This project was conducted under Wisconsin Department of Natural Resources Aquatic Invasive Species Control Grant # AEPP-109-08. Lake Wissota's Waterbody Indentification Code (WBIC) is 2152800.

I. Lake Wissota, for All Generations

Why Have an Aquatic Plant Management Plan?

Lake Wissota is a remarkable resource and one of western Wisconsin's leading recreational lakes. A great recreational lake is characterized by good water quality and good water quality is attained only through a healthy aquatic ecosystem. Respondents to the Lake Wissota Planning Survey overwhelmingly indicated that Lake Wissota was valuable to them for the natural beauty and the recreational value it offers them. Fishing, swimming, boating, and spending time with family were responses repeated over and over when asked, "What does Lake Wissota mean to you?" The purpose of the Lake Wissota Aquatic Plant Management Plan is to protect the recreational and scenic values that make Lake Wissota a relaxing destination for lake users and to protect and improve habitat quality for fish, wildlife and aquatic life, through the protection of the aquatic plant community, which is ***directly linked to water quality.*** Families and citizens, particularly our children and future generations, deserve to have a lake with clean water to use and enjoy.

Respondents to the Lake Wissota Planning Survey overwhelmingly indicated that Lake Wissota was valuable to them for the beauty and the recreational value it offers them.

Goals

The goals of the Lake Wissota Aquatic Plant Management plan are to:

(1) **Protect and enhance the native aquatic plant community** so that it provides sustainable and sufficient habitat for fish, wildlife, and aquatic life, especially those species mentioned in the Designation of Critical Habitat Areas, Lake Wissota, Chippewa County report (Konkel, 2007).

(2) **Control the aquatic invasive species currently in the lake**, Eurasian water milfoil (*Myriophyllum spicatum*) and curly-leaf pondweed (*Potamogeton crispus*), at levels below that which would displace or otherwise harm the native aquatic plant community, wildlife, and recreation.

(3) **Prevent new aquatic invasive species from entering the lake and prevent the spread of Lake Wissota invasive species to other lakes** by continuing to educate boaters through the Clean Boats, Clean Waters program and other education outreach.

(4) **Monitor the health and changes to the aquatic plant community on Lake Wissota over time** by conducting a full plant survey of the lake once every five years to assess the health of the aquatic plant community.

(5) **Reduce phosphorous loading to the lake** to reduce nuisance algal blooms and improve water quality.

Implementation

To accomplish the goals of the Lake Wissota aquatic plant management plan, it is necessary to maintain an adaptable, multi-faceted aquatic plant management strategy, as no single management strategy can achieve these goals.

A multi-faceted strategy for Lake Wissota will include all or some of the management strategies listed in Table 1.

Table 1. Aquatic plant management goals and strategies for Lake Wissota for 2008-2012.

Goal 1: Protect and enhance the native aquatic plant community			
Management Strategies	Who will help implement them?	Timeline for Completion?	Who will pay for it?
Educate lake users about the function of the aquatic plant community in Lake Wissota, the strategies in this plan to manage that plant community, and the actions they can take to help implement those strategies (ie. informational workshops, trainings, newsletters, etc.)	LWIPA, Beaver Creek Reserve, WDNR	Continuing with annual review	LWIPA and Beaver Creek Reserve
Encourage shoreline restoration practices	LWIPA, Chippewa County, Towns of Anson, Eagle Point, and Lafayette, Beaver Creek Reserve, Chippewa Rod and Gun Club, Muskies Inc., local media, WDNR	Begin in 2009, continuing with annual review	LWIPA and Beaver Creek Reserve via grants
Evaluate and revise shoreline zoning ordinances to ensure shoreland buffers are protected and restored	Chippewa County, LWIPA, Towns of Anson, Eagle Point and Lafayette, WDNR	2011	Chippewa County WDNR
Implement strategies for the protection of critical habitat areas	LWIPA, Towns of Anson, Eagle Point and Lafayette, WDNR	2012	LWIPA, Towns of Anson, Eagle Point and Lafayette, WDNR
Goal 2: Control aquatic invasive species currently in Lake Wissota			
Management Strategies	Who will help implement them?	Timeline for Completion?	Who will pay for it?
Post signs, where possible, of Eurasian water milfoil beds	LWIPA, Towns of Anson, Eagle Point and Lafayette, WDNR	2010	LWIPA via grants
Continue treatment with appropriate herbicides such as 2,4-D by certified applicators	LWIPA, Beaver Creek Reserve	Begin in 2009, continuing with annual review	LWIPA via grants
Hand pulling/raking, possibly with divers, small populations			
Strategic water level manipulation of the lake; Levels and duration to be defined by goals. Requires FERC approval	WDNR, LWIPA, Xcel	Only in the event of major infestation IF recommended by WDNR	To be determined

Table 1 cont'd on pg. 11.

Table 1 cont'd. Aquatic plant management goals and strategies for Lake Wissota for 2008-2012.

Goal 3: Prevent new aquatic species from entering the lake			
Management Strategies	Who will help implement them?	Timeline for Completion?	Who will pay for it?
Continue Clean Boats, Clean Waters program	LWIPA, UW-Extension Lakes, Beaver Creek Reserve, lake users and riparian land owners, WDNR, Lake Wissota State Park	Ongoing with annual review	LWIPA, Beaver Creek Reserve, UW-Extension Lakes, WDNR
Develop a Citizen Lake Monitoring team		Begin in 2009, ongoing with annual review	
Provide educational materials and presentations about Clean Boats, Clean Waters and aquatic invasive species to the local community and visitors		Ongoing with annual review	
Continue the citizen early detection reporting system (Neighborhood Watch) and volunteer monitoring			

Goal 4: Monitor the health and changes to the aquatic plant community on Lake Wissota over time			
Management Strategies	Who will help implement them?	Timeline for Completion?	Who will pay for it?
Conduct a plant survey of the lake every 5 years or less	LWIPA, Beaver Creek Reserve, WDNR	Begin in 2009, once every 5 years	LWIPA and Beaver Creek Reserve via WDNR and Xcel
Explore need for additional scientific study of sediment type and nutrient levels		2010	N/A
Conduct volunteer monitoring		Ongoing with annual review	LWIPA, Beaver Creek Reserve, WDNR

Goal 5: Reduce phosphorous loading to the lake			
Management Strategies	Who will help implement them?	Timeline for Completion?	Who will pay for it?
Develop phosphorous loading reduction implementation strategies to achieve the recommendations of the Little Lake Wissota and Yellow River TMDL's	WDNR, Chippewa County, LWIPA, Towns of Anson, Eagle Point, and Lafayette	Ongoing with annual review	WDNR, NRCS, EPA
Assist in developing the Little Lake Wissota and Yellow River TMDL Implementation Plans		Begin in 2010, ongoing with annual review	WDNR and LWIPA via grants

Potential Management Strategies for Lake Wissota

Descriptions of potential management strategies for Lake Wissota are listed in this section to provide a brief introduction to the various strategies. Always with invasive species, prevention is the best first management strategy, followed by early detection and rapid response (for new invasions), followed by control.

Shoreline restoration. Shoreline restoration is being used on many Wisconsin lakes as a tool to reduce erosion, improve water quality, and increase wildlife habitat (Figure 1). In the case of near-shore restoration, adding woody debris, such as dead trees, to areas near the shoreline often improves fish habitat. A study of 55 lakes in West Central Wisconsin (24 impoundments and 31 natural lakes) conducted between 2001 and 2006 found that natural shorelines had better quality aquatic plant communities than disturbed shorelines. The study also documented that **the mean occurrence of exotic aquatic invasive species was significantly greater** (statistically: $p>0.001$) **for disturbed shorelines than natural shorelines** (Konkel and Evans 2006). The second phase of the study showed that as the amount of disturbed shoreline on a lake increased, so did the occurrence of non-native species, filamentous algae, and macrophytic algae. These data demonstrate the importance of preserving and/or restoring the natural shoreline of the lake in order to preserve the aquatic plant community and discourage the spread of aquatic invasive species.

Figure 1. A well-vegetated shoreline on Lake Wissota.

A brochure describing shoreline restoration techniques and plant communities appropriate to Lake Wissota was developed by Beaver Creek Reserve Citizen Science Center (CSC) in conjunction with the Lake Wissota Improvement and Protection Association (LWIPA) and is available on the LWIPA and CSC websites or in hard copy from the LWIPA or the CSC.

Shoreland zoning. Shoreland zoning information is available on the Chippewa County website under "Your Government/Code of Ordinances" (Chapter 54) or at http://www.co.chippewa.wi.us/departments/zoning/shoreland.htm. Properties which are 1,000 feet from a lake and/or 300 feet from a river or stream are regulated by this ordinance. The ordinance should be reviewed by land owners before beginning any new projects on their property. Development of any new ordinances requires that all townships along the lake enact the same ordinance. Townships along Lake Wissota include: the Town of Anson, the Town of Eagle Point, the Town of Lafayette, and Chippewa Falls.

No-wake zones. The establishment of no-wake zones is one method of protecting shoreline and shallow water habitat, particularly critical habitat areas and shoreland restoration sites. No-wake zones prevent excessive erosion along shorelines and can protect aquatic plants in sensitive areas, near-shore areas, along sand bars, and during sensitive stages of growth. They could also be used to help prevent the spread

of invasive species in known areas of infestation. Development of any new ordinance requires that all townships abutting the lake enact the same ordinance.

Herbicide treatments. Herbicide treatments are one method used to control Eurasian water milfoil in Lake Wissota and have been used in some areas of the lake since 2006. Which herbicide to use and when to apply it should be determined by a WDNR aquatic plant management specialist as the factors influencing treatment change frequently. Effects of herbicide treatment on the native aquatic plant and animal community are influenced by a multitude of factors.

The following herbicide information, marked by **, is taken from a draft of the McDill Pond Aquatic Plant Management Plan (2009) with some modifications for Lake Wissota: A chart indicating the pros and cons of the various herbicides available for use is included in Appendix A.

**The appropriate chemical will be one that targets the nuisance plant growth specifically and does not unintentionally impact many native plants. Removal of native plants would open up bare ground for exotic species to invade.

Herbicides must be applied at the correct time and correct dosage to be effective. Once Eurasian water milfoil reaches the surface, it slows its growth and is less susceptible to some chemical treatments. A licensed professional is usually required to apply herbicides. Early spring, while the plant is first actively growing, is the best time to treat the exotic species EWM and CLP [curly-leaf pondweed]. The plants are readily absorbing and transporting nutrients throughout their systems as they are recovering from winter and are very susceptible to herbicide treatments. Moreover, many native plants are not yet actively growing, which provides an excellent opportunity to treat the exotics without the risk of damage to native plants. Protection of native plants is vital to control EWM and CLP re-growth…However, impoundments often have their highest flows at this time of year. Higher flow results in a shorter retention time, allowing less time for the chemical to contact the plant. The pellet form of 2,4-D requires a 14-day contact time. Later in the season when the flow generally decreases, the plants are less susceptible to chemicals. The [Lake Wissota Lake Association] should work with the chemical applicator and WDNR to decide the most effective time to apply chemical treatments.

Contact Herbicides. Contact herbicides affect only the plant tissue in contact with the chemical. These are typically fast-acting and are often used on annual plants (e.g. CLP). Plants that regenerate from roots, tubers, or rhizomes (perennials) can be harder to manage with contact herbicides because the foliage is often killed but not the roots. Herbicides that contain Endothall (Aquathol, Hydrothol), Glyphosate (Rodeo, RoundUp), or Diquat (Reward) are typical contact herbicides.

Systemic Herbicides. These are herbicides that are absorbed by the plant through leaves or roots and travel throughout the plant, interfering with growth or nutrient uptake. Systemic herbicides can be much more effective on perennials (e.g. EWM) than contact herbicides because the herbicide can kill the roots, preventing re-growth. Commonly used aquatic systemic herbicides are 2,4-D (Navigate, Weedar 64) and Triclopyr (Renovate). Systemic herbicides should only be used for EWM control on Lake Wissota in early-season treatments when water temperatures are near 60˚ F. Surviving colonies of EWM should be treated early in the season with a selective herbicide.

Algaecides. Algaecides are used to control nuisance algae. They work on-contact and kill a wide range of algae species. Some blue-green algae (cyanobacteria) are somewhat resilient and may not be affected, whereas most green algae are easily controlled. Algae treatments can be effective but often the relief is short-lived. Areas where algae are treated can often be re-colonized because of wind-blown mats translocating from other untreated areas. Other concerns are long-term use of copper-containing algaecides because copper toxicity may build up in the sediments that may affect important components of the lake ecosystem. Algaecides should be avoided in [Lake Wissota].

Some systemic and contact herbicides can be applied together for synergistic reasons. Using these two together ultimately uses less herbicide and has shown to deliver excellent results. As more research becomes available, the Lake [Association] should investigate the most efficient and safe manner of synergistic herbicide use.**

Figure 2. The Stop Aquatic Hitchhikers message is often symbolized by an image of a stop sign with a boat launching into the water.

Hand pulling/raking. Hand pulling and raking are two manual methods of controlling small Eurasian water milfoil beds in the lake. This method has been utilized in Lake Wissota at the State Park beach as well as along the Rod and Gun Club shoreline with some success. Hand pulling and raking are also useful methods for controlling "newly-established" milfoil plants.

Water level manipulation. Water level manipulation is a method of controlling aquatic plants, such as Eurasian water milfoil, but is not appropriate for every lake or for an individual lake under all conditions. The WDNR aquatic plant management specialist and fisheries biologist should be consulted to determine if and when water level manipulation is an appropriate management strategy for controlling Eurasian water milfoil on Lake Wissota. Effects of water level manipulation on the native aquatic plant and animal community are influenced by a multitude of factors. The late-winter drawdowns that were historically conducted on Lake Wissota were deemed inappropriate for the lake ecosystem because of how and when they were conducted, however a different drawdown strategy might be an appropriate option for the lake in the future. Again, the WDNR should be consulted to determine recommended time of year and length for a drawdown that would ensure the health of the aquatic ecosystem.

Clean Boats, Clean Waters. Clean Boats, Clean Waters is an educational program in which volunteers and sometimes paid staff, work at boat landings and educate boaters about aquatic invasive species (Figure 2). Volunteers and staff also inspect watercraft before they enter and after they leave the lake to ensure that no aquatic invasive species hitch a ride to the next lake. The Clean Boats, Clean Waters program is especially important to Lake Wissota because of the large amount of traffic the lake receives. The movement of so many boaters from nearby lakes and many other states to Lake Wissota and vice versa provides numerous opportunities for aquatic invasive species to enter or leave the lake and be spread to a previously uncontaminated lake nearby. The term for a high-traffic lake that contains one or

multiple invasive species, like Lake Wissota, is a "super-spreader" lake. The Lake Wissota Improvement and Protection Association and the Beaver Creek Reserve Citizen Science Center have and should continue to pursue grants to hire paid watercraft inspectors to work with and assist volunteer watercraft inspectors on the lake.

Water Quality Improvement. Non-point nutrient runoff from agricultural lands increases phosphorous loading to the lake, which stimulates algae blooms. The WDNR and local partners are working to develop implementation plans to identify the most feasible means to reduce nutrient influx and phosphorous loading to the lake.

Volunteer monitoring for Eurasian water milfoil (EWM). Volunteers interested in Lake Wissota are trained to identify Eurasian water milfoil and taught how to tell it apart from Northern water milfoil. They agree to monitor areas of the lake, for example the area around their dock or a nearby channel, for Eurasian water milfoil and report it if and when it is discovered. This type of monitoring has been conducted on Lake Wissota since Eurasian water milfoil was first discovered and should continue.

Figure 3. Spiny softshell turtle in Lake Wissota, 2009. *Photo courtesy of Jessica Soine.*

Citizen Lake Monitoring. The Citizen Lake Monitoring program trains volunteers to measure secchi depths and collect water samples for phosphorous and chlorophyll-*a* testing. It can be used to track changes in the water quality of a lake over time and should continue to be conducted on Lake Wissota.

Additional educational outreach. Educational outreach to all users of the lake is ongoing through a variety of groups such as the Lake Wissota Improvement and Protection Association and Beaver Creek Reserve. As new issues arise related to the lake, new educational efforts should continue to be conducted. These efforts may take the form of presentations from knowledgeable individuals, local lake fairs, sponsorship of new Lake Leaders, visits to local schools, and other educational outreach.

Mechanical Harvesting. Mechanical harvesting is a method of plant control that typically involves a large weed harvester or a rotovator. Harvesters cut and remove aquatic plants, but they are not selective to any particular species and often leave fragments of vegetation behind. Mechanical harvesting is not considered a viable option for Eurasian water milfoil on Lake Wissota because the fragments left behind by the harvester will probably contribute more to spreading the milfoil to uninfested locations than to controlling it.

Rotovators are essentially large tillers for the lake bottom and are used to till up the sediment in the lake. The use of a rotovator in Lake Wissota to control Eurasian water milfoil is impractical because it would create many fragments of milfoil that could float around the lake and infest new areas.

Biological Control. Biological control mechanisms using the milfoil weevil, *Eurychiopsis lecontei*, native to some WI lakes, is being investigated by researchers.

These weevils feed on all milfoil, both native and non-native species and damage milfoil by feeding on the top portion of the stem. It is thought that the weevils do not fly or swim well and they need natural vegetation near the water's edge to overwinter (Maccoux 2007). No milfoil weevils are known to be present on Lake Wissota. Biological control with the milfoil weevils is not considered a viable option for Lake Wissota at this time.

Bottom Barriers. Bottom barriers are often sold as mats of plastic or fabric, of varying colors, that can be laid over a bed of aquatic plants to stifle their growth. These barriers are non-selective and will kill off plants, however sediment collects on top of the barriers which allows new plants to establish growth. In addition, when barriers are removed, aquatic invasive species often re-establish in the site more readily than the natives that might have been mixed in with the invasive species previously. Bottom barriers are not considered a viable option to control Eurasian water milfoil in Lake Wissota at this time.

Dredging. Dredging of a lake is often done to remove excess sediment from the lake or restructure parts of the lake that may have altered in a negative way over time. Dredging is very expensive and takes a lot of time. It is not an effective method for removing aquatic invasive species and is not recommended for Lake Wissota at this time.

II. Lake Wissota, Yesterday and Today

Lake Description

Lake Wissota was created between 1915 and 1917 when a dam was built on the Chippewa River, which created the 4-mile long and 2-mile wide main impoundment (Borman 1991). Lake Wissota is 6,024 acres and has a maximum depth of 64 feet (Konkel 2007, Hartnett and Molnar 2005). There are two smaller embayments, Little Lake Wissota and Moon Bay. The Wissota dam impounds water up to the Jim Falls dam, 13 miles upstream. The Yellow River, Stillson Creek, Frederick Creek and Paint Creek empty into the lake and drain an area of roughly 941 square miles (Brakke 1996). Lake Wissota has a total drainage area of approximately 5,548 square miles (Tinker 1996). Lake Wissota is located north east of Chippewa Falls in T28-29N R7-8W, in the civil towns of Anson, Eagle Point and Lafayette, and the city of Chippewa Falls. The Waterbody Identification Code (WBIC) for Lake Wissota is 2152800. A 2005 map of Lake Wissota, Little Lake Wissota, and Moon Bay is included in Appendix B. A new map of the lake will be available in 2010.

Fishing, swimming, boating, and spending time with family were responses repeated over and over when asked, "What does Lake Wissota mean to you?"

Sociological Survey

A sociological survey entitled Lake Wissota Planning Survey (Braun, 2009) was conducted in 2008 and **was critical to the development of this Lake Wissota Aquatic Plant Management Plan**. The thoughts and ideas provided by survey respondents helped determine what management strategies