Shoreline Erosion

How Erosion Happens

When a 3 metre (10 feet) high shoreline bank erodes, it may look as if the entire height of the bank is being lost. In reality, it is only the "toe" of the bank—that is, the bottom 0.6 to 1.2 metres (2 to 4 feet)—that is falling away. As this part of the bank is eroded, it reaches a point where it can no longer support the weight of the soil and plants overhead. As a result, the overhanging portion of the bank breaks away in what is known as "slumping." This "slumped" material ends up at the bottom of the bank. Here, it is quickly washed away, giving the false impression that the entire bank is being eroded.

If the toe of the existing bank can be protected, then the erosion rate will be much lower. With time, the remaining portion of the bank will stabilize. Over a three- to four-year period there may be little or no change to the existing bank. However, with the ever constant natural forces of erosion, it is not uncommon to see 0.6 to 0.9 metres (2 to 3 feet) disappear from a shoreline bank during a single storm event.

How Climate Change is Affecting Erosion

The rate of shoreline erosion, and the frequency and degree of coastal flooding events, are now on the rise on PEI because of several climate change impacts:

- **Sea level rise –** Global sea level is expected to rise between 0.6 metres (2 feet) and 2.0 metres (6.5 feet) per century. PEI may well see an additional rise of 0.2 metres (0.6 foot) because of land subsidence (the gradual sinking of a land mass).

- **Loss of winter ice cover –** Increasing temperatures are reducing the amount of sea ice cover around PEI, as well as the time during which it is present. Less ice means more frequent shoreline attack by waves and more associated erosion.

- **Potential increase in the frequency and/or intensity of rainfall and storm surge**

events – Heavier rainfall events and stronger or more frequent storm surges will contribute to shoreline erosion and flooding.

Alternatives

Shoreline erosion is a normal process of nature, and development within this zone can be subject to considerable risk. When development is undertaken, many problems can be averted by using setback limits and by following provincial regulations (see the PEI *Planning Act*). This can help to lessen the likelihood of having to undertake shoreline stabilization projects in the future.

In the past, however, development along PEI's shoreline was often undertaken with little thought given to bank erosion. As a result, numerous waterfront property owners on PEI are now faced with severe erosion problems. When trying to address these problems, they must select from limited alternatives:

- Move the cottage, house, or other structure and let nature take its course along the shoreline (i.e., retreat),
- Reduce the erosion rate by installing some type of shoreline stabilization (i.e., protect), or
- Do nothing and risk the loss of property and existing structures.

The Department of Environment, Labour and Justice **does not recommend** the use of shoreline stabilization along PEI's perimeter coastline. Construction costs are high, and these areas often experience severe weather conditions. As well, protecting only a small section of the coastline can negatively impact adjacent properties and the immediate coastal area. This can include:

- increased erosion to neighbouring properties, which have not been protected,
- 'starvation' or a loss of sand buildup on down-shore beaches, when sediment movement along the shore is blocked, and
- damaged aesthetics, when pristine shorelines are replaced with (sometimes unattractive) construction works.

If shoreline protection is undertaken, materials must be constantly upgraded and maintained to ensure their effectiveness. And no construction works, no matter how elaborate or expensive, can be guaranteed to stand up to the extreme forces of erosion. If the property is large enough, the best long-term solution to an erosion problem involves moving the structure to a more secure location.

Often, however, a cottage or house cannot be moved and shoreline stabilization may be

necessary to protect the property. It is essential that these projects be conducted in an environmentally sensitive manner.

Permits and Approvals

A **Watercourse, Wetland and Buffer Zone Activity Permit** will be granted when there is sufficient justification for a project, and no adverse environmental effects are likely to result from the work. All permits include certain terms and conditions. These must be strictly followed in order to protect the environment.

It is the responsibility of the landowner to pay for all shoreline stabilization work. The government does not provide funding for these projects. The landowner is also responsible for the on-going upkeep of any existing or new shoreline stabilization system. A Watercourse, Wetland and Buffer Zone Activity Permit is also required to carry out repair work or additional modifications to the structure.

If you act as the contractor OR you hire a non-licensed contractor

Before starting any work YOURSELF, remember that **you must get a permit** from the Department of Environment, Labour and Justice. Make sure you have reviewed a copy of your permit with the contractor and they are familiar with its terms and conditions. If you have questions, please contact the Department of Environment, Labour and Justice at (902) 368-5052.

If you hire a licensed contractor

A permit is not required if you hire a licensed contractor to complete all of the work on your behalf. It is the contractor's responsibility to make sure that they have obtained all of the necessary approvals to do the work. If you have questions, please contact the Department of Environment, Labour and Justice at (902) 368-5052.

Planning a Shoreline Stabilization Project

Before undertaking a shoreline stabilization project, property owners should consider:

- long-term erosion rates at that location (for information on erosion rates, contact Environment Land Management staff at 368-5049);
- type of structure best suited for the location;
- initial installation and long-term maintenance costs of a control structure versus other options (e.g., moving the cottage or house);
- possible impact on adjacent shorelines;
- seasonal changes in beach structure;
- aesthetic look of the property now and what the 'modified' shoreline will look like;
- design and building of a structure that will be needed to withstand the worst weather conditions including climate change; and

- in the case of inland bays and estuaries, long-term protection. Here, vegetative erosion controls (grass, shrubs, and trees) should be used whenever possible rather than building structures that will have a limited lifespan.

Just how high a protection system will need to be depends upon the property owners' tolerance to risk and the amount of regular maintenance they are willing to perform. At a minimum, they should plan for a sea level rise of at least 1.0 metre (3 feet) per century or 10 cm (4 inches) every 10 years. A protection system that plans for a rise of 20 cm (8 inches) every 10 years is presently considered conservative.

Common Ways to Minimize Shoreline Erosion on your Property

There are three common ways to minimize shoreline erosion:

- Placement of riprap material – rock (sandstone or granite) and concrete (slabs or rubble),
- Construction of a retaining wall (the majority are built using timbers), or
- Placement of gabion baskets

These are not the only alternatives available for shoreline protection, but they are the most common. Each property along Prince Edward Island's coast is unique. Choosing the right shoreline protection method for a specific property is not an easy task. One option may be quite acceptable to a property owner, while their neighbours may prefer something very different.

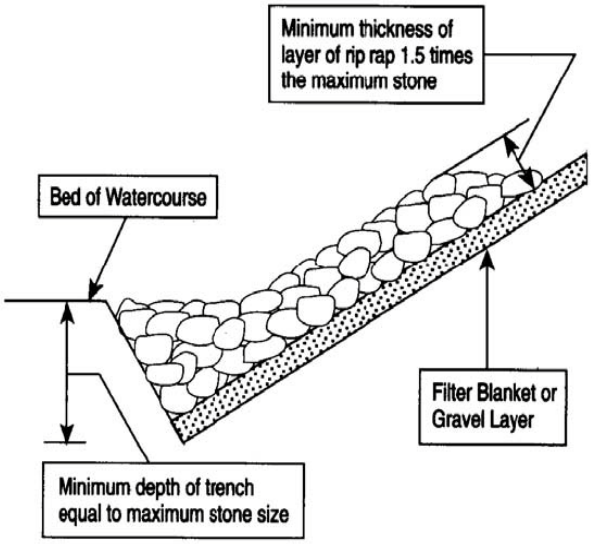
The most important thing to remember is that these methods are not **solutions** to shoreline erosion. At best, they will help to slow down or **limit** the amount of erosion. Even when the work is done to the highest standard and at considerable expense, the structure will still require on-going maintenance and improvement to battle the forces of natural erosion.

Oceanfront properties are directly exposed to wave attack. As these beaches adjust to seasonal changes and rising sea levels, a hard fixed barrier (vertical wall or gabion baskets) will cause greater erosion at its base. This may then lead to a premature collapse. The use of riprap, while requiring more maintenance, does allow for greater flexibility in adapting to rising water levels and retreating shorelines. The riprap can be more easily repositioned or topped with new material, as needed.

Placement of Riprap Material

When this method is used, layers of rock are placed at the toe and on the slope of the eroding bank. Depending upon the type of riprap material, and whether filter fabric (a mechanically woven geotextile blanket that prevents soil suspension and movement) is used together with the riprap, this method generally proves to be the least expensive. However, the completed system

may not be aesthetically pleasing to some waterfront property owners. This is often the case if broken concrete is used. Large Island sandstone generally best simulates natural shoreline conditions, but often it is not available. Granite, while it must be imported at considerable cost, is the most durable material available.



Construction of a Retaining Wall

When building a retaining wall, upright support posts are installed at regular intervals below the existing shoreline sediment. Other timbers are placed perpendicular to the support posts. Tie-back supports are then installed behind the wall to prevent it from pushing out over time. The area behind the wall is usually backfilled with rock and soil. Filter fabric should be installed between the inner wall boundary and the backfill material. This will help to prevent the backfill from escaping between the timbers. Depending upon the availability and cost of materials used, this method can be quite reasonably priced.

Placement of Gabion Baskets

When this method is used, wire (galvanized or plastic coated) mesh baskets or gabions are filled with rocks and placed at the base of the eroding slope. Granite rock is recommended for use in filling the baskets. Island stone, which is a sedimentary material, should not be used as it erodes quickly and requires frequent maintenance. The use of gabion baskets is generally the most expensive option available. Usually, an experienced contractor is needed to perform the work.

Gabion baskets are generally not recommended for sites that are directly exposed to wave action. The wires have only a limited resistance to the combination of waves (which cause cracks to form in the coating) and saltwater corrosion. When one part of the gabion structure fails, the remaining sections will usually fail shortly after.