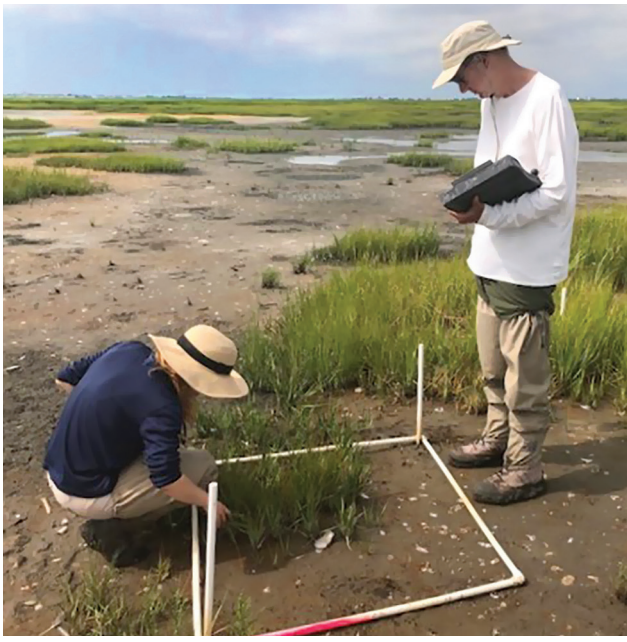

A Community Resource Guide for

Planning Living Shorelines Projects

NEW JERSEY

Introduction

This guide provides information and resources on the key steps in identifying, planning, and implementing living shorelines in your community.

This Community Resource Guide was originally developed as part of the New Jersey Resilient Coastlines Initiative, a network of conservation, academic, state and federal partners supported by funding from the National Oceanic and Atmospheric Administration. The guide has been updated through support from the Climate Resilience Fund, as part of The Nature Conservancy's Living Shorelines Grants and Technical Assistance Program. For information contact either Bill Shadel, The Nature Conservancy's Coastal Projects Manager, at william.shadel@tnc.org or any of the organizations listed on pages 19 and 20.

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COVER PHOTOS CLOCKWISE Intalling bio-log © Parnership for the Delaware Estuary; Filling branch boxes with discarded Christmas trees. © Princeton Hydro; Assessing plant coverage © Patty Doerr/TNC; Marsh Sill tombolo © Jim Dugan THIS PAGE Eroding marsh shoreline in Waretown © Bill Shadel/TNC



LEFT TO RIGHT Passive accretion and plant colonization at natural living shoreline. © Partnership for the Delaware Estuary

What are Living Shorelines?

Living shorelines are a nature-based solution to shoreline erosion. The State of New Jersey defines them as a shoreline management practice that addresses the loss of vegetated shorelines and beaches by providing for the protection, restoration, or enhancement of these habitats. This is accomplished through the strategic placement of plants, stone, sand or other living and non-living natural materials.

Categories of Living Shorelines:

Natural living shorelines are typically used in lower energy environments. They include native vegetation (e.g., marsh grasses and seagrass), clean sediment and biodegradable organic materials (e.g., logs made from coconut fiber).

Hybrid living shorelines are typically used in lower to moderate energy environments. They incorporate native vegetation, clean sediment, biodegradable organic materials, and low-profile rock structures such as segmented sills, stone containment, and concrete breakwaters (e.g., oyster castles and reef balls) which can be seeded with native shellfish.

Structural living shorelines, typically used in higher energy environments, include revetments, breakwaters, and groins. Although they have fewer ecological benefits, they allow for the natural connection between land and water to be maintained and, when used in conjunction with other techniques (e.g., natural living shorelines or planting vegetation), ecological benefits can be increased.

The Living Shorelines App — an on-line tool discussed further on page 6 — currently provides information on the applicability of six specific living shoreline techniques (graphics can be found on pages 7-9.):

- Nature-Based Living Shoreline
- Beach Restoration
- Marsh Sill
- Living Reef Breakwater
- Breakwater
- Ecologically-Enhanced Revetment

How Do Living Shorelines Benefit Communities?

Living shorelines help reduce erosion while preserving natural coastal processes, such as the collection of mud, sand, and nutrients, as well as plant growth. They are just one way to maintain the health and characteristics of New Jersey's near-shore habitats, which are key to improving water quality, providing opportunities for recreational activities (e.g., kayaking, sport fishing, bird watching) and supporting key commercial and recreational fish species — among other benefits.

While traditional armoring approaches to address erosion problems (e.g., bulkheads) can be effective in the appropriate locations, they reflect wave energy and can erode adjacent shorelines as well as the land in front of and behind the structure. In contrast, creating a healthier, more natural transition where land meets open water can help to absorb wave energy (rather than reflect it) while maintaining the multiple benefits of healthy coastal habitats.

CLOCKWISE FROM TOP LEFT Paddle in Cape May, New Jersey. © Erika Nortemann/TNC; Bird watching © Erika Nortemann/TNC; Migrating shorebirds at Gandys Beach Preserve © Erika Nortemann/TNC; Commercial fishing boats © iStockphoto

Using the Coastal Resilience Tool

Aerial view of Ocean City, New Jersey © iStockphoto

What is the Coastal Resilience Tool?

The Coastal Resilience Tool[1] (Figure 1) is a web-based service that includes resources and information to help coastal communities adapt to and withstand coastal hazards. Specifically, it provides local decision makers and stakeholders with regional and local data, summaries, and visualizations via the following applications Each application is launched by clicking on the icons on the left-hand side of the screen.

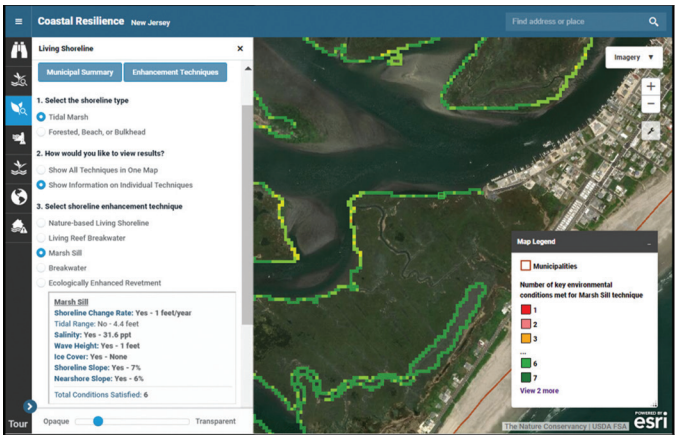


Figure 1.
New Jersey's page on the Coastal Resilience Tool, with the Living Shorelines application launched.

Marsh Explorer allows users to explore marsh integrity and relative need for restoration based on several indicators such as amount of edge erosion and ratio of vegetated marsh to unvegetated marsh.

Living Shorelines allows users to visualize which of 6 living shoreline techniques could be selected for a particular location based on engineering and ecological criteria.

Future Habitat shows which salt marshes are most likely to convert to open water or mud flats and which salt marshes are most able to advance inland under multiple sea level rise scenarios.

Regional Planning contains layers that allow users to visualize the intersection of a host of factors, including social vulnerability, critical facilities, land use, and many others.

Flood and Sea Level Rise viewer displays current and possible future water levels under multiple sea level rise and storm surge scenarios.

Risk Explorer informs users about the areas of coastline most at risk to sea level rise and where coastal habitats have the most risk-reduction benefit.

Identifying Living Shorelines using the Living Shorelines App

Those interested in embarking on living shoreline projects can utilize the Living Shorelines App.[2] The tool has multiple mapping views and, with options, overlay multiple tools alongside potential living shoreline techniques. A step-by-step user guide for the Living Shorelines App is available online.[3]

When using the App, the user is provided with summary information about which living shoreline techniques (see pages 7-9) are applicable for a particular area of coastline.

- Via a decision-tree, the user can choose to view the applicability of all techniques on one map or choose to view more detailed information about individual techniques.
- If the user chooses to view all the techniques on one map, s/he will be able to zoom in and select a square representing a 10-meter length of shoreline.
- By selecting a square, a pop-up box will be displayed that highlights whether each technique is appropriate within the selected area.
- If the user chooses to view more detailed information on each technique's applicability at a particular location, s/he can click on each of the environmental conditions to view detailed information on how each of the conditions determines if a technique is applicable.

The data provided by the App is high-level and using the App is just the first step in considering potential options for living shorelines at your site. When developing a project, it is important to consult with engineers and ecologists to determine the best living shoreline technique based on more detailed site characteristics. Stevens Institute of Technology has created engineering guidelines [4] that can help to inform the planning and design process.

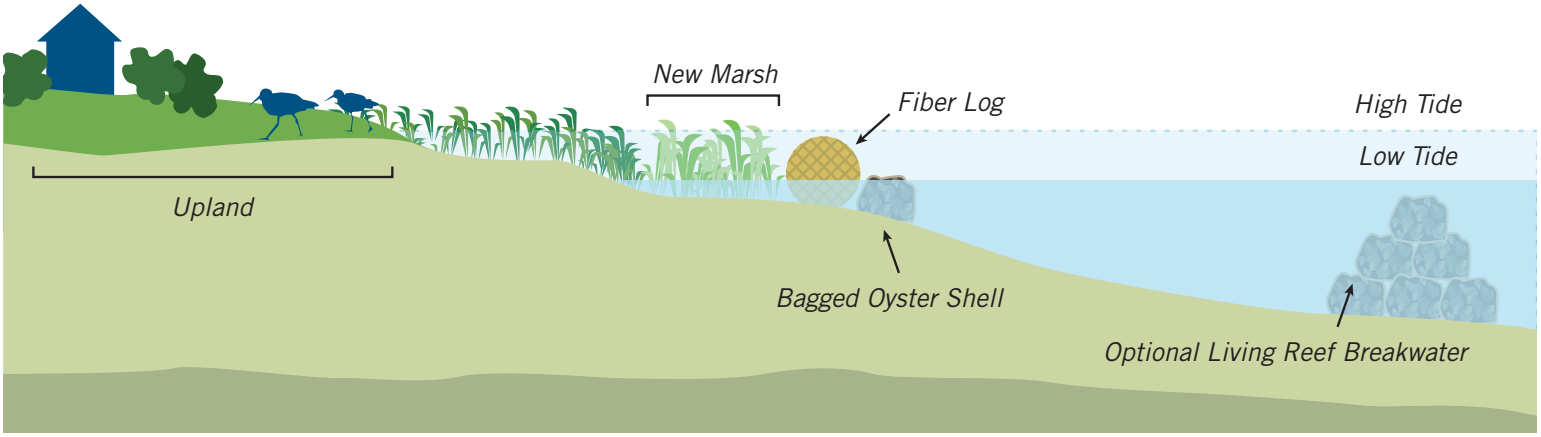
LEFT TO RIGHT Piping Plover © Pixabay; The Living Shorelines App provides a summary of information on which living shoreline techniques are applicable for a particular area of coastline © iStockphoto

Techniques Included in the Restoration Explorer

Partners and volunteers help build a man-made oyster reef © TNC

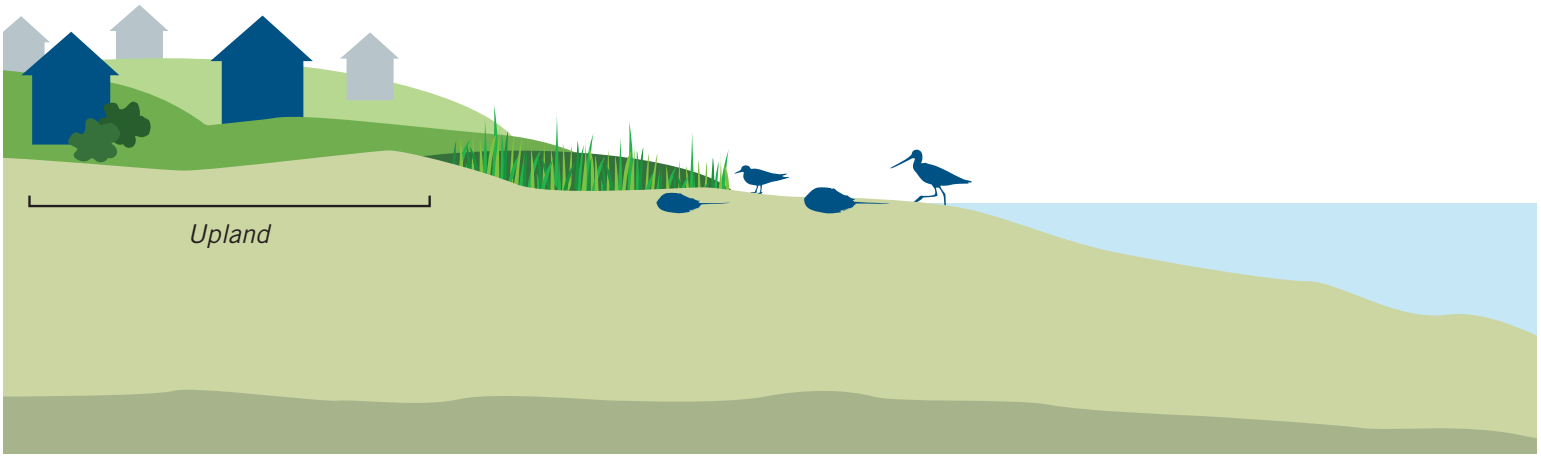
Nature-Based Living Shoreline

Nature-based living shorelines are best in low-energy areas. "Biological enhancements," like biodegradable fiber logs (which also provide habitat for ribbed mussels) or bagged oyster shell, are placed along the tidal marsh edge to provide a contained area for sediment to accumulate and marsh vegetation to grow. In more moderate energy areas, it might be possible to use a hybrid approach that pairs nature-based living shorelines with living reef breakwaters.



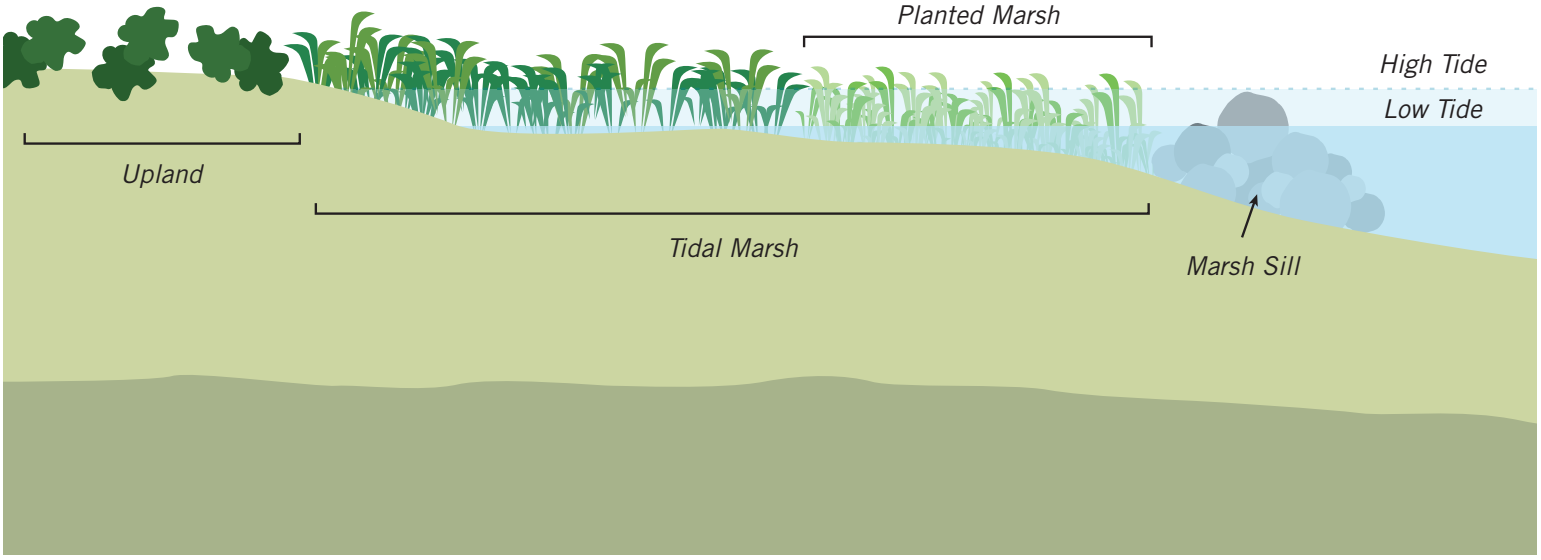
Beach Restoration

Restoring beaches requires placing additional sand along a shoreline to help maintain habitat for key species—like horseshoe crabs, red knots and piping plovers—that use sandy beaches for spawning or feeding. The natural sloping beach allows waves to break across the sand, minimizing erosion of the shoreline edge.



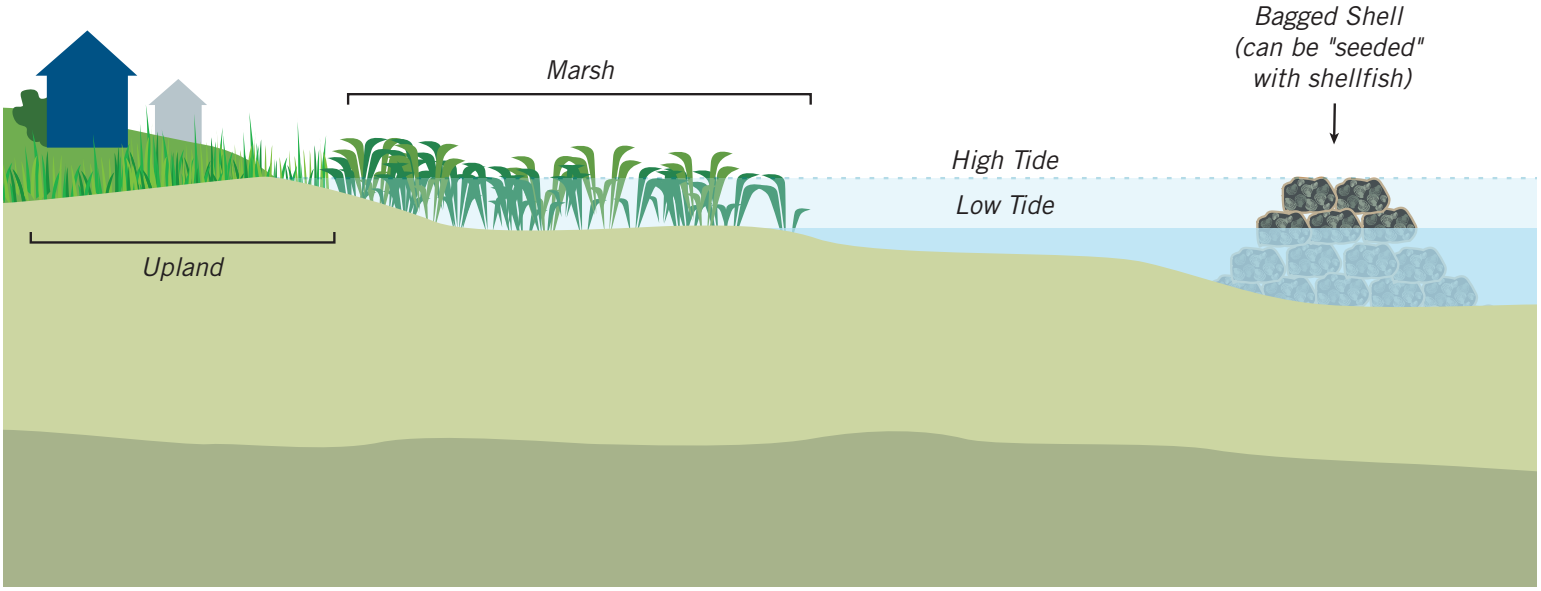
Marsh Sill

Marsh sills are low elevation structures (e.g., rocks or bagged oyster shell) that run parallel to the shoreline and are below water at high tide. The area between the sill and the marsh is often filled and planted with marsh vegetation to speed up shoreline stabilization.



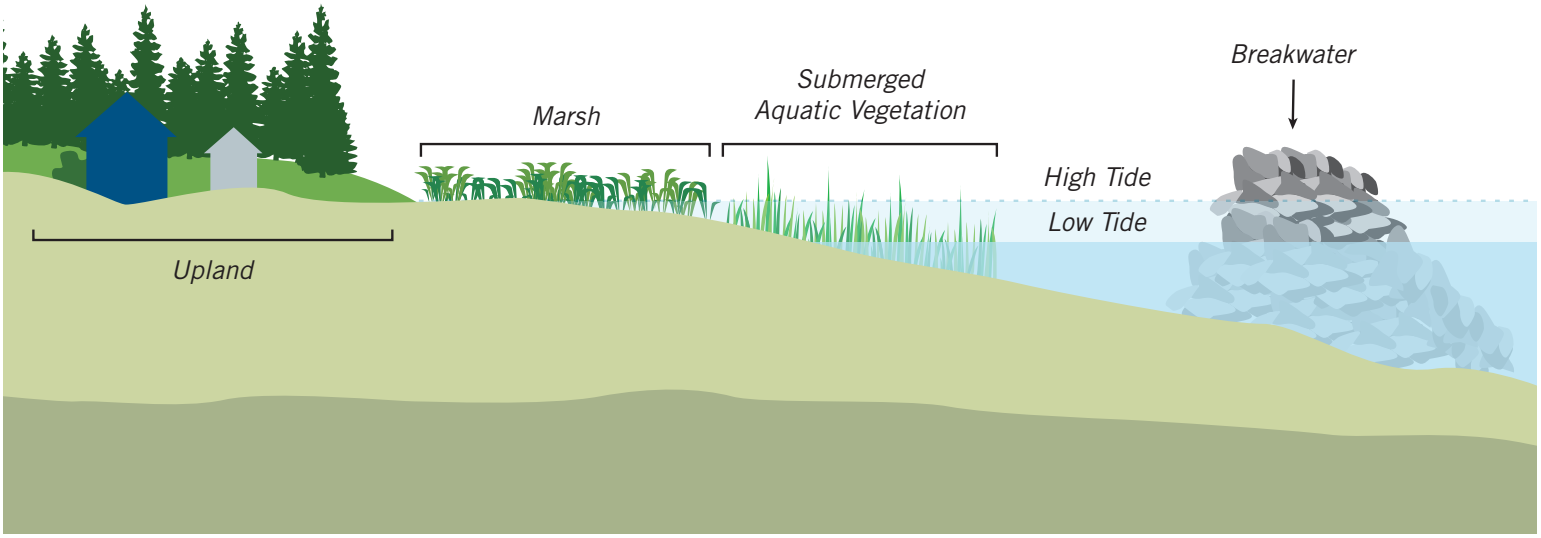
Living Reef Breakwaters

Living reef breakwaters function similarly to constructed breakwaters, but are built to provide habitat for baby oysters, mussels and other reef species to settle upon. Reef balls, oyster castles, bagged shell and other reef structures provide a durable and heavily-weighted substrate. Over time, large reef structures can form that not only serve as a natural breakwater, but also provide critical aquatic habitat.



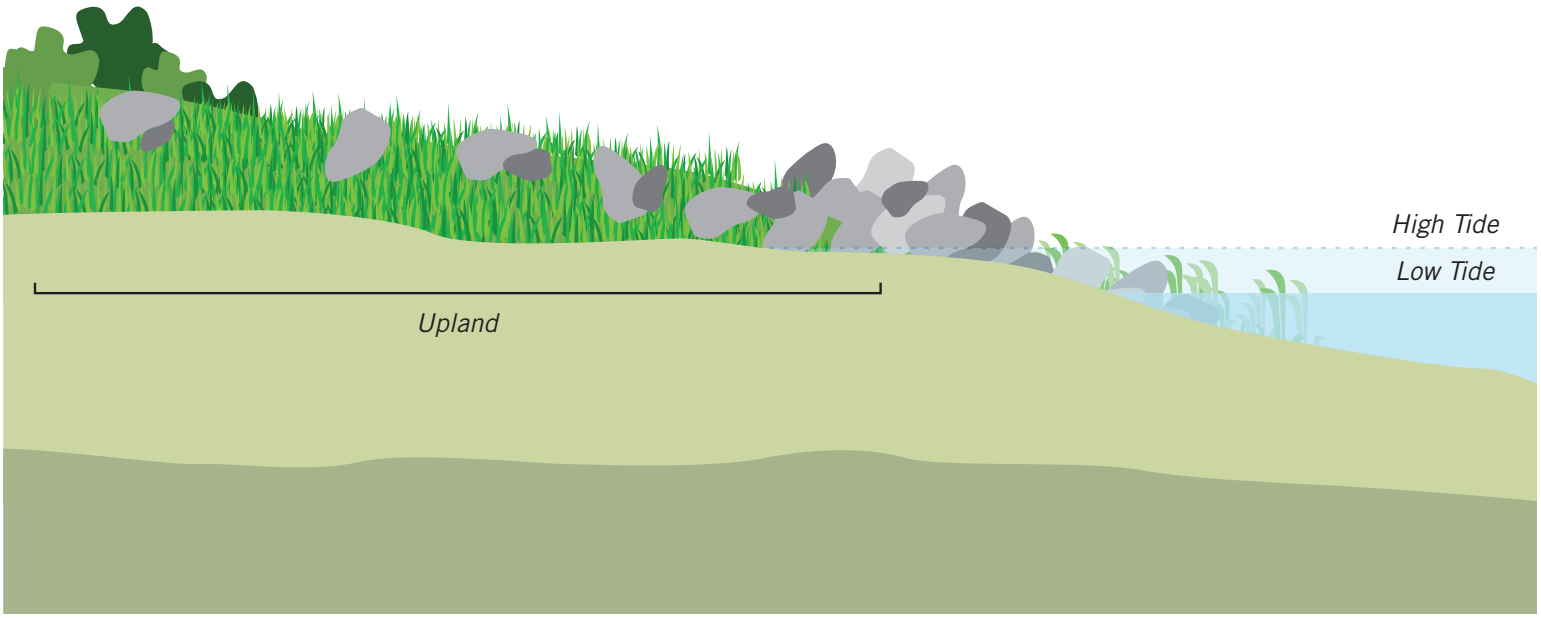
Breakwater

Breakwaters are typically constructed parallel to the shoreline and designed to reduce the amount of wave energy experienced by the shoreline directly behind them. Sometimes a vegetated (typically marsh) shoreline is established behind the breakwater. Unlike marsh sills, they are typically constructed in deeper water with more energetic waves. They also tend to be slightly larger and are typically visible at high tide.



Ecologically Enhanced Revetment

Ecologically-enhanced revetments are porous, vegetated structures attached to the shore. They are typically constructed from rock or broken up concrete, although other materials can be used (e.g., gabion baskets, rubble/debris, and even felled trees). They can be used at both open coastal locations and on lower energy sheltered areas.



Practical Considerations for Projects

Students take measurements at a new rock sill at Berkeley Island © Jon Miller/Stevens Institute of Technology

The Cost of a Living Shoreline Project

The cost of a living shoreline project will vary based on size, location, and complexity. Important factors that will determine the cost of a project include:

- Engineering and design of project*;
- Labor associated with the construction of the living shoreline;
- Shipping of materials;
- Accessibility of the project site for staging materials;
- Accessibility and procurement of bagged shell, oyster castle material and stone;
- Annual or bi-annual project monitoring and maintenance (e.g., additional vegetation plantings, removal of debris at the project site, possible repositioning of structural project components)
- Technique

Technique	Additional Benefits and Practical Considerations
Nature-Based Living Shoreline	This is the most natural shoreline restoration option and it is only applicable in low energy areas. Additional factors to consider include availability of oyster or clam shell and the procurement of coconut-fiber logs. Please note that the state of New Jersey does not currently allow live oysters to be "planted" in waters designated as closed to shellfish harvest. More information on cost and construction of nature-based living shorelines can be found in the Partnership for the Delaware Estuary's Practitioner's Guide.[5]
Beach Restoration	Depending on the location, beach restorations can provide habitat for shorebirds and other key species that also provide ecotourism opportunities (e.g., red knots and horseshoe crabs). Factors to consider include slope of the beach, wave energy, storm frequency, beach density (volume/unit length) and sand grain size, access to and transportation of material and labor.
Marsh Sill	Marsh sills are most appropriate in low-to-moderate energy environments. Factors to consider include erosion rate, tidal range, land slope, waves, currents, soil-bearing capacity, offshore depth, and more.
Living Reef Breakwater	Breakwaters attenuate higher energy waves further off the shore, ultimately reducing shoreline erosion. If breakwaters are designed to promote oyster setting, the development of a three-dimensional reef can improve water quality and support important fish species. Decisions to use bagged shell, Oyster Castles, rock, or marl should consider the need to stabilize the structures, and soil-bearing capacity. In addition, the state of New Jersey does not currently allow live oysters to be "planted" in waters designated as closed to shellfish harvest.**
Breakwater	Implementation of rock breakwaters in higher energy wave environments requires scrutiny of the soil substrate conditions (i.e., what type of ground will the breakwater be sitting on). Breakwaters will reduce wave energy, but careful attention should be placed on monitoring bottom scour, which can result in unforeseen negative consequences affecting adjacent coastal areas.**
Ecologically Enhanced Revetment	Although ecologically enhanced revetments can be used in a wide range of wave energy environments, this technique lacks the inherent environmental benefits associated with lower impact living shoreline projects. In addition, this technique stabilizes shorelines but does not accrete sediment. Therefore, it should only be considered in high energy environments and areas where other techniques will not work.

**For both Living Reef Breakwaters and Breakwaters, it is especially important to investigate permitting and licensing requirements early in the process. The U.S. Army Corps of Engineers has additional requirements given that breakwaters tend to be further offshore, and the New Jersey's Bureau of Tidelands will require a license if installing in a Tidelands area.

Planning and Constructing a Living Shoreline Project

Collecting site data at proposed living shoreline site in Little Egg Harbor Township © Martha Doyle/Barnegat Bay Partnership

Local conservation organizations, like those listed at the end of the guide, can be helpful advisors to municipalities that are interested in pursuing a living shoreline project. It's most useful to consult with local conservation groups, the landowner and permitting officials early in the planning process to ensure the highest likelihood of success. While the Coastal Resilience Tool provides information that informs the planning process, it is just the first step of the process. An effective planning process should include the steps below. These are not necessarily in order, but each is important to address at some point in the planning process. More information is also available in the Living Shoreline Best Practices Handbook[6] from the Partnership for the Delaware Estuary.

Effective planning process steps:

Engage property owner.
Property owners must be included in the planning and implementation of a living shoreline project from the outset to both minimize conflict and maximize project success.

Set project goals.
Goal setting should take priority in the planning process as it informs project design and monitoring. Determine what the project seeks to achieve (e.g., reduce erosion, reduce tidal flooding, etc.) and note the existing environmental conditions.

Determine a timeline.
Understanding time constraints for permitting and construction will heavily determine the timing of the funding, design, permitting, construction, and monitoring. Be sure to note all fixed dates for funding applications and consult with state and federal wildlife management agencies about the best time of year start a project to avoid disrupting fish and migrating and nesting birds.

Identify project partners.
Project partners can assist with design, implementation, monitoring, and maintenance of the project site. This can include conservation groups as well as community organizations interested in volunteering time and resources to the project.

Newly assembled Oyster Castles at the Gandy's Beach Preserve © TNC

Determine permitting requirements.
Consult with municipal, state, and federal officials to discuss project feasibility and permitting requirements. It is highly recommended to engage the NJDEP Coastal Land Use Office and the U.S. Army Corps of Engineers during the early planning stages of the project.

Develop your project budget and potential funding sources.
Budgets for living shoreline projects can vary greatly depending on size and scope. Contact funding sources to determine the most applicable possibilities, timelines for proposal submission, and how the timelines of a funding source match up with your project timeline.

Determine site conditions and develop conceptual design.
Work with engineers, ecologists, and marine contractors to gather initial information about the project site and develop a conceptual design. The Living Shorelines App[7] data should only be used as an initial screening tool. Collecting site-specific, on-the-ground information is critical to engineering and design.

Request Project Proposals.
With project goals, potential partners, site locations, and funding sources in hand, develop a request for proposals (RFP) that will give contractors the chance to provide cost estimates and proposals for the project. Traditional RFPs can be limiting in how contractors respond, so take advantage of this Procurement Guide for Nature-Based Solutions[8] to craft your RFP to get the best possible project ideas for your particular site.

Develop a monitoring plan.
Work with ecologists and engineers to develop a monitoring plan. Monitoring should begin with the collection of baseline data during the design process and continue for several years after construction depending on size and scope of your project. Guidance on developing a monitoring plan can be found on page 8 in A Framework for Developing Monitoring Plans for Coastal Wetland Restoration and Living Shoreline Projects in New Jersey.[9]

Plan for project construction.
Contact marine contractors to determine a construction schedule, access to materials, and pricing. Also, conduct site visits during preparation stages to monitor conditions. In preparation for the installation of the project, work with local conservation organizations to best coordinate volunteers, the construction schedule, preliminary site work, tools, access to the site and to galvanize media attention.

Hybrid living shoreline in Atlantic City © Bill Shadel/TNC

Budget Template

The budget categories in the budget template (Figure 2) are presented to show the range of costs associated with a living shoreline project. The materials listed are specific to a nature-based living shoreline that uses a combination of bio-logs and bagged shell. Please consult with engineers and ecologists to determine any other categories that should be included in a budget.

Creative partnerships with conservation and community groups can help reduce some costs. For example, it can save time and resources to contract with a conservation group to monitor projects and engaging community groups can both provide volunteer time for installation and maintenance (depending on the complexity and accessibility of the project).

NATURE-BASED LIVING SHORELINE BUDGET	
Materials	
Bio-logs / Coir (coconut-fiber) Logs - 12' x 12' - 60lbs	$-
Estimated total number of bio-logs required (12)	$-
Coir (coconut-fiber) Mat 6.6' X 165' (est. quantity: 3)	$-
Oyster Shell Bags (est. quantity: 600)	$-
Vegetation for planting	$-
Stakes for securing materials logs, etc. (est. quantity: 600)	$-
Tools (wheel barrows, sledge hammers, etc..)	$-
Materials Total	**$-**
Additional Costs	$-
Engineering Surveys and Design Contracts.	$-
Permit Application and License Fees.	$-
Transportation of Material. Rental of truck, boat, or barge	$-
Installation. Labor and materials for site preparation, installation of nature-based living shoreline, planting, and site-clean-up	$-
Monitoring. Labor and materials.	$-
Post-Construction Site Assessment. Labor and any materials to replant v egetation, replace bio-logs, etc.	$-
Annual maintenance. Any materials to repair from damages to the project site.	$-
Additional Total	**$-**
TOTAL PROJECT COSTS	**$-**

Figure 2. Sample project budget template

Potential Funding Sources

Nature trail in Perth Amboy © Elizabeth Schuster/TNC

Although project funding cannot be guaranteed, resources are available for communities to explore. Additional information, as well as a link to the particular funding source, is included below.

NFWF National Coastal Resilience Fund.[10]
National Fish and Wildlife Foundation in partnership with NOAA has created this fund to strengthen natural systems that can help communities increase preparedness and improve coastal resiliency. NFWF will award up to $30 million in grants to create, expand and restore natural systems in areas that will both increase protection for communities from coastal storms, sea and lake level changes, flooding, and coastal erosion and improve valuable habitats for fish and wildlife species.

U.S. Department of the Interior's Fish and Wildlife Service (USFWS), Coastal Program.[11]
To reinvest in conservation and coastal wetland ecosystems, the USFWS's Coastal Program utilizes tax revenue from hunting, boating, and fishing. A primary goal of the program is centered on seeking to help mitigate flooding and increase water quality. USFWS recently awarded nearly $19 million to 22 projects in 13 coastal states to protect, restore or enhance more than 30,000 acres of coastal wetlands and adjacent upland habitats under the National Coastal Wetlands Conservation Grant Program.

U.S. Environmental Protection Agency (EPA) Urban Waters Small Grants Program.[12]
The Urban Waters Small Grants program addresses urban runoff pollution to best serve community health benefits, with importance on underserved communities and award amounts of up to $60,000. The proposed project must take place entirely within one of the Eligible Geographic Areas. This program helps to influence how healthy and accessible urban waters can help to grow local businesses and enhance educational, recreational, social, and employment opportunities.

New Jersey Department of Environmental Protection (NJDEP) - Shore Protection Grants and Loans Program.[13]
To protect existing development from sea level rise, this NJDEP funding opportunity offers a cost share program whereby 25% of the cost is municipally funded and 75% of the cost is State funded. Loans are available from the State for the 25% of the cost owed by the municipality. For additional questions regarding qualification for this program contact the NJDEP Office of Engineering and Construction.

New Jersey Corporate Wetlands Restoration Partnership.[14]
The New Jersey Corporate Wetlands Restoration Project (NJCWRP) is a public-private partnership that helps fund a multitude of restoration work including living shorelines. The project must be in

New Jersey, have a Federal partner, and request less than $25,000. Each application is required to include a NJCWRP Project Executive Summary Sheet and a project location map.

FEMA Pre-Disaster Mitigation (PDM) Grant Program.[15]
FEMA offers funding aimed at reducing and mitigating flood risk to communities through its Hazard Mitigation Assistance Program. FEMA requires state, territorial, tribal, and local governments to develop and adopt hazard mitigation plans as a condition for receiving certain types of non-emergency disaster assistance, including funding for PDM mitigation projects. For more information on the mitigation plan requirement, visit the Hazard Mitigation Plan Requirement[16] web page.

Sustainable Jersey Grants Program.[17]
To support communities as they pursue sustainability programs, Sustainable Jersey provides tools, training, and financial incentives, including financial resources in the form of grants and incentives. Sustainable Jersey registered towns get special priority access and notification of incentives and grants and are eligible for the Small Grants program.

CLOCKWISE FROM TOP LEFT Erosion at a future living shoreline site on the Navesink River © Bill Shadel/TNC; Installing the cribbing for branch-box breakwaters to protect a shoreline in Point Pleasant. © Capt. Al Modjeski / American Littoral Society; Living shoreline installation off TNC's Gandy's Beach Preserve © Steve Jacobus/NJDEP

Governance and Permitting

2018 workshop on state and federal permits for living shoreline projects. © Patty Doerr/TNC

State and Federal Permitting

All living shoreline projects in New Jersey are subject to state and federal permitting requirements. Consult with permitting agencies early in your planning process—prior to the completion of formal designs—to ensure that the potential project can be permitted. Should there be any issues with conceptual designs, representatives from the state and federal agencies can provide recommended changes to the project design to help ensure a smooth permitting process.

State Permitting Requirements

N.J.A.C. 7:7 Coastal Zone Management Rules. These regulations enable living shoreline projects to be implemented under the State of New Jersey Department of Environmental Protection Division of Land Use Regulation (NJDEP DLUR). Lawfully this provision is recognized as Coastal General Permit 24 (N.J.A.C. 7:7-6.24.) Contact the NJDEP DLUR[18] with any questions or concerns regarding regulations and permitting.

Federal Army Corps of Engineers (USACE) Permit

Depending on the goals and design of a living shoreline project, it will need either a "nationwide" or "individual" permit before construction can begin. Nationwide Permit 54 allows property owners to implement living shoreline techniques for bank stabilization and erosion control. A Pre-Application Meeting Request Form is required to be completed prior to the NWP 54 application. If the Nationwide Permit is not applicable for your project, then the Individual Permit Application Submittal Form should be completed. For more information on the different permits and necessary forms, visit the USACE webpage.[19]

NJDEP Bureau of Tidelands Management

The State of New Jersey has ownership of New Jersey's tidelands. Tidelands are public lands considered to be land currently and previously flooded by the mean high tide of a natural waterway. To use these lands, written permission from the State and a payment are required. A Tidelands license or lease is required for structures (e.g., breakwaters or living reef breakwaters) that are constructed offshore and are situated anywhere in the tidelands. For more information about Tidelands, visit this page at NJDEP DLUR.[20]

Monitoring Project Success & Benefits

Monitor a project site © Erika Nortemann/TNC

Monitoring Plan

A successful living shoreline project will require some long-term maintenance and adaptive management. Monitoring the project over time will help you determine how well the project is holding up, if it is providing the expected benefits, and if it is impacting adjacent areas. If the project is falling short of your expectations, monitoring can help identify maintenance or adaptive management actions to make the project more successful. An additional benefit of monitoring is that lessons can be learned from the project and shared with living shoreline practitioners, regulators, and the public that will help to improve site selection, design, and maintenance of future projects.

A "how to" guide[21] for developing a monitoring plan for living shoreline and coastal restoration projects was developed in 2016. Monitoring plans, which can fit a range of budgets and expertise, should be developed alongside your engineering and design plans and should serve as a way to measure progress toward your project goals. Monitoring should begin prior to construction so that you will have baseline information to compare future, intended and unintended post-construction changes. Periodic monitoring of the same variables should continue after construction. It is important to monitor a project site after a strong storm so that any repairs or maintenance can happen quickly. In addition, be sure to contact NJ DEP's Division of Land Use Regulation[22] to discuss any additional monitoring requirements based on state regulations and check with your funding source to determine its monitoring requirements.

Oysters settle and grow on sub-tidal Oyster Castles © Adrianna Zito-Livingston/TNC

Additional Considerations for Project Planning and Permitting

Additional information on the design process and regulatory factors are discussed in the Stevens Institute of Technology Living Shorelines Engineering Guidelines.[23] For more information on regulatory factors, please refer to the Permits/Regulatory section on page 32 of that document.

Private landowners wishing to obtain a permit for a living shoreline may need sponsorship from a government or academic partner. For questions regarding permitting living shorelines you can contact Jill Aspinwall, Living Shorelines Project Coordinator at NJDEP's Office of Policy Implementation: Jill.aspinwall@dep.nj.gov

When identifying living shoreline project areas, impacts to adjacent properties should be considered. When examining on-the-ground conditions, shifts in wave energy and bottom scour that can result in unforeseen negative consequences to adjacent locations should be thoroughly examined by engineers and ecologists.

To ensure that the project enhances the ecosystem as much as possible, careful attention should be placed on the nature and quality of materials used to construct the project.

If the planting or seeding of commercial shellfish species (e.g., oysters) is included in the project plan, engage state officials and federal regulators early in project planning.

CLOCKWISE A site with a failing bulkhead can be a good candidate for a living shoreline © TNC; Osprey in natural nest © Damon Noe; Shell-bag reef immediately after construction © TNC

Additional Resources & References

Shorebirds feeding in the intertidal zone © Damon Noe/TNC

Several conservation non-profits, NJDEP, and academic partners throughout New Jersey, as well as federal partners, are actively involved in the identification, permitting, and monitoring of living shoreline projects. They welcome the opportunity to support projects throughout the state.

American Littoral Society (ALS).[24]
ALS provides resources for communities and project leads about habitat restoration and overall environmental health. It can also assist in the development and possible implementation of living shoreline projects.

Barnegat Bay Partnership (BBP).[25]
BBP can assist communities and planners in the development and possible implementation of living shoreline projects, including ways in which community outreach can help project success. Its primary focus is on Barnegat Bay.

NOAA Fisheries.[26]
NOAA resources can help communities and planners better understand habitat zones and living shorelines treatments.

NJ Department of Environmental Protection (NJDEP).[27]
NJDEP can assist communities and planners in better understanding State regulations concerning living shoreline management and permitting.

NY/NJ Baykeeper.[28]
The Baykeeper works to conserve the waterways and coastline of the NY-NJ Harbor Estuary, including repopulating the bays with oysters and creating sustainable habitat.

Partnership for the Delaware Estuary (PDE).[29]
PDE provides resources for communities and planners centered on implementation of living shorelines and scientific research in the Delaware Estuary.

Rutgers University's Center for Remote Sensing and Spatial Analysis (CRSSA).[30]
Rutgers CRSSA can be a useful resource to learn about geospatial information sciences, and to learn how mapping can be an effective tool for planning a project.

Society for Ecological Restoration (SER).[31]
SER resources include "Guidelines for Developing and Managing Ecological Restoration Projects"[32] and other publications that can help guide the development of ecological restoration projects.



THIS PAGE LEFT TO RIGHT Black skimmer feeding © Dan Pancamo; Cape May peninsula © TNC; Measuring bathymetry (submarine topography) © Martha Doyle/Barnegat Bay Partnership

Stevens Institute of Technology: NJ Coastal Protection Technical Assistance Service (CPTAS).[33]
Housed within the Coastal Engineering Research Laboratory, the CPTAS can help municipalities and planners to better understand the engineering parameters and design process for living shoreline implementation.

The Nature Conservancy in New Jersey.[34]
The Conservancy's resources can help communities and project leaders better understand coastal ecological benefits associated with living shoreline projects and assist in the development and possible implementation of living shoreline projects.

Stockton University Coastal Research Center (CRC).[35]
The CRC works on shoreline monitoring and assessment programs with the State of New Jersey and several municipalities. The CRC is also a resource for geotechnical data working on numerous projects with federal, state, and municipal governments.

USFWS Partners for Fish and Wildlife Program.[36]
The Partners Program provides technical and financial assistance to private landowners and Tribes to help meet the habitat needs of our Federal Trust Species. The Partners Program can assist with projects that conserve or restore native vegetation, hydrology, and soils associated with imperiled ecosystems (e.g., marshes, rivers and streams) or that otherwise provide habitat required for a rare, declining or protected species. USWFS field biologists work one-on-one with private landowners and other partners to plan, implement, and monitor their projects.

For more guidance on planning living shoreline projects.
NOAA's Guidance for Considering the Use of Living Shorelines 2015[37] outlines twelve guiding questions and answers for communities to consider when planning to install living shorelines and the Partnership for the Delaware Estuary developed a Living Shoreline Best Practices Handbook[38] based on their work in the Delaware Estuary to install nature-based living shorelines. The Naturally Resilient Communities[39] website offers a variety of case-study examples and documents that provide guidance through the planning process for implementing living shorelines.

A COMMUNITY RESOURCE GUIDE FOR PLANNING LIVING SHORELINES PROJECTS

List of Web Links in this Document

Field visit during the planning phase of a living shoreline project to protect this eroding marsh in West Wildwood. © The Nature Conservancy

Using the Coastal Resilience Tool

1 Coastal Resilience Tool
maps.coastalresilience.org/newjersey/#

2 Living Shorelines App
maps.coastalresilience.org/newjersey/#

3 User Guide for Living Shorelines App
https://maps.coastalresilience.org/newjersey/plugins/living-shorelines-nj/resources/UserGuide.pdf

4 Living Shorelines Engineering Guidelines
www.nj.gov/dep/cmp/docs/living-shorelines-engineering-guidelines-final.pdf

Practical Considerations for Projects

5 Practitioner's Guide: Shellfish-based Living Shorelines for Salt Marsh Erosion Control and Environmental Enhancement in the Mid-Atlantic
delawareestuary.s3.amazonaws.com/pdf/Living%20Shorelines/Final_DELSI%20Practitioners%20Guide_2012.pdf

Planning and Constructing A Living Shoreline Project

6 Living Shorelines in the Delaware Estuary: Best Practices from Lessons Learned and Information Collected by the Partnership for the Delaware Estuary and the Rutgers Haskin Shellfish Research Laboratory
delawareestuary.s3.amazonaws.com/pdf/Living%20Shorelines/living_shorelines_best_practices.pdf

7 Living Shorelines App
maps.coastalresilience.org/newjersey/#

8 Procurement Guide to Nature-Based Solutions
nrcsolutions.org/wp-content/uploads/2018/02/NBS_Procurement_Guide.pdf

9 A Framework for Developing Monitoring Plans for Coastal Wetland Restoration and Living Shoreline Projects in New Jersey
www.conservationgateway.org/ConservationPractices/Marine/crr/library/Documents/Framework-Coastal-Wetland-Shoreline-Projects-New-Jersey.pdf

Potential Funding Sources

10 NFWF National Coastal Resilience Fund
www.nfwf.org/coastalresilience/Pages/home.aspx

11 USFWS Coastal Program
www.fws.gov/coastal/

12 USEPA Urban Waters Small Grants Program
www.epa.gov/urbanwaters/urban-waters-small-grants

13 NJDEP - Shore Protection Grants and Loans Program
www.nj.gov/dep/grantandloanprograms/nhr_spgl.htm

14 New Jersey Corporate Wetlands Restoration Partnership
www.njcwrp.org/

15 FEMA Pre-Disaster Mitigation Grant Program
www.fema.gov/pre-disaster-mitigation-grant-program

16 FEMA Hazard Mitigation Plan Requirement
https://www.fema.gov/hazard-mitigation-plan-requirement

17 Sustainable Jersey Grants Program
www.sustainablejersey.com/grants-resources/sustainable-jersey-grants-program/

Governance and Permitting

18 NJDEP Division of Land Use Regulation
nj.gov/dep/landuse/coastal/cp_main.html

19 Army Corps of Engineers Permit
www.usace.army.mil/Missions/Civil-Works/Regulatory-Program-and-Permits/Obtain-a-Permit/

20 NJDEP Bureau of Tidelands Management
www.nj.gov/dep/landuse/tl_main.html

Monitoring Project Success & Benefits

21 A Framework for Developing Monitoring Plans for Coastal Wetland Restoration and Living Shoreline Projects in New Jersey
https://www.conservationgateway.org/ConservationPractices/Marine/crr/library/Documents/Framework-Coastal-Wetland-Shoreline-Projects-New-Jersey.pdf

22 NJDEP Division of Land Use Regulation
www.nj.gov/dep/landuse/index.html

23 Living Shorelines Engineering Guidelines
www.nj.gov/dep/cmp/docs/living-shorelines-engineering-guidelines-final.pdf

Additional Resources & References

24 American Littoral Society
www.littoralsociety.org/

25 Barnegat Bay Partnership
www.barnegatbaypartnership.org/

26 NOAA Fisheries
www.fisheries.noaa.gov/insight/understanding-living-shorelines

27 NJ Department of Environmental Protection
www.state.nj.us/dep/opi/living-shorelines.html

28 NY/NJ Baykeeper
nynjbaykeeper.org/

29 Partnership for the Delaware Estuary
www.delawareestuary.org/science-and-research/living-shorelines/

30 Rutgers University's Center for Remote Sensing and Spatial Analysis
crssa.rutgers.edu/

31 Society for Ecological Restoration
www.ser.org/

32 Guidelines for Developing and Managing Ecological Restoration Projects
cdn.ymaws.com/www.ser.org/resource/resmgr/custompages/publications/ser_publications/Dev_and_Mng_Eco_Rest_Proj.pdf

33 Stevens Institute of Technology: NJ Coastal Protection Technical Assistance Service
www.stevens.edu/research-entrepreneurship/research-centers-labs/davidson-laboratory/facilities-centers/coastal-engineering-research-laboratory-cerl

34 The Nature Conservancy in New Jersey
www.nature.org/en-us/about-us/where-we-work/united-states/new-jersey/

35 Stockton University Coastal Research Center
www.stockton.edu/coastal-research-center/

36 USFWS Partners for Fish and Wildlife Program
www.fws.gov/partners/aboutus.html

For more guidance on planning Living Shoreline Projects

37 NOAA's Guidance for Considering the Use of Living Shorelines 2015
www.habitatblueprint.noaa.gov/wp-content/uploads/2018/01/NOAA-Guidance-for-Considering-the-Use-of-Living-Shorelines_2015.pdf

38 Living Shorelines in the Delaware Estuary: Best Practices from Lessons Learned and Information Collected by the Partnership for the Delaware Estuary and the Rutgers Haskin Shellfish Research Laboratory
delawareestuary.s3.amazonaws.com/pdf/Living%20Shorelines/living_shorelines_best_practices.pdf

39 Naturally Resilient Communities
nrcsolutions.org/

A COMMUNITY RESOURCE GUIDE FOR PLANNING LIVING SHORELINES PROJECTS

Living Shoreline Case Studies

A natural armor, this colony of ribbed mussels helps protect this stretch of shoreline on Mordecai Island. © Bill Shadel/TNC

LIVING SHORELINE CASE STUDY

Shoreline at 30 Hubbard Park showing failing wooden bulkhead and severe erosion. © Bill Shadel/TNC

Red Bank Private Residence

The primary goal of this project is to restore the shoreline using natural and nature-based features rather than hardening the shoreline.

The residential property at 30 Hubbard Park is situated on the Navesink River in Red Bank, NJ. In the 1970s, a wooden bulkhead was installed well above the high tide behind a sloping beach and wetland. Since then, the shoreline has been eroded significantly by storm-driven waves and the bulkhead is now failing. A typical high tide now reaches much further inland—far past the old bulkhead toward the driveway—and the sandy beach has eroded away completely.

The primary goal of this project is to restore the shoreline using natural and nature-based features rather than hardening the shoreline. The family was interested in restoring habitat for fish and shellfish. They also expect that a living shoreline will be more naturally resilient in the face of rising sea levels and more frequent, more severe storms.

This project started when Dr. Mary Lee contacted NJDEP about her failing bulkhead. When NJDEP suggested a living shoreline, she contacted firms specializing in their design and construction and the hired a firm to perform a site assessment, prepare a project design, and submit permit applications. The Lee family could have easily replaced their bulkhead, but they wanted to something longer lasting, natural and resilient and hope that other property owners in the region will learn from their example.

Overview

Living Shoreline Type
Marsh sill

Project Location
Red Bank, NJ

Project Lead
Dr. Mary Lee

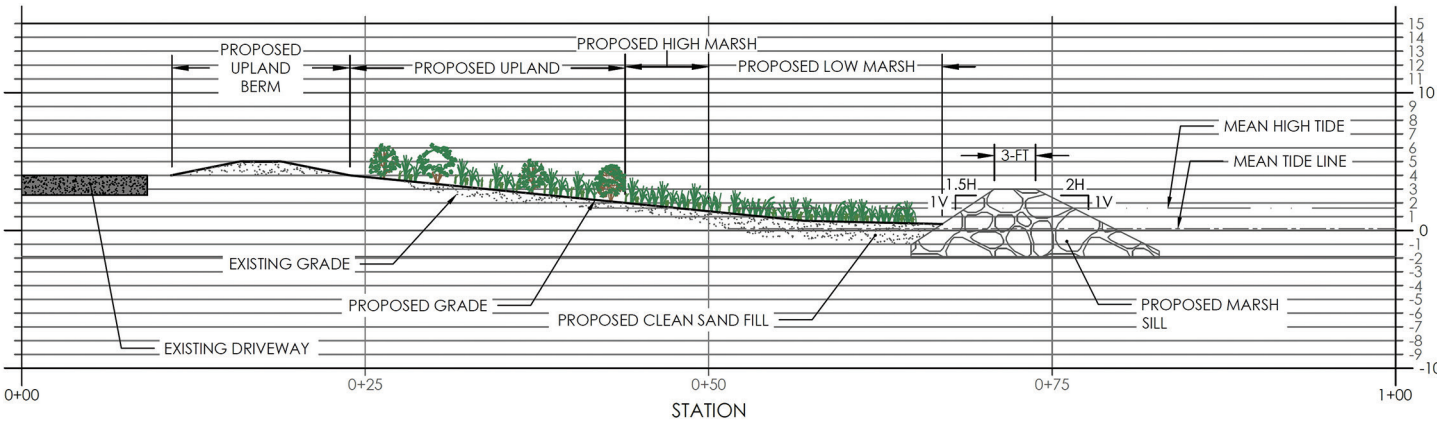
Point of Contact
Kelly Klein, Senior Project Manager for Princeton Hydro
kklein@princetonhydro.com

Land Owner
The Lee Family

Project Funders
The Lee Family, The Nature Conservancy

Project Partners and Contractors
Lee Family, Princeton Hydro, USFWS Partners for Fish and Wildlife Program, Enviroscapes Inc.

Red Bank: Private Residence Living Shoreline



Cross section view of the living shoreline: marsh sill, regraded sloping shoreline including low and high marsh. © Princeton Hydro

Living Shoreline Features

Marsh Sill: Constructed from rock to abate energy from wind-driven waves

Regraded Shoreline: Restore and stabilize a vegetated sloping shoreline, planted with species appropriate for low-marsh, high-marsh, and maritime upland.

Naturalized swale: Wide, shallow planted ditch that allows excess rainwater or tidal water to flow from upland to the river.

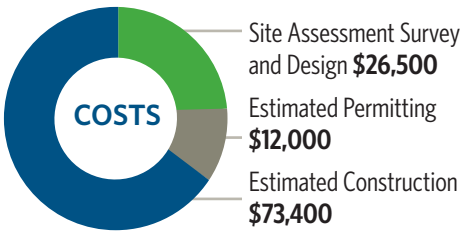
Upland berm: Constructed of soil in the upland and planted with lawn grass, the berm provides further protection of the upland from high river water. It also helps direct through the swale the water draining from upland to the river.

Project Status

The Lee family secured $10,000 from The Nature Conservancy's Living Shorelines Small Grant Program to help pay for site assessment and design, and the family continues to seek grants to defray the cost of moving forward with this project. The application for state and federal permits is delayed by a lack of information about the ownership of an adjacent property: a narrow parcel with a stormwater pipe. It is likely owned by either the Borough or the County, but historical records appear unavailable. Because the pipe's outfall area needs armoring to protect the side of the Lee's property and shoreline, and because NJDEP requires notification to nearby landowners, the project team is working to resolve ownership in order to move forward with the project.

Total Estimated Project Cost $111,900

(as of July 2019)



Project Champion

Dr. Mary Lee

Dr. Lee co-owns the property at 30 Hubbard Park with her siblings, Greg and Nancy. It was their childhood home. Their father, an engineer, designed and built the existing bulkhead in 1970. At the time it was constructed, the bulkhead was well above high tide in the upland area of the property. (More than 30 years later, the failing bulkhead now sits below mid-tide.) Having grown up on the Navesink River skiing, fishing, and swimming, the three children formed an early connection to the river and its wildlife, and this has continued through adulthood. Mary understood that, to avoid further loss of their property and increased flood risk, they needed to act.

The Nature Conservancy New Jersey

The Nature Conservancy in New Jersey
200 Pottersville Road
Chester, NJ 07930
nature.org/newjersey

CRF CLIMATE RESILIENCE FUND

TNC's Living Shorelines Incentives Program was supported, in part, by the Climate Resilience Fund

LIVING SHORELINE CASE STUDY

The marsh experience 2 forms of energy degradation; undercutting of the marsh edge & top-down surface erosion. © Bill Shadel/TNC

Lighthouse Center Shoreline Stabilization Project

The primary goal of the hybrid living shoreline—the first phase in the overall restoration plan—is to reduce the rate of shoreline and marsh loss caused by wave energy and allow the beach to re-establish itself.

The Lighthouse Center for Natural Resource Education is on the western shoreline of Barnegat Bay nearly opposite Barnegat Inlet. It is an environmental education and research center situated on one of the last undeveloped bay-front. The 194-acre site includes a suite of coastal habitats including maritime forest, mudflats, lagoons, fields, salt marshes, and a small artesian spring. The site receives significant public use, with thousands of visitors each year including schools, community groups, and researchers.

Over the past 50 years, the Lighthouse Center's marsh and shoreline have suffered extensive degradation, predominantly from historic mosquito-management, farming, sea-level rise, chronic boat wakes, and severe storms. Recently, the rate of shoreline loss has increased to an average of 4 feet per year. The degraded marsh and shoreline have made the Lighthouse Center's facilities more vulnerable to coastal flooding. After suffering significant damage during Hurricane Sandy, the Foundation recognized the need to restore the shoreline and marsh and convened experts to develop a restoration plan.

Overview

Living Shoreline Type
Breakwater

Project Location
Waretown, NJ

Lead Organization
Natural Resource Education Foundation of New Jersey (the Foundation)

Point of Contact
Pola Galie, Operations Manager, Lighthouse Center for Natural Resource Education, pgalie@nrefnj.org

Land Owner
New Jersey Department of Environmental Protection, Division of Fish and Wildlife

Project Funders
Natural Resource Education Foundation of New Jersey, The Nature Conservancy

Project Team
Natural Resource Education Foundation of New Jersey, Sovereign Consulting, Ocean County Soil Conservation District, Academy of Natural Sciences of Drexel University, Barnegat Bay Partnership.

Waretown, NJ: Lighthouse Center Shoreline Stabilization Project

3.5-ft.-highWADs being installed to create a breakwater at the Seagrass Plantation Restoration Site in Delaware © Douglas Janiec

Project Description

The primary goal of the hybrid living shoreline the first phase in the overall restoration plan—is to reduce the rate of shoreline and marsh loss caused by wave energy and allow the beach to re-establish itself. Once this is done, the next phases—restoration of the marsh edge and platform—are more feasible.

Experts from academic institutions, non-profit conservation organizations, consulting firms, and other stakeholders provided insight and developed a conceptual restoration plan for the property including a living shoreline, marsh restoration, and hydrological improvements. The first step was to design and implement a living shoreline to protect and restore 1,600 feet of natural shoreline. To assess the current condition of the site, the Foundation employed Sovereign Consulting—a firm experienced in nature-based coastal restoration—and partnered with Drexel University. With the site assessment completed, a design was created for a living shoreline that would reduce wave energy before it reached the marsh and allow sediment to accrete passively along the shoreline.

Living Shoreline Features

Wave Attenuation Devices (WADs®)

The design calls for WADs along the 1,600-foot shoreline. WADs® are hollow concrete structures specially designed to dampen wave energy and create accretion landward. The structures allow wildlife passage and the natural exchange of water and sediment in the shorezone, and their holes provide refuge for smaller fish. As large as they are, their weight is distributed over a wide base, resulting in less pressure on the bottom than a person's foot.

Shorter, 3.5-ft.-high WADs® will be installed parallel to the northern shoreline where the elevation is higher. Taller, 7-ft.-high WADs® will be installed parallel to the southern shoreline where the elevation is lower. To properly size and place the WAD® units, Sovereign modeled potential significant flooding for existing and proposed site conditions.

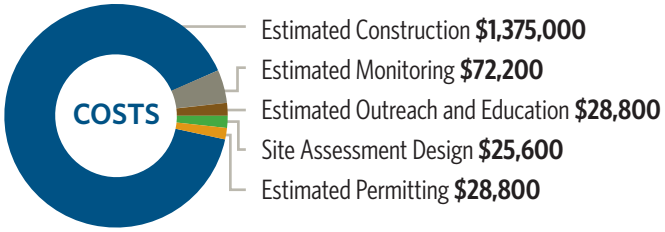
Project Status

The Foundation is actively seeking funds for permitting and installation of the hybrid living shoreline. As of July 2019, the design is complete, and the necessary permits have been identified but permit applications have not yet been prepared or submitted.

Costs

Note: Below are cost estimates to build a 1,600-foot WAD® breakwater along the entire shoreline and to restore 0.2-acres of marsh, which are Phase 1 of a larger restoration plan.

Estimated Total Project Cost $1,530,400



The Nature Conservancy New Jersey

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nature.org/newjersey

CRF CLIMATE RESILIENCE FUND

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LIVING SHORELINE CASE STUDY

The western shoreline of Mordecai Island: undercutting and slumping of the marsh edge caused by wave energy. © Bill Shadel/TNC

Mordecai Island

The goal of this project is to reduce wave energy reaching the marsh edge, capture sediment, and provide suitable habitat for oyster settlement.

Mordecai Island is an undeveloped marsh island situated near the densely developed Long Beach Island. The 45-acre island buffers 30 percent of Beach Haven's bayside shoreline, protecting the community from waves and storm surge. Its deteriorating condition prompted the formation of the Mordecai Land Trust, which purchased the island in 2001 and has been responsible for its stewardship ever since.

The western shoreline of Mordecai Island had severely eroded over decades from storms and boat wakes (the Intracoastal Waterway was moved closer to the island in 1945). In the mid-1980s, the erosion created a cut that split the island fully in two. Since 2006, the Land Trust has been piloting various natural and hybrid living shoreline projects along segments of the island's western shore.

Project Description

Multiple living shoreline projects were installed along segments of the shoreline. In 2010, sand-filled geotube sills were installed. In 2017, '18, and '19, a series of Oyster Castle® breakwaters and sills were constructed. All of the project management and construction labor was provided by volunteers, saving significant cost.

Overview

Living Shoreline Type
Breakwater, Marsh Sill

Project Location
Beach Haven, NJ

Lead Organization
Mordecai Land Trust

Point of Contact
Jim Dugan, Vice President, Mordecai Land Trust, jimdugan@comcast.net

Land Owner
Mordecai Land Trust

Project Funders
(2018 breakwater and sills): Mordecai Land Trust, Atlantic City Electric, The Nature Conservancy

Project Team
(2018 breakwater and sills): Mordecai Land Trust, ReClam the Bay, USFWS Partners Program

Beach Haven, NJ: Mordecai Island Living Shoreline

Features of this living shoreline

Geotube sills (top): Installed in 2010, two heavy-duty polypropylene tubes filled with fine sand were installed parallel to the shoreline to intercept oncoming waves. Oyster Castle® Breakwater (center): Units were assembled in a larger pod to form a breakwater a few units were seeded with oyster spat to jump-start shellfish settlement (Mordecai Land Trust). Marsh sills (bottom): Oyster Castles® were assembled in smaller pods along the marsh edge to stem erosion, trap sediment, and encourage plant growth (Mordecai Land Trust).

The Land Trust has approached each of these installations as a way to learn and inform future work. Therefore, they have a robust monitoring plan: shoreline position, wave attenuation (of the breakwaters), and nearshore bathymetry. In addition, monitoring is performed on nesting birds (including threatened and endangered species) and other wildlife, such as diamondback terrapins. Adaptive management and maintenance of the living shoreline features is ongoing.

Project Champion

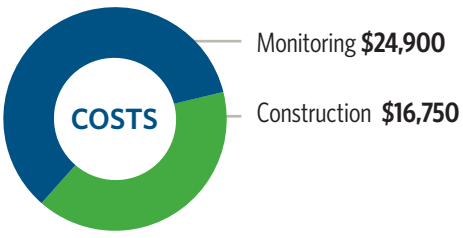
Jim Dugan

Jim Dugan has dedicated several years of his life to Mordecai Island. A business owner and engineer, Jim has led the restoration efforts at Mordecai Island, donating countless hours to protecting and restoring the shoreline of Mordecai Island. It was Jim's responsibility to install the island's first living shoreline feature (the geotube sills) and he managed the entire process. He has led many volunteer workdays to build the breakwaters and marsh sills and continues to share the lessons learned from the project.

Costs

Note: Below is the cost breakdown for the breakwater and five sills installed in 2018. Because so much of the work at Mordecai Island—project management, design, permit applications, construction labor, and some monitoring—is done by volunteers, the costs have been very low.

Total 2018 Project Costs $41,650



The Nature Conservancy
New Jersey

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Chester, NJ 07930
nature.org/newjersey

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CLIMATE RESILIENCE FUND

TNC's Living Shorelines Incentives Program was supported, in part, by the Climate Resilience Fund

LIVING SHORELINE CASE STUDY

"Before" conditions at Shore Avenue Park, looking toward the manmade lagoon at the end of 12th St. © Owen Little and Associates

Shore Avenue Park

The project goal is to slow the rate of shoreline loss and ultimately build back shoreline.

Shore Avenue Park is situated next to Causeway Bridge, which connects Long Beach Island to the mainland. Heavily used year-round, the park has many amenities including a boat ramp, walking trails, pavilion, fishing pier, playground, and comfort station. With its shoreline rapidly eroding from boat wakes and high currents, the park is not only suitable for a living shoreline, but the high visitation of the park will allow it to serve as a demonstration site. The Borough prides itself on being proactive and environmentally conscious, so when it was evident to the town engineers and municipal officials that action was needed, they were excited for the opportunity to take an innovative and greener approach to shoreline protection.

Project Description

The park was severely affected by Superstorm Sandy, which damaged the park's infrastructure and its shoreline. The Borough's Department of Public Works was able to make repairs in time to re-open for the summer season, but a long-term solution to protect the shoreline was needed to stem the loss of property. Municipal engineers began to evaluate the site and gather information to pursue design and construction of a living shoreline on the site. Borough representatives attended a workshop, organized by The Nature Conservancy, where they were able to discuss feasibility of their living

Overview

Living Shoreline Type
Marsh Sill

Project Location
Ship Bottom, NJ

Project Lead
Borough of Ship Bottom

Point of Contact
Frank J. Little, Jr., Borough Engineer, flittle@owenlittle.com

Land Owner
Borough of Ship Bottom

Project Funder
The Nature Conservancy

Project Team
Borough of Ship Bottom, USFWS Partners for Wildlife Program, Landscape Architect Bryce Bennett

Ship Bottom, NJ: Shore Avenue Park Living Shoreline

Example of a marsh sill from a site in the Chesapeake Bay Estuary. © Chesapeake Bay Trust.

shoreline project with state and federal regulators. Encouraged by the positive response, the Borough's engineers submitted a proposal to and were then awarded a grant from The Nature Conservancy's Living Shorelines Grant Program to fund project design and permitting.While the project was still in the design phase, the Borough purchased a subtidal in-holding – an underwater piece of land owned by another party. Not only did this purchase ease the permitting and eventual construction phases of the project, it also demonstrated the Borough's commitment to constructing a living shoreline at Shore Avenue Park. The project goal is to slow the rate of shoreline loss and ultimately build back shoreline. The project's design consists of nearshore rock sills parallel to shore to intercept onshore waves and fast currents. The sills will be backfilled using as much onsite soil as possible and this will be graded into a gentle slope. A space between the sills will allow the passage of sediment and wildlife. Riprap already present on the shoreline will be re-used to construct the sills, serving the added purpose of clearing the upland for grading and planting. Native species of trees and shrubs will be planted between the upland edge and the parking area, enhancing soil stability, providing food for birds and insects, and beautifying the park.

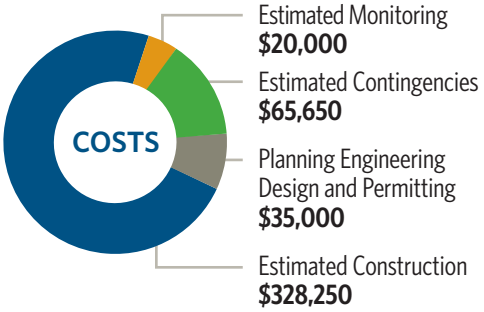
Living Shoreline Features

Marsh Sill: Constructed from granite riprap to abate energy from wind-driven waves

Regraded Shoreline: Restore a natural sloping shoreline planted with low marsh and high marsh plants to stabilize the upland edge

Plantings: Low-marsh and high-marsh plants to trap and hold sediment, stabilize the shoreline, and slow water flow.

Estimated Total Project Cost
$448,900
(as of July 2019)



Project Status

The Borough is actively seeking funds for permitting and installation of the living shoreline. As of July 2019, the design is complete, and the necessary permits have been identified but permit applications have not yet been prepared or submitted.

Key Lessons Learned

- When planning or designing a living shoreline,consider engaging a landscape architect on your project team. A landscape architect can bring an understanding of the natural landscape, wildlife habitat needs, and aesthetics, all of which complementthe expertise of an engineer.
- Investigate land ownership thoroughly within and nearby your area of interest. The Borough was grateful that the inholding land owner was willing to sell to the Borough, otherwise the project might have been delayed while anagreement was struck.
- Innovative projects like livingshorelines require a great deal of advance planning and high-quality information on tidesand currents.The Borough was fortunatethat local datais provided bya tide station near the project site.

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TNC's Living Shorelines Incentives Program was supported, in part, by the Climate Resilience Fund

LIVING SHORELINE CASE STUDY

Branchbox breakwaters just filled with re-purposed Christmas trees. First tree vane installed (right foreground). © Bill Shadel/TNC

Slade Dale Christmas Tree Breakwater

The primary goal of this living shoreline project is to reduce the loss of marsh within the Sanctuary to maintain wildlife habitat and a natural buffer against flooding.

Slade Dale Sanctuary (left) is a 13-acre preserve located along Beaverdam Creek in Point Pleasant, NJ. It is one of the largest protected open spaces in the town. The Sanctuary is open to the public and features trails with habitats supporting a variety of birds and other wildlife. In the face of sea-level rise and storms of increasing frequency and intensity, the community became aware that both the Sanctuary and the surrounding residential properties were vulnerable if they didn't take action.

Project Description

The primary goal of this living shoreline project is to reduce the loss of marsh within the Sanctuary to maintain wildlife habitat and a natural buffer against flooding.

The Slade Dale Living Shoreline was initiated by a member of the Point Pleasant Environmental Commission. He reached out to The American Littoral Society (ALS), a non-profit coastal conservation organization with experience in habitat restoration and living shorelines. ALS staff then visited the Sanctuary and met with the Mayor and other Borough officials who were willing to contribute funds toward project design and implementation. ALS secured a grant to supplement

Overview

Living Shoreline Type
Breakwater

Project Location
Point Pleasant, NJ

Lead Organization
American Littoral Society (ALS)

Point of Contact
Capt. Al Modjeski, Habitat Restoration Program Director, alek@littoralsociety.org

Land Owner
Borough of Point Pleasant

Project Funders
NOAA Restoration Center, Point Pleasant Rotary Club, Borough of Point Pleasant, The Nature Conservancy, NJ Coastal Wetland Restoration Partnership

Project Team
American Littoral Society, Borough of Point Pleasant, Princeton Hydro, USFWS Partners Program, Point Pleasant Rotary Club, Good Shepherd Lutheran Church, Atlantic Lifts Dock and Bulkhead, Seapoint Condominium Association, NJDEP, Pinelands Nursery

Point Pleasant, NJ: Slade Dale Christmas Tree Breakwater Living Shoreline

project costs. To assess the site and design the living shoreline, ALS hired Princeton Hydro, an engineering firm with the right expertise for designing a project with an ecological goal.

The design called for branchbox breakwaters parallel to shore and near-shore tree vanes perpendicular to shore. The material used in these structures could be locally sourced from the community at a very low cost – discarded Christmas trees! Constructing the first Christmas-tree breakwater in the state required coordination and cooperation. The Borough contributed public works staff time and trucks to collect the trees from residents and stage them at a local church. In late 2018, a local contractor installed the branchbox cribbing and, in spring of 2019, volunteers filled the branchboxes with Christmas trees.

Living Shoreline Features

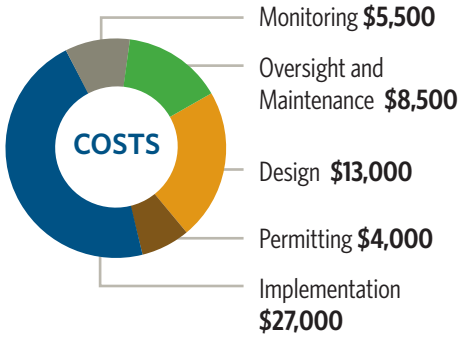
Two types of structures work together to slow water and trap sediment:

Branchbox Christmas tree breakwaters (above): Wooden pilings were driven into the bottom in double rows to create cribbing and re-purposed Christmas trees were placed in between and secured by volunteers. Oriented parallel to shore, the breakwaters will intercept and dissipate wave energy that would otherwise have hit the marsh edge. In addition, mesh bags filled with recycled shell were tied together and used as weights to better anchor the trees and to also provide more diverse habitat for fish and invertebrates.

Christmas tree vanes: Starting at the shoreline, single rows of Christmas trees were placed end-to-end to form a chain—slightly perpendicular to shore – and secured to the bottom. This will help stabilize the eroding shoreline and trap sediment introduced into the water column from the energy dissipation of the living branchbox breakwaters.

Volunteers carefully place and secure Christmas trees to branch boxes. © Princeton Hydro

Total Project Cost $58,000



Project Champion

Dennis Blazak

Dennis Blazak is a resident of Point Pleasant, member and Past President of the Point Pleasant Rotary Club, and he also serves on the Environmental Commission. In his own words, he started the Slade Dale Project because he wanted to see positive actions to increase storm resiliency in his hometown. Dennis personally advocated for a grant of $4,000 from the Rotary Club to fund the permitting phase of the project and a was driving force in the community that ultimately led to the project being implemented. Dennis believes it is imperative for people at the local level to identify and advocate for projects that will make a difference in their community!

The Nature Conservancy New Jersey

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Passive accretion and plant colonization at natural living shoreline. © Partnership for the Delaware Estuary

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