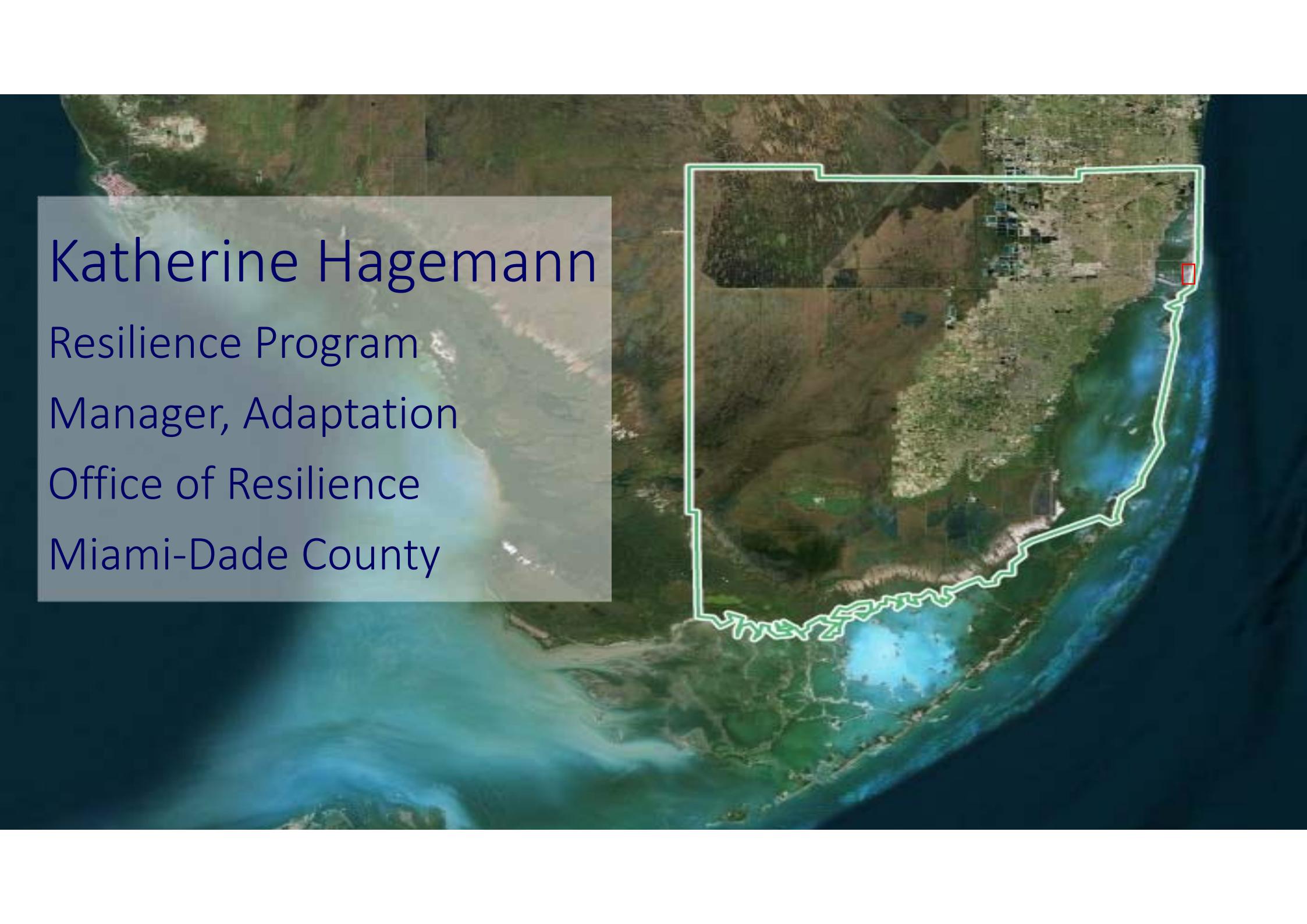


A wide-angle photograph of the Miami skyline, featuring numerous skyscrapers of various heights and architectural styles, reflected in the calm water of Biscayne Bay in the foreground. The sky is a vibrant blue with scattered white and grey clouds.

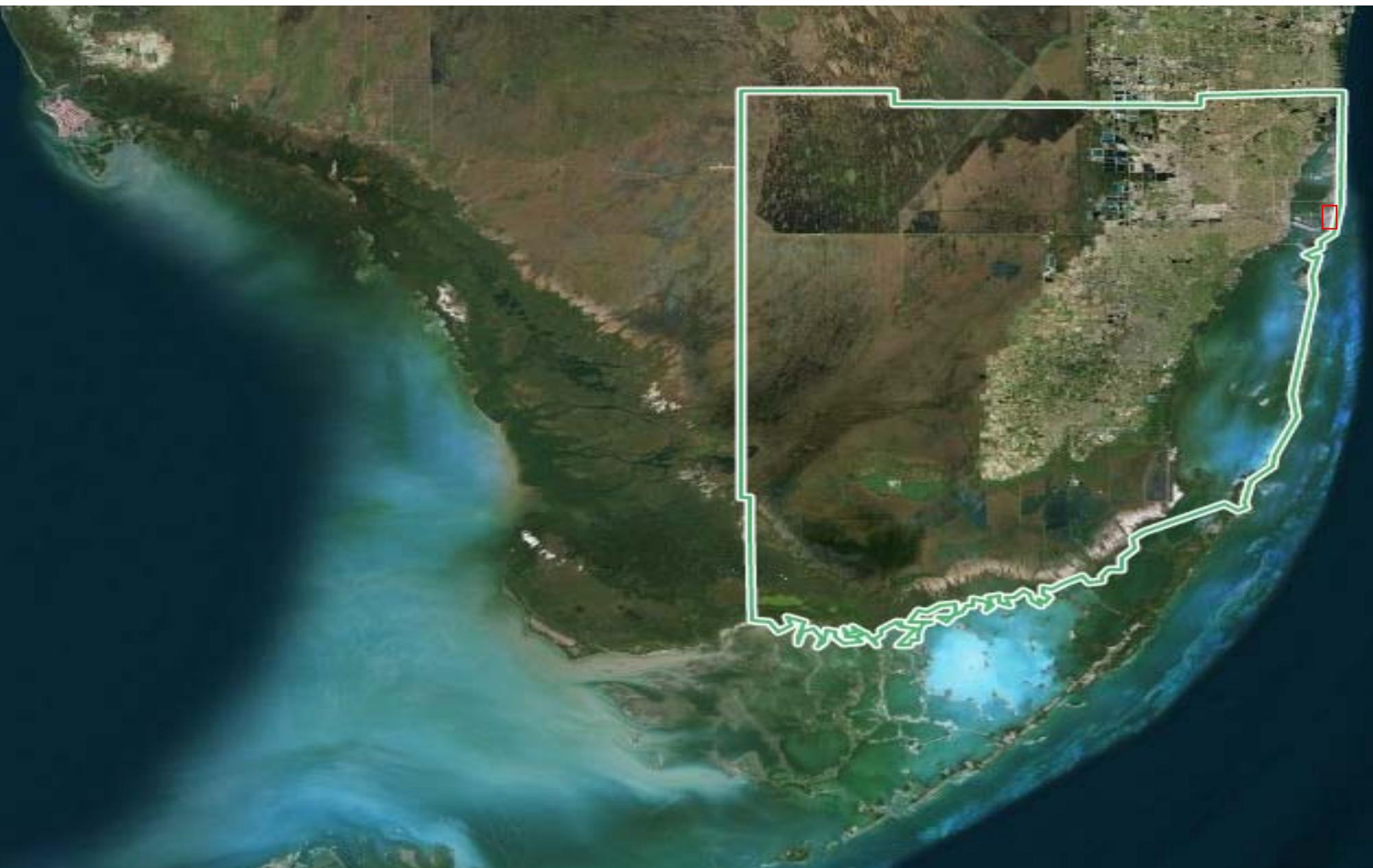
Sea Level Rise: Impacts on Miami-Dade County

October 23, 2017

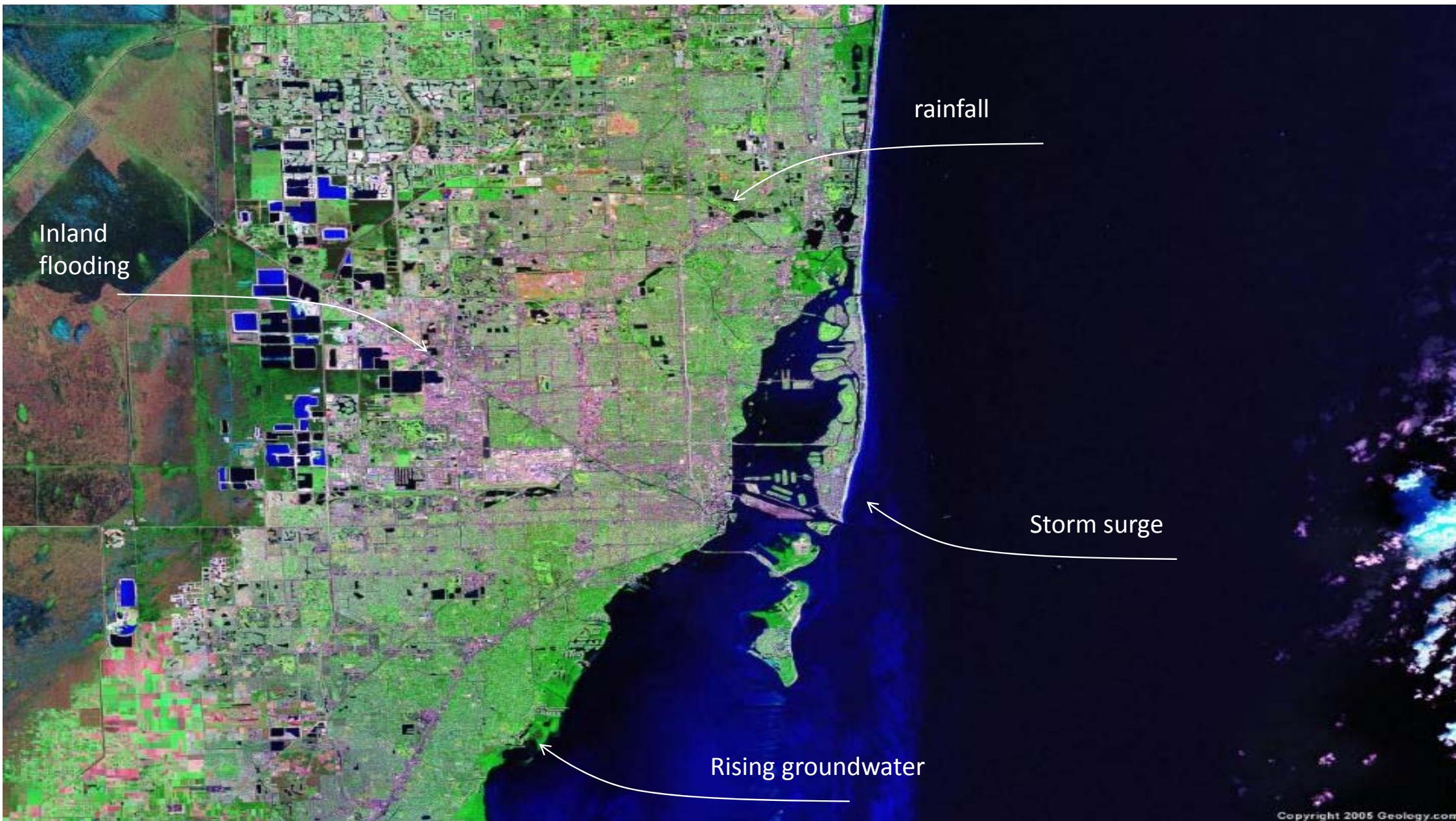


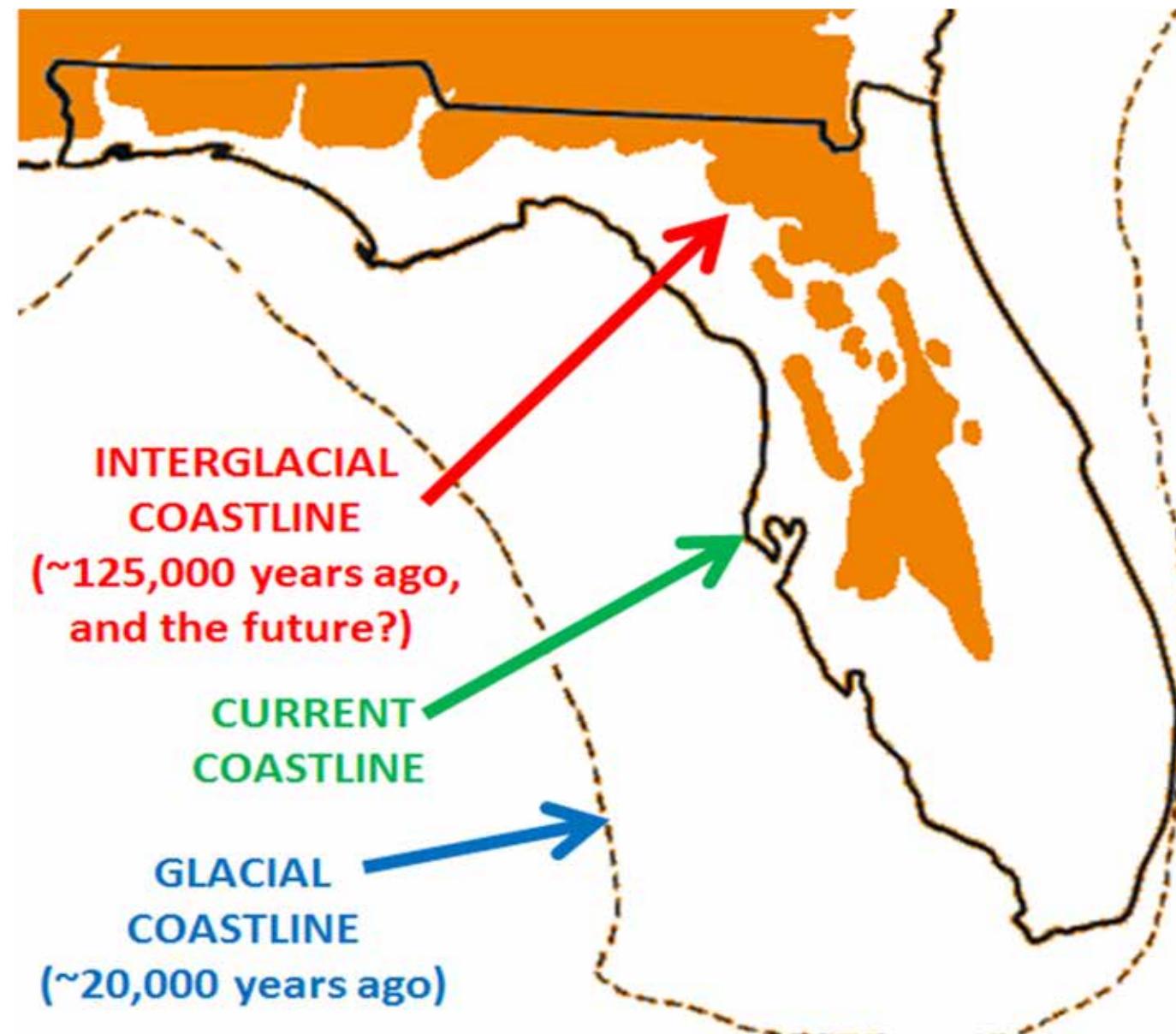
Katherine Hagemann
Resilience Program
Manager, Adaptation
Office of Resilience
Miami-Dade County

















Brickell

Downtown

Brickell

Downtown





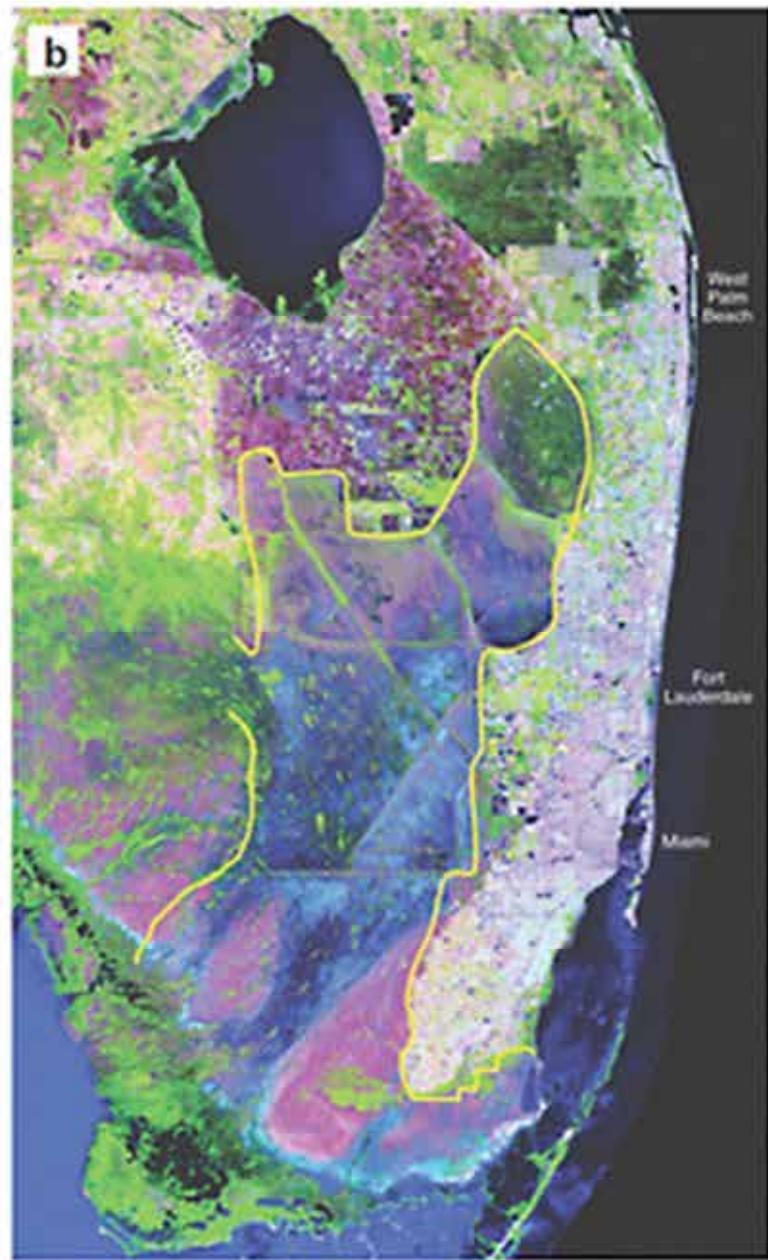
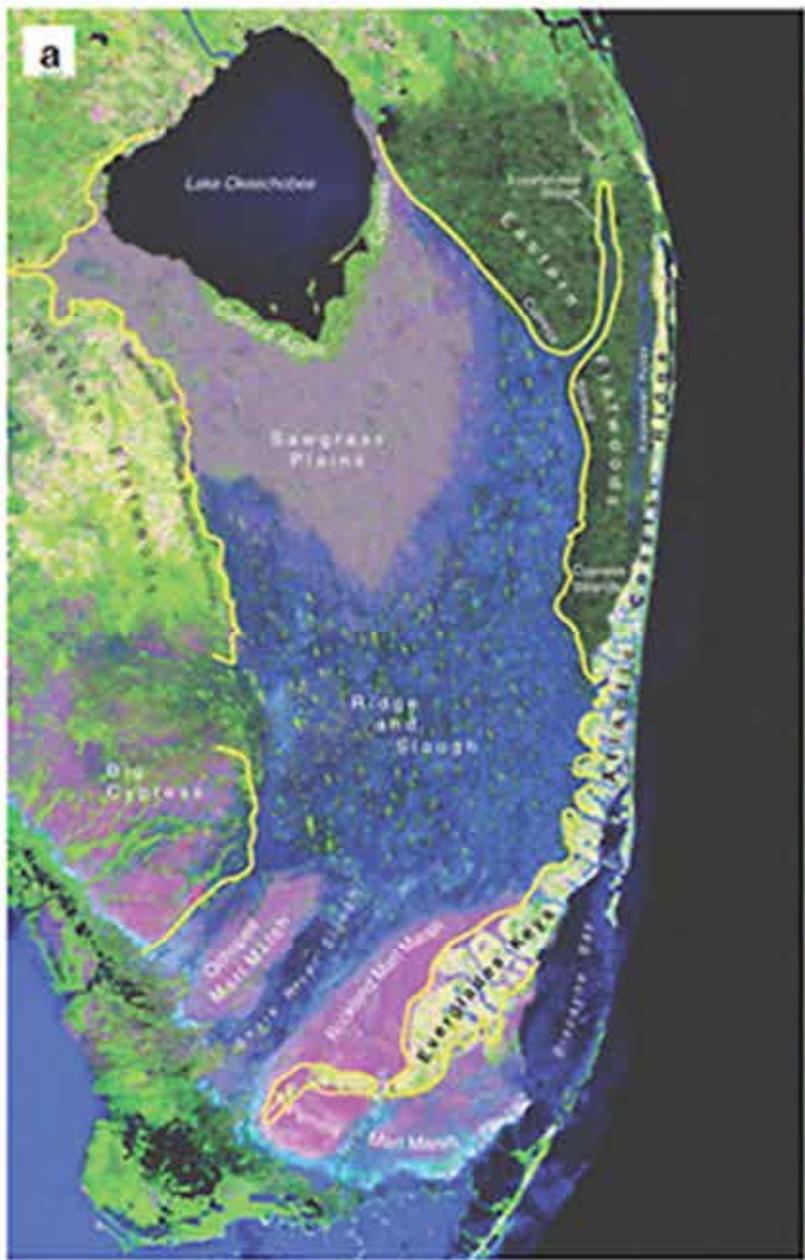
Historic Flow



Current Flow



The Plan (CERP) Flow





NEIGHBORHOOD DRAINAGE SYSTEM

Tertiary Drainage System



DRAINAGE GRATES

After a heavy rain, excess "surface water" slowly drains to community lakes and ponds via street and drainage grates, swales, ditches or neighborhood canals. Maintenance of community drainage facilities is typically the responsibility of residents or homeowner associations.



CULVERTS

The water then drains from the neighborhood or "tertiary" system through culverts or underground pipes to the "secondary system," usually operated by special drainage districts or the county/city.

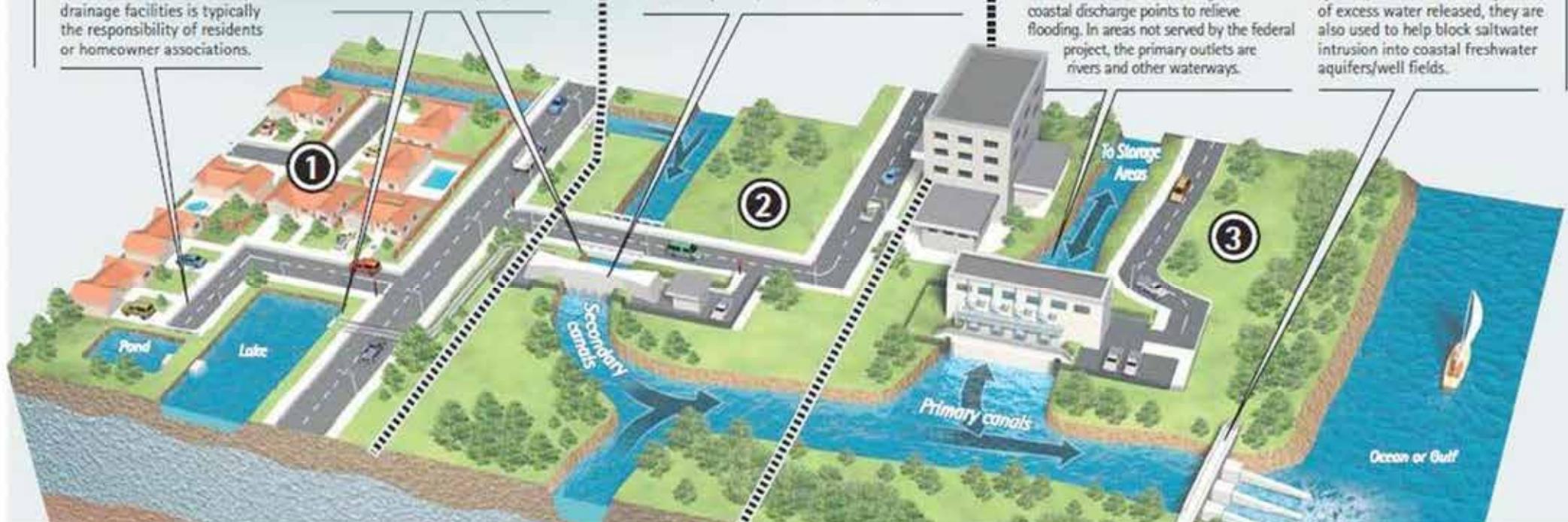
SECONDARY DRAINAGE SYSTEM

Local Drainage District/County or City



LOCAL STRUCTURE

Usually a network of local gates, pump stations, canals, structures and storage areas, "secondary" drainage systems can cover several hundred square miles and serve a number of communities. The secondary system's canals typically discharge water into the "primary" flood control system.



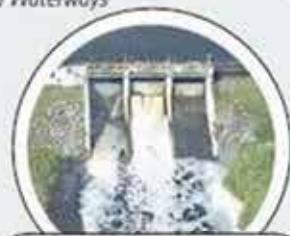
PRIMARY DRAINAGE SYSTEM

South Florida Water Management District (SFWMD) Canals and Natural Rivers/Other Waterways



PUMP STATIONS

The SFWMD operates and maintains the "primary" drainage system built by the federal government along with other flood control facilities. During and after heavy rains, excess water is routed through primary waterways using pump stations and other structures to storage areas or coastal discharge points to relieve flooding. In areas not served by the federal project, the primary outlets are rivers and other waterways.



GATED SPILLWAYS

Huge gravity-operated gated spillways help control the amount of excess water discharged to the ocean or gulf as quickly and safely as possible. Because these large-volume spillways can control the quantity of excess water released, they are also used to help block saltwater intrusion into coastal freshwater aquifers/well fields.

Gravity-based drainage challenged



[Learn About This Map](#)

Surging Seas MAPPING CHOICES



Miami, FL, USA

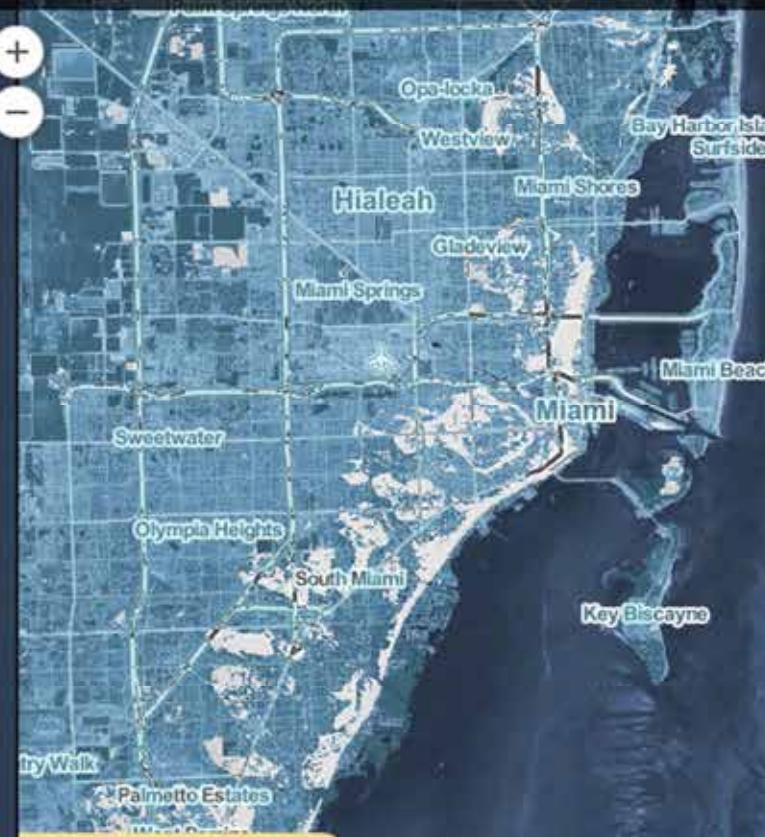


Which sea level will we lock in?

When will this happen?



1.5° C Warming (2.7° F)



Sea level tools and analysis by CLIMATE CENTRAL

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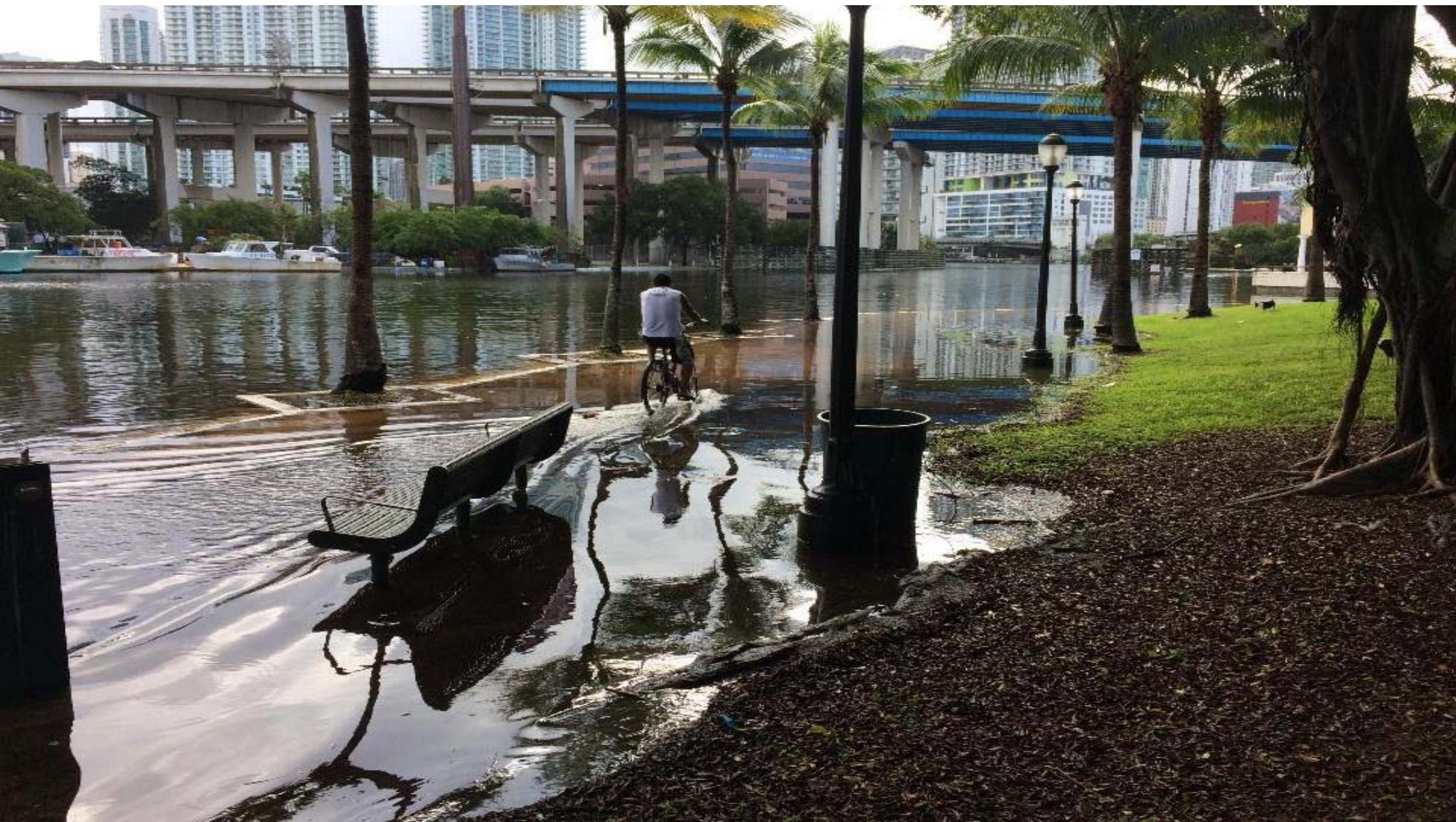


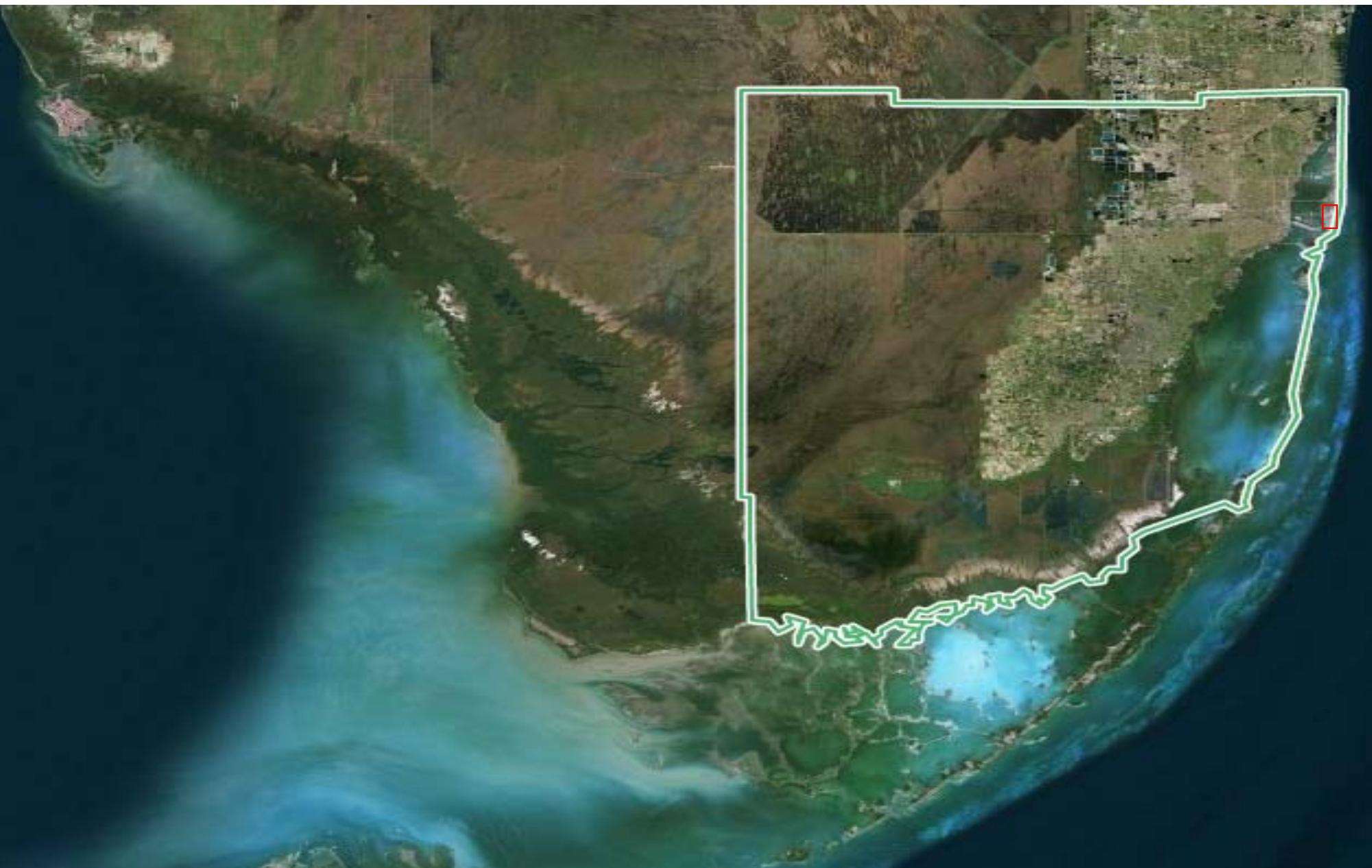


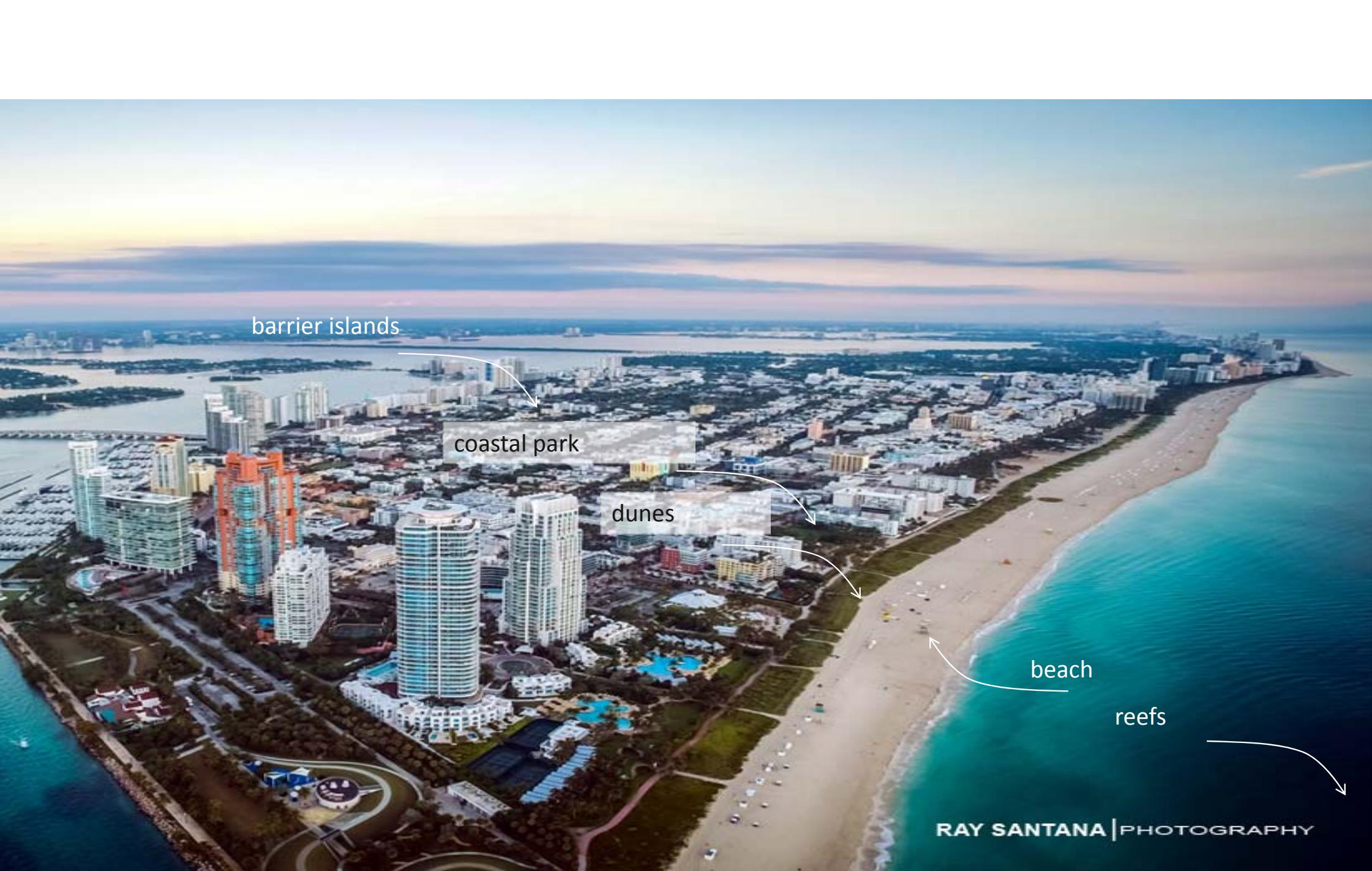


Photo: Brian McNoldy











Vegetation traps sand

An aerial photograph of a coastal city, likely Miami Beach, during the day. The foreground shows a wide, sandy beach with several small, green, rounded plantings. To the left, there's a large, developed area with numerous white buildings and palm trees. In the background, a dense city skyline with many tall skyscrapers is visible under a blue sky with scattered white clouds.

Dunes have accreted several feet



Figure Beach replenishment in Miami, Fla. This project restored a declining tourist industry and paid for itself in revenue.

Sand from inland paleo beaches



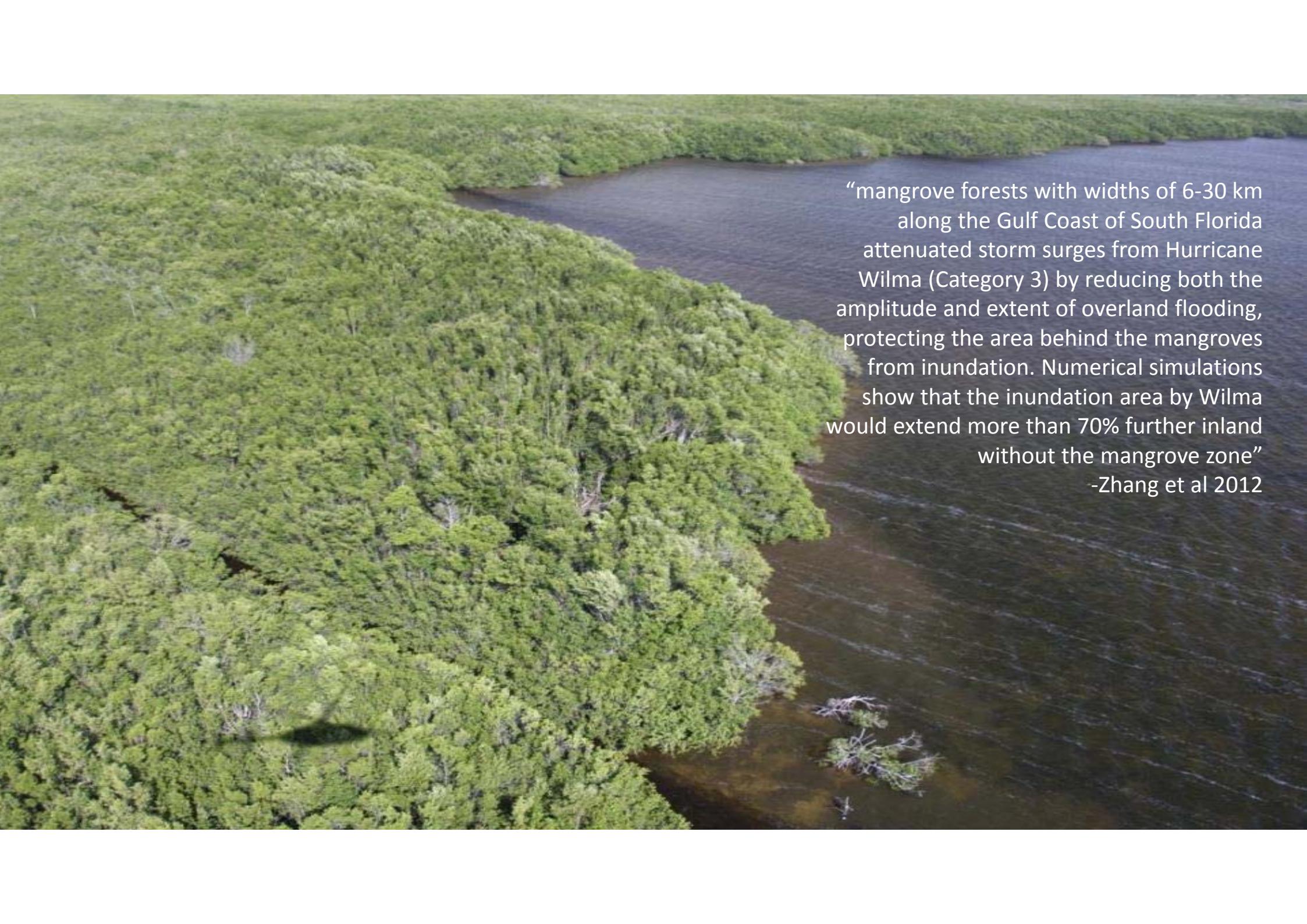
Protect our natural defenses



Biscayne Bay Coastal Wetlands Project

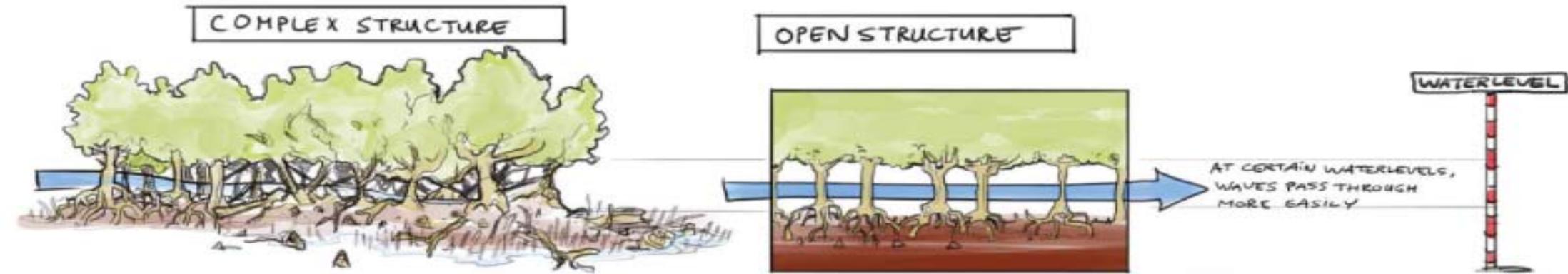
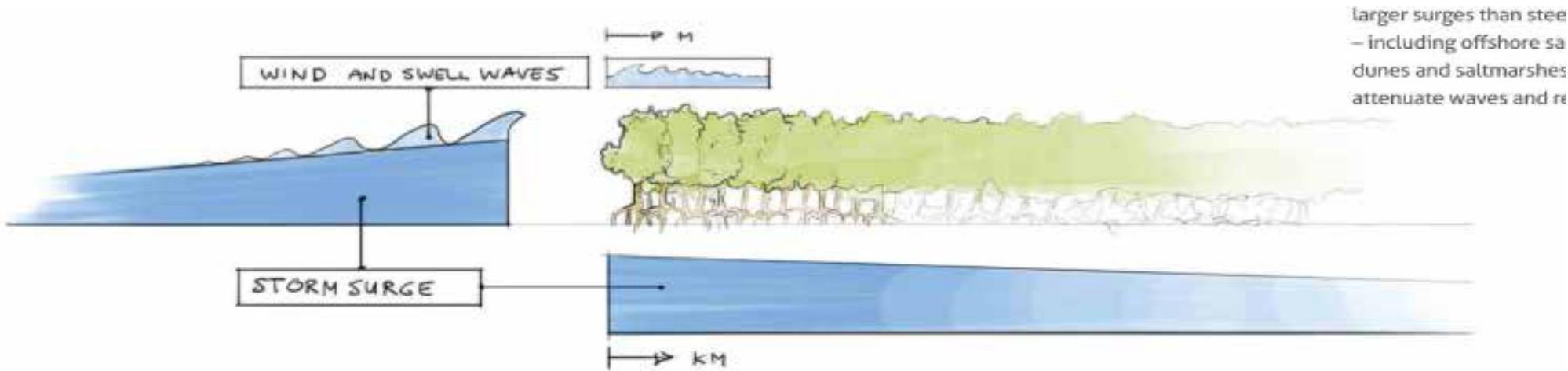




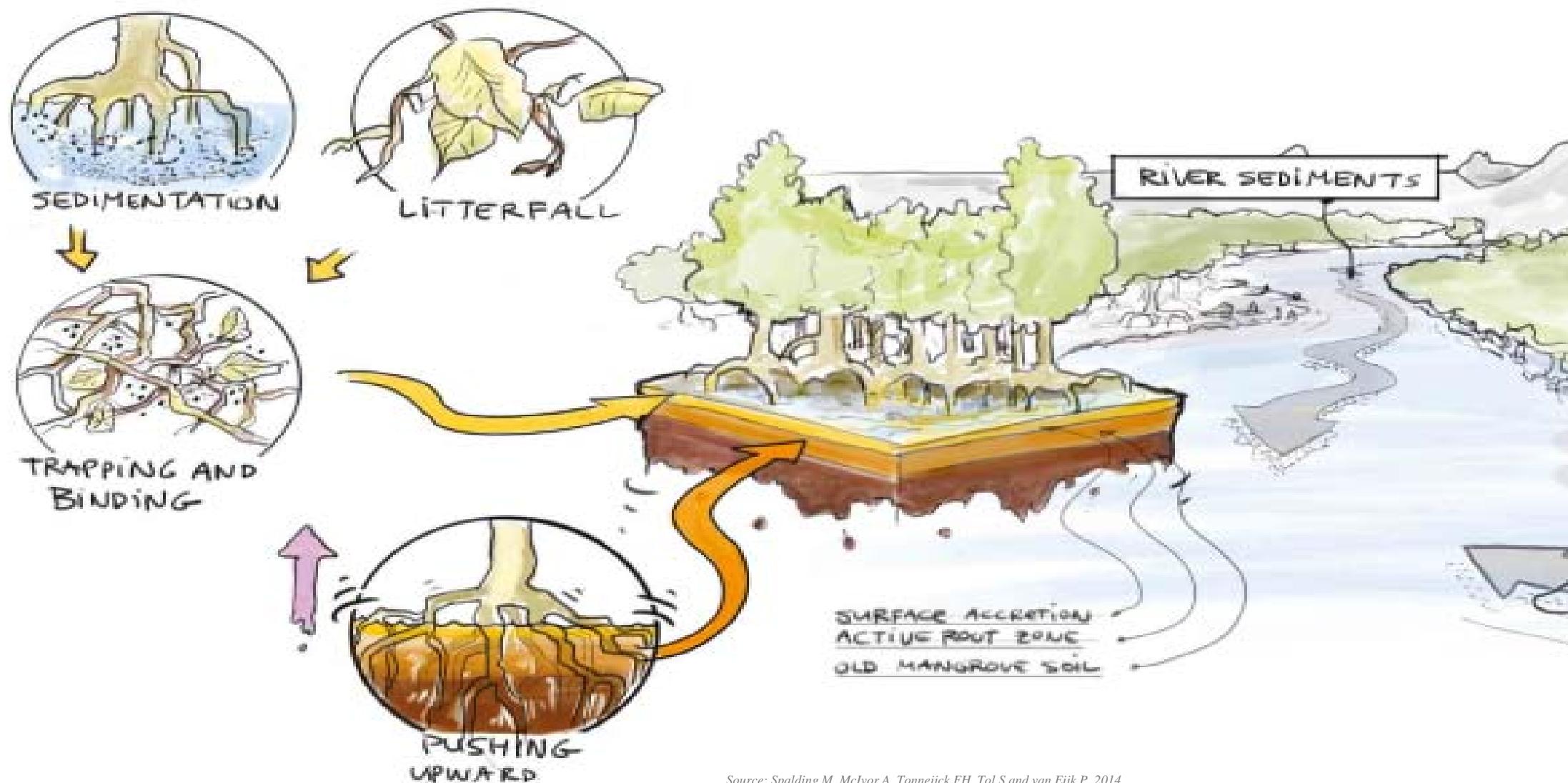
An aerial photograph showing a dense mangrove forest on the left, characterized by its dark green, textured canopy. A narrow, dark waterway or river cuts through the forest and extends towards the bottom right of the frame. The surrounding area beyond the mangroves appears to be a mix of wetland and possibly some low-lying vegetation or sandbars.

"mangrove forests with widths of 6-30 km along the Gulf Coast of South Florida attenuated storm surges from Hurricane Wilma (Category 3) by reducing both the amplitude and extent of overland flooding, protecting the area behind the mangroves from inundation. Numerical simulations show that the inundation area by Wilma would extend more than 70% further inland without the mangrove zone"

-Zhang et al 2012

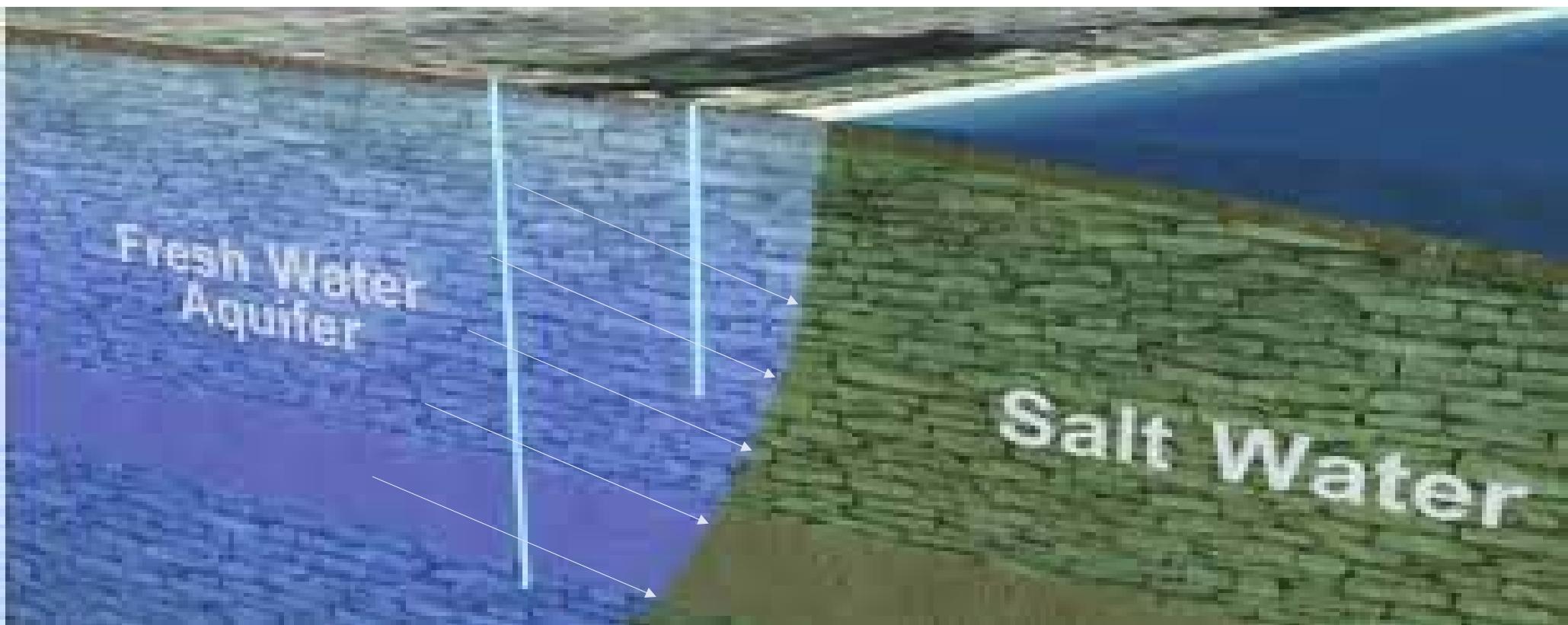


Source: Spalding M, McIvor A, Tonneijck FH, Tol S and van Eijk P, 2014



Source: Spalding M, McIvor A, Tonneijck FH, Tol S and van Eijk P, 2014





Strengthening Infrastructure

- Assessing vulnerability of critical infrastructure (rapid action plan + WASD + septic systems)
- Incorporating SLR into the design of new infrastructure (checklist + online viewer + new policy guidance)
- Incorporating SLR into water management (modeling + coordination with District + stormwater)
- Planning for long-term infrastructure needs (enhanced capital plan)

Planning for Resilient Communities

- Adaptation Action Area's
- Community outreach & presentations
- Integrating SLR into planning policies (CDMP & Zoning Policies)

Enhancing Natural Protections

- Protecting shorelines with beach nourishment & dune management
- Environmentally Endangered Lands Program & mangrove restoration
- Studies w/ the Army Corps & academics

Promoting Economic Resilience

- Insurance (insurance dialogue & monitoring NFIP)
- Equity
- Engaging the business community & Beacon Council



design standards



Raising roadways



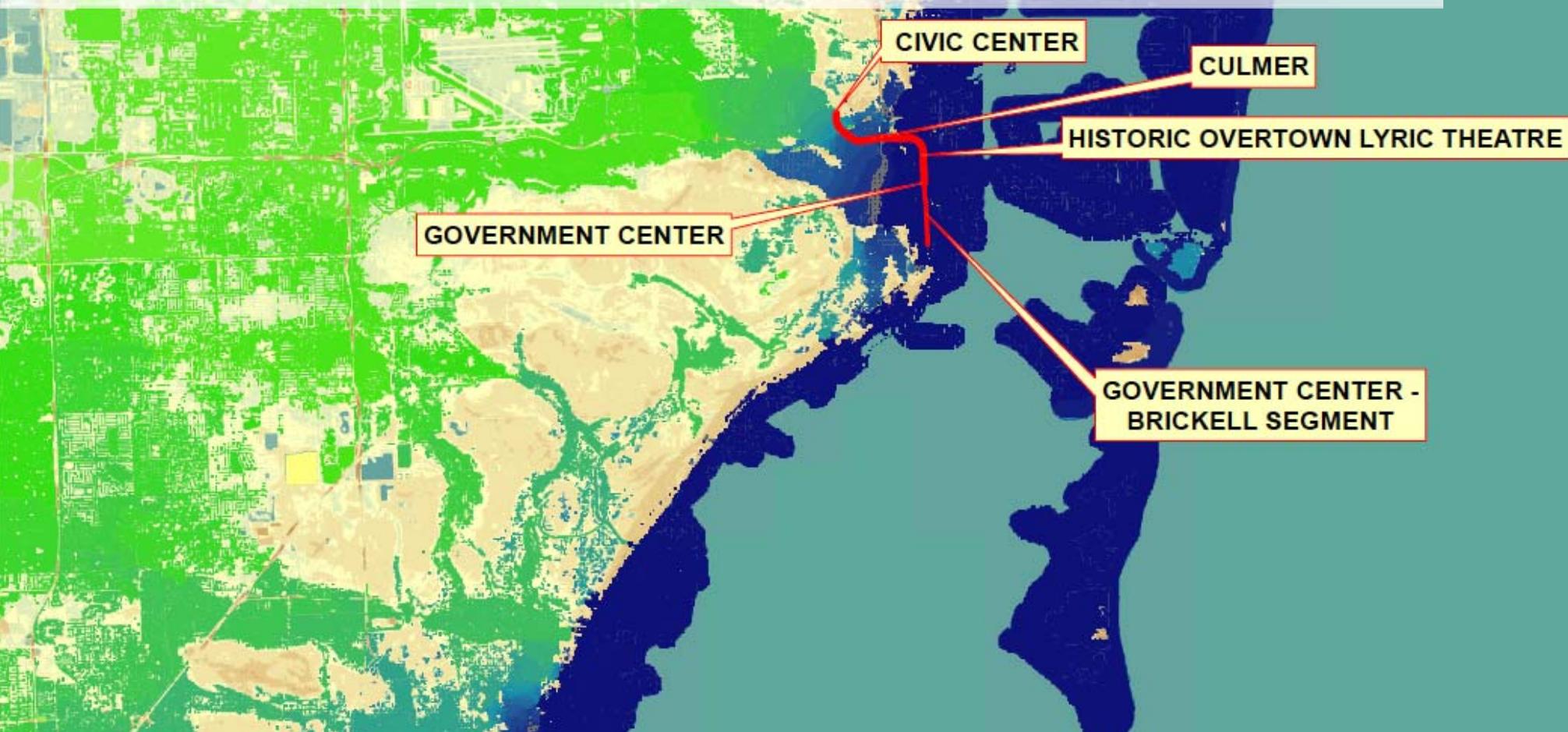
installing pump stations



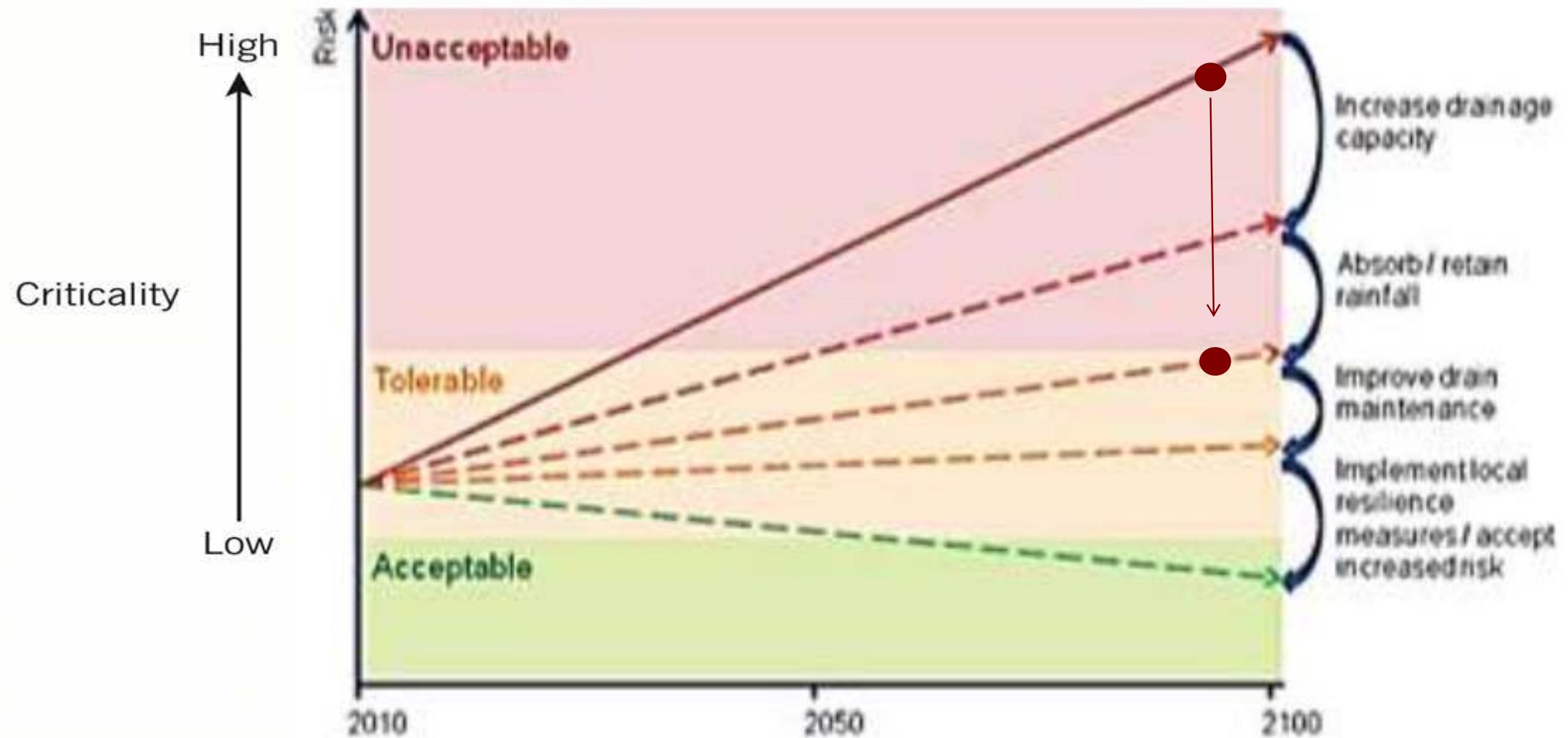
installing berm

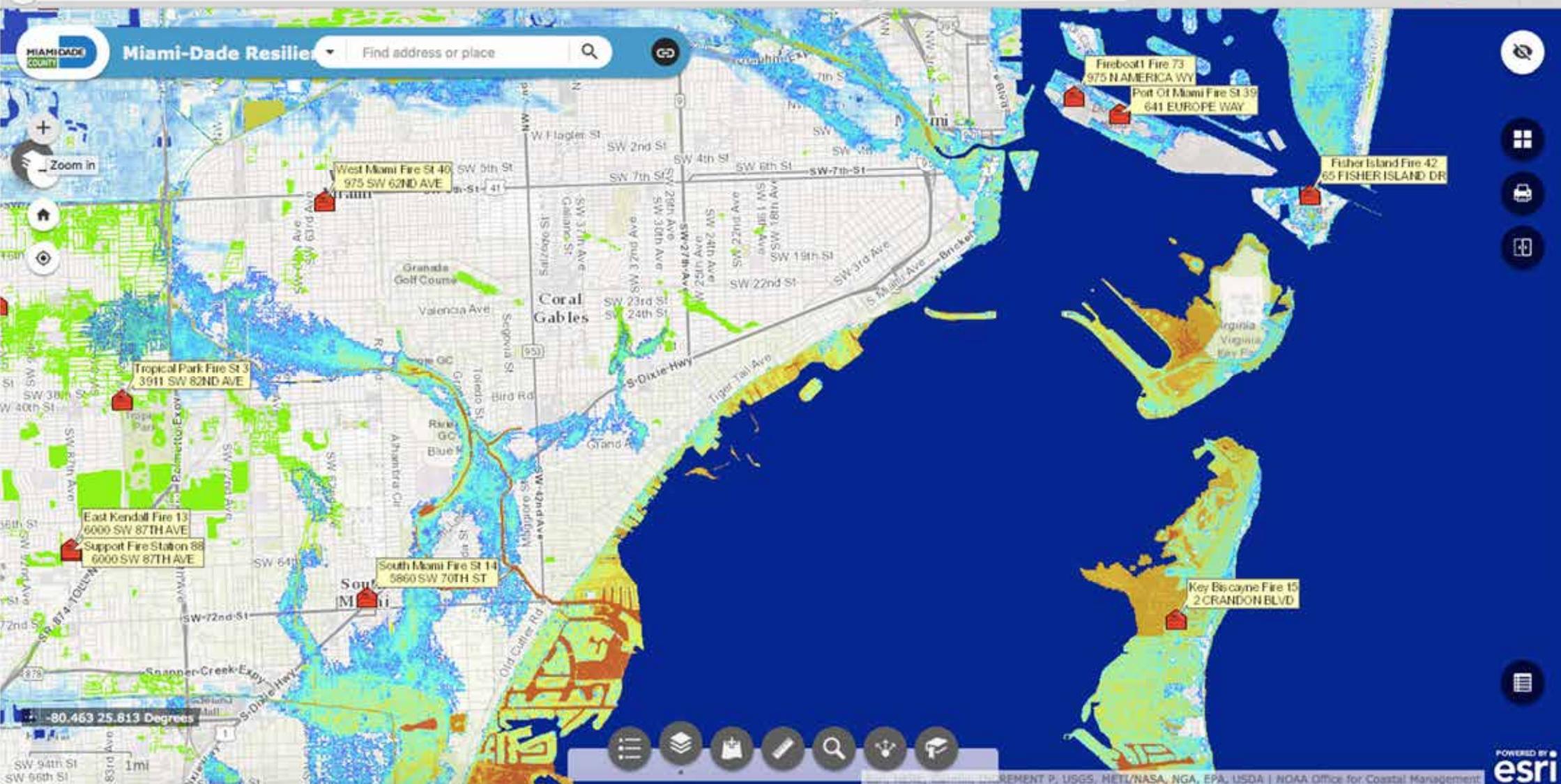
Rapid Action Plan:

Working with a consulting firm to assess vulnerability of our most critical infrastructure



Protecting the County's critical infrastructure





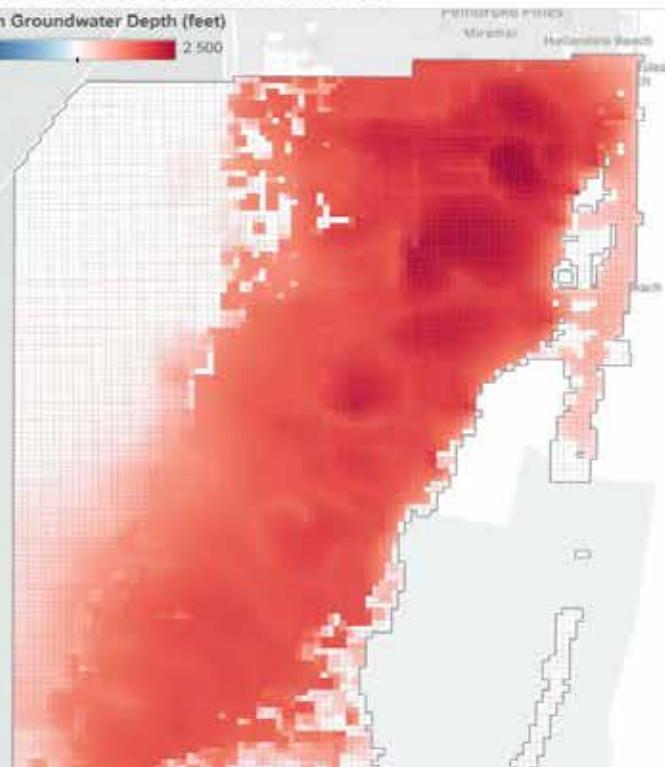
< RAND - Profile

Favorite

< Broward VALUE CHANGE (UMD) VALUATION Methods (Broward) VALUATION Methods (UMD) GROUNDWATER HAZARDS GROUNDWATER HAZARD (fut...) GROUNDWATER CHANGES VALUE AT GW RISK Chan| >

Change In Groundwater Level Relative to Surface

Change in Groundwater Depth (feet)
-2,500 2,500



In / Out of Asset Regions (future)

In
 Out

Model

Broward
 UMD

Season

dry
 wet

SLR

low
 mid
 high

Precipitation

driest
 dry
 avg
 wet
 wettest

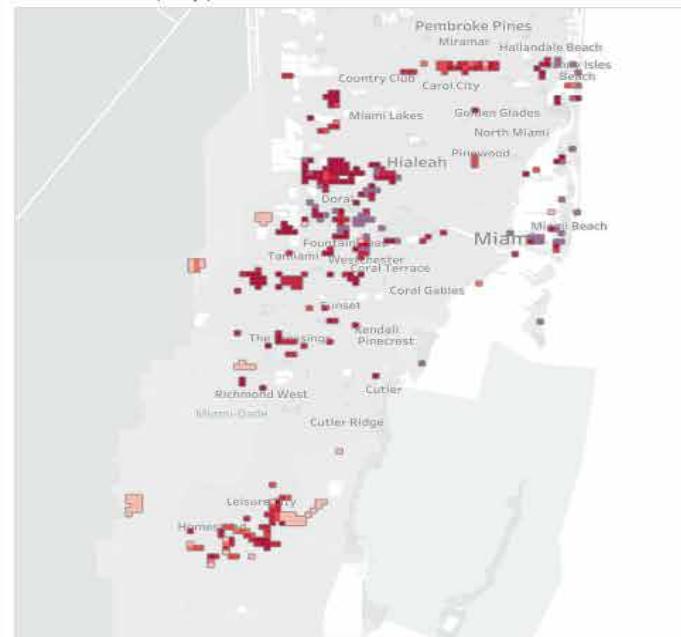
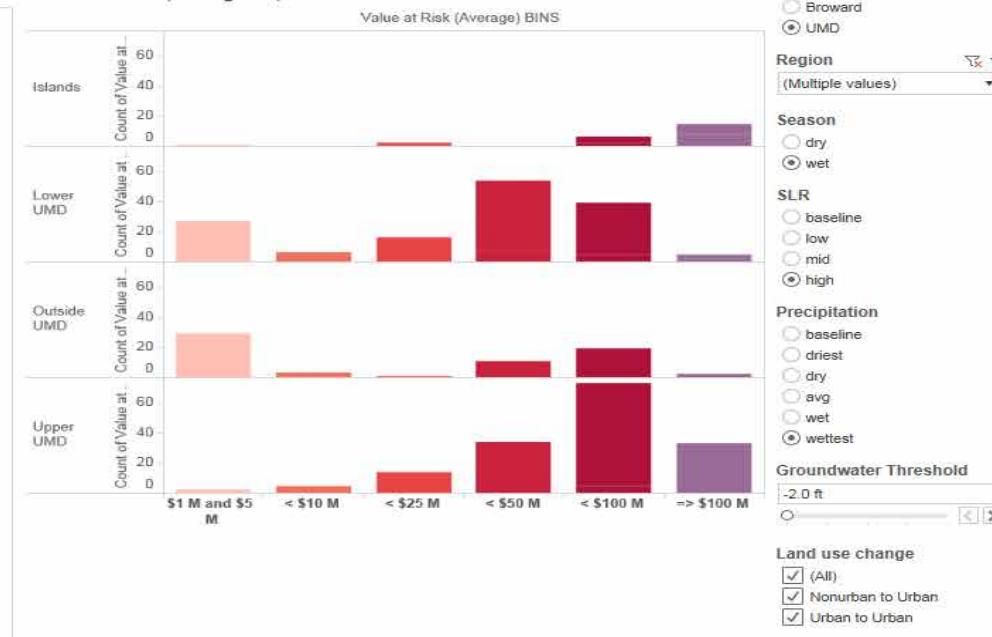
Groundwater Depth Below Surface (Average)

-20.74 0.00

RAND: Advanced Modeling (McArther Foundation)



< RAND - Profile

 Favorite
< WATER HAZARDS GROUNDWATER HAZARD (fut...) GROUNDWATER CHANGES VALUE AT GW RISK Change in GW at Risk VALUE AT GW RISK (futures) DISSAGREGATED COASTAL R... BROWARD GS >
Value at risk (map)**Value at risk (histogram)****Model**

- Broward
- UMD

Region

(Multiple values)

Season

- dry
- wet

SLR

- baseline
- low
- mid
- high

Precipitation

- baseline
- driest
- dry
- avg
- wet
- wettest

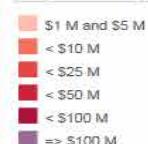
Groundwater Threshold

-2.0 ft

Land use change

- (All)
- Nonurban to Urban
- Urban to Urban

RAND: Advanced Modeling (McArther Foundation)


Undo Redo Reset

+ a b | e a u

7 views | more by this author

Share Download

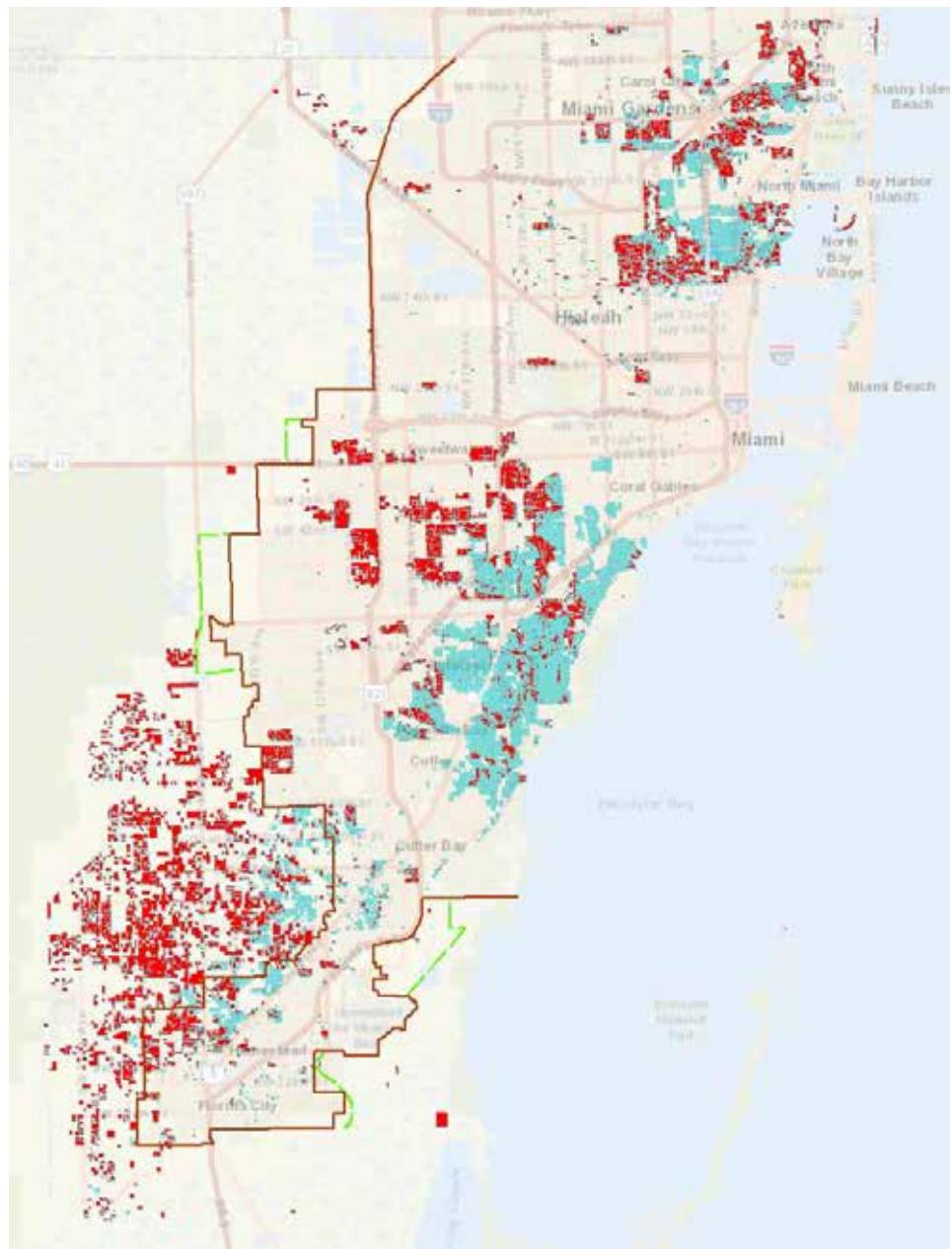
A wide-angle photograph of a waterway under a clear blue sky. In the background, there's a long, light-green, two-story apartment building with many windows. A concrete bridge with yellow railings spans the water. The water surface is dark and reflects the surrounding environment, including the bridge and some greenery. There is a significant amount of debris, including plastic bottles and other trash, floating on the water. A chain-link fence runs along the right side of the frame.

Collaborating with the District

Impact of SLR on Septic Systems



- Significant # of systems compromised today
- Concerning levels of bacteria
- Majority of problem in UMSA
- Report to BCC due in October



Adaptation Action Areas (AAA)



A ULI Advisory Services Panel Report

Arch Creek Basin
Miami-Dade County, Florida
May 22-27, 2016

Urban Land Institute

TRANSFORMING THE WAY CITIES SOLVE PROBLEMS

CityMart powered cities to develop innovative infrastructure

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Boston | Atlanta | Newark | San Diego | Seattle | Honolulu

RAMBOLL
ACF
ENVIRONMENTAL

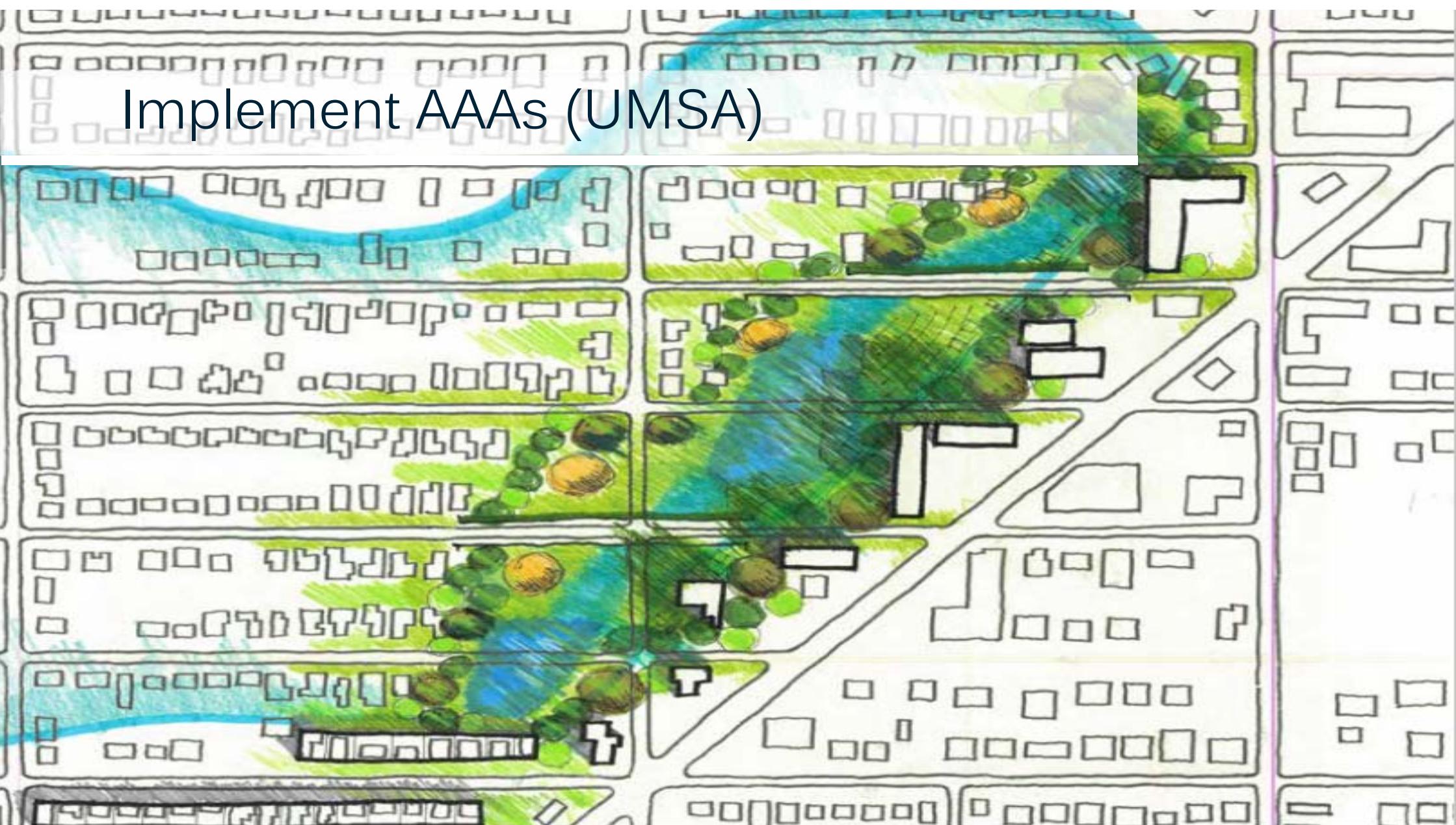
Addressing Miami-Dade Flood Risks with Blue+Green Infrastructure

Office of Regulatory and Economic Resources

Request for Information
June 2, 2017...

CityMart Challenge

Implement AAA's (UMSA)



AAA: CityMart Challenge

Marvel Architects
NEW YORK | SAN JUAN

INTEGRATED RESILIENCE

AN APPROACH TO MAKING MIAMI-DADE COUNTY MORE FLOOD RESILIENT

JUNE 9, 2017

| Enhancing Natural Protections

- Protecting shorelines with beach nourishment & dune management
- Environmentally Endangered Lands Program & mangrove restoration
- Studies w/ the Army Corps & academics

“Non-structural” Flood Risk Mitigation Study

- Storm surge (ADCIRC) modeling with & without natural systems
- Alternative futures: optimistic, pessimistic, futuristic
- Incorporating future sea level rise



Adapting Matheson Hammock

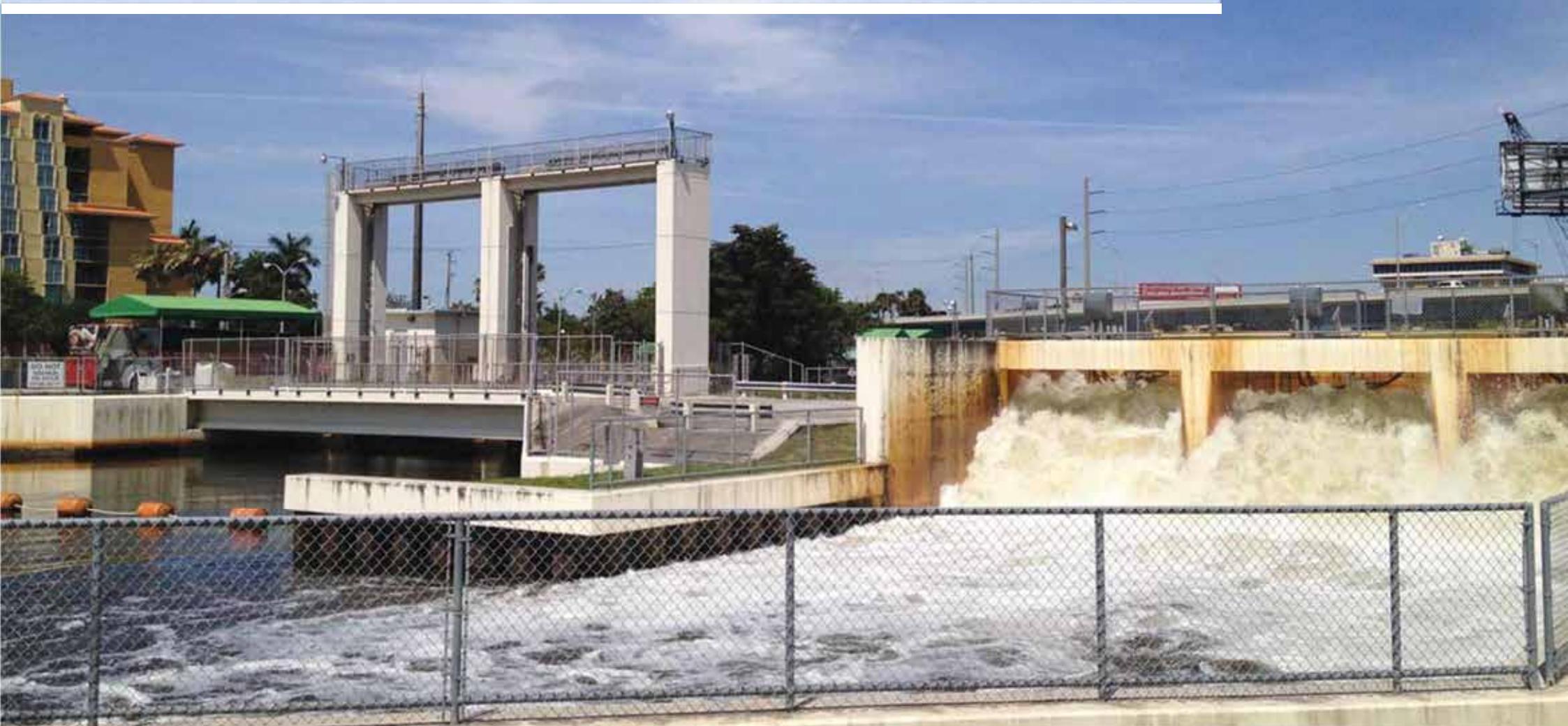


Beach
nourishment

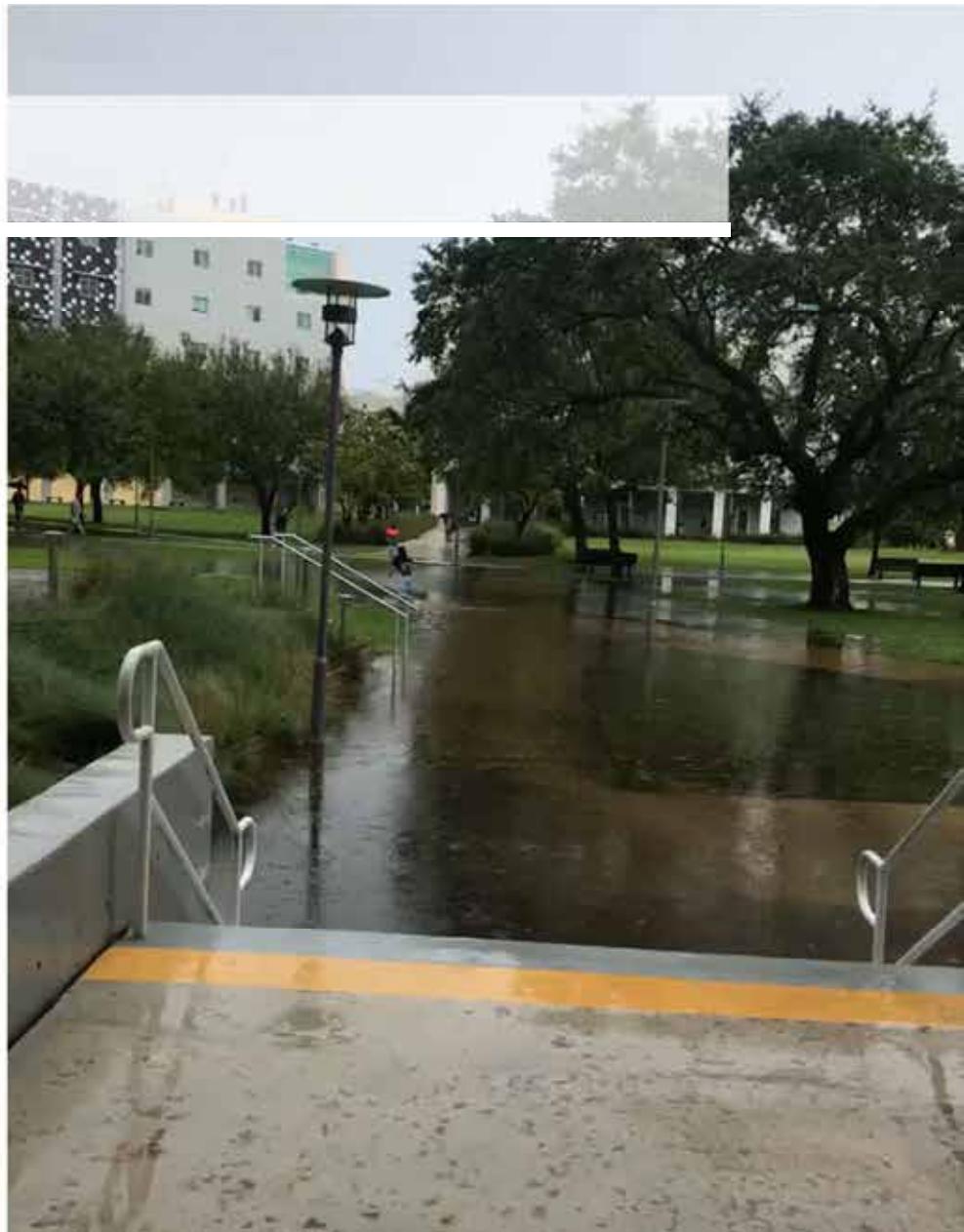


key challenges

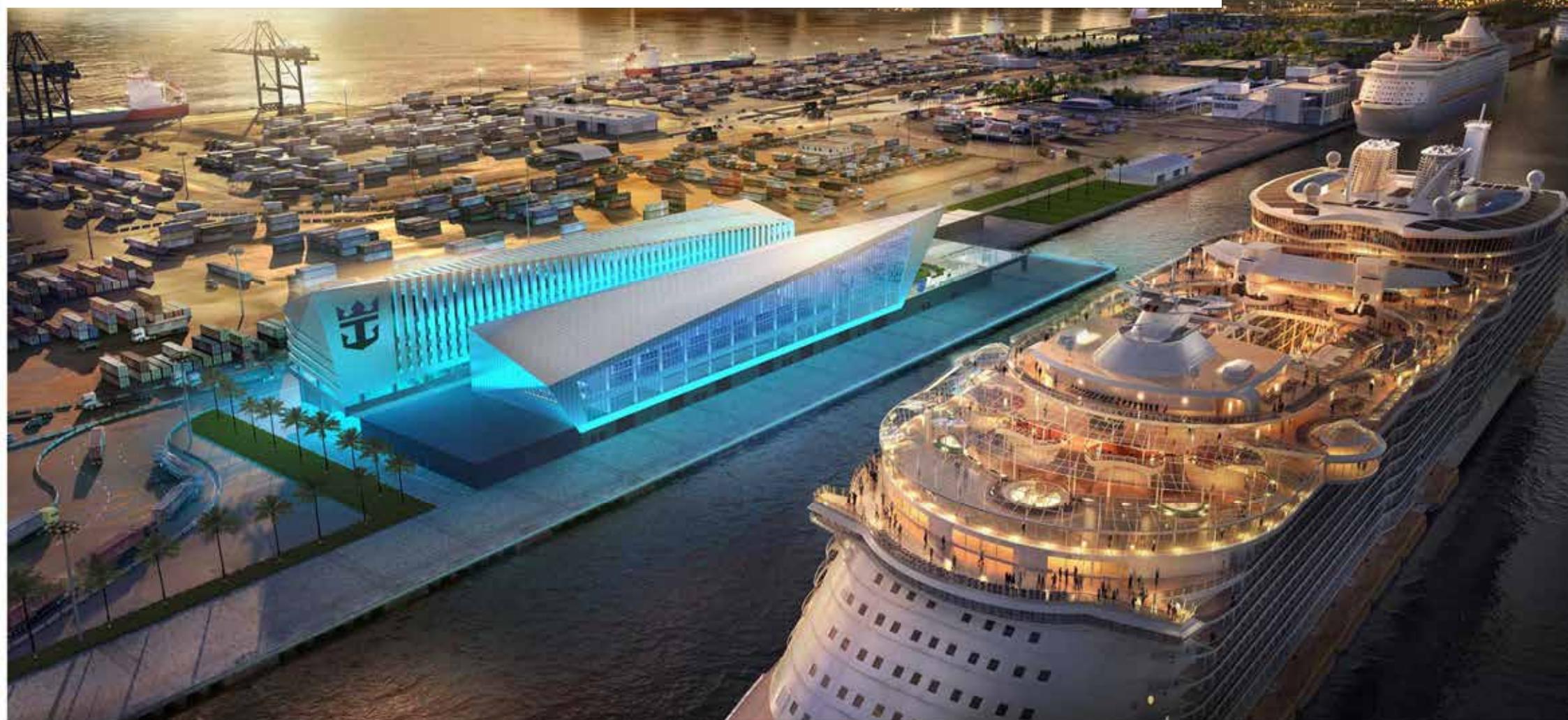
Evaluating overall policy for flood mitigation



Groundwater rise



Building brand new infrastructure



Modifying building code



Addressing evacuation routes





Supporting DERM & Parks & Planning

King tide outreach & policy



Partner with others

**SOUTHEAST FLORIDA
REGIONAL COMPACT
CLIMATE
CHANGE**



The Nature Conservancy



The Miami Foundation
For A Greater Miami

PIONEERED BY THE
ROCKEFELLER FOUNDATION

100

RESILIENT



CITIES



**Urban Land
Institute**

I.C.L.E.I
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Governments
for Sustainability

USGS
science for a changing world



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Miami**

MacArthur
Foundation

SFRC
South Florida Regional Council

**Institute for
Sustainable
Communities**



FHWA

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HEALTH**

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ROCKEFELLER FOUNDATION

**Florida
Climate Institute**
AT THE UNIVERSITY OF FLORIDA

UF UNIVERSITY OF
FLORIDA

FIU | **Sea Level
Solutions Center**
FLORIDA INTERNATIONAL UNIVERSITY

The background of the slide is a vibrant, abstract painting of a coastal city skyline. The scene features a variety of colorful buildings, including several tall white skyscrapers and lower, more colorful structures. In the foreground, there's a beach area with green and blue shapes representing sand and water. Palm trees are scattered throughout the landscape.

Thank you

Katherine Hagemann
Katherine.hagemann@miamidade.gov
@BlueGreenMiami