

Beaver Lake
Process for Developing a Naturalized Shorelines Plan
Developed for
Friends of Beaver Lake
by
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Lake shorelines are a vibrant transition zone between the land and the lake and are critical to maintaining the value of lake property. Shorelines can be beautiful water gardens that serve to expand lake property and contribute to the health of a lake. Natural shorelines capture nutrients that run off surrounding lands and use these nutrients to enhance the growth of a wide variety of nearshore plants and emergent vegetation like bulrush, sedges and cattails. This complex community of nearshore plants holds sediments in place and reduces erosion of lake property. Emergent plants along with floating leafed plants and underwater plants absorb wave energy that otherwise kick up sediment and wash away lake property. Suspended sediment from the lake bottom and eroded shorelines reduce water clarity and increase nutrients. Increased nutrients can spark algae blooms that can further reduce water clarity. In addition to physical benefits, natural shorelines are also a refuge for early life stages of game fish. Several species of sunfish as well as northern pike spawn along the shoreline and the young fish depend on nearshore vegetation to hide from predators. Young and adult fish also feed on the wide variety of aquatic insects and crustaceans that live in the diverse shoreline community. The invertebrates and fish are also a large source of food for many amphibians and shore birds that contribute to the exciting experience of living next to a lake.

Lake property owners often modify shorelines to prevent erosion and allow access to the lake. Historically some shoreline modifications have included removal of native vegetation and hardening of the shore. Structures such as bulkheads (vertical wall of poured concrete, steel, or timber), revetments (solid, sloping wall, of asphalt or poured concrete) and riprap (rocks and/or stones placed along the shoreline) were once “state of the art” in shoreline protection (Figure 1).

With this type of shoreline modification wave energy is reflected rather than absorbed and can cause an increase in suspended sediment in the lake. More recently, “soft” shoreline protection techniques (Figure 2), referred to as “vegetative shoreline protection” involving a combination of materials, including native plantings, are increasingly popular with lake property owners (SEWRPC 2015).

Riprap



Revetment



Bulkhead



Figure 1: Examples of hardened shorelines. (SEWRPAC 2015)

Natural Shoreline



Vegetative Strips



Bio-logs



Figure 2: Examples of “soft” shorelines (SEWRPC 2015)

The use of vegetative strips to prevent shoreline erosion provides a buffer from upland nutrients as well as wave energy from the lake. The complex community of plants that grow along the shore and emerge from the shallow water near shore, have extensive root systems that hold the soil and lake sediments in place (Figure 3). Shoreline plants and soil microbes can remove a great deal of nitrogen and phosphorus from surface runoff that is headed for the lake (Strayer and Findlay 2010). By establishing vegetative buffer strips on the shore, runoff water is slowed and may penetrate the soil before it reaches the lake. Once in the soil, microbes and plant roots can use the nitrogen and phosphorus for growth. Nutrients that are already in the the lake can also be reduced by the near shore plant community. In this way the vegetative shoreline

serves as a filter that reduces nutrient input to the lake and reduces nutrients already in the lake. As more development occurs in the lake's watershed these filters become more important to maintaining the quality of the lake.

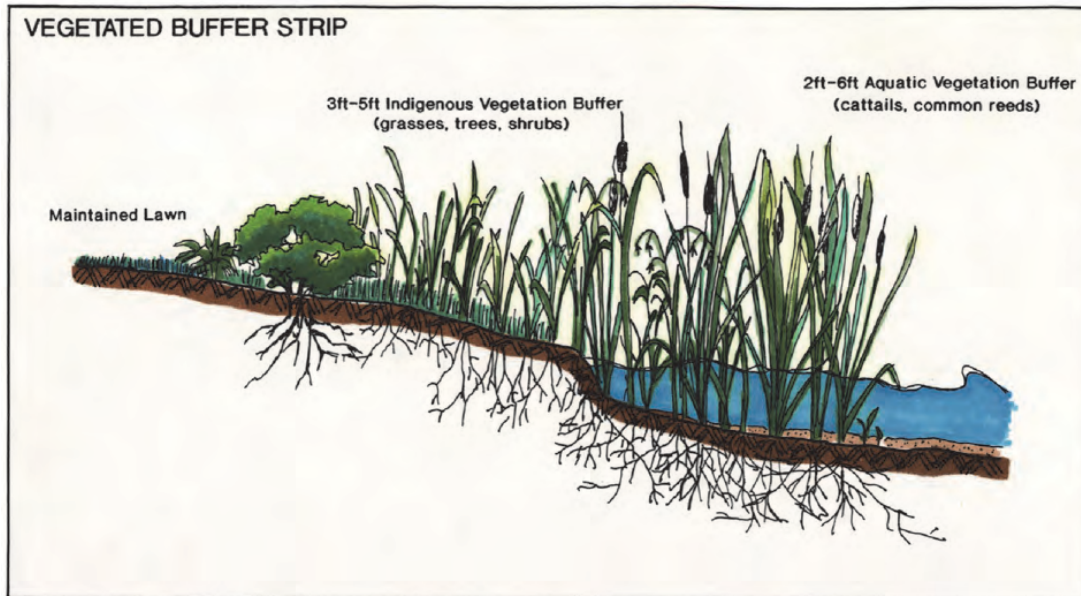


Figure 3: Vegetative buffer strips that make up a “soft” shoreline (SEWRPC 2015)

Wave energy that moves into shore from the open water areas of the lake create shear stresses at the sediment surface that can stir up sediment into the water column releasing nutrients that can stimulate plankton blooms. Vegetative shorelines have the ability to dampen this wave energy and reduce sediment and nutrients in the water column (Gregg & Rose 1982; Madsen and Warncke 1983; Deiter 1990; Madsen et al. 2001). In this way, a sequence of plants on shore and into the nearshore waters helps to reduce negative impacts from the land and from the open water.

In addition to reducing wave energy and nutrients, the value of vegetated shorelines for fish and wildlife has been well documented (Killgore et al. 1993; Meyer et al. 1997; Engel and Pederson 1998). Radomski and Goeman (2001) studied 24 walleye and sunfish lakes in northcentral Minnesota and found that fish abundance was greater in lakes that had more emergent and floating-leaf aquatic plants. They attributed the increase in fish size and abundance to better conditions for juvenile fish in the more diverse nearshore habitat. In a glacial lake in northwestern Iowa Bryan and Scarnecchia (2004) found that eighteen of the 20 young-of-the-year fish species studied were most abundant where nearshore plant species

richness was the greatest. Their study clearly demonstrated the importance of nearshore aquatic vegetation to fishes during their first summer of life. The young-of-the-year fish survive and grow larger in these vegetated nearshore areas because their food; aquatic insects, crustaceans and zooplankton, are much more abundant amongst the stems and leaves of these plants. In addition, the plants reduce turbulence and offer hiding places for the young fish (Stahr and Kaemingk 2017).

Not all lake property owners want to have a vegetated shoreline since they feel it will interfere with their use of the lake. Haack (2009) addressed six concerns identified by lake property owners in focus groups and through surveys in Burnett County, Wisconsin. The following is an excerpt from Haack's study:

“Watching Kids Swim

One of the highest rated barriers to restoring buffers was an obstructed view of the lake and a reduced ability to see children or grandchildren while they are playing in or near the water. One option to address this concern is the strategic planting of low growing native shrubs and grasses that still provide a view of the lake and the ability to watch over their children. With a little research, parents and grandparents can learn how to get the best of both worlds on their property - a clear view of their children to assure their safety along with a more natural shoreline to protect water quality and natural habitat.

Life's a Beach and We Like It

Another significant concern expressed was the perception that having natural shoreline plants would prevent their property from having a sandy beach. While that may be true for very extensive beaches, statewide standards allow for a 35 foot access corridor and use area. It is important for lakeshore property owners to realize they can strike a balance between their desire to recreate by the water and protect the quality of their lake.

Ticked Off by Ticks

One concern about maintaining a natural shoreline was that people were worried that having a buffer would increase the prevalence of nuisance insects such as ticks. Including the use of mulched paths or mulched yard edges, which ticks avoid, can help people prevent ticks on their property and encourage more natural lake shorelines.

Protect the Habitat of Your Favorite Animals

Another area we examined was what wildlife people enjoy seeing most, with the intent of explaining how specific native plants and natural habitat contribute to the well-being of their favorite animals. Surveys in Burnett County indicated that eagles and loons were animals people wanted to see more abundantly around their properties. Some lamented the loss of lake frogs and wished more were around for the kids to enjoy. Knowing specific types of habitat that will attract birds, frogs or other desired lakeshore animals

(for optimum nesting and survival of their young) may encourage some property owners to protect specific sites or habitat features.

Duck...Duck...GOOSE?

Most of the lakeshore property owners we interviewed really like wildlife. On the other hand, most said they are not interested in attracting certain kinds of animals to their property – most notably geese. Many property owners are okay with watching geese fly overhead or swim in the water, but they do not like them congregating on their lawns and leaving nasty green goose droppings. Lawn-loving geese will be deterred from spending too much time on shoreline property with areas of 20 to 30 inch tall vegetation because they fear that natural shoreline vegetation may harbor predators.

Not Everyone Likes the Wild Look

Part of our research also looked at how people wanted their lakeshore property to look. We wanted to know whether some people were more willing to just “let it be” and allow natural, native vegetation to take over or whether property owners preferred a look that was more clearly controlled. Not surprisingly, some liked to let native vegetation just “go wild” while others liked to be much more in control of the vegetation on their property. Fortunately, there are lake-friendly options for both. Expert advice and educational materials on lakeshore landscaping plans can show how to let more natural elements emerge in the shoreline area while allowing some flexibility to plant native shrubs in an organized manner to fit a more manicured yard. Many property owners are surprised at how elegant planned plots of native trees, shrubs and wildflowers can look in their yards.”

Working with lake property owners to move toward enhancing the lake through increasing vegetated shoreline area would be best approached in an inclusive and progressive manner. Shaw et al. (2011) found a Stages of Change Model to be effective in understanding and addressing owner’s propensities toward adopting more natural shorelines. This model assumes that people will “differentially adopt a new behavior based on their respective knowledge, beliefs, and motivations.” The model also assumes that individuals must move through a natural progression of stages before adopting a new practice. These stages of progression include precontemplation, contemplation, preparation, action, and maintenance. Use of this model recognizes that lake property owners are at different stages of knowledge regarding lake ecology and have a wide variety of desires regarding lake use. Through a process of gathering input from owners, providing information and demonstrating the potential of shoreline enhancement owners can recognize the potential benefits to the lake.

Addressing the stages:

Precontemplation

This group of lake property owners is unaware, uninformed, or underinformed about the benefits of naturalized shorelines. Providing relevant information may increase awareness and lead to a desire to learn more.

Contemplation

This is a stage during which people are aware of the pros and cons of shoreline improvement, but the cons likely continue to outweigh the pros. Early contemplators are just beginning to think about potential benefits of shoreline enhancement. It is important to provide a cost benefit analysis. This is a particular challenge since the benefits of more natural shorelines are long-term while the costs are mainly near-term.

Preparation

During this stage people are intending to naturalize their shoreline in the immediate future. They may have decided that they are willing to stop mowing natural vegetation or stop raking out native aquatic plants along the lakeshore. They may be considering planting a buffer of native plants but need assistance to proceed.

Action

At this point people have made significant changes to make their shoreline more natural. These changes may require further enhancements over time. Regular encouragement through newsletters and monitoring reports about the improvements that have been made around the lake will help to make these improvements last.

Maintenance

At this stage people have established a stable naturalized shoreline for a number of years. In order to maintain these shorelines regular encouragement should be provided through involvement in lake enhancement citizens groups sharing success through newsletters and receiving regular lake ecology monitoring reports.

In approaching the process of developing a Beaver Lake Naturalized Shoreline Program it would be beneficial to consider the stages suggested by Shaw et al. (2011). It is very likely that there are a wide variety of thoughts amongst Beaver Lake property owners regarding naturalized shorelines. An extensive information sharing campaign and involvement of a significant number of property owners will be important to developing a successful program. It would be good to begin by identifying a committed nucleus of concerned property owners to work on developing and carrying out this program. This core group could become a lake

shoreline naturalization committee. Wisconsin Lutheran College faculty and students would be happy to work with this committee to develop informational materials derived from the shoreline protection resource links provided in this document. This information could be shared on the FOBL web site, in printed informational flyers and shared at lake community workshops. Initially, in an effort to stimulate interest as broadly as possible, all lake residents could be provided a copy of the Minnesota DNR's "Citizen Shoreline Description Survey". This document provides very good overview of the benefits of naturalized shorelines as well as detailed instructions on how to perform a descriptive survey of lake properties. Each property owner could be encouraged to complete a shoreline survey of their property. Those that participate will learn a great deal about their lake properties' contribution to the overall ecology of the lake. Experts from UW Extension and landscape architect firms along with WLC faculty and students could provide presentations and help to facilitate shoreline workshops. Existing naturalized shorelines could be highlighted in these workshops with the land owners sharing how they developed these shorelines. In time, if other property owners enhance their shoreline their stories could be shared. As existing monitoring efforts on the lake continue the results shared with all property owners could be related to the need and potential benefits of naturalized shorelines to lake quality.

Summary of steps leading to a Lake Naturalized Shoreline Program

- Develop shoreline informational materials
- Distribute informational materials to all lake property owners
- Encourage shoreline descriptive surveys
- Provide a series of informational shoreline workshops
- Share success stories
- Tie existing monitoring programs to shoreline naturalization

We suggest the following steps to begin moving towards a Beaver Lake Naturalized Shoreline Program.

- FOBL Board members review this document and the associated shoreline protection links.
- WLC faculty and students meet with FOBL to discuss findings and potential approaches to a Naturalized Shoreline Program for Beaver Lake.
- Based on these discussions determine a means to move through the various stages of change that could lead to significant progress in shoreline enhancement for Beaver Lake.

Shoreline Protection Resources

Natural Shoreline Construction Video

<http://www.shoreline.msu.edu/shorelinemgt/natural-shoreline-constructing-encapsulated-soil-lifts/>

Wisconsin Lakeshore Restoration Project - Lakeshore Treatments and Techniques Used

<https://www.uwsp.edu/cnr-ap/UWEXLakes/Pages/resources/WiLakeshoreRestorationProject/techniques.aspx>

UW- Extension Lakes: Wisconsin Lakeshore Restoration Project portal

<https://www.uwsp.edu/cnr-ap/UWEXLakes/Pages/resources/WiLakeshoreRestorationProject/default.aspx>

Controlling Runoff and Erosion from Your Waterfront Property – A Guide for Landowners

<http://www.burnettcounty.com/DocumentCenter/Home/View/119>

Cloverleaf Lakes Shoreland Restoration: A Guide for Lake Residents

<http://neswi.com/wp-content/uploads/2012/12/CLPA-Restoration-Guide.pdf>

CITIZEN SHORELINE DESCRIPTION SURVEY VERSION 2. JANUARY 2012

<https://files.dnr.state.mn.us/assistance/backyard/shorelandmgmt/scoreyourshore/sys-manual.pdf>

Minnesota DNR: Restore Your Shore (RYS)

<https://www.dnr.state.mn.us/rys/index.html>

Volunteer Guidebook – Organizing a Volunteer Training Program

<http://www.shorelandmanagement.org/depth/volunteerguide.pdf>

Literature Cited

- Bryan, Michael D. and Dennis L. Scarnecchia. 2004. Species richness, composition, and abundance of fish larvae and juveniles inhabiting natural and developed shorelines of a glacial Iowa lake. *Environmental Biology of Fishes* 35, 329-341. DOI:[10.1007/BF00004984](https://doi.org/10.1007/BF00004984)
- Dieter, C. D., 1990. The importance of emergent vegetation in reducing sediment resuspension in wetlands. *J. Freshwat. Ecol.* 5: 467–473.
- Engel, S., and J. L. Pederson, Jr. 1998. The construction, aesthetics, and effects of lakeshore development: a literature review. Wisconsin Department of Natural Resources, Research, Report 177, Madison.
- Gregg, W. W. & F. L. Rose, 1982. The effects of aquatic macrophytes on the stream micro-environment. *Aquat. Bot.* 14:309–324.
- Haack, John. 2009. Why Not Go Natural? Addressing Six Concerns About Maintaining A More Natural Lakeshore. *Lake Tides* 34:4. UW-Extension Lakes
- Killgore, K. J., E. D. Dibble, and J. J. Hoover. 1993. Relationships between fish and aquatic plants: a plan of study. U.S. Army Corps of Engineers, Miscellaneous Paper A-93–1, Vicksburg, Mississippi.
- Madsen, T. V. & E. Warncke. 1983. Velocities of currents around and within submerged aquatic vegetation. *Arch. Hydrobiol.* 97:389–394.
- Madsen, J. D., P. A. Chambers, W. F. James, E. W. Koch and D. F. Westlake. 2001. The interaction between water movement, sediment dynamics and submersed macrophytes. *Hydrobiologia* 444: 71–84
- Meyer, M., J. Woodford, S. Gillum, and T. Daulton. 1997. Shoreland zoning regulations do not adequately protect wildlife habitat in northern Wisconsin. U.S. Fish and Wildlife Service, State Partnership Grant P-1-W, Segment 17, Final Report, Madison, Wisconsin.
- Radomski, Paul and Timothy J. Goeman. 2001. Consequences of Human Lakeshore Development on Emergent and Floating-Leaf Vegetation Abundance. *North American Journal of Fisheries Management* 21:46–61
- SEWRPC (Southeastern Wisconsin Regional Planning Commission. 2015. A Lake protection and aquatic plant management plan for Rock Lake, Kenosha County, Wisconsin. Community Assistance Planning Report Number 323.
- ShawBR, Radler BT, Haack J. 2011. Exploring the utility of the stages of change model to promote natural shorelines. *Lake Reserv Manage.* 27:310–320.
- Stahr, Kristopher J. and Mark A. Kaemingk. 2017. An evaluation of emergent macrophytes and use among groups of aquatic taxa. *Papers in Natural Resources.* 687.
<https://digitalcommons.unl.edu/natrespapers/687>
- Strayer, David L. and Stuart E. G. Findlay. 2010. Ecology of freshwater shore zones. *Aquat. Sci.* 72:127–163 DOI 10.1007/s00027-010-0128-9