CENTER LAKE AQUATIC PLANT MANAGEMENT PLAN UPDATE – 2006

PREPARED FOR:

CENTER LAKE CONSERVATION ASSOCIATION
270 GILLIAM DRIVE
WARSAW, INDIANA 46580

PREPARED BY:

V3 COMPANIES, LTD.
9601 N. INDUSTRIAL DRIVE, SUITE A
ST. JOHN, IN 46373
219.558.8850

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EXECUTIVE SUMMARY

Center Lake is a 120-acre lake in Warsaw, Kosciusko County, Indiana (S5 T32N R6E). The Center Lake Conservation Association (CLCA) received a grant in March, 2006 from the Indiana Department of Natural Resources, Division of Fish and Wildlife (IDNR) through the Lake and River Enhancement Program (LARE). The grant covered aquatic plant mapping and inventorying (Tier I and Tier II) and updating the aquatic plant management plan. Under a separate request, CLCA received a supplemental grant award, on June 26, 2006, of $6,300 as 90% match for the $7,000 herbicide treatment of 22 acres of Eurasian watermilfoil.

The 2006 vegetation surveys performed by V3 Companies, Ltd. (V3) identified an aquatic plant community covering only the very shallow areas of Center Lake (less than 8 feet deep). In total, seven aquatic plant beds were identified, covering approximately 44 acres (37% of the lake by surface area), and composed of 29 aquatic plant species. No deep beds were present in Center Lake during 2006. The maximum depth of submersed vegetation decreased from 13 feet in 2005 (Benson 2006) to 8 feet in 2006. This result may stem from the current lack of a coontail-dominated deep bed, which is present in many lakes in the zone between 8 and 15 feet deep. The coontail population may have been negatively impacted by herbicide applications in 2005 and 2006, possibly by the whole-lake treatment in 2005 with fluridone.

Although dense beds of native aquatic plants can be a nuisance where they inhibit lake access and recreational uses, aquatic vegetation is important to maintaining a healthy lake ecosystem. Aquatic plants provide habitat for fish and other wildlife, improve water quality, and stabilize shoreline areas.

Eurasian watermilfoil is an aggressive invasive aquatic species that can have a detrimental effect on the native aquatic plant community, provides poor fish habitat, inhibits boat navigation, and causes annoyances and serious health hazards to swimmers, and other members of the general public who wish to enjoy the lake. Eurasian watermilfoil has been present in Center Lake for many years and there have been many different approaches implemented to control its population. Biological (stocking weevils), chemical (various treatments) and physical (weed harvester) means of treatment have been implemented with varying levels of effectiveness. Approximately 35 acres infested with Eurasian watermilfoil were treated with Sonar during June 2005, and 22 acres were treated with Renovate3 during June 2006. These treatments were thought to be effective, since after the herbicide treatments, only a few scattered individuals were observed during the August 2006 vegetation survey. However, Troy Turley of CLCA noticed and documented a bed of Eurasian watermilfoil at the northern portion of Center Lake in September 2006.

The following actions are proposed for 2007 to identify and treat areas with Eurasian watermilfoil re-growth, and document the overall health, diversity, and distribution of desirable native aquatic plant beds. A Target Species Distribution Map and Proposed Treatment Area Map will be created during early spring 2007 to determine the extent of follow-up chemical application that will be necessary to treat Eurasian watermilfoil. An early spring (3rd week of

April to mid-May) systemic herbicide application of 2,4-D or Renovate is proposed to treat any Eurasian watermilfoil that may re-grow from the 2006 herbicide application. A post treatment Tier II aquatic plant survey is proposed during the summer 2007 to document the diversity, distribution and abundance of aquatic plants. Follow-up plant surveys and herbicide applications should be conducted during 2008 to ensure that the native plant community is protected, and that the Eurasian watermilfoil population is kept under control.

The proposed management schedule and budgets for 2007 and 2008 are summarized below.

2007

Target Species Distribution Map and Proposed Treatment Area Map	$1,000
Early Spring Systemic Herbicide Application of 2,4-D or Renovate (assumed 30 acres)	$12,000
Late season post treatment aquatic plant survey (Tier II) and plan update	$5,500

2008

Target Species Distribution Map and Proposed Treatment Area Map	$1,000
Late season (post treatment) aquatic plant survey (Tier II) and plan update	$5,500

Any herbicide applications will depend on the results of the surveys

These management activities and plant surveys are proposed to improve Center Lake's ecosystem and facilitate the achievement of overall goals established by the IDNR. These overall goals established by the IDNR for all lakes applying for LARE funding are: 1) develop or maintain a stable, diverse aquatic plant community that supports a good balance of predator and prey fish and wildlife species, good water quality, and is resistant to minor habitat disturbances and invasive species; 2) direct efforts to preventing and/or controlling the negative impacts of aquatic invasive species; and 3) provide reasonable public recreational access while minimizing the negative impacts on plant and wildlife resources.

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TABLE OF CONTENTS

EXECUTIVE SUMMARY **1**

ACKNOWLEDGEMENTS **3**

TABLE OF CONTENTS **4**

LIST OF EXHIBITS **6**

LIST OF FIGURES **6**

LIST OF TABLES **7**

INTRODUCTION AND BACKGROUND **8**

WATERSHED AND LAKE CHARACTERISTICS **9**

Water Quality Data 10

LAKE USES **13**

FISHERIES **14**

PROBLEM STATEMENT **16**

AQUATIC VEGETATION MANAGEMENT GOALS AND OBJECTIVES **17**

PAST MANAGEMENT EFFORTS **18**

TIER I AND TIER II SAMPLING METHODS **19**

Tier I Sampling Methods 19

Tier II Sampling Methods 20

RESULTS OF THE TIER I AND TIER II SAMPLING **21**

Tier I Sampling Results 23

Tier II Sampling Results 29

Comparison of 1996 - 2006 Quantitative Sampling Data 31

AQUATIC PLANT MANAGEMENT ALTERNATIVES **34**

PUBLIC INVOLVEMENT AND EDUCATION **40**

INTEGRATED TREATMENT ACTION STRATEGY **44**

PROJECT BUDGET **45**

MONITORING AND PLAN UPDATES **46**

APPENDICES **47**

REFERENCES CITED **48**

LIST OF EXHIBITS

Exhibit I. Lake Vicinity Map
Exhibit II. Lake Vicinity Aerial
Exhibit III. Center Lake Watershed
Exhibit IV. Bathymetric Map
Exhibit V. Aquatic Plant Beds 2006 Sampling
Exhibit VI. Tier II (2006) Sampling Locations
Exhibit VII. Eurasian Watermilfoil Abundances Prior to Treatment and Treatment Areas
Exhibit VIII. Eurasian Watermilfoil Abundances After Treatment

LIST OF FIGURES

Figure 1. View of public beach at the southern end of Center Lake.
Figure 2. Canopy of pre-treatment Eurasian watermilfoil in northern portion of Center Lake during June 2006.
Figure 3. Submersed sago pondweed and yellow pond lilies.
Figure 4. Great blue heron amongst the lilies in Bed 02.
Figure 5. View of lilies in Bed 04.
Figure 6. White water lilies and other aquatic plants in Bed 05.
Figure 7. Sago pondweed being collected during Tier II quantitative sampling.
Figure 8. Summary totals from completed Lake Use Survey forms.
Figure 9. Hydrilla (*Hydrilla verticillata*) sketch
Figure 10. Comparison of Elodea, Egeria and Hydrilla

LIST OF TABLES

Table 1. Surface Water Quality Data in 2006 at Center Lake
Table 2. Fisheries Data 1984 – 2005 (Benson 2006)
Table 3. Coverage Rating Categories for Tier I Sampling
Table 4. Sample Size Requirements for Tier II Sampling (IDNR 2006)
Table 5. Vegetation Density Ratings for Tier II Sampling
Table 6. Bed 01 - Composite Aquatic Plant Inventories (June and July, 2006)
Table 7. Bed 02 - Composite Aquatic Plant Inventories (June and July, 2006)
Table 8. Bed 03 - Composite Aquatic Plant Inventories (June and July, 2006)
Table 9. Bed 04 - Composite Aquatic Plant Inventories (June and July, 2006)
Table 10. Bed 05 - Aquatic Plant Inventory (July, 2006)
Table 11. Bed 06 - Composite Aquatic Plant Inventories (June and July, 2006)
Table 12. Bed 07 - Composite Aquatic Plant Inventories (June and July, 2006)
Table 13. Tier II July Sampling Results 2006
Table 14. Dominance Index of Each Species in Sampling Depth Zones
Table 15. Tier II Data Comparison from 2004 to 2006
Table 16. Site frequency of aquatic plant species at Center Lake 1996-2006 (Frequency values greater than 30 are shown in bold)

INTRODUCTION AND BACKGROUND

Center Lake is a 120-acre lake in Warsaw, Kosciusko County, Indiana (S5 T32N R6E, Exhibit I). The Center Lake Conservation Association (CLCA) received a grant in March, 2006 from the Indiana Department of Natural Resources, Division of Fish and Wildlife (IDNR) through the Lake and River Enhancement Program (LARE). The grant covered aquatic plant mapping and inventorying (Tier I and Tier II) and updating the aquatic plant management plan. Under a separate request, CLCA received a supplemental grant award, on June 26, 2006, of $6,300 as 90% match for the $7,000 herbicide treatment of 22 acres of Eurasian watermilfoil.

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

WATERSHED AND LAKE CHARACTERISTICS

Center Lake has a surface area of 120 acres (0.19 square miles), a maximum depth of 42 feet and average depth of 20 feet. The western shore is mainly residential areas. The southern and eastern shores have commercial development and municipal uses such as the public swimming beach on the south shore (Exhibit II). The northern shore consists mostly of wetlands and a few channels that lead to residential areas. In 2005 there were 49 buildings lakeside and 35 buildings along the channels, according to data collected by V3 Companies. The overall Center Lake watershed consists of 9,611 acres (V3 2005, Exhibit III). The overall Center Lake watershed is comprised of three sub-watersheds: Center/Pike Lake (888 acres), Tippecanoe River (7,368 acres), and Walnut Creek (1,355 acres). Exhibit IV is a bathymetric map of Center Lake.

Center Lake was historically isolated from Pike Lake until the manmade connection occurred to Lones Ditch along with underground pipes that were installed to directly drain Pike Lake into Center Lake (V3 2006). The manmade connections to Pike Lake have created an inflow of water, which carries additional pollution and sediment into Center Lake and has contributed to degraded water quality. The direct Center Lake tributary watershed is generally a small area immediately around the lake and including portions of Warsaw. However, because the manmade channels have been constructed to connect Pike Lake and Center Lake, a much larger tributary watershed influences the Center Lake water quality.

A periodic flow of water comes from the Pike Lake (Lones Ditch) connection channel during high flow conditions and a constant flow of water from the Pike Lake underground pipe. This flow of water carries with it the pollutant loading that currently exists in Pike Lake. Center Lake discharges into Walnut Creek which in turn flows into the Tippecanoe River. Water also flows out from Center Lake to Lones Ditch which is located between the Pike Lake outfall and the Tippecanoe River (V3 2005). Concluded by the Center Lake Diagnostic Study, V3 2005, and the Center Lake Engineering Feasibility Study, V3 2006, it is likely that high water flows from the Tippecanoe River and Lones Ditch contribute to excessive nutrient loads. Minimizing inflows from the tributaries may reduce the severity of nutrient (nitrogen and phosphorus) loading impacts to Center Lake that cause an increased growth in algae and aquatic plants.

The Center/Pike Lake sub-watershed is 888 acres and is largely composed of cropland and pasture (35.24%), commercial and services (27.17%), residential (16.93%), lakes (14.66%), industrial (3.69%) and deciduous forest land (2.31%) (V3 2005). The area around Center Lake is largely urbanized. The area south of the lake has been and is still more urbanized than the area north of the lake (V3 2005). The area north of the lake has been and remains mainly forest land and cropland pastures. The area immediately east of the lake has been heavily industrialized since the 1980's and continues to develop as such. The area west of the lake has been and remains largely residential.

WATER QUALITY DATA

Center Lake is rated as an eutrophic lake (V3 2005). Eutrophic lakes are characterized by low water transparency (<6'), high concentrations of nutrients (total phosphorus >35 µg/L), abundant weeds and algae, and a lack of dissolved oxygen in the hypolimnion during the summer (Jones and Medrano 2006). It has declined in water quality since the 1990s (Benson 2006).

As summarized by V3 (2005), nutrient loading and low dissolved oxygen levels below the thermocline have been identified as the predominant water quality impairments to Center Lake. Nutrient influx from the man-made ditch connecting Center Lake to Lones Ditch, which flows from Pike Lake, provides additional pollutants and sediment into Center Lake from outside its natural watershed, degrading its water quality (V3 2005).

Water sample analysis from Center Lake conducted during the diagnostic study (V3 2005) suggested intense bacterial activities at the bottom of the lake. These indications were supported by a consistent pattern of higher concentrations of ammonium and very low dissolved oxygen concentrations in the hypolimnion. Additionally, consistent high concentrations of nutrients (total phosphorus and total nitrogen) in the bottom of the lake suggested that nutrients are released from the sediments at the bottom of the lake. This is common in eutrophic lakes that have decaying plant and algae settling out of the lake, which causes low dissolved oxygen levels. The condition of low dissolved oxygen levels at the bottom of Center Lake could be improved by reducing the amount of nutrients (nitrogen and phosphorus) that are entering the lake and leading to an increased growth of algae and aquatic plants.

Water quality of Center Lake has been increasingly influenced by humans over the years. Because the manmade channels and pipes have been constructed to connect Pike Lake and Center Lake, a much larger tributary watershed influences the Center Lake water quality. The manmade connections have created an inflow of water, which carries additional pollution and sediment into Center Lake and has contributed to degraded water quality. This flow of water carries with it the pollutant loading that currently exists in Pike Lake.

Although not specifically required as part of the aquatic vegetation sampling protocol, V3 collected water quality data during 2006 vegetation sampling. Representative water quality data was collected from the surface waters (1 m) over the deep, well-mixed portion of the lake. Water quality data was collected in the field using an YSI 63 pH, Conductivity/Salinity/Temperature Meter, YSI Model 50B Dissolved Oxygen Meter, LaMotte 2020 Turbidimeter, and secchi disk. V3 performed water quality measurements for the following parameters: temperature, conductivity, specific conductance, salinity, pH, dissolved oxygen, flow and turbidity (Table 1).

<u>Temperature.</u> The ecological effects of light and temperature on the photosynthesis and growth of algae are inseparable because of the interrelationships in metabolism and light saturation. One commonly observed change in the rate of respiration of planktonic algae is an increase of the rate with increasing temperature. Additionally, the ability of water to hold oxygen decreases as temperatures increase. When water is oxygen saturated, warmer water has the ability to

possess lower amounts of oxygen when compared to colder water that is likewise oxygen saturated. In 2006, the water temperate was 23.1°C in June and increased to 29.2 in late July.

Conductivity. The conductance of lake water is the reciprocal of its resistance to electrical flow. The resistance of a water solution to electrical current or electron flow is reduced with increasing content of ionized salt. Distilled water has a conductivity of zero. The purer the water is, the lower its conductivity. The conductivity at Center Lake ranged from 529 to 585.

Specific Conductance. Specific Conductance is the conductance at 25ºC. This reading is important because conductivity readings are directly linked to temperature and can change up to 3% for a change of one degree Celsius. Typical conductivity and specific conductance readings for lakes in Indiana are approximately 400, with readings over 1,000 being indicative of excessive metal or salt inputs. The specific conductance at Center Lake ranged from 531 to 549 which is slightly higher than typical for lakes in Indiana. The immediate watershed of Center Lake is highly urbanized and may contribute metals and other pollutants to the lake, resulting in a relatively high specific conductance.

Salinity. Salinity is a measure of the total salts that are dissolved in water, in parts per thousand (ppt). Salinity will be variable from location and time of year. Plants are adversely affected by high salinity, which can cause stunted growth, leaf burn and defoliation. The ocean's salinity is approximately 35 ppt. The following list denotes various concentration levels of salinity in natural environments, however, urban influences of salt distribution during wintertime provides a non-natural situation:

- Fresh water, 0 ppt, no tidal influence
- Tidal Fresh, 0 – 1 ppt, tidal influence
- Oligohaline, 2 – 5 ppt, slightly brackish
- Mesohaline, 8 – 15 ppt, brackish
- Polyhaline, >18 ppt, salt water

The most commonly used road salt is sodium chloride (NaCl). NaCl dissociates in aquatic systems into chloride ions (Cl^-) and sodium cations (Na^+). This also results in a higher conductivity reading. Elevated sodium and chloride levels create osmotic imbalances in plants, which inhibit water absorption and reduce root growth. Various species of fish, amphibians and aquatic macroinvertebrates are adversely impacted by increased levels of sodium and chloride.

pH (Acidic and Alkaline). The pH of a water body reflects the concentration of hydroxide (OH^-) in the water body. A low pH signifies an acidic medium (lethal effects of most acids begin to appear at pH = 4.5) while a high pH signifies an alkaline medium (lethal effects of most alkalis begin to appear at pH = 9.5). Neutral pH is 7. The actual pH of a water sample indicates the buffering capacity of that water body. The pH at Center Lake ranged from 8.1 to 8.75. Those ranges are relatively alkaline, and typical of natural lakes in the area. Calcareous limestone and dolomite constituents of bedrock and glacial till in the watershed generally influence the pH of groundwater in the region, and resulting pH values in natural lakes.

Dissolved Oxygen. Dissolved oxygen is the gaseous form of oxygen and is essential for respiration of aquatic organisms (i.e. fish and plant). Dissolved oxygen enters water by diffusion from the atmosphere and as a byproduct of photosynthesis by algae and plants. Oxygen saturation in water would equal 100% if equilibrium were reached. Values greater than 100% saturation indicate photosynthetic activity within the water. Large amounts of dissolved oxygen in the water indicate excessive algae growth. Dissolved oxygen is consumed by respiration of aquatic organisms and during bacterial decomposition of plant and animal matter. The Indiana Administrative Code lists a minimum standard of 4.0 mg/L for dissolved oxygen. Dissolved oxygen at the surface in Center Lake was good in 2006, ranging from 10.18 (July) to 10.82 mg/L (June).

Turbidity. The waters transparency can be affected by two primary factors: algae and suspended particulate matter. An increase in the density of the phytoplankton or suspended particles signifies an increase in the waters turbidity. During sampling, turbidity at Center Lake was generally high.

Secchi Disk. Secchi disk transparency measurements were determined by the depth at which a standard black and white disk is no longer visible in the water column. Similar to the turbidity measurements, visibility was higher during early June sampling, as measured by the secchi disk readings, before algae growth increased during the warm summer months and visibility correspondingly decreased. Secchi disk measurements ranged from 3.6 to 7.2 feet between 1991 and 2003 (V3 2005). In 2005, the secchi disk measurement was recorded at 5 feet (Benson 2006). In 2006, secchi depth ranged from 3.5 to 5 feet. This low water transparency, in general, is characteristic of eutrophic lakes.

Table 1. Surface Water Quality Data in 2006 at Center Lake

Date	Air Temp. (°C)	H2O Temp. (°C)	Turb. (NTU)	pH	Cond. (µmhos)	SpC (µmhos)	Salinity (ppt)	D.O. (mg/L)	Secchi (ft)
6/12	20	23.1	3.9	8.75	529	549	0.3	10.82	3.5
7/31	36	29.2	2.6	8.1	585	531	0.3	10.18	5

LAKE USES

Water from Center Lake is no longer used for public drinking water, although it was a municipal water supply until December 31, 1999 (H. Gerkin in Benson 2006).

Eighteen acres of land along the southern shoreline of Center Lake are owned by the City of Warsaw for recreational uses including but not limited to public boat launch, public beach, gardens, picnic areas and open spaces (V3 2005). The public swimming beach is located along the southern shore.

Designated trapping, fishing and hiking activities are allowed in the 25.5-acre Center Lake Wetland Conservation Area located in the northwest side of the lake. Hunting is not permitted in this area as it acts as a wildlife sanctuary area. A 7.19-acre area on the north shore that consists of a significant wetland component was donated to the Kosciusko County Soil and Water Conservation District. A second significant natural area is the privately owned Donna Jean Simpson property that consists of 13.49 acres on the west shore.

One public boat launch is located along the southern shoreline. A powerboat restriction is enforced on the lake limiting the speed limit for boats to 10 mph. While windsurfing is an occasional recreational use on the lake, waterskiing and jetskiing activities are not allowed. Recreational boating typically includes pontoon boats, fishing boats, canoes and kayaks.

Figure 1. View of public beach at the southern end of Center Lake.

FISHERIES

As summarized in Benson (2006), fisheries studies have been conducted at Center Lake in 1970, 1976, 1984, 1997, 2001, and 2005. The most recent fisheries survey (June 6-7, 2005) used electro-fishing, gill nets and trap nets to collect 3,257 fish with a total weight of 588 pounds. Table 2 below compares the fishery surveys data from 1984 to 2005. Twenty-four species of fish and one hybrid were collected in 2005, with bluegills being the most abundant fish by number (1,999) and the second most abundant fish by weight (76.13 lbs.). Redear sunfish was the second most abundant fish by number (577). Gizzard shad was the third most abundant fish by number (390) and first most abundant fish by weight. Spotted gar was the third most abundant fish by weight.

Major trends in the fisheries survey data were outlined in recent fisheries surveys. The results of the 2001 fisheries survey demonstrated that the Center Lake fishery is healthy (V3 2005). Twenty species and one hybrid were collected totaling 2,834 fish. 83% of the fish (50% of the total weight) collected were considered important game species.

Since aquatic plants and fisheries health are closely related, it is important to evaluate how changes in the aquatic plant community may impact the fishery of Center Lake. Aquatic plants provide ambush cover for predators, as well as protective cover for young fish. Optimal aquatic plant coverage for fish varies between species, but is generally considered to be between 20 to 40% of the lake's surface area. Plant coverage percentages generally considered optimum for healthy fish communities should not be misconstrued as target objectives for plant distribution and abundance. Recent scientific studies have shown that fish communities are adversely affected when submersed aquatic vegetation (SAV) falls below 10% of the total surface area, or increases to 60% of the total surface area. Based on V3's 2006 plant surveys, aquatic plant beds cover approximately 37% of the lake's surface area, which is within the optimal range recommended for healthy ecosystems. The diverse fish community is further evidence that SAV coverage is at an appropriate level in Center Lake (Benson 2006).

Although the amount of fish habitat is important to the fishery's health, the quality of fish habitat is equally as important. In cases of exotic plant invasion, the decline in habitat quality is problematic since diverse plant beds often are replace by a monoculture. In October 1996 Eurasian watermilfoil abundances were suppressed due to chemical treatments, followed by a strong recruitment class in 1997 for largemouth bass, bluegill, redear and yellow perch. The growth of bluegill, redear sunfish, and largemouth bass decreased between the 2001 and 2005 surveys (Benson 2006). This is probably a direct result of an abundance of Eurasian watermilfoil in the lake. It is particularly important to continue to monitor and treat the Eurasian watermilfoil population and its impact on the growth of important game fish (i.e., largemouth bass, bluegill, and redear sunfish). In addition, it is equally as important to promote and maintain a high diversity of native aquatic plants.

Table 2. Fisheries Data 1984 – 2005 (Benson 2006)

Fish species and number of individuals captured in Center Lake general surveys from 1984 through 2005					
***Common name of fish**	**Scientific name of fish**	**1984**	**1997**	**2001**	**2005**
Spotted gar	*Lepisosteus oculatus*	12	35	25	35
Bowfin	*Amia calva*	4	2	9	15
Gizzard shad	*Dorosoma cepedianum*	223	76	294	390
Grass pickerel	*Esox americanus*	0	0	0	2
Nothern pike	*Esox lucius*	11	26	11	7
Carp	*Cyprinus carpio*	4	17	9	5
Golden shiner	*Notemigonus crysoleucas*	11	13	6	6
Bluntnose minnow	*Pimephales notatus*	0	0	0	1
White sucker	*Catostomus commersoni*	5	5	0	4
Spotted sucker	*Minytrema melanops*	13	26	14	1
Lake chubsucker	*Erimyzon tenuis*	0	1	0	0
Northern hog sucker	*Hypentelium nigricans*	0	1	0	0
River redhorse	*Moxostoma carinatum*	4	0	0	0
Shorthead redhorse	*Moxostoma macrolepidotum*	0	2	0	0
Golden redhorse	*Moxostoma erythrurum*	0	2	4	6
Channel catfish	*Ictalurus punctatus*	2	0	0	2
Yellow bullhead	*Ameiurus natalis*	3	4	7	5
Black bullhead	*Ameiurus melas*	3	0	0	0
Brown bullhead	*Ameiurus nebulosus*	10	24	20	29
Brook silverside	*Labidesthes sicculus*	0	23	3	1
White bass	*Morone chyrsops*	0	2	0	0
Black crappie	*Pomoxis nigromaculatus*	38	48	36	33
Rock bass	*Ambloplites rupestris*	0	2	0	0
Largemouth bass	*Micropterus salmoides*	26	49	72	65
Warmouth	*Lepomis gulosus*	35	42	25	13
Green sunfish	*Lepomis cyanellus*	0	2	2	0
Bluegill	*Lepomis macrochirus*	239	1051	1990	1999
Redear sunfish	*Lepomis microlophus*	43	430	154	577
Pumpkinseed	*Lepomis gibbosus*	90	22	10	2
Longear sunfish	*Lepomis megalotis*	14	22	24	8
Hybrid sunfish	*Lepomis spp.*	0.0	1	10	7
Walleye	*Stizostedion vitreum*	0	0	0	1
Hybrid walleye	*Stizostedion spp.*	0	1	0	0
Yellow perch	*Perca flavescens*	10	135	109	43
Total:		**890**	**2064**	**2834**	**3257**

1984 effort: gill net = 6 lifts, trap net = 6 lifts, DC electrofishing = 1 h
1997 effort: gill net = 6 lifts, trap net = 6 lifts, DC electrofishing = 1 h
2001 effort: gill net = 5 lifts, trap net = 6 lifts, DC electrofishing = 1 h
2005 effort: gill net = 4 lifts, trap net = 3 lifts, DC electrofishing = 1h
* Common and scientific names of fishes recognized by the American Society

PROBLEM STATEMENT

Water quality in Center Lake has declined since the 1990s (Benson 2006). As summarized by V3 (2005), nutrient loading and low dissolved oxygen levels below the thermocline have been identified as the predominant water quality impairments to Center Lake. Nutrient influx from the man-made ditch connecting Center Lake to Lones Ditch, which flows from Pike Lake, provides additional pollutants and sediment into Center Lake from outside its natural watershed, degrading its water quality (V3 2005).

Eurasian watermilfoil is an aggressive, invasive aquatic species that can have a detrimental effect on the native aquatic plant community. This nuisance species grows and spreads rapidly, forming dense weed beds that outcompete native species for light and nutrients. In lakes where Eurasian watermilfoil is left unchecked, even well-diversified plant communities can become decimated and taken over by a single species.

The biology and life cycle of Eurasian watermilfoil provide it with a significant advantage over native species. Eurasian watermilfoil lies dormant during the winter months, instead of dying back completely like many native species. As spring arrives, the dormant Eurasian watermilfoil is able to grow earlier and reach the surface faster than other native species. It then grows horizontally across the water surface to form a canopy and effectively shade out other plants. Eurasian watermilfoil grows profusely, provides poor fish habitat, inhibits boat navigation, and causes annoyances and serious health hazards to skiers, swimmers, and other members of the general public who wish to enjoy the lake.

In part due to water quality problems, Eurasian watermilfoil has been a dominant plant in Center Lake for many years. Center Lake was treated with Sonar aquatic herbicide in 1996, but Eurasian watermilfoil had reestablished its dominance by 2001 (Benson 2006). Approximately 35 acres infested with Eurasian watermilfoil were treated with Sonar during June 2005, and 22 acres were treated with Renovate3 during June 2006. These treatments were thought to be effective, since after the herbicide treatments, only a few scattered individuals were observed during the August 2006 vegetation survey. However, Troy Turley of CLCA noticed and documented a bed of Eurasian watermilfoil at the northern portion of Center Lake in September 2006. IDNR encouraged CLCA to apply for LARE funding for 2007 Eurasian watermilfoil treatment. Treatments should be continued over three or four years to really eliminate all of the Eurasian watermilfoil, since it can lay dormant on the lake bed where it may not be affected by herbicide in a given year (Sturdevant 2006).

Figure 2. Canopy of pre-treatment Eurasian watermilfoil in northern portion of Center Lake during June 2006.

AQUATIC VEGETATION MANAGEMENT GOALS AND OBJECTIVES

The following management goals have been established by the IDNR for all lakes applying for LARE funding. Any management practices implemented at Center Lake must facilitate the achievement of these three goals.

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

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

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

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

1. **Tier I and Tier II Plant Surveys**. Tier II surveys should be conducted for the next two years to monitor the distribution and abundance of Eurasian watermilfoil, and document any changes in the native plant community of Center Lake. Changes in the plant community will be identified, and the survey results will be used to inform future management strategies.

2. **Chemical/Follow-up Treatment of Eurasian Watermilfoil**. Based on the post-treatment plant survey results (see below), the chemical treatment of Eurasian watermilfoil during June 2006 was successful in significantly reducing the milfoil population size. However, scattered individuals were still observed. Therefore, the population should be closely monitored during 2007, and specific patches of Eurasian watermilfoil should be treated where observed.

3. **Promote and Maintain the Diversity of Native Aquatic Plant Species.** A healthy, diverse community of native aquatic plants is important to provide good fish habitat, stabilize the shoreline, and prevent the establishment and/or spread of Eurasian watermilfoil and other invasive species. Due to these multiple benefits, one of the specific goals of this plan is to promote and maintain a healthy diversity of native aquatic plant species, while recognizing that some vegetation management may be necessary to provide reasonable public access for recreation.

PAST MANAGEMENT EFFORTS

Eurasian watermilfoil has been dominant in the shallow areas of Center Lake for many years. The northern portion of the lake is a shallow area that has historically had a large abundance of Eurasian watermilfoil. This has been negatively impacting recreational boat usage on the lake. Three weed control methods, chemical, biological and mechanical, have been used in the past at Center Lake.

No treatments, other than copper sulfate to treat algae, had been made prior to 1996 as Center Lake provided Warsaw with drinking water during this time. After Center Lake stopped being used as potable water, 2,4-D herbicide application was allowed in the channels at the north end of the lake and near the public swimming area.

In October 1996, the SePro Corporation conducted an experimental treatment on the entire lake using Sonar® aquatic herbicide at a concentration of 12 parts per billion (Braun, 1997 or V3, 2005). This treatment was allowed because Sonar® is labeled as safe for potable water. By 1997, Eurasian watermilfoil had decreased greatly and was no longer considered a nuisance to recreational users on Center Lake.

In the late 1990's, mechanical weed harvesting was used to control Eurasian watermilfoil especially in boat lanes. However, mechanical weed harvesting was breaking the milfoil into fragments which floated in the water and eventually grew back when the fragments came it contact with soil.

In 2000, 2001 and 2003, milfoil beetles (*Euhrychiopsis lecontei*) were released to decrease the population of milfoil that had again become dominant in the lake. However, the beetle release effort was unsuccessful.

LARE granted a whole lake treatment in 2005. Sonar AR was used at a concentration of 6 ppb on May 12, 2005 and a treatment of 2 ppb on June 2, 2005 was used to bump up the treatment back to 6 ppb in order to control Eurasian watermilfoil more effectively (Weed Patrol 2005).

The 2006 treatments included two events, May 9, 2006 three acres of Eurasian watermilfoil was treated, and on June 28, 2006 Renovate3 (55 Gallons) was used to treat 22 acres of Eurasian watermilfoil (Exhibit VII).

TIER I AND TIER II SAMPLING METHODS

Tier I and Tier II aquatic sampling protocols were established by the IDNR to accurately describe and characterize the aquatic plant community of any particular lake, in a repeatable, consistent and analytical manner. Tier I sampling provides **qualitative** data on the distribution of aquatic plant species within a waterbody. In addition, it is useful to document gross changes in the extent of a particular plant bed or the relative abundance of a species within a waterbody. Tier II sampling provides **quantitative** data on the occurrence, distribution, and abundance of aquatic plants within a waterbody. Together, these sampling protocols are intended to:

1. Document the distribution and abundance of submersed and floating-leaved aquatic vegetation within selected areas and at a lakewide scale, and

2. Compare present distribution and abundance of particular aquatic plants with past distribution and abundance within select areas and at a lakewide scale.

TIER I SAMPLING METHODS

The Tier I survey involves identifying and mapping the major plant beds in a lake. A Tier I survey is conducted during late spring (May 15 to June 15) and summer (July 15 to August 30). Two surveys are required to provide an accurate representation of all plant species in a lake. Some species such as eel grass (*Vallisneria americana*) or naiads (*Najas* spp.) 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, and the need to document changes in plant community composition based on management activities (e.g., herbicide applications), two surveys are conducted per year to adequately characterize the plant community composition.

In lakes with high water clarity or in shallow areas where aquatic vegetation is visible from the surface, the Tier I survey can be accomplished visually, with limited rake throws. In lakes with low water clarity or in deeper beds where aquatic vegetation is not visible from the surface, a standard rake is used to collect plants and identify plant beds locations and composition. The general location of each bed is recorded on a bathymetric map of the lake, and limits of the bed are mapped in the field using a WAAS enabled GPS unit. Generally, a zig-zag pattern is used of visually inspecting the littoral zone from a boat, with passes conducted no farther apart than can be visually inspected. Plant beds are differentiated based on a substantial change in vegetative composition and/or a change in substrate.

Each bed is assigned a reference number, and each plant species observed in that bed is recorded. Plants are identified to the species levels using the following taxonomic keys: Voss (1972, 1985), Swink and Wilhelm (1994), and Fassett (1957). Based on visual estimation, canopy ratings are assigned to each plant bed for each of the major type of aquatic plants present (i.e., emergent, rooted floating-leaved, non-rooted floating-leaved, submersed). In addition, the abundance rating of each species is assigned using visual estimation. The coverage ratings for the overall vegetation canopy and for each individual species follow the categories in Table 3.

Table 3. Coverage Rating Categories for Tier I Sampling

Cover (%)	Cover Rating
>61%	4
21-60%	3
2-20%	2
< 2%	1
None	0

TIER II SAMPLING METHODS

Tier II sampling is conducted to provide quantitative data on the occurrence, distribution, and abundance of aquatic plants in a lake. Quantitative data is useful to track changes in the plant community composition through time, and provide a standard method of making comparisons between different lakes. LARE Tier II aquatic plant monitoring is conducted once each season between July 15 and August 31.

The number and depth of sampling locations are determined by lake size, trophic state, and apportioned by depth class. The following table was used to determine the number and depths of sampling locations (note: table excludes hypereutrophic status).

Table 4. Sample Size Requirements for Tier II Sampling (IDNR 2006)

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

Since Center Lake has a surface area of 120 acres and is rated as eutrophic, 50 sample sites were required at the depth distribution shown in bold in Table 4. Approximate sample site locations were randomly spaced on a bathymetric map based on the depth categories. Pre-designated sample site locations were navigated to based on visual markers, and the depth category in the vicinity was found using a Humminbird 383c depth finder. The location of each sampling point was recorded using a WAAS-enable GPS unit (estimated accuracy ± 3m).

A double-headed thatch rake with attached nylon rope was used to sample the aquatic vegetation at each sampling location. The rake was lowered to the bottom of the lake, and an extra ten feet of slack was let out in the rope as the boat drifted. Then the rake was dragged along the lake bottom for a few feet and pulled up through the water column. All vegetation caught on the teeth of the rake was gathered into the boat and separated by species. Plants of each species were piled onto one side of the rake for a score of 1-5, based on the following table. Visible "holes" in the rake teeth were filled without overly packing plants onto the rake. In addition to recording the density of each species, the overall density was recorded of all plants at a sampling location.

Table 5. Vegetation Density Ratings for Tier II Sampling

Rake Teeth Filled (%)	Density Rating
100+	5
21-99	3
1-20	1
No plants retrieved	0

After the Tier II data was collected, it was imported into a Microsoft Excel spreadsheet to calculate plant community metrics used by IDNR (IDNR 2006). Site frequency measures how often a species was collected at the Tier II sampling locations. It is calculated by the following equation:

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

Relative density is calculated as the sum of the rake scores for a species divided by the total number of sample sites in the survey. In contrast, mean density measures the abundance of a species in areas where it is growing. These values are calculated by the following equations:

$$\text{Mean Density} = \frac{\text{(Sum of all rake scores for a species)}}{\text{(Total \# of sites where the species was collected)}}$$

$$\text{Relative Density} = \frac{\text{(Sum of all rake scores for a species)}}{\text{(Total \# of sample locations)}}$$

The dominance index of each species is a metric that combines the frequency of occurrence and relative density to reflect the relative dominance of a species within the aquatic plant community. It is calculated as:

$$\text{Dominance Index} = \frac{\text{(Sum of all rake scores for a species)}}{\text{(Total \# of sample locations X 5)}} \times 100$$

RESULTS OF THE TIER I AND TIER II SAMPLING

The submersed plant community of Center Lake covers approximately 44 acres of the lake, or 37% of the lake surface. Seven aquatic plant beds were mapped, composed of 29 aquatic plant

species (Exhibit V). The beds are generally are located between 0 to 8 feet in depth. Typically, they are moderately vegetated (21-60% submersed vegetative coverage). Plant growth in some areas may be inhibited by degraded water quality, substrate, wave action, boat traffic, herbicide treatment and/or other factors.

Sago pondweed was a dominant species found throughout most of the beds in Center Lake. Generally, sago pondweed is one of the most common aquatic plants in lakes, and normally indicates a calcareous condition (V3 2005). Additionally, the occurrence of sago pondweed may be an indicator of conditions suitable for Eurasian watermilfoil invasion (Jacono and Richerson 2002). Eurasian watermilfoil was present in moderate abundance in June in the northern portion of the lake (Bed 01), but was observed in very low abundance in July which was after the 2006 herbicide application.

White water lily and yellow pond lily were dominant emergent species in Beds 02 and 04 and were present in patches around the perimeter of Center Lake. Beds 06 and 07 were located in the channels north of Center Lake, not in the lake proper, and contained a higher diversity of aquatic plant species than beds in the lake itself.

No deep beds were found in Center Lake during 2006. Submersed vegetation was found to a maximum depth of 13 feet in 2005 (Benson 2006), but only to a maximum depth of 8 feet in 2006. One explanation for the shallower growth of vegetation in 2006 is degraded water quality and associated low water transparency. However, secchi disk readings remained consistent with previous years' values (5' depth). Coontail also decreased between 2005 and 2006, from 38% of sampling sites in 2005 to only 2% in 2006.

In many lakes, such as Winona Lake, coontail is often the dominant species in the deeper aquatic plant bed (8-20'; see V3 2006). A possible explanation for the lack of a deeper plant bed during 2006 is that the herbicide applications conducted during 2005 and 2006 may have had a side result of negatively impacting coontail. In particular, this result may have been a side result of the whole-lake treatment using fluridone in June 2005. Based on these observations and hypothesis, it is particularly important to monitor and document if a deeper plant bed dominated by coontail re-establishes in the 8 to 14 foot depth range. It would be particularly unfortunate if Eurasian watermilfoil takes advantage of the current lack of coontail in this area, and establishes itself as a deeper plant bed around the entire lake.

TIER I SAMPLING RESULTS

Each plant bed is discussed in detail below:

Plant Bed 01

Size: 29.4 acres
Substrate: silt/organics/marl
Number of Species: 13
Overall Vegetative Coverage: >60%

Figure 3. Submersed sago pondweed and yellow pond lilies.

Description: This shallow bed (0 to 8 feet) is located in the northern portion of Center Lake. Bed 01 was characterized as a dense bed largely dominated by sago pondweed (>60%) in June and July. Richardson's pondweed and curly-leaf pondweed were present in moderate abundance (2-20%) in June but were not observed in July. Eurasian watermilfoil was also in moderate abundance (2-20%) in June but was observed in very low abundance (>2%) in July which was after the 2006 herbicide application.

Table 6. Bed 01 - Composite Aquatic Plant Inventories (June and July, 2006)

Acronym	Scientific Name	Common Name	June Abund.	July Abund.
Submersed				
CEDE4	*Ceratophyllum demersum*	Coontail	--	< 2%
CH?AR	*Chara* sp.	A chara species	--	< 2%
LEMI3	*Lemna minor*	Common duckweed	< 2%	--
LETR	*Lemna trisulca*	Star duckweed	< 2%	--
MYSP2	*Myriophyllum spicatum*	Eurasian watermilfoil	2-20%	< 2%
NYTU	*Nymphaea tuberosa*	White water lily	< 2%	< 2%
POCR3	*Potamogeton crispus*	Curly-leaf pondweed	2-20%	--
POIL	*Potamogeton illinoensis*	Illinois pondweed	--	2-20%
POPE6	*Potamogeton pectinatus*	Sago pondweed	>60%	>60%
POPU7	*Potamogeton pusillus*	Small pondweed	< 2%	--
PORI2	*Potamogeton richardsonii*	Richardson's pondweed	2-20%	--
ZODU	*Zosterella dubia*	Water stargrass	--	< 2%
Emergent				
	Pontederia cordata	Pickerel Weed	< 2%	--

Plant Bed 02

Size: 3.2 acres
Substrate: silt/organic/marl
Number of Species: 14
Overall Vegetative Coverage: >60%

Figure 4. Great blue heron amongst the lilies in Bed 02.

Description: This shallow bed (0 to 3 feet) is located along the north shoreline of Center Lake. This bed excluded the nearby channels, which were identified as different beds. Bed 02 was characterized as a dense emergent bed with some aquatic vegetation. It was largely dominated by white water lily and yellow pond lily. Sago pondweed was observed in moderate abundances. Eurasian watermilfoil was moderately abundant (2-20%) in June but was not observed in July after the herbicide application.

Table 7. Bed 02 - Composite Aquatic Plant Inventories (June and July, 2006)

Acronym	Scientific Name	Common Name	June Abund.	July Abund.
		Submersed		
CH?AR	*Chara* sp.	A chara species	< 2%	--
LEMI3	*Lemna minor*	Common duckweed	< 2%	--
MYSP2	*Myriophyllum spicatum*	Eurasian watermilfoil	2-20%	--
NULU	*Nuphar variegetum*	Yellow pond lily	21-60%	> 60%
NYTU	*Nymphaea tuberosa*	White water lily	> 60%	--
POCR3	*Potamogeton crispus*	Curly-leaf pondweed	< 2%	--
POPE6	*Potamogeton pectinatus*	Sago pondweed	2-20%	21-60%
POPU7	*Potamogeton pusillus*	Small pondweed	< 2%	--
POZO	*Potamogeton zosteriformis*	Flat-stemmed pondweed	< 2%	--
		Emergent		
	Cephalanthus occidentalis	Buttonbush	< 2%	< 2%
	Hibiscus palustris	Swamp rose mallow	--	< 2%
	Justicia americana	Water willow	--	< 2%
	Lythrum salicaria	Purple loosestrife	--	< 2%
	Typha angustifolia	Narrow-leaved cattail	< 2%	< 2%

Plant Bed 03

Size: 7.2 acres
Substrate: silt/organics/marl
Number of Species: 16
Overall Vegetative Coverage: 21-60%

Description: This shallow bed (0 to 8 feet) is located along the western shoreline of Center Lake. It extends from the shallow shore to the depth that no longer supports rooted plants (8 feet) in Center Lake. The plant species composition and depths were consistent throughout. Bed 03 was similar to Bed 01 but less densely vegetated.

Bed 03 was dominated by sago pondweed (21-60%) in June and July. Chara, Eurasian watermilfoil, curly-leaf pondweed, and white water lily were observed in moderate abundances (2-20%) during June or July.

Table 8. Bed 03 - Composite Aquatic Plant Inventories (June and July, 2006)

Acronym	Scientific Name	Common Name	June Abund.	July Abund.
Submersed				
CEDE4	*Ceratophyllum demersum*	Coontail	--	< 2%
CH?AR	*Chara* sp.	A chara sp.	2-20%	< 2%
MYSP2	*Myriophyllum spicatum*	Eurasian watermilfoil	2-20%	< 2%
NAFL	*Najas flexilis*	Slender naiad	--	--
NULU	*Nuphar variegetum*	Yellow pond lily	< 2%	< 2%
NYTU	*Nymphaea tuberosa*	White water lily	2-20%	2-20%
POCR3	*Potamogeton crispus*	Curly-leaf pondweed	2-20%	< 2%
POIL	*Potamogeton illinoensis*	Illinois pondweed	--	< 2%
PONO2	*Potamogeton nodosus*	American pondweed	--	< 2%
POPE6	*Potamogeton pectinatus*	Sago pondweed	21-60%	21-60%
PORI2	*Potamogeton richardsonii*	Richardson's pondweed	< 2%	--
POZO	*Potamogeton zosteriformis*	Flat-stemmed pondweed	< 2%	--
ZODU	*Zosterella dubia*	Water stargrass	--	< 2%
Emergent				
	Lythrum salicaria	Purple Loosestrife	--	< 2%
	Scirpus acutus	Hard-stemmed bulrush	--	< 2%
	Typha angustifolia	Narrow-leaved cattail	< 2%	< 2%

Plant Bed 04

Size: 1.0 acre
Substrate: silt/organics/marl
Number of Species: 5
Overall Vegetative Coverage: >60%

Description: This shallow bed (0 to 3 feet) is located along the western shoreline of Center Lake. It is located between the shoreline and Bed 03. The plant species composition and depths were consistent throughout and similar to Bed 02.

Figure 5. View of lilies in Bed 04.

Bed 04 was characterized as a dense emergent bed with some aquatic vegetation. It was dominated by yellow pond lily (>60%). White water lily and sago pondweed also were present in moderate abundances.

Table 9. Bed 04 - Composite Aquatic Plant Inventories (June and July, 2006)

Acronym	Scientific Name	Common Name	June Abund.	July Abund.
Submersed				
CH?AR	*Chara* sp.	A chara species	2-20%	--
NULU	*Nuphar variegetum*	Yellow pond lily	> 60%	> 60%
NYTU	*Nymphaea tuberosa*	White water lily	--	21-60%
POCR3	*Potamogeton crispus*	Curly-leaf pondweed	< 2%	--
POPE6	*Potamogeton pectinatus*	Sago pondweed	21-60%	2-20%

Plant Bed 05

Size: 3.1 acres
Substrate: sand/silt/organics/marl
Number of Species: 12
Overall Vegetative Coverage: 21-60%

Description: This shallow bed (0 to 8 feet) is located along the shoreline in the southern portion of Center Lake. The vegetation in this bed is sparser than in Bed 01, which may be due in part to vegetation management conducted for the public swimming beach within Bed 05. Other than being sparser, the vegetative composition was similar to Bed 01.

Figure 6. White water lilies and other aquatic plants in Bed 05.

Bed 05 was characterized as a moderately vegetated bed dominated by sago pondweed (21-60%). Chara, white water lily and Illinois pondweed were also observed in moderate abundances (2-20%). This bed was added as a separate plant bed during July 2006 sampling, due to its differing vegetative coverage.

Table 10. Bed 05 - Aquatic Plant Inventory (July, 2006)

Acronym	Scientific Name	Common Name	July Abund.
Submersed			
CEDE4	*Ceratophyllum demersum*	Coontail	< 2%
CH?AR	*Chara* sp.	A chara species	2-20%
NAFL	*Najas flexilis*	Slender naiad	< 2%
NAMA	*Najas marina*	Spiny naiad	<2%
NYTU	*Nymphaea tuberosa*	White water lily	2-20%
POGR8	*Potamogeton gramineus*	Variable pondweed	< 2%
POIL	*Potamogeton illinoensis*	Illinois pondweed	2-20%
PONO2	*Potamogeton nodosus*	American pondweed	< 2%
POPE6	*Potamogeton pectinatus*	Sago pondweed	21-60%
POZO	*Potamogeton zosteriformis*	Flat-stemmed pondweed	< 2%
ZODU	*Zosterella dubia*	Water stargrass	< 2%
Emergent			
	Scirpus acutus	Hard-stemmed bulrush	< 2%

Plant Bed 06

Size: 5.4 acres
Substrate: silty/organics/marl
Number of Species: 22
Overall Vegetative Coverage: 21-60%

Description: This shallow bed (0 to 6 feet) is a diverse bed located in the western channels off of the northwestern portion Center Lake. Vegetation was dense near the channel edges and sparse in the middle of the channel. This is most likely due to the boat traffic that occurs through these channels and/or herbicide applications.

Twenty-one total species were identified in moderate or low abundances throughout Bed 06. This floristic diversity was higher than any of the aquatic plant beds in the main body of Center Lake.

Eurasian watermilfoil and curly-leaf pondweed had the highest abundances (21-60%) in June in Bed 06. In July, however, Eurasian watermilfoil was not observed and curly-leaf pondweed was only observed in a low abundance (<2%). Filamentous algae, common duckweed and white water lily were observed in moderate abundances (2-20%) in June and July. Small pondweed and Richardson's pondweed were also observed in moderate abundances (2-20%) in June but

were not observed in July. Common bladderwort had a low abundance (<2%) in June and a moderate abundance (2-20%) in July.

Table 11. Bed 06 - Composite Aquatic Plant Inventories (June and July, 2006)

Acronym	Scientific Name	Common Name	June Abund.	July Abund.
		Submersed		
ALGA	Filamentous alga	Algae	2-20%	2-20%
CEDE4	*Ceratophyllum demersum*	Coontail	--	< 2%
CH?AR	*Chara* sp.	A chara species	--	< 2%
LEMI3	*Lemna minor*	Common duckweed	2-20%	2-20%
LETR	*Lemna trisulca*	Star duckweed	< 2%	--
NAFL	*Najas flexilis*	Slender naiad	--	< 2%
MYSP2	*Myriophyllum spicatum*	Eurasian watermilfoil	21-60%	--
NULU	*Nuphar variegetum*	Yellow pond lily	< 2%	< 2%
NYTU	*Nymphaea tuberosa*	White water lily	2-20%	2-20%
POCR3	*Potamogeton crispus*	Curly-leaf pondweed	21-60%	< 2%
POIL	*Potamogeton illinoensis*	Illinois pondweed	--	< 2%
PONO2	*Potamogeton nodosus*	American pondweed	--	< 2%
POPE6	*Potamogeton pectinatus*	Sago pondweed	< 2%	< 2%
POPU7	*Potamogeton pusillus*	Small pondweed	2-20%	--
PORI2	*Potamogeton richardsonii*	Richardson's pondweed	2-20%	--
RALO2	*Ranunculus longirostris*	White water-cup	< 2%	--
UTMA	*Utricularia vulgaris*	Common bladderwort	< 2%	2-20%
WOCO	*Wolffia columbiana*	Watermeal	< 2%	--
		Emergent		
	Cephalanthus occidentalis	Buttonbush	--	< 2%
	Hibiscus palustris	Swamp rose mallow	--	< 2%
	Iris virginica	Blue flag iris	--	< 2%
	Typha angustifolia	Narrow-leaved cattail	--	< 2%

Plant Bed 07

Size: 1.5 acres
Substrate: silt/organics/marl
Number of Species: 11
Overall Vegetative Coverage: 2-20%

Description: This shallow bed (0 to 6 feet) is located in the eastern channel of the northern end of the lake.

Overall, Bed 07 was rather sparsely vegetated, with vegetation concentrated along the perimeter of the channel. White water lily, sago pondweed, white water-cup, and common bladderwort had moderate abundances. Eurasian watermilfoil had a moderate abundance (2-20%) in June

and decreased to a low abundance (<2%) in July. The lower abundance of the Eurasian watermilfoil was most likely a result of the herbicide application in July.

Table 12. Bed 07 - Composite Aquatic Plant Inventories (June and July, 2006)

Acronym	Scientific Name	Common Name	June Abund.	July Abund.
Submersed				
LEMI3	*Lemna minor*	Common duckweed	--	< 2%
MYSP2	*Myriophyllum spicatum*	Eurasian watermilfoil	2-20%	--
NULU	*Nuphar variegetum*	Yellow pond lily	--	< 2%
NYTU	*Nymphaea tuberosa*	White water lily	2-20%	2-20%
POCR3	*Potamogeton crispus*	Curly-leaf pondweed	< 2%	--
POPE6	*Potamogeton pectinatus*	Sago pondweed	< 2%	2-20%
RALO2	*Ranunculus longirostris*	White water-cup	2-20%	--
UTMA	*Utricularia vulgaris*	Common bladderwort	< 2%	2-20%
Emergent				
	Hibiscus palustris	Swamp rose mallow	--	< 2%
	Lythrum salicaria	Purple loosestrife	--	< 2%
	Scirpus acutus	Hard-stemmed bulrush	--	< 2%

TIER II SAMPLING RESULTS

As sampled on July 31, 2006, 74% of the sampling locations were vegetated (37/50); in general, the deeper sampling locations were unvegetated and the shallow locations were vegetated (Exhibit VI). Fifteen species were recorded, of which 13 are native. On average, only 1.2 species were recorded from each sampling location. The maximum number of species recorded from a sampling location was five species.

As a whole, sago pondweed was the most dominant species in July 2006, with a dominance index (DI) of 27.6. It was recorded from 66% of the sampling locations. White water lily (4.0), yellow pond lily (3.6), and chara (3.2) had the next highest dominance indices. The remaining 15 species had dominance indices of 1.6 or less.

Table 13. Tier II July Sampling Results 2006

Occurrence and Abundance of Submersed Aquatic /Emergent Plants in Center Lake

Date:	7/31/06	Sites with plants:	37	Mean # species/site:	1.24
Secchi (ft):	5.0	Sites with native plants:	37	Standard Error:	0.18
Trophic Status:	Eutrophic	# of species:	14	Mean native species/site:	1.22
# of sites:	50	# of native species:	13	Standard Error:	0.18
Max. plant depth:	8’	Maximum species/site:	5	Species diversity:	0.98
				Native diversity:	0.98

Scientific Name	Site frequency	Relative density	Mean density	Dominance

Potamogeton pectinatus	**66**	**53.2**	**2.09**	**27.60**
Nymphaea tuberosa	**8**	**6.5**	**2.50**	**4.00**
Nuphar variegatum	6	4.8	**3.00**	**3.60**
Chara sp.	**8**	**6.5**	2.00	**3.20**
Potamogeton illinoensis	**8**	**6.5**	1.00	1.60
Utricularia vulgaris	4	3.2	2.00	1.60
Potamogeton nodosus	4	3.2	2.00	1.60
Zosterella dubia	6	4.8	1.00	1.20
Potamogeton zosteriformis	4	3.2	1.00	0.80
Najas marina	2	1.6	1.00	0.40
Ceratophyllum demersum	2	1.6	1.00	0.40
Myriophyllum spicatum	2	1.6	1.00	0.40
Najas flexilis	2	1.6	1.00	0.40
Potamogeton gramineus	2	1.6	1.00	0.40
Filamentous Algae	4	3.2	1.00	0.80
Other observed plants:	See Tier I results			

Figure 7. Sago pondweed being collected during Tier II quantitative sampling.

When analyzed for the sampling depth zones, the most diverse zone was the 0 to 5 foot zone. Fourteen species were identified in this zone, with DI indices ranging from 0.9 to 41.7. Sago pondweed (DI 41.7) was by far the most dominant species. The next three most dominant species in this zone were white water lily (DI 8.7), yellow pond lily (DI 7.8) and chara (DI 7.0). The remaining ten species in the 0 to 5 foot depth zone had dominance indices of 3.5 or less.

Only six species were identified in the 6 to 10 foot zone, with DI indices ranging from 1.2 to 24.7. In this depth zone, sago pondweed (DI 24.7) was still the most dominant species. Water stargrass (DI 2.4) was the second most dominant species in this zone. The remaining four species in the 6 to 10 foot depth were Illinois pondweed, coontail, flat-stemmed pondweed and filamentous algae that all had dominance indices of 1.2.

In the 11 to 15 foot depth zone, no species were present.

Table 14. Dominance Index of Each Species in Sampling Depth Zones

Scientific Name	Common Name	0-5'	6-10'	11-15'
Potamogeton pectinatus	Sago pondweed	**41.7**	**24.7**	0.0
Nymphaea tuberosa	White water lily	**8.7**	0.0	0.0
Nuphar variegatum	Yellow pond lily	**7.8**	0.0	0.0
Chara sp.	Chara	**7.0**	0.0	0.0
Potamogeton illinoensis	Illinois pondweed	2.6	1.2	0.0
Utricularia vulgaris	Common bladderwort	3.5	0.0	0.0
Potamogeton nodosus	American pondweed	3.5	0.0	0.0
Zosterella dubia	Water stargrass	0.9	**2.4**	0.0
Potamogeton zosteriformis	Flat-stemmed pondweed	0.9	1.2	0.0
Najas minor	Brittle waternymph	0.9	0.0	0.0
Ceratophyllum demersum	Coontail	0.0	1.2	0.0
Myriophyllum spicatum	Eurasian watermilfoil	0.9	0.0	0.0
Najas flexilis	Slender naiad	0.9	0.0	0.0
Potamogeton gramineus	Variable pondweed	0.9	0.0	0.0
	Filamentous Algae	0.9	1.2	0.0

COMPARISON OF 1996 - 2006 QUANTITATIVE SAMPLING DATA

Quantitative sampling of the aquatic plant community was conducted in 1996 and 1997 by Aquest (Weed Patrol 2005), in 2004 by Weed Patrol, Inc. (Weed Patrol 2005), in 2005 by the IDNR (Benson 2006), and in 2006 by V3. Although the sampling methods varied through the years, a summary of sampling data is provided in Table 15. The secchi disk reading remained relatively constant at five feet between 2005 and 2006. However, the maximum depth of plants was reported to be 14.0 feet in 2004, whereas aquatic plants were recorded up to a depth of only 8 feet in 2006.

Table 15. Tier II Data Comparison from 2004 to 2006

Sampling Date:	July 31, 2006	Aug. 2, 2005*	May 11, 2005*	Aug. 24, 2004**
Secchi:	5	5	5	18 ‡
# of Sites:	50	60	60	41
Max Plant Depth (ft):	8	9.5	13	14
Sites with Plants (%):	74%	85%	92%	73%
# of Species:	15	10	7	9
# of Native Species:	13	8	6	7

* Data from IDNR (Benson 2006)

** Data from Weed Patrol, Inc. (Weed Patrol 2005)

‡ Assumed to be an incorrect measurement, since no other value higher than 7.2 was recorded from 1991 to 2006.

Table 16 shows a summary of quantitative sampling conducted between 1996 and 2006. The site frequency of each aquatic plant species is shown. Although some of the variability between sampling dates may be the result of varying sampling techniques and timing, management activities conducted at Center Lake may be the cause of more consistent trends. Eurasian watermilfoil was present at 60-100% of sampling sites prior to treatment events (Exhibit VII). During sampling conducted after herbicide applications (July 1997, August 2005, and July 2006), Eurasian watermilfoil was reported from less than 10% of sampling sites (Exhibit VIII).

Coontail was consistently recorded from more than 30% of sampling sites prior to August 2005 (Table 16). However, during recent sampling, it was recorded from only 2% of sampling sites in July 2006. This lack of coontail may explain the decrease in the maximum depth of plants between 2005 and 2006 from 14.0 feet to 8.0 feet. In many lakes, such as Winona Lake, coontail is often the dominant species in the deeper aquatic plant bed (8-20'; see V3 2006). However, no deeper plant bed was present at Center Lake in 2006.

Although degraded water quality and lowered water transparency might be one explanation for this change, the secchi disk readings remained relatively constant. Another possible explanation is that the herbicide applications conducted during 2005 and 2006 may have had a side result of negatively impacting coontail. In particular, this result may have been a side result of the whole-lake treatment using fluridone in June 2005. Based on these observations, it is particularly important to monitor and document if a deeper plant bed dominated by coontail re-establishes in the 8 to 14 foot depth range. It would be particularly unfortunate if Eurasian watermilfoil takes advantage of the current lack of coontail in this area, and establishes itself as a deeper plant bed around the entire lake.

Table 16. Site frequency of aquatic plant species at Center Lake 1996-2006 (Frequency values greater than 30 are shown in bold)

Scientific Name	Common Name	Site Frequency (%)*							
		10/96	03/97	06/97	07/97	08/04	05/05	08/05	07/06
Ceratophyllum demersum	Coontail	25	**86**	**40**	**32**	**36**	**38**	20	2
Chara sp.	Chara		2	25	9	**46**	8	**35**	8
Myriophyllum spicatum	Eurasian watermilfoil	**100**	**68**	**62**	5	**71**	**80**	8	2
Najas sp.	Naiads	**43**	16			**32**			
Najas flexilis	Slender naiad						2		2
Najas minor	Spiny naiad								2
Nuphar variegatum	Yellow pond lily				11				6
Nymphaea tuberosa	White water lily			**46**	**32**				8
Potamogeton amplifolis	Large-leaf pondweed	2	18	24	25	7	7	10	
Potamogeton crispus	Curly-leaf pondweed	2			1	0		2	
Potamogeton gramineus	Variable pondweed								2
Potamogeton illinoensis	Illinois pondweed	**37**		25				3	8
Potamogeton nodosus	American pondweed	3			**36**				4
Potamogeton pectinatus	Sago pondweed	**58**		**49**	**39**	25		15	**66**
Potamogeton pusillus	Small pondweed							2	
Potamogeton richardsonii	Richardson's pondweed			1		4			
Potamogeton zosteriformis	Flat-stem pondweed					14	2		4
Utricularia gibba	Humped bladderwort							7	
Utricularia vulgaris	Common bladderwort	18			9				4
Vallisneria americana	Eel grass						13		
Zosterella dubia	Water stargrass			3	11			28	6
Filamentous Algae						7			4
Total Number Species		9	5	9	11	9	7	10	14

* Data from 1996-1997 collected by Aquest (Weed Patrol 2005), data from 2004 collected by Weed Patrol (Weed Patrol 2005), data from 2005 collected by IDNR (Benson 2006), and data from 2006 collected by V3. Methods of selecting sampling locations varied between the years.

AQUATIC PLANT MANAGEMENT ALTERNATIVES

At the present time, the health of Center Lake's aquatic plant communities is fair. Native plant diversity is moderate. Continued management efforts to maintain the Eurasian watermilfoil population at a low level is desirable to prevent Eurasian watermilfoil from becoming the predominant species in the lake, such as was the case as recently as 2005. Additionally, watershed activities to improve the water quality of Center Lake are important to enhance the native plant diversity and restore a coontail-dominated deeper bed.

Many management strategies have been used to control Eurasian watermilfoil in Indiana lakes. A management strategy should be chosen based on its selectivity to the target species, it long-term effectiveness, and potential for detrimental side-effects (i.e., effects on non-target species). The foremost objective is to choose a management strategy that will effectively control the Eurasian watermilfoil population with minimal negative effects on non-target plants or fish species.

Although dense beds of native aquatic plants can be a nuisance where they inhibit lake access, aquatic vegetation is important to maintaining a healthy lake 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.

Because of the overall importance of beneficial aquatic vegetation, one of the most basic goals of the LARE aquatic vegetation program is to maintain healthy aquatic ecosystems by maintaining or improving biodiversity in Indiana lakes, which includes protecting beneficial aquatic vegetation. As such, it is recognized that competing uses of the lakes including access for boating and maintaining plant beds to provide habitat for juvenile fish must be incorporated into an overall management strategy for the lake.

Different types of aquatic plant management alternatives are discussed below. One or more of these alternatives may be employed to meet the objectives of Center Lake.

1 No Action

If no action is taken, the Eurasian watermilfoil abundance may remain stable, or it may increase from year to year. Eurasian watermilfoil spreads by fragmentation; when the plant is cut, the fragment has the ability to form an entirely new plant. Eurasian watermilfoil also over-winters as an adult plant and sprouts early in the spring. These reproductive characteristics cause milfoil beds to become denser over time, creating a monoculture as it out-competes and eliminates native species. A major goal of this aquatic plant management plan is to prevent Eurasian watermilfoil from becoming a monoculture, and to maintain and enhance the current diversity of native aquatic plants. Therefore, it is imperative that Eurasian watermilfoil be controlled. Eurasian watermilfoil has a history of coming back after treatments, and diligent treatment of re-

sprouts over several years is needed to provide longer-term control. Taking no action might allow the Eurasian watermilfoil population to re-sprout after the 2005 and 2006 treatments and again expand to a problematic level.

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 important aquatic plant beds, and protected ecological zones may be created to prevent erosion of shoreline vegetation caused by intense wave action from boating activities. Shallow areas of a lake may also be marked with buoys to prevent injury to boaters. There currently are no boating restricted areas with the specific intent of protecting beneficial plant areas. However, the lakewide speed limit effectively minimizes wave action due to wakes, and protects beneficial vegetation, such as the emergent wetland shoreline in the northeastern portion of the lake.

3 Environmental Manipulation

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

4 Nutrient Reduction

An overabundance of nutrients can greatly increase the possibility that an invasive species will proliferate in a body of water. 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 significant 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 become established and spread rapidly in a lake. If phosphorus is constantly being added to the system and is readily available in the water, invasive species can use the nutrient excess and take over an aquatic system within a few growing seasons. Additionally, herbicide applications to native plant beds can cause a single large release of nutrients as the killed vegetation decomposes, coupled with available space for the germination of new species. This combination of conditions presents a ripe opportunity for the establishment of an invasive species such as Eurasian watermilfoil.

Phosphorus and nitrogen are added to aquatic systems by many natural sources, such as the decomposition of plant material and animal waste. Human activity, however, 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 reduce the amount of phosphorus entering the lake by taking actions outlined in the public education section. In addition, implementation of best management practices throughout the watershed, such as filter strips, no till agriculture, wetland preservation or restoration, and streambank stabilization, would reduce the sediment and nutrient inputs into the lake, improve water quality, and lessen conditions that favor invasive species. A comprehensive effort to improve the water quality of Center Lake was recommended by the diagnostic study (V3 2005), and may include measures to eliminate the man-made connection between Pike Lake and Center Lake. Water from Pike Lake provides additional pollutants and sediment into Center Lake from outside its natural watershed, degrading its water quality (V3 2005).

5 Mechanical Cutting and Harvesting

Mechanical harvesting involves using a large machine to cut and collect unwanted aquatic plants. The machine picks up the cut weeds but leaves small fragments behind. Since Eurasian watermilfoil is able to reproduce from cut fragments, mechanical harvesting can spread this invasive species. Additionally, mechanical harvesting is not selective and will cut both native and exotic plant species. Where both are growing together, mechanical harvesting will give an advantage to Eurasian watermilfoil over any native species that are present, given its growth and reproductive characteristics. Each fragment clipping of Eurasian watermilfoil is capable of becoming reestablished as a complete plant. For these reasons, mechanical harvesting is not recommended in any area inhabited by Eurasian watermilfoil. Harvesting can be accomplished by individual owners around their dock areas. A lake property owner can legally harvest a 625 square foot area (25 feet by 25 feet).

Mechanical harvesting was used as the primary control means at Center Lake for many years, but is not recommended until Eurasian watermilfoil is eliminated from the lake and Center Lake remains milfoil-free for several years in a row. Additionally, harvesting in the future should be discontinued any time Eurasian watermilfoil is observed in Center Lake.

6 Hand-Pulling, Cutting, Raking

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 be identified and cleared 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 such as Eurasian watermilfoil 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 plant parts. Any plant fragments not removed from the water can form new plants, meaning that hand pulling and cutting can facilitate the spread of unwanted plant species such as Eurasian watermilfoil. The infestation of Eurasian watermilfoil has been too large in recent years, and shown too high a potential for expansion for hand-pulling, cutting, or raking to be viable options.

7 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, which is difficult for plants to penetrate. Often plastic or concrete barriers are installed during construction of a lake or pond to prevent subsequent growth of aquatic vegetation. This form of control is best implemented during construction of a new pond or lake. Placing a bottom barrier in an existing lake would involve significant logistical challenges and would be extremely expensive. A draw down of the lake may be necessary to install the barrier. Once in place, the barrier would prevent plant growth of both invasive and native species, and would deprive the lake ecosystem of the benefits provided by native aquatic plants. 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; bottom barriers generally do not provide effective long-term control. Bottom barriers may not be placed without a permit for shoreline construction from the IDNR Division of Water.

8 Biological Controls – Water Milfoil Weevil

The water milfoil weevil is a native North American insect that consumes Eurasian watermilfoil and northern milfoil. The milfoil weevil burrows into the stem and consumes tissue of the plant. Holes in the milfoil stem bored by weevil larvae allow disease an entrance pathway. These same holes also cause a release of the plant's gases, which reduces buoyancy and causes the plant to sink. All biological controls, including water milfoil weevil stocking, may not be implemented without an aquatic plant control permit from the IDNR Division of Fish & Wildlife.

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 watermilfoil populations were reduced, and past efforts to control Eurasian watermilfoil at Center Lake were ineffective. In addition to this potential ineffectiveness, a large population of Eurasian watermilfoil must be present to support the weevil population. For both of these reasons, using the water milfoil weevil as a biological control agent for Eurasian watermilfoil is not recommended at Center Lake.

9 Biological Controls – Grass Carp

The Asian grass carp (*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 are sterile and cannot reproduce. Stocking is restricted to privately owned bodies of water, and suppliers must obtain a special permit from the IDNR. All biological controls, including grass carp stocking, may not be implemented without an aquatic plant control permit from the IDNR Division of Fish & Wildlife.

Grass carp are completely vegetarian, feeding on many species of submersed plants, in addition to 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. However, grass carp avoid Eurasian watermilfoil and show strong preferences for many native plants in addition to hydrilla. Therefore, when Eurasian watermilfoil occurs with native plant populations, grass carp are not recommended.

10 Chemical Controls – Aquatic Herbicides

There are two major categories of aquatic herbicides: contact and systemic herbicides. Contact herbicides are not selective, and thus are best used to control plants around piers and in navigation channels. Given the lack of selectivity and their inability to eliminate the root systems of treated plants, contact herbicides have the potential to cause unnecessary damage to native species. Additionally, there is potential for re-infestation of Eurasian watermilfoil. Reward (active ingredient: diquat) and Aquathal (active ingredient: endothal) are two examples of contact herbicides.

Although contact herbicides generally are not selective, timing and dosage can be adjusted to make them affect the target species with less damage to non-target species. The phenological timing method of contact herbicide treatment for Eurasian watermilfoil has shown some success. Recent tests have shown that by adjusting the dosage higher and timing the treatment exactly, a systemic effect on Eurasian watermilfoil can be achieved with contact herbicides. This method involves treating the plants very early in the spring when carbohydrate reserves of Eurasian watermilfoil have left the root structure, promoting rapid growth in the other plant structures. Since Eurasian watermilfoil is growing more actively earlier in the spring than other species, the risk to non-target plants is relatively low if timed properly.

The contact herbicide commonly used for selective low-dose control of Eurasian watermilfoil in mid-season is Reward. A low-dose contact herbicide application can be relatively selective, since Eurasian watermilfoil is susceptible to some herbicides at a dose lower than most native plants due to their high growth rate. As a complicating factor, low-dose applications to control Eurasian watermilfoil with Reward are difficult in lakes where high levels of single-cell algae are present. Reward's mode of action is that it binds with positively charged particles in the water column. Since single-cell algae are positively charged, Reward will bind with algae in the

water column and not affect the milfoil. Although Reward is not marketed as an algaecide, alga is shown on the label as controlled by this product. Since alga is moderately abundant during mid-summer at Center Lake, the effectiveness of a low-dose contact treatment may be compromised.

Systemic herbicides are absorbed by the plant and transported to the root systems where they kill 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 products effectively kill Eurasian watermilfoil plants and roots. Whole lake treatments of fluridone are often used in lakes that have become severely infested with Eurasian watermilfoil. Fluridone can be applied at low rates to control the Eurasian watermilfoil while causing minimal damage to most of the native plant species present. Curly-leaf pondweed is also susceptible to fluridone at the low dose used on Eurasian watermilfoil.

Triclopyr and 2,4-D are both systemic herbicides that are often used for spot treatments in small areas of Eurasian watermilfoil. These herbicides kill all dicots (broadleaf plants such as coontail, waterweed, watermilfoils, etc.) but do not affect monocots (such as eel grass or pondweeds). In preliminary studies, triclopyr may have the ability to control Eurasian watermilfoil in select areas longer than 2,4-D, but this potential benefit is outweighed by higher cost. Neither chemical affects curly-leaf pondweed.

The public's primary concern with the use of aquatic herbicides is safety. Each chemical registered for aquatic applications has undergone extensive testing prior to becoming available for use. It is imperative that any aquatic herbicide be applied by a licensed professional in accordance with its label to minimize potential side-effects.

PUBLIC INVOLVEMENT AND EDUCATION

Public meetings have been held annually by the CLCA to discuss the vegetation management plan. Items discussed include a report on treatments done in the past, discussion of treatments planned for the remainder of the season, a description of the planning process, LARE grants, statewide aquatic vegetation management goals, and a timetable for completing the vegetation management plan updates. Various methods of controlling nuisance and exotic vegetation were discussed. A notice of the public meeting was published in the newspaper, and public input was solicited on proposed aspects of this aquatic plant management plan. CLCA held a public meeting on April 21, 2007, where V3 discussed the 2006 assessment and the Aquatic Plant Management Plan Update – 2006. Approximately 25 people were in attendance. The following is a summary of the public questionnaire data received from completed Lake Use Survey forms, a total of 13 were received (Figure 8). Seventy-five questionnaires were distributed to the local residents at their homes by Charlie Wheeler of CLCA. Individuals were encouraged to fill out the survey forms and turn them in even if they were unable to attend the public meeting. In addition, questionnaires were provided during the public meetings and attendees were encouraged to fill them out. Original survey sheets are located in Appendix I.

Figure 8. Summary totals from completed Lake Use Survey forms.

Aquatic Plant Management Plan
Lake Use Survey for Center Lake

Are you a lake property owner? Yes 12 No 1

Are you currently a member of your lake association? Yes 13 No 0

How many years have you been at the lake?
- 2 or less 0
- 2-5 years 1
- 5-10 years 4
- Over 10 years 8

How do you use the lake (mark all that apply)
- 6 Swimming
- 12 Boating
- 10 Fishing
- 7 Irrigation
- 0 Drinking water
- 1 Other Wildlife habitat

Do you have aquatic plants at your shoreline in nuisance quantities? Yes 8 No 6

Do you currently participate in a weed control project on the lake? Yes 12 No 1

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes 11 No 2

Does the level of vegetation in the lake affect your property values? Yes 10 No 2 N/A = 1

Are you in favor of continuing efforts to control vegetation on the lake? Yes 13 No 0

Are you aware that the LARE funds will only apply to work controlling invasive exotic species, and more work may need to be privately funded? Yes 12 No 1

Mark any of these you think are problems on your lake:
- 0 Too many boats access the lake
- 0 Too much fishing
- 0 Fish population problem
- 10.5 Dredging needed
- 1 Overuse by nonresidents
- 10 Too many aquatic plants
- 2 Not enough aquatic plants
- 4 Poor water quality
- 2 Pier/funneling problem

Please add any comments:

Lake residents play an important role in establishing and maintaining a healthy lake community. Lake association meetings and newsletters are excellent mechanisms through which information about management practices at Center Lake can be distributed. These meetings provide a forum where issues regarding conflicting uses and goals for the lake may be discussed.

Public involvement and educational needs are critical with respect to a new threat to Indiana lakes from an invasive aquatic plant called Hydrilla (*Hydrilla verticillata*). In 2006, on Lake Manitou (adjacent to Rochester in Fulton County), an area infested with this problematic aquatic plant was identified. Efforts are currently underway to resolve the problem, but it is critical if this plant is seen on Center Lake for the state to be notified as soon as possible.

Hydrilla can be differentiated from the native elodea in that there are typically 3 leaves per whorl on the native elodea and there are as many as eight leaves per whorl in Hydrilla. Elodea is also smooth to the touch where as Hydrilla is rough. Figure 9 (Washington State Department of Ecology 2007) shows a sketch of Hydrilla and Figure 10 (South Carolina Department of Natural Resources 2007) demonstrates a means of comparative identification.

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

Figure 9. Hydrilla (*Hydrilla verticillata*) sketch

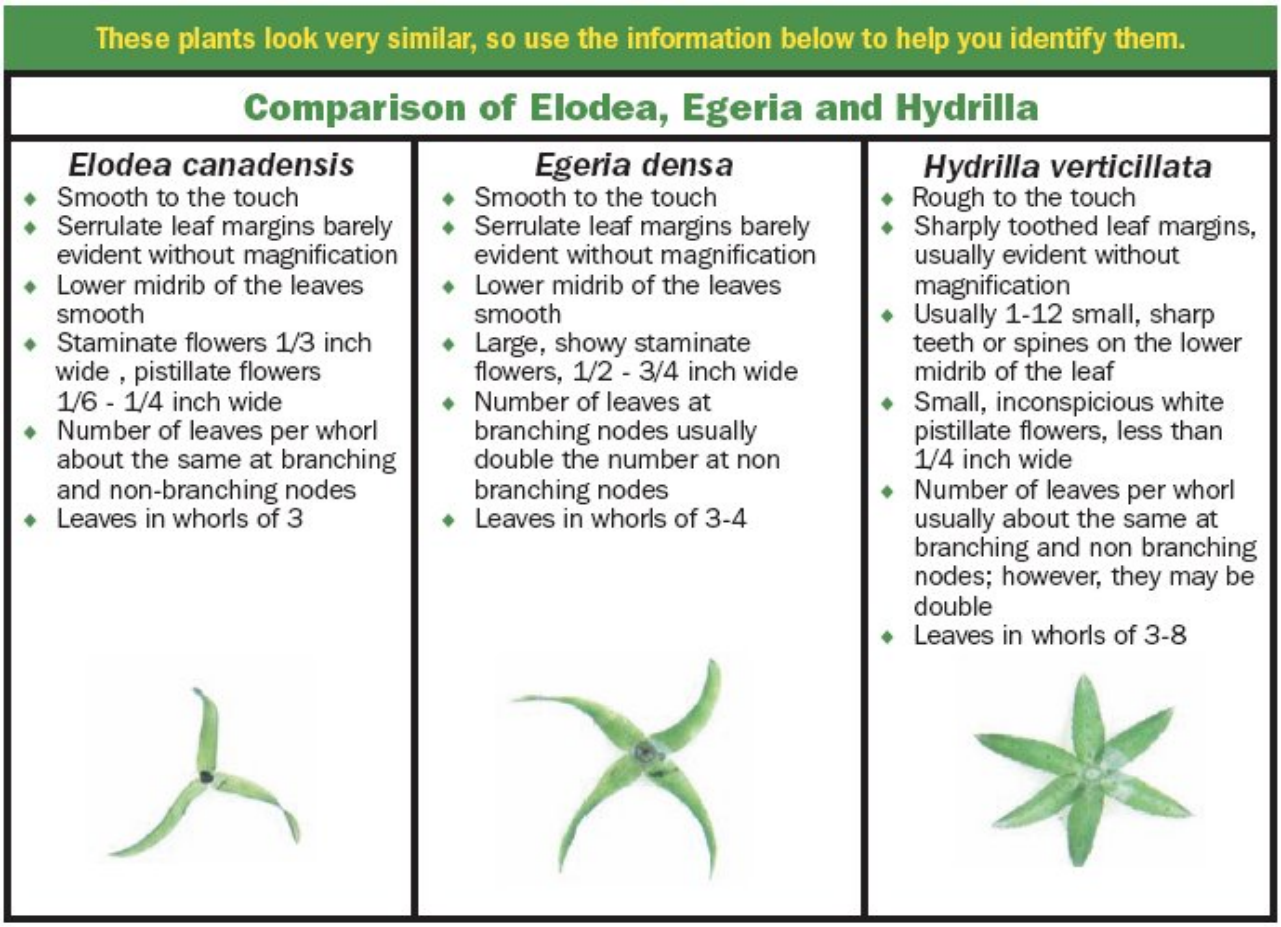

Figure 10. Comparison of Elodea, Egria and Hydrilla

In addition to these state and lake-wide issues, residents can be educated regarding practical steps that can reduce nutrient loading and improve the Center Lake ecosystem, when such practices are implemented collectively.

1. **Proper Maintenance of Boat Motors**. Improperly maintained boats may leak gasoline or oil directly into the lake, which is detrimental to the lake's ecosystem. Educating lake users about the importance of properly maintaining their boat motors is an easy and effective step to improve water quality.

2. **Limit Lawn Fertilizer Use Adjacent to Lake**. If a fertilizer application must be applied, avoid spreading fertilizer directly into the lake, on sidewalks, or seawall where it will wash into the lake. Fertilizer application should be avoided within 30 feet of the lakeshore, if possible. In addition, a buffer strip of native vegetation along the lakeshore allows runoff to be filtered before it enters the lake.

3. **Promote Agricultural Best Management Practices**. Work with farmers within the upstream watershed to increase filtration and purification of agricultural runoff before water reaches the lake. Indiana 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 erodable land or property adjacent to tributary streams or lakes may be eligible for funding to implement practices that increase water quality. Further information is available from the Indiana Natural Resources Conservation Service (NRCS).

4. **Disposal of Grass Clippings**. Avoid blowing grass clippings and tree leaves into the lake. Grass clippings blown into a pond or lake quickly can turn into a floating mat of algae because cut and decaying vegetation rapidly releases nutrients into the water.

5. **Urban Stormwater Best Management Practices**. 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. Nutrients and sediment are conveyed into the lake through storm sewers. Additionally, oil, antifreeze, gasoline, road salt, and other pollutants are washed from pavement through the storm sewer system, and are detrimental to a lake's ecosystem.

The following are practical steps recommended by the U.S. Environmental Protection Agency to reduce urban runoff. Additional information is available by contacting the EPA Region 5 National Pollution Discharge Elimination System Storm Water Coordinator at (312) 886-6100.

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 and 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, and
h) Develop and implement runoff pollution controls for existing road systems to reduce pollutant concentrations and volumes.

6. **Protect Wetlands**. Establish ecological zones to protect existing wetlands and emergent vegetation from turbulence caused by boats. Wetlands are valuable components of a lake ecosystem because they filter water and stabilize shoreline areas. Submersed and emergent vegetation can be eliminated by heavy wave action, which destabilizes the shoreline. In addition, preservation of existing wetland is important to aid in the natural water purification process. If possible, CLCA should identify significant wetland areas and work with the IDNR to protect them from drainage and disturbance.

INTEGRATED TREATMENT ACTION STRATEGY

1. Spring 2007 Target Species Distribution Map, and Proposed Treatment Area Map. The site visit and investigation necessary to create these two maps will allow for the determination of the extent of follow-up chemical treatment that will be necessary to treat Eurasian watermilfoil. As of August, the 2006 chemical treatment effectively reduced the Eurasian watermilfoil population, however, September 2006 observations of Eurasian watermilfoil beds are of great concern. The Spring 2007 mapping will determine the extent and location of milfoil re-growth.

2. Follow-up Herbicide Treatment to Eurasian Watermilfoil. An early spring (3rd week of April to mid-May) systemic herbicide application of 2,4-D or Renovate is proposed during 2007 to treat the Eurasian watermilfoil that has re-grown since the 2006 herbicide application.

3. Summer 2007 Tier II Aquatic Plant Survey. A Tier II aquatic plant survey should be conducted during the Summer 2007 to document the diversity, distribution and abundance of aquatic plants. This data is important to ensure that the native plant community is protected, and that the Eurasian watermilfoil population is kept under control.

PROJECT BUDGET

The following costs are estimated based on lake size, average depth, chemical and application costs, as well as LARE survey requirements. In an attempt to assist LARE staff with alternatives in the event of grant funding limitations, the implementation of the 2007 Herbicide Application and Tier II survey is of a higher priority than the 2008 Tier II survey. As the threat of lingering Eurasian watermilfoil present in the channels is a likely source for re-introduction of this nuisance species within Center Lake, the inclusion of treatmentin the channel is requested as a low priority item. The proposed management schedule and budgets for 2007 and 2008 are summarized below.

2007

Target Species Distribution Map and Proposed Treatment Area Map	$1,000
Early Spring Systemic Herbicide Application of 2,4-D or Renovate (assumed 30 acres)	$12,000
Late season post treatment aquatic plant survey (Tier II) and plan update	$5,500

2008

Target Species Distribution Map and Proposed Treatment Area Map	$1,000
Late season (post treatment) aquatic plant survey (Tier II) and plan update	$5,500

Any herbicide applications will depend on the results of the surveys

MONITORING AND PLAN UPDATES

As the action plan is implemented, aquatic plant surveys will help to monitor the effectiveness of the management strategy. The abundance distribution of Eurasian watermilfoil will be recorded using the current IDNR Tier II sampling protocol.

After the Spring 2007 Target Species Distribution Map is created, the distribution and abundance of Eurasian watermilfoil will be identified and treatment maps will be prepared. The survey will also document whether native plants have re-colonized areas of previous Eurasian watermilfoil infestation. The new data analysis results will be incorporated into the current lake management plan. This will provide property owners, applicators, and the IDNR with detailed records describing the changed in the plant community of Center Lake.

In years to follow, additional surveys will be conducted to determine how the Eurasian watermilfoil population and the native aquatic plant beds are reacting to any treatment regimes. These surveys will provide a basis for evaluation of the management strategy and can be presented to the public should the management strategy need to be modified. They will also serve to keep the public informed about management practices at the lake so they will be motivated and educated to actively participate in conservation of the Center Lake ecosystem.

APPENDICES

Appendix I. Data Sheets, Tier II Latitude/Longitude, and Survey Questionnaires
Appendix II. Calculations
Appendix III. Additional Maps and Exhibits
Appendix IV. Species List
Appendix V. IDNR 2007 Vegetation Permit
Appendix VI. Pesticide Use Restrictions
Appendix VII. Resources for Aquatic Vegetation Management
Appendix VIII. State Regulations Relevant to Aquatic Plant Management

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APPENDIX I

DATA SHEETS, TIER II LATITUDE/LONGITUDE,
AND SURVEY QUESTIONNAIRES

Aquatic Vegetation Plant Bed Data Sheet

Page ___ of ___

State of Indiana Department of Natural Resources

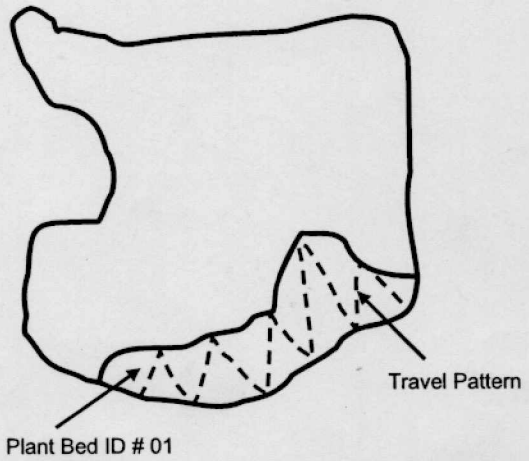
ORGANIZATION: V3 - WL, JJ	DATE: 6/12/06

SITE INFORMATION		SITE COORDINATES
Plant Bed ID: 01	Waterbody Name: Center Lake	Center of the Bed
Bed Size:		Latitude:
Substrate:	Waterbody ID:	Longitude:
Marl? 1	Total # of Species	Max. Lakeward Extent of Bed
High Organic?	CanopyAbundance at Site	Latitude:
	S: 4 N: 1 F: ~~4~~ 1 E: 0	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
POPE6	4	0	0	
POCR3	2	0	0	
~~PORI2~~				
POPU7	1	0	0	
MYSP2	2	0	0	
NYTU	1	0	0	
PORI2	2	0	0	
LEMI3	1	0	0	
LETR	1	0	0	
~~SACU~~ Poncor	1	0	0	

Individual Plant Bed Survey



Comments:

- Lg patch Myrspi at north end

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species suspe
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not varified
2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page ___ of ___

State of Indiana Department of Natural Resources

ORGANIZATION: V3 - WL, JJ	DATE: 6/12/06

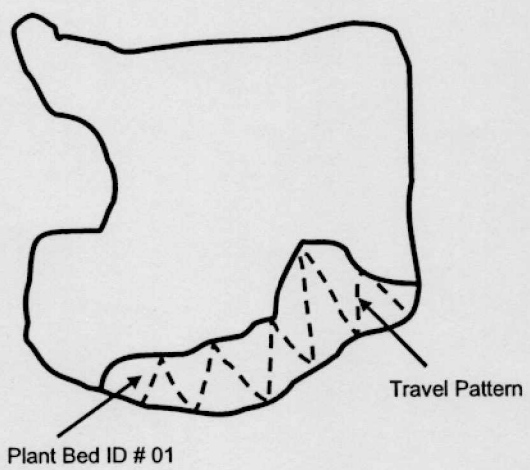
SITE INFORMATION		SITE COORDINATES
Plant Bed ID: 02	Waterbody Name: Center Lake	Center of the Bed
Bed Size:		Latitude:
Substrate:	Waterbody ID:	Longitude:
Marl?	Total # of Species	Max. Lakeward Extent of Bed
High Organic?	CanopyAbundance at Site	Latitude:
	S: 3 N: 0 F: 4 E: 1	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CH2AR	1	2	0	
NYTU	4	0	0	
POPE6	2	0	0	
NULU	3	0	0	
MYSP2	2	0	0	
POPU7	1	0	0	
Typang	1	0	0	
POZO	1	0	0	
Cepoc	1	0	0	
LEMI3	1	0	0	
POCR3	1	0	0	

N2-5% →

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

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Voucher:
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1 = Taken, not varified
2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page ___ of ___

State of Indiana Department of Natural Resources

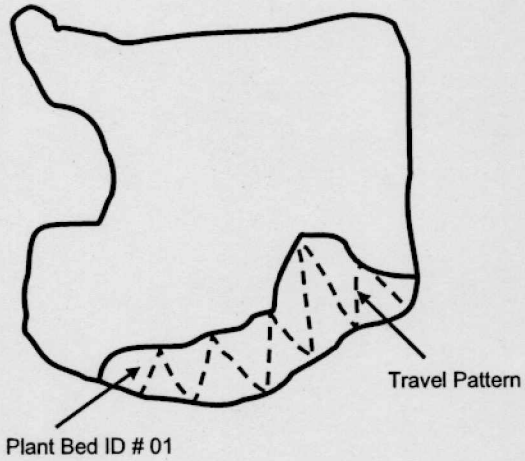
ORGANIZATION: V3 - WL, JJ	DATE: 6/12/06

SITE INFORMATION					SITE COORDINATES
Plant Bed ID: 03	Waterbody Name: Center Lake				Center of the Bed
Bed Size:					Latitude:
Substrate:	Waterbody ID:				Longitude:
Marl? 1	Total # of Species				Max. Lakeward Extent of Bed
High Organic?	CanopyAbundance at Site				Latitude:
	S: 4	N: 0	F: 2	E: 1	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
NYTU	2	0	0	
MYSP2	2	0	0	
POCR3	2	0	0	
POPE6	3	0	0	
CH?.AR	2	2	0	
NULU	1	0	0	
POZO	1	0	0	
Typang	1	0	0	
PORI2	1	0	0	

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species suspe
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not varified
2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page ___ of ___

State of Indiana Department of Natural Resources

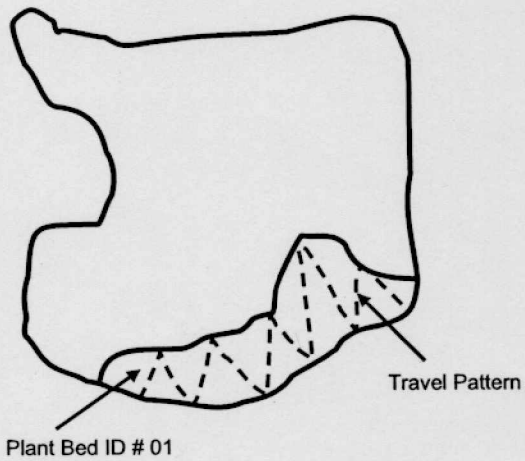
ORGANIZATION: V3 - WL, JJ	DATE: 6/12/06

SITE INFORMATION		SITE COORDINATES
Plant Bed ID: 04	Waterbody Name: Center Lake	Center of the Bed
Bed Size:		Latitude:
Substrate:	Waterbody ID:	Longitude:
Marl? 1	Total # of Species	Max. Lakeward Extent of Bed
High Organic?	CanopyAbundance at Site	Latitude:
	S: 4 N: 0 F: 4 E: 0	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
NULU	4	0	0	
POPE6	3	0	0	
CH2AR	2	2	0	
POCR3	1	0	0	

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species suspe
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not varified
2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page ___ of ___

State of Indiana Department of Natural Resources

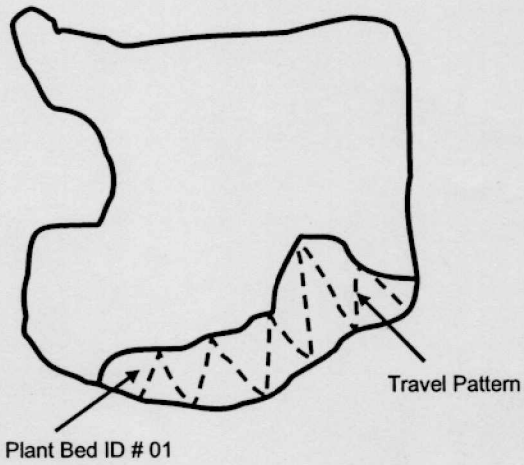
ORGANIZATION: V3 — WL, JJ	DATE: 6/12/06

SITE INFORMATION		SITE COORDINATES
Plant Bed ID: 06	Waterbody Name: Center Lake	Center of the Bed
Bed Size:		Latitude:
Substrate: Silty	Waterbody ID:	Longitude:
Marl? 0	Total # of Species	Max. Lakeward Extent of Bed
High Organic? 1	CanopyAbundance at Site	Latitude:
	S: 4 N: 2 F: 2 E: 0	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
NYTU	2	0	0	
PORI2	2	0	0	
POPE6	1	0	0	
POCR3	3	0	0	
MYSP2	3	0	0	
LEMI3	2	0	0	
LETR	1	0	0	
POPU7	2	0	0	
WOCO	1	0	0	
NULU	1	0	0	
HTMA	1	0	0	
RALO2	1	0	0	
ALGA	2	3	0	
		downstream		

Individual Plant Bed Survey



Comments:

- ~85% vegetetative coverage in band 15-20' wide along edges
- ~25-30% vegetative coverage in middle of channel

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species suspe
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not varified
2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

upstream - 75% vegetated all across

Aquatic Vegetation Plant Bed Data Sheet

Page ___ of ___

State of Indiana Department of Natural Resources

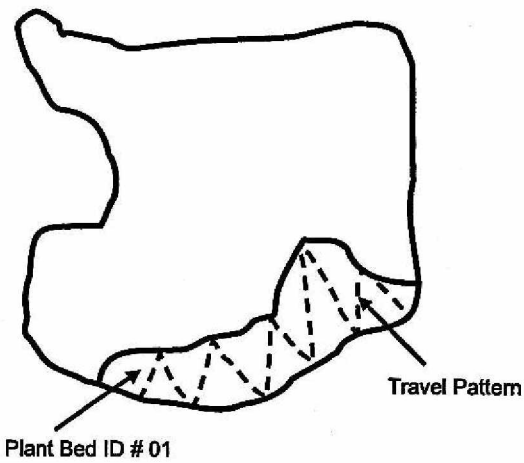
ORGANIZATION: V3 - WL, JJ	DATE: 6/12/06

SITE INFORMATION		SITE COORDINATES
Plant Bed ID: 05	Waterbody Name: Center Lake	Center of the Bed
Bed Size: new 07		Latitude:
Substrate: silty	Waterbody ID:	Longitude:
Marl? 1	Total # of Species	Max. Lakeward Extent of Bed
High Organic? 1	CanopyAbundance at Site	Latitude:
	S: 4 N: 0 F: 2 E: 0	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
NYTU	2	0	0	
MYSP2	2	0	0	
POPE6	1	0	0	
RABLO2	2	1	1	
UTMA	1	0	0	
POCR3	1	0	0	

Individual Plant Bed Survey



Comments:

side channel - NE end.

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species suspe
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not varified
2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page ___ of ___

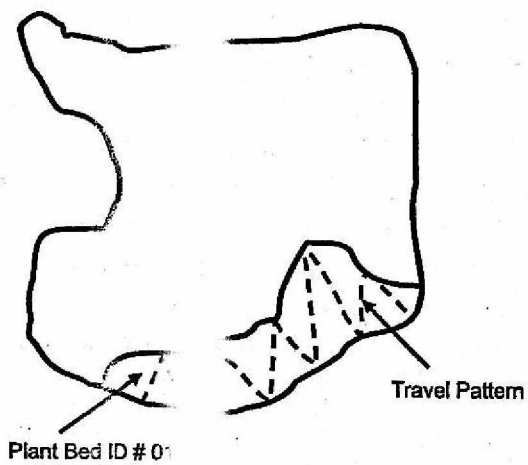
State of Indiana Department of Natural Resources

ORGANIZATION: V3 - WL, JJ		DATE: 7/31/06	
SITE INFORMATION			**COORDINATES**
Plant Bed ID: 01	Waterbody Name: Center Lake		nter of the Bed
Bed Size:		Latitude:	
Substrate: Silty	Waterbody ID:	Longitude:	
Marl? 1	Total # of Species	Max	eward Extent of Bed
High Organic? 1	**CanopyAbundance at Site**	Latitude:	
	S: 4 N: 0 F: 0 E: 0	Longitude:	

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
POPE6	4			
MYSPZ	1			
POIL	2			
NYTU	1			
CEDE4	1			
~~POZO~~	~~1~~			
CHAR	1			
~~NAFL~~	~~3~~			

Individu: nt Bed Survey



Comments:

Veg to 7' deep water

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
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3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species suspe
2 = Genus suspec
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not varif
2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page ___ of ___

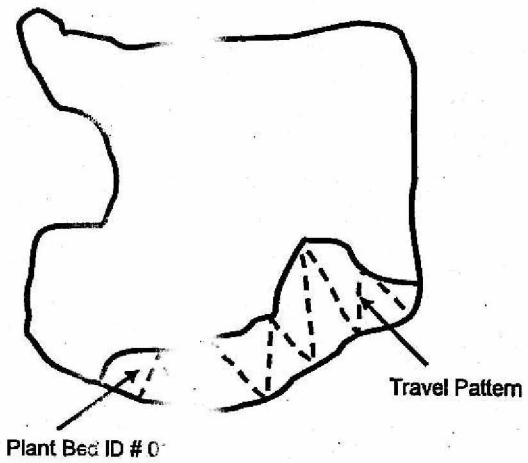
State of Indiana Department of Natural Resources

ORGANIZATION: V3 - WLJ		DATE: 7/31/06	
SITE INFORMATION			**COORDINATES**
Plant Bed ID: 02	Waterbody Name: Center Lake		nter of the Bed
Bed Size:		Latitude:	
Substrate: silty	Waterbody ID:	Longitude:	
Marl? 1	Total # of Species	Max	eward Extent of Bed
High Organic? 1	**CanopyAbundance at Site**	Latitude:	
	S: 3 N: 0 F: 4 E: 1	Longitude:	

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
NULU	4			
POPE6	3			
Typang	1			
Hibnat	1			
Cepbcc	1			
Jusame	1			
Lytsal	1			

Individu nt Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species suspe
2 = Genus suspe
3 = Unknown

Voucher:
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1 = Taken, not vari
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Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page ___ of ___

State of Indiana Department of Natural Resources

ORGANIZATION: V3 - WL, JJ

DATE: 7/31/06

SITE INFORMATION

Plant Bed ID: 03

Waterbody Name: Center Lake

Bed Size:

Substrate: Silty

Waterbody ID:

Marl? 1

Total # of Species

High Organic? 1

CanopyAbundance at Site

S: 3 N: 0 F: 2 E: 1

SITE COORDINATES

Center of the Bed

Latitude:

Longitude:

Max. Lakeward Extent of Bed

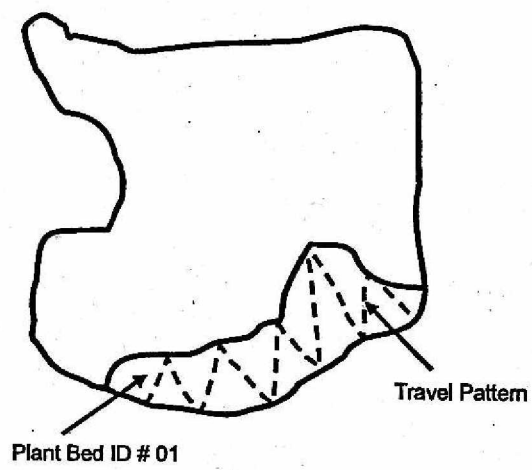
Latitude:

Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
NYTU	2			
PDPE6	3			
MYSP2	1			
POIL	1			
POCR3	1			
CEDE4	1			
Siacu	1			
Lutsal	1			
Typana	1			
NULU	1			
~~POZO~~	~~3~~			
CH?AR	1			
~~NAMS~~	~~3~~			

Individual Plant Bed Survey



Comments:

Veg to ~7' deep
↕ 7½'

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species suspe
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not varified
2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page ___ of ___

State of Indiana Department of Natural Resources

ORGANIZATION: V3 - WL, JJ

DATE: 7/31/06

SITE INFORMATION

Plant Bed ID: 04

Waterbody Name: Center Lake

Bed Size:

Substrate: Silty

Waterbody ID:

Marl? 0 0

Total # of Species

High Organic? 1

CanopyAbundance at Site

S:	N:	F:	E:
2	0	4	0

SITE COORDINATES

Center of the Bed

Latitude:

Longitude:

Max. Lakeward Extent of Bed

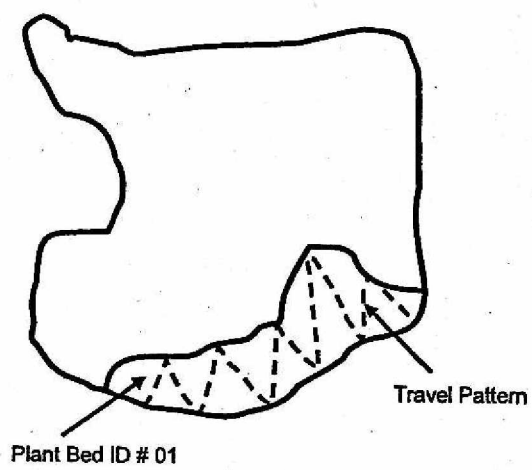
Latitude:

Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
NYTU	3			
POPEG	2			
NULU	4			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species suspe
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not varified
2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page ___ of ___

State of Indiana Department of Natural Resources

ORGANIZATION: V3 (WL, JJ)

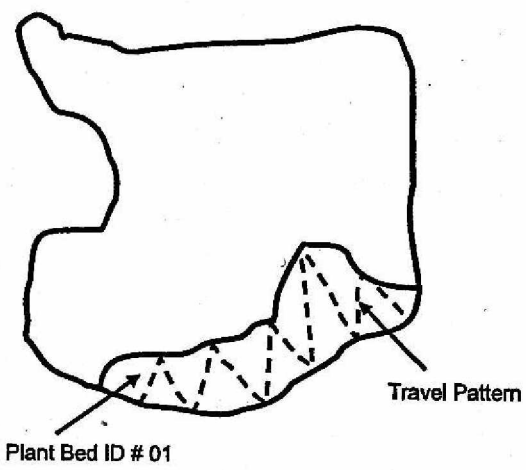
DATE: 7/31/06

SITE INFORMATION		SITE COORDINATES
Plant Bed ID: 05	Waterbody Name: Center Lake	Center of the Bed
Bed Size:		Latitude:
Substrate: Sandy	Waterbody ID:	Longitude:
Marl? 1 silty	Total # of Species	Max. Lakeward Extent of Bed
High Organic? 1	CanopyAbundance at Site	Latitude:
	S: 3 N: 0 F: 2 E: 0	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
POPE6	3			
POIL	2			
NYTU	2			
POZO	1			
CH?AR	2			
~~NAFL~~				
ZODU	1			
NAMI	1			
CEDE4	1			
POGR8	1			
PONO2	1			
Sciacu	1			
NAFL	1			

Individual Plant Bed Survey



Comments:

- Southern end - more diverse than elsewhere
- Recreational beach area less vegetated than rest of bed

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species suspe
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not varified
2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page ___ of ___

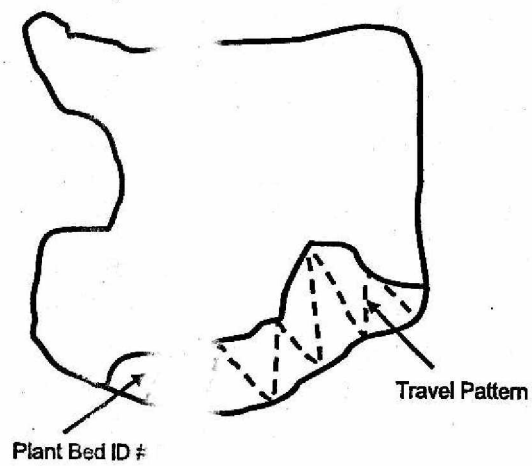
State of Indiana Department of Natural Resources

ORGANIZATION: V3 - WL, JJ		DATE: 7/31/06	
SITE INFORMATION		**E COORDINATES**	
Plant Bed ID: 06	Waterbody Name: Center Lake	enter of the Bed	
Bed Size:		Latitude:	
Substrate: Silty	Waterbody ID:	Longitude:	
Marl? 1 0	Total # of Species	Ma keward Extent of Bed	
High Organic? 1	CanopyAbundance at Site	Latitude:	
	S: 2 N: 2 F: 2 E: 0	Longitude:	

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
NULU	1			
UTMA	2			
POPE6	1			
LEMI	2			
POIL	1			
PONO2	1			
POCR3	1			
CEDE4	1			
CHAR	1			
NYTU	2			
Typang	1			
ALGA	2			
Iriver	1			
Cepocc	1			
Hibpal	1			

Individ ant Bed Survey



Comments:

little gn heron.
Channel - NW
Vegetation in band ~10' wide along perimeter - no veg in center of channel

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species susp
2 = Genus susp
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not va
2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

Aquatic Vegetation Plant Bed Data Sheet

Page ___ of ___

State of Indiana Department of Natural Resources

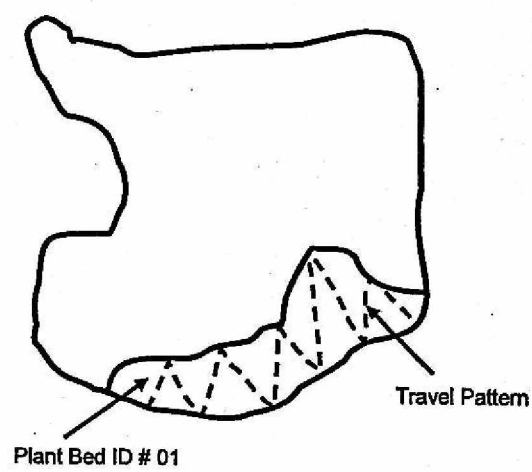
ORGANIZATION: V3 - WL, JJ	DATE: 7/31/06

SITE INFORMATION		SITE COORDINATES
Plant Bed ID: 05	Waterbody Name: Center Lake	Center of the Bed
Bed Size: 5 new 05		Latitude:
Substrate: silty	Waterbody ID:	Longitude:
Marl? 1	Total # of Species	Max. Lakeward Extent of Bed
High Organic? 1	CanopyAbundance at Site	Latitude:
	S: 2 N: 1 F: 2 E: 1	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
UTMA	2			
NYTU	2			
POPEG	2			
Scircu	1			
Hibpal	1			
NULU	1			
LEMI	1			
Lytsal	1			

Individual Plant Bed Survey



Comments:

Channel @ NE corner of lake

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
6 = Sand

Marl
1 = Present
0 = absent

High Organic
1 = Present
0 = absent

Overall Surface Cover
N = Nonrooted floating
F = Floating, rooted
E = Emergent
S = Submersed

Canopy:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

Abundance:
1 = < 2%
2 = 2-20%
3 = 21-60%
4 = > 60%

QE Code:
0 = as defined
1 = Species suspe
2 = Genus suspected
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not varified
2 = Taken, varifie

Reference ID:
Unique number or letter to denote specific location of a species; referenced on attached map

1 1 - 20%
3 20 - 99%
5 100% +

APPENDIX A

Submersed Aquatic Plant Survey Form

WATER BODY NAME	Center Lake
COUNTY	Kosk.
DATE	7/31/06
CREW LEADER	Wally L.
RECORDER	Jul. D.
SECCHI	5'
MAX PLANT DEPTH	~8'
WEATHER	HOT: sunny (36°C)
COMMENTS	

Rake score (1, 3, 5), observed only (9), algae present (p)

Use acronyms for species, V1, V2...for voucher codes

Bed	Site	Latitude	Longitude	Depth	All	Species Code										Note
—	1			13'	0	NOAQVG										
—	2			8'	0	NOAQVG										
05	3			3'	3	POPEG	3	CHAR	1	ZODU	1	POIL	1	NAMA	1	✓
05	4			6'	1	CEDE4	1									
01	5			7'	1	ZODU	1									
01	6			4'	3	POPEG	3									
—	7			14'	0	NOAQVG										
01	8			6'	3	POPEG	3									
01	9			3'	3	POPEG	3									
—	10			12'	0	NOAQVG										
01	11			7'	3	POPEG	3									
01	12			4'	3	POPEG	3									
—	13			11'	0	NOAQVG										
01	14			7'	1	POPEG	1									
01	15			3'	3	POPEG	3	POIL	1							
02	16			2'	3	NULU	3	POPEG	1							
02	17			2'	1	POPEG	1									
01	18			3'	3	POPEG	3	MYSP2	1	← stems left only - had been herbicided.						
01	19			6'	1	POPEG	1									
—	20			13'	0	NOAQVG										
01	21			6'	3	POPEG	3									
01	22			3'	3	POPEG	3									
01	23			3'	3	POPEG	3									
07	24			2'	3	UTMA	3	POPEG	1							
02	25			2'	3	NULU	3	POPEG	3							
02	26			3'	1	POPEG	1									
01	27			3'	3	POPEG	3									
06	28			3'	1	CHAR	1	POPEG	1	ALGA	1					
06	29			3'	3	NYTU	3	UTMA	1							
06	30			4'	5	CHAR	3	NYTU	3	POIL	1	NAFL	1	POPEG	1	
01	31			8'	1	ALGA	1									
—	32			11'	0	NOAQVG										

Other plant species observed at lake

1 = 0-20%
3 = 21-99%
5 = 100% +

APPENDIX A

Submersed Aquatic Plant Survey Form

WATER BODY NAME Center Lake
COUNTY Kosk.
DATE 7/31/06
CREW LEADER Wally L.
RECORDER Juli J.
SECCHI 5'
MAX PLANT DEPTH ~8'
WEATHER Hot & sunny (36°C)
COMMENTS

Rake score (1, 3, 5), observed only (9), algae present (p)
Use acronyms for species, V1, V2...for voucher codes

	Site	Latitude	Longitude	Depth	All	Species Code									Note
01	33			6'	3	POPE6	3								
03	34			3'	3	POPE6	3	PONO2	3						✓
—	35			14'	0	NOAQVG									
—	36			9'	0	NOAQVG									
03	37			4'	3	POPE6	3								
03	38			8'	1	POPE6	1								
04	39			2'	3	POPE6	3	NULU	3						
—	40			12'	0	NOAQVG									
03	41			8'	1	POPE6	1								
03	42			6'	1	POPE6	1								
—	43			15'	0	NOAQVG									
03	44			2'	3	NYTU	3	POPE6	1						
03	45			8'	1	POPE6	1								✓
—	46			13'	0	NOAQVG									
05	47			6'	3	POPE6	1	POZO	1	POIL	1				
05	48			4'	1	POPE6	1								
05	49			7'	3	POPE6	3								
05	50			3'	3	POPE6	1	CHAR	3	POGR8	1	PONO2	1	NYTU	1
						POZO	1								

Other plant species observed at lake

Center Lake Aquatic Plant Management Plan Update - 2006
Tier II Sampling, July 2006

Tier II Sampling Location Number	Latitude	Longitude
1	41.24268333	-85.85661667
2	41.24278333	-85.85626667
3	41.24275000	-85.85620000
4	41.24388333	-85.85400000
5	41.24458333	-85.85341667
6	41.24506667	-85.85320000
7	41.24546667	-85.85353333
8	41.24636667	-85.85380000
9	41.24716667	-85.85395000
10	41.24748333	-85.85436667
11	41.24793333	-85.85451667
12	41.24833333	-85.85443333
13	41.24811667	-85.85513333
14	41.24848333	-85.85491667
15	41.24935000	-85.85433333
16	41.25065000	-85.85425000
17	41.25133333	-85.85523333
18	41.25026667	-85.85551667
19	41.24895000	-85.85550000
20	41.24863333	-85.85600000
21	41.24906667	-85.85666667
22	41.24946667	-85.85663333
23	41.25020000	-85.85676667
24	41.25141667	-85.85746667
25	41.25096667	-85.85695000
26	41.25028333	-85.85748333
27	41.24960000	-85.85723333
28	41.25073333	-85.86096667
29	41.24916667	-85.86018333
30	41.24903333	-85.85906667
31	41.24880000	-85.85773333
32	41.24815000	-85.85746667
33	41.24775000	-85.85868333
34	41.24725000	-85.85915000
35	41.24683333	-85.85956667
36	41.24673333	-85.86010000
37	41.24668333	-85.86063333
38	41.24620000	-85.86068333
39	41.24601667	-85.86168333
40	41.24593333	-85.86058333
41	41.24533333	-85.86083333
42	41.24473333	-85.86050000
43	41.24435000	-85.85961667
44	41.24393333	-85.85971667
45	41.24363333	-85.85913333
46	41.24323333	-85.85848333
47	41.24278333	-85.85845000
48	41.24246667	-85.85820000
49	41.24245000	-85.85756667
50	41.24223333	-85.85721667

Aquatic Plant Management Plan
Lake Use Survey for Center Lake

Are you a lake property owner? Yes ✓ No____

Are you currently a member of your lake association? Yes ✓ No____

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

How do you use the lake (mark all that apply)
- ___ Swimming
- ✓ Boating
- ✓ Fishing
- ✓ Irrigation
- ___ Drinking water
- ___ Other_____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes ✓ No____

Do you currently participate in a weed control project on the lake? Yes ✓ No____

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes ✓ No____

Does the level of vegetation in the lake affect your property values? Yes ✓ No____

Are you in favor of continuing efforts to control vegetation on the lake? Yes ✓ No____

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 ✓ No____

Mark any of these you think are problems on your lake:
- ___ Too many boats access the lake
- ___ Too much fishing
- ___ Fish population problem
- ✓ Dredging needed
- ___ Overuse by nonresidents
- ✓ Too many aquatic plants
- ___ Not enough aquatic plants
- ___ Poor water quality
- ___ Pier/funneling problem

Please add any comments:

_____

_____

_____

Aquatic Plant Management Plan
Lake Use Survey for Center Lake

Are you a lake property owner? Yes X No____

Are you currently a member of your lake association? Yes X No____

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

How do you use the lake (mark all that apply)
- X Swimming
- X Boating
- X Fishing
- X Irrigation
- ___ Drinking water
- ___ Other_____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes____ No X

Do you currently participate in a weed control project on the lake? Yes X No____

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes X No____

Does the level of vegetation in the lake affect your property values? Yes X No____

Are you in favor of continuing efforts to control vegetation on the lake? Yes X No____

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 X No____

Mark any of these you think are problems on your lake:
- ___ Too many boats access the lake
- X Too much fishing
- X Fish population problem
- ? Dredging needed
- X Overuse by nonresidents
- X Too many aquatic plants
- ___ Not enough aquatic plants
- ___ Poor water quality
- ___ Pier/funneling problem

Please add any comments:

How will my sea wall be affected?

Aquatic Plant Management Plan
Lake Use Survey for Center Lake

Are you a lake property owner? Yes ✓ No____

Are you currently a member of your lake association? Yes ✓ No____

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

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

- ___ Swimming
- ✓ Boating
- ✓ Fishing
- ___ Irrigation
- ___ Drinking water
- ___ Other_____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes ✓ No____

Do you currently participate in a weed control project on the lake? Yes ✓ No____

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes ✓ No____

Does the level of vegetation in the lake affect your property values? Yes ✓ No____

Are you in favor of continuing efforts to control vegetation on the lake? Yes ✓ No____

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 ✓ No____

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

- ___ Too many boats access the lake
- ___ Too much fishing
- ___ Fish population problem
- ✓ Dredging needed
- ___ Overuse by nonresidents
- ✓ Too many aquatic plants
- ___ Not enough aquatic plants
- ✓ Poor water quality
- ✓ Pier/funneling problem

Please add any comments:

_____

_____

_____

Aquatic Plant Management Plan
Lake Use Survey for Center Lake

Are you a lake property owner? Yes_____ No ✓ Channel

Are you currently a member of your lake association? Yes ✓ No_____

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

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

___Swimming ___Irrigation
___Boating ___Drinking water
___Fishing ✓Other Currently looking to keep water flow in the North Channel + appealing for wild life

Everything listed at one time or another.

Do you have aquatic plants at your shoreline in nuisance quantities? Yes_____ No ✓

Do you currently participate in a weed control project on the lake? Yes_____ No ✓

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes_____ No ✓

Does the level of vegetation in the ~~lake~~ channel affect your property values? Yes ✓ No_____

Are you in favor of continuing efforts to control vegetation on the lake? Yes ✓ No_____

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_____ No ✓

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

___ Too many boats access the lake
___ Too much fishing
___ Fish population problem
___ Dredging needed
___ Overuse by nonresidents
___ Too many aquatic plants
___ Not enough aquatic plants
___ Poor water quality
___ Pier/funneling problem

Please add any comments:

Have had water flowing out of the lake through the North Channel this winter — that has been good for return of wild life. Back to keep water flow in the channel.

Aquatic Plant Management Plan
Lake Use Survey for Center Lake

Are you a lake property owner? Yes ✓ No____

Are you currently a member of your lake association? Yes ✓ No____

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

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

- ___Swimming
- ✓ Boating
- ___Fishing
- ✓ Irrigation
- ___Drinking water
- ___Other_____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes ✓ No____

Do you currently participate in a weed control project on the lake? Yes ✓ No____

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes ✓ No____

Does the level of vegetation in the lake affect your property values? Yes____ No ✓

Are you in favor of continuing efforts to control vegetation on the lake? Yes ✓ No____

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 ✓ No____

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

- ___ Too many boats access the lake
- ___ Too much fishing
- ___ Fish population problem
- ✓ Dredging needed
- ___ Overuse by nonresidents
- ✓ Too many aquatic plants
- ___ Not enough aquatic plants
- ___ Poor water quality
- ___ Pier/funneling problem

Please add any comments:

_____

_____

_____

Aquatic Plant Management Plan
Lake Use Survey for Center Lake

Are you a lake property owner? Yes ✓ No____

Are you currently a member of your lake association? Yes ✓ No____

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

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

- ✓ Swimming
- ✓ Boating
- ✓ Fishing
- ✓ Irrigation
- ___ Drinking water
- ___ Other_____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes____ No ✓

Do you currently participate in a weed control project on the lake? Yes ✓ No____

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes ✓ No____

Does the level of vegetation in the lake affect your property values? Yes ✓ No____

Are you in favor of continuing efforts to control vegetation on the lake? Yes ✓ No____

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 ✓ No____

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

- ___ Too many boats access the lake
- ___ Too much fishing
- ___ Fish population problem
- ✓ Dredging needed
- ___ Overuse by nonresidents
- ✓ Too many aquatic plants
- ✓ Not enough aquatic plants at 8ft? Below
- ✓ Poor water quality
- ___ Pier/funneling problem

Please add any comments:

_____

_____

_____

Aquatic Plant Management Plan
Lake Use Survey for Center Lake

Are you a lake property owner? Yes X No____

Are you currently a member of your lake association? Yes X No____

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

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

- ___Swimming
- X Boating
- ___Fishing
- ___Irrigation
- ___Drinking water
- ___Other_____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes X No____

Do you currently participate in a weed control project on the lake? Yes X No____

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes X No____

Does the level of vegetation in the lake affect your property values? Yes X No____

Are you in favor of continuing efforts to control vegetation on the lake? Yes X No____

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 X No____

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

- ___ Too many boats access the lake
- ___ Too much fishing
- ___ Fish population problem
- X Dredging needed
- ___ Overuse by nonresidents
- X Too many aquatic plants
- ___ Not enough aquatic plants
- ___ Poor water quality
- ___ Pier/funneling problem

Please add any comments:

_____

_____

_____

Aquatic Plant Management Plan
Lake Use Survey for Center Lake

(Supt. Parks + Rec) manager of Public Lake access areas

Are you a lake property owner? Yes X No____

Are you currently a member of your lake association? Yes X No____

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

How do you use the lake (mark all that apply)
- X Swimming
- X Boating
- X Fishing
- X Irrigation
- ___ Drinking water
- ___ Other_____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes____ No X

Do you currently participate in a weed control project on the lake? Yes X No____

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes X No____

Does the level of vegetation in the lake affect your property values? Yes____ No____

Are you in favor of continuing efforts to control vegetation on the lake? Yes X No____

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 X No____

Mark any of these you think are problems on your lake:
- ___ Too many boats access the lake
- ___ Too much fishing
- ___ Fish population problem
- ___ Dredging needed
- ___ Overuse by nonresidents
- ___ Too many aquatic plants
- X Not enough aquatic plants (non-evasive)
- X Poor water quality
- X Pier/funneling problem

Please add any comments:

E-coli problems closing Beach area several times in past year. Geese Problem

Aquatic Plant Management Plan
Lake Use Survey for Center Lake

Are you a lake property owner? Yes ✓ No____

Are you currently a member of your lake association? Yes ✓ No____

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

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

- ✓ Swimming
- ✓ Boating
- ✓ Fishing
- ___ Irrigation
- ___ Drinking water
- ___ Other_____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes____ No ✓

Do you currently participate in a weed control project on the lake? Yes ✓ No____

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes____ No ✓

Does the level of vegetation in the lake affect your property values? Yes____ No ✓

Are you in favor of continuing efforts to control vegetation on the lake? Yes ✓ No____

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 ✓ No____

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

- ___ Too many boats access the lake
- ___ Too much fishing
- ___ Fish population problem
- ✓ Dredging needed
- ___ Overuse by nonresidents
- ___ Too many aquatic plants
- ___ Not enough aquatic plants
- ___ Poor water quality
- ___ Pier/funneling problem

MILFOIL is USUALLY A PROBLEM ON the N.W. end.
None OF these ARE Really A problem.
There are SOME shallow areas in the channel.

Please add any comments:

Sometimes the water level gets Too high. This CAUSES EROSION AND once my pier FLOATED AWAY.

Aquatic Plant Management Plan
Lake Use Survey for Center Lake

Are you a lake property owner? Yes X No____

Are you currently a member of your lake association? Yes X No____

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

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

- ___ Swimming
- X Boating
- X Fishing
- X Irrigation
- ___ Drinking water
- ___ Other_____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes X No____

Do you currently participate in a weed control project on the lake? Yes X No____

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes X No____

Does the level of vegetation in the lake affect your property values? Yes X No____

Are you in favor of continuing efforts to control vegetation on the lake? Yes X No____

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 X No____

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

- ___ Too many boats access the lake
- ___ Too much fishing
- ___ Fish population problem
- X Dredging needed
- ___ Overuse by nonresidents
- X Too many aquatic plants
- ___ Not enough aquatic plants
- ___ Poor water quality
- ___ Pier/funneling problem

Please add any comments:

Center Lake is a treasure for all of Warsaw. Channel has previously been a step child but seems to be receiving more importance. Use of the lake for us depends on the quality of the channel. Please spray until dredging.

Aquatic Plant Management Plan
Lake Use Survey for Center Lake

Are you a lake property owner? Yes ✓ No____

Are you currently a member of your lake association? Yes ✓ No____

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

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

- ___ Swimming
- ✓ Boating
- ✓ Fishing
- ___ Irrigation
- ___ Drinking water
- ___ Other_____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes ✓ No____

Do you currently participate in a weed control project on the lake? Yes ✓ No____

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes ✓ No____

Does the level of vegetation in the lake affect your property values? Yes ✓ No____

Are you in favor of continuing efforts to control vegetation on the lake? Yes ✓ No____

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 ✓ No____

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

- ___ Too many boats access the lake
- ___ Too much fishing
- ___ Fish population problem
- ✓ Dredging needed
- ___ Overuse by nonresidents
- ___ Too many aquatic plants
- ___ Not enough aquatic plants
- ✓ Poor water quality
- ___ Pier/funneling problem

Please add any comments:

Center Lake is a treasure not only for the lake residents, but also the entire community of Warsaw. We need to make it healthy and then keep it that way.

Aquatic Plant Management Plan
Lake Use Survey for Center Lake

Are you a lake property owner? Yes X No____

Are you currently a member of your lake association? Yes X No____

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

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

- X Swimming
- X Boating
- X Fishing
- X Irrigation
- ___ Drinking water
- ___ Other_____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes X No____

Do you currently participate in a weed control project on the lake? Yes X No____

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes XX No____

Does the level of vegetation in the lake affect your property values? Yes X No____

Are you in favor of continuing efforts to control vegetation on the lake? Yes X No____

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 X No____

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

- ___ Too many boats access the lake
- ___ Too much fishing
- ___ Fish population problem
- X Dredging needed
- ___ Overuse by nonresidents
- X Too many aquatic plants
- ___ Not enough aquatic plants
- X Poor water quality
- ___ Pier/funneling problem

Please add any comments:

_____

_____

_____

Aquatic Plant Management Plan
Lake Use Survey for Center Lake

Are you a lake property owner? Yes X No____

Are you currently a member of your lake association? Yes X No____

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

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

- ___ Swimming
- X Boating
- X Fishing
- X Irrigation
- ___ Drinking water
- ___ Other_____

Do you have aquatic plants at your shoreline in nuisance quantities? Yes X No____

Do you currently participate in a weed control project on the lake? Yes X No____

Does aquatic vegetation interfere with your use or enjoyment of the lake? Yes X No____

Does the level of vegetation in the lake affect your property values? Yes X No____

Are you in favor of continuing efforts to control vegetation on the lake? Yes X No____

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 X No____

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

- ___ Too many boats access the lake
- ___ Too much fishing
- ___ Fish population problem
- X Dredging needed
- ___ Overuse by nonresidents
- X Too many aquatic plants
- ___ Not enough aquatic plants
- ___ Poor water quality
- ___ Pier/funneling problem

Please add any comments:

_____

_____

_____

APPENDIX II

CALCULATIONS

Center Lake - Tier II Survey 8/1/06

Site	Depth	No. Species	All Abund.	POPE6	CH?AR	ZODU	POIL	NAMI	CEDE4	NULU	MYSP2	UTMA	NYTU	NAFL	PONO2	POZO	POGR8	ALGA	AVE SP	AVE Native SP
16	2	2	3	1	0	0	0	0	0	3	0	0	0	0	0	0	0	0	2	2
17	2	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
24	2	2	3	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0	2	2
25	2	2	3	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	2	2
39	2	2	3	3	0	0	0	0	0	3	0	0	0	0	0	0	0	0	2	2
44	2	2	3	1	0	0	0	0	0	0	0	0	3	0	0	0	0	0	2	2
3	3	5	3	3	1	1	1	1	0	0	0	0	0	0	0	0	0	0	5	5
9	3	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
15	3	2	3	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	2	2
18	3	2	3	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	2	1
22	3	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
23	3	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
26	3	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
27	3	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
28	3	3	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	1	2	2
29	3	2	3	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	2	2
34	3	2	3	3	0	0	0	0	0	0	0	0	0	0	3	0	0	0	2	2
50	3	6	3	1	3	0	0	0	0	0	0	0	1	0	1	1	1	0	6	6
6	4	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
12	4	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
30	4	5	5	1	3	0	1	0	0	0	0	0	3	1	0	0	0	0	5	5
37	4	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
48	4	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
4	6	1	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1
8	6	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
19	6	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
21	6	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
33	6	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
42	6	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
47	6	3	3	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	3	3
5	7	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1
11	7	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
14	7	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
49	7	1	3	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
2	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	8	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
38	8	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
41	8	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
45	8	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1
36	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
																		Total sites with species	37	37
	AVE	1.3	1.8	1.4	0.2	0.1	0.1	0.0	0.0	0.2	0.0	0.1	0.2	0.0	0.1	0.0	0.0	0.0	1.24	1.22
																		Standard Error	0.181962095	0.181355441
																		SUM	62	61
																		SDI	0.983870968	0.983606557
																			TOTALS	
			FRQ COUNT (total # sites with veg)	33	4	3	4	1	1	3	1	2	4	1	2	2	1	2	62	
			SITE FRQ	66.00	8.00	6.00	8.00	2.00	2.00	6.00	2.00	4.00	8.00	2.00	4.00	4.00	2.00	4.00	124	
			REL FRQ	53.2	6.5	4.8	6.5	1.6	1.6	4.8	1.6	3.2	6.5	1.6	3.2	3.2	1.6	3.2	100	
			DENSITY	69	8	3	4	1	1	9	1	4	10	1	4	2	1	2	118	
			AVE DENSITY (mean density)	2.09	2.00	1.00	1.00	1.00	1.00	3.00	1.00	2.00	2.50	1.00	2.00	1.00	1.00	1.00		
			REL DENSITY	1.38	0.16	0.06	0.08	0.02	0.02	0.18	0.02	0.08	0.20	0.02	0.08	0.04	0.02	0.04	2.36	
			DOMINANCE (DI)	27.60	3.20	1.20	1.60	0.40	0.40	3.60	0.40	1.60	4.00	0.40	1.60	0.80	0.40	0.80	47.2	

Caculations for: Dominance Index of Each Species in Sampling Zone Depths Table

PINK BOLD = Most Dominant **BOLD = Next Dominant**

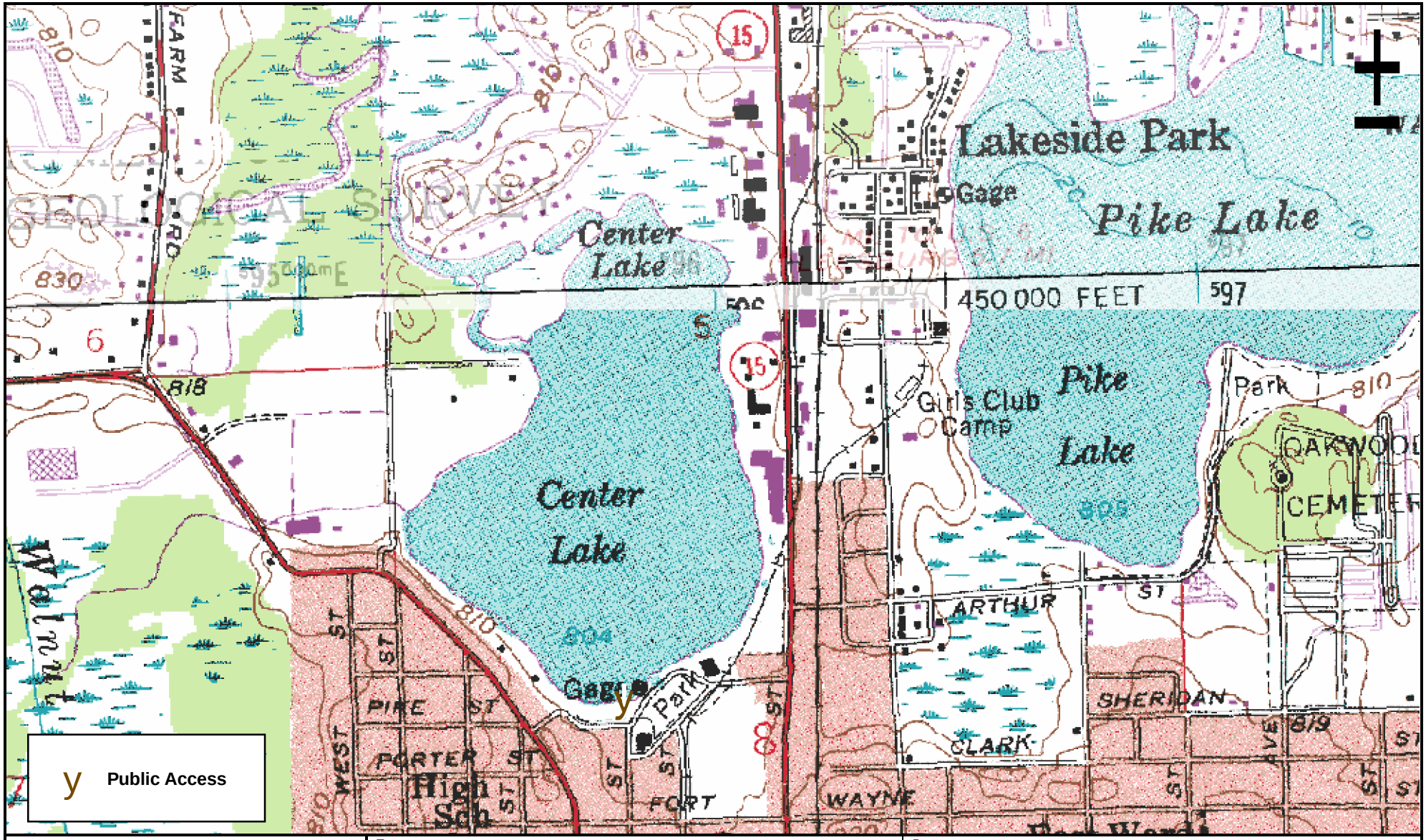
0-5 Depth Zone						
Species	***Frq. Occ.***	***0***	***1***	***3***	***5***	***Plant Dom (DI)***
Potamogeton pectinatus	**95.7**	**4.3**	**39.1**	**56.5**	**0.0**	**41.7**
***Chara* sp.**	**17.4**	**82.6**	**8.7**	**8.7**	**0.0**	**7.0**
Zosterella dubia	4.3	95.7	4.3	0.0	0.0	0.9
Potamogeton illinoensis	13.0	87.0	13.0	0.0	0.0	2.6
Najas minor	4.3	95.7	4.3	0.0	0.0	0.9
Ceratophyllum demersum	0.0	100.0	0.0	0.0	0.0	0.0
Nuphar variegatum	**13.0**	**87.0**	**0.0**	**13.0**	**0.0**	**7.8**
Myriophyllum spicatum	4.3	95.7	4.3	0.0	0.0	0.9
Utricularia vulgaris	8.7	91.3	4.3	4.3	0.0	3.5
Nymphaea tuberosa	**17.4**	**82.6**	**4.3**	**13.0**	**0.0**	**8.7**
Najas flexilis	4.3	95.7	4.3	0.0	0.0	0.9
Potamogeton nodosus	8.7	91.3	4.3	4.3	0.0	3.5
Potamogeton zosteriformis	4.3	95.7	4.3	0.0	0.0	0.9
Potamogeton gramineus	4.3	95.7	4.3	0.0	0.0	0.9
Filamentous algae	4.3	95.7	4.3	0.0	0.0	0.9

5-10 Depth Zone						
Species	***Frq. Occ.***	***0***	***1***	***3***	***5***	***Plant Dom (DI)***
Potamogeton pectinatus	**64.7**	**35.3**	**35.3**	**29.4**	**0.0**	**24.7**
Chara sp.	0.0	100.0	0.0	0.0	0.0	0.0
Zosterella dubia	**11.8**	**88.2**	**11.8**	**0.0**	**0.0**	**2.4**
Potamogeton illinoensis	5.9	94.1	5.9	0.0	0.0	1.2
Najas minor	0.0	100.0	0.0	0.0	0.0	0.0
Ceratophyllum demersum	5.9	94.1	5.9	0.0	0.0	1.2
Nuphar variegatum	0.0	100.0	0.0	0.0	0.0	0.0
Myriophyllum spicatum	0.0	100.0	0.0	0.0	0.0	0.0
Utricularia vulgaris	0.0	100.0	0.0	0.0	0.0	0.0
Nymphaea tuberosa	0.0	100.0	0.0	0.0	0.0	0.0
Najas flexilis	0.0	100.0	0.0	0.0	0.0	0.0
Potamogeton nodosus	0.0	100.0	0.0	0.0	0.0	0.0
Potamogeton zosteriformis	5.9	94.1	5.9	0.0	0.0	1.2
Potamogeton gramineus	0.0	100.0	0.0	0.0	0.0	0.0
Filamentous algae	5.9	94.1	5.9	0.0	0.0	1.2

11-15 Depth Zone						
Species	***Frq. Occ.***	***0***	***1***	***3***	***5***	***Plant Dom (DI)***
Potamogeton pectinatus	0.0	100.0	0.0	0.0	0.0	0.0
Chara sp.	0.0	100.0	0.0	0.0	0.0	0.0
Zosterella dubia	0.0	100.0	0.0	0.0	0.0	0.0
Potamogeton illinoensis	0.0	100.0	0.0	0.0	0.0	0.0
Najas minor	0.0	100.0	0.0	0.0	0.0	0.0
Ceratophyllum demersum	0.0	100.0	0.0	0.0	0.0	0.0
Nuphar variegatum	0.0	100.0	0.0	0.0	0.0	0.0
Myriophyllum spicatum	0.0	100.0	0.0	0.0	0.0	0.0
Utricularia vulgaris	0.0	100.0	0.0	0.0	0.0	0.0
Nymphaea tuberosa	0.0	100.0	0.0	0.0	0.0	0.0
Najas flexilis	0.0	100.0	0.0	0.0	0.0	0.0
Potamogeton nodosus	0.0	100.0	0.0	0.0	0.0	0.0
Potamogeton zosteriformis	0.0	100.0	0.0	0.0	0.0	0.0
Potamogeton gramineus	0.0	100.0	0.0	0.0	0.0	0.0
Filamentous algae	0.0	100.0	0.0	0.0	0.0	0.0

APPENDIX III

ADDITIONAL MAPS AND EXHIBITS



V3 Companies
9601 N. Industrial Dr.
Suite A
St. John, IN 46373
219.558.8850 phone
219.558.8851 fax
www.v3co.com

TITLE: Lake Vicinity Map		PROJECT: Center Lake Aquatic Plant Management Plan	
BASE LAYER: USGS Topographic Map		PROJECT NO.: 02218.02	EXHIBIT: I	SHEET: 1 OF: 1
CLIENT: Center Lake Conservation Association, One Miner Drive, Warsaw, IN 46580		QUADRANGLE: Warsaw	DATE: 11/28/06	SCALE: 1" = 934'

E:\2002\02218\02218.02\Reports\Natural Resources\Wetland\LARE Report Exhibits\Exhibit I Lake Vicinity Map.mxd

V3 Companies
9601 N. Industrial Dr.
Suite A
St. John, IN 46373
219.558.8850 phone
219.558.8851 fax
www.v3co.com

TITLE: Lake Vicinity Aerial		PROJECT: Center Lake Aquatic Plant Management Plan	
BASE LAYER: Indiana Spatial Data Service 2005 Orthophotography		PROJECT NO.: 02218.02	EXHIBIT: II	SHEET: 1 OF: 1
CLIENT: Center Lake Conservation Association One Miner Drive Warsaw, IN 46580		QUADRANGLE: Warsaw	DATE: 11/28/06	SCALE: 1" = 1010'

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V3 Companies
9601 North Industrial Drive
Suite A
St. John, IN 46373
219.558.8850 phone
219.558.9202 fax
www.v3co.com

Client:	Title:	Project:	Sheet: 1 of: 1
Center Lake Conservation Association	**Center Lake Watershed**	**Center Lake Aquatic Plant Management Plan**	

Address:	Base Layer:	Project No.:	Quadrangle:	Date:	Scale:	Exhibit:
One Miner Drive Warsaw, IN 46580	Indiana Spatial Data Service 2005 Orthophotography	02218.02	Warsaw	11/28/06	1" = 5754'	III

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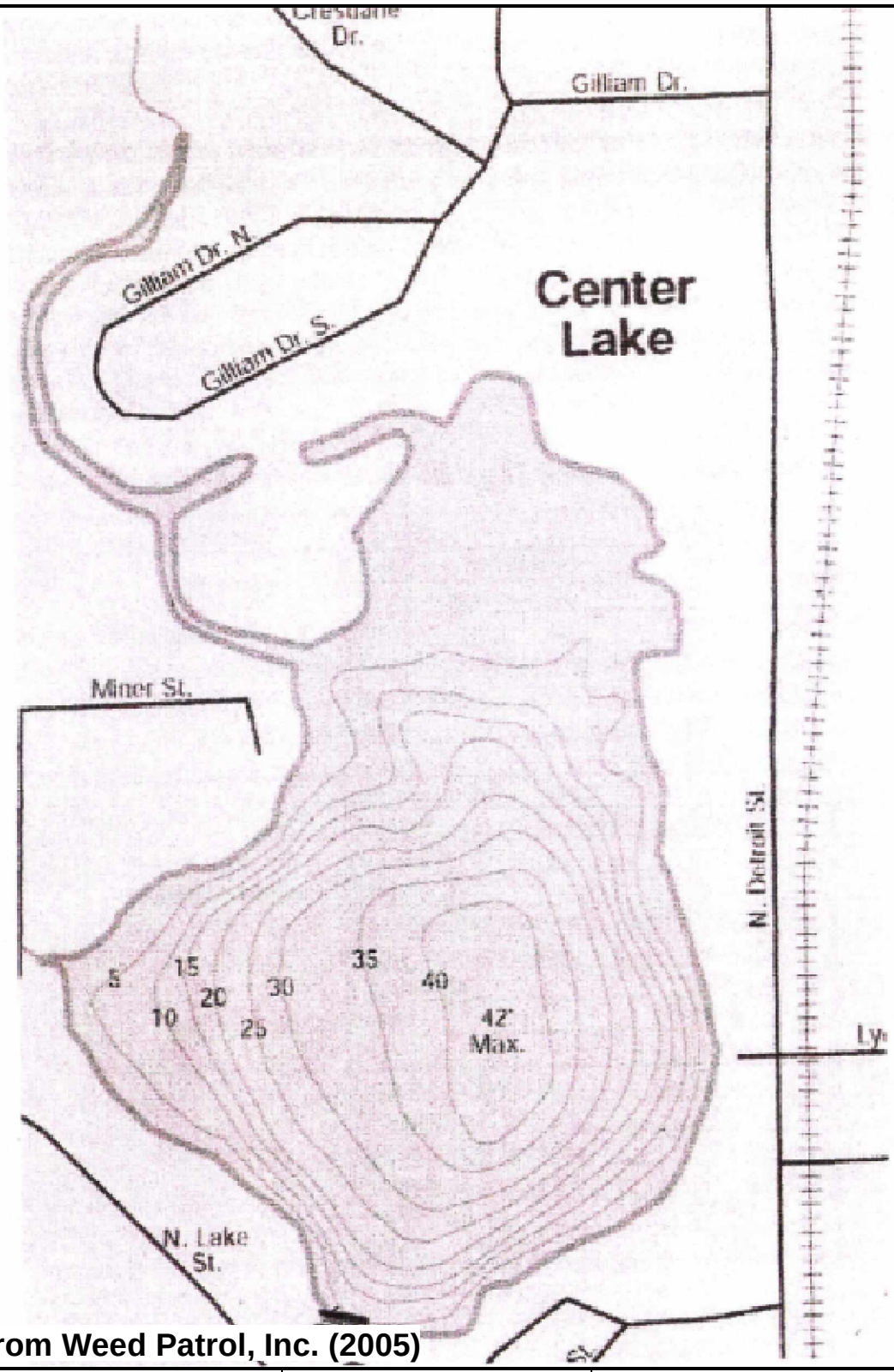

*** Image from Weed Patrol, Inc. (2005)**

V3 Companies
9601 N. Industrial Dr.
Suite A
St. John, IN 46373
219.558.8850 phone
219.558.8851 fax
www.v3co.com

TITLE: **Bathymetric Map**		PROJECT: **Center Lake Aquatic Plant Management Plan**		
BASE LAYER: N/A		PROJECT NO. 02218.02	EXHIBIT: IV	SHEET: 1 OF: 1
CLIENT: Center Lake Conservation Association, One Miner Drive, Warsaw, IN 46580		QUADRANGLE: Warsaw	DATE: 11/28/06	SCALE: NTS

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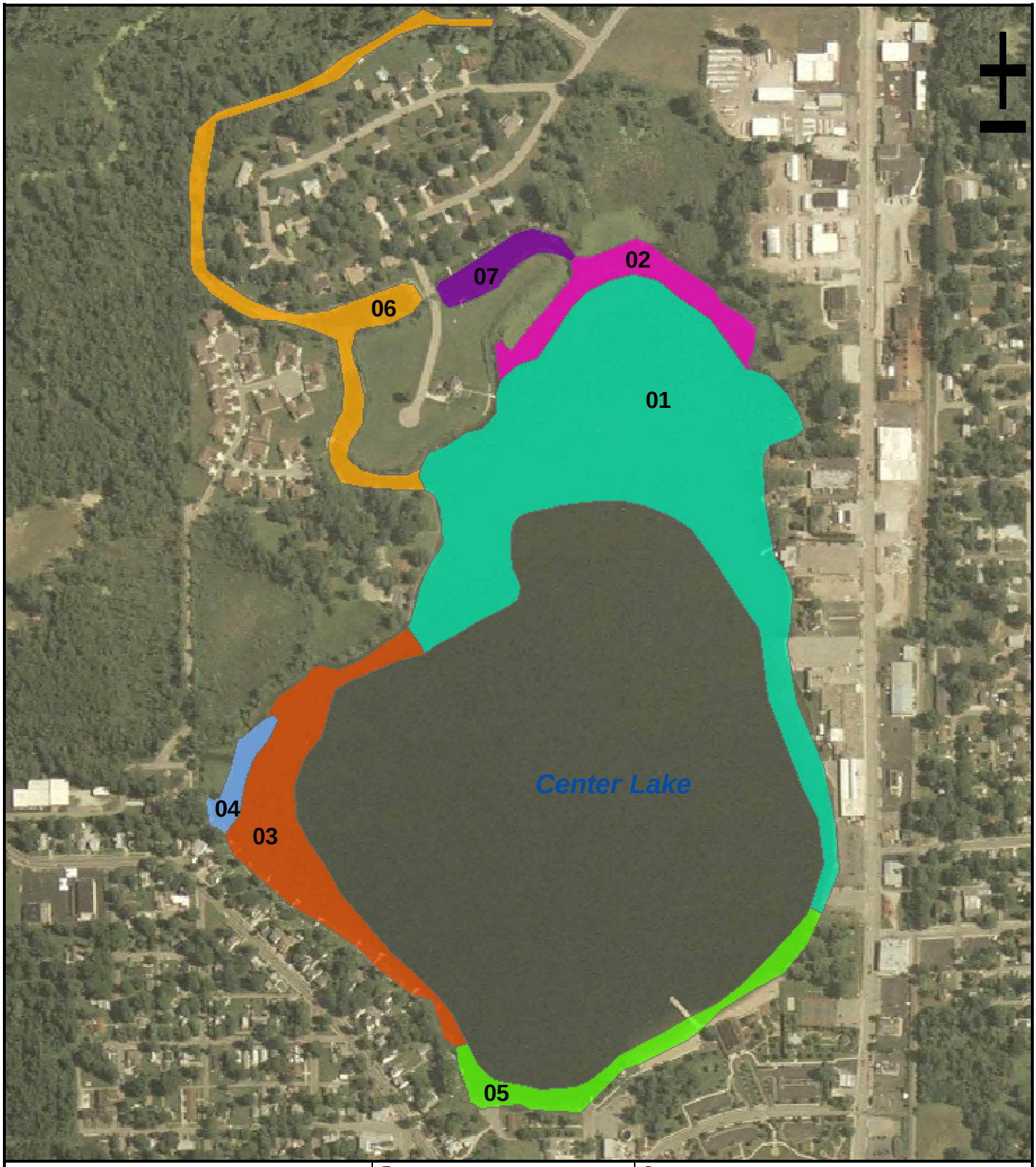

V3 Companies
9601 N. Industrial Dr.
Suite A
St. John, IN 46373
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219.558.8851 fax
www.v3co.com

TITLE: **Aquatic Plant Beds 2006 Sampling**	PROJECT: **Center Lake Aquatic Plant Management Plan**		
BASE LAYER: Indiana Spatial Data Service 2005 Orthophotography	PROJECT NO. 02218.02	EXHIBIT: V	SHEET: 1 OF: 1
CLIENT: Center Lake Conservation Association, One Miner Drive, Warsaw, IN 46580	QUADRANGLE: Warsaw	DATE: 11/28/06	SCALE: 1" = 552'

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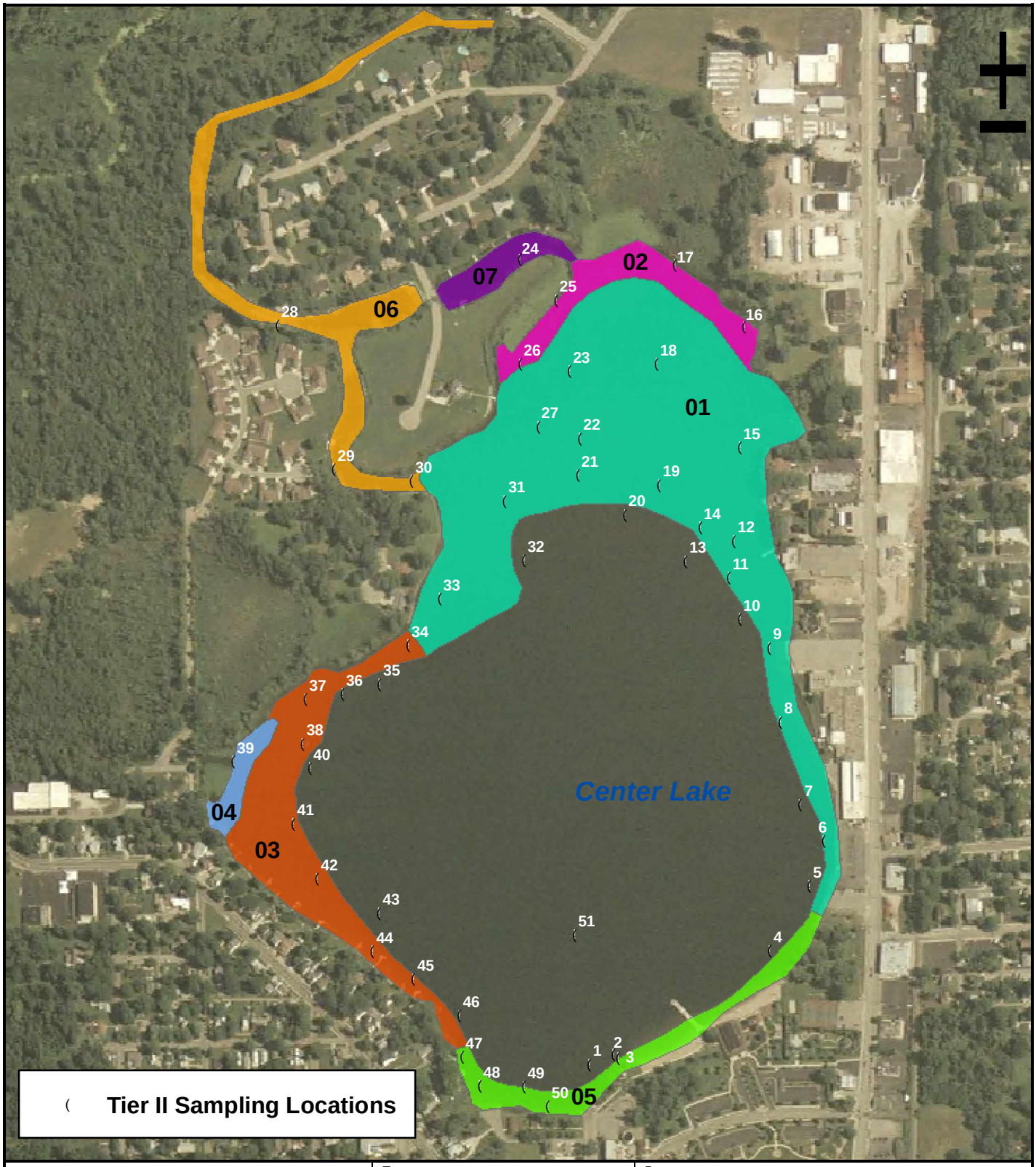

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9601 N. Industrial Dr.
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St. John, IN 46373
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219.558.8851 fax
www.v3co.com

TITLE: Tier II (2006) Sampling Locations	PROJECT: Center Lake Aquatic Plant Management Plan		
BASE LAYER: Indiana Spatial Data Service 2005 Orthophotography	PROJECT NO. 02218.02	EXHIBIT: VI	SHEET: 1 OF: 1
CLIENT: Center Lake Conservation Association, One Miner Drive, Warsaw, IN 46580	QUADRANGLE: Warswaw	DATE: 11/28/06	SCALE: 1" = 552'

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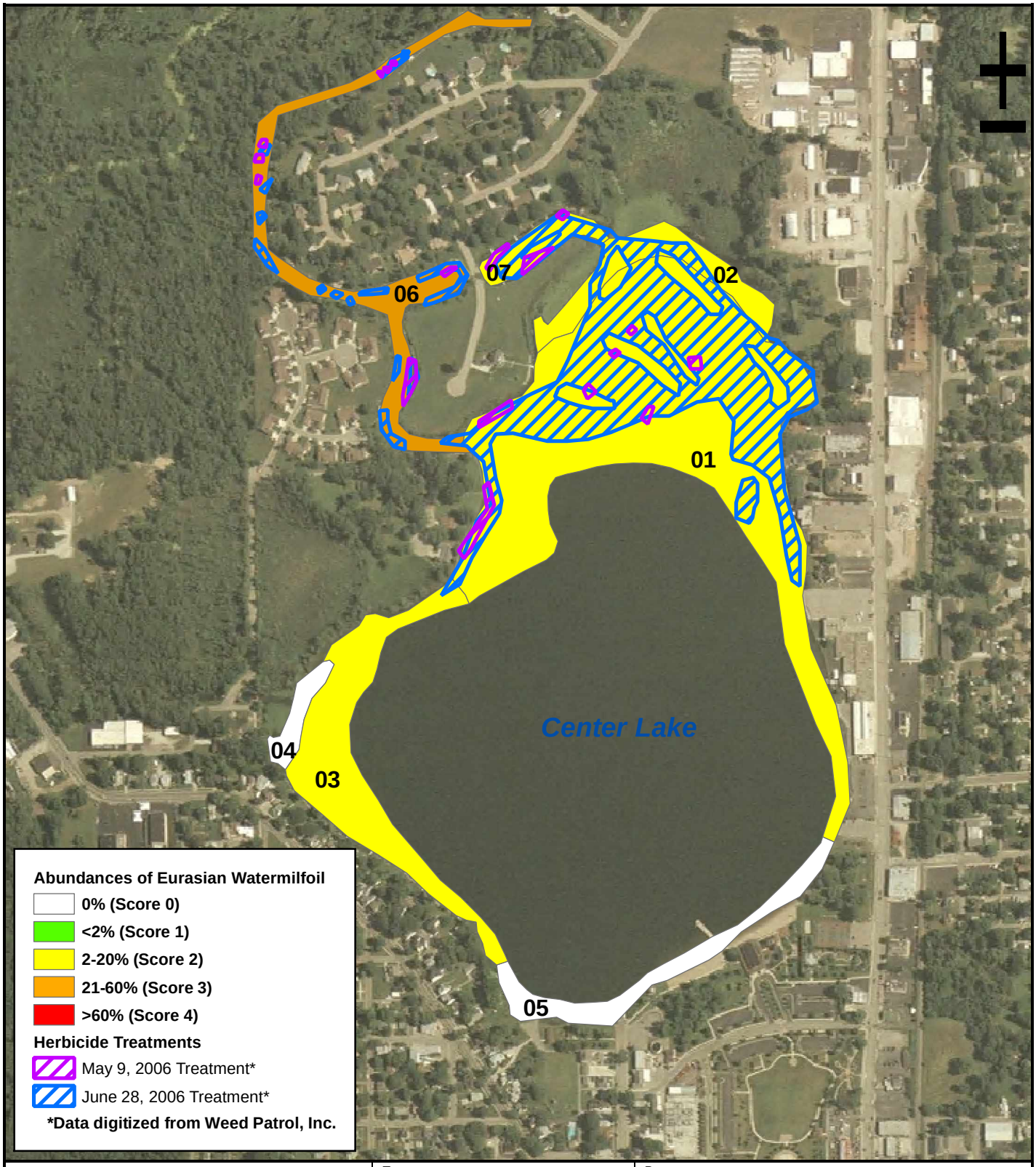

V3 Companies
9601 N. Industrial Dr.
Suite A
St. John, IN 46373
219.558.8850 phone
219.558.8851 fax
www.v3co.com

TITLE: **Eurasian Watermilfoil Abundances Prior to Treatment & Treatment Areas**	PROJECT: **Center Lake Aquatic Plant Management Plan**		
BASE LAYER: Indiana Spatial Data Service 2005 Orthophotography	PROJECT NO. 02218.02	EXHIBIT: VII	SHEET: 1 OF: 1
CLIENT: Center Lake Conservation Association, One Miner Drive, Warsaw, IN 46580	QUADRANGLE: Warswaw	DATE: 11/28/06	SCALE: 1" = 600'

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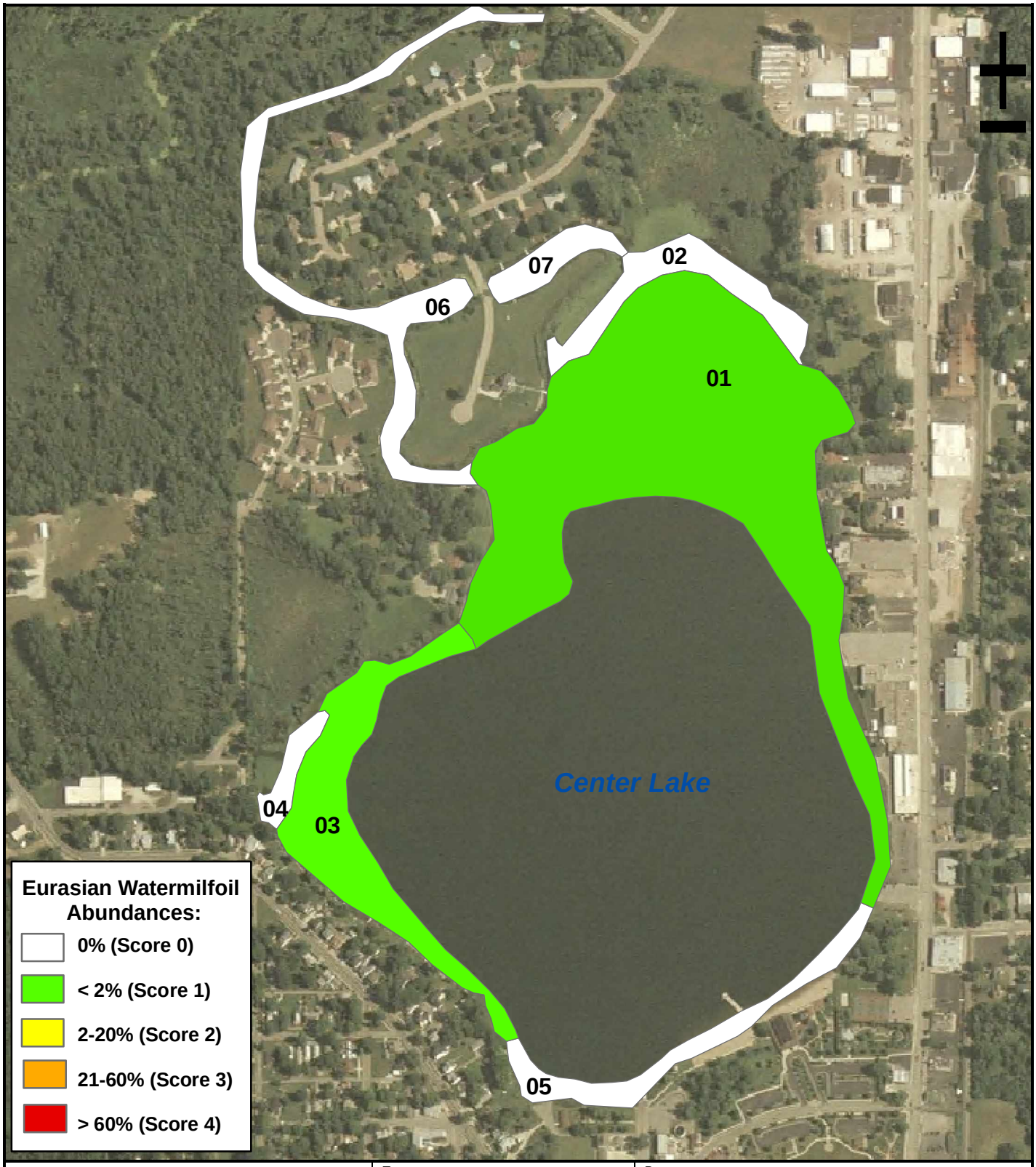

V3 Companies
9601 N. Industrial Dr.
Suite A
St. John, IN 46373
219.558.8850 phone
219.558.8851 fax
www.v3co.com

TITLE: **Eurasian Watermilfoil Abundances After Treatment**	PROJECT: **Center Lake Aquatic Plant Management Plan**		
BASE LAYER: Indiana Spatial Data Service 2005 Orthophotography	PROJECT NO. 02218.02	EXHIBIT: VIII	SHEET: 1 OF: 1
CLIENT: Center Lake Conservation Association, One Miner Drive, Warsaw, IN 46580	QUADRANGLE: Warswaw	DATE: 11/28/06	SCALE: 1" = 552'

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APPENDIX IV

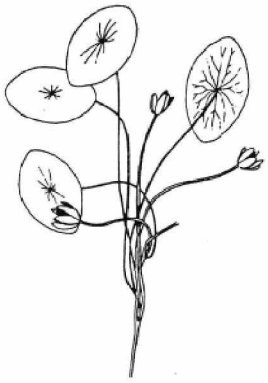
SPECIES LIST

APPENDIX IV – SPECIES LIST

The following information is found in the Illinois Department of Natural Resource's Aquatic Plants: their identification and management booklet. This information provides information on common aquatic plants.

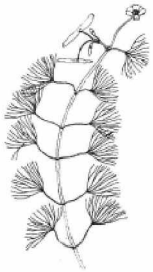
Chara

Advanced forms of algae, such as *Chara* and *Nitella*, grow from the lake bottom with stems and branches and feel bristly. *Chara* has a musky odor and is usually found in hard water. Common names of *Chara* are muskgrass and stonewart. *Chara* and *Nitella* are often mistaken for underwater plants such as coontail or milfoil. These plants are sometimes difficult to kill, even when the proper herbicide has been used.



Water Shield
(Brasenia schreberi)

Water shield has leaves the *shape of a shield* that float on the water surface. The stem is attached to the middle of the leaf. The leaves may be 2 to 5 inches in length, and the underside is usually covered with a thick layer of jelly-like material. Water shield blooms with a dull purple flower in early summer. Water shield is more common in southern Illinois. Usually, more than one treatment may be necessary.

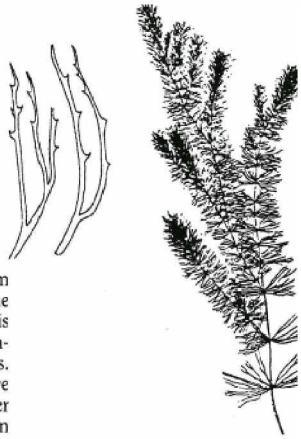


Fanwort
(Cabomba spp.)

Fanwort has fan-shaped leaves. Leaflets are forked and wider at the tip than at the base. Sometimes small floating leaves are present. Plants have a gelatinous slime. Flowers are white to lavendar.

Buttonbush
(Cephalanthus occidentalis)

Buttonbush is also called buck brush, and it grows as a woody shrub with leaves opposite or in three's. The flowers are round balls at the end of long stalks. This is where this plant gets its name buttonbush. Buttonbush can be found throughout Illinois.



PLANTS WITH WHORLED LEAF ATTACHMENTS
Coontail
(*Ceratophyllum demersum*)

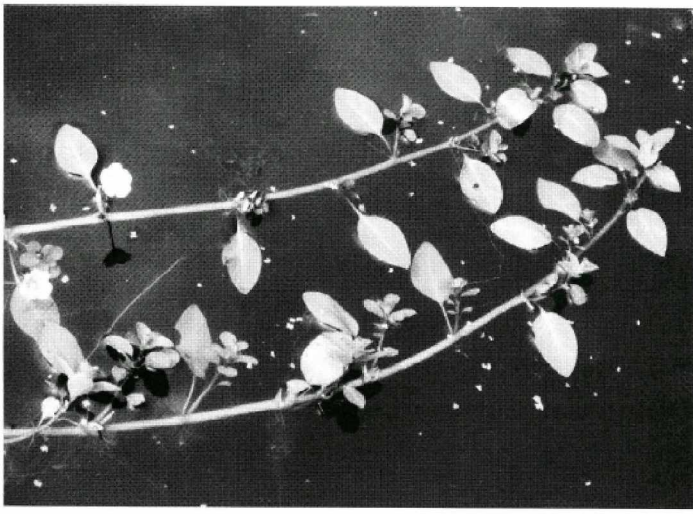
The common name of coontail comes from the resemblance of a branch of the plant to the tail of a raccoon. It is also called hornwort. This plant grows entirely under water and has a central hollow stem with thread-like forked leaves. The stems may be 20 feet long. Extensive growths of coontail resemble an underwater forest of "Christmas trees." Coontail grows in clear water to depths of 10 to 15 feet. *Do not confuse coontail with chara or milfoil.* Coontail is a common plant throughout Illinois.

American Elodea
(Elodea canadensis)

American elodea is also called water weed, anachris and ditch moss. It grows entirely under water with four leaves attached to a center stem. The margin of the leaves have microscopic barbs. Elodea can be found throughout Illinois.

Waterstargrass
(Heteranthera dubia)

Waterstargrass has flat, grass-like leaves and stems. It is a rooted plant, that grows underwater and has tiny pale yellow flowers the shape of a star. The leaves have almost a complete lack of a mid-vein. Waterstargrass is more common in the northern half of Illinois. The plant may flower July through October. Waterstargrass is also called mudplantain and ducksalad.



Creeping Water Primrose
(Jussiaea repens var. glabrescens)

Creeping water primrose grows in shallow water along the shorelines. The hollow red colored stems extend from the shoreline and support extensive light green leaves with bright yellow flowers in midsummer. An extensive fine root system extends below the water from the main stem. Primrose is more commonly found in the southern half of Illinois. Usually, more than one treatment may be necessary.

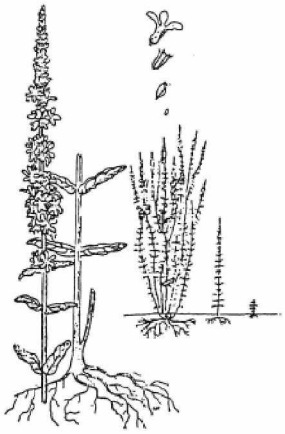
Water Willow
(Justica americana)

Water willow is a perennial plant growing in dense stands along the shoreline. It ha: opposite leaf attachments and the leaves are long and narrow. The plant has a smal bluish-white flower in mid summer. Water willow is found throughout Illinois.

Duckweed and Watermeal
(*Lemna spp.*) (*Wolffia spp.*)

Duckweed (*Lemna spp.*) and Watermeal (*Wolffia spp.*) are floating plants which often form a green blanket on the water surface. Duckweed has tiny leaves (fronds) with rootlets that hang down in the water. Watermeal appears as minute green grains floating on the water and is the smallest of all flowering plants.

Both of these plants may be found growing together, and frequently, their growth is so abundant that a layer of plants one to two inches thick may occur on the water surface. The wind and currents will concentrate duckweed and watermeal in certain portions of a lake. Because of this drifting and subsequent layering, these plants are *very* difficult to control. Duckweed and watermeal can be found throughout Illinois.



Purple Loosestrife
(Lythrum salicaria)

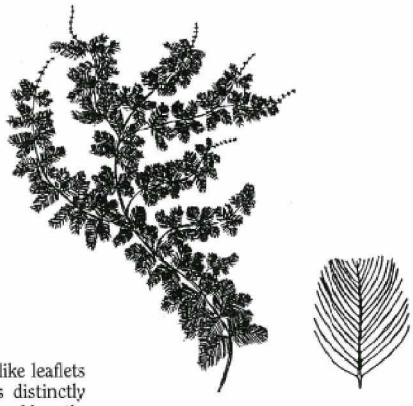
Purple loosestrife is an erect, perennial, wetland herb-type plant introduced from northern Europe. In recent years, it has become a serious threat to native emersed vegetation in Illinois. This aggressive weed out-competes surrounding vegetation, forming pure stands which are of little value. The plant is easily identified by its reddish-purple flower spikes, present from July through September.

By virtue of the Exotic Weed Act of 1987, Purple loosestrife has been designated an exotic weed. It is therefore unlawful for any person, corporation or political subdivision to buy, sell, offer for sale, distribute or plant seeds, plants or plant parts without a permit issued by the Illinois Department of Natural Resources.

Time of application is highly significant. Greatest control may be achieved during the period of late flowering (mid-August). Other recommended times for treatment include mid-June (prior to flowering) and mid-July (early flowering).

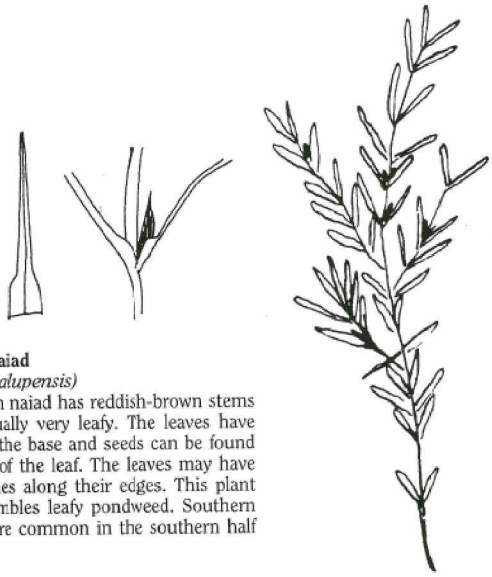
Water Milfoil
(Myriophyllum spp.)

The long hollow stem of water milfoil has fine feather-like leaflets which are usually bright green with tips usually not red tinged and which curve toward and extend nearly to the leaf tip. Milfoil grows entirely under the water and may be found growing in depths of 8 to 10 feet. Milfoil is commonly found throughout Illinois.



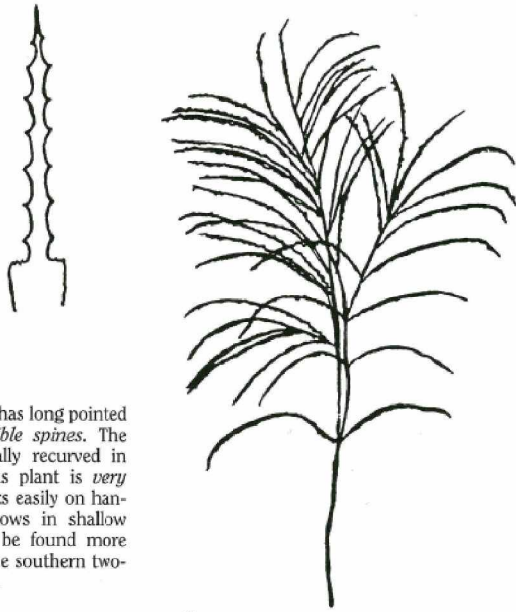
Eurasian Milfoil
(Myriophyllum spicatum)

This exotic has fine, feather-like leaflets which are dark green, with tips distinctly red, mostly straight and nearly equal length. Eurasian milfoil may grow in depths of 15 to 20 feet.



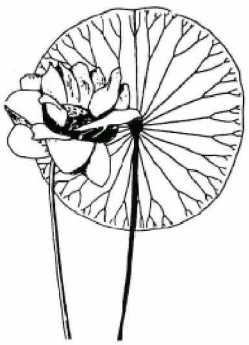
Southern Naiad
(Najas guadalupensis)

Southern naiad has reddish-brown stems that are usually very leafy. The leaves have sheathes at the base and seeds can be found in the axils of the leaf. The leaves may have minute spines along their edges. This plant closely resembles leafy pondweed. Southern naiad is more common in the southern half of Illinois.



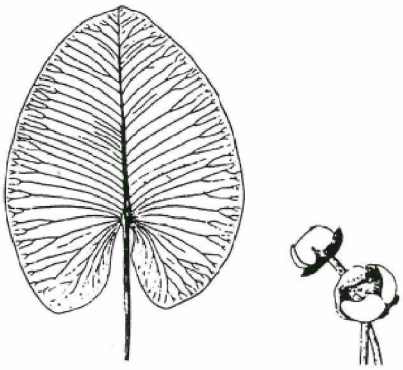
Brittle Naiad
(Najas minor)

Brittle naiad has long pointed leaves with *visible spines*. The leaves are usually recurved in appearance. This plant is *very brittle* and breaks easily on handling. Naiad grows in shallow water and can be found more commonly in the southern two-thirds of Illinois.



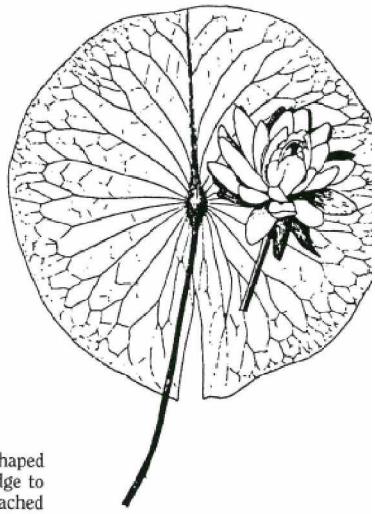
American Lotus
(Nelumbo lutea)

Lotus has large round leaves (up to 2 feet in diameter) that extend above the water; it produces a yellowish-white flower and later a large seed pod. The plant stem is attached in the center of a large *completely circular* leaf which is frequently cup-shaped. The leaf veins radiate from the junction of the stem in all directions and divide near the edge of the leaf. This plant has an extensive underground root stock. Lotus can be found throughout Illinois. It is also called yonkapen, yockernut, wankapen, duck acorn, water nut, and rattlenut from the nutlike seeds it produces. Lotus will grow in fairly deep water. *Lotus should be treated when the plants are in the flowering stage.* More than one treatment is usually necessary.



Spatterdock
(Nuphar advena)

Spatterdock has a *heart-shaped* leaf. The leaves may float or extend above the water surface. The stem is attached to the notch between the lobes of the leaf and extends to the tip of the leaf. From this main leaf vein, lateral veins extend to the edge where they are divided. The yellow flowers form a ball with petals that curve inward. Spatterdock is also called yellow pond lily and cow lily. More than one treatment is usually necessary. This plant is found throughout Illinois.



Water Lily
(Nymphae spp.)

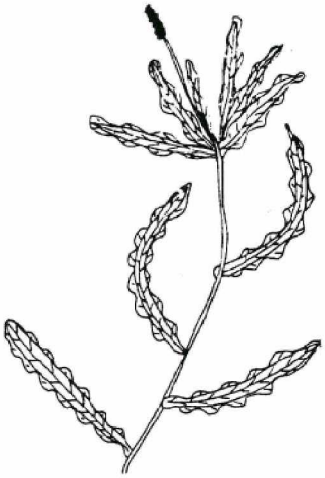
Water lilies have large circular-shaped floating leaves with a *slit* from the edge to the center of the leaf. The stem is attached to the center of the leaf from which veins radiate. The veins are branched or subdivided at the edge of the leaf. This plant produces a pink or white flower that *floats* on the water. Water lilies can be found throughout Illinois. More than one treatment is usually necessary.

Water Smartweed
(Polygonum spp.)

Water smartweed commonly grows in shallow water along the shorelines of lakes and ponds. However, there are some species that will grow in water up to twelve feet in depth. The plant has jointed stems with conspicuous stipules located at the joints. The oblong leaves are about 4 inches in length. Smartweed flowers in mid-summer with dense pink or rose-colored flowers held erect above the water. Usually, more than one treatment may be necessary.

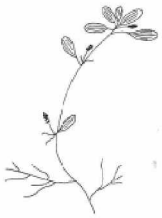
Largeleaf Pondweed
(Potamogeton amplifolius)

Largeleaf pondweed has large, elliptic-shaped floating leaves and broad, partially folded submersed leaves. This plant is more commonly found along the eastern edge of Illinois.



Curlyleaf Pondweed
(Potamogeton crispus)

Curlyleaf pondweed has thin membranous leaves approximately one-half inch wide and two to three inches in length. The leaves are wavy or curly along the edges with a row of small spines visible to the naked eye. This plant will grow along the shoreline to depths of about 12 feet. Curlyleaf pondweed may start growing in the fall and during the winter months. Seeds can be produced in late April or early May and then the plant may die down during late July. Curlyleaf pondweed is more common in the northern half of Illinois.



Waterthread Pondweed
(Potamogeton diversifolius)

Waterthread pondweed has thread-like submersed leaves and small, round floating leaves. The floating leaves may be three-fourths to one inch in length and one-fourth to one-half inch in width. They are usually seven-nerved. Waterthread pondweed is more commonly found in southwestern Illinois.

Leafy Pondweed
(Potamogeton foliosus)

Leafy pondweed has short, grass-like submersed leaves. During the summer, a clump of 4 to 8 fruiting bodies are attached to a center stem by a *short* seed stalk. Very few, if any, of these seeds ever reach the water surface. This plant grows from the shoreline to depths of approximately 4 feet. Leafy pondweed is the most common of all the pondweeds and is found throughout Illinois.

Illinois Pondweed
(Potamogeton illinoensis)

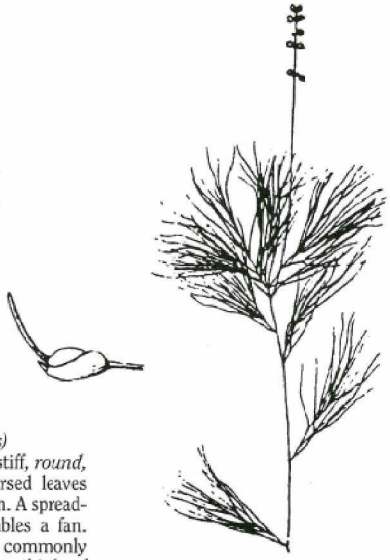
Illinois pondweed has long and narrow submersed leaves and wide oval-shaped floating leaves. This pondweed can be found throughout Illinois.

Floatingleaf Pondweed
(Potamogeton natans)

Floatingleaf pondweed has long an narrow submersed leaves and elliptic shaped floating leaves. This plant i found throughout Illinois.

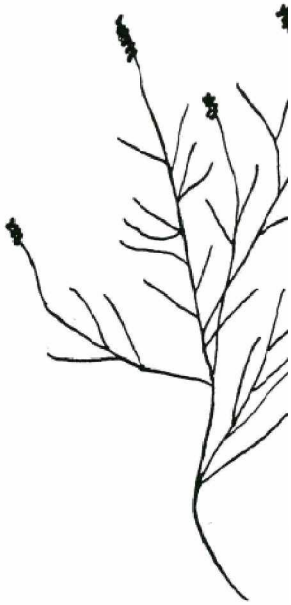
American Pondweed
(Ponamogeton nodosus)

American pondweed has submersed leaves that are very thin and linear in shape and floating leaves that are large and elliptic in shape. This is the most common of the floating leaf pondweeds in Illinois and is state wide in occurrence.



Sago Pondweed
(Potamogeton pectinatus)

Sago pondweed has stiff, *round, tapered* hair-like submersed leaves that appear bushy in form. A spreading of the leaves resembles a fan. This pondweed is more commonly found in the northern two-thirds of Illinois.



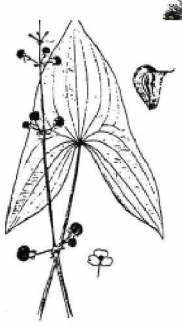
Small Pondweed
(Potamogeton pusillus)

Small pondweed has very tough slender stems with grass-like leaves. This plant tends to grow in clumps with a large number of stems reaching to the water surface. This pondweed grows in deeper water, usually about six to eight feet, and does not inhabit the shallow water along the shore. Very small flowers and seeds extend above the water surface. The seeds have a seed stalk located on the terminal end of the stem. Small pondweed can be easily confused with leafy pondweed. Small pondweed can be found throughout Illinois.

MISCELLANEOUS SUBMERSED PLANTS

Water Buttercup
(Ranunculus spp.)

Water buttercup is also called water crowfoot and white or yellow water buttercup. This plant grows completely underwater. Small white or yellow flowers bloom at the surface from June to October. Water buttercup has a hollow stem which supports tufts of thread-like leaves.

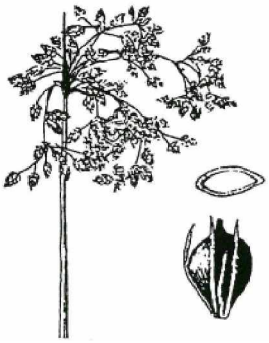


Arrowhead
(Sagittaria spp.)

Arrowhead plants usually have arrowhead-shaped leaves and tiny white flowers. The plant grows along the edge of lakes and ponds in shallow water. This plant is also called duck potato because of its tuber-like root. Arrowhead is found throughout Illinois.

Willow
(Salix spp.)

Willows are shrubs or trees with alternate leaves. The flowers are catkins and sometimes appear in the spring before the leaves do. Willows can be found throughout Illinois.



Bulrush
(Scirpus spp.)

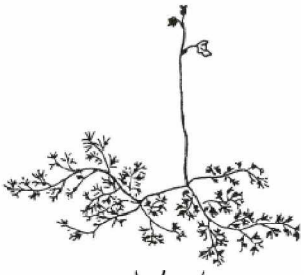
There are several species of bulrush, and they all grow in shallow water along shorelines. They may have triangular- or round-shaped stems and may be leafy or have no leaves at all but just long slender stems. The long stems usually will have a cluster of brownish flowers and seeds at the end of the stem. Bulrushes can be found throughout Illinois.

Cattail
(Typha spp.)

Cattails are tall erect plants with leaves long and flat about one inch in width. They usually produce a long stalk with a seed spike at the end. There are two types of cattails in Illinois, narrow-leaf and broad-leaf. The latter is more common and both types can be found throughout the state. Cattails grow along the water's edge in shallow water. *Cattails should be treated before they have formed seed spikes.*

Bladderwort
(Utricularia vulgaris)

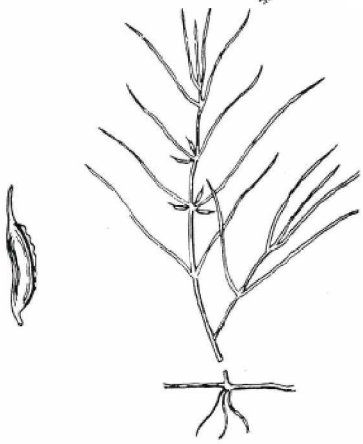
Bladderwort has stems that float horizontally beneath the water surface and may extend three feet or more. The leaves are alternate and divided many times. Some of the leaf segments have *bladders* on them that assist in floatation of the plant. This plant blooms from July through August with yellow flowers extending above the surface. Bladderwort is more commonly found in northern Illinois.



PLANTS WITH OPPOSITE LEAF ATTACHMENTS

Horned Pondweed
(Zannechellia palustris)

Horned pondweed has thread-like stems with the long narrow leaves arranged on the stems opposite of each other. This plant can be easily distinguished from others by its seeds being in clusters in the axils of the leaves. The mature seeds show a distinct horn-like projection from which this plant derives its name of horned pondweed. This plant is more commonly found in the northern half of Illinois.



APPENDIX V

IDNR 2007 VEGETATION PERMIT

APPLICATION FOR AQUATIC VEGETATION CONTROL PERMIT

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

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

INSTRUCTIONS: Please print or type information

FOR OFFICE USE ONLY
License No.
Date Issued
Lake County

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

FEE: $5.00

Applicant's Name: Bill Hilliard	Lake Assoc. Name: Center Lake Conservation Association	
Rural Route or Street: One Miner Drive		Phone Number: 574-267-4458
City and State: Warsaw, IN		ZIP Code: 46580
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): Center Lake	Nearest Town: Warsaw	County: Koskiusko
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 Lat: 41.28004 Lon: -85.79445		
Total acres to be controlled 30 ac. max	Proposed shoreline treatment length (ft) 8,931	Perpendicular distance from shoreline (ft) 1,037	
Maximum Depth of Treatment (ft) 8	Expected date(s) of treatment(s) 4/15/07 - 5/20/07		

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.

This is a follow-up application to the 2005 and 2006 treatments. An early spring (3rd week of April to mid-May) systemic herbicide application of 2,4-D or Renovate is proposed to treat any Eurasian watermilfoil that may re-grow from the 2006 herbicide application.

Plant survey method: [x] Rake [ ] Visual [ ] Other (specify) Based on Tier II data collected on 07/31/06

Aquatic Plant Name	Check if Target Species	Relative Abundance % of Community
Sago pondweed		66%
White water lily		8%
Chara		8%
Illinois pondweed		8%
Yellow pond lily		6%
Water stargrass		6%
Common bladderwort		4%
American pondweed		4%
Flat-stem pondweed		4%
Eurasian watermilfoil	x	2%
Coontail		2%
Slender naiad		2%

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. _____

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

APPENDIX VI

PESTICIDE USE RESTRICTIONS

APPENDIX VI – PESTICIDE USE RESTRICTIONS

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

Figure 17: Pesticide Use Restricitons

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.

APPENDIX VII

RESOURCES FOR
AQUATIC VEGETATION MANAGEMENT

APPENDIX VII – RESOURCES FOR AQUATIC VEGETATION 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)

APPENDIX VIII

STATE REGULATIONS RELEVANT TO AQUATIC PLANT MANAGEMENT

APPENDIX VIII – STATE REGULATIONS RELEVANT TO AQUATIC PLANT MANAGEMENT

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

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*