Living Shorelines
for Contractors and Project Designers

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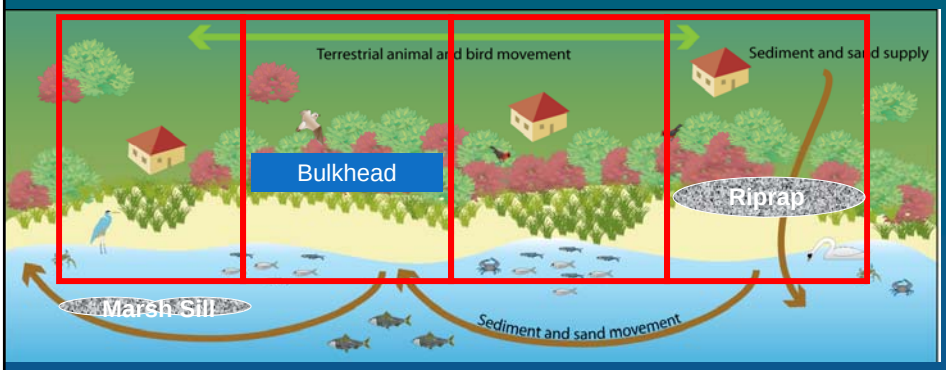
Part 1

- **Why We Need More Living Shorelines**
- **Alternatives Analysis**
- Site-Specific Designs
- Construction Planning
- Monitoring and Maintenance
- Permit Process

- Field Site Visit

Why We Need More Living Shorelines

Piecemeal Human Actions



- **Individual parcel choices for shoreline landscape**
- **"Piecemeal" effect interrupts ecosystem services, including shoreline stabilization and water quality protection**

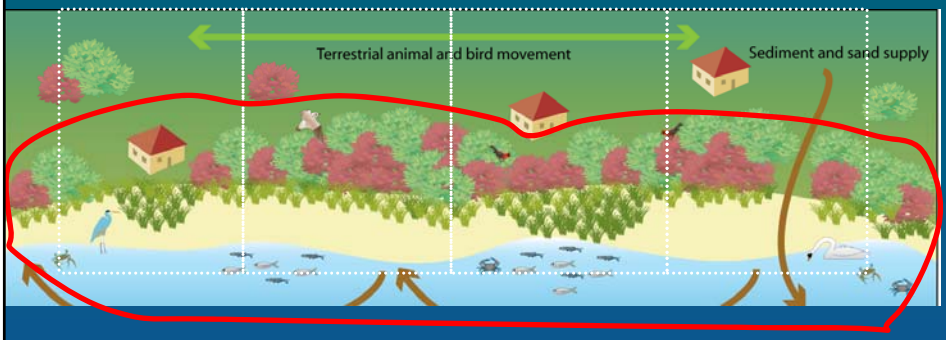
Cumulative Impacts on Living Resources

Riparian Buffer removal and suppression
+
Upland-Wetland habitat interruptions
+
Wetland and Beach Loss
from unnecessary structures & reflected waves

=

Degraded Water Quality
+
Poor Fisheries Habitat

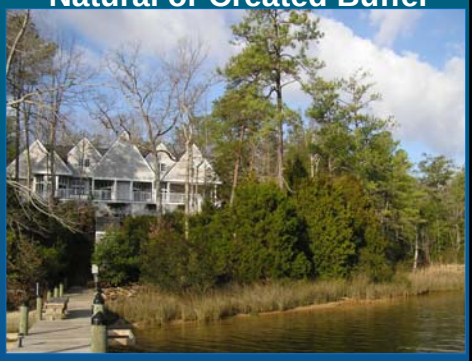
Integrated Shoreline Management



- **Mutually beneficial approach**
- **Take advantage of natural erosion and flood buffers across property lines**

Guiding Principles for Living Shoreline Projects
Preserve and Restore Riparian Buffers

Waterfront Lawn vs. **Natural or Created Buffer**



Nothing to intercept wave action or floodwaters

Runoff of lawn fertilizers and pesticides

Storm and flood buffering

Surface and groundwater interception

Soil Stabilization and Flood Protection
Woody Plant Functions

- **Root Reinforcement** – root tensile strength mechanically reinforces soil
- **Soil Moisture Depletion** – remove excess soil water through evapotranspiration
- **Buttressing and Arching** – anchored and embedded stems/roots counteract downslope shear forces
- **Flexible Stems** – deflect erosive energy

Source: C. Miller, USDA –NRCS Cape May Plant Materials Center

Guiding Principles for Living Shoreline Projects
Gradual Slopes and Connected Habitats

Instead of bulkhead or revetment....

Disconnected habitats

Gradual loss of intertidal area

Reflected wave action and sediment re-suspension

...Create or enhance integrated vegetation buffers with gradual slopes

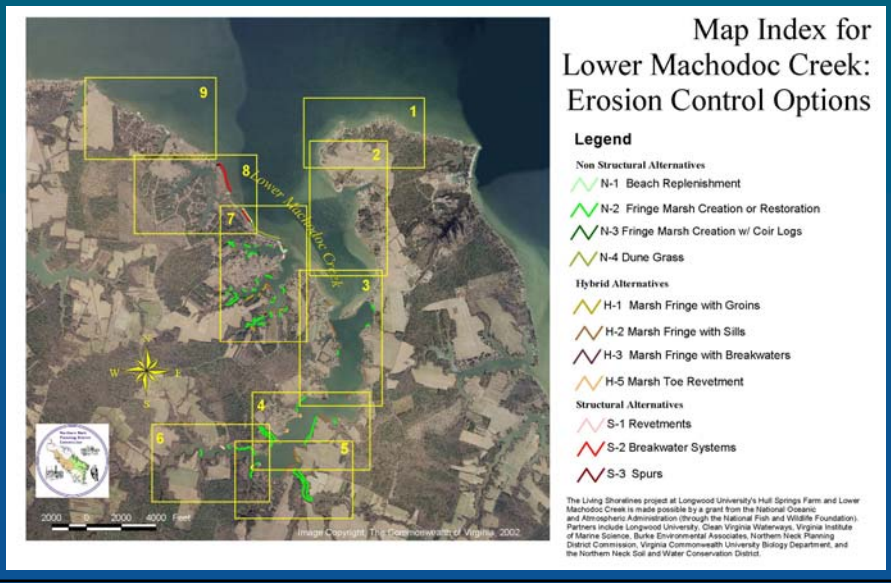
Connected habitats

Dense plant cover

Active biological community

Alternatives Analysis

Consult VIMS Special Reports
where available – more coming soon



What is the Nature of the Problem?

Upland Erosion caused by water runoff toward the shoreline?

- Manage water in the upland and riparian zones using vegetation, swales, rain gardens, berms, dry wells, etc

Flooding ?

- Use a wide intertidal area to move land-water interface offshore
- Plant the intertidal zone with vegetation to slow and absorb flood waters
- Raise or move structures to reduce flood risk

Tidal Erosion caused by waves or currents at water level ?

Use the appropriate living shoreline design where possible

What level of protection is needed?

Lower protection

- Has:
  - No structure at risk
  - Milder wave climates
  - Shorter fetch
- Use:
  - Vegetation only
  - Bank grading
  - Narrow intertidal zones possible

Higher protection

- Has:
  - Structure at risk
  - Higher wave climate
  - Longer fetch
- Use:
  - Hybrid or structural
  - Bank grading
  - Wide intertidal zones

Shoreline features to consider

- **Bank height**
  - **High banks**

    are subject to gravity and erosion caused by waves striking at bank toe

  - **Low banks**

    are subject to flooding influence

The condition at both the top and bottom of the bank (bank toe) should be considered.

Shoreline features to consider

- Bank Vegetation
  - Woody vegetation (trees, shrubs)

    may indicate relative stability if trees are growing straight , not falling into water
  - Herbaceous vegetation only (grasses, vines, ground covers)

    may indicate previous clearing, excessive vertical slope, or unconsolidated soil (moved easily by wind, waves, runoff, groundwater)
  - No vegetation on bank face

    may indicate previous clearing, excessive shade and/or erosion

Shoreline features to consider

- Wetland Vegetation
  - Dense tidal marsh vegetation

    may indicate gradual intertidal slope, plenty of sunlight, and/or sandy soil
  - Patchy marsh vegetation

    may indicate shading from overhanging trees and shrubs, variable water depth
  - No marsh vegetation

    may indicate excessive shade, elevation of intertidal area too low, and/or unsuitable soil type

Shoreline features to consider

- Slope
  - Bank slope

    an indicator of bank stability (steeper slopes less stable)
  - Intertidal slope

    a gradual slope, either natural or created, is needed to establish a wide fringe marsh or sand flat/beach
  - Nearshore (subaqueous) slope

    a steep slope may make offshore sills or fiber logs impractical

Shoreline features to consider

- Existing Shoreline Structures
  - Serviceable condition

    are they in good repair or failing
  - Evidence of adverse effects

    erosion at ends of structure, downdrift erosion, increased water depth along toe
  - Consider adjacent properties also

What are the local tides and wave climate at the site?

It is important to know what the existing vertical and horizontal extent of tidal action is in order to assess habitat condition, to plan habitat enhancements, and to determine permit requirements.

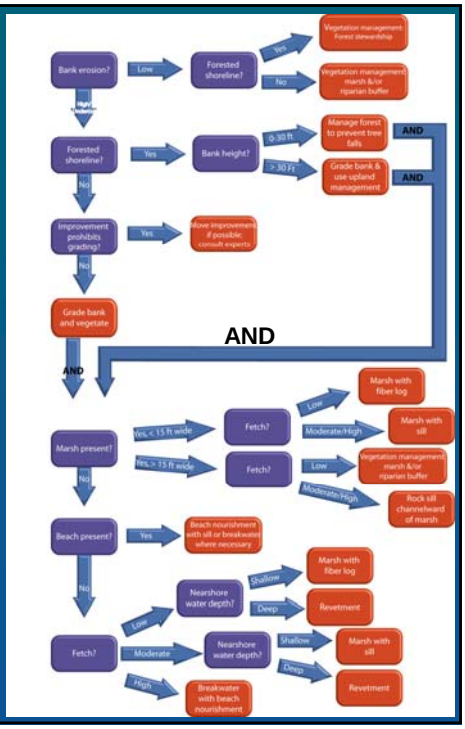
If erosion is present
<u>and</u>
it cannot be tolerated,

then first consider what actions can be taken in the upland area

VIMS Decision Tool for Undefended Shorelines

Upland Actions

Shoreline Actions



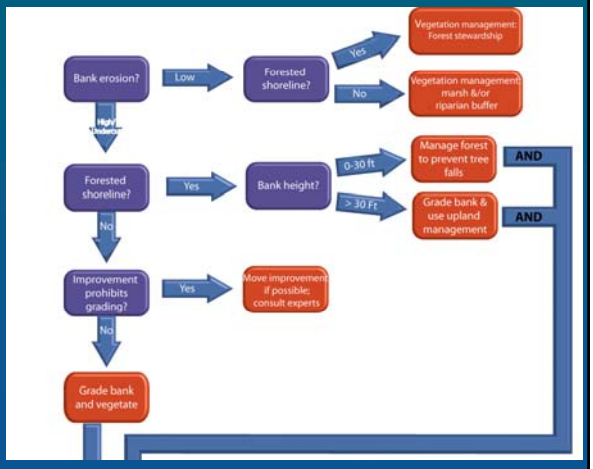
VIMS Decision Tool for Undefended Shorelines

Vegetation Actions

for low erosion

Upland AND Shoreline Actions

For undercut or high erosion



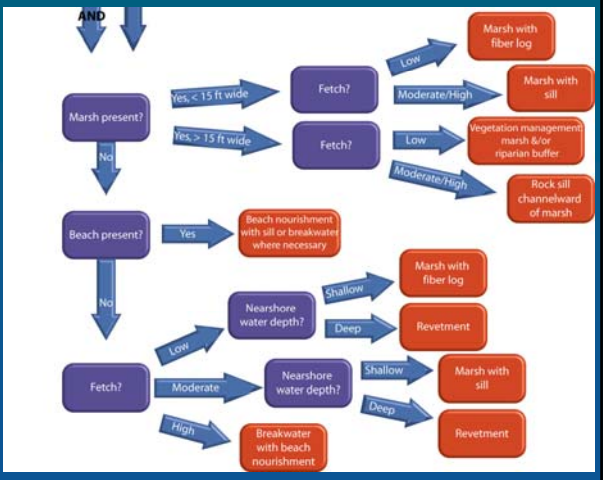
VIMS Decision Tool for Undefended Shorelines

Shoreline Actions

Tidal Marsh or Beach present or absent?

Fetch?

Nearshore Depth Shallow or Deep?



Forest Buffer Protection OR Bank Grading?

Existing forest condition is highly desirable and should be preserved and managed

Existing riparian buffer is disturbed, cleared lawn, and/or not providing stabilization or water quality services

Enhance Tidal Marshes if present

Wide Marsh
protect marsh edge

Narrow marsh
increase marsh width
Landward if possible
Channelward if necessary

May need marsh sill structure

Enhance Sand Beaches if present

Wide Beach
Identify & protect sand supply where possible

Narrow beach
increase beach width and elevation

May need sand containment structures nearshore sill or offshore breakwaters

Landward Design & Trade-Offs

Existing Wide Marsh with no edge erosion

One Line of Trees or Lawn

Low – Medium Bank Height

Bank Face High Erosion

Action:

Bank Grading

Resource Trade-Offs

Remove riparian buffer

Temporary sediment runoff

Channelward Design & Trade-Offs

House close to bank edge

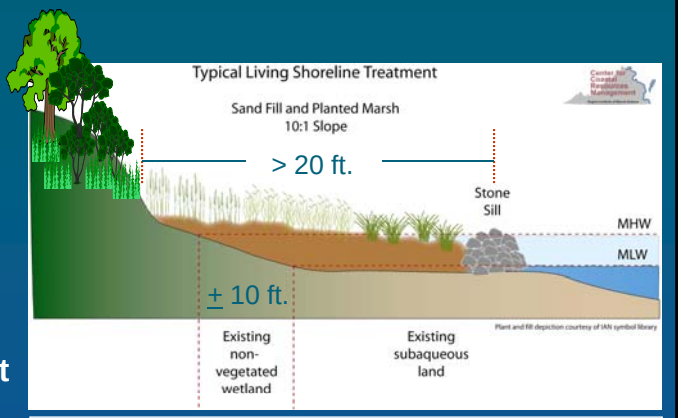
Stable Riparian Forest

Undercut Bank

Bank Height > 6 ft

Action:

Marsh sill



Resource Trade-Offs

Non-vegetated wetland to vegetated wetland

Shallow water to vegetated wetland

Hull Springs Farm Example

Physical Setting

Tidal creek setting close to Potomac River

Northeast orientation

Different conditions along same shoreline

Human Factors

Historic farm house and historic tree close to bank edge

Change in ownership

North section in winter

South section in summer w/ marsh

- **Few trees in buffer, previously cleared**
- **Bank height 10 ft with erosion where widest fetch is 1.5 mile**
- **Bank slope near vertical**
- **Regular high tides at the bank toe with no marsh at north section**
- **Existing marsh where widest fetch is only 0.4 mile across creek**
- **Shallow nearshore - water depth @ 30 ft offshore < -2 ft MLW**
- **Sand substrate**
- **Partial sun**

Alternatives Analysis for north section

- Bank erosion high, structures at risk
- Action necessary
- Buffer not forested
- House and historic tree only 55 feet from top of bank
- Bank grading not feasible
- Marsh and beach absent
- Fetch moderate > 0.5 mile
- Nearshore shallow
- Marsh with sill
- Revetment at bank toe at highest risk area

End Part 1

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