



SEA-LEVEL RISE POLICY:
**A HOMEOWNER'S BEST
PRACTICES MANUAL**

TASK 6, REPORT #4: A HOMEOWNER'S BEST PRACTICES MANUAL

Suggested Reference:

Cook, B., Cheng, A. & Fernandez, S. (2021). Land Regulatory Response to Sea-level Rise: A Homeowner's Best Practices Manual (Report #4). For the City of Tampa.



INTRODUCTION

This guidebook is meant to help property owners understand the implications of sea-level rise and to convey various strategies for mitigating risk. The document explains terminology, along with strategies, and includes illustrations to provide quick and convenient access. Strategies address both structures and site issues, and develop an understanding of spatial implications. Some strategies are immediately actionable whereas others will require community participation or advocacy within government.

This document is complimentary with, and sometimes duplicative of, reports created for the “Land Use Regulatory Response to Sea-Level Rise” project, funded by the Florida Department of Environmental Protection (Agreement #R2129) and commissioned by the City of Tampa. Overall, this project provides a foundation on which to base policy decisions and to begin a dialogue with the community about regulatory practices to mitigate risk from sea-level rise.

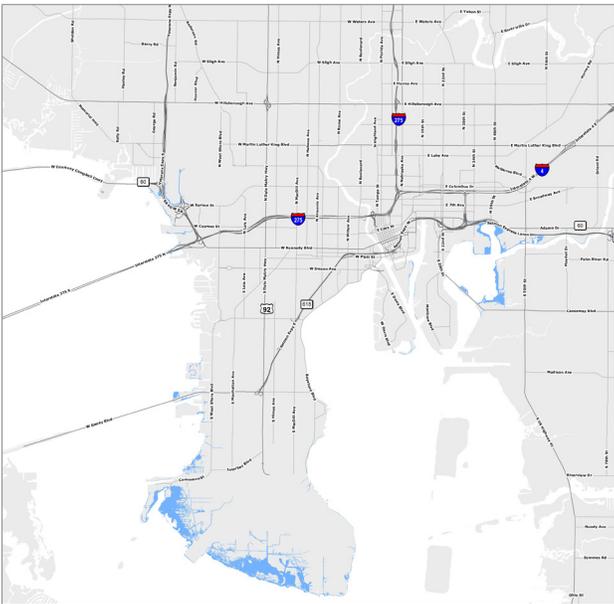
The following pages group together various policy options, from buildings and building heights to buffers and setbacks and other site aspects that can be affected by or can mitigate risk to sea-level rise. Some of the summaries describe existing requirements, such as the Federal Emergency Management Agency’s (FEMA) flood zones and associated requirements. Although FEMA flood zones are not directly correlated with sea-level rise, much of the terminology tends to be associative and so a description of these terms and regulatory requirements are also included. Other examples showcase policies either implemented by municipalities across the United States or suggested by academic research.

SEA-LEVEL RISE IN TAMPA

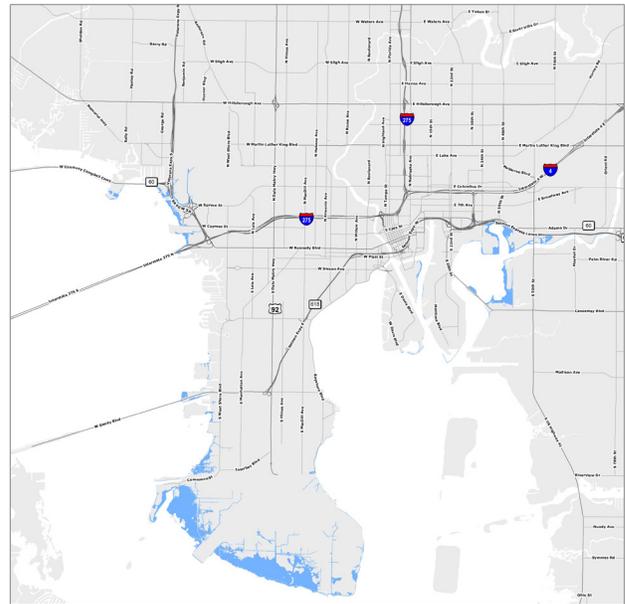
Based on the St. Petersburg tidal gauge, coastal waters have risen 7.8 inches since 1946 (CSAP, 2019). Going forward, the Tampa Bay Regional Resilience Coalition suggests that Tampa can expect 1.15 to 3.48 feet of change by the year 2060 and 2 to 8.5 feet by the year 2100 (CSAP, 2019). The variability within these scenarios is quite large. This will make monitoring important, but also planning for flexibility.

Projections (to the right, from CSAP, 2019) show projected sea-level rise change in ten-year increments, from the year 2000.

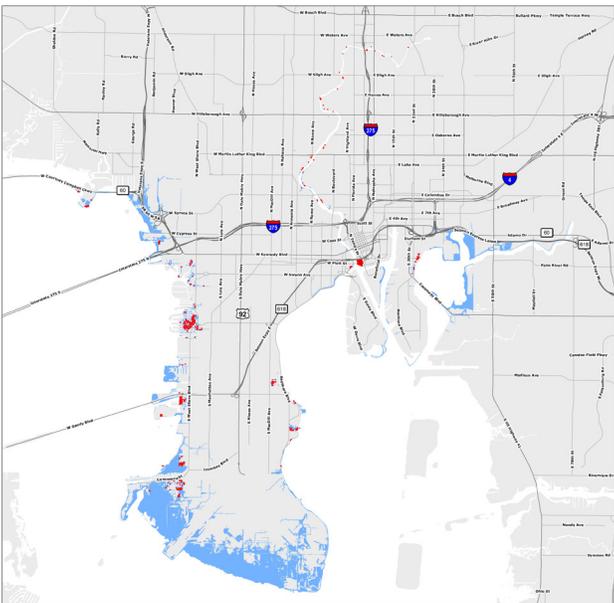
| Year | NOAA Int-Low (feet) | NOAA Intermediate (feet) | NOAA High (feet) |
|-------------------|---------------------|--------------------------|------------------|
| 2000 ³ | 0 | 0 | 0 |
| 2030 | 0.56 | 0.79 | 1.25 |
| 2040 | 0.72 | 1.08 | 1.77 |
| 2050 | 0.95 | 1.44 | 2.56 |
| 2060 | 1.15 | 1.87 | 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 |



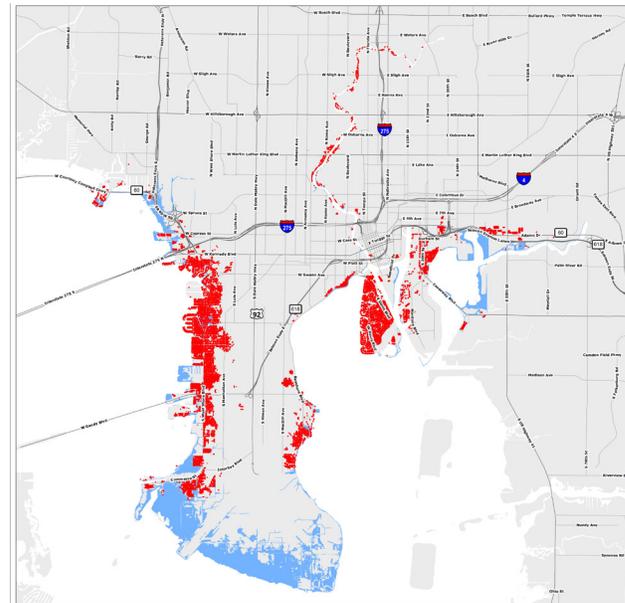
2045 Intermediate sea-level rise scenario



2045 High / 2060 Intermediate sea-level rise scenario



Buildings permanently affected in the 2060 High / 2100 Intermediate scenario



Buildings potentially affected in the 2100 High sea-level rise scenario

BUILDING ELEVATION REGULATIONS

The Federal Emergency Management Agency (FEMA) has established standards for flood resistance, which are associated with their National Flood Insurance Program. Structures that fall within designated flood zones have correlating structural requirements in order to be approved for insurance. In Florida, the state Building Code has adopted these standards, which are required for new or significantly new (over 50% cost of structure) construction. These policies are based on mitigating risk for extreme rain and storm surge scenarios, which are temporary events - not permanent like sea-level rise. FEMA does not yet have a position or policy that addresses future conditions with sea-level rise.

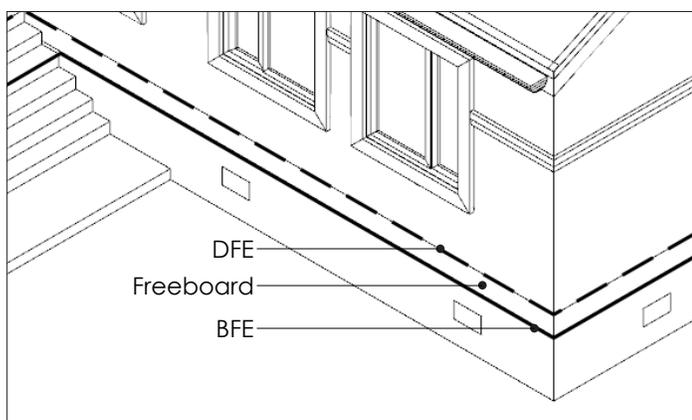
TERMS

Base Flood Elevation (BFE):

The elevation of surface water resulting from a flood that has a one percent chance of equaling or exceeding that level of rise in any given year. Base flood elevations are determined by (FEMA) or the local floodplain administrator (if not established by FEMA) and are shown on the Flood Insurance Rate Map (FIRM) for zones V and A (FEMA, 2020).

Freeboard:

An added factor of safety ranging up to 4 feet above the BFE. The Florida Building Code (FBC) calls for the lowest floor, including basements, to be at or above the BFE plus 1 foot, or the specified Design Flood Elevation (DFE) by jurisdiction, whichever is higher (City of Tampa, 2020; see also Florida Building Commission, 2017).



Elevation Terminology

Design Flood Elevation (DFE):

Typically, DFE is referred to as the elevation at the top of freeboard, above the BFE (Enterprise Green Communities, 2015). If BFEs are not shown on the flood hazard map, the FBC gives the building official authority to require the permit applicant to obtain and use data from another source or to determine the DFE using accepted engineering practices (Florida Building Commission, 2017).

Finished Flood Elevation (FFE), or Lowest Floor Elevation:

According to FEMA the lowest floor, and its associated FFE, describes the lowest enclosed or enclosable (per code) area (FEMA, 2010). For existing structures, the FFE could potentially be below the Design Flood Elevation (DFE), or the required freeboard. In this case, the structure would be subject to higher insurance premiums.

FLOOD ZONES

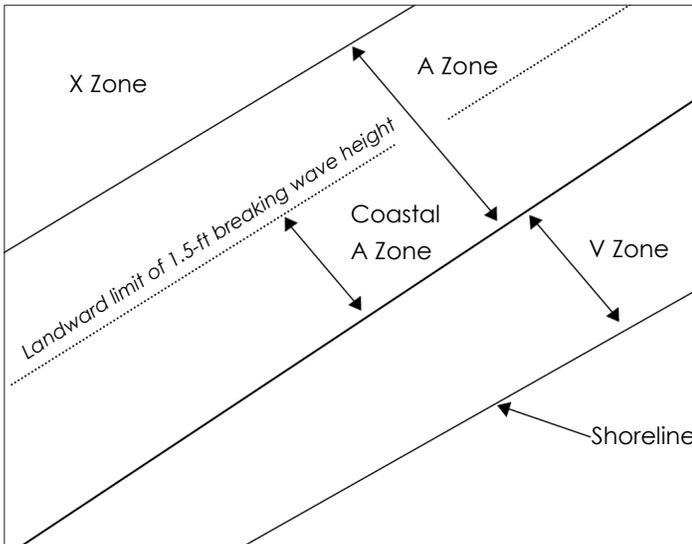
Any building located in an A (including AE or Coastal A) or V (including VE) zone is considered to be in a Special Flood Hazard Area, and is lower than the Base Flood Elevation. V and Coastal A zones are the most hazardous of the Special Flood Hazard Areas and have strict requirements (Federal Alliance for Safe Homes, 2020).

VE Zones

This area is defined by the 1% annual chance (base) flood and includes an additional hazard associated with storm waves, which are accounted for at 3 feet and higher (Hatheway et al., 2005; see also Florida Building Commission, 2017). Base flood elevations derived from detailed analyses are shown at selected intervals in the FIRM maps within these zones (FEMA, 2020a).

V Zones

This area must meet the requirements for a VE zone but do not have corresponding base flood elevations (BFE's) shown on a Flood Insurance Rate Map (FIRM). A design flood elevation (DFE) would have to be set by the floodplain administrator.



Plan-view diagram of flood zones. Image from Hatheway et al. (2005).

REQUIREMENTS FOR V ZONES

- The bottom of the lowest horizontal structural member of the elevated floor shall be elevated to meet or exceed the design flood elevation (Florida Building Commission, 2017).
- All buildings or structures shall be securely anchored on pilings or columns, no stem walls or fixed walls are allowed (City of Tampa, 2020).
- No fill shall be used as structural support, however, non-compacted fill may be used around the perimeter of a building for landscaping/aesthetic purposes provided the fill will wash out from storm surge, (thereby rendering the building free of obstruction) prior

to generating excessive loading forces, ramping effects, or wave deflection (City of Tampa, 2020).

- Areas below the design flood elevation can only be enclosed with breakaway walls and cannot be used for living space. Flood openings are required in breakaway walls (City of Tampa, 2020).
- Electrical, heating ventilation, plumbing, air conditioning equipment and other service facilities must be elevated to or above the BFE and cannot be mounted on breakaway walls or structures (Florida Building Commission, 2017).

A Zones

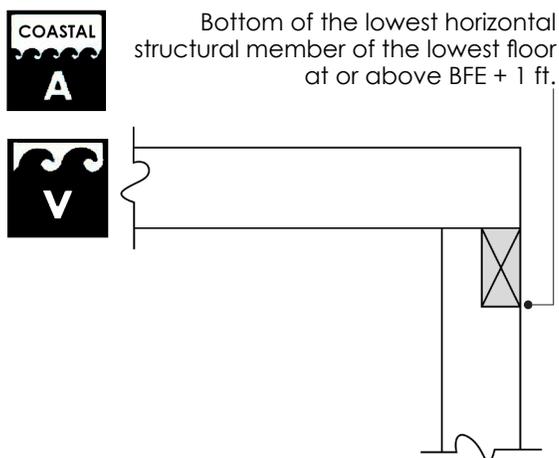
A and AE zones are shown on the Flood Insurance Rate Map (FIRM), however only AE zones have an associated BFE (FEMA, 2020a).

AE Zones

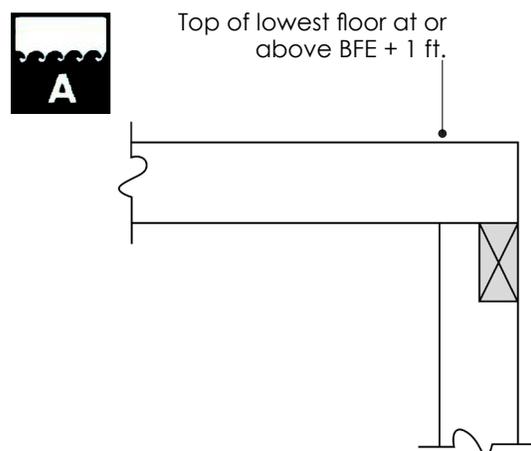
Areas subject to a one percent or greater annual chance of flooding in any given year.

Coastal A Zones

Coastal A zones are new to the 6th edition of the Florida Building Code. Located in the AE and A zones on a flood map, these zones are subject to wave heights between 1.5 and 3 feet and must follow similar requirements as V zones, except are allowed to have backfilled stem walls if foundations have deep footings to account for scour (Florida Building Commission, 2017).



Structural requirements in flood zones A and V. Image taken from Florida Building Commission (2017).



Structural requirements in flood zone A. Image taken from Florida Building Commission (2017).

REQUIREMENTS FOR A ZONES (AE AND A ZONES)

- The lowest floor elevation, including basements, must be above the BFE plus 1 foot or at DFE, whichever is higher (Florida Building Commission, 2017).
- Building can be elevated by means of fill or solid foundation perimeter walls with opening sufficient to facilitate the movement of floodwaters.
- In unnumbered A zones, the lowest floor of any new construction and substantial improvement shall be located at a minimum of two (2) feet above the elevation of the highest adjacent grade (City of Tampa, 2020).
- The area below elevated dwellings may be enclosed by foundation walls or framed walls, however flood openings are required.

GENERAL CITY OF TAMPA REQUIREMENTS

Building Height

Building height in Tampa is currently defined as “The vertical distance between the mean elevation of the proposed finished grade at the structure front, not including strictly aesthetic landscape berms to the highest point of the structure.” (City of Tampa, 2020b). Typically, in Tampa, residential neighborhoods have a maximum building height of 35 feet (City of Tampa, 2020a).

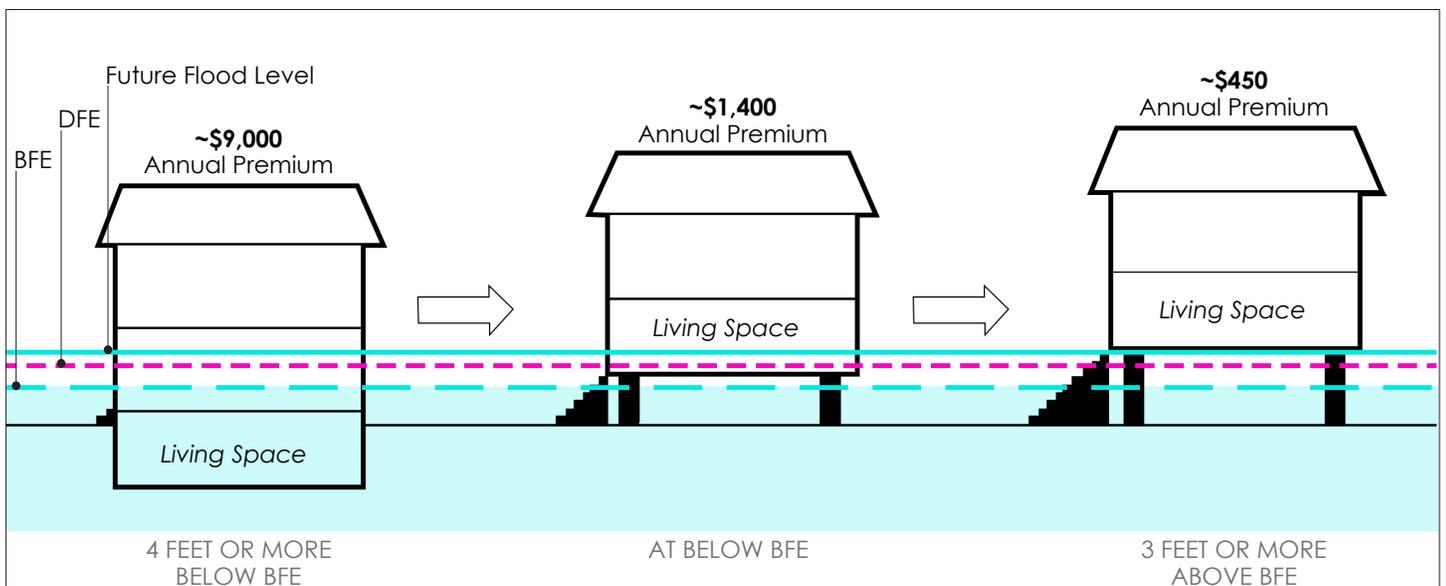
The 50% Rule

When a property is “substantially damaged,” or “substantially improved,” it must be renovated

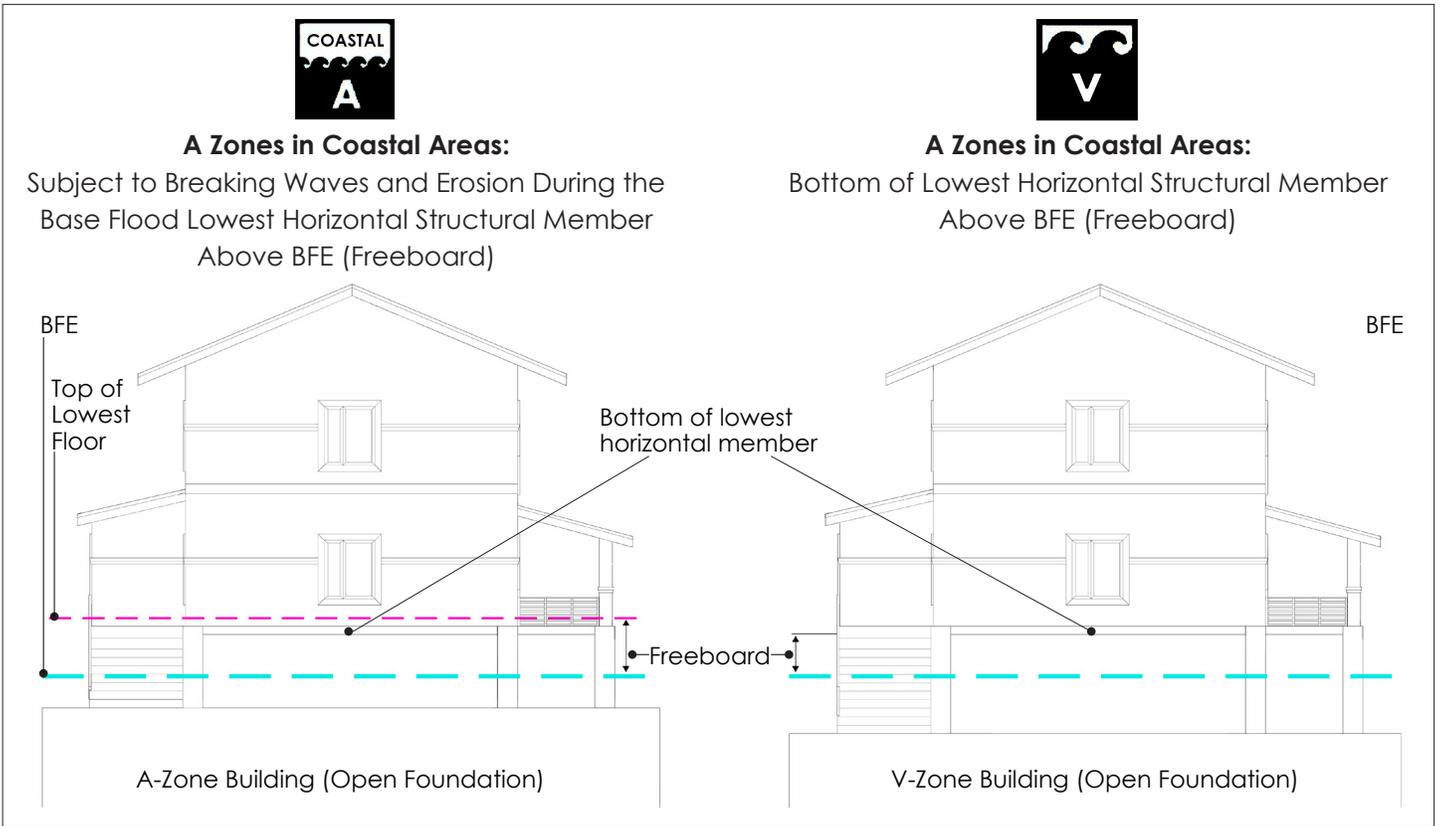


Future Flood Zones in Davis Islands, showing VE, Coastal A and AE zones. Image taken from FEMA’s Flood Map

to meet current building code and regulations. This is defined as, “Damage (or improvement) of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed fifty (50) percent of the market value of the structure before the damage occurred. Substantial damage also means repetitive loss flood-related damages sustained by a structure on two (2) separate occasions during a ten-year period for which the cost of repairs at the time of each such flood event, on the average, equals or exceeds twenty-five (25) percent of the market value of the structure before the damage occurred.” (City of Tampa, 2020).



FEMA Flood Zones. Image from New York City ‘Zoning for Coastal Flood Resiliency’ (2020).



Different freeboard requirements for zones A and V. Image taken from FEMA publication, *Homebuilder's Guide to Coastal Construction* (2010).

| District | Maximum Height (ft.) ¹ |
|----------|-----------------------------------|
| RS-150 | 35 |
| RS-100 | 35 |
| RS-75 | 35 |
| RS-60 | 35 |
| RS-50 | 35 |
| RM-12 | 35 |
| RM-16 | 35 |
| RM-18 | 35 |
| RM-24 | 60 ² |
| RM-35 | 120 ³ |
| RM-50 | 200 ³ |
| RM-75 | n/a ⁵ |
| RO | 35 |
| RO-1 | 35 |

Building height limitations in the City of Tampa, taken from City of Tampa Chapter 27 Division 1 Section 27-156 (City of Tampa, 2020a)

IMPACTS OF NON-COMPLIANCE

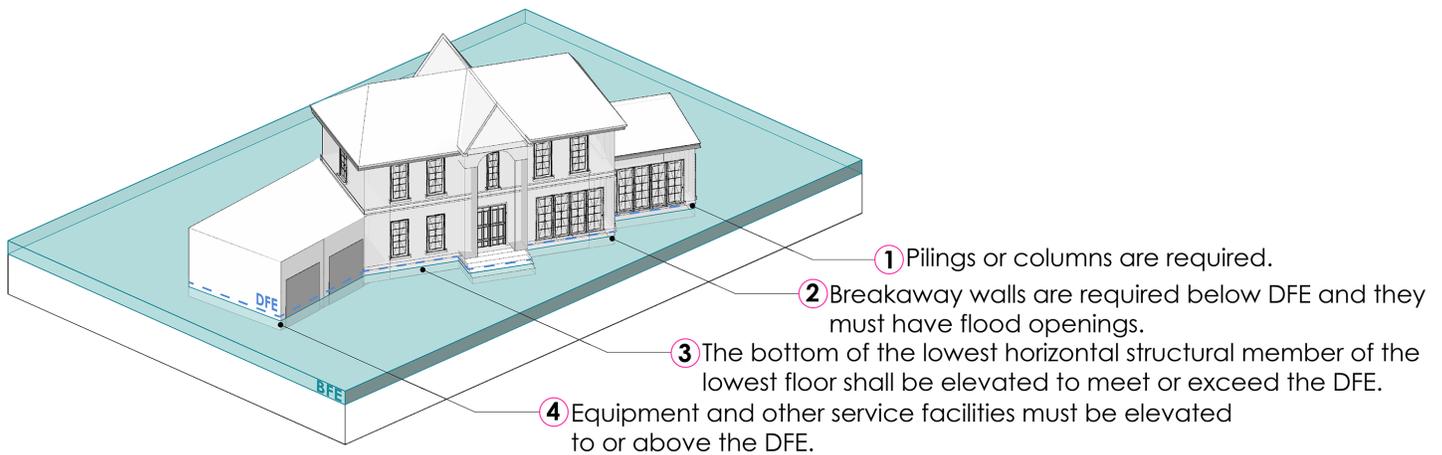
Homes and businesses that are located in a high-risk flood zone (A and V) with government-backed mortgages are required to have flood insurance (FEMA Floodsmart, 2020).

A building with an existing and active policy is considered “grand-fathered,” and rate increases are limited to 5-18% per year (Personal Communication, FEMA Representative, September 23, 2020). Otherwise new policies can be obtained at full market rate. Insurance is sold through the National Flood Insurance Program (NFIP).

The NFIP will insure a house for up to \$250,000, and personal belongings to \$100,000. If the house has a higher value, private insurance companies offer additional policies (Insurance.com, 2020).

FROM FLOOD ZONE AE TO VE (OR COASTAL A)

With upcoming Flood Insurance Rate Map (FIRM) changes, some houses that were previously in the A(E) zone will now be located in the V(E) zone, or in the Coastal A zone. In order to comply with flood zone criteria, these houses will need to provide:



These codes are useful in temporary flooding conditions. However, with the onset of permanent flooding due to sea-level rise they will be less effective, since their surroundings will be under water.

Sea-level rise is a slow occurring process, and properties will not immediately be in this dire situation. In the meantime, raising buildings may help with the compounding impacts from storm induced flooding, with elevated heights from sea-level rise. Also, raising buildings will keep interiors dry during extreme high tide events.



PLANNING POLICIES FOR HOMEOWNERS

CLUSTER DEVELOPMENT



Clustering development allows flexibility in water management. Whether at the scale shown below, or at a much larger scale, coordinating concentrations of housing can create opportunities to increase the greater area of landscape space and also physical adaptability to future conditions.

ASSOCIATED POLICIES:

Allow homeowners to relocate houses threatened by erosion to another location on their own property. Allow developers to subdivide if using deep lots that allow for coastal migration to occur.
(Neal, 2019)

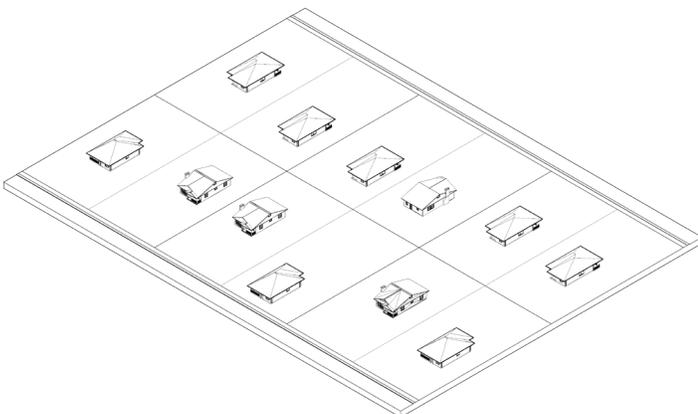
Provide tax incentives or density bonuses to encourage developers to site new development in lower-risk areas of a lot or a subdivision. Require a significant portion subdivision be set aside for open space (e.g., at least 50% for a subdivision with sewer lines), and include wetland buffers, among other requirements.

Scarborough, Maine (Center for Coastal Resources Management, 2020)

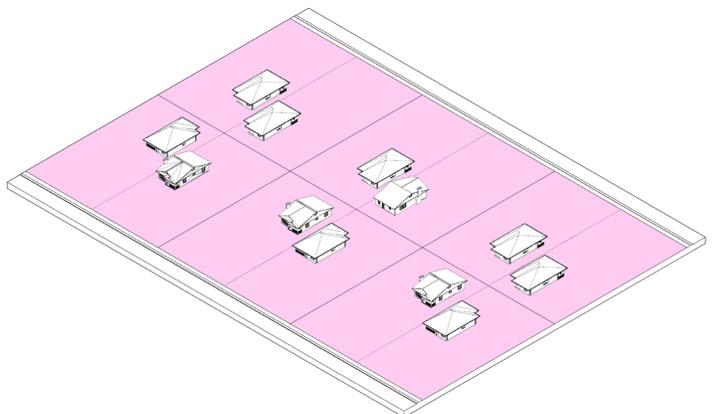
Promote clustered, mixed-use development, site development around infrastructure, and preservation of open space.

Maryland Growth Act and Smart Growth Initiative; California Adaption Strategy (Grannis, 2011)

Existing Policy



Policy Option



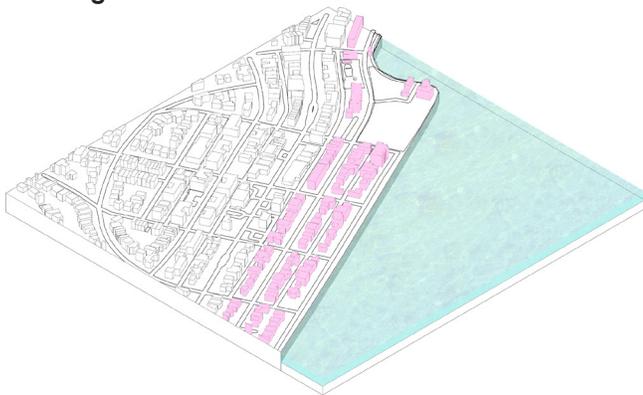
TRANSFER OF DEVELOPMENT RIGHTS



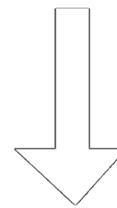
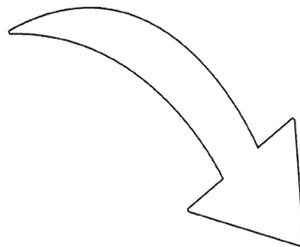
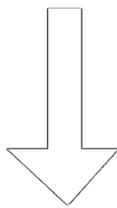
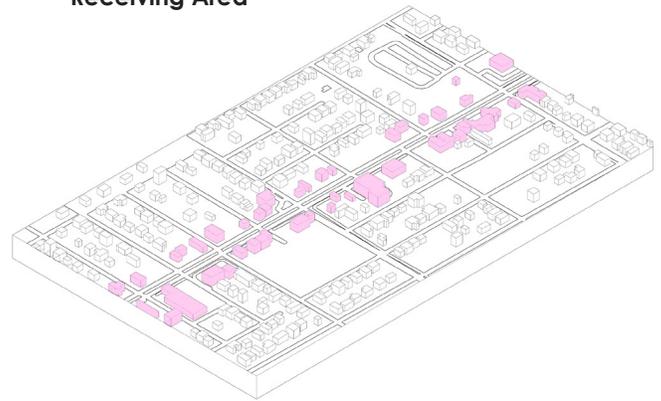
Transfer of development rights offer a unique strategy to support property owners through this difficult process while creating value for homeowner property and in other locations within the city. A transfer of development right (TDR) program establishes “sending zones,” in locations where the goal is to reduce density. In other areas, near transportation hubs or commercial districts for instance, “receiving zones” are created.

Density bonuses and other incentives can be associated with properties in sending areas. If purchased, a density bonus, for example, could be applied in another location within the city giving a developer opportunity to build higher with more units. This creates additional financial opportunity and the clustering of population density can stimulate commercial and transportation opportunities. This provides additional value for the sale and subsequent conservation of properties in areas vulnerable to sea-level rise, offsetting value lost.

Sending Area



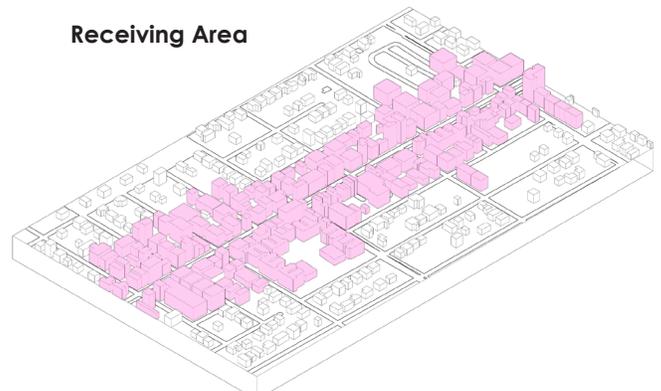
Receiving Area



Sending Area



Receiving Area



ROLLING EASEMENTS



| Land Development Code

Through the regulatory concept of “Rolling Easements,” property is purchased for conservation purposes by the municipality (or a part of the property), or it is purchased by another entity and transferred to municipal ownership. However, the occupant is able to stay until the property is unsuitable for inhabitation. Rather than losing all value for the property owner, or succumbing to the high cost of protective measures, this strategy provides assurances for both the owner and the municipality, and can be factored into future sea-level rise planning. If the municipality purchases the land, in order to mitigate their own financial hardship they may charge an annual rent at or below fair market value. This rent would generate funds to clean up the site and restore habitats once structures are abandoned (remember the long timeline associated with this process of sea-level rise) (Titus, 2011).

Other incentives can be added, such as tax benefits for putting land into conservation (for more information, see Titus, 2011). Rolling easements can also work in conjunction with transfer of development rights. In that scenario, the developer would buy the property rights and transfer them to the municipality, but the occupant could stay until the property is substantially inundated.

This strategy also allows the individual to make their own decision about comparable risk and value. A program can be structured so that the municipality offers price options, which are graduated over time, with initial planning efforts. This would incentivize property owners to comply with the program, if deemed the most suitable response. Similar to how flood insurance works, if land-holders are not concerned about their risk they could abstain from the program. However, their potential compensation would decrease over time (see diagram).

ASSOCIATED POLICIES:

Reevaluate the existing conservation easement programs to ensure that properties in vulnerable areas are eligible to receive tax credits, to ensure that property owners have sufficient incentive to sell or dedicate easements and acquire additional conservation easements along the coast to reduce development in flood prone areas that impedes the migration of coastal resources.

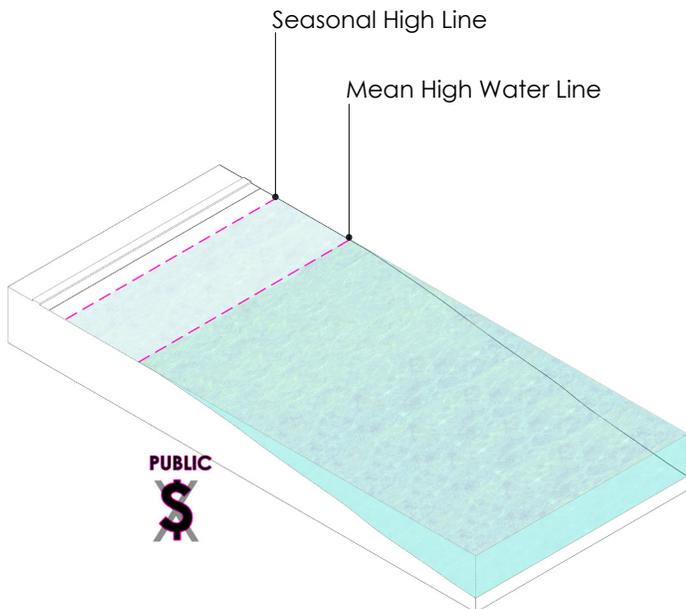
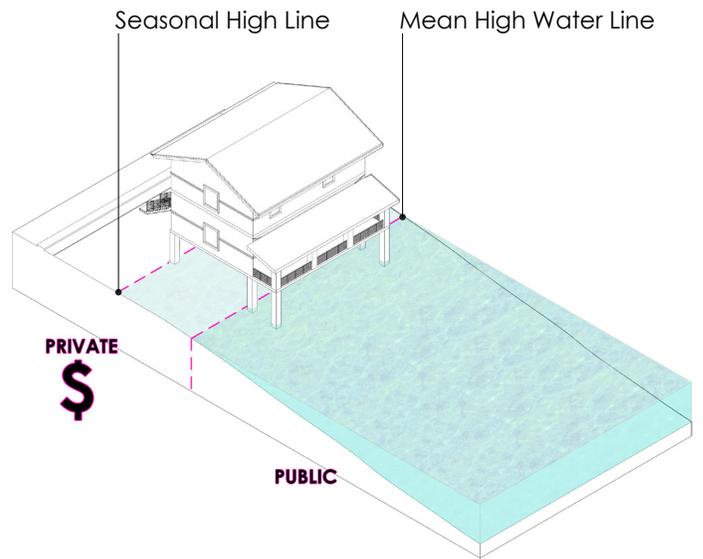
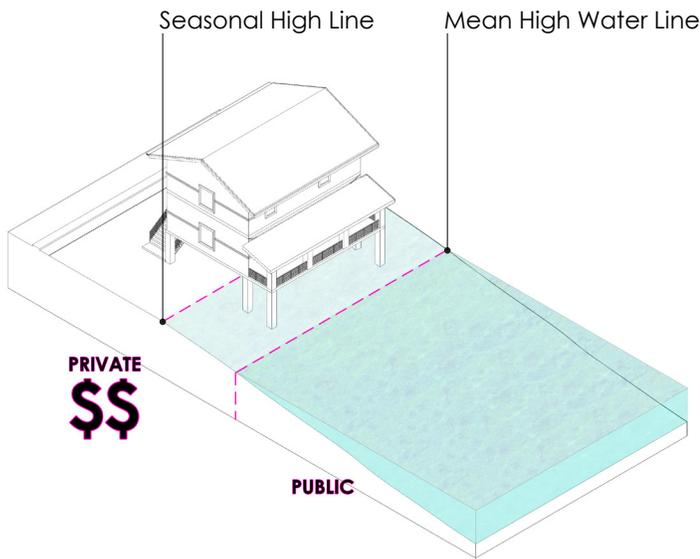
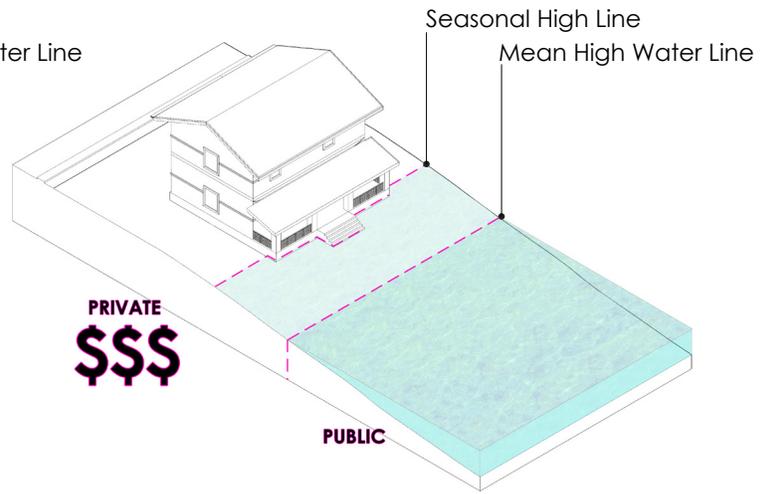
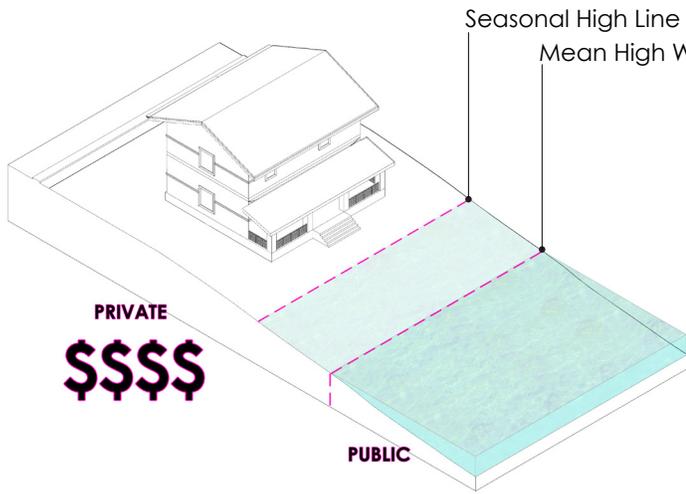
North Carolina Steering Committee; Maryland Environmental Trust; Implementation of Rolling Conservation Easements in a SLR Context (Grannis, 2011)

Utilize matching federal funds from NOAA Coastal and Estuarine Land Conservation Program (CELCP) or other state and federal funding programs to purchase conservation easements from coastal property owners.

NOAA Coastal and Estuarine Land Conservation Program (CELCP) (Grannis, 2011)

Offer preferential assessments to landowners who agree to conserve their property for flood control or open space purposes. Landowners who donate easements would be assessed lesser property taxes based upon the loss of value caused by the easement terms limiting uses of the property.

(Grannis, 2011)





PROPERTY POLICIES

BUILDING HEIGHT



Until sea-levels rise to permanently flood areas within the city, raising buildings may help with the compounding impacts from storm induced flooding, and will keep interiors dry during extreme high tide events.

ASSOCIATED POLICIES:

Elevate buildings and their utilities to account for changing water elevations at the coast.

Allow buildings that modify their ground floor or MEP components to trade FAR or provide other incentives that can make this a reasonable trade-off in value.

Increase building height 1' from what is required by Florida Building Code in flood-prone areas, to 2 feet above the base flood elevation.

This strategy mitigates impacts from storm surge and flooding for future conditions, however sea-levels are expected to increase one foot in the next 20-50 years (CSAP, 2019).

Somerset County Rising Sea Level Guidance. Maryland Jurisdictions (Environmental Resources Management, 2011); Sea Level Rise: Technical Guidance for Dorchester County. Worcester County Sea Level Rise Guidance Document (Environmental Resources Management, 2011); (Harris, 2019)

Create incentives such as a rebate on building permit fees for inclusion of increased freeboard in the building design.

Sea Level Rise Zoning Overlay in Hull, Massachusetts (Center for Coastal Resources Management, 2020)

Allow structures to exceed the existing 25 foot height limit by the number of feet needed to raise the house to the base flood elevation, plus a maximum credit of up to 4 feet above the base flood elevation. The maximum height for any structure is set at 40 feet (15 feet above current limit).

Flood Protection Building Height exception in the zoning regulations: Key West, Florida (Center for Coastal Resources Management, 2020)

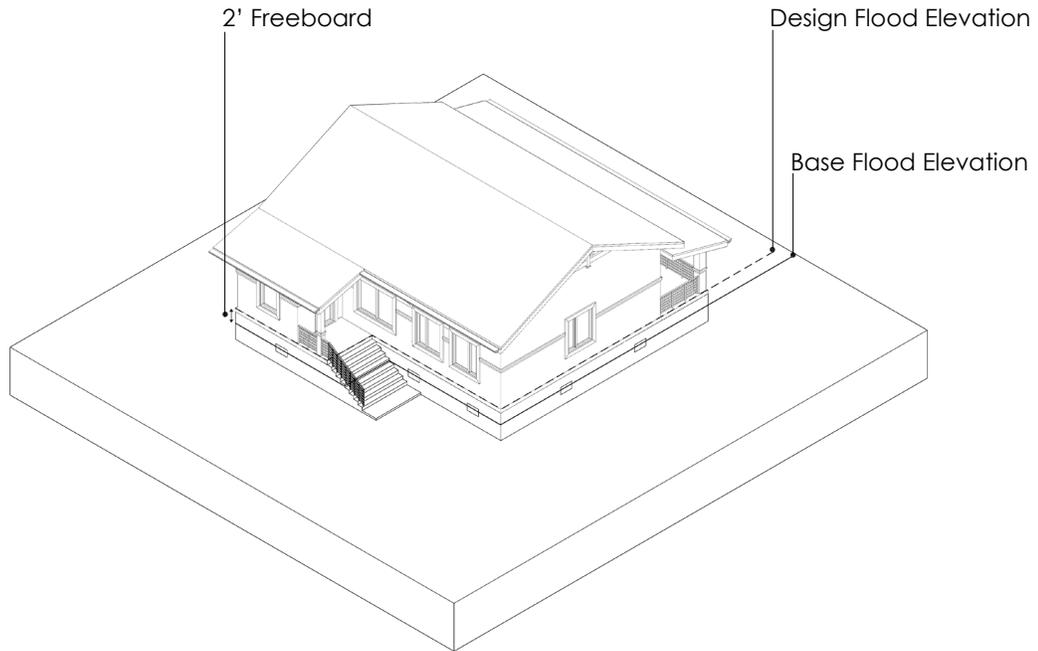
Allow height to be measured from either the design flood elevation or a reference plane rather than from grade, to allow buildings to meet flood-resistant construction standards.

In areas in which the base flood elevation above grade equals or exceeds four feet, allow height restrictions to be measured from a reference plane located higher than the design flood elevation—nine, 10 or 12 feet above grade depending on the building's use.

(New York City Planning, 2017)

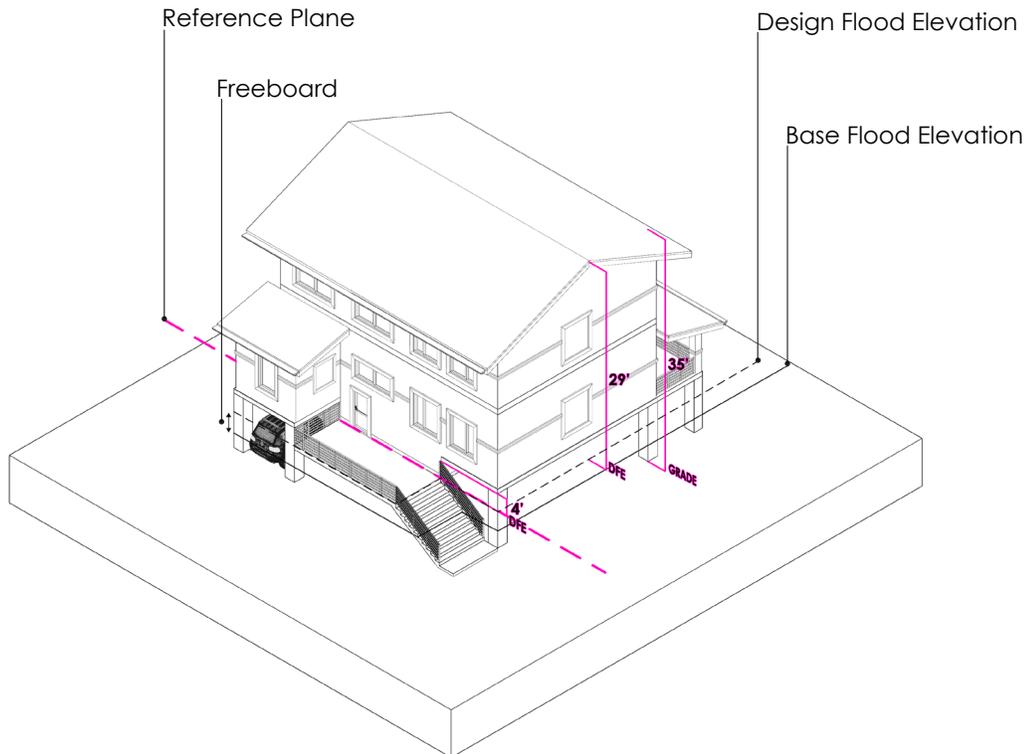
Policy Option

2 Feet of freeboard in areas vulnerable to sea level rise



Policy Option

Height limit measured from design flood elevation or reference plane



BUILDING ENVELOPE

 | Land Development Code

Increased building constraints, especially when buildings are raised, can create awkward structure configurations. In an effort to mitigate risk while also allowing for reasonable development footprints, policy can be specific in providing variance options. For example, on small lots, parameters can be set to allow buildings to encroach into setbacks. This creates clarity for residents and their neighbors.

ASSOCIATED POLICIES:

Reduce side yard requirements if the lot is narrow (for example, when less than 30 feet to a minimum of three feet)

(New York City Planning, 2020)

Reduce rear yard requirements if the lot is shallow (for example, when less than 95 feet to a minimum of 10 feet)

(New York City Planning, 2020)

Meet front yards and setbacks of neighboring buildings, to best align to surrounding neighborhood context.

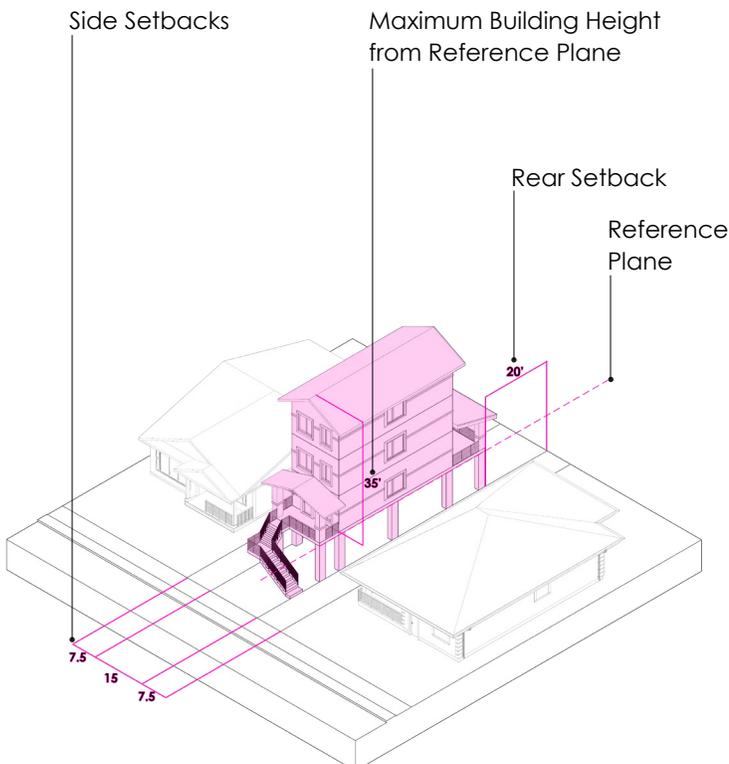
In exchange for this flexibility, the building would be limited to a maximum height of 25 feet, as measured from the reference plane, instead of 35 feet (most common maximum height in low-density districts).

(New York City Planning, 2020)

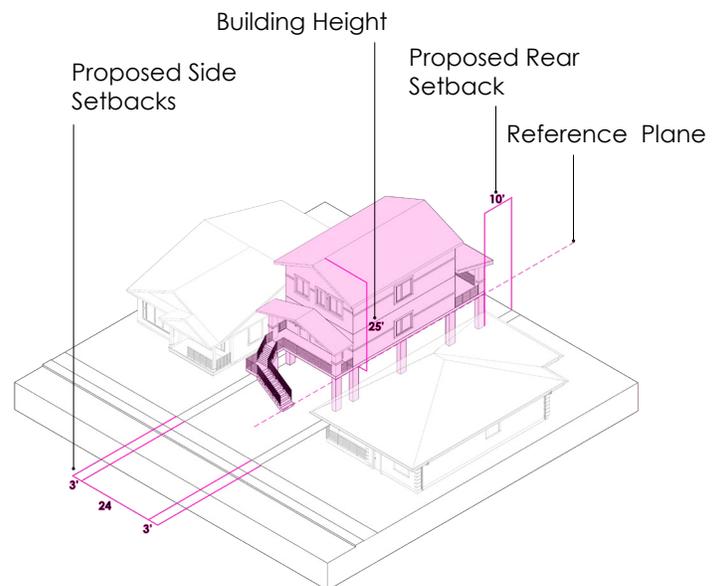
Allow for a variance if the lot does not have 30 feet of buildable space in either dimension, when abiding by required setbacks.

Maui, Hawaii (Grannis, 2011)

Existing Policy for a Raised Building



Policy Option



DESIGN STANDARDS FOR ELEVATED BUILDINGS

| Building Code

It is important to consider the impacts to the street environment when raising buildings. Height and other exterior elements can drastically change the 'feel' of the neighborhood.

ASSOCIATED POLICIES:

Provide exterior circulation.

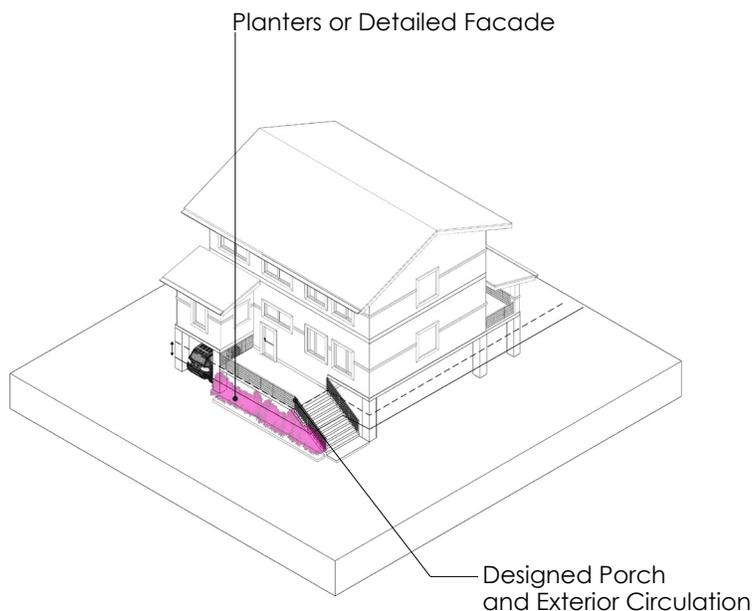
(City of Boston, 2019); (New York City Planning, 2020)

Single and two-family homes that elevate their first occupiable floor at or above five feet must either raise and plant the front yard, design a porch in front of the building, or design a stair turn and install planters to help alleviate blank walls.

(New York City Planning, 2020)

Policy Option

Establish design standards for raised buildings



BUFFERS AND SETBACKS

 | Land Development Code

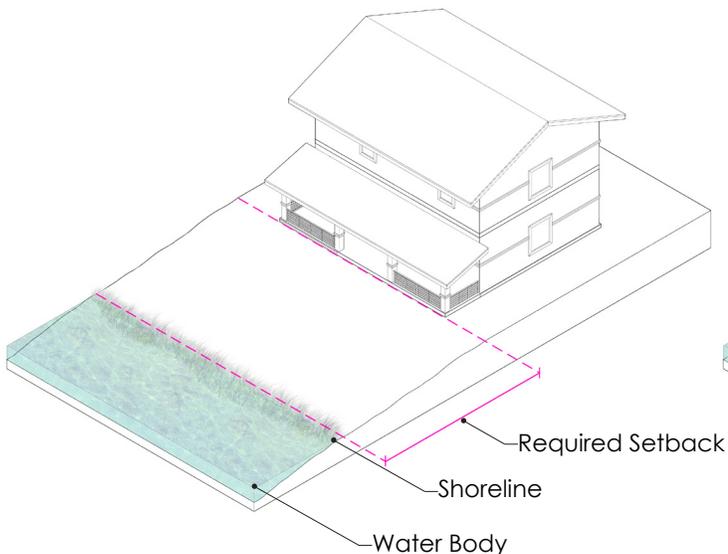
Buffers or setbacks may offers extra protection against rising seas if associated with topographic change. This space is also important in allowing habitats to migrate upslope. There are many options for buffers and setbacks to consider, including those that change over time to correlate to either erosion rates or increases in sea levels.

Policy Option: Standardized Setbacks

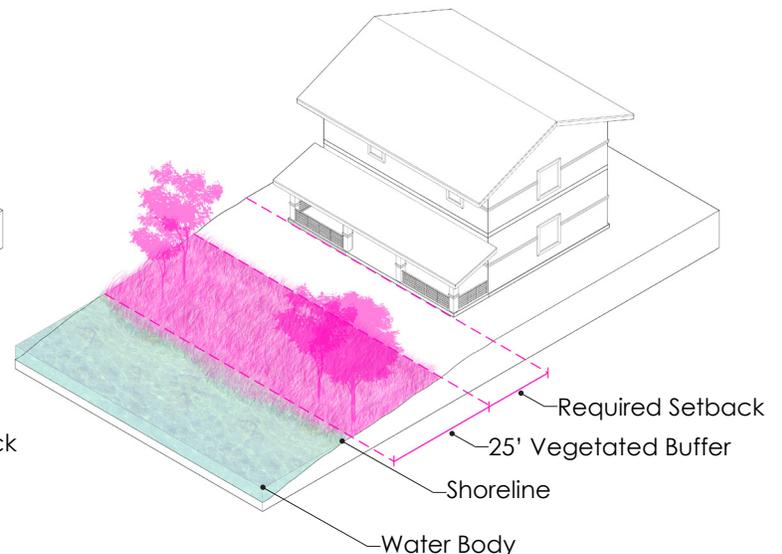
Require (for example, a 25-foot) minimum vegetated buffer for all new non-beachfront shoreline development in the Coastal zones.

South Carolina Shoreline Change Advisory Committee (Grannis, 2011)

Existing Policy

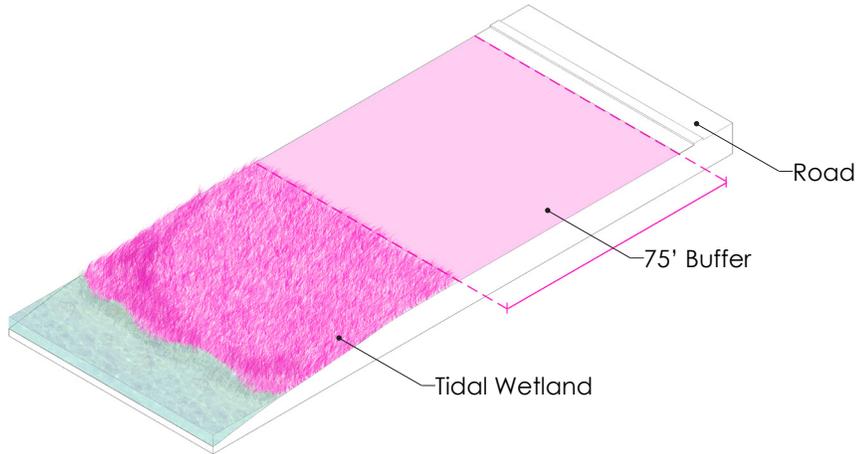


Policy Option



Policy Option: Buffers Near Tidal Wetlands

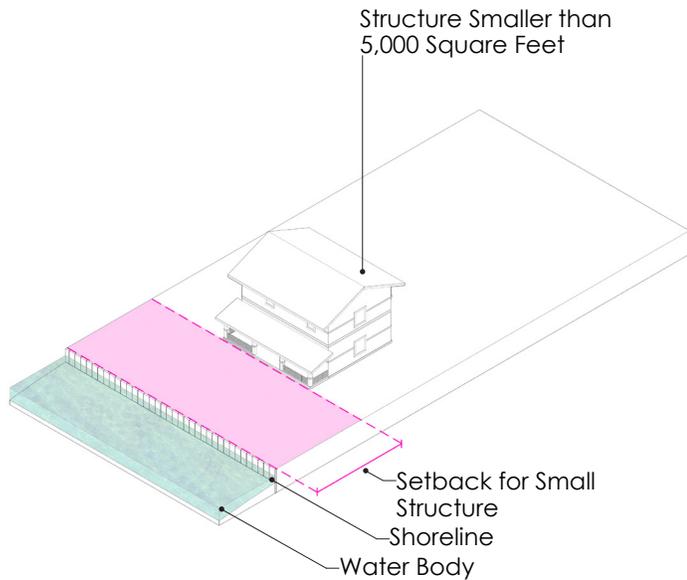
Situate roads and other infrastructure at least 75 feet from a tidal wetland.
New York State Tidal Wetlands Act (Land Use Law Center)



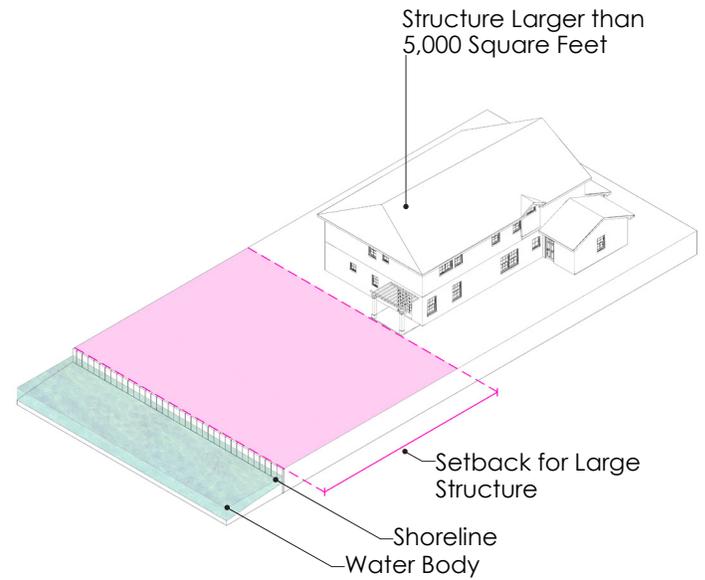
Policy Option: Tiered Setback

Setback smaller structures (less than 5,000 square feet) a smaller distance from the shoreline (for example, 30 times the erosion rate); larger structures should be set back further since they are less adaptable over time (for example, 60 to 90 times the erosion rate).
North Carolina (Grannis, 2011)

Policy Option



Policy Option



ASSOCIATED POLICIES:

Reduce rear yard requirements if the lot is shallow (for example, when less than 95 feet to a minimum of 10 feet)

(New York City Planning, 2020)

Meet front yards and setbacks of neighboring buildings, to best align to surrounding neighborhood context.

(New York City Planning, 2020)

Allow for a variance if the lot does not have 30 feet of buildable space in either dimension, when abiding by required setbacks.

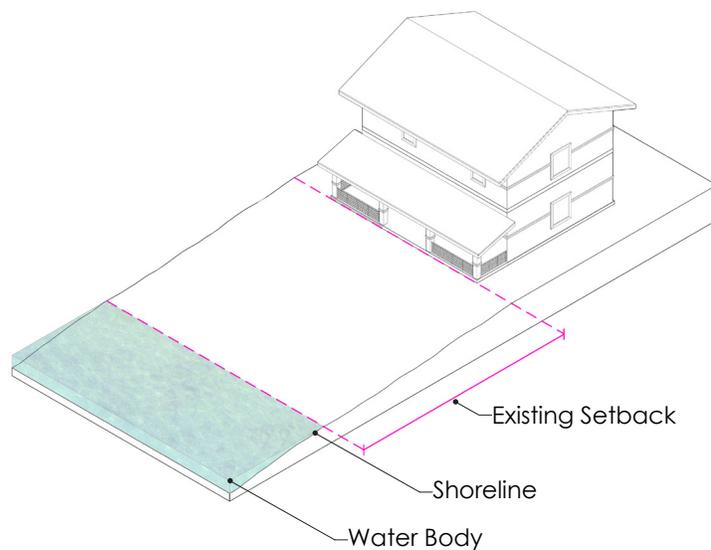
Maui, Hawaii (Grannis, 2011)

Policy Option: Erosion-Based Setback

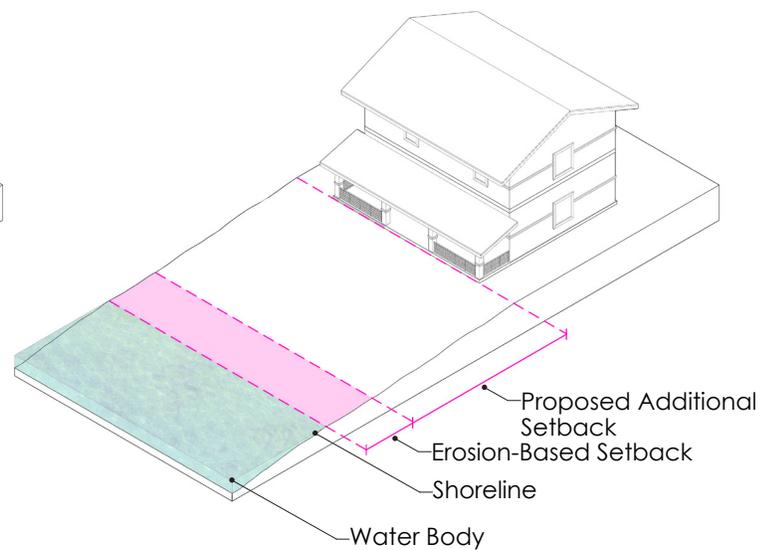
Establish an erosion-based minimum setback for shoreline development based upon the (annual coastal erosion rate) x (a planning period representing the economic lifetime of the coastal structure) + (an additional buffer)

The City of Lewes Hazard Mitigation and Climate Adaptation Action Plan, North Carolina (Grannis, 2011)

Existing Policy



Policy Option



LOW MAINTENANCE ZONE (LMZ)

 | Land Development Code

The gradient edge is one of its most important and productive zones within, or near, a water body. This area is responsible for sediment and nutrient reduction into the waterway, soil stabilization, and structural habitat. The displacement of this zone impacts the water

system, and if replaced with high maintenance plantings, can dramatically increase pollution and de-stabilize the coastal edge. The elimination of this habitat edge also decreases the opportunity for ecosystem migration, as sea-levels push upward and inland.

ASSOCIATED POLICIES:

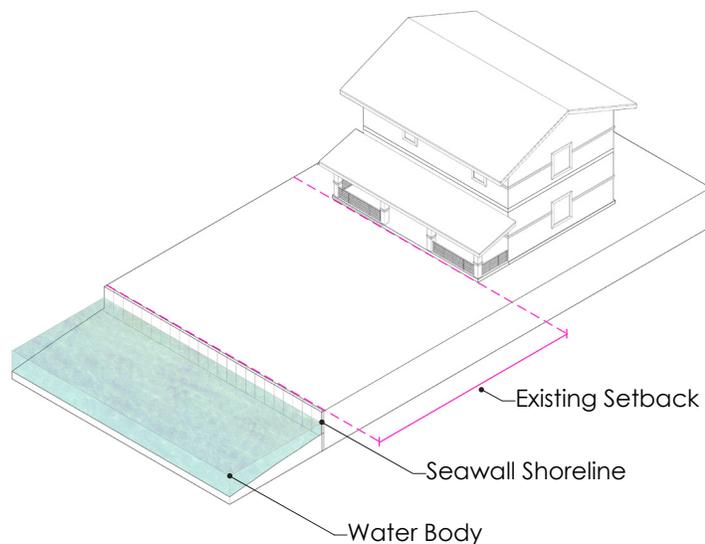
Require Low Maintenance Zones (LMZ) to be established between developed areas and shorelines, contiguous to any waterbody, wetland or seawall.

This helps to reduce impacts of climate change, the destructive forces from storm surge and tidal velocity, and the erosive effects of sea-level rise and wave action.

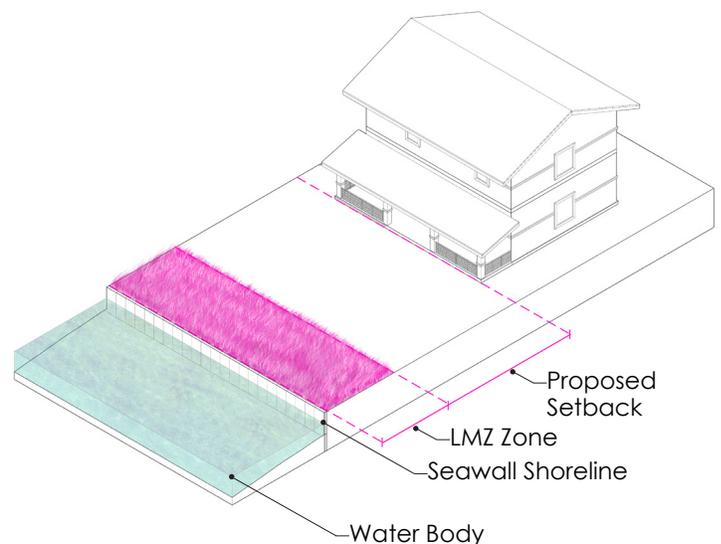
(FCCDR, 2020)

Development and redevelopment for non-water-dependent uses abutting marine shorelines should include beds of riparian vegetation in the (ie. 15-foot-wide) strip of land lying immediately landward of unarmored shorelines or on the landward edge of shoreline armoring. Beds must occupy a minimum percentage of shoreline (ie. 50% for new development and 25% for redevelopment).

Existing Policy



Policy Option



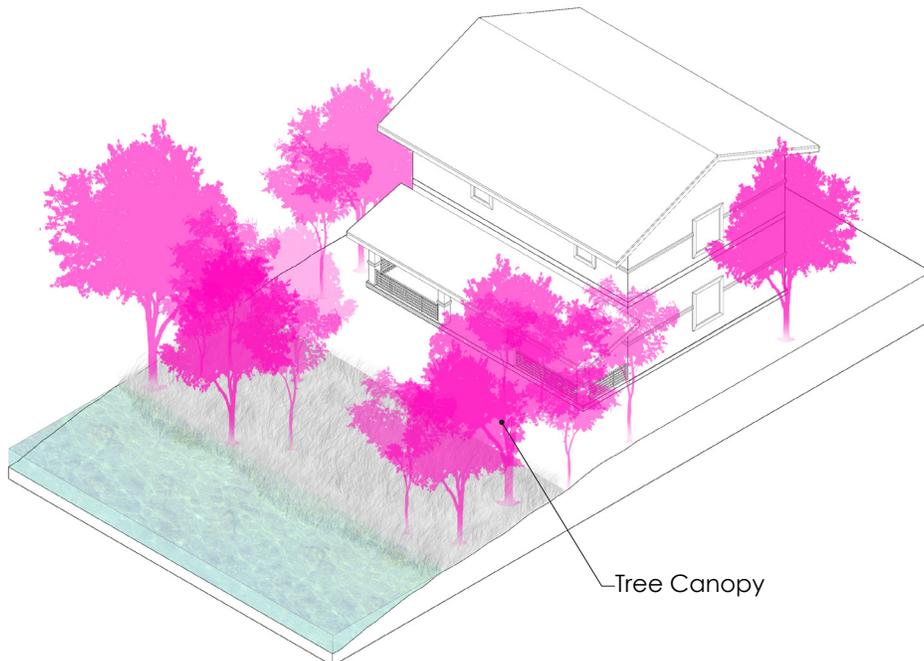
TREE CANOPY

 | Comprehensive Plan

Trees can collectively help to reduce greenhouse gases, which in turn have a relationship with climate change and sea-level rise (CSAP, 2019). Individually, trees dissipate rainwater and alleviate stormwater requirements. As groundwater levels increase, stormwater capacities will be reduced. This simple strategy is one of many small things that can be done to mitigate future conditions.

Policy Option

Improve tree canopy for hydrology benefits
(Charleston, 2019)



CONTINUOUS COASTAL HABITATS

 | Comprehensive Plan

Sea-level rise will increase exposure to the impacts of storm surge, especially at the coast. Where feasible, promoting storm barriers in open space can help to mitigate this situation. However, inland areas are only as strong as their lowest point. To create a formidable obstacle for future storm waters a continuous landscape with flood resistant plantings or structures can mitigate risk. The continuity of habitats also helps to strengthen ecosystems, providing an uninterrupted ecological edge.

ASSOCIATED POLICY:

Place a priority on coastal land acquisition through the Florida Forever program.

Acquisition efforts should be strategically targeted to protect coastal resources, reduce insured risk, and reduce the impacts of climate change on both ecosystems and community. Continuous park space may create optimal configurations for water storage and transference. These parks become green absorptive landscapes for collecting, filtering and dispersing waters. Regional stormwater system. Having floodable parks and green spaces alongside new and existing neighborhoods and development provides new amenities and elevates property values.

(Southeast Florida Regional Climate Compact, 2019); (FEMA, 2013); (City of Boston, 2019)

Existing Policy
Coastal Habitat



Policy Option
Continuous Coastal Habitat



SEA WALLS

 | Comprehensive Plan | Building Code

Coastal armoring is often considered as an approach to sea-level rise mitigation. However, since groundwater levels rise at the same time as sea-levels, sea walls do not keep the water out. Consequently, coastal armoring has its limits as a mitigation strategy. In fact, as sea-levels rise, hardened shorelines inhibit habitat migration, and amplify wave energy, scouring and erosion.

ASSOCIATED POLICIES:

Work toward the removal of sea walls

Require developers to pay a fee to cover the costs of future armoring, to mitigate the impacts to natural resources from armoring, or to flood-proof infrastructure that services a new development.

Limit the development of oceanfront hotels and condominiums.

Remove structures that come to be located on an inter-tidal zone (seaward of the mean high tide line) for a period of six consecutive months.

Policy Option

Find clusters of properties where structures are set back and it is possible to remove sea walls. Work with property owners to remove walls and establish living shorelines.

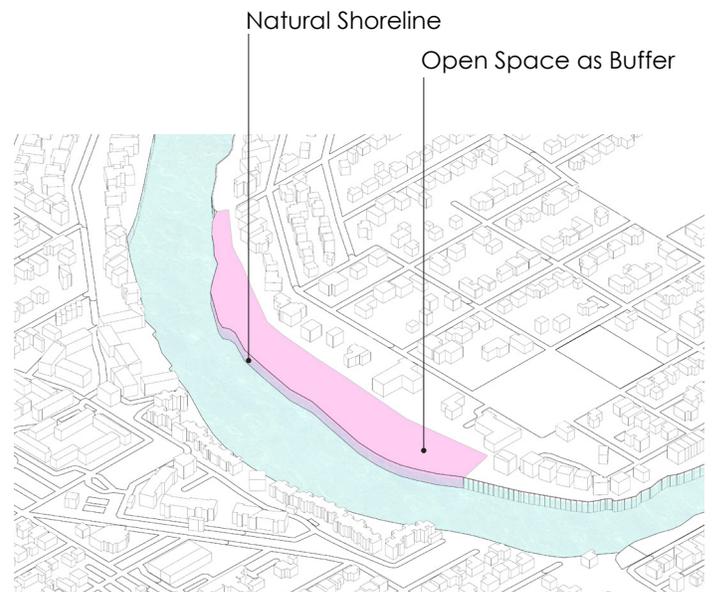
Existing Policy

Sea wall and shoreline properties



Policy Option

Natural shoreline with removal of properties



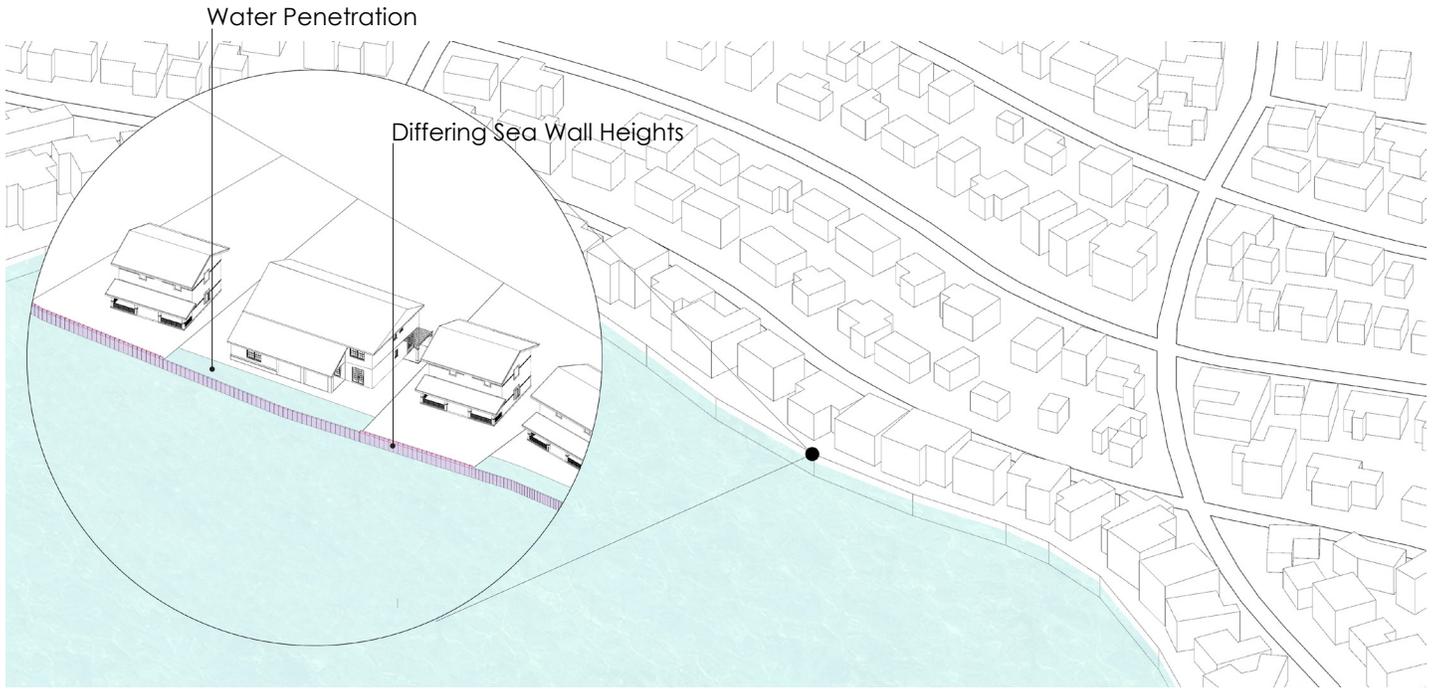
Policy Option

Establish a top of sea wall standard that must be implemented by a specific year. This can alleviate increase storm surge heights, but is not effective against sea-level rise.

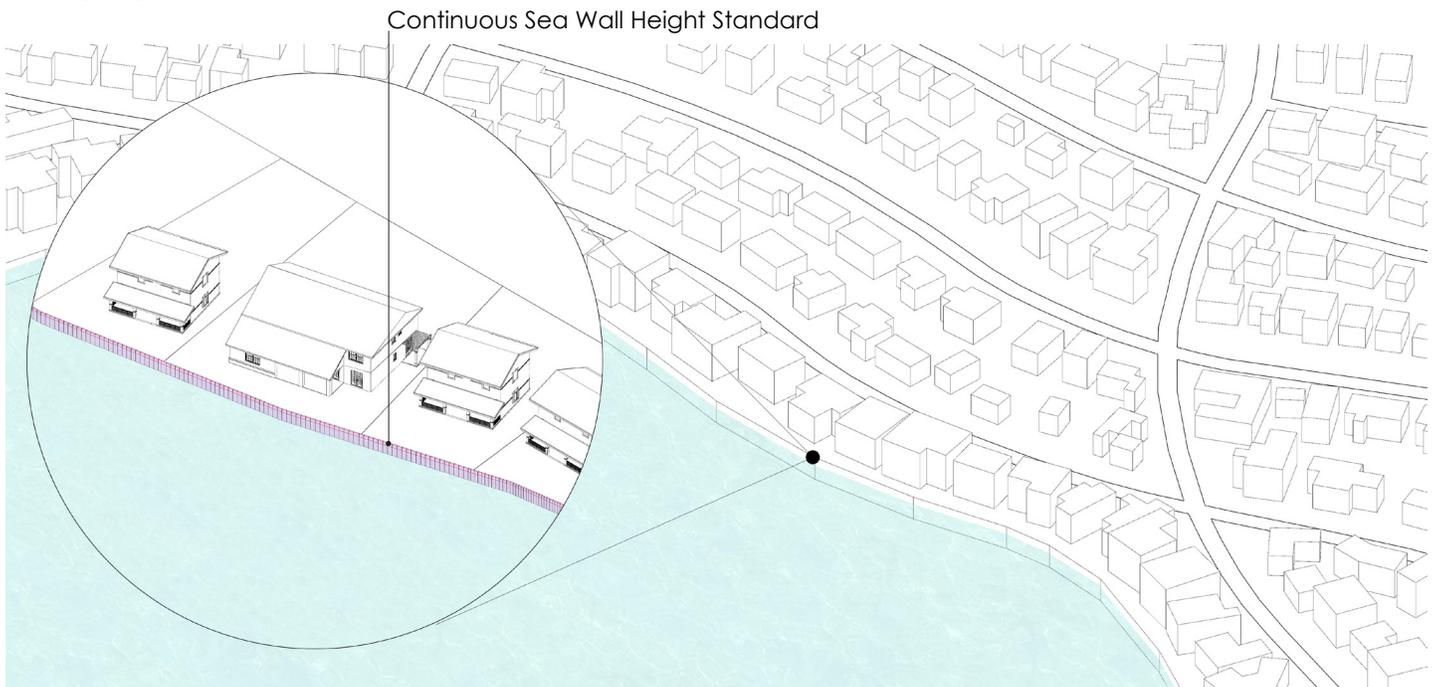
In Broward County, structures must be at least 5 feet above NAVD88.

(Broward County, 2021)

Existing Policy



Policy Option



CREATE FLEXIBLE LANDSCAPE SPACE

 | Comprehensive Plan | Land Use Code

Sea-level projections have a wide range of expectations; in Tampa anywhere between 1.9 to 8.5 feet by the year 2100. In order to minimize future risk to this changing condition, cities will benefit by creating flexibility at the edge of hydrologic systems. This strategy has multiple benefits. Giving room for landscape can help to maintain ecosystem functionality, which is responsible for nutrient reduction, habitat, climate stabilization and can be used as recreational space.

Climate Ready Boston



Creating flexible, functional ecosystems at the coastal edge can help to maintain habitats and other value that comes with healthy environments. This can be accomplished in public or private space.

INCREASE LIVING SHORELINES

 | Land Development Code | Comprehensive Plan

Sea-level rise can have cumulative affects on coastal habitats as waters deepen and inland areas become submerged. If space is not provided for this to occur, valuable ecosystems can decline as pieces are removed and important biotic relationships are lost.

Increasing living shorelines can happen by removing hardened erosion control structures, but they can also be constructed in front of such structures.

The Tampa Bay Estuary Program has created a tool to identify opportunity areas for living shorelines: The Living Shoreline Suitability Model (TBEP, 2021). This tool and other analyses can help to find areas for living shorelines. As a policy, the municipality can support these efforts and commit to targeted goals.

ASSOCIATED POLICIES:

To compensate for the loss of ecosystem services resulting from hard shoreline stabilization, require adequate mitigation through the construction of living shorelines in front of hard shoreline stabilization structures where feasible.

Collier County, FL (Ankersen et al., 2010)

Policy Option

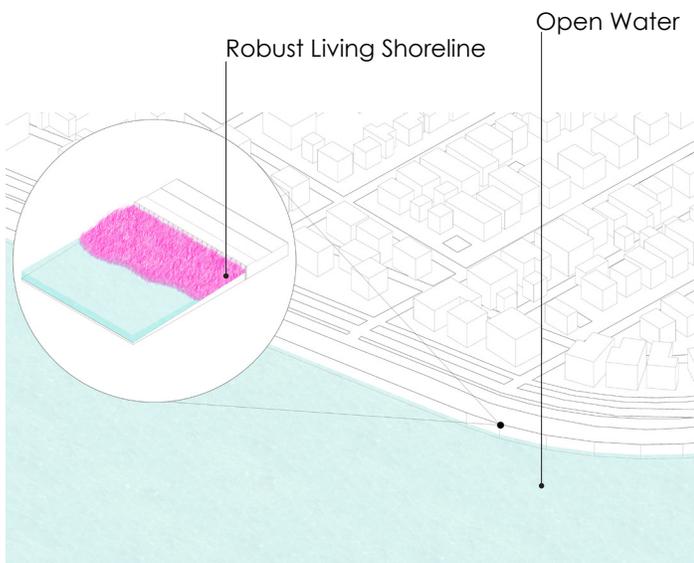
Require a living shorelines buffer where appropriate and ecologically feasible.

For example:

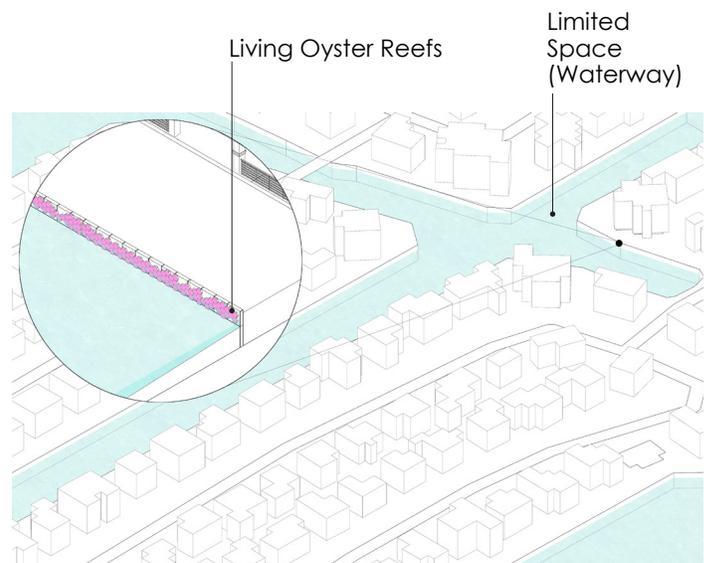
- a. Provide robust living shorelines in areas with access to open waters
- b. Provide infrastructure for oysters in limited waterways such as canals

(Ankersen et al., 2010); (Boland, 2019)

Proposed Policy: Expansive Coastlines



Proposed Policy: Narrow Coastlines



ADDITIONAL OPTIONS FOR HOMEOWNERS (LIST)

Encourage private owners of infrastructure to conduct a climate change vulnerability assessment.

Establish neighborhood level planning groups and/or representation.

Place mechanical, electrical and plumbing equipment in the building bulkhead.

Remove septic tanks and hazardous materials from vulnerable conditions.

Use design criteria so that buildings and infrastructure will withstand a minimum service life of 50 years.

Raise well heads above the base flood elevation plus a height to accommodate wave action from storm surge.

Amend conservation tax credit program to make the donation of unbuildable or threatened lots a more appealing option to homeowners.

Provide a one-time tax credit to landowners who voluntarily agree to preserve their property for conservation purposes.

Offer preferential assessments to landowners who agree to conserve their property for flood control or open space purposes. Landowners who donate easements would be assessed lesser property taxes based upon the loss of value caused by the easement terms limiting uses of the property.

Deduct up to 40 percent of the value of the easement from state income tax, for landowners who donate conservation easements. (not applicable in Florida)

Provide a one-time tax credit to property owners who move structures out of at-risk areas (either relocating on the same or a different parcel) or retrofit structures to be more resilient to flooding and surpass the minimum standards required by existing ordinances (i.e., the minimum required setbacks or building elevations).

REFERENCES

- Ankersen, T., Macadangdang, K. & Newmons, M. (2010). Sea level rise ready. Model comprehensive plan goals, objectives, and policies to address SLR impacts in Florida. University of Florida, Florida Sea Grant. Retrieved from https://www.law.ufl.edu/_pdf/academics/centers-clinics/clinics/conservation/sea_level_rise.pdf
- Boland, C. (2019). Suitable Sites for Living Shorelines in Tampa Bay. Retrieved from <https://storymaps.arcgis.com/stories/9fb7e956f2c145aa894d42291f7556b5>
- Broward County. (2017). Ordinance no. 2017-16, Future Conditions Average Wet Season Groundwater Elevation Map. Retrieved from <https://www.broward.org/Environment/WaterPrograms/Documents/OrdinanceNo2017-16.pdf> and <https://www.adaptationclearinghouse.org/resources/broward-county-florida-ordinance-2017-16-and-future-conditions-maps-for-infrastructure-design.html>
- Center for Coastal Resource Management. (web, accessed June 8, 2020). Adaptation stories: Zoning and building codes. Retrieved from <https://www.arcgis.com/apps/MapJournal/index.html?appid=1afbf2d80c6c4b1e8084ea37c7a80548>
- City of Tampa. (2020b). Code of ordinances: Section 5-111 – Flood resistant construction.
- City of Boston. (2019). Preparing for climate change. Retrieved from <https://www.boston.gov/departments/environment/climate-ready-boston>
- Retrieved from https://library.municode.com/fl/tampa/codes/code_of_ordinances?nodeId=COOR_CH5BUCO_S5-111FLRECO
- Charleston. (2019). Flooding and Sea Level Rise Strategy. Retrieved from <https://www.charleston-sc.gov/1981/Flooding-Sea-Level-Rise-Strategy>
- City of Tampa. (2020a). Code of ordinances: Chapter 27 Division 1 Section 27-156. Retrieved from MuniCode, at https://library.municode.com/fl/tampa/codes/code_of_ordinances?nodeId=COOR_CH27ZOLADE_ARTIIIESZODIDIRE_DIV1GEZODI_S27-156OFSCDIRE
- Climate Science Advisory Panel [CSAP]. (2019). Recommended projection of sea-level rise in the Tampa Bay Region. Retrieved from https://www.tbep.tech.org/TBEP_TECH_PUBS/2019/TBEP_05_19_CSAP_SLR_Recommendation.pdf
- Climate Ready Estuaries. (2011). Being Prepared for Climate Change: A Workbook for Developing Risk-Based Adaptation Plans. Retrieved from https://www.epa.gov/sites/production/files/2014-09/documents/being_prepared_workbook_508.pdf
- Enterprise Green Communities. (2015). Ready to respond: Strategies for multifamily building resilience. Enterprise Community Partners, 1-152. Retrieved from <https://www.enterprisecommunity.org/download?fid=2154&nid=4325>
- Environmental Resources Management. (2011). Regulatory response to sea level rise and storm surge inundation: City of Annapolis, Maryland. Retrieved from https://dnr.maryland.gov/ccs/Publication/Annapolis_RRSLRnSSI.pdf

REFERENCES

- Federal Alliance for Safe Homes. (2020). Flood zone - which one are you in. Retrieved from https://flash.org/peril_inside.php?id=58
- FEMA. (2010). Homebuilder's guide to coastal construction: Lowest floor elevation, Technical fact sheet no. 1.4. Retrieved from https://www.fema.gov/media-library-data/20130726-1537-20490-8154/fema499_1_4.pdf
- Federal Emergency Management Agency [FEMA]. (2013). Designing for Flood Levels Above the BFE. Retrieved from: https://www.fema.gov/media-library-data/20130726-1537-20490-8057/fema499_1_6_rev.pdf
- FEMA. (web, Sept. 2020). National Flood Insurance Program terminology index. Retrieved from <https://www.fema.gov/flood-insurance/terminology-index#>
- FEMA. (web, Sept. 2020a). Definitions of FEMA flood zone designations. Retrieved from <https://snmap-mod.snco.us/fmm/document/fema-flood-zone-definitions.pdf>
- FEMA Floodsmart. (2020). Who's required to have flood insurance? Retrieved from <https://www.floodsmart.gov/flood-insurance/requirements>
- Florida Building Commission. (2017). Flood resistant construction and the 6th edition Florida Building Code. Retrieved from http://www.floridabuilding.org/fbc/thecode/2017-6edition/BASF_2017_flood_061217.pdf
- The Florida Center for Community Design and Research [FCCDR]. (2020). The Community Vulnerability Study. Hillsborough County City-County Planning Commission. All documents related to this study can be found at <http://www.planhillsborough.org/hillsborough-county-community-vulnerability-study/>
- Grannis, J. (2011). Adaptation tool kit: sea-level rise and coastal land use. Georgetown Climate Center. Retrieved from https://www.georgetownclimate.org/files/report/Adaptation_Tool_Kit_SLR.pdf
- Hatheway, D., Coulton, K, DelCharco, M. & Jones, C. (2015) Flood hazard zones: FEMA Coastal flood hazard analysis and mapping guidelines focused study report. Published by FEMA. Retrieved from https://www.fema.gov/media-library-data/20130726-1541-20490-5411/frm_p1zones.pdf
- Insurance.com. (web, accessed Sept. 2020). Flood insurance: A complete guide. Retrieved from [https://www.insurance.com/home-and-renters-insurance/natural-disasters/flood-insurance.html#:~:text=The%20NFIP%20lets%20you%20insure,contents\)%20for%20up%20to%20%24100%2C000.&text=-For%20non%2Dresidential%20property%2C%20you,the%20building%20and%20its%20contents.](https://www.insurance.com/home-and-renters-insurance/natural-disasters/flood-insurance.html#:~:text=The%20NFIP%20lets%20you%20insure,contents)%20for%20up%20to%20%24100%2C000.&text=-For%20non%2Dresidential%20property%2C%20you,the%20building%20and%20its%20contents.)
- Jennings, D., City of Tampa Floodplain Manager (personal communication with Brian Cook, Sept. 8, 2020).
- Land Use Law Center. (ND). Local land use response to sea level rise. The Nature Conservancy on Long Island. Retrieved from <https://coast.noaa.gov/data/digitalcoast/pdf/long-island-land-use-law.pdf>
- Neal, W., Bush, D. & Pilkey, O. (2019) Encyclopedia of coastal science. Managed retreat. Retrieved from https://doi.org/10.1007/978-3-319-93806-6_201

REFERENCES

- New York City Planning. (2017). Flood resilience zoning. Retrieved from <https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/flood-resiliency-update/zoning-for-flood-resiliency.pdf> and <https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/flood-resiliency-update/proposal-slides.pdf>
- Tampa Bay Estuary Program [TBEP]. (web, accessed May 2021). Tampa Bay Living Shoreline Suitability Model. Retrieved from <https://myfwc.maps.arcgis.com/apps/webappviewer/index.html?id=e4d76fa267dc4bac97d407d20566ae42>
- Pinellas County. (2017). Stormwater Manual. Retrieved from https://www.pinellascounty.org/Plan/pdf_files/PC_Stormwater_Manual.pdf
- Southeast Florida Regional Climate Compact. (2019). About the Regional Climate Action Plan (RCAP). Retrieved from <https://southeastfloridaclimatecompact.org/regional-climate-action-plan/>
- Titus, J. (1998). Rising Seas, Coastal Erosion, and the Takings Clause: How to Save Wetlands and Beaches without Hurting Property Owners. Retrieved from <http://digitalcommons.law.umaryland.edu/mlr/vol57/iss4/3>
- Titus, J. (2011). Rolling Easements. For Climate Ready Estuaries. Retrieved from <https://www.epa.gov/sites/production/files/documents/rollingeasementsprimer.pdf>