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
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**

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**EXISTING CONDITIONS**

**ILLUSTRATIVE RENDERING**

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

**Stairs and stemwall**
- Proposed crest = 5.00 ft (NAVD 88)
- Stormwater conveyance pipe with inline check valve
- *Pumping may be required to convey stormwater

**Existing seawall**
- Existing seawall crest = 1.50 ft (NAVD 88)

**Projecting SLR**
- Sea Level Rise = 2.25 ft (NAVD 88)
- MHW = 0.09 ft (NAVD 88)
- MLW = -1.96 ft (NAVD 88)
- Canal bottom = -4.00 ft (NAVD 88)

**Precast planter**
- Intertidal shelf (supports fish, oysters, & crustaceans)

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LIVING SHORELINE

SHALLOW WATER | High Wake | Embayment

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

EXISTING CONDITIONS

- Stormwater swale and conveyance pipe with inline check valve
- Pumping may be required to convey stormwater

ILLUSTRATIVE RENDERING

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

Oyster bags
- SLR + King tide = 4.00 ft (NAVD 88)
- SLR = 2.25 ft (NAVD 88)
- MHW = 0.00 ft (NAVD 88)
- MLW = -1.96 ft (NAVD 88)
- Canal bottom = -5.00 ft (NAVD 88)

Proposed crest = 5.00 ft (NAVD 88)
Impervious geotextile keyed in at top and bottom of berm

Potential seagrass recruitment area

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**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**
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**

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**Existing conditions**

**Illustrative rendering**

**Proposed crest = 5.00 ft (NAVD 88)**
**Existing seawall height / Existing crest = 1.50 ft (NAVD 88)**

**Optional glass flood wall**
**Habitat panels / Seawall texturing**

**Stormwater swale and conveyance pipe with in-line check valve.**
* Pumping may be required to convey stormwater

**Rip rap toe scour**
(attracts sponges, corals, fish, & crustaceans)

**Canal Bottom = -14.0 ft (NAVD88)**

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

**Existing grade**

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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 (EEPD) regulates licensing of seawalls, docks, mangrove impacts, and all other work in, on, or under waters or wetlands of Broward County. Broward EEPD 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. EEPD 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 EEPD 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

START
The project is on your property
No
Yes
The project will not affect a neighboring property
No
Yes
The project impacts 500 feet or less of shoreline
No
Yes
The project extends less than 10 feet seaward of the mean high water line
No
Yes
The project will not affect essential fish habitat
No
Yes
The project includes native plantings or a breakwater with plantings
No
Yes
Contact Broward County EEPD regarding project licensing
No
Yes
The project will remove invasive plants from within the project area
No
Yes
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.

FINISH
Seek Nationwide Permit 27 or 54 qualification with USACE
If applicable verify ERP exemption with FDEP
†See website: fisheries.noaa.gov/national/habitat-conservation/essential-fish-habitat, for further detail.
Probable Costs Comparison

Construction Item Unit Costing Estimates

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

<table>
<thead>
<tr>
<th>SHORELINE CONDITION</th>
<th>LIVING SHORELINE</th>
<th>SEAWALL</th>
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<tbody>
<tr>
<td>Shallow Water/Low Wake</td>
<td>$85,000</td>
<td>$130,000</td>
</tr>
<tr>
<td>Shallow Water/High Wake</td>
<td>$105,000</td>
<td>$155,000</td>
</tr>
<tr>
<td>Deep Water/Low Wake</td>
<td>$155,000</td>
<td>$165,000</td>
</tr>
<tr>
<td>Deep Water/High Wake</td>
<td>$130,000</td>
<td>$195,000</td>
</tr>
</tbody>
</table>

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

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