

2015

Alpine Lake, Waushara County, Wisconsin Lake Management Plan



Prepared in 2015 by staff from the Center for Watershed Science and Education University of Wisconsin-Stevens Point



Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin-Stevens Point

2015 Lake Management Plan for Alpine Lake, Waushara County, Wisconsin

The Alpine Lake Management Plan was developed with input from residents and lake users at a series of four public planning sessions held at the Marion Town Hall in Wautoma, Wisconsin in May, June, July and August 2015. The inclusive community sessions were designed to learn about and identify key community opportunities, assets, concerns, and priorities. Representatives of state and local agencies, as well as nonprofit organizations, also attended the planning sessions to offer their assistance to the group in developing a strategic lake management plan (LMP).

The plan was adopted by Alpine Lake Protection & Rehabilitation District on: January 27, 2016.

The plan was adopted by the Town of Marion on: May 11, 2017.

The plan was adopted by Waushara County on: June 1, 2016.

The plan was approved by the Wisconsin Department of Natural Resources on: June 29, 2016.

Any changes, updates or revisions to this document after the last date on this page do not reflect contributions made or approved by University of Wisconsin-Stevens Point.

A special thanks to all who helped to create the 2015 Alpine Lake Management Plan and provided guidance during the plan's development.

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We are grateful to many for providing funding, support, and insight:

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Waushara County Staff and Citizens
Wisconsin Department of Natural Resources Professionals, Ted Johnson
Wisconsin Department of Natural Resources Lake Protection Grant Program

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Overarching Vision for Alpine Lake

Alpine Lake will remain a quiet retreat known for its great swimming, fishing and serene landscape. It will continue to be a place of fond memories where people and wildlife congregate to enjoy this special place.

Introduction

Alpine Lake is a 56-acre impoundment of Bruce Creek. The lake is located in the township of Marion, east of the city of Wautoma, Wisconsin, in Waushara County. It receives most of its water from Bruce Creek and, to lesser extents, from surface and groundwater. The maximum depth in Alpine Lake is 18 feet. Alpine Lake has an irregular shape and its lakebed has a slope that varies from gentle to steep on the eastern side. Its bottom sediments are mostly muck with some rock and sand along the southeastern side. The surface watershed of Alpine Lake is comprised primarily of forested land and cultivated cropland and includes portions of the towns of Marion, Mount Morris, Dakota and Wautoma. There are roads and some development around its perimeter as well as forested land.

The purpose of this plan is to provide a framework for the protection and improvement of the lake. Implementing the content of this lake management plan (LMP) will enable citizens and other supporters to achieve the vision for Alpine Lake now and in the years to come. The plan was developed by community members who learned about the lake and identified features important to the Alpine Lake community to help guide the fate of the lake. It is a dynamic document that identifies goals and action items for the purpose of maintaining, protecting and/or creating desired conditions in a lake and identifies steps to correct past problems, improve on current conditions, and provide guidance for future boards, lake users, and technical experts. Because many entities are involved in lake and land management, it can be challenging to navigate the roles, partnerships and resources that are available; the planning process and content of this plan have been designed to identify where some key assistance exists. The actions identified in this LMP can serve as a gateway for obtaining grant funding and other resources to help implement activities outlined in the plan.

Who can use the Alpine Lake Management Plan, and how can it be used?

- **Individuals:** Individuals can use this plan to learn about the lake they love and their connection to it. People living near Alpine Lake can have the greatest influence on the lake by understanding and choosing lake-friendly options to manage their land and the lake.
- **Alpine Lake Protection & Rehabilitation District:** This plan provides the Alpine Lake District with a well thought out plan for the whole lake and lists options that can easily be prioritized. Annual review of the plan will also help the District to realize its accomplishments. Resources and

funding opportunities for District management activities are made more available by placement of goals into the lake management plan, and the District can identify partners to help achieve their goals for Alpine Lake.

- **Neighboring lake groups, sporting and conservation clubs:** Neighboring groups with similar goals for lake stewardship can combine their efforts and provide each other with support, improve competitiveness for funding opportunities, and make efforts more fun.
- **The towns of Mount Morris, Marion, Wautoma, and Dakota and the city of Wautoma:** The municipalities can utilize the visions, wishes, and goals documented in this lake management plan when considering town-level management planning or decisions within the watershed that may affect the lake.
- **Waushara County:** County professionals will better know how to identify needs, provide support, base decisions, and allocate resources to assist in lake-related efforts documented in this plan. This plan can also inform county board supervisors in decisions related to Waushara County lakes, streams, wetlands, and groundwater.
- **Wisconsin Department of Natural Resources:** Professionals working with lakes in Waushara County can use this plan as guidance for management activities and decisions related to the management of the resource, including the fishery, and invasive species. Lake management plans help the Wisconsin Department of Natural Resources to identify and prioritize needs within Wisconsin’s lake community, and decide where to apply resources and funding. A well thought out lake management plan increases an application’s competitiveness for funding from the State – if multiple Waushara County lakes have similar goals in their lake management plans, they can join together when seeking grant support to increase competitiveness for statewide resources.

Background

One of the first steps in creating this plan was to gather and compile data about the lake and its ecosystem to understand past and current lake conditions. This was done alongside 32 other lakes as part of the Waushara County Lakes Project. The Waushara County Lakes Project was initiated by citizens in the Waushara County Watershed Lakes Council who encouraged Waushara County to work in partnership with personnel from UW-Stevens Point to assess 33 lakes in the county. This effort received funding from the Wisconsin Department of Natural Resources Lake Protection Grant Program. There was insufficient data available for many of the lakes to evaluate current water quality, aquatic plant communities, invasive species, and shorelands. The data that were available had been collected at differing frequencies or periods of time, making it difficult to compare lake conditions. Professionals and students from UW-Stevens Point and the Waushara County Land Conservation Department conducted the Waushara County Lakes Study and interpreted data for use in the development of lake management plans. Data collected by citizens, consultants, and professionals at the Wisconsin Department of Natural Resources were also incorporated into the planning process to provide a robust set of information from which informed decisions could be made. Sources of information used in the planning process are listed at the end of this document.

Several reports from the Alpine Lake Study and the materials associated with the planning process and reports can be found on the Waushara County website: <http://www.co.waushara.wi.us/> (select “Departments”, “Zoning and Land Conservation”, “Land Conservation”, and “Lake Management Planning”). Unless otherwise noted, data used in the development of this plan were detailed in the 2014 report *Waushara County Lakes Study - Alpine Lake*, University of Wisconsin-Stevens Point.

The Planning Process

The planning process included a series of four public planning sessions held between May and August 2015 at the Marion Town Hall. The Alpine Lake Planning Committee consisted of lake district members and property owners. Technical assistance during the planning process was provided by the Waushara County Conservationist, the Waushara County Community, Natural Resources and Economic Development Extension Agent, and professionals from the Wisconsin Department of Natural Resources (WDNR), Golden Sands Resource Conservation & Development Council, Inc. (RC&D), University of Wisconsin-Extension (UWEX), and the University of Wisconsin-Stevens Point Center for Watershed Science and Education (CWSE).

Participation in the planning process was open to everyone and was encouraged by letters mailed to Alpine Lake waterfront property owners and by press releases in local newspapers. In addition, members of the planning committee were provided with emails about upcoming meetings which could be forwarded to others. To involve and collect input from as many people as possible, a topic-specific survey related to the subject of each upcoming planning session was made available prior to each planning session. Property owners and interested lake users were notified about the surveys and how to access them (via postcards mailed to waterfront property owners and press releases in local newspapers). The surveys could be filled out anonymously online, or paper copies were available upon request. Survey questions and responses were shared at the planning sessions and can be found in Appendix F. Lake User Survey Results.

Implementing the content of this lake management plan will enable citizens and other supporters to achieve the vision for Alpine Lake now and in the years to come.

Guest experts and professionals attended the planning sessions. They presented information and participated in discussions with participants to provide context, insight and recommendations for the lake management plan, including environmental and regulatory considerations. This information was organized with the survey results into discussion topics, which included: the fishery and recreation; the aquatic plant community; water quality and land use; shoreland health; and communication. After learning about the current conditions of each topic, planning committee members identified goals, objectives, and actions for the lake management plan that were recorded by professionals from UW-Stevens Point. Planning session notes and presentations are available on the Waushara County website.

Goals, Objectives and Actions

The following goals, objectives, and associated actions were derived from the values and concerns of citizens interested in Alpine Lake and members of the Alpine Lake Management Planning Committee, as well as the known science about Alpine Lake, its ecosystem and the landscape within its watershed. A lake management plan is a living document that changes over time to meet the current needs, challenges and desires of the lake and its community. Implementing and regularly updating the goals and actions in the Alpine Lake Management Plan will ensure that the vision is supported and that changes or new challenges are incorporated into the plan. **The goals, objectives and actions listed in this plan should be reviewed annually and updated with any necessary changes.**

Although each lake is different, the Wisconsin Department of Natural Resources requires that each comprehensive lake management plan address a specific list of topics affecting the character of a lake, whether each topic has been identified as a priority or as simply something to preserve. In this way, every lake management plan considers the many aspects associated with lakes. These topics comprise the chapters in this plan and have been grouped as follows:

In-Lake Habitat and a Healthy Lake

Fish Community—fish species, abundance, size, important habitat and other needs

Aquatic Plant Community—habitat, food, health, native species, and invasive species

Critical Habitat—areas of special importance to the wildlife, fish, water quality, and aesthetics of the lake

Landscapes and the Lake

Water Quality and Quantity—water chemistry, clarity, contaminants, lake levels

Shorelands—habitat, erosion, contaminant filtering, water quality, vegetation, access

Watershed Land Use—land use, management practices, conservation programs

People and the Lake

Recreation—access, sharing the lake, informing lake users, rules

Communication and Organization—maintaining connections for partnerships, implementation, community involvement

Updates and Revisions—continuing the process

Governance—protection of the lake, constitution, state, county, local municipalities, Alpine Lake Protection & Rehabilitation District

List of Goals

- Goal 1. Alpine Lake will have the necessary elements to sustain a balanced fishery, which include sufficient habitat, water quality, and fishing regulations.
- Goal 2. Protect native plants in and around Alpine Lake.
- Goal 3. New aquatic invasive species will not become established in Alpine Lake. EWM/HWM and CLP will be controlled or eliminated.
- Goal 4. Protect unique areas that are valuable to the water quality and habitat of Alpine Lake.
- Goal 5. Minimize nutrient and sediment loading to the lake by improving land management practices near the lake and in the watershed.
- Goal 6. Continue long term data collection on Alpine Lake to monitor trends such as declines and improvements over time.
- Goal 7. Encourage shoreland property owners to preserve and restore healthy shorelands. To reach compliance with NR 115, 7499 feet of shoreland frontage are currently in need of shoreland restoration. Restore approximately 5% (350 feet) of the shoreline over the next 5 years.
- Goal 8. Explore and utilize resources for healthy lake management.
- Goal 9. Alpine Lake will retain its peaceful setting for people and nature while accommodating a variety of uses.
- Goal 10. Increase participation in lake stewardship.
- Goal 11. Review plan annually and update with partners as needed or every five years.

The following goals were identified as ‘high priority’:

New aquatic invasive species will not become established in Alpine Lake. EWM and CLP will be controlled or eliminated. (Aquatic Invasive Species (AIS))

(see Alpine Lake Aquatic Plant Management Plan)

Maintain navigable water. (Alpine Lake Aquatic Plant Management Plan)

Improve fishing opportunities. (The Fish Community)

Lead persons and resources are given under each objective of this plan. These individuals and organizations are able to provide information, suggestions, or services to accomplish objectives and achieve goals. The following table lists organization names and their common acronyms used in this plan. This list should not be considered all-inclusive – assistance may also be provided by other entities, consultants, and organizations.

Resource	Acronym
Alpine Lake Protection & Rehabilitation District	ALPRD
WDNR Citizen Lake Monitoring Network	CLMN
UWSP Center for Watershed Science and Education	CWSE
Wisconsin Department of Agriculture, Trade and Consumer Protection	DATCP
North Central Conservancy Trust	NCCT
USDA Natural Resources Conservation Service	NRCS
Golden Sands Resource Conservation & Development Council, Inc.	RC&D
UW- Extension	UWEX
University of Wisconsin-Stevens Point	UWSP
Waushara County Watershed Lakes Council	WCWLC
Wisconsin Department of Natural Resources	WDNR
Wisconsin Department of Transportation	WDOT
UWSP Water and Environmental Analysis Laboratory	WEAL
Waushara County Land Conservation Department	WLCD

Contact information for organizations and individuals who support lake management in Waushara County can be found in Appendix A. 2015 Waushara County Lake Information Directory.

In-Lake Habitat and a Healthy Lake

Many lake users value Alpine Lake for its solitude, scenery, fishing, and wildlife. These attributes are all interrelated; the health of one part of the lake system affects the health of the rest of the plant and animal community, the experiences of the people at the lake, and the quality and quantity of water in the lake. Habitat is the structure for a healthy fishery and wildlife community. It can provide shelter for some animals and food for others.

Lake habitat occurs within the lake, along all of its shorelands, and even extends into its watershed for some species. Many animals that live in and near the lake are only successful if their needs – food, a healthy environment, and shelter – are met. Native vegetation including wetlands along the shoreline and adjacent to the lake provides habitat for safety, reproduction, and food, and can improve water quality and balance water quantity. Some lake visitors such as birds, frogs, and turtles use limbs from trees that are sticking out of the water for perches or to warm themselves in the sun. Aquatic plants infuse oxygen into the water and provide food and shelter for waterfowl, small mammals, and people. The types and abundance of plants and animals that comprise the lake community also vary based on the water quality, and the health and characteristics of the shoreland and watershed. Healthy habitat in Alpine Lake includes the aquatic plants, branches, and tree limbs above and below the water.

The Fish Community

A balanced fish community has a mix of predator and prey species, each with different food, habitat, nesting substrate, and water quality needs in order to flourish. Activities in and around a lake that can affect a fishery may involve disturbances to the native aquatic plant community or substrate, excessive additions of nutrients or harmful chemicals, removal of woody habitat, shoreline alterations, and/or an imbalance in the fishery. Shoreland erosion can cause sediment to settle onto the substrate, causing the deterioration of spawning habitat. Habitat can be improved by allowing shoreland vegetation to grow, minimizing the removal of aquatic plants, providing fallen trees or limbs in suitable areas, and protecting wetlands and other areas of critical habitat.

People are an important part of a sustainable fish community; their actions on the landscape and the numbers and sizes of fish taken out of the lake can influence the entire lake ecosystem. Putting appropriate fishing regulations in place and adhering to them can help to balance the fishery with healthy prey and predatory species, can be adjusted as the fish community changes, and can provide for excellent fishing.

Managing a lake for a balanced fishery can result in fewer expenses to lake stewards and the public. While some efforts may be needed to provide a more suitable environment to meet the needs of the fish, they



Photo courtesy of Limnology Center, UW Madison

usually do not have to be repeated on a frequently reoccurring basis. Protecting existing habitat such as emergent, aquatic, and shoreland vegetation, and allowing trees that naturally fall into the lake to remain in the lake are free of cost. Alternatively, restoring habitat in and around a lake can have an up-front cost, but the effects will often continue for decades. Costs in time, travel, and other expenses are associated with routine efforts such as fish stocking and aeration. Ideally, a lake contains the habitat, water quality, and food necessary to support the fish communities that are present within the lake and provide fishing opportunities for people without a lot of supplemental effort and associated expenses to maintain these conditions.

Periodically, fish have been stocked to enhance populations in Alpine Lake. Between 1972 and 2015, over 256,950 walleye were reported to be stocked in Alpine Lake. Depending upon size and source, the cost per walleye ranged between \$0.75 and \$2.85; approximately 70% survive to become adults.

Table 1. History of fish stocking.

Year	Species	Age Class	Number Stocked	Average Length (inches)
1972	WALLEYE	FRY	250,000	1
1988	WALLEYE	FINGERLING	450	5
1989	WALLEYE	FINGERLING	5,400	7
1990	WALLEYE	FINGERLING	1,000	5
1995	WALLEYE	FINGERLING	350	10
1996	WALLEYE	FINGERLING	500	10
1998	WALLEYE	FINGERLING	500	10
2000	WALLEYE	FINGERLING	200	14.75
2002	WALLEYE	FINGERLING	750	8
2004	WALLEYE	FINGERLING	400	8
2006	WALLEYE	FINGERLING	750	8
2008	WALLEYE	FINGERLING	750	
2013	BLACK CRAPPIES		600	
2015	WALLEYE	FINGERLING	100	7
	WHITE SUCKERS		325	5
			200	9
	MINNOWS		100 lbs.	2

Most of the survey responses and participants at the August 10, 2015 planning session felt the fishery had not changed significantly during their time at Alpine Lake, but that the density of aquatic plant beds (including invasives) has limited its potential. David Bartz, Fisheries Biologist with the WDNR, was in attendance at the session to present results of monitoring the lake’s fishery in recent years. His strongest recommendation for improving the fishery was to enhance native shoreland vegetation and coarse woody habitat in shallow water.

The most recent comprehensive fishery surveys were conducted in Alpine Lake in 2014 by fisheries biologists with the WDNR. The 2014 surveys included an early spring (immediately after ice-out) fyke netting survey and a spring electrofishing survey. Survey results indicated panfish/bluegills were in somewhat high abundance (424/hr) with poor size structure (PSD6=17%, RSD7=6%, mean length 4.7"). Black crappies were in fair abundance with good growth. Many of the crappies were likely some of the 600 fish stocked in 2013 by We Really Kare fishing club. While black crappies should naturally reproduce in Alpine Lake, inadequate healthy near-shore habitat, including shoreland vegetation and woody habitat, is limiting their reproductive success. Largemouth bass were in slightly high abundance (149/hr > 8"), which had improved slightly from the overly abundant number (159/hr > 8") in a 2006 survey. Their size structure was fair (PSD12=56%, similar to 2006) with a mean length of 12 inches, which is average for lakes in the area. By the time boats were able to get onto the lake following ice-off, the northern pike had already moved into deeper water, which resulted in a small sample size, totaling 78. The fish that were captured indicated poor size structure with only one fish greater than 26 inches and a mean size of 17.8 inches. To help improve the overall fishery in Alpine Lake, the size limit for northern pike was removed from Alpine Lake beginning on January 1, 2015.

Guiding Vision for the Fish Community

The fishery in Alpine Lake will provide good fishing within a balanced lake ecosystem.

Goal 1. Alpine Lake will have the necessary elements to sustain a balanced fishery, which include sufficient habitat, water quality, and fishing regulations.

Objective 1.1. Improve the reproduction and size structure of the fishery through habitat improvements.

Actions	Lead person/group	Resources	Timeline
Inform property owners about the importance of habitat (aquatic vegetation, woody habitat, shoreland vegetation) to the fishery in Alpine Lake (see also Shorelands section).	ALPRD	UWEX Lakes – educational materials	Ongoing 2016
Shoreland property owners will work together to ensure that sufficient near- shore habitat (including shoreland vegetation and woody habitat) is available to sustain a healthy fish community.	Shoreland property owners	WDNR Fisheries Biologist WDNR Healthy Lakes Grants WLCD	Ongoing
The County Parks Dept. will identify areas where healthy shoreland vegetation can be sustained and the addition of woody habitat would not negatively affect recreation.	WC Park Director WLCD	ALPRD	2017
Work with WDNR Fisheries Biologist on placement of woody habitat to avoid obstruction of recreation including use of shorter pieces, placing at angles, etc.	Shoreland property owners	WDNR Fisheries Biologist WDNR Healthy Lakes Grants	Ongoing
Work with the county to determine how to improve management of the dike in a way that will provide better shoreland vegetation without compromising the structure.	ALPRD	WLCD WDNR Healthy Lakes Grants WDNR Dam Safety Staff	2017

Aquatic Plants

Aquatic plants provide the forested landscape within Alpine Lake. They provide food and habitat for spawning, breeding, and survival for a wide range of inhabitants and lake visitors including fish, waterfowl, turtles, amphibians, as well as invertebrates and other animals. They improve water quality by releasing oxygen into the water and utilizing nutrients that would otherwise be used by algae. A healthy lake typically has a variety of aquatic plant species which creates diversity that makes the aquatic plant community more resilient and can help to prevent the establishment of non-native aquatic species.

Aquatic plants near shore and in shallows provide food, shelter and nesting material for shoreland mammals, shorebirds and waterfowl. It is not unusual for otters, beavers, muskrats, weasels, and deer to be seen along a shoreline in their search for food, water, or nesting material. The aquatic plants that attract the animals to these areas contribute to the beauty of the shoreland and lake.

During the 2011 aquatic plant survey of Alpine Lake, ninety-nine percent (237) of 240 sampled sites had vegetative growth. Of the sampled sites within Alpine Lake, the average depth was 7.3 feet and the maximum depth with vegetation was 19 feet. Fourteen species of aquatic plants were found in Alpine Lake in 2011, with the greatest diversity located in the southern end of the lake. Figure 1 shows the number of species that were identified at each sampling site.

The dominant plant species in the survey was wild celery (*Vallisneria americana*), followed by common waterweed (*Elodea canadensis*) and muskgrass (*Chara* spp.). Wild celery is a premiere source of food for waterfowl, marsh birds and shore birds, and beds of this submersed plant also provide shade, shelter and feeding habitat for fish. Common waterweed offers shelter to fish and also provides food to waterfowl. Muskgrass is a favorite food source for a wide variety of waterfowl, and muskgrass beds offer cover and food to fish, especially young trout,

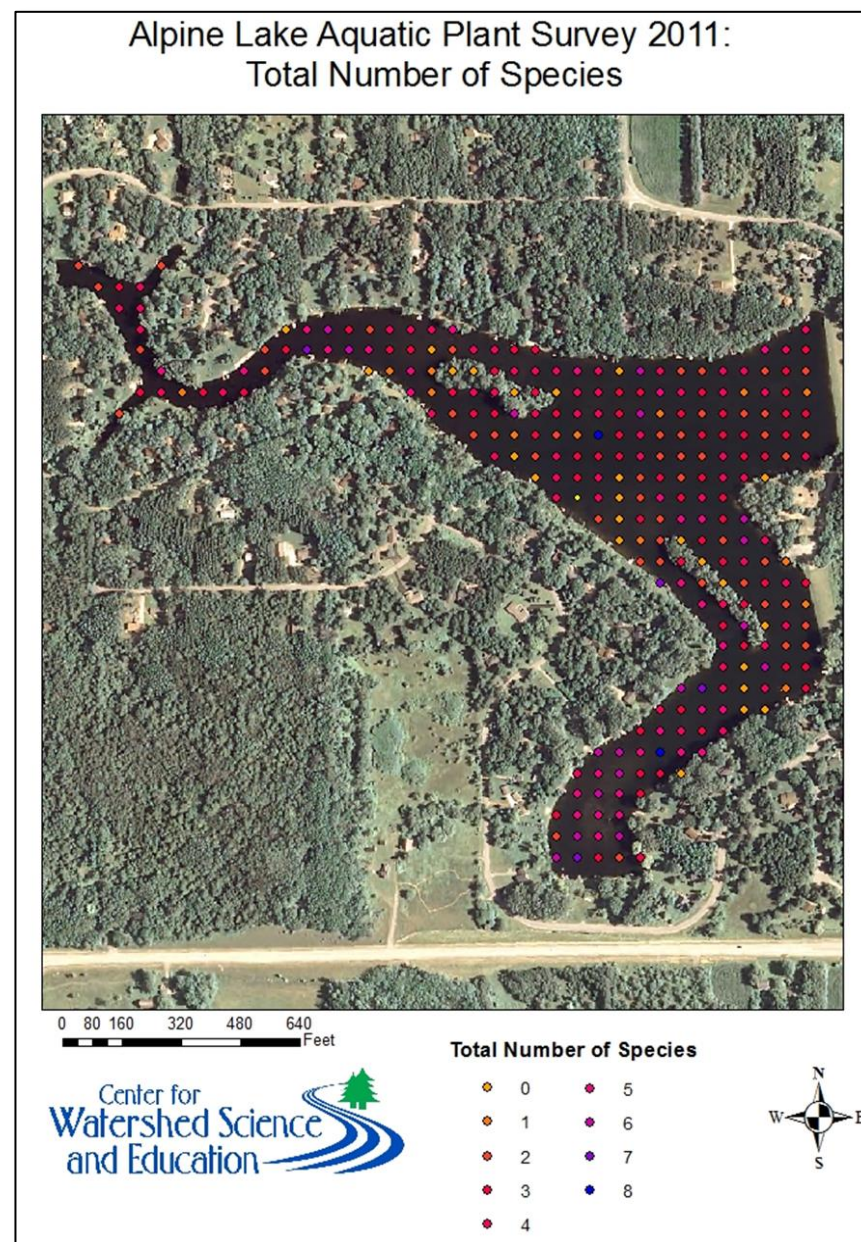


Figure 1. Total number of species at each site, 2011.

largemouth bass, and smallmouth bass (Borman et al., 2001). Two invasive species, curly-leaf pondweed and hybrid watermilfoil have been documented in the lake. More detailed information can be found in Appendix B. Aquatic Plants; the Aquatic Plant Survey of Alpine Lake, Waushara County; Waushara County Lakes Study – Alpine Lake; and, Aquatic Plant Management Plan 2015, Lake Alpine, Waushara County.

Most survey respondents (92%) indicated aquatic plants, especially invasives and water lilies, are dense in Alpine Lake and affect their use of the lake. All survey respondents felt some degree of aquatic plant management was necessary. Participants at the planning session indicated that parts of the lake are commonly in a choked state. Some harvesting has been done in the past to create navigable areas, most recently in 2014.

As an impoundment, Alpine Lake receives most of its water via the Bruce Creek inlet on its western end. Soils within this watershed consist of sand and loamy sand interspersed with highly organic and tight clay soils that were likely drainage channels for melting glaciers just to the north. This results in a high, nutrient-rich, sediment load to the lake that periodically fills the inlet channel. The ALPRD has dredged this channel from time to time, most recently about 8 years ago. This work requires a permit, and costs of dredging limit the volume of sediment removed. Participants at the planning session indicated an interest in the placement of aerators in this area following the next dredging operation to try and reduce sedimentation. Putting good management practice on the landscape within the watershed would help to reduce the amount of sediment delivery to Alpine Lake.

Guiding Vision for Aquatic Plants in Alpine Lake

Alpine Lake will have a diverse native aquatic plant community that balances healthy habitat, good water quality, and recreational use.

Goal 2. Protect native plants in and around Alpine Lake.

Objective 2.1. Avoid disturbing the native aquatic plant community.

Actions	Lead person/group	Resources	Timeline
Minimize removal and disturbance of native vegetation via educational materials provided in annual mailing, website, and at annual meeting.	ALPRD	UWEX Lakes WDNR Lake Manager WLCD WCWLC	Ongoing
Contact WDNR if water lilies become a significant obstruction in the main channel to discuss options.	ALPRD	WDNR Lake Manager	Ongoing
Refer to the Alpine Lake Aquatic Plant Management Plan, later in this section, for more detailed information and management options.	ALPRD	Consultants WDNR Lake Manager WLCD	Ongoing

Aquatic Invasive Species (AIS)

Aquatic invasive species are non-native aquatic plants and animals that are most often unintentionally introduced into lakes by lake users. This most commonly occurs on trailers, boats, equipment, and from the release of bait. In some lakes, aquatic invasive plant species can exist as a part of the plant community, while in other lakes populations explode, creating dense beds that can damage boat motors, make areas non-navigable, inhibit activities like swimming and fishing, and disrupt the lakes' ecosystems.

A special survey of Alpine Lake for curly-leaf pondweed (CLP) was conducted in June 2012. The life cycle of CLP can impact a lake's ecosystem. CLP grows under the ice during late winter and early spring, and when it dies back in late June/early July it releases phosphorus at a time when new plants and algae are beginning to grow. This phosphorus release may help fuel algae blooms and excessive plant growth. This seems to be the case in Alpine Lake, where participants indicated problems with filamentous algae during the summer months. During the 2012 CLP survey, CLP was found in numerous patches, some of which were relatively dense. A subsequent survey in 2013 yielded similar results (Figure 2).

Hybrid watermilfoil (HWM) was found in Alpine Lake during the 2011 aquatic plant survey. The lake was chemically treated for Eurasian watermilfoil (EWM) just before the survey was conducted in 2011, which likely impacted the distribution and density observed throughout the lake. The July 2013 survey revealed widespread EWM/HWM beds across the lake.

Continued monitoring of CLP and EWM/HWM is recommended to ensure that these populations are not growing or spreading to new locations within the lake.

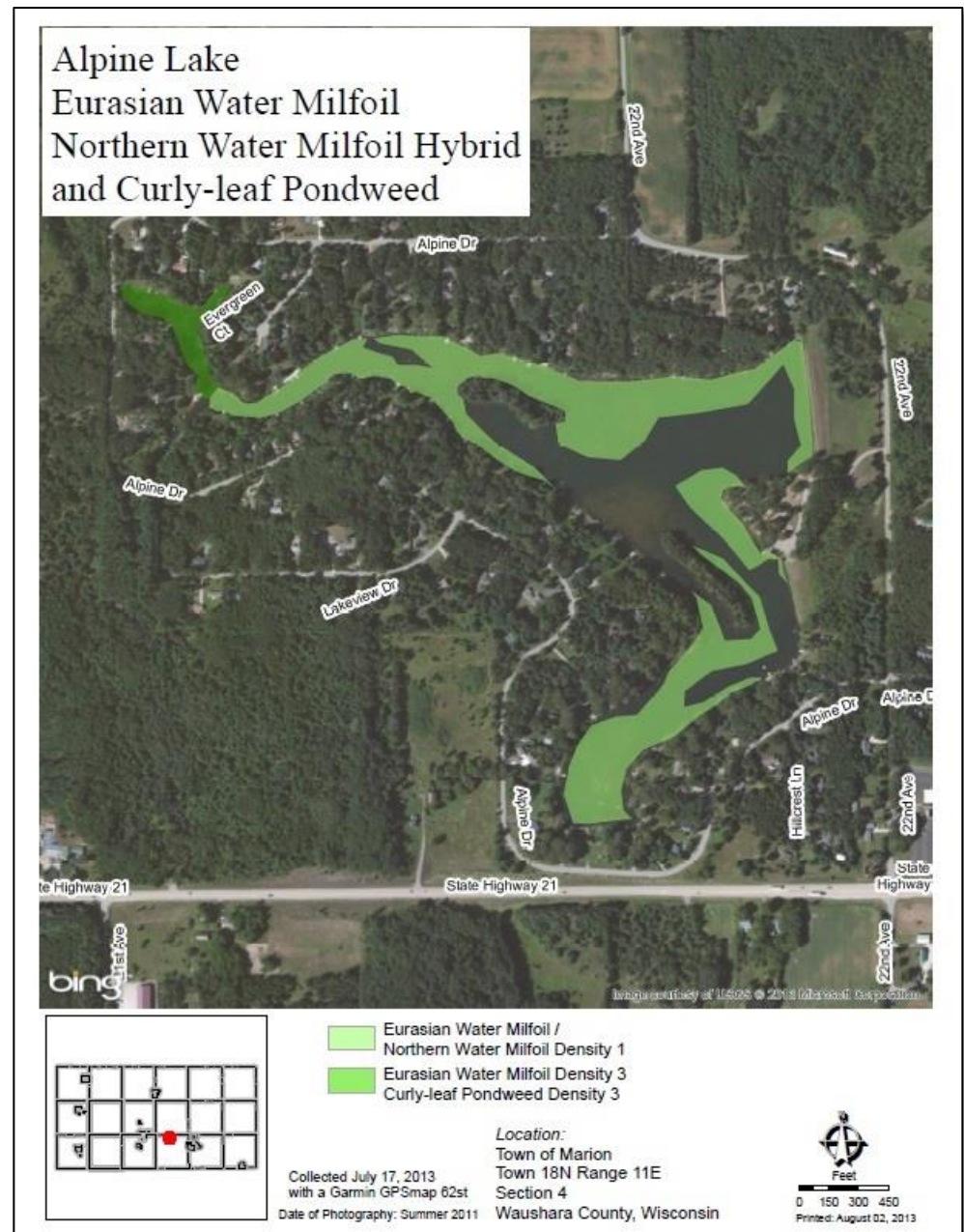


Figure 2. EWM and CLP in Alpine Lake, July 2013.



Originally documented in Alpine Lake in 2008, CLP can live in harmony with the rest of the aquatic plant community but may become invasive. The die-off of large beds of CLP in June can contribute to nuisance algae blooms throughout the summer. In Alpine Lake, CLP should be monitored annually in early June. Once the CLP is near the surface in late May or early June, harvesting it would help to remove nutrients from the lake.

Originally documented in Alpine Lake in 1992, EWM can exist as part of the plant community or it can create dense beds that can damage boat motors, make areas non-navigable, and inhibit activities like swimming and fishing. This plant produces viable seeds; however, it often spreads by fragmentation. Just a small fragment of the stem is enough to start a new plant, so spread can occur quickly if plants are located near points of activity such as beaches and boat launches.

Each lake is different and the response to EWM control may differ from lake to lake. No single approach will be appropriate for all lakes. Often multiple approaches and adaptive year-to-year changes in approach are most successful. The EWM population should be evaluated using a 'point-intercept' method (accompanied by more thorough observations) before and after treatments to determine the effectiveness of an approach in a given year. Strategies for the subsequent year should be adjusted accordingly. EWM management involves evolving scientific knowledge; therefore, the management strategies for the management of EWM in Alpine Lake should be adapted as EWM populations in the lake change and as new information becomes available.



Hybrid watermilfoil (HWM) results from a hybridization of native watermilfoil with EWM. HWM tends to be more resilient and less affected by certain types of chemical treatment. HWM was formally listed as present in Alpine Lake by the WDNR in 2013. Since HWM has been confirmed, a *challenge test* should be conducted to determine which combination of chemicals will be effective in controlling that particular strain of HWM. Over 13 combinations of chemicals can potentially be used to treat HWM. The only way to know the appropriate combination is by sending samples to be challenge tested. Treating HWM without knowing the appropriate combination of chemicals can result in a more resilient strain in the lake, damage the native aquatic plant population, and waste money.

Japanese knotweed, a terrestrial invasive species, was documented near the inlet at Alpine Lake in 2013. Also known as Japanese or Mexican bamboo, it is an herbaceous perennial that forms large colonies of erect, arching stems resembling bamboo. Stems are round, smooth and hollow with reddish-brown blotches. Plants reach up to 10 feet high and the dead stalks remain standing through the winter. Japanese knotweed can cause the following problems (WDNR, 2015):



- New infestations of Japanese knotweed often occur when soil contaminated with rhizomes is transported or when rhizomes are washed downstream during flooding.
- Japanese knotweed poses a significant threat to shoreland areas where it prevents streamside tree regeneration and increases soil erosion.
- Root fragments as small as two inches can sprout, producing new infestations.
- Japanese knotweed can disrupt nutrient cycling in forested shoreland areas.
- Japanese knotweed contains allopathic compounds (chemicals toxic to surrounding vegetation).

There are manual and chemical options for controlling Japanese knotweed. Young plants can be hand-pulled. They should be pulled up by the root crown, while trying to remove the rhizomes, since remaining rhizomes can produce new plants. It is possible to eradicate small patches of knotweed with repeated and persistent cutting of the plants. Plant debris should be properly disposed of, as fragments as small as two inches can sprout and produce new infestations. Chemical use may be required to eradicate large, established plants. Plants are more susceptible to herbicides if they are cut when 4-5' tall and the regrowth treated around 3' tall. Large plants can be cut low to the ground and herbicide applied directly into the hollow stem.

Guiding Vision for Aquatic Invasive Species

Aquatic invasive species (AIS) will not significantly impact recreation or the fishery in Alpine Lake.

Goal 3. New aquatic invasive species will not become established in Alpine Lake. EWM/HWM and CLP will be controlled or eliminated.

Objective 3.1. Prevent the establishment of any new invasive species (AIS) in Alpine Lake.

Actions	Lead person/group	Resources	Timeline
Learn to identify AIS and routinely look for it.	ALPRD Board		2015, Ongoing
Use signs, newsletters, and other methods to inform lake visitors about AIS and removing aquatic hitchhikers.	ALPRD Board or Project Committee	RC&D	Annually

Inform property owners of the importance of aquatic vegetation and to refrain from removing native aquatic vegetation to diminish the possibility of new AIS colonization.	Individuals	UWEX Lakes (educational materials)	Ongoing
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Objective 3.2. Reduce or eliminate populations of CLP in Alpine Lake.

The following table is a summary of actions associated with CLP management in Alpine Lake. It is not all-inclusive; please review the entirety of the Aquatic Plant Management Plan before choosing management options each year.

Actions	Lead person/group	Resources	Timeline
Map CLP beds in spring to assess the need for control, strategies to be employed, and to contribute to long-term assessment of CLP management.	ALPRD	Consultant WDNR Aquatic Plant Biologist	Annually – May/June
Prior to spring, review the results of the previous year’s treatment and survey results, and develop a strategy (if needed) for the upcoming year.	ALPRD	Consultant WDNR Aquatic Plant Biologist	Annually in winter
Harvest CLP in late May/early June to reduce plant biomass/nutrient inputs to the lake and to increase navigation. Avoid areas where EWM is present in beds that are accessible to the harvester.	ALPRD	WDNR Aquatic Plant Biologist Consultant WDNR AIS Grants	Annually in spring
If needed, use herbicide treatments to reduce CLP populations.	ALPRD	Consultant WDNR Aquatic Plant Biologist WDNR AIS Grants	2016 and as needed
Consider skimming to remove filamentous algae and floating plants to reduce biomass/phosphorus inputs and improve navigation. Avoid areas where EWM is present.	ALPRD	WDNR Aquatic Plant Biologist Consultants WDNR AIS Grants	As needed
Consider a winter drawdown to kill CLP and compact the sediment.	ALPRD	WDNR Aquatic Plant Biologist Consultants	As needed

Objective 3.3. Reduce or eliminate populations of EWM in Alpine Lake.

The following table is a summary of actions associated with the management of EWM in Alpine Lake. It is not all-inclusive; please review the entirety of the Aquatic Plant Management Plan before choosing management options each year.

Actions	Lead person/group	Resources	Timeline
Learn to identify and properly remove EWM where it is present in small areas of Alpine Lake.	ALPRD Shoreland property owners	RC&D	2016 and ongoing

Continue to work to eradicate EWM in Alpine Lake. Prior to spring, review the survey results and choose the appropriate management options for the upcoming year.	ALPRD	Consultant WDNR Aquatic Plant Biologist	Annually in fall
Conduct a point-intercept (P.I.) survey of the aquatic plant community at least every 5 years. Pre- and post-P.I. surveys are required to obtain a permit for chemical treatment and help to quantify changes over time. If chemical treatments are not conducted, conduct visual aquatic plant surveys in years between P.I. surveys. Use survey results to develop management strategies for the upcoming year.	ALPRD	<i>P.I. Survey:</i> WDNR Water Resource Spec. Consultant WDNR AIS Grants <i>Visual Survey:</i> RC&D	<i>P.I. Survey:</i> Pre- and post-chemical treatments Every 5 years <i>Visual Survey:</i> Annually between P.I. Surveys
Inform lake residents and lake users when chemical treatment is conducted.	ALPRD	WDNR Water Resource Spec. Consultant	As needed
If resistance of HWM to chemical treatment is observed, submit EWM samples to a lab for a challenge test to determine which chemicals will be effective.	ALPRD	WDNR Water Resource Spec.	As needed
Where small populations exist, hand-pull EWM in shallows and/or hire divers to hand pull in less accessible areas.	ALPRD	RC&D	Ongoing
If hiring divers is appropriate for the level of infestation, work with other lakes to submit a WDNR AIS grant to make your request more competitive.	ALPRD	WDNR AIS grant WDNR Water Resource Spec. RC&D Local lakes with AIS	As needed
Consider a winter drawdown to kill HWM and compact the sediment.	ALPRD	WDNR Aquatic Plant Biologist Consultants	As needed
Consider the use of milfoil weevil populations as a control method for HWM in parts of Alpine Lake Helen. Weevil over-wintering habitat could be improved by establishing healthy shoreland vegetation.	ALPRD	RC&D UWSP – Dr. Ron Crunkilton WDNR Lakes Specialist	

Objective 3.4. Reduce or eliminate populations of Japanese Knotweed around Alpine Lake.

Actions	Lead person/group	Resources	Timeline
Distribute information about Japanese knotweed to residents around the lake.	ALPRD	UWEX Lakes RC&D	Ongoing
Organize training on the identification and proper removal of Japanese knotweed.	ALPRD	Consultant RC&D	As needed
Routinely survey and monitor areas around the lake for new populations of Japanese knotweed. Inform and work with property owner for any observed populations.	ALPRD	Consultant RC&D	Annually in spring

Alpine Lake Aquatic Plant Management Plan

Management strategies in Alpine Lake were designed to achieve a balance between healthy aquatic habitat, good water quality, and recreation. With a permit from the WDNR, aquatic plant management may occur in areas of the lake exhibiting heavy aquatic plant and/or algae growth that restricts boating and other recreational activities. A variety of management options were discussed during the development of this plan. Some options were rejected due to the nature of the lake. Each lake is different and the response to HWM control efforts may differ from lake to lake. No single approach will be appropriate for all lakes. Often multiple approaches and adaptive year-to-year changes in approach are most successful. Each year, the state of the aquatic plants in Alpine Lake should be assessed. During fall or winter, the results of the assessment (point-intercept survey, mapped marked with CLP beds, etc.) should be reviewed by the ALPRD with assistance from the WDNR Lake Manager, Golden Sands RC&D, and/or a consultant. Based on conditions, the strategy for the upcoming year should be developed. A strategy may include one or more of the following options, some of which require a permit from the WDNR.



Manual removal, target species: HWM/EWM, CLP, other AIS

Manual removal of AIS is focused on limited areas. This is commonly conducted by individual waterfront property owners who are trained in the identification and removal of EWM and other aquatic invasive species. Plants can be removed manually at any time of year, without a permit. Trained divers can be hired to manually remove HWM in deeper parts of the lake in areas less than 1 acre. This is most effective as a follow-up to chemical treatments, where HWM presence is spotty.

Individuals may hand-pull aquatic plants adjacent to their dock (thirty feet or less) without a permit for the purpose of clearing a channel for access. Any hand-pulled aquatic plants should be removed from the water and composted away from the lake. Property owners should diligently monitor any cleared areas for AIS.

Option: Provide a pick-up service for hand-pulled plants from docks with the harvester.

Herbicide treatment, target species: HWM and CLP

An annual permit is required. The target population of HWM or CLP should be evaluated using a ‘point-intercept’ method (accompanied by more thorough observations) before and after chemical treatments to determine the effectiveness of an approach in a given year. This information should guide subsequent management such as manual removal. Strategies for the subsequent year should be adjusted accordingly. HWM management involves evolving scientific knowledge; therefore, the management strategies for HWM in Alpine Lake should be adapted as HWM populations in the lake change and as new information becomes available.

The use of herbicides to control aquatic invasive species is an evolving science. Results of recent studies of the effectiveness of chemical spot treatment suggest the treatment may be less effective than previously thought, and may actually promote chemically-resistant forms of HWM. While herbicides can have immediate effect on the target plant species, there can be unanticipated effects on other species. There are approximately 300 herbicides registered for use on land in the United States, but only 13 can be applied into or near aquatic systems. All herbicides must be applied according to the US Environmental Protection approved label rate and application requires a permit if “you are standing in socks and they get wet.”

The toxicity tests that have been conducted are related to specific effects such as carcinogenicity. There may be as-yet unidentified consequences to aquatic ecosystems. Despite this, chemical spot treatments may still be appropriate in certain conditions. AIS species such as HWM are best treated early in the growing season – typically before June 1 when water temperatures are below 60 degrees F – to minimize the impacts of the herbicides on native plants that often emerge later in the growing season. Balancing the eradication of invasive species with the survival and flourishing of native species is essential to long-term success.

Herbicides can be divided into two main categories: contact herbicides that cause extensive cellular damage upon contact and systemic herbicides that act more slowly, often by speeding up cellular division. Systemic herbicides are taken up by the plant and transported throughout the entire plant, often resulting in complete mortality. Successful control of the target plant is achieved when it is exposed to a lethal concentration of the herbicide for a sufficient amount of time.

Herbicides are applied directly to the water, either as a liquid or an encapsulated granular form. Factors such as water depth, water flow, treatment area size, retention time, lake stratification, and plant density play roles in determining the appropriate herbicide concentration. Application rates and exposure times are important considerations for aquatic herbicides. Herbicide costs vary greatly between about \$400 and \$1,500 per acre depending on the chemical used, who applies it, permitting procedures, and the size of the treatment area.

Herbicide Plan: Conduct herbicide spot treatments as appropriate to reduce populations of EWM/HWM. The type of chemical(s) used should be based on the specific type of HWM. If treating less than 5 acres, a contact herbicide such as endothall or diquat should be used. Treatment should occur early in the season, prior to emergence of native plants. To reduce the chance of developing resilient strains of HWM, different treatments should be used each year. Each application should coincide with pre- and post-treatment aquatic plant surveys to monitor impacts to native plants and measure the efficacy of the herbicide regime. Treatment should be supplemented with subsequent manual removal of HWM.

Mechanical harvesting, target species: CLP, dense native aquatic plants

A permit is required. Benefits of mechanically harvesting aquatic plants include the removal of nutrients and oxygen-demanding plant material from the lake system, and the temporary recreational relief from dense aquatic plant beds and filamentous algae. Harvesting may have negative effects on native aquatic plants that provide valuable habitat. Harvesting in depths less than 3 feet should be avoided to minimize impact on habitat and to reduce sediment disturbance. Areas where EWM/HWM is present should not be harvested since these plants spread by fragmentation.

CLP should be harvested in late May or early June when the plants surface. Removing the plant matter from the lake via harvester as opposed to chemical treatment will remove plant biomass and nutrients from the system.

Dense beds of native aquatic plants can be harvested as needed to provide navigation later in the summer. Areas of EWM should be avoided to prevent fragmentation and spread.

Mechanical Harvesting Plan: With a WDNR permit, harvesting in Alpine Lake may be conducted in depths of water greater than three feet, up to three times per year. A second pass with the harvester should be run on harvested areas to remove plant fragments and floaters. Based on the original lake bathymetry, these areas are shown in Figure 3. Since this map is outdated, it is recommended that the harvesting equipment have a depth finder with the transducer mounted on the cutting end to ensure that cutting is occurring in water depths greater than three feet. Alternatively, a new bathymetric map could be developed and the resulting geo-referenced map could be loaded into the depth finder for orientation.

Situations in which harvesting may occur:

1. Removal of CLP.
2. Nuisance aquatic plant beds and/or filamentous algae significantly impede recreation.
3. EWM is not present beyond isolated individual plants.

Skimming target: floating plant material including filamentous algae

Skimming of floating plant material can be conducted by mechanical or non-mechanical means. Skimming and removal of floating plant material could be conducted in areas where sediment and emergent plants would not be disturbed by this activity.

Water level manipulation (drawdown), target species: EWM/HWM, CLP

Temporary reduction of water levels in Alpine Lake can be used to reduce AIS populations and has the added benefit of compacting sediment. This technique has the greatest effect on vegetation located in the shallows. If done during the late fall and winter, the exposed plant crowns will desiccate and kill the plants. A permit is required. Consultation with WDNR lake and fisheries biologists is essential in determining the appropriate timing and duration needed for current conditions.

Weevils, target species: EWM/HWM

Milfoil weevils (*Euhrychiopsis lecontei*) are insects that are native to some Wisconsin lakes. They feed on both the native northern watermilfoil and the invasive EWM/HWM. They require unmowed shoreline vegetation nearby to overwinter and survive. Milfoil weevils are not commercially available in Wisconsin, so obtaining a starter population and rearing them in predator-free conditions is necessary to enhance the size of the population released into the lake. Professional assistance should be sought if stocking or if a survey of the existing population in Alpine Lake is pursued.

Plan: If use of weevils is desired, have a survey conducted to establish the presence and abundance of weevils in Alpine Lake. Weevils could be considered for keeping EWM/HWM in balance in the following circumstances:

- a. Shallow water less than three feet in depth where harvesting is not occurring.
- b. Areas not affected by chemical treatments.
- c. Primarily minimally disturbed/unmowed shoreline.
- d. Areas of concentrated HWM.

Aquatic Plant Management Plan Review

A good aquatic plant management plan strategy should reduce the amount of management activity that is needed as time goes on. In Alpine Lake, a succession of successful strategies should lead to a balance between healthy aquatic habitat, water quality and recreation with minimal annual management. To evaluate if management strategies are making progress, updates to aquatic plant point-intercept surveys should be conducted at least every five years. If chemical treatments are pursued, more frequent (pre- and post-treatment) surveys are necessary. Work with the Aquatic Plant Specialist with the WDNR and a consultant to update surveys.

Tracking historical conditions, changes in the lake, and how those changes have affected current conditions is very important in the development of management strategies for the lake. Progress or change that occurs due to management activities documented in a plan, aquatic plant surveys, and updates to both will support future strategic decision-making. The following documents contain additional information about aquatic plants and other aspects of the lake:

Waushara County Lakes Study – Alpine Lake, 2014. UWSP Center for Watershed Science and Education. Report to Waushara County and WDNR.

Visual Survey of EWM and CLP in Alpine Lake, 2013. Golden Sands RC&D, Inc. <http://www.goldensandsrkd.org>

Aquatic Plant Survey of Alpine Lake, Waushara County, 2011. McNelly, J. UWSP Center for Watershed Science and Education. Report to Waushara County and WDNR.

Critical Habitat

Special areas harbor habitat that is essential to the health of a lake and its inhabitants. In Wisconsin, critical habitat areas are identified by biologists and other lake professionals from the WDNR in order to protect features that are important to the overall health and integrity of the lake, including aquatic plants and animals. While every lake contains important natural features, not all lakes have official critical habitat designations. Designating areas of the lake as critical habitat enables these areas to be located on maps and information about their importance to be shared. Having a critical habitat designation on a lake can help lake groups and landowners plan waterfront projects that will minimize impact to important habitat, ultimately helping to ensure the long-term health of the lake.

Although Alpine Lake does not have an official critical habitat area designation, there are areas within Alpine Lake that are important for fish and wildlife. Natural, minimally-impacted areas with woody habitat such as logs, branches, and stumps; areas with emergent and other forms of aquatic vegetation; areas with overhanging vegetation; and, wetlands are all elements of good quality habitat. Identifying important areas around the lake that are important habitat and informing lake users of their value can help raise awareness for the protection of these areas.

Current and proposed critical habitat area designations and additional information can be found on the WDNR website.

Guiding Vision for Alpine Lake’s Critical Habitat

Sensitive areas in and around Alpine Lake will remain intact and protected.

Goal 4. Protect unique areas that are valuable to the water quality and habitat of Alpine Lake.

Objective 4.1. Identify and inform others of quality habitat in and near Alpine Lake.

Actions	Lead person/group	Resources	Timeline
If critical habitat is designated on Alpine Lake, communicate to property owners, visitors, and Town Board as to why these areas are important.	ALPRD	WDNR Biologists and Lake Manager	TBD

Landscapes and the Lake

Land use and land management practices within a lake's watershed can affect both its water quantity and quality. While forests, grasslands, and wetlands allow a fair amount of precipitation to soak into the ground, resulting in more groundwater and good water quality, other types of land uses may result in increased runoff and less groundwater recharge, and may also be sources of pollutants that can impact the lake and its inhabitants. Areas of land with exposed soil can produce soil erosion. Soil entering the lake can make the water cloudy and cover fish spawning beds. Soil also contains nutrients that increase the growth of algae and aquatic plants. Development on the land may result in changes to natural drainage patterns and alterations to vegetation on the landscape, and may be a source of pollutants. Impervious (hard) surfaces such as roads, rooftops, and compacted soil prevent rainfall from soaking into the ground, which may result in more runoff that carries pollutants to the lake. Wastewater, animal waste, and fertilizers used on lawns, gardens and crops can contribute nutrients that enhance the growth of algae and aquatic plants in our lakes. Land management practices can be put into place that better mimic some of the natural processes, and reduction or elimination of nutrients added to the landscape will help prevent the nutrients from reaching the water. In general, the land nearest the lake has the greatest impact on the lake water quality and habitat.



Shoreland vegetation is critical to a healthy lake's ecosystem. It helps improve the quality of the runoff that is flowing across the landscape towards the lake. It also provides habitat for many aquatic and terrestrial animals including birds, frogs, turtles, and many small and large mammals. Healthy shoreland vegetation includes a mix of tall grasses/flowers, shrubs, and trees which extend at least 35 feet landward from the water's edge. Shorelands include adjacent wetlands, which also serve the lake by allowing contaminants to settle out, providing shelter for fish and wildlife, and decreasing the hazard of shoreline erosion by providing a shoreland barrier from waves and wind.

The water quality in Alpine Lake is the result of many factors, including the underlying geology, the climate, and land management practices. Since we have little control over the climate and cannot change the geology, changes to land management practices are the primary actions that can have positive impacts on the lake's water quality. The water quality in Alpine Lake was assessed by measuring different characteristics including temperature, dissolved oxygen, water clarity, water chemistry, and algae. All of these factors were taken into consideration when management planning decisions were made.

Water Quality

All of the Alpine Lake survey respondents felt that water quality had an impact on both the personal enjoyment value and economic value of their lake property. Most felt that swimming and aesthetic enjoyment was moderately-substantially reduced due to algal blooms. Half of the respondents and committee members felt that the conditions had deteriorated during their time at the lake, but a small percentage thought that it had improved. Fertilizers and septic systems were perceived to be the most likely culprits.

A variety of water chemistry measurements were used to characterize the water quality in Alpine Lake. Water quality was assessed during the 2010-2012 lake study and involved a number of measures including temperature, dissolved oxygen, water chemistry, and nutrients (phosphorus and nitrogen). Nutrients are important measures of water quality in lakes because they are used for growth by algae and aquatic plants. Each of these interrelated measures plays a part in the lake's overall water quality. In addition, water quality data collected in past years was also reviewed to determine trends in Alpine Lake's water quality.

Dissolved oxygen is an important measure in Alpine Lake because a majority of organisms in the water depend on oxygen to survive. Oxygen is dissolved into the water from contact with air, which is increased by wind and wave action. Algae and aquatic plants also produce oxygen when sunlight enters the water, but the decomposition of dead plants and algae reduces oxygen in the lake. In spring and fall, dissolved oxygen in Alpine Lake was fairly uniform from top to bottom. During the summer, dissolved oxygen concentrations increased in depths of 6-10 feet, likely due to algal blooms, and generally decreased at about 12 feet. Dissolved oxygen concentrations below 5 mg/L can stress some species of fish and other aquatic organisms. In February 2011, only the upper six feet of water had dissolved oxygen concentrations above 5 mg/L, which should provide sufficient area to support the fishery.

Water clarity measured in Alpine Lake during the study was considered fair, ranging from 5.5 feet to 13 feet. Alpine Lake has a robust water clarity dataset that dates back to 1986. When compared with historic data, the average water clarity measured during the study was better in April and October, similar in May, and was much poorer during the growing season months of June, July, August and September (Figure 4). The perception of the citizen who is monitoring Alpine Lake is that algal blooms impair the usability of the water for part of the summer. When chlorophyll-*a* (measure of algae) and water clarity data that were collected at the same time are plotted, a fairly strong relationship exists between the two measures in

One pound of phosphorus entering a lake can result in up to 500 pounds of algal growth!
(Vallentyne, 1974)

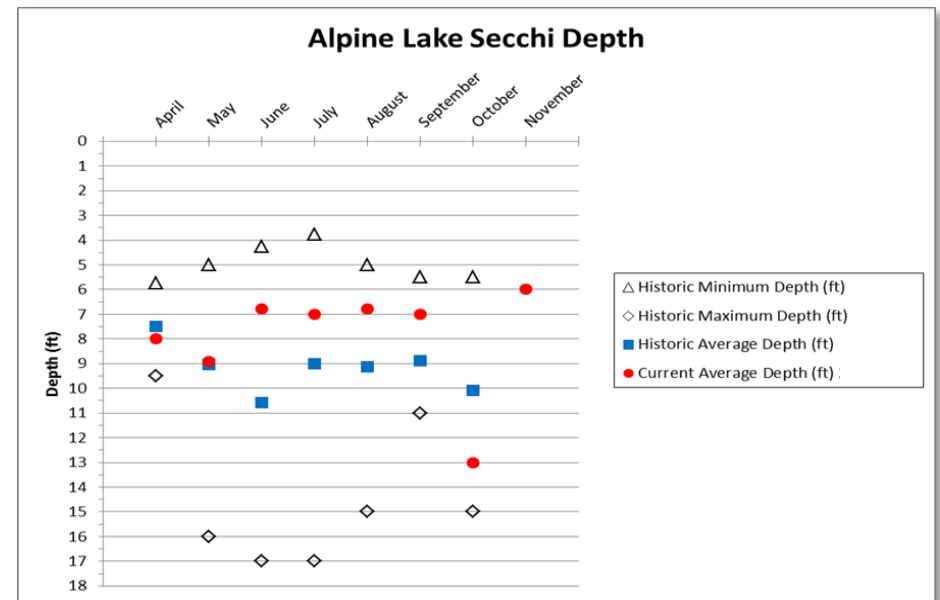


Figure 4. Water Clarity in Alpine Lake (2010-2012 is “current”; data prior to 2010 is “historic”).

Alpine Lake. As concentrations of algae increase, water clarity is reduced (Figure 6). In addition, algal production was also related to phosphorus; as the concentrations of phosphorus increased so did concentrations of algae (Figure 5).

Phosphorus is an element that is essential in trace amounts to most living organisms, including aquatic plants and algae. Sources of phosphorus can include naturally-occurring phosphorus in soils and wetlands, and groundwater. Common sources from human activities include soil erosion, animal waste, fertilizers, and septic systems. Although a variety of compounds are important to biological growth, phosphorus receives attention because it is commonly the “limiting nutrient” in many Wisconsin lakes. Due to its relatively short supply compared to other substances necessary for growth, relatively small increases in phosphorus result in significant increases in aquatic plants and algae.

During the study, total phosphorus concentrations in Alpine Lake ranged from 9 ug/L in February 2011 to 37 ug/L in May 2012. The summer median total phosphorus concentrations were 21 ug/L and 24 ug/L in 2011 and 2012, respectively. These median concentrations were below Wisconsin’s phosphorus standard of 40 ug/L for shallow impoundments. Summer monitoring of phosphorus concentrations has been conducted between 1995 and present. During this period of time, year to year variability has been observed. During the study, average spring inorganic nitrogen concentrations were 0.38 mg/L which is high enough to enhance algal blooms throughout the summer (Shaw et al., 2004).

Chloride, sodium and potassium concentrations are commonly used as indicators of how a lake is being impacted by human activity. The presence of these compounds where they do not naturally occur indicates sources of water contaminants. Average concentrations of chloride, sodium and potassium in Alpine Lake were elevated. Although these elements are not detrimental to the aquatic ecosystem, they indicate that sources of contaminants such as road salt, fertilizer, animal waste and/or septic system effluent may be entering the lake from either surface runoff or via groundwater. Atrazine, an herbicide commonly used on corn, was below the detection limit (<0.01 ug/L DACT) in the two samples that were analyzed from Alpine Lake.

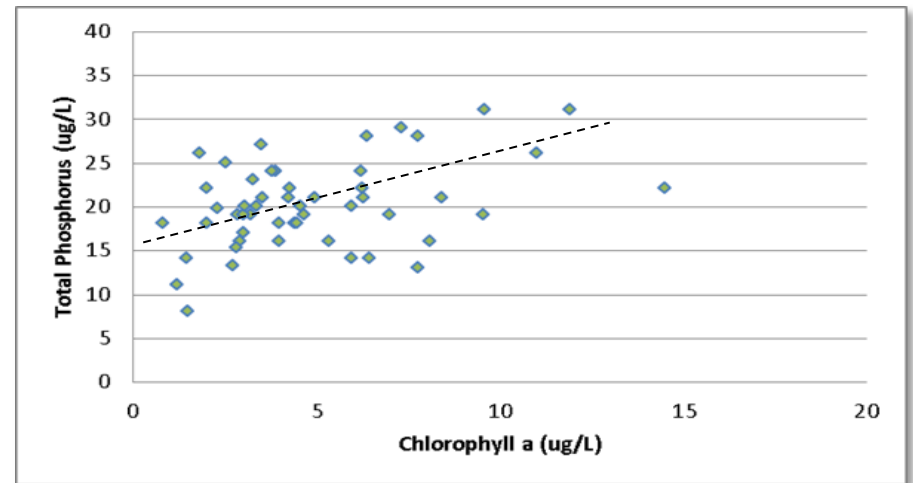


Figure 5. Total phosphorus and chlorophyll *a* (algae) concentrations in Alpine Lake

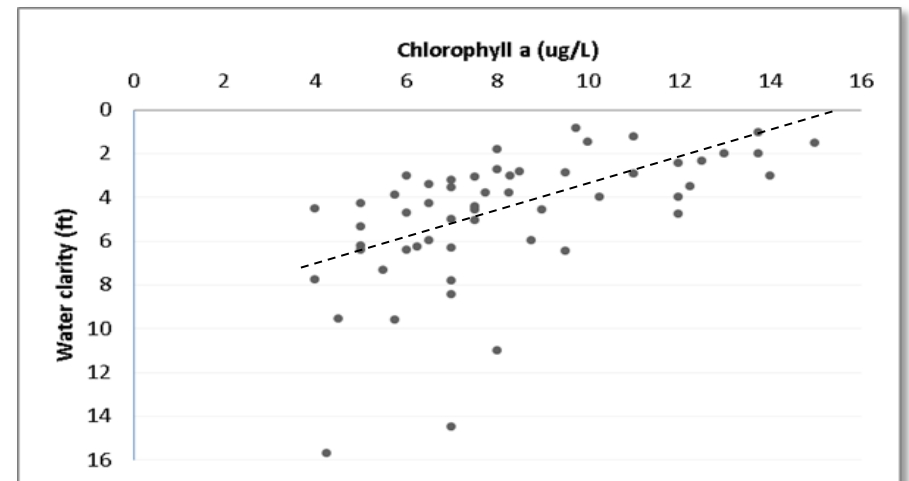


Figure 6. Water clarity depths and chlorophyll *a* (algae) concentrations in Alpine Lake.

Managing nitrogen, phosphorus and soil erosion throughout the Alpine Lake watershed is one of the keys to protecting the lake itself. Near shore activities that may increase the input of phosphorus to the lake include applying fertilizer, removing native vegetation (trees, bushes and grasses), mowing vegetation, and increasing the amount of exposed soil. Nitrogen inputs to Alpine Lake can be controlled by using lake-friendly land management decisions, such as the restoration of shoreland vegetation, elimination/reduction of fertilizers, proper management of animal waste and septic systems, and the use of water quality-based management practices.

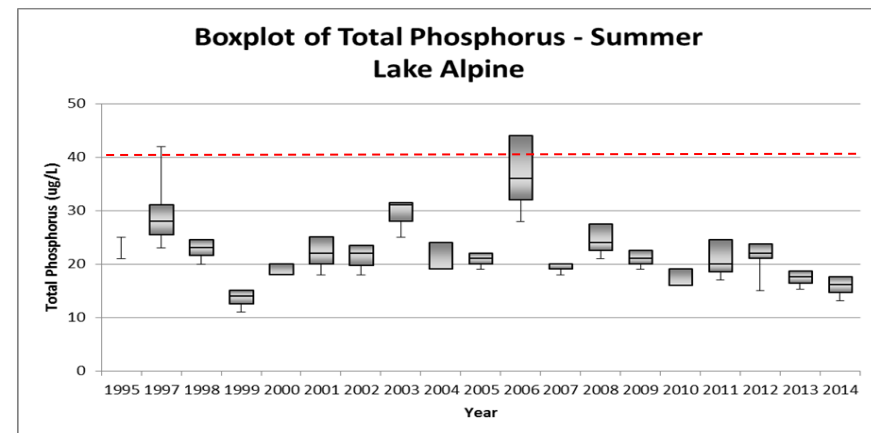


Figure 7. Summer phosphorus concentrations in Alpine Lake (red line indicates the WDNR phosphorus standard (40 ug/L)).

Guiding Vision for Water Quality in Alpine Lake

Alpine Lake will have good water quality that does not support excessive algal blooms or aquatic plant growth.

Goal 5. Minimize nutrient and sediment loading to the lake by improving land management practices near the lake and in the watershed.

Objective 5.1. Phosphorus concentrations will be maintained the same or better than the average measurements observed during the 2010-2012 study (summer median less than 22 ug/L). The goal for spring overturn inorganic nitrogen concentrations is less than 0.3 mg/L and showing a decreasing trend over the next 10 years.

Actions	Lead person/group	Resources	Timeline
Reduce nutrient inputs (P) to the lake by harvesting CLP in June and filamentous algae when it occurs, removing them from the aquatic system. See Aquatic Plants section.	ALPRD	WDNR Lake Manager	Annually, as needed
Improve shoreland areas where needed to reduce sediment and nutrient loading. See Shorelands section.	Shoreland property owners	UWEX Lakes	Ongoing
Work within the watershed to reduce runoff, increase infiltration and minimize the application of fertilizers and other chemicals. See Watershed section.	WCLCD		Ongoing

Inform others around the lake about the impacts of nutrients and land management on water quality through the distribution of an association newsletter and neighborly discussions. Consider including information on a lake sign.	ALPRD	UWEX Lakes (educational materials)	2016, Ongoing
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Goal 6. Continue long term data collection on Alpine Lake to monitor trends such as declines and improvements over time.

Objective 6.1. Continue any current monitoring initiatives and begin collecting data that has not been routinely recorded.

Actions	Lead person/group	Resources	Timeline
Monitor water clarity (>5 times a summer).	ALPRD or volunteer	CLMN Coordinator	Ongoing – summer
Continue monitoring water chemistry (total phosphorus and chlorophyll- <i>a</i>).	ALPRD or volunteer	CLMN Coordinator	Ongoing - summer
Test for inorganic nitrogen in lake water during spring overturn.	ALPRD or volunteer	WEAL or other state-certified water testing lab (for N)	Ongoing - spring
Submit any collected data to WDNR for long term storage, interpretation, and use.	ALPRD or volunteer	CLMN Coordinator	As needed
Encourage homeowners to test their drinking water for nitrates and atrazine.	ALPRD or volunteer	WC UWEX WEAL or other state-certified water testing lab	Ongoing - annually

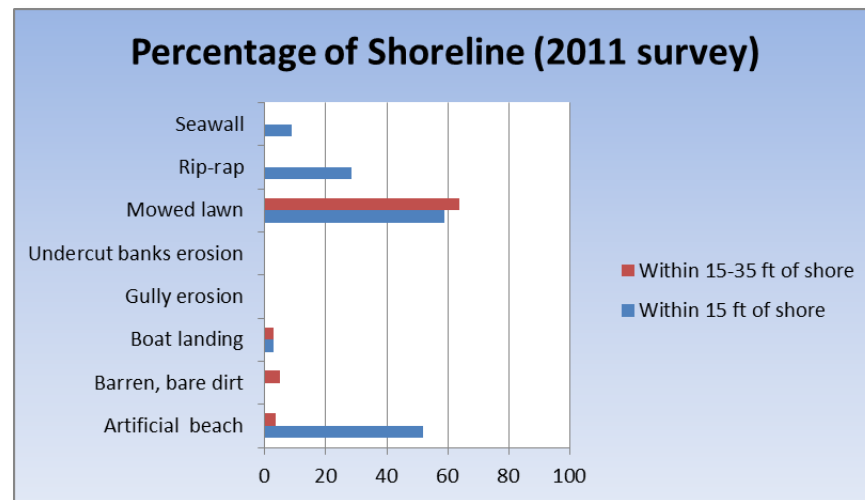
Shorelands

Shoreland vegetation is critical to a healthy lake ecosystem. It provides habitat for many aquatic and terrestrial animals including birds, frogs, turtles, and small and large mammals. It also helps to improve the quality of the runoff that is flowing across the landscape towards the lake. Healthy shoreland vegetation includes a mix of unmowed grasses/flowers, shrubs, trees, and wetlands which extends at least 35 feet landward from the water’s edge.

To better understand the health of the Waushara County lakes, shorelands were evaluated. The survey inventoried the type and extent of shoreland vegetation. Areas with erosion, rip-rap, barren ground, sea walls, structures and docks were also inventoried. A scoring system was developed for the collected data to provide a more holistic assessment. Areas that are healthy will need strategies to keep them healthy, and areas with potential problem areas and where management and conservation may be warranted may need strategies for improvement. The scoring system is based on the presence/absence and abundance of shoreline features, as well as their proximity to the water’s edge. Values were tallied for each shoreline category and then summed to produce an overall score. Higher scores denote a healthier shoreline with good land management practices. These are areas where protection and/or conservation should be targeted. On the other hand, lower scores signify an ecologically unhealthy shoreline. These are areas where management and/or mitigation practices may be desirable for improving water quality and habitat.

The summary of scores for shorelands around Alpine Lake is displayed on the map in Appendix D. Shoreland Survey – 2011. Alpine Lake’s shorelands are in good shape, but some portions have challenges that should be addressed. Restoration would benefit the lake. There were no stretches of Alpine Lake shoreland ranked as poor.

Shoreland ordinances were enacted to improve water quality and habitat, and to protect our lakes. To protect our lakes, county and state (NR 115) shoreland ordinances state that vegetation should extend at least 35 feet inland from the water’s edge, with the exception of an optional 30-foot viewing corridor for each shoreland lot. With a total of 85 lakefront lots, 2,550 feet (16%) of disturbed shorelands are permitted. Based on the 2011 shoreland inventory, 64% (10,395 feet) of Alpine Lake’s shoreland was mowed lawn. Although some properties were grandfathered in when the ordinance was initiated in 1966, following this guidance will benefit the health of the lake and its inhabitants.



Guiding Vision for Alpine Lake’s Shorelands

Alpine Lake will have a shoreland that provides aesthetic beauty, water quality benefits and wildlife habitat.

Goal 7. Encourage shoreland property owners to preserve and restore healthy shorelands. To reach compliance with NR 115, 7499 feet of shoreland frontage are currently in need of shoreland restoration. Restore approximately 5% (350 feet) of the shoreline over the next 5 years.

Objective 7.1. Inform lake residents of the importance of shoreland vegetation.

Actions	Lead person/group	Resources	Timeline
Host ‘Garden Walk’ open house to provide a social opportunity to view what others have done and get new healthy shoreland ideas and tips.	ALPRD	WLCD WC UWEX UWEX Lakes	Summer
Encourage hesitant homeowners to ‘start small’ with shoreland vegetation (such as 1’ the first year).	ALPRD	WLCD WDNR Healthy Lakes Grant	Ongoing Grant deadline Feb 1

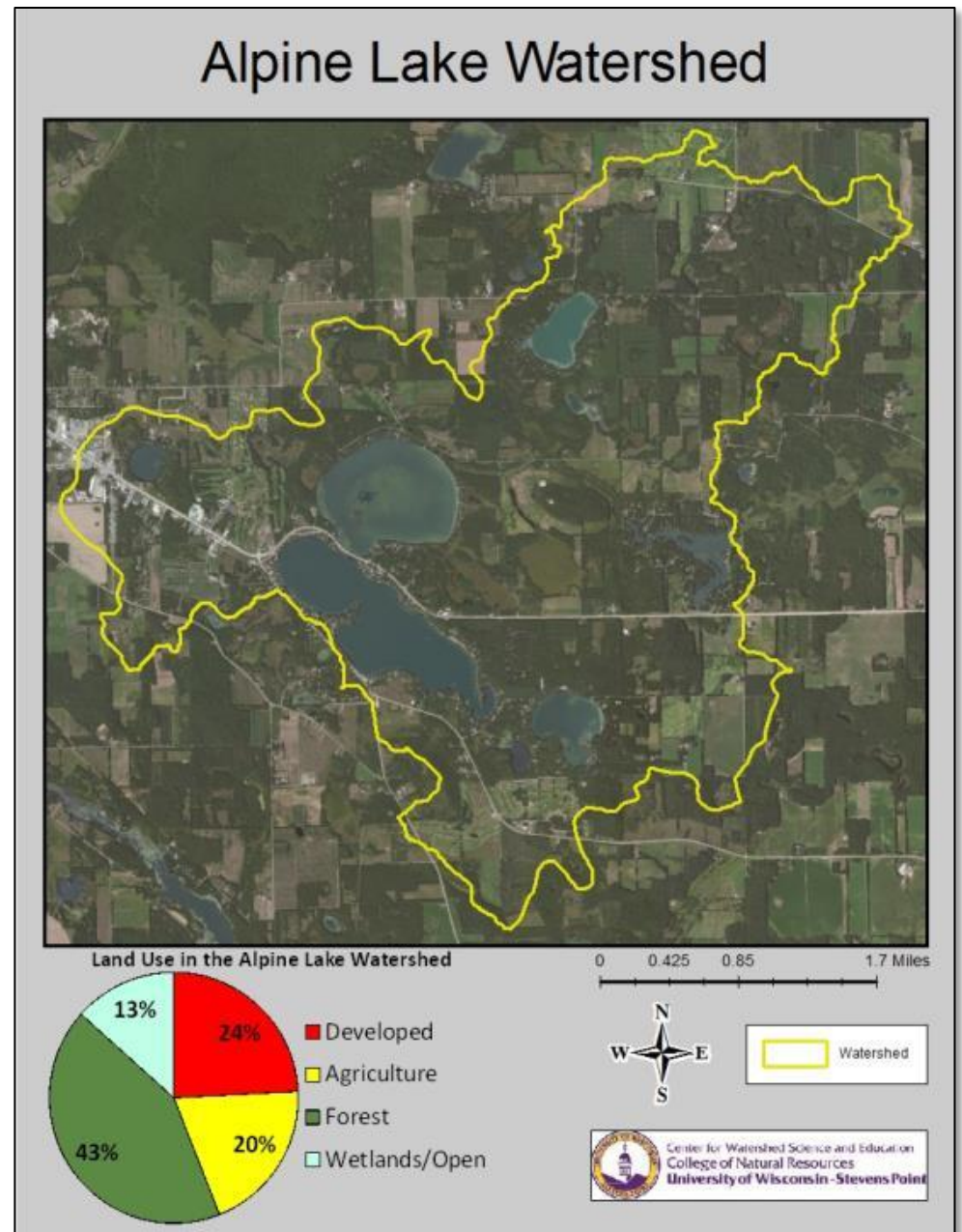
Invite a speaker to come and discuss shoreland plantings at a lake event or other gathering.	ALPRD	UWEX Lakes-Patrick Goggin Consultant	
Contact staff from the WLCD for suggestions about shoreland improvements (particularly those specific to Alpine Lake) and create handouts for members at the fall meeting.	Shoreland property owners	WLCD WDNR Healthy Lakes Grant	As needed

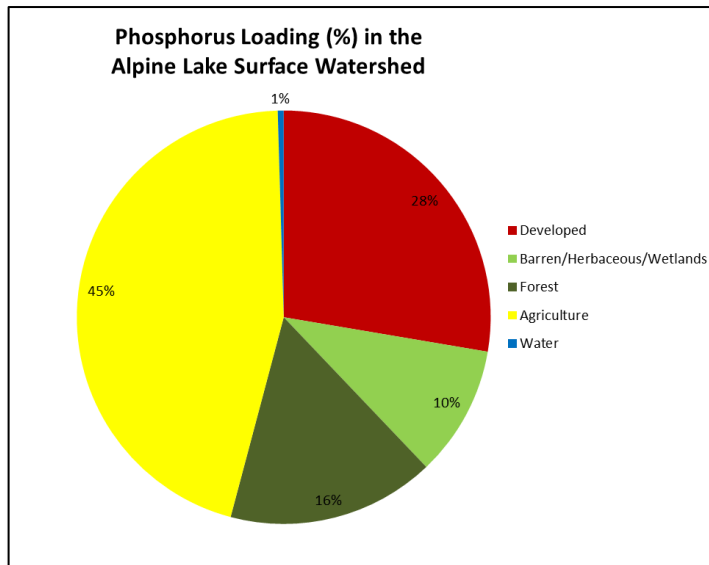
Watershed Land Use

It is important to understand where Alpine Lake's water originates in order to understand the lake's health. During snowmelt or rainstorms, water moves across the surface of the landscape (runoff) towards lower elevations such as lakes, streams, and wetlands. The land area that contributes runoff to a lake is called the surface watershed. Groundwater also feeds Alpine Lake; its land area may be slightly different than the surface watershed.

The capacity of the landscape to shed or hold water and contribute or filter particles determines the amount of erosion that may occur, the amount of groundwater feeding a lake, and ultimately, the lake's water quality and quantity. Essentially, landscapes with greater capacities to hold water during rain events and snowmelt slow the delivery of the water to the lake. Less runoff is desirable because it allows more water to recharge the groundwater, which feeds the lake year-round - even during dry periods or when the lake is covered with ice.

A variety of land management practices can be put in place to help reduce impacts to our lakes. Some practices are designed to reduce runoff. These include protecting/restoring wetlands, installing rain gardens, swales, rain barrels, and routing drainage from pavement and roofs away from the lake. Some practices are used to help reduce nutrients from moving across the landscape towards the lake. Examples include manure management practices, eliminating/reducing the use of fertilizers, increasing the distance between the lake and a septic drainfield, protecting/restoring wetlands and native vegetation in the shoreland, and using erosion control practices.





The surface watershed for Alpine Lake is 10,063 acres. Primary land uses are forested land and cultivated cropland. The lake’s shoreland is surrounded primarily by roads and some development as well as forests and agriculture. In general, the land closest to the lake has the greatest immediate impact on water quality.

Estimates of phosphorus from the landscape can help to understand the phosphorus sources to Alpine Lake. Land use in the surface watershed was evaluated and used to populate the Wisconsin Lakes Modeling Suite (WILMS) model. In general, each type of land use contributes different amounts of phosphorus in runoff and groundwater. The types of land management practices that are used and their distances from the lake also affect the contributions to the lake from a parcel of land. Based on modeling results, developed land and agriculture had the greatest percentages of phosphorus contributions from the watershed to Alpine Lake.

Guiding Vision for Alpine Lake’s Watershed

Land within the Alpine Lake watershed will be managed in a way that improves the lake and drinking water quality.

Goal 8. Explore and utilize resources for healthy lake management.

Objective 8.1. Increase participation in healthy land management activities around Alpine Lake and throughout its watershed.

Actions	Lead person/group	Resources	Timeline
Consider initiating watershed gatherings to learn from one another and work together to solve water quality problems.	ALPRD	WLCD WC UWEX	
Support property owners interested in testing their soil for needed amendments. Provide information to landowners on how and where to sample. Arrange for groups of samples.	ALPRD	WC UWEX	Fall
Conduct a water quality study to quantify nutrient sources from Bruce Creek, groundwater, and near shore runoff.	ALPRD	CWSE Consultant WDNR Lake grant	

The County will support and follow-up with water quality-based Best Management Practices (BMPs) within the watershed.	WCLCD	NRCS County Board Supervisors DATCP WDNR Lake Protection grants	Ongoing
Continue to use WLCD as a resource for land management activities.	Shoreland and watershed property owners	WLCD	As needed
Encourage subdivisions and other new developments to manage stormwater on-site and minimize septic system impacts to Alpine Lake.	Developers Town of Marion	Waushara Co. Planning and Zoning City of Wautoma Planning & Zoning	Ongoing
Encourage design of road and construction projects that will minimize impacts to Alpine Lake.	ALPRD Town of Marion	WLCD NRCS Waushara Co. Highway Dept. WDOT	Ongoing, as applicable
Encourage and support the implementation of runoff reduction practices during new construction and replacement of infrastructure throughout the watershed.	ALPRD		Ongoing
Support landowners interested in the protection of their land via a conservation program such as a conservation easement, purchase of development rights, or sale of land for protection.	ALPRD	NCCT NRCS WDNR Lake Protection grants	As needed
Explore funding options for land purchase within the watershed for conservation, preservation, or restoration purposes.	ALPRD	WDNR Lake Protection grants Knowles-Nelson Stewardship Funds	Ongoing

People and the Lake

The people that interact with the lake are a key component of the lake and its management. In essence, a lake management plan is a venue by which people decide how they would like people to positively impact the lake. The plan summarizes the decisions of the people to take proactive steps to improve their lake and their community. Individual decisions by lake residents and visitors can have positive impacts on the lake and on those who enjoy this common resource. Collaborative efforts may have bigger positive impacts; therefore, communication and cooperation between the lake district, community, and suite of lake users are essential to maximize the effects of plan implementation.

Boating hours, regulations, and fishing limits are examples of principles that are put into place to minimize conflicts between lake users and balance human activities with environmental considerations for the lake.

Recreation

Alpine Lake is enjoyed by people who live on and off of the lake. Popular activities enjoyed on the lake include fishing, swimming, canoeing/kayaking, motor boating, and ice skating. People also appreciate its beauty, its wildlife and enjoy its scenery and solitude. The eastern end of the flowage is home to the 15-acre Alpine Lake County Park. With more than 1,900 feet of shoreland, the park provides opportunities for swimming and picnicking, and a boat launch provides access to Alpine Lake. The launch is often congested with people fishing and launching boats, so the committee suggested the installation of a handicapped-access pier on the southern shore of the dike. From WDNR website: “The boarding dock is accessible but the route of travel to it is not (May 2014).” Additional facilities at the park include a shelter house, volleyball court, and a playground. Likely because of its *no wake* status, user conflicts were not identified in the survey or by committee members.



Photo courtesy of Waushara County

Guiding Vision for Recreation

Alpine Lake will provide recreational opportunities for families and lake users of all ages for generations to come.

Goal 9. Alpine Lake will retain its peaceful setting for people and nature while accommodating a variety of uses.

Objective 9.1. Ensure that the county park provides safe access for a variety of uses and users.

Actions	Lead person/group	Resources	Timeline
Place a handicap accessible pier on the southern shore of the dike. This will reduce congestion caused by fishing from the boat launch and would be located where there is better fishing.	ALPRD	WDNR Fisheries Biologist Local fishing clubs	
Install a No Parking sign on the boat launch.	Waushara County Parks	ALPRD	2015

Objective 9.2. Explore the use of dredging to remove sediments and increase the depth of Alpine Lake.

Actions	Lead person/group	Resources	Timeline
Hire a consultant to estimate the costs, permits, and tasks associated with dredging portions of Alpine Lake.	ALPRD	WDNR Fisheries Biologist Consultants	

Dam

Alpine Lake is a 56-acre impoundment along the Bruce Creek. The dam, located at the eastern end of the lake along 22nd Avenue, was constructed in 1970 and is owned by Waushara County. Information about this dam can be found on the WDNR website (<http://dnr.wi.gov/topic/dams/>), in Appendix E. Dam Details, or by contacting the WDNR Dam Safety Program at 608-261-6401 dnrdamsafety@wisconsin.gov.



Communication and Organization

Many of the goals outlined in this plan focus on distributing information to lake and watershed residents and lake users in order to help them make informed decisions that will result in a healthy ecosystem in Alpine Lake enjoyed by many people. Working together on common values will help to achieve the goals that are outlined in this plan.

Guiding Vision for Communication

The Alpine Lake community will be connected and informed in lake stewardship.

Goal 10. Increase participation in lake stewardship.

Objective 10.1. Develop opportunities for education and outreach among full and part-time residents.

Actions	Lead person/group	Resources	Timeline
Maintain the ALPRD website to provide a common source of communication.	ALPRD		Ongoing
Maintain an email list of shoreland property owners and others interested in Alpine Lake.	ALPRD	WC Land Information	Ongoing
Continue to distribute a welcome packet/mailling to all new shoreland property owners with basic lake stewardship information/brochures.	Waushara County	WCWLC UWEX Lakes	As needed
Communicate updates to this LMP and management activities to residents and users of the lake via email list and/or newsletter.	ALPRD		Ongoing
Host an annual meeting to discuss lake management and opportunities for shoreland property owners.	ALPRD		Annually
Host gatherings to learn about topics identified in this LMP. Invite speakers or conduct demonstrations. Incorporate food (potlucks, etc.) to increase attendance and make them more fun.	ALPRD	WCWLC UWEX Lakes WDNR	

Objective 10.2. Achieve good communication with clubs, municipalities, agency staff, elected officials, and organizations interested in Alpine Lake or lake health.

Actions	Lead person/group	Resources	Timeline
Network with other lake groups in Waushara County by having an Alpine Lake representative on the WCWLC.	ALPRD	WC UWEX	Quarterly
Network with other lakes in the state to learn lake management strategies, etc. by having a representative attend the Wisconsin Lake Convention	ALPRD	UWEX Lakes	Annually
Consider sending an individual interested in Alpine Lake to the Lake Leaders Institute	ALPRD	UWEX Lakes	

Encourage shoreland property owners and stewards to obtain “Lake Tides”, a quarterly newsletter about Wisconsin lakes.	ALPRD	UWEX Lakes	
Keep the contact information for the ALPRD commissioners current on the UWEX Lakes website.	ALPRD	UWEX Lakes	

Updates and Revisions

A management plan is a living document that changes over time to meet the current needs, challenges and desires of the lake and its community. The goals, objectives and actions listed in this plan should be reviewed annually and updated with any necessary changes.

Guiding Vision for Updates and Revisions

Alpine Lake will have an accurate, relevant, comprehensive lake management plan that is reviewed annually and documents all management activities and results.

Goal 11. Review plan annually and update with partners as needed or every five years.

Objective 11.1. Communicate updates with community members and members of the District.

Actions	Lead person/group	Resources	Timeline
Review this LMP at the annual meeting and discuss accomplishments and identification of goals/objectives/actions for upcoming year. Ask partners for updates ahead of the meeting.	ALPRD		Annually
Formally update this LMP as needed or every 5 years.	ALPRD	WCWLCWC UWEX	2019

Governance

This section was prepared by Waushara County UW-Extension.

Lake Management Plan Approval

The draft lake management plan will be completed by the lake association/district board, a committee, or a committee of the whole. The final draft of the lake management plan will be approved through a vote of the lake association/district membership or board. The final draft will be approved by the Wisconsin Department of Natural Resources (DNR) to have met the lake management plan requirements and grant requirements. If the DNR requires modifications or additional information before approving the plan, the plan will be changed to meet DNR requirements that are acceptable to the lake association/district. The completed plan that has been approved by the lake association/district and the DNR will be presented to the municipalities containing the lake and Waushara County. The municipality may reference the lake management plan or parts of the plan in their comprehensive plan to guide municipal or county decisions.

Lake Assistance

The lake management plan will enhance the ability of the lake to apply for financial assistance. The lake management plan will be considered as part of the application for grants through the Wisconsin Department of Natural Resources. Current listings of grants available from the DNR can be found at <http://dnr.wi.gov/aid/>. Waushara County offers technical and financial assistance through the Land Conservation and Zoning Department and University of Wisconsin-Extension Department. Additional assistance may be available from other agencies and organizations, including DNR, UW-Extension Lakes Program, Golden Sands RC&D, Wisconsin Wetlands Association, and Wisconsin Trout Unlimited.

Lake Regulations

The lake management plan is superseded by federal, state, county, and municipal laws and court rulings. However, the lake management plan may influence county and municipal ordinances and enforcement, which is why the lake management plan will be reviewed and included or referenced in the county and related municipal comprehensive plans. Federal laws contain regulations related to water quality, wetlands, dredging, and filling. State laws contain regulations related to water quality, water and lake use, aquatic plants and animals, shoreline vegetation, safety, and development. County laws contain regulations related to development, safety, use, and aquatic plants and animals. Municipal laws contain regulation of use and safety. The court system interprets these rules and regulations. The rules and regulations are primarily enforced by the US Army Corps of Engineers, the Wisconsin Department of Natural Resources, the Waushara County Sheriff Department, and the Waushara County Land Conservation and Zoning Office. If considering development near or on a lake, addressing problem plants or animals, or changing the lake bottom contact the Waushara County Land Conservation & Zoning Department at the Waushara County Courthouse (920) 787-0443 and/or the Wisconsin Department of Natural Resources (888) 936-7463.

Comprehensive Plans

The lake management plan and changes to the plan will be presented to the County and the Municipality for review and possible incorporation into their comprehensive plans. The comprehensive plan is intended to be used to guide future decision. Zoning, subdivision, and official mapping decisions must be consistent with the comprehensive plan.

Process for Inclusion in the Municipal Comprehensive Plan

The Municipal Plan Commission will review the lake management plan to determine if it is consistent with the municipality's comprehensive plan. If the lake management plan is found by the Municipal Plan Commission to not be consistent with the municipality's comprehensive plan, the plan commission may (a) recommend changes to the comprehensive plan or (b) ask that an aspect of the lake management plan be revisited. When the Municipal Plan Commission has reached a consensus that the lake management plan aligns with the municipality's vision, the Municipal Plan Commission will develop an amendment to the comprehensive plan referencing the lake management plan. This could include a reference to the lake management plan under local policies in the agricultural, natural and cultural resources background information and the addition of a recommendation to support the lake management plan and to implement the applicable recommendations contained in the lake management. The Municipal Plan Commission will recommend by resolution that the amendment to the comprehensive plan be adopted by the Municipal Board. A public hearing on the changes to the comprehensive plan will be held with a thirty-day class one notice. The Municipal Board will consider the recommendations from the Municipal Plan Commission. The Municipal Board may (a) adopt the recommendations to the comprehensive plan by ordinance, (b) adopt by ordinance the recommendations with changes, or (c) request the plan commission revisit the changes to the comprehensive plan.

Process for Inclusion in the County Comprehensive Plan

Waushara County Land Use Committee will review the updates to the municipality's comprehensive plan and the lake management plan as referenced by the municipality's comprehensive plan to determine if they are consistent with the County's comprehensive plan. If they are found by the land use committee to not be consistent with the municipality's comprehensive plan, the land use committee may (a) recommend changes to the County's comprehensive plan or (b) ask that an aspect of the lake management plan or municipality's comprehensive plan be revisited. When the Land Use Committee has reached a consensus that the updates to the municipality's comprehensive plan and the lake management plan aligns with the county's vision, and if it is not already consistent, it will develop an amendment to the County's comprehensive plan. The amendment may include a reference to the lake management plan under local policies in the agricultural, natural and cultural resources background information and the addition of a recommendation to support the lake management plan and to implement the applicable recommendations contained in the lake management. The Land Use Committee will recommend the amendment to the comprehensive plan to the Land, Water, and Education Committee.

The Land, Water, and Education Committee will review the amendment and if it concurs with the recommendation from the Land Use Committee, it will make a recommendation to the Planning & Zoning Committee. The Planning & Zoning Committee will hold a public hearing with a thirty-day class one notice. The Planning & Zoning Committee will recommend by resolution the amendment to the comprehensive plan or the amendment with changes be adopted by the County Board.

The County Board will consider the recommendations from the Planning & Zoning Committee. The County Board may (a) adopt the amendment to the comprehensive plan by ordinance, (b) adopt the amendment with changes, or (c) request the Land Use Committee or Planning & Zoning Committee revisit the changes to the comprehensive plan.

Use of the Comprehensive Plan

The lake management plans as referenced in the comprehensive plans will be used by the County and the Municipality to consider certain actions or in the implementation of zoning and other applicable regulations. The County Board of Adjustments and the County Planning and Zoning Committee may reference the lake management plans as referenced in the comprehensive plan when considering zone changes, variances, conditional uses, and suitable mitigation measures. The Municipality and County may take action as called for in the lake management plan as referenced in the comprehensive plan, including changes to zoning and other applicable regulations, shortly after the County's comprehensive plan has been updated or may take action as needed.

The lake organization, lake residents, riparian property owners, or other citizens may request that the Municipality or County take a specific action to implement aspects of the lake management plan as referenced in the comprehensive plan. The lake organization lake residents, riparian property owners, or other citizens may provide written or oral support to encourage the Municipality and County to reference the lake management plan when considering regulation or action that may impact the lake. The lake organization will inform the Municipality and the County when the lake management plan is updated and allow the Municipality and County an opportunity to participate in the update process.

References

- Bartz, David, 2015. The Fisheries of Alpine and Little Hills Lakes. Presentation given August 10, 2015 at the Marion Town Hall.
- Boat Ed, 2013. The Handbook of Wisconsin Boating Laws and Responsibilities. Approved by Wisconsin Department of Natural Resources. www.boat-ed.com
- Borman, Susan, Robert Korth, and Jo Temte, 2001. Through the looking glass, a field guide to aquatic plants. Reindl Printing, Inc. Merrill, Wisconsin.
- Epping, Dillon, 2015. Aquatic Invasive Species and Clean Boats Clean Waters. Presentation given June 5, 2015 at the Marion Town Hall.
- Haney, Ryan, 2015. How Is the Water in Alpine and Little Hills Lakes? Presentation given July 14, 2015 at the Marion Town Hall.
- McNelly, Jen, 2011. Aquatic Plant Survey of Alpine Lake, Waushara County. UW-Stevens Point Center for Watershed Science and Education.
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- Shaw, B., C. Mechenich, and L. Klessing, 2000. *Understanding Lake Data*. University of Wisconsin-Extension, Stevens Point. 20 pp.
- Turyk, Nancy, 2015. Aquatic Plants of Alpine and Little Hills Lakes. Presentation given June 5, 2015 at the Marion Town Hall.
- Turyk, Nancy, 2015. Healthy Land = Healthy Water. Presentation given July 14, 2015 and the Marion Town Hall.
- Turyk, Nancy, 2015. Healthy Shorelands. Presentation given August 10, 2014 at the Marion Town Hall.
- UW-Stevens Point Center for Watershed Science and Education, 2014. Waushara County Lakes Study – Alpine Lake. Final Report to Waushara County and Wisconsin Department of Natural Resources.
- UW-Stevens Point Center for Watershed Science and Education, 2013. Waushara County Lakes Study – Alpine Lake Summary. Report to Waushara County and Wisconsin Department of Natural Resources. Planning Meeting Presentations
- UW-Stevens Point Center for Watershed Science and Education, Waushara County Land Conservation, and Alpine Lake Protection & Rehabilitation District and Concerned Citizens, 2015. Aquatic Plant Management Plan 2015, Lake Alpine, Waushara County.
- Vallentyne, J.R., 1974. The Algal Bowl-Lakes and Man. Ottawa Department of the Environment.
- Wetzel, R.G., 2001. Limnology, Lake and River Ecosystems, Third Edition. Academic Press. San Diego, California.

Appendices

Appendix A. 2015 Waushara County Lake Information Directory

Algae - Blue-Green

Contact: Ted Johnson
Wisconsin Department of Natural Resources
Phone: 920-424-2104
E-mail: TedM.Johnson@wisconsin.gov
Website: <http://dnr.wi.gov/lakes/bluegreenalgae/>

Contact: Wisconsin Department of Health Services
1 West Wilson Street, Madison, WI 53703
Phone: 608-267-3242
Website:
<http://www.dhs.wisconsin.gov/eh/bluegreenalgae/contactus.htm>

Aquatic Invasive Species/Clean Boats Clean Water

Contact: Golden Sands RC&D
1100 Main St., Suite 150, Stevens Point, WI 54481
Phone: 715-343-6215
Websites: www.goldensandsrca.org
<http://dnr.wi.gov/invasives/>

Aquatic Plant Management (Native and Invasive)

Contact: Ted Johnson
Wisconsin Department of Natural Resources
Phone: 920-424-2104
E-mail: TedM.Johnson@wisconsin.gov
Website: <http://dnr.wi.gov/lakes/plants/>

Aquatic Plant Identification

Contact: Golden Sands RC&D
1100 Main St., Suite 150, Stevens Point, WI 54481
Phone: 715-343-6215
Website: www.goldensandsrca.org

Contact: Dr. Emmet Judziewicz
UWSP Freckmann Herbarium
TNR 301, 800 Reserve St., Stevens Point, WI 54481
Phone: 715-346-4248
E-mail: ejudziew@uwsp.edu

Contact: Ted Johnson
Wisconsin Department of Natural Resources
Phone: 920-424-2104
E-mail: TedM.Johnson@wisconsin.gov

Aquatic Plant Surveys/Management

Contact: Ted Johnson
Wisconsin Department of Natural Resources
Phone: 920-424-2104
E-mail: TedM.Johnson@wisconsin.gov
Website: <http://dnr.wi.gov/lakes/plants/>

Best Management Practices (rain gardens, shoreland buffers, agricultural practices, runoff controls)

Contact: Ed Hernandez
Waushara County Land Conservation Department
PO Box 1109, Wautoma, WI 54982
Phone: 920-787-0453
E-mail: lcdzoning.courthouse@co.waushara.wi.us
Website: <http://www.co.waushara.wi.us/zoning.htm>

Boat Landings, Signage, Permissions (County)

Contact: Scott Schuman
Waushara County Parks
PO Box 300, Wautoma, WI 54982
Phone: 920-787-7037
E-mail: wcparks.parks@co.waushara.wi.us
Website: <http://www.co.waushara.wi.us/parks.htm>

Boat Landings (State)

Contact: Dave Bartz
Wisconsin Department of Natural Resources
Hwy 22N, Box 430, Montello, WI 53949
Phone: 608-635-4989
E-mail: David.Bartz@wisconsin.gov
Website:
<http://dnr.wi.gov/org/land/facilities/boataccess/>

Boat Landings (Town)

Contact the clerk for the specific town/village in which the boat landing is located.

Conservation Easements

Contact: Gathering Waters Conservancy
211 S. Paterson St., Suite 270, Madison, WI 53703
Phone: 608-251-9131
E-mail: info@gatheringwaters.org
Website: <http://gatheringwaters.org/>

Conservation Easements (cont'd)

Contact: Ted Johnson
Wisconsin Department of Natural Resources
Phone: 920-424-2104
E-mail: TedM.Johnson@wisconsin.gov

Contact: Patrick Sorge
Wisconsin Department of Natural Resources
PO Box 4001, Eau Claire, WI 54702
Phone: 715-839-3794
E-mail: Patrick.Sorge@wisconsin.gov

Contact: North Central Conservancy Trust
PO Box 124, Stevens Point, WI 54481
Phone: 715-344-1910
E-mail: info@ncctwi.org
Website: <http://www.ncctwi.org/>

Contact: NRCS Stevens Point Service Center
1462 Strongs Ave., Stevens Point, WI 54481
Phone: 715-346-1325

Critical Habitat and Sensitive Areas

Contact: Ted Johnson
Wisconsin Department of Natural Resources
Phone: 920-424-2104
E-mail: TedM.Johnson@wisconsin.gov
Website: <http://dnr.wi.gov/lakes/criticalhabitat/>

Dams

Contact: Joe Behlen
Wisconsin Department of Natural Resources
473 Griffith Ave., Wisconsin Rapids, WI 54494
Phone: 715-421-9940
E-mail: joseph.behlen@wisconsin.gov
Website: <http://dnr.wi.gov/org/water/wm/dsfm/dams/>

Fertilizers/Soil Testing

Contact: Ken Williams
Waushara County UW- Extension
209 S St. Marie Street, PO Box 487, Wautoma, WI 54982
Phone: 920-787-0416
E-mail: ken.williams@ces.uwex.edu
Website: <http://waushara.uwex.edu/agriculture/services>

Fisheries Biologist (management, habitat)

Contact: Dave Bartz
Wisconsin Department of Natural Resources
Hwy 22N, Box 430, Montello, WI 53949
Phone: 608-635-4989
E-mail: David.Bartz@wisconsin.gov
Website: <http://dnr.wi.gov/fish/>

Frog Monitoring—Citizen Based

Contact: Andrew Badje, Wisconsin Department of Natural Resources
Phone: 608-266-3336
E-mail: Andrew.badje@wisconsin.gov
E-mail: WFTS@wisconsin.gov

Grants

Contact: Ted Johnson
Wisconsin Department of Natural Resources
Phone: 920-424-2104
E-mail: TedM.Johnson@wisconsin.gov
Website: <http://dnr.wi.gov/Aid/Grants.html#tabx8>

Contact: Ed Hernandez
Waushara County Land Conservation Department
PO Box 1109, Wautoma, WI 54982
Phone: 920-787-0453
E-mail: lcdzoning.courthouse@co.waushara.wi.us
Website: <http://www.co.waushara.wi.us/zoning.htm>

Groundwater Quality

Contact: Kevin Masarik
UWSP Center for Watershed Science & Education
TNR 224, 800 Reserve St., Stevens Point, WI 54481
Phone: 715-346-4276
E-mail: kmasarik@uwsp.edu
Website: <http://www.uwsp.edu/cnr/watersheds/>

Groundwater Levels/Quantity

Contact: Ed Hernandez
Waushara County Land Conservation Department
Address: PO Box 1109 Wautoma, WI 54982
Phone: 920-787-0453
E-mail: lcdzoning.courthouse@co.waushara.wi.us

Contact: George Kraft
UWSP Center for Watershed Science & Education
TNR 224, 800 Reserve St., Stevens Point, WI 54481
Phone: 715-346-2984
E-mail: george.kraft@uwsp.edu

Groundwater Levels/Quantity (Cont'd)

Contact: Scott Provost
Wisconsin Department of Natural Resources
473 Griffith Ave., Wisconsin Rapids, WI 54494
Phone: 715-421-7881
E-mail: scott.provost@wisconsin.gov
Website:
[http://prodoasext.dnr.wi.gov/inter1/hicap\\$.st
artup](http://prodoasext.dnr.wi.gov/inter1/hicap$.startup)

Informational Packets

Contact: UWSP Center for Watershed Science &
Education
TNR 224, 800 Reserve St. Stevens Point, WI 54481
Phone: 715-346-2497
E-mail: pclakes@uwsp.edu

Lake Groups – Friends, Associations, Districts

Contact: Patrick Nehring
UWEX Economic Resource Development Agent
PO Box 487, Wautoma, WI 54982
Phone: 920-787-0416
E-mail: Patrick.nehring@ces.uwex.edu

Contact: Patrick Goggin
UWEX Lakes
TNR 203, 800 Reserve St., Stevens Point, WI 54481
Phone: 715-365-8943
E-mail: pgoggin@uwsp.edu
Website:
[http://www.uwsp.edu/cnr/uwexlakes/o
rganizations/](http://www.uwsp.edu/cnr/uwexlakes/organizations/)

Lake Groups – Friends, Associations, Districts

Contact: Eric Olson
UWEX Lakes
TNR 206, 800 Reserve St., Stevens Point, WI 54481
Phone: 715-346-2192
E-mail: eolson@uwsp.edu
Website:
[http://www.uwsp.edu/cnr/uwexlake
s/organizations/](http://www.uwsp.edu/cnr/uwexlake/s/organizations/)

Contact: Susan Tesarik
Wisconsin Lakes
4513 Vernon Blvd., Suite 101, Madison, WI 53705
Phone: 1-800-542-5253
E-mail: lakeinfo@wisconsinlakes.org
Website: <http://wisconsinlakes.org/>

Lake Levels

See: Groundwater

Lake-Related Law Enforcement (no-wake, transporting invasives, etc.)

Contact: Ben Mott
State Conservation Warden
Wisconsin Department of Natural Resources
427 E. Tower Drive, Suite 100, Wautoma, WI 54982
Phone: 920-896-3383
Website: <http://www.wigamewarden.com/>

Land Use Plans and Zoning Ordinances

Contact: Terri Dopp-Paukstat
Waushara County Planning and Zoning
PO Box 1109, Wautoma, WI 54982
Phone: 920-787-0453
E-mail: lcdzoning.courthouse@co.waushara.wi.us
Website: <http://www.co.waushara.wi.us/zoning.htm>

Contact: UWSP Center for Land Use Education
TNR 208, 800 Reserve St., Stevens Point, WI 54481
Phone: 715-346-3783
E-mail: Center.for.Land.Use.Education@uwsp.edu
Website: <http://www.uwsp.edu/cnr/landcenter/>

Nutrient Management Plans

Contact: Ed Hernandez
Waushara County Land Conservation Department
PO Box 1109, Wautoma, WI 54982
Phone: 920-787-0453
E-mail: lcdzoning.courthouse@co.waushara.wi.us
Website: <http://www.co.waushara.wi.us/zoning.htm>

Nutrient Management Plans (cont'd)

Contact: NRCS Stevens Point Service Center
1462 Strongs Ave., Stevens Point, WI 54481
Phone: 715-346-1325

Parks (County)

Contact: Scott Schuman
Waushara County Parks
PO Box 300, Wautoma, WI 54982
Phone: 920-787-7037
E-mail: wcparks.parks@co.waushara.wi.us
Website: <http://www.co.waushara.wi.us/parks.htm>

Purchase of Development Rights

Contact: North Central Conservancy Trust
PO Box 124, Stevens Point, WI 54481
Phone: 715-341-7741
E-mail: info@ncctwi.org
Website: <http://www.ncctwi.org/>

Purchase of Land

Contact: Ted Johnson
Wisconsin Department of Natural Resources
Phone: 920-424-2104
E-mail: TedM.Johnson@wisconsin.gov
Website: <http://dnr.wi.gov/topic/stewardship/>

Rain Barrels – Order

Contact: Golden Sands RC&D
1100 Main St., Suite 150, Stevens Point, WI 54481
Phone: 715-343-6215
Website: <http://www.goldensandsrcd.org/store>

Rain Gardens and Stormwater Runoff

Contact: Ed Hernandez
Waushara County Land Conservation Department
PO Box 1109, Wautoma, WI 54982
Phone: 920-787-0453
E-mail: lcdzoning.courthouse@co.waushara.wi.us
Website: <http://www.co.waushara.wi.us/zoning.htm>

Septic Systems/Onsite Waste

Contact: Terri Dopp-Paukstat
Waushara County Planning and Zoning
PO Box 1109, Wautoma, WI 54982
Phone: 920-787-0453
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Shoreland Management

Contact: Ed Hernandez
Waushara County Land Conservation Department
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Website: <http://www.co.waushara.wi.us/zoning.htm>

Shoreland Vegetation

<http://dnr.wi.gov/topic/ShorelandZoning/>

Shoreland Zoning Ordinances

See: Land Use Plans and Zoning Ordinances

Soil Fertility Testing

Contact: Ken Williams
Waushara County UW- Extension
209 S St. Marie Street, PO Box 487, Wautoma, WI 54982
Phone: 920-787-0416
E-mail: Ken.williams@ces.uwex.edu
Website: <http://waushara.uwex.edu/index.html>

Water Quality Monitoring

Contact: Ted Johnson
Wisconsin Department of Natural Resources
Phone: 920-424-2104
E-mail: TedM.Johnson@wisconsin.gov

Water Quality Problems

Contact: Ted Johnson
Wisconsin Department of Natural Resources
Phone: 920-424-2104
E-mail: TedM.Johnson@wisconsin.gov

Contact: Nancy Turyk

UWSP Center for Watershed Science and Education
TNR 216, 800 Reserve St., Stevens Point, WI 54481
Phone: 715-346-4155
E-mail: nturyk@uwsp.edu

Wetlands

Contact: Keith Patrick
Wisconsin Department of Natural Resources
5301 Rib Mountain Drive, Wausau, WI 54401
Phone: 715-241-7502
E-mail: keith.patrick@wisconsin.gov
Website: <http://dnr.wi.gov/wetlands/>

Contact: Wisconsin Wetlands Association
214 N. Hamilton Street, #201, Madison, WI 53703
Phone: 608-250-9971
Email: info@wisconsinwetlands.org

Wetland Inventory

Contact: Dr. Emmet Judziewicz
UWSP Freckmann Herbarium
TNR 301, 800 Reserve St., Stevens Point, WI 54481
Phone: 715-346-4248
E-mail: ejudziew@uwsp.edu

Woody Habitat

Contact: Dave Bartz, Wisconsin Department of
Natural Resources

Phone:608-635-4989

Address: Hwy 22N Box 430, Montello, WI 53949

E-mail: David.Bartz@wisconsin.gov

If you are looking for any information that is not
listed in this directory, please contact:

Ryan Haney (wclakes@uwsp.edu)

UWSP Center for Watershed Science and
Education

TNR 224, 800 Reserve St., Stevens Point, WI 54481

Phone: 715-346-2497

Appendix B. Aquatic Plants

Alpine Lake Aquatic Plant Survey Summary, 2011.

	Lake Average	Statewide Average	North Central Hardwood Forests Ecoregion Average
Littoral Frequency of Occurrence (%)	98.8	74.3	76
Maximum Depth of Plant Growth (ft)	19	15.3	15.9
Species Richness	14	16.8	16.2
Floristic Quality Index (FQI)	19.1	24.1	23.3

Frequency of occurrence of aquatic plant species observed in Alpine Lake, 2011.

Scientific Name	Common Name	Coefficient of Conservatism Value (C Value)	2011 % Frequency of Occurrence
Emergent Species			
<i>Typha augustifolia</i>	narrow-leaved cattail	1	---
Floating Leaf Species			
<i>Nymphaea odorata</i>	white water lily	6	1.27
Submergent Species			
<i>Chara</i> spp.	muskgrass	7	64.14
<i>Vallisneria americana</i>	wild celery	6	57.81
<i>Elodea canadensis</i>	common waterweed	3	52.74
<i>Ceratophyllum demersum</i>	coontail	3	51.9
<i>Najas flexilis</i>	slender naiad	6	44.73
<i>Stuckenia pectinata</i>	sago pondweed	3	18.57
<i>Potamogeton illinoensis</i>	Illinois pondweed	6	13.92
<i>Potamogeton zosteriformis</i>	flat-stem pondweed	6	12.24
<i>Myriophyllum spicatum</i>	hybrid water-milfoil	0	8.86
<i>Utricularia vulgaris</i>	common bladderwort	7	7.2
<i>Heteranthis dubia</i>	water star-grass	6	4.64
<i>Utricularia gibba</i>	creeping bladderwort	9	0.84
<i>Potamogeton crispus</i> (2012 survey)	curly-leaf pondweed	0	---

Appendix C. Aquatic Plant Management Options

Summary of Aquatic Plant Management Planning Session Discussion – June 5, 2015

Residents have been attempting to manage the excessive aquatic plant growth, both native and invasive, for some time. A drawdown was conducted during the winter of 2011-2012; however, a mild winter led to limited success. A whole-lake treatment was conducted for CLP and EWM management in spring 2015 by Stantec. The future strategies will be based on the results of the post-treatment survey.

Management options will change depending upon the amount of EWM/HWM and CLP in Alpine Lake; therefore, routine annual monitoring of these species is essential. The presence of AIS will also define the type of aquatic plant management that could be conducted to address recreational impediments. The following aquatic plant management options were determined to be the most practical and effective options that would allow for recreational use of Alpine Lake and minimize impacts to native aquatic plant community:

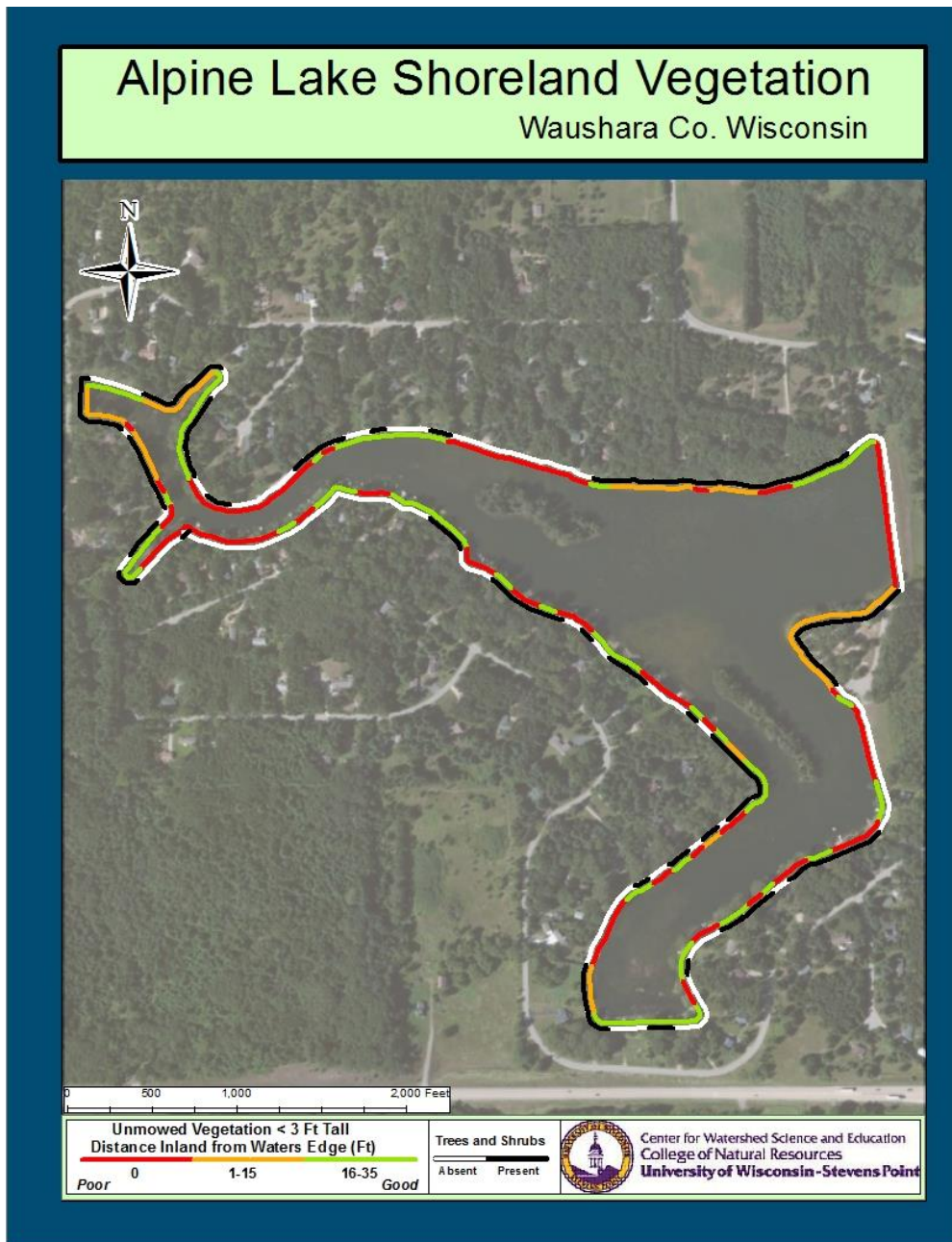
- **Manual removal.** (target species: HWM or CLP) This is essentially being done by individual lake front property owners now. They are permitted to clear an area up to 30' around their dock for boat and swimming access to open water. Additionally, those trained to properly identify and remove EWM and other aquatic invasive species can remove those plants manually any time of year, without a permit. Trained divers can be hired to manually remove HWM in deeper parts of the lake in areas less than 1 acre. This is most effective as a follow-up to chemical treatments, where HWM presence is spotty.
- **Chemical spot treatment.** (target species: HWM) Results of recent studies of the effectiveness of chemical spot treatment suggest the treatment is less effective than previously thought and may actually promote chemically resistant forms of HWM. However, chemical spot treatments may still be appropriate in certain conditions to control HWM in the future. The type of chemical(s) used should be based on the specific type of hybrid. If treating less than 5 acres, a contact herbicide such as endothall or diquat should be used. To avoid developing resistant plant strains, systemic herbicides should be avoided. Treatment should occur early in the season, prior to emersion of native plants. To reduce the chance of developing resilient strains of HWM; different treatments should be used each year.
- **Mechanical harvesting.** (Native aquatic plants) A harvester could be purchased or hired to cut access lanes through dense vegetation to provide boating access and improve fish habitat. However, HWM can be spread through fragmentation so the EWM population may be increased by mechanical harvesting. Therefore, it is desirable to treat HWM (by manual removal or chemical treatment prior to use of mechanical harvesting. If this technique is considered in the future, a more detailed harvesting plan should be developed, and a permit should be sought.
- **Skimming.** (Native aquatic plants and filamentous algae). Floating plant material that limits swimming during the later parts of summer may accumulate in some areas of the flowage and bays. Skimming and removal of this plant material could be conducted in areas deeper water depths where sediment and emergent plants would not be disturbed by this activity. Skimming can be conducted by mechanical or non-mechanical means.

- Milfoil weevils. (HWM) This option could be considered in areas of the lake with native or restored shorelines where harvesting and chemicals are not being used. Milfoil weevils are not commercially available so obtaining a starter population and rearing them in predator-free conditions can be desirable from a financial standpoint. Weevils cannot be used in conjunction with chemical application unless in a relatively isolated, untreated bay or lobe. Professional assistance should be sought if stocking or rearing is pursued.

Techniques applied within the watershed and on shoreland property can reduce the nutrient loading responsible for aquatic plant growth in the lake. Good shoreland management practices are especially critical in problem areas of Alpine Lake. This is discussed further in the Shoreland and Watershed sections.

Appendix D. Shoreland Survey – 2011

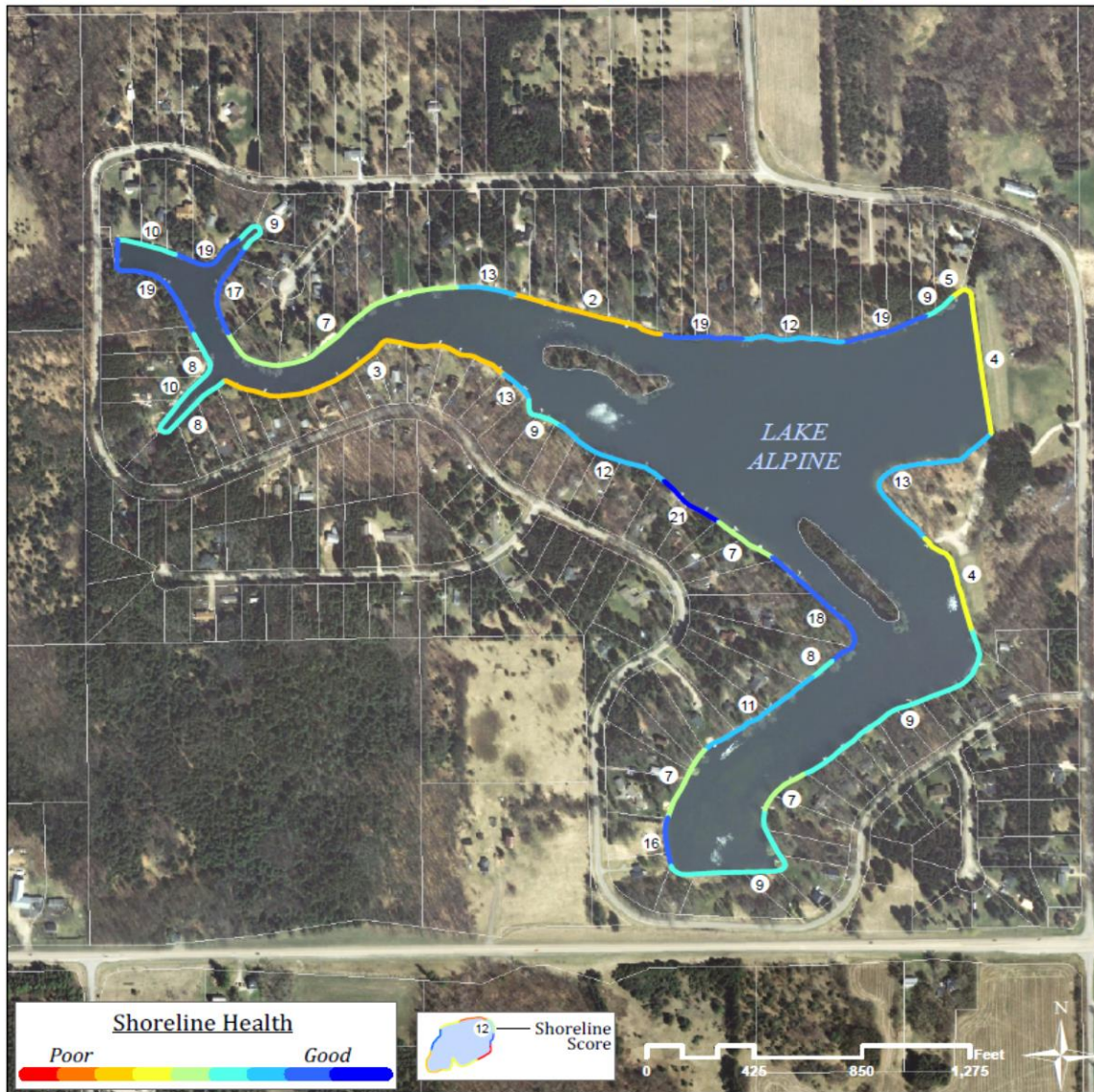
A scoring system was developed for the collected data to provide a more holistic assessment. Areas that are healthy will need strategies to keep them healthy, and areas with potential problem areas and where management and conservation may be warranted may need a different set of strategies for improvement. The scoring system is based on the presence/absence and abundance of shoreline features, as well as their proximity to the water's edge. Values were tallied for each shoreline category and then summed to produce an overall score. Higher scores denote a healthier shoreline with good land management practices. These are areas where protection and/or conservation should be targeted. On the other hand, lower scores signify an ecologically unhealthy shoreline. These are areas where management and/or mitigation practices may be desirable for improving water quality.



The summary of scores for shorelands around Alpine Lake are displayed below. The shorelands were color-coded to show their overall health based on natural and physical characteristics. Blue shorelands identify healthy shorelands with sufficient vegetation and few disturbances. Red shorelands indicate locations where changes in management or mitigation may be warranted.

Waushara County Shoreline Assessment *LAKE ALPINE*

Map Date -- July, 2011
Aerial Date -- April, 2010



Summary
Shorelines are color-coded to show their overall health based on natural and physical characteristics. For example, shorelines shown in red indicate locations where management or mitigation may be warranted. Blue shorelines mark healthy riparian areas with natural vegetation and few human influences.

Calculating Shoreline Scores
Scores are based on the presence/absence of:
+ Natural vegetation
+ Human influences (docks, boathouses, etc)
+ Erosion
+ Structures

Center for Land Use Education
Map created by Dan McFarlane
Center for Land Use Education

Overall shoreland health around Alpine Lake.

Appendix E. Dam Details

Detailed Information for Dam : ALPINE LAKE				
Dam Key Seq No	60	Field File No	69.21	
Size	LARGE	NID		
Popular Name		Former Name		
Location				
County	Waushara			
Latitude	44.062270	Longitude	-89.168890	
Permitted TRS		Located TRS		
QQ:SE QQ:SE Q:NE - Sec:04 T:16N R:11E		QQ:NE Q:SE - Sec: 04 T: 16N R: 11E		
Contacts				
Owner		Alternate		
Organization	WAUSHARA COUNTY			
Name		Name		
Address	P.O. BOX 300 Waushara			
Waterbody				
Drainage Basin (sq mi)	3.50			
Stream		Impoundment		
Local Name	BRUCE (THORSTAD) CREEK		Local Name	ALPINE LAKE
Row and Official Name		Row and Official Name		
Navigable ?	Y	Size (acres)	80	
When was navigability determined ?		Maximum Depth (ft)	17	
Regulatory/Inspection				
NR 333 Years	EAP-2012 IOM-2012 HYD-2008 STAB: ZONE 2007			
Auth Approval Desc	3WR471	Regulatory Agency	WDNR	
Hazard Rating	L	Estimated Hazard Rating	L	
Ferc No		Exempt Issue Date		
Ferc Inspection Year		License Expiration Year		
Construction Characteristics				
Normal Storage (acre-ft)	450	Max Storage (acre-ft)	950	
Structural Height (ft)	25	Hydraulic Height (ft)	19	
Crest Length (ft)	600	Spillway Type		
Discharge Through Principal Spillway (cfs)	110	Width/Diameter of Pricipal Spillway (ft)	3	
Total Discharge Through All Spillways (cfs)	110	Total Width/Diameter of all Spillways (ft)		
Core Type		Position		
Foundation Type		Foundation Certainty		
Purpose(s)		Structure Type(s)		
Water Levels				
	Normal		Winter	
	MSL	Datum	MSL	Datum
Minimum	847			
Normal				
Maximum	847.50			
Construction History				
Designer	Construction Firm		Complete Year	
RICE AND URBAN LTD			1970	
Outlet Gates				

Appendix F. Lake User Survey Results