



Lower Machodoc Creek... Shoreline Treatment Options

Key to Shoreline Treatments

Scroll through the pages following the key to find a brief description of living shoreline treatments and other erosion control options used in the Lower Machodoc Creek assessment.

Non-structural:

- N-1 – Beach replenishment
- N-2 – Fringe marsh creation
- N-3 – Fringe marsh with coir log edging
- N-4 – Dune grass planting

Hybrid:

- H-1 – Marsh fringe with groins
- H-2 – Marsh fringe with sills
- H-3 – Marsh fringe with breakwaters
- H-4 – Beach replenishment with breakwaters
- H-5 – Marsh toe revetment

Structural

- S-1 – Revetment
- S-2 – Breakwater system
- S-3 – Spurs





Lower Machodoc Creek... Shoreline Treatments

A Word About Potential Shoreline Treatments

The living shoreline treatments and other erosion control options identified through the Lower Machodoc Creek assessment are conceptual in nature. There are no requirements for landowners to implement shoreline management actions based on this assessment. Site specific plans and consultations with shoreline regulators and qualified professionals are recommended before any changes are made. In many cases, permits may be required.



Virginia Institute of Marine Science Staff Inspects Hull Springs Farm Shoreline



Lower Machodoc Creek... Living Shoreline Treatments

Definition:

Living Shoreline Treatment

A shoreline management practice that provides erosion control benefits; protects, restores or enhances natural shoreline habitat; and maintains coastal processes through the strategic placement of plants, stone, sand fill and other structural and organic materials (e.g. bio-logs, oyster reefs etc.).



Photo: Burke Environmental Associates

See glossary for other terms used in this document.



Medium & High Energy Environments

Treatment Type N-1: Beach Replenishment



Photo: Burke Environmental Associates

Description:

Beach Replenishment, also called beach fill or beach nourishment, involves replacement of appropriately sized sand material to an existing beach which is experiencing erosion

Key Elements:

- **The most likely candidates for this treatment are existing public beaches and other special situations**
- **Beach replenishment does not stop erosion and will be periodically required, particularly after extreme storm events**



Low Energy Environments

Treatment Type N-2: Fringe Marsh Creation or Restoration



Photo: Northumberland Association for Progressive Stewardship

Description:

**Planting fringe marsh in
existing substrate**

Key Elements:

- ❑ **Provides erosion protection of shoreline in limited fetch locations (<1/2 mile) with minor boat wake action**
- ❑ **Good sites have irregular coastlines, shallow offshore waters and evidence of marsh grass nearby**
- ❑ **At low tide there must be room to establish plants between the bank and mid-tide line. If, at low tide, water remains at the bank – planting is not feasible using this treatment**
- ❑ **Where N-2 is indicated, plants are installed as needed – selective branch limbing may be needed for minimum of 6 hrs. of sun during growing season**



Low & Medium Energy Environments

Treatment Types N-2, N-3, H-1, H-2, H-3: Fringe Marsh Creation or Restoration

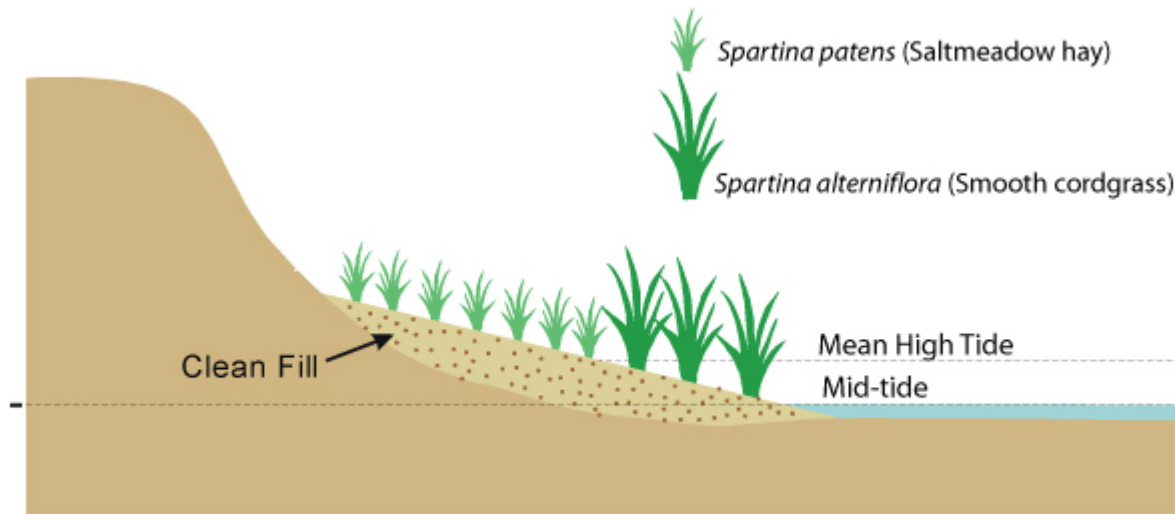


Diagram shows hydrologic zones and plant species recommended for fringe marsh creation in Lower Machodoc Creek. Fringe marsh creation or restoration is an important element of the treatment types listed.



Low Energy Environments

Treatment Type N-3:

Fringe Marsh Creation or Restoration with coir log edging



Description:

Fringe marsh creation with minor bio-degradable, structural support

Key Elements:

- ❑ **Biolog temporarily protects new plantings until they mature to provide erosion protection in limited fetch locations (< 1 mile) with minor boat wake action**
- ❑ **Often used in conjunction with sand fill to expand fringe marsh planting area and to protect from boat wake action**



Medium & High Energy Environments

Treatment Type N-4: Dune Grass Planting



Photo: USDA Cape May Plant Materials Center

Description:

Planting American beachgrass to stabilize moving sand and build dunes on the backshore of beaches

Key Elements:

- Native to mid-Atlantic coastal region; available through commercial nurseries; best planted in dormant stage from Oct. 15 - April 1; do not plant in summer
- Fencing should be used to prevent pedestrian traffic which can damage or kill plants
- Plant spacing, depth, fertilizer requirements and other information can be found online at:
<http://plant-materials.nrcs.usda.gov/>



Low Energy Environments

Treatment Type H-1:

**Fringe Marsh Creation or
Restoration with stone containment
groins**



Description:

**Fringe marsh creation on graded sand fill
stabilized by small stone containment
groins**

Key Elements:

- **Treatment can be used in shallow water areas to expand or create a graded, stable marsh planting terrace**
- **Appropriate for shorelines with minimal erosion, fetch less than 1 mile and limited boat wakes**
- **Wider planting terraces of 20' or more provide for erosion protection of shoreline and bank**



Medium Energy Environments

Treatment Type H-2:

Fringe Marsh Creation or Restoration with stone sills



Photo: Burke Environmental Associates

Description:

A segmented stone structure, parallel to the shore. Usually a foot or less above normal high water, located a short distance offshore to protect created fringe marsh

Key Elements:

- Sills hold additional fill material placed on channelward side of graded and planted marsh terrace and can be used in deeper waters with fetch exposures greater than 1 mile or frequent boating activity
- Sills height can be adjusted up or down & follow shoreline curves to provide tailored shore erosion control and habitat benefits
- Water flow - through, over the top, and via gaps between the sill permits free access to shoreline by marine life & allows better nutrient & detrital exchange with wetlands and tidal waters



Low Energy Environments

**Treatment Type H-2 (Maryland variation):
Fringe Marsh Creation or
Restoration with coir log edging and rock footer**

Description:

Fringe marsh creation with limited permanent structural support

Key Elements:

- Stone edge in front of marsh permanently protects new plantings after biologic decays and provides increased erosion protection in areas with greater fetch or increased boat wake action
- Typically used in conjunction with sand fill to create new or expand existing fringe marsh planting area; can be used in deeper waters

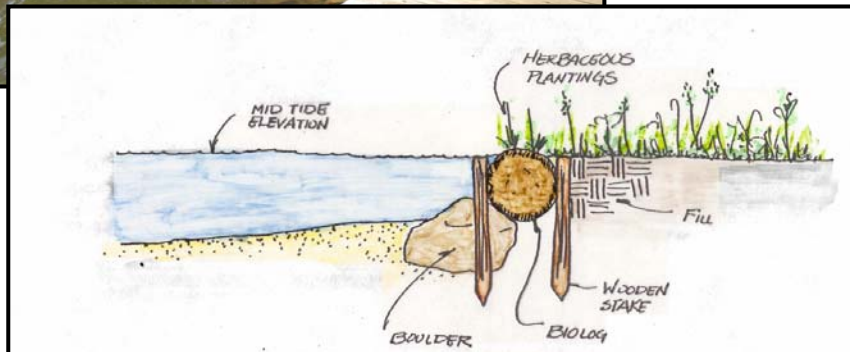


Photo & Drawing: Chesapeake Bay Foundation



Medium/High Energy Environments

Treatment Type H-3: Marsh Fringe Marsh Creation or Restoration with Breakwaters

Description:

Establishing a marsh fringe in conjunction with offshore stone breakwaters

Key Elements:

- ❑ **Massive stone structure erected offshore intercepts and protects from direct impact of incoming waves**
- ❑ **When attached to shoreline with sand fill a tombolo is formed upon which wetland vegetation can be planted in 3 or more zones keyed to hydrology, salinity etc.**
- ❑ **Often used to stabilize long shoreline segments**
- ❑ **Complex design considerations require experienced professional assistance**



Photo: Burke Environmental Associates



Medium/High Energy Environments

Treatment Type H-4:

Beach Replenishment with Breakwaters



Photo: Burke Environmental Associates

Description:

Establishing or replenishing a recreational beach using breakwaters

Key Elements:

- ❑ Massive stone structure erected offshore intercepts and protects from direct impact of incoming waves
- ❑ When detached from the shoreline, salients form and a low dune and beach grass can be incorporated on the backshore to protect the bank and provide a sand source to repair beaches after major storm events
- ❑ Requires extensive sand fill & heavy equipment for installation and materials placement
- ❑ Often used to stabilize long shoreline segments



Medium Energy Environments

Treatment Type H-5:

Marsh Toe Revetment



Photo: Karen Duhring, VIMS

Description:

Protecting the front edge of existing eroding marsh

Key Elements:

- Involves placement of a low profile, sloping stone revetment along the leading edge of the marsh; "spot" treatments possible for problematic areas
- Revetment is placed even with or not more than a foot above the marsh surface elevation
- Backfill is not used in conjunction with this treatment



Medium & High Energy Environments

Treatment Type S-1:

Revetment



Photo: Burke Environmental Associates

Description:

A sloping stone structure placed along eroding banks

Key Elements:

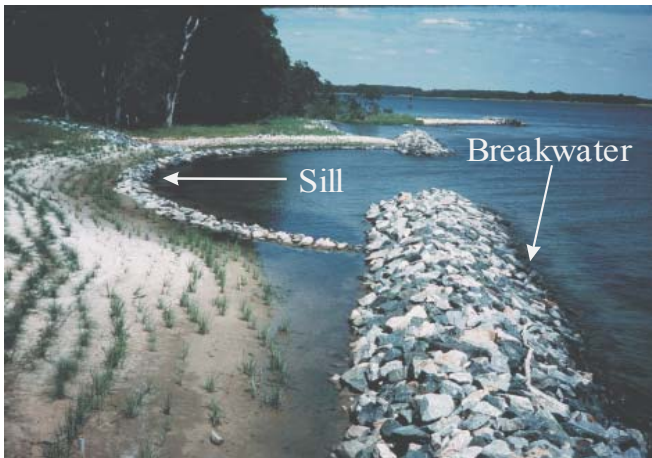
- ❑ Made of layered, well placed stone, concrete rubble or other materials
- ❑ Revetment height and scour depth at the toe of the structure are important design considerations
- ❑ Stone weights used in revetment design are sized to withstand expected storm surge and wave conditions



Medium & High Energy Environments

Treatment Type S-2:

Breakwater System



Description:

A series of offshore breakwaters designed to achieve site-specific shore erosion control and sediment transport goals

Key Elements:

- **May include supplementary sill and spur structures that work in conjunction with the breakwaters and habitat restoration features**
- **Work best when applied to at least a 300' area or an entire shoreline reach – terminating at a convenient reach break like an existing structure, inlet jetty, or a natural headland to minimize effects on adjacent shorelines**



Medium & High Energy Environments

Treatment Type S-3:

Spurs



Description:

A finger like extension of a structure extending channelward or parallel to the shoreline to achieve added erosion protection

Key Elements:

- ❑ **Can protect features leeward of the structure like a beach, channel or sill opening**
- ❑ **Also used to protect an adjacent beach downdrift from a terminal groin**



Lower Machodoc Creek... Living Shoreline Treatments

Glossary:

Branch limbing – Removing (pruning) branches from trees and shrubs that overhang the water in an effort to increase the amount of sunlight available for marsh plants.

Detritus – Organic debris formed by the decomposition of plants and animals.

Downdrift – The predominant direction material is carried as waves strike a shore and move “down” along a shoreline.

Fetch – The distance traveled by wind or waves across open water.

Leeward – Downwind; on or toward the side sheltered from the wind.

Salient – A bulge in the coastline projecting towards an offshore island or a breakwater, but not connected to it as in the case of a tombolo (see definition).

Scour – The removal of underwater material by waves and currents, especially at the base or toe of a shore erosion control structure.

Substrate – The bottom surface of a body of water which can be used as a site for attachment or rest. Substrates can consist of many materials including sand, stone, gravel and debris.

Tombolo – Sand accumulation between land and a detached breakwater (see treatment type S-2).



Lower Machodoc Creek... Living Shoreline Project

- **The Living Shorelines Project at Longwood University's Hull Springs Farm and Lower Machodoc Creek (Westmoreland County, VA) was made possible by a grant from:**

the National Oceanic and Atmospheric Administration through the National Fish and Wildlife Foundation

***This document prepared by :
David G. Burke & C. Scott Hardaway***

- **Partners include:**
 - **Longwood University**
 - **Clean Virginia Waterways**
 - **Burke Environmental Associates**
 - **Virginia Institute of Marine Science**
 - **Northern Neck Planning District Commission**
 - **Virginia Commonwealth University Biology Department**
 - **Northern Neck Soil and Water Conservation District.**