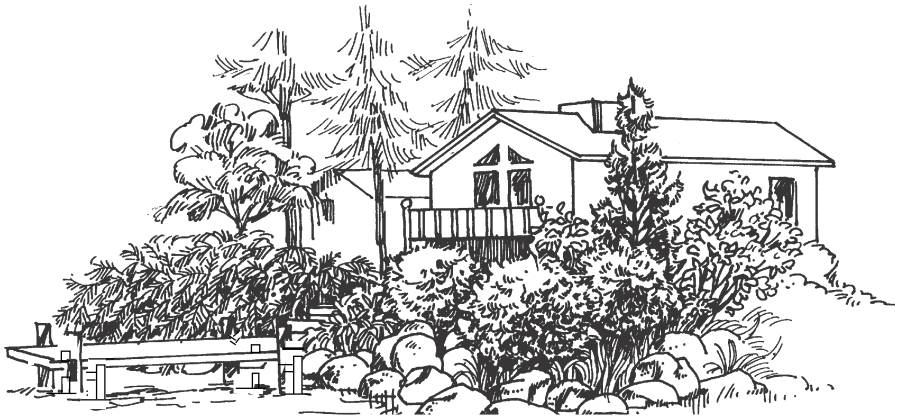
Lakeshore Protection in Indiana



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Life in the water and on shore meet at the lake shoreline. Many young children's earliest memories of a lake are from playing at the waterline—catching tadpoles and learning to swim. Shorelines furnish nursery areas for the young of other species as well, including fish, ducks, turtles, and dragonflies. A properly managed lakeshore will provide benefits to residents above and below the water by:

- protecting the lake shoreline from excessive erosion;
- enhancing the natural beauty and value of lakefront homes; and
- providing food and shelter for fish, birds, and other wildlife.

Improper management practices may increase erosion, degrade fish and wildlife habitat, limit recreational enjoyment, and diminish property values.

LIFE ON THE EDGE

Lake-dwelling fish depend on a diverse mixture of habitats for laying eggs and raising their young, particularly during spring and summer. The tree roots, fallen logs, boulders, and plants that occur naturally along lake shorelines provide places to hide from predators. Without protective cover in shallow water, predators will consume excessive numbers of young fish, leading to a decline in fish stocks. These crevices and plants also support a variety of vital food resources for many species of wading birds, waterfowl, turtles, fish, and other animals which feed on plants, insects, crayfish, snails, and small fish along the shoreline. Some species which live on land periodically use shore zones for feeding or reproduction. Access to drinking water from the shore is necessary for many wildlife species, as well.

CAUSES OF EROSION

Shorelines can erode through many processes. Natural causes of erosion include currents, waves, ice, and rain. Many human activities may significantly increase the rate of erosion. Some common causes include:

- removal of natural vegetation for property development or creation of beaches, both on shore and in the lake;
- improper installation of erosion control structures, such as seawalls;
- increased wave action from watercraft traveling close to the shore;
- dredging, filling, or construction on or near the shoreline;
- trampling of banks by human, animal, or vehicle traffic; and
- inadequate protection against stormwater run-off from roofs, driveways, streets, playing courts, and other developed areas.

Causes of shoreline erosion may differ due to location on the lake, water level changes, and season. Shorelines affected by wind-driven ice and waves will be predisposed to more erosive forces. The shallow water zone along the shoreline may dry out and flood seasonally due to natural or controlled fluctuations in lake levels. Shoreline areas that are dry during some years may provide additional habitat used by several species for spawning and raising young in rainy years. Changes in water levels can undermine poorly designed seawalls. Proper diagnosis of lake conditions is necessary for designing shoreline protection measures while minimizing damage to fish and wildlife habitat.

GENERAL LAKESHORE PROTECTION GUIDELINES

- Preserve the natural shoreline. The natural shape of the lakeshore and the plants existing at and above the water line usually provide excellent erosion control and habitat value.

- Maintain a proper watercraft speed when approaching or passing close to shore. Wakes generated by motorboats and personal watercraft can cause extensive shoreline damage when the waves impact the lakeshore and lake bottom. When passing within 200 feet of shore, a boat must not be operated at a speed greater than 10 miles per hour (IC 14-15-3-17) or greater than a speed which is reasonable and prudent (IC 14-15-3-7).

- Avoid new construction at or near the lakeshore. Moving heavy equipment and clearing land for construction makes soil vulnerable to erosion. Maintain a wide buffer zone of trees and shrubs between any structures and the edge of your lake. Lay mulch, straw or erosion control mats to control erosion during construction.

- Use a temporary or floating dock, rather than a permanent dock. Permanent docks disrupt lake bottom habitat during construction and may cause erosion problems by deflecting underwater currents. All permanent dock construction requires a permit from the Indiana Department of Natural Resources (IDNR). Because of the great potential for environmental harm and for unreasonable interference with public enjoyment of the lake, an application for a permanent dock must undergo a rigorous permit review process.

- Carefully select erosion control methods. Choosing the proper erosion control will save money, time, and maintenance worries.

EROSION CONTROL METHODS

If erosion poses a significant threat to lakeshore property, you will need to select the control method best suited to your needs and a method that will meet state regulations. The following guidelines include information about the most common construction materials used for controlling erosion:
1) vegetation, 2) bioengineering, 3) stone or riprap, and 4) concrete or sheet piling. These guidelines include information about cost, effectiveness, maintenance requirements, appearance, and impacts on fish and wildlife habitat for each set of materials. In some cases, a combination of methods may constitute the most effective design for protecting the shoreline and providing wildlife habitat.

With any shoreline protection or construction project, a design which does not take your lakeshore conditions into consideration may fail and leave you with a bigger and more expensive erosion problem than originally existed. Shoreline projects require an IDNR permit. Contacting a consulting firm that specializes in shoreline protection and who is familiar with state regulations can ensure the most time and cost effective results.

The scale and intensity of shoreline processes on Lake Michigan may require different techniques than smaller, inland lakes. Please seek assistance from the IDNR Lake Michigan Specialist (219) 874-8316 or other qualified professionals.

1. Vegetation

Shoreline vegetation protects property naturally, effectively and inexpensively. Erosion can result where vegetation has been damaged or removed by construction, herbicide application, or excessive wave action generated by boating. Trees offer excellent erosion control because of their deep roots which bind the soil and their leaves which intercept rain before it impacts and erodes the soil. Lower branches of trees may be trimmed to maintain a view of the lake. Trees and shrubs not only hold soil and nutrients that may otherwise contaminate the lake, but provide an aesthetically pleasing screen to protect the privacy of lakefront property owners. Nearshore water plants can help protect the shoreline against waves and provide excellent fish habitat.

District IDNR foresters or biologists and many local nurseries or landscape companies can recommend appropriate plant species for use in and near water. Avoid non-native or invasive species such as reed canary grass, European alder, amur honeysuckle, white mulberry, and purple loosestrife. Planting of purple loosestrife is prohibited in Indiana. Native Indiana trees especially well-adapted to the wet soils along lakeshores include black willow, silver maple, sycamore, green ash, and American elm.

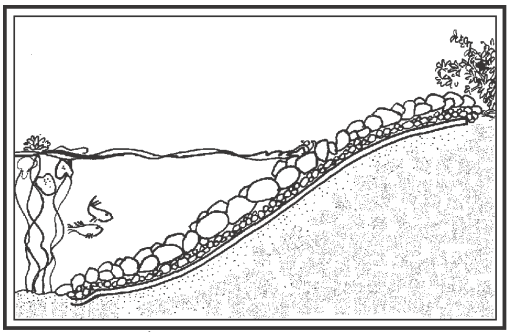
2. Bioengineering

Occasionally, steep bluffs or high wave energy make it difficult to establish or maintain shoreline vegetation. In these circumstances, property owners may need to utilize innovative engineering techniques, such as "bioengineering," to restore shoreline vegetation.

Common bioengineering techniques include: planting vegetation on slopes stabilized with blankets made of special, biodegradable fibers; transplanting trees into stone or riprap (known as "joint planting"); planting freshly cut willow limbs in the ground (known as "willow staking"); and laying interlocking blocks with gaps designed to promote plant growth.

Bioengineering can cost more than either vegetation or riprap alone. However, bioengineering methods can effectively protect highly vulnerable shorelines less expensively than seawalls or retaining walls. Unlike a solid seawall, bioengineering also maintains the valuable shoreline habitat and increases in strength over time as the plants grow. Because of the complexity of these techniques, the assistance of a professional is usually necessary to attain satisfactory results.

3. Glacial stone or riprap



Large stones placed on top of gravel or a filter blanket will stabilize gradual to moderately-sloped lakeshores by holding soils and dissipating wave action. The size of the stones and width of the stone layer required to effectively protect a shoreline depend on wave height, slope of the shoreline, fetch (extent of open water near the shore), and distance between the high and low water lines. Where underwater beaches reach the shoreline, use of pea gravel (small rounded stones about 1/4 inch diameter) is the only allowable material because it will provide more stability than sand in eroding or unstable areas.

Use of large stones also provides a rocky, natural-appearing shoreline with some habitat value, particularly if vegetation grows up through it. Variations in depth along the shoreline provide diverse habitat for different species of plants and animals. Fish, turtles, crayfish, and other animals look for food and protect their eggs and young among vegetation and gaps in the rocks.

Seawalls constructed of naturally occurring field stone or quarried limestone riprap will protect a shoreline effectively and inexpensively in most cases. However, improper

installation can cause any structure to fail. Inadequate protection along the base or toe of a stone wall can lead to erosion and slumping of the material. To protect against such failure, use large stones placed partially into the lake bottom on the lakeward side of the riprap as a buffer against currents and waves. Large ice sheets may roll over the stones, which can cause some rocks to shift and fall. Spring maintenance of stone seawalls involves placing these rocks in their original position.

4. Concrete or sheet piling

Seawalls constructed with an inflexible vertical surface protect shorelines by reflecting wave energy, rather than absorbing it like riprap or vegetation. As a result, such a seawall can worsen wave action on a lake and increase erosion in front of and to the sides of the seawall.

Wave reflection from inflexible seawalls can increase turbidity by stirring the lake bed. Unique and sensitive water plant species, including rushes and other plants necessary for maintaining the fish community, may disappear due to lower water clarity, increased wave action, and scouring of the lake bed.

Near vertical seawalls can permanently degrade shoreline habitat by replacing the naturally, sloping shore zone with a vertical face that cannot be used by plants or animals and eliminates gradual and diverse changes in water depth near shore. Near vertical faces can block access to and from the water for turtles, frogs, and other species that must periodically use underwater areas to feed or reproduce.

Inflexible seawall materials can cost substantially more to install than some other erosion control techniques and may reduce or eliminate vital aquatic habitat. These types of seawalls can require regular maintenance to repair damage from direct wave or ice impact, undercutting by currents or waves, and seepage from the landward side. Due to these constant stresses, seawall strength decreases over time. Common causes of failure include inadequate toe protection, subsidence of backfill soil, build-up of pressure behind the seawall from inadequate drainage or weak anchoring, and direct wave or ice impact exceeding the design specifications of the seawall.

Near vertical seawalls constructed of inflexible materials are best suited to areas with extremely high wave energy, vertical bluffs, at marinas which support intense boat traffic. Negative impacts of a vertical seawall can be lessened by facing the seawall with glacial stone or riprap on the lakeward side.

> Stabilizing the toe or refacing an existing vertical seawall with stone or riprap may replace some of the lost habitat value and minimize erosion due to wave reflection.

Comparison of Erosion Control Methods

	Effectiveness	Maintenance	Appearance	Habitat Value
Vegetation	Excellent at reducing erosion and stabilizing flat or moderate slopes.	Little maintenance required. Varies depending on desired effect.	Preserves natural, scenic beauty of shoreline. Can provide a privacy screen for lake residents.	Reduces soil erosion and nutrient contamination of lake. Excellent habitat for fish and wildlife.
Bioengineering	Excellent at dissipating moderate waves, controlling erosion, and stabilizing most slopes.	If installed properly, requires little maintenance beyond aesthetic management.	Supports natural vegetation and scenic value.	Dampens wave action. Strength and habitat value for fish and wildlife improve over time.
Glacial stone or riprap	Excellent at dissipating moderate waves and stabilizing slopes up to 2-to-1.	Occasional maintenance necessary to move and replace rocks.	Provides natural-appearing rocky shoreline. Allows native vegetation to grow between stones.	Dampens wave action. Good habitat for fish and wildlife, especially if plant growth is allowed.
Concrete, steel or vinyl piling	Structural barrier against strong waves and ice. May stabilize bluffs. Increases erosion in lake and along nearby shoreline.	Requires regular maintenance to repair cracks and check for toe erosion. Must be completely replaced or or refaced upon breaking.	Permanently alters shoreline contour and prevents establishment of native vegetation along lake shoreline.	Poor habitat value. Increases wave action. Reduces diverse feeding and spawning areas for fish and other aquatic animals.

* These are 2000 figures. Actual costs may vary considerably, depending on local prices, the conditions at your lakeshore, and the level of erosion protection desired.