PALMETTO BEACH SEAWALL FEASIBILITY MEMO

For the City of Tampa

September 19, 2023

APPLIED SCIENCES

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Current seawall condition

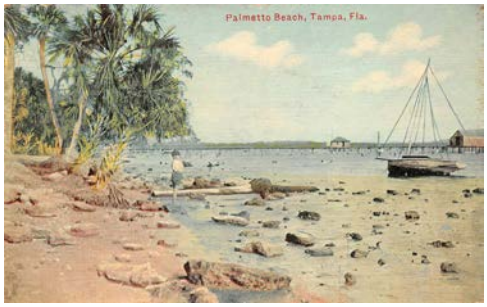
INTRODUCTION

PROJECT CONTEXT

Palmetto Beach is one of Tampa's oldest neighborhoods, a streetcar suburb established in 1894. The community was first assembled while taking advantage of the productive waters of McKay Bay, which was once incredibly rich and provided habitat for crabs, fish, shrimp, and over 200 bird species. Its mudflats, mangroves, salt marshes, and oyster bars supported a working waterfront community that included multiple crab shacks, with merchants that harvested and sold blue crabs from piers, a shrimping fleet, and cigar factories. Remnants of these structures remain; however, the businesses are gone. The community has transformed into a dense but single-family residential district inhabited by workers and lower wage earners, many of whom serve the nearby industrial businesses.

Bermuda Boulevard is located on the eastern side of the community in a diagonal southwest to northeast heading, marking the community's edge to McKay Bay to the east. The seawall was constructed after the infamous 1921 hurricane, which was the last to directly make landfall in Tampa. It is now more than 100 years old and has fallen into disrepair. There have been efforts since 2011 to rebuild the seawall, but so far only small amounts of patchwork have occurred. The neighborhood population has expressed that the seawall and adjacent Bermuda Boulevard are their primary focus for community improvement. As the seawall and roadway have deteriorated there have been associated increases in homelessness, crime, and urban blight. Replacing the seawall is critical to preserving the roadway and the buried infrastructure that serves critical services in the City.

There are multiple outfalls along the seawall. These structures are connected to pipes and stormwater inlets, which are located one to two blocks inland, at the lowest points within the neighborhood. According to permit-associated surveys, the top of seawall elevation is between 4.3-4.8 feet NAVD88. This is a reasonable height, just a few inches from the recommended regional guidance of 5.0 feet. The shoreline condition is muddy, with minimal amounts of oyster colonization. A portion of the lands just offshore from the seawall are privately owned submerged properties, a legacy issue from the historic over-water commercial development.



Historic postcards of the Palmetto Beach shoreline.

COMMUNITY

The Palmetto Beach community has been identified by multiple reports as a high risk, highly vulnerable area within the City of Tampa. There are currently 1,891 people within the community's boundary. Of that population, a.) 20% are under the age of 18; b.) 67% identify as Hispanic, another 8% as non-Hispanic black; and c.) $34,250 is the median income with 92.7% of households making less than $75,000 per year. Approximately 32% are living below the poverty line. Other identifying community characteristics include: d.) There are 823 total housing units with 729 of them occupied (11% unoccupied); e.) All but 4 housing units were built before important updates to the Florida Building Code in 2002 – there is a high percentage of historic buildings (FCCDR, 2020); and f.) Approximately half of home-owner occupied residences have mortgages, which suggests that homes have been passed down or that have been owned for a long time. Almost half of the homes in Palmetto Beach are occupied with people that moved in more than 10 years ago, and almost 40% of homes are owner-occupied.

SCOPE

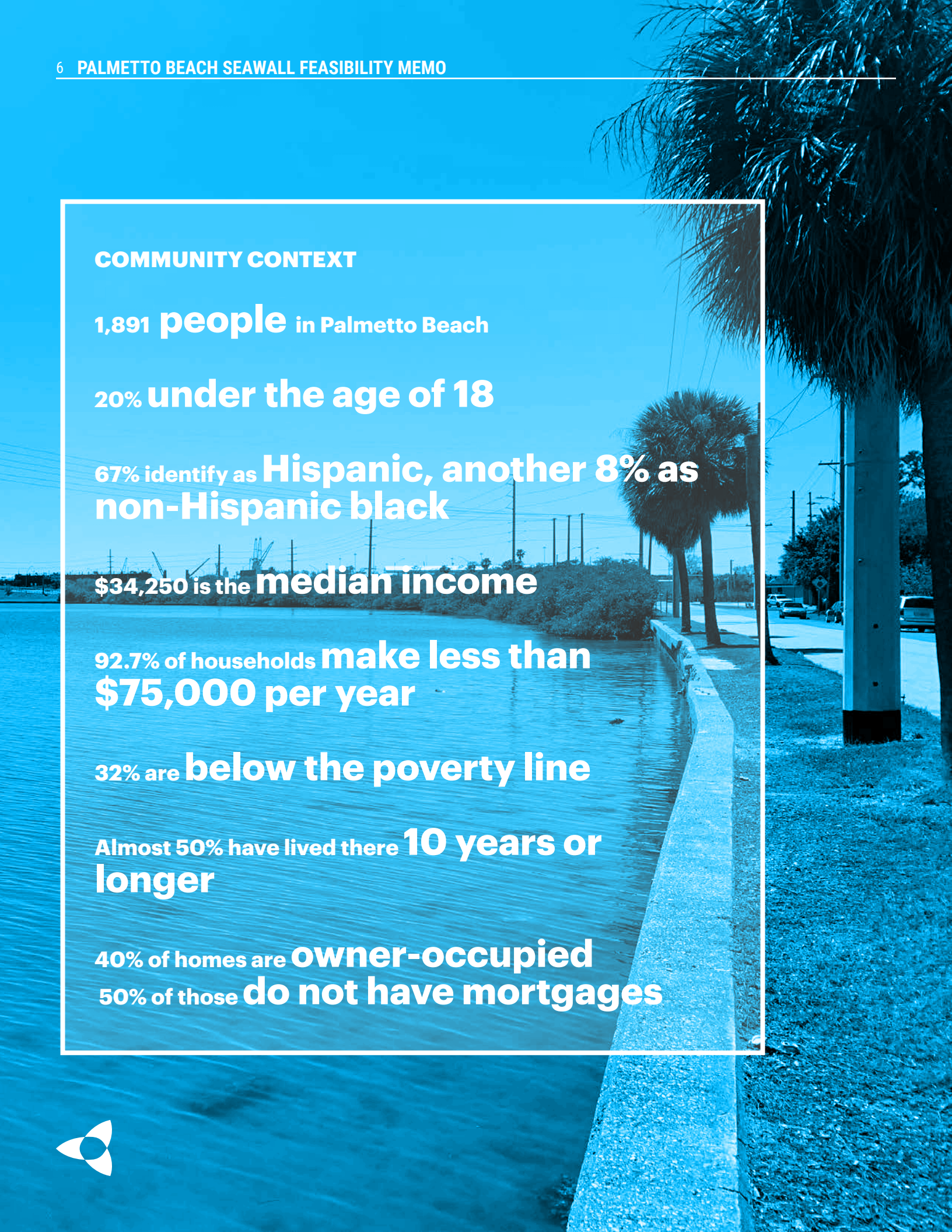
The goal of this scope of work is to develop a Preliminary Feasibility Report (PFR) that includes conceptual drawings for a permittable and constructible design of the coastline area. The conceptual design is focused on the seawall and adjacent public right-of-way at South Bermuda Boulevard. Prior to embarking on the technical design of these elements, a feasibility analysis will determine if all regulatory and City criteria can be met to execute the project, and to identify other site issues that may impact desired projects.

There are multiple grant opportunities that will be associated with this study. Evaluation of the seawall will also include multiple perspectives to identify the most appropriate grants for funding of future work along Bermuda Boulevard.

Historic waterfront of Palmetto Beach.

Damage to Palmetto Beach from the 1921 hurricane.

Current Palmetto Beach shoreline condition.



COMMUNITY CONTEXT

1,891 **people** in Palmetto Beach

20% **under the age of 18**

67% identify as **Hispanic, another 8% as non-Hispanic black**

$34,250 is the **median income**

92.7% of households **make less than $75,000 per year**

32% are **below the poverty line**

Almost 50% have lived there **10 years or longer**

40% of homes are **owner-occupied**
50% of those **do not have mortgages**

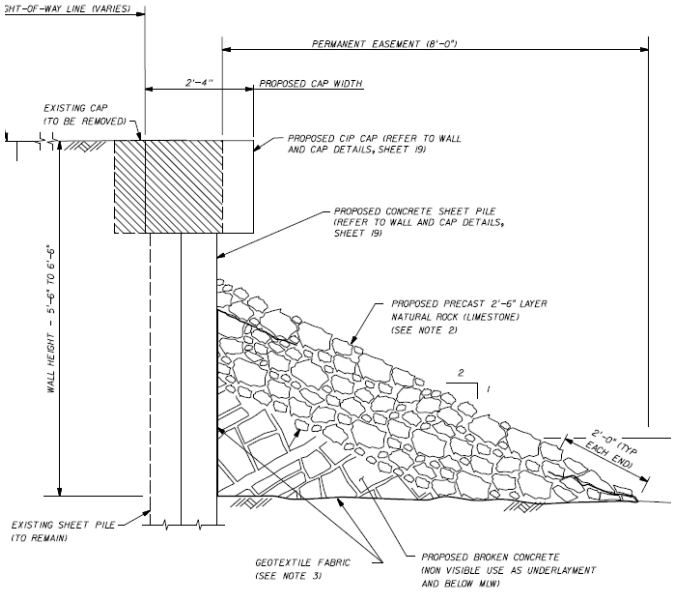
PREVIOUS BERMUDA BOULEVARD SEAWALL PROJECTS

Since 2011, the City has engaged in multiple project efforts to address the seawall in Palmetto Beach. Each are summarized in the following text.

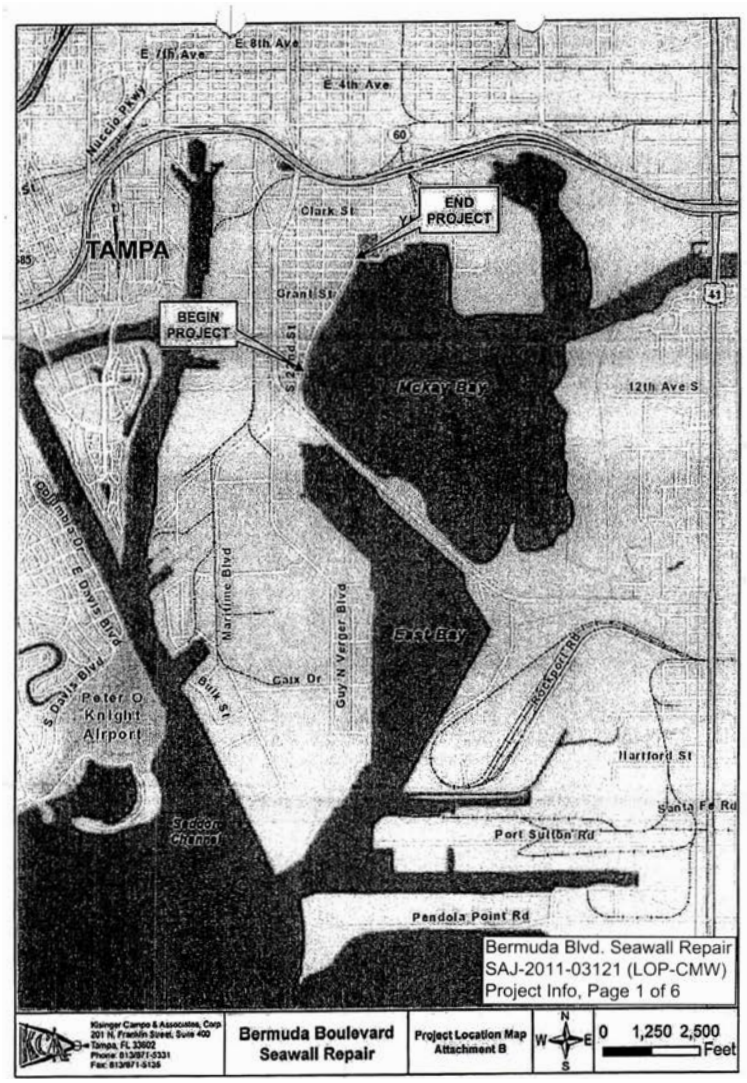
CITY OF TAMPA SOUTH BERMUDA BOULEVARD SEAWALL REHABILITATION PROJECT AND ARMY CORP. OF ENGINEERS PERMITTING REQUEST - 2011 (KCA)

In 2011, contract plans and an "Estuarine Habitat Assessment" were prepared and submitted to the Army Corp of Engineers in relation to renovations for the Bermuda Boulevard seawall. The plans included repair of approximately 2,577 linear feet of existing seawall, replacement of approximately 300 linear feet of failed seawall, and placement of rip rap along approximately 2,162 linear feet of the repaired/replaced seawall. The 2011 report suggested that the project would result in "an increase in substratum for colonization by oysters and other organisms, and would result in a net environmental benefit to the ecological resources within the project vicinity."

The project design included a replaced cast in place concrete cap and concrete sheet pile. In some locations a 2:1 (length:width) natural limestone rock embankment with broken concrete fill below. The design did not include any changes to the existing seawall design or cap elevation. All construction was expected to be accomplished from the adjacent uplands with no -in-water construction, other than installation and maintenance of turbidity control devices.



Typical detail for seawall repair or replacement (2011).



Project extents of the 2011 rehabilitation project.

The estuarine report for the project found that the area in front of the existing wall was a mud flat, "discontinuously colonized by oysters." There were no sea grasses or rhizophytic algal communities. Two mangroves areas were noted, with small areas of salt marsh vegetation.

This project provided insight into a few issues related to seawall rehabilitation:

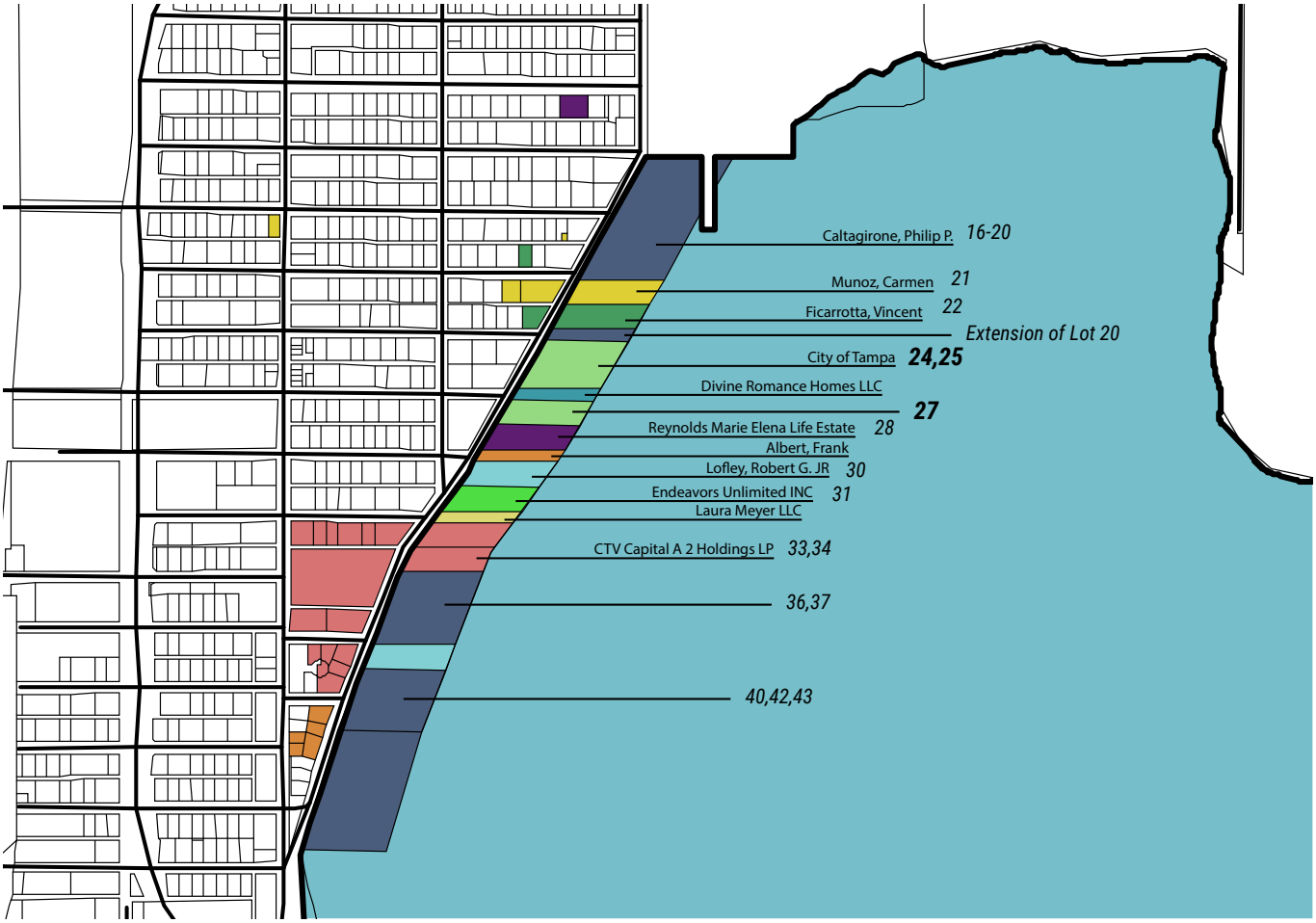
1. The submerged land just past the seawall is privately owned. An easement would need to be obtained to do work, whether temporary or permanent.
2. The horizontal distance of rip rap material from the toe of the seawall must be no more than eight feet.
3. The reconstruction of more than 300 linear feet of seawall would elevate the project permit to a Standard Work Permit, administered by the Tampa Port Authority (TPA), instead of a Minor Work Permit. This would require additional review and TPA Board approval.
4. The seawall repair/replacement has to be conducted within 18 inches of the face of the existing wall. Any installation of vertical structure beyond the 18 inch distance would require a variance and possible lease from TPA.
5. The project had the potential to affect three federally-protected species: the small-toothed sawfish (Pristis pectinata), sea turtles (Cheloniids) and the West Indian manatee (Trichechus manatus). "The project, if it includes rip rap placement, will most likely result in a determination of 'may affect but not likely to adversely affect', these three protected species and require the inclusion of standard construction conditions for these species as part of the USACE permit conditions and project specifications.
6. There are no project related impacts anticipated for mangrove or salt marsh habitats.
7. The oyster bed location (and quantification) within the project footprint needed to be submitted with the permit application.
8. The project work would have no substantial adverse impact on essential fish habitat or Federally managed fisheries within the McKay Bay.
9. The project would result in an increase of available substratum for colonization by oysters and other organisms. This project was expected to result in a net environmental benefit to the ecological resources within the project vicinity and therefore, no mitigation was required.
10. A turbidity curtain was required.

The City of Tampa requested permits from the Department of the Army (DOA) to make repairs. The DOA permitted the project with three special conditions:

1. No seawall or rip rap placement could take place in areas vegetated with mangrove and/or salt marsh, however minor repairs to existing seawall was acceptable.
2. The permittee shall comply with the "Standard Manatee Conditions for In-Water Work - 2011."
3. The permittee shall comply with National Marine Fisheries Service's "Sea Turtle and Smalltooth Sawfish Construction

Permits to begin work on the project were received in January 2012, with an end date of January 25th, 2017.

In 2014 a permit (No. 53229) was issued to the transportation division of the City to proceed with implementation of the seawall project. The permit stipulated that the project location only included water lots 24, 25, and 27 along South Bermuda Boulevard. The permit expired in October of 2015.



Property ownership for the submerged parcels along Bermuda Boulevard.

				ALTERNATIVE 2 PRESTRESSED CONCRETE		ALTERNATIVE 3 REPAIR & RIRPRAP	
ITEM NO.	DESCRIPTION	UNIT	COST	QUANTITY	SUBTOTAL	QUANTITY	SUBTOTAL
101-1	MOBILIZATION	LS	10%	1	$50,000	1	$50,000
102-1	MAINTENANCE OF TRAFFIC	LS	10%	1	$50,000	1	$50,000
104-11-1	FLOATING TURBIDITY BARRIER (SPECIAL)	LF	$15.00	200	$3,000	200	$3,000
104 75	TURBIDITY BARRIER RELOCATE	LF	$5.00	2647	$13,235	2647	$13,235
110-73	BULKHEAD REMOVAL	LF	$75.00	1329	$99,675	0	$0
121-70	FLOWABLE FILL	CY	$200.00	58	$11,560	400	$80,000
SP-15.01	RESTORING SPALLED AREAS	CF	$400.00	0	$0	2847	$1,138,800
SP-16.01	REINFORCING STEEL	LB	$1.30	28145	$36,589	15817	$20,562
400-4-8	CONCRETE CLASS IV (BULKHEAD)	CY	$1,000.00	180.4	$180,400	263.6	$263,611
455 14-4	CONCRETE SHEET PILING	LF	$160.00	20502	$3,280,320	0	$0
514-71-3	PLASTIC FILTER FABRIC	SY	$2.00	3163	$6,327	5061	$10,123
SP-18.01	RIPRAP (RUBBLE CONCRETE)	TN	$80.00	0	$0	1471	$117,677
SP-18.02	RIPRAP (RUBBLE LIMESTONE)	TN	$95.00	1645	$156,247	1471	$139,742
SP	TEMP. CONSTRUCTION EASEMENT	LF	$2.75	2487	6,839.25	2487	6,839.25
TOTALS FOR ENTIRE PROJECT LENGTH				TOTAL	**$3,894,191**		**$1,893,589**
				PER WALL FT	**$1,368**		**$665**

Cost estimate for seawall restoration.

BERMUDA BOULEVARD CONCEPT ASSESSMENTS - 2018 (AYRES)

The 2018 Bermuda Boulevard Concept Assessments report highlighted the seawall's extensive spalling, exposed and corroded reinforcing, cracking with rust staining, and deep scaling. The seawall was documented to be in poor condition, with 35% of the structure needing replacement and 20% needing extensive repairs. The report suggested two structural rehabilitation options:

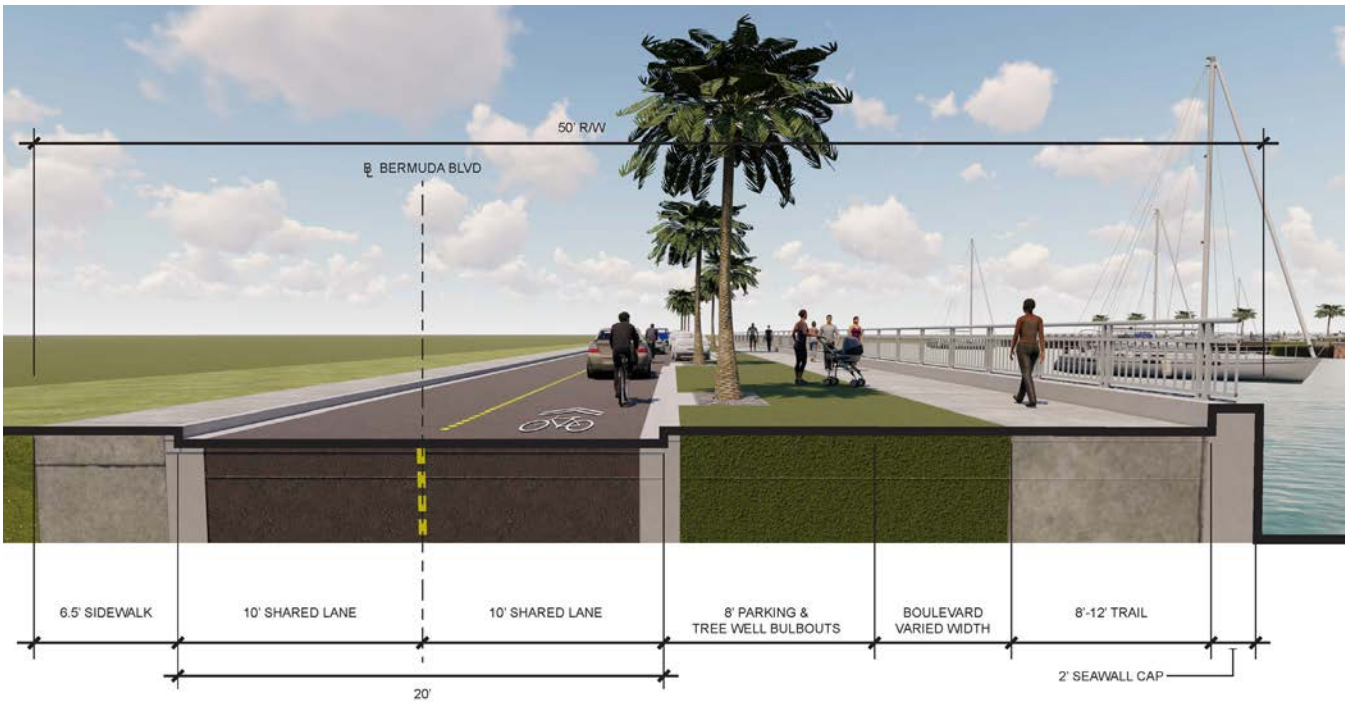
- Replacement of 2,073 linear feet (LF) of seawall (Option 1); or
- Replace 1,213 LF of seawall intermittently and repair 6,80 LF of seawall (Option 2).

Two concepts were proposed for the Bermuda Boulevard right of way, to enhance pedestrian, cycling, and green infrastructure. Both concepts were designed to be at or near the elevation of the existing grade, with one option having 10' lanes and the other 12' lanes. Both options included tree wells on the seawall side of the road to collect stormwater.

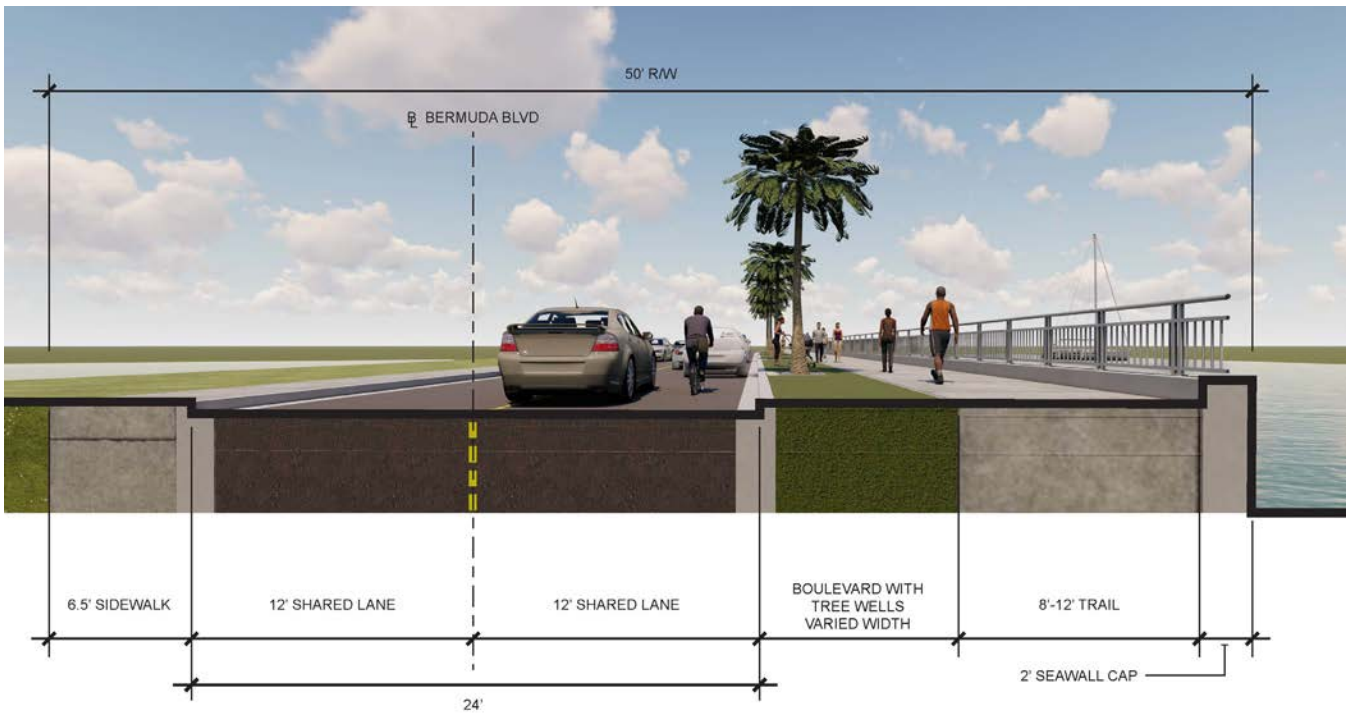
Option 1

Option 2

Proposed Concepts



ALTERNATE A
(2) 10-FOOT LANES WITH PARKING BAYS WHERE APPROPRIATE



ALTERNATE B
(2) 12-FOOT LANES WITH RANDOM ON-STREET PARKING

BERMUDA BOULEVARD SEAWALL REPAIR COST ESTIMATE REVIEW - 2019 (WSP)

A 2019 study reviewed the cost estimates associated with previous recommendations for Bermuda Boulevard and its seawall. The analysis found that cost estimates were low due to multiple factors, including inaccurate measurements, incorrect unit costs, and the inclusion/exclusion of factors that were or were not necessary.

Ultimately, the design recommendations were confirmed, with additional recommendations as follows:

"We suggest looking into not utilizing deadmen/anchors for the following reasons: 1) The existing wall shows signs of movement, therefore the current design is insufficient for the conditions. 2) While the existing soil conditions are unknown, given the relatively shallow exposed height of the wall, lengthening the wall embedment should be less expensive than anchors 8ft o.c. 3) Eliminating anchors at the top of the wall will better facilitate the future improvements by eliminating potential conflicts with future construction activities. 4.) For the shallow retained height, a cantilever wall will be more cost effective."

***Table 1**: Seawall repair estimates from May 3, 2019. Option 1 includes partial seawall replacement. Option 2 is for a full wall replacement.*

Option	2018 Report (Anchored Wall)	2018 Report Roadway Costs (Higher Cost Alt.)	2019 Report (Anchored Wall)	2019 Report (Cantilevered Wall)
1	$3,882,274		$6,267,725	$5,295,653
2	$2,218,816		$3,678,739	$3,110,061
		$1,110,736		

SITE FACTORS

UTILITIES

The City of Tampa maintains a substantial inventory of utilities that are located within the right of way of Bermuda Boulevard, including potable water mains, wastewater gravity lines, wastewater force mains, and storm sewers. The majority of potable water and sanitary facilities are organized to serve existing residential development to the west of Bermuda Boulevard. Storm sewers are oriented to collect and convey street runoff for direct discharge through the Bermuda Boulevard seawall into McKay Bay (see image below: Utilities survey; and on the following page: Utilities map, for reference).

Wastewater

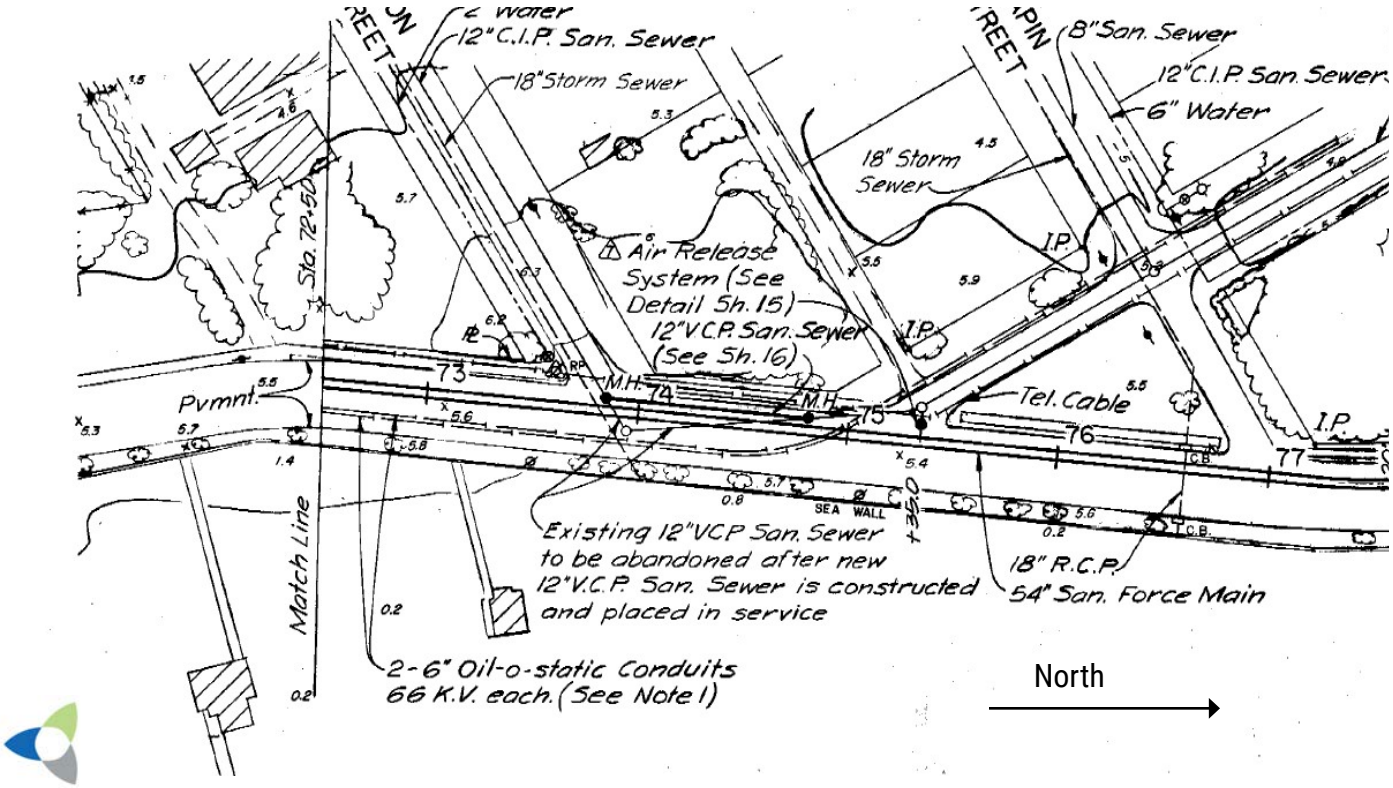
There is a major utility pipeline running under Bermuda Blvd - a Pre-stressed Concrete Cylinder Pipe (PCCP) 54-inch diameter force main, constructed in 1980. It extends from north of Palmetto Beach south to the City's Howard F. Curren Advanced Wastewater Treatment Facility in Hookers Point. At greater than 40 years old, this PCCP will need to be inspected and possibly replaced in kind.

There are two short segments of gravity sewer lines that run parallel to and west of Bermuda Boulevard. One is an 8" Vitrified Clay Pipe (VCP) that starts midway between Elmwood Avenue and runs south along Bermuda Boulevard then west along Maple Street. The other gravity sewer is an 18" VCP that starts on Saxon Street and flows east to Bermuda Boulevard, then north along South 24th Street. The only pump station within the area is a nine hundred gallon per minute (gpm) station located at 1702 South 20th Street (Hemlock and South 20th Street).

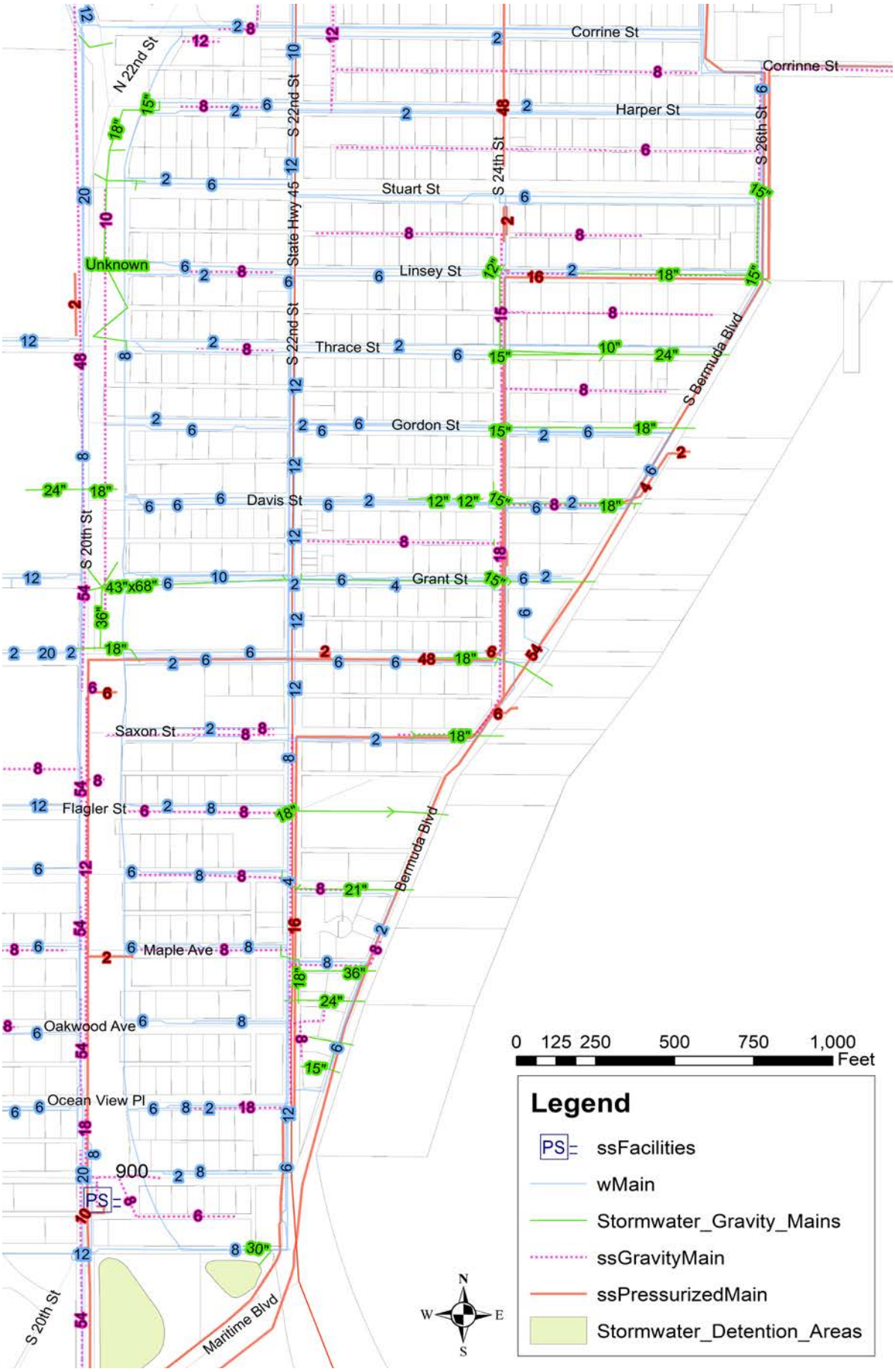
One or more pump stations would likely be necessary for new development requiring wastewater transfer to existing sanitary sewers west of Bermuda Boulevard.

Potable Water

All potable lines that run along Bermuda Boulevard service properties to the west. There are 6" ductile iron potable lines running along Bermuda Boulevard between Oceanview Place and Elmwood Avenue, Saxon Street and Chapin Street, Chapin Street toward Grant Street, two between Davis Street and Gordon Street, and midway between Gordon Street and Lindsey Street. There is also a 2" cast iron potable line running along Bermuda Boulevard between Oceanview Place and Elmwood



Utilities survey



Utilities Map for Palmetto Beach

Avenue. It is reasonable that several sections of water main would need to be connected for improved "looped" service especially if fire protection is a major concern.

Any property development east of the seawall would require planning and permitting to make the appropriate connections.

Power

In addition to the City of Tampa Utilities, as-built plans indicate that there are two Tampa Electric Company (TECO) 6" oil pressurized 66 kV electrical conduits located under the east lane of Bermuda Boulevard. There are major overhead power lines south of 24th Street. To the north, overhead wires span between light poles (not power poles) on the west side of the street.

Communications

A telephone cable is located along the west shoulder of Bermuda Boulevard.

Gas

The 2018 report suggests that TECO wanted to install a 4" to 8" gas main along Bermuda Boulevard. This appears to be completed, but is unverified - a surface meter at the corner of 26th and Lindsey streets has been renovated and moved (see images below).

Overhead utility lines south of 24th Street.

Gas Lines Before

Gas Lines After

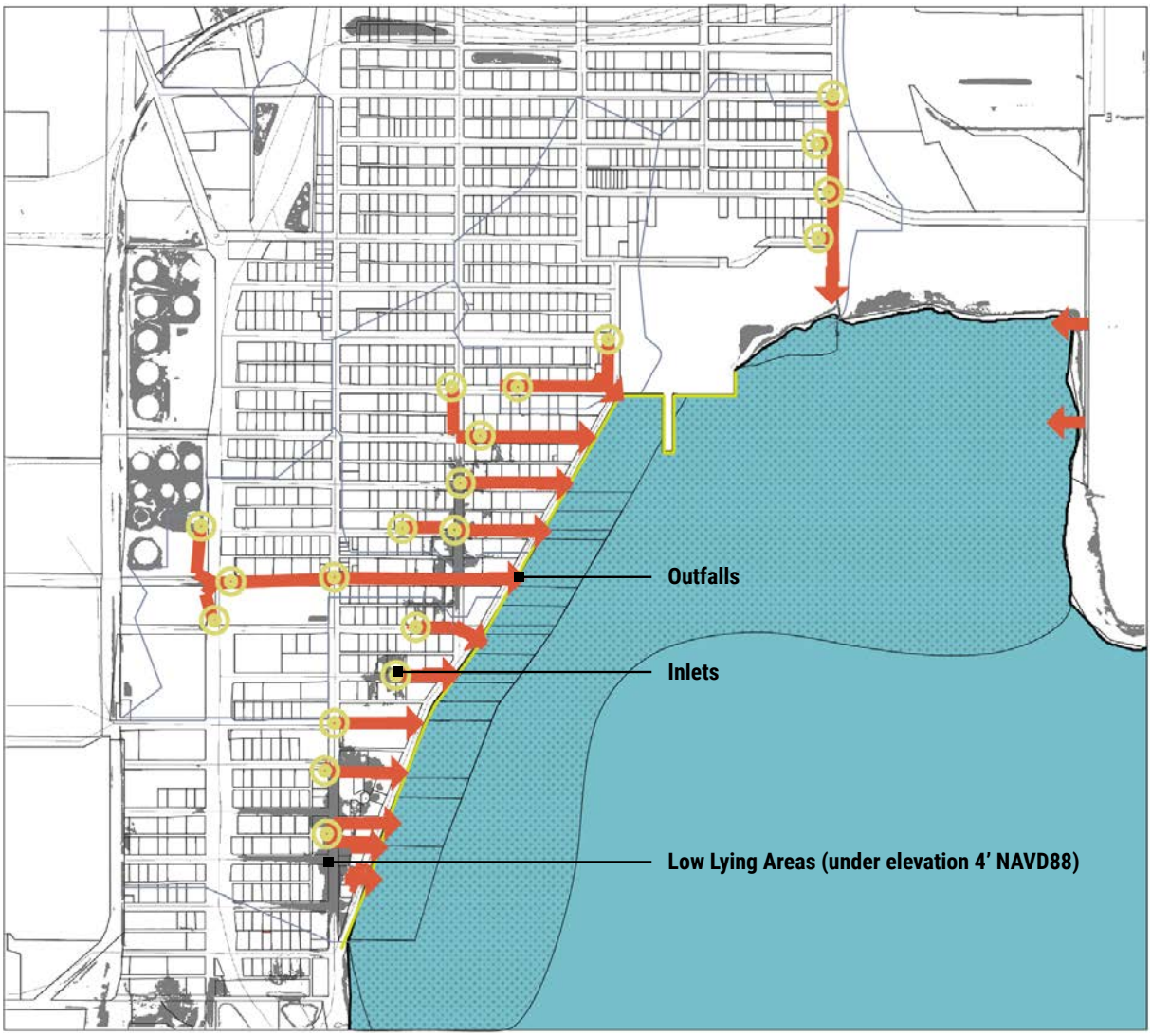
Gas infrastructure at the corner of 26th and Lindsey, showing before and after. Images taken from Google street view.

STORMWATER

The lowest areas within Palmetto Beach are about one block from the waterfront. There are inlets in these locations. Stormwater is directly discharged into the bay through pipes and outfalls. There are twelve reinforced concrete stormwater outfalls along Bermuda Boulevard, ranging in size from 15” round to 43”x 68” ellipse. Each pipe crosses through Bermuda Boulevard. Every one of them crosses at a street intersection except three, which cross between Oceanview Place and Maple Street.

The City does not have a basin study for this area, however there is some concern that pooling may occur since inlets are, in some cases, 2’ below seawall elevations. If tidal surge were to occur there would be constraints on the amount of outflow possible.

Inlet leading directly to McKay Bay

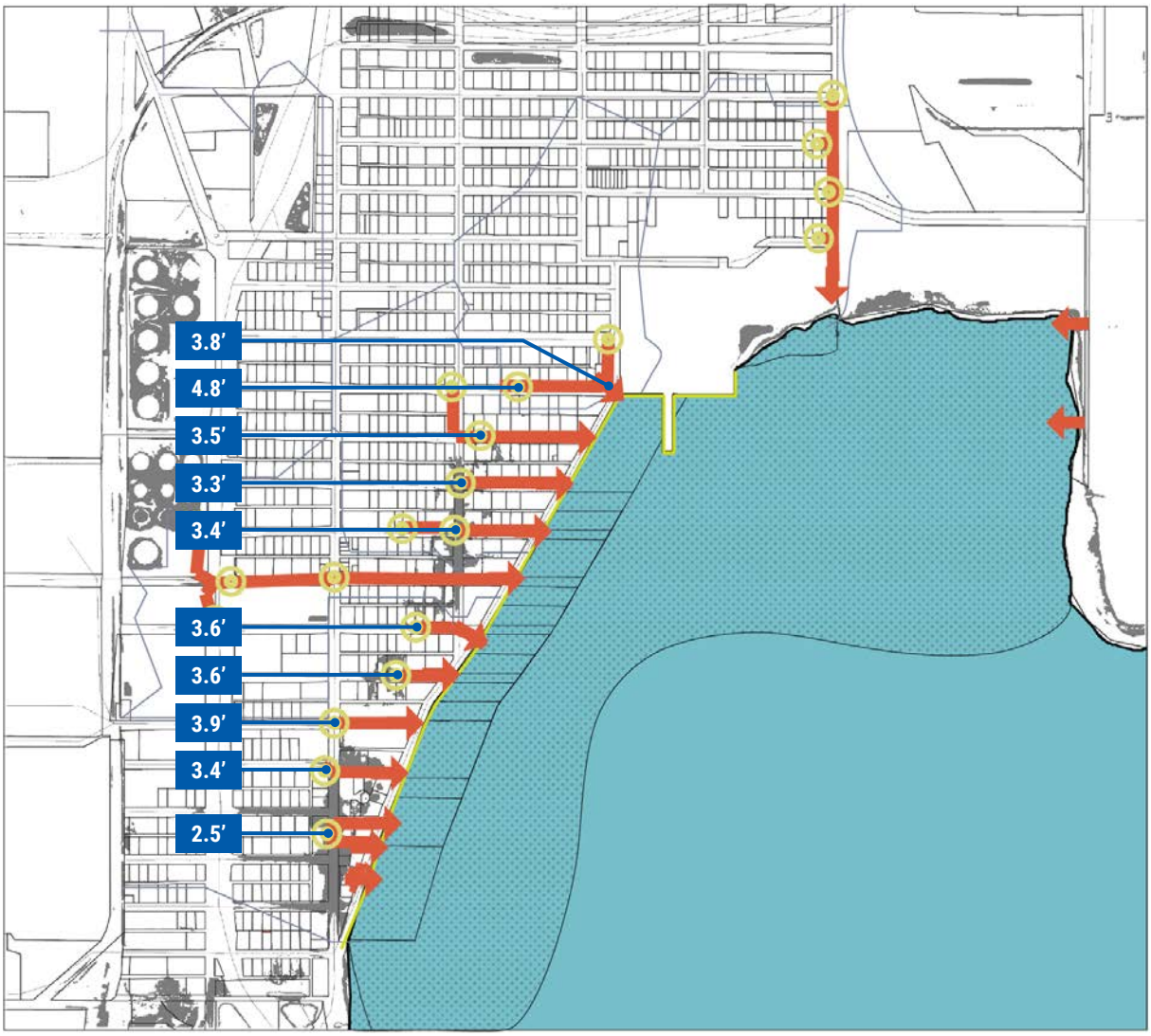


Map showing pipe and outfall locations to McKay Bay

Inlet elevations vary, generally, between 2.5’ NAVD and 3.9’, as shown below; they average near 3.5’. According to NOAA sea level rise projections, by 2050 the 1-year stillwater elevation should reach between 3.15 and 3.5’ NAVD. The Tampa Bay Climate Science Advisory Panel suggests that, with an intermediate high sea level rise projection, 1-year stillwater levels could reach 4.76 by the year 2070.

The grades shown below are approximations and are using best available data.

The Bermuda Boulevard roadway, adjacent to the seawall



Drainage map showing inlet elevations in Palmetto Beach.

SOILS

A query of the Unites States Department of Agriculture Natural Resources Conservation Service's Web Soil Survey indicates that the entire Palmetto Beach area is dominated by "Immokalee-Urban land complex" soil. All Immokalee soils are associated with pine flatwoods or marine terraces and formed in poorly drained sandy marine sediments.

An analysis of existing aquatic soils was recently completed by the University of South Florida. Soil in front of the Bermuda Boulevard seawall was found to be comprised of a high percentage of mud, which is not a healthy habitat substrate. It is assumed, but not verified, that mud is delivered from urban stormwater, and from deposition from the bypass canal. Limited tidal exchange of water may also be a problem at the edges of the bay.

Map showing the percentage of mud in surface sediments, completed for the Palmetto Beach Living Coastline and Community Engagement study (by Dr. Ping Wang, University of South Florida).

SEAWALL CONSIDERATIONS

The seawall is connected to multiple physical and regulatory factors that would need to be addressed when completing improvements:

Ownership: The seawall along the Bermuda Boulevard roadway is owned by the City of Tampa Mobility Department. At Desoto Park, the Parks and Recreation Department is responsible. The land offshore is mostly owned by other private entities - a few of the lots are owned by the City. Living shoreline elements could be constructed on private property if an easement was obtained. Adding additional erosion control elements may be valued by property owners since they would protect the soils and seawall, while maintaining development rights (if they exist).

Height: Top of seawall elevations, which were included in a prior development application, are surveyed near Saxon Street between 4.3' and 4.8' NAVD. If the seawall is replaced with a structure that is higher than what is there currently, additional wave action studies and/or studies of secondary impact will need to be completed.

Physical Factors and Connections: The seawall is connected to multiple stormwater pipes, which have outfalls along the face of the wall.

Construction: Previous reports had suggested that all seawall repairs could be accomplished from the shore - that no offshore barges or construction support would be necessary. However, it is possible, pending a construction and engineering review of the project, that construction may need to occur from a barge in the water. Additionally, sediment and erosion control for seawall construction would require a turbidity barrier. This element would have to be placed continuously along the shoreline on private property, which would require an easement.

There are 12 outfall penetrations in the Bermuda Boulevard seawall, which are noted with red arrows (wall locations are highlighted in yellow).

COASTAL VULNERABILITIES

One of the neighborhood's most significant challenges is its susceptibility to flooding and storm surge inundation. The newly released Flood Insurance Rate Maps designate almost the entire neighborhood as a Flood Zone AE. Near the shoreline of Bermuda Boulevard there are areas within the Limit of Moderate Wave Action (LIMWA), which specifies a reduced velocity zone, with similar requirements as "V" zones. V, or velocity, zones signify danger to wave run-up. The base flood elevation in Palmetto Beach ranges from 11 to 14' NAVD88.

The area was studied for its vulnerability to sea level rise in the 2021 Regulatory Approach to Sea Level Rise project. Outcomes are shown in the image below.

Map showing FEMA Flood Zones and the LIMWA line for Palmetto Beach

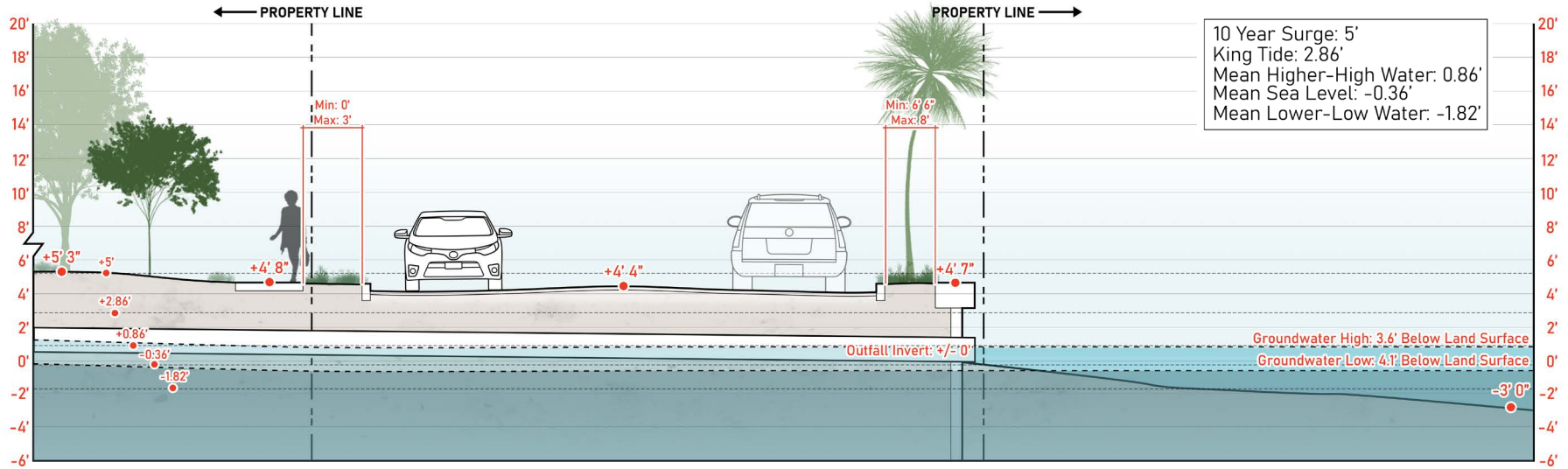
TIDES, NOW AND IN THE FUTURE

The East Port tide gauge shows that the 1-year stillwater for this area is approximately 2.0', with the king tide at 2.86' NAVD. The 10 year surge event was calculated to be 5' NAVD88. Other relevant data points are provided in the chart to the right.

Sea level rise is expected to increase 14" - 18" by the year 2050 for Gulf coastal communities (NOAA, 2022). Other scenarios have been defined by the Tampa Bay Climate Science Advisory Panel, which used NOAA 2017 data.

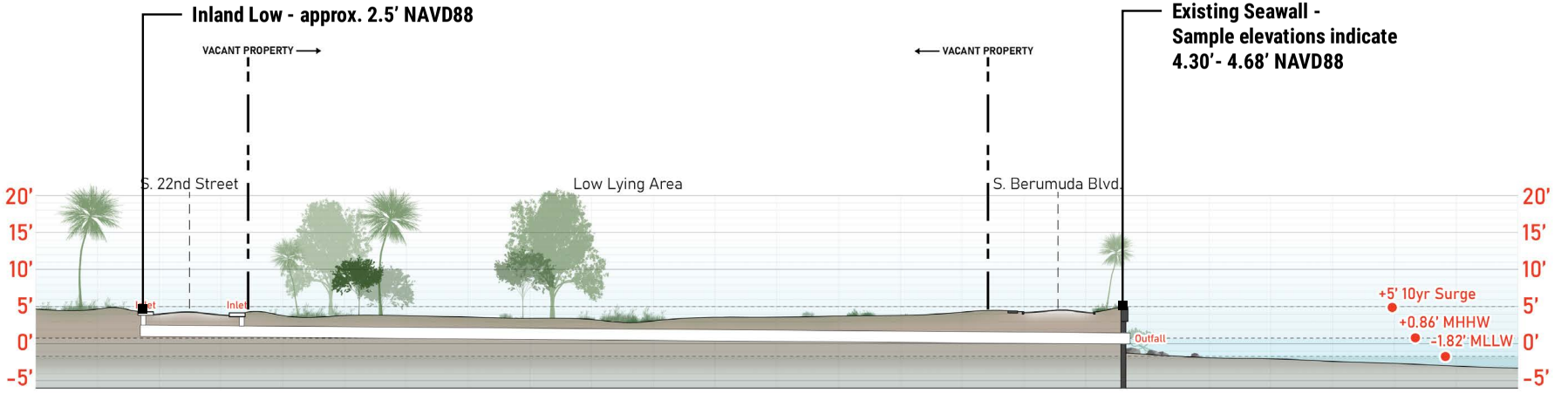
Year	NOAA Int-Low (feet)	NOAA Intermediate (feet)	NOAA High (feet)
2000[3]	0	0	0
2030	0.56	0.79	1.25
2040	0.72	1.08	1.77
2050	0.95	1.44	2.56
2060	1.15	1.87	3.48
2070	1.35	2.33	4.56
2080	1.54	2.82	5.71
2090	1.71	3.38	7.05
2100	1.90	3.90	8.50

Source: Tampa Bay Climate Science Advisory Panel (2019).



S. BERUMUDA BLVD.

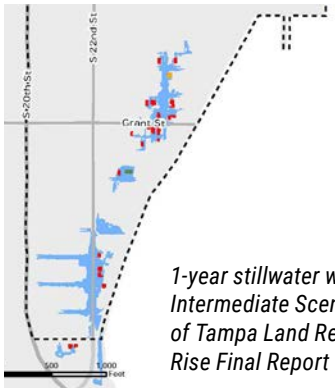
Tide data received from NOAA elevations in NAVD88, Epoch 1983-2001, for East Bay, FL



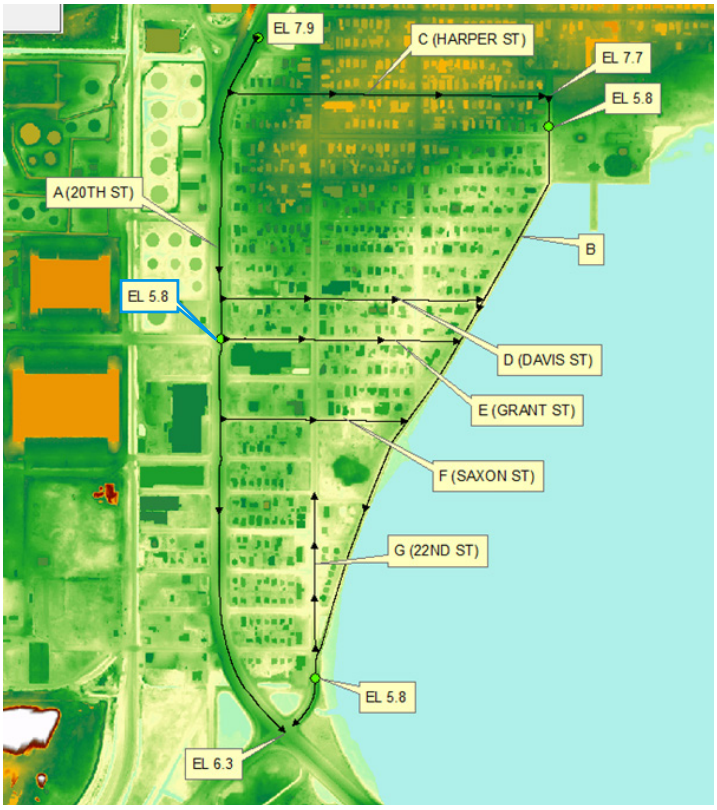
Elevations shown are representative, taken from a single transect along Bermuda Boulevard. Information is derived from the East Bay tide gauge (NOAA).

BERMUDA BOULEVARD ELEVATION STUDY

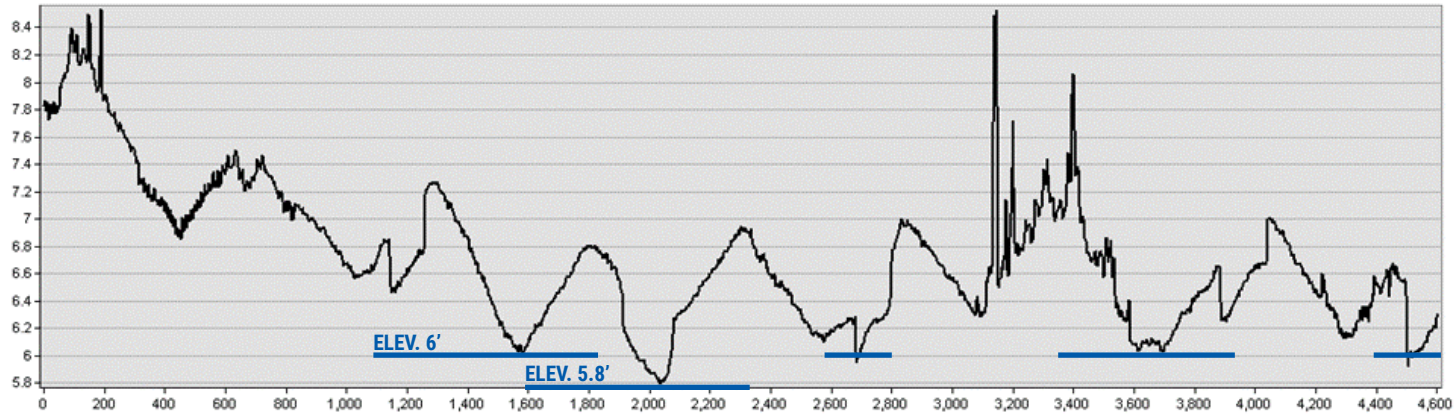
Seawall and topographic elevations were studied to evaluate potential protection levels, from coastal surge. The lowest elevations along 20th Street, a major boundary for the area, is at approximately 5.8’ NAVD88, with a consistent low elevation of about 6’. On the eastern edge, the centerline for Bermuda Boulevard ranges between elevation 3.2 to about 6.2 NAVD88. This does not account for the lowest points in the roadway, since the gutter at the edge of the street is lower, but provides a general sense of elevations.



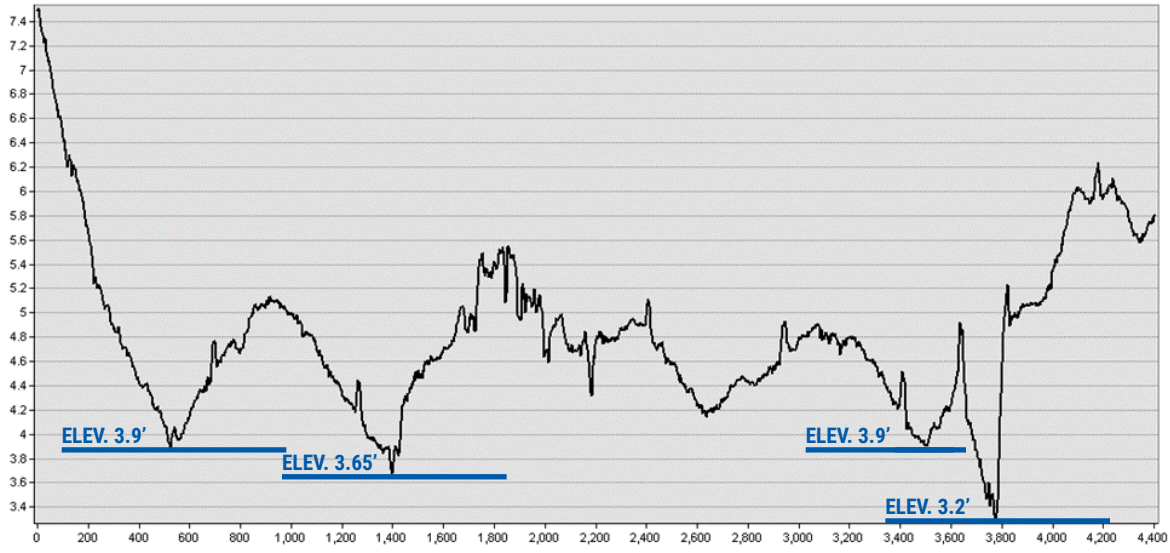
1-year stillwater with the 2060 High / 2100 Intermediate Scenario (per NOAA 2017), from the City of Tampa Land Regulatory Response to Sea-Level Rise Final Report (Cook, Cheng, & Fernandez, 2021)



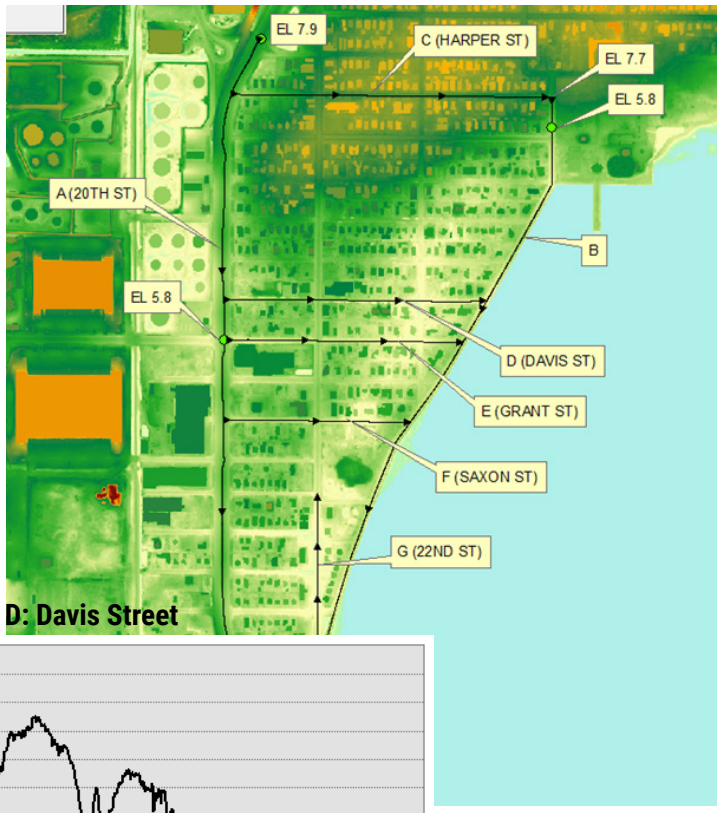
Section A: 20th Street



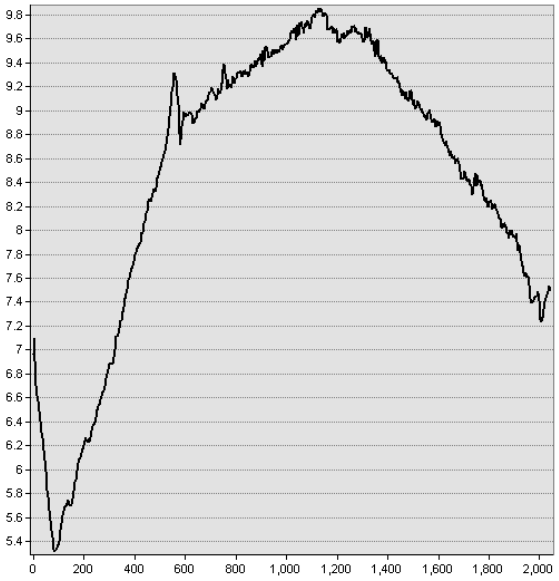
Elevation data is taken from the crown of the road, not the gutter



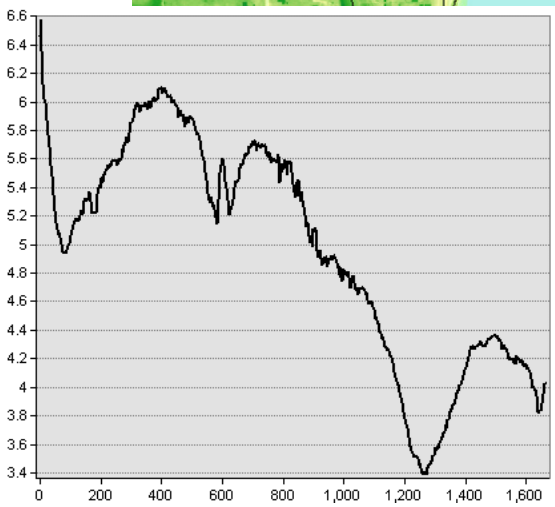
Section B: Bermuda Boulevard



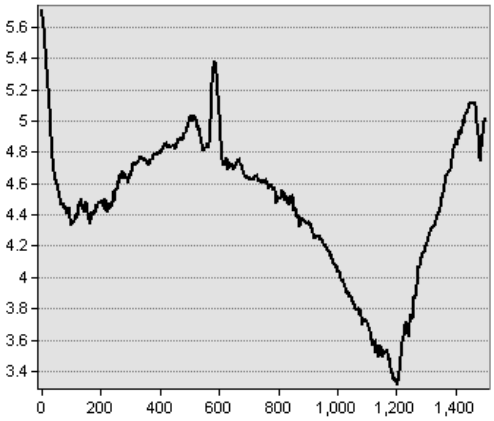
Section C: Harper Street



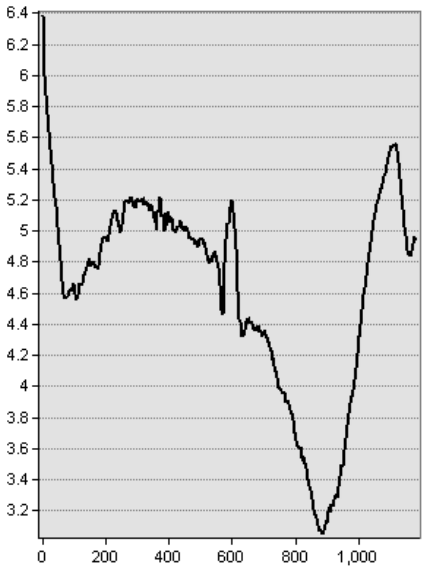
Section D: Davis Street



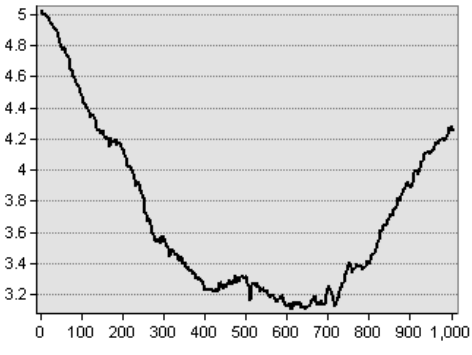
Section E: Grant Street



Section F: Saxon Street



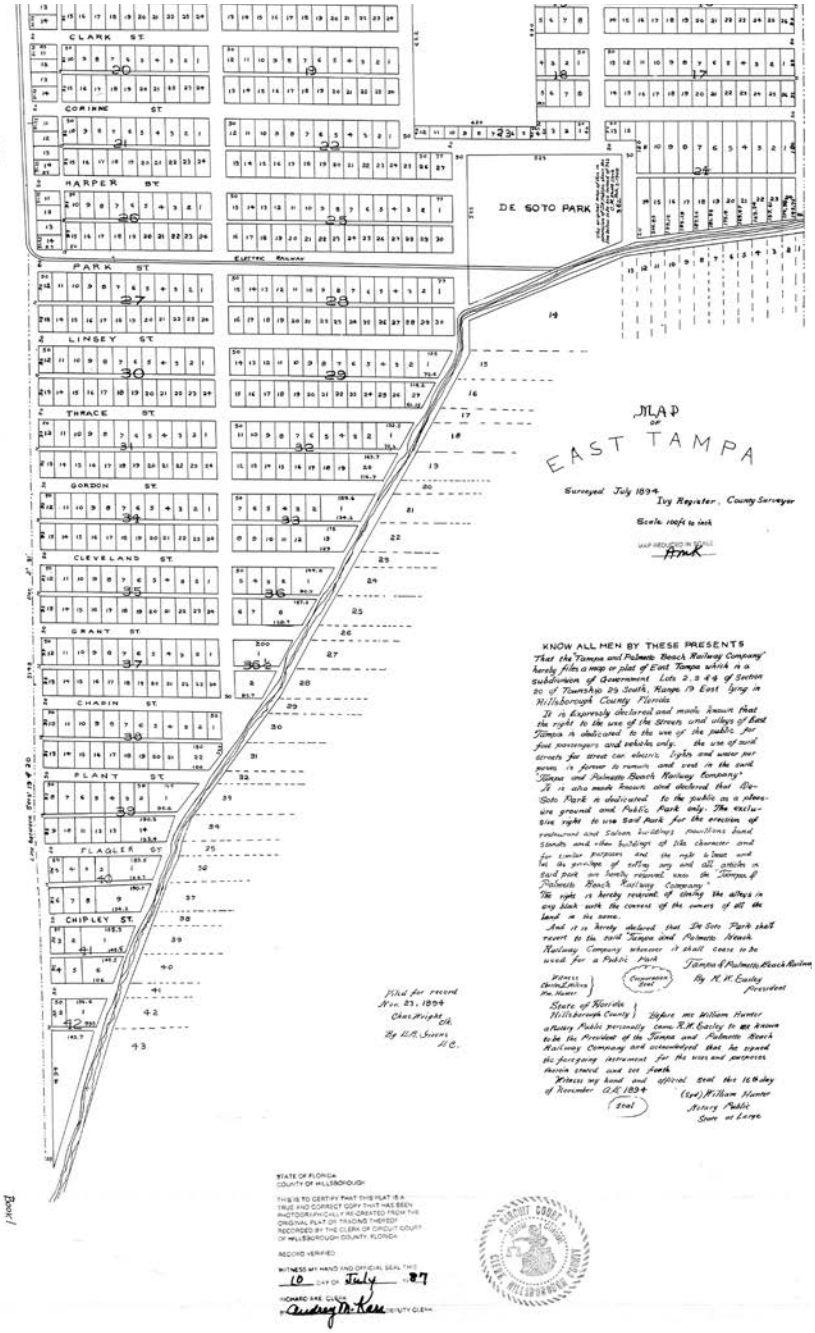
Section G: 22nd Street



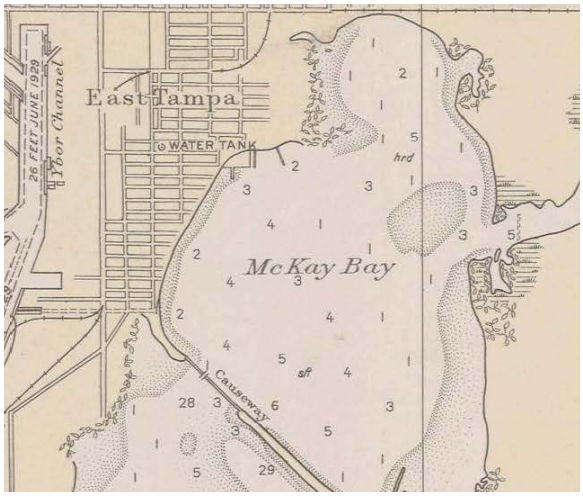
OWNERSHIP: RIGHT OF WAYS, PARCELS, AND EASEMENTS

SUBMERGED PARCELS

Original property ownership off the coast of Palmetto Beach was defined by lines that extended from inland lot lines, across the beach and into the water. It does not appear that a distance from shore was established.



1894 Plat Survey of Palmetto Beach, pre-seawall (1921 Hurricane)

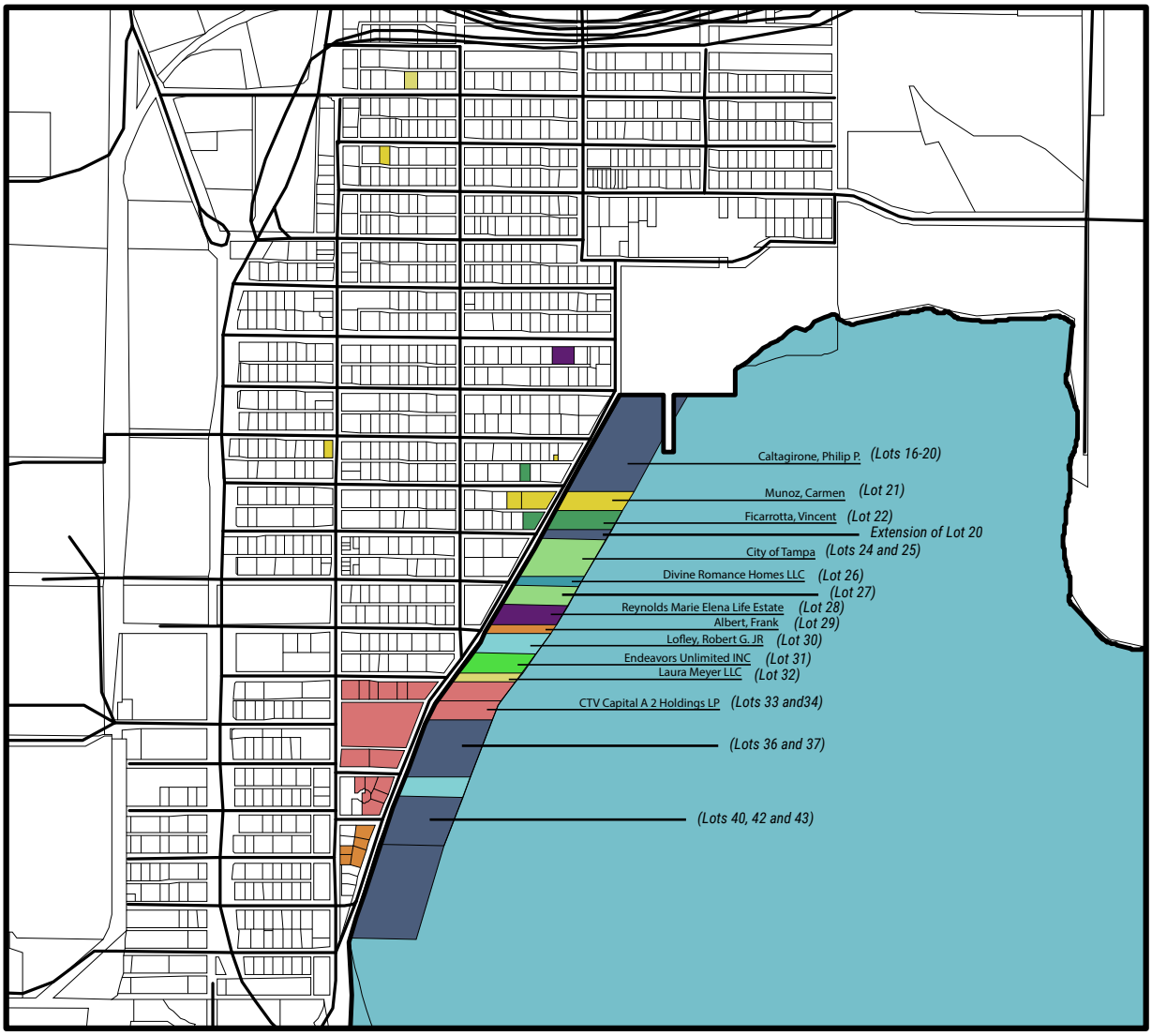


Historic 1930 beach/coastline of Palmetto Beach, post-1921 Hurricane

Historic beach/coastline of Palmetto Beach

Over time the inland properties were separated from the submerged property, possibly when the seawall was constructed. Some of the submerged properties were sold separately. There are currently eighteen submerged parcels covering 23.33 acres that abut the Bermuda Boulevard seawall. Only one of those parcels (605 South Bermuda Boulevard, Lot 22, Folio 1908990000) crosses Bermuda Boulevard. The owners that have maintained their adjacent property ownership, for inland and submerged parcels (although split), include Lot 21 (Munoz), 29 (Frank), and 33-34 (CTV Capital A2 Holdings LP). There are two submerged parcels belonging to the City.

A utility project in 1972 was responsible for constructing a 54" pressurized sewer main in Bermuda Boulevard. This project was funded through an Environmental Protection Agency (EPA) and property ownership of the road and right of way would have been necessary in order to confer the grant from a federal agency and construct the project. Other aspects of the property boundaries remain in question. For example, it would appear that the exact survey delineation of parcels has not been established, including the extent of property ownership into the bay.



Property ownership map

The submerged parcels not belonging to the City have an Assessed Value of $892,900 and a Tax Value of $842,900.

DOR_C	OWNER	SITE_ADDR	LEGAL2	ASD_VAL	TAX_VAL	ACREAGE
Single Family R	Vincent Ficarrotta	605 Bermuda Blvd	Lot 13 block 33 less w 63 ft thereof and water lot 22 and s 1/2 of vacated alley lying northerly of lot 13 less w 63 ft	180,699	130,699	1.03
Vacant Industry	Phillip P Caltagirone Et Al	402 S Bermuda Blvd	Water lots 15 to 20 incl and lot 23	160,376	160,376	4.37
Vacant Industry	Carmen Munoz	602 Bermuda Blvd	Water lot 21	37,482	37,482	0.83
Municipal	City Of Tampa	0 Bermuda Blvd	Water lots 24 and 25	62,125	-	1.63
Vacant Industry	Divine Romance Homes LLC	0 Bermuda Blvd	Water lot 26	17,325	17,325	0.4
Municipal	City Of Tampa	802 S Bermuda Blvd	Water lot 27	6,820	-	0.81
Vacant Industry	Marie Elena Reynolds/Life Estate	840 S Bermuda Blvd	Water lot 28	31,656	31,656	0.84
Vacant Industry	Frank Albert	0 Bermuda Blvd	Water lot 29	17,325	17,325	0.39
Boat Slips	Robert G Lofley Jr	902 S Bermuda Blvd	Water lot 30	36,651	36,651	0.83
Vacant Industry	Endeavors Unlimited Inc	904 S Bermuda Blvd	Water lot 31 block 38	5,896	5,896	0.84
Vacant Industry	Laura Meyer LLC	0 Bermuda Blvd	Water lot 32	16,516	16,516	0.39
Vacant Industry	Ctv Capital A 2 Holdings LP	1002 S Bermuda Blvd	Water lot 33	31,656	31,656	0.82
Vacant Industry	Ctv Capital A 2 Holdings LP	1006 S Bermuda Blvd	Water lot 34	31,656	31,656	0.81
Vacant Industry	Robert G Lofley Jr	1022 Bermuda Blvd	Water lot 39	43,690	43,690	0.83
Vacant Industry	Philip P Caltagirone Et Al	1300 S Bermuda Blvd	Water lots 35 to 38 incl and water lots 40 to 42	154,843	154,843	4.48
Vacant Industry	Philip P Caltagiorne Et Al	0 Bermuda Blvd	Water lot 43	127,129	127,129	4.03
			Total	961,845	842,900	23.33

Information is from the Hillsborough County Property Appraiser's office, for the submerged parcels in front of Bermuda Boulevard.

In Tampa, submerged properties are typically regulated by the Port Authority. The situation in Palmetto Beach is unique, since private property owners still hold lands that are below the mean high water line, a remnant of the historic working waterfront condition. Recently, a property owner created an agreement with the Port, which defined rights associated with submerged lots 33 and 34 and established a precedence for the neighborhood.

In an August 4th, 1992 Quit Claim Deed between the Port of Tampa (Grantor) and the trustees of the Fernando Hevia Jr. Living Trust (Grantee), the two parties agreed that the Port would *"remise, release and quit claim unto the said Grantee forever, all the right, title, interest, claim, and demand which the said grantor has in and to the legal title to but not regulatory rights over the following described lot…",* [Lot 33- 34], *"…To have and to hold the same together with all and singular the appurtenances thereunto belonging or in anywise appertaining and all the estate, right, title, interest, lien, equity and claim whatsoever of the said Grantor, either in law or equity, to the only proper use, benefit and behoof of the said Grantee forever subject, however, to all easements, covenants, conditions, rights and restrictions appearing of record at the time of conveyance."*

The Quit Claim Deed Exhibit A further states that "No structure shall be placed closer than 25' to the north property line of Lot 33 nor closer than 25' to the south property line of Lot 34, nor shall there be constructed within the said setback lines more than 10,000 square feet of actual physical dock construction nor more than two (2) separate structures. These setback lines and square footage restrictions shall be appurtenant to and shall run with the land and may be enforced by the Tampa Port Authority or any public entity owing the surrounding sovereign lands any interest therein."

The submerged Hevia properties are now owned by CTV Capital Holdings (Green).
The image above shows Quit Claim Deed Restrictions (Crosshatching).

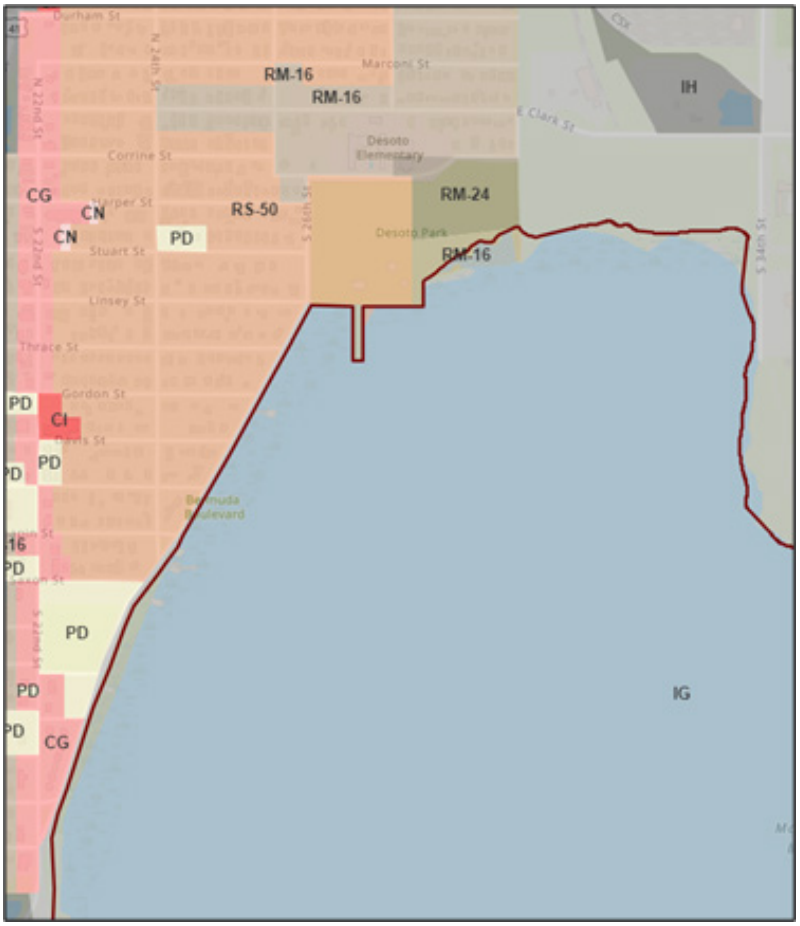
Construction on the submerged parcels in Palmetto Beach would likely be limited to shoreline improvements and docking. Property documents stipulate that improvements require a water-born need and "sufficient upland ownership interest." This determination would have to be legally defined.

CITY OF TAMPA ZONING

All submerged parcels in Palmetto Beach are zoned as "Industrial General." The City Code of Ordinances Section 27-156 states:

> *"(5) Industrial districts. The industrial districts provide primarily for manufacturing, processing, assembly, warehousing and related uses at appropriate intensities and locations in accordance with the Tampa Comprehensive Plan. Performance standards are used to ensure compatibility with neighboring uses and districts. Planned development districts (PD and PD-A) are also permitted in appropriate locations in accordance with the Tampa Comprehensive Plan.*
>
> *a. IG industrial-general. This district provides primarily for areas of light manufacturing, wholesaling, warehousing, assembly or product processing, heavy equipment and vehicular repairs and other light industrial uses. The industrial general district is established to provide areas for industry in locations, which are served by major transportation facilities and adequate utilities, but are not feasible nor highly desirable for heavier industrial development because of proximity to residential, recreational, commercial or related developments. The district is to permit development compatible with uses of residential property adjoining or surrounding the district, with suitable open spaces, landscaping and parking area, which emits limited noise, odors, or light which can be detected on surrounding land."*

The CTV Capital A2 Holdings LP (CTV) parcels located on the west side of Bermuda Boulevard are zoned as "Planned Development (PD)". Parcels along Bermuda Blvd to the north and south of the CTV parcels are zoned as "Residential Single Family" and "Commercial General", respectively (Figure 1). Development plans submitted to the City for the purposes of rezoning to Planned Development show five retail spaces with condominium spaces above ground floor located along 22nd street, seventy four retail/condominium parking spots, sixty residential units each with two parking spots, a swimming pool, a stormwater pond, and greenspace. Additionally, the plan labeled the CTV owned submerged parcel "restaurant/dock".



City of Tampa Zoning Map, Palmetto Beach

Other submerged property owners have shared development plans with the City. These plans have not yet been permitted or formally approved. For example, at the Lofley property, a dock and restaurant has been proposed (see the next page). This type of development would be subject to regulatory constraints, such as permitting by the Army Corp of Engineers for both boat traffic and dredging and manatee safety. The primary channel is located about half a mile from the shoreline. Tidal conditions would also be difficult for such a development, since the area is a tidal flat that goes dry during some low tide conditions. Lastly, any commercial development would be subject to zoning and City permitting requirements, such as parking and land use, and would need utility connections.

PROSPECTIVE DEVELOPMENT: LOFLEY PROPERTY

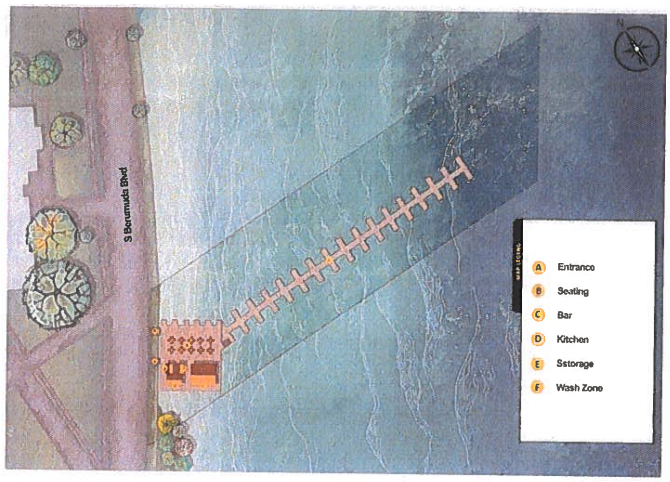


Image: Lofley Dock of the Bay Draft Rendition

Image: Draft Rendition of Lofley Dock of the Bay

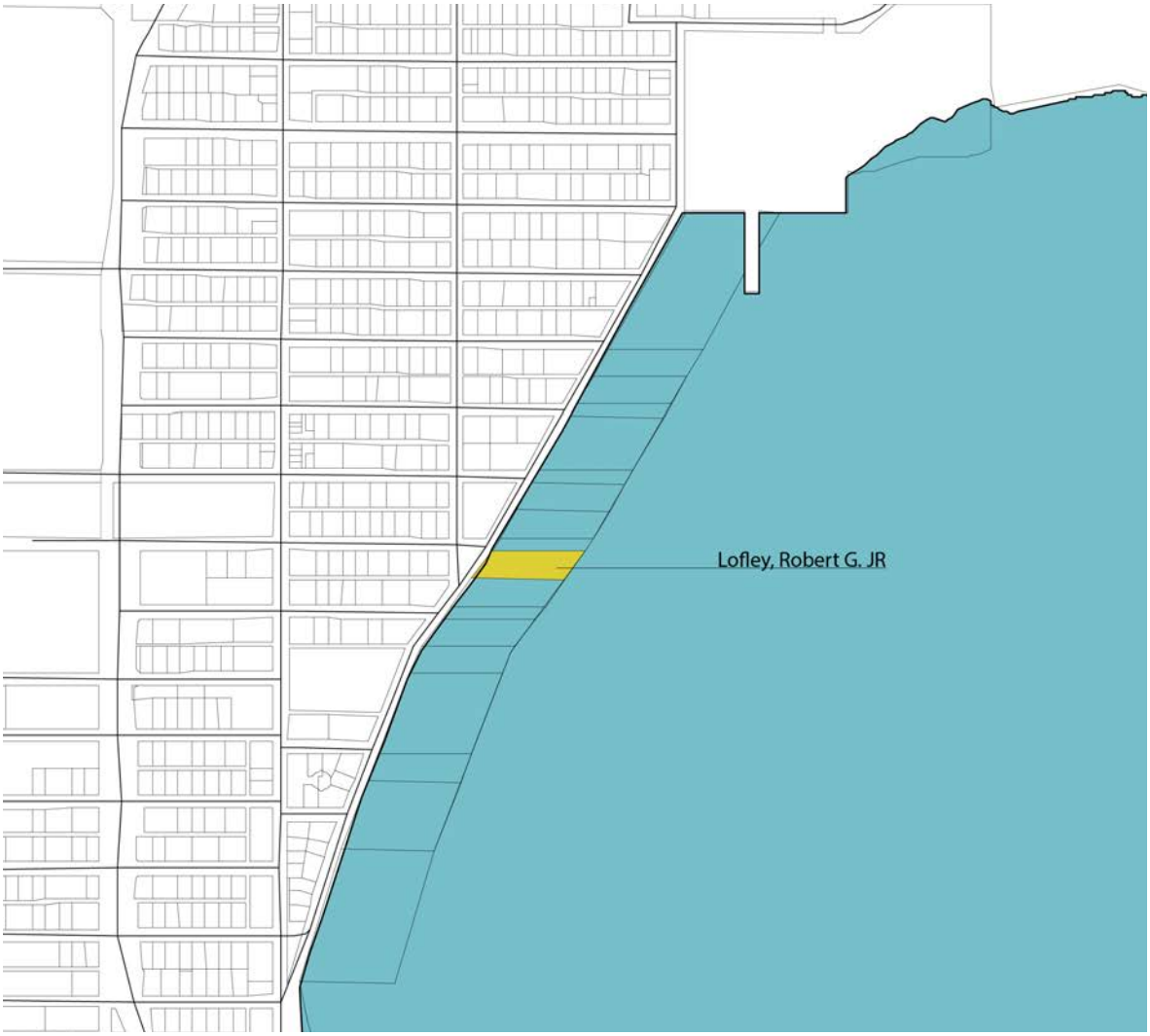
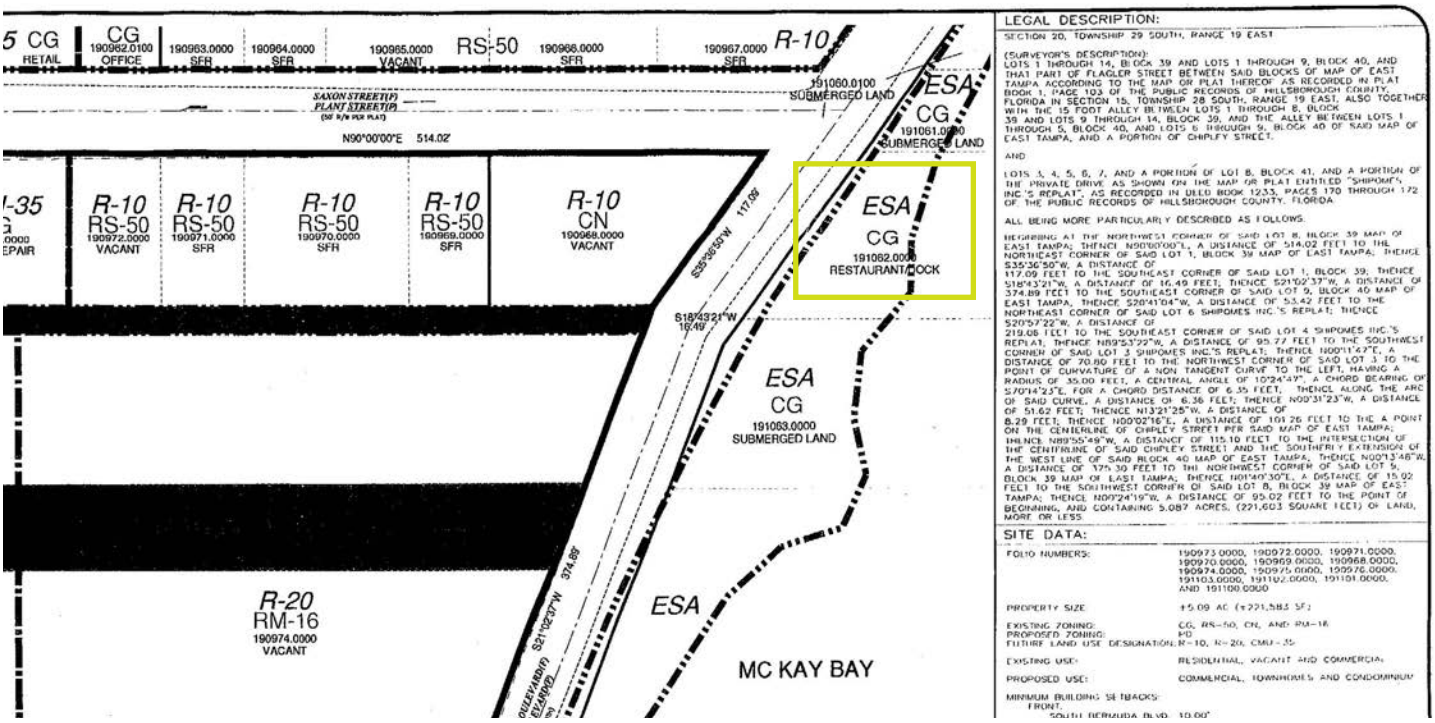


Image: Map showing property location

PROSPECTIVE DEVELOPMENT: CTV PROPERTY, 2007 DEVELOPMENT PLAN



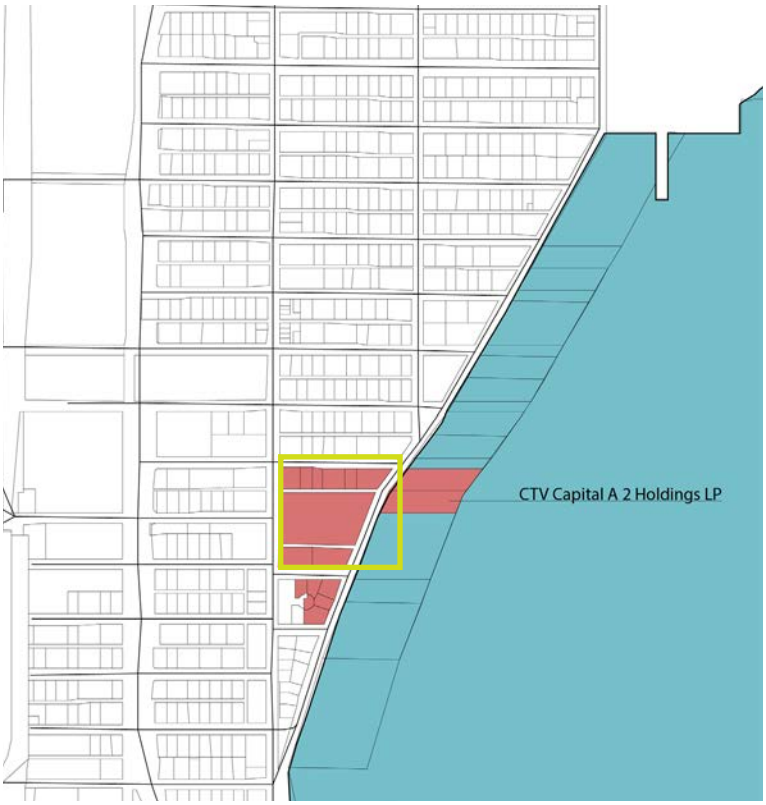


Image: Map showing property location

The property previously associated with the Hevia legal case has since changed ownership and is currently held by CTV Capital A 2 Holdings. Before that, in 2006/2007, a Planned Development (PD) was submitted to the city for the subject property. GLG Magnolia Oaks LLC. was the owner at the time, and the development was named “Bermuda Vistas.”

In that plan, a submerged parcel (highlighted) was labeled as “Restaurant/Dock,” with an Environmental Sensitive Area (EAS) and Commercial, General (CG) zoning designation.

A more fully developed plan can be seen on the following page.

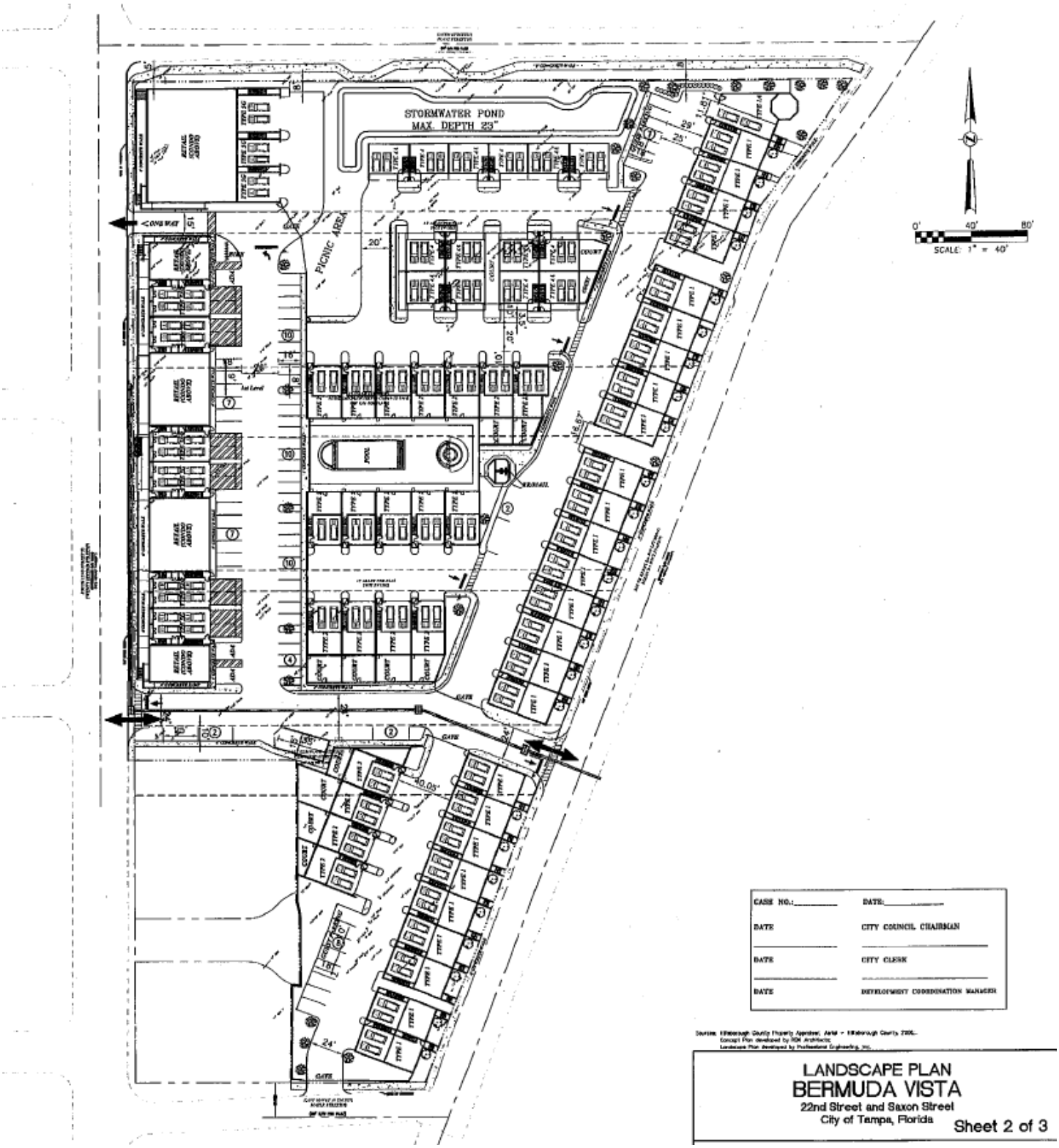


Image: Detailed plan for Bermuda Vista

ENVIRONMENTAL AND PROJECT PERMITTING

Proposed activities in, on, over, or below the Mean High Water (MHW) line (wetlands and surface waters) are subject to the following permit requirements. The Mean High Water Line boundary is the average daily high tide and delineates lands owned by the State of Florida in its sovereign capacity (submerged) and the uplands, which are subject to private ownership.

Federal Permitting

At the Federal level, the U.S. Army Corps of Engineers (USACE) can issue a 'Nationwide' permit, usually where project wetland impacts are less than 0.5 acres. They can also issue an 'Individual' permit where there are greater environmental impacts. The Individual permit includes Public Notice and other federal coordination. The USACE can also issue an 'Exemption' or a 'No Permit Required' (NPR) for low environmental impact plans. USACE/State 404 Commenting, Coordinating, Permitting and Consultation Agencies include the following:

- United States Environmental Protection Agency (USEPA)
- US Fish and Wildlife Service (USFWS)
    - Threatened and Endangered Species Consult/Permit
- National Marine Fisheries Service (NMFS)
    - Essential Fish and Endangered Species habitat Consult/Permit
- State Historic Preservation Office (SHPO) - consults with USACE
    - Historic or Archaeological Consult/Permit
- Tribal Historic Preservation Office (THPO) - consults with USACE
    - Tribal Consultation

State Permitting

State Environmental Resource Permits (ERPs) are issued by either the Florida Department of Environmental Protection (FDEP) or the Southwest Florida Water Management District (SWFWMD): depending on previous site permitting and other permit history one of the two agencies will accept and review the project, and either agency can issue the same level of state permits. These agencies can also issue exemptions for minor permitting plans. Permits that may be necessary include:

- Environmental Resource Permit, general permit or individual permit: The state individual permit is needed for a project proposing wetland or MHW impacts. General permits are more easily attained and involve more minor activities, for example a General permit for geotechnical investigation in wetlands (if needed).

State commenting, coordinating, permitting, and consultation agencies may confer with FDEP or SWFWMD. These include:

- Florida Fish and Wildlife Conservation Commission - Threatened and endangered species consult/permit
- State Historic Preservation Office (SHPO) - Historic or archaeological consult/permit
- Tribal Historic Preservation Office (THPO) - Tribal consultation

Local Permitting

Local permitting will also be required, which may include the following:

- Environmental Protection Commission of Hillsborough County (EPC) Wetlands Division – Permits are required for wetland impacts and activities in, on, over, above or below MHW. EPC Issues Minor Work Permit for seawall repair or reconstruction, a responsibility delegated by Port Tampa Bay (PTB). EPC also issues Maintenance Activities in Wetlands (MAIW) Permit for wetland impacts < 500 sq. ft. or a Wetland Mitigation Permit for greater wetland impacts.
- Port Tampa Bay (PTB) – The Port issues Standard and Minor Work Permits for construction activities in, on, over, above or below MHW, which are not delegated to EPC. For the waterward parcel development proposals, PTB may be the Agency issuing the Standard or Minor Work Permit.
- City of Tampa (COT) Construction Permit - Needed for seawall construction permitting. The City Coordinates with EPC and Port Tampa Bay for Standard or Minor Work Permits, prior to issuing building permits for areas over the water.

HABITAT & LISTED SPECIES

A query of the Florida Natural Areas Inventory (FNAI) Biodiversity Matrix for Listed Species indicated that the twenty-four listed species may occur in grid 26046 which encompasses all of Palmetto Beach and parts of McKay Bay (Table 1).

***Table 1**: FNAI Potential Listed Species for Palmetto Beach*

Scientific and Common Names	Federal Status	State Listing
Wood Stork, *Mycteria americana*	T	FT

Scientific and Common Names	Federal Status	State Listing
Animal		
Gulf Sturgeon, *Acipenser oxyrinchus desotoi*	T	FT
Florida Sandhill Crane, *Antigone canadensis pratensis*	N	ST
Florida Burrowing Owl, *Athene cunicularia floridana*	N	ST
Bicolored Burrowing Scarab Beetle, *Bolbocerosoma hamatum*	N	TN
Piping Plover, *Charadrius melodus*	T	FT
Eastern Indigo Snake, *Drymarchon couperi*	T	FT
Hawksbill Sea Turtle, *Eretmochelys imbricata*	E	FE
Florida bonneted bat, *Eumops floridanus*	E	FE
Gopher Tortoise, *Gopherus polyphemus*	C	ST
Southern Hognose Snake, *Heterodon simus*	N	N
Short-tailed Snake, *Lampropeltis extenuata*	N	ST
Florida Long-tailed Weasel, *Mustela frenata peninsulae*	N	N
Elongate June Beetle, *Phyllophaga elongata*	N	N
Florida Clapper Rail, *Rallus longirostris scottii*	N	N
Southeastern Fox Squirrel, *Sciurus niger niger*	N	N
Large-Jawed Cebrionid Beetle, *Selonodon mandibularis*	N	N
Florida Prairie Warbler, *Setophaga discolor paludicola*	N	N
Florida Manatee, *Trichechus manatus latirostris*	T	N
Plant		
Incised groove-bur, *Agrimonia incisa*	N	T
Sand butterfly pea, *Centrosema arenicola*	N	E
Godfrey's swampprivet, *Forestiera godfreyi*	N	E
Chapman's skeletongrass, *Gymnopogon chapmanianus*	N	N
Celestial lily, *Nemastylis floridana*	N	E
Giant orchid, *Pteroglossaspis ecristata*	N	T

A query of the United Stated Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) indicated that fourteen listed species may occur in or utilize habitats in Palmetto Beach and McKay Bay (Table 2).

Table 2: *Listed Species that May Occur in Palmetto Beach and McKay Bay (USFWS)*

Endangered Species	Status
Birds	
Audubon's Crested Caracara, *Polyborus plancus audubonii*	Threatened
Eastern Black Rail, *Laterallus jamaicensis ssp. jamaicensis*	Threatened
Red Knot, *Calidris canutus rufa**	Threatened
Whooping Crane, *Grus americana*	Experimental Population
Wood Stork, *Mycteria americana*	Threatened
Flowering Plants	
Florida Golden Aster, *Chrysopsis floridana*	Endangered
Pygmy Fringe-tree, *Chionanthus pygmaeus*	Endangered
Insects	
Monarch Butterfly, *Danaus plexippus*	Candidate for listing
Mammals	
West Indian Manatee, *Trichechus manatus**	Threatened
Reptiles	
American Crocodile, *Crocodylus acutus**	Threatened
Eastern Indigo Snake, *Drymarchon couperi*	Threatened
Hawksbill Sea Turtle, *Eretmochelys imbricata**	Endangered
Leatherback Sea Turtle, *Dermochelys coriacea**	Endangered
Loggerhead Sea Turtle, *Caretta caretta**	Threatened

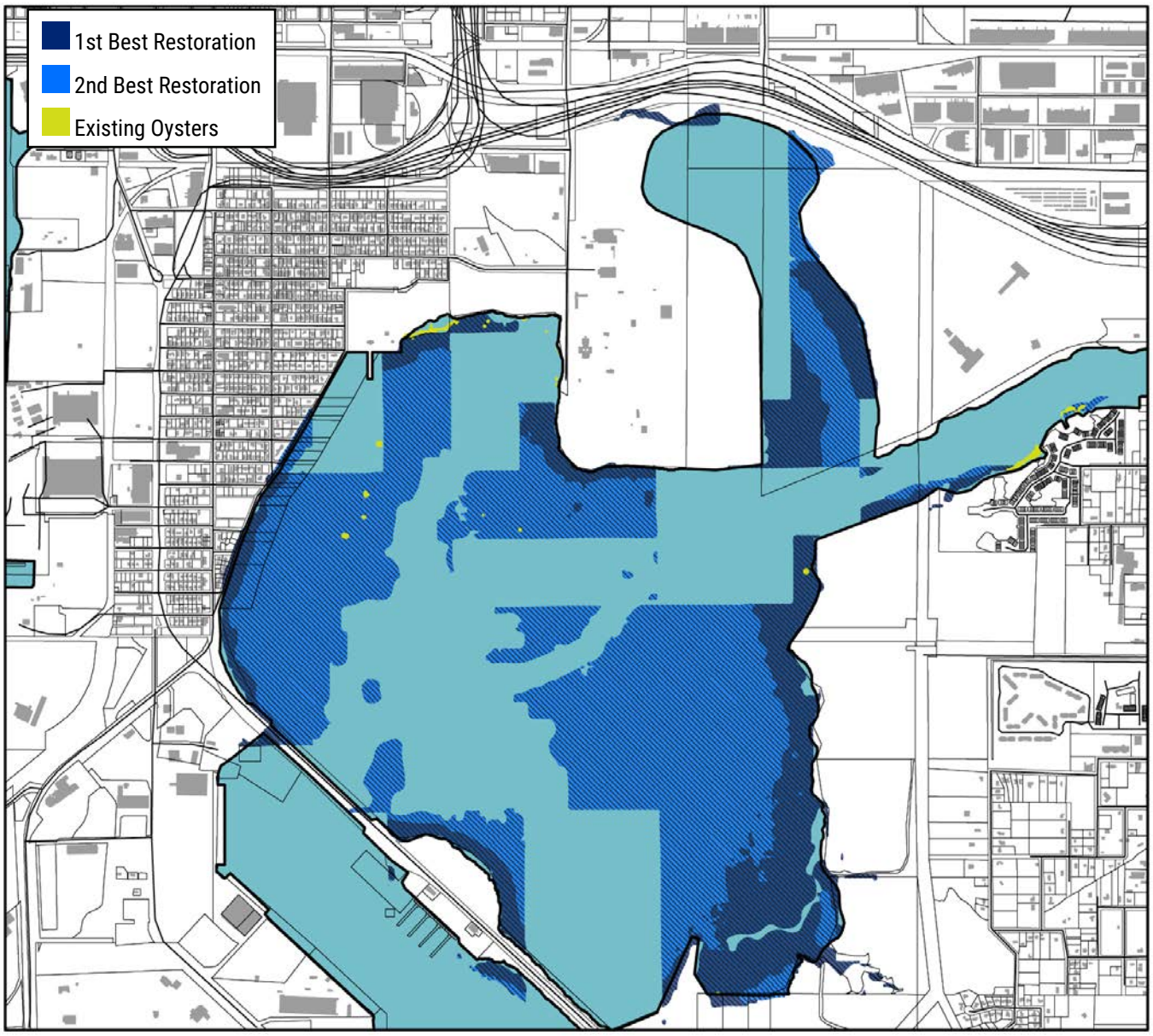
*This species has final critical habitat, i.e., specific geographic areas that contain features essential for the conservation of a threatened or endangered species and that may require special management and protection.

CURRENT AND POTENTIAL OYSTER LOCATIONS

Oysters are endemic to the McKay Bay estuary, and represent a significant habitat type for the bay. The Tampa Bay Oyster Habitat Sustainability Index was created by the Tampa Bay Estuary Program to provide a suitability mapping for where oysters may successfully be restored. The model helps by showing focus areas for this work.

Inputs that determine oyster suitability include:
Model Score = bathymetry score + isohaline score + sea grass score + navigation channels score + sediment score

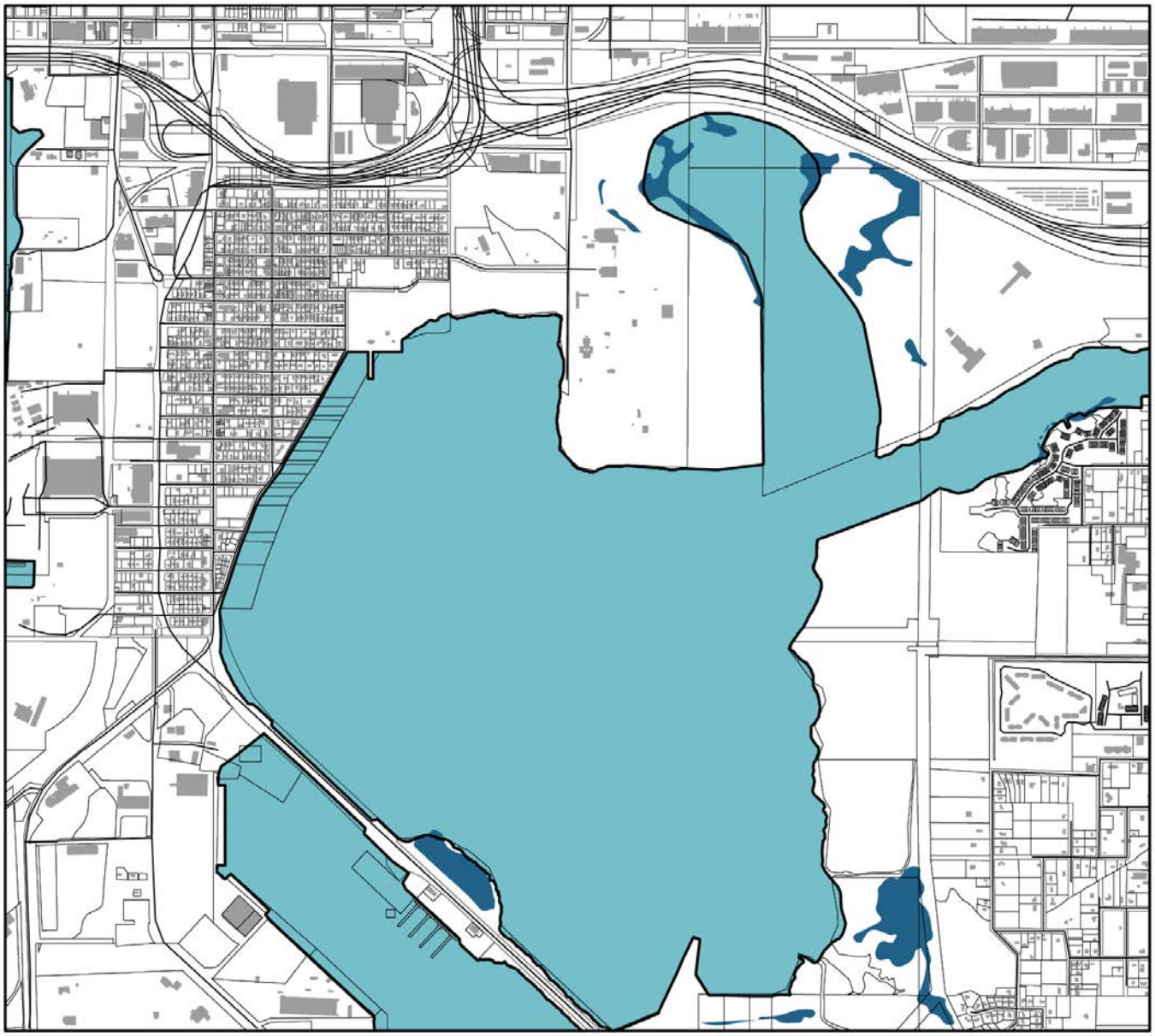
Within McKay Bay there are multiple areas that can be readily populated with oysters, but the map also shows areas that could be improved, for example the dredged channel that bisects the bay.



Source: Tampa Bay Estuary Program, Tampa Bay Oyster Habitat Sustainability Index

SALT MARSH

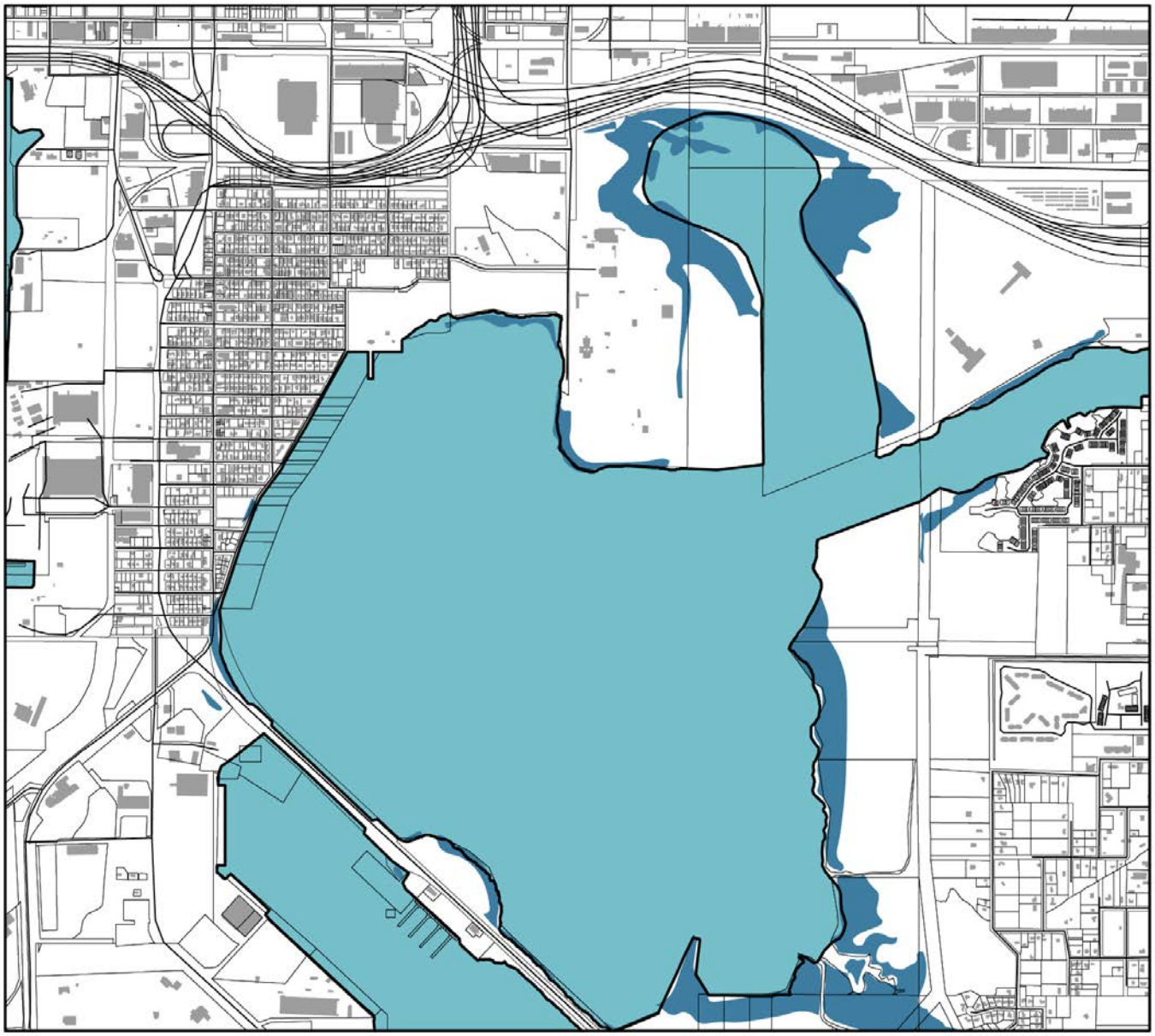
Salt marshes were found in limited areas within McKay Bay. These are becoming less frequent as mangroves tend to take over in marsh habitats.



Source: Florida Fish and Wildlife Conservation Commission GIS & Mapping Data Downloads

MANGROVES

Mangroves are typical shoreline colonizers, and contribute to both habitat and erosion control. They are located at most all shoreline edges of McKay Bay, except where seawalls and other heavy human disturbances occur.



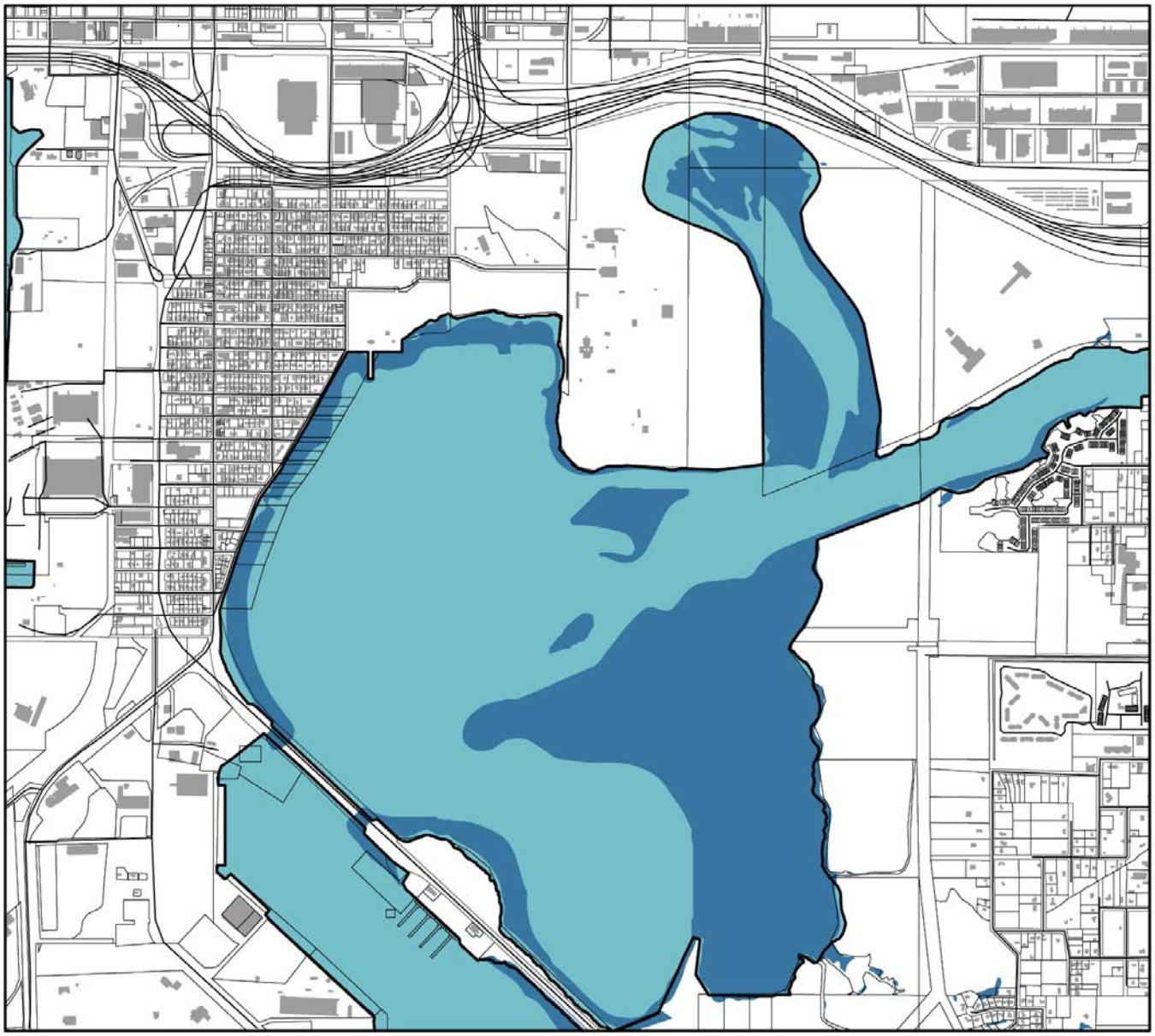
Source: Florida Fish and Wildlife Conservation Commission GIS & Mapping Data Downloads

TIDAL FLATS

McKay Bay has a low topographic gradient, especially where no dredging has previously occurred. The vertical tidal range has a very large horizontal effect, exposing a large amount of land. Tidal flats are highly productive ecosystems. Although their associated diversity is low, they contain large volumes of microorganisms and benthic infauna, which are food for fin and shellfish, as well as birds. Clean water and sediments are important factors for maintaining a healthy tidal flat environment.

SEA GRASS

No data is available showing whether the shoreline along the Bermuda Seawall has supported sea grasses, however sea grasses do occur in McKay Bay.



Source: Florida Fish and Wildlife Conservation Commission GIS & Mapping Data Downloads

WATER QUALITY & POLLUTION

There are no Total Maximum Daily Loads (TMDLs) or Basin Management Action Plans (BMAPs) for McKay Bay (WBID 1584B) currently. According to the Impaired Waters Rule (IWR) database run 64, McKay Bay is listed for enterococci. There is currently a reasonable assurance plan for Hillsborough Bay, which includes McKay Bay, in place that is administered Tampa Bay Estuary Program (TBEP). The 2022 Tampa Bay Water Quality Assessment completed by TBEP shows management plans are steering water quality in the right direction. There have been continued exceedances of nutrients and chlorophyll-a as recent as 2022.

A TMDL report from 2004 cites McKay Bay as having similar issues to present day. “Anthropogenic activities inherently contribute to water quality degradation. McKay Bay is intensely urbanized, receiving stormwater from industrial and residential areas. Tidal fluctuations are the dominant forces influencing the bay’s flow patterns. Water exchange has been constricted by the construction of the 22nd Street Causeway. This constriction reduces tidal flushing and contributes to the nutrient enrichment observed in the bay. Dredge-and-fill activities along mangrove shorelines and the bay bottom, former landfills, seawalls, and mosquito ditches all affect the bay’s water quality.” (Burger and Petrus, 2004).

Currently, there are four contamination sites close to the Bermuda Boulevard Seawall, and they are all FDEP Petroleum cleanup sites. From north to south, the sites are:

- Davis St. – Dixie Neon Co. Inc.
- Chapin St. and 22nd St. – Quick Food Store
- Saxon St. and 22nd St. – Majik Kwik Stop
- 22nd St. – McClendon Oil Co. Inc.

POTENTIAL STRATEGIES

This study has created a suite of options that address the coastal edge in the Palmetto Beach community. Multiple strategies are recommended for the Bermuda Boulevard seawall, which can be combined uniquely. Solutions address the seawall, the shoreline condition, and the Bermuda Boulevard right of way. These options can be further evaluated through a PD & E process.

An analysis is included for each, addressing:

- Components of the design
- Permitting
- Habitat Improvement, for people or for marine life
- Risk Reduction
- Constraining Factors
- Cost (Detailed cost breakdowns are included in the Appendix)

The strategies can be described as shown. Each is explained in the following pages.

SEAWALL DESIGNS		SHORELINE DESIGNS		RIGHT-OF-WAY DESIGNS
Replace In-Kind	X	Maintain Offshore Conditions	X	Parallel Street Parking with Bike Lane
Raise to Elevation 6'		Riprap Coastline		Sloped Road and Bioswale
~~Sloped Living Shoreline~~ (Not Recommended)				

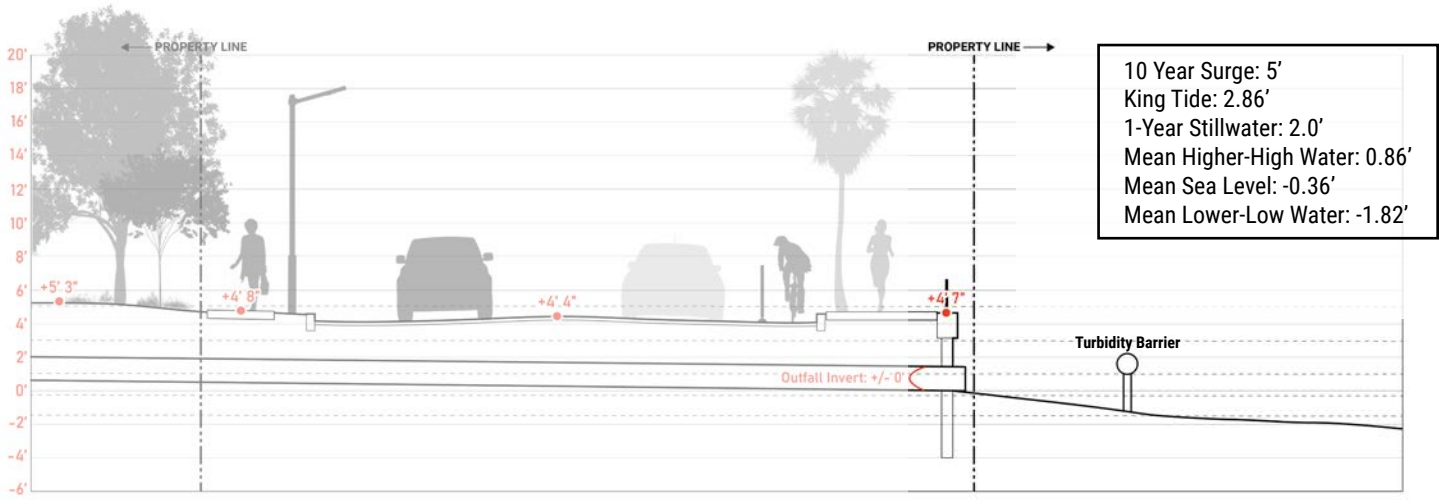
SEAWALL DESIGNS

A. REPLACE SEAWALL IN-KIND

This is the simplest of solutions, requiring the least amount of permitting and design analysis, but it will be difficult to find funding for a seawall that does not include habitat or improved risk mitigation.

Components

This design follows the guidance provided by previous reports for the Bermuda Boulevard seawall. This could include, as was suggested by the 2019 report, that 1,360 linear feet of existing seawall remain, while the remaining 2,073 is replaced, with all of it receiving a new concrete cap. Details are described in the 2018 and 2019 Bermuda Boulevard seawall assessment reports. A structural evaluation should be completed to determine if the entire seawall should be removed.



Tidal gate valves should also be considered for stormwater outfalls. There are 12. By 2050 it is expected that the 1-year stillwater event will be approximately equal to the average stormwater inlet elevation within the community. Any additional tidal flow, usually associated with storm conditions, could induce street flooding. This project could be deferred until conditions become worse, since there would not be any immediate protection to daily or seasonal tides. However, for unique events such as with tropical cyclones, tidal valves would provide approximately 15" of additional tidal flood relief since the area is protected at the perimeter by the seawall at an approximate elevation of between 4.3' and 4.8' NAVD. The area within the community below elevation 4.8 is shown in the map below, which is the effective area protected by the tidal gate valves.

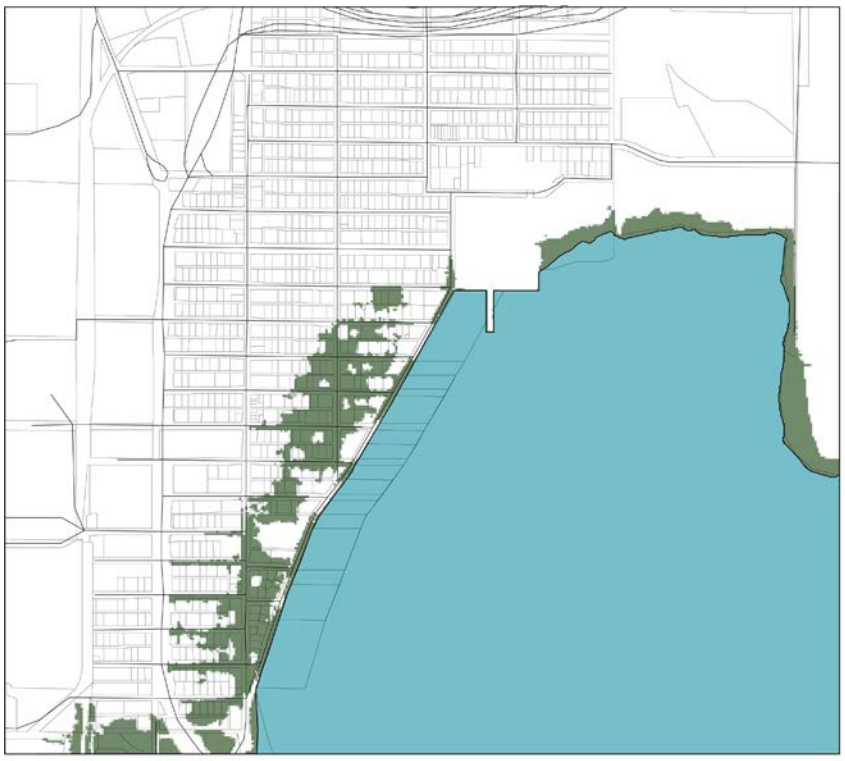
Permitting
This design has already been subject to permitting scrutiny and was approved by the Army Corp of Engineers and the Environmental Protection Commission.

Habitat Improvement
No change in habitat impact would result.

Risk Reduction
Replacing the seawall in-kind does not add new levels of storm surge and sea level rise protection, but it does increase the strength of the existing wall. Risk reduction would occur if tidal gate valves were installed at the 12 outfalls along the seawall.

Constraining Factors
Replacing the seawall in-kind is the least disruptive and easiest to permit, but doing so does not provide additional risk mitigation or habitat benefits, which is desired from most granting agencies.

Cost
The 2019 Bermuda Boulevard Seawall Repair Cost Estimate Review estimated that the seawall could be replaced with a cantilevered wall for a reduced cost of $5,295,653. Additional costs would result from incorporating tidal gate valves at all outfalls within the seawall, which would cost approximately $480,000, with an assumption of $40,000 each. A railing along the seawall is expected to add approximately $573,580 to the cost. Combined, the seawall restoration would total $6,901,484, not including other MOT, mobilization, and contingency costs. Opinion of total cost, as is detailed in the appendix, is $7,426,497.



Map: Areas affected by SLR that are below elevation 4.76', the 1-year stillwater associated with the 2070 Intermediate High Scenario.

B. REPLACE SEAWALL TO ELEVATION 6’

Elevation 6’ NAVD is the lowest grade found along 20th Street, which acts as a perimeter buffer from the west. It would be possible to connect this as a ‘low’ elevation to the Bermuda Boulevard perimeter edge on the east and to the park at the north. This would create a contained basin with a consistent ‘levee’ height of 6’ NAVD (see diagram on the next page).

Components

This option would replace the existing seawall with a new wall at elevation 6’. That height is above the 10-year storm surge elevation (5’ NAVD), and has the potential to create a continuous perimeter boundary for the community at a consistent 6’ NAVD elevation. Stormwater modeling is needed to determine the carrying capacity of the stormwater system and if enough head pressure will allow water to drain through pipes and out of the outfalls. The design increases the depth of the neighborhood basin an average of 18”. In a significant rainfall event, it is unknown if the basin would drain, or if pumps would be needed.

Similar to Option A for the seawall, tidal gate valves are recommended, especially with the increased basin depth. This would restrict water inflow during high tide events.

Permitting

Additional analysis would be required for permitting when raising the seawall, to examine wave deflection and secondary impacts to habitats in the area.

Habitat Improvement

No change in habitat impact would result.

Risk Reduction

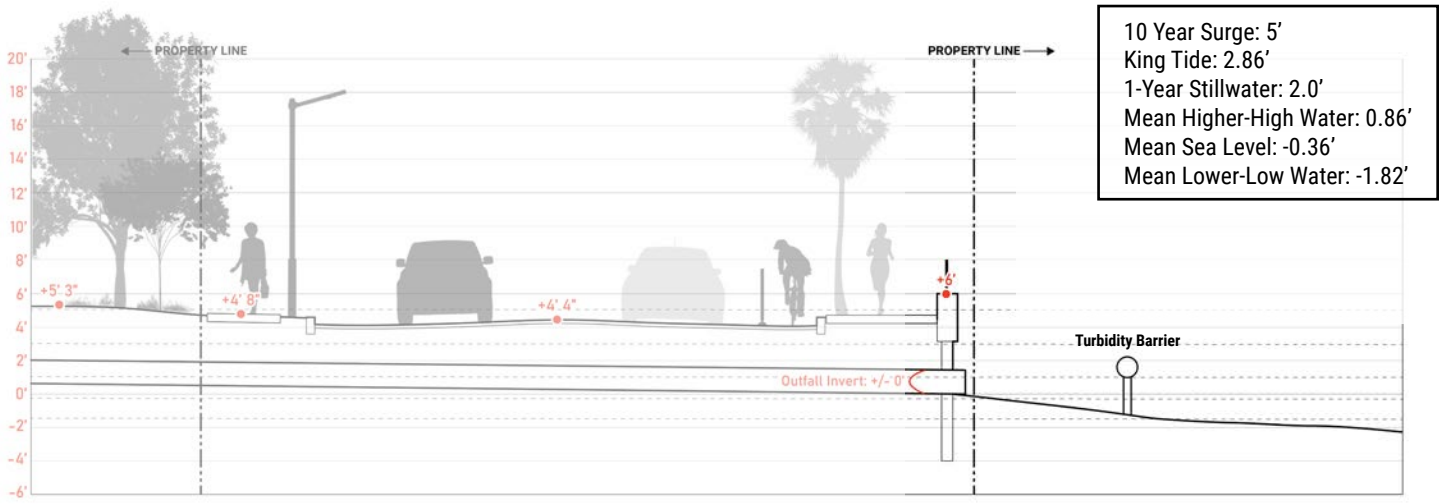
Significant risk reduction and increased levels of protection would occur for tidal surge events with combined increase of seawall height and tidal gate valves.

Constraining Factors

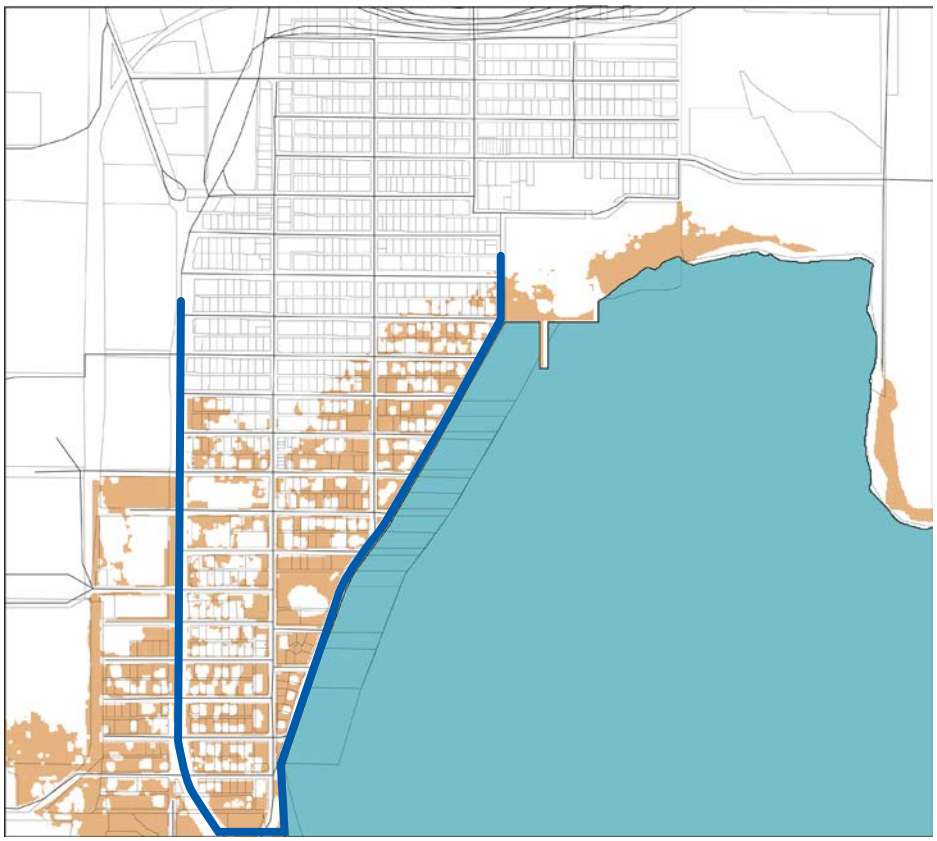
Rainfall events need to be modeled to determine if pumps are necessary for rainfall events when designing toward decreasing tidal surge impacts.

Cost

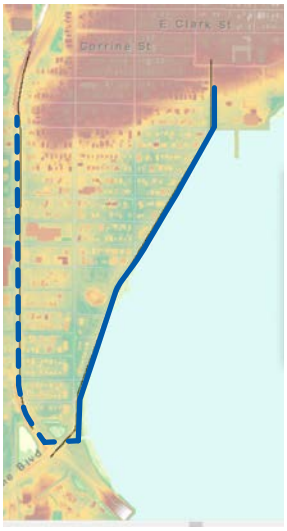
The added concrete cost to raise the seawall would be approximately $400,000, assuming the cubic yard (cy) cost of concrete at $1,000 per cy. Opinion of total cost to raise the seawall is $7,885,997.



The drawing to the right shows the potential for continuous perimeter protection for the Palmetto Beach community at elevation 6', shown by the red line. A seawall along Bermuda Boulevard could tie into road and park grades to create a basin. Areas in orange are below elevation 6', which would be the limit of protection. Additional study to relieve the 'basin' condition from stormwater accumulation need to be performed. A pump or pumps may be required.



Elevation 6' is shown in red, representing potential tie-in locations for a seawall constructed to meet that elevation. Most of 20th Street, the north-south road at the west of the community, is already at elevation 6'.



The 10 lowest structures and their elevations are shown in the diagram to the right. These elevations were formulated using the best available LIDAR data and need to be field-verified.

C. SLOPED LIVING SHORELINE

This strategy is not recommended because of limited right of way and loss of important public space along the waterfront.

Components

This design strategy removes the seawall and replaces uplands, from the edge of seawall inward, with a riprap 'living shoreline'. A concrete wall would be constructed at the top of the bank, providing soil stabilization and erosion control. This design results in loss of upland area within the right of way. It is recommended that tidal gate valves be included in the design strategy.

Permitting

This project approach would incur minimal federal and state permitting since it does not encroach into existing submerged lands or wetlands. The City of Tampa real estate department would have to agree with the loss of land.

Habitat Improvement

Habitat along the shoreline would be slightly increased by creating more surface area related to erosion control materials. Depending on the design of the living shoreline edge, whether rip rap or reef material (such as ECOncrete), mangroves (rather than oysters) may be the primary habitat to colonize the infrastructure, since it is mostly above the mean sea level.

Risk Reduction

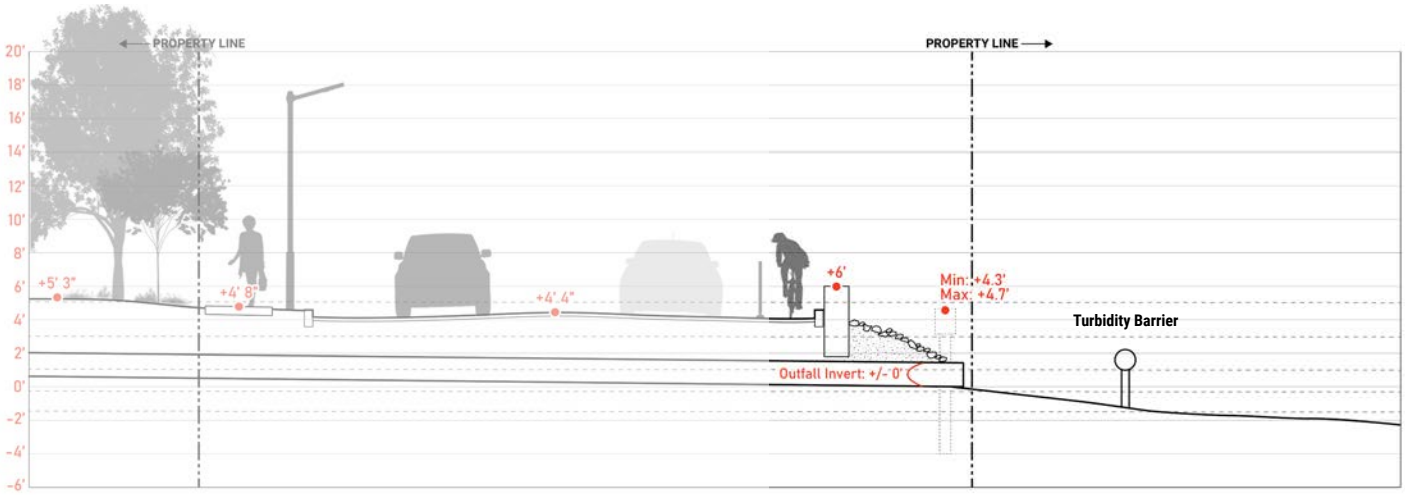
Any reduction of risk would be associated with the highest elevation of either living shoreline edge material or concrete wall. Constructing the erosion control system to an elevation of 6' would create a significant perimeter protection for the community, especially by including tidal gate valves.

Constraining Factors

Since many of the offshore submerged lands are privately owned, it is not possible to build continuous offshore living shorelines in front of the seawall unless easements are agreed upon. This strategy avoids that constraint by moving a living shoreline component inward of existing rights of way. A sloped living shoreline prevents the opportunity for a sidewalk along the coastline.

Cost

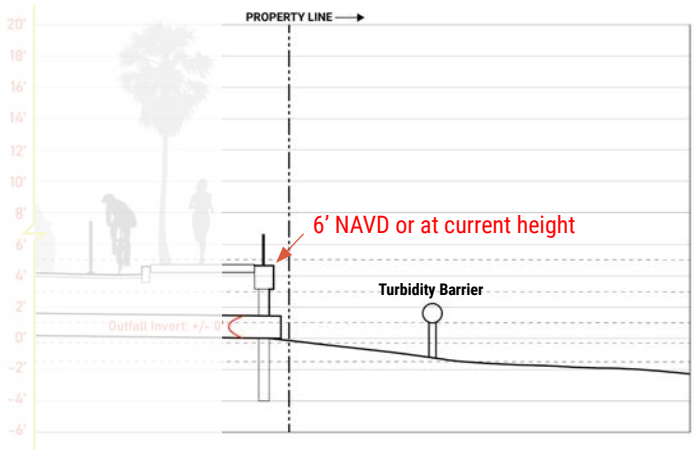
Total expected cost is $7,215,936, which includes a living shoreline the full length of Bermuda Boulevard, an upland concrete wall, tidal gate valves, and a turbidity barrier, along with removal of the existing seawall, MOT, and mobilization costs.



SHORELINE DESIGNS

A. MAINTAIN OFFSHORE CONDITIONS

Existing offshore conditions have small amounts of oysters that have colonized on rock and rubble. Maintaining the existing offshore condition would require the least amount of permitting and would have minimal disturbance to existing offshore habitats.



Components

The existing soils and habitats in front of the seawall are representative of its working waterfront history, which is no longer in operation. Sporadic rock and rubble litter the shoreline, with a small amount of oysters that have colonized the area.

The soils are fine particle mud, which are not conducive to habitat growth.

Permitting

Maintaining existing conditions would not incur any additional permitting.

Habitat Improvement

Maintaining existing offshore conditions would protects the small amount of habitat at the McKay Bay shoreline.

Risk Reduction

No change to current risk factors.

Constraining Factors

Any removal or excavation of existing soils should be aware of potential heavy metals or other pollutants that may be in the soils.

Cost

No additional costs.

B. ADD RIP RAP OR A REEF STRUCTURE TO THE BERMUDA BOULEVARD COASTLINE

Adding a hardened substrate in front of the seawall adds erosion protection and habitat opportunities.

Components

On the seaward side of the seawall, there is potential to include living shoreline elements such as rip rap or ECOncrete reef structures to create habitat and wave energy dissipation. These elements would be easier to include on properties owned by the City, where previous permits had allowed up to 8' of living shoreline material to be added. These materials could also be incorporated into privately owned submerged properties if an easement was created - for example a utilities easement - that continued the owners construction development rights while benefiting habitat and creating additional erosion protection for the seawall.

Any replacement of existing soils with hardened substrate will be beneficial to cultivating oysters, which clean water, provide habitat, calcify the shoreline substrate, and help to reduce erosion. Oyster colonization is also able to adapt to sea level rise. As

oysters grow and accumulate their elevation increases, matching changes to their marine environment.

Permitting
Past permit applications for living shorelines were approved for up to 8’ of material from the base of the wall. The city may want to increase this dimension to create a more robust living shoreline, which would require additional approvals.

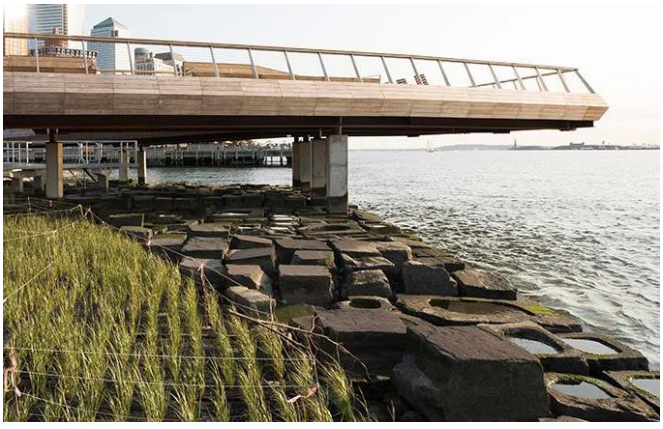
Habitat Improvement
Adding rip rap or reef material could have positive habitat benefits for the bay. The Oyster Suitability Map shows the southern half of the Bermuda Boulevard shoreline as having exceptional potential for oyster colonization. This can be dramatically improved by providing a hardened substrate for oysters to colonize.

Due to the fine particle soil that is found in front of the seawall, expanding the zone of hardened substrate could have positive affects for increasing oyster production. This may suggest working with the Army Corp and Port to install oyster reefs outside of the 8’ boundary. This has been accomplished in other parts of the bay, most recently near Safety Harbor and near the Skyway Bridge. Any combinations of removal of silty mud soils and installation of hardened bay bedding can help to create the appropriate conditions for either oyster or mangrove colonization, which in turn provides water cleaning and habitat for juvenile fish, shrimp, and other marine animals. Designs should be thoughtful of the importance of the tidal flat in this area.

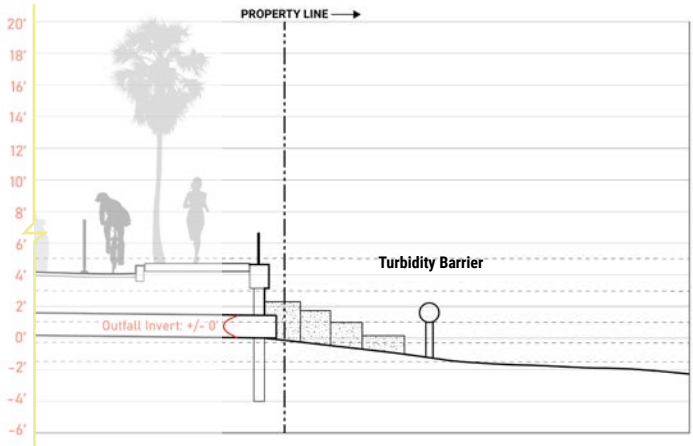
Risk Reduction
Riprap or reef structures can help to reduce wave action and energy along the seawall, and colonization by oysters can help to mitigate erosion.

Constraining Factors
Property ownership and permitting are the two primary constraints to installing living shorelines in front of the Bermuda Boulevard seawall. Publicly owned submerged lands provide the most simple arrangement for construction of these features, however, it is suggested that the City work with private submerged property owners to expand opportunities for living shorelines. This can be accomplished through easements, where the city provides the cost for living shoreline construction and exchanges this additional shoreline protection for the ability to construct the project.

Cost
The quantity of living shoreline material can vary depending on the design, but at an assumed price of $2,000 per linear foot along approximately 2,119 feet of shoreline (all areas except where there are existing mangroves) results in an opinion of cost of approximately $4.5 million. This could increase if the area can cover more than 8’ beyond the seawall, or less if contained to only publicly owned submerged properties. Other construction costs such as turbidity barriers and mobilization costs would add $45,000 and 10% of construction costs, respectively.



Concrete reef coastline example using ECOncrete at *Pier 26, New York City, NY*

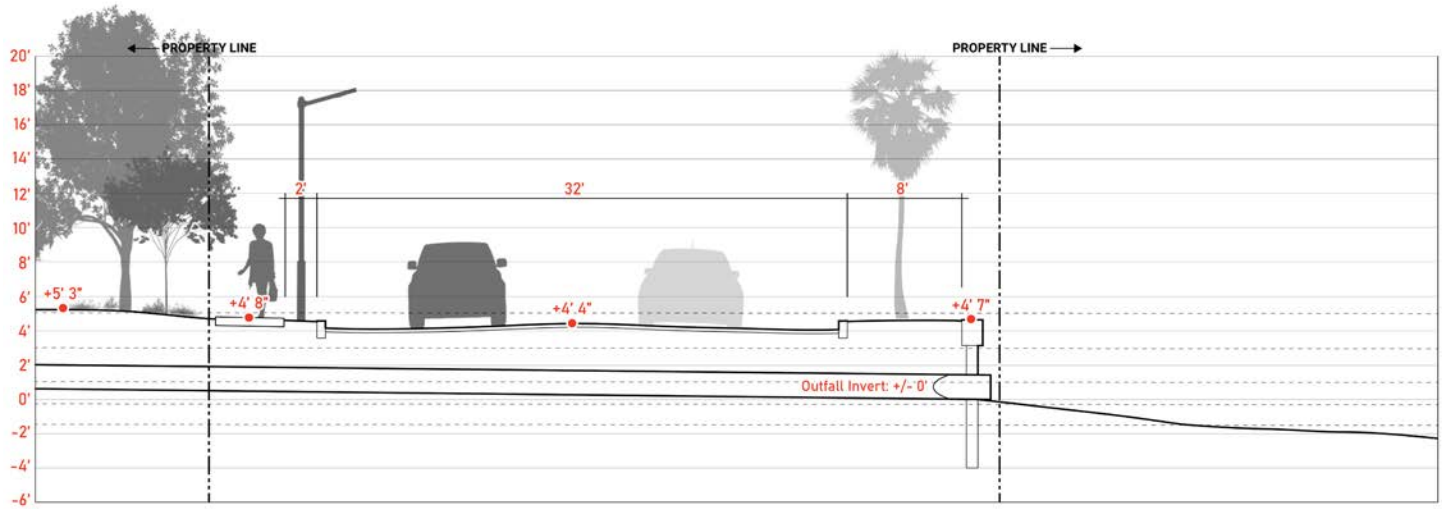


BERMUDA BOULEVARD RIGHT-OF-WAY DESIGNS

EXISTING CONDITIONS

The existing roadway and right of way space is approximately 40 feet, on average, from the back of seawall to the curb on the other side of the street. The road is generally 32’ wide, is crowned, and includes a few stormwater inlets along the corridor. The pavement is in poor condition. There is a grass vegetated area, approximately 8’ wide, between the curb and seawall, with occasional cabbage palms, and overhead wires along the west side of the road. South of 24th Street the utility wire masts are much larger in size, whereas north of 24th Street they are only used to provide power to individual street lights. This street is not supposed to be used by heavy trucks, although the neighborhood has complained that they occasionally use the road.

Bermuda Boulevard is a primary pedestrian corridor that connects residents to Desoto Park and the waterfront. The community has complained of safety, garbage, vandalism, and homelessness on the street.



A. PARALLEL STREET PARKING AND BIKE LANE

This design uses the same street right of way as existing condition, but re-allocates space.

Components

The right of way is reconfigured to include an 8’ parallel parking lane, two 10.5’ drive lanes, a 3’ bike lane, and a 7’ walkway (with drainage included as necessary). Street furnishings could be integrated into the new design.

Permitting

With minimal change from existing conditions, this design would have to be reviewed through the mobility, stormwater, and parks and recreation departments, but this is essentially a re-paving and re-striping project.

Habitat Improvement

Trees could be added to the space along the waters edge.

Risk Reduction

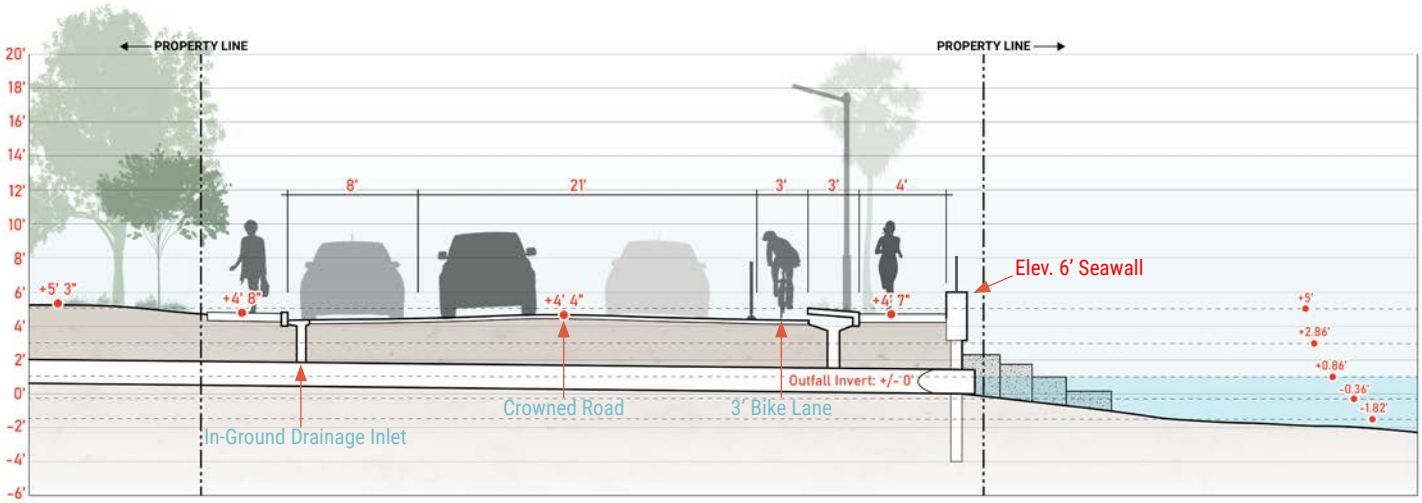
No change to current risk factors.

Constraining Factors

This project provides an opportunity to bury power lines between street lighting fixtures, and potentially where major utility lines exist.

Cost

The cost for suggested right of way modifications, from back of seawall to western edge of the street, is approximately $4,246,225.72



Project drawing with Parallel Street Parking and Bike Lane, Seawall at Elevation 6’, and Living Shoreline. Opinion of cost (as shown): $24,484,300

The combined cost for additive designs are shown below and in the following pages.

SEAWALL DESIGNS		SHORELINE DESIGNS		RIGHT-OF-WAY DESIGNS
Replace In-Kind	X	Maintain Offshore Conditions	X	Parallel Street Parking with Bike Lane
Raise to Elevation 6'		Riprap or Reef Coastline		Sloped Road and Bioswale

	Item	Unit	Unit Cost	Qty	Cost
Seawall Design	Seawall Bulkhead Demo	LF	$ 106.50	3,374	$ 359,331.00
	Railing for Seawall	LF	$ 170.00	3,374	$ 573,580.00
	New Seawall - Concrete Sheet Piling	LF	$ 164.00	21,594	$ 3,541,350.40
	Concrete Class IV, New Bulkhead Cap	CY	$ 1,000.00	899.85	$ 899,850.00
	Reinforced Steel - Bulkhead	LB	$ 1.19	112,481	$ 133,852.69
	Prestressed Soil Anchors	Each	$ 7,017.00	260	$ 1,824,420.00
	Prest. Soil Anchor, Perf Test	Each	$ 1,100.00	26	$ 28,600.00
	Turbidity Barrier	LF	$ 11.92	3,776	$ 45,013.50
	Tidal Gate Valves	Each	$ 40,000.00	12	$ 480,000.00
				Total	$ 7,885,997.58
Shoreline	Living Shoreline	LF	$ 2,000.00	2,119	$ 4,238,000.00
				Total	$ 4,238,000.00
Right-of-Way Design	Roadway Milling	SY	$ 30.00	11,247	$ 337,410.00
	Sidewalk - New (East and West)	LF	$ 229.17	6,748	$ 1,546,439.16
	Street Furniture (trash bins + bench)	Each	$ 4,500.00	9	$ 40,500.00
	Landscape ($7k per tree every 25')	LF	$ 140.00	3,374	$ 472,360.00
	Enhanced Crossings at Roadways	Each	$ 75,000.00	4	$ 300,000.00
	Lighting (cost per pole @ 50' o.c.)	Each	$ 7,000.00	67	$ 469,000.00
	Concrete Curb and Gutter, Type F	LF	$ 52.22	6,548	$ 341,936.56
	Pipe Inlets	Each	$ 10,000.00	12	$ 120,000.00
	Roadway Paving	SY	$ 40.00	11,247	$ 449,880.00
				Total	$ 4,077,525.72
	SUBTOTAL Demo & Construction				**$ 16,201,523.30**
	General Conditions	%	8.00%		$ 1,296,121.86
	Design Contingency	%	15.00%		$ 2,430,228.50
	Construction Contingency	%	8.00%		$ 1,296,121.86
	General Contracting Services	%	15.00%		$ 2,430,228.50
	Soils and Remediation	%	5.00%		$ 810,076.17
	Geotechnical Report				$ 20,000.00
	TOTAL				**$ 24,484,300.19**

B. SLOPED ROAD AND BIOSWALE

This design uses the same street right of way as existing condition, but re-allocates space.

Components

Along the west side of Bermuda Boulevard, a five foot wide bioswale is included. This provides both water quality improvements as well as increased drainage opportunities. Sloping the road towards the bioswale also eliminates the need for drainage inlets on the east side of the road. A protected bike lane and sidewalk are added along the east side of Bermuda Boulevard. This design has the option to be curbed or curb-less.

Permitting

With minimal change from existing conditions, this design would have to be reviewed through the mobility, stormwater, and parks and recreation departments, but this is essentially a re-paving and re-striping project.

Habitat Improvement

Green infrastructure could help to remove sediment and nutrients prior to funneling stormwater through pipes to the bay. Trees could be added to the space along the waters edge.

Risk Reduction

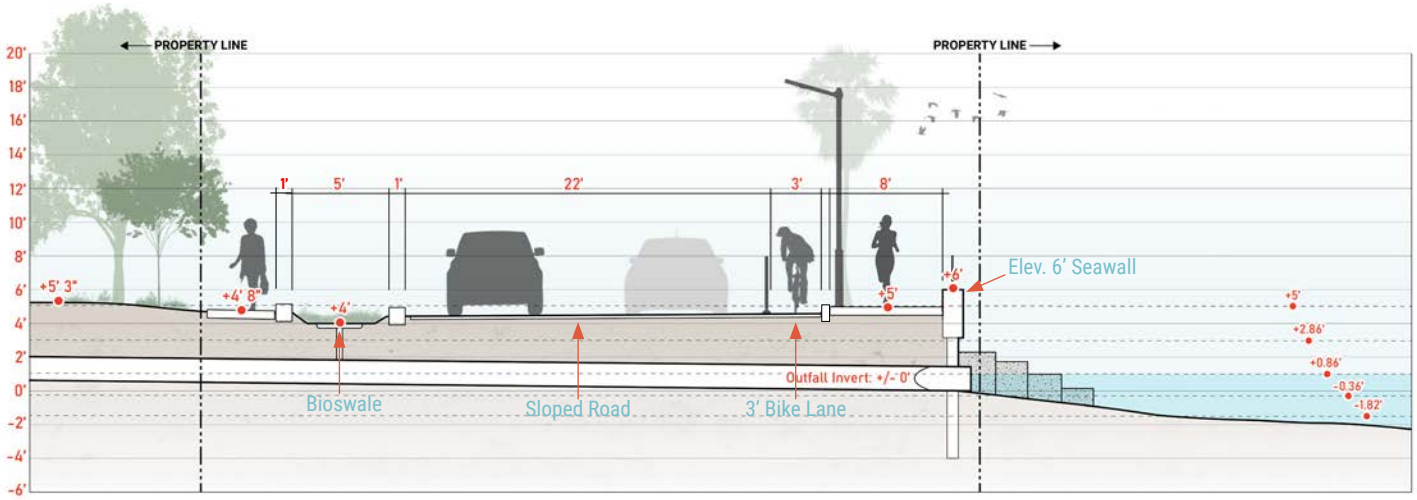
It is possible to reduce flooding potential with the modification of or addition to the street's stormwater infrastructure.

Constraining Factors

This strategy may add cost to the project, and bioswales may need more maintenance than typical inlets with curb and gutter.

Cost

The cost for suggested right of way modifications, from back of seawall to western edge of the street, is approximately $4,199,985.72



Project drawing with Bioswale and Bike Lane, Seawall at Elevation 6', and Living Shoreline. Opinion of cost (as shown): $24,669,214

SEAWALL DESIGNS		SHORELINE DESIGNS		RIGHT-OF-WAY DESIGNS
Replace In-Kind	X	Maintain Offshore Conditions	X	Parallel Street Parking with Bike Lane
Raise to Elevation 6'		Riprap or Reef Coastline		Sloped Road and Bioswale

	Item	Unit	Unit Cost	Qty	Cost
Seawll Design	Seawall Bulkhead Demo	LF	$ 106.50	3,374	$ 359,331.00
	Railing for Seawall	LF	$ 170.00	3,374	$ 573,580.00
	New Seawall - Concrete Sheet Piling	LF	$ 164.00	21,594	$ 3,541,350.40
	Concrete Class IV, New Bulkhead Cap	CY	$ 1,000.00	899.85	$ 899,850.00
	Reinforced Steel - Bulkhead	LB	$ 1.19	112,481	$ 133,852.69
	Prestressed Soil Anchors	Each	$ 7,017.00	260	$ 1,824,420.00
	Prest. Soil Anchor, Perf Test	Each	$ 1,100.00	26	$ 28,600.00
	Turbidity Barrier	LF	$ 11.92	3,776	$ 45,013.50
	Tidal Gate Valves	Each	$ 40,000.00	12	$ 480,000.00
				Total	$ 7,885,997.58

Shoreline	Living Shoreline	LF	$ 2,000.00	2,119	$ 4,238,000.00
				Total	$ 4,238,000.00

Right-of-Way Design	Clearing and Excavation (Bioswale)	CY	$ 15.00	294	$ 4,410.00
	Roadway Milling	SY	$ 30.00	11,247	$ 337,410.00
	Sidewalk - New (East and West)	LF	$ 229.17	6,748	$ 1,546,439.16
	Street Furniture (trash bins + bench)	Each	$ 4,500.00	9	$ 40,500.00
	Landscape ($7k per tree every 25')	LF	$ 140.00	3,374	$ 472,360.00
	Enhanced Crossings at Roadways	Each	$ 75,000.00	4	$ 300,000.00
	Lighting (cost per pole @ 50' o.c.)	Each	$ 7,000.00	67	$ 469,000.00
	Bioswale	LF	$ 75.00	3,174	$ 238,050.00
	Concrete Curb and Gutter, Type F	LF	$ 52.22	6,548	$ 341,936.56
	Roadway Paving	SY	$ 40.00	11,247	$ 449,880.00
				Total	$ 4,199,985.72

General Conditions	%	8.00%		$ 1,305,918.66
Design Contingency	%	15.00%		$ 2,448,597.50
Construction Contingency	%	8.00%		$ 1,305,918.66
General Contracting Services	%	15.00%		$ 2,448,597.50
Soils and Remediation	%	5.00%		$ 816,199.17
Geotechnical Report				$ 20,000.00

TOTAL **$ 24,669,214.79**

INLAND DRAINAGE

STORMWATER PIPE REPLACEMENT

In Palmetto Beach, each low area drain inlet moves water directly to the bay, where it is discharged (see diagram to the right). The quantity of outfalls is inefficient for modifications, such as tidal gate valves and baffle boxes, since there are so many distribution and outfall pipes.

It is recommended to simplify the configuration by manifolding the pipe system to create fewer exit points to the bay, creating 'trunk' lines.

Image: Existing storm drains (yellow) and outfalls (orange arrows).

Components

Manifolding the pipe system would require street excavation and replacement of pipes, inlets, and access structures. New pipes, placed in the City's right of way, would create connections between existing pipes. New inlets may be necessary. A trunk line would be established, including a sediment 'drop out' structure, such as a baffle box, if the water table would allow. The number of outfalls would be reduced. At each outflow a tidal gate valve would be included.

Permitting

New outfalls could be located where the City owns submerged lands. Stormwater permitting would be required, as would be environmental designs affecting manatees and other coastal marine habitats.

Habitat Improvement

This design would allow significant water quality improvement for the water collected from the Palmetto Beach neighborhood.

Risk Reduction

Flood modeling needs to be completed to determine the final extents of impact, however it is assumed that new pipes could be designed to acceptable levels of stormwater as well as consider future sea level rise.

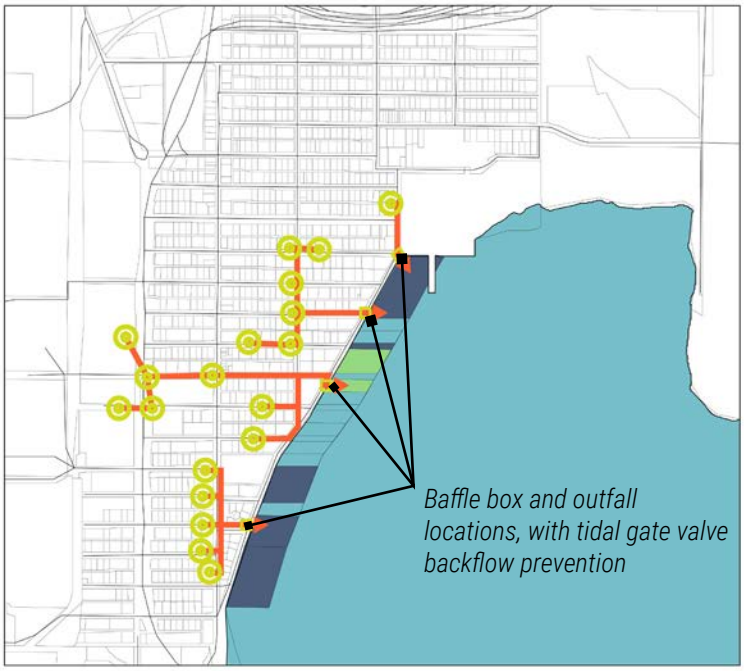


Image: Proposed storm system piping (orange arrows) and baffle boxes (yellow boxes, labeled).

Constraining Factors

Rearranging the stormwater system would require excavation and installation of pipes within the right of way, which may be a short-term nuisance for the community.

Cost

Approximately $5,781,991.13

CONCLUSION

Replacing the seawall to a higher elevation would provide significant tidal surge protection for the community, although all aspects of stormwater drainage and potential pumping have not yet been modeled. Additionally, modifications to the right-of-way could provide multiple community amenities, including stormwater flood mitigation and pollution reduction. Lastly, a living shoreline focused on hardening the soil structure and providing oyster habitat substrate would provide erosion protection and wave dissipation for the seawall. These projects could be accomplished independently or combined, as a comprehensive project. The suggested designs assume that the City does not have ownership over all submerged lands in front of the Bermuda Boulevard seawall, thus the limited living shoreline scope and focus on a seawall for erosion control. If a continuous living shoreline can be created outward from the existing seawall, removal of the seawall and replacement with a living shoreline is recommended. The Bermuda Boulevard coastal edge was once a sandy beach with a native Florida scrub landscape. However, since all lands are not controlled by the City, a mixed system is suggested, which uses a combination of seawall and living shoreline.

Available funding will guide next steps, as will discussions with the community. This report serves as a preliminary fact finding and feasibility study, to enable city staff to identify the best direction forward.

REFERENCES

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APPENDIX

DETAILED OPINION OF PROBABLE COST - SEAWALL DESIGNS

New Seawall (Replace In-Kind)

	Item	Unit	Unit Cost	Qty	Cost
Seawll Design	Seawall Bulkhead Demo	LF	$ 106.50	3,374	$ 359,331.00
	Railing for Seawall	LF	$ 170.00	3,374	$ 573,580.00
	New Seawall - Concrete Sheet Piling	LF	$ 164.00	21,594	$ 3,541,350.40
	Concrete Class IV, New Bulkhead Cap	CY	$ 1,000.00	499.85	$ 499,850.00
	Reinforced Steel - Bulkhead	LB	$ 1.19	62,481	$ 74,352.69
	Prestressed Soil Anchors	Each	$ 7,017.00	260	$ 1,824,420.00
	Prest. Soil Anchor, Perf Test	Each	$ 1,100.00	26	$ 28,600.00
	Turbidity Barrier	LF	$ 11.92	3,776	$ 45,013.50
	Tidal Gate Valves	Each	$ 40,000.00	12	$ 480,000.00
				Total	$ 7,426,497.58

New Seawall (Raise to Elev. 6')

	Item	Unit	Unit Cost	Qty	Cost
Seawll Design	Seawall Bulkhead Demo	LF	$ 106.50	3,374	$ 359,331.00
	Railing for Seawall	LF	$ 170.00	3,374	$ 573,580.00
	New Seawall - Concrete Sheet Piling	LF	$ 164.00	21,594	$ 3,541,350.40
	Concrete Class IV, New Bulkhead Cap	CY	$ 1,000.00	899.85	$ 899,850.00
	Reinforced Steel - Bulkhead	LB	$ 1.19	112,481	$ 133,852.69
	Prestressed Soil Anchors	Each	$ 7,017.00	260	$ 1,824,420.00
	Prest. Soil Anchor, Perf Test	Each	$ 1,100.00	26	$ 28,600.00
	Turbidity Barrier	LF	$ 11.92	3,776	$ 45,013.50
	Tidal Gate Valves	Each	$ 40,000.00	12	$ 480,000.00
				Total	$ 7,885,997.58

DETAILED OPINION OF PROBABLE COST - SHORELINE DESIGNS

Living Shoreline

	Item	Unit	Unit Cost	Qty	Cost
Seawall	Seawall Bulkhead Demo	LF	$ 106.50	3,374	$ 359,331.00
	Turbidity Barrier	LF	$ 11.92	3,776	$ 45,013.50
	Tidal Gate Valves	Each	$ 40,000.00	12	$ 480,000.00
	Clearing and Excavation (Shoreline)	CY	$ 15.00	6,279	$ 94,185.00
	Living Shoreline	LF	$ 2,000.00	2,119	$ 4,238,000.00
	Concrete Wall	CY	$ 1,000.00	1,999	$ 1,999,407.41
				Total	$ 7,215,936.90

DETAILED OPINION OF PROBABLE COST - RIGHT-OF-WAY DESIGNS

Parallel Street Parking and Bike Lane

	Item	Unit	Unit Cost	Qty	Cost
Right-of-Way Design	Roadway Milling	SY	$ 30.00	11,247	$ 337,410.00
	Sidewalk - New (East and West)	LF	$ 229.17	6,748	$ 1,546,439.16
	Street Furniture (trash bins + bench)	Each	$ 4,500.00	9	$ 40,500.00
	Landscape ($7k per tree every 25')	LF	$ 140.00	3,374	$ 472,360.00
	Enhanced Crossings at Roadways	Each	$ 75,000.00	4	$ 300,000.00
	Lighting (cost per pole @ 50' o.c.)	Each	$ 7,000.00	67	$ 469,000.00
	Concrete Curb and Gutter, Type F	LF	$ 52.22	6,548	$ 341,936.56
	Pipe Inlets	Each	$ 10,000.00	12	$ 120,000.00
	Roadway Paving	SY	$ 40.00	11,247	$ 449,880.00
				Total	$ 4,077,525.72

Sloped Road and Bioswale

	Item	Unit	Unit Cost	Qty	Cost
Right-of-Way Design	Clearing and Excavation (Bioswale)	CY	$ 15.00	294	$ 4,410.00
	Roadway Milling	SY	$ 30.00	11,247	$ 337,410.00
	Sidewalk - New (East and West)	LF	$ 229.17	6,748	$ 1,546,439.16
	Street Furniture (trash bins + bench)	Each	$ 4,500.00	9	$ 40,500.00
	Landscape ($7k per tree every 25')	LF	$ 140.00	3,374	$ 472,360.00
	Enhanced Crossings at Roadways	Each	$ 75,000.00	4	$ 300,000.00
	Lighting (cost per pole @ 50' o.c.)	Each	$ 7,000.00	67	$ 469,000.00
	Bioswale	LF	$ 75.00	3,174	$ 238,050.00
	Concrete Curb and Gutter, Type F	LF	$ 52.22	6,548	$ 341,936.56
	Roadway Paving	SY	$ 40.00	11,247	$ 449,880.00
				Total	$ 4,199,985.72

DETAILED OPINION OF PROBABLE COST - STORMWATER PIPE REPLACEMENT

Stormwater Pipe Replacement

Item	Unit	Unit Cost	Qty	Cost
Seawall Demo	LF	$ 106.50	160	$ 17,040.00
Roadway Demo and Excavation	CY	$ 18.00	13,136	$ 236,448.00
Pipe Demo and Excavation	CY	$ 25.00	9,387	$ 234,666.67
Pipes/Culverts	LF	$ 250.00	7,960	$ 1,990,000.00
Roadway Paving	SY	$ 40.00	6,568	$ 262,720.00
Inlets	Each	$ 10,000.00	19	$ 190,000.00
Baffle Boxes	Each	$ 100,000.00	4	$ 400,000.00
Seawall - New at Outfalls	LF	$ 1,500.00	160	$ 240,000.00
Turbidity Barrier	LF	$ 11.92	3,776	$ 45,013.50
Outfalls	Each	$ 10,000.00	4	$ 40,000.00
Tidal Gate Valves	Each	$ 40,000.00	4	$ 160,000.00

SUBTOTAL Demo & Construction **$ 3,815,888.16**

General Conditions	%	8.00%		$ 305,271.05
Design Contingency	%	15.00%		$ 572,383.22
Construction Contingency	%	8.00%		$ 305,271.05
General Contracting Services	%	15.00%		$ 572,383.22
Soils and Remediation	%	5.00%		$ 190,794.41
Geotechnical Report				$ 20,000.00

TOTAL **$ 5,781,991.13**