2015

Kusel Lake Management Plan

Prepared 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

Kusel Lake Management Plan

The Kusel Lake Management Plan was developed with input from residents and lake users at a series of four public planning sessions held at the Wild Rose Community Center in Wild Rose, Wisconsin during February-May 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 the Kusel/Wilson/Round Lakes Protection & Rehabilitation District on: September 19, 2015 .
Date

The plan was adopted by the Town of Springwater on: _____.
Date

The plan was adopted by Waushara County on: _____.
Date

The plan was approved by the Wisconsin Department of Natural Resources on: _____.
Date

A special thanks to all who helped to create the Kusel 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 to this planning process:

Waushara County Watershed Lakes Council

Waushara County Staff and Citizens

Wisconsin Department of Natural Resources Lake Manager, Ted Johnson

Wisconsin Department of Natural Resources Lake Protection Grant Program

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Overarching Vision for Kusel Lake

Kusel Lake will remain a clean, peaceful place for a variety of recreational activities and provide a respite for residents, visitors, and wildlife alike. Excellent water clarity, good fishing and navigability will continue to be assets of the lake, and will be maintained by the collaborative lake stewardship of Kusel Lake community members.

Introduction

Kusel Lake is a 74- to 80-acre seepage lake located in the township of Springwater, west of Saxeville and east of County Highway H. It is home to approximately 97 lakefront residences, and the public is able to enjoy the lake via the public boat launch on its eastern side. The maximum depth in Kusel Lake is 29 feet, and its bottom is mostly sand with a small amount of muck. In 2015, community members around Kusel Lake came together in partnership with Waushara County and technical professionals to develop this lake management plan.

The purpose of this plan is to provide a framework for the protection and improvement of Kusel Lake. Implementing the content of this lake management plan (LMP) will enable citizens and other supporters to achieve the vision for Kusel 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 Kusel 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 Kusel 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 Kusel Lake can have the greatest influence on the lake by understanding and choosing lake-friendly options to manage their land and the lake.
- **Kusel/Wilson/Round Lakes Protection & Rehabilitation District:** This plan provides the 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 Kusel 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 enjoyable.

- **The Towns of Springwater and Mount Morris:** The towns 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 state funding– 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 Wisconsin Department of Natural Resources professionals were also incorporated into the planning process, helping to create 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 Kusel 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, the data used in the development of this plan were detailed in the report *Waushara County Lake Study - Kusel Lake 2010-2012*, University of Wisconsin-Stevens Point.

The Planning Process

The planning process included a series of four public planning sessions held between February and May at the Wild Rose Community Center. The Kusel Lake Planning Management Committee consisted of property owners, recreational users, and District members. 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 and Development, 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 sent directly to Kusel 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 E: Lake User Survey Results.

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.

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

Goals, Objectives and Actions

The following goals, objectives and associated actions were derived from the values and concerns of citizens interested in Kusel Lake and members of the Kusel Lake Management Planning Committee, as well as the known science about Kusel 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 Kusel Lake Management Plan will ensure that the vision is supported and that changes or new challenges are incorporated into the plan. 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.**

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, Kusel, Wilson, Round Lakes Protection & Rehabilitation District

The following priorities have been identified as key elements of this plan:

- ✓ **Measures should be taken to reduce near shore and watershed-wide impacts to the lake.**
- ✓ **Private well owners should consider testing their well water for atrazine and nitrates.**
- ✓ **Landowners in the watershed should work to reduce their impacts through the implementation of water quality-based best management practices on the landscape.**
- ✓ **Routine monitoring should be done to evaluate changes in water quality.**
- ✓ **Improve water quality through changes in land management practices.**
- ✓ **Strategies should be developed to ensure healthy shorelands remain intact and efforts should be made to improve shorelands that have disturbance.**
- ✓ **Dissemination of relevant information to property owners is the recommended first step towards gaining healthy shorelands.**
- ✓ **Waushara County Land Conservation Department staff is available to assist shoreland property owners interested in learning how to improve water quality through changes in land management practices.**
- ✓ **Efforts should be made to control or eliminate Eurasian watermilfoil and curly-leaf pondweed.**
- ✓ **Minimizing disturbances to aquatic plants can greatly benefit Kusel Lake.**
- ✓ **Lake residents and lake users should be made aware of boat and trailer hygiene techniques to prevent introduction of new aquatic invasive species.**
- ✓ **Early identification of new infestations is helpful in controlling and possible eradication of aquatic invasive species.**

The following goals were identified as 'high priority' for Kusel Lake (short-term, first 1-3 years):

Goal 3. Kusel Lake will have no new aquatic or terrestrial invasive species, and current populations of invasive species will be eradicated. (Aquatic Invasive Species (AIS)**)**

Objective 3.1. Eradicate Eurasian watermilfoil (EWM) on Kusel Lake. Remove 100% of all observed plants.

- **Conduct regular aquatic plant surveys (by consultants).**
- **Retain experts to treat AIS (primarily EWM) with herbicide.**
- **Check effectiveness of treatment in late summer, then hand-pull any remaining EWM.**
- **Use Kusel Lake volunteers and others to hand pull EWM to the greatest extent possible.**

Goal 4. Lake users and shoreland property owners on Kusel Lake will remain informed on how to identify, monitor, prevent and control aquatic and terrestrial invasive species. (Aquatic Invasive Species (AIS)**)**

Objective 4.1. Identify, monitor and quickly address any new aquatic invasive species on Kusel Lake.

<u>Institute Clean Boats/Clean Waters Program</u>

- **Use volunteers.**
- **Hire young people to work on weekends.**
- **Install better signage.**

Goal 9. Foster an environment of compliance and consideration amongst lake users. (Recreation**)**

Objective 9.1. Inform lake users with the information they need to make responsible decisions.

<u>Educate lake users of lake rules, especially No Wake hours</u>

- **Install prominent signage at boat landings.**
- **Provide hand-outs to all riparian landowners.**
- **Notify renters of these rules.**

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
Citizen Lake Monitoring Network	CLMN
Center for Watershed Science and Education	CWSE
Kusel, Wilson, Round Lakes Protection & Rehabilitation District	KWRLPRD
North Central Conservancy Trust	NCCT
Golden Sands Resource Conservation and Development Council, Inc.	RC&D
UW Extension	UWEX
University of Wisconsin-Stevens Point	UWSP
Waushara County Land Conservation Department	WCLCD
Wisconsin Environmental Analysis Laboratory	WEAL
Wisconsin Department of Natural Resources	WDNR

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

In-Lake Habitat and a Healthy Lake

Many lake users value Kusel Lake for its fishing, wildlife, and good water quality. 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 seeking pleasure 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 Kusel Lake includes the aquatic plants, branches, and tree limbs above and below the water.

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 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.

Slightly over one third of survey respondents felt that the quality of fishing had declined in their time associated with the lake with very few fish large enough to keep. Water level decline, invasive species and overfishing were thought to be the culprits.

The most recent comprehensive fish survey was conducted in spring 2008 by the WDNR and included fyke-netting and boomshocking. Largemouth bass, the dominant predator fish in Kusel Lake, were found in above average abundance (slightly higher abundance than the previous 1999 survey), but had poor size structure and below average growth. Northern pike and Walleye are also present but in lesser numbers. All predator species exhibited slightly below average growth rates.


Dave Bartz, WDNR Fisheries Biologist

Bluegill, the dominant panfish in Kusel Lake, were found in average abundance and exhibited above average growth and good size structure. Crappie and yellow perch populations were fairly low. Yellow bullheads were common with most fish running from 8-10 inches. Other species were found in much lower abundance and made up a very small portion of the panfish/prey population.

The following are observations and management recommendations made by the WDNR Fisheries Biologist during the 2008 survey:

Low water levels the last few years have left critical spawning habitat for northern pike and yellow perch high and dry. Higher water conditions in the spring of 2008 should result in a boost for these 2 species populations. These 2 species especially, rely heavily on habitat such as bulrushes and wood in the water for their eggs to adhere and survive. The walleye stocked in the fall of 2007 had a high survival rate their first winter in Kusel Lake. Of all the walleyes we sampled 54% were from this stocking. The next largest year class is from the fall of 2003 stocking which probably achieved legal size (15 inches) during the summer of 2008. Largemouth Bass continue to be the most abundant predator, with a population similar to the 1999 survey. Size structure continues to be poor with very few fish over the state wide size limit of 14 inches. Competition for the limited amount of food and angler harvest has resulted in a slow growing relatively poor condition largemouth bass population. On the flip side, numerous predators keep the bluegill numbers in line, resulting in less competition and a quality bluegill fishery.

Habitat protection and enhancement remains the number one component in improving the fishery of Kusel Lake. Near shore habitat is critical for providing spawning areas and establishing the food base in which all life stages of fish rely on to flourish.

Slow growth rates of LMB and NP are directly related to available food. We will continue to monitor the bass population to assure that densities don't get to high. Although NP densities appear to be slightly low; size structure and growth are average and numbers may be at a healthy level for this lake. Both species have the potential to stockpile below the established size limits and create densities that are detrimental to the balance of the fishery.

Walleye stocking has done little to produce a fishable population. Fish that do survive their first year have a better chance of surviving to adulthood. Consideration should be given to stocking larger fish in alternate years and fin clipping fish to track their success.

Bluegill populations appear to be healthy. Predation by the gamefish helps to keep their numbers in check and reduces the chance for "stunting".

Guiding Vision for the Fish Community

Kusel Lake will have a healthy, well-balanced and sustainable fishery.

Goal 1. Improve the quality of the fishery on Kusel Lake through sustainable management practices. We will know we have achieved this goal when the current fishery surveys indicate a healthy, balanced and fishable community with self-sustaining populations.

Objective 1.1. Work to improve fish habitat along shoreland and near-shore areas and inform lake residents and users about fishery-related information and issues.

Actions	Lead person/group	Resources	Timeline
Inform individuals about the importance of woody habitat in shallow water near-shore areas of Kusel Lake and encourage placement in appropriate areas.	Dave Bartz, WDNR Fish Biologist	WDNR UW-Stevens Point WCLCD	Ongoing
Continue to protect and restore shoreland areas and avoid shoreland alterations to improve fish habitat.	KWRLPRD		Ongoing
Maintain contact with We Really Kare fishing club and keep them in the loop with Kusel Lake fishery-related issues and actions.	KWRLPRD	We Really Kare, Inc.	

Aquatic Plant Community

Aquatic plants provide the forested landscape within Kusel 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.

In 2011, the Wisconsin Department of Natural Resources conducted an aquatic plant survey of Kusel Lake. During the survey, 53% (125 of 236) of sites visited had vegetative growth. Of the sampled sites, the average depth was 9.2 feet and the maximum depth was 20 feet. Twenty-seven species of aquatic plants were found in Kusel Lake. When compared with other lakes in Waushara County, Kusel Lake had the second highest number of species. The greatest diversity was located in the northern and northwestern shallows.

The Floristic Quality Index (FQI) evaluates the closeness of a plant community to undisturbed conditions. Each plant is assigned a coefficient of conservatism (c value) that reflects its sensitivity to disturbance; these numbers are used to calculate the FQI. C values range from 0 to 10, with higher values designating species that are more intolerant of disturbance. A c value of zero is assigned to exotic and most nonvascular species; therefore, these species are not included in the calculation. The FQI for Kusel Lake was 29.2. This value was above average for lakes within the Waushara County lakes study and is above the statewide average of 24.1.

The dominant plant species in Kusel Lake during the survey was muskgrass (*Chara* spp.), followed by variable pondweed (*Potamogeton gramineus*) and water celery (*Valisneria americana*). Muskgrass is a favorite food source for a wide variety of waterfowl. Muskgrass beds offer cover and food for fish, especially young trout, largemouth bass, and smallmouth bass. The fruits and tubers of variable pondweed provide food for geese and ducks, and the entire plant may be eaten by a variety of wildlife such as deer, muskrat, beaver, and moose. Water celery is a favorite food for waterfowl grazing (Borman et al., 2001). No species of special concern were found.

During the 2011 aquatic plant survey of Kusel Lake, the aquatic invasive Eurasian water-milfoil (EWM) was found at five sampling sites. A reconnaissance survey was conducted for aquatic invasive species in 2013 by staff from Golden Sands RC&D, Inc. Fragments of uprooted EWM were found, but rooted plants were not observed during the survey.

Overall, the aquatic plant community in Kusel Lake can be characterized as having average species diversity. The identification of Eurasian water-milfoil within the lake is cause for concern and the densities and population within the lake should continue to be monitored. When considering future lake management strategies, protection against the introduction of additional invasive species should be combined with efforts to preserve the habitat, food source, and water quality benefits of the native plant community.

More detailed information can be found in the Kusel Lake Aquatic Plant Report or the Kusel Lake 2010-2012 Lake Study Report.

Summary of Aquatic Plant Management Planning Session Discussion – March 6, 2015

Survey responses to questions about aquatic plants in Kusel Lake indicated that most lake users did not perceive an overabundance of plants in the lake at most times.

The following aquatic plant management strategies were discussed:

- *Do nothing.* With the aquatic plants in the lake in an already 'choked' state, the density of aquatic plants cannot likely get much worse. This result can be achieved without the expenditure of aggressive management.
- *Chemical treatment* is generally not permitted for control of native species.
- *Manual removal.* This is essentially being done by individual lake front property owners now. They are permitted to clear an area up to 30 feet from their dock for boat and swimming access to open water. Additionally, those trained to properly identify and remove aquatic invasive species can remove those manually any time of year.
- *Mechanical harvesting.* A harvester can be purchased or hired to cut traffic and access lanes through dense vegetation to provide boating access and improve fish habitat (with the proper permit). However, Eurasian watermilfoil, which has a 'spotty' population in Kusel Lake, is commonly spread through fragmentation. For this reason the Eurasian watermilfoil population may be exacerbated by mechanical harvesting, so this invasive in particular would need to be controlled prior to mechanical harvesting occurring on the lake.
- *Techniques applied within the watershed* and on shoreland property can reduce the nutrient loading responsible for aquatic plant growth in the lake. This is discussed further in the Shoreland and Watershed sections.

Guiding Vision for Aquatic Plants in Kusel Lake

Kusel Lake will have a healthy and diverse native aquatic plant community that supports a balanced fishery and promotes good water quality while allowing for unimpeded recreation.

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

Objective 2.1. Maintain the native aquatic plant community within Kusel Lake while allowing for recreational use unimpeded by excessive aquatic plant growth.

Actions	Lead person/group	Resources	Timeline
Reduce dense aquatic plant growth by encouraging	KWRLPRD	Handouts	

property owners to refrain from using fertilizers on shoreland properties (see Shoreland Section of this plan).			
Keep disturbance to the native plant community to a minimum by informing District members of their importance.	KWRLPRD	Handouts District website	
If plants severely impede recreation, consider hand pulling small areas around personal docks.			

Objective 2.2. Enhance shoreland vegetation and encourage best management practices within the watershed.

Actions	Lead person/group	Resources	Timeline
See **Shorelands** and **Watersheds** sections.			

Aquatic Invasive Species (AIS)

Aquatic invasives species are non-native aquatic plants and animals that are most often unintentionally introduced into a lake 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.

According to WDNR records, hybrid Eurasian/northern watermilfoil (HWM) was first documented in Kusel Lake in 1993 and curly-leaf pondweed (CLP) was first documented in 1994. Records also show banded mystery snail found in 2009.

Figure 1. Curly-leaf pondweed.

Curly-leaf pondweed (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 Kusel Lake, CLP should be monitored annually in early June, and if the beds expand, management should be considered.

Eurasian watermilfoil (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 its response to control of EWM 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 population of EWM 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 Kusel Lake should be adapted as EWM populations in the lake change and as new information becomes available.

Figure 2. Eurasian watermilfoil.

Hybrid watermilfoil (HWM) results from a hybridization of native watermilfoils with Eurasian watermilfoil. HWM tends to be more resilient and less effected by chemical treatment. HWM may be suspect in a lake if 1) the plants appearance is different than EWM; 2) management with chemicals becomes difficult or ineffective; and 3) the lake is near other lakes with HWM. If these criteria are met, plant samples should be submitted to a lab for confirmation. Once HWM is 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 an even more resilient strain in the lake, damage to the native aquatic plant population, and a waste of money.

The EWM population in Kusel Lake is spotty with a few moderately dense beds along the north side of the lake typically totaling less than 1 acre (~1%).

Figure 1. Distribution of hybrid watermilfoil (*Myriophyllum spicatum x sibiricum*) identified on October 30, 2014 in Kusel Lake, Waushara County, WI.

Kusel Lake EWM 10/30/14

Moderately dense EWM

Scattered EWM

N W E S

0 0.125 0.25 0.5 Kilometers

Cason & ASSOCIATES, LLC
LAKE & POND MANAGERS

The following is taken from Cason's March 2015 memorandum to the lake district summarizing management activities conducted in 2014:

"***Recent Management Activity***

Eurasian watermilfoil and its hybrid have been managed over the past decade on Kusel Lake with the use of aquatic herbicides. In 2007, over 19 acres of milfoil were treated with Navigate (granular 2,4-D) at a rate of 100 lbs/acre. Since the 2007 treatment, milfoil has been maintained at relatively low levels with annual surveys and spring treatments. During the fall 2011 survey, only 1.2 acres of milfoil were mapped. A survey on October 24, 2012 found there was an increase in the abundance of milfoil beds. A total of 6.35 acres of sparsely distributed hybrid watermilfoil were found. A survey on October 11, 2013 found sparsely growing beds covering an area of approximately 0.35 acres. It was noted at the time of the survey, that the native plant community did not appear to be as robust as normal for Kusel Lake. In many of the areas where native and invasive species are commonly found in abundance, only a few species were identified.

The most recent treatment took place on June 4, 2014. A total of 0.5 acres in the northeast channel was targeted with 100 lbs of Navigate applied at a rate of 4 ppm.

Curly-leaf pondweed, another aquatic invasive species, was first identified in Kusel Lake over 10 years ago. In this time, curly-leaf pondweed has not expanded significantly and has yet to reach nuisance levels in the lake. In recent years, spring surveys of Kusel Lake have been conducted as a means to monitor curly-leaf pondweed growth. On May 24, 2014 a survey was conducted.

Survey Results

During the May 2014 survey, no AIS were identified, with the exception of the hybrid watermilfoil previously identified in the northeast channel.

A fair amount of hybrid watermilfoil was found during the October 30, 2014 survey ranging in density from scattered to moderately dense (Figure 1). In total, 6.5 acres were found growing primarily in the western half of the lake (Table 1). Two beds totaling 0.6 acres were found east of the sandbar. The remaining 5.9 acres were found in one generally horseshoe-shaped bed which followed the 10-foot contour along the western shore."

Table 1. Size and average depth of Eurasian/hybrid watermilfoil beds indentified on October 30, 2014 in Kusel Lake, Waushara County, WI.

Site	Acres	Average Depth (ft)
A	5.9	10
B	0.1	7
C	0.5	9
Total	6.5	

Diver-assisted suction harvesting (DASH) was conducted on an area of approximately 0.6 acre in the northeast channel in August 2014 to remove remaining EWM.

Summary of Aquatic Invasive Species Discussion – March 6, 2015

As noted by Cason, chemical treatments have been effective in the control of EWM in Kusel Lake, but collateral damage of native species may be reaching a threshold where further treatment should be considered cautiously. After treatment, planning participants seem inclined to focus on manual removal techniques such as hand pulling and diver assisted removal while continuing to carefully monitor the population annually. CLP does not appear to reach nuisance levels without treatment.

Management options will change depending upon the amount of EWM and CLP in Kusel 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 strategies were determined to be the most practical and effective options that would minimize impacts to Kusel Lake as a whole.

- *Manual removal.* (Native plants, EWM 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 AIS in deeper parts of the lake. **With the low populations of EWM currently in Kusel Lake, this is the WDNR's preferred approach for removal.**

- *Chemical spot treatment.* (EWM or CLP) 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 EWM. However, chemical spot treatments may still be appropriate in certain conditions to control EWM in the future. Because hybrid milfoil (HWM) is determined to be present, the type of chemical should be based on the specific type of hybrid. This can be determined through DNA testing. If EWM is found to not be a hybrid, and are typically less than 5 acres, a contact herbicide such as endothall or diquat should be used. Systemic herbicides should not be used. Treatment should occur early in the season, prior to emersion of native plants. To reduce the chance of developing resilient strains of EWM; different treatments should be used each year.

- *Chemical whole-lake treatment.* (EWM or CLP) Whole lake chemical treatments may be appropriate if invasive populations exceed 5% of the total area of the lake. However, this approach comes with drawbacks, most notably the potential impact to native plants and animals, exorbitant cost, and difficulty in determining the appropriate dose (controlled by lake depth, morphology, stratification, timing, etc.). Kusel Lake has an FQI above the state average. Particular caution should be used to protect this virtue. Be sure to involve the WDNR in discussions prior to February of any given year to allow sufficient time for permitting and collection of pre-treatment data.

- *Do nothing.* In some lakes, AIS do not reach nuisance levels even without active treatment.

- *Techniques applied within the watershed* and on shoreland property can reduce the nutrient loading responsible for aquatic plant growth in the lake. This is discussed further in the Shoreland and Watershed sections.

Guiding Vision for Aquatic Invasive Species

Aquatic invasive species will not adversely impact habitat or recreation on Kusel Lake.

Goal 3. Kusel Lake will have no new aquatic or terrestrial invasive species, and current populations of invasive species will be eradicated.

Objective 3.1. Eradicate Eurasian watermilfoil (EWM) on Kusel Lake. Remove 100% of all observed plants.

Actions	Lead person/group	Resources	Timeline
If deemed appropriate, treat EWM with herbicide using whole-lake or spot treatments.	KWRLPRD	Cason & Associates or other qualified contractor	Early summer
If a chemical treatment is done, follow-up with post-treatment surveys and manual removal methods (i.e. hand-pulling, SCUBA divers, suction, etc.).	KWRLPRD	Cason & Associates or other qualified contractor RC&D	Annually
Conduct regular aquatic plant surveys (at least annually) to assess EWM population and evaluate	KWRLPRD	Cason & Associates or other qualified contractor	Annually, post-chemical treatment

effectiveness of any chemical treatments.			
Use aggressive manual removal of all EWM in Kusel Lake using volunteers and others.	KWRLPRD		Ongoing Post-chemical treatment

Goal 4. Lake users and shoreland property owners on Kusel Lake will remain informed on how to identify, monitor, prevent and control aquatic and terrestrial invasive species.

Objective 4.1. Identify, monitor and quickly address any new aquatic invasive species on Kusel Lake.

Actions	Lead person/group	Resources	Timeline
Hold workshops to teach residents to identify, monitor and properly remove aquatic invasive species.	KWRLPRD	RC&D	
Arrange for Clean Boats, Clean Waters volunteers at the public boat launch on busy/holiday weekends.	KWRLPRD	RC&D	
Work with RC&D to coordinate volunteer monitoring shared with other area lakes through the Clean Boats, Clean Waters Program.	KWRLPRD	RC&D	
Improve signage at boat landing regarding AIS. Consider an interpretive kiosk or something similar.	KWRLPRD	UWEX Lakes Town of Springwater	
Protect native plant species so as not to create open niches for AIS.		WDNR Lake Manager	Ongoing

Objective 4.2. Identify, monitor, and prevent terrestrial invasive species on or around Kusel Lake.

Actions	Lead person/group	Resources	Timeline
Hold workshops to teach residents to identify, monitor and properly remove phragmites, purple loosestrife, Japanese knotweed and other terrestrial invasive species on their properties.	KWRLPRD	RC&D	
Protect native plant species so as not to create open niches for terrestrial invasive species.		WDNR Lake Manager	Ongoing

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 Wisconsin Department of Natural Resources 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 Kusel Lake does not have an official critical habitat area designation, there are areas within Kusel 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 elements of good quality habitat. Identifying other 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.

Guiding Vision Kusel Lake's Critical Habitat

Sensitive areas in and around Kusel Lake will be protected from degradation.

Goal 5. Identify and inform others of quality habitat in and near Kusel Lake.

Objective 5.1. Explore options for official identification of important habitat areas to inform others and to better protect habitat in the lake.

Actions	Lead person/group	Resources	Timeline
Request critical habitat designations from WDNR.	Kusel Lake Commissioner	WDNR Lake Specialists	
If critical habitat is designated on Kusel Lake, communicate to property owners, visitors, and Town Board as to why these areas are important.		WDNR Critical Habitat Report	

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 Kusel 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 Kusel 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

About two thirds of survey respondents indicated that they did not perceive any significant changes in water quality during their time at the lake. 100% of survey respondents said that water quality had a major impact on both the economic value of the lake and their own personal enjoyment.

A variety of water chemistry measurements were used to characterize the water quality in Kusel 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 Kusel Lake's water quality.

Dissolved oxygen is an important measure in Kusel 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. When the lake was mixed, the oxygen was consistent throughout the depths, and during summer and winter the dissolved oxygen concentrations were highest near the surface and lowest near the bottom of the lake. There were sufficient oxygen levels to maintain a balanced fishery during all time of the year throughout the study period.

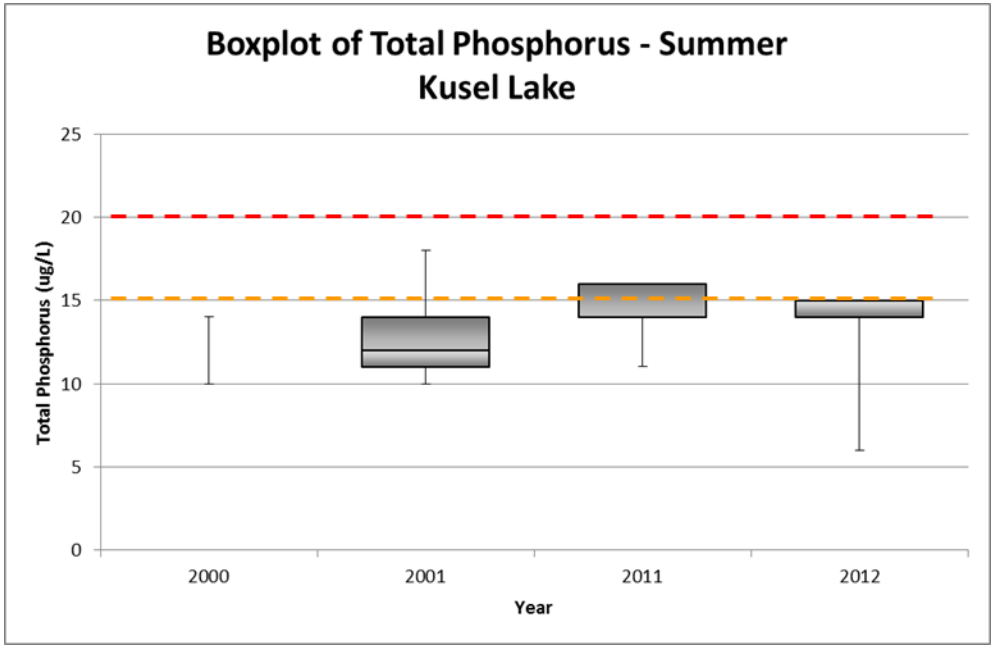
The water clarity measured in Kusel Lake during the study period was considered fair. For Kusel Lake, water clarity ranged from 7 feet to 13.7 feet, with an average of 10.6 feet over the two-year monitoring period. When compared with historic data collected between 1999 and 2005, the average water clarity measured during the study was about the same in July and slightly poorer in June and August. Water clarity in Kusel Lake was typically poorer in early summer and in the fall.

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. Water in Kusel Lake had low average chloride concentrations and moderate sodium and potassium concentrations over the monitoring period, suggesting that certain human activities may be impacting the lake. 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 (DACT), an herbicide commonly used on corn, was found in low concentrations in Kusel Lake (0.11 ug/L). The presence of this chemical suggests that agricultural activities in the surrounding area are impacting water quality. Some toxicity studies have indicated that reproductive system abnormalities can occur in frogs at these levels (Hayes, 2001; Hayes, 2003).

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 so much 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.

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



During the study, total phosphorus concentrations in samples collected from Kusel Lake ranged from a high of 30 ug/L when the lake was mixed in April 2012 to a low of 6 ug/L in August. Summer median total phosphorus concentrations were 14 ug/L and 15 ug/L in 2011 and 2012, respectively. This is below Wisconsin's phosphorus standard of 20 ug/L for deep seepage lakes such as Kusel Lake. Nitrogen concentrations were similar to background concentrations. Inorganic nitrogen concentrations were at background levels for lakes in central Wisconsin.

Managing nitrogen, phosphorus and soil erosion throughout the Kusel 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 Kusel 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.

Guiding Vision for Water Quality in Kusel Lake

Kusel Lake will have clean, clear water that supports a healthy lake ecosystem and great recreational opportunities.

Goal 6. Minimize nutrient and sediment loading to the lake by improving land management practices near the lake.

Objective 6.1. The water quality in Kusel Lake will be maintained the same or better than the average measurements observed during the 2010-2012 study. *(Median summer concentrations of total phosphorus less than 15 mg/L).*

Actions	Lead person/group	Resources	Timeline
Refrain from the use of fertilizers on shoreland properties (see Shorelands section). Consider distributing educational materials around the lake.	KWRLPRD Board	UWEX Lakes (educational materials)	2016, Ongoing

Inform others around the lake about the impacts of nutrients and land management on water quality through the distribution of a District newsletter and neighborly discussions. Consider including information on a lake sign.	KWRLPRD Board	UWEX Lakes (educational materials)	2016, Ongoing
Encourage the restoration of unmowed vegetation between in shoreland areas to slow and absorb runoff and pollutants from the road (see Shorelands section).	KWRLPRD Board	UWEX Lakes (educational materials)	2016, Ongoing
Encourage private well owners around Kusel Lake to test their water for nitrates and herbicides.	Volunteers	WEAL	Ongoing
Establish/continue a monitoring program for water clarity, phosphorus and chlorophyll-a.	Volunteers	CLMN	2016
Monitor dates of ice on/ice off and submit the information to the state database.	Kusel Lake volunteers UWSP		Ongoing

Objective 6.2. Develop strategies to ensure healthy shorelands remain intact and improvements are made to those that have disturbance.

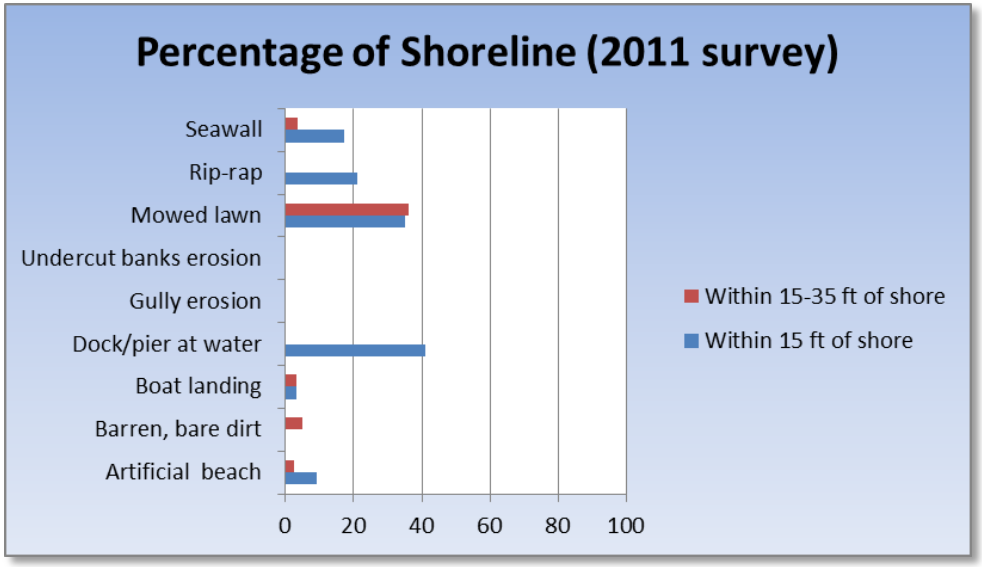
Actions	Lead person/group	Resources	Timeline
See **Shorelands** section.			

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 Kusel Lake is displayed on the map in the Appendix. Large stretches of Kusel Lake's shorelands were in good shape, especially along the southern shore. However, some portions along the northern and northeastern shore had challenges that may still need to be addressed. Some of these areas 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 97 lakefront lots, 2,910 feet (16%) of disturbed shoreland is permitted. Based on the 2011 shoreland inventory, 36% (6,505 feet) of Kusel 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.

Summary: Fish sticks were installed in nearshore areas of Kusel Lake during winter 2013-14.

Guiding Vision for Kusel Lake's Shorelands

The planning committee envisions protecting and re-establishing the shorelines around Kusel Lake so that they are all stable, healthy and naturally vegetated.

Goal 7. Protect and/or restore healthy stable shoreland habitat near and around Kusel Lake. Over the next five years, 50 feet of shoreland will be restored.

Objective 7.1. Maintain and protect vegetated shorelands where they already exist, and encourage restoring a vegetated buffer where the shorelands are mowed to the edge. Show support for healthy shoreland maintenance and restoration.

Actions	Lead person/group	Resources	Timeline
Continue to protect and restore shoreland areas and avoid shoreland alterations to improve fish habitat, water quality, etc.	Waushara County		Ongoing

Get assistance for restoration of shoreland vegetation, help with restoration/plantings, and cost-sharing for interested property owners.		WCLCD Consultants	
Consider restoration projects to create a shoreland demonstration site and offer tours.			
Inform individuals about the importance of woody habitat in shallow water near-shore areas of Kusel Lake and encourage placement in appropriate areas.	We Really Kare Fishing Club	WDNR UW-Stevens Point WCLCD	Ongoing
Support property owners interested in conservation easements, purchase of development rights, etc. Inform property owners of options.		Waushara Co. NCCT	

Objective 7.2. Shoreland property owners around Kusel Lake and local decision-makers will understand their roles in protecting and restoring shoreland vegetation and will make informed land management decisions.

Actions	Lead person/group	Resources	Timeline
Distribute welcome packets to all new shoreland property owners. Packets should contain information regarding the importance of healthy shoreland habitat and steps to restore areas near or surrounding the lake.	KWRLPRD Board Waushara Co.		
Provide materials to property owners about healthy shorelands and lake friendly practices in welcome packets.		Educational materials from: WCLCD UWEX Lakes WCWLC	

Watershed Land Use

It is important to understand where Kusel 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 Kusel 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 Kusel Lake is 1,179 acres. Primary land use is forest (Figure 3). The lake's shoreland is surrounded primarily by [lake specific]. In general, the land closest to the lake has the greatest immediate impact on water quality.

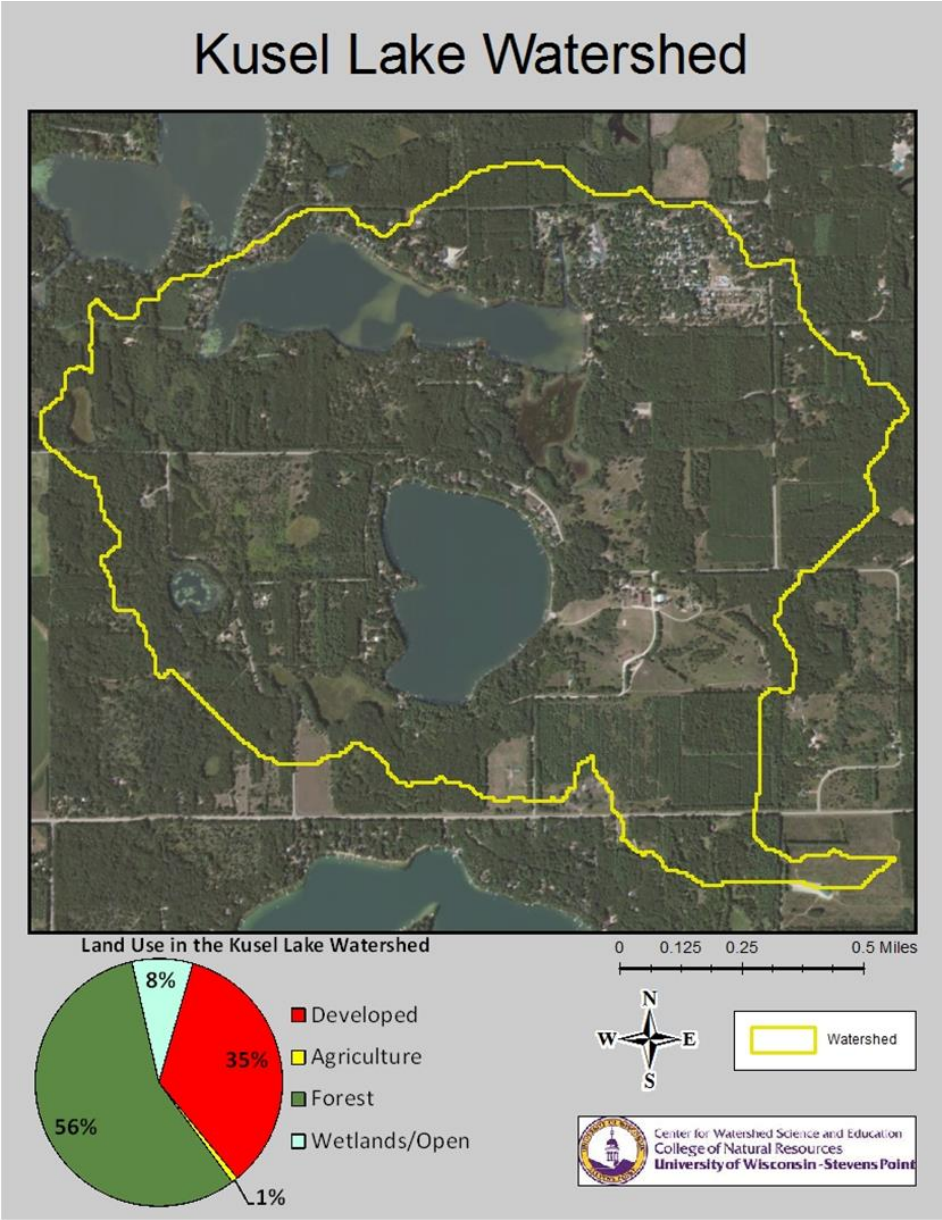
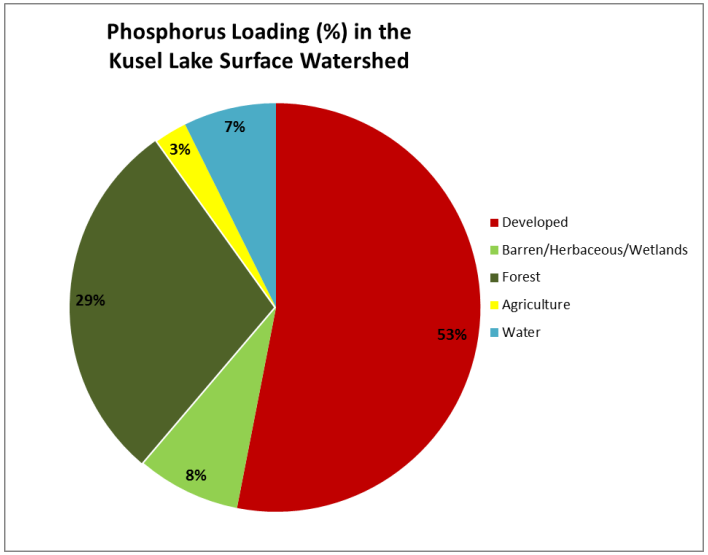


Figure 3. Surface watershed of Kusel Lake.



Estimates of phosphorus from the landscape can help to understand the phosphorus sources to Kusel 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 had the greatest percentages of phosphorus contributions from the watershed to Kusel Lake. The phosphorus export coefficients have been obtained from studies throughout Wisconsin (Panuska and Lillie, 1995).

Guiding Vision for Kusel Lake's Watershed

Kusel Lake will be protected so it is available for the use of future generations.

Goal 8. Land use in the Kusel Lake watershed will minimize impacts to its water quality.

Objective 8.1. Protect important habitat and reduce runoff around Kusel Lake and within its watershed by informing landowners of options and opportunities.

Actions	Lead person/group	Resources	Timeline
Explore the purchase of development rights that permanently protect the landscape while retaining private ownership.	KWRLPRD Membership	Waushara Co. Conservationist	2018, Ongoing
Encourage conservation easements to restrict development or uses of land that would impact critical habitat or natural features of the land.	KWRLPRD Board	NRCS NCCT Gathering Waters	2018, Ongoing
Encourage the County to support and follow-up with water quality-based Best Management Practices (BMPs) within the watershed.		WCLCD NRCS	

Encourage subdivisions and other new developments to manage stormwater on site and consider septic system impacts to Kusel Lake.		Waushara Co. Planning and Zoning	
Discourage large water withdrawal projects that may impact the water levels in Kusel Lake.		WCLWC Friends of the Central Sands	
Protect wetlands to maintain the water budget of Kusel Lake. Any altered wetlands will be mitigated within the lake's watershed.		WCLCD NRCS Waushara Co. Highway Dept. WDOT	
Continue to use Waushara Co. Land Conservation as a resource for land management activities.		WCLCD	

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 a positive impact on the lake and on those who enjoy this common resource. Collaborative efforts may have a bigger positive impact; therefore, communication and cooperation between a 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

One public boat launch is located on the eastern side of the lake. No Wake hours are from 5pm to 10 am. The lake is enjoyed by people who swim, boat, fish, and appreciate its beauty. 90% of survey respondents like the No Wake hours as they are, but feel some sort of enforcement is necessary. Many voiced concerns over the sheer numbers of boats on the lake during busy weekends.

Guiding Vision for Recreation

Kusel Lake will be a place for cordial multiuse recreation including activity-filled days and quiet, cozy nights.

Goal 9. Foster an environment of compliance and consideration amongst lake users.

Objective 9.1. Inform lake users with the information they need to make responsible decisions.

Actions	Lead person/group	Resources	Timeline
Educate lake users on No Wake hours and impacts of erosion through improved signage and information available at rental units.	KWRLPRD Private owners		
Maintain signage at Kusel Lake boat landing regarding lake rules.	Town of Springwater	UWEX	
Notify landowners of the Waushara County noise ordinance.	KWRLPRD	Handouts District website	
Ask landlords to inform renters of No Wake hours and noise ordinance.	KWRLPRD	Handouts District website	

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 Kusel 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 Kusel, Wilson, Round Lakes Protection and Rehabilitation District and its members will maintain and build communications internally and within the community.

Goal 10. Maintain open communications with lake users to keep visitors and residents informed about responsible lake stewardship and encourage involvement.

Objective 10.1. Distribute important lake information to residents and lake visitors.

Actions	Lead person/group	Resources	Timeline
Notify landowners of www.KWR-lakes.com website.	KWRLPRD		
Continue distribution of a welcome packet to all new shoreland owners via WC or WCWLC.	Waushara County	WCWLC WCLCD	
Maintain contact with various entities and ensure they are informed of lake related issues, events, and information. (i.e. We Really Kare, Inc., Jim Button – Evergreen Campsite, etc.)	KWRLPRD		

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

The lake management plan for Kusel Lake will be reviewed annually and updated as needed.

Goal 11. Kusel Lake will have an up-to-date, accurate and comprehensive lake management plan that is reviewed annually and documents all management activities and effects.

Objective 11.1. Communicate updates to District and community members.

Actions	Lead person/group	Resources	Timeline
The plan will be reviewed by the District board incorporating updates from the membership.	KWRLPRD	Membership	Annually

Governance

Written by Patrick Nehring, Community Agent, UW-Extension Waushara County.

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 be 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

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.

Haney, Ryan, 2014. Water Quality in Kusel, Wilson and Round Lakes. Presentation given at the Wild Rose Community Center on April 10, 2015.

Hayes, T., K. Haston, M. Tsui, A. Hoang, C. Haeffele and A. Vonk. 2003. *Atrazine-Induced Hermaphroditism at 0.1 PPB in American Leopard Frogs (Rana pipiens): Laboratory and Field Evidence*. Environmental Health Perspectives 111: 568-575.

Hayes, T.K. A. Collins, M, L,, Magdelena Mendoza, N. Noriega, A. A. Stuart, and A. Vonk. 2001. *Hermaphroditic, demasculinized frogs after exposure to the herbicide atrazine at low ecologically relevant doses*. National Academy of Sciences vol. 99 no. 8, 5476–5480.

Panuska and Lillie, 1995. Phosphorus Loadings from Wisconsin Watershed: Recommended Phosphorus Export Coefficients for Agricultural and Forested Watersheds. Bulletin Number 38, Bureau of Research, Wisconsin Department of Natural Resources.

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Turyk, Nancy, 2014. The Aquatic Plants of Kusel, Wilson and Round Lakes. Presentation given at the Wild Rose Community Center on March 6, 2015.

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UW-Stevens Point Center for Watershed Science and Education, 2013. Waushara County Lake Study - Kusel Lake 2010-2012 Mini-Report. Report to Waushara County and Wisconsin Department of Natural Resources. Planning Meeting Presentations

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: Waushara County Lakes 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.goldensandsrcd.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.goldensandsrcd.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.

Citizen Lake Monitoring Network
Contact: Brenda Nordin
Wisconsin Department of Natural Resources
Phone: 920-662-5141
E-mail: brenda.nordin@wisconsin.gov

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/

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 St, PO Box 487, Wautoma, WI 54982
Phone: 920-787-0416
E-mail: ken.williams@ces.uwex.edu
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
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/organizations/

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/uwexlakes/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

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
E-mail: lcdzoning.courthouse@co.waushara.wi.us
Website: http://www.co.waushara.wi.us/zoning.htm

Shoreland Management

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

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

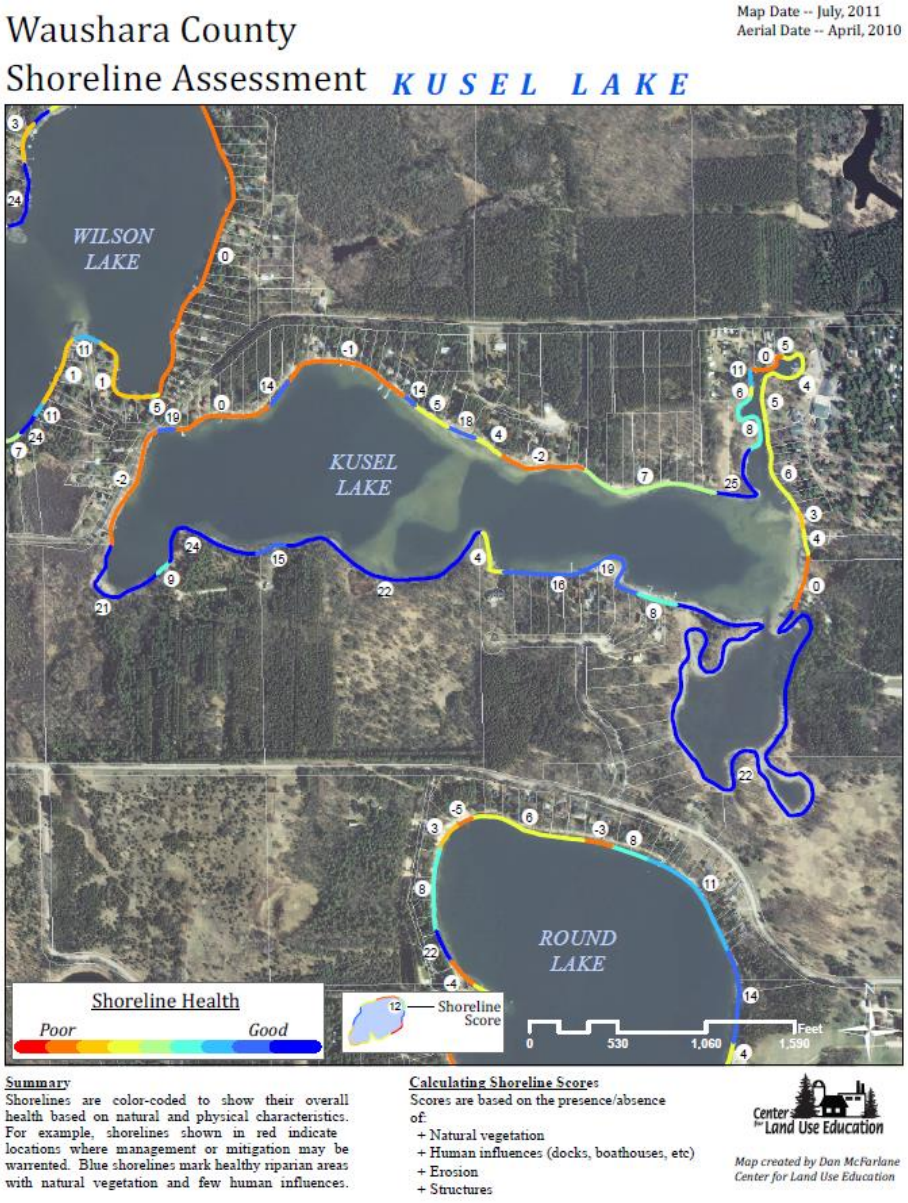
Contact: Dave Bartz
Wisconsin Department of Natural Resources
Phone:608-635-4989
Address: Hwy 22N Box 430, Montello, WI 53949
E-mail: David.Bartz@wisconsin.gov

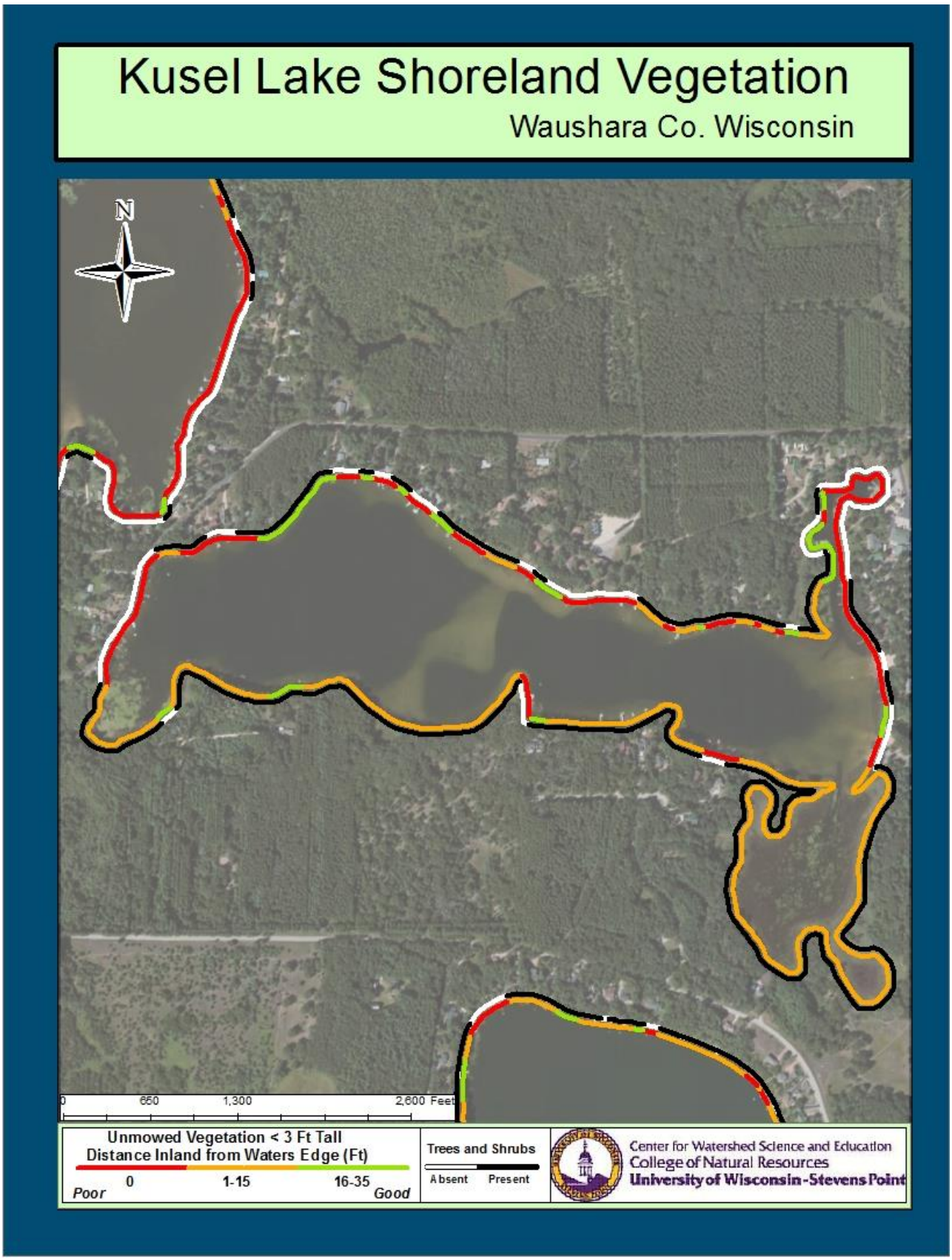
If you are looking for any information that is not listed in this directory, please contact:
Ryan Haney (wclakes@uwsp.edu)
UWSP Center for Watershed Science and Education
TNR 224, 800 Reserve St., Stevens Point, WI 54481
Phone: 715-346-2497

Appendix B: Shoreland Survey – 2010

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 Kusel Lake are displayed on the following page. 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. Large stretches of Kusel Lake's shorelands were in good shape, especially along the southern shore. However, some portions along the northern and northeastern shore had challenges that may still need to be addressed. Some of these areas ranked as poor. For a more complete understanding of the ranking, an interactive map showing results of the shoreland surveys can be found on Waushara County's website at http://gis.co.waushara.wi.us/ShorelineViewer/.




Kusel Lake Shoreland Vegetation
Waushara Co. Wisconsin
N
0
650
1,300
2,600 Feet
Unmowed Vegetation < 3 Ft Tall
Distance Inland from Waters Edge (Ft)
0
1-15
16-35
Poor
Good
Trees and Shrubs
Absent
Present
Center for Watershed Science and Education
College of Natural Resources
University of Wisconsin-Stevens Point

Appendix C: Rapid Response Plan

SURVEY/MONITOR

1. Learn how to survey/monitor the lake.	**Contacts:** **Water Resource Management Specialist** Wisconsin Department of Natural Resources Phone: 920-424-2104 E-Mail: TedM.Johnson@wisconsin.gov **Regional Aquatic Invasive Species (AIS) Coordinator** Golden Sands RC&D 1100 Main St., Suite #150 Stevens Point, WI 54481 Phone: 715-343-6278 E-Mail: info@goldensandsrcd.org
2. Survey/monitor the lake monthly/seasonally/annually.	If you find a suspected invasive species, report it as soon as possible using the procedure below.

REPORTING A SUSPECTED INVASIVE SPECIES

1. Collect specimens or take photos. Regardless of the method used, provide as much information as possible. Try to include flowers, seeds or fruit, buds, full leaves, stems, roots and other distinctive features. In photos, place a coin, pencil or ruler for scale. Deliver or send specimen ASAP.	Collect, press and dry a complete sample. This method is best because a plant expert can then examine the specimen. **-OR-** Collect a fresh sample. Enclose in a plastic bag with a moist paper towel and refrigerate. **-OR-** Take detailed photos (digital or film).
2. Note the location where the specimen was found. If possible, give the exact geographic location using a GPS (global positioning system) unit, topographic map, or the Wisconsin Gazetteer map book. If using a map, include a photocopy with a dot showing the plant's location. You can use TopoZone.com to find the precise location on a digital topographic map. Click the cursor on the exact collection site and note the coordinates (choose UTM or Latitude/Longitude).	Provide one or more of the following: • Latitude & Longitude • UTM (Universal Transverse Mercator) coordinates • County, Township, Range, Section, Part-section • Precise written site description, noting nearest city & road names, landmarks, local topography

3. Gather information to aid in positive species identification.	• Collection date and county • Your name, address, phone, email • Exact location (Latitude/Longitude or UTM preferred, or Township/Range/Section) • Plant name (common or scientific) • Land ownership (if known) • Population description (estimated number of plants and area covered) • Habitat type(s) where found (forest, field, prairie, wetland, open water)
4. Mail or bring specimens and information to any of the following locations: Digital photos may be emailed.	**Wisconsin Dept. Natural Resources** 427 E. Tower Drive, Suite 100 Wautoma, WI 54982 Phone: (920) 787-4686 **Regional AIS Coordinator** Golden Sands RC&D 1100 Main St., Suite #150 Stevens Point, WI 54481 Phone: 715-343-6214 E-Mail : info@goldensandsrcd.org **UW-Stevens Point Herbarium** 301 Trainer Natural Resources Building 800 Reserve Street Stevens Point, WI 54481 Phone: 715-346-4248 E-Mail: ejudziew@uwsp.edu **Wisconsin Invasive Plants Reporting & Prevention Project** Herbarium-UW-Madison 430 Lincoln Drive Madison, WI 53706 Phone: (608) 267-7612 E-Mail: invasiveplants@mailplus.wisc.edu
5. Once the specimen is dropped off or sent for positive identification, be sure to contact:	**Regional AIS Coordinator** Golden Sands RC&D 1100 Main St., Suite #150 Stevens Point, WI 54481 Phone: 715-343-6214 E-Mail : info@goldensandsrcd.org

If an invasive species is confirmed, the Regional AIS Coordinator will make the following public information contacts:

- **Wisconsin Department of Natural Resources**
  427 E. Tower Drive, Suite 100
  Wautoma, WI 54982
  Phone: (920) 787-4686

  The town board(s) in which the water body is located

  Town of: Springwater

- **The Lake District** in which the waterbody is located.
  Contact:
  Phone:

- **University of Wisconsin-Stevens Point**
  Water Resource Scientist
  Nancy Turyk
  Trainer Natural Resources Building
  800 Reserve Street
  Stevens Point, WI 54481Telephone: 715-346-4155
  E-mail: nturyk@uwsp.edu

- **Local Residents**

- **Lake District/Association**

If an invasive species is confirmed the secretary of the Kusel Wilson Round Lake District will make the following public information contacts:

- **Newspapers**: The Argus, The Resorter

Contact the WDNR to post notice(s) at the access point(s) to the water body.

Appendix D: Aquatic Plant Management Strategies

General recommendations:

- Reduce nutrients traveling to the lake from the landscape.
- Avoid increasing algal blooms by maintaining a healthy amount of aquatic plants.
- Don't denude the lakebed.
    - Increases potential for aquatic invasive species establishment.
    - Sediments can add phosphorus to the water which may lead to increased algal growth.
- Choose options that are appropriate for your lake's situation.
- Monitor and adjust your strategies if you are not making headway!

List of Aquatic Plant Management Options (selection of options varies with situation):

No Action

ADVANTAGES	LIMITATIONS
∗ No associated cost. ∗ Least disruptive to lake ecosystem.	∗ May not be effective in achieving aquatic plant management objectives.

Hand Pulling

ADVANTAGES	LIMITATIONS
∗ Can be used for thinning aquatic plants around docks. ∗ Can target specific plants - with proper training. ∗ Can be effective in controlling small infestations of aquatic invasive species. ∗ No associated cost. ∗ If aquatic invasive species are not pulled properly, could worsen the problem.	∗ Removes near-shore wildlife and fish habitat. ∗ Opens up areas where invasives to become established.

Hand Pulling Using Suction

ADVANTAGES	LIMITATIONS
∗ Can be used for thinning plants around docks. ∗ Can be used in deeper areas (with divers). ∗ Can target specific plants with proper training. ∗ Can be effective in controlling small infestations of aquatic invasive species. ∗ May be useful in helping to remove upper root mass of aquatic invasive species.	∗ Costs associated with hiring a diver may be comparable to chemical treatment expenses. ∗ Currently an experimental treatment – not readily available. ∗ If aquatic invasive species are not pulled properly, could worsen the problem.

Mechanical Harvesting

ADVANTAGES	LIMITATIONS
∗ Removes plant material and nutrients. ∗ Can target specific locations. ∗ Used to manage larger areas for recreational access or fishery management.	∗ Not used in water depths less than 3 feet. ∗ Some harm to aquatic organisms. ∗ Is a temporary control. ∗ Risk of introduction of new aquatic invasive species (on a hired harvester) or spread of some existing invasive species. ∗ Hired cost at least $150/hr.

Water Level Manipulation

ADVANTAGES	LIMITATIONS
∗ Controls aquatic plants in shallower, near-shore areas. ∗ Can be low cost.	∗ Requires a controlling structure on the lake. ∗ May cause undesired stress on ecosystem. ∗ Cannot be used frequently.

Milfoil Weevils

ADVANTAGES	LIMITATIONS
∗ Natural, native maintenance of native and exotic milfoils. ∗ Prefers the aquatic invasive Eurasian Watermilfoil. ∗ Some lakes may already have a native populations; need a professional stem count and assessment of shoreland health, structure of fishery, etc. ∗ Doesn't harm lake ecosystem.	∗ Require healthy shoreline habitat for overwintering. ∗ Cannot survive in areas of mechanical harvesting or herbicide application. ∗ Effectiveness highly variable between lakes (only works well for some lakes). ∗ Limited access to weevils for purchase in WI. ∗ Still considered experimental.

Chemical Treatment: Spot

ADVANTAGES	LIMITATIONS
∗ May be less destructive to lake ecosystem than lake-wide treatment.	∗ Only considered in lakes with aquatic invasive plants. ∗ Usually not fully effective in eradicating target species. ∗ Contaminants may remain in sediment. ∗ Effects on lake ecosystem not fully understood. ∗ Does not remove dead vegetation, which depletes oxygen and releases nutrients, adds to build-up of muck. ∗ Extra nutrients may spur additional aquatic plant and algae growth.

Chemical Treatment: Lake-wide

ADVANTAGES	LIMITATIONS
∗ May reduce aquatic invasives for a time. ∗ Treatment not needed as frequently.	∗ Only considered in lakes with aquatic invasive plants. ∗ Usually not fully effective in eradicating target species. ∗ Contaminants may remain in sediment. ∗ Does not remove dead vegetation, which depletes oxygen and releases nutrients, adds to build-up of muck. ∗ Extra nutrients may spur additional aquatic plant and algae growth. ∗ Negatively affects native vegetation. ∗ Effects on lake ecosystem not fully understood. ∗ Opens up space once taken up by natives for invasive species to colonize once again. ∗ ~$4000 per 5 acres.

Appendix E: Lake User Survey Results

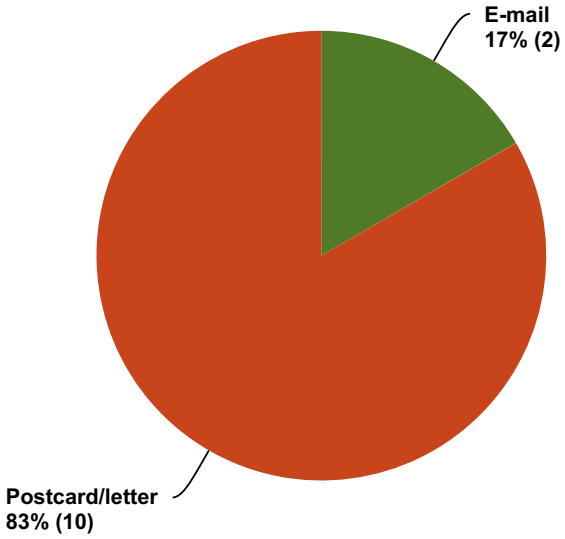
Q1 What is your Waushara County Lakes Survey ID?

Answered: 14 Skipped: 0

#	Responses	Date
1	[redacted]	2/5/2015 11:48 AM
2	[redacted]	2/5/2015 11:34 AM
3	[redacted]	1/29/2015 5:43 PM
4	[redacted]	1/23/2015 6:45 PM
5	[redacted]	1/21/2015 5:04 PM
6	[redacted]	1/21/2015 4:01 PM
7	[redacted]	1/21/2015 3:27 PM
8	[redacted]	1/21/2015 2:53 PM
9	[redacted]	1/21/2015 1:58 PM
10	[redacted]	1/21/2015 10:30 AM
11	[redacted]	1/20/2015 8:49 PM
12	[redacted]	1/20/2015 6:53 PM
13	[redacted]	1/20/2015 5:06 PM
14	[redacted]	1/20/2015 4:24 PM

Q2 How did you hear about this survey?

Answered: 12 Skipped: 2

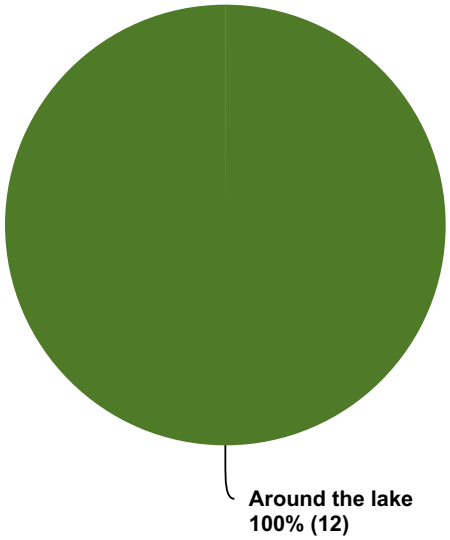


Answer Choices	Responses	
E-mail	17%	2
Newspaper	0%	0
Postcard/letter	83%	10
Facebook	0%	0
Radio	0%	0
Total		12

#	Other (please specify)	Date
	There are no responses.	

Q3 Do you own or rent property...

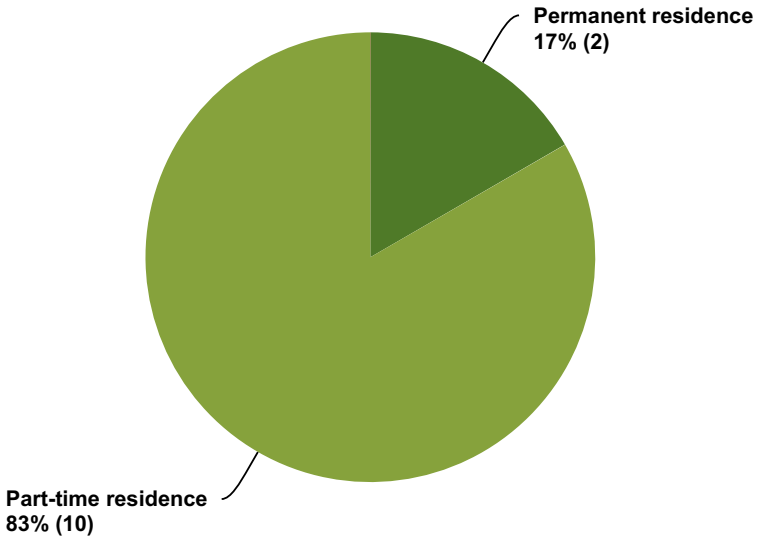
Answered: 12 Skipped: 2



Answer Choices	Responses	
Around the lake	**100%**	12
Less than 1/2 mile from the lake	**0%**	0
1/2 mile to 1 mile of the lake	**0%**	0
More than 1 mile from the lake	**0%**	0
I do not own or rent property near the lake	**0%**	0
Total		**12**

Q4 If you own or rent property near the lake, is this property your permanent residence, a part-time residence (such as a vacation home, rental, etc.), or other?

Answered: 12 Skipped: 2

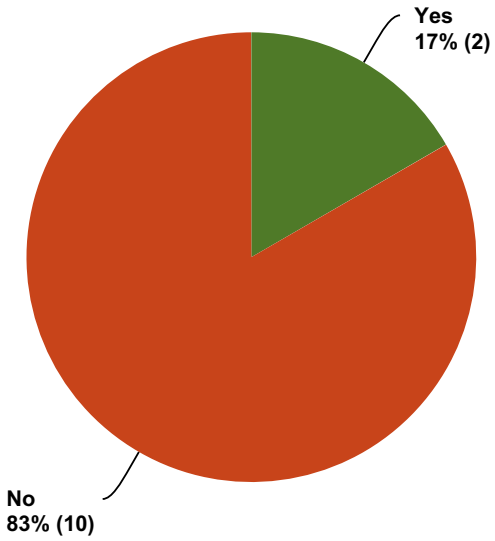


Answer Choices	Responses	
Permanent residence	17%	2
Part-time residence	83%	10
I do not own or rent property near the lake	0%	0
Total		12

#	Other (please specify)	Date
	There are no responses.	

Q5 I own property on or near the lake because I inherited it.

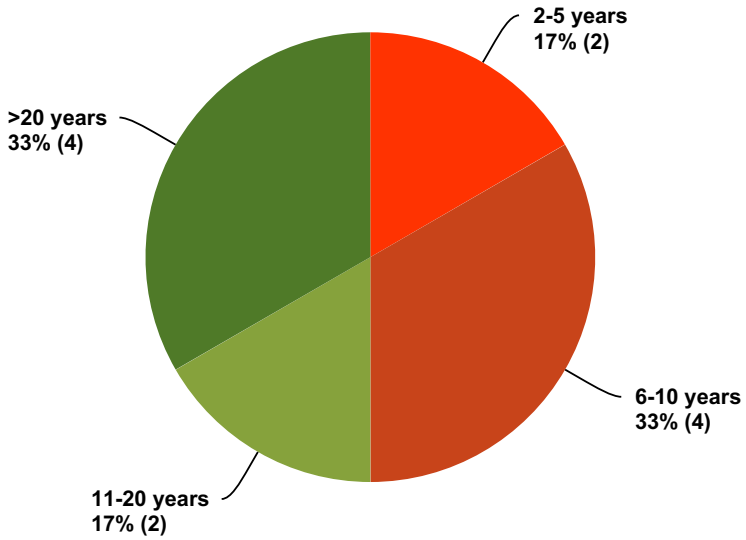
Answered: 12 Skipped: 2



Answer Choices	Responses	
Yes	17%	2
No	83%	10
Total		12

Q6 How long have you lived on, visited or recreated on the lake?

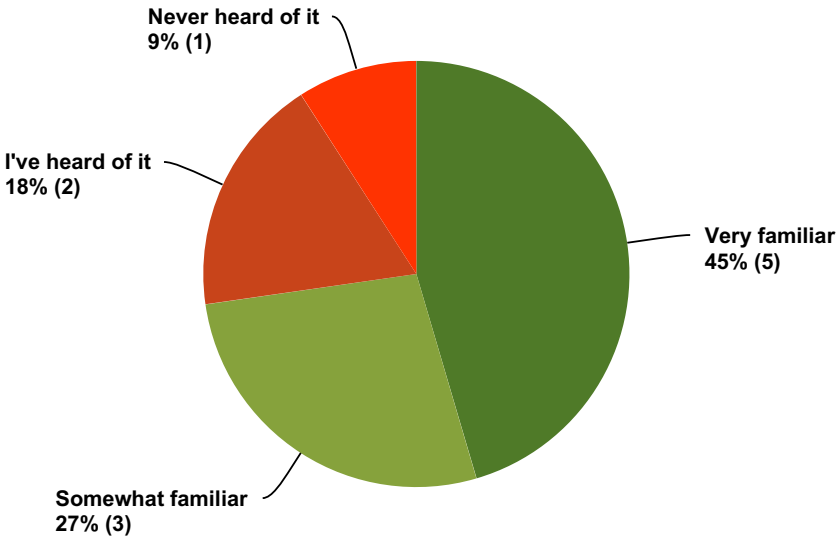
Answered: 12 Skipped: 2



Answer Choices	Responses	
<2 years	0%	0
2-5 years	17%	2
6-10 years	33%	4
11-20 years	17%	2
>20 years	33%	4
Total		12

Q7 Are you familiar with the Kusel/Wilson/Round Lake Protection & Rehabilitation District?

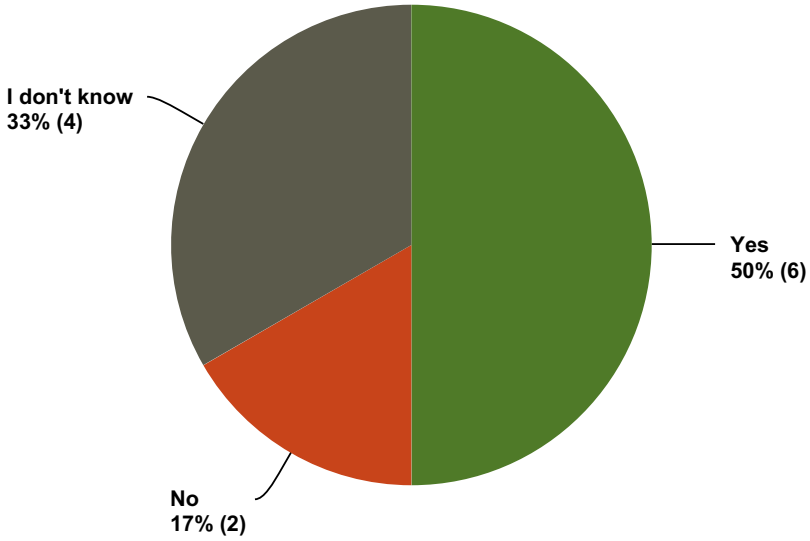
Answered: 11 Skipped: 3



Answer Choices	Responses	
Very familiar	45%	5
Somewhat familiar	27%	3
I've heard of it	18%	2
Never heard of it	9%	1
Total		11

Q8 Are you a member of the Kusel/Wilson/Round Lakes Protection & Rehabilitation District?

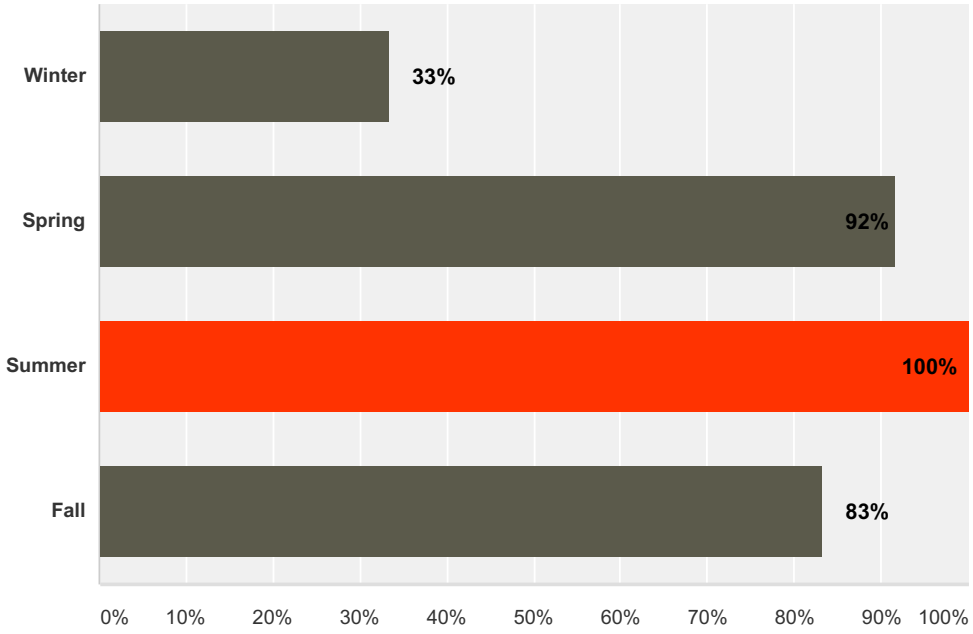
Answered: 12 Skipped: 2



Answer Choices	Responses	
Yes	50%	6
No	17%	2
I don't know	33%	4
Total		12

Q9 What time of year do you generally use the lake? Select all that apply.

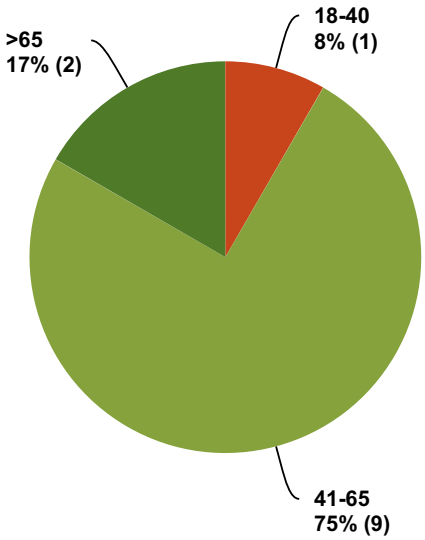
Answered: 12 Skipped: 2



Answer Choices	Responses	
Winter	33%	4
Spring	92%	11
Summer	100%	12
Fall	83%	10
Total Respondents: 12		

Q10 Which category below includes your age?

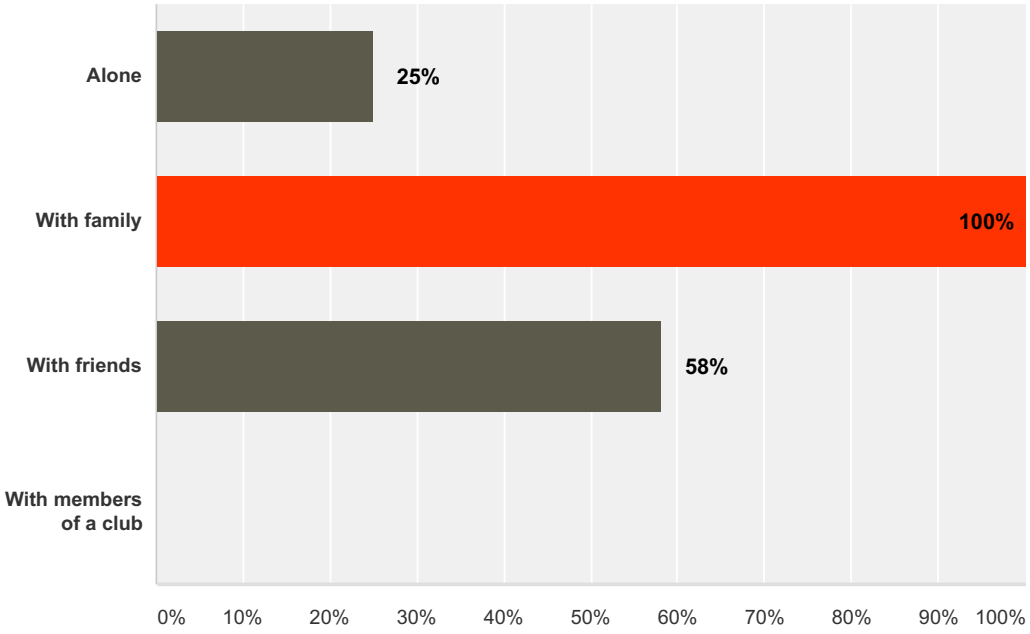
Answered: 12 Skipped: 2



Answer Choices	Responses	
Under 18	0%	0
18-40	8%	1
41-65	75%	9
>65	17%	2
Total		12

Q11 When you visit Kusel Lake, are you typically...(check all that apply)

Answered: 12 Skipped: 2

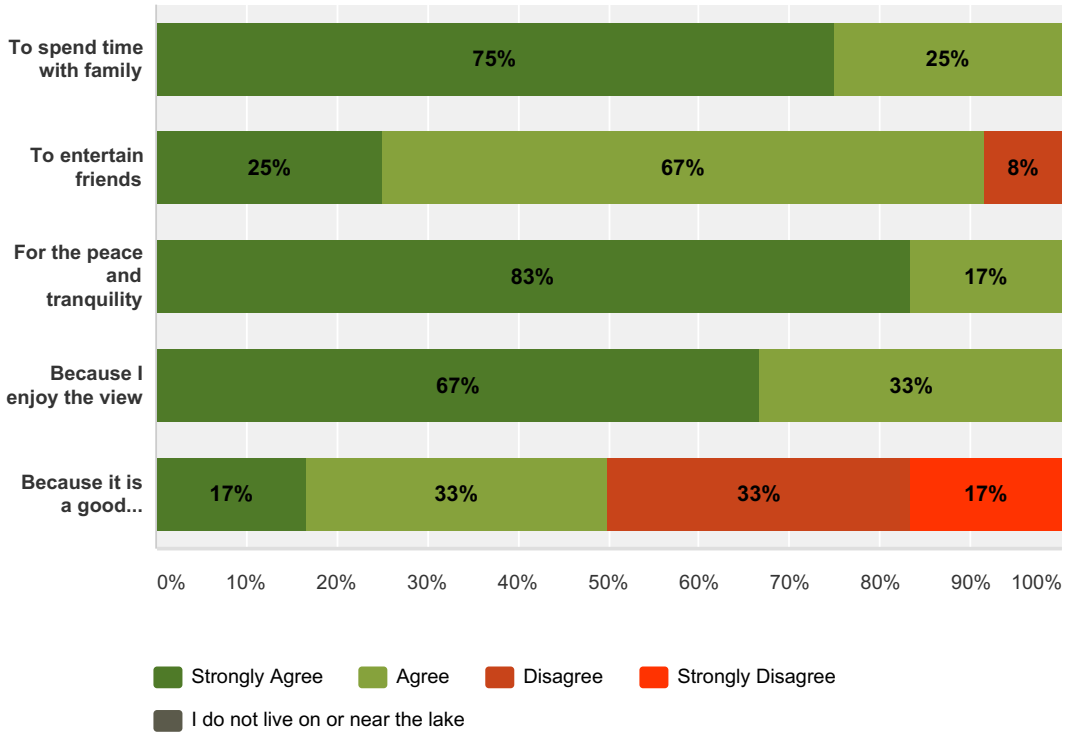


Answer Choices	Responses	
Alone	25%	3
With family	100%	12
With friends	58%	7
With members of a club	0%	0
Total Respondents: 12		

#	Other (please specify)	Date
	There are no responses.	

Q12 I live on or near the lake...

Answered: 12 Skipped: 2



	Strongly Agree	Agree	Disagree	Strongly Disagree	I do not live on or near the lake	Total
To spend time with family	**75%** 9	**25%** 3	**0%** 0	**0%** 0	**0%** 0	12
To entertain friends	**25%** 3	**67%** 8	**8%** 1	**0%** 0	**0%** 0	12
For the peace and tranquility	**83%** 10	**17%** 2	**0%** 0	**0%** 0	**0%** 0	12
Because I enjoy the view	**67%** 8	**33%** 4	**0%** 0	**0%** 0	**0%** 0	12
Because it is a good investment	**17%** 2	**33%** 4	**33%** 4	**17%** 2	**0%** 0	12

Q13 What do you value most about Kusel Lake?

Answered: 12 Skipped: 2

#	Responses	Date
1	getting away from my usual routine	2/5/2015 11:39 AM
2	Quiet	1/29/2015 5:45 PM
3	Mixed use with good quiet times	1/21/2015 5:07 PM
4	clarity of water and view	1/21/2015 4:03 PM
5	clean water	1/21/2015 3:29 PM
6	lack of density of people - not too crowded the county park with sand beach no wake times water quality	1/21/2015 3:00 PM
7	It used to be nice and peaceful. Now all you hear are noises from housing that should not have been built and more and more people raping the land on the side across from Springwater Bar and now at the opposite end of the beach! It makes most of us locals sick!	1/21/2015 2:17 PM
8	No wake hours for quiet and calm boating (sailing, stand up paddle board, kayak, canoe)	1/21/2015 10:35 AM
9	Having the before 10 am and after 5 pm no wake. This allows skiers and people fishing time to enjoy both activities. I like that it is a clear lake with much of a sandy bottom.	1/20/2015 9:16 PM
10	The clear, clean water. The limited ski hours	1/20/2015 7:00 PM
11	Clean water	1/20/2015 5:10 PM
12	Peace and Quiet. Beauty.	1/20/2015 4:30 PM

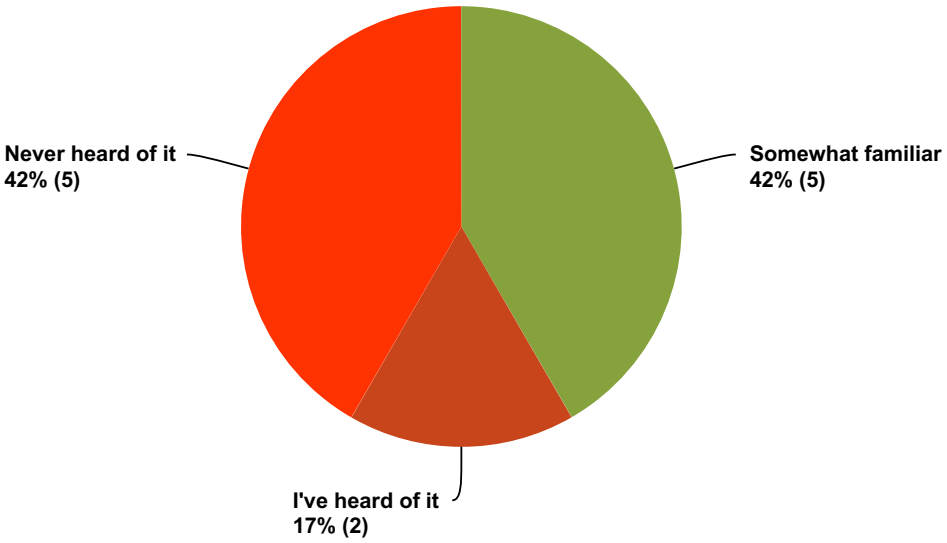
Q14 In your opinion, what should be done to restore, maintain, or improve Kusel Lake?

Answered: 12 Skipped: 2

#	Responses	Date
1	have all persons who use the lake protect its quality and respect other persons using it	2/5/2015 11:39 AM
2	less boat traffic	1/29/2015 5:45 PM
3	Dredging to clear out sludge going into slough. Enforce limited clearing of new lots.	1/21/2015 5:07 PM
4	?	1/21/2015 4:03 PM
5	not sure	1/21/2015 3:29 PM
6	do not allow too much building, maintain no wake times, weed management, water depth management, fish habitat/food, keep diving platforms and other structures near the shoreline and not in the middle of the lake, how much pollution do all the fireworks create?, do not improve beyond the values of the properties with high costs to the home owners	1/21/2015 3:00 PM
7	STOP LETTING MORE PEOPLE DEVELOP IT!!!!! Most of them are not locals and do not think the lake rules apply to them. Most of them think they can speed across the lake after five,have loud parties because they don't live here day to day and could care less about the people that have to get up and work the next day. They do not get permits to burn and a lot of them don't keep an eye on their fires. If you only knew how many times we prayed these morons would not start a lake fire. Calling the DNR And the Police are a BIG joke around here. In the end, sooner or later we will all pay for their arrogance!	1/21/2015 2:17 PM
8	Closer watch on public access	1/21/2015 10:35 AM
9	Stations at the public park and the campsite to wipe down boats before entering and exiting the water to protect against transporting more invasive aquatic species. Decrease antagonistic attitude between private lake home owners and campsite. It serves no purpose and all want the same thing, a wonderful lake and shore for our families. People that use their residences more in the spring/summer, can not attend the planning meetings held on Friday or in the evenings on weeknights.	1/20/2015 9:16 PM
10	I do not know enough about the history of the lake. I would say to maintain the invasive weeds would be very important and also the lake level. I do believe the lake levels are attained by ground water, run off and rain, etc.. It seems to be very low the last couple of years.. not sure if the farmers and there watering systems have anything to do with the water levels or not. If they do it would be great to limit how much ground water they can use.	1/20/2015 7:00 PM
11	Dredge sandbar in middle of the lake since it's a safety issue, maintain water clarity and quality, reduce weeds, and do something to maintain water levels	1/20/2015 5:10 PM
12	No wake at all times in the channel through the sand bar otherwise maintain all current lake rules as is. Restore a fish population and type of fish to what was there 55 years ago.	1/20/2015 4:30 PM

Q15 How familiar are you with Wisconsin's Public Trust Doctrine?

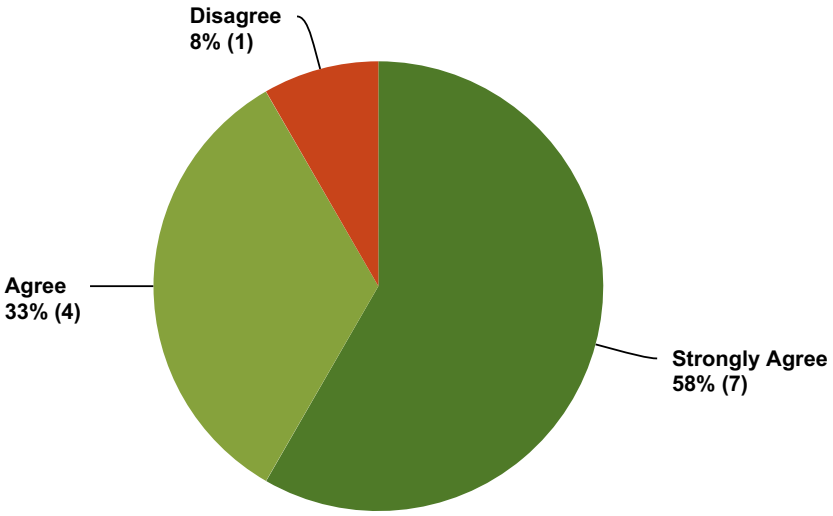
Answered: 12 Skipped: 2



Answer Choices	Responses	
Very familiar	0%	0
Somewhat familiar	42%	5
I've heard of it	17%	2
Never heard of it	42%	5
Total		12

Q16 How I recreate in and around the lake can affect other lake users.

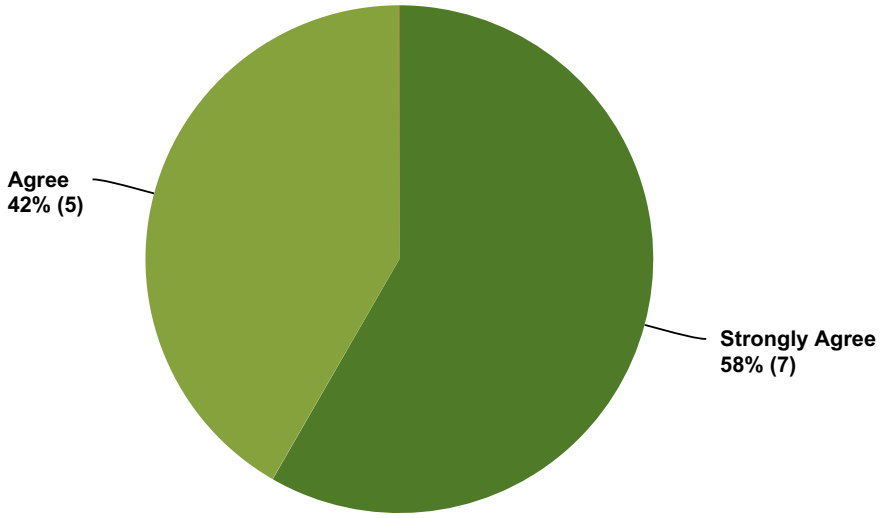
Answered: 12 Skipped: 2



Answer Choices	Responses	
Strongly Agree	58%	7
Agree	33%	4
Disagree	8%	1
Strongly Disagree	0%	0
Total		12

Q17 How I manage my land can affect other lake users.

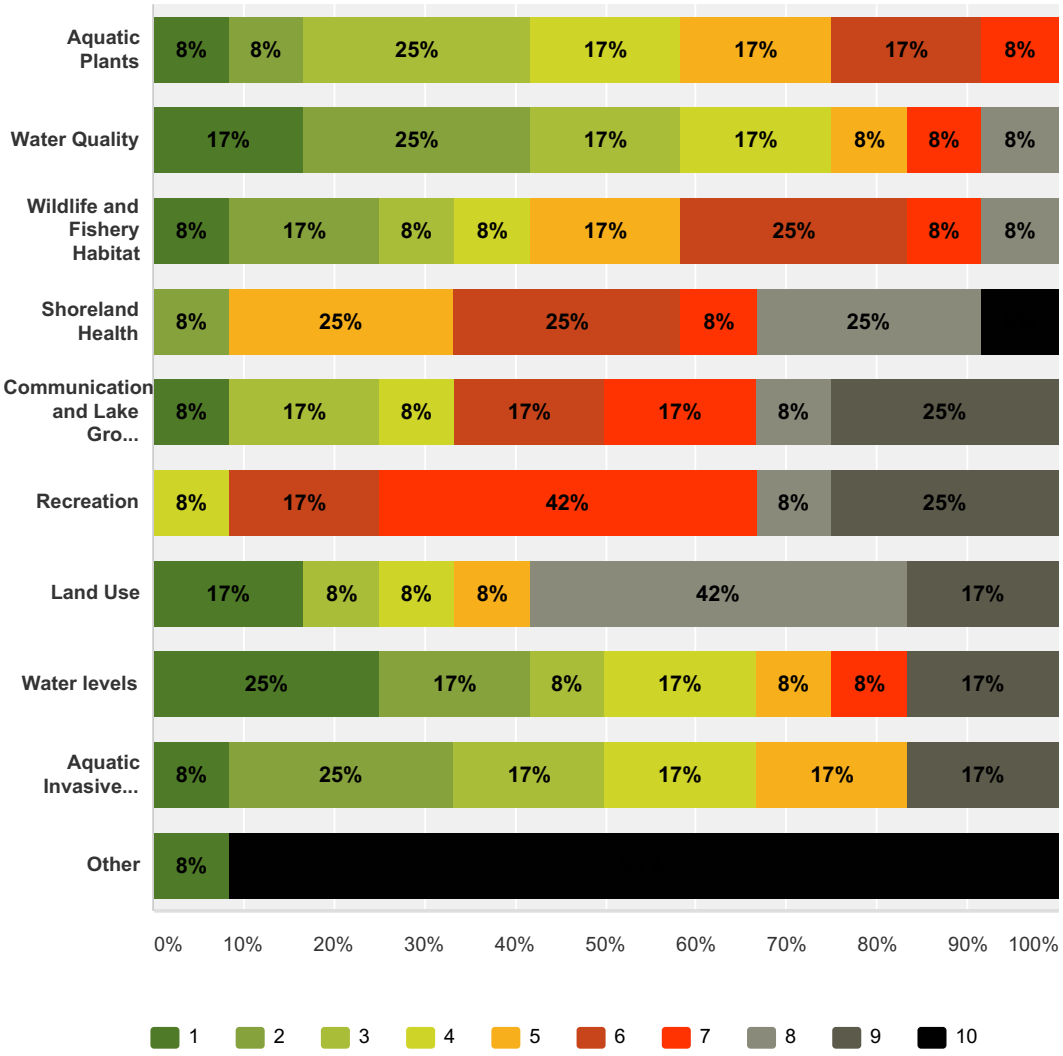
Answered: 12 Skipped: 2



Answer Choices	Responses	
Strongly Agree	58%	7
Agree	42%	5
Disagree	0%	0
Strongly Disagree	0%	0
Total		12

Q18 Which of the following meeting topics, in your opinion, are the most important to talk about regarding Kusel Lake? (Please rank at least your top three.)

Answered: 12 Skipped: 2

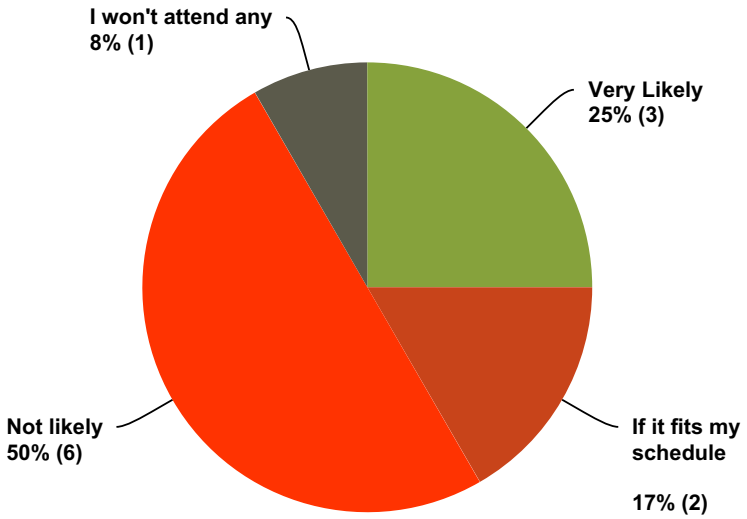


	1	2	3	4	5	6	7	8	9	10	Total	Score
Aquatic Plants	8% 1	8% 1	25% 3	17% 2	17% 2	17% 2	8% 1	0% 0	0% 0	0% 0	12	6.92
Water Quality	17% 2	25% 3	17% 2	17% 2	8% 1	0% 0	8% 1	8% 1	0% 0	0% 0	12	7.50
Wildlife and Fishery Habitat	8% 1	17% 2	8% 1	8% 1	17% 2	25% 3	8% 1	8% 1	0% 0	0% 0	12	6.42
Shoreland Health	0% 0	8% 1	0% 0	0% 0	25% 3	25% 3	8% 1	25% 3	0% 0	8% 1	12	4.67
Communication and Lake Group Support	8% 1	0% 0	17% 2	8% 1	0% 0	17% 2	17% 2	8% 1	25% 3	0% 0	12	5.00

Recreation	**0%** 0	**0%** 0	**0%** 0	**8%** 1	**0%** 0	**17%** 2	**42%** 5	**8%** 1	**25%** 3	**0%** 0	12	3.83
Land Use	**17%** 2	**0%** 0	**8%** 1	**8%** 1	**8%** 1	**0%** 0	**0%** 0	**42%** 5	**17%** 2	**0%** 0	12	5.00
Water levels	**25%** 3	**17%** 2	**8%** 1	**17%** 2	**8%** 1	**0%** 0	**8%** 1	**0%** 0	**17%** 2	**0%** 0	12	7.00
Aquatic Invasive Species	**8%** 1	**25%** 3	**17%** 2	**17%** 2	**17%** 2	**0%** 0	**0%** 0	**0%** 0	**17%** 2	**0%** 0	12	6.92
Other	**8%** 1	**0%** 0	**0%** 0	**0%** 0	**0%** 0	**0%** 0	**0%** 0	**0%** 0	**0%** 0	**92%** 11	12	1.75

Q19 Many of the decisions determining the final lake management plan will be made at the planning sessions. Sessions will typically take place monthly on weeknights. How likely is it that you will attend one or more of the planning sessions?

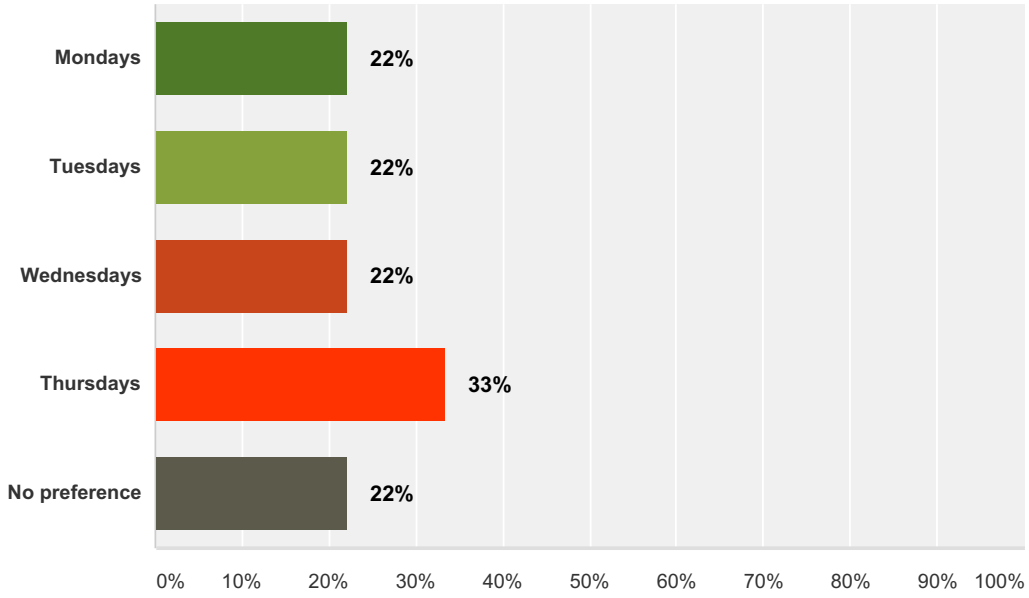
Answered: 12 Skipped: 2



Answer Choices	Responses	
Definitely	0%	0
Very Likely	25%	3
If it fits my schedule	17%	2
Not likely	50%	6
I won't attend any	8%	1
Total		12

Q20 Previous experience has shown that weekday evenings work best for most people. If you will attend the planning sessions, which weeknights do you prefer?

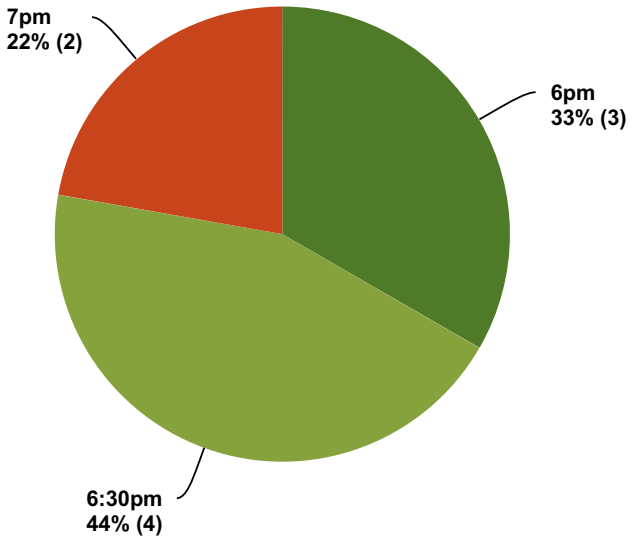
Answered: 9 Skipped: 5



Answer Choices	Responses	
Mondays	22%	2
Tuesdays	22%	2
Wednesdays	22%	2
Thursdays	33%	3
No preference	22%	2
Total Respondents: 9		

Q21 Most sessions will last around 2 hours. If you will attend the planning sessions, which times do you prefer to start?

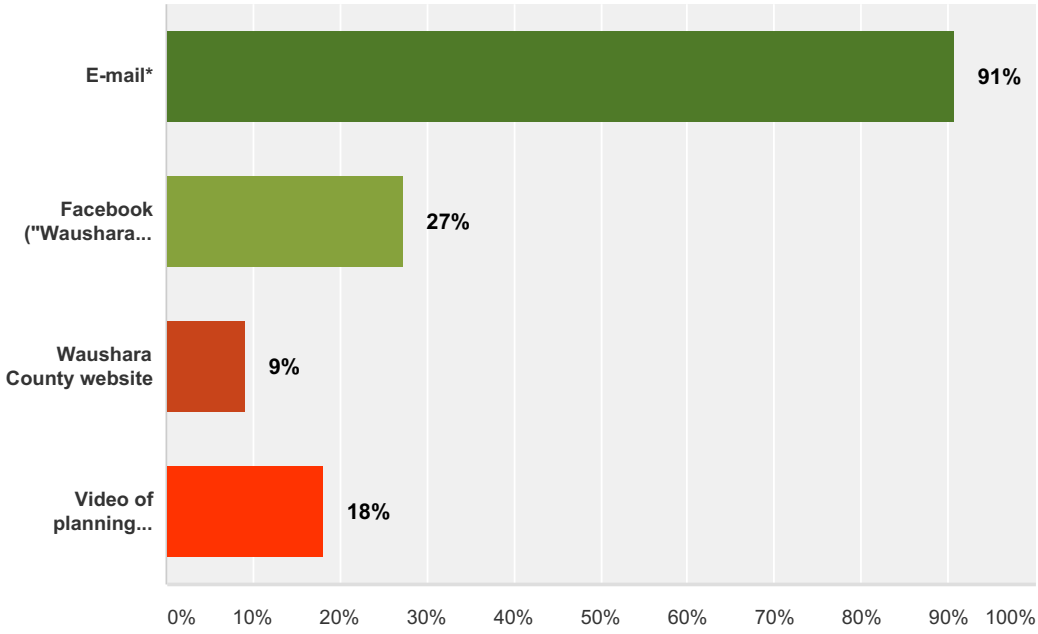
Answered: 9 Skipped: 5



Answer Choices	Responses	
6pm	33%	3
6:30pm	44%	4
7pm	22%	2
7:30pm	0%	0
No preference	0%	0
Total		9

Q22 How would you like to receive information about meetings (agendas, minutes), the planning process, and updates? (Select all that apply)

Answered: 11 Skipped: 3



Answer Choices	Responses	
E-mail*	91%	10
Facebook ("Waushara County Lakes Project")	27%	3
Waushara County website	9%	1
Video of planning meeting posted on the web	18%	2
Total Respondents: 11		

#	Other (please specify)	Date
1	Mail. The same way notice of this survey arrived.	1/20/2015 9:16 PM

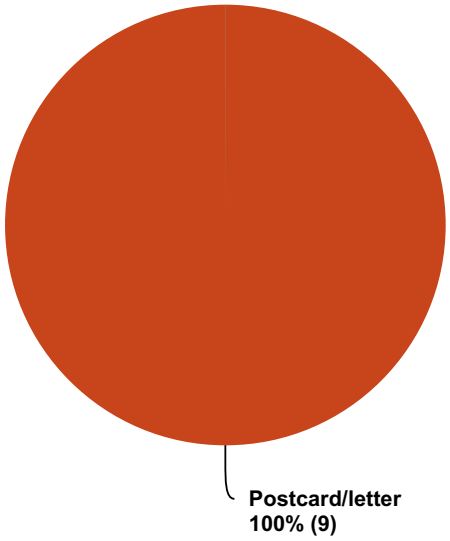
Q1 Enter your Waushara County Lakes Survey ID. If you've forgotten your ID or haven't created one yet, follow the instructions below.

Answered: 9 Skipped: 0

#	Responses	Date
1	[redacted]	3/5/2015 1:23 PM
2	[redacted]	3/3/2015 1:25 PM
3	[redacted]	3/3/2015 12:40 PM
4	[redacted]	3/1/2015 1:03 PM
5	[redacted]	2/28/2015 10:57 AM
6	[redacted]	2/28/2015 8:44 AM
7	[redacted]	2/27/2015 3:45 PM
8	[redacted]	2/27/2015 3:44 PM
9	[redacted]	2/27/2015 1:24 PM

Q2 How did you hear about this survey?

Answered: 9 Skipped: 0

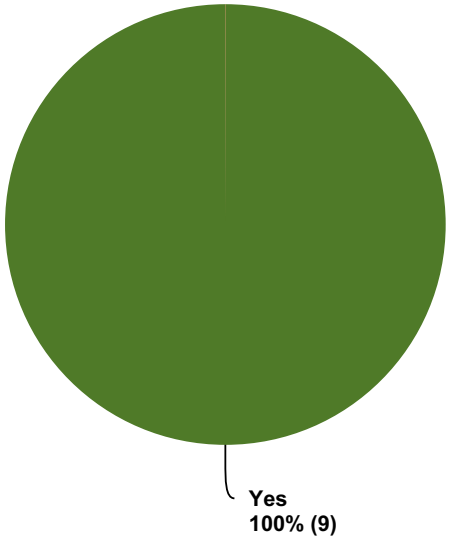


Answer Choices	Responses	
E-mail	0%	0
Newspaper	0%	0
Postcard/letter	100%	9
Facebook	0%	0
Radio	0%	0
Total		9

#	Other (please specify)	Date
	There are no responses.	

Q3 Were you aware of the importance of aquatic plants?

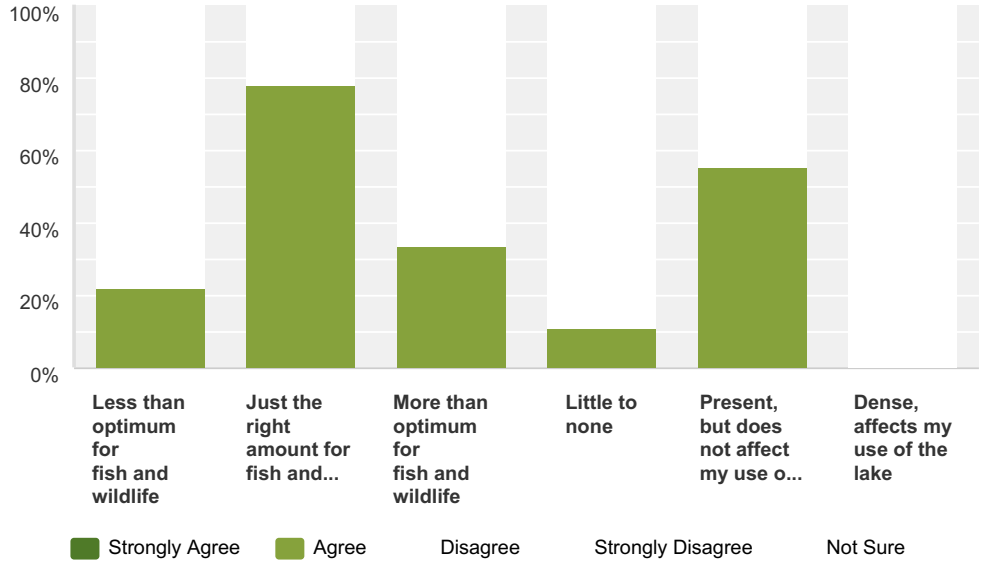
Answered: 9 Skipped: 0



Answer Choices	Responses	
Yes	100%	9
No	0%	0
Unsure	0%	0
Total		9

Q4 In your opinion, which statement best describes the amount of aquatic plant growth in Kusel Lake?

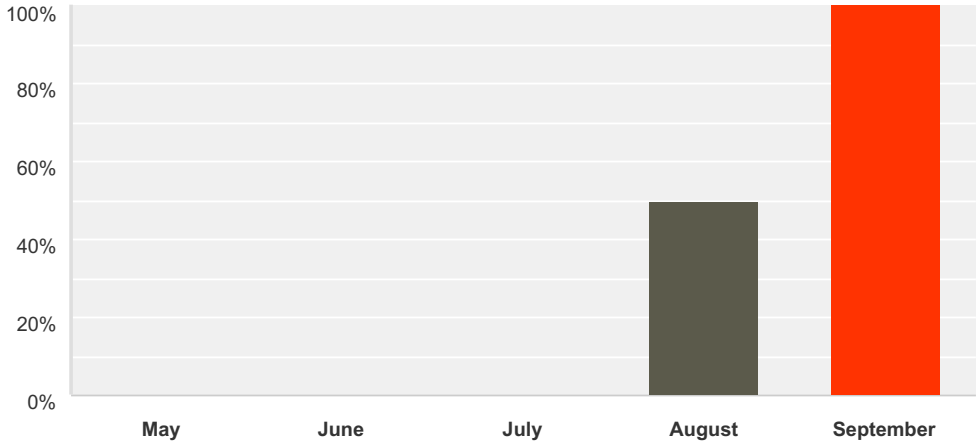
Answered: 9 Skipped: 0



	Strongly Agree	Agree	Disagree	Strongly Disagree	Not Sure	Total
Less than optimum for fish and wildlife	0% 0	22% 2	56% 5	22% 2	0% 0	9
Just the right amount for fish and wildlife	0% 0	78% 7	22% 2	0% 0	0% 0	9
More than optimum for fish and wildlife	0% 0	33% 3	67% 6	0% 0	0% 0	9
Little to none	0% 0	11% 1	11% 1	78% 7	0% 0	9
Present, but does not affect my use of the lake	0% 0	56% 5	11% 1	22% 2	11% 1	9
Dense, affects my use of the lake	0% 0	0% 0	56% 5	33% 3	11% 1	9

Q5 If you selected dense or choked, what month(s) do the problems occur? Check all that apply.

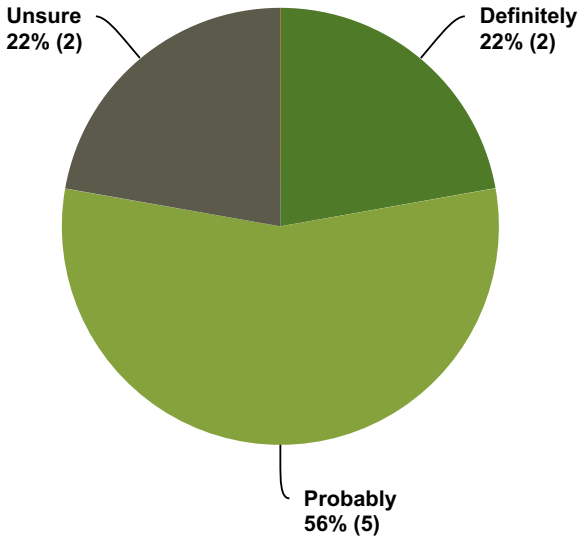
Answered: 2 Skipped: 7



Answer Choices	Responses	
May	0%	0
June	0%	0
July	0%	0
August	50%	1
September	100%	2
Total Respondents: 2		

Q6 Do you believe aquatic plant control is needed on Kusel Lake?

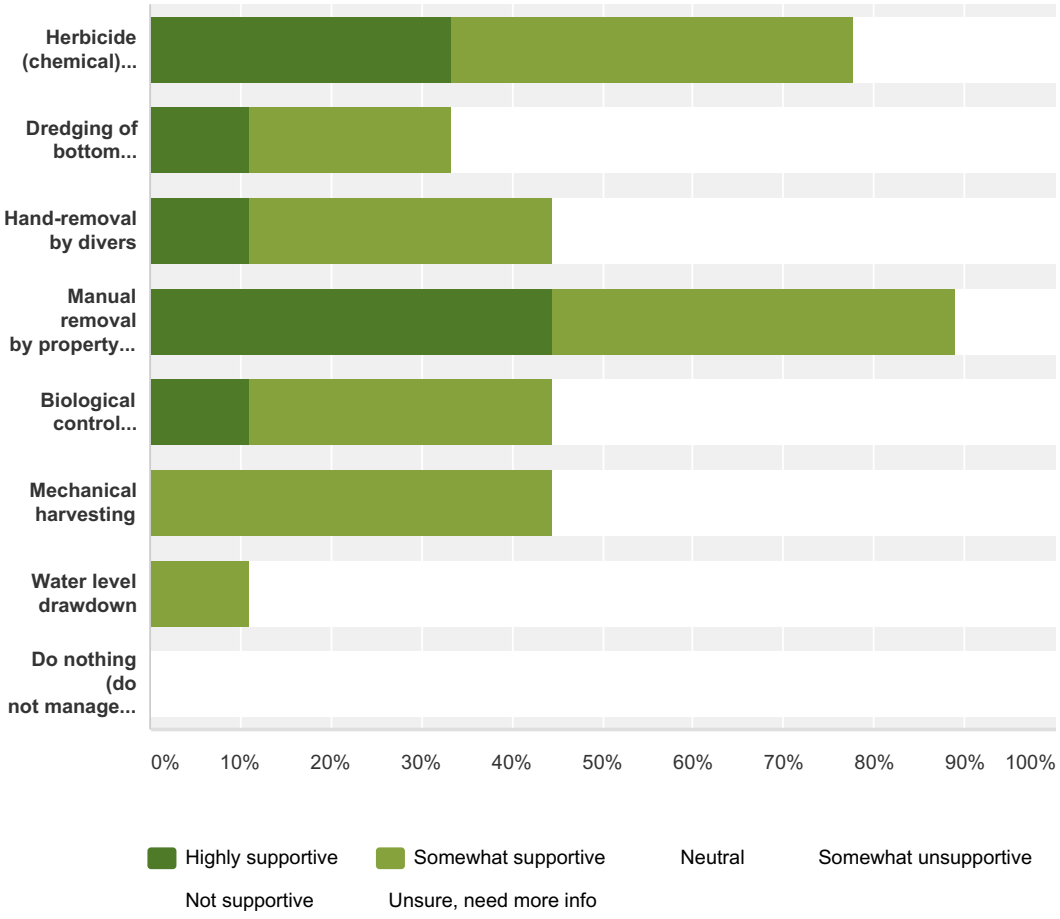
Answered: 9 Skipped: 0



Answer Choices	Responses	
Definitely	22%	2
Probably	56%	5
Unsure	22%	2
Probably not	0%	0
Definitely not	0%	0
Total		9

Q7 What is your level of support for the responsible use of the following techniques TO MANAGE AQUATIC PLANTS on Kusel Lake?

Answered: 9 Skipped: 0

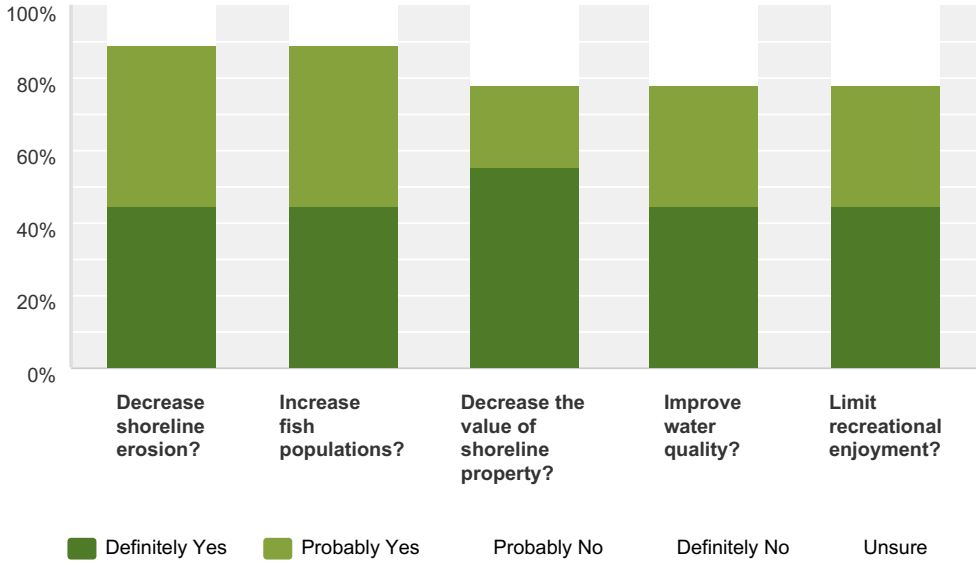


	Highly supportive	Somewhat supportive	Neutral	Somewhat unsupportive	Not supportive	Unsure, need more info	Total	Weighted Average
Herbicide (chemical) control	33% 3	44% 4	11% 1	0% 0	0% 0	11% 1	9	1.56
Dredging of bottom sediments	11% 1	22% 2	11% 1	11% 1	33% 3	11% 1	9	3.00
Hand-removal by divers	11% 1	33% 3	33% 3	0% 0	22% 2	0% 0	9	2.89
Manual removal by property owners	44% 4	44% 4	11% 1	0% 0	0% 0	0% 0	9	1.67
Biological control (milfoil weevil, loosestrife beetle, etc.)	11% 1	33% 3	0% 0	44% 4	0% 0	11% 1	9	2.56
Mechanical harvesting	0% 0	44% 4	22% 2	11% 1	22% 2	0% 0	9	3.11

Water level drawdown	**0%** 0	**11%** 1	**0%** 0	**11%** 1	**78%** 7	**0%** 0	9	4.56
Do nothing (do not manage plants)	**0%** 0	**0%** 0	**0%** 0	**29%** 2	**71%** 5	**0%** 0	7	4.71

Q8 In your opinion, does establishing or maintaining native vegetation IN THE WATER in the near-shore area…

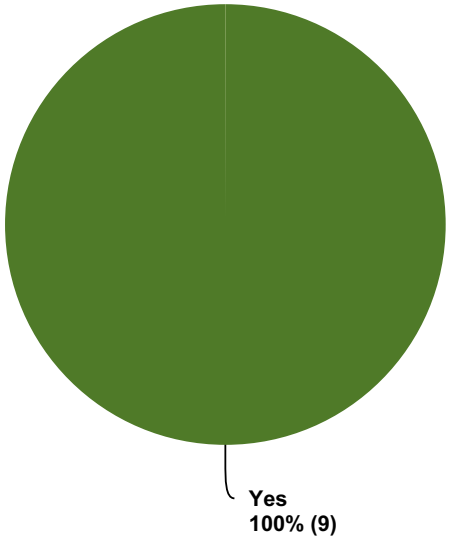
Answered: 9 Skipped: 0



	Definitely Yes	Probably Yes	Probably No	Definitely No	Unsure	Total
Decrease shoreline erosion?	**44%** 4	**44%** 4	**11%** 1	**0%** 0	**0%** 0	9
Increase fish populations?	**44%** 4	**44%** 4	**0%** 0	**11%** 1	**0%** 0	9
Decrease the value of shoreline property?	**56%** 5	**22%** 2	**11%** 1	**11%** 1	**0%** 0	9
Improve water quality?	**44%** 4	**33%** 3	**11%** 1	**0%** 0	**11%** 1	9
Limit recreational enjoyment?	**44%** 4	**33%** 3	**0%** 0	**22%** 2	**0%** 0	9

Q9 Have you ever heard of aquatic invasive species?

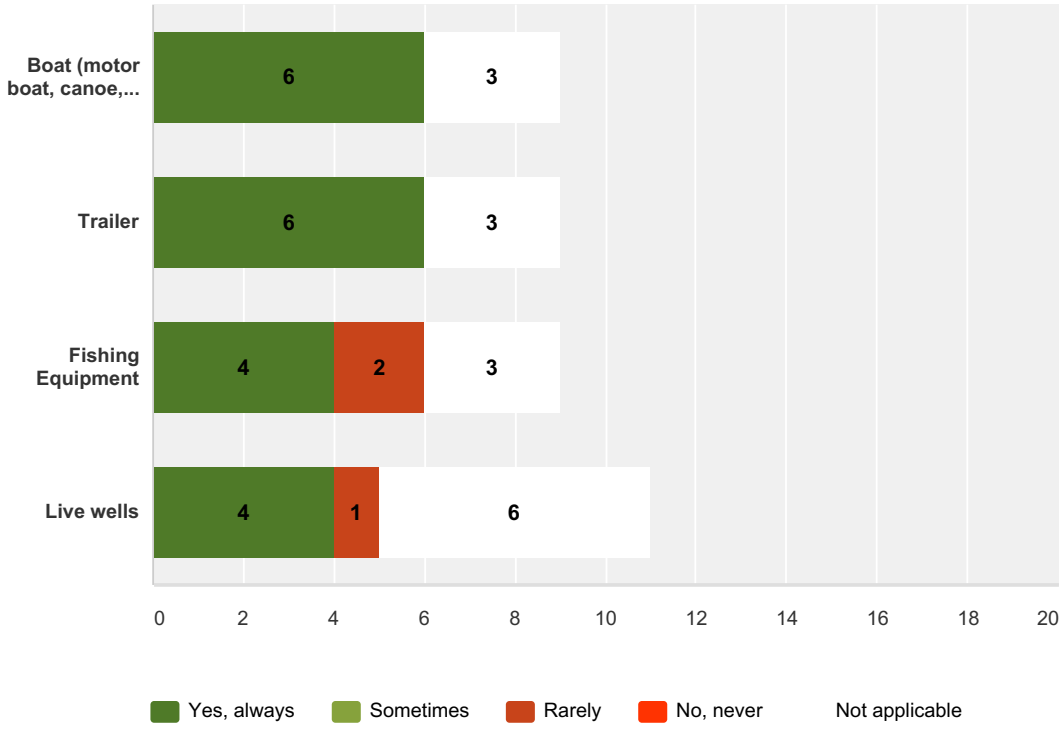
Answered: 9 Skipped: 0



Answer Choices	Responses	
Yes	100%	9
No	0%	0
Total		9

Q10 After you have been to another lake, do you clean your ... before bringing it back to Kusel Lake?

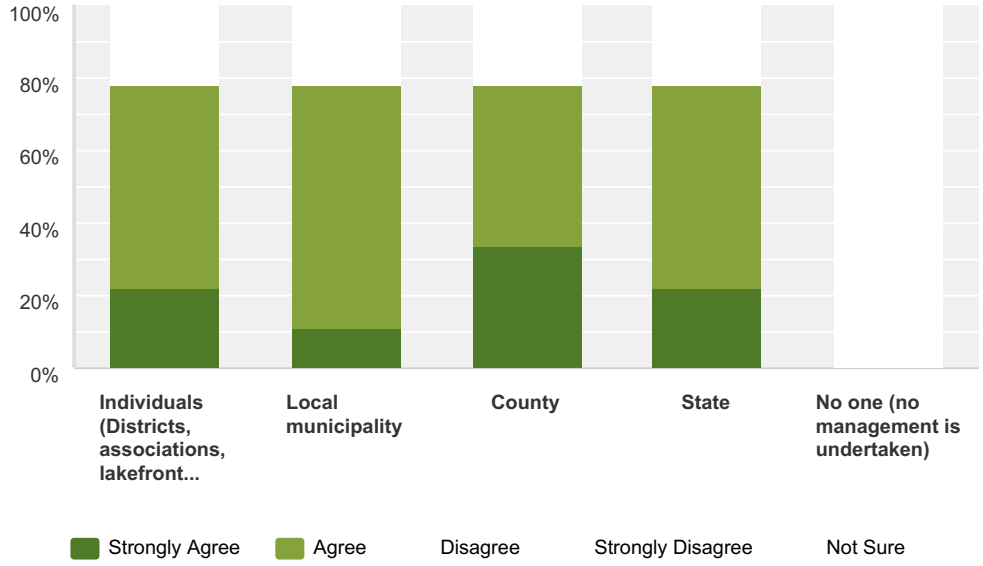
Answered: 9 Skipped: 0



	Yes, always	Sometimes	Rarely	No, never	Not applicable	Total Respondents
Boat (motor boat, canoe, kayak, etc.)	**67%** 6	**0%** 0	**0%** 0	**0%** 0	**33%** 3	9
Trailer	**67%** 6	**0%** 0	**0%** 0	**0%** 0	**33%** 3	9
Fishing Equipment	**44%** 4	**0%** 0	**22%** 2	**0%** 0	**33%** 3	9
Live wells	**44%** 4	**0%** 0	**11%** 1	**0%** 0	**67%** 6	9

Q11 Who should pay for the cost of managing invasive aquatic plants? Check all that apply.

Answered: 9 Skipped: 0

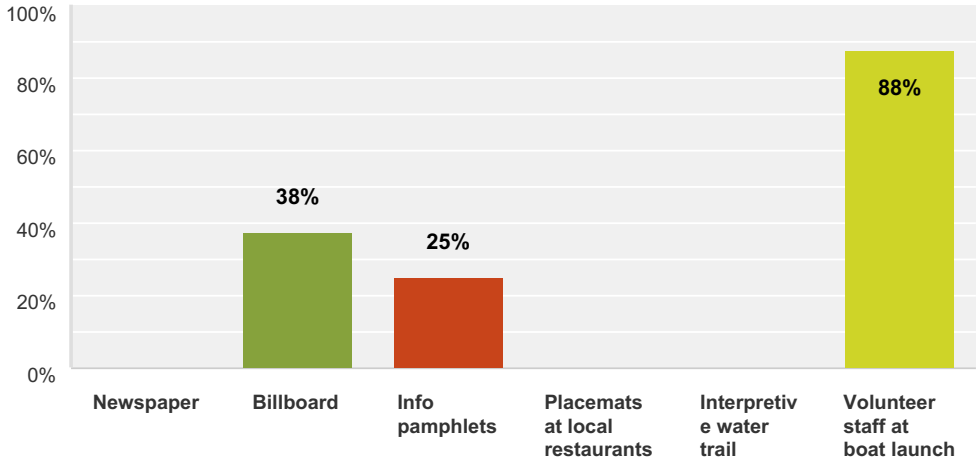


	Strongly Agree	Agree	Disagree	Strongly Disagree	Not Sure	Total
Individuals (Districts, associations, lakefront property owners)	**22%** 2	**56%** 5	**11%** 1	**11%** 1	**0%** 0	9
Local municipality	**11%** 1	**67%** 6	**11%** 1	**0%** 0	**11%** 1	9
County	**33%** 3	**44%** 4	**11%** 1	**0%** 0	**11%** 1	9
State	**22%** 2	**56%** 5	**11%** 1	**0%** 0	**11%** 1	9
No one (no management is undertaken)	**0%** 0	**0%** 0	**20%** 1	**80%** 4	**0%** 0	5

#	Other (please specify)	Date
1	lake users ie fisherman,boaters,campers,swimmers,etc	3/5/2015 1:55 PM
2	Individual property owners are most likely aware of the potential harm on incoming boats and trailers. The public use though the county park and campgrounds should increase awareness and share in the cost burden to control invasive plant growth.	3/3/2015 12:54 PM
3	Share the cost between public and private	3/1/2015 1:09 PM

Q12 What is the most effective way to inform others about aquatic invasive species?

Answered: 8 Skipped: 1

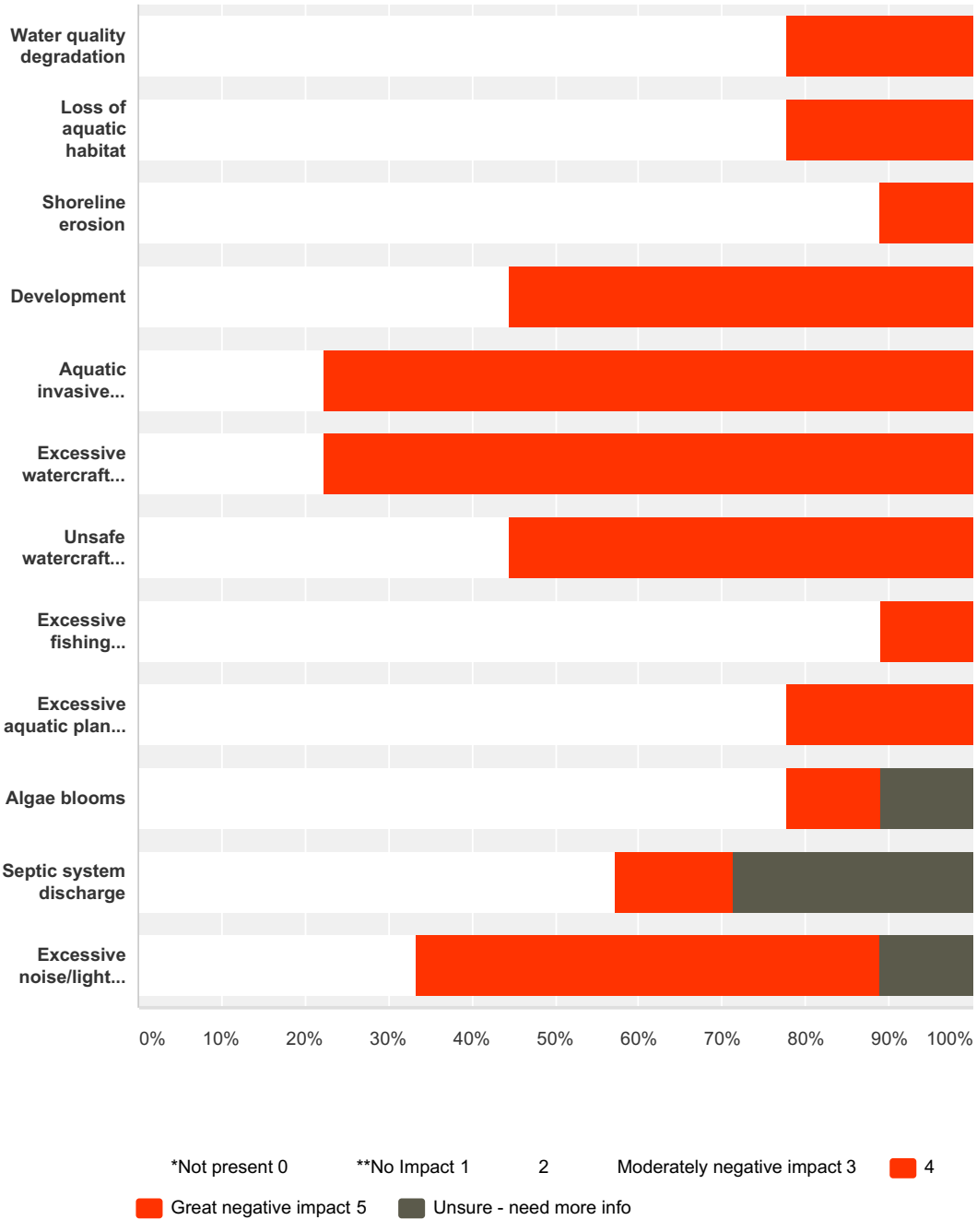


Answer Choices	Responses	
Newspaper	0%	0
Billboard	38%	3
Info pamphlets	25%	2
Placemats at local restaurants	0%	0
Interpretive water trail	0%	0
Volunteer staff at boat launch	88%	7
Total Respondents: 8		

#	Other (please specify)	Date
1	multiple approaches needed	3/5/2015 1:55 PM
2	I would like to see more responsibility taken by the campsite for creating awareness and accepting responsibility of the boat usage on the lake. The county should also do more to create awareness at the county boat launch.	3/3/2015 12:54 PM
3	Sign at luanch sites including camp ground	3/1/2015 1:09 PM

Q13 Below is a list of possible negative impacts commonly found in Wisconsin lakes. To what level do you believe each of the following factors may be impacting Kusel Lake? (Please rate 0 - 5)* Not Present means that you believe the issue does not exist on Kusel Lake.**No Impact means that the issue may exist on Kusel Lake but it is not negatively impacting the lake.

Answered: 9 Skipped: 0

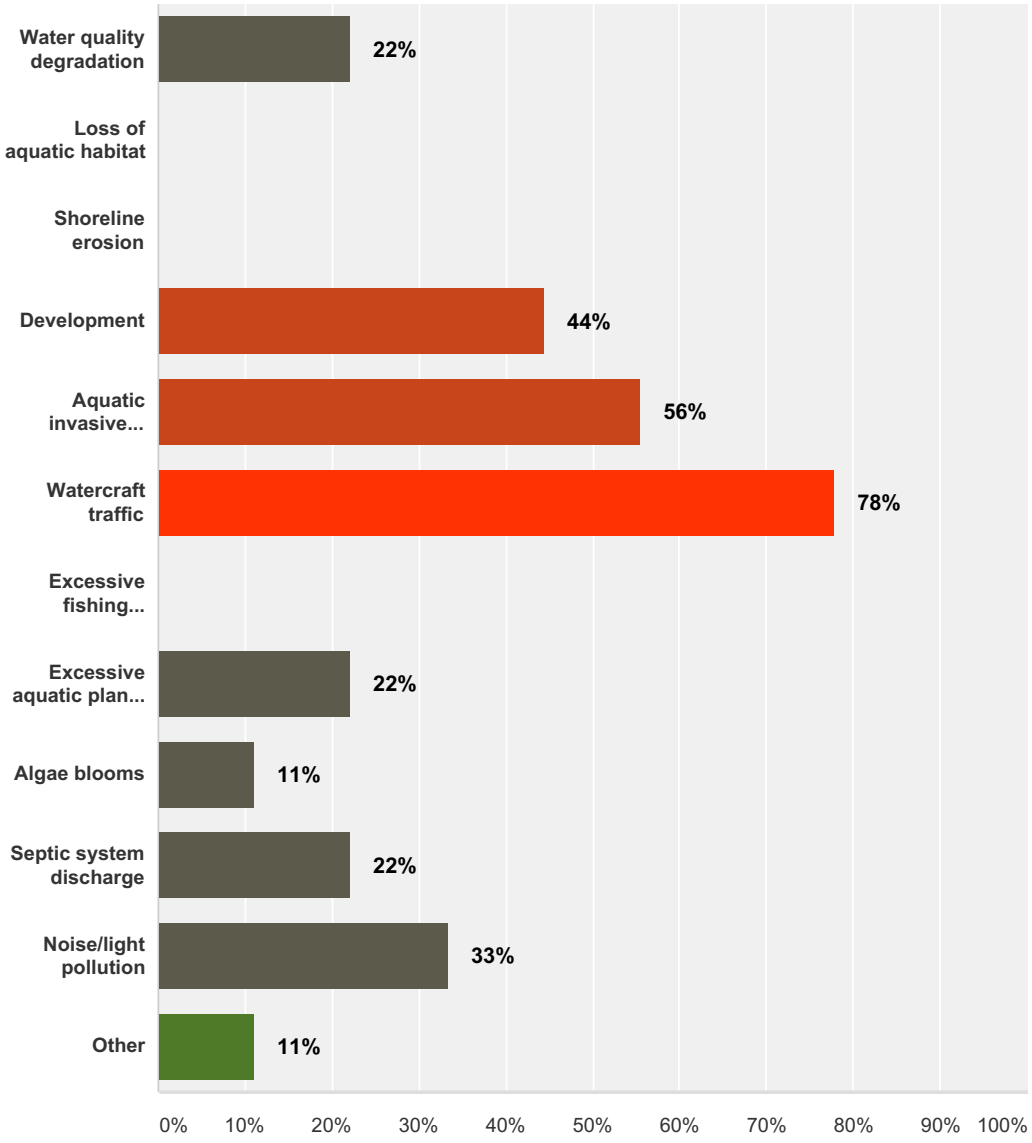


	*Not present 0	**No Impact 1	2	Moderately negative impact 3	4	Great negative impact 5	Unsure - need more info	Total	Weighted Average
Water quality degradation	11% 1	0% 0	44% 4	22% 2	11% 1	11% 1	0% 0	9	2.56
Loss of aquatic habitat	0% 0	33% 3	22% 2	22% 2	11% 1	11% 1	0% 0	9	2.44
Shoreline erosion	11% 1	22% 2	22% 2	33% 3	11% 1	0% 0	0% 0	9	2.11
Development	0% 0	11% 1	0% 0	33% 3	22% 2	33% 3	0% 0	9	3.67
Aquatic invasive species introduction	0% 0	11% 1	11% 1	0% 0	22% 2	56% 5	0% 0	9	4.00
Excessive watercraft traffic	0% 0	0% 0	11% 1	11% 1	11% 1	67% 6	0% 0	9	4.33
Unsafe watercraft practices	0% 0	0% 0	11% 1	33% 3	0% 0	56% 5	0% 0	9	4.00
Excessive fishing pressure	0% 0	33% 3	33% 3	22% 2	11% 1	0% 0	0% 0	9	2.11
Excessive aquatic plant growth (excluding algae)	0% 0	22% 2	33% 3	22% 2	22% 2	0% 0	0% 0	9	2.44
Algae blooms	0% 0	33% 3	11% 1	33% 3	0% 0	11% 1	11% 1	9	2.11
Septic system discharge	0% 0	0% 0	14% 1	43% 3	14% 1	0% 0	29% 2	7	2.14
Excessive noise/light pollution	0% 0	0% 0	11% 1	22% 2	22% 2	33% 3	11% 1	9	3.44

#	Other (please specify)	Date
1	lg groups renting cabins/multiple families - zoned single family residential	3/5/2015 1:55 PM
2	Land development and beach maintenance have contributed greatly the shoreline damage related to erosion and shoreline vegetation. All too often I see land owners spraying to kill vegetation on their beach and/or shoreline with no regard to the use of chemicals getting into the water.	3/3/2015 12:54 PM

Q14 From the list below, please mark your top three concerns regarding Kusel Lake.

Answered: 9 Skipped: 0



Answer Choices	Responses	
Water quality degradation	22%	2
Loss of aquatic habitat	0%	0
Shoreline erosion	0%	0
Development	44%	4
Aquatic invasive species introduction	56%	5
Watercraft traffic	78%	7

Excessive fishing pressure	**0%**	0
Excessive aquatic plant growth (excluding algae)	**22%**	2
Algae blooms	**11%**	1
Septic system discharge	**22%**	2
Noise/light pollution	**33%**	3
Other	**11%**	1
Total Respondents: 9		

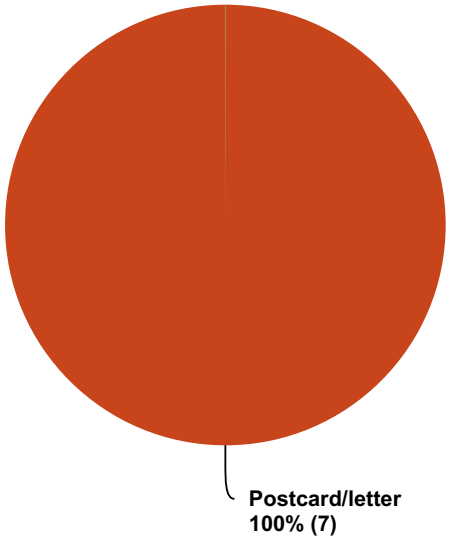
Q1 What is your Waushara County Lakes Study ID?

Answered: 7 Skipped: 0

#	Responses	Date
1	[redacted]	4/8/2015 8:31 PM
2	[redacted]	4/8/2015 12:28 PM
3	[redacted]	3/31/2015 11:49 AM
4	[redacted]	3/31/2015 8:48 AM
5	[redacted]	3/30/2015 4:11 PM
6	[redacted]	3/27/2015 9:55 AM
7	[redacted]	3/27/2015 9:33 AM

Q2 How did you hear about this survey?

Answered: 7 Skipped: 0

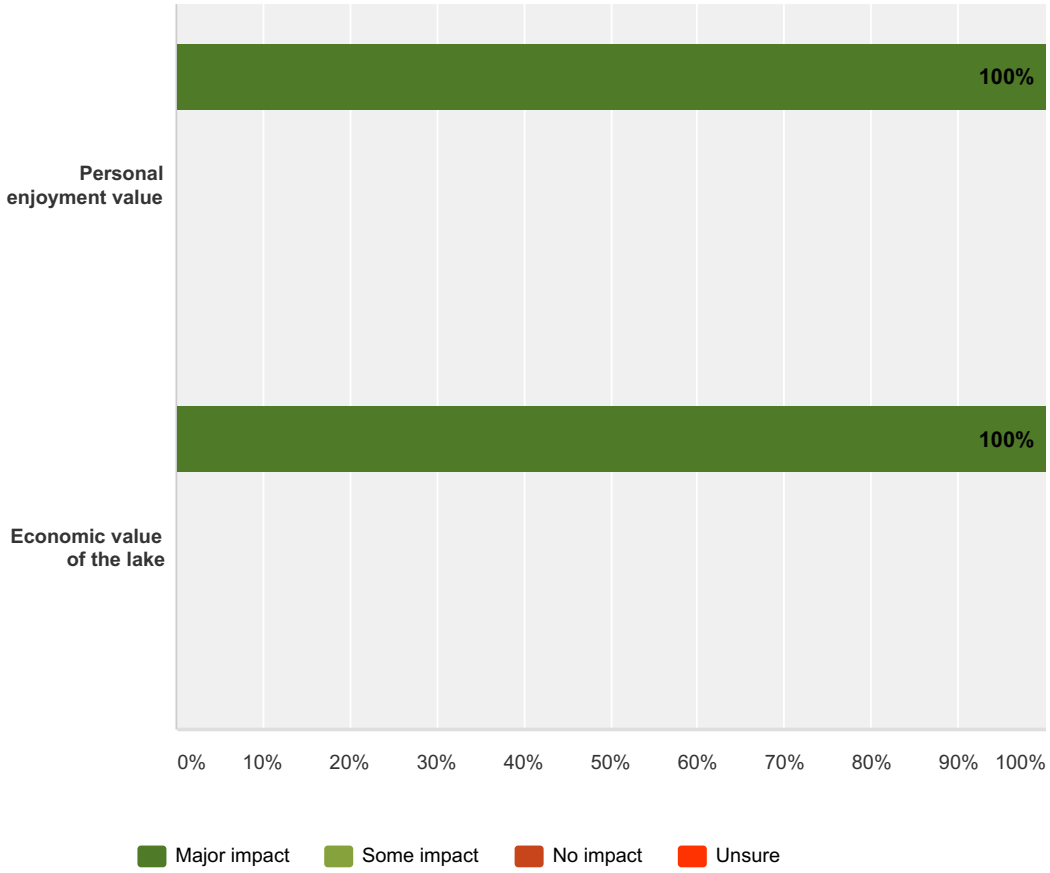


Answer Choices	Responses	
E-mail	0%	0
Newspaper	0%	0
Postcard/letter	100%	7
Facebook	0%	0
Radio	0%	0
Word of mouth	0%	0
Total		7

#	Other (please specify)	Date
	There are no responses.	

Q3 How much impact does the water quality of Kusel Lake have on the following?

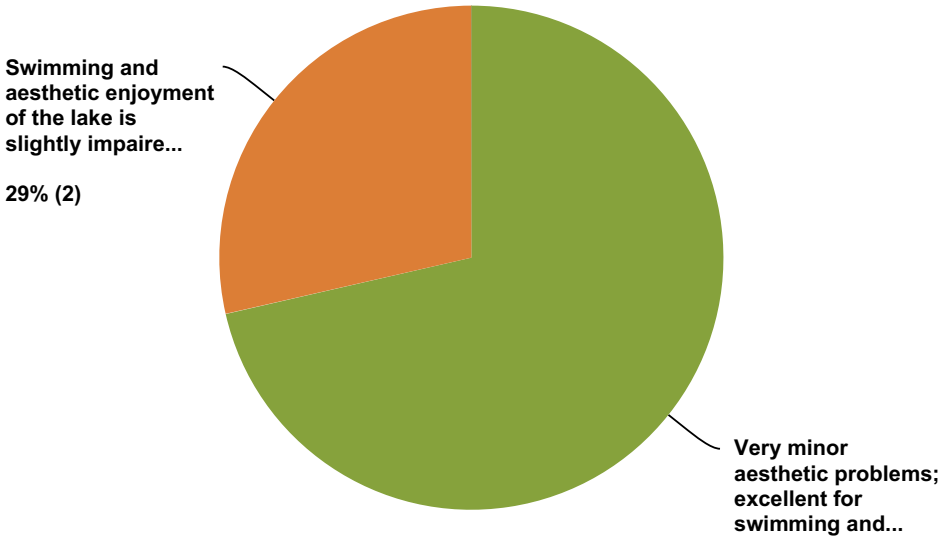
Answered: 7 Skipped: 0



	Major impact	Some impact	No impact	Unsure	Total
Personal enjoyment value	**100%** 7	**0%** 0	**0%** 0	**0%** 0	7
Economic value of the lake	**100%** 7	**0%** 0	**0%** 0	**0%** 0	7

Q4 Which statement best describes water clarity during the times you spend most on the lake?

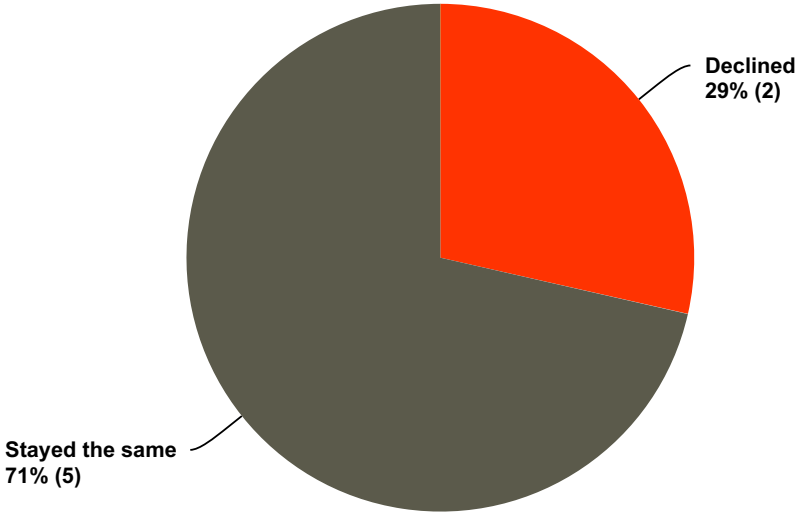
Answered: 7 Skipped: 0



Answer Choices	Responses	
Beautiful, could not be any nicer	0%	0
Very minor aesthetic problems; excellent for swimming and boating enjoyment	71%	5
Swimming and aesthetic enjoyment of the lake is slightly impaired because of algae	29%	2
Swimming and aesthetic enjoyment of the lake is moderately reduced because of algae	0%	0
Swimming and aesthetic enjoyment of the lake is substantially reduced because of algae	0%	0
None of the above	0%	0
Unsure	0%	0
Total		**7**

Q5 During the time that you have lived on, visited, or recreated on the lake, how would you say the water quality has changed?

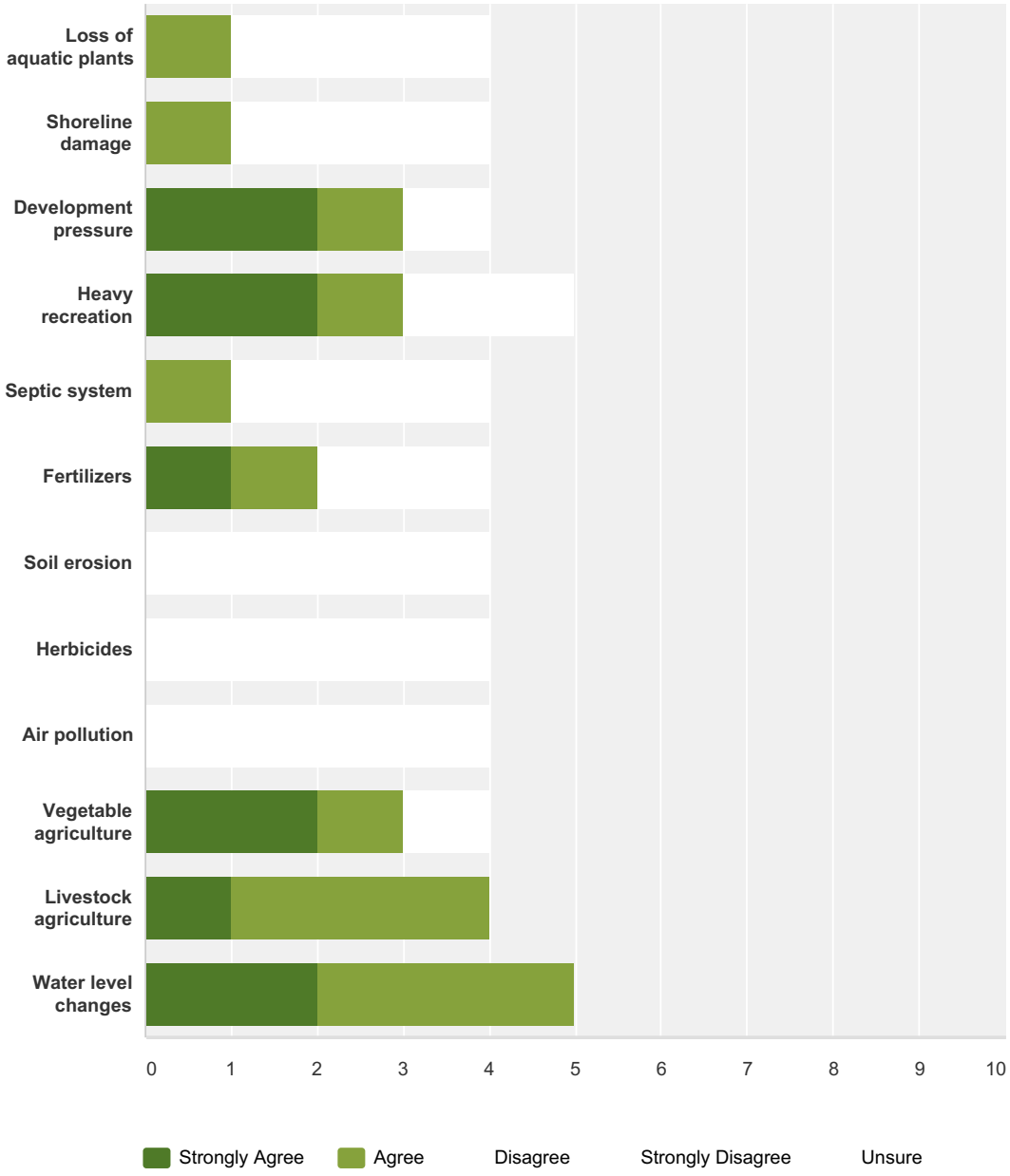
Answered: 7 Skipped: 0



Answer Choices	Responses	
Improved	0%	0
Declined	29%	2
Stayed the same	71%	5
Unsure	0%	0
Total		7

Q6 If it has declined, in your opinion, what are the primary causes?

Answered: 5 Skipped: 2

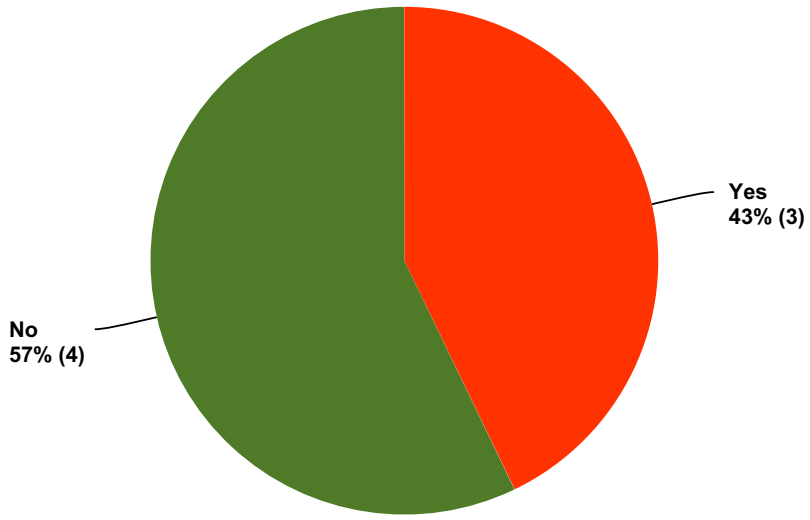


	Strongly Agree	Agree	Disagree	Strongly Disagree	Unsure	Total Respondents
Loss of aquatic plants	0% 0	25% 1	25% 1	25% 1	25% 1	4
Shoreline damage	0% 0	25% 1	25% 1	25% 1	25% 1	4
Development pressure	50% 2	25% 1	0% 0	25% 1	0% 0	4
Heavy recreation	50% 2	25% 1	25% 1	25% 1	0% 0	4

Septic system	**0%** 0	**25%** 1	**25%** 1	**0%** 0	**50%** 2	4
Fertilizers	**25%** 1	**25%** 1	**0%** 0	**0%** 0	**50%** 2	4
Soil erosion	**0%** 0	**0%** 0	**25%** 1	**50%** 2	**25%** 1	4
Herbicides	**0%** 0	**0%** 0	**25%** 1	**25%** 1	**50%** 2	4
Air pollution	**0%** 0	**0%** 0	**50%** 2	**25%** 1	**25%** 1	4
Vegetable agriculture	**50%** 2	**25%** 1	**25%** 1	**0%** 0	**0%** 0	4
Livestock agriculture	**25%** 1	**75%** 3	**0%** 0	**0%** 0	**0%** 0	4
Water level changes	**40%** 2	**60%** 3	**0%** 0	**0%** 0	**0%** 0	5

Q7 Do you use herbicides or pesticides (i.e. "weed and feed") on your land? If selecting No, please skip to Question 11.

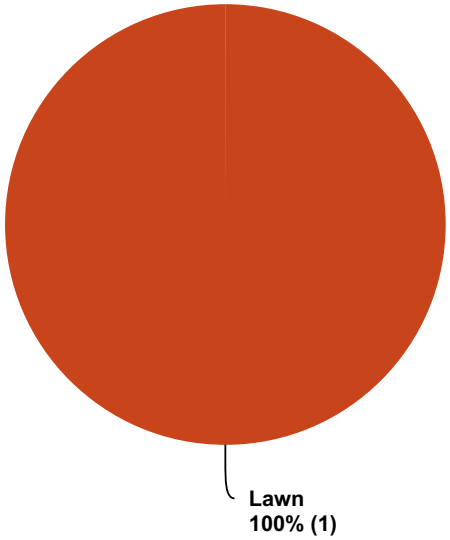
Answered: 7 Skipped: 0



Answer Choices	Responses	
Yes	43%	3
No	57%	4
Total		7

Q8 Where do you apply herbicides and/or pesticides?

Answered: 1 Skipped: 6

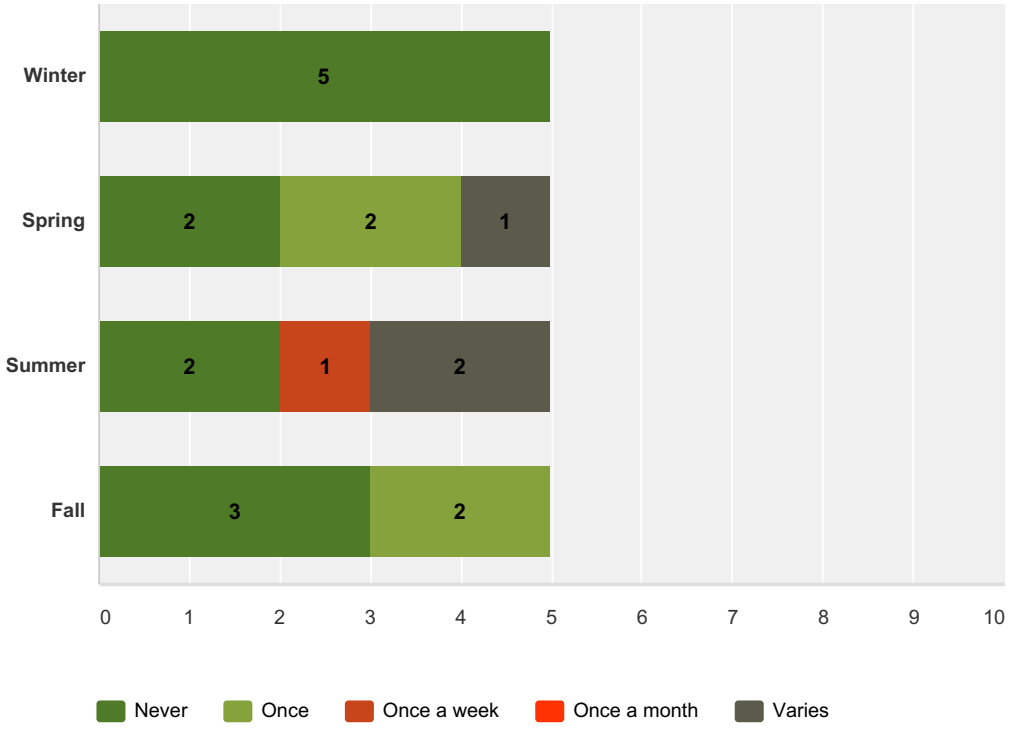


Answer Choices	Responses	
Agricultural fields	0%	0
Garden	0%	0
Lawn	100%	1
Total		1

#	Other (please specify)	Date
1	Weed control in driveway / pathways	3/30/2015 4:19 PM
2	to kill poison ivy in wooded areas	3/27/2015 9:58 AM

Q9 In a typical year, how often do you apply herbicides and/or pesticides?

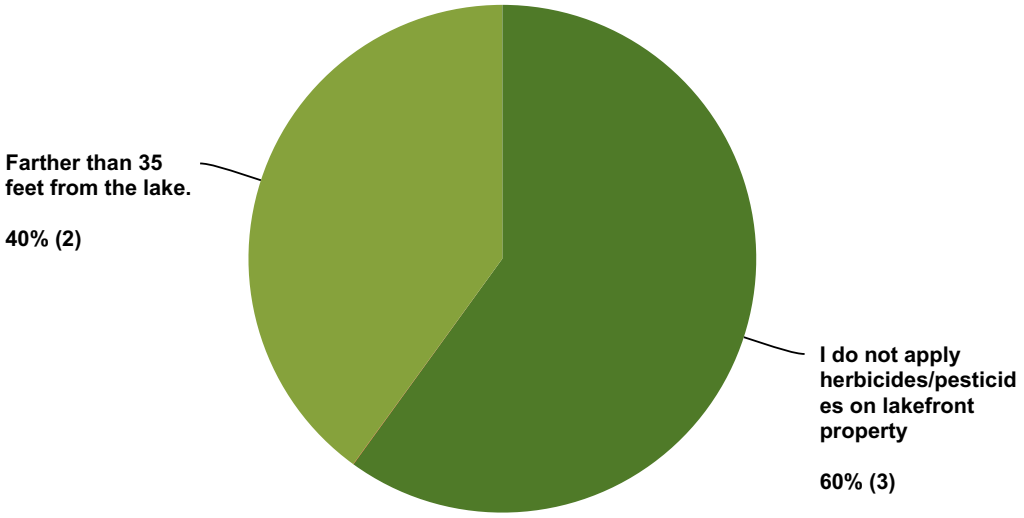
Answered: 5 Skipped: 2



	Never	Once	Once a week	Once a month	Varies	Total Respondents
Winter	**100%** 5	**0%** 0	**0%** 0	**0%** 0	**0%** 0	5
Spring	**40%** 2	**40%** 2	**0%** 0	**0%** 0	**20%** 1	5
Summer	**40%** 2	**0%** 0	**20%** 1	**0%** 0	**40%** 2	5
Fall	**60%** 3	**40%** 2	**0%** 0	**0%** 0	**0%** 0	5

Q10 If you apply herbicides and/or pesticides on lakefront property, how close to the lake are they applied (select the closest distance to the lake where herbicides/pesticides are applied)?

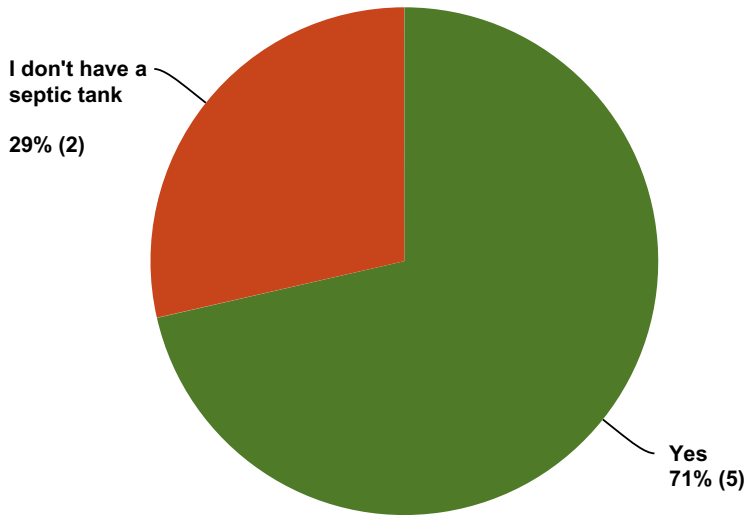
Answered: 5 Skipped: 2



Answer Choices	Responses	
I do not apply herbicides/pesticides on lakefront property	60%	3
Up to the lake	0%	0
Within 35 feet of the lake	0%	0
Farther than 35 feet from the lake.	40%	2
Total		5

Q11 Do you have your septic tank pumped at least every 3 years?

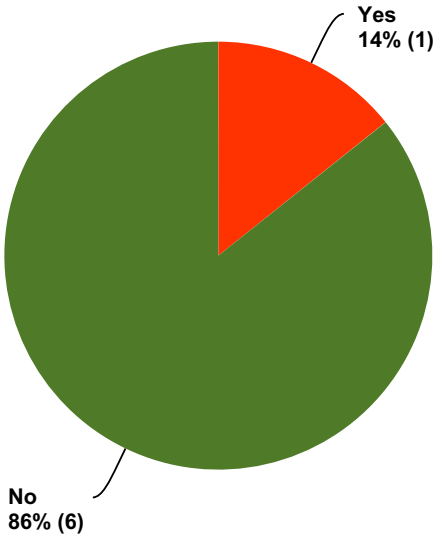
Answered: 7 Skipped: 0



Answer Choices	Responses	
Yes	71%	5
No	0%	0
I don't have a septic tank	29%	2
Total		7

Q12 Do you use fertilizer on your land?

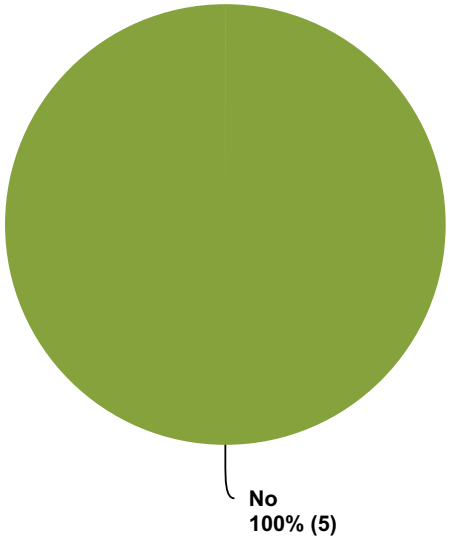
Answered: 7 Skipped: 0



Answer Choices	Responses	
Yes	14%	1
No	86%	6
Total		7

Q13 Do you use fertilizer which contains phosphorus?

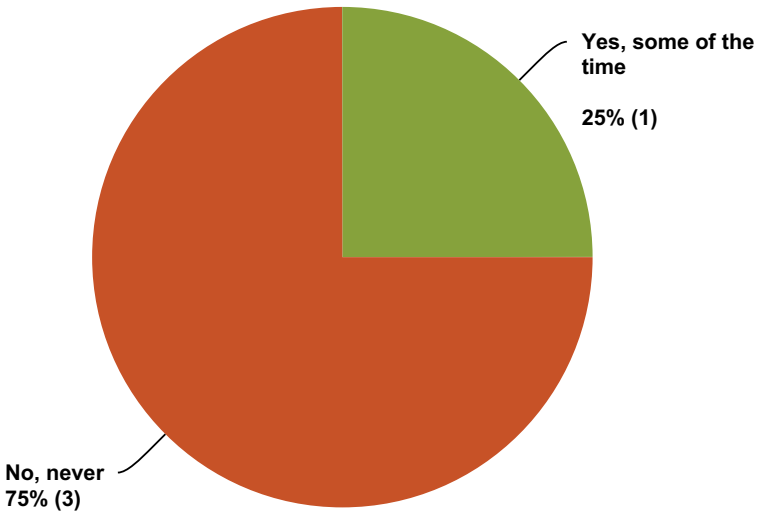
Answered: 5 Skipped: 2



Answer Choices	Responses	
Yes	0%	0
No	100%	5
I don't know	0%	0
Total		5

Q14 Do you have your soil tested before applying fertilizer?

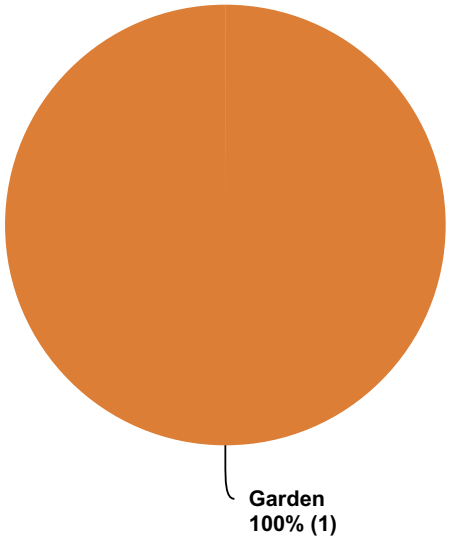
Answered: 4 Skipped: 3



Answer Choices	Responses	
Yes, all of the time	0%	0
Yes, some of the time	25%	1
No, never	75%	3
Total		4

Q15 Where do you apply fertilizer?

Answered: 1 Skipped: 6

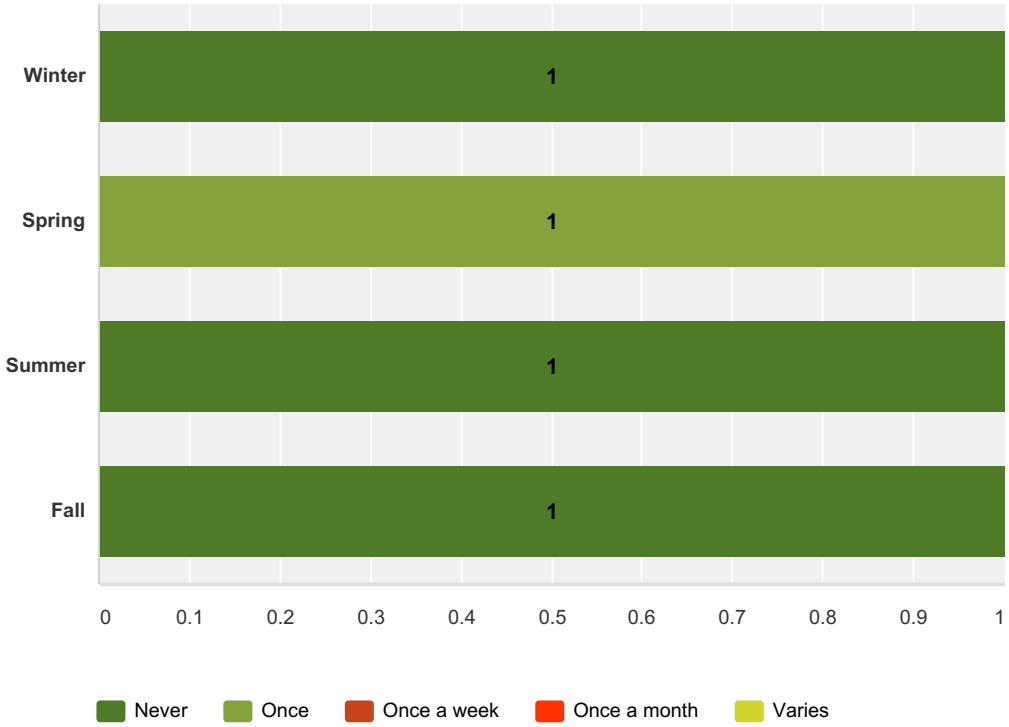


Answer Choices	Responses	
Agricultural fields	0%	0
Garden	100%	1
Lawn	0%	0
Total		1

#	Other (please specify)	Date
1	more than 100 from water	3/27/2015 9:58 AM

Q16 In a typical year, how often do you apply fertilizer?

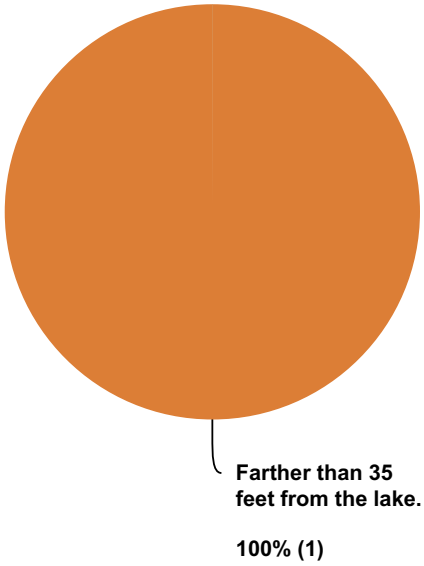
Answered: 1 Skipped: 6



	Never	Once	Once a week	Once a month	Varies	Total Respondents
Winter	100% 1	0% 0	0% 0	0% 0	0% 0	1
Spring	0% 0	100% 1	0% 0	0% 0	0% 0	1
Summer	100% 1	0% 0	0% 0	0% 0	0% 0	1
Fall	100% 1	0% 0	0% 0	0% 0	0% 0	1

Q17 If you apply fertilzer on lakefront property, how close to the lake is it applied (select the closest distance to the lake where fertilzer is applied)?

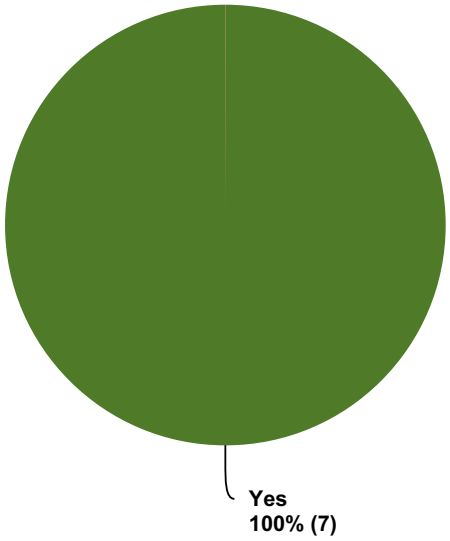
Answered: 1 Skipped: 6



Answer Choices	Responses	
I do not apply fertilizer on lakefront property	0%	0
Up to the lake	0%	0
Within 35 feet of the lake	0%	0
Farther than 35 feet from the lake.	100%	1
Total		1

Q18 Before reading the previous paragraph, did you know about the effects of phosphorus on lakes?

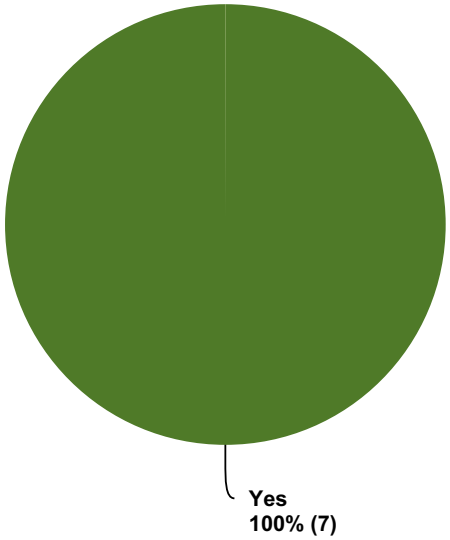
Answered: 7 Skipped: 0



Answer Choices	Responses	
Yes	100%	7
No	0%	0
Unsure	0%	0
Total		7

Q19 Do you own shoreland property? If selecting No, please skip to the last page.

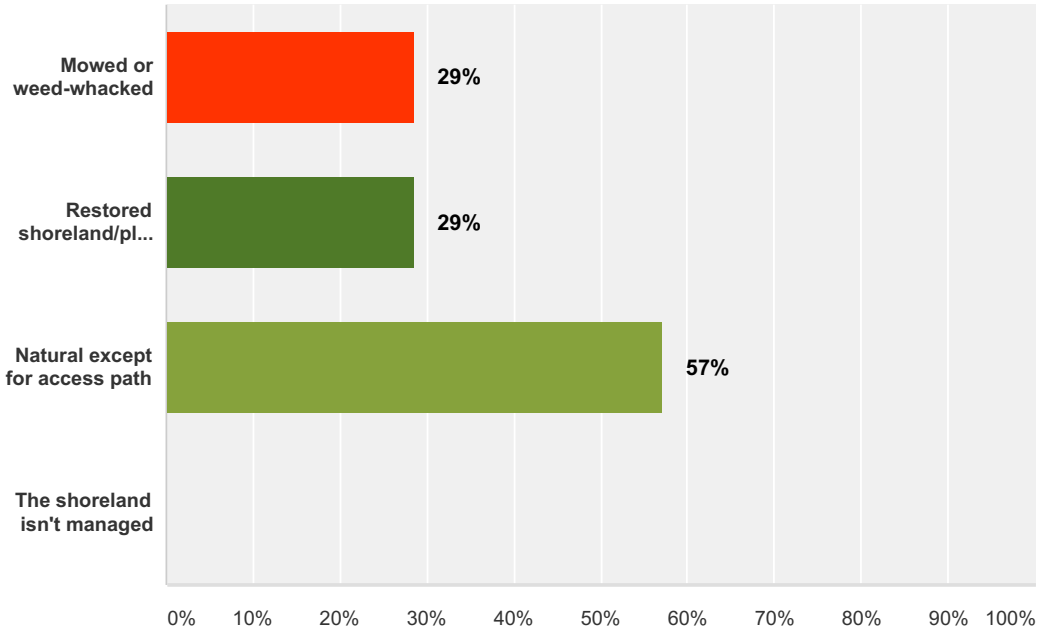
Answered: 7 Skipped: 0



Answer Choices	Responses	
Yes	100%	7
No	0%	0
Total		7

Q20 How do you currently manage the majority of your property within 35 feet of the lake? Check all that apply.

Answered: 7 Skipped: 0

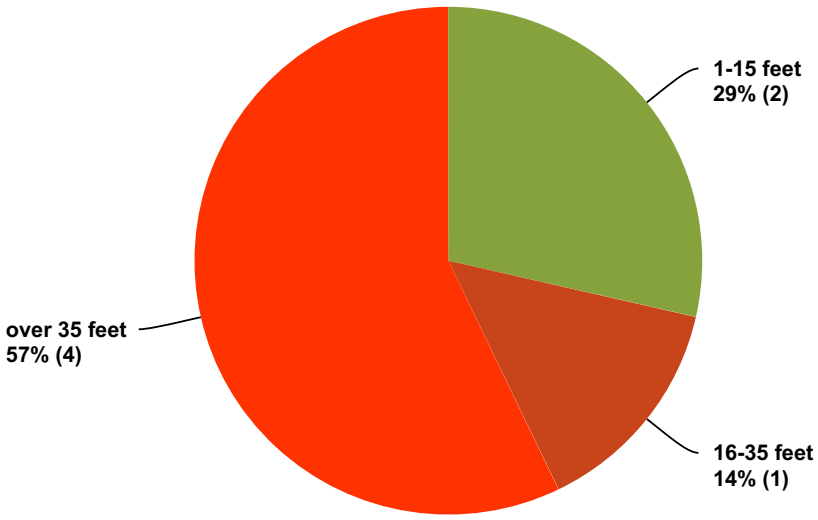


Answer Choices	Responses	
Mowed or weed-whacked	**29%**	2
Restored shoreland/planted	**29%**	2
Natural except for access path	**57%**	4
The shoreland isn't managed	**0%**	0
Total Respondents: 7		

#	Other (please specify)	Date
1	Only cut back overgrown weeds ~ my shoreline is natural, no grass	3/30/2015 4:22 PM
2	35 ft of shoreline mowed/sand	3/27/2015 10:00 AM

Q21 If you have unmowed shoreland vegetation, how far inland from the water's edge does it extend?

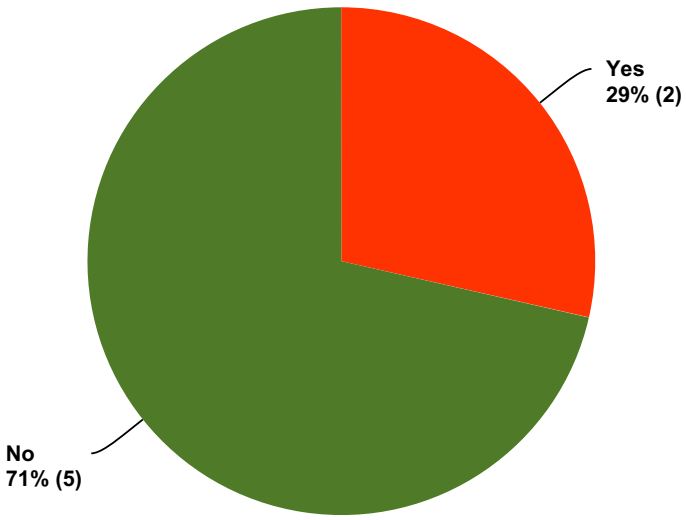
Answered: 7 Skipped: 0



Answer Choices	Responses	
I do not have unmowed shoreland vegetation	0%	0
1-15 feet	29%	2
16-35 feet	14%	1
over 35 feet	57%	4
Total		7

Q22 Have you observed erosion from your path to the lake?

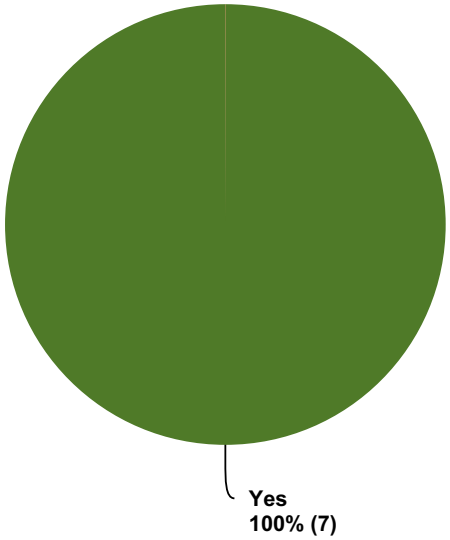
Answered: 7 Skipped: 0



Answer Choices	Responses	
I have no path	0%	0
Yes	29%	2
No	71%	5
Unsure	0%	0
Total		7

Q23 Did you understand the importance of shoreland vegetation before reading this?

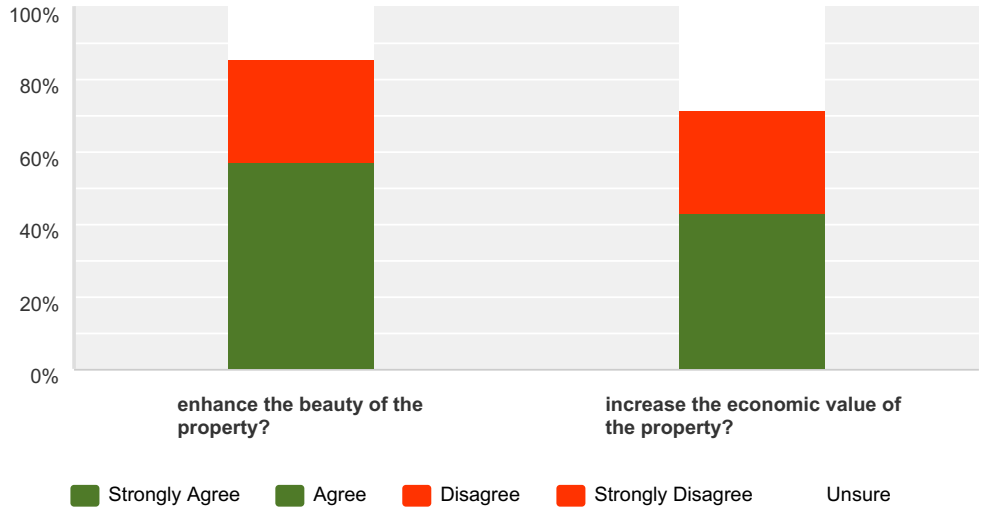
Answered: 7 Skipped: 0



Answer Choices	Responses	
Yes	100%	7
No	0%	0
Unsure	0%	0
Total		7

Q24 In your opinion, does shoreland vegetation...

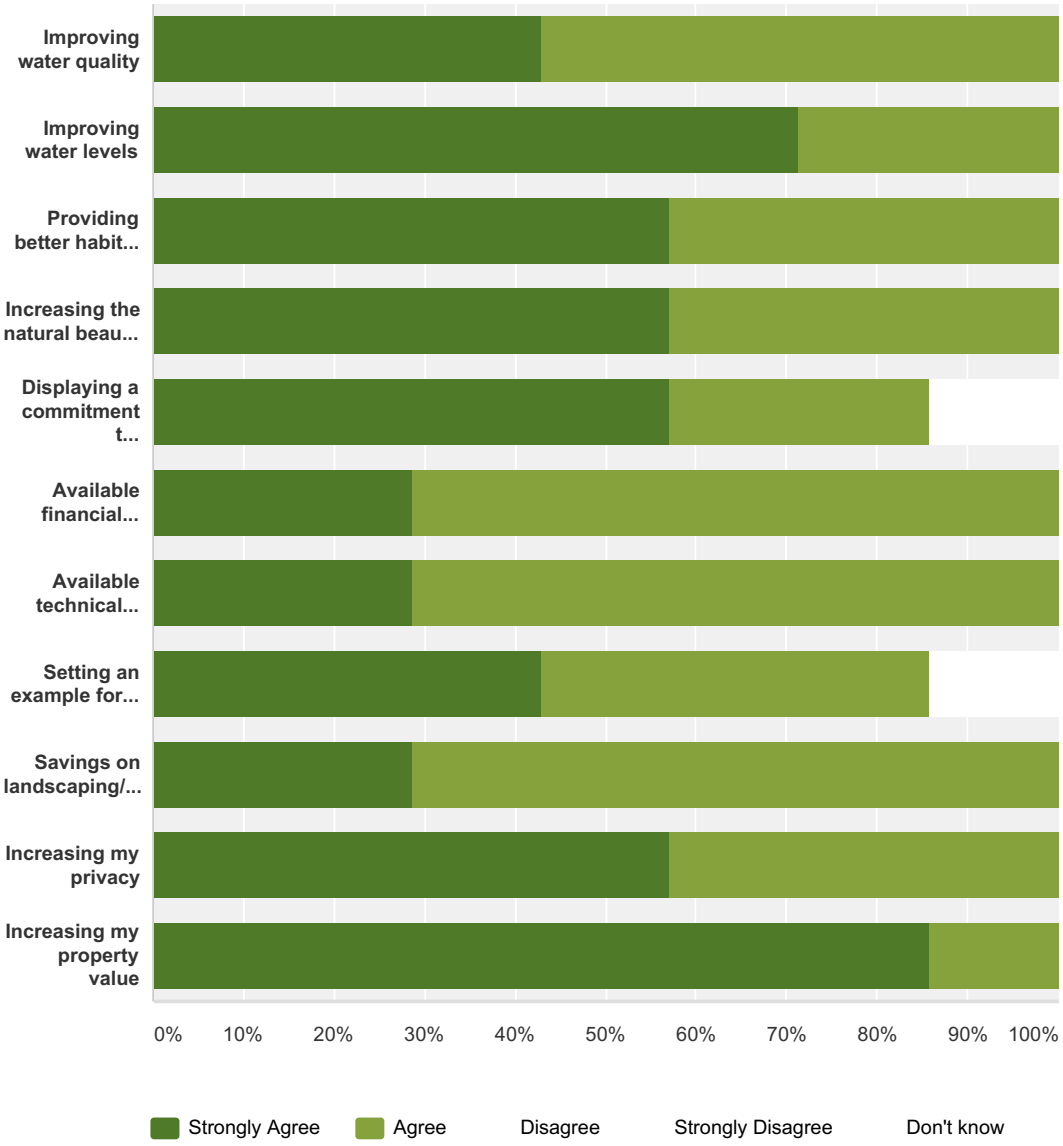
Answered: 7 Skipped: 0



	Strongly Agree	Agree	Disagree	Strongly Disagree	Unsure	Total
enhance the beauty of the property?	**14%** 1	**43%** 3	**14%** 1	**14%** 1	**14%** 1	7
increase the economic value of the property?	**14%** 1	**29%** 2	**14%** 1	**14%** 1	**29%** 2	7

Q25 What might motivate you to change how you manage your land?

Answered: 7 Skipped: 0



	Strongly Agree	Agree	Disagree	Strongly Disagree	Don't know	Total
Improving water quality	**43%** 3	**57%** 4	**0%** 0	**0%** 0	**0%** 0	7
Improving water levels	**71%** 5	**29%** 2	**0%** 0	**0%** 0	**0%** 0	7
Providing better habitat for fish and wildlife	**57%** 4	**43%** 3	**0%** 0	**0%** 0	**0%** 0	7
Increasing the natural beauty of my property	**57%** 4	**43%** 3	**0%** 0	**0%** 0	**0%** 0	7
Displaying a commitment to the environment	**57%** 4	**29%** 2	**14%** 1	**0%** 0	**0%** 0	7

Available financial assistance	**29%** 2	**71%** 5	**0%** 0	**0%** 0	**0%** 0	7
Available technical assistance	**29%** 2	**71%** 5	**0%** 0	**0%** 0	**0%** 0	7
Setting an example for community members	**43%** 3	**43%** 3	**14%** 1	**0%** 0	**0%** 0	7
Savings on landscaping/maintenance costs	**29%** 2	**71%** 5	**0%** 0	**0%** 0	**0%** 0	7
Increasing my privacy	**57%** 4	**43%** 3	**0%** 0	**0%** 0	**0%** 0	7
Increasing my property value	**86%** 6	**14%** 1	**0%** 0	**0%** 0	**0%** 0	7

#	Other (please specify)	Date
	There are no responses.	

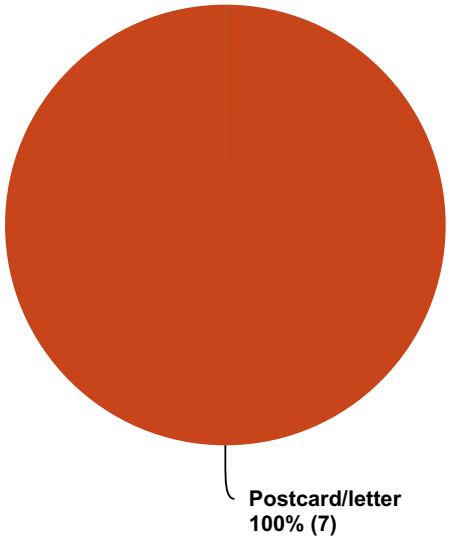
Q1 Enter your Waushara County Lakes Survey ID. Your survey cannot be processed without this information. If you've forgotten your ID or haven't created one yet, follow the instructions below.

Answered: 9 Skipped: 0

#	Responses	Date
1	[redacted]	4/29/2015 7:28 AM
2	[redacted]	4/28/2015 12:19 PM
3	[redacted]	4/27/2015 6:23 PM
[redacted]	[redacted]	4/27/2015 2:02 PM
5	[redacted]	4/24/2015 9:12 AM
6	[redacted]	4/23/2015 8:01 PM
7	[redacted]	4/23/2015 10:15 AM
8	[redacted]	4/22/2015 4:57 PM
9	[redacted]	4/22/2015 12:52 PM

Q2 How did you hear about this survey?

Answered: 7 Skipped: 2

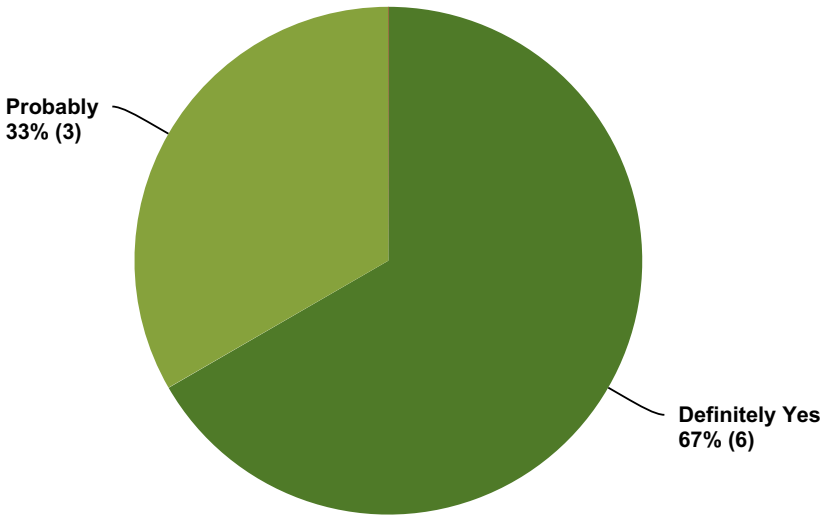


Answer Choices	Responses	
E-mail	0%	0
Newspaper	0%	0
Postcard/letter	100%	7
Facebook	0%	0
Radio	0%	0
Total		7

#	Other (please specify)	Date
1	Heard from a friend	4/29/2015 7:28 AM
2	previous postcard-didn't get one this time	4/28/2015 12:19 PM

Q3 Does a desire to provide better habitat for fish and wildlife motivate you to support (morally) efforts to improve Kusel Lake?

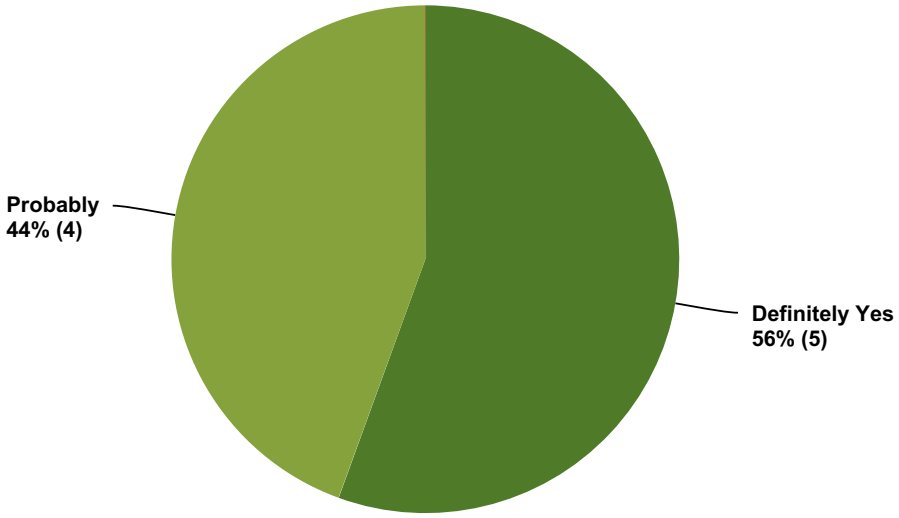
Answered: 9 Skipped: 0



Answer Choices	Responses	
Definitely Yes	67%	6
Probably	33%	3
Not Likely	0%	0
Definitely No	0%	0
Unsure	0%	0
Total		9

Q4 Does a desire to provide better habitat for fish and wildlife motivate you to support (by direct action) efforts to improve Kusel Lake?

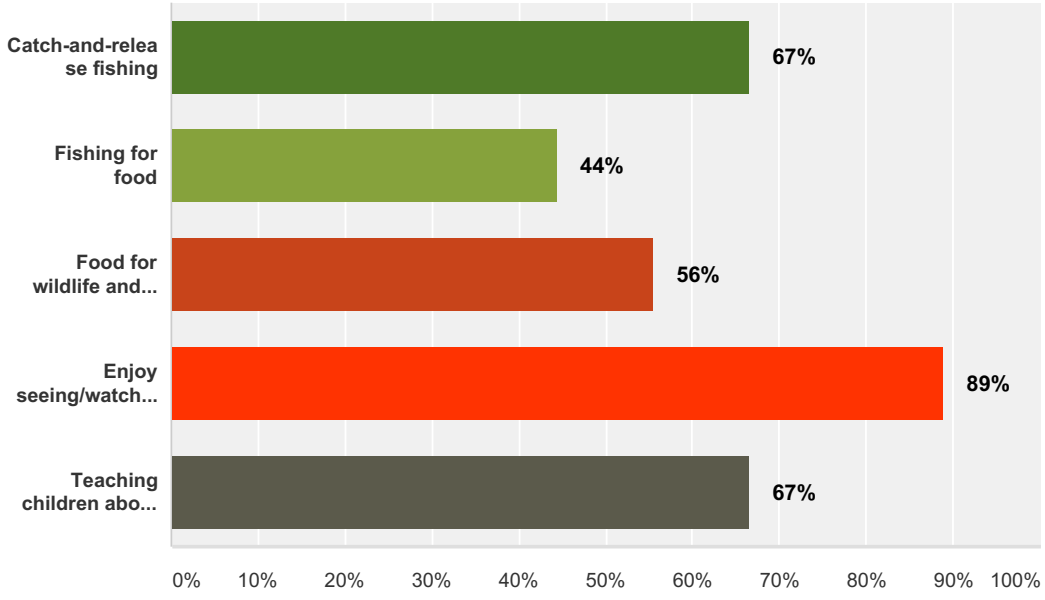
Answered: 9 Skipped: 0



Answer Choices	Responses	
Definitely Yes	56%	5
Probably	44%	4
Not Likely	0%	0
Definitely No	0%	0
Unsure	0%	0
Total		9

Q5 For what purposes do you value the fishery in Kusel Lake? (Check all that apply.)

Answered: 9 Skipped: 0

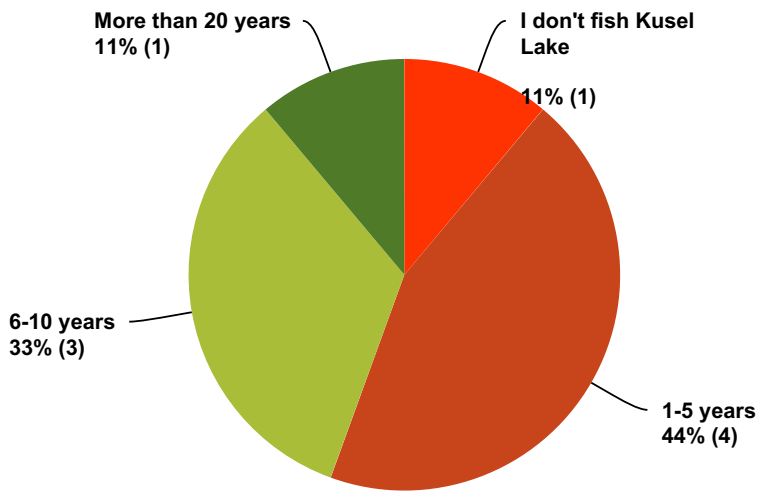


Answer Choices	Responses	
Catch-and-release fishing	67%	6
Fishing for food	44%	4
Food for wildlife and birds	56%	5
Enjoy seeing/watching fish	89%	8
Teaching children about fishing/lakes	67%	6
Total Respondents: 9		

#	Other (please specify)	Date
	There are no responses.	

Q6 How many years of fishing experience do you have on Kusel Lake? If you don't fish Kusel Lake, skip to Question 14.

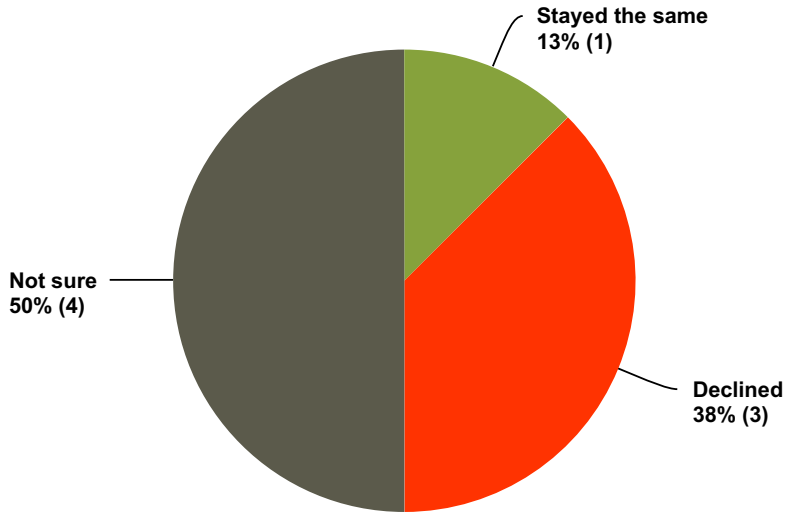
Answered: 9 Skipped: 0



Answer Choices	Responses	
I don't fish Kusel Lake	11%	1
1-5 years	44%	4
6-10 years	33%	3
11-20 years	0%	0
More than 20 years	11%	1
Total		9

Q7 In the years you have been fishing Kusel Lake, would you say the quality of fishing has... (If answering 'Stayed the same' or 'Not sure', skip to Question 9).

Answered: 8 Skipped: 1



Answer Choices	Responses	
Improved	0%	0
Stayed the same	13%	1
Declined	38%	3
Not sure	50%	4
Total		8

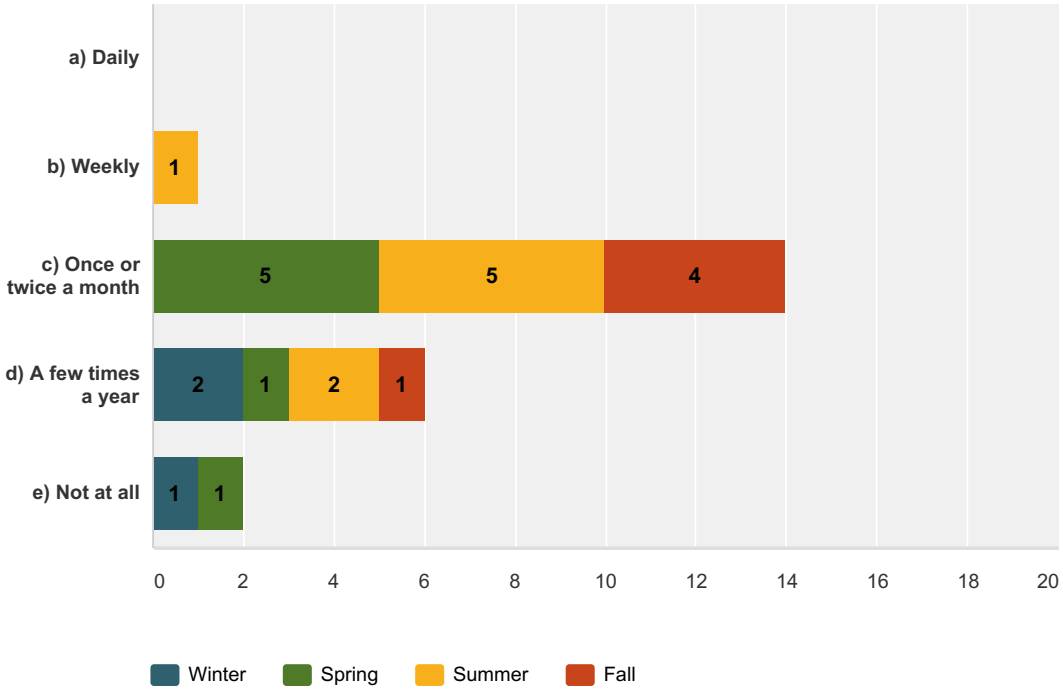
Q8 What factors do you feel have contributed to the change in fishing?

Answered: 5 Skipped: 4

#	Responses	Date
1	Not sure	4/28/2015 12:27 PM
2	Fished too heavy for bigger fish	4/27/2015 6:31 PM
3	too many motor boats	4/27/2015 2:07 PM
4	Overfishing	4/24/2015 9:15 AM
5	Lake not getting stocked or fish not surviving.	4/22/2015 12:55 PM

Q9 When and how often do you typically fish Kusel Lake?(Please answer a-e)

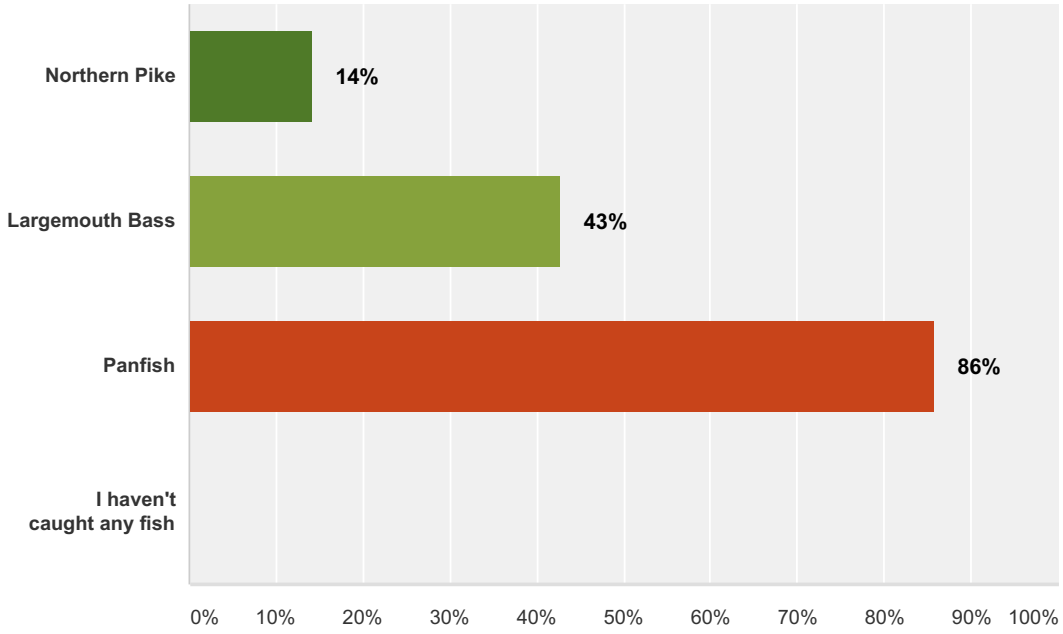
Answered: 8 Skipped: 1



	Winter	Spring	Summer	Fall	Total Respondents
a) Daily	0% 0	0% 0	0% 0	0% 0	0
b) Weekly	0% 0	0% 0	100% 1	0% 0	1
c) Once or twice a month	0% 0	83% 5	83% 5	67% 4	6
d) A few times a year	67% 2	33% 1	67% 2	33% 1	3
e) Not at all	100% 1	100% 1	0% 0	0% 0	1

Q10 What fish do you typically catch at Kusel Lake? Check all that apply.

Answered: 7 Skipped: 2

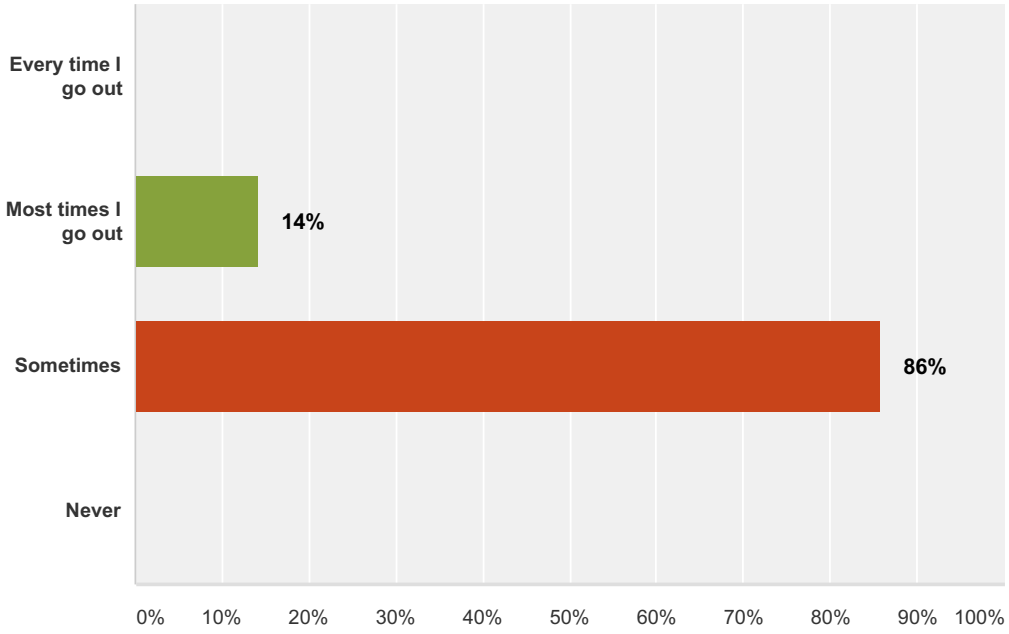


Answer Choices	Responses	
Northern Pike	14%	1
Largemouth Bass	43%	3
Panfish	86%	6
I haven't caught any fish	0%	0
Total Respondents: 7		

#	Other (please specify)	Date
	There are no responses.	

Q11 In general, how often do you catch fish on Kusel Lake?

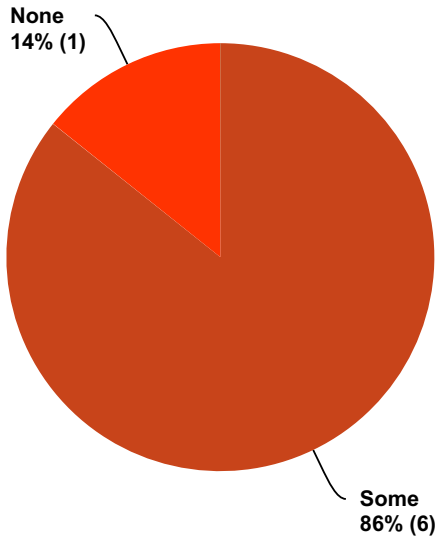
Answered: 7 Skipped: 2



Answer Choices	Responses	
Every time I go out	0%	0
Most times I go out	14%	1
Sometimes	86%	6
Never	0%	0
Total Respondents: 7		

Q12 In general, how many of the fish you catch are big enough to keep?

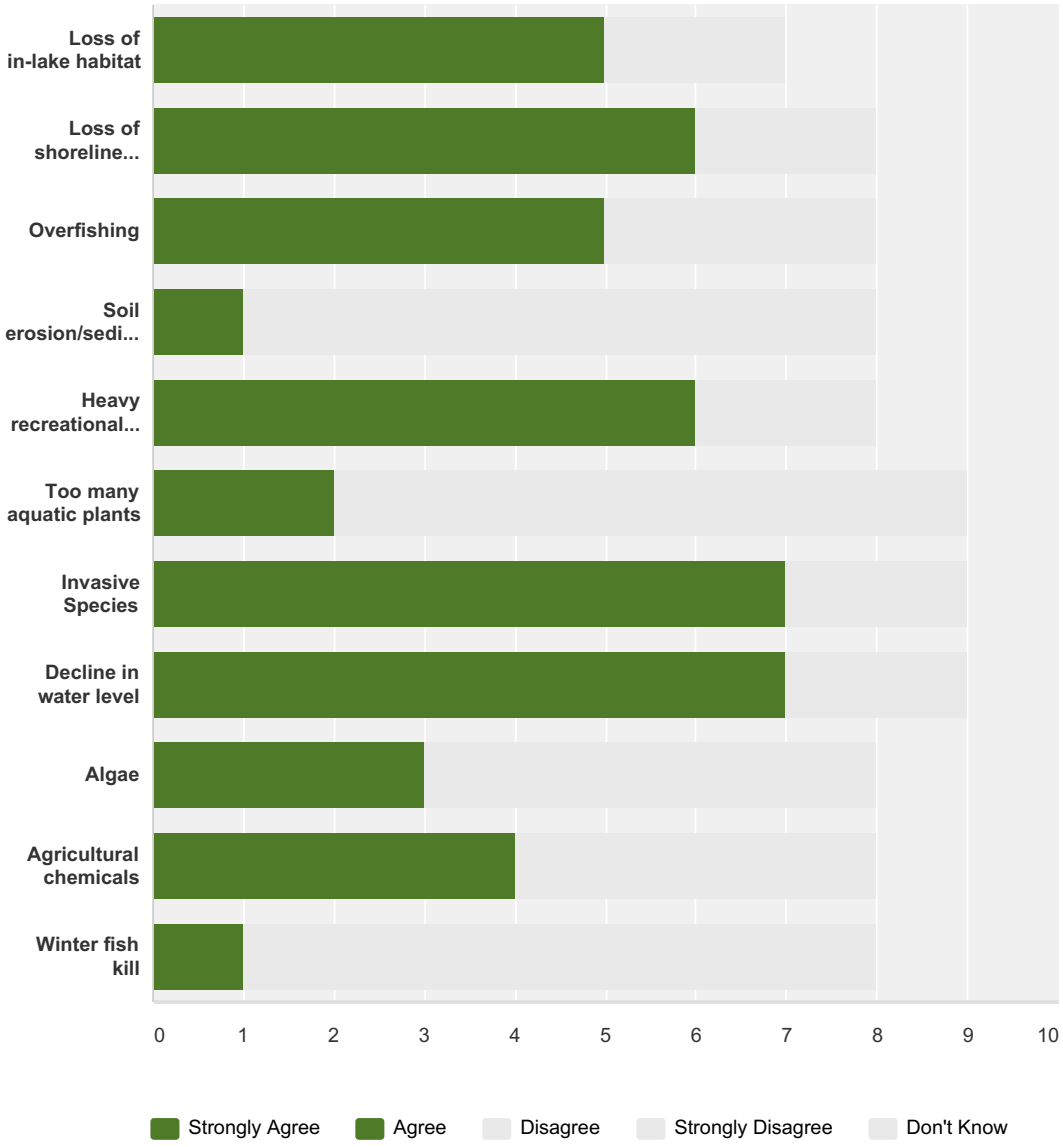
Answered: 7 Skipped: 2



Answer Choices	Responses	
All	0%	0
Most	0%	0
Some	86%	6
None	14%	1
Total		7

Q13 What do you believe is the greatest threat to the fishery in Kusel Lake in the next 10 years?

Answered: 9 Skipped: 0



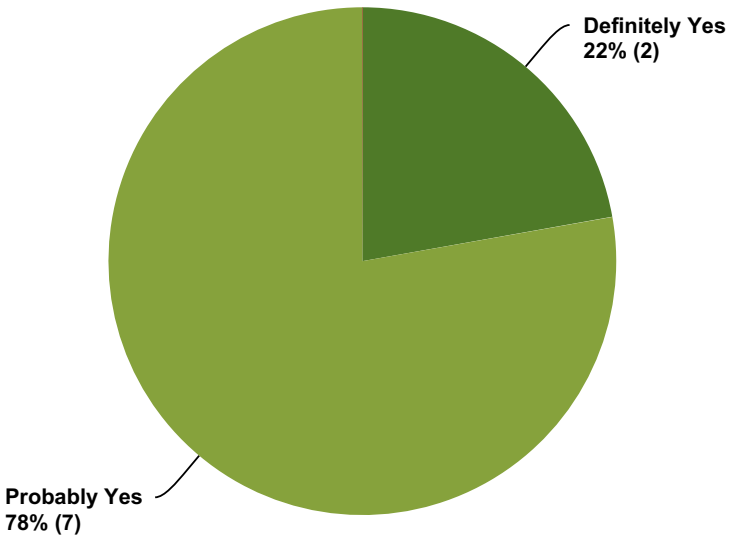
	Strongly Agree	Agree	Disagree	Strongly Disagree	Don't Know	Total Respondents
Loss of in-lake habitat	**14%** 1	**57%** 4	**14%** 1	**0%** 0	**14%** 1	7
Loss of shoreline habitat	**25%** 2	**50%** 4	**25%** 2	**0%** 0	**0%** 0	8
Overfishing	**38%** 3	**25%** 2	**38%** 3	**0%** 0	**0%** 0	8
Soil erosion/sedimentation	**0%** 0	**13%** 1	**63%** 5	**13%** 1	**13%** 1	8

Heavy recreational use	**50%** 4	**25%** 2	**13%** 1	**13%** 1	**0%** 0	8
Too many aquatic plants	**11%** 1	**11%** 1	**67%** 6	**0%** 0	**11%** 1	9
Invasive Species	**22%** 2	**56%** 5	**11%** 1	**0%** 0	**11%** 1	9
Decline in water level	**33%** 3	**44%** 4	**11%** 1	**0%** 0	**11%** 1	9
Algae	**0%** 0	**38%** 3	**25%** 2	**38%** 3	**0%** 0	8
Agricultural chemicals	**13%** 1	**38%** 3	**13%** 1	**0%** 0	**38%** 3	8
Winter fish kill	**0%** 0	**13%** 1	**38%** 3	**0%** 0	**50%** 4	8

#	Other (please specify)	Date
	There are no responses.	

Q14 Do you believe fish from Kusel Lake are safe to eat?

Answered: 9 Skipped: 0



Answer Choices	Responses	
Definitely Yes	22%	2
Probably Yes	78%	7
Probably No	0%	0
Definitely No	0%	0
Unsure	0%	0
Total		9

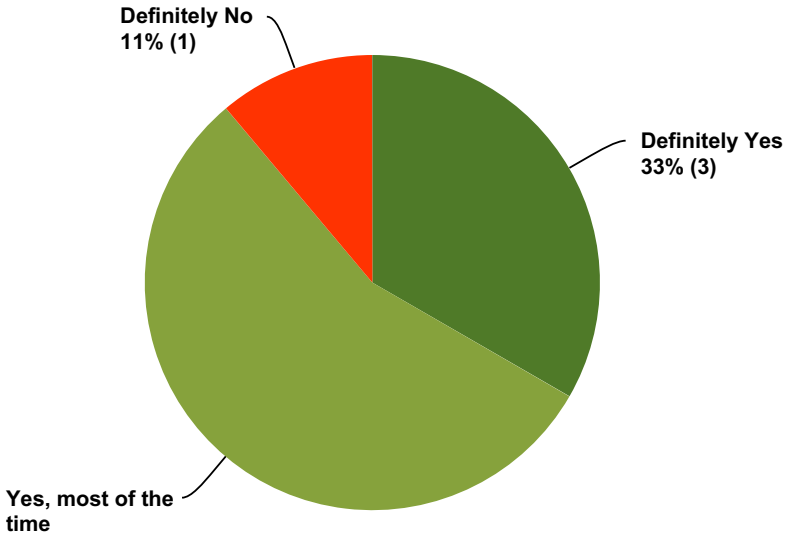
Q15 Do you have any additional comments regarding the fishery in Kusel Lake?

Answered: 2 Skipped: 7

#	Responses	Date
1	No	4/27/2015 6:31 PM
2	need more pan fish	4/27/2015 2:07 PM

Q16 The "No Wake" hours on Kusel Lake are 5pm to 10am. Do you like the current "No Wake" hours as they are? (If answering 'Definitely Yes', please skip to Question 18.)

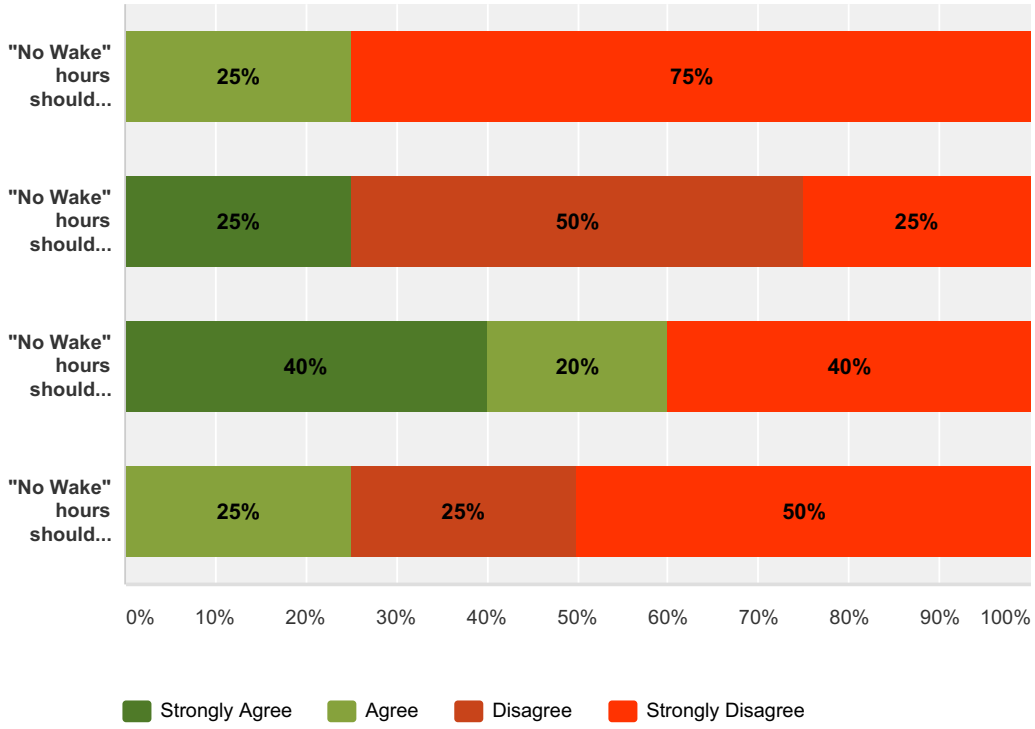
Answered: 9 Skipped: 0



Answer Choices	Responses	
Definitely Yes	33%	3
Yes, most of the time	56%	5
No, not most of the time	0%	0
Definitely No	11%	1
Unsure	0%	0
Total		9

Q17 If you think the "No Wake" hours should be adjusted...in what way?

Answered: 5 Skipped: 4

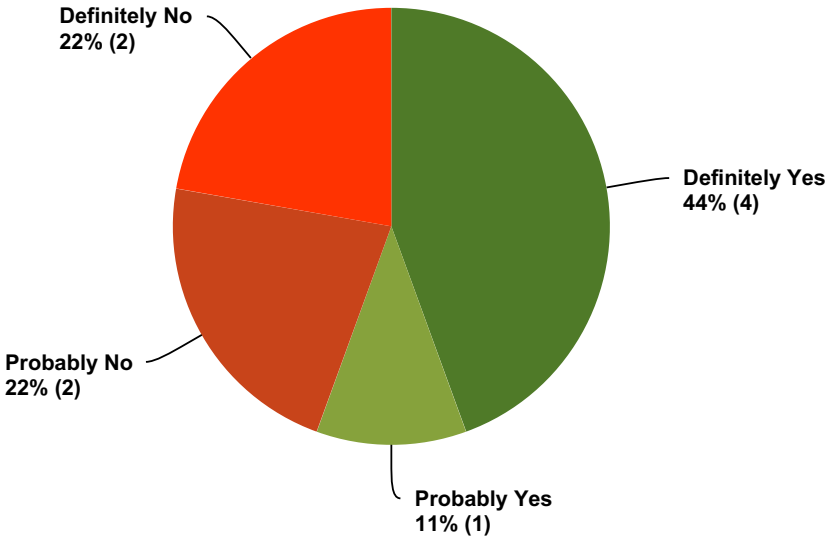


	Strongly Agree	Agree	Disagree	Strongly Disagree	Total
"No Wake" hours should start earlier in the day	**0%** 0	**25%** 1	**0%** 0	**75%** 3	4
"No Wake" hours should start later in the day	**25%** 1	**0%** 0	**50%** 2	**25%** 1	4
"No Wake" hours should end earlier in the day	**40%** 2	**20%** 1	**0%** 0	**40%** 2	5
"No Wake" hours should end later in the day	**0%** 0	**25%** 1	**25%** 1	**50%** 2	4

#	Other (please specify)	Date
1	Would prefer mo wake to start at 4 pm, also should be enforced somehow	4/29/2015 7:35 AM
2	The no wake hours are OK, if they are obeyed.	4/27/2015 2:10 PM

Q18 Do you think there should be a maximum speed limit on Kusel Lake?

Answered: 9 Skipped: 0



Answer Choices	Responses	
Definitely Yes	44%	4
Probably Yes	11%	1
Probably No	22%	2
Definitely No	22%	2
Total		9

Q19 What could be done to improve your recreation experience on Kusel Lake?

Answered: 7 Skipped: 2

#	Responses	Date
1	Limit rentals of single family dwellings to single family with a household maximum; consider outdoor lighting regulations & recommendations - want safety but not big, very bright lights on all night long-bulb/fixture type cosiderations? Quiet hours/noise ordinance cosiderations at times...	4/28/2015 12:50 PM
2	Better policing of the jet skiis	4/27/2015 6:37 PM
3	Enforce the no wake rules, and enforce boating regulations.	4/27/2015 2:10 PM
4	Charge a boat ramp fee to limit the number of boats entering.	4/24/2015 9:20 AM
5	Limit PWA from doing doughnuts	4/23/2015 8:06 PM
6	People who would obey the existing boating laws. People who would be more considerate in anchoring on the sandbar where the lake is very narrow ~ virtually impossible to pass through there safely. One boat is fine, but often there are 4-5.	4/23/2015 10:25 AM
7	water level	4/22/2015 5:02 PM

Waushara County Lakes Study

Kusel Lake

Spring 2014

University of Wisconsin-Stevens Point

University of Wisconsin
Stevens Point

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UW-Stevens Point Water and Environmental Analysis Lab

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KUSEL LAKE STUDY RESULTS

WAUSHARA COUNTY LAKES STUDY BACKGROUND

Lakes and rivers contribute to the way of life in Waushara County. Local residents and visitors alike enjoy fishing, swimming, boating, wildlife viewing, and the peaceful nature of the lakes. Healthy lakes add value to our communities. They provide places to relax and recreate, and they can stimulate tourism. Like other infrastructure in our communities, lakes require attention and good management practices to remain healthy in our developing watersheds.

Thirty-three lakes in Waushara County were selected for this study. The study focused on learning about the lakes' water quality, aquatic plant communities, shoreland habitats, watersheds and histories in order to help people make informed lake management decisions. This report summarizes data collected for Kusel Lake between fall 2010 and fall 2012.

ABOUT KUSEL LAKE

To understand a lake and its potential for water quality, fish and wildlife, and recreational opportunities, we need to understand its physical characteristics and setting within the surrounding landscape. The lake is located in the township of Springwater, west of Saxeville, and east of County Highway H, with one public boat launch located on its eastern side. Kusel Lake is a 74 acre seepage lake with surface runoff and groundwater contributing most of its water. The maximum depth in Kusel Lake is 29 feet; the lakebed has a moderate slope with three distinct deep areas (Figure 1). Its bottom sediments are mostly sand with a small amount of muck.

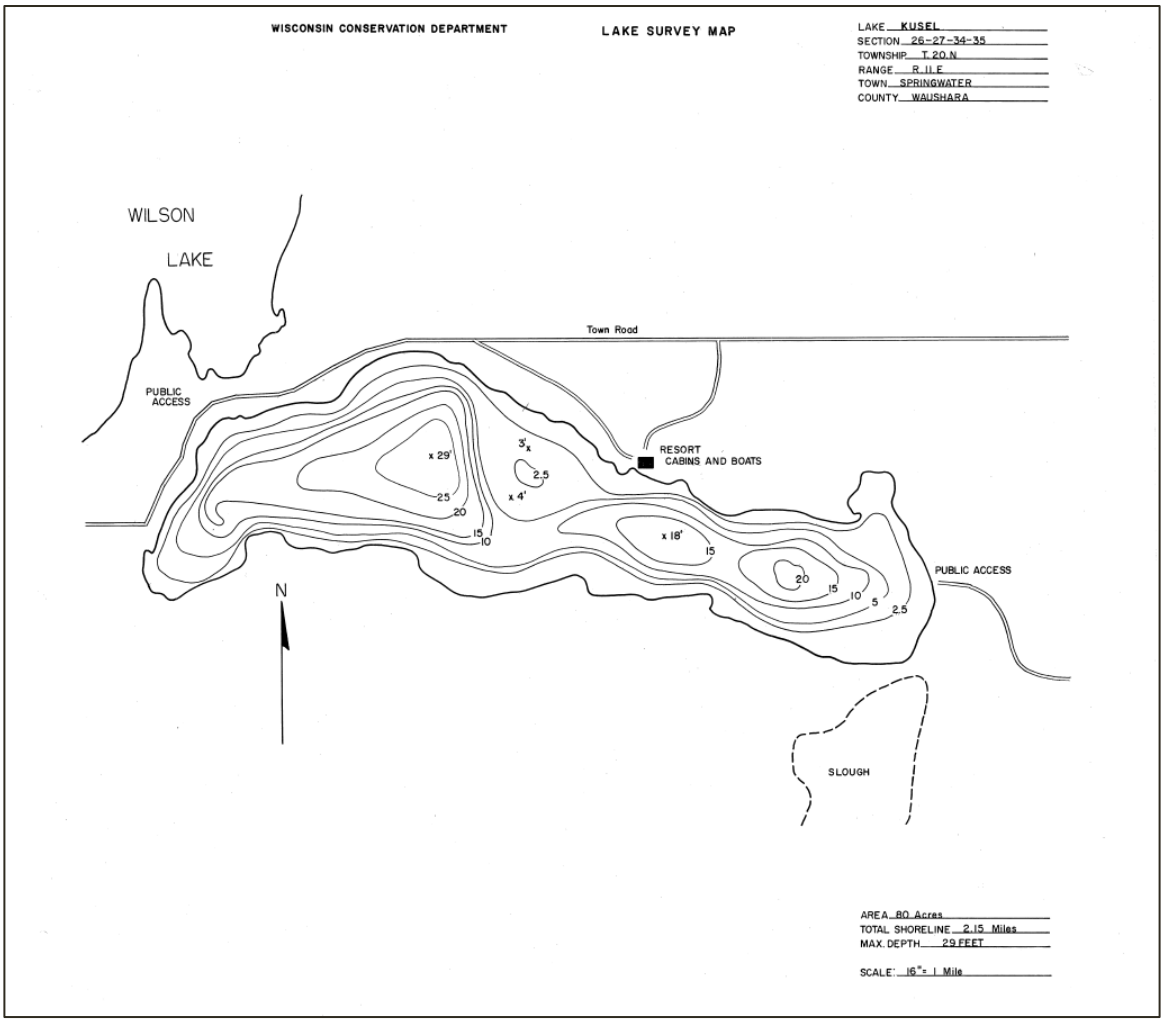


FIGURE 1. CONTOUR MAP OF THE KUSEL LAKE LAKEBED.

WHERE IS THE WATER COMING FROM? - WATERSHEDS AND LAND USE

The water quality in Kusel Lake is a reflection of the land that drains to it. The water quality, the amount of algae, aquatic plants, the fishery and other animals in the lake are all affected by natural and manmade characteristics. Natural characteristics that affect a lake include the amount of land that drains to the lake, the hilliness of the landscape, types of soil, extent of wetlands, and the type of lake. Within the lake's watershed, alterations to the landscape, the types of land use, and the land management practices are examples of how people may affect the lake.

It is important to understand where Kusel Lake's water originates in order to understand the lake's health. During snowmelt or a rainstorm, 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 Kusel Lake is called a surface watershed. Groundwater also feeds Kusel Lake; its land area may be slightly different than the surface watershed. The surface watershed is shown in Figure 2.

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 a greater capacity to hold water during rain events and snowmelt help to slow the delivery of the water to the lake. Minimizing excess 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.

Land use and land management practices within a lake's watershed can affect both its water quantity and quality. While forests and grasslands allow a fair amount of precipitation to soak into the ground, resulting in more groundwater and better water quality, other types of land uses may result in increased runoff and less groundwater recharge, and may 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 often results in changes to natural drainage patterns, 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 can enhance the growth of algae and aquatic plants in our lakes.

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 native vegetation in the shoreland, and using erosion control practices. Waushara County staff and other professionals can work with landowners to determine which practices are best suited to a particular property.

KUSEL LAKE SURFACE WATERSHED

The surface watershed for Kusel Lake is approximately 1,179 acres (Figure 2). The dominant types of land use in the watershed are forests (56%) and developed lands (35%). The land closest to the lake often has the greatest impact on water quality and habitat; Kusel Lake's shoreland is surrounded primarily by development, forests and wetlands.

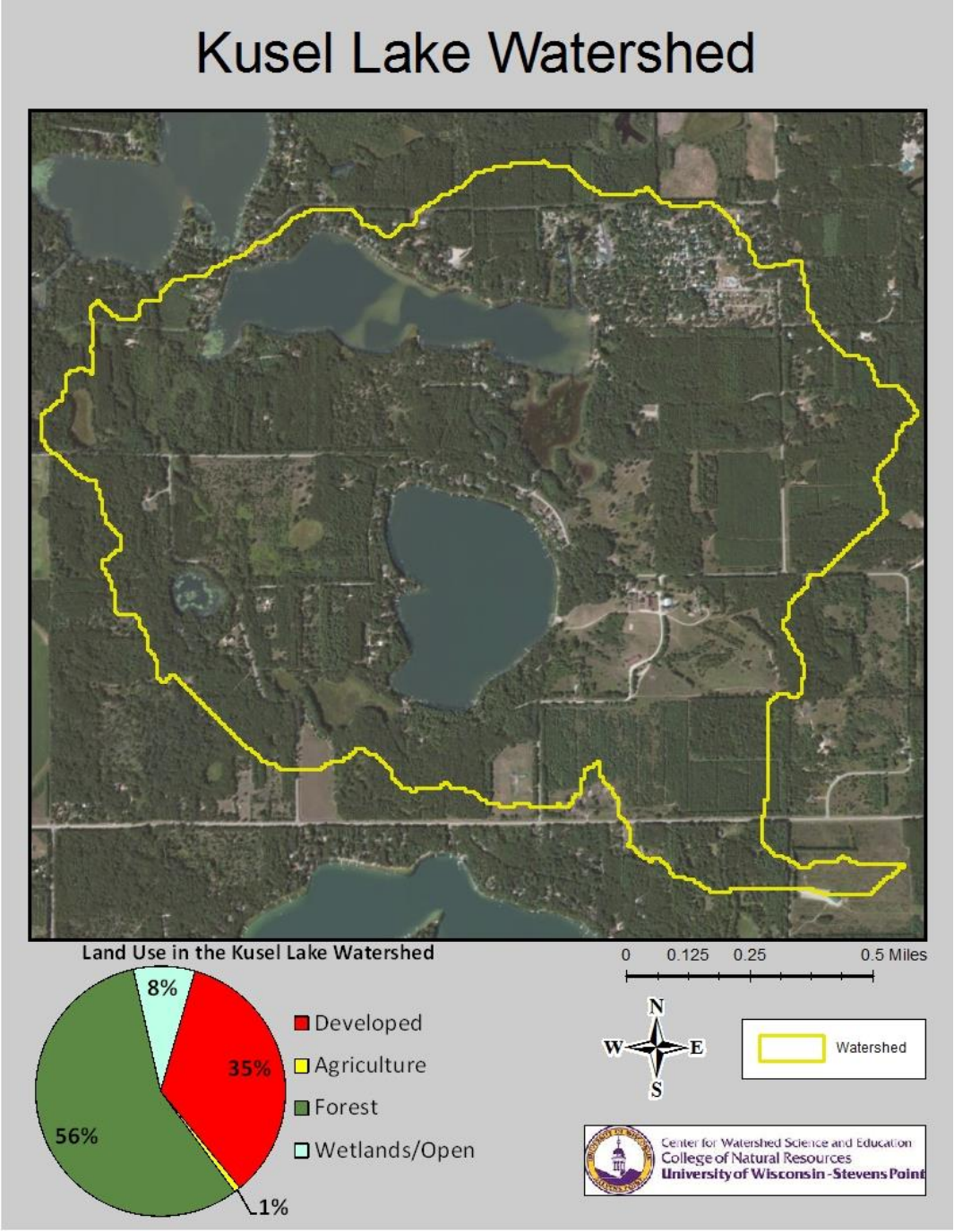


FIGURE 2. LAND USE IN THE KUSEL LAKE SURFACE WATERSHED.

The more the lake's water interacts with groundwater, the more influence the geology has on the lake. The length of time water remains below ground affects the temperature and chemistry of the groundwater. Groundwater temperature is near constant year round; during the summer, groundwater feeding Kusel Lake will help keep the lake water cooler.

Groundwater flows below ground from higher to lower elevations, discharging into wetlands, streams, and lakes. The groundwater feeding the lakes in Waushara County originates nearby. The black arrows in Figure 3 indicate the general direction of groundwater flow. Much of the groundwater enters Kusel Lake from the southwest.

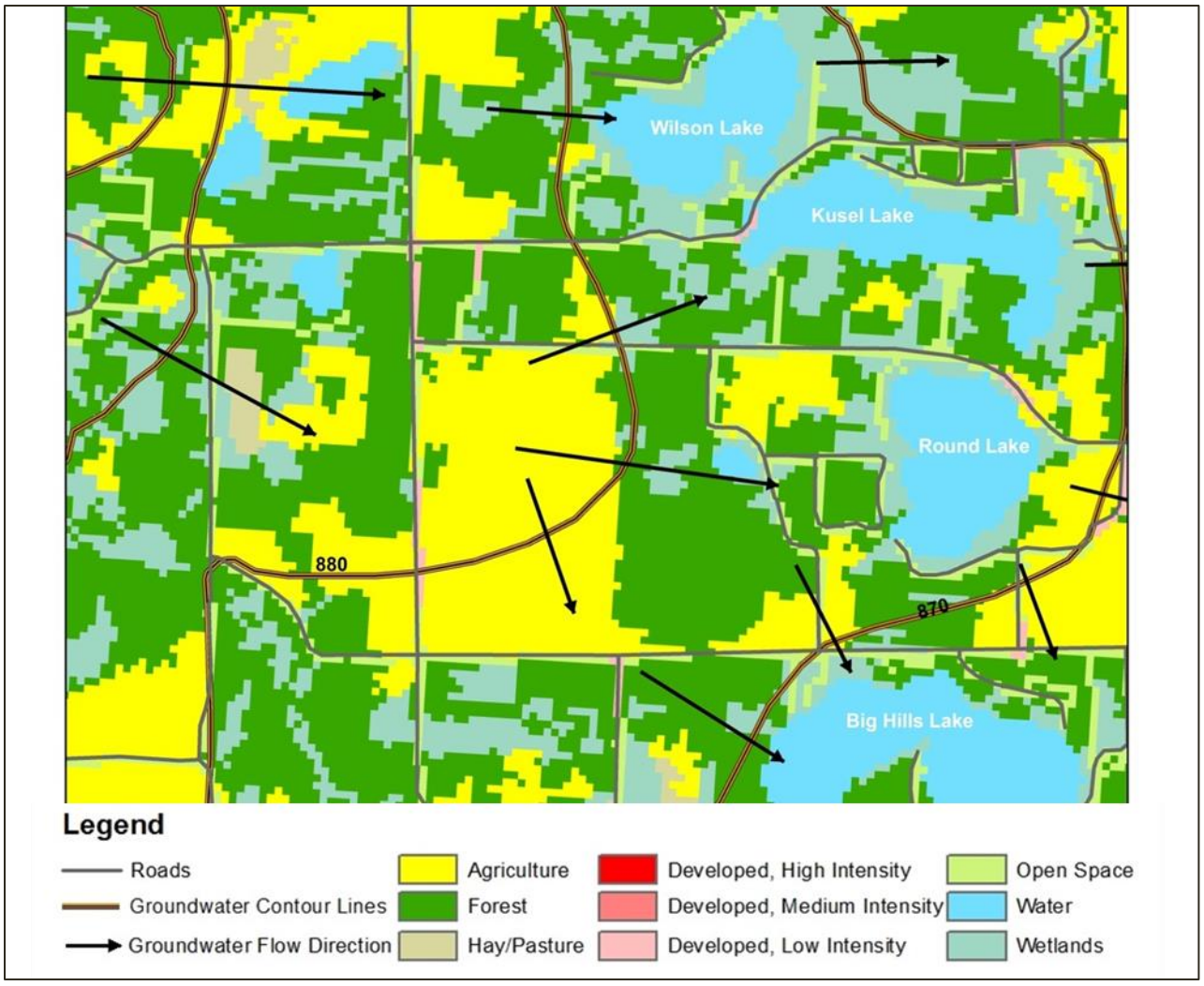
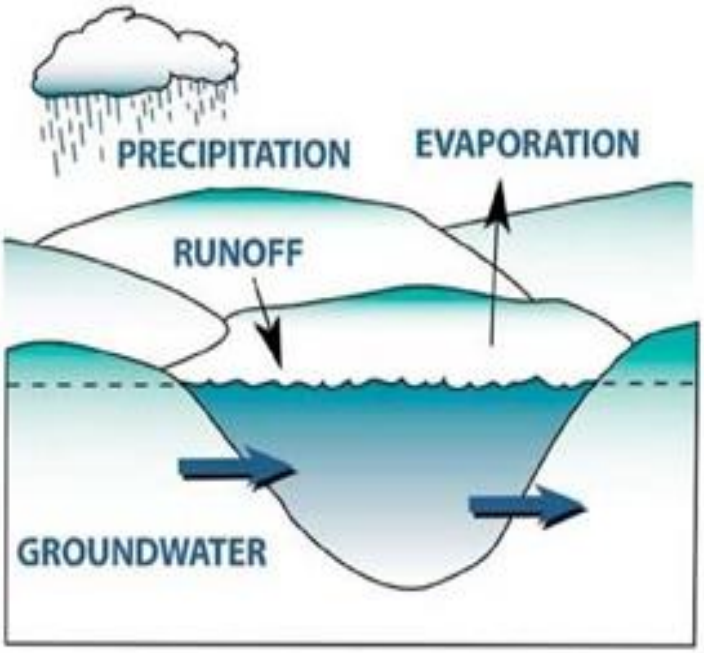


FIGURE 3. GROUNDWATER FLOW DIRECTION NEAR KUSEL LAKE.

Lake water quality is a result of many factors including the underlying geology, the climate, and land management practices. Assessing lake water quality allows us to evaluate current lake health and changes from the past. We can then identify what is needed to achieve a more desirable state or preserve an existing state for aesthetics, recreation, wildlife and the fishery. During this study, water quality in Kusel Lake was assessed by measuring different characteristics including temperature, dissolved oxygen, water clarity, water chemistry, and algae.



The source of a lake's water supply is important in determining its water quality and choosing management practices to preserve or influence that quality. Kusel Lake is classified as a seepage lake, or a lake that receives its water primarily through groundwater, and, to a lesser extent, direct runoff and precipitation (Figure 4). Seepage lakes generally have longer retention time (length of time water remains in the lake), which affects contact time with nutrients that feed the growth of algae and aquatic plants. Seepage lakes have higher concentrations of minerals, which are picked up as groundwater moves through soil and rock. Seepage lakes are generally more vulnerable to contamination moving towards the lake in the groundwater. Examples for Kusel Lake may include septic systems, agriculture, and road salt.

FIGURE 4. CARTOON SHOWING INFLOW AND OUTFLOW OF WATER IN A SEEPAGE LAKE.

The geologic composition that lies beneath a lake has the ability to influence the temperature, pH, minerals, and other properties in a lake. As groundwater moves, some substances are filtered out, but some materials in the soil dissolve into the groundwater. Minerals such as calcium and magnesium in the soil around Kusel Lake are dissolved in the water, making the water hard. The average hardness for Kusel Lake during the 2010-2012 sampling period was 114 mg/L, which is considered hard (Table 1). Hard water provides calcium necessary for building bones and shells for animals in the lake. The average alkalinity was 122 mg/L; higher alkalinity in inland lakes can support greater species productivity. Hardness and alkalinity also play roles in the type of aquatic plants that are found in a lake (Shaw et al., 2000; Wetzel, 2001).

TABLE 1. MINERALS AND PHYSICAL MEASUREMENTS IN KUSEL LAKE, 2010-2012.

Kusel Lake	Alkalinity (mg/L)	Calcium (mg/L)	Magnesium (mg/L)	Hardness (mg/L as $CaCO_3$)	Color (SU)	Turbidity (NTU)
Average Value	122	23.8	12.1	114	12	1.8

Chloride concentrations, and to a lesser degree 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.

Water in Kusel Lake had low average chloride concentrations and moderate sodium and potassium concentrations over the monitoring period, suggesting that certain human activities may be impacting the lake (Table 2). Sources of sodium include animal waste, septic systems, fertilizer, and road-salting chemicals. Sources of potassium are similar to sodium with the exception of road-salting chemicals. Atrazine (DACT), an herbicide commonly used on corn, was found in low concentrations in Kusel Lake (0.11 ug/L); however, some toxicity studies have indicated that reproductive system abnormalities can occur in frogs at these levels (Hayes et al., 2003). The presence of this chemical suggests that agricultural activities in the surrounding watershed are impacting Kusel Lake.

TABLE 2. KUSEL LAKE AVERAGE WATER CHEMISTRY, 2010-2012.

Kusel Lake	**Average Value**			**Reference Value**		
(mg/L)	**Low**	**Medium**	**High**	**Low**	**Medium**	**High**
Potassium		1.0		<.75	0.75-1.5	>1.5
Chloride	2.6			<3	3.0-10.0	>10
Sodium		2.0		<2	2.0-4.0	>4

Dissolved oxygen is an important measure in aquatic ecosystems because a majority of organisms in the water depend on oxygen to survive. Oxygen is dissolved into the water from contact with the 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. Some forms of iron and other metals carried by groundwater can also consume oxygen when the groundwater discharges to the lake.

In a lake, the water temperature changes throughout the year and may vary with depth. During winter and summer when lakes stratify (layer), the amount of dissolved oxygen is often lower towards the bottom of the lake. Dissolved oxygen concentrations below 5 mg/L can stress some species of cold water fish and over time can reduce the amount of available habitat for sensitive cold water species of fish and other aquatic organisms.

Water temperature and dissolved oxygen were measured in Kusel Lake from surface to bottom at the time of sample collection in the 2010-2012 study. Typical of many Wisconsin lakes, Kusel Lake exhibited periods of mixing in the spring and fall and stratification (layering) during summer and winter. Temperature data (Figure 5) illustrated a very typical late winter profile for February 2011 and 2012, with freezing temperatures at the surface and gradual warming with depth. Vertical profiles for spring and fall turnover clearly showed thorough mixing in November 2010 and April 2011, then again in late October 2011 and early May 2012. Thermal stratification was well developed by June in Kusel Lake, with similar profiles observed between the two years (2011-2012). The data illustrated decreasing temperatures with depth, ranging as high as 27C (80ºF) at the surface in mid-summer to 8C (46ºF) near the bottom.

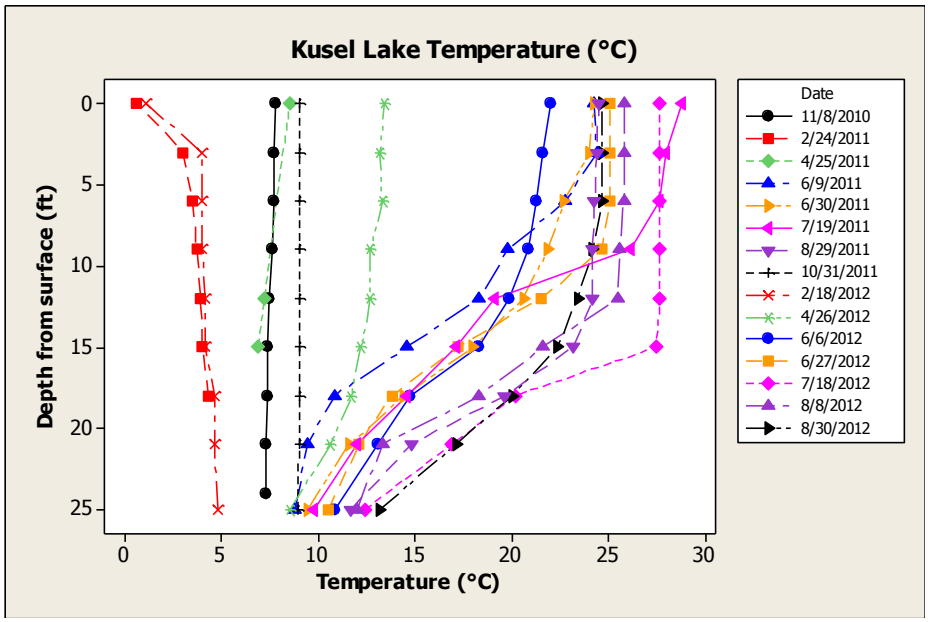


FIGURE 5. TEMPERATURE PROFILES IN KUSEL LAKE, 2010-2012.

Dissolved oxygen concentrations in Kusel Lake followed a pattern similar to temperature. When the lake was mixed, the oxygen was consistent throughout the depths, and during summer and winter the dissolved oxygen concentrations were highest near the surface and lowest near the bottom of the lake (Figure 6). During the summer, dissolved oxygen was sufficient to support many species of fish in the upper 12 feet of water. Winter saw the greatest decline in dissolved oxygen, as identified on February 24, 2011. During the winter, ice cover prevents contact with oxygen from the atmosphere and the decomposers at the bottom of the lake consume available oxygen. Algae can produce oxygen below ice, but snow cover on the ice can prevent algae from receiving the sunlight needed for growth and oxygen production.

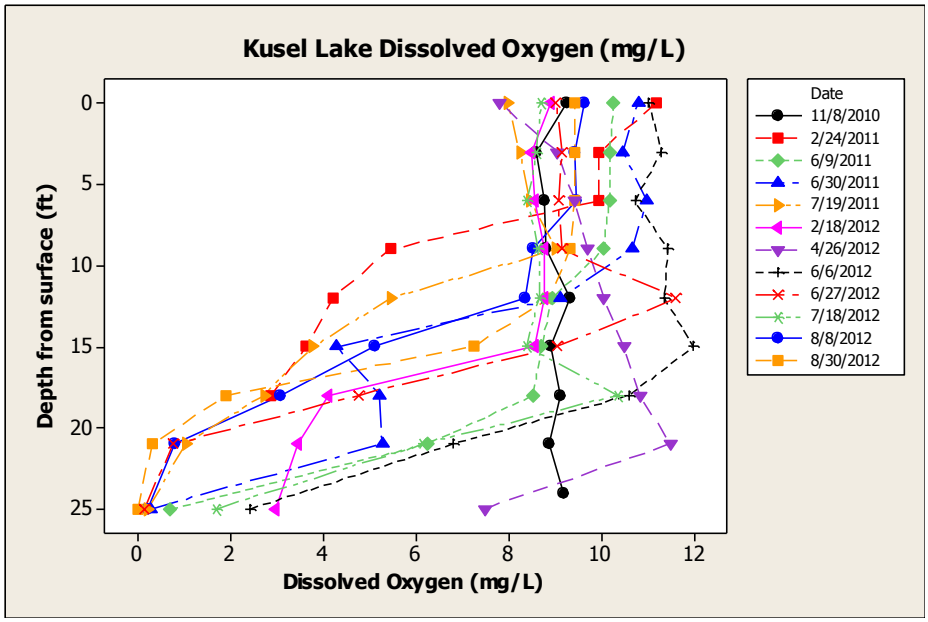


FIGURE 6. DISSOLVED OXYGEN PROFILES IN KUSEL LAKE, 2010-2012.

Water clarity is a measure of the depth that light can penetrate into the water. It is an aesthetic measure and is also related to the depth that rooted aquatic plants can grow. Water clarity is affected by water color, turbidity (suspended sediment), and algae, so it is normal for water clarity to change throughout the year and from year to year.

In Kusel Lake, color was relatively low (Table 1), so the variability in transparency throughout the year is primarily due to fluctuating algae concentrations and re-suspended sediment following storms, heavy boating, and sometimes during the formation of marl.

The water clarity measured in Kusel Lake during the study period was considered fair. For Kusel Lake, water clarity ranged from 7 feet to 13.7 feet, with an average of 10.6 feet over the two-year monitoring period (Figure 7). When compared with historic data collected between 1999 and 2005, the average water clarity measured during the study was about the same in July and slightly poorer in June and August. Water clarity in Kusel Lake was typically poorer in early summer and in the fall.

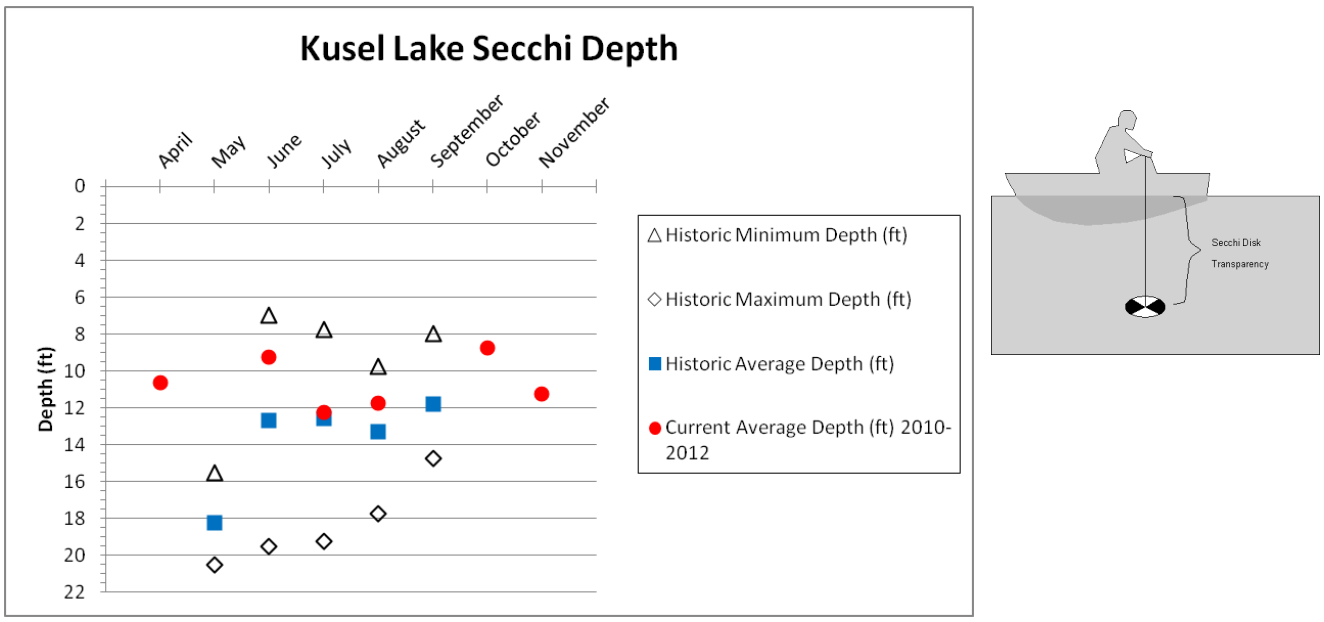


FIGURE 7. WATER CLARITY IN KUSEL LAKE, 2010-2012 AND HISTORIC.

Nutrients (phosphorus and nitrogen) are used by algae and aquatic plants for growth. Phosphorus is present naturally throughout the watershed in soil, plants, animals and wetlands. Common sources from human activities include soil erosion, animal waste, fertilizers and septic systems.

It is most common for phosphorus to move from the land to the water through surface runoff, but it can also travel to the lake in groundwater. Once in a lake, a portion of the phosphorus becomes part of the aquatic system in the form of plant and animal tissue, and sediment. The phosphorus continues to cycle within the lake for many years.

During the study, total phosphorus concentrations in samples collected from Kusel Lake ranged from a high of 30 ug/L when the lake was mixed in April 2012 to a low of 6 ug/L in August (Table 3). Summer median total phosphorus concentrations were 14 ug/L and 15 ug/L in 2011 and 2012, respectively. This is below Wisconsin's phosphorus standard of 20 ug/L for deep seepage lakes such as Kusel Lake. Nitrogen

concentrations were similar to background concentrations. Inorganic nitrogen concentrations were at background levels for lakes in central Wisconsin.

Chlorophyll *a* is a measurement of algae in the water. Chorophyll a concentrations in Kusel Lake varied slightly throughout the monitoring period, ranging from a high of 2.4 ug/l in February 2012 to a low of 0.5 ug/L in April and July 2011. The average for the monitoring period was 1.5 ug/L. These low concentrations were similar to earlier chlorophyll *a* data dating back to 2000.

TABLE 3. SEASONAL SUMMARY OF NUTRIENT CONCENTRATIONS IN KUSEL LAKE, 2010-2012.

Kusel Lake	Inorganic Nitrogen (mg/L)			Organic Nitrogen (mg/L)			Total Nitrogen (mg/L)			Soluble Reactive Phosphorus (ug/L)			Total Phosphorus (ug/L)		
	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max	Min	Avg	Max
Fall	0.03	0.04	0.05	0.62	0.65	0.67	0.82	0.85	0.87	5	6	6	17	18	18
Spring	0.05	0.05	0.05							4	4	4	30	30	30
Summer													6	14	19
Winter	0.08	0.08	0.08	0.50	0.57	0.63	0.88	0.92	0.95	2	7	11	9	9	9

Estimates of phosphorus from the landscape can help to understand the phosphorus sources to Kusel 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 through 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 forests had the greatest percentages of phosphorus contributions from the watershed to Kusel Lake (Figure 8). The phosphorus contributions by land use category, called phosphorus export coefficients, are shown in Table 4. The phosphorus export coefficients have been obtained from studies throughout Wisconsin (Panuska and Lillie, 1995).

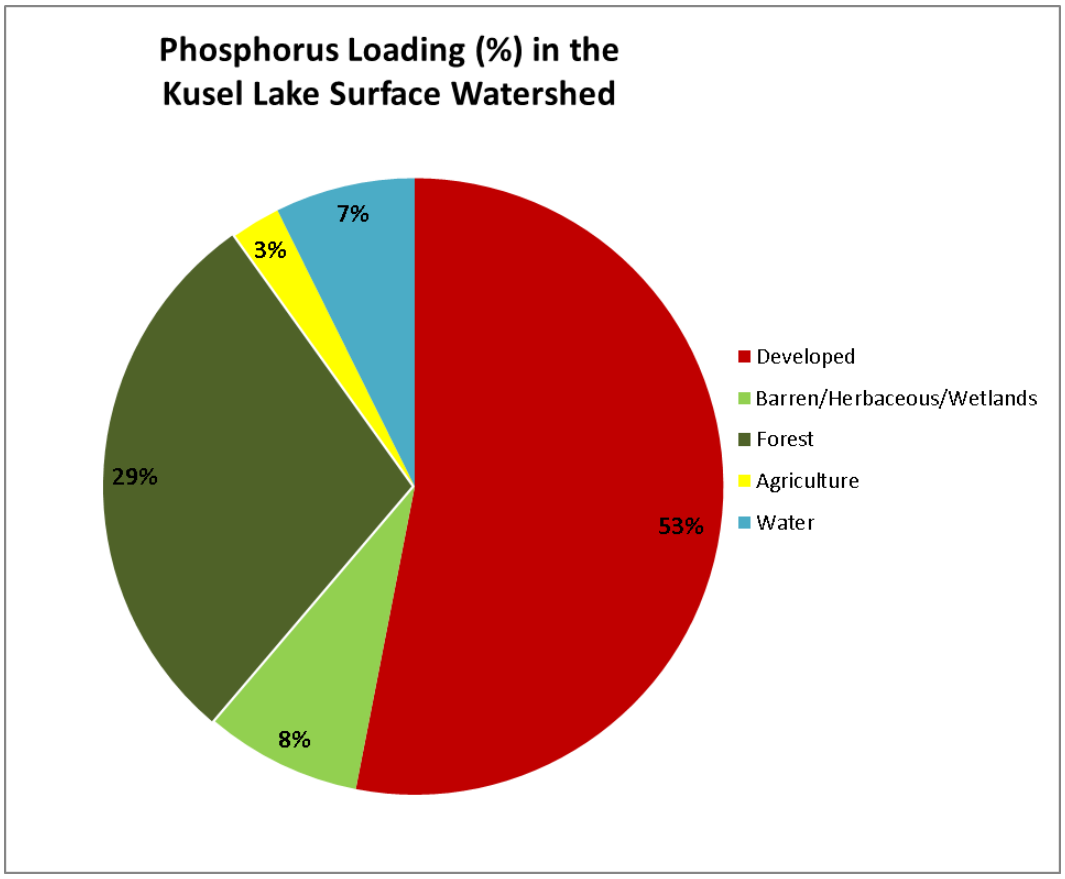


FIGURE 8. ESTIMATED PHOSPHORUS LOADS FROM LAND USES IN THE KUSEL LAKE WATERSHED.

TABLE 4. MODELING DATA USED TO ESTIMATE PHOSPHORUS INPUTS FROM LAND USES IN THE KUSEL LAKE WATERSHED (LOW AND MOST LIKELY COEFFICIENTS USED TO CALCULATE RANGE IN POUNDS).

Kusel Lake Land Use	Phosphorus Export Coefficient (lbs/acre-yr)	Land Use Area Within the Watershed		Estimated Phosphorus Load	
		Acres	Percent	Pounds	Percent
Water	0.1	152	**13**	7-20	**8**
Developed	0.13	355	**30**	58-159	**57**
Barren/Herbaceous/Wetland	0.09	82	**7**	7-22	**9**
Forest	0.04	581	**49**	26-46	**31**
Cultivated Agriculture	0.45	9	**1**	2-7	**8**
*Values are not exact due to rounding and conversion.					

Aquatic plants are the forested landscape within a lake. They provide food and habitat for a wide range of species including fish, waterfowl, turtles, amphibians, as well as invertebrates and other aquatic 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.

In 2011, the Wisconsin Department of Natural Resources conducted an aquatic plant survey of Kusel Lake. During the survey, 53% (125 of 236) of sites visited had vegetative growth. Of the sampled sites, the average depth was 9.2 feet and the maximum depth was 20 feet.

The diversity of an aquatic plant community is defined by the type and number of species present throughout the lake. Twenty-seven species of aquatic plants were found in Kusel Lake (Table 5). When compared with other lakes in Waushara County, Kusel Lake had the second highest number of species. The greatest diversity was located in the northern and northwestern shallows of the lake (Figure 9).

The dominant plant species in Kusel Lake during the survey was muskgrass (*Chara* spp.), followed by variable pondweed (*Potamogeton gramineus*) and water celery (*Valisneria americana*). Muskgrass is a favorite food source for a wide variety of waterfowl. Muskgrass beds offer cover and food for fish, especially young trout, largemouth bass, and smallmouth bass. The fruits and tubers of variable pondweed provide food for geese and ducks, and the entire plant may be eaten by a variety of wildlife such as deer, muskrat, beaver, and moose. Water celery is a favorite food for waterfowl grazing (Borman et al., 2001).

The Floristic Quality Index (FQI) evaluates the closeness of a plant community to undisturbed conditions. Each plant is assigned a coefficient of conservatism (C-value) that reflects its sensitivity to disturbance. These numbers are used to calculate the FQI. C-values range from 0 to 10. The higher the number, the more intolerant the plant is of disturbance. A C-value of zero is assigned to exotic and most nonvascular species; therefore, these species are not included in the calculation. The FQI for Kusel Lake was 29.2. This value was slightly above average for lakes in the Waushara County Lakes Study.

Of the aquatic plant species within Kusel Lake, three had a C-value equal to or greater than 8 (Table 5). No species of special concern in Wisconsin were found in Kusel Lake.

The Simpson Diversity Index (SDI) quantifies biodiversity of the aquatic plant community based on a formula that uses the number of species surveyed and the number of individuals per site. The SDI uses a decimal scale from zero to one. Values closer to one represent higher amounts of biodiversity. Kusel Lake had an SDI value of 0.83, which represents average biodiversity when compared to all the other lakes in the Waushara County Lakes Study.

During the 2011 aquatic plant survey of Kusel Lake, the aquatic invasive Eurasian water-milfoil (EWM) was found at five sampling sites. It is critical to take action against invasive plants early in their infestation. A reconnaissance survey was conducted for aquatic invasive species in 2013 by staff from Golden Sands RC&D, Inc. Fragments of uprooted EWM were found, but rooted plants were not observed during the survey. EWM can grow in dense beds that can damage boat motors, make areas less navigable, stunt or alter the fishery, create problems with dissolved oxygen, and affect activities like fishing and swimming. This plant can produce a viable seed; however, its primary mode of reproduction and spread is

fragmentation. A one-inch fragment is enough to start a new plant, making EWM very successful at reproducing.

Minimizing disturbance to the native plant community helps to reduce the ability of invasive species to become established in a lake. Diligence in inspecting watercraft before entering the lake and before leaving the boat landing is necessary to prevent the spread of undesirable exotics.

Overall, the aquatic plant community in Kusel Lake can be characterized as having average species diversity. The identification of Eurasian water-milfoil within the lake is cause for concern and the densities and population within the lake should continue to be monitored. When considering future lake management strategies, protection against the introduction of additional invasive species should be combined with efforts to preserve the habitat, food source, and water quality benefits of the native plant community.

TABLE 5. LIST OF AQUATIC PLANT SPECIES IDENTIFIED IN THE 2011 AQUATIC PLANT SURVEY OF KUSEL LAKE.

Common Name	Scientific Name	Coefficient of Conservatism Value
Emergent Species		
needle spikerush	*Eleocharis acicularis*	5
creeping spikerush	*Eleocharis palustris*	6
hardstem bulrush	*Schoenoplectus acutus*	6
three-square bulrush	*Schoenoplectus pungens*	5
water bulrush	*Schoenoplectus subterminalis*	5
Floating Leaf Species		
white water lily	*Nymphaea odorata*	6
Submergent Species		
coontail	*Ceratophyllum demersum*	3
muskgrass	*Chara* spp.	7
common waterweed	*Elodea canadensis*	3
water star-grass	*Heteranthera dubia*	6
Eurasian water-milfoil*	*Myriophyllum spicatum*	0
slender naiad	*Najas flexilis*	6
southern naiad	*Najas guadalupensis*	8
nitella	*Nitella* spp.	7
large-leaf pondweed	*Potamogeton amplifolius*	7
Fries' pondweed	*Potamogeton friessii*	8
variable pondweed	*Potamogeton gramineus*	7
Illinois pondweed	*Potamogeton illinoensis*	6
floating-leaf pondweed	*Potamogeton natans*	5
stiff pondweed	*Potamogeton strictifolius*	8
flat-stem pondweed	*Potamogeton zosteriformis*	6
sago pondweed	*Stuckenia pectinata*	3
common bladderwort	*Utricularia vulgaris*	7
water celery	*Valisneria americana*	6

*=non-native species in Wisconsin.

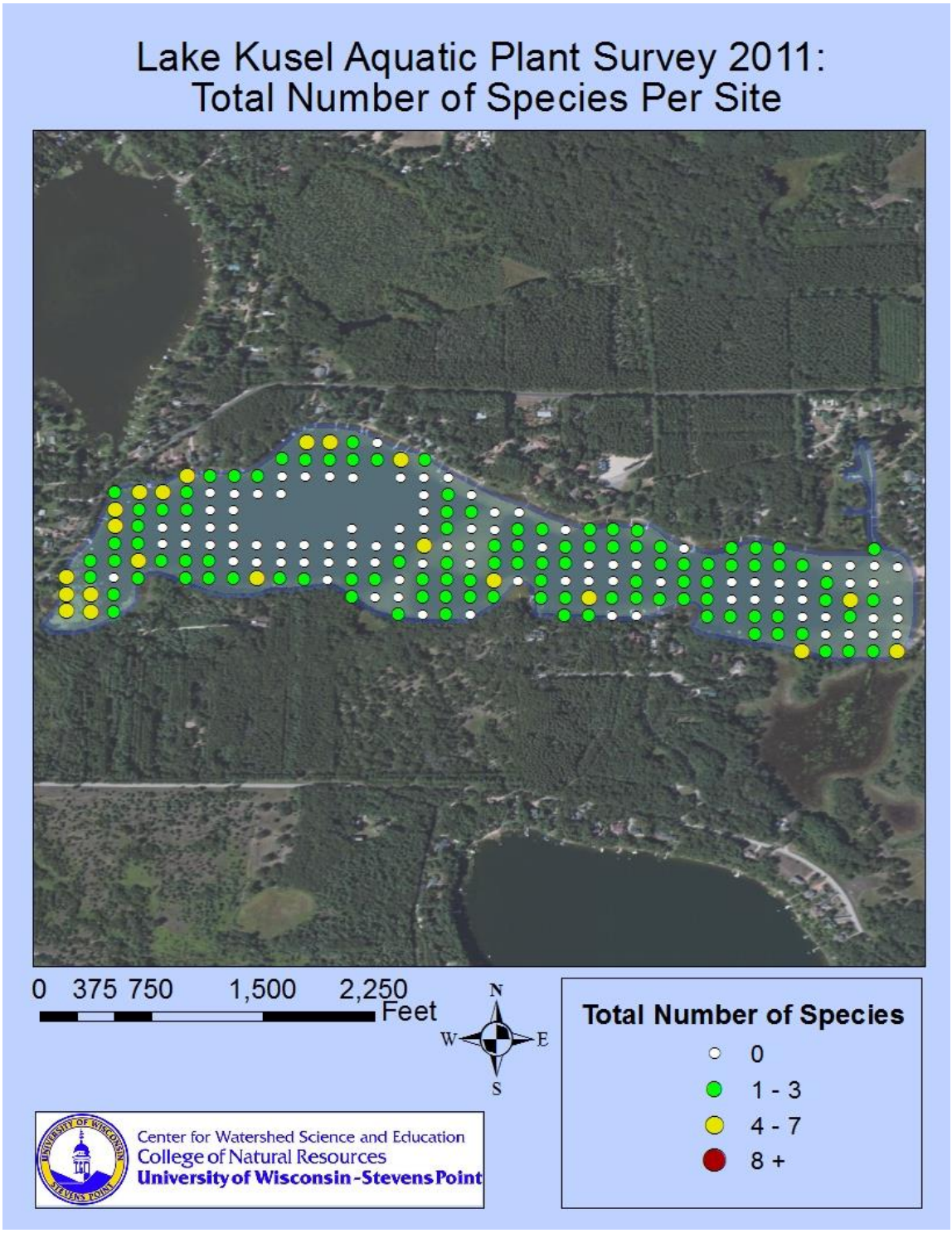


FIGURE 9. NUMBER OF AQUATIC PLANT SPECIES OBSERVED AT EACH SAMPLE SITE IN KUSEL LAKE, 2011.

Shoreland vegetation is critical to a healthy lake's ecosystem. It provides habitat for many aquatic and terrestrial animals including birds, frogs, turtles, and many 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 tall grasses/flowers, shrubs and trees which extend at least 35 feet landward from the water's edge.

To better understand the health of the Waushara County lakes, shorelands were evaluated by professionals from the Center for Land Use Education and Waushara County as a part of the Waushara County Lakes Study. 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. Healthy areas need strategies to keep them healthy, and areas with potential problem areas and where management and conservation may be warranted need different 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 Kusel Lake is displayed in Figure 10. 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 human disturbances. Red shorelands indicate locations where changes in management or mitigation may be warranted. Large stretches of Kusel Lake's shorelands were in good shape, especially along the southern shore. However, some portions along the northern and northeastern shore had challenges that smay still need to be addressed. Some of these areas ranked as poor. For a more complete understanding of the ranking, an interactive map showing results of the shoreland surveys can be found on Waushara County's website at http://gis.co.waushara.wi.us/ShorelineViewer/.

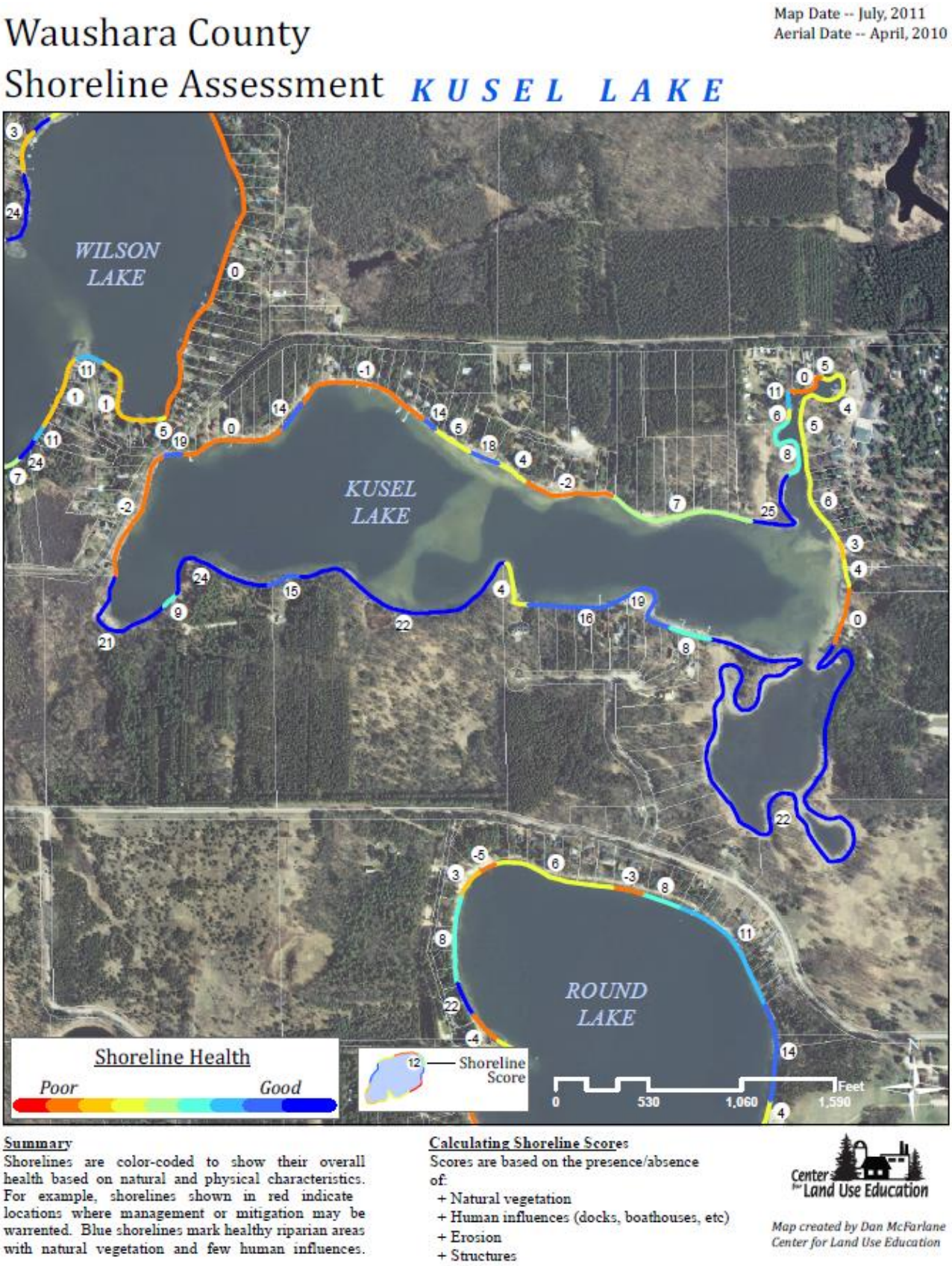


FIGURE 10. OVERALL SHORELAND HEALTH AROUND KUSEL LAKE, 2011.

CONCLUSIONS & RECOMMENDATIONS

In general, Kusel Lake had good water quality; however, a few water quality measurements such as sodium, potassium, and atrazine indicated that land use management practices in the watershed are influencing the water quality in Kusel Lake. Although sources of phosphorus from developed land exist in the Kusel Lake watershed, the hard water (from calcium in the groundwater) in Kusel Lake has helped to buffer the additional nutrients. This is evidenced by lower measures of algae and average density of aquatic plants.

- The hard water has limited capacity to buffer phosphorus, so measures should be taken to reduce near shore and watershed-wide impacts to the lake.
- Atrazine was present in Kusel Lake. This chemical, commonly applied to corn cropland, is likely traveling in the groundwater that flows into the lake. Low concentrations of atrazine have been shown to impact frogs and some fish species. Private well owners should consider testing their well water for atrazine as there are health concerns associated with atrazine. Over-application of chemicals and nutrients should be avoided. Landowners in the watershed should work to reduce their impacts through the implementation of water quality-based best management practices on the landscape.
- Routine monitoring should be done to evaluate changes in water quality in Kusel Lake.
- The Waushara County Land Conservation Department and Natural Resources Conservation Service (NRCS) have professional staff available to assist landowners interested in learning how to improve water quality through changes in land management practices.

Large stretches of Kusel Lake's shorelands were in good shape, especially along the southern shore. However, some portions along the northern and northeastern shore had challenges that may still need to be addressed. Some of these areas ranked as poor.

- Strategies should be developed to ensure that healthy shorelands remain intact and efforts should be made to improve shorelands that have disturbance. Depending upon the source of disturbance, erosion should be controlled, vegetation should be restored, and/or excess runoff should be minimized.
- Dissemination of relevant information to property owners is the recommended first step towards maintaining healthy shorelands.
- The Waushara County Land Conservation Department has professional staff available to assist shoreland property owners interested in learning how they can improve water quality through changes in land management practices.

The aquatic plant community in Kusel Lake appeared to be quite healthy based on the 2011 survey by professionals from the Wisconsin Department of Natural Resources; however, Eurasian water-milfoil (EWM) was identifed at five sites within the lake. The quality of aquatic plants in Kusel Lake was slightly above average compared with the other lakes in the Waushara County Lakes Study. Three high quality plants were identified in Kusel Lake: Fries' pondweed, stiff pondweed, and southern naiad.

- Minimizing disturbance to aquatic plants can greatly benefit Kusel Lake. Aquatic plants help to reduce the amount of sediment stirred up during windy high boating periods – re-suspended sediments can result in algal blooms and reduce the quality of fish spawning beds. Aquatic plants also act as baffles, helping to break up the energy of waves and reduce shoreland erosion. Healthy

native aquatic plant beds also make it difficult for non-native, potentially invasive aquatic plant species to become established.

- A follow-up survey for aquatic invasive species conducted in 2013 by staff from Golden Sands RC&D, Inc. also confirmed the presence of Eurasian water-milfoil (EWM). Fragments of uprooted EWM were located, but rooted plants were not found. EWM can grow in dense beds that can damage boat motors, make areas less navigable, stunt or alter the fishery, create problems with dissolved oxygen, and affect activities like fishing and swimming. This plant produces a viable seed; however, its primary mode of reproduction and spread is fragmentation. A one-inch fragment is enough to start a new plant, making EWM very successful at reproducing.
- Efforts should be made to control or eliminate EWM. Using proper techniques to manually remove EWM plants is the best approach to controlling a small infestation. Anyone interested in helping with this effort should be trained in proper removal techniques to ensure that EWM plants are not fragmented during the removal process.
- The presence of EWM in the lake is a clear indication that aquatic invasive species are able to make their way into Kusel Lake. Lake residents and lake users should be made aware of boat and trailer hygiene techniques to prevent the introduction of new species.
- Early identification of new infestations is helpful in their control and possible eradication. Efforts should be made to learn how to identify non-native aquatic plant species and routinely look for them.

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GLOSSARY OF TERMS

Algae: One-celled (phytoplankton) or multicellular plants either suspended in water (plankton) or attached to rocks and other substrates (periphyton). Their abundance, as measured by the amount of chlorophyll a (green pigment) in an open water sample, is commonly used to classify the trophic status of a lake. Numerous species occur. Algae are an essential part of the lake ecosystem and provide the food base for most lake organisms, including fish. Phytoplankton populations vary widely from day to day, as life cycles are short.

Atrazine: A commonly used herbicide. Transports to lakes and rivers by groundwater or runoff. Has been shown to have toxic effects on amphibians.

Blue-Green Algae: Algae that are often associated with problem blooms in lakes. Some produce chemicals toxic to other organisms, including humans. They often form floating scum as they die. Many can fix nitrogen (N2) from the air to provide their own nutrient.

Calcium (Ca++): The most abundant cation found in Wisconsin lakes. Its abundance is related to the presence of calcium-bearing minerals in the lake watershed. Reported as milligrams per liter (mg/1) as calcium carbonate (CaCO3), or milligrams per liter as calcium ion (Ca++).

Chloride (Cl-): The chloride ion (Cl-) in lake water is commonly considered an indicator of human activity. Agricultural chemicals, human and animal wastes, and road salt are the major sources of chloride in lake water.

Chlorophyll *a*: Green pigment present in all plant life and necessary for photosynthesis. The amount present in lake water depends on the amount of algae, and is therefore used as a common indicator of algae and water quality.

Clarity: See "Secchi disk."

Color: Color affects light penetration and therefore the depth at which plants can grow. A yellow-brown natural color is associated with lakes or rivers receiving wetland drainage. Measured in color units that relate to a standard. The average color value for Wisconsin lakes is 39 units, with the color of state lakes ranging from zero to 320 units.

Concentration units: Express the amount of a chemical dissolved in water. The most common ways chemical data is expressed is in milligrams per liter (mg/l) and micrograms per liter (ug/l). One milligram per liter is equal to one part per million (ppm). To convert micrograms per liter (ug/l) to milligrams per liter (mg/l), divide by 1000 (e.g. 30 ug/l = 0.03 mg/1). To convert milligrams per liter (mg/l) to micrograms per liter (ug/l), multiply by 1000 (e.g. 0.5 mg/l = 500 ug/l).

Cyanobacteria: See "Blue-Green Algae."

Dissolved oxygen: The amount of oxygen dissolved or carried in the water. Essential for a healthy aquatic ecosystem in Wisconsin lakes.

Drainage basin: The total land area that drains runoff towards a lake.

Drainage lakes: Lakes fed primarily by streams and with outlets into streams or rivers. They are more subject to surface runoff problems, but generally have shorter residence times than seepage lakes.

Emergent: A plant rooted in shallow water and having most of its vegetative growth above water.

Eutrophication: The process by which lakes and streams are enriched by nutrients, and the resulting increase in plant and algae. The extent to which this process has occurred is reflected in a lake's trophic classification: oligotrophic (nutrient poor), mesotrophic (moderately productive), and eutrophic (very productive and fertile).

Groundwater drainage lake: Often referred to as a spring-fed lake, it has large amounts of groundwater as its source and a surface outlet. Areas of high groundwater inflow may be visible as springs or sand boils. Groundwater drainage lakes often have intermediate retention times with water quality dependent on groundwater quality.

Hardness: The quantity of multivalent cations (cations with more than one +), primarily calcium (Ca++) and magnesium (Mg++) in the water expressed as milligrams per liter of CaCO3. Amount of hardness relates to the presence of soluble minerals, especially limestone or dolomite, in the lake watershed.

Intermittent: Coming and going at intervals, not continuous.

Macrophytes: See "Rooted aquatic plants."

Marl: White to gray accumulation on lake bottoms caused by precipitation of calcium carbonate (CaCO3) in hard water lakes. Marl may contain many snail and clam shells. While it gradually fills in lakes, marl also precipitates phosphorus, resulting in low algae populations and good water clarity. In the past, marl was recovered and used to lime agricultural fields.

Mesotrophic: A lake with an intermediate level of productivity. Commonly clear water lakes and ponds with beds of submerged aquatic plants and mediums levels of nutrients. See also "eutrophication".

Nitrate (NO3-): An inorganic form of nitrogen important for plant growth. Nitrate often contaminates groundwater when water originates from manure, fertilized fields, lawns or septic systems. In drinking water, high levels (over 10 mg/L) are dangerous to infants and expectant mothers. A concentration of nitrate-nitrogen (NO3-N) plus ammonium-nitrogen (NH4-N) of 0.3 mg/L in spring will support summer algae blooms if enough phosphorus is present.

Oligotrophic: Lakes with low productivity, the result of low nutrients. Often these lakes have very clear waters with lots of oxygen and little vegetative growth. See also "eutrophication".

Overturn: Fall cooling and spring warming of surface water increases density, and gradually makes lake temperatures and density uniform from top to bottom. This allows wind and wave action to mix the entire lake. Mixing allows bottom waters to contact the atmosphere, raising the water's oxygen content. Common in many lakes in Wisconsin.

Phosphorus: Key nutrient influencing plant growth in more than 80% of Wisconsin lakes. Soluble reactive phosphorus is the amount of phosphorus in solution that is available to plants. Total phosphorus includes the amount of phosphorus in solution (reactive) and in particulate form.

Rooted aquatic plants (macrophytes): Refers to higher (multi-celled) plants growing in or near water. Macrophytes are beneficial to lakes because they produce oxygen and provide substrate for fish habitat and aquatic insects and provide food for many aquatic and terrestrial animals. Overabundance of such plants, especially problem species, is related to shallow water depth and high nutrient levels.

Secchi disk: An 8-inch diameter plate with alternating quadrants painted black and white that is used to measure water clarity (light penetration).

Sedimentation: Materials that are deposited after settling out of the water.

Stratification: The layering of water due to differences in density. As water warms during the summer, it remains near the surface while colder water remains near the bottom. Wind mixing determines the thickness of the warm surface water layer (epilimnion), which usually extends to a depth of about 20 feet. The narrow transition zone between the epilimnion and cold bottom water (hypolimnion) is called the metalimnion. Common in many deeper lakes in Wisconsin.

Watershed: See "Drainage basin."

Aquatic Plant Survey of Kusel Lake, Waushara County

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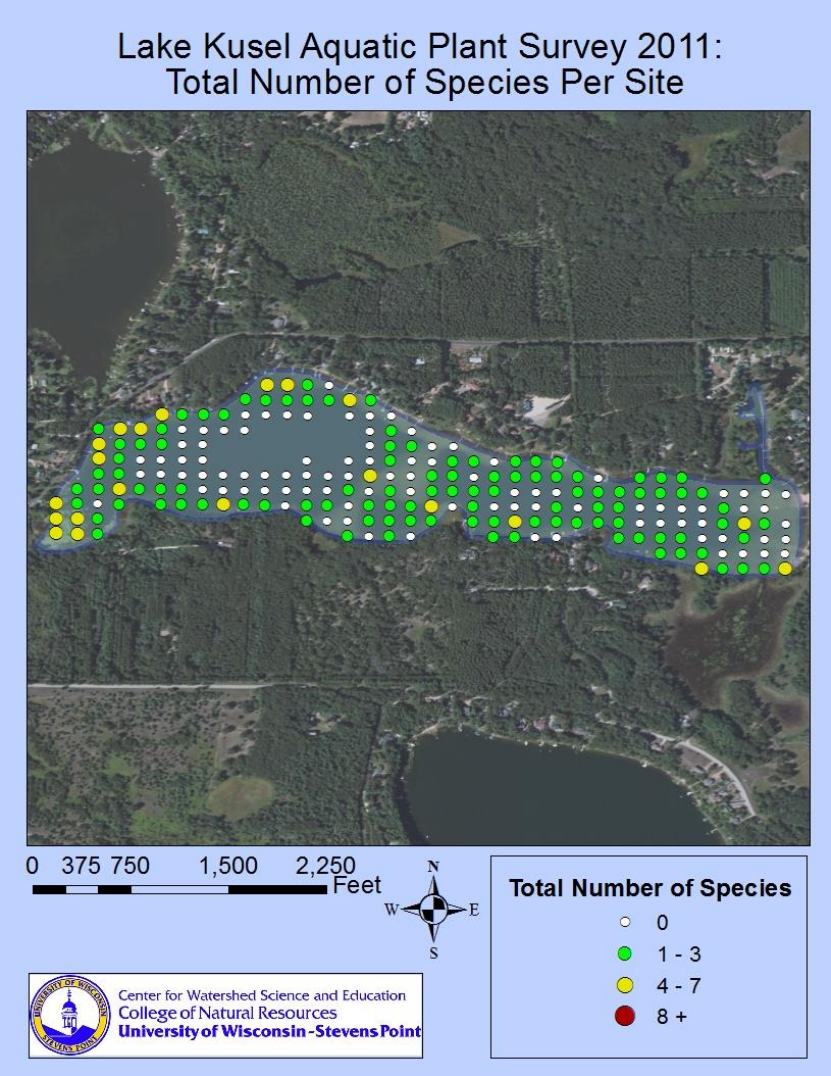
Aquatic plants are the forested landscape within a lake. They provide food and habitat for a wide range of species including fish, waterfowl, turtles, amphibians, as well as invertebrates and other aquatic animals. They improve water quality by releasing oxygen into the water and utilizing nutrients 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.



In 2011, the Wisconsin Department of Natural Resources conducted an aquatic plant survey of Kusel Lake. In the survey, 53% (125 of 236) of sites sampled had vegetative growth. Of the sampled sites within Kusel Lake, the average depth was 9.2 feet with a maximum of 20 feet.

Twenty-seven species of aquatic plants were found in Kusel Lake (Table), with the greatest diversity located in the north and northwest shallows of the lake. Figure shows the number of species that were identified at each sampling site.

The dominant plant species in the survey was muskgrass (*Chara sp.*), followed by variable pondweed (*Potamogeton gramineus*) and water celery (*Valisneria americana*). Chara is a favorite food source for a wide variety of waterfowl. Beds of chara offer cover and food for fish, especially young trout, largemouth bass, and smallmouth bass. The fruits and tubers of variable

pondweed provide valuable food for geese and ducks, and the entire plant may be eaten by a variety of wildlife such as muskrat, beaver, deer, and moose. Water celery is a favorite food for waterfowl grazing.

The Floristic Quality Index (FQI) evaluates the closeness of a plant community to undisturbed conditions. Each plant is assigned a coefficient of conservatism (c value) that reflects its sensitivity to disturbance; these numbers are used to calculate the FQI. C values range from 0 to 10, with higher values designating species that are more intolerant of disturbance. A c value of zero is assigned to exotic and most nonvascular species; therefore, these species are not included in the calculation. The FQI for Kusel Lake was 29.2. This value was above average for lakes within the Waushara County lakes study.

Of the aquatic plant species within Kusel Lake, three had a c value equal to or greater than 8 (Table). No species of special concern within Wisconsin were found in Kusel Lake.

Table 1: List of aquatic plants identified adapted from 2011 survey of Kusel Lake completed by the Wisconsin Department of Natural Resources.

Common Name	Scientific Name	Coefficient of Conservatism Value (C Value)
Emergent Species		
Needle spikerush	*Eleocharis acicularis*	5
Creeping spikerush	*Eleocharis palustris*	6
Hardstem bulrush	*Schoenoplectus acutus*	6
Three-square bulrush	*Schoenoplectus pungens*	5
Water Bulrush	*Schoenoplectus subterminalis*	5
Floating Leaf Species		
White water lily	*Nymphaea odorata*	6
Submergent Species		
Coontail	*Ceratophyllum demersum*	3
Muskgrass	*Chara sp.*	7
Common waterweed	*Elodea Canadensis*	3
Water star-grass	*Heteranthera dubia*	6
Eurasian water milfoil*	*Myriophyllum spicatum*	0
Slender naiad	*Najas flexilis*	6
Southern naiad	*Najas guadalupensis*	8
Nitella	*Nitella spp.*	7
Large-leaf pondweed	*Potamogeton amplifolius*	7
Fries' pondweed	*Potamogeton friessii*	8

Variable pondweed	*Potamogeton gramineus*	7
Illinois pondweed	*Potamogeton illinoensis*	6
Floating-leaf pondweed	*Potamogeton natans*	5
Stiff pondweed	*Potamogeton strictifolius*	8
Flat-stem pondweed	*Potamogeton zosteriformis*	6
Sago pondweed	*Stuckenia pectinata*	3
Common bladderwort	*Utricularia vulgaris*	7
Water Celery	*Valisneria Americana*	6

*=non-native species in Wisconsin

The Simpson Diversity Index (SDI) quantifies biodiversity based on a formula that uses the number of species surveyed and the number of individuals per site. The SDI uses a scale of zero to one with values closer to one representing higher amounts of biodiversity. Kusel Lake has an SDI value of 0.83. This represents average biodiversity when compared to all the lakes in the Waushara County study.

During the aquatic plant survey of Kusel Lake, the aquatic invasive Eurasian water-milfoil was found at five sampling sites. It is critical to take actions against invasive plants early in the invasion. Diligence in inspection of watercraft before entering the lake as well as before leaving the boat landing is necessary to prevent the further spread of undesirable exotics.

Overall, the aquatic plant community in Kusel Lake can be characterized as having average species diversity. The identification of Eurasian water-milfoil within the lake should cause some concern and the densities and population within the lake should continue to be monitored. Protecting Kusel Lake against invasive species should be coupled with preserving the habitat, food source, and water quality benefits of the native plant community within the lake in future decision-making concerning lake management strategies.

Table 2. Summary of 2011 aquatic plant survey completed by the Wisconsin Department of Natural Resources. Table courtesy of WDNR

	LAKE	STATEWIDE AVERAGE	NCHW ECOREGION AVERAGE
Littoral Frequency of Occurrence (%)	69.06	74.3	76.0
Maximum Depth of Plant Growth (feet)	19.5	15.3	15.9
Species Richness	27	16.8	16.2
Floristic Quality Index (FQI)	29.2	24.1	23.3