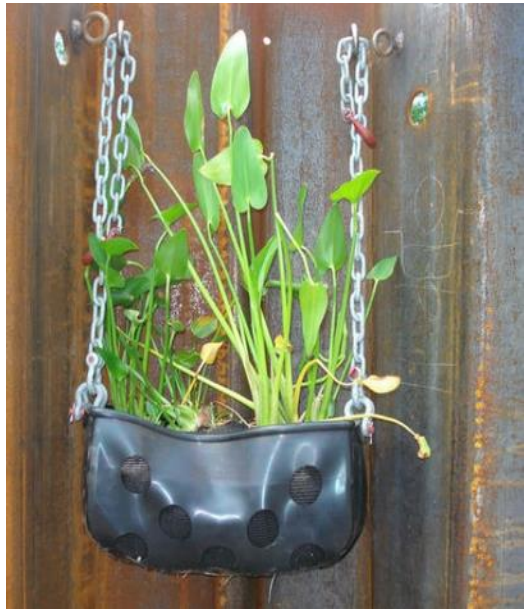
Engineering Design of Living Shorelines

Green is the New Grey

NJ League of Municipalities

Jon K. Miller
Research Associate Professor
Stevens Institute of Technology

What is a Living Shoreline?



Cleveland

Sydney

Seattle

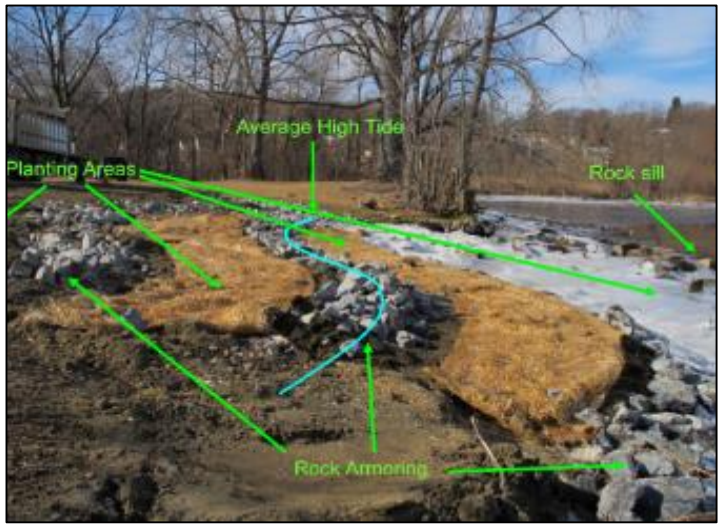
United Kingdom

Virginia

Delaware

Local Examples

Coxsackie, NY Boat Launch



- Sill designed to mimic "natural" effect of adjacent shipwreck
- Stone toe terraces
- Contractor modified stone size
- Ice/debris/wakes play a significant role
- Lack of maintenance may be problem

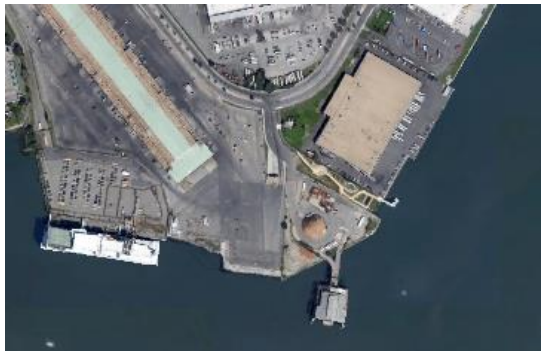
Esopus Meadows Preserve

- First attempt using vegetated slope failed during spring storm (<1 yr)
- Storm-modified slope survived Irene/Lee/Sandy
- Well-maintained

Habirshaw Park, Yonkers

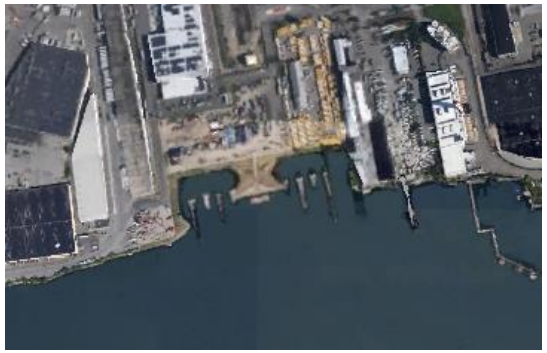
- Sill originally under designed (adaptive management used to correct)
- Maintenance essential
- Low slope submerged during Sandy
- Ice and wakes are a long term concern

Hunts Point Landing, Bronx NY

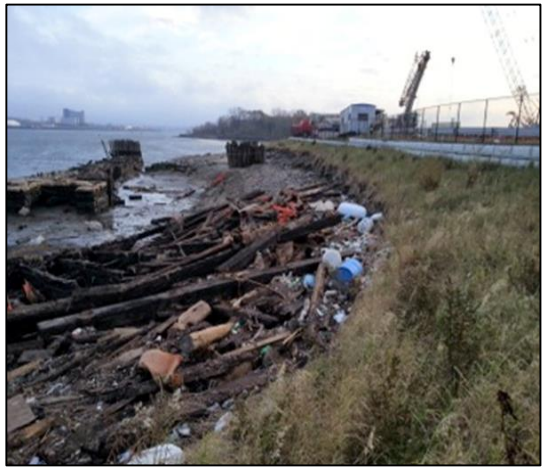


- Designed as a public access point to the water
- Terraces used to create appropriate slopes (~1:12)
- Mix of marsh and upland vegetation
- Storm water detention incorporated
- Survived Sandy with minimal damage to structural elements or vegetation

Oak Point, Bronx NY



- Wetland creation a condition of the development permit
- Heavy upland use
- Steep slopes utilized (up to 1:2)
- Debris impact during Sandy scoured slope



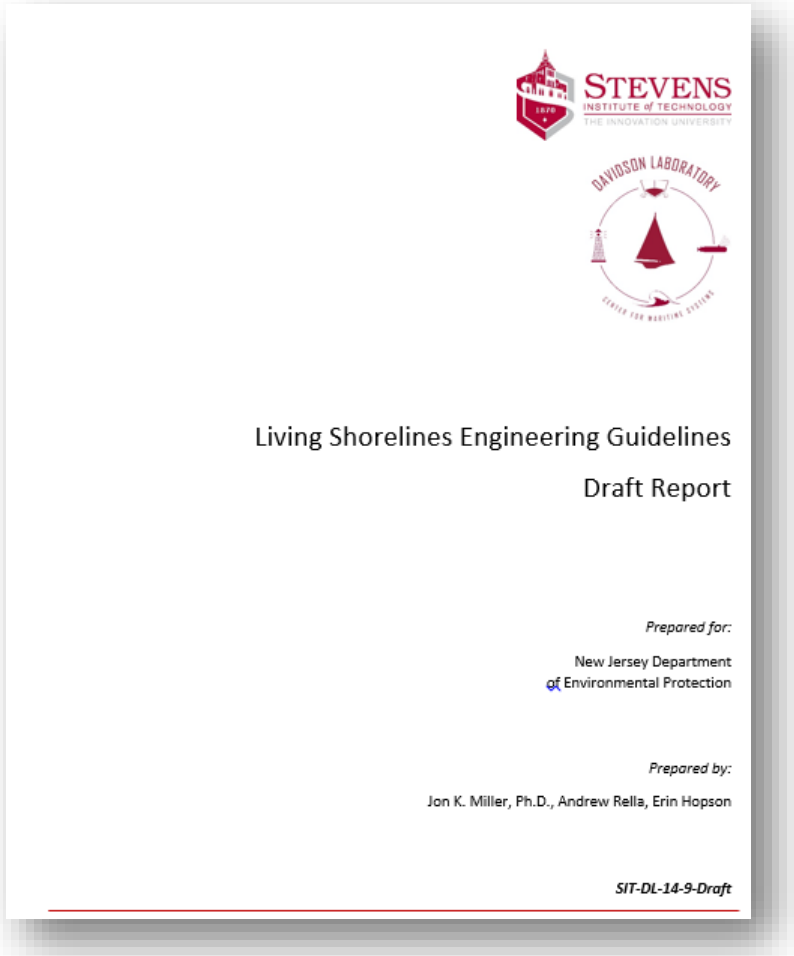
Living Shorelines Engineering Guidelines

Draft Report

NJ Living Shorelines Engineering Guidelines

Engineering Guidelines

- Primary Objectives
  - Provide guidance to engineers and regulators on the engineering components of living shorelines design
  - ***Provide a common starting place to ensure consistency with GP 24 (N.J.A.C. 7:7-6.24) – "Living Shorelines GP"***
  - Reduce the number of potential failures due to poor design/construction



Approach

1. Identify factors relevant to living shoreline design
   - Mix of traditional, traditional evaluated non-traditionally, and non-traditional
   - Categorize as system, hydrodynamic, terrestrial, ecological, additional considerations
   - Provide guidance for selecting between alternatives
2. Describe approaches for determining required parameters
   - Consider different levels of rigor for different parameters and projects
3. Provide example of how these parameters influence design
   - Sills*, breakwaters*, joint planted revetment, reef balls*, living reef*

* Marsh creation assumed behind the structures

Suggested Design Approach

Parameter List

System Parameters

Erosion History

Sea Level Rise

Tidal Range

Hydrodynamic Parameters

Wind Waves

Wakes

Currents

Ice

Storm Surge

Ecological Parameters

Water Quality

Soil Type

Sunlight Exposure

Terrestrial Parameters

Upland Slope

Shoreline Slope

Width

Nearshore Slope

Offshore Depth

Soil Bearing Capacity

Additional Considerations

Permits/Regulatory

End Effects

Constructability

Native/Invasive Species

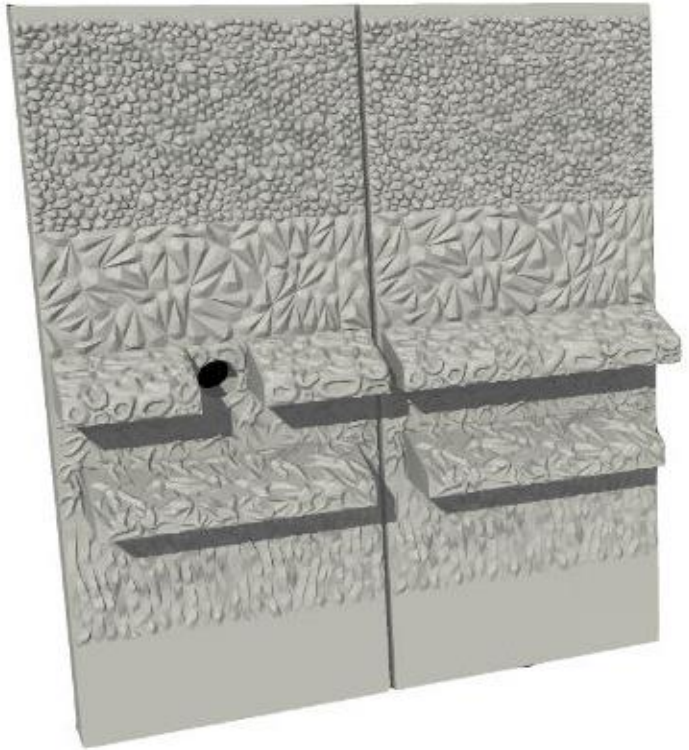
Debris Impact

Project Monitoring

Selection Criteria

	Marsh Sill	Breakwater	Revetment	Living Reef	Reef Balls
System Parameters					
Erosion History	***Low-Med***	***Med-High***	***Med-High***	***Low-Med***	***Low-Med***
Relative Sea Level	Low-Mod	Low-High	***Low-High***	Low-Mod	Low-Mod
Tidal Range	***Low-Mod***	Low-High	Low-High	***Low-Mod***	Low-Mod

	Criterion		
Parameter	Low/Mild	Moderate	High/Steep
System Parameters			
Erosion History	<2 ft/yr	2 ft/yr to 4 ft/yr	>4 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
Storm Surge	<1 ft	1 ft to 3 ft	>3 ft



Eco-engineering Design Principles

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- Roughness / texture
- Irregularity
- Material composition
- Slope
- Diversity

Harlem River Designing the Edge Project

Concluding Thoughts

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1. Significant progress is being made
2. Local ecology should always be considered during the engineering design phase
3. Many options exist if we think in terms of ecological principles rather than project types
4. Many design tools exist and more are currently being developed
   - Engineering guidelines
   - TNC restoration explorer tool
   - PDE's contractors guide/training
5. Communicating project objectives is key

For More Info

Jon Miller
Davidson Laboratory
Stevens Institute of Technology
711 Hudson Street, Hoboken, NJ
jmiller@stevens.edu Ph:201-216-8591