



PROGRESSIVE BIOENGINEERING:

**The Latest Developments in Non-structural Alternatives for
Shoreline Stabilization**



Based on Site Specific Criteria



If a beach has a base
elevation.

Based on Site Specific Criteria



If a beach has a base elevation.



The function a fringe marsh plays.

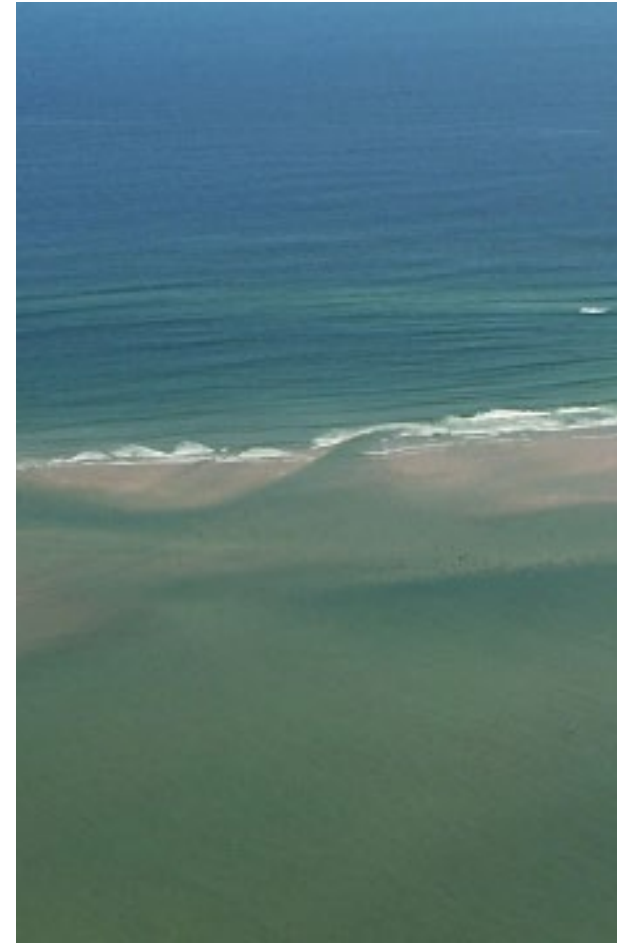
Based on Site Specific Criteria



If a beach has a base elevation.



The function a fringe marsh plays.



Near shore characteristics like fetch, water depths, sand bars, and location within a given littoral cell.

Bioengineering Strategies

Importance of Fringe Marshes
in Coastal Stabilization

Bioengineering Strategies

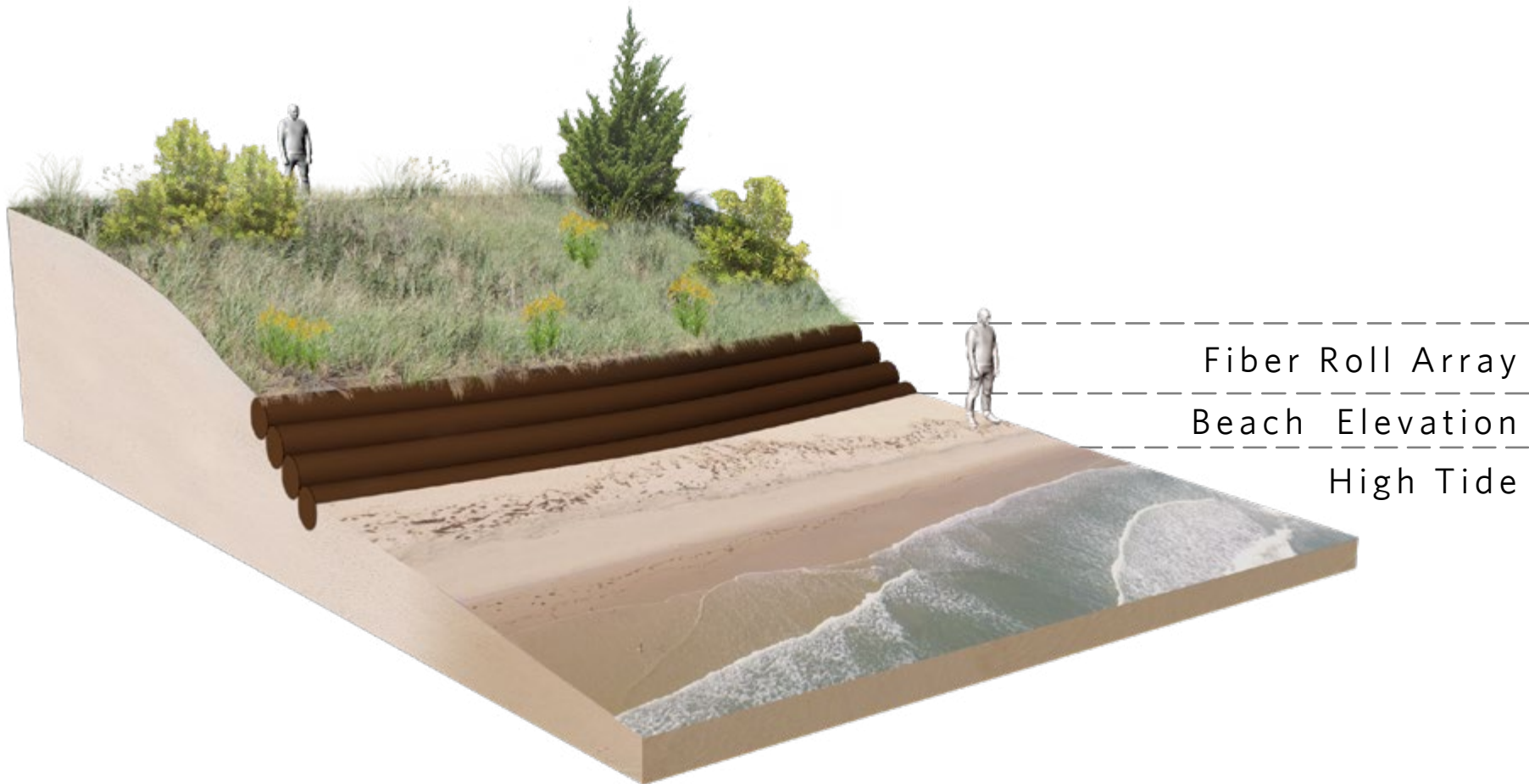
Importance of Fringe Marshes in Coastal Stabilization

- Woven coir-filled mats used as a growing medium.
- Pre-vegetated to establish prior before installation.



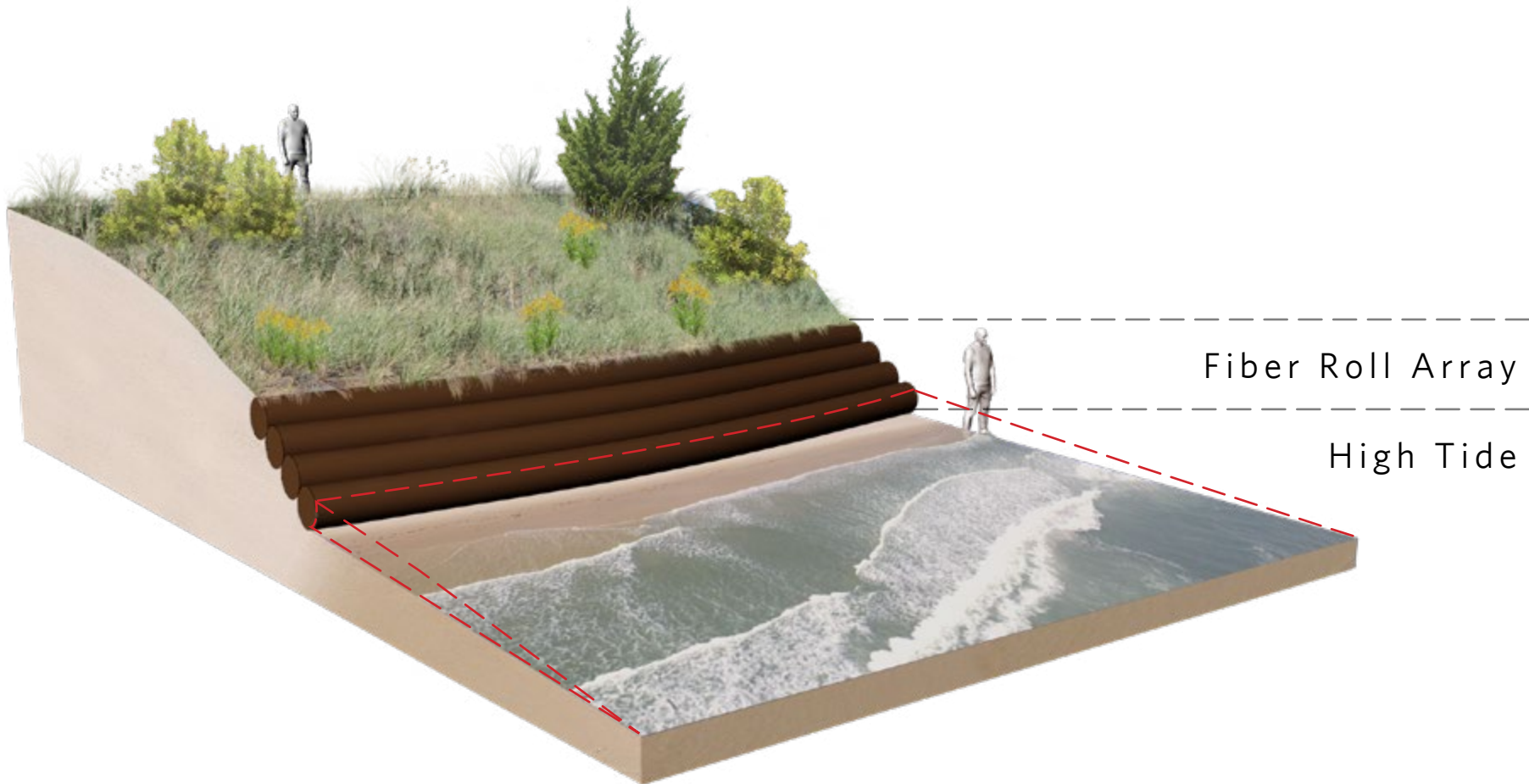
Bioengineering Strategies

Importance of Fringe Marshes in Coastal Stabilization



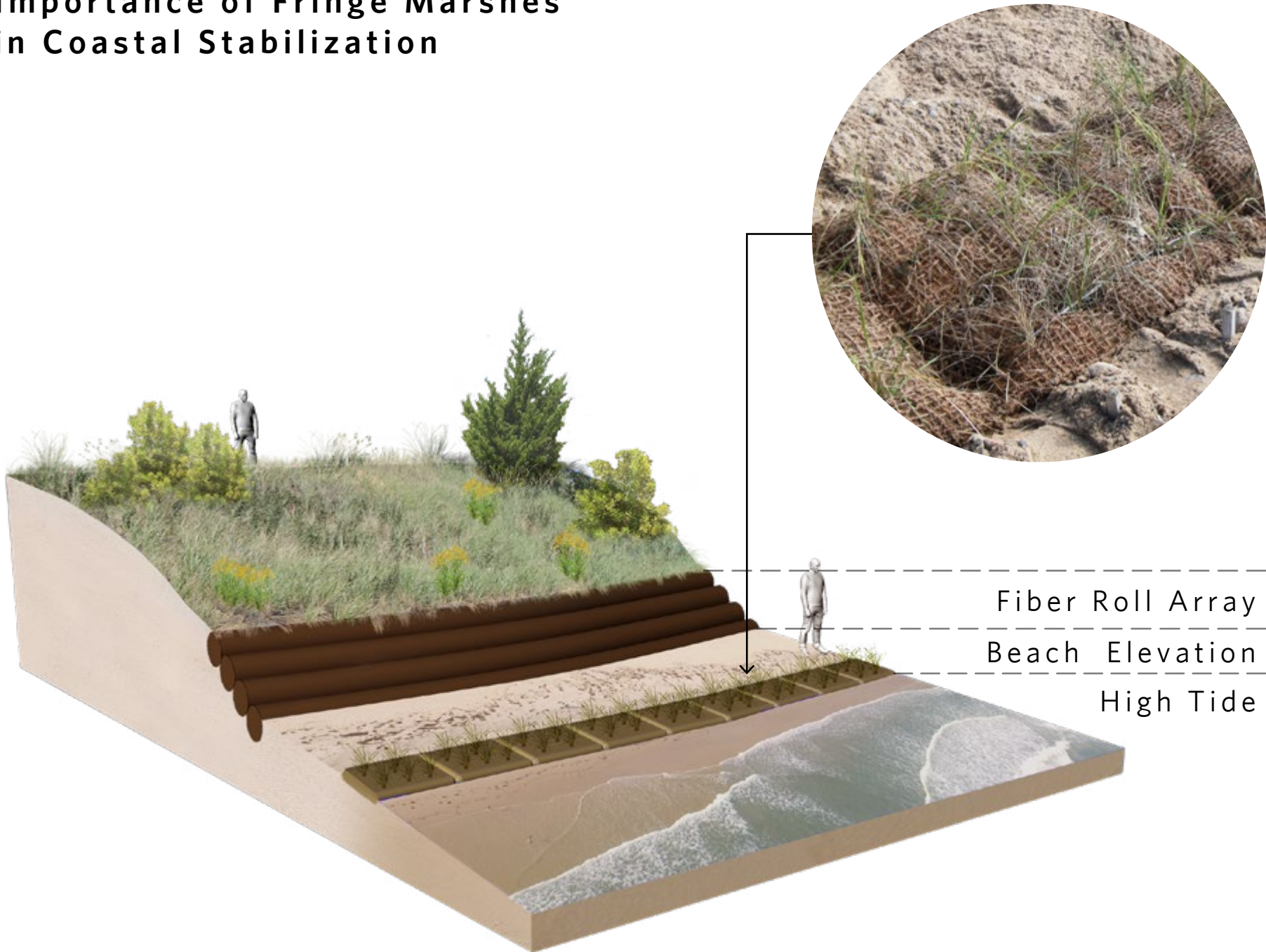
Bioengineering Strategies

Importance of Fringe Marshes in Coastal Stabilization



Bioengineering Strategies

Importance of Fringe Marshes in Coastal Stabilization



Installation & Case Studies

Fringe Marshes

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Installation & Case Studies

Fringe Marshes

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Installation & Case Studies

Fringe Marshes

1 2 3



Installation & Case Studies

Fringe Marshes

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Installation & Case Studies

Fringe Marshes

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Installation & Case Studies

Fringe Marshes

1 2



Installation & Case Studies

Fringe Marshes

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Installation & Case Studies

Fringe Marshes

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Installation & Case Studies

Fringe Marshes

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Installation & Case Studies

Fringe Marshes

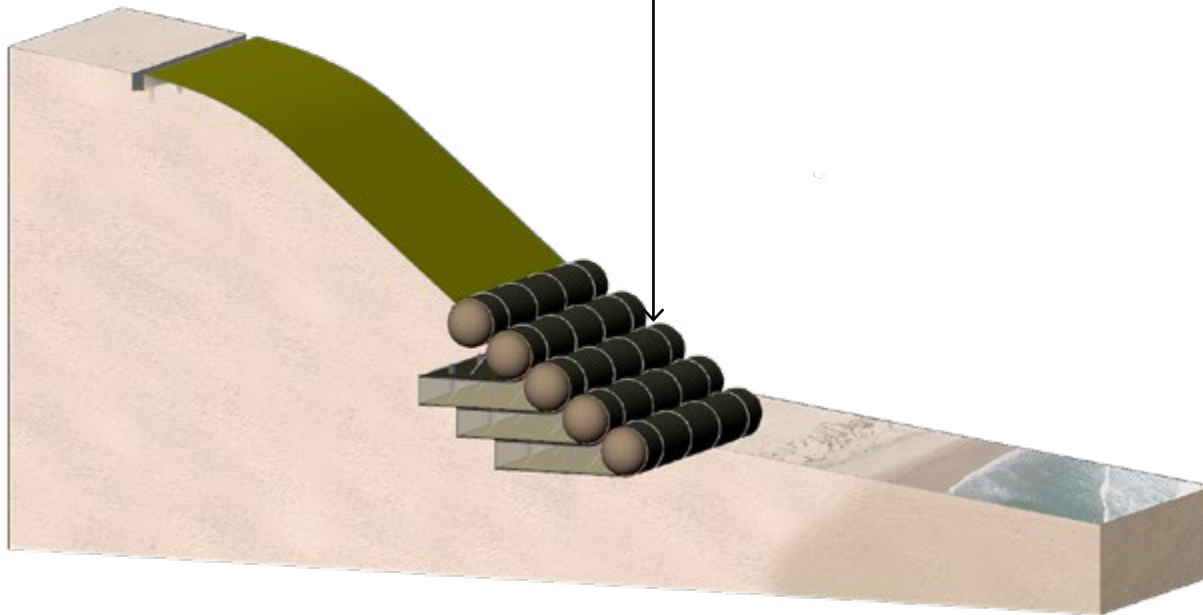
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Bioengineering Strategies

Materials for Stabilizing Coastal Banks

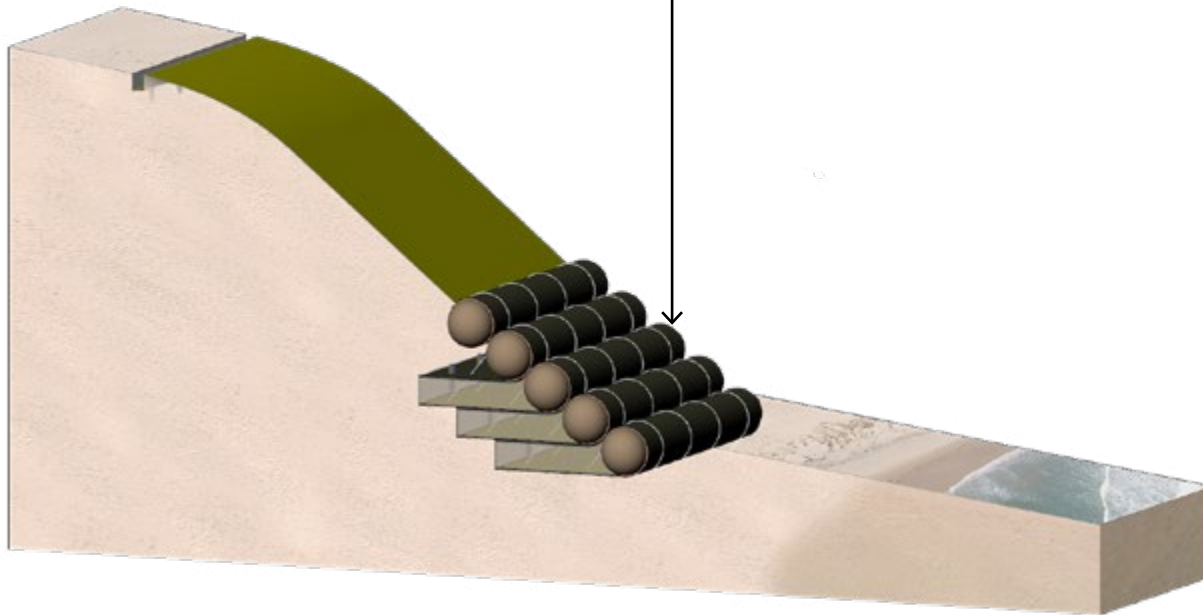
- Coir fiber roll and reinforced fiber roll lifts add stability and protection to the toe of a bank and provides a window of opportunity to establish vegetation.



Bioengineering Strategies

Materials for Stabilizing Coastal Banks

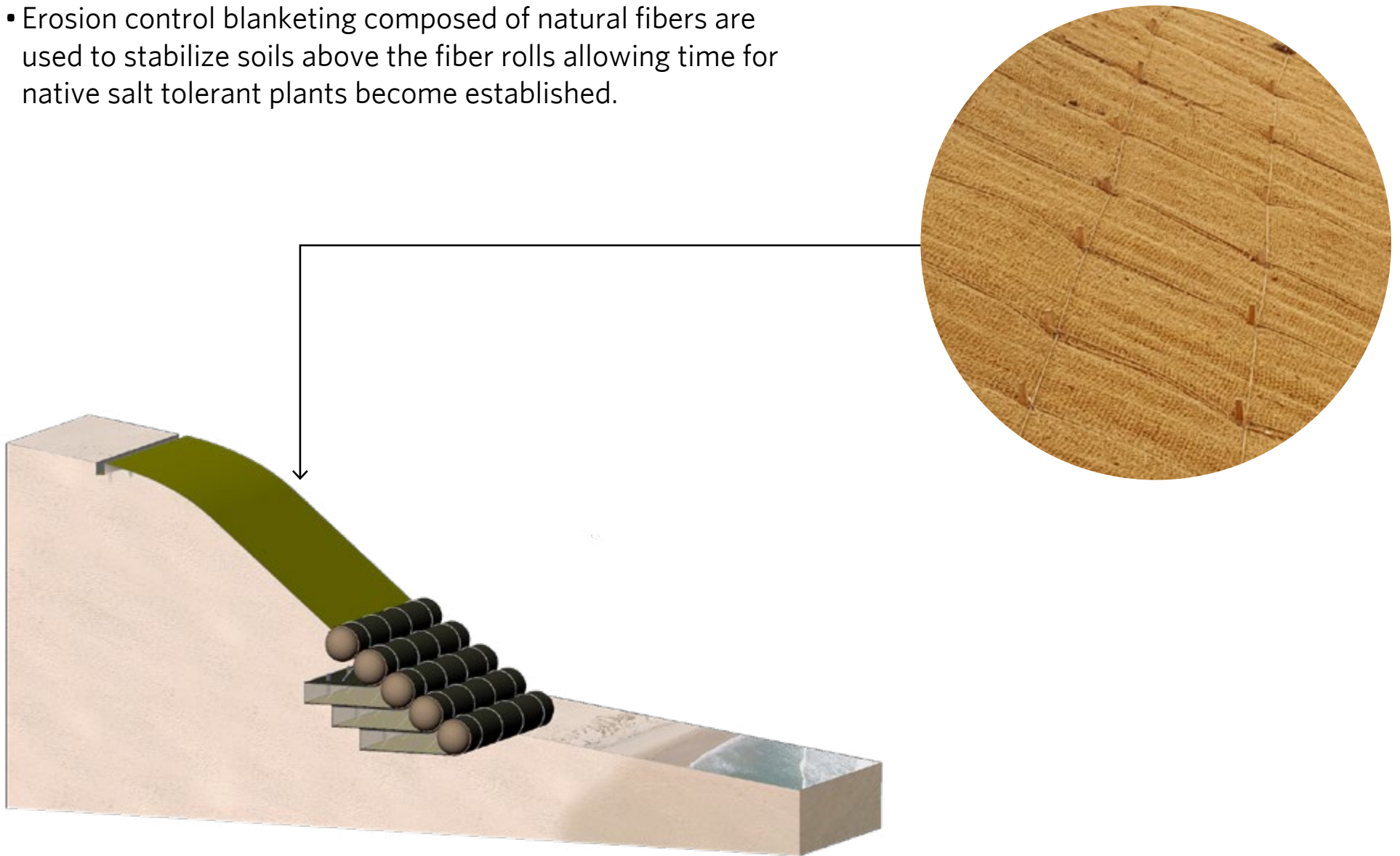
- Robust anchoring systems.



Bioengineering Strategies

Materials for Stabilizing Coastal Banks

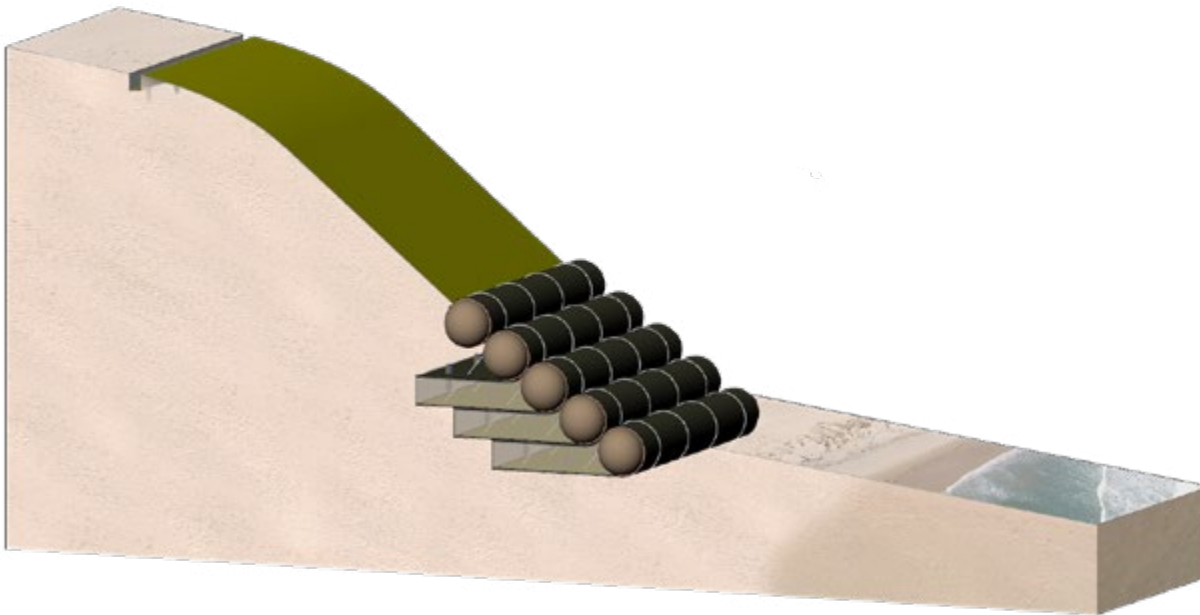
- Erosion control blanketing composed of natural fibers are used to stabilize soils above the fiber rolls allowing time for native salt tolerant plants become established.



Bioengineering Strategies

Materials for Stabilizing Coastal Banks

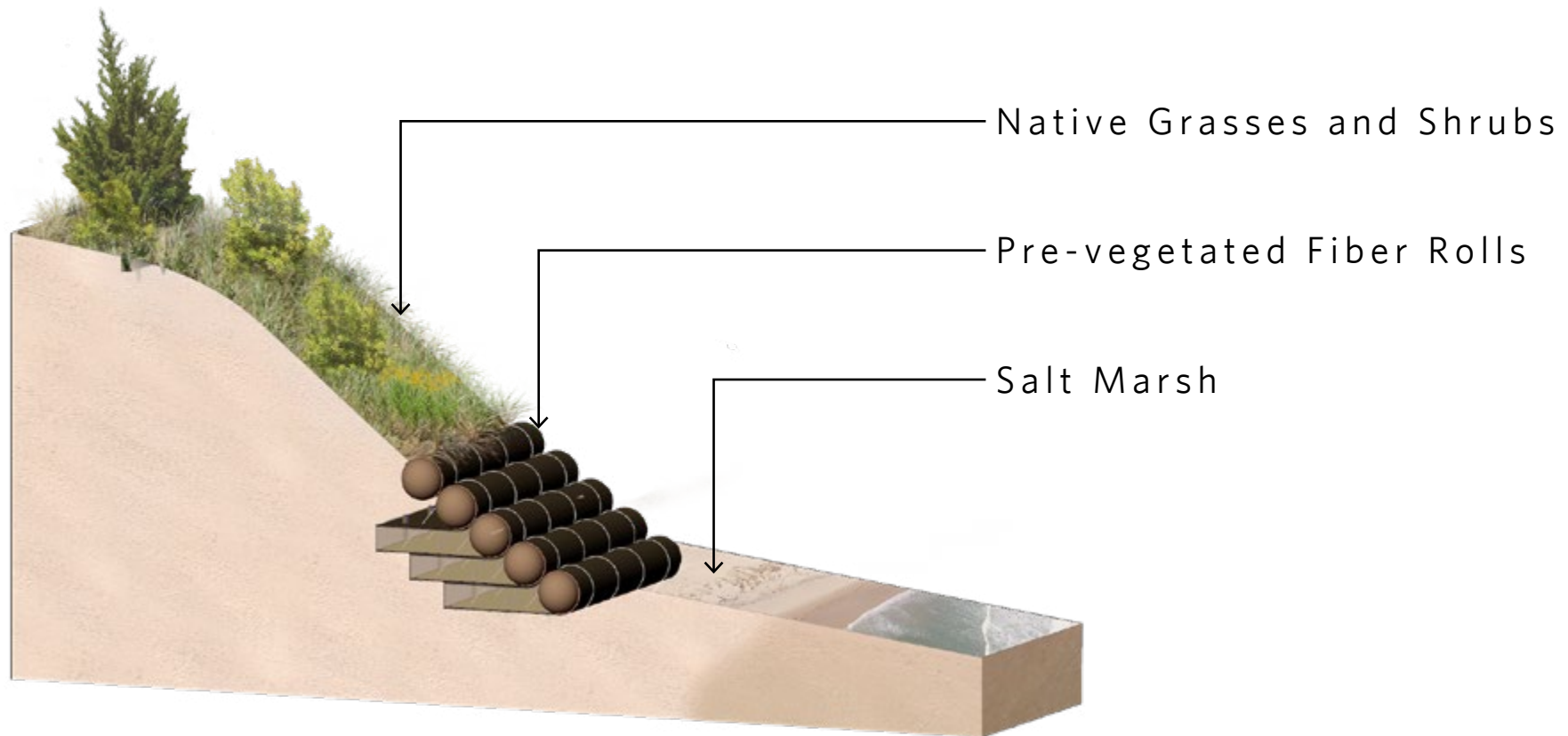
- Resists degradation from the marine environment.
- Absorbs some of the force of wave energy unlike many hard solutions that deflect the energy of wave action to surrounding areas.
- Materials life-expectancy to stabilize sediments matches the time required to **establish native plants.**



Bioengineering Strategies

Materials for Stabilizing Coastal Banks

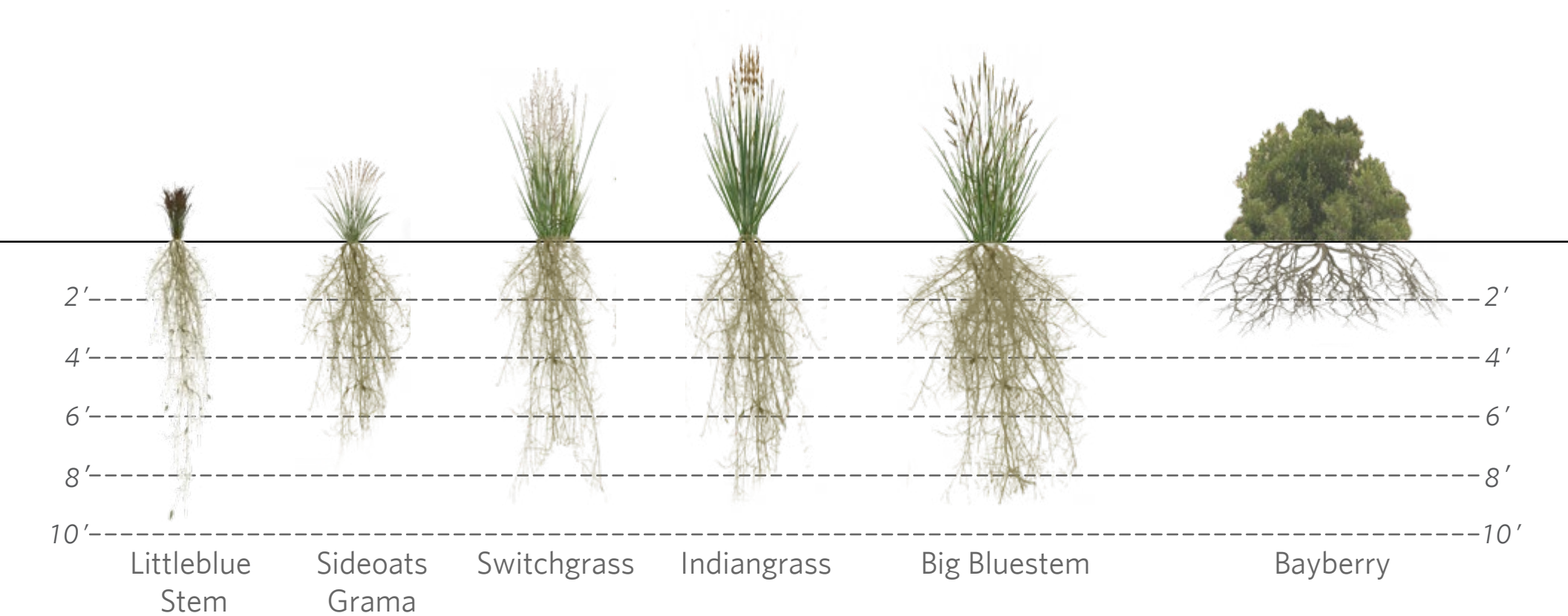
- Establish native plants.



Bioengineering Strategies

Materials for Stabilizing Coastal Banks

- Root Depths of Native Plant Species



Installation & Case Studies

Installation & Case Studies

Typical Eroding Bank

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Installation & Case Studies

Importance of Establishing a Stable Slope

- Utilizing a portion of the upper bank can create a more stable slope angle.
- Adds increased stability and storm damage prevention to the bank.
- Without this step, an investment in bioengineering can be lost due to bank collapses.

(MA CZM Storm Smart Properties Fact Sheet 4)

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Installation & Case Studies

Stabilizing toe of bank - Fiber rolls

- Installation begins at the base of the array and proceeds up bank.
- Proper anchoring strategy to hold toe protection in place.
- Synthetic filter fabrics DO NOT ENHANCE success of a bioengineering project.

1 2 3



Installation & Case Studies

Stabilizing toe of bank - Pre-vegetated fiber rolls

- Use of pre-vegetated fiber rolls along top of array.
- Added vegetation to the root matrix.
- Full season of plant growth prior to installation.

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Installation & Case Studies

Stabilizing soils above toe protection

- Native salt tolerant grasses are seeded into the bank prior to installation of erosion control blankets.
- The erosion control blankets protect soils from erosion and helps to retain moisture to promote seed germination.

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Installation & Case Studies

Sand cover for fiber rolls

- Sand nourishment protects coir fiber rolls from photo-degradation “Sun Block”.
- Nourishment also functions as sediment source to the adjacent coastal resource areas.

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Installation & Case Studies

Native plant species

- Native beach plum and bayberry planted through erosion control blanketing.
- Temporary above ground irrigation for plant establishment.

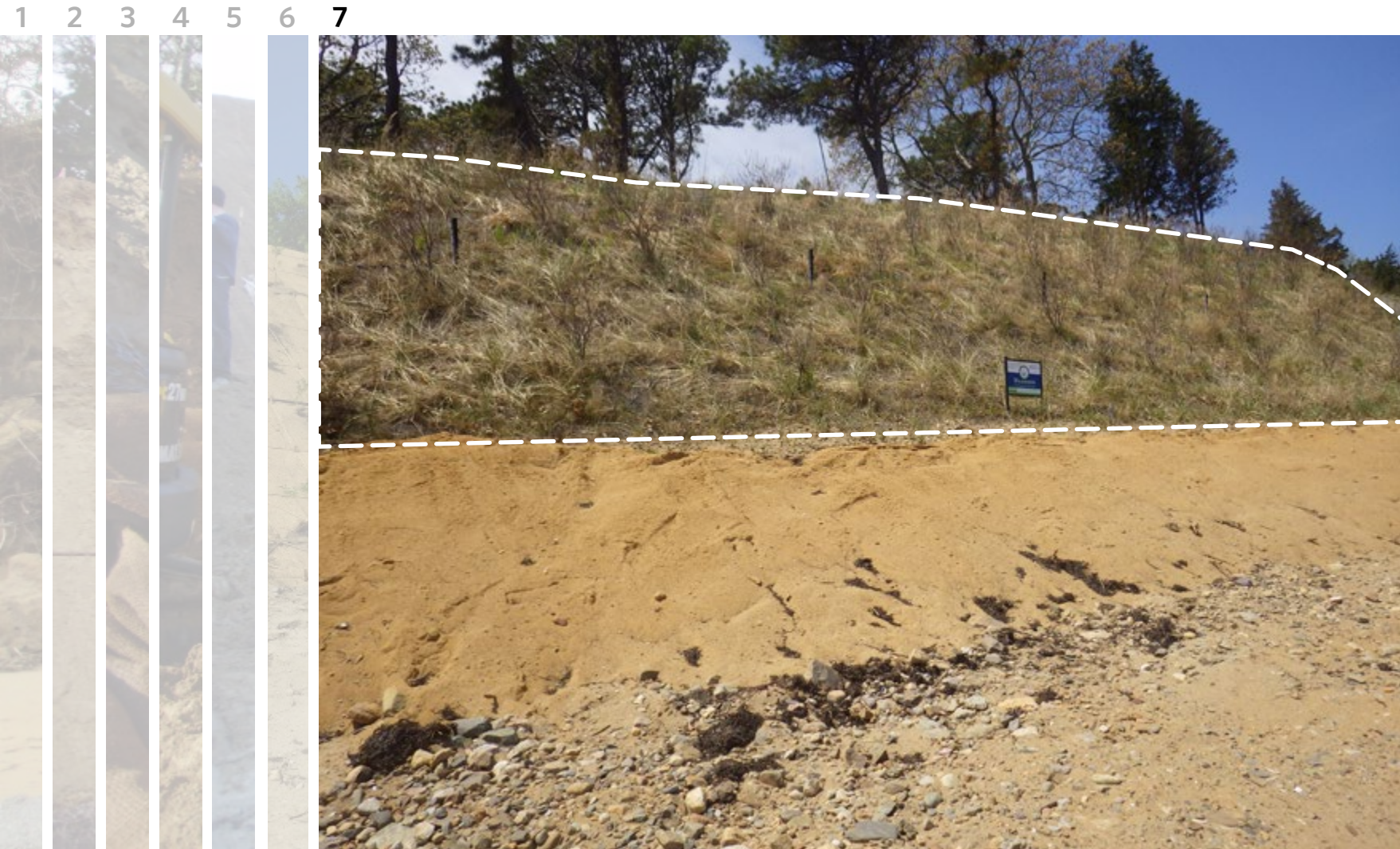
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Installation & Case Studies

Native plant species

- Establishment of native vegetation after two seasons of growth.



Installation & Case Studies

- Condition of fiber roll array following Hurricane Sandy - 11/2012



Waves reached above fiber roll array with no damage.

Installation & Case Studies

- Condition of fiber roll array following named storm Nemo - 2/2013

1 2 3 4 5 6 7 8 9



Installation & Case Studies

- Condition of fiber roll array following named storm Nemo - 2/2013

1 2 3 4 5 6 7 8 9



Waves
reached
above
fiber roll
array
with no
damage.

Installation & Case Studies

- Fiber roll array increased in length by 90' - 6/2013

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Installation & Case Studies

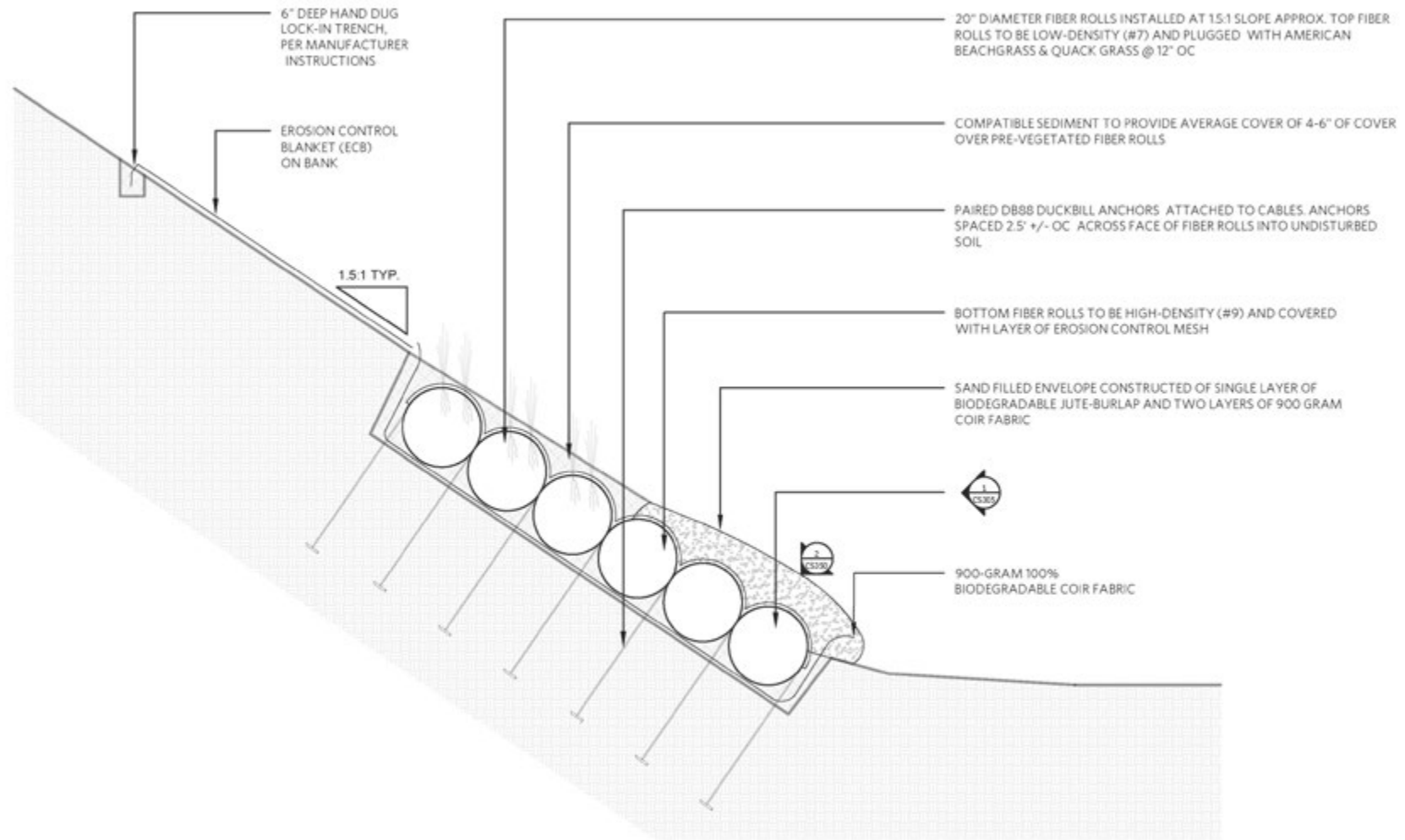
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Evolution of Bioengineering

Evolution of Bioengineering

Sand Envelopes



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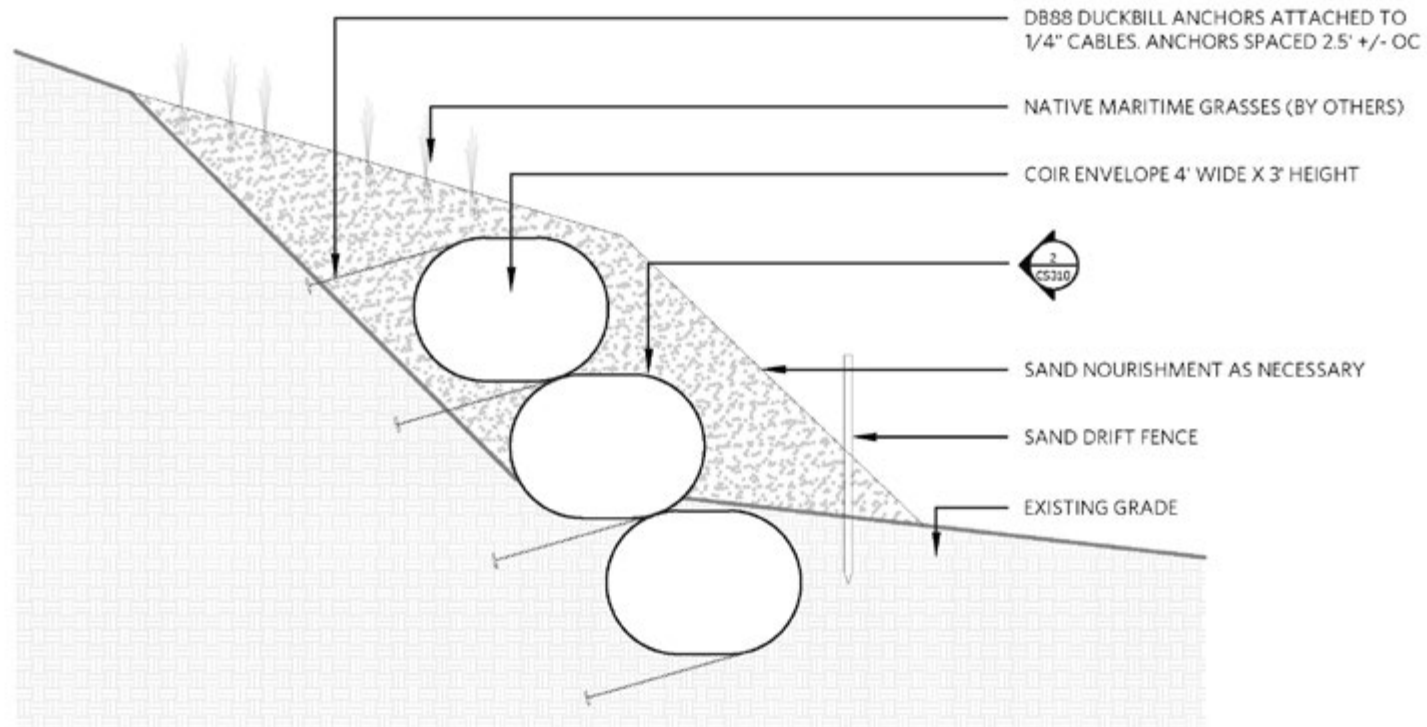
FIBER ROLL SECTION, TYPICAL

DETAIL PROVIDED BY WILKINSON ECOLOGICAL DESIGN, SPECIALISTS IN COASTAL STABILIZATION CONSTRUCTION

Scale: 3/8" = 1'

Evolution of Bioengineering

Sand Envelopes



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COIR ENVELOPE SECTION TYP.

DETAIL PROVIDED BY WILKINSON ECOLOGICAL DESIGN, SPECIALISTS IN
COASTAL STABILIZATION CONSTRUCTION

Scale: 1/4" = 1'

Evolution of Bioengineering

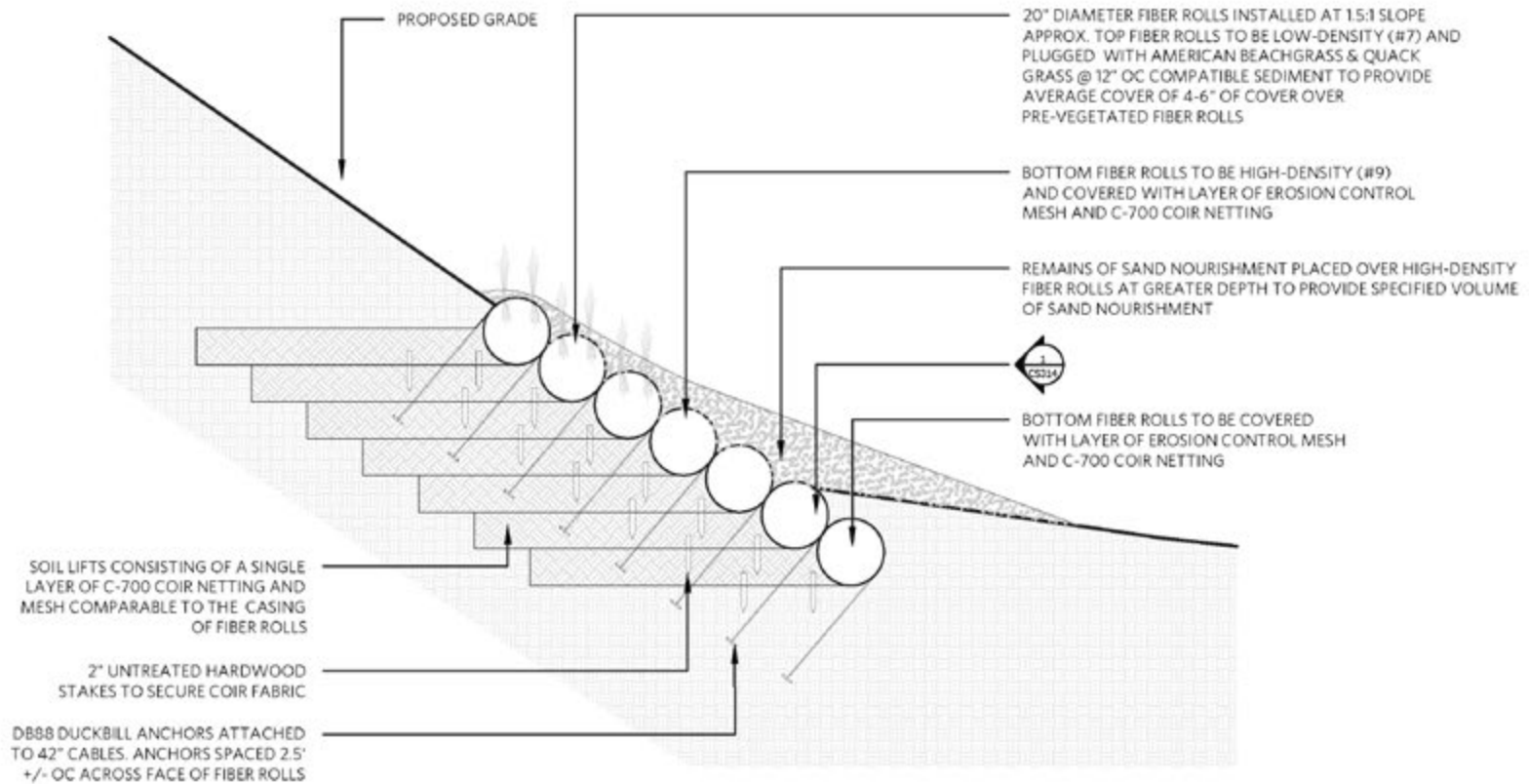
Sand Envelopes



Evolution of Bioengineering

Reinforced Fiber Roll Lift

U.S. Patent No. 10,125,462



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FIBER ROLL REINFORCED LIFT SECTION, TYPICAL

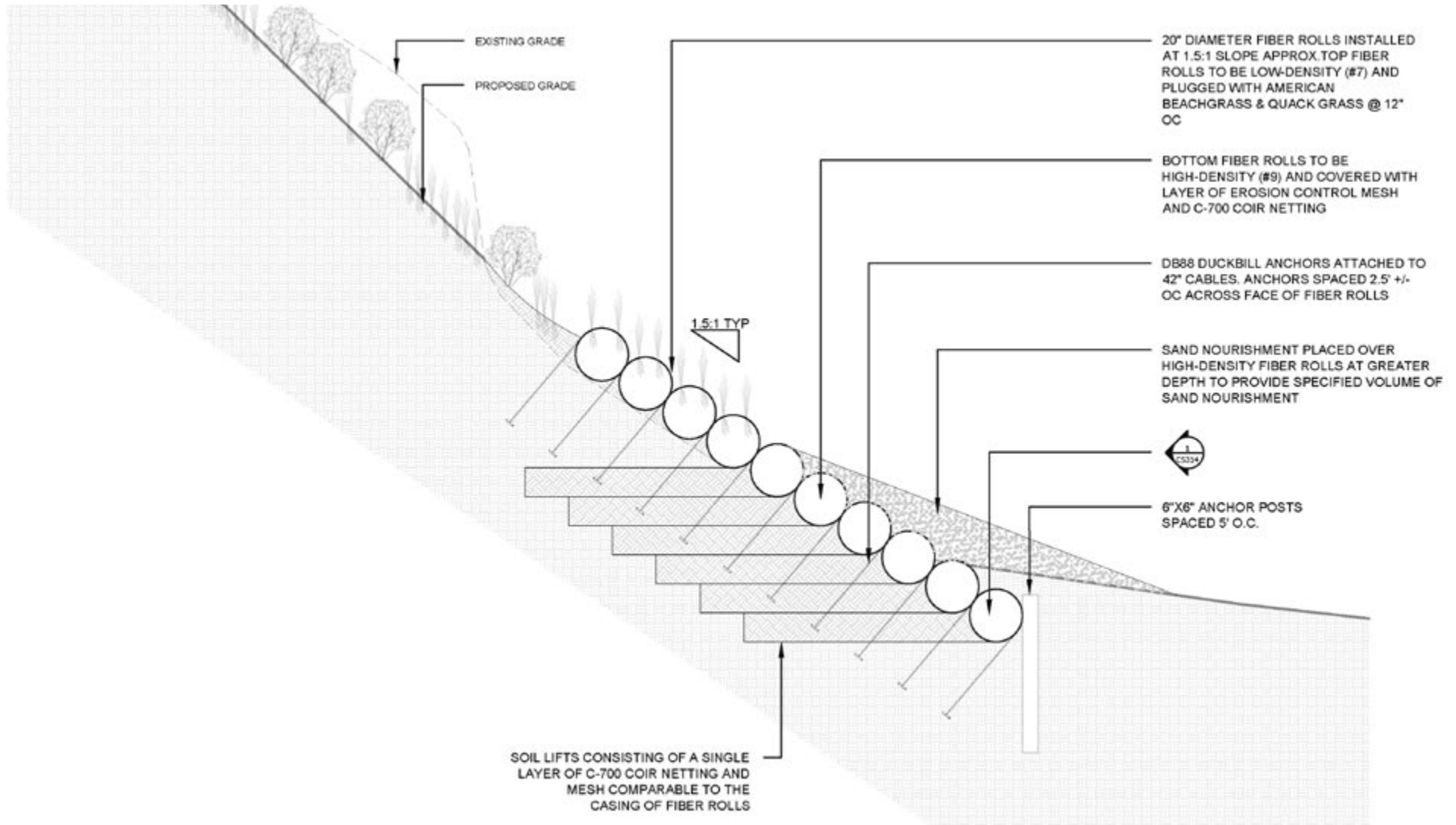
DETAIL PROVIDED BY WILKINSON ECOLOGICAL DESIGN, SPECIALISTS IN COASTAL STABILIZATION CONSTRUCTION
U.S. PATENT NO. 10,125,462

Scale: 1/4" = 1'

Evolution of Bioengineering

Reinforced Fiber Roll Lift

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FIBER ROLL REINFORCED LIFT SECTION, TYPICAL

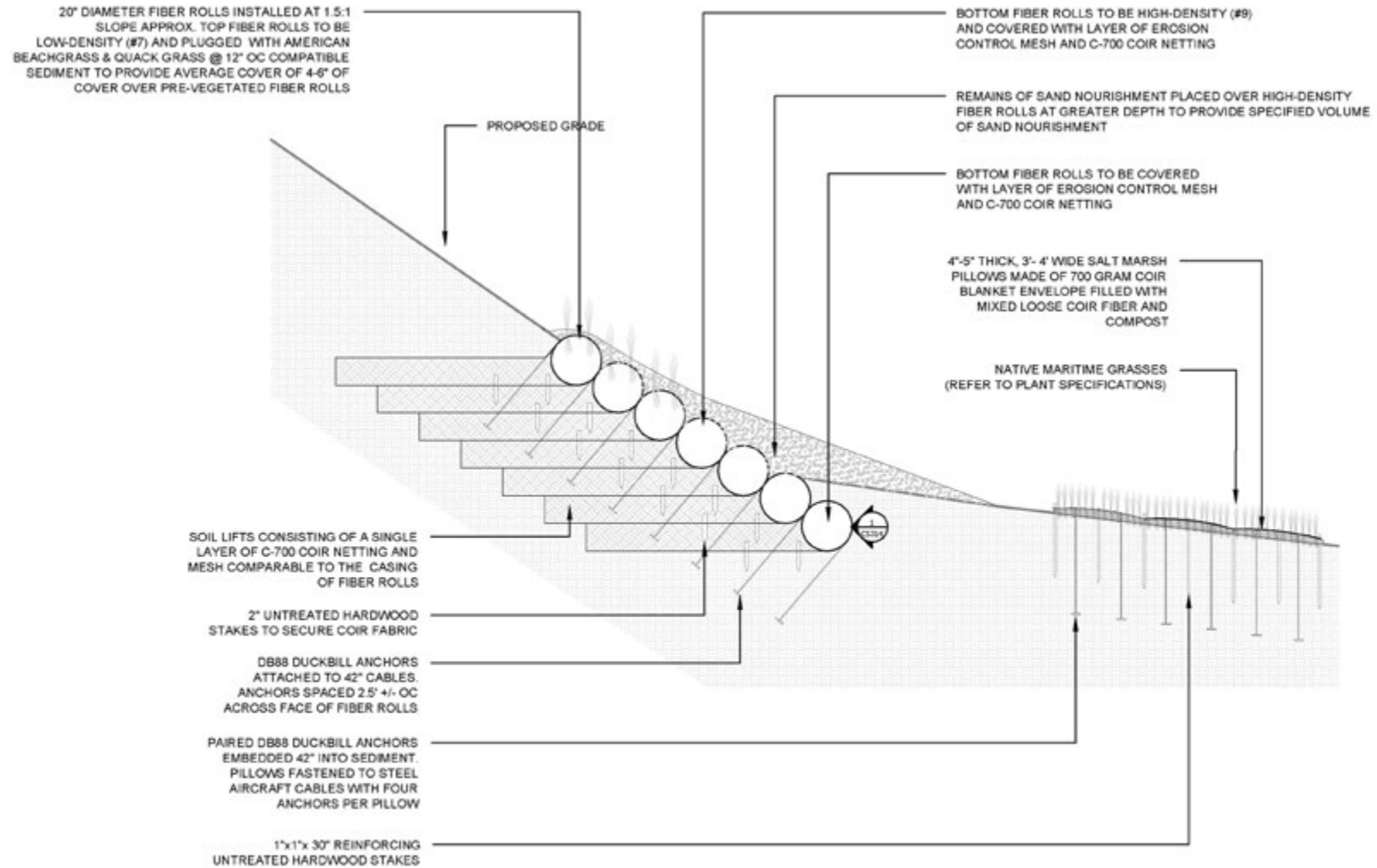
DETAIL PROVIDED BY WILKINSON ECOLOGICAL DESIGN, SPECIALISTS IN COASTAL STABILIZATION CONSTRUCTION
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Scale: 1/4" = 1'

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FIBER REINFORCED LIFT AND COIR SALT MARSH PILLOW SECTION ,TYPICAL

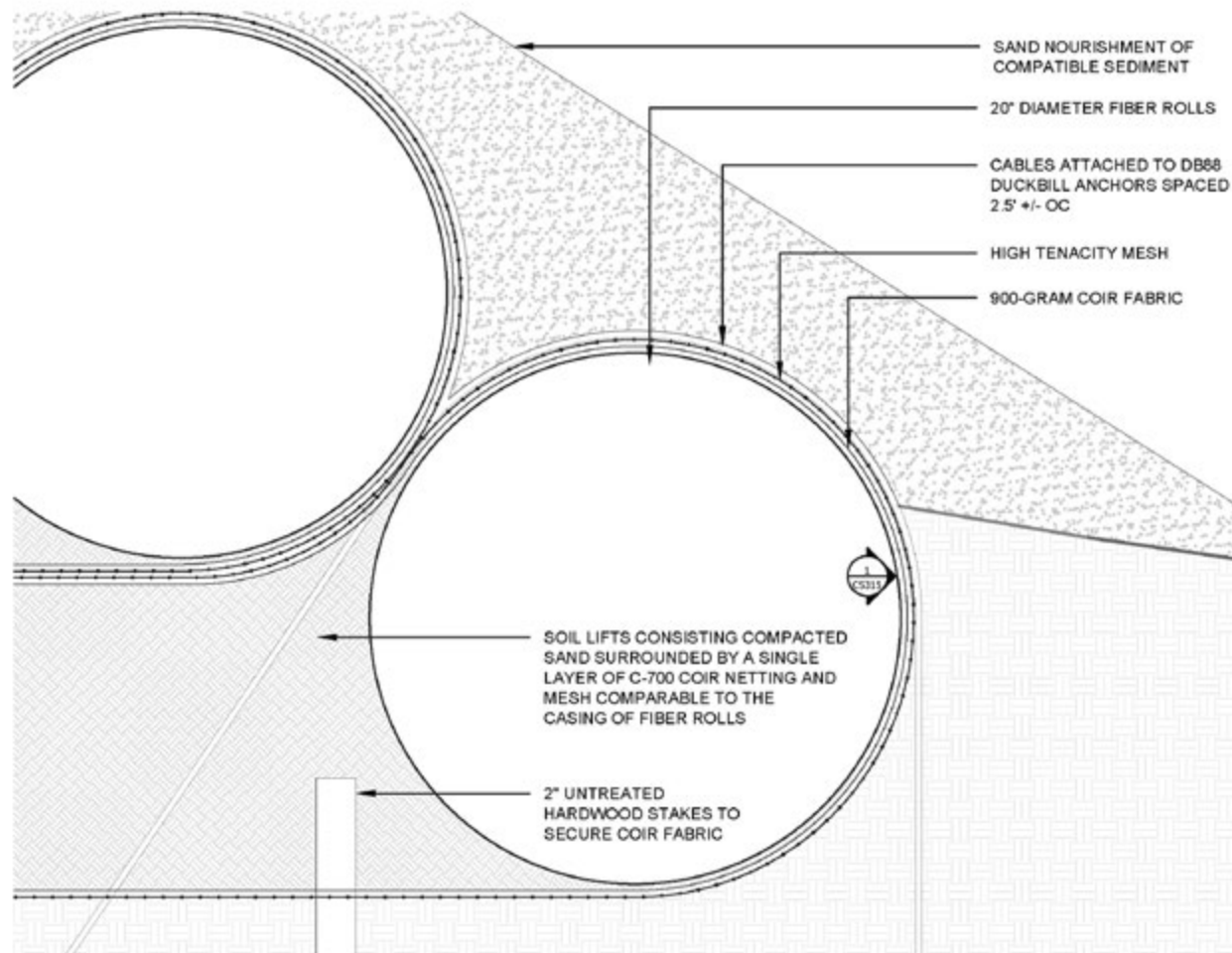
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U.S. PATENT NO. 10,125,462

Scale: 1/4" = 1'

Evolution of Bioengineering

Reinforced Fiber Roll Lift

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FIBER ROLL REINFORCED LIFT SECTION ,TYPICAL

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U.S. PATENT NO. 10,125,462

Scale: 2" = 1'

Installation & Case Studies

Reinforced Fiber Roll Lift

U.S. Patent No. 10,125,462

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Installation & Case Studies

Reinforced Fiber Roll Lift

U.S. Patent No. 10,125,462

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Installation & Case Studies

Reinforced Fiber Roll Lift

U.S. Patent No. 10,125,462

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Installation & Case Studies

Reinforced Fiber Roll Lift

U.S. Patent No. 10,125,462

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Installation & Case Studies

Reinforced Fiber Roll Lift

U.S. Patent No. 10,125,462

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Installation & Case Studies

Reinforced Fiber Roll Lift

U.S. Patent No. 10,125,462

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Installation & Case Studies

Reinforced Fiber Roll Lift

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Installation & Case Studies

Reinforced Fiber Roll Lift

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