LAKE MAXINKUCKEE AQUATIC PLANT MANAGEMENT PLAN UPDATE - 2006

PREPARED FOR:

LAKE MAXINKUCKEE ENVIRONMENTAL COUNCIL
P.O. BOX 187
CULVER, INDIANA 46854

PREPARED BY:

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

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EXECUTIVE SUMMARY

Lake Maxinkuckee is a 1864-acre oligotrophic lake adjacent to the Town of Culver in Marshall County, Indiana. The Lake Maxinkuckee Environmental Council (LMEC) received a grant in March, 2006 from the Indiana Department of Natural Resources (IDNR, Division of Fish and Wildlife through the Lake and River Enhancement Program (LARE). The grant covered aquatic plant mapping and inventorying, and updating the aquatic plant management plan.

The 2006 vegetation surveys performed by V3 Companies, Ltd. (V3) identified a generally sparse but diverse aquatic plant community covering the shallow areas of Lake Maxinkuckee that were less than 25 feet deep. In addition, ten underwater vegetated mid-lake rises were located. In total, twenty aquatic plant beds were identified, covering approximately 1,102 acres, or 59.1% of the lake by surface area. Aquatic vegetation is important to maintaining a healthy lake ecosystem by providing habitat for fish and other wildlife, improving water quality, and stabilizing shoreline areas.

The results of V3's 2006 sampling were compared with the 1991 and 1999 vegetative sampling conducted at Lake Maxinkuckee. Although the sampling methods were different, several emergent and floating-leaf aquatic plants such as yellow pond lily, white water lily, common arrowhead, and arrow arum had been recorded from shallow areas in the lake interior during 1991 or 1999, but were absent from those areas during 2006. Instead, low-growing, submersed species such as chara, naiads, pondweed, and eel grass were dominant in those areas during 2006. The cause of these vegetation shifts is unknown, but may be due to boat traffic, herbicide applications, changes in water levels or other factors.

An additional change since previous sampling was that spiny naiad was only recorded from one location in 1999. In contrast, spiny naiad was recorded from 15 plant beds during 2006, and was estimated to have 21-60% coverage in three of those beds. In fact, spiny naiad was the most dominant species on the lake in 2006. Continued monitoring of this species should be conducted to determine if the spiny naiad population is increasing or remaining stable, and to determine if it is displacing other native species.

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 water skiers, swimmers, and other members of the general public who wish to enjoy the lake. Eurasian watermilfoil has been present in Lake Maxinkuckee for many years, in varying abundances. During the 2006 sampling, it was present in ten plant beds, and covered approximately nine acres in the southeastern portion of lake. Eurasian watermilfoil was also present in the channels in the southeastern portion of the lake. Two herbicide applications were contracted by groups of homeowners to treat Eurasian watermilfoil in the channels (Plant Bed 05) in order to provide unobstructed access to the lake. These treatments were effective, since after the herbicide treatments, only a few scattered individuals were observed during the August 2006 vegetation survey.

The following actions are proposed for 2007 to continue to monitor the lake's plant communities and to observe the spread of invasive species, particularly Eurasian watermilfoil and spiny naiad. Tier II aquatic plant surveys should be conducted during the summer of 2007. The Tier II survey will serve to document the diversity, distribution and abundance of aquatic plants. A follow-up Tier II survey should be conducted during 2008 to ensure the continued stability of the native plant community and to evaluate if Eurasian watermilfoil is spreading.

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

2007

Late season aquatic plant survey (Tier II) and plan update	$6,000

2008

Late season aquatic plant survey (Tier II) and plan update	$6,000

Any recommendations for herbicide applications will depend on the results of the surveys

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

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INTRODUCTION AND BACKGROUND

Lake Maxinkuckee is a 1864-acre lake in Culver, Marshall County, Indiana (Sections 15, 16, 21, 22, 27, 28, 34 T32N R1E, Exhibit I). The Lake Maxinkuckee Environmental Council (LMEC) 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.

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

Lake Maxinkuckee has a surface area of 1,864 acres, a maximum depth of 88 feet, and mean depth of 24 feet (Cwalinski 1997). Based on the Environmental Protection Agency's calculation, the lake has a residence time of 6.7 years (Scribailo and Alix 1999). The lake bottom consists primarily of sand, gravel, muck and marl. The shores of the lake are heavily developed with single family residences (Exhibit II). The Town of Culver is located along the lake's northwestern shore and the Culver Military Academy is on the north shore. The undeveloped portions of the shoreline are generally characterized by steep slopes.

The Lake Maxinkuckee watershed consists of 8,768 acres (Cwalinski 2001). The dominant land cover types are agriculture (~41%), open water (~21%), pasture (~17%), and forest (~14%). Urban land uses including residential, commercial, and industrial land uses account for <3% of the land cover in the watershed (Indiana Geological Survey 2002). The majority of the drainage enters the lake through three tributaries: Wilson Ditch, Curtiss Ditch, and Kline Ditch. Wilson Ditch enters Lake Maxinkuckee in the northeast corner, Curtiss Ditch enters the lake on the eastern shore, and Kline Ditch enters Lake Maxinkuckee in the southeastern portion of the lake through the channels. Lake Maxinkuckee discharges into Lost Lake by means of the Wilson Ditch, on the western shore.

Geologically, the Lake Maxinkuckee watershed was formed by the retreat of the Huron-Saginaw lobe of the last Wisconsinan age glacier. The watershed occurs near the southwestern portion of the Maxinkuckee Moraine (Exhibit III). Lake Maxinkuckee is a kettle lake, typical of kettle and moraine topography characteristic of end moraines. Soils in the watershed are formed in glacial outwash. Underlying bedrock in Antrim shale is from the Devonian-Mississippian period (J.F. New & Associates 2005). In 2003, the outlet control structure was modified and the water level elevation was raised to add additional depth within the lake (LARE Program Meeting 2006).

Lake Maxinkuckee is rated as oligotropic by the Indiana Department of Environmental Management (IDEM). Oligotrophic lakes are generally clear and deep, with little aquatic vegetation and lacking large algae blooms. They are low in nutrients and do not support large numbers of fish. However, oligotrophic lakes often develop a food chain capable of sustaining a very desirable fishery of large game fish (EPA 2003).

WATER QUALITY DATA

Although not specifically required as part of the aquatic vegetation sampling protocol, V3 collected water quality data once per day 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, and turbidity (Table 1).

Temperature. 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. Water temperature reading at Lake Maxinkuckee are normal and in accordance with the natural climactic air temperatures during 2006.

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 ranges at Lake Maxinkuckee (380 - 410 µmhos) are typical.

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 1000 being indicative of excessive metal or salt inputs. The ranges at Lake Maxinkuckee (382 - 396.2 µmhos) are typical.

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 relatively alkaline pH at Lake Maxinkuckee (8.75 – 8.83) is reflective of calcareous groundwater inputs into the lake derived from groundwater seepage through limestone and dolomite constituents of glacial till in the watershed.

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 in Lake Maxinkuckee was good, with all recorded levels between 8.79 and 9.91 mg/L.

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. Generally, turbidity at Lake Maxinkuckee was higher during early June sampling.

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. Secchi readings were consistent throughout the summer sampling events with visibility to 9 feet. This is consistent with average depth readings from 1983 to 2000 as presented in Cwalinski (2001). These readings exceed the 2003 median depth for "typical northern Indiana lakes" of 5.7 feet as presented in DJ Case & Associates (2005).

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

Date	**Air Temp.** (°C)	**Water Temp.** (°C)	**Turb.** (NTU)	**pH**	**Cond.** (µmhos)	**SpC** (µmhos)	**Salinity** (ppt)	**D.O.** (mg/L)	**Secchi** (ft)
6/13/06	21.0	21.4	2.20	8.79	396.6	395.8	0.2	9.91	9.0
6/14/06	24.0	23.0	2.60	8.75	380.0	396.2	0.2	9.83	9.0
8/7/06	30.0	28.5	0.10	8.80	410.0	385.0	0.2	8.83	9.0
8/8/06	32.0	28.0	0.65	8.82	402.0	382.0	0.2	8.79	9.0
8/10/06	27.0	26.9	0.75	8.83	410.0	396.0	0.2	8.85	9.0

LAKE USES

Lake Maxinkuckee is used heavily for recreational activities such as boating, fishing, swimming, and skiing/tubing. The town of Culver is located along the northwestern shoreline of Lake Maxinkuckee. The majority of the lake's shoreline is privately owned with residential land use. Two public access boat ramps are located on the lake with one each on the east and west sides of the lake. The Culver Military Academy is located on the lake's northern shore. The academy uses the lake for both training and recreational purposes.

The majority of the developed shoreline of the lake has seawalls. Seawalls may reflect wave action and limit the growth of native aquatic plants in shallow areas adjacent to the seawalls. It is generally accepted that natural glacial stone wave breaks or stone seawalls disperse a greater amount of the wave's energy and provides less damage to the aquatic vegetation beds in comparison to the concrete or metal sheetpile seawalls. Naturally vegetated portions of the shoreline are generally restricted to those areas with steep slopes that have prevented the development of wetlands along the shoreline.

Figure 1. View of tall ship at the Culver Military Academy.

FISHERIES DATA

The IDNR, Division of Fish & Wildlife has been actively tracking fish population dynamics in Lake Maxinkuckee for over 20 years. The survey activities have, to a large degree, focused on walleye populations since the lake has been stocked annually since 1980 (Price 2005). Creel surveys, netting and electrofish sampling, and inventories of angler catches have been used to evaluate fish populations. Creel surveys were conducted in 1985, 1988, 1989, 1990, 1991, 1996, 1999, and 2004 (Price 2005). Sampling based studies were conducted in 1995, 1996, and 2000 (Cwalinski 1997 & 2001). The most recent of the sampling based surveys (September 11–14, 2000) used gill nets and electrofishing to collect 364 fish with a total weight of 459.66 pounds. See Table 2 for a summary of fish caught during the 2000 fishery study (Cwalinski 2001). Seventeen species of fish were collected, with smallmouth bass being the most abundant fish by number (25%) and tied with longnose gar for the most abundant fish by weight (29% of the total weight). Longnose gar ranked third in abundance by number (11%). Walleye ranked second in abundance by number (18%) and second in abundance by weight (13%). Rock bass, yellow perch, and bluegill were the next three highest ranked species in number, each accounting for 7-10% of the total number caught.

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 Lake Maxinkuckee. 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. One notable exception is northern pike, which may prefer that 80% of the lake be covered with submersed aquatic vegetation (SAV). 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 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 59% of the lake's surface area, which is greater than the optimal range recommended for healthy ecosystems. However, a large portion of the lake is covered by plant beds with a low density of vegetation. Therefore, vegetation growth on Lake Maxinkuckee is not excessive and may be on the lower end of desirable SAV; if on average, only 20% of mapped aquatic plant beds are covered in vegetation, the percentage of SAV value falls to approximately 12% at Lake Maxinkuckee.

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 and to promote and maintain a high diversity of native aquatic plants.

Table 2. Summary of Fish Caught During the 2000 IDNR Fishery Study (Cwalinski 2001)

Common Name	Number	Percent	Length Range (Inches)	Weight (Pounds)	Percent
Longnose gar	40	11.0	21.2 – 46.0	132.96	29.0
Spotted gar	2	1.0	19.6 – 24.0	3.18	1.0
Bowfin	1	0.0	24.2	5.47	1.0
Gizzard shad	13	4.0	16.5 – 20.0	32.19	7.0
White sucker	2	1.0	18.0 – 19.3	6.11	1.0
Spotted sucker	1	0.0	11.0	0.60	0.0
Channel catfish	6	2.0	13.6 – 24.8	15.33	3.0
Yellow bullhead	1	0.0	11.7	0.89	0.0
Brown bullhead	7	2.0	12.7 – 15.1	9.51	2.0
White bass	7	2.0	10.6 – 16.0	10.08	2.0
Rock bass	38	10.0	4.1 – 11.1	12.11	3.0
Largemouth bass	16	4.0	5.5 – 15.0	14.90	3.0
Smallmouth bass	91	25.0	5.4 – 19.0	133.92	29.0
Warmouth	10	3.0	4.5 – 8.8	3.81	1.0
Bluegill	25	7.0	4.2 – 10.5	10.46	2.0
Walleye	67	18.0	7.0 – 21.9	60.29	13.0
Yellow perch	37	10.0	4.6 – 12.6	7.85	2.0
TOTAL	**364**			**459.66**	

PROBLEM STATEMENT

The IDNR, Lake and River Enhancement Section has identified nutrient loading as one problem affecting Lake Maxinkuckee (Cwalinski 2001). Although nutrient loading and sediment accumulation may be problematic in particular portions of the lake (such as where ditches outlet into the lake), Lake Maxinkuckee generally has good water quality in comparison to other lakes in Indiana. Sediment traps have been installed near inlets to control the nutrient influx. High nutrient levels and areas with sediment accumulation provide conditions that are ripe for the establishment and expansion of invasive species, such as Eurasian watermilfoil. Lake Maxinkuckee was investigated in 2006 for presence of hydrilla, as Lake Maxinkuckee is within close proximity to Lake Manitou, but none was found (LARE Program Meeting 2006).

Eurasian watermilfoil has been present in Lake Maxinkuckee for many years. During the 2006 surveys, Eurasian watermilfoil was present in several plant beds. The greatest concentration of Eurasian watermilfoil is located in the southeastern portion of the lake near the Kline Ditch outlet. 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.

Figure 2. Close-up view of Eurasian watermilfoil at Lake Maxinkuckee, collected during 2006 sampling.

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 Lake Maxinkuckee 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 Lake Maxinkuckee.

1. **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 Lake Maxinkuckee. Changes in the plant community will be identified, and the survey results will be used to provide well informed future management strategies.

2. **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.

Figure 3. View of turtle nesting near the shore of Lake Maxinkuckee.

PAST MANAGEMENT EFFORTS

Management activities on Lake Maxinkuckee have been limited to selective treatment of Eurasian watermilfoil and other aquatic vegetation in the channels. All management has been undertaken by homeowners, either individually or collectively, in order to provide unobstructed access to channels and docks. No lake-wide management vegetation management activities have been undertaken as part of the LARE program or by the LMEC.

During 2006, at least two herbicide treatments were contracted by two separate groups of homeowners within the Venetian Village. The treatments were performed in the area of the channels in the southeastern portion of the lake. As noted in the discussion of the Tier I sampling results, provided later in this report, there was a significant reduction in the abundance of Eurasian watermilfoil and other vegetation in the channels between the June and August sampling events. The herbicide applications occurred between the two sampling events. Specific permitted records for aquatic herbicide applications are listed in Table 3 (IDNR 2007).

Table 3. Permitted Records of Aquatic Herbicide Applications

Permit Number	Treatment Date	Acres Treated	Licensed Applicator
2113	06/30/2004	1.8	Weed Patrol
2159	06/21/2004	3.87	Soper
2271	05/27/2005	3.87	Soper
2320	06/16/2005	1.5	Weed Patrol
2427	05/25/2006	3.87	Soper
2569	06/09/2006	3.0	Aquatic Control
2619	06/19/2006	1.8	Weed Patrol

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 (IDNR 2006a). 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 (IDNR 2006b). 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 sampling methods presented here are a summary of the "Tier I Aquatic Vegetation Reconnaissance Survey Protocol" (IDNR 2006a). 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 Wide Area Augmentation System (WAAS) enabled Global Positioning System (GPS) unit (estimated accuracy ± 3m). 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 4.

Table 4. Coverage Rating Categories for Tier I Sampling

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

Tier II Sampling Methods

The Tier II survey sampling methods presented here are a summary of the "Tier II Aquatic Vegetation Survey Protocol" (IDNR 2006b). 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 5. Sample Size Requirements for Tier II Sampling (IDNR 2006b)

		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 Lake Maxinkuckee has a surface area of 1,864 acres and is rated as oligotrophic, 100 sample sites were required at the depth distribution shown in bold in Table 5. Approximate sample site locations were randomly spaced on a bathymetric map based on the depth categories. Pre-selected sample sites were located based on visual markers and the depth, as determined by using a Humminbird 383c depth finder. The location of each sampling point was recorded using a WAAS enabled GPS unit.

A double-sided 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. The rake was then 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 6. Vegetation Density Ratings for Tier II Sampling

Rake Teeth Filled	Density Rating
No Plants Retrieved	0
1-20%	1
21-99%	3
100+%	5

After the Tier II data was collected, it was imported into a Microsoft Excel spreadsheet to calculate plant community metrics used by IDNR (IDNR 2006b). 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:

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

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

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:

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

RESULTS OF THE TIER I AND TIER II SAMPLING

TIER I SAMPLING RESULTS

Pre-treatment Tier I sampling was performed June 13 through June 15, 2006. Post-treatment Tier I sampling was performed August 7 through August 11, 2006. The submersed plant community of Lake Maxinkuckee covers approximately 1,102 acres of the lake, or 59.1% of the lake surface. The shallow beds (#01, 04, 05, 06, 07, 08, 09, and 10) are located from 0 to 10 feet in depth (Exhibit IV). Typically, they are sparsely vegetated (generally 2% to 20% submersed vegetative coverage). Plant growth in these areas may be inhibited by substrate, nutrient availability, wave action, boat traffic and/or other factors. Chara (*Chara* sp.) typically is dominant in these shallow beds, with Illinois pondweed (*Potamogeton illinoensis*), common pondweed (*Potamogeton natans*), sago pondweed (*Potamogeton pectinatus*), and wild celery (*Vallisneria americana*) also abundant. A large degree of variability was noted in the beds between the June and August surveys, particularly in the assemblage of pondweeds present.

A few shallow plant beds (04, 06, 08, and 10) were more densely vegetated, largely as a result of increased accumulation of organic material and sediment from the inflows of Wilson's Ditch and other tributaries. These areas generally were dominated by eel grass and pondweeds, and had a greater diversity of aquatic plant species than other beds.

The deeper beds are located from 11 to 25 feet in depth along the deeper edge of the littoral zone (#02 and 03) and on mid-lake rises (underwater islands; Beds 11-20). In general, dominants in these beds included chara, nitella (*Nitella sp.*), Eurasian watermilfoil (*Myriophyllum spicatum*), spiny naiad (*Najas marina*), and slender naiad (*Najas flexilis*) (Exhibits VI and VII).

Figure 4. Yellow pond lilies still present in only a few locations on Lake Maxinkuckee during 2006.

In general, several trends were observed in the data. Naiads (*N. marina* and *N. flexilis*) are annuals that germinate later and are observed later in the season. These species generally increased in abundance between June and August sampling. Correspondingly, nitella, pondweeds, and other relatively abundant species were generally observed to decrease in vegetative abundance between June and August. This result may be reflective of sampling variability or the competitive advantage of naiads. Spiny naiad, in particular, is noted by Voss (1985) to be "very aggressive". During 1999 sampling at Lake Maxinkuckee, spiny naiad was only recorded from one location, although Scribailo and Alix (1999) noted that "it is particularly abundant in the high pH lakes of Northeastern Indiana where

it can form a dense cover." However, Scribailo and Alix (1999) concluded that spiny naiad "never grows more than a foot high and does not have the potential to become a problem weed." In contrast with this conclusion, spiny naiad was recorded from 15 plant beds during 2006, and was estimated to have 21-60% coverage in three of those beds. In fact, spiny naiad was the most dominant species on the lake in 2006.

Another change that was noted since 1999 was that emergent and floating aquatic species such as lilies and arrowhead were noted during 1999 from particular areas within the lake, but absent during 2006 sampling. Apparently, as a result of boat traffic, herbicide activities, water level changes, or other modifications, these species were eliminated from several areas during that time period.

Ecological zones may be established to protect aquatic vegetation. Aquatic vegetation beds currently susceptible to damage from watercrafts may be possible candidates for consideration. These beds must be greater than 200 feet from shore, have the potential for restoring rooted aquatic plants, or have important existing rooted aquatic vegetation beds. Please see further discussion of ecological zones within the Public Involvement and Education section of this report.

Each plant bed is discussed in detail below:

Plant Bed 01

Size: 264 acres
Substrate: sand/gravel
Number of Species (2006): 14
Overall Vegetative Coverage: 2-20%

Description: This shallow bed (0 to 10 feet) is located along the west, southwest, and southern portions of the shoreline. Vegetation was sparse throughout the bed. Chara (*Chara sp.*) was dominant during 2006 sampling events, with an estimated abundance of 2-20%. Twelve other species were present at low abundances.

Floating aquatics such as duckweed (*Lemna obscura*) or watermeal (*Wolffia columbiana*) were observed in 1999, but not in any other year. Since these species move about on the water surface in response to wind direction and other causes, their presence in a particular part of the lake can be transient. Three other species (Canadian waterweed, flat-stem pondweed, and common arrowhead) were observed in 1991 or 1999, but not in 2006. In contrast, five species were observed in 2006 that had not been recorded previously. With sparse vegetation spread over a large area, changes in species observed or relative abundances between sampling events may be the result of sampling error (e.g., a particular plant encountered or missed) or the removal of particular individuals by boat propellers or other means.

Table 7. Bed 01 - Composite Aquatic Plant Inventories (June and August 2006)

Acronym	Scientific Name	Common Name	1991	1999	June 2006	Aug. 2006
ALGA	filamentous alga	Algae			<2%	
CH?AR	*Chara* sp.	a chara species	x		2-20%	2-20%
ELCA7	*Elodea canadensis*	Canadian waterweed	x			
Lemobs	*Lemna obscura*	duckweed		x		
MYSP2	*Myriophyllum spicatum*	Eurasian watermilfoil	x		<2%	<2%
NAFL	*Najas flexilis*	slender naiad	x			<2%
NAMA	*Najas marina*	spiny naiad				<2%
NULU	*Nuphar variegetum*	yellow pond lily	x	x	<2%	<2%
POCR3	*Potamogeton crispus*	curly-leaf pondweed		x	<2%	
POGR8	*Potamogeton gramineus*	Variable pondweed				<2%
POIL	*Potamogeton illinoensis*	Illinois pondweed	x	x	2-20%	<2%
PONO2	*Potamogeton nodosus*	American pondweed				<2%
POPE6	*Potamogeton pectinatus*	sago pondweed	x		<2%	<2%
POPU7	*Potamogeton pusillus*	small pondweed			<2%	
Potnat	*Potamogeton natans*	common pondweed			<2%	
POZO	*Potamogeton zosteriformis*	flat-stem pondweed	x	x		
Saglat	*Sagittaria latifolia*	common arrowhead		x		
VAAM3	*Vallisneria americana*	wild celery	x		2-20%	<2%
WOCO	*Wolffia columbiana*	watermeal		x		
		Total No. Species	**9**	**7**	**10**	**10**

Plant Bed 02

Size: 14 acres
Substrate: sand/silt
Number of Species (2006): 11
Overall Vegetative Coverage: 21-60%

Figure 5. Nitella was abundant in Bed 02 during 2006.

Description: This bed (15- 25 feet in depth) is located around the perimeter of a deeper hole, located within Bed 01. A nitella species (*Nitella* sp.) was dominant throughout the summer. Canadian waterweed (*Elodea canadensis*), Eurasian watermilfoil, and flat-stemmed pondweed (*Potamogeton zosteriformis*) were all present at moderate abundances during the June sampling, but were observed at reduced densities or not observed during the August sampling. During the August sampling, spiny naiad (*Najas marina*), sago pondweed (*Potamogeton pectinatus*), and wild celery were observed at moderate abundances; none of these species had been observed during the June sampling event.

Naiads are annuals that tend to germinate later in the season, and typically are recorded in greater abundance in late season sampling. Likewise, eel grass generally grows larger as the

season progresses. Other observed changes in estimated abundance likely result from sampling variability. As a whole, reduced vegetative coverage was observed during August; the cause of this observation is unknown.

Table 8. Bed 02 - Composite Aquatic Plant Inventories (June and August 2006)

Acronym	Scientific Name	Common Name	June Abund.	Aug. Abund.
ALGA	Any species of filamentous alga	algae		2-20%
CH?AR	*Chara* sp.	a chara species	<2%	
ELCA7	*Elodea canadensis*	Canadian waterweed	2-20%	<2%
MYSI	*Myriophyllum sibiricum*	northern watermilfoil	<2%	
MYSP2	*Myriophyllum spicatum*	Eurasian watermilfoil	2-20%	<2%
NAFL	*Najas flexilis*	slender naiad		<2%
NAMA	*Najas marina*	spiny naiad		2-20%
NI?TE	*Nitella* sp.	a nitella sp.	21-60%	2-20%
POPE6	*Potamogeton pectinatus*	sago pondweed		2-20%
POZO	*Potamogeton zosteriformis*	flat-stemmed pondweed	2-20%	<2%
VAAM3	*Vallisneria americana*	wild celery		2-20%
		Total No. Species	**6**	**8**

Plant Bed 03

Size: 351 acres
Substrate: sand/silt
Number of Species (2006): 18
Overall Vegetative Coverage: >60%

Figure 6. Eurasian watermilfoil collected from Bed 03 during 2006.

Description: This bed is located at the transition from the major, shallow shoreline beds (Beds 01, 07 and 09) to the deeper center of the lake. The width of the bed varies greatly but is generally widest in the southeastern portion of the lake. Depth across the bed ranged from 10-28 feet. A chara species (2-20%), Eurasian watermilfoil (2-20%), and a nitella species (20-60%) were dominant throughout the summer. Slender naiad (*Najas flexilis*) and spiny naiad were present at moderate to dense abundances during the August sampling event (abundance 2-20% and 20-60%, respectively). These species are annuals that generally are more abundant later in the season. Canadian waterweed and wild celery had been present in moderate abundances (2-20%) during the June event but were recorded at reduced densities during August, which may have been the result of sampling variability.

Generally, several emergent species (yellow pond lily, arrow arum, and common arrowhead) were recorded in 1991 or 1999, but were not observed in 2006. These species generally are

present in shallow standing water. Given the depth of Bed 03 (i.e., 10-28 feet deep), it is likely that these species were present in one of the shallower beds, but not in Bed 03. However, none of these emergent species were present in 2006 from the general vicinity of their recorded locations in the 1990s.

Table 9. Bed 03 - Composite Aquatic Plant Inventories (June and August 2006)

Acronym	Scientific Name	Common Name	1991	1999	June 2006	Aug. 2006
ALGA	filamentous alga	Algae				<2%
CEDE4	*Ceratophyllum demersum*	coontail				<2%
CH?AR	*Chara sp.*	a chara sp.			2-20%	2-20%
ELCA7	*Elodea canadensis*	Canadian waterweed			2-20%	<2%
MYSI	*Myriophyllum sibiricum*	northern watermilfoil			<2%	
MYSP2	*Myriophyllum spicatum*	Eurasian watermilfoil	x		2-20%	2-20%
NAFL	*Najas flexilis*	slender naiad			<2%	2-20%
NAMA	*Najas marina*	spiny naiad				20-60%
NI?TE	*Nitella sp.*	a nitella sp.			21-60%	2-20%
NULU	*Nuphar variegetum*	yellow pond lily	x			
Pelvir	*Peltandra virginica*	arrow arum	x			
POCR3	*Potamogeton crispus*	curly-leaf pondweed		x	<2%	
POFO3	*Potamogeton foliosus*	leafy pondweed			<2%	<2%
POGR8	*Potamogeton gramineus*	variable pondweed				<2%
POIL	*Potamogeton illinoensis*	Illinois pondweed	x		<2%	<2%
Potnat	*Potamogeton natans*	common pondweed				<2%
POPE6	*Potamogeton pectinatus*	sago pondweed			<2%	2-20%
POPR5	*Potamogeton praelongus*	white-stem pondweed	x			
POPU7	*Potamogeton pusillus*	small pondweed				<2%
POTNAT	*Potamogeton natans*	common pondweed				<2%
PONO2	*Potamogeton nodosus*	American pondweed	x			
POZO	*Potamogeton zosteriformis*	flat-stem pondweed			<2%	<2%
Saglat	*Sagittaria latifolia*	common arrowhead		x		
SPPO	*Spirodela polyrhiza*	greater duckweed	x			
VAAM3	*Vallisneria americana*	wild celery			2-20%	<2%
		Total No. Species	**7**	**2**	**12**	**16**

Plant Bed 04

Size: 32 acres
Substrate: sand/silt
Number of Species (2006): 20
Overall Vegetative Coverage: >60%

Description: This shallow bed is located in the southeastern corner of the lake. This bed had more organic matter than other shallow, sandy beds, and consequently more vegetative growth. Increased organic matter and silt accumulation likely result from material discharged from Kline Ditch.

Figure 7. Canadian waterweed collected during 2006 sampling from Bed 04.

Wild celery was dominant throughout the summer with abundances of 20-60% during the June survey and >60% during the August sampling. Sago pondweed was present at abundance of 2-20% throughout the summer. Eurasian watermilfoil, pickerel weed (*Pontederia cordata*), Illinois pondweed, small pondweed (*Potamogeton pusillus*), variable pondweed (*Potamogeton gramineus*), American pondweed (*Potamogeton nodosus*) and flat-stemmed pondweed (*Potamogeton zosteriformis*) were present in moderate abundances. Sampling variability explains estimated changes in presence or abundance of sparsely present vegetation.

More species were recorded from this area in 2006, as compared with 1991, perhaps as the result of more intensive sampling. Only Canadian waterweed was recorded from 1991 sampling, but not from 2006.

Table 10. Bed 04 - Composite Aquatic Plant Inventories (June and August 2006)

Acronym	Scientific Name	Common Name	1991	June 2006	Aug. 2006
ALGA	filamentous alga	Algae		20-60%	2-20%
CEDE4	*Ceratophyllum demersum*	coontail	x	<2%	<2%
ELCA7	*Elodea canadensis*	Canadian waterweed	x		
Jusame	*Justicia americana*	water willow		<2%	
LEMI3	*Lemna minor*	small duckweed		<2%	<2%
LETR	*Lemna trisulca*	star duckweed			<2%
MYSP2	*Myriophyllum spicatum*	Eurasian watermilfoil	x	2-20%	<2%
NAFL	*Najas flexilis*	Slender naiad	x		<2%
NULU	*Nuphar variegetum*	yellow pond lily		<2%	<2%
Poncor	*Pontederia cordata*	pickerel weed		2-20%	
POTFRI	*Potamogeton friesii*	Fries's pondweed			<2%
POGR8	*Potamogeton gramineus*	variable pondweed			2-20%
POIL	*Potamogeton illinoensis*	Illinois pondweed	x	2-20%	<2%
PONO2	*Potamogeton nodosus*	American pondweed			2-20%
POPE6	*Potamogeton pectinatus*	sago pondweed		2-20%	2-20%
POPU7	*Potamogeton pusillus*	small pondweed		2-20%	<2%

Acronym	Scientific Name	Common Name	1991	June 2006	Aug. 2006
Potamp	*Potamogeton amplifolius*	large-leaved pondweed		<2%	
Potnat	*Potamogeton natans*	common pondweed		2-20%	
POZO	*Potamogeton zosteriformis*	flat-stemmed pondweed	x		2-20%
SACU	*Sagittaria cuneata*	northern arrowhead		<2%	
VAAM3	*Vallisneria americana*	wild celery	x	20-60%	>60%
WOLO	*Wolffia columbiana*	watermeal			<2%
ZAPA	*Zannichellia palustris*	horned pondweed		<2%	
		Total No. Species	**7**	**14**	**15**

Plant Bed 05

Size: 9 acres
Substrate: muck/silt
Number of Species: 19
Overall Vegetative Coverage (2006): >60% (June), 2-20% (Aug)

Figure 8. View of one of the channels at the southeastern corner of the lake (Bed 05).

Description: This shallow bed (0 to 6 feet) is located throughout the access channels located at the southern end of the lake. The channels had an approximate depth of four feet in the center. Eurasisn watermilfoil was present at a moderate abundance (20-60%) during the June survey. Abundances of <2% were observed during the August survey, indicating that herbiciding had been conducted throughout the channels. Similar reductions were also noted in the abundance of coontail (*Ceratophyllum demersum*), curly-leaf pondweed (*Potamogeton crispus*) small pondweed, northern arrowhead and wild celery. It should be noted that the herbicide application was not performed as part of the LARE program.

Fewer species were recorded in this area during 2006, as compared with 1991 or 1999, perhaps as the result of herbicide activities over the years.

Table 11. Bed 05 - Composite Aquatic Plant Inventories (June and August 2006)

Acronym	Scientific Name	Common Name	1991	1999	June Abund.	Aug. Abund.
ALGA	filamentous alga	Algae			>60%	2-20%
CEDE4	*Ceratophyllum demersum*	Coontail	x	x	20-60%	<2%
Cepocc	*Cephalanthus occidentalis*	buttonbush		x		<2%
Chaglo	*Chara globularis*	Stonewort	x	x		
ELCA7	*Elodea canadensis*	Canadian waterweed	x	x		
HIBPAL	*Hibiscus palustris*	swamp rose mallow				<2%
IRIVIS	*Iris virginica shrevei*	blue flag iris				<2%
JUSAME	*Justicia americana*	water willow	x			<2%
LEMI3	*Lemna minor*	small duckweed			2-20%	2-20%

Acronym	Scientific Name	Common Name	1991	1999	June Abund.	Aug. Abund.
LETR	*Lemna trisulca*	star duckweed				<2%
LYTSAL	*Lythrum salicaria*	purple loosestrife	x	x		<2%
MYSP2	*Myriophyllum spicatum*	Eurasian watermilfoil			20-60%	<2%
NAFL	*Najas flexilis*	slender naiad		x		
NULU	*Nuphar variegetum*	yellow pond lily	x	x	2-20%	2-20%
NYTU	*Nymphaea tuberosa*	white water lily	x	x	2-20%	2-20%
Pelvir	*Peltandra virginica*	arrow arum	x	x		<2%
Polflu	*Polygonum fluitans*	water smartweed	x	x		
Poncor	*Pontederia cordata*	pickerel weed	x			
POCR3	*Potamogeton crispus*	curly-leaf pondweed	x		2-20%	
Potnat	*Potamogeton natans*	common pondweed	x	x		
PONO2	*Potamogeton nodosus*	American pondweed		x		
POPE6	*Potamogeton pectinatus*	sago pondweed	x	x		
POPR5	*Potamogeton praelongus*	white-stem pondweed		x		
POPU7	*Potamogeton pusillus*	small pondweed			2-20%	
PORI2	*Potamogeton richardsonii*	Richardson's pondweed	x	x		
POZO	*Potamogeton zosteriformis*	flat-stem pondweed	x			
Rospal	*Rosa palustris*	swamp rose		x		
SACU	*Sagittaria cuneata*	northern arrowhead			2-20%	
Saglat	*Sagittaria latifolia*	common arrowhead	x	x		
Sciacu	*Scirpus acutus*	hard-stem bulrush				<2%
Scival	*Scirpus validus*	soft-stem bulrush	x	x		
Typang	*Typha angustifolia*	narrow-leaved cattail	x	x	<2%	<2%
VAAM3	*Vallisneria americana*	wild celery	x	x	2-20%	
Vercat	*Veronica catenata*	water speedwell	x			
WOCO	*Wolffia columbiana*	watermeal		x		<2%
		Total No. Species	**20**	**21**	**10**	**15**

Plant Bed 06

Size: 9 acres
Substrate: sand/silt
Number of Species: 8
Description: This bed, ranging in depth from 7-15 feet is located in the lake's southeastern corner. Similar to Bed 04, this bed is located near the mouth of the Kline Ditch, resulting in increased accumulation of silt and organic material. This bed was heavily dominated by Eurasian watermilfoil (>60%) during both the June and August surveys. Due to the depth of the bed, the milfoil did not reach to the surface. Seven other species were present at low abundances.

Figure 9. Bed 06 was heavily dominated by Eurasian watermilfoil during 2006.

Table 12. Bed 06 - Composite Aquatic Plant Inventories (June and August 2006)

Acronym	Scientific Name	Common Name	June Abund.	Aug. Abund.
CEDE4	*Ceratophyllum demersum*	coontail		<2%
CH?AR	*Chara* sp.	A chara species	2-20%	
MYSP2	*Myriophyllum spicatum*	Eurasian watermilfoil	>60%	>60%
NAFL	*Najas flexilis*	slender naiad		<2%
NAMA	*Najas marina*	spiny naiad		<2%
POPE6	*Potamogeton pectinatus*	sago pondweed		<2%
POZO	*Potamogeton zosteriformis*	flat-stemmed pondweed	<2%	
VAAM3	*Vallisneria americana*	wild celery		<2%
		Total No. Species	**3**	**6**

Plant Bed 07

Size: 16 acres
Substrate: sand/rocky
Number of Species: 11
Overall Vegetative Coverage: 2-20%

Description: This bed runs along the entire length of the eastern shoreline. The depth of the bed ranges from 0-10 feet. Vegetative coverage throughout the bed is sparse. Chara was the most dominant species throughout the summer. Eleven other species were present at low densities. No Eurasian watermilfoil was observed in this bed.

More species were recorded from this area in 2006, as compared with 1991, perhaps as the result of more intensive sampling. Pickerel weed and great duckweed were recorded from 1999, but not from 2006. However, as noted before, great duckweed is a floating aquatic species, and its distribution throughout the lake is dependent on wind and lake currents.

Table 13. Bed 07 - Composite Aquatic Plant Inventories (June and August 2006)

Acronym	Scientific Name	Common Name	1991	1999	June 2006	Aug. 2006
ALGA	filamentous alga	Algae			<2%	<2%
CH?AR	*Chara* sp.	a chara species	x		2-20%	2-20%
LEMI3	*Lemna minor*	common duckweed				<2%
MYSP2	*Myriophyllum spicatum*	Eurasian watermilfoil			<2%	<2%
NAFL	*Najas flexilis*	slender naiad	x		<2%	<2%
NAMA	*Najas marina*	spiny naiad				<2%
Poncor	*Pontederia cordata*	pickerel weed		x		
POGR8	*Potamogeton gramineus*	variable pondweed				<2%
POIL	*Potamogeton illinoensis*	Illinois pondweed			<2%	
POPE6	*Potamogeton pectinatus*	sago pondweed	x		<2%	<2%
POPU7	*Potamogeton pusillus*	small pondweed			<2%	
Potnat	*Potamogeton natans*	common pondweed	x		<2%	

Acronym	Scientific Name	Common Name	1991	1999	June 2006	Aug. 2006
SPPO	*Spirodela polyrhiza*	greater duckweed		x		
VAAM3	*Vallisneria americana*	wild celery			<2%	<2%
WOCO	*Wolffia columbiana*	watermeal				<2%
		Total No. Species	**4**	**2**	**8**	**9**

Plant Bed 08

Size: 18 acres
Substrate: silt/sand
Number of Species: 14
Overall Vegetative Coverage: >60%

Description: This bed is located in the northeast corner of the lake at the mouth of Wilson's Ditch. Depths across the bed range from 0-10 feet. Similar to Bed 04, this bed was more densely vegetated than other beds of similar depth. Also like Bed 04, the substrate in this area had greater accumulation of organic material and sediment, due to nutrients and sediment discharged from Wilson's Ditch.

Chara, sago pondweed, and wild celery were observed at moderate abundances throughout the summer. Illinois pondweed, small pondweed, variable pondweed, American pondweed, water stargrass, and Eurasian milfoil were observed in moderate abundance during either the June or August survey. In contrast with the 1991 and 1999 surveys, emergent species such as white water lily, arrow arum, common arrowhead, and soft-stem bulrush were not observed in Bed 08 during 2006. Since the area is actively used by the Culver Military Academy for sailing training and other recreational activities, the emergent vegetation may have been removed by dredging, heavy boat traffic, shoreline construction activities, herbicide applications, or other means in the interim period.

Table 14. Bed 08 - Composite Aquatic Plant Inventories (June and August 2006)

Acronym	Scientific Name	Common Name	1991	1999	June 2006	Aug. 2006
ALGA	filamentous alga	Algae			2-20%	
CEDE4	*Ceratophyllum demersum*	Coontail	x			
CH?AR	*Chara* sp.	a chara species			20-60%	2-20%
LEMI3	*Lemna minor*	common duckweed	x			<2%
Lemobs	*Lemna obscura*	Duckweed		x		
MYSP2	*Myriophyllum spicatum*	Eurasian watermilfoil	x		2-20%	<2%
NAFL	*Najas flexilis*	slender naiad			<2%	2-20%
NYTU	*Nymphaea tuberosa*	white water lily		x		
Pelvir	*Peltandra virginica*	arrow arum	x			
POCR3	*Potamogeton crispus*	curly-leaf pondweed		x		
POGR8	*Potamogeton gramineus*	variable pondweed				2-20%
POIL	*Potamogeton illinoensis*	Illinois pondweed		x	2-20%	
PONO2	*Potamogeton nodosus*	American pondweed				2-20%

Acronym	Scientific Name	Common Name	1991	1999	June 2006	Aug. 2006
POPR5	*Potamogeton praelongus*	white-stem pondweed		x		
POPE6	*Potamogeton pectinatus*	sago pondweed			2-20%	2-20%
POPU7	*Potamogeton pusillus*	small pondweed			2-20%	
PORI2	*Potamogeton richardsonii*	Richardson's pondweed		x		
POZO	*Potamogeton zosteriformis*	flat-stem pondweed	x		<2%	<2%
Saglat	*Sagittaria latifolia*	common arrowhead		x		
Scivac	*Scirpus validus*	softstem bulrush		x		
VAAM3	*Vallisneria americana*	wild celery			20-60%	2-20%
WOCO	*Wolffia columbiana*	Watermeal				<2%
ZODU	*Zosterella dubia*	water stargrass				2-20%
		Total No. Species	**5**	**8**	**8**	**11**

Plant Bed 09

Size: 201 acres
Substrate: sandy/rocky
Number of Species: 8
Overall Vegetative Coverage: 2-20%

Description: This shallow bed (0 to 10 feet) runs along the north and northwest shore of the lake. Like Beds 01 and 07, this bed was sparsely vegetated and dominated by chara. Illinois pondweed and wild celery were also present in moderate abundances, but only five other species were observed at low abundances during 2006.

In contrast, thirteen species were recorded from this area in 1999 that were absent during 2006 sampling. In particular, many emergent and floating-leaf aquatic species such as buttonbush, yellow pond lily, white water lily, swamp rose, common arrowhead, and water speedwell were recorded from the area during 1999. This emergent and floating-leaf aquatic community was completely lacking during 2006.

Table 15. Bed 09 - Composite Aquatic Plant Inventories (June and August 2006)

Acronym	Scientific Name	Common Name	1999	June Abund.	Aug Abund.
Cepocc	*Cephalanthus occidentalis*	buttonbush	x		
CH?AR	*Chara* sp.	a chara sp.		2-20%	<2%
LEMI3	*Lemna minor*	common duckweed	x		
MYSP2	*Myriophyllum spicatum*	Eurasian watermilfoil			<2%
NAFL	*Najas flexilis*	slender naiad	x	<2%	<2%
NAMA	*Najas marina*	spiny naiad			<2%
NULU	*Nuphar variegetum*	Yellow pond lily	x		
NYTU	*Nymphaea tuberosa*	white water lily	x		
POCR3	*Potamogeton crispus*	curly-leaf pondweed	x		
POGR8	*Potamogeton gramineus*	variable pondweed			<2%
POIL	*Potamogeton illinoensis*	Illinois pondweed		2-20%	<2%

Acronym	Scientific Name	Common Name	1999	June Abund.	Aug Abund.
PONO2	*Potamogeton nodosus*	American pondweed	x		
POPE6	*Potamogeton pectinatus*	sago pondweed		<2%	<2%
POPR5	*Potamogeton praelongus*	white-stem pondweed	x		
PORI2	*Potamogeton richardsonii*	Richardson's pondweed	x		
Rospal	*Rosa palustris*	swamp rose	x		
Saglat	*Sagittaria latifolia*	common arrowhead	x		
SPPO	*Spirodela polyrhiza*	greater duckweed	x		
VAAM3	*Vallisneria americana*	wild celery		2-20%	<2%
Vercat	*Veronica catenata*	water speedwell	x		
WOCO	*Wolffia columbiana*	watermeal	x		
		Total No. Species	**14**	**5**	**8**

Plant Bed 10

Size: 12 acres
Substrate: sand/silt
Number of Species: 9
Overall vegetative coverage: >60%

Description: This shallow bed (0 to 7 feet) is located in the northeastern portion of the lake adjacent to the town of Culver. Unlike many of the other shallow beds at Lake Maxinkuckee, this bed was relatively well-vegetated, and had a higher amount of organic matter in the substrate, likely because it is more sheltered than other beds. Chara was the dominant species. Slender naiad, variable pondweed, American pondweed and sago pondweed, and wild celery also were moderately abundant. No Eurasian watermilfoil was observed in this area.

Table 16. Bed 10 - Composite Aquatic Plant Inventories (June and August 2006)

Acronym	Scientific Name	Common Name	Aug. Abund.
CH?AR	*Chara* sp.	A chara sp.	20-60%
JUSAME	*Justicia americana*	water willow	<2%
NAFL	*Najas flexilis*	slender naiad	2-20%
POGR8	*Potamogeton gramineus*	variable pondweed	2-20%
PONO2	*Potamogeton nodosus*	American pondweed	2-20%
POPE6	*Potamogeton pectinatus*	sago pondweed	2-20%
TYPANG	*Typha angustifolia*	narrow-leaved cattail	<2%
VAAM3	*Vallisneria americana*	wild celery	2-20%

Plant Bed 11

Size: 3.2 acres
Substrate: sand/silt
Number of Species: 5
Overall Vegetative Coverage: 21-60%

Description: This relatively deep bed (12 to 25 feet) is located on a mid-lake rise (submerged island) in the north-central portion of the lake. Chara was dominant in the bed throughout the summer, although at decreased abundances (2-20%) during the August survey. Sago pondweed and wild celery were present at moderate abundances in June, but decreased to limited abundances during the August survey. Slender naiad and spiny naiad were not observed during the June survey but were both present at moderate abundances during the August survey.

Table 17. Bed 11 - Composite Aquatic Plant Inventories (June and August 2006)

Acronym	Scientific Name	Common Name	June Abund.	Aug. Abund.
ALGA	Any species of filamentous alga	algae		<2%
CH?AR	*Chara* sp.	A chara sp.	20-60%	2-20%
NAFL	*Najas flexilis*	slender naiad		2-20%
NAMA	*Najas marina*	spiny naiad		2-20%
POPE6	*Potamogeton pectinatus*	sago pondweed	2-20%	<2%
VAAM3	*Vallisneria americana*	wild celery	2-20%	<2%

Plant Bed 12

Size: 22 acres
Substrate: sand/silt
Number of Species: 8
Overall Vegetative Coverage: >60%

Description: This moderately shallow bed (12 to 25 feet) is located on a mid-lake rise (submerged island) in the north-central portion of the lake, southwest of Bed 11. Wild celery and chara were dominant in the bed throughout the summer. The abundance of chara decreased slightly between the June and August surveys. Variable pondweed (*Potamogeton gramineus*) and sago pondweed were both observed at moderate abundances. Slender naiad, present at limited abundance (<2%) during the June survey and spiny naiad, not observed during the June survey, were both present at moderate abundances during the August survey.

Table 18. Bed 12 - Composite Aquatic Plant Inventories (June and August 2006)

Acronym	Scientific Name	Common Name	June Abund.	Aug. Abund.
ALGA	Any species of filamentous alga	algae		<2%
CH?AR	*Chara* sp.	A chara sp.	20-60%	2-20%
NAFL	*Najas flexilis*	slender naiad	<2%	2-20%
NAMA	*Najas marina*	spiny naiad		20-60%
POGR8	*Potamogeton gramineus*	variable pondweed	2-20%	2-20%
POPE6	*Potamogeton pectinatus*	sago pondweed	2-20%	2-20%
POPU7	*Potamogeton pusillus*	small pondweed	<2%	
POTNAT	*Potamogeton natans*	common pondweed		<2%
VAAM3	*Vallisneria americana*	wild celery	2-20%	2-20%

Plant Bed 13

Size: 2.0 acres
Substrate: sand/silt
Number of Species: 5
Overall Vegetative Coverage: >60%

Description: This bed is located on a mid-lake rise (underwater island) at a depth of approximately 9 to 25 feet in the north-central portion of the lake. Early season dominants included chara, sago pondweed, and wild celery, all occurring at moderate abundances (2-20%). During the August survey there was an increase in the abundance of chara (20-60%). Spiny naiad, not observed during the June survey was observed at moderate abundances (20-60%) during the August survey.

Table 19. Bed 13 - Composite Aquatic Plant Inventories (June and August 2006)

Acronym	Scientific Name	Common Name	June Abund.	Aug. Abund.
ALGA	Any species of filamentous alga	algae		<2%
CH?AR	*Chara* sp.	A chara sp.	2-20%	20-60%
NAMA	*Najas marina*	spiny naiad		20-60%
POPE6	*Potamogeton pectinatus*	sago pondweed	2-20%	
RALO2	*Ranunculus longirostris*	white water-cup	<2%	
VAAM3	*Vallisneria americana*	wild celery	2-20%	

Plant Bed 14

Size: 14 acres
Substrate: sand/silt
Number of Species: 7
Description: This bed is located on a mid-lake rise (underwater island) at a depth of approximately 12 to 25 feet in the central portion of the lake. Early season dominants included chara and sago pondweed, both were present at moderate abundances (2-20%). During the August survey there was an estimated increase in the abundance of chara (20-60%). Slender

naiad and spiny naiad, not observed during the June survey were present at moderate abundances (20-60%) during the August survey.

Table 20. Bed 14 - Composite Aquatic Plant Inventories (June and August, 2006)

Acronym	Scientific Name	Common Name	June Abund.	Aug. Abund.
CH?AR	*Chara* sp.	A chara sp.	2-20%	20-60%
NAFL	*Najas flexilis*	slender naiad		2-20%
NAMA	*Najas marina*	spiny naiad		2-20%
POEP2	*Potamogeton epihydrus*	ribbon-leaf pondweed	<2%	
POGR8	*Potamogeton gramineus*	variable pondweed		<2%
POPE6	*Potamogeton praelongus*	sago pondweed	2-20%	2-20%
VAAM3	*Vallisneria americana*	wild celery		<2%

Plant Bed 15

Size: 3.2 acres
Substrate: sand/silt
Number of Species: 8
Overall Vegetative Coverage: 2-20%

Description: This bed is located on a mid-lake rise in the south-central portion of the lake. Vegetation presence and abundances are very similar to Bed 13. Chara, sago pondweed, and wild celery were present in moderate abundances (2-20%) during the June survey. During the August survey the only species present at more than minimal abundances was spiny naiad (abundance 2-20%).

Table 21. Bed 15 - Composite Aquatic Plant Inventories (June and August 2006)

Acronym	Scientific Name	Common Name	June Abund.	Aug. Abund.
ALGA	Any species of filamentous alga	algae		<2%
CH?AR	*Chara* sp.	A chara sp.	2-20%	<2%
NAMA	*Najas marina*	spiny naiad		2-20%
NI?TE	*Nitella sp.*	A nitella sp.	<2%	
POCR3	*Potamogeton crispus*	curly-leaf pondweed	<2%	
POIL	*Potamogeton illinoensis*	Illinois pondweed		<2%
POPE6	*Potamogeton pectinatus*	sago pondweed	2-20%	
POPU7	*Potamogeton pusillus*	small pondweed	<2%	
VAAM3	*Vallisneria americana*	wild celery	2-20%	<2%

Plant Bed 16

Size: 2.0 acres
Substrate: silt
Number of Species: 7
Overall Vegetative Coverage: 21-60%

Description: This bed is located on a mid-lake rise at a depth of 9 to 20 feet in the southern portion of the lake. This bed was added during the August 2006 survey. Vegetative cover was similar to the composition of Bed 14, with chara, slender naiad, spiny naiad, and sago pondweed present at moderate abundances (2-20%).

Table 22. Bed 16 - Composite Aquatic Plant Inventories (June and August 2006)

Acronym	Scientific Name	Common Name	Aug. Abund.
ALGA	Any species of filamentous alga	algae	<2%
CH?AR	*Chara* sp.	A chara sp.	2-20%
NAFL	*Najas flexilis*	slender naiad	2-20%
NAMA	*Najas marina*	spiny naiad	2-20%
POGR8	*Potamogeton gramineus*	variable pondweed	<2%
POIL	*Potamogeton illinoensis*	Illinois pondweed	<2%
POPE6	*Potamogeton pectinatus*	sago pondweed	2-20%
VAAM3	*Vallisneria americana*	wild celery	<2%

Plant Bed 17

Size: 0.7 acres
Substrate: silt
Number of Species: 5
Overall Vegetative Coverage: 21-60%

Description: This bed is located on a small mid-lake rise in the north-central portion of the lake. Bed 17 was not located during the June survey. Similar to the other small mid-lake rises at moderate depths, chara and spiny naiad were present at moderate abundances (2-20%).

Table 23. Bed 17 - Composite Aquatic Plant Inventories (June and August 2006)

Acronym	Scientific Name	Common Name	Aug. Abund.
CH?AR	*Chara* sp.	A chara sp.	2-20%
NAFL	*Najas flexilis*	slender naiad	<2%
NAMA	*Najas marina*	spiny naiad	2-20%
POGR8	*Potamogeton gramineus*	variable pondweed	<2%
POPE6	*Potamogeton pectinatus*	sago pondweed	<2%

Plant Bed 18

Size: 0.3 acres
Substrate: silt
Number of Species: 5
Overall Vegetative Coverage: >60%

Description: Bed 18 is located on a small mid-lake rise in the central portion of the lake. Vegetation composition was similar to similar to other beds on mid-lake rises, particularly Beds 14 and 16. Chara (2-20%), slender naiad (20-60%), and sago pondweed (2-20%) were present at moderate abundances during the August survey event. This bed was not located during the June survey.

Table 24. Bed 18 - Composite Aquatic Plant Inventories (June and August 2006)

Acronym	Scientific Name	Common Name	Aug. Abund.
ALGA	Any species of filamentous alga	algae	<2%
CH?AR	*Chara* sp.	a chara sp.	2-20%
NAFL	*Najas flexilis*	slender naiad	20-60%
NAMA	*Najas marina*	spiny naiad	<2%
POGR8	*Potamogeton gramineus*	variable pondweed	<2%
POPE6	*Potamogeton pectinatus*	sago pondweed	2-20%

Plant Bed 19

Size: 0.6 acres
Substrate: silt
Number of Species: 5
Overall Vegetative Coverage:

Description: Bed 19 is located on a small mid-lake rise in the central portion of the lake. Vegetation composition was similar to Bed 18 with the addition of wild celery. This bed was not located during the June survey.

Table 25. Bed 19 - Composite Aquatic Plant Inventories (June and August 2006)

Acronym	Scientific Name	Common Name	Aug. Abund.
CH?AR	*Chara* sp.	a chara sp.	2-20%
NAFL	*Najas flexilis*	slender naiad	2-20%
NAMA	*Najas marina*	spiny naiad	<2%
POPE6	*Potamogeton pectinatus*	sago pondweed	2-20%
VAAM3	*Vallisneria americana*	wild celery	2-20%

Plant Bed 20

Size: 0.2 acres
Substrate: silt
Number of Species: 4
Description: This moderate depth bed (15 to 25 feet) is located on a small mid-lake rise located to the east of Bed 19. This bed was not located during the June survey. Unlike the other mid-olake rise beds, Eurasian milfoil was present at moderate abundances (20-60%). Coontail and nitella were also present at moderate abundances (2-20%).

Table 26. Bed 20 - Composite Aquatic Plant Inventories (June and August 2006)

Acronym	Scientific Name	Common Name	Aug. Abund.
CEDE4	*Ceratophyllum demersum*	coontail	2-20%
MYSP2	*Myriophyllum spicatum*	Eurasian watermilfoil	20-60%
NI?TE	*Nitella* sp.	A nitella sp.	2-20%
POCR3	*Potamogeton crispus*	curly-leaf pondweed	<2%

TIER II SAMPLING RESULTS

Post-treatment Tier II sampling was performed August 7 through August 11, 2006. As sampled on August 8 and 10, 2006, nearly all of the sampling locations were vegetated (83/1000, 83%, Exhibit V). Thirteen species were recorded, of which 11 are native. On average, 1.9 species were recorded from each sampling location. The maximum number of species recorded from a sampling location was 8 species.

As a whole, spiny naiad was the most dominant species, with a dominance index (DI) of 10.80 (Exhibit VI). It was recorded from 34% of the sampling locations, and had a high mean density of 1.59. Chara (8.80), slender naiad (6.80), sago pondweed (5.00), and wild celery (4.60) had the next highest dominance indices. The remaining eight species had dominance indices less than 4.0. Filamentous alga was also abundant, with a dominance index of 4.20. It was recorded from 21% of the sampling locations. Exhibit VII shows the abundances of Eurasian watermilfoil during the 2006 Tier II sampling.

Table 27. Tier II Sampling Results for Lake Maxinkuckee (August 2006)

Occurrence and Abundance of Submersed Aquatic Plants in Maxinkuckee Lake

Date:	8/8 & 10/06	Sites with plants:	83	Mean number species/site:	1.94
Secchi (ft):	9.0	Sites with native plants:	71	Standard Error:	0.19
Trophic Status:	Oligotrophic	Number of species:	13	Mean native species/site:	1.55
Number of sites:	100	Number of native species:	11	Standard error:	0.16
Maximum plant depth:	24’	Maximum species/site:	8	Species diversity:	0.99
				Native diversity:	0.99

Scientific Name	Common Name	Site Frequency	Relative Density	Mean Density	Dominance
Najas marina	spiny naiad	34.00	0.54	1.59	10.80
Chara sp.	a chara species	38.00	0.44	1.16	8.80
Najas flexilis	slender naiad	30.00	0.34	1.13	6.80
Potamogeton pectinatus	sago pondweed	19.00	0.25	1.32	5.00
Vallisneria americana	wild celery	23.00	0.23	1.00	4.60
Alga	algae	21.00	0.21	1.00	4.20
Nitella sp.	a nitella sp.	16.00	0.18	1.13	3.60
Potamogeton gramineus	variable pondweed	15.00	0.15	1.00	3.00
Myriophyllum spicatum	Eurasian watermilfoil	5.00	0.11	2.20	2.20
Potamogeton zosteriformis	flat-stemmed pondweed	8.00	0.08	1.00	1.60
Potamogeton pusillus	small pondweed	3.00	0.03	1.00	0.60
Elodea canadensis	Canadian waterweed	1.00	0.03	3.00	0.60
Potamogeton natans	common pondweed	1.00	0.03	3.00	0.60
Ceratophyllum demersum	coontail	1.00	0.01	1.00	0.20
Other Observed Plants: see Tier I results					

When analyzed for the sampling depth zones, chara was the most dominant species (DI 10.0) in the 0 to 5 foot depth zone. The next most dominant species in this zone were slender naiad (DI 4.55). The remaining species in the 0 to 5 foot depth zone had dominance indices less than 2.0.

In the 6 to 10 foot depth zones, chara and sago pondweed tied for the most dominant species, with DI values of 10.48. Slender naiad, spiny naiad, and variable pondweed were tied for the second most dominant species, with DI values of 8.57. Eurasian watermilfoil was present in this depth range (DI 3.81). In the 11 to 15 foot depth zone, spiny naiad was strongly dominant with a DI of 21.82. Chara (DI 15.45) and slender naiad (DI 11.82) were the second and third ranked species respectively. Eurasian watermilfoil showed an increasing dominance in this depth bracket (DI 6.36). The 11 to 15 foot depth range had the greatest abundance and diversity of aquatic vegetation.

The 16 to 20 foot depth range has a sharp drop off in the number and abundance of aquatic vegetation. Eurasian watermilfoil is the most dominant species in this range with a DI of 11.0. Nitella (DI 4.00) and slender naiad (DI 3.00) were the second and third most abundant species, respectively. The 21 to 25 foot depth zone was dominated by nitella (DI 12.00). Spiny naiad and variable pond weed were present, both with a DI of 2.00. Filamentous algae was also present at its greatest abundance, DI of 6.00.

Table 28. Dominance Index of Each Species in Sampling Depth Zones

Scientific Name	Common Name	0-5’	6-10’	11-15’	16-20’	21-25’
Alga	algae	0.00	3.81	3.64	3.00	6.00
Ceratophyllum demersum	coontail	0.00	0.00	0.00	1.00	0.00
Chara sp.	a chara species	10.00	10.48	15.45	1.00	0.00
Elodea canadensis	Canadian waterweed	0.00	0.00	2.73	0.00	0.00
Myriophyllum spicatum	Eurasian watermilfoil	0.00	3.81	6.36	11.00	0.00
Najas flexilis	slender naiad	4.55	8.57	11.82	3.00	0.00
Najas marina	spiny naiad	0.00	8.57	21.82	0.00	2.00
Nitella sp.	a nitella sp.	0.00	0.00	4.55	4.00	12.00
Potamogeton gramineus	variable pondweed	1.82	8.57	1.82	0.00	2.00
Potamogeton natans	common pondweed	0.00	0.00	2.73	0.00	0.00
Potamogeton pectinatus	sago pondweed	0.91	10.48	10.00	0.00	0.00
Potamogeton pusillus	small pondweed	0.00	0.00	1.82	1.00	0.00
Potamogeton zosteriformis	flat-stemmed pondweed	0.91	0.95	2.73	1.00	0.00
Vallisneria americana	wild celery	1.82	0.00	10.91	2.00	2.00

AQUATIC PLANT MANAGEMENT ALTERNATIVES

At the present time, the health of Lake Maxinkuckee's aquatic plant communities is fair. Native plant diversity is relatively high, although overall vegetative cover is sparse throughout the majority of beds. Eurasian watermilfoil and curly-leaf pondweed (both exotic species) along with spiny naiad (nuisance native species) are present in a number of the beds. While curly-leaf pondweed is present in five of the beds, its coverage is limited to less than 20% and is unlikely to pose serious management concern at this time. Spiny naiad has increased dramatically since 1999, when it was only recorded from one location in Lake Maxinkuckee. In 2006, spiny naiad was the most dominant species, and was recorded from 15 out of 20 beds. Eurasian watermilfoil was recorded from ten beds, and had greater than 21% coverage in two beds. Continued monitoring, and management activities if necessary, should be conducted to maintain the Eurasian watermilfoil and spiny naiad populations at low levels and prevent them from becoming the predominant species in the lake.

At this time Eurasian watermilfoil control will be focused on monitoring to evaluate its spread and abundance throughout the lake. Limited control efforts will be required in near shore areas and in channels in order to promote lake access to all shoreline property owners. If needed, a variety of 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.

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 and/ or enhancing beneficial aquatic vegetation.

Different types of aquatic plant management alternatives are discussed below. One or more of these alternatives may be employed to meet the objectives of Lake Maxinkuckee. This discussion of management alternatives is adapted from Aquatic Weed Control (2005).

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, as it was prior to 1996, and to maintain and enhance the current diversity of native aquatic plants. Therefore, it is imperative that Eurasian

watermilfoil be controlled while its population is still small. Taking no action might allow the Eurasian watermilfoil population to expand and become as dominant as it had been prior to 1996.

The nutrient levels and lake morphology naturally promote dense vegetation growth in almost all shallow areas (i.e., < 25' deep). If no action is taken, it is likely that individual residents and groups will continue to apply herbicides to native plant beds in a haphazard fashion to improve their lake access. By formulating a more comprehensive, integrated management strategy that incorporates all competing uses of Lake Maxinkuckee, the goal of this plan is to facilitate vegetation management as needed to meet lake objectives, but minimize haphazard management that may have detrimental side-effects.

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. Such disturbed areas may include areas where the perennial native plant beds are treated with herbicide due to perceived nuisance conditions.

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 and water skiers. It is important that all lake users obey boating restrictions to protect beneficial plant species and prevent personal injury. There currently are no boating restricted areas with the specific intent of protecting beneficial plant areas. However, there are a few nearshore areas demarcated with buoys, such as the northwestern corner of the lake, to prevent injury to boaters and water skiers.

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. Since areas infested by Eurasian watermilfoil are generally greater than eight feet deep, such a large water level drawdown is not only unfeasible, but unwarranted by the current level of Eurasian watermilfoil infestation.

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. Implementation of best management practices in the watershed was recommended by the Lake Maxinkuckee Lake and Watershed Management Plan (Hey & Associates 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).

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.

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.

However, the water milfoil weevil was suspected to cause the crash of the Eurasian watermilfoil population in 1996. Like many insects used as biological control agents, it is likely that a large population of Eurasian watermilfoil must be present to support the water milfoil weevil population. Water milfoil weevil populations likely may not be supported by small or sparse stands of Eurasian watermilfoil. Additionally, where they co-exist, it is likely that the two populations may naturally cycle in boom and bust cycles, causing nuisance levels of Eurasian watermilfoil to be present until the water milfoil weevil population spikes.

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.

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 LMEC 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.

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 Lake Maxinkuckee 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 Lake Maxinkuckee 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 10 (Washington State Department of Ecology 2007) shows a sketch of Hydrilla and Figure 11 (South Carolina Department of Natural Resources 2007) demonstrates a means of comparative identification.

Figure 10. Hydrilla (*Hydrilla verticillata*) sketch

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

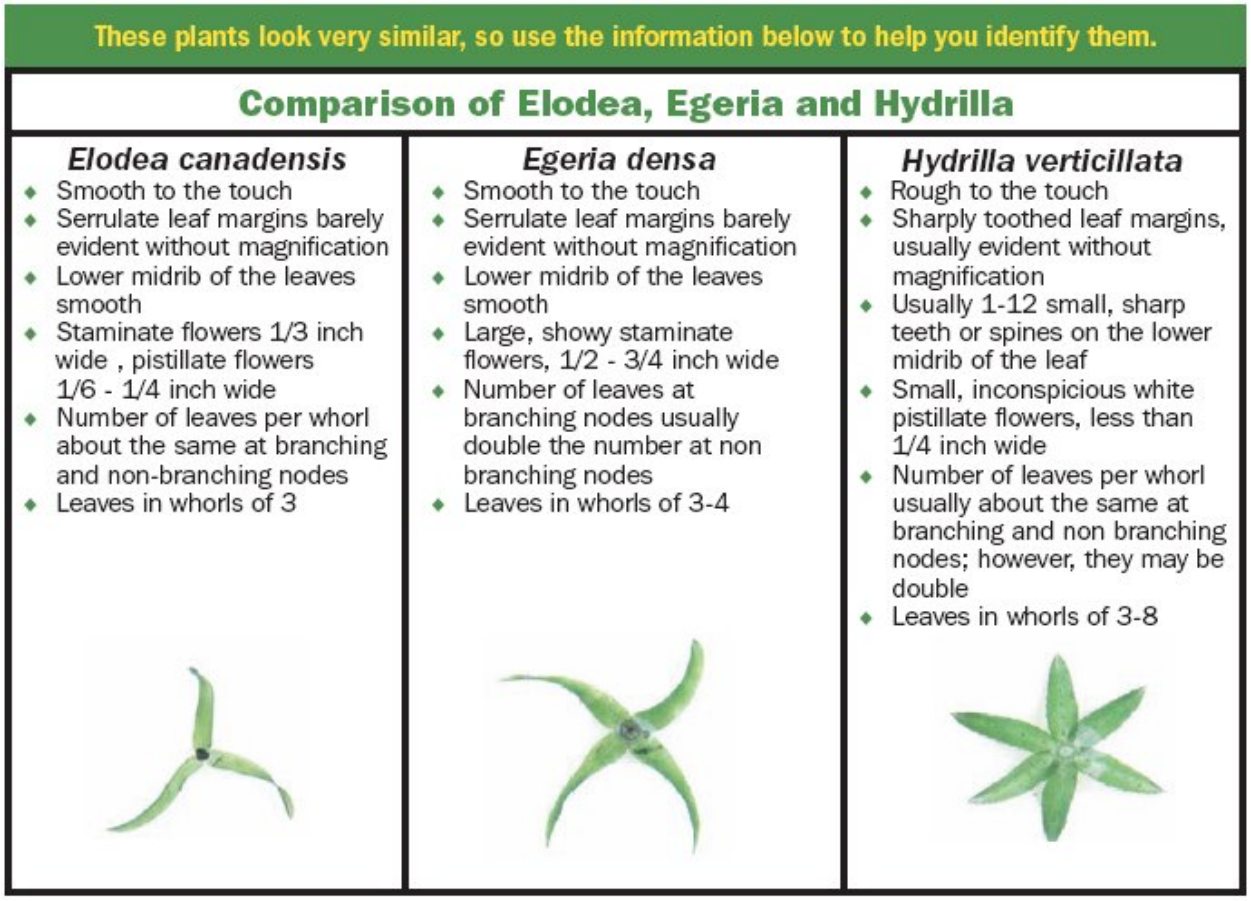

Figure 11. Comparison of Elodea, Egria and Hydrilla

In addition to these state and lake-wide issues, residents can be educated regarding practical steps that can reduce nutrient loading and improve the Lake Maxinkuckee 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. **Proper Maintenance of Septic Systems**. Many older homes possess septic systems without proper filter beds. Some systems may have leaks, allowing sewage directly into the lake. Sewage leaks greatly increase nutrients in the water, along with harmful bacteria. Proper maintenance of septic systems by all lake residents is important to maintain good water quality. If possible, a lake wide sewer system may be installed to reduce the chance of failure of individual septic systems.

3. **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.

4. **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).

5. **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.

6. **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.

7. **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, LMEC should identify significant wetland areas and work with the IDNR to protect them from drainage and disturbance.

8. **Ecological Zones to Protect Aquatic Vegetation Beds**. In situations where detrimental impacts from watercrafts degrade lake ecology, provisions for boating restrictions can be allowed. Legislation enacted in 2000 (HEA 1075) amended IC 14-15-7-3 to allow for establishment of zones on public waters where the use of watercraft may be limited or prohibited for fish, wildlife, or botanical resource management, or for the protection of users. Regulations in 312 IAC 5-6-1 allow establishment of zones on specified public freshwater lakes to govern the operation of watercraft for any of the following purposes: addressing unusual conditions or hazards; fish, wildlife or botanical resource management; protection of users. In order to be effective, a zone established under this rule must be identified on-site by buoys placed in accordance with 312 IAC 5-4. Watercraft operation may be restricted on specified lakes and reservoirs with state or federal funding under 312 IAC 5-10-1.

INTEGRATED TREATMENT ACTION STRATEGY

1. Summer 2007 Tier II Aquatic Plant Survey. A Tier II aquatic plant survey should be conducted during the summer of 2007 to determine the distribution and abundance of aquatic plants as well as to chart the spread and dominance of non-native species throughout the lake.

2. Summer 2008 Tier II Aquatic Plant Survey. A Tier II aquatic plant survey should be conducted during the summer of 2008 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 2008 Tier II survey is of a higher priority than the 2007 Tier II survey.

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

2007

Late season aquatic plant survey (Tier II) and plan update	$6,000

2008

Late season aquatic plant survey (Tier II) and plan update	$6,000

Any recommendations for herbicide applications will depend on the results of the surveys

MONITORING AND PLAN UPDATES

Aquatic plant surveys should be continued to monitor the spread and abundance of non-native species as well as to evaluate the abundance of desirable native vegetation. The abundance and distribution of aquatic vegetation will be recorded using the current IDNR Tier II sampling protocols.

After the 2007 vegetation surveys, 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 Lake Maxinkuckee. It 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 Lake Maxinkuckee ecosystem.

APPENDICES

Appendix I. Data Sheets
Appendix II. Calculations
Appendix III. Additional Maps and Exhibits
Appendix IV. Species List
Appendix V. Pesticide Use Restrictions
Appendix VI. Resources for Aquatic Vegetation Management
Appendix VII. State Regulations Relevant to Aquatic Plant Management

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APPENDIX I

DATA SHEETS

Aquatic Vegetation Plant Bed Data Sheet

Page ___ of ___

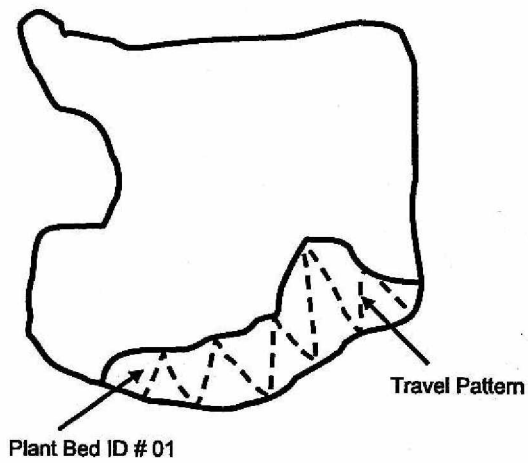
State of Indiana Department of Natural Resources

ORGANIZATION: V3 - JJ, WL			**DATE:** 6/14/06
~~03~~	**SITE INFORMATION**		**SITE COORDINATES**
Plant Bed ID: ~~09~~ 08	Waterbody Name: Lake Max		Center of the Bed
Bed Size: new			Latitude:
Substrate: Sandy w/	Waterbody ID: part of 01		Longitude:
Marl? 1 silt	Total # of Species		Max. Lakeward Extent of Bed
High Organic? 1	**CanopyAbundance at Site**		Latitude:
	S: 3	N: 0	F: 3	E: 0	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
NULU	3	0	0	
POPE6	3	0	0	
VAAM3	2	0	0	
POIL	2	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

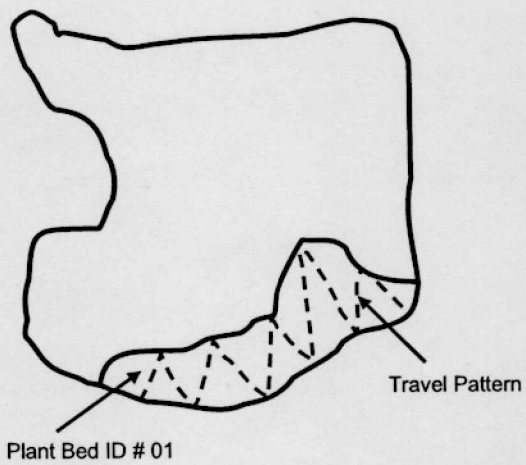
ORGANIZATION: V3 - JJ, WL	DATE: 6/14/06

SITE INFORMATION		SITE COORDINATES
Plant Bed ID: ~~06~~ 01	Waterbody Name: Lake Max	Center of the Bed
Bed Size:		Latitude:
Substrate: sandy	Waterbody ID:	Longitude:
Marl? 1	Total # of Species	Max. Lakeward Extent of Bed
High Organic? 0	CanopyAbundance at Site	Latitude:
	S: 2 N: 2 F: 0 E: 0	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
* CHARAR	2			
* POIL	2			
* VAAM3	2			
POCR3	1			
POPU7	1			
Potnat	2			
MYSPZ	1			
ALGA	2			

Individual Plant Bed Survey



Comments:

West side
7-12' sparsely veg.

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

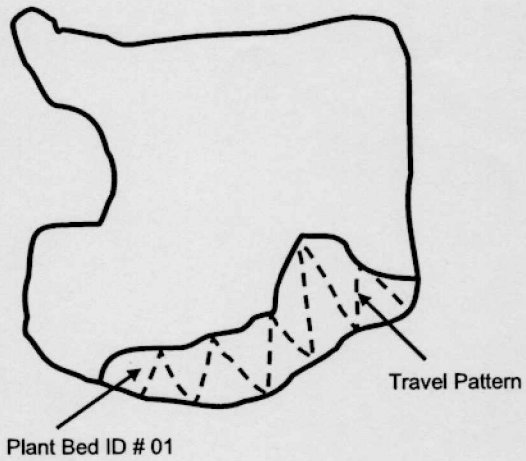
ORGANIZATION: V3 - JJ, V3	DATE: 6/14/06

SITE INFORMATION		SITE COORDINATES
Plant Bed ID: ~~07~~ 02	Waterbody Name: Lake Max	Center of the Bed
Bed Size:		Latitude:
Substrate: sandy	Waterbody ID:	Longitude:
Marl? 1	Total # of Species	Max. Lakeward Extent of Bed
High Organic? 0	CanopyAbundance at Site	Latitude:
	S: 4 N: 0 F: 0 E: 0	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
NI?TE	3			
CH?AR	1			
ELCA7	2			
MYSP2	2			
MYSI	1			
POZO	2			

Individual Plant Bed Survey



Comments:

15-25' deep - sheltered drop-off

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 ___

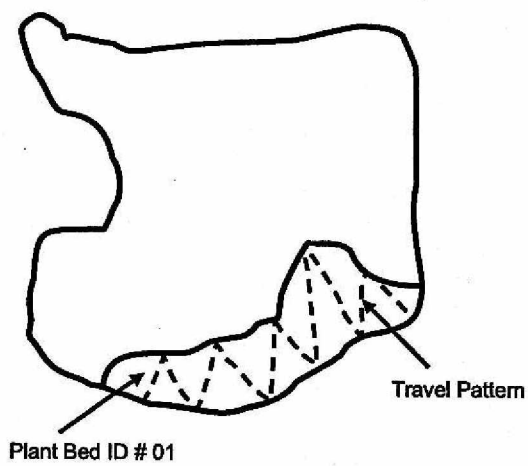
State of Indiana Department of Natural Resources

ORGANIZATION: V3 - JJ WL		DATE: 6/14/06
Old 08	**SITE INFORMATION**	**SITE COORDINATES**
Plant Bed ID: 13	Waterbody Name: Lake Max	Center of the Bed
Bed Size: New 03		Latitude:
Substrate: sandy	Waterbody ID:	Longitude:
Marl? 1 0	Total # of Species	Max. Lakeward Extent of Bed
High Organic? 0	**CanopyAbundance at Site**	Latitude:
	S: 4 N: 0 F: 0 E: 0	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CH?AR	2	2		
NI?TE	3	2		
ELCA7	2	0		
POZO	1	0		
POIL	1	0		
MYSP2	2	0		
VAAM3	2	0		
POPE6	1	0		
POFO2	1	0		
NAFL	1	0		
POCR3	1	0		
MYSI	1	0		

Individual Plant Bed Survey



Comments:

15 - 28' deep

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

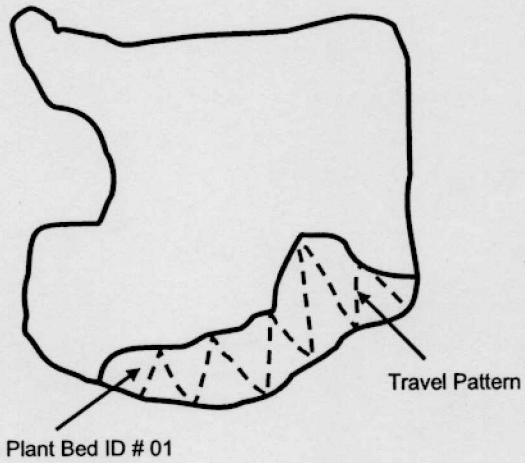
ORGANIZATION: V3 - WL, JJ	DATE: 6/14/06

SITE INFORMATION		SITE COORDINATES
Plant Bed ID: ~~09~~ 04	Waterbody Name: Lake Max	Center of the Bed
Bed Size:		Latitude:
Substrate: Sandy w/ silt sp	Waterbody ID:	Longitude:
Marl?	Total # of Species	Max. Lakeward Extent of Bed
High Organic? 1	CanopyAbundance at Site	Latitude:
	S: 4 N: 3 F: 1 E: 1	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
VAAM3	3			
POPE6	2			
POPU7	2			
Poncor	2			
POIL	2			
ALGA	3			
Potnat	2			
MYSP2	2			
Potamp	1			
ZAPA	1			
CEDE4	1			
LEMI3	1			
NULU	1			
SACU	1			
Jusame	1			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
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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
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Overall Surface Cover
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Canopy:
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Abundance:
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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

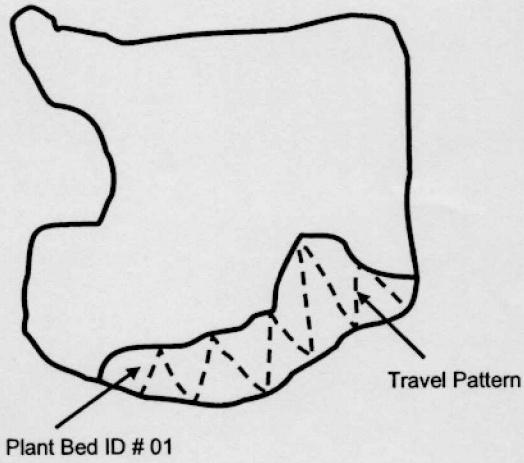
ORGANIZATION: V3 - JJ, WL	DATE: 6/14/06

SITE INFORMATION		SITE COORDINATES
Plant Bed ID: ~~10~~ 05	Waterbody Name: Lake Max	Center of the Bed
Bed Size:		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: 4 F: 2 E: 2	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
MYSP2	3			
SACU	2			
NYTU	2			
POCR3	2			
LEMI3	2			
VAAM3	2			
CEDE4	3			
NULU	2			
POPU7	2			
Typang	1			
ALGA	4			
Potamp				

Individual Plant Bed Survey



Comments:

channels at south

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
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Canopy:
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Abundance:
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Aquatic Vegetation Plant Bed Data Sheet

Page ___ of ___

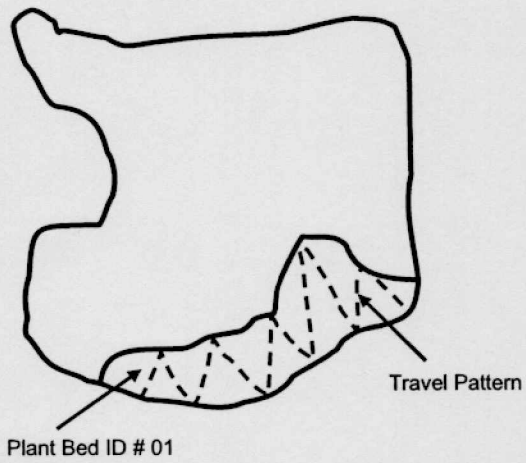
State of Indiana Department of Natural Resources

ORGANIZATION: V3- JJ, WL		DATE: 6/14/06	
06	**SITE INFORMATION**		**SITE COORDINATES**
Plant Bed ID: 11	Waterbody Name: Lake Max		Center of the Bed
Bed Size:			Latitude:
Substrate: Sandy	Waterbody ID:		Longitude:
Marl? 1 0	Total # of Species		Max. Lakeward Extent of Bed
High Organic? 0	**CanopyAbundance at Site**		Latitude:
	S: 4	N: 0 / F: 0 / E: 0	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
MYSP2	4	0		
POZO	1	0		
CHARA	2	2		

Individual Plant Bed Survey



Comments:

Myrspi patch @ south end lake
8-10' deep

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
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S = Submersed

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

Aquatic Vegetation Plant Bed Data Sheet

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State of Indiana Department of Natural Resources

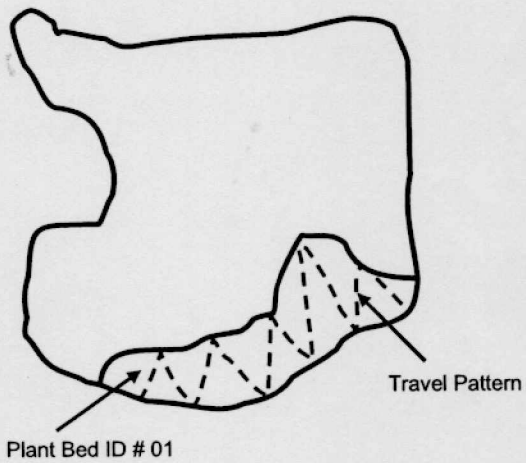
ORGANIZATION: V3 - JJ, WL	DATE: 10/14/06

SITE INFORMATION		SITE COORDINATES
Plant Bed ID: 07 12	Waterbody Name: Lake Max	Center of the Bed
Bed Size:		Latitude:
Substrate: Sandy	Waterbody ID:	Longitude:
Marl? 1 0	Total # of Species	Max. Lakeward Extent of Bed
High Organic? 0	**CanopyAbundance at Site**	Latitude:
	S: 2 N: 1 F: 0 E: 0	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CH?AR	2			
POIL	2			
VAAM3	2			
NAFL	1			
Potnat	2			
POPE6	1			
MYSP2	1			
POPU7	1			
ALGA	1			

Individual Plant Bed Survey



Comments:

East side sparse veg
7-12' deep

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
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Canopy:
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Abundance:
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QE Code:
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2 = Genus suspected
3 = Unknown

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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

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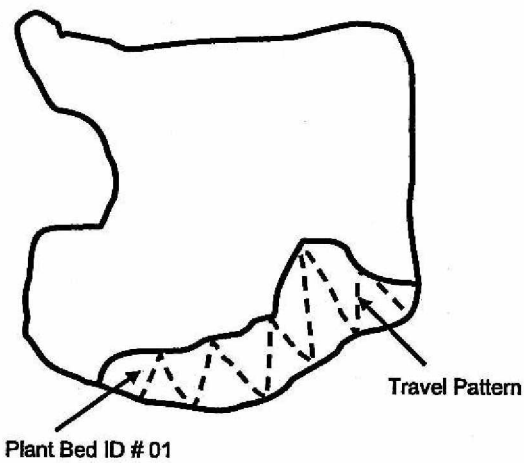
State of Indiana Department of Natural Resources

ORGANIZATION: V3 - JJ, WL		DATE: 6/14/06
(Old 09)	**SITE INFORMATION**	**SITE COORDINATES**
Plant Bed ID: 14	Waterbody Name: Lake Max	Center of the Bed
Bed Size: New 08		Latitude:
Substrate: Silty sand	Waterbody ID:	Longitude:
Marl? 1	Total # of Species	Max. Lakeward Extent of Bed
High Organic? 1	**CanopyAbundance at Site**	Latitude:
	S: 4 N: 2 F: 0 E: 0	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CH?AR	3			
VAAM3	3			
POPE6	2			
MYSP2	2			
POPU7	2			
POIL	2			
POZO	1			
NAFL	1			
ALGA	2			

Individual Plant Bed Survey



Comments:

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
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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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Abundance:
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2 = 2-20%
3 = 21-60%
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1 = Taken, not varified
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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 ___

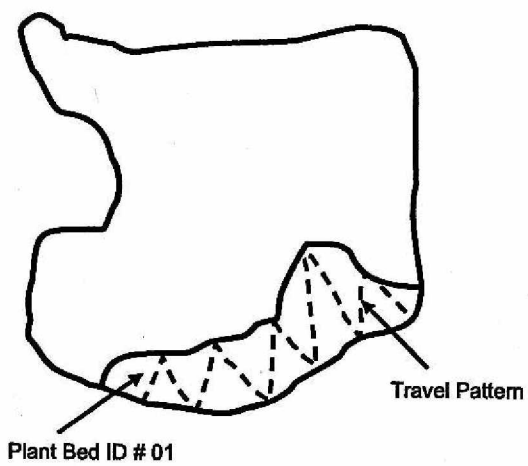
State of Indiana Department of Natural Resources

ORGANIZATION: V3 - JJ, WL		DATE: 6/14/06	
	SITE INFORMATION	**SITE COORDINATES**	
Plant Bed ID: ~~15~~ 10	Waterbody Name:	Center of the Bed	
Bed Size: (new 09)	Lake Max	Latitude:	
Substrate: sandy / rocky	Waterbody ID:	Longitude:	
Marl? 1	Total # of Species	Max. Lakeward Extent of Bed	
High Organic? 0	**CanopyAbundance at Site**	Latitude:	
	S: 2 N: 0 F: 0 E: 0	Longitude:	

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
POIL	2			
CH?AR	2			
VAAM3	2			
NAFL	1			
POPE6	1			

Individual Plant Bed Survey



Comments:

7-15' deep

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:
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2 = 2-20%
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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 ___

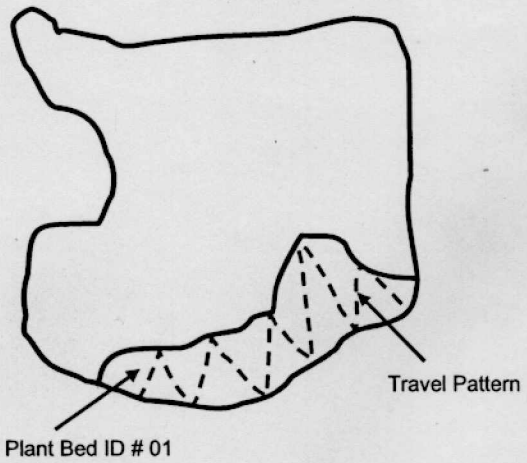
State of Indiana Department of Natural Resources

ORGANIZATION: V3 - WL, JJ		**DATE:** 6/13/06	
11	**SITE INFORMATION**		**SITE COORDINATES**
Plant Bed ID: 01	Waterbody Name: Lake Maxinkuckee		Center of the Bed
Bed Size:			Latitude:
Substrate: sandy	Waterbody ID:		Longitude:
Marl? 1	Total # of Species		Max. Lakeward Extent of Bed
High Organic? 0	**CanopyAbundance at Site**		Latitude:
	S: 3	N: 0 F: 0 E: 0	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CH?AR	3			
VAAM3	2			
POPE6	2			

Individual Plant Bed Survey



Comments:

island 12-14' deep

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:
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2 = 2-20%
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4 = > 60%

QE Code:
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3 = Unknown

Voucher:
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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

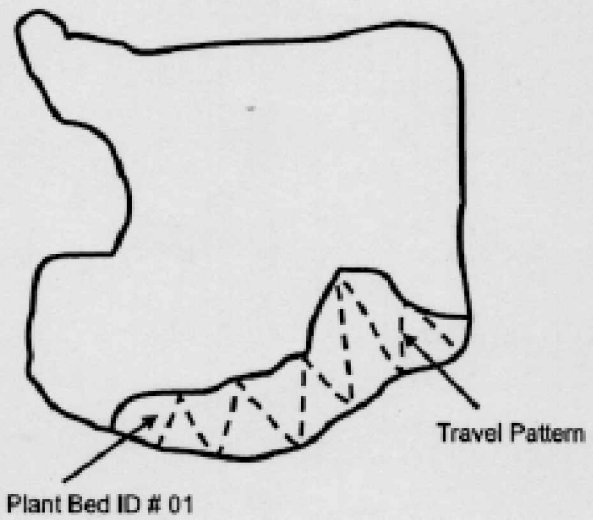
ORGANIZATION: V3 - JJ, WL	DATE: 6/13/06

SITE INFORMATION					SITE COORDINATES
Plant Bed ID: ~~02~~ 12	Waterbody Name: Lake Max				Center of the Bed
Bed Size:					Latitude:
Substrate: Sandy	Waterbody ID:				Longitude:
Marl? 1 0	Total # of Species				Max. Lakeward Extent of Bed
High Organic? 0	CanopyAbundance at Site				Latitude:
	S: 3	N: 0	F: 0	E: 0	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CHAR	3			
POPE6	2			
POEP2	2			
POPU7	1			
VAAM3	2			
NAFL	1			

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:
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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 - JJ, WL

DATE: 6/13/06

SITE INFORMATION

Plant Bed ID: 13 ~~03~~	Waterbody Name: Lake Max
Bed Size:	
Substrate: sandy	Waterbody ID:
Marl? 1 0	Total # of Species
High Organic? 0	

CanopyAbundance at Site

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

SITE COORDINATES

Center of the Bed

Latitude:

Longitude:

Max. Lakeward Extent of Bed

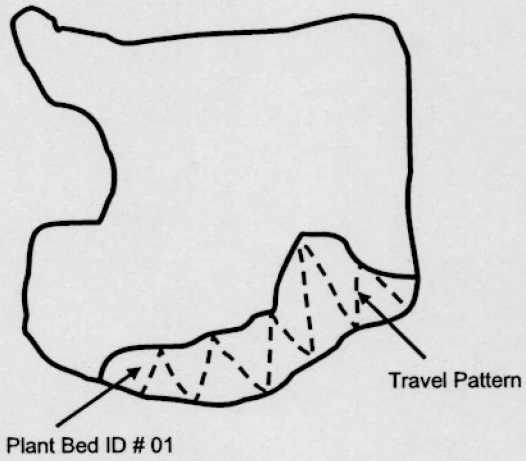
Latitude:

Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CHAR	2			
VAAM3	2			
POPE6	2			
RALO2	1			

Individual Plant Bed Survey



Comments:

Island ~10-15' deep

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
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Canopy:
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Reference ID:
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Aquatic Vegetation Plant Bed Data Sheet

Page ___ of ___

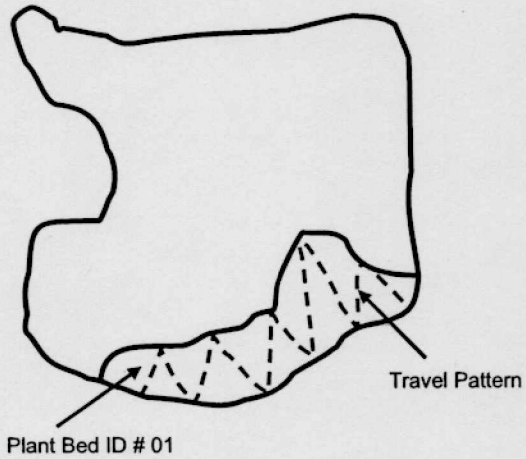
State of Indiana Department of Natural Resources

ORGANIZATION: V3 - JJ, WL			**DATE:** 6/13/06
14	**SITE INFORMATION**		**SITE COORDINATES**
Plant Bed ID: 04	Waterbody Name: Lake Max		Center of the Bed
Bed Size:			Latitude:
Substrate: Sandy	Waterbody ID:		Longitude:
Marl? 1	Total # of Species		Max. Lakeward Extent of Bed
High Organic? 0	**CanopyAbundance at Site**		Latitude:
	S: 2	N: 0	F: 0 E: 0 Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CH2AR	2			
POPE6	2			
POEP2	1			

Individual Plant Bed Survey



Comments:
Island 12-15' deep

REMINDER INFORMATION

Substrate:
1 = Silt/Clay
2 = Silt w/Sand
3 = Sand w/Silt
4 = Hard Clay
5 = Gravel/Rock
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Marl
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High Organic
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Overall Surface Cover
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Reference ID:
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Aquatic Vegetation Plant Bed Data Sheet

Page ___ of ___

State of Indiana Department of Natural Resources

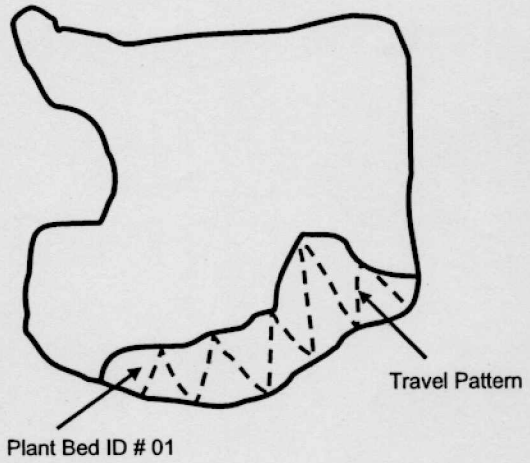
ORGANIZATION: V3 - JJ, WL	DATE: 6/13/06

SITE INFORMATION		SITE COORDINATES
Plant Bed ID: ~~05~~ 15	Waterbody Name: Lake Max	Center of the Bed
Bed Size:		Latitude:
Substrate: Sandy	Waterbody ID:	Longitude:
Marl? 1	Total # of Species	Max. Lakeward Extent of Bed
High Organic? 0	CanopyAbundance at Site	Latitude:
	S: 2 N: 0 F: 0 E: 0	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
NITE	1			
VAAM3	2			
CHAR	2			
POPE6	2			
POCR3	1			
POPU7				

Individual Plant Bed Survey



Comments:

Island

REMINDER INFORMATION

Substrate:
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5 = Gravel/Rock
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Voucher:
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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

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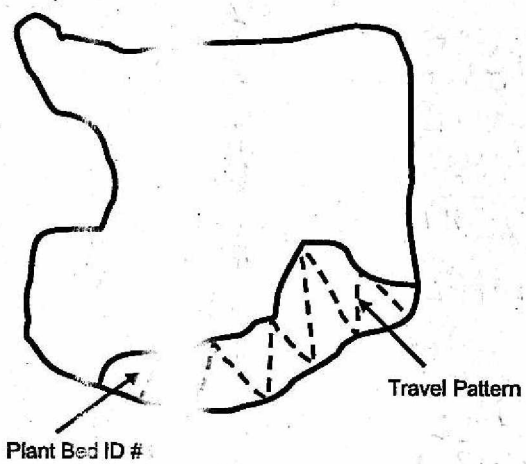
State of Indiana Department of Natural Resources

ORGANIZATION: V3 - EBJD		**DATE:** 8/7/06	
SITE INFORMATION		**E COORDINATES**	
Plant Bed ID: 01	**Waterbody Name:** Lake Max	enter of the Bed	
Bed Size:		**Latitude:**	
Substrate: Sandy	**Waterbody ID:**	**Longitude:**	
Marl? 1	**Total # of Species**	Ma:	keward Extent of Bed
High Organic? 0	**CanopyAbundance at Site**	**Latitude:**	
	S: 2 N: 0 F: 0 E: 0	**Longitude:**	

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
VAAM3	1			
POPE6	1			
CHAR	2			
POTL	1			
NAFL	1			
NAMA	1			
POGR8	1			
Pothat	1			
PONO2	1			

Individ ant Bed Survey



Comments:

Shallow - to 10' deep
sparsely vegetated

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 sus d
2 = Genus sus d
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, not v d
2 = Taken, varif

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

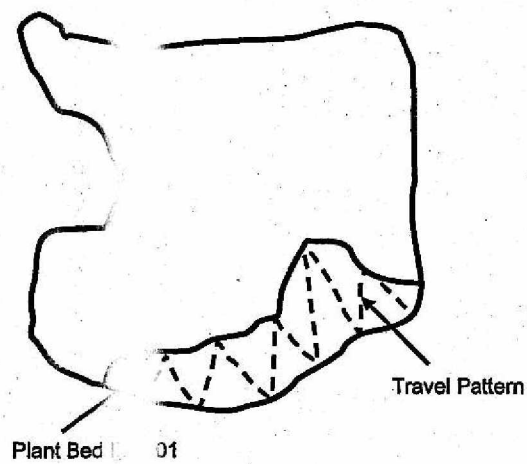
ORGANIZATION: V3 - EB, JI	DATE: 8/11/06

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

SPECIES INFORMATION ↳ incl algae, 2

Species Code	Abundance	QE	Vchr.	Ref. ID
POPE6	2			
VAAM3	2			
NAFL	1			
NITE	2			
ALGA	2			
ELCA7	1			
NAMA	2			

Ind al 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:
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2 = 2-20%
3 = 21-60%
4 = > 60%

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

QE Code:
0 = as defi
1 = Species pe
2 = Genus pected
3 = Unknov

Voucher:
0 = Not Ta
1 = Taken, varified
2 = Taken, fie

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

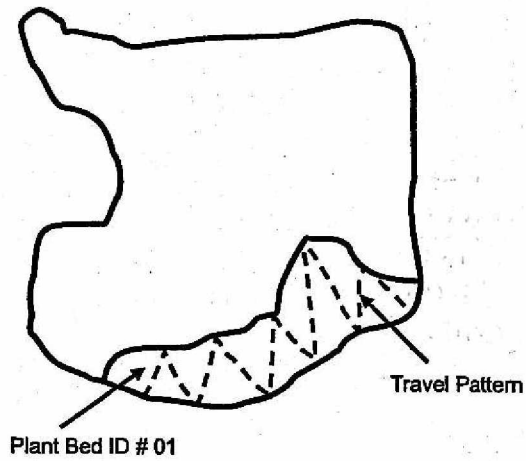
ORGANIZATION: V3 - EB, JJ	DATE: 8/7/06

SITE INFORMATION		SITE COORDINATES
Plant Bed ID: Old (08)	Waterbody Name: Lake Max	Center of the Bed
Bed Size: New 03		Latitude:
Substrate: silty	Waterbody ID:	Longitude:
Marl? 1 0	Total # of Species	Max. Lakeward Extent of Bed
High Organic? 0	CanopyAbundance at Site	Latitude:
	S: 4 N: 0 F: 0 E: 0	Longitude:

SPECIES INFORMATION ↳ incl algae, 1

Species Code	Abundance	QE	Vchr.	Ref. ID
NITE	2			
MYSP2	2			
POPEL6	2			
VAAM3	2			
NAFL	2			
NAMA	3			
CEDE4	1			
POPU7	1			
ELCA7	1			
POFO3	1			
POTL	1			
CHAR	2			
Potnat	1			
ALGA	1			

Individual Plant Bed Survey



Comments:

deeper transitional area
~10 -20' deep
*Najmar, *Najfle, Chara, Valame,

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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2 = 2-20%
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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

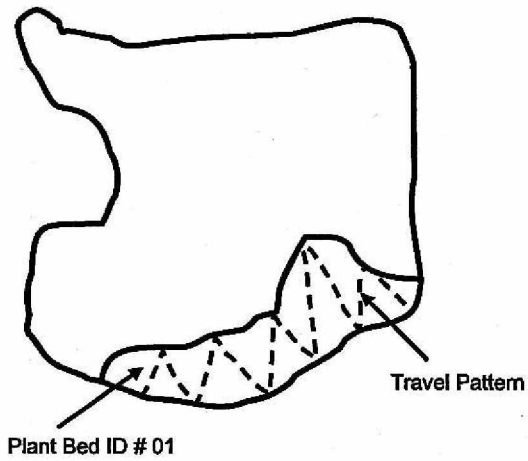
ORGANIZATION: V3 - EBJJ	DATE: 8/11

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

SPECIES INFORMATION ↳ incl. algae, 2

Species Code	Abundance	QE	Vchr.	Ref. ID
VAAM3	4			
LETR3	1			
LEMI	1			
WOLO	1			
PONO2	2			
POZO	2			
POPEG	2			
NAFL	1			
CEDE4	1			
POPU7	1			
POIL	1			
POGR8	2			
ALGA	2			
NULU	1			
MYSP2	1			
POFR7	1			

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

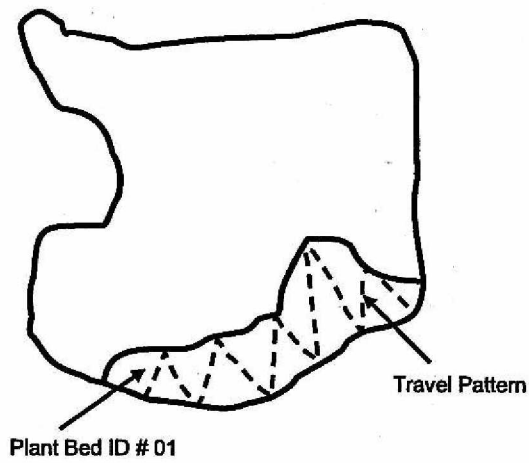
ORGANIZATION: V3 - EB, JJ	DATE: 8/11/06

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

SPECIES INFORMATION ↳ incl algae, 3

Species Code	Abundance	QE	Vchr.	Ref. ID
LEMI3	2			
WOCO	1			
NULU	2			
ALGA	2			
Jusame	1			
Hibpal	1			
Typans	1			
Lytsal	1			
Pelvir	1			
NYTU	2			
MYSP2	1			
CEDE4	1			
Irivir	1			
LETR	1			
Cepoce	1			
Sciacu	1			

Individual Plant Bed Survey



Comments:

Channels @ south end of lake - Centers ~ 4' deep - marina channels appear to have been herbicided.

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

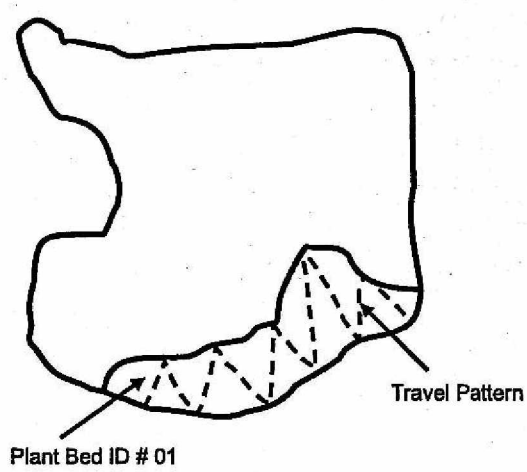
ORGANIZATION: V3 - ERJJ	DATE:

SITE INFORMATION		SITE COORDINATES
Plant Bed ID: 06	Waterbody Name: Lake Max	Center of the Bed
Bed Size:		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: F: E:	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
MVSP2	4			
VAAM3	1			
POPE6	1			
CEDE4	1			
NAFL	1			
NAMA	1			

Individual Plant Bed Survey



Comments:

Milfoil bed - ~7-15' deep
WPT001- Edge Bed 06/01
milfoil not reaching surface

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 ___

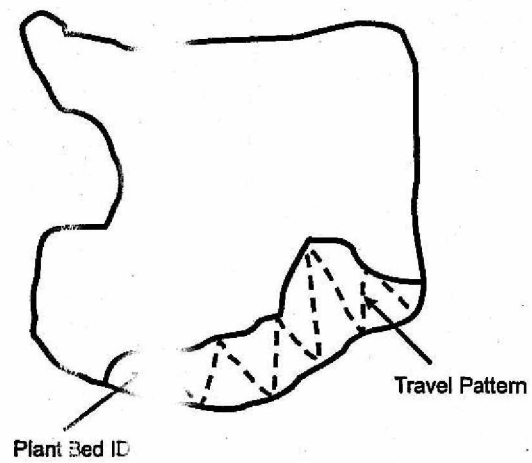
State of Indiana Department of Natural Resources

ORGANIZATION: V3 - NFR		**DATE:** 8/11/06	
SITE INFORMATION			**TE COORDINATES**
Plant Bed ID: 07	Waterbody Name: Lake Max		Center of the Bed
Bed Size:		Latitude:	
Substrate: sandy/rocky	Waterbody ID:	Longitude:	
Marl? 1	Total # of Species	M	akeward Extent of Bed
High Organic? 0	**CanopyAbundance at Site**	Latitude:	
	S: 2 N: 1 F: 0 E: 0	Longitude:	

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CHAR	2			
ALGA	1			
POPE6	1			
NAFL	1			
VAAM3	1			
WOCO	1			
LEMI3	1			

Indivi Plant Bed Survey



Comments:

- Shallows on east side of lake 0-10'
- sparsely vegitated

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 define
1 = Species s
2 = Genus s ted
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, no fied
2 = Taken, va

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 ___

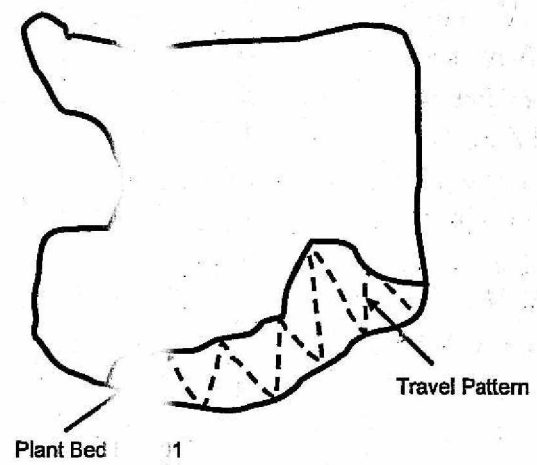
State of Indiana Department of Natural Resources

ORGANIZATION: V3 - ER, JJ		**DATE:** 8/11/06	
SITE INFORMATION		**SITE COORDINATES**	
Plant Bed ID: (Old) 09	**Waterbody Name:** Lake Max		Center of the Bed
Bed Size: New 08		**Latitude:**	
Substrate: Silty	**Waterbody ID:**	**Longitude:**	
Marl? 10	**Total # of Species**		Lakeward Extent of Bed
High Organic? 1	**CanopyAbundance at Site**	**Latitude:**	
	S: 4 N: 1 F: 0 E: 0	**Longitude:**	

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
WOCO	1			
VAAM3	2			
POGR8	2			
ZOPU	2			
CHAR	2			
PONO2	2			
NAFL	2			
MYSP2	1			
POPE6	2			
LEMI3	1			

Ind al Plant Bed Survey



Comments:

- higher organic area in NE corner of lake - near Culver Academy
- more veg'tated than other shallow areas
- mouth of Wilson's ditch - (contributing organics)

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 defi
1 = Specie: pe
2 = Genu: pected
3 = Unkno

Voucher:
0 = Not Ta
1 = Taken, arified
2 = Taken, e

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

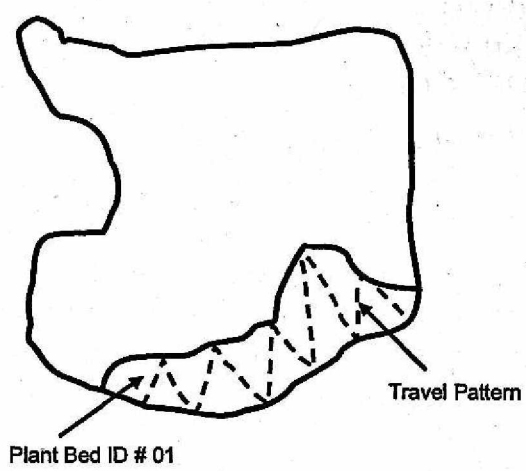
ORGANIZATION: V3 - EB, JJ	DATE: 8/7/06

SITE INFORMATION					SITE COORDINATES
Plant Bed ID: 03	Waterbody Name:				Center of the Bed
Bed Size: (new09)	Lake Max				Latitude:
Substrate: Sandy /	Waterbody ID:				Longitude:
Marl? 1 rocky	Total # of Species				Max. Lakeward Extent of Bed
High Organic? 0	CanopyAbundance at Site				Latitude:
	S: 2	N:	F:	E:	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CHAR	1			
POGR8	1			
VAAM3	1			
POIL	1			
POPE6	1			
NAFL	1			
NAMA	1			

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 - JJ, EB

DATE:

SITE INFORMATION

Plant Bed ID: 10	Waterbody Name: Lake Max
Bed Size:	
Substrate: Sandy	Waterbody ID:
Marl? 1	Total # of Species
High Organic? 0	

CanopyAbundance at Site

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

SITE COORDINATES

Center of the Bed

Latitude:

Longitude:

Max. Lakeward Extent of Bed

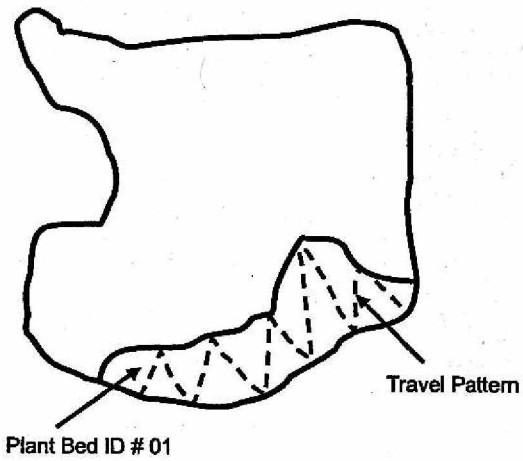
Latitude:

Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CHAR	3			
NAFL	2			
~~VAAM3~~				
POPEL	2			
Jusame	1			
POGR8	2			
Typang	1			
PONO2	2			
VAAM3	2			

Individual Plant Bed Survey



WPT 03 - edge betw Bed 10 & 03

Comments:

- Shallow areas on north side ~~0-10~~ near docks
- more vegetated than open sandy shallows, more sheltered

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%
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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 - ER, JJ

DATE: 8/8/06

SITE INFORMATION

Plant Bed ID: 11	Waterbody Name: Lake Max
Bed Size:	
Substrate: silty	Waterbody ID:
Marl? 1 0	Total # of Species 6
High Organic? 0	

CanopyAbundance at Site

S:	N:	F:	E:
3	0	0	0

SITE COORDINATES

Center of the Bed

Latitude:

Longitude:

Lakeward Extent of Bed

Latitude:

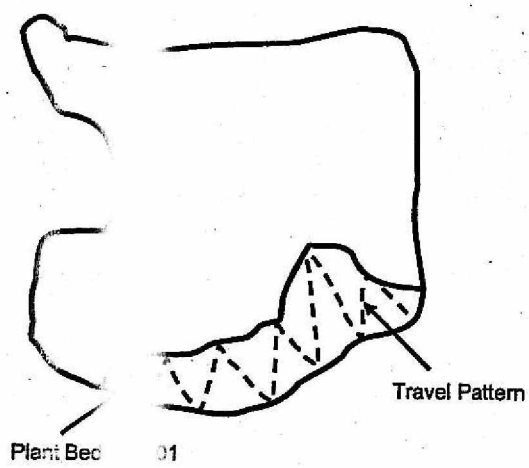
Longitude:

SPECIES INFORMATION

4 w/ algae

Species Code	Abundance	QE	Vchr.	Ref. ID
~~VAAM~~ CHRAR	2	2	0	
NAFL	2	0	0	
ALGA	1	3	0	
NAMA	2	0	0	
VAAM3	1	0	0	
POPEG	1	0	0	

Inc al Plant Bed Survey



Comments:

Atoll in NE part 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 dei
1 = Specie pe
2 = Gen pected
3 = Unkno

Voucher:
0 = Not Ta
1 = Taken varified
2 = Taken fie

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

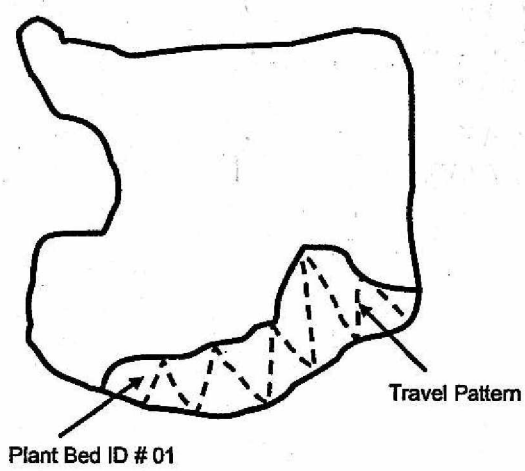
ORGANIZATION: V3 - EB, JJ	DATE: 8/11/06

SITE INFORMATION		SITE COORDINATES
Plant Bed ID: 12	Waterbody Name: Lake Max	Center of the Bed
Bed Size:		Latitude:
Substrate: Silty	Waterbody ID:	Longitude:
Marl? 0	Total # of Species	Max. Lakeward Extent of Bed
High Organic? 0	CanopyAbundance at Site	Latitude:
	S: 4 N: 0 F: 0 E: 0	Longitude:

SPECIES INFORMATION ↳ incl algae, 1

Species Code	Abundance	QE	Vchr.	Ref. ID
CHAR	2			
NAFL	2			
POGR8	2			
Potnat	1			
VAAM3	2			
NAMA	3			
ALGA	~~2~~ 1			

Individual Plant Bed Survey



Comments:

Island in north part of lake, east of main peninsula

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 - FB, JJ		DATE: 8/7/06	
SITE INFORMATION			**COORDINATES**
Plant Bed ID: 13/14	Waterbody Name: Lake Max		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? 0	**CanopyAbundance at Site**	Latitude:	
	S: 4 N: 0 F: 0 E: 0	Longitude:	

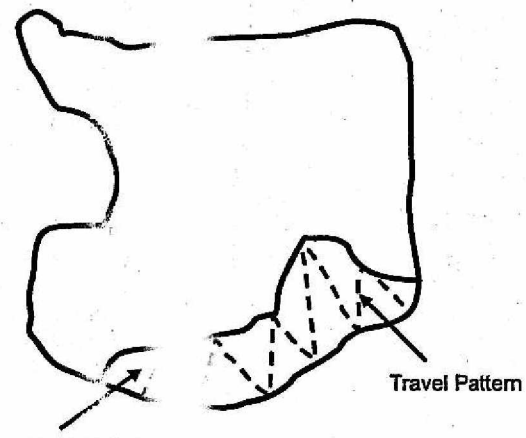
SPECIES INFORMATION 4 w/ algae, 1

Species Code	Abundance	QE	Vchr.	Ref. ID
~~VAAM3~~				
~~MYSP2~~				
~~POPE6~~				
NAMA	3	0	0	
CHAR	3	2	0	
ALGA	1	3	0	
NAMA	2	0	0	
CHAR	3	2	0	
POPE6	2	0	0	
VAAM3	1	0	0	
NAFL	2	0	0	
POGR8	1	0	0	

Bed 13

Bed 14

Individu ant Bed Survey



Comments:

~~[illegible]~~

Island in NE part of lake
9-20' vegetated

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 sus
2 = Genus sus
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 ___

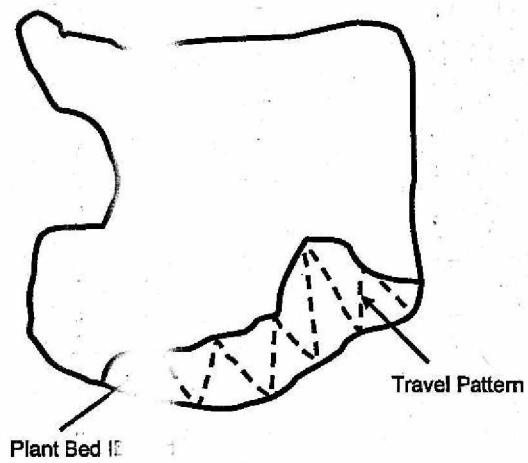
State of Indiana Department of Natural Resources

ORGANIZATION: V3 - EB, JJ		**DATE:** 8/10/06	
SITE INFORMATION			**ITE COORDINATES**
Plant Bed ID: 15	**Waterbody Name:** Lake Max		Center of the Bed
Bed Size:		**Latitude:**	
Substrate: Silty	**Waterbody ID:**	**Longitude:**	
Marl? 1	**Total # of Species**	N	Lakeward Extent of Bed
High Organic? 0	**CanopyAbundance at Site**	**Latitude:**	
	S: 2 N: 0 F: 0 E: 0	**Longitude:**	

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
POIL	1			
CHAR	1			
ALGA	1			
NAMA	2			
VAAM3	1			

Indiv Plant Bed Survey



Comments:

Atoll in SE 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 defin
1 = Species
2 = Genus ected
3 = Unknow

Voucher:
0 = Not Take
1 = Taken, r rified
2 = Taken, v

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 ___

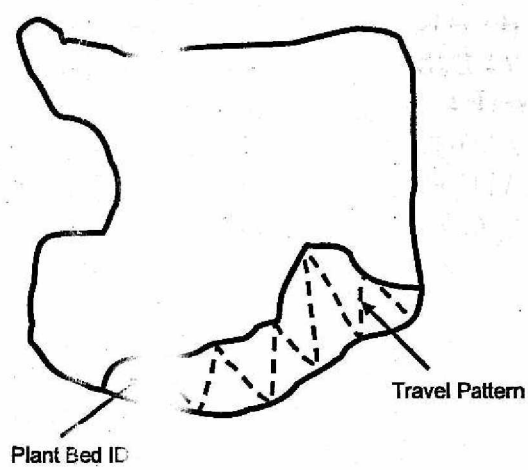
State of Indiana Department of Natural Resources

ORGANIZATION:	V3 - EB, JJ	**DATE:**	8/10/06
SITE INFORMATION		**TE COORDINATES**	
Plant Bed ID: 16	Waterbody Name: Lake Max		Center of the Bed
Bed Size:		Latitude:	
Substrate: Silt	Waterbody ID:	Longitude:	
Marl? 1	Total # of Species	M	akeward Extent of Bed
High Organic? 0	**CanopyAbundance at Site**	Latitude:	
	S: 3 N: 0 F: 0 E: 0	Longitude:	

SPECIES INFORMATION ↳ incl algae, 1

Species Code	Abundance	QE	Vchr.	Ref. ID
NAFL	2			
ALGA	1			
CHAR	2			
POPE6	2			
NAMA	2			
~~LEMI3~~				
POIL	1			
~~PONO2~~				
VAAM3	1			
POGR8	1			

Indiv **Plant Bed Survey**



Comments:

Atoll in SE part of lake
9-20' ~~big~~ down

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 define
1 = Species
2 = Genus cted
3 = Unknown

Voucher:
0 = Not Taker
1 = Taken, no fied
2 = Taken, va

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

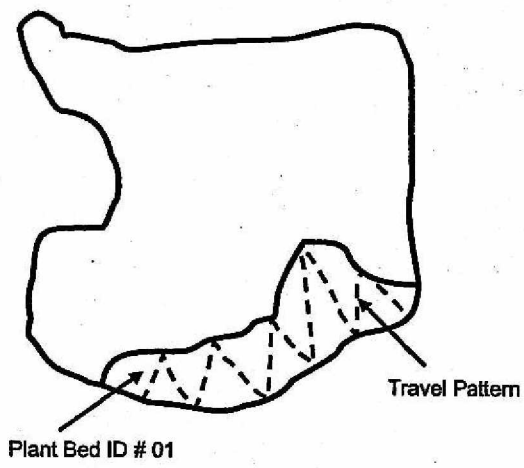
ORGANIZATION: V3 - JJ, EB	DATE: 8/8/06

SITE INFORMATION					SITE COORDINATES
Plant Bed ID: 17	Waterbody Name: Lake Max				Center of the Bed
Bed Size:					Latitude:
Substrate: Silty	Waterbody ID:				Longitude:
Marl? 1	Total # of Species 5				Max. Lakeward Extent of Bed
High Organic? 0	CanopyAbundance at Site				Latitude:
	S: 3	N: 0	F: 0	E: 0	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
CHAR	2	2	0	
NAMA	2	0	0	
POGR8	1	0	0	
NAFL	1	0	0	
POPE6	1	0	0	

Individual Plant Bed Survey



Comments:

Atoll in NE part 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

Aquatic Vegetation Plant Bed Data Sheet

Page ___ of ___

State of Indiana Department of Natural Resources

ORGANIZATION: V3

DATE: 8/7/06

SITE INFORMATION

Plant Bed ID: 18	Waterbody Name: Lake Max
Bed Size:	
Substrate: Silty	Waterbody ID:
Marl? 1 0	Total # of Species 6
High Organic? 0	

CanopyAbundance at Site

S: ~~3~~ 4 N: 0 F: 0 E: 0

SITE COORDINATES

Center of the Bed

Latitude:

Longitude:

Max. Lakeward Extent of Bed

Latitude:

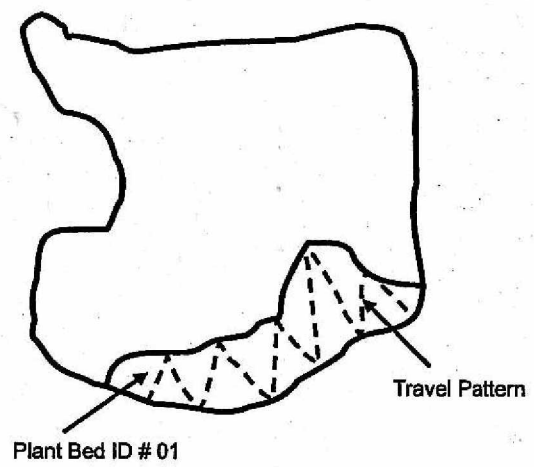
Longitude:

SPECIES INFORMATION

4 w/ algae; 1

Species Code	Abundance	QE	Vchr.	Ref. ID
CHAR	2	2	0	
POPE6	2	0	0	
NAFL	3	0	0	
NAMA	1	0	0	
ALGA	1	3	0	
POGR8	1	0	0	

Individual Plant Bed Survey



Comments:

Water Quality Data 8/7/06
16:30 PM, Partly Cloudy
Water Temp 28.5°C pH 8.80
Turbidity 0.10 NTU DO 8.83 mg/L
Cond 410 µmho/cm air temp 30°C
Sp. Cond 385 µmho/cm Secchi 9'
Salinity 0.2 ppt

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

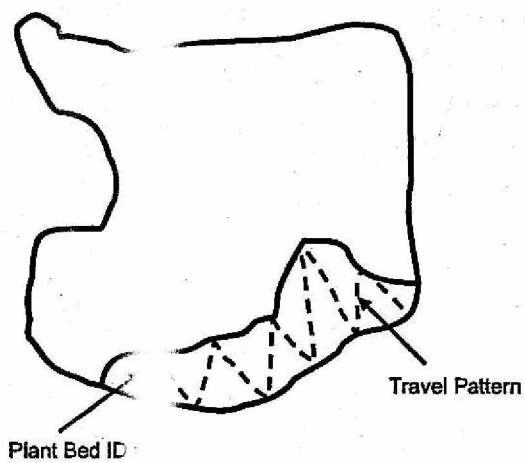
ORGANIZATION: V3 – ER, JJ	DATE: 8/10/06

SITE INFORMATION					SITE COORDINATES
Plant Bed ID: 19	Waterbody Name: Lake Max				Center of the Bed
Bed Size:					Latitude:
Substrate: silty	Waterbody ID:				Longitude:
Marl? 1 0	Total # of Species				Lakeward Extent of Bed
High Organic? 0	CanopyAbundance at Site				Latitude:
	S: 3	N: 0	F: 0	E: 0	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
VAAM3	2			
NAFL	2			
NAMA	1			
CHAR	2			
POPE6	2			

Individual Plant Bed Survey



Comments:

Island in SE portion 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 s
2 = Genus s cted
3 = Unknown

Voucher:
0 = Not Taken
1 = Taken, no fied
2 = Taken, var

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

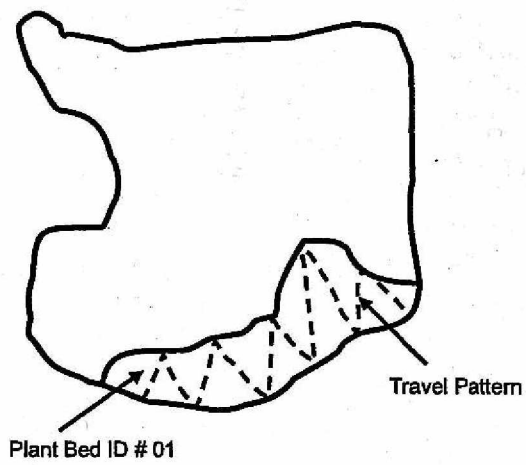
ORGANIZATION: V3 - EB, JJ	DATE: 8/10/06

SITE INFORMATION					SITE COORDINATES
Plant Bed ID: 20	Waterbody Name: Lake Max				Center of the Bed
Bed Size:					Latitude:
Substrate: Silty	Waterbody ID:				Longitude:
Marl? 1 0	Total # of Species				Max. Lakeward Extent of Bed
High Organic? 0	CanopyAbundance at Site				Latitude:
	S: 4	N: 0	F: 0	E: 0	Longitude:

SPECIES INFORMATION

Species Code	Abundance	QE	Vchr.	Ref. ID
NITE	2	2		
MYSP2	3	0		
CEDE4	2	0		
POCR3	1	0		

Individual Plant Bed Survey



Comments:

Atoll in SE part of lake
15-20' Deep

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 = <20%
3 = 21-99%
5 = 100%+

APPENDIX A

Submersed Aquatic Plant Survey Form

WATER BODY NAME Lake Max
COUNTY Marshall
DATE 8/8/06
CREW LEADER Ed B.
RECORDER Tim K.
SECCHI 9'
MAX PLANT DEPTH
WEATHER 82°F & partly cloudy
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
1			2'	0	NOAQVG										
2			19'	1	NAMA	1									
3			22'	1	NITE	1									
4			12'	1	NAMA	1	NAFL	1	VAAM3	1	CHAR	1			
5			3'	0	NOAQVG										
6			6'	1	CHAR	1	MISP2	1	VAAM3	1					
7			17'	1	NITE	1									
8			8'	3	MISP2	3									
9			4'	1	CHAR	1									
10			12'	3	NAMA	1	MISP2	1	NITE	1	NAFL	1	POPE6	1	
					POPU7	1	CHAR	1	POZO	1					
11			22'	1	NITE	1									
12			2'	0	NOAQVG										
13			6'	1	CHAR	1	NAFL	1	POGR8	1					
14			18'	1	NITE	1									
15			12'	3	POPE6	1	MISP2	3							
16			18'	3	NAMA	3	VAAM3	1	NAFL	1	POGR8	1	CHAR	1	
17			5'	0	NOAQVG										
18			17'	1	ALGA	1									
19			7'	1	POGR8	1	POPE6	1	NAFL	1	CHAR	1			
20			22'	1	ALGA	1									
21			4'	1	CHAR	1									
22			7'	1	NAFL	1									
23			12'	1	NAMA	1	VAAM3	1	CHARA	1	NAFL	1	ALGA	1	
24			2'	0	NOAQVG										
25			6'	0	NOAQVG										
26			3'	0	NOAQVG										
27			7'	1	POPE6	1									
28			4'	3	CHAR	3	NAFL	3	POPE6	1	VAAM3	1	POGR8	1	
					POZO	1									
29			4'	0	NOAQVG										
30			12	1	VAAM3	1									
Other plant species observed at lake															

Submersed Aquatic Plant Survey Form

WATER BODY NAME Lake Max
COUNTY Marshall
DATE 8/8/06
CREW LEADER Ed B
RECORDER Juli J.

SECCHI 9'
MAX PLANT DEPTH
WEATHER 82°F & partly cloudy
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
31			18'	1	ALGA	1								
32			11'	3	NAMA	1	POPE6	3	VAAM3	1	CH?AR	1	NAFL	1
—			—	—	POZO	1								
33			24'	0	NOAQVG									
34			17'	1	ALGA	1								
35			16'	1	ALGA	1	VAAM3	1	NAFL	1				
36			9'	3	POPE6	3	NAMA	1	CH?AR	1	VAAM3	1	NAFL	1
37			15'	3	POPE6	1	CH?AR	3	NAFL	1	VAAM3	1	NAMA	1
38			8'	3	NAFL	1	VAAM3	1	POPE6	1	CH?AR	1	NAMA	1
—			—	—	POGR8	1	ALGA	1						
39			14'	3	ELCA7	3	CH?AR	1	NAMA	1	NI?TE	1	ALGA	1
—			—	—	POZO	1								
40			13'	3	CH?RA	1	NAMA	3						
41			17'	1	VAAM3	1	CEDE4	1	NI?TE	1	NAFL	1	POPU7	1
42			3'	1	CH?RA	1								
43			3'	0	NOAQVG									
44			22'	1	VAAM3	1								
45			8'	1	CH?RA	1								
46			3'	0	NOAQVG									
47			14'	3	VAAMS	1	NI?TE	1	DOPU7	1	MISP2	3		
48			16'	3	ALGA	1	NI?TE	1	VAAMS	1	CH?RA	1	NAMA	3
					POPE6	1	POZO	1						
49			16'	1	NAMA	1	CH?RA	1	ALGA	1				
50			11'	3	NAMA	3	CH?RA	1	NAFL	1	POPE6	1	VAAM3	1
51			22'	1	ALGA	1								
52			7'	0	NOAQVG									
53			4'	0	NOAQVG									
54			4'	1	CH?RA	1								
55			9'	1	ALGA	1								
56			13'	3	CH?RA	3	VAAM3	1	NAMA	1				
57			17'	1	CH?RA	1	VAAM3	1	NAFL	1	NAMA	1		
58			12'	3	NAMA	3	CH?RA	1	POPE6	1	VAAMS	1	NAFL	3
Other plant species observed at lake														

APPENDIX A

Submersed Aquatic Plant Survey Form

Page 3 of

WATER BODY NAME	Lake Max	SECCHI	9'
COUNTY	Marshall	MAX PLANT DEPTH	
DATE	8/10/06	WEATHER	foggy → thunderstorms
CREW LEADER	Ed B.	COMMENTS	
RECORDER	Juli J.		

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
59			22'	1	NI?TE	1									
60			14'	1	NI?TE	1	NAMA	1							
61			6'	3	CH?AR	1	POGR8	1	NAFL	1					
62			4'	0	NOAQVG										
63			19'	1	ALGA	1									
64			12'	1	POPE6	1	NAFL	1	VAAM3	1	POGR8	1	NAMA	1	
—					CH?AR	1									
65			7'	3	NAMA	3	POPE6	1							
66			4'	1	POGR8	1	NAFL	1							*
67			3'	0	NOAQVG										
Bed 2 68			16'	3	NAMA	1	POZO	1	NI?TE	1					
69			14'	1	NI?TE	1	NAMA	1							
70			7'	1	POGR8	1	NAMA	1	NAFL	1	CH?AR	1			
71			14'	1	POPE6	1									
72			23'	1	ALGA										
73			17'	1	NI?TE	1									
74			13'	1	NAFL	1	ALGA	1							
75			12'	3	Potnat	3	POGR8	1	VAAM3	1					
76			6'	1	CH?AR	1	POZO	1	NAMA	1					
77			23'	3	NI?TE	3									
78			7'	1	POGR8	1	CH?AR	1							
79			3'	1	CH?AR	1									
80			4'	1	CH?AR	1	NAFL	1							
81			2'	0	NOAQVG										
82			4'	1	VAAM3	1									
83			7'	3	POPE6	3	ALGA	1							
84			2'	1	CH?AR	1									
85			12'	3	NAMA	3	NAFL	1	VAAM3	1	CH?AR	1	POPE6	1	
86			17'	3	NAMA	3	NI?TE	1							
87			9'	1	ALGA	1									
88			8'	1	NAMA	1									
89			3'	0	NOAQVG										
Other plant species observed at lake															

Submersed Aquatic Plant Survey Form

WATER BODY NAME: Lake Max
COUNTY: Marshall
DATE: 8/10/06
CREW LEADER: EdB
RECORDER: Julie J.
SECCHI: 9'
MAX PLANT DEPTH:
WEATHER: foggy → thunderstorms
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
90			8'	1	NAFL	1	POGR8	1							
91			16'	1	NAFL	1	ALGA	1							
92			17'	3	NAMA	3	NAFL	1	ALGA	1					
93			12'	1	NAMA	1	NAFL	1	ALGA	1					
94			22'	1	NAMA	1	POGR8	1							
95			18'	3	NAMA	3	POZO	1							
96			7'	1	CH?AR	1	NAFL	1	POGR8	1	NAMA	1			
97			4'	1	CH?AR	1									
98			12'	3	CH?AR	1	NAMA	1							
99			9'	1	POPEG	1	POGR8	1							
100			16'	1	CH?AR	1	NAMA	1	NAFL	1	POPEG	1	ALGA	1	

Other plant species observed at lake

Lake Maxinkuckee Aquatic Plant Management Plan Update - 2006
Tier II Sampling, August 2006

Tier II Sampling Location Number	Latitude	Longitude
1	41.20531667	-86.41403333
2	41.20828333	-86.41156667
3	41.20811667	-86.41370000
4	41.20730000	-86.41520000
5	41.20545000	-86.41771667
6	41.20836667	-86.41735000
7	41.20970000	-86.41661667
8	41.21053333	-86.41728333
9	41.21040000	-86.42010000
10	41.21150000	-86.41861667
11	41.21265000	-86.41733333
12	41.21435000	-86.42071667
13	41.21523333	-86.41816667
14	41.21498333	-86.41676667
15	41.21645000	-86.41633333
16	41.21653333	-86.41516667
17	41.21830000	-86.41651667
18	41.21540000	-86.41298333
19	41.21630000	-86.41390000
20	41.21688333	-86.41221667
21	41.21910000	-86.41160000
22	41.21838333	-86.41001667
23	41.21698333	-86.40863333
24	41.21978333	-86.40651667
25	41.21963333	-86.40416667
26	41.22173333	-86.40288333
27	41.22068333	-86.40026667
28	41.22131667	-86.39893333
29	41.21973333	-86.39795000
30	41.21810000	-86.40010000
31	41.21758333	-86.40130000
32	41.21790000	-86.40268333
33	41.21713333	-86.40381667
34	41.21701667	-86.40531667
35	41.21548333	-86.40543333
36	41.21291667	-86.40731667
37	41.21096667	-86.40923333
38	41.21021667	-86.41115000
39	41.21205000	-86.41156667
40	41.21423333	-86.40190000
41	41.21596667	-86.39825000
42	41.21700000	-86.39665000
43	41.21325000	-86.39618333
44	41.21183333	-86.39691667
45	41.21165000	-86.39491667
46	41.21128333	-86.39283333
47	41.21016667	-86.39358333
48	41.20898333	-86.39555000
49	41.20713333	-86.39653333
50	41.20750000	-86.39485000

Tier II Sampling Location Number	Latitude	Longitude
51	41.20611667	-86.39571667
52	41.20728333	-86.39256667
53	41.20673333	-86.39000000
54	41.20445000	-86.39003333
55	41.20543333	-86.39140000
56	41.20516667	-86.39313333
57	41.20290000	-86.39470000
58	41.20045000	-86.39988333
59	41.20370000	-86.41196667
60	41.20318333	-86.41013333
61	41.20235000	-86.41366667
62	41.20116667	-86.41593333
63	41.20026667	-86.41386667
64	41.19951667	-86.41570000
65	41.19698333	-86.41515000
66	41.19490000	-86.41506667
67	41.19118333	-86.41123333
68	41.19278333	-86.41206667
69	41.19491667	-86.40970000
70	41.19661667	-86.40881667
71	41.19803333	-86.41070000
72	41.19828333	-86.40826667
73	41.19626667	-86.40596667
74	41.19838333	-86.40530000
75	41.19228333	-86.40516667
76	41.19138333	-86.40716667
77	41.19055000	-86.40398333
78	41.18945000	-86.40401667
79	41.18818333	-86.40461667
80	41.18638333	-86.40156667
81	41.18553333	-86.39718333
82	41.18683333	-86.39383333
83	41.18801667	-86.39541667
84	41.19045000	-86.39523333
85	41.19201667	-86.39825000
86	41.19210000	-86.40115000
87	41.19345000	-86.40250000
88	41.18996667	-86.39953333
89	41.19383333	-86.39406667
90	41.19570000	-86.39530000
91	41.19406667	-86.39753333
92	41.19755000	-86.39641667
93	41.19850000	-86.39563333
94	41.19810000	-86.39913333
95	41.19923333	-86.39911667
96	41.20065000	-86.39425000
97	41.19901667	-86.39228333
98	41.20798333	-86.40050000
99	41.20988333	-86.39965000
100	41.20913333	-86.40610000

APPENDIX II

CALCULATIONS

Lake Maxinkuckee - Tier II Aquatic Plant Survey, 8-8-06

Site	Depth	No. Species	All Abund.	Aquatic Veg Species														AVE SP	AVE Native Sp
				ALGA	MYSP2	NAMA	CEDE4	CH?AR	ELCA7	NAFL	NI?TE	POGR8	POPE6	POPU7	POTNAT	POZO	VAAM3		
1	2	0	0															0	0
12	2	0	0															0	0
24	2	0	0															0	0
81	2	0	0															0	0
84	2	1	1					1										1	1
5	3	0	0															0	0
26	3	0	0															0	0
42	3	1	1					1										1	1
43	3	0	0															0	0
46	3	0	0															0	0
67	3	0	0															0	0
79	3	1	1					1										1	1
89	3	0	0															0	0
9	4	1	1					1										1	1
21	4	1	1					1										1	1
28	4	6	3					3		3		1	1			1	1	6	6
29	4	0	0															0	0
53	4	0	0															0	0
54	4	1	1					1										1	1
62	4	0	0															0	0
66	4	2	1							1		1						2	2
80	4	2	1					1		1								2	2
82	4	1	1														1	1	1
97	4	1	1					1										1	1
17	5	0	0															0	0
6	6	3	1		1			1									1	3	2
13	6	3	1					1		1		1						3	3
25	6	0	0															0	0
61	6	3	3					1		1		1						3	3
76	6	1	1			1		1								1		3	2
19	7	4	1					1		1		1	1					4	4
22	7	1	1							1								1	1
27	7	1	1										1					1	1
52	7	0	0															0	0
65	7	2	3			3							1					2	1
70	7	4	1			1		1		1		1						4	3
78	7	2	1					1				1						2	2
83	7	2	3	1									3					1	1
96	7	4	1			1		1		1		1						4	3
8	8	1	3		3													1	0
38	8	7	3	1		1		1		1		1	1				1	6	5
45	8	1	1					1										1	1
88	8	1	1			1												1	0
90	8	2	1							1		1						2	2
36	9	5	3			1		1		1			3				1	5	4
55	9	1	1	1														0	0
87	9	1	1	1														0	0
99	9	2	1									1	1					2	2
32	11	6	3			1		1		1			3			1	1	6	5
50	11	5	3			3		1		1			1				1	5	4
4	12	4	1			1		1		1							1	4	3
10	12	8	3		1	1		1		1	1		1	1		1		8	6
15	12	2	3		3								1					2	1
23	12	5	1	1		1		1		1							1	4	3
30	12	1	1														1	1	1
58	12	5	3			3		1		3			1				1	5	4
64	12	6	1			1		1		1		1	1				1	6	5
75	12	3	3									1			3		1	3	3
85	12	5	3			3		1		1			1				1	5	4
93	12	3	1	1		1				1								2	1
98	12	2	3			1		1										2	1
37	13	5	3			1		3		1			1				1	5	4
40	13	2	3			3		1										2	1
56	13	3	3			1		3									1	3	2
74	13	2	1	1						1								1	1
39	14	6	3	1		1		1	3		1					1		5	4
47	14	4	3		3						1			1			1	4	3
60	14	2	1			1					1							2	1
69	14	2	1			1					1							2	1
71	14	1	1										1					1	1
16	16	5	3			3		1		1		1					1	5	4
35	16	3	1	1						1							1	2	2
48	16	7	3	1		3		1			1		1			1	1	6	5
49	16	3	1	1		1		1										2	1
68	16	3	3			1					1					1		3	2
91	16	2	1	1						1								1	1
100	16	5	1	1		1		1		1			1					4	3
7	17	1	1								1							1	1
18	17	1	1	1														0	0
34	17	1	1	1														0	0
41	17	5	1				1			1	1			1			1	5	5
57	17	4	1			1		1		1							1	4	3
73	17	1	1								1							1	1
86	17	2	3			3					1							2	1
92	17	3	3	1		3				1								2	1
14	18	1	1								1							1	1
31	18	1	1	1														0	0
95	18	2	3			3										1		2	1
2	19	1	1			1												1	0
63	19	1	1	1														0	0
3	22	1	1								1							1	1
11	22	1	1								1							1	1
20	22	1	1	1														0	0
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51	22	1	1	1														0	0
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72	23	1	1	1														0	0
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33	24	0	0															0	0
AVE		2.13	1.37	1.00	2.20	1.59	1.00	1.16	3.00	1.13	1.13	1.00	1.32	1.00	3.00	1.00	1.00	1.94	1.55
Standard Error		0.19															**Standard Error**	0.19	0.16
																	SUM	194.00	155.00
																	SPECIES DIVERSITY INDEX	0.99	0.99
FRQ COUNT				21.00	5.00	34.00	1.00	38.00	1.00	30.00	16.00	15.00	19.00	3.00	1.00	8.00	23.00	74.00	71.00
SITE FRQ				21.00	5.00	34.00	1.00	38.00	1.00	30.00	16.00	15.00	19.00	3.00	1.00	8.00	23.00	74.00	71.00
REL FRQ				28.38	6.76	45.95	1.35	51.35	1.35	40.54	21.62	20.27	25.68	4.05	1.35	10.81	31.08	100.00	100.00
DENSITY				21.00	11.00	54.00	1.00	44.00	3.00	34.00	18.00	15.00	25.00	3.00	3.00	8.00	23.00	194.00	155.00
AVE DENSITY				1.00	2.20	1.59	1.00	1.16	3.00	1.13	1.13	1.00	1.32	1.00	3.00	1.00	1.00	2.62	2.18
REL DENSITY				0.21	0.11	0.54	0.01	0.44	0.03	0.34	0.18	0.15	0.25	0.03	0.03	0.08	0.23	1.94	1.55
DOMINANCE INDEX				4.20	2.20	10.80	0.20	8.80	0.60	6.80	3.60	3.00	5.00	0.60	0.60	1.60	4.60	38.80	31.00

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: Lake Maxinkuckee Aquatic Plant Management Plan	
BASE LAYER: USGS Topographic Map		PROJECT NO.: 06085	EXHIBIT: I	SHEET: 1 OF: 1
CLIENT: Lake Maxinkuckee Environmental Council, P.O. Box 187, Culver, Indiana 46854		QUADRANGLE: Culver, Rutland	DATE: 10-31-06	SCALE: 1" = 2,500'

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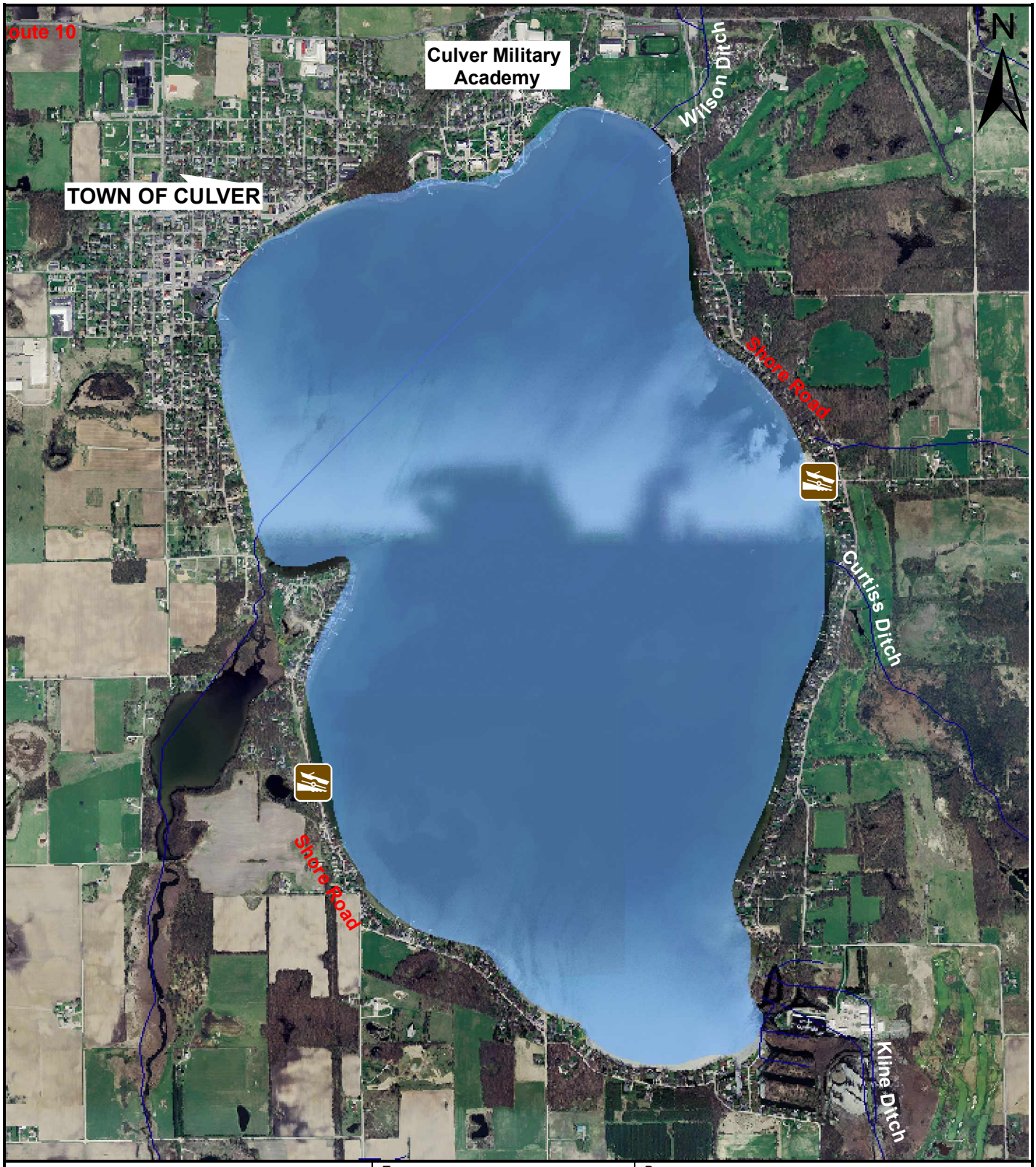

V3 Companies
9601 N. Industrial Dr.
Suite A
St. John, IN 46373
219.558.8850 phone
219.558.8851 fax
www.v3co.com

TITLE: Lake Vicinity Aerial Map	PROJECT: Lake Maxinkuckee Aquatic Plant Management Plan		
BASE LAYER: Indiana Spatial Data Service 2005 Orthophotography	PROJECT NO. 06085	EXHIBIT: II	SHEET: 1 OF: 1
CLIENT: Lake Maxinkuckee Environmental Council P.O. Box 187 Culver, Indiana 46854	QUADRANGLE: n/a	DATE: 11/2/06	SCALE: 1" = 2000'

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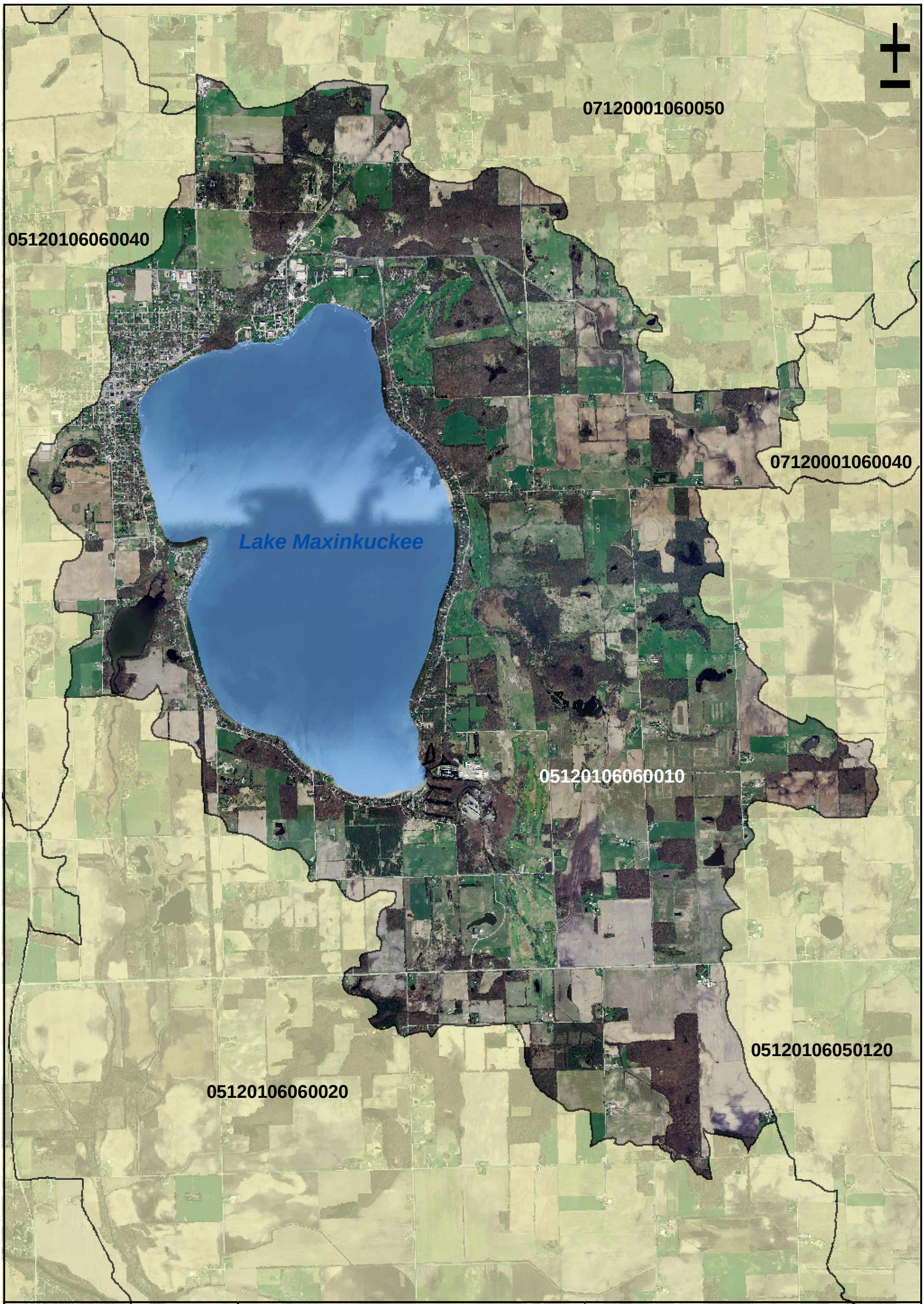

V3 Companies
9601 N. Industrial Dr.
Suite A
St. John, IN 46373
219.558.8850 phone
219.558.8851 fax
www.v3co.com

TITLE: Lake Maxinkuckee Watershed		PROJECT: Lake Maxinkuckee Aquatic Plant Management Plan	
BASE LAYER: Indiana Spatial Data Service 2005 Othophotography		PROJECT NO.: 06085	EXHIBIT: III	SHEET: 1 OF: 1
Client: Lake Maxinkuckee Environmental Council, P.O. Box 187, Culver, Indiana 46854		FILE NAME: n/a	DATE: 10/31/06	SCALE: 1" = 2,500'

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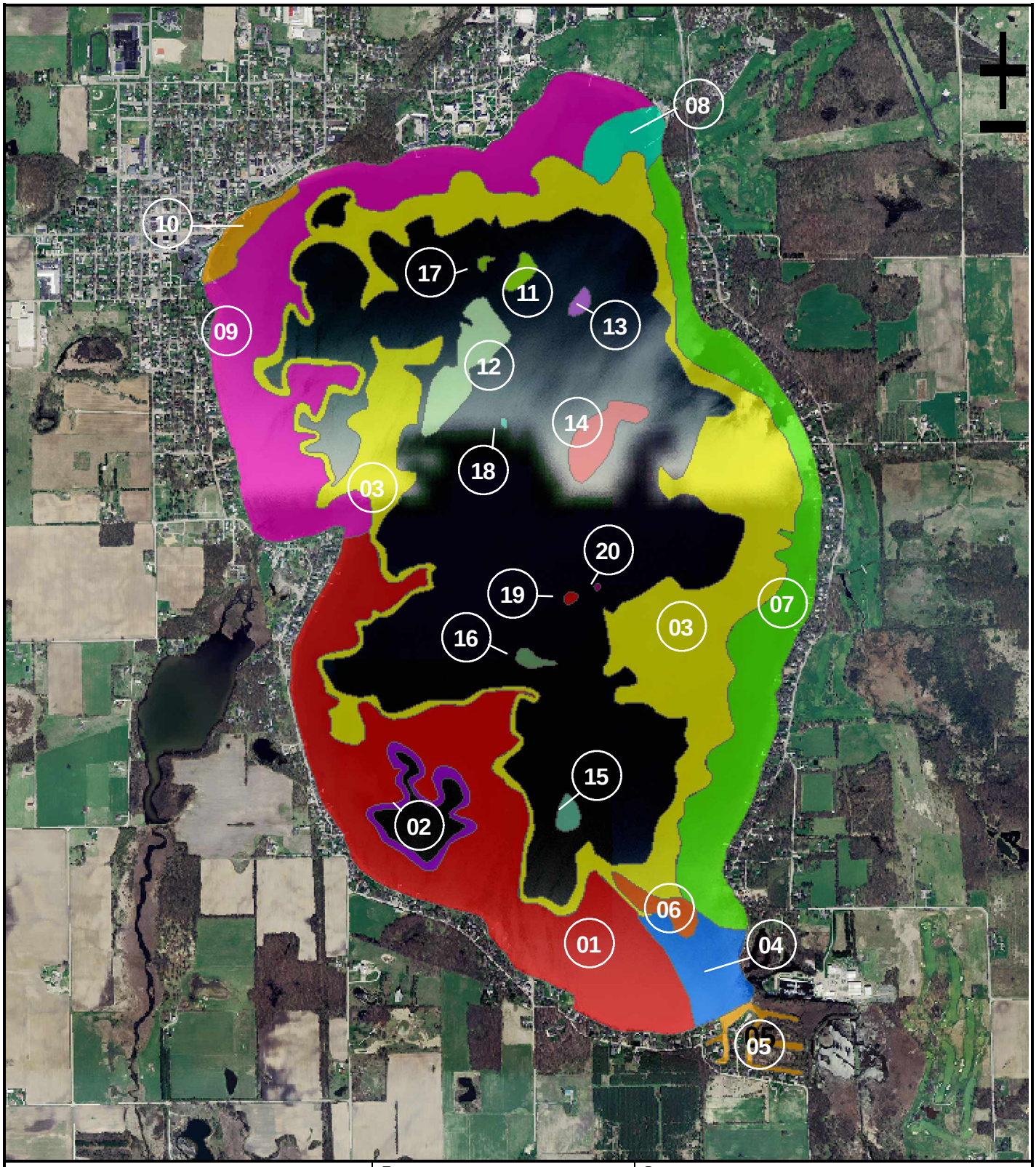

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9601 N. Industrial Dr.
Suite A
St. John, IN 46373
219.558.8850 phone
219.558.8851 fax
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TITLE: **Aquatic Plant Beds 2006 Sampling**	PROJECT: **Lake Maxinkuckee Aquatic Plant Management Plan**		
BASE LAYER: Indiana Spatial Data Service 2005 Orthophotography	PROJECT NO. 06085	EXHIBIT: IV	SHEET: 1 OF: 1
CLIENT: Lake Maxinkuckee Environmental Council P.O. Box 187 Culver, Indiana 46854	QUADRANGLE: n/a	DATE: 11/3/06	SCALE: 1" = 2000'

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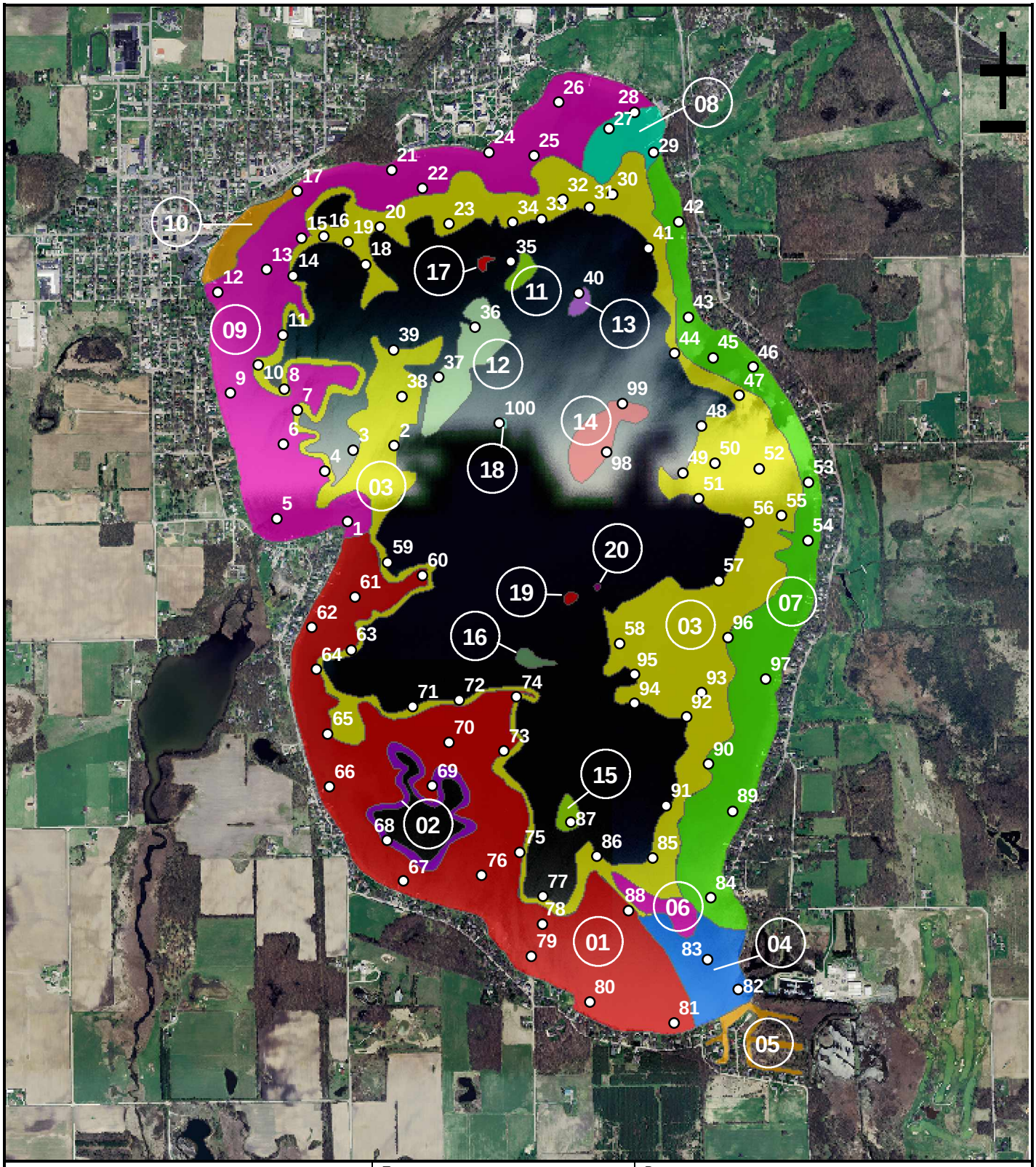

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9601 N. Industrial Dr.
Suite A
St. John, IN 46373
219.558.8850 phone
219.558.8851 fax
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TITLE: **Tier II Sampling Locations (2006)**		PROJECT: **Lake Maxinkuckee Aquatic Plant Management Plan**	
BASE LAYER: Indiana Spatial Data Service 2005 Orthophotography	PROJECT NO. 06085	EXHIBIT: V	SHEET: 1 OF: 1
CLIENT: Lake Maxinkuckee Environmental Council P.O. Box 187 Culver, Indiana 46854	QUADRANGLE: n/a	DATE: 11/3/06	SCALE: 1" = 2000'

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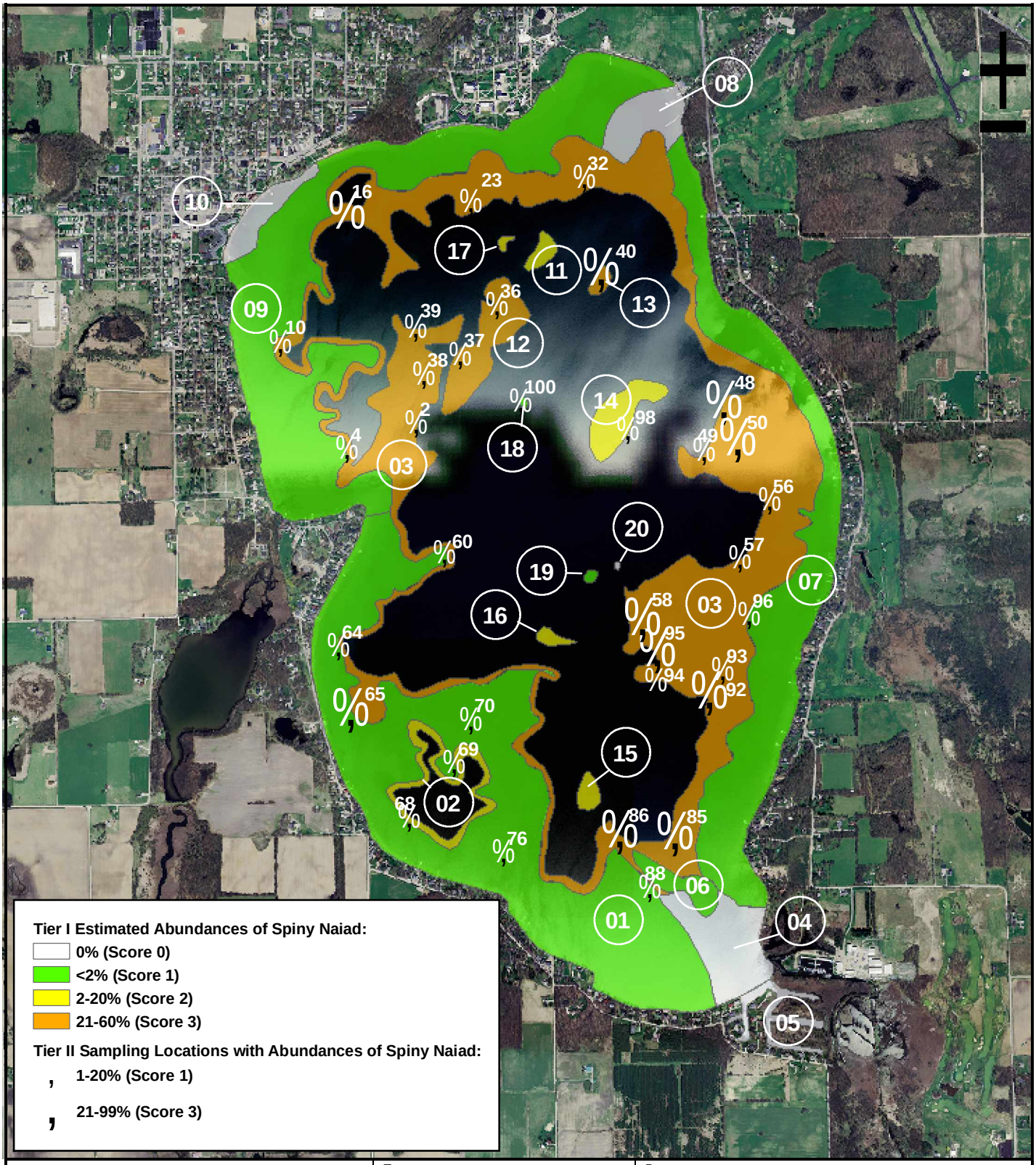

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St. John, IN 46373
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219.558.8851 fax
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TITLE: Tier I & Tier II (2006) Spiny Naiad Results		PROJECT: Lake Maxinkuckee Aquatic Plant Management Plan	
BASE LAYER: Indiana Spatial Data Service 2005 Orthophotography	PROJECT NO. 06085	EXHIBIT: VI	SHEET: 1 OF: 1
CLIENT: Lake Maxinkuckee Environmental Council P.O. Box 187 Culver, Indiana 46854	QUADRANGLE: n/a	DATE: 11/3/06	SCALE: 1" = 2000'

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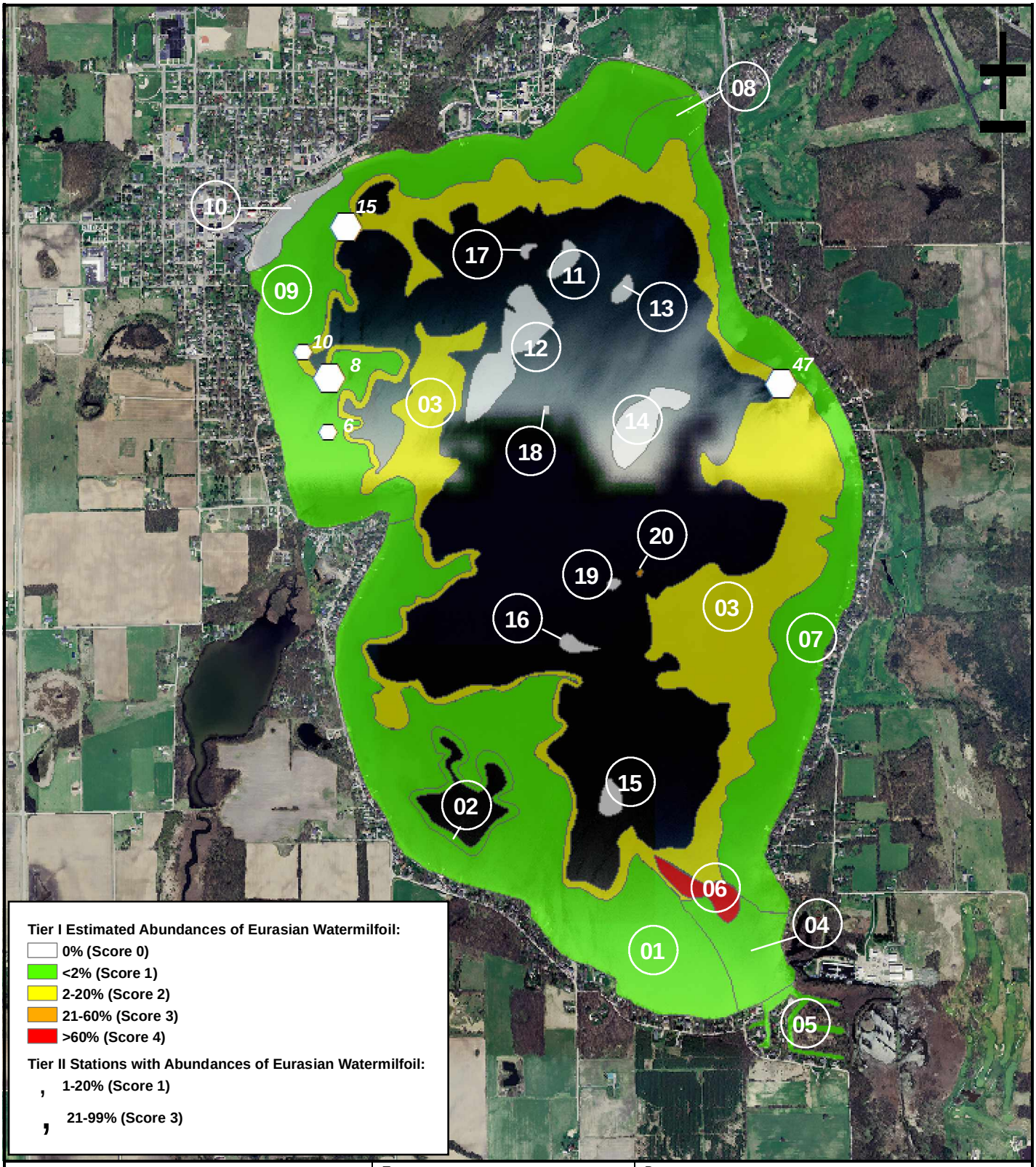

V3 Companies
9601 N. Industrial Dr.
Suite A
St. John, IN 46373
219.558.8850 phone
219.558.8851 fax
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TITLE: **Tier I and II (2006) Eurasian Watermilfoil Results**	PROJECT: **Lake Maxinkuckee Aquatic Plant Management Plan**		
BASE LAYER: Indiana Spatial Data Service 2005 Orthophotography	PROJECT NO. 06085	EXHIBIT: VII	SHEET: 1 OF: 1
CLIENT: Lake Maxinkuckee Environmental Council P.O. Box 187 Culver, Indiana 46854	QUADRANGLE: n/a	DATE: 11/3/06	SCALE: 1" = 2000'

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APPENDIX IV

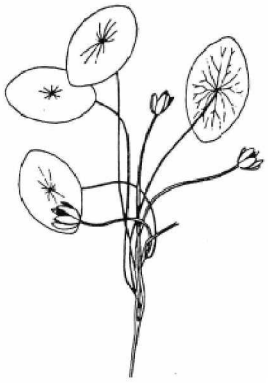
SPECIES LIST

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.

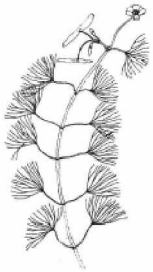
Chara

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.

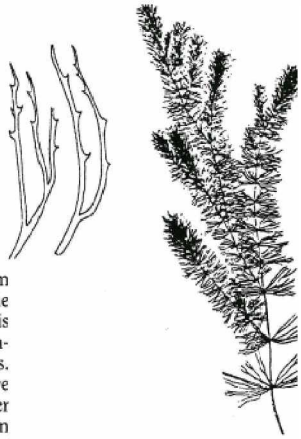


Fanwort
(Cabomba spp.)

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*)

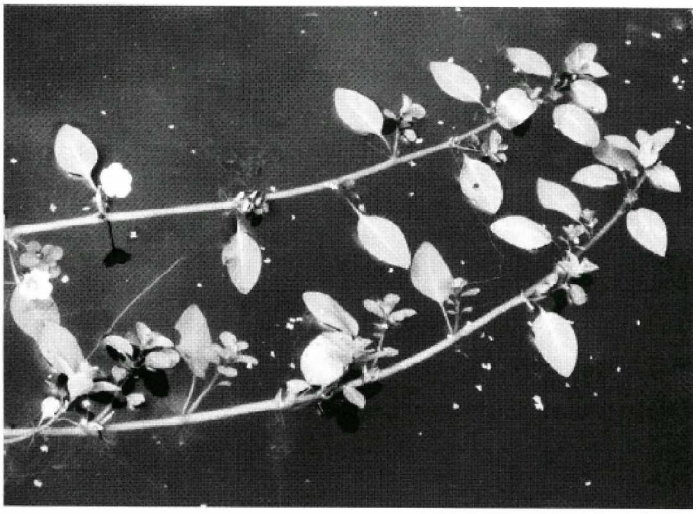
The common name of coontail comes from the resemblance of a branch of the plant to the tail of a raccoon. It is also called hornwort. This plant grows entirely under water and has a central hollow stem with thread-like forked leaves. The stems may be 20 feet long. Extensive growths of coontail resemble 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.

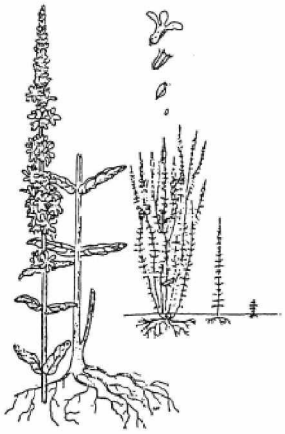
Water Willow
(Justica americana)

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)

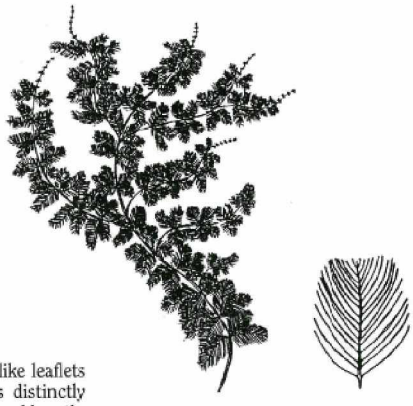
Purple loosestrife is an erect, perennial, wetland herb-type plant introduced from northern Europe. In recent years, it has become a serious threat to native emersed vegetation in Illinois. This aggressive weed out-competes surrounding vegetation, forming pure stands which are of little value. The plant 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).

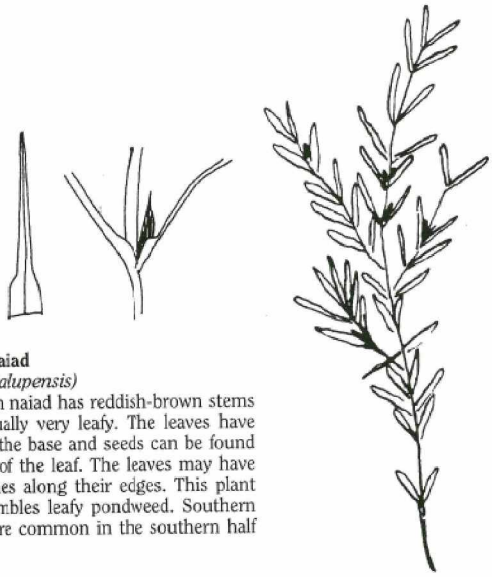
Water Milfoil
(Myriophyllum spp.)

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.



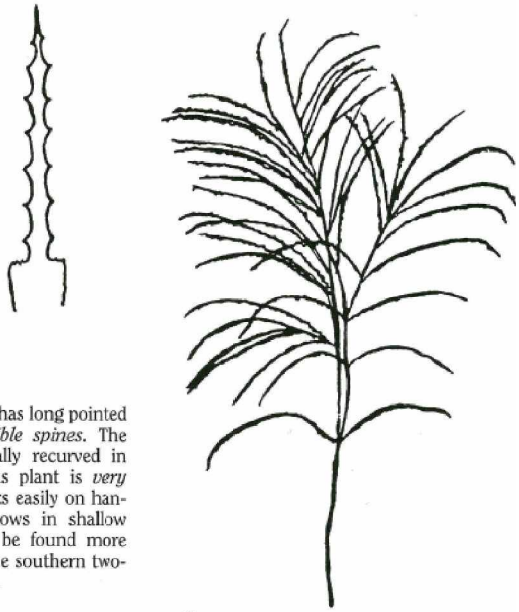
Eurasian Milfoil
(Myriophyllum spicatum)

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.



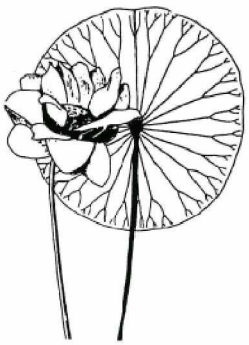
Southern Naiad
(Najas guadalupensis)

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.



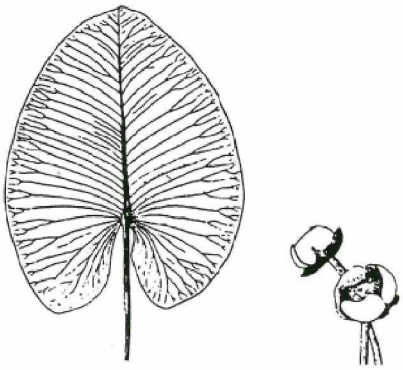
Brittle Naiad
(Najas minor)

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.



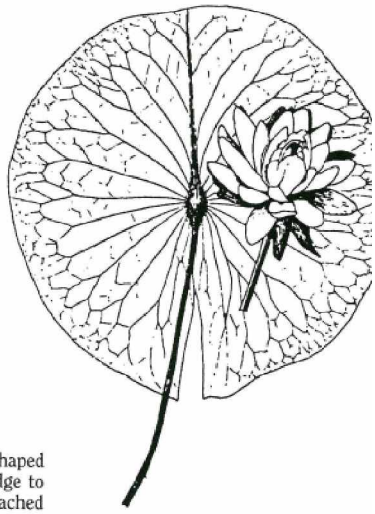
American Lotus
(Nelumbo lutea)

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.)

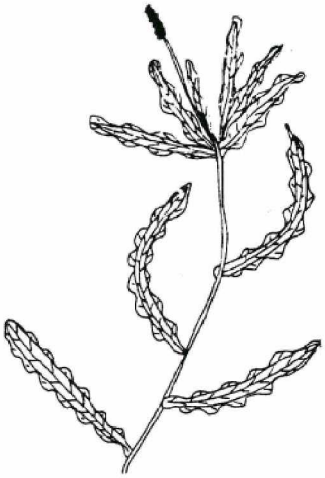
Water lilies have large circular-shaped floating leaves with a *slit* from the edge to the center of the leaf. The stem is attached to the center of the leaf from which veins radiate. The veins are branched or subdivided at the edge of the leaf. This plant produces a pink or white flower that *floats* 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.

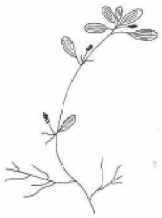
Largeleaf Pondweed
(Potamogeton amplifolius)

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)

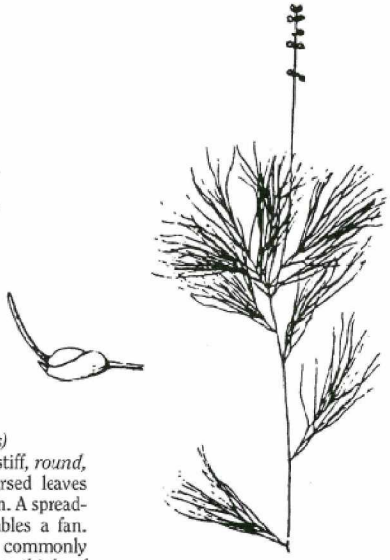
Illinois pondweed has long and narrow submersed leaves and wide oval-shaped floating leaves. This pondweed can be found throughout Illinois.

Floatingleaf Pondweed
(Potamogeton natans)

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

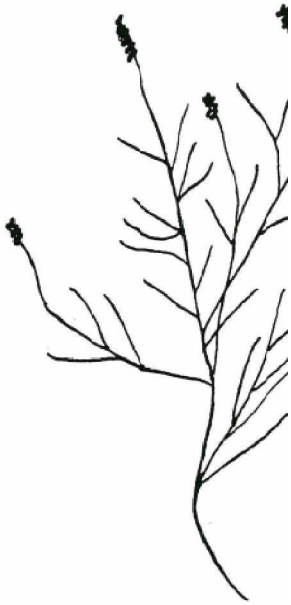
American Pondweed
(Ponamogeton nodosus)

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.



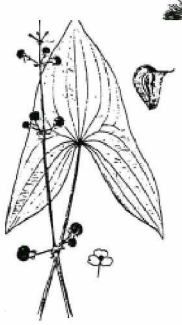
Small Pondweed
(Potamogeton pusillus)

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.

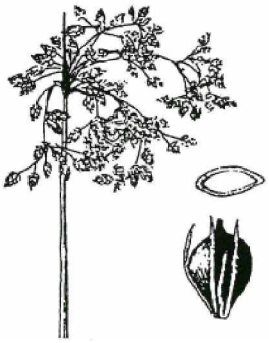


Arrowhead
(Sagittaria spp.)

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.)

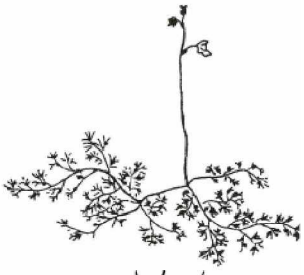
There are several species of bulrush, and they all grow in shallow water along shorelines. They may have triangular- or round-shaped stems and may be leafy or have no leaves at all but just long slender stems. The long stems usually will have a cluster of brownish flowers and seeds at the end of the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

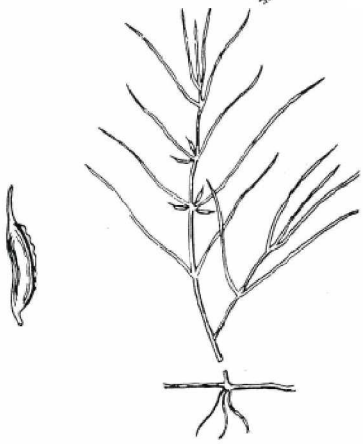
Bladderwort has stems that float horizontally beneath the water surface and may extend three feet or more. The leaves are alternate and divided many times. Some of the leaf segments have *bladders* on them that assist in floatation of the plant. This plant blooms from July through August with yellow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

PESTICIDE USE RESTRICTIONS

APPENDIX V – 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 VI

RESOURCES FOR
AQUATIC VEGETATION MANAGEMENT

APPENDIX VI – 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 VII

STATE REGULATIONS RELEVANT TO AQUATIC PLANT MANAGEMENT

APPENDIX VII – 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*