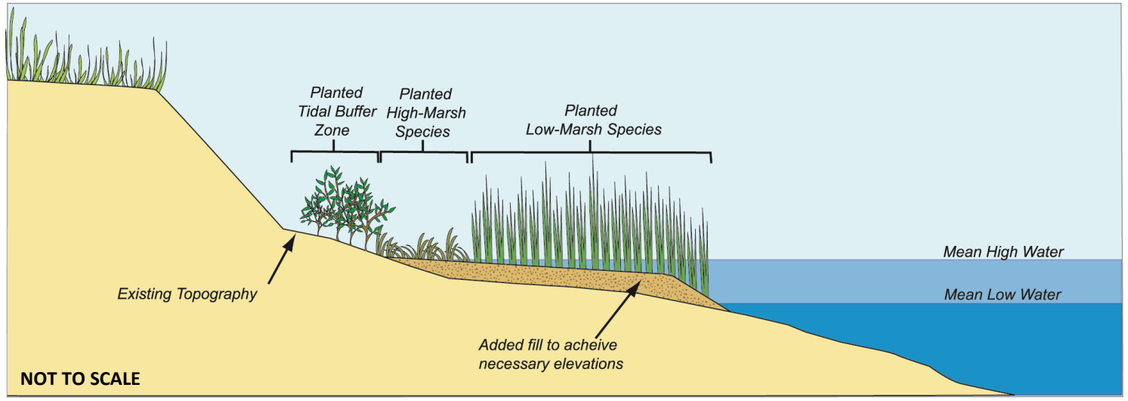
Natural Marsh Creation/Enhancement

Marsh vegetation, such as native low (*Spartina alterniflora)* and high marsh (*Spartina patens*) species, can be planted along the shoreline. Roots help hold soil in place, and shoots will break small waves and increase sedimentation – vegetation projects such as this are a minimally invasive approach.

Objectives: dissipates wave energy, habitat creation, shoreline stabilization

Design Schematics



Case Study

Sachuest Point Restoration, Middletown, RI

The U.S. Fish & Wildlife Service and The Nature Conservancy developed this project at the Sachuest Point National Wildlife Refuge to help the area better withstand the impacts of sea-level rise and coastal storm surge. Storm surge and wave erosion, combined with the lack of sediment replenishment from estuaries whose rivers have been dammed, left the existing salt marsh at a point where it could not keep up with sea-level rise. With little opportunity to migrate, due to being constrained by Third Beach, the best solution to protect Sachuest Point was to raise the elevation of the marsh itself.


Sachuest Point, Middletown, RI
Photo courtesy of Jennifer White

Project Proponent	USFWS, The Nature Conservancy, Save The Bay, Town of Middletown, Norman Bird Sanctuary
Status	Initial construction and planting: Spring 2016.
Permitting Insights	Care was taken to prevent sediment plumes from entering the Sakonnet that could negatively affect winter flounder. Testing was done to ensure material was clean and of appropriate grain size. Ensured that elevations remained within the tidal marsh elevation range.
Construction Notes	Sand was trucked to the site and placed on the marsh with machines. The surface was contoured to create high and low marsh elevations. Salt tolerant grass plugs grown out from local seed sources were planted in the spring following sediment placement.
Maintenance Issues	Fencing was used to protect plant plugs from winter grazing by Canada Geese. Additional planting will occur in 2017.
Final Cost	$634,000 for sediment placement; $36,100 for growing of plant plugs.
Challenges	A drought during the growing season of 2016 caused mortality of some plant plugs, and maintenance of anti-grazing fencing during/after winter storms to prevent damage by geese.

Design Overview

Materials	Native marsh plants appropriate for salinity and site conditions. Plugs of marsh grass can be planted to augment bare or sparse areas.[11] Sediment may be necessary if the project area needs to be filled to obtain appropriate elevations, to provide a suitably gradual slope for marsh creation, or to enable a marsh to maintain its elevation with respect to the sea-level rise.[11] Bird exclusion fencing may be necessary to avoid predation while plants develop.[16]
Habitat Components	Salt marsh; Tidal buffer landward of the salt marsh; Coastal beach; Mud flat.
Durability and Maintenance	Plants that are removed or die during the early stages of growth must be replaced immediately to ensure the undisturbed growth of the remaining plants. The removal of debris and selective pruning of trees is also a good maintenance practice to ensure that sunlight reaches plants. Protection measures, such as fencing, must be taken to keep waterfowl from eating the young plants.[6] Ongoing maintenance of invasive species and runoff issues will be important to the long-term success of the project. After significant growth has occurred only periodic inspections may be necessary.
Design Life	It is important to recognize that design life may be shorter in the future given changes in sedimentation rates, accelerating sea-level rise and other climate change impacts.
Ecological Services Provided	Increases water infiltration, uptake of nutrients, filtration, denitrification and sediment retention.[2,3] The extensive root systems of marsh vegetation help to retain the existing soil, thus reducing erosion while plant stems attenuate wave energy.[11] A healthy salt marsh may reduce wave energy. Marshes provide habitat for many species of plants and animals, and maintain the aquatic/terrestrial interface.[2] Marshes also provide natural shore erosion control, better water quality, recreation and education opportunities, and carbon sequestration (blue carbon).[12]
Unique Adaptations to NE Challenges (e.g. ice, winter storms, cold temps)	Including roughened surfaces, such as emergent vegetation can help break up ice sheets.[4] Marshes can respond better to ice if gentler slopes (6:1-10:1) are used and by incorporating shrubs. Planting in the spring will allow vegetation time to become established before it has to withstand ice.[8,13] Consider using pre-planted mats to compensate for a shorter growing season. Hardy, salt-tolerant shrubs (e.g., *Iva frutescens* and *Baccharis halimifolia*) are well-suited for shorelines affected by ice.[13]

Natural Marsh Creation/Enhancement

Fringing marsh living shoreline projects have proven successful with or without protective structures such as fiber rolls or sills, but projects without protective structures are most likely to be successful on sheltered waterways where there is low natural wave action and limited wave action from boating activities.

Allin's Cove, Barrington, RI
Photo courtesy of Janet Freedman

Fringing Marsh Project, Indigo Point, S. Kingstown, RI
Photo courtesy of Janet Freedman

Regulatory and Review Agencies

Maine	Municipal Shoreland Zoning, Municipal Floodplain, ME Dept. of Environmental Protection, ME Land Use Planning Commission, ME Coastal Program, ME Department of Marine Resources, ME Department of Inland Fisheries and Wildlife, ME Geological Survey, and ME Submerged Lands Program.
New Hampshire	Local Conservation Commission, NH Natural Heritage Bureau, NH Department of Environmental Services (Wetlands Bureau, Shoreland Program, and Coastal Program), and NH Fish & Game Department.
Massachusetts	Local Conservation Commission, MA Dept. of Environmental Protection (Waterways and Water Quality), MA Division of Fisheries and Wildlife (Natural Heritage and Endangered Species Program), MA Environmental Policy Act, and MA Office of Coastal Zone Management.
Rhode Island	Coastal Resources Management Program, and RI Dept. of Environmental Management.
Connecticut	Local Planning and Zoning Commission, and CT Department of Energy and Environmental Protection.
Federal (for all states)	U.S. Army Corps of Engineers, National Marine Fisheries Service, U.S. Environmental Protection Agency, and U.S. Fish and Wildlife Service.

Siting Characteristics and Design Considerations

Selection Characteristics	Detail
ES Energy State	Low to moderate. Works best in low energy sites (i.e. less than 2 feet of short waves, low current and low storm surge).[3] Sites with a fetch >5 miles are not recommended.[15]
EE Existing Environmental Resources	Coastal beach; mud flat; salt marsh
SR Nearby Sensitive Resources	Endangered and threatened species. If the project is proposed in or adjacent to habitat for protected wildlife species or horseshoe crab spawning areas, there may be limitations on the time of year for construction.[1] Shellfish beds and essential fish habitats will restrict where a marsh can be extended. Construction may produce short term habitat impacts, but in the long term, the marsh area should provide enhanced wildlife and fisheries habitat.
TR Tidal Range	Low to high
EL Elevation	MLW to MHW; Above MHW. For low marsh, the lowest grade should be MTL and extend up to MHW. High marsh plantings should extend between MHW and MHHW.[5] Tidal buffer should be planted above highest observable tide.
IS Intertidal Slope	Flat. With slopes 5:1 (base:height) and flatter, plants can be utilized without additional erosion control.[3] Between 5:1 and 3:1, marsh projects may not work without additional toe stabilization.[3] The wider the intertidal zone, the more effective the marsh is at dissipating wave energy.[7] A minimum width of the planting should be 10 feet.[15]
BS Bathymetric Slope	Flat to moderate
ER Erosion	Low to moderate
Other Characteristics	**Detail**
Boat Traffic	If boat wakes are perceived to be a significant problem, the site should be treated as a higher energy site and may be more suitable with a sill or other toe protection.
Ice Sensitivity	Planted marsh areas with gentle slopes and intermixed shrubs will handle ice the best. Shrubs have a significant advantage over other types of vegetation because they have deep fibrous root systems and a structure that remains in place throughout the winter months.[8] Plant in the spring to allow plants to become established well before ice becomes a concern.[8]
Climate Vulnerability	Planted marsh areas may have a difficult time adapting to sea level rise.[7] If there is space on a project site, designs should anticipate marsh migration in response to sea level rise.[13]
Surrounding Land Use	Existing structures on site, like seawalls, may force living shoreline projects to have a steeper slope than desirable. Seawalls will limit the inland migration potential of the salt marsh in the future. Steeper slopes leave little opportunity for wave energy dissipation.[13] Marshes require sunlight to thrive; trees must be pruned or removed to allow for at least four to six hours of sunlight a day;[6] this will increase vegetation growth.[11,15] Although it is possible to create a marsh on most shorelines, marsh creation is not recommended for sites where they are not a natural feature along comparable natural shorelines.[11]