BORDER WALLS, FIREWALLS, SEAWALLS: GLOBAL-CULTURAL RESOURCES AS *LIMITS*

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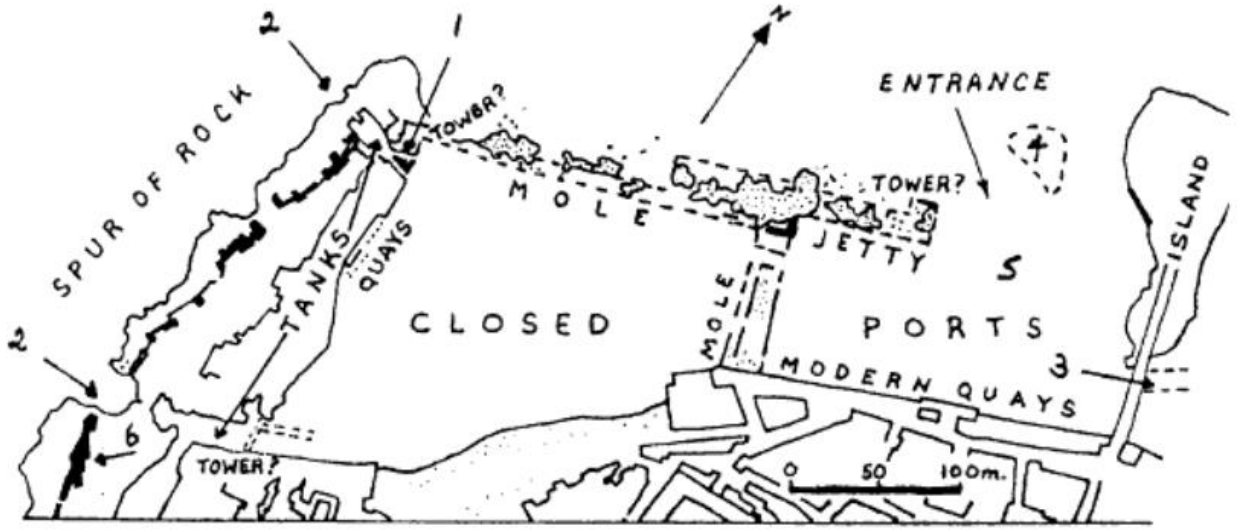
SEA

WALLS

SEAWALLS IN HISTORY
CAESAREA MARITIMA, ISRAEL

- Built by Herod during the early Roman Empire
- The largest artificial harbor at the time
- The various sea walls and protective structures were built using hydraulic concrete
- Tanks to collect and distribute water were built into the natural reef
- Main role was to absorb the wave energy for protection of the site's buildings

Map from Caesarea Maritima: Its Strategic and Political Significance to Rome

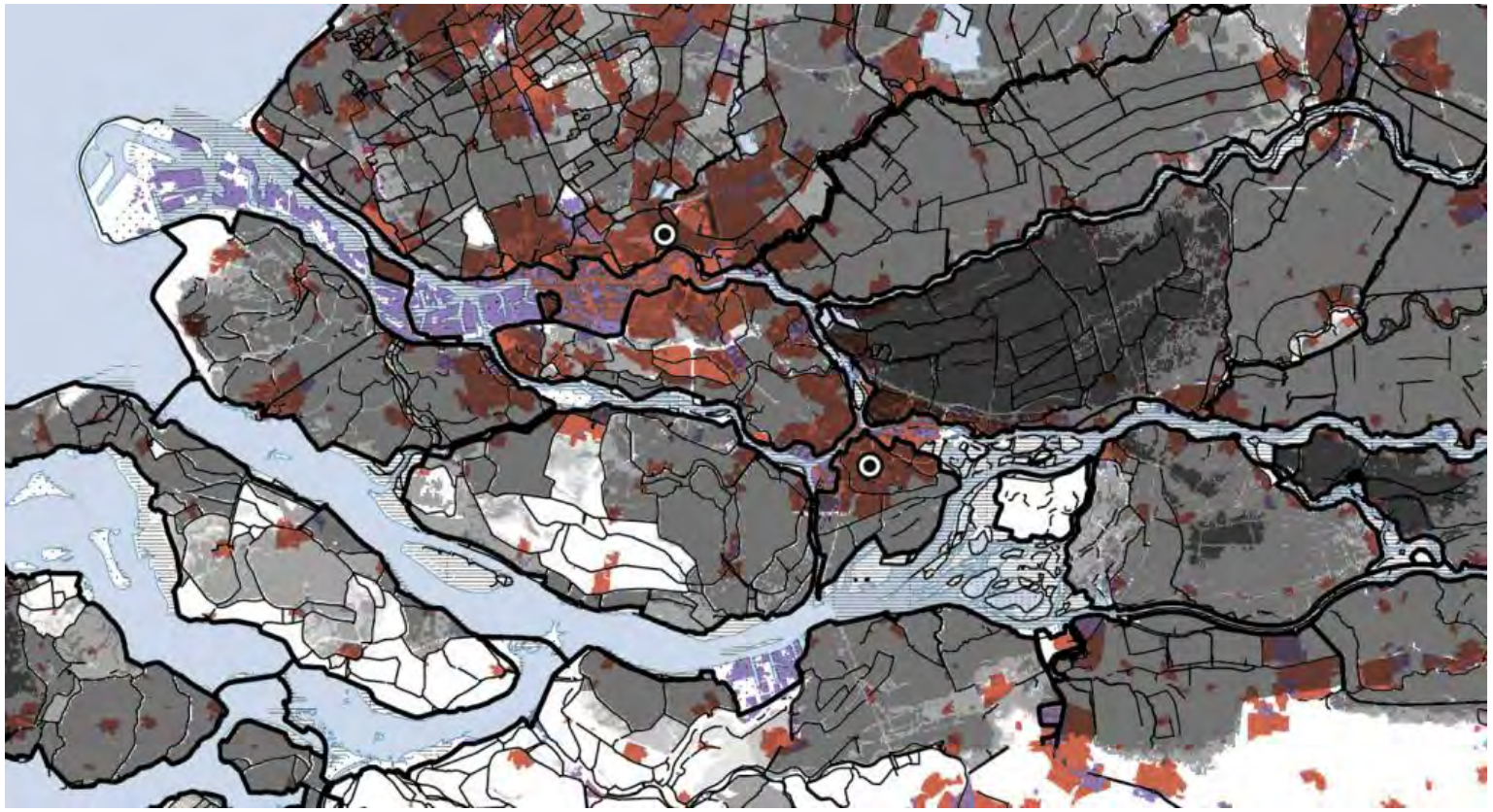


2b—Key: 1) sluices; those south tanks have been destroyed; 2) gaps in sea wall where high waves filled tanks; 3) channel before construction to causeway; 4) submerged masonry; 5) sunken ships; 6) steps to top of sea wall (adapted from Frost, *Under the Mediterranean*, pp. 89, 90.)

SEAWALLS IN HISTORY
THE NETHERLANDS

- Small structures were built throughout the middle ages with **wood**
- Eventually, sea levels began to rise and the year 1500 began the construction of dikes and other **stone** structures
- With even more concern over climate change, the dikes are a never-ending "fixer-upper"
- This constant work has had a negative impact on the environment with constant alterations and changes to habitats

Map from dutchdikes.net



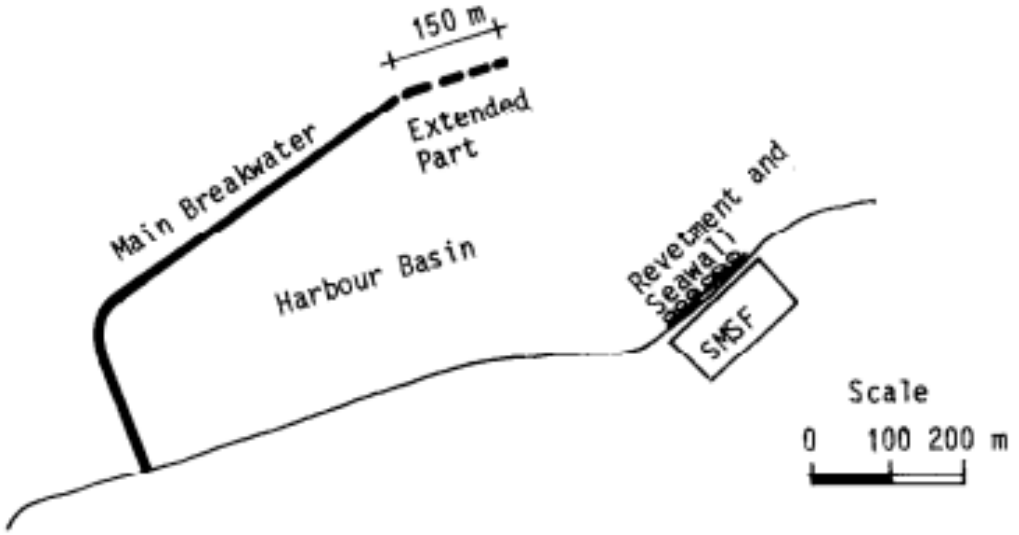
Grey- Areas prone to flooding- increases with darker shade
Red- Areas of higher sea level
Purple- Industrial Areas

Images from Management of Coastal Erosion along Pondicherry Coast

SEAWALLS IN HISTORY **PONDICHERRY, INDIA**

- Area is affected by cyclones on a yearly basis- walls are a necessary protective part of life
- However, the coastal walls have totally erased the beach environment that once existed in Pondicherry
- As storms have gotten stronger, only more structure and adjustments have been made

Map from Coastal erosion in Eastern Black Sea Region, Turkey



SEAWALLS IN HISTORY
BLACK SEA- TURKISH COAST

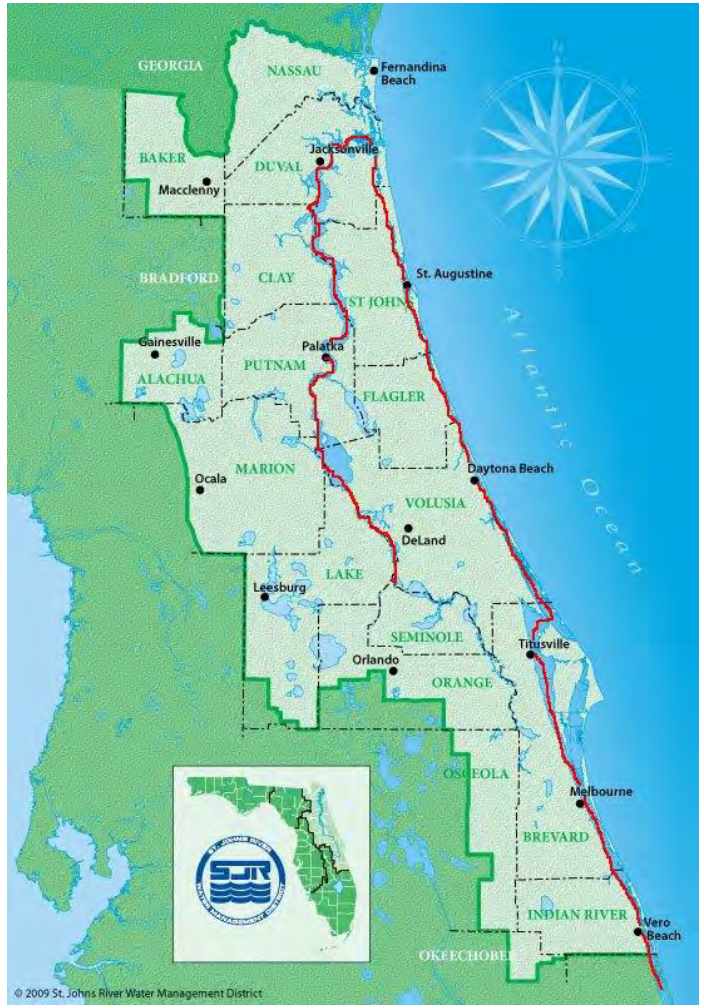
- Erosion in the area has been caused by human activity such as highway building and sand mining
- Only solution to fix this problem has been the building of sea walls yet problem is so large that "groin fields" are required
- Thus, major instability in habitats has occurred

SEAWALLS TODAY: THE ATLANTIC COASTLINE AND ST JOHNS RIVER

A brief introduction to the St. Johns River:

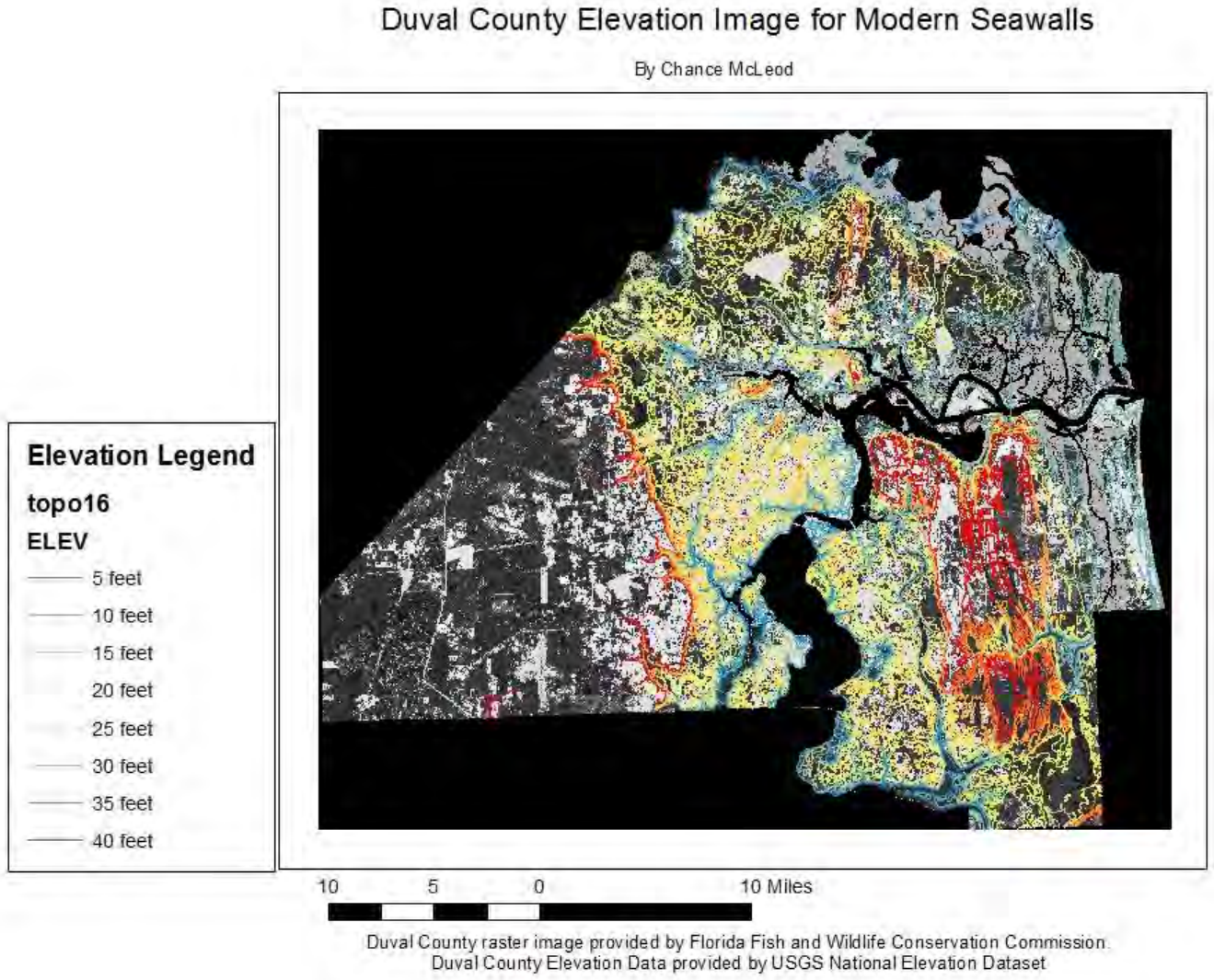
- One of the few rivers in the world that flows Northwards
- Flows into the Atlantic coastline in Duval county
- Flows next to the highly populated area of Jacksonville, Florida

For the purposes of evaluating modern sea walls and to provide an example close to home I looked at the relative elevation levels of Duval county relative to flooded conditions.



SEAWALLS TODAY: POTENTIAL FLOODING IN DUVAL COUNTY

- Elevation lines are labelled by coloration from blue (5 feet) to yellow (20-25 feet) to red (40 feet).
- Metropolitan Jacksonville is at a high elevation, but the outskirts are lower.
- Flooding elevations have been recorded in Duval county at up to a record defining 25 feet (caused by Hurricane Irma), which is around yellow lines on the map.
- Western portion of Duval county occurs above 40 feet in elevation, and is less threatened by flooded conditions



SEAWALLS TODAY: SOME TAKEAWAYS FROM DUVAL COUNTY FLOODING

- The sea wall of the atlantic coastline is around 5-10 feet within 5 miles of the coastline, but strengthens further inland.
- Elevations in blue are potentially under water in 100 years due to rising sea levels, being only 5 feet above sea level.

SEAWALLS IN THE FUTURE: THE WORLD AT A 2° AND 4° CELSIUS TEMPERATURE RISE

A potential scenario of future sea level rise in South Beach, Miami, Florida. Photograph: Nickolay Lamm/Courtesy Climate Central

We're going to be discussing how the increase of 2 degree and 4-degrees Celsius will affect sea level rise and will result in the reduction of landmass in Jakarta, the fastest sinking city in the world, and Miami and New Orleans.

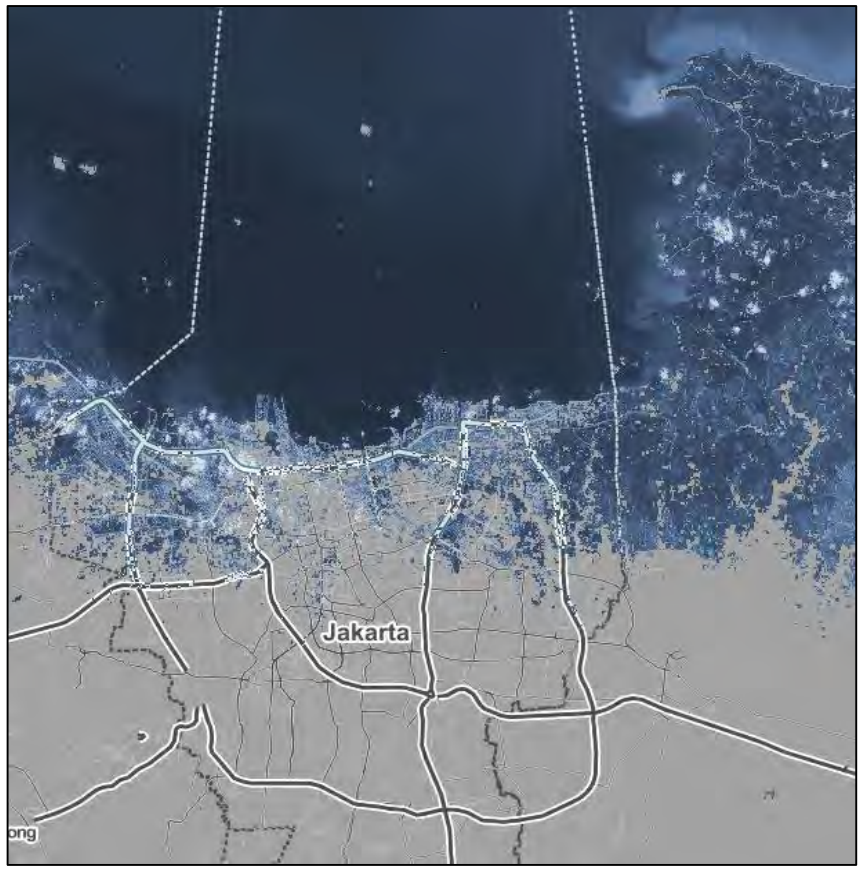
JAKARTA, INDONISIA

Current Population: **10,638,689**

- About 40 percent of the city is below sea level

- one-third of Jakarta could be submerged by 2050. Jakarta has been described as one of the world's fastest sinking cities.

At 2° Celsius rise



At 4° Celsius rise

NEW ORLEANS, LA

- Current Population: **391,006**
- Sea levels in Louisiana are rising over 1 inch every two years.
- The state has lost approximately 25 square miles of land per year in the last decade due to sea level rise.
- New Orleans is the city with the largest population in the state and is experiencing one of the highest rates of sea level rise in the world.

New Orleans Now

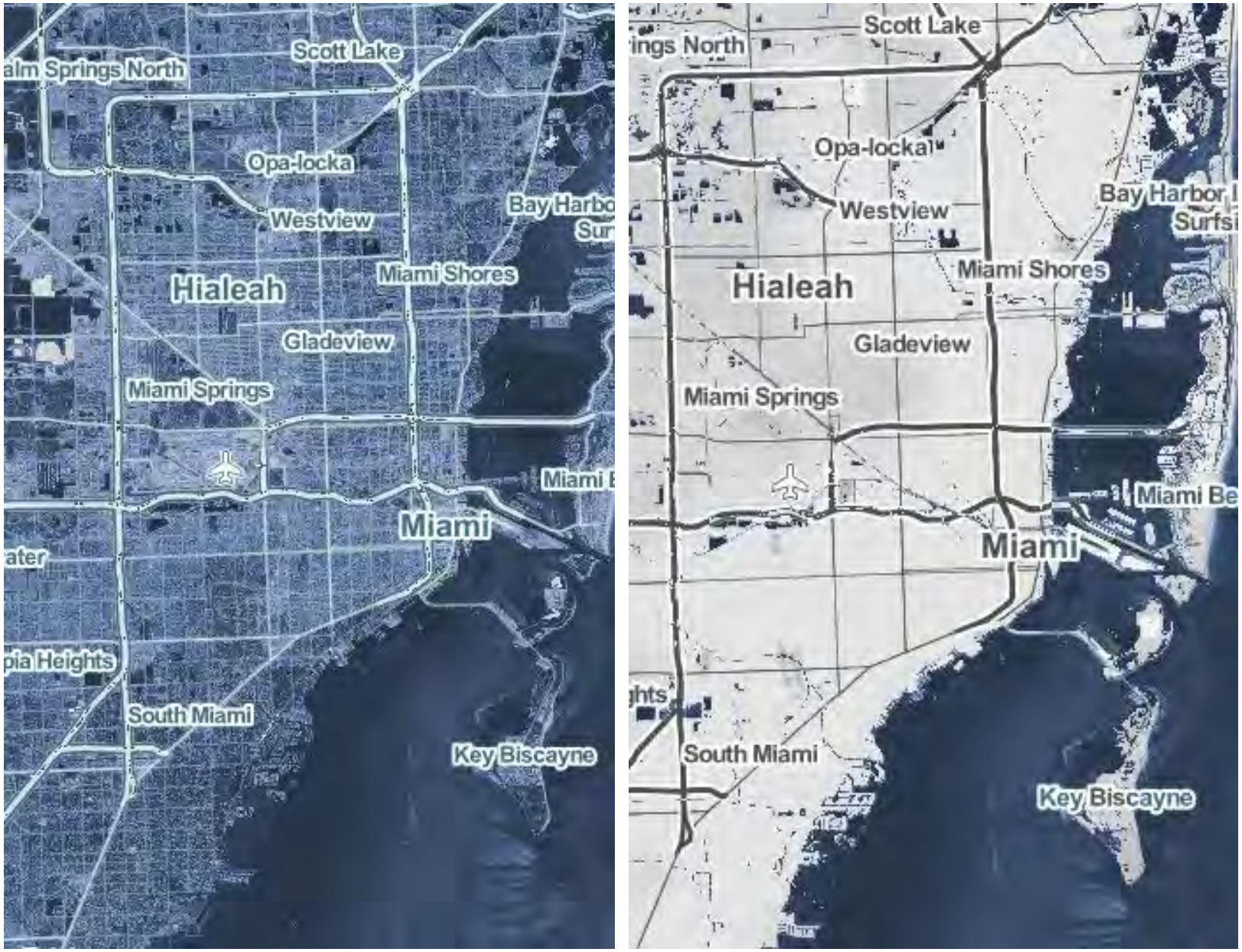
New Orleans at 2° Celsius temperature rise

SOLUTIONS IN NEW ORLEANS, LA

- Louisiana has a $25 billion plan that will build levees, pump sediment into sinking areas, and build natural infrastructure.
- The city's new defense is a 1.8-mile-long wall that cuts across wetlands at a corner of Lake Borgne, east of the city. It stands 26 feet above the water line and cost $1.1 billion.

RISING SEA LEVELS IN MIAMI, FL

- Miami is being faced with the challenge of rising sea levels which threaten their coastal communities.
- Most of Florida resides on a limestone base, and as sea levels continue to rise more water is due to seep through the porous limestone, causing mass flooding. This along with rising sea levels will eventually lead to a large migration Northward as landmass continues to be submerged.
- *The map on the right demonstrates the dramatic change



Sea levels at an increase of 4°Celsius (left) and at 2° Celsius (right).

FLOODING IN MIAMI

Miami's low-lying topography makes them susceptible to flooding, such as that that's evident after hurricanes and strong storms. An increase in sea level temperatures has caused hurricanes to gain more strength, thus further impacting the cities that are affected by hurricanes.

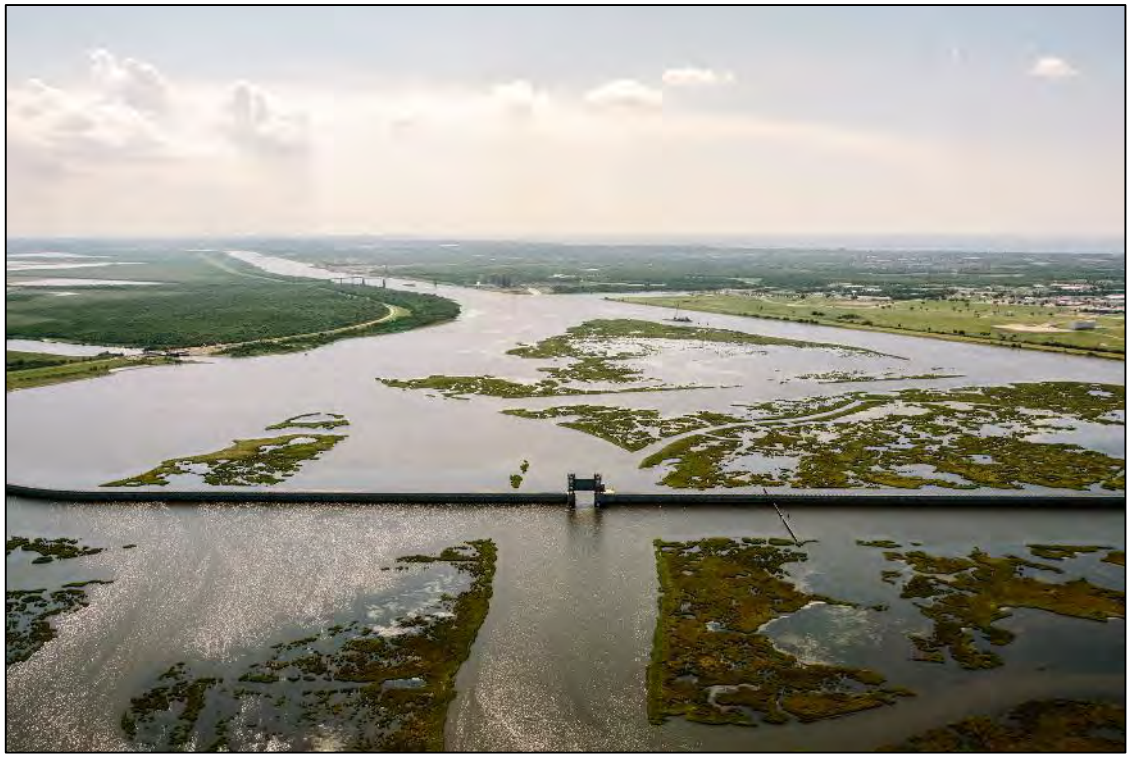
*Flooding in Miami after Hurricane Irma in 2017

POSSIBLE SOLUTIONS

- The city of Miami Beach is directing their attention towards adaptation initiatives to combat this issue. Such as installing pump stations, rising roads, and introducing innovative drainage improvements.
- Another general solution would be to implement living shorelines, such as mangroves and coral reefs to create a buffer between the impact of storms, and to ensure that ecosystems in that area are conserved and biodiversity is plentiful.

IN CONCLUSION...

Seawalls have played a significant role in our history and will continue to affect humanity today and tomorrow. Our environment is changing, and sea walls can save us and, yet, they can also cause some complications of their own. Sea walls may seem like a small and insignificant type of boundary, but past walls, present walls, and future walls have an enormous impact on mankind.



SOURCES CITED:

"Miami Beach & Sea Level Rise." *Miami Beach – Rising Above*, 2019, http://www.mbrisingabove.com/climate-science/sea-level-rise/.

Flechas, Joey, et al. "Irma Hit Downtown Miami - and Turned Its Biggest Streets into Rivers." *Miami Herald*, Miami Herald, 10 Sept. 2017, https://www.miamiherald.com/news/weather/hurricane/article172495761.html.

Fancher, Trish. "Volunteers Plant, Study Red Mangrove Propagules: Bonita Spring Florida Weekly." *Bonita Spring Florida Weekly*, 2 Aug. 2018, https://bonitasprings.floridaweekly.com/articles/volunteers-plant-study-red-mangrove-propagules/.

Graauw, Arthur de. "Geodatabase of Ancient Ports and Harbours (Xls Table)." *Academia.edu*, https://www.academia.edu/6211487/Geodatabase_of_Ancient_Ports_and_Harbours_xls_table_.

Boyce, Joseph I, et al. "Marine Magnetic Survey of a Submerged Roman Harbour, Caesarea Maritima, Israel." *Marine Magnetics*, http://www.marinemagnetics.com/resources/marine-magnetic-survey-caesarea-maritima-int-journal-of-nautical-archaeology/.

Beebe, H. Keith. "Caesarea Maritima: Its Strategic and Political Significance to Rome." *Journal of Near Eastern Studies*, vol. 42, no. 3, 1983, pp. 195–207. *JSTOR*, www.jstor.org/stable/545073.

"Dutch Dikes History." *Dutch Dikes*, Lola Landscape Architects Rotterdam, http://dutchdikes.net/history/.

Roger H. Charlier, Marie Claire P. Chaineux, and Selim Morcos (*2005*) Panorama of the History of Coastal Protection. Journal of Coastal Research: Volume 21, Issue 1: pp. 79 – 111. https://www.jcronline.org/doi/full/10.2112/03561.1

Anandabaskaran, V, and G Vijayakumar. "Monitoring Shoreline Changes of the Puducherry Coast, South India: A Review and a Case Study" *Semantic Scholars*, https://pdfs.semanticscholar.org/2dc2/fa6a1bb131542240f02488ce81f94a390a77.pdf.

Yulsek, Omer, et al. "Coastal Erosion in Eastern Black Sea Region, Turkey." *Science Direct*, 27 Jan. 2000. https://www.sciencedirect.com/science/article/pii/0378383995000224

Jeyagopal, Sriganesh. (2014). Management of Coastal Erosion Along Pondicherry Coast.

Huizinga, H J. "Flood Risk in Unembanked Areas." *Rotterdam Climate Intiative*, HKV Consultants.https://edepot.wur.nl/325899

Bernhardt, Alex. "Bonds: How To Finance Climate Adaptation." *Brink*, 19 Feb. 2018, https://www.brinknews.com/bonds-how-to-finance-climate-adaptation/.

Schwartz, John and Mark Schleifstein. "FORTIFIED BUT STILL IN PERIL, NEW ORLEANS BRACES FOR ITS FUTURE" *NewYork Times,* 24 Feb. 2018 https://www.nytimes.com/interactive/2018/02/24/us/new-orleans-flood-walls-hurricanes.html

Win, Thin Lei. "In flood-prone Jakarta, will 'Giant Sea Wall' plan sink or swim?" *Reuters,* 14 Sep. 2017 https://www.reuters.com/article/us-indonesia-infrastructure-floods/in-flood-prone-jakarta-will-giant-sea-wall-plan-sink-or-swim-idUSKCN1BP0JU

"Sinking Jakarta needs Giant Sea Wall: Indonesia President" *Bangkok Post,* 28 July 2019 https://www.bangkokpost.com/world/1720435/sinking-jakarta-needs-giant-sea-wall-indonesia-president

Prior, Ryan. "Why New Orleans is Vulnerable to Flooding: It's Sinking" *CNN,* 11 July 2019 https://www.cnn.com/2019/07/10/us/new-orleans-sinking-into-sea-trnd/index.html

"Louisiana's Sea Leven is Rising" *Sea Level Rise,* https://sealevelrise.org/states/louisiana/