

Engineering Guidelines for Living Shorelines Projects (2022 Update)

What is a Living Shoreline?

New Jersey's Coastal Zone Management Rules define a living shoreline as a "shoreline management practice that addresses the loss of vegetated shorelines, beaches, and habitat in the littoral zone by providing for the protection, restoration or enhancement of these habitats" (N.J.A.C. 7:7-1.5). While originally applied only to marsh sill projects, the term "living shoreline" has evolved to take on a broader meaning which encompasses a wide variety of projects that incorporate ecological principles into engineering design.

Why Develop Guidance?

This guidance was developed to provide project designers, regulators, property owners, and others with a consistent framework to ensure that living shorelines projects built within the State of New Jersey are designed, permitted, and constructed in a consistent manner using the best available information. This includes increasing awareness of state initiatives designed to encourage implementation of strategies which lead to increased coastal resilience such as the Climate Change Resilience Strategy, Sea Level Rise Guidance, and Coastal General Permit 24 (N.J.A.C. 7:7-6.24).

Design Approach

The approach taken in developing the guidelines was to identify the set of factors which most frequently play a critical role in the success or failure of a living shorelines project, and then to outline a methodology for taking these factors into consideration when designing a project. The integration of living components into coastal stabilization projects means that parameters which affect the natural components of a project must be considered in addition to the traditional engineering parameters. In alignment with the International Guidelines on Natural and Nature-Based Features for Flood Risk Management (IGNNBF), living shorelines are traditionally completed in phases. During the Scoping Phase, a general understanding of the site and a clear understanding of the intended outcomes is developed. During the Planning Phase, more detailed information about the site conditions is collected and one or more conceptual designs are generated. During the Implementation Phase, additional information is collected as required to generate final designs and construction specifications. Finally, during the Operations Phase, monitoring is performed to inform maintenance and adaptive management actions. Typical living shorelines design parameters are presented in the left sidebar on the next page of this document.



Figure 1. Example of living shoreline design implementation.

Scoping	Planning	Implementation	Operations
<p>At the scoping stage, generally only a limited amount of information is needed to assess the possibility of applying a nature-based technique at a site.</p> <p>At this stage it is critically important that the project objectives, as well as any potential limitations be identified and communicated.</p> <p>The project designer is encouraged to contact the New Jersey Department of Environmental Protection (NJDEP) Office of Policy and Coastal Management to identify any potential regulatory issues.</p>	<p>Living shorelines projects can take many different forms. Site complexity combined with unique project specific objectives and constraints drive constant innovation; however, some approaches can be considered "traditional".</p> <p>Some of the more traditional approaches and the conditions under which they have been found to be appropriate are shown in Table 1 on the back page; ranges for these parameters are defined in Table 2.</p> <p>Typically, a preliminary site visit and a desktop analysis are enough to obtain reasonable estimates of many of the site parameters. Site characterization data collected during the Planning Phase is generally sufficient to generate conceptual designs consisting of a proposed layout (plan and cross-section) and estimates on the quantity and type of materials to be used.</p>	<p>The final project design should be based on a higher-level analysis of the factors considered critical to the performance of the specific alternative selected such as through field data collection and/or numerical modeling. Parameters considered critical to the success of each approach are bolded in Table 1.</p> <p>It should be noted that each project is different; thus, the critical parameters requiring deeper analysis will vary from project to project.</p>	<p>The IGNNBF stresses the importance of monitoring for both the purpose of assessment and adaptive management.</p> <p>Assessment is deemed critical for both documenting the benefits of living shorelines and improving future design.</p> <p>Current best practice calls for incorporating adaptive management into the design and permitting of living shorelines. Specifically, adaptive management manages risk related to uncertainties related to climate change and future interactions between various aspects of the hydrodynamic, morphologic, ecologic, economic, and social landscapes.</p>

Design Parameters

System

Erosion History
Sea Level Rise
Tidal Range

Hydrodynamic

Wind Waves
Wakes
Currents
Ice
Storm Water Level

Terrestrial

Upland Slope
Shoreline Slope
Width
Nearshore Slope
Offshore Depth
Soil Bearing Capacity

Ecological

Water Quality
Sunlight Exposure
Soil Type

Additional Considerations

Permits/Regulatory
End Effects
Constructability
Native/Invasive Species
Debris Impact
Project Monitoring

Adaptive Management Beneficial Reuse

Added since 2016

*Changed from "storm surge" in
2016 Framework***

Table 1. Appropriate conditions for three common living shoreline approaches.

	Marsh Sill	Breakwater	Living Reef
System Parameters			
Erosion History	Low-Med	Med-High	Low-Med
Sea Level Rise	Low-Mod	Mod-High*	Low-Mod
Tidal Range	Low-High*	Low-High	Low-Mod
Hydrodynamic Parameters			
Wind Waves	Low-Mod	Mod-High*	Low-Mod
Wakes	Low-Mod	Mod-High*	Low-Mod
Currents	Low-Mod	Low-High*	Low-Mod
Ice	Low	Low-High*	Low
<i>Storm Water Level</i>	Low	Mod-High	Low
Terrestrial Parameters			
Upland Slope	Mild-Mod*	Mod-Steep*	Mild-Mod*
Shoreline Slope	Mild-Mod	Mild-Steep	Mild-Mod
Width	Mod-High	Mod-High	Mod-High
Nearshore Slope	Mild-Mod	Mild-Mod	Mild-Mod
Offshore Depth	Shallow-Mod	Mod-Deep	Shallow-Mod
Soil Bearing	Mod-High	High	Low-Mod*
Ecological Parameters			
Water Quality	Poor-Good	Poor-Good	Good
Soil Type	Any	Any	Any
Sunlight Exposure	Mod-High	Low-High	Mod-High

Table 1 Notes:

*Change in conditions from 2016 guidelines document

**New Parameter

Table 2. Approximate quantitative bounds corresponding to the qualitative parameter ranges.

	Criterion		
Parameter	Low/Mild	Moderate	High/Steep
System Parameters			
Erosion History	<2 ft/yr	2 ft/yr to 6 ft/yr*	>6 ft/yr*
Sea Level Rise	<0.2 in/yr	0.2 in/yr to 0.4 in/yr	>0.4 in/yr
Tidal Range	< 1.5 ft	1.5 ft to 4 ft	> 4 ft
Hydrodynamic Parameters			
Waves	< 1 ft	1 ft to 3 ft	> 3 ft
Wakes	< 1 ft	1 ft to 3 ft	> 3 ft
Currents	< 1.25 kts	1.25 kts to 4.75 kts	>4.75 kts
Ice	< 2 in	2 in to 6 in	> 6 in
<i>Storm Water Level</i>	<25 yr	25yr to 50yr	>50 yr
Terrestrial Parameters			
Upland Slope	<1 on 30	1 on 30 to 1 on 10	>1 on 10
Shoreline Slope	<1 on 15	1 on 15 to 1 on 5	> 1 on 5
Width	<30 ft	30 ft to 60 ft	>60 ft
Nearshore Slope	<1 on 30	1 on 30 to 1 on 10	>1 on 10
Offshore Depth	< 2 ft	2 ft to 5 ft	> 5 ft
Soil Bearing Capacity	< 500 psf	500 psf - 1500 psf	> 1500 psf
Ecological Parameters			
Water Quality	-	-	-
Soil Type	-	-	-
Sunlight Exposure	<2 hrs/day	2 to 6 hrs/day*	>6 hrs/day*

Table 2 Notes:

*Change in range from 2016 guidelines document

**New Parameter

Updates from 2016 Guidelines

- This updated version of the New Jersey Living Shorelines Engineering Guidelines adopts the simplified IGNNBF terminology (design phases) to be more in line with the broader community.
- A Scoping Phase is added before the Planning Phase's alternative analysis and conceptual design work.
- Adaptive management is added as a key design parameter of the Operations Phase.
- An appendix has been added to address gaps related to climate change/sea level rise, design, regulations, and assessment.
- Changes have been made to design parameters (see above sidebar), conditions where approaches are applicable (see Table 1 notes), and the ranges of criterion (see Table 2 notes).
- Joint-planted revetments and reef balls have been removed as suggested living shoreline design alternatives.

Produced by:

Jon K. Miller, Ph.D., Laura Kerr, Amy Bredes and Katherine Gannon of Stevens Institute of Technology

For more information contact:
Jon Miller (jmill@stevens.edu)
Phone: 201-216-8591
Social: @StevensCoastal

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