Lake Superior Shoreland Erosion and Safe Building Setbacks

A Guide to Developing Coastal Property in Bayfield County
Erosion and Your Lake Property

Coastal shoreline property has unique characteristics that require special attention. Due to erosion, several Lake Superior houses have had to be removed or relocated in recent years because they were literally in danger of falling into the lake.

If you are planning to build on your Lake Superior property, or purchase new property that you hope to build on in the future, this guide is for you. It is designed to help you understand the impact of erosion and plan a safe setback distance for your new building. It can also help you evaluate property before you purchase it. Planning a sufficient setback now will safeguard your investment by protecting your structure from erosion. This will minimize the chances that it will need to be moved or even destroyed in the future.

A Shifting Coastline

Unlike inland shores, Lake Superior's coastline is subject to significant erosion. In fact, every year an average of 97,000 cubic feet of soil and rock per mile of shoreline is eroded along Lake Superior.

Much of the Lake Superior shoreline in Bayfield County is bordered by steep bluffs with or without an adjacent beach. These bluffs are very susceptible to erosion. Some, like rock slopes, erode very slowly. Others, especially those made of clay, can be stable for years and then erode or slump very quickly. Because the rate of erosion is so variable, many property owners or potential buyers don't notice changes and are unaware of the dangers this process can pose to their property.
Why do bluffs erode?

A steep bank is not as stable as one with a more gradual slope. Picture a sandcastle on the beach. When left alone, wind, rain, and waves will gradually wear down the structure until it eventually becomes part of the smooth sloping beach again. Like the walls of a sandcastle, all slopes will eventually reach a stable angle – an angle with a more gradual slope that is not as likely to erode.

Most slopes that are undisturbed have reached that stable angle. However, on the Lake Superior shoreline, waves undercut the base making it steeper and causing significant erosion. When the base of the bluff is undercut, soil or rock above is no longer stable, and the slope begins to fail as shown in the figure above. This continual inland movement of shoreline is known as recession. Storm water runoff, groundwater seepage, varying lake levels, and even wind and other forces of nature can impact the erosion rate.

Some types of slope failure, like slides and slumps, occur suddenly. At times, 20 to 30 feet of bluff top can collapse at once. Even if there are not obvious large slope failures, disturbed slopes recede slowly through a process called creep. This is slow down-slope movement that commonly occurs on clay. Although this process is slow, it is nonetheless difficult to stop and will eventually cause the bluff top to recede.

What is a stable slope angle?

Even if all wave action were stopped, a bluff top will continue to recede until it reaches a more gradual slope. The actual angle that it needs to achieve in order to become stable depends on the type of material in the bluff. A bank composed primarily of clay, for example, becomes stable when it reaches a 14 degree angle. A bank composed of bedrock, on the other hand, can stabilize at a much steeper angle.
Planning for the Future

Erosion is inevitable so it’s critical to plan for it by including a safe setback for new buildings. Previously Bayfield County required a minimum setback of 75 feet. New research has proven that, in some areas, this distance is not sufficient and a greater setback is required. Therefore, new criteria are being established that include allowance for erosion. These distances vary from one location to another as soil type, recession rates, and other conditions vary.

The Bayfield County Planning & Zoning Website Can Help (Visit www.bayfieldcounty.org/zoning)
The Planning & Zoning website can help you calculate a safe setback for your proposed building based on the conditions in your location. Permitting will be based on this calculated setback and will depend on the specific characteristics of your parcel. In some cases, property owners who use approved stabilization measures may reduce their required setback. Contact the Planning & Zoning Department to discuss stabilization plans.

Determining a Safe Setback Distance

On the website, the setback calculator will determine a safe setback by combining three separate components:

- **Recession Setback**—The number of feet your shoreline is likely to recede during 60 years (the expected lifetime of a structure) based on the known past recession rate in your area.

- **Stable Angle Setback**—The distance your bluff will recede before it reaches a stable angle. To determine this setback, you will need to know the current angle of your bluff and the stable slope angle. The Setback Calculator and the Bayfield County Planning & Zoning Department can help you determine this.

- **Minimum Facility Setback**—The distance between your structure and the future edge of the bluff. If you include only the first two setbacks above, your structure may be perched right on the edge of the bluff after 60 years. The minimum setback allows a buffer between your building and the future shoreline.

The Total Safe Setback distance is determined by combining these three distances:

\[
\text{Recession Setback} + \text{Stable Slope Setback} + \text{Minimum Facility Setback} = \text{Total Safe Setback}
\]

**Example:**
In the parcel shown at right, the Recession Rate is determined to be 1/2 foot per year. Therefore, the Recession Setback (the recession expected in 60 years) is **30 feet**. The Stable Slope Setback is calculated to be **35 feet** and the Minimum Facility Setback is **75 feet**. Combining all three gives a required setback of **140 feet**.

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Compliments of: The Bayfield County Planning & Zoning Department 715.373.6138 or www.bayfieldcounty.org/zoning