Coastal Wetlands Ranking for Co-Benefits

STAC Workshop
March 22, 2022
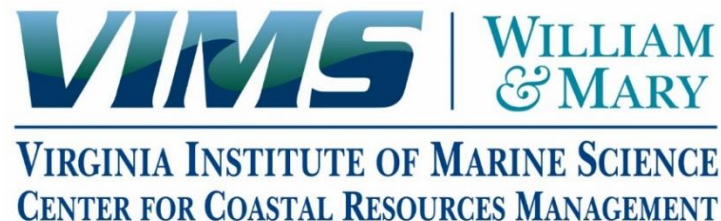
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Wetland Ranking

- Rank existing coastal wetlands in Virginia for Co-benefits
- Identify targets for wetland restoration/ creation
  - Co-benefits possible

- Identify targets for Living Shoreline
- Rank living shorelines for co-benefits

Load Reduction Calculation Method

- Two management practices specifically inclusive of marsh vegetation planting: Non-structural and Plant Marsh with Sill

- Selected Shoreline with no marsh

- Converted shoreline arcs into polygons with an 8 foot width
  - Uses VMRC Living Shoreline General Permit 2 Criteria for minimum marsh dimensions

- Determined areal extent of created marsh and applied protocols for load reductions.
  - For Projections uses Protocols 2, 3 & 4
  - For Back-casting uses all 4 protocols

Natural and Nature-Based Features Ranking Factors (NNBF)

Four components:

1. NNBF flooding mitigation services

2. How many buildings does the NNBF benefit?

3. Are there any critical community facilities the NNBF benefits?

4. Can the NNBF be used to take advantage of existing programmatic incentives?

Overall NNBF Score for Priority Ranking: Add score for each category	low	medium	high
1. NNBF Total Capacity Flooding mitigation potential based on elevation and feature type.	0-0.0008 (1-33 percentile)	0.008-0.4 (33-66 percentile)	>0.4 (66-100 percentile)
2. Number of buildings impacted Number of buildings that the NNBF benefits.	0	1 building	>= 2 buildings
3. Critical Facility Benefit Does the NNBF benefit a community critical facility?	no		yes
4. Co-Benefits Potential Potential for NNBF to be used in incentive programs.	0	1 cobenefit	>=2 cobenefits
Score	1	2	3

NNBF flooding mitigation services

**Capacity * Opportunity =
Total Capacity Score**

**Ranking of the potential for each NNBF
to act on and mitigate tidal flooding**

Living shoreline project (marsh with breakwaters)
in Gloucester County. Photo: K. Duhring, CCRM

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Score	**1**	**2**	**3**

How do we link NNBFs with buildings that they benefit?

Inundation Pathways (IPs)

…depict lowest elevation areas connecting the shoreline to buildings.

IPs represent where rising waters begin to flood onto the land, but *do not represent flooding extent.*

IPs depicted as multicolored lines. Building footprints are outlined in black.
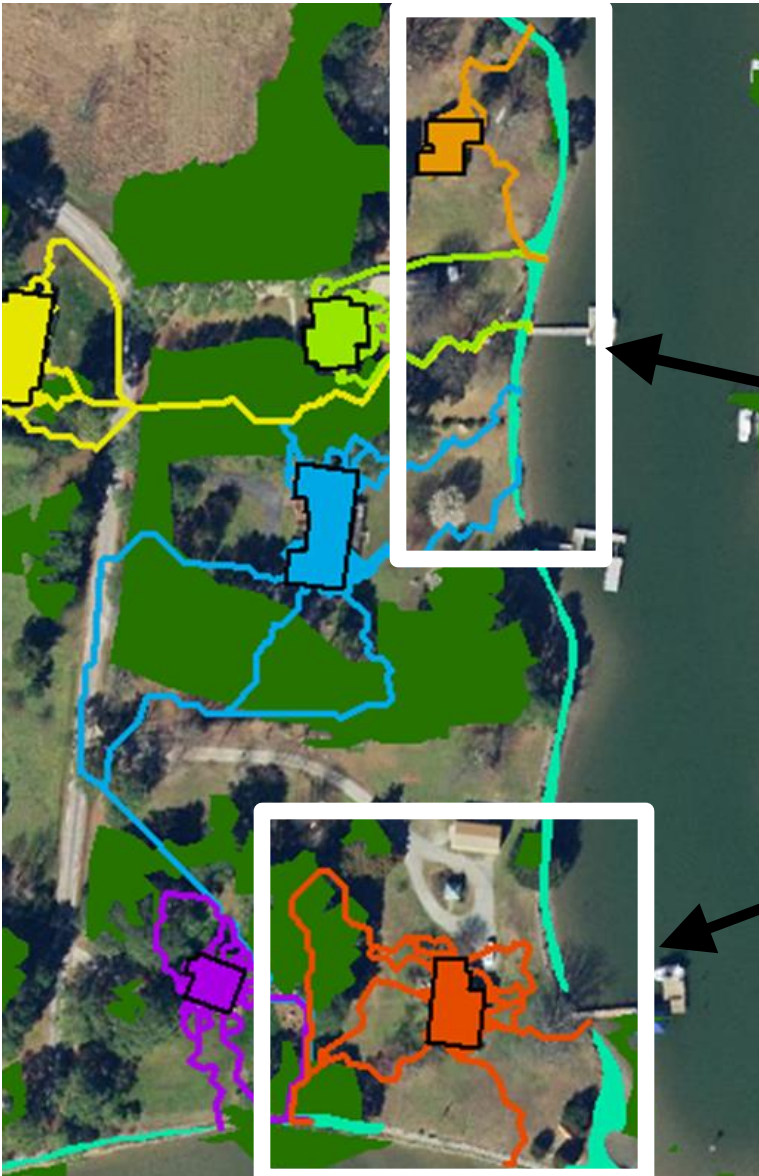
Using these IPs, we can find NNBFs that lie between the shoreline and building and in the path of rising water

For each NNBF, count the number of building IPs that intersect

→ *This NNBF (tidal marsh) benefits 4 buildings*

For each building, count how many NNBFs intersect its' IP
→ *This building receives benefits from 2 NNBFs (a tidal marsh and a wooded area)*

NNBF Types (on this map):
  Tidal Marsh
  Wooded

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CRS and Water Quality Co-Benefits

1. FEMA Community Rating System (CRS) credits. Potentially qualifying NNBFs are in 100-year flood zone Special Flood Hazard Area and overlay the Resource Protection Area (RPA) or RPA 100-ft buffer

   - Undeveloped set-aside lands in the Special Flood Hazard Area (SFHA).
   - Land must have some level of protection: Regulatory or Property ownership
   - Resource Protection Area Buffer considered Regulatory Protection
   - CRS Potential = all open space in SFHA and the Resource Protection Area 100 foot buffer

2. Water quality/TMDL credit potential – N, P, TSS reductions. All NNBFs except for beaches and dunes

   - NNBFs provide water quality services to varying degree dependent on intrinsic factors and location
   - Within the study area and proximal to the shore
   - Assumed all NNBF features other than beach and dune provide service
   - Existing Chesapeake Bay Program approved BMPs for tidal and nontidal wetlands and riparian buffers

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Add score for each category

	low	medium	high
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Protection/Restoration

▽ ☑ Lands for Protection

    ☑ Coastal NNBFs Ranked: ...
      Benefits to Coastal
      Buildings

    ☐ Conservation   ...
      Lands/Easements

▷ ☐ Restoration Opportunities

Legend

Lands for Protection

Coastal NNBFs Ranked: Benefits to Coastal Buildings

NNBF Ranked

■ Most Benefits

■ Many Benefits

□ Some Benefits

⊕ Zoom to

Coastal NNBFs Ranked: Benefits to Coastal Buildings   ▢ ✕

Type of NNBF: **Tidal Marsh**

This Tidal Marsh feature provides **the Most Benefits** to buildings and communities, including:

- **High rank** for the natural capacity of NNBF to mitigate coastal flooding
- **High rank** for the number of buildings on land less than 10 feet in elevation that the NNBF benefits *(93 buildings)*
- **Low rank** for the number of critical community facilities on land less than 10 feet in elevation that the NNBF benefits *(0 critical community facilities)*
- **High rank** for the NNBF to be used for incentive programs (2 out of 2: The NNBF has water quality benefit of nitrogen, phosphorus, and/or sediment reduction, and all or a portion of the NNBF has potential to earn credit in the CRS Program.)

Fort Monroe

Adapt VA Interactive Map

ADAPT VA — Center for Coastal Resources Management — VIMS | Virginia Institute of Marine Science | WILLIAM & MARY

Find address or place

Protection/Restoration

▽ ☑ Lands for Protection

☑ Coastal NNBFs Ranked: Benefits to Coastal Buildings ···

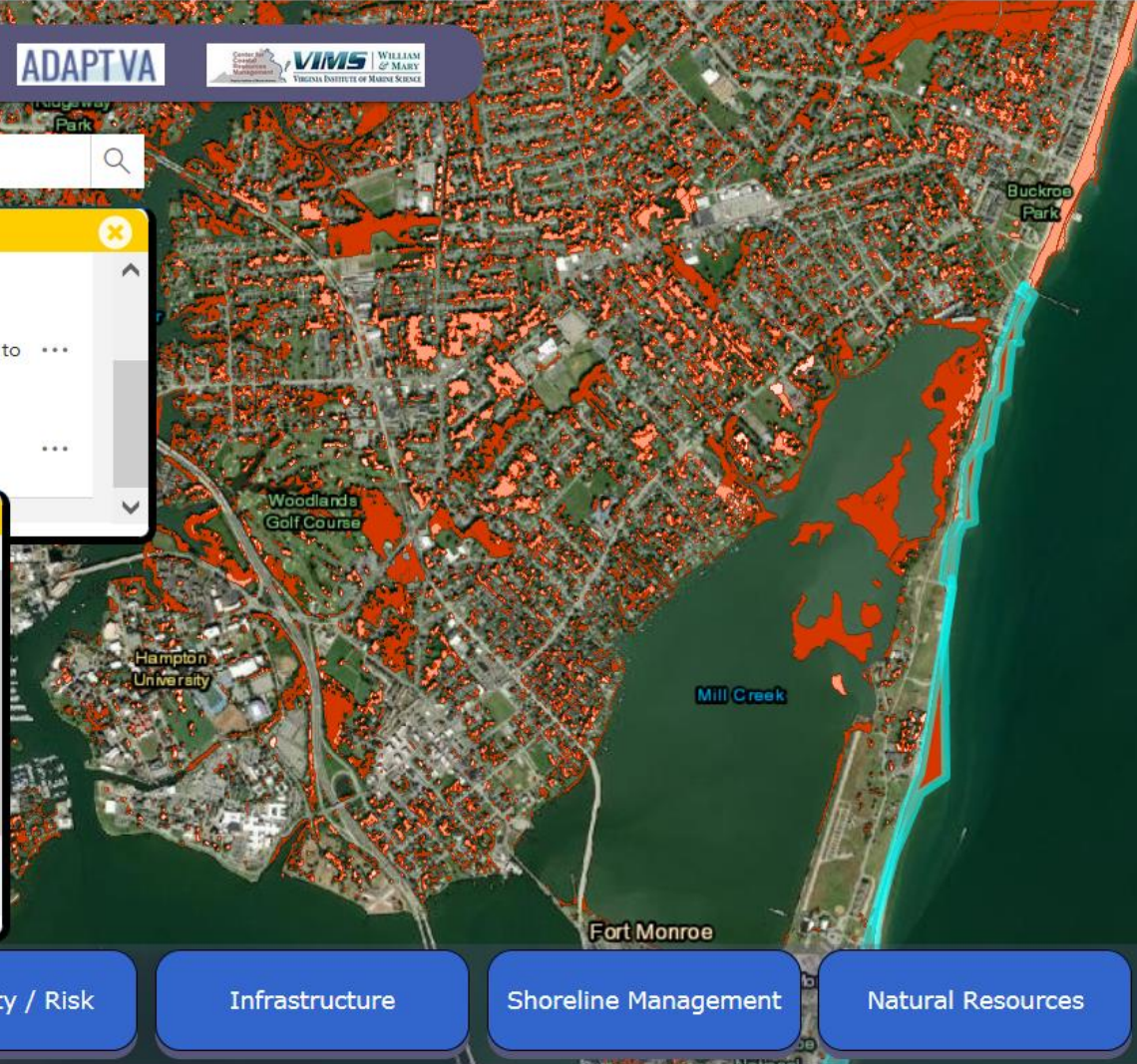☐ Conservation Lands/Easements ···

Legend

Lands for Protection

Coastal NNBFs Ranked: Benefits to Coastal Buildings

NNBF Ranked

- Most Benefits
- Many Benefits
- Some Benefits

Coastal NNBFs Ranked: Benefits to Coastal Buildings

⊕ Zoom to   ◁ 1 of 4 ▷

Type of NNBF: **Beach**   Fact Sheet (opens in a new tab)

This Beach feature provides **the Most Benefits** to buildings and communities, including:

- **Medium rank** for the natural capacity of NNBF to mitigate coastal flooding
- **High rank** for the number of buildings on land less than 10 feet in elevation that the NNBF benefits *(9 buildings)*
- **Low rank** for the number of critical community facilities on land less than 10 feet in elevation that the NNBF benefits *(0 critical community facilities)*
- **Medium rank** for the NNBF to be used for incentive programs (1 out of 2: The NNBF or portion of the NNBF potential to earn credit in the CRS Program.)

Ridgway Park | Buckroe Park | Woodlands Golf Course | Hampton University | Mill Creek | Fort Monroe | Sentara Careplex

Sea Level Rise / Flooding / Storm Surge | Vulnerability / Risk | Infrastructure | Shoreline Management | Natural Resources | Protection / Restoration Opportunities | Legend | Tools | How To

Int-High SLR scenario   ▷   1/1/2020

2010   2020   2030   2040   2050   2060   2070   2080   2090   2100

Shoreline areas where NNBF benefits are absent for vulnerable buildings
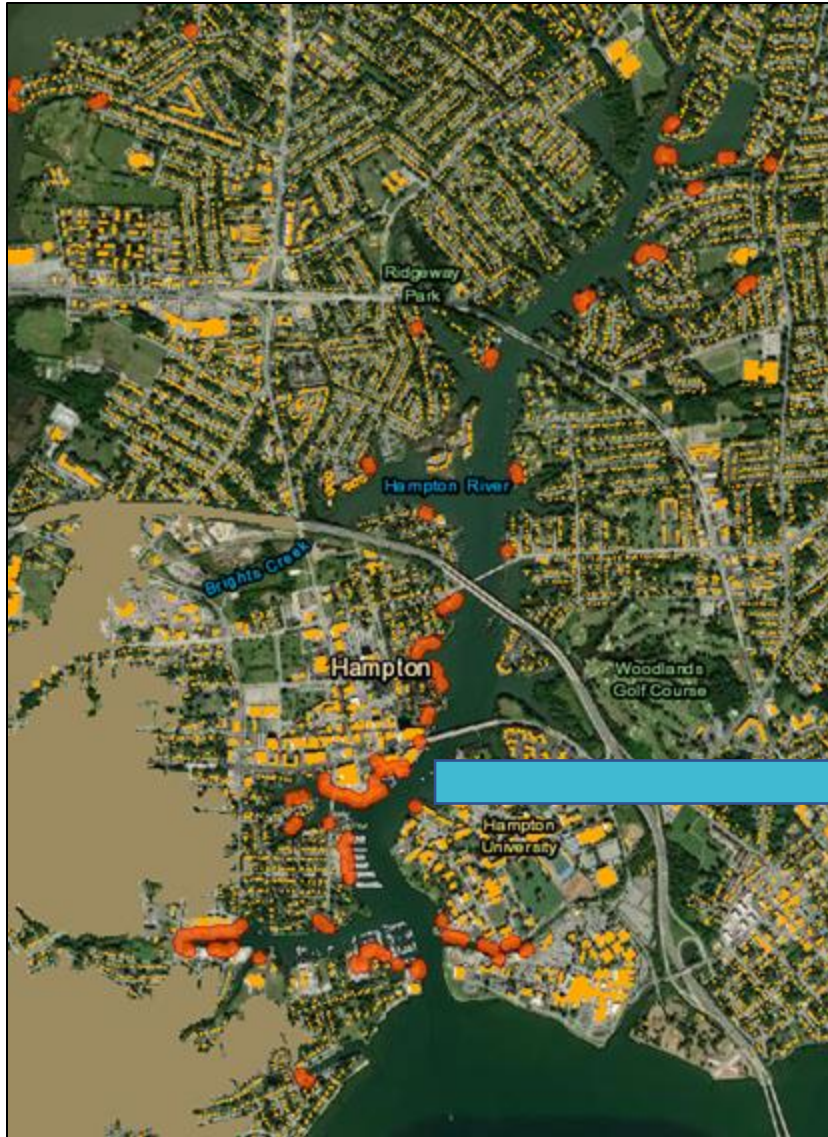
Target Areas: Create/Restore shoreline NNBFs to benefit coastal buildings

Total 208 building(s) will benefit
Including 78 building(s) with no other benefit from NNBFs

Potential NNBF Restoration Options

Convert Existing Land Cover:
Impervious
Turf Grass

Expand Adjacent Existing NNBFs:
Tidal Marsh, Wooded
(pdf links open in a new tab)

NNBF Erosion Control Recommendation (SMM v. 5.1)
Highly Modified Area. Seek expert advice.
Click here for more information

Shoreline Structure Enhancements
Add natural features to existing structures: Bulkhead, Marina, Unconventional, Wharf.

Ranking Living Shorelines: Shoreline Management Model

- GIS analytical model uses bio-physical criteria to derive a recommended management approach reflective of State policy for Living Shorelines
- Javascript coding is applied to run the analysis
- Critieria:
    - Fetch
    - Marsh, Beach presence
    - Existing structures
    - Nearshore bathymetry
    - Landuse
    - Proximal infrastructure

- Output - One of Eleven Shoreline BMPS
- Complete for all Virginia
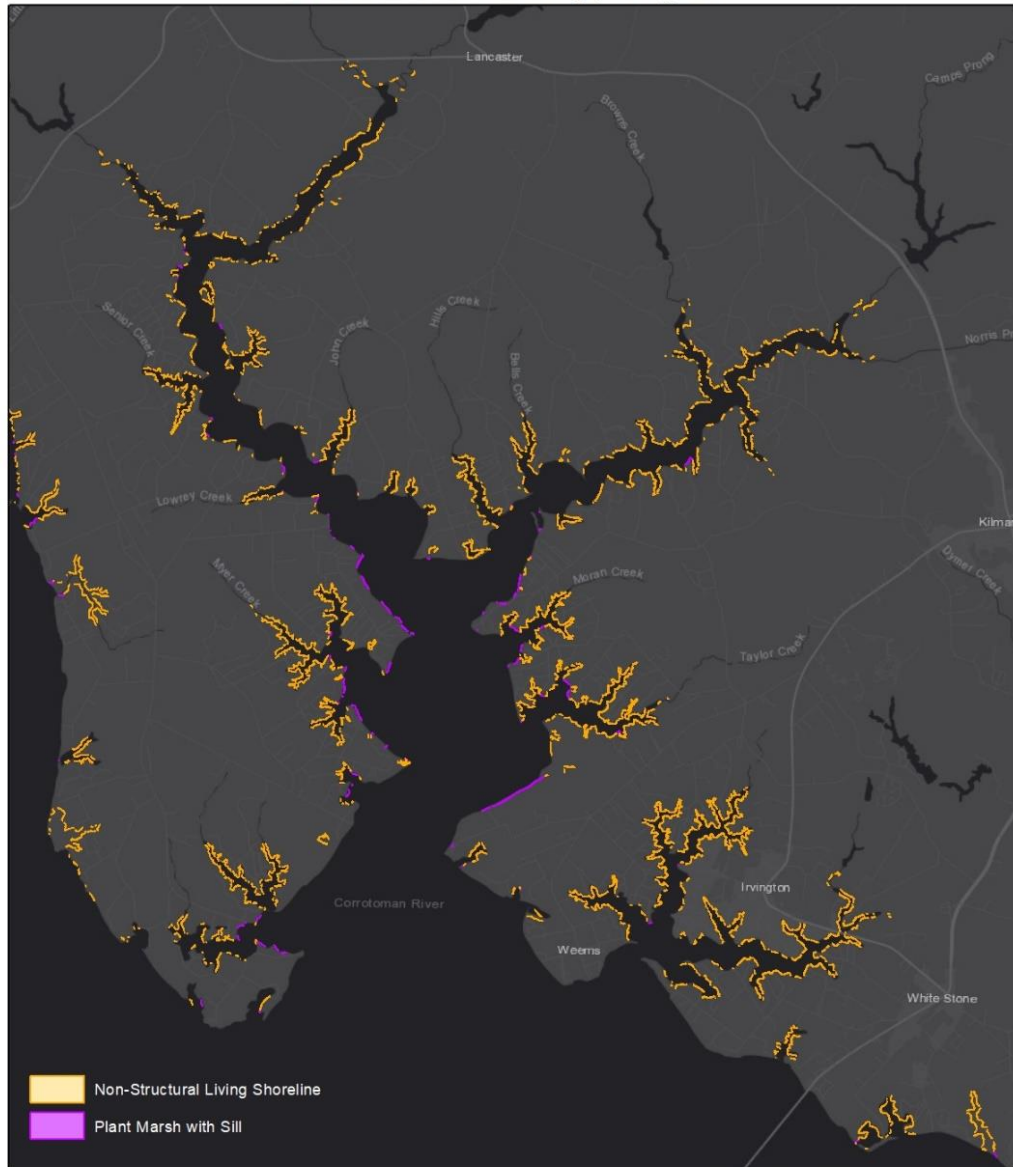
Modeled Living Shorelines Load Reductions

CBP Tidal Shoreline BMP Protocols

- Protocol 1, "Prevented Sediment" provides an annual mass sediment reduction credit for qualifying shoreline management practices that prevent tidal shoreline erosion that would otherwise be delivered to nearshore/downstream waters. The pollutant loads are reduced for sand content and bank instability (based on the state's assessment).

- Protocol 2, "Credit for Denitrification" provides an annual mass nitrogen reduction credit for qualifying shoreline management practices that include vegetation.

- Protocol 3, "Credit for Sedimentation" protocol provides an annual mass sediment and phosphorus reduction credit for qualifying shoreline management practices that include vegetation.

- Protocol 4 "Credit for Marsh Redfield Ratio" provides one-time nutrient reduction credit for qualifying shoreline management practices that include vegetation.

- A "Default Rate" provides an annual mass sediment and nutrient reduction credit for qualifying shoreline management practices.
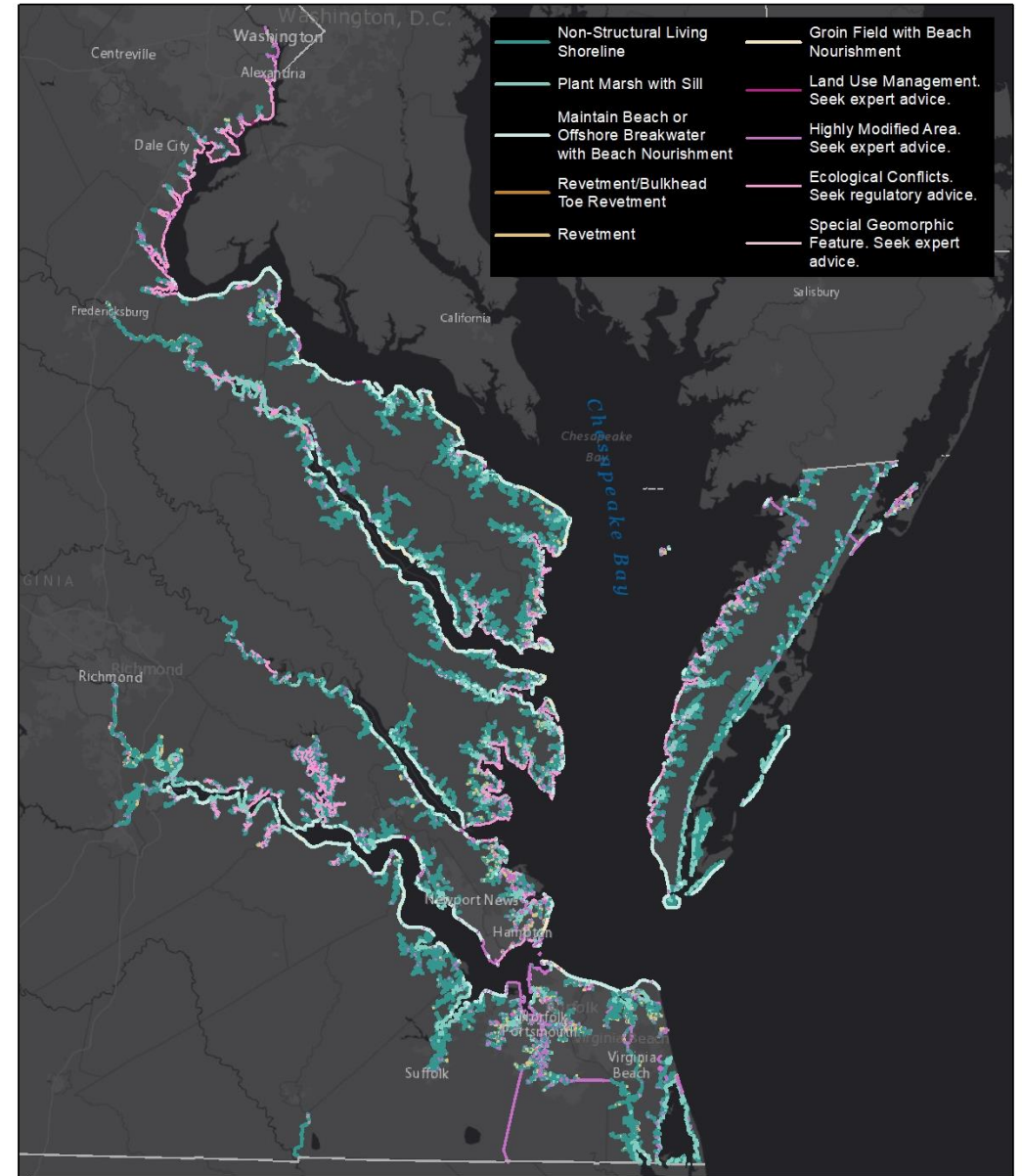
CBP Shoreline Approved BMP

Protocol	Submitted Unit	Total Nitrogen (lbs per unit)	Total Phosphorus (lbs per unit)	Total Suspended Sediment (lbs per unit)
Prevented Sediment	Linear Feet	Project-Specific*	Project-Specific*	Project-Specific
Denitrification	Acres of re-vegetation	85	NA	NA
Sedimentation	Acres of re-vegetation	NA	5.289	6,959
Redfield Ratio	Acres of re-vegetation	6.83	0.3	NA
Non-conforming/ Existing Practices*	Linear Feet	MD = 0.04756 VA = 0.01218	MD = 0.03362 VA = 0.00861	MD = 164 VA = 42

Living Shoreline Modeled Extent in Corrotoman River, Lancaster County, Virginia

Non-Structural Living Shoreline

Plant Marsh with Sill

Virginia Preferred Shoreline BMPs

Non-Structural Living Shoreline

Plant Marsh with Sill

Maintain Beach or Offshore Breakwater with Beach Nourishment

Revetment/Bulkhead Toe Revetment

Revetment

Groin Field with Beach Nourishment

Land Use Management. Seek expert advice.

Highly Modified Area. Seek expert advice.

Ecological Conflicts. Seek regulatory advice.

Special Geomorphic Feature. Seek expert advice.

Converted SMM linear feet to square feet. L * 8 = N

Tidal Shoreline Preferred BMPs - Length of Shoreline in Linear Feet												
Shoreline Type	Maintain Beach/ Breakwater w/ Beach Fill	Ecological Conflicts	Groin Field with Beach Fill	Highly Modified Area	Landuse Management	No Action Needed	Non-Structural Living Shoreline	Plant Marsh with Sill	Revetment	Revetment / Bulkhead Toe	Special Geomorphic Feature	Total
Undefended - Marsh	168892	2145334	0.00	4441823	21765	8575671	23945516	2479651	7579	0.00	31211	37819802
Undefended - No Marsh	1044630	917796	0.00	342682	93613	134344	5710913	522189	486668	0.00	44640	9297473
Defended - Marsh	91959	121588	4917	147415	5246	3901	614035	186953	49997	3832	1077	1230921
Defended - No Marsh	905048	466089	92077	1168978	12475	524	1245374	266835	152003	13897	2997	4326299
Total	2210531	3650806	96994	2103257	133099	8714439	31515839	3455629	696247	17730	79924	52,674,495

■ Modeled shoreline used for calculations

■ Additional Shoreline possible for marsh creation

Living Shoreline Ranking Factors

- Water Quality: Load Reduction Potential = Length (all are same width)
- Habitat Continunity
  - High = connects tidal or nontidal wetlands
  - Medium= connects wooded, beach, dune
- Benefits Buildings
  - Protects 2 or more, or critical facility(ies)
- Benefits to socially vulnerable communities
  - High, moderate, low

Adapt VA Interactive Map

ADAPT VA

VIMS | WILLIAM & MARY

Protection/Restoration

▽ ☑ Restoration Opportunities

- ☐ Target Areas: Create/Restore shoreline NNBFs to benefit coastal buildings ⓘ

- ☑ Living Shorelines: Suitable Areas for Marsh Ranked for Co-Benefits ⓘ

- ☐ Protected Lands Suitable for Living Shoreline ⋯

🔍 Zoom to

Areas Suitable for Marsh Living Shorelines

This layer shows locations where the Shoreline Management Model (SMM) recommends living shorelines with marsh. A **Non-Structural Living Shoreline** is recommended at this location.

This potential living shoreline site is 1184 feet long by 8 feet wide, and provides **the most** benefits:

Nutrient Reduction Potential	High
Habitat Continuity Benefit	High
Benefits to Local Buildings	High
Benefits to Socially Vulnerable Communities	Low

More information about the SMM and recommendations for other shoreline segments can be found in the Shoreline Management panel.

Legend

Restoration Opportunities

Living Shorelines: Suitable Areas for Marsh Ranked for Co-Benefits

Rank of Benefits Provided

- Most Benefits Provided
- Many Benefits Provided
- Some Benefits Provided

Sea Level Rise / Flooding / Storm Surge
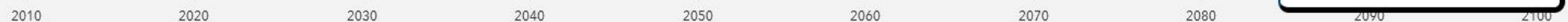
Vulnerability / Risk

Infrastructure

Shoreline Management

Natural Resources

Protection / Restoration Opportunities

How To

▷ 1/1/2020

int-High SLR scenario

2010 2020 2030 2040 2050 2060 2070 2080 2090 2100

Identify target areas for New NNBFs: Tidal & Nontidal Wetlands

Why target the shoreline?

- First line of defense

- Programmatic incentives – in RPA

- Other tools available to help inform NNBF creation (e.g., CCRM Shoreline Management Model)

Hampton River, Hampton