Living Shorelines Summit Conference Agenda

Wednesday, December 6	
8:30 – 9:30 Empire Foyer	**Registration, Coffee, and Continental Breakfast** *Conference Services and VIMS/CBNERR Staff, Partners, Sponsors*
9:30 – 9:45 Empire A/B	**Welcome and Introductions** *Willy Reay - VIMS/CBNERR* **Setting the Stage for the Summit** *Shep Moon – Virginia Coastal Zone Management Program* *Audra Luscher - Maryland Dept. of Natural Resources*
9:45 – 10:30 Empire A/B	**Demonstrating Cumulative Impacts of Bulkheads and Revetments** *Keynote Speaker: Susan Roberts - Ocean Studies Board, National Academy of Sciences. Mitigating Erosion Along Sheltered Coasts: A report of the National Academies.*
10:30 – 10:45 Empire Foyer	**Break**
10:45 – 11:00 Empire A/B	**Ecological and Habitat Values of Natural Shorelines** *Donna Bilkovic (VIMS/Center for Coastal Resources Management) Coastal Development Impacts on Biological Communities in the Chesapeake Bay: Examples from the Atlantic Slope Consortium*
11:00 – 11:15 Empire A/B	**Overview of Living Shorelines Design Options** *Karen Duhring - VIMS/Center for Coastal Resources Management*
11:15 – 12:30 Empire A/B	**Panel Session: Understanding Landowner Shoreline Management Choices** *Facilitator: Mike Paolisso - University of Maryland* *Panel Members:* *Drew Koslow - South River Federation* *Skip Stiles - Wetlands Watch* *Steve Dodson – private landowner, York County* *Craig Landry - East Carolina University*
12:30 – 1:30 Westminster	**Lunch**

1:30 – 3:00 Empire A/B	**Panel Session: Case Studies: Design and Technical Considerations for Living Shorelines** *Facilitator: Brian Barnes - GreenShore Solutions* *Introductory Presentation: C. Scott Hardaway – VIMS/Shoreline Studies Program. Chesapeake Bay Living Shorelines: An Historical Perspective* *Panel Members:* *Scott Hardaway - VIMS/Shoreline Studies Program* *Evamaria Koch - Univ. of MD, Horn Point Laboratory* *Walter Priest - NOAA Restoration Center* *Mike VanLandingham – Department of Conservation and Recreation* *Sue McInich – Shoreline Sensations*
3:00 – 3:20 Empire Foyer	**Break**
3:20 – 4:00 Empire A/B	**Regional (MD-VA-NC) Regulatory and Permit Overview** *Doldon Moore - MD Board of Public Works, Wetlands Administration* *Tony Watkinson - Virginia Marine Resource Commission* *Tancred Miller - NC Division of Coastal Management*
4:00 – 5:00 Empire A/B	**Break-Out Session: Exploring Regulatory Options to Support Living Shorelines - Virginia** Virginia: *Facilitator: Shep Moon – Virginia Coastal Zone Management Program* *Panel Members:* *Pam Mason - VIMS/Center for Coastal Resource Management* *Brian Barnes - GreenShore Solutions* *Chris Jett - Local Wetland Board* *Tony Watkinson - Virginia Marine Resource Commission* *Anna Drake - York County Dept. of Environmental Services*
4:00 – 5:00 Empire C	**Break-Out Session: Exploring Regulatory Options to Support Living Shorelines - Maryland** Maryland: *Facilitator: Jana Davis - Chesapeake Bay Trust* *Panel Members:* *Doldon Moore - MD Board of Public Works, Wetlands Administration* *Amy Moredock - Kent County Planning Office* *Kevin Smith - MD Dept. of Natural Resources, Riparian and Wetland Restoration* *Sue Veith - Saint Mary's County*

5:30 – 7:30 Westminster Foyer and Westminster	**Poster Session, Exhibits and Networking Social** Demonstrations: *Koslow, D. South River demonstration project.* Planning Tools: *Leiterman, L. Tools: Maryland's local natural resources.* Design: *Veazey, W. Innovative structures for living shorelines.* Outreach: *Maryland Coastal Program. Maryland's Coastal Hazard Panel Series*
Thursday, December 7	
8:00 – 8:30 Empire Foyer	**Coffee and Continental Breakfast**
8:30 – 10:10 Empire A/B	**Site Suitability, Modeling, and Developed Tools and Related Applications** *Facilitators: Audra Luscher - Maryland Dept. of Natural Resources and Marcia Berman - VIMS/Center for Coastal Resources Management* *Identified Presenters:* *Castellan, A. Shoreline Management Toolbox: Alternative Approaches to Shoreline Management* *Luscher, A., M. Berman, and C. McCall. Geospatial Tools to Assist Coastal Communities with Selecting Sustainable Shoreline Management Approaches.* *Berman, M., J. Herman, K. Nunez, and K. Duhring. A Geospatial Tool for Recommending Living Shoreline Alternatives* *Bendell, B. Recommending Appropriate Shoreline Stabilization Methods for Different Estuarine Shoreline Types in North Carolina.* *Clifford, K. Sedimentsheds: Improving Water Clarity for SAV*
10:10 – 10:30 Empire Foyer	**Break**
10:30 – 12:00 Empire A/B	**Current Understanding of the Effectiveness of Non-Structural and Marsh Sill Approaches** *Facilitator: Kevin Sellner - Chesapeake Research Consortium* *Panel:* *Kevin Smith - MD Dept. of Natural Resources, Riparian and Wetland Restoration* *Gene Slear - Environmental Concern Inc.* *Karen Duhring - VIMS/Center for Coastal Resources Management* *Bhaskaran Subramanian - MD Department of Natural Resources, RC&D*

12:00 – 1:00 Westminster	**Lunch**
1:00 – 3:00 Empire A/B	**Concurrent Session - Living Shoreline Functions: Habitat Value** *Facilitator: Carl Hershner - VIMS/Center for Coastal Resources Management* *Identified presenters:* *Seitz, R.D., R.N. Lipcius, N.H. Olmstead, M.S. Seebo, D.M. Lambert, and A. Lawless. Effects of Shoreline Development Upon Abundance, Biomass, and Diversity of Chesapeake Bay Benthos and Their Predators.* *Davis, J.L.D., R. Takacs, and R. Schnabel. Evaluating Ecological Impacts of Living Shorelines: An Example from the Upper Western Chesapeake Bay.* *Carroll, R.A. and W.G. Reay. A Comparison of Nekton Utilization of Fringing Salt Marsh and Revetment Hardened Shorelines* *Lawless, A. and R. Seitz. Secondary Production of Infaunal Benthic Communities in Chesapeake Bay in Comparison to Restored Oyster Reefs.* *Jivoff, P. R., H. K. Liff, and M. D. Tresselt. Habitat Quality, Species Diversity and Secondary Production at Artificial Versus Natural Shorelines in Little Egg Harbor, New Jersey.*
1:00 – 3:00 Empire C	**Concurrent Session - Living Shoreline Structure Design, Construction and Site Criteria Considerations** *Facilitator: Kirk Havens - VIMS/Center for Coastal Resources Management* *Identified presenters:* *Koch, E. W. Sediment Dynamics and Sediment Composition: The Key to Healthy Habitats Shoreward of Wave-attenuating Structures.* *Burke, R., R. Lipcius, and T. Leggett. Construction of Living Oyster Reef Shorelines Using Shell and Alternative Structures in the Lynnhaven River System of Lower Chesapeake Bay.* *Priest, W. I., III. Hermitage Museum Foundation Living Shoreline and Wetland Restoration: A Case Study in Wetlands Design and Construction.* *Veazey, W. Innovative Structures for Living Shoreline Protection with Increased Habitat Value.* *Wilkins, M. Living Shorelines with Living Walls – Complimenting Technologies*

3:00 – 3:15 Empire Foyer	**Break**
3:15 – 4:15 Empire A/B	**Related Outreach, Incentives, and Case Studies** *Facilitator: Laura McKay – Virginia Coastal Zone Management Program* *Identified Presenters and Case Studies:* *Register, K. Longwood University. Hull Springs Farm, Westmoreland County, Virginia: Case Study.* *Schnabel, R. Chesapeake Bay Foundation, St. Johns College, Annapolis, Maryland: Case Study.* *Stiles, W. A., Jr. Making Living Shorelines Work Better on the Ground in Virginia.* *Davis, J.L.D. Incentives for Using Living Shorelines Techniques.*
4:15 – 4:30 Empire A/B	**Future Direction and Conference Wrap-Up** *Summit Overview:* *Shep Moon – Virginia Coastal Zone Management Program and Audra Luscher - MD Department of Natural Resources* Participant discussion on next steps (eg., upcoming products by various programs/partners) *Survey items: Sandra Erdle - VIMS/CBNERR*

The following information was included in the Living Shoreline Summit registration notebook, immediately behind the agenda.

Sponsors and Partners

Steering Committee for the Living Shorelines Summit

List of Attendees

Abstracts for Scientific Session Papers

Summit Evaluation Form

Living Shorelines Summit: Sponsors and Partners

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http://www.dnr.state.md.us/bay/cbnerr/

Chesapeake Bay National Estuarine Research Reserve (VA)
http://www.vims.edu/cbnerr/

Chesapeake Bay Trust
http://www.chesapeakebaytrust.org/

Chesapeake Research Consortium
http://www.chesapeake.org/

Keith Campbell Foundation
http://www.campbellfoundation.com/

Maryland Coastal Zone Management Program
http://www.dnr.state.md.us/bay/czm/

NOAA Chesapeake Bay Office
http://noaa.chesapeakebay.net/

NOAA Restoration Center
http://www.nmfs.noaa.gov/habitat/restoration/

Virginia Coastal Zone Management Program
http://www.deq.state.va.us/coastal/

Virginia Department of Conservation and Recreation
http://www.state.va.us/dcr/

Virginia Institute of Marine Science
http://www.vims.edu/

VIMS Center for Coastal Resources Management
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David Burke – Burke Environmental Associates and Keith Campbell Foundation for the Environment

Jana Davis – Chesapeake Bay Trust

Karen Duhring – Virginia Institute of Marine Science, Center for Coastal Resources Management

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Walter Priest – National Oceanic and Atmospheric Administration, Restoration Center

William Reay – Virginia Institute of Marine Science, Chesapeake Bay National Estuarine Research Reserve in Virginia

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December 6-7, 2006

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Geospatial tools to assist coastal communities with selecting sustainable shoreline management approaches

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Maryland has put forth considerable effort and resources to improve geospatial information along the shoreline, including LIDAR, updated shoreline change data (DSAS), and the development of the Comprehensive Shoreline Inventory (CSI). In particular, the CSI is providing State and local planners the information to comprehensively assess shoreline conditions on a regional and local scale, significantly improving the capacity to identify and target the appropriate means of shore erosion response. Although acquiring new data provides the science to make planning and policy decisions, often the data needs to be developed into a spatial decision support tools for local land use managers; in an accessible format like internet mapping systems; and utilized in an array of educational campaigns. In Maryland, the data products have been packaged and distributed through a web portal called Maryland Shorelines Online (MSO). Two coastal managers will discuss how they are cooperatively building coastal community capacity to plan for and promote sustainable shoreline management approaches.

Recommending Appropriate Shoreline Stabilization Methods for Different Estuarine Shoreline Types in North Carolina

Bendell, B. North Carolina Division of Coastal Management

Estuarine shorelines are dynamic features that experience continued erosion by short and long term processes. As coastal populations encroach on estuarine shorelines, coastal states have begun to formulate new management plans to deal with estuarine shoreline erosion. These plans try to strike a balance between the need to provide protection to the public from coastal hazards with the need to maintain the integrity of the natural system. The North Carolina Division of Coastal Management concluded that more research and discussion was needed between managers and researchers to effectively address and understand the impact of shoreline stabilization methods on the habitats and productivity of estuarine systems and was the main motivation for the formation of the Estuarine Biological and Physical Processes Work Group.

The Work Group was charged with the task of developing recommendations for appropriate shoreline stabilization methods for different shoreline types. The Work Group did not conduct any research, but merely utilized prior research and best scientific judgment in developing recommendations. The Work Group evaluated the ecological functions and values of the different North Carolina shoreline types and the habitat changes due to the physical impacts associated with each shoreline stabilization method. The recommendations of shoreline stabilization methods are based upon the Work Group's stated goal of maintaining the current shoreline type and continuation of the current ecological functions and values. The final report has been submitted to an Estuarine Shoreline Stabilization Subcommittee to help guide the development of new estuarine shoreline stabilization rules.

Sedimentsheds: Improving Water Clarity for SAV

Clifford, K. Chesapeake Bay Program Office

The Chesapeake Bay Program (CBP) partners agreed to reduce upland sediment input to the Chesapeake Bay from the current estimated 5.83 million tons per year to 4.15 million tons by 2010. These phosphorous-based sediment reduction goals, adopted as loading caps allocated by major tributary basins by jurisdiction, are to help achieve the water clarity in tidal shallow water habitats necessary to restore 185,000 acres of submerged aquatic vegetation (SAV). To meet this goal, Maryland, Virginia, Delaware and Washington, D.C. recently adopted water clarity standards into their water quality regulations. Federal, state and local partners are developing management strategies that will reduce the amount of sediment entering the Bay from the watershed and to holistically manage shorelines to help achieve the water clarity necessary to support 185,000 acres of SAV while ensuring wetlands and beaches are replenished as necessary.

Suspended sediment is identified as one of several factors that contribute to decreased water clarity and subsequent stress on SAV in the near-shore area of the Bay. To determine the source of the sediment impacting water clarity a "sedimentshed" concept is applied. The determination of sedimentsheds are expected to play a critical role in understanding where sediment originates and aid in setting an appropriate geographic frame of reference for setting/revising sediment cap allocations by 2010.

The Chesapeake Bay Program's Sediment Workgroup is applying a two-phase approach to identify the source of sediment to the near-shore shallow water designated use areas. This multi-phase effort will be combined with the Bay Program's new modeling tools in 2008 to build the knowledge base necessary to support revising the sediment allocation in 2010. This major upgrade of our models will improve the accuracy and predictions of sediment transport in the watershed and sediment transport and resuspension in the Bay.

Effects of Shoreline Development Upon Abundance, Biomass, and Diversity of Chesapeake Bay Benthos and Their Predators

Seitz, R.D., R.N. Lipcius, N.H. Olmstead, M.S. Seebo, D.M. Lambert, and A. Lawless
Virginia Institute of Marine Science, The College of William and Mary, Gloucester Point, VA 23062; seitz@vims.edu

Within the coastal zone, waterfront development has caused severe loss of shallow-water habitats such as salt marshes and seagrass beds. Much is known about how habitat degradation affects community structure within intertidal marshes. However, little is known about the impact of habitat degradation and ecological value of subtidal shallow-water habitats, despite their prevalence in coastal ecosystems. In coastal habitats, bivalves are dominant benthic organisms that can comprise over 50 % of benthic prey biomass and are indicative of benthic production. We examined the effects of shoreline alteration in shallow habitats by contrasting the benthos of the subtidal areas adjacent to Natural Marsh, Bulkhead, and Rip-Rap shorelines. Benthic abundance and diversity were higher in subtidal habitats adjacent to Natural Marsh than those adjacent to Bulkhead shorelines; abundance and diversity were intermediate in Rip-Rap shorelines, and appeared to depend on landscape features. Predator density and diversity tended to be highest adjacent to Natural Marsh shorelines. There is thus a crucial link between natural marshes, benthic infaunal prey in subtidal habitats, and predator abundance. Consequently, the indirect effects of coastal habitat degradation upon secondary production in the shallow, subtidal habitats adjacent to salt marshes may be as great as or greater than direct habitat effects. Therefore, protection and restoration of marsh habitats may be essential to the maintenance of high benthic production and consumer biomass in Chesapeake Bay.

Evaluating ecological impacts of living shorelines: An example from the upper Western Chesapeake Bay

Davis, J.L.D., Chesapeake Bay Trust, Annapolis, MD 21401, jdavis@cbtrust.org; R. Takacs, NOAA Restoration Center, Annapolis, MD 21401; R. Schnabel, Chesapeake Bay Foundation, Annapolis, MD 21401

The Chesapeake Bay Trust, the NOAA Restoration Center, the Campbell Foundation, and the National Fish and Wildlife Foundation have, for the past three years, partnered to fund installation of living shorelines in place of hard shoreline armor. In summer 2006, the Trust and NOAA-RC began an effort to document how quickly living shorelines assume "natural" ecological function. In the upper Western Shore of the Chesapeake Bay, macrofauna at control marsh sites and at bulkhead sites slated for living shoreline installation were sampled before and after construction in a BACI design. Those species with higher densities at the marsh than the bulkhead prior to bulkhead removal (e.g., mummichog (*Fundulus heteroclitus*), grass shrimp (*Palemonetes pugio*), and spot (*Leiostomus xanthurus*)) were expected to increase after living shoreline installation, and those with higher densities at the bulkhead than the marsh (e.g., white perch (*Morone americana*) were expected to decrease. Two months after bulkhead removal and living shoreline installation, densities of mummichog, grass shrimp, and pumpkinseed (*Lepomis gibbosus*) had increased at the experimental site relative to the control marsh, though densities of some marsh species (e.g., chain pickerel, sticklebacks) had not. Results suggest that certain species can respond almost immediately to installation of living shorelines. However, ultimate species assemblage may not be expected to exactly mirror natural marshes, as living shorelines often incorporate elements such as riprap or oyster shell sills not found in natural marsh. A separate study comparing assemblage structure on several structural habitat types (riprap, vegetation, and oyster shell) indicates that riprap hosts a greater proportion of older life-history stages than vegetation and oyster shell, and all three habitats host different suites of species. The Trust and NOAA-RC will continue to sample macrofauna, sediment grain size, and bottom topography before and after construction of several living shoreline projects per year for the next several years.

A Comparison of Nekton Utilization of Fringing Salt Marsh and Revetment Hardened Shorelines

Carroll, R. A., and W. G. Reay. Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, Virginia 23062

The incremental hardening of natural shorelines by stone revetment to reduce erosion has resulted in loss of intertidal fringe marshes. The effect of shoreline hardening on shallow estuarine nekton communities has received little attention. This study utilized flume nets to quantify nekton abundance and biomass in narrow (~ 3 m wide) intertidal fringe marshes and in adjacent shoreline riprap revetment in Sarah Creek, Virginia. Both total fish abundance (19.9 vs. 11.7 inds$\cdot$m^{-1}; p=<0.001) and biomass (11.36 vs. 7.84 gdw$\cdot$m^{-1}; p=0.006) were greater in the fringe marsh than the riprap revetment. Sixteen species were captured within fringing wetlands as compared to 11 species in the riprap revetment. Commercially important species, such as white perch (*Morone americana*), spot (*Leiostomus xanthurus*), summer flounder (*Paralichthys dentatus*), all exhibited a strong preference for fringe marsh habitat over riprap revetment. While blue crab (*Callinectes sapidus*) abundance was significantly greater in the fringe marsh than the riprap revetment (10.9 vs. 5.7 inds$\cdot$m^{-1}; p=<0.001), biomass was comparable between the two habitat types (22.53 vs. 23.42 gdw$\cdot$m^{-1}; p=0.878). Juvenile crabs (CW 20-50 mm) were caught at greater frequency in the fringe marsh in contrast to larger crabs (CW > 60 mm) whose frequency was greater in the hardened shoreline. Statistically similar numbers (197.7 vs. 231.8 inds$\cdot$m^{-1}; p=<0.059) and biomass (15.87 vs. 17.72 gdw$\cdot$m^{-1}; p=0.269) of grass shrimp (*Palaemonetes pugio*) were captured in the fringe marsh and riprap shorelines. In terms of commercially and ecologically important finfish and juvenile blue crabs, fringing marshes within the study area provided a better overall habitat value. In light of increased shoreline development pressure and rising sea levels, efforts should be made to maintain and/or incorporate fringing wetlands into shoreline protection strategies provided appropriate site conditions.

Secondary Production of Infaunal Benthic Communities in Chesapeake Bay Comparison to Restored Oyster Reefs

Lawless, A., and R. Seitz. Virginia Institute of Marine Science, The College of William and Mary, Gloucester Point, VA 23062; alawless@vims.edu

Restoration projects involving the Eastern oyster, *Crassostrea virginica*, are underway in many locations throughout Chesapeake Bay. The placement of oyster reefs upon certain areas of the bottom requires covering the existing benthic infaunal communities. We designed a replicated experiment to examine the abundance, biomass, diversity, and secondary production of infaunal communities in the footprint of two new "living shoreline" experimental reefs in Lynnhaven Bay, Virginia. The sites are shallow subtidal habitats in muddy sand sediments located four meters offshore. The benthic community is comprised of large bivalves such as *Macoma balthica*, *Tagelus plebeius*, *Mercenaria mercenaria*, and *Ensis directus* that dominate the biomass and secondary production of these communities, along with polychaetes and other taxa. The reef areas consist of four experimental "living shoreline" reefs (oyster shell, concrete modules, rip rap, and reef balls) and were constructed in June 2006 at two Lynnhaven sites, thus productivity of those reefs will not be known for several years. However, we are using production values for existing oyster reefs to estimate expected production of the restored Lynnhaven reefs. For example, production values published for similar Eastern oyster shell reefs have been estimated at 720 g AFDW m^{-2} per year. Preliminary results indicate that the reefs provide enhanced secondary production over the original infaunal community on a per unit area basis. We propose that it would be beneficial to construct oyster reefs over existing infaunal communities with similarly moderate productivity. These data suggest that "living shoreline" reefs can enhance productivity of the estuarine benthic system.

Habitat Quality, Species Diversity And Secondary Production At Artificial Versus Natural Shorelines In Little Egg Harbor, New Jersey.

Jivoff, P. R., Department of Biology, Rider University, Lawrenceville, NJ 08468; H. K. Liff, Department of Geo-Marine Science, Rider University, Lawrenceville, NJ 08468; and M. D. Tresselt, Department of Geo-Marine Science, Rider University, Lawrenceville, NJ 08468.

Over the past three decades, coastal development has replaced a considerable amount of natural shoreline with artificial retaining structures (bulkheads or riprap) along estuaries in the mid-Atlantic region. Natural shorelines provide critical near-shore habitats for estuarine species however; little research has examined the effect of coastline development on near-shore estuarine habitats or estuarine species. We compared select physical characteristics, species diversity, abundance of fish and decapods, and mortality of juvenile blue crabs among three shoreline types; bulkhead, *Spartina* marsh, and beach in Little Egg Harbor, New Jersey. Sampling occurred monthly (May-August) at four sites per shoreline using otter trawl (bulkhead) or seine (marsh and beach). Blue crab mortality was assessed by tethering ten blue crabs at each shoreline type per month. Water characteristics and blue crab mortality were similar among the shorelines. Bulkheads were deeper, entirely lacking areas of less than 1.0m depth, and contained more course-grained sediments than either natural shoreline. Species richness and the abundance of fish and decapods were greater at the beach and marsh than the bulkhead. The juveniles of several important fisheries species (blue crabs, spot, kingfish, bluefish) completely avoided bulkheads. Forty percent of species present at all three shorelines were more abundant at one or both natural shorelines than at bulkheads. Our results suggest that bulkheads eliminate shallow areas and alter sediment size composition, producing lower quality habitats for a variety of species. Future research should quantify the physical effects of bulkheads and examine their effects over time.

Sediment dynamics and sediment composition: the key to healthy habitats shoreward of wave-attenuating structures.

Koch, E. W. Horn Point Laboratory, University of Maryland Center for Environmental Science, P.O. Box 775, Cambridge, MD 216013, koch@hpl.umces.edu

As shoreline erosion accelerates with increasing sea level rise, the desire and need to protect shorelines is also increasing. The type of shoreline protecting structure chosen is often based on what worked to protect the shoreline in adjacent areas. The ecological soundness or benefits of the structure are usually not taken into consideration in the decision making process. In part, the problem comes from our general lack of knowledge regarding ecologically-relevant processes associated with wave-attenuating structures. The objective of our study was to determine why areas protected by sand bars appear to be more ecologically sound than areas protected by breakwaters. We studied two breakwaters and two natural sand bars. Sediments in the areas protected by breakwaters were finer and more organic than those in adjacent unprotected areas and can reach levels considered unsuitable for seagrass growth, an indicator of habitat health. While sediments in the area protected by sand bars were also finer and more organic than adjacent unprotected areas, they did not reach detrimental levels. Degree of wave attenuation did not explain this difference in sediment composition between sand bars and breakwaters. Instead, while the sand bar attenuated waves, it also served as a source of sand. In contrast, the breakwaters only attenuated waves. The sand appears to be necessary to “dilute” the fine and organic particles being trapped due to the more quiescent conditions shoreward of sand bars and breakwaters never allowing it to reach detrimental levels. Therefore, in order to attain maximum ecological benefits when designing living shorelines, sediment dynamics and sediment composition in the area to be protected should be taken into account. Ideally, the wave attenuating structure should also be a source of sand.

Construction of living oyster reef shorelines using shell and alternative structures in the Lynnhaven River system of lower Chesapeake Bay

Burke[1], R., Lipcius[1], R., Leggett[2], T., [1]Virginia Institute of Marine Science, The College of William and Mary, Gloucester Point, Virginia, USA; [2]Chesapeake Bay Foundation

Ecological restoration of the Eastern oyster in Chesapeake Bay has been a long-term multi-agency effort. The use of living shorelines to restore oyster populations in the Lynnhaven River system has been a strategy of Lynnhaven River 2007 (LR07; a local community group geared toward rehabilitating the watershed and its waters), the Virginia Institute of Marine Science (VIMS), the Chesapeake Bay Foundation (CBF), and the U.S. Army Corps of Engineers (USACE; Norfolk District). The USACE intends to restore over 100 acres of oyster bottom in the Lynnhaven River system, which represents a unique opportunity to link community-wide efforts with state and federal interests. In summer 2006, we constructed 12 structures just below mean low water at each of two sites: three 3' L x 3' W x 18" H oyster shell reefs, three 3' x 3' x 18" rip rap reefs, and six stacked sets of two to four 2' L x 2' W x 3.5" concrete modular reefs. In addition, we placed six reef balls at each site, half of which had been seeded with oysters in controlled settings pre-deployment. The primary goal of this construction was the development of healthy oyster reef habitat as a living shoreline in the subtidal zone adjoining natural marshes. We assessed the comparative success of the reef types with respect to oyster recruitment, growth, and survival, and reef structural integrity. We will discuss the performance of these potential living shorelines, with emphasis on the comparison of shell reefs and alternative artificial reefs.

Hermitage Museum Foundation Living Shoreline and Wetland Restoration: A Case Study in Wetlands Design and Construction

Priest, W. I. III, IM Systems Group, NOAA Restoration Center, Gloucester Point, VA.

A Living Shoreline project was undertaken at the Hermitage Foundation on the Lafayette River in Norfolk, VA. The purposes of the project were to protect an historic wall from erosion, remove a stand of *Phragmites* and restore an area of filled wetlands. The Living Shoreline segment consisted of approximately 250 linear feet (LF) of stone breakwater and marsh toe protection together with approximately 600 cubic yards of sand beach fill and the planting of 7500 square feet (SF) of marsh grass, primarily smooth cordgrass (*Spartina alterniflora*). This protected over 300 LF of shoreline including an historic brick wall surrounding the formal garden at the Hermitage. The next phase involved the removal of a stand of invasive *Phragmites australis* and replacing it with 5000 SF of tidal marsh. The last phase involved the removal of 110 linear feet of riprap and approximately 400 cubic yards of debris to restore approximately 7500 SF of tidal wetlands. These marshes were planted with a combination of smooth cordgrass and saltmeadow hay (*Spartina patens*), depending on the elevation. All totaled, the project restored almost ½ acre of wetlands by removing riprap and debris placed in historic wetlands and providing a "softer" approach to shoreline stabilization that provides intrinsic habitat value as well. The presentation will detail all aspects of the project from concept to monitoring including: design, permitting, contracting, construction, planting and monitoring.

Innovative structures for Living Shoreline protection with increased habitat value

Veazey, W. Seament Shoreline Systems, Inc.

SSSI's family of open-topped precast concrete boxes has been installed along the Potomac River for over 12 years. In that time we noticed much natural recruitment of SAV and EAV inside the boxes as well as use by aquatic animals. This past year we endeavored to incorporate habitat enhancement properties to the new hexagonal breakwater box and sill box lines.

There many advantages compared to conventional breakwater and sill building materials. Only a third of the bottom is impacted by their footprint and there is increased habitat for SAV, EAV, and Nekton. Also, installation and relocation as needed are easier and animals can transit back and forth through the sill to the new marsh created behind it.
The unique open-topped design allows sunlight into the impacted area to grow SAV or EAV inside the protective structure. Large holes in the walls of the boxes can be sealed temporarily to provide ease of seeding the structure with shellfish larva or aquatic plant seeds. They also allow large creatures such as turtles and horseshoe crabs to pass through them to access the beach zone to lay their eggs.

A low ground pressure limits settling in soft bottom soils. The ability to float the boxes in from the water instead of traversing the marsh for installation means the wetlands won't be disturbed.

Living Shorelines with Living Walls – Complimenting Technologies

Wilkins, M.

The presentation will discuss the need for considering all the ecological factors that may impact a living shoreline restoration endeavor. One must consider the entire “lay of the land” to ensure what is put in place will last and thrive. Upland factors and topography must be considered in ‘engineering’ your living shoreline project.

The discussions will uniquely examine the installation of a living wall for cliff restoration as part of creating a flourishing living shoreline. Considering factors such as the height of the eroded cliff face, steepness, and vegetation will provide a sense of the velocity and force of the stormwater runoff that will impact the living shoreline. Conversely, one must consider the design of the living shoreline with respect to the tidal and storm wave action that is undermining of the cliff, or bank. The two components, eroded cliff or bank, and eroded shoreline, must be considered as a whole within the projects scope and design.

The presentation will offer before and after pictures of installations, and provide cross section schematics of each technique. The pictures show the use of coir fiber biologs for the shoreline work and compost filled FILTREXX SOXX’s for the cliff restoration. This project was funded at Back Creek Nature Park, Annapolis, MD by the Chesapeake Bay Trust, National Fish and Wildlife Foundation, NOAA, and The Campbell Foundation. Time permitting, lessons learned will be offered, e.g., getting materials barged to an inaccessible shoreline and cliff face.

Considering that some estimate that 56% of the silt entering the Chesapeake Bay comes from cliff and bank erosion, this presentation will be helpful in demonstrating the melding of two complimentary techniques for a greater benefit than each would offer separately.

South River Federation: poster

Koslow, D.

Fullerton Beach Living shoreline: 750 linear feet restored with segmented stone sills, sand fill and spartina planting. This project also included the addition of a buffer onto this community-owned property and buffer plantings by the Federation and by the community.

South River Landing Living Shoreline: 650 linear feet Biolog project. Federation volunteers installed 650 linear feet of biologs, backfilled with sandy fill and planted in *Spartina alterniflora* and *S. patens*.

Edgewater Beach Shaded Section Living Shoreline: 500 linear feet of shoreline restored and stabilized. Includes the construction of 3 large segmented sills, building up 2 stone groins and the installation of approximately 100 linear feet of biologs with sand fill, *S. alterniflora* and *S. patens* plantings and the establishment of a natural buffer. This project was installed by volunteers and involved more than 500 tons of rock, sand and topsoil, 4,000 sprigs of Spartina, and plantings of *Panicum virginica, Clethra alnifolia, Viburnum dentatum, Vaccinium angustifolia,* and *Myrica cerifera.*

***TOOLS* – Maryland's Local Natural Resource Planning Toolkit**

Leiterman, L. Maryland Coastal Zone Management - Poster

Throughout Maryland, local governments lead land use planning activities and are key in carrying out the watershed goals of the Chesapeake 2000 Agreement. However, a significant gap exists between the data and technology available at the state level and that which is in use at the local level. Maryland's *TOOLS* (*Targeted Outreach and On-Line Support*) aims to bridge this gap by focusing on the effective integration of numerous natural resource issues, such as shoreline and coastal zone management, water quality, living resources, and habitat concerns, into local planning and management actions. *TOOLS* facilitates locally based natural resource management, including coastal and watershed planning, in the form of a user-friendly toolkit that provides research based recommendations, guidelines, education, training, technical services, and planning support. Maryland's *TOOLS* strives to increase active management by building capacity among local level decision makers to independently assess and manage natural resources. Targeted users include county and city resource managers, planners, and elected officials; watershed organizations; land trusts; non-governmental organizations; homeowners; educators; and businesses.

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Maryland's Coastal Hazard Panel Series

Maryland’s Coastal Program - Poster

Maryland's Coastal Program put out as series of panels on the hazards that affect Maryland coastal zone. This series is distributed throughout the state and discusses topic such as shore erosion, sea level rise, storm surge, and coastal development.

Living Shorelines Summit
(December 6 & 7, 2006)

1. **How would you best characterize your organizational affiliation?** ____Engineering/Consulting Firm

   ____Local Government ____State/Federal Agency

   ____College/University ____Construction/Contractor ____Private citizen

   ____Other (please specify)_____

2. **Please evaluate the following components of this workshop by circling the appropriate number.**

	Unsatisfied		*Satisfied*		*Very Satisfied*
Topics/Material Covered	1	2	3	4	5
Presentations	1	2	3	4	5
Panel Discussions	1	2	3	4	5
Workshop Format	1	2	3	4	5
Networking Opportunities	1	2	3	4	5
Take Home Materials	1	2	3	4	5
Food and Refreshments	1	2	3	4	5
Overall	1	2	3	4	5

3. **Do you have a better understanding of living shoreline options after attending this conference?**

   ___Yes ___No ___Can't rate

4. **If *Yes*, do you plan to apply this new knowledge to your work with tidal shorelines?**

   ___Yes ___No ___Can't rate

   How do you plan to use the information you learned in this workshop?

5. **Do you think you will integrate new and/or diverse points of view in future shoreline management decisions?**

   ___Yes ___No ___Can't rate

6. **Prior to attending this conference, where did you get most of your information regarding shoreline management options?**

   _____

7. **Are you better able to find answers and resources to assist you with management choices for tidal shorelines after attending this conference?** ___Yes ___No ___Can't rate

8. **Are you more aware of opportunities to collaborate with others after participating in this conference?**

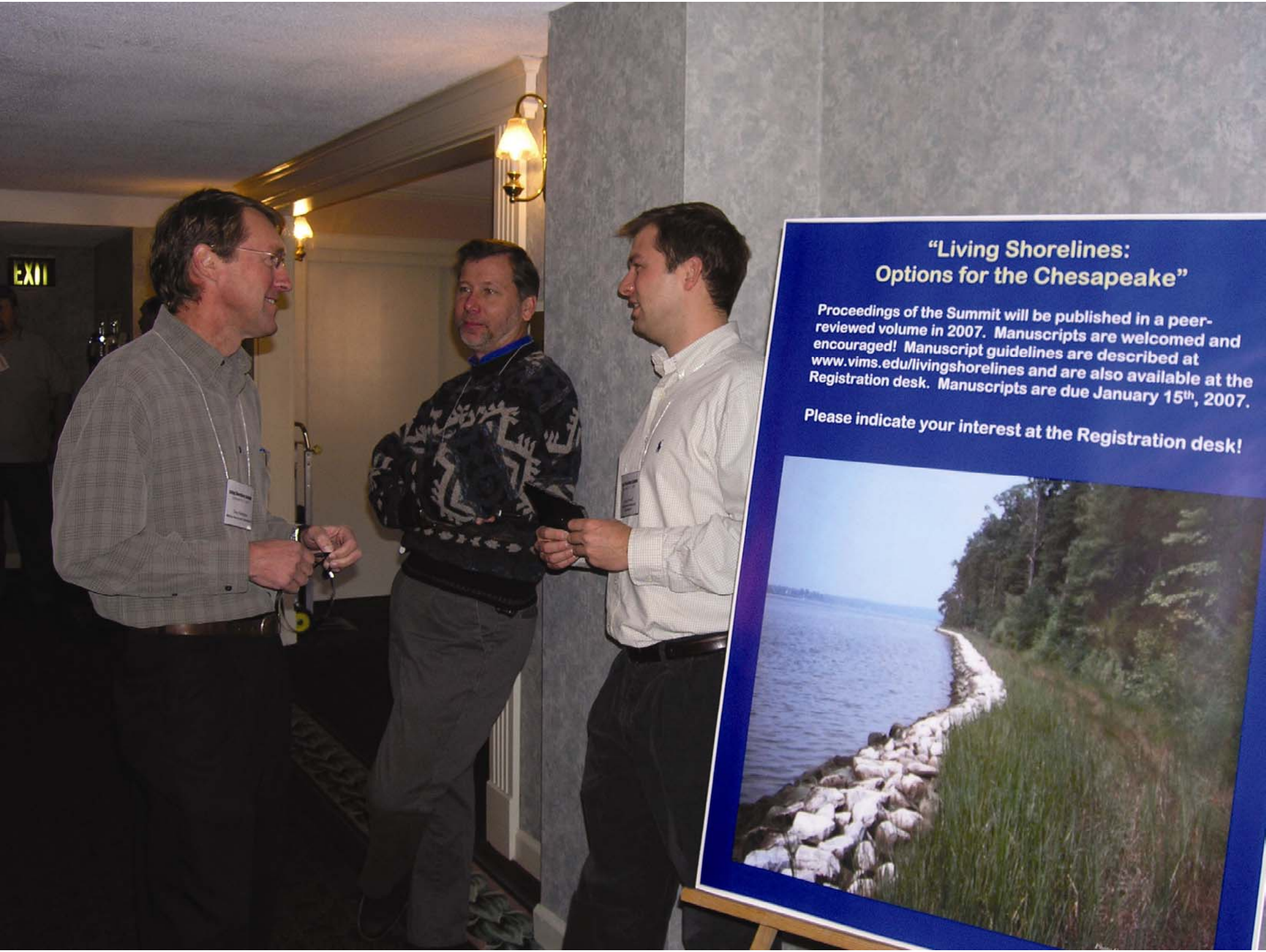
   ___Yes ___No ___Can't rate

9. **Which component of this conference was most useful to you and WHY?**

10. **What topics would you like to see covered in future workshops and conferences?**

Your thoughtful comments will be carefully considered as we plan future training programs. **Please use the back of this form to add any additional comments about this workshop or to suggest topics that should be covered in future training programs.** Thanks for your participation!! Sandra Erdle (syerdle@vims.edu, 804-684-7144)

Living Shorelines Summit – Steering Committee
HI-TIDE


EXIT
"Living Shorelines:
Options for the Chesapeake"
Proceedings of the Summit will be published in a peer-reviewed volume in 2007. Manuscripts are welcomed and encouraged! Manuscript guidelines are described at www.vims.edu/livingshorelines and are also available at the Registration desk. Manuscripts are due January 15th, 2007.
Please indicate your interest at the Registration desk!

Living Shorelines Summit – Steering Committee