Aquatic Plant Management Plan

Miller Dam Lake

Miller Dam Lake Association

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Bonestroo

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1.0 Executive Summary

The Miller Dam Lake Association (MDLA) was formed in 2001 to address resource management concerns on Miller Dam Lake also known as Chequamegon Waters Flowage. The Association has been active in a number of lake management activities on Miller Dam Lake including: lake aeration, aquatic plant management, invasive species monitoring and control, and community education activities. MDLA contracted Bonestroo, Inc. to help develop an aquatic plant management (APM) plan for Miller Dam Lake. The Miller Dam Lake APM Plan includes a review of available lake information, an aquatic plant survey, watershed assessment, water quality evaluation and an evaluation of feasible physical, mechanical, biological, and chemical aquatic plant management alternatives if deemed appropriate. The APM plan also recommends specific management activities for aquatic invasive species (AIS) in the lake systems, which are discussed below.

Bonestroo, Inc. completed an aquatic plant survey on Miller Dam Lake in 2010, which identified 28 aquatic plant species. The most abundant aquatic plants identified during the survey were coontail (*Ceratophyllum demersum*), northern wild rice (*Zizania palustris*), and Eurasian water-milfoil (*Myriophyllum spicatum*). The Floristic Quality Index (FQI) is an index that uses the aquatic plant community as an indicator of lake health. Miller Dam Lake exhibited an FQI of 26.06, higher than the state northern ecoregion average (24.3).

RECOMMENDED AQUATIC PLANT MANAGEMENT PLAN

Two aquatic invasive plants were found during the aquatic plant survey in 2010; Eurasian water-milfoil (EWM) and curly-leaf pondweed (*Potamogeton crispus* – CLP). Both species have been previously identified within the lake and have not been actively managed for. EWM is present on a large scale basis and ongoing management and control efforts are highly recommended. This will help prevent spread of this AIS, along with CLP, to other lakes. Because of this, the following Recommended Action Plan focuses on AIS control and public education.

The following Active Goals form the structure of the Miller Dam Lake Aquatic Plant Management Plan:

Active Goal: Manage EWM and CLP to improve recreation, increase recreational opportunities and rehabilitate native plants.

Active Goal: Manage wild rice in selected areas to improve navigational access to lake.

Active Goal: To continue and expand the WDNR Clean Boats, Clean Waters program on Miller Dam Lake.

Active Goal: To provide visitors with educational information concerning the potential impact their activities could have on introduction of aquatic invasive species, wildlife, habitats and Miller Dam Lake water quality.

Active Goal: To implement and maintain an aquatic invasive species monitoring program that will survey for invasive species, and if found, monitor their locations and extent of population spread.

Active Goal: To continue and expand the Miller Dam Lake comprehensive water quality monitoring program through the WDNR Citizen Lake Monitoring Network. The program would include Water Clarity Monitoring and Water Chemistry Monitoring.

Active Goal: To work in concert with the WDNR and US Forest Service staff and representatives of fishing related businesses to evaluate Miller Dam Lake fish management practices and develop goals in order to maintain and enhance a quality family sport fishery.

Active Goal: To develop and implement a fishing tournament AIS management and monitoring program.

Active Goal: To support the identification and preservation of critical species and critical habitat lands, and wetlands within the watershed. (These are areas with rare vegetation, important habitat for wildlife, or important spawning and nursery areas for fish. Preservation of these lands has a direct impact on the water quality of the lake).

Active Goal: To encourage the incorporation of water quality protection measures in the design, construction and maintenance of all lake access sites on Miller Dam Lake (e.g. storm water control, site drainage control, appropriate plant matter disposal, and watercraft wash down facilities if found to be needed).

Active Goal: To meet on a regular basis with local government agencies and representatives of lakes located within Taylor County to identify essential and new lake management issues and determine collaborative solutions.

2.0 Introduction

Miller Dam Lake, also known as Chequamegon Waters Flowage, was created by damming up the Yellow River for logging in the 1800s. Earlier dams have since been broken or torn down while the current dam was erected in 1967 with 12 feet of head. Taylor and the surrounding Counties (Price, Clark, Rusk, Marathon, Lincoln and Chippewa) account for 7,794 square miles of area, 14.4% of the entire State, and 15.4% (2,326) of all lakes within Wisconsin. Miller Dam Lake is the largest of all 284 lakes within Taylor County and the fifth largest within all surrounding Counties. Miller Dam Lake is surrounded by the Chequamegon National Forest, which occupies roughly 88% of its 34 miles of shoreline and because of this much of its 125 square mile watershed is undeveloped forest and wetlands. There are four public boat landings, several unimproved carry-in landings, a Federal campground, one private campground, two additional picnic areas, a play area, and multiple swimming beaches on the lake that offer plenty of access to the water. These ample access and recreational areas draw statewide users to this area of Taylor County.

Historically, Miller Dam Lake has been a great draw for fishermen from around Wisconsin and the Midwest. Numerous publications and magazines list the waters of Miller Dam Lake as a top destination in the State for fishing opportunities. Many fishing tournaments have been held on its waters while it remains a popular destination for bass fisherman. In 2008-2009, nine tournaments were held with over 4,200 participants and $21,900 in prize money. Because of its high use and value to the community, State, and Midwest, the Miller Dam Lake Association (MDLA) was formed in 2001 to protect and enhance recreational opportunities on the lake for future generations. The MDLA has held an annual ice fishing tournament that has drawn upwards of 1000 participants to help fund its projects including upkeep of boat landings, fish stocking, and the purchase of new piers.

Miller Dam Lake contains a diverse aquatic plant community (28 species in 2010) and is listed by the WDNR as an Area of Special Natural Resource Interest because of the presence of wild rice. Miller Dam Lake is also home to rare, aquatic plant species with an identified Natural Heritage Inventory specie present within the lake. Though the aquatic ecosystem in Miller Dam Lake is very diverse, the aquatic invasive species (AIS) curly-leaf pondweed and Eurasian water-milfoil were confirmed within the lake in 2001 and 2002, respectively. Though both AIS are present, there is currently no aquatic plant management (APM) plan in place. Fishing tournaments held on the lake annually draw participants from across the Midwest. Though good for the community, this diverse and expansive user group presents a unique and extensive threat for the introduction of new AIS or the spread of existing AIS to not only surrounding water bodies, but to the local water bodies of tournament fishermen & vacationers alike.

This document is the APM Plan for Miller Dam Lake and discusses the following:

- Lake morphology and lake watershed characteristics
- Historical aquatic plant management activities
- Stakeholder's goals and objectives
- Aquatic plant ecology
- 2010 baseline aquatic plant survey
- Feasible aquatic plant management alternatives
- Selected suite of aquatic plant management options

3.0 Baseline Information

3.1 LAKE HISTORY AND MORPHOLOGY

Miller Dam Lake is located in the Towns of Cleveland, Ford and Grover in the western Taylor County, Wisconsin. The lake is part of the Yellow River system that drains to the south into Lake Wissota. Figure 1 depicts the lake location. The following summarizes the lake's physical attributes:

Lake Name	Miller Dam Lake – Miller Dam Lake
Lake Type	Drainage
Surface Area (acres)	2714
Maximum depth (feet)	22
Mean depth (feet)	5
Shoreline Length (miles)	34.42 (including islands)
Public Landing	Yes

Source: Wisconsin Lakes, WDNR 2005 and WDNR Lake Survey map, 1969

Figure 2 illustrates the lake bathymetry. Miller Dam Lake provides year-round recreation activities ranging from, fishing, swimming, waterskiing, pleasure boating, snowmobiling, and more.

3.2 WATERSHED OVERVIEW

The Miller Dam Lake watershed encompasses approximately 88,469 acres. Most of the watershed is located in the Chequamegon National Forest and as a result if forested. There are a few acres of agricultural land in the northern portion of the watershed and very few homes along the perimeter of the lake. The following table lists the acres and percent of area of each land cover.

Land Cover	Acres	Percent
Agricultural	1880	2.1
Barren	148	0.2
Forest - Broad Leaved Deciduous	48105	54.4
Forest - Coniferous	4797	5.4
Forest - Mixed	10217	11.5
Grassland	1262	1.4
Open Water	3582	4.0
Shrubland	91	0.1
Wetland Emergent	1971	2.2
Wetland Forest	6257	7.1
Wetland Shrub	10158	11.5

The Miller Dam Lake area consists of four soil associations as described below:

Crystal Lake-Comstock: silt loam, very deep, moderately well to somewhat poorly drained soils formed on glacial lake plains and stream terraces. Parent material consists of mostly silty lacustrine deposits. Land slope generally ranges from 0 to 6 percent.

Loxley-Beseman: peat, very deep, very poorly drained soils formed on moraines. Parent material consists of herbaceous organic material. Land slope ranges from 0 to 1 percent.

Magnor-Freeon: silt loam, very deep to dense loamy glacial till, moderately to somewhat poorly drained soils formed on moraines. Parent material consists of loess or silty alluvium underlain by dense loamy glacial till. Land slope ranges from 0 to 15 percent.

Newood-Newot: sandy loam, deep or very deep to dense loamy glacial till, moderately well drained soils formed on moraines. Parent material consists of dense loamy glacial till. Land slope ranges from 2 to 15 percent.

3.3 WATER QUALITY

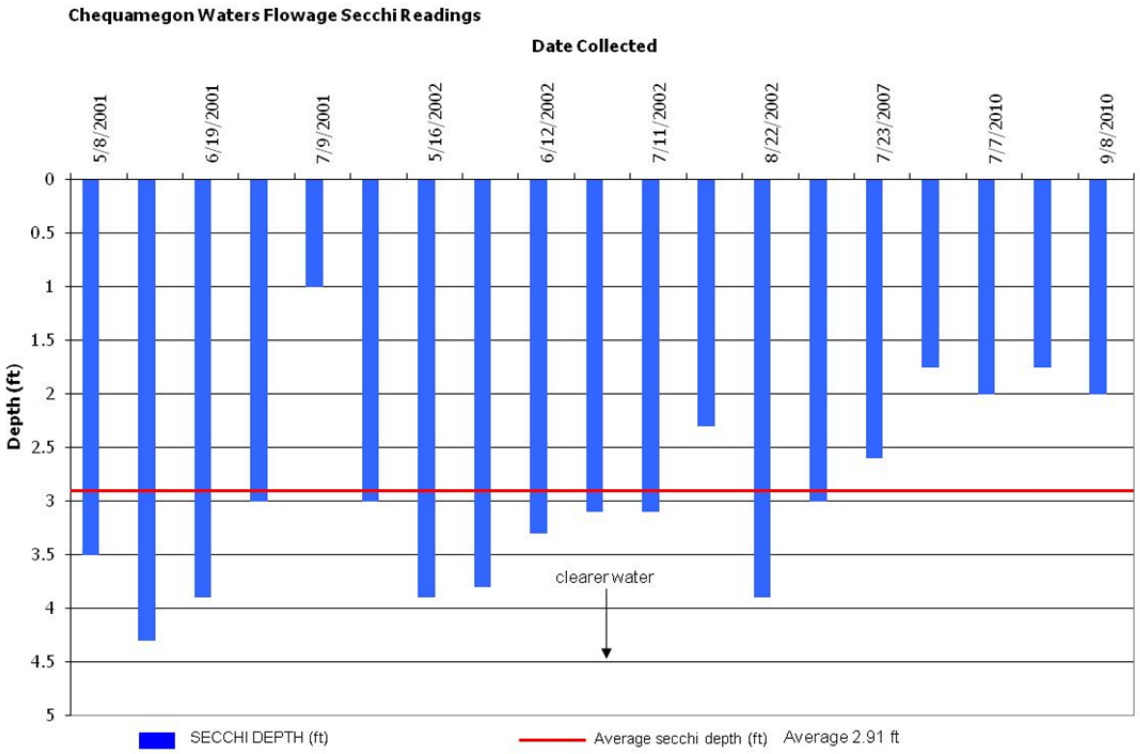
WDNR Lake Water Quality Database indicates that the following water quality information is available

- Water clarity (Secchi depth) - 2001-2002, 2007, & 2010 (Citizen Lake Monitoring)
- Total phosphorus – 1973-1975, 2001-2002, 2007, & 2010 (WDNR baseline monitoring)
- Chlorophyll a – 2001-2002, 2007, & 2010 (WDNR baseline monitoring)

The above referenced data was used in creating the Miller Dam Lake APM Plan. Higher Secchi depth readings indicate clearer water and deeper light penetration. Total Phosphorus is a measure of nutrients available for plant growth. Chlorophyll a is green pigment present in all plant life and necessary for photosynthesis. The amount present in lake water depends on the amount of algae suspended in the water column of a lake. Chlorophyll a is used as a common indicator of water quality (Shaw et al, 2004). Higher chlorophyll a values indicate lower water quality.

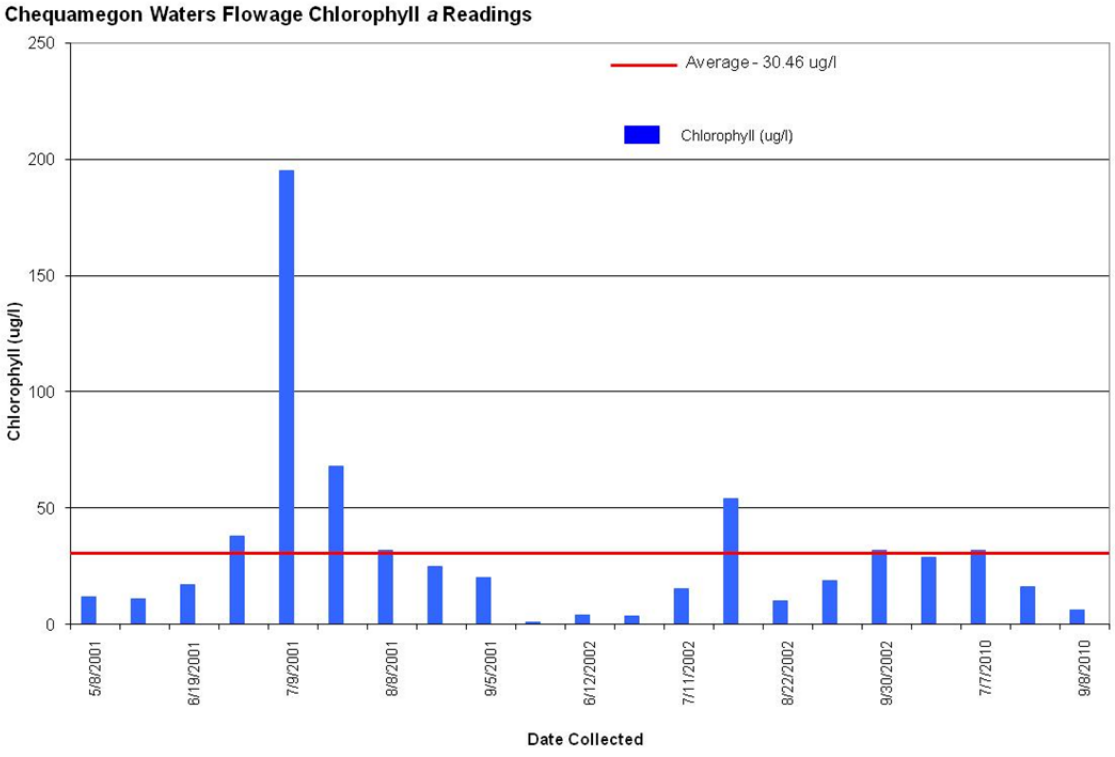
3.3.1 WATER CLARITY

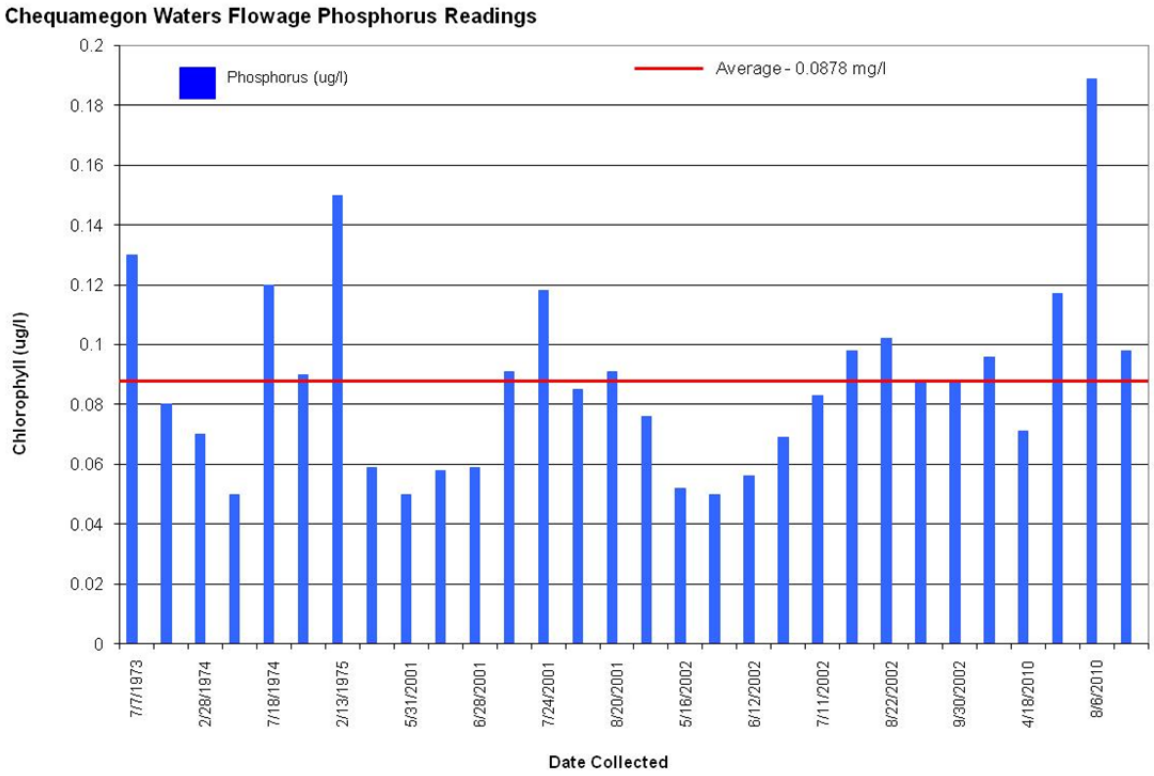
The historical water clarity average based on Secchi Disk readings is very poor at 2.91 feet (0.91 meters) and ranges from 1.0 to 4.3 feet. The Wisconsin average Secchi Disk reading in 2005 was 10 feet (Larry Bresina, The Secchi Disk and Our Eyes - Working Together to Measure Clarity of Our Lakes; internet document). The following graph illustrates the historical water clarity measurements on Miller Dam Lake.



3.3.2 TOTAL PHOSPHORUS AND CHLOROPHYLL *A*

Historically, Miller Dam Lake has had an average phosphorus reading of 0.0878 milligrams per litter (mg/L - parts per million). The total phosphorus has varied from 0.05 mg/L to 0.189 mg/L. Chlorophyll *a* data has an average of 22.23 micrograms per liter (ug/L - parts per billion). Data ranged from 1.0 ug/L to 68 ug/L. A chlorophyll a reading of 198 on July 9, 2001 was removed from the data because it is high beyond reason and does not accurately represent the data. The following graphs illustrate the historical phosphorus and chlorophyll *a* measurements on the Flowage.





3.3.3 Dissolved Oxygen and Temperature

During the 2010 aquatic plant survey a dissolved oxygen (DO) and temperature profile was recorded. Readings were taken at one foot intervals for 18 feet over the deepest portion of the lake. Results can be found in the following table.

Depth (ft)	Temperature (F)	DO (mg/l)
1	79.2	5.7
2	79.2	5.7
3	79.1	5.6
4	78.9	5.6
5	77.6	5.4
6	76.5	5.2
7	75.7	5.2
8	75.7	5
9	74.8	4.9
10	74.6	4.7
11	74.6	4.4
12	74.4	4.4

3.3.4 Trophic State Index

Trophic State Index (TSI) values are assigned to a lake based on total phosphorus, chlorophyll *a*, and water clarity values. The TSI is a measure of a lake's biological productivity. The TSI used for Wisconsin lakes is described below.

Category	TSI	Lake Characteristics	Total P *(ug/l)*	Chlorophyll a *(ug/l)*	Water Clarity *(feet)*
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.	< 12	<2.6	>13
Mesotrophic	41-50	Moderately clear; increasing probability of low to no oxygen in bottom waters.	12 to 24	2.6 to 7.3	13 to 6.5
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.	> 24	>7	<6.5
Miller Dam Lake	**63.81**	**Eutrophic**	**87.8**	**22.23**	**2.91**

Adopted from Carlson 1977, Lillie and Mason, 1983, and Shaw 1994 et. al.

The historical water clarity, total phosphorus, and chlorophyll a data indicate that Miller Dam Lake is a eutrophic lake.

3.4 SUMMARY OF LAKE FISHERY

The following table identifies the fish species the WDNR lists as being present in Miller Dam Lake.

Fish Species	Present	Common	Abundant
Northern Pike		X	
Largemouth Bass			X
Panfish			X

Source: WDNR Wisconsin Lakes Publication # PUB-FH-800, 2005

The WDNR website presents records of fish stocked in Miller Dam Lake (WDNR Fish stocking website, 2010).

Year	Largemouth Bass	Northern Pike	Walleye*
1974	44,080	---	---
1976	135,700	---	---
1977	9,060	150,000	---
1978	501,200	---	---
1979	500,000	---	---
1980	74,653	600,000	---
1981	176,222	500,000	---
1982	339,075	352,800	---
1983	276,403	625,000	---
1984	---	561,925	---
1985	---	500,000	---
1991	50343	---	---
1992	50,000	7,500	---
1993	25,000	2,500	---
1993	25,000	---	---
1994	25,000	2,500	---
1995	---	2,500	---
1995	---	300,000	---
1996	---	3,600	---
1998	---	2,500	---
1999	---	2,500	---
2000	---	4,100	---
2001	---	1,460	---
2002	---	6,251	---
2002	---	1,038	---
2007	---	---	2700
2008	---	---	1350
2009	---	---	1350
2010	---	---	1350

* Walleye (7-10 inches) stocked privately with DNR permit

Miller Dam Lake has been stocked in the past by WDNR. Both large mouth bass and northern pike were stocked from 1974 – 1994 and 1977 – 2002 respectively. DNR does not plan to stock Miller Dam in the near future. Walleye have been privately stocked from 2007 – 2010 by MDLA and Taylor County Sportsman Club under a WDNR permit. There have not been walleye documented through DNR fish surveys but, fisherman have reported catching them.

Jeff Scheirer, DNR fisheries biologist, was contacted to discuss the fishery of Miller Dam. Mr. Scheirer feels that the fishery is meeting the goals outlined in the fish management plan for the lake. The lake is supporting a quality fishery with stable populations of panfish, bass and northern pike. A fish survey was conducted by DNR in 2010. The results indicated that the black crappie population had the desired abundance but not the desired size structure. According to

the data it appears that anglers are selectively harvesting the largest crappies of the population. Under the current regulations the daily bag limit of panfish is 25. Reducing the daily bag limit to 10 panfish may help to improve the size structure of the crappie. The bluegill population is similar to the crappie population; the abundance is on goal but the size structure is not. Again it appears that anglers are selecting the larger bluegills. Reducing the daily bag limit to 10 may improve the bluegill population also. The northern pike population meets or exceeds the abundance (low to moderate proportion) and size structure goals for the flowage; no change in management is recommended. Large mouth bass catch rates during the survey may have been impacted by unseasonable high water temperatures. The results indicated low population abundance. The population abundance is assumed to be near goal since there have been no complaints from the high number of bass fishermen on the lake; no change in management is anticipated.

There may be steps taken to improve the habitat in the flowage. Flowages that are created by damming rivers generally have an abundance of coarse woody habitat when they are new and young. As they age the wood ages and decays leaving less habitat. Tree drops along the shoreline and strategic placement of low, reef style fish cribs may increase habitat structure for fish. Tree drops may be considered along the public shoreline throughout the lake and in Beaver Creek area; consult with USFS to determine potential locations. Fish crib reefs may be created along popular shore fishing areas to increase habitat that can be reached by shore fishermen. The cribs should be placed in a configuration that will mimic natural habitat. Jeff Scheirer should be contacted to determine the best type and location of the fish cribs

3.5 LAKE MANAGEMENT HISTORY

There has been very little management of Miller Dam in the past; management mainly consisted of fish stocking and wild rice seeding. Fish stocking has been done by DNR and by private organizations as discussed in the previous section. Wild rice was planted by USFS and GLIFWC with support form local sportsman club. The initial seeding took place in 1988 when 3 acres was seeded; this seeding did not take off. From 1991-1996 3 to 5 acres was seeded each year at Bear and Beaver Creek inlets. This seeding was effective and has since spread to inhabit approximately 660 acres of the flowage. Although CLP and EWM are present in the flowage there has been no management of these AIS.

3.6 GOALS AND OBJECTIVES

MDLA identified the following goals for aquatic plant management on Miller Dam Lake.

- Control EWM and CLP
- Conduct pre and post evaluation monitoring of APM management activities
- Limited management of wild rice
- Maintain and improve recreational opportunities
- Protect and improve fish and wildlife habitat
- Preserve native aquatic plants
- Prevent the spread of existing, and introductions of new of AIS
- Identify and Protect sensitive areas
- Identify sources of financial assistance for aquatic plant management activities
- Coordinate sound aquatic plant management practices where needed within Miller Dam Lake
- Educate the Miller Dam Lake community on proper AIS identification and prevention efforts
- Gather citizen input
- Increase citizen participation in lake management

4.0 Project Methods

To accomplish the project goals, the MDLA needs to make informed decisions regarding APM on the lake. To make informed decisions, MDLA 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. An aquatic plant community survey was completed onsite to provide the data needed to evaluate aquatic plant management alternatives.

4.1 EXISTING DATA REVIEW

Bonestroo, Inc. researched a variety of information resources to develop a thorough understanding of the ecology of the Lake. Information sources included:

- Local and regional geologic, limnologic, hydrologic, and hydrogeologic research
- Discussions with lake members
- Available topographic maps and aerial photographs
- Data from WDNR files

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 8.0 of this report.

4.2 AQUATIC PLANT SURVEY AND ANALYSIS

The aquatic plant community of the lake was surveyed on July 21 and 22, 2010 by Bonestroo, Inc. The survey was completed according to the point intercept sampling method described by Madsen (1999) and as outlined in the WDNR draft guidance entitled “Aquatic Plant Management in Wisconsin” (WDNR, 2005).

WDNR research staff determined the sampling point resolution in accordance with the WDNR guidance and provided a base map with the specified sample point locations. The sample resolution was a 98 meter grid with 1020 pre-determined intercept points (Figure 3). Latitude and longitude coordinates and sample identifications were assigned to each intercept point on the grid (Appendix A). Geographic coordinates were uploaded into a global positioning system (GPS) receiver. The GPS unit was then used to navigate to intercept points. At each intercept point, plants were collected by tossing a specialized rake on a rope and dragging the rake along the bottom sediments. All collected plants were identified to the lowest practicable taxonomic level (e.g., typically genus or species) and recorded on field data sheets. Visual observations of aquatic plants were also recorded. Water depth and, when detectable, sediment types at each intercept point were also recorded on field data sheets.

The point intercept method was used to evaluate the existing emergent, submergent, floating-leaf, and free-floating aquatic plants. If a species was not collected at a specific point, the space on the datasheet 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 sites)
- **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.

4.3 SHORELINE CHARACTERIZATION

The point intercept method described above may not accurately identify emergent and floating leaved aquatic plants in near shore areas. Therefore, a boat tour was completed traveling the entire perimeter of the lake's shoreline. During the boat tour, visual observations of the emergent and floating leaved plant communities were located and recorded. The boat tour also included a shoreline characterization, which provides an evaluation of shoreline development on the Lake. The following scale was used to rate the level of shoreline development.

1: Undeveloped (i.e. Forested or wetland)

2: Minor development (i.e. Properties may have mostly natural shoreline, sparse structures set further away from the lake, one pier, and little or no clearing of natural vegetation).

3: Moderate development (i.e. Properties may exhibit clearing and/or manipulation to the shore and lawn areas but not to waters edge. More elaborate piers or boathouses may be present).

4: Major development (i.e. Properties may include large lawn areas extending to the shoreline, which contains little or no natural shoreline vegetation. Increased building density, possibly close to the shore, multiple docks or boathouses, and significant shoreline alteration such as seawalls or rip rap may be present).

4.4 PUBLIC INVOLVEMENT, QUESTIONNAIRE, AND PLAN REVIEW

A public questionnaire was developed by Bonestroo, Inc., the MDLA and the WDNR. This questionnaire was designed to gauge lake users' opinions on a number of important topics related to APM Plan implementation. The survey inquired about the users' perception of aquatic plant problems and other lake issues. The survey was also developed to determine what lake users consider an appropriate plant management intensity and cost. The public questionnaire can be found in Appendix H.

4.5 WATER QUALITY METHODS

On July 22, 2010, water samples were collected during the aquatic plant survey at 5 different inflows to the flowage (Bear Creek, Weasel Creek, Yellow River, Brush Creek, and Beaver Creek) along with one sample from the Flowage itself. Chlorophyll a and Phosphorus were both collected with a grab sample at each location and sent to a lab for analysis. All procedures were completed in accordance with Citizen Lake Monitoring protocols.

5.0 Discussion of Project Results

5.1 AQUATIC PLANT ECOLOGY

Aquatic plants are vital to the health of a water body. Unfortunately, people all 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 possess many positive attributes. Despite their importance, aquatic macrophytes sometimes grow to nuisance levels that hamper recreational activities. This is especially prevalent in degraded ecosystems. The introduction of certain aquatic invasive species (AIS), such as EWM, often can exacerbate nuisance conditions, particularly when they compete successfully with native vegetation and occupy large portions of a lake.

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, and diverse. Appendix B includes a discussion about aquatic plant ecology, habitat types and relationships with water quality.

5.2 AQUATIC INVASIVE SPECIES

Aquatic Invasive Species (AIS) are aquatic plants and animals that have been introduced by human action to a location, area, or region where they did not previously exist. 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 a decline of a lake's ecology and interfere with recreational use of a lake. Common Wisconsin AIS include:

- Eurasian Watermilfoil
- Curly Leaf Pondweed
- Zebra Mussels
- Rusty Crayfish
- Spiny Water Flea
- Purple Loosestrife

Appendix C provides additional information on these AIS.

5.3 2010 AQUATIC PLANT SURVEY

The survey was carried out July 21 and 22, 2010, and included sampling at 1020 intercept points. Of the 1020 original sample locations, 770 were sampled. The remaining points could not be accessed due to various reasons including a combination of shallow water and thick vegetation (mainly wild rice) while some points were actually located on land or marshy areas without water, especially in the southern portion of the Flowage. The aquatic macrophyte community of the Flowage included twenty eight free floating, floating leaved, emergent, and submerged aquatic vascular plant species during 2010. Table 1 lists the taxa identified during the 2010 aquatic plant survey. Figures 4a through Figure 4i illustrate the locations of each species identified.

Vegetation was identified to a maximum depth of 6 feet (photic zone). Aquatic vegetation was detected at 46.4 percent (%) of photic zone intercept points. A diverse plant community inhabited the lake during 2010. The Simpson Diversity Index value of the community was 0.93, taxonomic richness was 28 species, and there was an average of 1.38 species identified at points that were within the photic zone. There was an average of 2.98 species present at points with vegetation present. Table 2 summarizes these overall aquatic plant community statistics.

The most abundant aquatic plant identified during the aquatic plant survey was coontail *(Ceratophyllum demersum*). It exhibited a 19.9% frequency of occurrence (percent of photic zone intercept points at which the taxa was detected). It was present at 42.9% of the sites with vegetation and had a 14.4% relative frequency of occurrence. Table 3 includes the abundance statistics for each species.

Ceratophyllum demersum (Coontail) is one of the most widely distributed aquatic plants within Wisconsin. The plant lacks true roots and can be found in water up to 16 feet deep. The leaves are arranged in a whorled fashion and are stiff and located closer together at the tip of the plant, giving it the appearance of a raccoon tail. Coontail is excellent habitat for invertebrates, especially in the winter when most other plants have died. The plant itself is food for waterfowl and provides shelter and foraging opportunities for fish (Borman, et al., 1997). Coontail may be mistaken for EWM.

Northern wild rice (*Zizania palustris*) was the second most abundant species occurring at 17.4% of the photic zone. It was present at 37.5% of the sites with vegetation and had a 42.6% relative frequency of occurrence. In many shallow locations, wild rice grew extremely thick, limiting navigation.

Zizania palustris (Northern Wild Rice) is a shallow rooted emergent plant that sprouts from seed each spring. The first leaves to grow in May and June are narrow, limp and float on the waters surface. The have a smooth surface and pointed tip. By midsummer, flower stalks emerge. Northern wild rice is usually shorter than 3 meters with leaves ranging 4mm-3cm wide. Wild rice has a very specific habitat requirement, including water chemistry (Borman et al., 1997). Silt and muck sediment are the best substrates for growth with water depths ranging from 10cm to 1 meter. In Miller Dam the rice was mainly found shallower than 0.5 meters and up to 1 meter in depth. Rice plays an important ecological role as is food source for a variety of wildlife, from sora rails, swans and red-wing blackbirds to muskrats, while also providing needed habitat for local fish communities.

Wild rice is now a prevalent aquatic plant in Miller Dam that was seeded in the flowage in 1990's to provide food and habitat; especially in the Beaver Creek area. When the flowage was created the Beaver Creek area was intended to be a shallow water area for wildlife and fish habitat, wild rice fits perfectly into this intended use. The benefits of wild rice are as follows:

- Very important waterfowl food that is heavily consumed by mallards, blue-winged teal, ring-necked ducks, wood ducks and other species.
- Provides habitat for waterfowl for breeding, roosting, loafing for adults and essential brood cover for young.
- Favorite food of muskrats.
- Stabilizes sediment and helps contain sediment load from tributaries
- Provides important spawning area for fish such as northern pike and habitat for small fish, edge habitat.

- Provides habitat for macroinvertabrates which are food for fish.
- Takes the place of less desirable aquatic vegetation such as EWM and CLP.
- May reduce BOD levels during winter and hold nutrients.

Wild rice can also become a nuisance plant in certain areas of the lake to shore land residents, boaters and fisherman, potentially impeding or preventing navigation and rendering certain areas of the lake virtually unfishable. The rice has exponentially expanded to areas that were clear of the tall growing plant prior to its introduction. The rice has grown so thick in some areas near shore that riparian owner's and other lake user groups have found it is difficult to navigate or even see the lake from shore during later stages of growth. For this reason limited management options of wild rice are offered as a potential alternative in designated areas. This is further discussed in Section 6.0.

Eurasian water-milfoil (*Myriophyllum spicatum*), an invasive species, was the third most abundant vascular plant species occurring at 16.9% of the photic zone. It was present at 36.3% of the sites with vegetation and had a 12.2% relative frequency of occurrence. See Appendix C for a full description of this plant.

5.3.1 FREE-FLOATING PLANTS

The following three floating-leaf aquatic plant species were identified during the 2010 aquatic plant survey.

- *Lemna minor* (small duckweed)
- *Lemna trisulca* (forked duckweed)
- *Spirodela polyrhiza* (large duckweed)

5.3.2 FLOATING-LEAF PLANTS

The following two floating-leaf aquatic plant species were identified during the 2010 aquatic plant survey.

- *Nuphar variegata* (spatterdock)
- *Nymphaea odorata* (white water lily)

5.3.3 SUBMERGENT PLANTS

The following seventeen submergent aquatic plant species were identified during the 2010 aquatic plant survey.

- *Algae sp.* (filamentous algae) [algal]
- *Ceratophyllum demersum* (coontail)
- *Chara sp.* (chara or muskgrass) [algal]
- *Elodea canadensis* (elodea or common waterweed)
- *Heteranthera dubia* (water star-grass)
- *Moss sp.* (watermoss)
- *Myriophyllum sibiricum* (northern water-milfoil)
- ***Myriophyllum spicatum*** **(Eurasian water-milfoil)**
- Najas *flexilis* (bushy pondweed or slender naiad)
- *Nitella sp.* (nitella) [algal]
- *Potamogeton amplifolius* (large-leaf pondweed)
- ***Potamogeton crispus*** **(curly-leaf pondweed)**

- *Potamogeton richardsonii* (clasping-leaf pondweed)
- *Potamogeton spirillus* (spiral-fruited pondweed)
- *Potamogeton zosteriformis* (flat-stem pondweed)
- *Utricularia vulgaris* (common bladderwort)
- *Vallisneria americana* (wild celery)

5.3.4 EMERGENT PLANTS

The following six emergent aquatic plant species were identified during the 2010 aquatic plant survey.

- *Sagittaria sp.* (arrowhead species)
- *Sagittaria latifolia* (common arrowhead)
- *Schoenoplectus tabernaemontanii* (softstem bulrush)
- *Sparganium eurycarpum* (common bur-reed)
- *Typha latifolia* (broad-leaved cattail)
- Zizania palustris (northern wild rice)

Table 1 lists the species identified. Appendix D includes brief descriptions of all aquatic plants identified.

5.4 FLORISTIC QUALITY INDEX

Higher FQI numbers indicate higher floristic quality and biological integrity and a lower level of disturbance impacts. FQI varies around the state of Wisconsin and ranges from 3.0 to 44.6 with the average FQI of 22.2 (WDNR, 2005). The FQI calculated from the 2010 aquatic plant survey data was 26.06 with an average coefficient of conservatism of 5.43. The coefficient of conservatism is a value that is assigned to each species based on the tolerance of that species to disturbance. The following lists the range of Coefficient of Conservatism and the conditions under which the plant is generally found.

0-3: species found in wide variety of plant communities and very tolerant of disturbance.

4-6: species found in specific plant community but tolerant of moderate disturbance.

7-8: species found in narrow range of plant communities in advanced stages of succession but can tolerate minor disturbance.

9-10: species restricted to narrow range of conditions with low tolerance of disturbance.

This FQI value is higher than Wisconsin's northern region mean of 24.3 and suggests that Miller Dam Lake exhibits good water quality when using aquatic plants as an indicator. The coefficient of conservatism of 5.43 is a community of plants that is moderately tolerant to disturbance indicating that the conditions in the lake have been disturbed and are not representative of pre-settlement conditions. Table 5 summarizes the FQI values. Arrowhead and watermoss were not identified down to species level and were not included in calculation of the FQI.

5.5 SHORELINE CHARACTERIZATION

Emergent and floating leaved plants identified along the shoreline outside of formal grid sample points included: *Sagittaria sp.* (arrowhead), *Nuphar variegata* (spatterdock), *Nymphaea odorata* (white water lily) *Eleocharis palustris* (creeping spikerush), *Pontederia cordata* (pickerelweed), *Typha sp*. (cattail), *Schoenoplectus tabernaemontanii* (softstem bulrush), *Zizania palustris* (northern wild rice), *Carex sp.* (sedges species) and *Sparganium sp.* (bur-reed). Refer to Appendix D for descriptions of these plants. Plants identified during the shoreline survey but not

during the point-intercept method were not included in the community statistics or calculation of the FQI.

The majority of the shoreline was undeveloped and with the Chequamegon National Forest. There are a few residences along the west shore and a State owned campground along the north-northeast shoreline.

5.6 PUBLIC QUESTIONNAIRE

The results of the survey were very informative and there was a good response rate. Of the surveys sent, 50 surveys were returned. The majority of the surveys were returned by offshore, year round residents (25), followed by waterfront landowners (9). Most of the respondents have used the lake for 40 to 50 year (16) with the next category of 1 to 10 years (14). The activities that respondents participate in the most on the lake are ice fishing (42), fishing from boat (39), fishing from shore (36) and enjoyment of scenery (28). When asked to rank activities fishing (38) came in 1st, with nature viewing 2nd (10) and enjoyment of scenery (11) 3rd. The most popular types of boats used on the flowage are motorized less than 50hp (18), motorized over 50hp (9) and pontoon (7) with canoe/kayak (6) close behind. The most used boat launch is at the dam (19) followed by CTH G (10). The users of the lake are very satisfied (32) with the recreational experience on the lake followed by somewhat satisfied (15). The top three concerns on the area 1: too much wild rice (37), 2: excessive plant growth (8), water quality (7), algae growth (7), 3: excessive plant growth (10). The personal opinion of the overall quality of the lake is good (27). The greatest current threats are 1: deterioration of fishery (13) and 2: new invasive species infestation (14). The greatest future threats are similar with 1: deterioration of fishery (20) and 2: deterioration of water quality (15). When asked to rate the extent to which aquatic plant growth negatively impacts activities ice fishing (13) was slightly impacted, while fishing from boat (26) moderately impacted and fishing from shore (33) was greatly impacted. Most all respondents agreed that aquatic plant growth has increased (42) since they have been using the lake. Most respondents were aware of AIS (40) and knew that they existed in Miller Dam. EWM is considered to be a large problem (17) as is CLP (10). The majority support aggressive lake wide management (35) of AIS. The following methods of management are supports: hand pulling (24), mechanical harvesting (29), aquatic herbicide (21) and drawdown (14).

5.7 WATER QUALITY SAMPLING

2010 collected water samples were tested and resulted in phosphorus and chlorophyll *a* readings by location as follows:

Inlet Location	**Total Phosphorus (ug/l)**	**Total Chlorophyll *a (ug/l)***
Brush Creek	320	1.70
Yellow River	250	1.40
Weasel Creek	240	0.87
Bear Creek	550	1.50
Beaver Creek	230	9.60
Lake	320	14

The results of the water quality testing for 2010 may not be an accurate picture of typical conditions in Miller Dam. The samples were collected during a high rainfall/sever storm event. The phosphorus concentrations are very high when compared to averages over the years. High phosphorus values during rain events are not uncommon due to the amount of runoff during storms. The rain flushes the sediment and nutrients form the landscape into the lakes. Summer 2010 was a season of high rainfall events. The data that was collected from 2010 by CLMN indicated high values of phosphorus also. This is likely due to the rainfall and not a change in the land use; the majority of the watershed is forested with wetlands. The dry years preceding 2010 allowed many of the wetlands to "dry out" and collect nutrients. The high rain events flush these nutrients out contributing to the high phosphorus values in the lake. The average phosphorous concentration in the lake from data collected 1973 to 2007 is 83.03 ug/l. The readings from 2010 ranged from 71 to 320 ug/l in the lake and 230 to 550 ug/l in the tributaries. The lower concentrations in the lake may be a result of the dilution of the water from the tributaries after it mixes with the lake and the timing of the sample (high rain event).

The chlorophyll a values are low compared to the average from 2001 to 2007 of 32.5 ug/l. This indicates low algae populations. The secchi readings in 2010 were quite low also with readings from 1.75 to 2 feet, the average from 2001 to 2007 was 3.18 feet. The low chlorophyll readings along with the decreased secchi readings indicate that the low water clarity is likely due to staining of the water or increased suspended solids. Many area lakes have exhibited an increased stain in the water due to the recharge of the wetlands from the wet weather of the summer. There may also be increased suspended solids in many lakes due to the high runoff rates produced by the rainfall. In general the water clarity in the lake is low and likely due to a combination of stained water and algae blooms.

The TSI averaged over the years that parameters were tested for is 63.8 indicating eutrophic (productive) water quality. Following is a list of area waterbodies and a range of the average TSI taken from graphs on WDNR lake data website:

- Eau Pleine flowage, Marathon County: 50-70
- Lake Dubay, Marathon County: 55-65
- Jersey City Flowage, Lincoln County: 50-60
- Mohawksin, Lincoln County: 55-60
- Rice River Flowage, Lincoln County: 45-60
- Spirit River Flowage, Lincoln County: 48-62
- Lac Sault Dore, Price County: 50-65
- Musser Lake, Price County: 35-55
- Round Lake, Price County: 48-60
- Pike Lake, Price County: 34-62

Based on the above data Miller Dam has a TSI that is a bit higher than the area flowages but all are in the same range and are considered mesotrophic (41-50) to eutrophic (51-70).

6.0 Management Alternatives and Recommendations

Based on the goals of the stakeholders as mentioned in section 3.6, several management alternatives are available for this APM plan. Some general alternatives are discussed below. More information on management alternatives is included in Appendix E. Currently, the Northern Region of the WDNR is working under an aquatic plant management strategy that is officially titiled Aquatic Plant Management Strategy, Northern Region WDNR, Summer, 2007 (working draft), or commonly referred to the NOR Region APM Strategy (Appendix I). This strategy lays out an approach for acceptable aquatic plant management in Northern Region lakes. The strategy protects native aquatic plant communities in northern Wisconsin and does not allow permits to control native plants unless documented circumstances of nuisance levels exist. The following management alternatives are based on the approaches described in the NOR Region APM Strategy, and incorporate recommendations of Bonestroo, Inc.

6.1 AQUATIC PLANT MAINTENANCE ALTERNATIVES

The maintenance alternative may be used at a lake in which a healthy aquatic plant community exists and invasive and non-native plant species are generally not present. The maintenance alternative is a protection-oriented management alternative because no significant plant problems exist or no active manipulation is required. This alternative can include an educational plan to inform lake shore owners of the value of a natural shoreline and encourage the protection of the lake water quality and the native aquatic plant community.

6.1.1 AQUATIC INVASIVE SPECIES MONITORING

Two AIS were identified during the 2010 survey in Miller Dam Lake. In order to monitor existing spread of current AIS and for new AIS in the future a strong Citizen Lake Monitoring program that surveys for AIS is highly recommended. In some lake systems, native aquatic plants “hold their own” and AIS never grow to nuisance levels, in others however, vigilant and active management is required. This can be based on several things including water quality. Data provided on the WDNR Citizen Lake Monitoring website indicates monitoring of water clarity was last completed in 2010. Miller Dam Lake residents should also consider becoming active Citizen Lake Monitors for water quality (Secchi depth, total phosphorus and chlorophyll *a*).

The University of Wisconsin-Extension Lake’s Program provides training and coordinates the Citizen Lake Monitoring Program. More information about the program is available by contacting Laura Herman, Citizen Lake Monitoring Network Education Specialist, (715) 346-3989, email: lherman@uwsp.edu, website: http://www.uwsp.edu/cnr/uwexlakes/clmn/.

Bonestroo, Inc. recommends completing pre and post aquatic plant monitoring in any areas that are actively managed to evaluate management effectiveness. In general lake-wide aquatic plant surveys are recommended every 5 years (essentially repeating the 2010 point intercept aquatic plant survey) to monitor changes in the overall aquatic plant community and the effects of the APM activities. Aquatic plant communities may change with varying water levels, water clarity, nutrient levels, and aquatic plant management actions.

6.1.2 Clean Boats/Clean Waters Campaign

Measures for the prevention of the introduction of new AIS to the lake and containment of existing AIS should be a priority. To prevent the spread of AIS into Miller Dam Lake, a monitoring program such as Clean Boats/Clean Waters is an excellent choice. There are four public landing on Miller Dam Lake and lake residents are currently participating in Clean Boats/Clean Waters (CB/CW) program. This program is carried out by trained volunteers who inspect the incoming boats at public launches. Signage also accompanies the use of CB/CW to inform lake users of proper identification of AIS and boat inspection procedures. Education of the public, along with private property and resort owners, about inspecting watercraft for AIS before launching a boat or leaving access sites on other lakes could help prevent new AIS infestations. Contact with lake users at this time is a great way to distribute other educational materials. Continuation of this program is recommended and should be promoted by the current CB/CW coordinator on the lake.

6.1.3 Aquatic Plant Protection and Shoreline Management

Protection of the native aquatic plant community is needed to slow the spread of EWM from lake to lake and within a lake once established. Therefore, riparian landowners should refrain from removing native vegetation. Additionally, EWM can thrive in nutrient (phosphorus and nitrogen) enriched waters or where nutrient rich sediments occur. Two simple actions can prevent excessive nutrients and sediments from reaching the lake.

The first activity is the restoration of natural shorelines, which act as a buffer for runoff containing nutrients and sediments. Properties classified in the shoreland survey as having a level 3: Moderate Development or level 4: Major Development would be good candidates for shoreland restorations. Establishing natural shoreline vegetation can sometimes be as easy as not mowing to the waters edge. Native plants can also be purchased from nurseries for restoration efforts. Shoreline restoration has the added benefits of providing wildlife habitat and erosion prevention. A vegetated buffer area can also prevent surface water runoff from roads, parking areas and lawns from carrying nutrients to the lake.

The second easy nutrient prevention effort is to use lawn fertilizers only when a soil test shows a lack of nutrients. Phosphorus free fertilizers should be used when possible. The fertilizers commonly used for lawns and gardens have three major plant macronutrients: Nitrogen, Phosphorus, and Potassium. These are summarized on the fertilizer package by three numbers. The middle number represents the amount of phosphorus. Since most Wisconsin lakes are “Phosphorus limited”, meaning additions of phosphorus can cause increased aquatic plant or algae growth, preventing phosphorus from reaching the lake is a good practice. Landowners should be encouraged to use phosphorus free fertilizers on lakeshore lawns. Local retailers and lawn care companies can provide soil test kits to determine a lawn’s nutrient needs. Of course, properties with an intact natural buffer require very little maintenance, and no fertilizers.

Another possible source of nutrients to a lake is the septic systems surrounding the lake. Septic systems should be properly installed and maintained in order to prevent improperly treated wastewater, which carries a lot of nutrients, from reaching the lake. Property owners who are not sure if their septic system is adding nutrients to the lake should contact a professional inspector and have their system assessed.

The Taylor County Land Conservation Department (LCD) may be able to offer assistance to restore native vegetation to shoreland property. LCD has been involved in several shoreland restoration projects in the last few years on Miller Dam that have ranged from plantings to bank stabilization projects. The LCD also provides soil testing to determine nutrients needs for lawns and gardens. Interested landowners can contact the Taylor County Land & Water Conservation Department at (715) 748-1469 to request an application form for the program. LCD and local NRCS have been working with the agricultural landowners in the watershed to improve conservation practices. In the last several years a number of nutrient management plans have been created for area farms, a manure storage facility was constructed, prescribed grazing and pasture planning and fencing has been implemented to help improve water quality.

6.1.4 Public Education and Involvement

The MDLA should continue to keep abreast of current AIS issues throughout the County. The County Land Conservation Department and the WDNR Lakes Coordinator, and the UW Extension are good sources of information. Many important materials can be ordered at the following website:

http://www.uwsp.edu/cnr/uwexlakes/publications/

Appendix G includes resources for further information about public education opportunities.

If the above hyperlink to web address becomes inactive, please contact Bonestroo, Inc. for appropriate program and contact information.

6.2 AQUATIC PLANT MANIPULATION ALTERNATIVES

The management alternative may be used when aquatic plants present some sort of problem that must be dealt with or manipulated by human action. EWM and CLP have proven to create navigation and recreational nuisance on the lake. Management of these AIS is required to improve the recreational quality of the lake. The following alternatives may be used to manage AIS such as EWM and CLP. Wild rice is a native plant and is protected by state statutes. Wild rice may not be managed or manipulated in state waters without an approved APM Plan and WDNR permit. A sub-section at the end of this section will discuss the options for managing wild rice.

6.2.1 Manual Removal

Native plants may be found at nuisance levels at individual properties. Manual removal efforts, including hand raking or hand pulling unwanted plants (except wild rice in the northern region), is allowed under Wisconsin law, to a maximum width of 30 feet (recreational zone). The intent is to provide pier, boatlift or swimming raft access in the recreation zone. A permit is not required for hand pulling or raking if the maximum width cleared does not exceed this 30-foot recreation zone (manual removal of any native aquatic vegetation beyond the 30-foot area would require a permit from the WDNR that satisfies the requirements of Chapter NR 109, Wisconsin Administrative Code, see Appendix F). However, manual removal is **not** recommended because it could open a niche for non-native invasive aquatic plants to occupy. Removal of native plants also destroys habitat for fish and wildlife.

If a small isolated stand of AIS is present hand pulling may be a viable option. No permit is required to remove non-native invasive aquatic vegetation, as long as the removal is conducted completely by hand with no mechanical assistance of any kind. All aquatic plant material must be removed from the

water to minimize dispersion and re-germination of unwanted aquatic plants. Portions of the roots may remain in the sediments, so removal may need to be repeated periodically throughout the growing season.

Manual removal of aquatic plants can be quite labor intensive and time consuming. This technique is well suited for small areas in shallow water where property owners can weed the aquatic garden. Hiring laborers to remove aquatic vegetation is an option, but also increases cost. Scuba divers can be contracted to remove unwanted vegetation in deeper areas. Benefits of manual removal by property owners include low cost compared to chemical control methods, quick containment of pioneering (new) populations of invasive aquatic plants, and the ability for a property owner to slowly and consistently work on active management. The drawback of this alternative is that pulling aquatic plants include the challenge of working in the water, especially deep water, the threat of letting fragments escape and colonize a new area, and the fact that control of any significant sized population is quite labor intensive. Again, hiring laborers to remove aquatic vegetation is an option, but also increases cost.

6.2.2 Aquatic Invasive Plant Species Chemical Herbicide Treatment

A chemical herbicide treatment may be an appropriate way treat large areas of AIS to conduct restoration of native plants. When using chemicals to control AIS it is a good idea to reevaluate the lake and the extent of the AIS conditions before, during and after chemical treatment. The WDNR may require another whole-lake plant survey and will certainly require a proposed treatment area survey. Along with the above mentioned survey, pre and post treatment monitoring should be included for all aquatic plant treatments and is typically a WDNR requirement in their Northern Region.

The science regarding what chemicals are most effective and how they can be used is constantly being updated. Currently EWM is the most common aquatic invasive plant species targeted for chemical treatment in the Northwoods. At present, granular 2,4-D is the most common herbicide used on EWM in the Northwood's area. In order to decrease damage to native plants and be as selective as possible for EWM, treatments are completed in the spring when native plant growth is minimal.

Chemical treatment is usually a long term commitment and requires a specific plan with a goal set for "tolerable" levels of the relevant AIS. One such landmark might be 10% or less of the littoral area being occupied by aquatic invasive plants. WDNR recommends conducting a whole-lake point-intercept survey on a five year bases (for Miller Dam Lake the next would be 2015). Such a survey may reveal a new AIS and at the very least would provide good trend data to see how the aquatic plant community is evolving.

Advantages of herbicides include broader control than hand pulling, and represents a true restoration effort, which harvesters do not (this is why harvesters are not discussed in this document). Disadvantages include negative public perception of chemicals in natural lakes, the potential to affect non-target plant species (if not applied at an appropriate application rate and/or time of year) and water use restrictions after application may be necessary.

6.2.3 Water Level Drawdown

Drawdown of water level can be a very effective tool in managing EWM. During a drawdown the water level are lowered to expose the bed of the lake where EWM is present; the winter temperatures freeze and dry the plants and roots killing them. The drawdown has drastically reduced EWM in some lakes

for several years before it made a comeback. Drawdowns impact native plants but not to the extent that it does EWM. Many native plants typically respond well to fluctuating water levels and there is usually an increase in diversity and density of native aquatic plants which usually rebound within the first summer after refilling the reservoir. Certain emergent plants benefit from a drawdown and need lowered water levels to germinate and reproduce. Bulrushes are one of the plants that usually come back in abundance after a drawdown.

Drawdowns also help to turn back the clock on the aging process a flowage undergoes. The drawdown tends to initially knock back the vegetation that grows in abundance as a flowage ages. It also aids in sediment compaction; especially in the mucky areas of the lake. These areas can experience compaction of up to 12 inches after a drawdown.

Drawdowns do have negative impacts also; mainly to the recreational use of the lake, though this is minimized as the drawdowns are typically over-winter events. When the lake is drawdown there is limited access to the water and use is very limited on the lake. There is a popular belief that drawdowns negatively impact fish populations but that has not been scientifically proven. There are area lakes that have periodic drawdowns and have not noticed a negative impact to the fishery. The fish become more concentrated in the water that is available so there is likely more predation that occurs that thins out the smaller fish. There is also the belief that the fish will be “fished out” when they are concentrated; but with the increase in natural prey they are not so likely to take the anglers bait. A drawdown of this depth and duration will likely not impact the wild rice, this assumption is based on comment’s received from Lisa David of GLIFWC.

The dam head allows a maximum drawdown of 13 feet at the dam itself. A drawdown of 6 feet should expose nearly all of the EWM to freezing and drying conditions as EWM was found to a depth of 5 feet in the lake. If good weather conditions (low temperatures and little snow cover) were encountered during a drawdown much of the EWM would likely be impacted.

During the public meeting it should be noted this option was <u>not</u> supported due to the possible impacts to the fishery resource and the reduced recreation during drawdown. The fish that are present in the lake will congregate in the pools that are left during drawdown and may be susceptible to over fishing during this period. The lake is highly used during the winter months for ice fishing; the drawdown would decrease use on the lake and increase pressure on the water that is remaining. If the lake could be closed to fishing during the drawdown this may make this a more attractive, viable option.

6.2.4 WILD RICE MANAGEMENT

Wild rice is a protected plant in Wisconsin; as a result management must be approved under an APM Plan and permit must be issued before any control measures area taken in water of the state. If a riparian on the flowage owns the bed of the flowage then that land owner may take steps to control the wild rice. However, according to Taylor County GIS maps the flowage bed is owned by United States or Taylor County, not by the riparian landowner. There are several options that may be used to manage the wild rice on Miller Dam in the areas where it is causing the most nuisance to riparian landowners.

<u>Manage large areas near affected main lake and shoreland properties</u>
This may be done in areas where a number of adjacent riparian landowners or boaters have an issue with rice where it was historically not present. The rice in these areas may be removed through a

number of methods including manual harvesting or chemical control. Under this potential option, larger navigation lanes allowing more than one boat to safely pass through these areas of rice may be controlled on an annual basis. Navigational channels can vary in width depending on boat traffic patterns but can be approved up to 30 feet in width, or 50 feet by special exception depending on need and use patterns. This type of control would require a permit from the WDNR, and potential input/concurrence from GLIFWC.

Manage navigation lanes from each riparian

Under this option smaller areas of rice would be managed. A navigation lane up to 30 feet wide could be maintained from the dock/shore to the main body of water. This could also be done with chemical herbicides or mechanically cutting (both with a WDNR permit), or manually hand removed, please check with the WDNR as to any site visits or concurrence that may be need for this option.

Treatment, mechanical cutting or manual removal options would require a WDNR permit and manual removal would require concurrence with WDNR and likely GLIFWC, as well as being specifically addressed in the APM Plan. It is recommended that a site visit to assess wild rice conditions and management options be scheduled with DNR and GLIFWC prior to any action.

7.0 Conclusion and Recommended Action Plan

Two aquatic invasive plants were found during the aquatic plant survey in 2010; Eurasian water-milfoil, *Myriophyllum spicatum* (EWM), and curly-leaf pondweed, *Potamogeton crispus* (CLP). Both species have been previously identified within the lake and have been actively monitored for. EWM is present on a large scale basis and ongoing management and control efforts are highly recommended. This will help prevent spread of this AIS, along with CLP, to other lakes. Because of this, the following Recommended Action Plan focuses on AIS control and public education.

7.1 RECOMMENDED ACTIVE GOALS

The recommended action plan includes actions for Miller Dam Lake based on the Maintenance Alternative listed above in Section 6. The MDLA president has approved the following active goals. It will be up to residents of Miller Dam Lake and the MDLA to determine the actions, find the funding, and gather the individuals needed to implement the active goals.

Active Goal: Manage EWM and CLP to improve recreation, increase recreational opportunities and rehabilitate native plants.

Tasks: Treat EWM beds with 2,4-D or triclopyr to reduce EWM coverage in the lake.

Focus treatment on the following sites in the following order:

- Site 1
- Site 2
- Site 3

The goal is to reduce EWM to 10% coverage of littoral zone supporting aquatic plant growth.

At Sites 4 and 5 wild rice is present. EWM treatment in areas near wild rice will be limited and coordinated with USFS, GLIFWC and WDNR to determine concentration and timing.

Treat CLP beds to reduce coverage as much as possible. Based on the results of the 2010 PI survey the stands of CLP are small, isolated and sparse. The isolated beds will be managed first by hand-pulling. If the beds expand beyond the current boundaries and hand pulling is not an effective management tool, chemical treatment with endothall may be pursued.

See Figure 13 for management sites.

Active Goal: Consider managing wild rice in selected areas to improve access, promote safe navigation and allow angling opportunities within the lake.

The wild rice in the northern bay of Miller Dam Lake could be managed by manual harvest, herbicide or hand removal in the mapped areas to facilitate navigational use of the lake. Navigation/recreation channels up to 30 feet wide depending upon conditions dictated on the permit issued by the WDNR and may be created around the individual docks and out to a common navigation channel that leads to open water.

See Figure 14 for possible management sites.

Active Goal: To continue and expand the WDNR Clean Boats, Clean Waters program on Miller Dam Lake.

The boat landings should be monitored at a minimum on the holiday weekends and during fishing tournaments. Continue to recruit and train volunteers to conduct CBCW.

Active Goal: To provide visitors with educational information concerning the potential impact their activities could have on introduction of aquatic invasive species, wildlife, habitats and Miller Dam Lake water quality.

An informational kiosk has been installed at one of the boat landings; this will be maintained. Install kiosks/signs at all boat landings. Contact USFS regarding the landings they maintain.

Active Goal: To implement and maintain an aquatic invasive species monitoring program that will survey for invasive species, and if found, monitor their locations and extent of population spread.

A group should be formed to monitor the lake for invasives and to track the EWM beds. A GPS unit should be used to map the edge of the beds to determine if they are expanding year to year. The EWM and CLP beds that are treated should be surveyed and mapped before and after treatment according to DNR protocol to evaluate effectiveness of treatment.

Active Goal: To continue and expand the Miller Dam Lake comprehensive water quality monitoring program through the WDNR Citizen Lake Monitoring Network. The program would include Water Clarity Monitoring and Water Chemistry Monitoring.

Continue to monitor water quality through secchi readings; expand to collect samples for chlorophyll a and phosphorus and take temperature and dissolved oxygen profile.

Active Goal: To work in concert with the WDNR and USFS staff and representatives of fishing related businesses to evaluate Miller Dam Lake fish management practices and develop goals in order to maintain and enhance a quality family sport fishery.

Contact DNR fish biologist to evaluate possible private stocking of walleye and discuss DNR plans for future stocking. Discuss habitat improvements such as tree drops and fish cribs. Discuss reduction of bag limits on panfish.

Active Goal: To develop and implement a fishing tournament AIS management and monitoring program in order to be prepared when fishing tournaments come to Miller Dam Lake.

Contact DNR fish biologist to discuss fishing tournaments on lake and impact they may have. Contact local fishing groups to discuss tournaments, number of participants and dates; monitor boat landings and educate anglers on AIS.

Active Goal: To support the identification and preservation of critical species and critical habitat lands, and wetlands within the watershed. (These are areas with rare vegetation, important habitat for wildlife, or important spawning and nursery areas for fish. Preservation of these lands has a direct impact on the water quality of the lake).

Much of the watershed is forested and in National Forest so it is relatively protected from development.

Active Goal: To provide education and information to shoreline property owners regarding how native aquatic plant protection and shoreline management can slow the spread of aquatic invasive plants (if they become introduced), improve the lake fishery, improve wildlife habitat and affect the quality of the water in the lake.

The vast majority of the shoreline is natural and undeveloped. Contact property owners of the few developed lots and gauge interest in shoreland restoration. Taylor County Land Conservation may assist with restoration plans.

Active Goal: To encourage the incorporation of water quality protection measures in the design, construction and maintenance of all lake access sites on Miller Dam Lake (e.g. storm water control, site drainage control, appropriate plant matter disposal, and watercraft wash down facilities if found to be needed).

Assess the needs of each landing and pursue funds for improvements.

Active Goal: To meet on a regular basis with local government agencies and representatives of lakes located within Taylor County to identify essential and new lake management issues and determine collaborative solutions.

Contact Taylor County LCD and get involved in their local lake group.

Active Goal: Develop relationship with local US Forest Service to co-manage lake and watershed. The US Forest Service owns most of the shoreline and bed of Miller Dam as well as a large portion of the watershed. It is highly recommended that a contact be established to discuss wild rice management, EWM/CLP treatments, shoreline and fish habitat improvements, watershed management, public education and boat landing improvements.

Contact US Forest Service in Medford and Park Falls to establish contact with appropriate staff.

7.2 Closing

This APM Plan was prepared in cooperation with the Miller Dam Lake Association and the WDNR. It includes the major components outlined in the WDNR Aquatic Plant Management guidance. The "Recommended Action Plan" section of this report can be used as a stand alone document to facilitate EWM management activities for the lake. This section outlines important monitoring and management activities. The greater APM Plan document and appendices provides a central source of information for the lake's aquatic plant community information, the overall lake ecology, and sources of additional information. If there are any questions about how to use this APM Plan or its contents, please contact Bonestroo, Inc..

This APM Plan should be updated periodically to reflect current aquatic plant problems, and the most recent acceptable APM methods. Information regarding aquatic plant management and protection is available from the WDNR website: http://dnr.wi.gov/org/water/fhp/lakes/aquaplan.htm or from Bonestroo, Inc. upon request.

8.0 SIGNATURE OF ENVIRONMENTAL PROFESSIONAL

I declare that, to the best of my professional knowledge and belief, I meet the definition of Environmental Professional as defined in § 312.10 of 40 CFR 312 and I have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject property. I have developed and performed all the appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

Tiffiney Kleczewski, PE

9.0 References

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

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Figures

N

0 2500 5000

Horizontal Scale In Feet

LEGEND

- 1: Undeveloped (i.e. Forested or Wetland)
- 2: Minor development (i.e. Properties may have mostly natural shoreline, sparse structures set further away from the lake, one pier, and little or no clearing of natural vegetation.
- 3: Moderate development (i.e. Properties may exhibit additional clearing and/or manipulation to the shore and lawn areas but not to waters edge. More elaborate piers or boathouses may be present).
- 4: Major development (i.e. properties may include larger lawn areas extending to the shoreline, which contains little or natural shoreline vegetation. Increased building density, possible close to the shore, multiple docks or boathouses, and significant shoreline alteration such as seawalls or rip rap may be present).

SHORELINE CHARACTERIZATION

MILLER DAM LAKE ASSOCIATION FIGURE: 1

CHEQUAMEGON WATERS FLOWAGE, TAYLOR COUNTY, WISCONSIN

Bonestroo

P:\5456\5456091010\CAD\DWG\MILLER_LAND USE.DWG

5456-091010

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

LAKE SURVEY MAP

CHEQUAMEGON WATERS LAKE — TAYLOR COUNTY
SEC. 8 sections T. 31,32 N. R. 3 W.
Sheet 1 of 3

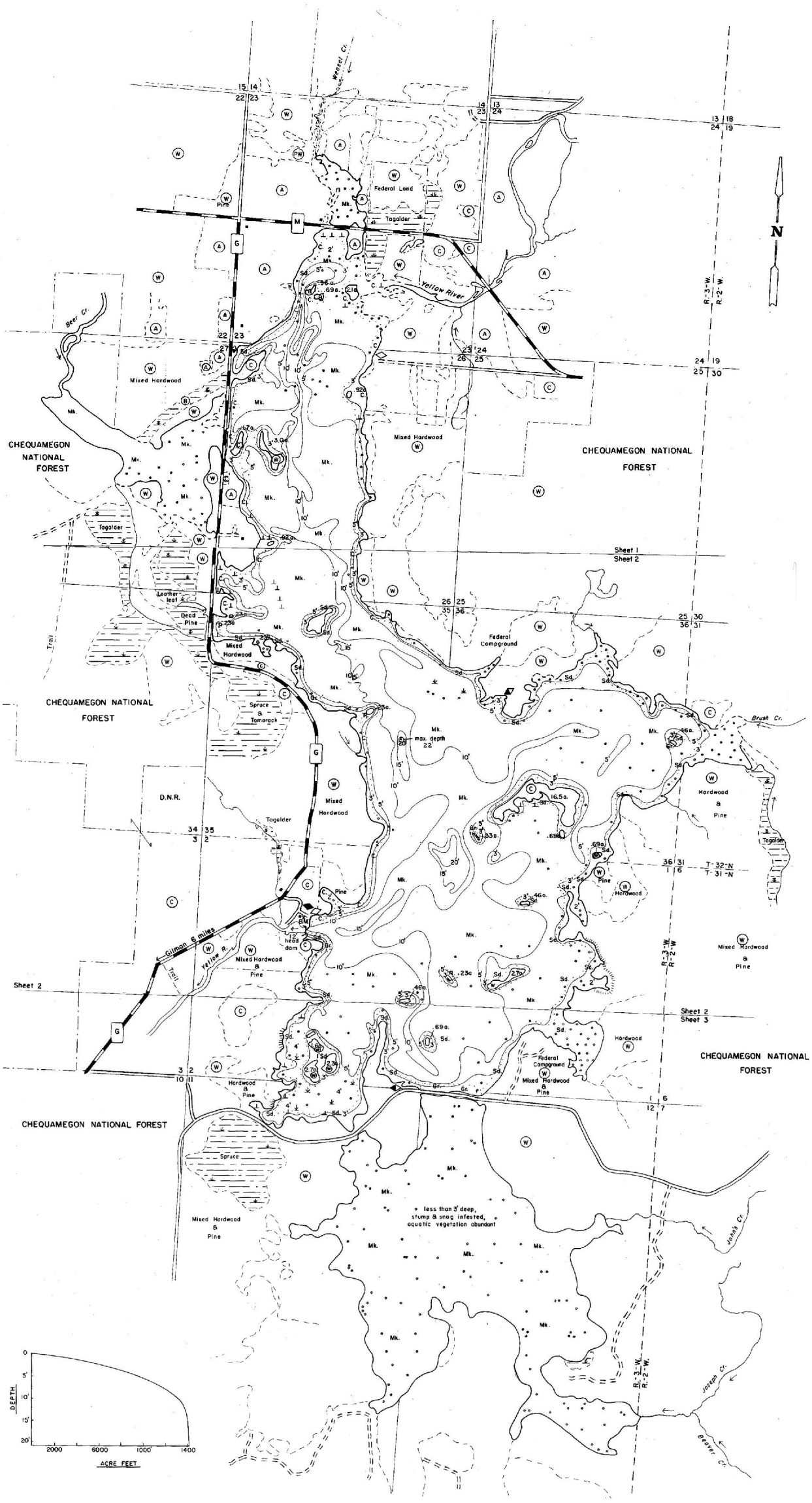


FIGURE 2

CHEQUAMEGON WATERS FLOWAGE LAKE SURVEY MAP

MILLER DAM LAKE ASSOCIATION
MILLER DAM CLMP - EXPANDED APM PLAN
CHEQUAMEGON WATERS FLOWAGE
TAYLOR COUNTY, WISCONSIN

Bonestroo

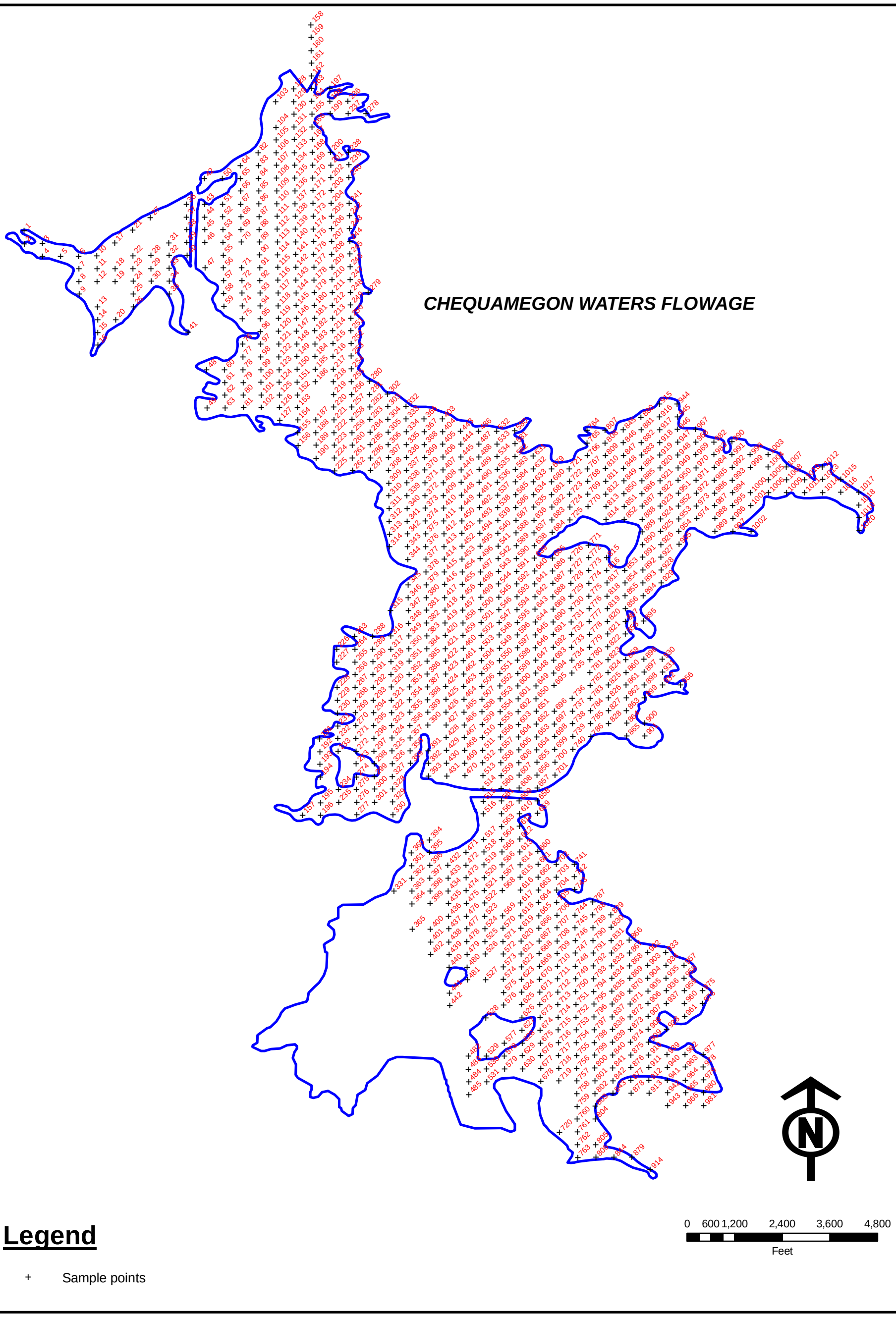
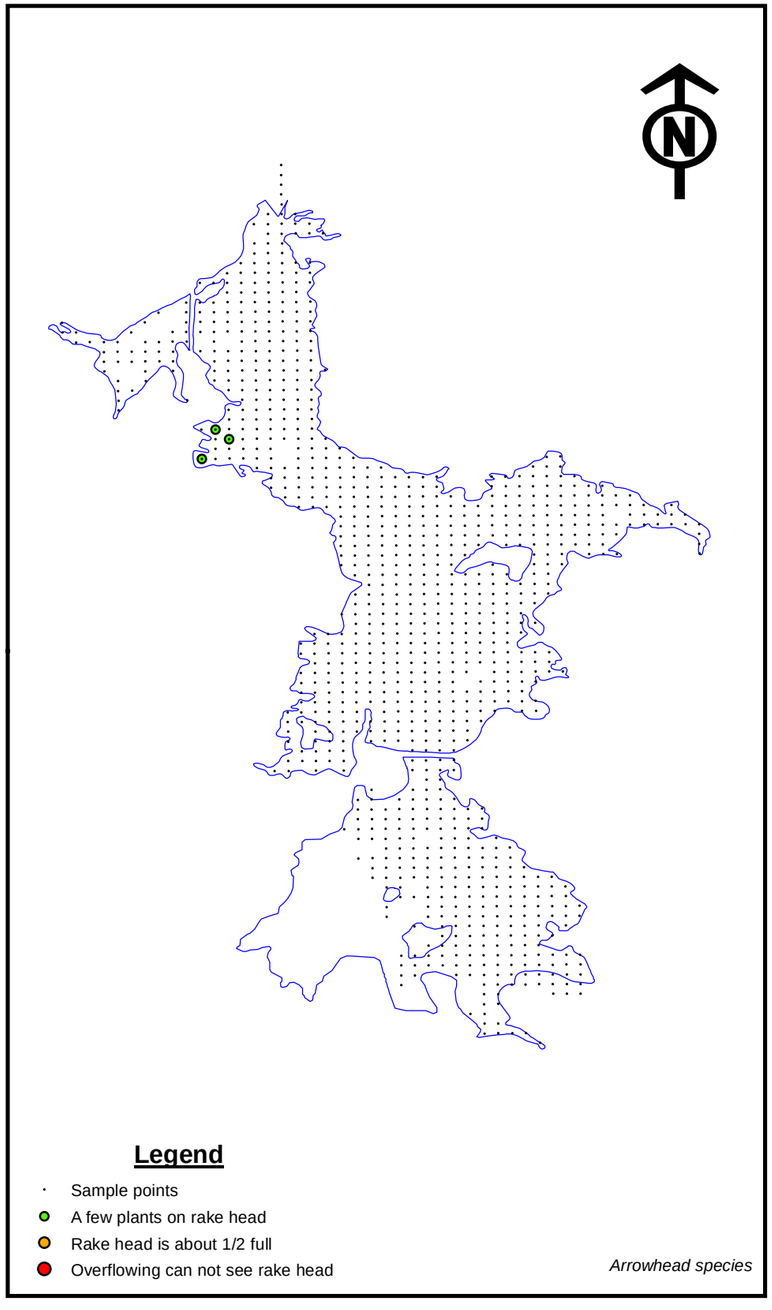


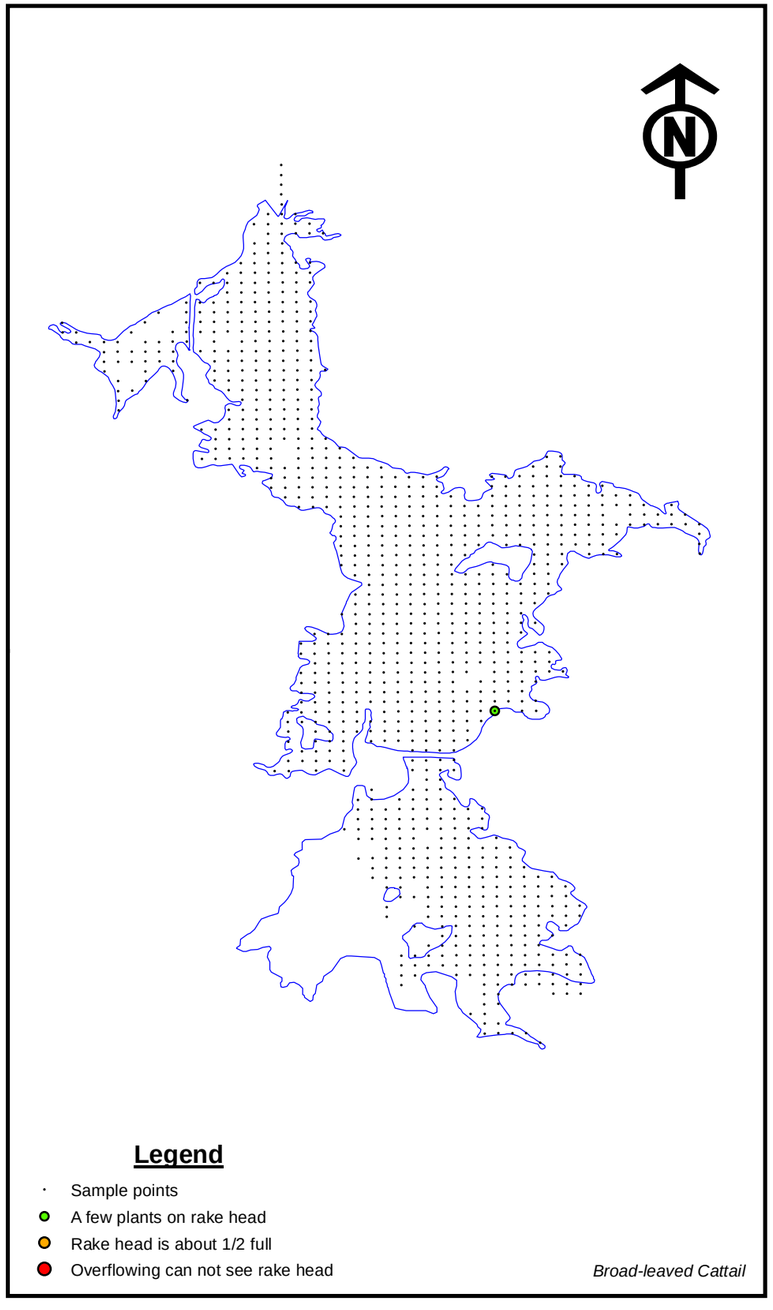
FIGURE 3

AQUATIC PLANT DISTRIBUTION MAP

MILLER DAM LAKE ASSOCIATION
MILLER DAM CLMP - EXPANDED APM PLAN
CHEQUAMEGON WATERS FLOWAGE
TAYLOR COUNTY, WISCONSIN

Bonestroo





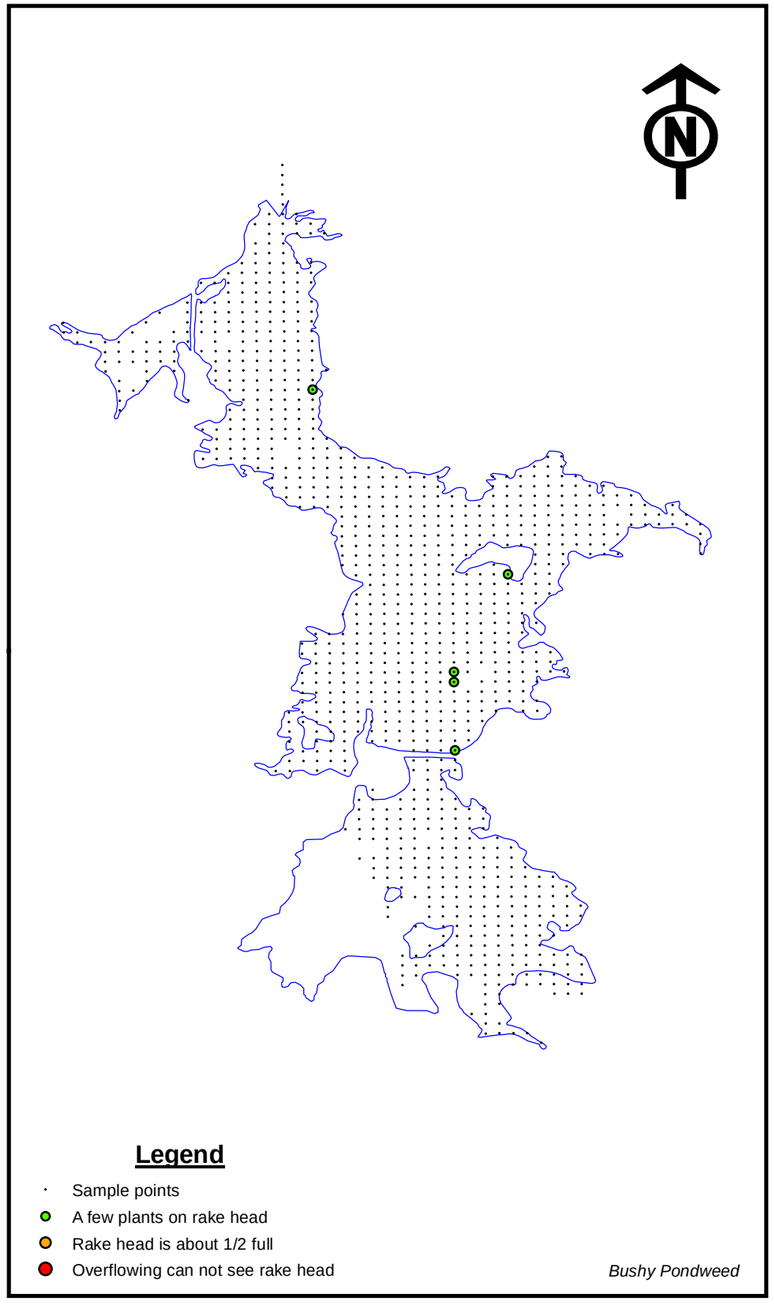
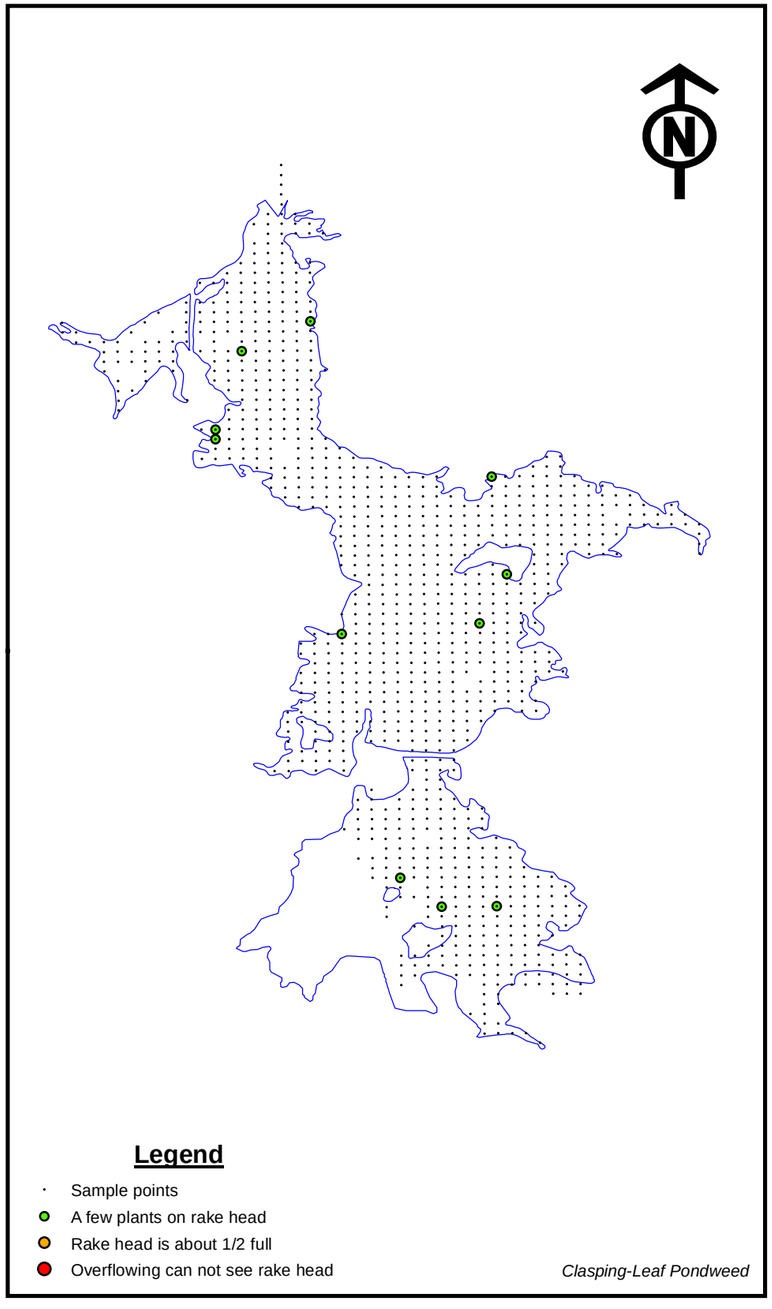


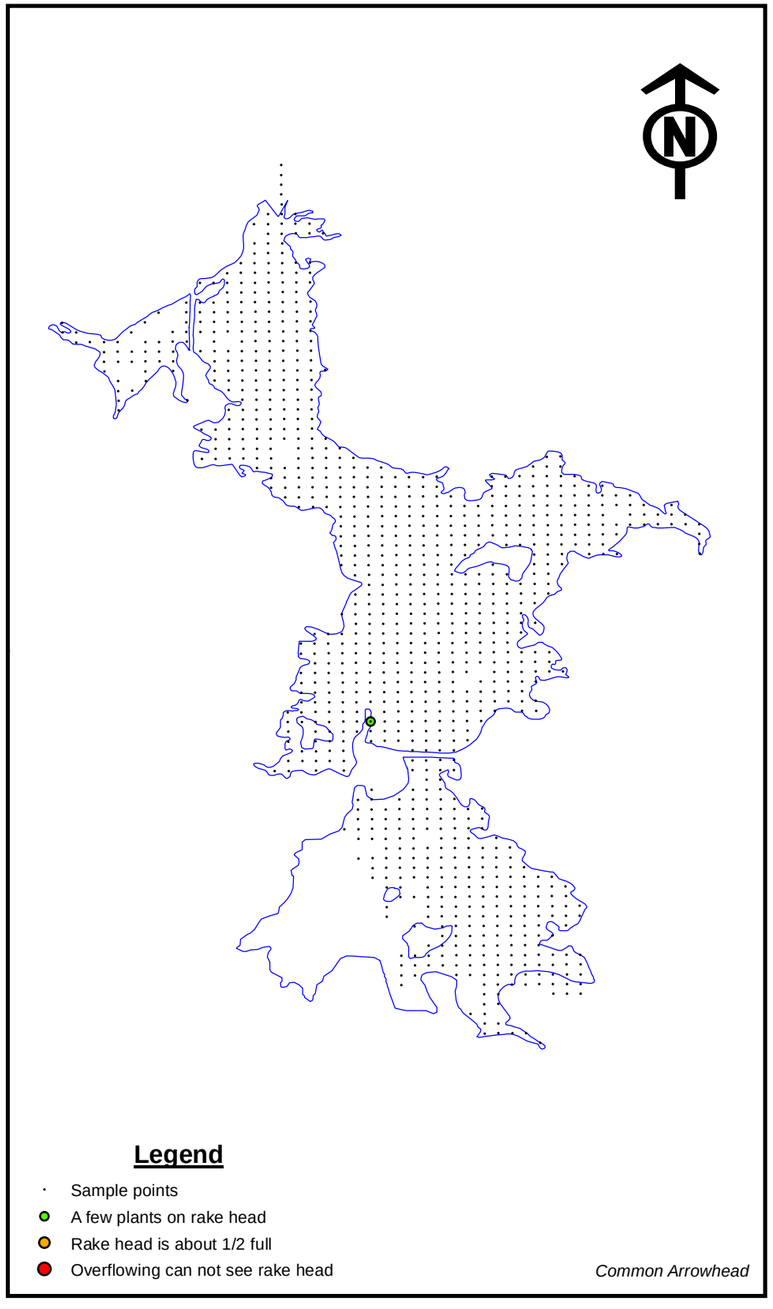
FIGURE 4a

AQUATIC PLANT DISTRIBUTION MAP

MILLER DAM LAKE ASSOCIATION
MILLER DAM CLMP - EXPANDED APM PLAN
CHEQUAMEGON WATERS FLOWAGE
TAYLOR COUNTY, WISCONSIN

Bonestroo





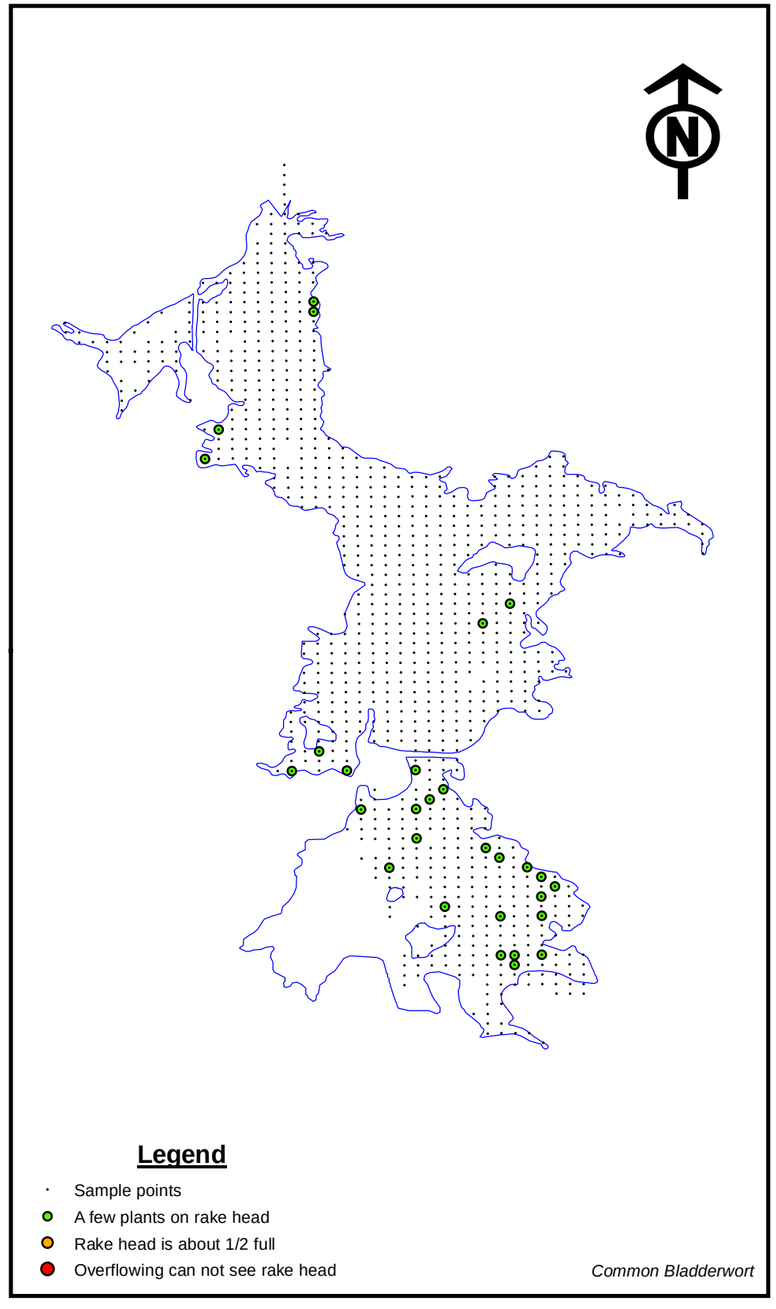
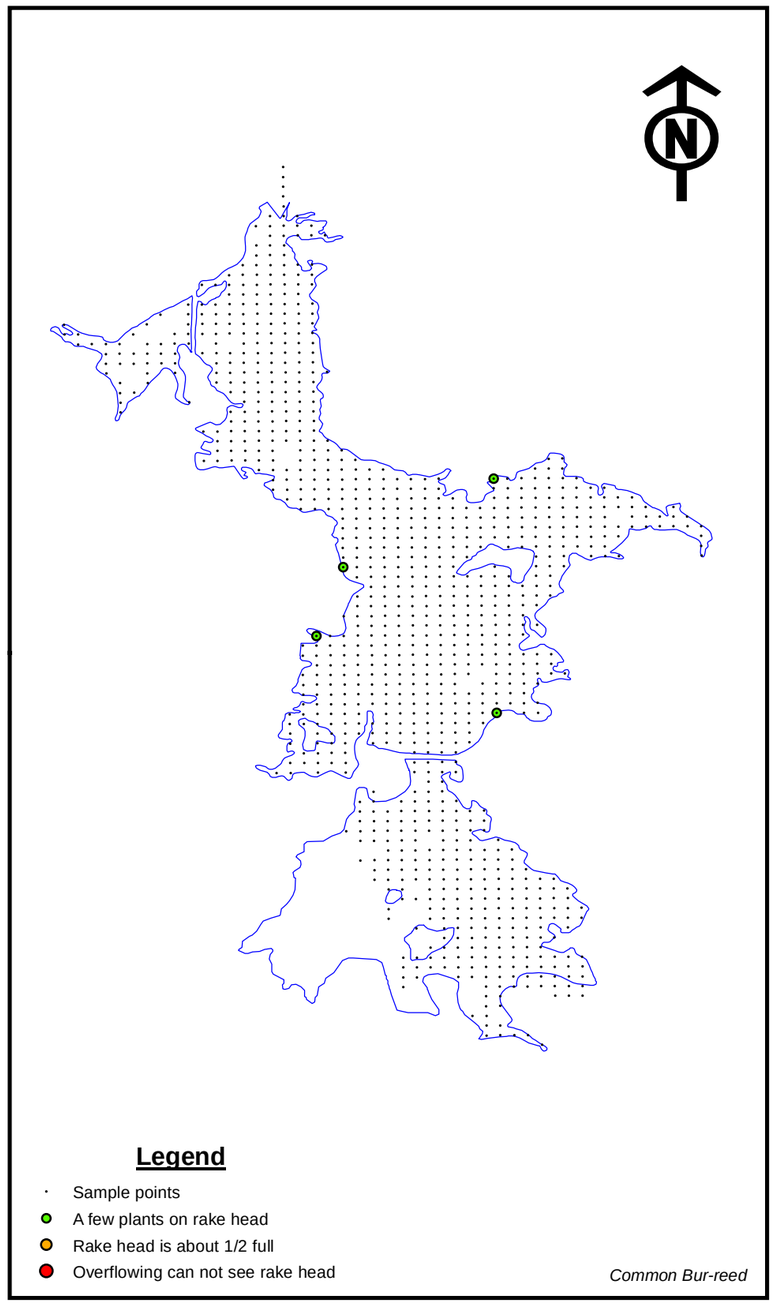


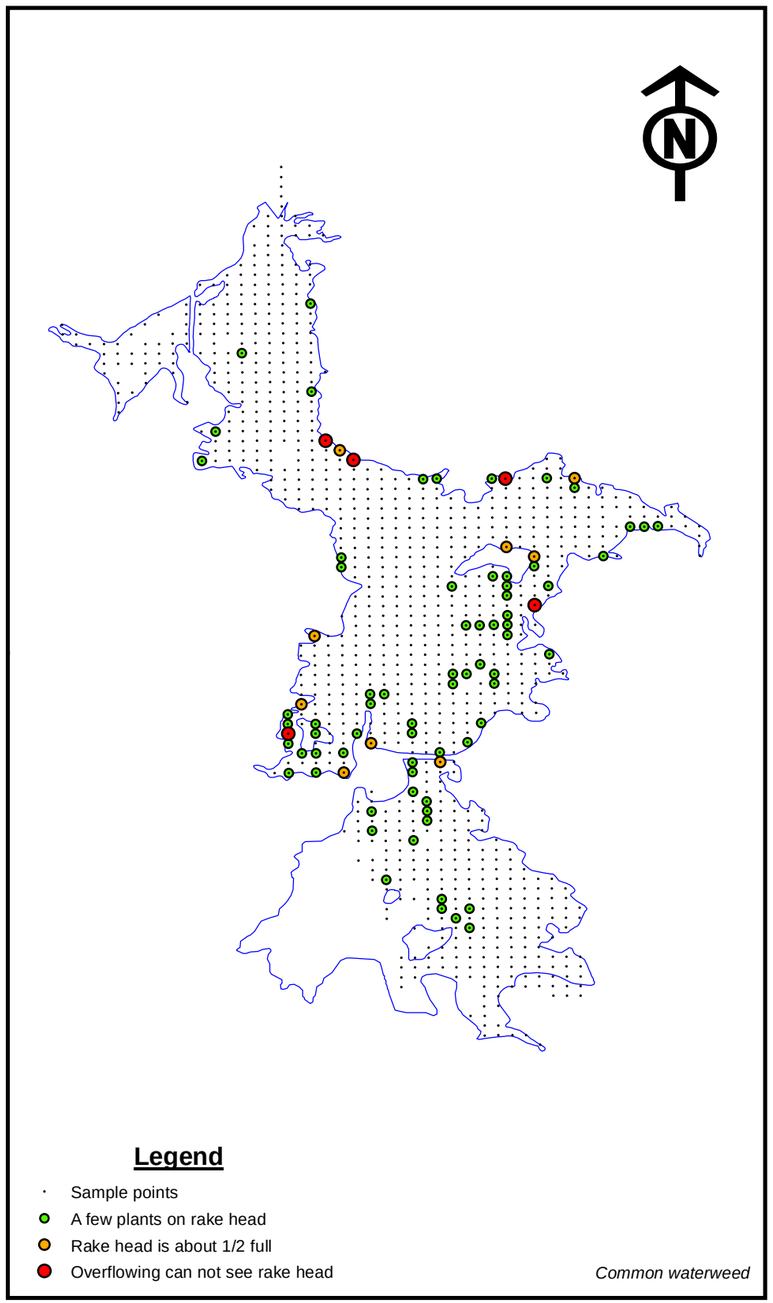
FIGURE 4b

AQUATIC PLANT DISTRIBUTION MAP

MILLER DAM LAKE ASSOCIATION
MILLER DAM CLMP - EXPANDED APM PLAN
CHEQUAMEGON WATERS FLOWAGE
TAYLOR COUNTY, WISCONSIN

Bonestroo





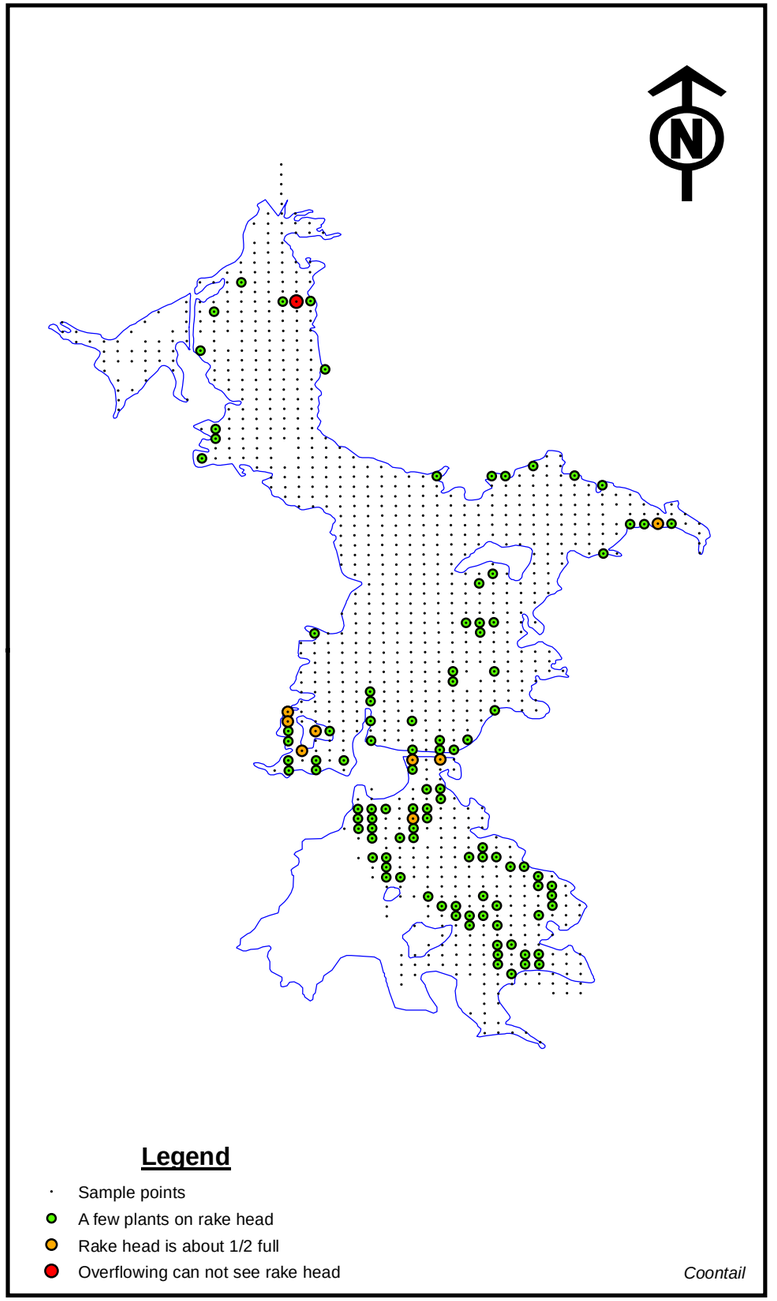
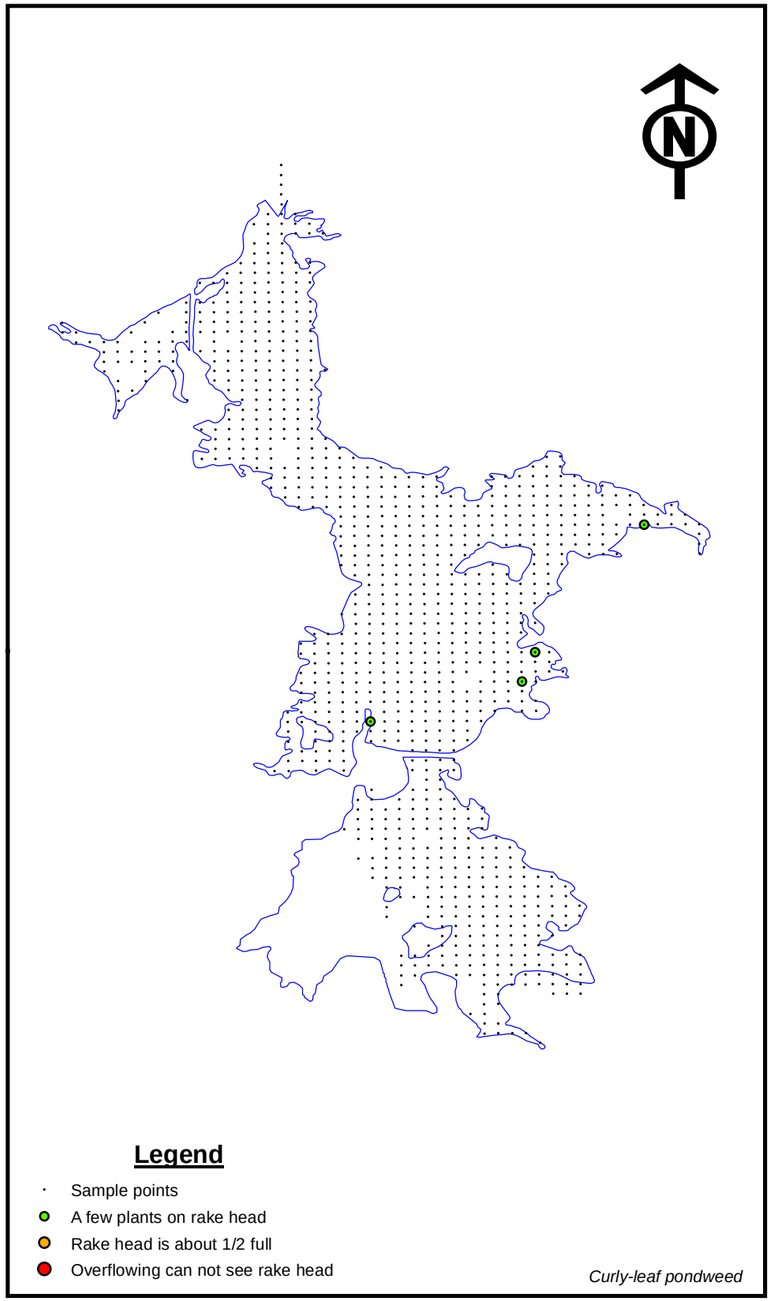


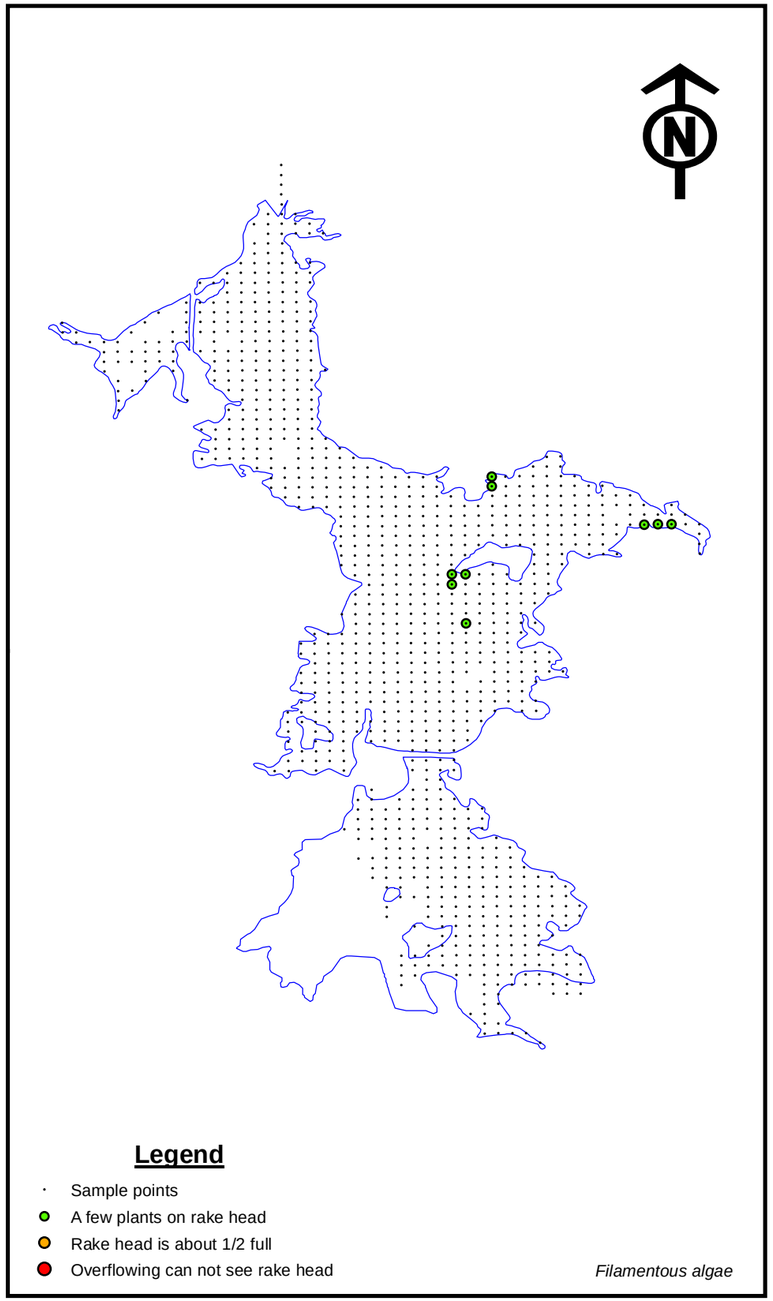
FIGURE 4c

AQUATIC PLANT DISTRIBUTION MAP

MILLER DAM LAKE ASSOCIATION
MILLER DAM CLMP - EXPANDED APM PLAN
CHEQUAMEGON WATERS FLOWAGE
TAYLOR COUNTY, WISCONSIN

Bonestroo





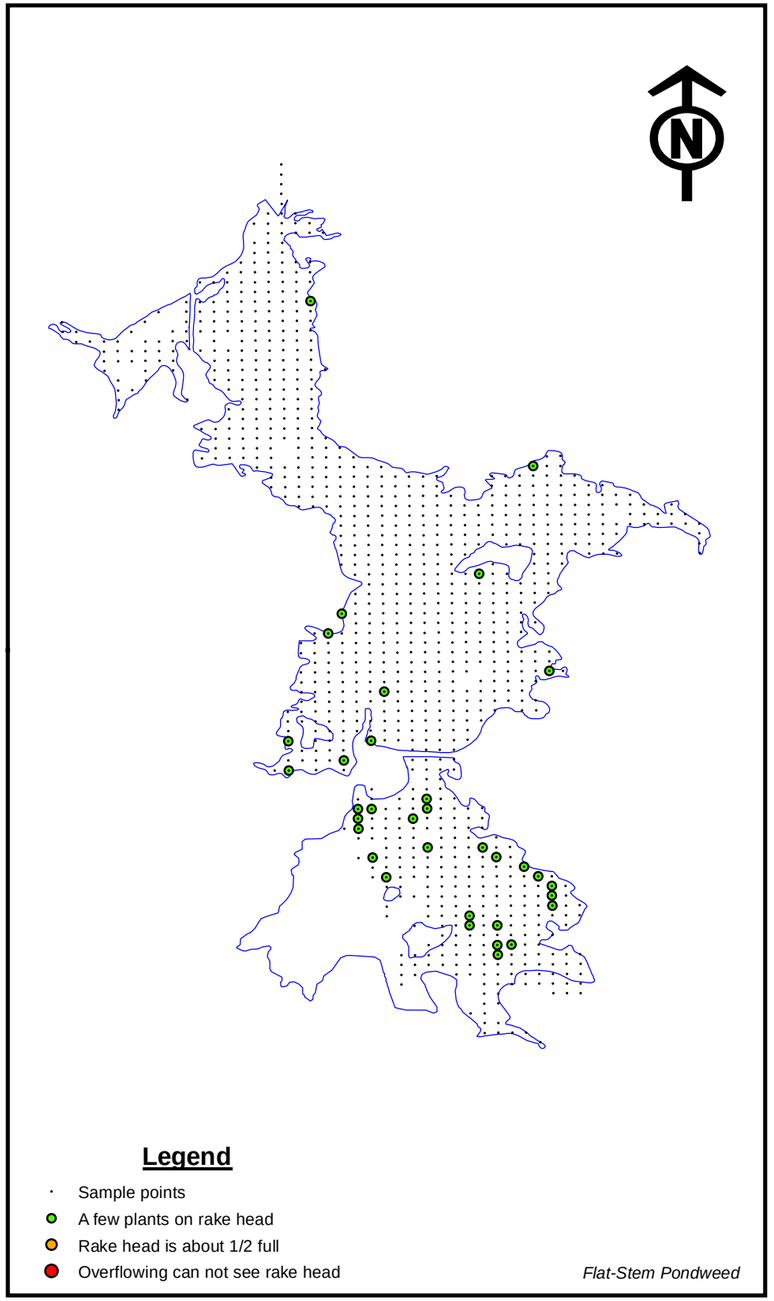
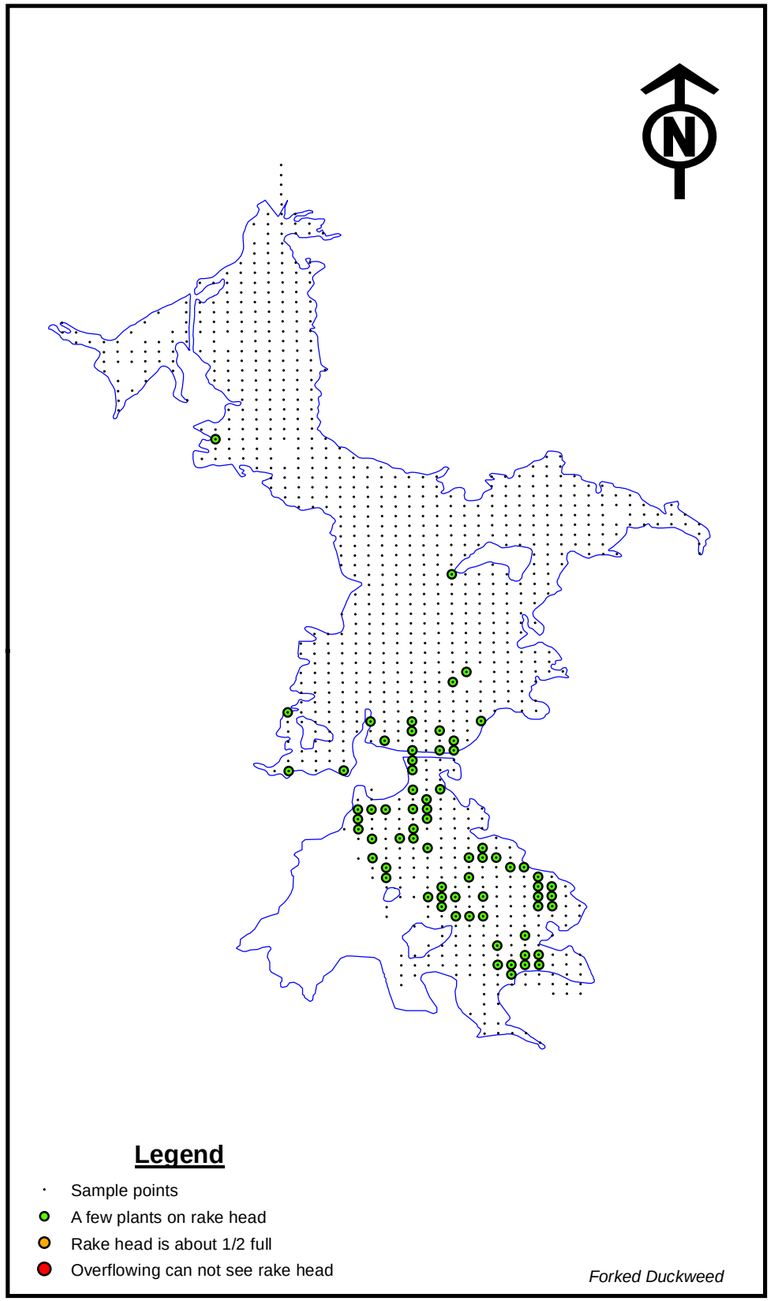


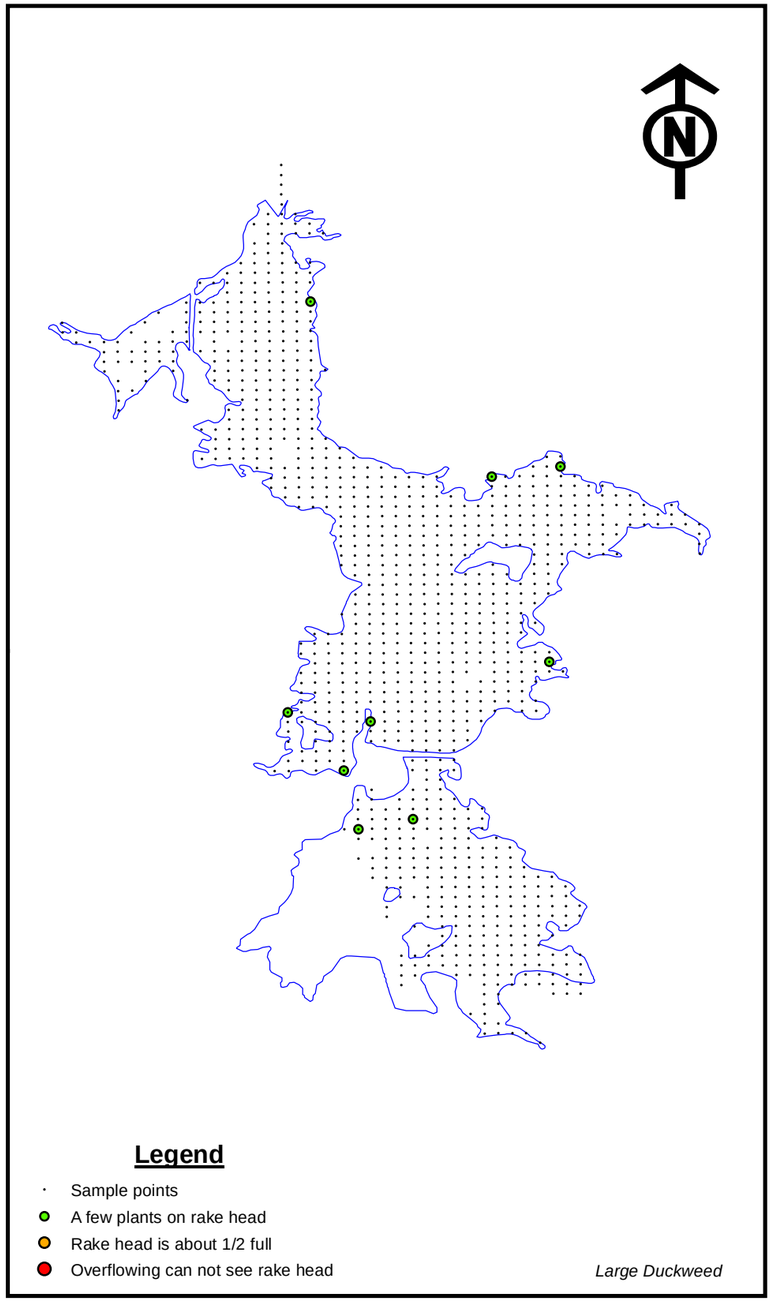
FIGURE 4d

AQUATIC PLANT DISTRIBUTION MAP

MILLER DAM LAKE ASSOCIATION
MILLER DAM CLMP - EXPANDED APM PLAN
CHEQUAMEGON WATERS FLOWAGE
TAYLOR COUNTY, WISCONSIN

Bonestroo





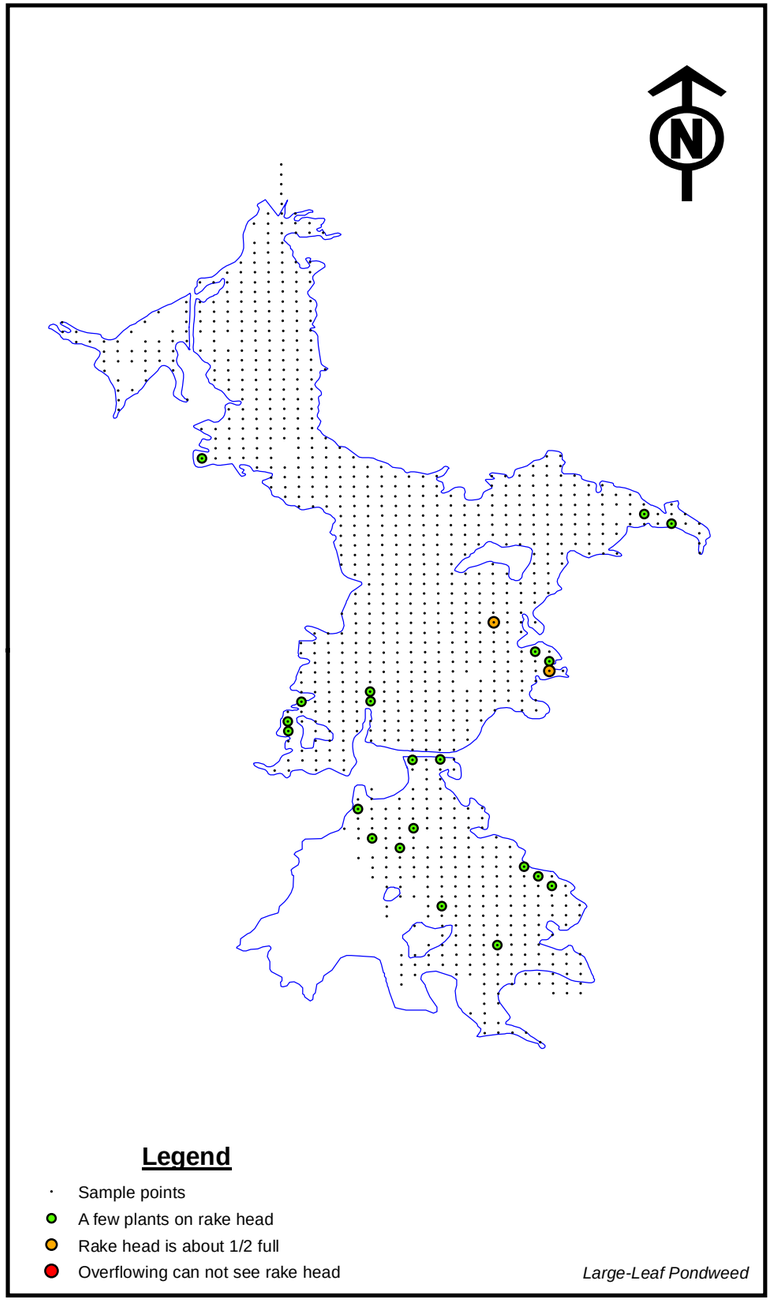
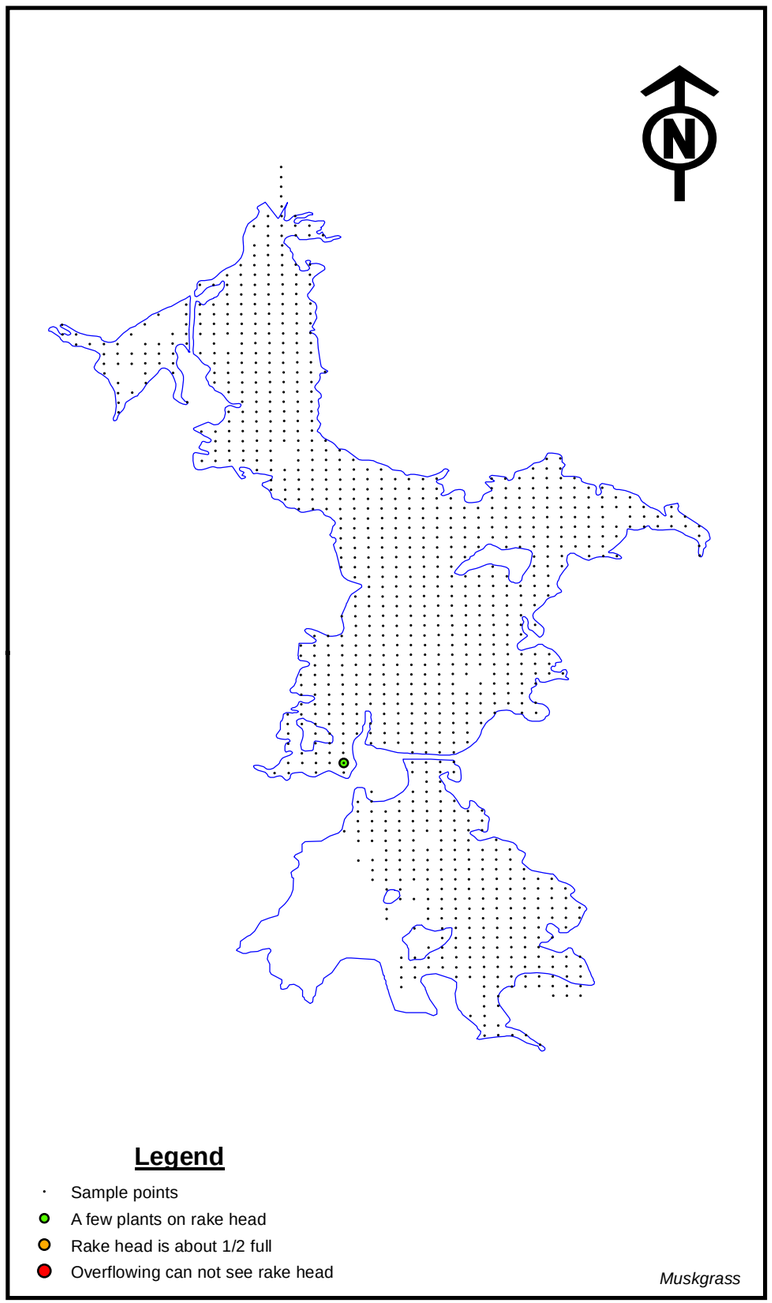


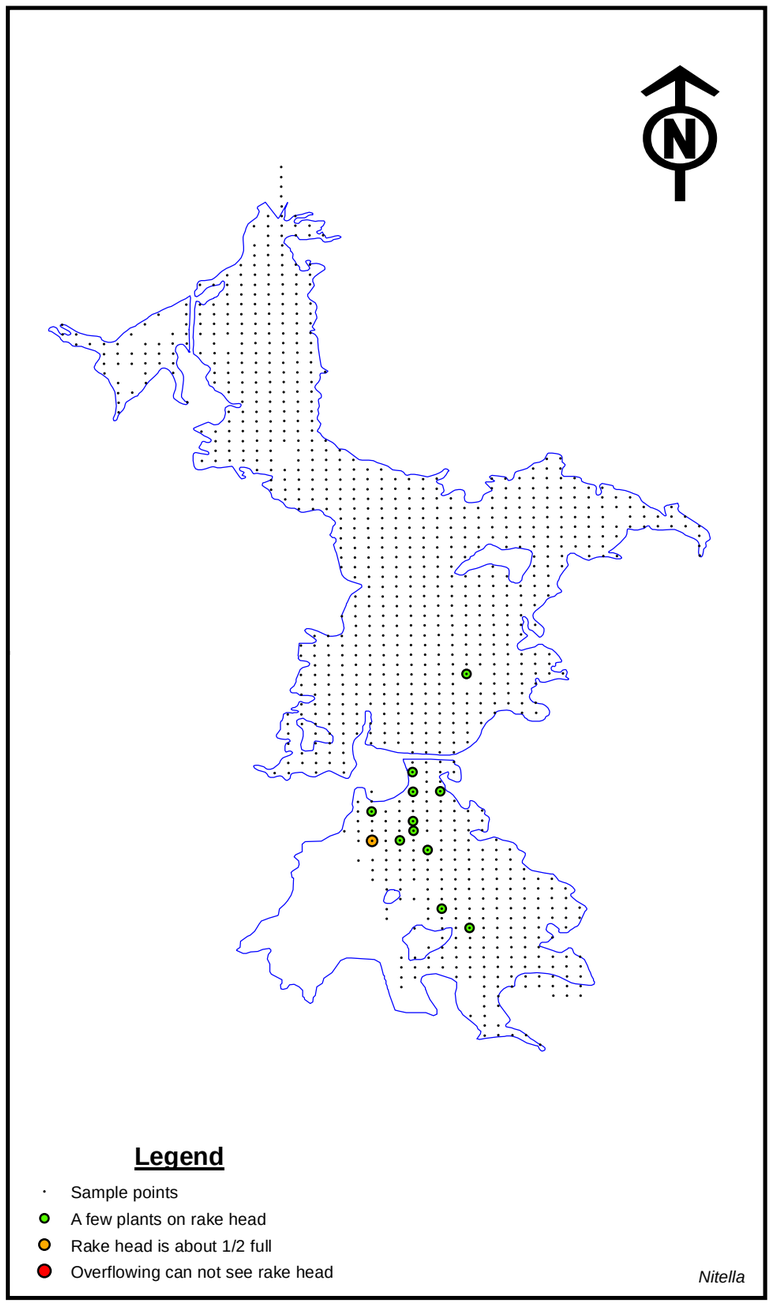
FIGURE 4e

AQUATIC PLANT DISTRIBUTION MAP

MILLER DAM LAKE ASSOCIATION
MILLER DAM CLMP - EXPANDED APM PLAN
CHEQUAMEGON WATERS FLOWAGE
TAYLOR COUNTY, WISCONSIN

Bonestroo





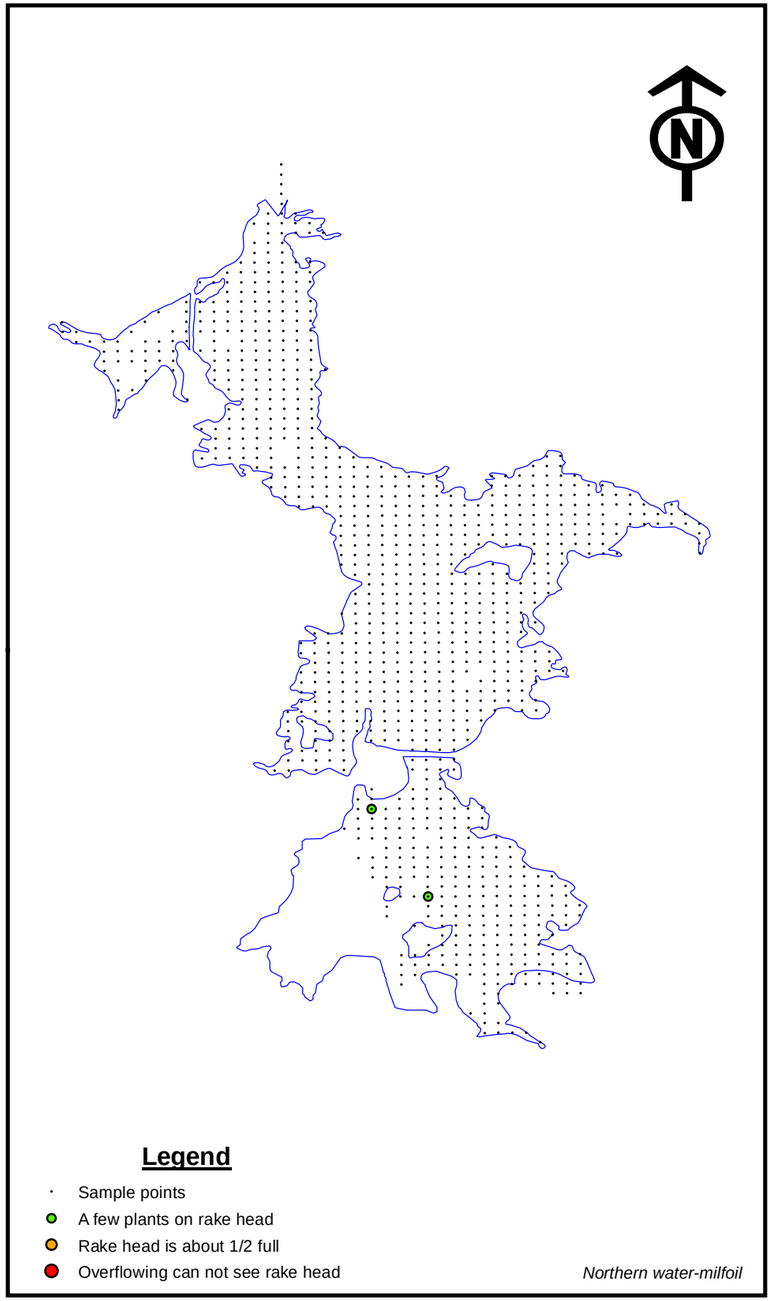
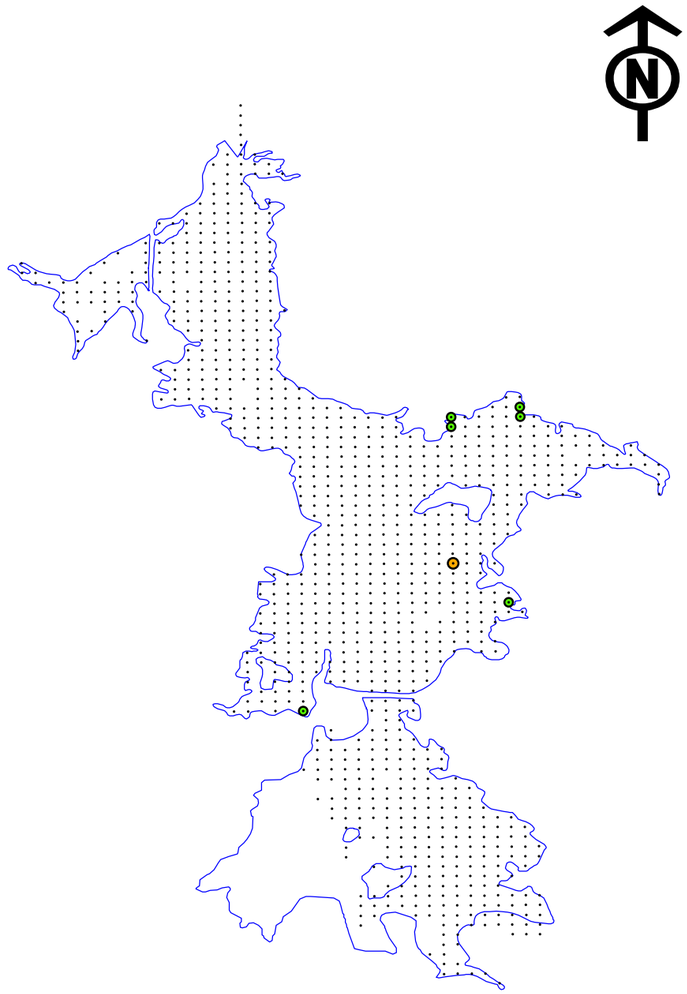


FIGURE 4f

AQUATIC PLANT DISTRIBUTION MAP

MILLER DAM LAKE ASSOCIATION
MILLER DAM CLMP - EXPANDED APM PLAN
CHEQUAMEGON WATERS FLOWAGE
TAYLOR COUNTY, WISCONSIN

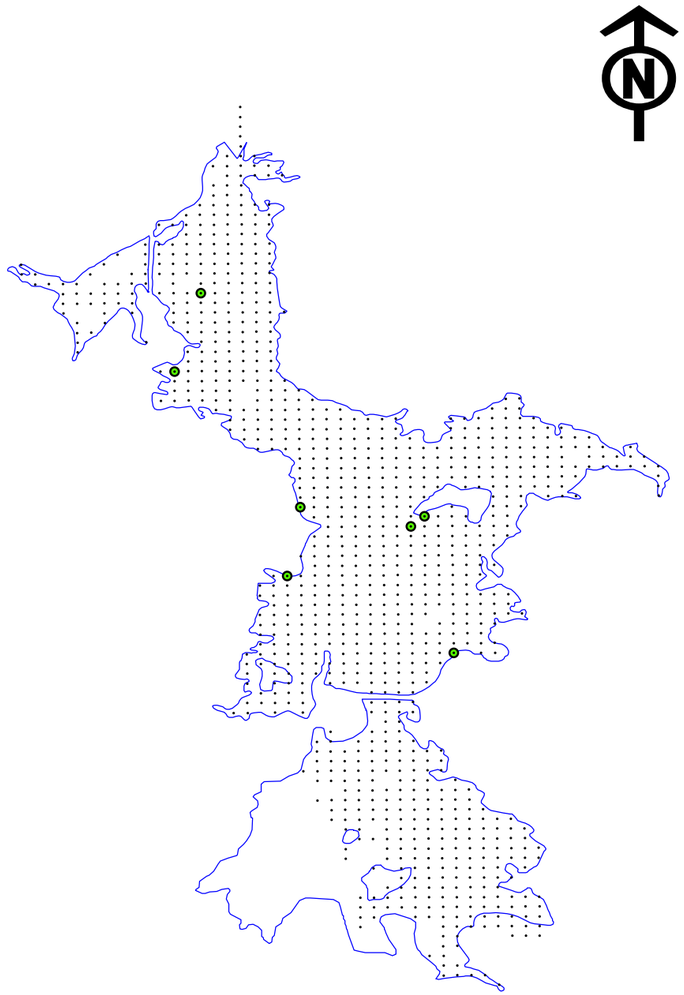
Bonestroo



Legend

- Sample points
- A few plants on rake head
- Rake head is about 1/2 full
- Overflowing can not see rake head

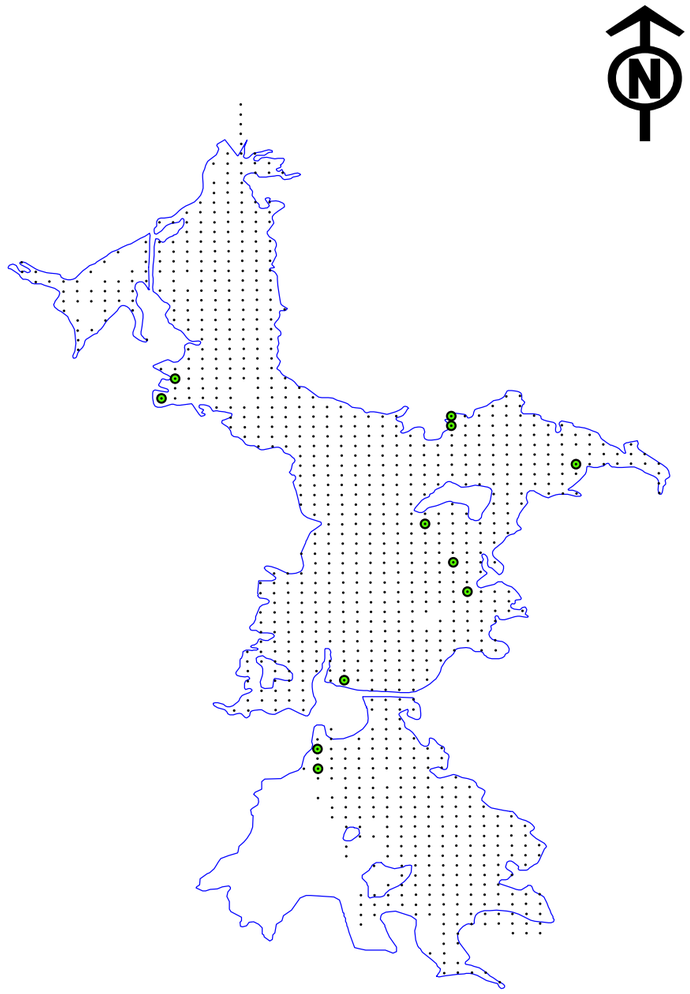
Small duckweed



Legend

- Sample points
- A few plants on rake head
- Rake head is about 1/2 full
- Overflowing can not see rake head

Soft-stem Bulrush



Legend

- Sample points
- A few plants on rake head
- Rake head is about 1/2 full
- Overflowing can not see rake head

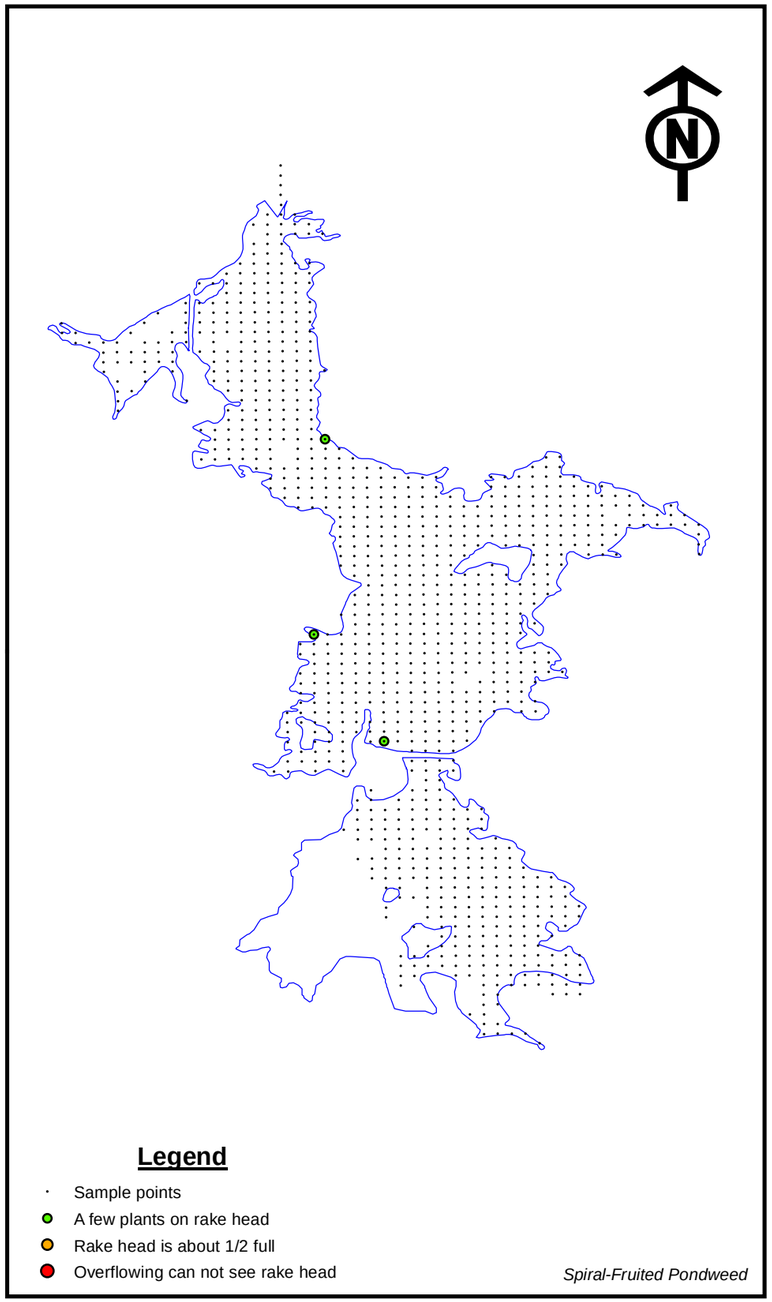
Spatterdock

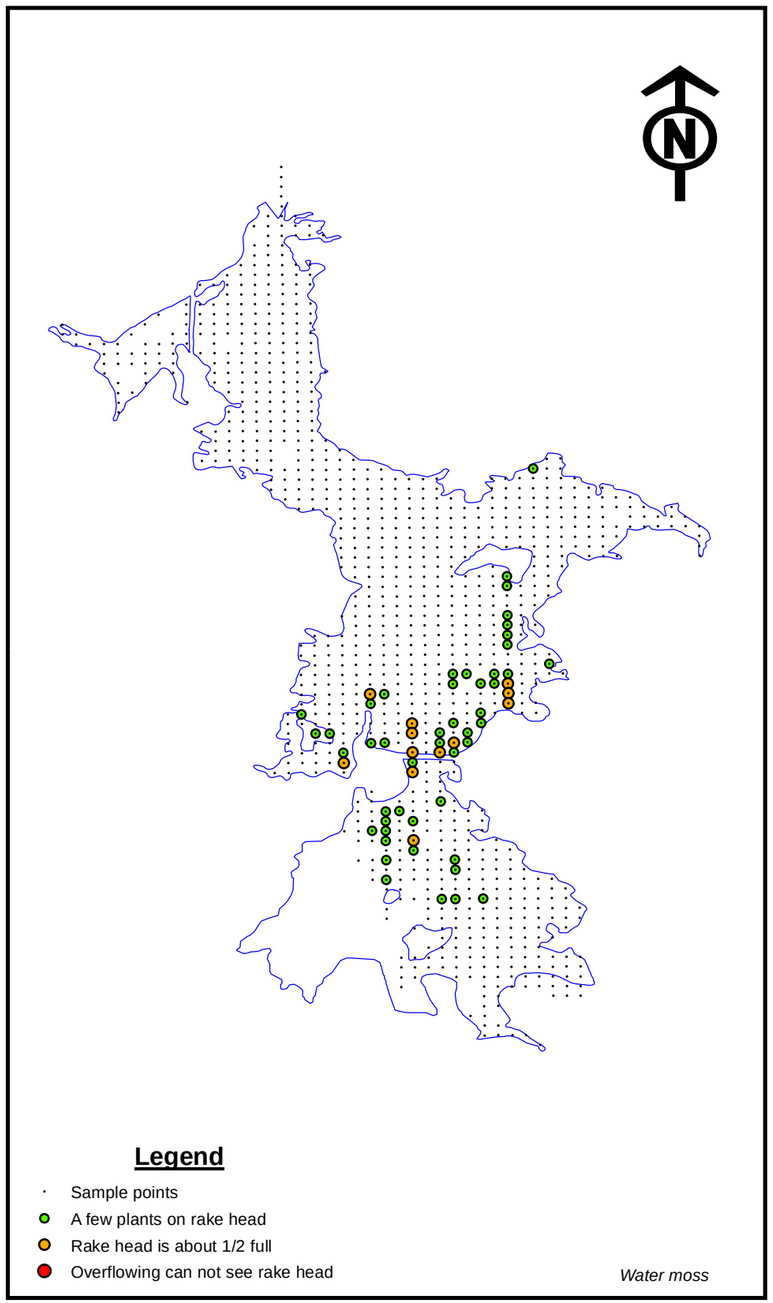
FIGURE 4g

AQUATIC PLANT DISTRIBUTION MAP

MILLER DAM LAKE ASSOCIATION
MILLER DAM CLMP - EXPANDED APM PLAN
CHEQUAMEGON WATERS FLOWAGE
TAYLOR COUNTY, WISCONSIN

Bonestroo





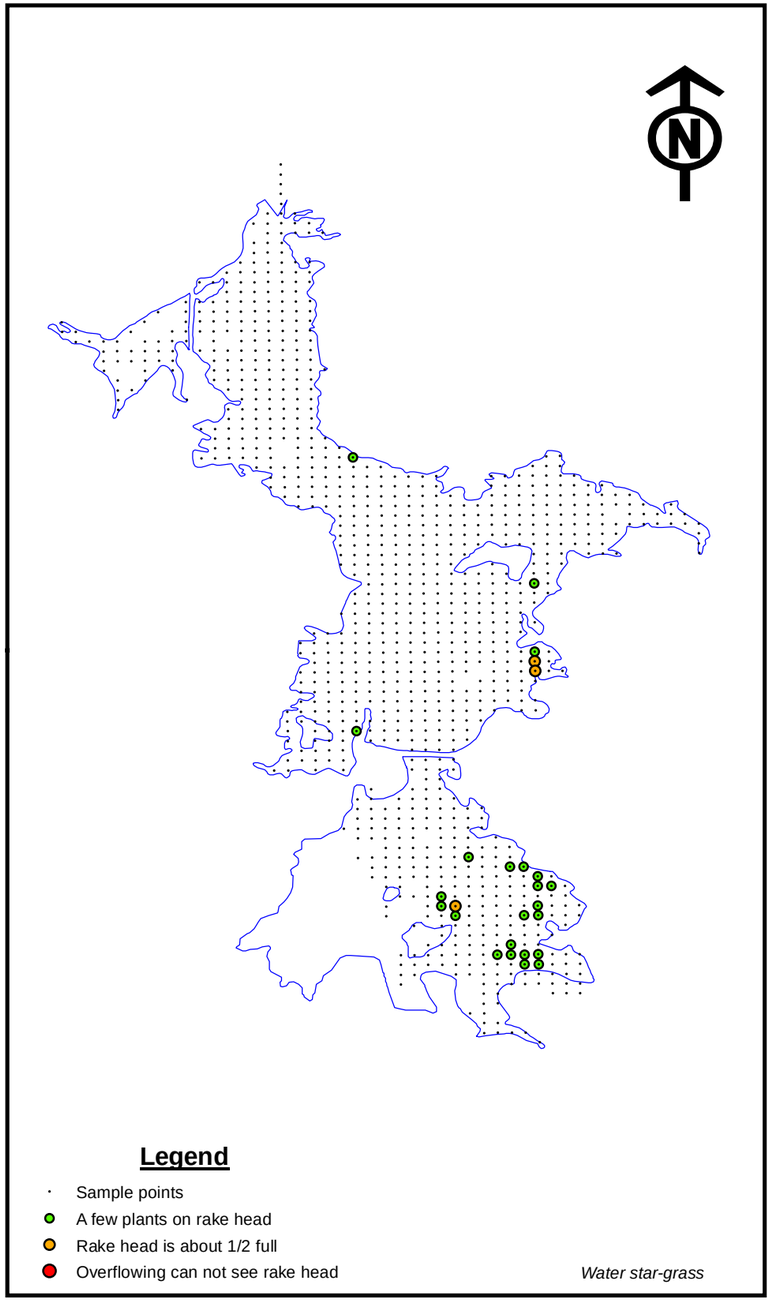
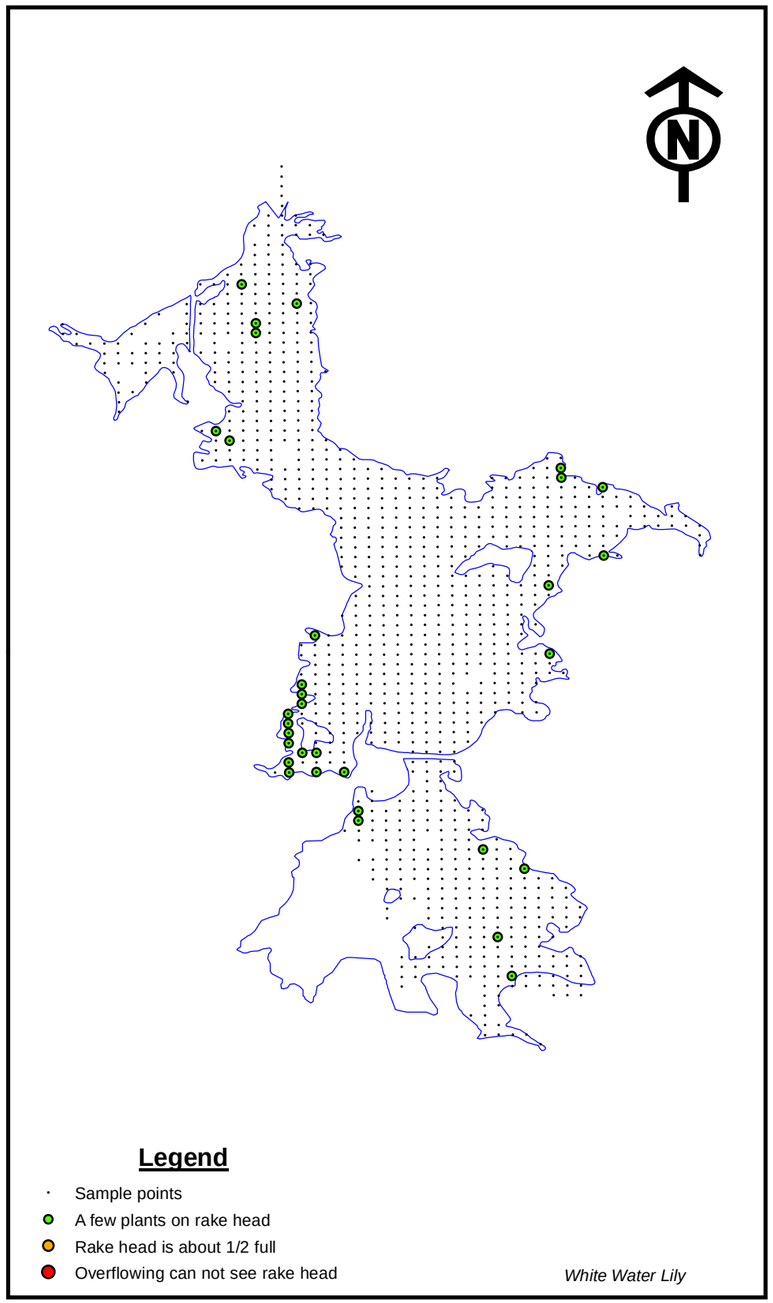


FIGURE 4h

AQUATIC PLANT DISTRIBUTION MAP

MILLER DAM LAKE ASSOCIATION
MILLER DAM CLMP - EXPANDED APM PLAN
CHEQUAMEGON WATERS FLOWAGE
TAYLOR COUNTY, WISCONSIN

Bonestroo



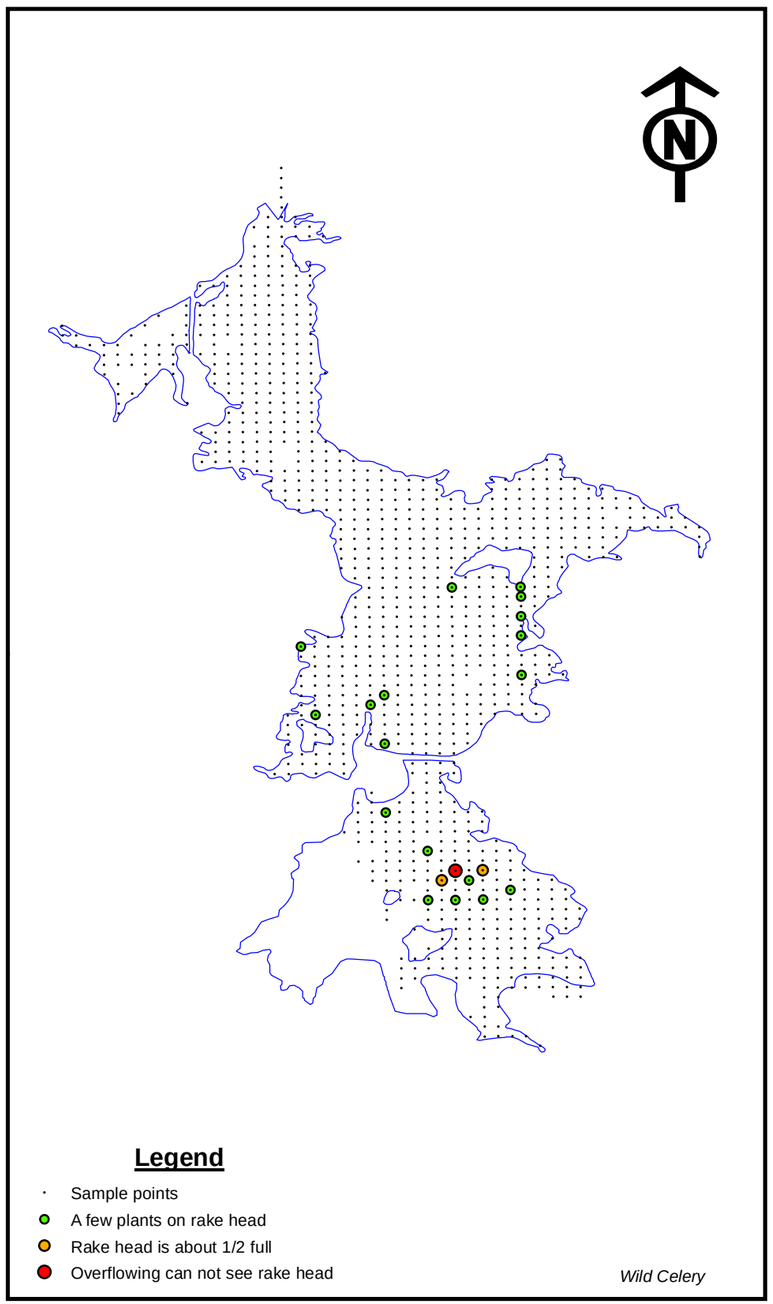
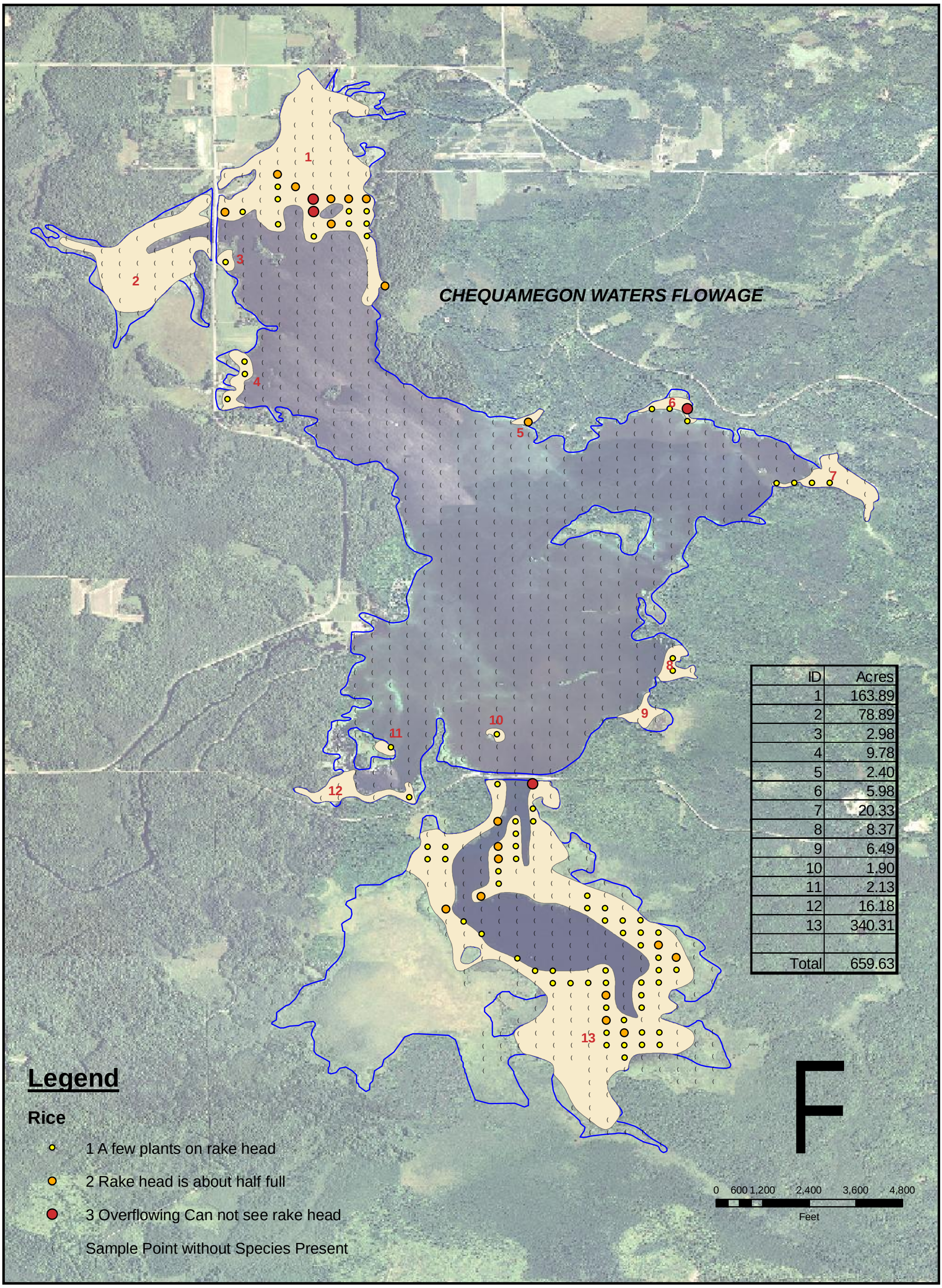


FIGURE 4i

AQUATIC PLANT DISTRIBUTION MAP

MILLER DAM LAKE ASSOCIATION
MILLER DAM CLMP - EXPANDED APM PLAN
CHEQUAMEGON WATERS FLOWAGE
TAYLOR COUNTY, WISCONSIN

Bonestroo



ID	Acres
1	163.89
2	78.89
3	2.98
4	9.78
5	2.40
6	5.98
7	20.33
8	8.37
9	6.49
10	1.90
11	2.13
12	16.18
13	340.31
Total	659.63

Zizania aquatica, Wild Rice

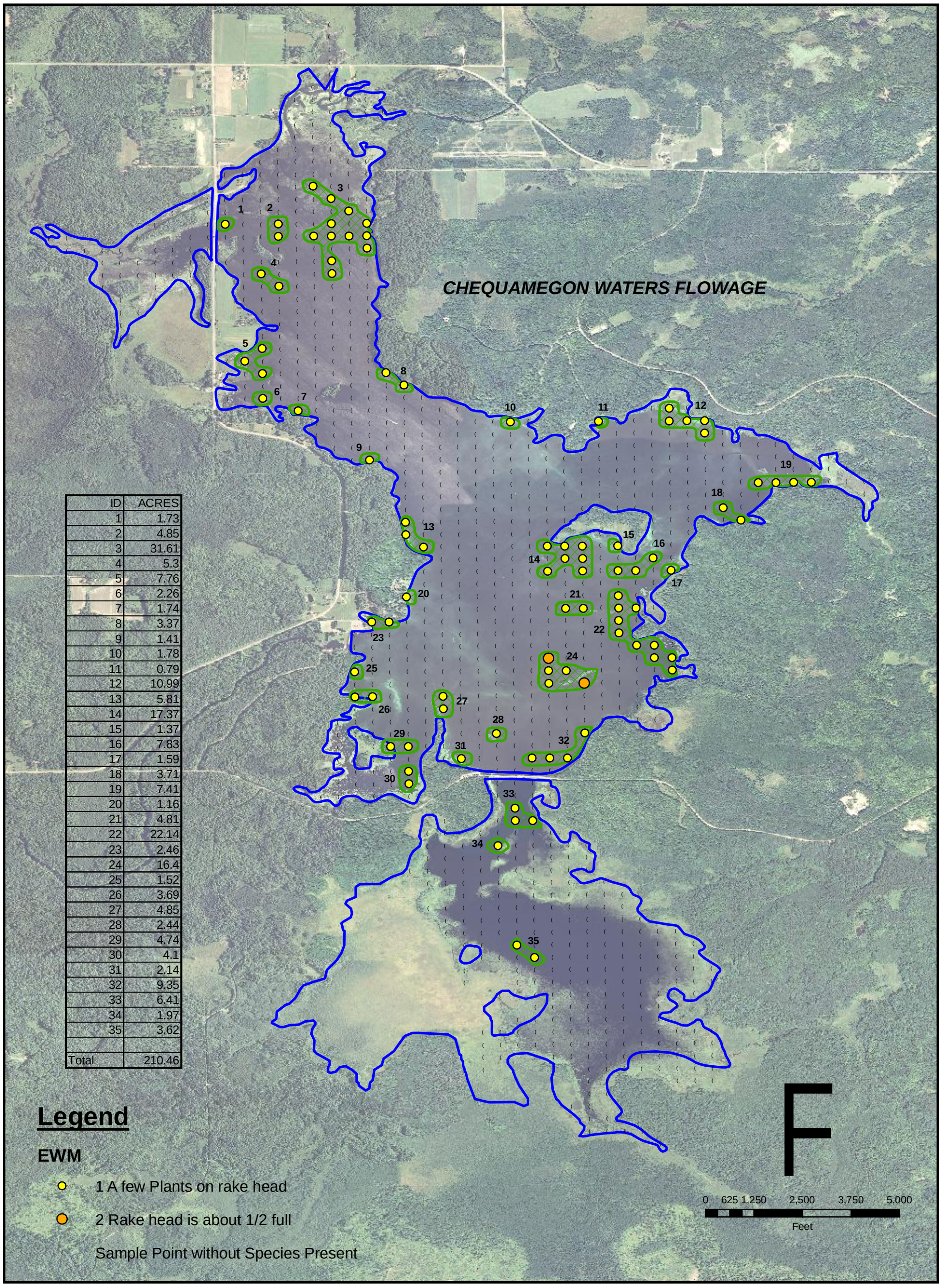
FIGURE 5

AQUATIC PLANT DISTRIBUTION MAP

MILLER DAM LAKE ASSOCIATION
MILLER DAM CLMP - EXPANDED APM PLAN
CHEQUAMEGON WATERS FLOWAGE
TAYLOR COUNTY, WISCONSIN

DATE: JULY 29, 2010 PROJECT NO. 5456-01-101-0

Bonestroo



ID	ACRES
1	1.73
2	4.85
3	31.61
4	5.3
5	7.76
6	2.26
7	1.74
8	3.37
9	1.41
10	1.78
11	0.79
12	10.99
13	5.81
14	17.37
15	1.37
16	7.83
17	1.59
18	3.71
19	7.41
20	1.16
21	4.81
22	22.14
23	2.46
24	16.4
25	1.52
26	3.69
27	4.85
28	2.44
29	4.74
30	4.1
31	2.14
32	9.35
33	6.41
34	1.97
35	3.62
Total	210.46

Myriophyllum spicatum, Eurasion water milfoil

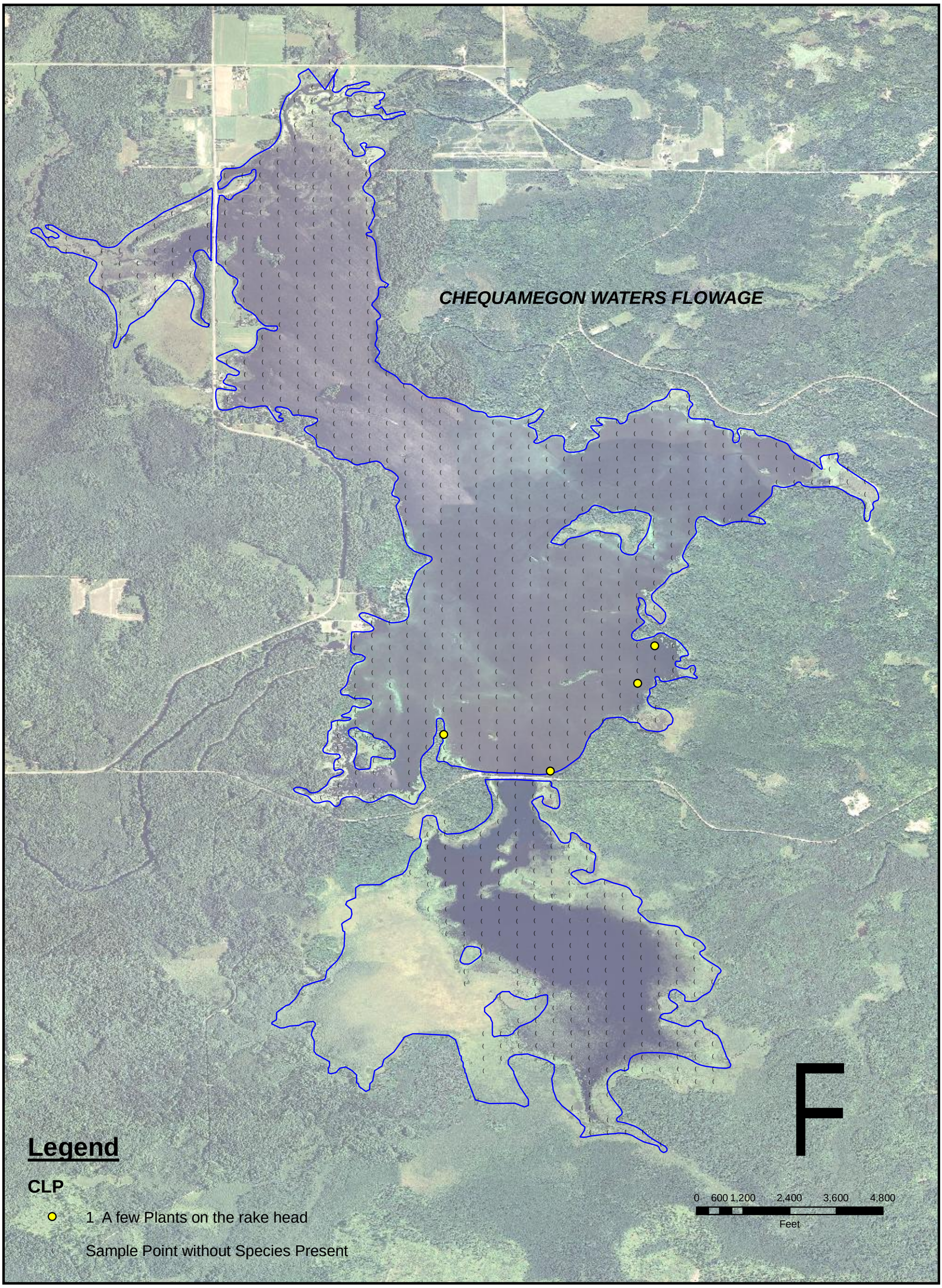
FIGURE 6

AQUATIC PLANT DISTRIBUTION MAP

MILLER DAM LAKE ASSOCIATION
MILLER DAM CLMP - EXPANDED APM PLAN
CHEQUAMEGON WATERS FLOWAGE
TAYLOR COUNTY, WISCONSIN

DATE: JULY 29, 2010 PROJECT NO. 5456-01-101-0

Bonestroo



Potamogeton crispus, Curlyleaf pondweed

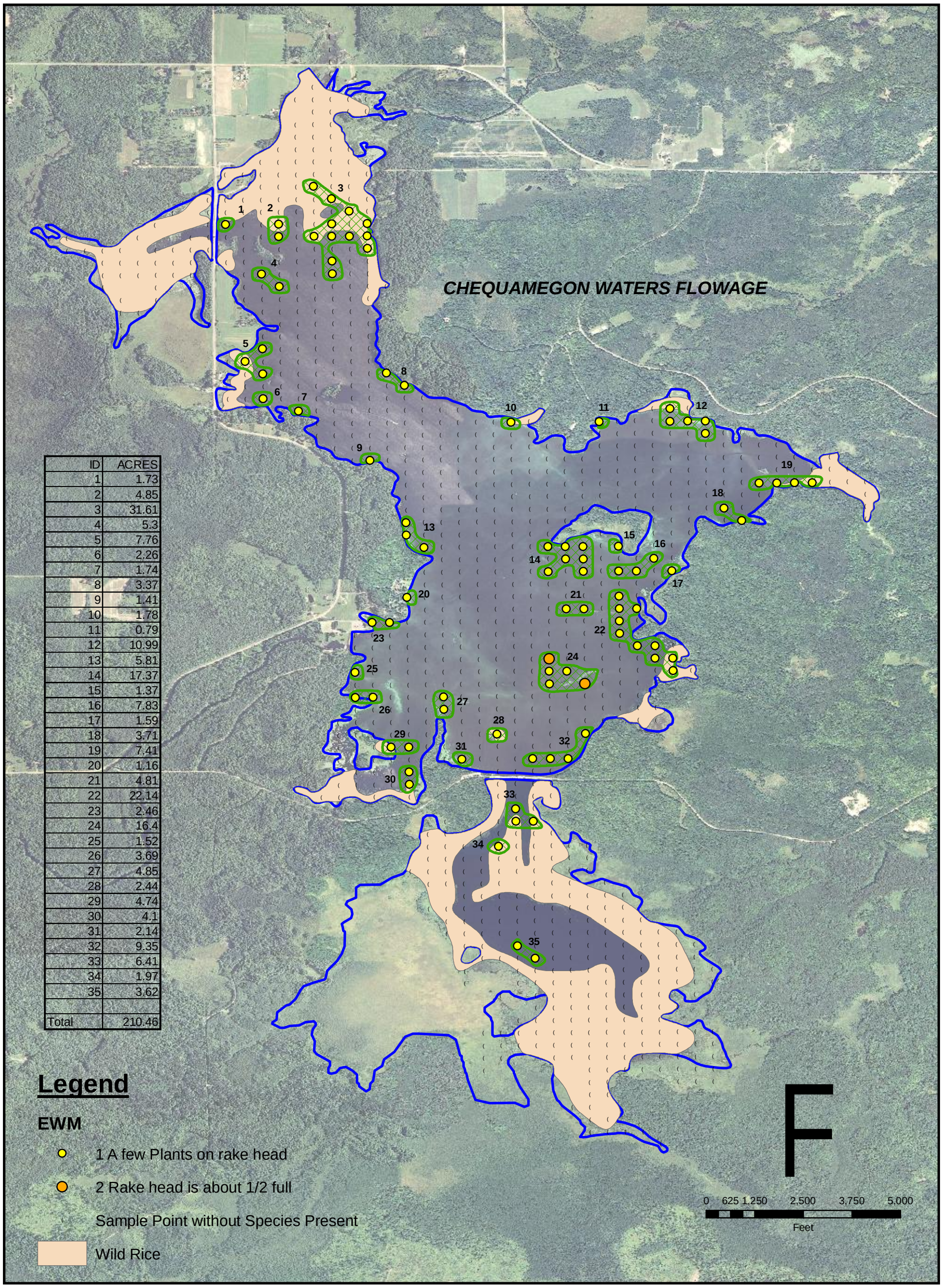
FIGURE 7

AQUATIC PLANT DISTRIBUTION MAP

MILLER DAM LAKE ASSOCIATION
MILLER DAM CLMP - EXPANDED APM PLAN
CHEQUAMEGON WATERS FLOWAGE
TAYLOR COUNTY, WISCONSIN

DATE: JULY 29, 2010 PROJECT NO. 5456-01-101-0

Bonestroo



ID	ACRES
1	1.73
2	4.85
3	31.61
4	5.3
5	7.76
6	2.26
7	1.74
8	3.37
9	1.41
10	1.78
11	0.79
12	10.99
13	5.81
14	17.37
15	1.37
16	7.83
17	1.59
18	3.71
19	7.41
20	1.16
21	4.81
22	22.14
23	2.46
24	16.4
25	1.52
26	3.69
27	4.85
28	2.44
29	4.74
30	4.1
31	2.14
32	9.35
33	6.41
34	1.97
35	3.62
Total	210.46

Myriophyllum spicatum, Eurasion water milfoil

FIGURE 8

AQUATIC PLANT DISTRIBUTION MAP

MILLER DAM LAKE ASSOCIATION
MILLER DAM CLMP - EXPANDED APM PLAN
CHEQUAMEGON WATERS FLOWAGE
TAYLOR COUNTY, WISCONSIN

DATE: JULY 29, 2010 PROJECT NO. 5456-01-101-0

Bonestroo

Chequamegon Waters Flowage Chlorophyll *a* Readings

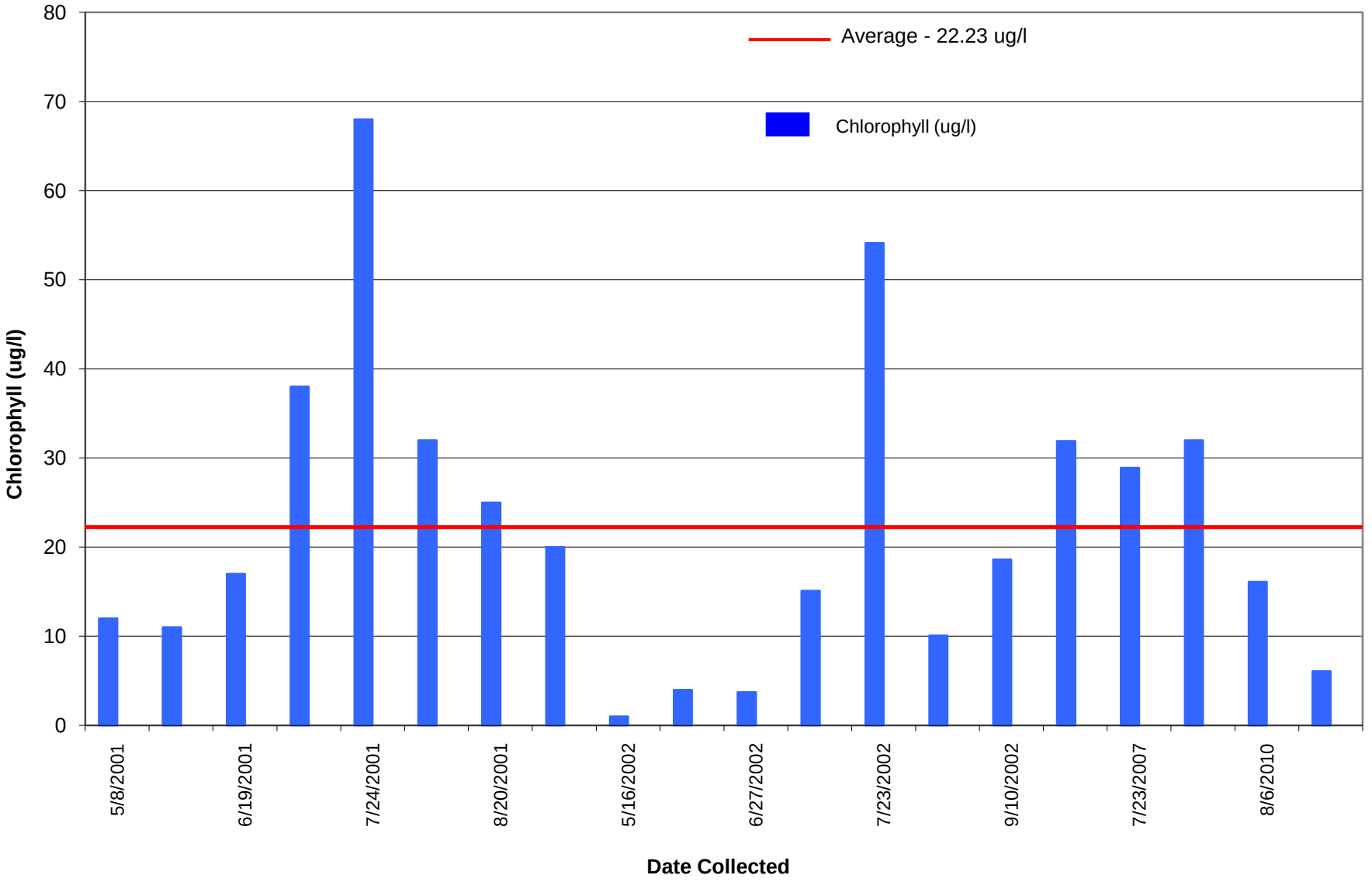


Figure 9

COLLECTION_DATE	Chlorophyll A	Average	
5/8/2001	12	22.23	1
5/31/2001	11	22.23	68
6/19/2001	17	22.23	
6/28/2001	38	22.23	
7/24/2001	68	22.23	
8/8/2001	32	22.23	
8/20/2001	25	22.23	
9/5/2001	20	22.23	
5/16/2002	1	22.23	
6/12/2002	3.99	22.23	
6/27/2002	3.73	22.23	
7/11/2002	15.1	22.23	
7/23/2002	54.1	22.23	
8/22/2002	10.1	22.23	
9/10/2002	18.6	22.23	
9/30/2002	31.9	22.23	
7/23/2007	28.9	22.23	
7/7/2010	32	22.23	
8/6/2010	16.1	22.23	
9/8/2010	6.08	22.23	

Chequamegon Waters Flowage Phosphorus Readings

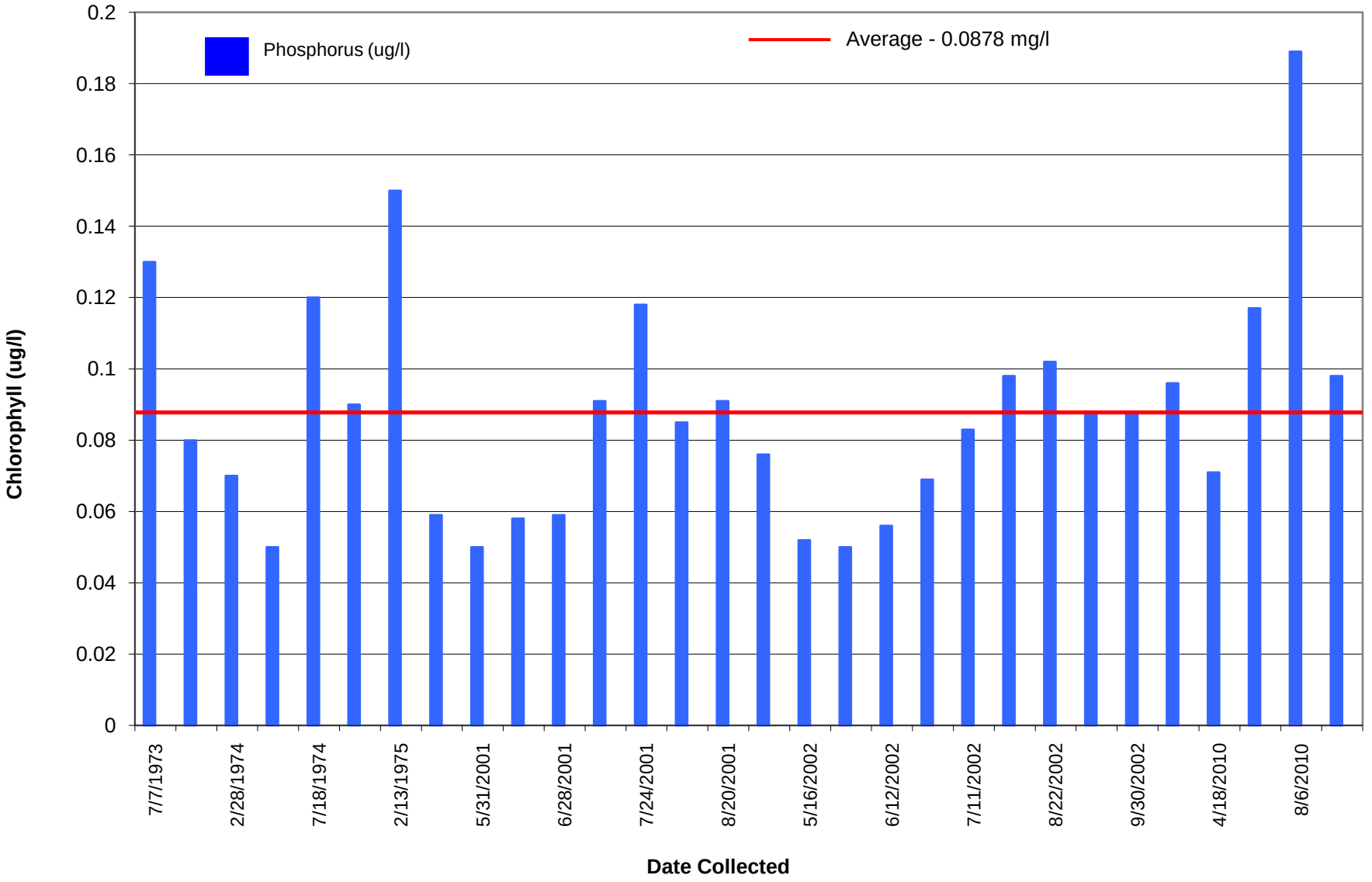


Figure 10

COLLECTION_DATE	Total P	Average	
7/7/1973	0.13	0.0878	0.189
10/29/1973	0.08	0.0878	0.05
2/28/1974	0.07	0.0878	
5/3/1974	0.05	0.0878	
7/18/1974	0.12	0.0878	
10/9/1974	0.09	0.0878	
2/13/1975	0.15	0.0878	
5/8/2001	0.059	0.0878	
5/31/2001	0.05	0.0878	
6/19/2001	0.058	0.0878	
6/28/2001	0.059	0.0878	
7/9/2001	0.091	0.0878	
7/24/2001	0.118	0.0878	
8/8/2001	0.085	0.0878	
8/20/2001	0.091	0.0878	
9/5/2001	0.076	0.0878	
5/16/2002	0.052	0.0878	
5/29/2002	0.05	0.0878	
6/12/2002	0.056	0.0878	
6/27/2002	0.069	0.0878	
7/11/2002	0.083	0.0878	
7/23/2002	0.098	0.0878	
8/22/2002	0.102	0.0878	
9/10/2002	0.088	0.0878	
9/30/2002	0.088	0.0878	
7/23/2007	0.096	0.0878	
4/18/2010	0.071	0.0878	
7/7/2010	0.117	0.0878	
8/6/2010	0.189	0.0878	
9/8/2010	0.098	0.0878	

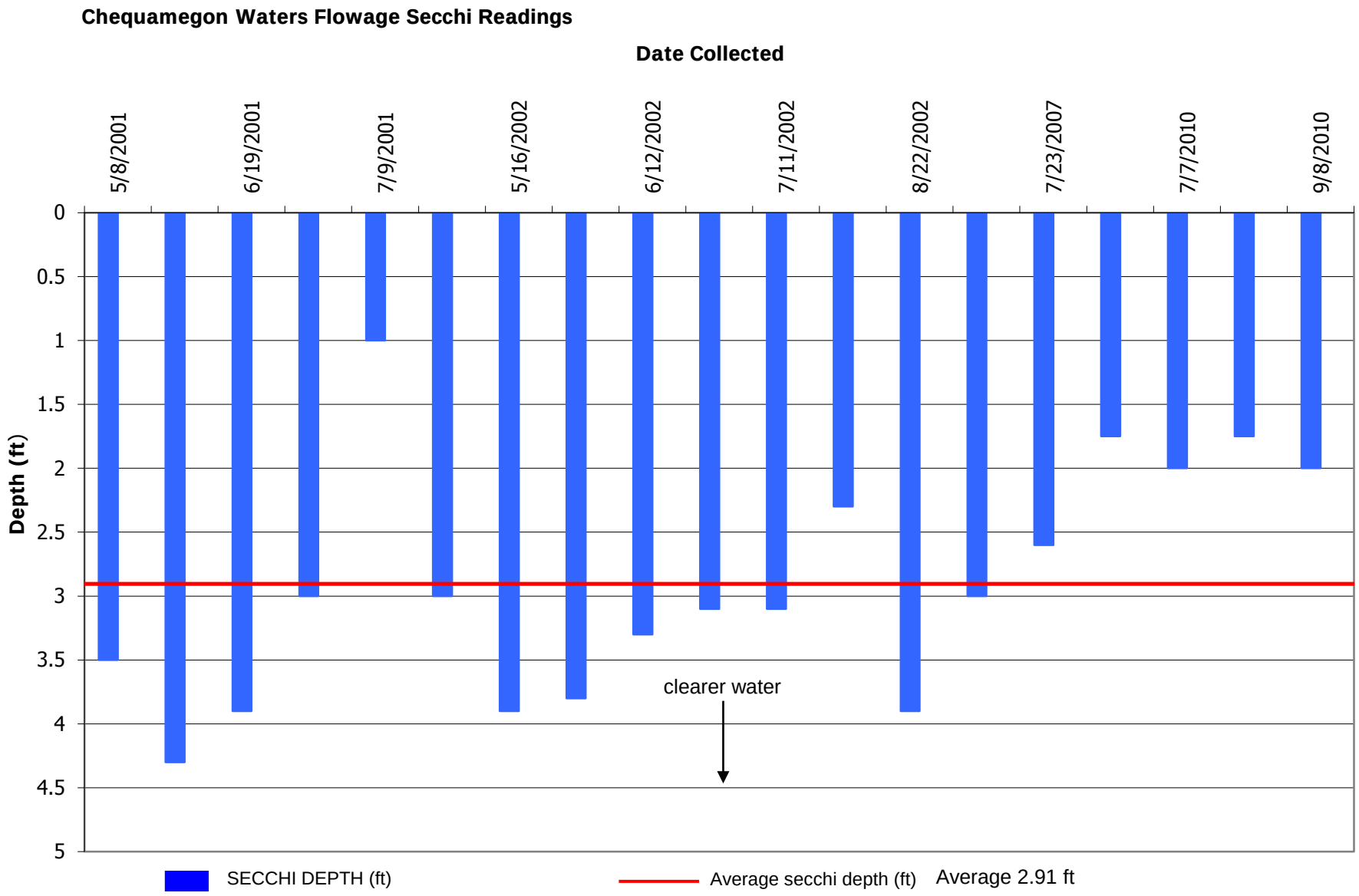
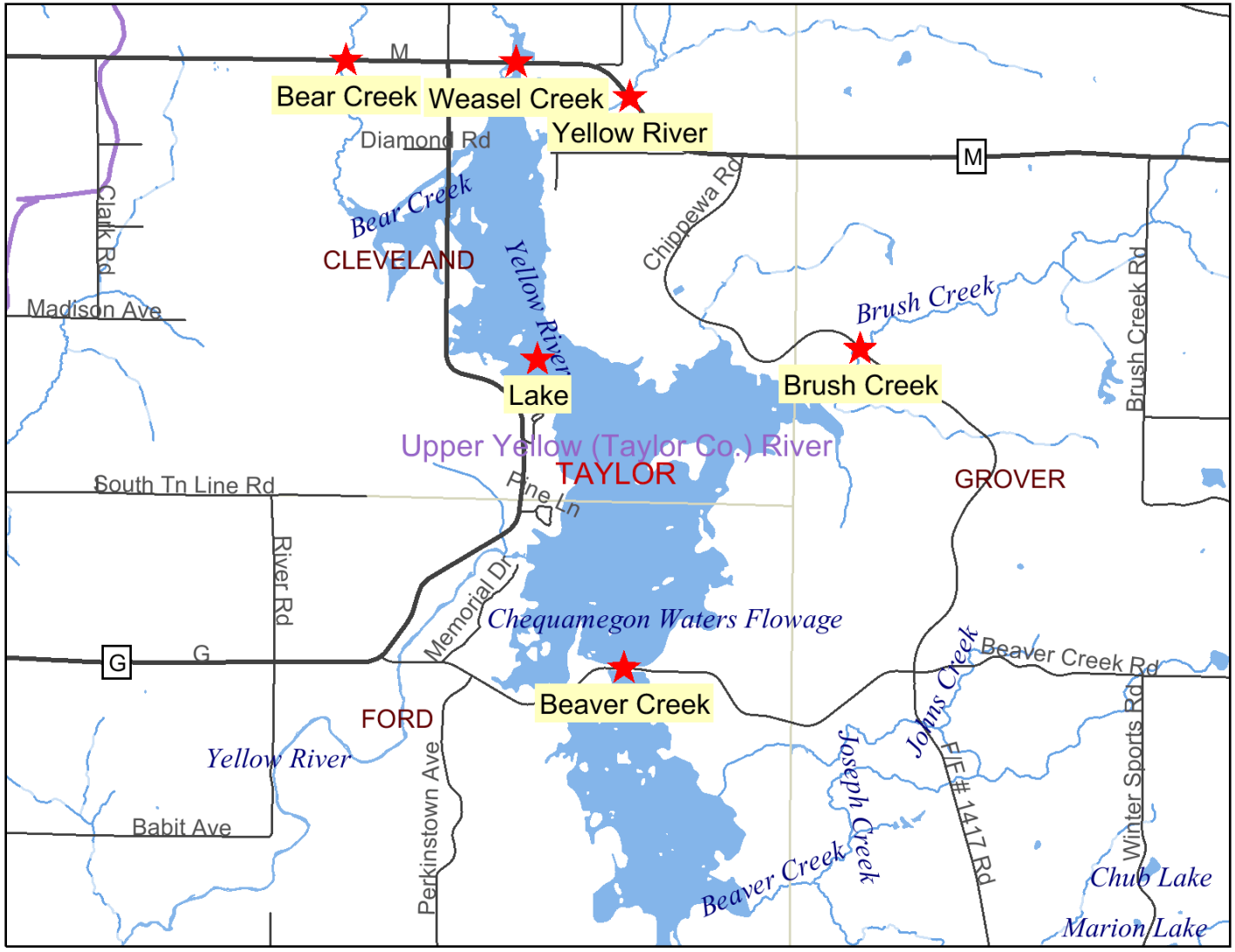

Chequamegon Waters Flowage Secchi Readings
Date Collected
5/8/2001
6/19/2001
7/9/2001
5/16/2002
6/12/2002
7/11/2002
8/22/2002
7/23/2007
7/7/2010
9/8/2010
Depth (ft)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
clearer water
SECCHI DEPTH (ft)
Average secchi depth (ft)
Average 2.91 ft

Figure 11

COLLECTION_DATE	SECCHI_FT	Secchi Average	
5/8/2001	3.5	2.91	4.3
5/31/2001	4.3	2.91	1
6/19/2001	3.9	2.91	
6/28/2001	3	2.91	
7/9/2001	1	2.91	
9/5/2001	3	2.91	
5/16/2002	3.9	2.91	
5/29/2002	3.8	2.91	
6/12/2002	3.3	2.91	
6/27/2002	3.1	2.91	
7/11/2002	3.1	2.91	
7/23/2002	2.3	2.91	
8/22/2002	3.9	2.91	
9/30/2002	3	2.91	
7/23/2007	2.6	2.91	
4/19/2010	1.75	2.91	
7/7/2010	2	2.91	
8/6/2010	1.75	2.91	
9/8/2010	2	2.91	

Water Quality Sample Locations



Legend

Major Highways
- Interstate
- State Highway
- U.S. Highways

County Roads

Local Roads

24K County Boundaries

24K Watersheds

Civil Towns
- Civil Town

24K Open Water

24K Rivers and Shorelines
- Intermittent
- Fluctuating
- Perennial

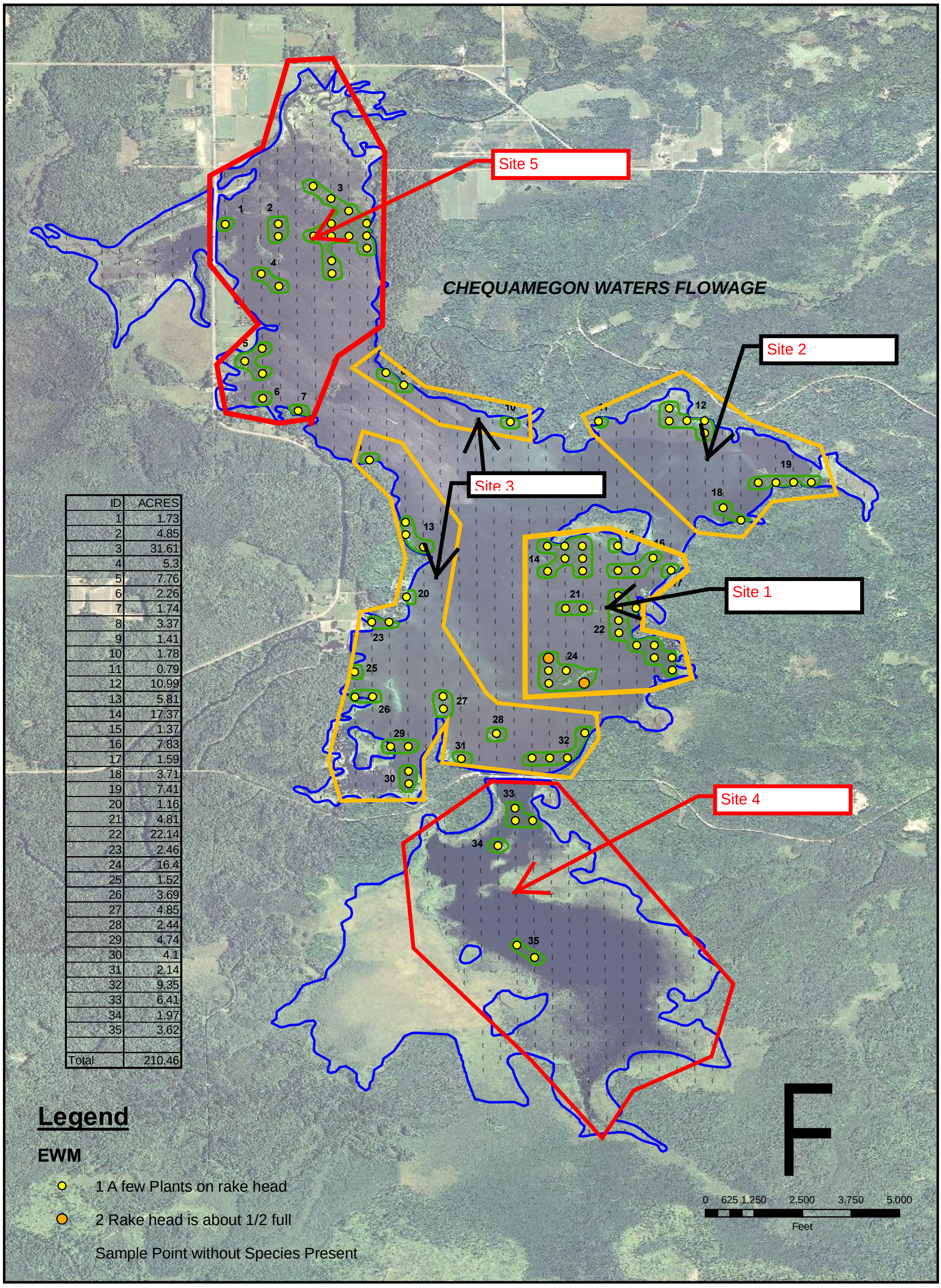
Cities and Villages
- Village
- City

0 6000 12000 18000 ft.

Scale: 1:61,065

This map is a user generated static output from an Internet mapping site and is for general reference only. Data layers that appear on this map may or may not be accurate, current, or otherwise reliable. THIS MAP IS NOT TO BE USED FOR NAVIGATION.

Figure 12



ID	ACRES
1	1.73
2	4.85
3	31.61
4	5.3
5	7.76
6	2.26
7	1.74
8	3.37
9	1.41
10	1.78
11	0.79
12	10.99
13	5.81
14	17.37
15	1.37
16	7.83
17	1.59
18	3.71
19	7.41
20	1.16
21	4.81
22	22.14
23	2.46
24	16.4
25	1.52
26	3.69
27	4.85
28	2.44
29	4.74
30	4.1
31	2.14
32	9.35
33	6.41
34	1.97
35	3.62
Total	210.46

Myriophyllum spicatum, Eurasion water milfoil

FIGURE 13

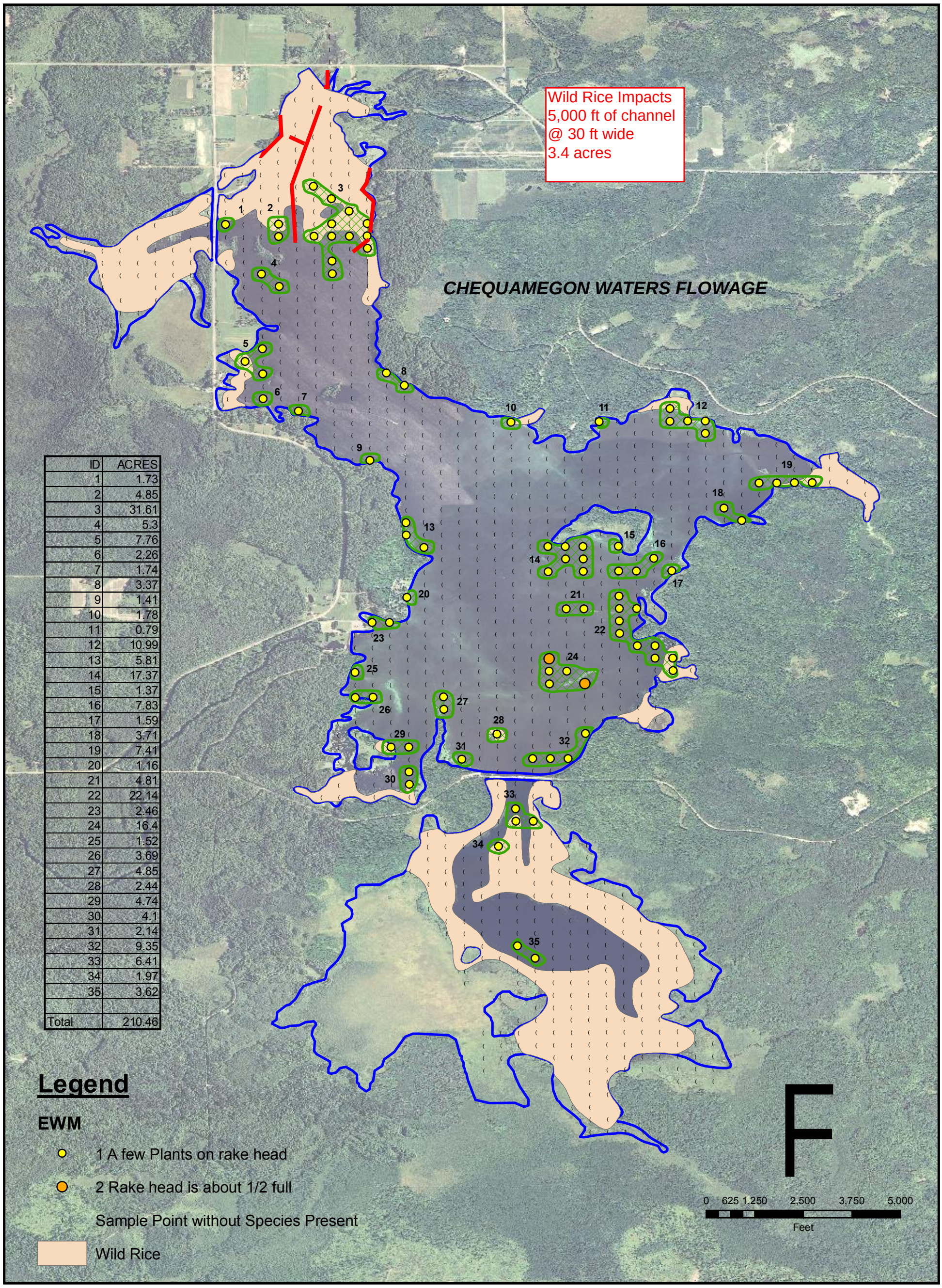
EWM Management Sites

AQUATIC PLANT DISTRIBUTION MAP

MILLER DAM LAKE ASSOCIATION
MILLER DAM CLMP - EXPANDED APM PLAN
CHEQUAMEGON WATERS FLOWAGE
TAYLOR COUNTY, WISCONSIN

DATE: JULY 29, 2010 PROJECT NO. 5456-01-101-0

Bonestroo



ID	ACRES
1	1.73
2	4.85
3	31.61
4	5.3
5	7.76
6	2.26
7	1.74
8	3.37
9	1.41
10	1.78
11	0.79
12	10.99
13	5.81
14	17.37
15	1.37
16	7.83
17	1.59
18	3.71
19	7.41
20	1.16
21	4.81
22	22.14
23	2.46
24	16.4
25	1.52
26	3.69
27	4.85
28	2.44
29	4.74
30	4.1
31	2.14
32	9.35
33	6.41
34	1.97
35	3.62
Total	210.46

Myriophyllum spicatum, Eurasion water milfoil

FIGURE 14

Wild Rice Management Areas

AQUATIC PLANT DISTRIBUTION MAP

MILLER DAM LAKE ASSOCIATION
MILLER DAM CLMP - EXPANDED APM PLAN
CHEQUAMEGON WATERS FLOWAGE
TAYLOR COUNTY, WISCONSIN

DATE: JULY 29, 2010 PROJECT NO. 5456-01-101-0

Bonestroo

Tables

Table 1 : 2010 Temperature and Dissolved Oxygen (DO)
Miller Dam Flowage, Taylor County, WI

Date	Depth (ft)	Temperature (F)	DO (mg/l)
7/22/2010	1	79.2	5.7
	2	79.2	5.7
	3	79.1	5.6
	4	78.9	5.6
	5	77.6	5.4
	6	76.5	5.2
	7	75.7	5.2
	8	75.7	5
	9	74.8	4.9
	10	74.6	4.7
	11	74.6	4.4
	12	74.4	4.4

Table 2: Taxa Detected During 2010 Aquatic Plant Survey, Miller Dam Flowage, Taylor County, WI

Genus	Species	ID	Common Name	Category
Algae	*sp.*	1	Filamentous algae	Submersed
Ceratophyllum	*demersum*	2	Coontail	Submersed
Chara	*sp.*	3	Muskgrass	Submersed
Elodea	*canadensis*	4	Common waterweed	Submersed
Heteranthera	*dubia*	5	Water star-grass	Submersed
Lemna	*minor*	6	Small duckweed	Free-floating
Lemna	*trisulca*	7	Forked duckweed	Free-floating
Moss	*sp.*	8	Common watermoss	Submersed
Myriophyllum	*sibiricum*	9	Northern water-milfoil	Submersed
Myriophyllum	***spicatum***	**10**	**Eurasian water-milfoil**	**Submersed**
Najas	*flexilis*	11	Bushy pondweed	Submersed
Nitella	*sp.*	12	Nitella	Submersed
Nuphar	*variegata*	13	Spatterdock	Floating-leaf
Numphaea	*odorata*	14	White water lily	Floating-leaf
Potamogeton	*amplifolius*	15	Large-leaf pondweed	Submersed
Potamogeton	***crispus***	**16**	**Curly-leaf pondweed**	**Submersed**
Potamogeton	*richardsonii*	17	Clasping-leaf pondweed	Submersed
Potamogeton	*spirillus*	18	Spiral-fruited pondweed	Submersed
Potamogeton	*zosteriformis*	19	Flat-stem pondweed	Submersed
Sagittaria	*latifolia*	20	Common arrowhead	Emergent
Sagittaria	*sp.*	21	Arrowhead	Emergent
Schoenoplectus	*tabernaemontani*	22	Softstem bulrush	Emergent
Sparganium	*eurycarpum*	23	Common bur-reed	Emergent
Spirodela	*polyrhiza*	24	Large duckweed	Free-floating
Typha	*latifolia*	25	Broad-leaved cattail	Emergent
Utricularia	*vulgaris*	26	Common bladderwort	Submersed
Vallisneria	*americana*	27	Wild celery	Submersed
Zizania	*palustris*	28	Northern wild rice	Emergent

Table 3: 2010 Aquatic Plant Community Statistics, Miller Dam Flowage, TaylorCounty, WI

Aquatic Plant Community Statistics	2010
Frequency of occurrence at sites shallower than maximum depth of plants	46.42%
Simpson Diversity Index	0.93
Maximum Depth of Plants (Feet)	6
Taxonomic Richness (Number Taxa)	28
Average Number of Species per Site (sites less than max depth of plant growth)	1.19
Average Number of Species per Site (sites with vegetation)	2.83
Average Number of NATIVE Species per Site (sites less than max depth of plant growth)	1.38
Average Number of NATIVE Species per Site (sites with vegetation)	2.98

Table 4: 2010 Aquatic Plant Taxa-Specific Statistics, Miller Dam Flowage, Taylor County, WI

Genus	Species	Common Name	Percent Frequency of Occurrence within vegetated areas	Percent Frequency of Occurrence at sites shallower than max depth of plants	Percent Relative Frequency of Occurrence	Number of Intercept Points Where Detected	Average Density
Ceratophyllum	*demersum*	Coontail	42.86	19.89	14.40	111	1.09
Zizania	*palustris*	Northern wild rice	37.45	17.38	12.58	97	1.28
Myriophyllum	***spicatum***	**Eurasian water-milfoil**	**36.29**	**16.85**	**12.19**	**94**	**1.02**
Elodea	*canadensis*	Common waterweed	32.43	15.05	10.89	84	1.23
Lemna	*trisulca*	Forked duckweed	27.03	12.54	9.08	70	1.00
Moss	*sp.*	Common watermoss	23.17	10.75	7.78	60	1.20
Potamogeton	*zosteriformis*	Flat-stem pondweed	13.13	6.09	4.41	34	1.00
Numphaea	*odorata*	White water lily	12.36	5.73	4.15	32	1.00
Utricularia	*vulgaris*	Common bladderwort	11.20	5.20	3.76	29	1.00
Heteranthera	*dubia*	Water star-grass	10.04	4.66	3.37	26	1.12
Potamogeton	*amplifolius*	Large-leaf pondweed	8.88	4.12	2.98	23	1.09
Vallisneria	*americana*	Wild celery	8.11	3.76	2.72	21	1.19
Nitella	*sp.*	Nitella	4.63	2.15	1.56	12	1.08
Nuphar	*variegata*	Spatterdock	4.25	1.97	1.43	11	1.00
Potamogeton	*richardsonii*	Clasping-leaf pondweed	4.25	1.97	1.43	11	1.00
Algae	*sp.*	Filamentous algae	3.47	1.61	1.17	9	1.00
Spirodela	*polyrhiza*	Large duckweed	3.47	1.61	1.17	9	1.00
Lemna	*minor*	Small duckweed	2.70	1.25	0.91	7	1.14
Schoenoplectus	*tabernaemonta*	Softstem bulrush	2.70	1.25	0.91	7	1.00
Najas	*flexilis*	Bushy pondweed	1.93	0.90	0.65	5	1.00
Potamogeton	***crispus***	**Curly-leaf pondweed**	**1.54**	**0.72**	**0.52**	**4**	**1.00**
Sparganium	*eurycarpum*	Common bur-reed	1.54	0.72	0.52	4	1.00
Potamogeton	*spirillus*	Spiral-fruited pondweed	1.16	0.54	0.39	3	1.00
Sagittaria	*sp.*	Arrowhead	1.16	0.54	0.39	3	1.00
Myriophyllum	*sibiricum*	Northern water-milfoil	0.77	0.36	0.26	2	1.00
Chara	*sp.*	Muskgrass	0.39	0.18	0.13	1	1.00
Sagittaria	*latifolia*	Common arrowhead	0.39	0.18	0.13	1	1.00
Typha	*latifolia*	Broad-leaved cattail	0.39	0.18	0.13	1	1.00

Table 5: 2010 Floristic Quality Index, Miller Dam Flowage, Taylor County, WI

Genus	Species	Common Name	Coefficient of Conservatism C
Ceratophyllum	*demersum*	Coontail	3
Chara	*sp.*	Muskgrass	7
Elodea	*canadensis*	Common waterweed	3
Heteranthera	*dubia*	Water star-grass	6
Lemna	*minor*	Small duckweed	4
Lemna	*trisulca*	Forked duckweed	6
Myriophyllum	*sibiricum*	Northern water-milfoil	6
Najas	*flexilis*	Bushy pondweed	6
Nitella	*sp.*	Nitella	7
Nuphar	*variegata*	Spatterdock	6
Numphaea	*odorata*	White water lily	6
Potamogeton	*amplifolius*	Large-leaf pondweed	7
Potamogeton	*richardsonii*	Clasping-leaf pondweed	5
Potamogeton	*spirillus*	Spiral-fruited pondweed	8
Potamogeton	*zosteriformis*	Flat-stem pondweed	6
Sagittaria	*latifolia*	Common arrowhead	3
Schoenoplectus	*tabernaemontani*	Softstem bulrush	4
Sparganium	*eurycarpum*	Common bur-reed	5
Spirodela	*polyrhiza*	Large duckweed	5
Typha	*latifolia*	Broad-leaved cattail	1
Utricularia	*vulgaris*	Common bladderwort	7
Vallisneria	*americana*	Wild celery	6
Zizania	*palustris*	Northern wild rice	8

N 23
Mean C 5.434782609
Floristic Quality Index (FQI) 26.06430176

Please note: There is no Coefficient of Conservatism for exotic species such as Eurasian Water-Milfoil.

Coefficient of Conservatism C
0-3 taxa found in wide variety of plant communities and very tolerant of disturbance.
4-6 taxa typically associated with specific plant communities and tolerate moderate disturbance.
7-8 taxa found in narrow range of plant communities and tolerate minor disturbance.
9-10 taxa restricted to a narrow range of ecological conditions, with low tolerance of disturbance.

Table 6 : Water Quality Data, Miller Dam Flowage, Taylor County, WI

Date	Secchi (Feet)	Chlorophyll a (ug/l)	Total Phosphorus (ug/l)	Secchi TSI	Total Phosphorus TSI	Chlorophyll TSI
7/7/1973			130		66	
10/29/1973			80		62	
2/28/1974			70		61	
5/3/1974			50		58	
7/18/1974			120		65	
10/9/1974			90		63	
2/13/1975			150		67	
5/8/2001	3.5	12	59	59	60	54
5/31/2001	4.3	11	50	56	58	53
6/19/2001	3.9	17	58	58	60	56
6/28/2001	3	38	59	61	60	62
7/9/2001	1	195	91	77	63	75
7/24/2001		68	118		65	67
8/8/2001		32	85		63	61
8/20/2001		25	91		63	59
9/5/2001	3	20	76	61	62	57
5/16/2002	3.9	1	52	58	59	35
5/29/2002	3.8		50	58	58	
6/12/2002	3.3	3.99	56	60	59	45
6/27/2002	3.1	3.73	69	61	61	45
7/11/2002	3.1	15.1	83	61	62	55
7/23/2002	2.3	54.1	98	65	64	65
8/22/2002	3.9	10.1	102	58	64	52
9/10/2002		18.6	88		63	57
9/30/2002	3	31.9	88	61	63	61
7/23/2007	2.6	28.9	96	63	63	60
4/18/2010			71		61	
4/19/2010	1.75			69		
7/7/2010	2	32	117	67	65	61
8/6/2010	1.75	16.1	189	69	69	56
9/8/2010	2	6.08	98	67	64	48

Table 7 : Water Quality Data, Miller Dam Flowage, Taylor County, WI

Date	Depth (ft)	Temperature	Dissolved Oxygen (mg/l)
7/23/2007	1.6	73.22	5.6
7/23/2007	3.3	73.22	5.3
7/23/2007	6.6	73.04	4.7
7/23/2007	9.8	72.86	4.4
7/23/2007	13.1	72.68	4
7/23/2007	14.8	72.68	4
7/7/2010	0	81.2	
7/7/2010	2	80.3	
7/7/2010	3	79.5	
7/7/2010	4	79.1	
7/7/2010	5	77.5	
7/7/2010	6	75.3	
7/7/2010	7	75	
7/7/2010	8	75	
7/7/2010	9	74.6	
7/7/2010	10	74.6	
7/7/2010	11	74.4	
7/7/2010	12	74.1	
8/6/2010	1	77.3	
8/6/2010	2	77.1	
8/6/2010	3	77	
8/6/2010	4	76.6	
8/6/2010	5	75.9	
8/6/2010	6	75.5	
8/6/2010	7	75.3	
8/6/2010	8	75.3	
8/6/2010	9	75.2	
8/6/2010	10	75.2	
8/6/2010	11	75.2	
8/6/2010	12	75.2	
8/6/2010	13	74.8	
9/8/2010	0	59	
9/8/2010	1	59.1	
9/8/2010	2	59.1	
9/8/2010	3	59.1	
9/8/2010	4	59.1	
9/8/2010	5	59.1	
9/8/2010	6	59.1	
9/8/2010	7	59.1	
9/8/2010	8	59.1	
9/8/2010	9	59.1	
9/8/2010	10	59.1	
9/8/2010	11	59.1	
9/8/2010	12	59.1	

Appendix A – Point Intercept Sample Coordinates

ID	latitude	longitude
1	45.23034741	-90.73205958
2	45.22946532	-90.73204826
3	45.22947332	-90.73079995
4	45.22859124	-90.73078865
5	45.22859922	-90.72954036
6	45.22860719	-90.72829208
7	45.22772510	-90.72828081
8	45.22684302	-90.72826955
9	45.22596094	-90.72825828
10	45.22861514	-90.72704379
11	45.22773306	-90.72703254
12	45.22685097	-90.72702130
13	45.22508681	-90.72699881
14	45.22420473	-90.72698757
15	45.22332264	-90.72697633
16	45.22244056	-90.72696508
17	45.22950516	-90.72580673
18	45.22774100	-90.72578428
19	45.22685891	-90.72577305
20	45.22421266	-90.72573938
21	45.23039517	-90.72456963
22	45.22863100	-90.72454721
23	45.22774892	-90.72453601
24	45.22686684	-90.72452480
25	45.22598476	-90.72451360
26	45.22510267	-90.72450239
27	45.23128517	-90.72333249
28	45.22863892	-90.72329893
29	45.22775683	-90.72328774
30	45.22687475	-90.72327655
31	45.22952890	-90.72206181
32	45.22864682	-90.72205064
33	45.22776473	-90.72203947
34	45.22688265	-90.72202830
35	45.22600057	-90.72201713
36	45.23218303	-90.72084695
37	45.23130095	-90.72083580
38	45.23041887	-90.72082465
39	45.22953678	-90.72081350
40	45.22865470	-90.72080235
41	45.22336220	-90.72073546
42	45.23395507	-90.71962085
43	45.23219091	-90.71959858
44	45.23130882	-90.71958745
45	45.23042674	-90.71957632
46	45.22954466	-90.71956519
47	45.22778049	-90.71954293
48	45.22072381	-90.71945391
49	45.21807756	-90.71942054
50	45.23396293	-90.71837244
51	45.23219877	-90.71835021
52	45.23131668	-90.71833910
53	45.23043460	-90.71832799
54	45.22955251	-90.71831688

55	45.22867043	-90.71830577
56	45.22778835	-90.71829466
57	45.22690626	-90.71828355
58	45.22602418	-90.71827244
59	45.22514209	-90.71826133
60	45.22073167	-90.71820579
61	45.21984958	-90.71819469
62	45.21896750	-90.71818358
63	45.21808541	-90.71817248
64	45.23485286	-90.71713513
65	45.23397078	-90.71712403
66	45.23308869	-90.71711294
67	45.23220661	-90.71710185
68	45.23132453	-90.71709075
69	45.23044244	-90.71707966
70	45.22956036	-90.71706857
71	45.22779619	-90.71704639
72	45.22691411	-90.71703529
73	45.22603202	-90.71702420
74	45.22514994	-90.71701312
75	45.22426785	-90.71700203
76	45.22250368	-90.71697985
77	45.22162160	-90.71696876
78	45.22073951	-90.71695768
79	45.21985743	-90.71694659
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81	45.21809325	-90.71692442
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Appendix B – Summary of Public Survey

MILLER DAM (CHEQUAMEGON WATERS) AQUATIC PLANT MANAGEMENT PLAN

PUBLIC QUESTIONNAIRE

The Miller Dam Lake Association is currently developing an aquatic plant management (APM) plan for Miller Dam Lake. An APM plan must be completed to obtain permits from the Wisconsin Department of Natural Resources (WDNR) for large scale management of aquatic plants. An APM plan is a management plan describing a current aquatic plant community for a specific water body with an associated action, designed to protect, preserve or enhance the aquatic plant community and future water quality.

Public input is needed to refine APM plan goals and formulate reasonable management methods to combat aquatic invasive species and manage the aquatic plant community in a manner desirable to the lake. The input will be used to formulate acceptable management strategies. By completing this survey you will help guide the plan development of the APM plan and future management on the lakes. Please complete and return this survey no later than **AUGUST 18, 2010**.

1. **Please place an X by the response that best describes your affiliation with the lake and the community (check all that apply).**

☐ Waterfront Landowner (Year round resident)

☐ Waterfront Landowner (Seasonal resident)

☐ Nearby (offshore) Resident-year round

☐ Nearby (offshore) Resident-seasonal

☐ Area Business Owner

☐ Other _____

2. **How many years have you been familiar or associated with Miller Dam? If less than 1 year please write 1.**

_____Years

3. From the list below please check all of the activities that you participate in on Miller Dam.

- ☐ Fishing from shore
- ☐ Fishing from boat
- ☐ Ice fishing
- ☐ Waterskiing
- ☐ Personal water craft
- ☐ Swimming
- ☐ Pontoon boating
- ☐ Sailing
- ☐ Pleasure boating
- ☐ Canoeing & kayaking
- ☐ Nature viewing
- ☐ Enjoyment of scenery
- ☐ Hunting
- ☐ Camping
- ☐ Snorkeling/scuba diving
- ☐ Other _____

4. In the spaces provided, please rank your top three activities that you most enjoy at Miller Dam. Write 1 to indicate your most enjoyable activity and 3 to indicate your third enjoyable activity.

_____ Fishing
_____ Waterskiing
_____ Personal water craft
_____ Swimming
_____ Pontoon boating
_____ Sailing
_____ Pleasure boating
_____ Canoeing & kayaking
_____ Nature viewing
_____ Enjoyment of scenery
_____ Hunting
_____ Camping
_____ Snorkeling/scuba divin
_____ Other

5. Considering the activities listed above, what is the average number of days per month that you use the lake during the summer months (between Memorial Day and Labor Day)?

_____ days/month

6. What types of watercraft do you use on Miller Dam (please check all that apply)? ***If you do not use watercraft please check the last box.***

- ☐ Pontoon boat
- ☐ Personal watercraft
- ☐ Canoe/kayak
- ☐ Sailboat
- ☐ Motorized boat less than 50 hp
- ☐ Motorized boat 50 hp or greater
- ☐ I do not use watercraft → **Go to Question 9**

7. How often do you launch your boat on Miller Dam during summer months (between Memorial Day and Labor Day)? Please check only one.

- ☐ Never
- ☐ 1-2 per season
- ☐ 1-3 per month
- ☐ 1-2 per week
- ☐ Several times per week
- ☐ Daily

8. Where do you launch your boat most often during summer months (between Memorial Day and Labor Day)? Please check only one.

- ☐ CTH G
- ☐ Dam
- ☐ Beaver Creek
- ☐ National Forest Campground

9. In general, how satisfied have you been with your recreational experiences on Miller Dam?

- ☐ Very satisfied
- ☐ Somewhat satisfied
- ☐ Not too satisfied
- ☐ Not at all satisfied

10. From the list below, please rank your top 3 lake concerns on Miller Dam. Write 1 for your primary concern and 3 to indicate your third concern.

_____ Water quality/pollution
_____ Shoreline vegetation removal
_____ Shoreline erosion
_____ Excessive aquatic plant growth
_____ Insufficient fish habitat
_____ Algae growth
_____ Other _____

_____ Too much wild rice
_____ Low game fish populations
_____ Boating safety
_____ Excessive boat traffic
_____ Aquatic Invasive Species (AIS)

11. Considering the lake issues in the question above, please provide your personal opinion as to the overall quality of Miller Dam.

- ☐ Excellent
- ☐ Good
- ☐ Unsure
- ☐ Fair
- ☐ Poor

12. What do you feel are the greatest current and future threats to Miller Dam? Please rank your top 2 choices on a 1-2 scale with 1 being the greatest threat.

Current Threats

_____ Overdevelopment
_____ Deterioration of fishery
_____ Deterioration of water quality
_____ New invasive species infestation
_____ Spread of existing invasive species
_____ Over use of waterway
_____ Loss of wilderness experience

Future Threats

_____ Overdevelopment
_____ Deterioration of fishery
_____ Deterioration of water quality
_____ Invasive species infestation
_____ Spread of existing invasive species
_____ Over use of waterway
_____ Loss of wilderness experience

13. Using the scale below, please indicate the extent to which you believe aquatic plant growth *negatively* affects the following activities at Miller Dam?

Extent of Negative Impact of Aquatic Plants

	None	Slight	Unsure	Moderate	Great
Fishing from shore	☐	☐	☐	☐	☐
Fishing from boat	☐	☐	☐	☐	☐
Ice fishing	☐	☐	☐	☐	☐
Waterskiing	☐	☐	☐	☐	☐
Personal water craft	☐	☐	☐	☐	☐
Swimming	☐	☐	☐	☐	☐
Pontoon boating	☐	☐	☐	☐	☐
Sailing	☐	☐	☐	☐	☐
Pleasure boating	☐	☐	☐	☐	☐
Canoeing & kayaking	☐	☐	☐	☐	☐
Nature viewing	☐	☐	☐	☐	☐
Enjoyment of scenery	☐	☐	☐	☐	☐
Hunting	☐	☐	☐	☐	☐
Camping	☐	☐	☐	☐	☐
Snorkeling/scuba diving	☐	☐	☐	☐	☐
Other_____	☐	☐	☐	☐	☐

14. Since you have been using the lake has aquatic plant growth (including algae):

☐ Increased
☐ Decreased
☐ Stayed the same
☐ Unsure

15. Aquatic invasive species (AIS) are non-native plants and animals that are introduced into our lakes and streams and can potentially upset the natural balance of a lake ecosystem while decreasing recreation opportunities. Examples of AIS include animals such as carp, white perch, zebra mussels, rusty crayfish, round goby and spiny waterflea; and plants such as Eurasian water milfoil and curly-leaf pondweed.

Before reading the statement above, had you ever heard of aquatic invasive species?

☐ Yes
☐ No

16. Before reading the statement above, had you ever heard of Eurasian water milfoil or curly-leaf pondweed?

☐ Yes
☐ No → **Go to Question 21**

17. Are you aware of any Eurasian water milfoil in Miller Dam?

☐ Yes
☐ No → **Go to Question 19**

18. How much of a problem, if at all, do you consider Eurasian water milfoil to be in the Miller Dam?

No problem	**Small**	**Moderate**	**Large**	**Unsure**
☐	☐	☐	☐	☐

19. Are you aware of any curly-leaf pondweed in Miller Dam?

☐ Yes
☐ No → **Go to Question 21**

20. How much of a problem, if at all, do you consider curly-leaf pondweed to be in the lake?

No problem	**Small**	**Moderate**	**Large**	**Unsure**
☐	☐	☐	☐	☐

21. Aquatic plant management varies depending on a lake's Aquatic Invasive Species (AIS) problems, the lake's users' tolerance for a particular level of AIS, acceptability of a particular management alternative, and management costs. Considering your answers to the above questions, please indicate what you would consider an acceptable level of AIS control.

☐ Do nothing
☐ Manage problem areas only
☐ Aggressive lake wide management

22. To what extent do you support the following Aquatic Plant Management (APM) control techniques? Please rank each 1 to 3 according to list below.

1=Support use of this management technique
2=Do not support use of this management technique
3=No opinion

_____ Do nothing
_____ Hand pulling and raking
_____ Mechanical harvesting
_____ Biological controls (weevils)
_____ Aquatic herbicides
_____ Draw down (temporarily lower water level to expose lake bed)

23. Lake user education is an important part of the lake management planning effort. From the list below, please tell us which subject, if any, you would like to learn more about. Check all that apply.

☐ AIS present in Taylor County
☐ Methods of AIS transport
☐ Effects of AIS on ecosystem
☐ Methods of AIS prevention
☐ Methods of AIS control
☐ Effects of AIS on recreation
☐ Long term results of AIS control
☐ Not interested in learning more on any subject

24. Do you support watercraft inspection programs at the boat launches to educate lake users on AIS and to prevent the spread of AIS into and out of Miller Dam?

☐ Yes
☐ No
☐ Unsure

25. There are several opportunities for citizens to become actively involved in important roles during APM Plan implementation. From the list below, please identify which activities, if any, you may be interested in helping with.

- ☐ Lake AIS monitor
- ☐ Water quality monitor
- ☐ Watercraft inspection at boat landings
- ☐ Grant writing
- ☐ Do not wish to volunteer

Thank you for taking the time to complete this questionnaire. Please return this questionnaire to the following address:

Mail to: **Joan Chwala**
W13567 CTH M
GILMAN, WI 54433

All questionnaires must be completed and received by AUGUST 18, 2010.

FINAL RESULTS-PUBLIC QUES

1. Affiliation	
	Waterfront Landowner (Year round resident)
	Waterfront Landowner (Seasonal resident)
	Nearby (offshore) Resident-year round
	Nearby (offshore) Resident-seasonal
	Area Business Owner
	Other
2. Number of Years	
	50 Years
	46 Years
	45 Years
	40 Years
	35 Years
	30 Years
	27 Years
	25 Years
	24 Years
	21 Years
	20 Years
	17 Years
	15 Years
	10 Years
	9 Years
	8 Years
	7 Years
	5 Years
	4 Years
	3 Years
	1 Year
3. Activities	Fishing from shore
	Fishing from boat
	Ice fishing
	Waterskiing
	Personal water craft
	Swimming
	Pontoon boating
	Sailing
	Pleasure boating
	Canoeing & kayaking
	Nature viewing
	Enjoyment of scenery
	Hunting
	Camping
	Snorkeling/scuba diving
	Other-non/no response
4. Rank Activities	

	Fishing
	Waterskiing
	Personal water craft
	Swimming
	Pontoon boating
	Sailing
	Pleasure boating
	Canoeing & kayaking
	Nature viewing
	Enjoyment of scenery
	Hunting
	Camping
	Snorkeling/scuba diving
	Other
5. Average # of Days/Month	
	No Reponse
	0
	1
	2
	3
	4
	5
	6
	8
	10
	15
	20
	30
6. Type of Watercraft	
	Pontoon boat
	Personal watercraft
	Canoe/kayak
	Sailboat
	Motorized boat less than 50 hp
	Motorized boat 50 hp or greater
	I do not use watercraft
7. Number of Times Launched	
	Never
	1-2 per season
	1-3 per month
	1-2 per week
	Several times per week
	Daily
8. Where Do You Launch	
	CTH G
	Dam
	Beaver Creek
	National Forest Campground

	Personal Dock
9. Satisified with Rec Experiences	
	Very satisfied
	Somewhat satisfied
	Not too satisfied
	Not satisified at all
10. Rank Top 3 Lake Concerns	
	Water quality/pollution
	Shoreline vegetation removal
	Shoreline erosion
	Excessive aquatic plant growth
	Insufficient fish habitat
	Algae growth
	Too much wild rice
	Low game fish populations
	Boating safety
	Excessive boat traffic
	Aquatic invasive species (AIS)
	Other
11. Personal Opinion of Lake Issues	
	Excellent
	Good
	Unsure
	Fair
	Poor
12. Greatest Current/Future Threats Rank Top 2	**Current Threats**
	Overdevelopment
	Deterioration of fishery
	Deterioration of water quality
	New invasive species infestation
	Spread of existing invasive species
	Over use of waterway
	Loss of wilderness experience
	Future Threats
	Overdevelopment
	Deterioration of fishery
	Deterioration of water quality
	Invasive species infestation
	Spread of existing invasive species
	Over use of waterway
	Loss of wilderness experience
13. Extent of Aquatic Plant Growth Negatively Affects Activities	
	Fishing from shore
	Fishing from boat

	Ice fishing
	Waterskiing
	Personal watercraft
	Swimming
	Pontoon boating
	Sailing
	Pleasure boating
	Canoeing/kayaking
	Nature viewing
	Enjoyment of scenery
	Hunting
	Camping
	Snorkeling/scuba diving
	Other
14. Has Aquatic Plant Growth	
	Increased
	Decreased
	Stayed the same
	Unsure
15. Knowledge of Aquatic Invasive Species	
	Yes
	No
16. Knowledge of Eurasian water milfoil / curly-leaf pondweed	
	Yes
	No
17. Knowledge of Eurasian water milfoil present	
	Yes
	No
18. Eurasian water milfoil a problem	
19. Knowledge of Curly-leaf pondweed in Dam	
	Yes
	No
20.Curly-leaf pondweed a problem	
21. Acceptable level of Aquatic Invasive Species	
	Do Nothing
	Manage problem areas only
	Aggressive lake wide management
22. Extent of Support for Aquatic Plant Management Control Techniques	
	Do Nothing

	Hand pulling and raking
	Mechanical harvesting
	Biological controls (weevils)
	Aquatic herbicides
	Draw down (temporarily lower water level to expose lake bed)
23. Subject of Interest	
	AIS present in Taylor County
	Methods of AIS transport
	Effects of AIS on ecosystem
	Methods of AIS prevention
	Methods of AIS control
	Effects of AIS on recreation
	Long term results of AIS control
	Not interested in learning more on any subject
24. Support watercraft inspection	
	Yes
	No
	Unsure
25. Activities to Volunteer	
	Lake AIS monitor
	Water quality monitor
	Watercraft inspection at boat landings
	Grant writing
	Do not wish to volunteer

STIONNARIE - MILLER DAM

2				
7				
25				
0				
5				
11				
4				
3				
3				
6				
1				
1				
1				
1				
1				
1				
4				
1				
2				
2				
4				
2				
1				
2				
3				
1				
1				
36				
39				
42				
5				
9				
17				
7				
0				
10				
6				
18				
28				
11				
9				
0				
2				
1st Choice	**2nd Choice**	**3rd Choice**		

38	7	2		
0	0	0		
0	1	1		
1	5	0		
2	2	2		
0	0	0		
0	2	2		
0	1	0		
0	10	9		
5	4	11		
2	5	3		
0	2	6		
0	0	0		
0	0	0		
3				
2				
5				
4				
5				
2				
2				
3				
3				
8				
3				
3				
2				
7				
4				
6				
0				
18				
9				
5				
1				
11				
13				
4				
3				
2				
10				
19				
2				
2				

4				
32				
15				
0				
0				
Primary	**Secondary**	**Third**		
3	7	3		
2	6	1		
0	0	2		
2	8	10		
0	3	0		
2	7	8		
37	3	2		
0	3	7		
0	1	1		
0	0	3		
2	5	5		
0	0	0		
2				
27				
8				
12				
0				
1st choice	**2nd choice**			
2	1			
13	10			
12	9			
7	14			
10	7			
1	1			
2	1			
1	2			
20	7			
11	15			
5	11			
9	3			
0	4			
2	1			
None	**Slight**	**Unsure**	**Moderate**	**Great**
1	2	1	10	33
2	2	4	26	10

4	13	19	7	3
3	2	18	9	4
1	5	16	12	4
4	3	13	10	11
1	4	11	16	5
5	2	19	5	4
0	4	18	10	6
2	6	13	9	6
3	9	15	10	3
4	10	10	7	7
8	9	16	2	1
6	10	15	3	1
4	1	17	0	15
0	0	0	0	0
42				
1				
0				
5				
40				
9				
30				
19				
23				
5				
No Problem	**Small**	**Moderate**	**Large**	**Unsure**
0	2	4	17	0
14				
11				
No Problem	**Small**	**Moderate**	**Large**	**Unsure**
1	1	3	10	1
0				
12				
35				
Support	**Don't Support**	**No Opinion**		
2	15	6		

24	7	2		
29	3	3		
12	5	8		
21	5	4		
14	4	9		
11				
11				
8				
14				
21				
14				
22				
8				
38				
3				
7				
9				
10				
10				
2				
21				

FINAL RESULTS-PUBLIC QUESTIONNARIE - MILLER DAM

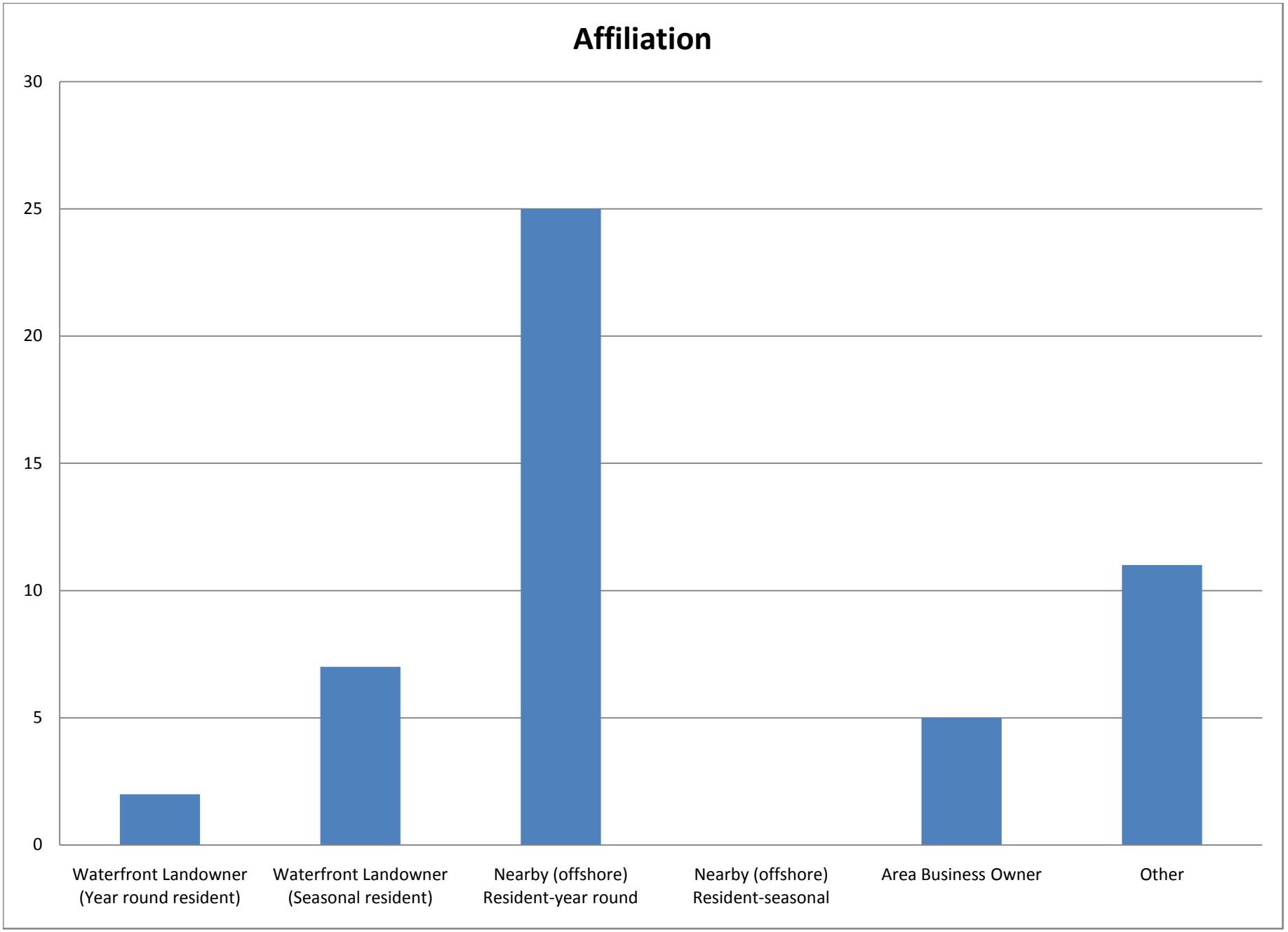
1. Affiliation						
	Waterfront Landowner (Year round resident)	2				
	Waterfront Landowner (Seasonal resident)	7				
	Nearby (offshore) Resident-year round	25				
	Nearby (offshore) Resident-seasonal	0				
	Area Business Owner	5				
	Other	11				
2. Number of Years						
	50 Years	4				
	46 Years	3				
	45 Years	3				
	40 Years	6				
	35 Years	1				
	30 Years	1				
	27 Years	1				
	25 Years	1				
	24 Years	1				
	21 Years	1				
	20 Years	4				
	17 Years	1				
	15 Years	2				
	10 Years	2				
	9 Years	4				
	8 Years	2				
	7 Years	1				
	5 Years	2				
	4 Years	3				
	3 Years	1				
	1 Year	1				
3. Activities	Fishing from shore	36				
	Fishing from boat	39				
	Ice fishing	42				
	Waterskiing	5				
	Personal water craft	9				
	Swimming	17				
	Pontoon boating	7				
	Sailing	0				
	Pleasure boating	10				
	Canoeing & kayaking	6				
	Nature viewing	18				
	Enjoyment of scenery	28				
	Hunting	11				
	Camping	9				
	Snorkeling/scuba diving	0				
	Other-non/no response	2				
4. Rank Activities		**1st Choice**	**2nd Choice**	**3rd Choice**		

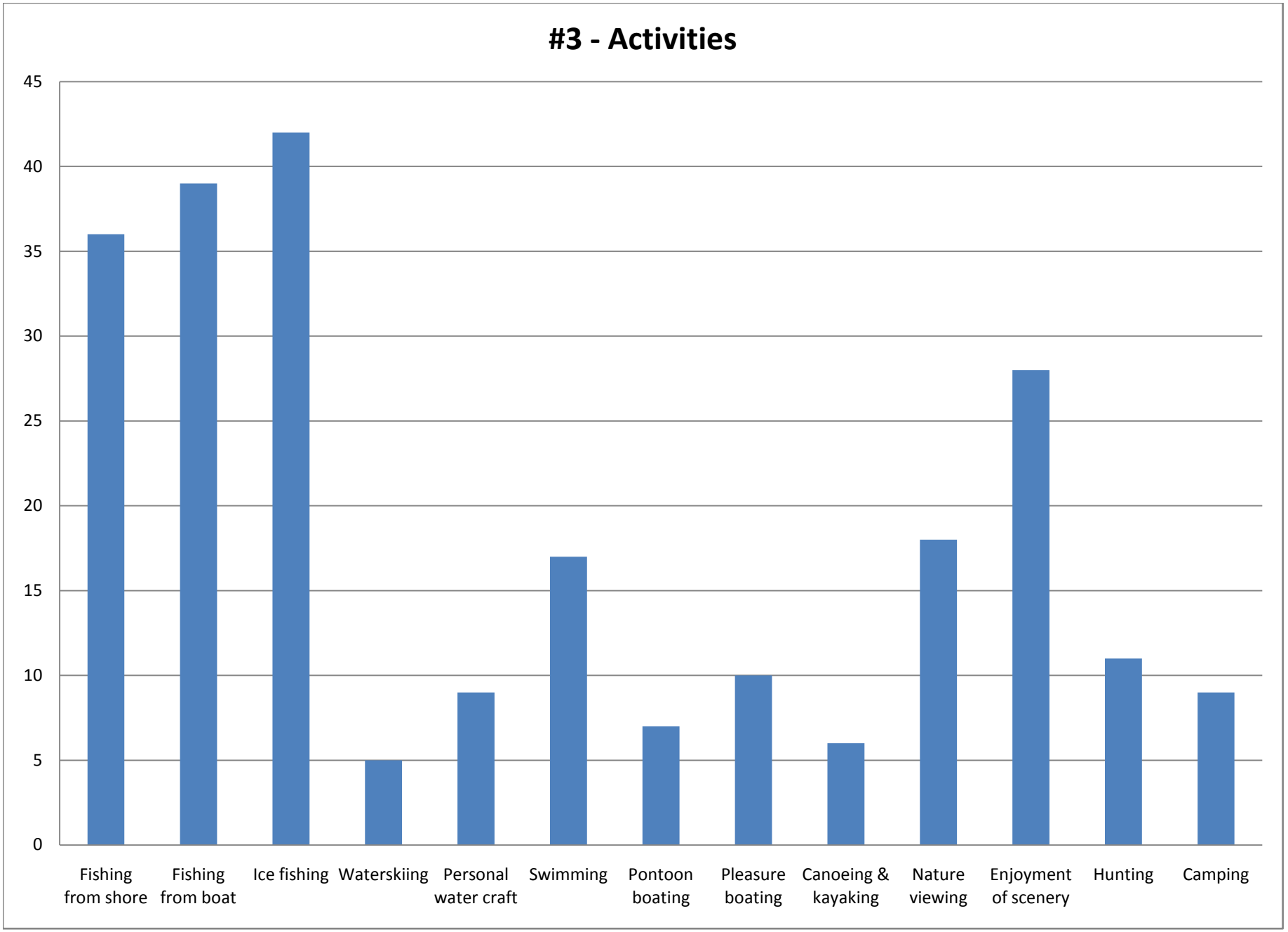
	Fishing	38	7	2		
	Waterskiing	0	0	0		
	Personal water craft	0	1	1		
	Swimming	1	5	0		
	Pontoon boating	2	2	2		
	Sailing	0	0	0		
	Pleasure boating	0	2	2		
	Canoeing & kayaking	0	1	0		
	Nature viewing	0	10	9		
	Enjoyment of scenery	5	4	11		
	Hunting	2	5	3		
	Camping	0	2	6		
	Snorkeling/scuba diving	0	0	0		
	Other	0	0	0		
5. Average # of Days/Month						
	No Reponse	3				
	0	2				
	1	5				
	2	4				
	3	5				
	4	2				
	5	2				
	6	3				
	8	3				
	10	8				
	15	3				
	20	3				
	30	2				
6. Type of Watercraft						
	Pontoon boat	7				
	Personal watercraft	4				
	Canoe/kayak	6				
	Sailboat	0				
	Motorized boat less than 50 hp	18				
	Motorized boat 50 hp or greater	9				
	I do not use watercraft	5				
7. Number of Times Launched						
	Never	1				
	1-2 per season	11				
	1-3 per month	13				
	1-2 per week	4				
	Several times per week	3				
	Daily	2				
8. Where Do You Launch						
	CTH G	10				
	Dam	19				
	Beaver Creek	2				
	National Forest Campground	2				

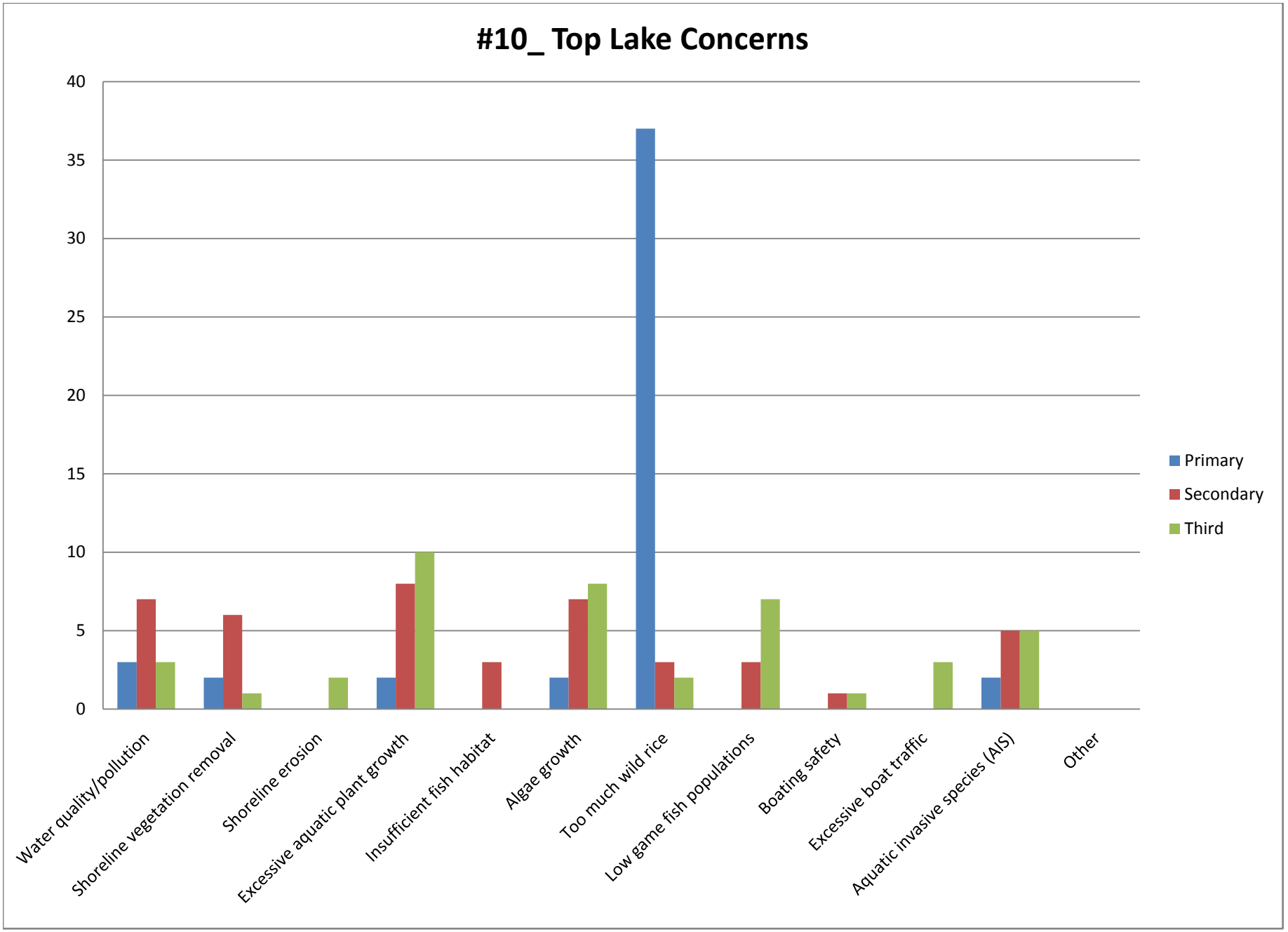
	Personal Dock	4				
9. Satisified with Rec Experiences						
	Very satisfied	32				
	Somewhat satisfied	15				
	Not too satisfied	0				
	Not satisified at all	0				
10. Rank Top 3 Lake Concerns		**Primary**	**Secondary**	**Third**		
	Water quality/pollution	3	7	3		
	Shoreline vegetation removal	2	6	1		
	Shoreline erosion	0	0	2		
	Excessive aquatic plant growth	2	8	10		
	Insufficient fish habitat	0	3	0		
	Algae growth	2	7	8		
	Too much wild rice	37	3	2		
	Low game fish populations	0	3	7		
	Boating safety	0	1	1		
	Excessive boat traffic	0	0	3		
	Aquatic invasive species (AIS)	2	5	5		
	Other	0	0	0		
11. Personal Opinion of Lake Issues						
	Excellent	2				
	Good	27				
	Unsure	8				
	Fair	12				
	Poor	0				
12. Greatest Current / Future Threats Rank Top 2	**Current Threats**	**1st choice**	**2nd choice**			
	Overdevelopment	2	1			
	Deterioration of fishery	13	10			
	Deterioration of water quality	12	9			
	New invasive species infestation	7	14			
	Spread of existing invasive species	10	7			
	Over use of waterway	1	1			
	Loss of wilderness experience	2	1			
	Future Threats					
	Overdevelopment	1	2			
	Deterioration of fishery	20	7			
	Deterioration of water quality	11	15			
	Invasive species infestation	5	11			
	Spread of existing invasive species	9	3			
	Over use of waterway	0	4			
	Loss of wilderness experience	2	1			
13. Extent of Aquatic Plant Growth Negatively Affects Activities		**None**	**Slight**	**Unsure**	**Moderate**	**Great**
	Fishing from shore	1	2	1	10	33
	Fishing from boat	2	2	4	26	10

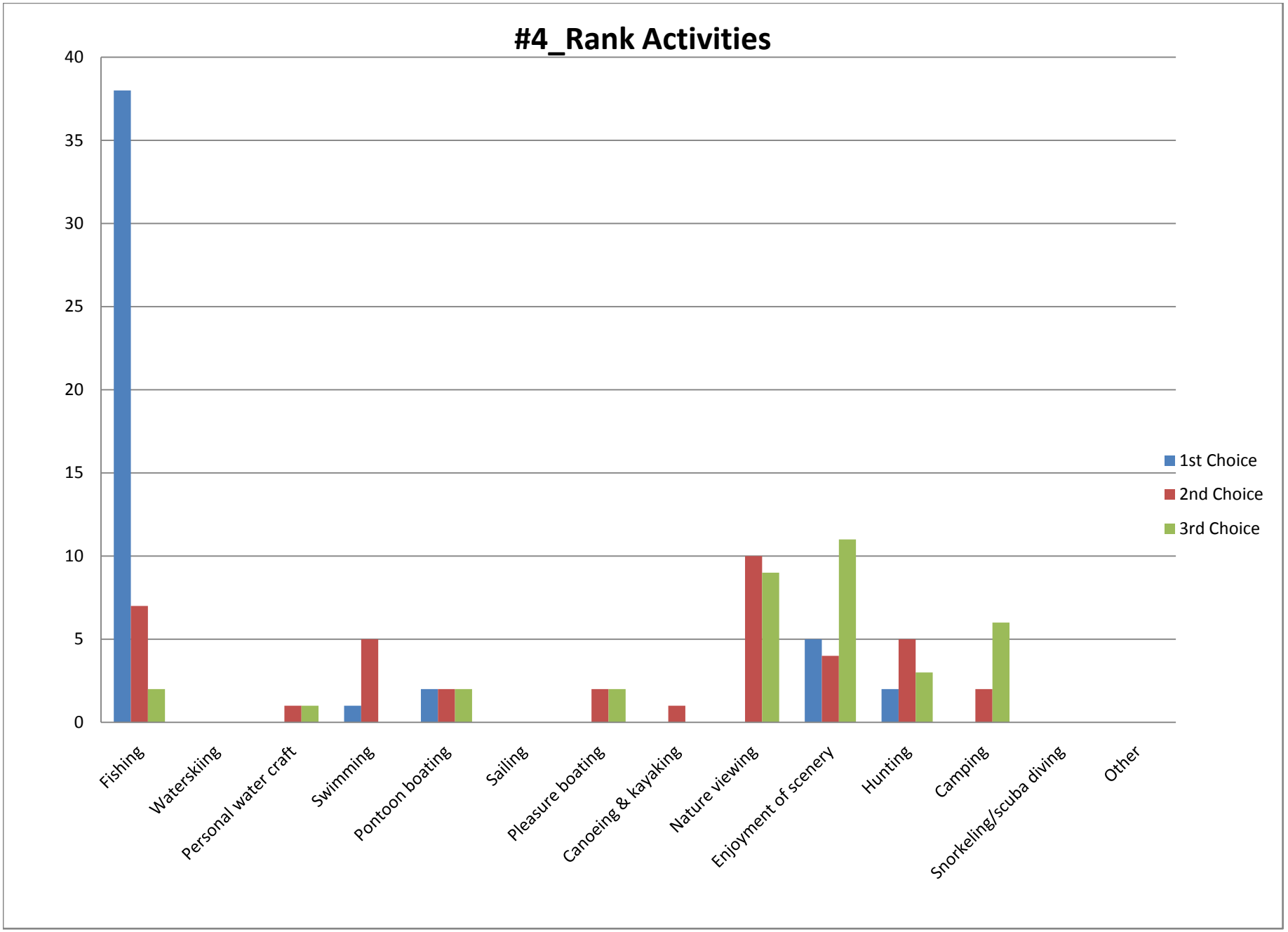
	Ice fishing	4	13	19	7	3
	Waterskiing	3	2	18	9	4
	Personal watercraft	1	5	16	12	4
	Swimming	4	3	13	10	11
	Pontoon boating	1	4	11	16	5
	Sailing	5	2	19	5	4
	Pleasure boating	0	4	18	10	6
	Canoeing/kayaking	2	6	13	9	6
	Nature viewing	3	9	15	10	3
	Enjoyment of scenery	4	10	10	7	7
	Hunting	8	9	16	2	1
	Camping	6	10	15	3	1
	Snorkeling/scuba diving	4	1	17	0	15
	Other	0	0	0	0	0
14. Has Aquatic Plant Growth						
	Increased	42				
	Decreased	1				
	Stayed the same	0				
	Unsure	5				
15. Knowledge of Aquatic Invasive Species						
	Yes	40				
	No	9				
16. Knowledge of Eurasian water milfoil / curly-leaf pondweed						
	Yes	30				
	No	19				
17. Knowledge of Eurasian water milfoil present						
	Yes	23				
	No	5				
18. Eurasian water milfoil a problem		**No Problem**	**Small**	**Moderate**	**Large**	**Unsure**
		0	2	4	17	0
19. Knowledge of Curly-leaf pondweed in Dam						
	Yes	14				
	No	11				
20.Curly-leaf pondweed a problem		**No Problem**	**Small**	**Moderate**	**Large**	**Unsure**
		1	1	3	10	1
21. Acceptable level of Aquatic Invasive Species						
	Do Nothing	0				
	Manage problem areas only	12				
	Aggressive lake wide management	35				
22. Extent of Support for Aquatic Plant Management Control Techniques		**Support**	**Don't Support**	**No Opinion**		
	Do Nothing	2	15	6		

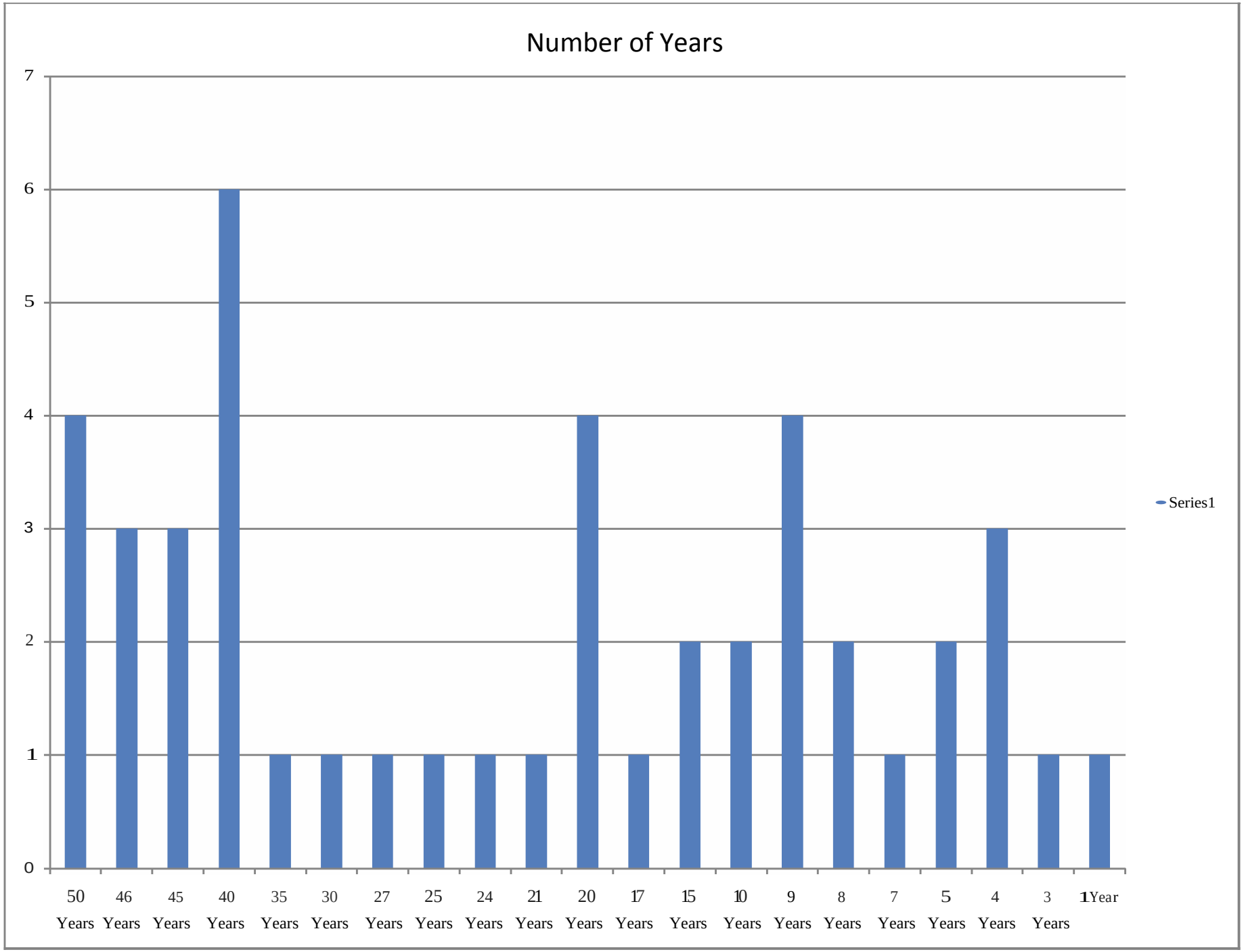
	Hand pulling and raking	24	7	2		
	Mechanical harvesting	29	3	3		
	Biological controls (weevils)	12	5	8		
	Aquatic herbicides	21	5	4		
	Draw down (temporarily lower water level to expose lake bed)	14	4	9		
23. Subject of Interest						
	AIS present in Taylor County	11				
	Methods of AIS transport	11				
	Effects of AIS on ecosystem	8				
	Methods of AIS prevention	14				
	Methods of AIS control	21				
	Effects of AIS on recreation	14				
	Long term results of AIS control	22				
	Not interested in learning more on any subject	8				
24. Support watercraft inspection						
	Yes	38				
	No	3				
	Unsure	7				
25. Activities to Volunteer						
	Lake AIS monitor	9				
	Water quality monitor	10				
	Watercraft inspection at boat landings	10				
	Grant writing	2				
	Do not wish to volunteer	21				

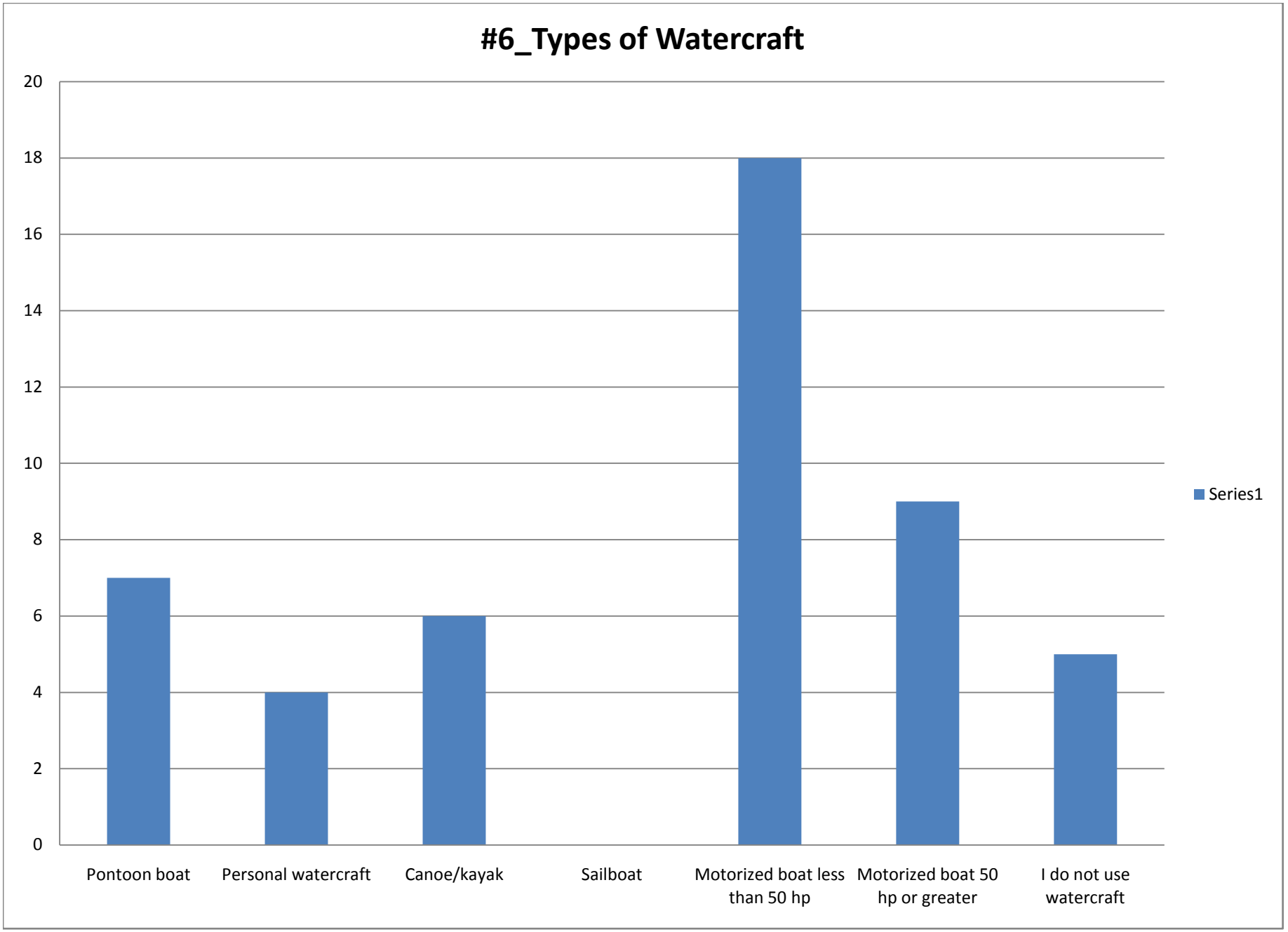

Affiliation
30
25
20
15
10
5
0
Waterfront Landowner (Year round resident)
Waterfront Landowner (Seasonal resident)
Nearby (offshore) Resident-year round
Nearby (offshore) Resident-seasonal
Area Business Owner
Other

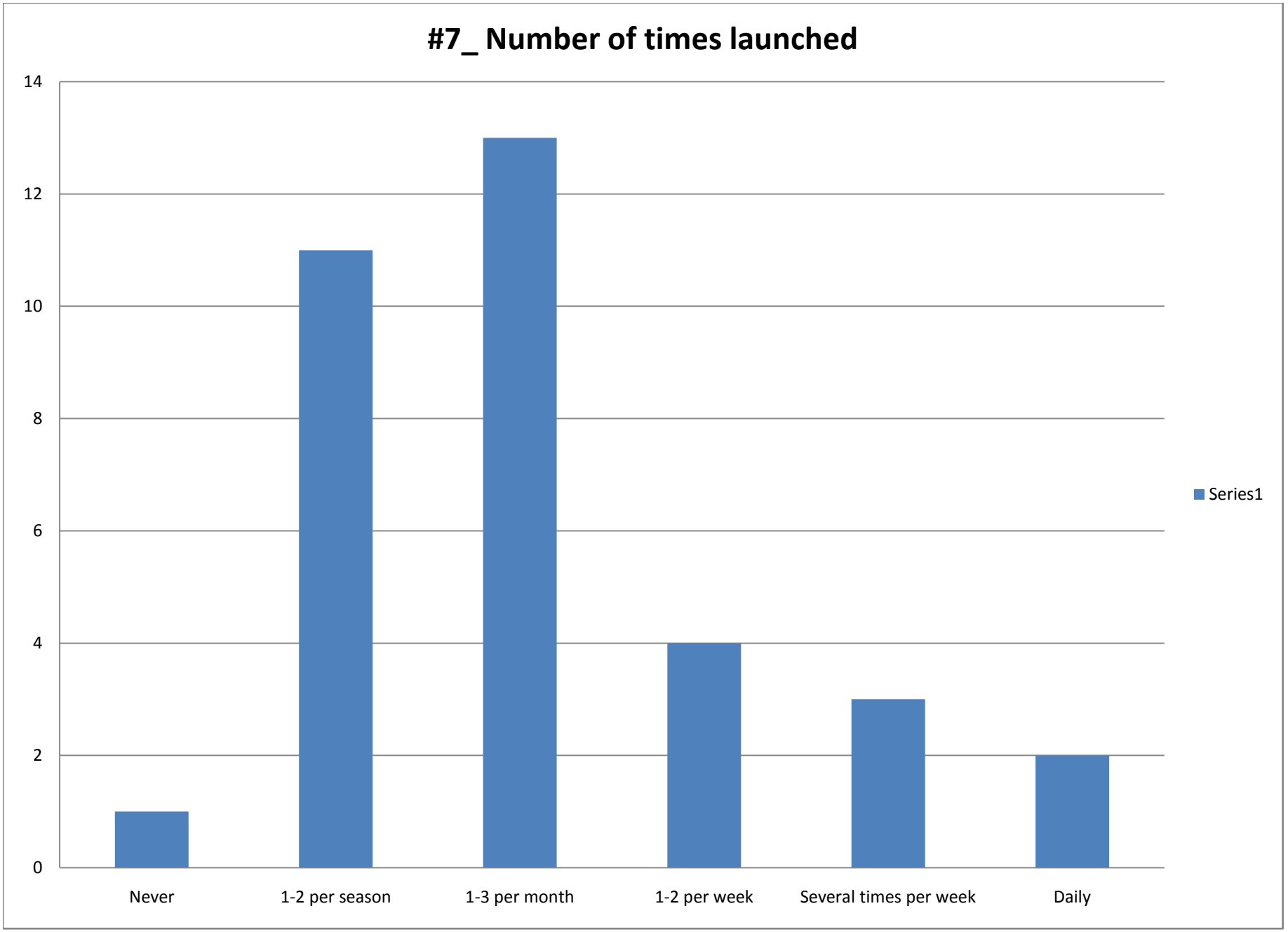

#3 - Activities
45
40
35
30
25
20
15
10
5
0
Fishing from shore
Fishing from boat
Ice fishing
Waterskiing
Personal water craft
Swimming
Pontoon boating
Pleasure boating
Canoeing & kayaking
Nature viewing
Enjoyment of scenery
Hunting
Camping

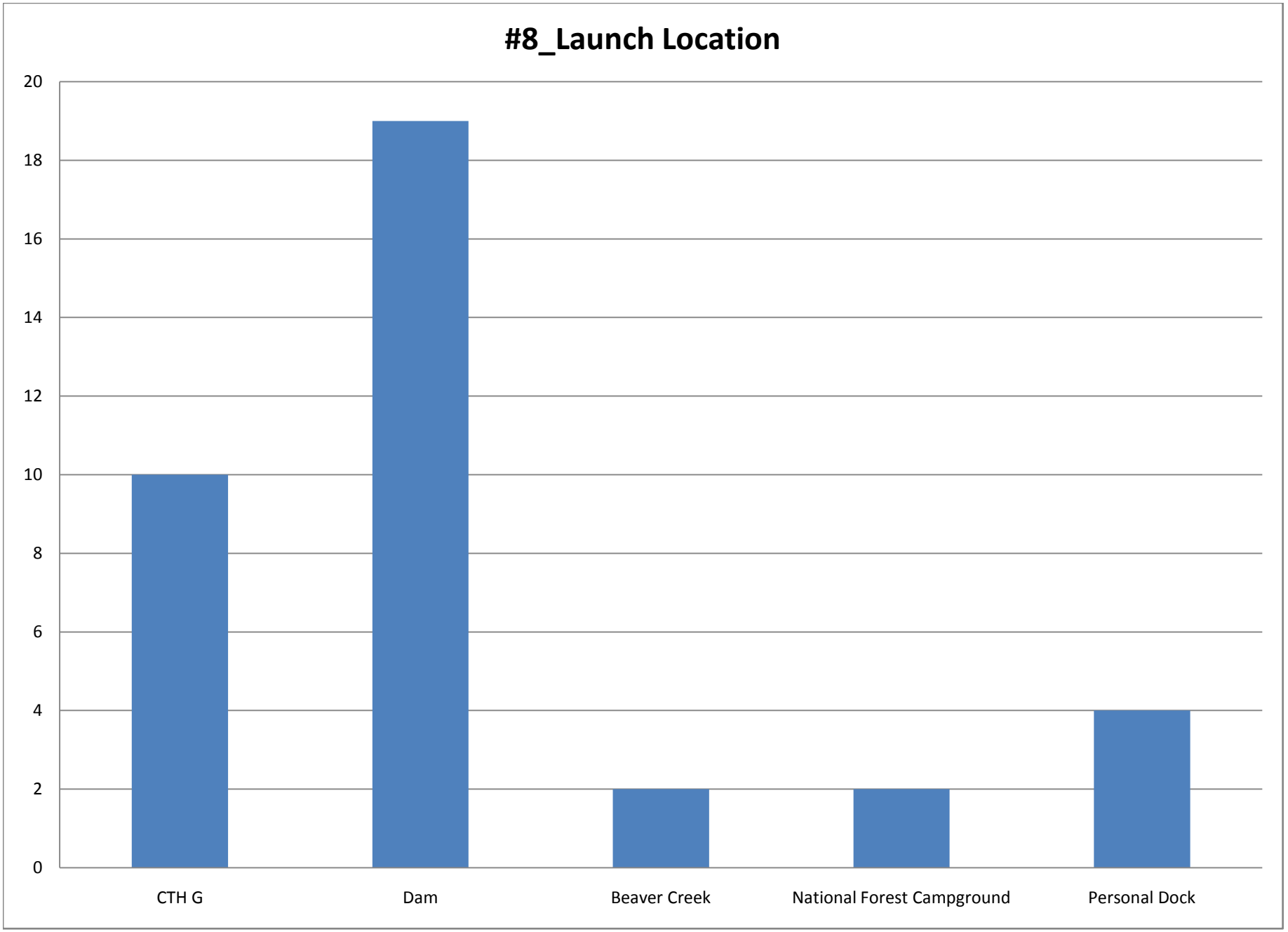

#10_ Top Lake Concerns
40
35
30
25
20
15
10
5
0
Primary
Secondary
Third
Water quality/pollution
Shoreline vegetation removal
Shoreline erosion
Excessive aquatic plant growth
Insufficient fish habitat
Algae growth
Too much wild rice
Low game fish populations
Boating safety
Excessive boat traffic
Aquatic invasive species (AIS)
Other

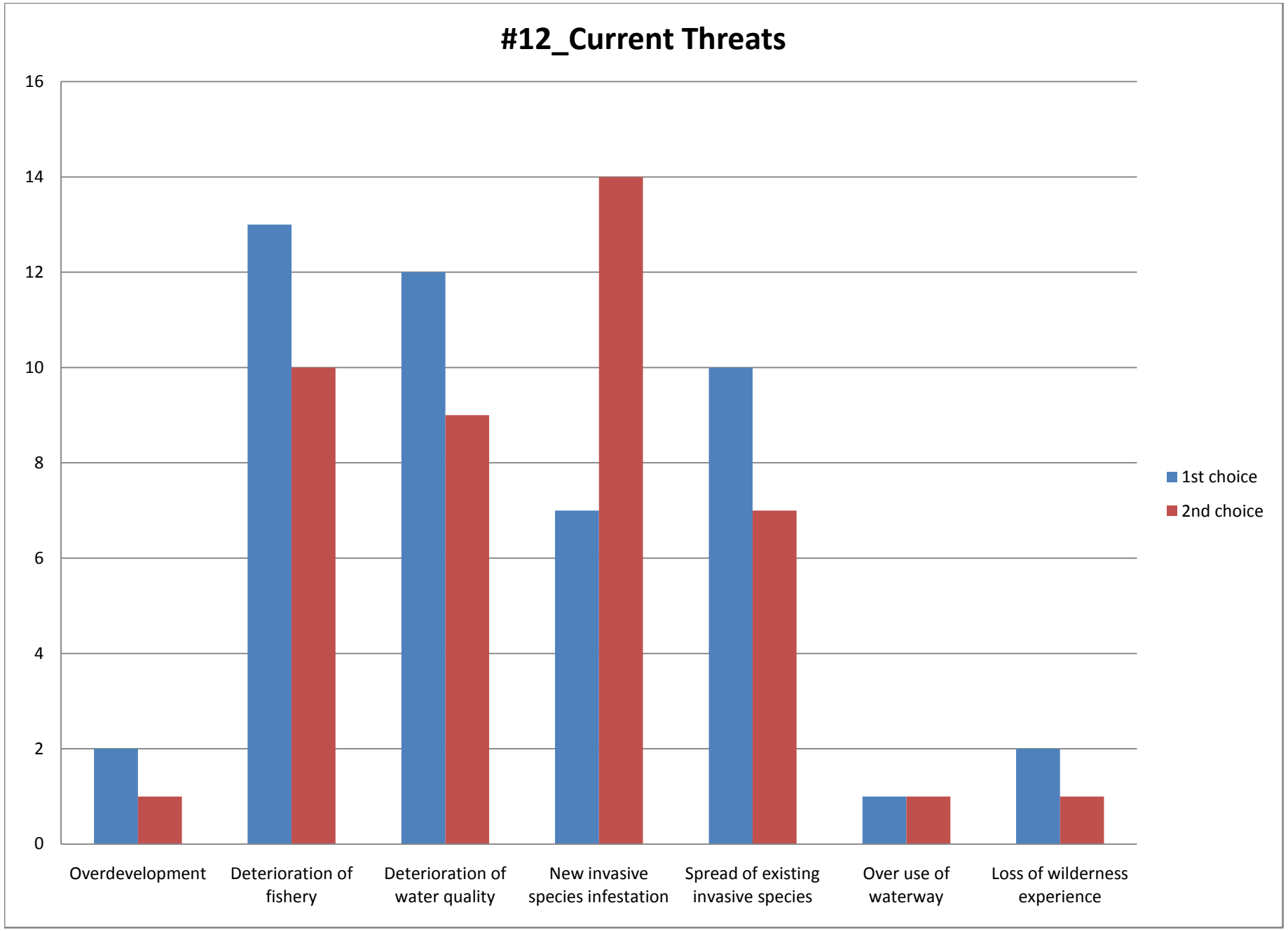

#4_Rank Activities
40
35
30
25
20
15
10
5
0
Fishing
Waterskiing
Personal water craft
Swimming
Pontoon boating
Sailing
Pleasure boating
Canoeing & kayaking
Nature viewing
Enjoyment of scenery
Hunting
Camping
Snorkeling/scuba diving
Other
1st Choice
2nd Choice
3rd Choice

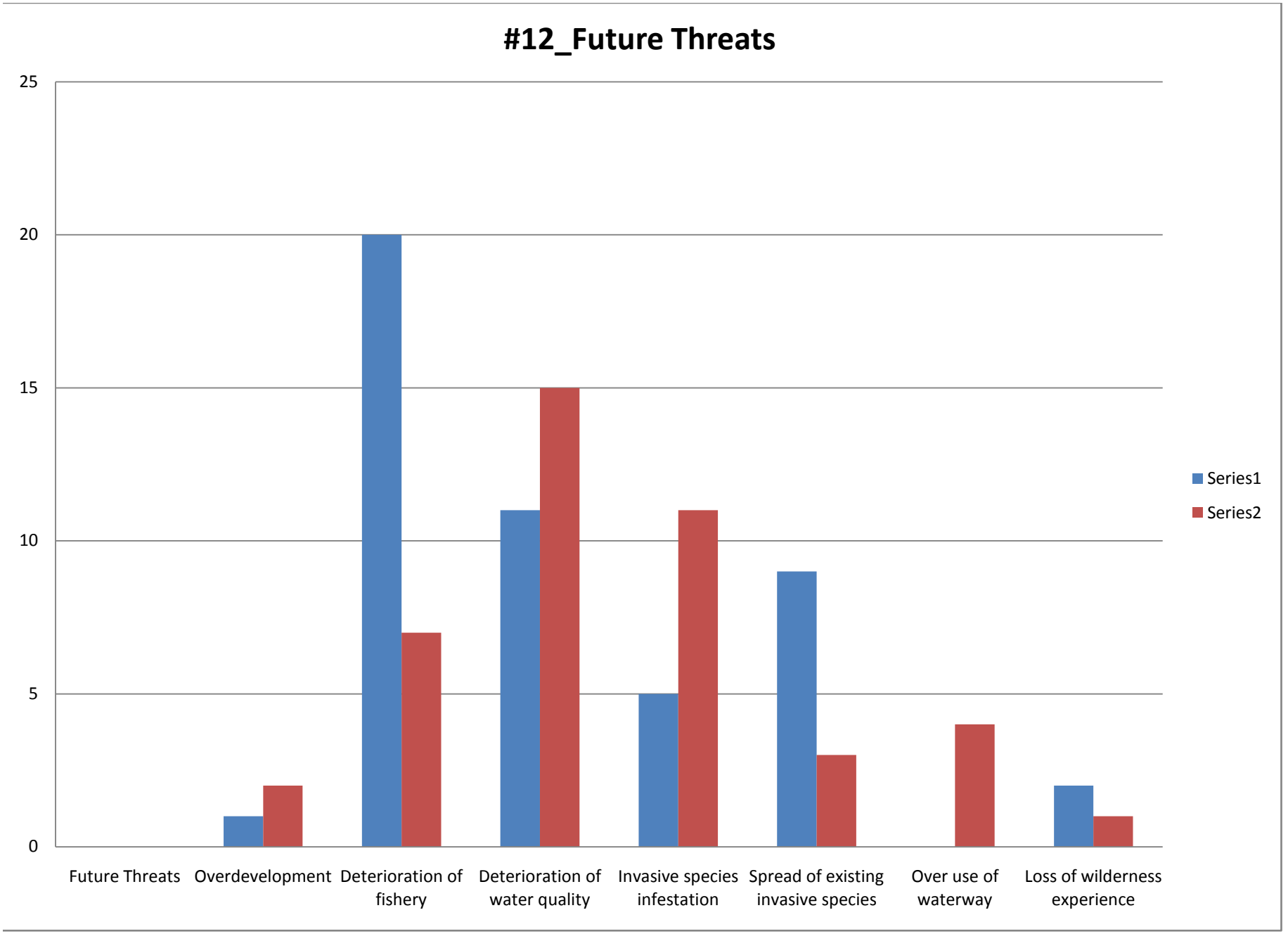

Number of Years
7
6
5
4
3
2
1
0
50 Years
46 Years
45 Years
40 Years
35 Years
30 Years
27 Years
25 Years
24 Years
21 Years
20 Years
17 Years
15 Years
10 Years
9 Years
8 Years
7 Years
5 Years
4 Years
3 Years
1 Year
Series1

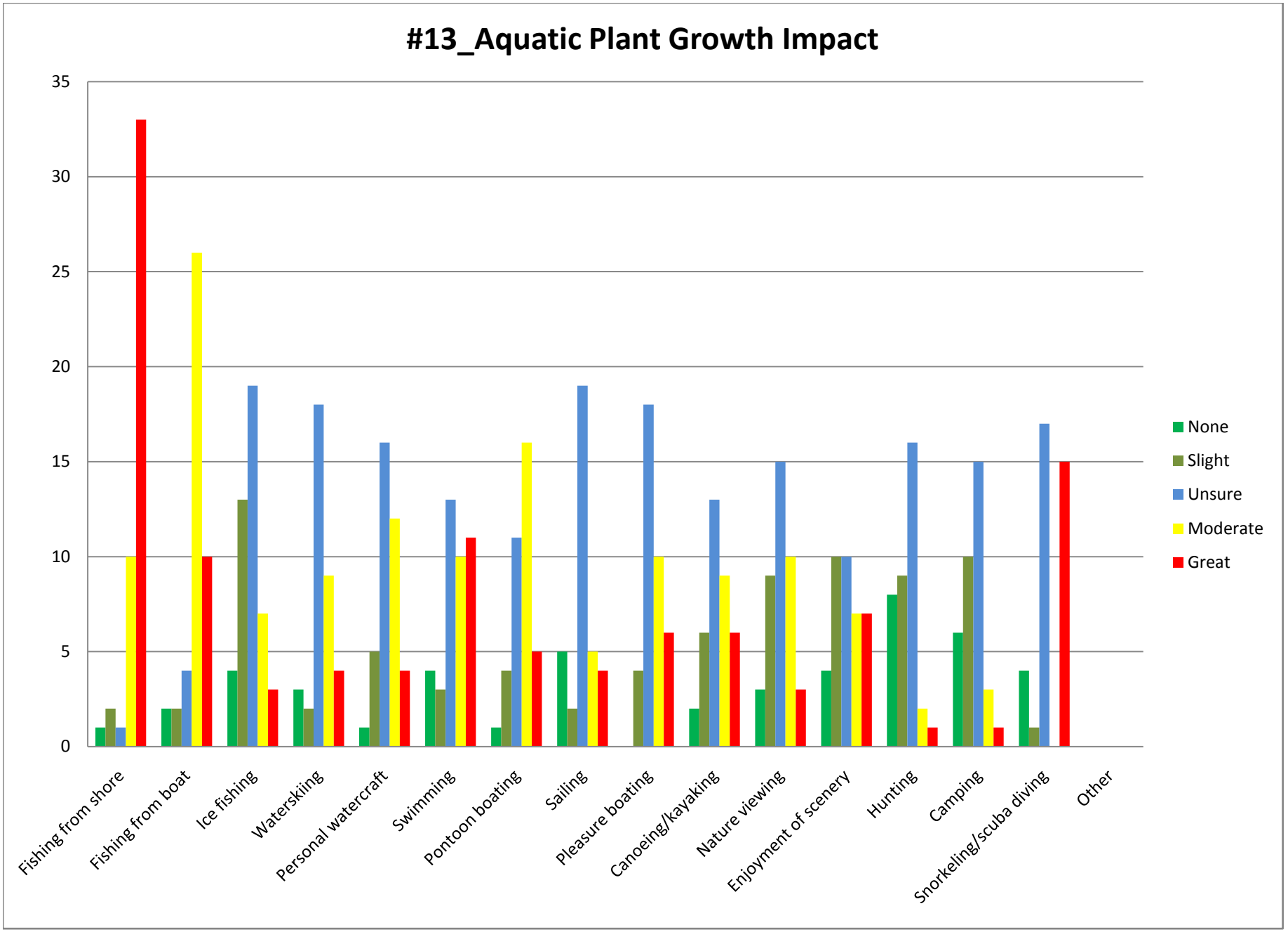

#6_Types of Watercraft
20
18
16
14
12
10
8
6
4
2
0
Pontoon boat
Personal watercraft
Canoe/kayak
Sailboat
Motorized boat less than 50 hp
Motorized boat 50 hp or greater
I do not use watercraft
Series1

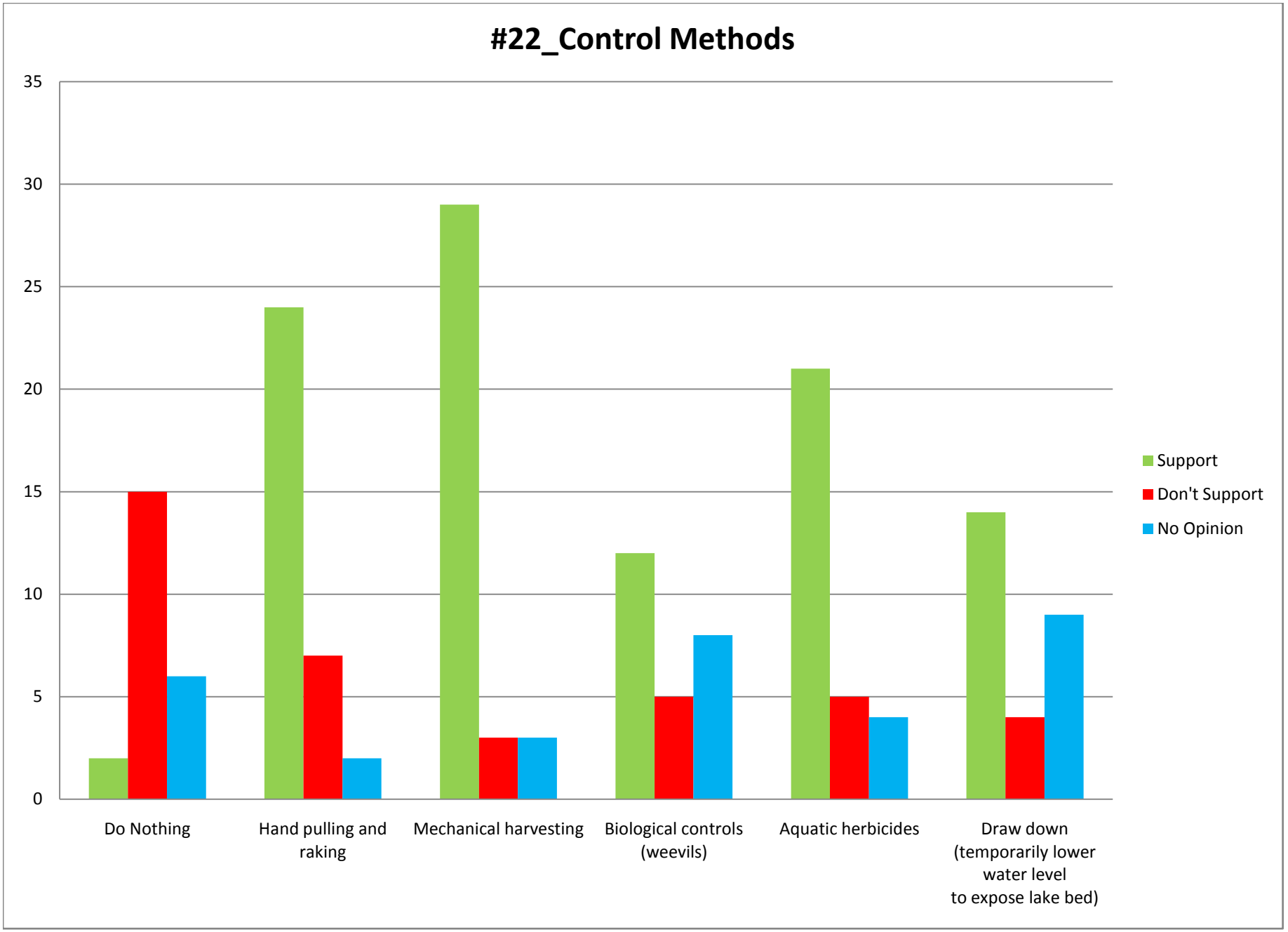

#7_ Number of times launched
14
12
10
8
6
4
2
0
Never
1-2 per season
1-3 per month
1-2 per week
Several times per week
Daily
Series1


#8_Launch Location
20
18
16
14
12
10
8
6
4
2
0
CTH G
Dam
Beaver Creek
National Forest Campground
Personal Dock


#12_Current Threats
16
14
12
10
8
6
4
2
0
Overdevelopment
Deterioration of fishery
Deterioration of water quality
New invasive species infestation
Spread of existing invasive species
Over use of waterway
Loss of wilderness experience
1st choice
2nd choice


#12_Future Threats
25
20
15
10
5
0
Future Threats
Overdevelopment
Deterioration of fishery
Deterioration of water quality
Invasive species infestation
Spread of existing invasive species
Over use of waterway
Loss of wilderness experience
Series1
Series2


#13_Aquatic Plant Growth Impact
35
30
25
20
15
10
5
0
Fishing from shore
Fishing from boat
Ice fishing
Waterskiing
Personal watercraft
Swimming
Pontoon boating
Sailing
Pleasure boating
Canoeing/kayaking
Nature viewing
Enjoyment of scenery
Hunting
Camping
Snorkeling/scuba diving
Other
None
Slight
Unsure
Moderate
Great


#22_Control Methods
35
30
25
20
15
10
5
0
Do Nothing
Hand pulling and raking
Mechanical harvesting
Biological controls (weevils)
Aquatic herbicides
Draw down (temporarily lower water level to expose lake bed)
Support
Don't Support
No Opinion

Appendix C1 – Importance of Aquatic Plants to Lake Ecosystem

Bonestroo

AQUATIC PLANT TYPES AND HABITAT

Aquatic plants can be divided into two major groups: microphytes (phytoplankton and epiphytes) composed mostly of single-celled algae, and macrophytes that include macro algae, flowering vascular plants, and aquatic mosses and ferns. Wide varieties of microphytes co-inhabit all habitable 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).

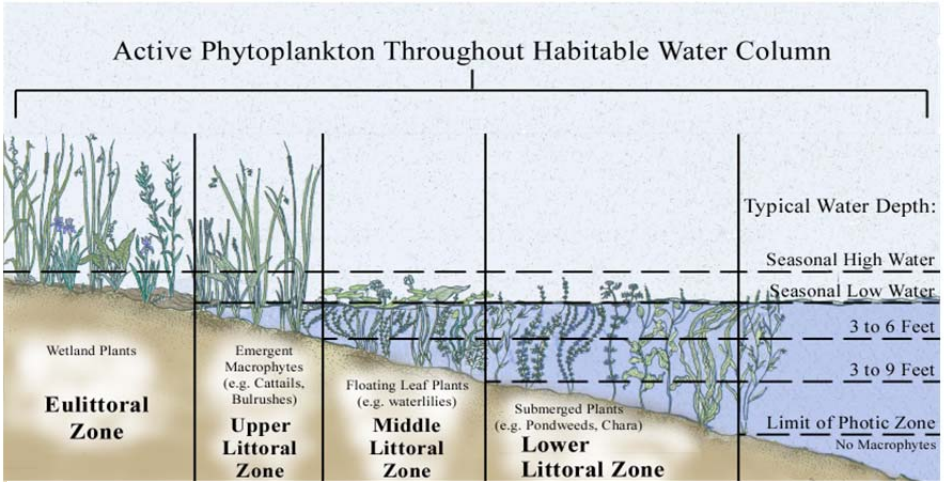
Eulittoral Zone: Includes the area between the highest and lowest seasonal water levels, and often contains many wetland plants.

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

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

Lower Littoral Zone: Extends to a depth equivalent to the limit of the photic zone, which is the maximum depth that sufficient light can support photosynthesis. This area is dominated by submergent aquatic plant types.

The following illustration depicts these particular zones and aquatic plant communities.



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).

AQUATIC PLANTS AND WATER QUALITY

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 too many 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 re-suspension 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. Studies have shown that if 30 percent or less of a lake areas 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, adding to the aesthetic quality of the lake and impacting recreational activities.

Appendix C2 – Aquatic Invasive Species

Bonestroo

INVASIVE AQUATIC PLANTS

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, 2007). 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 including Vilas County.

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, 2007).

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, 2007).

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, 2007).

Curly leaf pondweed *(Potamogeton crispus)*

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 curly-leaf pondweed 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, 2007).

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. Leaves are opposite, nearly linear, and attached to four-sided stems without stalks. It has a large, woody taproot with fibrous rhizomes that form a dense mat.

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, 2007).

OTHER AQUATIC INVASIVE SPECIES

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

Rusty Crayfish *(Orconectes rusticus)* are large crustaceans that feed aggressively on aquatic plants, small invertebrates, small fish, and fish eggs. They can remove nearly all the aquatic vegetation from a lake, offsetting the balance of a lake ecosystem. More information about this invader can be found at http://dnr.wi.gov/invasives/fact/rusty.htm.

Zebra Mussels *(Dreissena polymorpha)* are small freshwater clams that can attach to hard substrates in water bodies, often forming large of thousands of individual mussels. They are prolific filter feeders, removing valuable phytoplankton from the water, which is the base of the food chain in an aquatic ecosystem. More information about this invader can be found at

http://dnr.wi.gov/invasives/fact/zebra.htm.

Spiny Water Fleas (*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.

Appendix D – Descriptions of Aquatic Plants

Bonestroo

COONTAIL (CERATOPHYLLUM DEMERSUM)

- Submersed
- Native and common throughout WI
- Tolerant of low light conditions, drifts between depth zones due to lack of rooted structure
- Offer prime habitat inverts especially during winter; grazed by waterfowl; provide shelter and foraging for fish

MUSKGRASS (CHARA)

- Submersed algae
- Native and common throughout WI
- Found in hard water; prefers muddy or sandy substrate
- Favorite waterfowl food, fish habitat, provides cover and produces food for trout, largemouth bass and smallmouth bass

Common waterweed (Elodea Canadensis)

- Submersed plant up to 1 m long
- Native and common in WI
- Found in water depths from ankle to several meters deep, most abundant in fine sediments rich in organic matter
- Provide shelter and grazing opportunities for fish, food for muskrats and waterfowl

Water star-grass (Heteranthera dubia)

- Submersed
- Native and common throughout WI
- Found in variety of water depths and sediment types
- Food source for geese and ducks, good cover and forage for fish

Small duckweed (Lemna minor)

- Free-floating; individually or in groups
- Native and common throughout WI
- Often intermingled with other duckweed in quiet bays; not dependent on depth, sediment type or clarity
- Nutritious food source that can provide 90% of dietary needs for ducks; consumed by muskrat, beaver and fish; provides shade and cover for fish and inverts

Forked duckweed (Lemna trisulca)

- Free-floating; hooked together in tangled mass
- Native, found throughout WI
- Found just beneath the surface in quiet bays; drifts, not dependant on depth, sediment or water clarity
- Good food for waterfowl; provides habitat for fish and inverts

Northern water milfoil (Myriophyllum sibiricum)

- Submersed
- Native and common throughout WI
- Found in soft sediment in fairly clear water; grows in shallow zones to over 4 meters deep; sensitive to reduced water clarity
- Consumed by waterfowl; provide invertebrate habitat; provides shade, shelter and forage for fish.

Bushy pondweed (Najas flexilis)

- Submersed
- Native and common throughout WI
- Grows in wide range of depth from very shallow to several meters deep
- One of most important waterfowl plant; stems, leaves and seeds are consumed by variety of ducks; important to marsh birds and muskrats; provides food and shelter for fish

Nitella

- Submersed
- Native and common throughout WI
- Found in soft sediments in deeper zones (10 meters +)
- Grazed by waterfowl; provides forage for fish

Spatterdock (Nuphar variegate)

- Floating leaf
- Native and widely distributed in WI
- Found in sun or shade, prefers soft sediment in water 2 meters or less
- Anchors shallow water community; provides food for waterfowl, deer, muskrat, bever; provides shade and shelter for fish

White water lily (Nymphaea odorata)

- Floating leaf
- Native and widely distributed in WI
- Found in quiet water, variety of sediments in water 2 meters or less
- Provides food for waterfowl, deer, muskrat, beaver; provides shade and shelter for fish

Large-leaf pondweed (Potamogeton amplifolius)

- Submersed
- Native, throughout WI
- Found in one to several meters deep water , soft sediment; sensitive to increased turbidity and suffers when top-cut by motors
- Offers shade and foraging for fish, valuable waterfowl food

Clasping-leaf pondweed (Potamogeton richardsonii)

- Submersed
- Native and common throughout WI
- Found in a variety of sediment types; tolerant of disturbed sites and found growing with coontail and small pondweed
- Important food source for waterfowl; grazed by muskrat, deer, beaver, moose; provides forage and cover for fish and inverts

Spiralfruited pondweed (Potamogeton spirillus)

- Submersed
- Native; primarily in northern WI
- Found in shallow water in a variety of sediment types
- Stabilizes sediment; provides shallow water habitat; important food for waterfowl; provides invert habitat and fish forage

Flat-stem pondweed (Potamogeton zosteriformis)

- Submersed
- Native, common throughout WI
- Found in soft sediment from shallow to several meter deep water
- Important food for waterfowl, grazed by muskrat, beaver, deer, moose; provided food source and cover for fish

Common arrowhead (Sagittaria latifolia)

- Emergent; white flowers
- Native; common in WI
- Found in shallow water; variety of sediment type
- High value plant for wildlife, provides high energy tubers; offer shade and shelter for young fish

Softstem bulrush (Schoenoplectus tabernaemontani)

- Emergent; 1 – 3 meters tall
- Native, common throughout WI
- Found in wetlands and shallow water; prefers soft, mucky sediment

- Offers habitat for inverts and young fish; food for waterfowl and muskrats; nesting cover for waterfowl, marsh birds and muskrats

Large duckweed (Spirodela polyrhiza)

- Free-floating; largest of duckweed
- Native throughout WI
- Found intermingled with other duckweed; must have adequate nutrients in water
- Good waterfowl food; eaten by muskrats and some fish; provides shade and cover for fish

Broad-leaved cattail (Typha latifolia

- Emergent; 1+ meters tall
- Native and common throughout WI
- Found in marshes and lakeshores in saturated soils up to 1 meter deep water
- Provides nesting habitat; shoots rhizomes eaten by muskrat; provides spawning habitat for fish

Common bladderwort (Utricularia vulgaris)

- Submersed; floating stems 2 – 3 meters in length
- Native and common throughout WI
- Carnivorous plant; found in still water
- Provide food,habitat and cover for fish

Wild celery (Vallisneria Americana)

- Submersed
- Native, throughout WI
- Found in firm substrate in water from ankle to several meters deep; turbidity tolerant and survives wide range of water chemistries
- Premiere source of food for waterfowl, all portions of plant are consumed; grazed by muskrats, good fish habitat that provide shade, shelter and food

Wild rice (Zizania palustris)

- Emergent, Shallow rooted annual
- Native; most abundant in Northern WI
- Very specific habitat including water chemistry; silt or muck sediment
- Valued waterfowl food; provides food and shelter for muskrats

Appendix E – Summary of Aquatic Plant Management Alternatives

Management Options for Aquatic Plants

Option	Permit Needed?	How it Works	PROS	CONS
No treatment	N	Do not treat plants	Protects native species that can prevent spread of invasive or exotic species, enhance water quality, and provide habitat for aquatic fauna	May allow small population of invasive plants to become larger, more difficult to control later
			No financial cost	
			No system disturbance	
			No harmful effects of chemicals	
			Permit not required	
Mechanical Control	Required under NR 109	Plants reduced by mechanical means	Flexible control	Must be repeated, often more than once per season
		Wide range of techniques, from manual to highly mechanized	Can balance habitat and recreational needs	Can suspend sediments and increase turbidity and nutrient release
a. Handpulling/Manual raking	Y/N	SCUBA divers or snorkelers remove plants by hand or plants are removed with a rake	Little to no damage done to lake or to native plant species	Very labor intensive
		Works best in soft sediments	Can be highly selective	Needs to be carefully monitored
			Can be done by shoreline property owners without permits within an area <30 ft wide OR where selectively removing EWM or CLP	Roots, runners, and even fragments of some species (including EWM) will start new plants, so all of plant must be removed
			Can be very effective at removing problem plants, particularly following early detection of an invasive exotic species	Small-scale control only

b.	Harvesting	Y	Plants are "mowed" at depths of 2-5 ft, collected with a conveyor and off-loaded onto shore	Immediate results	Not selective in species removed
			Harvest invasives only if invasive is already present throughout the lake	EWM removed before it has the opportunity to autofragment, which may create more fragments than created by harvesting	Fragments of vegetation can re-root
				Usually minimal impact to the lake	Can remove some small fish and reptiles from lake
				Harvested lanes through dense weed beds can increase growth and survival of some fish	Initial cost of harvester expensive
				Can remove some nutrients from lake	
Biological Control		Y	Living organisms (e.g. insects or fungi) eat or infect plants	Self-sustaining; organism will over-winter, resume eating its host the next year	Effectiveness will vary as control agent's population fluctates
				Lowers density of problem plant to allow growth of natives	Provides moderate control - complete control unlikely
					Control response may be slow
					Must have enough control agent to be effective
a.	Weevils on EWM*	Y	Native weevil prefers EWM to other native water-milfoil	Native to Wisconsin: weevil cannot "escape" and become a problem	Need to stock large numbers, even if some already present
				Selective control of target species	Need good habitat for overwintering on shore (leaf litter) associated with undeveloped shorelines
				Longer-term control with limited management	Bluegill populations decrease densities through predation
b.	Pathogens	Y	Fungal/bacterial/viral pathogen introduced to target species to induce mortalitiy	May be species specific	Largely experimental; effectiveness and longevity unknown
				May provide long-term control	Possible side effects not understood
				Few dangers to humans or animals	

c.	Allelopathy	Y	Aquatic plants release chemical compounds that inhibit other plants from growing	May provide long-term, maintenance-free control	Initial transplanting slow and labor-intensive
				Spikerushes (*Eleocharis* spp.) appear to inhibit Eurasian watermilfoil growth	Spikerushes native to WI, and have not effectively limited EWM growth
					Wave action along shore makes it difficult to establish plants; plants will not grow in deep or turbid water
d.	Restoration of native plants	N; strongly recommend plan and consultation with DNR	Diverse native plant community established to repel invasive species	Native plants provide food and habitat for aquatic fauna	Initial transplanting slow and labor-intensive
				Diverse native community more repellant to invasive species	Nuisance invasive plants may outcompete plantings
				Supplements removal techniques	Largely experimental; few well-documented cases

Physical Control		Required under Ch. 30 / NR 107	Plants are reduced by altering variables that affect growth, such as water depth or light levels		
a.	Drawdown	Y, May require Environmental Assessment	Lake water lowered; plants killed when sediment dries, compacts or freezes	Can be effective, especially when done in winter, provided drying and freezing occur. Sediment compaction is possible over winter	Plants with large seed bank or propagules that survive drawdown may become more abundant upon refilling
			Must have a water level control device or siphon	Summer drawdown can restore large portions of shoreline and shallow areas as well as provide sediment compaction	Species growing in deep water (e.g. EWM) that survive may increase, particularly if desirable native species are reduced
			Season or duration of drawdown can change effects	Emergent plant species often rebound near shore providing fish and wildlife habitat, sediment stabilization, and increased water quality	May impact attached wetlands and shallow wells near shore
				Success for EWM, variable success for CLP*	Can affect fish, particularly in shallow lakes if oxygen levels drop or if water levels are not restored before spring spawning
				Restores natural water fluctuation important for all aquatic ecosystems	Winter drawdawn must start in early fall or will kill hibernating reptiles and amphibians
					Controversial
b.	Dredging	Y	Plants are removed along with sediment	Increases water depth	Expensive
			Most effective when soft sediments overlay harder substrate	Removes nutrient rich sediments	Increases turbidity and releases nutrients
			For extremely impacted systems	Removes soft bottom sediments that may have high oxygen demand	Exposed sediments may be recolonized by invasive species
			Extensive planning required		Sediment testing is expensive and may be necessary
					Removes benthic organisms
					Dredged materials must be disposed of
					Severe impact on lake ecosystem

c.	Dyes	Y	Colors water, reducing light and reducing plant and algal growth	Impairs plant growth without increasing turbidity	Appropriate for very small water bodies
				Usually non-toxic, degrades naturally over a few weeks.	Should not be used in pond or lake with outflow
					Impairs aesthetics
					Affects to microscopic organisms unknown
d.	Mechanical circulation (Solarbees)	Y	Water is circulated and oxygenated	Reduces blue-green algae	Method is experimental; no published studies have been done
			Oxygenation of water decreases ammonium-nitrogen, which is a preferred nutrient source of EWM, theoretically limiting EWM growth (has not been demonstrated scientifically)	May reduce levels of ammonium-nitrogen in the water and at the sediment interface, which could reduce EWM growth	Although EWM prefers ammonium-nitrogen to nitrate, it will uptake nitrate efficiently, so EWM growth may not be affected
				Oxygenated water may reduce phosphorus release from sediments if mixing is complete	Units are aesthetically unpleasing
				Reduces chance of fish kills by aerating water	Units could be a navigational hazard
e.	Non-point source nutrient control	N	Runoff of nutrients from the watershed are reduced (e.g. by controlling construction erosion or reducing fertilizer use)	Attempts to correct source of problem, not treat symptoms	Results can take years to be evident due to internal recycling of already-present lake nutrients
				Could improve water clarity and reduce occurrences of algal blooms	Expensive
				Native plants may be able to compete invasive species better in low-nutrient conditions	Requires landowner cooperation and regulation
					Improved water clarity may increase plant growth

Chemical Control		Required under NR 107	Granules or liquid chemicals kill plants or cease plant growth; some chemicals used primarily for algae Results usually within 10 days of treatment, but repeat treatments usually needed	Some flexibility for different situations Some can be selective if applied correctly Can be used for restoration activities	Possible toxicity to aquatic animals or humans, especially applicators May kill desirable plant species, e.g. native water-milfoil or native pondweeds Treatment set-back requirements from potable water sources and/or drinking water use restrictions after application, usually based on concentration May cause severe drop in dissolved oxygen causing fish kill, depends on plant biomass killed, temperatures and lake size and shape Controversial
a.	2,4-D (Weedar, Navigate)	Y	Systemic[1] herbicide selective to broadleaf[2] plants that inhibits cell division in new tissue Applied as liquid or granules during early growth phase	Moderately to highly effective, especially on EWM Monocots, such as pondweeds (e.g. CLP) and many other native species not affected. Can be used in synergy with endotholl for early season CLP and EWM treatments Widely used aquatic herbicide	May cause oxygen depletion after plants die and decompose Cannot be used in combination with copper herbicides (used for algae) Toxic to fish
b.	Endothall (Aquathol)	Y	Broad-spectrum[3], contact[4] herbicide that inhibits protein synthesis Applied as liquid or granules	Especially effective on CLP and also effective on EWM May be effective in reducing reestablishment of CLP if reapplied several years in a row in early spring Can be selective depending on concentration and seasonal timing Can be combined with 2,4-D for early season CLP and EWM treatments, or with copper compounds Limited off-site drift	Kills many native pondweeds Not as effective in dense plant beds Not to be used in water supplies Toxic to aquatic fauna (to varying degrees) 3-day post-treatment restriction on fish consumption

c.	Diquat (Reward)	Y	Broad-spectrum, contact herbicide that disrupts cellular functioning	Mostly used for water-milfoil and duckweed	May impact non-target plants, especially native pondweeds, coontail, elodea, naiads
			Applied as liquid, can be combined with copper treatment	Rapid action	Toxic to aquatic invertebrates
				Limited direct toxicity on fish and other animals	Needs to be reapplied several years in a row
					Ineffective in muddy or cold water (<50°F)
d.	Fluridone (Sonar or Avast)	Y; special permit and Environmental Assessment may be required	Broad-spectrum, systemic herbicide that inhibits photosynthesis; some reduction in non-target effects can be achieved by lowering dosage	Effective on EWM for 1 to 4 years with aggressive follow-up treatments	Affects many non-target plants, particularly native milfoils, coontails, elodea, and naiads, even at low concentrations. These plants are important to combat invasive species
			Must be applied during early growth stage	Applied at very low concentration	Requires long contact time: 60-90 days
			Available with a special permit only; chemical applications beyond 150 ft from shore not allowed under NR 107	Slow decomposition of plants may limit decreases in dissolved oxygen	Demonstrated herbicide resistance in hydrilla subjected to repeat treatments, EWM has the potential to develop resistance
				Low toxicity to aquatic animals	Unknown effect of repeat whole-lake treatments on lake ecology
e.	Glyphosate (Rodeo)	Y	Broad-spectrum, systemic herbicide that disrupts enzyme formation and function	Effective on floating and emergent plants such as purple loosestrife	Effective control for 1-5 years
			Usually used for purple loosestrife stems or cattails	Selective if carefully applied to individual plants	Ineffective in muddy water
			Applied as liquid spray or painted on loosetrife stems	Non-toxic to most aquatic animals at recommended dosages	Cannot be used near potable water intakes
					RoundUp is often illegally substituted for Rodeo
					Associated surfactants of RoundUp believed to be toxic to reptiles and amphibians
					No control of submerged plants

f.	Triclopyr (Renovate)	Y	Systemic herbicide selective to broadleaf plants that disrupts enzyme function	Effective on many emergent and floating plants	Impacts may occur to some native plants at higher doses (e.g. coontail)
			Applied as liquid spray or liquid	More effective on dicots, such as purple loosestrife; may be more effective than glyphosate	May be toxic to sensitive invertebrates at higher concentrations
				Results in 3-5 weeks	Retreatment opportunities may be limited due to maximum seasonal rate (2.5 ppm)
				Low toxicity to aquatic animals	Sensitive to UV light; sunlight can break herbicide down prematurely
				No recreational use restrictions following treatment	Relatively new management option for aquatic plants (since 2003)
g.	Copper compounds (Cutrine Plus)	Y	Broad-spectrum, systemic herbicide that prevents photosynthesis	Reduces algal growth and increases water clarity	Elemental copper accumulates and persists in sediments
			Used to control planktonic and filamentous algae	No recreational or agricultural restrictions on water use following treatment	Short-term results
				Herbicidal action on hydrilla, an invasive plant not yet present in Wisconsin	Precipitates rapidly in alkaline waters
					Small-scale control only, because algae are easily windblown
					Toxic to invertebrates, trout and other fish, depending on the hardness of the water
					Long-term effects of repeat treatments to benthic organisms unknown
					Clear water may increase plant growth

h.	Lime slurry	Y	Applications of lime temporarily raise water pH, which limits the availablity of inorganic carbon to plants, preventing growth	Appears to be particularly effective against EWM and CLP	Relatively new technique, so effective dosage levels and exposure requirements are not yet known
				Prevents release of sediment phosphorus, which reduces algal growth	Short-term increase in turbidity due to suspended lime particles
				Increases growth of native plants beneficial as fish habitat	High pH detrimental to aquatic invertebrates
					May restrict growth of some native plants
i.	Alum (aluminum sulfate)	Y	Removes phosphorus from water column and creates barrier on sediment to prevent internal loading of phosphorus	Most often used against algal problems	Must not eat fish for 30 days from treatment area
			Dosage must consider pH, hardness and water volume	Improves water clarity	Minimal effect on aquatic plants, or increased light penetration may increase aquatic plants
					Toxic to aquatic animals, including fish at some concentrations

***EWM - Eurasian water-milfoil**
***CLP - Curly-leaf pondweed**
[1]Systemic herbicide - Must be absorbed by the plant and moved to the site of action. Often slower-acting than contact herbicides.
[2]Broadleaf herbicide - Affects only dicots, one of two groups of plants. Aquatic dicots include waterlilies, bladderworts, watermilfoils, and coontails.
[3]Broad-spectrum herbicide - Affects both monocots and dicots.
[4]Contact herbicide - Unable to move within the plant; kills only plant tissue it contacts directly.

Techniques for Aquatic Plant Control Not Allowed in Wisconsin

	Option	How it Works	PROS	CONS
Biological Control				
a.	Carp	Plants eaten by stocked carp	Effective at removing aquatic plants	Illegal to transport or stock carp in Wisconsin
			Involves species already present in Madison lakes	Carp cause resuspension of sediments, increased water temperature, lower dissolved oxygen levels, and reduction of light penetration
				Widespread plant removal deteriorates habitat for other fish and aquatic organisms
				Complete alteration of fish assemblage possible
				Dislodging of plants such as EWM or CLP turions can lead to accelerated spreading of plants
b.	Crayfish	Plants eaten by stocked crayfish	Reduces macrophyte biomass	Illegal to transport or stock crayfish in Wisconsin
				Control not selective and may decimate plant community
				Not successful in productive, soft-bottom lakes with many fish predators
				Complete alteration of fish assemblage possible
Mechanical Control				
a.	Cutting (no removal)	Plants are "mowed" with underwater cutter	Creates open water areas rapidly	Root system remains for regrowth
			Works in water up to 25 ft	Fragments of vegetation can re-root and spread infestation throughout the lake
				Nutrient release can cause increased algae and bacteria and be a nuisance to riparian property owners
				Not selective in species removed
				Small-scale control only
b.	Rototilling	Sediment is tilled to uproot plant roots and stems	Decreases stem density, can affect entire plant	Creates turbidity
		Works in deep water (17 ft)	Small-scale control	Not selective in species removed
			May provide long-term control	Fragments of vegetation can re-root
				Complete elimination of fish habitat
				Releases nutrients
				Increased likelihood of invasive species recolonization

c.	Hydroraking	Mechanical rake removes plants from lake Works in deep water (14 ft)	Creates open water areas rapidly	Fragments of vegetation can re-root May impact lake fauna Creates turbidity Plants regrow quickly Requires plant disposal
Physical Control				
a.	Fabrics/ Bottom Barriers	Prevents light from getting to lake bottom	Reduces turbidity in soft-substrate areas Useful for small areas	Eliminates all plants, including native plants important for a healthy lake ecosystem May inhibit spawning by some fish Need maintenance or will become covered in sediment and ineffective Gas accumulation under blankets can cause them to dislodge from the bottom Affects benthic invertebrates Anaerobic environment forms that can release excessive nutrients from sediment

Aquatic Plant Management

Aquatic plants are a critical component in an aquatic ecosystem. Any management of an ecosystem can have negative or even detrimental effects on the whole ecosystem. Therefore, the practice of managing aquatic plants should not be taken lightly. The concept of Aquatic Plant Management (APM) is highly variable since different aquatic resource users want different things. Ideal management to one individual may mean providing prime fish habitat, for another it may be to remove surface vegetation for boating. The practice of APM is also highly variable. There are numerous APM strategies designed to achieve different plant management goals. Some are effective on a small scale, but ineffective in larger situations. Others can only be used for specific plants or during certain times of the growing season. Of course, the types of plants that are to be managed will also help determine which APM alternatives are feasible. The following paragraphs discuss the APM methods used today. The discussion is largely adopted from *Managing Lakes and Rivers, North American Lake Management Society, 2001*, supplemented with other applicable current resources and references. The methods summarized here are largely for management of rooted aquatic plants, not algae. While some methods may also have effects on nuisance algae blooms, the focus is submergent rooted aquatic macrophytes. This information is provided to allow the user to gain a basic understanding of the APM method, it is not designed to an all-inclusive APM decision-making matrix. APM alternatives can be divided into the following categories: Physical Controls, Chemical Controls, and Biological Controls.

Physical Controls

Physical APM controls include various methods to prevent growth or remove part or all of the aquatic plant. Both manual and mechanical techniques are employed. Physical APM methods include:

- Hand pulling
- Hand cutting
- Bottom barriers
- Light limitation (dyes, covers)
- Mechanical harvesting
- Hydroraking/rototilling
- Suction Dredging
- Dredging
- Drawdown

Each of these methods are described below. The costs, benefits, and drawbacks of each APM strategy are provided.

Hand Pulling: This method involves digging out the entire unwanted plant including stems and roots with a hand tool such as a spade. This method is highly selective and suitable for shallow areas for removing invasive species that have not become well established. This technique is obviously not for use on large dense beds of nuisance aquatic plants. It is best used in areas less than 3 feet, but can be used in deeper areas with divers using scuba and snorkeling equipment. It can also be used in combination with the suction dredge method. In Wisconsin, hand pulling may be completed outside a designated sensitive area without a permit but is limited to 30 feet of shoreline frontage. Removal of exotic species is not limited to 30 feet.

Advantages: This technique results in immediate clearing of the water column of nuisance plants. When a selective technique is desired in a shallow, small area, hand pulling is a good choice. It is also useful in sensitive areas where disruption must be minimized.

Disadvantages: This method is labor intensive. Disturbing the substrate may affect fish habitat, increase turbidity, and may promote phosphorus re-suspension and subsequent algae blooms.

Costs: The costs are highly variable. There is practically no cost using volunteers or lakeshore landowners to remove unwanted plants, however, using divers to remove plants can get relatively expensive. Hand pulling labor can range from $400 to $800 per acre.

Hand Cutting: This is another manual method where the plants are cut below the water surface. Generally the roots are not removed. Tools such as rakes, scythes or other specialized tools are pulled through the plant beds by boat or several people. This method is not as selective as hand pulling. This method is well suited for small areas near docks and piers. Plant material must be removed from the water. In Wisconsin, hand cutting may be completed outside a designated sensitive area without a permit but is limited to 30 feet of shoreline frontage. Removal of exotic species is not limited to 30 feet.

Advantages: This technique results in immediate clearing of the water column of nuisance plants. Costs are minimal.

Disadvantages: This is also a fairly time consuming and labor intensive option. Since the technique does not remove the entire plant (leaves root system and part of plant), it may not result in long-term reductions in growth. This technique is not species specific and results in all aquatic plants being removed from the water column.

Costs: The costs range from minimal for volunteers using hand equipment up to over $1,000 for a hand-held mechanized cutting implement. Hand cutting labor can range from $400 to $800 per acre.

Bottom Barriers: A barrier material is applied over the lake bottom to prevent rooted aquatics from growing. Natural barriers such as clay, silt, and gravel can be used although eventually plants may root in these areas again. Artificial materials can also be used for bottom barriers and anchored to the substrate. Barrier materials include burlap, nylon, rubber, polyethylene, polypropylene, and fiberglass. Barriers include both solid and porous forms. A permit is required to place any fill or barrier structure on the substrate of a waterbody. This method is well suited for areas near docks, piers, and beaches. Periodic maintenance may be required to remove accumulated silt or rooting fragments from the barrier.

Advantages: This technique does not result in production of plant fragments. Properly installed, it can provide immediate and multiple year relief.

Disadvantages: This is a non-selective option, all plants beneath the barrier will be affected. Some materials are costly and installation is labor intensive. Other disadvantages include limited material durability, gas accumulation beneath the cover, or possible re-growth of plants from above or below the cover. Fish and invertebrate habitat is disrupted with this technique. Anchored barriers can be difficult to remove.

Costs: A 20 foot x 60 foot panel cost $265, while a 30 foot x 50 foot panel cost $375 (this does not include installation costs). Costs for materials vary from $0.15 per square foot ($ft^2$) to over $0.35/ ft^2. The costs for installation range from $0.25 to $0.50/ ft^2. Barriers can cost $20,000 to $50,000 per acre.

Light Limitation: Limiting the available light in the water column can prevent photosynthesis and plant growth. Dark colored dyes and surface covers have been used to accomplish light limitation. Dyes are effective in shallow water bodies where their concentration can be kept at a desired concentration and loss through dilution is less. This method is well suited for small, shallow water bodies with no outlets such as private ponds.

Surface covers can be a useful tool in small areas such as docks and beaches. While they can interfere with aquatic recreation, they can be timed to produce results and not affect summer recreation uses.

Advantages: Dyes are non-toxic to humans and aquatic organisms. No special equipment is required for application. Light limitation with dyes or covers method may be selective to shade tolerant species. In addition to submerged macrophyte control, it can also control the algae growth.

Disadvantages: The application of water column dyes is limited to shallow water bodies with no outlets. Repeated dye treatments may be necessary. The dyes may not control peripheral or shallow-water rooted plants. This technique must be initiated before aquatic plants start to grow. Covers inhibit gas exchange with the atmosphere.

Costs: Costs for a commercial dye and application range from $100 to $500 per acre.

Mechanical Harvesting: Mechanical harvesters are essentially cutters mounted on barges that cut aquatic plants at a desired depth. Maximum cutting depths range from 5 to 8 feet with a cutting width of 6.5 to 12 feet. Cut plant materials require collection and removal from the water. Conventional harvesters combine cutting, collecting, storing, and transporting cut vegetation into one piece of equipment. Transport barges and shoreline conveyors are also available to remove the cut vegetation. The cut plants must be removed from the water body. The equipment needs are dictated by severity of the aquatic plant problem. Contract harvesting services are available in lieu of purchasing used or new equipment. Trained staff will be necessary to operate a mechanical harvester. To achieve maximum removal of plant material, harvesting is usually completed during the summer months while submergent vegetation is growing to the surface. The duration of control is variable and re-growth of aquatic plants is common. Factors such as timing of harvest, water depth, depth of cut, and timing can influence the effectiveness of a harvesting operation. Harvesting is suited for large open areas with dense stands of exotic or nuisance plant species. Permits are now required in Wisconsin to use a mechanical harvester.

Advantages: Harvesting provides immediate visible results. Harvesting allows plant removal on a larger scale than other options. Harvesting provides flexible area control. In other words, the harvester can be moved to where it is needed and used to target problem areas. This technique has the added benefit of removing the plant material from the water body and therefore also eliminates a possible source of nutrients often released during fall decay of aquatic plants. While removal of nutrients through plant harvesting has not been quantified, it can be important in aquatic ecosystem with low nutrient inputs.

Disadvantages: Drawbacks of harvesting include: limited depth of operation, not selective within the application area, and expensive equipment costs.

Harvesting also creates plant fragments, which can be a concern since certain plants have the ability to reproduce from a plant fragment (e.g. Eurasian watermilfoil). Plant fragments may re-root and spread a problem plant to other areas. Harvesting can have negative effects on non-target plants, young of year fish, and invertebrates. The harvesting will require trained operators and maintenance of equipment. Also, a disposal site or landspreading program will be needed for harvested plants.

Costs: Costs for a harvesting operation are highly variable dependant on program scale. New harvesters range from $40,000 for small machines to over $100,000 for large, deluxe models. Costs vary considerably, depending on the model, size, and options chosen. Specially designed units are available, but may cost more. The equipment can last 10 to 15 years. A grant for ½ the equipment cost can be obtained from the Wisconsin Waterways Commission and a loan can be obtained for the remaining capital investment. Operation costs include insurance, fuel, spare parts, and payroll. Historical harvesting values have been reported at $200 up to $1,500 per acre. A survey of recent Wisconsin harvesting operations reported costs to be between $100/acre and $200/acre.

A used harvester can be purchased for $10,000 to $20,000. Maintenance costs are typically higher.

Contract harvesting costs approximately $125/per hour plus mobilization to the water body. Contractors can typically harvest ¼ to ½ acre per hour for an estimated cost of $250 to $500/per acre.

Hydroraking/rototilling: Hydroraking is the use of a boat or barge mounted machine with a rake that is lowered to the bottom and dragged. The tines of the rake rip out roots of aquatic plants. Rototilling, or rotovation, also rips out root masses but uses a mechanical rotating head with tines instead of a rake. Harvesting may need to be completed in conjunction with these methods to gather floating plant fragments. This application would best be used where nuisance populations are well established and prevention of stem fragments is not critical. A permit would be required for this type of aquatic plant management and would only be issued in limited cases of extreme infestations of nuisance vegetation. In Wisconsin, this method is not looked upon favorably or at all by the WDNR.

Advantages: These methods have the potential for significant reductions in aquatic plant growth. These methods can remove the plant stems and roots, resulting in thorough plant disruption. Hydroraking/rototilling can be completed in "off season" months avoiding interference with summer recreation activities.

Disadvantages: Hydroraking/rototilling are not selective and may destroy substrate habitat important to fish and invertebrates. Suspension of sediments will increase turbidity and release nutrients trapped in bottom sediments into the water column potentially causing algal blooms. These methods can cause floating plant and root fragments, which may re-root and spread the problem. Hydroraking/rototilling are expensive and not likely to be permitted by regulatory agencies.

Costs: Bottom tillage costs vary according to equipment, treatment scale, and plant density. For soft vegetation costs can range from $2,000 to $4,000 per acre. For dense, rooted masses, costs can be up to $10,000 per acre. Contract bottom tillage reportedly ranges from $1,200 to $1,700 per acre (Washington Department of Ecology, 1994).

Suction Dredging: Suction dredging uses a small boat or barge with portable dredges and suction heads. Scuba divers operate the suction dredge and can target removal of whole plants, seeds, and roots. This method may be applied in conjunction with hand cutting where divers dislodge the plants. The plant/sediment slurry is hydraulically pumped to the barge through hoses carried by the diver. Its effectiveness is dependent on sediment composition, density of aquatic plants, and underwater visibility. Suction dredging may be best suited for localized infestations of low plant density where fragmentation must be controlled. A permit will be required for this activity.

Advantages: Diver suction dredging is species –selective. Disruption of sediments can be minimized. These methods can remove the plant stems and roots, resulting in thorough plant disruption and potential longer term control. Fragmentation of plants is minimized. This activity can be completed near and around obstacles such as piers or marinas where a harvester could not operate.

Disadvantages: Diver suction dredging is labor intensive and costly. Upland disposal of dredged slurry can require additional equipment and costs. Increased turbidity in the area of treatment can be a problem. Release of nutrients and other pollutants can also be a problem.

Costs: Suction dredging costs can be variable depending on equipment and transport requirements for slurry. Costs range from $5,000 per acre to $10,000 per acre.

Dredging

Sediment removal through dredging can work as a plant control technique by limiting light through increased water depth or removing soft sediments that are a preferred habitat to nuisance rooted plants. Soft sediment removal is accomplished with drag lines, bucket dredges, long reach backhoes, or other specialized dredging equipment. Dredging has had mixed results in controlling aquatic plant, however it can be highly effective in appropriate situations. Dredging is most often applied in a major restructuring of a severely degraded system. Generally, dredging is an activity associated with other restoration efforts. Comprehensive pre-planning will be necessary for these techniques and a dredging permit would be required.

Advantages: Dredging can remove nutrient reserves which result in nuisance rooted aquatic plant growth. Dredging, when completed, can also actually improve substrate and habitat for more desirable species of aquatic plants, fish, and invertebrates. It allows the complete renovation of an aquatic ecosytem. This method has the potential for significant reductions in aquatic plant growth. These methods can be completed in "off season" months avoiding interference with summer recreation activities.

Disadvantages: Dredging can temporarily destroy important fish and invertebrate habitat. Suspension of sediments usually increases turbidity significantly and can possibly releases nutrients causing algae blooms. Dredging is extremely expensive and requires significant planning. Dredged materials may contain toxic materials (metals, PCBs). Dredged material transportation and disposal of toxic materials are additional management considerations and are potentially expensive. It could be difficult and costly to secure regulatory permits and approvals.

Costs: Dredging costs depend upon the scale of the project and many other factors. It is generally an extremely expensive option.

Drawdown: Water level drawdown exposes the plants and root systems to prolonged freezing and drying to kill the plants. It can be completed any time of the year, however is generally more effective in winter, exposing the lake bed to freezing temperatures. If there is a water level control structure capable of drawdown, it can be an in-expensive way to control some aquatic plants. Aquatic plants vary in their susceptibility to drawdown, therefore, accurate identification of problem species is important. Drawdown is often used for other purposes of improving waterfowl habitat or fishery management, but sometimes has the added benefit of nuisance rooted aquatic plant control. This method can be used in conjunction with a dredging project to excavate nutrient-rich sediments. This method is best suited for use on reservoirs or shallow man-made lakes. A drawdown would require regulatory permits and approvals.

Advantages: A drawdown can result in compaction of certain types of sediments and can be used to facilitate other lake management activities such as dam repair, bottom barrier, or dredging projects. Drawdown can significantly impact populations of aquatic plants that propagate vegetatively. It is inexpensive.

Disadvantages: This method is limited to situations with a water level control structure. Pumps can be used to de-water further if groundwater seepage is not significant. This technique may also result in the removal of beneficial plant species. Drawdowns can decrease bottom dwelling invertebrates and overwintering reptiles and amphibians. Drawdowns can affect adjacent wetlands, alter downstream flows, and potentially impair well production. Drawdowns and any water level manipulation are often highly controversial since shoreline landowners access and public recreation are limited during the drawdown. Fish populations are vulnerable during a drawdown due to over-harvesting by fisherman in decreased water volumes.

Costs: If a suitable outlet structure is available then costs should be minimal. If dewatering pumps would be required or additional management projects such as dredging are completed, additional costs would be incurred. Other costs would include recreational losses and perhaps loss in tourism revenue.

Chemical Controls

Using chemical herbicides to kill nuisance aquatic plants is the oldest APM method. However, past pesticides uses being linked to environmental or human health problems have led to public wariness of chemicals in the environment. Current pesticide registration procedures are more stringent than in the past. While no chemical pesticide can be considered 100 percent safe, federal pesticide regulations are based on the premise that if a chemical is used according to its label instructions it will not cause adverse environmental or human health effects.

Chemical herbicides for aquatic plants can be divided into two categories, systemic and contact herbicides. Systemic herbicides are absorbed by the plant, translocated throughout the plant, and are capable of killing the entire plant, including the roots and shoots. Contact herbicides kill the plant surface in which in comes in contact, leaving roots capable of re-growth. Aquatic herbicides exist under various trade names, causing some confusion. Aquatic herbicides include the following:

- Endothall Based Herbicide
- Diquat Based Herbicide
- Fluridone Based Herbicide
- 2-4 D Based Herbicide
- Glyophosate Based Herbicide
- Triclopyr Based Herbicide
- Phosphorus Precipitation

Each of these methods are described below. The costs, benefits, and drawbacks of each chemical APM alternative are provided.

Endothall Based Herbicide: Endothall is a contact herbicide, attacking a wide range of plants at the point of contact. The chemical is not readily transferred to other plant tissue, therefore regrowth can be expected and repeated treatments may be needed. It is sold in liquid and granular forms under the trade names of Aquathol® or Hydrothol®. Hydrothol is also an algaecide. Most endothall products break down easily and do not remain in the aquatic environment. Endothall products can result in plant reductions for a few weeks to several months. Multi-season effectiveness is not typical. A permit is required for use of this herbicide.

Advantages: Endothall products work quickly and exhibit moderate to highly effective control of floating and submersed species. This herbicide has limited toxicity to fish at recommended doses.

Disadvantages: The entire plant is not killed when using endothall. Endothall is non-selective in the treatment area. High concentrations can kill fish easily. Water use restrictions (time delays) are necessary for recreation, irrigation, and fish consumption after application.

Costs: Costs vary with treatment area and dosage. Average costs for chemical application range between $400 and $700 per acre.

Diquat Based Herbicide: Diquat is a fast-acting contact herbicide effective on a broad spectrum of aquatic plants. It is sold under the trade name Reward®. Diluted forms of this product are also sold as private label products. Since Diquat binds to sediments readily, its effectiveness is reduced by turbid water. Multi-season effectiveness is not typical. A permit is required for use of this herbicide.

Advantages: Diquat works quickly and exhibit moderate to highly effective control of floating and submersed species. This herbicide has limited toxicity to fish at recommended doses.

Disadvantages: The entire plant is not killed when using diquat. Diquat is non-selective in the treatment area. Diquat can be inactivated by suspended sediments. Diquat is sometimes toxic to zooplankton at the recommended dose. Limited water used restrictions (water supply, agriculture, and contact recreation) are required after application.

Costs: Costs vary with treatment area and dosage. A general cost estimate for treatment is between $200 and $500 per acre.

Fluoridone Based Herbicide: Fluoridone is a slow-acting systemic herbicide, which is effectively absorbed and translocated by both plant roots and stems. Sonar® and Avast!® is the trade name and it is sold in liquid or granular form. Fluoridone requires a longer contact time and demonstrates delayed toxicity to target plants. Eurasian watermilfoil is more sensitive to fluoridone than other aquatic plants. This allows a semi-selective approach when low enough doses are used. Since the roots are also killed, multi-season effectiveness can be achieved. It is best applied during the early growth phase of the plants. A permit and extensive planning is required for use of this herbicide.

Advantages: Fluoridone is capable of killing roots, therefore producing a longer lasting effect than other herbicides. A variety of emergent and submersed aquatics are susceptible to this herbicide. Fluoridine can be used selectively, based on concentration. A gradual killing of target plants limits severe oxygen depletion from dead plant material. It has demonstrated low toxicity to aquatic fauna such as fish and invertebrates. 3 to 5 year control has been demonstrated. Extensive testing has shown that, when used according to label instructions, it does not pose negative health affects.

Disadvantages: Fluoridine is a very slow-acting herbicide sometimes taking up to several months for visible effects. It requires a long contact time. Fluoridine is extremely soluble and mixable, therefore, not effective in flowing water situations or for treating a select area in a large open lake. Impacts on non-target plants are possible at higher doses. Time delays are necessary on use of the water (water supply, irrigation, and contact recreation) after application.

Costs: Costs vary with treatment area and dosage. Treatment costs range from $500 to $2,000 per acre.

2,4-D Based Herbicide: 2,4-D based herbicides are sold in liquid or granular forms under various trade names. Common granular forms are sold under the trade names Navigate® and Aqua Kleen®. Common liquid forms include DMA 4® and Weedar 64®. 2,4-D is a systemic herbicide that affects broad leaf plants. It has been demonstrated effective against Eurasian watermilfoil, but it may not work on many aquatic plants. Since the roots are also killed, multi-season effectiveness may be achieved. It is best applied during the early growth phase of the plants. Visible results are evident within 10 to 14 days. A permit is required for use of this herbicide.

Advantages: 2,4-D is capable of killing roots, therefore producing a longer lasting effect than some other herbicides. It is fairly fast and somewhat selective, based on application timing and concentration. 2,4-D containing products are moderately to highly effective on a few emergent, floating, or submersed plants.

Disadvantages: 2,4-D can have variable toxicity effects to aquatic fauna, depending on formulation and water chemistry. 2,4-D lasts only a short time in water, but can be detected in sediments for months after application. Time delays are necessary on use of the water (agriculture and contact recreation) after application. The label does not permit use of this product in water used for drinking, irrigation, or livestock watering.

Costs: Costs vary with treatment area and dosage. Treatment costs range from $300 to $800 per acre.

Glyophosate Based Herbicide: Glyophosate has been categorized as both a contact and a systemic herbicide. It is applied as a liquid spray and is sold under the trade name Rodeo® or Pondmaster®. It is a non-selective, broad based herbicide effective against emergent or floating leaved plants, but not submergents. It's effectiveness can be reduced by rain. A permit is required for use of this herbicide.

Advantages: Glyophoshate is moderately to highly effective against emergent and floating-leaf plants resulting in rapid plant destruction. Since it is applied by spraying plants above the surface, the applicator can apply it selectively to target plants. Glyophosate dissipates quickly from natural waters, has a low toxicity to aquatic fauna, and carries no restrictions or time delays for swimming, fishing, or irrigation.

Disadvantages: Glyophoshate is non-selective in the treatment area. Wind can dissipate the product during the application reducing it's effectiveness and cause damage to non-target organisms. Therefore, spray application should only be completed when wind drift is not a problem. This compound is highly corrosive, therefore storage precautions are necessary.

Costs: Costs average $500 to $1,000 per acre depending on the scale of treatment.

Triclopyr Based Herbicide: Triclopyr is a systemic herbicide. It is registered for experimental aquatic use in selected areas only. It is applied as a liquid spray or injected into the subsurface as a liquid. Triclopyr is sold under the trade name Renovate® or Restorate®. Triclopyr has shown to be an effective control to many floating and submersed plants. It has been demonstrated to be highly effective against Eurasian watermilfoil, having little effect on valued native plants such as pondweeds. Triclopyr is most effective when applied during the active growth period of younger plants.

Advantages: This herbicide is fast acting. Triclopyr can be used selectively since it appears more effective against dicot plant species, including several difficult nuisance plants. Testing has demonstrated low toxicity to aquatic fauna.

Disadvantages: At higher doses, there are possible impacts to non-target species. Some forms of this herbicide are experimental for aquatic use and restrictions on use of the treated water are not yet certain.

Biological Controls

There has been recent interest in using biological technologies to control aquatic plants. This concept stems from a desire to use a "natural" control and reduce expenses related to equipment and/or chemicals. While use of biological controls is in its infancy, potentially useful technologies have been identified and show promise for integration with physical and chemical APM strategies. Several biological controls that are in use or are under experimentation include the following:

- Herbivorous Fish
- Herbivorous Insects
- Plant Pathogens
- Native Plants

Each of these methods are described below. The costs, benefits, and drawbacks of each biologic APM method are provided.

Herbivorous Fish: A herbivorous fish such as the non-native grass carp can consume large quantities of aquatic plants. These fish have high growth rates and a wide range of plant food preferences. Stocking rates and effectiveness will depend on many factors including climate, water temperature, type and extent of aquatic plants, and other site-specific issues. Sterile (triploid) fish have been developed resulting in no reproduction of the grass carp and population control. This technology has demonstrated mixed results and is most appropriately used for lake-wide, low intensity control of submersed plants. Some states do not allow stocking of herbivorous fish. In Wisconsin, stocking of grass carp is prohibited.

Advantages: This technology can provide multiple years of aquatic plant control from a single stocking. Compared to other long-term aquatic plant control techniques such as bottom tillage or bottom barriers, costs may be relatively low.

Disadvantages: Sterile grass carp exhibit distinct food preferences, limiting their applicability. Grass carp may feed selectively on the preferred plants, while less preferred plants, including milfoil, may increase. The effects of using grass carp may not be immediate. Overstocking may result in an impact on non-target plants or eradication of beneficial plants, altering lake habitat. Using grass carp may result in algae blooms and increased turbidity. If precautions are not taken (i.e. inlet and outlet control structures to prevent fish migration) the fish may migrate and have adverse effects on non-target vegetation.

Costs: Costs can range from $50/acre to over $2,000/acre, at stocking rates of 5 fish/acre to 200 fish/acre.

Herbivorous Insects: Non-native and native insect species have been used to control rooted plants. Using herbivorous insects is intended to selectively control target species. These aquatic larvae of moths, beetles, and thrips use specific host aquatic plants. Several non-native species have been imported under USDA approval and used in integrated pest management programs, a combination of biological, chemical, and mechanical controls.

These non-native insects are being used in southern states to control nuisance plant species and appear climate-limited, their northern range being Georgia and North Carolina. While successes have been demonstrated, non-native species have not established themselves for solving biological problems, sometimes creating as many problems as they solve. Therefore, government agencies prefer alternative controls.

Native insects such as the larvae of midgeflies, caddisflies, beetles, and moths may be successful APM controls in northern states. Recently however, the native aquatic weevil *Euhrychiopsis lecontei* has received the most attention. This weevil has been associated with native northern water milfoil. The weevil can switch plant hosts and feed on Eurasian watermilfoil, destroying it's growth points. While the milfoil weevil is gaining popularity, it is still experimental.

Advantages: Herbivorous insects are expected to have no negative effects on non-target species. The insects have shown promise for long term control when used as part of integrated aquatic plant management programs. The milfoil weevils do not use non-milfoil plants as hosts.

Disadvantages: Natural predator prey cycles indicate that incomplete control is likely. An oscillating cycle of control and re-growth is more likely. Fish predation may complicate controls. Large numbers of milfoil weevils may be required for a dense stand and can be expensive. The weevil leaves the water during the winter, may not return to the water in the spring, and are subject to bird predation in their terrestrial habitat. Application is manual and extremely time consuming. Introducing any species, especially non-native ones, into an aquatic ecosystem may have undesirable effects. Therefore, it is extremely important to understand the life cycles of the insects and the host plants.

Costs: Reported costs of herbivorous insects rang from $300/acre to $3,000/acre.

Specifically, the native milfoil weevils cost approximately $1.00 per weevil. It is generally considered appropriate to use 5 to 7 weevils per stem. Dense stands of milfoil may contain 1 to 2 million stems per acre. Therefore, costs of this new technology are currently prohibitive.

Plant Pathogens: Using a plant pathogen to control nuisance aquatic plants has been studied for many years, however, plant pathogens still remain largely experimental. Fungi are the most common pathogens, while bacteria and viruses have also been used. There is potential for highly specific plant applications.

Advantages: Plant pathogens may be highly species specific. They may provide substantial control of a nuisance species.

Disadvantages: Pathogens are experimental. The effectiveness and longevity of control is not well understood. Possible side effects are also unknown.

Costs: These techniques are experimental therefore a supply of specific products and costs are not established.

Native Plants: This method involves removing the nuisance plant species through chemical or physical means and re-introducing seeds, cuttings, or whole plants of desirable species. Success has been variable. When using seeds, they need to be planted early enough to encourage the full growth and subsequent seed production of those plants. Transplanting mature plants may be a better way to establish seed producing populations of desirable aquatics. Recognizing that a healthy, native, desirable plant community may be resistant to infestations of nuisance species, planting native plants should be encouraged as an APM alternative. Non-native plants can not be translocated.

Advantages: This alternative can restore native plant communities. It can be used to supplement other methods and potentially prevent future needs for costly repeat APM treatments.

Disadvantages: While this appears to be a desirable practice, it is experimental at this time and there are not many well documented successes. Nuisance species may eventually again invade the areas of native plantings. Careful planning is required to ensure that the introduced species do not themselves become nuisances. Hand planting aquatic plants is labor intensive.

Costs: Costs can be highly variable depending on the selected native species, numbers of plants ordered, and the nearest dealer location.

Aquatic Plant Prevention

The phrase "an ounce of prevention is worth a pound of cure" certainly holds true for APM. Prevention is the best way to avoid nuisance aquatic plant growth. Prevention of the spread of invasive aquatic plants must also be achieved. Inspecting boats, trailers, and live wells for live aquatic plant material is the best way to prevent nuisance aquatic plants from entering a new aquatic ecosystem. Protecting the desirable native plant communities is also important in maintaining a healthy aquatic ecosystem and preventing the spread of nuisance aquatics once they are present.

Prolific growth of nuisance aquatic plants can be prevented by limiting nutrient (i.e. phosphorus) inputs to the water body. Aeration or phosphorus precipitation can achieve controls of in-lake cycling of phosphorus, however, if there are additional outside sources of nutrients, these methods will be largely ineffective in controlling algae blooms or intense aquatic macrophyte infestations. Watershed management activities to control nutrient laden storm water runoff are critical to controlling excessive nutrient loading to the water bodies. Nutrient loading can be prevented/minimized by the following:

- Shoreline buffers
- Using non-phosphorus fertilizers on lawns
- Settling basins for storm water effluents

Appendix F – NR 107 and NR 109 Wisconsin Administrative Code

Chapter NR 107

AQUATIC PLANT MANAGEMENT

Note: Chapter NR 107 as it existed on February 28, 1989 was repealed and a new Chapter NR 107 was created effective March 1, 1989.

NR 107.01 Purpose. The purpose of this chapter is to establish procedures for the management of aquatic plants and control of other aquatic organisms pursuant to s. 227.11 (2) (a), Stats., and interpreting s. 281.17 (2), Stats. A balanced aquatic plant community is recognized to be a vital and necessary component of a healthy aquatic ecosystem. The department may allow the management of nuisance–causing aquatic plants with chemicals registered and labeled by the U.S. environmental protection agency and labeled and registered by firms licensed as pesticide manufacturers and labelers with the Wisconsin department of agriculture, trade and consumer protection. Chemical management shall be allowed in a manner consistent with sound ecosystem management and shall minimize the loss of ecological values in the water body.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; **correction made under s. 13.93 (2m) (b) 7., Stats., Register, December, 2000, No. 540.**

NR 107.02 Applicability. Any person sponsoring or conducting chemical treatment for the management of aquatic plants or control of other aquatic organisms in waters of the state shall obtain a permit from the department. Waters of the state include those portions of Lake Michigan and Lake Superior, and all lakes, bays, rivers, streams, springs, ponds, wells, impounding reservoirs, marshes, watercourses, drainage systems and other ground or surface water, natural or artificial, public or private, within the state or its jurisdiction as specified in s. 281.01 (18), Stats.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; **correction made under s. 13.93 (2m) (b) 7., Stats., Register, December, 2000, No. 540.**

NR 107.03 Definitions. (1) "Applicator" means the person physically applying the chemicals to the treatment site.

(2) "Chemical fact sheet" means a summary of information on a specific chemical written by the department including general aquatic community and human safety considerations applicable to Wisconsin sites.

(3) "Department" means the department of natural resources.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 107.04 Application for permit. (1) Permit applications shall be made on forms provided by the department and shall be submitted to the district director for the district in which the project is located. Any amendment or revision to an application shall be treated by the department as a new application, except as provided in s. NR 107.04 (3) (g).

Note: The DNR district headquarters are located at:

1. Southern — 3911 Fish Hatchery Road, Fitchburg 53711
2. Southeast — 2300 N. Dr. Martin Luther King Jr. Dr., Box 12436, Milwaukee 53212
3. Lake Michigan — 1125 N. Military Ave., Box 10448, Green Bay 54307
4. North Central — 107 Sutliff Ave., Box 818, Rhinelander 54501
5. Western — 1300 W. Clairemont Ave., Call Box 4001, Eau Claire 54702
6. Northwest — Hwy 70 West, Box 309, Spooner 54801

(2) The application shall be accompanied by:

(a) A nonrefundable permit application fee of $20, and, for proposed treatments larger than 0.25 acres, an additional refundable acreage fee of $25.00 per acre, rounded up to the nearest whole acre, applied to a maximum of 50.0 acres.

1. The acreage fee shall be refunded in whole if the entire permit is denied or if no treatment occurs on any part of the permitted treatment area. Refunds will not be prorated for partial treatments.

2. If the permit is issued with the proposed treatment area partially denied, a refund of acreage fees shall be given for the area denied.

(b) A legal description of the body of water proposed for treatment including township, range and section number;

(c) One copy of a detailed map or sketch of the body of water with the proposed treatment area dimensions clearly shown and with pertinent information necessary to locate those properties, by name of owner, riparian to the treatment area, which may include street address, local telephone number, block, lot and fire number where available. If a local address is not available, the home address and phone number of the property owner may be included;

(d) A description of the uses being impaired by plants or aquatic organisms and reason for treatment;

(e) A description of the plant community or other aquatic organisms causing the use impairment;

(f) The product names of chemicals proposed for use and the method of application;

(g) The name of the person or commercial applicator, and applicator certification number, when required by s. NR 107.08 (5), of the person conducting the treatment;

(h) A comparison of alternative control methods and their feasibility for use on the proposed treatment site.

(3) In addition to the information required under sub. (2), when the proposed treatment is a large–scale treatment exceeding 10.0 acres in size or 10% of the area of the water body that is 10 feet or less in depth, the application shall be accompanied by:

(a) A map showing the size and boundaries of the water body and its watershed.

(b) A map and list identifying known or suspected land use practices contributing to plant–related water quality problems in the watershed.

(c) A summary of conditions contributing to undesirable plant growth on the water body.

(d) A general description of the fish and wildlife uses occurring within the proposed treatment site.

(e) A summary of recreational uses of the proposed treatment site.

(f) Evidence that a public notice of the proposed application has been made, and that a public informational meeting, if required, has been conducted.

1. Notice shall be given in 2 inch x 4 inch advertising format in the newspaper which has the largest circulation in the area affected by the application.

2. The notice shall state the size of the proposed treatment, the approximate treatment dates, and that the public may request within 5 days of the notice that the applicant hold a public informational meeting on the proposed application.

a. The applicant will conduct a public informational meeting in a location near the water body when a combination of 5 or more individuals, organizations, special units of government, or local units of government request the meeting in writing to the applicant

with a copy to the department within 5 days after the notice is made. The person or entity requesting the meeting shall state a specific agenda of topics including problems and alternatives to be discussed.

b. The meeting shall be given a minimum of one week advance notice, both in writing to the requestors, and advertised in the format of subd. 1.

(g) The provisions of pars. (a) to (e) shall be repeated once every 5 years and shall include new information. Annual modifications of the proposed treatment within the 5–year period which do not expand the treatment area more than 10% and cover a similar location and target organisms may be accepted as an amendment to the original application. The acreage fee submitted under sub. (2) (a) shall be adjusted in accordance with any proposed amendments.

(4) The applicant shall certify to the department that a copy of the application has been provided to any affected property owners' association, inland lake district, and, in the case of chemical applications for rooted aquatic plants, to any riparian property owners adjacent to and within the treatment area.

(5) A notice of the proposed treatment shall be provided by the department to any person or organization indicating annually in writing a desire to receive such notification.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 107.05 Issuance of permit. (1) The department shall issue or deny issuance of the requested permit between 10 and 15 working days after receipt of an acceptable application, unless:

(a) An environmental impact report or statement is required under s. 1.11, Stats. Notification to the applicant shall be in writing within 10 working days of receipt of the application and no action may be taken until the report or statement has been completed; or

(b) A public hearing has been granted under s. 227.42, Stats.

(2) If a request for a public hearing is received after the permit is issued but prior to the actual treatment allowed by the permit, the department is not required to, but may, suspend the permit because of the request for public hearing.

(3) The department may deny issuance of the requested permit if:

(a) The proposed chemical is not labeled and registered for the intended use by the United States environmental protection agency and both labeled and registered by a firm licensed as a pesticide manufacturer and labeler with the Wisconsin department of agriculture, trade and consumer protection;

(b) The proposed chemical does not have a current department aquatic chemical fact sheet;

(c) The department determines the proposed treatment will not provide nuisance relief, or will place unreasonable restrictions on existing water uses;

(d) The department determines the proposed treatment will result in a hazard to humans, animals or other nontarget organisms;

(e) The department determines the proposed treatment will result in a significant adverse effect on the body of water;

(f) The proposed chemical application is for waters beyond 150 feet from shore except where approval is given by the department to maintain navigation channels, piers or other facilities used by organizations or the public including commercial facilities;

(g) The proposed chemical applications, other than those conducted by the department pursuant to ss. 29.421 and 29.424, Stats., will significantly injure fish, fish eggs, fish larvae, essential fish food organisms or wildlife, either directly or through habitat destruction;

(h) The proposed chemical application is in a location known to have endangered or threatened species as specified pursuant to s. 29.604, Stats., and as determined by the department;

(i) The proposed chemical application is in locations identified by the department as sensitive areas, except when the applicant demonstrates to the satisfaction of the department that treatments can be conducted in a manner that will not alter the ecological character or reduce the ecological value of the area.

1. Sensitive areas are 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.

2. The department shall notify any affected property owners' association, inland lake district, and riparian property owner of locations identified as sensitive areas.

(4) New applications will be reviewed with consideration given to the cumulative effect of applications already approved for the body of water.

(5) The department may approve the application in whole or in part consistent with the provisions of subs. (3) (a) through (i) and (4). Denials shall be in writing stating reasons for the denial.

(6) Permits may be issued for one treatment season only.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; **corrections in (3) (g) and (h) made under s. 13.93 (2m) (b) 7., Stats., Register, December, 2000, No. 540.**

NR 107.06 Chemical fact sheets. (1) The department shall develop a chemical fact sheet for each of the chemicals in present use for aquatic nuisance control in Wisconsin.

(1m) Chemical fact sheets for chemicals not previously used in Wisconsin shall be developed within 180 days after the department has received notice of intended use of the chemical.

(2) The applicant or permit holder shall provide copies of the applicable chemical fact sheets to any affected property owners' association and inland lake district.

(3) The department shall make chemical fact sheets available upon request.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 107.07 Supervision. (1) The permit holder shall notify the district office 4 working days in advance of each anticipated treatment with the date, time, location, and proposed size of treatment. At the discretion of the department, the advance notification requirement may be waived.

(2) Supervision by a department representative may be required for any aquatic nuisance control project involving chemicals. Supervision may include inspection of the proposed treatment area, chemicals, and application equipment before, during or after treatment. The inspection may result in the determination that treatment is unnecessary or unwarranted in all or part of the proposed area, or that the equipment will not control the proper dosage.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 107.08 Conditions of the permit. (1) The department may stop or limit the application of chemicals to a body of water if at any time it determines that chemical treatment will be ineffective, or will result in unreasonable restrictions on current water uses, or will produce unnecessary adverse side effects on nontarget organisms. Upon request, the department shall state the reason for such action in writing to the applicant.

(2) Chemical treatments shall be performed in accordance with label directions, existing pesticide use laws, and permit conditions.

(3) Chemical applications on lakes and impoundments are limited to waters along developed shoreline including public parks except where approval is given by the department for projects of public benefit.

(4) Treatment of areas containing high value species of aquatic plants shall be done in a manner which will not result in adverse long–term or permanent changes to a plant community in a specific aquatic ecosystem. High value species are individual species of aquatic plants known to offer important values in spe-

cific aquatic ecosystems, including *Potamogeton amplifolius, Potamogeton Richardsonii, Potamogeton praelongus, Potamogeton pectinatus, Potamogeton illinoensis, Potamogeton robbinsii, Eleocharis spp., Scirpus spp., Valisneria spp., Zizania aquatica, Zannichellia palustris* and *Brasenia schreberi.*

(5) Treatment shall be performed by an applicator currently certified by the Wisconsin department of agriculture, trade and consumer protection in the aquatic nuisance control category whenever:

(a) Treatment is to be performed for compensation by an applicator acting as an independent contractor for hire;

(b) The area to be treated is greater than 0.25 acres;

(c) The product to be used is classified as a "restricted use pesticide"; or

(d) Liquid chemicals are to be used.

(6) Power equipment used to apply liquid chemicals shall include the following:

(a) Containers used to mix and hold chemicals shall be constructed of watertight materials and be of sufficient size and strength to safely contain the chemical. Measuring containers and scales for the purpose of measuring solids and liquids shall be provided by the applicator;

(b) Suction hose used to deliver the chemical to the pump venturi assembly shall be fitted with an on–off ball–type valve. The system shall also be designed to prevent clogging from chemicals and aquatic vegetation;

(c) Suction hose used to deliver surface water to the pump shall be fitted with a check valve to prevent back siphoning into the surface water should the pump stop;

(d) Suction hose used to deliver a premixed solution shall be fitted with an on–off ball–type valve to regulate the discharge rate;

(e) Pressure hose used to discharge chemicals to the surface water shall be provided with an on–off ball–type valve. This valve will be fitted at the base of the hose nozzle or as part of the nozzle assembly;

(f) All pressure and suction hoses and mechanical fittings shall be watertight;

(g) Equipment shall be calibrated by the applicator. Evidence of calibration shall be provided at the request of the department supervisor.

(h) Other equipment designs may be acceptable if capable of equivalent performance.

(7) The permit holder shall be responsible for posting those areas of use in accordance with water use restrictions stated on the chemical label, but in all cases for a minimum of one day, and with the following conditions:

(a) Posting signs shall be brilliant yellow and conspicuous to the nonriparian public intending to use the treated water from both the water and shore, and shall state applicable label water use restrictions of the chemical being used, the name of the chemical and date of treatment. For tank mixes, the label requirements of the most restrictive chemical will be posted;

(b) Minimum sign dimensions used for posting shall be 11 inches by 11 inches or consistent with s. ATCP 29.15. The department will provide up to 6 signs to meet posting requirements. Additional signs may be purchased from the department;

(c) Signs shall be posted at the beginning of each treatment by the permit holder or representing agent. Posting prior to treatment may be required as a permit condition when the department determines that such posting is in the best interest of the public;

(d) Posting signs shall be placed along contiguous treated shoreline and at strategic locations to adequately inform the public. Posting of untreated shoreline located adjacent to treated shoreline and noncontiguous shoreline shall be at the discretion of the department;

(e) Posting signs shall be made of durable material to remain up and legible for the time period stated on the pesticide label for water use restrictions, after which the permit holder or representing agent is responsible for sign removal.

(8) After conducting a treatment, the permit holder shall complete and submit within 30 days an aquatic nuisance control report on a form supplied by the department. Required information will include the quantity and type of chemical, and the specific size and location of each treatment area. In the event of any unusual circumstances associated with a treatment, or at the request of the department, the report shall be provided immediately. If treatment did not occur, the form shall be submitted with appropriate comment by October 1.

(9) Failure to comply with the conditions of the permit may result in cancellation of the permit and loss of permit privileges for the subsequent treatment season. A notice of cancellation or loss of permit privileges shall be provided by the department to the permit holder accompanied by a statement of appeal rights.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89**;** correction in (7) (b) made under s. 13.93 (2m) (b) 7., Stats., Register, September, 1995, No. 477.

NR 107.09 Special limitation. Due to the significant risk of environmental damage from copper accumulation in sediments, swimmer's itch treatments performed with copper sulfate products at a rate greater than 10 pounds of copper sulfate per acre are prohibited.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 107.10 Field evaluation use permits. When a chemical product is considered for aquatic nuisance control and does not have a federal label for such use, the applicant shall apply to the administrator of the United States environmental protection agency for an experimental use permit under section 5 of the federal insecticide, fungicide and rodenticide act as amended (7 USC 136 et seq.). Upon receiving a permit, the permit holder shall obtain a field evaluation use permit from the department and be subject to the requirements of this chapter. Department field evaluation use permits shall be issued for the purpose of evaluating product effectiveness and safety under field conditions and will require in addition to the conditions of the permit specified in s. NR 107.08 (1) through (9), the following:

(1) Treatment shall be limited to an area specified by the department.

(2) The permit holder shall submit to the department a summary of treatment results at the end of the treatment season. The summary shall include:

(a) Total chemical used and distribution pattern, including chemical trade name, formulation, percent active ingredient, and dosage rate in the treated water in parts per million of active ingredient;

(b) Description of treatment areas including the character and the extent of the nuisance present;

(c) Effectiveness of the application and when applicable, a summary comparison of the results obtained from past experiments using the same chemical formulation;

(d) Other pertinent information required by the department; and

(e) Conclusions and recommendations for future use.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89.

NR 107.11 Exemptions. (1) Under any of the following conditions, the permit application fee in s. NR 107.04 (2) (a) will be limited to the basic application fee:

(a) The treatment is made for the control of bacteria on swimming beaches with chlorine or chlorinated lime;

(b) The treatment is intended to control algae or other aquatic nuisances that interfere with the use of the water for potable purposes;

(c) The treatment is necessary for the protection of public health, such as the control of disease carrying organisms in sanitary sewers, storm sewers, or marshes, and the treatment is sponsored by a governmental agency.

(2) The treatment of purple loosestrife is exempt from ss. NR 107.04 (2) (a) and (3), and 107.08 (5).

(3) The use of chemicals in private ponds is exempt from the provisions of this chapter except for ss. NR 107.04 (1), (2), (4) and (5), 107.05, 107.07, 107.08 (1), (2), (8) and (9), and 107.10.

(a) A private pond is a body of water located entirely on the land of an applicant, with no surface water discharge or a discharge that can be controlled to prevent chemical loss, and without access by the public.

(b) The permit application fee will be limited to the non–refundable $20 application fee.

(4) The use of chemicals in accordance with label instructions is exempt from the provisions of this chapter, when used in:

(a) Water tanks used for potable water supplies;

(b) Swimming pools;

(c) Treatment of public or private wells;

(d) Private fish hatcheries licensed under s. 95.60, Stats.;

(e) Treatment of emergent vegetation in drainage ditches or rights–of–way where the department determines that fish and wildlife resources are insignificant; or

(f) Waste treatment facilities which have received s. 281.41, Stats., plan approval or are utilized to meet effluent limitations set forth in permits issued under s. 283.31, Stats.

History: Cr. Register, February, 1989, No. 398, eff. 3–1–89; **corrections in (4) (d) and (f) made under s. 13.93 (2m) (b) 7., Stats., Register, December, 2000, No. 540.**

Chapter NR 109

AQUATIC PLANTS: INTRODUCTION, MANUAL REMOVAL and MECHANICAL CONTROL REGULATIONS

NR 109.01 Purpose. The purpose of this chapter is to establish procedures and requirements for the protection and regulation of aquatic plants pursuant to ss. 23.24 and 30.715, Stats. Diverse and stable communities of native aquatic plants are recognized to be a vital and necessary component of a healthy aquatic ecosystem. This chapter establishes procedures and requirements for issuing aquatic plant management permits for introduction of aquatic plants or control of aquatic plants by manual removal, burning, use of mechanical means or plant inhibitors. This chapter identifies other permits issued by the department for aquatic plant management that contain the appropriate conditions as required under this chapter for aquatic plant management, and for which no separate permit is required under this chapter**.** Introduction and control of aquatic plants shall be allowed in a manner consistent with sound ecosystem management, shall consider cumulative impacts, and shall minimize the loss of ecological values in the body of water. The purpose of this chapter is also to prevent the spread of invasive and non–native aquatic organisms by prohibiting the launching of watercraft or equipment that has any aquatic plants or zebra mussels attached.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03.

NR 109.02 Applicability. A person sponsoring or conducting manual removal, burning or using mechanical means or aquatic plant inhibitors to control aquatic plants in navigable waters, or introducing non–native aquatic plants to waters of this state shall obtain an aquatic plant management permit from the department under this chapter.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03.

NR 109.03 Definitions. In this chapter:

(1) "Aquatic community" means lake or river biological resources.

(2) "Beneficial water use activities" mean angling, boating, swimming or other navigational or recreational water use activity.

(3) "Body of water" means any lake, river or wetland that is a water of this state.

(4) "Complete application" means a completed and signed application form, the information specified in s. NR 109.04 and any other information which may reasonably be required from an applicant and which the department needs to make a decision under applicable provisions of law.

(5) "Department" means the Wisconsin department of natural resources.

(6) "Manual removal" means the control of aquatic plants by hand or hand–held devices without the use or aid of external or auxiliary power.

(7) "Navigable waters" means those waters defined as navigable under s. 30.10, Stats.

(8) "Permit" means aquatic plant management permit.

(9) "Plan" means aquatic plant management plan.

(10) "Wetlands" means an area where water is at, near or above the land surface long enough to be capable of supporting aquatic or hydrophytic vegetation and which has soils indicative of wet conditions.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03.

NR 109.04 Application requirements and fees. **(1)** Permit applications shall be made on forms provided by the department and shall be submitted to the regional director or designee for the region in which the project is located. Permit applications for licensed aquatic nursery growers may be submitted to the department of agriculture, trade and consumer protection.

Note: Applications may be obtained from the department's regional headquarters or service centers. DATCP has agreed to send application forms and instructions provided by the department to aquatic nursery growers along with license renewal forms. DATCP will forward all applications to the department for processing.

(2) The application shall be accompanied by all of the following unless the application is made by licensed aquatic nursery growers for selective harvesting of aquatic plants for nursery stock. Applications made by licensed aquatic nursery growers for harvest of nursery stock do not have to include the information required by par. (d), (e), (h), (i) or (j).

(a) A nonrefundable application fee. The application fee for an aquatic plant management permit is:

1. $30 for a proposed project to manage aquatic plants on less than one acre.

2. $30 per acre to a maximum of $300 for a proposed project to manage aquatic plants on one acre or larger. Partial acres shall be rounded up to the next full acre for fee determination. An annual renewal of this permit may be requested with an additional application fee of one–half the original application fee, but not less than $30.

(b) A legal description of the body of water including township, range and section number.

(c) One copy of a detailed map of the body of water with the proposed introduction or control area dimensions clearly shown. Private individuals doing plant introduction or control shall provide the name of the owner riparian to the management area, which includes the street address or block, lot and fire number where available and local telephone number or other pertinent information necessary to locate the property.

(d) One copy of any existing aquatic management plan for the body of water, or detailed reference to the plan, citing the plan references to the proposed introduction or control area, and a description of how the proposed introduction or control of aquatic plants is compatible with any existing plan.

(e) A description of the impairments to water use caused by the aquatic plants to be managed.

(f) A description of the aquatic plants to be controlled or removed.

(g) The type of equipment and methods to be used for introduction, control or removal.

(h) A description of other introduction or control methods considered and the justification for the method selected.

(i) A description of any other method being used or intended for use for plant management by the applicant or on the area abutting the proposed management area.

(j) The area used for removal, reuse or disposal of aquatic plants.

(k) The name of any person or commercial provider of control or removal services.

(3) (a) The department may require that an application for an aquatic plant management permit contain an aquatic plant management plan that describes how the aquatic plants will be introduced, controlled, removed or disposed. Requirements for an aquatic plant management plan shall be made in writing stating the reason for the plan requirement. In deciding whether to require a plan, the department shall consider the potential for effects on protection and development of diverse and stable communities of native aquatic plants, for conflict with goals of other written ecological or lake management plans, for cumulative impacts and effect on the ecological values in the body of water, and the long–term sustainability of beneficial water use activities.

(b) Within 30 days of receipt of the plan, the department shall notify the applicant of any additional information or modifications to the plan that are required. If the applicant does not submit the additional information or modify the plan as requested by the department, the department may dismiss the aquatic plant management permit application.

(c) The department shall approve the aquatic plant management plan before an application may be considered complete.

(4) The permit sponsor may request an annual renewal in writing from the department under s. NR 109.05 if there is no change proposed in the conditions of the original permit issued.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03.

NR 109.05 Permit issuance. (1) The department shall issue or deny issuance of the requested permit within 15 working days after receipt of a completed application and approved plan as required under s. NR 109.04 (3).

(2) The department may specify any of the following as conditions of the permit:

(a) The quantity of aquatic plants that may be introduced or controlled.

(b) The species of aquatic plants that may be introduced or controlled.

(c) The areas in which aquatic plants may be introduced or controlled.

(d) The methods that may be used to introduce or control aquatic plants.

(e) The times during which aquatic plants may be introduced or controlled.

(f) The allowable methods used for disposing of or using aquatic plants that are removed or controlled.

(g) Annual or other reporting requirements to the department that may include information related to pars. (a) to (f).

(3) The department may deny issuance of the requested permit if the department determines any of the following:

(a) Aquatic plants are not causing significant impairment of beneficial water use activities.

(b) The proposed introduction or control will not remedy the water use impairments caused by aquatic plants as identified as a part of the application in s. NR 109.04 (2) (e).

(c) The proposed introduction or control will result in a hazard to humans.

(d) The proposed introduction or control will cause significant adverse impacts to threatened or endangered resources.

(e) The proposed introduction or control will result in a significant adverse effect on water quality, aquatic habitat or the aquatic community including the native aquatic plant community.

(f) The proposed introduction or control is in locations identified by the department as sensitive areas, under s. NR 107.05 (3) (i) 1., except when the applicant demonstrates to the satisfaction of the department that the project can be conducted in a manner that will not alter the ecological character or reduce the ecological value of the area.

(g) The proposed management will result in significant adverse long–term or permanent changes to a plant community or a high value species in a specific aquatic ecosystem. High value species are individual species of aquatic plants known to offer important values in specific aquatic ecosystems, including Potamogeton amplifolius, Potamogeton Richardsonii, Potamogeton praelongus, Stuckenia pectinata (Potamogeton pectinatus), Potamogeton illinoensis, Potamogeton robbinsii, Eleocharis spp., Scirpus spp., Valisneria spp., Zizania spp., Zannichellia palustris and Brasenia schreberi.

(h) If wild rice is involved, the stipulations incorporated by *Lac Courte Oreilles v. Wisconsin*, 775 F. Supp. 321 (W.D. Wis. 1991) shall be complied with.

(i) The proposed introduction or control will interfere with the rights of riparian owners.

(j) The proposed management is inconsistent with a department approved aquatic plant management plan for the body of water.

(4) The department may approve the application in whole or in part consistent with the provisions of sub. (3). A denial shall be in writing stating the reasons for the denial.

(5) (a) The department may issue an aquatic plant management permit on less than one acre in a single riparian area for a 3–year term.

(b) The department may issue an aquatic plant management permit for a one–year term for more than one acre or more than one riparian area. The permit may be renewed annually for up to a total of 3 years in succession at the written request of the permit holder, provided no modifications or changes are made from the original permit.

(c) The department may issue an aquatic plant management permit containing a department–approved plan for a 3 to 5 year term.

(d) The department may issue an aquatic plant management permit to a licensed nursery grower for a 3–year term for the harvesting of aquatic plants from a publicly owned lake bed or for a 5–year term for harvesting of aquatic plants from privately owned beds with the permission of the property owner.

(6) The approval of an aquatic plant management permit does not represent an endorsement of the permitted activity, but represents that the applicant has complied with all criteria of this chapter.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03**; reprinted to restore dropped language from rule order, Register October 2003 No. 574.**

NR 109.06 Waivers. The department waives the permit requirements under this chapter for any of the following:

(1) Manual removal or use of mechanical devices to control or remove aquatic plants from a body of water 10 acres or less that is entirely confined on the property of one person with the permission of that property owner.

Note: A person who introduces native aquatic plants or removes aquatic plants by manual or mechanical means in the course of operating an aquatic nursery as authorized under s. 94.10, Stats., on privately owned non–navigable waters of the state is not required to obtain a permit for the activities.

(2) A riparian owner who manually removes aquatic plants from a body of water or uses mechanical devices designed for cutting or mowing vegetation to control plants on an exposed lake bed that abuts the owner's property provided that the removal meets all of the following:

(a) 1. Removal of native plants is limited to a single area with a maximum width of no more than 30 feet measured 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; or

2. Removal of nonnative or invasive aquatic plants as designated under s. NR 109.07 when performed in a manner that does not harm the native aquatic plant community; or

3. Removal of dislodged aquatic plants that drift on–shore and accumulate along the waterfront.

(b) Is not located in a sensitive area as defined by the department under s. NR 107.05 (3) (i) 1., or in an area known to contain threatened or endangered resources or floating bogs.

(c) Does not interfere with the rights of other riparian owners.

(d) If wild rice is involved, the procedures of s. NR 19.09 (1) shall be followed.

(4) Control of purple loosestrife by manual removal or use of mechanical devices when performed in a manner that does not harm the native aquatic plant community or result in or encourage re–growth of purple loosestrife or other nonnative vegetation.

(5) Any aquatic plant management activity that is conducted by the department and is consistent with the purposes of this chapter.

(6) Manual removal and collection of native aquatic plants for lake study or scientific research when performed in a manner that does not harm the native aquatic plant community.

Note: Scientific collectors permit requirements are still applicable.

(7) Incidental cutting, removal or destroying of aquatic plants when engaged in beneficial water use activities.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03.

NR 109.07 Invasive and nonnative aquatic plants. (1) The department may designate any aquatic plant as an invasive aquatic plant for a water body or a group of water bodies if it has the ability to cause significant adverse change to desirable aquatic habitat, to significantly displace desirable aquatic vegetation, or to reduce the yield of products produced by aquaculture.

(2) The following aquatic plants are designated as invasive aquatic plants statewide: Eurasian water milfoil, curly leaf pondweed and purple loosestrife.

(3) Native and nonnative aquatic plants of Wisconsin shall be determined by using scientifically valid publications and findings by the department.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03.

NR 109.08 Prohibitions. (1) No person may distribute an invasive aquatic plant, under s. NR 109.07.

(2) No person may intentionally introduce Eurasian water milfoil, curly leaf pondweed or purple loosestrife into waters of this state without the permission of the department.

(3) No person may intentionally cut aquatic plants in public/navigable waters without removing cut vegetation from the body of water.

(4) (a) No person may place equipment used in aquatic plant management in a navigable water if the person has reason to believe that the equipment has any aquatic plants or zebra mussels attached.

(b) This subsection does not apply to equipment used in aquatic plant management when re–launched on the same body of water without having visited different waters, provided the re–launching will not introduce or encourage the spread of existing aquatic species within that body of water.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03.

NR 109.09 Plan specifications and approval. (1) Applicants required to submit an aquatic plant management plan, under s. NR 109.04 (3), shall develop and submit the plan in a format specified by the department.

(2) The plan shall present and discuss each of the following items:

(a) The goals and objectives of the aquatic plant management and protection activities.

(b) A physical, chemical and biological description of the waterbody.

(c) The intensity of water use.

(d) The location of aquatic plant management activities.

(e) An evaluation of chemical, mechanical, biological and physical aquatic plant control methods.

(f) Recommendations for an integrated aquatic plant management strategy utilizing some or all of the methods evaluated in par. (e).

(g) An education and information strategy.

(h) A strategy for evaluating the efficacy and environmental impacts of the aquatic plant management activities.

(i) The involvement of local units of government and any lake organizations in the development of the plan.

(3) The approval of an aquatic plant management plan does not represent an endorsement for plant management, but represents that adequate considerations in planning the actions have been made.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03.

NR 109.10 Other permits. Permits issued under s. 30.12, 30.20, 31.02 or 281.36, Stats., or under ch. NR 107 may contain provisions which provide for aquatic plant management. If a permit issued under one of these authorities contains the appropriate conditions as required under this chapter for aquatic plant management, a separate permit is not required under this chapter. The permit shall explicitly state that it is intended to comply with the substantive requirements of this chapter.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03.

NR 109.11 Enforcement. (1) Violations of this chapter may be prosecuted by the department under chs. 23, 30 and 31, Stats.

(2) Failure to comply with the conditions of a permit issued under or in accordance with this chapter may result in cancellation of the permit and loss of permit privileges for the subsequent year. Notice of cancellation or loss of permit privileges shall be provided by the department to the permit holder.

History: CR 02–061: cr. Register May 2003 No. 569, eff. 6–1–03.

Appendix G – Resource for Additional Information

Online References for More Information

General Information

http://www.dnr.state.wi.us/org/water/fhp/lakes/aquaplan.htm
Wisconsin Department of Natural Resources - Aquatic Plant Management

http://www.uwsp.edu/cnr/uwexlakes/ecology/APMguide.asp
UW Extension Lakes Program – Aquatic Plant Management in Wisconsin

http://www.wisconsinlakes.org/
Wisconsin Association of Lakes

http://www.uwsp.edu/cnr/uwexlakes/
UW Extension Lakes Program – Homepage

http://datcp.state.wi.us/index.jsp
Wisconsin Department of Agriculture, Trade and Consumer Protection

http://el.erdc.usace.army.mil/aqua/
Army Corps of Engineers – Aquatic Plant Control Research Program

http://www.nalms.org/
North American Lake Management Society

http://www.apms.org/
Aquatic Plant Management Society

http://www.fapms.org/
Florida Aquatic Plant Management Society

http://www.mapms.org/
Midwest Aquatic Plant Management Society

http://www.epa.gov/
Environmental Protection Agency

http://web.fisheries.org/main/
American Fisheries Society

http://www.botany.wisc.edu/herbarium/
Wisconsin State Herbarium – Aquatic Plant Indenfication

http://www.uwsp.edu/cnr/uwexlakes/CBCW/default.asp
UW Extension Lakes Program – Clean Boats Clean Waters

Aquatic Invasive Species

http://www.dnr.state.wi.us/invasives/aquatic/
Wisconsin Department of Natural Resources – Aquatic Invasive Species

http://www.uwex.edu/erc/invasives.html
UW Extension- Environmental Resources Center

http://www.ipaw.org/
Invasive Plants Association of Wisconsin

http://www.seagrant.wisc.edu/ais/
University of Wisconsin Sea Grant Institute– Aquatic Invasive Species

http://www.anstaskforce.gov/default.php
Aquatic Nuisance Species Task Force

http://www.invasivespeciesinfo.gov/aquatics/databases.shtml
United States Department of Agriculture – Invasive Species Information Center

http://aquat1.ifas.ufl.edu/welcome.html
University of Florida - Center for Aquatic and Invasive Plants

Grants

http://www.dnr.state.wi.us/org/caer/cfa/Grants/Lakes/Largelake.html
Lake Management Planning – Large Scale Grants

http://www.dnr.state.wi.us/org/caer/cfa/Grants/Lakes/smalllake.html
Lake Management Planning – Small Scale Grants

http://www.dnr.state.wi.us/org/caer/cfa/Grants/Lakes/invasivespecies.html
Aquatic Invasive Species

http://www.dnr.state.wi.us/org/caer/cfa/Grants/Lakes/lakeprotection.html
Lake Protection and Classification Grants

http://www.dnr.state.wi.us/org/caer/cfa/Grants/recboat.html
Recreation Boating Facilities

http://www.dnr.state.wi.us/org/caer/cfa/Grants/Rivers/riverplanning.html
River Protection Planning

http://www.dnr.state.wi.us/org/caer/cfa/Grants/Rivers/riverprotection.html
River Protection Management

Appendix H – Aquatic Plant Management Strategy

AQUATIC PLANT MANAGEMENT STRATEGY

Northern Region WDNR
Summer, 2007
(working draft)

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR

ISSUES

- Protect desirable native aquatic plants.
- Reduce the risk that invasive species replace desirable native aquatic plants.
- Promote "whole lake" management plans
- Limit the number of permits to control native aquatic plants.

BACKGROUND

As a general rule, the Northern Region has historically taken a protective approach to allow removal of native aquatic plants by harvesting or by chemical herbicide treatment. This approach has prevented lakes in the Northern Wisconsin from large-scale loss of native aquatic plants that represent naturally occurring high quality vegetation. Naturally occurring native plants provide a *diversity of habitat* that *helps maintain water quality*, helps *sustain the fishing* quality known for Northern Wisconsin, supports common lakeshore wildlife from loons to frogs, and helps to provide the *aesthetics* that collectively create the "up-north" appeal of the northwoods lake resources.

In Northern Wisconsin lakes, an inventory of aquatic plants may often find 30 different species or more, whereas a similar survey of a Southern Wisconsin lake may often discover less than half that many species. Historically, similar species diversity was present in Southern Wisconsin, but has been lost gradually over time from stresses brought on by cultural land use changes (such as increased development, and intensive agriculture). Another point to note is that while there may be a greater variety of aquatic vegetation in Northern Wisconsin lakes, the vegetation itself is often *less dense*. This is because northern lakes have not suffered as greatly from nutrients and runoff as have many waters in Southern Wisconsin.

The newest threat to native plants in Northern Wisconsin is from invasive species of aquatic plants. The most common include Eurasian Water Milfoil (EWM) and CurlyLeaf Pondweed (CLP). These species are described as *opportunistic invaders*. This means that these "invaders" benefit where an opening occurs from removal of plants, and without competition from other plants may successfully become established in a lake. Removal of native vegetation not only diminishes the natural qualities of a lake, it *may increase the risk that an invasive species can successfully invade onto the site where native plants have been removed*. There it may more easily establish itself without the native plants to compete against. This concept is easily observed on land where bared soil is quickly taken over by replacement species (often weeds) that crowd in and establish themselves as new occupants of the site. While not a providing a certain guarantee against invasive plants, protecting and allowing the native plants to remain may reduce the success of an invasive species becoming established on a lake. Once established, the invasive species cause far more inconvenience for all lake users, riparian and others included; can change many of the natural features of a lake; and often lead to *expensive annual control plans*. Native vegetation may cause localized concerns to some users, but as a natural feature of lakes, they generally do not cause harm.

To the extent we can maintain the normal growth of native vegetation, Northern Wisconsin lakes can continue to offer the water resource appeal and benefits they've historically provided. A regional position on removal of aquatic plants that carefully recognizes how native aquatic plants benefit lakes in Northern Region can help prevent a gradual decline in the overall quality and recreational benefits that make these lakes attractive to people and still provide abundant fish, wildlife, and northwoods appeal.

GOALS OF STRATEGY:

1. Preserve native species diversity which, in turn, fosters natural habitat for fish and other aquatic species, from frogs to birds.
2. Prevent openings for invasive species to become established in the absence of the native species.
3. Concentrate on a" whole-lake approach" for control of aquatic plants, thereby fostering systematic documentation of conditions and specific targeting of invasive species as they exist.
4. Prohibit removal of wild rice. WDNR – Northern Region will not issue permits to remove wild rice unless a request is subjected to the full consultation process via the Voigt Tribal Task Force. We intend to discourage applications for removal of this ecologically and culturally important native plant.
5. To be consistent with our WDNR Water Division Goals (work reduction/disinvestment), established in 2005, to "not issue permits for chemical or large scale mechanical control of native aquatic plants – develop general permits as appropriate or inform applicants of exempted activities." This process is similar to work done in other WDNR Regions, although not formalized as such.

BASIS OF STRATEGY IN STATE STATUTE AND ADMINISTRATIVE CODE

State Statute 23.24 (2)(c) states:

"The requirements promulgated under par. (a) 4. may specify any of the following:

1. The **quantity** of aquatic plants that may be managed under an aquatic plant management permit.
2. The **species** of aquatic plants that may be managed under an aquatic plant management permit.
3. The **areas** in which aquatic plants may be managed under an aquatic plant management permit.
4. The **methods** that may be used to manage aquatic plants under an aquatic plant management permit.
5. The **times** during which aquatic plants may be managed under an aquatic plant management permit.
6. The **allowable methods** for disposing or using aquatic

plants that are removed or controlled under an aquatic plant management permit.

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

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

Wisconsin Administrative Code NR 109.04(3)(a) states:
“The department may require that an application for an aquatic plant management permit contain an aquatic plant management plan that describes how the aquatic plants will be introduced, controlled, removed or disposed. Requirements for an aquatic plant management plan shall be made in writing stating the reason for the plan requirement. In deciding whether to require a plan, the department shall consider the potential for effects on protection and development of diverse and stable communities of native aquatic plants, for conflict with goals of other written ecological or lake management plans, for cumulative impacts and effect on the ecological values in the body of water, and the long-term sustainability of beneficial water use activities.”

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR

APPROACH

1. After January 1, 2009* no individual permits for control of native aquatic plants will be issued. Treatment of native species may be allowed under the auspices of an approved lake management plan, and only if the plan clearly documents "impairment of navigation" and/or "nuisance conditions". Until January 1, 2009, individual permits will be issued to previous permit holders, only with adequate documentation of "impairment of navigation" and/or "nuisance conditions". No new individual permits will be issued during the interim.

2. Control of aquatic plants (if allowed) in documented sensitive areas will follow the conditions specified in the report.

3. Invasive species must be controlled under an approved lake management plan, with two exceptions (these exceptions are designed to allow sufficient time for lake associations to form and subsequently submit an approved lake management plan):
   a. Newly-discovered infestations. If found on a lake with an approved lake management plan, the invasive species can be controlled via an amendment to the approved plan. If found on a lake without an approved management plan, the invasive species can be controlled under the WDNR's Rapid Response protocol (see definition), and the lake owners will be encouraged to form a lake association and subsequently submit a lake management plan for WNDR review and approval.
   b. Individuals holding past permits for control of *invasive* aquatic plants and/or "mixed stands" of native and invasive species will be allowed to treat via individual permit until January 1, 2009 if "impairment of navigation" and/or "nuisance conditions" is adequately documented, unless there is an approved lake management plan for the lake in question.

4. Control of invasive species or "mixed stands" of invasive and native plants will follow current best management practices approved by the Department and contain an explanation of the strategy to be used. Established stands of invasive plants will generally use a control strategy based on Spring treatment. (typically, a water temperature of less than 60 degrees Fahrenheit, or approximately May 31st, annually).

5. Manual removal (see attached definition) is allowed (Admin. Code NR 109.06).

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* *Exceptions to the Jan. 1, 2009 deadline will be considered only on a very limited basis and will be intended to address unique situations that do not fall within the intent of this approach.*

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR

DOCUMENTATION OF IMPAIRED NAVIGATION AND/OR NUISANCE CONDITIONS

Navigation channels can be of two types:

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

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

Severe impairment or nuisance will generally mean vegetation grows thickly and forms mats on the water surface. Before issuance of a permit to use a regulated control method, a riparian will be asked to document the problem and show what efforts or adaptations have been made to use the site. (This is currently required in NR 107 and on the application form, but the following helps provide a specific description of what impairments exist from native plants).

Documentation of *impairment of navigation* by native plants must include:

a. Specific locations of navigation routes (preferably with GPS coordinates)
b. Specific dimensions in length, width, and depth
c. Specific times when plants cause the problem and how long the problem persists
d. Adaptations or alternatives that have been considered by the lake shore user to avoid or lessen the problem
e. The species of plant or plants creating the nuisance (documented with samples or a from a Site inspection)

Documentation of the *nuisance* must include:

a. Specific periods of time when plants cause the problem, e.g. when does the problem start and when does it go away.
b. Photos of the nuisance are encouraged to help show what uses are limited and to show the severity of the problem.
c. Examples of specific activities that would normally be done where native plants occur naturally on a site but can not occur because native plants have become a nuisance.

AQUATIC PLANT MANAGEMENT STRATEGY
Northern Region WDNR

DEFINITIONS

Manual removal:	Removal by hand or hand-held devices without the use or aid of external or auxiliary power. Manual removal cannot exceed 30 ft. in width and can only be done where the shore is being used for a dock or swim raft. The 30 ft. wide removal zone cannot be moved, relocated, or expanded with the intent to gradually increase the area of plants removed. Wild rice may not be removed under this waiver.
Native aquatic plants:	Aquatic plants that are indigenous to the waters of this state.
Invasive aquatic plants:	Non-indigenous species whose introduction causes or is likely to cause economic or environmental harm or harm to human health.
Sensitive area:	Defined under s. NR 107.05(3)(i) (sensitive areas are 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).
Rapid Response protocol:	This is an internal WDNR document designed to provide guidance for grants awarded under NR 198.30 (Early Detection and Rapid Response Projects). These projects are intended to control pioneer infestations of aquatic invasive species before they become established.