

Living Shorelines Website Final Report

To

Virginia Coastal Zone Management Program

Center for Coastal Resources Management
Virginia Institute of Marine Science

December 2010



This report serves as the final report for the Living Shorelines website revisions project funded by the Virginia Coastal Zone Management Program through NOAA. The project was task 94.04 Fy2009.

The Center for Coastal Resources Management (CCRM) has completed work on a new, revised, Living Shorelines website served through the CCRM subsite on the Virginia Institute of Marine Science website.

Feedback on our previous website was that it was a bit confusing in the navigation and lacked some of the information folks needed. To seek input on the format and content of the new site we conducted 3 focus group meetings of agencies folks, contractors, and representatives of non-governmental groups and the general public. Input from the focus groups was valuable to the final website design and content.

Changes from the original site are great in terms of the amount of information and the degree of detail. Most notable is the addition of detailed descriptions of various living shoreline options and accompanying photographs of actual projects over time. We also are serving a forum to enable interested parties to post and respond to questions regarding living shorelines.

The website was highlighted in a presentation at the CCRM/ VIMS biannual Wetlands Workshop on November 4th, 2010 attended by 80 people. We also distributed a brochure created and printed with previous VCZMP funding that advertises the concept of living shorelines and points people to the website for additional information.

The remaining content herein is the presentation made at the Nov.4 workshop.

The website is

<http://ccrm.vims.edu/livingshorelines/index.html>

This project was funded, in part, by the Virginia Coastal Zone Management Program at the Department of Environmental Quality through Grant #NA NA09NOS4190163 of the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, under the Coastal Zone Management Act of 1972, as amended.



LIVING SHORELINES WEBSITE 2010

Karen Reay
November 2010

Preserving our coasts one shoreline at a time

Problem: Old LS Site Good But Needed Improvement

Center for Coastal Resources Management

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Living Shorelines

- Definition
- Design Options
- Projects
- Documents
- Agencies
- Photo Gallery

W&M > VIMS > CCRM > Living Shorelines

Living Shorelines

A "**Living Shoreline Treatment**" is a shoreline management practice that addresses erosion by providing for long-term protection, restoration or enhancement of vegetated shoreline habitats. This is accomplished through the strategic placement of plants, stone, sand fill and other structural and organic materials.

Living Shoreline Treatments do not include structures that sever natural processes & connections between riparian, intertidal and aquatic areas such as tidal exchange, sediment movement, plant community transitions & groundwater flow.

Coastal Shoreline Profile & Living Shoreline Treatments

UPLAND BUFFER	BANKFACE	COASTAL WETLANDS & BEACH STRAND	SUBTIDAL WATERS
Riparian Vegetation Management	Tidal Marsh Enhancement	Living Breakwater	
Bank Grading	Tidal Marsh Creation	Offshore Breakwater System	
Fiber Logs	Beach Nourishment & Dune Restoration	Oyster Reef	
	Marsh Toe Revetment		
	Marsh Sill		
	Marsh With Groins		

Graphic courtesy Burke Environmental Associates

Steps in the Project

- Funding from Virginia Coastal Zone Management Program for:
 - 3 targeted user group meetings,
 - website revision, and
 - tri-fold brochure advertising the new Living Shorelines Website.

User Group Meetings

- January 2010 – 3 User Groups:
 - Business and Industry – Shoreline Marine Contractors
 - NGOs and Shoreline Property Owners
 - Regulatory - Coastal Managers

LS Website Development

- After consideration of comments from all user group meetings, modifications were made to the living shorelines website to improve functionality and ease of use
- Improvement classifications: revised site architecture, better navigational flow, improved links, new information, and more graphics/photos

Specific Modifications

- **Better guidance for property owners** on the main page – directs right to the FAQ section with questions that drop to anchored answers or links to more information within the site.
- A **decision tree** that helps coastal property owners and managers determine the environmentally preferred approach to protecting currently undefended shorelines, given specific site conditions.
- An **extensive design and build criteria** for nonstructural and structural shoreline treatment options. **Nonstructural:** vegetation management, planted marsh, fiber logs, bank grading, beach nourishment and dune restoration. **Structural/Hybrid:** marsh toe revetment with natural marsh, marsh sill with planted marsh, offshore breakwater system, oyster reef. Each section includes information on suitable sites, guidelines for consideration, and photographic examples.
- A **permits section** related to living shorelines.

Specific Modifications 2

- **Upgraded LS plants and vendors** – individual plants by zonation with new page of native plants for beaches & sand dunes and improved shoreline planting suggestions and an updated list of plant vendors.
- **Learn about living shorelines** with link to VIMS teaching marsh.
- A **map** with living shoreline public demonstration projects including address, GPS location and contacts.
- **Expanded gallery** of before and after photos with a split screen and larger sized photos.
- A **FAQ** (frequently asked questions) page with answers, as well as links to additional information.
- A modified **publications, resources and contacts** page including a funding source and quick links to agencies & organizations, and articles & projects.

Living Shorelines 2010

Old Home Page

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Living Shorelines

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Living Shoreline Treatments do not include structures that sever natural processes & between riparian, intertidal and aquatic areas such as tidal exchange, sediment movement, plant community transitions & groundwater flow.



Better navigation

New Home Page

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Living Shorelines 2010: Why a Living Shoreline?

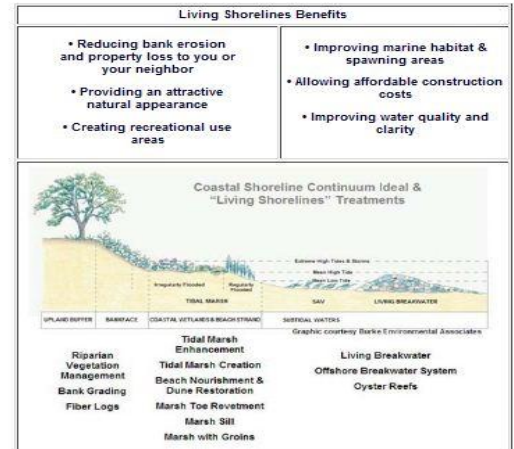
Living Shoreline Treatments address erosion in lower energy situations by providing long-term protection, restoration or enhancement of vegetated shoreline habitats through strategic placement of plants, stone, sand fill and other structural or organic materials. Living Shoreline Treatments do not include structures that sever the natural processes & connections between uplands and aquatic areas.

Remember: Any action on a single shoreline has the potential to impact adjacent shorelines. Shoreline alterations should be avoided where they are not really necessary. When erosion along a shoreline has the potential to result in significant loss of property and upland improvement, then the consideration of shoreline erosion protection activities may be appropriate. Preserving, creating or enhancing natural systems such as marshes and dunes is always the preferred approach to shoreline erosion protection.



Marsh Silt During Construction

FAQ Pointer



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Living Shorelines 2010

Old Design Options

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W&M > VIMS > CCRM > Living Shorelines > Design Options

Living Shorelines: Design Options

Any action on one shoreline has the potential to impact adjacent shorelines. Shoreline alterations should be avoided where they are not really necessary. When erosion along a shoreline has the potential to result in significant loss of property and upland improvement, then the consideration of shoreline erosion protection activities may be appropriate. Preserving, creating or enhancing natural systems such as marshes, beaches and dunes is always the preferred approach to shoreline erosion protection.

Choosing the right living shoreline design option depends on the site location and erosion factors, such as wind, wave activity from storms or boat wakes, tidal currents, and bank height. A combination of design options may also be appropriate, such as bank grading with a planted marsh. Managing shoreline erosion is a complex subject. Always seek professional guidance for the design of your project.

[Non-structural Options](#) (for low energy shorelines) and [Structural Options](#) (for higher energy shorelines).



New Design Options

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W&M > VIMS > CCRM > Living Shorelines > Design & Build Criteria

Living Shorelines: Design & Build Criteria

The main objective for living shorelines is to create wide vegetation and sand buffers on gradual slopes. Choosing the right living shoreline design option depends on the site location and erosion factors, such as wind, wave activity from storms and boat wakes, and bank height.

Do I have the right site conditions for a living shoreline project? These links will help determine what treatment is best for your shoreline.

Decision Tree



CCRM Decision Trees - leads users through a series of questions about shoreline characteristics and results in a recommendation of the environmentally preferable treatment(s) for that shoreline

- [Undefended / Failed Structures Decision Tree Webpage or \(easy-read .pdf\)](#)
- [Reference Manual and Worksheet](#)



[Non-structural Options](#) (for low energy shorelines)



[Hybrid Options](#) (structure used to assist marsh and wetland plant growth in medium and higher energy shorelines)

Design Options

Within Design Options

First – Nonstructural Landing Page

Link to subpage

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W&M > VIMS > CCRM > Living Shorelines > Design& Build Criteria > Nonstructural

Living Shorelines: Non-Structural Options for Low Energy Shorelines

Non-structural design options are most suitable in very low energy settings with minor erosion, minor wave action and good growing conditions. Target areas include the upper reaches of tidal creeks, tidal coves, and other areas protected from excessive wind and wave action.

More information can be found for each option by clicking the link.

	Vegetation Management Create and maintain an integrated vegetation network using riparian buffer + upland bank + tidal marsh plants.
	Planted Marsh Using wetland plants to create a new tidal marsh or enhance an existing one.
	Fiber Logs Manufactured, bio-degradable logs that provide temporary erosion control and support for new wetland and bank vegetation.
	Bank Grading Reduce the steepness of the bank slope. Allows for wave run-up and improves plant growing.

Within Design Options - Subpage

Second: Instructional Page – Planted Marsh

Suitable sites

Guidelines

Example Gallery

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WSM > VIMS > CCRM > Living Shorelines > Design Options > Non-Structural Options

Living Shorelines: Design Options - Planted Marsh

If a natural marsh is absent or too narrow to prevent bank erosion, planting a new wide marsh may be possible. Upland areas with low banks can be excavated and graded to create new tidal marshes. Sand fill can be placed channelward into the water to raise the elevation, but this practice is typically not effective without some type of containment structure (see [fiber log](#) and [marsh sill](#)).

Suitable Sites

- Low energy settings with minor wave action and plenty of sunlight (at least 6 hrs full sun daily)
- Gradual slopes, wide flat intertidal area
- Sandy soils, no excessive muck or clay
- Recently cleared or graded shorelines
- Previously developed or filled area that can be restored

Guidelines for Planted Marshes

- Planted marsh width ≥ 15 feet, including low marsh and high marsh zones
- If upland will be excavated, test soil conditions at target grade
- Only clean sand fill should be used to raise elevation of planting area, topsoil and other soil amendments are not necessary to tidal marshes
- Create suitable slope and elevation for each zone, with positive drainage at low tide
 - low marsh 8 : 10 : 1
 - high marsh 3 : 8 : 1
- Monitor actual tide levels before planting
- Choose wetland plant species based on local salinity and available planting zones
- Plant spacing depends on area to be covered and available labor
 - 18 inches apart for average conditions
 - 12 inches apart for rapid cover
 - 2 ft apart for large areas
- Securely pack around each plug, remove air pockets
- Mix low marsh and high marsh species for 2-3 rows where zones meet
- Plant above and below predicted planting zone levels
- Keep grazing predators out of planted area during first growing season



Within Design Options (scrolled page)

Scroll Down of Planted Marsh Sub-Page with Informative Photos



A degraded upland and wetland area was excavated and graded to create a planted marsh at VIMS. Note the gradual slopes and rapid plant growth after the first growing season. Photos by K. Duhring



Wetland plants purchased from nurseries are healthy and ready to grow. Volunteers are shown removing and separating plugs from large nursery flats to transport them to the shoreline for planting. Photo by K. Duhring



The planting process includes pre-drilling holes then inserting a plug into each hole. It's very important to pack the soil around each plug to remove air pockets. A small quantity of slow-release fertilizer can be placed in the hole under each plug, but this step is not essential for successful plant growth. Photo by K. Duhring



Grazing predators will readily consume a planted marsh. If these animals are present in your project area, there are various temporary methods to exclude them using string, fences and other barriers that can be removed once the planted marsh is established. Goose Exclusion by W. Priest, Canada. Geese and Mute Swans by K. Duhring



Planting marshes in heavy shade is usually not successful. Removing healthy shoreline trees is not encouraged just to create suitable growing conditions for a planted marsh. Other erosion protection methods

New Permitting Page

Permitting page with specifics for living shorelines (local govt permitting agency for riparian buffer modifications and tidal wetlands and VMRC permitting agency for subaqueous modifications)

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W&M > VMRC > CCRM > Living Shorelines > Permits

Living Shorelines: Permitting Steps

- Design projects based on [shoreline conditions](#) & desired level of protection, not jurisdictional boundaries.
- Check with your local county or city environmental office BEFORE doing any shoreline work.
- Check with your Local Wetlands Board staff contacts.

Illustration of Shoreline Permit Zones

Steps For Riparian Buffer Modifications

Permitting Agencies: Local Government

Riparian Buffer Modifications	Permits & Forms that may be required
- Tree pruning - Tree removal - Bank grading - Upland retaining structures	- Land disturbance - Erosion and sediment control (E&S) - Riparian buffer modification - Water quality impact assessment - Landscape restoration agreement - Building permit

Updated Plants & Vendors

Updated with beach & dune plants
and plants by zonation

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W&M > VIMS > CCRM > Living Shorelines > Plants & Vendors

Living Shorelines: Plants and Vendors

- Plants for Salt Marshes and Upland Banks
- Plants for Freshwater Marshes
- Plants for Beaches and Sand Dunes
- Living Shoreline Plant Vendors List
- Invasive Plants to Avoid on the Shoreline
- USDA Invasive Plant Species List

Useful Plant Links

- USDA Plants Database
- Native Plants for Wildlife Habitat and Conservation Landscaping: Chesapeake Bay Watershed, USFWS, 2005
- Native Plants for Conservation, Restoration, and Landscaping: Coastal Plain, VADCR, 2001

PLANTS Database

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Updated Plants & Vendors - Subpage

Native plants for beaches and sand dunes with detailed view, description and plant habit

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W&M > VIMS > CORM > Living Shorelines > Plants & Vendors > Dune Plants

Living Shorelines: Native plants for Beaches and Sand Dunes

Detailed View	Plant Descriptions	Habit of Plant
	Sea Oats - <i>Uniola paniculata</i> Warm-season grass, height 3-6 ft, seed head is a large open panicle with flat spikelets, seed heads become yellow-brown in late summer and fall	
	American beach grass - <i>Ammophila brevifolula</i> Cool-season bunch grass with strong underground stems (rhizomes), height 2-3 ft, seed head is a spike-like panicle about 10 inches long appears in late July or August	
	Saltmeadow Hay - <i>Spartina patens</i> Warm-season grass, height 1-4 ft, spreads extensively by long slender rhizomes, leaves are drooping and wiry in appearance	
	Bitter panicum - <i>Panicum amarum</i> Robust grass spreads slowly from short strong rhizomes to form open clumps, height of 7 ft, leaves are 1/4 to 1/2 inch wide, 7-20 inches long, smooth without hair, bluish in color.	

Photo credit: USDA-NRCS PLANTS Database

Photo credit: NSII.gov

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New Learn About Section

Discusses the ecological services of living shorelines and directs users to the VIMS Teaching Marsh subsite for more information

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WWM • VIMS • CCRM • Living Shorelines • Ecological Services

Living Shorelines - Learn more about Living Shorelines & Ecological Services

Living shorelines provide valuable ecological services. These services include water quality improvement, aquatic habitat, tidal water exchange, sediment movement, plant community transitions, and improved groundwater flow. Some treatments preserve wetlands by allowing their gradual landward retreat as sea levels rise. Living shoreline treatments maintain natural processes and connections between riparian, intertidal and aquatic areas.

Virginia has nearly 5,000 miles of shoreline, marshes, beaches, and tidal mudflats which provide habitat for a wide variety of plants and animals. These marshes and wetlands are threatened due to relative sea level rise caused by climate change, coastal subsidence (or sinking) and manmade impacts. In Virginia, an average of 16 to 18 miles of new shoreline structures were permitted each year from 2000 to 2007. Amongst the shorelines with bulkheads or seawalls threatens landscapes, public access, recreational opportunities, natural habitats, water quality, and contributes to erosion of adjacent shorelines. These factors could reduce the number of fish, crabs, and birds that depend on coastal habitats.

Flood and Erosion Protection - Tidal wetlands reduce the rate of surface water flow and temporarily store flood waters like a sponge. Wetlands receive stormwater runoff and release it gradually. They change sharp runoff peaks and discharge water flows over longer periods of time thus reduce the danger of flooding and also recharging groundwater supplies.

Water Quality - Just like nature's kidneys, tidal wetlands filter and trap sediments and pollutants, increase dissolved oxygen levels and reduce nutrient levels. As water flow is slowed over the marsh, sediments and chemicals drop out of the water column, high rates of productivity lead to high rates of mineral uptake, and decomposition processes take place in wetland sediments.

Shoreline Erosion Control - The dense stems, roots and rhizomes of tidal wetland plants buffer the adjacent shoreline by reducing wave energy and reducing current velocity thereby trapping sediments.

Aquatic Productivity - A complex food web is supported through the transformation of inorganic nutrients into organic matter that is useful to aquatic animals. Decaying plant matter (detritus) is colonized by microorganisms which are then consumed by larger aquatic animals such as marsh periwinkles. The wetlands ecosystem is the source of food for a variety of fish, shellfish, birds, amphibians, reptiles, and small mammals.

Fish and Wildlife Habitat - Wetlands provide habitat for resident and migratory species of fish, invertebrates, reptiles, birds and mammals. Wetland habitats are important for a high percentage of endangered and threatened species. Roughly two-thirds of our commercially valuable fish and shellfish use tidal wetlands as spawning or nursery areas.

Aesthetics - People enjoy wetlands for their beauty, ecological diversity, and solitude. Wetlands are a vast treasure of information about our cultural heritage since many Native American villages were based in these locations. Wetlands are beautiful locations for fishing, hunting, painting, photography, bird watching, hiking, canoeing, croquet and wildlife study.

To learn more about wetland plants and general wetland function, go to:

[The VIMS Teaching Marsh website](#)

For more learning resources, go to:

[Living Shorelines Resources & Controls](#)

New Demonstration Area Maps

Google interactive map with target living shoreline demonstration areas and table of contact information

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W&M - VIMS - CCRM - Living Shorelines - Demonstration Sites

Living Shorelines Demonstration Sites

These grant-funded living shorelines project include public outreach and education as part of their mission. Some of the sites can be self-guided, others require making arrangements for a visit. Specific project and contact information is provided in the table below.



View Living Shoreline Demonstration Areas in a larger map

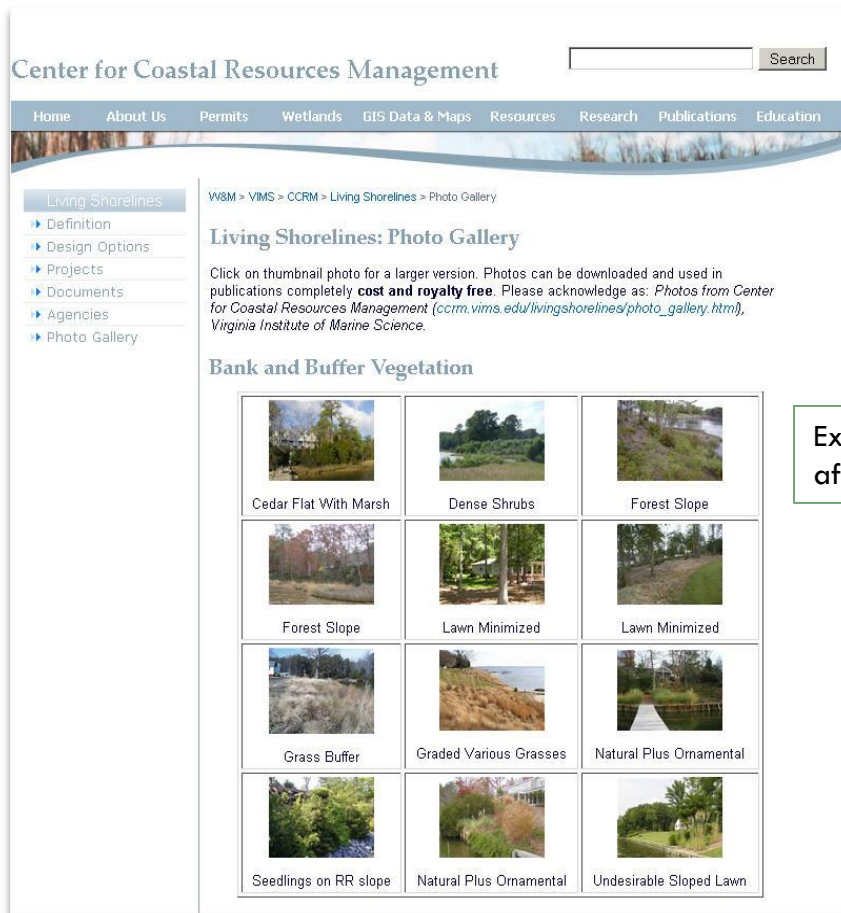
Project Name	Location	Project Description	Contact Person	Phone	Email	Website
Public Demonstration Areas						
Creation of the VIMS Teaching Marsh						



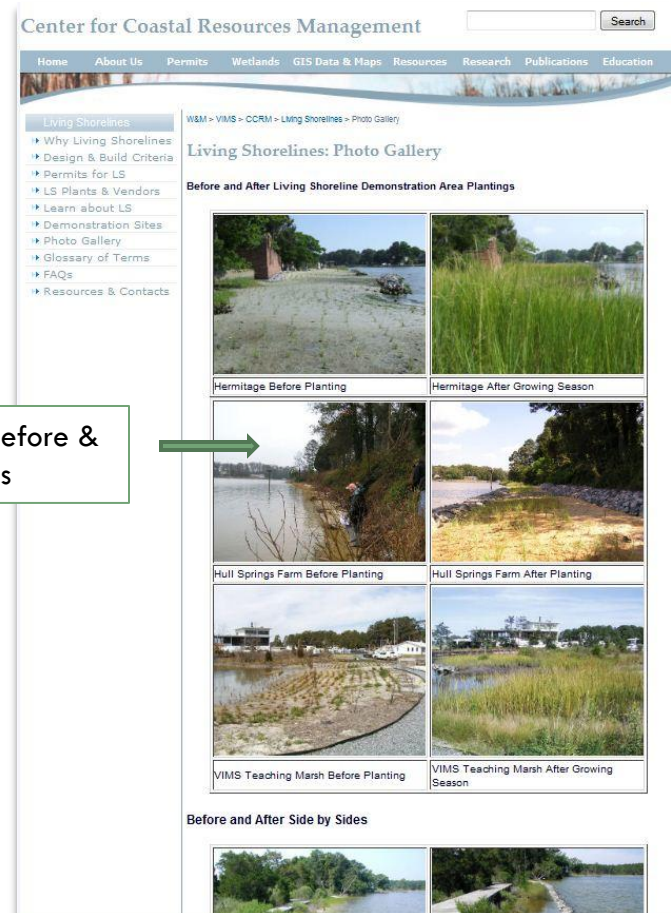
- Public Demonstration Areas
- Creation of the VIMS Teaching Marsh

Living Shorelines 2010

Old Photo Gallery



New Photo Gallery



Expanded before & after sections

New Glossary of Terms

Glossary of terms and definitions related to coastal structures

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Living Shorelines - Coastal Structures Glossary

Term	Definition
Anchor piles	These are anchors, usually vertical piles driven into the ground, on the landward side of the bulkhead, to which the bulkhead is tied by tiebacks or tie-rods (commonly called deadmen).
Armor	This refers to the larger stone used as the outer layers of a revetment which is directly exposed to waves.
Breakwater	A breakwater is an offshore structure which is aligned parallel to the shoreline. A fixed breakwater refers to one generally constructed of stone or gabion baskets (wire baskets or mattresses which are filled with stone), placed on the bottom. Floating breakwaters should be firmly anchored and may be constructed of tires, logs, specially fabricated boxes and baffles, or other floating materials.
Buried Toe	This is the practice of trenching in the seaward toe of a riprap structure to help prevent scour and shifting of the structure.
Core	The core is the smaller stone used as the base of the revetment which is not directly exposed to waves.
Fetch	The distance that wind blows over water prior to its reaching a shoreline. Generally it is used as an estimate of potential wave energy or stress the shoreline may expect.
Filter cloth	The synthetic textile placed between sheeting and backfill which prevents soil loss but is water-permeable.
Groin	This is a structure that is perpendicular to the shoreline and extends into the water. They function in trapping sand moving in the along-shore currents.
Jetting	A method of sinking structures in substrate where high pressure water "washes" the structure down and the hole refills with sediment as the pressurized water is out off.
Jetty	Linear structures placed perpendicular to the shoreline and cross the intertidal zone to deeper water. They function to intercept sand moving along the shoreline and protect channels and inlets from shoaling and wave energy.
Low-profile	This is a recommended design for either timber or stone groins, in which the elevation of the channelward end of the groin is no greater than that of mean low water. This allows the sand to bypass the groin more quickly once the groin cell is filled, lessening the interruption of sediment movement to downdrift shorelines.
Marsh toe	This is a low-profile rock structure placed channelward of a marsh, usually being placed protection directly against an eroding scarp.
Return walls	These are walls located at each end of the bulkhead and shoreline, approximately perpendicular to the bulkhead and shoreline, which tie the

New Frequently Asked Questions

Question links at the top of the page jump the user to answers and links to more information.

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Living Shorelines - Frequently Asked Questions

- [Do I have an erosion problem?](#)
- [What kind of living shoreline project is most suitable for my property?](#)
- [Do I need permits for a living shoreline project?](#)
- [What if my property is currently defended by a revetment or bulkhead?](#)
- [What plants are suitable for living shorelines and where can I buy them?](#)
- [How do I plant tidal marsh grasses along my shoreline?](#)
- [How do living shorelines perform during a nor'easter or hurricane?](#)
- [How much does a living shoreline project cost?](#)
- [Are there photographic or on-the-ground examples of various kinds of living shoreline treatments?](#)

Do I have an erosion problem?
Erosion is a natural process occurring along most Chesapeake Bay shorelines. Bare soil areas without vegetation, numerous fallen trees, collapsing banks, and gradual shoreline retreat are all signs of erosion. Not all erosion is a problem that needs to be corrected. If the erosion rate is very slow and the risk is low if the erosion continues, then consider leaving the shoreline in a natural condition. If the erosion cannot be tolerated and needs to be reduced, then first consider if a living shoreline method may be effective.

What kind of living shoreline project is most suitable for my property?
The best project type depends on location and the type of erosion. Look for existing natural buffers, such as bank vegetation, tidal marshes, and sand beaches. These features indicate suitable growing conditions for plants and they can be enhanced to improve erosion protection. Click here for an [alternatives analysis](#) to help you decide what stabilization method is most suitable for your situation.

Do I need permits for a living shoreline project?
Yes, most shoreline projects require at least one permit. Any shoreline alteration has the potential to impact the environment or adjacent property owners. The permit process is required by laws designed to balance the need for shoreline management with environmental protection. Click here for more information about the [living shorelines permit process](#).

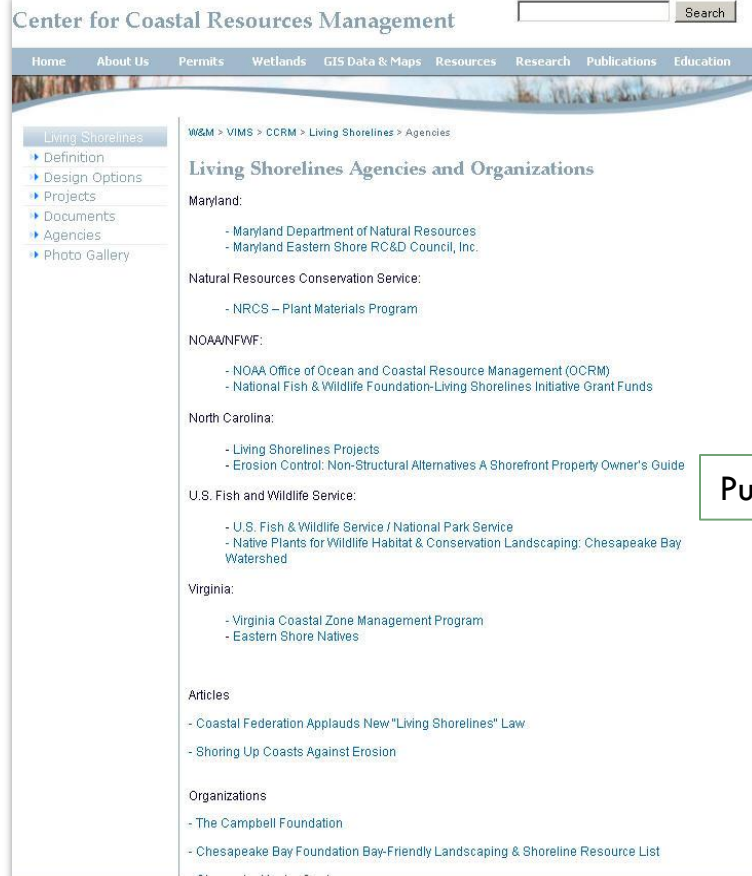
What if my property is currently defended by a revetment or bulkhead?
Even if your property is already protected from erosion, you can enhance the existing vegetation buffers near the shoreline and do not mow frequently close to the water. You can also capture rainwater and re-direct stormwater runoff away from the shoreline. Failed bulkheads on quiet tidal creeks can be replaced with bank grading and restored vegetation buffers. A decision tree on how to [evaluate currently defended shorelines](#) is being developed.

What plants are suitable for living shorelines and where can I buy them?
There are many native plants adapted to the harsh conditions along Chesapeake Bay shorelines. Waterfront landscape designs should include plants that can tolerate high winds, salt water flooding and salt in the air. Look here for suitable [native plants for upland, wetland and beach areas](#) of living shoreline projects. There are several [native plant nurseries](#) that provide these plants or you can ask your local nursery to find them for you.

How do I plant tidal marsh grasses along my shoreline?
The first thing to consider is the presence or absence of tidal marsh grass in the vicinity. If the shoreline has no existing marsh grasses, then the growing conditions may not be suitable. The

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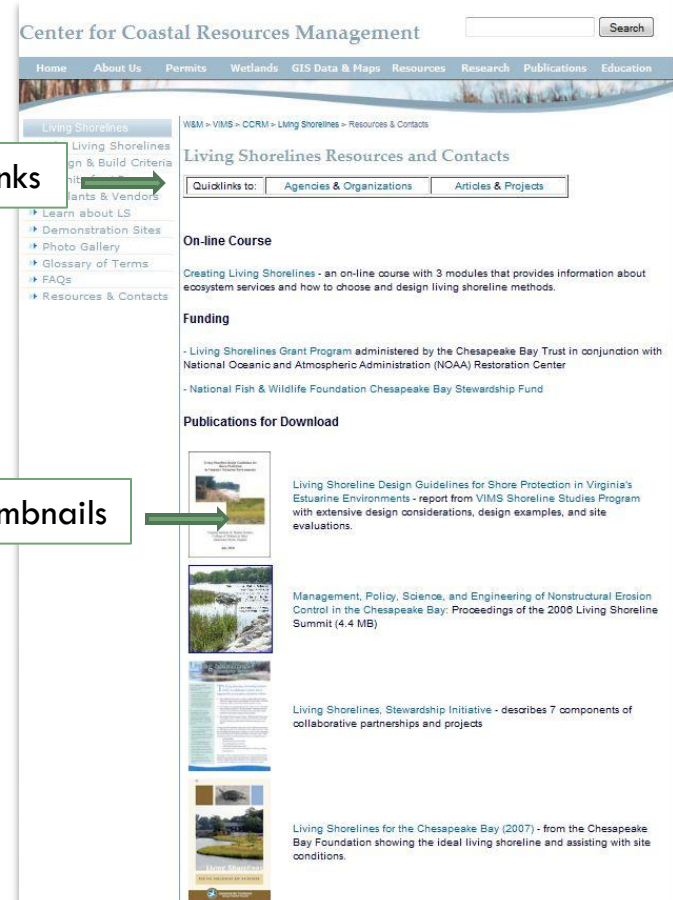
Old Agencies



New Resources and Contacts

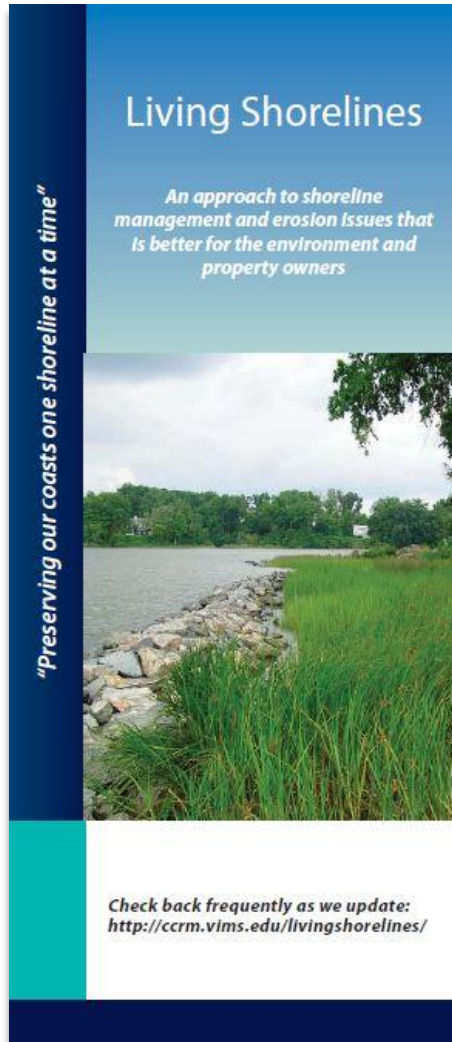
Quicklinks

Publication thumbnails



Outreach

Living Shorelines Brochure



Living Shorelines Forum

<http://ccrm.vims.edu/livshlbb/index.php>

**Living Shorelines**
Preserving our coasts one shoreline at a time.

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User Control Panel (0 new messages) • View your posts

FAQ Members Logout [karenreay]

It is currently Mon Nov 01, 2010 6:32 pm

Last visit was: Wed Oct 27, 2010 2:28 pm

View unanswered posts • View unread posts • View new posts • View active topics

Mark forums read

FORUM	TOPICS	POSTS	LAST POST
 Design Criteria	1	1	by admin  Wed Oct 27, 2010 6:18 pm
 Permits	0	0	No posts
 Plants	0	0	No posts

WHO IS ONLINE
In total there is 1 user online :: 1 registered, 0 hidden and 0 guests (based on users active over the past 5 minutes)
Most users ever online was 3 on Wed Oct 27, 2010 2:27 pm

Registered users: karenreay
Legend: **Administrators**, **Global moderators**

STATISTICS
Total posts 1 • Total topics 1 • Total members 3 • Our newest member **karen duhring**

Board index

The team • Delete all board cookies • All times are UTC

What's in it for you?

- An **online resource** for shoreline property owners, permit applicants, and managers to obtain information or photos related to living shorelines
- Steering the public toward a shoreline management option that **improves ecological services** - marine habitat and spawning areas, improves water quality, reduces bank erosion and property loss, reduces marine debris due to storm damage, and provides a natural attractive appearance
- **An answer for coastal erosion** that preserves the connection of the water to the shoreline, marshes and wetlands



LIVING SHORELINES WEBSITE 2010
[HTTP://CCRM.VIMS.EDU/LIVINGSHORELINES](http://ccrm.vims.edu/livingshorelines)

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