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AQUATIC PLANT MANAGEMENT PLAN

LAZY LAKE
COLUMBIA COUNTY, WISCONSIN

May 21, 2007

Prepared for:

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1.0 EXECUTIVE SUMMARY

Lazy Lake is a 161 acre lake located in the town of Fountain Prairie in southeast Columbia County, Wisconsin. Lazy Lake exhibits fair water quality but experiences periods of dense aquatic plant and algal growth. The aquatic plants on the lake provide important habitat for fish and wildlife, but dense plant growth has historically been a nuisance condition, interfering with recreation on the lake (e.g. boat navigation). The District currently operates one aquatic plant harvester to address nuisance plant growth on the lake and developed an Aquatic Plant Management (APM) Plan to obtain a harvesting permit from the Wisconsin Department of Natural Resources (WDNR).

Water quality data collected in 2000 and 2003 indicate a mesotrophic to eutrophic lake system. Nutrients from within the lake, nutrients flowing into the lake from the Crawfish River and from land uses within the watershed are likely enhancing aquatic plant growth. During summer 2005 an aquatic plant survey was completed on Lazy Lake. Sixteen aquatic plants were identified on Lazy Lake. Two aquatic invasive plant species Eurasian watermilfoil (*Myriophyllum spicatum*) and Curly-leaf pondweed (*Potamogeton crispus*) were identified in high densities and frequency. The most abundant free-floating aquatic plants were free-floating small duckweed (*Lemna minor*) and common watermeal (*Wollfia columbiana*). The most abundant submersed aquatic plants were curly-leaf pondweed (*Potamogeton crispus*), Eurasian watermilfoil (*Myriophyllum spicatum*), and Coontail (*Ceratophyllum demersum).*

The District has prepared a comprehensive APM Plan to manage nuisance aquatic plant growth on Lazy Lake which includes the following components

Manual Removal:	Individual property owners can manually remove nuisance aquatic plants in the lake offshore from their property to a maximum width of 30 feet for native aquatic plants and an unlimited width for exotic species to provide pier or swimming raft access.
Harvesting:	The District will continue mechanical harvesting for navigation purposes in accordance with the conditions of a WDNR-issued harvesting permit.
Selective Chemical Control:	The District will consider use of selective chemical herbicides for navigation and exotic species relief purposes in near shore areas where the harvestor can not operate. This activity can be completed by the District or individual landowners (WDNR permit is required).

Other components of the APM Plan include periodic review of APM technologies, nutrient control efforts by the District and landowners within the District, water quality monitoring, periodic aquatic macrophyte surveys, aquatic species prevention and control, and public education about the value of aquatic plants and threat of aquatic invasive plant species.

2.0 INTRODUCTION

Lazy Lake is located in the town of Fountain Prairie in southeast Columbia County, Wisconsin. Figure 1 depicts the lake location [United States Geological Survey (USGS) 1982]. Lazy Lake provides year around activities ranging from, fishing, waterfowl hunting, motorized boating activities (early and late in the open water season), snowmobiling, cross country skiing, and ice fishing. Lazy Lake is primarily used for sport fishing.

Lazy Lake exhibits fair water quality and experiences periods of dense aquatic plant and algal growth. While the aquatic plants on the lake provide important habitat for fish and wildlife, dense aquatic plant growth on Lazy Lake has historically interfered with recreation on the lake (e.g. boat navigation). In response to the lake users concerns, the Lazy Lake Management District was formed in 1976 specifically for the purpose of controlling lake vegetation. Control methods used have included draw down of the lake water level, aquatic herbicide applications, and weed harvesting and removal. Recent changes in Wisconsin's aquatic plant management laws and the subsequent Wisconsin Department of Natural Resources' (WDNR) administration of their aquatic plant management program (NR 109 Wis. Adm. Code) required that the District develop an Aquatic Plant Management Plan (APM Plan).

This APM Plan was designed to meet the District's needs for nuisance plant relief and the WDNR's requirements (e.g. applying for permits under Chapter NR 109 Wisconsin Administrative Code for aquatic plant harvesting). This APM Plan summarizes the lake morphology and lake watershed characteristics; reviews historical aquatic plant management activities; discusses the District's, goals and objectives; presents the aquatic plant ecology; presents results of the recent 2005 aquatic plant survey; evaluates feasible aquatic plant management alternatives; and provides a selected suite of aquatic plant management options in a comprehensive and integrated APM Plan.

2.1 Lake History and Morphology

Lazy Lake is a 161-acre impoundment and has approximately 4.2 miles of shoreline. The lake's mean depth is 3.6 feet and the maximum depth is reported as 8 feet on the WDNR lake survey map. Figure 2 illustrates the bathymetry of Lazy Lake measured during the June 2005 aquatic plant survey. Surface water enters Lazy Lake from precipitation, groundwater and via an impoundment of the Crawfish River. A static water level is maintained on Lazy Lake at the lake's south end.

The fishery is comprised of panfish, largemouth bass, northern pike, and walleye. The WDNR stocked Lazy Lake with northern pike fry in 1978, 1989 – 1991 and fingerlings in 1992, 1994-1996. The Fall River Rod and Gun Club also stocked walleyes in 1990.

2.2 Watershed Overview

The Lazy Lake Watershed is approximately 39,330 acres. Figure 3 illustrates the watershed. The watershed to Lake Ratio is approximately 250:1, a high-ratio lake. A high watershed to lake ratio generally means that runoff within the watershed has more of an impact on a lake's water quality.

The watershed lies in a region of glacial drift overlying dolomite bedrock. The watershed generally is within the Grellton-Gilford-Friesland, Plano-Griswold-Saybrook, and St. Charles-Ossian-Dodge Soil Associations. Soils in this association formed in moraines, outwash terraces, and lacustrine plains and consist of gently sloping to steep, well drained loamy soils (United States Department of Agriculture, 1978).

Nutrients from runoff within the watershed may contribute to abundant aquatic plant growth on Lazy Lake. Analysis of Lazy Lakes watershed identified the following land uses within the watershed.

Agriculture (34,725 acres)
Forest (2,143 acres)
Wetland (1,829 acres)
Water (228 acres)
Urban (404 acres)

Potential nutrient loadings to Lazy Lake may be occurring from all of the above land uses. Agricultural runoff however, is the number one sediment and nutrient loading source to Lazy Lake.

2.3 Water Quality

2.3.1 Trophic Status

Total phosphorus, chlorophyll *a*, and secchi disk depths are used to classify the trophic state of a lake. A trophic state is a measure of a lake's biological productivity. Water resource managers and scientists use the Carlson's and/or Wisconsin Trophic State Index (TSI) to monitor Wisconsin lakes water quality. Aquatic resource managers use the secchi disk, total Phosphorus, and chlorophyll *a* data and apply Carlson's and/or Wisconsin's TSI to place the water into one of the following categories.

Trophic Category Descriptions

Category	TSI	Lake Characteristics
Oligotrophic	1-40	Clear water; oxygen rich at all depths, except if close to mesotrophic border; then may have low or no oxygen; cold-water fish likely in deeper lakes.
Mesotrophic	41-50	Moderately clear; increasing probability of low to no oxygen in bottom waters.
Eutrophic	51-70	Decreased water clarity; probably no oxygen in bottom waters during summer; warm-water fisheries only; blue-green algae likely in summer in upper range; plants also excessive.
Hypereutrophic	70-100	Heavy algal blooms throughout the summer; if > 80, fish kills likely in summer and rough fish dominate.

All lakes undergo a natural aging process, shifting from an oligotrophic state to an eutrophic state. Human activities can accelerate this aging process through nutrient and sediment additions from agriculture, lawn fertilizers, septic systems, and urban storm sewers. Using the summer 2003 surface water data, (total phosphorus concentration of 354 µg/l, chlorophyll *a* concentration of 23.2 µg/l, and a secchi depth of 5.5 feet), Lazy Lake is classified at the lower end of the eutrophic spectrum with an average Wisconsin TSI of 53 using Secchi Disk, in the eutrophic spectrum with an average Wisconsin TSI of 58 using chlorophyll *a* and in the hypereutrophic spectrum with a average Wisconsin TSI of 74 using total phosphorus levels. Eutrophic lakes typically have turbid water, can develop anoxic hypolinia during the summer, may have excessive aquatic macrophytes, and will normally only support warm-water fisheries (Shaw, 1994).

Trophic classification of Wisconsin lakes based on chlorophyll *a*, water clarity measurements, and total phosphorus values. (*Adapted from Lillie and Mason, 1983.*)

Trophic class	**Total phosphorus** µg/l	**Chlorophyll *a*** µg/l	**Secchi Disc** feet
Oligotrophic	3	2	12
	10	5	8
Mesotrophic	18	8	6
	27	10	6
Eutrophic	30	11	5
	50	15	4

Several sampling events by WDNR in 2000 and 2003 also provided secchi disk, total phosphorus, or chlorophyll *a* data that was also used to establish the TSI of Lazy Lake. Historical TSI values were calculated from these sample results. Water quality parameters were collected as part of the Self-Help Lake Monitoring program in 2000 and 2003. Analysis of the water quality information from 2000 and 2003 indicates that Lazy Lake is a mesotrophic to eutrophic lake. Eutrophic lakes have the potential for: heavy algal blooms throughout the summer, fish kills, and a fishery typically dominated by rough fish.

2.4 Aquatic Plant Management History

Lake users have historically reported problems with dense aquatic plant growth on Lazy Lake. The Lazy Lake Management District was formed in 1976 specifically for the purpose of controlling lake vegetation. The District acquired an aquatic plant harvester in 1991, and presumably began harvesting plants that year although contract harvesting may have been completed previously. Limited information is available, but WDNR files indicate that aquatic herbicide treatment occurred on 34 acres in 1991 and 1992. A five acre treatment permit was requested in 2001, but it is unknown if the treatment occurred. The District continued operation of the harvester since then to manage the excessive aquatic macrophyte growth.

A WDNR file review indicated that an aquatic plant assessment was completed in conjunction with a feasibility study and management alternatives report completed in 1979 by the WDNR Office of Inland Lake Renewal. This feasibility and management alternatives report identified thirteen genera of aquatic macrophytes. *Myriophyllum spp.* was reported as an identified species in 1979 (WDNR, 1979) and presumably was Eurasian Watermilfoil. Eurasian Watermilfoil (*Myriophyllum spicatum* - EWM) was officially verified by WDNR staff on Lazy Lake in 1994 (WDNR, 2004). Dense aquatic plant growth continues to impair most recreation on Lazy Lake. EWM and Curlyleaf Pondweed (CLP) in particular have been problem species. Therefore, aquatic plant harvesting has been used to manage the abundant vegetation.

2.5 Goals and Objectives

Since there previously was no aquatic plant survey information available, a main project objective is to complete an aquatic plant survey, which can then be used to quantify and map the abundance and distribution of aquatic plant species. Since there is no formal APM Plan, another District goal is to develop an integrated aquatic APM Plan. At the time of the grant application, discussions with the District indicated that the following items were important APM Plan goals and objectives:

- Maintain and improve recreational opportunities
- Educate lake users on invasive species and benefits of native aquatic plant communities
- Preserve native aquatic plants
- Protect sensitive areas
- Prevent the spread of aquatic invasive species (AIS), such as Eurasian watermilfoil, Curlyleaf pondweed, and Purple loosestrife
- Protect and improve fish and wildlife habitat
- Strive to manage the potential sources of nutrients

3.0 PROJECT METHODS

To accomplish the District's goals, the District needs to make informed decisions regarding APM on the Lake. To make informed decisions, the District proposed to:

- Collect, analyze, and interpret basic aquatic plant community data
- Recommend practical, scientifically-sound aquatic plant management strategies

Offsite and onsite research methods were used during this study. Offsite methods included a thorough review of available background information on the Lake, its watershed and water quality. One aquatic plant community survey was completed onsite to provide data needed to evaluate aquatic plant management alternatives.

3.1 Existing Data Review

A variety of background information resources were researched to develop a thorough understanding of the ecology of the Lake. Information sources included:

- Local and regional pedologic, geologic, limnologic, hydrologic, and hydrogeologic research
- Discussions with District members
- Available topographic maps and aerial photographs
- Data from WDNR files
- Past Lake Study Reports

These sources were essential to understanding the historic, present, and potential future conditions of the Lake, as well as to ensure that previously completed studies were not unintentionally duplicated. Specific references are listed in Section 7.0 of this report.

3.2 Aquatic Plant Survey and Analysis

The aquatic plant community of the Lake was surveyed during June 13, 2005. The survey was conducted using the point intercept sampling method described by Madsen (1999), as is recommended in the draft guidance on APM in Wisconsin (WDNR, 2005). The point intercept method is readily adapted to "whole-lake" or large plot assessments as compared to the transect method that is best used in evaluating study plots or selected areas to evaluate aquatic macrophyte communities.

To use the point intercept method, a base map was developed with 142 sampling points (i.e., intercept points) established on a 75 meter grid (Figure 4). Latitude and longitude coordinates and sample identifications were assigned to each intercept point on the grid (Appendix A). A Trimble GeoXT™ global positioning system (GPS) was used to navigate to intercept points. At each intercept point, plants were observed visually or collected with a rake on a telescopic pole or a rake attached to a rope. All observed plants were identified to the lowest practicable taxonomic level (e.g., typically genus or species) and recorded on field data sheets. Water depth and, when detectable, sediment types at each intercept point were also recorded on field data sheets. A general density rating, based on the following criteria, and observations regarding substrate type were recorded along with the depth in feet.

The point intercept method was used to evaluate the existing emergent, submergent, floating-leaf, and free-floating aquatic plants. At each intercept point, a value of 1-3 was assigned to the species collected based on densities observed on the rake, or rake fullness ratings. 1 being a few plants on the rake head, 2 when the rake head is approximately ½ full, and three being full of aquatic plants with the rake head not visible. If a species was not collected at that point, the space was left blank. For the survey, the data for each sample point was entered into the WDNR "Worksheets" (i.e., a data-processing spreadsheet) to calculate the following statistics:

- **Taxonomic richness** (the total number of taxa detected)
- **Maximum depth of plant growth**
- **Community frequency of occurrence** (number of intercept points where aquatic plants were detected divided by the number of intercept points shallower than the maximum depth of plant growth)
- **Mean intercept point taxonomic richness** (the average number of taxa per intercept point)
- **Mean intercept point native taxonomic richness** (the average number of native taxa per intercept point)
- **Taxonomic frequency of occurrence within vegetated areas** (the number of intercept points where a particular taxon (e.g., genus, species, etc.) was detected divided by the total number of intercept points where vegetation was present)

- **Taxonomic frequency of occurrence at sites within the photic zone** (the number of intercept points where a particular taxon (e.g., genus, species, etc.) was detected divided by the total number of intercept points which are equal to or shallower than the maximum depth of plant growth)

- **Relative taxonomic frequency of occurrence** (the number of intercept points where a particular taxon (e.g., genus, species, etc.) was detected divided by the sum of all species' occurrences)

- **Mean density** (the sum of the density values for a particular species divided by the number of sampling site)

- **Simpson Diversity Index (SDI)** is an indicator of aquatic plant community diversity. SDI is calculated by taking one minus the sum of the relative frequencies squared for each species present. Based upon the index of community diversity, the closer the SDI is to one, the greater the diversity within the population.

- **Floristic Quality Index (FQI)** (This method uses a predetermined Coefficient of Conservatism (C), that has been assigned to each native plant species in Wisconsin, based on that species' tolerance for disturbance. Non-native plants are not assigned conservatism coefficients. The aggregate conservatism of all the plants inhabiting a site determines its floristic quality. The mean C value for a given lake is the arithmetic mean of the coefficients of all native vascular plant species occurring on the entire site, without regard to dominance or frequency. The FQI value is the mean C times the square root of the total number of native species. This formula combines the conservatism of the species present with a measure of the species richness of the site. Each plant is assigned a number from 1 to 10. Low nutrient and undisturbed conditions are given a higher number and plants typically found in more nutrient rich and/or disturbed waters are given a lower coefficient of conservatism. Lake quality is quantified by the number of species found, the identity of plants and the coefficient of conservatism. The FQI was developed by Stan Nichols (Wisconsin Geological and Natural History Survey) to help assess lake quality using the aquatic plants that live in a lake.

4.0 AQUATIC PLANTS AND WATER QUALITY

Aquatic plants are vital to the health of a water body. Unfortunately, people too often refer to rooted aquatic plants as "weeds" and ultimately wish to eradicate them. This type of attitude, and the misconceptions it breeds, must be overcome in order to properly manage a lake ecosystem. Rooted aquatic plants (macrophytes) are extremely important for the well being of a lake community and posses many positive attributes. These attributes are what make the littoral zone the most important and productive aquatic habitat in freshwater lakes. Despite their positive role, aquatic macrophytes can become a nuisance when aquatic invasive species (AIS) occupy large portions of a lake and/or excessive growth of AIS or native macrophytes negatively affects recreational activities. When "managing" aquatic plants, it is important to maintain a well-balanced, stable, and diverse aquatic plant community that contains high percentages of desirable native species. To be effective, aquatic plant management in most lakes must maintain a plant community that is:

- Robust
- Species rich
- Diverse
- Predominantly native

4.1 The Ecological Role of Aquatic Plants

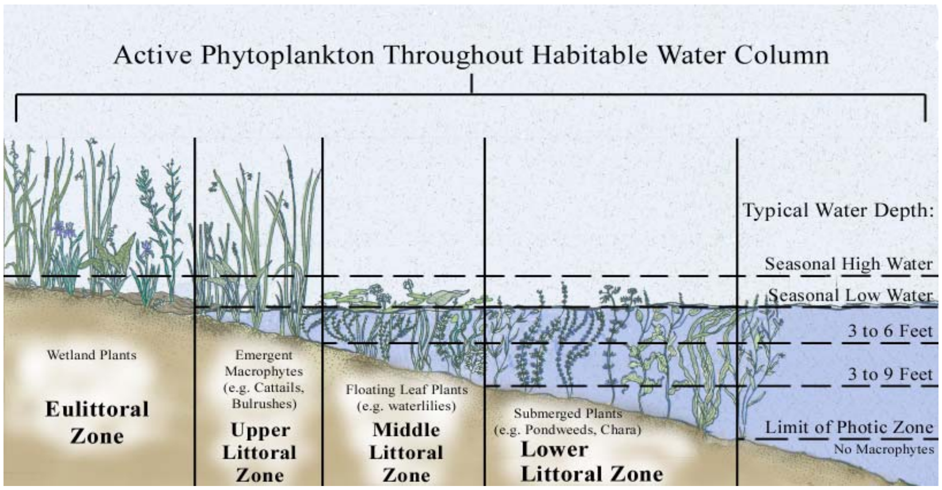
Aquatic plants can be divided into two major groups: microphytes (phytoplankton and epiphytes) composed mostly of single-celled algae, and macrophytes that include macroalgae, flowering vascular plants, and aquatic mosses and ferns. Wide varieties of microphytes co-inhabit all hospitable areas of a lake. Their abundance depends on light, nutrient availability, and other ecological factors. In contrast, macrophytes are predominantly found in distinct habitats located in the littoral (i.e., shallow near shore) zone where light sufficient for photosynthesis can penetrate to the lake bottom. The littoral zone is subdivided into four distinct transitional zones: the eulittoral, upper littoral, middle littoral, and lower littoral (Wetzel, 1983).

Eulittoral Zone: Includes the area between the highest and lowest seasonal water levels, and often contains many wetland plants.

Upper Littoral Zone: Dominated by emergent macrophytes and extends from the water edge to water depths between 3 and 6 feet.

Middle Littoral Zone: Occupies water depths of 3 to 9 feet, extending lakeward from the upper littoral zone. The middle littoral zone is dominated by floating-leaf plants.

Lower Littoral Zone: Extends to a depth equivalent to the limit of the photic zone, which is defined as percent of surface light intensity.



Aquatic Plant Communities Schematic

The abundance and distribution of aquatic macrophytes are controlled by light availability, lake trophic status as it relates to nutrients and water chemistry, sediment characteristics, and wind energy. Lake morphology and watershed characteristics relate to these factors independently and in combination (NALMS, 1997).

In many instances aquatic plants serve as indicators of water quality due to the sensitive nature of plants to water quality parameters such as water clarity and nutrient levels. To grow, aquatic plants must have adequate supplies of nutrients. Microphytes and free-floating macrophytes (e.g., duckweed) derive all their nutrients directly from the water. Rooted macrophytes can absorb nutrients from water and/or sediment. Therefore, the growth of phytoplankton and free-floating aquatic plants is regulated by the supply of critical available nutrients in the water column. In contrast, rooted aquatic plants can normally continue to grow in nutrient-poor water if lake sediment contains adequate nutrient concentrations. Nutrients removed by rooted macrophytes from the lake bottom may be returned to the water column when the plants die. Consequently, killing aquatic macrophytes may increase nutrients available for algal growth.

In general, an inverse relationship exists between water clarity and macrophyte growth. That is, water clarity is usually improved with increasing abundance of aquatic macrophytes. Two possible explanations are postulated. The first is that the macrophytes and epiphytes out-compete phytoplankton for available nutrients. Epiphytes derive essentially all of their nutrient needs from the water column. The other explanation is that aquatic macrophytes stabilize bottom sediment and limit water circulation, preventing resuspension of solids and nutrients (NALMS, 1997).

If aquatic macrophyte abundance is reduced, then water clarity may suffer. Water clarity reductions can further reduce the vigor of macrophytes by restricting light penetration, reducing the size of the littoral zone, and further reducing water clarity. Studies have shown that if 30 percent or less of the area of a lake occupied by aquatic plants is controlled, water clarity will generally not be affected. However, lake water clarity will likely be reduced if 50 percent or more of the macrophytes are controlled (NALMS, 1997).

Aquatic plants also play a key role in the ecology of a lake system. Aquatic plants provide food and shelter for fish, wildlife and invertebrates. Plants also improve water quality by protecting shorelines and the lake bottom, improving water quality and adding to the aesthetic quality of the lake.

4.2 Aquatic Invasive Plant Species

Invasive species have invaded our backyards, forests, prairies, wetlands, and waters. Invasive species are often transplanted from other regions, even from across the globe. "A species is regarded as invasive if it has been introduced by human action to a location, area, or region where it did not previously occur naturally (i.e., is not native), becomes capable of establishing a breeding population in the new location without further intervention by humans, and spreads widely throughout the new location " (Source: WDNR website, Invasive Species, 2006). AIS include plants and animals that affect our lakes, rivers, and wetlands in negative ways. Once in their new environment, AIS often lack natural control mechanisms they may have had in their native ecosystem and may interfere with the native plant and animal interactions in their new "home". Some AIS have aggressive reproductive potential and contribute to ecological declines and problems for water based recreation and local economies. AIS often quickly become a problem in already disturbed lake ecosystems (i.e. one with relatively few native plant species). While native plants provide numerous benefits, AIS can contribute to ecological decline and financial constraints to manage problem infestations.

<u>Eurasian Watermilfoil *(Myriophyllum spicatum)*</u>

EWM is the most common AIS found in Wisconsin lakes. EWM was first discovered in southeast Wisconsin in the 1960's. During the 1980's, EWM began to spread to other lakes in southern Wisconsin and by 1993 it was common in 39 Wisconsin counties. EWM continues to spread across Wisconsin and is now found in the far northern portion of the state.

Unlike many other plants, EWM does not rely on seed for reproduction. Its seeds germinate poorly under natural conditions. It reproduces vegetatively by fragmentation, allowing it to disperse over long distances. The plant produces fragments after fruiting once or twice during the summer. These shoots may then be carried downstream by water currents or inadvertently picked up by boaters. EWM is readily dispersed by boats, motors, trailers, bilges, live wells, or bait buckets, and can stay alive for weeks if kept moist (WDNR website, 2006).

Once established in an aquatic community, EWM reproduces from shoot fragments and stolons (runners that creep along the lake bed). As an opportunistic species, EWM is adapted for rapid growth early in spring. Stolons, lower stems, and roots persist over winter and store the carbohydrates that help milfoil claim the water column early in spring, photosynthesize, divide, and form a dense leaf canopy that shades out native aquatic plants. Its ability to spread rapidly by fragmentation and effectively block out sunlight needed for native plant growth often results in monotypic stands. Monotypic stands of EWM provide only a single habitat, and threaten the integrity of aquatic communities in a number of ways; for example, dense stands disrupt predator-prey relationships by fencing out larger fish, and reducing the number of nutrient-rich native plants available for waterfowl (WDNR website, 2006).

Dense stands of EWM also inhibit recreational uses like swimming, boating, and fishing. The visual impact that greets the lake user on milfoil-dominated lakes is the flat yellow-green of matted vegetation, often prompting the perception that the lake is "infested" or "dead". Cycling of nutrients from sediments to the water column by EWM may lead to deteriorating water quality and algae blooms of infested lakes (WDNR website, 2006).

<u>Curly-leaf pondweed *(Potamogeton crispus)*</u>

Curly-leaf pondweed (CLP) spreads through burr-like winter buds (turions), which are moved among waterways. These plants can also reproduce by seed, but this plays a relatively small role compared to the vegetative reproduction through turions. New plants form under the ice in winter, making CLP one of the first nuisance aquatic plants to emerge in the spring.

The leaves of CLP are reddish-green, oblong, and about 3 inches long, with distinct wavy edges that are finely toothed. The stem of the plant is flat, reddish-brown and grows from 1 to 3 feet long. The plant usually drops to the lake bottom by early July.

CLP becomes invasive in some areas because of its tolerance for low light and low water temperatures. These tolerances allow it to get a head start on and out-compete native plants in the spring. CLP forms surface mats that interfere with aquatic recreation in mid-summer, when most aquatic plants are growing, CLP plants are dying off. Plant die-offs may result in a critical loss of dissolved oxygen. Furthermore, the decaying plants can increase nutrients which contribute to algal blooms, as well as create unpleasant stinking messes on beaches (WDNR website, 2006).

Purple Loosestrife (*Lythrum salicaria*)

Purple loosestrife is a perennial herb 3-7 feet tall with a dense bushy growth form. Showy flowers vary from purple to magenta, possess 5-6 petals aggregated into numerous long spikes, and bloom from July to September.

Purple loosestrife was first detected in Wisconsin in the early 1930's, but remained uncommon until the 1970's. It is now widely dispersed in the state, and has been recorded in 70 of Wisconsin's 72 counties. Low densities in most areas of the state suggest that the plant is still in the pioneering stage of establishment. Areas of heaviest infestation are sections of the Wisconsin River, the extreme southeastern part of the state, and the Wolf and Fox River drainage systems.

This plant's optimal habitat includes marshes, stream margins, alluvial flood plains, sedge meadows, and wet prairies. It is tolerant of moist soil and shallow water sites such as pastures and meadows, although established plants can tolerate drier conditions. Purple loosestrife has also been planted in lawns and gardens, which is often how it has been introduced to many of our wetlands, lakes, and rivers. Purple loosestrife spreads mainly by seed, but it can also spread vegetatively from root or stem segments. A single stalk can produce from 100,000 to 300,000 seeds per year. Seed survival is up to 60-70%, resulting in an extensive seed bank. Mature plants with up to 50 shoots grow over 2 meters high and produce more than two million seeds a year. Germination is restricted to open, wet soils and requires high temperatures, but seeds remain viable in the soil for many years. Even seeds submerged in water can live for approximately 20 months (WDNR website, 2006).

4.3 Other Aquatic Invasive Species

The following AIS are not plants, but are mentioned here because they also can significantly disrupt healthy aquatic ecosystems.

Zebra mussels (*Dreissena polymorpha*) are a tiny (1/8-inch to 2-inch) bottom-dwelling clam native to Europe and Asia. Zebra mussels were introduced into the Great Lakes in 1985 or 1986, and have been spreading throughout them since that time. They were most likely brought to North America as larvae in ballast water of ships that traveled from fresh-water Eurasian ports to the Great Lakes. Zebra mussels look like small clams with a yellowish or brownish D-shaped shell, usually with alternating dark- and light-colored stripes. They can be up to two inches long, but most are under an inch. Zebra mussels usually grow in clusters containing numerous individuals.

http://www.dnr.state.wi.us/invasives/fact/zebra.html

photo by Jeff Gunderson, MN Sea Grant

Rusty crayfish (*Orconectes rusticus*) have invaded portions of Minnesota, Wisconsin, Ontario, and many other areas. Although native to parts of some Great Lakes states, rusty crayfish have spread to many northern lakes and streams where they cause a variety of ecological problems. Rusty crayfish were probably spread by non-resident anglers who brought them north to use as fishing bait. As rusty crayfish populations increased, they were harvested for the regional bait market and for biological supply companies. Such activities probably helped spread the species further. Invading rusty crayfish frequently displace native crayfish, reduce the amount and kinds of aquatic plants and invertebrates, and reduce some fish populations. Long term and labor intensive trapping efforts, along with special fishing regulations designed to increase predation on juvenile crayfish has demonstrated control of a "rusty" infestation. The best way to prevent further ecological problems is to prevent or slow their spread into new waters.

http://www.seagrant.umn.edu/exotics/rusty.html

Spiny Water Flea (*Bythotrephes cederstoemi)* are predatory zooplankton (tiny aquatic animals) that have a barbed tail making up most of their body length (one centimeter average). They compete with small fish for food supplies (zooplankton) and small fish cannot swallow the spiny water flea due to the long spiny appendage. More research is being completed to determine the potential impacts of the spiny water flea. More information about this invader can be found at http://dnr.wi.gov/invasives/fact/spiny.htm.

4.4 Aquatic Plant Survey (2005)

The aquatic macrophyte community of the Lake included 16 floating leaved, emergent, and submerged aquatic vascular plant species during the June 2005 aquatic macrophyte survey. The survey included sampling at 142 intercept points and the observed taxa are summarized in Table 1. The distribution of aquatic plant species during June 2005 survey are illustrated in Figures 5a-5d, respectively.

The aquatic plant community present on Lazy Lake during 2005 exhibited a relatively low species diversity. During June, the Simpson Diversity Index value of the community was 0.87 (Table 2). Aquatic vegetation was detected at 100% of the intercept points. The photic zone depth included the entire lake as indicated by the maximum depth that plants were observed at (Table 2). The taxonomic richness of the aquatic plant community was 16 taxa in June (Table 2). An average of 6.2 taxa were detected at intercept points during June.

During the June survey, the most abundant aquatic plant excluding free-floating Small Duckweed (*Lemna minor*) and Common Watermeal (*Wollfia columbiana*) whose abundance typically changes greatly throughout the summer - was curly-leaf pondweed (*Potamogeton crispus*). It had a 95.8 percent frequency of occurrence (percent of photic zone intercept points at which the taxa was detected) during June (Table 3). Further, it was detected at 136 of 142 intercept points during June, and had greater relative frequency values than other taxa (Table 3).

Eurasian watermilfoil (*Myriophyllum spicatum*) was the second most abundant vascular plant species during June, occurring at 133 of 142 of intercept points and having a 93.7 percent frequency of occurrence (Table 3). Its relative frequency of occurrence, 15 percent, indicates that it was slightly less common than CLP at vegetated intercept points.

Coontail (*Ceratophyllum demersum)* was the third most abundant vascular plant species during June, occurring at 130 of 142 of intercept points and having a 91.5 percent frequency of occurrence (Table 3). Its relative frequency of occurrence, 14.6 percent, indicates that it was slightly less common than EWM and CLP at vegetated intercept points.

Invasive species, such as Eurasian watermilfoil (*Myriophyllum spicatum*) and curly-leaf pondweed (*Potamogeton crispus*), tend to densely colonize affected lakes and out compete native species. Unfortunately, both invasives were detected in Lazy Lake in 2005. Additional information about these exotic aquatic plants is available in the educational materials in Appendix G. Additional information is also available from the WDNR website:

http://dnr.wi.gov/invasives/aquatic.htm

or from Northern Environmental upon request.

4.4.1 Free-Floating Plants

The free-floating aquatic plant species identified during the 2005 aquatic plant surveys are listed in Table 1. A brief description about these plants follows.

Lemna minor (Small Duckweed)

Small Duckweed
Source: University of Florida Website

Lemna minor (Small Duckweed), is a common free-floating aquatic plant. Duckweed has round oval shaped leaf bodies called fronds. These fronds float individually or in groups on the waters surface. Duckweed reproduces commonly by budding. The plants obtain nutrients from the water by absorbing nutrients through its leaf undersurface and dangling roots. Duckweed is a nutritious food source for a variety of waterfowl. Duckweed can reproduce at tremendous rates sometimes doubling in number in as little of three to five days (Borman, et al., 1997).

Wolffia columbiana (Common watermeal)

Wolffia columbiana (Common watermeal), is a common free-floating aquatic plant. Common watermeal is composed of pale green, asymmetrical globes with out roots, stems, or true leaves. Common watermeal is often found intermingled with other duckweed species and commonly drifts with the wind or current and is not dependent on depth, sediment type or water clarity. However, it needs adequate nutrients in the water to sustain growth. Common watermeal is a good waterfowl food consumed by a variety of ducks and geese including mallard and scaup. (Borman, et al., 1997).


Common watermeal
Source: UW Herbarium Website

4.4.2 Floating-Leaf Plants

Floating-leaf aquatic plant species were identified during the 2005 aquatic plant surveys and are listed in Table 1. A brief description of these plant species follows.

Brasenia schreberi (Watershield)

Brasenia schreberi (Watershield) has floating leaves with elastic stems with the leaf stalk attaching to the middle of the leaves. All submersed portions of the plant are usually covered with a gelatinous coating. Watershield is commonly identified by the lack of a leaf notch and the central location of the petiole. Watershield is most commonly found growing in soft sediments that contain partially decomposed organic matter. The seeds, leaves, stems and buds are a source of food by waterfowl. The floating leaves also offer shelter and shade for fish and invertebrates (Borman, et al., 1997). Watersheild is a sensitive aquatic plant this is not tolerant of pollutants and adverse human impacts to the lake ecosystem (Nichols, 1999).

Watershield
Source: University of Florida Website

Nuphar variegata (Spatterdock)

Spatterdock
Source: UW Herbarium Website

Nuphar variegata (Spatterdock) shows a preference for soft sediment and water that is 6 feet or less in depth. Floating leaves emerge in early summer from rhizomes that are actively growing in the soft sediments. Yellow flowers occur throughout the summer. Floating leaves provide cover and shade for fish as well as habitat for invertebrates (Borman, et al., 1997).

Nymphaea odorata (White Water Lily)

Nymphaea odorata (White Water Lily) has a flexible stalk with a round floating leaf. Most of the leaves float on the water surface. White Water Lily is typically found growing in a variety of sediment types in less than 6 feet of water. Floating leaves emerge in early summer from rhizomes that are growing in the soft sediments. White flowers occur throughout the summer. The floating leaves provide shelter and shade for fish as well as habitat for invertebrates (Borman, et al., 1997).

White Water Lily
Source: UW Herbarium Website

4.4.3 Submergent Plants

Submergent aquatic plant species were identified during the 2005 aquatic plant surveys and are listed in Table 1. A brief description of some of these plant species follows.

Coontail
Source: UW Herbarium Website

Ceratophyllum demersum (Coontail)

Coontail (*Ceratophyllum demersum*) is a submergent aquatic plant. Unlike most other submergent aquatic plants, coontail is not rooted and can drift, making it tolerant to higher water levels. Because it does not have roots, it absorbs nutrients dissolved in the lake water. Coontail provides excellent shelter and foraging opportunities for fish and invertebrates, and waterfowl consume its foliage and fruit (Borman, et al., 1997). Coontail is also commonly misidentified and mistaken for *Myriophyllum spicatum* (Eurasian watermilfoil).

Elodea canadensis (Elodea)

*Elodea canadensis (*Elodea or common waterweed) is an abundant native plant species that is distributed statewide. It prefers soft substrate and water depths to 15 feet (Nichols, 1999). Elodea reproduces by seed and sprigs (USDA, 2002). The stems of elodea offer shelter and grazing to fish, but very dense elodea can interfere with fish movement. Elodea can be considered invasive at times and out-competes other more desirable plants.

Elodea
Source: UW Herbarium Website

Myrionphyllum spicatum (Eurasian watermilfoil-EWM)

Eurasian watermilfoil
Source: UW Herbarium Website

Eurasian watermilfoil (EWM) is a submersed aquatic plant native to Europe, Asia and northern Africa. It was introduced to the United States by early European settlers. Eurasian watermilfoil has proliferated in waterways across North America. Eurasian watermilfoil was first detected in Wisconsin lakes during the 1960's. In the past three decades, this exotic species has significantly expanded its range to about 61 of Wisconsin's 72 counties. The range of Eurasian watermilfoil continues to expand in Wisconsin from 1994 to 2001 (DNR, 2004). Because of its potential for explosive growth and its incredible ability to regenerate, Eurasian watermilfoil can successfully out-compete most native aquatic plants, especially in disturbed areas.

Eurasian watermilfoil shows no substrate preference, and can grow in water depths greater than 4 meters (Nichols, 1999). Eurasian watermilfoil does not rely on seed for re-production; its seeds germinate poorly under natural conditions. It reproduces vegetatively by fragmentation, allowing it to disperse over long distances. The plant produces fragments after fruiting once or twice during the summer. These shoots may then be carried down or up the Lake by water currents or inadvertently picked up by boaters. EWM is readily dispersed by boats, motors, trailers, bilges, live wells, or bait buckets, and can stay alive for weeks if kept moist. Once established in an aquatic community, milfoil reproduces from shoot fragments and stolons (runners that creep along the substrate).

As an opportunistic species, Eurasian watermilfoil is adapted for rapid growth early in spring. Stolons, lower stems, and roots persist over winter and store the carbohydrates that help milfoil claim the available light from water column early in spring, photosynthesize, divide, and form a dense leaf canopy that shades out native aquatic plants. Its ability to spread rapidly by fragmentation and effectively block out sunlight needed for native plant growth often results in monotypic stands. Monotypic stands of Eurasian watermilfoil provide only a single habitat, and threaten the integrity of aquatic communities in a number of ways. For example, dense stands disrupt predator-prey relationships by fencing out larger fish, and reducing the number of nutrient-rich native plants available for waterfowl (DNR 2002).

Najas flexilis (Slender Naiad)

Slender Naiad
Source: UW Herbarium Website

Najas flexilis (Slender Naiad) is sometimes called bushy pondweed and has fine branched stems that emerge from a slight rootstalk. Leaves are paired and sometimes smaller leaves are bunched. Slender Naiad can grow in very shallow and very deep waters. Waterfowl, marsh birds, and muskrats consume the stems, leaves, and seeds of naiad. The foliage produces forage and shelter opportunities for fish and invertebrates (Borman, et al., 1997).

Potamogeton crispus (Curly-leaf Pondweed -CLP)

Curly-leaf pondweed (*Potamogeton crispus*) is also an exotic plant of eurasian origin that forms surface mats that interfere with aquatic recreation. CLP was the most severe nuisance aquatic plant in the Midwest until Eurasian watermilfoil appeared. CLP grows under the ice, but dies relatively early, releasing nutrients to the water column in summer possibly leading to algal blooms. It provides cover and foraging opportunities to fish and invertebrates. It also provides critical spawning habitat for perch in March and April. The plant usually drops to the lake bottom throughout July. It prefers soft substrate and shallow water depths (Nichols, 1999). CLP reproduces by seed and vegetative buds called turions. Seeds play a relatively small role in reproduction compared to germination of turions. CLP can also out-compete more desirable native plant species.

Curly-leaf pondweed
Source: UW Herbarium Website

Potamogeton foliosus (Leafy Pondweed)

Leafy Pondweed
Source: UW Herbarium Website

*Potamogeton foliosus (*Leafy Pondweed) has a freely branched stems that emerge from slender rhizomes. This plant is easily identifiable by a stipule that is found wrapped around the stem. However, leafy pondweed can be confused with small pondweed. Leafy pondweed tends to bloom early in the season with a short flower stalk and a tight cluster of flowers. Waterfowl eat the fruits of this early to mature aquatic and can be of local importance. Muskrat, beaver, and deer eat the foliage and fruit. Invertebrates and fish forage hide in the foliage (Borman, et al., 1997).

(*Potamogeton pusillus*) Small Pondweed

Small Pondweed (*Potamogeton pusillus*) has small slender stems, emerges from a slight rhizome, and branches repeatedly near its ends. Small pondweed over-winters as rhizomes and winter buds. There is some limited reproduction by seed. Small pondweed can be locally important as a food source for a variety of wildlife. Waterfowl tend to feed on small pondweed as well as deer, muskrat, and some small fish (Borman, et al., 1997).

Small Pondweed
Source: UW Herbarium Website

Potamogeton zosteriformis (Flat-Stem Pondweed)

Flat-Stem Pondweed (*Potamogeton zosteriformis*) is a submergent pondweed with freely-branched stems of flat-stem pondweed that emerge from a slight rhizome. The stems are strongly flattened and have a angled appearance. Flat-stem pondweed has a prominent midvein and many fine, parallel veins. Flat stem pondweed is commonly confused with *Zosterella dubia* (water stargrass) by the similar leaf arrangement. However lack of a prominent midvein in water stargrass helps distinguish the two species. Flat-stem pondweed grows in a variety of water depths from shallow to several meters deep and is usually found in soft sediment. Flat-stem pondweed is a locally important food source for a variety of geese and ducks and may also be grazed by muskrat, deer, beaver while providing a food source and cover for fish and invertebrates (Borman, et al., 1997).

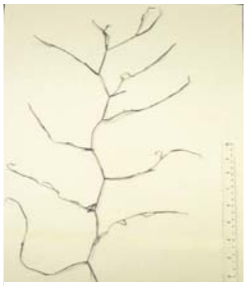
Ranunculus flabellaris (Yellow water buttercup)

Ranunculus flabellaris (Yellow water buttercup) has long, branched stems with leaves that are finely cut into thread-like divisions and either attach directly to the stem or have a very short leaf stalk. Leaves emerge along the stem in an alternate arrangement and are stiff enough to hold their shape when lifted out of the water. Yellow water buttercup is found in both lakes and streams with higher alkalinity, usually in less than 6 feet of water. New stems

Yellow Water Buttercup
Source: UW Herbarium Website

emerge from rhizomes in the spring and flowers come into bloom over several weeks. Both fruit and foliage are consumed by a variety of waterfowl. When it is growing in shallow areas it may also be grazed upon by upland birds. Stems and leaves of yellow water buttercup provide valuable invertebrate habitat and it is considered a fair producer of food for trout (Borman, et al., 1997).

Stuckenia pectinata (Sago Pondweed)


Sago Pondweed
Source: UW Herbarium Website

Stuckenia pectinata (Sago Pondweed) resembles two other pondweeds with needle-like leaves, but sago pondweed is more common. The fruit and tubers of sago pondweed are very important food sources for waterfowl, while leaves and stems provide shelter for small fish and invertebrates (Borman, et al., 1997).

4.4.4 Emergent Plants

Emergent aquatic plant species were identified during the 2005 aquatic plant surveys and are listed in Table 1. A brief description of some of these plant species follows.


Broad-leaf Cattail
Source: UW Herbarium Website

Typha latifolia (Broad-leaf Cattail)

Typha latifolia (Broad-leaf Cattail) has pale green, sword-like leaves that emerge from a robust, spreading rhizome. The leaves are sheathed around on another at the base and junction of the leaf sheath and blasé the sheath is usually tapered. Broad-leaved cattail can be distinguished from narrow-leaved cattail by the presence of male and female flower spikes immediately adjacent to each other, and the leaves are wider and flatter. Cattails provide nesting habitat for many marsh birds and cover for small fish (Borman, et al., 1997).

4.5 WDNR Plant Survey (1979)

The WDNR aquatic plant survey completed in 1979 did not include a formal point-intercept survey; however, the following species were identified during the plant monitoring efforts:

- **Submergent**

Ceratophyllum demersum	coontail
Myriophyllum spp.	milfoil
Heteranthera dubia	mud plantain
Potamogeton crispus	curlyleaf pondweed
P. pectinatus	sago pondweed
P. zosteriformis	flatstem pondweed
Ranunculus longirostris	buttercup
Najas flexilis	bushy pondweed
Elodea Canadensis	waterweed

- **Floating-leaf**

Nymphaea sp.	white lily pad
Lemna minor	duckweed

- **Emergent**

Scirpus sp.	bulrush
Sagittaria sp.	arrowhead
Typha sp.	cattail
Sparganium sp.	burreed

Coontail was the most abundant plant species identified (WDNR, 1979).

4.6 Floristic Quality Index

FQI varies around the state of Wisconsin and ranges from 3.0 to 44.6 with the average FQI of 22.2 (Aquatic Plant Management in Wisconsin - Draft, 2005). FQI is used to help compare lakes around the state and to assess the lake over time. Higher FQI numbers indicate better lake quality. During June, the Lake FQI was 19.2 a value slightly below Wisconsin's median of 22.2 (Table 4). This FQI value suggests that the Lake has below average water quality.

4.7 Chlorophyll *a*

Chlorophyll *a* concentrations correspond to the abundance of algae in lake water. Chlorophyll *a* concentrations respond to seasonal light changes, lake water nutrient content and transparency, aquatic macrophyte growth, temperature, and zooplankton abundance. High chlorophyll *a* concentrations relate to algal blooms. Algal blooms can occur when events liberate nutrients into the lake system or otherwise upset nutrient equilibrium. Examples of events that could cause an algal bloom are:

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- Severe thunderstorms washing nutrient-laden water or sediment into a lake
- Decrease in zooplankton abundance
- Significant manipulation of the macrophyte community

If significant amounts of aquatic macrophytes are destroyed and are not removed from the water, the demand for limiting nutrients is decreased and nutrients are returned to the water from decomposing aquatic plants. This chain of events can cause algal blooms.

Blue-green algae levels were measured by the WDNR in 2005. A water sample was collected on October 5, 2005 on Lazy Lake as part of monitoring effort to examine the frequency, severity and duration of blue-green algae blooms in Wisconsin. High concentrations of blue-green algae were detected in Lazy Lake during 2005. *Anabaena sp.* 1 was 6,000 natural units/ml, *Anabaena sp.* 2 was 100 natural units/ml, *Planktothrix sp.* was 1,000 natural units/ml, and *Aphanizomenon sp.* was 2,500 natural units/ml. The total density of blue-green algae in this sample was very likely over the World Health Organization guideline of 100,000 cells/ml (there are many cells in each filament). The species of blue-green algae identified in this sample is capable of producing toxins, including anatoxin-a (a neurotoxin). When blue-green algae are growing, they sometimes produce toxins and store them within the algal cell. Algal toxins are naturally produced chemical compounds that are sometimes found within the cells of certain species of blue-green algae. If a cell is broken open, the toxins may be released. Additional information about blue-green algae is available in Appendix B.

5.0 CONCLUSIONS AND POSSIBLE MANAGEMENT OPTIONS

5.1 Conclusions

Lazy Lake has historically been perceived as a lake with fair water quality, and abundant aquatic macrophytes. Water quality data collected in 2003 indicate an eutrophic lake system. Nutrients from both within the lake, land uses within the watershed, and inputs from the Crawfish River are likely contributing nutrients to the lake which can enhance aquatic plant and algal growth. Lazy Lake is similar to many Wisconsin "shallow water" lake ecosystems. Aquatic macrophytes compete with algae for available nutrients. If too many macrophytes are removed, algae can become the dominant form of plant growth. Carp can excaserbate the problem. Additional information on shallow lake ecology is available from Northern Environmental or the WDNR upon request.

The lake is a popular sport fishing lake especially in the winter. Recreational activities are extremely limited due to excessive aquatic plant growth. An aquatic plant harvester helps manage dense aquatic plant growth for boat navigation and provide lanes for game fish.

During the June 2005 aquatic plant survey, sixteen aquatic plant species were found, respectively - an indicator of a low to moderately diverse aquatic plant community. EWM and CLP, two aquatic invasive species were identified. During the June survey, the most abundant aquatic plants excluding free-floating Small Duckweed (*Lemna minor*) and Common Watermeal (*Wollfia columbiana*) was two exotics Curly-leaf Pondweed (*Potamogeton crispus*), Eurasian watermilfoil (*Myriophyllum spicatum*), and Coontail (*Ceratophyllum demersum*) with frequency of occurrences of 95.8, 93.7 and 91.5% respectively

Dense growth of Curly-leaf Pondweed, Eurasian watermilfoil, and Coontail cause navigation problems for boats throughout the summer. Dense aquatic plant growth makes it extremely difficult for lake users to access many parts of the lake and also may contribute to stunted fish populations.

5.2 Possible Management Options

Some areas of Lazy Lake exhibit aquatic plant growth that interferes with recreational activities. Dense aquatic plants tangle boat props and the riparian landowners report problems getting their boats from their piers to open water areas. As such, the District has operated an aquatic plant harvesting program. Historically, the harvesting activities were often largely un-regulated. The WDNR promulgated NR 109, Wis. Adm. Code requiring development of APM Plans in order to obtain an aquatic plant management permit for harvesting activities. The NR 109 program is intended to allow management for nuisance conditions but protect aquatic plant communities from improper management.

Lazy Lake, Fall River Wisconsin

NR 109 requires that an applicant review all available aquatic plant management techniques before selecting a management strategy. Existing physical, biological, and chemical management techniques and current available research were reviewed in detail. A comprehensive comparision of APM techniques, including descriptions about the technology, benefits, drawbacks, and costs are included in Appendix C. Based on these comparisons and the specific aquatic plant problems on Lazy Lake, the following potential management strategies were considered.

5.2.1 Manual Removal

Hand raking or hand pulling can be completed to remove aquatic plants from the water. Benefits include low costs, and the drawbacks are the labor intensive nature of this option. Manual removal by individual landowners can be completed to a maximum width of 30 feet to provide pier or swimming raft access. A permit is not required for hand pulling or raking if the maximum width cleared does not exceed 30 feet. Manual removal exceeding 30 feet in width requires a permit from the WDNR for native aquatic macrophytes. Removal exceeding 30 feet in width is permitted without a permit for exotic species such as EWM and CLP.

5.2.2 Mechanical Harvesting

Aquatic plant harvesting allows easy treatment of large areas of nuisance aquatic plant stands. Advantages of this technology include immediate results, removal of plant material and nutrients, and the flexibility to move to problem areas and at multiple times of the year "as needed". Disadvantages of this method include the limited depth of operation in shallow areas, high initial equipment costs, disposal site requirements, and a need for trained staff to operate the harvester. A full discussion about harvesting is included in Appendix C.

The District currently operates one aquatic plant harvester and a shore conveyer. The District has recently purchased a used harvester. A harvester will typically last 10 years, potentially longer with proper use and maintenance.

5.2.3 Aquatic Herbicide Treatment

Use of an aquatic herbicide was considered as a potential management option. Chemical treatments are discussed at length in Appendix C. Chemical treatment of aquatic plants offers more control in confined areas (e.g. around docks) than harvesters can. The systemic herbicide containing an active ingredient of 2,4-Dichlorophenoxy acetic acid (2,4 D) has demonstrated EWM control and selectivity for protection of native plant species. 2, 4-D results can be seen in 10 to 14 days. A suitable herbicide applied at a suitable dose by an experienced licensed pesticide applicator can target exotic plant species but leave native species relatively unaffected. Navigate®, a granular 2,4-D product, has demonstrated watermilfoil control while not affecting white water lilies, yellow water lilies, watershield, or other high value aquatic plant species found in Lazy Lake. Disadvantages include: 2,4-D lasts only a short time in water and may potentially be detected in sediments after application. After the application, water use restrictions may be necessary as well.

Chemical treatments are discussed at length in Appendix C. While chemical treatments of large areas of aquatic vegetation is not typically supported by WDNR who approve/deny aquatic plant management permits, specific circumstances may be permitted where the aquatic plants exhibit a significant nuisance condition.

5.2.4 Drawdown

Lazy Lake's water level is maintained by a dam located on the south end of the Lake. (one should consult dam engineering documents for an approximate elevation). The intake structure in this dam allows the water level to be lowered. By lowering the lake level, parts of the lake bed could be exposed and subject to freezing conditions. Advantages of drawdowns include the relative inexpense of the proposed action. Drawdowns have the capability to significantly impact populations of aquatic plants, including EWM. Disadvantages include: adverse effects on other aquatic plants; the controversy associated with shoreline landowners if the drawdown and a dry spring result in low water levels once summer returns; complex coordination effort with multiple regulatory agencies; and possible negative affects on fish populations. DNR recently observed good EWM control with a drawdown on Montello Lake in Marquette County, altough, Montello Lake also is implementing an aquatic herbicide program for invasive species. A drawdown may be largely successful if there is a cold winter with relatively little snow cover. Mild winters and increased snow limit their effectiveness.

6.0 RECOMMENDED ACTION PLAN

Consistent with the goals of the APM Plan, and the feasible aquatic plant management alternatives discussed in Section 5.2, the District should implement comprehensive aquatic plant management plan that integrates aquatic plant management techniques for nuisance growth on Lazy Lake. These techniques and other important components of the comprehensive APM Plan are discussed in the following sections. The District should periodically update this APM Plan to reflect current aquatic plant problems, and the most recent acceptable APM methods. Information is available from the WDNR website: http://dnr.wi.gov/org/water/fhp/lakes/aquaplan.htm or from Northern Environmental upon request.

6.1 Manual Removal

Individual property owners may manually remove nuisance aquatic plants in the lake offshore from their property. Manual removal can be completed to a maximum width of 30 feet to provide pier or swimming raft access. A permit is not required for hand pulling or raking if the maximum width cleared does not exceed 30 feet. Manual removal of native aquatic plant species exceeding 30 feet in width requires a permit from the WDNR. Removal exceeding 30 feet in width is permitted without a permit for exotic species such as EWM and CLP making sure not to disturb native species that may be present. However, requests to exceed 30 foot removal width should be brought to the District's attention and alternative management could be considered (e.g. harvesting and/or chemical treatment).

6.2 Mechanical Harvesting

The District should continue mechanical harvesting for navigation purposes using District-owned harvesting equipment. The WDNR reguates mechanical harvesting under Chapter NR109 of the Wisconsin Administrative Code (NR 109 Wis. Adm. Code). The District must comply with the conditions of a WDNR-issued harvesting permit. A copy of the current harvesting permit and NR 109 Wis. Adm. Code is included in Appendix D. Harvesting for aesthetic reasons is not allowed. Harvesting is allowed to provide nuisance relief for navigation subject to the following restrictions.

Areas

Aquatic plant harvesting should be completed on Lazy Lake for navigation purposes only within the permitted area illustrated on Figure 6. Harvester operators shall target nuisance areas of dense submergent aquatic plant growth that interferes with boat traffic or other recreation within this areas. The operator shall not harvest emergent (e.g. cattails) or floating leaved plants (e.g. water lilies). The harvesting map (Figure 6) illustrates approximately 80 acres (54% of lake area) where aquatic plants may potentially be harvested. The area illustrated is between 3 and 8 feet of water depth minus areas where floating leaved vegetation is present or shoreline areas that are not developed. The nuisance aquatic plants within the mapped area are only harvested for pier access, swimming areas and boat navigation lanes. Furthermore, the harvester is not operated in less than 3 feet of water depth. Harvesting may occur at half the water column depth and aquatic plants growing to 8 feet are only cut to the 5 foot harvester cutter head depth. Some areas of harvesting may have 8 feet of vertical plant growth and only require a few cuttings to a depth of 5 feet to provide safe boating. Residents not wanting an access channel should request "No Cut" in front of their property.

The WDNR suggested that the District consider implementing Global Positioning System (GPS) technology on the harvesters. GPS can be used to mark navigation hazards and document harvesting areas.

Depth

The harvester operator shall not operate the harvester in less than 3 feet of water depth to prevent disruption of the bottom sediments, turbidity, and/or damage to the cutting head. If any sediments are encountered, the cutter head will be raised immediately. Harvesters will cut approved harvesting areas at half the water column depth. Full cutter depth (5 feet) is only operated at water depths of 6 feet or greater.

Operators

Prior to each harvesting season, each operator will be required to review the APM Plan and conditions of the harvesting permit. Harvester operators will be trained to know the limitations of harvesting (areas and depths). The approved harvesting area map (Figure 6), a copy of the DNR harvesting permit, and the harvesting restrictions listed above will be included in a harvester guidance binder on each aquatic plant harvester. Harvesting operators report to the District commissioners who identify proposed harvesting routes based on plant density and navigation need.

Timing

Timing of aquatic plant harvesting is a useful tool in selective management and therefore is considered an important component of the APM Program activities. Aquatic plant harvesting activities should normally begin after Memorial Day. This date is protective of April and May fish spawning seasons. Based upon past experience, harvesting intensity will typically increase into late summer when EWM becomes a significant nuisance species.

Record Keeping

The District should maintain detailed records including harvesting dates, harvesting areas, types, and amounts of aquatic plants harvested. A sample record keeping form is included in Appendix E.

Additional specific information about the Lazy Lake harvesting program (completed WDNR harvesting worksheet) is included in Appendix E.

6.3 Selective Herbicide Treatment

The District should consider using an approved aquatic herbicide to treat dense areas of EWM and/or CLP in near shore areas by individual properties (e.g. by individual piers) where the harvestor can not operate. This activity could be completed by the District or individual landowners (WDNR permit is required). Aquatic herbicide treatments have changed greatly over the past couple of years on selectivity and have also demonstrated safety to other aquatic plants while providing safety to both other plants and animals. Early spring treatments (before water reaches 60º F) for CLP and EWM in nearshore areas around piers using endothall (Aquathol) for CLP and 2,4-D (Weedar, Navigate) for EWM are an effective alternative. A typical control measure for EWM is described below. A similar management plan would be followed for CLP control.

A granular 2,4 D product sold under the trade name Navigate® is a herbicide that has been used to selectively reduce populations of EWM. Navigate® has demonstrated EWM control while not affecting white water lilies, yellow water lilies, or watershield, or other high value aquatic plant species based on application rate and timing in which the treatment takes place. A typical treatment scenario follows.

An early to mid-May EWM Assessment should be completed to map proposed treatment areas. The assessment along with a permit for chemical application should be submitted to the WDNR Water Resource Specialist for Columbia County. Once an approved permit is awarded a chemical treatment using a selective systemic aquatic herbicide like Navigate® could be applied by a licensed applicator.

The treatment using Navigate® targeting EWM should occur once water temperatures reach 60°F. In some instances one treatment may only be required, however a potential follow up "spot treatment" may also be needed. All NR 107 public notice and water use restriction posting requirements would need to be followed. A public notice would also be published in the largest circulating newspaper for Lazy Lake if the proposed treatment area exceeds 10 acres in size or over 10% of the total littoral area is proposed to be treated. A public hearing may be requested if more than five or more individuals, organizations, or special units of government request a meeting to be held.

A yellow sign describing the treatment should be posted by the dock or shoreline of any property being treated. A swimming and water use restriction for 24 hours would follow the application. Also, the water should not be used to irrigate fruit or vegetable plants until an approved assay analyzing for 2,4-D is completed and residual levels have dropped below 70 parts per billion (ppb).

6.4 Sensitive Areas

WDNR may designate sensitive areas on Wisconsin Lakes. Sensitive Areas are defined as "areas of aquatic vegetation identified by the department as offering critical or unique fish and wildlife habitat, including seasonal or lifestage requirements, or offering water quality or erosion control benefits to the body of water". Sensitive areas are often located where there is little to no shoreline development. Shoreline features (developed areas and undeveloped areas) are illustrated on Figure 7. WDNR has not conducted any sensitive area surveys on Lazy Lake. If such surveys are completed, additional restrictions to the harvesting program or APM in general may be required. Information about sensitive areas is included in Appendix F.

6.5 AIS Prevention and Control Plan

An important component of the overall APM plan is an AIS Prevention and Control Plan (AIS Plan). The current AIS on the Lake include EWM and CLP. To date other common AIS (purple loosestrife, zebra mussels, rusty crayfish, spiny water flea, etc.) have not been found in the Lake. Invasive aquatic plants were discussed in Section 4.2. Additional AIS were discussed in Section 4.3.

The AIS component of the APM Plan includes the following components to address the current AIS and prevent new infestations.

6.5.1 Watercraft Inspection

A watercraft inspection program should be developed for Lazy Lake in accordance with the Clean Boat/ Clean Waters (CB/CW) Program developed by the University of Wisconsin Extension Lakes Program. CB/CW is a highly regarded volunteer watercraft inspection program developed by the WDNR and UWEX Lakes Program. The CB/CW efforts in Wisconsin involves providing information to lake users about what invasive species look like and what precautions they should take to avoid spreading them. It also involves visual inspection of boats to make sure they are "clean" and demonstration to the public of how to take the proper steps to clean their boats and trailers. Watercraft inspectors also install signs at boat landings informing boaters of infestation status, state law, and steps to prevent spreading AIS. The **Clean Boats Clean Waters** Program is sponsored by the DNR, UW Extension, and the Wisconsin Association of Lakes and offers training to volunteers on how to organize a watercraft inspection program. For more information see the following website:

http://www.uwsp.edu/cnr/uwexlakes/CBCW/default.asp

Training materials, a list of workshop dates, publications, supplies, and links to other important information are all provided on the CB/CW web page. Volunteers may also contact Laura Felda-Marquardt, Volunteer Coordinator for the Invasive Species Program, UW Extension-Lakes Program at (715) 346-3366 or (715) 365-2659 for details. Please note if any of the above hyperlinks to web addresses become inactive, please contact the WDNR, UW Extension Lakes Program, or Northern Environmental for appropriate program and contact information. At a minimum, AIS and CB/CW signs at public boat launches should be maintained.

6.5.2 Monitoring

In addition to monitoring boat launches, volunteers should establish a lake monitoring program. An organized volunteer monitoring group should be established to closely observe the aquatic plant community of the Lake and document any noteworthy changes in the abundance of aquatic plants or algae. Close attention should be paid to frequency of algae blooms.

The District should either contract for annual AIS monitoring or have a volunteer trained to complete the AIS monitoring through the WDNR self help program. At a minimum the harvester operator should be able to recognize AIS such as EWM and CLP. The monitors should report any significant expansion of CLP or EWM to a District commissioner. Also any noted changes in native aquatic plants should also be reported as this may indicate current management practices may need modification to increase protection of native species. Additional information about these exotic aquatic plants is available in the educational materials in Appendix F. Additional information is also available from the WDNR website http://dnr.wi.gov/invasives/aquatic.htm or from Northern Environmental upon request. The operator shall report any new AIS areas to a District Commissioner immediately. Grants may be available to help fund hiring professionals to complete these monitoring efforts or local lake enthusiasts can become trained in the WDNR self-help citizen monitoring program. For more information on having volunteers provide AIS monitoring, please visit the following website:

http://dnr.wi.gov/org/water/fhp/lakes/selfhelp/shlmhowto.htm

Or contact your local lake coordinator from the list at:

http://www.dnr.state.wi.us/org/water/fhp/lakes/selfhelp/shlmcont.asp

If any of the above hyperlinks to web addresses become inactive, please contact Northern Environmental for appropriate program and contact information.

6.5.3 APM & AIS Education

Education is the key to understanding the negative impacts of AIS, identifying AIS, and preventing the spread (both in the Lake and to nearby lakes). The District should establish an organized education effort focusing on AIS prevention and control. The following education approaches could be implemented.

1) A newsletter is an excellent way to reach a large audience and share information. The District currently publishes and distributes a newsletter. AIS article topics can be published in the newsletter.
2) Annual meeting - the District currently holds an annual meeting. This meeting can also serve as an education opportunity. Topics focusing on AIS issues can include a summary of the previous year's efforts and successes, and samples of EWM and CLP.
3) Conduct a "Clean Sweep" Lake Day - the District should coordinate a day in late July or early August where property owners observe their shoreline for all plant species present. Any unknown or suspicious plants should be identified by trained volunteers or WDNR staff to document the spread of EWM and CLP and the presence of native plants.
4) Purchase plastic buckets to be placed at the boat landings for residents and transient boaters to place any plant fragments.

In addition to informing the Lazy Lake community, the District should publish an article in the local newspaper detailing the efforts the District is taking to address AIS on the Lake and prevent the spread of AIS to other area lakes.

Information should emphasize:

- The values aquatic plants provide
- The importance of keeping excessive nutrients out of a lake
- The importance of preventing and controlling AIS

Several WDNR and UW Extension fact sheets are available. The District can order copies of WDNR and UW Extension publications by visiting the following website:
http://www.uwsp.edu/cnr/uwexlakes/publications/

If the above hyperlinks to web addresses become inactive, please contact Northern Environmental for appropriate program and contact information. Public education should continue with emphasis on the above topics. If you need additional public education materials, contact your WDNR lake coordinator, local UW Extension agent, or Northern Environmental for more information.

6.6 Nutrient Controls and Watershed Management

Recognizing that nutrients in runoff and from septic systems can contribute to excessive aquatic plant growth on Lazy Lake, the District should consider developing a Lake Management Plan incorporating an aggressive nutrient and water quality component to help assess "problem areas" around Lazy Lake. See also Section 6.7.

Lazy Lake has both natural and manicured shoreline areas. Natural shorelines are beneficial to a lake's health in that they filter nutrients and sediments from storm water runoff. The District should also consider encouraging landowners to install a natural shoreline buffer on their property. Offering lakeshore residents within the District who complete such a project a tax credit is one idea.

Since agriculture is the land use that was predicted to contribute the majority of the nutrients to Lazy Lake, efforts should be made to minimize agricultural runoff. Agricultural best management practices (BMPs) can help prevent erosion and nutrient runoff. The District should work with the Columbia County LCD to identify areas of potential concern and implement BMPs as needed. A watershed inventory is being completed to identify and prioritize agricultural sites within the watershed not meeting the minimum runoff performance standards established by the WDNR. This study is extremely valuable in locating high priority runoff problem sites and to identify nutrient sources. Cost sharing is available for agricultural BMPs (e.g. Conservation Reserve Enhancement Program (CREP)).

After completion of the watershed inventory, the District should consider developing a formal lake management plan (LMP). The District is currently eligible for several WDNR grant funds (e.g. Lake Management Planning grants). However, completing a lake management plan would allow the District to qualify for WDNR Lake Management Protection grant funds.

As always, contact your local WDNR grant specialist and lake staff to discuss your project ideas and the potential for funding sources.

6.7 Public Education

The District should continue to educate to lake users about the importance of aquatic plants to the lake ecosystem. AIS prevention and control is an important component as explained in section 6.5.3.

6.8 Monitoring

To evaluate the effectiveness of the APM Program, the District should complete monitoring of multiple APM Plan components. The District should constantly evaluate their program for potential improvement opportunities, however the following items are considered minimum monitoring components.

6.8.1 APM Technologies

The APM technologies listed in Appendix C should be re-visited periodically to evaluate if new or improved technologies are available. The professional environmental science community includes universities, state natural resource regulatory agencies (e.g. WDNR), and federal regulatory agencies (e.g. USFWS, USACE, EPA, and USGS). These parties along with private conservation groups continuously seek government funding for research about exotic species. The District is encouraged to "stay current" with this research as the knowledge gained from these endeavors may prove useful for APM activities or overall aquatic ecosystem management in the future.

6.8.2 Public Input

The District should assess the public's perception of APM on Lazy Lake. Periodic questionnaires should be solicited in District mailings to evaluate the opinions of lake users about aquatic plants and management on Lazy Lake.

6.8.3 Periodic Aquatic Macrophyte Surveys

In addition to evaluating EWM and CLP, the District should complete lakewide aquatic macrophyte surveys every 5 to 10 years to monitor changes in the aquatic plant community and the effects of APM in the management area. Aquatic plant communities may change with varying water levels, water clarity, nutrient levels, and aquatic plant management. At a minimum, the aquatic plant surveys should duplicate the 2005 point intercept survey.

6.8.4 Water Quality Monitoring

Lazy Lake's water quality is determined to be fair and an adequate monitoring system can help track changes within the lake and prevent significant lake problems. The District should complete water quality monitoring. A good program to be involved in is the WDNR Self-Help Citizen Lake Monitoring Network. WDNR records indicate that self help monitoring has been completed in 2000 and 2003. Using the self help program, volunteers measure water clarity, using the Secchi Disk method, as an indicator of water quality. Volunteers may also collect water chemistry, parameters, temperature, and dissolved oxygen data.

The WDNR provides all equipment to the volunteer. Training of the volunteers is provided by either DNR or University of Wisconsin - Extension staff. Volunteers provide their time to collect samples. The information can be used by WDNR and other lake experts to track changes in the lake's health. Portions of the equipment and laboratory work are eligible for funding through lake management planning grant funds. For more information on volunteer monitoring, visit the following DNR web page on the internet: http://dnr.wi.gov/org/water/fhp/lakes/selfhelp/. Or contact your local DNR lake professionals for more information.

The following illustrates a typical WDNR Citizen Lake Monitoring Network parameter and schedule for citizen lake monitoring.

	April – May	June	July	August	Sept. – Oct.	Winter
Water Clarity	Biweekly	Biweekly	Biweekly	Biweekly	Biweekly	
Total Phosphorus	1X	1X	1X	1X	1X	
Chlorophyll a		1X	1X	1X	1X	
Dissolved Oxygen / Temperature	1X	1X	1X	1X	1X	X

* Note: Completing Nitrogen sampling is also encouraged to better understand nutrient sources.

Every few years, this data should be reviewed collectively to determine if the lake's trophic status has changed. A lake management planning grant could pay for updating and interpreting this lake data. If the lake's clarity, chlorophyll *a*, or phosphorus levels indicate a reduction in water quality or lake users notice a perceived change in water quality, then the District may consider completing a full lake water budget and nutrient budget to determine the sources of water quality deterioration. After that is completed, the District should consider completing a feasibility study for controlling the nutrient sources of concern.

7.0 REFERENCES

While not all references are specifically cited, the following references were used in preparation of this report.

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APPENDIX A

2005 AQUATIC PLANT SURVEY DATA

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APPENDIX B

BLUE-GREEN ALGAE IN WISCONSIN WATERS
-FREQUENTLY ASKED QUESTIONS

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APPENDIX C

SUMMARY OF AQUATIC PLANT MANAGEMENT ALTERNATIVES

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APPENDIX D

HARVESTING PERMIT
AND
NR 109 WIS. ADM. CODE

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APPENDIX E

WDNR HARVESTING WORKSHEET
AND
RECORD KEEPING LOGS

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APPENDIX F

SENSITIVE AREA INFORMATION

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APPENDIX G

PUBLIC EDUCATION MATERIALS

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FIGURES

TABLES

AQUATIC PLANT MANAGEMENT PLAN

LAZY LAKE
COLUMBIA COUNTY, WISCONSIN

DNR LAKE PLANNING
GRANT NO: LPL–996-05

May 21, 2007