

# CENTRAL AND SOUTHERN FLORIDA (C&SF) FLOOD RESILIENCY STUDY

Plan Formulation Team Agency Meeting  
H&H Modeling Discussion

22 September 2023

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# AGENDA

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## Study Overview

### H&H Modeling Tool and Input

- MIKE Model

- Land Use and Land Cover

- Canal Configuration and Operation

- Meteorologic Data

- Coastal Input

- Compound Flooding

## Climate Change Strategy

## H&H Schedule



# CENTRAL AND SOUTHERN FLORIDA (C&SF) FLOOD RESILIENCY (SECTION 216) STUDY OVERVIEW



## Authority

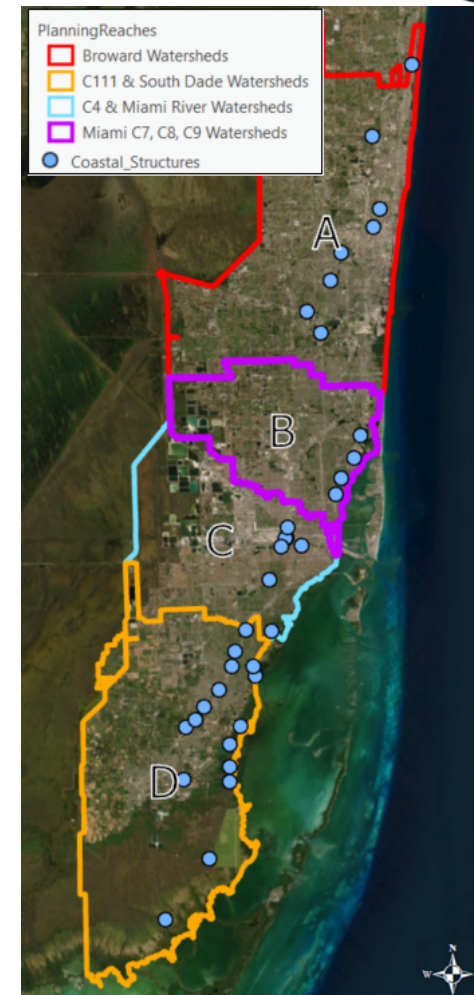
- Section 216 of the Flood Control Act of 1970 (33 U.S.C. 549a).

## Purpose

- The Study will identify flood risk management (FRM) recommendations to build flood resiliency, now and into the future, and reduce flood risks within the lower southeast coast of Florida in Palm Beach, Broward and Miami-Dade Counties.

## Focus

- Increasing the resilience and function of vulnerable coastal structures and the conveyance of the primary inflow canals



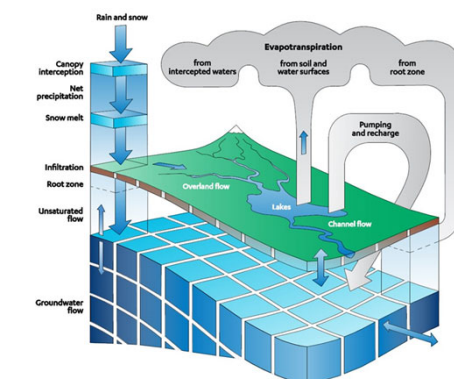
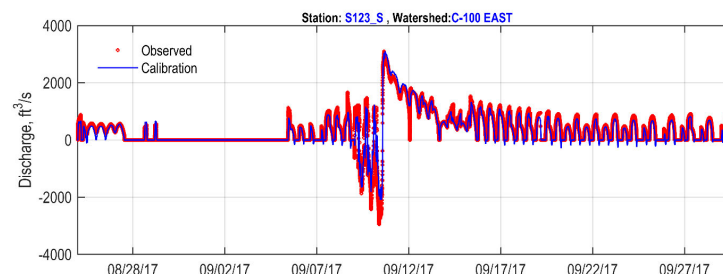
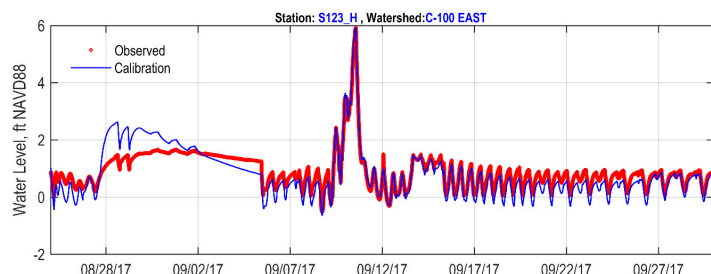
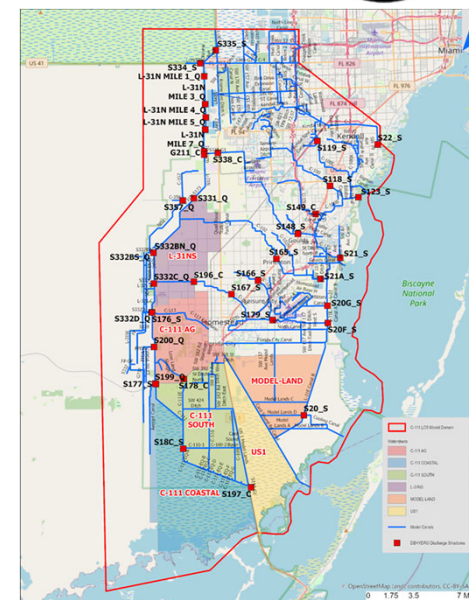


# H&H MODELING TOOL



The integrated/coupled surface-groundwater model MIKE SHE/MIKE Hydro (2022) will be used to simulate the hydraulics and hydrology for the project area. Models have been developed and calibrated under the SFWMD FPLOS program and Broward Resiliency but are being refined to meet the needs of the Section 216 study

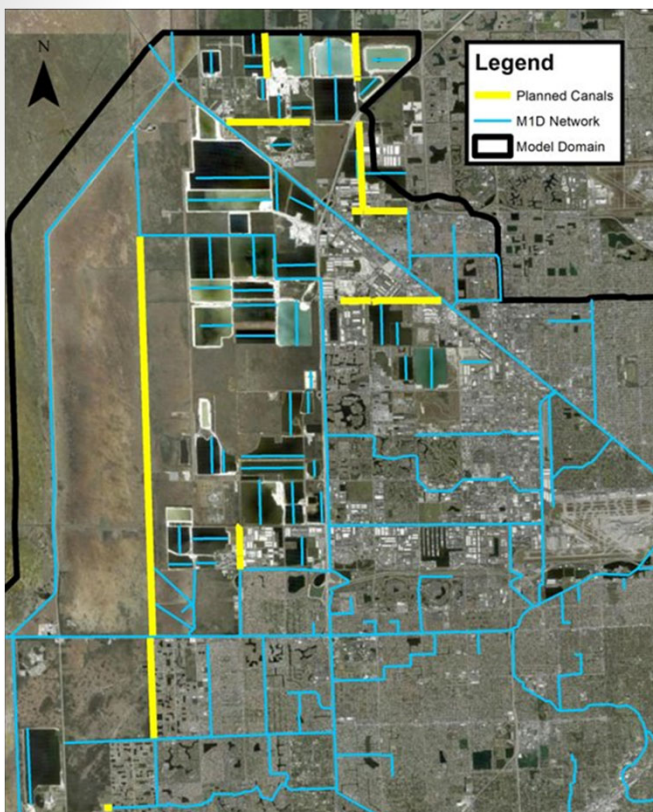
- Capability of conducting sub-regional scale simulations
- Able to conduct event simulations while including the effects of different tidal boundary conditions such as storm surge-influenced tailwater conditions with current and future sea-level rise scenarios
- Simulate surface water and groundwater interactions
  - Allows for the accounting of rising water tables as a result of rising sea levels
    - Reduced soil storage, Increased runoff during storms
- Simulate structure gate operating rules at the canal structures, incl. salinity operations







# H&H MODEL ADAPTATION



- MIKE SHE/HYDRO Models are being expanded to include the downstream tidal reaches to the intracoastal/bay
- Future land use will be updated with changes to parameterization in the model including topography where appropriate to the scale of the model
- The focus of this study is on the primary system with a high level of detail placed on the secondary/tertiary canal systems; new canals and proposed extensions from Miami Dade County as well as the Broward County Resiliency model additional canal network will be included

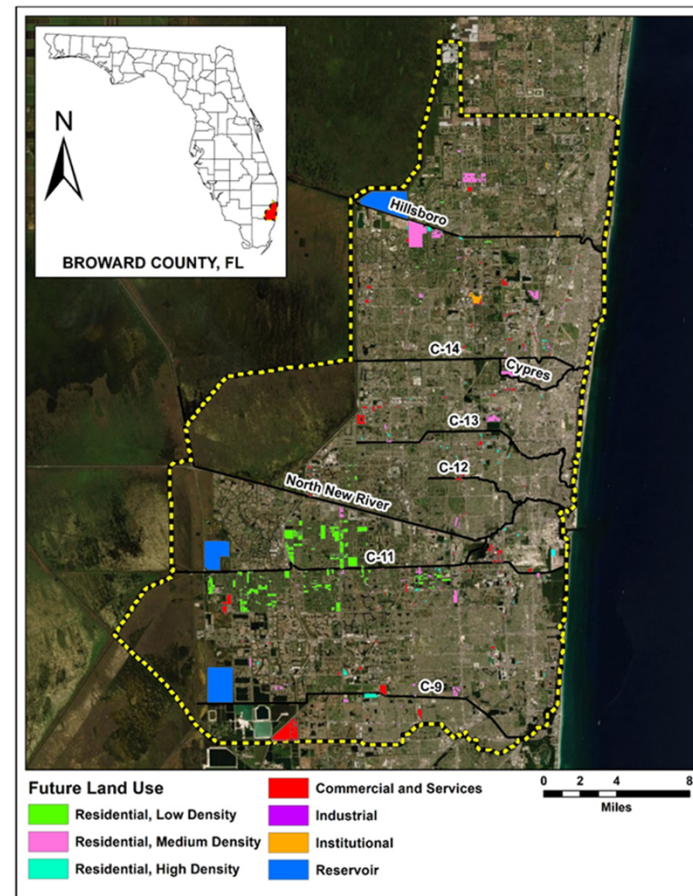


Figure 2.2-1: Areas of Future Land Use Change



# LAND USE AND LAND COVER



## Broward

- Combination of SFWMD 2014-2016 Land Use dataset and the 2019 Broward County Current Conditions model, which was developed from the SFWMD Land Use Land Cover data with minor changes based on satellite imagery from 2015 with 2018.
- The future conditions land use map was developed by modifying the current conditions land use map to reflect projected future changes. Areas of future change were identified by comparing undeveloped, agricultural, and low development areas (such as low density residential) to future conditions land use maps for 2040 from the Broward County Planning Council, Palm Beach County Planning, Zoning and Building Department, and Miami-Dade County (2030 condition).

## Miami-Dade

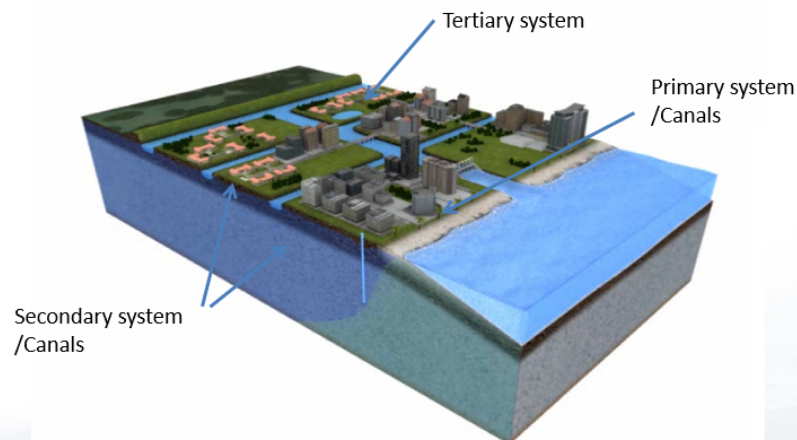
- Reach C land-use is based on the Florida Land Use Cover Classification System (FLUCCS) categorization codes for the model domain through the Florida Department of Environmental Protection (FDEP) for a range of years between 2017 and 2019. Reach B and D Land Use and Land Cover Classification use 2014-2016 Land Use dataset as prepared by the SFWMD.
- The future land use was informed by Miami-Dade County Future Land Use 2030.



# CANAL CONFIGURATION AND OPERATIONS



- The focus of this study is on the primary system with a high level of detail placed on the secondary/tertiary canal systems, as they are both a major source of discharge into the primary system and storage prior to discharging into the primary system.
- Assumes high rainfall and pre-storm drawdown operations
- Tidal structures assume salinity operations
- SFWMD structure flow parameters from SFWMD flow rating analysis reports and the SFWMD Atlas of Flow Computations (2015)







# CANAL CONFIGURATION AND OPERATIONS



## Broward

- C&SF system and operating rules for SFWMD structures from Eastern Broward County Water Control Operations Atlas updated Dec. 9, 2022
- Broward County and South Broward Drainage District structures operations from the 2019 Broward County Current Conditions model which has operating criteria inherited from the 2014 FEMA model and verified/updated based on stakeholder data and the SBDD Facilities Report, 2013, GIS database and Water Control Plan

## Miami-Dade

- C&SF system and operating rules for SFWMD structures from the Water Control Operations Atlas, North and Central Miami-Dade County, Part 2, May 2016, and South M-D, Part 2, May 2021.
- Miami Dade County Flood Mitigation Program, C-4 Basin Operating Plan (SFWMD, 2019) will be utilized to develop a simulated representation utilizing the “Logical Operands” parameterization scheme within the MIKE framework for operation of the C-4 Emergency Detention Basin



Water Control Operations Atlas: Eastern Broward County

Part 2: Structure Descriptions

South Florida Water Management District  
Hydrology and Hydraulics Bureau

August 12, 2021

Updated on December 9, 2022

This report supersedes DRC-231, Eastern Broward County Basin Atlas, November 1987.



Water Control Operations Atlas: North and Central Miami-Dade County – Part 2: Structure Descriptions

South Florida Water Management District  
Hydrology and Hydraulics Bureau

October 11, 2016 DRAFT

This report supersedes the 2015 Water Control Operations Atlas: Miami River System, as well as portions of DRC-218, East Dade County Basin Atlas, October 1987.







# METEOROLOGIC DATA

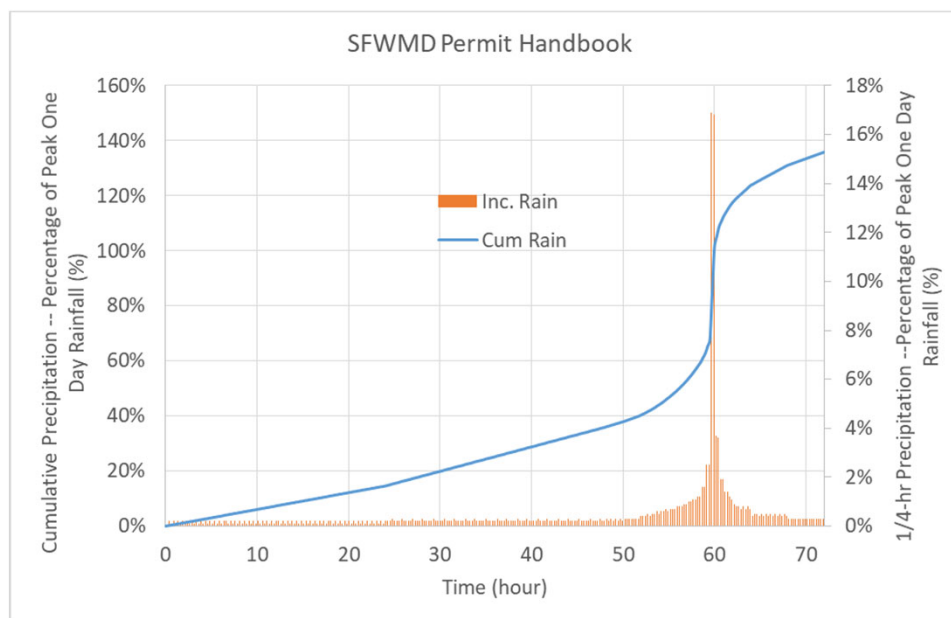


The design storm will use spatially distributed gridded input derived from NOAA Atlas 14 rainfall depths that are temporally distributed based on the SFWMD 3-day distribution.

- The 72-hour rainfall distribution is found in the District's Surface Water Environmental Resource Permit Manual (SFWMD, Environmental Resource Permit Applicant's Handbook Volume II (2016) – Frequency Analysis of One and Three Day Rainfall Maxima for central and southern Florida, Paul Trimble, October 1990).

| Time (hours) | Cumulative Percentage of Peak One Day Rainfall |
|--------------|--|
| 0            | 0  |
| 24           | 14.6   |
| 48           | 35.9   |
| 58           | 57.2   |
| 59           | 62.8   |
| 59.5         | 67.8   |
| 59.75        | 82.8   |
| 60           | 101.5  |
| 60.5         | 108.8  |
| 61           | 112.6  |
| 62           | 117.7  |
| 72           | 135.9  |

100% One Day Rainfall





# COASTAL DATA



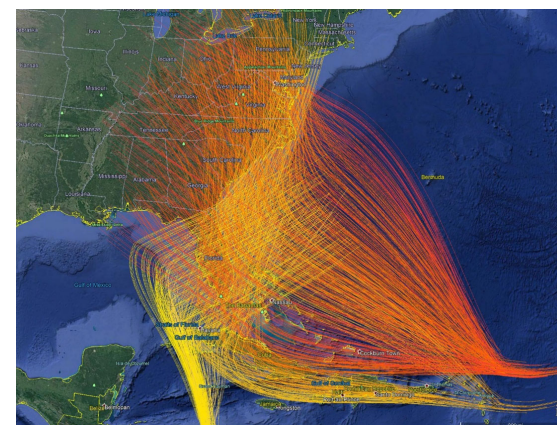
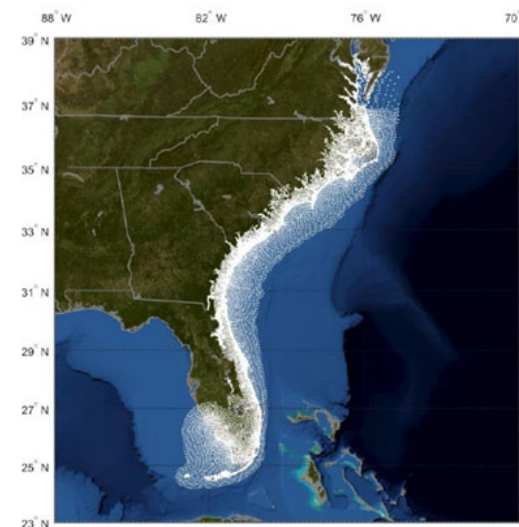
The South Atlantic Coastal Study (SACS) Coastal Hazard System (CHS) provides numerical and probabilistic modeling results for coastal forcings, including storm surge. The CHS stage-hydrographs will be applied as a downstream boundary condition within the MIKE model.

## CHS Savepoint & Storm Selection

- CHS savepoints were grouped based on peak still water levels to identify representative savepoints throughout each model reach.
- Tropical events were selected for various return periods

## Tidal Hydrograph Development

- Developed based on historic, predicted tides in the months of September through November to capture steric effects.
- Tides combined with storm data to create 28-day hydrographs





# COMPOUND FLOODING



## Compound Flooding

- The total water level (i.e., compound flooding) due to multiple flood sources, including rainfall runoff, groundwater and coastal forcings will be simulated
- H&H model simulations will include an array of rainfall and coastal return frequency events ranging from the 0.5 Annual Exceedance Probability (AEP) event to 0.002 AEP (2-year through 500-year).
- No formulation of risk reduction features will be performed for coastal surge propagation inland, however it is important to identify and understand the risk of surge events that limits primary system design and operation.
- H&H simulations will align the peak of coastal event with the peak of rainfall.



# CLIMATE CHANGE STRATEGY

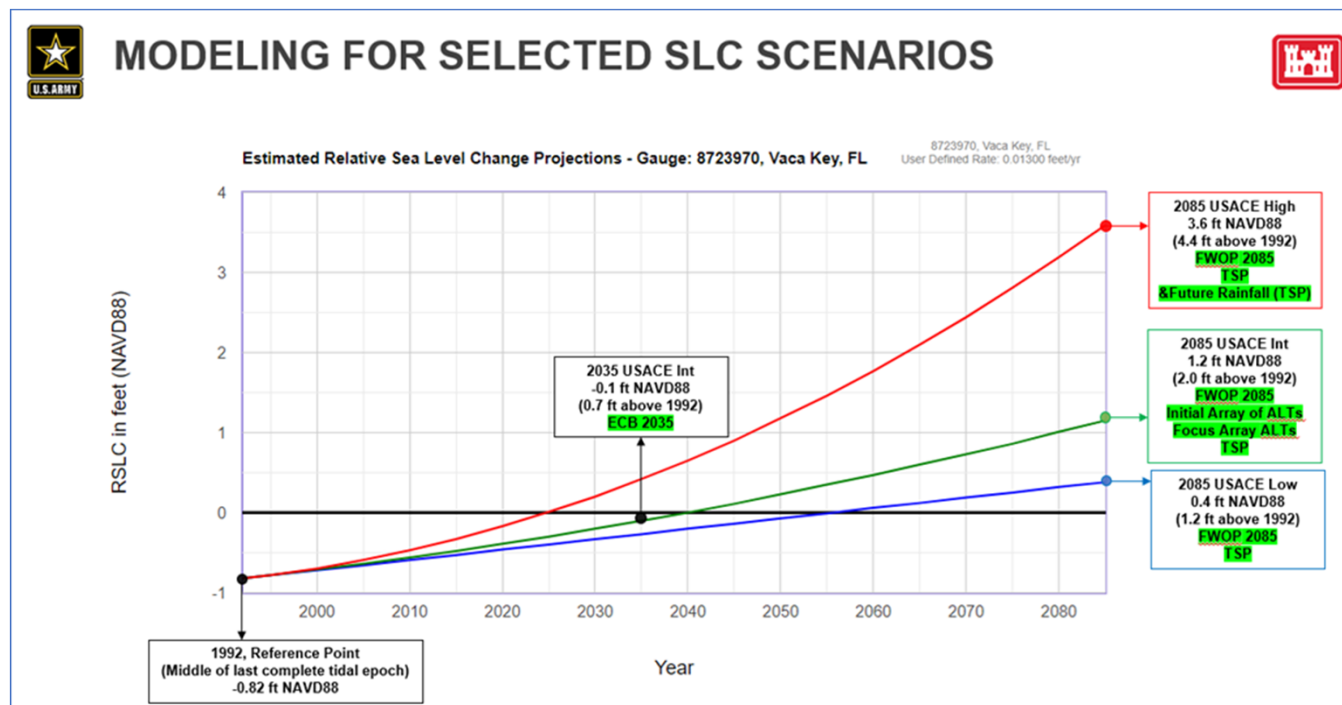


## Inland Hydrology

- Future Extreme Rainfall: Existing USGS/SFWMD study will be used as a sensitivity run for the tentatively selected plan.
- Potential to use in adaptation strategy

## Sea Level Change

- Vaca Key gauge
- SLC will be incorporated into the modeling as a boundary condition. The Future conditions will assess project performance for the Low, Int., and High curves for 2085







# H&H SCHEDULE



| <u>Task</u>  | <u>Completion Date</u> |
|--|------------------------|
| MIKE Model Modifications for Future without project (FWOP) and Base Conditions | NOV 2023               |
| Production runs for Compound Flooding scenarios for FWOP and Base              | FEB 2024               |
| Coordinate Findings with Stakeholders, Agency, Public                          | APR 2024               |
| Development of Initial Array of Alternatives                                   | MAY 2024               |
| Production runs for Future With Project (FWP) Alternatives                     | NOV 2024               |



# C&SF FLOOD RESILIENCY STUDY

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## Comments and Questions

Amanda Bredesen, P.E., Water Resources Lead  
[Amanda.T.Bredesen@usace.army.mil](mailto:Amanda.T.Bredesen@usace.army.mil)

Carol Ballard, P.E., CFM, Modeling Lead  
[cballard@sfwmd.gov](mailto:cballard@sfwmd.gov)

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