WATER INSTITUTE SYMPOSIUM

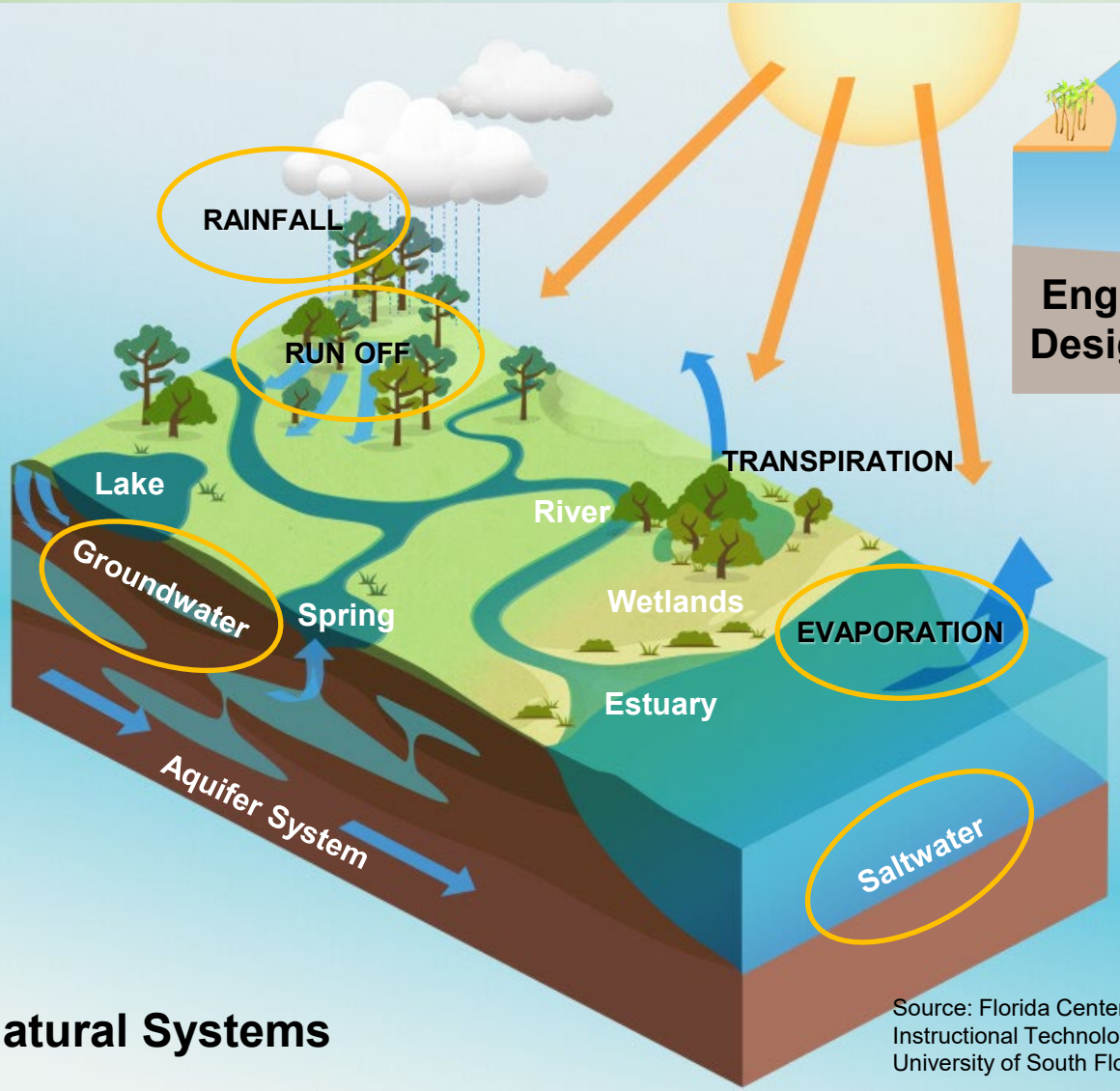
Carolina Maran, P.E., Ph.D.
Chief of District Resiliency

# District Resiliency Initiatives

February 21, 2024

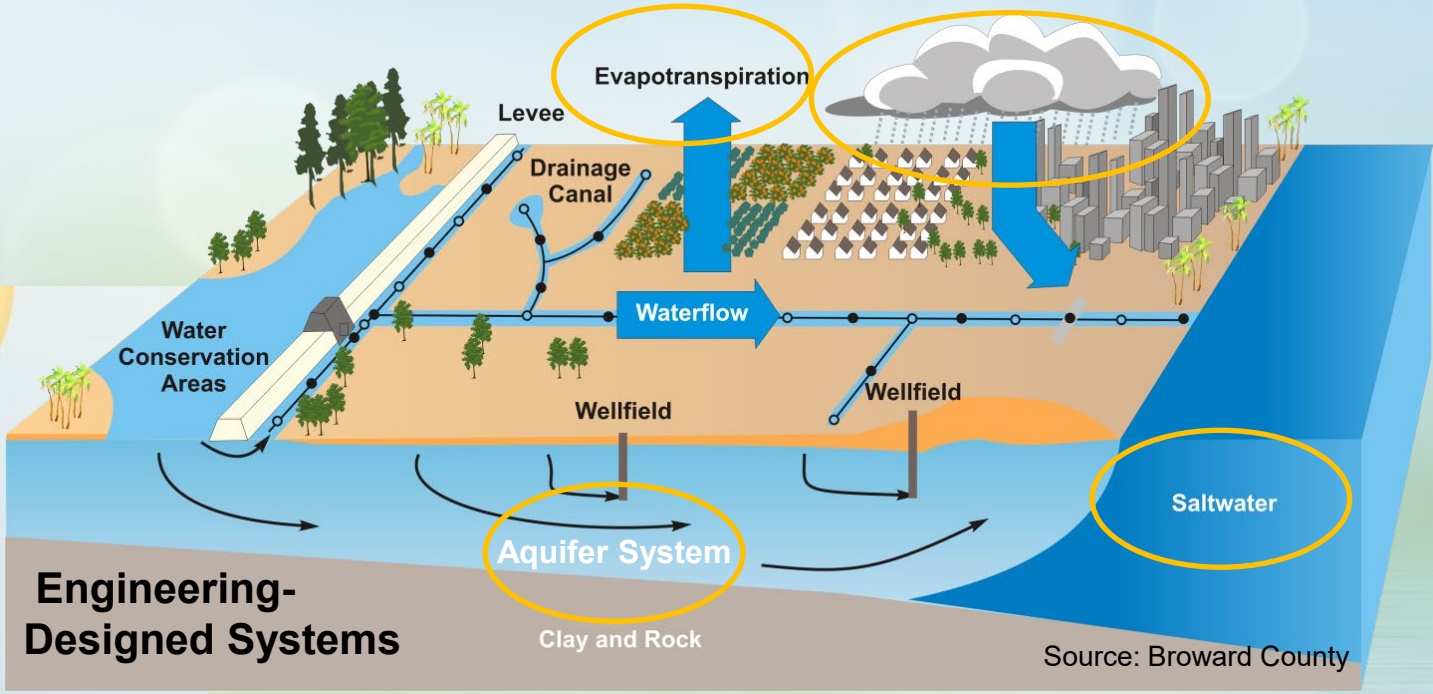
sfwmd.gov

# South Florida Water Management System




**Natural Systems**

Source: Florida Center for Instructional Technology – University of South Florida

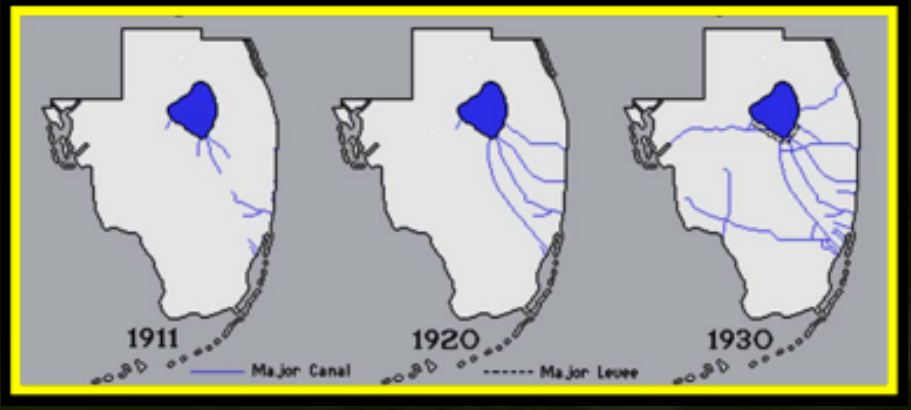


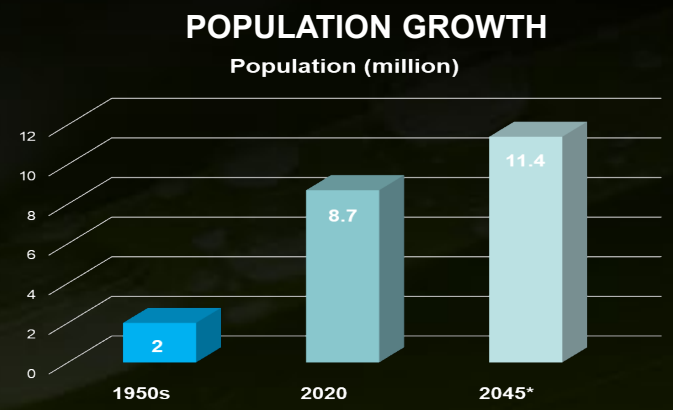

**Engineering-Designed Systems**

Source: Broward County

# Recognizing Changing Conditions

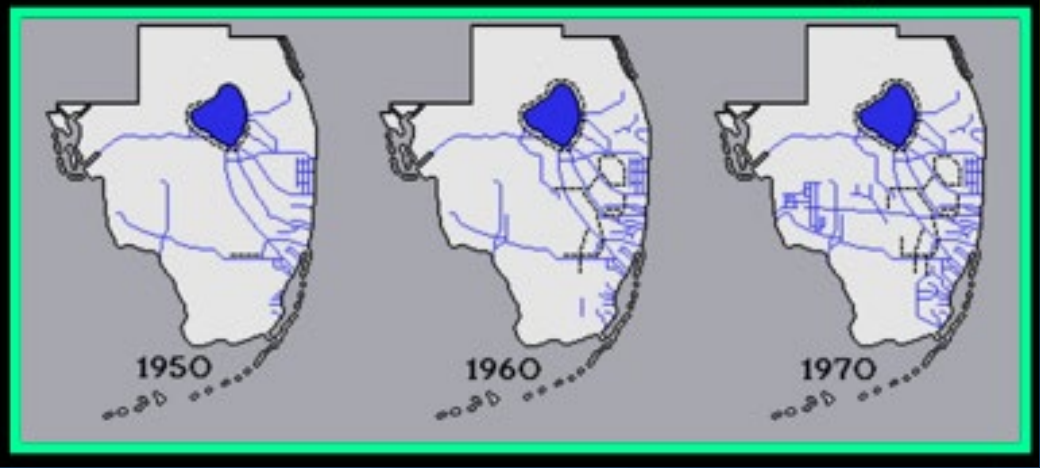
## Pre-1948 Drainage Projects

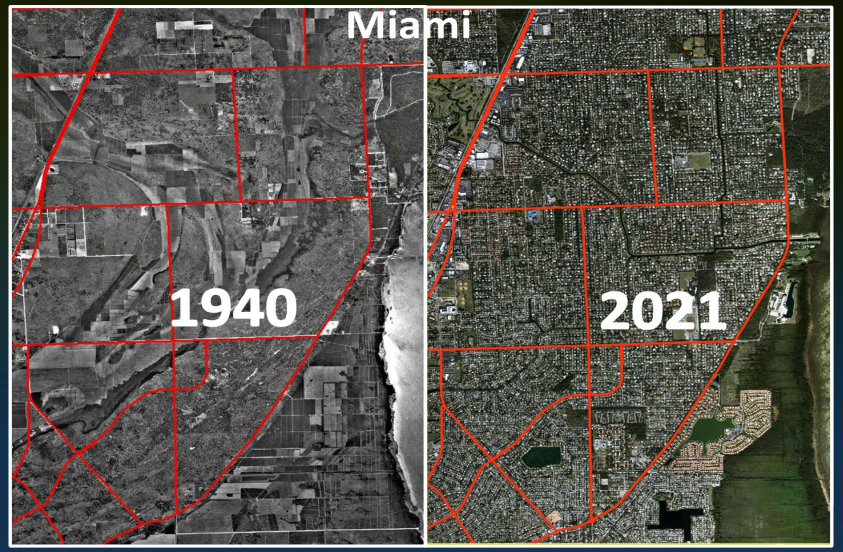



* Estimate taken from BEBR 2017 publication (Median, SFWMD boundaries)


## Post-1948 C & S Florida Project



# Recognizing Changing Conditions: Emerging Trends in Regional Resiliency

Resilience Metrics Hub

# Water and Climate Resilience Metrics

SFWMD.gov/WaterandClimateResilienceMetrics

SFWMD.gov/ResiliencyMetricsHub

Regional Rainfall

Changes in rainfall patterns will impact people and ecosystems by altering the amount of water in our region throughout the year.

Evapotranspiration Trends in South Florida

Evapotranspiration (ET) determines water exchanges between the land, plant communities, and the atmosphere.

Tidal Elevations at Coastal Structures and Sea Level

Flood control and the prevention of saltwater intrusion in South Florida relies heavily on the operation of coastal gravity structures.

Saltwater Intrusion in Coastal Aquifers

The inland migration of saltwater poses a threat to water supply and critical freshwater habitats.

Salinity in the Everglades

The salinization of previously freshwater systems poses threats to several factors.

Estuarine and Mangrove Inland Migration

Trends in Estuarine Inland Migration provide insights to the impacts of sea level rise in...

Soil Subsidence in South Florida

Maintaining soil elevations within coastal and intertidal habitats, as sea level changes, is a...

## SFWMD Data and Support

DBHydro Insights

DBHydro Insights

DBHYDRO is the South Florida Water Management District's corporate environmental database that stores hydrologic, meteorologic, hydrogeologic and water quality data.

Details | View

SFWMD GIS Open Data Hub

SFWMD GIS Hub

Our Open Data site is where our publicly available spatial datasets can be viewed and downloaded. Additional Web Apps and Story Maps are featured to explore and learn more about the data.

Details | View


## Local Agencies' Information

Local Agencies are using their resources to help us understand the potential risks that come with Coastal Resiliency efforts.

Broward County Resiliency Dashboard

Broward County continues to build resilience at a number of scales, internally for government operations, and county-wide through coordination with municipalities and regionally across Southeast Florida.

Details | Main Page

Miami-Dade County Sea Level Rise Strategy

Miami-Dade County faces an unprecedented challenge in the coming decades to adapt to climate change and sea level rise.

Details | Main Page

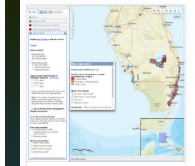
Palm Beach County Office of Resilience

The Office of Resilience (OOR) works to ensure that Palm Beach County remains a great place to live, work, and play while addressing physical, social, and economic challenges including climate change.

Details | Main Page

## Federal and State Agencies' Information

Federal and State Agencies are using their resources to help us understand the potential risks that come with Coastal Resiliency efforts.



USGS Water Mapper

This website is designed to conduct automated statistical and graphical analyses on water-level and salinity data collected from sites monitored by the U.S. Geological Survey (USGS) in South Florida

Details | View

FDEP

Florida Resilient Coastlines Program

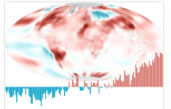
The Florida Department of Environmental Protection is committed to marshaling resources to prepare Florida's coastal communities and habitats for the effects of climate change, especially rising sea levels.

Details | View

NOAA Resilience HUB

This page is a hub for NOAA-related resilience resources. Here you can peruse the agency's related assets, explore ELP-funded resilience projects, and learn more about our grantee community. The ELP Community Resilience Education Theory of Change can also be found on this hub.

Details | View



NOAA Global Climate Dashboard

NOAA Climate.gov provides timely and authoritative scientific data and information about climate science, adaptation, and mitigation.

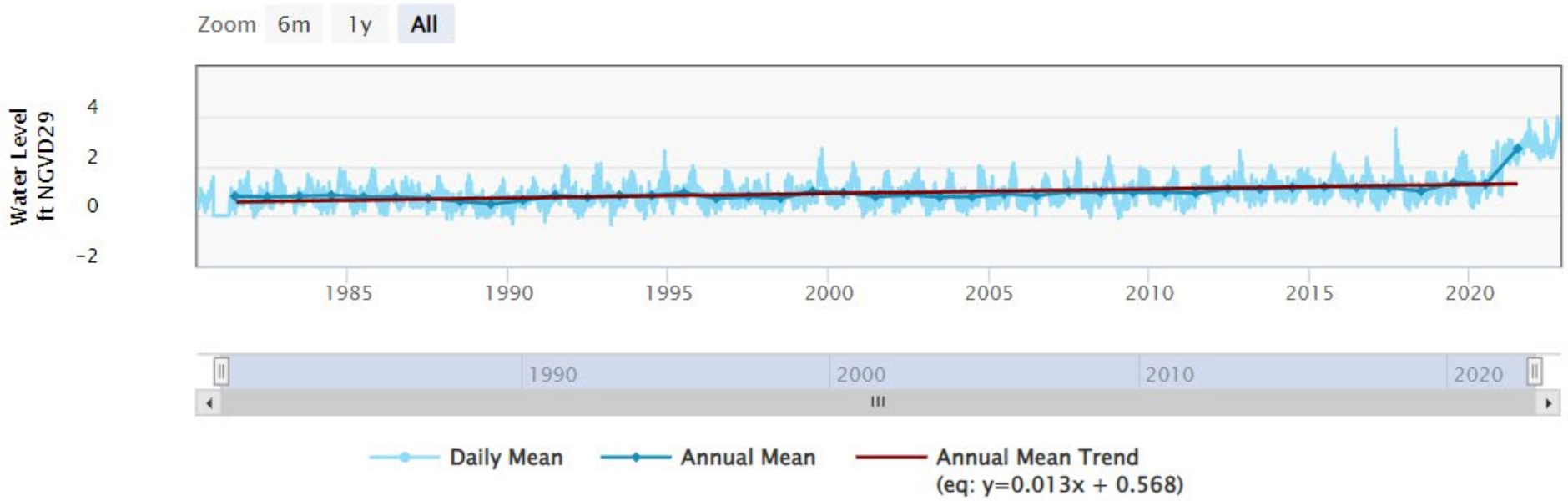
Details | Explorer

DBHYDRO insights

Lens Options | Pages | Favorites | Search (2 characters min) | filterBy

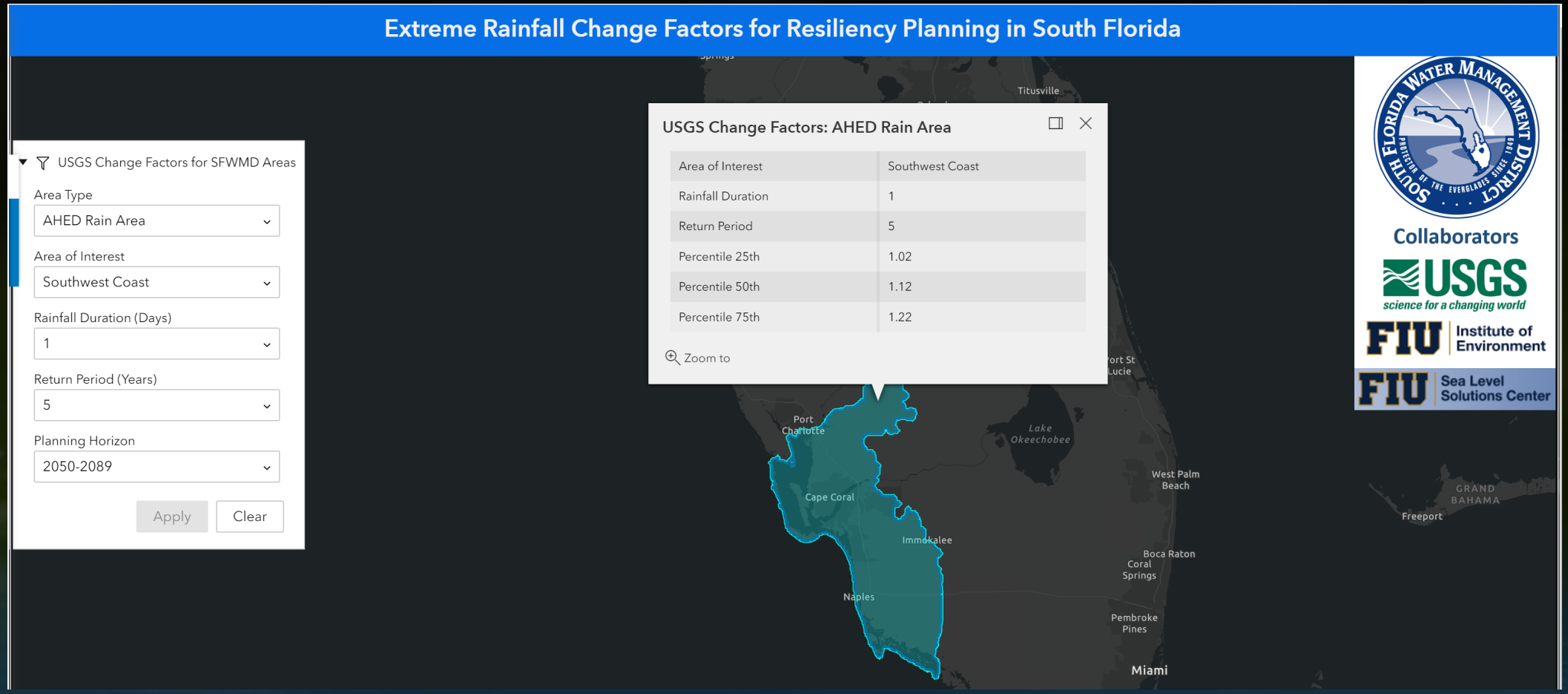
## Tidal Water Level at S28
## Daily and Annual Means

Station: S28_T Unit: ft NGVD29
4/15/1980 through 12/20/2023




P-Value: <0.001

# Projections – Extreme Rainfall




Web App Link:
Future Extreme Rainfall Change Factors for Flood Resiliency Planning in South Florida Web Application | Resilience Metrics Hub (arcgis.com)

Technical Memorandum Link:
https://apps.sfwmd.gov/sfwmd/gsdocs/TPubs/2022_SFWMD_TM_Adoption_of_Future_Extreme_Rainfall_Change_Facotrs_for_Resiliency_Planning_in_South_Florida_rev2.0.pdf

# Statewide Effort: Florida Flood Hub

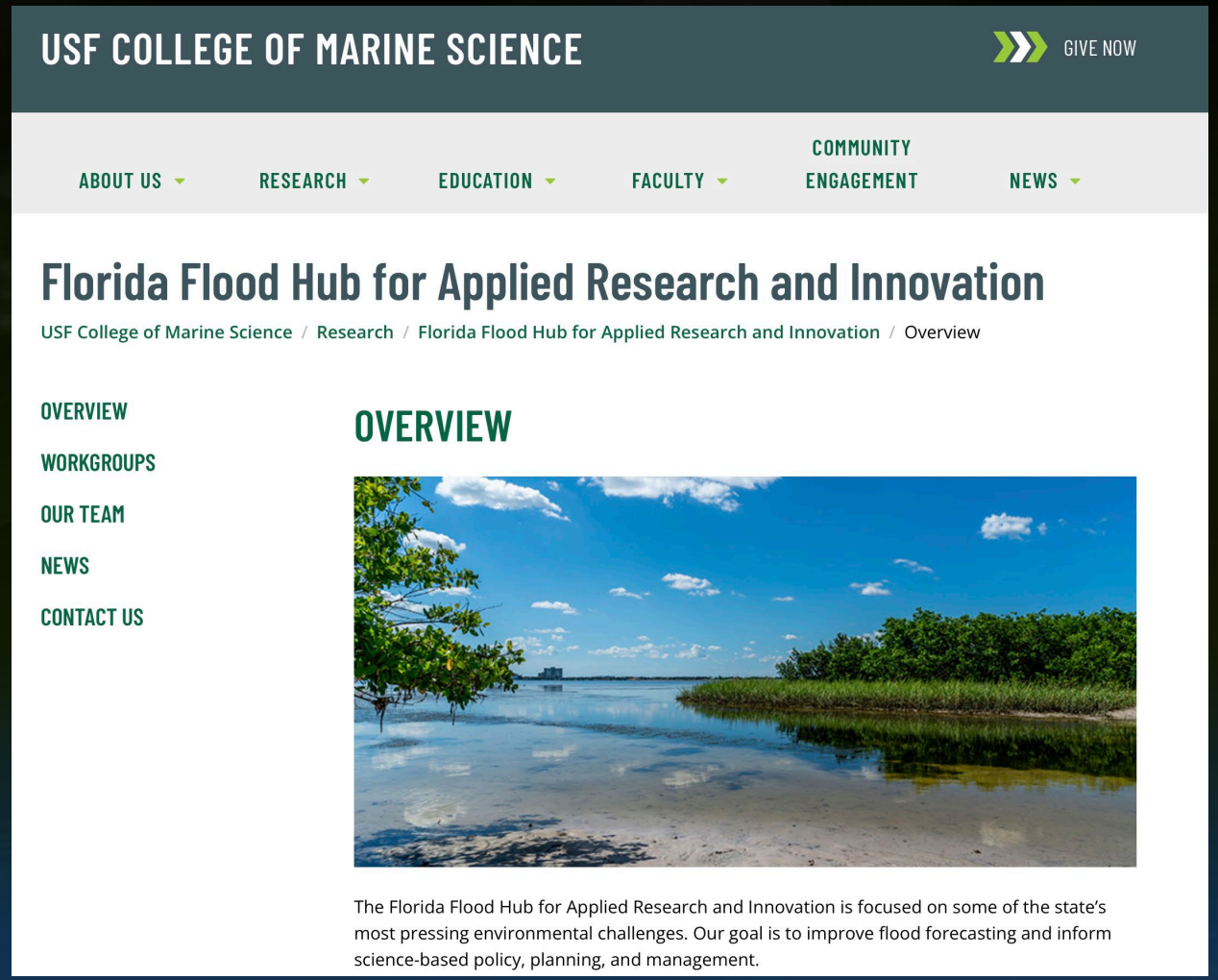
## SCIENTIFIC AND TECHNICAL WORKGROUPS

## SEA LEVEL RISE WORKGROUP

## RAINFALL WORKGROUP

- estimate changes to the depth, duration, and frequency of extreme rainfall events
- improve short-term forecasts and longer-term projections

*Irizarry-Ortiz, M.M., and Dixon, J., 2023, Change factors to derive projected future precipitation depth-duration-frequency (DDF) curves at 242 National Oceanic and Atmospheric Administration (NOAA) Atlas 14 stations in Florida (ver 1.1, September 2023): U.S. Geological Survey data release, https://doi.org/10.5066/P9Q3LEIL.*



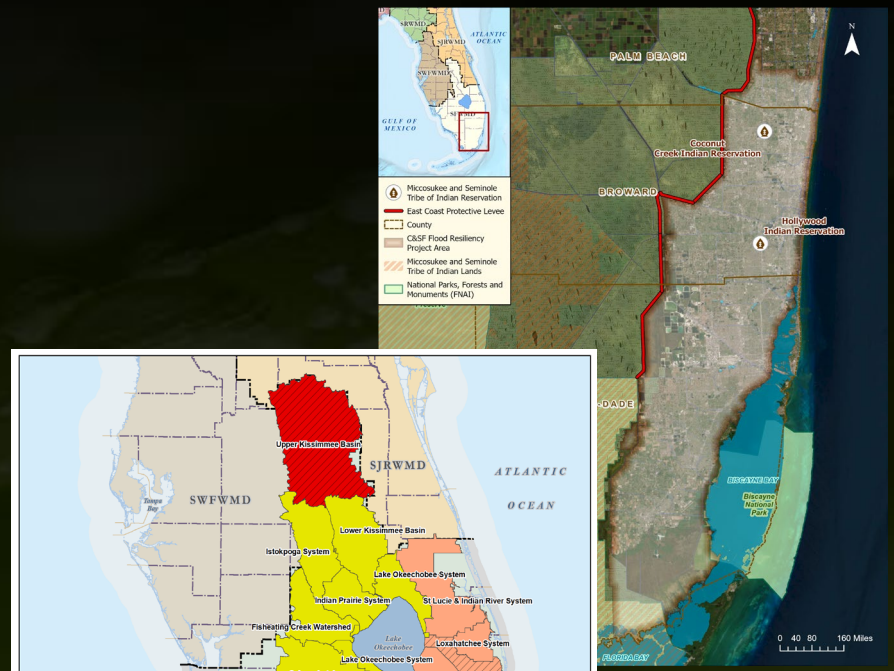
# Flood Resiliency Studies

## SFWMD

## FPLOS Program

- District's strategy for assessing the impacts of land development and changing climate on flood control infrastructure
- Evaluate current and future flood risks to communities in South Florida
- Support decision making on prioritizing and sequencing infrastructure investments

www.sfwmd.gov/our-work/flood-protection-level-service







## USACE/SFWMD

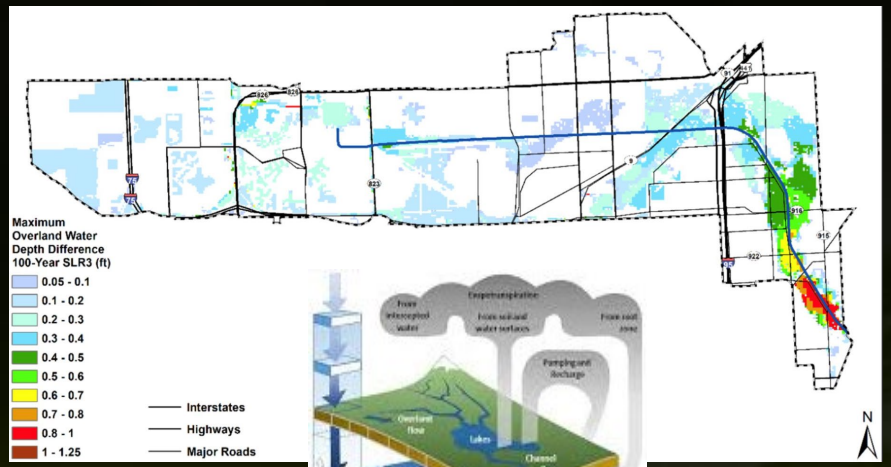
## C&SF Flood Resiliency Study

- Improve the C&SF Project and enhance SEFL Communities' quality of life
- Reduce flood risk and increase flood resiliency in high-risk urban watersheds in southeast Florida, while looking to enhance the overall benefits of the multipurpose C&SF Project
- Ongoing study phase: Round 1 Modeling – Future Without Conditions

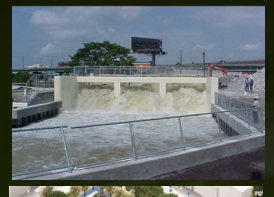
www.sfwmd.gov/C&SF

sfwmd.gov

# District Resiliency Planning



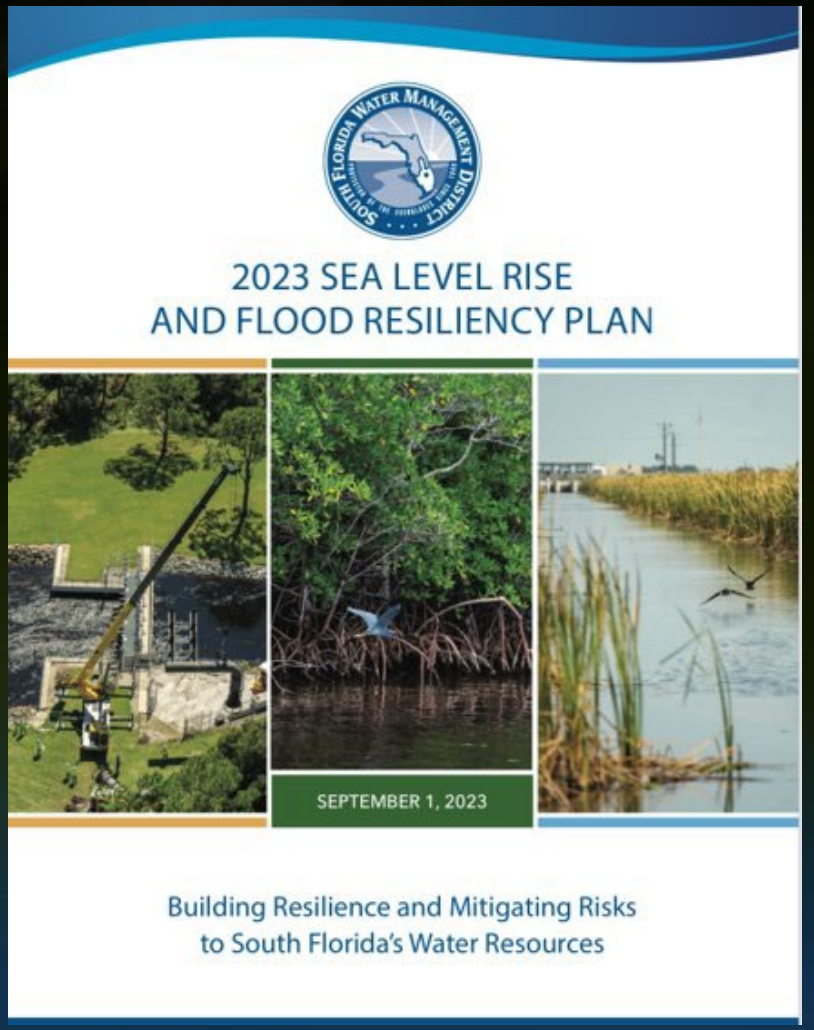






Reducing the risks of flooding, sea level rise and other climate impacts on water resources and increasing community and ecosystem resiliency in South Florida

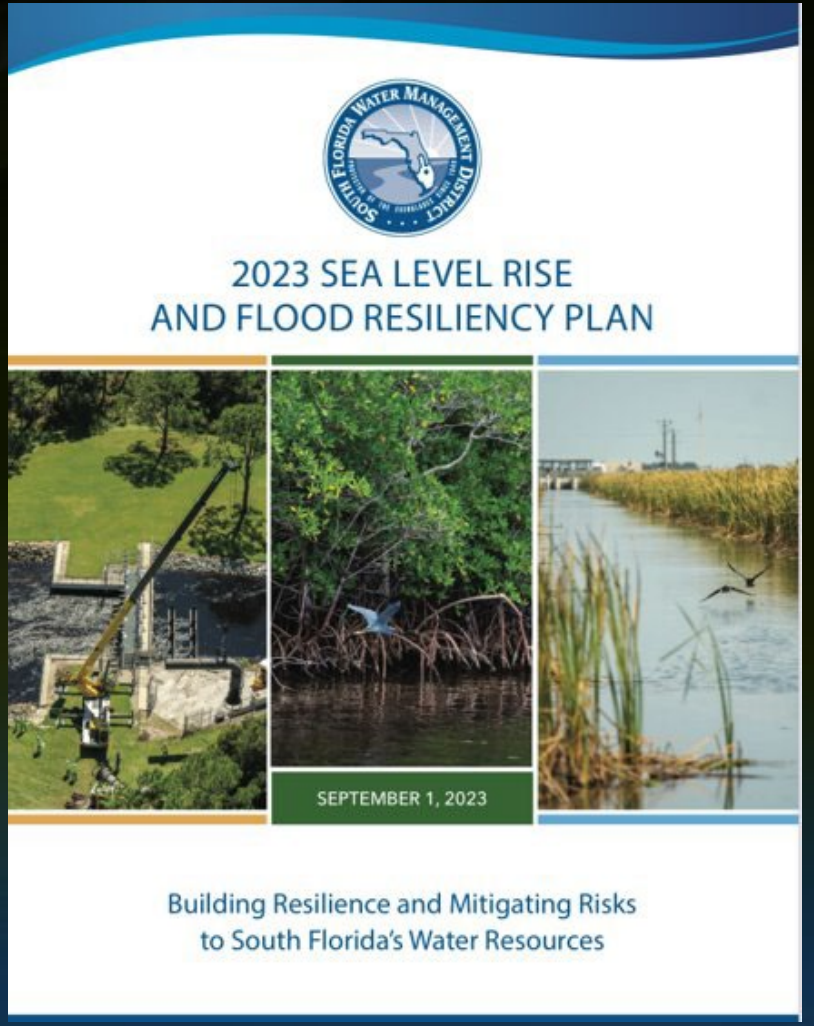





https://www.sfwmd.gov/our-work/sea-level-rise-and-flood-resiliency-plan

# District Resiliency Planning

- Risk Reduction / Effectiveness
- Implementation Resources
- Anticipated Future Conditions
- Critical Infrastructure and Disadvantaged Population Impacted
- Public Engagement & Leveraging Partners
- Ongoing Ecosystem Restoration Efforts
- Innovative Green/Nature-Based Solutions
- Offsetting New Energy Demands with Sustainable Sources





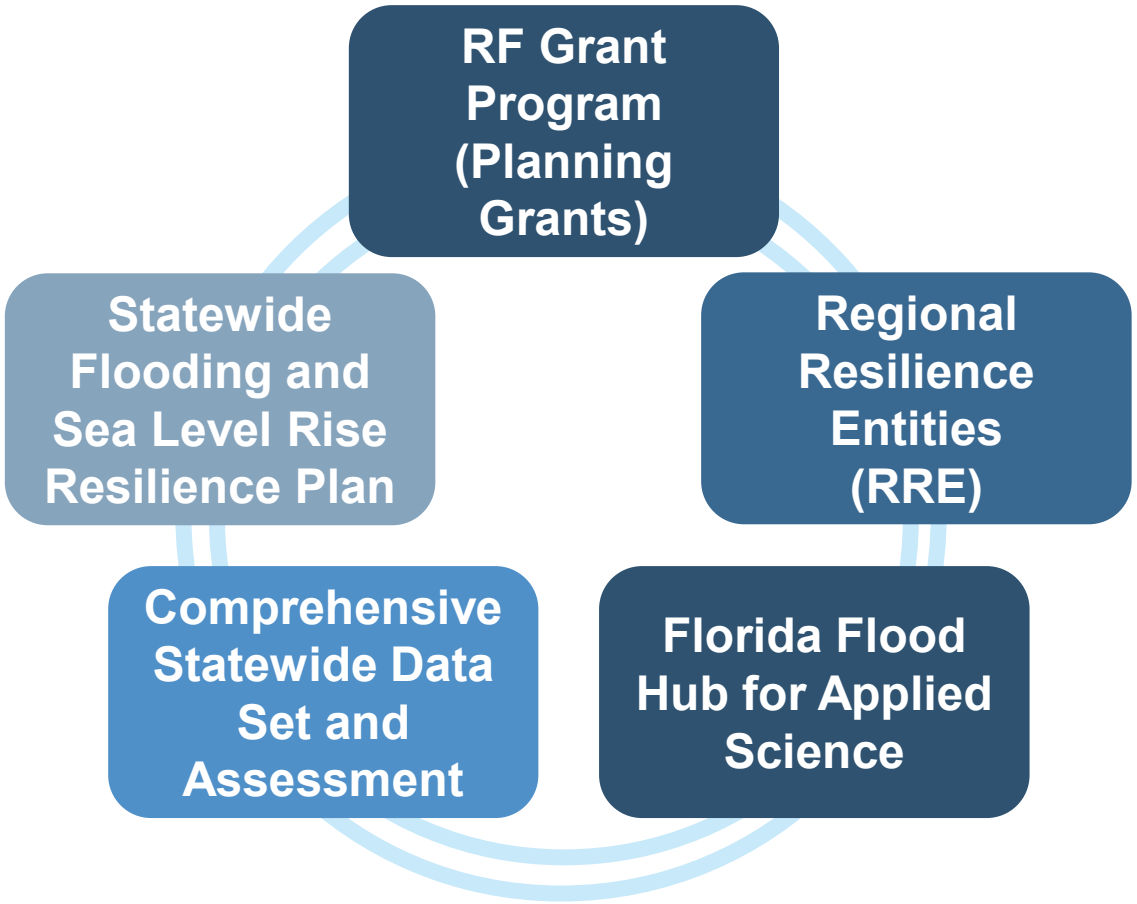

https://www.sfwmd.gov/our-work/sea-level-rise-and-flood-resiliency-plan

"…hard to recognize, but there used to be a canal somewhere in the foreground." – Merritt Canal Plugged

Ecosystem Restoration supports mitigation against sea level rise and other impacts from a changing climate.

CERP goals are aligned with the adaptation strategies needed to build Resiliency in South Florida.

# FDEP Resilient Florida




**"Always Ready Bill" Establishin the Program and 380.093, F.S.**

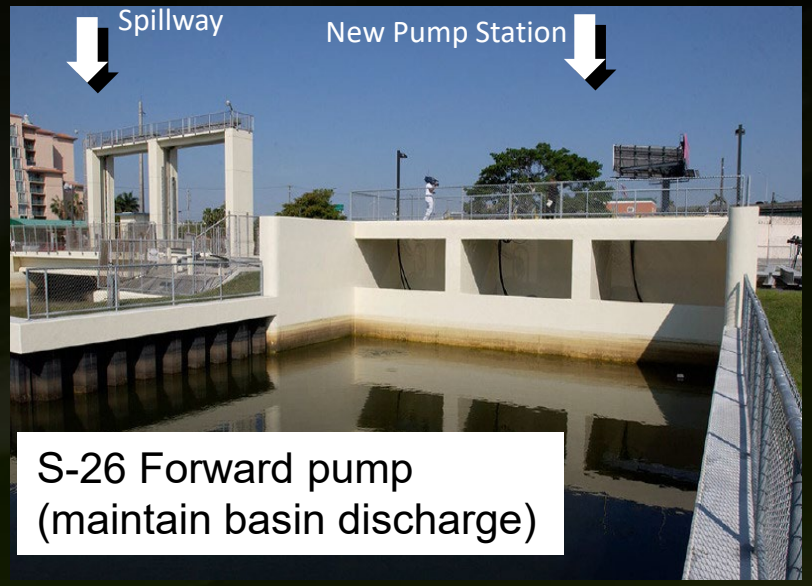
**Senate Bill 1954/2021 & House Bill 7019/2021**

***Unanimously passed i both chambers.***

Slide Courtesy: Eddy Bouza, Resilient Florida Program Director, FDEP

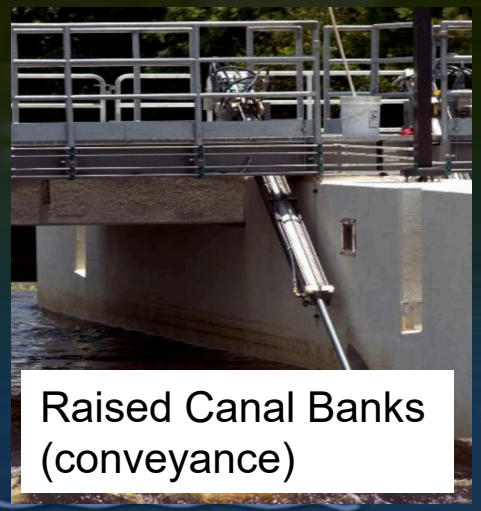
# Examples of Flood Mitigation Solutions

Seawall (protect against surge)




S-26 Forward pump (maintain basin discharge)

C-4 Emergency Detention Basin (increase basin storage)



Raised Canal Banks (conveyance)

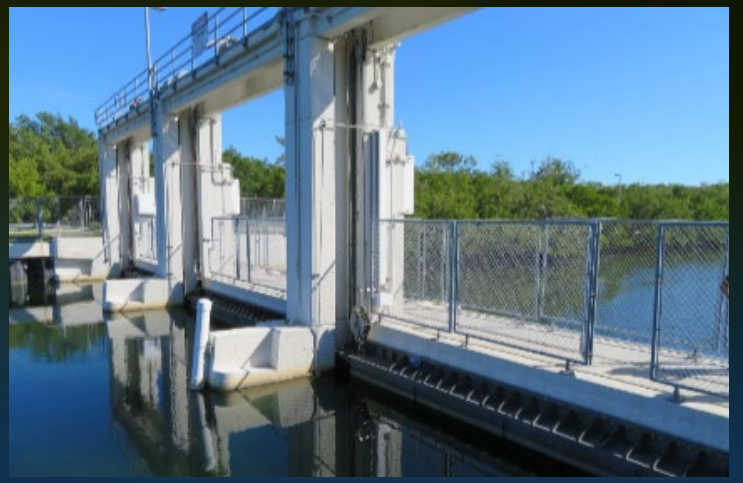
C-4 Floodwall

Flap Gate (enhance basin connectivity)

Convertible Flood Barrier (harden infrastructure)

# Moving into Implementation: Coastal Structures Hardening - Self Preservation Mode

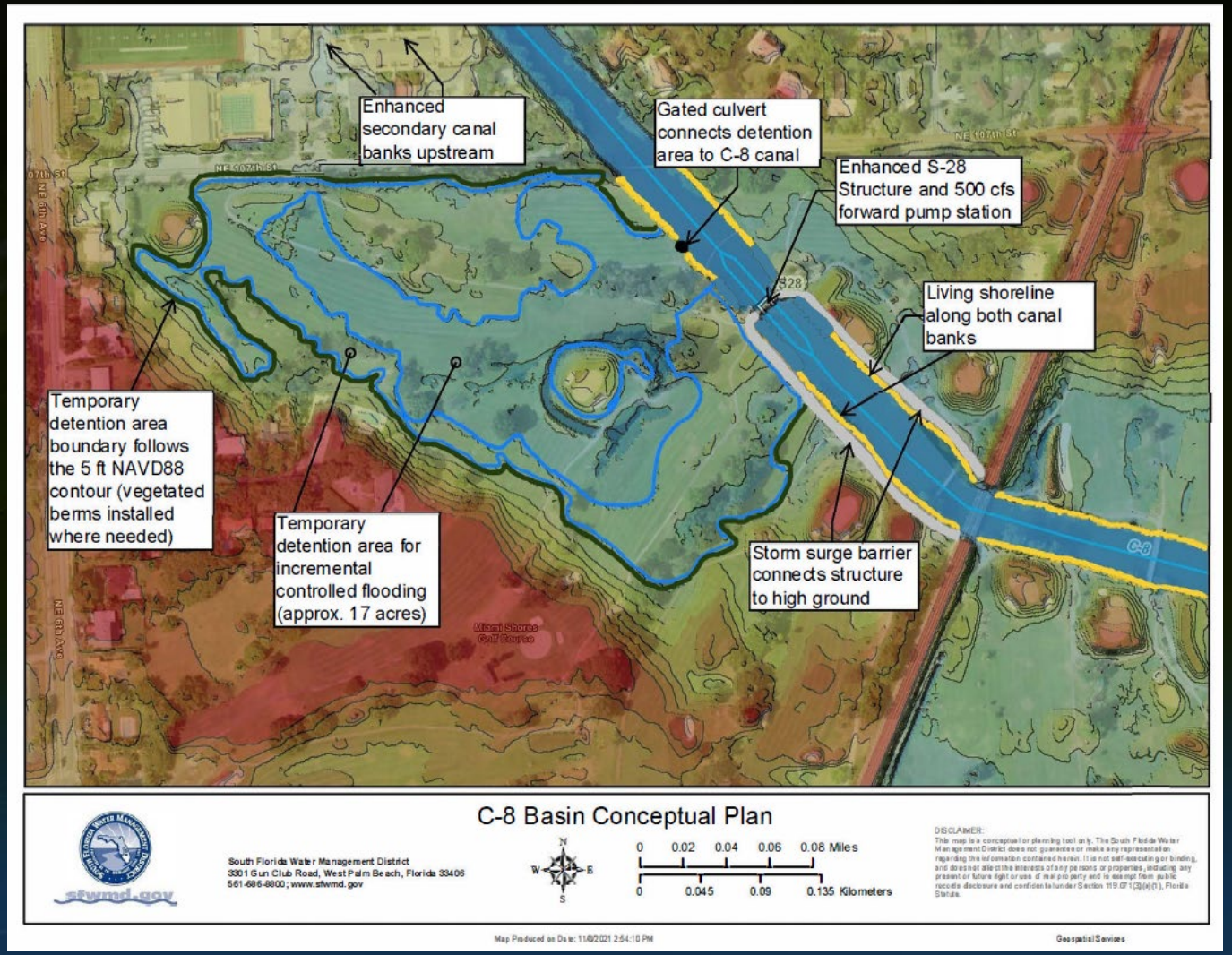
- Urgent need to optimize and harden operation of structures during storm surge and higher tide events, addressing Hurricane Ian/Irma/Matthew/Dorian gate-open lockouts
- Water Supply exposure to saltwater intrusion: wellfield protection zones vulnerability – **Regional Significant Assets**
- Exacerbated upstream flood risks (reflected in FEMA Coastal Zone A Maps)
- Short-term benefits: “self-preservation lockdown” system for several highly vulnerable critical structures
- Focus on enhancing electronic/mechanical components, extending top of gates and floodproofing of coastal structures
- FDEP – Resilient Florida is providing ~$6.3M, into a 50% cost-share agreement with SFWMD



| | | | | | |
|---|---|---|---|---|---|
| Additional Programing; storm resilient Back Up Controller instrument and platform | Install Backup Controller and other automation features | Modify gates for added high tide protection against reverse flow | Modify Structure by adding seals | Other automation and floodproofing needs | Control Panel Upgrades / Hardening |

# Moving into Implementation: C-8 Basin Resiliency

- Basinwide strategy to reduce flood risks due to sea-level rise and extreme rainfall; protect water resources and water supply sources
- Combination of Green and Gray Infrastruct.
- Increasing water management flexibility
- Restore S-28 Structure discharge capacity
- Increase the basin's flood protection level of service, including Miami Dade's secondary canal enhancements
- Enhance quality of life in the region
- Currently Advancing Design
- FDEM/FEMA BRIC Recom.: $50M Award for a 25%/75% cost share agreement



# C-9 Basin Resiliency

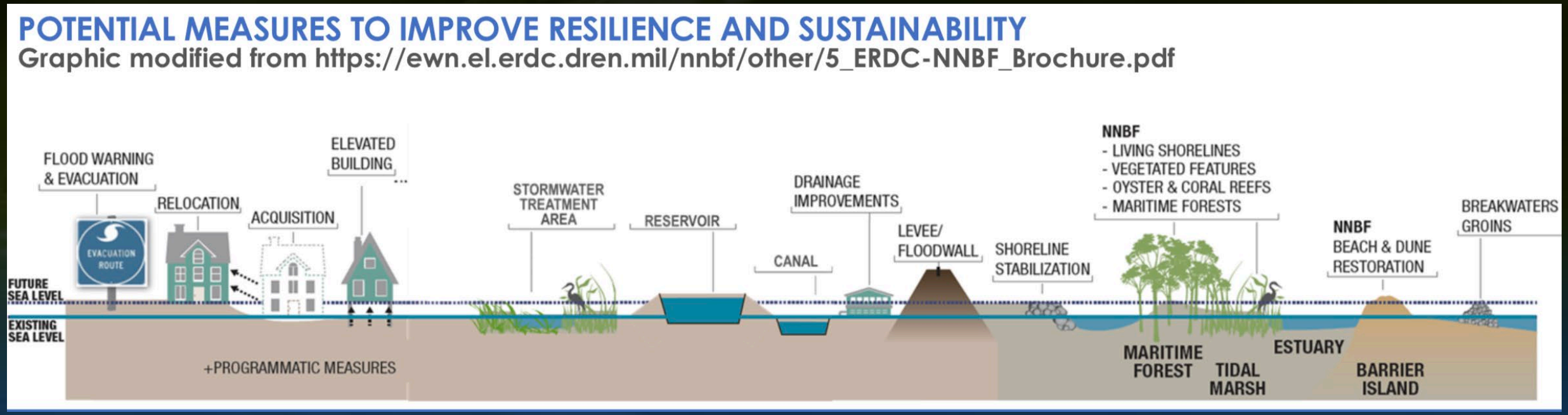
# Canal Enhancement Project

(conceptual design)

# Resiliency Initiatives Coordination

## Integrating Inland and Coastal Strategies

| Counties Projects | Local Municipalities Projects | USACE Studies/ Projects | Regional Climate Compacts | Other Partners |
|---|---|---|---|---|



# Thank You

**Carolina Maran, P.E., Ph.D., SFWMD, Chief of District Resiliency**
cmaran@sfwmd.gov
www.sfwmd.gov/resiliency

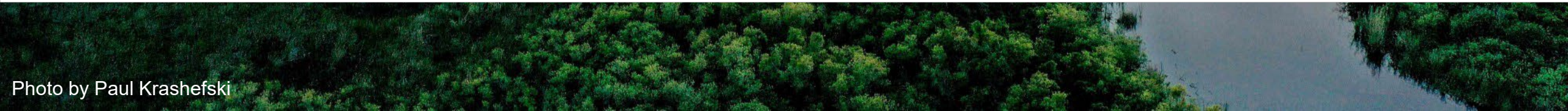


Photo by Paul Krashefski