



Living Shorelines Design Options

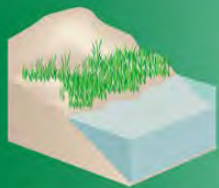
Devon Eulie & Tracy Skrabal

HOW GREEN OR GRAY SHOULD YOUR SHORELINE SOLUTION BE?

GREEN - SOFTER TECHNIQUES

GRAY - HARDER TECHNIQUES

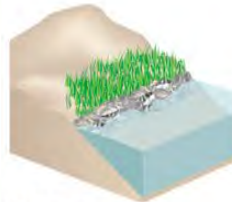
Living Shorelines



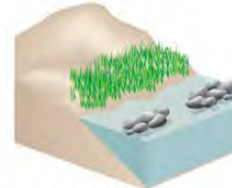
VEGETATION



EDGING -

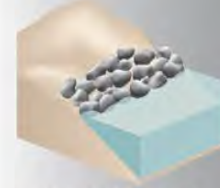


SILLS -

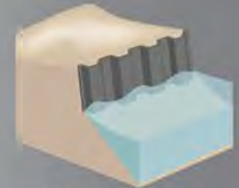


BREAKWATER -

Coastal Structures



REVETMENT -



BULKHEAD -

Review of Shoreline Stabilization Techniques



So why living shorelines?

Camp Albemarle Post-Hurricane Florence

Pre- and Post-Hurricane Matthew, New River, Sneads Ferry

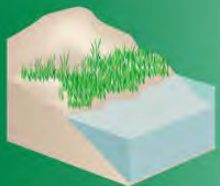


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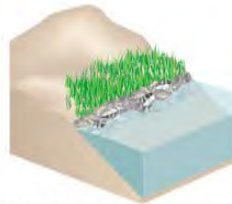
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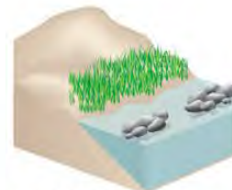
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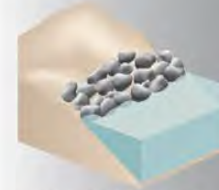
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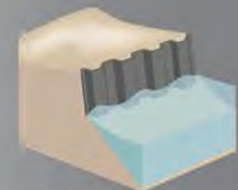
SILLS -



BREAKWATER -



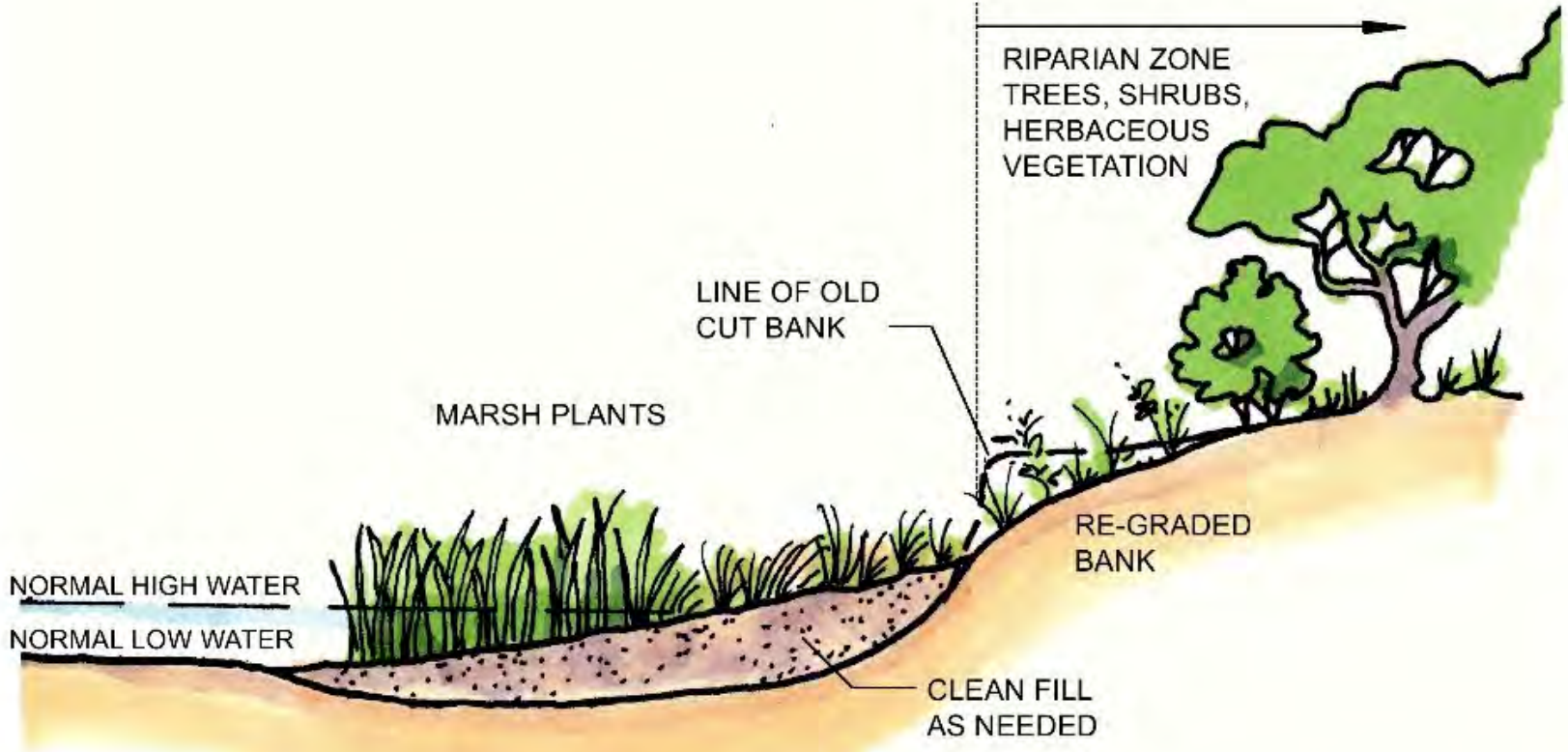
REVETMENT -



BULKHEAD -

Coastal Structures





**VEGETATION PLANTING WITH
BANK RE-GRADING**
not to scale

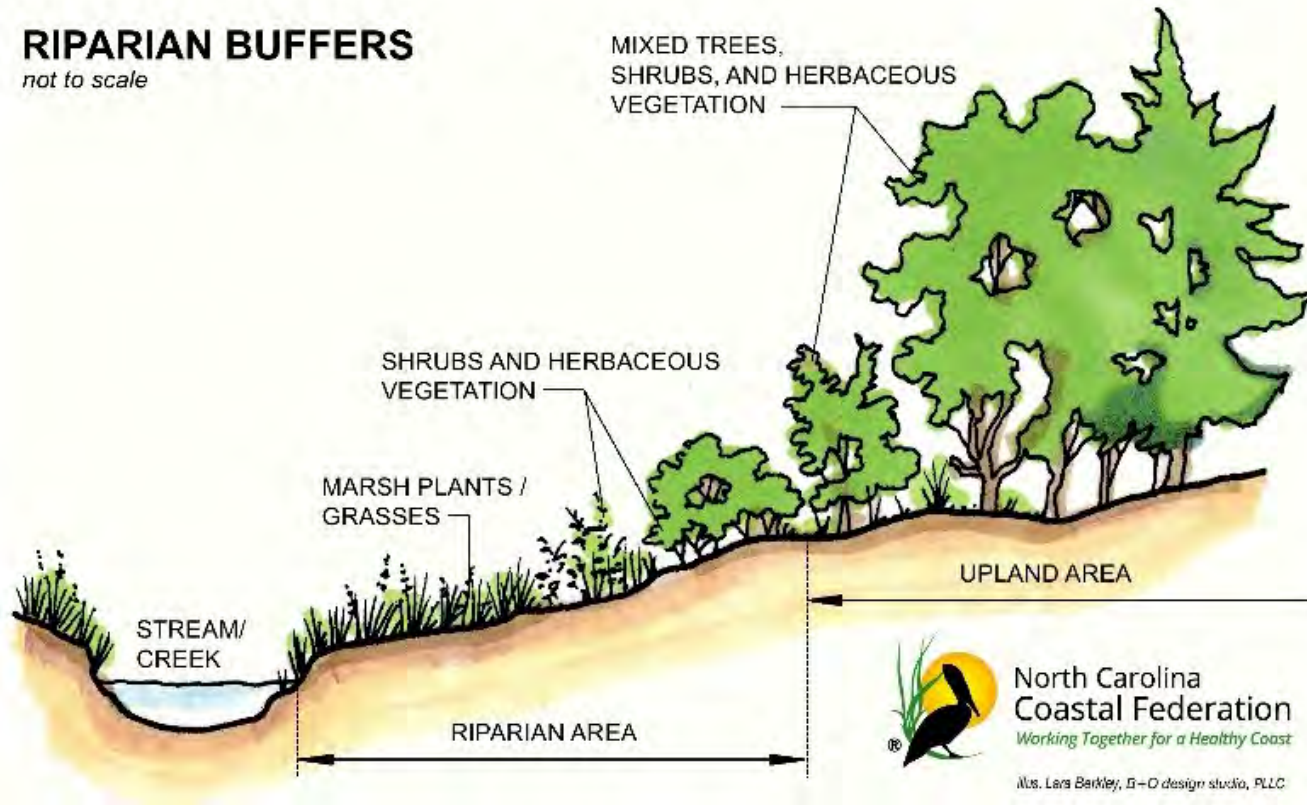


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Coastal Federation
Working Together for a Healthy Coast

illus. Lara Berkley, B+O design studio, PLLC

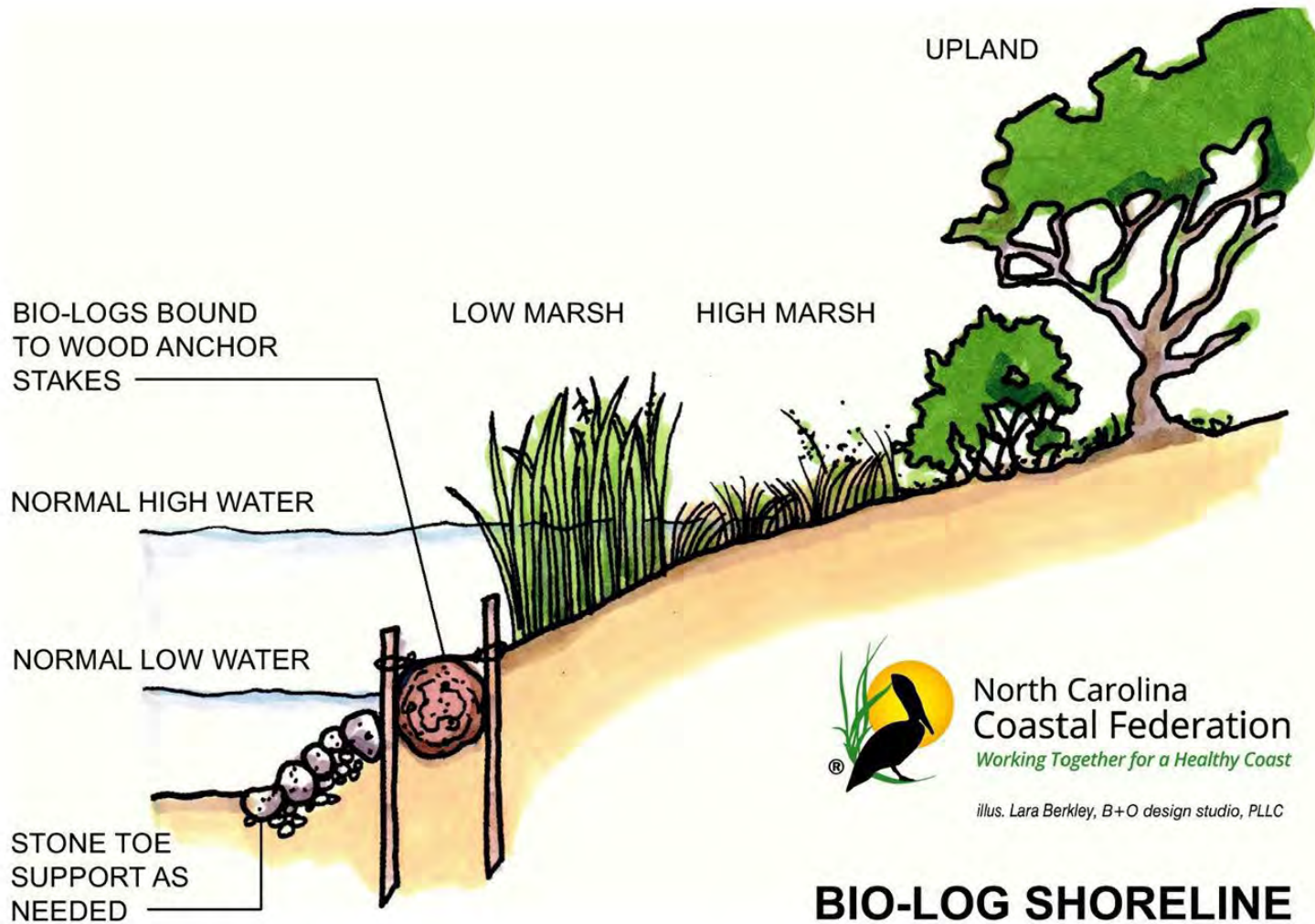
RIPARIAN BUFFERS

not to scale



Riparian Buffer Restoration with Marsh Creation





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BIO-LOG SHORELINE
not to scale



Marsh Plantings and Biologs

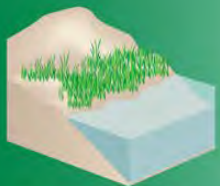
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Living Shorelines

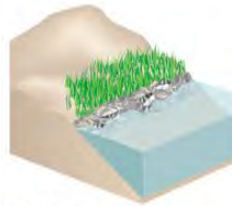
Coastal Structures



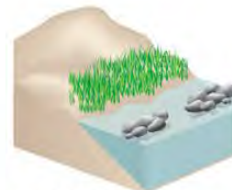
VEGETATION



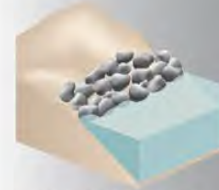
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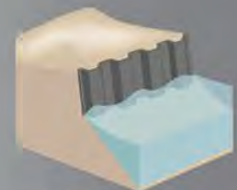
SILLS -



BREAKWATER -



REVETMENT -



BULKHEAD -

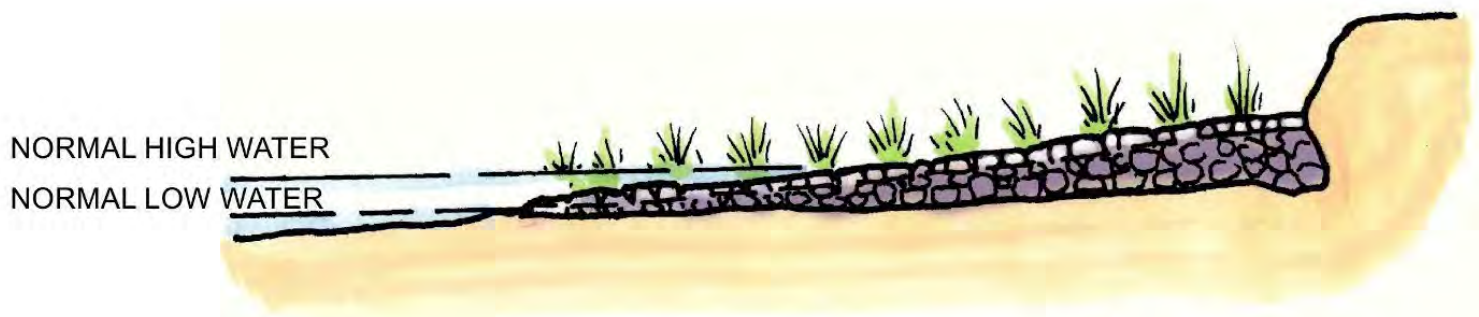
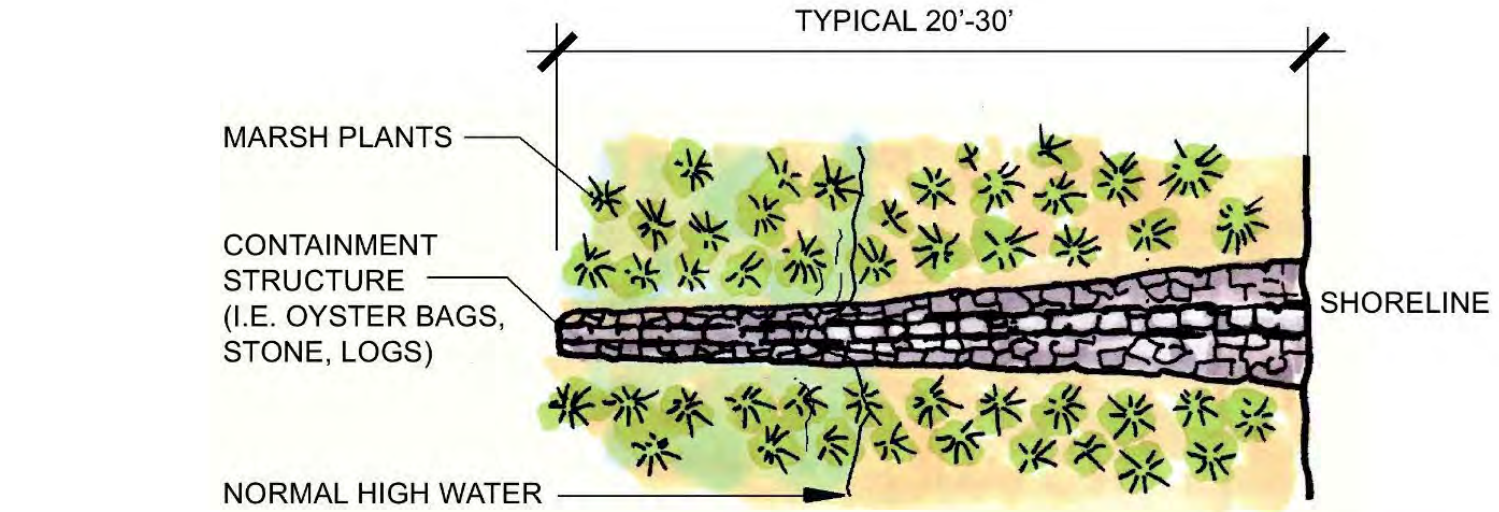


Living Shoreline (Hybrid) Projects



Photo: North Carolina Coastal Federation





**CONTAINMENT STRUCTURES
WITH PLANTINGS**
not to scale



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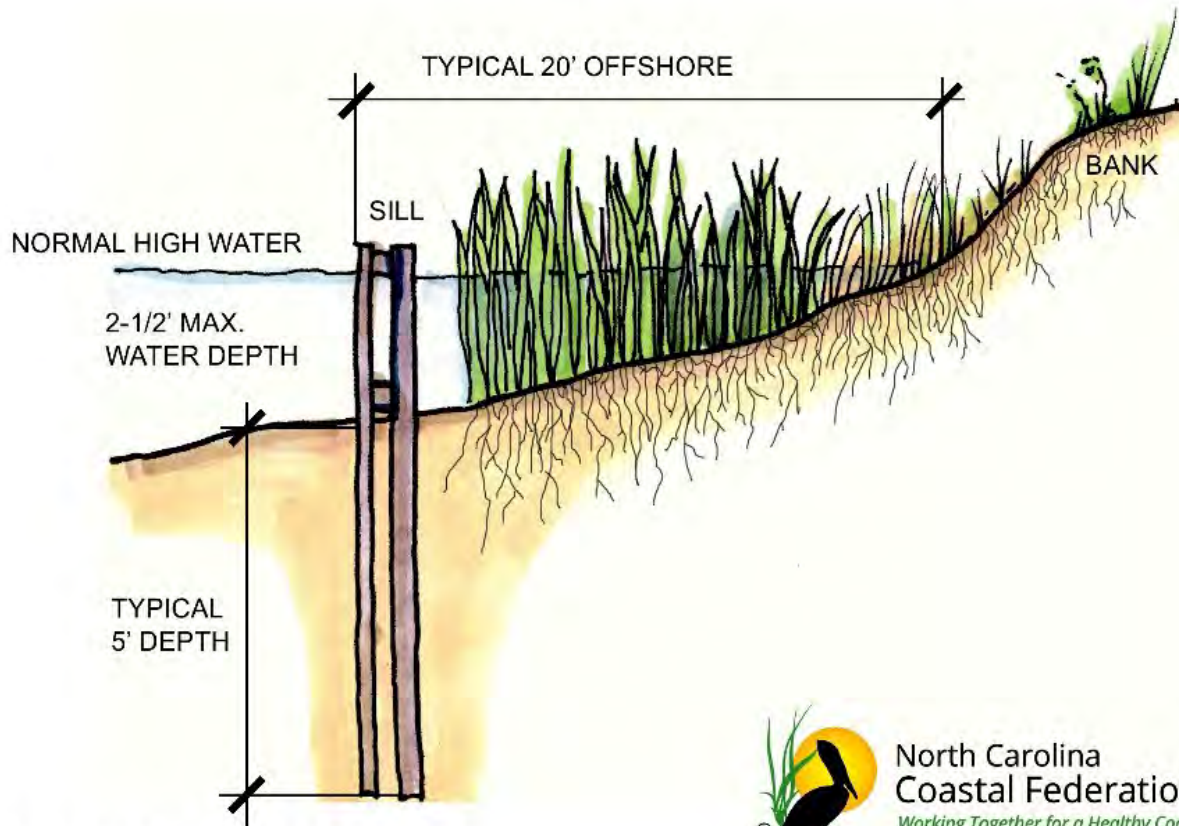
Stone Containment Structures



**Stone Containm
Structure**



Stone Containment Structure



VERTICAL WALL SILL
not to scale



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Vertical Wall Living Shoreline Sills

Vertical Wall Sills



Photos: North Carolina Coastal Federation

3 OPTIONS: OYSTER REEF / SILL WITH PLANTINGS

not to scale

EXISTING OR RESTORED MARSH GRASSES



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Use of Oyster Domes For Living Shorelines



Photos by North Carolina Coastal Federation

Typical Costs for Oyster Dome Project Morris Landing, NC

Typical costs for 150 linear feet*:

Plantings: 1,500 plants @ \$1.50 = \$750

Domes: 200 @ \$90/dome= \$18,000

Delivery of domes (from VA): \$1,500

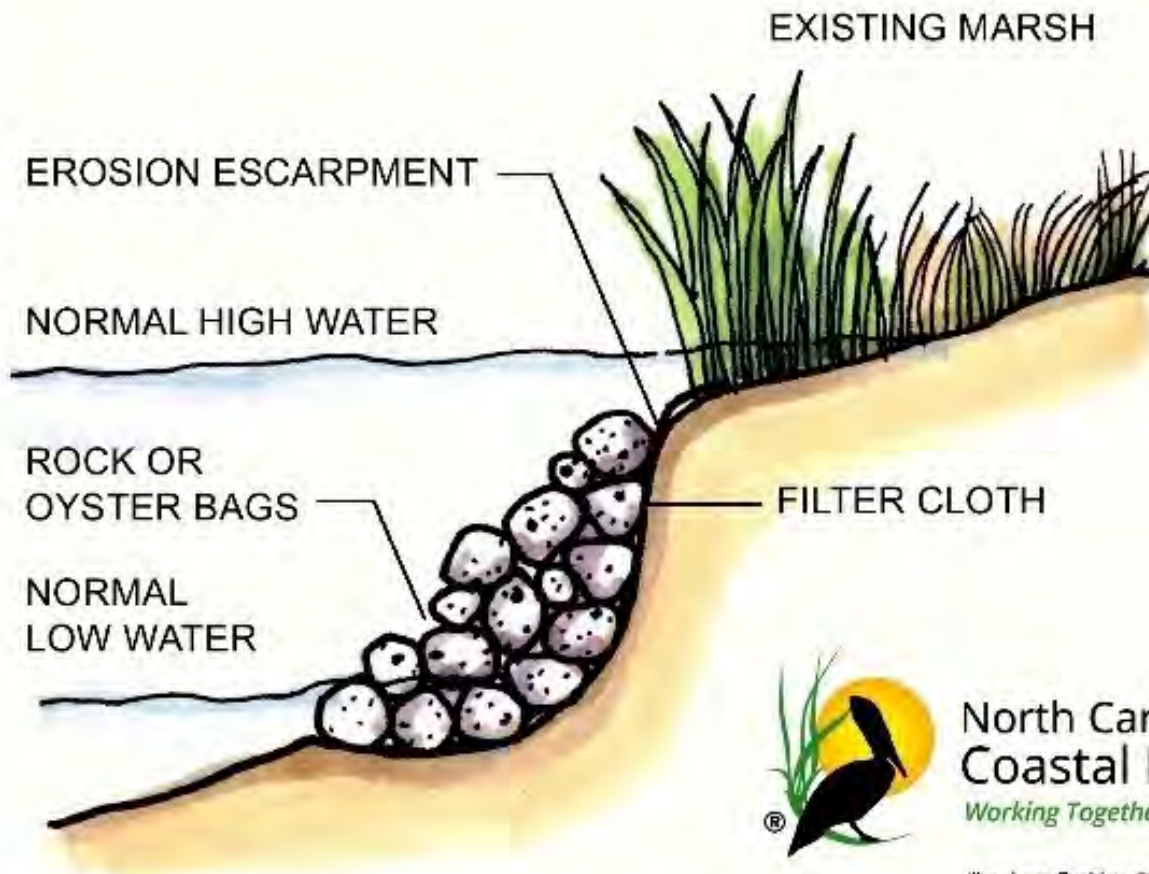
Installation of domes: \$7,000

Total cost = \$27,250, or \$182/ft.

(For comparison: \$9,083 for 50 feet)



* Note: Costs of sills vary significantly by size of structure, mobilization/demobilization costs, location, availability/transport of material, and market conditions.



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MARSH TOE REVETMENT

not to scale

Oyster Shell Bag Living Shorelines



Photo: North Carolina Coastal Federation



Typical Costs for Oyster Shell Bag Marsh Toe Revetments

Typical construction costs for 50 linear feet*

700 bags, 175 bushels @ \$3.00/bushel
= \$525 (14 bags/lf)

3 rolls of mesh @ \$125/roll = \$375

Bagging frame = \$100

Labor, \$5.00 per bag = \$3,500

Plantings, 1,500 plants @ \$1.00 =
\$1,500

Total cost = \$6,000 or \$120/linear ft.



* Note: Costs of stone sills vary significantly by size of structure, mobilization/demobilization costs, location, availability/transport of material, and market conditions

Oyster Shell Bag Sills at Jones Island



Photo: North Carolina Coastal Federation



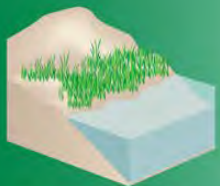
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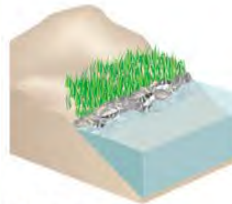
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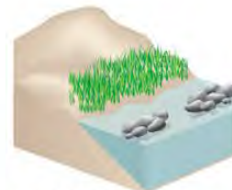
VEGETATION



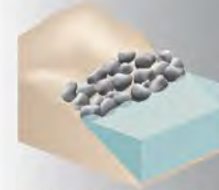
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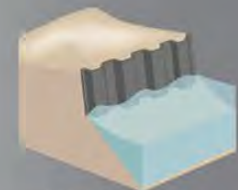
SILLS -



BREAKWATER -



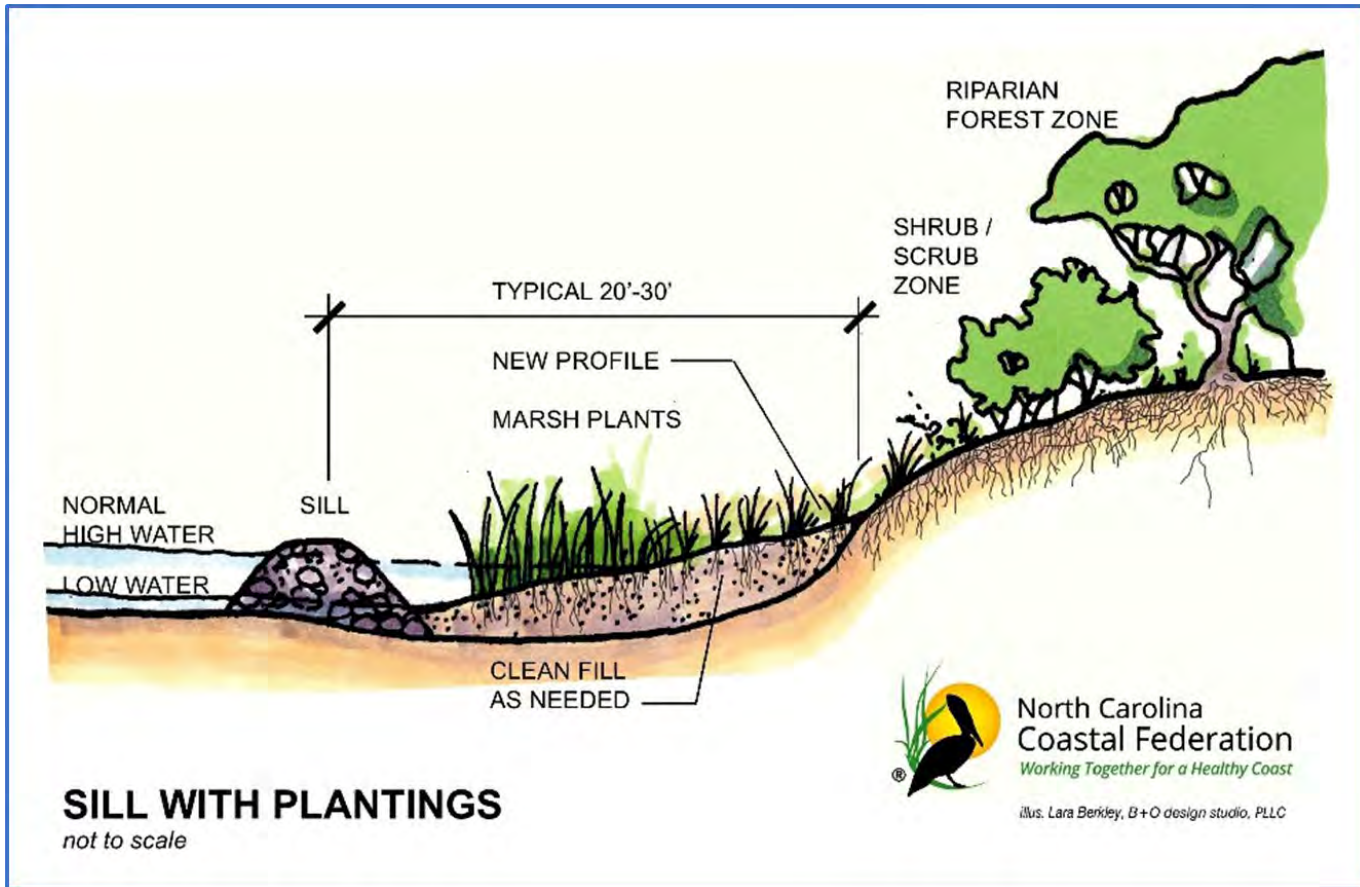
REVETMENT -



BULKHEAD -

Coastal Structures





Living Shoreline Sills With Plantings

Typical Costs for Stone Sills



- Stone installed (materials + labor) @ \$150-\$200/linear foot=
 - \$7,500-\$10,000
- Plantings, 1,500 plants (1,500 square feet) @ \$1.00/per =
 - \$1,500
- **Total cost = \$9,000- \$11,500**

Typical construction costs for 50 linear feet of stone sill *

* Note: Costs of sills vary significantly by size of structure, mobilization/demobilization costs, location, availability/transport of material, and market conditions



Stone Sills with Marsh Plantings



Photo: North Carolina Coastal Federation

Stone Sills with Marsh Plantings



Columbia, North Carolina (Albemarle Sound)

Pivers Island, Beaufort, North Carolina
(Beaufort Channel)



Photo: North Carolina Coastal Federation



Edenhouse Boat Ramp, Chowan River, Edenton, NC



Edenhouse Boat Ramp, Chowan River Edenton, NC 2020

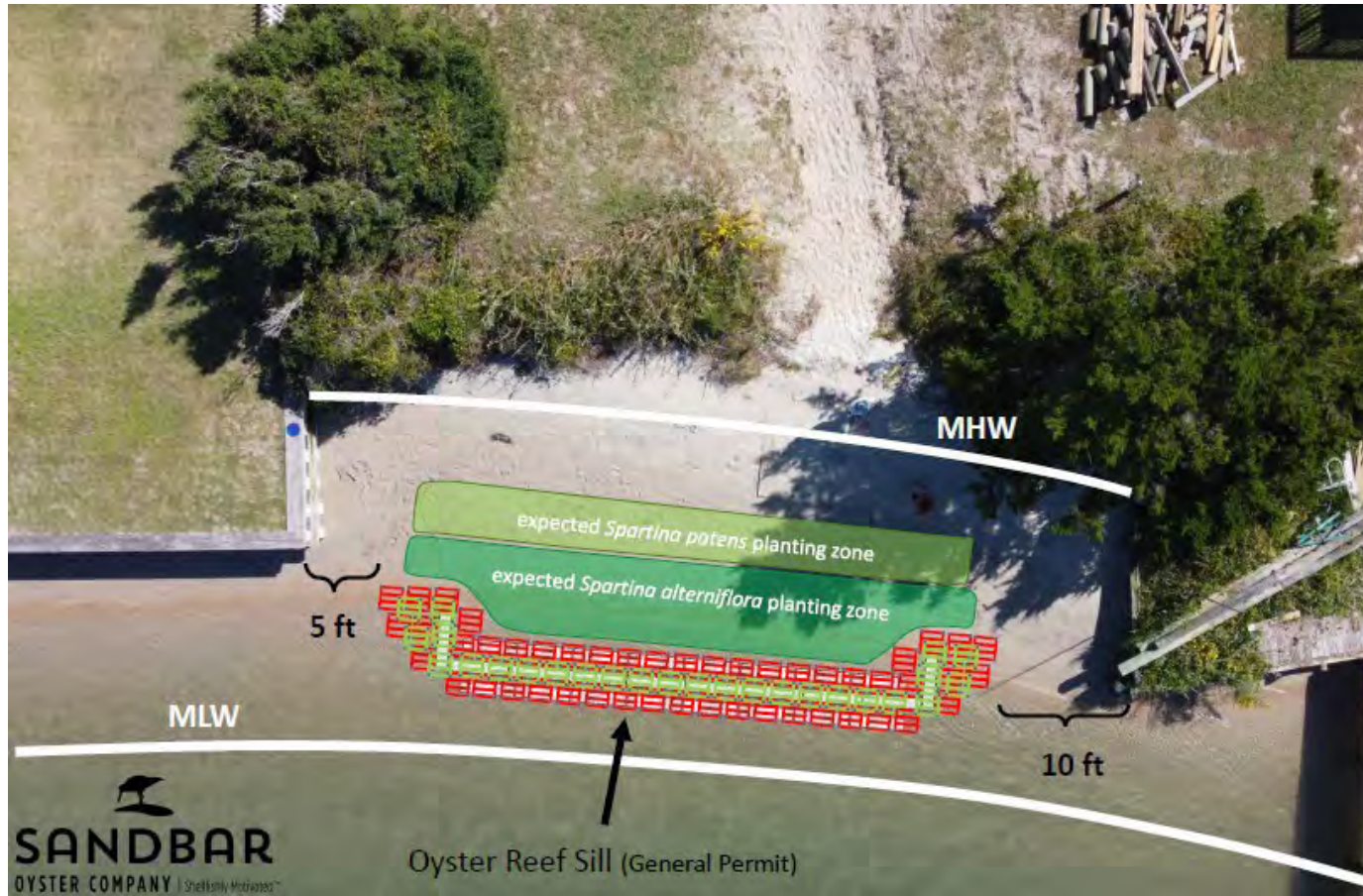




Innovative Approaches

Living Shorelines: Innovative Approaches

Oyster Catcher™ from Sandbar Oyster Company



Living Shorelines: Innovative Approaches

Oyster Catcher™ from Sandbar Oyster Company



Figure 10. Examples of oyster growth on stacked Oyster Catcher™ Tables (top; 2 tables each stack); rows of single Oyster Catcher™ Tables (bottom) and close-up of oyster growth on Tables (bottom insert) 18 months after deployment in North Carolina.



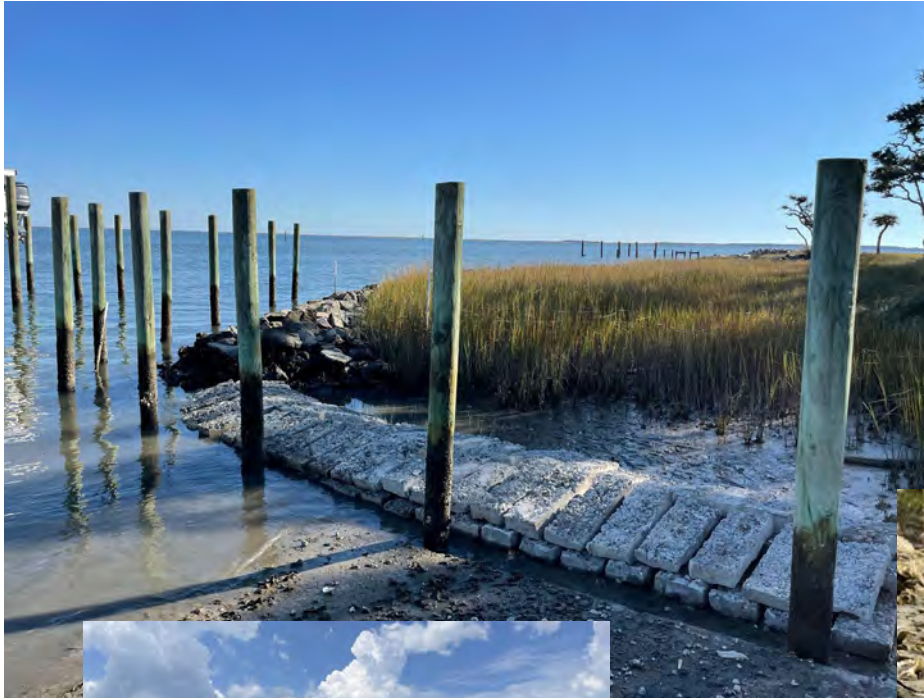
Surf City Soundside Park 090622

Living Shorelines: Innovative Approaches- Oyster Castles®

Oyster Castles® from Allied Concrete alliedconcrete.com



QuickReef™ (Restoration Systems) Living



Bulkhead & Rip-Rap Revetment Enhancement Projects

- Bulkhead or revetment enhancement projects can be utilized when existing structures are already in place or if there are infrastructure conflicts
- Elements such as rip-rap, marsh plantings, or other shoreline plants can provide wave dissipation and habitat
- These features can mitigate the effects of erosion on the existing structures and extend the life of the structure



Photo: North Carolina Coastal Federation

North Carolina Erosion Control Costs Estimates*

*Costs vary across regions, material costs and market conditions

- ❑ **Oyster Sills** (Including Marsh Toe Revetments) with Marsh Plantings
\$100-\$250/ linear foot
- ❑ **Stone Sills** (Marsh Toe Revetments)
\$125-\$300/ linear foot
- ❑ **Vertical Wall Sills** (Wood or Vinyl)
\$125-\$300/ linear foot
- ❑ **Rip-Rap Revetments**
\$150-\$500/linear foot
- ❑ **Bulkheads**
\$150-\$500/linear foot

*Costs are based on
typical residential
settings and conditions*



Questions?