Living Shorelines and DCR

BMPs to Meet Water Quality Goals
Shoreline Erosion Advisory Service (SEAS)
Coastal Resilience Master Plan

Aaron Wendt
Environmental Specialist
Virginia Department of Conservation and Recreation
Shoreline Erosion Advisory Service

DCR SEAS ROLES: Technical Advisors and BMP Verification

Shoreline Erosion Advisory Service (SEAS)

- established 1980
- science-based technical assistance on environmentally sound shoreline mgmt alternatives
- private property owners & public land mgmt agencies experiencing erosion
- tidal shorelines or non-tidal streambanks & impoundments

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SEAS SERVICES

- **on-site** field investigation of erosion issues
- **written advisory reports** with recommended **solutions**
- **review designs and plans**
- **construction inspections**
- **guidance on financial incentive** programs
- all SEAS services are **NO COST** to property owners

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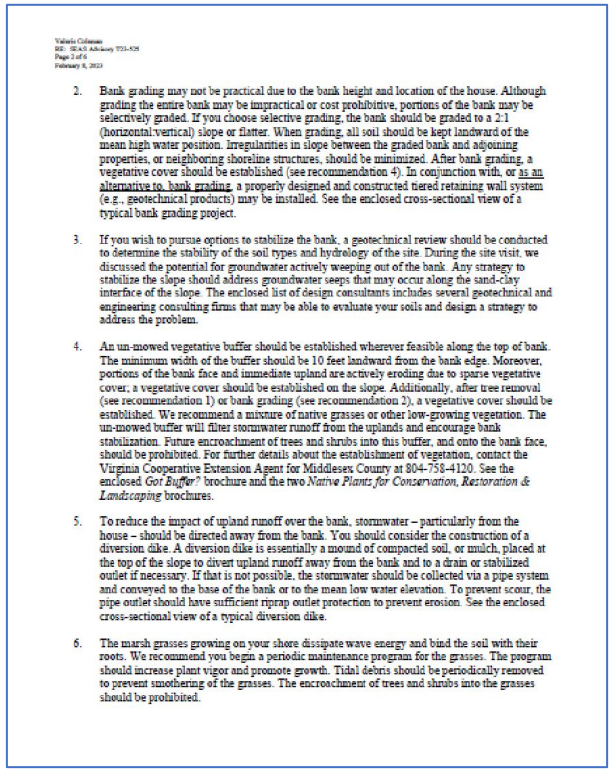
SEAS Written Advisory Report



Valerie Coleman
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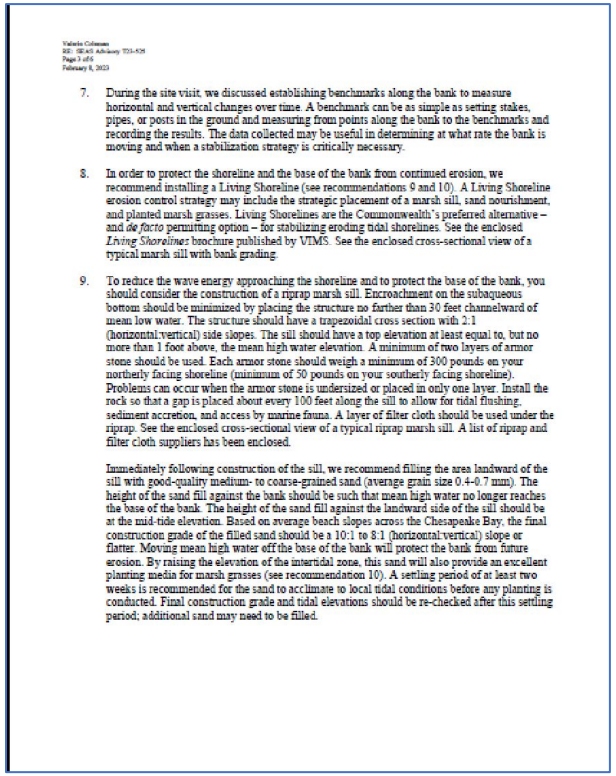
2. Bank grading may not be practical due to the bank height and location of the house. Although grading the entire bank may be impractical or cost prohibitive, portions of the bank may be selectively graded. If you choose selective grading, the bank should be graded to a 2:1 (horizontal:vertical) slope or flatter. When grading, all soil should be kept landward of the mean high water position. Irregularities in slope between the graded bank and adjoining properties, or neighboring shoreline structures, should be minimized. After bank grading, a vegetative cover should be established (see recommendation 4). In conjunction with, or as an alternative to, bank grading, a properly designed and constructed tiered retaining wall system (e.g., geotechnical products) may be installed. See the enclosed cross-sectional view of a typical bank grading project.

3. If you wish to pursue options to stabilize the bank, a geotechnical review should be conducted to determine the stability of the soil types and hydrology of the site. During the site visit, we discussed the potential for groundwater actively weeping out of the bank. Any strategy to stabilize the slope should address groundwater seeps that may occur along the sand-clay interface of the slope. The enclosed list of design consultants includes several geotechnical and engineering consulting firms that may be able to evaluate your soils and design a strategy to address the problem.

4. An un-mowed vegetative buffer should be established wherever feasible along the top of bank. The minimum width of the buffer should be 10 feet landward from the bank edge. Moreover, portions of the bank face and immediate upland are actively eroding due to sparse vegetative cover, a vegetative cover should be established on the slope. Additionally, after tree removal (see recommendation 1) or bank grading (see recommendation 2), a vegetative cover should be established. We recommend a mixture of native grasses or other low-growing vegetation. The un-mowed buffer will filter stormwater runoff from the uplands and encourage bank stabilization. Future encroachment of trees and shrubs into this buffer, and onto the bank face, should be prohibited. For further details about the establishment of vegetation, contact the Virginia Cooperative Extension Agent for Middlesex County at 804-758-4120. See the enclosed *Got Buffer?* brochure and the two *Native Plants for Conservation, Restoration & Landscaping* brochures.

5. To reduce the impact of upland runoff over the bank, stormwater – particularly from the house – should be directed away from the bank. You should consider the construction of a diversion dike. A diversion dike is essentially a mound of compacted soil, or mulch, placed at the top of the slope to divert upland runoff away from the bank and to a drain or stabilized outlet if necessary. If that is not possible, the stormwater should be collected via a pipe system and conveyed to the base of the bank or to the mean low water elevation. To prevent scour, the pipe outlet should have sufficient riprap outlet protection to prevent erosion. See the enclosed cross-sectional view of a typical diversion dike.

6. The marsh grasses growing on your shore dissipate wave energy and bind the soil with their roots. We recommend you begin a periodic maintenance program for the grasses. The program should increase plant vigor and promote growth. Tidal debris should be periodically removed to prevent smothering of the grasses. The encroachment of trees and shrubs into the grasses should be prohibited.



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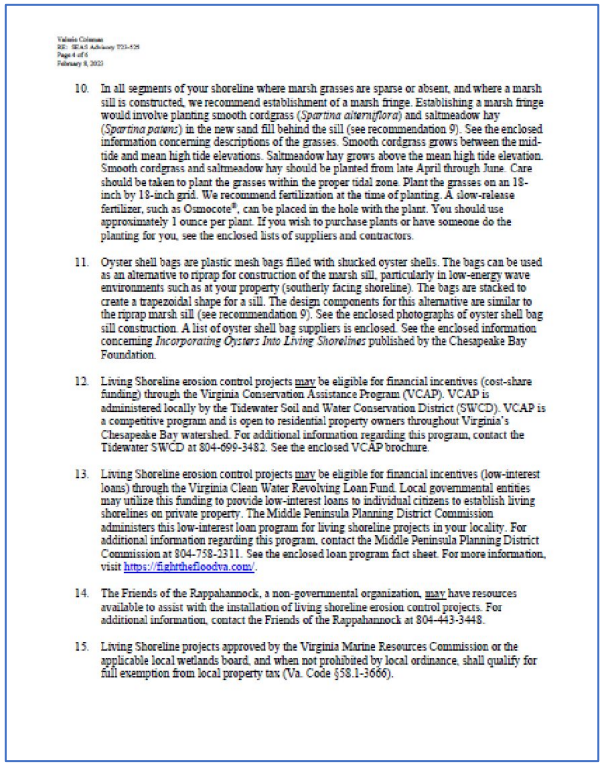
7. During the site visit, we discussed establishing benchmarks along the bank to measure horizontal and vertical changes over time. A benchmark can be as simple as setting stakes, pipes, or posts in the ground and measuring from points along the bank to the benchmarks and recording the results. The data collected may be useful in determining at what rate the bank is moving and when a stabilization strategy is critically necessary.

8. In order to protect the shoreline and the base of the bank from continued erosion, we recommend installing a Living Shoreline (see recommendations 9 and 10). A Living Shoreline erosion control strategy may include the strategic placement of a marsh sill, sand nourishment, and planted marsh grasses. Living Shorelines are the Commonwealth's preferred alternative – and *de facto* permitting option – for stabilizing eroding tidal shorelines. See the enclosed *Living Shorelines* brochure published by VIMS. See the enclosed cross-sectional view of a typical marsh sill with bank grading.

9. To reduce the wave energy approaching the shoreline and to protect the base of the bank, you should consider the construction of a riprap marsh sill. Encroachment on the subaqueous bottom should be minimized by placing the structure no farther than 30 feet channelward of mean low water. The structure should have a trapezoidal cross section with 2:1 (horizontal:vertical) side slopes. The sill should have a top elevation at least equal to, but no more than 1 foot above, the mean high water elevation. A minimum of two layers of armor stone should be used. Each armor stone should weigh a minimum of 300 pounds on your northerly facing shoreline (minimum of 50 pounds on your southerly facing shoreline). Problems can occur when the armor stone is undersized or placed in only one layer. Install the rock so that a gap is placed about every 100 feet along the sill to allow for tidal flushing, sediment accretion, and access by marine fauna. A layer of filter cloth should be used under the riprap. See the enclosed cross-sectional view of a typical riprap marsh sill. A list of riprap and filter cloth suppliers has been enclosed.

   Immediately following construction of the sill, we recommend filling the area landward of the sill with good-quality medium- to coarse-grained sand (average grain size 0.4-0.7 mm). The height of the sand fill against the bank should be such that mean high water no longer reaches the base of the bank. The height of the sand fill against the landward side of the sill should be at the mid-tide elevation. Based on average beach slopes across the Chesapeake Bay, the final construction grade of the filled sand should be a 10:1 to 8:1 (horizontal:vertical) slope or flatter. Moving mean high water off the base of the bank will protect the bank from future erosion. By raising the elevation of the intertidal zone, this sand will also provide an excellent planting media for marsh grasses (see recommendation 10). A settling period of at least two weeks is recommended for the sand to acclimate to local tidal conditions before any planting is conducted. Final construction grade and tidal elevations should be re-checked after this settling period; additional sand may need to be filled.



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10. In all segments of your shoreline where marsh grasses are sparse or absent, and where a marsh sill is constructed, we recommend establishment of a marsh fringe. Establishing a marsh fringe would involve planting smooth cordgrass (*Spartina alterniflora*) and saltmeadow hay (*Spartina patens*) in the new sand fill behind the sill (see recommendation 9). See the enclosed information concerning descriptions of the grasses. Smooth cordgrass grows between the mid-tide and mean high tide elevations. Saltmeadow hay grows above the mean high tide elevation. Smooth cordgrass and saltmeadow hay should be planted from late April through June. Care should be taken to plant the grasses within the proper tidal zone. Plant the grasses on an 18-inch by 18-inch grid. We recommend fertilization at the time of planting. A slow-release fertilizer, such as Osmocote®, can be placed in the hole with the plant. You should use approximately 1 ounce per plant. If you wish to purchase plants or have someone do the planting for you, see the enclosed lists of suppliers and contractors.

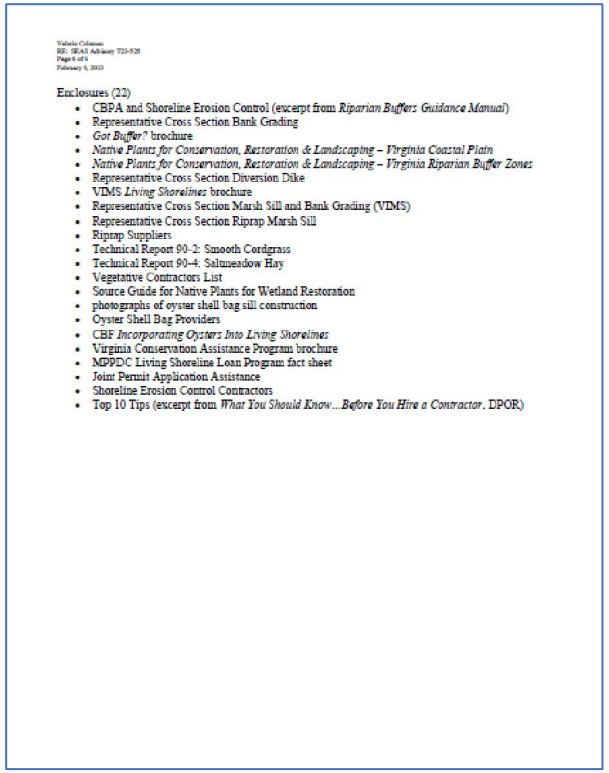
11. Oyster shell bags are plastic mesh bags filled with shucked oyster shells. The bags can be used as an alternative to riprap for construction of the marsh sill, particularly in low-energy wave environments such as at your property (southerly facing shoreline). The bags are stacked to create a trapezoidal shape for a sill. The design components for this alternative are similar to the riprap marsh sill (see recommendation 9). See the enclosed photographs of oyster shell bag sill construction. A list of oyster shell bag suppliers is enclosed. See the enclosed information concerning *Incorporating Oysters Into Living Shorelines* published by the Chesapeake Bay Foundation.

12. Living Shoreline erosion control projects may be eligible for financial incentives (cost-share funding) through the Virginia Conservation Assistance Program (VCAP). VCAP is administered locally by the Tidewater Soil and Water Conservation District (SWCD). VCAP is a competitive program and is open to residential property owners throughout Virginia's Chesapeake Bay watershed. For additional information regarding this program, contact the Tidewater SWCD at 804-699-3482. See the enclosed VCAP brochure.

13. Living Shoreline erosion control projects may be eligible for financial incentives (low-interest loans) through the Virginia Clean Water Revolving Loan Fund. Local governmental entities may utilize this funding to provide low-interest loans to individual citizens to establish living shorelines on private property. The Middle Peninsula Planning District Commission administers this low-interest loan program for living shoreline projects in your locality. For additional information regarding this program, contact the Middle Peninsula Planning District Commission at 804-758-2311. See the enclosed loan program fact sheet. For more information, visit https://fightfloodva.com/.

14. The Friends of the Rappahannock, a non-governmental organization, may have resources available to assist with the installation of living shoreline erosion control projects. For additional information, contact the Friends of the Rappahannock at 804-443-3448.

15. Living Shoreline projects approved by the Virginia Marine Resources Commission or the applicable local wetlands board, and when not prohibited by local ordinance, shall qualify for full exemption from local property tax (Va. Code §58.1-3666).



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Enclosures (22)

- CBPA and Shoreline Erosion Control (excerpt from *Riparian Buffers Guidance Manual*)
- Representative Cross Section Bank Grading
- *Got Buffer?* brochure
- *Native Plants for Conservation, Restoration & Landscaping – Virginia Coastal Plain*
- *Native Plants for Conservation, Restoration & Landscaping – Virginia Riparian Buffer Zones*
- Representative Cross Section Diversion Dike
- VIMS *Living Shorelines* brochure
- Representative Cross Section Marsh Sill and Bank Grading (VIMS)
- Representative Cross Section Riprap Marsh Sill
- Riprap Suppliers
- Technical Report 90-2: Smooth Cordgrass
- Technical Report 90-4: Saltmeadow Hay
- Vegetative Contractors List
- Source Guide for Native Plants for Wetland Restoration
- photographs of oyster shell bag sill construction
- Oyster Shell Bag Providers
- CBF *Incorporating Oysters Into Living Shorelines*
- Virginia Conservation Assistance Program brochure
- MPPDC Living Shoreline Loan Program fact sheet
- Joint Permit Application Assistance
- Shoreline Erosion Control Contractors
- Top 10 Tips (excerpt from *What You Should Know…Before You Hire a Contractor*, DPOR)

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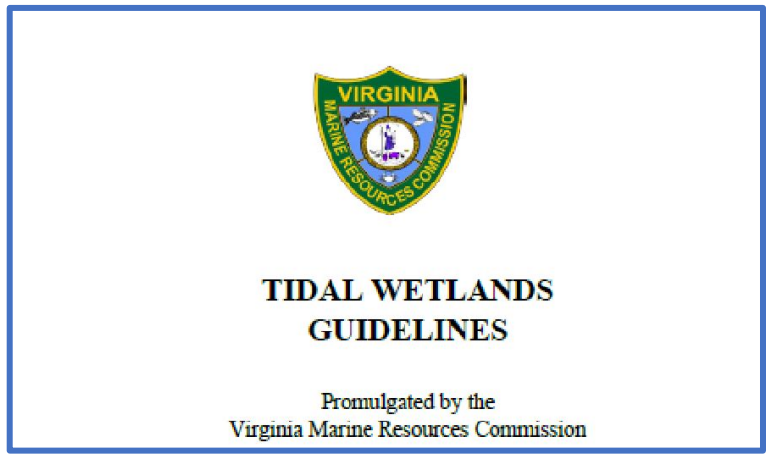
Best Available Science vs Technical Advisors/Resource

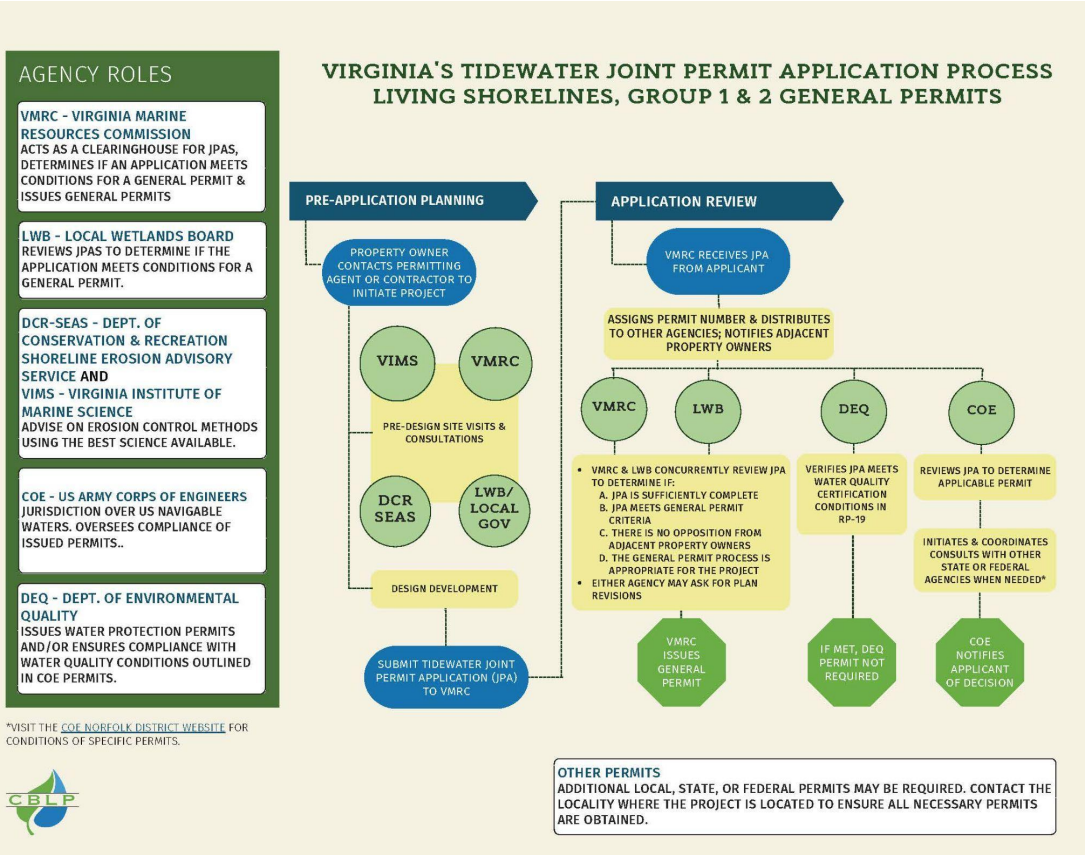


Best Available Science

DCR-SEAS ≠ VIMS Office of Research & Advisory Services

"designed to survive the impacts of **sea level rise**, using…the **2017 National Oceanographic and Atmospheric Administration's (NOAA) Intermediate-High scenario** projection curve or updated projection based on the **best available science** and selected through the **Coastal Master Plan** process".

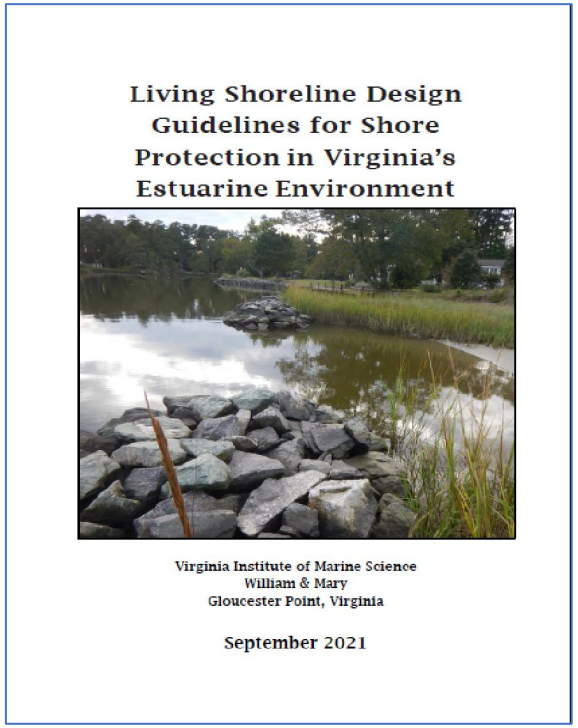
Understanding & Navigating the Permitting Process



Legislation	Administration	Over-Sight/ Review	Determination and Delineation
Tidal Wetlands Act	Local: Wetlands Board VMRC if no Board	VMRC	Locality Determines 1.Contiguous to MLW 2. Elevation MLW to 1.5 x tide range or to MHW 3. Plants listed in 28.2-1300
Coastal Primary Sand Dunes & Beaches Act	Local: Wetlands Board VMRC if no Board	VMRC	Locality Determines 1. Mounds of unconsolidated sand 2. Contiguous to MHW 3. Limits marked by a change in grade from >10% to <10% 4. Plants listed in 28.2-1400
Chesapeake Bay Preservation Act	Local: Wetlands Board, "Bay" Board or Staff	DEQ	Locality Determines 100 ft riparian buffer landward of RPA features (Tidal wetlands, tidal shores, nontidal wetlands connected by surface water, other lands as specified)
Subaqueous Lands	VMRC		VMRC Determines Beds of the bays, rivers, creeks, or shores of the sea channelward of the MLW
Virginia Water Protection Permit	DEQ	Courts	DEQ Determines 1. Hydrology 2. Plants 3. Soils
Clean Water Act	Corps of Engineers	EPA and Courts	Corps Determines Urban/ Residential/ Commercial NRCS Determines Agricultural

Utilize and Follow Guidance Documents

VIMS

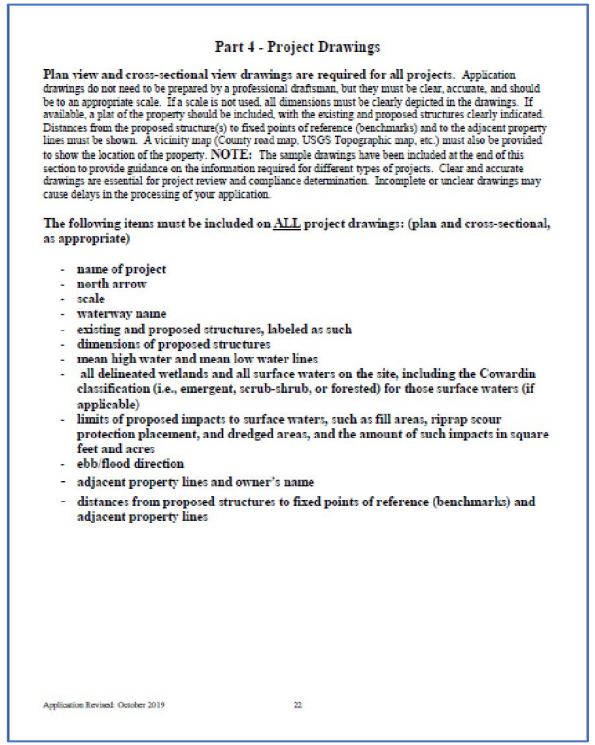


Living Shoreline Design Guidelines for Shore Protection in Virginia's Estuarine Environment

Virginia Institute of Marine Science
William & Mary
Gloucester Point, Virginia

September 2021

JPA



Part 4 - Project Drawings

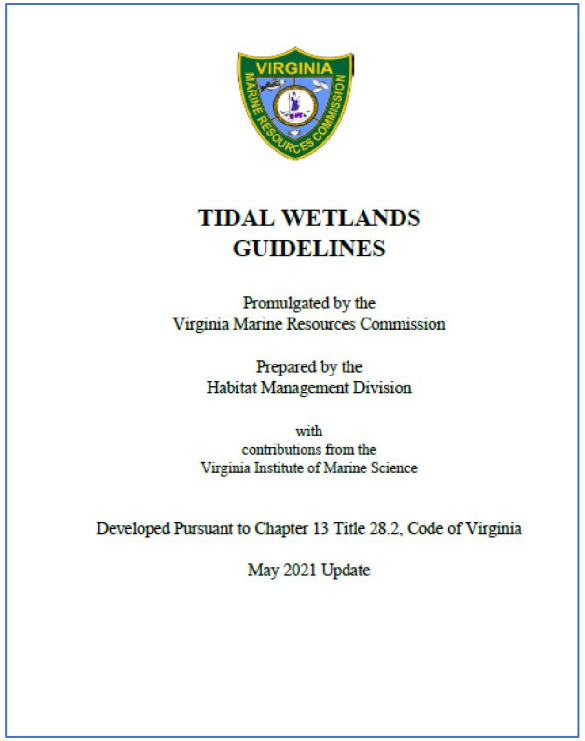
Plan view and cross-sectional view drawings are required for all projects. Application drawings do not need to be prepared by a professional draftsman, but they must be clear, accurate, and should be to an appropriate scale. If a scale is not used, all dimensions must be clearly depicted in the drawings. If available, a plat of the property should be included, with the existing and proposed structures clearly indicated. Distances from the proposed structure(s) to fixed points of reference (benchmarks) and to the adjacent property lines must be shown. A vicinity map (County road map, USGS Topographic map, etc.) must also be provided to show the location of the property. **NOTE:** The sample drawings have been included at the end of this section to provide guidance on the information required for different types of projects. Clear and accurate drawings are essential for project review and compliance determination. Incomplete or unclear drawings may cause delays in the processing of your application.

The following items must be included on ALL project drawings: (plan and cross-sectional, as appropriate)

- name of project
- north arrow
- scale
- waterway name
- existing and proposed structures, labeled as such
- dimensions of proposed structures
- mean high water and mean low water lines
- all delineated wetlands and all surface waters on the site, including the Cowardin classification (i.e., emergent, scrub-shrub, or forested) for those surface waters (if applicable)
- limits of proposed impacts to surface waters, such as fill areas, riprap scour protection placement, and dredged areas, and the amount of such impacts in square feet and acres
- ebb/flood direction
- adjacent property lines and owner's name
- distances from proposed structures to fixed points of reference (benchmarks) and adjacent property lines

Application Revised: October 2019 22

VMRC



VIRGINIA MARINE RESOURCES COMMISSION

TIDAL WETLANDS GUIDELINES

Promulgated by the
Virginia Marine Resources Commission

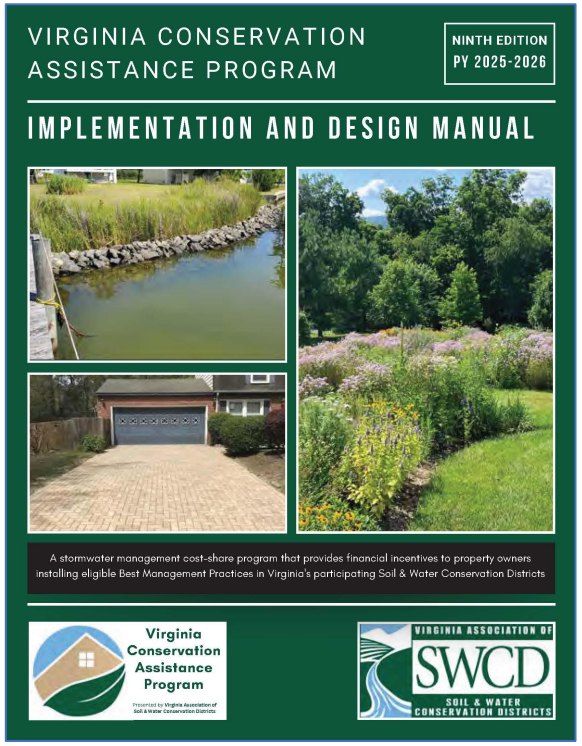
Prepared by the
Habitat Management Division

with
contributions from the
Virginia Institute of Marine Science

Developed Pursuant to Chapter 13 Title 28.2, Code of Virginia

May 2021 Update

VCAP



VIRGINIA CONSERVATION ASSISTANCE PROGRAM

NINTH EDITION PY 2025-2026

IMPLEMENTATION AND DESIGN MANUAL

A stormwater management cost-share program that provides financial incentives to property owners installing eligible Best Management Practices in Virginia's participating Soil & Water Conservation Districts

Virginia Conservation Assistance Program

VIRGINIA ASSOCIATION OF SWCD SOIL & WATER CONSERVATION DISTRICTS

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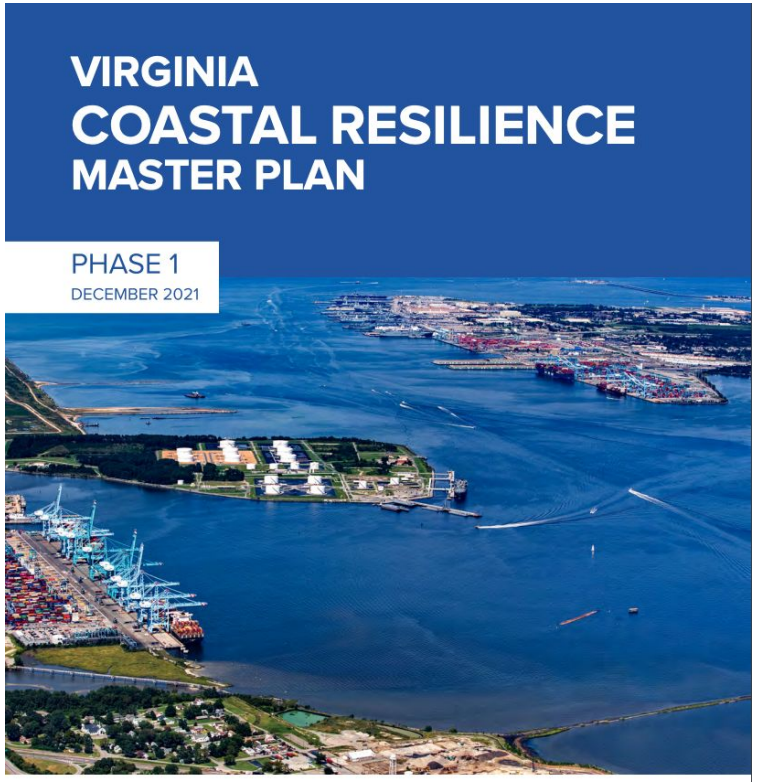
Design for Sea Level Rise and Coastal Hazards - Resilience



Dynamic Living Shoreline Design

Minimize Wave Energy

Wide tidal marshes

Wave attenuation structures that allow tidal inundation & sedimentation

Maximize Sediment Accretion

Dense plants in clusters + ribbed mussels

Provide Retreat Pathway

Grade bank for suitable slopes wherever possible

Reserve adjacent upland spaces with compatible land uses

Maintenance Interventions

Reserve access for future thin-layer fill additions & raise sill height

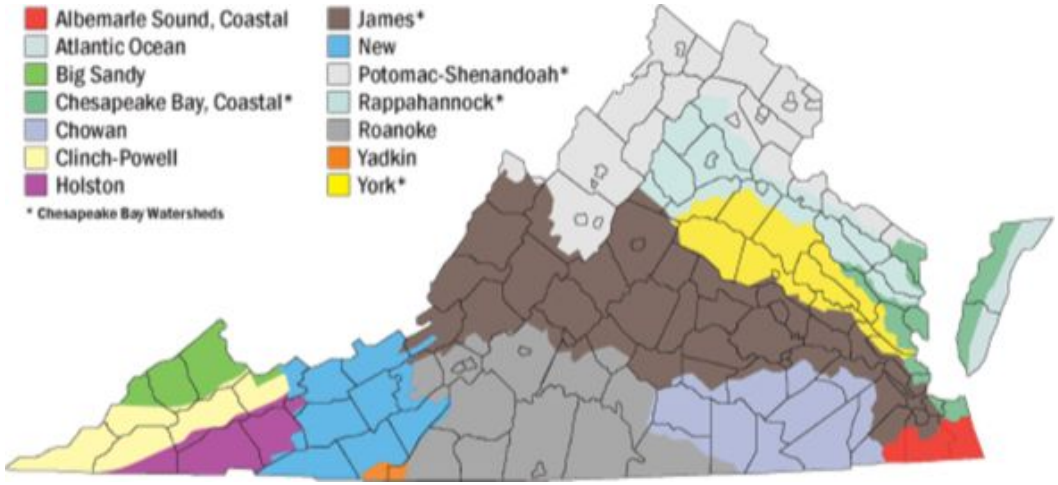
M. Mitchell & D. Bilkovic 2019 Embracing dynamic design for climate-resilient living shorelines.

slide borrowed from Karen Durhing, VIMS-CCRM, webinar 08/11/2021

Living Shorelines: BMPs to Meet TMDL Goals

Chesapeake Bay Phase III Watershed Implementation Plan (WIP)

- TMDL – total maximum daily load is pollution diet to reduce nitrogen, phosphorus, and sediment in Chesapeake Bay
- WIP released mid-2019 guides actions through 2025 (Beyond 2025?, CESR report)
- BMPs - Best Management Practices proposed by the Commonwealth to achieve TMDLs
- Shoreline Management goals including living shorelines as a BMP



Basin	WIP3 (ft)	WIP3 (mi)
Potomac	70,051	13.27
Rappahannock	132,484	25.09
York	141,042	26.71
James	79,446	15.05
Eastern Shore	76,977	14.58
SUM	500,000	94.70

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Shoreline Management BMP - Chesapeake Bay Program

Expert Panel established pollutant reductions and qualifying criteria

- **Living Shorelines**
  - **Nonstructural**
  - **Hybrid System Including Sill**
  - **Hybrid System Including Breakwater**
- Revetment and/or Breakwater - no Living Shoreline
  - ONLY if site experiencing erosion + LS not technically feasible + NO impact to SAV, shellfish beds or wetlands
- Bulkhead/Seawalls
  - ONLY if erosion + marine commercial/ industrial/ ports w/ >= 10 ft deep water 35 ft from shore

Recommendations of the Expert Panel to Define Removal Rates for Shoreline Management Projects

, George Janek, Lee Karrh, Eva
or, Kevin Smith, Bill Stack, Steve

: April 15, 2014
: February 13, 2015
n Team: July 13, 2015
une, 2017

PRIOR VERSIONS

hed Protection, Inc. and EPA
m Restoration Coordinator

Good Recipes for the Bay Pollution Diet

U-14 SHORELINE MANAGEMENT PRACTICES

PRACTICE AT A GLANCE

Shoreline management practices improve water quality and ecological conditions within the Bay and the surrounding tidal tributaries.

Shoreline management practices protect property, prevent erosion, improve nearshore aquatic habitat, and mitigate unintended consequences of storm events.

Shoreline management practices exist on a spectrum based on the amount of hardened armor used. They range from living shorelines to bulkheads, seawalls and revetments.

Nutrient and sediment reductions are calculated using four protocols. Specific qualifying criteria and verification standards must be satisfied to receive credits.

DESCRIPTION

Shoreline management is any tidal shoreline practice that prevents and/or reduces delivery of tidal sediments to the Bay from both bank and nearshore erosion. There is no clear geographic boundary that defines where shoreline management can be implemented, though practices are typically placed in tidal areas where erosion is most prevalent. This fact sheet focuses on the shorelines of Maryland and Virginia, but the protocols can be applied to the District of Columbia and Delaware depending on the local regulatory conditions.

Shoreline management practices exist on a spectrum based on the amount of hardened armor used. The type of shoreline management practice selected will vary based on local policies, site characteristics, owner preference, available funding, and multiple other factors.

Living shorelines are erosion control measures that use natural materials to protect, restore or enhance natural shoreline habitat. They have few structural components and rely on elements like marsh vegetation, oyster reefs, coarse woody debris, and sand.

Hybrid living shorelines are projects that include natural habitat elements as well as some hard structures such as stone sills or breakwaters.

Watershed
States
Tidal shoreline

Shaded areas represent portions of the watershed adjacent to Chesapeake Bay tidal waters

Structural shoreline practices include bulkheads, seawalls, revetments, breakwaters, groins, and jetties. These practices have no natural habitat components and should only be considered when living shorelines are not technically feasible. Qualifying criteria needed to receive nutrient and sediment reduction credit for each type of shoreline management practice is summarized in Table 1.

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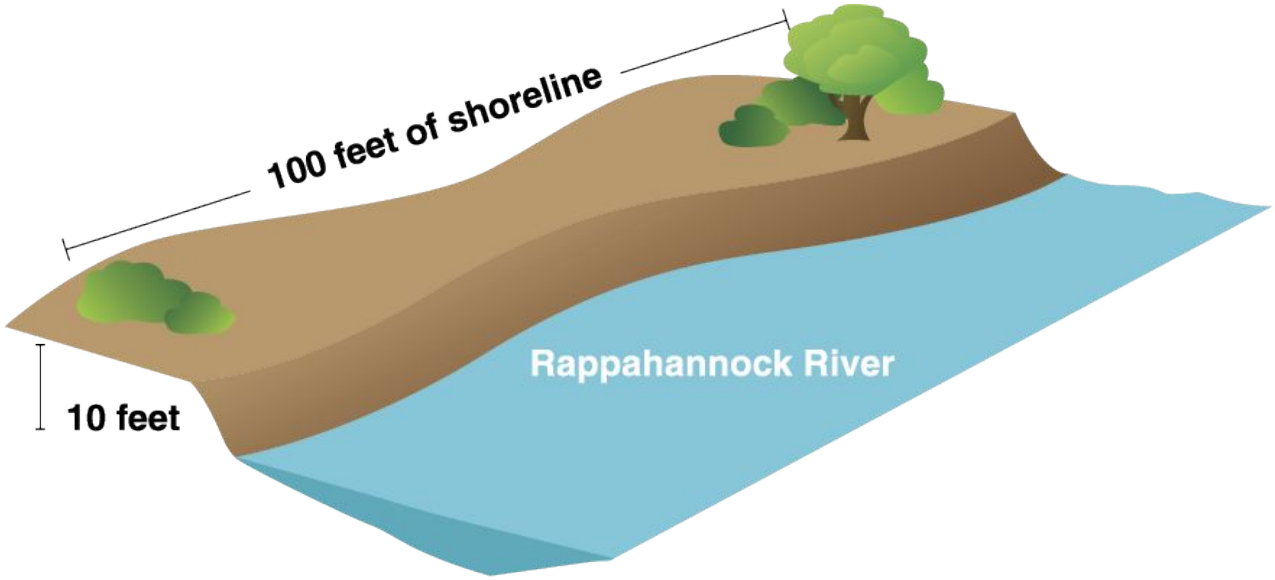
TMDL pollutant load redux protocols

Protocol	Submitted Unit	Total Nitrogen (lbs per unit)	Total Phosphorus (lbs per unit)	Total Suspended Sediment (lbs per unit)
Protocol 1 - Prevented Sediment	Linear Feet	Project-Specific*	Project-Specific*	Project-Specific
Protocol 2 – Denitrification	Acres of re-vegetation	85	NA	NA
Protocol 3 - Sedimentation	Acres of re-vegetation	NA	5.289	6,959
Protocol 4 – Marsh 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

Example



annual erosion rate = 1 foot

15.77 tons of sediment
27.14 pounds of nitrogen
19.19 pounds of phosphorus

SEAS BMP Verification for TMDL WIP Reporting to DEQ

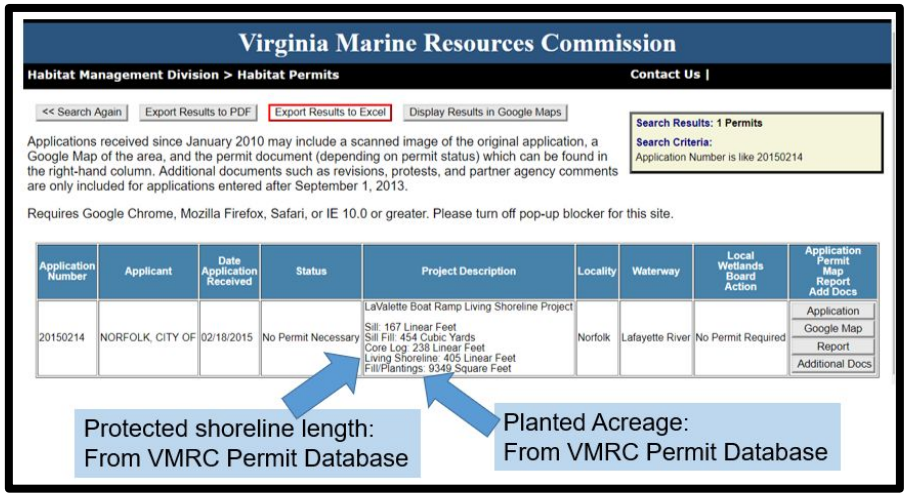
Data and Sources SEAS uses to Verify BMP

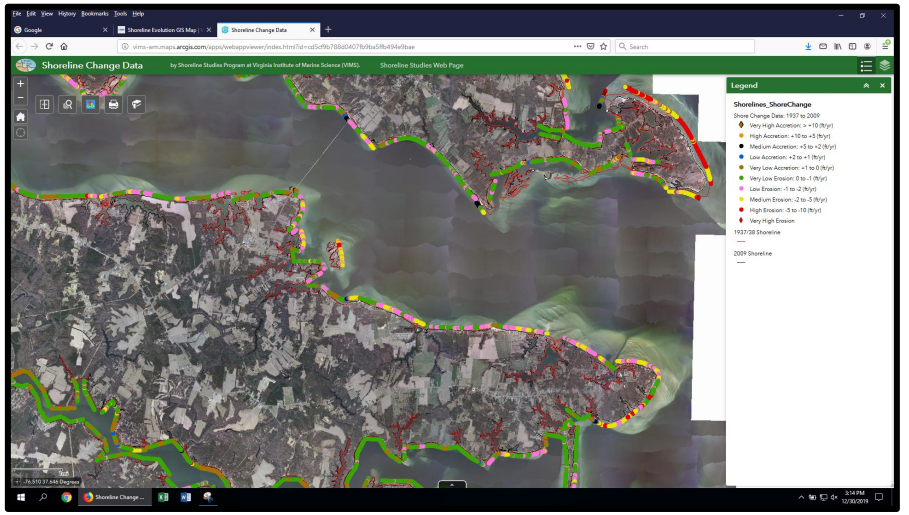
From VMRC *Permit* Database

- Project Construction Date
- Protected Shoreline Length (ft)
- Planted Marsh (ac)

From Other Sources

- Erosion Rate (ft/yr) – VIMS Shoreline Studies Program – actual historic shoreline erosion from aerial images (1937-2009)
- Bank Height (ft) – VGIN LiDAR digital elevation models
- Upland Land Use (Agricultural, Forest, or Urban) – National Land Cover Dataset, VBMP Land Cover, VBMP aerial photography, NAIP aerial photography, VIMS CCRM





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WIP TMDL pollutant load redux

Shoreline Mgmt BMP Verification – WIP3 Goals vs. Reported Credits

	WIP 3 Goals		
Major Basin	goal (ft)	rprtd (ft)	% of goal
Potomac	70,051	55,077	78.6%
Rappahannock	132,484	103,796	78.3%
York	141,042	107,255	76.0%
James	79,446	81,624	102.7%
Eastern Shore	76,977	27,924	36.3%
TOTAL	500,000	375,676	75.1%

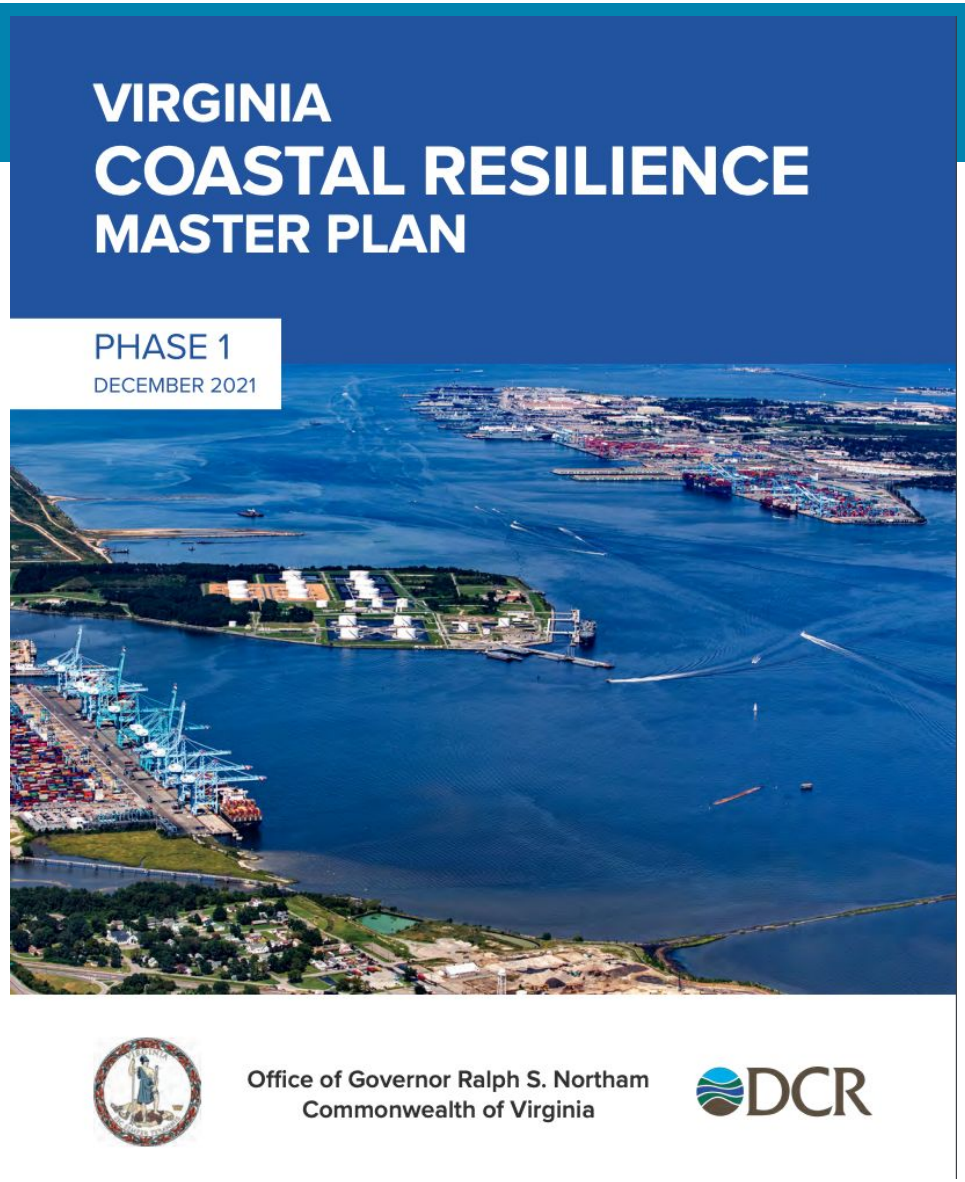
DCR - Coastal Resilience MP

Public Perspectives: Community Benefits from Natural and Nature-Based Projects

Over 1,300 Virginians responded to a public online survey with questions relating to their lived flooding experiences and their views on what types of projects would increase resilience in their community. Of those respondents:

61% believe their community would benefit from nature-based shoreline stabilization.

57% said their community would benefit from habitat creation and restoration.



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Do You Need Technical Advice? Contact Us

SEAS Shoreline Engineers

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PO Box 1425
Tappahannock, VA 22560

http://www.dcr.virginia.gov/soil-and-water/seas