AMENDMENT 3
Aquatic Plant Management Plan, Lake Mendota, Lower Rock River Basin, Dane County Wisconsin

Approved by the Wisconsin Department of Natural Resources on 2/22/2024

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Introduction

This is the third amendment to the Aquatic Plant Management Plan, Lake Mendota, Lower Rock River Basin, Dane County Wisconsin, published in January 2007 by the Dane County Office of Lakes and Watersheds. The Wisconsin Department of Natural Resources approved the 2007 plan on March 17, 2007 and the Dane County Lakes and Watershed Commission approved the plan on April 12, 2007. The first amendment to the 2007 plan was approved by the Wisconsin Department of Natural Resources on March 27, 2014 and by the Dane County Lakes and Watershed Commission on April 10, 2014. The second amendment to this plan was in 2018. Aquatic Plant Management Plans are required under NR 109.04(d), Wisconsin Administrative Code, to guide mechanical harvesting activities and the effective management of aquatic plants in water bodies.

This plan is prepared in support of Dane County's permit for its mechanical aquatic plant harvesting program, operated in accordance with NR 109 Wisconsin Administrative Code. Individuals and groups that propose herbicide treatments of aquatic plants in Dane County waters would need to go through a separate planning and permitting process with the Wisconsin Department of Natural Resources.

Recent Plant Survey Methods and Results

Wisconsin Lake & Ponds Resource LLC conducted the aquatic plant survey of Lake Mendota on July 21, 24, Aug 3, and Aug 4, 2023, using current Wisconsin DNR approved protocols and the point intercept method. Refer to the point intercept maps in the 2007 plan for the sampling locations for the Mendota surveys. As part of the Mendota survey, the area also included the upper portion of the lake/Yahara River from Skipper Buds to the mouth which was the first time in the planning this area was surveyed.

Table 1 below indicates species present during the 2023 survey for Lake Mendota, and Figure 1 indicates species richness from 1989-2023 for Lake Mendota.

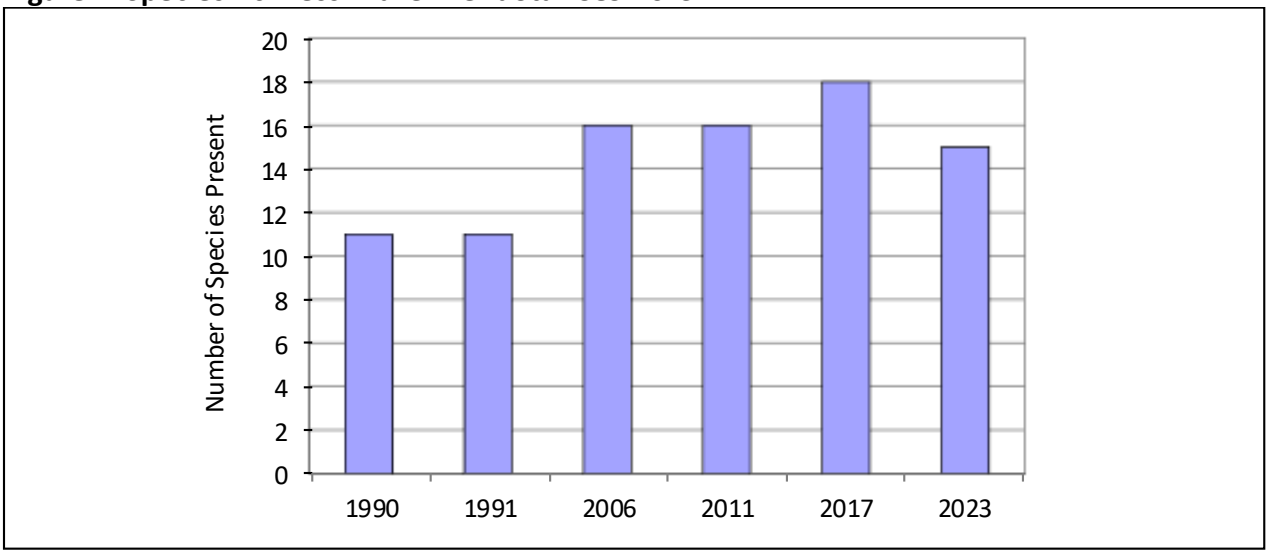
Species richness is a count of the total number of different plant species found in a lake. Generally, the better the water quality the higher the species richness count.

Appendix A includes Lake Mendota plant statistics from the 2023 plant survey. Appendix C includes maps of aquatic plant distributions for Lake Mendota in 2023.

Table 1. Species present during 2023 aquatic plant survey – Lake Mendota

Genus	Species	Common Name	Category
Algae	*sp.*	Filamentous algae	Submersed
Ceratophyllum	*demersum*	Coontail	Submersed
Chara	*sp.*	Muskgrass	Submersed
Elodea	*canadensis*	Common waterweed	Submersed
Heteranthera	*dubia*	Water star-grass	Submersed
Lemna	*minor*	Small duckweed	Free floating
Myriophyllum	*spicatum*	Eurasian water-milfoil (EWM)	Submersed - Invasive
Najas	*flexilis*	Slender Naiad	Submersed
Nelumbo	*lutea*	American lotus	Emergent
Potamogeton	*foliosus*	Leafy pondweed	Submersed
Potamogeton	*richardsonii*	Clasping-leaf pondweed	Submersed
Potamogeton	*zosteriformis*	Flat-stem pondweed	Submersed
Potamogeton	*nodosus*	Long-leaf pondweed	Submersed
Stuckenia	*pectinata*	Sago pondweed	Submersed
Vallisnera	*americana*	Wild celery	Submersed

Figure 1. Species richness - Lake Mendota 1989-2023



Species richness is a count of the total number of different plant species found in a lake. Generally, the better the water quality the higher the species richness count.

Discussion of historical plant community changes

Definition of terms used in this section

Maximum depth of plant growth is the deepest depth at which plants were found in the lake. This is a function of water clarity. The clearer the water, the better the light penetration and presumably the deeper plants are able to grow. Not all plants grow in deep water some may prefer the shallower parts of the lake, but with clearer water the opportunity to grow deeper is available. Oligotrophic lakes (very clear water lakes) will have some plants growing in waters deeper than 20 feet. Hypereutrophic lakes (the opposite of oligotrophic) are characterized by excessive algal blooms and turbid poor water quality and clarity. Rooted plants are few, and restricted to either unusual weather conditions or very shallow water where light can penetrate. Plant diversity is usually restricted to species that can tolerate poor water clarities.

Frequency of occurrence is calculated by taking the total number of times a species is sampled divided by the total number of points at which depth was less than or equal to the maximum depth of plant growth.

The photic zone is the area where light penetrates enough to support plant growth.

The Floristic Quality Index (FQI) is a metric that evaluates the closeness of the flora in a lake to that of an undisturbed condition. The higher a FQI value, the closer that plant community is to an undisturbed ecosystem. Just for reference, compare a lake's numbers to the statewide average (24) or ecoregion average (20)(lakes also within the Southeast Glacial Plans ecoregion - see map here http://dnr.wi.gov/topic/landscapes/documents/StateMaps/Map_S1_ELs.pdf), calculated from a subset of approximately 250 lakes across Wisconsin.

Coefficients of conservatism (C) range from 0 to 10 and represent an estimated probability that a plant is likely to occur in a landscape relatively unaltered from what is believed to be a pre-settlement condition (see the end of Table 4 in Appendix A). The lower numbers indicate more of a disturbed ecosystem, while the higher numbers indicate a community more like one that would have been found before human settlement.

Prior survey results

The 2006 survey showed plant depth to 16 feet and diversity to 16 total species. Coontail and EWM remained dominant in 2006, while common waterweed increased by 38%. The 2011 survey showed similar, overall community statistics mirroring the species richness and maximum depth of plants found in 2006. However, the most prevalent species found in 2011 was wild celery, with abundant coontail and EWM. Over these sampling periods, the FQI and average coefficient of conservatism (C) both increased. From 1989-1991, the FQI and average C were stable at 15 and 5, respectively. In 2006, these rose to 19.14 and 5.31 and then rose in

again after the 2011 survey to 20.58 and 5.5. These values can be used to gauge the health of the lake and potentially show an increasingly healthy aquatic plant community on the lake.

In the previous two surveys, 16 species were identified during both. Though maximum depth remained the same at 16 feet, the amount of photic zone inhabited by plants decreased from 67.04% to 51.36%. Wild celery saw the biggest increase in abundance from 9.0% relative frequency to 29.6% while EWM also increased. Slender naiad, Illinois pondweed, and common watermeal were new species found during the 2011 survey while curly-leaf pondweed (invasive species), leafy pondweed, and sago pondweed were not found in 2011 but were found in 2006. In the 2017 survey, an increase in the community diversity and makeup was observed compared to the 2011 survey. The total number of species present was 18 to a maximum depth of 15 feet. The FQI rose to 21.5, and C declined slightly to 5.38.

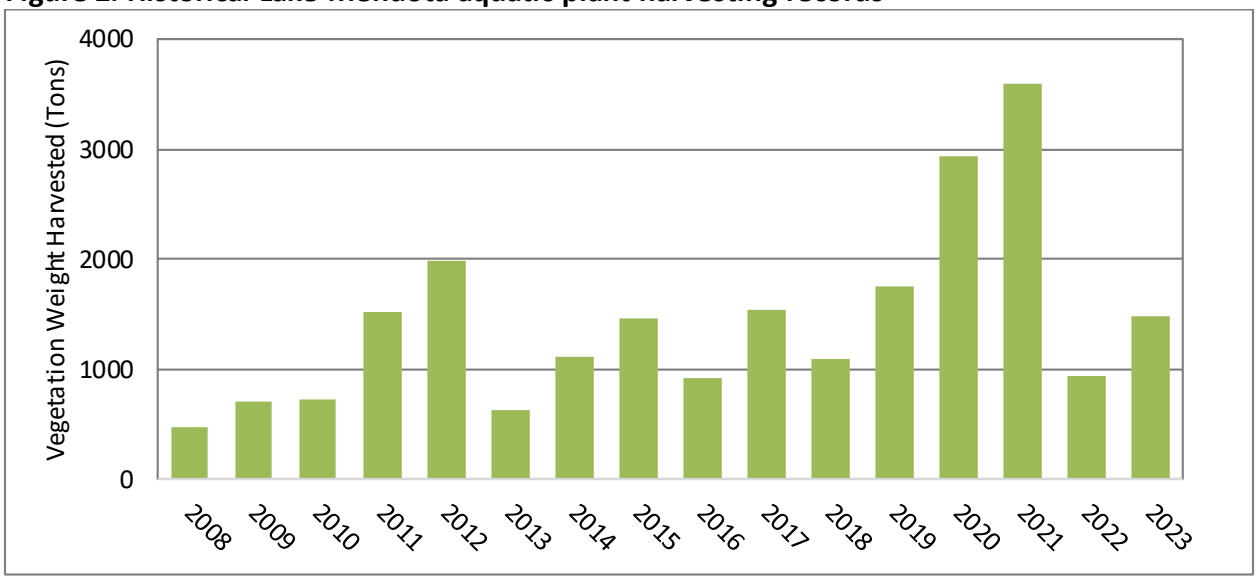
The 2017 survey was dominated by wild celery, coontail and Eurasian water-milfoil. The amount of plants in the photic zone increased to 68.29% and wild celery increased to a relative frequency of 47.36%. The new species during the 2017 survey were Northern water-milfoil, long leaf pondweed, and large duckweed. Curly-leaf pondweed, common watermeal, and Illinois pondweed were not found during the 2017 survey. Comparing the 2017 vegetation survey to previous ones conducted on Lake Mendota, in 2017 the number of species present increased. This led to a slight increase in the mean C and more significant increase in the FQI. Table 5 in appendix

In 2023 the survey the plant community continued to be dominated by Eurasion Water-milfoil, wild celery and coontail. Leafy pondweed was the plant that showed significant increase in frequency 27.91% within vegetated areas. Maximum depth of plants increased and can be attributed to limited runoff events and nutrient loading in 2023 resulting in clear water conditions. Total number of species found went from 16 in 2017 to 15 in 2023. Mean C and FQI had slight decreases. See table 4 in the appendix.

Harvesting Aquatic Plant Management Records

Figure 2 summarizes Dane County's mechanical harvesting operations in Lake Mendota since 2007.

Figure 2: Historical Lake Mendota aquatic plant harvesting records



The Dane County Land and Water Resources has no information regarding any chemical treatments of aquatic plants by private entities in the Yahara River chain of lakes since 2011.

Public Input Opportunities

The complete draft plans can be viewed on the webpage: https://lwrd.countyofdane.com/What-We-Do/lake-management/aquatic-plant-management/Aquatic-Plant-Management-Plan-Updates

Public comment will be solicited until December 30, 2023.

Aquatic Plant Management in Dane County

The overall goal of Dane County's mechanical harvesting program in the lakes is to cut and harvest Eurasian water-milfoil and other nuisance vegetation to help provide for reasonable use of the lakes for boating, fishing and swimming, while preserving the health and balance of the lake ecosystem. During periods of high water, harvesting of plants in the Yahara River between lakes Waubesa and Kegonsa becomes the highest priority.

Aquatic plant growth varies from lake to lake and year to year. Dane County Lake Management staff evaluate plant growth conditions and recommend appropriate harvesting in response,

within the limits of the plan harvesting priority areas and DNR permit. In times of heavy plant growth, local residents often advocate for additional harvesting in their areas, harvesting longer into the season (into the fall), or dedicating a harvester for a particular waterbody. County managers balance staff and harvesting equipment resources and priorities with needs and ecological conditions countywide.

Working closely with the Wisconsin Department of Natural Resources, the Dane County Land and Water Resources Department has developed harvesting priority maps that are included in many of the aquatic plant management plans and referred to in DNR harvesting permits issued to Dane County. Not every area that is identified for potential harvesting on the map will be harvested in any given harvesting season if there is little to no plant growth, because attention to higher priority areas does not permit it, or due to budget constraints. Harvester operators are instructed not to cut and remove plants outside of harvesting priority areas identified on these maps, unless authorized by their Supervisor in consultation with the Wisconsin Department of Natural Resources.

Harvesting machines are designed to cut, collect and remove plant fragments. In general, machine operators do not cut and harvest aquatic plants in water less than three feet in depth. However, in the Yahara River, machine operators perform minimal cutting and harvesting of aquatic plants in water less than three feet in depth, as approved by the Wisconsin Department of Natural Resources.

Limits of the equipment, staff, and budget mean that plant harvesting collection of wind-blown plant fragments due to boat propeller action, and the removal of plants that release from the sediment and float free in the fall cannot generally be accomplished. However, Dane County helps clean up plant materials at beaches and other public access points, even when the plant material is not associated with harvesting operations. Program managers also do their best to accommodate requests for collection of naturally-occurring windblown and boat motor chopped plant fragments near private shorelines, as time and budget permit. Occasionally this collection of plant fragments occurs in waters less than three feet deep. The Dane County Lake Management Operations Manual provides instructions to harvesting machine operators about plant fragment collection.

There is a common misperception that excessive external nutrients carried into lakes in runoff from the watershed causes macrophyte (large aquatic plant) problems. In fact, external nutrient loading usually produces algal blooms that shade and reduce macrophyte biomass. Attempts to control biomass by controlling nutrients in the water column are unproductive, according to G. Dennis Cooke and others in the third edition of Restoration and Management of Lakes and Reservoirs (2005). This is because rooted macrophytes, such as the nuisance Eurasian water-milfoil, usually get their phosphorus and nitrogen directly from sediments. In the short-term, reduced phosphorus in the water column resulting from watershed controls may actually result in more macrophyte growth, because clearer water permits more light penetration that fosters plant growth.

It could take many years to reduce the historical nutrient additions to lake sediments especially in agricultural areas. Much important work is underway in the Yahara River watershed to reduce watershed phosphorus loadings. Long-term, scientists and managers hope that community efforts can reduce sediment phosphorus, thereby more directly affecting plant growth.

Fisheries

Anglers sometimes raise concerns over harvesting vegetation in late spring and early summer during the fish spawning period. Harvesting aquatic vegetation during this critical time impacts a small fraction of the available spawning habitat for any given species and we continue to monitor the fish populations closely for any impacts aquatic plant harvesting may have. Dane County works closely with WDNR Fisheries and there appears to be no negative impact on the fishery as a whole. The Yahara Chain of Lakes continue to provide excellent fishing opportunities of all sorts including panfish, walleye, northern pike, largemouth bass, and musky.

Invasive Species

Much of the focus of Dane County's mechanical harvesting program is to cut and harvest Eurasian water-milfoil and other invasive and nuisance vegetation to help provide for reasonable use of the lakes for boating, fishing and swimming.

Dane County staff will continue to take steps to ensure that its plant harvesting equipment is cleaned and disinfected before moving it to other waterbodies, and follow all other Wisconsin invasive species laws (see Appendix B) to prevent transport of invasive plants to other waterbodies.

The invasive species below are more recent arrivals to the Yahara chain of lakes. Dane County staff, along with recreational users, following cleaning and disinfecting protocols will help prevent the spread of these and other invasive plants and animals.

Spiny Waterflea

In 2009 populations of spiny waterflea (SWF) were verified by the Wisconsin DNR to be present in the Yahara chain of lakes. Spiny waterfleas are zooplankton that are native to Europe and Asia. Introduction of SWF into the Great Lakes by ballast water discharged from ocean going ships most likely occurred in the 1980's, and since then the spread to inland waters has continued.

The most likely method of introduction of SWF into the Yahara chain of lakes was by a boat, bilge water, or live well that had not be decontaminated. Research suggests that the SWF were introduced into Lake Mendota in the mid 1990's based upon sediment core samples where spines are present. By 2009 SWF were found in Lake Mendota at densities that are higher than any other waterbody in its native or invaded range. (Walsh 2016)

The SWF are carnivorous predators eating native herbivorous zooplankton. This loss of native zooplankton can have negative impacts on the lake ecology, impacting the zooplankton structure and distribution. This loss of native zooplankton can also affect fish populations that rely on the zooplankton as a food source. Small fish try to prey upon SWF but their spines make them difficult to swallow. The loss of zooplankton can also increase the amount of phytoplankton, leading to greater turbidity, degraded plant health and reduced maximum depth where plants grow. As a result we see greater algal blooms and more impacts on people using the water.

One of the impacts to anglers is that SWF clog fishing rod eyelets and accumulate on fishing lines.

Zebra Mussels

In 2011 in Lake Mendota a population of zebra mussels was verified by the Wisconsin DNR. Additionally in 2016 a population of zebra mussels was verified by the Wisconsin DNR in Lake Monona. Zebra mussels are native to Europe and Asia. The zebra mussel is a small bottom dwelling clam that spread through microscopic larvae called veligers. The zebra mussels were introduced into the Great Lakes in the 1980's most likely through the ballast water from ocean going ships, and since then zebra mussels have been spread to other inland waters.

The most likely method of introduction of zebra mussels into the Yahara chain of lakes was by a boat, bilge water, or live well that had not been decontaminated. The first observation of zebra mussels in the Yahara was in Lake Monona in 2001 when adults were found.

The zebra mussels are the only freshwater mollusk that can attach themselves to solid objects. They attach to native mussels and outcompete them for food, thereby killing the native mussel. The zebra mussels also become so prolific and are very efficient at filtering the water that they can increase water clarity, leading to an increase in vegetation. Zebra mussels affect shoreline residents, boat owners and swimmers when their shells accumulate on hard surfaces making them a hazard to grab or stand on. Adult females can produce one million eggs per year.

Chinese Mystery Snails

In 2012 these invasive snails were found in Lake Waubesa. In 2015 they were found in Stewart Lake, and in 2017 they were found in Lake Monona. These snails are native to eastern Asia and have been transported to the area for aquarium trade and possibly on boats or trailers. With a hard operculum (trap door that seals the shell) these snails can survive out of water for four weeks (*Unstad, K.M. and others. Management of Biological Invasions (2013) Volume 4, Issue 2: 123–127*), making their transport to a new waterbody likely. The impacts of these snails are not very well-studied.

Recommended management

Dane County staff have reviewed the plant survey data and public input, and recommends the management elements found in this section, which are largely unchanged from 2017.

Lake Mendota Goals

Because Eurasian water-milfoil has dominated the littoral zone for several decades, the goals for managing Lake Mendota aquatic plants are to: (1) improve recreational access in the lake, (2) protect areas of unique natural value and historical significance, and (3) restore documented losses and declines of high value species [NR 107.08(4)] in the lake including large-leaf pondweed (*Potamogeton amplifolius*), Illinois pondweed (*Potamogeton illinoensis*), clasping-leaf pondweed (*Potamogeton richardsonii*), horned pondweed (*Zannichelia palustris*), wild celery (*Vallisneria Americana*), sago pondweed (*Struckenia pectinatus*), bulrush (*Scirpus*), and wild rice (*Zizania*). Other important native plants that have declined in Lake Mendota and also require protection include flat-stem pondweed (*P. zosteriformis*) yellow water lily (*Nuphar*), white water lily (*Nymphaea tuberosa*), American lotus (*Nelumbo lutea*), *Chara*, slender naiad (*Najas flexilis*), leafy pondweed (*Potamogeton foliosus*), and water stargrass (*Heteranthera dubia*).

These overarching aquatic plant management goals are coupled with the more specific goals of Dane County's mechanical harvesting program: to cut and harvest Eurasian water-milfoil and other nuisance vegetation to help provide for reasonable use of the lakes for boating, fishing and swimming, while preserving the health and balance of the lake ecosystem.

Lake Mendota Recommendations

1. Conduct large-scale mechanical harvesting in areas where EWM grows in dense monotypic stands. Goals for managing EWM are to improve boating access and fish habitat, and to expand native rooted plant species.
2. Avoid Critical Habitat Areas and where applicable, document high value native plants in regular field visits, including shoreline reference and GPS location.
3. Incorporate real time GPS location data with harvesters to allow interested parties and others to view current locations.
4. Continue the barge pick up program to service those areas that can only have manual removal options *(i.e. between piers or in areas less than 3 ft of water.)*
5. Dane County's mechanical harvesting crews should continue to take steps to prevent the spread of exotic invaders across Dane County lakes and streams. These steps include removing any visible plants, mud, debris, water, fish or animals from the machinery and thoroughly washing the equipment (see Appendix C).

Proposed Critical Habitat Areas

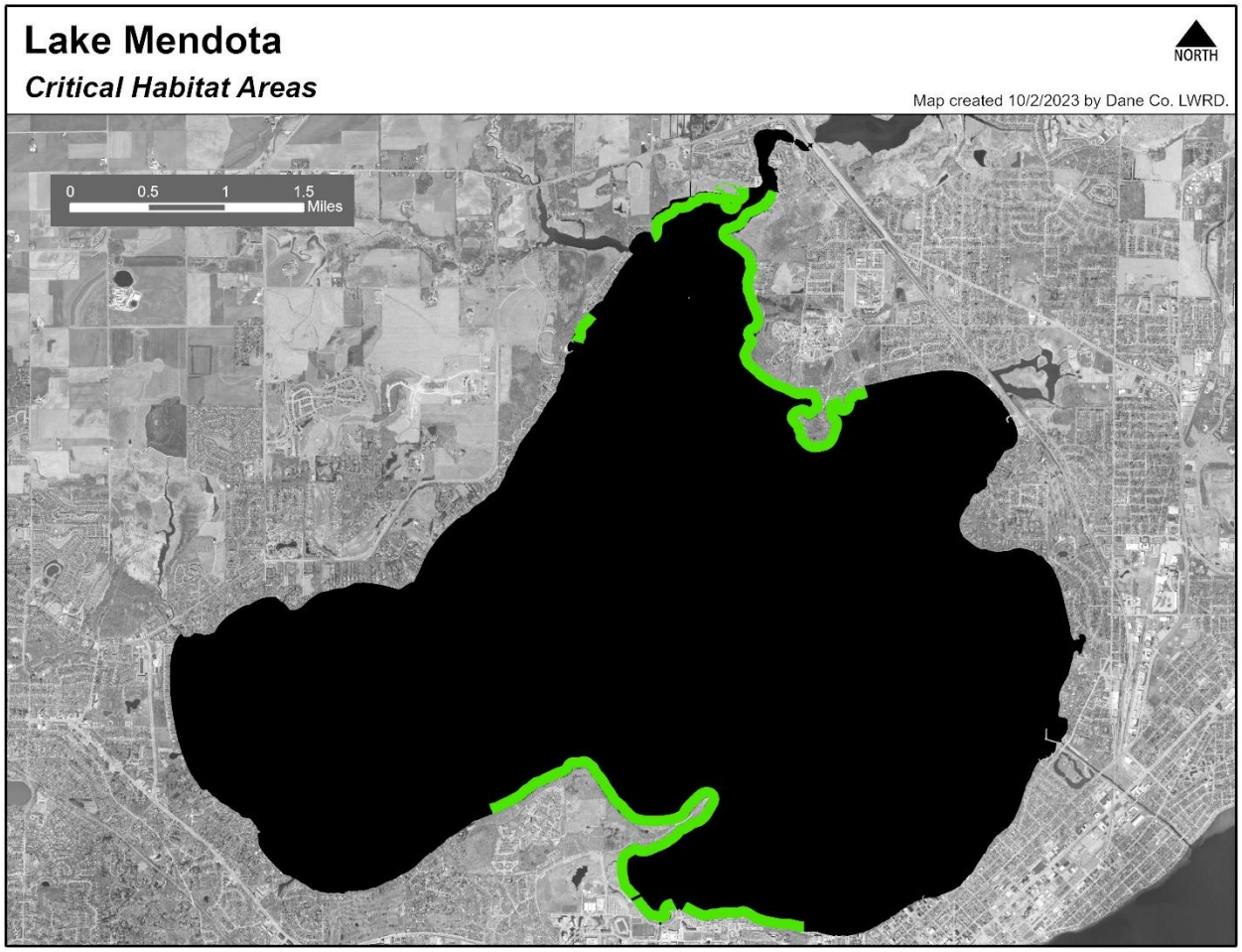
Wisconsin DNR's website describes the importance of the DNR's designation of Critical Habitat Areas as follows: "Every waterbody has critical habitat - those areas that are most important to the overall health of the aquatic plants and animals. Remarkably, eighty percent of the plants

and animals on the state's endangered and threatened species list spend all or part of their life cycle within the near shore zone. As many as ninety percent of the living things in lakes and rivers are found along the shallow margins and shores. Wisconsin law mandates special protections for these critical habitats. Critical Habitat Designation is a program that recognizes those areas and maps them so that everyone knows which areas are most vulnerable to impacts from human activity. A critical habitat designation assists waterfront owners by identifying these areas up front, so they can design their waterfront projects to protect habitat and ensure the long-term health of the lake they where they live."

Lake Mendota

Figure 4 is the Critical Habitat Area map for Lake Mendota. Dane County in conjunction with WDNR propose no new critical habitat designations.

Figure 4. Proposed Critical Habitat Areas for Lake Mendota



Harvesting Priorities

Dane County holds annual training sessions for new and returning harvester operators before the harvesting season begins. In that training, permanent and seasonal staff receive instruction

on many topics including aquatic invasive species prevention protocols, plant identification, and communications. The Lakes Management Supervisor directs the day-to-day operations of the staff, guided by the Water Resources Planner who evaluates conditions on the water. Particular concerns with a water body, deep v. shallow harvesting, collection of plant fragments from harvesters, plant senesces, boat propellers etc. are all addressed in the supervision.

The harvesting priorities map for Lake Mendota (Figure 5) shows areas that may be harvested. Additional background on harvesting priorities is found in the Lake Management website https://lwrd.countyofdane.com/what-we-do/lake-management/aquatic-plant-management Annual training and daily supervision of harvester operators reinforce that plants should be harvested only from these approved areas, unless a variance from the plan has been approved by Wisconsin DNR. Actual effort is dictated based on plant conditions, as evaluated and reported by Dane County's Water Resources Planner.

Figure 5. Lake Mendota harvesting priorities