Reports

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Living Shorelines

Center for Coastal Resources Management, Virginia Institute of Marine Science

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A living shoreline utilizes a 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/or other structural and organic materials. Living shorelines do not utilize structures that sever natural connections between riparian, intertidal and subaqueous areas.

**What is a living shoreline?**

Preserving natural vegetation or creating new marshes and forest buffers can protect against erosion.

- **Riparian area** – upland area along a shoreline, next to the water, marsh or beach
- **Intertidal area** – zone between high and low tides; in Virginia this area is generally a vegetated marsh, a sand beach, or a mudflat
- **Subaqueous area** – the bottom of the bay, river or creek below the low tide line; in Virginia this area is generally mud or sand, and may have submerged aquatic vegetation (SAV)
Why are they desirable?

Living shoreline treatments can provide both private and public benefits, often much more effectively than more traditional shoreline treatments such as bulkheads and rock revetments. A properly designed living shoreline treatment can provide the shoreline stabilization that a private property owner may desire. Its advantage is that it can also preserve the capacity of the shoreline to provide many other ecological services important to both the property owner and the public.

Natural shorelines provide a number of valuable benefits to people who live, play, and work in Virginia’s waters. Natural shorelines provide shelter and food for a wide variety of organisms (beaver, muskrats, herons, king fishers, crabs, oysters, mussels, wetland plants, etc.). They also serve to reduce the amounts of nutrients, sediments, and other pollutants carried by runoff and groundwater from uplands to rivers and the bay. Natural shorelines can be a source of sand for beaches, can provide flood and erosion buffering for low lying lands, provide recreational and commercial opportunities for humans, and are general aesthetic features for everyone in the coastal zone. Environmental managers refer to these benefits as ecosystem services – benefits provided to man by naturally functioning ecosystems.

A living shoreline treatment is intended to preserve and sustain the ecosystem services of a shoreline reach while accommodating property owner interests in erosion control. The design of a living shoreline typically involves gradual slopes through the intertidal area and into the riparian area. This allows the shoreline to gradually dissipate the energy of waves running up on the shore. It also provides suitable areas for growth of marsh grasses. Because living shoreline designs do not employ bulkheads or riprap revetments behind intertidal areas, there is no structure to impede the movement of water or animals between uplands, marshes, and open water. In this way a living
shoreline preserves and sometimes enhances the capacity of the area to serve as habitat, improve water quality, and trap sediments.

Where can they be used?

Living shoreline designs will not work in all situations. High energy shorelines, such as those along the open ocean or those bordering the Bay, generally have too much wave energy to allow plants to survive in either the intertidal area or the riparian area immediately behind the intertidal zone. Living shorelines also require sufficient horizontal space to establish the low slopes (typically 10% or less) necessary to establish vegetation and dissipate wave energy. This much space is sometimes not available even in very low energy environments if the riparian area is heavily developed.

Ecosystem Services

Ecosystem services are things that naturally functioning systems do that are valuable to humans. Generally they can be grouped into four broad categories: production (growing plants and animals); regulation (maintaining the water cycle and atmospheric gas balances, moderating temperatures); habitat (providing shelter and nursery areas for organisms); information (aesthetics, recreation). Maintaining the capacity of natural systems to provide these services is a major reason for government regulation.

Oyster Shell and Living Shorelines

There is growing interest in the potential use of oyster shell for shoreline erosion protection. Unfortunately, this concept has more charm than merit.

There are several observations that might lead one to consider oyster shells as part of a shoreline management design. They are naturally occurring in the coastal environment, unlike rock, concrete or treated wood. Oyster shells clearly have the potential to be colonized with attached animals and become ‘living’ habitat. And oyster reefs are sometimes associated with healthy sustained marshes suggesting some role in stabilizing the shoreline.

Technical evidence for oyster shells capacity to serve as an erosion buffer is sparse. Oyster shells are small, lightweight and readily movable. As such they cannot provide much resistance to wave energy and tidal currents. This makes them unsuitable for the kinds of structures typically used in living shoreline designs.

Oyster shells are also no longer plentiful. In part this is because there are no longer as many oysters making them. Another reason is that over time they dissolve, a process frequently accelerated by borers. So, unless the shells are colonized by new oysters, and material is constantly replaced by those organisms, the prospects for lasting impact on a shoreline are not encouraging.

Shell can be used to create a preferred substrate for natural oyster settlement. While success in this effort is far from assured in most settings, it is a much more practical use of the resource than trying to construct shoreline defenses.
Living Shoreline Types
The important characteristics of a living shoreline (i.e. addresses erosion control, has sustained vegetation communities, and no structures interfering with natural connections within the shoreline system) can be developed with a variety of different designs. The appropriate design is determined by: the potential wave energies and tidal currents affecting the site; the bathymetry and topography of the site; and the nature of the landuse on the site.

Without a Structure

**Vegetation Management**
- Trimmed tree branches overhanging a marsh in order to promote better growth of the grasses

**Beach Nourishment & Dune Restoration**
- Addition of sand to a beach to raise its elevation and increase its width
- Reshaping and stabilizing a dune with plants

**Tidal Marsh Enhancement**
- Planting plugs of marsh grass in barren or sparsely vegetated marsh areas
- Adding sediment to a marsh surface to maintain its position in the tide range

**Tidal Marsh Creation**
- Grading a riparian area or filling a subtidal area to an intertidal elevation and planting appropriate marsh vegetation

**Bank Grading**
- Changing the slope of a shoreline segment and replanting the area to reduce the impacts of erosion

Beach nourishment and dune restoration are both used to establish and maintain a recreational beach and protect adjacent uplands.

Tidal marsh creation establishes a vegetative buffer between the riparian land and open water. In some cases it may be preferable to grade the bank. The marsh reduces erosive wave energy, reduces nutrient and sediment runoff, and provides valuable habitat.
**Fiber Logs**
Manufactured coconut fiber logs staked in front of or behind marsh vegetation to trap or retain sediments and reduce erosion.

A newly planted marsh is buffered from waves by fiber logs. The logs allow the young plants to establish their root systems. The roots bind sediments and support the above-ground portion of the grasses.

Fiber logs may be used to help protect an eroding scarp while the planted marsh matures. The logs slowly break down, usually disappearing after 3 to 5 years. By that time the marsh should be sufficiently established to provide erosion protection.
**Marsh Toe Revetments & Sills**
- Low profile rock revetments placed along the eroding edge of a marsh or backfilled with sediment to create an intertidal marsh.

**Beach Sills**
- Low profile rock revetments or filled fabric bags positioned and backfilled to create and maintain an unvegetated beach.

**Offshore Breakwater System**
- Rock revetments positioned offshore to refract waves producing a scalloped but stable shoreline.

**Living Breakwaters**
- Offshore revetments that have been colonized by oysters, mussels, algae, or other organisms.

Offshore breakwater systems use structures combined with beaches to protect shorelines. One advantage of breakwater systems is that shoreline sections, usually comprised of more than one property, can be protected.
Creating a living shoreline involves changing the existing shoreline. The goal is to establish conditions that mimic those along stable, vegetated shorelines. Erosion is generally not a problem on shorelines with vegetated and sloping riparian areas, intertidal marshes, and shallow subaqueous waters. Creating these conditions, where they do not already exist, generally involves significant modification to one or more of the three zones.

In Virginia, the riparian zone is managed by local governments implementing the Chesapeake Bay Preservation Act. Intertidal areas fall under the purview of local wetlands boards, and the subaqueous environment is the responsibility of the Virginia Marine Resources Commission. Each of these programs tends to seek avoidance of impacts in areas under their jurisdiction. This preference for the status quo can be in conflict with living shoreline designs.

While not all living shoreline designs are identical, creating the necessary conditions can involve:

- grading the riparian area, disrupting the natural vegetation, and creating a potential conflict with Bay Act guidelines; or
- moving design elements channelward to preserve an existing vegetated riparian area, impacting wetlands and creating a conflict with wetlands guidelines; or
- filling nearshore waters to create intertidal wetlands, creating significant conflicts with subaqueous land guidelines.

The consequence is that in order for a living shoreline design to be implemented, one or more of the agencies involved in shoreline management, may have to accept impacts within targeted resources.

Recognition that living shoreline designs are a desirable approach for many of the Commonwealth’s tidal areas means coordination among management agencies will be essential. The first step in this process will be identification of all the points of potential conflict among the various program guidelines. Following this, integrated guidance can be developed to coordinate programmatic interests and promote effective shoreline management.

Promoting Living Shorelines: Can we manage it?

Regulatory programs involved in living shoreline design.
Policy Options for Encouraging Use of Living Shorelines

There are a variety of options for actions that might promote application of the living shoreline concept to tidal shoreline management in Virginia. They run the gamut from legislation giving localities authority to require utilization of living shoreline concepts, to a variety of incentives for private property owners. The list below is neither exhaustive nor ranked in any way. It is merely a sampling of ideas to provide a sense of the options available.

Regardless of the policy approach, significant success in promoting living shoreline concepts will require effective coordination among regulatory programs. As noted in the preceding section of this issue, there are multiple agencies with potentially overlapping or incompatible objectives. Agencies are currently investigating the substance of potential conflicts with an eye toward resolving them to avoid frustrating good intentions and good designs.

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<th>Policy Action</th>
<th>Financial Implications</th>
<th>Legislative Action</th>
<th>Regulatory Coordination</th>
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<td>General / Streamlined Permits</td>
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<td>Establish general permits or provide a streamlined application process.</td>
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<td>Permit Fee Waivers</td>
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<td>Eliminate or reduce permit fees</td>
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<td>Compensation Waivers</td>
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<td>Eliminate or reduce requirements to compensate for riparian or wetland impacts.</td>
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<td>Low Impact Development Credit</td>
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<td>Provide LID credits for utilization of living shorelines.</td>
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<td>Subaqueous Royalty Waivers</td>
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<td>Eliminate or reduce rents and royalties associated with encroachment onto State subtidal bottom.</td>
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<td>Tax Assessment Reduction</td>
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<td>Provide relief from increased property taxes associated with increased property value when installing a living shoreline.</td>
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<td>Cost Share</td>
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<tr>
<td>Create cost share opportunities for property owners installing living shorelines.</td>
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<td>Subdivision Ordinance Addition</td>
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<td>Allow inclusion of living shorelines in local subdivision ordinances for rezoning projects that involve tidal</td>
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Note:
- **Financial Implications** refers to impacts to State or Local revenue or a need for funding allocation.
- **Legislative Action** refers to the need for General Assembly involvement.
- **Regulatory Coordination** refers to actions that may require involvement of one or more regulatory agencies.