Upper Peninsula Power Company
800 Greenwood Street
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March 14, 2025

Dead River Storage Basin Property Owners
Marquette County, Michigan

To Our Friends and Neighbors of the Dead River Storage Basin:

Dead River Hydroelectric Project
RE: Informational Outreach to DRCI – Shoreline Erosion Protection and Repair

Upper Peninsula Power Company (UPPCO) wants to continually help educate and assist, where possible, the landowners surrounding its facilities for the betterment of the natural resources.

As spring nears, the inevitable melting of our snow brings excess water into our river systems and reservoirs. This fluctuation in water levels naturally causes the potential for shoreline erosion. With that, we wanted to provide some educational materials on shoreline erosion repair and protection.

Rip rap (rocks) and concrete shorelines have detrimental effects to the basin and its aquatic species. It destroys habitat along the shoreline and contributes to the warming of water both of which is harmful to fish and other aquatic life. Permitting these types of projects with EGLE is also becoming less and less feasible when more natural options exist.

Attached with this document are the educational resources for shoreline erosion protection and repair provided by Michigan's Department of Environment, Great Lakes, and Energy (EGLE). These means and methods are the preferred options for armoring and protecting your shorelines. This allows a much more natural shoreline to be maintained benefitting both the aesthetics of the basin as well as the aquatic species.

If you have any additional questions, please do not hesitate to reach out to me at mannala@uppco.com

Regards,

Matt Annala
Environmental Program Administrator-Engineer

INLAND LAKE FACT SHEET SERIES

Native Aquatic Plants

Native aquatic plant preservation and restoration is a best management practice for Michigan's inland lakes. Aquatic plants play an extremely important role in lake processes by stabilizing sediments, reducing turbidity, absorbing wave energy, oxygenating the water, and providing habitat and food resources for a variety of fish and wildlife. Shoreline development projects that remove or shade submerged, emergent, and floating-leaf plants can reduce lake ecosystem services and alter fish recruitment and impair fishing and other recreational opportunities. Native aquatic plants are a vital component of inland lake systems, and preserving and restoring aquatic plants can benefit fishing and other recreational opportunities in addition to protecting shoreline properties and improving water quality.

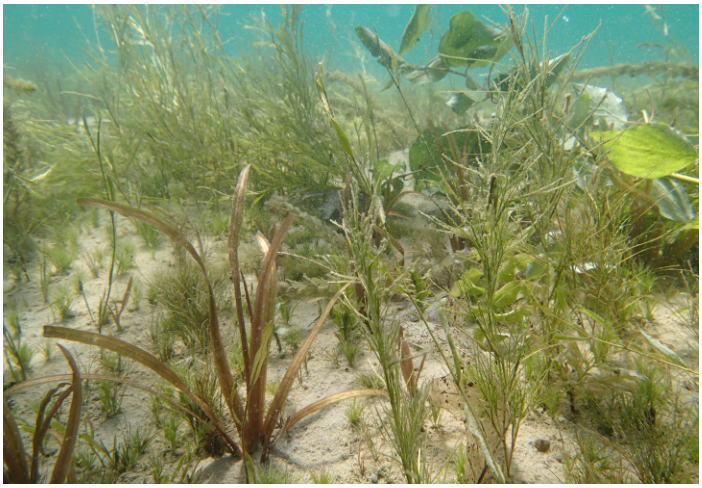
ADVANTAGES
of native aquatic plants

Stabilizes Sediment
Aquatic plants hold sediment in place which reduces turbidity and protects water quality. Turbid conditions result in a loss of biodiversity and reduced water quality.

Absorbs Wave Energy
Aquatic plants dampen wave energy and protect shoreline properties from erosion.

Fish and Wildlife Habitat
Aquatic plants provide valuable habitat and food resources for birds, amphibians, reptiles, invertebrates, and fish. Additionally, plants provide spawning and nursery areas for many species and refuge from predators.

Elimination of aquatic and nearshore plants have resulted in erosion, reduced recreational opportunities, and loss of productive habitat. Photo courtesy of Michigan Natural Shoreline Partnership.



Native aquatic plants of Michigan's inland lakes are essential component of lake health. Water quality, biodiversity, and recreation depend on healthy native aquatic plant populations. Photo courtesy of Eric Calabro.

DISADVANTAGES
of removal of native aquatic plants

Reduced Habitat Quality
Increased shoreline development and excessive removal of aquatic plants reduces habitat complexity and has had negative implications for fish and other aquatic species. Physically complex shore zones support a richer biota than simple ones, with higher species diversity.

Increased Erosion
The absence of wave dampening aquatic plants, in combination with shallow-rooted turfgrass, results in shoreline erosion.

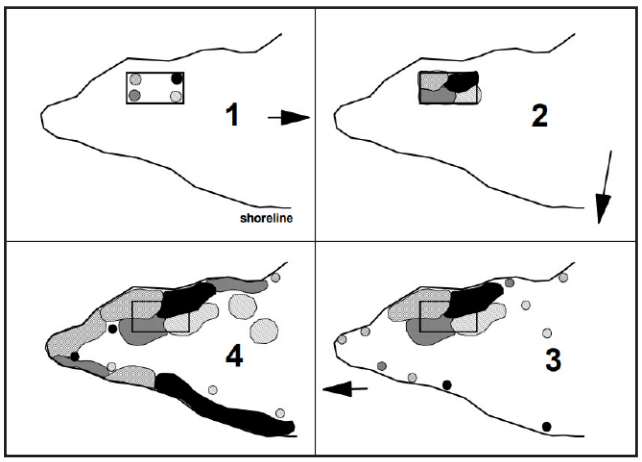
Decreased Water Quality
Lack of sediment stabilizing aquatic plants results in increased turbidity and a decrease in water quality.

Protect native aquatic plants by using selective control techniques for aquatic invasive species. Maintain an "aquatic garden" of native aquatic plants within your riparian area.

Minimize shoreline development and impacts. Design shoreline projects to minimize native plant removal and shading of native plants.

Restore native aquatic and wetland plants to shoreline areas. Coir logs or natural, biodegradable wave breaks can be used to establish plants along shoreline areas. There are a variety of restoration methods that can be employed in various situations. The resources referenced in the photo captions are a good starting point to narrow down restoration options for your property.

Reduce aquatic invasive species and use selective control techniques to manage aquatic invasive species.



Founder colonies (1) are established by planting in well-protected areas. Plants grow (2) to fill protected areas and begin to spread. Spread continues (3) and new colonies begin to develop from seeds and fragments. New colonies then spread (4) to provide large-scale fish habitat. Image credit: Smart, M., G. Dick, J. Snow, L. Williams. 2006. Aquatic Plant Establishment Workshop.

Different techniques for propagating aquatic plants. Left to right: Hand plant, weights, plaster, peat pot, and burrito. Image credit: Rohal, C.B., L.K. Reynolds, C.R. Adams, C.W. Martin, E. Latimer, S.J. Walsh, J. Slater. 2021. Biological and practical tradeoffs in planting techniques for submerged aquatic vegetation. Aquatic Botany 170 (2021) 103347

Apply for a Permit

If you would like to restore aquatic plants in your lake, a permit from EGLE may be required. Some activities may also be exempt from permitting. If your project meets the criteria in EGLE's Minor Project Categories or General Permit Categories it can be processed on a faster timeline and at a reduced fee. For more information, and to submit a permit application at Michigan.gov/JointPermit.

For More Information

EGLE Inland Lakes: Michigan.gov/LakesAndStreams
Michigan Natural Shoreline Partnership: ShorelinePartnership.org
Michigan Inland Lakes Partnership: Canr.msu.edu/MichiganLakes
Michigan Shoreland Stewards: MiShorelandStewards.org

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INLAND LAKE FACT SHEET SERIES

Biotechnical Erosion Control (Higher-Energy)

Biotechnical Erosion Control is a best management practice in which both structural and vegetative measures are used to protect high-energy shorelines from erosion. This type of higher-energy bioengineering design is used in areas where erosive energy from waves and ice are relatively high, and vegetation alone would be inadequate in protecting the shoreline. Deep rooting, native plants in combination with coir logs and field stone protect against erosion and pollution, and provide habitat for fish and wildlife.

ADVANTAGES
of installing shoreline bioengineering

Erosion Control
Coir logs and shallow-sloped (4 horizontal:1 vertical) fieldstone provide a gentle runup for waves and ice. This provides immediate erosion protection. As vegetation becomes established, the roots grow through the coir, rock and soil, creating a strong form of shoreline protection that also provides habitat and water quality protection.

Improved Water Quality
Biotechnical erosion control uses native plants to intercept nutrients and pollutants before they enter the lake, leading to clearer water and decreased algal blooms.

Fish and Wildlife Habitat
The shallow-sloped fieldstone provides easy access to and from the water for frogs and turtles. Biotechnical erosion control also provides feeding habitat for fish, birds, butterflies, and other wildlife. This practice also deters property damaging geese!

The pictures above compare the shoreline of a Michigan inland lake in 1938 (top) to the same shoreline in 2014 (bottom). Over-engineered shoreline stabilization (seawalls) are not only costly, they lead to poor lakeshore habitat.

This bioengineering design protects the shoreline on this high energy lake by dissipating wave energy from wind and boats while still providing lake access and not impeding lake views. Photo courtesy of Jennifer Buchanan, Tip of the Mitt Watershed Council.

DISADVANTAGES
of hardened shorelines and lawn to water's edge

Wave Reflection
Seawalls and hardened shorelines don't allow for the absorption and dispersal of wave energy, they reflect wave energy. The reflection of waves can make erosion worse in other areas through wave flanking and scour.

Weak Roots
Turf-grass (lawns) are not naturally found at the lake edge, and the shallow roots of turf-grass do not have enough strength to withstand waves and ice in high energy areas. Turf-grass also attracts property damaging geese.

Poor Water Quality
Seawalls degrade your lake by promoting runoff of nutrients and pollutants that lower water quality. Waves reflecting off seawalls suspend sediment in the water column, reducing water quality. Seawalls fragment the land and water interface and eliminate habitat required by fish and wildlife.

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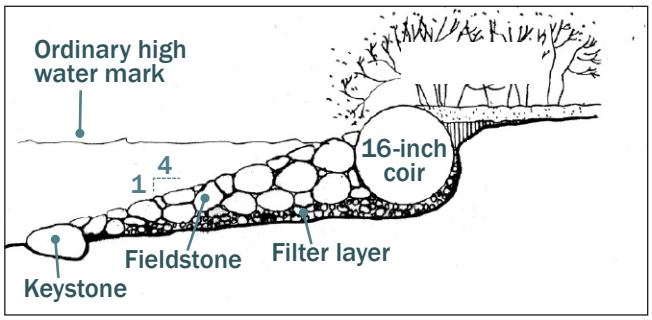
Protect natural shoreline areas by using selective control techniques for invasive species. Maintain natural areas containing native shoreline plants, shrubs, and trees on your riparian property.

Minimize shoreline development and impacts. Design shoreline projects to minimize native vegetation removal and shading of native aquatic plants. Utilizing EGLE's Minor Project and General Permit Categories can assist in project minimization.

Restore native aquatic and wetland plants to shoreline areas. There is a continuum of options for erosion control for shorelines with increasing energy potential. The pictures to the right show examples of strategies for a relatively high-energy area. These examples show a coir log used in conjunction with fieldstone placed on a a 4:1 slope. Shallow-sloped fieldstone is important for erosion protection and lake health. Your property does not necessarily have to be restored to predevelopment conditions, but it should provide many of the same benefits to a lake, such as habitat and shoreline stabilization. There is more than one right way to develop a bioengineered shoreline, so create a shoreline that incorporates your goals as well as changes that will benefit the lake. More information on recommended installation methods and procedures, and a list of Certified Natural Shoreline Professionals can be found at MiShorelinePartnership.org.



Biotechnical erosion control project being installed at a higher energy inland lake shoreline. Photos courtesy of Jennifer Buchanan, Tip of the Mitt Watershed Council.

This higher-energy bioengineering project is protecting this shoreline from ice-push. Photo courtesy of Jennifer Buchanan, Tip of the Mitt Watershed Council.

Apply for a Permit

If you would like to install bioengineering on your shoreline, a permit from EGLE is required. If your project meets the criteria in EGLE's Minor Project Categories or General Permit Categories it can be processed on a faster timeline and at a reduced fee. For more information, and to submit a permit application visit Michigan.gov/JointPermit.

For More Information

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INLAND LAKE FACT SHEET SERIES

Bioengineering (Lower-Energy)

Bioengineering is a best management practice in which native Michigan plants are restored in lower-energy nearshore areas along a lake shoreline. Lower-energy areas along a shoreline are typically characterized by site-specific conditions that may include a relatively short unobstructed distance across the lake from the proposed project, and the project being in a location where erosive forces from wind and boats are low, such as a protected bay. Bioengineering serves many functions that protect lakeshore properties and property values, improve recreational opportunities, and promote lake health. Natural shorelines are a critical component of a healthy lake, and a well-designed bioengineered shoreline can balance lake access, views, aesthetics, and lake health. A bioengineered shoreline does not have to look messy, a finished and well-manicured look can be achieved through careful planning.

ADVANTAGES
of installing shoreline bioengineering

Erosion Control
Bioengineering stabilizes the shoreline by utilizing native plants with strong, deep rooting, and complex root systems that hold soil and sediment and protect the shoreline from erosion.

Improved Water Quality
Bioengineering uses native plants to intercept nutrients and pollutants before they enter the lake, leading to clearer water and decreased algal blooms.

Fish and Wildlife Habitat
Bioengineering provides clean water, cover, feeding habitat for fish; nesting, basking, and feeding habitat for turtles, frogs, birds, butterflies, and other wildlife. Bioengineering also deters property damaging geese!

Turf-grass to the shoreline leads to poor lakeshore habitat. Poor biological health is three times more likely in lakes with poor lakeshore habitat. Forty percent of Michigan's inland lakes have poor lakeshore habitat. Photo courtesy of Michigan Natural Shoreline Partnership.

This bioengineered shoreline stabilizes the soil, slows runoff from upland areas, increases fish and wildlife habitat, improves water quality, and dissipates wave energy from wind and boats. Photo courtesy of Eric Calabro.

DISADVANTAGES
of hardened shorelines and lawn to water's edge

Wave Reflection
Seawalls and hardened shorelines don't allow for the absorption and dispersal of wave energy, they reflect wave energy. The reflection of waves can make erosion worse in other areas through wave flanking and scour - potentially causing erosion problems on neighboring properties.

Weak Roots
Turf-grasses (lawns) are not naturally found at the lake edge, and the shallow roots of turf-grass do not have enough strength to withstand waves and ice. Turf-grass also attracts property damaging geese.

Poor Water Quality
Seawalls degrade lakes by promoting runoff of nutrients and pollutants that lower water quality. Waves reflecting off seawalls suspend sediment in the water column, reducing water quality. Seawalls block the ability of animals, like turtles and frogs, to move in and out of the water, and eliminate habitat required by fish and wildlife.

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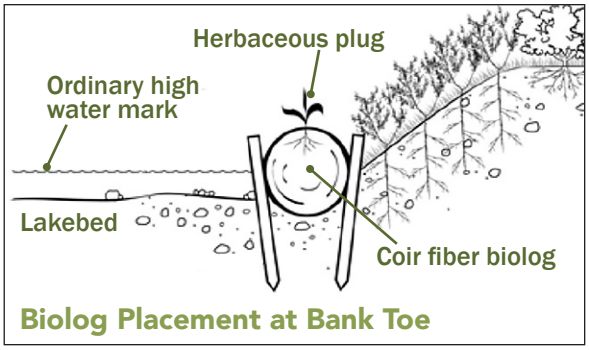
Protect natural shoreline areas by using selective control techniques for invasive species. Maintain natural areas containing native shoreline plants, shrubs, and trees on your riparian property.

Minimize shoreline development and impacts. Design shoreline projects to minimize native vegetation removal and shading of native aquatic plants. Utilizing EGLE's Minor Project and General Permit Categories can assist in project minimization.

Restore shorelines with native aquatic and wetland plants. There is a continuum of options for erosion control for shorelines with increasing energy potential. The pictures to the right show an example of a strategy for a relatively low-energy area. This example shows a coir log being staked-in at the bank toe and native plants installed behind the coir log. Your property does not necessarily have to be restored to predevelopment conditions, but it should provide many of the same benefits to a lake, such as habitat and shoreline stabilization. There is more than one right way to design a bioengineered shoreline, so create a shoreline that incorporates your goals as well as changes that will benefit the lake. More information on recommended installation methods and procedures, and a list of Certified Natural Shoreline Professionals can be found at shorelinepartnership.org.



Example cross-section of a lower-energy bioengineering project design.

Bioengineering project right after installation. Photo courtesy of Michigan Natural Shoreline Partnership.

Bioengineering project being installed as part of the Michigan Natural Shoreline Partnership Certified Natural Shoreline Professional (CNSP) Training

Apply for a Permit

If you would like a bioengineered shoreline, a permit from EGLE is required. If your project meets the criteria in EGLE's Minor Project Categories or General Permit Categories it can be processed on a faster timeline and at a reduced fee. For more information, and to submit a permit application visit Michigan.gov/JointPermit.

For More Information

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INLAND LAKE FACT SHEET SERIES

Encapsulated Soil Lifts

Encapsulated soil lifts are a best management practice that are used as a bioengineered shoreline erosion control strategy. Encapsulated soil lifts create a lake-friendly shoreline that can be used on lakefronts that experience moderate to high wind, wave, and ice action. Encapsulated soil lifts can also be used to replace seawalls. These bioengineered structures are built on a rock base and are used to rebuild eroded shorelines. Layers of soil are "encapsulated" inside biodegradable fabric to form the lift. Each lift is placed on top of the preceding lift, but stepped back, to create the desired slope. Encapsulated soil lifts are planted or seeded with deep-rooted, Michigan-native plants that stabilize the soil layers. Once plants are established, the encapsulated soil lifts will protect lakeshore properties and property values, improve recreational opportunities, and promote lake health. Diverse, natural plant communities and natural shorelines are the foundation of a healthy lake.

ADVANTAGES
of installing encapsulated soil lifts

Erosion Control
Encapsulated soil lifts built on a rock base effectively stabilize the shoreline – even in areas of relatively high wave and ice action.

Improved Water Quality
Encapsulated soil lifts' natural vegetation filters pesticides and pollutants before they enter the lake.

Fish and Wildlife Habitat
Encapsulated soil lifts' natural vegetation provides habitat for wildlife, while acting as a deterrent for geese.

Seawalls cause poor lakeshore habitat. Poor biological health is three times more likely in lakes with poor lakeshore habitat. Forty percent of Michigan's inland lakes have poor lakeshore habitat. Photo courtesy of Michigan Natural Shoreline Partnership.

This encapsulated soil lift and the established native shoreline vegetation stabilize the shoreline – even with moderate to high wave and ice action. Encapsulated soil lifts also slow runoff from upland areas, improve fish and wildlife habitat, improve water quality, and deter geese from damaging property. Photo courtesy of Michigan Natural Shoreline Partnership.

DISADVANTAGES
of hardened shorelines and lawn to water's edge

Habitat Elimination
Seawalls eliminate habitat required for fish and wildlife feeding, nesting, and spawning. Seawalls also act as a wildlife barrier, impeding natural movement.

Degraded Water Quality
Seawalls cause the suspension of sediments, increasing lake turbidity and algae. Seawalls also promote runoff, lowering the water quality of the lake.

Cumulative Impacts
The effects of multiple shoreline developments around a lake accumulate over time, impairing peoples' use of the water.

The figure below shows a cross-section of a typical soil lift design, although soil lifts may be constructed to various heights (up to 8 feet) and at various slopes.

The height of the rock base should be adjusted to accommodate the Ordinary High Water Mark (OHWM) and wave energy at the site. The lower lift should be placed as close to the OHWM as possible to allow for capillary action of water into the lift. For traditional, built-on-site lifts, plywood forms are lined with a layer of woven coir mat and then a layer of light-grade totally biodegradable coir fiber erosion control blanket. Soil is tamped into the forms to create the lift. If the lift is to be seeded, seeds must be added and lightly tamped (to create soil contact) before securing the blanket.

If the lift is to be planted with plants or shrubs (potted stock, bare root stock or dormant live cuttings) position the plant stock between lifts so as to provide as much soil contact as possible for adventitious rooting along the stems. Lifts may be planted and seeded. Long-rooted native plants that have the ability to stabilize the soil layers are recommended.

For the next course of lift, reposition the forms and repeat the process, stepping the forms back to create the desired slope. Seed or plant the lift and repeat until the desired bank height is reached.

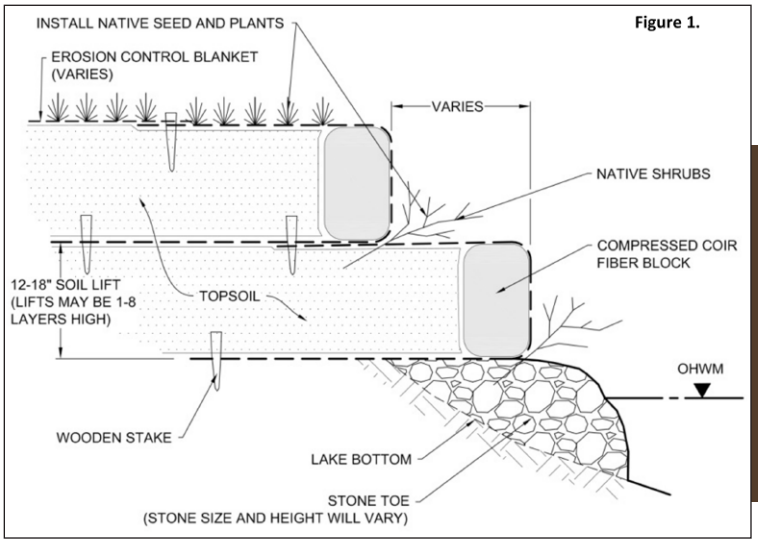

Figure 1.

Stages of encapsulated soil lift establishment from construction through three years of growth. A video of encapsulated soil lift construction is available at Shoreline.msu.edu/shorelinemgt/natural-shoreline-constructing-encapsulated-soil-lifts. Photos courtesy of Michigan Natural Shoreline Partnership.

Apply for a Permit

If you would like to install encapsulated soil lifts on your shoreline, a permit from EGLE is required. If your project meets the criteria in EGLE's Minor Project Categories or General Permit Categories it can be processed on a faster timeline and at a reduced fee. For more information, and to submit a permit application visit Michigan.gov/JointPermit.

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INLAND LAKE FACT SHEET SERIES

Shoreline Woody Structure

Coarse woody structure is a best management practice in which woody habitat is retained or restored in lake nearshore areas. These partially or fully submerged trees and branches in nearshore areas serve many functions that protect lakeshore properties and property values, improve recreational opportunities, and promote lake health. Woody habitat, as well as diverse, native plant communities, and natural shorelines are all indicators of a healthy lake.

ADVANTAGES
of shoreline woody structure

Erosion Control and Improved Water Clarity
Coarse woody structure can stabilize the shoreline and may prevent sediment suspension.

Attract More Fish
Woody habitat can improve fishing by attracting fish and increasing the number of fish in an area.

Wildlife Habitat
Coarse woody structure provides cover, feeding, nesting, and basking habitat for birds, turtles, and other wildlife.

In developed lakes, shoreline woody structure is often removed and shorelines are developed, leading to poor lakeshore habitat. On Michigan lakes in forested landscapes, we would expect one log approximately every 8 feet and on most Michigan lakes we see 3 to 17 percent of that. Poor biological health is three times more likely in lakes with poor lakeshore habitat. Forty percent of Michigan's inland lakes have poor lakeshore habitat. Photo courtesy of Michigan Natural Shoreline Partnership.

Nearshore areas on a lake, such as this relatively pristine lake in northern Michigan, trees and branches enter the lake through methods such as wind, ice, waves, or beavers. This shoreline woody structure, as well as native shoreline vegetation, can stabilize the soil, slow runoff from upland areas, increase fish and wildlife habitat, improve water quality, and dissipate wave energy from wind and boats. Photo courtesy of Eric Calabro.

DISADVANTAGES
of no shoreline woody structure

Erosion
Lack of shoreline woody structure leaves property unprotected and vulnerable to erosion.

Turbid Water
Lack of shoreline woody structure can allow for the suspension of sediments, increasing the turbidity and lowering water quality of the lake.

Habitat Elimination
Lack of shoreline woody structure eliminates habitat required for fish and wildlife feeding, nesting, and spawning.

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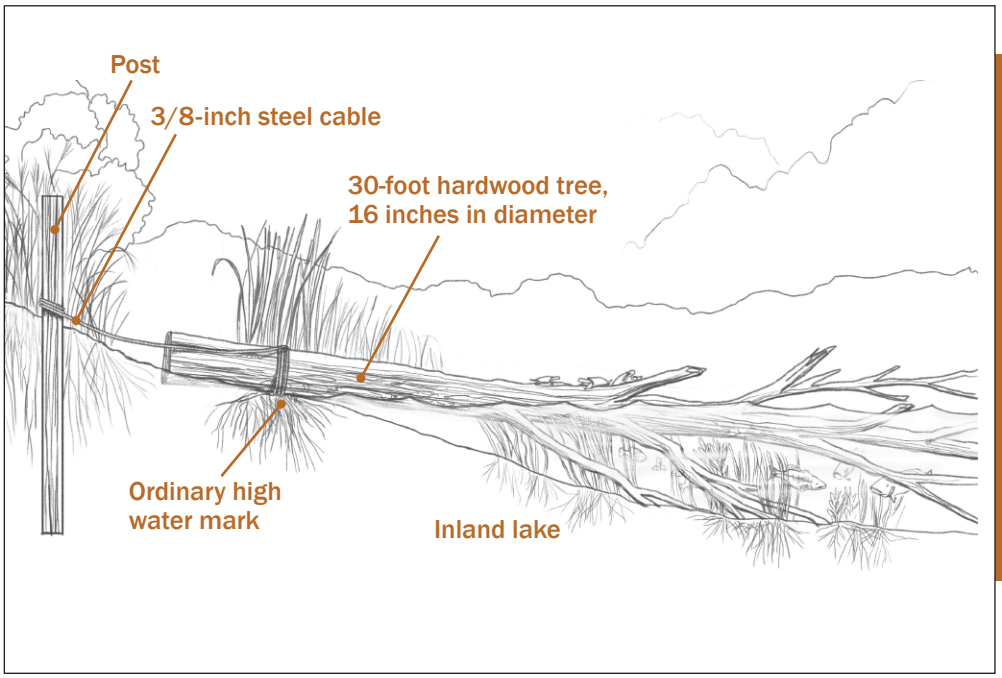
Protect trees and branches that naturally fall into the lake. Woody structure can be a critical part of an "aquatic garden" of native aquatic plants and habitat features within your riparian area.

Minimize shoreline development and impacts. Design shoreline projects to minimize removal of woody structure and native plants.

Restore shoreline woody structure to the nearshore area of your lake. Root wads, logs, and whole trees can be installed as shoreline woody structure, but don't use trees that are currently growing near the shoreline, because they are stabilizing it from erosion. It is best to use recently live trees. The structure must be securely anchored. EGLE recommends placing woody structure 100 feet away from docks, boat ramps, and designated swimming areas. Below is one installation strategy that uses posts and cable to anchor trees to the shoreline.

Coarse woody structure project installed as part of the Michigan Natural Shoreline Partnership Certified Natural Shoreline Professional (CNSP) Training. Photo courtesy of Michigan Natural Shoreline Partnership.



Apply for a Permit

If you would like to build shoreline woody structure in your lake, a permit from EGLE is required. If your project meets the criteria in EGLE's Minor Project Categories or General Permit Categories it can be processed on a faster timeline and at a reduced fee. For more information, and to submit a permit application visit Michigan.gov/JointPermit.

(Left) Example cross-section of a shoreline woody structure design.

For More Information

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