

Estuarine Shoreline Stabilization

Property Owner's Guide to Determining the Most Appropriate Stabilization Method



Estuarine shorelines are dynamic features that experience continued erosion. Land is lost by short-term processes, such as erosion by storms, boat wakes, and tidal currents, and to the long-term process of rising sea level. As coastal populations increase, states have begun to formulate new policies and management plans that strike a balance between the need to provide for the protection of private property and the need to maintain the integrity of the natural system.

Estuarine erosion management in North Carolina allows property owners to protect their shoreline from erosion, while attempting to minimize the impacts of erosion control structures. These efforts include limiting encroachment and fill on, or waterward of, coastal wetlands, as well as coastal waters. Property owners have the option to stabilize their shoreline with a wide range of vertical and sloped structures. However, due to the reaction of specific shoreline habitats to these structures, it is becoming apparent that some stabilization methods are not appropriate for all shoreline types.

Shoreline stabilization is defined as the use of structures, vegetation, or land management practices to provide protection of a shoreline from future or existing erosion. "Living shorelines" are defined as shoreline stabilization techniques that use natural habitat elements to protect shorelines from erosion while also providing critical habitat for wildlife. This brochure presents information on a variety of shoreline stabilization structures available to coastal property owners and provides a tool to determine the most appropriate stabilization method based upon shoreline type and other site characteristics.

Estuarine Shoreline Stabilization Method Selection Key

This key should be used by property owners as a tool to determine which type of shoreline stabilization structure they should consider based on site-specific characteristics. Start at the beginning of the key and determine which statement most accurately reflects the conditions on your property. Move through the key as directed until you reach a specific recommendation or alternative.

1. Engineered Structure

- a. There is an existing engineered structure (bulkhead, riprap, etc...) on the property.....**go to 2**
- b. There is NOT an engineered structure on the property.....**go to 3**

2. Extent of Damage

- a. Existing engineered structure is easily repairable**REPAIR OR REPLACE STRUCTURE**
- b. Existing engineered structure is NOT easily repairable.....**go to 5**

3. Erosion

- a. There is measurable erosion occurring on the property.....**go to 4**
- b. Erosion is NOT occurring on the property.....**NO ACTION NECESSARY**

4. Land Planning

- a. Erosion can be managed using land planning.....**USE LAND PLANNING**
- b. Erosion CANNOT be planned around.....**go to 5**

5. Wave Energy

- a. The property is located in an area with low wave action and/or minimal boat wakes.....**go to 6**
- b. The property is located in an area with moderate to high wave action and/or substantial boat wakes.....**go to 7**

6. Vegetation Control

- a. Vegetation plantings can be used to stabilize the property.....**USE VEGETATION CONTROL**
- b. Vegetation plantings are NOT feasible on property (steep shoreline, deep water, or located on man-made canal).....**go to 7**

7. Property Location

- a. Property has one or more of the following site characteristics: limited land availability, narrow basin/canal, or is located on a man-made canal, an upland basin, or a bluff.....**BULKHEAD**
- b. Property does NOT have any of the above site characteristics.....**go to 8**

8. Wetlands

- a. There is wetland vegetation (marsh or swamp forest) on the property.....**go to 9**
- b. There is NO wetland vegetation on the property.....**go to 11**

- 9. Wetlands with Submerged Aquatic Vegetation (SAV), Mudflats, Woody Debris, or Oyster Beds**
- a. The wetland vegetation is NOT associated with SAV, mudflats, woody debris or oyster beds.....**go to 10**
 - b. In addition to wetland vegetation, SAV, mudflats, woody debris, or oyster beds are present.....**WETLAND TOE PROTECTION RIPRAP REVETMENT or SILL**

- 10. Maintain or Restore**
- a. Property owner is interested in restoring or enhancing wetland vegetation along the shoreline**SILL**
 - b. Property owner is interested primarily in protecting existing wetlands.....**WETLAND TOE PROTECTION RIPRAP REVETMENT**

- 11. Shoreline without Wetlands (sediment bank)**
- a. The property does not have wetland vegetation, but SAV, mudflats, woody debris, or oyster beds are present.....**RIPRAP REVETMENT**
 - b. There are NO SAV, mudflats, woody debris, or oyster beds present in the nearshore area.....**go to 12**

- 12. Sand in Nearshore System**
- a. Property receives low to moderate wave action and there is minimal to no sand moving in the nearshore area.....**SILL**
 - b. There is significant sand in the nearshore area or the property has an existing sandy beach.....**GROIN**
 - c. Property receives moderate to high wave action.....**RIPRAP REVETMENT**

Use of this key does not imply that the Division of Coastal Management will issue a permit for the suggested structure. Contact your District Office for specific permitting requirements.

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Estuarine Shoreline Stabilization Descriptions

Land Planning

Land planning is designing your property around existing conditions and possible erosion. This includes using the land as it exists without construction of shoreline stabilization methods. The most common practices associated with land planning include setbacks and buffers. Land planning allows wetland vegetation to migrate with sea level rise. This method also maintains a natural shoreline, is an environmentally friendly and low-cost option, and requires no permit.

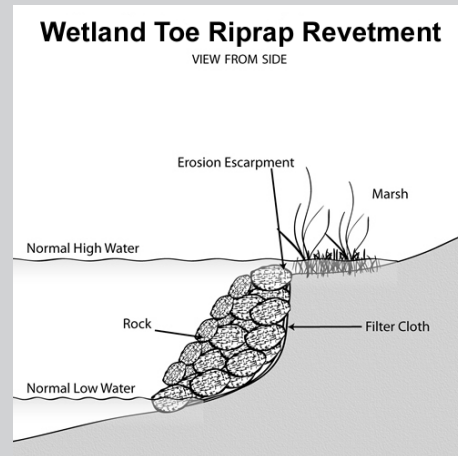


Vegetation Control

Vegetation control is the use of wetland or upland vegetation (new plantings or preserving existing vegetation) to control or prevent further erosion. Vegetation may be planted or allowed to colonize naturally. This method can be employed on most shorelines with minimal wave action. This is an environmentally friendly, low-cost option that will allow wetland vegetation to migrate with sea level rise. Vegetation control also maintains a natural "living shoreline".

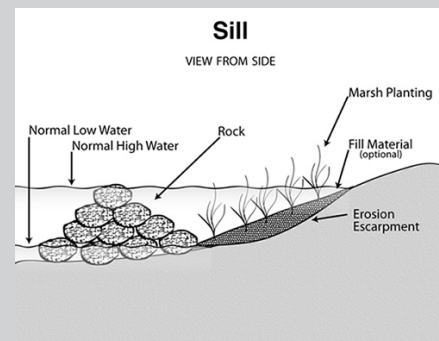
Wetland Toe Protection Riprap Revetments

A wetland toe protection riprap revetment is a shore-parallel, sloping structure constructed against an eroding wetland shoreline to protect, enhance, or restore the marsh vegetation and protect the wetland roots from being undermined. Typically, these structures are constructed immediately waterward of the wetland from rock/riprap or oyster shell, but other materials can be used. This is an environmentally friendly, low-cost option that will allow wetland vegetation to migrate with sea level rise and maintain a natural "living shoreline".



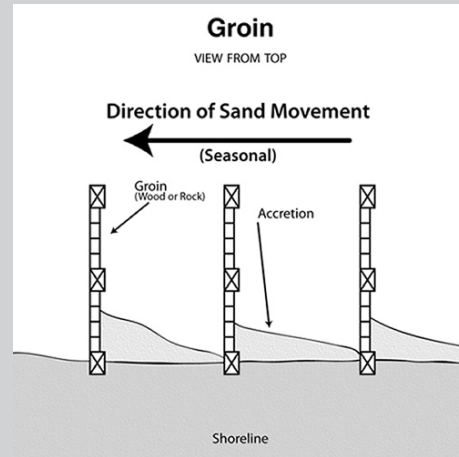
Sill

A sill is a shore-parallel, wood or rock structure that is designed to protect, enhance, or restore existing or newly planted wetland vegetation. Typically, these structures are constructed from rock/riprap or oyster bags, but other materials can be used. This is an environmentally friendly, low-cost option that will allow wetland vegetation to migrate with sea level rise and maintain a natural "living shoreline".



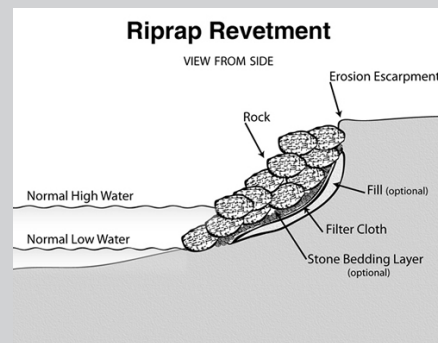
Groins

A groin is a straight structure that is perpendicular to the shore, constructed with stone, sheet pile or similar material to stabilize a stretch of beach against erosion. Groins function only when sand is moving in the nearshore area. Groins create or build out a sandy beach that then acts as a wave dissipation zone. Groins can be constructed either singly or in a series (as shown). A saw-toothed shaped shoreline is created with a series of groins.



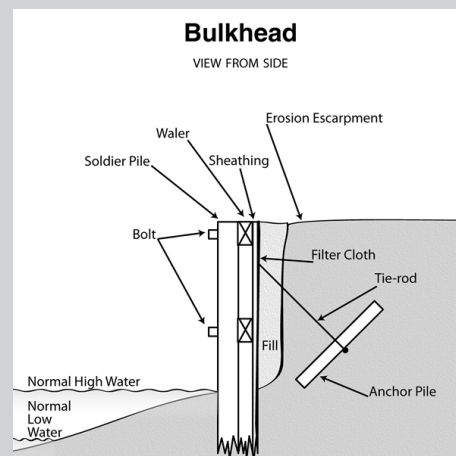
Riprap Revetments

A revetment is a sloping structure parallel to the shoreline constructed against a bank/escarpment to protect it from erosion while absorbing wave energy. Revetments are typically constructed from rock/riprap, or concrete pieces. These structures can be used on shorelines with small to large waves; however, the size of the stone must be suitable to remain in place under the site's wave action. Riprap revetments are durable, easily maintained, long-lasting structures that also create aquatic habitat.



Bulkheads

A bulkhead is any vertical structure that is parallel to the shoreline that is designed to prevent overtopping, flooding, or erosion of the land. Bulkheads are usually placed along an eroding bank or escarpment and constructed from timber, steel, or vinyl sheet pile. Bulkheads are ideally located in places with limited land availability, narrow canals, man-made basins, and along high escarpments. Bulkheads are durable, long-lasting structures that can be designed to withstand a wide range of wave forces.



Shoreline Types in North Carolina

Modified with Engineered Structure

Modified engineered structure shorelines utilize bulkheads and riprap revetments to halt a loss of coastal property, to aid recreational activities, to keep shipping channels and ports open, for aesthetic purposes, or to simply hold the current shoreline in place.



Shorelines with Submerged Aquatic Vegetation, Mudflats, Oysters, and/or Woody Debris

Shorelines can have submerged aquatic vegetation (SAV), mudflats, oysters, and/or woody debris in the nearshore area. SAV is vegetation rooted in the bottom of a body of water (usually no deeper than 10 feet) that does not characteristically extend above the water surface and usually grows in beds (*bottom left picture*). Mudflats are relatively flat, muddy regions found in intertidal areas that are exposed during times of low tide. An oyster reef is defined as a structure created by oysters growing on a firm surface such as shell or rock where new oysters attach to the older oysters, often forming clusters. Woody debris is characterized by naturally occurring drowned trees, logs, and brush (*bottom right picture*).



Shoreline Types in North Carolina



Swamp Forests

Swamp forests are poorly drained forested wetlands or shrub/scrub areas that are regularly, occasionally, seasonally, or semi-permanently flooded by lunar tides and/or wind tides. In the estuarine system, swamp forests occur along the margins of freshwater and brackish sounds and along the lower reaches of coastal rivers and streams. Swamp forests can occur directly on the estuarine shoreline or grade down a slope to marsh. A common example of swamp forest is tidal cypress gum swamp.

Marshes

Coastal marshes are low-lying meadows of salt tolerant plants that occur along the margins of estuaries and along the shorelines of coastal rivers and streams. Most marshes along the estuarine shoreline are subject to regular or irregular flooding by lunar tides and/or wind generated water level fluctuations.



Sediment Banks

Sediment bank shorelines are defined as any natural coastal area without wetland vegetation. They usually consist of a gently sloping nearshore area and an associated steeply sloping, wave-cut/erosion scarp on the landward side of the beach. Sediment bank shorelines can also include characteristics such as sandy beaches or non-wetland vegetation up to the water's edge. Bluff shorelines are high sediment bank shorelines with a steep headland, escarpment, or cliff.

ACKNOWLEDGEMENTS

This guide is based on the recommendations of the North Carolina Estuarine Biological and Physical Processes Work Group for appropriate shoreline stabilization methods for the different North Carolina estuarine shoreline types (August 2006).



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