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2004 Clear Lake Aquatic Plant Survey
Technical Report and Management Plan

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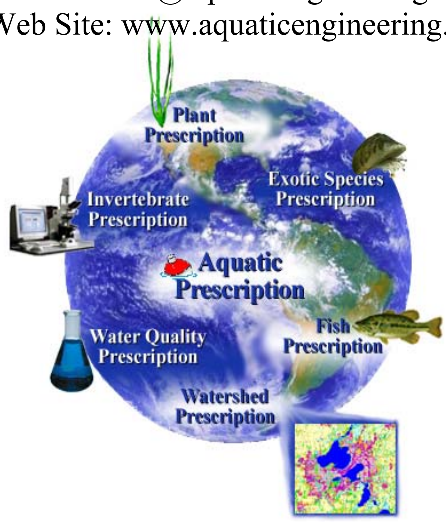

2004 Clear Lake Aquatic Plant Survey
Technical Report and Management Plan

September 2006

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In cooperation with the Wisconsin Department of Natural Resources

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Executive Summary

Clear Lake is an 82 acre seepage lake located near the town of Milton in Rock County, Wisconsin. It is a valuable resource to local residents and offers numerous recreational opportunities to both lake residents and visitors. Plant and algae problems on Clear Lake continue to worsen and are reducing recreational and aesthetic appeal.

Biological indices of Clear Lake show signs of disturbance or disruption of the lake ecosystem. The major problem facing Clear Lake is excessive nutrients. As a result, overgrowths of plants and algae have impacted the fish and wildlife communities. The results of these surveys show that 100 percent of the lake contains aquatic vegetation at some point throughout the year and that coontail, curly-leaf pondweed, and Eurasian watermilfoil compose the majority of the plant community. The survey also identified the lake contains only three native plant species that were coontail (*Ceratophyllum demersum*), common waterweed (*Elodea Canadensis*), and northern milfoil (*Myriophyllum sibiricum*). Residents of Clear Lake have expressed that problems have gotten worse over time and they want to protect and improve water quality and aquatic plant conditions within the lake. In addition, they believe that, if they do not take action, the lake will continue toward eutrophication.

Clear Lake is currently in an undesirable condition with regards to aquatic plant growth, water quality and the fish and wildlife community. Many steps need to occur before any improvements will be realized. The first steps should focus on maintaining the current water quality and plant community by limiting nutrient inputs and minimizing disturbances to the plant community. Once the system is stabilized improvements may be possible.

The steps necessary to improve the aquatic plant, water quality and fish and wildlife characteristics of Clear Lake include promoting native plant growth, establishing floating leaf and emergent plant species, limiting exotic plant growth, designating sensitive areas, implement watershed Best Management Practices, minimizing nutrient inputs, and promoting game and panfish while removing or limiting rough fish species.

Nuisance plants were managed with mechanical harvesting prior to 2000 and with chemical treatments from 2000 to present. Currently, the Association wishes to focus their management activities on mechanical harvesting and is investigating the possibility of an integrated management approach.

The Aquatic Plant Management Plan focuses on improving water quality, promoting high-value native plant growth, and limiting the growth of nuisance exotic and native plants. The plan was written to follow the WDNR guidelines outlined in the draft version of "Aquatic Plant Management in Wisconsin"[1].

The new guidelines provide an objective method for collecting plant inventory data, analyzing the data, making management decisions, and implementing management activities. The guidelines help lake groups create goals, assess the need for management and select the level of management required to meet their goals. The guidelines further break down management practices into three levels and provide a description of items needed for each level of management. The APM plan in this report is written to meet the guidelines for level III management (the most intensive level).

[1] Available on-line at: http://www.uwsp.edu/cnr/uwexlakes/ecology/APMguide.asp

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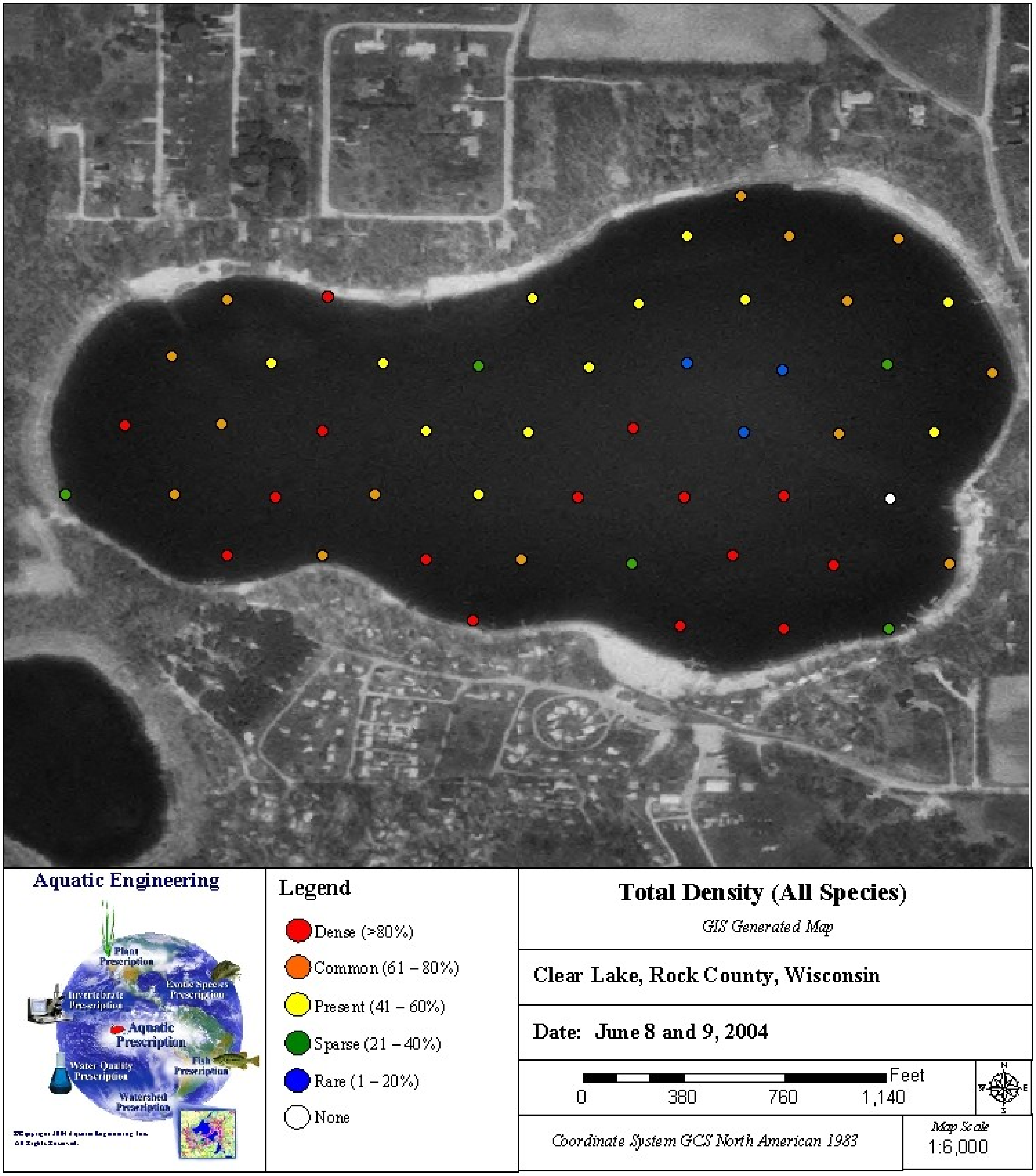


Figure 1. Total plant density at plant sample sites for Clear Lake (Rock County, WI) June 2004.

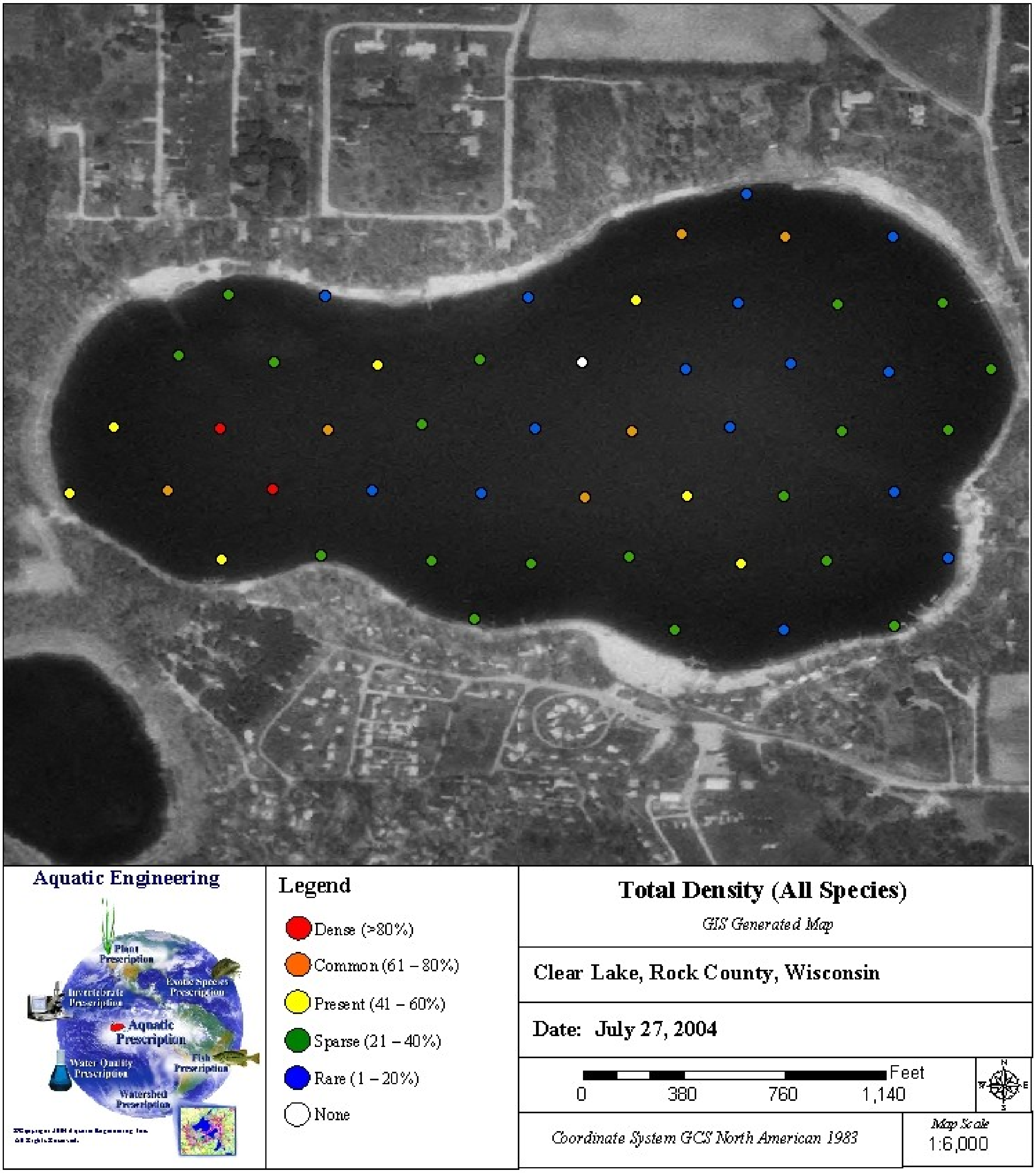


Figure 2. Total plant density at plant sample sites for Clear Lake (Rock County, WI) July 2004.

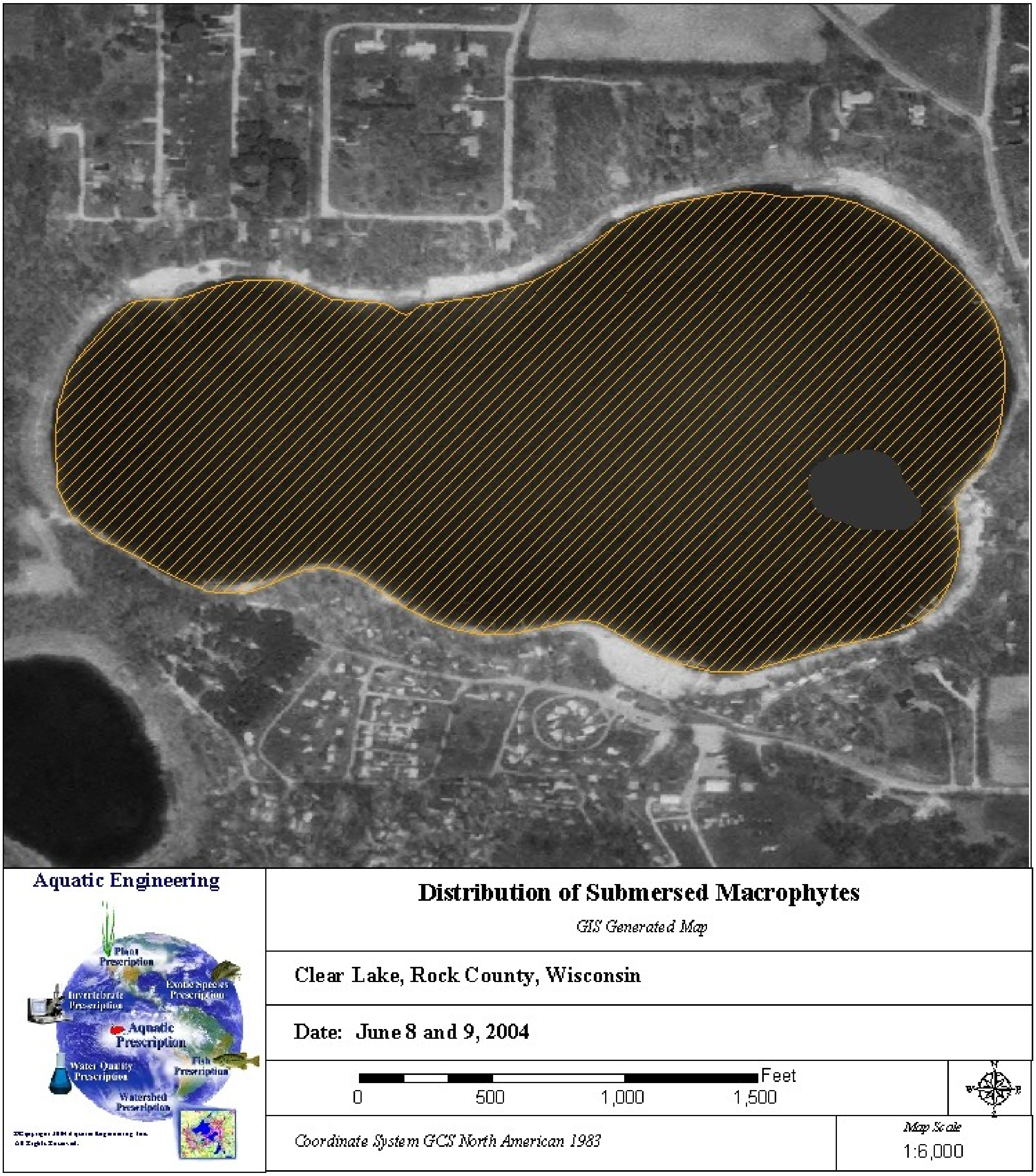


Figure 3. Distribution of submersed macrophytes in Clear Lake (Rock County, WI) June 2004.

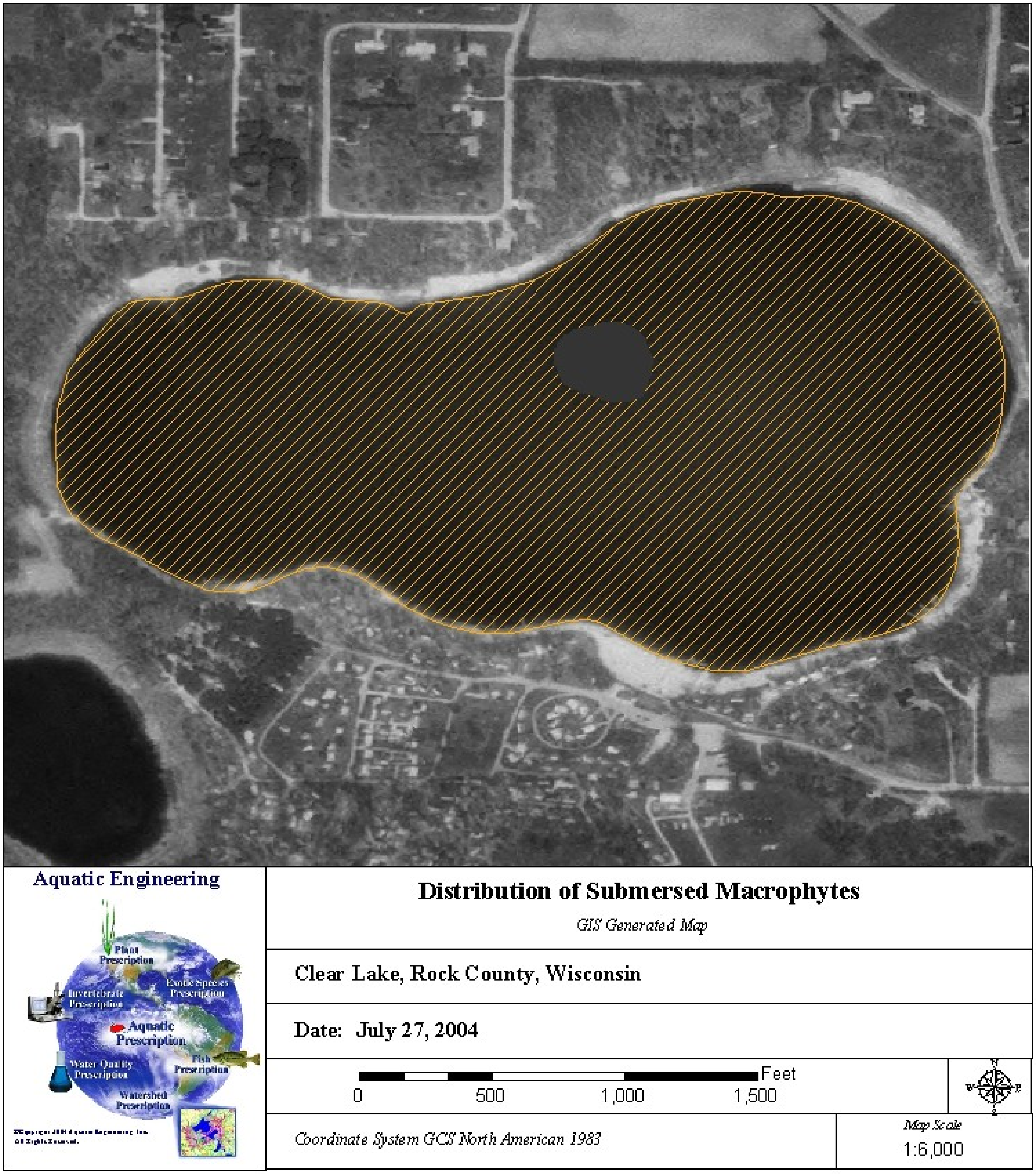


Figure 4. Distribution of submersed macrophytes in Clear Lake (Rock County, WI) July 2004.

1.0 Introduction

Clear Lake is an 82 acre seepage lake located near the town of Milton in Rock County, WI (Figure 5, Figure 6, WBIC 775000; NE ¼ T4N R13E S20). The Clear Lake Association was formed on October 31, 1967. The Association has prepared the following official purpose statement: *"The purpose of the Clear Lake Improvement Association is to promote the preservation, conservation and improvement of the water quality, plant life and animal life in Clear Lake, and to take such action as may be necessary to promote safe use of the lake."*

Clear Lake is a valuable resource to local residents, evident by the excellent Self-help monitoring program (1990-present) and the history of physical and chemical management of nuisance aquatic plants (1999-present). There is one public boat launch and a private launch at a campground which includes a beach and swimming area. The lake offers numerous recreational opportunities to both lake residents and visitors that include boating, fishing, and swimming.

Historical data show that Clear Lake is a mesotrophic lake with good water quality. In recent years, Self-help data show that water clarity has been impacted by frequent lake-wide planktonic algae blooms occurring mid to late summer. The lake also suffers from dense aquatic vegetation starting with curly-leaf pondweed (CLP) in the spring and continuing with Eurasian watermilfoil (EWM) and coontail in the summer. The aquatic plant community is so significantly impacted that only a few native species remain.

The exotic macrophyte EWM is well established in Clear Lake. A 2003 investigative survey estimated 80 percent of the lake bottom was covered with EWM. Eurasian watermilfoil can impair water quality by creating localized pH and dissolved oxygen fluctuations and by releasing nutrients during decay. Lakes with high nutrient levels like Clear Lake, generally experience nuisance algal blooms which decrease water clarity. The tendency of EWM to "top-out" and branch at the surface is increased in cloudy or turbid water (Valley and Newman 1998).

Figure 5. Topography of region surrounding Clear Lake (Rock County, WI.)

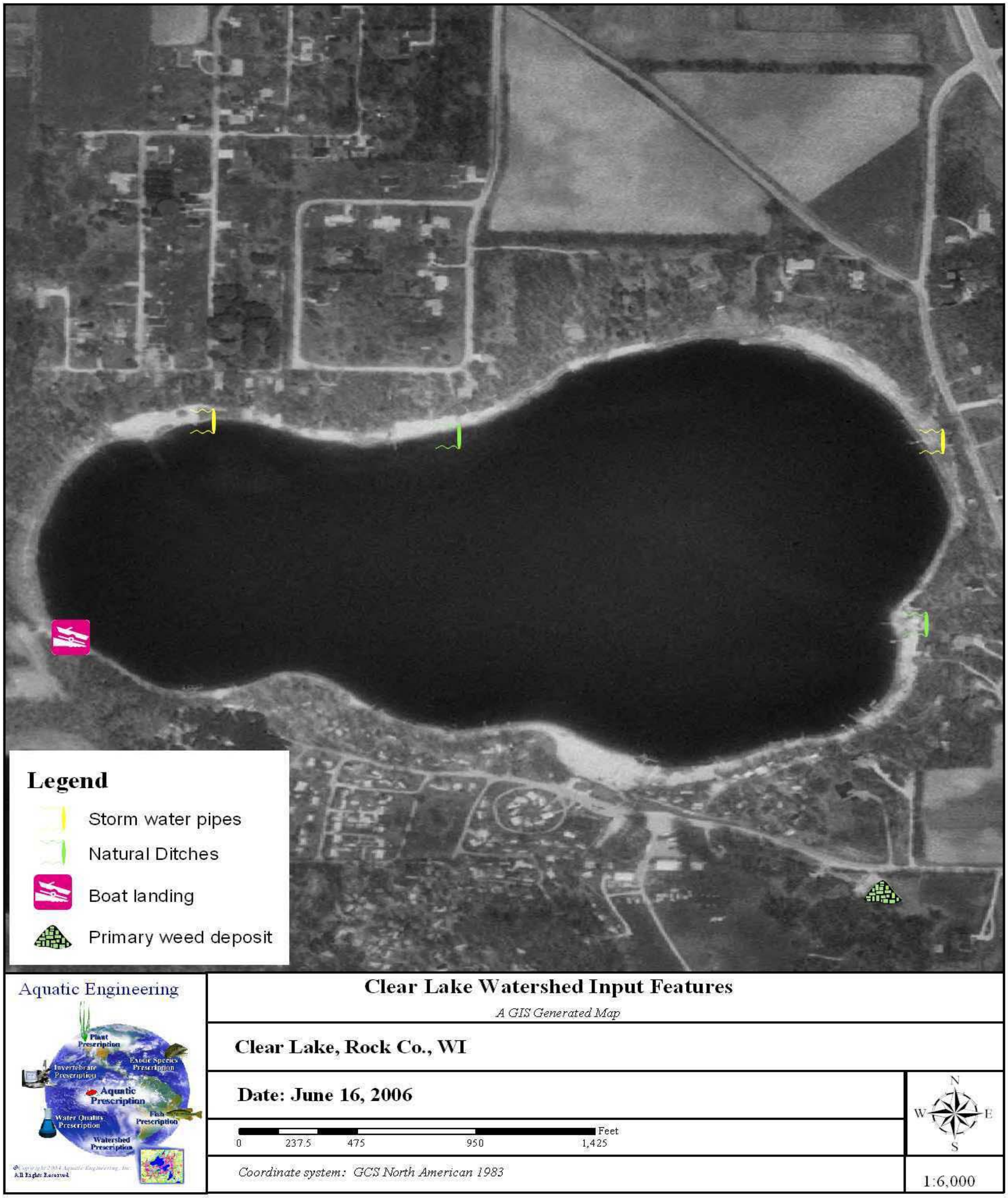


Figure 6. Watershed features of Clear Lake (Rock County, WI)

Curly-leaf pondweed is another invasive exotic plant inhabiting Clear Lake that grows under the ice in the winter and completes its reproductive cycle in early spring. By late spring, CLP dies off and releases nutrients into the water column as it decays. Algae quickly respond to increased nutrient levels in summer due to favorable water temperatures potentially resulting in large blooms and reduced water quality (Crowell 2003).

Planktonic algae blooms are fueled by excessive nutrients from the water column. Phosphorus is generally the limiting nutrient within lake ecosystems and any addition of phosphorus will likely increase the severity, duration, and frequency of algal blooms. Sources of phosphorus include ground water, surface runoff, septic systems, and the atmosphere. Recent studies show that CLP can also contribute large amounts of phosphorus each summer when it decays.

In 2003, the Association contracted The Limnological Institute (TLI) to write a grant for WDNR funding to conduct a macrophyte survey through the Lake Planning and Protection Grant Program. Through TLI, Aquatic Engineering, Inc. (AEI), was contracted for technical support and ecological services. The WDNR and Clear Lake Association also contributed to the project by providing field services during the macrophyte surveys. This report is a summary of the aquatic plant assessment activities that took place during 2004 which were funded, in part, by monies awarded through the Wisconsin Department of Natural Resources Lake Planning and Protection Grant program.

As part of the grant, TLI outlined the activities that were necessary to perform an adequate macrophyte survey. Deliverables listed in the grant and covered in this report include:

- Quantitative Aquatic Plant Community Assessment
- Qualitative Aquatic Plant Community Assessment
- Water quality assessment at plant sampling sites
- Sediment characterization at plant sampling sites
- Delineated monotypic Curly-leaf pondweed and Eurasian watermilfoil beds
- Assessment of riparian land use
- List of potential sensitive areas of the lake
- An updated Aquatic Plant Management Plan
- Watershed assessment and Phosphorus Budget

2.0 Project Overview

During the summer of 2004, biologists assessed several key aspects of the Clear Lake ecosystem. Aquatic macrophytes, sediments, and various water quality parameters were sampled. Sampling of all parameters was performed twice during the aquatic plant growing season in 2004. Water quality monitoring and watershed analysis were also performed in 2004 under funding of a separate lake planning grant.

Aquatic plant surveys planned for late spring and late summer of 2004 produced data yielding a greater understanding of the composition and distribution of the existing aquatic plant community, determined the extent of the CLP and EWM infestation and provided data to be used to evaluate impacts of future management efforts. Biological assessments provide insight into the ecological integrity—how far an ecosystem deviates from its natural, pristine state (Gerristen 1998). This project will implement activities outlined by the Lower Rock River Basin Plan by evaluating the extent of CLP and EWM present in Clear Lake and formulating an action plan to reduce the spread of exotics to other lakes.

Data gathered were analyzed and compared to accepted values for similar lakes in the region. It was found that Clear Lake has a plant community dominated by exotics and coontail most of the year. The largest change in the macrophyte community over the summer is due to CLP which dominates the community in the spring but dies off in the summer. During the summer die-off, excess nutrients are released from decomposing plant material which is then used by algae and fast-growing aquatic plants like coontail and EWM. This plant community data will be used to update the baseline information available for Clear Lake, create an aquatic plant management plan, and provide information relevant to creating a Lake Management Plan.

2.1 Aquatic Plant Distribution within Lakes

Aquatic plants grow in the area of a lake, pond, or impoundment called the littoral zone. The littoral zone is the area between dry land and open water (Figure 7). The littoral zone can vary greatly from lake to lake but is generally considered the area where the water depth is less than 15 feet. This depth is a general guideline and can increase with clear, calm water and decrease with cloudy, disturbed water. Open water is considered any area greater than 15 feet or where aquatic vegetation does not grow from the sediment.

The littoral zone is the area where most of the lake's "productivity" takes place. Abundant light and suitable sediment provide prime habitat for plants and algae, which in turn provide the energy source for all other life forms in the lake. Because of this, the littoral zone is the most biologically active area of a lake. Open water areas are also biologically productive; planktonic algae and zooplankton can be found everywhere in open water where photosynthetically active radiation penetrates the water.

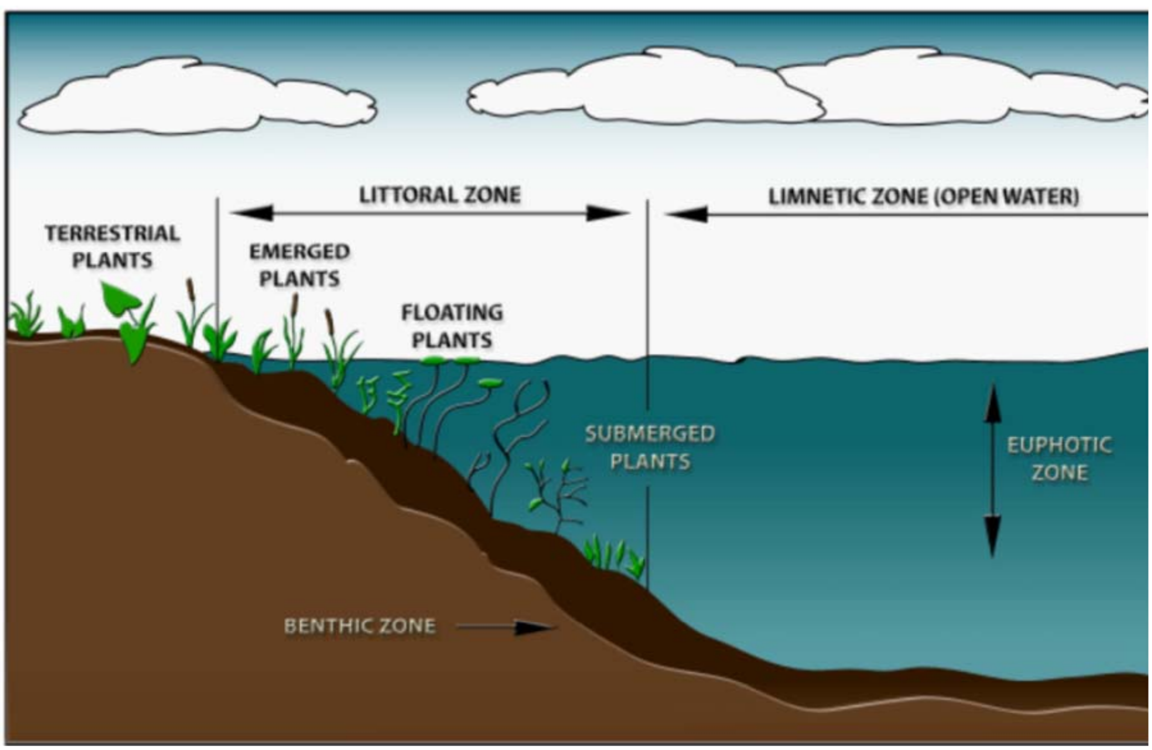


Figure 7. Diagram of a typical littoral zone in a lake.

2.2 Types of Aquatic Plants

There are 4 major categories of aquatic plants: algae, submerged macrophytes, floating-leaved, and emergent. Each category occupies a unique niche of the lake ecosystem and provides benefits to the organisms which occupy those areas.

Algae can be found in every area of a lake where sunlight penetrates. They have no true roots or leaves and can be single-celled or multi-cellular organisms. Planktonic algae are free-floating microscopic organisms that can be found anywhere light penetrates the water with blooms of planktonic algae giving the lake the "pea soup" look.

Filamentous algae are only found in the littoral zone, because it first grows at or near the bottom. As these organisms reproduce, they form tangled mats that eventually trap gasses released during photosynthesis and float to the water surface where they create unpleasant odors while they decay.

Submersed macrophytes are true plants and have true stems and leaves that grow entirely underwater. These plants have a wide range of morphologies and can grow in any area of the littoral zone. Although they grow entirely underwater, some produce flowers or seed heads that can stick out of the water completely. These plants can form dense beds or be scattered intermittently throughout the lake. They can grow close to the bottom or form long arrangements of stems that create surface mats.

Floating-leaved plants are often found where the lake surface is relatively protected from wave action caused by wind or boats. These plants have true roots and often prefer soft sediment types. The leaves and flowers of these plants are found floating at the water surface. An example of floating-leaved plants are water lilies.

Emergent plants, such as cattails, have roots that are submersed but their stems and leaves grow above the water surface. These plants are found in the shallow areas of the littoral zone and in wetlands. Emergent plants provide cover and food for wildlife and help protect shorelines from wave action.

2.3 Value of Aquatic Plants

Food source – Aquatic plants provide a source of food for insects, snails, and freshwater shrimp. Fish also feed on insects associated with aquatic plants (macroinvertebrates). Many animals also graze on plants or plant parts (roots, seeds, etc.) and some fish feed directly on plants.

Shelter/Habitat – Besides providing a source of food, plants provide a place for fish to escape from sunlight and predators. They also provide an attachment point for certain insect larvae and are used by many fish species for spawning.

Stabilize shoreline and sediment – Plant roots secure the sediments of a lake and keep them from being disrupted by wave action. Plants also protect the shoreline from wave action created by wind and boats. Therefore plants are an important natural erosion control mechanism.

Improve water quality – Some plants absorb and break down harmful pollutants in the water. Plants also bind nutrients and make them unavailable to algae.

Improve aesthetics – Many plants produce beautiful flowers and seeds that enhance the natural beauty of the lake.

Economic value – Because aquatic plants fuel the aquatic ecosystem, they are responsible for maintaining the tourism value of this resource. Lakes with healthy plant communities generally have healthy fish and wildlife populations, which draw recreationists interested in fishing, camping, and hunting. Improved water quality and shoreline aesthetics can also raise the value of lake shore property.

2.4 Water Quality and Trophic Status

Trophic status is a term used to describe the amount of primary productivity that occurs within a body of water. Primary productivity is the production of biomass by the bottom layer of the aquatic food pyramid, plants, phytoplankton and algae. Water quality parameters such as phosphorous concentrations, Secchi depth, and chlorophyll *a* concentrations were used to classify nutrient levels in the water and determine trophic status. The four general classifications based on the trophic status of a lake are: (1) Oligotrophic (low productivity); (2) Mesotrophic (average productivity); (3) Eutrophic (elevated productivity); and (4) Hyper-eutrophic (highly productive). Analyzing water quality parameters may also help determine if monotypic stands of CLP or EWM have localized effects on water quality. Please refer to the *Water Quality Monitoring Technical Report* for more information regarding the trophic status of Clear Lake.

The DNR describes conditions expected in lakes based on their trophic status as follows[2]:

Oligotrophic Lakes

Oligotrophic Lakes are those that are generally clear, deep, and free of weeds and large algae blooms. These lakes are low in nutrients, have low primary production, and do not support large fish populations. The food chain in oligotrophic lakes is very structured, and is capable of sustaining a fishery of large game fish. These lakes tend to be the most aesthetically pleasing of lakes due to their clear blue water. In oligotrophic lakes, there is usually a very high Secchi disc reading (in relation to the depth of the lake), and low phosphorus and chlorophyll readings.

Mesotrophic Lakes

Mesotrophic lakes are in the boundary between oligotrophic lakes and eutrophic lakes. They have more nutrients and production than the oligotrophic lakes, but not nearly as much as eutrophic lakes. Mesotrophic lakes have some accumulated organic matter on the bottom of the lake, as well as an occasional algae bloom at the surface. Mesotrophic lakes are usually good lakes for fishing, as they are able to support a wide variety of fish. In the late summer, the hypolimnion can become depleted in oxygen, which limits cold water fish and causes phosphorus cycling from the sediments. Mesotrophic Lakes have Secchi disc, phosphorus, and chlorophyll readings between those of eutrophic and oligotrophic lakes.

[2] Adapted from the WDNR website (http://www.dnr.wi.gov/org/water/fhp/lakes/selfhelp/trophic.htm)

Eutrophic Lakes

Eutrophic Lakes are the most productive lakes, and thus support a very large biomass. These lakes are normally weedy and subject to frequent algae blooms yearly. There is often a large amount of accumulated organic matter on the bottom of the lake. Eutrophic lakes support large fish populations, however, rough fish, like carp, are common in these lakes. Eutrophic lakes are susceptible to oxygen depletion in the hypolimnion, and shallow eutrophic lakes may be vulnerable to winterkill situations. Eutrophic lakes have low Secchi disc readings in relation to the depth of the lake, and high phosphorus and chlorophyll readings.

All lakes age in a way that they start off as oligotrophic lakes, and gradually change to eutrophic lakes. Allowing nutrients into the lakes through agriculture, fertilizers, streets, sewage, and storm drains can speed up this process.

3.0 Review of Existing Data

3.1 Water Quality

Secchi depth data is available for the last 14 years through the WDNR website. Although self-help monitoring comprised a large portion of the data, regular sampling did not occur until 2000. From 2000 to 2004, Secchi readings were performed on a regular basis from June to October each year. Existing Secchi depth, chlorophyll *a*, and total phosphorus data posted on the WDNR website show that Clear Lake is moderately eutrophic and has a historical average TSI value in the low 50's. TSI value over 50 is considered eutrophic.

3.2 Aquatic Macrophytes

Existing macrophyte data is comprised of several years of Secchi depth recorders' comments. The comments most often recorded described algal blooms, topped out CLP and EWM. Nuisance plant conditions were mostly reported from June to August each year. The types of plants and total lake surface area covered with nuisance plants were not recorded.

There has not been an official whole-lake macrophyte survey performed for Clear Lake. The Clear Lake Improvement Association does not have a lake management plan or an aquatic plant management plan currently in place. The aquatic plant conditions within the lake have been worsening over the past decade and need to be managed on an annual basis. Because the Association does not manage their nuisance conditions as a group, some individual property owners chose to create relief around their high recreational use areas by manually removing weeds or by having those areas chemically treated.

3.3 Fishery

Fishery stocking data is available for 1993 – 99. In five of the seven years, northern pike fingerlings were stocked and in two of the seven years, channel catfish were stocked. There have been only two other stockings since 1999. In 2000 the lake was stocked with 164 large northern pike fingerlings, and in 2001 was stocked with 174 northern pike fingerlings. The annual quota is for 164 large northern pike fingerlings, but due to problems with inadequate staff and funding, the pike have not been available the last few years. There is also a standing quota of up to 250 adult channel catfish if they become available.

Table 1. Historical fish stocking efforts for Clear Lake (Rock County, WI).

Year	# of Northern Pike	# of Channel Catfish
1993	410 (39 lbs)	100 (300 pounds)
1994	410 (34.9 pounds)	280 (840 pounds)
1995	155 (36 pounds)	0
1996	0	0
1997	164 (15 pounds)	0
1998	0	0
1999	164 (14.2 pounds)	0

The fisheries management staff from the Newville field station conducted a boom shocking, fish survey on May 23, 2000. The survey consisted of a half-hour sample from the WDNR launch facility to Silver Poplar Beach, with all fish species counted and measured. A second sample, also a half-hour in length, occurred from Silver Poplar Beach back to the DNR launching facility. Only game fish were counted and measured in the second sample. The survey was conducted at 12:32 p.m. and the water temperature was 71 degrees F.

Table 2. Fish species and numbers of individuals captured, with catch per unit effort (CPUE) in parenthesis, on May 23, 2000. There was a total of eleven species from both runs.

Largemouth bass (25)	Channel catfish (1)	Yellow perch (7)	Bluegill (38)
Pumpkin seed (43)	Green sunfish (1)	Hybrid sunfish (15)	carp (358)
Warmouth (1)	Smallmouth bass (1)	Yellow bullhead (1)	

Clear Lake is scheduled for a Baseline Survey for the 2005-2006 fiscal year. The DNR is planning on beginning work on Clear Lake after July 1, 2005.

3.4 Watershed Analysis and Phosphorus Budget

The watershed of Clear Lake is approximately 200 acres. A delineated watershed is not currently on record with the WDNR or Rock County offices. In addition, there is no existing information regarding nutrient or hydrologic budgets for Clear Lake.

3.5 Designated Sensitive Areas

There are no designated sensitive areas within Clear Lake as of November 8, 2005. There likely should be areas designated as fragile habitat containing high-quality vegetation which are essential for fish and wildlife. Most lakes have certain areas where biological, physical or historical conditions have provided invaluable resources for fish and wildlife. The inventory of the aquatic plant community gathered as part of this work can further assist the WDNR in the designation and classification for these areas within Clear Lake.

4.0 Methods

4.1 Macrophyte Surveys

Qualitative and quantitative aquatic plant surveys were conducted once in the spring and once in the summer of 2004. The quantitative surveys applied a point-intercept and rake method while the qualitative surveys were visual and occurred in all areas of the lake. Global positioning system (GPS) integrated with geographical information system (GIS) technology was used to identify and record sample sites and map monotypic stands of non-native species.

4.1.1 Qualitative Surveys

Prior to conducting the quantitative aquatic macrophyte survey, ecologists toured the lake collecting all unique species found. Whole plants were collected, including flowers and seeds if available. Herbarium samples were bagged and stored on ice until they were returned to the lab for processing.

4.1.2 Quantitative Surveys

Measurements were taken at regularly spaced, defined locations to avoid subjectively selecting locations by field ecologists (Figure 8). We pre-selected the sample points using ArcGIS and located each point in the field with a GPS and desktop mapping software. This point intercept method was adopted to survey the whole-lake, utilizing GPS technology. The principle of this intercept method has been widely used in terrestrial plant and animal ecology survey techniques.

A variation on rake coverage techniques (Deppe and Lathrop 1992, Jessen and Lound 1962) was used to sample macrophytes. The following methodology was followed in the study.

- Sample locations were evenly distributed throughout the lake by creating a digital grid overlay using GIS software and selecting the intersections of the grid as sample locations.
- Each sample point was a circle around the boat eight feet in diameter and divided into quadrants. A two-headed, weighted rake was extended from a boat to the furthest extent of each quadrant, and then dragged along the bottom while being retrieved to collect plants.
- GPS coordinates were collected at each sample point to accurately record each sample location. The normal error for the WASS enabled GPS unit was approximately 15 feet. There was no pre-determined acceptable error with regards to the distance from the pre-selected point the actual samples must be collected; every reasonable effort was made to collect the samples as close as possible to the pre-selected point.
- A plant density rating was given for each species on a scale from 0-5, depending on the percent of the rake head covered by that species.

Table 3. Rake head coverage classification system for quantitative macrophyte surveys of Clear Lake (Rock County, Wisconsin).

Rake Coverage (% of rake head covered by a species)	**Density Rating**
81-100%	5
61-80%	4
41-60%	3
21-40%	2
1-20%	1
No Plants Recovered	0
Present but Not Collected	P

In addition to rake coverage, the Floristic Quality Index (I) was calculated on Clear Lake in 2004 with the following equation: $I = ((\sum C_i) / N) \sqrt{N}$. Besides the Floristic Quality Index, a Simpon's Diversity index was calculated with the following formula:

$$D_S = \sum [n_i (n_i - 1)] \div [N (N - 1)]$$

where n_i = the numbers of individuals belonging to the i^{th} species and where N = the total number of individuals found.

A third index, Shannon index (H), was determined to measure the uncertainty the taxon of a randomly chosen individual can be predicted (Shannon and Weaver 1949). Diversity communities will have a high value for the Shannon index. This index is sensitive to the presence of rare species and widely used to analyze biological communities, not just plants. The calculation for the Shannon index is:

$$H = \sum -p_i \log_2 p_i$$

where p_i is the relativized proportion of taxon i.

The H value can be compared to the H_{max} value which is a measure of the maximum diversity possible given the taxa pool of the community. It is calculated as:

$$H_{max} = \log_2 P$$

where P is the total number of taxa present.

The ratio of H/H_{max} provides an estimate of how close a community approaches its theoretical maximum diversity. Ideally, a climax plant community will approach H_{max} but rarely achieve it.

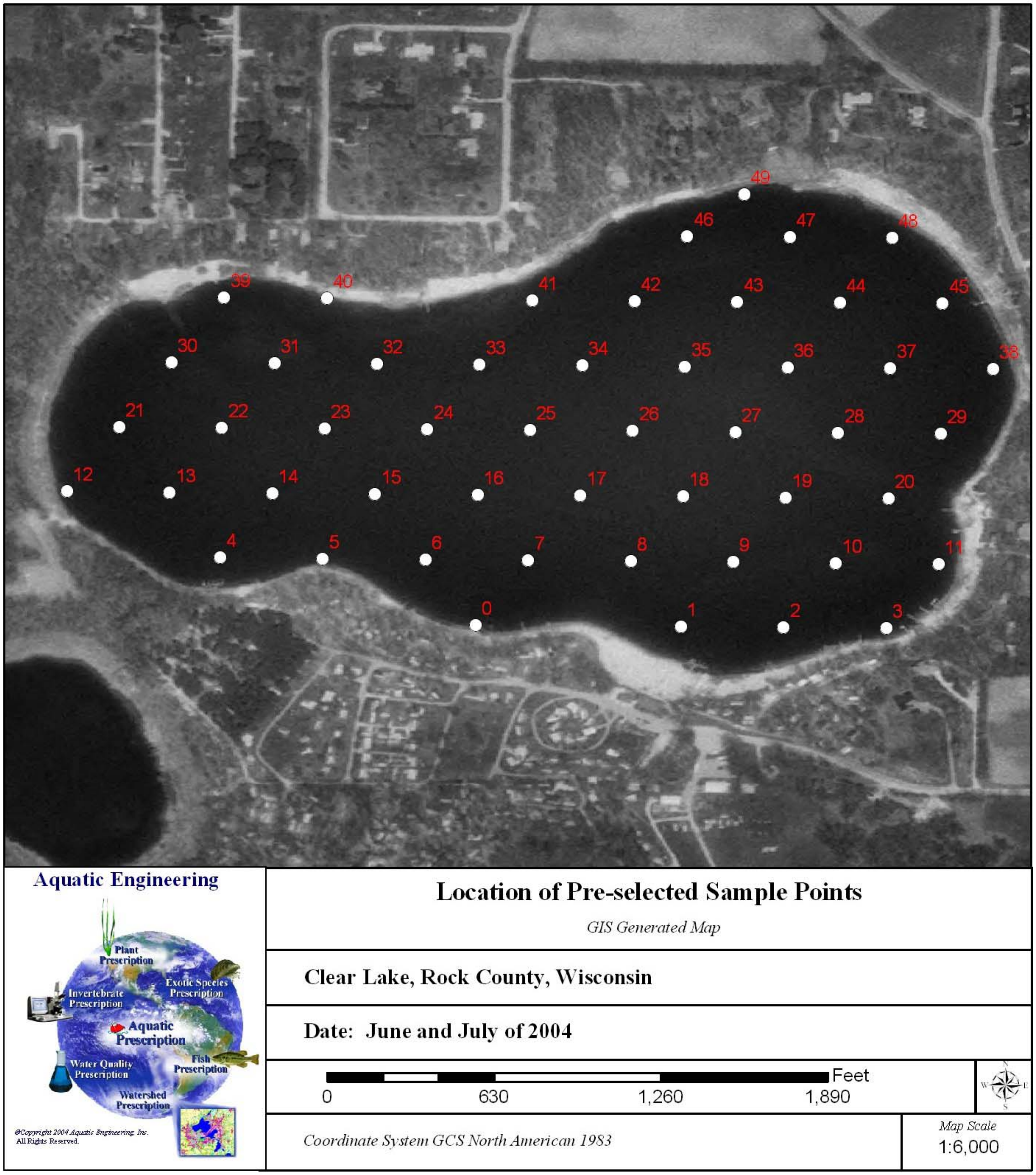


Figure 8. Pre-selected aquatic plant survey sites created with GIS software at regular intervals throughout Clear Lake (Rock County, WI). The points are shown with their "Auto ID" numbers assigned by the GIS software.

4.2 Water Quality at Plant Survey Sites

Secchi depth readings were collected once per survey event and were taken at a mid-lake site near the deepest point of the lake. At each aquatic plant sampling point, the dissolved oxygen, pH, and temperature were collected with a YSI SONDE probe. The probe was submersed to elbow depth in the majority of sites and to ½ the total depth in water too shallow for an elbow depth reading. The probe was left in the water until readings stabilized and the readings were transcribed to data sheets.

The SONDE probes were calibrated prior to each sampling event in 2004. The dissolved oxygen probe was calibrated using oxygen saturated deionized water and calibrating to 100% saturation. The pH probe was calibrated using a two-point bracketing calibration method. The two pH standards used for each calibration were pH 7.0 and pH 10.0. The conductivity probe was calibrated using a stock conductivity solution diluted with deionized water to a concentration close to the expected value of the lake water. The temperature probe is designed to hold its factory calibration and does not require additional calibration prior to sampling.

4.3 Substrate at Plant Survey Sites

The sediment was characterized at each plant sampling location during the plant sampling events. At sites were the sediment was not evident either visually from the boat or collected on the plant rake, an Eckman dredge was used to collect the sediment. At sites were sediment was visible or apparent on the rake, no further collection was performed. The sediment was characterized based on predominant particle size (sand, gravel, organic, etc.). When the sediment appeared to be an even mix of any two sediment types, the type with the largest particle size was recorded (i.e. an equal mix of gravel and sand was recorded as gravel). Depth at each site was measured using a surveyor's staff for sites less than 16 feet deep and a boat-mounted Eagle® depth finder for sites greater than 16 feet.

4.4 Bathymetric Survey

Transects were created 100 feet apart and traversed the lake from east to west with GIS software prior to conducting the bathymetric survey (Figure 9). Navigation during the survey was conducted using a WASS enabled GPS connected to a laptop PC with GIS software which allowed the technician to follow the pre-determined transects. A Lowrance LCX18C recording sonar with GPS was used to digitally record the location of the boat and the depth to bottom as the boat traveled the transects. All position and depth data was recorded on a Secure Digital (SD) Card. The information on the SD card was copied to a desktop computer and read using Lowrance Sonar Viewer v1.2.2. GPS coordinates were recorded for every change in depth of 2 feet from 0 to 16 feet deep (i.e. as the boat traveled a transect the depth would change continuously and the locations where the depth changed from 2' to 4', 4' to 6', 6' to 8', etc. were mapped in ArcMap). Those locations were used to create points which marked the edges of those depth zones. The outline of the lake was used as the zero depth line and points created in ArcMap for each depth zone were connected to create the contour lines for the 2 through 16 foot depth zones. The area of each depth zone was multiplied by two feet and summed to obtain a total lake volume in acre-feet.

4.5 Riparian Land use Assessment at Plant Survey Sites

The riparian survey occurred at points where aquatic plant survey points came in close proximity with the shoreline. The immediate shoreline (50 feet wide and 30 feet back) was surveyed using the below characteristics as guidelines (Table 4). Buffer strips were noted when present, but the size of the buffer was not measured.

Table 4. Shoreline classification categories for Clear Lake (Rock County, WI) in 2004.

Natural	Wooded
	Native herbaceous
	Shrubs
	Emergent Aquatic Plants
	Wetland
Disturbed	Cultivated lawn
	Hard Structures (decks, walkways, etc.)
	Modified shoreline (beach, rip-rap, etc.)

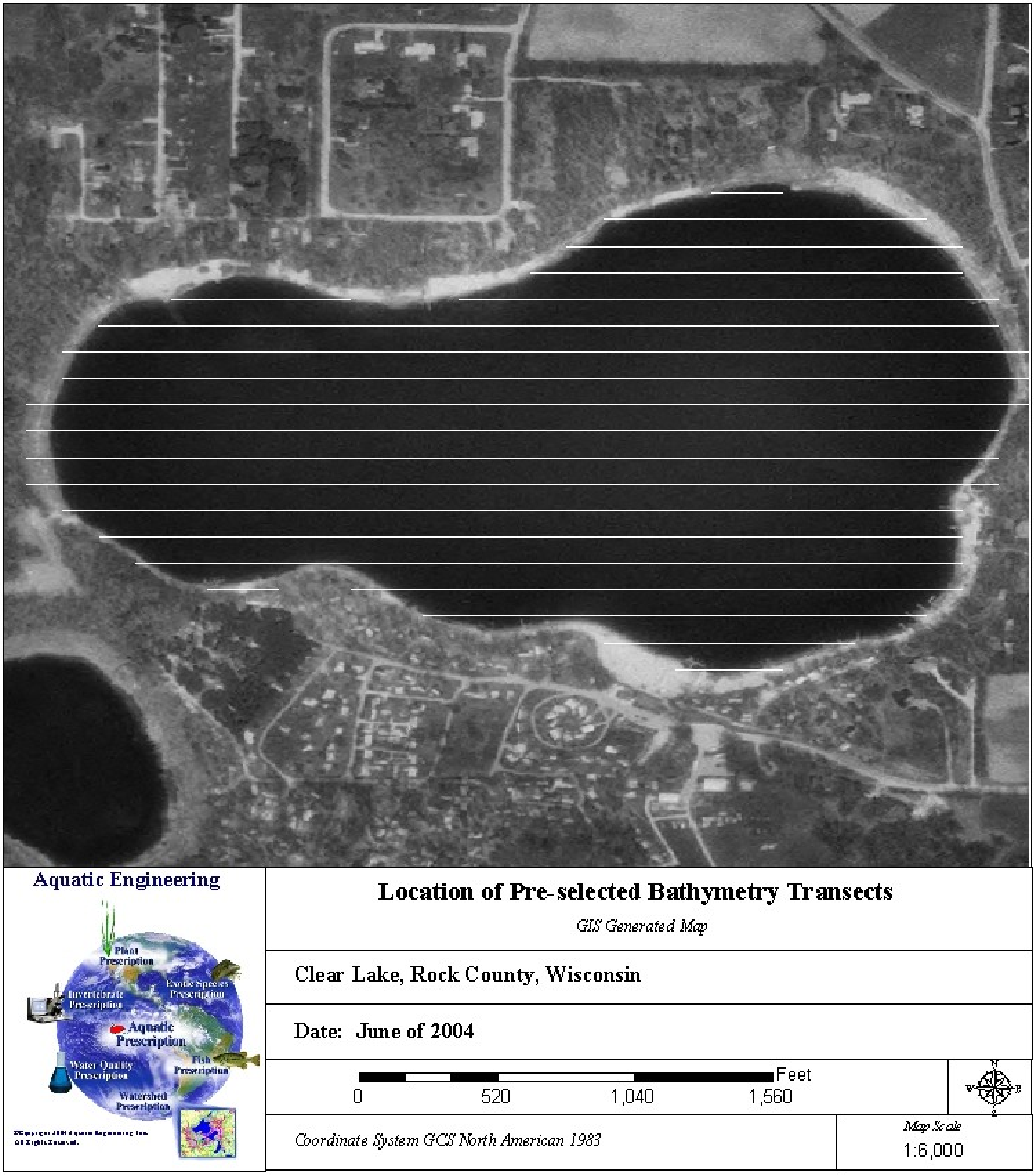


Figure 9. Pre-selected transects for the bathymetric survey of Clear Lake (Rock County, WI).

4.6 Water Quality Sampling

Laboratory Analysis

A “mid-lake” sample site location was created at the deepest point in the lake, marked with a GPS and used for each sampling event. Water samples were collected monthly from the surface and bottom of Clear Lake’s water column and delivered to the Wisconsin State Laboratory of Hygiene in Madison for analysis. Surface samples were collected using a surface integrated sampling device which sampled a column of water from the surface to 6-feet deep. The bottom samples were collected near the water-sediment interface using a Van Dorn sampling device. All water samples were immediately place on ice and delivered to the state lab in Madison, Wisconsin. The parameters tested at the lab were reactive phosphorus, total phosphorus, total Kjeldahl nitrogen, and chlorophyll *a*.

On-Site Water Quality Measurements

Depth profiles were collected monthly at the mid-lake sampling site during the summer sampling period. Data points were collected at one meter intervals throughout the water column for dissolved oxygen, pH, conductivity, and temperature with a YSI SONDE probe. The same calibration protocol used for sampling water quality at plant sampling sites (Section 4.2) was used for these sampling events.

4.7 Public Use Survey

The public use survey was created by TLI and delivered to the Clear Lake Association on May 15, 2005 during a scheduled Association meeting. The surveys were distributed to those in attendance during the meeting. The Association members also identified several other members that were not in attendance and hand delivered surveys to their lake homes. The Association estimates there are 35 properties within the boundaries of the Association and each house received a survey.

4.8 Sediment Core Analysis

Paul Garrison of the WDNR was contracted for sediment core analysis. A core was taken on 5 October 2004 in the deepest area of the lake (Figure 10). The core was taken with a piston corer with an acrylic tube having an inside diameter of 8.8 cm. The core was 100 cm long. Four sections from the core were kept for analysis. These sections were: 0-2, 35-37, 48-50, and 58-60 cm.

The cleaning methods used by Paul Garrison were: 1) hydrogen peroxide/potassium dichromate, 2) boiling with 10% potassium hydroxide, and 3) nitric acid. It was anticipated that the top sample would represent recent deposition while the deepest sample would have been deposited over 150 years ago.

Figure 10. Sediment core sample from Clear Lake (Rock County, Wisconsin) October 4, 2004.

5.0 Results

5.1 Overview of Macrophyte Surveys

Four aquatic plant taxa were found in the spring and five in the summer. Filamentous algae and northern milfoil were only present during the summer survey. There were no rare, threatened, endangered or species of special concern found during these surveys. In each survey, one sample location did not contain aquatic vegetation. The locations did not overlap and therefore the entire lake contained submersed aquatic vegetation at some point throughout the year.

Table 5. Plant taxa by common name, identified during 2004 qualitative aquatic plant surveys on Clear Lake (Rock County, WI).

Species number	Scientific Name	Common Name	Relative Frequency of Occurrence	
			Spring	Summer
1	*Ceratophyllum demersum*	Coontail	38.1%	64.8%
2	*Potamogeton crispus*	Curly-leaf pondweed	41.0%	1.4%
3	*Elodea canadensis*	Common waterweed	1.9%	4.2%
4	*Myriophyllum spicatum*	Eurasian watermilfoil	19.0%	26.8%
5	*Myriophyllum sibiricum*	Northern milfoil	0.0%	1.4%
6	Not keyed	Filamentous algae	0.0%	1.4%

The two invasive species found were CLP and EWM. Curly-leaf pondweed has a yearly cycle that differs from native plants. It begins its annual cycle in the fall when other plants have senesced for the year. The plant over-winters while actively photosynthesizing even though its biological activity, or metabolism, is slowed by cold water temperatures. In early spring, just after ice out, its metabolism increases and the plant begins actively growing, i.e. adding biomass. By late spring, the plant is fully grown and begins to produce hard pinecone like structures called turions. The turions become detached from the tip of the plant, float around the lake, and eventually settle to the sediment where they wait until fall to germinate.

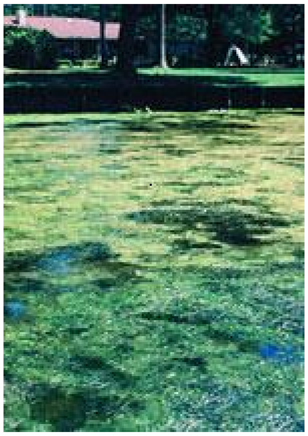
The CLP life cycle has clear advantages over natives and is the reason for the nuisance it creates throughout the spring and summer. The advantages are that CLP has an "out-of-season" growth cycle that allows it to have plenty of space and nutrients when it germinates. Another advantage is that it over winters as an evergreen which gives it a head start during the growing season since it has already developed stems and leaves.

The ecological implications for the growth cycle of CLP include shading native plants in the spring and thereby reducing native plant growth and releasing large amounts of phosphorus when the water temperature and environmental conditions favor algal growth over plant growth.

Eurasian watermilfoil has a life cycle far different from CLP but also has competitive advantages over native plants. When water warms in late spring, EWM begins to grow rapidly and by early summer, EWM has reached the water surface and begins to sprawl out and forms surface mats. The mat-forming growth shades out native plants growing near the sediment. Growing along the water surface improves the plants primary means of reproduction – fragmentation. Eurasian watermilfoil can easily be fragmented by boat propellers as recreationists pass through beds with even cautious boaters causing fragmentation. The plant has the ability to fragment on its own by creating fragile nodes along the stem. Auto-fragmentation occurs as normal wave action breaks the plant apart at the delicate nodes and EWM is capable of reproducing from plant fragments only a couple inches long.

Coontail is by far the most dominant native plant throughout the season. Coontail also over-winters as a photosynthesizing evergreen. Coontail is not a true rooted plant, but rather is capable of forming specialized leaves that act as small roots. Because coontail does not have true roots, it can easily become dislodged, float around the lake and reattach to the sediment. Coontail is also resistant to low-light conditions, will grow in highly degraded aquatic systems, and has been known to cause nuisance conditions for recreationists.

Algae – Filamentous algae was documented only during the summer survey. Planktonic algae were not documented during either survey but are historically present.



Common name: Filamentous Algae
Scientific name: N/A
Description: This group is does not belong to the true plants. Filamentous algae usually begin growing on or near the sediment. They attach to plants and substrate while they reproduce. Eventually the individual filaments become entangled and form a mat. The mat traps gasses produced during photosynthesis and respiration and causes the mat to float to the surface. Filamentous algae can be present anywhere in the littoral zone or found floating anywhere in the lake.

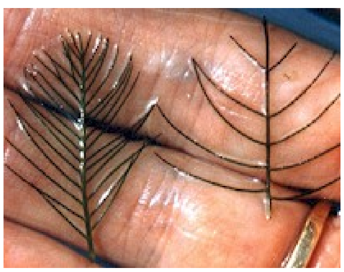
Submersed vegetation – Submersed macrophytes made up 100 percent of the plant coverage sampled during the spring and summer surveys. Coontail, CLP and EWM were the dominant species present.

Common name: Curly-leaf pondweed, CLP
Scientific name: *Potamogeton crispus*
Comments: CLP is a non-native aquatic plant. CLP is a cold-water annual which grows from fall to spring each year. CLP can be found in water from approximately one foot deep to the maximum rooting depth of the lake.

Common name: Common waterweed
Scientific name: *Elodea Canadensis*
Comments: This perennial plant is native to the state and is common in many lakes. It over winters as an evergreen and reproduces primarily by fragmentation (seeds are rarely produced). Flowering occurs in mid summer and the plants contain either male or female flowers. This plant will also grow from approximately one foot deep to the maximum rooting depth.

Common name: Coontail
Scientific name: *Ceratophyllum demersum*
Comments: This perennial plant also over winters as an evergreen. It rarely produces seeds and reproduces by fragmentation. Because this plant does not have true roots, it can be found anywhere in the littoral zone and sometimes mats will drift across open water and anchor elsewhere in the littoral zone.

Common name: Eurasian watermilfoil, EWM
Scientific name: *Myriophyllum spicatum*
Comments: This is the most infamous non-native aquatic plant in Wisconsin. The annual plant reproduces by fragmentation and can be present anywhere in the littoral zone. Small fragments allow the plant to occupy the shallowest water.



Pictured left is two milfoil leafs – the left most belonging to the invasive species EWM and the right belonging to the native northern watermilfoil. The main distinguishing feature is the number of leaflets. EWM typically has 14 to 20 pairs while northern milfoil has 5 to 12 pairs.

Common name: Northern watermilfoil
Scientific name: *Myriophyllum sibiricum*
Comments: Northern watermilfoil is a perennial plant that prefers soft sediments but is intolerant of low light conditions and is becoming limited in eutrophic lakes. This is the native cousin of the invasive species EWM. Northern milfoil rarely produces nuisance conditions.

Floating-leaf vegetation – Floating-leaf plants were not sampled during either quantitative survey and were not found during the qualitative surveys.

Emergent plants – No emergent plants were sampled during either quantitative survey. Areas of the lake were noted during the qualitative survey where emergent vegetation occurred.

5.2 Quantitative Macrophyte Surveys

Of the five plant species found during the qualitative surveys, four were found in the spring and all five in the summer. The most abundant plants, by site occurrence, in the spring were CLP (43 of 50 sites) and coontail (40 of 50 sites). The two most common species in the summer survey were coontail (46 of 50 sites) and EWM (19 of 50 sites). The average density per sample site was 4.46 (on a 0-5 scale; approximately 89% coverage) for the spring survey and 2.45 (on a 0-5 scale; approximately 49% coverage) for the summer survey. The maximum rooting depth located during either survey was 16’2” and was located at point number 20 during the summer survey. Only coontail was found at this depth.

The Floristic Quality Index (Swink and Wilhelm 1994, FQI), calculated: $FQI = ((\sum C_i) \div N) \sqrt{N})$, was performed for the species found in Clear Lake in 2004. The FQI is a biological index developed for assessing plant communities of Wisconsin. The FQI is based on qualitative data (presence/absence) but provides a good idea of how impacted a community is. Each plant is assigned a value of conservatism (C) based on the species sensitivity to disturbances (low light, boat traffic, sedimentation, etc.). Plant species that are tolerant of disturbances are assigned a low “C” value while those less tolerant are assigned a high “C” value. The other factor in calculating the FQI is the total number of native species found (N). A total of three unique native species (N) had an average coefficient of conservatism of 4.33. The FQI for Clear Lake in 2004 was 7.50 which is considered bad. For more interpretation, refer to page 46 of this report.

The Simpson's diversity index (D_S) is another biological index but this one uses quantitative data rather than qualitative. This index can also be applied to many biological assessments, not just plants. This index estimates the probability that any two randomly selected individuals represent to two different species.

The D_S values for Clear Lake during the spring and summer surveys were 0.343 and 0.487 respectively. This number is inversely related to diversity and therefore many ecologists convert this index to the Simpson's reciprocal index by:

$$1 / D_S$$

or to the Simpson's index of diversity by:

$$1 - D_S$$

Each of these two indices, Simpson's diversity index and Simpson's reciprocal index, results in numbers directly proportionate to the diversity of the plant community. The Simpson's reciprocal index values for spring and summer are 2.91 2.06, respectively, and the Simpson's index of diversity values are 0.657 and 0.514, respectively. We will be using the Simpson's index of diversity values later to evaluate the plant community health in the discussion section.

The Shannon index was also applied to the data set. This index measures the uncertainty that the taxon of a randomly chosen individual can be predicted with diverse communities having a high value for the Shannon index (Shannon and Weaver 1949). The Shannon index for Clear Lake was low in the fall of 2004 being 0.804 with a H_{max} of 1.585. The H/H_{max} ratio is 0.507 which suggests a few plants are dominating the aquatic macrophyte community.

The Aquatic Macrophyte Community Index *(AMCI)* is based on seven characteristics of aquatic plant communities called metrics. The scoring system for metrics is based on characteristics of reference or undisturbed plant communities. A lake can score from 7 to 70 where 70 reflects an ideal plant community (Weber, Nichols, and Shaw 1995). The metrics used in the AMCI are: the maximum rooting depth, percent littoral zone vegetated, Simpson's index, total taxa, relative frequency of submersed taxa, relative frequency of exotic species, and the relative frequency of sensitive species. A score for each metric is assigned and the individual scores are summed for the overall score. The AMCI for Clear Lake in July 2004 was 30. Unlike the Simpson's index of diversity or the Shannon index, this value only has meaning when compared to other lakes.

5.3 Invasive Species Assessment

Curly-leaf pondweed

The spring survey found CLP at 43 sites (86% of sites sampled). The average CLP coverage per occurrence was 1.6 (on a 0-5 scale; roughly 32% coverage) with 11 sites having nuisance conditions (generally considered any site with CLP coverage at or above 60%). The location of CLP beds were recorded as part of the qualitative survey in both the spring and summer (Figure 11).

The summer survey found CLP at 2% of sites sampled (one site) in the summer had CLP as opposed to 86% during the spring survey. The average coverage of CLP per occurrence in the summer was 0.25 (on a 0-5 scale; approximately 5% coverage) with no sites having nuisance conditions. This is expected because of CLP's early season growth cycle. The summer survey in 2004 took place after CLP had senesced for the year.

Eurasian watermilfoil

The spring survey found EWM at 40% of sites sampled (20 sites). The average EWM coverage per occurrence was 2.3 (on a 0-5scale; roughly 46% coverage) with 9 sites having nuisance conditions. The location of EWM beds was recorded as part of the qualitative surveys in both the spring and summer (Figure 12).

The summer survey found EWM at roughly 48% of sites sampled (19 sites) as opposed to 40% during the spring survey. The average coverage of EWM per occurrence was 1.2 (on a 0-5 scale; approximately 24% coverage) with two sites having nuisance conditions.

5.4 Substrate at Plant Survey Sites

Only two different types of substrate were characterized during the 2004 surveys with the majority of sites (45) consisting of mud and the remaining sites (five) consisting of sand (Figure 13).

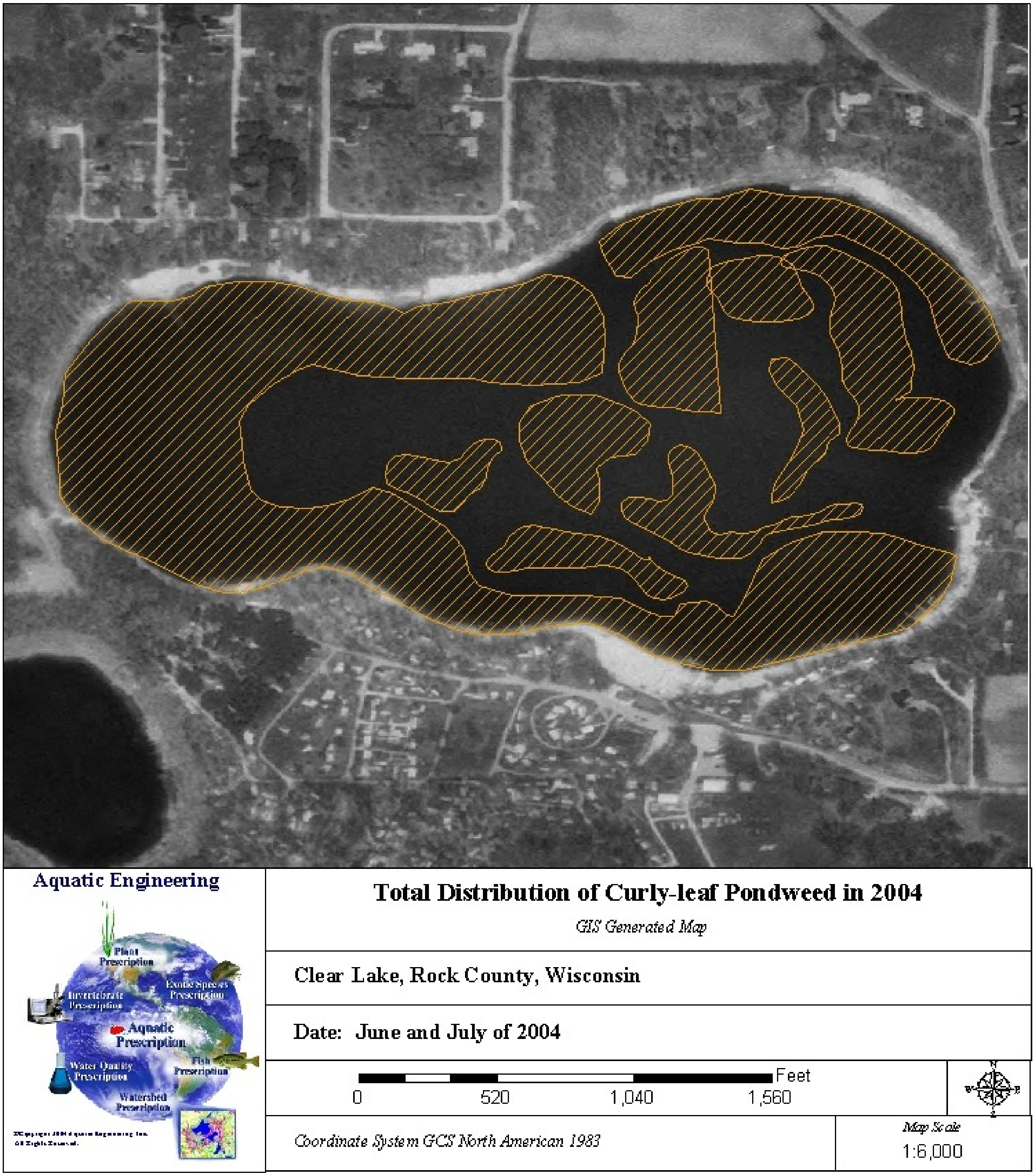


Figure 11. Location of Curly-leaf pondweed as documented during the June and July 2004 qualitative and quantitative macrophyte surveys of Clear Lake (Rock County, WI).

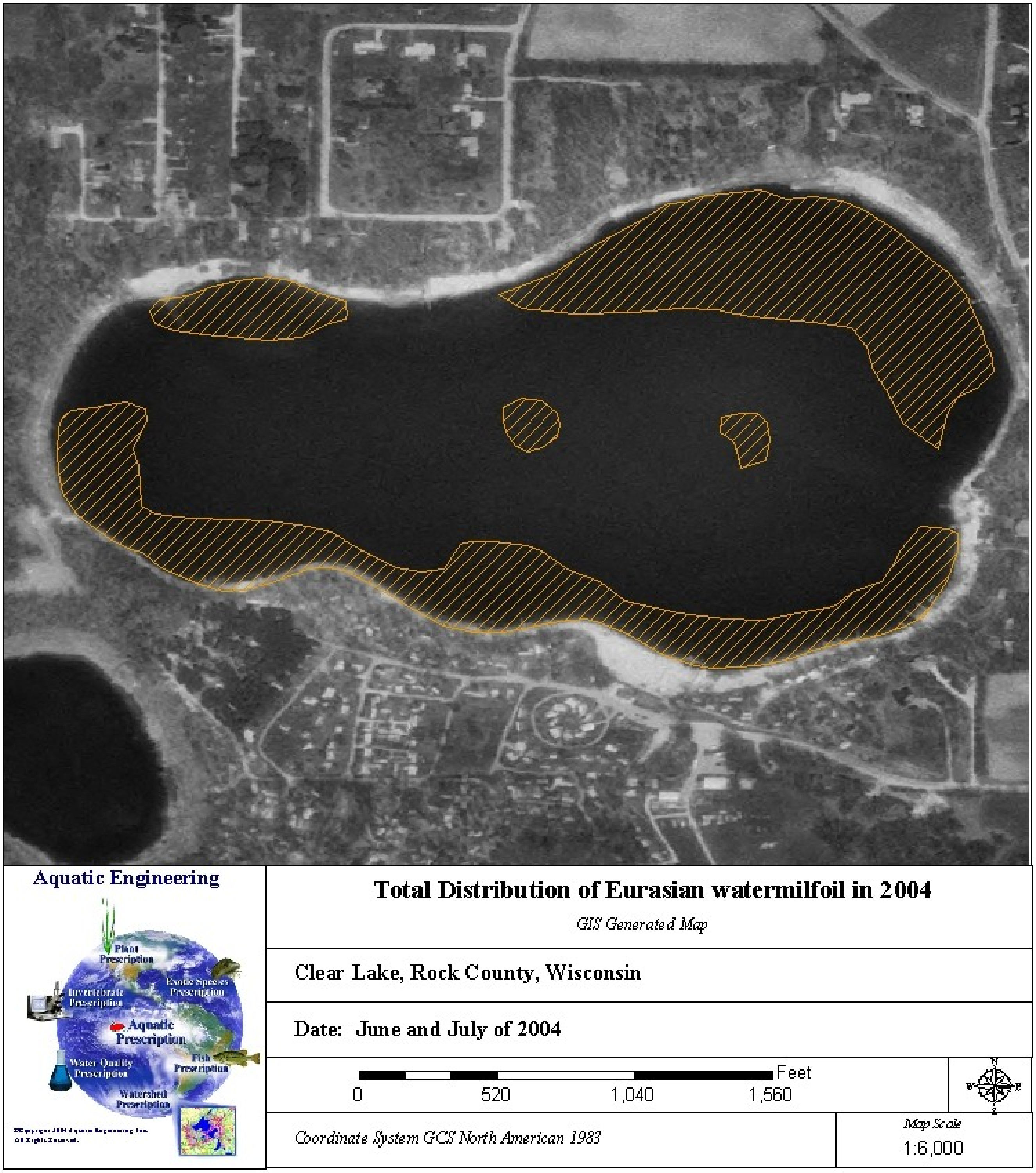


Figure 12. Location of Eurasian watermilfoil as documented during the June and July 2004 qualitative and quantitative macrophyte surveys of Clear Lake (Rock County, WI).

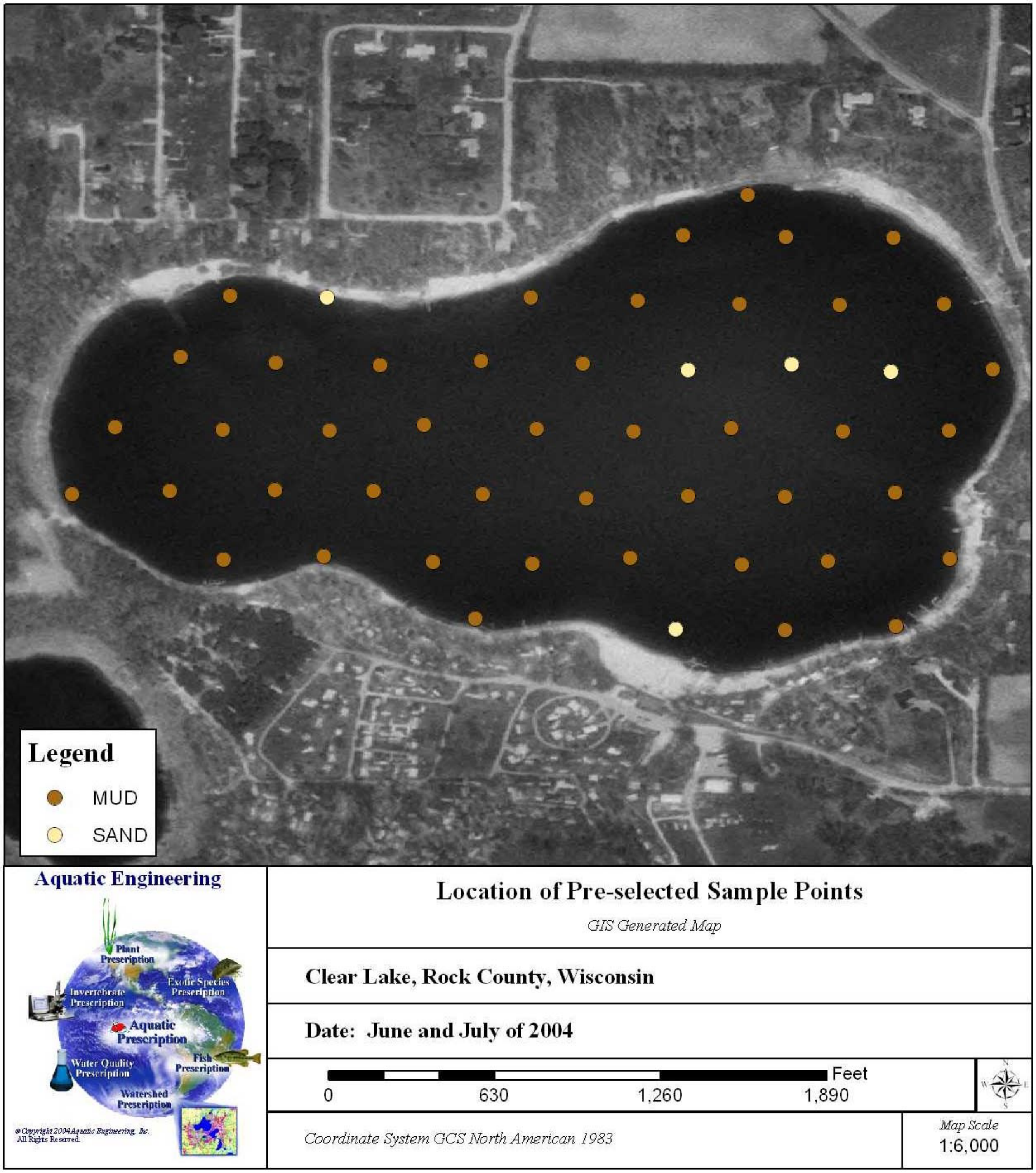


Figure 13. Sediment characteristics of Clear Lake (Rock County, WI).

5.5 Bathymetric Survey

The bathymetric survey conducted in the early spring of 2005 shows a “bowl-shaped” contour in Clear Lake (Figure 14). The deepest point in the lake is 16’6” and is located at the East end of the lake. Clear Lake is an 82-acre lake has a mean depth of approximately 8 feet and holds approximately 700 acre-feet of water.

5.6 Riparian Land use Assessment at Plant Survey Sites

From the riparian land use assessment, the majority of the immediate shoreline of Clear Lake is in a "disturbed" condition which reflects the residential development around the lake. There is also a fair amount of natural shoreline around the lake. Though most of the lake is developed, many residents have chosen to maintain at least some of the natural upland vegetation.

Table 6. Riparian land use coverage for Clear Lake (Rock County, WI) 2004.

Condition	Number of Sites[3]	Percent Shoreline[4]
Natural	**5**	**38**
Wooded	2	
Native herbaceous	3	
Disturbed	**7**	**62**
Lawn	6	
Altered shore	1	

[3] A total of 8 sites were evaluated and each site could be any combination of natural and/or disturbed conditions.
[4] The percent shoreline was calculated by adding the total percent coverage of natural and disturbed conditions separately and dividing by the sum of their percents coverage.

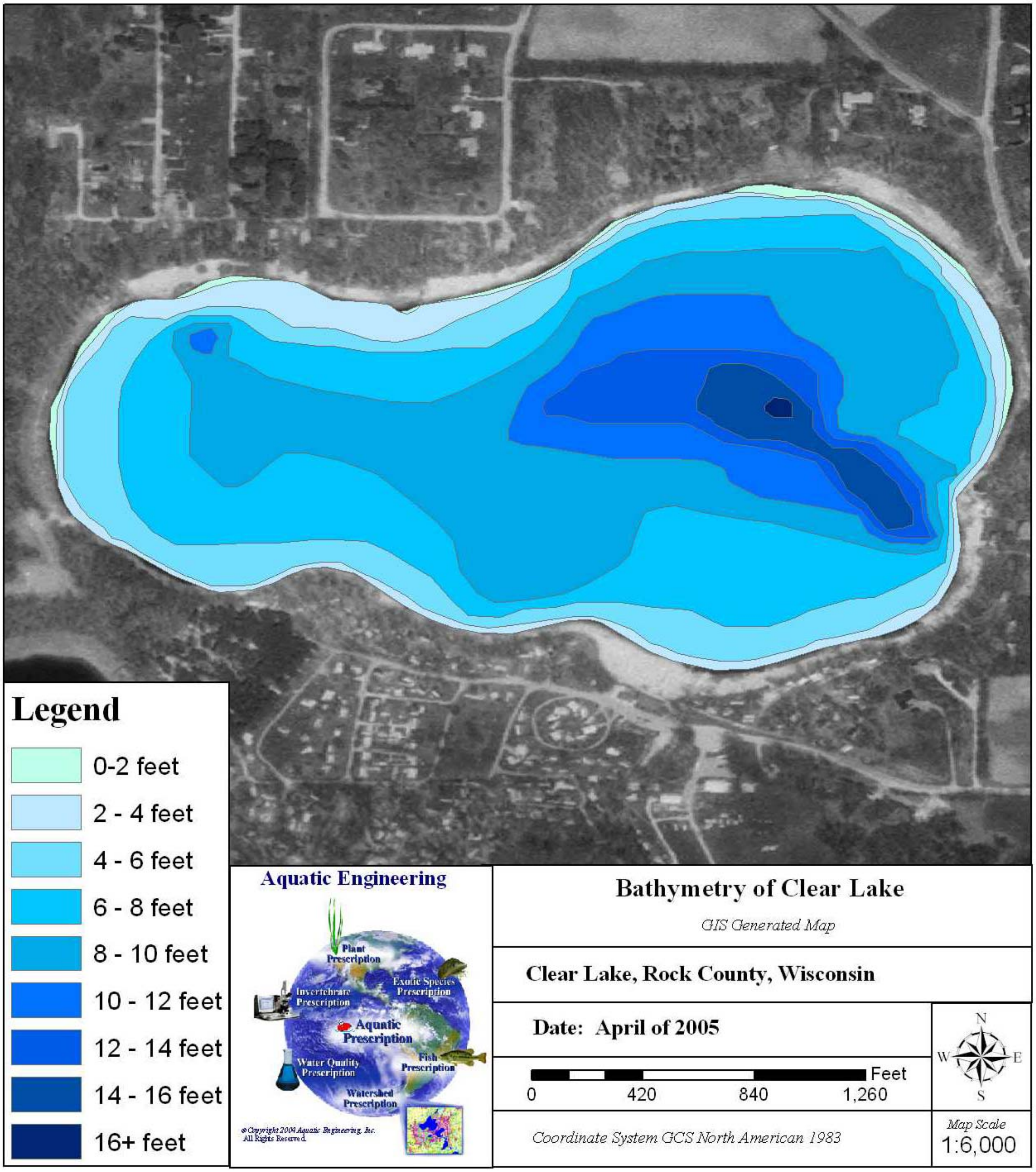


Figure 14. Bathymetry of Clear Lake (Rock County, WI) in April 2005.

5.7 Water Quality at Plant Survey Sites

The water quality sampled at the plant survey sites in 2004 did not reveal any affects of dense vegetation on localized water quality. The dissolved oxygen readings show that there is a lot of primary productivity occurring within the lake. Since almost the entire lake is a littoral zone and is covered with dense macrophytes and planktonic algal blooms are common, high levels of oxygen during the day are not surprising. In addition, the average surface temperature of Clear Lake did not vary from spring to summer. This suggests that the spring aquatic plant survey took place after the water had already warmed for the year. This means any physical or chemical properties affected by temperature, such as dissolved oxygen, would also be the same for both surveys.

Table 7. Water quality averages for aquatic plant sample sites. Clear Lake (Rock County, WI) 2004.

Parameter	Spring	Summer
Temperature (Celsius)	26.67	26.94
Temperature (Fahrenheit)	80.0	80.5
DO (mg/L)	10.71	8.79
DO (percent saturation)	141	110
pH	9.51	9.31

5.8 Clear Lake Water Quality

Total phosphorus was reported for each sampling event. The average TP for Clear Lake in 2004 was 27.5 µg/L ranging from 23 µg/L to 32 µg/L. The TSI_{TP} value for Clear Lake in 2004 was 51.9. The July 29th hypolimnetic phosphorus concentration was 118 µg/L (more than four times the surface integrated concentration) which suggests internal loading and/or ground water interaction.

Chlorophyll *a* was also reported for the June through October sampling events. The average chlorophyll a for Clear Lake in 2004 was 10.7 µg/L ranging from 5.89 µg/L to 13.0 µg/L. The TSI_{chl} value for Clear Lake in 2004 was 53.9.

Secchi disk readings were collected six times in 2004. The average Secchi reading in 2004 was 6.0 feet and ranged from 3.75 to 9.0 feet. The TSI_{SD} for Clear Lake in 2004 was 51.3.

Nitrogen, like phosphorus, is an essential macronutrient needed for algal production. Most lakes, however, are phosphorus driven, and attempts to reduce lake nitrogen levels may have little effect on algal biomass (Holdren 2001). The average TKN for Lake Clear in 2004 was 857 µg/L. The N:P ratio was approximately 31 to 1 (by mass) and supports the fact that Clear Lake is phosphorus limited (generally any ratio over 7:1 N:P by weight, is phosphorus limited).

In 2004, Clear Lake did not form a thermocline. During the July 29th sampling event, the lake showed signs of forming a thermocline but the August 31st profile showed a well mixed lake. As the summer progressed, it was clear that no thermal stratification was occurring within the lake since the surface and bottom temperatures were not significantly different.

The average conductivity at 2 meters depth for Clear Lake in 2004 was 248 µS/cm, which is typical of freshwater lakes. Conductivity is increased by additions of urban runoff, minerals leeching from soils and products of microbial decomposition. In addition, conductivity is generally higher at the water-sediment interface due to the presence of these factors.

5.9 Public Input

Public input came in two forms during the planning and implementation of this study and during the creation of the APM Plan and are discussed in the following sub-sections.

5.9.1 Recreational Use Survey

Fifteen of the thirty-five surveys were returned to the Association (43 percent participation). The results of the survey are provided in Appendix X of this report. The majority of respondents fit the following description:

As a Clear Lake resident I am a residential home owner (100%) that pays Association dues (87%) but am not opposed to forming a Lake District (69%). I live at my lake residence year-round (80%) and originally acquired the property because of its proximity to my friends and family and because of the type and tranquility of Clear Lake. I maintain a mowed lawn to the waters edge (72%) but believe fertilizers are required less than once a year (79%). I own one non-powered watercraft (52% respondents own a row or paddle boat and 45% own a canoe or kayak) and one powered craft (45% respondents own a pontoon boat and 38% own a "speed boat"). When I fish, I usually fish for pan fish and almost always practice voluntary catch-and-release. I usually find my average fishing experience on this lake is fair (33%) to poor (56%).

Since moving to the lake, I have noticed nuisance weed growth (80%) and algae blooms (60%) have worsened. Currently, I feel that there are too many plants within the lake as a whole (69%) and definitely too many plants in certain areas of the lake (93%). I believe that plants have the number-one negative impact on recreational activity (60%) and that the current plant management plan is not working (80%). I also feel that I have a voice in the lake management effort (93%).

I believe that maintaining clear water should be the number-one priority of management activities (90%). I also believe that farm field erosion/runoff, motor boat traffic, leaking septic systems and inappropriate lake management efforts contribute to the problems facing recreational use and enjoyment of the lake.

5.9.2 Association Meetings

The Clear Lake Association holds two formal scheduled meetings per year. Additional meetings are sometimes called to address specific issues as they arise. During Association meetings, members have an opportunity to learn about relevant lake topics, ask questions, and voice their opinions regarding lake management issues.

5.10 Sediment Core Analysis[5]

All of the diatom extraction methods implemented produced the poor diatom recovery. An unprocessed sediment sample was also analyzed with similar results. Because the processed and unprocessed samples yielded poor diatom recovery, one can conclude Clear Lake is likely one of the rare cases where diatoms are not well preserved.

Because the diatom samples provided little insight, the core sample was analyzed based on sediment color. Historical conditions were predicted based on what is known about the natural surrounding region and how past human impacts were translated into sedimentation patterns.

[5] The technical components of this section were written by Paul Garrison and adapted by AEI.

6.0 Discussion

6.1 Qualitative Aquatic Plant Surveys

During the qualitative plant surveys in 2004 ecologists found no emergent and floating leaf aquatic plants in Clear Lake. The littoral zone of the lake contained dense populations of CLP and coontail in the spring and had a high density of coontail in the summer. A total of three native species were found which were comprised entirely of submersed species. There were no rare species and 2 non-native invasive species found (EWM and CLP). It is clear from these surveys that the aquatic macrophyte community of Clear Lake is in a highly disturbed condition.

Disturbances such as urban development, watershed manipulations, sedimentation, and invasive plant species all contribute to disturbances affecting Clear Lake. In addition, historical lake management practices, motor boating, and carp have also contributed to disturbances. A common problem for seepage lakes is that once nutrient levels become elevated, there is no “flushing” of the water and nutrients accumulate year after year increasing the eutrophication of the lake. Once eutrophic or hyper-eutrophic conditions have been established they are difficult, if not impossible to reverse.

Eutrophic lakes will typically have low plant diversity and experience frequent filamentous and planktonic algae blooms. The temperature will generally increase over time and sport fish populations will be replaced by panfish and rough fish species. In the absence of predators, these populations will expand rapidly until overpopulation results in stunted fish.

6.2 Quantitative Aquatic Plant Surveys

Clear Lake’s aquatic plant community was analyzed for a number of diversity and quality indices that allow it to be compared objectively to other lakes statewide and in the Southern Till Plains region. The Shannon Diversity Index, maximum Shannon Diversity, Simpson's Index of Diversity, Floristic Quality Index, and Aquatic Macrophyte Community Index were calculated for Clear Lake.

The Shannon Diversity Index value for Clear Lake is 0.804 out of a possible 1.585. This indicates that the aquatic plant community in Clear Lake is far from an ideal community. The Simpson's Index values of 2.91 and 2.06 for spring and summer surveys are low compared to other Wisconsin lakes (Weber, Nichols and Shaw, 1995) and reflects the dominance of a few plant species.

The Floristic Quality Index value was 4.5 which is well below the mean value for both the Southeastern Wisconsin Till Plains Lakes (20.9) and the state (22.2). It is also below the lower quartile value for both the region (17.0) and the state (16.9); the most degraded lakes would fall into the lower quartile range in both categories. This is an indication that Clear Lake is one of the least diverse and most impacted lakes in the state. The total number of native species found in Clear Lake (3) is well below the lower quartile for both the region (10) and state (7). The average Aquatic Macrophyte Community Index value for Clear Lake is 29 which is also low compared to the Wisconsin state-wide average (40 ± 8) for lakes (Weber, Nichols, and Shaw, 1995).

In general, the data indicate that the aquatic plant community in Clear Lake is in a highly disrupted state. As previously explained, once disturbed conditions are set a high amount of management will be necessary to restore historical conditions if it is even possible. The three possible management strategies for Clear Lake are to protect against further degradation, attempt to restore to a better state, or simply do nothing. These options will be explained in greater detail in sections 7 and 8 of this report.

Table 8. Interpretation of biological indices for the aquatic plant community of Clear Lake (Rock County, WI).

Index	**Result**	**Interpretation**
FQI	4.5	Extremely Low
AMCI	29	Low
Simpson's Index	2.06-2.91	Low
Shannon Diversity Index	0.804	Low
Shannon Evenness	0.53	Low

6.3 Water Quality at Plant Survey Sites

The water quality sampling performed at the aquatic plant sampling sites did not reveal any abnormalities or localized affects due to dense vegetation. The water chemistry from point to point was relatively constant and monotypic beds of CLP did not seem to affect any of the parameters measured. However, since the spring survey took place after the lake had already warmed for the summer and the summer survey took place after the CLP die-off, one can not draw any conclusions on the localized affect CLP may be having on water quality. Future studies of CLP's effects on water quality in Clear Lake should occur at the peak of CLP growth in the spring (before June in the case of Clear Lake) and during the seasonal die-off of CLP in the early summer (between June 5 and July 27).

6.4 Substrate at Plant Survey Sites

The most commonly occurring sediment in the littoral zone of Clear Lake is mud. Some aquatic plants prefer one sediment type over others and are able to out compete plants less suited to that particular substrate. In sandy areas, you will typically find various pondweeds, naiad, and wild celery which were not found in Clear Lake in 2004. Areas that contain soft substrates tend to be dominated by CLP, EWM and coontail. Not much can be done to change the substrate of a natural seepage lake other than dredging. Dredging is quite costly and very disruptive to the aquatic plant community. However, in certain situations, dredging is the only option and can provide many years of relief.

Geographically and ecologically speaking, lakes are designed to fill in. With this in mind, the Clear Lake Association should take every reasonable step to decrease the sedimentation rate within the lake. This can be accomplished through watershed management. Run-off retention ponds and vegetated buffer strips help reduce the amount of sediments entering the lake by slowing water down and holding sediments in place.

6.5 Riparian Land Use Assessment at Plant Survey Sites

Cultivated lawn was the most common type of shoreline coverage (56%). This type of coverage would generally cause nutrient and sediment problems for lakes. Typical symptoms would include excessive plant growth and algal blooms. Algal blooms can occur in two varieties: filamentous algal blooms and planktonic algal blooms. While both types can create problems for lake patrons, filamentous algae can form dense floating mats that decay and cause noxious odors. This type of algae tends to cause nuisance conditions more easily than planktonic algae. Planktonic algae cause the "pea soup" affect in lakes and can also create noxious odor and taste problems.

Three of the 6 sites that had cultivated lawns also contained at least some native wooded or herbaceous vegetation. Some of these sites also contained a buffer strip of native vegetation between cultivated lawn and the water edge. This type of riparian management is ideal for those property owners that wish to have a cultivated lawn but want to prevent excessive nutrients and sediments from entering the lake. Though the width necessary for an effective buffer strip is debated, it is agreed that any buffer is better than no buffer at all. The WDNR suggests that the state mandated 35 foot buffer may be insufficient to fully protect against erosion and nutrient loading even when most vegetation is intact (WDNR 1999).

6.6 Recreational Use Survey

The recreational use survey reveals that even though the large majority of people feel that excessive plant growth most negatively impacts recreational enjoyment, an even larger majority feel that achieving good water clarity should be the number-one concern of the Association. This conflict between what they feel is the problem and what the primary objective of management actions will require some discussion prior to implementing management practices. Some management activities, such as alum treatments, could satisfy the water clarity concerns. Alum binds to phosphorus making the phosphorus unavailable for algae. A result of the improved water clarity could be more nuisance plant growth, as experienced by Lake Delavan. However, the Association's plan to aggressively harvest aquatic plants could offset that consequence.

A similar conflict in land usage exists. The majority of respondents have a cultivated lawn, but feel that farm erosion and runoff are major contributors to the problems seen on Clear Lake. This conflict arises from wanting to maintain a manicured lawn while knowing that certain land uses contribute to increased nutrient and sediment loading. In addition, residential areas tend to drain faster and therefore carry waste faster. The waste is typically sand, oils, salts, etc. Nutrients are also carried as fertilizers, leaves, grass, etc. break down. Nutrients from non-agricultural waste also contributes (i.e. domestic and wild animal and human wastes). These residents can begin to improve water quality by maintaining buffer strips of native vegetation between their cultivated lawns and the lake shore. This type of watershed management should be a component of the public education campaign.

One of the benefits of a small lake group is that decisions can be made more easily because communicating with all the members is simply easier. With a small group, however, personal feelings can more easily direct the group. To prevent having one person or group of people within the Association direct actions based on personal feelings, the Association should repeatedly refer to their Purpose Statement and Goal Statement as listed in this report. This will ensure the actions selected by the Association are directed by timeless values and a long-term vision for Clear Lake. These statements will also help maintain clear focus as new members are transitioned into the Association.

6.7 Clear Lake Water Quality

Clear Lake residents are genuinely concerned about the water quality (as it relates to clarity) within Clear Lake and feel that the clarity of water has degraded over time. Clear Lake has water quality parameters similar to other lakes in Wisconsin.

The watershed of Clear Lake is small and therefore minor changes in the watershed can create noticeable changes in the water quality. The key to future management of the water quality of Clear Lake lies in responsible management of its watershed. Refer to the "2004 Clear Lake Water Quality Report" for a detailed discussion of Clear Lake's water quality.

6.8 Fishery Review

Don Bush, a fisheries biologist with the WDNR, was contacted and asked to write a brief summary of the condition of the fishery of Clear Lake. The following section is a synopsis of what Mr. Bush had to say:

"Generally speaking, Clear Lake is typical of many small ponds in southern Wisconsin. An abundance of water-milfoil has been fueled by excessive nutrients. The abundance of vegetation inhibits predation on the small panfish. An overabundance of green sunfish may in fact be limiting the growth and survival of largemouth bass. With an inferior panfish population, angler may target the larger predators. A heavy harvest of bass can then lead to inadequate predation on panfish."

Mr. Bush also provided the following recommendations for managing the fishery:

1) Trapping and removal of sunfish, to be relocated to Lake Koshkonong. This would ease the over crowding and therefore competition between the fish that results in a stunted population.

2) Stocking of adult and juvenile channel and possibly flathead catfish. Catfish are tremendously effective predators and should contribute to the reduction of smaller sunfish. Catch and release of these catfish should be encouraged.

3) An extended size limit for largemouth bass should be implemented. The current size limit is 14 inches. A new size limit of 18 inches should also help maintain an adequate population of sunfish-eating largemouth bass.

AEI believes the Clear Lake Association should be proactive in managing the fishery of Clear Lake. Successful stocking of predator fish, evaluation of the benefits of rough fish removal, and maintain numbers, size, and health of panfish will all be a result of public awareness and participation. This also means keeping the needs of the fish community in mind when making decisions on aquatic vegetation.

6.9 Sediment Core Analysis[6]

The reason for taking the core was to compare the current water quality with presettlement conditions. This is largely done by examining the diatom community. Unfortunately the diatoms were not well preserved in the sediments. All four samples were examined and only a few large, heavily silicified valves were found. This occasionally happens most likely because of elevated pH levels due to the naturally hard water nature of the lake. This result is not common but is also not unheard of. Similar results have been found at least once before but usually not until further down in the core (representing a time period of at least 200 years ago).

A visual examination of the core did reveal that changes have occurred in the lake. The top 30 cm were dark gray in color while the next 20 cm had a medium gray color. The upper section probably represents the time period when Europeans were present around the lake. Cores from other lakes have shown that with the increase in runoff from the watershed following the arrival of Europeans, plant (weed) growth in the lake significantly increased. This increase in organic matter deposition from the plants probably is the cause of the darker sediment color. The section 50-90 cm contained abundant plant fragments. This probably means that water levels were lower so that emergent plants were more common than they are today. These emergent plants had more cellulose and thus were better preserved in the sediments. The section from 90-100 cm had a similar color as the 30-50 cm section. This probably indicates that water levels were higher and fewer plants were present in the lake.

[6] The technical components of this section were written by Paul Garrison.

7.0 Review of Management Options

7.1 Managing Aquatic Macrophytes

The following sub-sections provide an overview of management strategies that are commonly used to manage eutrophic effects on lakes. The purpose of this section is to provide a general introduction to popular management strategies for future reference and consideration. Methods described are derived from Managing Lakes and Reservoirs prepared by the North American Lake Management Society. Practices that are relevant to Clear Lake are described in more detail in the following sections.

Mechanical weed harvesting can be used to remove the upper portion of rooted vegetation. Weed harvesters are low-draft barges that cut and remove vegetation growing at or near the water surface. A harvester can operate at approximately 0.2 to 0.6 acres per hour depending on the equipment. Once cut, the plants are moved via conveyer to a holding area on the barge itself until they can be unloaded, via a second conveyer, at the shore. Plants are usually transported away from the lake to a compost site or a landfill. The physical removal of plant material means that the nutrients trapped in the plants are also removed from the lake ecosystem.

Harvesting is most effective to remove plants in 3 to 6 feet of water growing in dense beds. Harvesting can be used to open navigational channels, remove weedy obstructions from highly used recreational areas, or to produce relief for fish in weed-choked areas of a lake. Mechanical weed harvesting requires permits and approval from the WDNR. Contact your local APM coordinator regarding requirements prior to performing any management activities.

Manual weed harvesting is a scaled-down method of mechanical harvesting. In manual weed harvesting, weeds can be uprooted completely or simply cut close to the sediment using a variety of equipment from drag lines and garden rakes to specially designed weed cutters. This method is the most species-specific mechanical method of plant removal since an individual can physically see which plants are going to be removed and which will be missed. This method, however, is also the most labor-intensive means of controlling plants and its feasibility is directly affected by the available labor force. This method is most applicable to individual property owners that wish to maintain clear areas for swimming, fishing, and for boat access to their dock. And, since many times plants are not removed from the root, repeated efforts are needed to maintain the benefits. Manual weed harvesting may require permits and approval from the WDNR. Contact your local APM coordinator regarding requirements prior to performing any management activities.

Sediment Screens range from fiberglass or plastic mesh screens to simply sand or gravel and are placed on the existing sediment and plants to block light and suppress growth. While the synthetic barriers make better screens, they are the most difficult to install and maintain. The screens must be installed early in the year and securely anchored to the sediment to prevent them from being disturbed. The screens must be removed and cleaned periodically to prevent sediment from building up on top of them.

Sand and gravel is a more natural means of suppressing aquatic vegetation and is less expensive, but it also requires maintenance on an annual basis and is less effective. The use of sediment screens requires permits and approval from the WDNR. Contact your local APM coordinator regarding requirements prior to performing any management activities.

Water level manipulation, commonly referred to as “draw down”, is a useful way to control nuisance vegetation that occurs in the shallow regions of a lake. This method is typically applied in the fall and over winter. Cold dry conditions are best for a draw down event because the frozen sediments will kill most of the seed bank and compresses soft sediments. Both of these conditions prevent plant growth in the following spring when the water level is brought back up to normal conditions. This method severely impacts recreational uses while the water level is lowered and has the potential to trap fish and other wild life in shallow areas that may not become completely dry but do freeze from top to bottom over the winter.

Drawing the water level down in the summer has an opposite affect on plant growth. Lowering the water level generally increased the wetland area and littoral zone of a lake becomes larger. This provides more habitat for plants to become established.

Water level manipulation is a low-labor option but can become expensive if power is generated at the dam. The power company may be entitled to compensation for loss of power generated during the draw down.

Raising the water level in the summer can also suppress aquatic vegetation by limiting the amount of light penetrating to the bottom thereby making the littoral zone smaller. Water level manipulation requires permits and approval from the WDNR. Contact your local APM coordinator regarding requirements prior to performing any management activities.

The feasibility of this management tool is very low for Clear Lake due to the lack of an outlet or physical water level control structure.

Dredging sediments and plants is usually only performed when an increase in depth is a required part of the management outcome. If the depth is increased sufficiently, light penetration is limited in the dredged area and plant growth is suppressed. Dredging an entire lake bed is very rarely performed. Dredging small areas for boat access and other recreational uses is a cheaper and more applicable compromise. Dredging requires permits and approval from the WDNR. Contact your local APM coordinator regarding requirements prior to performing any management activities.

Chemical control of aquatic plants and algae is often used in areas where vegetation has created nuisance conditions. Herbicides and algaecides are used to control a wide variety of plant and algae species. Some herbicides are very specific in which plants they will control. Others control a wide variety of vegetation. In some cases, the concentration a herbicide is applied at will determine which species are controlled.

Chemical applications are designed to control vegetation which is already present and rarely address the underlying nutrient problem associated with nuisance plants and algae. They are sometimes the only economically feasible method for creating short-term relief. Herbicide applications require permits and approval from the WDNR. Contact your local APM coordinator regarding requirements prior to performing any management activities.

Biomanipulation refers to altering a food web in order to obtain a desired end result. In the case of controlling algae, a "top-down" approach is taken. Promoting top-level predator fish like muskellunge, walleye, largemouth bass, and northern pike, naturally reduces the panfish population. Panfish typically graze on zooplankton (algae eaters). When zooplankton reach higher numbers, more algae is consumed and the water clarity is increased. Biomanipulation requires permits and approval from the WDNR. Contact your local APM coordinator regarding requirements prior to performing any management activities.

Biological Control Agents are typically insects or insect larvae that spend part of their life cycle living on and consuming plant material. The two most common biological control agents used to manage aquatic or semi-aquatic vegetation are milfoil weevils and loosestrife weevils. The use of the latter has been more successful in Wisconsin than the former. To be affective, agents usually need to maintain a certain population density which can be difficult to depending on environmental conditions. The use of biological control agents require permits and approval from the WDNR. Contact your local APM coordinator regarding requirements prior to performing any management activities.

Physical Control Devices such as aerators and circulators can be used in smaller lakes or bays of large lakes to disrupt the normal physical condition of the lake. In lakes that suffer from elevated nutrient levels due to internal loading, aerators and circulators can prevent a thermocline from forming and eventually prevent internal loading of phosphorus. The water current caused by some devices also limits the growth of algae and duckweeds. Physical control devices usually require a power source and regular maintenance to work properly. New developments in this area have produced solar powered units that reduce or even eliminate the need for electricity. The installation and use of physical control devices requires permits and approval from the WDNR. Contact your local APM coordinator regarding requirements prior to performing any management activities.

8.0 Aquatic Plant Management Plan Overview

A complete aquatic macrophyte management plan follows a series of events. A plan should organize labor and resources for a clearly defined mission and outline a way to measure success. The WDNR is currently in the process of creating a guide for aquatic plant management in Wisconsin. The guide outlines a seven-step process to managing aquatic plants. The steps to completing an aquatic plant management plan are:

- Setting Goals. . .Why are We Doing This?
- Inventory. . .Gather Information
- Analysis. . .Synthesis of Information
- Alternatives. . .Providing Choices
- Recommendations. . .Completing a Plan for a Formal Decision
- Implementation. . .Taking Action
- Monitor and Modify. . . How are We Doing?

The following sections outline the concept or "overview" of each step, describe what has already been completed, and discuss what still needs to be done to complete the step.

8.1 Setting Goals

Overview

In order to set goals for the Association's aquatic plant management plan, the Association must identify the problems facing lake users and what endpoint is desired through management efforts. Setting goals involve the following three steps: (1) develop a goal statement; (2) create a plan of work; (3) create a communication and education strategy.

The main aquatic problem facing Clear Lake is an over abundance of nutrients. Excessive nutrients have correlated in an over abundance of plants in general. More specifically, Eurasian watermilfoil and curly-leaf pondweed create nuisance conditions in the spring and summer. In addition to nuisance pant growth, the lake experiences impaired water clarity due to frequent planktonic algae blooms. The three possible sources of nutrients are (1) watershed runoff, (2) internal loading, and (3) ground water interactions. Water quality may be further impaired in the summer due to nutrients released during CLP decay, in the fall by Canadian Geese, and possible septic seepage. A study could be done to determine the possible nutrient additions for Canadian Geese and carp to Clear Lake.

Completed

Goal Statement[7]: The Association has noticed a significant change in the water quality and plant life in Clear Lake. Older residents recall that Clear Lake was, in fact, clear, and that it supported an abundance of native, non-nuisance plants. Over the past decade, Eurasian watermilfoil and curly-leaf pondweed were introduced into Clear Lake. They have since reached nuisance levels. Current levels have impaired swimming, boating, and fishing and reduced or nearly eliminated native plant species. The large mats of these species float on or protrude from the lake surface and have a negative impact on recreation.

Currently, Clear Lake also experiences significant and long lasting algal blooms that we believe are associated with changes in water quality. Clear Lake is no longer clear.

To this end, our goals are to:

- Discourage nuisance plant growth
- Educate the public in the prevention of further introduction of invasive species into and out of Clear Lake
- Promote the growth and spread of high value native plants
- Educate shoreline owners how plant and nutrient management along the shore will benefit water quality
- Encourage shoreline preservation and restoration
- Look for ways to improve water quality and prevent further degradation of the aquatic resources of the lake
- Identify and protect sensitive areas around the lake
- Mechanically remove or chemically manage nuisance plant species to improve recreational opportunities, water quality and the health of the lake
- Explore ways to prevent water quality degradation from the large number of Canadian Geese that use the lake

[7] Prepared by the Clear Lake Improvement Association

Additional action required

There are no additional goal setting requirements for the Clear Lake Improvement Association.

8.2 Inventory

Overview

In this step of the plan, information regarding several aspects of the lake and surrounding area need to be collected and analyzed. Examples of information that should be gathered include:

- Existing management plans and studies
- Data regarding plants, fish, wildlife, and water quality within the lake
- Maps and historical documentation that describes past conditions of the lake
- Aerial photographs of the lake
- State and local regulations and ordinances
- Technical information or research on the topics of concern to the Association
- Examples of other lake APM plans

Additional information may have to be reviewed depending on the goals of the Association. The WDNR, UW-Extension and regional resources such as county zoning, town clerk, and planning offices are great places to gather most of this information. Past consulting firms may also be able to provide some information specific to their findings.

Completed

As part of this study, TLI has gathered available inventory information regarding the aquatic plant community of Clear Lake and included it in section 3.0 (Review of Existing Data) of this report.

Additional Action Required

There is no additional action required by the Association to implement the plan outlined in section 9.0 of this report. The Association should have a complete hydrological budget and an intensive septic system inspection performed if the goal is to reduce nutrient loading.

8.3 Analysis

Overview

The analysis step is the most critical step in the management process. It is in this step that the information gathered in the previous step is thoroughly analyzed and compared to the initial issues voiced. The information provides an objective view of the perceived problems. Individuals dedicated to completing this step need to approach the analysis with open and objective minds so that decisions are based on fact and not emotion or public pressure. To arrive at an objective endpoint, these three variables are considered: (1) What is the nature of people's concerns? (2) Where do conflicts occur? and (3) Has the problem changed over time?

Considering the nature of people's concerns involves dissecting public input to decide if opinions genuinely have the health of the resource in mind. People must understand that not all plants are nuisances and that a certain amount of vegetation is necessary to sustain fish and wildlife and also helps improve water quality and general aesthetics. Based on conversations during regular Association meetings, the Clear Lake Association has a genuine concern that aquatic plants are creating nuisance conditions throughout the lake and that water quality is in an undesirable state. The Association is knowledgeable about the value of aquatic plants and is open-minded regarding management methods and is proactive in seeking help to reach their goals.

Identifying areas where conflicts regarding lake use and proposed management may occur will help create a more detailed management plan. Areas that will have restricted use based on management activities need to be identified and management activities timed according to expected lake use. For example, one would not propose to perform a large scale herbicide treatment prior to the 4th of July when use restrictions may prevent activities such as swimming or fishing over the holiday weekend. The Association has discussed areas where management will occur and appropriate timing of management activities. There are no use conflicts with the proposed management plan. Additionally, the Association has investigated the existence of water supplies and states "To our knowledge, there are no pumps, anywhere on Clear Lake, drawing water for any use."

Completed

Based on the public use survey, the aquatic plant community and water clarity have changed over time. More specifically, residents feel the abundance and distribution of macrophytes have increased in the last several years. In addition, water quality has not improved over the last decade and recent data show that the water quality of Clear Lake may be declining rapidly. The Association wished to maintain and then improve water quality conditions, reduce nuisance plant growth, and promote high value native plant growth.

Additional Action Required

An analysis report will characterize the lake's condition, its natural features, recreational uses, community values, and problems based on objective information. This report touches on many of the issues that will be addressed in the Association's report. However, the Association will create their own analysis report so that ownership of the report is inherent. The report will include a list of conclusions and findings according to the need for management intervention.

8.4 Alternatives

Overview

Mechanical harvesting, chemical control, and physical control devices are the three most applicable techniques from section 7.0 for managing the aquatic vegetation situation encountered in Clear Lake. Individuals may consider manual removal of CLP or EWM from anywhere in the lake. Manual removal, however, is labor intensive and will not result in the scale of control needed to noticeably improve conditions within Clear Lake.

A list of alternatives adopted from Managing Lakes and Reservoirs is provided at the end of this section. Benefits and drawbacks are provided so that an informed decision can be made by the Association.

Alternatives for improving water quality include:

- Improve natural buffers along shorelines and throughout the watershed
- Minimize sedimentation by reducing material transportation from the watershed
- Minimize nutrient inputs from watershed
- Actively monitor water quality parameters to track changes in conditions
- Assess the need for artificial nutrient reduction through Alum treatments or implementation of aerators or circulators

Alternatives for promoting native aquatic plant growth include:

- Minimize disturbances to the plant community, especially to native plants
- Identify areas within the lake that are of "high ecological value" and have them designated as sensitive
- Identify the physical and chemical requirements of native plants and promote the growth of those plants most likely to flourish in Clear Lake
- Reduce the advantage of invasive species by managing their conditions on an annual basis (e.g. remove EWM canopy to provide light to low-growing natives)
- Consider establishing fish exclosures around patches of native plants to prevent plant disturbance by rough fish
- Maintain and improve current water quality required for native plant growth

Completed

Based on the goals of the Association and the objective information gathered by Aquatic Engineering, Inc. in 2004, Level III is the appropriate level of management for Clear Lake. Level III management is defined by the DNR as "Moderate to severe plant concerns exist. Extensive management is proposed that may substantially impact or change the current state of the lake ecosystem. Established infestations of invasive or exotic species usually are present." All Level I, II and III management requirements must be met in order to perform Level III management. A checklist of necessary items is included in section 9.1 of this report. All items not currently satisfied need to be completed prior to seeking DNR approval.

Additional Action

The items in section 9 not already fulfilled need to be completed prior to finalizing their plan. The Association has chosen the level of management they desire and will get WDNR approval to implement their management plan.

Table 9. Aquatic plant management alternatives.

	Benefits	Drawbacks	Applicable	Recommended	Costs[8]	Effective Depths	Longevity
Mechanical Harvesting	Removes plants and nutrients	Small areas controlled	Yes	Yes	$200,000 equipment and $200-1,500 per acre	5 feet deep minimum with approximately 3 feet of relief	1-3 Weeks
	Immediate relief	Can not reach shallow areas					
	No use restrictions	Not species selective					
	No potentially harmful chemicals	Promotes growth of opportunistic plants					
Manual Harvesting	Species specific	Labor intensive	Yes	Conditionally	$100-500 per acre	All depths	1-3 Weeks
	Shallow areas affected	Very small areas controlled					
	No chemicals	Slow					
	Removes plants and nutrients	Correct plant ID required					
Sediment Screens	Little negative impact to whole lake	Harms benthic invertebrates	Yes	No	$20,000-50,000 per acre	All depths	Months to Years
	Site specific control	Difficult to install					
	No chemicals	Permit required					
	Reversible	Expensive					
Water Level Manipulation	Controls plants in shallows	Restricts recreational use during	No	No	$<100-2,000 per acre	Approximately 0 to 5 feet depending on dam or control device	1-2 Years
	2 years of control	Perfect weather conditions required					
	Sediment compaction	Disrupts wildlife					
	Inexpensive (maybe)	Expensive (maybe)					
Dredging	Improves navigation	Very expensive	Yes	No	$20,000-80,000 per acre	All depths	Depends on sedimentation rate
	Removes plants and nutrients	Releases toxic contaminants					
		Destroys habitat					
		Increases turbidity					
Chemical Control	Quick relief	Repeat treatments required	Yes	Conditionally	$200-2,000 per acre	All depths	Weeks to Years
	Species specific	Does not remove nutrients					
	2 months of relief	Can promote aggressive species					
	Cost effective	Can increase algal blooms					
Biomanipulation	Long lasting	Hard to start	Yes	No	$50-300 per acre	All depths	Years
	Self sustaining	Alters habitat					
	No chemicals	May have negative impacts on habitat					
	Improves water quality	Can be irreversible					
	Improves fishery						

[8] Cost range per acre treated without consideration of longevity of effects (Holdren et.al. 2001)

8.5 Recommendations

Overview

In this step of the plan, a preferred management tool is selected. This requires reviewing the goals and objectives set in step one, reviewing existing conditions from step two, reviewing the level of management decided in step three, and reviewing management alternatives from step four. The next step in the recommendations is to evaluate the action plan, organize resources such as volunteer time and Association budget, and identify and meet legal obligations prior to implementing the plan. Such legal obligations may be obtaining state permits for managing plants or informing the public of herbicide applications. Many of the requirements are listed in Wisconsin state statutes NR 107 and NR 109.

Completed

Primary Management Tool Selected[9]: The Association has been through multiple cycles of chemical treatments and mechanical harvesting since the late 1960's. Each of these treatment options has had their pros and cons. In the early years of the Association, it was common for land owners to treat their own swimming and dock areas with chemicals that were readily available and unregulated. When that situation changed, we moved to mechanical harvesting. We were still using a mechanical harvester in the early 1990's when the public launch was built. The lake suddenly was open to unlimited boat usage, and we were soon infested with Eurasian watermilfoil. We understand that our harvesting control efforts may have to the spread of the invasive species by allowing cut turions, or stems of plants, to be lost into the lake, and root themselves. In the year 2002, we changed back to chemical control of our booming populations of milfoil, curly leaf pondweed and coontail. We found in those years, that the plants that were killed by the chemicals, decayed into the water, and released their nutrients which then fostered an increase in filamentous algal blooms. And, although we went ahead with the treatments, some of our members had perceptual issues with that technology, expressing an underlying distrust of the safety of chemical treatments.

[9] Prepared by the Clear Lake Improvement Association

In recent years, as other local lakes have struggled with the same problems, done their own studies, and implemented their own solutions, we have heard and read about some small successes. One of these is Lake Ripley in Jefferson County Wisconsin, where a plant inventory was conducted over a period of 12 years, and an analysis performed, identifying a gradual decline in milfoil abundance over the period of the study. They also found an increase in the number of native plants present, and that the areas with higher native plant diversity were less susceptible to being displaced by milfoil. We found the Eurasian watermilfoil Density-Distribution Trend map contained in their aquatic plant management plan to be noteworthy. These results show that their mechanical weed harvesting program has been effective in keeping their Eurasian watermilfoil at bay and helping to renew their native plant population.

The UW-Extension's publication: The Facts on Eurasian watermilfoil also states that "Harvesting encourages growth of native plants while removing milfoil canopies that limit native plant growth".

In choosing our primary management tool, we would like to resume mechanical harvesting on Clear Lake, hoping for results similar to those seen on Lake Ripley, and those described in the UW-Extension publication.

Additionally, knowing that our lake has an overabundance of nutrients, we believe that removing the harvested plants from the lake will remove some nutrients. Although we understand it will not be a significant amount, it will, at least, be something, and the Association fully promotes and supports this activity.

If necessary, the Association would like to give the shoreland owners the option to resort to spot chemical treatments to make their dock and swimming areas useable.

We also would like to, on a trial basis, with the proper permit, and with closely monitored results, do spot dredging around their docks, which, in addition to removing nuisance plants, would serve to vary the substrate and bring native plants back in those areas.

Since our water quality has severely declined, we plan to look at alum treatments as a possible means of restoring water clarity and encouraging native plants.

Alum is a widely used treatment for drinking water, wastewater treatment and lakes. Alum (aluminum sulfate) binds with phosphorus, causing it to settle out of the water column and stop phosphorus from being released from the sediments. In a lake this is beneficial since phosphorus causes plant and algal growth. Alum treatments can be very effective and can last up to 10 years. It can also greatly improve clarity in a water body since it removes the suspended materials that contribute to cloudiness.

The Association also plans to continue discussion with a company that manufactures a water-moving device that shows some evidence of reducing algae and Eurasian Watermilfoil growth. We will monitor the use of these devices in other lakes. We have discussed the possibility of becoming a study site for the company and considered the possibility of trying the units, with an option to purchase them, for the cost of installation. If these devices were to prove out, they would easily be within our budgetary possibility once we become a lake district.

The Association plans to keep an eye out for all promising new technologies.

Additional Action

There are no additional items the Association needs to complete in order to implement their management plan.

8.6 Implementation

Overview

Implementation can be broken down into three steps. The first step is to adopt the plan. The plan will be made available for all vested parties to review prior to releasing a final draft. The final plan should then be adopted by the Association. The Association should present the adopted plan to local units of government for additional support. In the case of creating ordinances as part of the plan, government bodies will be essential in creating and enforcing laws.

The second step is to prioritize and schedule actions. Actions can be immediate, short-range, and long-range. The following three subsections outline an implementation plan suitable for Clear Lake.

Short-range actions

- Public Education
- Self-help water quality monitoring
- Clean-boats, Clean-water program
- Watershed BMP's
- Promote native plant growth
- Mechanical harvesting
- Aquatic herbicides

Intermediate actions

- Public Education
- Designate Sensitive Areas
- Hydrologic Budget
- Watershed BMP's
- Promote native plant growth
- Investigate Management Alternatives
- Sanitary Sewer Survey (including inspections)

Long-range actions

- Public Education
- Promote native plant growth
- Watershed BMP's

The final step of implementation is to assign roles and responsibilities for the various agencies involved in the management activities. The responsibilities need to be clearly defined and recognized by the individuals and organizations responsible ("Person(s) Responsible", PR) for carrying them out. Formal resolutions and contracts are usually adequate in covering these responsibilities.

Completed

Plan for APM Plan Appraisal and Adoption[10]: The Committee will make the plan available to the entire Association for review. Feedback will be incorporated into the plan. Two copies of the plan adopted by the Association will be provided to the public at the local library. (PR: Gail Nordlof) A notice will be put in the Milton Courier on multiple pages, to increase the likelihood that it will be seen, that the plan is available for review, where it is, how long it will be there, and where and when the public forum will be to discuss the plan for it's approval. (PR: Gail Nordlof)

The public meeting will take place 1-2 weeks later at the Milton Township Hall. The meeting will be chaired by the Association. (PR: Mike Striegl) Members of the Association, the Limnological Institute, Aquatic Engineering and the WDNR will all be present to answer questions. Open discussion will ensue. When discussion has been satisfied, a survey will be handed out (PR: Mike Striegl) to solicit feedback on specific topics within the plan. These questionnaires will serve as a voting tool, as well, to approve or disapprove the plan.

If the plan is disapproved, input and recommendations will be taken from the public to guide revisions to the plan to make it acceptable. Discussion will continue until the plan is approved.

Once the plan is approved by the Association it will be provided to the Town of Milton, the City of Milton, and the Rock County Planning Commission for their approval. (PR: Mike Striegl) An Association member will be available to answer questions at their subsequent board meetings regarding the plan. Any recommendations provided by these entities will be taken into consideration and used to edit the plan, so that we have their acceptance.

When the plan is approved, it will then go to the WDNR for final approval. In turn, their advice will become input into the plan, and revisions will be made in kind.

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[10] Prepared by the Clear Lake Improvement Association.

The plan will then be formally adopted and approved.

Statement of Intent for Funding of Management Activities[11]

The current budget of the Association consists of $50 dues from members. In past years, we have had 25-30 members/member families. This gives us $1250-1500 annually to work with. We assess the membership for additional funds for lake treatments, based on work hours or shoreline footage. This can result in $2500-3000 more per year. We feel that currently we can fund mechanical harvesting and perhaps, an alum treatment.

In order to cover our current bills, we will hold a benefit picnic in conjunction with Blackhawk Campground. As part of this effort, we will ask local businesses to donate food and supplies to serve at the picnic. Local businesses and individuals will be invited to supply items that we would raffle or auction, with a raffle license from the Department of Revenue. We will also solicit monetary donations from attendees and local businesses. We will then assess the membership for any outstanding deficit. We plan to hold this benefit event at future intervals to continue additional funding, as it becomes necessary. The Clear Lake Improvement Association has drafted a budget for 2007 that allows for $10,630.13 for expenditures (Appendix G).

The Association has earnest interest in creating a lake district. (PR: Mike Striegl, Gail Nordlof) A committee will be put together in 2006 to investigate this possibility and, if warranted, guide the formation. Our goal in reorganizing into a lake district is to allow us greater flexibility in management options by sharing the costs of management with the entire tax base affecting the lake by their proximity. This increase in funds would allow us to consider other, more costly technologies such as dredging, aerator units, or whole lake treatments.

Additional Action

There are no additional actions required for the Association to implement their management plan.

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[11] Prepared by the Clear Lake Improvement Association in November, 2005.

8.7 Monitor and Modify

Overview

Monitoring the plant community with methods outlined by the WDNR ensures that objective values are obtained and that management activities are evaluated without bias. Future decisions concerning the plant community will be based on objective data gathered annually throughout implementation of the plan. Effective monitoring will be the result of clearly defined performance objectives.

The new WDNR APM guidelines outline the necessary monitoring and background information needed to perform large-scale aquatic plant management activities in Wisconsin lakes. The method for tracking progress occurs prior to and after management activities. The WDNR recommends calculating the Floristic Quality Index value annually. Calculating the FQI is explained in the WDNR's "Aquatic Plant Management in Wisconsin" guide.

Specific monitoring methods are also outlined in the guide. Specific monitoring is required for years when management activities occur, while other recommendations exist for the monitoring of current exotic species and prevention of others. The current expectations regarding management activities and monitoring for known exotics and preventing others is outlined in sections 9.2 and 9.3 of this report. The Association insists that all management and monitoring activities follow the recommendations within the guide.

Completed[12]

The Association will reevaluate its plan every 3-5 years as results of current management activities become apparent, new technologies become available, and/or priorities alter. Tracking the data from our participation in the Self-help monitoring program and annual quantitative plant surveys will give us a means to appraise the success or failure of our current program. We will then reconsider all the management options that have become

[12] Prepared by the Clear Lake Improvement Association

available and will implement integrated strategies that would be more effective than any single strategy can be.

Additional Action

There are no additional actions required for the Association to implement their management plan.

9.0 Clear Lake APM Plan

9.1 Specific Elements of the Clear Lake APM Plan

This section lists the specific recommendations of the WDNR for level III management. The recommendations have either been satisfied based on information gathered during the 2004 Aquatic Engineering, Inc. study (black items) or still need to be fulfilled (red items).

Goals

- ✓ Purpose Statement *(Section 1.0)*
- ✓ Goal Statement *(Section 8.1)*

Management History

- ✓ Summary of past management activities *(Section 8.5)*

Plant Community

- ✓ Comprehensive species list and review growth cycles of dominant species *(Section 5.1)*
- ✓ Total surface area covered by aquatic vegetation *(pages vi and vii)*
- ✓ Highlight rare, threatened or endangered species and species of concern *(Section 5.1)*
- ✓ Highlight invasive and non-native species, map, and compare to native community *(Section 5.3 and Appendix A and C)*
- ✓ Describe beneficial use of plants as well as nuisance or use conflicts associated with plant community *(Sections 2.1 through 2.3 and 5.1)*
- ✓ Describe vegetative characteristics of near shore or shoreland areas *(Section 5.6)*
- ✓ Collect quantitative data of the lake's aquatic plant community *(Section 5.2 and Appendix B and D)*
- ✓ Determine the percent frequency of each species present *(Section 5.1)*
- ✓ Determine the lake's FQI *(Section 5.2)*
- ✓ Collect 3 samples of each species for herbarium specimens *(Section 4.1.1)*
- ✓ Label sites where rare, threatened, endangered, special concern, invasive, and non-native plants were found *(Appendix A and C)*
- ✓ Map areas to show dominant species type and aquatic invasive species *(AIS) (Appendix A and C)*
- ✓ Maintain plant information in database or GIS including species name, location, and date sampled *(Appendix A and C)*
- ✓ Create map depicting proposed management areas and affect of management *(Section 9.3)*
- ✓ Map coordinates to be recorded on GIS map *(Section 9.3)*

Lake Map

- ✓ Obtain map with accurate scale *(Section 1.0 and Appendix A and C)*
- ✓ Determine township, range and section of lake *(Section 1.0)*
- ✓ Tabulate lake surface area, maximum and mean depths *(Section 5.5)*
- ✓ Find Water Body Identification Code (WBIC) assigned by WDNR *(Section 1.0)*
- ✓ Obtain aerial photos of lake *(Appendix A and C)*
- ✓ Obtain bathymetric map of lake *(Section 5.6)*
- ✓ Identify sediment characteristics *(Section 5.4)*
- ✓ Use GPS to record locations of specific sites of interest such as plant sampling locations *(Appendix A through D)*

Fishery & Wildlife

- ✓ Prepare a narrative describing the fish and wildlife community and their relationship to the plant community *(Section 2.0)*
- ✓ Identify any areas designated as "Sensitive Areas" by the WDNR *(Section 3.6)*
- ✓ Identify areas where rare, threatened, or endangered species or species of special concern exist *(Appendix A and C & Section 5.1)*
- ✓ Conduct specific surveys as required *(N/A)*

Water Quality

- ✓ Obtain one year of current water quality, including a minimum of 5 Secchi disk readings from June 1 to August 31 of 2004 *(2004 Clear Lake Water Quality Report)*
- ✓ Prepare summary of historical data *(Section 3.0 & 2004 Clear Lake Water Quality Report)*
- ✓ Measure the temperature and dissolved oxygen at one meter intervals at the deepest point of the lake during the summer *(2004 Clear Lake Water Quality Report)*
- ✓ Measure nutrient levels for TP, TKN, nitrate, ammonium and nitrite throughout the summer and obtain nutrient budget if available *(2004 Clear Lake Water Quality Report)*
- ✓ Measure chlorophyll-*a* concentrations, turbidity, alkalinity and pH throughout the summer of 2004 *(2004 Clear Lake Water Quality Report)*

Water Use

- ✓ Note primary human use patterns in the lake and on shore *(Section 5.9)*
- ✓ Note areas where use is restricted for any reason *(Section 5.9)*
- ✓ Collect public survey to gather opinions and perceptions on plant and water conditions *(Section 5.9)*
- ✓ Note water intakes for public water supply or irrigation *(Section 8.3)*
- ✓ Include the above information on GIS map

Watershed Description

- ✓ Provide topographical map showing watershed boundaries, inflows and outflows *(Section 4.3 Water Quality Monitoring Technical Report)*
- ✓ Determine watershed area *(Section 4.3 Water Quality Monitoring Technical Report)*
- ✓ Quantify land use areas within watershed *(Water Quality Monitoring Technical Report, Section 4.3)*
- ✓ Calculate nutrient loading by area *(Water Quality Monitoring Technical Report, Section 4.3)*
- ✓ Locate all inputs into lake including streams, drainage ditches, drain tile, etc. *(Section 1.0)*
- ✓ Include the above information on GIS map (Section 1.0)
- ✓ Model the lake and watershed to develop annual nutrient budget *(Water Quality Monitoring Technical Report, Section 4.3)*

Analysis

- ✓ Identify management objectives needed to maintain and restore beneficial uses of the lake *(Sections 8.5 and 9.2)*
- ✓ Create maps and overlays of the information from the inventory and interpret the results *(Appendix A and C)*
- ✓ Identify target levels or intensity of manipulations *(Section 8.4)*
- ✓ Map areas proposed for management *(Section 9.3)*
- ✓ Mapping coordinates should be recorded on a GIS map *(Section 9.3)*

Alternatives

- ✓ Plans should include measures to protect the valuable elements of the aquatic plant community as well as measures to control nonnative and invasive plants, plants that interfere with beneficial lake uses, and plants that enhance habitat for fish and aquatic life *(Section 9.2 through 9.6)*
- ✓ Discuss most common plant control techniques, benefits, drawbacks with vested parties *(Section 7.0)*
- ✓ Provide sufficient information regarding the feasibility, costs, and duration of control expected of each alternative *(Section 8.4)*
- ✓ Discuss the potential adverse impacts of each alternative *(Sections 7.0 and 8.4)*

Recommendations

- ✓ Develop an invasive species prevention program including education and monitoring *(Sections 9.2 and 9.4)*
- ✓ Implement "Clean Boats, Clean Waters" program *(Section 9.4)*
- ✓ Involve the public in keeping the lake healthy by finding ways to decrease harmful watershed inputs *(Section 9.2)*
- ✓ List proposed control actions beyond those strictly necessary for aquatic plant management that will be implemented to achieve desired level of control *(Sections 8.5 and 9.2 through 9.6)*

- ✓ Identify specific areas for control on a map and list the level of proposed management *(Section 9.3, and Section 8.3)*
- ✓ Identify plant offloading and disposal locations for harvested plants *(Section 9.3)*
- ✓ Identify where and how you plan on obtaining equipment necessary for harvesting *(Section 9.3)*

Implementation

- ✓ A description of education or prevention strategies needed to maintain and protect the plant community *(Sections 9.5)*
- ✓ A description of how all the management recommendations will be implemented, the methods and schedules applicable to the operation, including, timing, capital, operational cost estimates, and maintenance schedules if applicable. A description of the roles and responsibilities of the persons and/or organizations involved in the management process *(Section 8.6)*
- ✓ A description of how the public will be involved *(Section 9.2 through 9.6)*
- ✓ A budget and identification of funding sources, including plans for grant application *(Section 8.6)*
- ✓ A description of the process by which the plan will be adopted, revised, and coordinated, with DNR approval *(Section 8.6)*

Monitoring and Evaluation (Lakes with Known Invasive Populations and Following Management Actions)

- ✓ Monitor for invasive aquatic plants in early spring and twice in summer *(Section 9.6)*
- ✓ Perform quantitative plant survey at least once every five years. Track diversity indices such as FQI for early warning signs of decreasing diversity or water quality *(Section 9.6)*
- ✓ Contract for a professional survey every 3 to 5 years for the presence of exotic species and for updating the native plant list *(Section 9.6)*
- ✓ For lakes with known exotics, sample more often, use the rake method, and sample areas of know infestation, major inlets, and boat launches *(Section 9.6)*
- ✓ Following management activities collect basic water chemistry and physical parameters such as TP, TKN, temperature, pH, dissolved and dissolved oxygen at a mid lake site and within each management zone *(Sections 9.6)*

9.2 Public Education Campaign[13]

Our plan for public education and prevention strategies includes:

- Develop an informational packet regarding lake laws and best management practices including prevention of shoreline erosion, plant management, runoff management, and fertilizer use (PR: Gail Nordlof)

[13] Prepared by the Clear Lake Improvement Association

- Distribute the informational packet to area realtors, existing and new property owners, the Chamber of Commerce, and Blackhawk Campground (PR: Randi Yttri)
- Continue the Self-help lake monitoring program to continue to assess our progress (PR: Gail Nordlof)
- Implement the Clean Boats, Clean Waters program (PR: Gail Nordlof) on Clear Lake in 2006.

The public education and prevention strategy can be further broken down into the following areas:

Association Meetings Clear Lake Improvement Association holds 2 meetings a year, spring (usually May) and fall (usually September), and will call additional meetings if needed (usually in July). We will place a notice in the Milton Courier, the local newspaper, the week prior to our meetings to invite the public. We will also post large signs at our two local crossroads, the Clear Lake Road curve, and the Clear Lake Road/Dix Drive intersection, to make certain lake residents are aware of the meetings. Subcommittees of the Association will meet as needed all year round.

Informational Literature In the past, in lieu of an official newsletter, the Association has sent its complete meeting minutes via email to all members (PR: Bob Schrank). We have also published a brochure about the Association, our goals and activities, and mailed them to every household within the ward/township boundary. Going forward, as part of our informational packet, we will update our brochure with more information, and it will have a wider reach into the public domain, by benefit of the packet distribution plan. We will also create a yearly "state of the lake" newsletter (PR: Gail Nordlof). The "state of the lake" will include:

- current lake issues, business, and follow-ups
- an activity calendar
- meeting agenda, minutes, committee reports
- volunteer opportunities and recognition
- educational information that helps us understand lake science

- state and community issues that may affect our lake
- contributions of lake history, stories, or photos from members

Signage The WDNR has a sign posted at the public launch warning of the existence of an invasive species, Eurasian watermilfoil, in Clear Lake. The Association will maintain that sign, making sure the information is there and is up to date (PR: Gail Nordlof). We will provide Blackhawk Campground with the same information (PR: Mike Striegl), as well as the Clear Lake Beach residents (PR: Richard Heiman). In the future, we will solicit the Town of Milton, which has been very forthcoming in their support, for additional signage to disperse information about the lake.

Goose Management Regarding Canadian goose management, the Association has begun a daily count in March 2006 to continue through the December freeze in 2006 (PR: John Nordlof). This count will then be analyzed and recommendations for control will be sought from the WDNR, United States Department of Fish and Wildlife Services, and any other agencies responsible for goose management.

Shoreline Restoration Volunteer member(s) (PR: Roger Hack) from the Association will meet with shoreline owners to get commitments from them for restoring the shorelines on their properties. We will emphasize a buffer zone, where native plants should be planted. As we can, we will provide the shoreline owners with plants from existing perennials by dividing existing perennial beds or by obtaining donated plants from local nurseries. Records will be kept by property including who is contracted, the current state, and any action taken.

Designated Sensitive Areas The Association will recommend the west end of the lake become a designated sensitive area. It appears to be the healthiest part of the lake as far as native plant growth and lack of development. We would like to create a no wake zone in that area and place buoys indicating this (PR: Mike Striegl).

Fish and Wildlife Habitat The Association would like to do what it can to improve its fishery. We will encourage shoreland owners to leave dropped trees for fish and wildlife habitat. We will look for volunteers to build cribs, place them and record GPS coordinates of each crib. The cribs will help fish escape predators. We encourage all fish restoration efforts to focus on encouraging natural breeding versus stocking fish, for sustainability reasons. We will request assistance from the WDNR on managing our carp population (PR: Roger Hack).

General Lake Monitoring The Association would like to learn as much as we can about our lake level and what contributes to its changes. Volunteers monitored lake level and rainfall during the 2004 studies and we plan to continue this tracking seasonally. We will also add some water temperature monitoring by volunteers at intervals around the lake in an attempt to identify natural springs, then place their GPS coordinates on lake maps. In addition, we will attempt to do a high water mark survey by requesting from its members any historic photographs that show high water levels with useful references to today's levels. We hope to create an overlay map, as a protection measure, so that, as the water level recedes, we will not encroach on that shoreline area with more development (PR: Gail Nordlof).

9.3 Annual Mechanical Harvesting Program

The Association would like to resume a mechanical harvesting program on Clear Lake in 2006. The Association has contacted Midwest Aquatics and requested a proposal to perform the desired harvesting. The cost to have the company perform the harvests would be $130 per hour which results in approximately $5,000 per harvest. The Association would like to perform three harvests per year but is willing to perform only two if funding is not available for three. For early season treatments, the Association has chosen to harvest CLP at designated locations totaling 21.6 acres (Figure 15). Besides the early season harvesting locations, a "worst-case" scenario harvesting map was created and is based off of the 2004 CLP distribution (Figure 16). In time, the "worst-case" scenario may progress to cover all of Clear Lake's littoral zone. In addition to early season CLP harvesting, the Association has chosen to harvest EWM and nuisance native plants in the summer. This summer harvest will be to cut transportation channels throughout the littoral zone (Figure 17). In addition, a "worse case" scenario

The Association is also going to support riparian property owners if they choose to continue managing their high use recreational areas through manual or chemical removal of aquatic vegetation or through individual dredging projects. The Association will not organize a lake wide effort but will support interested parties by providing educational materials and contact information for local resources that may help manage nuisance plant conditions while promoting native plant growth.

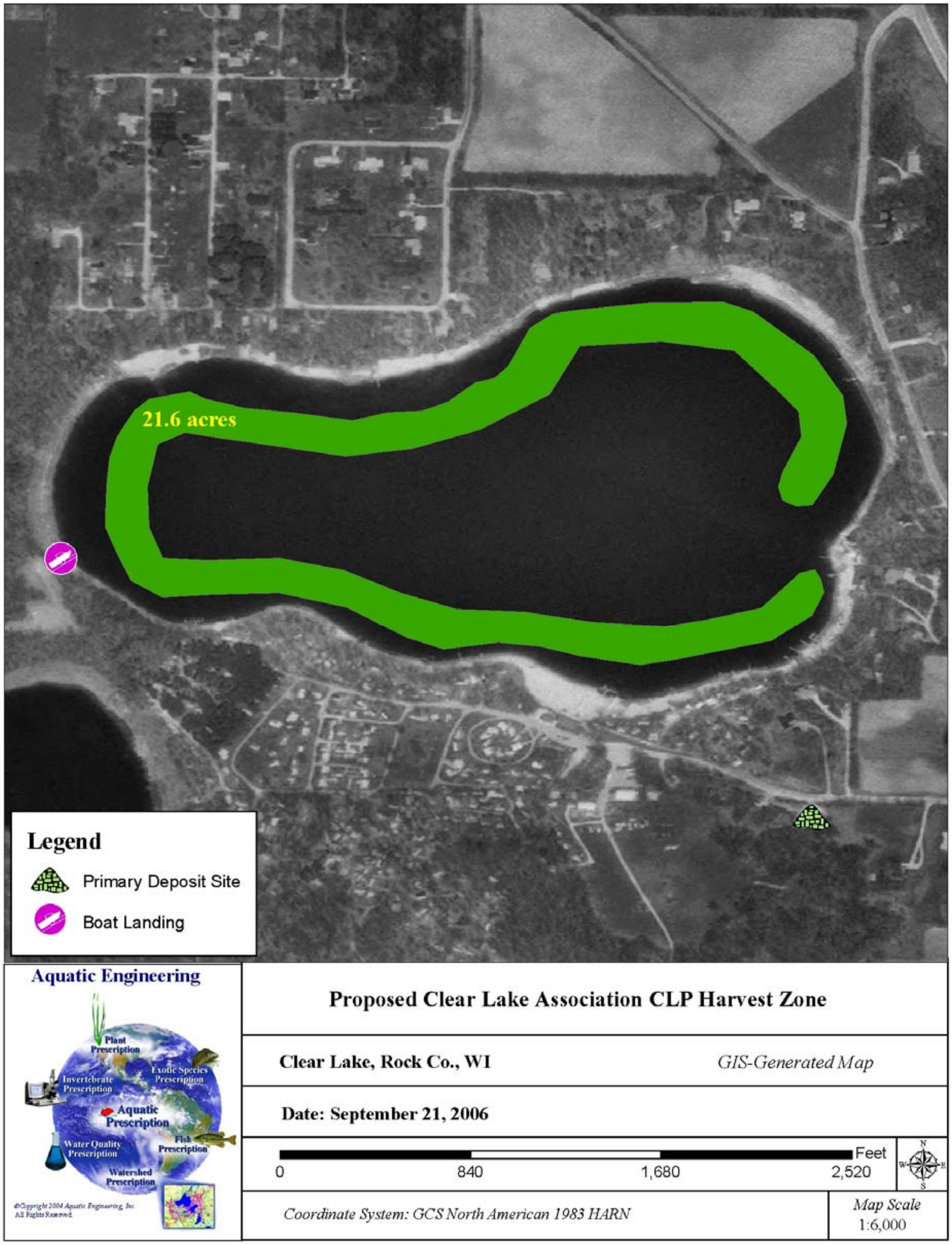
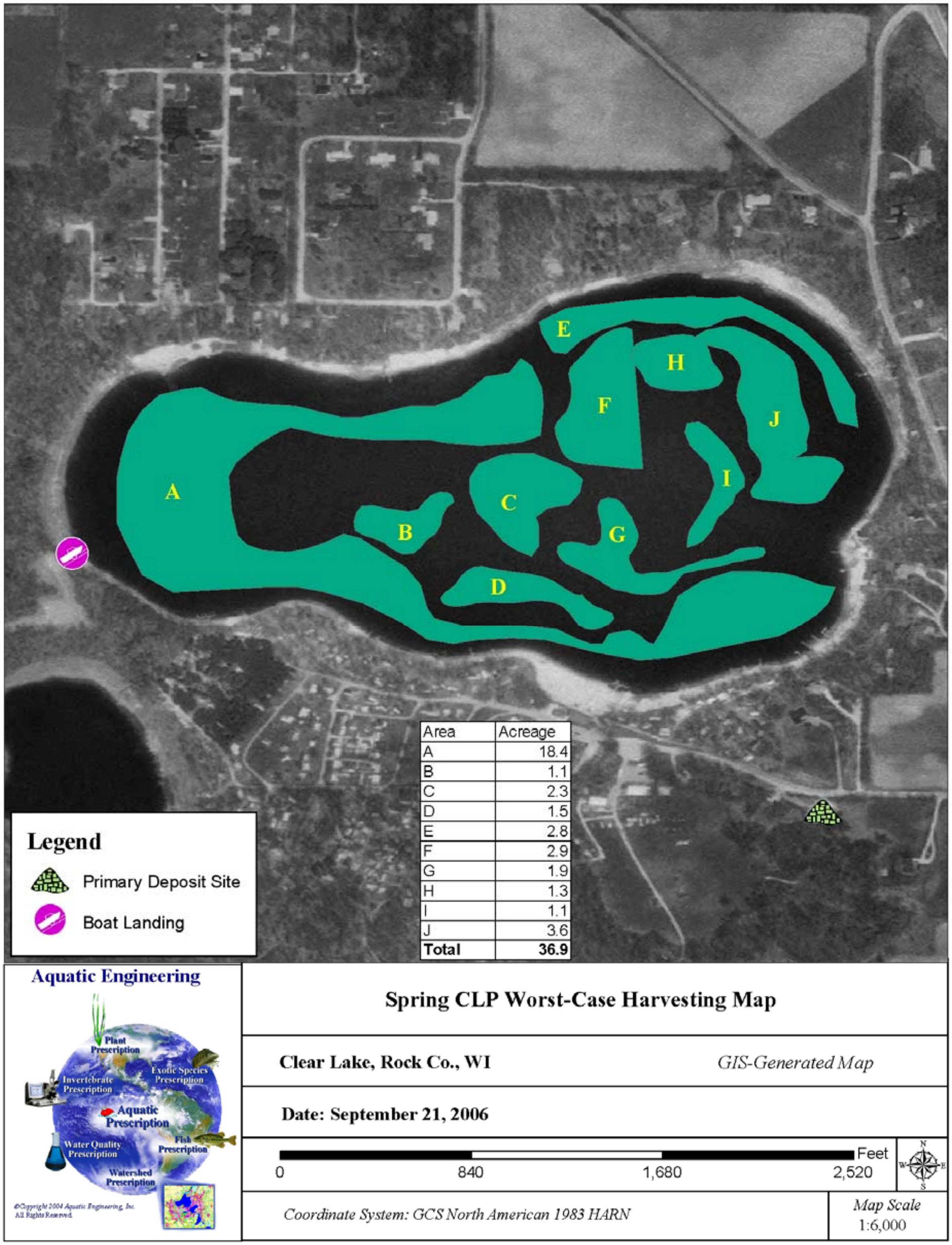


Figure 15. 2006 Curly leaf pondweed early season harvesting locations for Clear Lake (Rock County, WI)



Area	Acreage
A	18.4
B	1.1
C	2.3
D	1.5
E	2.8
F	2.9
G	1.9
H	1.3
I	1.1
J	3.6
Total	**36.9**

Figure 16. Spring CLP “worst-case scenario” harvesting map for Clear Lake (Rock County, WI).

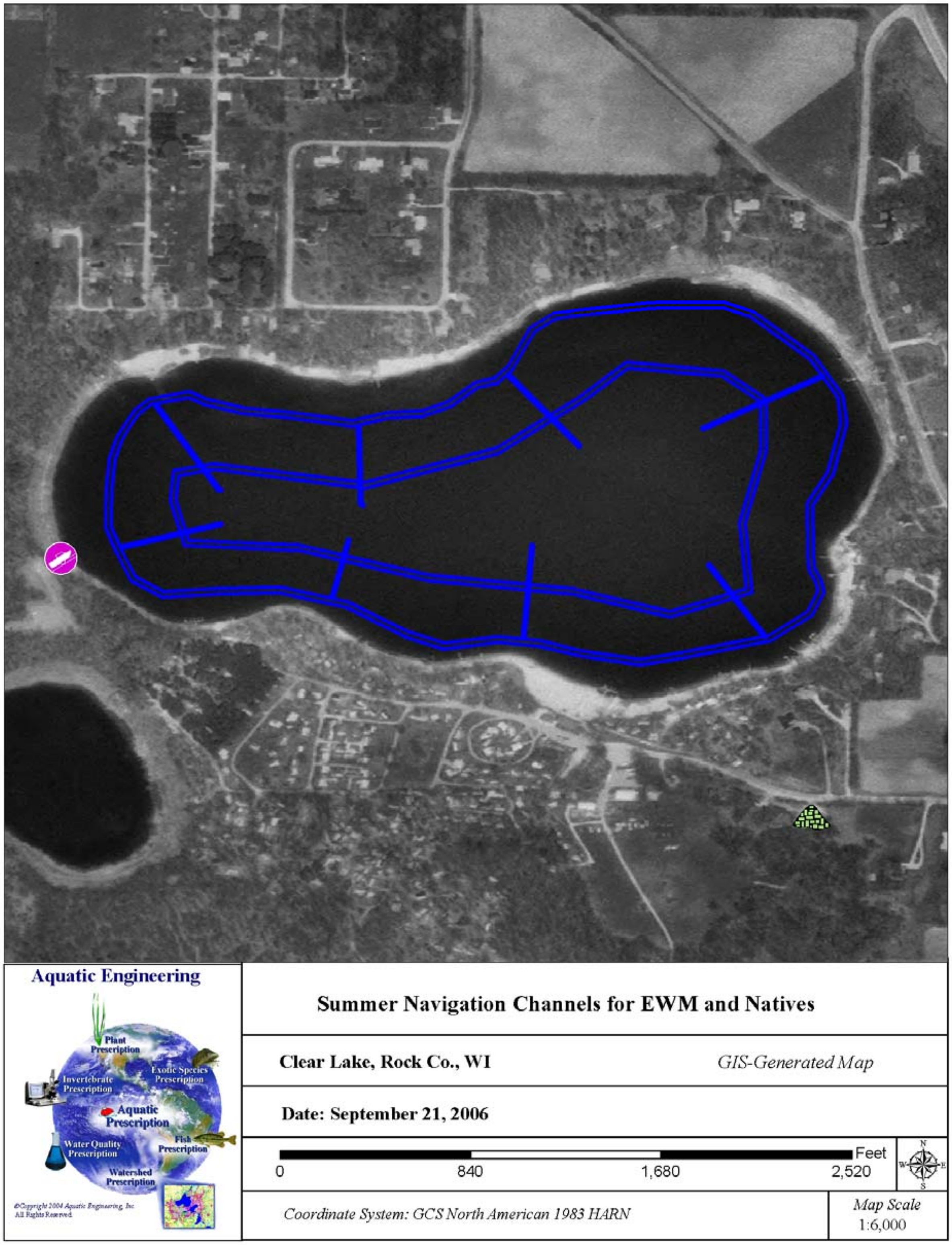


Figure 17. 2007 and beyond proposed spring and summer harvesting locations navigation channels in Clear Lake (Rock County, WI).

9.4 High Use Recreational Area Programs

Property owners may want to provide relief around their high use recreational areas (e.g. individual docks, swimming areas and in navigational channels). This management can be used to provide each property owner with unimpeded access to their beaches and piers. Past management actions have been met with mixed results. This is likely due to the major nuisance plant, coontail, having weak root systems and being able to uproot from untreated areas and quickly occupy managed areas once vegetation there has been removed. Removal of native plants is limited to a single area with a maximum width of 30 feet along the shoreline provided that any piers, boatlifts, swimrafts and other recreational and water use devices are located within that 30-foot wide zone and may not be in a new area or additional to an area where plants are controlled by another method. There are a few exceptions to this rule which are that the 30-foot area can not be in a designated sensitive zone or can not contain threatened or endangered resources or floating bogs. WDNR permits will always be required for herbicide applications while hand removal is typically exempt from permitting. Contact the regional WDNR APM coordinator for more information regarding the legalities of each practice.

9.5 Exotic Species Control Program

The Association is not responsible for preventing the spread of exotic species to other lakes. However, some lake residents have expressed interest in monitoring boat launches through the Clean Boats, Clean Waters program. By monitoring boat trailers and boats residents can help prevent the accidental spread of EWM and CLP from Clear Lake to other lakes. Again, it is not the responsibility of the Clear Lake residents to prevent the spread of exotics, but they want to help by doing their part.

Steps to implementing a Clean Boats, Clean Waters program include:

1. Recruit volunteers.
2. Organize and hold a training session for volunteers - the lake association already has the materials to implement the program, as well as a member trained in this program who will disseminate the information to volunteers.
3. Schedule monitoring days to target 1) the last half of the month of May when nearly all the resident boats are launched on the lake, and 2) the

busiest holiday weekend dates when other outside boats are launched on the lake.

4. Logs will be kept of the number of people reached by this program.
5. Results of these activities will be reported to the Association at their regularly scheduled meetings and to the UW-Extension, the organizers of the Clean Boats, Clean Waters program in the State of Wisconsin, and the Wisconsin Department of Natural Resources.
6. Place signs/information brochures at campground

9.6 Aquatic Plant and Water Quality Monitoring and Protection

Invasive aquatic plants should be monitored once in early spring and twice during the summer. Sampling should be done more frequently, with rake method, in areas of the lake where know exotics have been documented. In addition to known locations, additional sampling with the rake method should be administered at major inlets and boat launches. A professional survey should be done every three to five years to evaluate the presence of exotic species and for updating the native plant list. In addition, a quantitative plant survey should be done at least once every five years which would track diversity indices such as FQI. The FQI can be an early warning sign of decreasing water quality. Besides aquatic plant surveys, water quality parameters such as Secchi depth, total phosphorus, and chlorophyll *a* should be monitored on a regular basis. Recent studies suggest that CLP may play an important role in nutrient cycling and water quality as it decays in the summer. Though more research is required to determine exact effects of monotypic CLP beds on water quality, it is widely recognized that the release of phosphorus from CLP in the summer can fuel local algae blooms and disrupt the annual cycling of phosphorus.

The Association should monitor the water quality every three years using sampling protocols similar to those used in the 2004 monitoring. The TSI values can be calculated and compared from year to year to determine if the trophic status of the lake is increasing, decreasing or remaining the same and can be a good long-term indicator for the lake. Yearly variability can be high based on environmental conditions, so it is generally not good to make short-term comparisons.

Since the water quality has severely declined, the Association plans to look at alternative treatments as a possible means of restoring water clarity and keeping plant growth at bay. Alum is a widely used treatment for drinking water, wastewater treatment and lakes. Alum (aluminum sulfate) binds with phosphorus, causing it to settle out of the water column and stop phosphorus from being released from the sediments. Alum treatments can be very effective and can last up to 10 years. It can also greatly improve clarity in a water body since it removes the suspended materials that contribute to cloudiness.

The Association also plans to continue discussion with a company that manufactures a water-moving device that shows some evidence of reducing algae and EWM growth. We have discussed the possibility of becoming a study site for the company, since they need a scientific study. We have also considered the possibility of trying the units, with an option to purchase them, for the cost of installation. Having priced the units, they will easily be within our budgetary possibility once a lake district is formed.

10.0 References

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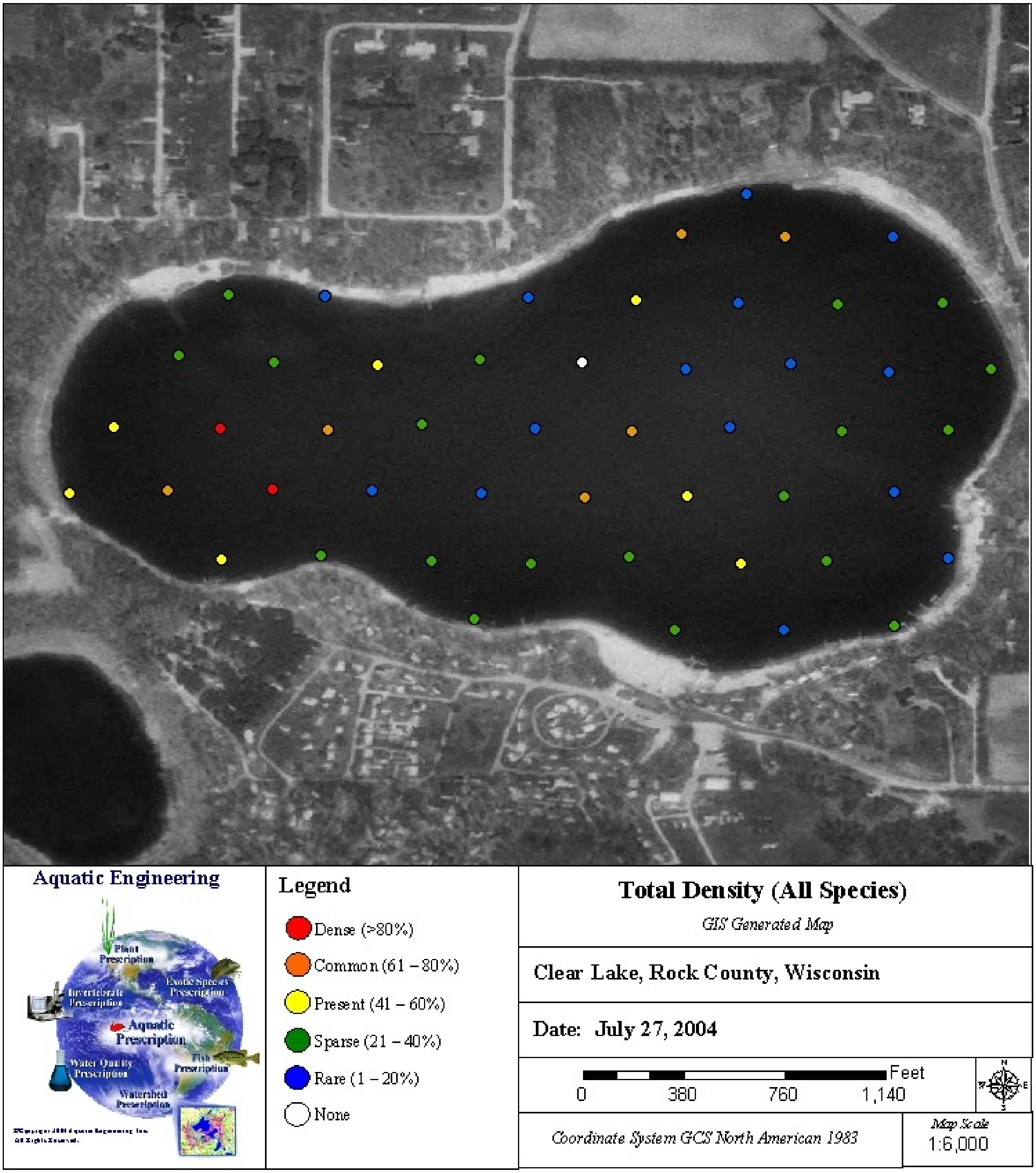
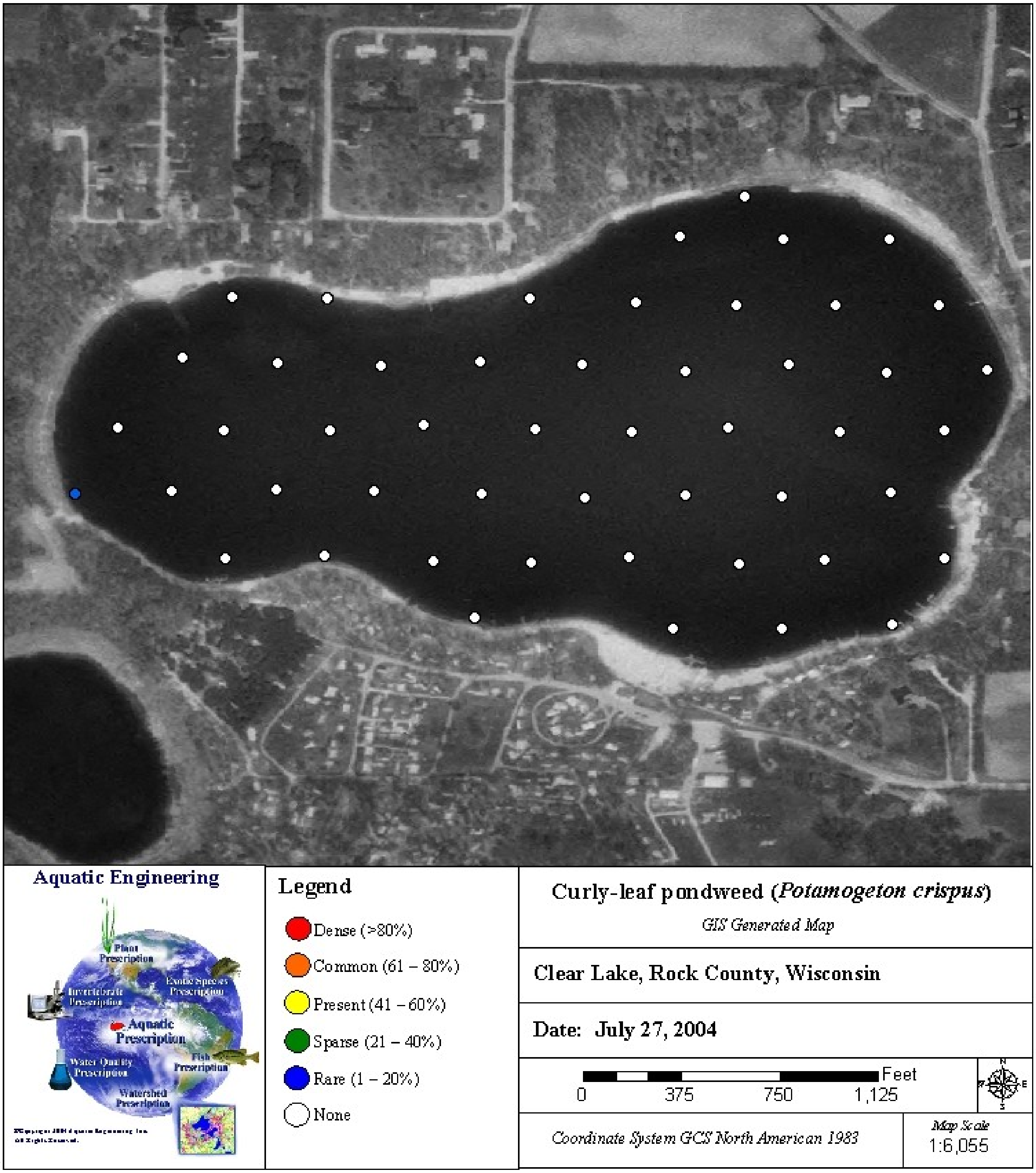
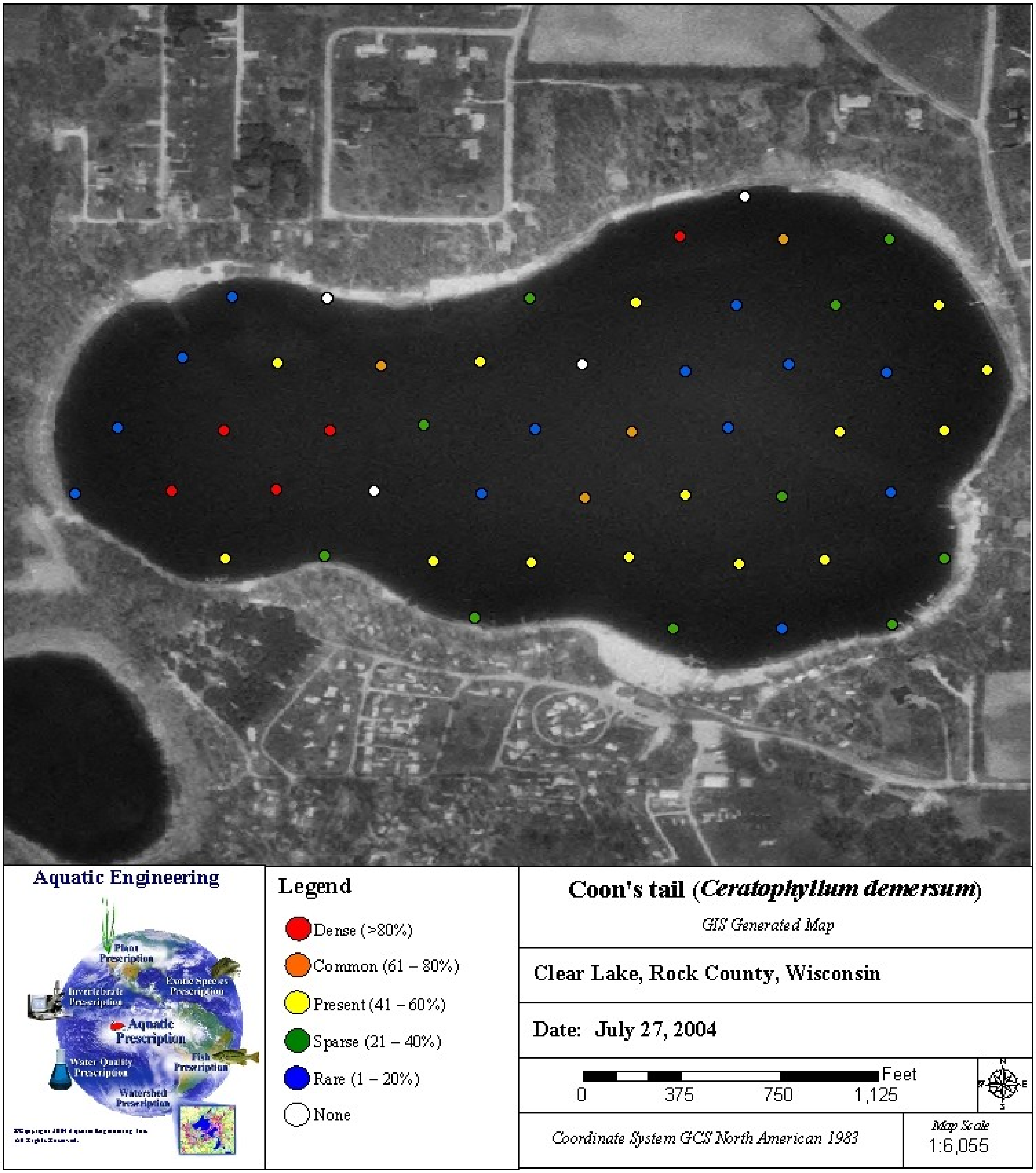
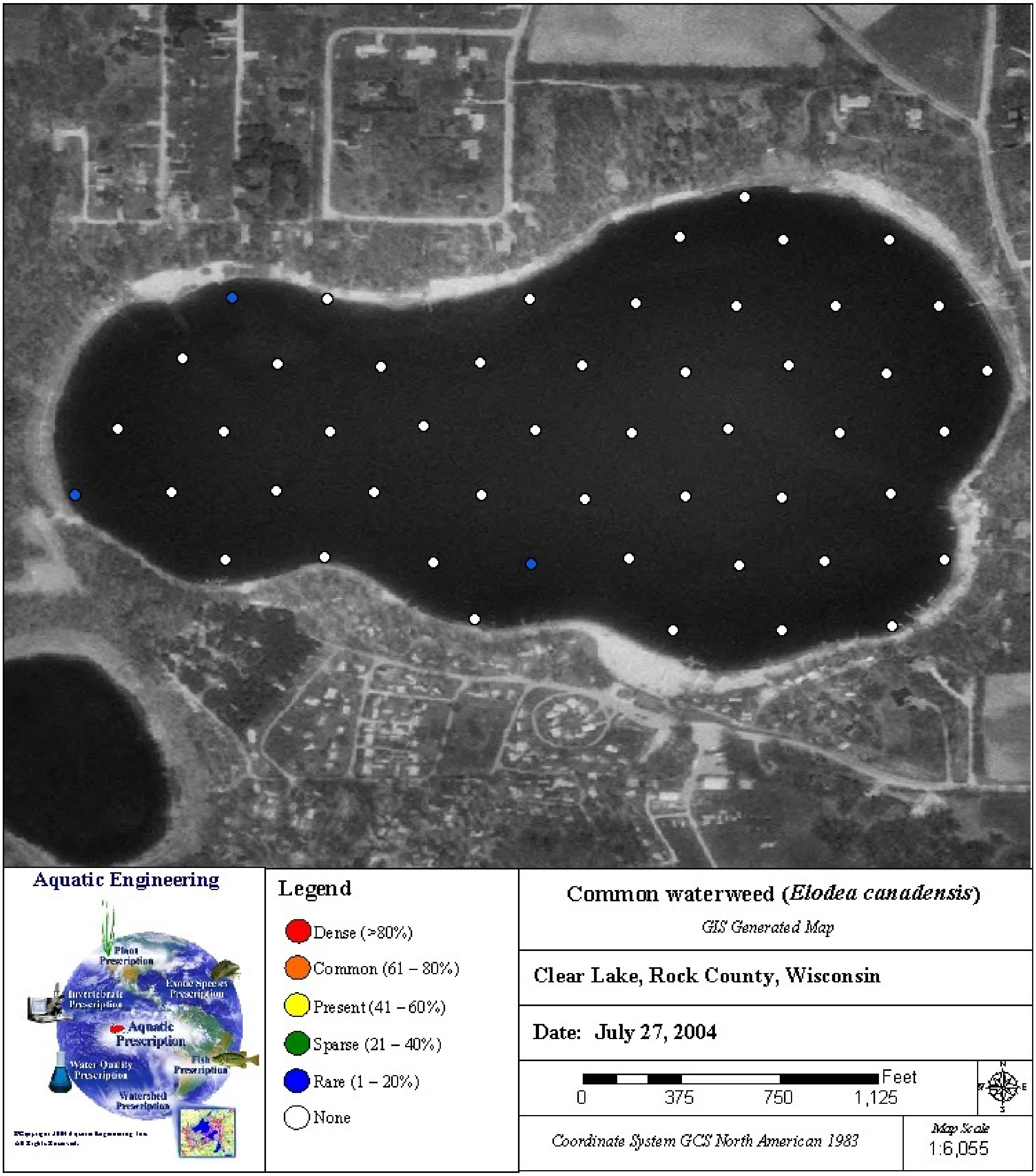
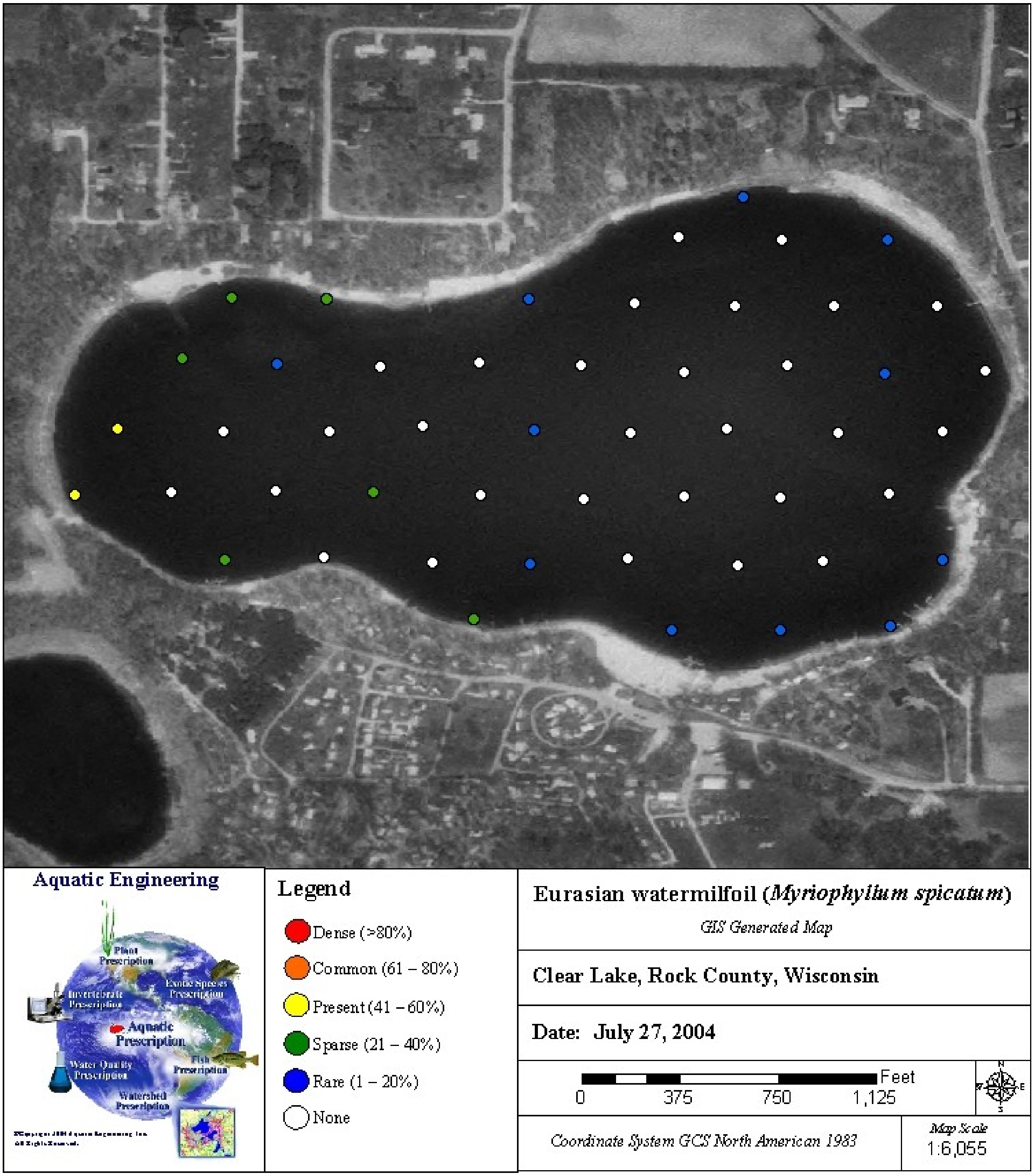
Appendix A: ***July Plant Survey Maps***

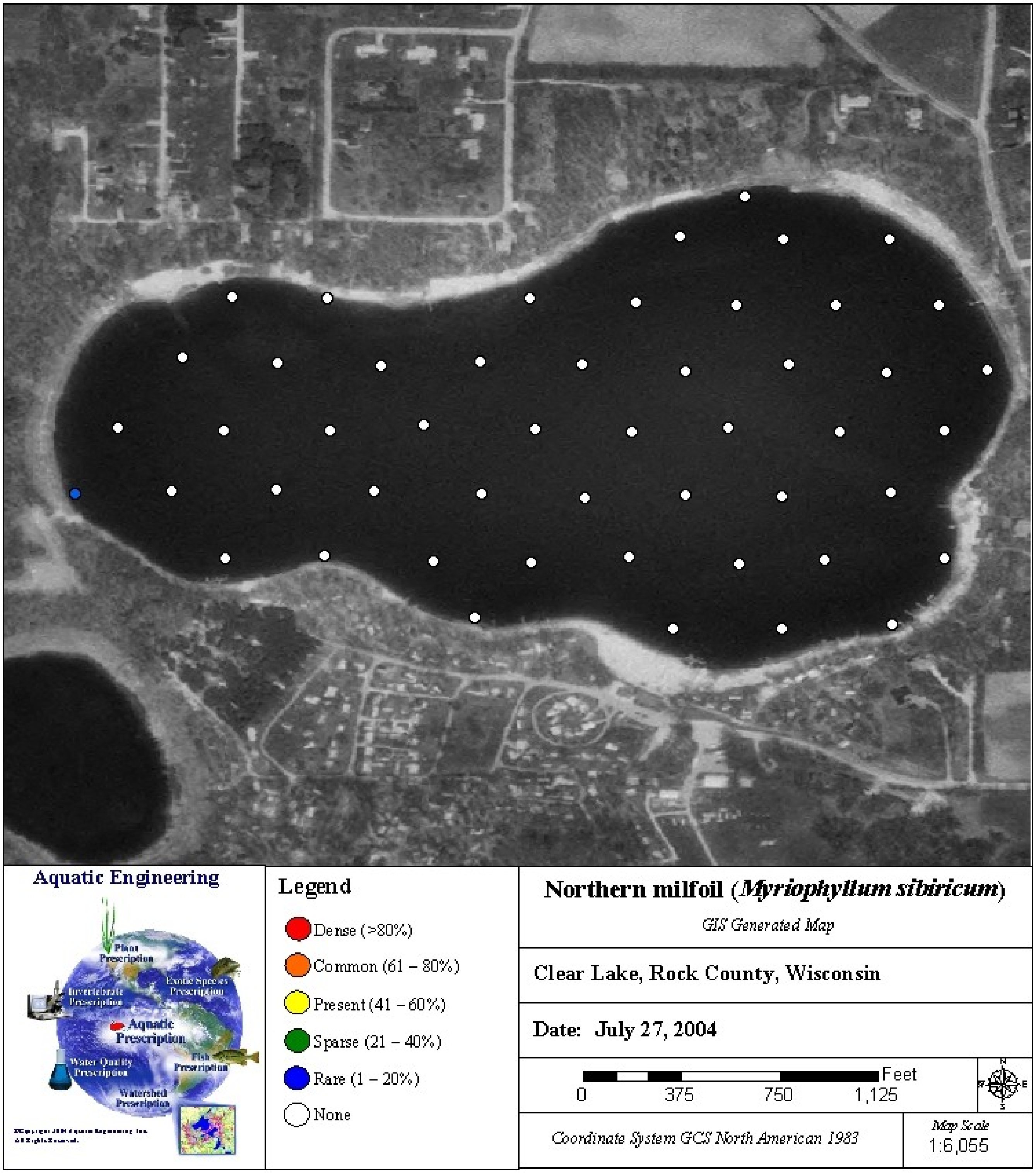

Aquatic Engineering
Legend
Dense (>80%)
Common (61 – 80%)
Present (41 – 60%)
Sparse (21 – 40%)
Rare (1 – 20%)
None
Total Density (All Species)
GIS Generated Map
Clear Lake, Rock County, Wisconsin
Date: July 27, 2004
Feet
0
380
760
1,140
Coordinate System GCS North American 1983
Map Scale
1:6,000


Aquatic Engineering
Legend
Dense (>80%)
Common (61 – 80%)
Present (41 – 60%)
Sparse (21 – 40%)
Rare (1 – 20%)
None
Curly-leaf pondweed (Potamogeton crispus)
GIS Generated Map
Clear Lake, Rock County, Wisconsin
Date: July 27, 2004
Feet
0
375
750
1,125
Coordinate System GCS North American 1983
Map Scale
1:6,055


Aquatic Engineering
Plant Prescription
Exotic Species Prescription
Invertebrate Prescription
Aquatic Prescription
Water Quality Prescription
Fish Prescription
Watershed Prescription
Legend
Dense (>80%)
Common (61 – 80%)
Present (41 – 60%)
Sparse (21 – 40%)
Rare (1 – 20%)
None
Coon's tail (*Ceratophyllum demersum*)
GIS Generated Map
Clear Lake, Rock County, Wisconsin
Date: July 27, 2004
Feet
0 375 750 1,125
Coordinate System GCS North American 1983
Map Scale
1:6,055


Aquatic Engineering
Legend
Dense (>80%)
Common (61 – 80%)
Present (41 – 60%)
Sparse (21 – 40%)
Rare (1 – 20%)
None
Common waterweed (Elodea canadensis)
GIS Generated Map
Clear Lake, Rock County, Wisconsin
Date: July 27, 2004
Feet
0
375
750
1,125
Coordinate System GCS North American 1983
Map Scale
1:6,055


Aquatic Engineering
Plant Prescription
Exotic Species Prescription
Invertebrate Prescription
Aquatic Prescription
Water Quality Prescription
Fish Prescription
Watershed Prescription
Legend
Dense (>80%)
Common (61 – 80%)
Present (41 – 60%)
Sparse (21 – 40%)
Rare (1 – 20%)
None
Eurasian watermilfoil (Myriophyllum spicatum)
GIS Generated Map
Clear Lake, Rock County, Wisconsin
Date: July 27, 2004
0 375 750 1,125 Feet
Coordinate System GCS North American 1983
Map Scale
1:6,055


Aquatic Engineering
Legend
Dense (>80%)
Common (61 – 80%)
Present (41 – 60%)
Sparse (21 – 40%)
Rare (1 – 20%)
None
Northern milfoil (Myriophyllum sibiricum)
GIS Generated Map
Clear Lake, Rock County, Wisconsin
Date: July 27, 2004
Feet
0
375
750
1,125
Coordinate System GCS North American 1983
Map Scale
1:6,055

Appendix B: ***July Plant Survey Raw Data***

Date	FID	Depth (ft)	DO (mg/L)	DO %	pH	Temp	Cond	Sediment	Shoreline	Total Rake Density	Coontail Density	CLP Density	Elodea Density	EWM Density	Filamentous Algae Density	N. milfoil Density
7/27/2004	0	6.6	8.97	115	9.36	28.08	0.223	3	26	1	1	0	0	1	0	0
7/27/2004	0									2	2	0	0	2	0	0
7/27/2004	0									3	1	0	0	2	0	0
7/27/2004	0									4	2	0	0	1	0	0
7/27/2004	1	6.6	8.2	105	9.25	28.21	0.224	2		1	2	0	0	1	0	0
7/27/2004	1									2	2	0	0	1	0	0
7/27/2004	1									3	2	0	0	0	0	0
7/27/2004	1									4	1	0	0	1	0	0
7/27/2004	2	6	7.85	100	9.24	28.03	0.225	3		1	1	0	0	1	0	0
7/27/2004	2									2	1	0	0	1	0	0
7/27/2004	2									3	1	0	0	1	0	0
7/27/2004	2									4	0	0	0	1	0	0
7/27/2004	3	5.2	8.82	113	9.31	28.17	0.223	3	1126	1	2	0	0	1	0	0
7/27/2004	3									2	3	0	0	1	0	0
7/27/2004	3									3	1	0	0	0	0	0
7/27/2004	3									4	1	0	0	1	0	0
7/27/2004	4	6	8.21	103	9.28	27.09	0.222	3		1	3	0	0	1	0	0
7/27/2004	4									2	3	0	0	1	0	0
7/27/2004	4									3	1	0	0	1	0	0
7/27/2004	4									4	2	0	0	2	0	0
7/27/2004	5	8.6	8.35	105	9.28	26.85	0.223	3		1	2	0	0	0	0	0
7/27/2004	5									2	2	0	0	0	0	0
7/27/2004	5									3	2	0	0	0	0	0
7/27/2004	5									4	2	0	0	0	0	0
7/27/2004	6	9.6	8.09	101	9.25	26.77	0.224	3		1	3	0	0	0	0	0
7/27/2004	6									2	3	0	0	0	0	0
7/27/2004	6									3	2	0	0	0	0	0
7/27/2004	6									4	2	0	0	0	0	0
7/27/2004	7	8.9	7.91	101	9.24	27.76	0.224	3		1	2	0	0	0	0	0
7/27/2004	7									2	3	0	0	0	0	0
7/27/2004	7									3	2	0	1	1	0	0
7/27/2004	7									4	2	0	0	0	0	0
7/27/2004	8	8	7.86	100	9.23	27.81	0.225	3		1	2	0	0	0	0	0
7/27/2004	8									2	2	0	0	0	0	0
7/27/2004	8									3	3	0	0	0	0	0
7/27/2004	8									4	2	0	0	0	0	0
7/27/2004	9	7.8	8.55	108	9.28	27.16	0.223	3		1	4	0	0	0	0	0
7/27/2004	9									2	2	0	0	0	0	0
7/27/2004	9									3	3	0	0	0	0	0
7/27/2004	9									4	2	0	0	0	0	0
7/27/2004	10	7.5	8.21	104	9.27	27.55	0.224	3		1	2	0	0	0	0	0
7/27/2004	10									2	3	0	0	0	0	0
7/27/2004	10									3	3	0	0	0	0	0
7/27/2004	10									4	2	0	0	0	0	0

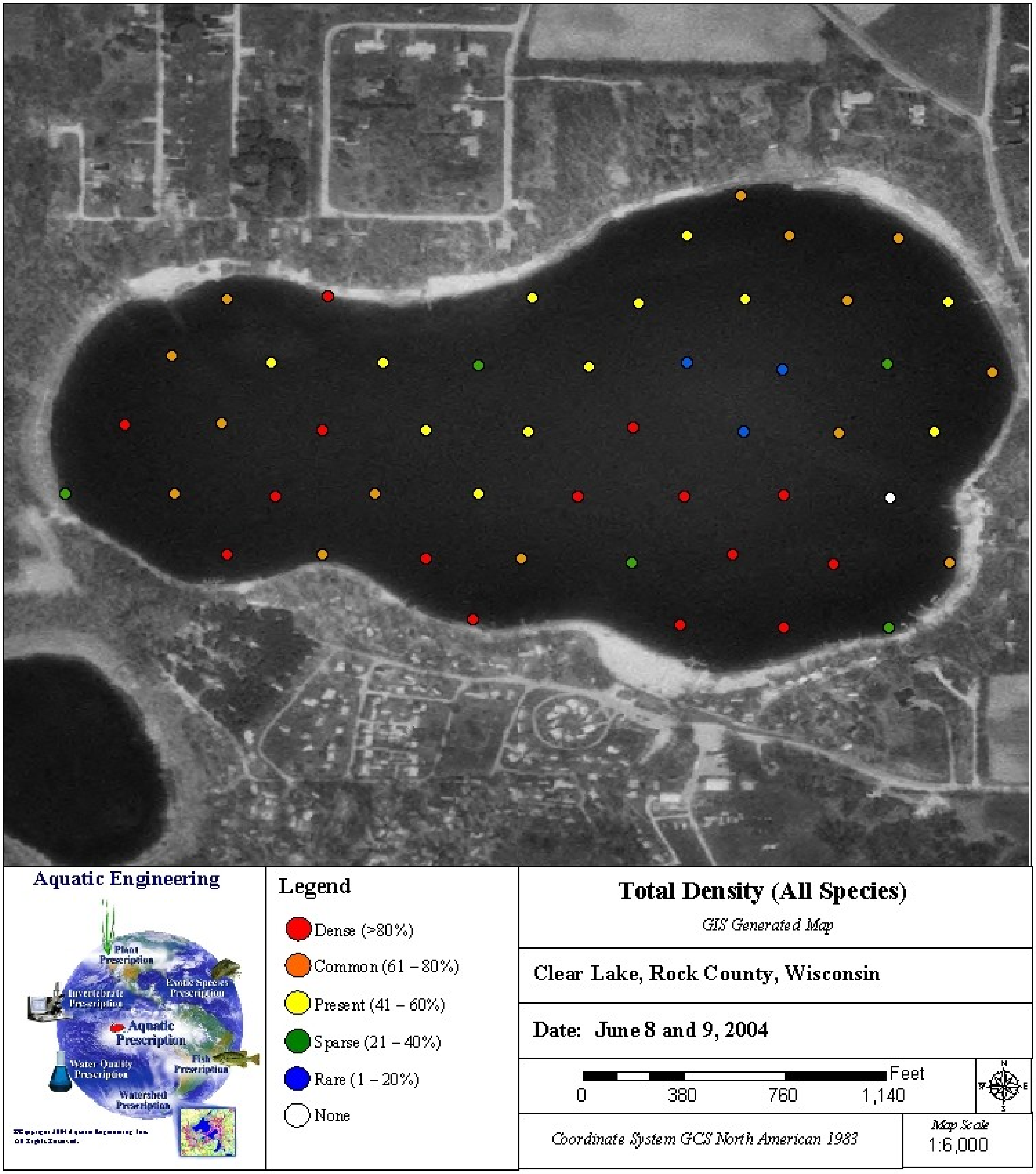
Date	FID	Depth (ft)	DO (mg/L)	DO %	pH	Temp	Cond	Sediment	Shoreline	Total Rake Density	Coontail Density	CLP Density	Elodea Density	EWM Density	Filamentous Algae Density	N. milfoil Density
7/27/2004	11	7.5	10.71	134	9.5	27.02	0.22	3	1228	1	2	0	0	0	0	0
7/27/2004	11									2	2	0	0	1	0	0
7/27/2004	11									3	1	0	0	1	0	0
7/27/2004	11									4	1	0	0	1	0	0
7/27/2004	12	3.5	13.3	166	9.39	26.88	nr	3	11	1	1	0	1	3	0	0
7/27/2004	12									2	0	0	0	3	0	0
7/27/2004	12									3	0	1	0	2	0	0
7/27/2004	12									4	1	0	0	3	0	1
7/27/2004	13	8.5	7.98	100	9.27	26.82	0.222	3		1	4	0	0	0	0	0
7/27/2004	13									2	5	0	0	0	0	0
7/27/2004	13									3	3	0	0	0	0	0
7/27/2004	13									4	5	0	0	0	0	0
7/27/2004	14	9	8.27	104	9.29	26.69	0.222	3		1	5	0	0	0	0	0
7/27/2004	14									2	5	0	0	0	0	0
7/27/2004	14									3	4	0	0	0	0	0
7/27/2004	14									4	5	0	0	0	0	0
7/27/2004	15	5.6	11.44	143	9.55	26.83	0.214	3		1	0	0	0	1	0	0
7/27/2004	15									2	0	0	0	2	0	0
7/27/2004	15									3	0	0	0	1	0	0
7/27/2004	15									4	0	0	0	2	0	0
7/27/2004	16	11.6	8.16	102	9.25	26.72	0.224	3		1	1	0	0	0	0	0
7/27/2004	16									2	1	0	0	0	0	0
7/27/2004	16									3	1	0	0	0	0	0
7/27/2004	16									4	1	0	0	0	0	0
7/27/2004	17	9	8.24	103	9.26	27.1	0.224	3		1	4	0	0	0	0	0
7/27/2004	17									2	3	0	0	0	0	0
7/27/2004	17									3	4	0	0	0	0	0
7/27/2004	17									4	5	0	0	0	0	0
7/27/2004	18	9.5	8.06	102	9.25	27.8	0.224	3		1	3	0	0	0	0	0
7/27/2004	18									2	3	0	0	0	0	0
7/27/2004	18									3	3	0	0	0	0	0
7/27/2004	18									4	2	0	0	0	0	0
7/27/2004	19	10.5	8.2	104	9.27	27.33	0.224	3		1	1	0	0	0	0	0
7/27/2004	19									2	2	0	0	0	0	0
7/27/2004	19									3	2	0	0	0	0	0
7/27/2004	19									4	3	0	0	0	0	0
7/27/2004	20	16.2	7.85	101	9.28	27.6	0.224	3		1	0	0	0	0	0	0
7/27/2004	20									2	0	0	0	0	0	0
7/27/2004	20									3	0	0	0	0	0	0
7/27/2004	20									4	1	0	0	0	0	0
7/27/2004	21	nr	9.6	119	9.4	26.09	0.217	3		1	1	0	0	3	0	0
7/27/2004	21									2	1	0	0	3	0	0
7/27/2004	21									3	1	0	0	2	0	0
7/27/2004	21									4	1	0	0	2	0	0

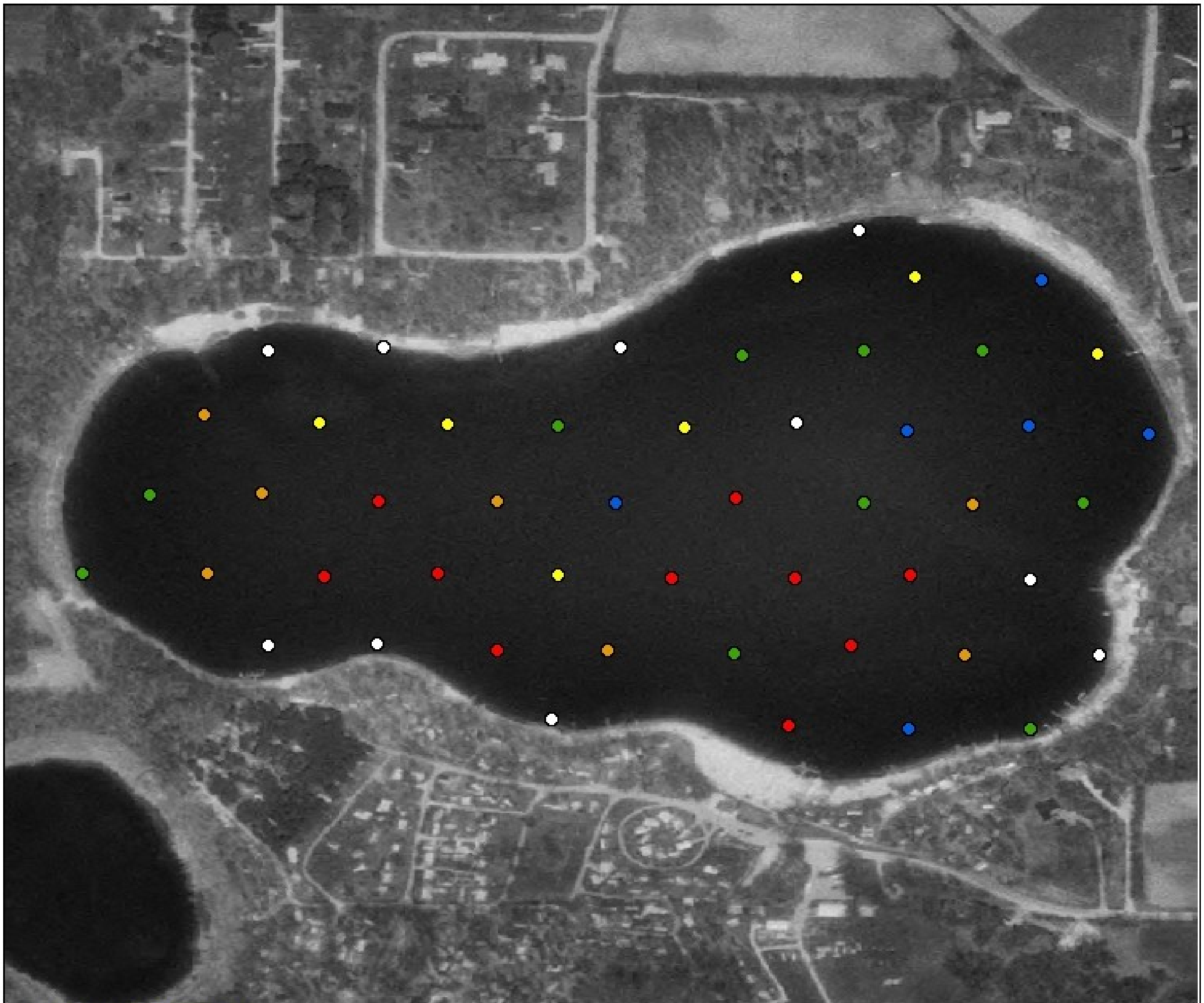
Date	FID	Depth (ft)	DO (mg/L)	DO %	pH	Temp	Cond	Sediment	Shoreline	Total Rake Density	Coontail Density	CLP Density	Elodea Density	EWM Density	Filamentous Algae Density	N. milfoil Density
7/27/2004	22	10	8.41	105	9.29	26.47	0.222	3		1	5	0	0	0	0	0
7/27/2004	22									2	5	0	0	0	0	0
7/27/2004	22									3	5	0	0	0	0	0
7/27/2004	22									4	3	0	0	0	0	0
7/27/2004	23	9.3	8.57	106	9.31	26.43	0.221	3		1	3	0	0	0	0	0
7/27/2004	23									2	5	0	0	0	0	0
7/27/2004	23									3	4	0	0	0	0	0
7/27/2004	23									4	5	0	0	0	0	0
7/27/2004	24	10.2	8.4	105	9.28	26.5	0.222	3		1	2	0	0	0	0	0
7/27/2004	24									2	2	0	0	0	0	0
7/27/2004	24									3	1	0	0	0	0	0
7/27/2004	24									4	3	0	0	0	0	0
7/27/2004	25	12.8	8.43	105	9.27	26.36	0.223	3		1	1	0	0	0	0	0
7/27/2004	25									2	1	0	0	0	0	0
7/27/2004	25									3	1	0	0	0	0	0
7/27/2004	25									4	1	0	0	1	0	0
7/27/2004	26	11	8.14	103	9.26	27.35	0.224	3		1	4	0	0	0	0	0
7/27/2004	26									2	5	0	0	0	0	0
7/27/2004	26									3	3	0	0	0	0	0
7/27/2004	26									4	3	0	0	0	0	0
7/27/2004	27	13.5	8.3	105	9.27	27.05	0.224	3		1	0	0	0	0	0	0
7/27/2004	27									2	0	0	0	0	0	0
7/27/2004	27									3	1	0	0	0	0	0
7/27/2004	27									4	1	0	0	0	0	0
7/27/2004	28	13	8.57	107	9.3	26.4	0.223	3		1	1	0	0	0	0	0
7/27/2004	28									2	4	0	0	0	0	0
7/27/2004	28									3	3	0	0	0	0	0
7/27/2004	28									4	1	0	0	0	0	0
7/27/2004	29	8.1	8.35	106	9.29	27.74	0.224	3		1	2	0	0	0	0	0
7/27/2004	29									2	3	0	0	0	0	0
7/27/2004	29									3	2	0	0	0	0	0
7/27/2004	29									4	2	0	0	0	0	0
7/27/2004	30	8.66	9.6	118	9.41	25.81	0.218	3		1	1	0	0	2	0	0
7/27/2004	30									2	0	0	0	1	0	0
7/27/2004	30									3	1	0	0	2	0	0
7/27/2004	30									4	2	0	0	1	0	0
7/27/2004	31	9	8.56	105	9.31	25.88	0.221	3		1	3	0	0	0	0	0
7/27/2004	31									2	3	0	0	1	0	0
7/27/2004	31									3	2	0	0	0	0	0
7/27/2004	31									4	3	0	0	0	0	0
7/27/2004	32	9.6	8.47	105	9.3	26.48	0.222	3		1	4	0	0	0	0	0
7/27/2004	32									2	3	0	0	0	0	0
7/27/2004	32									3	3	0	0	0	0	0
7/27/2004	32									4	4	0	0	0	0	0

Date	FID	Depth (ft)	DO (mg/L)	DO %	pH	Temp	Cond	Sediment	Shoreline	Total Rake Density	Coontail Density	CLP Density	Elodea Density	EWM Density	Filamentous Algae Density	N. milfoil Density
7/27/2004	33	9.8	8.43	105	9.29	26.61	0.222	3		1	2	0	0	0	1	0
7/27/2004	33									2	2	0	0	0	0	0
7/27/2004	33									3	3	0	0	0	0	0
7/27/2004	33									4	2	0	0	0	0	0
7/27/2004	34	nr	nr	nr	nr	nr	nr	3		1	0	0	0	0	0	0
7/27/2004	34									2	0	0	0	0	0	0
7/27/2004	34									3	0	0	0	0	0	0
7/27/2004	34									4	0	0	0	0	0	0
7/27/2004	35	12.5	8.27	104	9.27	26.84	0.224	2		1	0	0	0	0	0	0
7/27/2004	35									2	2	0	0	0	0	0
7/27/2004	35									3	0	0	0	0	0	0
7/27/2004	35									4	0	0	0	0	0	0
7/27/2004	36	13.5	8.47	106	9.29	27.03	0.223	2		1	0	0	0	0	0	0
7/27/2004	36									2	1	0	0	0	0	0
7/27/2004	36									3	1	0	0	0	0	0
7/27/2004	36									4	0	0	0	0	0	0
7/27/2004	37	10.3	8.42	105	9.29	26.7	0.223	2		1	1	0	0	1	0	0
7/27/2004	37									2	1	0	0	1	0	0
7/27/2004	37									3	1	0	0	1	0	0
7/27/2004	37									4	1	0	0	0	0	0
7/27/2004	38	6	8.89	113	9.34	27.74	0.223	3	26	1	2	0	0	0	0	0
7/27/2004	38									2	2	0	0	0	0	0
7/27/2004	38									3	4	0	0	0	0	0
7/27/2004	38									4	2	0	0	0	0	0
7/27/2004	39	6.15	11.12	137	9.55	25.88	0.214	3		1	1	0	1	1	0	0
7/27/2004	39									2	1	0	1	2	0	0
7/27/2004	39									3	1	0	0	2	0	0
7/27/2004	39									4	0	0	1	2	0	0
7/27/2004	40	4	11.88	147	9.59	26.13	0.216	2	2612	1	0	0	0	1	0	0
7/27/2004	40									2	0	0	0	3	0	0
7/27/2004	40									3	0	0	0	1	0	0
7/27/2004	40									4	0	0	0	1	0	0
7/27/2004	41	6.8	9.06	113	9.35	26.5	0.222	3		1	1	0	0	0	0	0
7/27/2004	41									2	2	0	0	1	0	0
7/27/2004	41									3	2	0	0	0	0	0
7/27/2004	41									4	1	0	0	1	0	0
7/27/2004	42	11	8.59	107	9.3	26.34	0.223	3		1	1	0	0	0	0	0
7/27/2004	42									2	2	0	0	0	0	0
7/27/2004	42									3	4	0	0	0	0	0
7/27/2004	42									4	5	0	0	0	0	0
7/27/2004	43	11	8.4	105	9.27	26.74	0.223	3		1	1	0	0	0	0	0
7/27/2004	43									2	1	0	0	0	0	0
7/27/2004	43									3	1	0	0	0	0	0
7/27/2004	43									4	1	0	0	0	0	0

Date	FID	Depth (ft)	DO (mg/L)	DO %	pH	Temp	Cond	Sediment	Shoreline	Total Rake Density	Coontail Density	CLP Density	Elodea Density	EWM Density	Filamentous Algae Density	N. milfoil Density
7/27/2004	44	10.5	8.38	104	9.28	26.66	0.224	3		1	2	0	0	0	0	0
7/27/2004	44									2	2	0	0	0	0	0
7/27/2004	44									3	2	0	0	0	0	0
7/27/2004	44									4	2	0	0	0	0	0
7/27/2004	45	8.8	8.44	107	9.28	27.38	0.224	3		1	3	0	0	0	0	0
7/27/2004	45									2	2	0	0	0	0	0
7/27/2004	45									3	2	0	0	0	0	0
7/27/2004	45									4	3	0	0	0	0	0
7/27/2004	46	8	8.48	106	9.27	26.85	0.223	3		1	4	0	0	0	0	0
7/27/2004	46									2	4	0	0	0	0	0
7/27/2004	46									3	4	0	0	0	0	0
7/27/2004	46									4	5	0	0	0	0	0
7/27/2004	47	8	8.58	107	9.28	26.73	0.223	3		1	3	0	0	0	0	0
7/27/2004	47									2	4	0	0	0	0	0
7/27/2004	47									3	4	0	0	0	0	0
7/27/2004	47									4	4	0	0	0	0	0
7/27/2004	48	6	8.47	106	9.27	26.9	0.223	3	26	1	2	0	0	1	0	0
7/27/2004	48									2	0	0	0	1	0	0
7/27/2004	48									3	2	0	0	1	0	0
7/27/2004	48									4	2	0	0	0	0	0
7/27/2004	49	3.5	10.42	130	9.47	26.32	0.226	3	1226	1	0	0	0	1	0	0
7/27/2004	49									2	0	0	0	1	0	0
7/27/2004	49									3	0	0	0	1	0	0
7/27/2004	49									4	0	0	0	1	0	0
			Riparian land						Sediment							
		Nat		Wooded		11			rock	1						
				Herbacious		12			sand	2						
				Shrubs		13			mud	3						
				Emergents		14			detritus	4						
				Wetland		15										
		Disturbed		Cult. Lawn		26										
				Hard Struct.		27										
				Mod. Shore		28										

Appendix C: ***June Plant Survey Maps***


Aquatic Engineering
Plant Prescription
Exotic Species Prescription
Invertebrate Prescription
Aquatic Prescription
Water Quality Prescription
Fish Prescription
Watershed Prescription
Legend
Dense (>80%)
Common (61 – 80%)
Present (41 – 60%)
Sparse (21 – 40%)
Rare (1 – 20%)
None
Total Density (All Species)
GIS Generated Map
Clear Lake, Rock County, Wisconsin
Date: June 8 and 9, 2004
Feet
0
380
760
1,140
Coordinate System GCS North American 1983
Map Scale
1:6,000



Aquatic Engineering

Plant Prescription
Invertebrate Prescription
Exotic Species Prescription
Aquatic Prescription
Water Quality Prescription
Fish Prescription
Watershed Prescription

Legend

- Dense (>80%)
- Common (61 – 80%)
- Present (41 – 60%)
- Sparse (21 – 40%)
- Rare (1 – 20%)
- None

Coon's tail (*Ceratophyllum demersum*)

GIS Generated Map

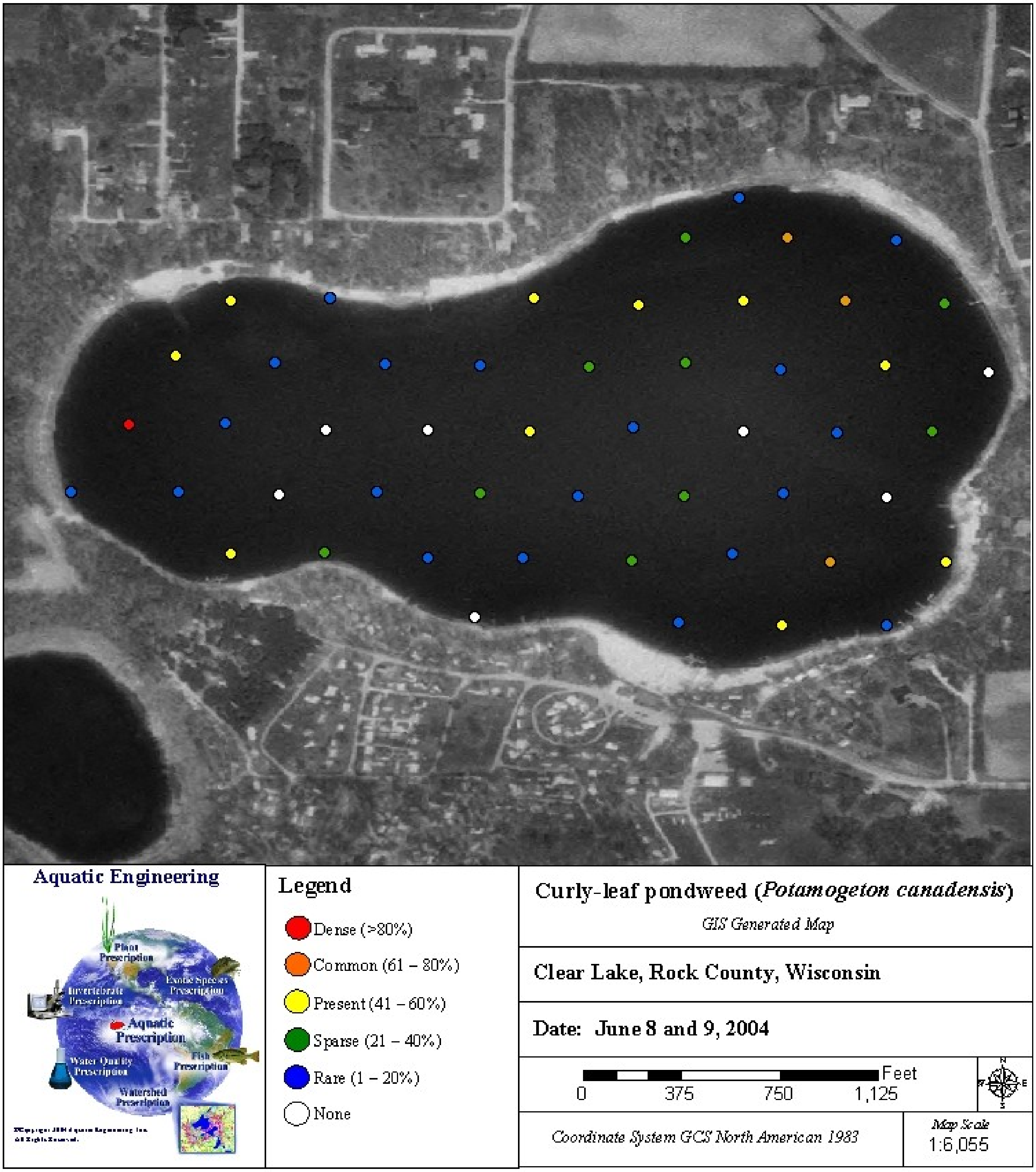
Clear Lake, Rock County, Wisconsin

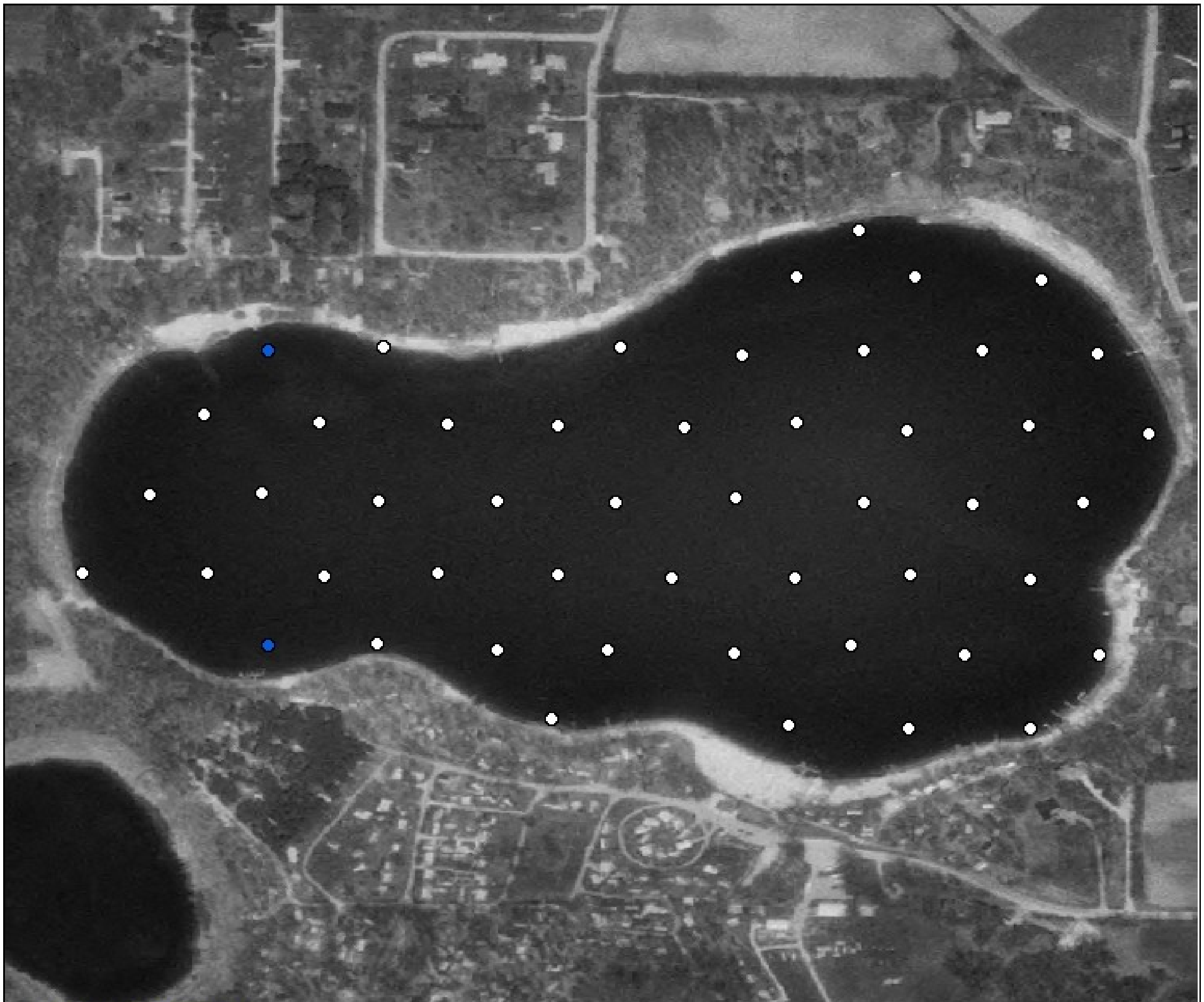
Date: June 8 and 9, 2004

Feet: 0 | 375 | 750 | 1,125

Coordinate System GCS North American 1983

Map Scale 1:6,055


Aquatic Engineering
Plant Prescription
Exotic Species Prescription
Invertebrate Prescription
Aquatic Prescription
Water Quality Prescription
Fish Prescription
Watershed Prescription
Legend
Dense (>80%)
Common (61 – 80%)
Present (41 – 60%)
Sparse (21 – 40%)
Rare (1 – 20%)
None
Curly-leaf pondweed (Potamogeton canadensis)
GIS Generated Map
Clear Lake, Rock County, Wisconsin
Date: June 8 and 9, 2004
Feet
0
375
750
1,125
N
S
E
W
Coordinate System GCS North American 1983
Map Scale
1:6,055



Aquatic Engineering

Legend

- Dense (>80%)
- Common (61 – 80%)
- Present (41 – 60%)
- Sparse (21 – 40%)
- Rare (1 – 20%)
- None

Common waterweed (*Elodea canadensis*)

GIS Generated Map

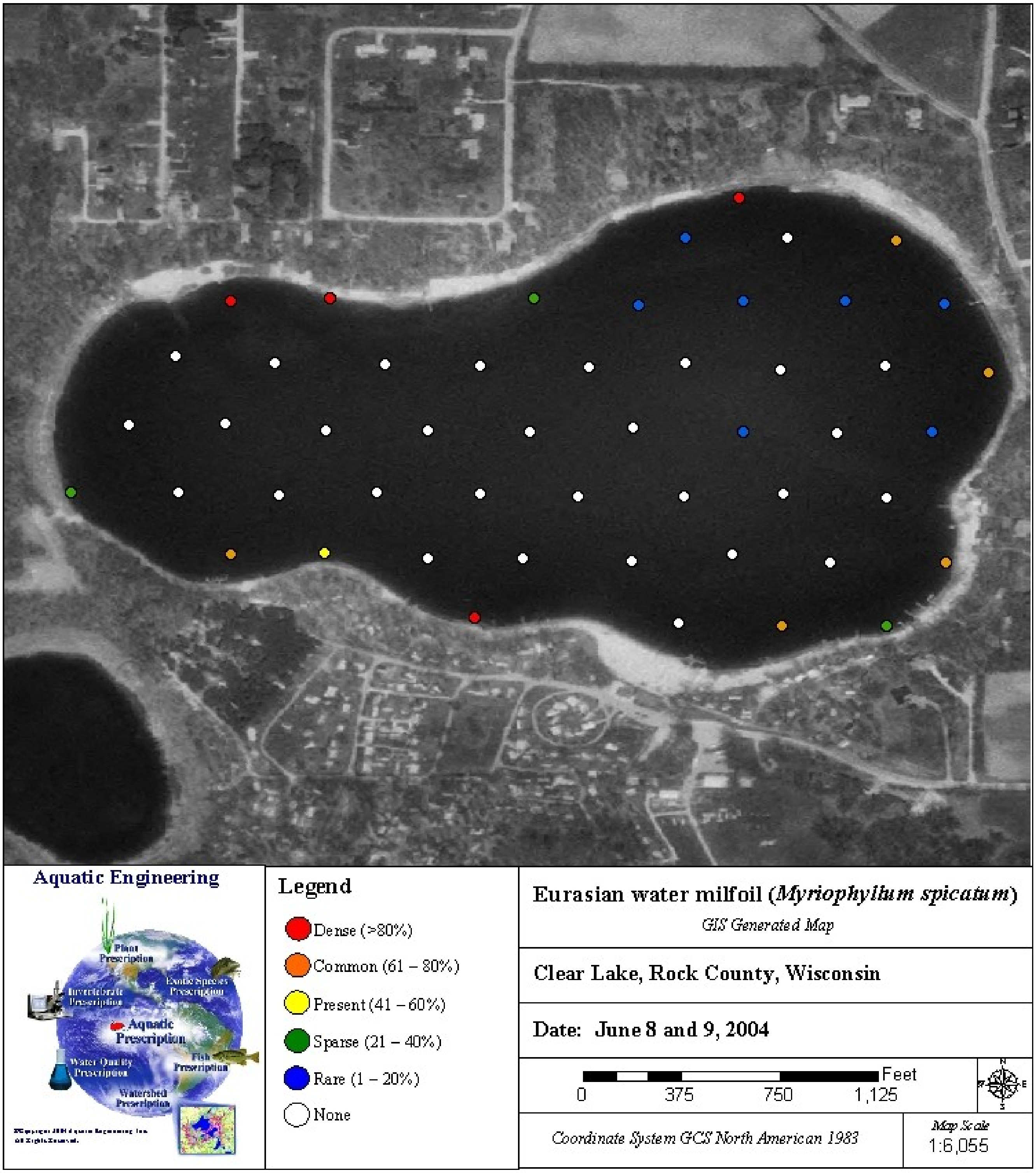
Clear Lake, Rock County, Wisconsin

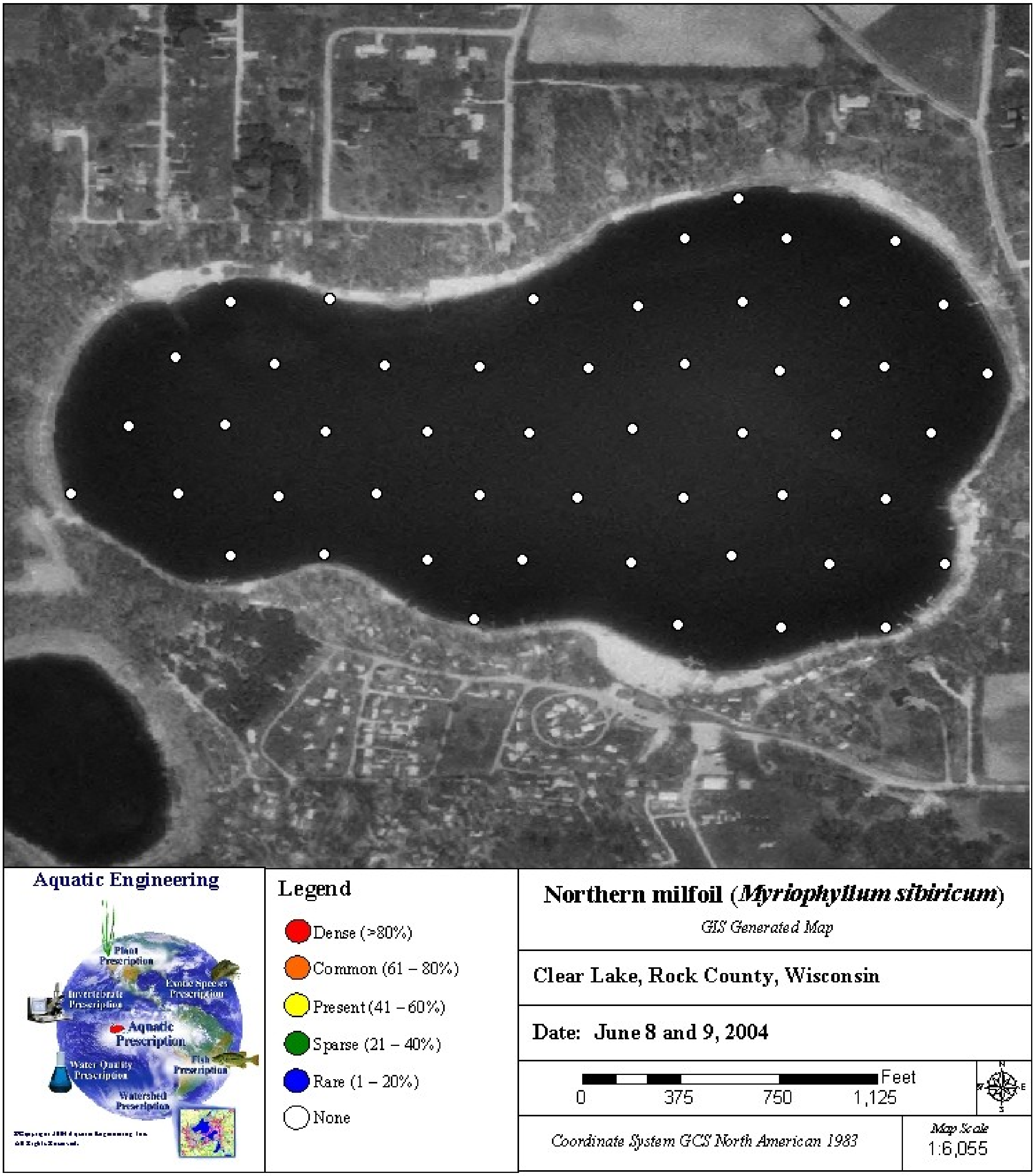
Date: June 8 and 9, 2004

Feet
0 375 750 1,125

Coordinate System GCS North American 1983

Map Scale
1:6,055


Aquatic Engineering
Plant Prescription
Exotic Species Prescription
Invertebrate Prescription
Aquatic Prescription
Water Quality Prescription
Fish Prescription
Watershed Prescription
Legend
Dense (>80%)
Common (61 – 80%)
Present (41 – 60%)
Sparse (21 – 40%)
Rare (1 – 20%)
None
Eurasian water milfoil (*Myriophyllum spicatum*)
GIS Generated Map
Clear Lake, Rock County, Wisconsin
Date: June 8 and 9, 2004
Feet
0 375 750 1,125
Coordinate System GCS North American 1983
Map Scale
1:6,055


Aquatic Engineering
Legend
Dense (>80%)
Common (61 – 80%)
Present (41 – 60%)
Sparse (21 – 40%)
Rare (1 – 20%)
None
Northern milfoil (*Myriophyllum sibiricum*)
GIS Generated Map
Clear Lake, Rock County, Wisconsin
Date: June 8 and 9, 2004
Feet
0
375
750
1,125
Coordinate System GCS North American 1983
Map Scale
1:6,055

Appendix D: ***June Plant Survey Raw Data***

Date	FID	Depth (ft)	DO (mg/L)	DO %	pH	Temp	Cond	Sediment	Shoreline	Total Rake Density	Coontail Density	CLP Density	Elodea Density	EWM Density	Filamentous Algae Density	N. milfoil Density
6/9/2004	0	2.6	10.33	153	9.61	26.3	33.7	3	26	1	0	0	0	5	0	0
6/9/2004	0									2	0	0	0	5	0	0
6/9/2004	0									3	0	0	0	4	0	0
6/9/2004	0									4	0	0	0	5	0	0
6/9/2004	1	9.2	10.8	140	9.69	27.3	34.3	2		1	5	0	0	0	0	0
6/9/2004	1									2	5	0	0	0	0	0
6/9/2004	1									3	2	3	0	0	0	0
6/9/2004	1									4	5	0	0	0	0	0
6/9/2004	2	5.8	12.3	162	9.68	29.3	32.3	3		1	1	3	0	4	0	0
6/9/2004	2									2	0	1	0	5	0	0
6/9/2004	2									3	0	3	0	3	0	0
6/9/2004	2									4	0	5	0	1	0	0
6/9/2004	3	2.7	10.3	134	9.6	27.4	33.6	3	1126	1	2	0	0	1	0	0
6/9/2004	3									2	2	1	0	1	0	0
6/9/2004	3									3	1	1	0	2	0	0
6/9/2004	3									4	0	1	0	2	0	0
6/9/2004	4	5	13.88	186	9.77	28.1	33.6	3		1	0	2	1	4	0	0
6/9/2004	4									2	0	3	0	5	0	0
6/9/2004	4									3	0	4	0	3	0	0
6/9/2004	4									4	0	3	0	3	0	0
6/9/2004	5	2.3	12.25	152	9.52	25.7	33.2	3		1	0	2	0	3	0	0
6/9/2004	5									2	0	1	0	4	0	0
6/9/2004	5									3	0	1	0	3	0	0
6/9/2004	5									4	0	2	0	2	0	0
6/9/2004	6	6.5	10.32	129	9.47	25.8	33.9	3		1	4	1	0	0	0	0
6/9/2004	6									2	5	1	0	0	0	0
6/9/2004	6									3	5	1	0	0	0	0
6/9/2004	6									4	5	0	0	0	0	0
6/9/2004	7	7.3	11.37	143	9.34	26.3	34	3		1	4	1	0	0	0	0
6/9/2004	7									2	5	1	0	0	0	0
6/9/2004	7									3	3	1	0	0	0	0
6/9/2004	7									4	4	1	0	0	0	0
6/9/2004	8	7.7	10.5	138	9.7	27.2	32.7	3		1	1	1	0	0	0	0
6/9/2004	8									2	3	0	0	0	0	0
6/9/2004	8									3	2	2	0	0	0	0
6/9/2004	8									4	2	3	0	0	0	0
6/9/2004	9	7.6	10.38	132	9.54	26.7	34.4	3		1	5	1	0	0	0	0
6/9/2004	9									2	5	1	0	0	0	0
6/9/2004	9									3	5	1	0	0	0	0
6/9/2004	9									4	4	1	0	0	0	0
6/9/2004	10	8	10.7	137	9.58	27.7	33.2	3		1	4	3	0	0	0	0
6/9/2004	10									2	3	3	0	0	0	0
6/9/2004	10									3	2	5	0	0	0	0
6/9/2004	10									4	4	3	0	0	0	0

Date	FID	Depth (ft)	DO (mg/L)	DO %	pH	Temp	Cond	Sediment	Shoreline	Total Rake Density	Coontail Density	CLP Density	Elodea Density	EWM Density	Filamentous Algae Density	N. milfoil Density
6/9/2004	11	2.2	9.96	128	9.47	27.1	33.6	3	1228	1	0	3	0	4	0	0
6/9/2004	11									2	0	2	0	4	0	0
6/9/2004	11									3	0	3	0	3	0	0
6/9/2004	11									4	0	2	0	3	0	0
6/9/2004	12	3.6	14.1	186	9.63	28.5	33.1	3	11	1	1	0	0	1	0	0
6/9/2004	12									2	2	0	0	2	0	0
6/9/2004	12									3	1	2	0	1	0	0
6/9/2004	12									4	2	0	0	2	0	0
6/9/2004	13	6.3	11.2	139	9.49	25.6	33.5	3		1	4	0	0	0	0	0
6/9/2004	13									2	4	0	0	0	0	0
6/9/2004	13									3	5	0	0	0	0	0
6/9/2004	13									4	3	1	0	0	0	0
6/9/2004	14	6.8	12.18	154	9.46	26	34.5	3		1	4	0	0	0	0	0
6/9/2004	14									2	4	0	0	0	0	0
6/9/2004	14									3	5	0	0	0	0	0
6/9/2004	14									4	5	0	0	0	0	0
6/9/2004	15	8.3	10.62	134	9.44	25.6	34	3		1	3	1	0	0	0	0
6/9/2004	15									2	5	0	0	0	0	0
6/9/2004	15									3	4	1	0	0	0	0
6/9/2004	15									4	5	0	0	0	0	0
6/9/2004	16	8.4	10.03	185	9.45	25.6	33.8	3		1	3	1	0	0	0	0
6/9/2004	16									2	5	0	0	0	0	0
6/9/2004	16									3	1	3	0	0	0	0
6/9/2004	16									4	2	2	0	0	0	0
6/9/2004	17	7.9	10.2	129	9.34	25.8	33.8	3		1	5	1	0	0	0	0
6/9/2004	17									2	5	0	0	0	0	0
6/9/2004	17									3	4	0	0	0	0	0
6/9/2004	17									4	4	0	0	0	0	0
6/9/2004	18	8.3	10.05	127	9.27	26	33.9	3		1	5	1	0	0	0	0
6/9/2004	18									2	5	1	0	0	0	0
6/9/2004	18									3	4	2	0	0	0	0
6/9/2004	18									4	5	1	0	0	0	0
6/9/2004	19	9.9	10	189	9.44	26.3	33.9	3		1	5	0	0	0	0	0
6/9/2004	19									2	4	0	0	0	0	0
6/9/2004	19									3	5	0	0	0	0	0
6/9/2004	19									4	5	1	0	0	0	0
6/9/2004	20	17	10.85	139	9.49	27.2	33.9	3		1	0	0	0	0	0	0
6/9/2004	20									2	0	0	0	0	0	0
6/9/2004	20									3	0	0	0	0	0	0
6/9/2004	20									4	0	0	0	0	0	0
6/9/2004	21	3.9	11.65	160	9.7	27.2	33	3		1	3	4	0	0	0	0
6/9/2004	21									2	1	5	0	0	0	0
6/9/2004	21									3	1	4	0	0	0	0
6/9/2004	21									4	2	5	0	0	0	0

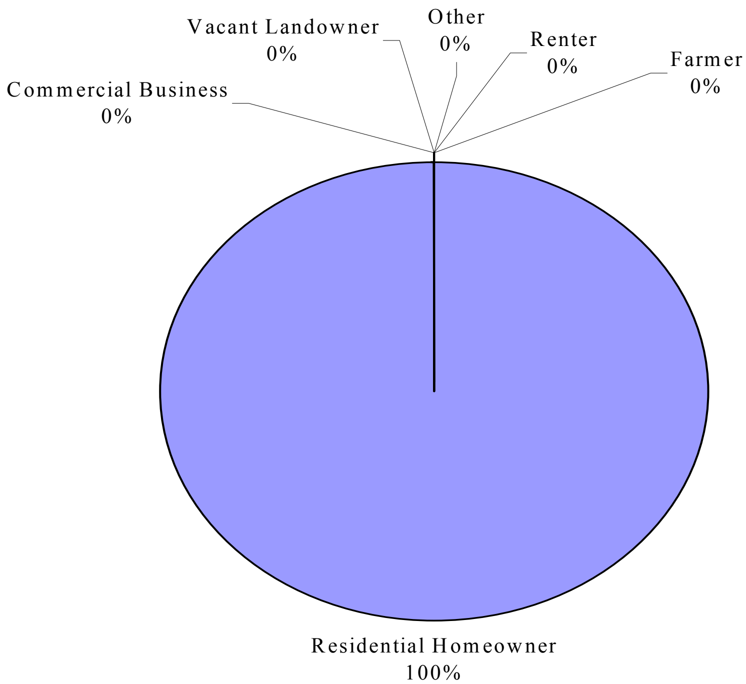
Date	FID	Depth (ft)	DO (mg/L)	DO %	pH	Temp	Cond	Sediment	Shoreline	Total Rake Density	Coontail Density	CLP Density	Elodea Density	EWM Density	Filamentous Algae Density	N. milfoil Density
6/9/2004	22	8	10.85	139	9.48	26	34.5	3		1	5	0	0	0	0	0
6/9/2004	22									2	5	0	0	0	0	0
6/9/2004	22									3	4	0	0	0	0	0
6/9/2004	22									4	1	1	0	0	0	0
6/9/2004	23	6.8	11.77	150	9.44	26.7	34.5	3		1	4	0	0	0	0	0
6/9/2004	23									2	5	0	0	0	0	0
6/9/2004	23									3	5	0	0	0	0	0
6/9/2004	23									4	4	0	0	0	0	0
6/9/2004	24	7.5	9.84	124	9.45	25.4	33.9	3		1	4	0	0	0	0	0
6/9/2004	24									2	4	0	0	0	0	0
6/9/2004	24									3	2	0	0	0	0	0
6/9/2004	24									4	4	0	0	0	0	0
6/9/2004	25	11.1	10.1	128	9.44	25.8	34.1	3		1	0	2	0	0	0	0
6/9/2004	25									2	1	2	0	0	0	0
6/9/2004	25									3	1	3	0	0	0	0
6/9/2004	25									4	1	3	0	0	0	0
6/9/2004	26	10.5	10.8	136	9.43	25.9	34	3		1	4	0	0	0	0	0
6/9/2004	26									2	5	0	0	0	0	0
6/9/2004	26									3	5	1	0	0	0	0
6/9/2004	26									4	4	1	0	0	0	0
6/9/2004	27	13.3	10.4	130	9.3	26.1	33.9	3		1	2	0	0	0	0	0
6/9/2004	27									2	2	0	0	0	0	0
6/9/2004	27									3	0	0	0	1	0	0
6/9/2004	27									4	1	0	0	0	0	0
6/9/2004	28	11.7	10.3	132	9.44	27.1	34.2	3		1	5	1	0	0	0	0
6/9/2004	28									2	4	1	0	0	0	0
6/9/2004	28									3	4	0	0	0	0	0
6/9/2004	28									4	3	0	0	0	0	0
6/9/2004	29	7.5	9.95	188	9.49	27.2	33.8	3		1	2	2	0	0	0	0
6/9/2004	29									2	1	3	0	0	0	0
6/9/2004	29									3	2	3	0	0	0	0
6/9/2004	29									4	1	0	0	1	0	0
6/9/2004	30	7.6	9.97	128	9.52	27.1	34.3	3		1	3	3	0	0	0	0
6/9/2004	30									2	4	0	0	0	0	0
6/9/2004	30									3	4	2	0	0	0	0
6/9/2004	30									4	4	4	0	0	0	0
6/9/2004	31	8.2	10.74	137	9.46	26.6	34.6	3		1	3	1	0	0	0	0
6/9/2004	31									2	1	0	0	0	0	0
6/9/2004	31									3	4	1	0	0	0	0
6/9/2004	31									4	4	0	0	0	0	0
6/9/2004	32	7.5	10.41	135	9.4	27.8	34.6	3		1	3	0	0	0	0	0
6/9/2004	32									2	3	0	0	0	0	0
6/9/2004	32									3	3	1	0	0	0	0
6/9/2004	32									4	3	1	0	0	0	0

Date	FID	Depth (ft)	DO (mg/L)	DO %	pH	Temp	Cond	Sediment	Shoreline	Total Rake Density	Coontail Density	CLP Density	Elodea Density	EWM Density	Filamentous Algae Density	N. milfoil Density
6/9/2004	33	7.8	9.1	115	9.51	25.7	33.8	3		1	2	1	0	0	0	0
6/9/2004	33									2	1	1	0	0	0	0
6/9/2004	33									3	2	1	0	0	0	0
6/9/2004	33									4	1	1	0	0	0	0
6/9/2004	34	12	9.8	123	9.45	25.6	34	3		1	4	1	0	0	0	0
6/9/2004	34									2	2	2	0	0	0	0
6/9/2004	34									3	2	2	0	0	0	0
6/9/2004	34									4	1	2	0	0	0	0
6/9/2004	35	12.2	9.7	122	9.42	25.8	33.7	2		1	0	1	0	0	0	0
6/9/2004	35									2	0	2	0	0	0	0
6/9/2004	35									3	0	1	0	0	0	0
6/9/2004	35									4	0	2	0	0	0	0
6/9/2004	36	14.6	9.7	122	9.37	26.4	33.6	2		1	0	1	0	0	0	0
6/9/2004	36									2	1	1	0	0	0	0
6/9/2004	36									3	1	1	0	0	0	0
6/9/2004	36									4	1	0	0	0	0	0
6/9/2004	37	10.1	9.3	120	9.42	26.8	33.9	2		1	1	3	0	0	0	0
6/9/2004	37									2	1	3	0	0	0	0
6/9/2004	37									3	1	3	0	0	0	0
6/9/2004	37									4	1	2	0	0	0	0
6/9/2004	38	5.7	10.7	138	9.5	27.3	33.7	3	26	1	0	0	0	5	0	0
6/9/2004	38									2	0	0	0	3	0	0
6/9/2004	38									3	2	0	0	4	0	0
6/9/2004	38									4	0	0	0	4	0	0
6/9/2004	39	2.9	12.7	166	9.9	28.1	33.3	3		1	0	1	0	5	0	0
6/9/2004	39									2	0	3	1	5	0	0
6/9/2004	39									3	0	4	0	3	0	0
6/9/2004	39									4	0	2	0	4	0	0
6/9/2004	40	3	15.2	202	9.85	29	33.4	2	2612	1	0	0	0	5	0	0
6/9/2004	40									2	0	1	0	5	0	0
6/9/2004	40									3	0	0	0	5	0	0
6/9/2004	40									4	0	0	0	5	0	0
6/9/2004	41	6.3	11.01	156	9.63	28	33.4	3		1	0	4	0	2	0	0
6/9/2004	41									2	0	4	0	1	0	0
6/9/2004	41									3	0	2	0	2	0	0
6/9/2004	41									4	0	1	0	2	0	0
6/9/2004	42	10.3	10.5	132	9.46	25.8	33.8	3		1	0	2	0	0	0	0
6/9/2004	42									2	1	3	0	0	0	0
6/9/2004	42									3	2	2	0	1	0	0
6/9/2004	42									4	2	3	0	0	0	0
6/9/2004	43	10	10.26	129	9.46	25.9	33.7	3		1	0	2	0	0	0	0
6/9/2004	43									2	1	2	0	1	0	0
6/9/2004	43									3	0	4	0	0	0	0
6/9/2004	43									4	4	1	0	0	0	0

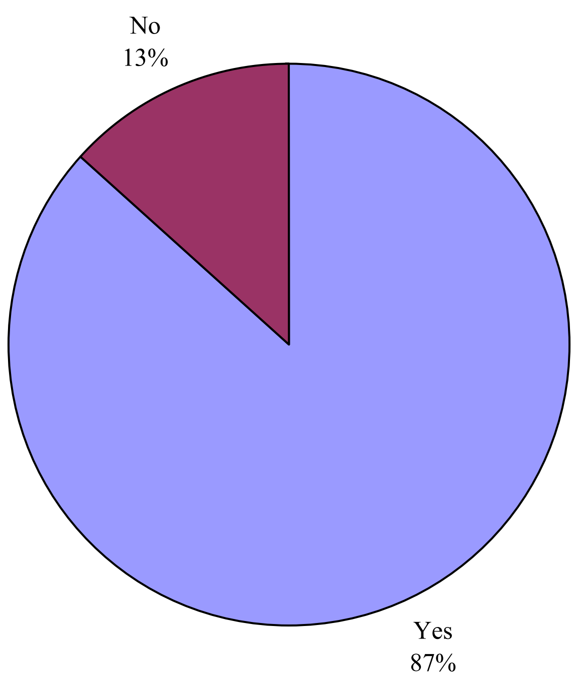
Date	FID	Depth (ft)	DO (mg/L)	DO %	pH	Temp	Cond	Sediment	Shoreline	Total Rake Density	Coontail Density	CLP Density	Elodea Density	EWM Density	Filamentous Algae Density	N. milfoil Density
6/9/2004	44	9.8	10.1	129	9.4	26.5	33.7	3		1	4	1	0	1	0	0
6/9/2004	44									2	0	3	0	0	0	0
6/9/2004	44									3	1	5	0	0	0	0
6/9/2004	44									4	3	4	0	0	0	0
6/9/2004	45	5.3	10.2	131	9.56	27	33.8	3		1	3	1	0	0	0	0
6/9/2004	45									2	3	1	0	0	0	0
6/9/2004	45									3	3	1	0	0	0	0
6/9/2004	45									4	1	4	0	1	0	0
6/9/2004	46	6.2	9.5	120	9.44	26.1	33.6	3		1	3	1	0	0	0	0
6/9/2004	46									2	2	2	0	0	0	0
6/9/2004	46									3	1	2	0	2	0	0
6/9/2004	46									4	3	2	0	1	0	0
6/9/2004	47	7.5	9.64	122	9.47	26.2	32.4	3		1	3	2	0	0	0	0
6/9/2004	47									2	2	4	0	0	0	0
6/9/2004	47									3	4	3	0	0	0	0
6/9/2004	47									4	1	4	0	0	0	0
6/9/2004	48	6	9.8	123	9.58	26.7	33.7	3	26	1	0	0	0	5	0	0
6/9/2004	48									2	0	0	0	4	0	0
6/9/2004	48									3	0	1	0	4	0	0
6/9/2004	48									4	1	3	0	2	0	0
6/9/2004	49	1.7	9.4	120	9.47	26.4	33.3	3	1226	1	0	2	0	3	0	0
6/9/2004	49									2	0	0	0	4	0	0
6/9/2004	49									3	0	0	0	5	0	0
6/9/2004	49									4	0	1	0	5	0	0
			Riparian land						Sediment							
		Nat		Wooded		11			rock	1						
				Herbacious		12			sand	2						
				Shrubs		13			mud	3						
				Emergents		14			detritus	4						
				Wetland		15										
		Disturbed		Cult. Lawn		26										
				Hard Struct.		27										
				Mod. Shore		28										

Appendix E: ***2005 Residential Use Survey and Results***

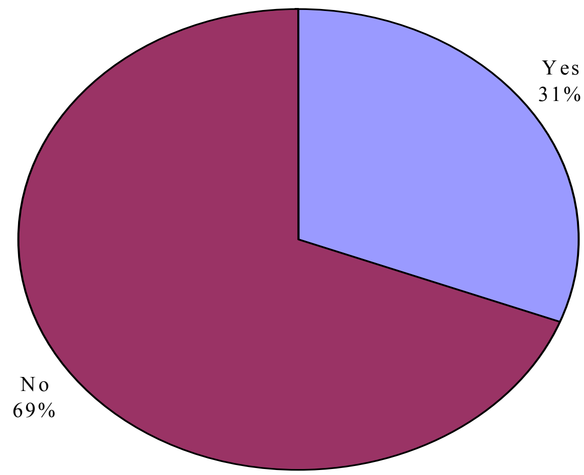
1. What type of property owner are you? (15 of 15 responded)



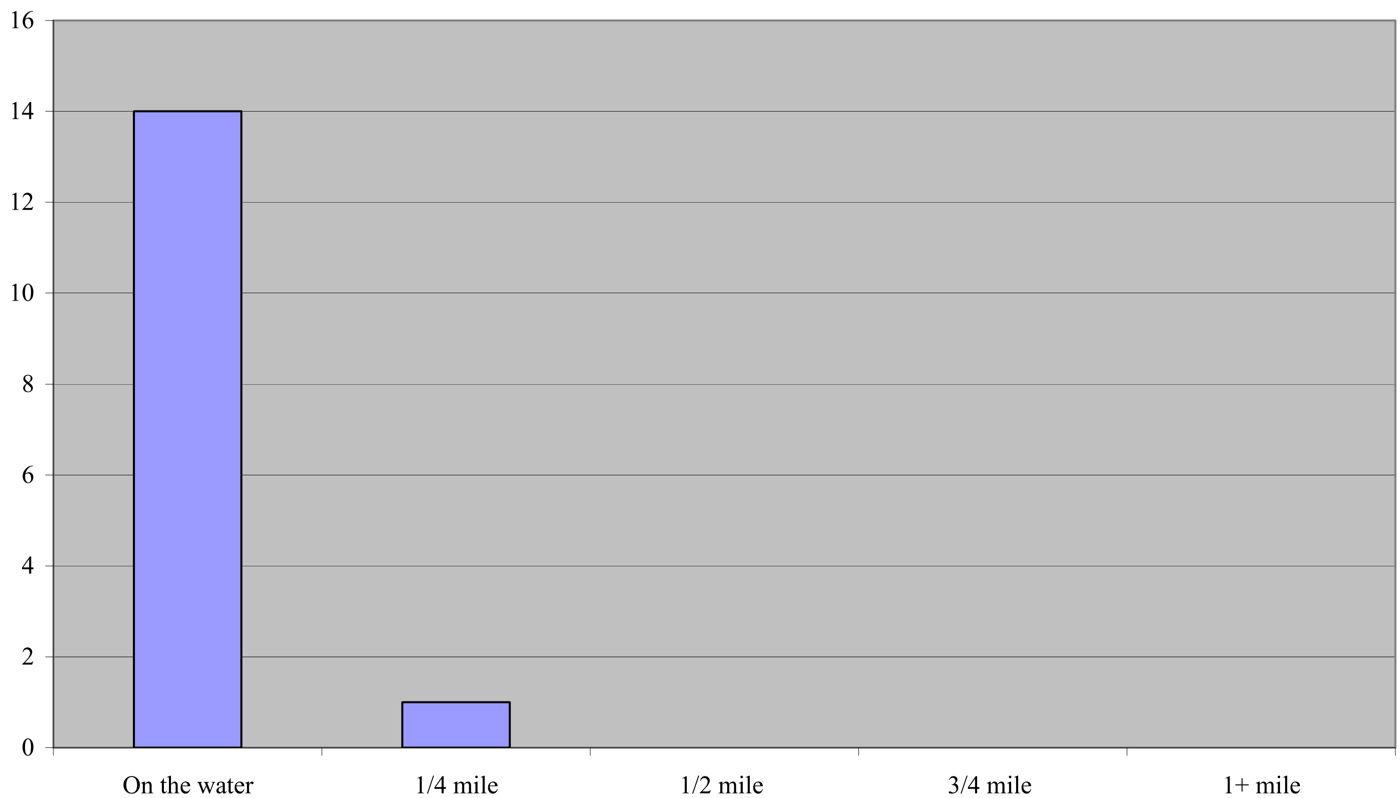
2A. Are you a dues-paying resident of the Lake Association? (15 of 15 responded)



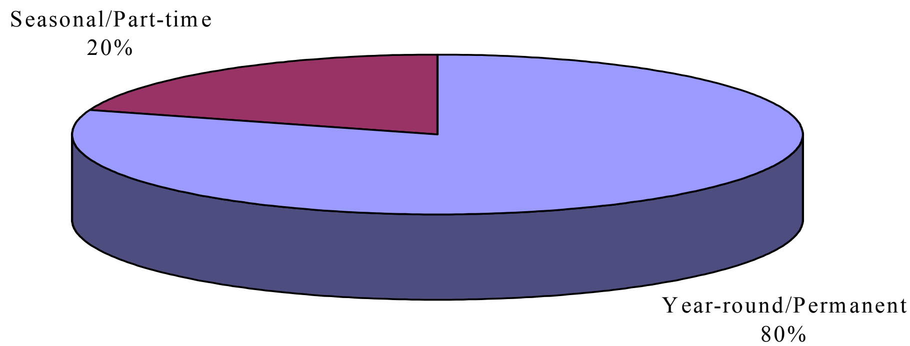
2B. Are you apposed to forming a Lake District? (13 of 15 responded)



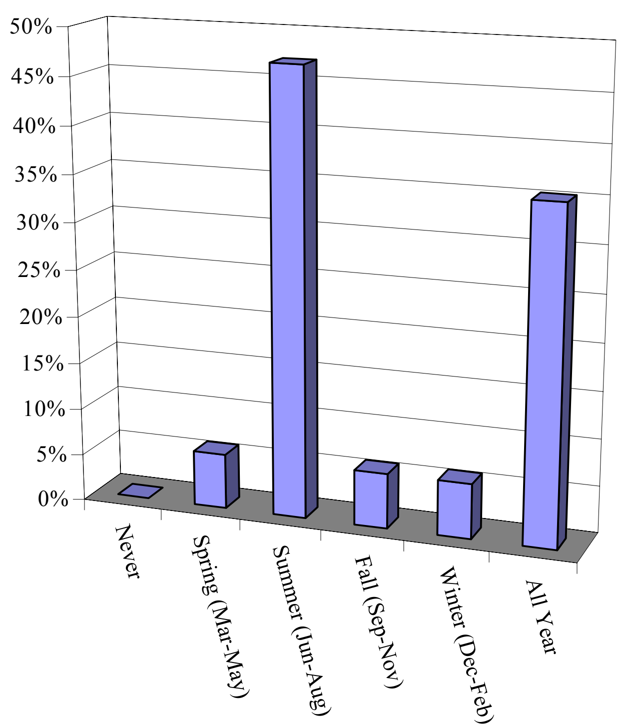
3. Approximately what distance from the lake is your property located? (15 of 15 responded)



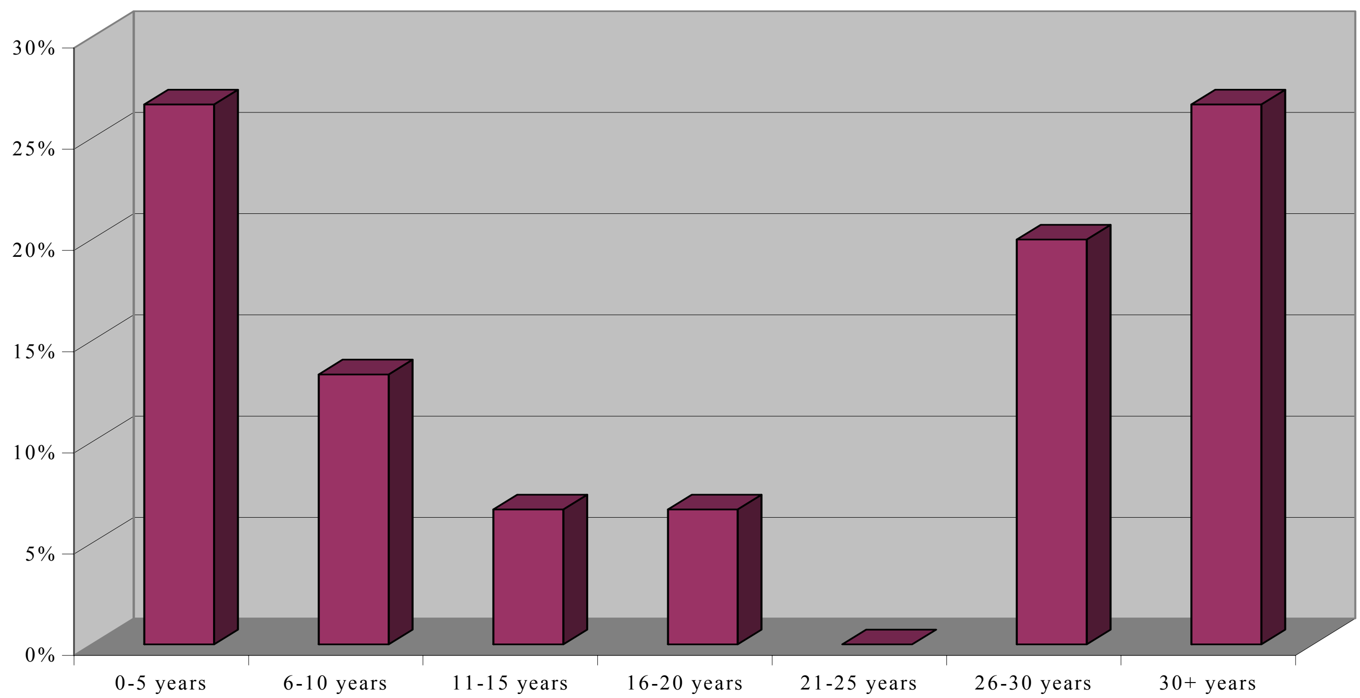
4. Which of the following best describes your residency status? (15 of 15 responded)



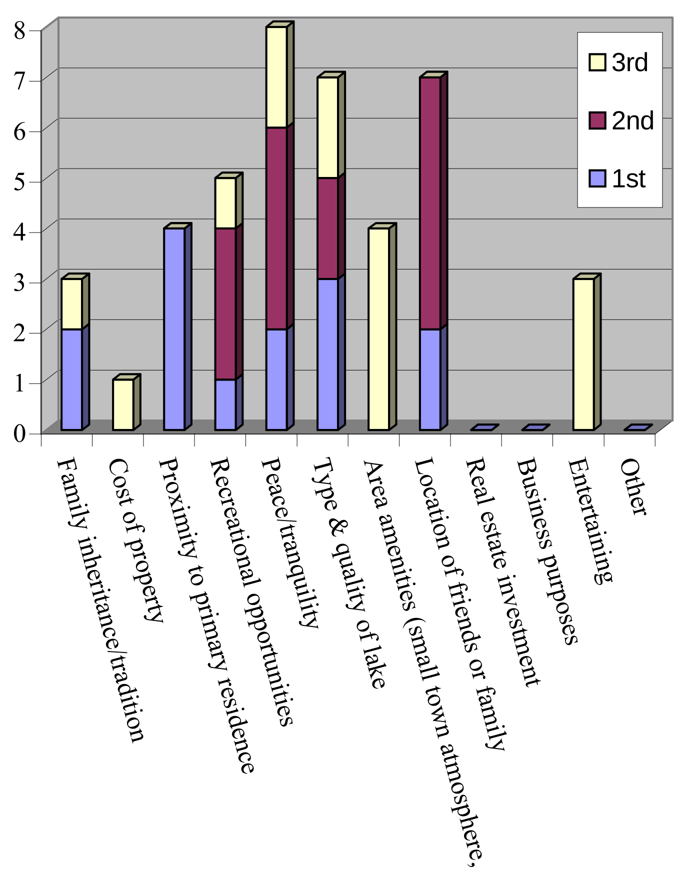
5. When do you most often spend time recreating on your lake? (15 of 15 responded)



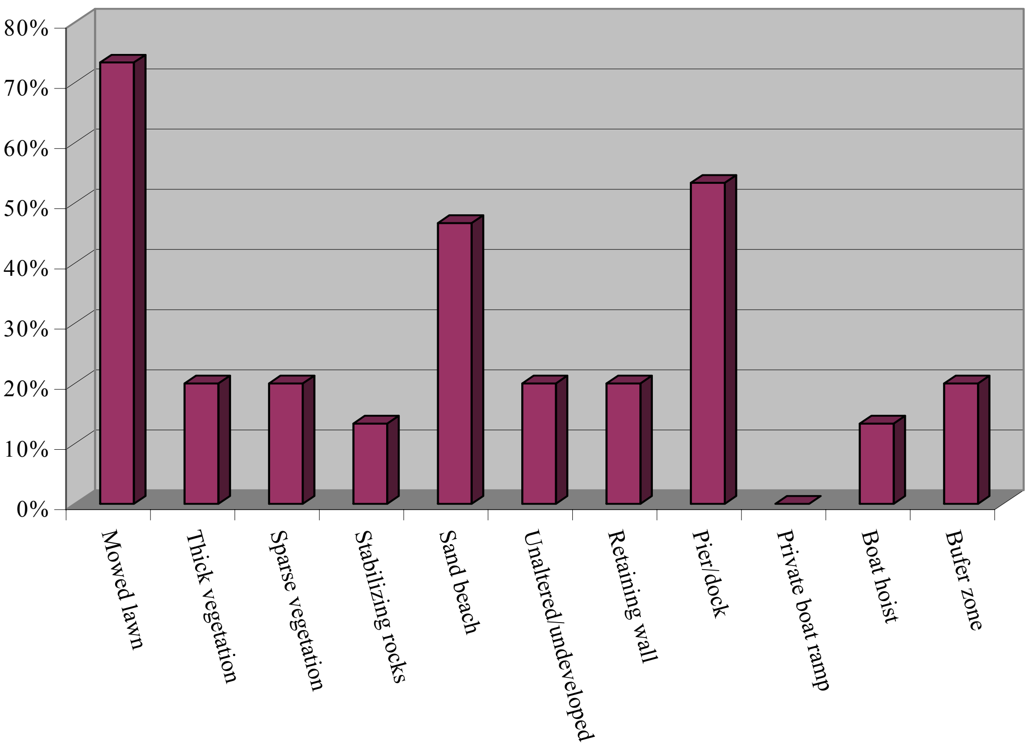
6. How many years have you owned property in your lake District? (15 of 15 responded)



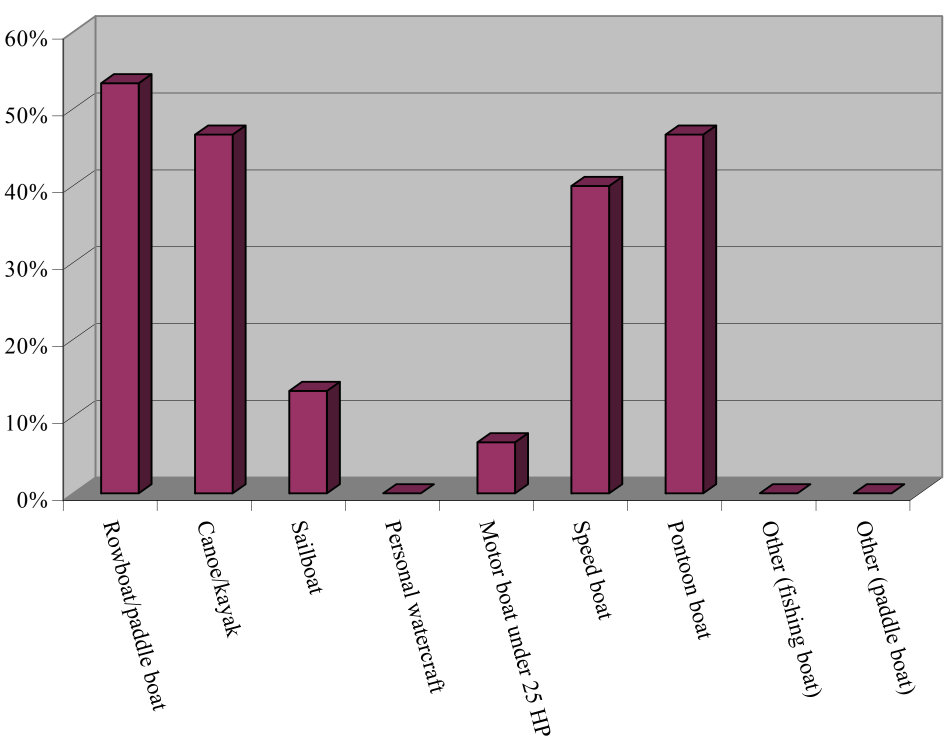
7. List the top three reasons why you chose to own property on or near your lake? (14 of 15 responded)



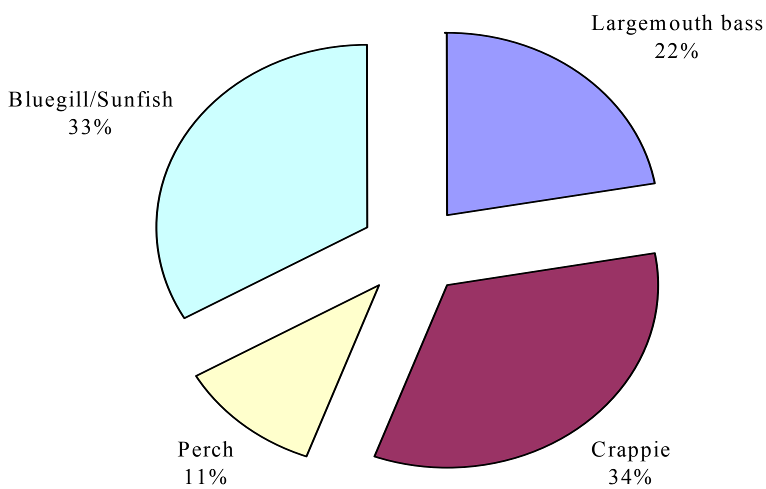
8. If you own lakefront property, which of the following describes your lake frontage within 25 feet of the water's edge? (Check all that apply.) (14 of 15 responded)



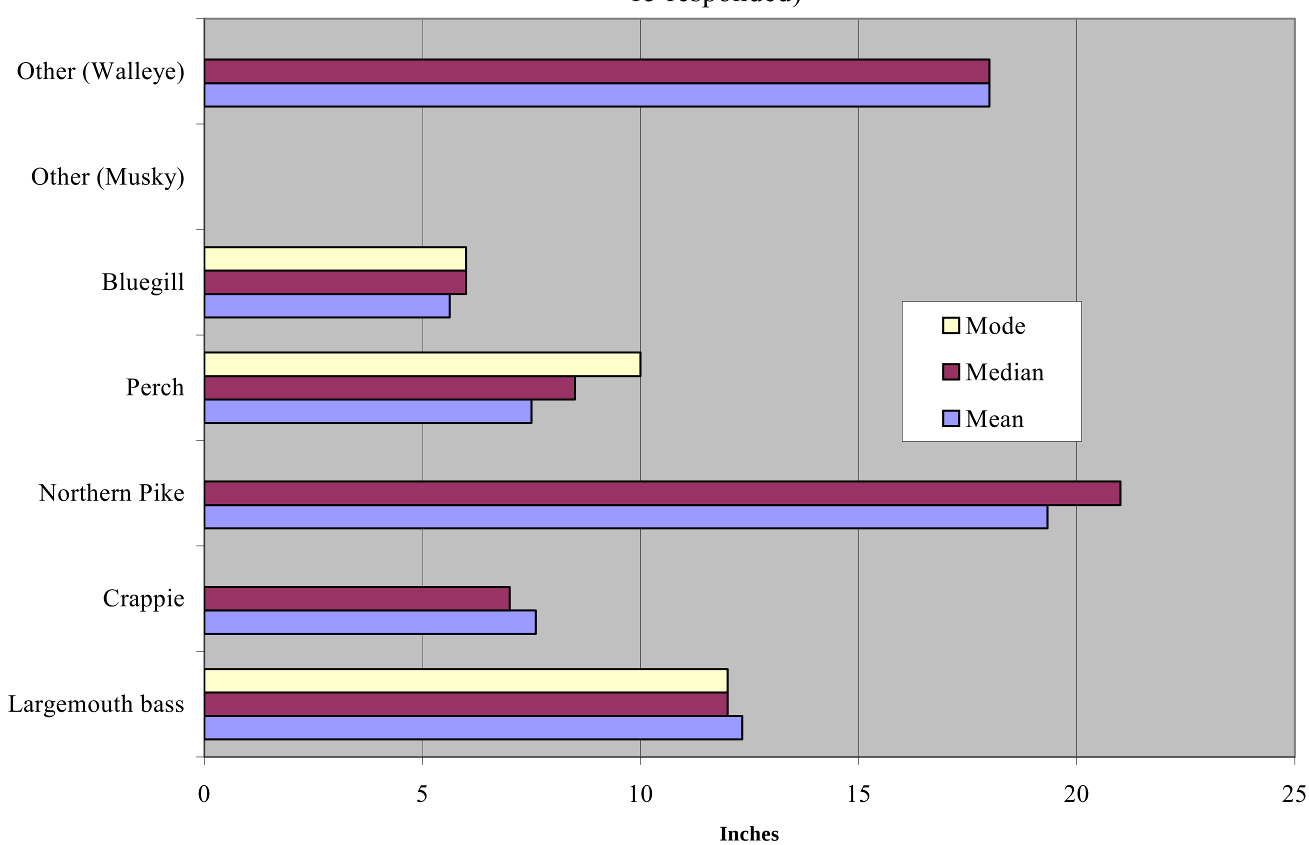
9. What types of watercraft do you routinely use on your lake? (Check all that apply.) (15 of 15 responded)



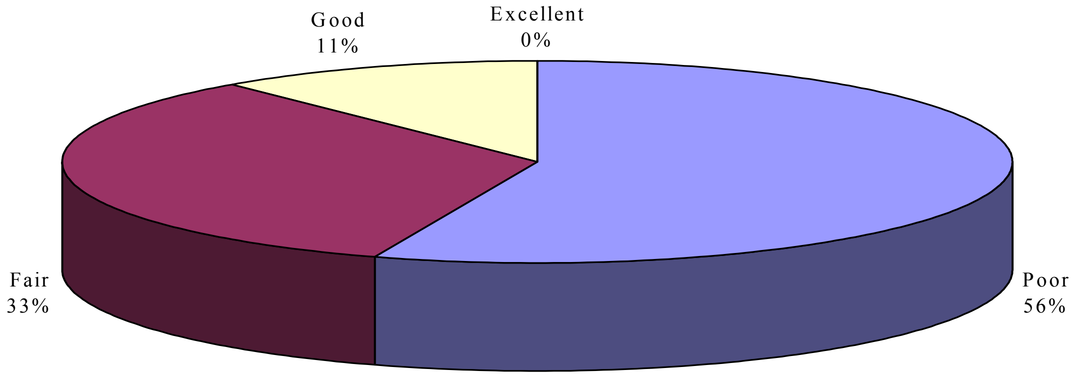
10A. Rank the following fish species that you prefer to catch on your lake? (shows % of people that ranked each species #1) (8 of 15 responded)



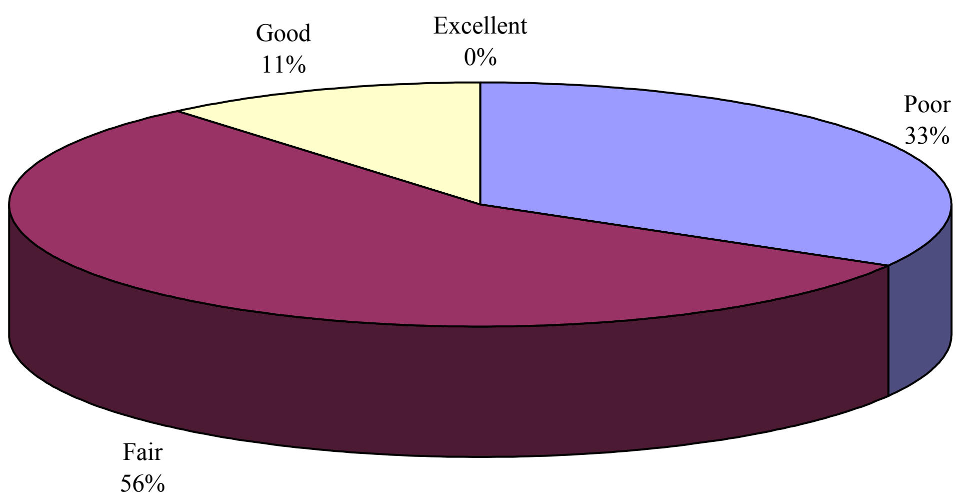
10B. What is the average size of each type of fish that can be caught on your lake? (8 of 15 responded)



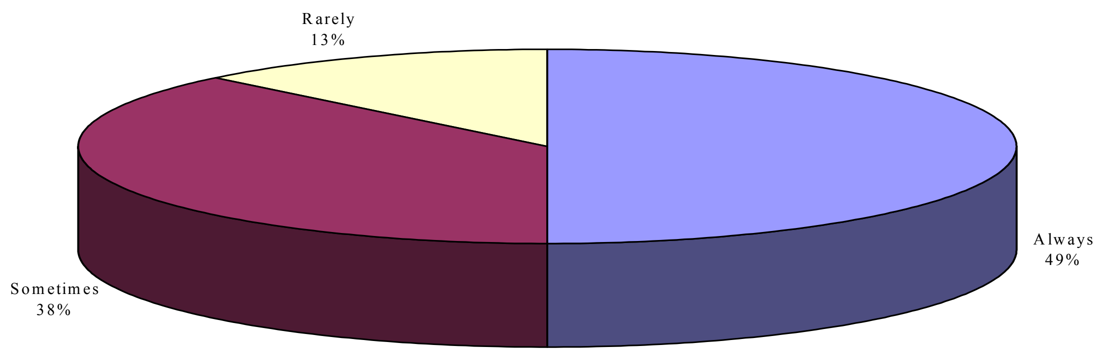
10C. How would you rate the quality of fishing on your lake in terns of fish SIZE? (9 of 15 responded)



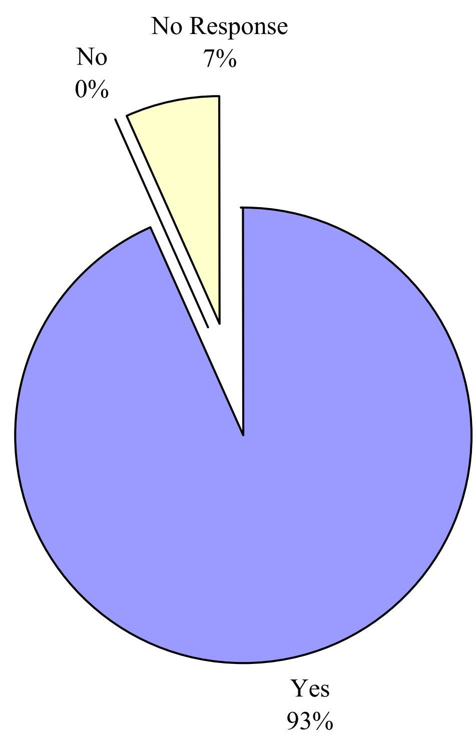
10D. How would you rate the quality of fishing on your lake in terns of fish NUMBERS?
(9 of 15 responded)



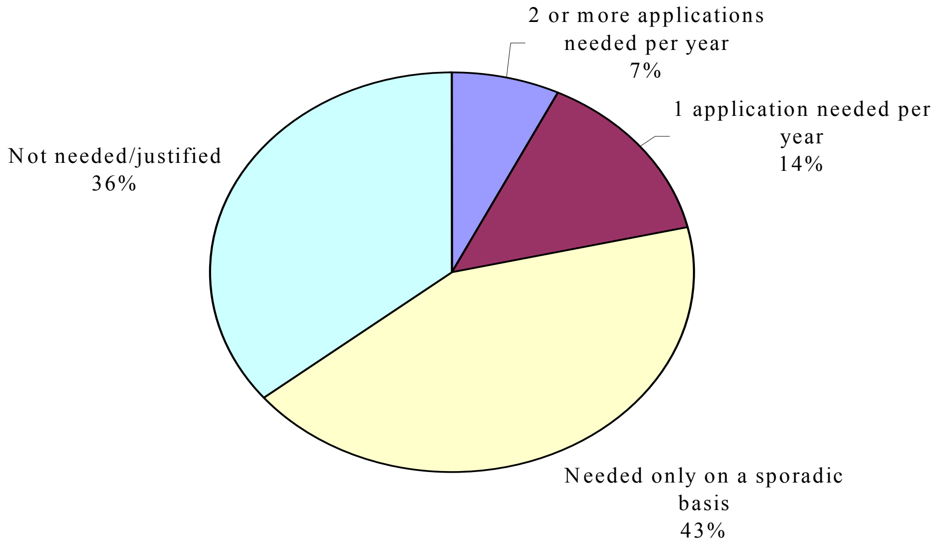
10E. Do you voluntarily practice "catch and relaese" when fishing for species other than panfish? (8 of 15 responded)



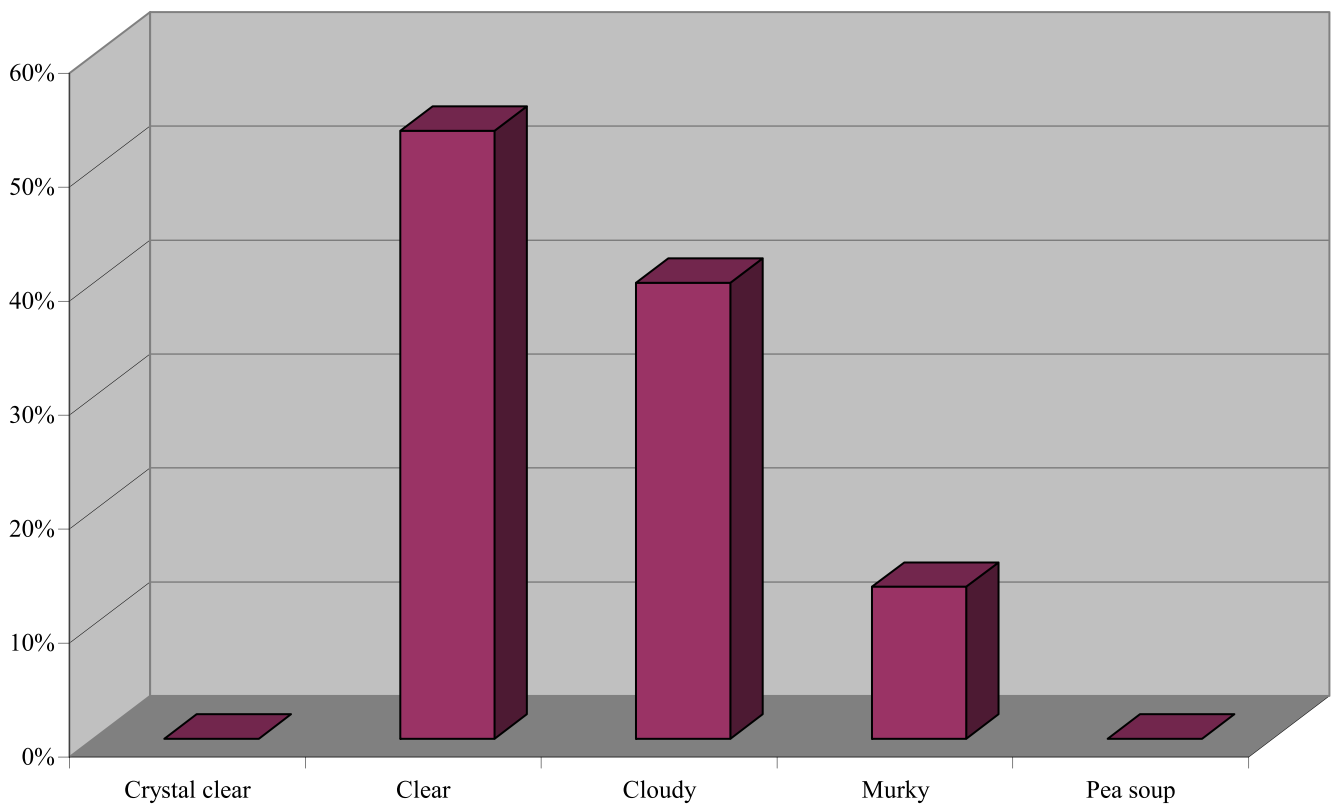
11. Do you feel your lake has more than adequate public access? (14 of 15 responded)



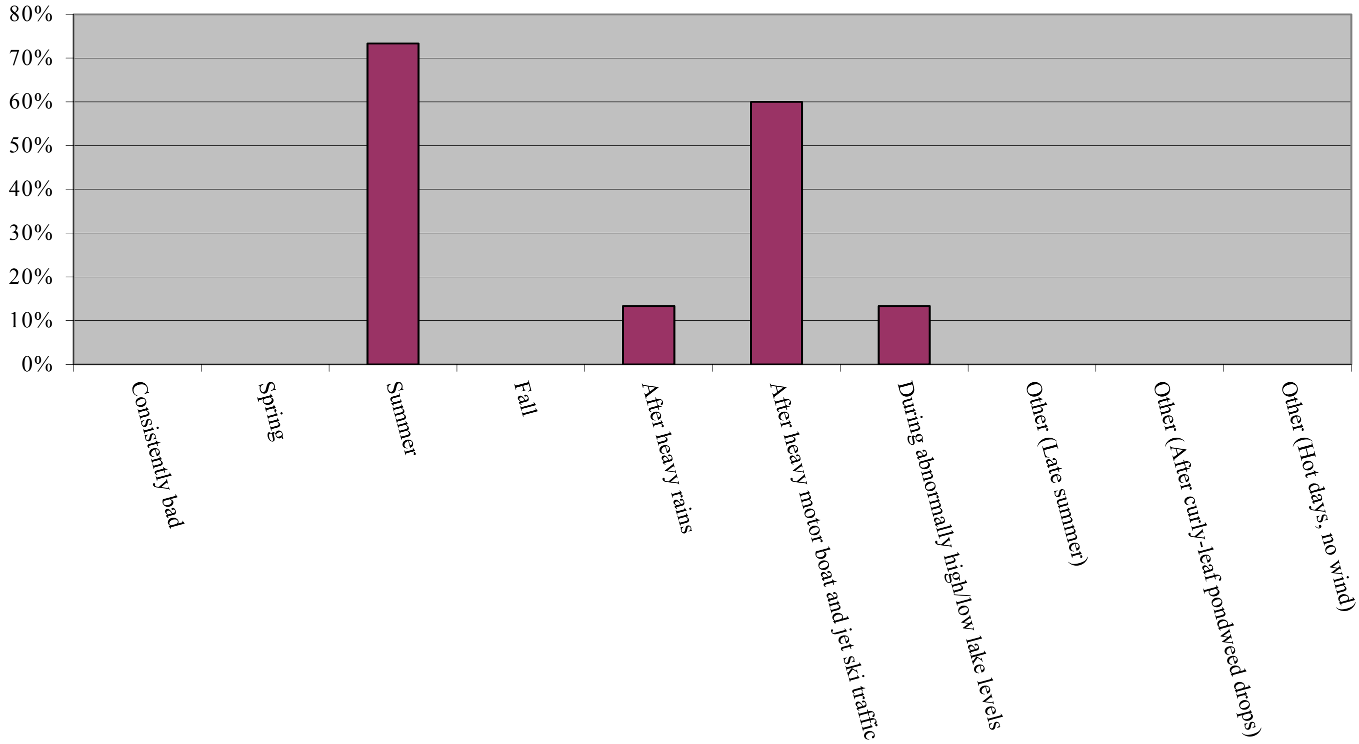
12. What is your opinion regarding the use of fertilizers and/or weed killer to maintain lawns around your lake (check all that apply) (14 of 15 responded)



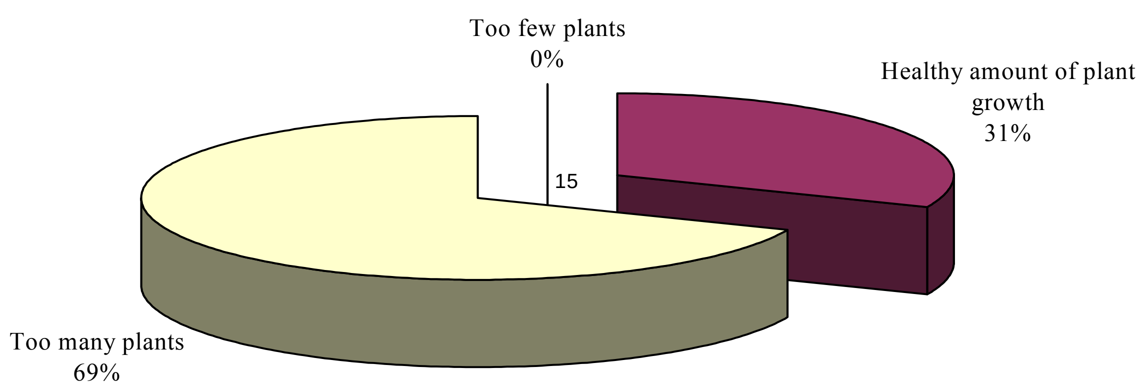
13. Overall, how would you descibe the water clarity in your lake during the winter months? (15 of 15 responded)



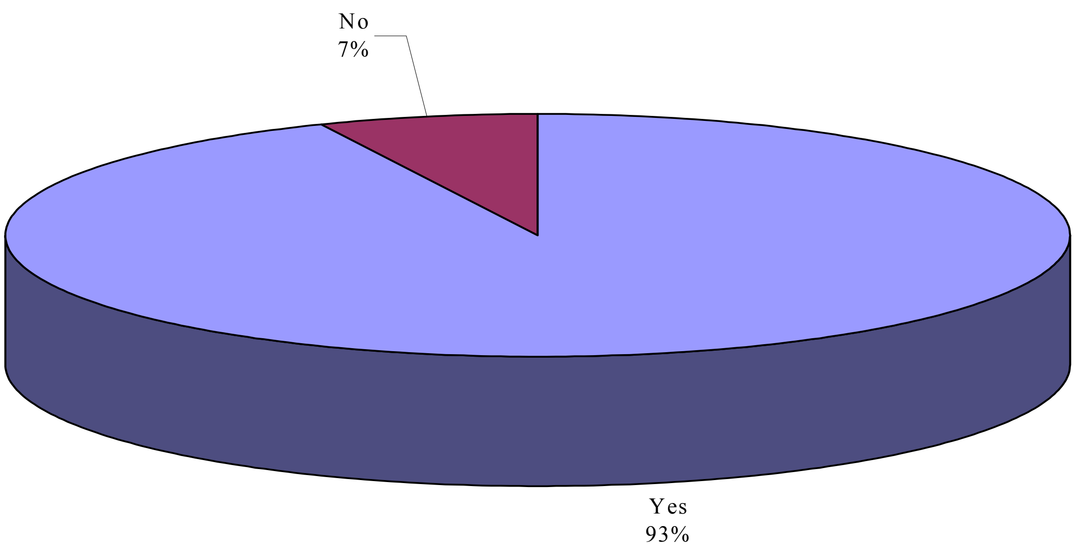
14. When is water clarity at its worst? (check all that apply) (15 of 15 responded)



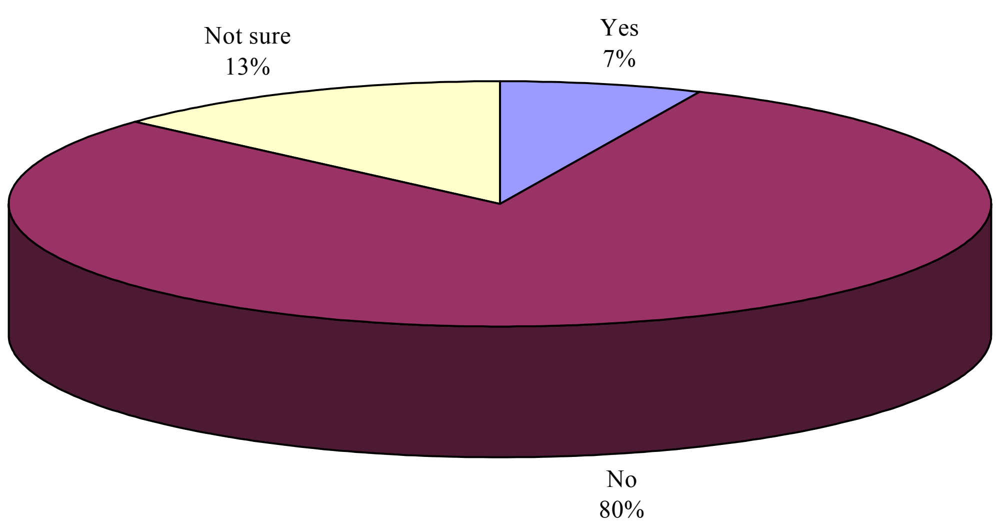
15. Overall, how would you describe your lake's aquatic plant growth? (15 of 15 responded)



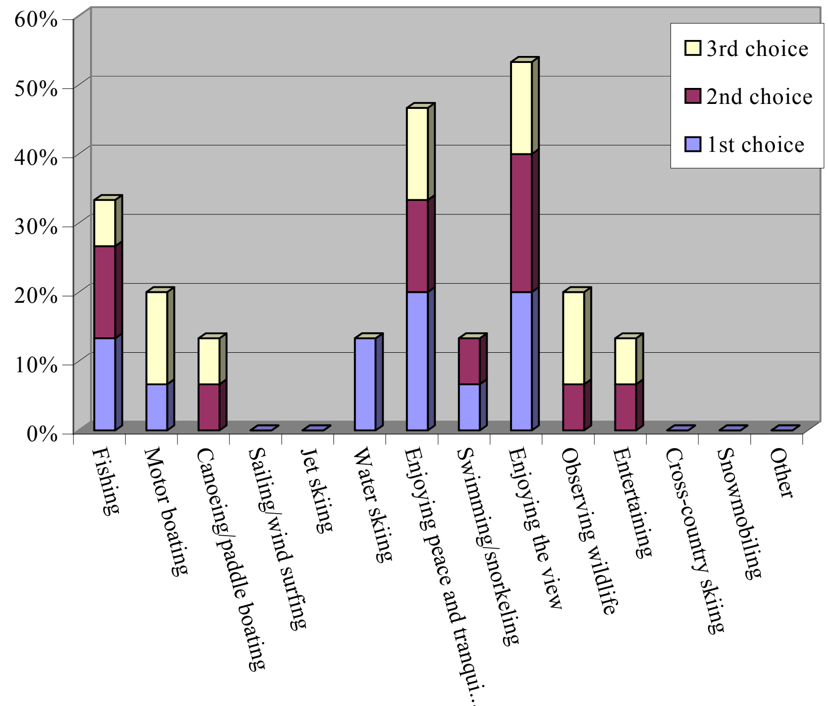
16. Are there areas on the lake where aquatic plant growth becomes especially problematic? (15 of 15 responded)



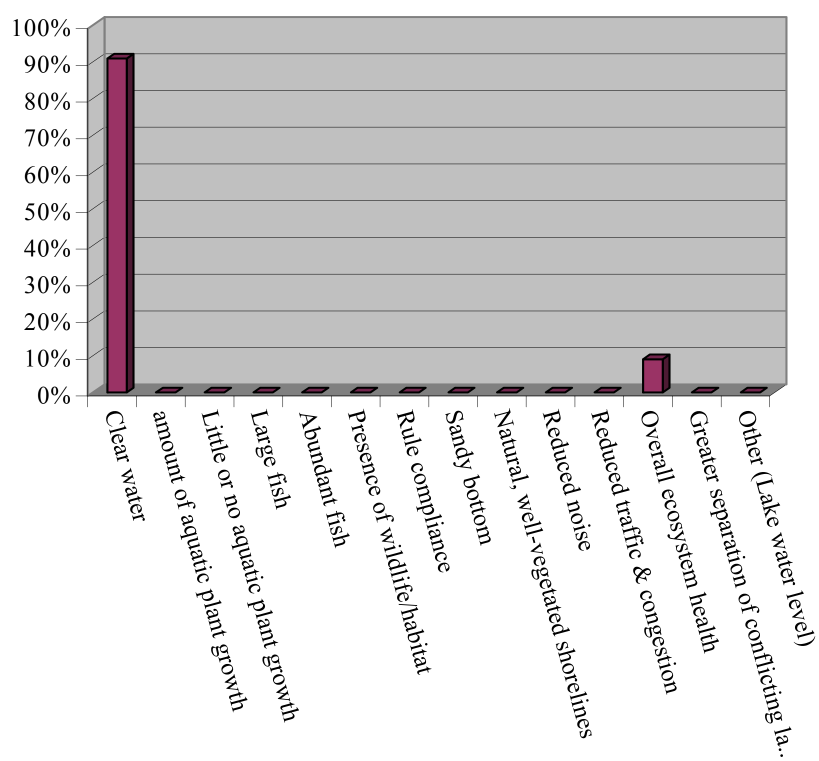
17. Do you feel the current weed management program is effectively controlling nuisance plant growth? (15 of 15 responded)



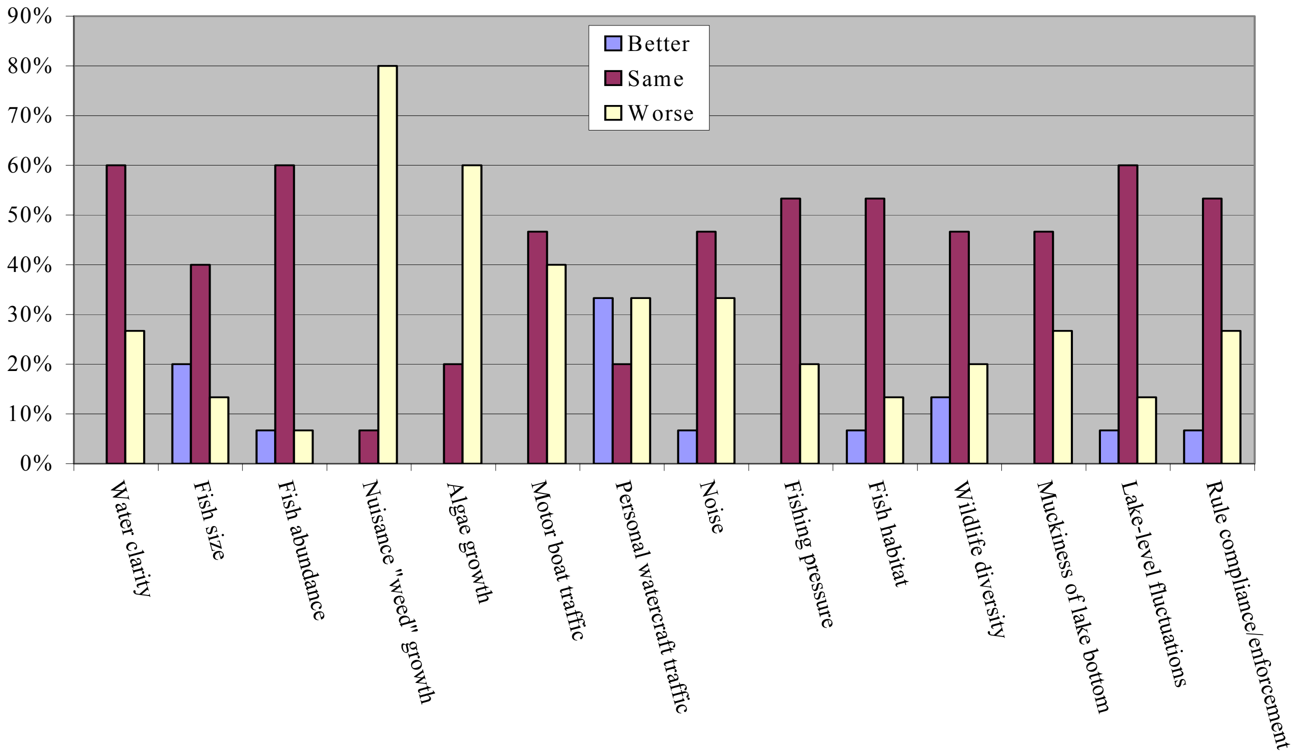
18. What activities do you and the members of your household most enjoy while recreating on your lake? (List the letters of your top three choices) (12 of 15 responded)



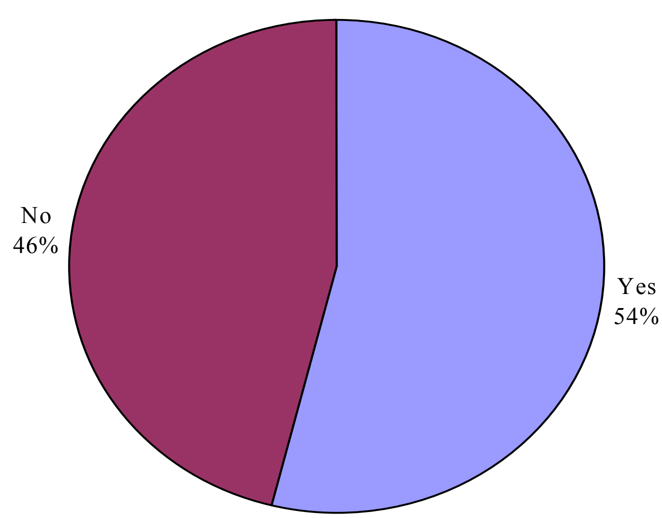
19. Rank the following according to their level of importance to you. (% ranked #1) (11 of 15 responded)



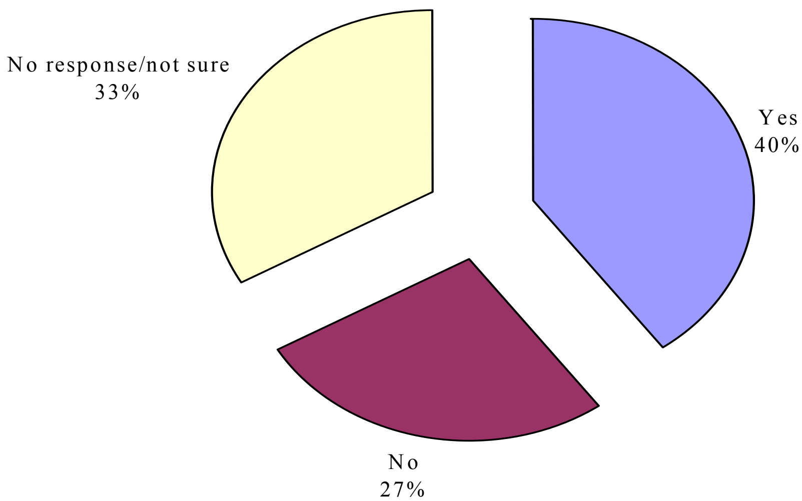
20. How have the following changed since you've lived on or near your lake? (13 of 15 responded)



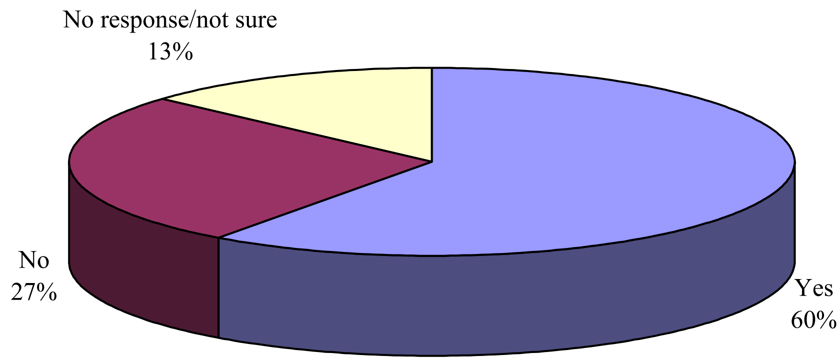
21. Do you feel that there is an adequate law enforcement presence on your lake? (13 of 15 responded)



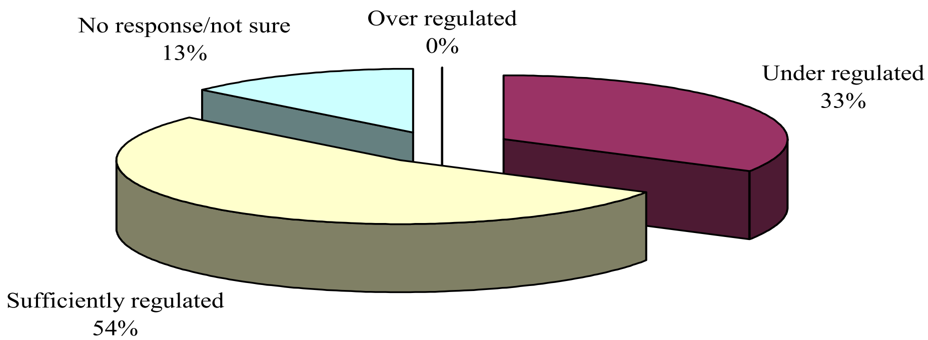
22. Are there any types of behavior, recreational activities or lake uses that you believe are seriously jeopardizing the health and safety of the lake? (10 of 15 responded)



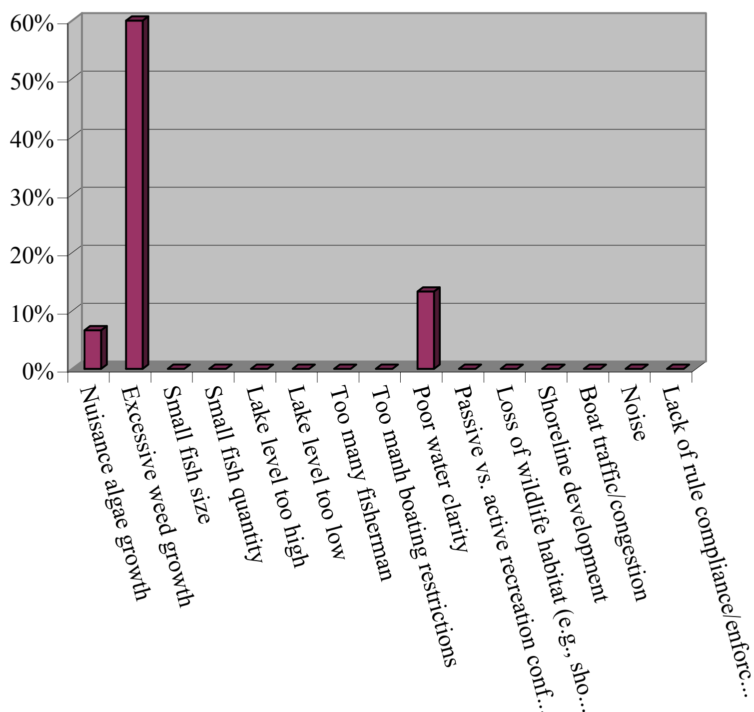
23. Would you be in favor of expanding "slow-no-wake" times and/or locations to promote safety and protect sensitive habitat areas on your lake? (13 of 15 responded)



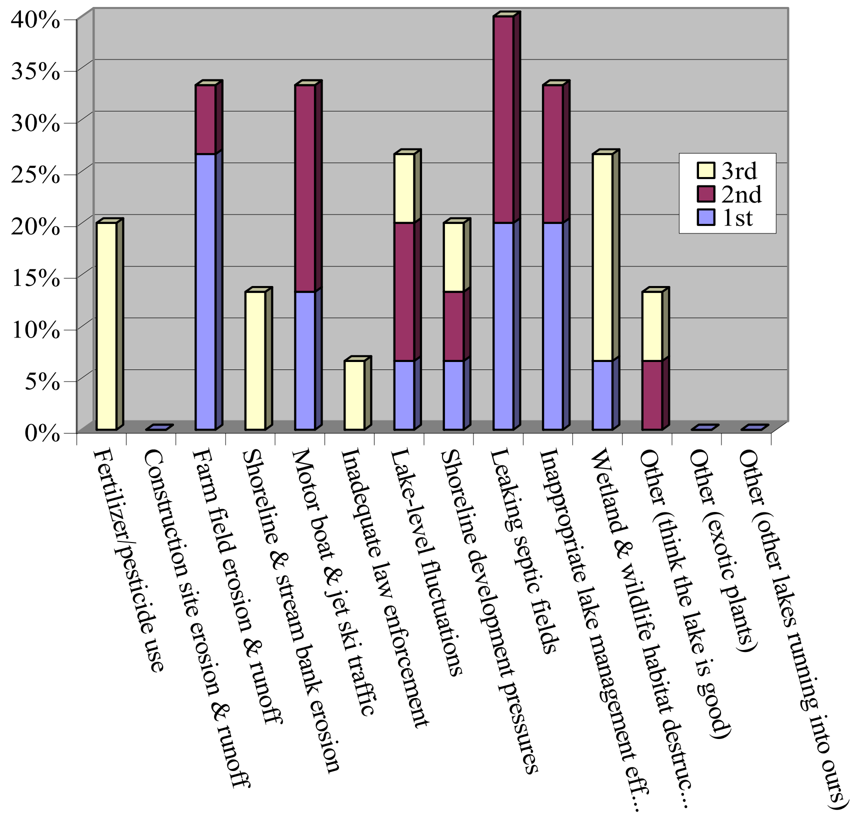
24.What is your opinion regarding lake-use regulations on your lake in general? (15 of 15 responded)



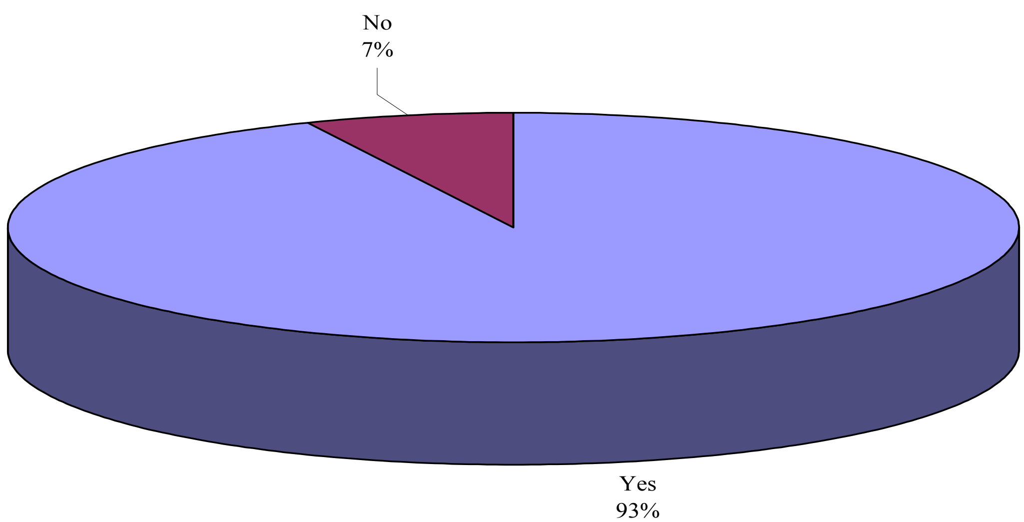
25. Rank the following according to the degree each condition negatively impacts your use or enjoyment of your lake? (Shows % of people who ranked each category #1) (12 of 15 responded)



26. What do you feel are the top three factors that contribute to problems an your lake? (list the letters of your top three choices) (15 of 15 responded)



27. Do you feel that you have a voice in decision-making matters regarding the management of your lake? (15 of 15 responded)



Appendix F: ***2006 Clear Lake Improvement Association Timeline***

1-Mar	Begin Canadian Goose/Waterfowl count
4-Mar	Committee meeting with Aquatic Engineering and Limnological Institute
10-Mar	Send Committee input to Limnological Institute
22-Mar	Obtain draft of APM and WQ plans from Limnological Institute
26-Mar	Forward information to the entire Association/DNR for review
2-Apr	Review Association feedback and revise accordingly
9-Apr	Solicit preliminary input from DNR
9-Apr	Put copies of plans in local library/Place notice in Milton Courier, sign at campground if permitted
9-Apr	Solicit volunteers for Clean Boats Clean Waters
16-Apr	Prepare public meeting and questionnaire
23-Apr	Public meeting in Milton Township Hall/solicit questionnaire input/plan approval
30-Apr	Backup date for public meeting
30-Apr	Request support from Town of Milton, City of Milton, Rock County
30-Apr	Train/Schedule Clean Boats, Clean Waters volunteers
7-May	Request approval of plan from the DNR
14-May	Enact Clean Boats, Clean Waters campaign at public launch, and campground if permitted
	Check invasive species warning sign at boat launch
14-May	Put notice in Milton Courier/signs on road for Association meeting
21-May	1 PM Spring Meeting of the Clear Lake Improvement Association
21-May	Enact Clean Boats, Clean Waters campaign at public launch, and campground if permitted
22-May	Tentative date for ice-off self help lake monitoring
28-May	Place the no-wake area buoys in the lake to protect swimmers and shoreline
28-May	Possible first mechanical harvesting date

28-May	Enact Clean Boats, Clean Waters campaign at public launch, and campground if permitted
28-May	Potential Benefit Picnic date (?)
4-Jun	Distribute final plans to CLIA, township, city, library, Rock County (?)
11-Jun	Send Association meeting minutes out to all attendees, members and property owners
12-Jun	Tentative date for June self help lake monitoring
18-Jun	Submit grant payment request to DNR
25-Jun	DNR grant deadline
2-Jul	Enact Clean Boats, Clean Waters campaign at public launch, and campground if permitted
	Check invasive species warning sign at boat launch
2-Jul	Put notice in Milton Courier/signs on road for Association meeting
9-Jul	Probable date for a special July meeting of the Clear Lake Improvement Association
14-Jul	Possible second mechanical harvesting week
15-Jul	Tentative date for July self-help lake monitoring
23-Jul	
30-Jul	
6-Aug	
13-Aug	
14-Aug	Tentative date for August self-help lake monitoring
20-Aug	
27-Aug	
3-Sep	Have information packet ready for distribution at Association meeting
3-Sep	Put notice in Milton Courier/signs on road for Association meeting
10-Sep	Probable date for Fall Meeting of the Clear Lake Improvement Association
17-Sep	Distribute informational packets to realtors, property owners, Chamber, Campground

17-Sep	Remove buoys from the lake
24-Sep	Send Association meeting minutes out to all attendees, members and property owners
30-Sep	
1-Oct	Tentative date for end-of-season self-help lake monitoring
	Report self-help results to DNR
	Report Clean Boats Clean Waters results to UW-Ext, DNR
21-Dec	End Canadian Goose/waterfowl count

Appendix G: ***2007 Clear Lake Improvement Association's Budget***

	Category	Budget
Income		
	Dues	$1,350.00
	Frontage assessment	$4,500.00
	Donations	$500.00
	Fundraising	$500.00
	State APM Grant	$2,108.62
	State WQM Grant	$3,193.10
	Total	$12,151.72
Expenditures	Nonstock Corp Fee	($10.00)
	State Harvest Permit	($300.00)
	Midwest Aquatics	($5,000.00)*
	Aquatic Engineering	($5,320.13)
	Total	($10,630.13)

*Represents half of the aquatic plant harvest on Clear Lake. This budgeted amount and the associated hours of weed harvesting are matched by Blackhawk Campgrounds, a private business, which co-ops with us on weed harvesting.

Appendix H: *GPS locations of pertinent locations in and around Clear Lake (Rock County, WI)*

Site	Site description	GPS location	
		North	West
Natural ditch #1	Storm sewer ditch excess runoff from Dix Drive	N82* 48.051’	WO88*58.882’
Natural ditch #2	Storm runoff from Highway 59	N42* 47.922’	WO88* 58.516’
Buried pipe	Storm sewer excess runoff from Edgewater Street	N42* 48.066’	WO88* 58.984’
DNR boat landing	Parking lot and boat landing that pitches towards lake	N42* 47.916’	WO88* 59.077’
Deep hole	Location where water quality sampling occurred	N42* 47.993’	WO88* 58.638’
EWM deposit site	Primary EWM harvest deposit site	N42* 47.732’	WO88* 58.543’