

Adopted by the Broward Board of County Commissioners, January 7, 2020, **Land Use Policy 2.21.7** ensures for regionally consistent tidal flood barrier elevations to provide a resiliency standard against coastal inundation. This brochure provides illustrative renderings of living shoreline seawall features, relative to traditional vertical, flat-surface, seawall installation, substantial repair, or rehabilitation, as encouraged under this policy. Please check municipal code for local requirements.



For more information on the newly adopted seawall policy and standards, visit Broward.org/Climate or e-mail resilience@broward.org

Resilient Shorelines



SEAWALL REPLACEMENT ALTERNATIVES TO PROVIDE FLOOD PROTECTION AND ENHANCE HABITAT AND PROPERTY VALUE



Shorelines will need to adapt to over 2 feet of sea level rise by 2070.



Broward Policy 2.21.7 establishes a minimum elevation for tidal flood barriers



The policy encourages projects to incorporate natural features that provide ecosystem services



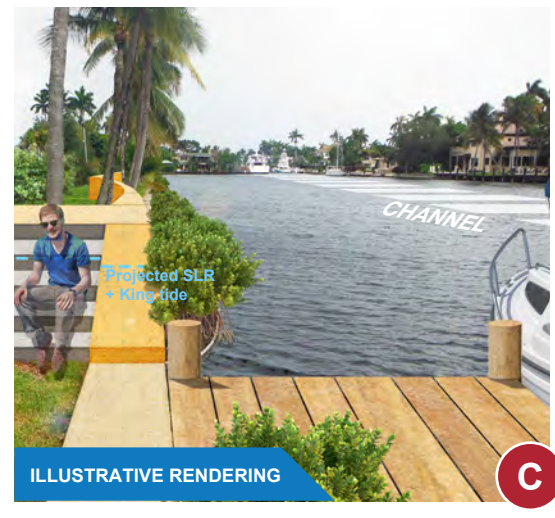
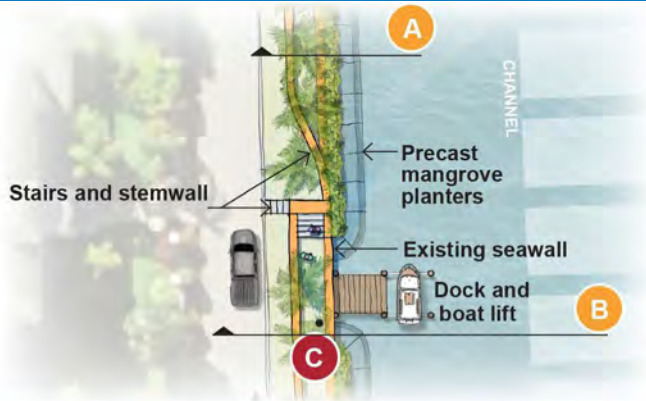
Living shoreline inspired seawalls use natural materials, forms, and methods to provide ecological value and improve water quality



Inside, explore living shoreline flood barrier design possibilities based on space, depth, and wave conditions

PLANTED TERRACE/SEAWALL ENHANCEMENT

SHALLOW WATER | Low Wake | Neighborhood Canal



DESIGN FEATURES

- **Back-set stemwall**
 - ✓ Good option when space constrained - can accommodate a small project footprint
 - ✓ Provides effective flood barrier height
 - ✓ Primarily upland development - facilitates permitting
 - ✓ Stairs can be replaced with ramp to accommodate ADA access
- **Intertidal terrace**
 - ✓ Preserves waterside access - boat dock and mooring space
 - ✓ Adds resilient habitat - can be planted with native, salt-tolerant species
- **Intertidal planter**
 - ✓ Can be precast or constructed from natural rock
 - ✓ Adds intertidal and subtidal habitat - supports fisheries
 - ✓ Dissipates wave energy - may extend life of existing seawall
 - ✓ Specifications for planting maintenance (e.g. minimum trim heights) can be requested at time of permitting
- **Costs of rehabilitation may be 50%-75% of traditional seawall replacement**

SLR = Sea Level Rise
 MHW = Mean High Water
 MLW = Mean Low Water

Stairs and stemwall

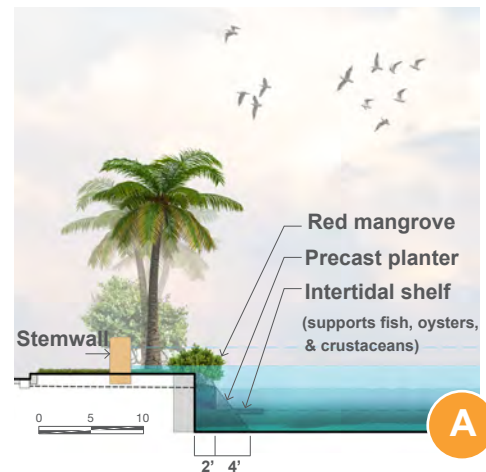
Proposed crest = 5.00 (NAVD 88)

Stormwater conveyance pipe with inline check valve

*Pumping may be required to convey stormwater



B



A

LIVING SHORELINE

SHALLOW WATER | High Wake | Embayment



EXISTING CONDITIONS

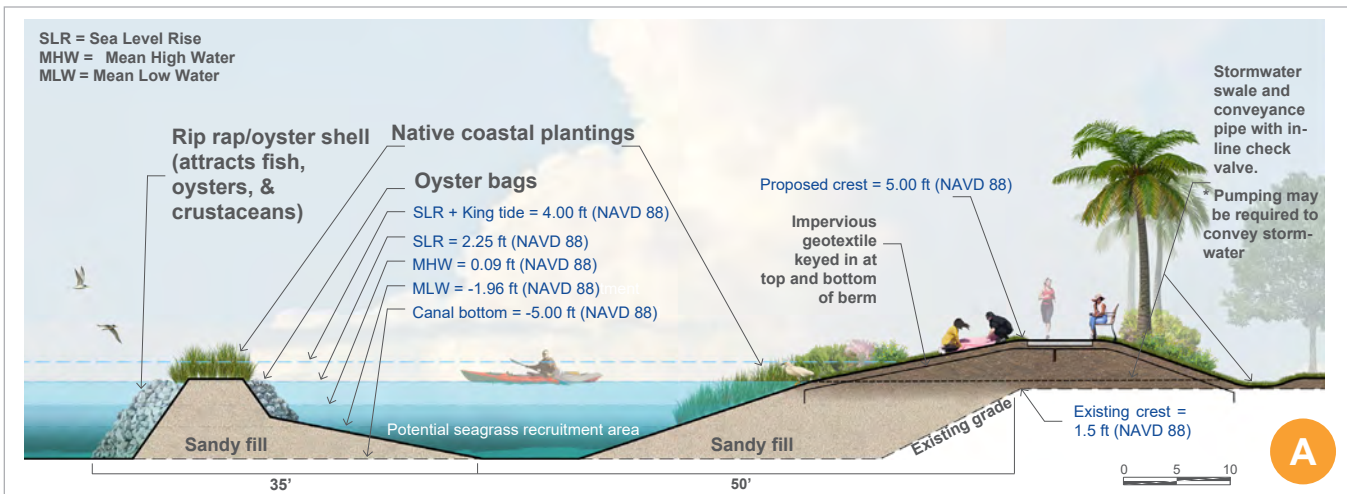


ILLUSTRATIVE RENDERING

B

DESIGN FEATURES

- **Full living shoreline rehabilitation**
 - ✓ Good option for large properties with available shoreline area
 - ✓ Preserves or enhances community space
- **Earthen berm**
 - ✓ Provides effective flood barrier height
 - ✓ Offers elevated recreational space or viewing area
- **Sloped shoreline**
 - ✓ Facilitates waterside access and maintains recreational space
 - ✓ Adds resilient coastal habitat - planted with native, intertidal and salt-tolerant species
 - ✓ Filters stormwater runoff - improves water quality
- **Offshore breakwater**
 - ✓ Adds subtidal and intertidal habitat - supports fisheries and provides potential bird foraging and nesting habitat
 - ✓ Dissipates wave energy - protects against wave run-up and shoreline erosion
 - ✓ Boardwalk option can accommodate recreational access
- **Costs of rehabilitation may be 65% to 75% of traditional seawall replacement**



LIVING SHORELINE with FLOATING-LIVING DOCK

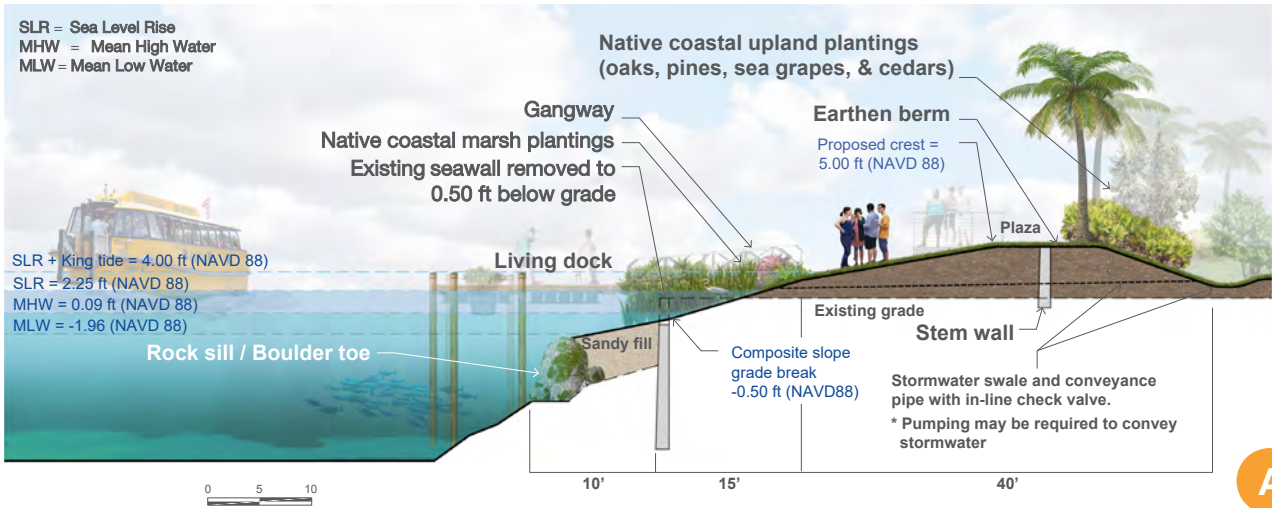
DEEP WATER | Low Wake | Major Channel



DESIGN FEATURES

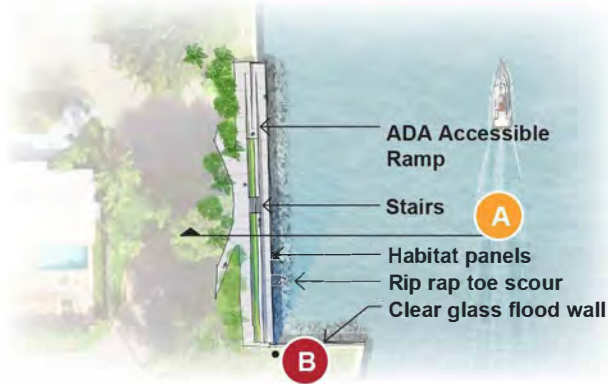
- **Truncated seawall to subtidal retaining wall**
 - ✓ Good option for properties with available shoreline area
 - ✓ Preserves space while enhancing shoreline connectivity
- **Earthen berm**
 - ✓ Provides effective flood barrier height
 - ✓ Offers elevated entertainment or viewing area
- **Sloped shoreline**
 - ✓ Facilitates water access and maintains recreational space
 - ✓ Adds resilient coastal habitat - planted with native, intertidal and salt-tolerant species
 - ✓ Filters stormwater runoff - improves water quality
- **Subtidal rock sill or scour toe**
 - ✓ Provides subtidal habitat - supports fisheries
- **Optional living floating-dock**
 - ✓ In-water, hanging planters and oyster substrate add habitat, provide a natural aesthetic, and filter water
 - ✓ Adjusts with sea level changes
- **Costs of rehabilitation may approximate traditional seawall replacement**

SLR = Sea Level Rise
 MHW = Mean High Water
 MLW = Mean Low Water



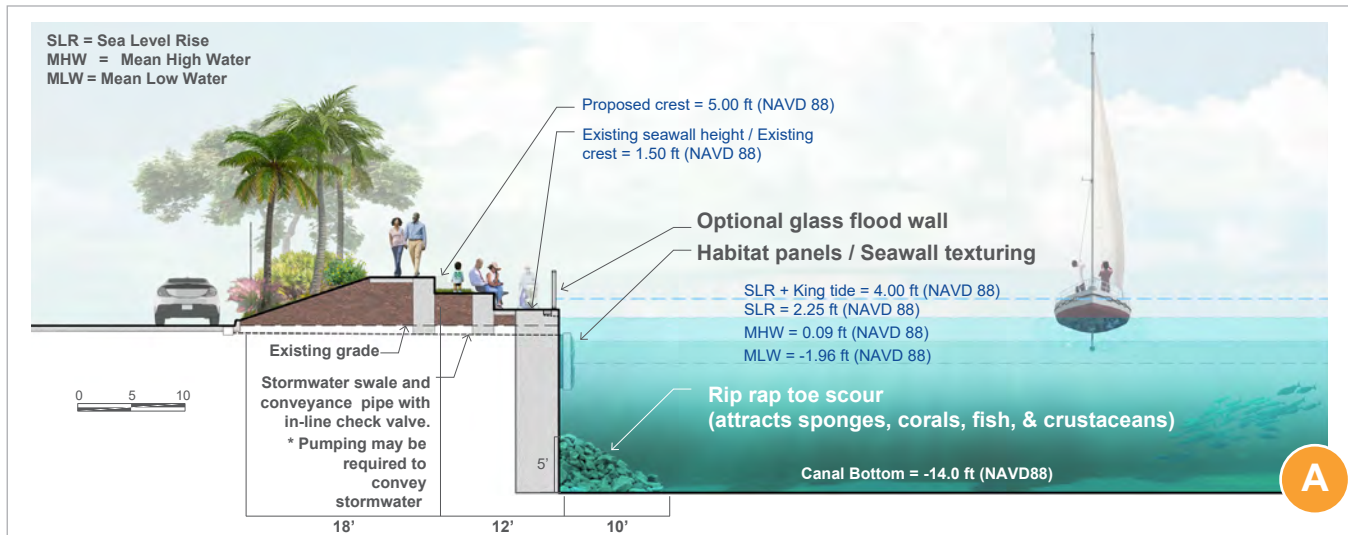
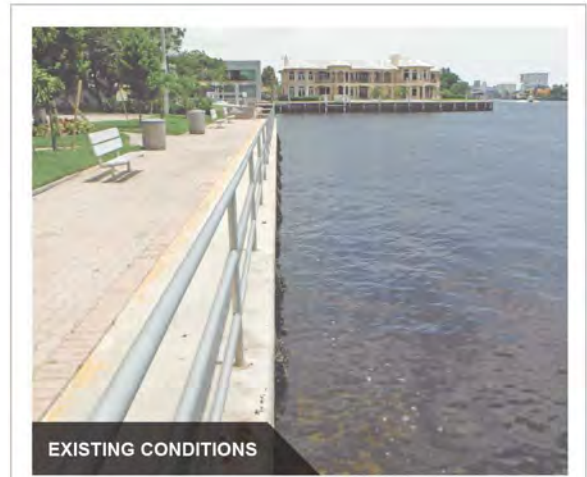
BIOFRIENDLY SEAWALL

DEEP WATER | High Wake | Intracoastal Waterway



DESIGN FEATURES

- Back-set, terraced, stemwall**
 - ✓ Good option when space constrained - can accommodate a small project footprint
 - ✓ Provides effective flood barrier height
 - ✓ Primarily upland development - facilitates permitting
 - ✓ Facilitates recreational use and accommodates ADA access
- Intertidal shelf**
 - ✓ Maintains waterside access - boat dock and mooring space
 - ✓ Adds resilient habitat - can be planted with native, salt-tolerant species
- Habitat panels/texturing**
 - ✓ Adds intertidal habitat - supports fisheries
- Seawall scour toe**
 - ✓ Inhibits undermining - may extend life of existing seawall
 - ✓ Provides subtidal habitat - supports fisheries
- Optional glass flood wall**
 - ✓ Provides effective flood barrier height and preserves view
- Costs of rehabilitation may be 65%-75% of traditional seawall replacement**





Permitting Process

Does Your Project Qualify for a Small-Scale Living Shorelines Permit Exemption?

Regulatory agencies, at all levels of review, are encouraging community climate change adaptation through environmentally beneficial, green, coastal infrastructure development. Broward County regulatory ordinances governing dredge and fill activities, seawall construction, and the protection of aquatic and wetland resources are specified within Broward County Code, Chapter 27, Article XI. - Aquatic and Wetland Resource Protection. Under this authority, Broward County Environmental Engineering and Permitting Division (EPPD) regulates licensing of seawalls, docks, mangrove impacts, and all other work in, on, or under waters or wetlands of Broward County. Broward EPPD has also been delegated authority to oversee permitting, compliance, and enforcement of certain State of Florida, Environmental Resource Permit (ERP), Wetland Resource Management and Mangrove Protection Act responsibilities. However, if a project lies outside of this delegation, for example qualifying under a green infrastructure ERP exemption* or United States Army Corps of Engineers (USACE) Nationwide 54 permit, applicability will need to be verified through those agencies. EPPD staff are available to answer project design and permitting queries, and schedule pre-application meetings, to assure project feasibility and facilitate proper licensing. Prior to submitting permit application materials, please contact EPPD and, if necessary, other jurisdictional offices for guidance.

Broward Environmental Protection and Growth Management, Environmental Engineering and Permitting Division

Website: broward.org/Environment/WaterPrograms • Telephone: (954) 519-1483 • e-mail: AWRLicense@broward.org

Florida Department of Environmental Protection, Southeast District Office

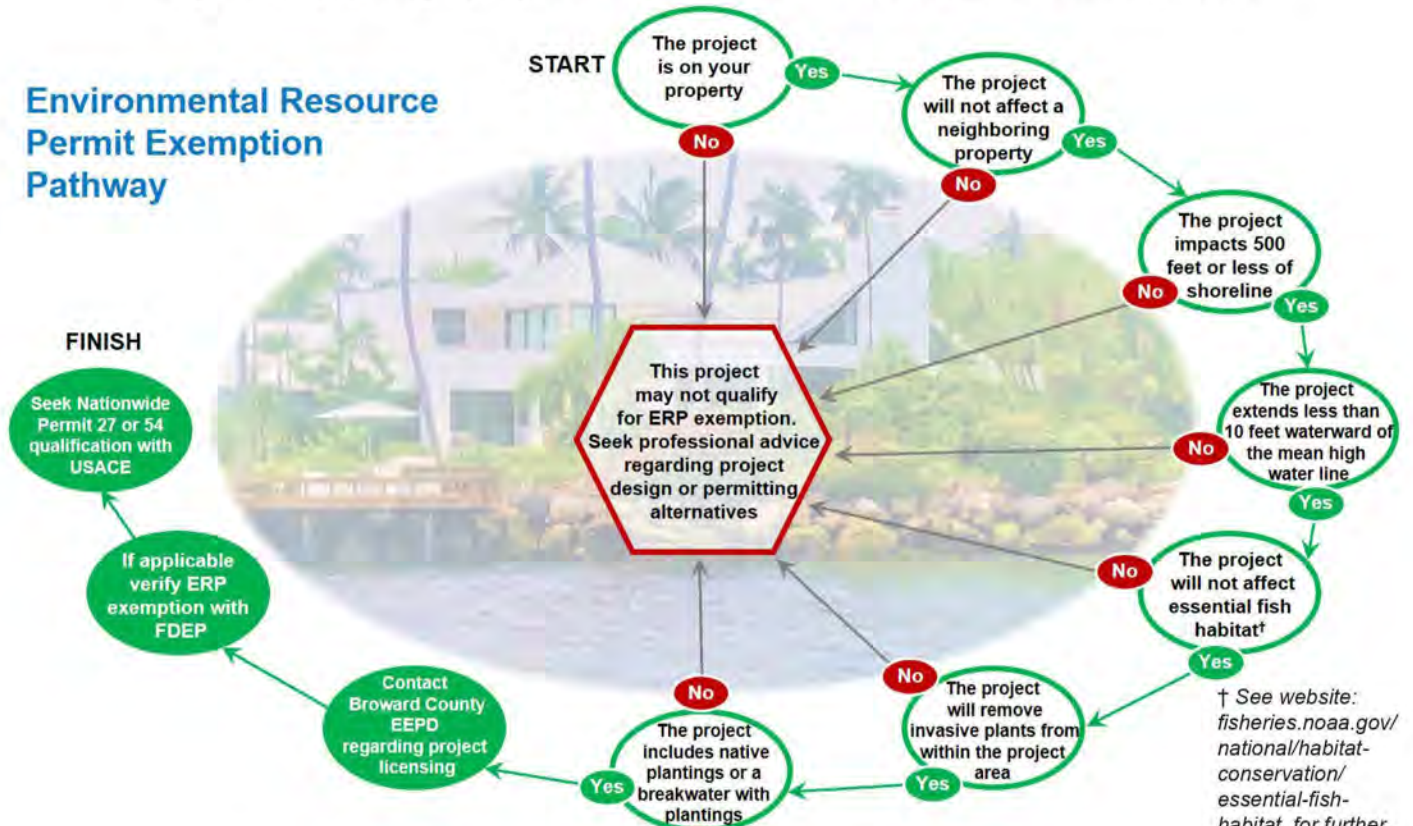
Website: floridadep.gov/Southeast • Telephone: (561) 681-6600 • e-mail: Southeast.District@floridadep.gov

United States Army Corps of Engineers, South Atlantic Division, Jacksonville District, West Palm Beach

Website: saj.usace.army.mil • Telephone: (561) 472-3504 • e-mail: application-sp@usace.army.mil

*The Environmental Resource Permit Exemption Pathway, below, is meant to provide guidance on whether your living shoreline project might qualify for exemption under Rules 62-330.051, Florida Administrative Code.

Environmental Resource Permit Exemption Pathway



† See website: fisheries.noaa.gov/national/habitat-conservation/essential-fish-habitat, for further detail.

If the project warrants a breakwater, it must be built with natural rock or oyster shell and have 5-foot wide gaps installed at least every 75 feet. The project footprint must not approach within 3-feet of seagrasses.



Probable Costs Comparison

Construction Item Unit Costing Estimates

ITEM	UNIT	COST
Turbidity Curtain	Linear Foot	\$17
Silt Fence	Linear Foot	\$4
Clearing & Grubbing	Acre	\$11,000
Native Estuarine/Upland Plantings	Each	\$20
Earthen Berm/Embankment Fill	Cubic Yard	\$36
Impervious Liner	Linear Foot	\$125
Geotextile	Linear Foot	\$20
Rip Rap (Rock sill)	Ton	\$300
Oyster Bags	Each	\$3
Seed/Sod	Square Foot	\$9
French Drain	Linear Foot	\$160
8" HDPE Pipe	Linear Foot	\$150
Check Valve	Each	\$500
Living Floating Dock	Square Foot	\$400
Precast Planter	Each	\$5,000
Concrete Seatwall	Linear Foot	\$350
Concrete Stairs	Each	\$3,000
Remove Seawall	Linear Foot	\$150
3 ft Stem Wall	Linear Foot	\$350
Precast Seawall with texture	Linear Foot	\$800
Glass Flood Wall	Linear Foot	\$350
Habitat Panels	Linear Foot	\$40
Annual Maintenance	Lump Sum	5%

Design, Permitting & Construction Costing

SHORELINE CONDITION	LIVING SHORELINE	SEAWALL
Shallow Water/Low Wake	\$85,000	\$130,000
Shallow Water/High Wake	\$105,000	\$155,000
Deep Water/Low Wake	\$155,000	\$165,000
Deep Water/High Wake	\$130,000	\$195,000

Design, Permitting & Construction costs are based on 100 feet of shoreline, 2018 costs, rounded, and include living shoreline rehabilitation or repair of existing structures presented relative to seawall replacement costs.



- Non-proprietary construction costing considerations are based on Florida Department of Transportation historical cost information, Area-12, and the RS Means construction cost database
- Design, Permitting & Construction considerations include raising the crest elevation of the flood barrier to +5 feet NAVD88 to fully comply with Land Use Policy 2.21.7
- Prior to 2035, new or substantially rehabilitated tidal flood barriers may be raised to elevation +4 feet NAVD88, if designed to accommodate later rehabilitation to Land Use Policy, year 2050 elevation requirements
- Survey, geotechnical, and biological assessments are included in Design, Permitting & Construction costing
- Planting costs will vary depending on type, size, and maturity of the desired species palette
- Elevated maintenance costs of planting elements may be incurred immediately after installation; however, once established, costs are typically limited to routine landscape maintenance requirements