Long Lake Aquatic Plant Management Plan

Prepared for
Long Lake Protection and Rehabilitation District

November 2007

Long Lake Aquatic Plant Management Plan

Prepared for
Long Lake Protection and Rehabilitation District

November 2007

BARR

4700 West 77th Street
Minneapolis, MN 55435-4803
Phone: (952) 832-2600
Fax: (952) 832-2601

Long Lake Aquatic Plant Management Plan

Table of Contents

List of Tables

List of Figures

List of Appendices

1.0 Executive Summary

The completion of the Long Lake Aquatic Plant Management Plan has been a several year process. The idea for an aquatic plant management plan began with the response of residents to a survey in 2001 when a total of 81 percent of residents indicated a lake management goal of decreasing weed growth was important to them. An aquatic plant survey completed in 2000 substantiated the residents' concerns. In 2005 the District Board responded to residents' concerns by voting to complete an aquatic plant survey and an aquatic plant management plan, subject to approval by District residents. The proposed project was approved by District residents during the 2005 annual meeting and completed during 2007.

Long Lake notes problematic algal blooms throughout the summer months and notes problematic curlyleaf pondweed (CLP) growth during the early summer period. The Long Lake Water Quality Management Plan (Barr 2003) determined that curlyleaf pondweed senescence comprises 33 percent of the lake's annual total phosphorus load. The plan concluded that management of curlyleaf pondweed is necessary to attain the lake's water quality improvement goal. Hence, the Long Lake Aquatic Plant Management Plan not only addresses residents' desire to manage the lake's aquatic plants, but also is essential to the attainment of the lake's water quality goals.

Results of the 2007 aquatic plant survey indicates a total of 22 aquatic plant species were observed in Long Lake. A comparison of 2007 and 2000 data indicate diversity in 2007 was improved from 2000. Floristic quality was relatively unchanged during the 2000 through 2007 period and was slightly below the state median. The FQI of Long Lake was 21.79 in 2007 and the state median is 22.2. Phytoplankton frequency and density increased during the 2000 through 2007 period. The increase resulted from increased algal mats on the lake bottom and increased algae in the lake's water column during 2007.

Survey data confirmed that CLP was a problematic species in need of management. CLP was the most frequently occurring species in 2007 and, depending upon the sample method, either the densest species (transect method of collection) or the second densest species (point intercept method). In 2007 CLP covered 97 acres, which is 75 percent of the lake's littoral zone. A comparison of 2000 and 2007 data indicate CLP coverage has remained relatively stable during this period. Degrading CLP adds phosphorus to the lake annually and degrades the lake's water quality.

The Long Lake Aquatic Plant Management (APM) Plan outlines management practices required to attain the lake's water quality goal, manage problematic growths of curlyleaf pondweed, and sustain the lake's beneficial uses. The APM Plan is divided into 2 sections, a long-term improvement program and an annual maintenance program.

The long-term improvement program is comprised of a series of intensive, annual chemical treatments to Long Lake to reduce CLP and improve the water quality of the lake. A permit must be obtained from the Wisconsin Department of Natural Resources (WDNR) before treatment can begin. Treatments will occur in early spring to maximize treatment effectiveness and to minimize impact upon native species. The herbicide Endothall (Aquathol K) will be used at a dose rate of 1.0 to 1.5 mg/L. Treatment will occur only at depths greater than 3 feet to avoid disturbing the lake's fishery while they are spawning. A total of 87 acres will be treated during the first year of treatment. Treatment areas during subsequent years are not known at this time. Curlyleaf pondweed turions (similar to seeds) in the lake's sediments are expected to grow annually during the next several years. Areas of the lake in which turions grow will need to be treated. An annual early spring survey will determine curlyleaf pondweed coverage and the area to be treated.

Each July, an aquatic plant survey of Long Lake will monitor the overall health of the lake. The survey results will indicate the response of the lake's native plant community to treatment. Natives are expected to grow in treated areas, thus displacing curlyleaf pondweed.

The cost of the first year of treatment and monitoring is expected to be approximately $50,000, but can range from $50,000 to $65,000 depending upon Endothall dose which can range from 1.0 to 1.5 mg/L. The cost of subsequent years of treatment will depend upon the area treated.

The Long Lake annual maintenance program is comprised of the treatment of navigation channels when nuisance conditions occur. Treatment will only occur when a severe impairment or nuisance condition occurs (i.e., when a boat cannot go through the vegetation and it is not possible to go around the vegetation). A permit must be obtained from the WDNR before treatment can begin. Documentation of impairment of navigation by native plants will be provided to WDNR concurrently with the application for a treatment permit.

2.0 Introduction

Long Lake (see Figure 1) is considered a significant water resource by the Long Lake Protection and Rehabilitation District, the Wisconsin Department of Natural Resources (WDNR), Polk County Land and Water Resources Department, and area residents. The lake is located in Polk County, Wisconsin and comprises a surface area of approximately 277 acres. The lake is relatively shallow, noting a maximum depth of 18 feet. Although the lake has no stream inlet or outlet, two ditches (along with overland flow from other areas of the watershed) add stormwater to the lake during storm events.

Long Lake notes problematic algal blooms throughout the summer months. The lake also notes problematic curlyleaf pondweed growth during the early summer period. In recognition of the lake's value and current water quality problems, the Long Lake Protection and Rehabilitation District completed a study of the lake over the course of six project phases. This work culminated in a lake management plan whose primary objective is the improvement of Long Lake's water quality.

The Long Lake Water Quality Management Plan (Barr 2003) identified curlyleaf pondweed as a major contributor to the lake's water quality problems. In 2000, approximately 33 percent of the lake's annual phosphorus load resulted from curlyleaf pondweed degradation. The plan concluded that management of curlyleaf pondweed is necessary to attain the lake's water quality improvement goal. Long Lake residents were surveyed in 2001 to determine desired lake management goals. Respondents indicated improving the lake's water quality and decreasing weed growth were important lake management goals. In response to resident's desires and the need to manage curlyleaf pondweed to attain the lake's water quality goals, an aquatic plant survey was completed in 2007. This report presents the survey results and an aquatic plant management plan for Long Lake.

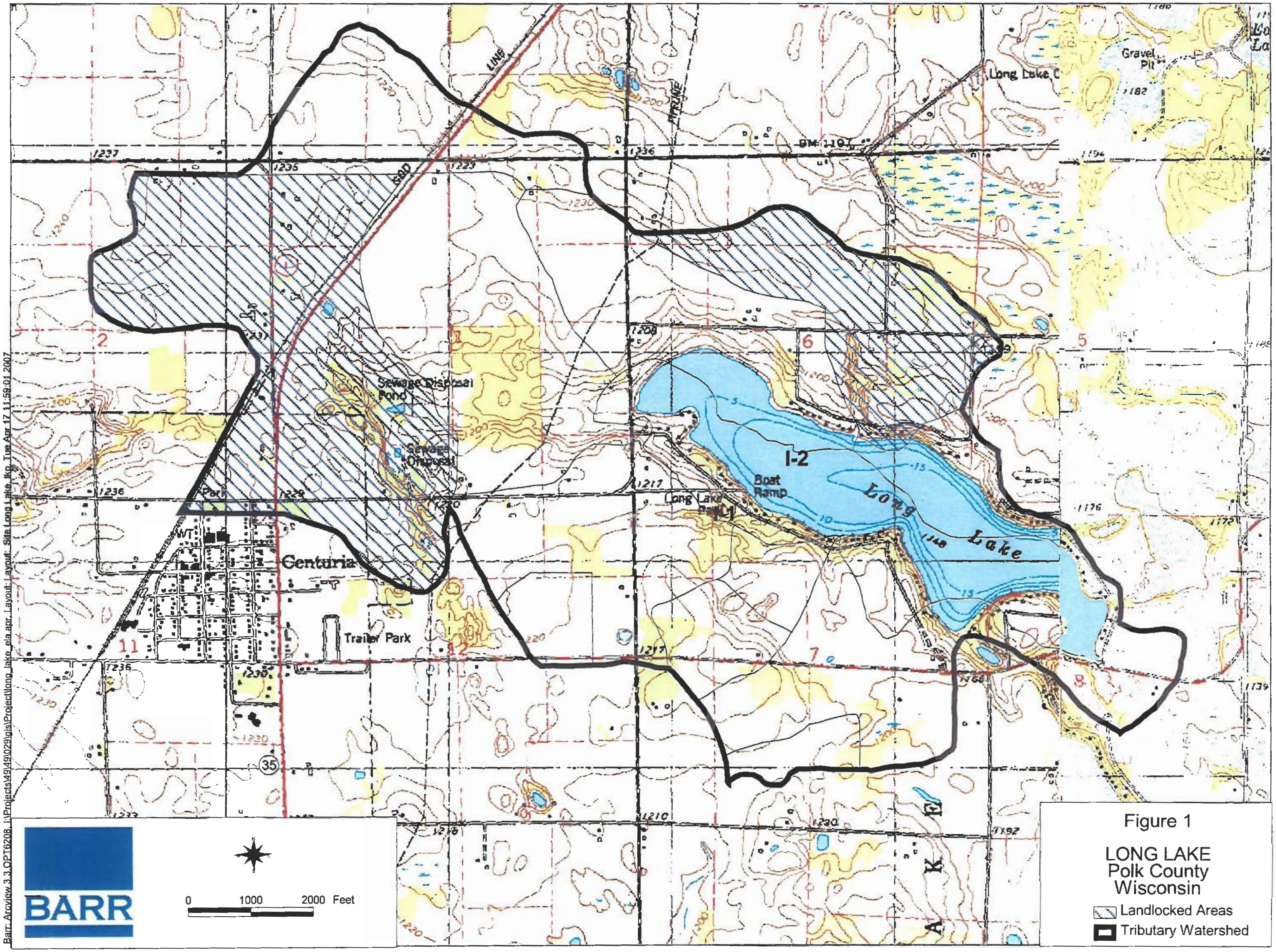


Figure 1
LONG LAKE
Polk County
Wisconsin
Landlocked Areas
Tributary Watershed
0 1000 2000 Feet
BARR
Long Lake
I-2
Boat Ramp
Long Lake Park
Sewage Disposal Pond
Sewage Disposal
Centuria
Trailer Park
Park
Gravel Pit
Long Lake C
Barr: Arcview 3.3, OPT6208, I:\Projects\49\49\029\gis\Project\long_lake_ela.apr, Layout: Layout: Site Long Lake, lkp, Tue Apr 17 11:59:01 2007

3.0 Overview of Aquatic Plant Growth in Lakes

The basis of the following text on macrophyte growth in lakes is Minnesota Department of Natural Resources (MDNR) *A Guide to Aquatic Plants Identification and Management* (1994).

3.1 Location of Aquatic Plant Growth Within Lakes and Impoundments

Within a lake, pond, or impoundment, aquatic plants grow in the area known as the littoral zone—the shallow transition zone between dry land and the open water area of the lake. The littoral zone extends from the shore to a depth of about 15 feet, depending on water clarity. The littoral zone is highly productive. The shallow water, abundant light, and nutrient-rich sediment provide ideal conditions for plant growth. Aquatic plants, in turn, provide food and habitat for many animals such as fish, frogs, birds, muskrats, turtles, insects, and snails. Protecting the littoral zone is important for the health of a lake's fish and other animal populations.

The width of the littoral zone often varies within a lake and among lakes. In places where the slope of the lake bottom is steep, the littoral area may be narrow, extending several feet from the shoreline. In contrast, if the lake is shallow and the bottom slopes gradually, the littoral area may extend hundreds of feet into the lake or may even cover it entirely. Impoundments frequently note extensive littoral areas in the upper portion due to sedimentation and shallow depths. In contrast, the lower portions of impoundments may have little littoral area.

Cloudy or stained water, which limits light penetration, may restrict plant growth. In lakes where water clarity is low all summer, aquatic plants will not grow throughout the littoral zone, but will be restricted to the shallow areas near shore.

Other physical factors also influence the distribution of plants within a lake or pond. For example, aquatic plants generally thrive in shallow, calm water protected from heavy wind, wave, or ice action. However, if the littoral area is exposed to the frequent pounding of waves, plants may be scarce. In a windy location, the bottom may be sand, gravel, or large boulders—none of which provides a good place for plants to take root. In areas where a stream or river enters a lake, plant growth can be variable. Nutrients carried by the stream may enrich the sediments and promote plant growth; or, suspended sediments may cloud the water and inhibit growth.

3.1.1 Categories of Aquatic Plants

Aquatic plants are grouped into four major categories:

- Algae have no true roots, stems, or leaves and range in size from tiny, one-celled organisms to large, multi-celled plant-like organisms, such as *Chara*. Plankton algae, which consist of free-floating microscopic plants, grow throughout both the littoral zone and the well-lit surface waters of an entire lake. Other forms of algae, including *Chara* and some stringy filamentous types (such as *Cladophora*), are common only in the littoral area.

- Submersed plants have stems and leaves that grow entirely underwater, although some may also have floating leaves. Flowers and seeds on short stems that extend above the water may also be present. Submerged plants grow from near shore to the deepest part of the littoral zone and display a wide range of plant shapes. Depending on the species, they may form a low-growing "meadow" near the lake bottom, grow with lots of open space between plant stems, or form dense stands or surface mats.

- Floating-leaf plants are often rooted in the lake bottom, but their leaves and flowers float on the water surface. Water lilies are a well-known example. Floating leaf plants typically grow in protected areas where there is little wave action.

- Emergent plants are rooted in the lake bottom, but their leaves and stems extend out of the water. Cattails, bulrushes, and other emergent plants typically grow in wetlands and along the shore, where the water is less than 4 feet deep.

3.1.2 Value of Aquatic Plants

Aquatic plants are a natural part of most lake communities and provide many benefits to fish, wildlife, and people. In lakes, life depends—directly or indirectly—on water plants. They are the primary producers in the aquatic food chain, converting the basic chemical nutrients in the water and soil into plant matter, which becomes food for all other aquatic life. Aquatic plants serve many important functions, including:

- ***Provide fish food***—More food for fish is produced in areas of aquatic vegetation than in areas where there are no plants. Insect larvae, snails, and freshwater shrimp thrive in plant beds. Sunfish eat aquatic plants besides aquatic insects and crustaceans.

- ***Offer fish shelter***—Plants provide shelter for young fish. Because bass, sunfish, and yellow perch usually nest in areas where vegetation is growing, certain areas of lakes are protected and posted by the DNR as fish spawning areas during spring and early summer. Northern pike use aquatic plants, too, by spawning in marshy and flooded areas in early spring.

- ***Improve water quality***—Certain water plants, such as rushes, can actually absorb and break down polluting chemicals.

- ***Protect shorelines and lake bottoms***—Aquatic plants, especially rushes and cattails, dampen the force of waves and help prevent shoreline erosion. Submerged aquatic plants also weaken wave action and help stabilize bottom sediment.

- ***Provide food and shelter for waterfowl***—Many submerged plants produce seeds and tubers (roots), which are eaten by waterfowl. Bulrushes, sago pondweed, and wild rice are especially important duck foods. Submerged plants also provide habitat to many insect species and other invertebrates that are, in turn, important foods for brooding hens and migrating waterfowl.

- ***Improve aesthetics***—The visual appeal of a lakeshore often includes aquatic plants, which are a natural, critical part of a lake community. Plants such as water lilies, arrowhead, and pickerelweed have flowers or leaves that many people enjoy.

- ***Provide economic value***—As a natural component of lakes, aquatic plants support the economic value of all lake activities. Wisconsin has a huge tourism industry centered on lakes and the recreation they support. Residents and tourists spend large sums of money each year to hunt, fish, camp, and watch wildlife on and around the state's lakes.

4.0 Compilation of Existing Information

4.1 Long Lake Water Quality Management Plan

During 2000 through 2003, the Long Lake Protection and Rehabilitation District completed the Long Lake Water Quality Management Plan. The project was comprised of six project phases. A summary of the project follows:

Phase 1: An aquatic plant survey of the lake was conducted in mid-June, 2000 in order to characterize the type and extent of aquatic plant coverage in the lake. Barr Engineering Company completed the aquatic plant survey, with assistance from volunteers. In addition, a concentrated inflow point on the south side of the lake was monitored for flow and water quality constituents. Inflow monitoring was performed by volunteers.

Phase 2: A second concentrated inflow point on the north side of the lake was monitored for flow and water quality constituents. The monitoring was performed by volunteers.

Phase 3: A water quality survey of Long Lake was conducted during spring and summer, 2000 to establish the current water quality conditions of the lake. Samples were collected by volunteers. Volunteers also collected information on the daily lake levels and precipitation in and around the lake throughout the year. A membership survey intended to determine the lake residents' opinions about Long Lake's water quality and how they are affected by it was circulated and completed by residents as well.

Phase 4: The Long Lake watershed was delineated, surface runoff patterns were identified, and existing land uses and associated acreage were determined to estimate annual pollutant loadings from the watershed using standard runoff coefficients. All of the data gathered in Phases 1 through 3 of the project, as well as watershed land use information gathered during Phase 4, were used to estimate the lake's annual water and total phosphorus budgets.

Phase 5: A long term water quality goal was defined for the lake and various potential management scenarios that would control TP sources (watershed sources as well as curlyleaf pondweed and lake sediment loads) were evaluated. Sediment core experiments were conducted in order to determine the cost and benefit of a potential alum/lime slurry treatment of Long Lake.

Phase 6: In this final phase, the Long Lake management plan was completed, using the modeling results and sediment core experiment results from Phase 5 and the data, results and conclusions of Phases 1 through 4.

4.1.1 Phases 1 Through 4 Summary

Data collected during 2000 were evaluated to determine the lake's current water quality. The average summer total phosphorus concentration (92 μg/L) from the epilimnion (i.e., surface waters) of Long Lake was within the hypereutrophic (i.e., extremely nutrient-rich) category, indicating the lake has the potential for problematic algal blooms throughout the summer period. Figure 2 shows the TP concentration in Long Lake during 2000. The estimated TP concentration in Long Lake prior to human settlement can be estimated to be between 8 and 15 μg/L (Vighi and Chiaudani,1985.)

The lake's average summer chlorophyll *a* concentration (28 μg/L) from the epilimnion was within the hypereutrophic (i.e., very highly productive) category, indicating undesirable algal blooms occur during the summer period. The average summer Secchi disc measurement (1.2 meters) was within the eutrophic category, indicating the average recreational-use impairment during the summer period was moderate. Secchi disc measurements during mid-July through August were within the hypereutrophic category and indicated moderate to severe recreational use-impairment.

Good water quality was noted during the early summer and poor water quality was noted during the mid-through late-summer period. Of particular interest are the significant increases in epilimnetic (surface water) phosphorus concentrations in late-June and again in mid-August. Late-June epilimnetic increases coincided with the die-off of curlyleaf pondweed within the lake. Mid-August epilimnetic phosphorus increases coincided with an apparent lake mixing event in which phosphorus-rich bottom waters were added to the lake's epilimnion (surface waters).

The watershed tributary to Long Lake is approximately 1,279 acres or approximately 5 times the surface area of the lake (i.e., approximately 277 acres). The lake's watershed is largely agricultural (74 percent), but also has significant amounts of open space (8 percent) and residential areas (17 percent).

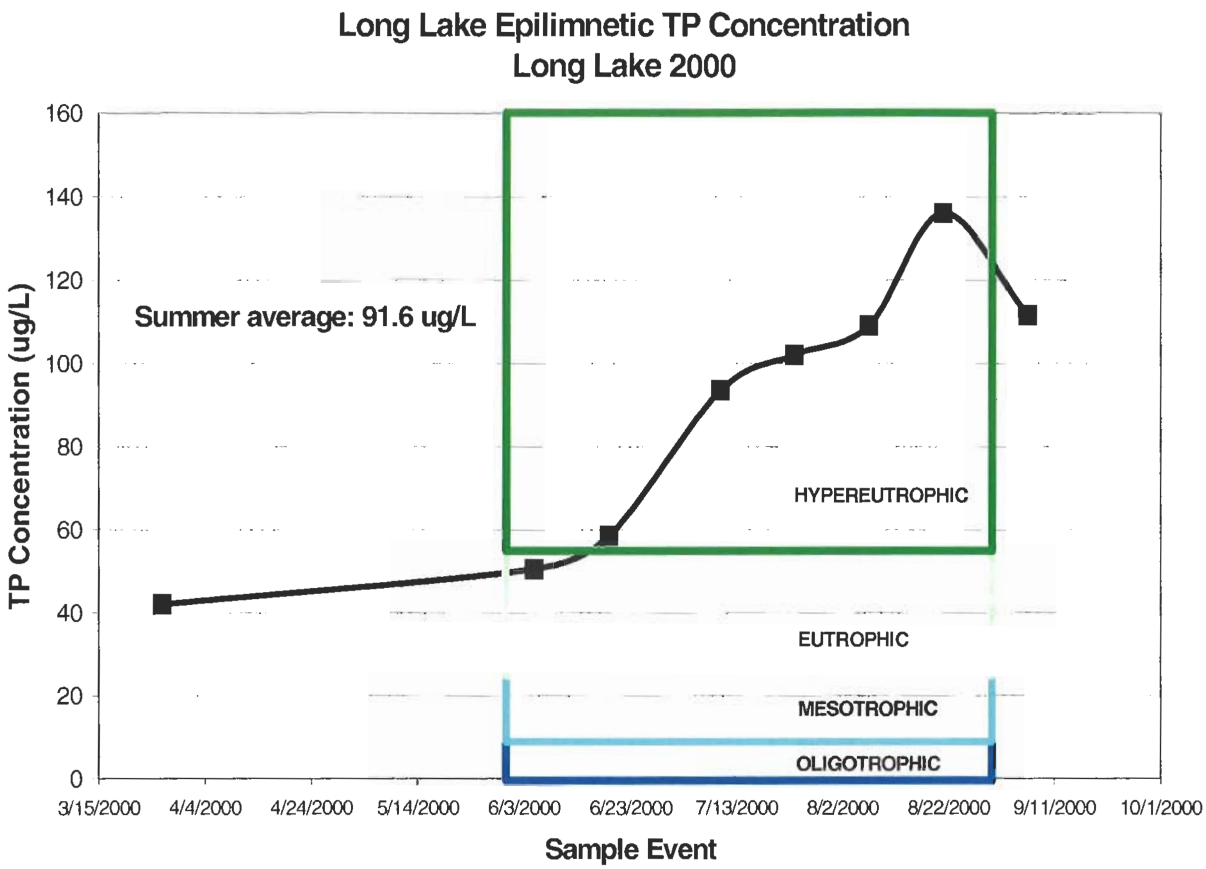


Figure 2

Figure 2. Long Lake Epilimnetic Total Phosphorus Concentration Long Lake 2000

The lake's annual hydrologic budget indicates Long Lake receives water from three sources:

- Direct precipitation on the lake – 622 acre-feet (57 percent)
- Watershed runoff – 431 acre-feet (39 percent) (includes 392 acre-feet from snowmelt runoff)
- Net groundwater inflow – 39 acre-feet (4 percent)

Figure 3 shows the contribution of each of these water sources graphically.

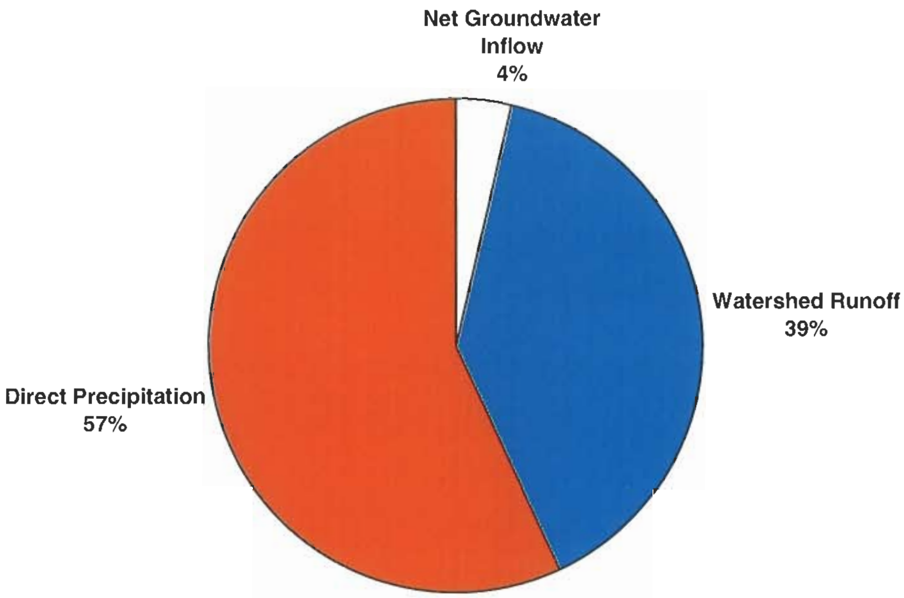


Figure 3 Long Lake Sources of Water 2000

Annual water loss is limited to evaporation and groundwater seepage, since the lake has no outlet.

The lake's estimated annual phosphorus budget indicates the total phosphorus load to Long Lake is 537 kilograms. Sources of phosphorus include:

- Agricultural and developed areas within the tributary watershed – 168 kg (31 percent)
- Septic systems around the lake – 24 kg (4 percent)
- Die-off of Curly leaf pondweed in late-June – 174 kg (33 percent)
- Internal load of phosphorus from the sediments in mid-August – 109 kg (20 percent)
- Atmospheric loading of phosphorus directly on the lake surface – 62 kg (12 percent)

Figure 4 shows the contribution of each of these TP sources graphically.

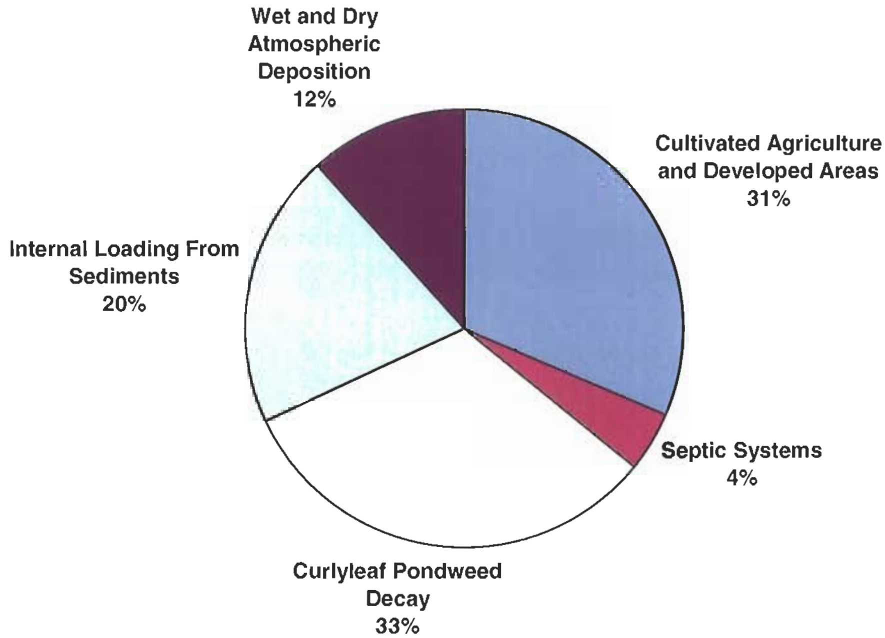


Figure 4. Long Lake Sources of Phosphorus 2000

A membership survey of 160 property owners around Long Lake was conducted in late 2001 to evaluate local impressions of the current and desired quality of the lake, the current and desired activities in the lake, and the desired lake management goals. Twenty six percent of the 160 property owners responded. Most the of the respondents considered the current clarity of the lake to be "cloudy" or "murky" as opposed to "clear" or "crystal clear". Ninety to one hundred percent of the respondents use the lake for fishing and/or viewing wildlife, and eighty to ninety percent use the lake for swimming and/or boating. Most of the respondents said that improving the lake's water quality (88%) and decreasing weed growth (81%) were important lake management goals.

4.1.2 Phases 5-6 Summary

Phases 5 and 6 included defining a long term water quality goal for the lake and evaluating various potential management scenarios that would control TP sources (watershed sources as well as curlyleaf pondweed and lake sediment loads). Sediment core experiments were conducted in order to determine the cost and benefit of a potential alum/lime slurry treatment of Long Lake. Finally, the

Long Lake management plan was completed, using the modeling results and sediment core experiment results from Phase 5 and the data, results and conclusions of Phases 1 through 4

The long-term water quality goal defined for Long Lake is an average summer epilimnetic (upper 6 feet) TP concentration not to exceed 45 μg/L. Figure 5 shows the estimated change in Long Lake's summer average total phosphorus concentration following a 90 percent reduction in phosphorus from sediment loading and a 90 percent reduction in phosphorus from curlyleaf pondweed decay. Achieving this water quality goal would result in a 50% reduction in TP and a corresponding 67% increase in transparency (See Figure 5).

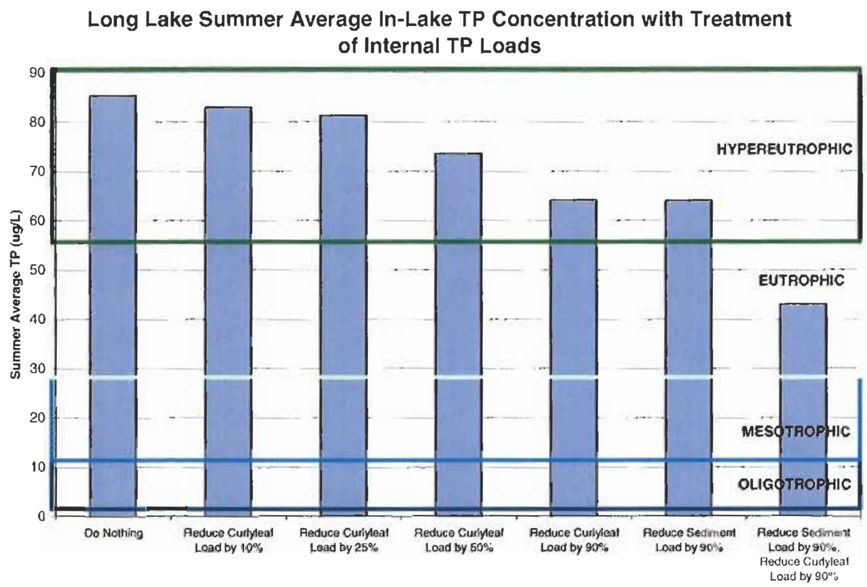


Figure 5. Long Lake Summer Average In-Lake Total Phosphorus Concentration With Treatment of Internal Loads

The lake's current water quality does not meet the lake's goal. If no action is taken at present, the lake's water quality would be expected to, at best, stay the same and, at worst, degrade further.

A long-term management plan for the lake identified management measures to attain the recommended water quality goal. Both an in-lake alum/lime slurry treatment and watershed best management practices (BMPs) are recommended for Long Lake. While watershed BMPs are good watershed stewardship, by themselves they may not make a significant impact on water quality within the lake because they only comprise approximately 30% of the overall TP load to the lake.

However, a combination of watershed measures (a stormwater ordinance, shoreland gardens, a septic system ordinance and additional watershed BMPs) and a reduction of internal phosphorus loading is expected to attain the water quality goal. Management of the lake's curlyleaf pondweed and an in-lake treatment to reduce internal loading from phosphorus rich sediment are the key to goal attainment. While aluminum salts (alum) have been used extensively throughout the world for decades, fewer lakes have received lime and alum/lime treatments. The idea behind a combined alum and lime treatment is that alum will bind and inactivate sediment phosphorus while lime buffers the alum. Calcium in the lime compound will also bind with a small portion of the available mobile phosphorus. Management of the lake's curlyleaf pondweed is addressed in this report, Long Lake Aquatic Plant Management Plan.

Following management of the lake's curlyleaf pondweed and an alum/lime treatment of the lake, the lake's average annual total phosphorus concentration is expected to be 45 µg/L. Benefits from the alum/lime treatment are estimated to last approximately 10 to 15 years.

4.2 Self Help Monitoring Data

Self-Help Monitoring data (i.e., Secchi disc water transparency data) were collected from Long Lake during 1992 through the present. The data indicate Long Lake seasonally notes water quality degradation during the summer. The lake's Secchi disc water transparency has generally ranged from 3 to 5 meters during the spring (i.e., May through early June period) and 0.5 to 0.8 meters during the late summer. Water transparency reduction following curlyleaf pondweed die-off has generally ranged from 1 to 3 meters (See Figure 6).

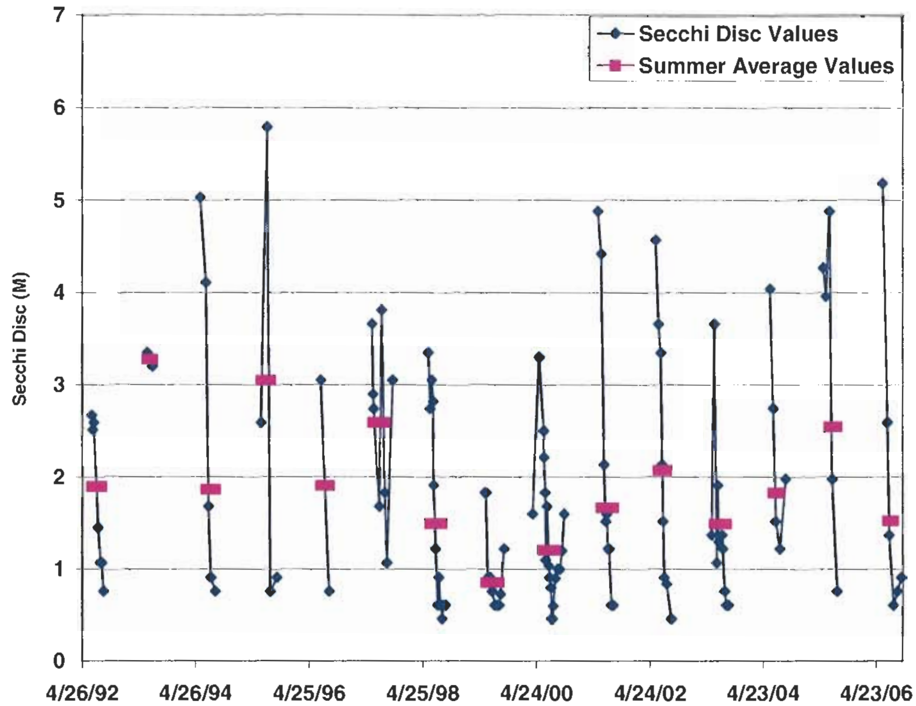


Figure 6. 1992-2006 Long Lake Secchi Disc Water Transparency

5.0 Methods

5.1 2007 Long Lake Aquatic Plant Survey

An aquatic plant survey was completed in Long Lake on June 8 through 10, 2007 to characterize existing conditions. The survey was completed by a Barr Engineering Company professional with assistance from Long Lake volunteers.

The Long Lake survey consisted of 2 separate surveys. One survey used line transect methodology. The second survey used point intercept methodology. The line transect methodology was the WDNR recommended method when the 2000 Long Lake aquatic plant survey was completed. The 2007 survey duplicated the 2000 survey. Since 2000, WDNR has changed methodology and currently recommends the point intercept methodology. Hence, a Long Lake point intercept survey was completed in 2007.

5.1.1 Line Transect Method

The 25 line transects monitored in Long Lake during 2000 were again monitored during 2007 to characterize existing conditions and to determine whether changes in the lake's plant community have occurred. The methodology is based upon Jessen and Lound (1962) and is outlined in *Wisconsin's Department of Natural Resources Long-Term Trend Lake Monitoring Methods*, (Bureau of Water Resources Management, July 1987) as modified by Deppe and Lathrop (1992). Methodology details follow:

In June, a total of 73 sample points located along 25 transects in Long Lake (See Figure 7) were surveyed. Transects extended from shore to the maximum depth of plant growth. GPS values from the 2000 sample locations were used to locate sample locations along transects during 2007.

Four rake samples were taken at each sample location to determine the species present and their abundance. The sample point at each sample location consisted of a 6-foot diameter circle divided into four quadrants. A tethered garden rake with an extended handle (16 feet) was used to collect a sample from each quadrant.

Collection of samples, identification of species, and determination of density ratings for each species occurred at all sampling points. A determination of overall plant density also occurred at all sampling points. The rake coverage technique was used to assign density ratings (Deppe and Lathrop 1992) in accordance with the criteria shown in Table 1.

BARR

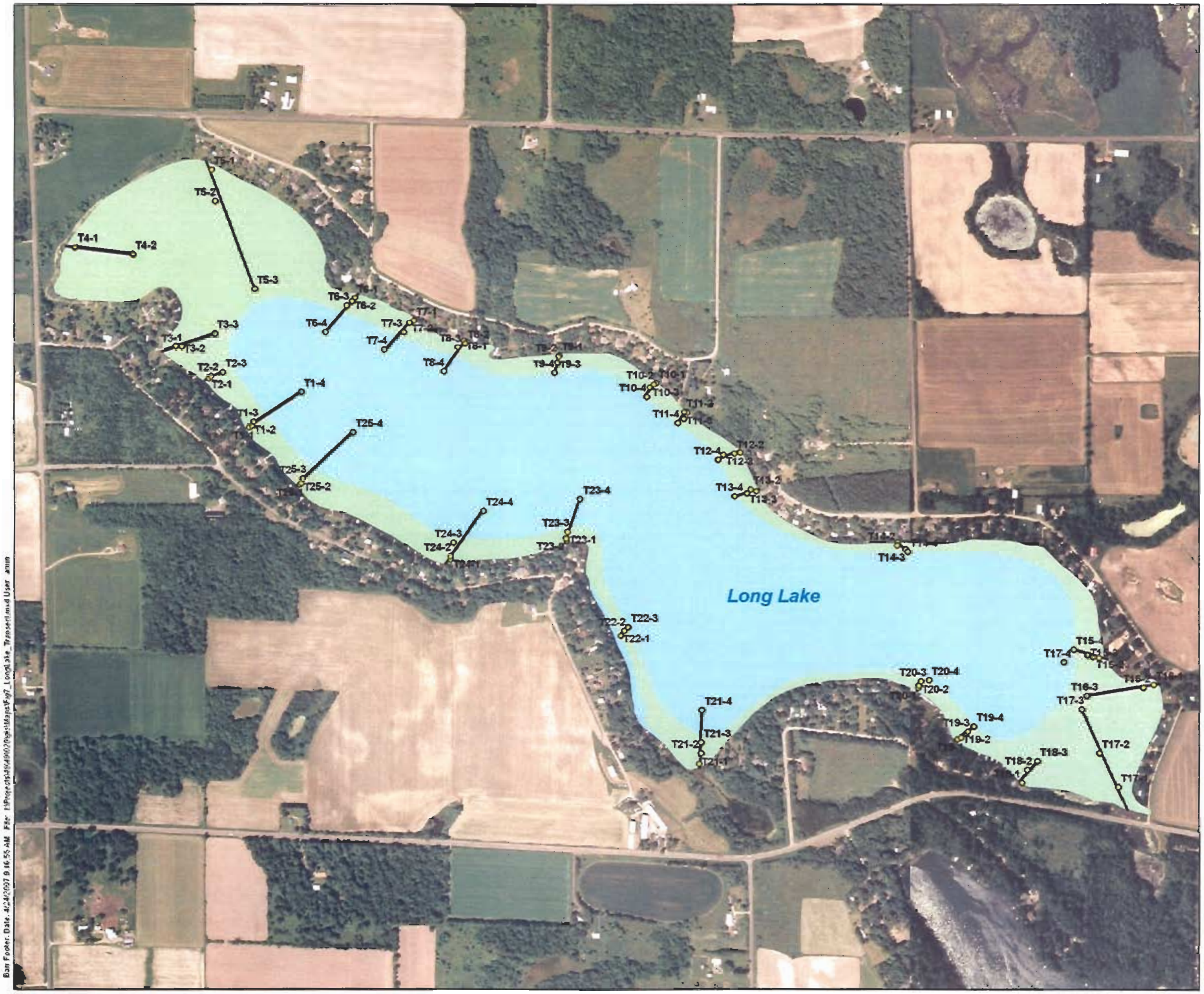


Figure 7

Long Lake Transect Locations

Table 1. Density Rating Criteria Based Upon Rake Coverage

Rake Coverage (% of Rake Head Covered)	Density Rating
81-100	5
61-80	4
41-60	3
21-40	2
1-20	1
0	0

Sediment type was determined at each sampling point.

5.1.2 Point Intercept Method

WDNR currently recommends use of the point intercept method for aquatic plant surveys. The point intercept method uses a grid of sample points in the lake's littoral area rather than transects. The spacing between sample points is based upon the lake's surface area. The WDNR recommends collection of one sample per each 0.6 acres of lake surface area in Long Lake. The WDNR also requires the collection of at least one sample in the area beyond the plant growth area to define the maximum plant growth depth. "If no plants are found at a sampling site while approaching a deep section in the lake, record the depth but do not record any species information. Sample one more (deeper) site beyond that point to ensure that you have correctly identified the maximum plant depth. This should be done for each set of points surrounding the deep portion of the lake. Along any north/south or east/west transect, sampling should continue for at least 2 points beyond the last site with plants" (WDNR 2007a).

Point intercept sample methodology is based upon Jessen and Lound (1962) and is outlined in *Wisconsin's Department of Natural Resources Long-Term Trend Lake Monitoring Methods*, (Bureau of Water Resources Management, July 1987) as modified by Deppe and Lathrop (1992). Methodology details follow:

In June, an aquatic plant survey included a total of 333 point intercept sample locations in Long Lake (See Figure 8). One sample location could not be sampled due to inability to access the site. Hence, samples were collected from 332 locations.

A Global Positioning System (GPS) was used to record the location of each survey site.

Sediment type was determined at each survey location.

One rake sample was taken at each survey location to determine the presence and abundance of species. A tethered garden rake with an extended handle (16 feet) was used to collect each sample in water depths equal to or less than 17 feet. In water depths greater than 17 feet, a rake on a rope was used to collect each sample. For the rake on a pole or rake on a rope, the rake was dragged along the bottom for 2.5 feet (0.75 meters) and then flipped 180 degrees to ensure that none of the plants snagged on the teeth of the rake were lost.

Collection of samples, identification of species, and determination of density ratings for each species occurred at all sampling points. The overall plant density at each survey site was also determined. Density ratings were given in accordance with the criteria shown in Figure 9.

Under sampling near shore – One problem with the grid system is that it may under sample very shallow sites where the vegetation is often quite different, even from sites just a bit deeper. To compensate for this problem, shoreline areas missed by the grid were evaluated by a visual survey. Species seen, especially emergent species, were recorded.

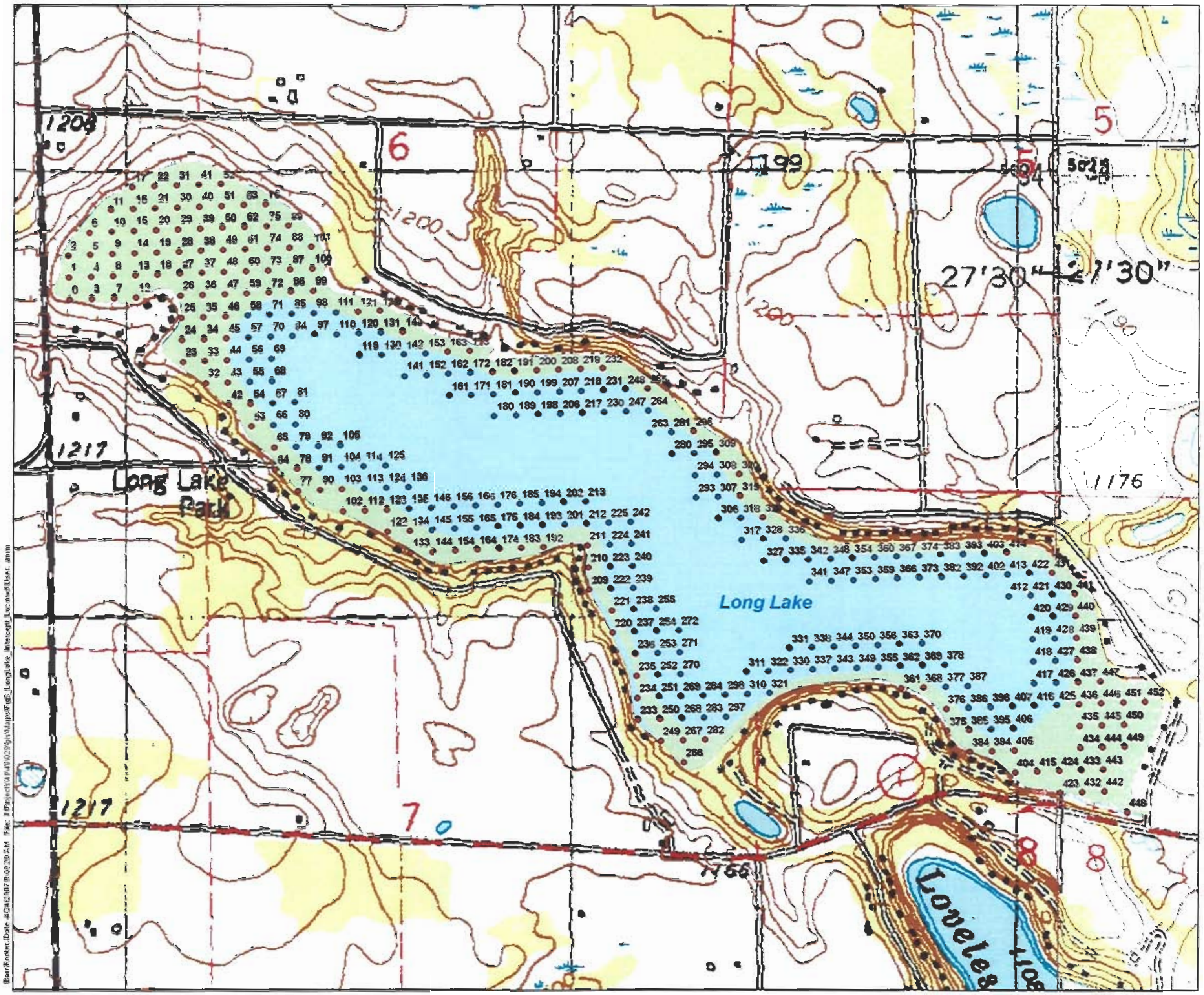
Observations – Often there will be a localized occurrence of certain species (e.g., floating-leaf or emergent species) that are obvious to the viewer but could possibly be missed by the point intercept grid. Species observed but not sampled in the survey were noted.

If no plants were found – If no plants were found at a sampling site while approaching a deep section in the lake, the depth was recorded, but no species information was recorded since no plants were collected. When this occurred, one more (deeper) site was sampled to ensure that the maximum plant depth has been correctly identified. This was done for each set of points surrounding the deep portion of the lake. Along any north/south or east/west transect, sampling continued for at least 2 points beyond the last site with plants.

Collect voucher samples – 2 samples of each species found in the lake were collected. These samples were pressed, dried, and labeled. One sample was sent to the WDNR.

Figure 8

Long Lake Intercept Locations



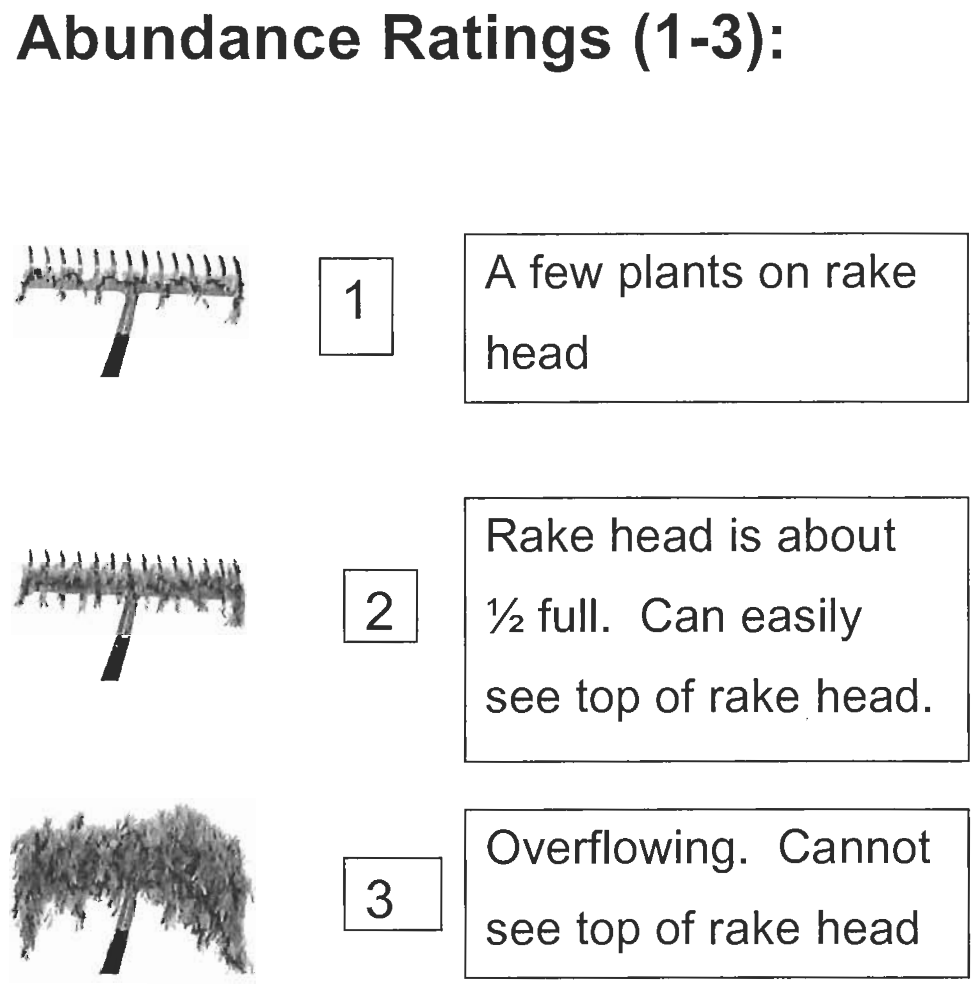


Figure 9. Abundance Rating Criteria For Point Intercept Method

5.1.3 Data Summary and Analysis

All plant survey data was summarized in tabular format (i.e., in a spreadsheet). Analyses of data included frequency of occurrence, average density, diversity, Floristic Quality Index (FQI), and the preparation of several maps to show aquatic plant coverage and density, types, and curlyleaf pondweed coverage and density. Analyses comparing 2007 and 2000 data were completed.

6.0 Results and Discussion

6.1 Aquatic Plant Survey Results

6.1.1 Aquatic Plant Types

Results of the Long Lake 2007 aquatic plant survey indicates the lake contained a diverse assemblage of aquatic plant species representing four aquatic plant types—submersed plants, floating-leaf plants, emergent plants, and algae. Of the four types, submersed plants dominated the plant community with a coverage of 108 acres (See Figure 10). Floating and emergent vegetation coverage was 52 acres. Algae coverage was 38 acres. Thick growths of algae occurred on the lake bottom in locations in which algae was the sole type of plant collected on the rake.

6.1.2 Number of Species

The large number of species noted in Long Lake is indicative of a stable and healthy aquatic plant community. In June of 2007, a total of 22 species were found in Long Lake. The presence of a large number of species in the lake (1) Provides a diverse habitat for fish and invertebrates (i.e., food for fish) and encourages a more diverse fish and invertebrate community and (2) Protects fisheries' habitat from destruction as a species specific disease would affect only one species of the community.

6.1.3 Frequently Occurring Species

6.1.3.1 Frequently Occurring Species in 2007

Although a diverse aquatic plant community was observed, a few species were abundant. One measure of abundance is the frequency of occurrence of a species measured as the percentage of sample locations containing species. As shown in Figures 11 and 12, *Potamogeton crispus* (curlyleaf pondweed) was the most frequently occurring species during 2007. The seven most frequently occurring species in Long Lake during June of 2007 were (See Figures 11 and 12):

1. *Potamogeton crispus* (curlyleaf pondweed) was found in 72 percent of sample locations
2. *Ceratophyllum demersum* (coontail) was found in 50 to 52 percent of sample locations
3. *Lemna trisulca* (star duckweed) was found in 30 to 31 percent of sample locations
4. *Nymphaea tuberosa* (white waterlily) was found in 24 to 28 percent of sample locations
5. Phytoplankton was found in 27 percent of sample locations
6. *Elodea Canadensis* (Canada waterweed) was found in 20 to 26 percent of sample locations

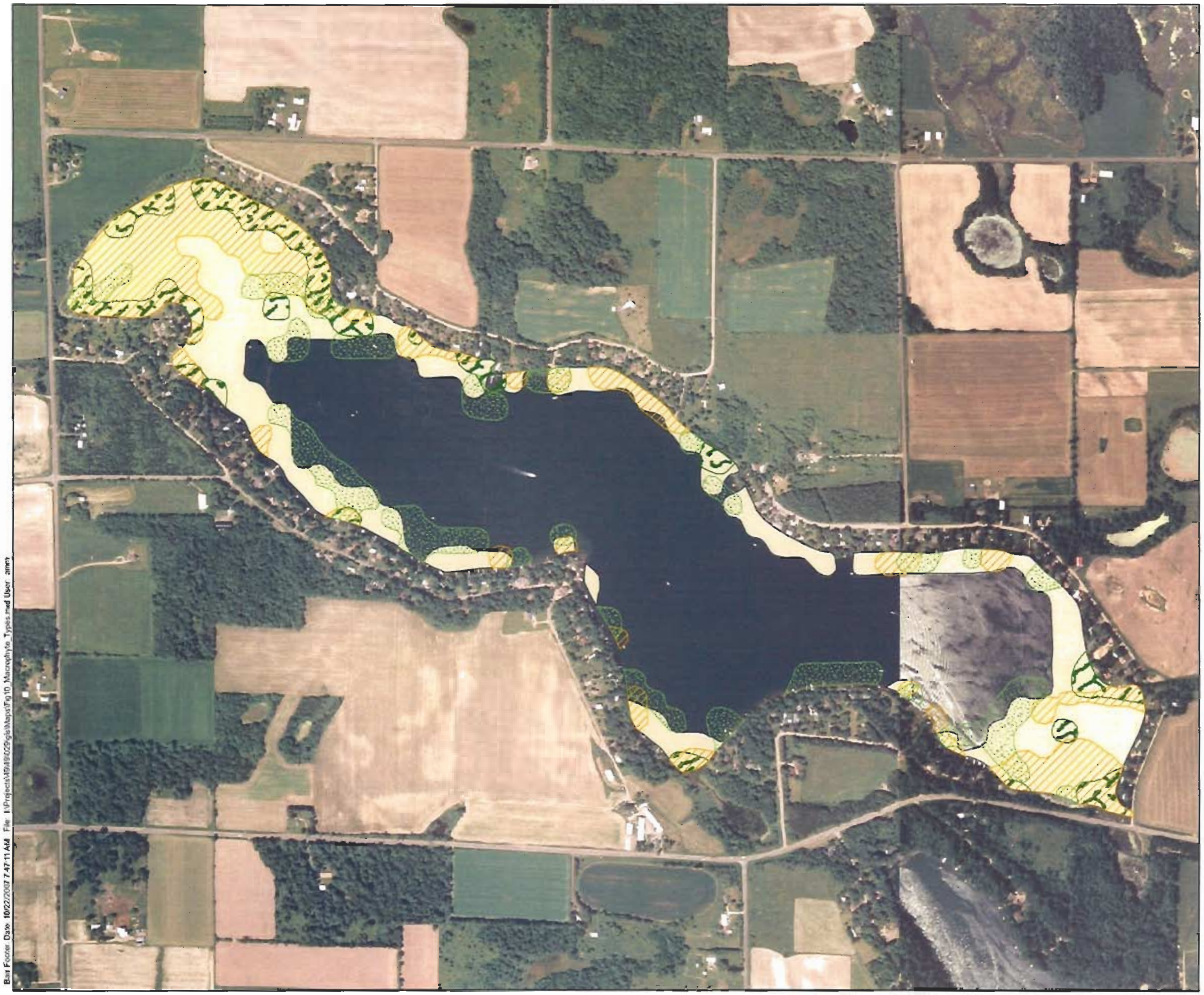
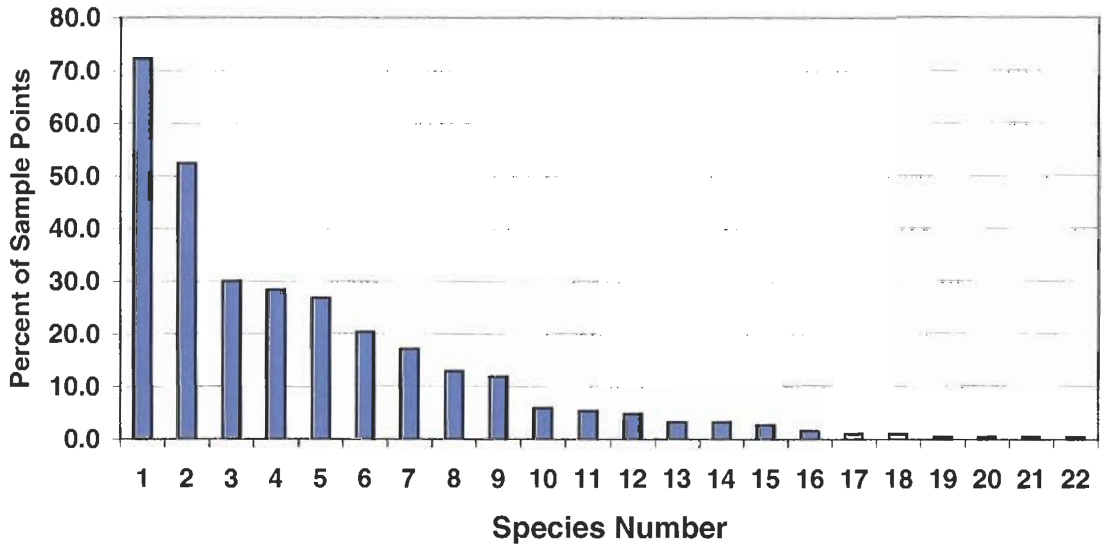


Figure 10

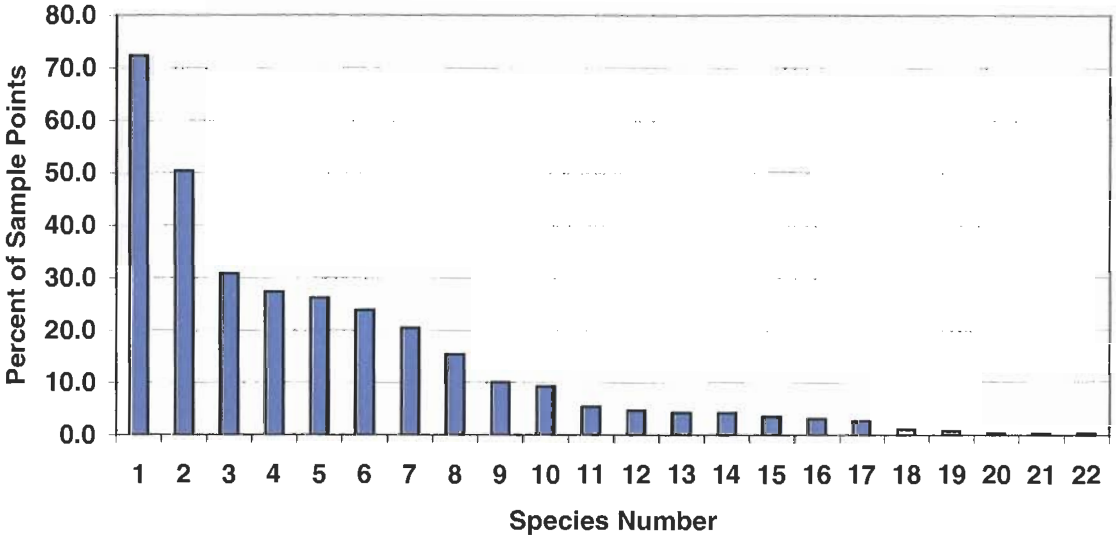
MACROPHYTE TYPES
Long Lake, WI

Figure 11
2007 Long Lake Lake Aquatic Plant Survey
Frequency of Occurrence (Percent of Sample Points)
Point Intercept Sample Methodology



Species Number	Scientific Name	Common Name	Frequency (% of Sample Points)
1	*Potamogeton crispus*	curlyleaf pondweed	72.2
2	*Ceratophyllum demersum*	coontail	52.4
3	*Lemna trisulca*	star duckweed	29.9
4	*Nymphaea tuberosa*	white waterlily	28.3
5	*Phytoplankton*	algae	26.7
6	*Elodea canadensis*	Canada waterweed	20.3
7	*Myriophyllum sibiricum*	northern watermilfoil	17.1
8	*Potamogeton sp.*	pondweed	12.8
9	*Sparganium eurycarpum*	common bur-reed	11.8
10	*Spirodela polyrhiza*	great duckweed	5.9
11	*Scirpus sp.*	bulrush	5.3
12	*Zosterella dubia*	mud plantain	4.8
13	*Eleocharis spp.*	spikerush	3.2
14	*Typha. spp.*	cattail	3.2
15	*Potamogeton zosteriformis*	flatstem pondweed	2.7
16	*Sagittaria sp.*	arrowhead	1.6
17	*Najas flexilis*	bushy naiad	1.1
18	*Wolffia columbiana*	Columbian watermeal	1.1
19	*Cyperus strigosus*	strawcolored flatsedge	0.5
20	*Nitella sp.*	stonewort	0.5
21	*Potamogeton strictifolius*	narrowleaf pondweed	0.5
22	*Chara spp*	muskgrass	0.5

Figure 12
2007 Long Lake Lake Aquatic Plant Survey
Frequency of Occurrence (Percent of Sample Points)
All Sample Points (Point Intercept and Transect Sample Points)



Species Number	Scientific Name	Common Name	Frequency (% of Sample Points)
1	Potamogeton crispus	curlyleaf pondweed	72.3
2	Ceratophyllum demersum	coontail	50.4
3	Lemna trisulca	star duckweed	30.8
4	Phytoplankton	algae	27.3
5	Elodea canadensis	Canada waterweed	26.2
6	Nymphaea tuberosa	white waterlily	23.8
7	Myriophyllum sibiricum	northern watermilfoil	20.4
8	Potamogeton sp.	pondweed	15.4
9	Zosterella dubia	mud plantain	10.0
10	Sparganium eurycarpum	common bur-reed	9.2
11	Spirodela polyrhiza	great duckweed	5.4
12	Eleocharis spp.	spikerush	4.6
13	Scirpus sp.	bulrush	4.2
14	Potamogeton zosteriformis	flatstem pondweed	4.2
15	Najas flexilis	bushy naiad	3.5
16	Sagittaria sp.	arrowhead	3.1
17	Typha. spp.	cattail	2.7
18	Chara spp	muskgrass	1.2
19	Wolffia columbiana	Columbian watermeal	0.8
20	Cyperus strigosus	strawcolored flatsedge	0.4
21	Nitella sp.	stonewort	0.4
22	Potamogeton strictifolius	narrowleaf pondweed	0.4

P:\49\51\006\Solberg_Lk\Macrophyte_data.xls

6.1.3.2 Comparison of 2000 and 2007 Frequently Occurring Species

A comparison of plant species' frequency of occurrence during 2000 and 2007 is shown in Figure 13. *Potamogeton crispus* (curlyleaf pondweed) was the most frequently occurring species during both 2000 and 2007. Its frequency declined by approximately 20 percent during this period. *Ceratophyllum demersum* (coontail) was the second most frequently occurring species during 2000 and 2007. Its frequency increased by approximately 20 percent during this period. Increased phytoplankton frequency of occurrence occurred during the 2000 through 2007 period. The change in phytoplankton frequency of occurrence from 0 percent in 2000 to 29 percent in 2007 indicates water quality degradation has occurred. Twelve native species increased in frequency of occurrence during the 2000 to 2007 period or were collected in 2007 but not in 2000. They include *Elodea Canadensis, Myriophyllum sibiricum, Zosterella dubia, Potamogeton sp., Najas flexilis, Eleocharis spp., Potamogeton zosteriformis, Sagittaria sp, Nymphaea odorata, Sparganium eurycarpum, Scirpus sp.,* and *Typha spp.* A total of six native species either decreased in frequency of occurrence during the 2000 to 2007 period or were collected in 2000 and but not in 2007. They include *Lemna trisulca, Nymphaea tuberosa, Spirodela polyrhiza, Chara spp., Lemna minor,* and *Vallisneria Americana.*

6.1.4 Density

6.1.4.1 Point Intercept Method of Sample Collection

2007 aquatic plant density in Long Lake ranged from 0 to 3 (See Figure 14). The most dense aquatic plant growth occurred on the west end of the lake. Areas of dense plant growth were also noted on the east end of the lake and portions of the littoral region along the north and south shores.

6.1.4.1.1 Density of Individual Species

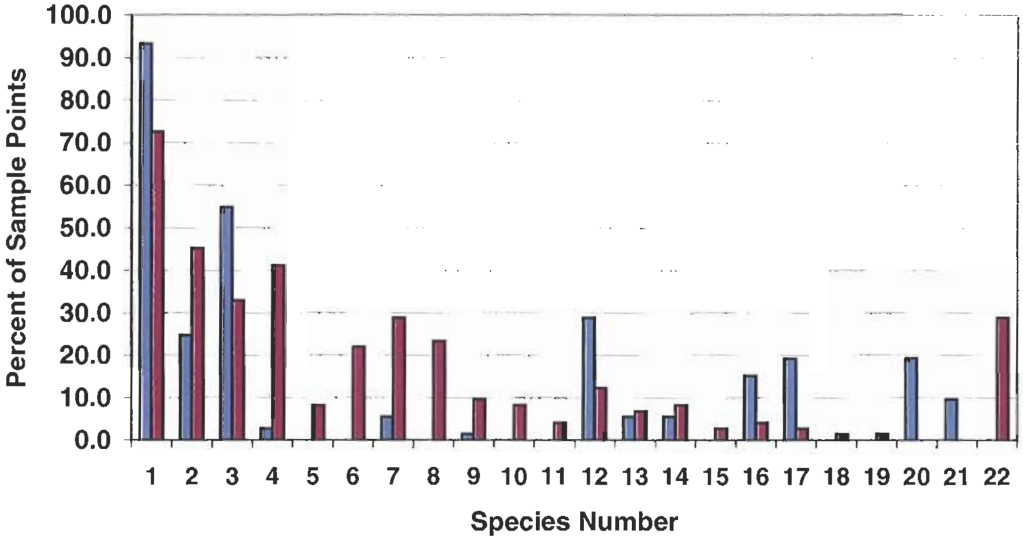
Densities of individual plant species varied from light to heavy (See Figure 15). Phytoplankton (fibrous algae) noted the highest average density per sample point (i.e., average density of 1.93) and *Potamogeton crispus* (curlyleaf pondweed) noted a close second (i.e., average density of 1.80).

6.1.4.2 Comparison of 2000 and 2007 Densities (Transect Method of Sample Collection)

Overall, little change in overall aquatic plant density occurred during the 2000 through 2007 period (Figures 16 and 17). The most dense aquatic plant growth occurred on the west end of the lake. The east end of the lake also noted a dense plant growth during both years.

Potamogeton crispus (curlyleaf pondweed) noted both the highest density and the highest average density during 2000 and 2007 (See Figures 16 through 18). Phytoplankton (fibrous algae) was not collected in 2000 and noted the second highest high density and average density in 2007. Ten native species noted increased density in 2007. Six native species noted a decreased density in 2007.

Figure 13
Comparison of 2000 and 2007 Long Lake Lake Aquatic Plant Surveys
Frequency of Occurrence (Percent of Sample Points)
Transect Sample Points



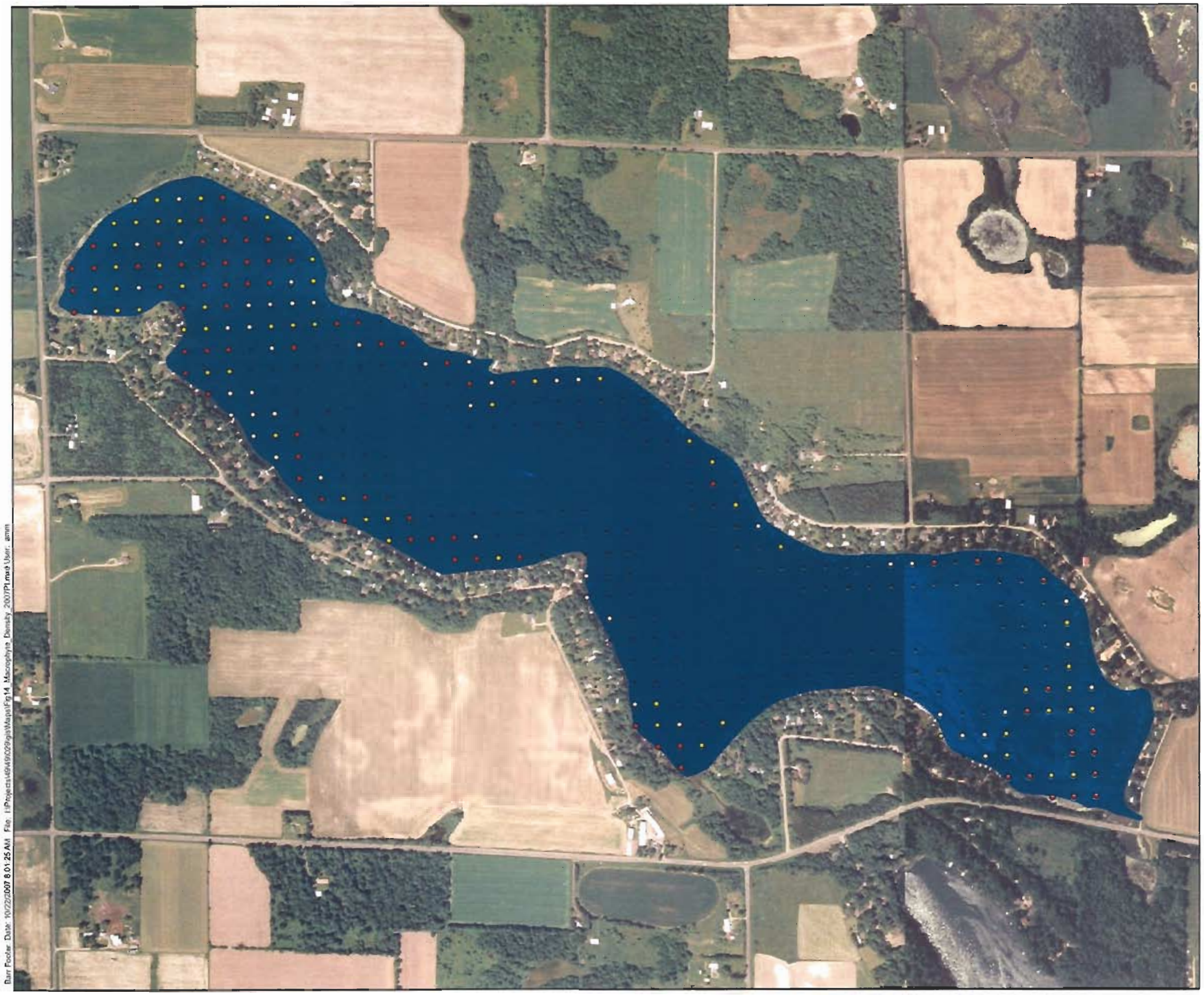
Species Number	Scientific Name	Common Name	Frequency (% of Sample Points) 2000	2007
1	*Potamogeton crispus*	curlyleaf pondweed	93.2	72.6
2	*Ceratophyllum demersum*	coontail	24.7	45.2
3	*Lemna trisulca*	star duckweed	54.8	32.9
4	*Elodea canadensis*	Canada waterweed	2.7	41.1
5	*Eleocharis spp.*	spikerush	0.0	8.2
6	*Potamogeton sp.*	pondweed	0.0	21.9
7	*Myriophyllum sibiricum*	northern watermilfoil	5.5	28.8
8	*Zosterella dubia*	mud plantain	0.0	23.3
9	*Najas flexilis*	bushy naiad	1.4	9.6
10	*Eleocharis spp.*	spikerush	0.0	8.2
11	*Nymphaea odorata*	American white waterlily	0.0	4.1
12	*Nymphaea tuberosa*	white waterlily	28.8	12.3
13	*Sagittaria sp.*	arrowhead	5.5	6.8
14	*Potamogeton zosteriformis*	flatstem pondweed	5.5	8.2
15	*Sparganium eurycarpum*	common bur-reed	0.0	2.7
16	*Spirodela polyrhiza*	great duckweed	15.1	4.1
17	*Chara spp.*	muskgrass	19.2	2.7
18	*Scirpus sp.*	bulrush	0.0	1.4
19	*Typha. spp.*	cattail	0.0	1.4
20	*Lemna minor*	small duckweed	19.2	0.0
21	*Vallisneria Americana*	wild celery	9.6	0.0
22	Phytoplankton	fibrous algae	0.0	28.8

P:\49\51\006\Solberg_Lk\Macrophyte_data.xls

BARR

Figure 14

MACROPHYTE DENSITY -
2007 POINT INTERCEPT METHOD
Long Lake, WI



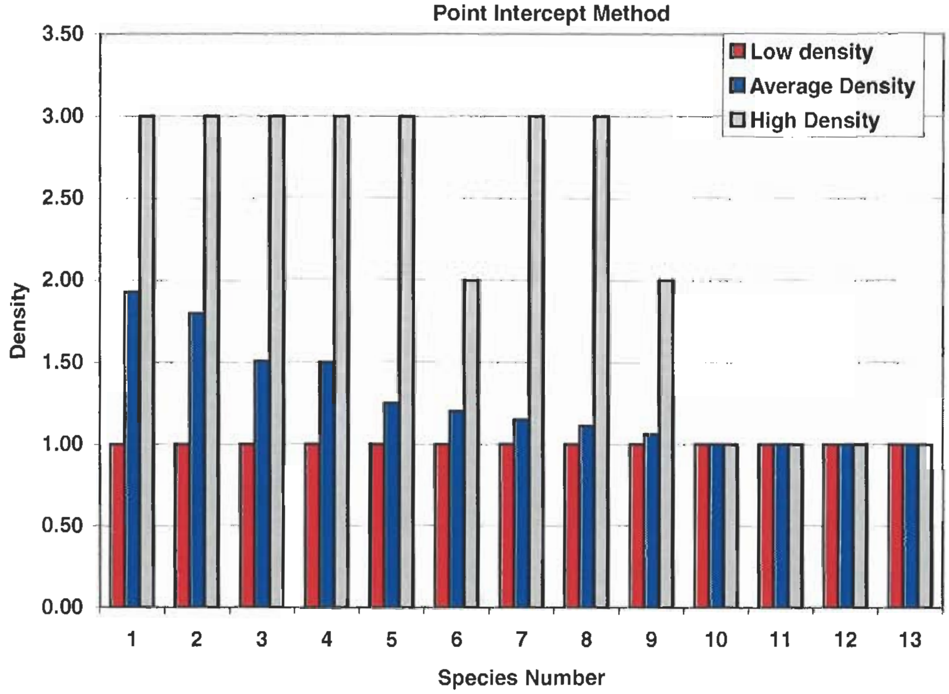
Density Rating (Macrophytes)

- 0 - Zero plants found
- 1 - A few plants on rake head
- 2 - Rake head is about 1/2 full. Can easily see top of rake head.
- 3 - Overflowing. Cannot see top of rake head.

Feet: 0, 500, 1,000, 2,000

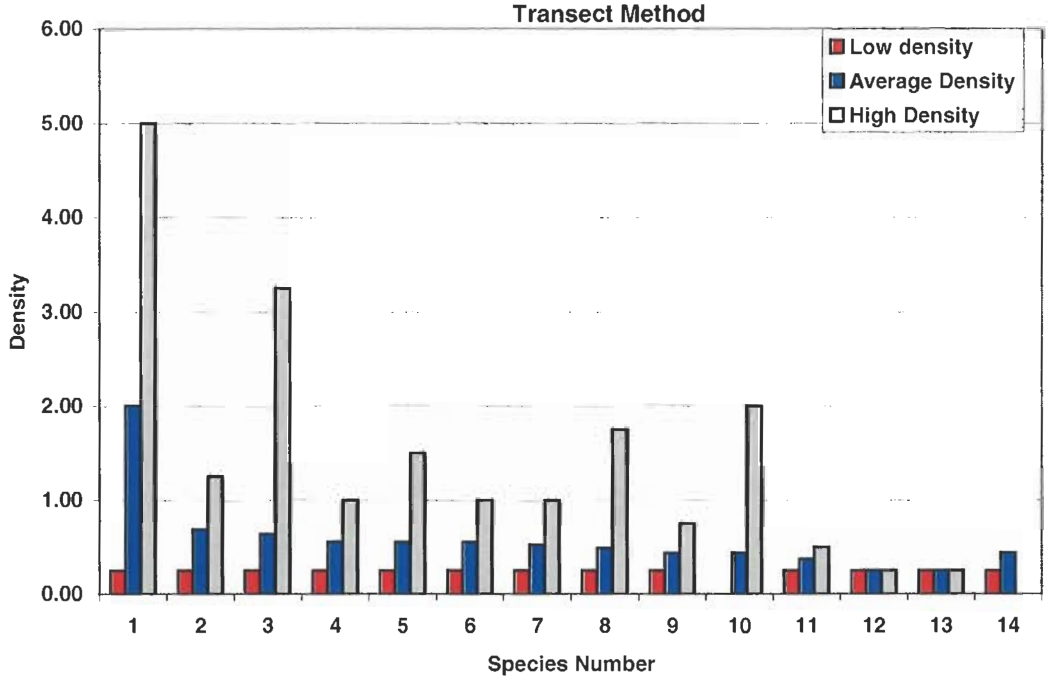
Miles: 0, 0.1, 0.2, 0.4

Figure 15
2007 Long Lake Point Intercept Low, Average, and High Density
Point Intercept Method



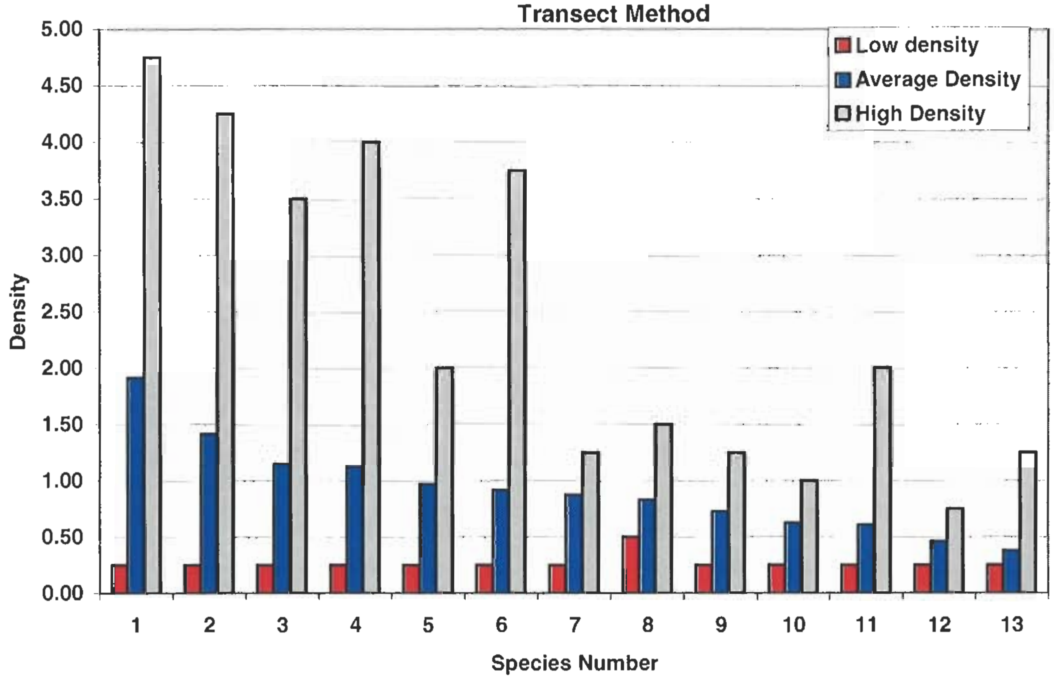
	Species (Scientific Name)	Species (Common name)	Average Density Per Sample Point	Low Density	High Density
1	*Phytoplankton*	fibrous algae	1.93	1.00	3.00
2	*Potamogeton crispus*	curlyleaf pondweed	1.80	1.00	3.00
3	*Ceratophyllum demersum*	coontail	1.51	1.00	3.00
4	*Nymphaea tuberosa*	white waterlily	1.50	1.00	3.00
5	*Potamogeton sp.*	pondweed	1.25	1.00	3.00
6	*Eleocharis spp.*	spikerush	1.20	1.00	2.00
7	*Elodea canadensis*	Canada waterweed	1.15	1.00	3.00
8	*Lemna trisulca*	star duckweed	1.11	1.00	3.00
9	*Myriophyllum sibiricum*	northern watermilfoil	1.06	1.00	2.00
10	*Potamogeton strictifolius*	narrowleaf pondweed	1.00	1.00	1.00
11	*Potamogeton zosteriformis*	flatstem pondweed	1.00	1.00	1.00
12	*Zosterella dubia*	mud plantain	1.00	1.00	1.00
13	*Chara spp.*	muskgrass	1.00	1.00	1.00

Figure 16
2000 Long Lake Transect Low, Average, and High Density
Transect Method



	Species (Scientific Name)	Species (Common name)	Average Density Per Sample Point	Low Density	High Density
1	Potamogeton crispus	curlyleaf pondweed	2.00	0.25	5.00
2	Potamogeton zosteriformis	flatstem pondweed	0.69	0.25	1.25
3	Ceratophyllum demersum	coontail	0.64	0.25	3.25
4	Lemna trisulca	star duckweed	0.56	0.25	1.00
5	Chara spp.	muskgrass	0.55	0.25	1.50
6	Lemna minor	lesser duckweed	0.55	0.25	1.00
7	Spirodela Polyrhiza	greater duckweed	0.52	0.25	1.00
8	Nymphaea tuberosa	white waterlily	0.49	0.25	1.75
9	Myriophyllum sibiricum	northern watermilfoil	0.44	0.25	0.75
10	Sagittaria sp.	arrowhead	0.44	0.00	2.00
11	Elodea canadensis	Canada waterweed	0.38	0.25	0.50
12	Najas flexilis	bushy naiad	0.25	0.25	0.25
13	Vallisneria Americana	wild celery	0.25	0.25	0.25
14	Sagittaria sp.	arrowhead	0.44	0.25	0.75

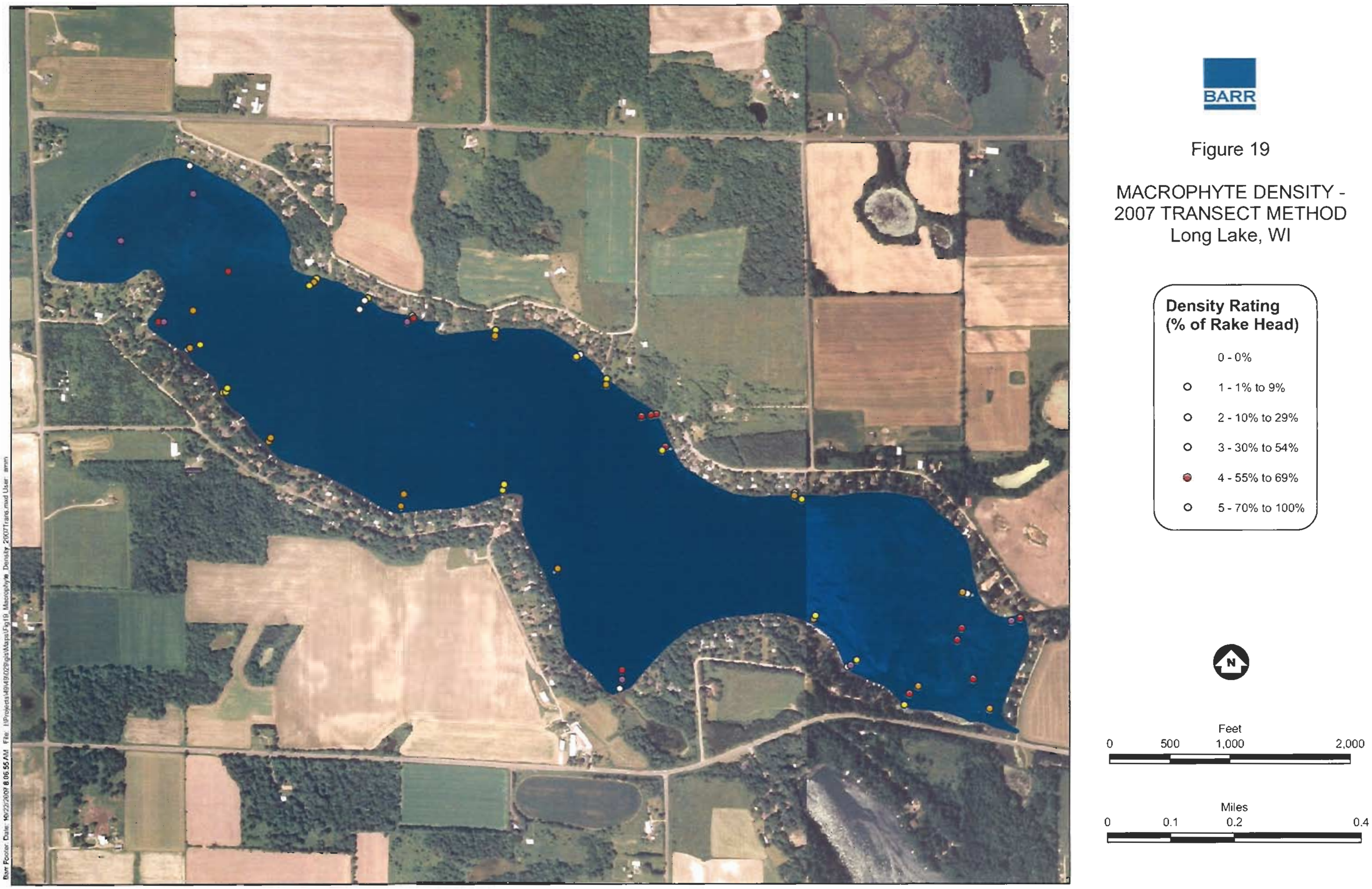
Figure 17
2007 Long Lake Transect Low, Average, and High Density
Transect Method



	Species (Scientific Name)	Species (Common name)	Average Density Per Sample Point	Low Density	High Density
1	Potamogeton crispus	curlyleaf pondweed	1.92	0.25	4.75
2	Phytoplankton	fibrous algae	1.42	0.25	4.25
3	Ceratophyllum demersum	coontail	1.15	0.25	3.50
4	Lemna trisulca	star duckweed	1.13	0.25	4.00
5	Nymphaea tuberosa	white waterlily	0.97	0.25	2.00
6	Potamogeton sp.	pondweed	0.92	0.25	3.75
7	Najas flexilis	bushy naiad	0.88	0.25	1.25
8	Eleocharis spp.	spikerush	0.83	0.50	1.50
9	Myriophyllum sibiricum	northern watermilfoil	0.73	0.25	1.25
10	Chara spp.	muskgrass	0.63	0.25	1.00
11	Elodea canadensis	Canada waterweed	0.61	0.25	2.00
12	Potamogeton zosteriformis	flatstem pondweed	0.46	0.25	0.75
13	Zosterella dubia	mud plantain	0.38	0.25	1.25

Figure 18

MACROPHYTE DENSITY -
2000 TRANSECT METHOD
Long Lake, WI



BARR
Figure 19
MACROPHYTE DENSITY -
2007 TRANSECT METHOD
Long Lake, WI
Density Rating
(% of Rake Head)
0 - 0%
1 - 1% to 9%
2 - 10% to 29%
3 - 30% to 54%
4 - 55% to 69%
5 - 70% to 100%
N
Feet
0 500 1,000 2,000
Miles
0 0.1 0.2 0.4

6.1.5 Aquatic Plant Diversity

Long Lake's 2007 plant community consisted of a diverse assemblage of many species. To determine the diversity of this assemblage, an aquatic plant diversity calculation was completed for Long Lake using a modification of Simpson's Index (1949):

$1 - \sum (rf/100)^2$

Where:

rf = the relative frequency of each species.

Frequencies were calculated as the number of sampling points where a species occurred divided by the total number of sampling points at depths less than or equal to the maximum depth of plant growth. Frequencies were relativized to 100 percent to describe community structure (i.e., rf). Frequencies and relative frequencies are presented in Appendix A and Table .2.

Table 2. Long Lake Diversity

Year	Sample Method	Diversity
2000	Transect	0.83
2007	Transect	0.90
2007	Point Intercept	0.87
2007	Point Intercept and Transect (All Points)	0.88

On a scale of 0 to 1, with 0 indicating no plant diversity and 1 indicating the highest plant diversity, Long Lake diversity ranged from 0.83 to 0.90, depending upon sample collection method and date. In 2007, diversity ranged from 0.87 to 0.90 depending upon sample collection method. During the 2000 through 2007 period, diversity in Long Lake increased from 0.83 to 0.90, an increase of 0.07. The diversities measured in Long Lake during 2000 and 2007 using the transect method of sample collection are within the range of early season diversities measured in 56 Wisconsin Lakes using the transect method of sample collection (See Table 3).

Table 3. Diversities of Some Early Season Wisconsin Plant Communities (from Nichols 1997 and Barr1998-2005—Samples Collected by WDNR Unless Otherwise Indicated

Lake Name	Diversity	Lake Name	Diversity
Amnicon Lake	0.95	Cedar Lake	0.88
Balsam Lake 2005	0.93*	Okauchee Lake	0.88
Church Pine Lake	0.93*	Spider Chain of Lakes—Clear Lake	0.88*
Little Elkhart Lake	0.91	Como Lake	0.87
Spider Chain of Lakes—North Lake	0.93*	Enterprise Lake	0.86
White Ash Lake	0.93	Bear Lake	0.86
Decorah Lake	0.92	Little Arbor Vitae Lake	0.85
Balsam Lake 1999	0.92*	Chute Pond	0.83
Half Moon Lake	0.92	Helen Lake	0.83
Round (Wind) Lake	0.92*	**Long Lake 2000 (T34)**	**0.83**
Spider Chain of Lakes—Fawn Lake	0.92*	White Ash Lake, North	0.83
Spider Chain of Lakes--Spider Lake (north)	0.92*	Big Butternut Lake	0.82
Apple River Flowage	0.92	Dowling Lake	0.81
Ashippun Lake	0.92	Island Lake	0.81
Pine Lake	0.92	Big Hills Lake (Hills)	0.81
Big Blake Lake (Blake)	0.91*	McCann Lake	0.80
Muskellenge Lake	0.91	Cary Pond	0.80
Morris Lake (Mt. Morris)	0.91	Long Lake T32N	0.78
Pigeon Lake	0.91	Clear Lake	0.77
Sand Lake	0.91*	Twin Lake, South	0.77
Half Moon Lake T47N	0.90	Oconomowoc Lake, Upper	0.76
Pike Lake	0.90	Chain Lake	0.74
Mud Hen Lake	0.90	Leota Lake	0.73
Spider Chain of Lakes--Spider Lake (south)	0.90*	Silver Lake (Anderson)	0.73
Long Lake 2007 (T34)	**0.90**	Twin Lake, North	0.71
Pearl Lake	0.89	Rib Lake	0.70
Post Lake, Upper	0.89	Tichigan Lake	0.70
Big Hills Lake (Hills)	0.88	Mid Lake (Nawaii)	0.66
Big Round Lake	0.88	George Lake	0.49

*Sampled by Barr Engineering Company

6.1.6 Floristic Quality Index

The Long Lake plant community was assessed using the Wisconsin Floristic Quality Assessment (WFQA). The WFQA is an adaptation for use in Wisconsin of the original floristic quality assessment method developed for the Chicago region (Swink and Wilhelm 1994). The basis of the floristic quality assessment is the concept of species conservatism, the degree to which a species can tolerate disturbance and its fidelity to undegraded conditions. Conservatism is not always equated with rarity. The method uses the aggregate conservatism of all species found on a site as a measure of the site's intactness, an indication of its ecological integrity (Bernthal 2003).

The method requires the *a priori* assignment of "coefficients of conservatism" to every aquatic plant species in a regional flora, relying on the collective knowledge of a group of experts. The coefficients for Wisconsin aquatic plants were assigned by a group of aquatic ecologists led by Stanley Nichols (Bernthal 2003)

The method requires an accurate and complete inventory of aquatic plants within a lake. The appropriate coefficient is applied to each species, and an average coefficient of conservatism (Mean C) is calculated for the entire lake. The Floristic Quality Index (FQI) adds a weighted measure of species richness by multiplying the Mean C by the square root of the total number of native species. FQI = Mean C * $\sqrt{N}$

Where:

Mean C = $\sum(c_1+c_2+c_3+\ldots c_n)/N$

Non-native species are assigned a C value of 0. Higher Mean C and FQI numbers indicate higher floristic integrity and a lower level of disturbance impacts to the site (Bernthal 2003)

The method is based on the concept of species conservatism. Each native aquatic plant species occurring in a regional flora is assigned a coefficient of conservatism (C) representing an estimated probability that a species is likely to occur in a lake relatively unaltered from what is believed to be a pre-settlement condition. The most conservative species require a narrow range of ecological conditions, are intolerant of disturbance, and are unlikely to be found outside undegraded remnant natural settings, while the least conservative species can be found in a wide variety of settings, and thrive on disturbance. Coefficients range from 0 (highly tolerant of disturbance, little fidelity to any natural community) to 10 (highly intolerant of disturbance, restricted to pre-settlement remnants). Conceptually, this 10-point scale can be subdivided into several ranges.

- 0-3—taxa found in a wide variety of plant communities and very tolerant of disturbance

- 4-6—taxa typically associated with a specific plant community, but tolerate moderate disturbance
- 7-8—taxa found in a narrow range of plant communities, but can tolerate minor disturbance
- 9-10—taxa restricted to a narrow range of synecological conditions, with low tolerance of disturbance(Bernthal 2003)

A summary of Long Lake Floristic Quality Index values is shown in Table 4.

Table 4. Long Lake Floristic Quality Index

Year	Method	Mean C	N	FQI
2007	Point Intercept	5.0	19	21.79
2000	Transect	4.9	14	18.17
2007	Transect	4.7	15	18.07

As shown in Table 4, the mean C of Long Lake indicates the lake's taxa are tolerant of moderate disturbance. Long Lake's FQI is lower than the median Wisconsin Lake, indicating the lake's plant community is of lower quality and more tolerant to disturbance than the plant community of the median Wisconsin lake. The median FQI for Wisconsin is 22.2 (WDNR 2005). The 2007 mean FQI of Long Lake was 21.79 for data collected by the point intercept method. The lake's mean C and FQI were similar during 2000 and 2007, with a slightly higher mean C and FQI noted in 2007.

6.1.7 Percent Open Area

The cumulative effect of the lake's diverse aquatic plant community was assessed from the proportion of open area in the littoral zone (i.e., Percent Open Area). The percent open area was estimated from the number of sampling points containing no vegetation divided by the total number of sampling points at a depth less than or equal to the maximum depth of rooted plant growth. Maximum depth of rooted plant growth is the deepest water depth at which rooted plant growth was found. In 2007, the maximum depth of rooted plant growth was 12 feet. In June 2007, a 12 percent open area was observed in Long Lake.

6.1.8 Total Acreage Covered by Aquatic Plants

In June 2007, the total plant coverage of Long Lake was 130 acres, which is 48 percent of the lake's surface area.

6.2 Functions and Values of Aquatic Plants

The Long Lake aquatic plant community (See Appendices A, and B) performs a number of valuable functions. These include:

- Habitat for fish, insects, and small aquatic invertebrates
- Food for waterfowl, fish, and wildlife
- Oxygen producers
- Provide spawning areas for fish in early spring
- Helps stabilize marshy borders of the lake; helps protect shorelines from wave erosion
- Provides nesting sites for waterfowl and marsh birds

Functions of individual species found in Long Lake are presented in Table 5. Plant functions are from: Borman, S. et al. 1997. *Through the Looking Glass...A Field Guide to Aquatic Plants* and Minnesota Department of Natural Resources. 1997. *A Guide to Aquatic Plants--Identification and Management.*

Table 5 Functions of Aquatic Plant Species Found in Long Lake*

Scientific Name (Common Name)	Plant Type	Plant Functions
Ceratophyllum demersum (coontail)	Submersed	Many waterfowl species eat the shoots; it provides cover for young bluegills, perch, largemouth bass, and northern pike; supports insects that fish and ducklings eat.
Chara spp. (muskgrass)	Submersed	Muskgrass is a favorite waterfowl food. Algae and invertebrates found on muskgrass provide additional grazing. It is also considered valuable fish habitat. Beds of muskgrass offer cover and are excellent producers of food, especially for largemouth bass and smallmouth bass.
Cyperus strigosus (strawcolored flatsedge)	Emergent	Sedge species are an essential food source for a variety of wildlife including marsh birds, shorebirds, upland game birds (bobwhite, ruffed grouse, sharp-tailed grouse, pheasant, turkey) and most waterfowl. Sedges also provide food for moose, beaver, deer, and muskrat.
Eleocharis spp (spike rush)	Emergent	Spike rush provides food for a variety of waterfowl as well as muskrats. Submersed beds offer habitat and shelter for invertebrates and small fish.
Elodea canadensis (Canada waterweed)	Submersed	Provides habitat for many small aquatic animals, which fish and wildlife eat.

Table 5 (Continued) Functions of Aquatic Plant Species Found in Long Lake

Scientific Name (Common Name)	Plant Type	Plant Functions
Lemna trisulca (star duckweed)	Floating	Star duckweed is a good food source for waterfowl. Tangled masses of fronds also provide cover for fish and invertebrates.
Myriophyllum sibericum (formerly exalbescens) (northern milfoil)	Submersed	Provides cover for fish and invertebrates; supports insects and other small animals eaten by fish; waterfowl occasionally eat the fruit and foliage.
Najas flexilis (nushy naiad)	Submersed	Bushy naiad is one of the most important plants for waterfowl. Stems, leaves, and seeds are all consumed by a wide variety of ducks including black duck, bufflehead, canvasback, gadwall, mallard, pintail, redhead, ringnecked duck, scaup, shoveler, blue-winged teal, green-winged teal, wigeon, and wood duck. It is also important to a variety of marsh birds as well as muskrats.
Nitella sp. (stonewort)		*Nitella* is sometimes grazed by waterfowl. The algae and invertebrates on its surface are attractive to ducks and geese. *Nitella* also offers foraging opportunities for fish.
Nymphaea tuberosaa (white water lily)	Floating	White water lily provides seeds for waterfowl. Rhizomes are eaten by deer, muskrat, beaver, moose and porcupine. The leaves offer shade and shelter for fish.
Potamogeton crispus (curlyleaf pondweed)	Submersed	Provides some cover for fish; several waterfowl species feed on the seeds; diving ducks often eat the winter buds.
Potamogeton strictifolius (narrowleaf pondweed) *Potamogeton sp.* (pondweed)	Submersed	Pondweeds are a primary source of food for waterfowl. Some eat the entire plant and others select certain parts. They are also consumed by marsh birds, shore-birds, muskrats, beavers, deer, and moose. Pondweeds also provide shade, shelter, spawning sites and foraging opportunities.

Table 5 (Continued) Functions of Aquatic Plant Species Found in Long Lake

Scientific Name (Common Name)	Plant Type	Plant Functions
Potamogeton zosteriformis (flat-stem pondweed),	Submersed	Flat-stem pondweed can be a locally important food source for a variety of geese and ducks including redhead and green-winged teal. The plant may also be grazed by muskrat, deer, beaver, and moose. Flat-stem pondweed provides a food source and cover for fish and invertebrates.
Sagittaria sp. (arrowhead)	Emergent	Arrowhead is one of the highest value aquatic plants for wildlife. Waterfowl depend on the high-energy tubers during migration and the seeds are also consumed by a wide variety of ducks, geese, marsh birds, and shore birds. Muskrats, beavers, and porcupines are known to eat both tubers and leaves. Arrowhead beds offer shade and shelter for young fish.
Scirpus sp. (bulrush)	Emergent	Bulrush offers habitat for invertebrates and shelter for young fish, especially northern pike. The nutlets are consumed by a wide variety of waterfowl, marsh birds, (including bitterns, herons, rails) and upland birds. Stems and rhizomes are eaten by geese and muskrats. Bulrushes also provide nesting material and cover for waterfowl, marsh birds, and muskrats.
Sparganium eurycarpum (common bur-reed)	Emergent	Colonies of bur-reed help anchor sediment and provide nesting sites for waterfowl and shorebirds. The fruit is eaten by a variety of waterfowl including mallards and tundra swans. The whole plant is grazed by muskrat and deer.
Spirodela polyrhiza (great duckweed)	Floating	Great duckweed is a good waterfowl food, consumed by many ducks and geese including canvasback, mallard, and wood duck. It is also eaten by muskrat and some fish. Rafts of duckweed offer shade and cover for fish and invertebrates.
Typha spp. (cattail)	Emergent	Cattails provide nesting habitat for many marsh birds ranging from small (red-winged blackbird, marsh wren) to large (least bittern, coot). Shoots and rhizomes are consumed by muskrats and geese. Submersed stalks provide spawning habitat for sunfish and shelter for young fish.

Table 5 (Continued) Functions of Aquatic Plant Species Found in Long Lake

Scientific Name (Common Name)	Plant Type	Plant Functions
Wolffia Columbiana (Columbian watermeal)	Floating	Watermeal is good waterfowl food consumed by a variety of ducks and geese including mallard and scaup. It is also eaten by muskrat and some fish. When large floating rafts form, mosquito larvae can be prevented from reaching the surface for oxygen.
Zosterella dubia (water stargrass)	Submersed	Water stargrass can be a locally important source of food for geese and ducks including northern pintail, blue-winged teal, and wood duck. It also offers good cover and foraging opportunities for fish.

6.3 Comparison of 2000 and 2007 Data

A comparison of aquatic plant survey data from 2000 and 2007 indicates Long Lake's aquatic plant community has changed substantially over time. The comparison tool used to assess changes in the lake's plant community was percent similarity. The percent similarity (C) is a means of comparing data from the two surveys by estimating the degree to which the communities share common components. Percent similarity C is computed as follows:

$$C_{ij} = 1 - 1/2 \sum_{k=1}^{s} |p_{ik}-p_{ij}|)$$

Where C_{ij} = percent similarity between survey 1 (2000) and 2 (2007).

$\sum_{k=1}^{s}$ = summing over all species, from species k=1 to the last species (k=s)

$|p_{ik}-p_{jk}|$ = absolute value of the relative frequency of species k at sampling period I (or the first sampling in 2000) minus the relative frequency of species k at sampling period j (or the second sampling in 2007).

The maximum similarity, in which there is the same frequency of each species at both sampling times, is 1. The minimum similarity, where there is no overlap of any species, is 0. A similarity less than 0.75 indicates a significant difference. Long Lake aquatic plant survey data sampled by the transect method during June of 2000 and 2007 were compared. The comparison yielded a similarity of 0.5 (See Table 6). The data indicate the lake's plant community has significantly changed during the past 7 years. The change in the lake's plant community resulted from small changes in the relative frequency of a large number of species and did not result from a large change in any one species. The absolute value of the changes in relative frequency of individual species was small, ranging from 0.001 to 0.128. Because the lake's plant community is diverse, the cumulative total of individual species' differences resulted in a significant community difference when the percent similarity for the lake was computed. The changes that occurred are not harmful. Rather, the changes represent fluctuations in frequency of occurrence of the lake's diverse aquatic plant community.

Table 6. Percent Similarity: Long Lake 2000 and 2007 Aquatic Plant Surveys*

Species Number	Scientific Name	Common Name	Relative Frequency 2000 (P1)	Relative Frequency 2007 (P2)	[P1-P2]	Absolute Value [P1-P2]
1	*Potamogeton crispus*	curlyleaf pondweed	0.32678822	0.199	0.128	0.128
2	*Ceratophyllum demersum*	coontail	0.08660589	0.124	-0.037	0.037
3	*Lemna trisulca*	star duckweed	0.19214586	0.090	0.102	0.102
4	*Elodea canadensis*	Canada waterweed	0.00946704	0.113	-0.103	0.103
5	*Eleocharis spp.*	spikerush	0	0.023	-0.023	0.023
6	*Potamogeton sp.*	pondweed	0	0.060	-0.060	0.060
7	*Myriophyllum sibiricum*	northern watermilfoil	0.01928471	0.079	-0.060	0.060
8	*Zosterella dubia*	mud plantain	0	0.064	-0.064	0.064
9	*Najas flexilis*	bushy naiad	0.00490884	0.026	-0.021	0.021
10	*Eleocharis spp.*	spikerush	0	0.023	-0.023	0.023
11	*Nymphaea odorata*	American white waterlily	0	0.011	-0.011	0.011
12	*Nymphaea tuberosa*	white waterlily	0.10098177	0.034	0.067	0.067
13	*Sagittaria sp.*	arrowhead	0.01928471	0.019	0.001	0.001
14	*Potamogeton zosteriformis*	flatstem pondweed	0.01928471	0.023	-0.003	0.003
15	*Sparganium eurycarpum*	common bur-reed	0	0.007	-0.007	0.007
16	*Spirodela polyrhiza*	great duckweed	0.0529453	0.011	0.042	0.042
17	*Chara spp.*	muskgrass	0.06732118	0.007	0.060	0.060
18	*Scirpus sp.*	bulrush	0	0.004	-0.004	0.004
19	*Typha. spp.*	cattail	0	0.004	-0.004	0.004
20	*Lemna minor*	small duckweed	0.06732118	0.000	0.067	0.067
22	*Vallisneria Americana*	wild celery	0.03366059	0.000	0.034	0.034
23	Phytoplankton	fibrous algae	0	0.079	-0.079	0.079
				Sum [P1-P2] =		1.000
				Percent Similarity = 1-(0.5 * Sum [P1-P2])		0.500

*Transect Sample Methodology Used for 2000 and 2007 Surveys.

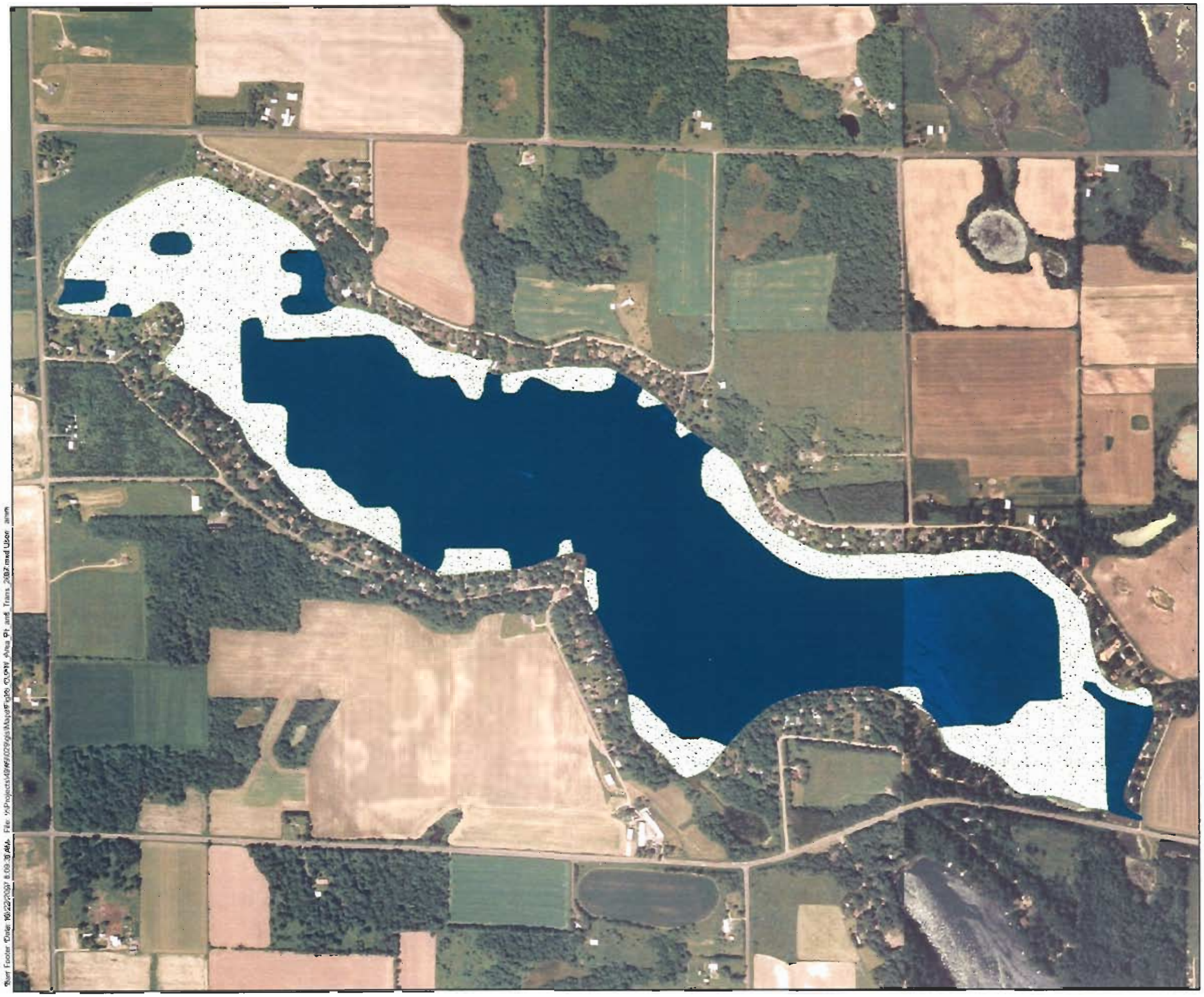
6.4 Aquatic Invasive Species

In 2000 and 2007, aquatic plants in Long Lake primarily consisted of native species (i.e., species historically present in this region). However, one aquatic invasive species (i.e., not native) occurred in the lake, *Potamogeton crispus* (curlyleaf pondweed, CLP). Aquatic invasive species are undesirable because their natural control mechanisms are not introduced with the species. Consequently, aquatic invasive species (AIS) frequently exhibit unchecked growth patterns.

6.4.1 Curlyleaf Pondweed (CLP)

Curlyleaf pondweed presents two problems of management concern in infested lakes: (1) Because of its earlier growth timing, the plant can gain a strong foothold early in the season, allowing it to dominate the system, choking out other native macrophytes. (2) It can be a substantial source of internal phosphorus to the lake as it senesces in late June to early July. The result is the potential degradation of water quality for the remainder of the growing season.

Curlyleaf pondweed was found in over 70% of all sample sites in June 2007. CLP was the most frequently occurring species in Long Lake and either the densest or second densest species, depending upon survey method (transect or point intercept). CLP coverage in 2007 was 97 acres which is 75 percent of the littoral zone (shallow area of the lake containing aquatic plants) and 35 percent of the lake (See Figure 20). CLP coverage in 2007 was similar to 2000 (See Figure 21). Densest CLP growth was found in the west end of the lake. Dense growths were also observed in the east end of the lake and in areas along the north and south shore (See Figure 22). A comparison of 2000 and 2007 CLP density indicates little change has occurred during this period (See Figures 23 through 25). The data indicate CLP growth has remained stable relative to area of coverage and density during the 2000 through 2007 period. Decaying CLP annually adds phosphorus to the lake and degrades the lake's water quality. The data indicates management of CLP is necessary to reduce phosphorus loading from CLP decay and improve the lake's water quality.



BARR

Figure 20

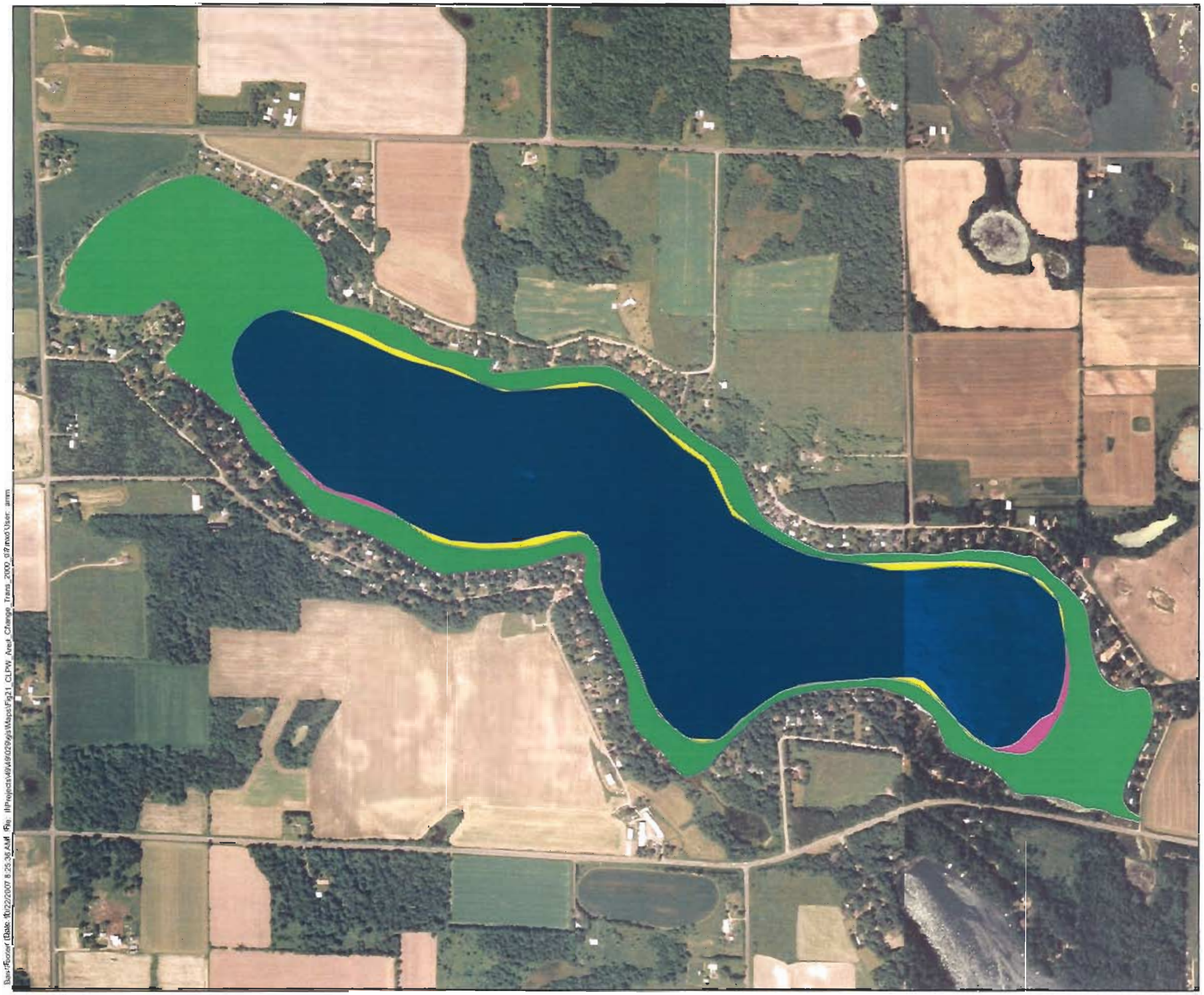
CURLYLEAF PONDWEED AREA - 2007 POINT INTERCEPT AND TRANSECT DATA
Long Lake, WI

Curlyleaf Area (96.5 acres)

N

Feet
0 500 1,000 2,000

Miles
0 0.1 0.2 0.4



BARR

Figure 21

CURLYLEAF PONDWEED
AREA COMPARISON -
2000-2007
Long Lake, WI

Curlyleaf Area

- Present 2000 Only (2.9 acres)
- Present 2007 Only (5.9 acres)
- Present in 2000 and 2007 (101.5 acres)

2000 Total CLPW Area = 104 acres
2007 Total CLPW Area = 107 acres

N

Feet: 0, 500, 1,000, 2,000

Miles: 0, 0.1, 0.2, 0.4

Figure 22

CURLYLEAF PONDWEED
DENSITY -
2007 POINT INTERCEPT METHOD
Long Lake, WI

Density Rating
(Curlyleaf pondweed)

- 0 - Zero plants found
- 1 - A few plants on rake head
- 2 - Rake head is about 1/2 full. Can easily see top of rake head.
- 3 - Overflowing. Cannot see top of rake head.

Feet
0 500 1,000 2,000

Miles
0 0.1 0.2 0.4

Figure 23

CURLYLEAF PONDWEED DENSITY - 2000 TRANSECT METHOD
Long Lake, WI

Density Rating (% of Rake Head)

- 0 - 0%
- 1 - 1% to 20%
- 2 - 21% to 40%
- 3 - 41% to 60%
- 4 - 61% to 80%
- 5 - 81% to 100%

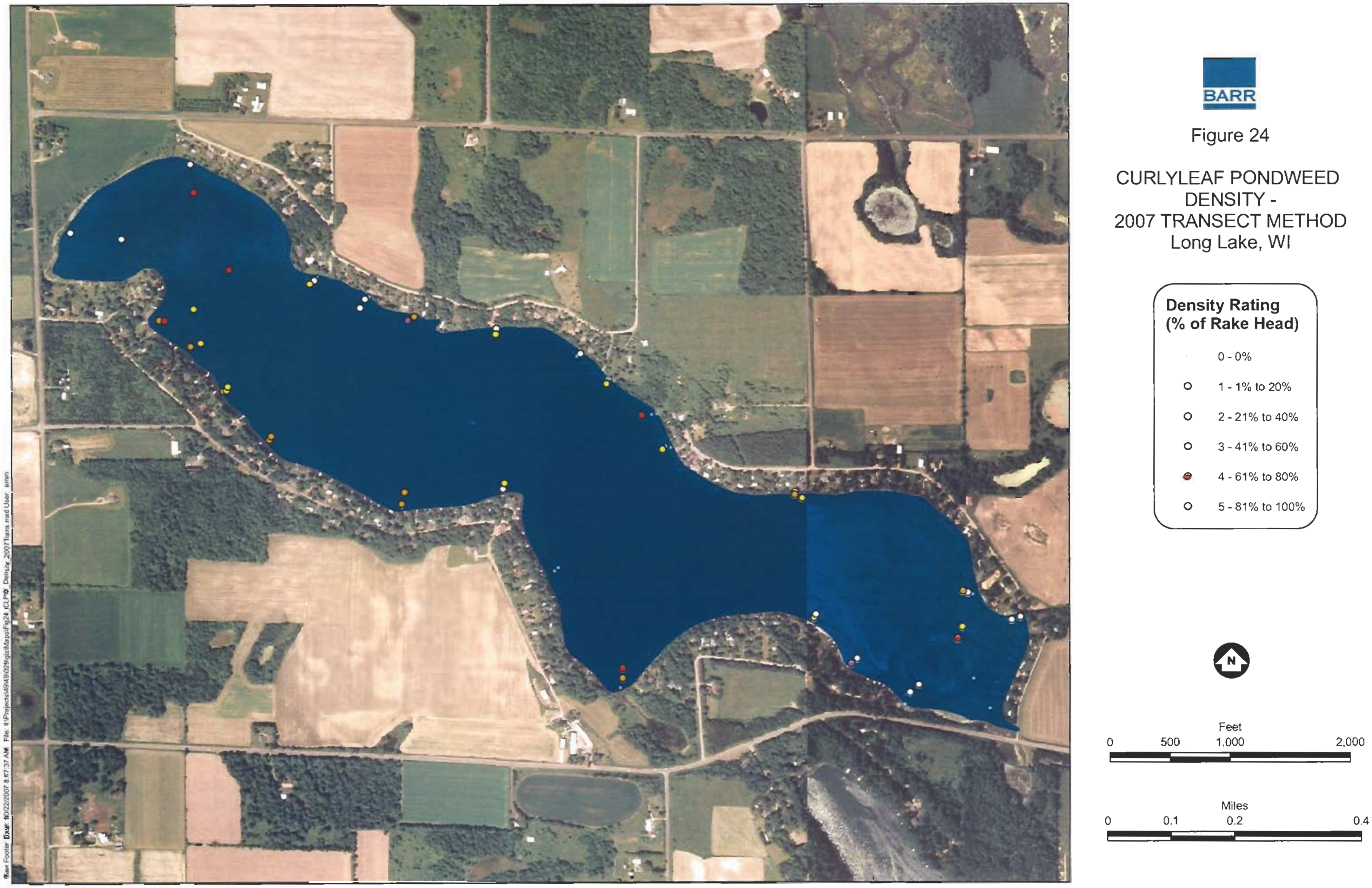
Feet: 0, 500, 1,000, 2,000

Miles: 0, 0.1, 0.2, 0.4

BARR

Figure 24

CURLYLEAF PONDWEED DENSITY - 2007 TRANSECT METHOD
Long Lake, WI



BARR

Figure 25

CHANGE IN CURLYLEAF PONDWEED DENSITY - 2000 - 2007
Long Lake, WI

Change in Density Rating (2000-2007)

- 2.0 - 3.0
- 1.0 - 2.0
- 0.5 - 1.0
- 0
- (-0.5) - (-1.0)
- (-1.0) - (-2.0)
- (-2.0) - (-3.0)
- (-3.0) - (-4.75)

Increasing Density

Decreasing Density

Feet: 0, 500, 1,000, 2,000

Miles: 0, 0.1, 0.2, 0.4

6.5 Conclusions

A total of 22 aquatic plant species were observed in Long Lake during 2007. Diversity in 2007 was improved from 2000. Floristic quality was relatively unchanged during 2000 through 2007 and was slightly below the state median. The FQI of Long Lake was 21.79 in 2007 and the state median is 22.2. Phytoplankton frequency and density increased during the 2000 through 2007 period. The increase resulted from increased algal mats on the lake bottom and increased algae in the lake's water column during 2007.

Survey data confirmed that CLP was a problematic species in need of management. CLP was the most frequently occurring species in 2007 and, depending upon the sample method, either the densest species (transect method of collection) or the second densest species (point intercept method). In 2007 CLP covered 97 acres which is 75 percent of the lake's littoral zone. A comparison of 2000 and 2007 data indicate CLP coverage has remained relatively stable during this period. Degrading CLP adds phosphorus to the lake annually and degrades the lake's water quality. It is estimated that degrading CLP annually adds 33 percent of the lake's total phosphorus load.

7.0 Long Lake Aquatic Plant Management Plan

An aquatic plant management plan is an orderly and effective approach to plant management. The plan defines the problem, establishes goals, evaluates possible management options, selects a feasible management option, and determines an effective monitoring program to evaluate results of the management strategy. A successful aquatic plant management plan is based upon six principles:

- Define the problem
- Establish goals
- Understand plant ecology
- Consider all the techniques
- Develop management plan
- Monitor the results

7.1 Define the Problem

Long lake notes problematic CLP growth during the early summer period (See Figure 26). The 2007 aquatic plant survey determined that CLP is the most frequently occurring plant species in Long Lake and either the densest or second densest species depending upon sample collection method (transect or point intercept method). The dense growths of CLP create navigation problems, particularly in the west and east ends of the lake. Because CLP creates a poorer fisheries habitat than native species, frequent and dense growths of CLP reduce the quality of fisheries habitat in the lake. The results of a resident survey in 2000 indicated 81 percent of residents desired a decrease in weed growth.

Degrading CLP adds phosphorus to the lake and causes water quality problems. The 2007 aquatic plant survey determined that phytoplankton has increased in frequency of occurrence and density during the 2000 through 2007 period. Long Lake annually notes problematic algal blooms throughout the summer months (See Figure 26).

Figure 26 Curlyleaf Pondweed Growth and Algal Bloom on West End of Long Lake

The results of a resident survey during 2001 indicate 88 percent of residents desired improved water quality. The Long Lake Water Quality Management Plan (Barr 2003) identified CLP as a major contributor to the lake's water quality problems. In 2000, approximately 33 percent of the lake's annual phosphorus load resulted from CLP degradation. The plan concluded that management of CLP is necessary to attain the lake's water quality improvement goal.

Long Lake's primary problem is excessive CLP growth which causes water quality problems, navigation problems, and reduces the quality of fisheries habitat in the lake. Dense growths of native species also cause navigation problems, particularly in the west and east ends of the lake.

7.2 Establish Goals

7.2.1 Goals of the District and Objectives to Support District Goals

The Long Lake Protection and Rehabilitation District has adopted the following goals for the management of Long Lake aquatic plants. Following each goal are objectives which articulate the District's strategy for attaining the goal.

Goal 1: Reduce phosphorus loading from curlyleaf pondweed by reducing its coverage to less than 10 acres and preventing its spread within Long Lake

Objective 1A Use low dose (1 to 1.5 mg/L) endothall treatment to reduce curlyleaf pondweed coverage to less than 10 acres in Long Lake (large scale treatment, approximately 87 acres during the first year of treatment)

Objective 1B Treat water depths greater than 3 feet in early spring prior to formation of curlyleaf pondweed reproductive turions to prevent its spread within Long Lake

Objective 1C Survey curlyleaf pondweed annually in early spring using WDNR approved point intercept methods to map and document curlyleaf pondweed plant locations and determine areas in need of treatment

Goal 2: Restore the lake's ecosystem by promoting the replacement of curlyleaf pondweed with native aquatic plants

Objective 2A Chemically treat curlyleaf pondweed in early spring when native plants are at least risk for control

Objective 2B Survey native plant community annually in July to document replacement of curlyleaf pondweed with native aquatic plants

Goal 3: Protect the lake's current fishery

Objective 3A No treatment in water depths 3 feet and less will occur in spring to avoid disturbing the lake's fishery when they are spawning.

Objective 3B Protect fisheries habitat by treating curlyleaf pondweed in spring to protect native aquatic plants from harm and to encourage the replacement of curlyleaf pondweed with native aquatic plants.

Goal 4: Protect current emergent vegetation

Objective 4A Survey emergent vegetation annually to document protection of current emergent vegetation and to detect any changes that occur

Goal 5: Balance recreational and riparian needs with the District Management Goals

Objective 5A Coordinate any riparian requests for plant control with the district plan

Objective 5B Restrict treatment of native species to "impairment of navigation" and/or "nuisance conditions".

Goal 6: Improve water quality/clarity

Objective 6A: Continue to evaluate the lake's water quality/clarity by annually monitoring the lake's Secchi disc water transparency to detect any changes in water transparency that are unfavorable to the lake's native plant community.

Objective 6B: Actively stay abreast of and continue to evaluate new implementation methods/techniques approved by WDNR that could be used to further improve the water quality/clarity of Long Lake.

7.3 Understand Plant Ecology

Aquatic plant management is based upon an understanding of plant ecology. Understanding the biology of aquatic plants and their habitat requirements is necessary to effectively manage plants. Effective management is necessary to maintain the delicate balance of preservation of fish and wildlife habitat and concurrently provide reasonable lake-use opportunities to area residents.

The biology of aquatic plants and their habitat requirements are inseparably interrelated. The habitat requirements of plants are divided into two general groups, the living group (biotic) and the nonliving group (abiotic). The following discussion of plant habitat requirements is based upon Nichols (1988).

The biotic group contains the predators, parasites, and other organisms which depend upon or compete with an organism for their livelihood. These interrelationships form the basis for biological plant management methods.

The abiotic factors form the basis of plant control techniques involving habitat manipulation, and include those physical and chemical attributes which are necessary for plant growth and development: light, bottom type, water, temperature, wind, dissolved gases and nutrients. Light, water, temperature, dissolved gases and nutrients relate to the plant's ability to carry out the vital processes of photosynthesis and respiration. Bottom type and wind relate to specific physical locations where a plant can grow. The following discussion will show the relationship between critical habitat requirements and possibilities for management.

Both the quantity and quality of light influence plant growth. Light in the red and blue spectral bands is used for photosynthesis; low and high light intensities inhibit photosynthesis. Management activities that make use of shade and dyes, for example, are based on limiting light intensity or changing the spectral qualities of the light. Deepening the lake through dredging or damming is another method of altering the light available to a plant, as light is naturally attenuated in water and the spectral qualities changed.

In the aquatic environment, water is available in abundance and is, therefore, often overlooked as being critical for aquatic plants. Yet, aquatic plants are adapted to growing in an environment with an abundant water supply and are, therefore, sensitive to water stress. Aquatic plants might be controlled by removing their water supply, resulting in the desiccation of the plant.

Plants are generally tolerant of a wide range of temperatures, and temperature fluctuations in the aquatic environment are smaller than in the surrounding aerial environment. Therefore, plant management schemes involving temperature effects depend on artificially exposing aquatic plants to the harsher aerial environment, where not only temperature but desiccation and other factors aid in controlling plant growth.

The two gases of primary importance in the aquatic system are carbon dioxide and oxygen, which are used for photosynthesis and respiration, respectively. The availability of carbon in the form of free CO_2 or bicarbonate appears to influence the distribution of some plant species (Hutchinson, 1970). Although oxygen is many times limiting in the aquatic system, most plants are adapted to living in low oxygen conditions. Because the carbon dioxide reaction is so well buffered by an equilibrium with CO_2 in the air and because the plants are tolerant to low oxygen supplies, the success of any scheme to manage plants by altering the dissolved gases in water seems doubtful.

Aquatic plant problems are caused by nutrient enrichment of the sediment. Nitrogen and phosphorus are the two nutrients of prime concern (Vollenweider, 1968; Sawyer, 1947; Stewart and Rohlich, 1967). Gerloff and Krombholz (1966) and Gerloff (1969) point out that the concentration of nutrients in the habitat may not be related to the concentration in the plant, depending on the availability of the nutrients. Plants remove nutrients in excess of their needs and store excess nutrients (i.e., luxury consumption, Gerloff 1969). These excess nutrient supplies could be used at times when the plant undergoes nutrient stress. These factors inherent in the biology of the plant will have to be overcome when developing practical, in-lake methods of nutrient limitation for aquatic plant control.

Wind and bottom type are physical conditions that may limit plant growth. Heavy winds create waves that tear and uproot the plant, and soil types that are too coarse or are not consolidated enough make rooting very difficult. Some bottom types are rich in nutrients essential for plant growth. Substrates may be altered by removing, covering, or nutrient inactivation.

By manipulating the plant's environment, management tries to induce these limiting conditions and thus restrict the growth of the plants.

Differences in growth patterns between exotic plants (i.e., not native to this area) and native plants provide a compelling reason for management of exotic species to protect native communities. Native plant communities are typically dominated by growth forms that concentrate biomass below the surface of the water, contain a high diversity of species, and have low to moderate levels of biomass.

Exotic plants typically follow an extremely rapid growth pattern. Exotic species generally produce a dense canopy of vegetation at the air:water interface and develop high levels of biomass. Such a growth pattern interferes with use of the water resource by recreational-users and may eliminate the beneficial native plant community through shading (Smart, et al., 1996). Management to control the growth of exotic species is necessary to protect the native plant community and provide a reasonable use of the lake to recreational-users. The exotic species of primary concern in Long Lake is CLP.

7.4 Identify Beneficial Uses

Beneficial uses of a water body must be compatible with its capacity to sustain those uses, both human and natural. A single water body often supports many different beneficial uses. Aquatic plant growth may impair the beneficial uses of a lake and, hence, may create many use conflicts. The management challenge involves identifying the lake's beneficial uses, and realistically managing for those uses.

To determine the beneficial uses of Long Lake, members of the Long Lake Protection and Rehabilitation District were surveyed in 2001 to determine their:

- Perception of the lake's current water clarity
- Desired future water clarity
- Current recreational activities
- Desired recreational activities
- Lake management goals.

Survey respondents indicate the lake's current uses are diverse (See Table 7).

Table 7. Recreational Uses of Long Lake and % of Members Participating

Recreational Use	**% of Members Participating in Recreational Use**
Appreciating Peace and Tranquility,Observing Wildlife, Enjoying the View, Fishing	90-100
Swimming, Motorized Boating	80-90
Non-Motorized Canoeing, Rowing, Water Skiing	60-70
Snorkeling, Sailing, Wind Surfing, Jet Skiing	50-60
Scuba Diving, Other Activities, such as Pontooning, Wake Boarding, and Water Tubing	10% or Less

Respondents indicated an interest in lake management goals to attain and protect the lake's beneficial uses (See Table 8).

Table 8. Lake Management Goals of Interest to Membership Survey Participants

Lake Management Goal	Responses	% of Total Responses
Increase weed growth	0	0%
Protect existing weed growth	10	24%
Protect existing water quality of the lake	17	40%
Protect aesthetics (how the lake looks)	19	45%
Improve fisheries	20	48%
Improve aesthetics (how the lake looks)	27	64%
Protect existing fisheries	27	64%
Decrease weed growth	34	81%
Improve the lake's water quality	37	88%

Survey respondents indicated the three lake management goals of greatest interest were improvement of the lake's water quality, decrease weed growth, and protect the existing fisheries. Management of CLP is necessary to attain the three goals.

In addition to human uses, the lake provides habitat for fish, waterfowl, and other animals. The Wisconsin Department of Natural Resources (WDNR) has identified fish and wildlife sensitive areas in Long Lake (See Figure 27). Sensitive areas include habitats that are integral to the lake ecosystem such as nesting sites or fish spawning areas. To protect sensitive areas, plant management within sensitive areas is restricted by the WDNR. The WDNR will not allow treatment during the spring at depths 3 feet or less within sensitive areas to protect fish while spawning.

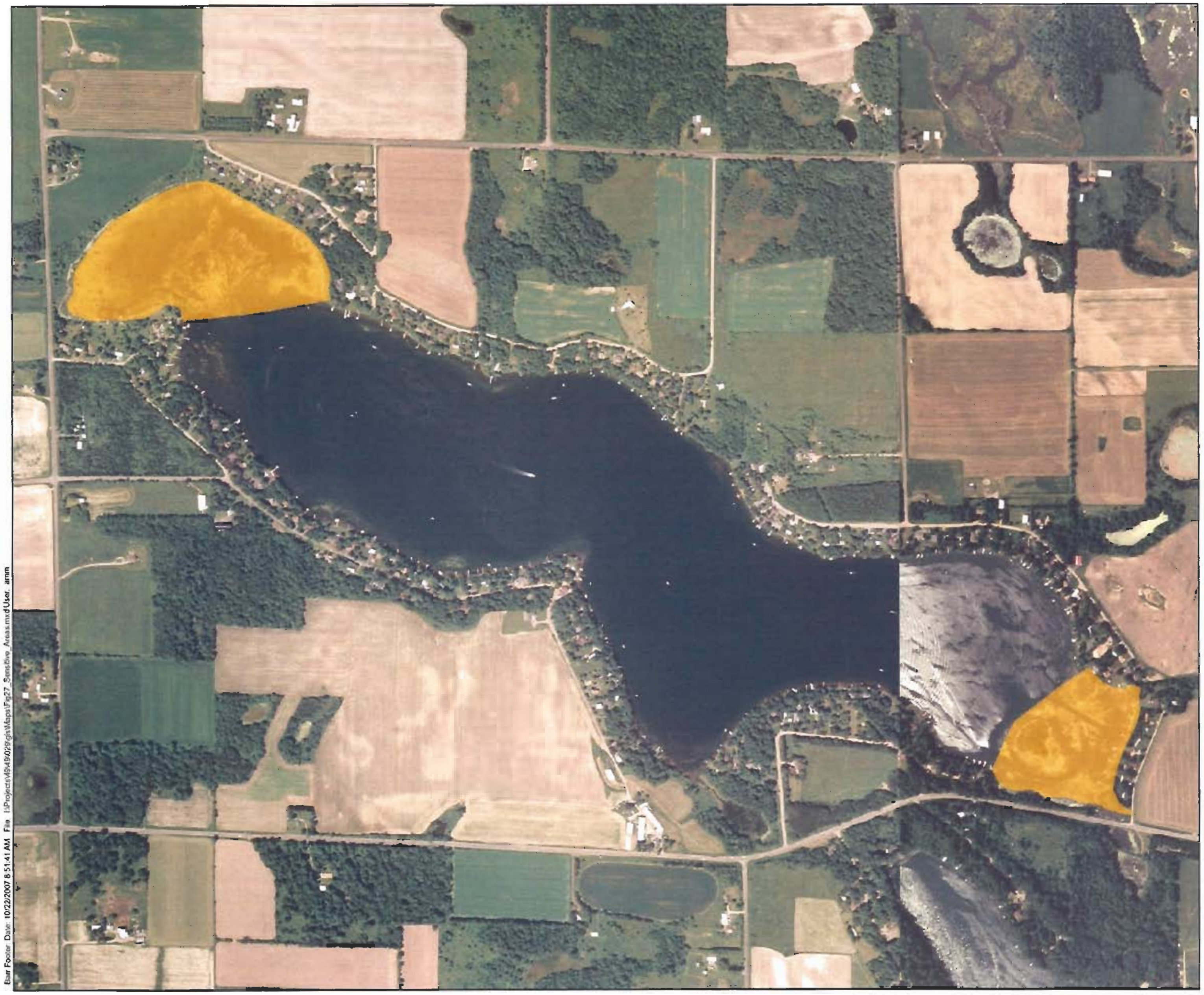


Figure 27

LONG LAKE
FISH AND WILDLIFE
SENSITIVE AREAS
2000 - 2007
Long Lake, WI

7.5 Consider All Techniques

Following a consideration of all possible management alternatives, a feasible management option may be identified for Long Lake. The following discussion focuses on four types of aquatic plant management techniques currently used for aquatic plant control. They include:

1. Physical
2. Mechanical
3. Chemical
4. Biological

7.5.1 Physical

Physical tactics typically used to manage aquatic plants are light manipulation and habitat manipulation. Habitat manipulation includes such techniques as overwinter lake drawdown, dredging, sand blanketing, the use of dyes, and nutrient limitation and inactivation (Barr, 1997).

Although light manipulation has been used in lakes with some success, its greatest utility has been found in managing dense vegetation in streams through streamside shading. Shading by use of different densities of shading cloth has resulted in decreased plant biomass. Natural shade from streamside vegetation has also reduced plant biomass along the stream course (Barr, 1997). Dark colored dyes are sometimes used in small ponds and lakes to reduce aquatic plant growth. The dyes are added to the lake or pond. The resultant change in water color reduces the amount of light reaching the submersed plants, thereby limiting plant growth. Use of dyes is limited to shallow waterbodies with no outflow. The use of dyes is not feasible for Long Lake because it is too large and deep for this technique.

Lake level drawdown, particularly over winter, is commonly used to control nuisance aquatic plants in northern North America. Biomass studies before and after drawdown have demonstrated that drawdown was effective in controlling plants down to the depth of drawdown, but had no effect at greater depths. While drawdown is an extremely effective technique for some species, it may actually stimulate the growth of other species. (Madsen and Bloomfield, 1992). A study of Trego Flowage (Washburn County, Wisconsin) indicated the benefits of drawdown were temporary, and the same species of plants returned in about their former abundance within a few years (Barr, 1994).

Drawdown as a plant management technique is only feasible when a dam is present and lowering the water level for a period of time is feasible. Drawdown is not a feasible option for Long Lake.

Another commonly-used group of physical control techniques uses benthic barriers, weed rollers, or sediment alteration to inhibit the growth of aquatic plants at the sediment surface. Barrier material is applied over the lake bottom to prevent plants from growing, leaving the water clear of rooted plants. Benthic barriers are generally applied to small areas (Barr, 1997). Negatively buoyant (i.e., sink in water) screens are available in rolls 7 feet wide and 100 feet long. The screens can be laid on the lake bottom in the spring and removed in the fall. These screens can be reused for about 10 years. Burlap has been found to provide up to 2 to 3 years of relief from problematic growth before eventually decomposing (Truelson 1985 and Truelson 1989). Bottom barriers would be appropriate for controlling aquatic plant nuisances for small applications such as adjacent to a boat dock or from small swimming areas. The barriers are safe, effective, non-chemical control using a simple technology. Bottom barriers do not result in significant production of plant fragments (critical for milfoil treatment). Bottom barriers may cause harm to fisheries and invertebrate habitat. Consequently, the WDNR should be contacted prior to barrier installation to determine whether a permit is needed. Bottom barriers are not feasible for Long Lake because the area requiring management is larger than this method is designed for.

Weed rollers or 'Automated Unintended Aquatic Plant Control Devices' are motor-drive rollers (round bars) placed on the lake bottom and roll over and uproot plants. The rollers are 25-to-30 feet long and are centered on the end post of a dock. The rollers roll in a circular pattern, normally covering 270^0 or using a 25-foot roller over a full circular area. Weed rollers would be appropriate for controlling aquatic plant nuisances in small areas such as adjacent to a boat dock or for small swimming areas. The rollers are an effective non-chemical control using a simple technology. However, weed rollers cause harm to fisheries and invertebrate habitat. Consequently, use of rollers in Wisconsin lakes is not allowed. Hence, this technique cannot be used on Long Lake.

7.5.2 Mechanical

Mechanical control involves aquatic plant removal via harvesting, handpulling, hand-digging, rotovation/cultivation, or diver-operated suction dredging. Small scale harvesting may involve the use of the hand or hand-operated equipment such as rakes, cutting blades, or motorized trimmers. Individual residents frequently clear swimming areas via small scale harvesting or hand pulling or hand digging. Small scale harvesting is not a feasible option for Long Lake because the area requiring management is too large for management by small scale methods.

Large-scale mechanical control often uses floating, motorized harvesting machines that cut the plants and remove them from the water onto land, where they can be disposed. Harvesting has not proven to be an effective means of sustaining long-term reductions for plants such as coontail and Eurasian watermilfoil (EWM) because they can propagate from fragments generated from mechanical harvesting. Fragments from harvesting may cause coontail or EWM to regrow to preharvest levels or to spread to new areas and increase coverage of these species within a lake. Hence, harvesting is not a feasible option for Long Lake because fragments from coontail harvesting may increase the coverage of this species within the lake.

Rotovation/cultivation (underwater rototilling) are bottom tillage methods that remove aquatic plant root systems. This results in reduced stem development and seriously impairs growth of rooted aquatic plants. Derooting methods were developed by aquatic plant experts with the British Columbia Ministry of Environment. Essentially two types of tillage machinery have been developed. Deep water tillage is performed in water depths of 1.5 to 11.5 feet using a barge-mounted rototiller equipped with a 6-10 foot wide rotating head. Cultivation in shallow water depths up to a few meters is accomplished by means of an amphibious tractor or modified WWII "DUCW" vehicle towing a cultivator. Both methods involve tilling the sediment to a depth of 4 to 6 inches, which dislodges plants including roots. Certain plants have roots that are buoyant and float on the surface where they can be collected. Treatments are made in an overlapping swath pattern. Bottom tillage is usually performed in the cold "off-season" months of winter and spring to reduce plant growth potential. Bottom tillage is not a feasible option for Long Lake because of the high nutrient concentration of Long Lake sediment that could potentially be transported to the water column during operations.

Diver dredging utilizes a small barge or boat carrying portable dredges with suction heads that are operated by scuba divers to remove individual rooted plants (including roots) from the sediment. Divers physically dislodge plants with sharp tools. The plant/sediment slurry is then suctioned up and carried back to the barge through hoses operated by the diver. On the barge, plant parts are sieved out and retained for later off-site disposal. The water sediment slurry can be discharged back to the water or piped off-site for upland disposal. Diver dredging can be highly effective under appropriate conditions (Gibbons 1994). Efficiency of removal is dependent on sediment conditions, density of aquatic plants and underwater visibility (Cooke et al. 1993). Diver dredging is not feasible for Long Lake because it is exclusively used to control Eurasian watermilfoil, and a different problematic species (i.e., curlyleaf pondweed) is found in Long Lake. The infestation of curlyleaf pondweed in Long Lake is too large for this method of removal to be feasible.

7.5.3 Chemical

Chemical aquatic vegetation management programs are widespread, being the preferred method of control in many areas. Chemical control involves the use of a herbicide (i.e., a plant-killing chemical) that is applied in liquid, granular, or pellet form. Herbicides are of two types, systemic herbicides and contact herbicides. Systemic herbicides, such as 2, 4-D, fluoridone, and glyphosate, are absorbed by and translocated throughout the plant, capable of killing the entire plant (roots and shoots). In contrast, contact herbicides, such as diquat and endothal, kill the plant surface with which it comes in contact, leaving roots alive and capable of regrowth. The aquatic plants (sometimes only stems and leaves) die and decompose in the lake. To reduce human exposure to the chemicals, temporary water-use restrictions are imposed in treatment areas whenever herbicides are used. Only herbicides for aquatic use are allowed, and any use of a herbicide requires a WDNR permit. Use of the herbicides Diquat (Reward) and endothal (Aquathol K) can be used to treat selected aquatic plants in Long Lake. Endothall can be used to treat curlyleaf pondweed and Diquat can be used for navigation channel treatment of native species.

7.5.4 Biological

Biological control involves the use of a biological control agent to control aquatic plant growth. Biological controls include predation by herbivorous fish, mammals, waterfowl, insects and other invertebrates, diseases caused by microorganisms and competition from other aquatic plants (Little, 1968). The most widely used biological control agent is herbivorous fish, particularly grass carp. Use of grass carp as a biological control agent is not allowed in Wisconsin. Hence, biological control is not a feasible option for Long Lake.

Mechanical, physical, and chemical aquatic plant control techniques and estimated costs are summarized in Table 9. The costs are somewhat dated (i.e., based upon 1997 dollars), but provide a relative cost comparison between the various techniques.

Table 9 Control Techniques for Aquatic Plants: Procedure, Cost, Advantages and Disadvantages (Modified from a Summary Prepared by the Vermont DNR in 1997)

Control Technique	Procedure	Cost	Advantages	Disadvantages
Mechanical and Physical Removal			+Immediate plant removal and creation of open water +No interference with water supplies or water-use	-- Creates plant fragments – Usually disturbs sediments, affecting biota and causing short-term turbidity – Plant disposal necessary
Harvesting	Plant stems and leaves cut up to 8 ft below water surface, collected and removed from lake	Cut from 1 to 2 ac/day @ $1,200/day New machine: $80,000-100,000+	+Relatively low operational cost	– Can get regrowth within 4 weeks – Removes small fish, turtles, etc. – Plant fragments may cause spread of Eurasian watermilfoil
Hydro-raking	Mechanical rake removes plants up to 14 ft below water surface and deposits them on shore	Rake up to 1 ac/day @ $1,500–$2,000/ac	+Longer lasting control than harvesting because of root removal	– Regrowth by end of growing season
Rotovating	Sediment is "tilled" to a depth of 4"-6" to dislodge plant roots and stems Can work in depths up to 17 ft	Can do up to 2-3 ac/day @$700–$1,200/ac Cost of new machine is $100,000+	+Immediate 85% – 95% decrease in stem density +Up to 2 years control +Frequently done in fall when plant fragments not viable	
Hydraulic Dredging	Steel cutter blade dislodges sediment and plants; removed by a suction pump	$2,500/ac and up Cost of new machine is $100,000+	+90% effective at root removal, with plant regrowth probable within 1 year	– Expensive

Table 9 (Continued) Control Techniques for Aquatic Plants: Procedure, Cost, Advantages and Disadvantages (Modified from a Summary Prepared by the Vermont DNR in 1997)

Control Technique	Procedure	Cost	Advantages	Disadvantages
Diver-operated Suction Harvesting	Scuba divers use 4" suction hose to selectively remove plants from lake bottom Plants disposed of on shore	Cost is $800–$10,000/ac depending on cost of divers, type of sediments, travel time, etc. Cost of new machine $20,000+	+Up to 97% effective at removing plant roots and stems +1–2 years of control +Can work in areas with underwater obstruction	– Effectiveness varies greatly with type of sediment – Slow and labor intensive – Expensive – Potentially hazardous because of scuba
Handpulling	Plants and roots are removed by hand using snorkeling and wading Plants disposed of on shore	Variable, depending on volunteers; divers cost $15-$60/hr	+Most effective on newly established populations of EWM that are scattered in density +Volunteers can keep cost down +Long term control if roots removed	– Too slow and labor intensive to use on large scale – Short-term turbidity makes it difficult to see remaining plants
Chemical Treatment			+ Doesn't interfere with underwater obstructions	– Affects water-use; can be toxic to biota – Plants remain in lake and decompose, which can cause oxygen depletion late in the season
2,4-D (Aquakleen, Aquacide, Navigate)	Systemic herbicide available in liquid and pellet form. Kills plants by interfering with cell growth and division. Can be applied at surface or subsurface in early spring as soon as plants start to grow, or later in the season	$350–$700/ac depending on plant density and water depth; cost does not include collection or analysis of water samples, which may be required	+Under favorable conditions can see up to 100% decrease +Kills roots and root crowns +Fairly selective for EWM	– Plants decompose over 2-3 weeks

Table 9 (Continued) Control Techniques for Aquatic Plants: Procedure, Cost, Advantages and Disadvantages (Modified from a Summary Prepared by the Vermont DNR in 1997)

Control Technique	Procedure	Cost	Advantages	Disadvantages
Tripclopyr (Garlon 3A)	Liquid systemic herbicide that kills plants by interfering with hormones that regulate normal plant growth	$75/gal or $1200-$1700/ac, depending on water depth, concentration of chemical, etc.	+Effectively removes up to 99% of EWM biomass 4 weeks after treatment +Fast-acting herbicide +Kills roots and root crowns +Fairly selective for EWM	– No domestic-use of water within 1 mile of treated area for 21 days after treatment – No fishing in treated area for 30 days after treatment – Expensive
Fluridone (Sonar)	Systemic herbicide available in liquid and pellet form that inhibits a susceptible plant's ability to make food Can be applied to surface or subsurface in early spring as soon as plants start to grow	$500-$1500/ac depending on water depth and formulation	+Can be applied near water intakes if concentration is less than 20 ppb +Under favorable conditions susceptible species may decrease 100% after 6-10 weeks +Control lasts 1-2 years depending supplemental hand removal +Because slow-acting, low oxygen generally not a problem	– Long contact time required; may take up to 3 months to work – Potential risk to human health remains controversial – Not selective for milfoil – Spot treatments generally not effective
Endothal (Aquathol and Aquathol K)	Granular (Aquathol) and liquid (Aquathol K) kills plants on contact by interfering with protein synthesis Can be applied to surface or subsurface when water temperature is at least 65°F	$300-$700/ac depending on treatment area and use of adjuvants	+Under favorable conditions can see up to 100% decrease +Fast-acting herbicide	– Regrowth within 30 days – Not selective for milfoil – Does not kill roots; only leaves and stems that it contacts – No swimming for 24 h, no fishing for 3 days

Table 9 (Continued) Control Techniques for Aquatic Plants: Procedure, Cost, Advantages and Disadvantages (Modified from a Summary Prepared by the Vermont DNR in 1997)

Control Technique	Procedure	Cost	Advantages	Disadvantages
Diquat (Reward)	Liquid kills plants on contact by interfering with photosynthesis Can be applied to surface or subsurface when water temperature is at least 65°F	\$200-\$500/ac	+Fast-acting herbicide +Relatively cheap per acre	– Retreatment within same season may be necessary – Not selective for milfoil – Does not kill roots; only leaves and stems that it contacts – No swimming for 24 h, no drinking for 14 days – Toxic to wildlife

8.0 Long Lake Aquatic Plant Management Plan

The Long Lake Aquatic Plant Management Plan (APM) outlines management practices required to attain the lake's water quality goal, manage problematic growths of curlyleaf pondweed, and sustain the lake's beneficial uses. The APM Plan is divided into 2 sections:

- Long-Term Improvement Program
- Annual Maintenance Program

8.1 Long-Term Improvement Program

The goal of the long-term improvement program is long-term change. The long-term improvement program is comprised of a series of intensive, annual chemical treatments to Long Lake to reduce CLP and improve water quality in the lake. Program details are as follows:

- Chemically treat Long Lake intensively for at least three years to reduce CLP
- Inspect the lake through annual aquatic plant surveys specifically monitoring areas of CLP growth.
- If CLP growth is detected after the initial intensive treatment schedule, spot treatments will be conducted

8.1.2 Treatment Dose Recommendations and Considerations

In order to obtain efficient and effective management of CLP, treatment must be designed properly. The treatment of Endothall will target CLP but the concentration in the water column must be maintained for a specified period for treatment to be as effective as possible. The following dose of Endothall herbicide and duration of treatment is recommended for Long Lake:

- Endothall – 1.0 to 1.5 mg/L

Treatment should be conducted during early spring when CLP is growing but native species are not and before water temperatures reach 58 to 60 degrees F. Endothall will kill the roots of the plants first when temperatures are colder (~54 degrees F).

8.1.3 Herbicide Use and Restrictions

Endothall (Aquathol K) is classified as a contact herbicide and works by inactivating plant protein synthesis. Endothall works well when targeting CLP as it is selective for this species. Other species, such as Naiads may be affected which is why it is important to apply this herbicide in the early spring when CLP is present and most other aquatic plants are not.

During and after treatment, the following restrictions on Long Lake water use will apply. No swimming will be allowed for 24 hours and no fishing for 3 days after the end of the treatment period. The Long Lake Protection and Rehabilitation District will require the herbicide applicator, as part of the subcontractor contract, to post advisories at potential public access points. Because the treatment will occur when it is too cold to swim and is expected to occur prior to the fishing opener, the restrictions are not expected to be an issue for lake users.

8.1.4 CLP Treatment

Research has shown that the appropriate herbicide to treat CLP is endothall, and that this herbicide should be applied at a dose of 1 to 1.5 mg/L in the spring when the water temperature is approximately 55 to 60 °F (Poovey et al. 2002, Vlach et al. 2006, Skogerboe et al. 2006). Results from a study of Medicine Lake in Plymouth, Minnesota indicated that endothall effectively controlled CLP during each year of treatment. However, regrowth of turions necessitated treatment for at least 3 consecutive years (Vlach et al. 2006). Results from other studies in Minnesota indicate endothall is effective in controlling CLP during the year of treatment, but that at least 3 consecutive years of treatment are necessary to address turion regrowth (Skogerboe et al. 2006). Because regrowth of turions is expected to occur following CLP treatment in Long Lake, annual early spring treatment of CLP in Long Lake will occur for at least 3 consecutive years.

Because the Long Lake fishery spawns in spring within water depths of 3 feet or less, spring herbicide treatment will occur only at water depths greater than 3 feet to avoid disturbing the lake's fishery while they are spawning. A total of 87 acres will be treated during the first year of spring treatment (See Figure 28), assuming the treatment is financially feasible. If budget constraints prevent treatment of the entire 87 acre area, a smaller area may be treated (e.g., treatment of the west end). Treatment areas during subsequent years will be determined by an annual spring survey to determine curlyleaf pondweed coverage.

8.1.5 Aquatic Plant Monitoring Program

The aquatic plant monitoring program is divided into 2 parts:

1. Annual point intercept monitoring in July to assess overall health of the lake

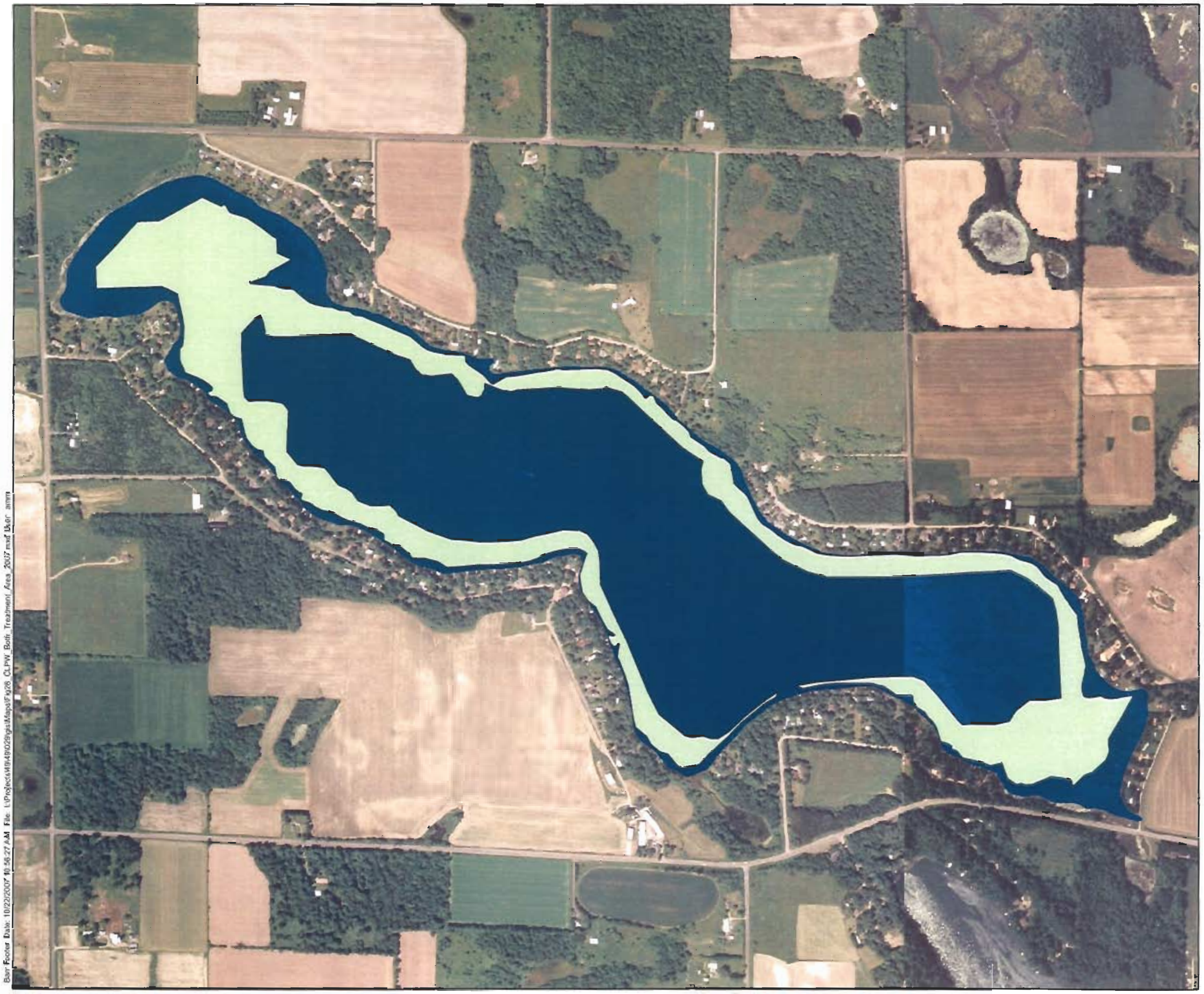
2. Annual point intercept monitoring in early spring to determine treatment areas

BARR

Figure 28

CURLYLEAF PONDWEED
SPRING TREATMENT AREA

Long Lake, WI



8.1.5.1 Monitor to Assess Overall Health of Lake

Each July an aquatic plant survey of Long Lake will monitor the overall health of the lake. The survey results will indicate the response of the lake's native plant community to treatment. Native plants are expected to grow in treated areas, thus displacing CLP.

The point intercept method of sampling detailed in Section 5.1.2 of this report will be used for the monitoring program. Samples will be collected from sample locations pre determined by WDNR for the 2007 monitoring program. The point intercept sample locations are shown in Figure 8. If budget constraints result in a smaller treatment area, the monitoring locations may be modified accordingly, subject to WDNR approval.

The data will be summarized and analyzed to determine the health of the native plant community and any changes that occur. Assesment will include frequency of occurrence, floristic quality index, plant density, and plant diversity. Percent similarity will be used to compare data from the current year of monitoring with a previous year (e.g., 2009 compared with 2008). The data will be presented and discussed in an annual report.

8.1.5.2 Monitor to Determine Treatment Areas

An annual early spring survey of curlyleaf pondweed in Long Lake will determine the area of curlyleaf pondweed coverage. Sample results will be used to determine treatment areas.

The point intercept method of sampling detailed in Section 5.1.2 of this report will be used for the monitoring program. Samples will be collected from sample locations pre determined by WDNR for the 2007 monitoring program. The point intercept sample locations are shown in Figure 8. Only CLP will be surveyed.

Data from the spring survey will be presented and discussed in an annual report.

8.1.6 Treatment and Monitoring Cost Estimate

The estimated cost of the first year of treatment and monitoring is expected to be approximately $50,000, but can range from $50,000 to $65,000 depending upon Endothall dose which can range from 1.0 to 1.5 mg/L (See Table 10). The costs are based upon 2007 costs with a 5 percent inflationary cost increase applied to the 2007 costs. If costs (e.g., endothall costs) increase by more than the estimated 5 percent inflationary cost increase, the project costs may be higher than costs estimated in Table 10. If budget constraints prevent treatment of the entire 87 acre area, a smaller area may be treated and the treatment cost would be reduced accordingly. Estimated costs during subsequent years of treatment may vary depending upon treatment area which will change when curlyleaf pondweed coverage changes.

Table 10. Estimated Annual Cost of Long Lake Curlyleaf Pondweed Treatment and Aquatic Plant Monitoring

Task	Estimated Cost*
Spring herbicide treatment of 87 acres with Endothall at a dose rate of 1.0 to 1.5 ppm	$30,000-$45,000
Aquatic Plant Monitoring Program including July and early spring aquatic plant surveys, data summary and analyses, and final report	$20,000
Total Annual Cost	$50,000-$65,000

*A 5 percent inflation rate was added to 2007 costs to determine the estimated costs

8.1.7 Permit and Notification Requirements

8.1.7.1 Permit Requirements From State Statutes and Administrative Code

The 2001 Wisconsin Act 109 established a statutory framework for the comprehensive state aquatic invasive species program (statewide program; invasive species council; watercraft inspection program; reporting process to the legislature; re-writes of statutes dealing with nuisance weed [purple loosestrife and multiflora rose) control, research, education; re-writes of statutes dealing with aquatic plant permits; regulations prohibiting the launch of boats with plants or zebra mussels attached). Statutes pertaining to the Long Lake CLP treatment program include: (In statutes that follow, "the department" refers to the Department of Natural Resources):

s. 23.22 Invasive species – Definitions; includes department responsibilities in establishing a statewide program; specific duties of the Governor's council, including subcommittees watercraft inspections guidelines; reporting guidelines

s. 23.24 Aquatic plants – Directs the department to establish an aquatic plant management program that protects and develops diverse native plant communities, regulate management of aquatic plants, and administer procedures/requirements for issuing permits for aquatic plant management; outlines management activities that require permits, along with penalties.

s, 23,24 (2) (c) states: "The requirements promulgated under par. (a) 4. may specify any of the following:

1. The quantity of aquatic plants that may be managed under an aquatic plant management permit

2. The species of aquatic plants that may be managed under an aquatic plant management permit.

3. The areas in which aquatic plants may be managed under an aquatic plant management permit.

4. The methods that may be used to manage aquatic plants under an aquatic plant management permit.

5. The times during which aquatic plants may be managed under an aquatic plant management permit.

6. The allowable methods for disposing or using aquatic plants that are removed or controlled under an aquatic plant management permit

7. The requirements for plans that the department may require under sub. (3) (b)."

State Statute 23.24 (3)b states: "The department may require that an application for an aquatic plant management permit contain a plan for the department's approval as to how the aquatic plants will be introduced, removed, or controlled."

Wisconsin Administrative Code NR 109 requires a permit to chemically treat aquatic plants. An aquatic plant management plan is a permit condition as stated in Wisconsin Administrative Code NR 109.04 (3) (a): "The department may require an application for an aquatic plant management permit contain an aquatic plant management plan that describes how the aquatic plants will be introduced, controlled, removed or disposed."

8.1.7.2 Aquatic Plant Treatment Permit

An application for a plant treatment permit will be submitted to WDNR annually during years of treatment. Each permit application will indicate that the treatment is an implementation of the Long Lake Aquatic Plant Management Plan.

8.1.7.3 Notification Requirements

All riparian owners within 150 feet of treatment must be notified prior to each treatment. Notification letters will be sent annually to effected riparian owners.

8.2 Annual Maintenance—Navigation Channel Treatment

Severe impairment or nuisance conditions within navigation channels in Long Lake may warrant chemical treatment during the summer period. Navigation channels can be of two types:

- **Common use navigation channel.** This is a common navigation route for the general lake user. It often is offshore and connects areas that boaters commonly would navigate to or across, and should be of public benefit.

- **Individual riparian access lane.** This is an access lane to shore that normally is used by an individual riparian shore owner.

Severe impairment or nuisance will generally mean vegetation grows thickly and forms mats on the water surface (WDNR 2007). If a boat cannot go through the vegetation and it is not possible to go around the vegetation, a severe impairment or nuisance condition exists.

A permit must be obtained from the WDNR prior to treatment of navigation channels in which severe impairment or nuisance conditions occur. Before issuing the permit, the WDNR will ask the District to document the problem and show what efforts or adaptations have been made to use the site (This is currently required in Administrative Code NR 107 and on the application form). Documentation of impairment of navigation by native plants must include (WDNR 2007):

a. Specific locations of navigation routes (preferably with GPS coordinates)

b. Specific dimensions in length, width, and depth

c. Specific times when plants cause the problem and how long the problem persists

d. Adaptations or alternatives that have been considered by the lake shore user to avoid or lessen the problem

e. The species of plant or plants creating the nuisance (documented with samples or from a site inspection)

Documentation of the nuisance must include:

a. Specific periods of time when plants cause the problem (e.g., when does the problem start and when does it go away)

b. Photos of the nuisance are encouraged to help show what uses are limited and to show the severity of the problem

c. Examples of specific activities that would normally be done where native plants occur naturally on a site but can not occur because native plants have become a nuisance (WDNR 2007)

Riparian owners who desire treatment of a navigation channel to give them access to the lake will contact the Lake District. The Lake District will coordinate any riparian requests for plant control with the District plan.

9.0 Public Participation In Long Lake Management Plan Completion

Public participation in the Long Lake Management Plan has occurred from its beginning. In fact, the idea for management of the lake's vegetation originated from the results of a 2001 survey of District residents. The survey asked District residents to indicate lake management goals that were important to them. A total of 81 percent of survey respondents indicated a lake management goal of decreasing weed growth in the lake was important to them.

In August of 2005, the District Board responded to the wishes of District residents by voting to complete an aquatic plant survey and aquatic plant management plan, subject to residents' approval at the annual District meeting. Residents voted to complete an aquatic plant survey and aquatic plant management plan at the District's 2005 annual meeting held on August 27. The District President sent a letter to District residents on August 31 which summarized the outcome of the meeting, including the District vote to complete an aquatic plant survey and aquatic plant management plan (See Appendix G). The letter encouraged District residents to contact one of the Board members for more information and provided Board member contact information.

The District applied for Lake Planning grant monies during 3 grant cycles (See Table 11) and successfully procured grant funds during the February 2007 grant cycle. On May 15, 2007, the District President sent a letter to District residents letting them know the District had been awarded grant monies and would complete the aquatic plant survey and aquatic plant management plan during 2007. District residents were again encouraged to contact Board members for more information and Board contact information was provided.

District residents were involved with the aquatic plant survey, which occurred on June 8 through 10, 2007. A total of 8 individuals volunteered to assist with the survey (i.e., record data on data sheets during the survey).

Barr Engineering staff presented preliminary results of the aquatic plant survey on August 25, 2007 at the District's annual meeting. Attendees discussed the preliminary results, the lake's aquatic plant management plan, and received answers to questions. Barr staff also presented information regarding the favorable impact on the lake's water quality that is expected to result from the management of the lake's curlyleaf pondweed.

During September of 2007, the District Board discussed goals for the lake's aquatic plant management plan. District residents were welcome to attend and provide input if they wished to do so.

On October 4, 2007, the District Board met with WDNR and Polk County Land Conservation Department staff. Barr Engineering Company presented results from the aquatic plant survey. WDNR staff presented recommendations for management of curlyleaf pondweed. County staff provided input and received answers to questions that arose.

Following the meeting, District Board members finalized aquatic plant management goals for the APM plan. A draft version of the Long Lake Aquatic Plant Management Plan was provided to the District for review and comment during November. The draft plan was sent via email to District members and they were given until Friday November 23, 2007 to provide any feedback. The Board reviewed feedback from members and then met to vote on acceptance of the plan. The Board voted to accept the plan and the plan was submitted to the WDNR.

Table 11. Long Lake Aquatic Plant Management Plan Timeline

Planning Activity	Date	Comments
Membership Survey	2001	Results are -- Lake Management Goals: 81% = Decrease Weed Growth, 24% = Protect Existing Weed Growth, 88% = Improve the lake's water quality, Protect existing water quality = 40%, Protect aesthetics = 45%, Improve Fisheries = 45%, and Improve Aesthetics = 64%
Board Meeting to Discuss Completion of AP Survey and APM Plan, Consider Barr's Proposal	August 13, 2005	Frank Koshere, Meg Rattei, Josh Britton, Patti Langer, Jeff Larson, and Tim Draeger attended, Board voted to go forward with AP Survey and APM Plan. Board voted to approve Barr proposal for AP Survey and APM Plan
District Annual Meeting – Approve AP Survey and APM Plan	August 27, 2005	District Members Voted to complete AP survey and APM Plan per Barr's proposal. The vote was 24 members in favor and 5 against, no one abstained

Table 11 (Continued). Long Lake Aquatic Plant Management Plan Timeline

Planning Activity	Date	Comments
District President Sends Letter to District Residents	August 31, 2005	Letter summarizes outcome of the meeting. District voted to complete APM plan
Apply for Lake Planning Grants to Help Fund AP Survey	February 1, 2006, August 1, 2006, and February 1, 2007	Received $10,000 grant during February 1, 2007 grant cycle
District President Sends Letter to District Residents	May 15, 2007	Letter informed residents that the District had been awarded grant monies and would complete the aquatic plant survey and aquatic plant management plan during 2007
Completed Aquatic Plant Survey	June 8-10, 2007	Completed Long Lake Aquatic Plant Survey – Barr Staff with help from lake resident volunteers
District's Annual Meeting—Discuss APM Plan and Water Quality Management Plan	August 25, 2007	Barr staff presented preliminary results of AP survey and discussed APM Plan, Barr staff presented information regarding implementation of the lake's Water Quality Management Plan, including a discussion of AP Management to attain water quality goals
September Board Meeting	Sept. 2007	Board meeting to discuss APM goals
Meeting With WDNR Staff, County Staff, and District Board to Discuss AP Study and APM Plan	October 4, 2007	WDNR staff (Frank Koshere, Pamela Toshner, and Heath Benike), Polk County Land & Water (Jeremy Williamson and Amy Kelsey), District Board & At Large Reps (Patti Langer, Jeff Larson, Gene Braund, Michael Langer, and Tim Draeger), and Barr staff (Meg Rattei) attended. Discussed AP survey results and APM Plan.
Draft APM Plan submitted to Board and District Members for Review	November 2007	Draft APM plan submitted to District Board for Review and Comment and sent to District members via email for feedback.
Board Approves Plan and Submits Plan to WDNR	November 2007	District Board voted to approve plan. Plan submitted to WDNR

10.0 References

Barr Engineering Company. 2003. *Long Lake Management Plan Phases V and VI: Lake Management Plan.* Prepared for Long Lake Protection and Rehabilitation District. 70p.

Barr Engineering Company. 2001. *Long Lake Management Plan Phases I-IV: Lake Management Plan.* Prepared for Long Lake Protection and Rehabilitation District. 105 p.

Barr Engineering Company. 1997. *Big Lake Macrophyte Survey and Management Plan.* Prepared for Church Pine, Round, and Big Lake Protection and Rehabilitation District. 53p.

Barr Engineering Company. 1994. *Trego Flowage Survey and Macrophyte Management Plan.* Prepared for NSP as Directed by Article 405 of its FERC Operating License for the Trego Hydro Project (FERC No. 2711). 34p.

Bernthal, T.W. 2003. *Wetland Monitoring Strategies: One Step at a Time.* Wisconsin Department of Natural Resources. Unpublished Report to EPA.

Borman, S., R. Lorth, and J. Temte. 1997. *Through the Looking Glass...A Field Guide to Aquatic Plants.* Wisconsin Lakes Partnership, a division of the University of Wisconsin-Extension and the Wisconsin Department of Natural Resources. 248p.

Cooke, G.E., E.B. Welch, S.A. Peterson, and P.R. Newroth. 1993. *Restoration and Management of Lakes and Reservoirs.* Second Edition. Lewis Publishers, Boca Raton. 548 p.

Deppe, E.R. and R.C. Lathrop. 1992. *A Comparison of Two Rake Sampling Techniques for Sampling Aquatic Macrophytes.* Research and Management Findings, 32:1-4.

Gerloff, G.C. 1969. *Evaluating Nutrient Supplies for the Growth of Aquatic Plants in Natural Waters.* In Eutrophication: Causes, Consequences, Correctives. Nat. Acad. SCi., Washington D.C. p. 537-555.

Gibbons, M.V., H.L. Gibbons, Jr., and M.D. Sytsma. 1994. *A Citizens Manual for Developing Integrated Aquatic Vegetation Management Plans.* No. 93-93. Washington Department of Ecology. 68 p.

Jessen R. and R. Lound. 1962. *An Evaluation of a Survey Technique for Submerged Aquatic Plants*. Game Investigational Report. Minnesota Department of Conservation.

Little, E.C.S. 1968. *The Control of Water Weeds*. Weed Res. 8(2):79-105.

Madsen, J.D. and J.A. Bloomfield. 1992. *Aquatic Vegetation Monitoring and Assessment Protocol Manual*. A Report to the Finger Lakes Water Resources Board. 27 p.

Minnesota Department of Natural Resources. 1994. *A Guide to Aquatic Plants Identification and Masnagement*. 52p.

Nichols, S.A. 1997. *Seasonal and Sampling Variability in Some Wisconsin Lake Plant Communities*. Journal of Freshwater Ecology 12 (2): 173-182.

Nichols, S.A., S. Engel, and T. McNabb. 1988. *Developing a Plan to Manage Lake Vegetation*. Aquatics 10 (3): 10-19.

Poovey, A.G., Skogerboe, J.G., and Owens, C.S. 2002. *Spring Treatments of Diquat and Endothall for Curlyleaf Pondweed Control*. J. Aquat. Plant Manage. 40:63-67.

Sawyer, C.N. 1947. *Fertilization of Lakes by Agriculture and Urban Drainage.* J.N. Engl. Waste Works Assoc. 51: 109-127.

Simpson, W. 1949. *The Biology of Aquatic Vascular Plants*. Edward Arnold, Ltd. London, 610 p.

Skogerboe, J.G. and K.D. Getsinger. 2006. *Selective Control of Eurasian Watermilfoil and Curlyleaf Pondweed Using Low Doses of Endothall Combined With 2,4-D*. APCRP Technical Notes Collection (ERDC/TN APCRP-CC-05). Vicksburg, MS. US Army Research and Development Center, Vicksburg, MS. http://el.erdc.usace.army.mil/aqua/

Smart, R.M., R.D. Doyle, J.D. Madsen, and G.O. Dick. 1996. *Establishing Native Submersed Aquatic Plant Communities in Southern Reservoirs*. Technical Report A-96-2, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Smart, R.M., J.W. Barko, and D.G. McFarland. 1994. *Competition Between Hydrilla verticillata and Vallisneria Americana Under Different Experimental Conditions*. Technical Report A-94-1, U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Stewart, K.M. and G. Rohlich. 1967. *Eutrophication. A Review.* Publ. No. 34. A Report to the State Water Quality Control Board, California. Sacramento, California. 188 p.

Swink, F. and G. Wilhelm. 1979. *Plants of the Chicago Region.* 3rd, Rev. and Exp. Edition with Keys. Morton Arboretum. Lisle, IL.

Truelson, R.L. 1989. *Use of Bottom Barriers to Control Nuisance Aquatic Plants.* Water Management Branch Rep. British Columbia Ministry of Environment.

Truelson, R.L. 1985. *Assessment of the 1984 Eurasian Watermilfoil Control Program in Cultus Lake.* Water Management Branch Rep. No. 3308. British Columbia Ministry of Environment.

Vlach, B. and J. Barten. 2006. *Medicine Lake Endothal Treatment to Control Curlyleaf Pondweed* 2005 Status Report. Three Rivers Park District.

Vollenweider, R.A. 1968. *Scientific Fundamentals of the Eutrophication of Lakes and Flowing Waters With Particular Reference to Nitrogen and Phosphorus as Factors in Eutrophication.* Organization for Economic Cooperation and Development. Directorate for Scientific Affairs. (Reference DAS/CSF/62.27/Bibliography). Paris

Wisconsin Department of Natural Resources. 2007a. *Aquatic Plant Management in Wisconsin.* http://www.uwsp.edu/cnr/uwexlakes/ecology/APMguide.asp

Wisconsin Department of Natural Resources. 2007b. *Aquatic Plant Management Strategy Northern Region WDNR Summer, 2007.* 7p.

Wisconsin Department of Natural Resources. 1995. *Chapter NR 107: Aquatic Plant Management.* Register, 477:63-67.

Wisconsin Department of Natural Resources. 1987. *Wisconsin's Department of Natural Resources Long-term Trend Lake Monitoring Methods.* Bureau of Water Resources Management. Pp. 121-125.

Appendices

Appendix A

2007 Aquatic Plant Data Summary—Point Intercept Method

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Observed (x)	Type[1]	Total Density
Long 007	1.0	Silt	SPEU	*Sparganium eurycarpum*	common bur-reed		X	3	
Long 007	1.0	Silt	SCSP	*Scirpus sp.*	bulrush		X	3	2
Long 008	3.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	2		2	
Long 008	3.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 008	3.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		X	1	2
Long 009	3.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	2		1	
Long 009	3.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	
Long 009	3.0	Muck	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 009	3.0	Muck	algae	*Phytoplankton*	algae		X	4	
Long 009	3.0	Muck	POSP	*Potamogeton sp.*	pondweed		X	1	
Long 009	3.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		X	1	2
Long 010	3.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	2		1	
Long 010	3.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 010	3.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	
Long 010	3.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily		X	2	
Long 010	3.0	Muck	LETR	*Lemna trisulca*	star duckweed		X	2	
Long 010	3.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed		X	1	
Long 010	3.0	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		X	1	2
Long 011	2.5	Silt, Muck	CEDE	*Ceratophyllum demersum*	coontail	2		1	
Long 011	2.5	Silt, Muck	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	
Long 011	2.5	Silt, Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 011	2.5	Silt, Muck	SPPO	*Spirodela polyrhiza*	great duckweed		X	2	
Long 011	2.5	Silt, Muck	POSP	*Potamogeton sp.*	pondweed		X	1	
Long 011	2.5	Silt, Muck	ELCA	*Elodea canadensis*	Canada waterweed		X	1	
Long 011	2.5	Silt, Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		X	1	
Long 011	2.5	Silt, Muck	SPEU	*Sparganium eurycarpum*	common bur-reed		x	3	2
Long 012	1.0	Silt, Muck	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	
Long 012	1.0	Silt, Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	2		1	
Long 012	1.0	Silt, Muck	ELCA	*Elodea canadensis*	Canada waterweed	1		1	
Long 012	1.0	Silt, Muck	ZODU	*Zosterella dubia*	mud plantain	1		1	
Long 012	1.0	Silt, Muck	LETR	*Lemna trisulca*	star duckweed		X	2	
Long 012	1.0	Silt, Muck	SPPO	*Spirodela polyrhiza*	great duckweed		X	2	
Long 012	1.0	Silt, Muck	SPEU	*Sparganium eurycarpum*	common bur-reed		X	3	
Long 012	1.0	Silt, Muck	SASP	*Sagittaria sp.*	arrowhead		X	3	
Long 012	1.0	Silt, Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		X	1	2
Long 013	3.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 013	3.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 013	3.0	Muck	LETR	*Lemna trisulca*	star duckweed	1		2	

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Observed (x)	Type[1]	Total Density
Long 013	3.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	1
Long 014	3.0	Muck	LETR	*Lemna trisulca*	star duckweed	2		2	
Long 014	3.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	3		1	
Long 014	3.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	
Long 014	3.0	Muck	POSP	*Potamogeton sp.*	pondweed		X	1	3
Long 015	3.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 015	3.5	Muck	ELCA	*Elodea canadensis*	Canada waterweed	1		1	
Long 015	3.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 015	3.5	Muck	POSP	*Potamogeton sp.*	pondweed	1		1	
Long 015	3.5	Muck	LETR	*Lemna trisulca*	star duckweed	1		2	1
Long 016	3.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	2		1	
Long 016	3.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	2		2	
Long 016	3.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed	1		1	
Long 016	3.0	Muck	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 016	3.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily		X	2	
Long 016	3.0	Muck	LETR	*Lemna trisulca*	star duckweed		X	2	
Long 016	3.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		X	1	2
Long 017	1.0	Silt, Muck	NYTU	*Nymphaea tuberosa*	white waterlily	2		2	
Long 017	1.0	Silt, Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 017	1.0	Silt, Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 017	1.0	Silt, Muck	ZODU	*Zosterella dubia*	mud plantain	1		1	
Long 017	1.0	Silt, Muck	SPEU	*Sparganium eurycarpum*	common bur-reed		X	3	
Long 017	1.0	Silt, Muck	SPPO	*Spirodela polyrhiza*	great duckweed		X	2	
Long 017	1.0	Silt, Muck	WOCO	*Wolffia columbiana*	Columbian watermeal		X	2	
Long 017	1.0	Silt, Muck	LETR	*Lemna trisulca*	star duckweed		X	2	
Long 017	1.0	Silt, Muck	ELCA	*Elodea canadensis*	Canada waterweed		X	1	
Long 017	1.0	Silt, Muck	SCSP	*Scirpus sp.*	bulrush		X	3	2
Long 018	3.0	Silt	CEDE	*Ceratophyllum demersum*	coontail	3		1	
Long 018	3.0	Silt	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 018	3.0	Silt	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	
Long 018	3.0	Silt	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 018	3.0	Silt	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		X	1	
Long 018	3.0	Silt	TYSP	*Typha. spp.*	cattail		X	3	
Long 018	3.0	Silt	SCSP	*Scirpus sp.*	bulrush		X	3	
Long 018	3.0	Silt	SPEU	*Sparganium eurycarpum*	common bur-reed		X	3	3
Long 019	4.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	2		1	
Long 019	4.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 019	4.5	Muck	POSP	*Potamogeton sp.*	pondweed	1		1	

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Observed (x)	Type[1]	Total Density
Long 019	4.5	Muck	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 019	4.5	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		X	1	2
Long 020	4.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	3		1	
Long 020	4.5	Muck	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 020	4.5	Muck	NYTU	*Nymphaea tuberosa*	white waterlily		X	2	3
Long 021	3.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	2		1	
Long 021	3.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 021	3.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed	1		1	
Long 021	3.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	
Long 021	3.0	Muck	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 021	3.0	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		X	1	2
Long 022	2.0	Silt	ELCA	*Elodea canadensis*	Canada waterweed	2		1	
Long 022	2.0	Silt	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	
Long 022	2.0	Silt	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 022	2.0	Silt	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 022	2.0	Silt	SPPO	*Spirodela polyrhiza*	great duckweed		X	2	
Long 022	2.0	Silt	POCR	*Potamogeton crispus*	curlyleaf pondweed		X	1	
Long 022	2.0	Silt	SPEU	*Sparganium eurycarpum*	common bur-reed		X	3	
Long 022	2.0	Silt	NYTU	*Nymphaea tuberosa*	white waterlily		X	2	2
Long 023	3.5	Silt	ELCA	*Elodea canadensis*	Canada waterweed	2		1	
Long 023	3.5	Silt	CEDE	*Ceratophyllum demersum*	coontail	2		1	
Long 023	3.5	Silt	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 023	3.5	Silt	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 023	3.5	Silt	NYTU	*Nymphaea tuberosa*	white waterlily		X	2	
Long 023	3.5	Silt	SASP	*Sagittaria sp.*	arrowhead		X	3	3
Long 024	5.0	Silt, Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 024	5.0	Silt, Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	3
Long 025	3.5	Sand, Gravel	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 025	3.5	Sand, Gravel	ELCA	*Elodea canadensis*	Canada waterweed	1		1	
Long 025	3.5	Sand, Gravel	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 025	3.5	Sand, Gravel	ELSP	*Eleocharis spp.*	spikerush	2		3	2
Long 026	5.0	Silt	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 026	5.0	Silt	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 026	5.0	Silt	SPEU	*Sparganium eurycarpum*	common bur-reed		X	3	3
Long 027	6.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 027	6.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 027	6.0	Muck	LETR	*Lemna trisulca*	star duckweed	1		2	2
Long 028	5.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Observed (x)	Type[1]	Total Density
Long 028	5.0	Muck	LETR	*Lemna trisulca*	star duckweed	1		2	3
Long 029	4.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	1
Long 030	3.5	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	2		2	
Long 030	3.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 030	3.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 030	3.5	Muck	POSP	*Potamogeton sp.*	pondweed		X	1	
Long 030	3.5	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		X	1	2
Long 031	2.5	Silt	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	
Long 031	2.5	Silt	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 031	2.5	Silt	ELCA	*Elodea canadensis*	Canada waterweed	1		1	
Long 031	2.5	Silt	POCR	*Potamogeton crispus*	curlyleaf pondweed		X	1	
Long 031	2.5	Silt	LETR	*Lemna trisulca*	star duckweed		X	2	1
Long 032	4.5	Sand, Gravel, Silt	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 032	4.5	Sand, Gravel, Silt	CEDE	*Ceratophyllum demersum*	coontail	3		1	
Long 032	4.5	Sand, Gravel, Silt	ELCA	*Elodea canadensis*	Canada waterweed	3		1	3
Long 033	7.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	2
Long 034	7.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 034	7.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	3
Long 035	8.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	2
Long 036	7.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	2		1	
Long 036	7.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 036	7.5	Muck	LETR	*Lemna trisulca*	star duckweed	1		2	2
Long 037	6.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	3
Long 038	5.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 038	5.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 038	5.5	Muck	ELCA	*Elodea canadensis*	Canada waterweed	1		1	3
Long 039	5.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	2		1	
Long 039	5.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	3
Long 040	4.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	3		1	
Long 040	4.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 040	4.5	Muck	LETR	*Lemna trisulca*	star duckweed	1		2	3
Long 041	3.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	2		2	
Long 041	3.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 041	3.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 041	3.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed	1		1	
Long 041	3.0	Muck	LETR	*Lemna trisulca*	star duckweed		X	2	
Long 041	3.0	Muck	SPPO	*Spirodela polyrhiza*	great duckweed		X	2	
Long 041	3.0	Muck	SPEU	*Sparganium eurycarpum*	common bur-reed		X	3	2

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Observed (x)	Type[1]	Total Density
Long 042	4.5	Sand/Gravel	CEDE	*Ceratophyllum demersum*	coontail	1		1	1
Long 043	8.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 043	8.5	Muck	ELCA	*Elodea canadensis*	Canada waterweed	1		1	
Long 043	8.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	1
Long 044	9.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	2
Long 045	10.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	3
Long 046	10.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	1
Long 047	8.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 047	8.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 047	8.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed	1		1	3
Long 048	6.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 048	6.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	3
Long 049	5.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 049	5.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	3		1	
Long 049	5.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed	1		1	3
Long 050	5.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 050	5.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	2		1	
Long 050	5.0	Muck	LETR	*Lemna trisulca*	star duckweed		X	2	3
Long 051	4.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 051	4.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	3		1	3
Long 052	2.5	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	3		2	
Long 052	2.5	Muck	ELCA	*Elodea canadensis*	Canada waterweed	2		1	
Long 052	2.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 052	2.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 052	2.5	Muck	SCSP	*Scirpus sp.*	bulrush		X	3	
Long 052	2.5	Muck	SPEU	*Sparganium eurycarpum*	common bur-reed		X	3	
Long 052	2.5	Muck	WOCO	*Wolffia columbiana*	Columbian watermeal		X	2	
Long 052	2.5	Muck	POSP	*Potamogeton sp.*	pondweed		X	1	3
Long 053	8.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 053	8.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	1
Long 054	10.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 054	10.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	1
Long 055	11.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	1
Long 056	12.0	Muck							
Long 057	12.5	Muck							
Long 058	10.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 058	10.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed	1		1	1
Long 059	7.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Observed (x)	Type[1]	Total Density
Long 059	7.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	1
Long 060	3.0	Silt/Gravel/Sand	algae	*Phytoplankton*	algae	3		4	
Long 060	3.0	Silt/Gravel/Sand	ELCA	*Elodea canadensis*	Canada waterweed	1		1	
Long 060	3.0	Silt/Gravel/Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 060	3.0	Silt/Gravel/Sand	CEDE	*Ceratophyllum demersum*	coontail	1		1	3
Long 061	4.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 061	4.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	2		1	
Long 061	4.5	Muck	LETR	*Lemna trisulca*	star duckweed	1		2	3
Long 062	4.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	3		1	
Long 062	4.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2.5		1	
Long 062	4.0	Muck	LETR	*Lemna trisulca*	star duckweed	1		2	3
Long 063	3.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	2		1	
Long 063	3.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 063	3.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	
Long 063	3.0	Muck	POSP	*Potamogeton sp.*	pondweed	1		1	
Long 063	3.0	Muck	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 063	3.0	Muck	SPEU	*Sparganium eurycarpum*	common bur-reed		X	3	3
Long 064	4.0	Rock/Sand							
Long 065	9.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	1
Long 066	10.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 066	10.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	2
Long 067	11.5	Muck	algae	*Phytoplankton*	algae		X	4	
Long 067	11.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 067	11.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 067	11.5	Muck	ELCA	*Elodea canadensis*	Canada waterweed	1		1	1
Long 068	13.0	Muck							
Long 069	13.0	Muck							
Long 070	12.0	Muck	algae	*Phytoplankton*	algae	1		4	
Long 070	12.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	1
Long 071	11.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 071	11.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	2
Long 072	6.0	Silt/Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 072	6.0	Silt/Sand	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 072	6.0	Silt/Sand	SCSP	*Scirpus sp.*	bulrush		X	3	1
Long 073	2.5	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	
Long 073	2.5	Muck	algae	*Phytoplankton*	algae	3		4	
Long 073	2.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 073	2.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	3

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Observed (x)	Type[1]	Total Density
Long 074	3.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 074	3.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	2		1	
Long 074	3.5	Muck	ELCA	*Elodea canadensis*	Canada waterweed	1		1	
Long 074	3.5	Muck	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 074	3.5	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	3
Long 075	3.5	Silt/Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 075	3.5	Silt/Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	3
Long 076	1.5	Silt	NYTU	*Nymphaea tuberosa*	white waterlily	2		2	
Long 076	1.5	Silt	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 076	1.5	Silt	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 076	1.5	Silt	ELCA	*Elodea canadensis*	Canada waterweed	1		1	
Long 076	1.5	Silt	SPEU	*Sparganium eurycarpum*	common bur-reed		X	3	
Long 076	1.5	Silt	POSP	*Potamogeton sp.*	pondweed		X	1	
Long 076	,	Silt	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	1		1	2
Long 077	3.5	Sand/Gravel	algae	*Phytoplankton*	algae		X		
Long 077	3.5	Sand/Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	1
Long 078	9.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 078	9.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	3
Long 079	11.0	Muck	algae	*Phytoplankton*	algae	3	X	4	3
Long 080	12.0	Muck	algae	*Phytoplankton*	algae	3		4	3
Long 081	13.0	Muck							
Long 084	13.0	Muck	algae	*Phytoplankton*	algae			4	3
Long 085	11.0	Muck	algae	*Phytoplankton*	algae	2		4	
Long 085	11.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	2
Long 086	5.5	Silt	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 086	5.5	Silt	ZODU	*Zosterella dubia*	mud plantain	1		1	1
Long 087	1.5	Silt/Sand	algae	*Phytoplankton*	algae	1		4	
Long 087	1.5	Silt/Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 087	1.5	Silt/Sand	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	
Long 087	1.5	Silt/Sand	ZODU	*Zosterella dubia*	mud plantain	1		1	
Long 087	1.5	Silt/Sand	NYTU	*Nymphaea tuberosa*	white waterlily		X	2	
Long 087	1.5	Silt/Sand	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		X	1	1
Long 088	3.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	3		1	
Long 088	3.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	
Long 088	3.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed	1		1	
Long 088	3.0	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		X	1	3
Long 089	2.0	Silt/Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 089	2.0	Silt/Muck	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Observed (x)	Type[1]	Total Density
Long 089	2.0	Silt/Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 089	2.0	Silt/Muck	ELCA	*Elodea canadensis*	Canada waterweed	1		1	
Long 089	2.0	Silt/Muck	SPEU	*Sparganium eurycarpum*	common bur-reed		X	3	2
Long 090	7.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	3
Long 091	10.5	Muck	algae	*Phytoplankton*	algae	1		4	
Long 091	10.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	1
Long 092	14.0	Muck	algae	*Phytoplankton*	algae			4	
Long 097	14	Muck							
Long 098	10.5		POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	2
Long 099	2.0	Sand/Gravel	algae	*Phytoplankton*	algae	1		4	
Long 099	2.0	Sand/Gravel	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	1		1	
Long 099	2.0	Sand/Gravel	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 099	2.0	Sand/Gravel	SCSP	*Scirpus sp.*	bulrush		X	3	
Long 099	2.0	Sand/Gravel	SPEU	*Sparganium eurycarpum*	common bur-reed		X	3	2
Long 100	1.0	Silt/Muck	NYTU	*Nymphaea tuberosa*	white waterlily	2		2	
Long 100	1.0	Silt/Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 100	1.0	Silt/Muck	ZODU	*Zosterella dubia*	mud plantain	1		1	
Long 100	1.0	Silt/Muck	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 100	1.0	Silt/Muck	SPEU	*Sparganium eurycarpum*	common bur-reed		X	3	
Long 100	1.0	Silt/Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		X	1	
Long 100	1.0	Silt/Muck	POSP	*Potamogeton sp.*	pondweed	1		1	
Long 100	1.0	Silt/Muck	SASP	*Sagittaria sp.*	arrowhead		X	3	
Long 100	1.0	Silt/Muck	SPPO	*Spirodela polyrhiza*	great duckweed		X	2	2
Long 101	1.0	Silt/Muck	NYTU	*Nymphaea tuberosa*	white waterlily	2		2	
Long 101	1.0	Silt/Muck	POSP	*Potamogeton sp.*	pondweed	1		1	
Long 101	1.0	Silt/Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	1		1	
Long 101	1.0	Silt/Muck	SPEU	*Sparganium eurycarpum*	common bur-reed		X	3	
Long 101	1.0	Silt/Muck	ZODU	*Zosterella dubia*	mud plantain	1		1	
Long 101	1.0	Silt/Muck	SPPO	*Spirodela polyrhiza*	great duckweed		X	2	
Long 101	1.0	Silt/Muck	LETR	*Lemna trisulca*	star duckweed		X	2	
Long 101	1.0	Silt/Muck	ELCA	*Elodea canadensis*	Canada waterweed		X	1	2
Long 102	3.0	Gravel	algae	*Phytoplankton*	algae			4	
Long 102	3.0	Gravel	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 102	3.0	Gravel	ELSP	*Eleocharis spp.*	spikerush	1		3	
Long 102	3.0	Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed		X	1	3
Long 103	9.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 103	9.0	Muck	algae	*Phytoplankton*	algae			4	2
Long 104	11.0	Muck	algae	*Phytoplankton*	algae			4	

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Observed (x)	Type[1]	Total Density
Long 105	15.0								
Long 110	13.0	Muck	algae	*Phytoplankton*	algae			4	
Long 111	9.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 111	9.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 111	9.0	Muck	SPEU	*Sparganium eurycarpum*	common bur-reed		X	3	
Long 111	9.0	Muck	SCSP	*Scirpus sp.*	bulrush		X	3	3
Long 112	8.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	2
Long 113	11.0	Muck	algae	*Phytoplankton*	algae	3		4	
Long 113	11.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	3
Long 114	15.0	Muck							
Long 119	13.5								
Long 120	12.0	Muck	algae	*Phytoplankton*	algae	1		4	1
Long 121	5.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 121	5.5	Muck	SCSP	*Scirpus sp.*	bulrush		X	3	
Long 121	5.5	Muck	SPEU	*Sparganium eurycarpum*	common bur-reed		X	3	3
Long 122	7.5	Silt/Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 122	7.5	Silt/Sand	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	1		1	2
Long 123	10.0		algae	*Phytoplankton*	algae	2		4	
Long 123	10.0		POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	2
Long 124	14.0	Muck							
Long 125	16.0								
Long 130	13.0	Muck							
Long 131	10.0	Muck	algae	*Phytoplankton*	algae	3		4	3
Long 132	2.0	Sand/Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed		X	1	
Long 133	2.0	Sand/Rock							
Long 134	10.0	Muck	algae	*Phytoplankton*	algae			4	3
Long 135	12.5		algae	*Phytoplankton*	algae			4	3
Long 141	14.5	Muck							
Long 142	12.5	Muck							
Long 143	6.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 143	6.0	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	1		1	
Long 143	6.0	Muck	POSP	*Potamogeton sp.*	pondweed	1		1	3
Long 145	10.5	Muck	algae	*Phytoplankton*	algae			4	3
Long 146	15.0								
Long 152	14.0	Muck							
Long 153	10.0	Muck	POSP	*Potamogeton sp.*	pondweed	1		1	
Long 153	10.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	1
Long 154	7.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	3

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Observed (x)	Type[1]	Total Density
Long 155	11.0		algae	*Phytoplankton*	algae			4	3
Long 156	15.0								
Long 161	15.0	Muck							
Long 162	13.0	Muck							
Long 163	7.5	Silt/Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 163	7.5	Silt/Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	3
Long 164	8.0	Sand/Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	3
Long 165	12.0		algae	*Phytoplankton*	algae	1		4	1
Long 166	15.5								
Long 171	14.5	Sand	algae	*Phytoplankton*	algae	1		4	1
Long 172	9.0	Silt/Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 172	9.0	Silt/Sand	algae	*Phytoplankton*	algae	3		4	
Long 172	9.0	Silt/Sand	ELCA	*Elodea canadensis*	Canada waterweed	1		1	3
Long 173	1.5	Sand/Gravel	ELSP	*Eleocharis spp.*	spikerush	1		3	
Long 173	1.5		POCR	*Potamogeton crispus*	curlyleaf pondweed		X	1	1
Long 174	9.0	Silt/Sand	LETR	*Lemna trisulca*	star duckweed	2		2	
Long 174	9.0	Silt/Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	2
Long 175	17.0								
Long 176	17.0								
Long 180	16.0	Muck							
Long 181	11.0	Sand/Gravel	algae	*Phytoplankton*	algae	2		4	2
Long 182	2.5	Gravel	ELSP	*Eleocharis spp.*	spikerush	1		3	1
Long 183	9.5	Silt/Sand	algae	*Phytoplankton*	algae	3		4	3
Long 184	16.0								
Long 185	17.0								
Long 189	16.0	Muck							
Long 190	13.0	Sand/Gravel							
Long 191	6.5	Sand	CEDE	*Ceratophyllum demersum*	coontail	3		1	
Long 191	6.5	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 191	6.5	Sand	ELCA	*Elodea canadensis*	Canada waterweed	1		1	
Long 191	6.5	Sand	LETR	*Lemna trisulca*	star duckweed	1		2	3
Long 192	3.0	sand							
Long 193	16.0								
Long 194	18.0								
Long 198	16.5	Muck							
Long 199	15.0	Muck							
Long 200	9.0	Sand/Gravel	algae	*Phytoplankton*	algae	2		4	2
Long 201	12.0	Sand/Gravel	algae	*Phytoplankton*	algae			4	

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Observed (x)	Type[1]	Total Density
Long 202	12.0								
Long 206	17.0	Muck							
Long 207	15.5	Muck							
Long 208	10.0	Sand/Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 208	10.0	Sand/Gravel	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 208	10.0	Sand/Gravel	algae	*Phytoplankton*	algae	1		4	1
Long 209	8.0	sand	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 209	8.0	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 209	8.0	Sand	CEDE	*Ceratophyllum demersum*	coontail	1		1	1
Long 210	12.0	Sand/Gravel	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 210	12.0	Sand/Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed		X	1	1
Long 211	2.0	Sand/Gravel							
Long 212	12.5	Sand/Gravel							
Long 213	20.0								
Long 217	17.0	Muck							
Long 218	15.5	Muck							
Long 219	11.0	Silt	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 219	11.0	Silt	POCR	*Potamogeton crispus*	curlyleaf pondweed		X	1	1
Long 220	8.5	Sand/Gravel							
Long 221	13.0	Sand/Gravel	algae	*Phytoplankton*	algae	1		4	1
Long 222	17.0	Muck							
Long 223	18.0	Muck							
Long 224	19.0	Muck							
Long 225	20.0								
Long 230	16.5	Muck							
Long 231	15.0	Muck							
Long 232	10.0	Sand/Silt	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 232	10.0	Sand/Silt	LETR	*Lemna trisulca*	star duckweed	1		2	2
Long 233	3.5	Silt	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 233	3.5	Silt	POSP	*Potamogeton sp.*	pondweed	1		1	
Long 233	3.5	Silt	LETR	*Lemna trisulca*	star duckweed	1		2	3
Long 234	8.0	Sand	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 234	8.0	Sand	ELCA	*Elodea canadensis*	Canada waterweed	1		1	
Long 234	8.0	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 234	8.0	Sand	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 234	8.0	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed		X	1	1
Long 235	11.0	Sand	algae	*Phytoplankton*	algae			4	
Long 236	15.0								

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Observed (x)	Type[1]	Total Density
Long 237	18.0								
Long 238	18.0								
Long 239	18.0								
Long 240	19.0								
Long 241	19.0								
Long 242	20.0								
Long 247	16.5	Muck							
Long 248	13.5	Muck							
Long 249	5.0	Silt	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 249	5.0	Silt	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 249	5.0	Silt	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	1		1	3
Long 250	10.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 250	10.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	2
Long 251	13.0		algae	*Phytoplankton*	algae	2		4	2
Long 252	15.0	Muck							
Long 253	18.0								
Long 254	19.0								
Long 255	19.5								
Long 263	18.0								
Long 264	14.5	Silt							
Long 265	3.0	Rock							
Long 266	3.0		POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 266	3.0		LETR	*Lemna trisulca*	star duckweed	1		2	
Long 266	3.0		CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 266	3.0		POSP	*Potamogeton sp.*	pondweed	1		1	
Long 266	3.0		NYTU	*Nymphaea tuberosa*	white waterlily	1	X	2	
Long 266	3.0		SCSP	*Scirpus sp.*	bulrush		X	3	
Long 266	3.0		SPEU	*Sparganium eurycarpum*	common bur-reed		X	3	
Long 266	3.0		MYSI	*Myriophyllum sibiricum*	northern watermilfoil	1	X	1	3
Long 267	8.0	Silt/Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 267	8.0	Silt/Muck	ELCA	*Elodea canadensis*	Canada waterweed	1		1	3
Long 268	12.0	Muck	algae	*Phytoplankton*	algae	1		4	1
Long 269	16.0								
Long 270	17.5								
Long 271	19.0								
Long 272	20.0								
Long 280	17.5	Muck							
Long 281	16.0	Sand/Silt							

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Observed (x)	Type[1]	Total Density
Long 282	9.0	Silt/Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 282	9.0	Silt/Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	2
Long 283	14.0	Muck							
Long 284	16.0								
Long 293	19.0								
Long 294	17.5	Muck							
Long 295	15.5	Sand/Gravel							
Long 296	5.0	Gravel	ELCA	*Elodea canadensis*	Canada waterweed	1		1	
Long 296	5.0	Gravel	algae	*Phytoplankton*	algae	2		4	2
Long 297	12.0	Silt/Sand	algae	*Phytoplankton*	algae	2			2
Long 298	17.0								
Long 306	19.0								
Long 307	15.5	Sand/Gravel							
Long 308	12.0	Sand/Gravel	algae	*Phytoplankton*	algae	3		4	3
Long 308/Long 320			POCR	*Potamogeton crispus*	curlyleaf pondweed		X		
Long 309	6.0	Sand/Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 309	6.0	Sand/Gravel	ELCA	*Elodea canadensis*	Canada waterweed	1		1	
Long 309	6.0	Sand/Gravel	ECSE	*Cyperus strigosus*	strawcolored flatsedge		X	3	
Long 309	6.0	Sand/Gravel	TYSP	*Typha. spp.*	cattail		X	3	2
Long 310	16.0	Silt							
Long 311	20.0								
Long 317	18.5								
Long 318	16.5	Sand/Silt							
Long 319	8.0	Sand/Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 319	8.0	Sand/Gravel	ELCA	*Elodea canadensis*	Canada waterweed	1		1	
Long 319	8.0	Sand/Gravel	algae	*Phytoplankton*	algae	1		4	2
Long 320	2.5	Gravel/Rock							
Long 321	5.0	Sand/Gravel							
Long 322	19.0								
Long 327	19.0								
Long 328	14.5	Gravel							
Long 329	5.0	Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 329	5.0	Gravel	ELCA	*Elodea canadensis*	Canada waterweed	1		1	1
Long 330	1.5								
Long 331	18.0								
Long 335	19.0								

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Observed (x)	Type[1]	Total Density
Long 336	7.0	Sand/Silt	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 336	7.0	Sand/Silt	ELCA	*Elodea canadensis*	Canada waterweed	1		1	
Long 336	7.0	Sand/Silt	POSP	*Potamogeton sp.*	pondweed	1		1	2
Long 337	12.5	Gravel	algae	*Phytoplankton*	algae			4	
Long 338	18.0								
Long 341	19.0								
Long 342	18.0								
Long 343	7.5	Sand/Silt	algae	*Phytoplankton*	algae			4	
Long 344	18.0								
Long 347	19.0								
Long 348	15.5	Muck							
Long 348/Long 352			POCR	*Potamogeton crispus*	curlyleaf pondweed		X		
Long 348/Long 354			POCR	*Potamogeton crispus*	curlyleaf pondweed		X		
Long 349	10.0	Sand/Silt	algae	*Phytoplankton*	algae			4	
Long 350	17.0								
Long 353	19.0								
Long 354	14.0	Silt							
Long 355	13.0	Sand/Silt	algae	*Phytoplankton*	algae			4	
Long 356	18.0								
Long 359	19.0								
Long 360	13.5	Sand/Silt							
Long 360/Long 367			POCR	*Potamogeton crispus*	curlyleaf pondweed		X		
Long 361	3.0	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 361	3.0	Sand	NAFL	*Najas flexilis*	bushy naiad	1		1	2
Long 362	16.0								
Long 363	19.0								
Long 366	18.0								
Long 367	12.0	Sand	LETR	*Lemna trisulca*	star duckweed	1		2	1
Long 367/Long 374			POCR	*Potamogeton crispus*	curlyleaf pondweed		X		
Long 368	12.0	Sand	algae	*Phytoplankton*	algae			4	

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Observed (x)	Type[1]	Total Density
Long 369	19.0								
Long 370	19.0								
Long 373	19.0								
Long 374	10.0		LETR	*Lemna trisulca*	star duckweed	1		2	
Long 374	10.0		algae	*Phytoplankton*	algae	1		4	
Long 374	10.0		POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 374	10.0		CEDE	*Ceratophyllum demersum*	coontail	1		1	1
Long 374/Long 383			POCR	*Potamogeton crispus*	curlyleaf pondweed		X		
Long 375	5.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 375	5.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 375	5.5	Muck	ZODU	*Zosterella dubia*	mud plantain	1		1	
Long 375	5.5	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	1		1	2
Long 376	13.0	Sand	LETR	*Lemna trisulca*	star duckweed	1		2	1
Long 377	18.0								
Long 378	19.0								
Long 382	18.0								
Long 383	13.0	Sand/Silt	algae	*Phytoplankton*	algae	3		4	3
Long 383/Long 393			POCR	*Potamogeton crispus*	curlyleaf pondweed		X		
Long 384	3.0	Sand/Gravel							
Long 384	3.0	Sand/Gravel	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		X	1	
Long 384	3.0	Sand/Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed		X	1	
Long 384	3.0	Sand/Gravel	ZODU	*Zosterella dubia*	mud plantain		X	1	
Long 385	12.0	Muck	algae	*Phytoplankton*	algae	1		4	1
Long 386	17.5								
Long 387	18.0								
Long 392	18.0								
Long 393	14.0	Sand/Silt							
Long 393/Long 403			POCR	*Potamogeton crispus*	curlyleaf pondweed		X		
Long 394	7.0	Silt/Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 394	7.0	Silt/Sand	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 394	7.0	Silt/Sand	POSP	*Potamogeton sp.*	pondweed	1		1	
Long 394	7.0	Silt/Sand	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	1		1	1

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Observed (x)	Type[1]	Total Density
Long 395	13.0	Muck	algae	*Phytoplankton*	algae	1		4	1
Long 396	17.0								
Long 402	18.0								
Long 403	12.0	Sand	algae	*Phytoplankton*	algae	3		4	3
Long 403/Long 413			POCR	*Potamogeton crispus*	curlyleaf pondweed		X		
Long 404	3.0	Silt/Sand	CEDE	*Ceratophyllum demersum*	coontail	3		1	
Long 404	3.0	Silt/Sand	POSP	*Potamogeton sp.*	pondweed	2		1	
Long 404	3.0	Silt/Sand	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 404	3.0	Silt/Sand	POZO	*Potamogeton zosteriformis*	flatstem pondweed	1		1	
Long 404	3.0	Silt/Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 404	3.0	Silt/Sand	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	1		1	3
Long 405	5.0	Sand/Gravel	algae	*Phytoplankton*	algae	1		4	
Long 405	5.0	Sand/Gravel	CEDE	*Ceratophyllum demersum*	coontail	1			
Long 405	5.0	Sand/Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed	1			
Long 405	5.0	Sand/Gravel	LETR	*Lemna trisulca*	star duckweed	1			2
Long 406	7.5	Gravel/Rock	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 406	7.5	Gravel/Rock	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 406	7.5	Gravel/Rock	algae	*Phytoplankton*	algae	2		4	2
Long 407	15.5	Sand/Silt	algae	*Phytoplankton*	algae	1		4	1
Long 412	18.0								
Long 413	17.0								
Long 414	10.5	Sand	LETR	*Lemna trisulca*	star duckweed	1		2	3
Long 414	10.5	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 414	10.5	Sand	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	1		1	1
Long 415	5.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	3		1	
Long 415	5.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 415	5.0	Muck	algae	*Phytoplankton*	algae	1		4	
Long 415	5.0	Muck	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 415	5.0	Muck	POSP	*Potamogeton sp.*	pondweed	1		1	
Long 415	5.0	Muck	POZO	*Potamogeton zosteriformis*	flatstem pondweed	1		1	3
Long 416	8.0	Sand/Rock	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 416	8.0	Sand/Rock	algae	*Phytoplankton*	algae	3		4	
Long 416	8.0	Sand/Rock	CEDE	*Ceratophyllum demersum*	coontail	1		1	3
Long 416	8.0	Sand/Rock	TYSP	*Typha. spp.*	cattail		X		
Long 417	13.0	Gravel	algae	*Phytoplankton*	algae	2		4	2
Long 418	16.0	Muck							

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Observed (x)	Type[1]	Total Density
Long 419	18.0								
Long 420	18.0								
Long 421	18.0								
Long 422	14.5	Muck							
Long 423	1.5	Sand	LETR	*Lemna trisulca*	star duckweed	3		2	
Long 423	1.5	Sand	POSP	*Potamogeton sp.*	pondweed	2		1	
Long 423	1.5	Sand	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	
Long 423	1.5	Sand	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 423	1.5	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 423	1.5	Sand	SPEU	*Sparganium eurycarpum*	common bur-reed		X	3	
Long 423	1.5	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		X	1	3
Long 424	3.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	2		1	
Long 424	3.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 424	3.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	
Long 424	3.0	Muck	LETR	*Lemna trisulca*	star duckweed	1		2	2
Long 425	5.5	Sand/Gravel	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 425	5.5	Sand/Gravel	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 425	5.5	Sand/Gravel	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	1		1	
Long 425	5.5	Sand/Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	2
Long 426	10.0	Gravel	algae	*Phytoplankton*	algae	3		4	3
Long 427	15.0	Muck							
Long 428	16.0	Muck							
Long 429	15.5	Muck							
Long 430	14.0	Muck							
Long 431	5.0	Gravel/Rock	POCR	*Potamogeton crispus*	curlyleaf pondweed		X	1	
Long 431	5.0	Gravel/Rock	algae	*Phytoplankton*	algae	3		4	3
Long 432	2.5	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	2		2	
Long 432	2.5	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	1		1	
Long 432	2.5	Muck	POZO	*Potamogeton zosteriformis*	flatstem pondweed	1		1	
Long 432	2.5	Muck	LETR	*Lemna trisulca*	star duckweed	2		2	
Long 432	2.5	Muck	algae	*Phytoplankton*	algae	2		4	
Long 432	2.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 432	2.5	Muck	POST	*Potamogeton strictifolius*	narrowleaf pondweed	1		1	3
Long 433	3.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	2		1	
Long 433	3.5	Muck	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 433	3.5	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	
Long 433	3.5		POCR	*Potamogeton crispus*	curlyleaf pondweed		X	1	2
Long 434	4.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	3		1	

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Observed (x)	Type[1]	Total Density
Long 434	4.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1	X	1	
Long 434	4.5	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	
Long 434	4.5	Muck	NYTU	*Nymphaea tuberosa*	white waterlily		X	2	
Long 434	4.5	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		X	1	3
Long 435	6.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 435	6.0	Muck	TYSP	*Typha. spp.*	cattail		X	3	3
Long 436	7.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	2
Long 437	6.0	Sand/Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 437	6.0	Sand/Gravel	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 437	6.0	Sand/Gravel	NISP	*Nitella sp.*	stonewort		X	1	1.5
Long 438	9.0	Sand/Silt	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 438	9.0	Sand/Silt	ELCA	*Elodea canadensis*	Canada waterweed	1		1	2
Long 439	11.0	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	1
Long 440	9.5	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 440	9.5	Sand	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 440	9.5	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed		x	1	2
Long 441	3.5	Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 441	3.5	Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed		X	1	1
Long 442	1.5	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	3		2	
Long 442	1.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 442	1.5	Muck	POZO	*Potamogeton zosteriformis*	flatstem pondweed		X	1	
Long 442	1.5	Muck	LETR	*Lemna trisulca*	star duckweed		X	2	
Long 442	1.5	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		X	1	
Long 442	1.5	Muck	TYSP	*Typha. spp.*	cattail		X	3	
Long 442	1.5	Muck	SPEU	*Sparganium eurycarpum*	common bur-reed		X	3	3
Long 443	2.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	3		1	
Long 443	2.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1		1	
Long 443	2.5	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	1		2	
Long 443	2.5	Muck	LETR	*Lemna trisulca*	star duckweed	1		2	
Long 443	2.5	Muck	POSP	*Potamogeton sp.*	pondweed		X	1	3
Long 444	5.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	
Long 444	5.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	
Long 444	5.0	Muck	LETR	*Lemna trisulca*	star duckweed	1		2	3
Long 445	5.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3		1	3
Long 446	6.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2		1	
Long 446	6.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	1		1	2
Long 447	0.5	Sand	CHSP	*Chara spp.*	muskgrass	1		1	
Long 447	0.5	Sand	ELSP	*Eleocharis spp.*	spikerush	1		3	

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Observed (x)	Type[1]	Total Density
Long 447	0.5	Sand	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		X	1	
Long 447	0.5	Sand	NAFL	*Najas flexilis*	bushy naiad		X	1	1
Long 448			TYSP	*Typha. spp.*	cattail		X	3	
Long K	15.0	Muck							
Long L	16.0	Muck							
Long M	18.0								
Point A	14.0	Muck							
Point B	13.5	Muck							
Point C	14.0								
Point D	15.0								
Point E	15.0								
Point F	16.0								
Point G	16.0								
Point H	16.0								
Point I	16.0								
Point J	17.0								

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Comments/Observations
Long 012	
Long 012	
Long 012	
Long 012	
Long 012	
Long 012	On Shore
Long 012	
Long 012	
Long 013	
Long 013	
Long 013	
Long 013	
Long 014	
Long 014	
Long 014	
Long 014	
Long 015	
Long 015	
Long 015	
Long 015	
Long 015	
Long 016	
Long 016	
Long 016	
Long 016	
Long 016	North, South, East, West
Long 016	
Long 016	
Long 017	
Long 017	
Long 017	
Long 017	
Long 017	On Shore
Long 017	
Long 017	
Long 017	
Long 017	
Long 017	On Shore

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Comments/Observations
Long 018	
Long 018	
Long 018	
Long 018	
Long 018	
Long 018	On Shore
Long 018	On Shore
Long 018	On Shore
Long 019	
Long 019	
Long 019	
Long 019	
Long 019	
Long 020	
Long 020	
Long 020	
Long 021	
Long 021	
Long 021	
Long 021	
Long 021	
Long 021	
Long 022	
Long 022	
Long 022	
Long 022	
Long 022	
Long 022	
Long 022	On Shore
Long 022	North, South, East, West
Long 023	
Long 023	
Long 023	
Long 023	
Long 023	
Long 023	
Long 024	
Long 024	

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Comments/Observations
Long 025	
Long 025	
Long 025	
Long 025	
Long 026	
Long 026	
Long 026	On Shore
Long 027	
Long 027	
Long 027	
Long 028	
Long 028	
Long 029	
Long 030	North, South, East, West
Long 030	
Long 030	
Long 030	
Long 030	
Long 031	
Long 031	
Long 031	
Long 031	
Long 031	
Long 032	
Long 032	
Long 032	
Long 033	
Long 034	
Long 034	
Long 035	
Long 036	
Long 036	
Long 036	
Long 037	
Long 038	
Long 038	
Long 038	
Long 039	

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Comments/Observations
Long 039	
Long 040	
Long 040	
Long 040	
Long 041	
Long 041	
Long 041	
Long 041	
Long 041	
Long 041	
Long 041	On Shore
Long 042	
Long 043	
Long 043	
Long 043	
Long 044	
Long 045	
Long 046	
Long 047	
Long 047	
Long 047	
Long 048	
Long 048	
Long 049	
Long 049	
Long 049	
Long 050	
Long 050	
Long 050	
Long 051	
Long 051	
Long 052	
Long 052	
Long 052	
Long 052	
Long 052	
Long 052	On Shore
Long 052	

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Comments/Observations
Long 052	
Long 053	
Long 053	
Long 054	
Long 054	
Long 055	
Long 056	No Rooted Plants
Long 057	No Rooted Plants
Long 058	
Long 058	
Long 059	
Long 059	
Long 060	Fibrous Algae
Long 060	
Long 060	
Long 060	
Long 061	
Long 061	
Long 061	
Long 062	
Long 062	Density of 2-3 so indicated 2.5 for density
Long 062	
Long 063	
Long 063	
Long 063	North, South, East, West
Long 063	
Long 063	
Long 063	On Shore
Long 064	No Plants
Long 065	
Long 066	
Long 066	
Long 067	Fibrous Algae
Long 067	
Long 067	
Long 067	
Long 068	No Plants
Long 069	No Plants

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Comments/Observations
Long 070	Fibrous Algae
Long 070	
Long 071	
Long 071	
Long 072	
Long 072	
Long 072	On Point
Long 073	
Long 073	Fibrous Algae
Long 073	
Long 073	
Long 074	
Long 074	
Long 074	
Long 074	
Long 074	
Long 075	
Long 075	
Long 076	
Long 076	
Long 076	
Long 076	
Long 076	On Shore
Long 076	
Long 076	
Long 077	Fibrous Algae
Long 077	
Long 078	
Long 078	
Long 079	Fibrous Algae
Long 080	Fibrous Algae
Long 081	No Plants
Long 084	Fibrous Algae
Long 085	Fibrous Algae
Long 085	
Long 086	
Long 086	
Long 087	Fibrous Algae

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Comments/Observations
Long 087	
Long 087	
Long 087	
Long 087	
Long 087	
Long 088	
Long 088	
Long 088	
Long 088	
Long 089	
Long 089	
Long 089	
Long 089	
Long 089	On Shore
Long 090	
Long 091	Fibrous Algae
Long 091	
Long 092	Fibrous Algae, No Rooted Plants
Long 097	No Plants
Long 098	
Long 099	Fibrous Algae
Long 099	
Long 099	
Long 099	On Shore
Long 099	On Shore
Long 100	
Long 100	
Long 100	
Long 100	
Long 100	On Shore
Long 100	
Long 100	
Long 100	
Long 100	
Long 101	All Around
Long 101	
Long 101	
Long 101	On Shore

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Comments/Observations
Long 101	
Long 101	
Long 101	
Long 101	
Long 102	Fibrous Algae
Long 102	
Long 102	
Long 102	
Long 103	
Long 103	Fibrous Algae
Long 104	Fibrous Algae, No Rooted Plants
Long 105	No Plants
Long 110	Fibrous Algae, No Rooted Plants
Long 111	
Long 111	
Long 111	On Shore
Long 111	On Shore
Long 112	
Long 113	Fibrous Algae
Long 113	
Long 114	No Plants
Long 119	No Plants
Long 120	Fibrous Algae, No Rooted Plants
Long 121	
Long 121	Along Shoreline
Long 121	Along Shoreline
Long 122	
Long 122	
Long 123	Fibrous Algae
Long 123	
Long 124	No Plants
Long 125	No Plants
Long 130	No Plants
Long 131	Fibrous Algae, No Rooted Plants
Long 132	Out From Shore
Long 133	No Plants
Long 134	Fibrous Algae, No Rooted Plants
Long 135	Fibrous Algae, No Rooted Plants

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Comments/Observations
Long 141	No Plants
Long 142	No Plants
Long 143	
Long 143	
Long 143	
Long 145	Fibrous Algae, No Rooted Plants
Long 146	No Plants
Long 152	No Plants
Long 153	
Long 153	
Long 154	
Long 155	Fibrous Algae, No Rooted Plants
Long 156	No Plants
Long 161	No Plants
Long 162	No Plants
Long 163	
Long 163	
Long 164	
Long 165	Fibrous Algae, No Rooted Plants
Long 166	No Plants
Long 171	Fibrous Algae, No Rooted Plants
Long 172	
Long 172	Fibrous Algae
Long 172	
Long 173	
Long 173	
Long 174	
Long 174	
Long 175	No Plants
Long 176	No Plants
Long 180	No Plants
Long 181	Fibrous Algae, No Rooted Plants
Long 182	
Long 183	Fibrous Algae, No Rooted Plants
Long 184	No Plants
Long 185	No Plants
Long 189	No Plants
Long 190	No Plants

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Comments/Observations
Long 191	
Long 191	
Long 191	
Long 191	
Long 192	No Plants
Long 193	No Plants
Long 194	No Plants
Long 198	No Plants
Long 199	No Plants
Long 200	Fibrous Algae, No Rooted Plants
Long 201	Fibrous Algae, No Rooted Plants
Long 202	No Plants
Long 206	No Plants
Long 207	No Plants
Long 208	
Long 208	
Long 208	Fibrous Algae
Long 209	
Long 209	
Long 209	
Long 210	
Long 210	From Point to South Near Shore
Long 211	No Plants
Long 212	No Plants
Long 213	No Plants
Long 217	No Plants
Long 218	No Plants
Long 219	
Long 219	Near Shore
Long 220	No Plants
Long 221	Fibrous Algae, No Rooted Plants
Long 222	No Plants
Long 223	No Plants
Long 224	No Plants
Long 225	No Plants
Long 230	No Plants
Long 231	No Plants
Long 232	

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Comments/Observations
Long 232	
Long 233	
Long 233	
Long 233	
Long 234	
Long 234	
Long 234	
Long 234	
Long 234	Along Shoreline, Shallow Water
Long 235	Fibrous Algae, No Rooted Plants
Long 236	No Plants
Long 237	No Plants
Long 238	No Plants
Long 239	No Plants
Long 240	No Plants
Long 241	No Plants
Long 242	No Plants
Long 247	No Plants
Long 248	No Plants
Long 249	
Long 249	
Long 249	
Long 250	
Long 250	
Long 251	Fibrous Algae, No Rooted Plants
Long 252	No Plants
Long 253	No Plants
Long 254	No Plants
Long 255	No Plants
Long 263	No Plants
Long 264	No Plants
Long 265	No Plants
Long 266	
Long 266	
Long 266	
Long 266	
Long 266	All along shore
Long 266	Shoreline

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Comments/Observations
Long 266	Shoreline
Long 266	
Long 267	
Long 267	
Long 268	Fibrous Algae, No Rooted Plants
Long 269	No Plants
Long 270	No Plants
Long 271	No Plants
Long 272	No Plants
Long 280	No Plants
Long 281	No Plants
Long 282	
Long 282	
Long 283	No Plants
Long 284	No Plants
Long 293	No Plants
Long 294	No Plants
Long 295	No Plants
Long 296	
Long 296	Fibrous Algae
Long 297	Fibrous Algae, No Rooted Plants
Long 298	No Plants
Long 306	No Plants
Long 307	No Plants
Long 308	Fibrous Algae, No Rooted Plants
Long 308/Long 320	Observed between Long 308 and Long 320
Long 309	
Long 309	
Long 309	On Shore
Long 309	On Shore
Long 310	No Plants
Long 311	No Plants
Long 317	No Plants
Long 318	No Plants
Long 319	
Long 319	

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Comments/Observations
Long 319	Fibrous algae
Long 320	No Plants
Long 321	No Plants
Long 322	No Plants
Long 327	No Plants
Long 328	No Plants
Long 329	Possibly Not Rooted?
Long 329	
Long 330	No Plants
Long 331	No Plants
Long 335	No Plants
Long 336	
Long 336	
Long 336	
Long 337	Fibrous Algae, No Rooted Plants
Long 338	No Plants
Long 341	No Plants
Long 342	No Plants
Long 343	Fibrous Algae, No Rooted Plants
Long 344	No Plants
Long 347	No Plants
Long 348	No Plants
Long 348/Long 352	Observed near shore between Long 348/Long 352
Long 348/Long 354	Observed near shore between Long 348/Long 354
Long 349	Fibrous Algae, No Rooted Plants
Long 350	No Plants
Long 353	No Plants
Long 354	No Plants
Long 355	Fibrous Algae, No Rooted Plants
Long 356	No Plants
Long 359	No Plants
Long 360	No Plants

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Comments/Observations
Long 360/Long 367	Observed near shore between Long 360/Long 367
Long 361	
Long 361	
Long 362	No Plants
Long 363	No Plants
Long 366	No Plants
Long 367	
Long 367/Long 374	Observed Near Shore Between Long 367/Long 374
Long 368	Fibrous Algae, No Rooted Plants
Long 369	No Plants
Long 370	No Plants
Long 373	No Plants
Long 374	
Long 374	Fibrous Algae
Long 374	
Long 374	
Long 374/Long 383	Observed Near Shore Between Long 374/Long 383
Long 375	
Long 375	
Long 375	
Long 375	
Long 376	
Long 377	No Plants
Long 378	No Plants
Long 382	No Plants
Long 383	Fibrous Algae, No Rooted Plants
Long 383/Long 393	Observed Near Shore Between Long 383/Long 393
Long 384	No Plants Collected on Rake
Long 384	
Long 384	

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Comments/Observations
Long 384	
Long 385	Fibrous Algae, No Rooted Plants
Long 386	No Plants
Long 387	No Plants
Long 392	No Plants
Long 393	No Plants
Long 393/Long 403	Observed Near Shore Between Long 393/Long 403
Long 394	
Long 394	
Long 394	
Long 394	
Long 395	Fibrous Algae, No Rooted Plants
Long 396	No Plants
Long 402	No Plants
Long 403	Fibrous Algae, No Rooted Plants
Long 403/Long 413	Observed Near Shore Between Long 403/Long 413
Long 404	
Long 404	
Long 404	
Long 404	
Long 404	
Long 404	
Long 405	Fibrous Algae
Long 405	
Long 405	
Long 405	
Long 406	
Long 406	
Long 406	Fibrous Algae
Long 407	Fibrous Algae
Long 412	No Plants
Long 413	No Plants
Long 414	
Long 414	

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Comments/Observations
Long 414	
Long 415	
Long 415	
Long 415	Fibrous Algae
Long 415	
Long 415	
Long 415	
Long 416	
Long 416	Fibrous Algae
Long 416	
Long 416	On Shore Island
Long 417	Fibrous Algae, No Rooted Plants
Long 418	No Plants
Long 419	No Plants
Long 420	No Plants
Long 421	No Plants
Long 422	No Plants
Long 423	
Long 423	
Long 423	
Long 423	
Long 423	
Long 423	On Shore
Long 423	
Long 424	
Long 424	
Long 424	
Long 424	
Long 425	
Long 425	
Long 425	
Long 425	
Long 426	Fibrous Algae, No Rooted Plants
Long 427	No Plants
Long 428	No Plants
Long 429	No Plants
Long 430	No Plants
Long 431	

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Comments/Observations
Long 431	Fibrous Algae, No Rooted Plants
Long 432	
Long 432	
Long 432	
Long 432	
Long 432	Fibrous Algae
Long 432	
Long 432	
Long 433	
Long 433	
Long 433	
Long 433	
Long 434	
Long 434	
Long 434	
Long 434	Observed on Island
Long 434	Observed on Island
Long 435	
Long 435	On Shore/Island
Long 436	
Long 437	
Long 437	
Long 437	Density 1-2 so Density is 1.5
Long 438	
Long 438	
Long 439	
Long 440	
Long 440	
Long 440	Near Shore
Long 441	
Long 441	Observed Farther Out at Same Density (i.e, 1)
Long 442	
Long 442	
Long 442	
Long 442	
Long 442	
Long 442	On Shore
Long 442	On Shore

2007 Long Lake Aquatic Plant Survey
Point Intercept Method
June 8-9, 2007

Point	Comments/Observations
Long 443	
Long 443	
Long 443	
Long 443	
Long 443	
Long 444	
Long 444	
Long 444	
Long 445	
Long 446	
Long 446	
Long 447	
Long 447	
Long 447	
Long 447	
Long 448	Unable to Get To Location
Long K	No Plants
Long L	No Plants
Long M	No Plants
Point A	No Plants
Point B	No Plants
Point C	No Plants
Point D	No Plants
Point E	No Plants
Point F	No Plants
Point G	No Plants
Point H	No Plants
Point I	No Plants
Point J	No Plants

Appendix B

2007 Aquatic Plant Data Summary—Transect Method

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Density Rating	Density Rating	Density Rating	Average Density Rating
						Cast #1	Cast #2	Cast #3	Cast #4	
T1-1	7.0	Silt, Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	1	2	1	2	1.5
T1-1	7.0	Silt, Sand	CEDE	*Ceratophyllum demersum*	coontail	0	1	1	0	0.5
T1-1	7.0	Silt, Sand	LETR	*Lemna trisulca*	star duckweed	0	0	0	1	0.25
T1-1					**Total Density**	1	2	1	2	1.5
T1-2	8.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2	1	2	2	1.75
T1-2	8.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed	1	1	0	0	0.5
T1-2	8.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	0	0	0	2	0.5
T1-2					**Total Density**	2	1	2	2	1.75
T1-3	8.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2	2	2	1	1.75
T1-3	8.5	Muck	ELCA	*Elodea canadensis*	Canada waterweed	1	0	0	0	0.25
T1-3	8.5	Muck	LETR	*Lemna trisulca*	star duckweed	0	1	0	0	0.25
T1-3	8.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	0	0	0	1	0.25
T1-3					**Total Density**	2	2	2	1	1.75
T2-1	2.0	Sand	ELSP	*Eleocharis spp.*	spikerush	3	0	0	0	0.75
T2-1					**Total Density**	3	0	0	0	0.75
T2-2	6.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	4	3	1	2	2.5
T2-2	6.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1	1	3	1	1.5
T2-2	6.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed	1	1	1	0	0.75
T2-2					**Total Density**	4	3	3	2	3
T2-3	8.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1	4	2	2	2.25
T2-3	8.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed	0	0	1	0	0.25
T2-3					**Total Density**	1	4	2	2	2.25
T3-1	3.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	3	1	0	1	1.25
T3-1	3.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3	4	3	3	3.25
T3-1	3.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed	2	1	0	0	0.75
T3-1	3.0	Muck	ZODU	*Zosterella dubia*	mud plantain	1	0	0	0	0.25
T3-1	3.0	Muck	LETR	*Lemna trisulca*	star duckweed	1	0	0	0	0.25
T3-1	3.0	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	0	0	0	1	0.25

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Density Rating	Density Rating	Density Rating	Average Density Rating
						Cast #1	Cast #2	Cast #3	Cast #4	
T3-1					**Total Density**	4	4	3	3	3.5
T3-2	4.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	4	5	4	3	4
T3-2	4.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	4	1	2	2	2.25
T3-2	4.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed	1	2	2	1	1.5
T3-2					**Total Density**	5	5	5	3	4.5
T3-3	8.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2	2	2	3	2.25
T3-3	8.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed	0	3	1	1	1.25
T3-3	8.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	0	0	1	1	0.5
T3-3					**Total Density**	2	3	2	3	2.5
T4-1	2.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	4	4	2	4	3.5
T4-1	2.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	1	2	1	2	1.5
T4-1	2.0	Muck	POSP	*Potamogeton sp.*	pondweed	2	2	3	2	2.25
T4-1	2.0	Muck	SPPO	*Spirodela polyrhiza*	great duckweed	0	0	0	0	0
T4-1	2.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1	1	0	0	0.5
T4-1	2.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed	0	0	2	1	0.75
T4-1					**Total Density**	4	5	5	5	4.75
T4-2	3.0	Muck	LETR	*Lemna trisulca*	star duckweed	4	2	3	4	3.25
T4-2	3.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	2	3	2	3	2.5
T4-2	3.0	Muck	POSP	*Potamogeton sp.*	pondweed	2	0	0	2	1
T4-2	3.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	2	2	1	0	1.25
T4-2	3.0	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	1	0	0	0	0.25
T4-2	3.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	0	1	0	1	0.5
T4-2	3.0	Muck	POZO	*Potamogeton zosteriformis*	flatstem pondweed	0	0	0	1	0.25
T4-2					**Total Density**	4	5	4	5	4.5
T5-1	1.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1	0	0	1	0.5
T5-1	1.0	Muck	NYSI	*Nymphaea odorata*	American white waterlily	1	0	0	1	0.5
T5-1	1.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed	0	1	0	0	0.25
T5-1	1.0	Muck	SASP	*Sagittaria sp.*	arrowhead	0	1	0	0	0.25

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Density Rating	Density Rating	Density Rating	Average Density Rating
						Cast #1	Cast #2	Cast #3	Cast #4	
T5-1	1.0	Muck	ZODU	*Zosterella dubia*	mud plantain	0	0	1	0	0.25
T5-1	1.0	Muck	SPPO	*Spirodela polyrhiza*	great duckweed	0	0	0	0	0
T5-1					**Total Density**	1	1	1	1	1
T5-2	3.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	5	5	5	2	4.25
T5-2	3.5	Muck	SPPO	*Spirodela polyrhiza*	great duckweed	1	0	0	0	0.25
T5-2	3.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	3	1	3	3	2.5
T5-2	3.5	Muck	ELCA	*Elodea canadensis*	Canada waterweed	0	0	1	1	0.5
T5-2	3.5	Muck			Fibrous algae	0	0	0	2	0.5
T5-2	3.5	Muck	LETR	*Lemna trisulca*	star duckweed	0	0	0	1	0.25
T5-2					**Total Density**	5	5	5	5	5
T5-3	5.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	2	2	2	1	1.75
T5-3	5.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2	4	4	4	3.5
T5-3	5.5	Muck	ELCA	*Elodea canadensis*	Canada waterweed	0	1	0	0	0.25
T5-3					**Total Density**	2	4	4	4	3.5
T6-1	1.5	Rock			Fibrous algae	2	4	0	1	1.75
T6-1	1.5	Rock	ELSP	*Eleocharis spp.*	spikerush	0	0	1	1	0.5
T6-1	1.5	Rock	ZODU	*Zosterella dubia*	mud plantain	0	0	0	1	0.25
T6-1	1.5	Rock	ELCA	*Elodea canadensis*	Canada waterweed	0	0	0	1	0.25
T6-1					**Total Density**	2	4	1	1	2
T6-2	3.0	Sand, Gravel	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	2	1	1	1	1.25
T6-2	3.0	Sand, Gravel	LETR	*Lemna trisulca*	star duckweed	1	0	0	0	0.25
T6-2	3.0	Sand, Gravel	ELCA	*Elodea canadensis*	Canada waterweed	1	2	0	1	1
T6-2	3.0	Sand, Gravel			fibrous algae	1	2	0	3	1.5
T6-2	3.0	Sand, Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed	0	1	1	0	0.5
T6-2	3.0	Sand, Gravel	CEDE	*Ceratophyllum demersum*	coontail	0	0	0	1	0.25
T6-2	3.0	Sand, Gravel	ZODU	*Zosterella dubia*	mud plantain	0	0	0	1	0.25
T6-2					**Total Density**	2	4	1	3	2.5
T6-3	7.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2	2	2	1	1.75

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Density Rating	Density Rating	Density Rating	Average Density Rating
						Cast #1	Cast #2	Cast #3	Cast #4	
T6-3	7.5	Muck	POSP	*Potamogeton sp.*	pondweed	1	1	0	0	0.5
T6-3	7.5	Muck	ZODU	*Zosterella dubia*	mud plantain	0	1	1	0	0.5
T6-3	7.5	Muck	ELCA	*Elodea canadensis*	Canada waterweed	0	0	1	0	0.25
T6-3	7.5	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	0	0	1	0	0.25
T6-3	7.5	Muck	ELSP	*Eleocharis spp.*	spikerush	0	0	0	2	0.5
T6-3					**Total Density**	2	2	2	2	2
T7-1	1.5	Sand, Gravel	ELSP	*Eleocharis spp.*	spikerush	1	1	2	2	1.5
T7-1	1.5	Sand, Gravel	SASP	*Sagittaria sp.*	arrowhead	0	0	0	1	0.25
T7-1					**Total Density**	1	1	2	2	1.5
T7-2	3.0	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	1	0	1	0	0.5
T7-2	3.0	Sand	NAFL	*Najas flexilis*	bushy naiad	1	1	1	1	1
T7-2	3.0	Sand	ZODU	*Zosterella dubia*	mud plantain	1	2	1	1	1.25
T7-2	3.0	Sand	NYSI	*Nymphaea odorata*	American white waterlily	0	1	0	0	0.25
T7-2					**Total Density**	1	2	1	1	1.25
T7-3	8.0	Silt, Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	1	1	1	1	1
T7-3	8.0	Silt, Sand	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	1	1	0	0	0.5
T7-3	8.0	Silt, Sand	CEDE	*Ceratophyllum demersum*	coontail	1	0	0	0	0.25
T7-3	8.0	Silt, Sand	LETR	*Lemna trisulca*	star duckweed	0	1	0	0	0.25
T7-3	8.0	Silt, Sand			Fibrous algae	0	0	0	2	0.5
T7-3	8.0	Silt, Sand	ZODU	*Zosterella dubia*	mud plantain	0	0	0	1	0.25
T7-3					**Total Density**	1	1	1	1	1
T8-1	2.0	Gravel, Rock	ELSP	*Eleocharis spp.*	spikerush	1	1	1	1	1
T8-1	2.0	Gravel, Rock	ELCA	*Elodea canadensis*	Canada waterweed	0	0	1	0	0.25
T8-1					**Total Density**	1	1	1	1	1
T8-2	3.0	Silt, Sand			Fibrous algae	2	0	0	0	0.5
T8-2	3.0	Silt, Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	2	3	4	4	3.25
T8-2	3.0	Silt, Sand	NAFL	*Najas flexilis*	bushy naiad	2	1	0	0	0.75
T8-2	3.0	Silt, Sand	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	0	2	1	1	1

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Density Rating	Density Rating	Density Rating	Average Density Rating
						Cast #1	Cast #2	Cast #3	Cast #4	
T8-2	3.0	Silt, Sand	CEDE	*Ceratophyllum demersum*	coontail	0	2	1	0	0.75
T8-2	3.0	Silt, Sand	ELCA	*Elodea canadensis*	Canada waterweed	0	1	0	0	0.25
T8-2	3.0	Silt, Sand	LETR	*Lemna trisulca*	star duckweed	0	1	0	0	0.25
T8-2					**Total Density**	3	4	5	4	4
T8-3	6.0	Silt, Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	4	5	5	5	4.75
T8-3	6.0	Silt, Sand	CEDE	*Ceratophyllum demersum*	coontail	0	1	0	1	0.5
T8-3	6.0	Silt, Sand	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	0	0	1	0	0.25
T8-3					**Total Density**	4	5	5	5	4.75
T9-1	2.0	Rock, Gravel			No Plants	0	0	0	0	0
T9-1					**Total Density**	0	0	0	0	0
T9-2	3.5	Silt, Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	3	2	0	0	1.25
T9-2	3.5	Silt, Sand	ZODU	*Zosterella dubia*	mud plantain	1	0	0	0	0.25
T9-2	3.5	Silt, Sand	LETR	*Lemna trisulca*	star duckweed	0	1	0	0	0.25
T9-2	3.5	Silt, Sand	NAFL	*Najas flexilis*	bushy naiad	0	1	1	1	0.75
T9-2	3.5	Silt, Sand	POSP	*Potamogeton sp.*	pondweed	0	1	0	0	0.25
T9-2	3.5	Silt, Sand	CEDE	*Ceratophyllum demersum*	coontail	0	1	0	0	0.25
T9-2					**Total Density**	3	2	1	1	1.75
T9-3	7.0	Sand, Silt	POCR	*Potamogeton crispus*	curlyleaf pondweed	3	2	2	1	2
T9-3	7.0	Sand, Silt	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	3	0	0	0	0.75
T9-3	7.0	Sand, Silt	LETR	*Lemna trisulca*	star duckweed	1	2	2	1	1.5
T9-3	7.0	Sand, Silt	ZODU	*Zosterella dubia*	mud plantain	0	2	0	0	0.5
T9-3	7.0	Sand, Silt			Fibrous algae	0	0	2	1	0.75
T9-3					**Total Density**	3	3	4	2	3
T10-1	1.5	Rock			No Plants	0	0	0	0	0
T10-1					**Total Density**	0	0	0	0	0
T10-2	5.0	Rock	POCR	*Potamogeton crispus*	curlyleaf pondweed	1	1	0	0	0.5
T10-2					**Total Density**	1	1	0	0	0.5
T10-3	8.5	Sand, Gravel	LETR	*Lemna trisulca*	star duckweed	1	1	3	2	1.75

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Density Rating	Density Rating	Density Rating	Average Density Rating
						Cast #1	Cast #2	Cast #3	Cast #4	
T10-3	8.5	Sand, Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed	0	1	0	0	0.25
T10-3	8.5	Sand, Gravel	POSP	*Potamogeton sp.*	pondweed	0	0	1	0	0.25
T10-3					**Total Density**	1	1	3	2	1.75
T11-1	1.5	Rock, Gravel			Fibrous algae	0	1	0	0	0.25
T11-1					**Total Density**	0	1	0	0	0.25
T11-2	3.0	Rock	ELCA	*Elodea canadensis*	Canada waterweed	2	0	2	0	1
T11-2	3.0	Rock	algae		Fibrous algae	1	0	3	3	1.75
T11-2	3.0	Rock	NYSI	*Nymphaea odorata*	American white waterlily	1	0	0	0	0.25
T11-2					**Total Density**	2	0	3	3	2
T11-3	8.0	Gravel, Rock	POCR	*Potamogeton crispus*	curlyleaf pondweed	2	2	3	2	2.25
T11-3	8.0	Gravel, Rock	ELCA	*Elodea canadensis*	Canada waterweed	0	0	1	2	0.75
T11-3	8.0	Gravel, Rock	CEDE	*Ceratophyllum demersum*	coontail	0	0	1	0	0.25
T11-3					**Total Density**	2	2	3	3	2.5
T12-1	1.5	Rock, Gravel			Fibrous algae	5	4	4	4	4.25
T12-1	1.5	Rock, Gravel	ELCA	*Elodea canadensis*	Canada waterweed	1	0	0	0	0.25
T12-1	1.5	Rock, Gravel	POSP	*Potamogeton sp.*	pondweed	0	0	0	0	0
T12-1					**Total Density**	5	4	4	4	4.25
T12-2	3.0	Rock			Fibrous algae	4	2	4	4	3.5
T12-2					**Total Density**	4	2	4	4	3.5
T12-3	7.5	Silt, Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	4	5	4	4	4.25
T12-3	7.5	Silt, Sand	ELCA	*Elodea canadensis*	Canada waterweed	1	1	0	1	0.75
T12-3					**Total Density**	4	5	4	4	4.25
T13-1	1.5	Rock, Gravel			No Plants	0	0	0	0	0
T13-1					**Total Density**	0	0	0	0	
T13-2	4.0	Rock			Fibrous algae	4	4	4	1	3.25
T13-2	4.0	Rock	ELCA	*Elodea canadensis*	Canada waterweed	1	1	1	4	1.75
T13-2					**Total Density**	4	4	4	4	4
T13-3	7.5	Sand, Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed	3	2	1	1	1.75

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Density Rating	Density Rating	Density Rating	Average Density Rating
						Cast #1	**Cast #2**	**Cast #3**	**Cast #4**	
T13-3	7.5	Sand, Gravel			Fibrous algae	0	2	2	2	1.5
T13-3	7.5	Sand, Gravel	ELCA	*Elodea canadensis*	Canada waterweed	0	0	1	0	0.25
T13-3					**Total Density**	3	2	2	2	2.25
T14-1	1.5	Sand, Gravel	NAFL	*Najas flexilis*	bushy naiad	0	2	0	0	0.5
T14-1	1.5	Sand, Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed	0	1	1	0	0.5
T14-1	1.5	Sand, Gravel	ELCA	*Elodea canadensis*	Canada waterweed	0	1	0	0	0.25
T14-1	1.5	Sand, Gravel			Fibrous algae	0	0	1	0	0.25
T14-1					**Total Density**	0	2	1	0	0.75
T14-2	3.5	Sand	ELCA	*Elodea canadensis*	Canada waterweed	3	2	2	1	2
T14-2	3.5	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	2	2	3	3	2.5
T14-2	3.5	Sand	CEDE	*Ceratophyllum demersum*	coontail	0	1	0	0	0.25
T14-2					**Total Density**	3	3	3	3	3
T14-3	8.0	Sand, Silt	POCR	*Potamogeton crispus*	curlyleaf pondweed	2	1	2	1	1.5
T14-3	8.0	Sand, Silt	LETR	*Lemna trisulca*	star duckweed	1	2	2	1	1.5
T14-3	8.0	Sand, Silt	ELCA	*Elodea canadensis*	Canada waterweed	1	1	0	0	0.5
T14-3					**Total Density**	2	2	2	1	1.75
T15-1	1.5	Rock, Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed	0	1	0	0	0.25
T15-1					**Total Density**	0	1	0	0	0.25
T15-2	3.5	Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed	1	1	0	0	0.5
T15-2	3.5	Gravel	ZODU	*Zosterella dubia*	mud plantain	0	0	0	1	0.25
T15-2					**Total Density**	1	1	0	1	0.75
T15-3	7.0	Silt, Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	2	3	2	3	2.5
T15-3	7.0	Silt, Sand	POSP	*Potamogeton sp.*	pondweed	1	1	1	1	1
T15-3	7.0	Silt, Sand	CEDE	*Ceratophyllum demersum*	coontail	1	1	0	0	0.5
T15-3	7.0	Silt, Sand	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	0	1	0	1	0.5
T15-3					**Total Density**	2	3	2	3	2.5
T16-1	1.5	Silt, Sand	LETR	*Lemna trisulca*	star duckweed	4	2	4	4	3.5
T16-1	1.5	Silt, Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	1	2	1	1	1.25

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Density Rating	Density Rating	Density Rating	Average Density Rating
						Cast #1	Cast #2	Cast #3	Cast #4	
T16-1	1.5	Silt, Sand	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	1	1	1	2	1.25
T16-1	1.5	Silt, Sand	CEDE	*Ceratophyllum demersum*	coontail	1	0	0	1	0.5
T16-1	1.5	Silt, Sand	POSP	*Potamogeton sp.*	pondweed	0	1	0	0	0.25
T16-1	1.5	Silt, Sand	ZODU	*Zosterella dubia*	mud plantain	0	1	0	0	0.25
T16-1	1.5	Silt, Sand	NYTU	*Nymphaea tuberosa*	white waterlily	0	0	0	0	0
T16-1					**Total Density**	4	3	4	4	3.75
T16-2	3.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	4	2	3	2	2.75
T16-2	3.0	Muck	SASP	*Sagittaria sp.*	arrowhead	1	0	0	0	0.25
T16-2	3.0	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	2	1	1	1	1.25
T16-2	3.0	Muck	LETR	*Lemna trisulca*	star duckweed	2	2	5	3	3
T16-2	3.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1	2	1	1	1.25
T16-2	3.0	Muck	ZODU	*Zosterella dubia*	mud plantain	1	1	0	0	0.5
T16-2	3.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed	0	1	1	0	0.5
T16-2	3.0	Muck	POSP	*Potamogeton sp.*	pondweed	0	0	0	1	0.25
T16-2					**Total Density**	4	5	5	4	4.5
T16-3	5.0	Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed	2	2	2	2	2
T16-3	5.0	Gravel	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	2	0	2	0	1
T16-3	5.0	Gravel	ELCA	*Elodea canadensis*	Canada waterweed	2	0	0	0	0.5
T16-3	5.0	Gravel		*#N/A*	Fibrous algae	1	2	1	2	1.5
T16-3	5.0	Gravel	CEDE	*Ceratophyllum demersum*	coontail	0	2	2	2	1.5
T16-3	5.0	Gravel	LETR	*Lemna trisulca*	star duckweed	0	0	0	2	0.5
T16-3					**Total Density**	4	4	4	4	4
T17-1	1.0	Sand, Muck	NYTU	*Nymphaea tuberosa*	white waterlily	2	2	1	3	2
T17-1	1.0	Sand, Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	1	1	0	0	0.5
T17-1	1.0	Sand, Muck	LETR	*Lemna trisulca*	star duckweed	0	4	0	2	1.5
T17-1	1.0	Sand, Muck		*#N/A*	Fibrous algae	0	1	0	0	0.25
T17-1	1.0	Sand, Muck	TYSP	*Typha. spp.*	cattail	0	0	0	0	0
T17-1	1.0	Sand, Muck	SPEU	*Sparganium eurycarpum*	common bur-reed	0	0	0	0	0

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Density Rating	Density Rating	Density Rating	Average Density Rating
						Cast #1	Cast #2	Cast #3	Cast #4	
T17-1	1.0	Sand, Muck	ZODU	*Zosterella dubia*	mud plantain	0	0	0	0	0
T17-1					**Total Density**	2	4	1	3	2.5
T17-2	4.5	Muck	LETR	*Lemna trisulca*	star duckweed	3	5	4	4	4
T17-2	4.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1	0	0	0	0.25
T17-2	4.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	2	1	3	2	2
T17-2	4.5	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	1	0	1	0	0.5
T17-2	4.5	Muck		*#N/A*	Fibrous algae	0	1	0	0	0.25
T17-2	4.5	Muck	POZO	*Potamogeton zosteriformis*	flatstem pondweed	0	0	2	0	0.5
T17-2	4.5	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	0	0	0	0	0
T17-2					**Total Density**	3	5	5	4	4.25
T17-3	7.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	4	4	3	4	3.75
T17-3	7.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	0	1	1	0	0.5
T17-3					**Total Density**	4	4	3	4	3.75
T18-1	2.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	2	2	1	1	1.5
T18-1	2.0	Muck	POSP	*Potamogeton sp.*	pondweed	1	0	0	1	0.5
T18-1	2.0	Muck	POZO	*Potamogeton zosteriformis*	flatstem pondweed	1	1	1	0	0.75
T18-1	2.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	1	0	0	0	0.25
T18-1	2.0	Muck	LETR	*Lemna trisulca*	star duckweed	0	2	2	0	1
T18-1	2.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	0	0	1	0	0.25
T18-1	2.0	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	0	0	1	0	0.25
T18-1	2.0	Muck	SPEU	*Sparganium eurycarpum*	common bur-reed	0	0	0	0	0
T18-1	2.0	Muck	SASP	*Sagittaria sp.*	arrowhead	0	0	0	0	0
T18-1					**Total Density**	2	2	2	1	1.75
T18-2	4.5	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	1	0	0	0	0.25
T18-2	4.5	Muck	POSP	*Potamogeton sp.*	pondweed	3	5	4	3	3.75
T18-2	4.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2	2	1	0	1.25
T18-2	4.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	2	1	1	3	1.75
T18-2	4.5	Muck	POZO	*Potamogeton zosteriformis*	flatstem pondweed	0	0	2	1	0.75

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Density Rating	Density Rating	Density Rating	Average Density Rating
						Cast #1	Cast #2	Cast #3	Cast #4	
T18-2	4.5	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	0	0	1	0	0.25
T18-2					**Total Density**	4	5	4	4	4.25
T18-3	4.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily	1	0	0	0	0.25
T18-3	4.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	3	4	2	2	2.75
T18-3	4.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	2	0	2	1	1.25
T18-3	4.0	Muck	POZO	*Potamogeton zosteriformis*	flatstem pondweed	1	0	0	0	0.25
T18-3	4.0	Muck	LETR	*Lemna trisulca*	star duckweed	2	2	0	0	1
T18-3	4.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed	1	0	0	0	0.25
T18-3	4.0	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	0	0	1	1	0.5
T18-3					**Total Density**	3	4	2	2	2.75
T19-1	1.5	Sand, Gravel	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	1	0	0	1	0.5
T19-1	1.5	Sand, Gravel	ZODU	*Zosterella dubia*	mud plantain	1	0	0	0	0.25
T19-1	1.5	Sand, Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed	1	0	0	0	0.25
T19-1	1.5	Sand, Gravel	CEDE	*Ceratophyllum demersum*	coontail	0	0	0	1	0.25
T19-1					**Total Density**	1	0	0	1	0.5
T19-2	5.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	5	5	3	5	4.5
T19-2	5.0	Muck	POSP	*Potamogeton sp.*	pondweed	4	2	2	1	2.25
T19-2	5.0	Muck	CEDE	*Ceratophyllum demersum*	coontail	0	1	0	1	0.5
T19-2	5.0	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	0	1	2	0	0.75
T19-2	5.0	Muck	LETR	*Lemna trisulca*	star duckweed	0	0	0	2	0.5
T19-2					**Total Density**	5	5	4	5	4.75
T19-3	10.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	2	0	1	0	0.75
T19-3	10.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1	1	0	1	0.75
T19-3	10.5	Muck	POSP	*Potamogeton sp.*	pondweed	1	0	0	0	0.25
T19-3	10.5	Muck			Fibrous algae	1	1	3	2	1.75
T19-3					**Total Density**	2	1	3	2	2
T20-1	1.0	Sand, Gravel	ZODU	*Zosterella dubia*	mud plantain	0	0	0	0	0
T20-1					**Total Density**	0	0	0	0	0

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Density Rating	Density Rating	Density Rating	Average Density Rating
						Cast #1	Cast #2	Cast #3	Cast #4	
T20-2	4.0	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	3	3	1	1	2
T20-2	4.0	Sand	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	0	1	0	0	0.25
T20-2	4.0	Sand	NAFL	*Najas flexilis*	bushy naiad	0	0	2	2	1
T20-2	4.0	Sand			Fibrous algae	0	0	0	1	0.25
T20-2					**Total Density**	3	3	2	2	2.5
T20-3	7.0	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	1	2	1	1	1.25
T20-3	7.0	Sand	ZODU	*Zosterella dubia*	mud plantain	1	0	0	0	0.25
T20-3	7.0	Sand	LETR	*Lemna trisulca*	star duckweed	0	0	1	2	0.75
T20-3	7.0	Sand	CEDE	*Ceratophyllum demersum*	coontail	0	0	0	1	0.25
T20-3					**Total Density**	1	2	1	2	1.5
T21-1	1.5	Sand	SASP	*Sagittaria sp.*	arrowhead	1	0	0	0	0.25
T21-1	1.5	Sand	NYTU	*Nymphaea tuberosa*	white waterlily	1	0	1	0	0.5
T21-1	1.5	Sand	ELSP	*Eleocharis spp.*	spikerush	1	2	0	0	0.75
T21-1	1.5	Sand	POSP	*Potamogeton sp.*	pondweed	1	0	0	1	0.5
T21-1	1.5	Sand	SCSP	*Scirpus sp.*	bulrush	0	0	0	0	0
T21-1					**Total Density**	1	1	2	1	1.25
T21-2	4.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	5	4	4	1	3.5
T21-2	4.5	Muck	LETR	*Lemna trisulca*	star duckweed	1	1	0	1	0.75
T21-2	4.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	1	2	4	5	3
T21-2	4.5	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	0	0	1	1	0.5
T21-2	4.5	Muck	ELCA	*Elodea canadensis*	Canada waterweed	0	0	0	1	0.25
T21-2					**Total Density**	5	4	4	5	4.5
T21-3	7.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3	3	4	5	3.75
T21-3	7.5	Muck	CEDE	*Ceratophyllum demersum*	coontail	1	1	0	1	0.75
T21-3					**Total Density**	3	3	4	5	3.75
T22-2	4.0	Gravel			No Plants	0	0	0	0	0
T22-2					**Total Density**	0	0	0	0	0
T22-3	11.0	Sand, Gravel			Fibrous algae	2	1	3	4	2.5

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Density Rating	Density Rating	Density Rating	Average Density Rating
						Cast #1	Cast #2	Cast #3	Cast #4	
T22-3	11.0	Sand, Gravel	LETR	*Lemna trisulca*	star duckweed	1	0	0	0	0.25
T22-3					**Total Density**	2	1	3	4	2.5
T23-1	1.5	Sand, Gravel, Rock	ZODU	*Zosterella dubia*	mud plantain	1	0	0	0	0.25
T23-1	1.5	Sand, Gravel, Rock	CHSP	*Chara spp.*	muskgrass	1	0	0	0	0.25
T23-1	1.5	Sand, Gravel, Rock	NAFL	*Najas flexilis*	bushy naiad	1	0	0	0	0.25
T23-1					**Total Density**	1	0	0	0	0.25
T23-2	3.5	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	1	0	0	1	0.5
T23-2	3.5	Sand	CHSP	*Chara spp.*	muskgrass	1	1	1	1	1
T23-2	3.5	Sand	NAFL	*Najas flexilis*	bushy naiad	1	1	1	2	1.25
T23-2	3.5	Sand			Fibrous algae	2	2	2	2	2
T23-2					**Total Density**	2	2	2	2	2
T23-3	7.5	Sand			Fibrous algae	2	1	0	1	1
T23-3	7.5	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	1	1	1	3	1.5
T23-3	7.5	Sand	LETR	*Lemna trisulca*	star duckweed	0	0	1	0	0.25
T23-3	7.5	Sand	ELCA	*Elodea canadensis*	Canada waterweed	0	0	0	1	0.25
T23-3	7.5	Sand	POSP	*Potamogeton sp.*	pondweed	0	0	0	1	0.25
T23-3					**Total Density**	2	1	1	3	1.75
T24-1	2.0	Sand, Gravel			No Plants	0	0	0	0	0
T24-1					**Total Density**					
T24-2	4.0	Sand, Silt	POCR	*Potamogeton crispus*	curlyleaf pondweed	2	3	4	4	3.25
T24-2	4.0	Sand, Silt	POZO	*Potamogeton zosteriformis*	flatstem pondweed	0	1	0	0	0.25
T24-2					**Total Density**	2	3	4	4	3.25
T24-3	8.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3	2	3	4	3
T24-3					**Total Density**	3	2	3	4	3
T25-1	1.5	Gravel, Rock			No Plants	0	0	0	0	0

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Density Rating	Density Rating	Density Rating	Density Rating	Average Density Rating
						Cast #1	Cast #2	Cast #3	Cast #4	
T25-1					**Total Density**	0	0	0	0	0
T25-2	4.5	Silt, Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed	4	3	2	4	3.25
T25-2	4.5	Silt, Sand	POSP	*Potamogeton sp.*	pondweed	0	1	0	1	0.5
T25-2					**Total Density**	4	3	2	3	3
T25-3	7.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed	3	3	3	3	3
T25-3					**Total Density**	3	3	3	3	3

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Observed (x)	Type[1]
T1-1	7.0	Silt, Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T1-1	7.0	Silt, Sand	CEDE	*Ceratophyllum demersum*	coontail		1
T1-1	7.0	Silt, Sand	LETR	*Lemna trisulca*	star duckweed		2
T1-1					**Total Density**		
T1-2	8.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T1-2	8.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed		1
T1-2	8.0	Muck	CEDE	*Ceratophyllum demersum*	coontail		1
T1-2					**Total Density**		
T1-3	8.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T1-3	8.5	Muck	ELCA	*Elodea canadensis*	Canada waterweed		1
T1-3	8.5	Muck	LETR	*Lemna trisulca*	star duckweed		2
T1-3	8.5	Muck	CEDE	*Ceratophyllum demersum*	coontail		1
T1-3					**Total Density**		
T2-1	2.0	Sand	ELSP	*Eleocharis spp.*	spikerush		3
T2-1					**Total Density**		
T2-2	6.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T2-2	6.0	Muck	CEDE	*Ceratophyllum demersum*	coontail		1
T2-2	6.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed		1
T2-2					**Total Density**		
T2-3	8.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T2-3	8.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed		1
T2-3					**Total Density**		
T3-1	3.0	Muck	CEDE	*Ceratophyllum demersum*	coontail		1
T3-1	3.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T3-1	3.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed		1
T3-1	3.0	Muck	ZODU	*Zosterella dubia*	mud plantain		1
T3-1	3.0	Muck	LETR	*Lemna trisulca*	star duckweed		2
T3-1	3.0	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		1

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Observed (x)	Type[1]
T3-1					**Total Density**		
T3-2	4.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T3-2	4.0	Muck	CEDE	*Ceratophyllum demersum*	coontail		1
T3-2	4.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed		1
T3-2					**Total Density**		
T3-3	8.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T3-3	8.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed		1
T3-3	8.0	Muck	CEDE	*Ceratophyllum demersum*	coontail		1
T3-3					**Total Density**		
T4-1	2.0	Muck	CEDE	*Ceratophyllum demersum*	coontail		1
T4-1	2.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily		2
T4-1	2.0	Muck	POSP	*Potamogeton sp.*	pondweed		1
T4-1	2.0	Muck	SPPO	*Spirodela polyrhiza*	great duckweed	X	
T4-1	2.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T4-1	2.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed		1
T4-1					**Total Density**		
T4-2	3.0	Muck	LETR	*Lemna trisulca*	star duckweed		2
T4-2	3.0	Muck	CEDE	*Ceratophyllum demersum*	coontail		1
T4-2	3.0	Muck	POSP	*Potamogeton sp.*	pondweed		1
T4-2	3.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily		2
T4-2	3.0	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		1
T4-2	3.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T4-2	3.0	Muck	POZO	*Potamogeton zosteriformis*	flatstem pondweed		1
T4-2					**Total Density**		
T5-1	1.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T5-1	1.0	Muck	NYSI	*Nymphaea odorata*	American white waterlily		2
T5-1	1.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed		1
T5-1	1.0	Muck	SASP	*Sagittaria sp.*	arrowhead		3
T5-1	1.0	Muck	ZODU	*Zosterella dubia*	mud plantain		1

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Observed (x)	Type[1]
T5-1	1.0	Muck	SPPO	*Spirodela polyrhiza*	great duckweed	X	
T5-1					**Total Density**		
T5-2	3.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T5-2	3.5	Muck	SPPO	*Spirodela polyrhiza*	great duckweed		
T5-2	3.5	Muck	CEDE	*Ceratophyllum demersum*	coontail		1
T5-2	3.5	Muck	ELCA	*Elodea canadensis*	Canada waterweed		1
T5-2	3.5	Muck			Fibrous algae		
T5-2	3.5	Muck	LETR	*Lemna trisulca*	star duckweed		2
T5-2					**Total Density**		
T5-3	5.5	Muck	CEDE	*Ceratophyllum demersum*	coontail		1
T5-3	5.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T5-3	5.5	Muck	ELCA	*Elodea canadensis*	Canada waterweed		1
T5-3					**Total Density**		
T6-1	1.5	Rock			Fibrous algae		
T6-1	1.5	Rock	ELSP	*Eleocharis spp.*	spikerush		3
T6-1	1.5	Rock	ZODU	*Zosterella dubia*	mud plantain		1
T6-1	1.5	Rock	ELCA	*Elodea canadensis*	Canada waterweed		1
T6-1					**Total Density**		
T6-2	3.0	Sand, Gravel	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		1
T6-2	3.0	Sand, Gravel	LETR	*Lemna trisulca*	star duckweed		2
T6-2	3.0	Sand, Gravel	ELCA	*Elodea canadensis*	Canada waterweed		1
T6-2	3.0	Sand, Gravel			fibrous algae		
T6-2	3.0	Sand, Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T6-2	3.0	Sand, Gravel	CEDE	*Ceratophyllum demersum*	coontail		1
T6-2	3.0	Sand, Gravel	ZODU	*Zosterella dubia*	mud plantain		1
T6-2					**Total Density**		
T6-3	7.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T6-3	7.5	Muck	POSP	*Potamogeton sp.*	pondweed		1
T6-3	7.5	Muck	ZODU	*Zosterella dubia*	mud plantain		1

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Observed (x)	Type[1]
T6-3	7.5	Muck	ELCA	*Elodea canadensis*	Canada waterweed		1
T6-3	7.5	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		1
T6-3	7.5	Muck	ELSP	*Eleocharis spp.*	spikerush		3
T6-3					**Total Density**		
T7-1	1.5	Sand, Gravel	ELSP	*Eleocharis spp.*	spikerush		3
T7-1	1.5	Sand, Gravel	SASP	*Sagittaria sp.*	arrowhead		3
T7-1					**Total Density**		
T7-2	3.0	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T7-2	3.0	Sand	NAFL	*Najas flexilis*	bushy naiad		1
T7-2	3.0	Sand	ZODU	*Zosterella dubia*	mud plantain		1
T7-2	3.0	Sand	NYSI	*Nymphaea odorata*	American white waterlily		2
T7-2					**Total Density**		
T7-3	8.0	Silt, Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T7-3	8.0	Silt, Sand	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		1
T7-3	8.0	Silt, Sand	CEDE	*Ceratophyllum demersum*	coontail		1
T7-3	8.0	Silt, Sand	LETR	*Lemna trisulca*	star duckweed		2
T7-3	8.0	Silt, Sand			Fibrous algae		
T7-3	8.0	Silt, Sand	ZODU	*Zosterella dubia*	mud plantain		1
T7-3					**Total Density**		
T8-1	2.0	Gravel, Rock	ELSP	*Eleocharis spp.*	spikerush		3
T8-1	2.0	Gravel, Rock	ELCA	*Elodea canadensis*	Canada waterweed		1
T8-1					**Total Density**		
T8-2	3.0	Silt, Sand			Fibrous algae		
T8-2	3.0	Silt, Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T8-2	3.0	Silt, Sand	NAFL	*Najas flexilis*	bushy naiad		1
T8-2	3.0	Silt, Sand	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		1
T8-2	3.0	Silt, Sand	CEDE	*Ceratophyllum demersum*	coontail		1
T8-2	3.0	Silt, Sand	ELCA	*Elodea canadensis*	Canada waterweed		1
T8-2	3.0	Silt, Sand	LETR	*Lemna trisulca*	star duckweed		2

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Observed (x)	Type[1]
T8-2					**Total Density**		
T8-3	6.0	Silt, Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T8-3	6.0	Silt, Sand	CEDE	*Ceratophyllum demersum*	coontail		1
T8-3	6.0	Silt, Sand	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		1
T8-3					**Total Density**		
T9-1	2.0	Rock, Gravel			No Plants		
T9-1					**Total Density**		
T9-2	3.5	Silt, Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T9-2	3.5	Silt, Sand	ZODU	*Zosterella dubia*	mud plantain		1
T9-2	3.5	Silt, Sand	LETR	*Lemna trisulca*	star duckweed		2
T9-2	3.5	Silt, Sand	NAFL	*Najas flexilis*	bushy naiad		1
T9-2	3.5	Silt, Sand	POSP	*Potamogeton sp.*	pondweed		1
T9-2	3.5	Silt, Sand	CEDE	*Ceratophyllum demersum*	coontail		1
T9-2					**Total Density**		
T9-3	7.0	Sand, Silt	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T9-3	7.0	Sand, Silt	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		1
T9-3	7.0	Sand, Silt	LETR	*Lemna trisulca*	star duckweed		2
T9-3	7.0	Sand, Silt	ZODU	*Zosterella dubia*	mud plantain		1
T9-3	7.0	Sand, Silt			Fibrous algae		
T9-3					**Total Density**		
T10-1	1.5	Rock			No Plants		
T10-1					**Total Density**		
T10-2	5.0	Rock	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T10-2					**Total Density**		
T10-3	8.5	Sand, Gravel	LETR	*Lemna trisulca*	star duckweed		2
T10-3	8.5	Sand, Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T10-3	8.5	Sand, Gravel	POSP	*Potamogeton sp.*	pondweed		1
T10-3					**Total Density**		
T11-1	1.5	Rock, Gravel			Fibrous algae		

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Observed (x)	Type[1]
T11-1					**Total Density**		
T11-2	3.0	Rock	ELCA	*Elodea canadensis*	Canada waterweed		1
T11-2	3.0	Rock	algae		Fibrous algae		
T11-2	3.0	Rock	NYSI	*Nymphaea odorata*	American white waterlily		2
T11-2					**Total Density**		
T11-3	8.0	Gravel, Rock	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T11-3	8.0	Gravel, Rock	ELCA	*Elodea canadensis*	Canada waterweed		1
T11-3	8.0	Gravel, Rock	CEDE	*Ceratophyllum demersum*	coontail		1
T11-3					**Total Density**		
T12-1	1.5	Rock, Gravel			Fibrous algae		
T12-1	1.5	Rock, Gravel	ELCA	*Elodea canadensis*	Canada waterweed		1
T12-1	1.5	Rock, Gravel	POSP	*Potamogeton sp.*	pondweed	X	1
T12-1					**Total Density**		
T12-2	3.0	Rock			Fibrous algae		
T12-2					**Total Density**		
T12-3	7.5	Silt, Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T12-3	7.5	Silt, Sand	ELCA	*Elodea canadensis*	Canada waterweed		1
T12-3					**Total Density**		
T13-1	1.5	Rock, Gravel			No Plants		
T13-1					**Total Density**		
T13-2	4.0	Rock			Fibrous algae		
T13-2	4.0	Rock	ELCA	*Elodea canadensis*	Canada waterweed		1
T13-2					**Total Density**		
T13-3	7.5	Sand, Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T13-3	7.5	Sand, Gravel			Fibrous algae		
T13-3	7.5	Sand, Gravel	ELCA	*Elodea canadensis*	Canada waterweed		1
T13-3					**Total Density**		
T14-1	1.5	Sand, Gravel	NAFL	*Najas flexilis*	bushy naiad		1
T14-1	1.5	Sand, Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed		1

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Observed (x)	Type[1]
T14-1	1.5	Sand, Gravel	ELCA	*Elodea canadensis*	Canada waterweed		1
T14-1	1.5	Sand, Gravel			Fibrous algae		
T14-1					**Total Density**		
T14-2	3.5	Sand	ELCA	*Elodea canadensis*	Canada waterweed		1
T14-2	3.5	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T14-2	3.5	Sand	CEDE	*Ceratophyllum demersum*	coontail		1
T14-2					**Total Density**		
T14-3	8.0	Sand, Silt	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T14-3	8.0	Sand, Silt	LETR	*Lemna trisulca*	star duckweed		2
T14-3	8.0	Sand, Silt	ELCA	*Elodea canadensis*	Canada waterweed		1
T14-3					**Total Density**		
T15-1	1.5	Rock, Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T15-1					**Total Density**		
T15-2	3.5	Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T15-2	3.5	Gravel	ZODU	*Zosterella dubia*	mud plantain		1
T15-2					**Total Density**		
T15-3	7.0	Silt, Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T15-3	7.0	Silt, Sand	POSP	*Potamogeton sp.*	pondweed		1
T15-3	7.0	Silt, Sand	CEDE	*Ceratophyllum demersum*	coontail		1
T15-3	7.0	Silt, Sand	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		1
T15-3					**Total Density**		
T16-1	1.5	Silt, Sand	LETR	*Lemna trisulca*	star duckweed		2
T16-1	1.5	Silt, Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T16-1	1.5	Silt, Sand	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		1
T16-1	1.5	Silt, Sand	CEDE	*Ceratophyllum demersum*	coontail		1
T16-1	1.5	Silt, Sand	POSP	*Potamogeton sp.*	pondweed		1
T16-1	1.5	Silt, Sand	ZODU	*Zosterella dubia*	mud plantain		1
T16-1	1.5	Silt, Sand	NYTU	*Nymphaea tuberosa*	white waterlily	x	2
T16-1					**Total Density**		

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Observed (x)	Type[1]
T16-2	3.0	Muck	CEDE	*Ceratophyllum demersum*	coontail		1
T16-2	3.0	Muck	SASP	*Sagittaria sp.*	arrowhead		3
T16-2	3.0	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		1
T16-2	3.0	Muck	LETR	*Lemna trisulca*	star duckweed		2
T16-2	3.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T16-2	3.0	Muck	ZODU	*Zosterella dubia*	mud plantain		1
T16-2	3.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed		1
T16-2	3.0	Muck	POSP	*Potamogeton sp.*	pondweed		1
T16-2					**Total Density**		
T16-3	5.0	Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T16-3	5.0	Gravel	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		1
T16-3	5.0	Gravel	ELCA	*Elodea canadensis*	Canada waterweed		1
T16-3	5.0	Gravel		*#N/A*	Fibrous algae		
T16-3	5.0	Gravel	CEDE	*Ceratophyllum demersum*	coontail		1
T16-3	5.0	Gravel	LETR	*Lemna trisulca*	star duckweed		2
T16-3					**Total Density**		
T17-1	1.0	Sand, Muck	NYTU	*Nymphaea tuberosa*	white waterlily		2
T17-1	1.0	Sand, Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		1
T17-1	1.0	Sand, Muck	LETR	*Lemna trisulca*	star duckweed		2
T17-1	1.0	Sand, Muck		*#N/A*	Fibrous algae		
T17-1	1.0	Sand, Muck	TYSP	*Typha. spp.*	cattail	x	3
T17-1	1.0	Sand, Muck	SPEU	*Sparganium eurycarpum*	common bur-reed	x	3
T17-1	1.0	Sand, Muck	ZODU	*Zosterella dubia*	mud plantain	x	1
T17-1					**Total Density**		
T17-2	4.5	Muck	LETR	*Lemna trisulca*	star duckweed		2
T17-2	4.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T17-2	4.5	Muck	CEDE	*Ceratophyllum demersum*	coontail		1
T17-2	4.5	Muck	NYTU	*Nymphaea tuberosa*	white waterlily		2
T17-2	4.5	Muck		*#N/A*	Fibrous algae		

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Observed (x)	Type[1]
T17-2	4.5	Muck	POZO	*Potamogeton zosteriformis*	flatstem pondweed		1
T17-2	4.5	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil	x	1
T17-2					**Total Density**		
T17-3	7.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T17-3	7.0	Muck	CEDE	*Ceratophyllum demersum*	coontail		1
T17-3					**Total Density**		
T18-1	2.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily		2
T18-1	2.0	Muck	POSP	*Potamogeton sp.*	pondweed		1
T18-1	2.0	Muck	POZO	*Potamogeton zosteriformis*	flatstem pondweed		1
T18-1	2.0	Muck	CEDE	*Ceratophyllum demersum*	coontail		1
T18-1	2.0	Muck	LETR	*Lemna trisulca*	star duckweed		2
T18-1	2.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T18-1	2.0	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		1
T18-1	2.0	Muck	SPEU	*Sparganium eurycarpum*	common bur-reed	x	3
T18-1	2.0	Muck	SASP	*Sagittaria sp.*	arrowhead	x	3
T18-1					**Total Density**		
T18-2	4.5	Muck	NYTU	*Nymphaea tuberosa*	white waterlily		2
T18-2	4.5	Muck	POSP	*Potamogeton sp.*	pondweed		1
T18-2	4.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T18-2	4.5	Muck	CEDE	*Ceratophyllum demersum*	coontail		1
T18-2	4.5	Muck	POZO	*Potamogeton zosteriformis*	flatstem pondweed		1
T18-2	4.5	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		1
T18-2					**Total Density**		
T18-3	4.0	Muck	NYTU	*Nymphaea tuberosa*	white waterlily		2
T18-3	4.0	Muck	CEDE	*Ceratophyllum demersum*	coontail		1
T18-3	4.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T18-3	4.0	Muck	POZO	*Potamogeton zosteriformis*	flatstem pondweed		1
T18-3	4.0	Muck	LETR	*Lemna trisulca*	star duckweed		2
T18-3	4.0	Muck	ELCA	*Elodea canadensis*	Canada waterweed		1

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Observed (x)	Type[1]
T18-3	4.0	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		1
T18-3					**Total Density**		
T19-1	1.5	Sand, Gravel	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		1
T19-1	1.5	Sand, Gravel	ZODU	*Zosterella dubia*	mud plantain		1
T19-1	1.5	Sand, Gravel	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T19-1	1.5	Sand, Gravel	CEDE	*Ceratophyllum demersum*	coontail		1
T19-1					**Total Density**		
T19-2	5.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T19-2	5.0	Muck	POSP	*Potamogeton sp.*	pondweed		1
T19-2	5.0	Muck	CEDE	*Ceratophyllum demersum*	coontail		1
T19-2	5.0	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		1
T19-2	5.0	Muck	LETR	*Lemna trisulca*	star duckweed		2
T19-2					**Total Density**		
T19-3	10.5	Muck	CEDE	*Ceratophyllum demersum*	coontail		1
T19-3	10.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T19-3	10.5	Muck	POSP	*Potamogeton sp.*	pondweed		1
T19-3	10.5	Muck			Fibrous algae		
T19-3					**Total Density**		
T20-1	1.0	Sand, Gravel	ZODU	*Zosterella dubia*	mud plantain	x	1
T20-1					**Total Density**		
T20-2	4.0	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T20-2	4.0	Sand	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		1
T20-2	4.0	Sand	NAFL	*Najas flexilis*	bushy naiad		1
T20-2	4.0	Sand			Fibrous algae		
T20-2					**Total Density**		
T20-3	7.0	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T20-3	7.0	Sand	ZODU	*Zosterella dubia*	mud plantain		1
T20-3	7.0	Sand	LETR	*Lemna trisulca*	star duckweed		2
T20-3	7.0	Sand	CEDE	*Ceratophyllum demersum*	coontail		1

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Observed (x)	Type[1]
T20-3					**Total Density**		
T21-1	1.5	Sand	SASP	*Sagittaria sp.*	arrowhead		3
T21-1	1.5	Sand	NYTU	*Nymphaea tuberosa*	white waterlily		2
T21-1	1.5	Sand	ELSP	*Eleocharis spp.*	spikerush		3
T21-1	1.5	Sand	POSP	*Potamogeton sp.*	pondweed		1
T21-1	1.5	Sand	SCSP	*Scirpus sp.*	bulrush	x	3
T21-1					**Total Density**		
T21-2	4.5	Muck	CEDE	*Ceratophyllum demersum*	coontail		1
T21-2	4.5	Muck	LETR	*Lemna trisulca*	star duckweed		2
T21-2	4.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T21-2	4.5	Muck	MYSI	*Myriophyllum sibiricum*	northern watermilfoil		1
T21-2	4.5	Muck	ELCA	*Elodea canadensis*	Canada waterweed		1
T21-2					**Total Density**		
T21-3	7.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T21-3	7.5	Muck	CEDE	*Ceratophyllum demersum*	coontail		1
T21-3					**Total Density**		
T22-2	4.0	Gravel			No Plants		
T22-2					**Total Density**		
T22-3	11.0	Sand, Gravel			Fibrous algae		
T22-3	11.0	Sand, Gravel	LETR	*Lemna trisulca*	star duckweed		2
T22-3					**Total Density**		
T23-1	1.5	Sand, Gravel, Rock	ZODU	*Zosterella dubia*	mud plantain		
T23-1	1.5	Sand, Gravel, Rock	CHSP	*Chara spp.*	muskgrass		
T23-1	1.5	Sand, Gravel, Rock	NAFL	*Najas flexilis*	bushy naiad		
T23-1					**Total Density**		
T23-2	3.5	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed		1

2007 Long Lake Aquatic Plant Survey
Transect Method
June 9-10, 2007

Transect	Depth (ft)	Substrate Type	Species Code	Species (Scientific Name)	Species (Common name)	Observed (x)	Type[1]
T23-2	3.5	Sand	CHSP	*Chara spp.*	muskgrass		1
T23-2	3.5	Sand	NAFL	*Najas flexilis*	bushy naiad		1
T23-2	3.5	Sand			Fibrous algae		
T23-2					**Total Density**		
T23-3	7.5	Sand			Fibrous algae		
T23-3	7.5	Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T23-3	7.5	Sand	LETR	*Lemna trisulca*	star duckweed		2
T23-3	7.5	Sand	ELCA	*Elodea canadensis*	Canada waterweed		1
T23-3	7.5	Sand	POSP	*Potamogeton sp.*	pondweed		1
T23-3					**Total Density**		
T24-1	2.0	Sand, Gravel			No Plants		
T24-1					**Total Density**		
T24-2	4.0	Sand, Silt	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T24-2	4.0	Sand, Silt	POZO	*Potamogeton zosteriformis*	flatstem pondweed		1
T24-2					**Total Density**		
T24-3	8.0	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T24-3					**Total Density**		
T25-1	1.5	Gravel, Rock			No Plants		
T25-1					**Total Density**		
T25-2	4.5	Silt, Sand	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T25-2	4.5	Silt, Sand	POSP	*Potamogeton sp.*	pondweed		1
T25-2					**Total Density**		
T25-3	7.5	Muck	POCR	*Potamogeton crispus*	curlyleaf pondweed		1
T25-3					**Total Density**		

Appendix C

2000 Aquatic Plant Data Summary—Transect Method

2000 Long Lake Aquatic Plant Survey
Transect Method
June 14-15, 2000

Lake Location	Location Code	Depth Code	Depth (ft)	Substrate	Species Code	Species	Density Rating Cast 1	Density Rating Cast 2	Density Rating Cast 3	Density Rating Cast 4	Average Density Rating
Long Lake	1	A	2.0	Sand/Gravel	TOTAL	Total Density @ Station	3	2	5	2	3.00
Long Lake	1	A	2.0	Sand/Gravel	POCR3	Potamogeton crispus	3	2	5	2	3.00
Long Lake	1	B	4.5	Rock/Mud	TOTAL	Total Density @ Station	2	2	3	1	2.00
Long Lake	1	B	4.5	Rock/Mud	POCR3	Potamogeton crispus	2	2	3	1	2.00
Long Lake	1	B	4.5	Rock/Mud	LETR	Lemna trisulca	0	1	0	0	0.25
Long Lake	1	B	4.5	Rock/Mud	PO SP.	Nymphaea tuberosa	0	0	0	1	0.25
Long Lake	1	C	7.0	Mud/Sand	TOTAL	Total Density @ Station	2	3	2	2	2.25
Long Lake	1	C	7.0	Mud/Sand	POCR3	Potamogeton crispus	2	3	2	2	2.25
Long Lake	1	C	7.0	Mud/Sand	POZO	Potamogeton zosteriformis	0	1	0	0	0.25
Long Lake	2	A	2.0	Mud/Sand	TOTAL	Total Density @ Station	1	1	2	2	1.50
Long Lake	2	A	2.0	Mud/Sand	EL SP.	Chara spp.	1	1	1	0	0.75
Long Lake	2	A	2.0	Mud/Sand	SAGR	Sagittaria sp.	0	0	1	1	0.50
Long Lake	2	A	2.0	Mud/Sand	POCR3	Potamogeton crispus	0	0	1	1	0.50
Long Lake	2	A	2.0	Mud/Sand	LETR	Lemna trisulca	0	0	1	1	0.50
Long Lake	2	A	2.0	Mud/Sand	PO SP.	Nymphaea tuberosa	0	0	0	1	0.25
Long Lake	2	B	4.5	Sand	TOTAL	Total Density @ Station	3	3	1	2	2.25
Long Lake	2	B	4.5	Sand	POCR3	Potamogeton crispus	3	3	1	2	2.25
Long Lake	2	B	4.5	Sand	LETR	Lemna trisulca	0	1	1	0	0.50
Long Lake	2	B	4.5	Sand	PO SP.	Nymphaea tuberosa	0	0	1	0	0.25
Long Lake	2	C	7.0	Mud	TOTAL	Total Density @ Station	2	2	3	2	2.25
Long Lake	2	C	7.0	Mud	POCR3	Potamogeton crispus	2	2	3	2	2.25
Long Lake	2	C	7.0	Mud	PO SP.	Nymphaea tuberosa	0	1	0	0	0.25
Long Lake	3	A	1.5	Mud	TOTAL	Total Density @ Station	5	5	3	5	4.50
Long Lake	3	A	1.5	Mud	POCR3	Potamogeton crispus	5	5	3	5	4.50
Long Lake	3	A	1.5	Mud	LEMI3	Lemna minor	1	1	1	1	1.00
Long Lake	3	A	1.5	Mud	SPPO	Spirodela Polyrhiza	1	1	1	1	1.00
Long Lake	3	A	1.5	Mud	LETR	Lemna trisulca	0	1	0	0	0.25

2000 Long Lake Aquatic Plant Survey
Transect Method
June 14-15, 2000

Lake Location	Location Code	Depth Code	Depth (ft)	Substrate	Species Code	Species	Density Rating Cast 1	Density Rating Cast 2	Density Rating Cast 3	Density Rating Cast 4	Average Density Rating
Long Lake	3	A	1.5	Mud	VAAM3	Vallisneria Americana	0	0	1	0	0.25
Long Lake	3	B	3.0	Mud	TOTAL	Total Density @ Station	1	2	2	2	1.75
Long Lake	3	B	3.0	Mud	POCR3	Potamogeton crispus	1	2	0	1	1.00
Long Lake	3	B	3.0	Mud	SAGR	Sagittaria sp.	0	0	2	1	0.75
Long Lake	3	C	7.0	Mud	TOTAL	Total Density @ Station	3	4	3	3	3.25
Long Lake	3	C	7.0	Mud	POCR3	Potamogeton crispus	3	4	3	3	3.25
Long Lake	4	A	1.5	Mud	TOTAL	Total Density @ Station	4	5	5	4	4.50
Long Lake	4	A	1.5	Mud	NYTU	Nymphaea tuberosa	2	1	1	1	1.25
Long Lake	4	A	1.5	Mud	CEDE4	Ceratophyllum demersum	2	4	4	3	3.25
Long Lake	4	A	1.5	Mud	POCR3	Potamogeton crispus	1	0	1	0	0.50
Long Lake	4	A	1.5	Mud	POZO	Potamogeton zosteriformis	1	1	1	1	1.00
Long Lake	4	A	1.5	Mud	LEMI3	Lemna minor	1	1	0	0	0.50
Long Lake	4	A	1.5	Mud	SPPO	Spirodela Polyrhiza	1	1	0	0	0.50
Long Lake	4	A	1.5	Mud	PO SP.	Nymphaea tuberosa	0	1	1	0	0.50
Long Lake	4	A	1.5	Mud	LETR	Lemna trisulca	0	0	1	1	0.50
Long Lake	4	A	1.5	Mud	ELCA7	Elodea canadensis	0	0	0	1	0.25
Long Lake	4	B	3.5	Mud	TOTAL	Total Density @ Station	4	4	5	5	4.50
Long Lake	4	B	3.5	Mud	NYTU	Nymphaea tuberosa	1	1	1	0	0.75
Long Lake	4	B	3.5	Mud	POCR3	Potamogeton crispus	1	1	0	2	1.00
Long Lake	4	B	3.5	Mud	PO SP.	Nymphaea tuberosa	1	0	0	0	0.25
Long Lake	4	B	3.5	Mud	LETR	Lemna trisulca	1	1	1	1	1.00
Long Lake	4	B	3.5	Mud	LEMI3	Lemna minor	1	1	1	0	0.75
Long Lake	4	B	3.5	Mud	SPPO	Spirodela Polyrhiza	1	1	1	0	0.75
Long Lake	4	B	3.5	Mud	CEDE4	Ceratophyllum demersum	1	0	1	1	0.75
Long Lake	4	B	3.5	Mud	POZO	Potamogeton zosteriformis	0	1	2	2	1.25
Long Lake	4	B	3.5	Mud	MYSI	Myriophyllum sibiricum	0	0	0	1	0.25
Long Lake	5	A	1.0	Mud	TOTAL	Total Density @ Station	2	2	1	1	1.50

2000 Long Lake Aquatic Plant Survey
Transect Method
June 14-15, 2000

Lake Location	Location Code	Depth Code	Depth (ft)	Substrate	Species Code	Species	Density Rating Cast 1	Density Rating Cast 2	Density Rating Cast 3	Density Rating Cast 4	Average Density Rating
Long Lake	5	A	1.0	Mud	POCR3	Potamogeton crispus	1	1	1	1	1.00
Long Lake	5	A	1.0	Mud	SPPO	Spirodela Polyrhiza	1	0	1	1	0.75
Long Lake	5	A	1.0	Mud	LEMI3	Lemna minor	1	0	1	1	0.75
Long Lake	5	A	1.0	Mud	CEDE4	Ceratophyllum demersum	1	1	1	1	1.00
Long Lake	5	A	1.0	Mud	LETR	Lemna trisulca	1	1	1	0	0.75
Long Lake	5	B	4.0	Mud	TOTAL	Total Density @ Station	5	5	5	5	5.00
Long Lake	5	B	4.0	Mud	POCR3	Potamogeton crispus	4	4	3	4	3.75
Long Lake	5	B	4.0	Mud	LEMI3	Lemna minor	1	1	0	0	0.50
Long Lake	5	B	4.0	Mud	SPPO	Spirodela Polyrhiza	1	1	0	0	0.50
Long Lake	5	B	4.0	Mud	POZO	Potamogeton zosteriformis	1	0	0	0	0.25
Long Lake	5	B	4.0	Mud	CEDE4	Ceratophyllum demersum	0	1	2	1	1.00
Long Lake	5	B	4.0	Mud	LETR	Lemna trisulca	0	0	1	1	0.50
Long Lake	5	C	7.5	Mud	TOTAL	Total Density @ Station	1	2	3	5	2.75
Long Lake	5	C	7.5	Mud	POCR3	Potamogeton crispus	1	2	3	5	2.75
Long Lake	5	C	7.5	Mud	ELCA7	Elodea canadensis	0	1	1	0	0.50
Long Lake	5	C	7.5	Mud	CEDE4	Ceratophyllum demersum	0	0	1	0	0.25
Long Lake	6	A	2.0	Rock	TOTAL	Total Density @ Station	1	1	1	1	1.00
Long Lake	6	A	2.0	Rock	LETR	Lemna trisulca	1	1	1	1	1.00
Long Lake	6	B	5.5	Sand/Rock	TOTAL	Total Density @ Station	1	1	1	1	1.00
Long Lake	6	B	5.5	Sand/Rock	LETR	Lemna trisulca	1	1	1	1	1.00
Long Lake	6	B	5.5	Sand/Rock	EL SP.	Chara spp.	0	0	1	1	0.50
Long Lake	6	B	5.5	Sand/Rock	CEDE4	Ceratophyllum demersum	0	0	1	0	0.25
Long Lake	6	C	8.0	Sand/Mud	TOTAL	Total Density @ Station	3	2	2	2	2.25
Long Lake	6	C	8.0	Sand/Mud	POCR3	Potamogeton crispus	3	2	2	2	2.25
Long Lake	6	C	8.0	Sand/Mud	LETR	Lemna trisulca	3	0	0	0	0.75
Long Lake	7	A	1.5	Sand	TOTAL	Total Density @ Station	2	1	2	3	2.00
Long Lake	7	A	1.5	Sand	VAAM3	Vallisneria Americana	1	0	0	0	0.25

2000 Long Lake Aquatic Plant Survey
Transect Method
June 14-15, 2000

Lake Location	Location Code	Depth Code	Depth (ft)	Substrate	Species Code	Species	Density Rating Cast 1	Density Rating Cast 2	Density Rating Cast 3	Density Rating Cast 4	Average Density Rating
Long Lake	7	A	1.5	Sand	EL SP.	Chara spp.	1	1	2	2	1.50
Long Lake	7	A	1.5	Sand	LETR	Lemna trisulca	1	0	0	1	0.50
Long Lake	7	A	1.5	Sand	POCR3	Potamogeton crispus	1	0	1	1	0.75
Long Lake	7	B	5.0	Sand/Mud	TOTAL	Total Density @ Station	3	2	2	2	2.25
Long Lake	7	B	5.0	Sand/Mud	POCR3	Potamogeton crispus	3	2	2	2	2.25
Long Lake	7	B	5.0	Sand/Mud	CEDE4	Ceratophyllum demersum	0	0	0	1	0.25
Long Lake	7	C	9.0	Mud	TOTAL	Total Density @ Station	2	3	1	1	1.75
Long Lake	7	C	9.0	Mud	POCR3	Potamogeton crispus	2	3	1	1	1.75
Long Lake	7	C	9.0	Mud	PO SP.	Nymphaea tuberosa	0	0	0	1	0.25
Long Lake	8	A	2.0	Gravel/Rock	TOTAL	Total Density @ Station	2	1	1	4	2.00
Long Lake	8	A	2.0	Gravel/Rock	POCR3	Potamogeton crispus	2	1	0	3	1.50
Long Lake	8	A	2.0	Gravel/Rock	EL SP.	Chara spp.	0	0	1	0	0.25
Long Lake	8	A	2.0	Gravel/Rock	LETR	Lemna trisulca	0	0	1	1	0.50
Long Lake	8	A	2.0	Gravel/Rock	VAAM3	Vallisneria Americana	0	0	0	1	0.25
Long Lake	8	B	4.0	Mud	TOTAL	Total Density @ Station	5	3	1	5	3.50
Long Lake	8	B	4.0	Mud	POCR3	Potamogeton crispus	5	3	1	5	3.50
Long Lake	8	B	4.0	Mud	LETR	Lemna trisulca	0	1	0	0	0.25
Long Lake	8	C	7.5	Mud	TOTAL	Total Density @ Station	4	3	4	2	3.25
Long Lake	8	C	7.5	Mud	POCR3	Potamogeton crispus	4	3	4	2	3.25
Long Lake	9	A	2.0	Rock/Sand	TOTAL	Total Density @ Station	1	1	1	1	1.00
Long Lake	9	A	2.0	Rock/Sand	POCR3	Potamogeton crispus	1	1	0	1	0.75
Long Lake	9	A	2.0	Rock/Sand	LETR	Lemna trisulca	1	0	1	1	0.75
Long Lake	9	A	2.0	Rock/Sand	PO SP.	Nymphaea tuberosa	0	0	0	1	0.25
Long Lake	9	B	4.0	Mud/Sand	TOTAL	Total Density @ Station	2	1	1	1	1.25
Long Lake	9	B	4.0	Mud/Sand	POCR3	Potamogeton crispus	2	1	1	1	1.25
Long Lake	9	B	4.0	Mud/Sand	LETR	Lemna trisulca	1	1	1	1	1.00
Long Lake	9	B	4.0	Mud/Sand	PO SP.	Nymphaea tuberosa	0	0	1	0	0.25

2000 Long Lake Aquatic Plant Survey
Transect Method
June 14-15, 2000

Lake Location	Location Code	Depth Code	Depth (ft)	Substrate	Species Code	Species	Density Rating Cast 1	Density Rating Cast 2	Density Rating Cast 3	Density Rating Cast 4	Average Density Rating
Long Lake	9	B	4.0	Mud/Sand	CEDE4	Ceratophyllum demersum	0	0	0	1	0.25
Long Lake	9	C	10.0	Mud	TOTAL	Total Density @ Station	2	2	2	3	2.25
Long Lake	9	C	10.0	Mud	POCR3	Potamogeton crispus	2	2	2	3	2.25
Long Lake	10	A	2.0	Rock	TOTAL	Total Density @ Station	1	1	1	1	1.00
Long Lake	10	A	2.0	Rock	POCR3	Potamogeton crispus	1	1	1	0	0.75
Long Lake	10	A	2.0	Rock	LETR	Lemna trisulca	0	0	0	1	0.25
Long Lake	10	B	4.5	Rock	TOTAL	Total Density @ Station	1	1	1	1	1.00
Long Lake	10	B	4.5	Rock	POCR3	Potamogeton crispus	1	1	0	1	0.75
Long Lake	10	B	4.5	Rock	LETR	Lemna trisulca	0	0	1	1	0.50
Long Lake	10	C	9.0	Gravel/Sand	TOTAL	Total Density @ Station	3	2	2	1	2.00
Long Lake	10	C	9.0	Gravel/Sand	POCR3	Potamogeton crispus	3	2	2	1	2.00
Long Lake	11	A	1.5	Rock	TOTAL	Total Density @ Station	1	0	0	0	0.25
Long Lake	11	A	1.5	Rock	POCR3	Potamogeton crispus	1	0	0	0	0.25
Long Lake	11	B	3.5	Gravel/Sand	TOTAL	Total Density @ Station	1	1	1	0	0.75
Long Lake	11	B	3.5	Gravel/Sand	POCR3	Potamogeton crispus	1	1	1	0	0.75
Long Lake	11	C	9.0	Gravel	TOTAL	Total Density @ Station	3	2	1	2	2.00
Long Lake	11	C	9.0	Gravel	POCR3	Potamogeton crispus	3	2	1	2	2.00
Long Lake	12	A	1.0	Rock	TOTAL	Total Density @ Station	1	0	0	0	0.25
Long Lake	12	A	1.0	Rock	POCR3	Potamogeton crispus	1	0	0	0	0.25
Long Lake	12	B	3.5	Rock	TOTAL	Total Density @ Station	0	0	1	0	0.25
Long Lake	12	B	3.5	Rock	POCR3	Potamogeton crispus	0	0	1	0	0.25
Long Lake	12	C	8.5	Mud	TOTAL	Total Density @ Station	2	2	3	3	2.50
Long Lake	12	C	8.5	Mud	POCR3	Potamogeton crispus	2	2	3	3	2.50
Long Lake	13	A	1.5	Rock/Sand	TOTAL	Total Density @ Station	1	1	1	1	1.00
Long Lake	13	A	1.5	Rock/Sand	POCR3	Potamogeton crispus	1	1	1	1	1.00
Long Lake	13	B	3.5	Rock	TOTAL	Total Density @ Station	0	1	1	1	0.75
Long Lake	13	B	3.5	Rock	POCR3	Potamogeton crispus	0	1	1	1	0.75

2000 Long Lake Aquatic Plant Survey
Transect Method
June 14-15, 2000

Lake Location	Location Code	Depth Code	Depth (ft)	Substrate	Species Code	Species	Density Rating Cast 1	Density Rating Cast 2	Density Rating Cast 3	Density Rating Cast 4	Average Density Rating
Long Lake	13	C	8.5	Rock/Sand	TOTAL	Total Density @ Station	2	2	1	2	1.75
Long Lake	13	C	8.5	Rock/Sand	POCR3	Potamogeton crispus	2	2	1	2	1.75
Long Lake	14	A	1.5	Sand	TOTAL	Total Density @ Station	1	1	0	1	0.75
Long Lake	14	A	1.5	Sand	LETR	Lemna trisulca	1	0	0	0	0.25
Long Lake	14	A	1.5	Sand	POCR3	Potamogeton crispus	0	1	0	0	0.25
Long Lake	14	A	1.5	Sand	VAAM3	Vallisneria Americana	0	0	0	1	0.25
Long Lake	14	A	1.5	Sand	PO SP.	Nymphaea tuberosa	0	0	0	1	0.25
Long Lake	14	B	4.5	Sand	TOTAL	Total Density @ Station	2	1	3	5	2.75
Long Lake	14	B	4.5	Sand	POCR3	Potamogeton crispus	2	1	3	5	2.75
Long Lake	14	B	4.5	Sand	PO SP.	Nymphaea tuberosa	1	0	0	0	0.25
Long Lake	14	B	4.5	Sand	VAAM3	Vallisneria Americana	0	1	0	0	0.25
Long Lake	14	C	10.5	Sand	TOTAL	Total Density @ Station	1	2	4	2	2.25
Long Lake	14	C	10.5	Sand	POCR3	Potamogeton crispus	1	2	4	2	2.25
Long Lake	14	C	10.5	Sand	PO SP.	Nymphaea tuberosa	1	0	0	0	0.25
Long Lake	14	C	10.5	Sand	CH SP.	Chara spp.	0	1	0	0	0.25
Long Lake	15	A	1.5	Rock/Sand	TOTAL	Total Density @ Station	0	0	0	1	0.25
Long Lake	15	A	1.5	Rock/Sand	VAAM3	Vallisneria Americana	0	0	0	1	0.25
Long Lake	15	B	4.0	Sand	TOTAL	Total Density @ Station	1	0	1	1	0.75
Long Lake	15	B	4.0	Sand	POCR3	Potamogeton crispus	1	0	1	1	0.75
Long Lake	15	B	4.0	Sand	VAAM3	Vallisneria Americana	1	0	0	0	0.25
Long Lake	15	B	4.0	Sand	LETR	Lemna trisulca	0	0	0	1	0.25
Long Lake	15	C	8.0	Mud	TOTAL	Total Density @ Station	2	2	3	3	2.50
Long Lake	15	C	8.0	Mud	POCR3	Potamogeton crispus	2	2	3	3	2.50
Long Lake	15	C	8.0	Mud	MYSI	Myriophyllum sibiricum	0	0	1	0	0.25
Long Lake	16	A	1.0	Rock/Sand	TOTAL	Total Density @ Station	1	1	1	1	1.00
Long Lake	16	A	1.0	Rock/Sand	LETR	Lemna trisulca	1	1	1	1	1.00
Long Lake	16	A	1.0	Rock/Sand	POCR3	Potamogeton crispus	1	1	1	1	1.00

2000 Long Lake Aquatic Plant Survey
Transect Method
June 14-15, 2000

Lake Location	Location Code	Depth Code	Depth (ft)	Substrate	Species Code	Species	Density Rating Cast 1	Density Rating Cast 2	Density Rating Cast 3	Density Rating Cast 4	Average Density Rating
Long Lake	16	B	3.5	Mud	TOTAL	Total Density @ Station	5	5	5	5	5.00
Long Lake	16	B	3.5	Mud	POCR3	Potamogeton crispus	4	4	4	5	4.25
Long Lake	16	B	3.5	Mud	CEDE4	Ceratophyllum demersum	1	1	0	1	0.75
Long Lake	16	B	3.5	Mud	LETR	Lemna trisulca	1	1	0	1	0.75
Long Lake	16	B	3.5	Mud	CH SP.	Chara spp.	1	1	1	0	0.75
Long Lake	16	B	3.5	Mud	LEMI3	Lemna minor	0	0	1	0	0.25
Long Lake	16	B	3.5	Mud	SPPO	Spirodela Polyrhiza	0	0	1	0	0.25
Long Lake	16	C	6.5	Mud	TOTAL	Total Density @ Station	1	1	2	2	1.50
Long Lake	16	C	6.5	Mud	POCR3	Potamogeton crispus	1	1	0	1	0.75
Long Lake	16	C	6.5	Mud	CH SP.	Chara spp.	1	1	2	2	1.50
Long Lake	16	C	6.5	Mud	LETR	Lemna trisulca	1	1	0	0	0.50
Long Lake	17	A	1.0	Mud/Sand	TOTAL	Total Density @ Station	2	2	2	2	2.00
Long Lake	17	A	1.0	Mud/Sand	NYTU	Nymphaea tuberosa	2	2	2	1	1.75
Long Lake	17	A	1.0	Mud/Sand	LETR	Lemna trisulca	1	1	1	1	1.00
Long Lake	17	A	1.0	Mud/Sand	CH SP.	Chara spp.	1	0	0	0	0.25
Long Lake	17	B	4.5	Mud	TOTAL	Total Density @ Station	5	5	5	5	5.00
Long Lake	17	B	4.5	Mud	POCR3	Potamogeton crispus	5	5	5	5	5.00
Long Lake	17	B	4.5	Mud	LEMI3	Lemna minor	1	0	0	1	0.50
Long Lake	17	B	4.5	Mud	CEDE4	Ceratophyllum demersum	1	0	0	1	0.50
Long Lake	17	B	4.5	Mud	CH SP.	Chara spp.	1	0	0	0	0.25
Long Lake	17	C	7.0	Mud	TOTAL	Total Density @ Station	2	2	2	2	2.00
Long Lake	17	C	7.0	Mud	POCR3	Potamogeton crispus	2	2	2	2	2.00
Long Lake	17	C	7.0	Mud	LETR	Lemna trisulca	0	1	0	0	0.25
Long Lake	18	A	1.5	Mud	TOTAL	Total Density @ Station	5	5	4	4	4.50
Long Lake	18	A	1.5	Mud	NYTU	Nymphaea tuberosa	1	0	2	1	1.00
Long Lake	18	A	1.5	Mud	POCR3	Potamogeton crispus	4	4	2	3	3.25
Long Lake	18	A	1.5	Mud	LEMI3	Lemna minor	1	1	1	1	1.00

2000 Long Lake Aquatic Plant Survey
Transect Method
June 14-15, 2000

Lake Location	Location Code	Depth Code	Depth (ft)	Substrate	Species Code	Species	Density Rating Cast 1	Density Rating Cast 2	Density Rating Cast 3	Density Rating Cast 4	Average Density Rating
Long Lake	18	A	1.5	Mud	SPPO	Spirodela Polyrhiza	1	1	0	1	0.75
Long Lake	18	A	1.5	Mud	CEDE4	Ceratophyllum demersum	0	1	0	0	0.25
Long Lake	18	A	1.5	Mud	LETR	Lemna trisulca	0	0	0	1	0.25
Long Lake	18	B	4.0	Mud	TOTAL	Total Density @ Station	5	5	5	5	5.00
Long Lake	18	B	4.0	Mud	POCR3	Potamogeton crispus	5	5	5	5	5.00
Long Lake	18	B	4.0	Mud	LETR	Lemna trisulca	1	1	1	1	1.00
Long Lake	18	B	4.0	Mud	CEDE4	Ceratophyllum demersum	1	0	1	0	0.50
Long Lake	18	B	4.0	Mud	LEMI3	Lemna minor	1	0	0	0	0.25
Long Lake	18	B	4.0	Mud	SPPO	Spirodela Polyrhiza	0	1	0	0	0.25
Long Lake	18	B	4.0	Mud	CH SP.	Chara spp.	0	1	0	0	0.25
Long Lake	18	B	4.0	Mud	NYTU	Nymphaea tuberosa	0	0	1	0	0.25
Long Lake	18	C	5.0	Mud	TOTAL	Total Density @ Station	5	5	5	5	5.00
Long Lake	18	C	5.0	Mud	POCR3	Potamogeton crispus	5	5	5	5	5.00
Long Lake	18	C	5.0	Mud	LETR	Lemna trisulca	1	1	1	1	1.00
Long Lake	18	C	5.0	Mud	LEMI3	Lemna minor	0	1	0	0	0.25
Long Lake	18	C	5.0	Mud	MYSI	Myriophyllum sibiricum	0	1	1	0	0.50
Long Lake	18	C	5.0	Mud	CEDE4	Ceratophyllum demersum	0	0	1	1	0.50
Long Lake	19	A	1.5	Sand	TOTAL	Total Density @ Station	4	0	5	4	3.25
Long Lake	19	A	1.5	Sand	POCR3	Potamogeton crispus	3	0	4	4	2.75
Long Lake	19	A	1.5	Sand	CEDE4	Ceratophyllum demersum	1	0	0	0	0.25
Long Lake	19	A	1.5	Sand	LETR	Lemna trisulca	1	0	1	1	0.75
Long Lake	19	A	1.5	Sand	LEMI3	Lemna minor	0	0	1	1	0.50
Long Lake	19	A	1.5	Sand	SPPO	Spirodela Polyrhiza	0	0	0	1	0.25
Long Lake	19	B	4.5	Mud	TOTAL	Total Density @ Station	5	5	5	4	4.75
Long Lake	19	B	4.5	Mud	POCR3	Potamogeton crispus	5	5	5	4	4.75
Long Lake	19	B	4.5	Mud	LEMI3	Lemna minor	1	1	1	1	1.00
Long Lake	19	B	4.5	Mud	CH SP.	Chara spp.	1	0	0	0	0.25

2000 Long Lake Aquatic Plant Survey
Transect Method
June 14-15, 2000

Lake Location	Location Code	Depth Code	Depth (ft)	Substrate	Species Code	Species	Density Rating Cast 1	Density Rating Cast 2	Density Rating Cast 3	Density Rating Cast 4	Average Density Rating
Long Lake	19	B	4.5	Mud	LETR	Lemna trisulca	0	1	0	1	0.50
Long Lake	19	C	10.0	Sand	TOTAL	Total Density @ Station	1	1	1	1	1.00
Long Lake	19	C	10.0	Sand	POCR3	Potamogeton crispus	1	1	1	1	1.00
Long Lake	19	C	10.0	Sand	LETR	Lemna trisulca	1	0	1	0	0.50
Long Lake	20	A	2.0	Sand	TOTAL	Total Density @ Station	1	1	1	1	1.00
Long Lake	20	A	2.0	Sand	POCR3	Potamogeton crispus	1	0	0	1	0.50
Long Lake	20	A	2.0	Sand	NAFL	Najas flexilis	0	0	0	1	0.25
Long Lake	20	A	2.0	Sand	CH SP.	Chara spp.	0	1	0	0	0.25
Long Lake	20	A	2.0	Sand	LETR	Lemna trisulca	0	1	1	0	0.50
Long Lake	20	B	4.5	Sand	TOTAL	Total Density @ Station	5	5	4	4	4.50
Long Lake	20	B	4.5	Sand	POCR3	Potamogeton crispus	5	5	4	4	4.50
Long Lake	20	B	4.5	Sand	PO SP.	Nymphaea tuberosa	0	0	0	1	0.25
Long Lake	20	C	7.5	Sand	TOTAL	Total Density @ Station	2	2	1	2	1.75
Long Lake	20	C	7.5	Sand	POCR3	Potamogeton crispus	2	2	1	2	1.75
Long Lake	20	C	7.5	Sand	PO SP.	Nymphaea tuberosa	1	1	0	1	0.75
Long Lake	20	C	7.5	Sand	LETR	Lemna trisulca	0	0	0	1	0.25
Long Lake	21	A	1.5	Sand	TOTAL	Total Density @ Station	1	1	1	1	1.00
Long Lake	21	A	1.5	Sand	MYSI	Myriophyllum sibiricum	1	1	0	1	0.75
Long Lake	21	A	1.5	Sand	POCR3	Potamogeton crispus	1	0	0	1	0.50
Long Lake	21	A	1.5	Sand	SALA2	Sagittaria sp.	1	0	0	0	0.25
Long Lake	21	A	1.5	Sand	LETR	Lemna trisulca	1	1	1	0	0.75
Long Lake	21	A	1.5	Sand	NYTU	Nymphaea tuberosa	0	0	1	0	0.25
Long Lake	21	A	1.5	Sand	CEDE4	Ceratophyllum demersum	0	0	1	1	0.50
Long Lake	21	A	1.5	Sand	SPPO	Spirodela Polyrhiza	0	0	0	1	0.25
Long Lake	21	B	4.5	Mud	TOTAL	Total Density @ Station	3	2	1	4	2.50
Long Lake	21	B	4.5	Mud	POCR3	Potamogeton crispus	3	1	1	3	2.00
Long Lake	21	B	4.5	Mud	CEDE4	Ceratophyllum demersum	0	1	0	1	0.50

2000 Long Lake Aquatic Plant Survey
Transect Method
June 14-15, 2000

Lake Location	Location Code	Depth Code	Depth (ft)	Substrate	Species Code	Species	Density Rating Cast 1	Density Rating Cast 2	Density Rating Cast 3	Density Rating Cast 4	Average Density Rating
Long Lake	21	B	4.5	Mud	SPPO	Spirodela Polyrhiza	0	1	0	1	0.50
Long Lake	21	B	4.5	Mud	LEMI3	Lemna minor	0	0	0	1	0.25
Long Lake	21	C	7.5	Mud	TOTAL	Total Density @ Station	4	3	3	3	3.25
Long Lake	21	C	7.5	Mud	POCR3	Potamogeton crispus	4	3	3	3	3.25
Long Lake	21	C	7.5	Mud	LETR	Lemna trisulca	1	0	0	0	0.25
Long Lake	22	B	4.5	Sand	TOTAL	Total Density @ Station	1	1	1	1	1.00
Long Lake	22	B	4.5	Sand	PO SP.	Nymphaea tuberosa	1	1	0	1	0.75
Long Lake	22	B	4.5	Sand	LETR	Lemna trisulca	1	0	0	0	0.25
Long Lake	22	B	4.5	Sand	POCR3	Potamogeton crispus	0	0	1	0	0.25
Long Lake	22	C	12.5	Sand	TOTAL	Total Density @ Station	1	1	0	0	0.50
Long Lake	22	C	12.5	Sand	POCR3	Potamogeton crispus	1	1	0	0	0.50
Long Lake	22	C	12.5	Sand	LETR	Lemna trisulca	1	0	0	0	0.25
Long Lake	23	A	1.5	Sand	TOTAL	Total Density @ Station	0	0	0	0	0.00
Long Lake	23	B	3.5	Sand	TOTAL	Total Density @ Station	1	1	1	1	1.00
Long Lake	23	B	3.5	Sand	POCR3	Potamogeton crispus	1	1	1	1	1.00
Long Lake	23	B	3.5	Sand	LETR	Lemna trisulca	0	0	1	0	0.25
Long Lake	23	B	3.5	Sand	CH SP.	Chara spp.	0	0	0	1	0.25
Long Lake	23	C	8.0	Sand	TOTAL	Total Density @ Station	2	2	2	2	2.00
Long Lake	23	C	8.0	Sand	POCR3	Potamogeton crispus	1	2	2	2	1.75
Long Lake	23	C	8.0	Sand	CH SP.	Chara spp.	1	0	1	1	0.75
Long Lake	23	C	8.0	Sand	LETR	Lemna trisulca	1	0	1	1	0.75
Long Lake	24	A	1.0	Sand	TOTAL	Total Density @ Station	2	1	1	0	1.00
Long Lake	24	A	1.0	Sand	POCR3	Potamogeton crispus	2	1	0	0	0.75
Long Lake	24	A	1.0	Sand	LEMI3	Lemna minor	0	0	1	0	0.25
Long Lake	24	B	3.0	Sand	TOTAL	Total Density @ Station	2	1	1	5	2.25
Long Lake	24	B	3.0	Sand	POCR3	Potamogeton crispus	2	1	1	5	2.25
Long Lake	24	C	8.0	Sand	TOTAL	Total Density @ Station	2	3	2	2	2.25

2000 Long Lake Aquatic Plant Survey
Transect Method
June 14-15, 2000

Lake Location	Location Code	Depth Code	Depth (ft)	Substrate	Species Code	Species	Density Rating Cast 1	Density Rating Cast 2	Density Rating Cast 3	Density Rating Cast 4	Average Density Rating
Long Lake	24	C	8.0	Sand	POCR3	Potamogeton crispus	2	3	2	2	2.25
Long Lake	25	A	1.5	Sand	TOTAL	Total Density @ Station	3	1	1	5	2.50
Long Lake	25	A	1.5	Sand	POCR3	Potamogeton crispus	3	1	1	5	2.50
Long Lake	25	A	1.5	Sand	LETR	Lemna trisulca	1	0	0	0	0.25
Long Lake	25	A	1.5	Sand	CEDE4	Ceratophyllum demersum	1	1	0	0	0.50
Long Lake	25	A	1.5	Sand	SAGR	Sagittaria sp.	0	1	0	0	0.25
Long Lake	25	B	4.0	Mud	TOTAL	Total Density @ Station	2	2	4	3	2.75
Long Lake	25	B	4.0	Mud	POCR3	Potamogeton crispus	2	2	4	3	2.75
Long Lake	25	B	4.0	Mud	CEDE4	Ceratophyllum demersum	1	0	0	0	0.25
Long Lake	25	C	6.5	Mud	TOTAL	Total Density @ Station	4	5	4	3	4.00
Long Lake	25	C	6.5	Mud	POCR3	Potamogeton crispus	4	5	4	3	4.00

Appendix D

Diversity

2007 Long Lake Macrophyte Frequency of Occurrence, Relative Frequency, and Diversity
Point Intercept Survey Methodology

Lake: Long

Sample Date: June 8-9, 2007

Scientific Name	Common Name	Frequency of Occurrence	rf	rf/100	(rf/100)^2
Potamogeton crispus	curlyleaf pondweed	72.2	24	0.239	0.05689
Ceratophyllum demersum	coontail	52.4	17	0.173	0.02998
Lemna trisulca	star duckweed	29.9	10	0.099	0.00979
Nymphaea tuberosa	white waterlily	28.3	9	0.094	0.009
Phytoplankton	algae	26.7	9	0.088	0.00780
Elodea canadensis	Canada waterweed	20.3	7	0.067	0.00451
Myriophyllum sibiricum	northern watermilfoil	17.1	6	0.057	0.00320
Potamogeton sp.	pondweed	12.8	4	0.042	0.002
Sparganium eurycarpum	common bur-reed	11.8	4	0.039	0.00151
Spirodela polyrhiza	great duckweed	5.9	2	0.019	0.00038
Scirpus sp.	bulrush	5.3	2	0.018	0.00031
Zosterella dubia	mud plantain	4.8	2	0.016	0.000
Eleocharis spp.	spikerush	3.2	1	0.011	0.000
Typha. spp.	cattail	3.2	1	0.011	0.00011
Potamogeton zosteriformis	flatstem pondweed	2.7	1	0.009	0.00008
Sagittaria sp.	arrowhead	1.6	1	0.005	0.00003
Najas flexilis	bushy naiad	1.1	0	0.004	0.00001
Wolffia columbiana	Columbian watermeal	1.1	0	0.004	0.00001
Cyperus strigosus	strawcolored flatsedge	0.5	0	0.002	0.00000
Nitella sp.	stonewort	0.5	0	0.002	0.00000
Potamogeton strictifolius	narrowleaf pondweed	0.5	0	0.002	0.00000
Chara spp	muskgrass	0.5	0	0.002	0.000
TOTAL		302.7	100.00	1.000	0.12547

Diversity = 1 - sum of (rf/100)^2 **Diversity** **0.87453**

2000 Long Lake Macrophyte Frequency of Occurrence, Relative Frequency, and Diversity
Transect Survey Methodology

Lake: Long

Sample Date: June 14-15, 2000

Scientific Name	Common Name	Frequency of Occurrence	rf	rf/100	(rf/100)^2
Potamogeton crispus	curlyleaf pondweed	93.2	33	0.327	0.10679
Ceratophyllum demersum	coontail	24.7	9	0.087	0.00750
Lemna trisulca	star duckweed	54.8	19	0.192	0.03692
Elodea canadensis	Canada waterweed	2.7	1	0.009	0.000
Eleocharis spp.	spikerush	0.0	0	0.000	0.00000
Potamogeton sp.	pondweed	0.0	0	0.000	0.00000
Myriophyllum sibiricum	northern watermilfoil	5.5	2	0.019	0.00037
Zosterella dubia	mud plantain	0.0	0	0.000	0.000
Najas flexilis	bushy naiad	1.4	0	0.005	0.00002
Eleocharis spp.	spikerush	0.0	0	0.000	0.00000
Nymphaea odorata	American white waterlily	0.0	0	0.000	0.00000
Nymphaea tuberosa	white waterlily	28.8	10	0.101	0.001
Sagittaria sp.	arrowhead	5.5	2	0.019	0.000
Potamogeton zosteriformis	flatstem pondweed	5.5	2	0.019	0.00037
Sparganium eurycarpum	common bur-reed	0.0	0	0.000	0.00000
Spirodela polyrhiza	great duckweed	15.1	5	0.053	0.003
Chara spp.	muskgrass	19.2	7	0.067	0.00453
Scirpus sp.	bulrush	0.0	0	0.000	0.00000
Typha. spp.	cattail	0.0	0	0.000	0.00000
Lemna minor	small duckweed	19.2	7	0.067	0.00453
Vallisneria Americana	wild celery	9.6	3	0.034	0.00113
Phytoplankton	fibrous algae	0.0	0	0.000	0.00000
TOTAL		285.2	100.00	1.000	0.16627

Diversity = 1 - sum of (rf/100)^2 **Diversity** **0.83373**

Transect Survey Methodology

Lake: Long

Sample Date: June 9-10, 2007

Scientific Name	Common Name	Frequency of Occurrence	rf	rf/100	(rf/100)^2
Potamogeton crispus	curlyleaf pondweed	72.6	20	0.199	0.03972
Ceratophyllum demersum	coontail	45.2	12	0.124	0.01539
Lemna trisulca	star duckweed	32.9	9	0.090	0.00816
Elodea canadensis	Canada waterweed	41.1	11	0.113	0.013
Eleocharis spp.	spikerush	8.2	2	0.023	0.00051
Potamogeton sp.	pondweed	21.9	6	0.060	0.00361
Myriophyllum sibiricum	northern watermilfoil	28.8	8	0.079	0.00625
Zosterella dubia	mud plantain	23.3	6	0.064	0.004
Najas flexilis	bushy naiad	9.6	3	0.026	0.00069
Eleocharis spp.	spikerush	8.2	2	0.023	0.00051
Nymphaea odorata	American white waterlily	4.1	1	0.011	0.00013
Nymphaea tuberosa	white waterlily	12.3	3	0.034	0.000
Sagittaria sp.	arrowhead	6.8	2	0.019	0.000
Potamogeton zosteriformis	flatstem pondweed	8.2	2	0.023	0.00051
Sparganium eurycarpum	common bur-reed	2.7	1	0.007	0.00005
Spirodela polyrhiza	great duckweed	4.1	1	0.011	0.000
Chara spp.	muskgrass	2.7	1	0.007	0.00005
Scirpus sp.	bulrush	1.4	0	0.004	0.00001
Typha. spp.	cattail	1.4	0	0.004	0.00001
Lemna minor	small duckweed	0.0	0	0.000	0.00000
Vallisneria Americana	wild celery	0.0	0	0.000	0.00000
Phytoplankton	fibrous algae	28.8	8	0.079	0.00625
TOTAL		364.3	100.00	1.000	0.09933

Diversity = 1 - sum of (rf/100)^2 **Diversity** **0.90067**

2007 Long Lake Macrophyte Frequency of Occurrence, Relative Frequency, and Diversity
All Sample Points (Point Intercept and Transect Points)

Lake: Long

Sample Date: June 8-10, 2007

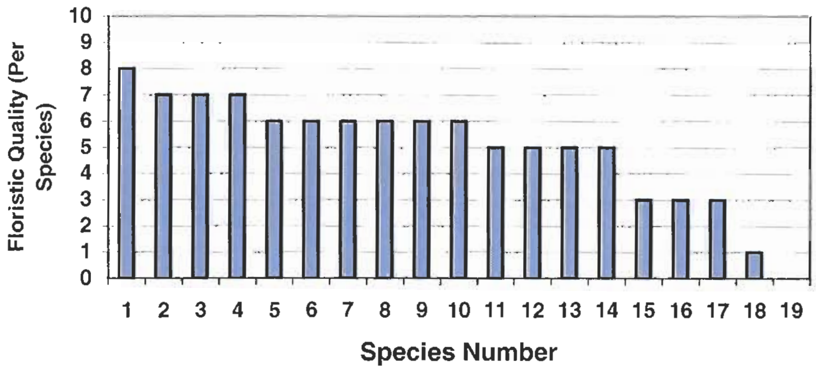
Scientific Name	Common Name	Frequency	rf	rf/100	(rf/100)^2
Potamogeton crispus	curlyleaf pondweed	72.3	23	0.228	0.05218
Ceratophyllum demersum	coontail	50.4	16	0.159	0.02534
Lemna trisulca	star duckweed	30.8	10	0.097	0.00945
Phytoplankton	algae	27.3	9	0.086	0.007
Elodea canadensis	Canada waterweed	26.2	8	0.083	0.00683
Nymphaea tuberosa	white waterlily	23.8	8	0.075	0.00568
Myriophyllum sibiricum	northern watermilfoil	20.4	6	0.064	0.00415
Potamogeton sp.	pondweed	15.4	5	0.049	0.002
Zosterella dubia	mud plantain	10.0	3	0.032	0.00100
Sparganium eurycarpum	common bur-reed	9.2	3	0.029	0.00085
Spirodela polyrhiza	great duckweed	5.4	2	0.017	0.00029
Eleocharis spp.	spikerush	4.6	1	0.015	0.000
Scirpus sp.	bulrush	4.2	1	0.013	0.000
Potamogeton zosteriformis	flatstem pondweed	4.2	1	0.013	0.00018
Najas flexilis	bushy naiad	3.5	1	0.011	0.00012
Sagittaria sp.	arrowhead	3.1	1	0.010	0.000
Typha. spp.	cattail	2.7	1	0.009	0.00007
Chara spp	muskgrass	1.2	0	0.004	0.00001
Wolffia columbiana	Columbian watermeal	0.8	0	0.002	0.00001
Cyperus strigosus	strawcolored flatsedge	0.4	0	0.001	0.00000
Nitella sp.	stonewort	0.4	0	0.001	0.00000
Potamogeton strictifolius	narrowleaf pondweed	0.4	0	0.001	0.00000
TOTAL		316.5	100.00	1.000	0.11633

Diversity = 1 - sum o! Diversity 0.88367

Appendix E

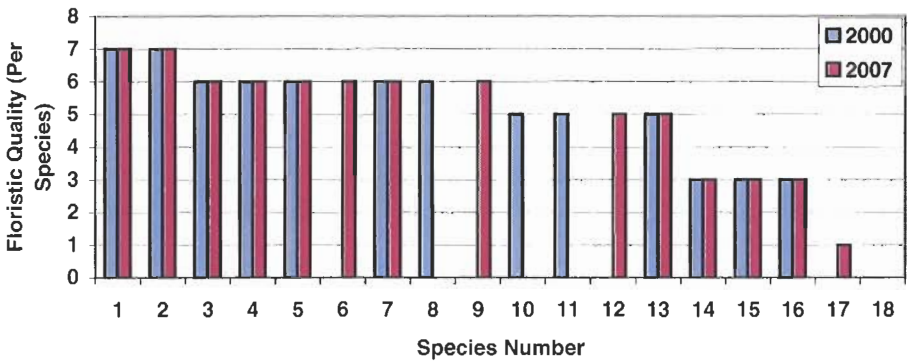
Floristic Quality Index

Figure
2007 Long Lake Aquatic Plant Survey
Floristic Quality (Per Species)
Point Intercept Sample Methodology



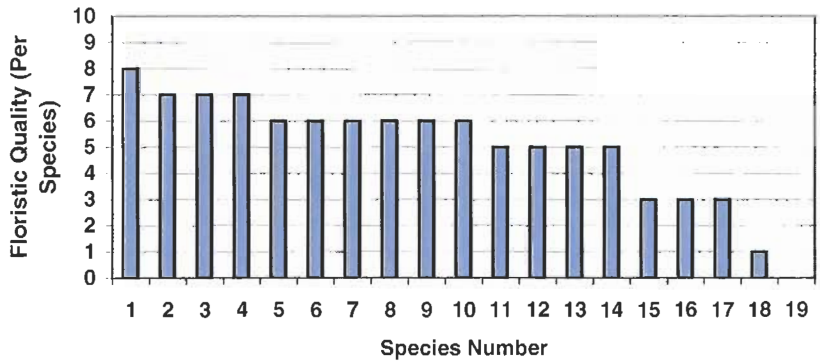
Species Number	Scientific Name	Common Name	Floristic Quality 2007
1	*Potamogeton strictifolius*	narrowleaf pondweed	8
2	*Nitella sp.*	stonewart	7
3	*Myriophyllum sibiricum*	northern watermilfoil	7
4	*Chara spp.*	muskgrass	7
5	*Zosterella dubia*	mud plantain	6
6	*Potamogeton zosteriformis*	flatstem pondweed	6
7	*Potamogeton sp.*	pondweed	6
8	*Nymphaea tuberosa*	white waterlily	6
9	*Najas flexilis*	bushy naiad	6
10	*Lemna trisulca*	star duckweed	6
11	*Wolffia columbiana*	Columbian watermeal	5
12	*Spirodela polyrhiza*	great duckweed	5
13	*Sparganium eurycarpum*	common bur-reed	5
14	*Eleocharis spp.*	spikerush	5
15	*Sagittaria sp.*	arrowhead	3
16	*Elodea canadensis*	Canada waterweed	3
17	*Ceratophyllum demersum*	coontail	3
18	*Typha spp.*	cattail	1
19	*Potamogeton crispus*	curlyleaf pondweed	0
	Mean C		**5.0**
	N (Number of plants in Lake)		**19**
FQI = (mean C)* Square Root of N			**21.79**

Figure 29
Comparison of 2000 and 2007 Long Lake Aquatic Plant
Floristic Quality (Per Species)
Transect Method



Species Number	Scientific Name	Common Name	Floristic Quality 2000	Floristic Quality 2007
1	*Chara spp.*	muckgrass	7	7
2	*Myriophyllum sibiricum*	northern watermilfoil	7	7
3	*Lemna trisulca*	star duckweed	6	6
4	*Potamogeton zosteriformis*	flatstem pondweed	6	6
5	*Najas flexilis*	bushy naiad	6	6
6	*Zosterella dubia*	mud plantain		6
7	*Nymphaea tuberosa*	white waterlily	6	6
8	*Vallisneria Americana*	wild celery	6	
9	*Potamogeton sp.*	pondweed		6
10	*Eleocharis spp.*	spikerush	5	
11	*Lemna minor*	lesser duckweed	5	
12	*Sparganium eurycarpum*	common bur-reed		5
13	*Spirodela Polyrhiza*	greater duckweed	5	5
14	*Ceratophyllum demersum*	coontail	3	3
15	*Elodea canadensis*	Canada waterweed	3	3
16	*Sagittaria sp.*	arrowhead	3	3
17	*Typha. spp.*	cattail		1
18	*Potamogeton crispus*	curlyleaf pondweed	0	0
	Mean C		**4.9**	**4.7**
	N (Number of plants in Lake)		**14**	**15**
FQI = (mean C)* Square Root of N			**18.17**	**18.07**

Figure
2007 Long Lake Aquatic Plant Survey
Floristic Quality (Per Species)
All Points (Point Intercept and Transect Sample Methodology)



Species Number	Scientific Name	Common Name	Floristic Quality 2007
1	*Potamogeton strictifolius*	narrowleaf pondweed	8
2	*Nitella sp.*	stonewart	7
3	*Myriophyllum sibiricum*	northern watermilfoil	7
4	*Chara spp.*	muskgrass	7
5	*Zosterella dubia*	mud plantain	6
6	*Potamogeton zosteriformis*	flatstem pondweed	6
7	*Potamogeton sp.*	pondweed	6
8	*Nymphaea tuberosa*	white waterlily	6
9	*Najas flexilis*	bushy naiad	6
10	*Lemna trisulca*	star duckweed	6
11	*Wolffia columbiana*	Columbian watermeal	5
12	*Spirodela polyrhiza*	great duckweed	5
13	*Sparganium eurycarpum*	common bur-reed	5
14	*Eleocharis spp.*	spikerush	5
15	*Sagittaria sp.*	arrowhead	3
16	*Elodea canadensis*	Canada waterweed	3
17	*Ceratophyllum demersum*	coontail	3
18	*Typha spp.*	cattail	1
19	*Potamogeton crispus*	curlyleaf pondweed	0
	Mean C		**5.0**
	N (Number of plants in Lake)		**19**
FQI = (mean C)* Square Root of N			**21.79**

Appendix F

2000 Water Quality Data

Long Lake

Date	Max. Depth (M)	Secchi Disc (M)	Sample Depth (M)	Chl a (ug/L)	Turbidity (NTU's)	D.O. (mg/L)	Temp. (C)	Specific Cond. umho/cm @ 25 C)	Total P (mg/L)	Soluble Reactive P (mg/L)	Total N (mg/L)	pH (Std. Units)
3/27/00	6.1	1.6										
			0-2	3.12	--	--	--	--	0.042	0.0025	0.69	7.69
			0.0	--		10.0	5.5	191	--	--	--	--
			1.0	--		10.0	5.5	199	--	--	--	--
			2.0	--		10.3	5.5	199	--	--	--	--
			3.0	--		10.3	5.5	199	--	--	--	--
			4.0	--		10.3	5.5	199	--	--	--	--
			5.0	--		10.3	5.5	199	--	--	--	--
			5.5	--		10.3	5.5	199	--	--	--	--
5/8/00	6.1	3.3										
			0-2	--	--	--	--	--	--	--	--	--
			0.0	--		9.8	15.5	198	--	--	--	--
			1.0	--		9.8	15.5	198	--	--	--	--
			2.0	--		9.8	15.2	199	--	--	--	--
			3.0	--		9.6	15.0	200	--	--	--	--
			4.0	--		9.6	15.0	200	--	--	--	--
			5.0	--		8.6	14.8	200	--	--	--	--
			5.5	--		6.4	14.8	200	--	--	--	--
6/5/00	6.1	2.5										
			0-2	10	--	--	--	--	0.049	0.002	0.61	--
			0.0	--		14.2	9.0	246	--	--	--	--
			1.0	--		14.2	16.0	207	--	--	--	--
			2.0	--		14.4	16.0	207	--	--	--	--
			3.0	--		12.8	16.5	205	0.052	--	--	--
			4.0	--		12.0	16.5	205	--	--	--	--
			5.0	--		11.4	16.5	205	0.068	--	--	--
			5.5	--		11.2	16.5	205	0.043	--	--	--

::

Long Lake

Date	Max. Depth (M)	Secchi Disc (M)	Sample Depth (M)	Chl a (ug/L)	Turbidity (NTU's)	D.O. (mg/L)	Temp. (C)	Specific Cond. umho/cm @ 25 C)	Total P (mg/L)	Soluble Reactive P (mg/L)	Total N (mg/L)	pH (Std. Units)
6/19/00	6.1	1.1										
			0-2	12	--	--	--	--	0.061	0.002	0.81	--
			0.0	--		11.0	18.0	198	--	--	--	--
			1.0	--		12.2	19.0	193	--	--	--	--
			2.0	--		11.0	19.0	193	--	--	--	--
			3.0	--		11.0	18.0	198	0.056	--	--	--
			4.0	--		7.8	18.0	198	--	--	--	--
			5.0	--		6.2	18.0	204	0.07	--	--	--
			5.5	--		5.0	18.0	204	0.192	--	--	--
7/10/00	6.1	1.0										
			0-2	31	--	--	--	--	0.078	0.007	1.57	--
			0.0	--		9.0	24.0	194	--	--	--	--
			1.0	--		7.0	25.0	190	--	--	--	--
			2.0	--		9.0	24.0	194	--	--	--	--
			3.0	--		9.0	23.0	193	0.109	--	--	--
			4.0	--		4.2	22.0	207	--	--	--	--
			5.0	--		2.0	21.0	212	0.185	--	--	--
			5.5	--		1.0	20.0	217	--	--	--	--
7/24/00	6.1	0.8										
			0-2	79	--	--	--	--	0.107	0.011	1.9	--
			0.0	--		8.2	22.0	181	--	--	--	--
			1.0	--		9.0	23.0	177	--	--	--	--
			2.0	--		7.2	23.0	188	--	--	--	--
			3.0	--		7.2	22.0	202	0.097	--	--	--
			4.0	--		7.2	22.0	213	--	--	--	--
			5.0	--		--	--	--	0.113	--	--	--
			5.5	--		7.2	21.0	217	0.146	--	--	--

::

Long Lake

Date	Max. Depth (M)	Secchi Disc (M)	Sample Depth (M)	Chl a (ug/L)	Turbidity (NTU's)	D.O. (mg/L)	Temp. (C)	Specific Cond. umho/cm @ 25 C)	Total P (mg/L)	Soluble Reactive P (mg/L)	Total N (mg/L)	pH (Std. Units)
8/7/00	6.1	0.6										
			0-2	8.9	--	--	--	--	0.122	0.059	1.75	--
			0.0	--		3.2	23.0	172	--	--	--	--
			1.0	--		4.0	23.0	167	0.082	--	--	--
			2.0	--		4.0	23.0	167	--	--	--	--
			3.0	--		4.0	23.0	167	0.123	--	--	--
			4.0	--		2.1	23.0	188	--	--	--	--
			5.0	--		2.1	22.0	202	0.231	--	--	--
			5.5	--		1.1	21.0	223	0.338	--	--	--
8/21/00	6.1	0.9										
			0-2	--	--	--	--	--	0.132	0.019	1.87	--
			0.0	--		4.0	22.0	170	--	--	--	--
			1.0	--		3.8	22.0	170	--	--	--	--
			2.0	--		3.6	22.0	170	--	--	--	--
			3.0	--		3.6	22.0	170	0.140	--	--	--
			4.0	--		3.6	22.0	176	--	--	--	--
			5.0	--		3.5	22.0	176	0.145	--	--	--
			5.5	--		3.5	22.0	176	0.135	--	--	--
9/6/00	6.1	1.0										
			0-2	59	--	--	--	--	0.106	0.011	1.48	--
			0.0	--		5.0	19.0	187	--	--	--	--
			1.0	--		5.0	19.0	187	--	--	--	--
			2.0	--		5.0	19.0	187	--	--	--	--
			3.0	--		4.0	19.0	187	0.117	--	--	--
			4.0	--		5.2	20.0	183	--	--	--	--
			5.0	--		4.4	20.0	189	0.104	--	--	--
			5.5	--		4.2	20.0	189	0.112	--	--	--

::

Long Lake

Date	Max. Depth (M)	Secchi Disc (M)	Sample Depth (M)	Chl a (ug/L)	Turbidity (NTU's)	D.O. (mg/L)	Temp. (C)	Specific Cond. umho/cm @ 25 C)	Total P (mg/L)	Soluble Reactive P (mg/L)	Total N (mg/L)	pH (Std. Units)
9/18/00	6.1	1.0										
			0-2	--	--	--	--	--	--	--	--	--
			0.0	--		5.2	20.0	189	--	--	--	--
			1.0	--		5.2	19.0	193	--	--	--	--
			2.0	--		5.4	19.0	193	--	--	--	--
			3.0	--		5.2	18.0	198	--	--	--	--
			4.0	--		4.4	18.0	198	--	--	--	--
			5.0	--		4.4	18.0	198	--	--	--	--
			5.5	--		4.2	18.0	198	--	--	--	--
10/2/00	6.1	1.2										
			0-2	--	--	--	--	--	--	--	--	--
			0.0	--		4.3	15.0	206	--	--	--	--
			1.0	--		4.5	15.0	206	--	--	--	--
			2.0	--		4.2	15.0	206	--	--	--	--
			3.0	--		4.3	15.0	206	--	--	--	--
			4.0	--		4.3	15.0	206	--	--	--	--
			5.0	--		4.3	15.0	206	--	--	--	--
			5.5	--		4.3	15.0	206	--	--	--	--
10/16/00	6.1	1.6										
			0-2	--	--	--	--	--	--	--	--	--
			0.0	--		6.2	11.0	206	--	--	--	--
			1.0	--		6.8	11.0	206	--	--	--	--
			2.0	--		5.9	11.0	213	--	--	--	--
			3.0	--		5.9	11.0	213	--	--	--	--
			4.0	--		4.5	11.0	213	--	--	--	--
			5.0	--		4.2	11.0	213	--	--	--	--
			5.5	--		3.9	11.0	213	--	--	--	--

Appendix G

Information Letters to Long Lake Protection and Rehabilitation District Residents and Letter to Board Members

August 31, 2005

Long Lake Residents,

The annual Long Lake Protection and Rehabilitation district meeting was held on Saturday August 27, 2005. Several guests were in attendance at the meeting including Frank Koshere from the DNR, Jim Bartlet from Aquatic Engineering, Meg Rattei from Barr Engineering, Karen Engelbretson President of the Polk County Lakes and Rivers Association, Amy Kelsy from Polk County, as well as a few members from the Bone Lake P&R board. For those who were able to attend, the board thanks you for your time and participation. For those who were not, this note is a summary of the outcome of that meeting.

To set some context to the goals of this meeting, it is important to remember that as residents of Long Lake we approved and pursued creation of a Lake Management and Implementation plan to help us collectively determine what to do to improve the water quality of the lake. It has been the Board's goal since that time to understand the lake implementation plan provided to us by Barr Engineering and to determine how and when to implement the necessary treatment. At a high level, Barr's Lake Management plan states that we should:

1. Complete a pilot study of alum and lime treatment to determine the effectiveness of this treatment in improving the quality of Long Lake.
2. Execute implementation of a whole lake treatment, pending success of #1.

When presented the implementation plan from Barr 2 years ago, the district was unable to execute on either of the above due to the fact that the DNR was in the process of completing their own study. Thus the DNR would not grant permits for our pilot study. While waiting for more information to become available, we have continued to treat the lake with chemicals to control the curly leaf pond weed population as well as ensure recreational use.

Since that time, the DNR has obtained additional information regarding alum and lime treatments. In addition there is interest in working with Long Lake to complete a pilot study on our lake. It is also important to note that the DNR now mandates that lakes have an up to date Aquatic Plant Management (APM) plan before executing any implementation (including spraying chemicals). We do not currently have an APM plan. With these pieces of information in mind, the goals of the meeting were as follows:

1. Review results of spraying this summer
2. Obtain additional information from the experts regarding alum/lime treatments as well as their recommendation regarding what we should do next year and going forward
3. Vote on pursuing a grant to create a APM plan for Long Lake,
    a. Included in this would be an analysis to help determine what dosage of alum/lime we would need if we were to proceed to the implementation stage
4. Vote on the budget for next year

In regards to the first goal, Aquatic Engineering presented the result of spraying this summer, specifically answering many questions regarding the weed mass that came up late summer on the South/West side of the lake. This weed is called Elodea and is native to our lake. For what ever reason, conditions were just right this year to allow that weed to grow out of control. Two weeks prior to the meeting on 8/27/05, the board took the DNR, Barr Engineering, and Aquatic Engineering on a boat tour of the lake and we determined that this weed was growing in many spots on the lake. This is new as in past years curly leaf pond weed has been more of an issue.

As was stated at the district meeting on 8/27/05, based on current budgets and the desire to treat the lake as a whole, the board hired Aquatic Engineering to propose and implement a plan for managing CLP. To address the additional desire of residents to manage their lake frontage, Aquatic Engineering offered a program that allowed individual residents to hire Aquatic Engineering directly. Given this, the board did not have additional monies to address the Elodea problem when it arose in late summer. To address this going forward, the board recommended that budgets for management of nuisance weeds be increased. This increase will allow the board to not only treat the whole lake, but also address lake frontage needs based on criteria set by the DNR and what ever company we hire next year. This increase was put to vote at the end of the meeting and passed. Next year the special assessment will be $220.00 per lot. An additional note on this subject, at the meeting it was stated that 6 acres were sprayed for CLP this year. I have confirmed that the full 17 acres were sprayed.

To address the second goal, Barr Engineering presented a summary of the results of the study completed on Long Lake in 2000. They also presented their recommendation regarding whether or not we should proceed with implementation of our current Lake Management plan. They confirmed our need for an APM plan and suggested that we apply for grants this year so that we can gather information and create the APM plan next year. They confirmed that they believe the alum and lime treatment was the correct solution on Long Lake as well as our need to complete a pilot study before full implementation. It was stated that the Army Corp was interested in working with us to complete a pilot study in 2007. Given that they laid out the following time line for us:

- Pursue a grant to complete an aquatic plant management plan in 2006
- Pursue a grant to allow us to complete a pilot study of alum/lime treatment in 2007
- Pursue a grant to treat the whole lake with alum/lime treatments in 2008 and for the subsequent 2-3 years.

The district voted on creation of an APM plan. The motion passed 24 to 5. Therefore the board will be pursuing grants this winter and scheduling the necessary work next summer to gather the information we need to create an APM plan. This means that next summer we will not be able to spray for weeds in early spring/summer. We will, however we able to spray in mid to late summer (July/August time frame). Given the increase in budgets that were approved, the board will be interviewing and selecting an Application firm to work with us next year in regards to managing nuisance weeds while not impacting the results of the APM study. If you have questions regarding management of your lake frontage, please contact one of the board members. It is critical that individuals DO NOT hire a firm independently to manage weeds around their docks next year.

As was stated earlier, the board did recommend increasing the budgets for next year. A motion was made to double the special assessment in support of this. The motion was seconded and approved via a vote. As a reminder, budgets are reviewed and approved yearly.

So in summary, next summer we will be pursuing the creation of an Aquatic Plant Management plan. This is required for any additional treatments we may do going forward. In the summer of 2007 we will consider completing a pilot study with the Army Corp to determine if alum/lime treatments will help the water quality on Long Lake. This will be discussed at the fall meeting in 2006. In the fall of 2007 we should have results of that study and at that time can determine if we should pursue treatment of the entire lake. In the mean time, the board will continue to work with the DNR and residents to manage nuisance weeds as is possible based on planned studies.

Two final notes, at the meeting it was announced that we would be filling the positions of Members at Large. Several Lake Residents volunteered. The board will be contacting volunteers in the near future to set up a meeting.

Also the position of Treasurer was up for election for another 3 year term. Jeff Larson was unanimously voted in. Thanks Jeff!

For more information please feel free to contact one of the board members:

Patti Langer	Jeff Larson	Tim Draeger
President/Chairman	Treasurer	Secretary

May 15, 2007

Dear Long Lake Residents,

Happy spring! I hope that everyone had a great winter and was able to enjoy some time at the lake during the winter months.

The Board is pleased to pass on that we were awarded a grant from the DNR which will allow us to complete an aquatic plant study on the lake this spring. The ultimate result of this study will be a Plant Management plan which we can use over the next few years as a roadmap to aid us in managing the weeds on our lake.

On behalf of the District, the P&R board hired Barr Engineering to complete the study and plant management plan. The study is scheduled to occur the weekend of June 8th, 9th, and 10th. Thanks to the volunteers who have said that they will help Barr with the study. We currently have 5 volunteers and could use at least one more. If you are interested, please contact one of the board members at the numbers provided below.

Due to the study, there will be no spraying for weeds on the lake until the mid to late June time frame. It is critical that we do not do anything to change the make up of the plant life during the study to ensure accurate results. This will only aid us in the long run. Our goal is to complete the study and spray for any nuisance weeds prior to the 4th of July week. Further information will be shared at the spring Association Meeting.

For more information please feel free to contact one of the board members:

Patti Langer	Jeff Larson	Tim Draeger
President/Chairman	Treasurer	Secretary
612-889-8003	715-485-3315	715-646-2486

List of Volunteers

Day	Morning Shift (6am - 1pm)	Contact Information	Afternoon Shift (1pm - 8pm)	Contact Information
7-Jun			Barr (Dave)	612-559-1832
8-Jun	Otte (Margo or Darrell)		Otte (Margo or Darrell)	
9-Jun	Gene Braund	715-646-2719	Patti Langer	612-889-8003
10-Jun	Mike Langer	952-221-4947	John Degan	715-646-2540
11-Jun	John Suzukida	651-343-4880	Kari Larson	

Letter To Board Members

Margaret Rattei

From: Patti Langer [patti.langer@us.lawson.com]

Sent: Sunday, November 18, 2007 4:00 PM

To: kbraund@lakeland.ws; larson.jeff@min.sysco.com; michael.j.langer@lmco.com; draegerdecorator@centurytel.net; richardconstinc@yahoo.com; dlolson@centurytel.net

Cc: Patti Langer; Margaret Rattei

Subject: Long Lake Protection and Rehabilitation Board Meeting

All,
To finalize and submit the Long Lake Aquatic Plant Management plan written by Barr Engineering, we need to complete the following before December 1, 2007.

1. Obtain feedback on the plan from district members
   The plan has been sent via email to district members and they have been given until Friday November 23, 2007 to provide any feedback.

2. Meet as a board to vote on acceptance of the plan
   Please let me know which of the proposed times below will work best for you for our board meeting

   Sunday November 25, 2007 at either 10:00am or 1:00pm
   Monday November 26, 2007 at 6:00pm

   Place TBD --- Jeff, do you think we can use the church again?

3. Provide feedback to Meg Rattei no later than Tuesday November 27, 2007

4. Submit the plan to the DNR no later than Saturday December 1, 2007

Please let me know as soon as possible regarding what time will work best for you for our board meeting.

Thanks.

Patti Langer, PMP
Sr. System Development Manager

Lawson Software
380 Saint Peter Street
St. Paul, MN 55102
Tel: 651-767-6946
Cell: 612-889-8003
http://www.lawson.com