Living Shorelines Techniques

Management Practices

A brief summary is provided to convey contextual knowledge of different living shoreline techniques, ranging from natural vegetated slopes to off-shore breakwaters (Figure 1). The appropriate living shoreline technique for a particular site is dependent on the site characteristics, including slope, elevation, geomorphology, existing coastal resources, tide range, and hydrodynamic and transport processes. The key is to develop a natural interface between the land and the water, where erosion is decreased and ecosystem services are enhanced (Figure 2). For more complete information, visit the Systems Approach to Geomorphic Engineering (SAGE) website.

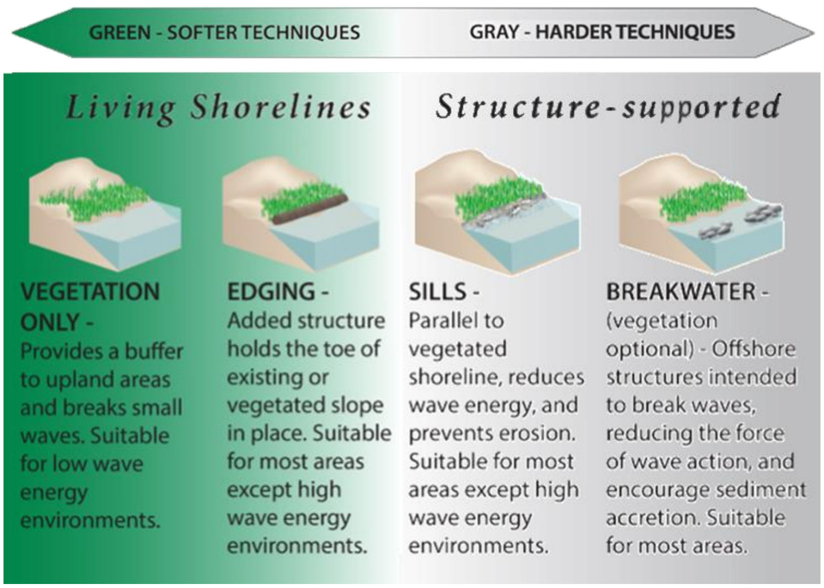

Figure 1. Soft to Hard range of Living Shoreline Techniques (adapted from NOAA Habitat Blueprint)

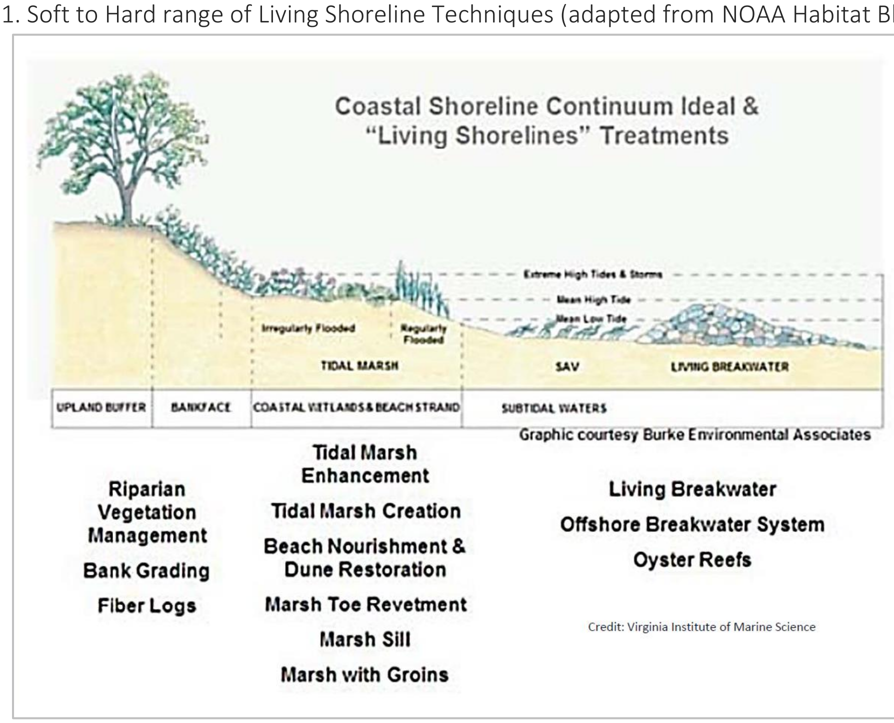

Figure 2. Coastal Shoreline Continuum Ideal & "Living Shorelines" Treatments

Nonstructural Techniques

Vegetation Maintenance/Restoration

Spartina patens plantings to restore tidal wetlands in Westbrook

Intertidal areas and stream banks

Planting wetland grasses and shrubs in low-energy areas increases the volume of roots and vegetative cover along wetland and riparian buffers. The increased plant mass inhibits bank erosion by softening small wave energies, holding sand and soil intact, absorbing rainfall, and acting as natural water filters. Nonstructural stabilization measures, such as natural fiber rolls ("coir logs") and/or coir fabric secured with temporary stakes may be needed to protect plantings from wind and wave damage. Coir log protection may also require replacement after a few years to enhance stabilization as plant mass continues to multiply.

Beach grass planting along dune at Lynde Point, Fenwick

Dunes and sandy backshore areas

Planting beach grass (*Ammophila breviligulata*) increases the volume of roots and vegetative cover to hold dune sand intact and deter sand dispersal by winds and wave surges. Temporary dune fencing is often needed to contain the sand and protect new plantings from being trampled.

Sand stockpiled for beach nourishment after Superstorm Sandy at Cove Island Park, Stamford

Beach Nourishment

Beach nourishment involves adding appropriate and complementary types of sand at a site to increase elevation and beach width at an eroded area. This creates or enhances habitat for wildlife and provides a buffer for upland banks from wave energies. Placement of sand during the lowest tide, wind, and wave conditions provides better opportunity for the supplemented beach sand to stabilize and compact.

Dune Creation

Dune construction at Stratford Point

Dune creation aids in rebuilding, reshaping, and stabilizing a dune, or hill of Aeolian (wind-blown) sand. Creation involves adding appropriate and complementary types of sand at a site to increase dune elevation and width. Typically, indigenous dune plants are also added to stabilize new dune sand. Hence, dune creation supplies new plant and wildlife habitat. Additional planting of some noxious species such as poison ivy helps deter trampling as the dune stabilizes.

Dune creation is usually performed in combination with beach nourishment to further limit the susceptibility of the new dune to erosion processes. In higher energy environments with marginal beach area, coir logs may be utilized as foundation material. Temporary dune fencing is also implemented to contain the sand and protect the new dune from trampling.

Organic, Nature-based Stabilization


Coir logs staked for erosion protection

Coir logs

Coir logs are rolls of natural fiber from coconut husks that can be used for temporary edge and toe stabilization of low marsh areas, dunes, banks, and slopes. Coir logs are staked into place to prevent sediment movement and promote root establishment. They are also used to protect new vegetation or restored wetlands. Coir fiber is very rot resistant and can last for several years, depending on environmental conditions.

Woody debris


Woody debris placed for dune protection at The Strand beach in Waterford

Woody debris may build up on shorelines through wind activity and storms, bank or bluff erosion, and felled trees washing ashore. The natural accumulation of woody debris serves as wildlife habitat, providing shelter for birds, small mammals, and juvenile fish species. Placement of woody debris such as driftwood or even discarded Christmas trees can also be used for toe stabilization of dunes, slopes, banks, and sand bluffs.


Root wads placed for bank stabilization on the Blackledge River, Colchester

Root Wads

Placement of tree root wads are a technique that provides toe stabilization for banks and slopes. They collect sediment and debris that enhances bank structure and protects new vegetation growth.


Oyster shell cultch placed as a marsh sill at Stratford Point

Shellfish Reefs

A cultch of oyster shells or shells put into aquaculture grade mesh bags are placed onshore as a natural bank stabilizer. They mimic a natural oyster reef and attract fish and other wildlife. The shells trap sediment to provide shoreline protection and prevent erosion by dispersing wave energy. In New England, the harsh winter temperatures limit oyster survival above the elevation of mean low water.


Ribbed mussels attached to saltmarsh grass

Incorporation of ribbed mussels into low marsh edges of saltmarsh grass (*Spartina alterniflora*) may be useful for promoting additional growth and increasing the process of sedimentation. These mussels naturally attach to the base of the grasses, which provides them shelter. The mussels contribute nutrients to the saltmarsh grass, stimulating its growth and increasing the ability of the grass to trap suspended sediments. Over time, the combination of growth and sedimentation builds up the marsh edge, slowing water currents and buffering wave energy.

Structure-supported or Hybrid Techniques

Riprap Sill protecting new tidal wetlands plantings in Westport

Sills

Stone sills of either small riprap or gabions are placed waterward and parallel to an existing or newly vegetated shoreline to contain sediments and attenuate wave energy, inhibiting marsh and upland erosion. Gapping the sills maintains tidal exchange and habitat connectivity, while also enabling waterfront access. The stone sills form new rocky shorefront habitat for intertidal plants and animals. They also provide toe protection, inhibiting wetland edge loss, and improve freshwater infiltration into the wetland.

Geotubes

These are woven sleeves of non-biodegradable geotextile fabric that are filled with sediment, which is usually native to the application site. They are buried with beach sand to form dunes, which are then planted with beach grass. The geotubes help to hold the dune sand in place while roots establish, and they also work to fortify the dune against storm surges.

Geotubes used for dune creation at Stratford Point

Reef ball placement at Stratford Point

Reef Balls

A reef ball is a hollow module with several different-sized openings made from a combination of sediment, shell material, and marine compatible concrete that is designed to mimic the structure and function of a natural reef. The hollow interior spaces and pH comparable to sea water enhance the appeal of the reef ball to colonizing organisms, which attract an assortment of fish that are able to swim in and out of the ball. The reef balls dissipate moderate and higher wave energies and allow sediments to become trapped behind them. Thus, they reduce erosion and increase sedimentation while providing attractive habitat for a variety of plants and animals.

Same site two years after reef ball placement

Offshore riprap breakwater at Fenwick Ave, Old Saybrook

Offshore Breakwaters

Offshore breakwater systems constructed of large riprap, concrete blocks, or wood can be utilized in moderate and higher wave energy areas to provide additional protection for the establishment of nearshore coastal resources in combination with living shoreline techniques such as beach nourishment and dune creation. They are strategically placed parallel to the shoreline to dampen wave energy, reduce erosion, and promote sedimentation inshore. Installing smaller breakwaters with gaps between them allows for greater tidal exchange, habitat connectivity, and waterfront access. Depending on the substance and location selected for an offshore breakwater, it may be capable of colonization by aquatic organisms, transforming it to a “living” breakwater.

To learn more about living shorelines in Connecticut, read the Connecticut’s Living Shoreline Projects story map.