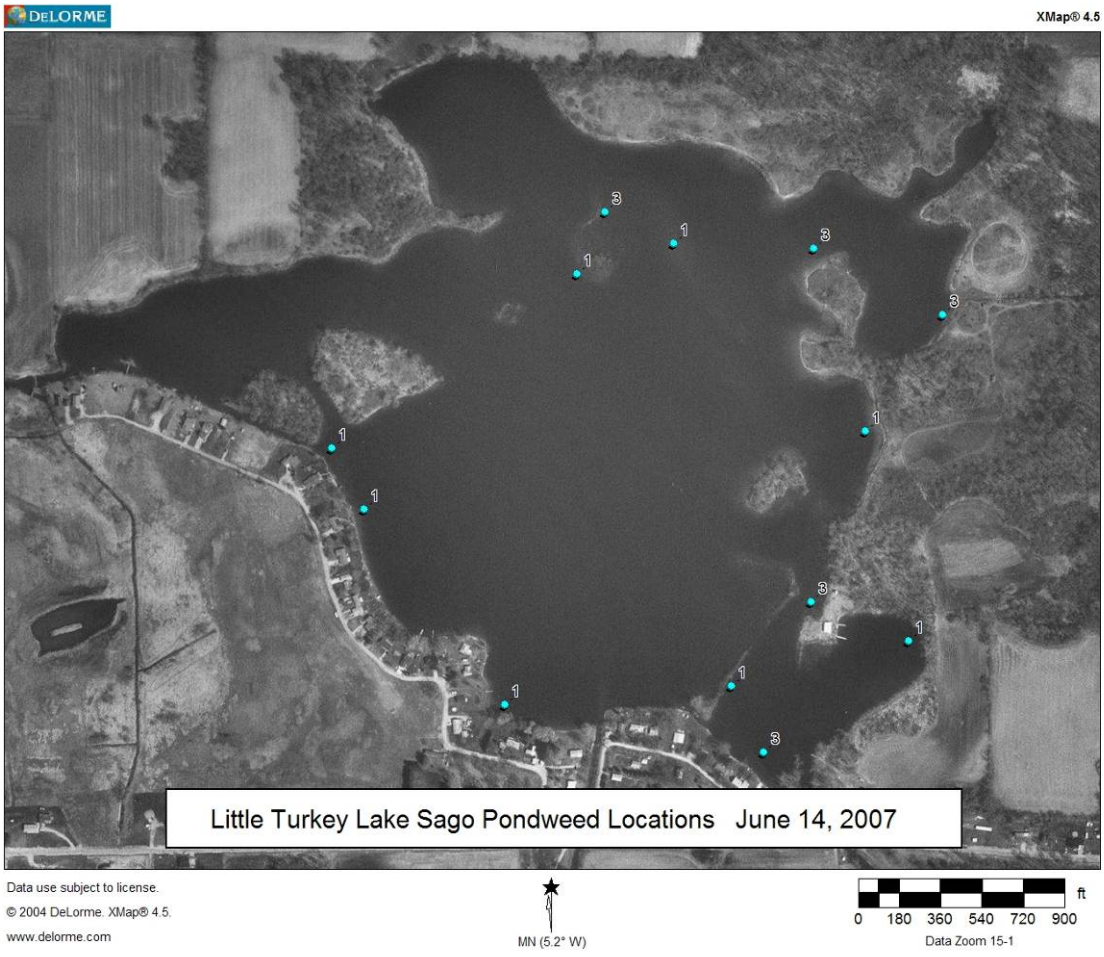


Figure 23: June 2007 Small Pondweed Locations

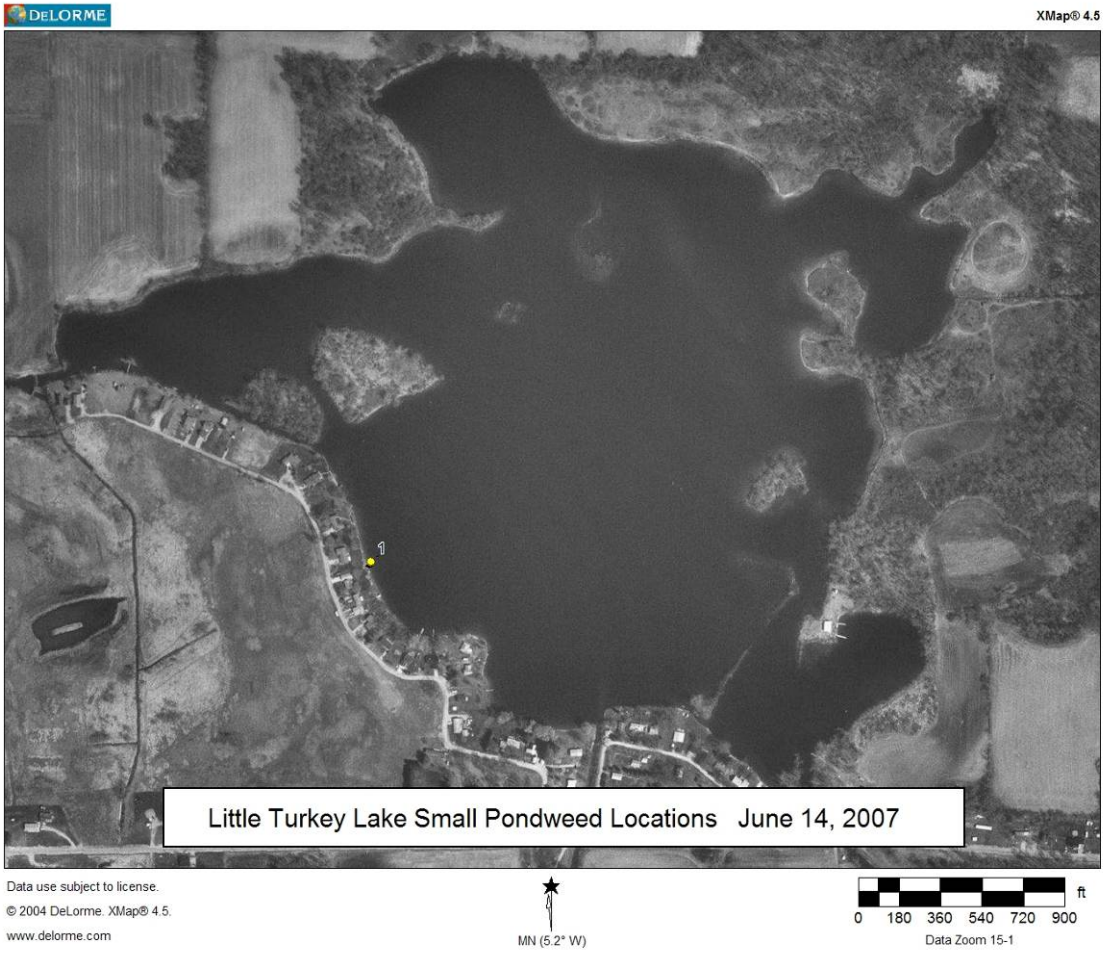
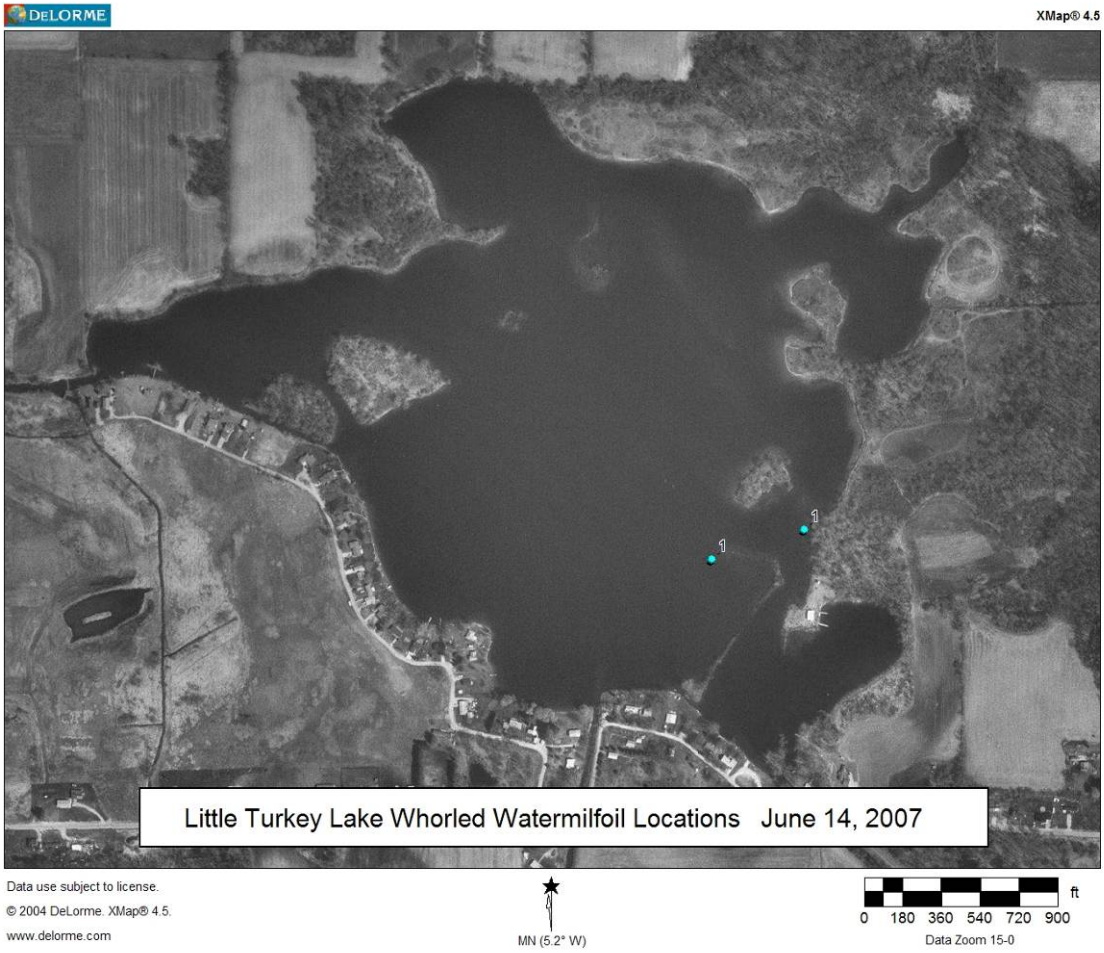


Figure 24: June 2007 Whorled Watermilfoil Locations



August 2007

Figure 25: August 2007 Bladderwort Locations

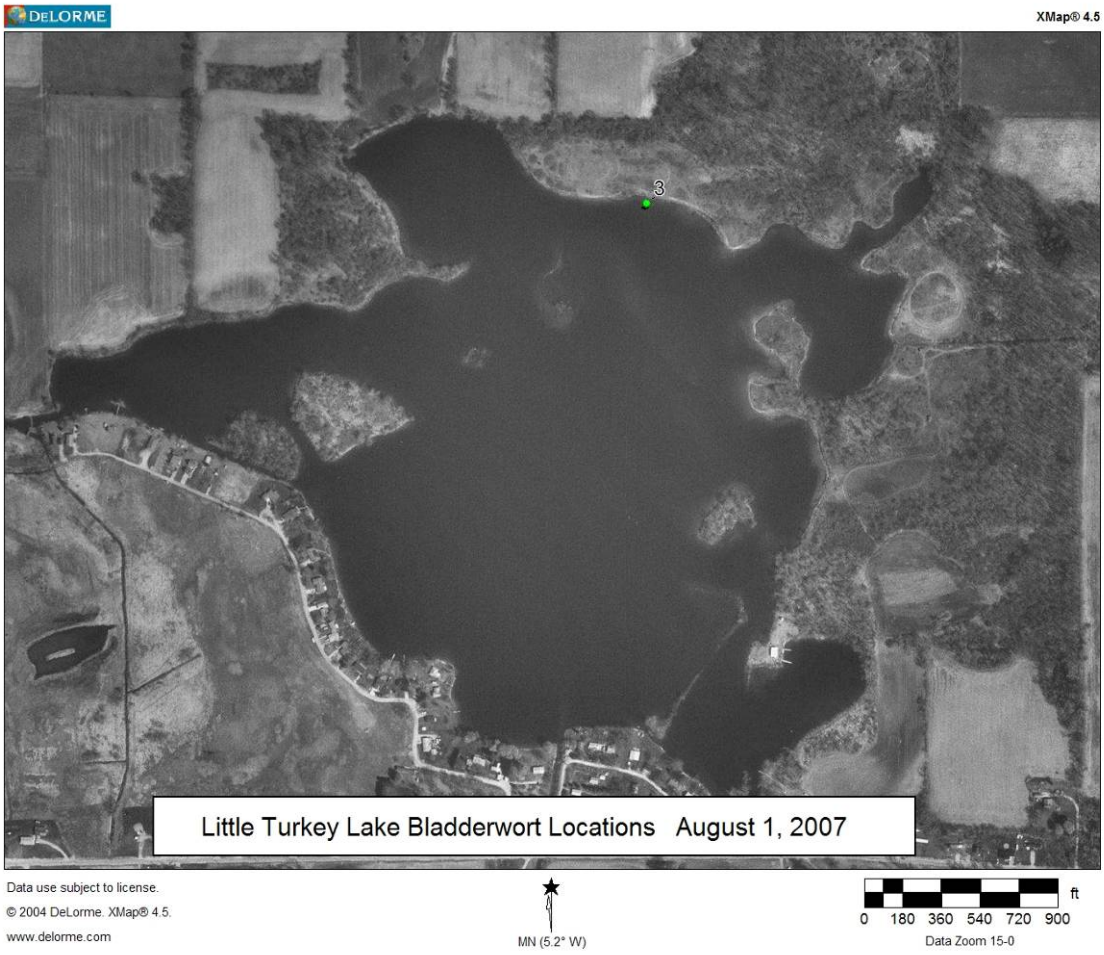


Figure 26: August 2007 Brittle Naiad Locations

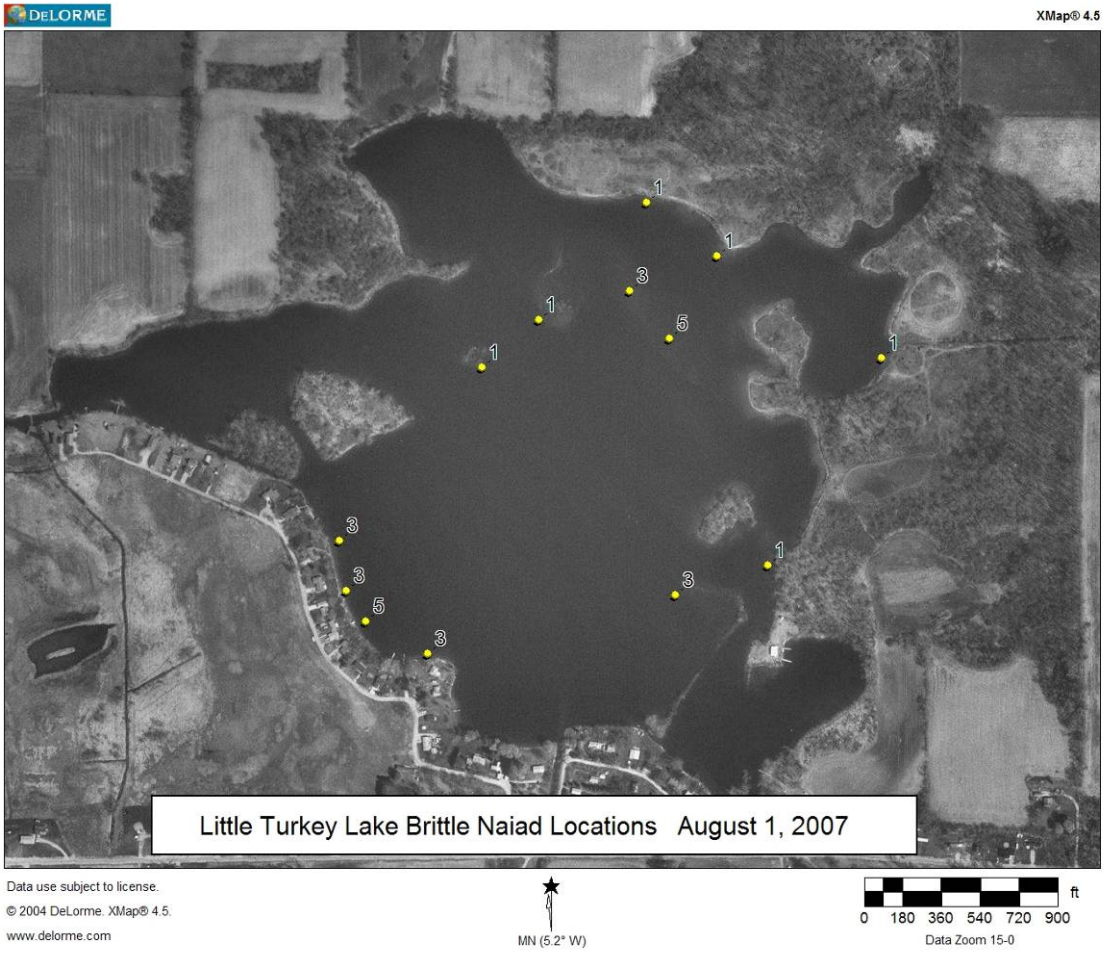


Figure 27: August 2007 Chara Locations

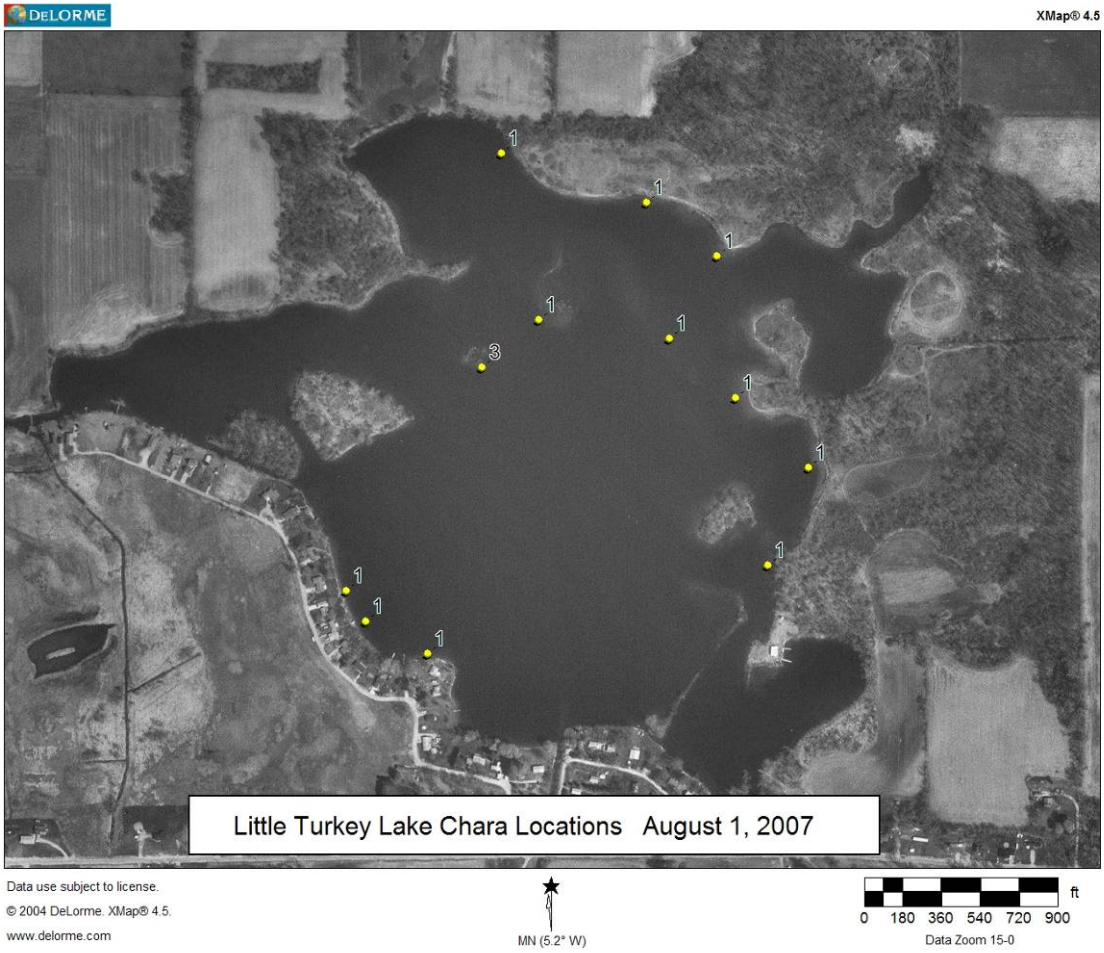


Figure 28: August 2007 Coontail Locations

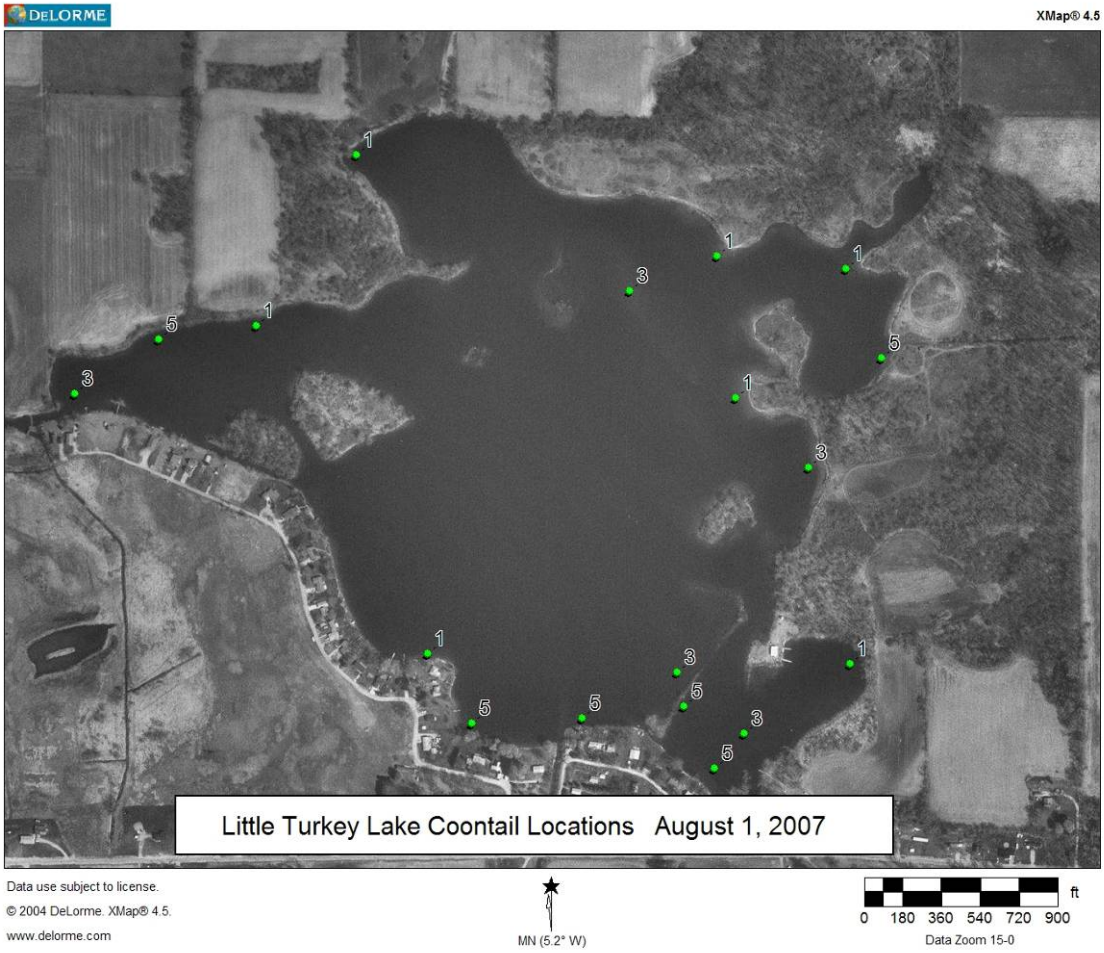


Figure 29: August 2007 Curly Leaf Pondweed Locations

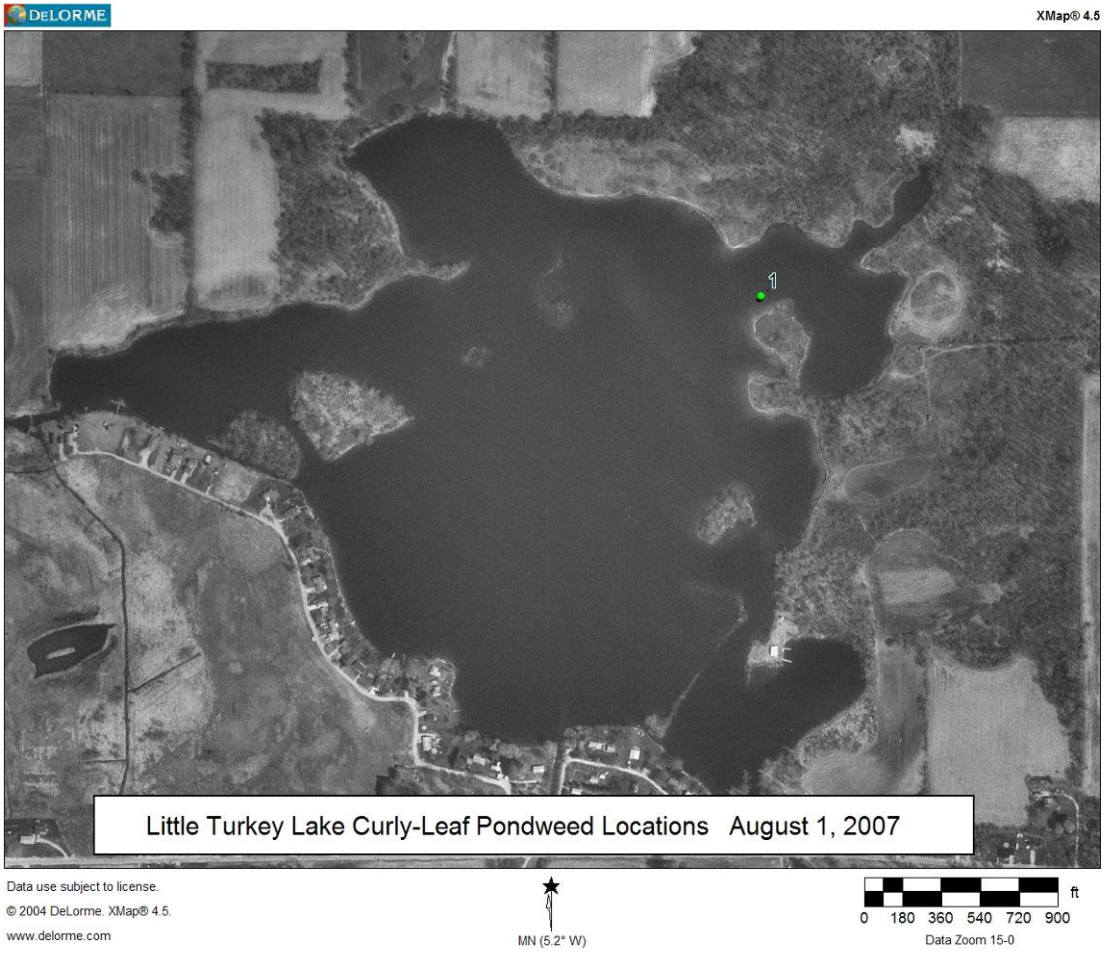


Figure 30: August 2007 Elodea Locations

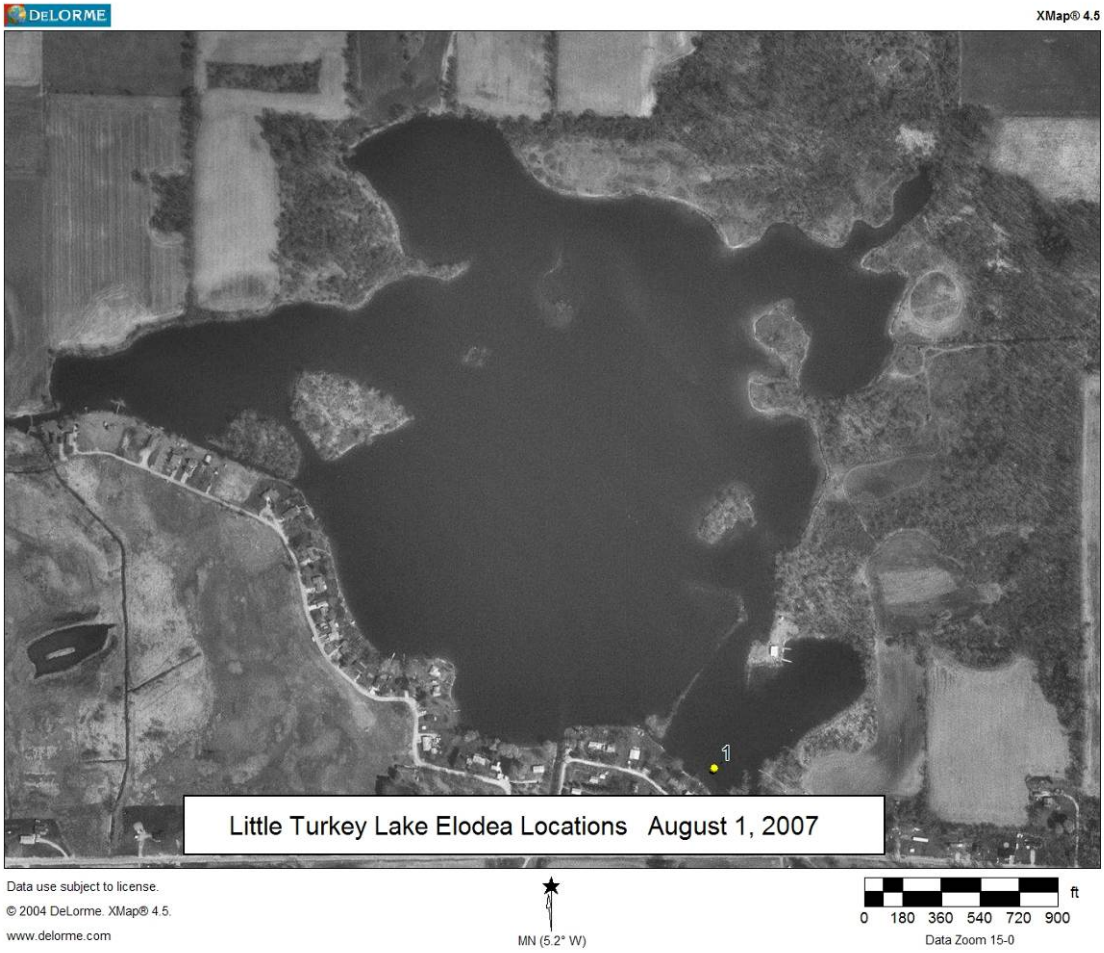


Figure 31: August 2007 Eurasian Watermilfoil Locations

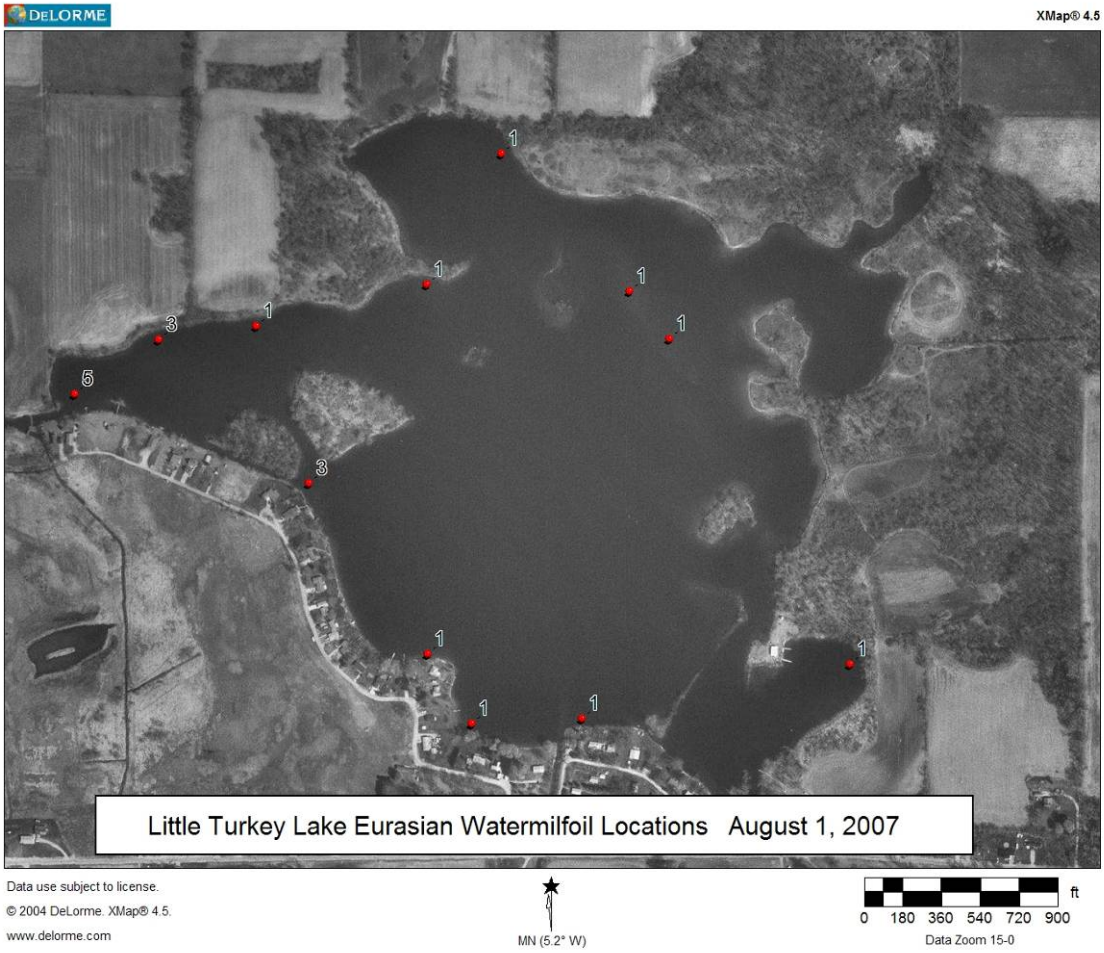


Figure 32: August 2007 Flat-Stemmed Pondweed Locations

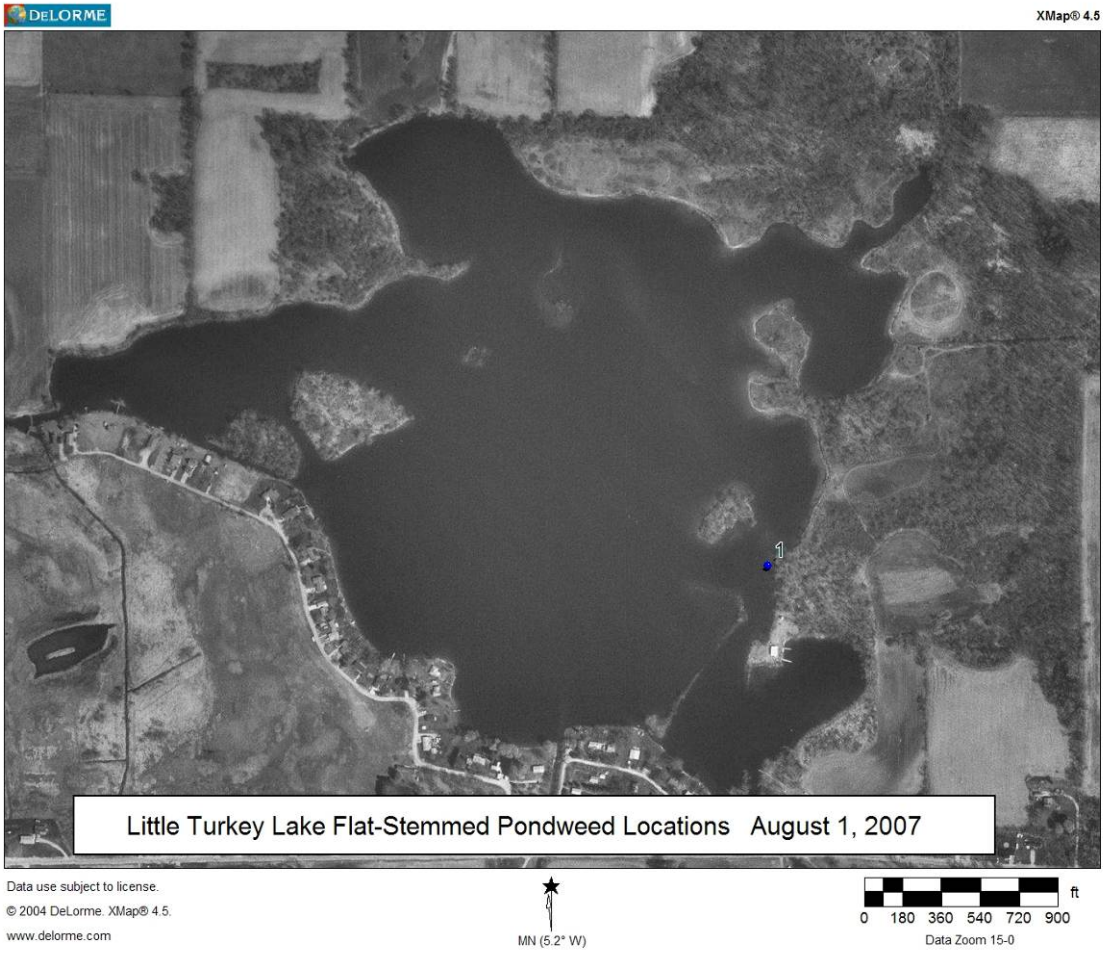


Figure 33: August 2007 Illinois Pondweed Locations

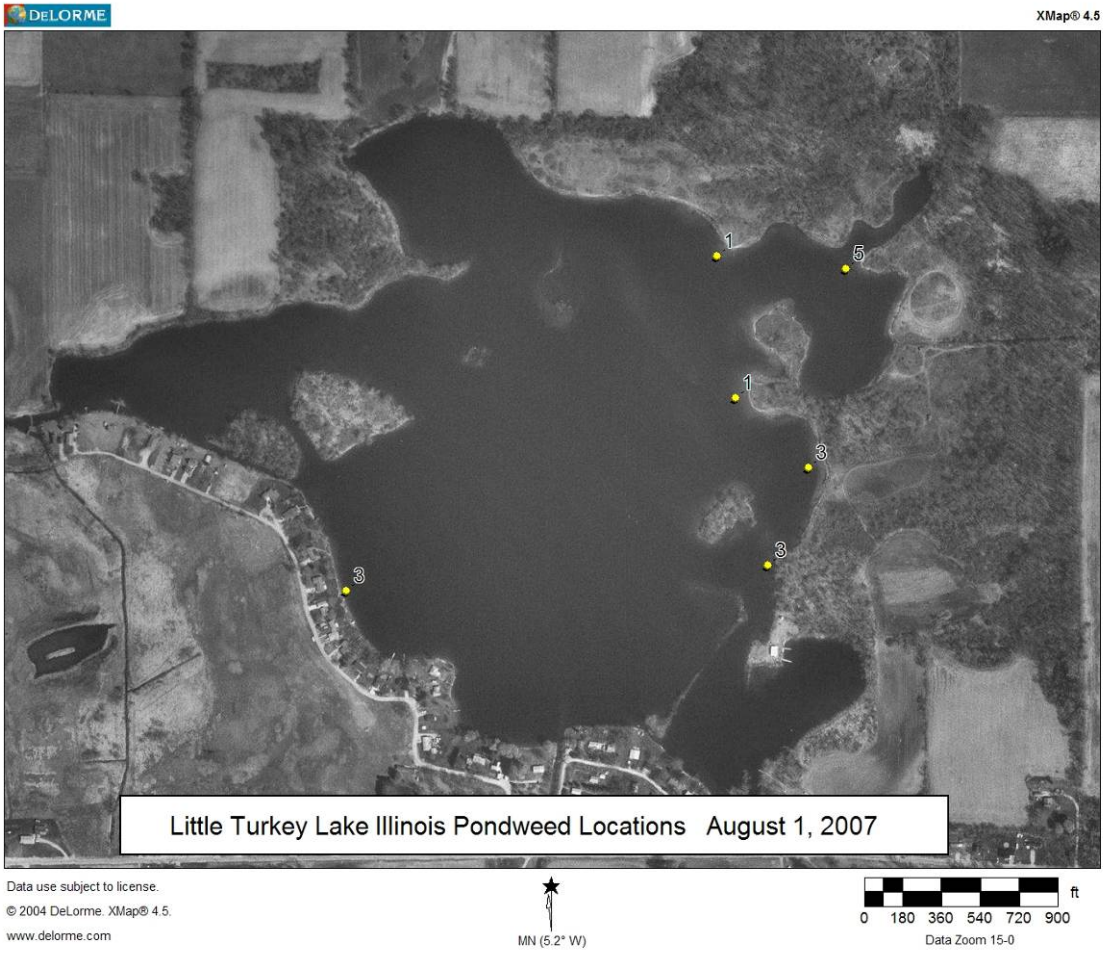


Figure 34: August 2007 Sago Pondweed Locations

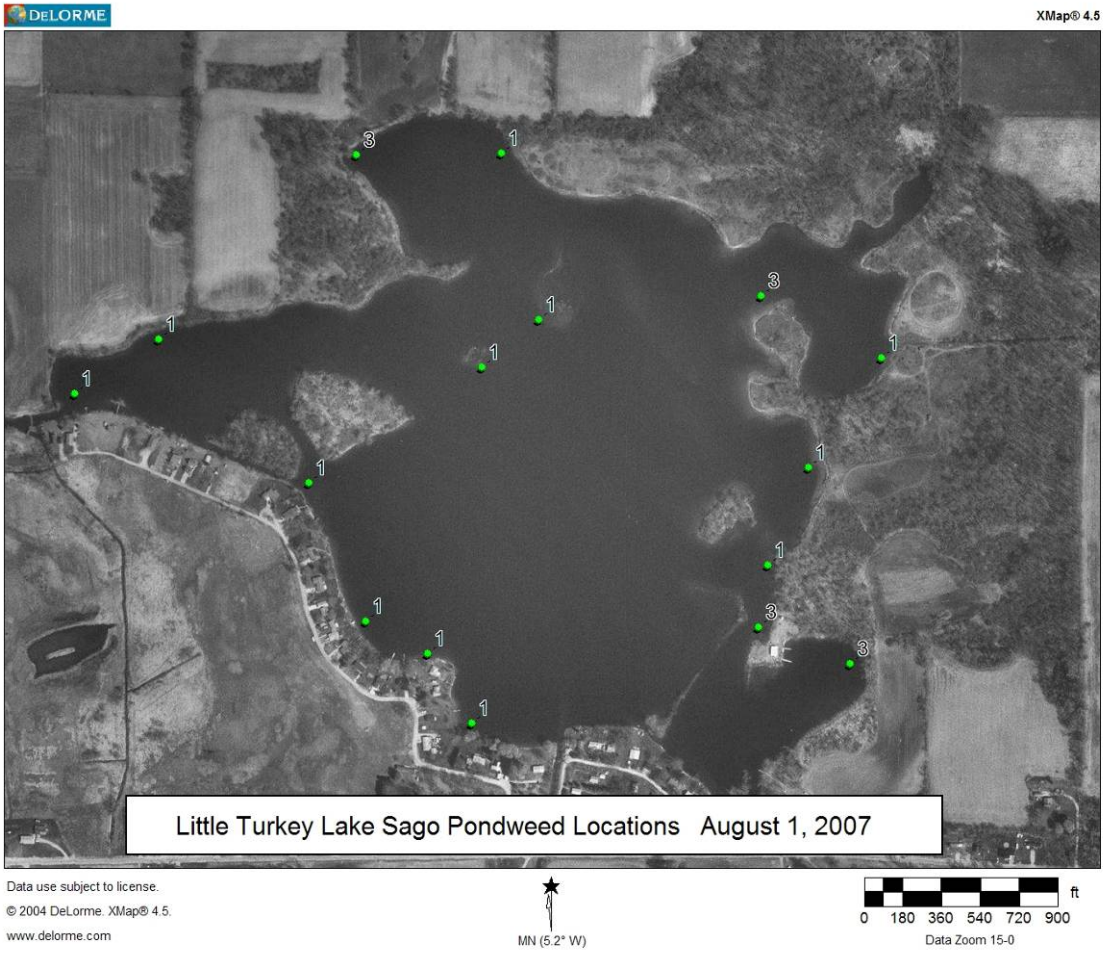


Figure 35: August 2007 Slender Naiad Locations

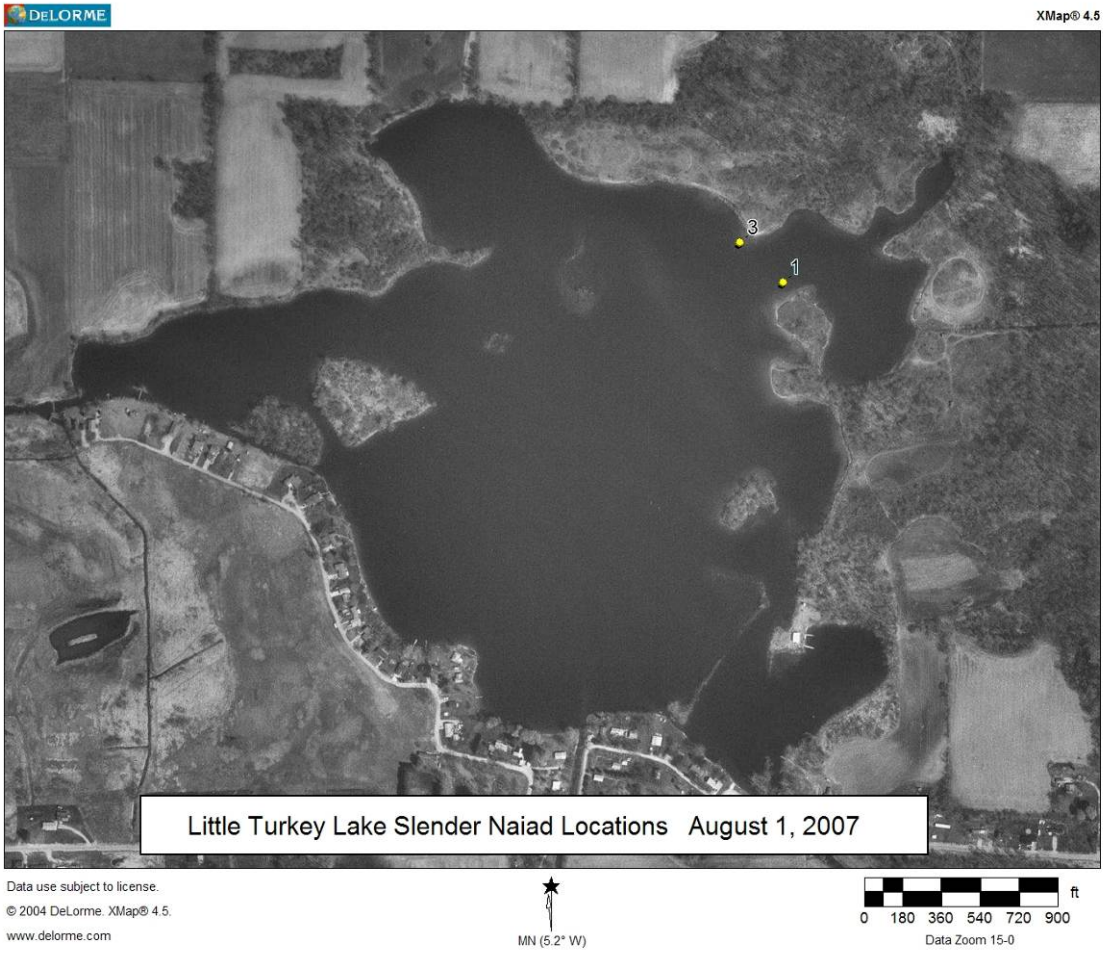
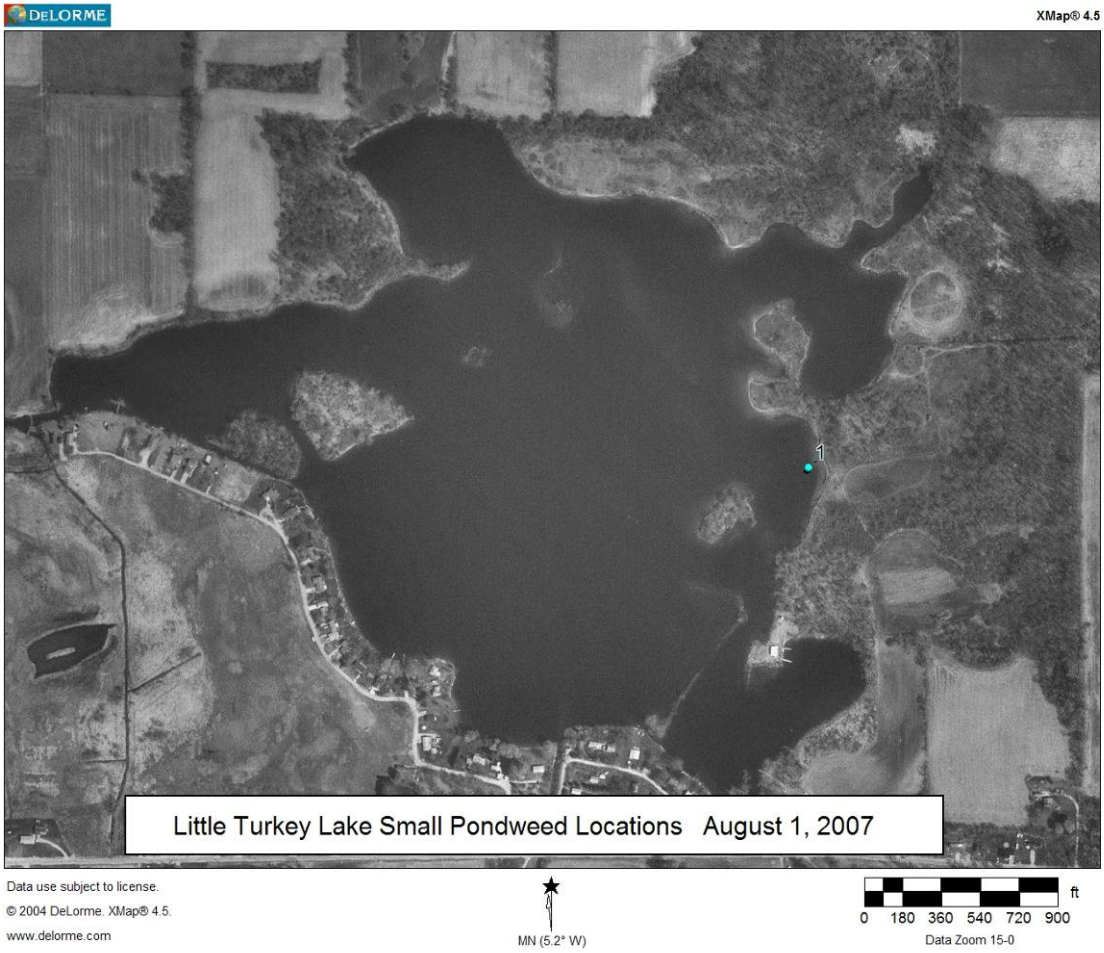


Figure 36: August 2007 Small Pondweed Locations



16.8 Data Sheets

Aquatic Vegetation Random Sampling (Tier 2)

Waterbody Cover Sheet

Surveying Organization: Aquatic Weed Control

Contact Information: 574-533-2597

Waterbody Name: Little Turkey Lake ID: Little Turkey

County(s): LaGrange Date: 6-14-07

Habitat Stratum: IL Avg. Lake Depth (ft): 11.5 ft Lake Level: Avg.

Crew Leader: Dave Keister

GPS Metadata — Datum: NAD83 Zone: 16 Accuracy: 30ft

Recorder: Dave Keister Method: W-Lts enabled GPS

Secchi Depth (ft): 3.2 ft Total # of Points Surveyed: 50 Total # of Species: 10

Littoral Zone Size (acres): 70
- ☐ Measured
- ☒ Estimated

Littoral Zone Max. Depth (ft): 9 ft
- ☐ Measured
- ☐ Estimate (historical Secchi)
- ☒ Estimated (current Secchi)

Notable Conditions: low Secchi - 3.2 ft; eurasian water milfoil common; coontail also very common; Water temp 75°-82°

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

Page 1 of 3

WATERBODY NAME: Little Turkey Lake	DATE: June 14, 2007
COUNTY: Lalorange	SECCHI DEPTH (FT): 3.2 feet
SITE ID: Little Turkey	MAX PLANT DEPTH (FT): 15-sample → actual → 9ft
SURVEYING ORGANIZATION: Aquatic Weed Control	WEATHER: Sunny, Calm, hot - Temp 86°
CREW LEADER: Dave Keister	COMMENTS (Include voucher codes - V1, V2...): 23 0-5 17 5-10 10 10-15
RECORDER: Dave Keister	Water Temp 75° - 82°
CONTACT INFO: 574-533-2597	*Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.*

Species Codes: sago, elodea, curly, Brittle, Small, Whorled Water Milfoil

Point #	R/T	Latitude	Longitude	Depth	myrspi	cerdem	Stipec	elocan	Potcri	CHARA	najmin	PotPus	Notes
1	R	GPS Waypoints		3	3	3	3	3	1				Algae
2				4	1	3	1						
3				2	1	1	3			5			P
4				5		3	1			1			
5				2						1			
6				3			3			1			
7				6	1	3	3			1			
8				3	1								
9				3									P
10				2						3			
11				3			3						
12				4	1	3	1			1			
13				4		1							
14				6						1			
15				4	1	3					1		
16				4	-					1			
17				6	1	3							P
18				5	-								
19				4	3	3							
20				6	5	3							P
21				5	1		1						
22				3						1		1	
23				3						1			P
24				4		3	1			5			
25				3		5				3			
26				4		3				1			
27				5									1
28				15	-								
29				9		1							
30				14	-								
31				6	3	3							
32				8	-								

Other plant species observed at lake:

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

Page 2 of 3

WATERBODY NAME: Little Turkey Lake	DATE: June 14, 2007
COUNTY: Lagrange County	SECCHI DEPTH (FT): 3.2 feet
SITE ID: Little Turkey	MAX PLANT DEPTH (FT): ~9 feet
SURVEYING ORGANIZATION: Aquatic Weed Control	WEATHER: Sunny Hot, Calm
CREW LEADER: Dave Kleister	COMMENTS (Include voucher codes - V1, V2...):
RECORDER: Dave Kleister	water temp 75-82°
CONTACT INFO: 574 533 2597	*Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.*

Point #	R/T	Latitude	Longitude	Depth	Species Codes: myrspi	lepdem	stupec	elocan	Poteri	CHARA	najmin	PotAmp	Whorled Notes	
33	R			7	3	3	1							Algae 1
34	↓	GPS Way Points		15	-									
35	↓	↓	↓	7	-									
36	↓			11	-									
37				8	-									
38				15	-									
39				7	-									
40				7	1		1							
41				8	1					1				
42				15	-									
43				12	-									
44				7		3				1	1			P
45				15	—									
46				15	-									
47				14	-									
48				6	1	1				1			1	bladder - 1
49				7	1	5	1							
50				7	3									

Other plant species observed at lake:

10-15 ||

5

7 14 ~~2 10 15~~

5-10 |||| ||

7

3 5-10

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

Page 3 of 3

WATERBODY NAME: Little Turkey Lake	DATE: 6-14-07
COUNTY: Lagrange	SECCHI DEPTH (FT): 3.2 ft
SITE ID: Little Turkey	MAX PLANT DEPTH (FT): ~ 9 feet
SURVEYING ORGANIZATION: Aquatic Weed Control	WEATHER: Sunny calm Hot
CREW LEADER: Dave Keister	COMMENTS (Include voucher codes - V1, V2...):
RECORDER: Dave Keister	water temp 75.0 - 82°
CONTACT INFO: 574 533 2597	*Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.*

Species Codes:

Point #	R/T	Latitude	Longitude	Depth	DO mg/L	Temp °F	Notes
					DO	Temp	
					mg/L	°F	
				surface	12.42	81.7	
				1.5	12.58	80.1	
				3	12.67	79.1	
				4.5	12.65	79.5	
				6	11.85	78.1	
				7.5	7.37	75.5	
				9	4.67	73.3	
				10.5	3.91	72.1	
				12	1.67	69.0	
				13.5	0.38	65.5	
				15	0.16	61.0	
				16.5	0.09	56.5	
				18	0.06	53.6	
				19.5	0.05	51.1	
				21	0.04	49.7	
				22.5	0.04	48.2	
				24	0.04	47.3	
				25.5	0.04	46.8	
				27	0.03	46.2	
				28.5	0.03	45.6	
				30	0.03	45.3	
				31.5	0.03	45.2	
				33	0.02	45.2	
				~~34.5~~			
				~~36~~			
				~~37.5~~			
				~~39~~			
				~~40.5~~			
				~~42~~			

DO/Temp profile

Other plant species observed at lake:

Aquatic Vegetation Random Sampling (Tier 2)

Waterbody Cover Sheet

Surveying Organization: Aquatic Weed Control

Contact Information: 574- 533- 2597

Waterbody Name: Little Turkey Lake

Lake ID: Little Turkey

County(s): LaGrange, IN

Date: August 1, 2007

Habitat Stratum: IL

Avg. Lake Depth (ft): 11.5 feet

Lake Level: Avg

Crew Leader: Dave Keister

GPS Metadata

Datum: NAD83

Zone: 16

Accuracy: 30 ft

Recorder: Dave Keister

Method: WAAS enabled GPS

Secchi Depth (ft): 3.2

Total # of Points Surveyed: 50

Total # of Species: 11

Littoral Zone Size (acres): 70

- ☐ Measured
- ☒ Estimated

Littoral Zone Max. Depth (ft): 9 ft

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

Notable Conditions:

Secchi depth unchanged from spring survey
Brittle naiad much more abundant
Coontail was the most abundant plant

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

Page 1 of 2

WATERBODY NAME: Little Turkey Lake	DATE: August 1, 2007
COUNTY: LaGrange	SECCHI DEPTH (FT): 3.2
SITE ID: Little Turkey	MAX PLANT DEPTH (FT): 8 feet
SURVEYING ORGANIZATION: Aquatic Weed Control	WEATHER: Hot – Sunny - Temp mid 90's
CREW LEADER: Dave Keister	COMMENTS (Include voucher codes - V1, V2...):
RECORDER: Dave Keister	
CONTACT INFO: 574-533-2597	*Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.*

Species Codes: ~~Cur~~ Sagg Ill Brit eladea small

Point #	R/T	Latitude	Site Longitude	Depth	Ceratem	myrspi	stupec	PotIll	Najmin	elocan	PotPus	Chara	Als Notes
⇒	R	Waypoints	1	3	5					1			
			2	4	1	1	3						
			3	2			3						P
			4	5	3		1	3			1	1	
			5	2	1			1				1	
			6	3			3						curly-1 slender-1
			7	6	5		1		1				
			8	3	1			5					
			9	3	1			1	1			1	Slender-3
			10	2					1			1	Bladder-3
			11	3	–								P
			12	4			1		1			1	
			13	4			1		1			3	
			14	6		1	1					1	
			15	4	5		3						
			16	4		1							
			17	6	–								
			18	5	1	1							
			19	4	5	3	1						
			20	6	3	5	1						
			21	5		3	1						
			22	3				3				1	
			23	3	1	1	1		3			1	
			24	4	5	1	1		3				
			25	3	5	1							P
			26	4	3								P
			27	5					3				
			28	15	–								
			29	9	–								
			30	14	–								
			31	6		1			5			1	
			32	8	–								
			33	7	3	1			3				

Other plant species observed at lake:

Submersed Aquatic Vegetation Survey (Tier II) Datasheet

Page 2 of 2

WATERBODY NAME: Little Turkey Lake	DATE: August 2, 2007
COUNTY: La Grange	SECCHI DEPTH (FT): 3.2
SITE ID: Little Turkey	MAX PLANT DEPTH (FT): 8 feet
SURVEYING ORGANIZATION: Aquatic Weed Control	WEATHER: HOT - Sunny
CREW LEADER: Dave Keister	COMMENTS (Include voucher codes - V1, V2...):
RECORDER: Dave Keister	
CONTACT INFO:	*Rake score (1, 3, 5). 9 = algae, emergent or species observed but not sampled.*

Species Codes: Ev Stag, Bi Ble, Il, Flot

Point #	R/T	Latitude	Site Longitude	Depth	Ceratophyllum demersum	Myriophyllum spicatum	Stuckenia pectinata	Najas minor	Potamogeton illinoensis	Chara	Potamogeton zosteriformis		AIG Notes
->	R	Waypoints	34	15	-								
			35	7	-								
			36	11	-								
			37	8	-								
			38	15	-								
			39	7	-								
			40	7				3					
			41	8			1	5		1			P
			42	15	-								
			43	12	-								
			44	7	-								
			45	15	-								
			46	15	-								
			47	14	-								
			48	6			1	1	3	1	1		
			49	7	5								
			50	7	3								

Other plant species observed at lake:

Rake Sample GPS Coordinates

Latitude	Longitude	Site
41.593397	-85.215295	1
41.594714	-85.212989	2
41.59518	-85.214548	3
41.597199	-85.213688	4
41.598077	-85.214926	5
41.599371	-85.214503	6
41.598585	-85.21246	7
41.599715	-85.213065	8
41.599876	-85.215247	9
41.600548	-85.216444	10
41.599804	-85.217815	11
41.599066	-85.218259	12
41.59847	-85.219222	13
41.601173	-85.218893	14
41.601149	-85.221353	15
41.599519	-85.220163	16
41.598441	-85.221439	17
41.598993	-85.223044	18
41.598818	-85.224703	19
41.59813	-85.22613	20
41.597006	-85.22216	21
41.595639	-85.221534	22
41.594844	-85.220141	23
41.593959	-85.219403	24
41.594024	-85.21753	25
41.594613	-85.21592	26
41.595592	-85.215949	27
41.595054	-85.216527	28
41.596647	-85.216299	29
41.598009	-85.216225	30
41.598834	-85.216047	31
41.598558	-85.213519	32
41.599429	-85.216722	33
41.598371	-85.217758	34
41.600122	-85.219409	35
41.598948	-85.220552	36
41.598531	-85.223303	37
41.598164	-85.224618	38
41.596773	-85.22123	39
41.596277	-85.221643	40
41.595255	-85.221203	41
41.595204	-85.220772	42
41.59442	-85.219194	43
41.593959	-85.218747	44
41.594472	-85.218229	45
41.597563	-85.216262	46
41.598642	-85.217145	47

41.595968	-85.214382	48
41.594177	-85.215813	49
41.593835	-85.214786	50

16.9 IDNR Vegetation Control Permit

APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT
State Form 26727 (R4 / 2-04)
Approved State Board of Accounts 2004
[X] Whole Lake [ ] Multiple Treatment Areas
Check type of permit

INSTRUCTIONS: Please print or type information

FOR OFFICE USE ONLY
License No.
Date Issued
Lake County

Return to: Page 1 of ___
DEPARTMENT OF NATURAL RESOURCES
Division of Fish and Wildlife
Commercial License Clerk
402 West Washington Street, Room W273
Indianapolis, IN 46204

FEE: $5.00

Applicant's Name	Lake Assoc. Name	
Dan Camp	Little Turkey Lake Association	
Rural Route or Street		Phone Number
3365 South 1075 East		260-351-3075
City and State		ZIP Code
Lagrange IN		46761
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
Little Turkey	Stroh	Lagrange
Does water flow into a water supply		[ ] Yes [X] No

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

Treatment Area # 1	LAT/LONG or UTM's whole Lake		
Total acres to be controlled whole	Proposed shoreline treatment length (ft)	Perpendicular distance from shoreline (ft)	
Maximum Depth of Treatment (ft) 10	Expected date(s) of treatment(s) Mid to late May		

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. Sonar

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

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Eurasian Milfoil	X	100

Page ____ of ____

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

Treatment method: ☐ Chemical ☐ Physical ☐ Biological Control ☐ Mechanical

Based on treatment method, describe chemical used, method of physical or mechanical control and disposal area, or the species and stocking rate for biological control. Reward, Aquathal K, Copper sulfate, 2-4D, renovate, Nautique

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

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

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

Applicant Signature	Date
Certified Applicant's Signature	Date

FOR OFFICE ONLY

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

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

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


DeLORME
Street Atlas USA® 2004 Plus
S 1150 E
S 1050 E
E 275 S
E 275 S
E 275 S
S 1150 E
1 - whole lake
Turkey Creek
Little Turkey Lake
S 1075 E
S 1150 E
E 340 S
S 1075 E
S 1080 E
S 1095 E
E 350 S
E 350 S
S 1140 E
E 350 S
Elmira
S 1145 E
Turkey Creek
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www.delorme.com
TN
MN (6.2°W)
Scale 1 : 12,000
1" = 1,000.0 ft
Data Zoom 14-1