

SUSTAINABLE LAND USE AND ZONING

Submitted By: Shruti Shubham

ORDINANCE NO. C-16:

June 21, 2016 “An ordinance amending the unified land development regulations of the city of Fort Lauderdale, Florida, amending section 47-19.3, “boat slips, docks, boat davits, hoists and similar mooring structures” to establish standards for seawall construction that contribute to coastal resilience and mitigate the effects of tidal flooding and sea level rise; providing for severability; repeal of conflicting ordinance provisions; and providing for an effective date.”

Link to the [ordinance](#).

BACKGROUND

Sea Level Rise (SLR) is one of the greatest issues plaguing south Florida. Cities such as Florida City, Miami, Fort Lauderdale and Miami Beach face constant threats to infrastructure, transportation systems, utilities and private property. In addition to financial damages, these severe storm surges can cause unprecedented human injury and loss to wildlife.

December 15, 2015 Resolution:
Use of this projection for the purposes of **sea level rise adaptation planning activities.**

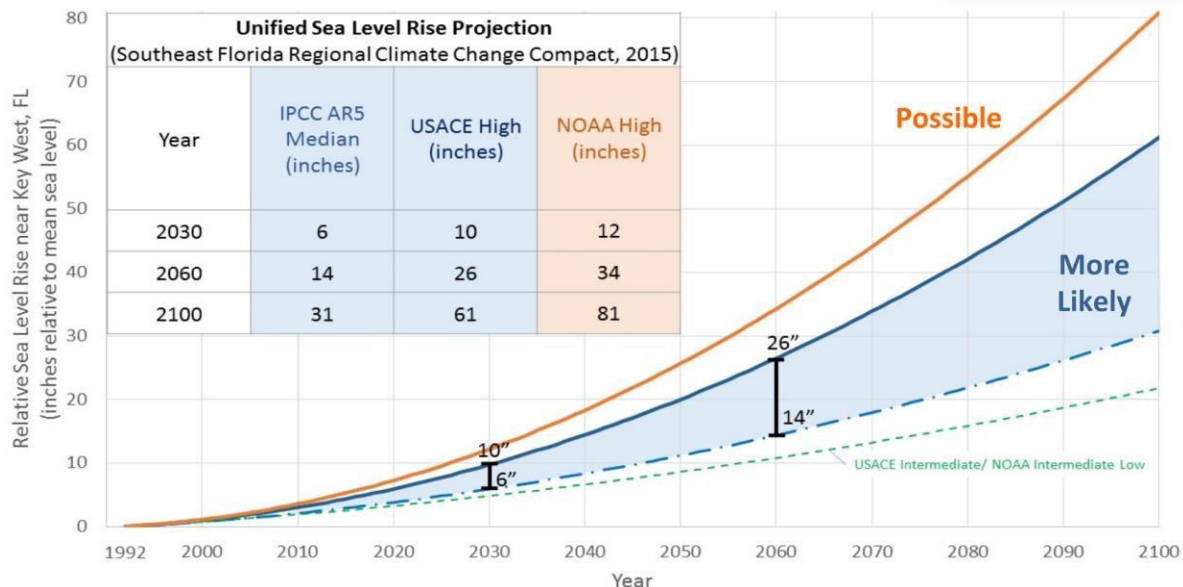


Image 1| Unified Sea Level Rise Projections
Source| Dr. Nancy Gassman, <http://www.southeastfloridaclimatecompact.org>

Image 1 indicates SLR projections in the South Florida region as predicted by IPCC AR5 (International Panel on Climate Change – Fifth Assessment Report), USACE (United States Army Corps of Engineers) and NOAA (National Oceanic and Atmospheric Administration),(Gassman, 2016). The graph indicates that the region could witness more than one foot of SLR by 2030 and more than two feet by 2060.

FORT LAUDERDALE- SHORT-TERM AND LONG-TERM VULNERABILITIES



Image 2| Pedestrians make their way through the flooded streets in the Brickell area of Miami on Aug. 1, 2015. Source| <http://www.miamiherald.com/news/politics-government/article184639683.html>

In **Fort Lauderdale**, a popular tourist destination situated on the south-east coast of Florida, the imminent dangers of sea-level rise became palpable when in fall 2015, widespread flooding occurred due to extremely high King Tides (Image 1). The peak high tide elevation recorded at the Lake Worth station was 2.615 feet, two feet above the average height of tide witnessed. This alarmed the City Commission which set to review the maximum allowable seawall elevation.

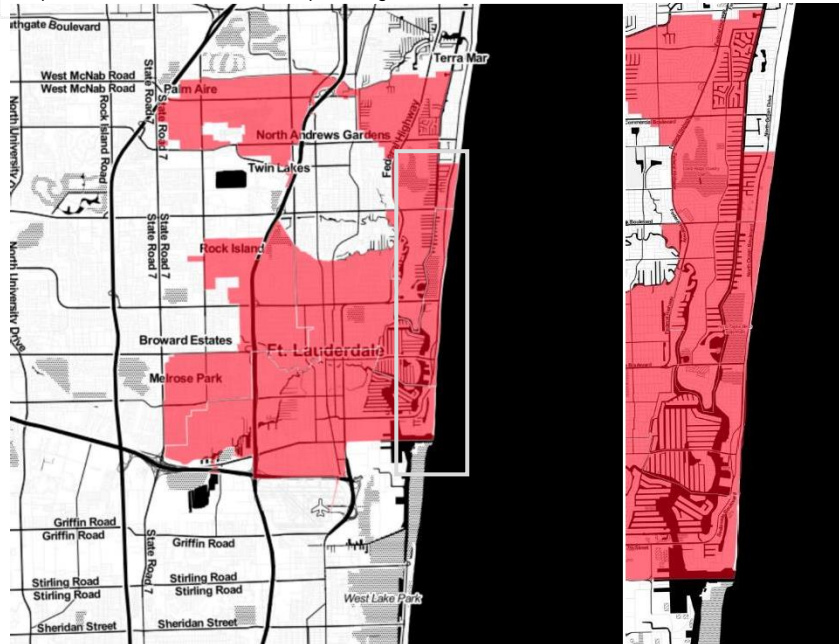


Image 3| The City of Fort Lauderdale and its Canal system. Source| Author, CartoDB

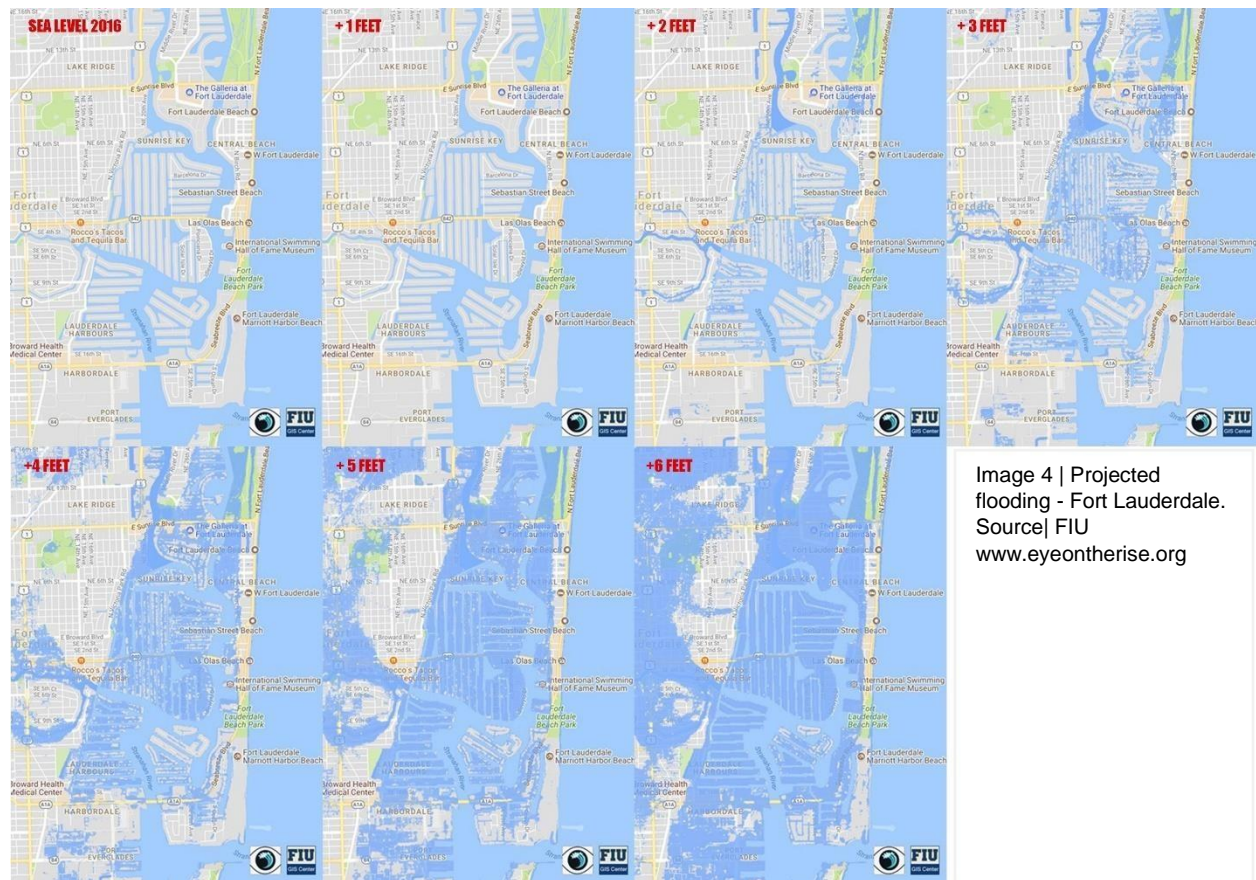
Home to 172,000 people, the city is known for its beaches and boating canals. It gets its name from Major William Lauderdale, who was the commander of the detachment of soldiers who built the first fort among the series of forts built by the United States during the Second Seminole War.

It has **165 miles of canals** connecting multi-million-dollar waterfront homes. It uses seawalls as its main defense against coastal flooding. The city is

protected by **191 miles** of private seawalls and **4 miles** of city-owned seawalls. The city is located

between two National Oceanographic and Atmospheric Administration (NOAA)¹ tide gauges; one at Virginia Key and another at Lake Worth.

The city faces the risk of flooding by the high tides and to safeguard its coast them, it proposed to raise the seawall. The sheer length of seawalls proved to be a challenge in postulating an ordinance and its eventual implementation. Image 4 depicts the long-time vulnerability of the City of Fort Lauderdale. It illustrates the vulnerable edges with 1 feet SLR and more than 2 feet, as projected in diagram 1.



POLITICAL CONTEXT

The political construct of Fort Lauderdale ensures direct representation of the people in the city government. The City is the county seat of Boward County and a principal city of the Miami Metropolitan Area. It has been operating under a Commission-Manager form of government since 1925. The City Commission is comprised of the Mayor, who is elected at-large, and four

¹ The **National Oceanic and Atmospheric Administration** is an American scientific agency within the United States Department of Commerce that focuses on the conditions of the oceans and the atmosphere. NOAA warns of dangerous weather, charts seas, guides the use and protection of ocean and coastal resources and conducts research to provide understanding and improve stewardship of the environment. (Service, 2016)

Commissioners, who are elected in non-partisan district races. A professional who is an unelected city manager reports to the city commission. (“City of Fort Lauderdale, FL: Government,” 2016.)

The ordinance team recognized the need for community approval and consensus for it to be approved by the democratically elected leaders. Assistant Public Works Director Nancy Gassman, an experienced climate adaptation planner, who had been assigned to lead the ordinance team consisting of representatives from the city’s public works, sustainability, and attorney’s offices through multiple stakeholder-involvement methods. (Gassman 2016; see also Feldman 2016).

PROPOSAL FOR ADOPTION OF ORDINANCE

Early 2016: An internal team of subject matter experts, such as staff with expertise in flood plain management, marine use, building code, zoning, *etc.* was convened to outline the major issues of concern and begin developing language for stakeholder review. The initial proposed ordinance was called the **Public Discussion Draft** which established standards for seawall construction that would mitigate the effects of tidal flooding and sea level rise over the next 50 years consistent with the City’s 2035 Fast Forward Fort Lauderdale vision of being “A safe and resilient City.”

Community Engagement: With 165 miles of canals lined with commercial and residential properties, the impact and the costs associated with the implementation of the proposed ordinance would be widespread and expensive. This resulted in invitations by concerned property owners to present the draft ordinance at numerous homeowners’ association’s meetings and to other special interest groups. Members of the ordinance development team met with the public and other concerned stakeholders.

Final Draft: Ninety days and twenty public meetings later, the draft that came before the Commission for approval in June differed greatly from the original public discussion draft. The accumulated stakeholder feedback resulted in two important products. The first was a list of continually updated Frequently Asked Questions and the second was the **Commission Consideration Draft**.

Adoption of the Ordinance: This draft was used in the second major wave of community outreach in advance of the public hearings for adoption. Because of the extensive public outreach and staff’s responsiveness to the feedback, the final ordinance (Figure 4) was adopted with little public comment or resistance.

KEY MODIFICATIONS - PUBLIC DISCUSSION DRAFT OF ORDINANCE

This section discusses the modification that the initial proposal- the Public Discussion Draft to the existing ordinance governing the seawall. The ordinance added the definitions for the seawall and for the North American Vertical Datum (NAV88).²

It set the minimum seawall elevation at 4.6 feet NAV88 and sets the maximum allowable height based on the base flood elevation of the property. It required individuals to reconstruct seawalls conforming to the threshold laid out in the new ordinance if the existing seawall requires substantial repair.³ Moreover, it required the completion of repairs within 180 days of citing and set a date by which all seawall must meet the minimum elevation requirement - March 1, 2035.

KEY PROVISIONS - PUBLIC DISCUSSION DRAFT OF ORDINANCE

Extensive community outreach enabled a consensus among residents who recognized the need for investing in both the public and private infrastructure to achieve community resilience to sea level rise. Few changes were adopted within the final draft. The ordinance defined seawall, riprap, and NAVD88. It reduced the proposed 4.6 feet as the minimum seawall elevation to 3.9 feet, which is the existing allowable maximum height. This was done as the Base Flood Elevation of several properties were lower than the minimum seawall elevation.

² The **North American Vertical Datum of 1988 (NAVD 88)** is the vertical control datum of orthometric height established for vertical control surveying in the United States of America based upon the General Adjustment of the North American Datum of 1988. In general, a datum is a base elevation used as a reference from which to reckon heights or depths. A tidal datum is a standard elevation defined by a certain phase of the tide. ("NOAA Tides & Currents," 2013)

³ As detailed in Section 4 of the ordinance.

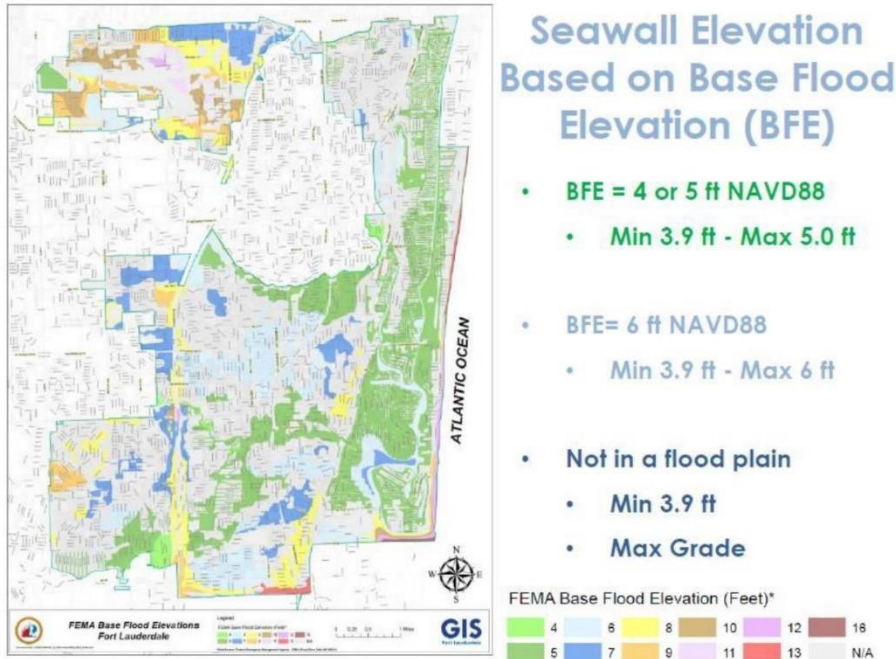


Image 5 | Base Flood Elevation.
Source | Dr. Nancy Gassman, <https://newpartners.org/2016>.

It was mandated by the ordinance that the maintenance of a seawall must be completed done within 365 days of being cited (raised from 180 days). The cost of building a seawall could be between \$800-\$2500 per linear foot. The blanket mandate of raising all the seawalls by March 1, 2035, was also lifted. There is no public assistance program currently in place to fund them.

Codified in the ordinance is the maximum and the minimum requirement of seawalls. The minimum seawall height limit is placed to secure the property from tidal flooding and sea level rise. On the other hand, the maximum seawall height is fixed to secure the property from flooding through rainwater. If the maximum limit is not adhered to, the stormwater run-off will end up flooding the properties. The life expectancy of the community depends on the difference between the maximum and the minimum height limit of the seawall.

IMPLEMENTATION OF THE SEAWALL ORDINANCE

Due to limited code enforcement officers, the city is relying largely on the community to cite damages sustained by its 165 seawalls. A seawall is presumed to be in a state of disrepair if it allows for upland erosion, transfer of material through the seawall or allows tidal waters to flow unimpeded through the seawall to adjacent property or public Right of Way such as a road. The enforcement of the ordinance is complaint-driven and disincentives neighbors might not report their neighbors. Many critics have pointed out that this could also impede the harmony within the neighborhoods as the plan forces.

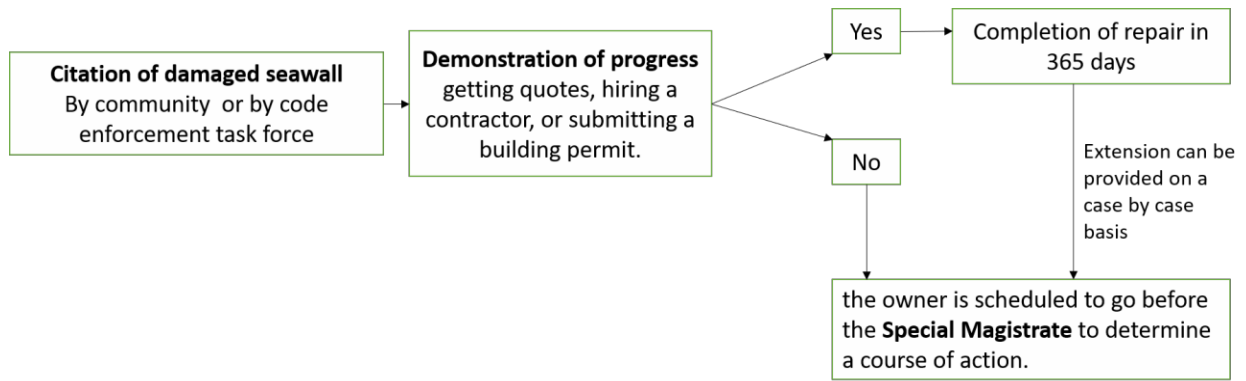


Image 6 | Implementation of the Seawall
Ordinance Source| Author, Fort Lauderdale Q &

SEAWALL - A DEFENSE FROM THE SEA

Armoring the edge of the land by levees and dikes is one of the oldest strategies to safeguard coastal settlements from getting inundated by water. These strategies require constant monitoring and maintenance and even a point of fracture could be potentially devastating for the community.

Thus, securing long edges along water such as in Fort Lauderdale by creating seawalls is an expensive strategy to tackle SLR. Given the expense of seawalls, property on an average would be required to spend \$125,000 to secure itself. Assuming the cost to be an average of \$1000, per linear foot, the city would need almost 2 Million dollars. Moreover, this investment would only render a short-term solution as the mandated minimum 3.9 feet of seawall cannot hold well against the SLR projections within the next 50 years. Thus, the benefit of this investment wouldn't last more than 50 years at best.

These standards were a result of the extensive public process as discussed earlier, and for the ordinance to pass the government of Fort Lauderdale adhered to their community. Even though the ordinance is bold implementation is unique building in flexibility for all kinds of properties based on their Base Flood Elevation, the seawalls can only be perceived as the first line of defense. It can be used in combination with other strategies such as the creation of large floodgate, redirecting canals, creating open parks and plazas that double up as reservoirs, to protect existing development from rising water.

Paradoxically, it increases vulnerability. Hard shoreline protection is not as effective as natural shorelines at dissipating the energy from waves and tides. As a result, armored shorelines tend to be more vulnerable to erosion, and to increase erosion of nearby beaches. Structural flood protection can also increase human vulnerability by giving people a false sense of security and encouraging development in areas that are vulnerable to flooding. To re-create the lost natural barriers/ defenses against SLR, Louisiana is redirecting sedimentation from the Mississippi River to create land.

The planners at Fort Lauderdale are currently developing a master plan to address Sea Level Rise comprehensively. With an extensive network of rivers and canal, the city of Fort Lauderdale should consider some of the systems listed above to generate a wider impact of their strategy.

Some critics believe that the best defense against SLR is to conduct a managed Retreat which is planned abandonment of threatened areas near the shoreline. It safely removes settlement from encroaching shorelines, allowing the water to advance unimpeded. It involves abandoning, demolishing or moving existing buildings and infrastructure to higher ground. Such strategies are considered as the next step as shoreline protection efforts become very expensive or are judged to be a losing battle.

Managed retreat is one of the few policies that offer a long-term solution for coastal communities (Alexander, Ryan, & Measham, 2012). The current decision-making criteria are safeguarding the community from immediate SLR (within 50 years) and the danger from king tides. Thus, the strategy of managed retreat does not meet the current demands of the existing community, that is to secure the value of their land. Any public policy is put in place to satisfy the wants and needs of its community. In this case, the government and the department aim to extend the life of the community. It is aimed to prevent water seeping through one person's fractured seawall to flood the backyards of their neighbor. As per Dr. Gassman, in the future (in 150-200 years) with the rise in water levels, managed retreat might be the only viable solution. However, until such a time comes, it will be necessary to enforce ordinances such as the one being discussed to maintain the tax base, property value, fiscal and political forces.

OTHER ORDINANCES DEALING WITH RESILIENCY USING SEAWALLS

While tracking the evolution of Seawall ordinances in the United States, one could observe that the government has started regulating these structures during the late 80s. At the time, regulations mostly governed any nuisance posted by rupturing seawalls. The structures were not mandated, and property owners based on their own need constructed the feature.

Seawall has been acknowledged in ordinances as a possible line of defense recently (2014 onwards). This may be the result of intensified storms such as Sandy, Irma and Katrina hitting the South-East coasts. The storms made the citizens and government cognizant of the imminent dangers. They acknowledged that the coasts need to be fortified against the rising sea, on the other hand, there should be adequate mechanisms to drain rainwater (brought by tropical storms), out into the city to prevent flooding. Some ordinances regarding Seawalls are discussed below.

SEAWALL ORDINANCES IN THE US

CITY	TYPE OF REGULATION	DATE
City of Naples	Ordinance	02/1987
It focuses on the design of the seawall and threat on public safety. In this case, a seawall is observed as a nuisance.		
City of Marco Island	Guidebook	2014
Miami Beach	Ordinance	02/10/2016
It recommends at least 4.0' NAVD minimum height of seawall for private construction and 5.0' NAVD for public construction. Although it primarily focuses on new construction. No interference with the existing construction.		
City of Newport Beach – Balboa Island	Megaproject drove by a public agency. Massive efforts to create a coastal development plan and execute it.	05/04/2017

COMPREHENSIVE STRATEGY AGAINST SEA LEVEL RISE- FLORIDA

On May 21, 2015, Governor Rick Scott signed into law CS/CS/CS Senate Bill 1094 focusing on flooding. This section of statutes has previously required that the coastal management elements of comprehensive plans include a “redevelopment component which outlines the principles which shall be used to eliminate inappropriate and unsafe development in the coastal areas when opportunities arise.” With this new law, Florida Statute section 163.3178(2)(f)1. Now includes “sea-level rise” as one of the causes of flood risk that must be addressed in the “redevelopment principles, strategies, and engineering solutions” to reduce flood risk. Previously the only mention of sea-level rise in the comprehensive planning chapter of Florida Statutes was the permissible language allowing local governments to incorporate “Adaptation Action Areas” into the coastal management element of their comprehensive plans (Fla. Stat. §163.3177(6)(g)10. (2014)) and a definition for “adaptation action area” in Florida Statute section 163.3164(1).

These laws only govern any new development. It does not disincentives high-density construction on the coast, but merely focusses on the construction quality. The state also fails to provide any monetary incentives or grants to safeguard such development. There are no tax-breaks or easy loans for construction of resilient infrastructure. Thus, living along the coast is increasingly becoming viable only for the rich, which might restructure the coastal communities all around Florida.

LESSONS IN RESILIENCY

As mentioned before Seawalls are just a line of defense and are required to be corroborated and reinforced by other strategies safeguarding communities against Sea Level Rise. While the city is

looking to create a comprehensive plan for creating resilient neighborhoods, planners could consider the existing ordinances and infrastructure.

LESSONS FROM NETHERLANDS

About one-third of Netherlands is below the sea. Constantly fighting to push back the sea has Dutch pioneer the realm of managing water systems. These lessons must be embraced while restructuring Fort Lauderdale. There are a series of defenses that the Dutch have laid out, the big guns being the Zuiderzee Works and the Delta works securing the north-west and south-west coasts respectively. Secondly, the rivers were made to meander and take up a larger area to ensure safety from flooding from river water. Instruments such as land-based cities with the ability to expand into the water (Blue 21), water square (water storage facility and a recreational space), rethinking collection of rainwater and redirecting them to the underground water systems ensure resiliency in the years to come.

The *Oosterscheldekering* dam, a part of Delta Works was created to keep Netherlands resilient for the next 1400 years, whereas the timeline for policies in Fort Lauderdale last only a few decades. This is one of the most essential takeaway and should be acknowledged in future plans laid down in Fort Lauderdale.

LESSONS FROM NEW ORLEANS

New Orleans has devised a comprehensive strategy just like the Dutch to hold back the sea. After the devastation (approx. \$135 Billion⁴) of hurricane Sandy including the inundation of the lower 9th ward, with the help of federal funding, New Orleans has unveiled \$14.5 Billion structural coastal flood protection system.

Current strategies for resiliency include the IHNC Lake Borgne Surge Barrier, a 1.8 miles wall resisting the sea. The wall which cost 1.1 Billion is meant to safeguard the city for at least 100 years. The longevity insured does not mirror the long-term thinking like the Dutch.

Actor Brad Pitt has donated \$250 million through the 'Make it Right' movement which helped build 150 resilient homes in the lower 9th ward. These homes are resilient enough to bear another storm like the Katrina and are being given to residents who had left the area post the disaster and are looking to move back. Thus, public and private agencies persevere together in New Orleans to create resilient communities.

Lastly, this paper will discuss new construction methods, downzoning and creating a coastal buffer as a potential strategy which if included in the master plan could ensure longevity without putting human and physical infrastructure at risk in Fort Lauderdale.

⁴ <https://www.greenbiz.com/article/how-new-orleans-plans-survive-next-katrina>

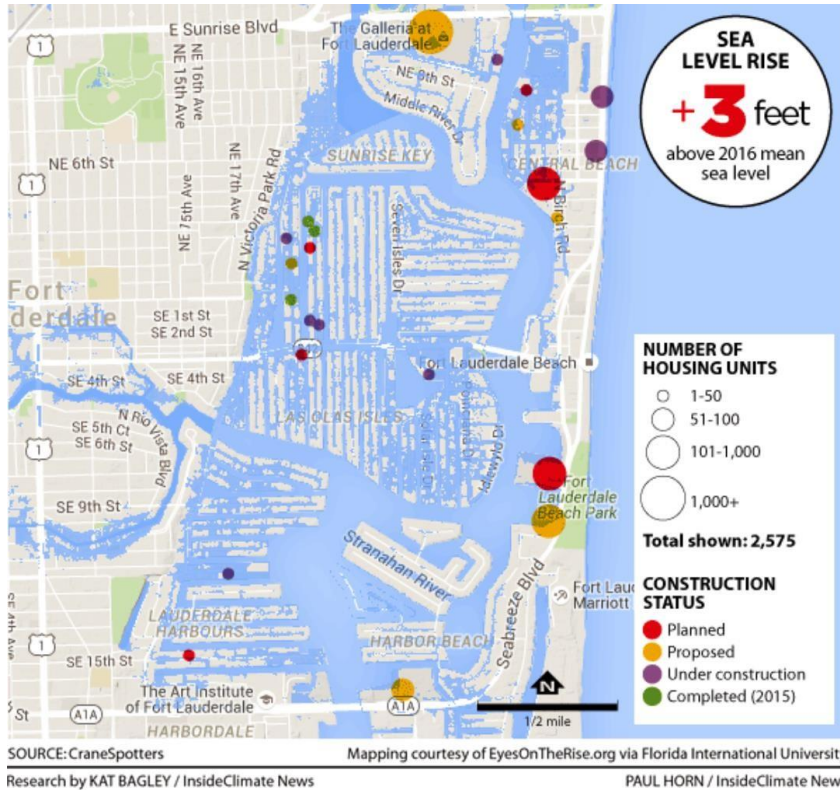


Image 7 | Upcoming infrastructure in Fort Lauderdale Source| www.insideclimatenews.org

There are several new developments proposed as indicated in the image above. Here, the city should refrain from allowing infrastructure at the edge. These areas can be downzoned in the comprehensive strategy and should be located at a lower risk, and more elevated area.

Should the city decide to allow the development, due to the valuable nature of real estate, aggressive design standards such as those employed by houses in ‘Make it Right’ campaign should be employed. With the imminent danger, redirecting growth and redefining building codes become crucial.

As in the city of Boulder, the city could buy strategic land to create a buffer system. The city could decide to create patterned growth weaved in with natural buffers such as the Fort Lauderdale Beach Park, to protect the existing development. These buffers could vary in scale from plazas to long linear protective layering.

With this ordinance, Fort Lauderdale embarked in the right direction in creating resilient settlements. However, there are many more strategies that they ought to employ to ensure the longevity of this thriving community. It has been able to devise an impactful legislature given the limited resources that they currently have. With more backing from federal and state agencies (as in the case of New Orleans) the city could provide more comprehensive and far-reaching solutions.

REFERENCES

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APPENDIX

Minutes of Meeting

Attendees: Dr. Nancy Gassman, Shruti Shubham

Date: 17th November 2017

Time: 10:00

Venue: On-call

Can you explain the major challenges during drafting the ordinance?

The drafting of the ordinance initiated as a reaction to major flooding that occurred due to the king tides that happened in October of 2015. Following that and in line with the vision “resilient and safe coastal community” by 2035, the government was compelled to mandate the raising of seawalls so that such events do not repeat. The initial ‘public discussion draft’ set the minimum seawall level as NADD 4.6 feet for the 165 miles of seawall that Fort Lauderdale has majority of which is privately built.

There were varied levels of pushback, individuals living in neighborhoods who did not live in neighborhoods which are prone to flooding were not on board to raise the seawalls to the newly decided minimum seawall level. The individuals living in communities which were prone to constant flooding urged for the ordinance to pass so that the prices of their properties do not fall. Another major concern was to maintain the visual continuity as viewed from the sea.

Thus, the ordinance mandated modifications in seawall, with maximum height based on a property’s base floor elevation and minimum height set by the jurisdiction. Moreover, because of 165 miles of seawalls, it makes it difficult for authority to administer every bit of the seawall. The code allows for neighbors to cite homeowners of neighboring properties which do not comply and hence cause flooding.

The code requires that all seawalls must comply with the requirements as described in the ordinance by 2035 and provides 180 days to them to change damaged seawalls.

Wouldn't it be better for the government to construct the seawalls instead of private individuals? This would maintain homogeneity in material and continuity in seawall.

The cost of construction of seawall is approximately 1000 dollars per linear foot. With Fort Lauderdale having 165 miles as coast, the total cost of construction would be close to 8 billion. If the government had this money, they would never invest all of it in creating seawalls, as every seawall is not needed to be raised.

It is codified in the ordinance that there needs to be a continuity between your and your neighbor's seawall. Presently, not all seawalls are built the same. They have different construction, they are built in different time periods. The ordinance enables individuals to build seawalls depending on their style, ability to spend money and control their height, while maintaining that there are no gaps.

Can you explain the challenges that you faced while building a consensus in the community?

The first key to build a consensus in the community is to listen to them and word the ordinance so that it addresses their concerns. For this we drafted the first draft of the ordinance and ensured that everyone knew that this was subjected to change as per their concerns and opinions. The community engagements are instruments in understanding their problems and how the ordinance was burdensome to the people.

Is seawall the best solution? shouldn't the government try to incentivize a move to higher grounds, especially when the bedrock of Fort Lauderdale has been described as 'swiss cheese' - porous and could never be totally protected by raising the seawalls?

Any public policy is put in place to satisfy the wants and needs of its community. In this case, the aim of the government and the department is to extend the life of the community. It is aimed to prevent one person flooding the backyards of the other. You are right about the bedrock of Fort Lauderdale being porous, and seawall here is only the first line of defense.

The case of Singer island: In Singer islands off the coast of Florida, according to the new FEMA flood requirements, the ordinance urges homeowners to raise their houses. With rising sea-level, the houses built in 50s and 60s are being torn down and new homes are being built which are raised substantially from the ground level. All of this is manifestation of market forces.

All this is an effort to extend the longevity of the coastal community. In the future with the rise in water levels, we would eventually have to abandon the communities that are currently built on the flood plains. Until such time comes, it will be necessary to enforce such ordinances to maintain tax base, property value, fiscal and political forces.

Furthermore, codified in the ordinance is the maximum and the minimum requirement of seawalls. The minimum seawall height limit is placed to secure the property from tidal flooding and sea level rise. On the other hand, the maximum seawall height is fixed to secure the property from flooding through rainwater. If the maximum limit is not adhered to, the storm water run-off will end up flooding the properties. The life expectancy of the community depends on the difference between the maximum and the minimum height limit of the seawall.

How is the city addressing their own seawall?

During the course of last year, the city is in a process of identifying public-seawalls that might contribute to nuisance and flooding of public spaces. The city is creating a masterplan to identify 1. Low level seawall, 2. Substantially damaged seawall, in order to priorities and remediate this problem.

What's the Jury on the ordinance?

- The ordinance has been up for a year and on February 2017 the first group of homeowners were cited. These homeowners have not completed the implementation of the seawall ordinance.
- The Fort Lauderdale planning department had formed a code enforcement staff. They pre-identified homeowners, with low seawalls during spring when the tides are low. During high-tide in October, they knew exactly which properties are creating nuisance and were able to cite those home-owners.
- As it has been only a year and there has been not much movement, the attitude of the people living in the community has not changed. It is anticipated, with more homeowners cited and notices issued, there will be more movement.