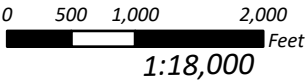


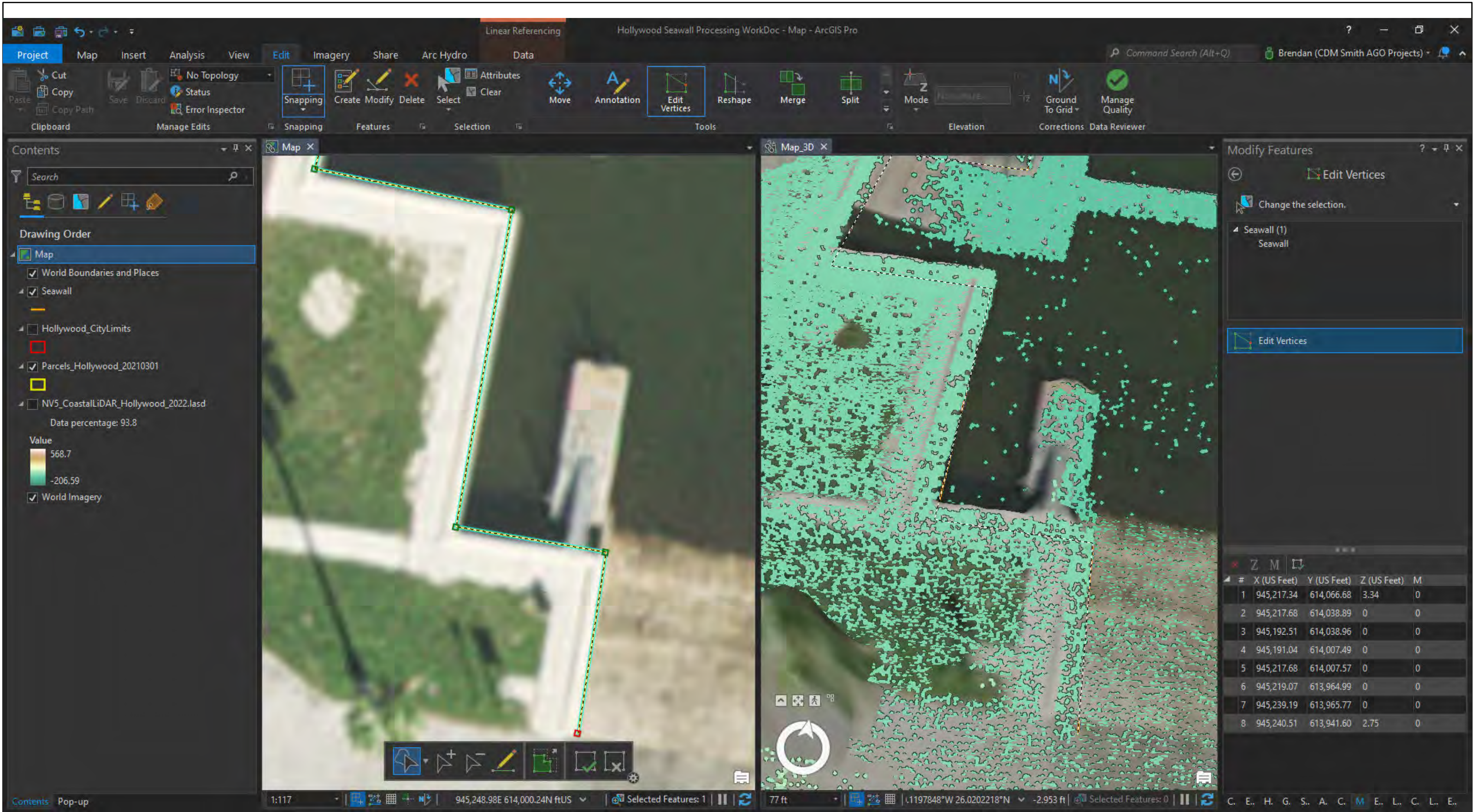
- Legend
- Hollywood City Limits
  - Seawall Survey Locations



### Data Gaps Survey Locations







## Point Cloud to Polyline GIS Transformation

0 10 20 40  
1:250 Feet

City of Hollywood Stormwater Master Plan  
Figure 2-7  
10/27/2022



## 3.0 Results and Conclusions

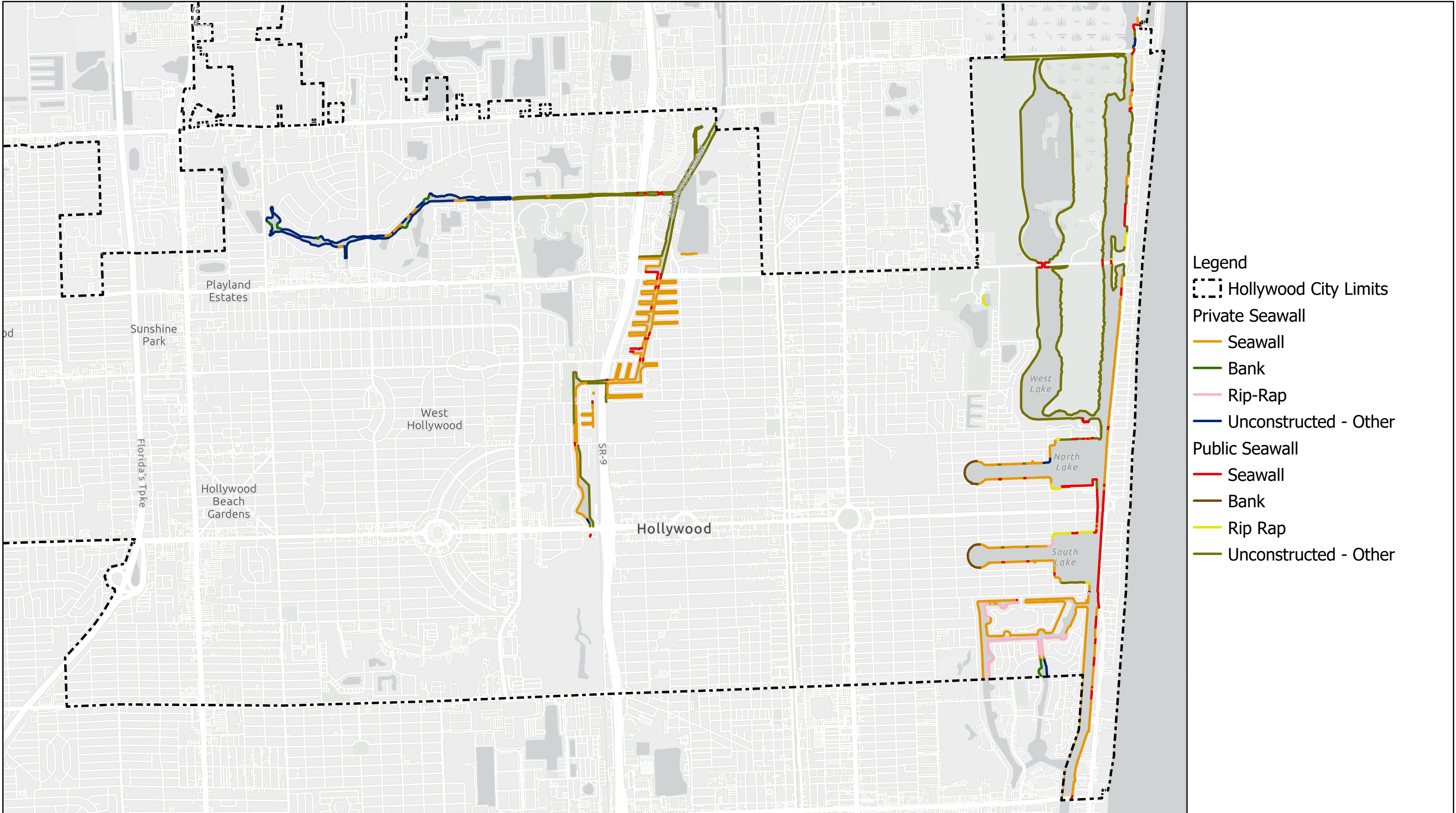
### 3.1 Seawall and Shoreline Analysis and Summary Statistics

The findings of the analysis are summarized in **Table 3-1**. The table disseminates the shoreline footage into statistics by owners and types and heights. With respect to heights, this does not account for small areas of seawall failures where water can get past the barrier, as that type of defect is beyond the detail of the LiDAR imaging.

**Figure 3-1** provides the existing shoreline data by type and owner. As shown on the figure:

- The barrier island (Hollywood Beach) is a mixture of FDOT, City, and Private-Owners along the ICW.
- The majority of the seawalls in the City are private or other owned.
- The City's shoreline is mainly found at the City-operated waterfront marinas and facilities, where roadways end at waterways dead ends and cul de sacs, and at City rights of way at the water's edge.
- Only 60% of the City's habitable shoreline (both public and private) is armored, and a significant portion of that armoring is below the current king tide elevation of 2.5 Ft-NAVD

For near-term planning purposes, it can be deduced from the initial data that the City's portion of the seawall CIP initiative (both new seawall where there is none now and raising existing seawall to required ordinance height) will need to include approximately 12,300 l.f. of shoreline for improvement. **Table 3-2** provides an initial planning budget for the seawall work for the City properties.



## Seawall and Shoreline Types and Locations

Table 3-1. City of Hollywood Shoreline Statistics

Parameter	Approx Length (LF)	Approx Length (Miles)	Percent of Total %	Comment
<b>Total Shoreline in City Limits</b>	209,520	36	100%	Includes Mangroves and Un-and Inhabited Areas
<b>Mangrove/Wetland</b>	42,240	8	20%	
<b>Total Habitable Shoreline</b>	167,280	28.7	80%	Shoreline adjacent to habitable areas requiring shoreline protection
<b>Total Seawalled Shoreline</b>	100,071	19.0	60%	Seawall Armoring
<b>Total Unimproved Shoreline</b>	67,209	12.7	40%	Other shoreline - berm, riprap, unimproved
<b>City Owned Seawalls</b>	4,686	0.89	5%	
Currently Below EL 4 ft NAVD (BC Ordinance)	4,497	0.85	96%	
Currently Below EL 2.0 NAVD (King Tide)	500	0.09	11%	
Approx Mean Height* of City Seawall (Ft-NAVD)	2.6			*This does not account for missing sections or cracks
<b>Privately Owned Seawalls</b>	84,232	16.0	84%	
Below EL 4 ft NAVD (BC Ordinance)	68,000	12.9	81%	
Below EL 2.0 NAVD (King Tide)	5,100	0.97	6%	
Mean Height* of Pvt Seawall (FT-NAVD)	3.25			*This does not account for missing sections or cracks
<b>Other Owned Seawalls</b>	11,153	2.1	11%	
Below EL 4 ft NAVD (BC Ordinance)	3,000	0.57	27%	
Below EL 2.0 NAVD (King Tide)	750	0.14	7%	
<b>Remaining Unarmored Shoreline</b>	67,209	12.7	40%	
City Owned	7,800	1.5	12%	
Private Owned	10,000	1.7	15%	
Other-Owned*	49,409	8.5	74%	*Canal and waterways R/O/W
Below EL 4 ft NAVD (BC Ordinance)	32,000	6.1	48%	
Below EL 2.0 NAVD (King Tide)*	10,500	2.0	16%	*Estimated from nearest available bank EL

Table 3-2. City of Hollywood Seawall CIP Planning Budget

Parameter	Length (LF)	Approx Length (Mile)	Approx Unit Cost Per l.f.	Design/Construction Contingency (25%)	Planning Totals
City Seawall 1 foot raise	1,200	4.00	\$1,500	\$1,875	\$ 2,250,000
City Seawall 2 foot raise	7,293	0.30	\$1,800	\$2,250	\$ 16,409,250
City Seawall 3 foot raise	2,815	0.01	\$2,100	\$2,625	\$ 7,389,375
New City Seawall to 4 ft NAVD none exists	989	1.50	\$2,500	\$3,125	\$ 3,090,625
Sub Total	12,297	5.81			\$ 29,139,250
Planning-level Contingency (20%)					\$ 5,827,850
Planning Budget for Seawall Improvements (USE)					\$ 35,000,000

## APPENDIX A

### BROWARD COUNTY SEAWALL REQUIREMENTS

## **ARTICLE XXV. – RESILIENCY STANDARDS FOR TIDAL FLOOD PROTECTION**

Adopted by the Broward County Board of Commissioners on March 31st, 2020 into the Broward County Code of Ordinances (Code), Article XXV within Chapter 39 serves as a model code and planning foundation for municipal adoption of regionally consistent minimum standards and a basis for resilience investments across the community.

### **Sec. 39-404. Purpose and intent.**

The purpose of this article is to establish a consistent minimum elevation for tidal flood barriers that will:

- (a) Provide a standard for flood mitigation infrastructure that serves as a barrier to tidal flooding, not seepage, by accounting for water levels predicted under combined conditions of sea level rise, high tides, and high frequency storm surge through the year 2070; and
- (b) Ensure new shoreline structures and major shoreline improvements are designed for use as tidal flood barriers through application of consistent standards that account for future predicted tidal flood conditions and coastal water levels associated with sea level rise in accordance with current regional sea level rise projections, as updated and adopted by the Broward County Board of County Commissioners.

### **Sec. 39-405. Applicability.**

This article applies to all new tidal flood barriers, substantial repair or substantial rehabilitation to shorelines and shoreline structures, and the installation of any fixed infrastructure attached to tidal flood barriers (such as mooring structures). This article is not applicable to oceanfront beaches or shorelines seaward of the Coastal Construction Control Line.

### **Sec. 39-406. Definitions.**

For the purposes of this article, the following terms, phrases, words, and their derivation shall have the meanings given herein, except when the context clearly indicates a different meaning. In the interpretation and application of this article, the definitions provided for herein shall control over definitions that may be included in other documents or manuals, including, but not limited to, the Florida Building Code. Words used in the present tense include the future tense, words in the plural number include the singular number, and words in the singular number include the plural number. The word "shall" is mandatory and the word "may" is permissive.

*Bank* means the level space separating a waterway from an inland area, often elevated and constructed of compacted soil.

*Berm* means an earthen mound designed with impermeability to resist the flow of tidal waters through it to an adjacent property or public right-of-way.



*Green-grey infrastructure* or *green-grey materials* means a combination of engineered and natural features that provide environmental qualities and ecosystem value.

*Mooring structure* means a boat dock, slip, davit, hoist, lift, floating vessel platform, mooring pile, or similar structure attached to land or to a seawall, to which a vessel can be moored.

*North American Vertical Datum (NAVD88)* means the vertical control for datum of orthometric height established for vertical control surveying in the United States of America based upon the General Adjustment of the North American Datum of 1988.

*Public nuisance* means a condition injurious to the public health or safety of the community or neighborhood, or injurious to any considerable number of persons, or a condition that obstructs the free passage or use, in the customary manner, of any public right-of-way.

*Rip-rap* means a foundation of unconsolidated boulders, stone, rubble, concrete without protruding rebar, or similar materials placed on or near a shoreline to mitigate wave impacts and prevent erosion.

*Seawall* means a vertical or near vertical (often interlocking) structure placed between an upland area and a waterway or waterbody for erosion control.

*Seawall cap* means a concrete box structure (usually reinforced) that connects seawall panels, piles, and anchoring system (if present) together at the top.

*Shoreline* means a tidally influenced area where land meets water.

*Substantial repair* or *substantial rehabilitation* means:

(a) Any modification to the shoreline or a shoreline structure along more than fifty percent (50%) of the length of the property's shoreline; or

(b) Any modification, alteration, or installation of an appurtenant structure (such as a mooring structure) that exceeds fifty percent (50%) of the cost of a tidal flood barrier along the property's shoreline.

*Tidal flood barrier* means any structure or shoreline feature including, but not limited to, banks, berms, green-grey infrastructure, seawalls, seawall caps, upland stem walls, or other infrastructure that impedes tidal waters from flowing onto adjacent property or public right-of-way, and located within or along a tidally influenced area. This definition is not meant to include rip-rap, derelict erosion control structures, or permeable earthen mounds that do not provide an impermeable water barrier to tidal flooding.

*Tidally influenced area* means the real property adjacent to, or affected by, a waterway with water level changes in response to the daily tide.

Sec. 39-407. Minimum elevations for coastal infrastructure within tidally influenced areas.

(a) All new or substantially repaired or substantially rehabilitated banks, berms, green-grey infrastructure, seawalls, seawall caps, upland stem walls, or other similar infrastructure shall be designed and constructed to perform as tidal flood barriers. Tidal flood barriers shall have a minimum elevation of five (5) feet NAVD88. Applications for new or substantially repaired or substantially rehabilitated tidal flood barriers submitted prior to January 1, 2035, may be permitted a minimum elevation of four (4) feet NAVD88, if designed and constructed to accommodate a minimum elevation of five (5) feet NAVD88 by January 1, 2050.

(b) All property owners must maintain a tidal flood barrier in good repair. A tidal flood barrier is presumed to be in disrepair if it allows tidal waters to flow unimpeded through or over the barrier and onto adjacent property or public right-of-way. Failure to maintain a tidal flood barrier in good repair shall be a citable offense. The owner of the tidal flood barrier shall demonstrate progress towards repairing the cited defect within sixty (60) days after receiving a citation and shall complete repairs within three hundred sixty-five (365) days after receipt of the citation. If the required repair or rehabilitation meets the substantial repair or substantial rehabilitation threshold, no later than three hundred sixty-five (365) days after receipt of the citation, the property owner shall design, obtain permits, cause to be constructed, and obtain final inspection approval of seawall improvements that meet the minimum elevation and design requirements.

(c) Tidal flood barriers below a minimum five (5) feet NAVD88 elevation shall be improved, designed, and constructed so as to prevent tidal waters from impacting adjacent property or public right-of-way. Causing, suffering, or allowing the trespass of tidal waters onto adjacent property or public right-of-way is hereby declared a public nuisance and a citable offense requiring abatement. The owner shall demonstrate progress toward addressing the cited concern within sixty (60) days after receipt of the citation and complete the construction of an approved remedy no later than three hundred sixty-five (365) days after receipt of the citation.

(d) Tidal flood barriers shall be designed and constructed to prevent tidal waters from flowing through the barrier, while still allowing for the release of upland hydrostatic pressure.

(e) To the extent practicable, tidal flood barriers shall be designed and constructed to adjoin immediately proximate tidal flood barriers to close gaps and prevent trespass of tidal water.

(f) All tidal flood barriers undergoing substantial repair or substantial rehabilitation shall be constructed along the property's entire shoreline.

(g) All tidal flood barriers shall be constructed with natural limerock rip-rap, or other approved habitat enhancement, at the waterward face of the structure.

(h) Property owners are encouraged to consider approaches and materials that enhance the biological value of traditional (flat surface) seawalls and flood barriers with the incorporation of living shoreline features, use of hybrid green-grey materials, and the use of biological forms, where practicable.

(i) This section shall not be construed to require the installation of a seawall where other flood protection measures serve as an equally effective tidal flood barrier.

(j) Tidal flood barriers capable of automatically being elevated in advance of high tides to prevent tidal flooding are permissible, provided that automation cannot require daily human intervention.

Sec. 39-408. Required disclosure in contracts for sale of real estate.

In any contract for the sale of real estate located in tidally influenced areas of Broward County executed after December 31, 2020, the seller shall include in the contract or a rider to the contract the following disclosure in not less than fourteen-point, capitalized, bold-faced type:

THIS REAL ESTATE IS LOCATED IN A TIDALLY INFLUENCED AREA. THE OWNER MAY BE REQUIRED BY COUNTY OR MUNICIPAL ORDINANCE TO MEET MINIMUM TIDAL FLOOD BARRIER ELEVATION STANDARDS DURING CONSTRUCTION OR SUBSTANTIAL REPAIR OR SUBSTANTIAL REHABILITATION OF SEAWALLS, BANKS, BERMS, AND SIMILAR INFRASTRUCTURE OR WHEN REQUIRED TO ABATE NUISANCE FLOODING.

#### **Policy Support: Risk Assessments and Modeling**

The regional standard was informed by technical work undertaken with support from the U.S. Army Corps of Engineers (USACE) as part of the joint Broward County/USACE Flood Risk Management Study for Tidally Influenced Coastal Areas authorized under the Planning Assistance for States Program.

The study focused on two tidally influenced coastal areas (not direct oceanfront) located within the County, to address flooding problems experienced in these areas:

- Las Olas Isles area in the City of Fort Lauderdale
- Hollywood Lakes area in the City of Hollywood

These areas and other low elevation coastal areas experience nuisance "sunny day" flooding during the highest tides of the year (i.e. [King Tides](#)). This flooding has become more frequent and severe over time due to rising sea levels and more severe storms.



The USACE collected water, ground, and seawall elevation data to model existing local conditions. This data was combined with rainfall, storm surge, and groundwater models to estimate peak water elevations. The USACE modeled various combinations of high tide levels and high frequency 5, 10, and 20-year storm surge events, in addition to alternative future conditions with +1 and +2 feet of sea level rise.

The USACE modeled the impacts of potential improvements to seawalls, which includes filling in existing seawall gaps, raising existing seawalls, and installing additional seawalls. The USACE may model other potential improvements, including raising streets, installing backflow preventer valves on stormwater drains, installing additional pumping capacity, and other structural and non-structural actions. The report can be [downloaded](#) for your review. Additionally, the [presentation](#) from the September 10, 2018 stakeholder workshop are available to download.

### **Economic Analysis**

Broward County consulted with Risk Management Solutions, Inc. (RMS) to undertake an economic impact assessment of potential economic losses caused by flood events. In 2018 RMS developed an exposure database of assets and operations potentially impacted by flooding and an assessment of hurricane storm surge hazard frequency and severity in the two study areas. The report can be [downloaded](#) for your review.

### **Ensuring Community Resilience, Together**

Stakeholder engagement was a critical component of the planning process. Participation by the marine industry, real estate community, engineers and planners from both the private and public sector, and other stakeholders in extensive public meetings and surveys was integral to the adoption of a regional standard that could be utilized by and serve to benefit the entire community.

Planning now for future water levels benefits property owners in multiple ways. First, it is prudent to budget for the necessary adaptation before impacts to property values or infrastructure occur. Also, coastal flood protection measures that do not consider sea-level rise will likely require premature reinvestment to replace failed infrastructure at a significant expense to the property owner and the community at large. Property owners who ensure their coastal flood protection project is designed to meet the resiliency standard will be better positioned to protect their property and investment. Floodproofing may also reduce the level of required investment in surface water management infrastructure (pumps) for areas that will be below sea level in the future.

To request a virtual presentation or outreach materials, contact [resilience@broward.org](mailto:resilience@broward.org).



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