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HABITAT RESTORATION
ENVIRONMENTAL MANAGEMENT

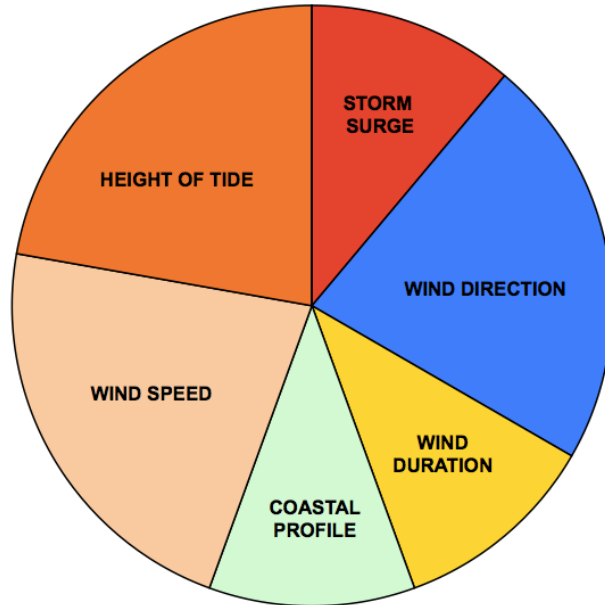
LIVING SHORELINE INNOVATIONS (REV) by Gordon Peabody
gordonpeabody@gmail.com Edited by Camille Smokelin, Tufts University, 2023



Image by Gordon Peabody. Reducing erosion risk at Ryder Cove, Chatham MA

Safe Harbor advocates for the use of "living shorelines" to offer a diversity of vegetation that can adapt to changing conditions. This is referred to as "Coastal Resiliency" and is a sought-after management strategy. Erosion reflects multiple cofactors: shoreline profiles, wind direction, tide height, wind speed, and wave fetch (distance a wave can travel before striking land). Living Shorelines offer a layered response system, of diverse Native vegetation over sand/shells/coir or other subsurface materials, which can be jacketed by coir fabric and secured with wire or fiber. Successful erosion management requires careful assessment of exposure and risk.

COASTAL EROSION CO-FACTORS



Safe Harbor Image, Cape Cod Bayside Experience Based, by Gordon Peabody

These multiple co-factors must interact for significant erosion to occur. Erosion may be minimal or non-existent, when most, but not all, of the co-factors are in play. “Normal”, synergistic erosion events, when they do occur, based on our experience on nourishment sites, are usually 1/3 cubic yard per linear foot of shoreline. Our Bayside nourishment sites receive 1 cubic yard per foot.

NEARSHORE ALTERNATIVE: INNOVATIVE, LIVING OYSTER REEF



Inter Tidal, Near Shore Oyster Reef. Image The Nature Conservancy.

Reduces storm wave energy underwater, in low-velocity zones, while providing habitat biomass.

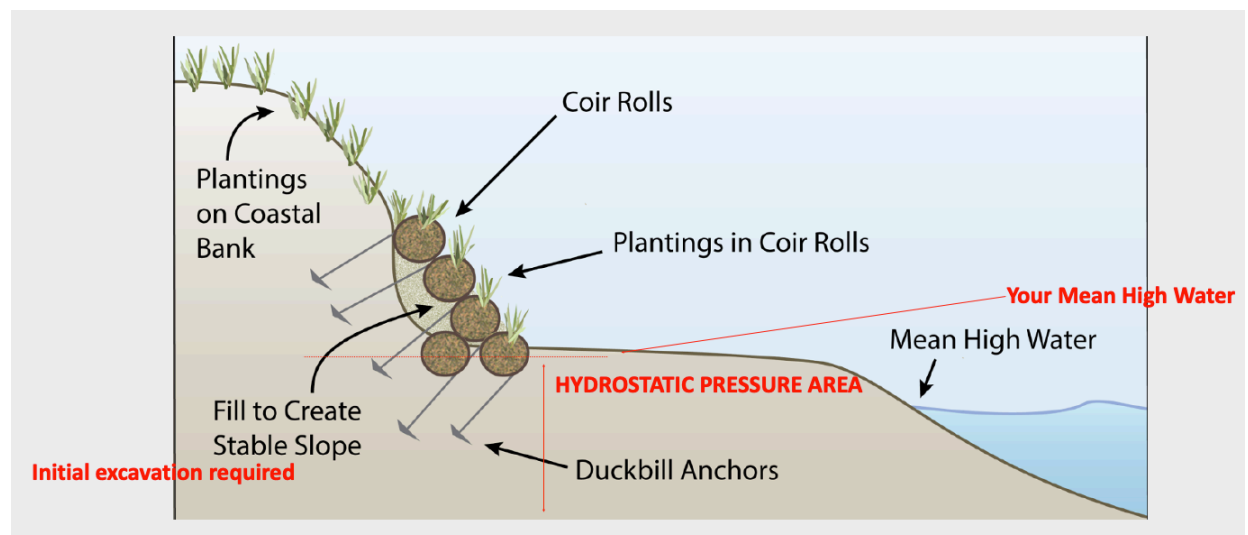
COIR COCONUT HUSK PRODUCTS

Safe Harbor is advocating for innovative, weighted Coir strategies, using Native shells inside coir to offset the tendency to float and wander, during surge events. Stone weighted Coir may seem intuitive but stones are not indigenous to Cape beaches. Native shells are indigenous materials and when the Coir deteriorate, the native shells can remain, instead of a pile of stones. Coir has gained popularity, because they are relatively light weight, easy to maneuver and resilient. Those same qualities have them roaming from their installations, when the anchoring fails during flooding, because hydrostatic pressure can release the anchoring systems.

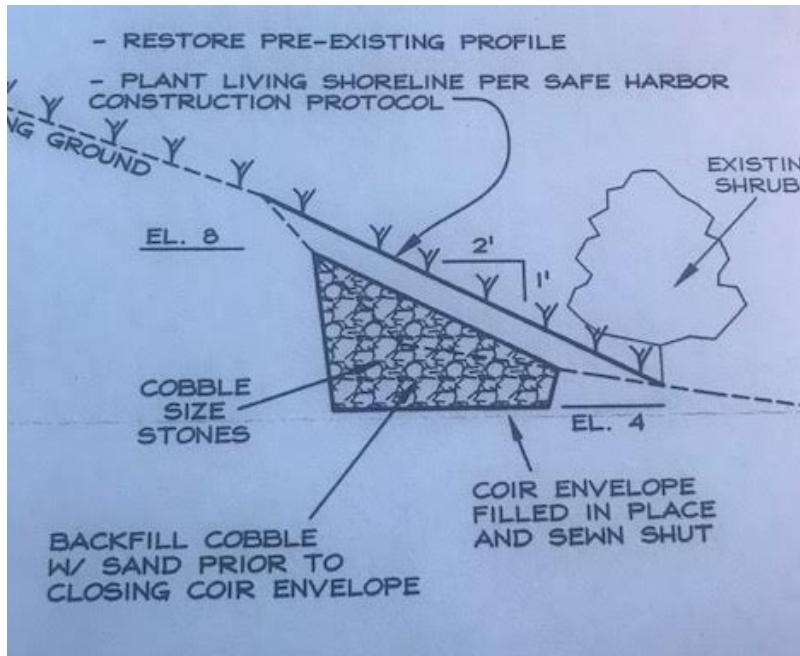
Sample Fiber Wrapped Coir Usage. *Image Delaware Living Shorelines Committee*



Sample Wire Wrapped Coir. *Image by G. Peabody*
Coir Will Fail In Velocity Zones If Not Properly Secured, Covered & Planted With Vegetation



INTRODUCING NON-FLOATING, BALLASTED COIR



Coconut Fiber Effectively Absorbs Wave Energy But Also Floats. We Have Used Varying Degrees Of Stone Ballast, Mixed Inside The Coir Envelope to Counteract Flotation. At some Point This Stone Strategy Gets Defined by Regulators As a Structure. Protective Coastal Structures Are Usually Prohibited In MA. Only Limited Approvals Have Been Issued On The Outer Cape. We Have Been Experimenting With Native Shell Ballast Weight Material See Page Seven.



Fully “Ballasted Coir”, in freshwater, with native plantings. *Muskegon Lake Watershed.*

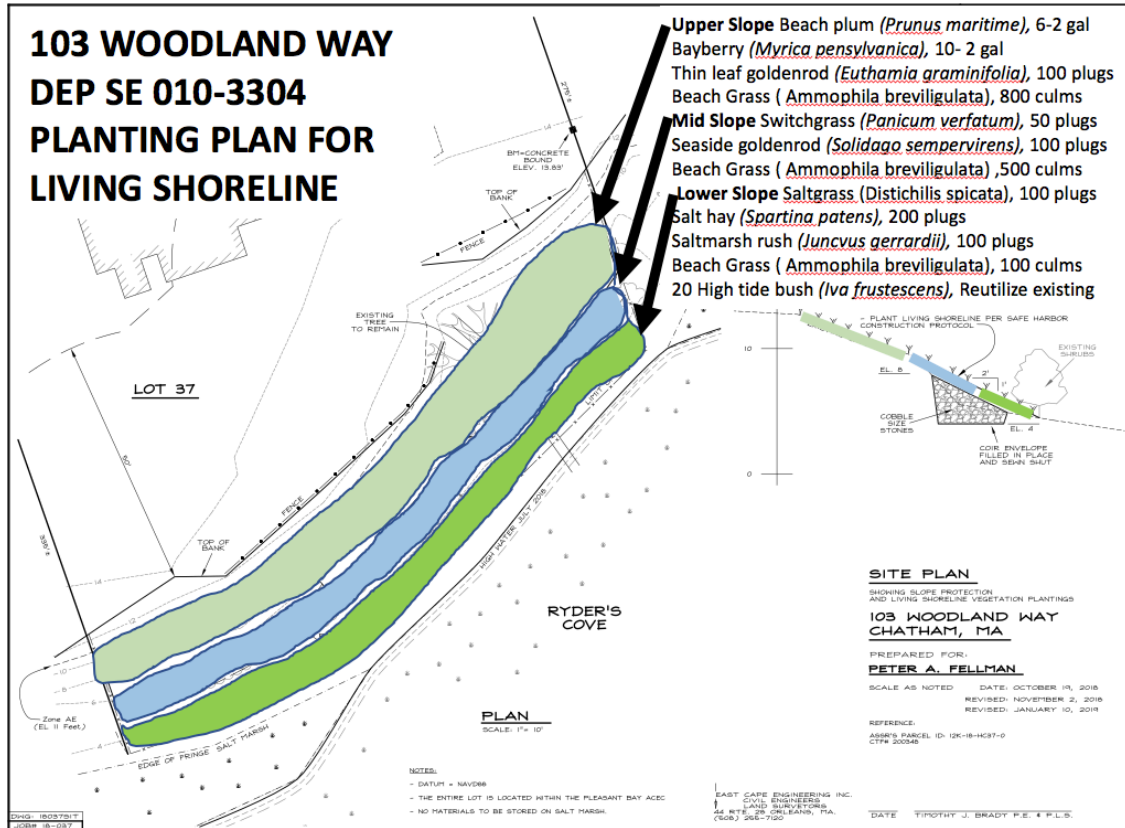


Image by East Cape Engineering. Approved Ballasted Coir, showing details of diverse layered, Native vegetation planted above compatible nourishment. Chatham, MA. Ballasted Coir Project approved in Chatham, Wilkenson/Safe Harbor, with detailed diversity of plantings, with management and monitoring plan, including irrigation. Safe Harbor workers performed the planting activity. Limited renourishment and minimal replanting were required.



Image G. Peabody, stone ballasted coir with nourishment and vegetation 1st year



Stone Ballasted Coir Living Shoreline Project in Chatham. *Image by G. Peabody.*
Detail Showing Second Year Growing Season and Layered Vegetation.



Stone Ballasted Coir Project in Chatham, Third Year. *Safe Harbor Image by K. Anderson.*

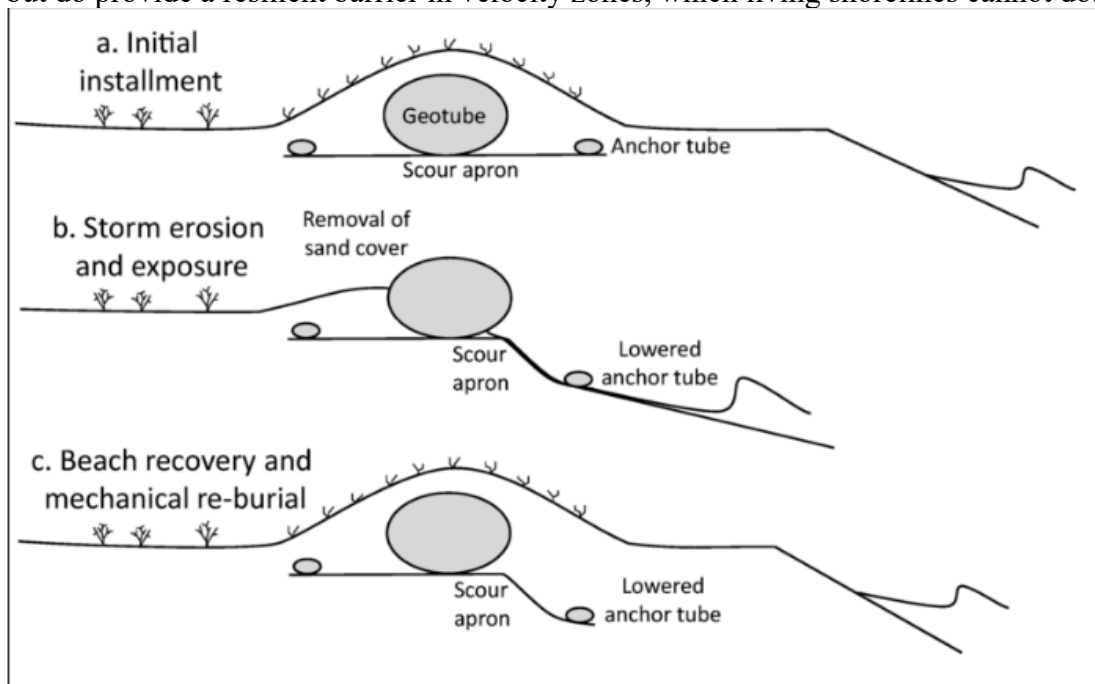


EXPERIMENTAL BALLASTED COIR Using Native Shells. *Images Camille Smokelin,*

Our idea of utilizing indigenous Native Shells introduces stabilizing weight through the use of a recycled, more compatible, acceptable, natural Native product. While full shells might tear into the coir envelope, shell pieces would not have the same impact. We would introduce the shells throughout the coir, with the goal of creating a more resilient, sustainable system, requiring lower density anchoring. Safe Harbor advocates for Natural Systems, such as Living Shorelines. **Any form of coir still needs to be nourished, secured, planted, monitored and managed.**

“OTHER”: GEO TUBES (which we do not recommend)

Geotextile fabric or polyester sand socks, wet filled with sand slurry, which bleeds out, leaving sand. Heavy, bulky and requiring infrastructure to implement. These still require nourishment but do provide a resilient barrier in velocity zones, which living shorelines cannot do.



Profile view of a single geotube emplaced as hard core covered with sand to represent a dune in general position and function