



2013 Mid-Atlantic



Living Shorelines Summit

December 10 – 11, 2013

Cambridge, Maryland



Where have we been ?

Where are we now ?

Where are we going ?



2013 Mid-Atlantic Living Shorelines Summit

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Links to Presentations

Session I

Opening

- [Kevin Smith](http://youtu.be/y9k81_vdp8E) youtu.be/y9k81_vdp8E

Setting the Stage - Key Note Speaker

- [Margaret Davidson](http://youtu.be/5VI9IUtOoJ4) youtu.be/5VI9IUtOoJ4

Session II

Understanding Lessons from Science

- [Karen Duhring](http://youtu.be/S_mm8GyNGwQ) youtu.be/S_mm8GyNGwQ
- [Carolyn Currin](http://youtu.be/08_7dRQg4ZM) youtu.be/08_7dRQg4ZM
- [Donna Marie Bilkovic](http://youtu.be/MpiQXK4Gg-Q) youtu.be/MpiQXK4Gg-Q
- [Sadie Drescher](http://youtu.be/MPmgTmPesPo) youtu.be/MPmgTmPesPo
- [Question and Answer](http://www.youtube.com/watch?v=166dB2e_DYU&feature=youtu.be) www.youtube.com/watch?v=166dB2e_DYU&feature=youtu.be

Session III

Evolving Living Shorelines: Techniques and Performance

- [Bill Shadel](http://youtu.be/2HEbFxWP60g) youtu.be/2HEbFxWP60g
- [Scott Hardaway](http://youtu.be/Bsn_XeruQfo) youtu.be/Bsn_XeruQfo
- [Tracy Skrabal](http://youtu.be/0cT9U4wH4jA) youtu.be/0cT9U4wH4jA
- [Jon Miller](http://youtu.be/OdAnffbTUtk) youtu.be/OdAnffbTUtk
- [Albert McCullough](http://youtu.be/I51GIUxU6R4) youtu.be/I51GIUxU6R4
- [Question and Answer](http://www.youtube.com/watch?v=2iloSrfB9Ag&feature=youtu.be) www.youtube.com/watch?v=2iloSrfB9Ag&feature=youtu.be

Session IV

[Adapting Living Shorelines: Forward Thinking](#)

- Bhaskar Subramanian, Keith Underwood, Rob Young, Joe Rieger
www.youtube.com/watch?v=4HaywLABixw&feature=youtu.be

Links to Presentations

(Continued)

Session V

Using Performance Data to Drive Change

- [Court Stevenson](https://youtu.be/uQsb_kjfdE) youtu.be/uQsb_kjfdE
- [Evamaria Koch](https://youtu.be/feJRzOdIWsl) youtu.be/feJRzOdIWsl
- [Pam Mason](https://youtu.be/gX2h3BzA_hA) youtu.be/gX2h3BzA_hA
- [Question and Answer](https://www.youtube.com/watch?v=K0m4Don5Qw4&feature=youtu.be) www.youtube.com/watch?v=K0m4Don5Qw4&feature=youtu.be

Session VI

Recognizing Barriers and Identifying Solutions: Programmatic Tools and Policies

- [Melanie Tymes](https://youtu.be/VbJz7G-rels) youtu.be/VbJz7G-rels
- [Dave Evans](https://youtu.be/VikvNgbfYfs) youtu.be/VikvNgbfYfs
- [Jonathan Stewart](https://youtu.be/W9C4Z8uOWaQ) youtu.be/W9C4Z8uOWaQ
- [Kevin Du Bois](https://youtu.be/7GX601I6hSM) youtu.be/7GX601I6hSM
- [Question and Answer](https://www.youtube.com/watch?v=rQ9FS3i69fA&feature=youtu.be) www.youtube.com/watch?v=rQ9FS3i69fA&feature=youtu.be

Session VII

The Business of Living Shorelines

- [J.C. Douglass](https://youtu.be/YLxV9Rzj6RY) youtu.be/YLxV9Rzj6RY
- [John Flood](https://youtu.be/kr_nRyBYGVI) youtu.be/kr_nRyBYGVI
- [Gene Slear](https://youtu.be/Cto7U2RItBI) youtu.be/Cto7U2RItBI
- [Jim Cahoon](https://youtu.be/HyRSE57T2YQ) youtu.be/HyRSE57T2YQ

Session VIII

Closing Remarks

- Buck Sutter and Jeff Benoit
www.youtube.com/watch?v=q_QZNIMUJjg&feature=youtu.be

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Acknowledgements

The vision and direction for the Summit resulted from the collaboration of a number of organizations. It would not have been possible to conduct the Summit without the input and guidance from the Steering Committee and individuals from the Maryland Department of Natural Resources and Restore America's Estuaries. We are extremely grateful to the Steering Committee and the following individuals for their support and hard work prior to, during, and after the Summit: Kimberly Burke, Sarah Hilderbrand, Scott Hymes, Jackie Koehn, Sasha Land, Siobhan Percey, Suzanne Simon, and Bhaskar Subramanian.

Steering Committee

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Rich Takacs	National Oceanic and Atmospheric Administration
Melanie Tymes	Delaware Department of Natural Resources and Environmental Control

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The 2013 Mid-Atlantic Living Shorelines Summit was not meant to be a consensus-building event. As such, the opinions stated within this document and the presentation recordings represent those of the presenters and the participants only. They do not necessarily reflect the views of the organizers, steering committee, or financial supporters.

**In remembrance of Dr. Evamaria Koch
and the energy, enthusiasm, dedication, and advances
she brought to the Chesapeake Bay restoration efforts**

Introduction

In December 2013, Maryland Department of Natural Resources, Restore America's Estuaries and the Chesapeake Bay Trust hosted the Mid-Atlantic Living Shorelines Summit in Cambridge, Maryland. This was a direct follow up to the Chesapeake Bay Summit held in 2006 in Williamsburg, Virginia. The geographic range was expanded to include Delaware, New Jersey, and North Carolina, in addition to Maryland and Virginia. There had been significant progress in the science and policy of Living Shorelines over the past seven years, and convening a 2-day summit was a way to bring practitioners together to understand, assess, discuss, and conduct an honest assessment of Living Shoreline practices. Participants included local, state, and federal government, non-profit organizations, marine contractors, scientists, restoration practitioners, environmental consultants, private industry, academicians, and private landowners.

The purpose of the 2013 Summit was to:

- Highlight advances over the past seven years
- Assess past and current restoration practices by means of an open dialogue
- Highlight new and emerging technologies
- Explore the use of shared information to energize programs at the state and local level across the Mid-Atlantic region
- Strengthen and coalesce the Living Shorelines Community across the region

Through exploration of a variety of themes and topics, it was hoped that the Summit would propel restoration practices and policy forward, galvanize the community of practitioners, and identify overlapping and synergistic areas of collaboration amongst the participants. The goal of this Summit was to address the questions: Where have we been? Where are we now? Where are we going?

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Session I

Opening

Kevin Smith

Director of the Habitat Restoration and Conservation Division

Maryland Department of Natural Resources

Presentation: youtu.be/y9k81_vdp8E

The first Living Shorelines Summit was held in 2006. The proceedings for that Summit contain a number of recommendations for the future ([Appendix E-2](#)). These include promoting Living Shorelines through social media and education, providing financial incentives to landowners, encouraging research about water quality and habitat benefits, validating Living Shorelines suitability models, and improving existing design criteria, amongst others. The Living Shorelines Community has progressed remarkably in some of these areas, while in other areas there is still much work to be done.

We are still wrestling with the definition and function of a “Living Shoreline”. The definition that seems to encompass the key components comes from the American Society of Civil Engineers: “The concept of Living Shorelines involves the use of native vegetation and low-lying structures to provide shoreline stabilization while attempting to mimic the natural landscape.” The common concepts among all definitions include shoreline protection, habitat enhancement, natural process, and tidal exchange. Shoreline protection is paramount, because without stabilization this method would not be pursued. However, in the Living Shorelines Community, we believe it is equally important to integrate habitat enhancement, tidal exchange, and natural process, such as littoral drift.

Since the 2006 Living Shorelines Summit we have made a great deal of progress in design, implementation, and research. We have much to share with the Living Shorelines Community as a whole. It’s time to converge again to discuss where we have been, where we are now, and where we need to go to advance the science of Living Shorelines. We are here to share research, tools, techniques, and “lessons learned”, to explore methods of communicating information energizing programs across the Mid-Atlantic region, and to strengthen the Living Shorelines Community as a whole.

Key Points

- Controversy continues regarding the definition and function of Living Shorelines.
- Common concepts include shoreline protection, habitat enhancement, natural process, and tidal exchange.
- Shoreline protection is crucial, because without stabilization this method would not be utilized.
- The 2013 Mid-Atlantic Living Shorelines Summit will discuss where we have been, where we are now, and where we need to go to advance Living Shorelines.

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Setting the Stage

Key Note Speaker

Margaret Davidson

Acting Director

Office of Ocean and Coastal Resource Management

National Oceanic and Atmospheric Administration

Presentation: youtu.be/5VI9IUtOoJ4

Living Shorelines in the Face of Sea Level Rise:

Coastal Resiliency

Over the past decade, sea level rise has dramatically accelerated in the Mid-Atlantic region consistent with the catastrophic loss of the Greenland Ice Sheet, which is collapsing at a rate unimaginable only fifteen years ago. There will be unprecedented consequences of these changes and the accompanying extreme weather events within the next 20-30 years, not the next 100 years as previously thought.

Coastal counties have long been valued assets, originally settled due to the availability of food and transportation. They currently generate 60% of the GDP (Gross Domestic Product). This is only one reason it is important to have resilient coasts – they are the veritable economic golden egg. However, the recently released national Status and Trends of Wetlands in the Coastal Watersheds of the Conterminous United States: 2004 to 2009 reports that we are losing more than 80,000 acres of coastal wetlands yearly ([Appendix E-2](#)).

Living Shorelines offer many opportunities in this situation; they are a concept whose time has come. By pursuing the watershed scale systems approach, they perform better and at lower cost, whilst maintaining a superior appearance. To succeed in the quest to push the Living Shorelines agenda forward, we must foster a community of practice or awareness, bringing together government agencies, NGOs (nongovernmental organizations), universities, and practitioners. Collaboration, sharing “lessons learned”, prevents the need to reinvent the solution to each new challenge so that the same old mistakes are not made repeatedly. Each person at this Living Shorelines Summit can make a contribution to this journey. This is our opportunity to make progress on issues up and down Delmarva. It is essential that we come together ... because we have no other choice.

A brief **Question and Answer Session** followed this presentation. This can be viewed on the same video, youtu.be/5VI9IUtOoJ4, beginning at 14:45 minutes. The primary topic addressed was the challenge that finances present to advancing Living Shorelines as a means of shoreline stabilization. It was noted that there is a need to determine which federal agencies have funds, and how those funds can be accessed. NGOs need to seek tax incentives for remediation and restoration in addition to seeking tax incentives for land acquisition. Ecosystems need not only be evaluated, but also monetized. Their value must be put into macroeconomic terms that mean something to those in charge of finances. Those individuals and institutions need to know how these systems affect their bottom line.

Key Points

- The Mid-Atlantic will experience dramatic sea level rise within the next 20-30 years with unprecedented consequences.
- Coastal counties, which generate 60% of GDP, are those primarily affected by the effects of sea level rise and the extreme weather events that accompany them.
- Coastal wetlands are being lost at a rate of 80,000 acres per year. By utilizing a watershed scale systems approach, Living Shorelines offer opportunities to increase the resiliency of our coasts.
- A Community of Practice is a crucial part of efficiently addressing these challenges by providing a forum for information exchange, experimentation, and effective forward movement.
- Ecosystems must be monetized to reinforce their economic value to those that hold the key to financial backing. They need to know how these habitats affect their bottom line.
- Each attendee at the 2013 Mid-Atlantic Living Shoreline Summit has a responsibility to contribute to this collaboration.

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Session II

Understanding Lessons from Science

Objective: Gain an understanding of scientific studies and research focusing on the ecological and project performance of Living Shorelines.

Moderator: Karen Duhring, Virginia Institute of Marine Science (VIMS)

Presentations:

- Living Shorelines Research Framework - Karen Duhring, VIMS
- Highlights of Living Shorelines Scientific Findings and Implications
 - Carolyn Currin, National Oceanic and Atmospheric Administration (NOAA)
 - Donna Marie Bilkovic, Virginia Institute of Marine Science (VIMS)
 - Sadie Drescher, Center for Watershed Protection

This session was intended to identify and synthesize the most relevant research regarding the ecology and performance of Living Shoreline projects. The areas to be addressed include the estuarine coasts in the Mid-Atlantic region. Presenters included Karen Duhring and Donna Marie Bilkovic, both from the Virginia Institute of Marine Science (VIMS), Carolyn Currin, National Oceanic and Atmospheric Administration (NOAA), and Sadie Drescher, Center for Watershed Protection.

Following this session, Summit attendees were asked to identify information gaps and challenges that limit their effectiveness in the Living Shorelines arena. This process is described in greater detail below. The information collected from this exercise is documented in [Appendix A](#) and synthesized in [Appendix B](#).

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Karen Duhring

Coastal Advisory Scientist

Center for Coastal Resources Management

Virginia Institute of Marine Science

Presentation: youtu.be/S_mm8GyNGwQ

Living Shoreline Research Framework

Coastal development in the Mid-Atlantic region continues to drive the demand for shoreline protection from erosion and storm damage. Historically, bulkheads and revetments were used to harden

shorelines for coastal protection, and these practices are still widely used today. Are Living Shorelines a better alternative to hardened shorelines? They are intended to control erosion while simultaneously providing habitat and ecosystem services similar to natural shorelines. Is this happening? In an attempt to answer these questions, this session will describe and summarize current research specifically focusing on Living Shorelines.

Recent shoreline and tidal marsh inventories show that more than 10% of the estuarine coastlines of Delaware, Maryland, Virginia, and North Carolina have been hardened. Maryland has the highest rate at 28%. Over time, the cumulative effect of many small shoreline projects can alter large geographic areas even where no structures exist. This occurs when a critical percentage of the shoreline is modified, referred to as the “tipping point”. The aim of Mid-Atlantic shoreline research is to better understand the management of shorelines in this region, and to determine the status of the Mid-Atlantic with regards to its tipping point. This critical stage approaches as natural shorelines continue to be replaced with artificial shoreline protection.

Social science research indicates that Living Shorelines remain poorly understood and distrusted compared to traditional hardening methods. Despite Living Shoreline research extending back to the early 1970s, many people remain skeptical of the ability of vegetation to reduce erosion and protect property. Techniques that combine hardened structures with softer living components have grown in popularity. However, the public still needs more exposure to the ecological benefits of Living Shorelines, the advantages of their use compared to that of hardened shorelines, and their success in protecting shorelines and property from erosion.

The Mid-Atlantic Summit will focus on the ideal designs and locations for Living Shorelines, the comparative benefit of ecological services provided by Living Shorelines versus natural marshes, the ability of Living Shorelines to mitigate the detrimental effects of hardened shorelines, and the ideal balance of structural to living components that will protect the coast while providing the most beneficial ecological services.

Key Points

- Coastal development requires protection from erosion and storm damage. Traditional hardening of shorelines for this purpose is detrimental to estuarine ecology.
- Hardening of shorelines in Delaware, Maryland, Virginia, and North Carolina continues to rise. Maryland tops the list at 28%.
- Many people are unconvinced of the ability of living components to reduce erosion and protect shorelines. Greater exposure of their benefits is necessary.
- This Summit will focus on ideal designs and locations for Living Shorelines, the benefit of ecological services provided, and the potential for mitigating effects of hardened shorelines.

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Carolyn Currin

Center for Coastal Fisheries and Habitat Research

National Oceanic and Atmospheric Administration

Presentation: youtu.be/08_7dRQg4ZM

Natural and Stabilized Estuarine Shorelines in North Carolina:

Research and Policy

The research presented focuses on erosion rates of natural shorelines compared to Living Shorelines. Potential causes of shoreline erosion include fetch (prevailing winds, bathymetry, boat wakes), geomorphology (slope, elevation, sediment types), and shoreline types (vegetated/unvegetated).

Fetch is often given credit for causing the most erosion. Studies of North Carolina marshes show that fetch and wave energy actually have little correlation with erosion rate. On the contrary, shoreline type has considerably more influence. Compared to other types of shoreline, aerial photography has shown that marsh borders significantly reduce erosion rate, and even cause accretion of sediments. Underground root production and sediment accretion in coastal marshes allow a consistent elevation, enabling the marsh to keep pace with sea level rise.

In a study of marsh surface elevations from 2004-2011, natural marshes maintained steady elevation. Living Shorelines with stone sills studied in similar locations at similar times showed an average increase in surface elevation of 4 mm per year. A shift in vegetative species from low marsh to high marsh was seen with this elevation change.

Studies show that rock sills and created marshes have ecosystem benefits and trade-offs. Ecosystem benefits include reduction of erosion, protection of shoreline, increase in marsh habitat, and storage of organic carbon. Ecosystem trade-offs include replacement of subtidal space and low marsh with rock and a shift from low marsh to high marsh habitat.

The superior resiliency of Living Shorelines as compared to bulkheads in the face of hurricanes, the promise of oyster shell as a rock substitute with appropriate site conditions, and the importance of recognizing erosion as a natural process necessary for long-term marsh health, were discussed. Studies cited suggest that rock should be minimized and sills should be as low as site conditions allow.

Additional resources can be found in [Appendix E-2](#).

Key Points

- Salt marsh vegetation is effective in reducing erosion across a range of wave energy settings.
- Stone sills contribute to sediment accretion and result in surface elevation gain, with a simultaneous change in vegetation from low marsh to high marsh.

- Living Shorelines are more resilient to hurricanes than hardened shorelines.
- Intertidal oysters are showing promise as an alternative to stone sills in North Carolina.
- Carbon sequestration is an important ecosystem service offered by Living Shoreline methods. This ecosystem benefit contributes to the mitigation of the effects of climate change.

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Donna Marie Bilkovic

Research Assistant Professor

Center for Coastal Resources Management

Virginia Institute of Marine Science

Presentation: youtu.be/MpiQXK4Gg-Q

Ecological Attributes and Trade-offs of Living Shorelines

Living Shorelines are designed to reduce erosion while enhancing habitat to maintain ecosystem services. These ecosystem services represent our “wish list” for Living Shoreline function. They include provision of habitat for feeding, refuge, and nesting, SAV (subaquatic vegetation) habitat, primary production by benthic algae, marsh, and sea grass, nutrient processing, decomposition of organic matter, secondary productivity transfer, wave attenuation, sediment stabilization, and biodiversity.

Armored shorelines, such as traditional bulkhead and riprap revetment, adversely affect these ecosystem functions resulting in loss of habitat, fragmentation of forest and tidal wetlands, severance of the connection between upland and wetland, alteration of sediment supply and transport, increased scouring and turbidity, decreased biodiversity including fish and benthos, an increase in invasive species, and the prevention of natural migration of habitats with sea level rise.

Research uses these ecosystem services as a means of comparing Living Shorelines to traditional armored shorelines, as well as to natural shorelines, in an effort to determine whether there is a net ecological benefit or loss, and whether that effect is persistent over time.

Compared to natural and/or created marshes, the vegetation of marsh-sills recovers within 2-3 years. However, biogeochemical processes such as organic matter and nutrient accumulation, as well as benthic infauna, lag significantly. Abundance of epibiotic filter feeders is highly variable, and there is less diversity in the composition of intertidal infauna although most ecological roles are present. Filter-feeding oysters and mussels are typically observed in lower densities in hybrid Living Shorelines than in natural marshes or reefs. However, despite some drawbacks compared to natural shorelines, it has been shown that well-designed marsh-sills are consistently beneficial compared to traditional armored shorelines when the alternative is an armored shoreline, the sill is colonized by filter-feeding epibiota, or shallow water habitat is maintained.

Key Points

- Living Shorelines are designed to reduce erosion while enhancing habitat to maintain ecosystem services. Ecosystem services represent a “wish list” for Living Shoreline function.
- To be considered ecologically beneficial, the net positive effect must persist over time.
- Vegetation of marsh-sills recovers within 2-3 years, whereas other ecosystem services and components lag considerably in function or diversity.
- Marsh-sills represent an ecological benefit when the alternative is an armored shoreline, the sill is colonized by filter-feeding epibiota, or shallow water habitat is maintained.

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Sadie Drescher

Watershed Researcher and Planner

Center for Watershed Protection

Presentation: youtu.be/MPmgTmPesPo

Chesapeake Bay Shoreline Management Expert Panel:

Water Quality, Models, and Panelists – Oh My!

The Chesapeake Bay Shoreline Management Expert Panel is comprised of 16 members from government and nongovernmental agencies. This panel is responsible for defining removal rates of sediment, total nitrogen, and total phosphorus by shoreline management projects. Erosion of unprotected shoreline is the source of one-third of the sediment discharged into the Bay, making shoreline management a crucial element in meeting the Chesapeake Bay TMDL (Total Maximum Daily Load).

The Chesapeake Bay TMDL was set by President Obama in 2010. The pollutant load reductions mandated by this Executive Order are to be achieved by new or retrofitted BMPs (Best Management Practices) specifically designed to protect the Bay from excess nitrogen, phosphorus, and sediment. The Chesapeake Bay TMDL is decreed to be 60% implemented by 2017, and 100% implemented by 2025.

Shoreline management includes any tidal shoreline practice that prevents or reduces tidal sediment discharge into the Bay. This includes non-structural Living Shorelines that contain natural elements only, hybrid Living Shorelines that contain natural elements as well as hard structures, such as stone sills, and structural practices that have no natural components, such as bulkhead or riprap.

The panel is reviewing shoreline practice modeling, developing pollutant removal rate protocols, providing qualifying characteristics, reviewing literature, defining reporting units, and recommending procedures for reporting, tracking, and verification.

The information currently used to credit shoreline management pollutant load reduction is outdated and based on very limited stream restoration data. Credited removal rates of these practices are less than those values reported in current literature, and shoreline practices themselves are under- or misreported. The panel is formulating four protocols: the reduction of sediment, denitrification, sedimentation, and the Marsh Redfield Ratio. The major obstacle to developing these protocols is the lack of water quality data. At this point, the panel is pursuing adaptive management with the option to reassess and revise recommendations in 5 years if new information becomes available.

Additional links can be found in [Appendix E](#).

Key Points

- The Chesapeake Bay TMDL, mandated by President Obama in 2010, requires pollutant load reductions of sediment, total nitrogen, and total phosphorus - 60% by 2017, and 100% by 2025.
- Shoreline erosion accounts for one-third of the sediment discharged into the Chesapeake Bay.
- The Chesapeake Bay Shoreline Management Expert Panel is updating the removal rates of sediment, nitrogen, and phosphorus by shoreline management practices.
- The major obstacle to formulating accurate pollutant removal rates of Living Shorelines is the lack of water quality data.

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Question and Answer: Understanding Lessons from Science

Complete Session: www.youtube.com/watch?v=166dB2e_DYU&feature=youtu.be

A period for questions and comments followed the Understanding Lessons from Science session. Topics addressed included the reduction of water quality benefits as subtidal space converts to high marsh, the need for monitoring Living Shorelines over extended periods of time to accurately assess their performance, the variability of shoreline types as a determinant in improvement of ecological services, social science demonstrating the effect visual impact of Living Shorelines has on landowners, increase in biodiversity seen with indented sills, credit for nonsource point pollution, and more.

There was consensus that a White Paper is needed, synthesizing the evolving science of Living Shorelines with subsections on water quality and ecological benefits of a range of Living Shoreline projects compared to armored shorelines. The need for separate documents addressing adaptive management methods including research, monitoring, and topics related to specific areas of Living Shorelines science was also raised.

Integration of targeted messaging summarizing the science of Living Shorelines into the strategy of the Living Shorelines mission was thought to be essential to move the Living Shorelines agenda forward. Incorporating consistent messaging into talking points used by advocates, regulators, and planners would help to inform the public of the benefits and superior function of Living Shorelines.

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Identifying Critical Research Gaps

Information Gathering

See [Appendix A](#)

Objective: Identify limiting data or knowledge needed to advance design, support, and understanding of Living Shorelines, and identify ways to resolve those questions.

Moderator: Jana Davis, Chesapeake Bay Trust

The previous session, Understanding Lessons from Science, was intended to clarify what is currently known about Living Shorelines. In this session, Identifying Critical Research Gaps, participants were asked to focus on what is not known, and what is essential to discover.

Attendees self-segregated into one of four constituent groups: (1) Research, Science, and Monitoring Community, (2) Project Managers and Restoration Program Implementers, (3) Designers and Builders, or (4) Regulatory and Policy Community. Each sector was then divided into small groups for the purposes of collaboration.

By brainstorming individually, as well as within small groups, participants identified the information gaps and challenges that limit their effectiveness in the field of Living Shorelines. The following questions were addressed:

Question 1: Based on your role within the Living Shorelines community, what information is lacking or what challenges arise when you are permitting, designing, studying, or implementing a project?

Question 2: Based on what you heard in the first session, did you learn any new information that would help to solve your identified priority issues as you permit, design, study, or implement Living Shoreline projects? If not, clarify the questions that you have, and the information that you need from the research community.

After each group generated a list of questions, they identified the two research gaps from their list that represented their highest priority need. All responses recorded during group collaboration are documented in [Appendix A](#). The gaps each sector believed to have the highest priority are reviewed below.

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Research, Science, and Monitoring Community

See [Appendix A-1](#)

Question 1: As a scientist, what questions are important to tackle next?

The most common questions noted by the Research, Science, and Monitoring Community as being of highest priority were in the areas of design criteria (30%, 3/10), as well as monitoring and assessment of Living Shoreline function (30%, 3/10). The specific questions proposed in these categories as well as others are documented in [Appendix A-1](#).

Question 2: What information do you need from the research community to achieve your goals within the Living Shorelines field?

Topics involving monitoring and assessment of Living Shorelines (100%, 4/4) were overwhelmingly cited as the most important subjects of concern by researchers, scientists, and monitors. The specific questions proposed within this category as well as others are documented in [Appendix A-1](#).

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Project Managers and Restoration Program Implementers

See [Appendix A-2](#)

Question 1: What information gaps or challenges limit your ability to achieve your goals within the Living Shorelines field?

The most common questions noted by the Project Manager and Restoration Program Implementer Community as being of highest priority were in the area of cost-benefit analysis (29%, 4/14). The specific questions proposed within this category as well as others are documented in [Appendix A-2](#).

Question 2: What information do you need from the research community to achieve your goals within the Living Shorelines field?

Topics involving monitoring and assessment of Living Shoreline function (56%, 5/9) were cited as the most important subjects of concern by project managers and restoration program implementers. The specific questions proposed within this category as well as others are documented in [Appendix A-2](#).

Designers and Builders

See [Appendix A-3](#)

Question 1: What information gaps or challenges limit your ability to achieve your goals within the Living Shorelines field?

The most common questions noted by the Design and Build Community as being of highest priority were in the area of regulatory and policy issues (40%, 6/15). The specific questions proposed within this category as well as others are documented in [Appendix A-3](#).

Question 2: What information do you need from the research community?

Topics involving regulatory and policy issues (36%, 5/14) were again cited as the most important subjects of concern by designers and builders. The specific questions proposed within this category as well as others are documented in [Appendix A-3](#).

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Regulatory and Policy Community

See [Appendix A-4](#)

Question 1: What information gaps or challenges limit your ability to achieve your goals within the Living Shorelines field?

The most common questions noted by the Regulatory and Policy Community as being of highest priority were in the areas of regulatory and policy (38%, 3/8), as well as ecosystem trade-offs (25%, 2/8). The specific questions proposed within these categories as well as others are documented in [Appendix A-4](#).

Question 2: What information do you need from the research community to achieve your goals within the Living Shorelines field?

Topics involving communication, including the development of an accessible database (38%, 3/8), were cited as the most important subjects of concern by regulators and policy-makers. The specific questions proposed within this category as well as others are documented in [Appendix A-4](#).

Research Priorities

See [Appendix B](#)

Objective: Identify limiting data or knowledge needed to advance design, support, and understanding of Living Shorelines, and identify ways to resolve those questions.

Following the information gathering session, Identifying Critical Research Gaps, the research gaps identified as having the highest priority overall were summarized by Jana Davis, Chesapeake Bay Trust, Karen Duhring and Sandra Erdle, Virginia Institute of Marine Science, Tracy Skrabal, North Carolina Coastal Federation, and Cindy Zook of Cindy Zook Associates. Through this process, a list of 29 topics under six broader categories was generated. As a final exercise, each participant was invited to vote for her/his two highest priority concerns from that comprehensive list generated by the entire group. Votes were color-coded so that interest in each topic could be traced to the originating constituent group.

The 29 individual topics and the number of votes each of those topics received are summarized in the Research Priorities table in [Appendix B](#). The number of votes for each topic is expressed both as a portion of the total number of votes, as well as the number of votes within each constituent group.

Information gaps having the highest priority in each constituent group, as well as in the group as a whole, are summarized below.

Constituent Group Participation

A total of 276 votes were cast during the final phase of the Identifying Critical Research Gaps session. Those votes were divided among the four constituent groups as follows: (1) Research, Science, and Monitoring: 21% (58/276 votes); (2) Project Managers and Restoration Program Implementers: 25% (70/276 votes); (3) Designers and Builders: 22% (61/276 votes); and Regulatory and Policy: 32% (87/276 votes).

Highest Priority Topics

The 29 topics identified as top priorities by the small discussion groups suggest interest in a wide variety of issues within the Living Shorelines arena. In order of frequency, the research gaps identified as having the greatest priority by garnering the most votes include:

- Efficacy of Living Shorelines, both short-term and long-term 15% (42/276 votes)
- Most effective type of Living Shoreline based on location 13% (35/276 votes)
- Habitat trade-offs, such as riparian buffer, subtidal zone, etc. 9% (24/276 votes)
- Cost-benefit analysis and life cycle costs 8% (23/276 votes)

Although interest in each of the four highest priority topics listed above ranges from only 8% to 15% (23-42/276) of the votes cast, 45% (124/276) of all votes indicated interest in at least one of these four topics.

When the votes were evaluated from the perspective of the six broader categories under which the individual topics were grouped (see [Appendix B](#): Function, Measurement, Communication, Cost/Money Efficiency, Site Suitability, and Philosophy), the Function of Living Shorelines easily garnered the greatest percentage of votes. This is the case both from the standpoint of total votes cast, as well as the percentage of votes cast by each constituent group, as shown below.

Sector interest in Function of Living Shorelines as being of highest priority:

• Research, Science, and Monitoring	48%	(28/58 votes)
• Project Managers and Restoration Program Implementers	54%	(38/70 votes)
• Designers and Builders	49%	(30/61 votes)
• Regulatory and Policy	52%	(45/87 votes)
	Total votes	51% (141/276 votes)

The Function of Living Shorelines category includes three of the individual topics of greatest interest: (1) Efficacy of Living Shorelines, (2) Most effective type of Living Shoreline based on location, and (3) Habitat trade-offs. Only the fourth topic, Cost-benefit analysis and life cycle costs, is not within the category of the Function of Living Shorelines.

Highest Priority Topics by Constituent Group

Research, Science, and Monitoring

Votes from the Research, Science, and Monitoring sector focused on 18 of the 29 topics. Of those, Efficacy of Living Shorelines garnered the greatest number of constituent votes at 19% (11/58). However, 48% (28/58) of researchers, scientists, and monitors expressed interest in the broader category of Function of Living Shorelines which includes seven other topics of interest to this group. This information is documented in [Appendix B](#).

Project Managers and Restoration Program Implementers

Votes from the Project Managers and Restoration Program Implementers sector focused on 17 of the 29 topics. Of those, Most effective type of Living Shoreline based on location garnered the greatest number of constituent votes at 21% (15/70). However, a total of 54% (38/70) of project managers and restoration program implementers expressed interest in the broader category of Function of Living Shorelines which includes six other topics of interest to this group. This information is documented in [Appendix B](#).

Designers and Builders

Votes from the Designers and Builders sector focused on 17 of the 29 topics. Of those, the Most effective type of Living Shoreline based on location garnered the greatest number of constituent votes at 18% (11/61). However, a total of 49% (30/61) of designers and builders expressed interest in the broader category of Function of Living Shorelines which includes five other topics of interest to this constituent group. This information is documented in [Appendix B](#).

Regulatory and Policy

Votes from the Regulatory and Policy sector focused on 18 of the 29 topics. Of those, Habitat trade-offs and the Efficacy of Living Shorelines garnered the greatest number of the constituent votes at 21% (18/87) and 20% (17/87), respectively. However, 52% (45/87) of regulators and policy makers expressed interest in the broader category of Function of Living Shorelines which includes five other topics of interest to this constituent group. This information is documented in [Appendix B](#).

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Session III

Evolving Living Shorelines: Techniques and Performance

Objective: Review current practices and learn about innovative approaches from different regions of the Mid-Atlantic.

Moderator: Bill Shadel, Interstate Environmental Commission (New York, New Jersey, Connecticut)

Presentations:

- Overview of Current Practices - Scott Hardaway, Virginia Institute of Marine Science (VIMS)
- Innovative Practices in North Carolina - Tracy Skrabal, North Carolina Coastal Federation
- Innovative Practices in New Jersey and New York - Jon Miller, Stevens Institute of Technology
- Innovative Practices in Maryland - Albert McCullough, Sustainable Science

This session was intended to review site-specific implementation of new and emerging technologies in the design and construction of Living Shorelines, as well as the effectiveness of those techniques under varying circumstances. The question as to whether current restoration practices are meeting the goals of habitat enhancement, shoreline protection, and erosion control was also explored.

Bill Shadel

Associate Director

Interstate Environmental Commission

Presentation: youtu.be/2HEbFxWP60g

For many, this session represents the core of the Living Shorelines Summit because it contains much of the technical detail. The speakers represent a range of Mid-Atlantic regions, as well as a mix of approaches to Living Shorelines restoration. Scott Hardaway, Virginia Institute of Marine Science, will address the basic groundwork regarding current practices, while Tracy Skrabal, North Carolina Coastal Federation, Jon Miller, Stevens Institute of Technology, and Albert McCullough of Sustainable Science, will discuss innovative practices in different regions. They have been asked to address the following: 1) proven techniques and their performance; 2) innovative approaches to Living Shorelines techniques and design considerations; and 3) “lessons learned”, as well as teachable moments during implementation of those projects.

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Scott Hardaway

Director, Shoreline Studies Program

Virginia Institute of Marine Science

Presentation: youtu.be/Bsn_XeruQfo

“Living Shorelines” An Historical Perspective from the Chesapeake Bay: Current Practices and How They Got Here

Living Shorelines have changed both in name and in form over the past several decades. In the 1970s, Living Shorelines were known as “Marsh Fringe Creations”. Several groups performed studies in Maryland and Virginia at that time. Between 1980 and the 1990s, Living Shorelines were called the “Non-structural Approach”. Grants supported the use of this approach in Maryland, and Virginia tested Living Shoreline projects. From 1981 to 1987, the Virginia Shoreline Erosion Advisory Services (SEAS) was formed (see [Appendix E-1](#)). In the 2000s, the “Living Shoreline” moniker was developed. The overall goal was to use marsh and/or beach fringe to establish shore erosion control rather than hardening the coast.

Design parameters and challenges were discovered. They included fetch, shoreline orientation, shore geometry, nearshore bathymetry, boat wakes, and sun exposure. Early trials led to the understanding that these projects performed well when the fetch was less than one mile, and that challenges arose with larger fetch exposure. An eroding shoreline with a larger fetch requires a wider marsh as well as wave attenuation for stabilization. This was addressed largely with stone sills at the toe of the marsh and sand placement to widen the marsh along a gradual slope.

Basic design guidance has been created for typical profiles of Living Shorelines based on “lessons learned”. It is essential that the design be adapted to the site conditions and project goals. Projects must always be designed with the possibility of large storm events in mind. Several examples of successful marsh creation and the accompanying challenges were illustrated. Failures in marsh construction were addressed as well. Both natural and created marshes change over time, and as a result, maintenance and monitoring of Living Shorelines are critical to long-term success.

Another type of coastal protection is natural and created beaches. Breakwaters can play an important role in beach creation and protection. In areas with larger fetch, beaches may be a more suitable method of shoreline protection.

There is a great deal of data showing the success and value of Living Shorelines. Their original use in shoreline protection was innovative and offered a valuable alternative to hardened shorelines. Over time, the installation of Living Shorelines has changed, built on past successes and failures. Promising results in shoreline protection and erosion control have arisen from the combination of hard structures and marsh creation.

Key Points

- The design of hybrid Living Shorelines must be adapted to the project site and goals.
- Living Shoreline projects perform best with a fetch less than one mile. A wider marsh and wave attenuation are necessary with a greater fetch.
- Maintenance and monitoring of Living Shorelines are critical to long-term success.
- Beaches provide coastal protection in areas with a greater fetch. Breakwaters contribute to beach creation and protection.

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Tracy Skrabal

Southeast Regional Manager

North Carolina Coastal Federation

Presentation: youtu.be/0cT9U4wH4jA

Living Shoreline Projects in North Carolina

Living Shorelines combine erosion control with restoration. The spectrum of projects addressing eroding shorelines includes no action, relocation of threatened structures, nonstructural stabilization (slope grading, marsh creation, bioengineering, beach nourishment), combination approaches (sills, stone containment cells with plantings), and hardening structures (groins, revetments, gabions, bulkheads). Ideally, a shoreline project should incorporate the least amount of structure necessary to achieve targeted goals.

Nonstructural approaches include marsh plantings and beach nourishment. These approaches don't stop erosion but they can postpone further damage. Hybrid projects include biologs, oyster shell patch reefs/sills, and vertical wall sills with marsh plantings. Biologs can be very successful in freshwater systems but they are generally not appropriate for high energy saltwater environments. Oyster shell patch reefs and sills can also be very successful in select environments. With the appropriate height and volume of shell, they can hold up well to high energy situations. In an area with sufficient oyster spat, integrating an oyster zone should be considered.

Vertical wall sills and marsh plantings can be very successful at dissipating wave energy at a very low cost. They are stand-alone structures with no tieback, gapped to allow water exchange. Open water is maintained behind the structure, preserving the natural relationship between the wind-driven, submerged intertidal zone and the riparian zone. This is not a good option in higher energy environments, or in the northeast where ice can cause dislodgment. Hybrid structures can be very intricate depending upon the site and the wave energy focused on the shoreline. They can protect the shoreline and also incorporate components to capture stormwater and improve water quality, such as incorporating a low berm and swale to catch runoff from impermeable surfaces.

By carefully evaluating the characteristics of the site, such as salinity, availability of oyster spat, and energy level, and then tailoring the project accordingly, one can be very successful at protecting the

shoreline while restoring some of its ecosystem functions. Success with erosion control is being achieved with no sand fill, lowering the elevation of sills, and decreasing the scale and magnitude of structures. Even in high energy environments, incorporating some living component into a project is recommended.

Key Points

- Incorporate the least amount of structure necessary to achieve goals. Some living component should be included, even in higher energy environments. Consider integrating oyster shell.
- Different design techniques are indicated based on salinity, the availability of oyster spat, and energy level, amongst other characteristics.
- Gaps in structures preserve the intertidal zone, allowing water exchange and fish utilization. The relationship between the intertidal zone and the riparian zone should also be maintained.
- Success with erosion control and plantings is being seen with no sand fill, lowering the elevation of sills, and decreasing the scale and magnitude of structures.

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Jon Miller

Assistant Director, Coastal Engineering

Davidson Laboratory

Stevens Institute of Technology

Presentation: youtu.be/OdAnffbTUtk

Innovative “Living Shoreline” Approaches in New York and New Jersey

The states of New York and New Jersey are pioneers in Living Shorelines implementation. They have unique challenges, such as a tidal range of 4-5 feet, a full spectrum of salinity, and the extremes present in urban environments. These variables make innovation essential in Living Shoreline construction in these locales. The goal of projects in these areas is to incorporate natural enhancements into existing or newly-created structures so that they provide greater ecological value, increased aesthetics, and improved public access, while simultaneously dampening wave energy and stabilizing the shoreline.

In New York State, the Hudson River Sustainable Shorelines Demonstration Site Network is one resource used to familiarize the public, government officials, and other contractors and designers with the components of Living Shorelines ([Appendix E-3](#)). The projects included in this network are not necessarily designed as Living Shoreline projects, but they embrace the principles of Living Shorelines. At this time, projects which are designed, built, and monitored as Living Shorelines do not exist. However, these projects highlight the desirable characteristics of Living Shorelines, helping to push the agenda for these types of projects forward.

Incorporating sustainable shoreline principles such as slope, roughness, tide pools, oyster shell, and natural plantings has moved the traditional armored shoreline toward projects that not only provide more habitat, but also stand up well to extreme weather events. Areas that are state-owned or are under conservation easement have provided opportunities with which to implement these nontraditional approaches. Although they do not have all of the desirable characteristics of a Living Shoreline due to the constraints of the locations, they are an immense improvement over traditional methods.

Several projects are reviewed, such as Habirshaw, Coxsackie, Esopus Meadows, and “Designing the Edge” on the Harlem River, all located in New York, and Lower Cape May Meadows, Reeds Beach, Mordecai Island, Delsi project, and Maurice River, all situated in New Jersey ([Appendix E-3](#)). Adaptations being explored in New York City are also highlighted, including lowering the pH of concrete used in traditional hardened shorelines to promote increased invertebrate colonization, and oyster encasement for pile enhancement ([Appendix E-3](#)).

Key Points

- Positive change is possible in all projects, at all locales, given an innovative mindset.
- Ecologists and engineers must work together to create structures that are beneficial to ecosystem enhancement as well as shoreline stabilization.
- Models simulate the changes predicted when modifications are made to a shoreline, facilitating a more effective and accurate design before the financial investment.
- Demonstration sites are needed to increase familiarity and authenticate the effectiveness and long-term durability of this method of shoreline stabilization. Monitoring is critical.
- New Jersey has recently adopted a Living Shorelines general permit that is expected to expedite the regulatory process for Living Shorelines approval.

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Albert McCullough

Principal Ecological Engineer

Sustainable Science

Presentation: youtu.be/I51GIUxU6R4

Innovative Living Shoreline Practices in Maryland

Every shoreline is unique. Design considerations include the historical progression of erosion, projected geometry, location and orientation of the structure to the shore, vegetation type, tolerance, substrate, and wave height, period, and angle of approach.

The intent of Living Shoreline projects is to protect the shoreline from further erosion secondary to wave action. Waves are generated by wind moving over open water as well as by boat traffic. Living Shoreline projects specific to each individual site can be appropriately designed by predicting and analyzing these factors.

Wind records from Thomas Point Lighthouse are used to predict waves using a limited open water method, where the waves generated are constrained by a limited fetch. The bimodal nature of wind in Maryland must be considered, with winter winds originating from the northwest, and summer winds originating from the south. Boat wake wave analysis is predicted using four shoreline approach conditions.

Wave action on a shoreline is dictated by the diffraction, refraction, and reflection that occur when waves encounter an object, bend, and then impact the shore. Areas of shoaling and erosion along the shoreline provide clues which can be used to forecast long-term trends. Design predictions must address those trends to be successful.

Two case studies are examined: 1) Smithsonian Environmental Research Center (SERC) Living Shoreline, and 2) Eastern Neck National Wildlife Refuge (ENNWR) Living Shoreline. Both are high energy projects, but located in different parts of the Bay. SERC, on the western shore, encounters high volume boat traffic, whereas ENNWR, on the Eastern Shore, experiences a reduced amount of activity. The importance of design calculations including historical shoreline recession analysis, wind wave analysis, and boat wake wave analysis are emphasized.

Key Points

- Every shoreline is unique. Aligning design standards accordingly maximizes the likelihood of success of the project.
- Waves are generated by wind (duration, speed, direction over open water) and by boats (speed, direction, shape and displacement of the hull), especially on the western shore of Maryland.
- Waves behave like light, diffracting, refracting, and reflecting. These properties and the properties of the objects they encounter determine the manner of impact on the shore.
- Design calculations such as historical shoreline recession analysis, wind wave analysis, and boat wake wave analysis are critical in predicting a successful Living Shoreline project.

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Question and Answer

Evolving Living Shorelines: Techniques and Performance

Complete Session: www.youtube.com/watch?v=2iloSrfB9Ag&feature=youtu.be

A 20-minute period for questions and comments followed the Evolving Living Shorelines session. Topics addressed included the use of sand fill, effects of Living Shoreline designs on neighboring properties, projected time until maintenance or adaptations are required, communication regarding the advantages of Living Shorelines compared to traditional methods of stabilization, a brief discussion of failed projects, and more. Emerging themes were described by the moderator, Bill Shadel, as evidence that there is clearly room for innovation in the Living Shorelines field, not only with respect to design considerations and the energy of natural forces, but also regarding the challenges presented by the perceptions of regulators, landowners, and the regulations themselves.

Session IV

Adapting Living Shorelines: Forward Thinking

Objective: Engage in provocative dialogue with the panel and gathered practitioners to understand different perspectives on Living Shoreline implementation practices.

Moderator: Bhaskar Subramanian, Maryland Department of Natural Resources

Panelists:

- Keith Underwood, Underwood and Associates (Maryland)
- Rob Young, Western Carolina University (North Carolina)
- Joe Rieger, Elizabeth River Project (Virginia)

Complete Session: www.youtube.com/watch?v=4HaywLAbixw&feature=youtu.be

This session was intended to expand thinking about Living Shoreline implementation by encouraging a provocative dialogue between the audience and the panelists. Panelists included Keith Underwood of Underwood and Associates, Maryland, Rob Young from Western Carolina University, North Carolina, and Joe Rieger of the Elizabeth River Project, Virginia. Panelists were asked to address the past, present, and future of coastal shoreline protection and restoration. Of particular interest was the progress made since the 2006 Living Shorelines Summit, as well as new and emerging technologies and the circumstances under which those methods perform best. This was followed by an opportunity for the audience to raise themes of personal interest.

Panelists were asked to introduce themselves and present their opinion regarding the progression of protection and restoration of shorelines.

Keith Underwood stated his belief that the Living Shorelines Community continues to over-armour shorelines. Because Living Shorelines are meant to mimic natural systems, natural particle size and natural materials should be used to promote the colonization of living natural resources and the stabilization of the shoreline. He quoted Joe Berg, claiming that structural approaches to shoreline stabilization are as good as they are going to be the day they go in the ground. Alternatively, a Living Shoreline creates the opportunity for natural regeneration of biota. This system will be as weak as it is going to be the day it goes in the ground, but will become stronger and more stable with time.

Joe Rieger described the Elizabeth River Project's focus as implementing on-the-ground projects such as wetland restorations, oyster reef restorations, and cleanup of contaminated sediments. The key is to restore not only the individual components, but more importantly, to restore the continuum of the system, that is, to combine wetland restoration with oyster restoration and the upland buffer. The upland buffer is a component that can be lost in the process. A true Living Shoreline restoration addresses the continuum, extending from the upland out to the oyster restoration.

Rob Young coauthored a White Paper, raising philosophical questions about methods of Living Shoreline construction, as well as questions about stabilizing shorelines in general ([Appendix E-2](#)). Concern revolves around the structural components of Living Shorelines, which often resemble rock revetments with token amounts of marsh vegetation. Although that type of structure may create some habitat, it is not a restoration. A Living Shoreline that emphasizes ecosystem values and ecosystem services is very different. What boundary separates a Living Shoreline, from a shoreline stabilization that is not a Living Shoreline? There is a need to reassess the meaning of “limited use of rock”, as well as where certain design elements are appropriate, and where they are not. Accepted features which distinguish Living Shorelines from other forms of stabilization are needed to establish a brand. There is a danger that this term will be used to justify projects that are just as damaging to the ecosystem as the traditional hardening techniques they are meant to replace.

A 90-minute **Question and Answer Session** ensued, addressing a number of topics such as the amount and size of structural elements, the use of geotextile fabric, long-term monitoring, building in the channel (a.k.a. the public domain), incorporating physical processes in the design phase, the dangers of structural components to wildlife, floating wetlands, a national repository for Living Shoreline research, and more.

The moderator, **Bhaskar Subramanian** of the Maryland Department of Natural Resources, summed up the session by noting:

- There are different shapes, forms and definitions of Living Shorelines. [The Evolving Living Shorelines: Techniques and Performance](#) session was designed to expose participants to innovative types of Living Shorelines.
- Each Living Shoreline project is unique, depending upon the site conditions. It is easier to adopt, and then adapt a project, than it is to try to morph the environment.
- “It takes a village” to raise a good Living Shoreline, that is, project partners such as the marine contractor, the regulator, and the landowner.
- Work with the system, not against it. This applies to the regulatory community, the project partners, and the environment or site.

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Session V

Using Performance Data to Drive Change

Objective: Review research to date assessing the physical performance of Living Shoreline techniques, discuss the technical feasibilities and limits of that research, and engage in group dialogue about how to move forward from here.

Presentations:

- Court Stevenson, University of Maryland Center for Environmental Science (UMCES)
- Evamaria Koch, University of Maryland Center for Environmental Science (UMCES)
- Pam Mason, Virginia Institute of Marine Science (VIMS)

The intent of this session was to review research done to date to assess the physical performance of Living Shoreline techniques and to discuss the advantages and limitations of their use. The challenge for the Living Shorelines Community is to progress to a point where monitoring becomes standard practice and the data collected is used to inform other sectors, thereby promoting the use of Living Shorelines stabilization through the support of research.

Court Stevenson, University of Maryland Center for Environmental Science (UMCES), was the moderator for this session. Panelists included Evamaria Koch, UMCES, and Pam Mason from the Virginia Institute of Marine Science (VIMS).

Following this session, Summit attendees were asked to comment on one of three subjects regarding the use of performance data to evaluate Living Shorelines restorations. This process is described in greater detail below. The information collected from this exercise is documented in [Appendix C](#).

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Court Stevenson

Professor, Horn Point Laboratory

University of Maryland Center for Environmental Science

Presentation: youtu.be/uQsb_kjfdE

Using Performance Data to Drive Change

The Chesapeake Bay possesses 190 miles of estuarine shoreline with a maximum tidal range of 2-3 feet at the mouth of the Bay. This deviates remarkably from Atlantic coastal shorelines which

experience a tidal range of 6-10 feet or more. The tidal range of those shorelines allows continual input of sediment to the marshes and surrounding areas, and the continual elimination of waste products. Whereas a global view of shoreline designs may be tempting, this example shows that the micro-view is very important when designing a project for a particular site.

In the last 100 years, global temperature has increased by 1°C. As this trend continues, pools without tidal exchange may experience problems with heating. Likewise, global monitoring shows a sea level rise of 3.2mm/year. Subsidence of 1-2mm/year is occurring in the Chesapeake Bay in addition to sea level rise. This means that a yearly minimum of 3-4mm of marsh accretion is needed to keep pace with local sea level rise.

Accretion in marshes is directly proportional to the tidal range. In areas with larger tidal ranges, marshes can sustain themselves with sediment gained from the input of water during daily high tides, as well as storm events. However, the tidal range at Blackwater National Wildlife Refuge in Dorchester County, Maryland, is approximately 1cm. The local sediment budget demonstrates a net export of sediment, resulting in the loss of thousands of acres of marsh from this system. With a net output of sediment, the ecosystem service provided by sequestration of blue carbon in marsh biomass and sediment is lost.

Sills engineered with windows allowing the import of sediment on a daily basis promote healthier habitats. Sills installed with no gaps present a barrier to water. The result is that sediment recruitment at these projects is through storm events only, and storm events alone are not a reliable source of sediment. Likewise, studies monitoring temperature and dissolved oxygen (DO) have shown that shallow waters sequestered by unbroken sills are subject to warming and anoxia. If one of the goals of a Living Shorelines project is to create healthy habitat, unbroken sills are not a technique supportive of that goal.

To maintain sustainability in the face of projected coastal changes, marsh systems must be considered on a long-term basis. We can affect marsh sustainability through Living Shoreline design choices. These design choices are most accurately informed by performance data research.

Key Points

- The Chesapeake Bay possesses 190mi of estuarine shoreline with a tidal range from 0.5 inches to a maximum of 2-3 feet at the mouth of the Bay, versus the Atlantic coast's 6-10ft tidal range.
- When designing a project for a particular site, the micro-view is very important. Each project must be adapted to the unique characteristics of the site.
- Accretion is directly proportional to the tidal range. Sediment input during daily high tides and storm events dictates marsh sustainability.
- In the Chesapeake Bay region, 3-4mm marsh accretion is needed to keep pace with global sea level rise (3.2mm/yr) and local subsidence (1-2mm/yr).
- Design choices affect marsh sustainability. Sills without gaps present a barrier, lowering the tidal exchange causing a sediment deficit as well as warming and anoxia of sequestered waters.

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Evamaria Koch

Associate Professor, Horn Point Laboratory

University of Maryland Center for Environmental Science

Presentation: youtu.be/feJRzOdIWsl

The Need to Create Direction in Shoreline Protection: Using Data to Drive Change

Natural shorelines are very dynamic systems. Hardening shorelines, even with Living Shoreline projects, reduces or eliminates this dynamic aspect and interrupts the interaction between the water and the land. What affect is this having on adjacent shorelines? Subaquatic vegetation (SAV) is used as an indication of what is occurring in the natural environment.

Evaluation of the performance of structures includes assessment of erosion control, marsh health, the presence of SAV, and the current state of the structure. The most valuable parameters affecting these characteristics include the fetch, depth profile, and marsh and nearshore sediment characteristics. Evaluation of SAV presence demonstrated that only Living Shorelines did not adversely affect the presence of SAV at the hardened structure or the adjacent marsh. Other structures result in water that is too deep for SAV growth, or in scouring adjacent to the structure which pushes the SAV bed offshore.

Techniques being used to re-create some of the habitat lost with hardening include Green Bulkheads, such as the "Peruvian flute" system at Ocean City, and the construction of breakwaters focused on SAV conservation and/or restoration. These breakwaters can be successful as long as certain habitat requirements are met. These habitat requirements include water quality, water depth, sandy sediment low in organic matter, and a fetch greater than 10km.

Monitoring sites to determine success or failure must occur over a long period of time. Some sites which initially appear to be successful by the presence of SAV can crash after a few years, while the opposite can occur as well. Hardening of some areas can be detrimental to an entire region. This highlights the need for regional shoreline management plans at the state and local level in partnership with the federal government. Finally, the future of shorelines in terms of both protection and ecosystem services depends on the collaboration of engineers and ecologists.

Key Points

- The dynamic system of natural shorelines is altered by hardening, leading to ecosystem service loss. A regional shoreline management plan is necessary to minimize the cumulative effects.
- Long-term monitoring is necessary to determine the success of a protected shoreline. Erosion control, marsh health, SAV presence, and physical state are used to evaluate structures.

- The future of shorelines and coasts in terms of shoreline protection and invaluable ecosystem services depends on the collaboration of engineers and ecologists.
- Green Bulkheads and breakwaters re-create some of the habitat lost due to hardening. Habitat requirements regarding water quality and depth, sediment characteristics, and fetch are necessary for success.

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Pam Mason

Wetlands Program

Virginia Institute of Marine Science

Presentation: youtu.be/gX2h3BzA_hA

What We Know and What We Need to Know:

The “Small” and “Big” Picture

Living Shorelines are thought to have many positive attributes, such as erosion control, improved water quality, enhanced marine and riparian habitat, resilience to sea level rise, and the potential for increasing wetland area. However, most of these characteristics are based on created or restored wetlands which have a very different hydrology than fringing marshes along shorelines.

Many of these assumptions have not been verified through research. A major reason for this is that there are very few reference sites for natural marshes, and even less for Living Shorelines. The data which is available suggests that primary production and erosion control offered by Living Shorelines will probably equal that of natural marshes over time. But many gaps remain. The contribution of below-ground and tidal-fresh vegetation to primary production is not well understood, nor is the erosion control provided by non-*Spartina* species, polytypic communities in various settings, or in response to different storm types. The performance of Living Shorelines with respect to water quality and habitat provision is even less clear-cut.

Research addressing these issues focuses primarily on the smaller scale, but current questions revolve around larger concerns. For example, what does information about denitrification indicate about the Chesapeake Bay TMDL (Total Maximum Daily Load)? What does carbon sequestration data offer regarding climate change? What does storm risk reduction suggest about coastal resilience and wetland sustainability?

Monitoring can be used to inform the large, as well as the small scale. It can meet regulatory requirements, as well as answer questions about the ecosystem. On the small scale, vegetation characteristics, upland protection, sediment trapping, faunal use, nutrient uptake, and denitrification can be measured. On the larger scale, models can be used to predict the best shoreline erosion control device, and monitoring can validate that prediction. Monitoring can follow wetlands status, trends, and sustainability, analyze the sediment budget, assess risk, evaluate water quality services, and examine habitat characteristics.

Data gathering through monitoring can be promoted through two avenues. The first is to include Living Shorelines in the state Wetland Monitoring Programs. These programs incorporate long-term monitoring, ranging from remote GIS evaluation to on-the-ground fieldwork. The second is to require monitoring as a condition of permits issued to large projects on public lands such as those issued to the National Park Service (NPS), the U.S. Army Corps of Engineers (USACE), and the U.S. Fish and Wildlife Service (USFWS). This information can then be used to answer the smaller scale questions and inform the larger scale decisions as well.

Key Points

- Many of the benefits associated with Living Shorelines are not supported by research data. Reference sites are very limited, restricting the availability and interpretation of data.
- Research focuses on smaller scale issues, while current questions revolve around larger concerns such as carbon sequestration, coastal resilience, and wetland sustainability.
- Monitoring can contribute to the larger issues as well as the smaller scale questions. It can be used to meet regulatory requirements as well as answer questions about the ecosystem.
- Including Living Shorelines in state Wetland Monitoring Programs and requiring monitoring for permits issued to large projects on public lands can promote monitoring as the standard.

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Question and Answer: Using Performance Data to Drive Change

Complete Session: www.youtube.com/watch?v=K0m4Don5Qw4&feature=youtu.be

A period for questions and comments followed the [Using Performance Data to Drive Change](#) session. Topics debated primarily revolved around sediment transport and erosion as a natural and necessary process. Discussion ensued about the incorporation of sediment budgets into the Virginia Institute of Marine Science (VIMS) tool and model, the potential for over-implementation of shoreline protection, the concept of offering tax credits to landowners who allow natural erosion to occur on their land, and more.

Using Performance Data to Drive Change

Collaborative Session

See [Appendix C](#)

Objective: Review research to date assessing the physical performance of Living Shoreline techniques, discuss the technical feasibilities and limits of that research, and engage in group dialogue about how to move forward from here.

Following the session, [Using Performance Data to Drive Change](#), Summit attendees were asked to comment on one of three topics regarding the use of performance data to evaluate Living Shoreline restorations. To complete this exercise, participants collaborated with members from other constituent groups so that input from all four sectors was captured in the commentaries.

The following questions were addressed:

1. Brainstorm the information we should be collecting
2. Brainstorm ways we can make monitoring a standard practice in all Living Shoreline projects
3. Brainstorm ways we can communicate the information more broadly across sectors

As in past information gathering sessions, groups were asked to identify their highest priority recommendations. All responses recorded by each group are documented in [Appendix C](#). The highest priority concerns are reviewed below.

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Topic 1: Performance Data to Collect

See [Appendix C-1](#)

Performance data to collect rated as highest priority fell into four primary categories: 1) biological information (28%); 2) water quality data (18%); 3) pre-construction information (15%); and 4) goal-based parameters (15%).

Biological information, accounting for the largest percentage of responses, focused on vegetative indices, both marsh and subaquatic vegetation (SAV). Specific parameters mentioned included area, percent coverage, density, composition, and diversity, as well as changes in these indices over time. Using remote sensing to evaluate SAV temporally was recommended. The use of reference sites, evaluation of ecological health (accretion rates, vegetation composition, quantity of marsh), and extrapolation of ecosystem services were mentioned.

Water quality information to collect focused primarily on the evaluation of sediment. This included sediment transport, deposition, accretion, and composition, onsite, as well as a reflection of the edge-effect. Evaluating the sediment budget both pre- and post-construction was suggested. Other water quality parameters recommended included measurement of nutrients and evaluation of nutrient uptake and cycling, both before and after construction.

Pre-project information of interest pointed primarily to erosion analysis to verify the need for shoreline protection, and evaluation of the site to determine a site-specific design. This included collecting information on fetch/energy, wind, and shoreline type.

Lastly, evaluation of parameters reflecting the specific goals of the Living Shoreline project was suggested. These standards included shoreline protection, habitat restoration and creation, water quality improvement, nutrient removal, sediment stabilization, and long-term performance and sustainability in light of sea level rise and other effects of global climate change.

Other priorities mentioned included remotely-sensed shoreline, off-site effects, and the comparison of Living Shorelines to hardened shorelines. The necessity of addressing a watershed-wide shoreline management plan was noted. It was suggested that without this strategy it might be impossible to create successful approaches to Living Shoreline projects. The information collected during this exercise is documented in [Appendix C-1](#).

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Topic 2: Making Monitoring Standard Practice

See [Appendix C-2](#)

Opinions regarding the highest priority approaches to promoting monitoring as standard practice in Living Shorelines fell into two primary categories: allocating funding (33%), and developing a reliable method of monitoring (33%).

Possible sources of funding mentioned included public as well private sources, private NGOs (non-government organizations), state wetland monitoring programs, and federal wetland programs, such as the National Estuarine Research Reserve System (NERRS). Generating funds specifically for the purpose of monitoring was also proposed, by means of creating programs or incentives for stakeholders (recreation and tourism sectors), or the use of tidal fee funds.

Establishing an effective method of monitoring was the other most common approach mentioned. Monitoring by citizen scientists and self-monitoring by landowners, contractors, or other practitioners were most commonly cited. Other avenues proposed were partnering with universities to create opportunities for monitoring by students, and monitoring by state regulatory agencies to promote

consistency and establishment of Standard of Practice (SOP). Comments included standardizing monitoring data, using only basic parameters, and developing an incentive for landowners. The lack of expertise at the county level was mentioned, and Sea Grant was suggested as a possible partner in this endeavor.

Other priorities mentioned included requiring monitoring as a condition of permitting, and educational programs for landowners and contractors. The information collected during this exercise is documented in [Appendix C-2](#).

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Topic 3: Improving Communication across Sectors

See [Appendix C-3](#)

Establishing an online presence was overwhelmingly chosen as the highest priority means of improving communication across sectors (52%). Participants proposed the creation of an online database to inventory data and to present analysis and interpretation of that data, including location of the project, shoreline type, etc., in a simple, easy-to-use format. Living Shorelines publications, mapping tools, research findings, design manuals, models, and monitoring protocols could all be made available online. Interactive, topic-specific social media was also proposed.

Other ideas included heightening public awareness through demonstration sites and informational meetings, professional training opportunities addressing monitoring and shoreline-appropriate protection projects, and establishment of a central collaborative organization such as a cross-sector Leadership Council or Living Shorelines Working Group.

It was noted that the problem may not be the need to improve communication about Living Shorelines, rather, that the challenges to Living Shorelines need to be reduced. Without addressing this issue, as long as hardening shorelines is “cheaper, easier, and faster”, promoting Living Shorelines will always be an uphill battle. The information collected during this exercise is documented in [Appendix C-3](#).

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Session VI

Recognizing Barriers and Identifying Solutions: Programmatic Tools and Policies

Objective: Gain an understanding of the mechanisms that Mid-Atlantic States have used to advance Living Shorelines, recognize barriers to Living Shoreline implementation, and identify solutions to those barriers through real-world examples.

Moderator: Melanie Tymes, Delaware Department of Natural Resources and Environmental Control (DDNREC) - Context and Review of Key Barriers for Living Shorelines

Presentations:

- The Federal Perspective - Dave Evans, Environmental Protection Agency (EPA)
- Regulatory Programs
 - Jonathan Stewart, Maryland Department of the Environment (MDE)
 - Kevin Du Bois, City of Norfolk, Virginia
- Non-Regulatory Programs: Group Inputs

This session was intended to highlight Mid-Atlantic state, local, and federal regulations, laws, programs, and policies, as well as consistencies and conflicts between state and federal agencies. Objectives included identifying barriers to Living Shoreline implementation and solutions that address those barriers. Goals included the commitment from leaders within the policy, regulatory, and programmatic realms to ensure that solutions identified are implemented at the federal, state, and local levels with the aim of improving coordination across the federal spectrum and between state agencies.

Melanie Tymes from the Delaware Department of Natural Resources and Environmental Control (DDNREC) was the Moderator for this session. Panelists included Dave Evans, Environmental Protection Agency (EPA), Jonathan Stewart, Maryland Department of the Environment (MDE), and Kevin Du Bois, City of Norfolk, Virginia.

Following discussion of regulatory programs, attendees were asked to identify non-regulatory tools. This process is described in greater detail below.

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Melanie Tymes

Wetlands and Subaqueous Lands Section

Delaware Department of Natural Resources and Environmental Control

Presentation: youtu.be/VbJz7G-reIs

Context and Review of Key Barriers for Living Shorelines

As applicants, consultants, builders, and advocates, participants at the Living Shorelines Summit have worked through the regulatory process, often encountering barriers, regulatory hurdles, and other challenging issues. Although the process is slow, steps have been made to overcome barriers in the regulatory process. Tools are available in the policy realm, as well as in outreach and finance. This session will address areas where advances have been made, as well as areas in which more progress is needed. The panelists will cover only the regulatory side of these issues. The good news is that progress is being made, and that Living Shorelines are still being discussed amongst the sectors. Within the community, the concept of Living Shorelines is moving forward.

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Dave Evans

Director of the Wetlands Division

Environmental Protection Agency

Presentation: youtu.be/VikvNgbfYfs

Living Shorelines:

One Federal Perspective

The Status and Trends of Wetlands in the Coastal Watersheds of the Eastern United States: 1998 to 2004 report by the U.S. Fish and Wildlife Service (USFWS) and National Oceanic Atmospheric Association (NOAA) cited a loss of 59,000 acres of coastal wetlands per year ([Appendix E-2](#)). In more recent years, 2004-2009, the updated report demonstrated a loss of 80,000 acres of coastal wetlands per year (Status and Trends of Wetlands in the Coastal Watersheds of the Conterminous United States: 2004 to 2009, [Appendix E-2](#)). The greatest losses have occurred in freshwater wetlands, specifically the 8-digit watersheds which drain to the coasts - Atlantic, Pacific, and Gulf of Mexico. The Coastal Wetlands Initiative was established by the EPA (Environmental Protection Agency) in response to these findings, with the goal of intensifying the conservation of coastal wetlands. An Interagency Coastal Wetlands Workgroup was formed from a partnership between the EPA, NOAA, USFWS, and USGS (U.S. Geological Survey), more recently joined by USACE (U.S. Army Corps of Engineers), USDA NRCS (U.S. Department of Agriculture Natural Resources Conservation Service), and FHWA (Federal Highway Administration).

A series of Coastal Wetland Reviews were held to examine the causes of wetland loss, tools and strategies being used to understand and address wetland loss, and the gaps that still need to be

addressed. This was done through literature review and stakeholder engagement, including the collation of data from Wetlands Status and Trends analyses ([Appendix E-2](#)), NOAA's C-CAP (Coastal Change Analysis Program), land cover analysis, USACE and state permit data, and reports addressing wetland losses in coastal watersheds. Protecting Wetlands in Coastal Watersheds, a report summarizing these results, was recently released ([Appendix E-3](#)).

The report found that tools successful for Living Shorelines include the USACE Regional General Permit (404), the VIMS (Virginia Institute of Marine Science) model which determines the best approach to shoreline stabilization, shoreline mapping, and state cost-share programs. Gaps include the need to streamline and balance the permit process, establish incentives promoting improved environmental results, education and outreach, and the incorporation of climate change.

The next steps, specifically addressing Living Shorelines, include convening stakeholders, coordinating other federal efforts, addressing permitting through the USACE, developing a web portal for easily accessible data, and communication ensuring congruent approaches with SERPPAS (Southeast Regional Partnership for Planning and Sustainability), SAGE (Systems Approach to Geomorphic Engineering), EWN (Engineering with Nature – Environmental Laboratory – U.S. Army), and the Sandy Recovery Improvement Act of 2013. Following this networking mission, other purposes for the Interagency Coastal Wetlands Workgroup, such as a role in policy, may be considered.

Key Points

- Status and Trends of Wetlands: 2004-2009 reports coastal wetlands being lost at a rate of 80,000 acres per year, with the greatest losses occurring in freshwater wetlands.
- Coastal Wetlands Initiative, a partnership between EPA, NOAA, USFWS, USGS, USACE, USDA NRCS, and FHWA, examined wetlands loss, tools being used successfully, and gaps still needing examination.
- Protecting Wetlands in Coastal Watersheds summarizes the Coastal Wetlands Initiative and its findings, as well as strategies to address coastal wetland health and other resources.
- Tools being used successfully include the USACE Regional General Permit (404), VIMS model, shoreline mapping, and state cost-share programs.
- Gaps include the need to address permitting, education and outreach, incentives, institutionalizing models and guidance, economic studies, and incorporation of climate change.

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Jonathan Stewart

Eastern Region Chief, Tidal Wetlands Division

Maryland Department of the Environment

Presentation: youtu.be/W9C4Z8uOWaQ

Moving Maryland from Structural to Nonstructural

Shoreline Erosion Control Measures

Historically, the accepted practice of protecting the shoreline was a hardened approach. In 2006, less than 10% of the shoreline protection projects were authorized for Living Shorelines. Although the Maryland Department of the Environment (MDE) maintained a preferred list of erosion control strategies with Living Shorelines in a more favored position, this rated list was not regulated resulting in a low percentage of Living Shorelines authorizations. Other challenges faced in permitting Living Shorelines were the higher cost compared to hardened options, and the lack of education in the target community regarding the effectiveness and benefits of Living Shorelines.

This situation changed with the implementation of the Living Shoreline Protection Act of 2008 (02/04/14) which mandates that shoreline stabilization methods be nonstructural, preserving the natural environment. Exceptions to this requirement include areas previously designated by MDE as appropriate for structural stabilization, and areas in which the homeowner can demonstrate excessive erosion, severe tides, or physical inaccessibility to nonstructural techniques. In these cases, MDE has the option of granting a waiver.

MDE may authorize a shoreline erosion control project if there is evidence of erosion, there are no wetlands present, or those wetlands are not controlling shoreline erosion, and if the proposed project does not adversely affect navigation, adjacent properties, threatened/endangered species, oysters, or significant historic/archeological resources.

Current design parameters preferred by MDE include accepted standards for sill heights, window openings, vegetation composition, and slope preferences. Sill measurements are designed to allow water exchange during tidal cycles, promoting flushing of low marsh as well as facilitating the movement of estuarine fauna. Predominance of low marsh vegetation is recommended for similar reasons, to mimic the estuarine faunal habitat, whereas the preferred slope establishes a stable area for those plantings as well as wave dissipation.

There have been challenges experienced in the current process of approving applications and waiver requests. This includes failure to receive waiver requests, Buffer Notice Forms, and proposed Buffer Management Plans in a timely manner. The MDE waiver must be granted before submitting the Joint Federal/State Application (JPA), and the Critical Area Buffer requirements must be submitted with the JPA. Delays occur when these guidelines are not met. Outreach and education about this process are needed to facilitate this process.

Key Points

- The Living Shoreline Protection Act of 2008 mandated a list of erosion control measures, requiring softer shoreline stabilization unless an MDE waiver is obtained.
- MDE design parameters for structural and nonstructural components are based on traditionally successful designs that mimic the habitat and hydrology of a natural shoreline.
- The applicant must submit a Critical Area Buffer Notification Form and a proposed Critical Area Buffer Management Plan with the Joint Federal/State Application (JPA).
- Outreach and education are needed to address challenges in the application and waiver request processes. Permits can only progress when paperwork is submitted in a timely manner.

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Kevin Du Bois

Environmental Engineer, Wetlands Board

Bureau of Environmental Services, City of Norfolk

Presentation: youtu.be/7GX601I6hSM

Promoting Living Shorelines:

Recognizing Barriers and Identifying Solutions

Obstacles preventing Living Shorelines from becoming the preferred method of shoreline protection revolve around the “fear of the unknown”. Designers, contractors, regulatory officials, and landowners are unfamiliar with Living Shorelines’ appearance, longevity, and resilience to coastal storms and sea level rise, among other performance parameters. This is interfering with the on-the-ground implementation of this method of shoreline stabilization.

This unfamiliarity is perpetuated by the fact that there are few experienced Living Shorelines project designers and contractors in Virginia. Promoting familiarity can be achieved by building demonstration projects, engaging and training non-government organizations and university students, and mentoring inexperienced contractors in the field. Installing Living Shoreline projects in all waterfront communities, and publicizing the beauty of Living Shorelines through education and outreach aimed at landscape architects as well as private homeowners will boost these projects into the mainstream.

Aligning Living Shoreline projects with recent regulatory guidelines such as the TMDL (Total Maximum Daily Load) requirements and FEMA’s CRS (Federal Emergency Management Agency’s Community Rating System) credits will drive the popularity of Living Shorelines from a financial viewpoint. Claiming TMDL credit for Living Shoreline projects on private property represents an opportunity for municipalities to cost-share with private landowners, resulting in a mutually beneficial product. Adoption of a general permit is likely to incentivize Living Shorelines in Virginia as well, making this technique a more popular choice.

Lastly, addressing the regulatory treatment of Living Shorelines is paramount to advancing its standing. Demonstrating success of previously approved installations, especially those that have endured over time, weathering hurricanes, nor'easters, and other extreme weather events, will increase the local Wetlands Board's comfort with Living Shorelines. Adopting a county or state requirement for Living Shoreline stabilization and preferentially permitting them over hardened shoreline approaches is mandatory to reaching an ecological tipping point. Relying on willing landowners alone is not enough. Lastly, fostering a common sense of purpose and improved coordination within the local, state, and federal regulatory community will ease the transition of Living Shorelines to the top of the choices available for shoreline stabilization.

Key Points

- "Fear of the unknown" is the greatest barrier Living Shorelines face. Education and outreach can ameliorate this problem.
- Living Shorelines can be incentivized by integration into TMDL requirements, FEMA CRS credits, and a general permit, increasing their frequency of installation.
- A state requirement for Living Shoreline projects is necessary, as well as improved coordination and collaboration between local, state, and federal regulatory agencies.

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Question and Answer Summary

Recognizing Barriers and Identifying Solutions: Programmatic Tools and Policies

Complete Session: www.youtube.com/watch?v=rQ9FS3i69fA&feature=youtu.be

A period for questions and comments followed the Recognizing Barriers and Identifying Solutions: Programmatic Tools and Policies session. Topics debated included the difficulty permitting hybrid Living Shoreline projects, the variability of tracking and monitoring Living Shorelines projects by different states, concerns about the increasing use of rock, damage hybrid Living Shorelines can cause by trapping and killing wildlife, the lack of trust by contractors of the "less is more" philosophy, and more.

Regulatory Tools

See [Appendix D](#)

Objective: Gain an understanding of the mechanisms that Mid-Atlantic States have used to advance Living Shorelines, recognize barriers to Living Shoreline implementation, and identify solutions to those barriers through real-world examples.

A regulatory program resource sheet, [Living Shoreline State Regulation at a Glance](#), was distributed to the 2013 Mid-Atlantic Living Shorelines Summit participants. This document is available in [Appendix D](#).

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Nonregulatory Tools and Techniques

See [Appendix E](#)

Objective: Gain an understanding of the mechanisms that Mid-Atlantic States have used to advance Living Shorelines, recognize barriers to Living Shoreline implementation, and identify solutions to those barriers through real-world examples.

Following the session, [Recognizing Barriers and Identifying Solutions](#), attendees were asked to identify and record examples of non-regulatory tools intended to encourage and expand Living Shorelines implementation. This included opportunities for technical training and formal education, financial incentives, informal outreach, and peer-to-peer messaging.

Resources identified during this session, as well as throughout the Summit, are documented in [Appendix E](#). Resources listed include Programs, Publications, Web Resources, and Organizations dedicated to Living Shorelines.

Session VII

The Business of Living Shorelines

Objective: Gain an understanding from the contractor / design sector about changes made in order to successfully incorporate Living Shoreline projects into their business.

Moderator: J.C. Douglass, Clark Nexsen (Virginia)

Panelists:

- John Flood, Flood Brothers Marine Consultant (Maryland)
- Gene Slear, Environmental Concern (Maryland)
- Jim Cahoon, Bay Environmental (Virginia)

The intent of this session was to consult practitioners who have embraced the new business model of Living Shorelines by blending traditional marine contracting with landscape architecture. Topics addressed included the evolution of the business of shoreline protection, incorporating Living Shorelines, and the economic/market drivers for implementing Living Shorelines including incentive-based programs. Essentially, what leads to more on-the-ground implementation?

Following a brief presentation by each of the panelists, there was a two-way dialogue with the audience. The goal was to prompt a discourse on the future course of the business of Living Shorelines, to determine what information is needed from regulators and resource managers, and to address other topics of interest concerning the business of Living Shorelines.

The Moderator for this session was J.C. Douglass of Clark Nexsen, Virginia. Panelists included John Flood of Flood Brothers Marine Contractors, Maryland, Gene Slear of Environmental Concern, Maryland, and Jim Cahoon of Bay Environmental, Virginia.

J.C. Douglass

Environmental Scientist

Clark Nexsen Architecture and Engineering

Presentation: youtu.be/YLxV9Rzj6RY

Between them, the panelists for this session have over 30 years of experience in the Business of Living Shorelines. They have been designing, building, bidding, and selling Living Shorelines, despite the complexities of public perception, regulatory hurdles, site issues, materials, methods, and landowner preferences. These characteristics make for an uncertain atmosphere - not a desirable trait for a

business model. Commitment, despite these challenges, makes Living Shoreline contractors unique. They must be inherently patient, adaptable, and passionate about what they do.

In this session, the panelists will discuss the specialty of Living Shoreline stabilization, including their business objectives, the range and size of projects they have completed, and the evolution of their business since this new mode of shoreline stabilization has come into existence.

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John Flood

Principal

Flood Brothers Marine Consultant

Presentation: www.youtube.com/watch?v=kr_nRyBYGVI&feature=youtu.be

Moving Forward

Every action has a reaction. When a natural habitat is altered, a chain reaction begins, affecting more than just that landowner's property. A river is a living body – a dynamic resource formed by all of its components. The shorelines of rivers are being destroyed by the installation of bulkheads and fill. Once the natural elements are gone, not all can be restored. Is it more important to conserve the river, or to make a living from it?

In the mid-1990s, a large eroding cliff was located at the mouth of Selby Bay. It was semi-stable, forming a sand spit with offshore subaquatic grass (SAV) beds and a natural oyster bar. The county legislated that marinas be located at the mouth of the river because of erosion along the main stem due to boat wakes. As a result, a marina was installed at the mouth of Selby Bay. Following construction, erosion increased exponentially. Huge sections of the cliff collapsed during storms. The resulting sediment smothered the SAV beds, and killed the oysters.

During shoreline stabilization, a low profile stone sill with vents was installed in front of the cliff. During the hurricanes that followed, further collapse of the cliff occurred. However, the sill captured the sediment, forming tombolos which subsequently became colonized with *Spartina*. The sediment structure offshore changed as well. The sills created an energy shadow which captured the fine material, leaving the coarse sand grains offshore beyond the breakwater. By preventing the influx of sediment and the associated phosphorus load into the river, the restoration prevented algal growth. Previously distributed widgeon seed was exposed, resulting in five acres of subaquatic vegetation. This in turn acted to improve water quality as well as stabilize the sediment. Shortly thereafter, the oyster bar set spat. This case study demonstrates that intentional actions result in other, often unforeseen results. Through these chain reactions our shoreline manipulations can cause degradation, but they can also contribute to the enhancement of these dynamic systems.

Key Points

- Do no harm. If the erosion is natural and no structures are at risk, no action is the right course of action. Integrity is the best sales tool.
- Use open structures to create beach strand habitat. With sediment accretion, the substrate can be colonized, forming marsh. Avoid sand import. Decrease the cost, and the use of fossil fuels.
- Limit channelward encroachment of the project into essential shallow water habitat. Keep the structure low and close to shore.
- Provide maintenance for the Living Shoreline by developing a long-term relationship with the client. Evolution of a Living Shoreline is similar to raising child - it needs nurturing. The contractor cannot walk away from a Living Shoreline project, leaving it untended, and expect normal development to occur.
- Try new things - be bold and experiment. Don't be afraid to fail; that is how we learn.

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Gene Slear

Senior Vice President

Environmental Concern

Presentation: youtu.be/Cto7U2RItBI

The Living Shoreline:

A Best Management Practice

A Living Shoreline is a vegetated wetland that re-creates the natural ecosystem of the shoreline, while simultaneously stabilizing the existing bank. An important ecosystem service provided by natural shorelines is improvement in water quality. One-third of contaminants enter streams through stormwater runoff and are therefore available for remediation by the re-created marshes of Living Shorelines. The narrower intertidal zone of the midshore limits the amount of *Spartina alterniflora* available for erosion control and other ecosystem services. This exemplifies the fact that Living Shoreline projects represent adaptive engineering; that is, the practitioner must work within the situation presented.

A low profile stone containment structure is placed at an appropriate distance channelward from the bank. As little rock as is necessary to protect the vertical edge of the new tidal plain is used. This is then backfilled with clean sand through the intertidal zone, above the high marsh, and above the storm tide, as mandated by the Maryland Department of the Environment (MDE). The intertidal zone and high marsh are planted with *Spartina alterniflora* and *Spartina patens*, respectively, while the transitional area is planted with vegetation specifically adapted to that area.

The demands in Living Shoreline construction include the challenge of satisfying competing interests. These include the landowner, since 70% of the shoreline in the Maryland watershed is privately owned, as well as the state of Maryland, which made a commitment to clean up the Bay and passed this responsibility on to its municipalities.

Perhaps the most difficult challenge in the field is the consequence of legislation passed in 2008, the Living Shorelines Protection Act, and the companion legislation which gave the Critical Area Commission (CAC) the authority to issue regulations. The first CAC regulation was published in 2010, and modified in 2012. The result of this regulation was to classify Living Shorelines as developmental structures, similar to revetments and bulkheads. This means that the practitioner must mitigate any disturbance to the transitional habitat by planting trees and shrubs.

When requesting a permit, the regulations of the CAC, MDE, USACE (United States American Corp of Engineers), and NMFS (National Marine Fisheries Service) - NOAA (National Oceanic Atmospheric Administration) must all be met, for between them, they control the area up to 1000 feet landward from MHW (Mean High Water), as well as all the waters of, and the lands under, the Chesapeake Bay. The aim of these regulations is to protect the shallow water habitat, as well as the vegetation in the buffer zone. However, it is very difficult to meet these requirements, and only the installation of a bulkhead would avoid disruption to these areas. Yet a structural stabilization like a bulkhead is the most detrimental to these habitats overall.

Key Points

- Living Shorelines represent adaptive engineering. The practitioner must work within the situation presented.
- 30% of contaminants enter streams through stormwater runoff and are therefore available for remediation by the re-created marshes of Living Shorelines.
- The narrower intertidal zone of the midshore limits the amount of *Spartina alterniflora* available for erosion control and other ecosystem services.
- The CAC, MDE, USACE, and NMFS-NOAA control the area 1000 feet landward from MHW, as well as the waters of, and the lands under, the Bay. A permit must meet all of these regulations.
- The Critical Area Commission Act of 2010 classifies Living Shorelines as developmental structures requiring mitigation, similar to revetments and bulkheads.

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Jim Cahoon

Vice President

Bay Environmental

Presentation: youtu.be/HyRSE57T2YQ

The Business of Living Shorelines

Significant boat traffic and wide-open waterways with notable fetch drive the necessity to use rock or oyster shell components to protect shorelines. There is an ecological trade-off with this type of Living Shoreline construction. However, if the toe is not protected, there is no point in placing the sand. Despite the difficulties of these situations, multiple examples have yielded good results, including natural oyster spat and juvenile fish recruitment. Coir log has been used as toe protection in areas with exposure but little fetch to stabilize the substrate long enough to allow vegetation to become established.

A contaminant remediation project was installed at Money Point at an industrial section of the Elizabeth River in Chesapeake, Virginia, one of the most polluted rivers in the Chesapeake Bay estuary. An offshore component created a cap to contamination, while an onshore portion graded a bank to form a tidal wetland. Substantial rock was necessary in this construction because of its location on the Intracoastal Waterway, as well as its placement on a highly industrialized section of the river with a channel deep enough to accommodate supertankers. A significant fetch due to the width and orientation of the river also contributed to the need for hard stabilization. Fish monitoring is performed at this site, and in spite of the restrictions noted, recruitment of natural oysters and juvenile fish has been achieved.

Scuffletown Creek, also in Chesapeake, Virginia, is a backwater creek off the Elizabeth River with a tidal flow of 3-4 feet. No boats traverse this area, and there is little sediment transport because it is a dead end creek with industrial facilities on either side of the mouth. Groins were installed by the American Corps of Engineers (ACOE). This design failed; over-engineering caused erosive issues. A sill would have been a better option in this situation.

We are on the forefront of science, learning from our mistakes. “Lessons learned” include the detriments of over-engineering and the need to consider planting time when striving for successful establishment of vegetation.

Key Points

- Hard components such as rock or oyster shell are necessary in areas with boat traffic and significant fetch. This represents an ecological trade-off, but biological benefits can still be seen.
- Living Shorelines can be used in contaminant remediation projects for shoreline stabilization and reestablishment of biological communities.
- Coir log can be used as toe protection in exposed areas with little fetch to stabilize the substrate long enough to allow vegetative growth and stabilization.

- Planting time is critical for successful establishment of vegetation.

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Question and Answer Summary: Business of Living Shorelines

Due to technical difficulties, there is no video coverage available for this session

A period for questions and comments followed the Business of Living Shorelines session. Topics debated included recruiting a prospective client, liabilities and risks of Living Shorelines vs. conventional projects, advantages of project site availability to address clients' expectations, the use of oyster shell, *Phragmites* control, permit approval times, and more.

Session VIII

Coalescing the Community and Next Steps

See [Appendix F](#)

Objective: Identify strategies to continue information sharing and strengthen collaboration across the region following the Summit.

This session was designed to encourage 2013 Mid-Atlantic Living Shorelines Summit participants to reflect on the past days' efforts, particularly the collaboration within and between constituent groups. The intent was to strengthen and solidify the Living Shorelines Community by integrating the ideas generated into directives shaping the future objectives and identity of the collective.

To complete this exercise, attendees collaborated in small groups with those from other constituent groups so that perspectives from all four sectors were captured in the commentaries. The following topics were discussed:

1. Define the key elements of our vision for this community. Consider whether we should be more than a collection of people who meet every 5 years to share information.
2. Define specific ways we can continue to share techniques, innovative new practices, and "lessons learned" during implementation of Living Shoreline initiatives.
3. Define specific ways we can continue to support the community in the policy and regulatory arena.
4. Define specific ways we can / should stay connected and ensure follow-up to the work we have done at this Summit.

All responses are documented in [Appendix F](#) and reviewed below.

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Topic 1: Key Elements of the Vision of the Living Shorelines Community

See [Appendix F-1](#)

Collaboration regarding the role of the Living Shorelines Community pointed to a number of obligations. Missions cited by the majority of participants included the responsibility to work with the regulatory sector (48%), and the need for outreach and education to align the professional and public sectors (40%).

Promoting communication between the regulatory and research communities, thereby connecting science with policy, was felt to be the primary aim of working with the regulatory sector. Online resources and the formation of a central office or shared database were suggested to facilitate access to evidence supporting Living Shoreline technologies. Partnering with universities would ensure that available information remains current.

Other approaches to aligning regulators and policy-makers with Living Shoreline practitioners include improving the permitting process through information checklists, joint permit meetings, and oversight ensuring that applications are accurate prior to submission. The need for predictability as well as flexibility in the permitting process was noted. Leveling the permitting process for Living Shoreline projects versus structural armoring was emphasized.

The second role cited for the Living Shorelines Community was promoting education and training to gain support of both the public and professional sectors. Developing agreed upon discussion points would clarify the value and efficacy of Living Shoreline approaches in a consistent manner. Outreach aimed specifically at contractors, inspectors, and construction companies was proposed, including discussion of Living Shoreline successes and failures. A network of well-monitored, innovative demonstration sites within a variety of coastal environments is key. Expanding funds available for the establishment of these demonstration sites is needed.

Other niches specified included development of Standards of Practice (SOP) and establishing monitoring as the standard in Living Shorelines projects. The information collected during this exercise is documented in [Appendix F-1](#).

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Topic 2: Sharing Techniques, Innovative Practices and “Lessons Learned”

See [Appendix F-2](#)

An overwhelming majority of participants suggested that the Living Shorelines Community establish an online presence to share information (63%). A dedicated website with a searchable project database could be used to highlight Living Shoreline case studies including details such as measurements, monitoring results, and photos. Successes as well as failures could be posted. Research findings could

be translated into practice recommendations. Workshops, research, and downloadable planting guides could be made available. Blogs or message boards, topic-related listservs, webinars, a project portal, website hub, and search engine were all recommended. Finally, joining the Living Shorelines LinkedIn Group and developing a Living Shorelines YouTube channel were proposed ([Appendix E-3](#)).

Other recommendations for sharing techniques, innovative practices, and “lessons learned” included public outreach, the formation of a representative organization, professional development, and streamlining the regulatory process, amongst others. The information collected during this exercise is documented in [Appendix F-2](#).

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Topic 3: Supporting the Community in the Policy and Regulatory Arena

See [Appendix F-3](#)

Strategies identified to support the community in the policy and regulatory realm varied widely, although the majority focused on the need for ongoing communication and information exchange through a variety of media and other settings (64%). Networking and online communication were most often cited. Mechanisms included face-to-face networking, online information exchange, and regularly scheduled Living Shorelines conferences. Specific networking relationships suggested were between marine contractors, coastal engineers, and the design, regulatory, and scientific communities. Participation in the Living Shorelines LinkedIn group and Chesapeake Network ([Appendix E-3](#)) were encouraged. A website with web pages for each state as well as web pages for different topics, such as design, subaquatic vegetation (SAV), regulation, etc., was endorsed.

A global Living Shorelines organization was proposed, along with individual topic or working groups addressing areas such as technical expertise, subaquatic vegetation (SAV), funding, legislation, etc. A “Community of Practice” composed of a guiding body of professionals with expertise in Living Shorelines was recommended. This organization would act as a source of information, scientific advances, and facilitation of dialogue between stakeholders. It would also play a role in continuing the momentum begun at this Summit.

Other recommendations to support the Living Shorelines in the regulatory and policy arena included public outreach, funding, and streamlining the regulatory process. The information collected during this exercise is documented in [Appendix F-3](#).

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Topic 4: Staying Connected after the 2013 Mid-Atlantic Living Shorelines Summit

See [Appendix F-4](#)

Information sharing/networking comprised the overwhelming majority of suggestions resulting from this collaboration (83%). A website, national web portal, or listserv connecting the Living Shorelines Community was proposed as a means of exchanging information about funding opportunities, policy updates, current research findings, publications, and newsfeeds. The website could be an informal communication tool as well, hosting a question and answer forum, blog, or discussion board. Another interest focused on an accessible database, detailing Living Shoreline projects linked to maps, designs, costs, photographs, monitoring data, etc. A website such as the Southern Environmental Law Center Box, Inc. was also mentioned; this site currently houses a page specifically for Living Shorelines with links to pertinent information and research ([Appendix E-3](#)).

Other means of exchanging and distributing information included networking opportunities, professional development, and formation of a representative organization. Networking opportunities centered on the Living Shorelines LinkedIn group ([Appendix E-3](#)), working groups, follow up to continue discussions begun at the 2013 Summit, and site visits to Living Shoreline projects. The importance of connecting engineers with ecologists was specifically mentioned.

Professional development suggestions included periodic webinars or conference calls on topics such as current research or regional interests, distribution of the 2013 Mid-Atlantic Living Shorelines Summit Proceedings, and increased frequency of Living Shoreline Summits. Finally, the formation of a representative organization was advanced for the purpose of identifying pertinent research to move policy forward, as well as promoting information sharing between regions, coasts, and countries.

Other tools promoting connection after the 2013 Mid-Atlantic Living Shorelines Summit included public outreach, improved monitoring tools, and increased visibility of the progress made within the field of Living Shorelines. The information collected during this exercise is documented in [Appendix F-4](#).

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Mid-Atlantic Living Shorelines Summit

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Appendix A

Identifying Critical Research Gaps

Objective

Identify limiting data or knowledge needed to advance design, support, and understanding of Living Shorelines, and identify ways to resolve those questions.

During the session, Identifying Critical Research Gaps, participants were asked to collaborate with other members of the same constituent group to identify information or data they think is lacking, as well as the challenges they experience which limit their ability to effectively achieve their goals within the Living Shorelines field. This exercise was done on an individual as well as a group basis. Participants were then asked to rate the research gaps that they generated as a group, identifying the two that represented their highest priorities. The highest priority concerns are reviewed in the 2013 Mid-Atlantic Living Shorelines Summit Proceedings ([Identifying Critical Research Gaps](#)).

The following questions were addressed:

1. Based on your role within the Living Shorelines community, what questions do you think are important to tackle next?
2. Based on what you heard in the first session, did you learn any new information that would help to solve your identified priority issues as you permit, design, study, or implement Living Shoreline projects? If not, clarify the questions you have, and the information you need from the research community.

All responses recorded by each group are documented below. Comments receiving the highest priority classification are listed first, followed by other recommendations generated within the groups. The results from this collaborative session are organized as follows:

Appendix A-1	Research, Science, and Monitoring Community
Appendix A-2	Project Managers and Restoration Program Implementers
Appendix A-3	Designers and Builders
Appendix A-4	Regulatory and Policy Community

Following this exercise, issues of greatest concern from all collaborative groups were compiled as described in Appendix B and the 2013 Mid-Atlantic Living Shorelines Summit Proceedings. Lastly, attendees were invited to vote for two of their highest priority interests from that comprehensive list generated by the entire group. This process and the synthesis of the results are described in [Appendix B](#), and reviewed in the 2013 Mid-Atlantic Living Shorelines Summit Proceedings ([Research Priorities](#)).

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Appendix A-1

Research, Science, and Monitoring Community

Objective

Identify limiting data or knowledge needed to advance design, support, and understanding of Living Shorelines, and identify ways to resolve those questions.

Question 1: As a scientist, what questions do you think are important to tackle next?

Highest Priority

Design Criteria

- Design criteria are critical – where, how, what materials?
 - Inclusion of wood substrate like logs, stumps.
 - Guidance with respect to a “How-to” for contractors.
 - How do we plan the LS to evolve and adjust to sea level rise, salt marsh movement.
 - Access for fauna, infauna.
- Incorporation of additional materials into Living Shoreline designs – logs, trees, stumps, woody substrate.
- How do we plan shorelines to be dynamic and evolve? Functional 20 years off?

Monitoring and Assessment

- Monitoring - metrics, question trigger points identified (what will work or not?): % cover, survival, SD (species diversity), biomass, etc., site stability.
- How do sediments travel / accrete under different Living Shoreline designs?
- Pros & cons for the lay community supported by high quality data.

Miscellaneous

- Cost-benefit analysis of Living vs. “Non-Living” Shoreline regeneration projects.
- Need good “communication tools” for other professions, lay people – cost-benefit analysis, social sciences, public perception, etc.
- We need to get a better understanding of which kinds of Living Shorelines are most effective and where – there are different kinds of Living Shoreline designs and different types of shorelines. How can they be combined most effectively?

- What are trigger values for adaptive management? If metric X is $><$ value Y, then managers should intervene and do Z.

Other Recommendations

- We need Living Shoreline information about the ecosystem, different levels of cost-effectiveness, etc.
- We need to have an ecosystems approach to installing Living Shorelines. Look at the bigger picture – watershed assessments? Where would Living Shorelines have the highest impact for the least cost? Where do we want to maintain other types of shorelines to maintain shoreline diversity? Where can Living Shorelines be incorporated into planning for sea level rise?
- Sediment budgets - what is the available supply to project site?
- What are our roles in adaptive management of a site? “Lessons learned”.
- What about sites that have been hardened and cannot be removed. How do we enhance those types of systems?
- How to design for long-term / sea level rise / climate change.
- Cost-benefit analysis? Want to see economic sense using LS versus riprap (installation costs). Contractors need to figure out “business costs”. Design criteria: need a model – long-term outlook.
- Guidelines for contractors – MD decision tree.
- Communication pieces for “selling” / describing LS to the lay person.
- Standard operating procedures showing how to maintain and evaluate Living Shoreline regeneration projects, e.g. *Spartina* counts / area / etc.
- Extent of privately owned shoreline that can be “regenerated” through small private projects and its contribution as a whole.
- Do accreting Living Shoreline areas “rob” other, more critical locations of a sediment supply?
- What are site characteristics that make a location suitable (or unsuitable) for a Living Shoreline?
- What ecosystem components are lacking in Living Shoreline systems compared to reference sites? How can we reconfigure Living Shorelines to incorporate those components?

Question 2: **What information do you need from the research community to achieve your goals within the Living Shorelines field?**

Highest Priority

Monitoring and Assessment

- Need more information on “lessons learned” – what worked, what didn’t, and why?
- How to monitor? What scale to monitor? How can scientists / citizen scientists monitor and evaluate success and / or progress?
- We heard this morning that there is almost no data on monitoring ecosystem impacts of Living Shorelines. So, we need the research community to conduct long-term monitoring of multiple Living

Shoreline designs and locations to assess their ecological impacts (on habitat, water quality and erosion / accretion).

- Yes! More strategic implementation of Living Shoreline projects: subtidal to critical area – grass, mussel counts → More M&E (monitoring & evaluation).

Other Recommendations

- Sentinel site monitoring to cut cost, cost prohibition.
- Cumulative impacts, evaluate for permitting community, what is working based on economics? Are we getting ecosystem services for the funding?
- Regulatory: Develop some type of tool to evaluate projects within a given area. i.e. SOP (Standards of Practice) for permitting and evaluation.
- Long-term function of marsh (fish, infauna, ecosystem services) – access for fauna - design for access.
- Wood chips? Add to organic substrate.
- Ribbed mussels (inoculate system with plants, animals).
- More “lessons learned”, failures, successes 3-5 years out (what were failures and why?).
- What scale needs to be monitored? (temporally)
- How to monitor? (SOP – Standards of Practice)
- What social science do we need to help the lay person understand and buy-in?
- Comparison to other habitats.
- Lack of WQ (water quality) information – we need more.
- Lack of estuarine-wide sediment budget.
- Return on investment.

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Appendix A-2

Project Managers and Restoration Program Implementers

Objective

Identify limiting data or knowledge needed to advance design, support, and understanding of Living Shorelines, and identify ways to resolve those questions.

Question 1: As a project manager or restoration program implementer, what information gaps or challenges limit your ability to achieve your goals within the Living Shorelines field?

Highest Priority

Cost-Benefit Analysis

- Costs / benefits / scientific support for different restoration approaches – consider life-cycle costs (what are these storms teaching U.S. about good decision-making models, alternatives) – monetization.
- Need to understand how Living Shorelines vs. others act in storms. What did the storms actually damage? How did storm angle / points affect the area and value of the area? (monetization)
- Cost-benefit analysis (risk reduction, water quality benefits, maintenance, lifespan, life-cycle costs, etc.).
- Cost-benefit.

Miscellaneous

- Institutional barriers / focused political will / lack of authority / integration of permitting / funding.
- Need to drive policy to permitting – permitting projects we know are damaging, not permitting projects that have unknown impacts.
- Water quality – need more information available.
- Need design data for different environments – freshwater, toxic soils, etc.
- What are the best practices for identifying and evaluating appropriate designers.
- Table had little experience in Living Shorelines – need a way to move forward with projects and programs.
- Tidal-freshwater plants – need to study for Living Shoreline projects.
- Funding – how can we best fund these projects and use publicly- / foundation-funded projects to advance the science.
- Mitigation of hardened shoreline impacts on adjacent or near-project sites.

- How you frame the message, common language.
 - Training of contractors – same vocabulary.
 - Communicating risk.
 - Interface of LA, science, homeowner.
 - How to build marshes that will adapt to sea level rise.
 - How to convince landowners and regulators that marshes will survive without a sill in low energy.

Other Recommendations

- Site identification and analysis to determine appropriateness for Living Shoreline projects.
- Long-term management and analysis of projects.
- Flashiness of urban creeks.
- Prioritizing “most important” project to pursue (create BMPs). Justifying one restoration approach over the other. Cost-benefit either financially or ecologically.
- Clear guidance on the optimal endpoint for restoration.
- What are the known “best practices” for restoration? People attached or invested in pre-existing circumstances blocking.
- Managing expectations about recovery.
- Different agency preferences / biases.
- Physical characteristics.
- Customer’s expectations and monitoring.
- Determine best site, best project for the problem (which design type to use?).
- Long-term monitoring, effects.
- Long-term monitoring data – synthesis of science on Living Shorelines versus bulkheads, etc.
- Messaging to inform – need targeted messaging (quantifying the human element).
- What’s the relative risk reduction?
- Costs versus traditional armoring (damage, maintenance, lifespan).
- Permits.
- Design (discussion with engineers about performance measurements).
- Permitting and design.
- TSS, N&P efficiencies – water quality benefits.
- Interface of land acquisition, science, homeowner.
- How to build marshes that will adapt to sea level rise.
- How to convince landowners and regulators that marshes will survive without sill in low energy.
- Monitoring data.

- Long-term monitoring data – 30years down the line. Will it all be *Phragmites*? Where will rock end up? Low to compete (cost-wise) with guerilla shoreline practices.
- Language-framing.

Question 2: What information do you need from the research community to achieve your goals within the Living Shorelines field?

Highest Priority

Monitoring and Assessment

- Data sets that are most important for effective monitoring of project? Most cost-effective? A uniform, predictable monitoring protocol.
- Compare apples to apples – natural shorelines are not the reference in this context for Living Shorelines – bulkheads / riprap are, as well as learning from storm experiences.
- Data gap.
- Monitoring.
- What monitoring is sufficient (when writing grants) – maybe 5 years?

Miscellaneous

- Cost-benefits – how the coastal residents are embracing the Living Shoreline technology (social parameters).
- Lack of an articulate understanding of how these ecological systems operate across different circumstances and lack of translation to permitting.
- Best practices for site identification / appropriate designs. Quick and dirty assessment? GIS model?
- How does science knowledge / best practice translate into and drive the policy and permitting process.

Other Recommendations

- Best Practices for site identification and evaluation.
- Why is it easier to permit bulkhead than Living Shorelines?
- Site access? Important for developing budget.
- Formal decision-making framework / model that would allow choices to be understood - decision / risk analysis tools.
- Documentation of effects of these storms.
- More data – what metrics are best to monitor?
- Geomorphologic science? Breakwater, broader sediment movement, how to work in high energy systems.
- What is the longevity (i.e. with or without a sill)? Still need better, more-informed cost-benefit analysis.

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Appendix A-3

Designers and Builders

Objective

Identify limiting data or knowledge needed to advance design, support, and understanding of Living Shorelines, and identify ways to resolve those questions.

Question 1: As a designer or builder, what information gaps or challenges limit your ability to achieve your goals within the Living Shorelines field?

Highest Priority

Regulatory and Policy

- Permitting challenges – trade-offs, more guidelines.
- Regulatory side – it's easier and cheaper to do a hardened shoreline (varies by state).
- Permitting concerns impact and drive the design - “compromise the design” – impact what and where we can build.
- Regulatory agencies obligated to consider comments of sister agency which delay and can impact design. This creates a bad situation with “too many untrained cooks in the kitchen”, each with their own preference and bias.
- Regulations – consistency within project (when agencies are not on the same page it affects implementation & success) & amongst projects (similar projects are not treated the same way).
- Local regulatory requirements!!

Funding / Cost

- How much money do they have?
- Where will funds come from for design?
- Maintenance? Necessary, but not well-funded.
- Substrate analysis / bathymetry elevation - drive cost and other design features.

Miscellaneous

- Site access – lack of information, challenge to bid, impact on cost.
- Site access first.
- The color of rock.
- Sources of reliable data: water quality, survey data, climate, bathymetry, storm surge, fetch.
 - Data needed to design for resiliency.

- Reliable and inexpensive tools to collect field data that can be used to calibrate a site model.
- Urban systems – little research gets allocated, contamination issues.

Other Recommendations

- Ownership, neighborhood issues –myths about restoration, reduce fragmentation – outreach.
- Public perception.
- Funding.
- Width of sill, height of sill, number of windows, width of sand fill.
- Critical Areas Commissions – self-defeating.
- Legislation.
- Arbitrary guidebook / cookie-cutter method by folks who are not experts.
- Design constraints are often based on permitting issues, i.e. 30 feet from shore; design issues stem from where to place the toe of the project and how.
- Problem in finding specific design drawings.
- Problem - permitting requirements.
- Recognizing upland land disturbance.
- Coir logs, stone, fetch, direction.
- Localized sand transport models to better understand accretion / erosion.
- Sills at lowest elevation and least amount of rock.
- Local guidelines, municipalities may have no knowledge.
- More / better design guidelines.
- Local jurisdictions take lead on regulations.
- Geotextile.
- Appropriate width, orientation, fetch limitations, design in buffer.
- SAV consideration.
- Dynamic models that can allow scenario assessment; “what if”.
- Ways to reduce risk of failure, cost effectively.
- Surge type (extreme), tides, winds.
- There is not a boiler-plate / cookie-cutter design – all designs must be site-specific.
- The permit process, on the other hand, should be cookie-cutter. Fast and responsive to the site-specific design.
- Need to move research money to implementation. Utilize the innovation of the practitioners to do good site-specific design and implementation, and then frame research around the implementation sites.
- GIS layers are good, but need ground truthing; there is not a lot of accurate living resource information.

- Challenges: from the project's start - how fast and accurate can we get this information?
- Limited available data on sites (ex. survey data, tidal, fetch, reference point, water quality).
- Range of alternatives – need more information on each.
- Average price per feet or acre for different approaches.
- Challenge to balance the key components of a successful Living Shoreline design and regulatory limitations / restrictions, ex: ration of HM:LM (high marsh: low marsh).
- What are the effects of using geotextile fabric in Living Shorelines (on biota, soils, etc.)? - long term versus short term.
- Technical specifications for these structures, BMP manual-type, standard, “ideal” designs to use as a guide across states (regional).
- Guidelines should require the use of a reference site for elevations, vegetation goals, etc. Examples of what happens when a reference marsh is not used.
- Involvement of geotechnical engineers should be required to provide assessment of the substrate and prediction for future subsidence. Often this is a cost-cutter that can severely impact the project (i.e., sunken marsh).
- Permitting agencies must work together to help streamline the process and incentivize Living Shorelines.
- Local regulatory requirements.
- Consistency among inspectors.
- Owner expectation (appearance and cost).
- Permitting – different regulatory “turf” impacts success.
- Permitting special conditions – long-term maintenance.
- Landowners – long-term maintenance discourages Living Shorelines.
- Guidelines for design – factors to consider and how they may affect the design.
- “Map” of regulatory issues that can impact the design (subset of the above).
- Degree of workmanship.
- Storm analysis to set top height of shoreline!
- Owner’s expectations: What does it look like? How much does it cost?
- Design grade survey evaluating designs for different elevations / slopes.

Question 2: What information do you need from the research community to achieve your goals within the Living Shorelines field?

Highest Priority

Regulatory and Policy

- Streamline acceptable flexible guidelines that might allow for permit approval.

- How do we get regulators to understand our projects and maybe be able to give U.S. advice on design rather than just comment after the fact?
- Permit types are limited; may be restrictive to innovation.
- How can we structure regulations to support site-specific design and innovation, instead of encouraging design for approval?
- Permitting agency needs to acknowledge existing science that supports project design through transitional area or through the landscape - “Best Professional Judgment”.

Miscellaneous

- Is the project considered unsuccessful if the elevation of the marsh does not continue to rise?
- Goals: clear design criteria, clear metrics for monitoring and effectiveness assessment.
- Monitoring – meeting goals?
- Technology in Design.
 - Can technology be used more effectively to develop models that integrate data – wind, surge, fetch, bathymetry, water quality - which can inform the design process to reduce risk?
- Research – feedback to designers / builders.
- Better understanding of vegetation communities (i.e. buffer maintenance, over longer time scale).
- More urban research.
- Need investments in pilot / demonstration projects that include a range of soil types, tidal range, etc., as well as research in these settings.
- Funding opportunities that support monitoring with project design and implementation.

Other Recommendations

- Sills are great, but not enough.
- NSF (National Science Foundation) – funding – great.
- Collaborator / partnership info is needed.
- New Orleans, Cape Charles – Hesco benefit / invest in experimental projects.
- Sea level rise – guidelines / directions needed.
- Living Shorelines and fish habitat.
- Positive and negative impact of structures on aquatic organisms.
- Prioritize benefits.
- Permits returned for technicalities, reviewers should have a more open mind.
- How to incorporate other living components (i.e., ribbed mussels, oysters, SAV).
- Long-term ecological impact of geotextile and erosion control.
- Research that supports our designs.
- More research is needed on Living Shoreline projects vs. natural shorelines.
- Clear criteria for the design using “Best Professional Judgment” based on the science.
- Need more information on the pros and cons of available alternatives.
- Need more information on new approaches.

- Studies on success of designs incorporating tombolos with particle sizes smaller than conventional revetments.
- Studies on the erosion rate of projects that have sills / tombolos lower than MHW (Mean High Water) vs. those that are higher.
- Closer coordination between research community and design / build teams (or funders) to study sites pre- and post-project.
- Since the designer's goals are, or should be, the same as those of the regulator, the permitting process should be far more collaborative than it tends to be.
- Do marsh toe sills represent an impediment to marsh migration and adaptation?
- How do these systems perform in urban watersheds? Sedimentation, etc.?
- Any set installations in urban watersheds?
- At what depth is benthic infauna evaluated? i.e., how do we determine success ecologically?
- How can the TMDLs act as a driver for Living Shoreline projects in localities? By acting as a financial stimulus and expanding potential projects.
- Research at built sites across regions is important; large scale vs. small scale, as well as various designs - quantify the long-term successes and failures of Living Shorelines.
- Big picture view.
- Research and builders – better tie-in / communications (similar to what exists in agriculture, i.e. Extension Service).
- Determine if project met goals – stabilized shoreline, water quality improvement, ecological data.
- Standardizing a permit - what is the process for designing and implementing Living Shorelines?
- How does the private sector apply and search for grant opportunities?
- Monitoring and maintenance are critical. How does that become part of the process? Project success!

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Appendix A-4

Regulatory and Policy Community

Objective

Identify limiting data or knowledge needed to advance design, support, and understanding of Living Shorelines, and identify ways to resolve those questions.

Question 1: As a regulator or policy maker, what information gaps or challenges limit your ability to achieve your goals within the Living Shorelines field?

Highest Priority

Regulatory and Policy

- Policy / planning: How do we strategically prioritize shorelines for Living Shoreline restoration vs. piecemeal? We are missing reach-wide or watershed-planning efforts.
- Conflicting regulations / policies. Permittee gets different messages from each agency (ex. federal vs. city support of LS).
- Lack of information on both sides of permitting process.
 - Regulators can't get the proper site information from landowners.
 - Agencies need to have staff able to evaluate a Living Shoreline projects, but lack of standards makes that difficult.

Ecosystem Trade-offs

- Science: Habitat trade-offs? How do you transition from the upland to the water and account for habitat gains or losses, both landward and marine-side?
- Integrating goals of effective Living Shoreline projects with enhancement / preservation of buffers and increased public access.

Miscellaneous

- Demonstrating initial cost versus long-term cost (contractors)?
- How do you measure success? Is scale a factor in success? Are the smallest projects beneficial? Are they too vulnerable?
- Need synthesized source of data and ongoing research on Living Shoreline projects that can be used to help policy makers, planners, and regulators make sound and defensible decisions.

Other Recommendations

- Need organized research to quantify how Living Shorelines did or did not function properly following a major storm event. FEMA (Federal Emergency Management Agency) could examine not just structures, but also the shoreline.
- Definition of issues – drives the regulatory treatment.
- Habitat trade-off justification.
- Private property / public trust.
- Long-term efficacy.
- Design and performance data by specific location characteristics.
- Streamlining regulatory process appropriately – by location and regulatory issues such as PNA (primary nursery areas), navigation.
- What is the longevity of the design?
- Is habitat being created? Is it beneficial?
- What is the best approach for erosion?
- Trade-offs – what do you lose and gain?
- Evaluation of erosion – how bad is the problem?
- Values (aesthetic and environmental), preferences.
- Is the contractor qualified? Reliable science, clear criteria for design and monitoring.
- Conflicting regulations and policies.

Question 2: What information do you need from the research community to achieve your goals within the Living Shorelines field?

Highest Priority

Communication / Accessible Database

- Contractor training - that being said, knowledge begins with research; this needs to be disseminated to regulators so it can inform policy and outreach.
- Updated scientific information needs to be disseminated to contractors and regulators.
- Need to synthesize all research findings in an accessible manner that can be used to drive decisions, including research that compares bulkheads / revetments with Living Shoreline projects. We always focus on Living Shoreline research when very compelling research exists on the comparison of approaches and / or the effects of riprap / bulkheads on the environment.

Miscellaneous

- How can you predict site-specific impact? ex. see potential for marsh accretion and depletion.
- Bang for buck – how much do you need to create to get protection and environmental benefit?

- How can we get longer-term monitoring to see if benthic communities do eventually mimic natural communities?
- Need research and regulation / policy to help determine when not to protect / restore a shoreline to a Living Shoreline design. Are we losing habitat function unnecessarily on shorelines that are not eroding?
- Need better information available on innovative approaches including engineering knowledge, monitoring protocols, etc., that will help all sectors move forward together.

Other Recommendations

- Information seems to exist for prioritization of habitats, but we seem to be missing the funding and the will to build those partnerships.
- Inventory what is out there, and what has worked in different environments.
- Water quality data, carbon credits possible incentives for funding as well as permitting.
- How did Maryland arrive at their tiered approach? e.g. suitable for soft stabilization, suitable for hybrid options, and not suitable for Living Shoreline.
- If a 5-10 feet window helps, what is the minimum? Design standards.
- Need engineering data that demonstrates efficiency, not just environmental influences.
- Are we ultimately helping or hurting?
- Fetch not being the biggest driver.
- Benthic resources.
- Value of the fringe.
- We learned what we don't know – especially water quality as it relates to TMDLs (Total Maximum Daily Loads) – WIPs (Watershed Implementation Plans) and WQC (Water Quality Control).
- Staying up-to-date with the science (need an information clearinghouse).
- Shift the burden of proof (prove it won't work, instead of prove it will).
- Cookie-cutter or not?

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Appendix B

Research Priority Selection

Objective

Identify limiting data or knowledge needed to advance design, support, and understanding of Living Shorelines, and identify ways to resolve those questions.

During the session, [Identifying Critical Research Gaps](#), participants were asked to collaborate with other members of the same constituent group to identify information or data they think is lacking, as well as the challenges that they experience which limit their ability to effectively achieve their goals within the Living Shorelines field.

The collaboration described was done on an individual, as well as a group basis. Groups were asked to rate the research gaps that they generated, identifying the two that represented their highest priorities. These results are documented in [Appendix A](#) and reviewed in the 2013 Mid-Atlantic Living Shorelines Summit Proceedings ([Identifying Critical Research Gaps](#)).

The top priority subjects were then collated across all groups, eliminating duplicate responses, resulting in 29 topics within six broader themes. As a final exercise, all attendees were invited to vote for their two highest priority concerns from the comprehensive list generated from the entire group. Votes were color-coded so that interest in each topic could be traced to the originating constituent group.

The number of votes indicating interest in each of the 29 topics, as well as in the six broader themes, is summarized in the table below. These numbers are expressed as a portion of the total number of votes, as well as the number of votes cast by each constituent group. Information of note is reviewed in the 2013 Mid-Atlantic Living Shorelines Summit Proceedings ([Research Priorities](#)).

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Research Priorities

Key

RSM - Research, Science, and Monitoring

PM&RPI - Project Managers and Restoration Program Implementers

DB - Designers and Builders

RP - Regulatory and Policy

Research Priority	RSM	PM&RPI	DB	RP	Total
Function					
Habitat trade-offs (riparian buffer, subtidal)	0	2	4	18 21%	24 9%
Function in storm events (project and shoreline)	0	0	2	0	2
Efficacy (long-term and short-term) in various sites and conditions (ecological resources, physical performance, water quality)	11 19%	9	5	17 20%	42 15%
Length of time for ecological recovery, mimicing natural conditions	0	0	0	0	0
Carbon credits possible through LS	1	1	0	0	2
Scale – Are small projects less variable? How large does it have to be to be valuable?	1	0	0	0	1
How to build marshes that will adapt to sea level rise	4	7	5	2	18
How to include tidal freshwater plants in LS projects	0	0	0	1	1
What types of LS are most effective and where?	7	15 21%	11 18%	2	35 13%
How to include wood substrate like logs and stumps	1	2	0	1	4
“Lessons learned” – what worked, what didn’t, and why?	2	2	3	4	11
Do marsh sills impede marsh migration and adaption?	1	0	0	0	1
LS project performance in urban watersheds	0	0	0	0	0
LS impact on adjacent sites	0	0	0	0	0

Research Priority	RSM	PM&RPI	DB	RP	Total
Total votes: Living Shoreline Function	28	38	30	45	141
% sector votes compared to total votes	48%	54%	49%	52%	51%
Measurement					
How do we measure success - physical, ecological, dynamics	3	3	6	6	18
Develop a monitoring protocol – how much is enough?	8	3	1	2	14
Survey multiple LS sites across regions	0	0	2	0	2
Total votes: Measurement	11	6	9	8	34
Communication					
Social science: what do landowners value (perceptions/aesthetics)	1	3	0	2	6
How to best disseminate science to regulators	1	3	3	2	9
How to best assess regulator perceptions	0	2	1	4	7
Social marketing tools for various stakeholders	3	3	2	2	10
Total votes: Communication	5	11	6	10	32
Cost-benefit / Finances					
Initial and long-term maintenance costs vs. armored approaches	2	1	2	0	5
Cost-benefit analysis and life cycle costs (risk reduction, water quality benefits, maintenance, life span)	3	6	7	7	23 8%
Affect of storm angle/points on area and value = monetization	0	0	1	0	1
Total votes: Cost-benefit / Finances	5	7	10	7	29
Site Suitability					
Prioritizing shoreline project sites basin-wide	4	5	2	6	17
Smaller scale site-suitability tool	0	1	0	0	1
Alternatives and risk analysis tool	1	0	1	2	4
Total votes: Site Suitability	5	6	3	8	22

Research Priority	RSM	PM&RPI	DB	RP	Total
Philosophy					
How do we evaluate whether erosion is a problem?	0	1	2	4	7
Information about shorelines not needing protection from erosion	4	1	1	5	11
Total votes: Philosophy	4	2	3	9	18
Totals					
Total number of votes	58	70	61	87	276
Percentage of votes overall	21%	25%	22%	32%	

Key

RSM - Research, Science, and Monitoring

PM&RPI - Project Managers and Restoration Program Implementers

DB - Designers and Builders

RP - Regulatory and Policy

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Appendix C

Using Performance Data to Drive Change

Objective

Review research to date assessing the physical performance of Living Shoreline techniques, discuss the technical feasibilities and limits of that research, and engage in group dialogue about how to move forward from here.

Following the session, Using Performance Data to Drive Change, Summit attendees were asked to comment on one of three questions about monitoring Living Shorelines projects. To complete this exercise, participants collaborated with members from other constituent groups so that input from all four sectors was captured in the commentaries. As in past information gathering sessions, groups were asked to identify their highest priority recommendations*. The highest priority concerns are reviewed in the 2013 Mid-Atlantic Living Shorelines Summit Proceedings ([Performance Data Collaboration](#)).

The following questions were addressed:

1. Brainstorm the information we should be collecting.
2. Brainstorm ways we can make monitoring a standard practice in all Living Shoreline projects.
3. Brainstorm ways we can communicate the information more broadly across sectors.

All responses recorded by each group are documented below in Appendix C. Comments receiving the highest priority classification are listed first, followed by other recommendations generated within the groups. The results from this collaborative session are organized as follows:

Appendix C-1	Performance Data to Collect
Appendix C-2	Making Monitoring Standard Practice
Appendix C-3	Improving Communication across Sectors

* Groups deliberating on the first topic, Performance Data to Collect, were asked to identify their three highest priority recommendations.

* Groups deliberating on the second and third topics, Making Monitoring Standard Practice and Improving Communication across Sectors, were asked to identify their two highest priority recommendations.

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Appendix C-1

Performance Data to Collect

Objective

Review research to date assessing the physical performance of Living Shoreline techniques, discuss the technical feasibilities and limits of that research, and engage in group dialogue about how to move forward from here.

Topic 1: Brainstorm the information we should be collecting.

Highest Priority

Biological

- Species diversity – vegetation and animals.
- Vegetation composition and density change over a longer time scales.
- Vegetation of Living Shoreline and adjacent or nearby reference.
- Ecological health of the marsh (vegetation, accretion).
- Consistent remotely sensed and delineated SAV.
- Marsh vegetation density and species diversity.
- Amount of marsh creation.
- Small private projects - area, % coverage, density.
 - Extrapolate ecosystem services based on research projects.
- Post-construction monitoring for additional parameters to measure marsh health (maybe more than plant coverage).
- Marsh habitat / subtidal habitat.
- Biological (SAV).

Water quality

- Water quality – before and after nutrients.
- Nutrient uptake and cycling.

Sediment

- Sediment transport and composition - onsite and edge-effect (elsewhere).

- Sediment deposition and accretion.
- Sediment transport / accretion.
- Sediment budget within a defined reach.
- Subestuary sediment budget – before & after.

Pre-project analysis

- Need to know if protection is even needed.
- Good initial erosion analysis – clear information that shows whether protection is even warranted.
- “Waterless” level shoreline segments (above high tide) – assessment by interdisciplinary team to identify approaches.
- Rate of erosion pre-construction.
- Pre-design data to drive Living Shorelines decision (if to install, what kind is best) - erosion rating, winds, fetch (energy), shoreline type.
- Physical (erosion, fetch).

Goal-based parameters

- Based on purpose – is it meeting its purpose?
- Survey of maintenance agreement benchmark.
- What is the goal of the project? Depends on whom you ask!
 - Habitat creation/restoration.
 - Shoreline protection.
 - Water quality improvement - nutrient removal, sediment stabilization.
- Long-term performance and sustainability in light of SLR (sea level rise) / GCC (global climate change).
- Site-specific data for Living Shoreline creation, as well as long-term parameters for monitoring success.
- Living Shorelines’ purpose – a better way to protect shorelines; water quality, habitat, biology is just a bonus.
 - Only monitor for specified function.

Miscellaneous

- Consistent remotely sensed and delineated shoreline.
- Geomorphic impacts off-site as well as on-site. Marsh accretion rate.
- Upstream and downstream impacts of sills.
- Need to find long-term monitoring of comparative effects (biological, chemical, physical) of bulkheads / revetments and Living Shoreline projects. Existing research often looks at Living Shoreline projects compared to existing bulkheads / revetments rather than projects constructed at the same time. Difficult to move away from large-scale hardening approaches without this data.
- Need to include researchers / designers / planners and landowners in a watershed-wide shoreline management plan – cannot apply 2-D matrix to watersheds and create successful approaches.

- Private owners / contractors will not want to be responsible for or pay for monitoring.
- Quantitative data from hardened shorelines (bulkheads, etc.) when they are installed, not from ones that have been in place for many years.
- Monitoring has to come from regulatory body, within existing framework for monitoring.
- Basic monitoring that is easy for landowner or partner to do; expanded monitoring at select sites (audit) and/or at demonstration sites.

Other Recommendations

- Effectiveness of underground biomass – root depth is important.
- Monitoring for SAV.
- Critters.
- SAV offshore.
- What is the natural species composition succession - so that it can be built into the permit.
- Storm event survival.
- Adaptive management – sill height, vent openings, windows, width of marsh in relation to the sill.
- Effect of different sized sill openings.
- Long-term tracking of shoreline profile. Is erosion occurring?
- Determine if the area pre-project is keeping up with sea level rise.
 - Why do projects that will be drowned in 20 years?
 - Why put in a sill? etc.
- Water quality monitoring similar to TMDL parameters.
- Temperature / DO (dissolved oxygen) / turbidity.
- Social views – aesthetics.
- Landowner input concerning their shoreline – social science.
- Monitor large public sites rather than small private projects.
- Efficacy of Living Shorelines – need to promote to public that hardened shorelines (bulkheads) fail.
 - Use community groups / NGOs to promote and aid in monitoring.
- Educate landowners – sell idea of marsh creation / Living Shoreline while simultaneously protecting their land for their peace of mind (landowners want to see results).
- Money through tax incentives and infrastructure like CBT (Chesapeake Bay Trust).
- Monitoring could be funded by wetland license fees.
- Long-term performance/sustainability in light of sea level rise and global climate change.
- Water quality.

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Appendix C-2

Making Monitoring Standard Practice

Objective

Review research to date assessing the physical performance of Living Shoreline techniques, discuss the technical feasibilities and limits of that research, and engage in group dialogue about how to move forward from here.

Question 2: Brainstorm ways we can make monitoring a standard practice in all Living Shoreline projects.

Highest Priority

Funding

- Provide sufficient funding.
- Funding.
 - Dedicated funding from public and private sources, private NGOs and donors / foundations.
- Include Living Shorelines in wetland monitoring programs run by the state – state waters, TMDL issues.
- Tap into federal funds like wetland program plans: National Estuarine Research Reserves (NERRS), other established federal programs for monitoring by practitioners – academics.
- How can we create incentives / programs for other user-sectors of the Bay to generate funds (e.g. recreation / tourism sector)?
- Use tidal fee shoreline money for long-term monitoring: 10% of project for 10 years.
- Monitoring is financially-limited. Must be tied to permit or grant, but it will increase costs. Who will pay?
- Find funding for scientific studies for chosen sites and practices.

Method

- Partner with universities, engage students.
- Citizen Science - initiative for landowners to share information on their property. (Sea Grant tie-in?)
- Standardized monitoring data to be collected by landowners – very basic.

- Third party-funded self-monitoring performed by contractors and project owners.
- KISS-principle (Keep It Simple Stupid) monitoring program.
- Throw out current process, MDE “sham” self-reporting. No follow-up is done. Not the job of the homeowner. Regulatory and resource agencies should do it for consistency and to establish SOP (Standard of Practice).
- Creation of core standard for monitoring so projects can be compared. Recommended standards that are voluntary.
- Developing standards that are the most efficient and provide the greatest benefit for cost. How about “macro” monitoring? i.e. is it still there after 1 year, 2 years, 5 years, etc.? Does it appear to be functioning as built? Are there macro benefits that can be seen?
- State agencies - periodic monitoring.

Permitting

- Put it in the permit conditions.
- Permitting requirements with specific criteria.
- Policy changes / policy shift to make it as a standard.
- Permit condition requirement.
- If an applicant wants a permit, a condition of that permit must be that they fund monitoring based on a standard protocol.

Miscellaneous

- Fund education programs for homeowner and contractors.
- Don't expect the homeowner to monitor because of money and expertise.
- County also doesn't have the money or expertise.
- Get rid of MDE's self-reporting process for applicant.

Other Recommendations

- Could incorporate citizens into this in long term.
- Map out where sites are and target where data is needed - then get it. Avoid redundancy.
- State wetland reporting.
- Central group to collect data (a repository).
- National data collection – annual national conference?
- Citizen monitoring programs for homeowners; missing oversight (limitations = QA / QC <Quality Assurance / Quality Control> of data, honor system).
- Uploading photos – crowd-sourcing hosted by central platform.
- Educate homeowners and contractors to perform monitoring as a function of the project.
- Volunteer efforts.

- Perform more rigorous, longer-term monitoring on a subset.
- Plant community.
- Time frame - short term, long term.
- Set long-term monitoring.
- Identify basic parameters for all projects (plants, elevations).
- Temperature changes.
- Define most important goals to monitor - big picture.
- Sediment accretion rate reporting.
- Standard data collection needs to be established.
- Grant requirement that provides funding in the grant for monitoring.
- Find funding for scientific studies.
- Make it a funding priority and spread funds across region.
- Private Living Shorelines might need incentives (tax credit).
- Marketing incentive to monitor successful progress.
- Establish dedicated funding for a person at state / federal level to monitor Living Shoreline projects (could be a contractor). This monitoring needs to include other shoreline types (bulkheads, etc.) for comparison.
- Regulatory fees into dedicated monitoring fund.
- Some stipulation within the permit to ensure monitoring is part of the program.
- Require monitoring in permits for specific sites (large scale?), or to study specific things. Avoid redundancy.
- State projects required to report.
- Permit conditions.
- Legislation establishes requirements.
- Monitoring needs to be someone's job, someone has to be responsible.
- Low-hanging fruit first.
- Need permission from landowners to study property.
- Do we need to monitor all projects?
- More partnership/coordination between practitioners and the science community, et al.
- Permitting requirements with specific criteria.

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Appendix C-3

Improving Communication across Sectors

Objective

Review research to date assessing the physical performance of Living Shoreline techniques, discuss the technical feasibilities and limits of that research, and engage in group dialogue about how to move forward from here.

Question 3: Brainstorm ways we can communicate the information more broadly across sectors.

Highest Priority

Online presence

- Inventory of data being collected (and what's not being collected – gap analysis). Need national (and Canada – Nova Scotia) database for monitoring data.
- Interpret / analyze data posted in database – synthesis.
- Web-based clearinghouse for design and property owners - research results in a digestible format – location, type characteristics (brief!).
- Central data clearinghouse so data is accessible to all.
- Web.
- Add other VIMS mapping tools and research findings and tools to the same website.
- MD DNR Living Shorelines website. SELC website.
- Interactive, real time, social media venue by topic.
- VIMS database of publications open to the public – link on municipal websites.
- Living Website; Living White Paper; Wikipedia page on Living Shorelines; having a social media presence.
- Central web-based agency that compiles information – university, NGO, VIMS website?
 - Design manuals, models, data-monitoring protocols.
 - Need coordinator, curator, outreach to encourage people to register projects.
 - Role of funders?

Training

- Professional training for contractors and inspectors for monitoring and shoreline-appropriate protection projects.
- Training modeled on Dave Rosgen stream courses or interagency training courses (in MD) on wetlands (soils, delineation, plants).
- Communication with local municipalities (where the planning is occurring).

Central / Cross-sector Organization

- Cross-sector Leadership Council.
- Living Shorelines Working Group? – including all groups, 3rd party group.

Outreach / Education

- Proactive Outreach.
 - Educate our children – bring the subject to schools.
 - Newspaper / magazine articles.
 - Central data clearinghouse so data is accessible to all.
 - Informational meetings for property owners – pro-active outreach – apossiles.
 - Contractors and landowners – Marine Contractors Association – w/ CEU's.
- Demonstration projects for communities.

Miscellaneous

- Is it really a case of needing to communicate “Living Shorelines”, or more a case that the challenges and barriers to Living Shorelines need to be reduced or eliminated? As long as “hardening” is cheaper / easier / faster, we’re always going to lose.
- Provide economic incentives to landowners who participate in data-sharing.
- Policy level – to create incentives.

Other Recommendations

- Identify target audience(s) – regulators, practitioners, landowners / managers
- Contact Eric Eckel at waterwordsthatwork.com for great ideas. He’s done a few workshops for U.S. in Maine about communicating science to others.
- Publications, websites, annual workshops.
- Negative campaign about hardening techniques – make the other side prove they are better. Communicate that bulkheads, breakwaters, etc., also fail.
- Convey the science.

- Get the science on both sides of the issue into the hands of regulators, planners, etc. (pro-Living Shorelines and con-hardening).
- Communicate with political levels (senators, etc.).
- Public interest.
- Living Shorelines need to be the 1st “hit” on Google.
- Add blog / open question-answer forum on the same website.
- Pay property owner for loss of sediment.
- “Focus on ...” (...what you want, not what you don't want).
- Identify core questions and monitoring metrics. (what does “performance” mean – what are core objectives/goals; how does that vary by region?)

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Appendix D

Living Shoreline State Regulation at a Glance

Delaware



Current Regulation

DE has a streamlined permit process (Statewide Activity Approval or SAA) for small scale bank stabilization/living shorelines. This eliminates the public notice process and reduces permit processing times. Larger living shoreline projects (exceeding limitations of the SAA) require a full Subaqueous Land Permit. DE also has a cost share program as an incentive to promote vegetated shorelines, offering a 50% match up to \$5,000 for projects that use vegetation for stabilization (with $\geq 2:1$, veg : rock). Federal permits are filed separately with the USACE.

Regulators

- DE Dept. of Natural Resources and Environmental Control (DNREC) Wetlands and Subaqueous Lands Section
- Possibly DNREC's Coastal Zone Mgmt
- USACE (Please contact your local district office.)

Implemented

Statewide Activity Approval (December 2012)

Further Information

http://delawareestuary.org/Living_Shorelines
<http://www.dnrec.delaware.gov/wr/Information/Permits/Pages/WetlandsandSubaqueousLandsPermittingInfo.aspx>



Maryland

Current Regulation

A Joint Permit Application is used to apply for federal and State authorization under the Maryland State Programmatic General Permit. This is required for work in tidal waters of the U.S. including tidal wetlands.

Tidal Wetland Regulations for Living Shorelines:

- 1) A shore erosion control project must consist of nonstructural shoreline stabilization measures that preserve the natural environment.
- 2) A property owner is not required to use nonstructural shoreline stabilization measures if determined to be impracticable by the Maryland Department of the Environment by obtaining a waiver, or if the project has been mapped as appropriate for structural shoreline stabilization by MDE.
- 3) In addition to the Joint Permit Application property owners must also submit:
 - a) A proposed Critical Area Buffer Management Plan; and
 - b) A signed Critical Area Buffer Notification Form

Regulators

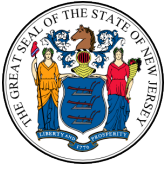
- Maryland Department of the Environment (MDE)
- USACE (Please contact your local district office.)

Implemented

Living Shorelines Law (October 2008); Regulations (February 4, 2013)

Further Information

<http://www.dnr.state.md.us/ccs/livingshorelines.asp>
<http://www.mde.state.md.us/programs/Water/WetlandsandWaterways/Pages/TidalRegsLivingShoreline.aspx>
<http://www.nab.usace.army.mil/Missions/Regulatory/PermitTypesandProcess.aspx>



New Jersey

Current Regulation

Coastal general permit for habitat creation, restoration, enhancement and living shoreline activities (N.J.A.C. 7:7-7.29)

This general permit authorizes the establishment of a living shoreline to protect, restore, or enhance habitat, provided the living shoreline activity:

- Is designed or sponsored by certain Federal or State agencies, or implemented by a college or university for the purpose of research. A “sponsor” is an entity that endorses the activity in writing;
- Is part of a plan for the restoration, creation, or enhancement of the habitat and water quality functions and values of wetlands, wetland buffers and/or State open waters;
- Is consistent with applicable coastal statutes and Coastal Zone Management (CZM) rules;
- Improves or maintains the values and functions of the ecosystem;
- Has a reasonable likelihood of success, or if performed by a college or university, advances the level of knowledge regarding living shorelines in New Jersey;
- Where located waterward of the mean high water line, is limited to one acre in size unless applicant is a Federal or State agency that demonstrates larger size is necessary to satisfy the goals of the project;
- Disturbs the minimum amount of special areas such as shellfish habitat, submerged vegetation habitat, intertidal and subtidal shallows, and wetlands, necessary to implement the project plan;
- Where restoring an existing shoreline to a pre-existing location, is limited to the footprint of the shoreline as it appeared on certain maps, including any proposed fill; and
- Includes public access in accordance with the CZM rules.

If a project does not meet the requirements of this coastal general permit, it may qualify for a coastal individual permit.

Regulators

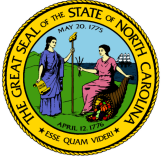
- New Jersey Dept. of Environmental Protection (NJDEP)
- USACE (Please contact your local district office.)

Implemented

N.J.A.C. 7:7 - Coastal Permit Program Rules (as amended through July 15, 2013) and N.J.A.C. 7:7E – CZM rules (as amended through July 15, 2013)

Further Information

http://www.nj.gov/dep/landuse/coastal/cp_gp29.html
http://www.nj.gov/dep/rules/rules/njac7_7.pdf



North Carolina

Current Regulation

Separate state and Federal permits are required. NC Division of Coastal Management requires a formal application and plan review for living shorelines. Three general permits are used by the state: vertical walled sills with marsh, marsh toe revetment, and stone or oyster bag sills with marsh plantings. General permits for vertical sills and marsh toe revetments are fast track permits (same as for bulkheads and revetments) with no formal application, and approval in field by agency staff. Stone or oyster bag sill projects require full application, and 2-3 month review process.

Regulators

- North Carolina Division of Coastal Management
- USACE (Please contact your local district office)

Further Information

<http://www.nccoast.org/Content.aspx?key=76664726-1d0d-4f30-a6b0-c2702bf97ee3&title=Living+Shorelines>
<http://portal.ncdenr.org/web/wq/ws>



Virginia

Current Regulation

In Virginia, separate local, state and federal permits are required for living shorelines with a Joint Permit Application. The State is working on a general permit. VA has a policy statement that encourages the use of living shorelines as the preferred alternative for stabilizing tidal shorelines but no implementation requirements. Wetland permits are determined by Local Wetland Boards with oversight by the State.

Regulators

- Local Wetland Boards, Virginia Marine Resources Commission ▪ VA Department of Environmental Quality ▪ USACE (Please contact your local district office.)

Implemented

Policy Statement - Senate Bill 964 (April 2011)

Further Information

<http://www.deq.virginia.gov/Programs/CoastalZoneManagement/CZMIssuesInitiatives/LivingShore.aspx>
http://ccrm.vims.edu/publications/pubs/rivers&coast/vol8_no1_2013ccrmp.pdf
http://ccrm.vims.edu/permits_web/guidance/local_wetlands_boards.html
<http://www.fairfaxcounty.gov/dpz/environment/finallivingshoreline.pdf>

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Appendix E

Resources

Objective

Gain an understanding of the mechanisms that Mid-Atlantic States have used to advance Living Shorelines, recognize barriers to Living Shoreline implementation, and identify solutions to those barriers through real-world examples.

Following the panel discussion and Question and Answer period for the session, Recognizing Barriers and Identifying Solutions, attendees were asked to collaborate to identify and record examples of non-regulatory tools available that encourage and expand Living Shorelines implementation. Suggestions included opportunities for technical training and formal education, informal outreach and peer-to-peer messaging, as well as financial incentives. The results of this collaboration, as well as other recommendations raised during the Summit, are documented below in Appendix E and organized as follows:

Appendix E-1	Programs
Appendix E-2	Publications
Appendix E-3	Web Resources
Appendix E-4	Organizations

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Appendix E-1

PROGRAMS

Objective

Gain an understanding of the mechanisms that Mid-Atlantic States have used to advance Living Shorelines, recognize barriers to Living Shoreline implementation, and identify solutions to those barriers through real-world examples.

Name: Chesapeake Bay TMDL (Total Maximum Daily Load)

Lead Organization: Environmental Protection Agency (EPA)

Website: www.epa.gov/chesapeakebaytmdl/

Description: Pollutant load reductions to be achieved by new or retrofitted BMPs specifically designed to protect the Bay from excess nitrogen, phosphorus, and sediment. The Chesapeake Bay TMDL is required to be 60% implemented by 2017, and 100% implemented by 2025.

Name: Coastal Change Analysis Program Regional Land Cover (C-CAP)

Lead Organization: National Oceanic and Atmospheric Administration (NOAA), Digital Coast, Coastal Services Center

Website: www.csc.noaa.gov/digitalcoast/data/ccapregional

Description: Nationally standardized database of land cover and land change information for the coastal regions, including inventories of coastal intertidal areas, wetlands, and adjacent uplands with the goal of monitoring these habitats by updating the land cover maps every five years.

Name: Coastal Zone Management Grants (CZM)

Lead Organization: National Oceanic and Atmospheric Administration (NOAA), Ocean and Coastal Resource Management

Website: coastalmanagement.noaa.gov/funding/welcome.html

coastalmanagement.noaa.gov/resources/docs/czmfundingfy12.pdf

Description: Funding to protect, restore and responsibly develop coastal communities and resources: (1) administrative grants; (2) coastal resource improvement programs; (3) coastal zone enhancement grants; and (4) coastal nonpoint pollution control programs (technical assistance).

Name: Community Rating System (CRS)

Lead Organization: Federal Emergency Management Agency (FEMA) www.fema.gov/

Website: www.fema.gov/national-flood-insurance-program-2/community-rating-system

Description: Encourages community floodplain management activities that exceed the National Flood Insurance Program (NFIP) minimum by reducing flood insurance premium rates for policyholders up to 45%. Technical assistance available.

Name: Critical Area Buffer, COMAR 27.01.09.01; 2012

Lead Organization: Critical Area Commission, Maryland Department of Natural Resources

Website: www.dnr.state.md.us/criticalarea/pdfs/LGAG_BR0210.pdf

www.dsd.state.md.us/comar/subtitle_chapters/27_Chapters.aspx

Description: Regulations establishing comprehensive standards and procedures for delineating, measuring, and expanding the Critical Area Buffer, mitigation and planting standards, and site-specific Buffer Management Plans. Emphasizes improving and enhancing the Buffer.

Name: Delaware Cost-Share for Vegetative Shoreline Stabilization

Lead Organization: Sussex County Conservation District, Delaware

Partner Organization: Delaware Department of Natural Resources and Environmental Control (DEDNREC), Division of Water Resources, Wetlands and Subaqueous Lands Section (WSLS), Division of Soil and Water Conservation

Contact: Division of Water Resources, DEDNREC: (302) 739-9943

Sussex County Conservation District: Deanna Killen (302) 856-3990 ext 3

Description: Cost-share assistance for vegetative shoreline stabilization. Details: 50% of cost of project up to \$5000, maintenance required for 3 years, shoreline stabilization projects using minimal (2:1 marsh:rock footprint) or no rock/hardening technique. Funded through EPA 319 grant funds.

Name: Engineering with Nature

Lead Organization: U.S. Army Corp of Engineers (USACE)

Website: el.erdc.usace.army.mil/ewn/

Description: Alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental, and social benefits associated with water resources infrastructure through collaborative processes.

Name: Federal Emergency Management Agency (FEMA) Flood Insurance Program (NFIP) and Reform

Lead Organization: Federal Emergency Management Agency (FEMA) www.fema.gov/

Website www.fema.gov/national-flood-insurance-program

www.fema.gov/flood-insurance-reform

Description: Provides financial protection to property owners in participating communities who agree to meet FEMA requirements to reduce the risk of flooding. Current focus on implementing recent legislation, issuing new rates and map updates, supporting mitigation, and educating policyholders.

Name: Living Shorelines Grant Program

Lead Organization: Chesapeake Bay Trust

Partner Organizations: National Oceanic and Atmospheric Administration (NOAA), Maryland Department of the Environment (MDE)

Website: www.cbtrust.org/site/c.miJPKXPCJnH/b.5457537/k.B2A2/Living_Shorelines.htm
www.cbtrust.org/site/c.miJPKXPCJnH/b.5457271/k.C58E/Grants.htm

Contact Person: Jana Davis: jdavis@cbtrust.org

Description: Solicits proposals to create and promote Living Shorelines in the Chesapeake Bay. Designed to reverse the trend of shoreline hardening by encouraging the creation of Living Shoreline restoration projects and enhancing public awareness.

Name: Maryland Department of Natural Resources Living Shorelines website

Lead Organization: Maryland Department of Natural Resources

Website: www.dnr.maryland.gov/livingshoreline

Contact Person: Bhaskar Subramanian: bhaskar.subramanian@maryland.gov

Description: Website offering information on financial and technical assistance, workshops, Living Shorelines law, and guidance regarding topics frequently queried by marine contractors, landowners, and local government.

Name: Maryland Living Shoreline Protection Act of 2008 (House Bill 973)

Lead Organization: Maryland Department of the Environment (MDE)

Website: mlis.state.md.us/2008rs/fnotes/bil_0003/hb0973.pdf
www.dnr.state.md.us/ccs/pdfs/ls/dnr/scm/2008_LSPA.pdf

Description: Mandates the requirement that shoreline stabilization methods be nonstructural. Exceptions include areas designated by MDE as appropriate for structural stabilization, and areas with excessive erosion, severe tides, or physical inaccessibility. MDE has the option of granting a waiver.

Name: Maryland Sea Grant Extension

*Recommended by Summit participant as possible resource for Citizen Science monitoring

Lead Organization: Maryland Sea Grant and University of Maryland Extension

Website: www.mdsg.umd.edu/topics/extension/our-services
www.mdsg.umd.edu/water-issues-and-restoration

Description: Works with local governments, community groups, and citizens to improve water quality locally and in the Bay. Assistance in locating technical assistance and funding to support watershed restoration activities, such as managing stormwater and restoring natural habitats.

Name: Maryland Tidal Wetland Regulations for Living Shorelines

Organization: Maryland Department of the Environment

Website:

www.mde.maryland.gov/programs/Water/WetlandsandWaterways/Pages/TidalRegsLivingShoreline.aspx

www.mde.maryland.gov/programs/Water/WetlandsandWaterways/Documents/www.mde.state.md.us/assets/document/wetlandswaterways/Living%20Shoreline%20Regulations.Final.Effective%2002-04-13.pdf

Description: Implements the Living Shoreline Protection Act of 2008. Links to Joint Federal / State Application for the Alteration of any Tidal Wetland in Maryland, proposed Critical Area Buffer Management Plan, Critical Area Buffer Notification Form, and Living Shoreline Waiver Request Form.

Name: National Fish Habitat Partnership

Lead Organization: Association of Fish and Wildlife Agencies (AFWA)

Partner Organizations: States, Federal Agencies, NGOs, Fishery Management Councils, Interstate Fisheries Commissions

Website: www.fishhabitat.org

Contact Person: Kara Meckley: kara.meckley@noaa.gov

Description: State-led state and federal partnership that uses a network of region-based partnerships to prioritize habitat conservation as a way of supporting fisheries. These partnerships could consider Living Shorelines a key strategy in rebuilding wetland habitats.

Name: National Oceanic and Atmospheric Administration (NOAA) Habitat Conservation: National Marine Fisheries Service funding

Lead Organization: National Oceanic and Atmospheric Administration (NOAA)

Website: www.habitat.noaa.gov/funding/index.html

www.habitat.noaa.gov/restoration/techniques/livingshorelines.html

Description: Awards grants and cooperative agreements to support research and conservation initiatives coordinated by state and local governments, non-profits, colleges, and universities.

Name: National Science Foundation funding (NSF)

Lead Organization: National Science Foundation (NSF) www.nsf.gov/

Website: www.nsf.gov/funding/aboutfunding.jsp

Description: Funds research and education in science and engineering through grants and cooperative agreements to colleges, universities, K-12 school systems, businesses, informal science organizations, and other research organizations.

Name: North Carolina Community Conservation Assistance Program (NC CCAP)

Lead Organization: North Carolina Department of Environmental and Natural Resources (NC DENR), Division of Soil and Water Conservation, Division of Coastal Management www.ncagr.gov/SWC/

Department of Agriculture and Consumer Services, Soil and Water Conservation, Nonpoint Source Programs

Website: www.conservation.nc.gov/web/cm/nc-community-conservation-asistance-program-ccap_data.osbm.state.nc.us/pls/pbis/dyn_cris_html.show?p_arg_names=cris_idandp_arg_values=2468

Description: State cost-sharing program encouraging Living Shoreline methods. Designed to improve water quality through the installation of various Best Management Practices (BMPs) on lands not involved in agricultural production. Educational, technical, and financial assistance.

Name: Pearl Homes, Virginia

Lead Organization: Lynnhaven River Now www.lynnhavenrivernow.org

Website: www.lynnhavenrivernow.org/Pearl-Homes.aspx
www.lynnhavenrivernow.org/files/pages/Single%20Page%20Pearl%20Home%20App%207.31.13.pdf

Description: Grassroots program that rewards property owners who install environmentally-friendly landscapes and shorelines. Very effective neighborhood-level program that incorporates local demonstration sites. "Every person and every home can make a difference."

Name: River Star Homes, Virginia

Lead Organization: Elizabeth River Project www.elizabethriver.org

Website: www.elizabethriver.org/#!river-star-homes/czow
www.elizabethriver.org/#!blank/cih4

Contact Person: Sara Felker: sfelker@elizabethriver.org

Description: Grassroots program that rewards property owners who install environmentally-friendly landscapes and shorelines. Very effective neighborhood-level program that incorporates local demonstration sites. "A cleaner river starts here."

Name: Sandy Recovery Improvement Act; 2013 (SRIA)

Lead Organization: Federal Emergency Management Agency (FEMA) www.fema.gov/

Website: www.fema.gov/sandy-recovery-improvement-act-2013

Description: Authorizes changes to the way FEMA delivers federal disaster assistance including the Hazard Mitigation Grant Program (HMGP), Lease and Repair Program, Community Disaster Loans, Disaster Relief fund Reporting, Debris Removal Program, and Public Assistance, amongst others.

Name: Sea Grant Maryland funding

Lead Organization: University System of Maryland

Website: www.mdsg.umd.edu/funding-opportunities
www.mdsg.umd.edu/topics/research-funding/funding

Description: Grants funding biennially for research proposals about the Chesapeake Bay watershed and Maryland's coastal bays. Numerous other grant and fellowship opportunities administered throughout the year.

Name: Stormwater Nutrient Abatement Program (SNAP)

Lead Organization: Maryland Department of Natural Resources, Chesapeake and Coastal Service

Contact Person: Ken Yetman: ken.yetman@maryland.gov or (410) 260-8812

Website: dnr.maryland.gov/ccs/restoration.asp

Description: Identifies and implements new stormwater practices on Maryland State Park lands, as well as other state facilities. Staff works to identify large areas of impervious surface (e.g. parking lots, roads, buildings) and recommends Best Management Practices that reduce runoff.

Name: USACE General Permit (404)

Lead Organization: United States Army Corp of Engineers (USACE)

Partner Organizations: Environmental Protection Agency (EPA), U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS)

Website: water.epa.gov/type/oceb/habitat/cwa404.cfm

www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits.aspx

water.epa.gov/grants_funding/wetlands/upload/2004_4_30_wetlands_reg_authority_pr.pdf

Description: General permit process eliminates individual review, allowing certain activities to proceed with little or no delay provided that the general or specific conditions for that general permit are met.

Name: Virginia Shoreline Erosion Advisory Service (SEAS)

Lead Organization: Virginia Department of Conservation and Recreation, Division of Soil and Water

Website: www.dcr.virginia.gov/recreational_planning/wabshoero.shtml

Contact Person: Michael Vanlandingham: Mike.Vanlandingham@dcr.virginia.gov (804) 443-3803

Description: Provides technical assistance to private, local, state, and federal property owners, designers, engineers, contractors, and regulatory and permitting agencies. SEAS technical assistance includes site visits, advisory reports, plan review, inspections, and education.

Name: VoiCeS Program (Volunteers as Chesapeake Stewards)

Lead Organization: Chesapeake Bay Foundation

Website: www.cbf.org/how-we-save-the-bay/programs-initiatives/virginia/voices

Description: Gives volunteers a greater understanding of the Bay, the issues that surround it and the ways that volunteers and their communities can help Bay restoration. Volunteers also gain a greater understanding of their own watersheds.

Name: Wetlands Program Development Grants

Lead Organization: Environmental Protection Agency (EPA)

Website: water.epa.gov/grants_funding/wetlands/grantguidelines/

Contact Persons: Kathleen Drake: drake.kathleen@epa.gov (Region 2: NJ, NY, PR, VI)

Danielle Algaz: algazi.danielle@epa.gov (Region 3: DE, MD, PA, VA, WV, DC)

Morgan Jackson: jackson.morgan@epa.gov (Region 4: AL, FL, FA, KY, MS, NC, SC, TN)

Description: Funding for research, training, demonstrations, surveys, and studies related to water pollution. Priority for projects that address: (1) monitoring and assessment; (2) improving effectiveness of compensatory mitigation; and (3) refining protection of vulnerable wetlands and aquatic resources.

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Appendix E-2

Publications

Objective

Gain an understanding of the mechanisms that Mid-Atlantic States have used to advance Living Shorelines, recognize barriers to Living Shoreline implementation, and identify solutions to those barriers through real-world examples.

Title: [2013 Mid-Atlantic Living Shorelines Summit Proceedings](#)

Partner Organizations: Maryland Department of Natural Resources Chesapeake and Coastal Service, Restore America's Estuaries, Chesapeake Bay Trust

Website: www.estuaries.org/2013-mid-atlantic-living-shorelines-summit.html
www.dnr.maryland.gov/livingshoreline

Description: Presentation summaries, video links, extensive resource appendices, and more. Focus: advancements in research, implementation, and policy. Goal: broaden ability to implement projects and programs, connect science with policy, and affect Living Shoreline research over the next 5 years.

Title: [Considering "Coastal Carbon" in Existing U.S. Federal Statutes and Policies; 2013](#)

Authors: Linwood Pendleton, David Gordon, Brian Murray, Britta Victor, Roger Griffis, Ariana Sutton-Grier, and Jen Lechuga

Website: nicholasinstitute.duke.edu/sites/default/files/publications/considering-coastal-carbon-in-existing-u.s.-federal-statues-and-policies-paper.pdf

Description: Carbon is sequestered in coastal ecosystems. Degradation of wetlands causes carbon release, adding to greenhouse gases and climate change. This ecosystem service could change policy implementation and federal policy actions for National Environmental Policy Act, Clean Water Act, etc.

Title: [Developing Alternative Shoreline Armoring Strategies: The Living Shoreline Approach in North Carolina; 2010](#)

Authors: C.A. Currin, W.S. Chappell and A. Deaton

Publication: Puget Sound Shorelines and the Impacts of Armoring, State of the Science Proceedings; May 2009, U.S. Geological Survey Scientific Investigations Report

Website: pubs.usgs.gov/sir/2010/5254/pdf/sir20105254_chap10.pdf

Description: Review of ecosystem services provided by shoreline habitats and adverse impacts of bulkheading. Rigorous scientific assessment of the benefits of natural shoreline habitats and negative impact of armoring is essential to policy changes and public support for those changes.

Title: Impact of Hurricane Irene on Pivers Island Shorelines; 2012

Author: Carolyn Currin

Website:

www.erh.noaa.gov/mhx/2012HurricaneConference/currin_nwshurricaneimpacts_July12.ppt

Description: Effects of Hurricane Irene: Natural shorelines experienced an absence of upland erosion and marsh loss in areas with intact marsh-upland boundaries, lack of erosion at oyster reef-marsh shorelines, and sediment gain. Hardened structures showed damage and were often overtopped.

Title: Impact of Land-Use Change and Hard Structures on the Evolution of Fringing Marsh Shorelines; 2010

Authors: Christopher R. Mattheus, Antonio B. Rodriguez, Brent A. McKee, and Carolyn A. Currin

Publication: Estuarine, Coastal and Shelf Science (2010) 88.3:365-376

Website: scholar.google.com/scholar?q=Impact%20of%20land-use%20change%20and%20hard%20structures%20on%20the%20evolution%20of%20fringing%20marsh%20shorelines&as_oq=&as_eq=&as_occt=any&as_sauthors=Mattheus&as_publication=&as_ylo=&as_yhi=&btnG=&hl=en&sciui=1&as_sdt=0%2C5&lookup=1

- Click on "(PDF) from researchgate.net" on right side of screen to download PDF

Description: Impact of landscape modifications on sedimentation and fringing marshes. Deforestation: accretion and marsh expansion. Hardened structures: marsh-shoreline erosion. Coastal development influences marsh-shoreline behavior and must be considered in models of response to sea level rise.

Title: Management, Policy, Science and Engineering of Nonstructural Erosion Control in the Chesapeake Bay; 2006

Publication: CRC Publication No. 08-164: Proceedings of the 2006 Living Shoreline Summit

Website: www.vims.edu/cbnerr/docs/ctp_docs/ls_docs/06_LS_Full_Proceed.pdf

Description: Investigated the science of Living Shorelines, identified areas where progress is needed; investigated implementation of Living Shorelines. Intention: encourage shoreline stabilization methods that serve habitat, water quality and erosion control functions; consider next steps.

Title: Marsh Sill Evaluation Final Report: Assessment of 27 Marsh Sills in North Carolina; 2011

Authors: John Fear and Bonnie Bendell

North Carolina Department of Environment and Natural Resources, Division of Coastal Management (NCDENR DCM)

Website: portal.ncdenr.org/c/document_library/get_file?uuid=a7366d0e-5d64-4440-b799-2557da7dbf3f&groupId=38319

portal.ncdenr.org/web/cm/marsh-sill-evaluation-project

Description: Investigated marsh sill projects to gain consensus on use of these structures. Bulkheads are the primary method of estuarine shoreline stabilization in North Carolina. Marsh-sill method is designed to provide similar stabilization, while minimizing adverse effects on ecosystem services.

Title: Mitigating Shore Erosion along Sheltered Coasts; 2007

Author: Ocean Studies Board Division on Earth and Life Studies National Research Council of the National Academies

Website: www.nap.edu/openbook.php?record_id=11764&page=R1

- *Read online by “paging” through publication above the image*

Description: Coastal areas experience land loss from erosion and sea level rise. Hard structures installed alter landscapes, reduce public access, and harm natural habitats and species. Coastal planning and permitting can encourage alternatives to retain natural features of coastal shorelines.

Title: Native Plants for Wetland Restoration and Enhancement: A Source Guide; 2013

Author: Kevin Du Bois

Website: www.norfolk.gov/DocumentCenter/View/3827

Description: Photographic field guide describes habitat requirements of wetland plants. Intended to provide information about adding beauty and plant diversity to wetland restoration projects as well as existing wetlands.

Title: Protecting Wetlands in Coastal Watersheds

Author: Coastal Wetland Initiative

Lead Organization: Environmental Protection Agency (EPA)

Partner Organizations: National Oceanic Atmospheric Association (NOAA), U.S. Fish and Wildlife Service (USFWS), U.S. Geological Survey (USGS), U.S. Army Corps of Engineers (USACE), U.S. Drug Administration Natural Resources Conservation Service (USDA NRCS), Federal Highway Administration (FHWA)

Website: water.epa.gov/type/wetlands/cwt.cfm

Description: Follow-up to Status and Trends of Wetlands: 2004-2009 which reported a loss of 80,000 acres of wetland per year, primarily in freshwater wetlands draining to coast. Summary of causes of wetland loss, tools and strategies used to address wetland loss, and gaps needing to be addressed.

Title: Protocol for the Development, Review and Approval of Loading and Effectiveness Estimates for Nutrient and Sediment Controls in the Chesapeake Bay Watershed Model; 2010

Author: Chesapeake Bay Program Water Quality Goal Implementation Team

Website: www.chesapeakebay.net/documents/Nutrient-Sediment_Control_Review_Protocol_07162013.pdf

Description: Reviews estimates quantifying amounts of nutrients and sediment loads from specific land uses or point sources. Loading rates and percentage adjustments are used in the Chesapeake Bay Watershed Model (CBWM). Definitions and values must be scientifically defensible.

Title: Rethinking Living Shorelines; March 2012

Authors: Orrin H. Pilkey, Rob Young, Norma Longo, and Andy Coburn

Website: www.poweryourmind.net/WebFiles/PDFs/PSDS_Living_Shorelines_White_Paper.pdf

Description: Living Shorelines do not sever connections essential for water quality, ecosystem services, and habitat value. Many projects rely on engineering structures vs. biological components. Need to reassess “limited use of rock”, where design elements are appropriate, and where they are not.

Title: Shoreline Erosion in Virginia; October 1980

Authors: Scott Hardaway and Gary Anderson

Lead Organization: Sea Grant Program - Marine Advisory Service

Publication: Educational Series No. 31

Website: nsgl.gso.uri.edu/vims/vimsg80002.pdf

Description: Review of shoreline erosion and shoreline protection methods in Virginia, both hardened and vegetative. Shoreline types, and erosion causes, rates, and amounts, are discussed. Sound judgment in coastal development, the primary drive for shoreline erosion control, is urged.

Title: Status and Trends of Wetlands in the Coastal Watersheds of the Conterminous United States: 2004 to 2009

Author: United States Fish and Wildlife Service (USFWS) and National Oceanic Atmospheric Association (NOAA)

Website: www.habitat.noaa.gov/pdf/Coastal_Watershed.pdf

Description: Updates information on coastal wetland loss incorporating data from the Pacific coast, in addition to the Atlantic, Gulf of Mexico, and Great Lakes. Reports a loss of 80,000 acres of wetlands per year between 2004 and 2009, with the greatest loss in freshwater wetlands that drain to the coasts.

Title: Status and Trends of Wetlands in the Coastal Watersheds of the Eastern United States: 1998 to 2004

Author: United States Fish and Wildlife Service (USFWS) and National Oceanic Atmospheric Association (NOAA)

Website: www.habitat.noaa.gov/pdf/pub_wetlands_status_trends.pdf

Description: Status and trends of wetland acreage in coastal watersheds adjacent to the Atlantic Ocean, Gulf of Mexico, and Great Lakes. Digital high-resolution imagery analysis identifies wetlands and land use changes. Reports a loss of 59,000 acres of wetlands per year between 1998 and 2004.

Title: Utilization of a Citizen Monitoring Protocol to Assess the Structure and Function of Natural and Stabilized Fringing Salt Marshes in North Carolina; 2008

Authors: Carolyn A. Currin, Priscilla C. Delano, and Lexia M. Valdes-Weaver

Publication: Wetlands Ecology Management (2008) 16:97-118

Website: coastalscience.noaa.gov/about/docs/Currinetal.WME.vol2.pdf

Description: Vegetation and sediment parameters were found to be the most sensitive and efficient metrics of success for a citizen-based restoration monitoring program, i.e. measurement of structural aspect used as predictor of functional attributes and guide to post-restoration adaptive management.

Title: Weighing Your Options - How to Protect your Property from Shoreline Erosion: a Handbook for Estuarine Property Owners in North Carolina; June 2011

Author: Seachange Consulting

Websites: portal.ncdenr.org/c/document_library/get_file?uuid=3ea68378-6f3f-4eb8-bd9d-04f6995f1d24&groupId=61572

Description: Overview of choices for shoreline erosion control on estuarine property in North Carolina. A tool which provides guidance in decision-making about primary erosion control options (vegetation, oyster reefs, marsh sills, riprap, breakwaters, bulkheads), as well as the costs and benefits of each.

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Appendix E-3

Web Resources

Objective

Gain an understanding of the mechanisms that Mid-Atlantic States have used to advance Living Shorelines, recognize barriers to Living Shoreline implementation, and identify solutions to those barriers through real-world examples.

Name: [2013 Mid-Atlantic Living Shorelines supporting materials](#)

Lead Organizations: Maryland Department of Natural Resources Chesapeake Coastal Services, Restore America's Estuaries, Chesapeake Bay Trust

Website: www.estuaries.org/2013-mid-atlantic-living-shorelines-summit.html
www.dnr.maryland.gov/livingshoreline

Description: 2013 Mid-Atlantic Living Shorelines: Where have we been? Where are we now? Where are we going? Supporting materials include Proceedings, links to video presentations, Summit agenda, speaker and moderator biographies, steering committee, and more.

Name: [Chesapeake Bay Program](#)

Lead Organizations: Environmental Protection Agency, the states of Pennsylvania, Virginia, and Maryland, and the District of Columbia

Partners: Federal and state agencies, local governments, non-profit organizations, and academic institutions.

Website: www.chesapeakebay.net/

Description: Partnership directing Chesapeake Bay restoration and protection. Programs to advance science, policy, and restoration include modeling, monitoring, quality assurance, resource lands assessment, Chesapeake Bay TMDL, Watershed Implementation Plans (WIPS). Grant opportunities.

Name: [Chesapeake Network](#)

Lead Organization: Alliance for the Chesapeake Bay

Website: www.chesapeakenetwork.org

Description: Working to protect and restore the Chesapeake Bay watershed. Tools, resources, and connections for collaboration and opportunities to bring people together for watershed restoration and protection. Grant opportunities, Bay-wide events, environmental blogs, and job announcements.

Name: ChesapeakeStat - Water Quality: Best Management Practice Review

Lead Organization: Chesapeake Bay Program

Website: stat.chesapeakebay.net/?q=node/130&quicktabs_10=3

Description: The Chesapeake Bay jurisdictions implement BMPs to achieve goals in the 2010 TMDL. Practices and technologies evaluated for inclusion in the Chesapeake Bay Program modeling tools. Existing practices re-evaluated for best scientific data and information. BMPs available for inspection.

Name: Coastal Management Decision Tools

Lead Organization: Virginia Institute of Marine Science Center for Coastal Resources Management (VIMS CCRM)

Website: ccrm.vims.edu/decisiontree/index.html

ccrm.vims.edu/ccrmp/index.html

ccrm.vims.edu/

Description: Site assessment tools including a shoreline management model with best practices. Shoreline inventories and tidal marsh inventories with GIS data are available. Additional decision tree tools for undefended and currently defended shorelines are also available.

Name: Coasts, Oceans, Ports, and Rivers Institute database (COPRI)

Lead Organization: Oceans, Ports, and Rivers Institute (COPRI) of the American Society of Civil Engineers (ASCE), Living Shorelines Subcommittee of the Coastal Zone Management Committee of the Coasts

Website: www.mycopri.org/

www.asce.org/copri/COPRIHome.aspx

Description: Resource for planning, design, and research. Living Shoreline database: post-project monitoring reports, pre-project conditions, coastal and environmental considerations, design parameters, structural and non-structural elements, project performance, and reference materials.

Name: ECONcrete

Lead Organization: Concrete Ecological Solutions

Website: www.econcretetech.com

Description: New York City adaptation: Concrete with a lower pH to be used in traditional hardened shorelines to promote increased invertebrate colonization.

Name: Hesco Delta Unit

Lead Organization: Hesco Bastion Environmental, Inc

Website: www.hesco.com/products/erosion-barriers

Description: Barrier constructed to protect newly or re-created marshland. Designed to dissipate wave energy and storm surge. Contains dredge material to anchor vegetation, and sections with oyster shell to attract living oysters, promoting long-term defense against wave erosion.

Name: Hudson River Sustainable Shorelines Demonstration Site Network

Lead Organization: Hudson River National Estuarine Research Reserve

Website: www.hrnerr.org/hudson-river-sustainable-shorelines/demonstration-site-network

Description: Resource to familiarize the public, government officials, contractors, and designers with Living Shorelines. Projects included are not necessarily designed as Living Shoreline projects, but embrace the principles of Living Shorelines and help push the agenda for Living Shorelines forward.

Name: Living Shoreline Erosion Control Forum

Lead Organization: LinkedIn group composed of Living Shoreline practitioners

Website: www.linkedin.com/groups/Living-Shoreline-Erosion-Control-Forum-4157277/about

Contact Person: Kevin Du Bois

Description: LinkedIn networking group of Living Shoreline practitioners that provides a forum for discussion of Living Shorelines, improving effectiveness and public acceptance. Topics: design, innovation, construction, implementation, problem-solving, monitoring, maintenance, amongst others.

Name: Maryland Tidal Wetland Permits, Licenses and Certifications (Permit Guide 3.18)

Lead Organization: Maryland Department of the Environment (MDE), Water Management Administration, Wetlands and Waterways Program

Website:

mde.maryland.gov/programs/Water/WetlandsandWaterways/PermitsandApplications/Pages/Programs/WaterPrograms/Wetlands_Waterways/permits_applications/tidal_permits.aspx

Description: Links to documents: Joint Federal/State Application for the Alteration of any Floodplain, Waterway, Tidal or Nontidal Wetland, General Waterway Construction Permit, Shore Erosion Control Guidelines, Shore Stabilization Factsheets, Wetlands and Waterways Program Checklist, and more.

Name: Maryland Watershed Restoration Assistance Directory

Lead Organization: Maryland Sea Grant

Website: ww2.mdsg.umd.edu/wra/

Description: Tool for locating funds and technical assistance to implement projects that restore Maryland's streams, rivers, bays, and watersheds. Programs offered by federal, state, and local governments, nonprofit organizations, private foundations, and others are included.

Name: New York City Adaptations: Oyster Encasement for Pile Enhancement

Author: Andrew Rella; 2013 Second Place Winner

Lead Organization: New York City Waterfront Construction Competition

Website: www.nycedc.com/WaterfrontCompetition

Contact Person: Andrew J. Rella: andrewjamesrella@gmail.com

Description: Wave pump installation down-welling oxygenated, nutrient-enriched water to oysters grown at deeper depths. Effects: improved growth, decreased mortality, creation of nesting grounds, increased strength of concrete structure, and increased water quality by oyster filtration.

Name: Shoreline Management Resources

Lead Organization: National Oceanic and Atmospheric Administration (NOAA) Restoration Center

Website: coastalmanagement.noaa.gov/initiatives/shoreline_resources.html

Description: Funds and provides technical assistance for Living Shoreline projects. Source of information on planning, implementation, and most appropriate type of Living Shoreline erosion control structure given the type of shoreline. Resource bibliography is available.

Name: Southern Environmental Law Center Box page (previously Box.net)

Lead Organization: Southern Environmental Law Center (SELC)

Website: allselc.app.box.com/s/y987jbkbfakry5kbzrz

www.southernenvironment.org/

Description: Repository of over 200 files of Living Shorelines resources including regional and state documents, PowerPoint presentations, general permits, economic impacts, products, ecological impacts, news articles, comparative documents, and critiques of Living Shorelines, amongst others.

Name: Virginia Association of Wetland Professionals LinkedIn Group

Lead Organization: Virginia Association of Wetland Professionals (VAWP) www.vawp.org/

Website: www.linkedin.com/groups/Virginia-Association-Wetland-Professionals-4485240/about

Description: LinkedIn networking group of VAWP and Virginia Steam Alliance members providing a forum for discussion of wetland-related ideas, promotion of scientifically based educational programs on wetland ecology, functions and values, and conservation of wetlands.

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Appendix E-4

ORGANIZATIONS

Objective

Gain an understanding of the mechanisms that Mid-Atlantic States have used to advance Living Shorelines, recognize barriers to Living Shoreline implementation, and identify solutions to those barriers through real-world examples.

Organization: Association of State Wetland Managers (ASWM)

Website: www.aswm.org

Description: Nonprofit organization whose mission is to protect and manage wetland resources through the application of sound science, and to provide training and education for ASWM members and the public.

Name: Bay Environmental

Website: bay-environmental.com/

Description: Natural resource management and assessment/remediation. Environmental services for property transaction, development, and maintenance projects. Services include wetland delineation and permitting, wetland mitigation, and Chesapeake Bay Preservation Act activities.

Name: Center for Watershed Protection

Website: www.cwp.org

Description: Non-profit with a practical approach to complex, technical stormwater and watershed management issues. Provides collaborative leadership across disciplines and professions with a commitment to protect, restore, and enhance our streams, rivers, lakes, wetlands, and bays.

Organization: Chesapeake Bay Foundation (CBF)

Website: www.cbf.org/

Description: Organization dedicated to “Saving the Bay and keeping it saved”, as determined by the Chesapeake Bay Foundation Health Index reported in the yearly State of the Bay report.

Name: Chesapeake Bay Trust (CBT)

Website: www.cbtrust.org

Description: Nonprofit grant-making organization dedicated to improving the Chesapeake Bay and its rivers through environmental education, community outreach, and local watershed restoration.

Name: Clark Nexsen www.clarknexsen.com/

Website: www.clarknexsen.com/go/services/environmental/

Description: Environmental and sustainable design services, due diligence to wetlands permitting, and National Environmental Policy Act compliance. Experienced environmental staff works with designers to increase efficiency, develop sustainable solutions, and simplify environmental compliance.

Name: Delaware Department of Natural Resources and Environmental Control (DDNREC), Division of Water, Wetlands and Subaqueous Lands Section

Website: www.dnrec.delaware.gov/wr/Services/Pages/WetlandsAndSubaqueousLands.aspx

Description: Provides protection and permitting services for activities in Delaware's wetlands, bays, rivers, streams, lakes, ponds, and other waterways that might require a permit, pursuant to Delaware law. Relevant regulations include the use of subaqueous lands and wetlands regulations.

Name: Delaware Estuary Living Shoreline Initiative (DELSI)

Lead Organization: Partnership for the Delaware Estuary (PDE)

Website: delawareestuary.org/Living_Shorelines

Description: Organization created to address tidal salt marsh loss in the Delaware Estuary. Utilizes a Living Shorelines tactic that combines an economical approach with the prevention of erosion in these tidal marshes which provide valuable services.

Organization: "Designing the Edge": Harlem River Park Project, New York

www.waterfrontalliance.org/projects/designtheedge

Lead Organization: Metropolitan Waterfront Alliance

Partner Organizations: New York City Economic Development Corporation, New York State Department of State Environmental Protection Fund, Department of Parks and Recreation, Metropolitan Waterfront Alliance (MWA), and local community initiatives

Website: www.waterfrontalliance.org/projects/designtheedge/harlemriverpark

Description: Collaboration on waterfront projects in an effort to replace the waterfront edge with waterfront designs that are dramatically different, possess greater habitat value, and allow recreational use of the water.

Organization: Elizabeth River Project

Website: www.elizabethriver.org/#

Contact Person: Joe Reiger, Deputy Director: jrieger@elizabethriver.org

Description: Organization leading community efforts to restore the highest practical level of

environmental health to the Elizabeth River, while affirming her value to the port economy through government, business, and community partnerships.

Name: Environmental Concern

Website: www.wetland.org/

Description: Constructs and restores wetland facilities to improve wastewater treatment and stormwater management. Increases public understanding, appreciation, and stewardship of wetland systems through curriculum development, schoolyard habitat, and innovative outreach.

Name: Flood Brothers Marine Consultant

Contact information: floodbros@yahoo.com

Description: Tidal wetland consultants offering construction, environmental assessment, design and engineering, mapping, mitigation, and regulatory and permit coordination.

Name: Hudson River Sustainable Shorelines

Lead Organization: Hudson River National Estuarine Research Reserve

Website: www.hrner.org/hudson-river-sustainable-shorelines/

Description: Develops science-based recommendations for shore zone management that preserve or enhance natural benefits while meeting engineering needs, and involves diverse stakeholders to identify priority information needs, respond to project findings, and shape products and tools.

Organization: Interstate Environmental Commission: New York - New Jersey - Connecticut

Partner Organizations: States of New York, New Jersey, and Connecticut

Website: www.iec-nynjct.org

Description: Tri-state water and air pollution control agency with a mission to protect and enhance environmental quality through cooperation, regulation, and communication between government officials and citizens in the tri-state region.

Organization: Lafayette Wetlands Partnership

Website: www.lrwpartners.org/LWP/Home.html

Description: Restores urban wetlands along the Lafayette River in Norfolk, Virginia, addressing stormwater runoff, as well as transition and upland habitats. Benefits extend to environment, education, and community-building. Community value extends beyond land preservation, inspiring neighborhoods.

Name: Maryland Department of the Environment, Wetlands and Waterways Program, Tidal Wetlands Division

Website:

www.mde.maryland.gov/programs/Water/WetlandsandWaterways/Pages/Programs/WaterPrograms/wetlands_waterways/index.aspx

Description: Responsible for the protection and management of Maryland's tidal wetlands and waters. Regulates activities conducted in tidal wetlands and provides training and technical assistance in the development of watershed management plans.

Name: Maryland Department of Natural Resources Chesapeake and Coastal Service

Website: www.dnr.maryland.gov/ccs/index.asp

Description: Provides technical assistance, training, information, tools, science, and funds to help restore waterways, prepare for storm events, shoreline change, and sea level rise, protect habitats, foster clean coastal industries, and encourage stewardship.

Organization: Maryland Marine Contractors Association (MMCA)

Website: www.mdmarinecontractors.org/

Description: Non-profit trade association dedicated to protecting and promoting the marine construction industry. Works with the regulatory community to achieve workable solutions to bureaucratic problems that threaten the viability of the industry.

Name: National Oceanic and Atmospheric Administration Fisheries (NOAA), previously known as the National Marine Fisheries Service (NMFS)

Website: www.nmfs.noaa.gov

Description: Responsible for the stewardship and management of living marine resources and habitat in the U.S. Exclusive Economic Zone (extending 200 nautical miles seaward from the coastline). Manages fisheries, predicts stocks, ensures compliance, and protects marine species of interest.

Name: North Carolina Coastal Federation

Website: www.nccoast.org

Description: Goals: advocates for land and water uses that protect clean water, critical habitats, and public access to coast, educates decision-makers and stewards to become informed and effective in protecting and restoring coastal resources, and restores and protects habitat and water quality.

Name: Office of Ocean and Coastal Resource Management (OCRM), National Oceanic and Atmospheric Administration (NOAA)

Website: coastalmanagement.noaa.gov/

Description: Assists states in managing marine and coastal resources, operates National Estuarine Research Reserves (NERRS), and implements National Coastal Zone Management Program. Authorized by Coastal Zone Management Act, Coastal and Estuarine Land Conservation, and more.

Name: Office of Wetlands, Oceans and Watersheds (OWOW), Office of Water (OW), Environmental Protection Agency (EPA)

Website: www2.epa.gov/aboutepa/about-office-water

Description: Protects marine and fresh water ecosystems including watersheds, coastal ecosystems, and wetlands. Regulates ocean dumping, manages dredged materials, reduces marine debris, protects water quality and habitat in estuaries, controls polluted runoff, and restores impaired waters.

Organization: Restore America's Estuaries (RAE)

Website: www.estuaries.org/

Description: Nonprofit organization with a mission to preserve the nation's network of estuaries by protecting and restoring the lands and waters essential to the richness and diversity of coastal life, and likewise, as essential resources for our nation.

Organization: Society for Ecosystem Restoration (SER)

Website: www.ser.org/

Description: Dedicated to promoting ecological restoration as a means of sustaining the diversity of life on Earth and re-establishing an ecologically-healthy relationship between nature and culture.

Organization: Society of Wetland Scientists (SWS)

Website: www.sws.org/

Description: International organization whose mission is to promote understanding, conservation, scientifically-based management, and sustainable use of wetlands throughout the world.

Name: Stevens Institute of Technology, Department of Civil, Environmental and Ocean Engineering

Website: www.stevens.edu/ses/ceoe/about_CEOE

Description: Located in New York City on one of the busiest waterways in the world. Research: high strength concrete, hydrodynamic modeling of currents, dispersion of effluents in coastal zone, coastal sediment transport, analysis of current and wave observations in coastal ocean, and remote sensing.

Name: Sustainable Science

Website: sustainable-science.com/

Description: Mission: develop and integrate engineering applications with sound ecological principals. Goal: generate cost-effective and sustainable solutions. Design team specialists and technical advisors specializing in wetland systems create solutions developed for efficient implementation.

Name: Systems Approach to Geomorphic Engineering (SAGE)

Website: www.ccrm.vims.edu/sage/

Description: Collaborative effort between federal agencies, non-governmental organizations, academic institutions, engineers, and other private businesses to promote the use of both grey (hard, structural engineering) and green (nature-based) solutions to make coastal communities more resilient.

Name: Underwood and Associates

Website: ecosystemrestoration.com/

Description: Committed to restoring interconnected hydrologic cycles through sand seepage wetland and stream restoration, reconnecting the water cycle from highlands to floodplain, and reestablishing natural microbial habitats and ecosystems imperative to nutrient reduction and sediment control.

Name: U.S. Fish and Wildlife Service (USFWS)

Website: www.fws.gov

Description: Agency within the U.S. Department of the Interior dedicated to the management of fish, wildlife, and natural habitats. Responsibilities include enforcing federal wildlife laws, protecting endangered species, managing migratory birds, restoring fisheries, and conserving and restoring wildlife habitat, such as wetlands.

Name: University of Maryland Center for Environmental Studies, Horn Point Laboratory (UMCES HPL) www.umces.edu/

Website: www.umces.edu/hpl

www.umces.edu/sites/default/files/hpl/hpl_colonial_history.pdf

Description: Principal institution for advanced environmental research within the University System of Maryland. Advances society's understanding of the world's estuarine and ocean ecosystems. Research includes ecosystem-based management, restoration science, and climate change.

Organization: Virginia Association of Wetland Professionals (VAWP)

Website: www.vawp.org/

Description: Dedicated to the discussion and exchange of wetland-related ideas, promotion of scientifically-based educational programs on wetland ecology, functions and values, and conservation of wetlands.

Name: Virginia Institute of Marine Science (VIMS)

Website: www.vims.edu/

Description: Three-part mission to conduct interdisciplinary research in coastal ocean and estuarine science, educate students and citizens, and provide advisory service to policy makers, industry, and the public. "Science for the Bay, Impact for the World"

Name: Western Carolina University, Program for the Study of Developed Shorelines (PSDS)

Website: psds.wcu.edu/

Description: Researches coastal processes and translates science into management and policy. Examines shoreline management under sea level rise and advocates for responsible strategies for long-term coastal ecosystem sustainability. Designs and implements coastal engineering projects.

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Appendix F

Coalescing the Community and Next Steps

Objective

Identify strategies to continue information sharing and strengthen collaboration across the region following the Summit.

The intent of the session, Coalescing the Community and Next Steps, was to strengthen and solidify the Living Shorelines community by integrating ideas generated throughout the Summit into directives shaping the future objectives and identity of the collective. To accomplish this goal, attendees were asked to comment on one of the four questions below. Participants collaborated with members from other constituent groups so that input from all four sectors was captured in the commentaries.

The following questions were addressed:

1. Define the key elements of our vision for this community. Consider whether we should be more than a collection of people who meet every 5 years to share information.
2. Define specific ways we can continue to share techniques, innovative new practices, and “lessons learned” during implementation of Living Shoreline initiatives.
3. Define specific ways we can continue to support the community in the policy and regulatory arena.
4. Define specific ways we can / should stay connected and ensure follow up to the work we have done at this Summit.

All responses recorded by each group are documented below in Appendix F and reviewed in the 2013 Mid-Atlantic Living Shorelines Summit Proceedings ([Coalescing the Community](#)). The results from this collaborative session are organized as follows:

- [Appendix F-1](#) **Key Elements of the Living Shorelines Community Vision**
- [Appendix F-2](#) **Sharing Techniques, Innovative Practices, and “Lessons Learned”**
- [Appendix F-3](#) **Supporting the Community in the Policy and Regulatory Arena**
- [Appendix F-4](#) **Staying Connected after the 2013 Mid-Atlantic Living Shorelines Summit**

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Appendix F-1

Key Elements of the Living Shorelines Community Vision

Objective

Identify strategies to continue information sharing and strengthen collaboration across the region following the Summit.

Question 1: Define the key elements of our vision for this community. Should we be more than a collection of people who meet every 5 years to share information?

Regulatory and Policy

- Help regulators define the questions to which they need answers.
- Increase approaches available to improve the regulatory process – information checklist (flexibility, predictability), joint permit meeting.
- Level the permitting process for structural armoring versus Living Shorelines.
- Oversight ensuring that a proposed design / application is 100% complete before uploading to the cloud where it will be viewed by regional agencies / parties.
- Encourage associations to communicate among one another to support policy changes.
- Regulators need to be flexible with respect to maintenance requirements – if something is not working, leave room for modification of the project.
- Cleaning house in each state or region.

Connect Policy with Science

- Clarify policy questions / relevance – connect science to current policy / make sure the best science is driving policy.
- Promote communication between regulators and scientists.
- The idea is to give regulators solid evidence to support new technologies.
- Websites – need to continually educate regulators about new advances in science. Partner with universities to obtain needed expertise.
- Establish a cross-federal office accessible by local, state, federal, and private (NGO) entities to facilitate the synthesis and summary of current Living Shoreline science, incorporating a digital mechanism to distribute that information.

Education and Outreach

- Promote better training and knowledge about practices.
- More outreach, conferences, sharing success and failures, site visits.
- Training and education (inspectors, contractors, homeowners) by regulating agencies.
- Workshops on specific topics.
- Education and outreach is still needed for construction companies.
- A shared database that is utilized by all involved parties (i.e., Cloud, Evernote).

Public Outreach

- Help the public understand the value and efficacy of approaches.
- Develop agreed upon talking points to promote Living Shoreline in outreach efforts.

Demonstration Sites

- Allow science to move forward through a coordinated network of well-monitored, innovative demonstration sites as a means of addressing core and technique-specific questions.
- Mechanisms to get money to the state agencies for the purpose of establishing Living Shoreline demonstration sites within a variety of coastal environments.

Miscellaneous

- Shore design standards.
- Ensure that we address SLR (sea level rise) with Living Shoreline practices and design criteria.
- Role of monitoring – increase the effort.

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Appendix F-2

Sharing Techniques, Innovative Practices and “Lessons Learned”

Objective

Identify strategies to continue information sharing and strengthen collaboration across the region following the Summit.

Question 2: Define ways we can continue to share techniques, innovative new practices, and “lessons learned” during implementation of Living Shoreline initiatives.

Online Presence

- Online network.
- Blog on website with a variety of links.
- List of listservs to which our members can contribute and spread the word.
- A Living Shoreline cable channel or YouTube channel.
- A website.
- Discussion / message board on website hosted by RAE (Restore America’s Estuaries).
- On website, highlight Living Shoreline project every month or two.
- Questions, failures, successes, photos, measurements – monitoring results.
- LinkedIn – join the existing group, Living Shoreline Erosion Control Forum.
- Listserv / conference calls.
- Living Shoreline blog / website / website hub.
- Share innovative techniques.
- Advice / lessons learned.
- Workshops.
- Downloadable research / case studies / planting guides.
- Project portal / search engine.
- Research translated into practice modifications.
- DNR Living Shoreline website.

- Website for case studies.
- ASCE (American Society of Civil Engineers) website - searchable project database.
- Listserv – topic-related.
- LinkedIn Group: Living Shoreline Erosion Control Forum –pre-approval: Kevin Du Bois.

Miscellaneous

- Episode on Outdoors Maryland and Outdoors Delaware to advertise Living Shorelines.
- Journal / publication – a specific issue – ex/ Bay Journal.
- Living Shoreline hip-hop and country songs!
- Unifying organization to lead and organize – SER (Society for Ecosystem Restoration), RAE (Restore America’s Estuaries), CBF (Chesapeake Bay Foundation), SWS (Society of Wetland Scientists).
- New organization or subcommittee to “ride herd” to make sure we reach our goals.
- Coordinate upcoming RAE conference, or another conference and offer a panel discussing Mid-Atlantic Living Shoreline projects.
- Workshops – smaller groups to ask questions and get onsite, regionally-specific support.
- Pre-permit forum for consultations about projects which incorporate innovative ideas.
- Expand areas that allow joint permit evaluation meetings.
- Work groups which focus on specific issues – meet via webinar / phone / or in person.
- Agency–spearheaded field trips every couple of years.
- Attendee list sortable by expertise or segment so people can connect after the LS Summit.
- Grant money for outreach videos with which to share projects and techniques.

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Appendix F-3

Supporting the Community in the Policy and Regulatory Arena

Objective

Identify strategies to continue information sharing and strengthen collaboration across the region following the Summit.

Question 3: Define specific ways we can continue to support the community in the policy and regulatory arena.

Professional Information Exchange

- The Mid-Atlantic region is seen as the lead – knowledge should be dispersed through training, workshops.
- Field training courses for practitioners.
- Contractors' workshops – certifications.
- Every 2-4 years hold a Summit.
- Every 2-4 years – big face-to-face meetings are important.
- International conference every other year.
- National summit in 5 years headed by the EPA (Environmental Protection Agency) / NOAA (National Oceanic and Atmospheric Administration) / USFWS (U.S. Fish and Wildlife Service) / USACE (U.S. Army Corps of Engineers).
- DNR has spearheaded this effort for the past several years and served as a catalyst for other regions to promote Living Shorelines.
- Share regional experiences as a means of sharing different tools.
- Representatives from organizations of contractors, regulators, public landowners, private landowners, scientists, NGOs.
- A central library of papers, proceedings, contacts.
- Peer-reviewed literature.
- Living Shoreline White Paper.

Online Presence

- Chesapeake Network.
- Chesapeake Network model listserv.

- Master web pages for different topics - design, regulation, information sharing.
- Webpage by state – e.g. SAV workgroup, periodic meetings.
- Promote / support / register on LinkedIn Living Shoreline group (Living Shoreline Erosion Control Forum) for information sharing and expanding the group.
- Website.

Networking

- Networking between marine contractors, the design community, professional certification associations, coastal engineers.
- Regular networking – in person and electronically.
- Outreach from the regulatory community to marine contractors.
- Regulatory community engaging the scientific community.
- Working Groups.
- Living Shoreline working groups that meet 1-2 times a year.
- Similar focus groups meeting on specific topics.
- Importance of group cohesion – frequent contact with individual small groups (e.g., SAV work group).

Representative Organization

- International association of Living Shoreline – sustainable living organization.
- Technical subcommittee.
- Regional subcommittee.
- Legislative subcommittee.
- Funding subcommittee.
- State-based, grassroots organizations (NGOs – non-governmental organizations).
- Need a guiding body of experts that can serve as a source of information, scientific advances, as well as a facilitator of dialogue between stakeholders and a means of keeping up the momentum until the next Summit.

Miscellaneous

- More community workshops about shoreline education for landowners and contractors with an emphasis on scheduling pre-application meetings.
- Increase signage on public Living Shoreline properties to educate people, especially at older Living Shoreline sites, stating how long they have been functioning.
- Promote the benefits and use of Living Shorelines.
- EPA (Environmental Protection Agency) Wetlands Program Development Grants.
- NOAA (National Oceanic and Atmospheric Administration), NERRS (National Estuarine Research Reserve System) Program.

- CZM (Coastal Zone Management) Grants.
- Encourage pre-application meetings, especially in more complicated projects. Attempt to convene all agencies in one meeting.
- In cases where some agencies are not available, county level permittees can forward permits to other agencies for review.

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Appendix F-4

Staying Connected after the 2013 Mid-Atlantic Living Shorelines Summit

Objective

Identify strategies to continue information sharing and strengthen collaboration across the region following the Summit.

Topic 4: Define specific ways we can / should stay connected and ensure follow-up to the work we have done at this Summit.

Online Presence

- Listserv (newsletter posts and webinar options).
- Create and manage a national web portal.
- Flexible, adopted, vetted ownership.
- State Living Shoreline website – linked as a community (VIM’s website = great model).
- Data – website.
- Funding opportunities.
- Latest updates on policies, standards, etc.
- GIS mapping of Mid-Atlantic projects with photos, costs, designs.
- Latest research and publications.
- Question and Answer forum.
- Quarterly newsfeeds about latest data and happenings.
- Must be run by a dedicated organization to keep information current and relevant, ideally RAE.
- State wide database of Living Shorelines – state water BMP.
- Google map database of all projects - link to the research data.
- Discussion board – blog.
- Repository and communication tool.
- Source of rigorous science, design and journal articles.
- Forum for informal communication / discussion / blog / writing.
- LinkedIn.

- Join LinkedIn web group: Living Shoreline Erosion Control Forum.
- LinkedIn or similar online community sharing.
- Inform and invite all attendees to LinkedIn group: Living Shoreline Erosion Control Forum.
- Set up sub-working groups in LinkedIn.
- Promote LinkedIn group (Living Shoreline Erosion Control Forum) as an immediate next step.
- Invitation to join LinkedIn.
- Get people linked to the Southern Environmental Law Center Box, Inc page (previously Box.net).

Networking

- More frequent networking.
- Open houses as well as site visits during and after construction.
- Subcommittees / working groups aligned with this Summit (Design and Build, Research, Science, and Monitoring, Regulatory and Policy, Project Managers and Program Implementers), within which information can be shared.
- LinkedIn networking.
- Direct follow-up – point people to contact to continue Summit discussions.
- Connect engineers and ecologists.

Professional Development

- Conference every 2-3 years, rotating locations.
- 6 years is too long – we should be revisiting yearly as a Mid-Atlantic Community.
- Convene periodic exchanges via conference calls, etc., on specific topics – top research findings, regional groups, etc. Perhaps CBT (Chesapeake Bay Trust) or another regional organization?
- Plan bimonthly webinar to catalyze energy – VIMS to present the first series / topic.
- Use RAE Summit 2014 as a platform to distribute the most recent Living Shoreline findings.
- Summarize and distribute proceedings from the Living Shorelines Summit 2013.

Miscellaneous

- Cross-sector leadership council.
- Create a regional task force to identify recommendations and scientific evidence that can be used to move regional policy forward – formalize the effort.
- One point group is needed to spearhead this effort – maybe a university or NGO that could raise money.
- Sharing between regions, along coast, amongst countries.
- Piggyback on existing meetings / newsletters / groups. Find non-traditional partners to distribute Living Shoreline information, “lessons learned”, etc.
- Educate contractors / landowners.

- A better tool is needed to understand sediment transport dynamics.
- Highlight the progress that's been made in the last 7 years, as well as today, before the next Summit.

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