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Living Shoreline Implementation: Challenges and Solutions

Center for Coastal Resources Management, Virginia Institute of Marine Science

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Living Shoreline Implementation: Challenges and Solutions

It's been over a decade since the term "living shorelines" burst on the scene; intended to garner attention and easily translate the idea that natural shoreline features which can provide erosion protection are also alive with terrestrial and aquatic plants, animals and biochemical processes. All this in contrast to the traditional shoreline erosion control approaches that provide little to no habitat, displace natural features and interrupt shoreline processes.

There has been an uptick in the number of requests and requirements for living shorelines as shoreline management efforts. However, the number of projects still falls quite a bit short of the anticipated percentages based on various assessment methodologies such as the Center for Coastal Resources Management (CCRM) Shoreline Management Model and decision trees that predict where living shorelines are appropriate. So, why is there a gap between the actual number of projects proposed and constructed and the number that should be constructed?

This question was posed at the recent Tidal Wetlands Workshop held at the Virginia Institute of Marine Science (VIMS) on May 22. The workshop was attended by about 140 representatives of wetlands boards, local government staffs, state agencies, environmental groups, contractors, and citizens. They tackled the subject of living shoreline challenges and solutions. The same subject was addressed in a questionnaire mailed to shoreline permittees last year. The questionnaire was part of a study directed by the Middle Peninsula Planning District Commission and funded by the Virginia Coastal Zone Management Program to assess the efficacy of low interest loans for living shoreline projects. Comments gathered at the workshop and responses to the questionnaire have identified three general challenges to widespread utilization of living shorelines. (The VIMS questionaire is appendix C in this report *http://deq.state.va.us/Portals/0/DEQ/CoastalZone Management/FundsInitiativesProjects/task54-12.pdf*)

- Information
  - What is a living shoreline?
  - Where do living shorelines work?
  - Where can I go to visit a living shoreline?
- Cost Concerns
- Permit Process

Possible solutions to the challenges have been a focus for VIMS' scientists, coastal managers, decision-makers and practitioners. Solutions were part of the workshop discussion as well as a topic of regional conferences, previous projects and meetings.

Living Shoreline Challenges

- Information
- Cost/ Financial Concerns
- Permit Process

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A living shoreline was a perfect solution for our property, since we had specific aesthetic goals to meet, while working through the many challenges of our site. Our goal was to protect our property, while maintaining its natural quality.

Our heavily wooded shoreline is fronted by the Potomac River, with a 3 mile fetch, on one side, and an established 30 acre freshwater marsh on the other.

We worked closely with VIMS, the Corps of Engineers, and other state agencies as well as an environmental engineer to determine the proper approach to achieve our goals, and aid us through the permitting process.

We live with the benefits of our living shoreline every day. It gives us aesthetically pleasing erosion protection while providing a natural habitat for the wildlife. It only grows better with every season.

Mary Rust
Citizen and Wetlands Board Member, Stafford County.

Information

Property owners, practitioners, and managers have all identified information limitations as a challenge. As a result, the confidence that this is a reasonable approach to control erosion is low.

While, there is a lot of information on living shorelines available at the CCRM website, there is information on other sites as well - like NOAA, the Chesapeake Bay Foundation, the Partnership for the Delaware Estuary, Maryland Department of Natural Resources and others. There are also various brochures and print materials. (See links page)

A fundamental question of decision makers and property owners is, where do living shorelines work? The CCRM website provides two decision support tools to help with that question. First, decision trees: one for properties with no previous erosion control structure(s), and a second one for properties with existing structure(s). Simple observations made on site will answer questions in the tree leading to a recommendation. Second, is an analytical GIS model called the Shoreline Management Model. The model follows the decision tree logic process and provides the preferred shoreline best management practice(s) via a map viewer. These tools are both found under the Comprehensive Coastal Resources Management Portal (CCRMP) on the CCRM website. *http://ccrm.vims.edu/ccrmp/index.html*

The CCRM website also houses an area dedicated to living shoreline information. This site is found under the living shorelines heading. *http://ccrm.vims.edu/livingshorelines/index.html*

At the website you can find information on:

- Definitions
- Design
- Project Drawings
- Photographic Examples
- Research
- Policy and Permitting

According to the CCRM questionnaire, the majority of people interested in shoreline protection seek advice from family, friends and contractors about best approaches. Since there are many more existing conventional structures (revetments and bulk-heads) along Virginia's shorelines than living shorelines the advice generally comes from owners of these conventional structures. This effect is compounded when contractors are also unfamiliar with living shoreline construction and recommend conventional hardened structures.

The fact that there are few living shorelines projects along the shore creates another challenge: questions about the erosion control effectiveness. Fewer projects and newer projects means less opportunity to observe and assess the erosion control capabilities of the living shoreline approach in the near term and over time.

Where Can I Visit a Living Shoreline?

There are a growing number of publicly accessible living shoreline projects that serve as demonstration projects. These living shorelines may be visited to see firsthand how they look and how they work. These projects are intended to serve as living shoreline ambassadors and communicate the ecology of living shorelines through observation, signage, brochures and on-site classes. Information about the project details can be found on the CCRM website and often by signage at each location. These projects have been built by and through partnerships with local governments, nonprofit organizations, and academic institutions with funding assistance from localities, state agencies, and groups like the Chesapeake Bay Trust, National Fish and Wildlife Foundation, and The Nature Conservancy.

Even with the increase in demonstration sites, there are many locales in Virginia that are far from one of these sites. A possible solution is the creation of a demonstration site implementation program. This would entail partnerships among many of those already involved in living shoreline planning, construction and funding. It also may be an option to leverage use of in lieu fees collected by localities for wetlands permits and Virginia Marine Resources Commission funds.

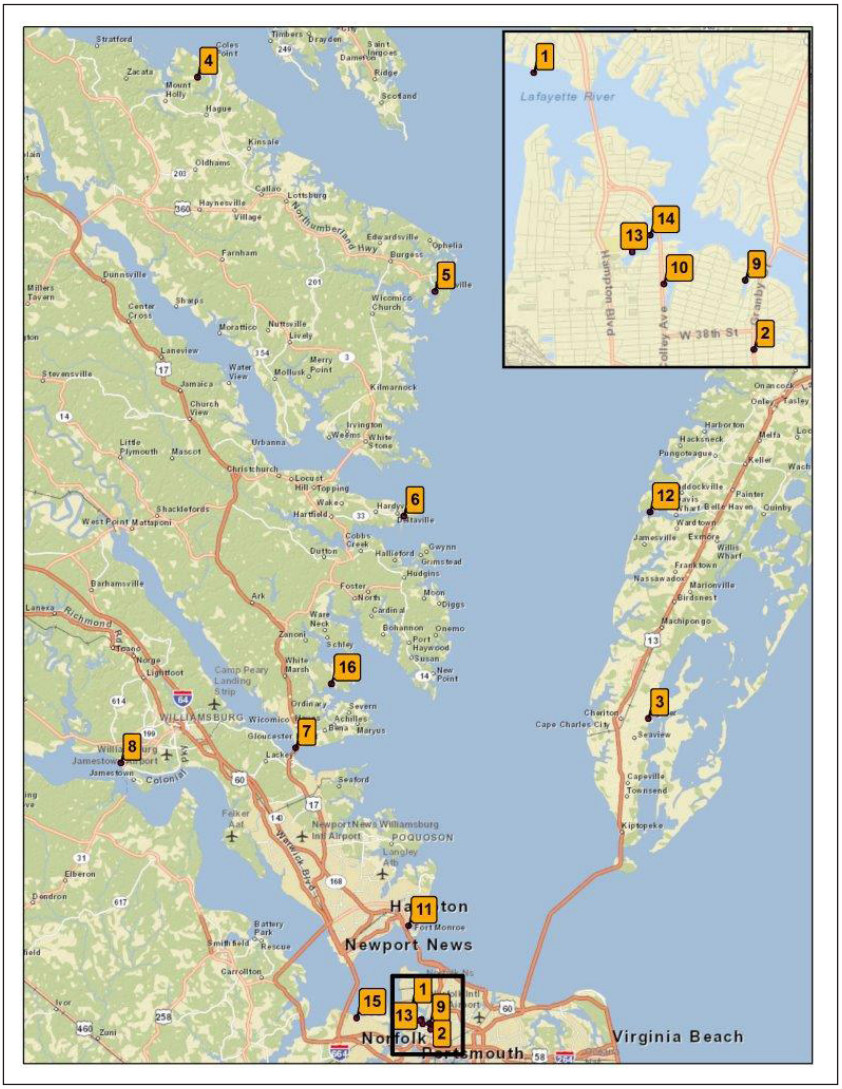

Figure 1. Map of Living Shoreline Demonstration Sites in Virginia (circa 2014) *http://ccrm.vims.edu/livingshorelines/demonstration_area_map.html*

Table 1. Living Shoreline Demonstration Sites in Virginia circa 2014

	Project and Location	Project Elements
1	Hermitage Museum and Gardens 7637 North Shore Road, Norfolk, VA	Marsh sill, planted marsh, oyster reefs, restored riparian buffer
2	Virginia Zoological Park 3500 Granby Street, Norfolk, VA	Retrofit rubble shoreline with marsh sill, planted marsh, restored riparian buffer, oyster reefs
3	Oyster Harbor Sunnyside Road, Oyster, VA	Bulkhead removal, planted marsh, marsh sill, oyster shell
4	Hull Springs Farm 645 Hull Springs Farm Road, Montross, VA	Marsh sill, planted marsh
5	Reedville Living Shorelines Teaching Garden 504 Main St, Reedville, VA	Restored tidal marsh and riparian buffer, marsh sill
6	Holly Point Nature Park Jackson Creek Road, Deltaville, VA	Planted marsh, fiber logs
7	VIMS Teaching Marsh Franklin Road, Gloucester Point, VA	Planted marsh, marsh sill
8	Jamestown 4H Educational Center 3751 4-H Club Road, Williamsburg, VA	Offshore breakwaters and beach nourishment
9	Haven Creek Living Shoreline Project East end of Massachusetts and Delaware Avenues, Norfolk, VA	Bulkhead removal, planted marsh, marsh sill
10	46th Street Project 46th street and Colley Avenue, Norfolk, VA	Retrofit rubble shoreline with marsh sill, planted marsh
11	Phoebus Living Shoreline Mugler Bridge at E. Mellon St, Hampton, VA	Retrofit rubble shoreline with marsh sill, planted marsh
12	Camp Occohannock Living Shoreline End of State Rt 801, Bell Haven, VA	Planted marsh, marsh sill, oyster reef
13	Colley Bay Living Shoreline Project 1145 Bolling Avenue, Norfolk, VA	Retrofit rubble shoreline with marsh sill, planted marsh
14	Bolling Square Living Shoreline Project East terminus of Delaware Ave, near 955 Bolling Avenue, Norfolk, VA	Planted marsh
15	Hoffler Creek Wildlife Preserve 4510 Twin Pines Rd, Portsmouth, VA	Oyster shell bags, planted marsh
16	Johns Point Landing Terminus of Johns Point Rd, Gloucester, VA	Marsh sill, planted marsh

Cost

Another challenging concern for property owners seeking erosion protection is the cost of living shoreline projects.

A comparison of costs for 100 linear feet of on-shore revetment to the same length of created marsh and off-shore sill are based on site conditions. How much rock is needed for the on-shore revetment versus the sill? If sand is necessary to create the marsh, how much will it cost? If the marsh is already there, is the sill less expensive than the revetment?

Consideration of these direct costs often don't take into account maintenance of either the conventional or living shoreline option – or the costs of replacement due to storm failure or dilapidation. Living shorelines tend to be much more resilient to storms and resistant to becoming dilapidated, so these costs could be avoided. Finally, a cost that is routinely left out of the equation is the cost to the ecosystem. Shoreline armoring typically results in reduced production of commercial and recreational fish and the loss of water quality improvement services. These are values maintained or enhanced by the vegetated and nonvegetated wetlands in living shoreline projects.

Another important consideration in the over-all project cost is the potential for compensatory mitigation requirements. Conventional shoreline armoring approaches often result in wetland and riparian vegetation loss. Wetland losses can lead to a requirement for mitigation, an increase in project cost. As living shorelines are considered self-mitigating, any vegetation loss is made up for in the wetland creation on site. There is a general sense among managers and practitioners that the costs of living shorelines are comparable to conventional structures.

Thinking creatively about solutions to funding living shoreline projects will also aid in getting more projects on the ground. Many ideas on funding have been identified such as low interest loans, cost share, tax relief, and others. There are some organizations that offer funding opportunities to offset project costs. The National Oceanic and Atmospheric Administration (NOAA) Restoration Center, the Chesapeake Bay Trust, National Fish and Wildlife Foundation, the Nature Conservancy and others have provided support for living shoreline projects. However, competition for project funds runs high and the on-going annual grant opportunities are limited.

One solution would be for Virginia to support a cost-share program comparable to those offered in other jurisdictions. There is also interest in access to low interest loans as a financial incentive.

This living shoreline in Mathews is over 10 years old and survived Hurricane Isabel in 2003.

Table 2. Cost Estimates for Shoreline Management Approaches (*average cost per linear foot)*

Nonstructural (planting grading/fill)	Hybrid (marsh + sill)	Breakwaters (offshore)	Structural (revetment)	Location	Date
$100-200	$250-400	$450-600	$500–1,200	Maryland	circa 2014
$100-225	$250-700	$450-1,000	$500-1,500	Delaware Estuary	circa 2012
$45+	$120-395	$125-200	$115-285 (low energy)	Northern Gulf of Mexico	circa 2008
$50 - $100	$150-$300	$350-$500	$500-$1000	Maryland	2007
$45+	$100+	$150-$250	$115-$1200	Florida	2008

References for Table 2

http://www.seagrant.sunysb.edu/Images/Uploads/PDFs/LivingShorelines0513-Presentations/5_NYSG_Living_Shorelines_Maryland.pdf
http://www.delawareestuary.org/pdf/Living%20Shorelines/LivingShorelinesBrochure_feb2012.pdf
http://msucares.com/crec/envi/publications/living_shorelines_cost_estimates.pdf
http://www.cbf.org/Document.Doc?id=60
http://www.gulfalliancetraining.org/dbfiles/Cost%20and%20Maintenance%20of%20Living%20Shorelines.pdf

Permit Process

Complex and/or conflicting permit processes are another challenge to living shoreline implementation. Shoreline erosion structures require permits, with the number of permits varying by locality. The sequence and timing of the review processes can be confusing as multiple local, state and federal agencies can be involved.

The number of permits and sequencing issues can arise whether the proposed action is a living shoreline or a conventional revetment. So permitting conventional structures is often equally complex.

Stream lining and coordination of permit processing is underway to provide a solution to the complex permit process. Virginia is working to make the permit process easier through the establishment of a general permit. The permit is planned to be faster and less expensive than a permit for a conventional structure. Along with the general permit, Virginia is tasked with development of integrated shoreline guidance. The Living Shorelines Act (SB 964) requires the guidance to improve communication and processing efficiencies among the regulatory authorities.

One complicating issue in permitting living shorelines is how to deal with the creation of a planted marsh or dune. Planting vegetation works best at certain times of the year and permit conditions for planting times can affect construction timelines. Also, creation of marsh may also impact wetland and shallow water ecosystems resulting in monitoring requirements to determine and ensure success. The task for the regulatory community is to find ways to integrate the guidance and coordinate permit review. One step in this direction is the development of the Virginia general permit for living shorelines. We should look for opportunities to accept existing permit requirements and conditions by all permitting authorities.

Integrated guidance and the general permit are both incremental cost savings solutions. However, real funding solutions would provide a great incentive for the use of living shorelines.

For any given living shoreline project, many regulatory authorities will require permits. Unfortunately conflicts can arise between the requirements from the different agencies. Additionally, review times vary, which presents conflict. For instance, a U.S. Army Corps of Engineers' Nationwide Permit for living shorelines may be attained in a relatively short timeframe, however, local wetland board approvals come later due to public advertisement and meeting schedules. The designer also needs to consider the implications of the Chesapeake Bay Preservation Act if any clearing of the buffer area of the Resource Protection Area must occur and what permit requirements are associated with those activities.

Jim Cahoon, PWD
Vice President, Bay Environmental, Inc.

Colley Bay Phase I - Before

Colley Bay Phase I - After

(photos by Kevin R. Du Bois)

The City of Norfolk has been successful in implementing living shoreline projects through a concerted effort of demonstration projects, Wetlands Board education, financial support and partnerships with citizens and NGOs.

Key components to our success are the highly visible and public living shoreline demonstration sites in the City. We took advantage of resources at VIMS to learn about living shoreline design and worked with VIMS and NOAA Restoration Center on other public demonstrations. The demonstration projects built regulatory confidence within the Wetlands Board. In 2013, the Board approved a living shoreline solution for 71% of all erosion control projects where one was technically feasible –including projects that were initially submitted with a shoreline hardening solution.

But perhaps most importantly, staff have developed a network of partnerships with local public schools, university graduate and undergraduate volunteers, local NGOs, Master Gardeners, Master Naturalists, and other interested citizens to build a constituency to promote, design, fund, and build living shorelines independent of city initiatives.

Kevin R. Du Bois, PWS, PWD, CFM
Bureau of Environmental Services, City of Norfolk

The Nature Conservancy, the Eastern Shore Resource, Conservation and Development Council (RC&D), and Occohannock on the Bay Camp and Retreat Center worked together to install a 1,030-ft marsh-sill living shoreline along the camp's property in Accomack County, Virginia. The goal of this project was to demonstrate to homeowners that living shorelines are a viable nature-based approach to mitigating shoreline erosion in the face of accelerating sea-level rise and storm surge events.

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The project faced some challenges in terms of design and permitting due to (1) the large fetch and acute erosion, and (2) a dense SAV bed in the nearshore. Working with the regulatory agencies, we were able to find a design that worked within the biological and physical shoreline conditions of the site. While working through the permit modifications delayed the project by several months, in the end it was absolutely worth ensuring the project more effectively met ecological goals for shoreline restoration and coastal resilience while also protecting the camp's critical infrastructure.

Gwynn Crichton
Senior Project Scientist, The Nature Conservancy

Solutions are available for some of the livings shoreline challenges and other solutions remain to be developed and implemented. The CCRM living shorelines website is full of information and decision-making tools. Other solutions, such as improved, simplified permitting are in progress with the general permit, but Virginia needs to produce the comprehensive integrated shoreline guidance. The number of demonstration sites is increasing, but more options should be available throughout Tidewater to visit. Finally, a greater commitment to continued funding to assist in implementation of living shorelines would help increase the use of this approach along Virginia's shorelines

Living Shorelines Information

Websites

NOAA Habitat Conservation
http://www.habitat.noaa.gov/restoration/techniques/livingshorelines.html
Delaware Estuary
http://www.delawareestuary.org/living-shorelines
Maryland Department of Natural Resources
http://www.dnr.state.md.us/ccs/livingshorelines.asp
Southern Environmental Law Center
http://www.southernenvironment.org/cases-and-projects/living-shorelines
North Carolina Coastal Federation
http://www.nccoast.org/Content.aspx?Key=76664726-1d0d-4f30-a6b0-c2702bf97ee3&title=Living+Shorelines
Northern Neck Master Gardeners
http://www.nnmg.org/shoreprotect.asp

Brochures, Articles, etc.

Virginia DEQ Living Shorelines Fact Sheet
http://www.deq.virginia.gov/Portals/0/DEQ/CoastalZoneManagement/lsfactsheet.pdf
Chesapeake Bay Foundation Brochure
http://www.cbf.org/Document.Doc?id=60
Galveston Bay Foundation Brochure
http://galvbay.org/docs/LS_brochure.pdf

Youtube Videos

Living Shorelines (Part 1): Mississippi-Alabama SeaGrant
https://www.youtube.com/watch?v=ZM7BSQewoGc
VIMS Living Shorelines
https://www.youtube.com/watch?v=R1Z_DtLdR0w