South Florida Water Management District

FLOOD PROTECTION LEVEL OF SERVICE (FPLOS) PROGRAM C-7 BASINS FPLOS ADAPTATION AND MITIGATION PLANNING PROJECT STUDY WORKSHOP
AGENDA

April 9, 2024
9:30 AM
Zoom Registration Link: https://sfwmd.link/3TzSddc

FINAL

1. Opening Remarks - Ana Carolina Coelho Maran, Ph.D., P.E., Chief of District Resiliency, SFWMD

2. FPLOS Program and C-7 Basin Study Overview - Hongying Zhao, Ph.D., P.E., Flood Protection Level of Service Program Manager, SFWMD

3. Municipal Efforts and Survey Results - Lynette Cardoch, Ph.D., Director of Resilience & Adaptation, Moffatt & Nichol

4. C-7 Basin Phase II Study Activities and Results - Michael DelCharco, P.E., Vice President of Water Resources,Taylor Engineering, Inc., and Joseph Wilder, P.E, Water Resources Engineer,Taylor Engineering, Inc.

5. Q&A

6. Project Next Steps - Ann Springston, Project Manager, SFWMD

7. Closing Remarks - Matahel Ansar, Ph.D., P.E., Administrator of Applied Hydraulics Section, SFWMD

8. Adjourn

Final Presentations

Agenda Item Background:

Final Presentations

C-7 Watershed
Flood Protection Level of Service (FPLOS)

Adaptation and Mitigation Planning Projects Study Workshop

April 9, 2024

Housekeeping

- This meeting is being recorded and livestreamed.
- There will be opportunities for questions throughout today's discussion.
  - Please use the 'raise hand' function at the bottom of your screen and we will ask you to unmute.

Workshop Objectives and Agenda

Workshop Objectives

To collaborate on developing basin-wide flood adaptation strategies and mitigation projects for the C-7 watershed, aimed at enhancing flood resilience in preparation for future conditions, including sea level rise, climate change, land use changes, and heightened groundwater levels.

Agenda Review

- SFWMD Opening Remarks
- FPLOS Program and C-7 Project Overview
- Survey Results and Municipal Efforts
- C-7 Activities and Results to Date
- Audience Questions and Discussion
- Project Next Steps
- Closing Comments

Project Team

SFWMD

- Ann Springston, PE
- Hongying Zhao, PhD, PE
- Carolina Maran, PhD, PE
- Francisco Pena, PhD
- Nicole Cortez
- Supported by other SFWMD staff

Consultants

- Taylor Engineering
  - Michael DelCharco, PE
  - Joe Wilder, P.E.
  - Ashley Lein, E.I.
- Anclote Consulting
  - John Loper, P.E.
- Moffatt and Nichol
  - Lynette Cardoch, PhD
- Nova Consulting
  - Peter Sahwell

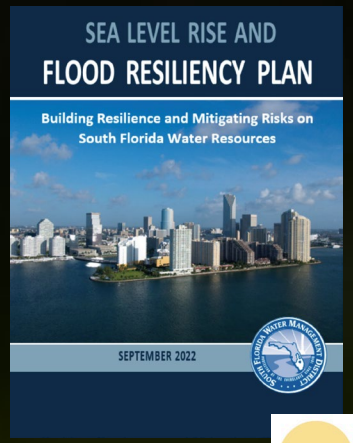
Presenter:

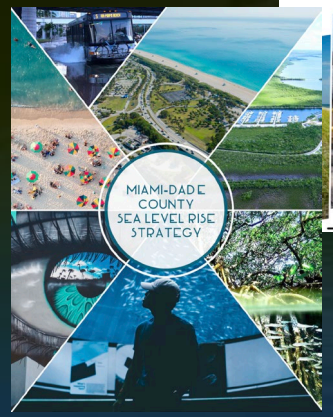
Lynette Cardoch

Welcome
Context and Big Picture

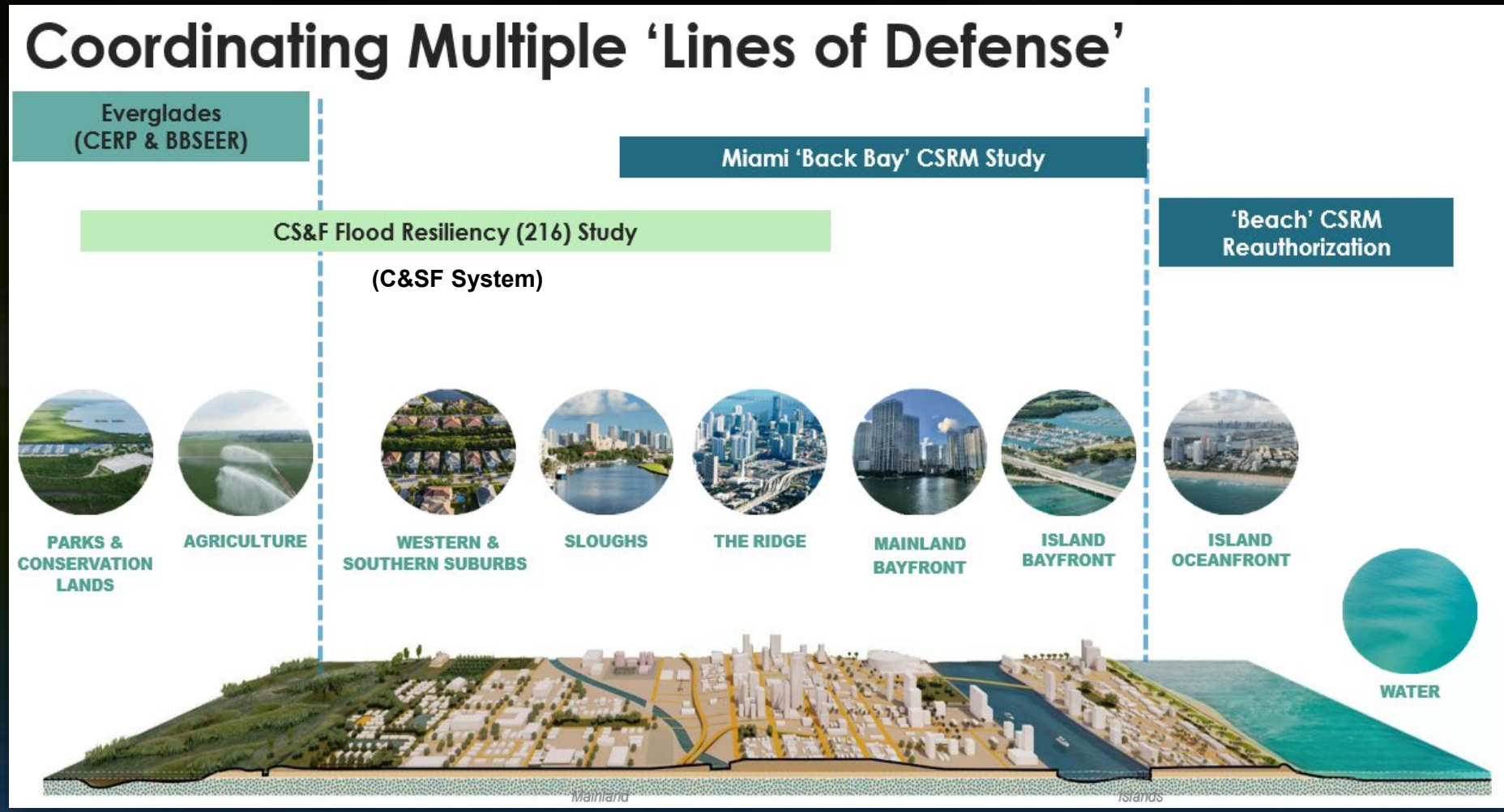
Carolina Maran, PhD, PE
District Resiliency Officer
South Florida Water Management District

South Florida's Studies Integration





Source: Image presented by Miami-Dade County on January 11, 2023, C&SF Flood Resiliency Study Planning Charrette



Presenter: Carolina Maran

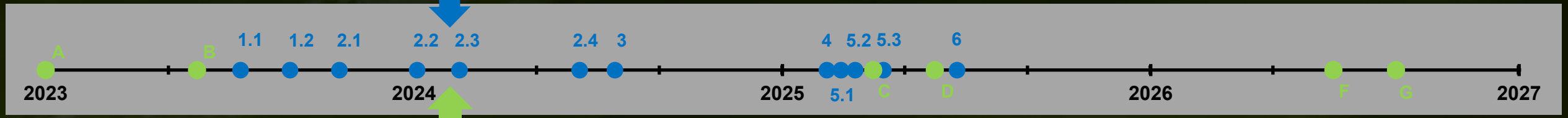
C-7 FPLOS Phase II Study & C&SF Flood Resiliency Study

Goals, Schedule and Next Steps

C-7 FPLOS Phase II Study

- **Basinwide Assessment** – include primary and secondary system flood protection infrastructure
- **Broader selection of mitigation and adaptation alternatives**, addressing compound flood drivers and including inland storage
- Performance Metrics: level of service assessment (canal, structure discharges and levels, overland extent/duration), and flood damage BCA

Task 1	Task 2	Task 3	Task 4	Task 5	Task 6
Alternative Mitigation Plans & Project Workplan 1.1 Workshop 1.2 Project Workplan	**H&H Evaluation for Mitigation Projects** 2.1 Model Tool, Model Development, Cal/Val 2.2 Model set-up & Base Conditions 2.3 FWOP Model set-up 2.4 FWP Model set-up	**Cost Estimates and Expected Annual Damages** 3. Mitigation and Adaptation Alternatives Cost estimates & Flood Damage Assessment	**Tentatively Selected Plan & Projects Sequencing** 4. TSP Project Selection & Sequence H&H Workplan & Modeling results Report & Models	**Dynamic Adaptation Pathway Planning (DAPP) and Associated Impacts** 5.1 DAPP results & Workshop 5.2 WQ Report 5.3 Cascading Impact Assessment Coordination	**Final Report**



PMP | SCOPING | FORMULATION | ALTERNATIVE EVALUATION | DOCUMENTATION & DECISION

Milestone A	Milestone B	Milestone C	Milestone D	Milestone E	Milestone F	Milestone G
Scoping Meetings	Alternatives Milestone Meeting (AMM)	Tentatively Selected Plan (TSP)	Draft Integrated Report Release	Agency Decision Milestone (TBC)	Final Integrated Report Release	Chief's Report

C&SF Flood Resiliency Study (Section 216)

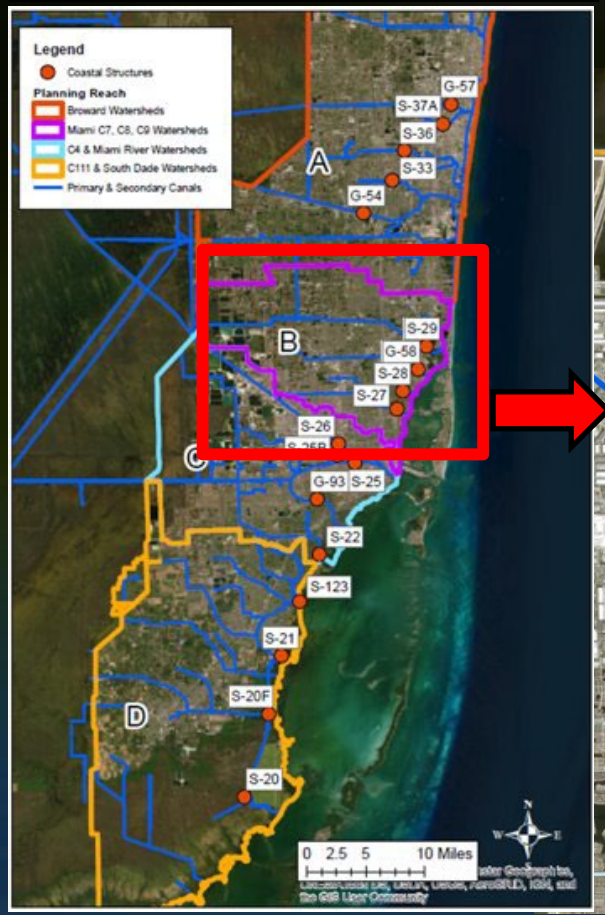
- Focus on **highly vulnerable infrastructure** along primary C&SF system (coastal structure and canal enhancement)
- Mitigation and adaptation alternatives within **Flood Risk Management authority** (mostly rainfall driven)
- Performance Metrics: National & Regional Economic Development (NED, RED), Environmental Quality (EQ), Other Social Effects (OSE)

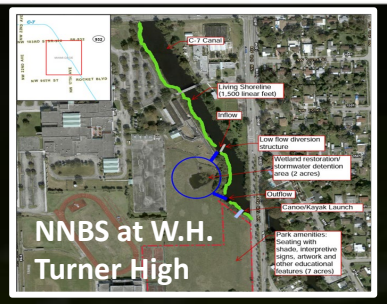
Presenter: Carolina Maran

C-7 FPLOS Phase II Study & C&SF Flood Resiliency Study

C&SF Resilience Study

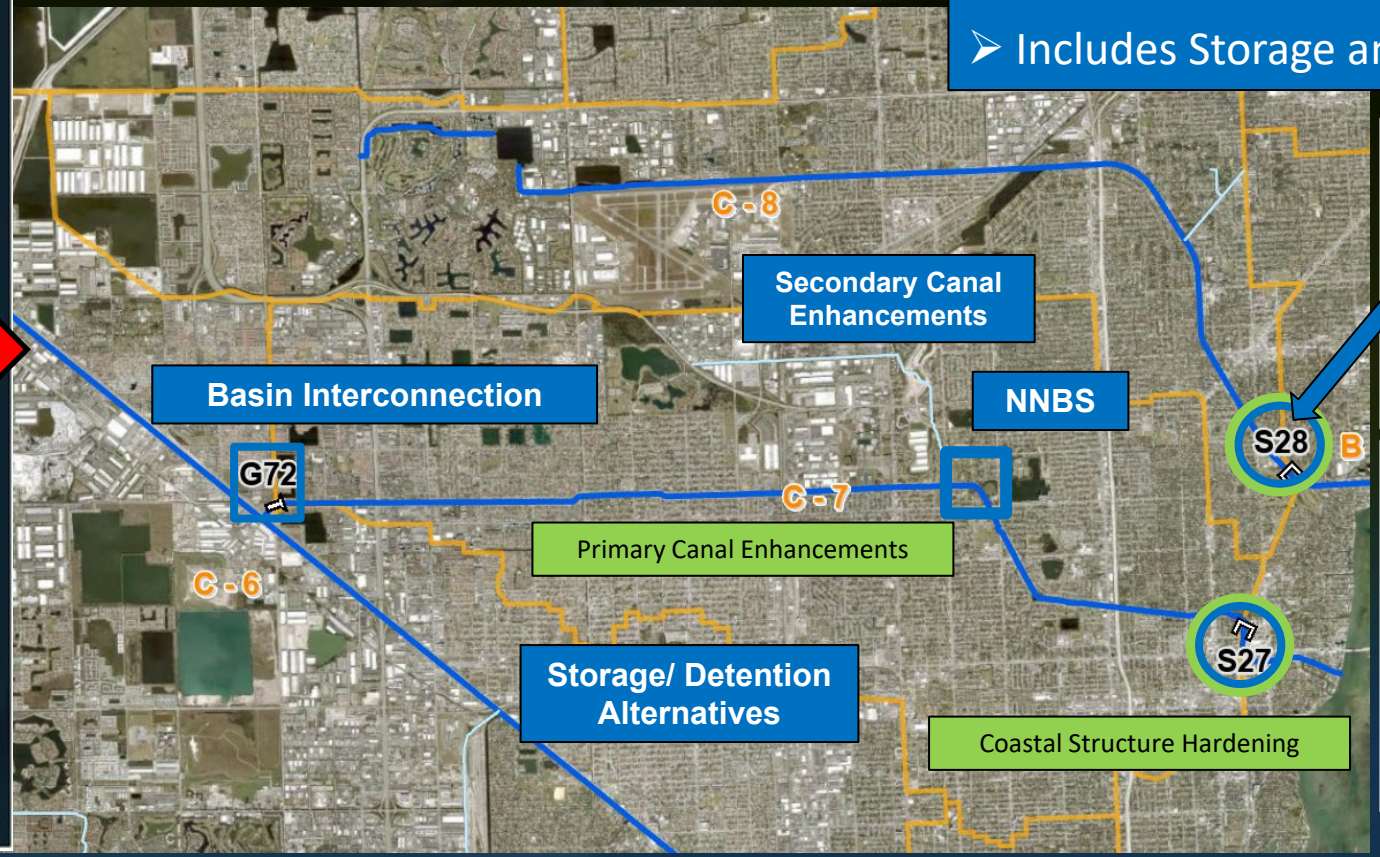
- Primary Canals
- Primary Structures

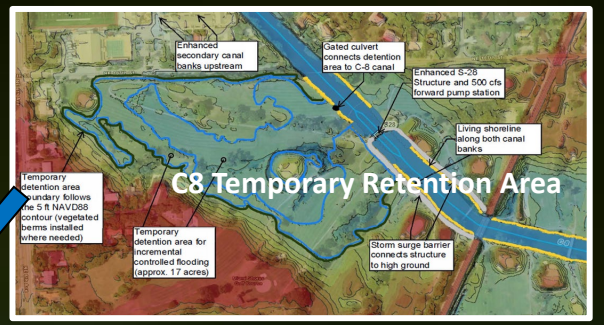




C7 Adaptation and Mitigation Study (2023 –2025)

- Develop comprehensive basin-wide strategies
- Includes projects from regional and local level
- Includes GI / Natural/Nature Based Solutions
- Includes Storage and Conveyance





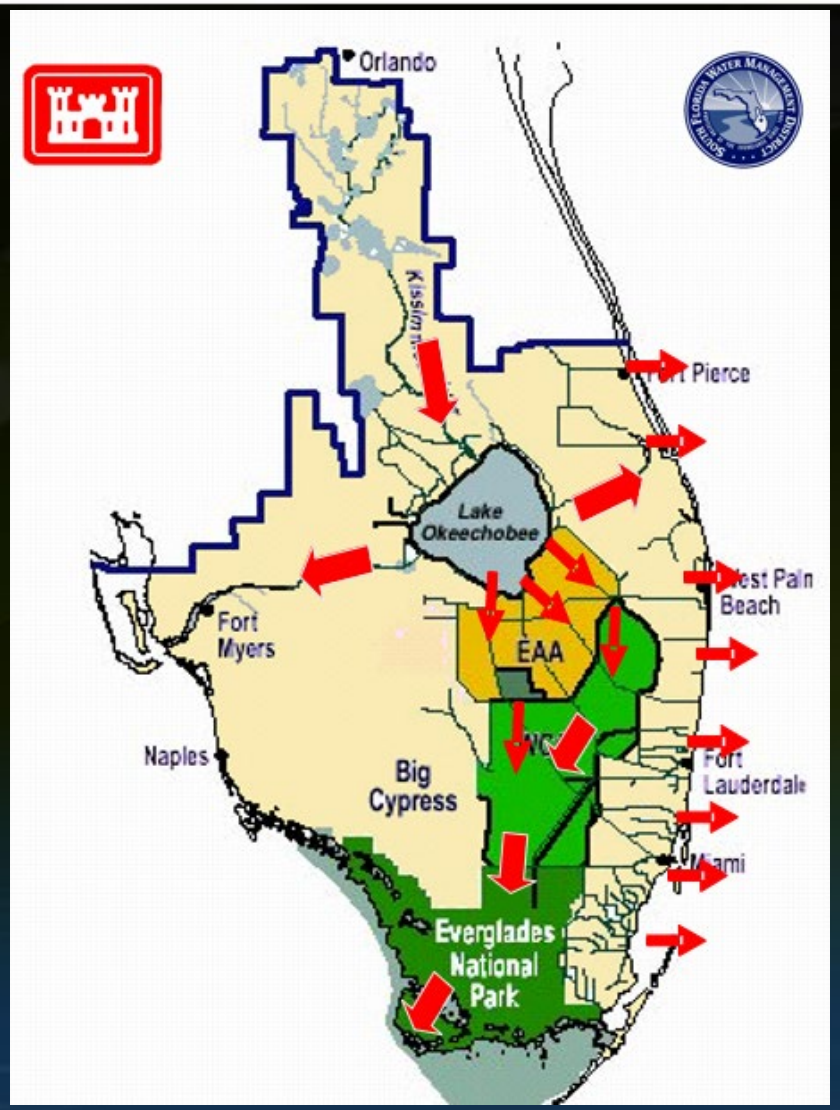
Flood Protection Level of Service Program and Building Flood Resilience for C-7 Watershed

A Systematic Approach for Infrastructure Readiness

Hongying Zhao, PhD, PE,
FPLOS Program Manager, Hydrology and Hydraulics Bureau
South Florida Water Management District

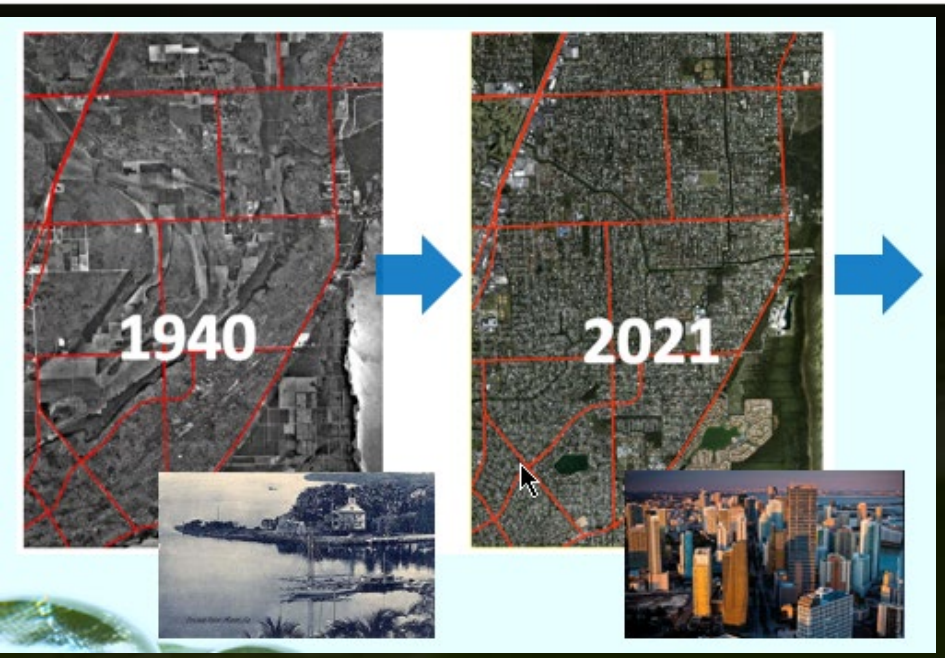
Water Management System

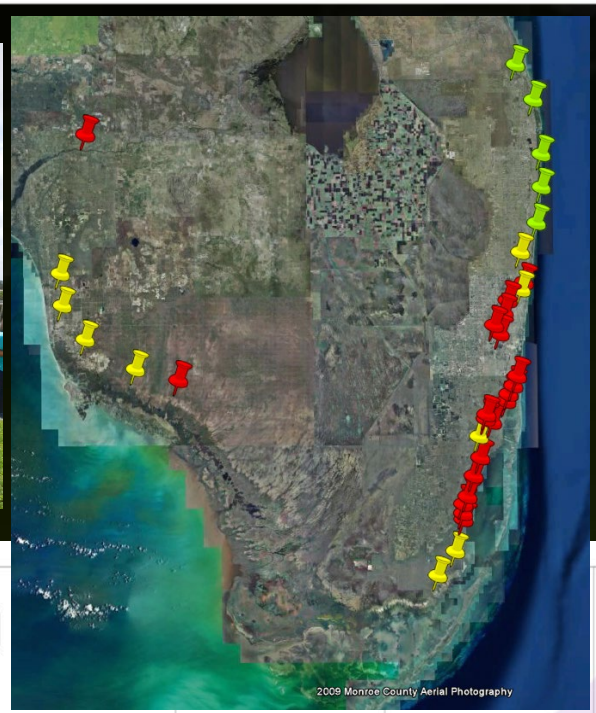
- 2,200+ miles of canals
- 2,100+ miles of levees
- 160 major drainage basins
- 1,469+ water control **structures**
- Including 89 pumping stations
- 60,000+ acres regional Stormwater Treatment Areas
- Lake Okeechobee: 450,000+ acres
- Water Conservation Areas: 959,000+ acres

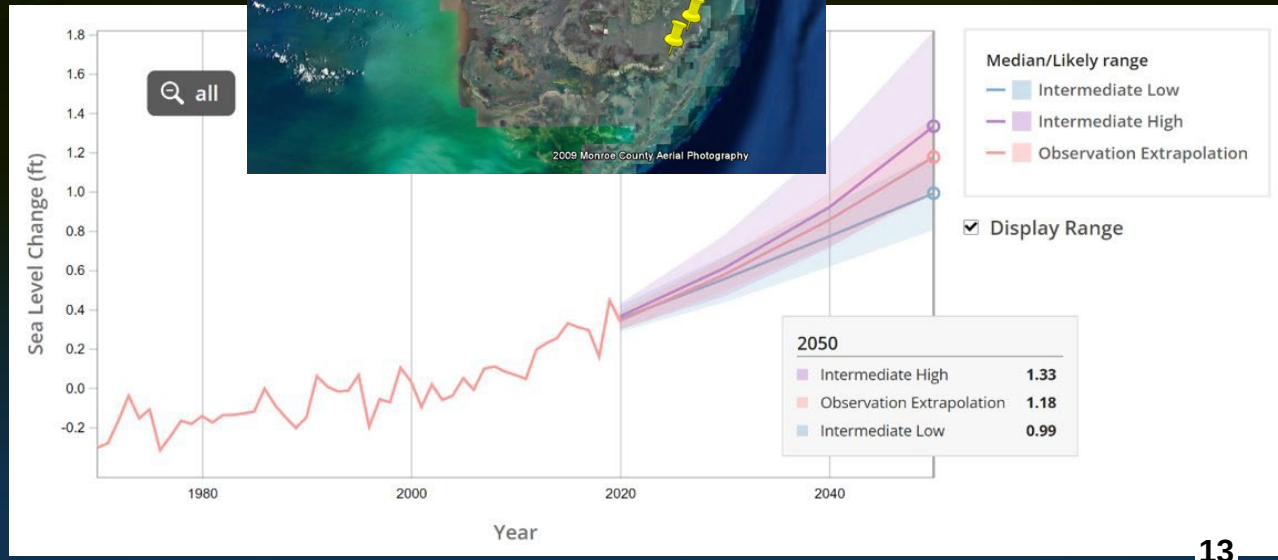


Presenter:
Hongying Zhao

Changing Conditions Altering System Performance







- High Urbanization
- Aging Infrastructure
- Sea Level Rise and Other Climate Change Impacts
- Vulnerable gravity coastal structures

Presenter: Hongying Zhao

Flood Protection Level of Service Program

District's strategy for assessing and addressing the impacts of urban development and changing climate patterns on flood control

Phase 1
Assessment

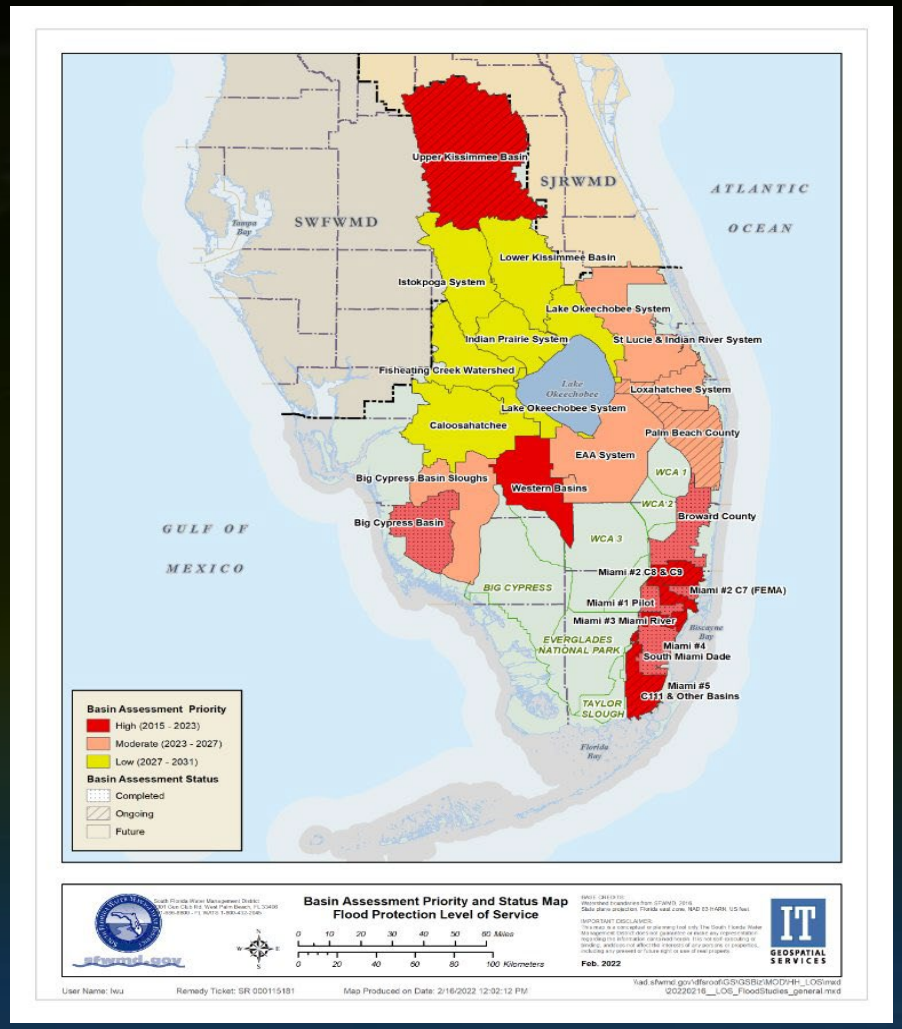
- Focus on Flood Control Assets in Primary system
- Identify flood vulnerable assets and regions

Phase 2
Mitigation and Adaptation Planning

- Focus on Primary, Secondary and Tertiary systems
- Collaboratively identify projects, operations or regulations to meet flood control needs

Phase 3
Implementation

- Design, permit and build identified projects to achieve resilient flood protection goals, integrated into the Sea Level and Flood Resiliency Plan



SFWMD.gov/FPLOS

Presenter: Hongying Zhao

C-7 – Little River Watershed

- Communities: Village of EL Portal, City of Hialeah, Miami shores Village, City of Miami, North Miami Beach, City Opa-Locka
- 254,000 residents (2022 ACS Census Tracts), additional visitors and workers
- 118+ critical assets (airport, fire stations, hazardous Waste Transport facility, hospital/medical facilities, public school, law enforcement center, etc.)
- Disadvantaged communities under the CEQ CEJST Climate Change Category: 46% of population
- CDC's Social Vulnerability Index (SVI):
  - 67%: 0.8 or higher (highest ranking)
  - 27%: 0.6 - 0.8 (second highest ranking)

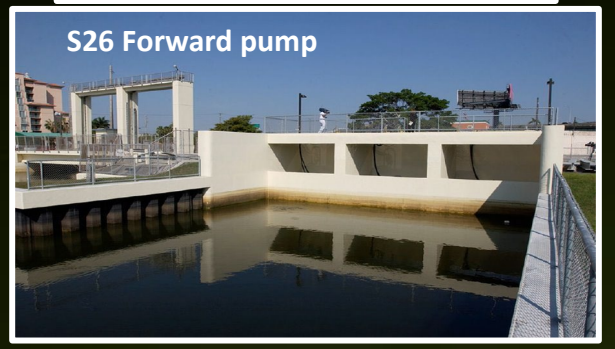

Hialeah

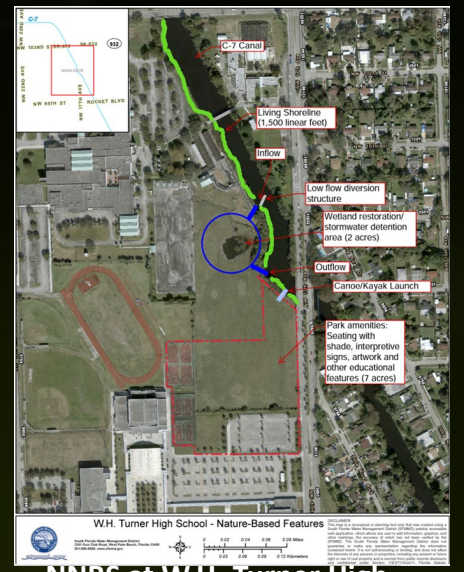
Opa-Locka

Presenter: Hongying Zhao

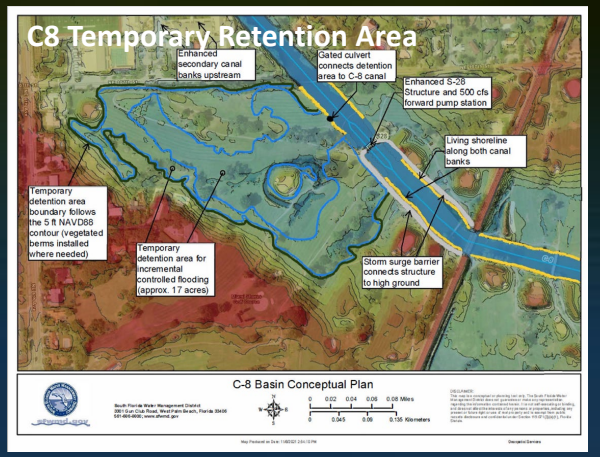
Building Flood Resilience for C-7 Watershed

- FEMA BRIC Award Recommendation – initial project components
  - S-27 Structure and tie-in flood barrier
  - Forward pump station
  - Stormwater detention area with associated NBS features
  - Living shorelines
  - Educational/recreational amenities (W.H Turner High School)
- No-regret strategies – advance the S27 Pump station design in 2023
- A key basin included in the C&SF Flood Resiliency Study (216 Study)
- Concurrently, C7 Adaptation and Mitigation Study (2023 –2025)
  - Include Phase I assessment
  - Develop comprehensive strategies
  - including projects from regional and local level
  - Including natural/nature based solutions
  - Include green infrastructure





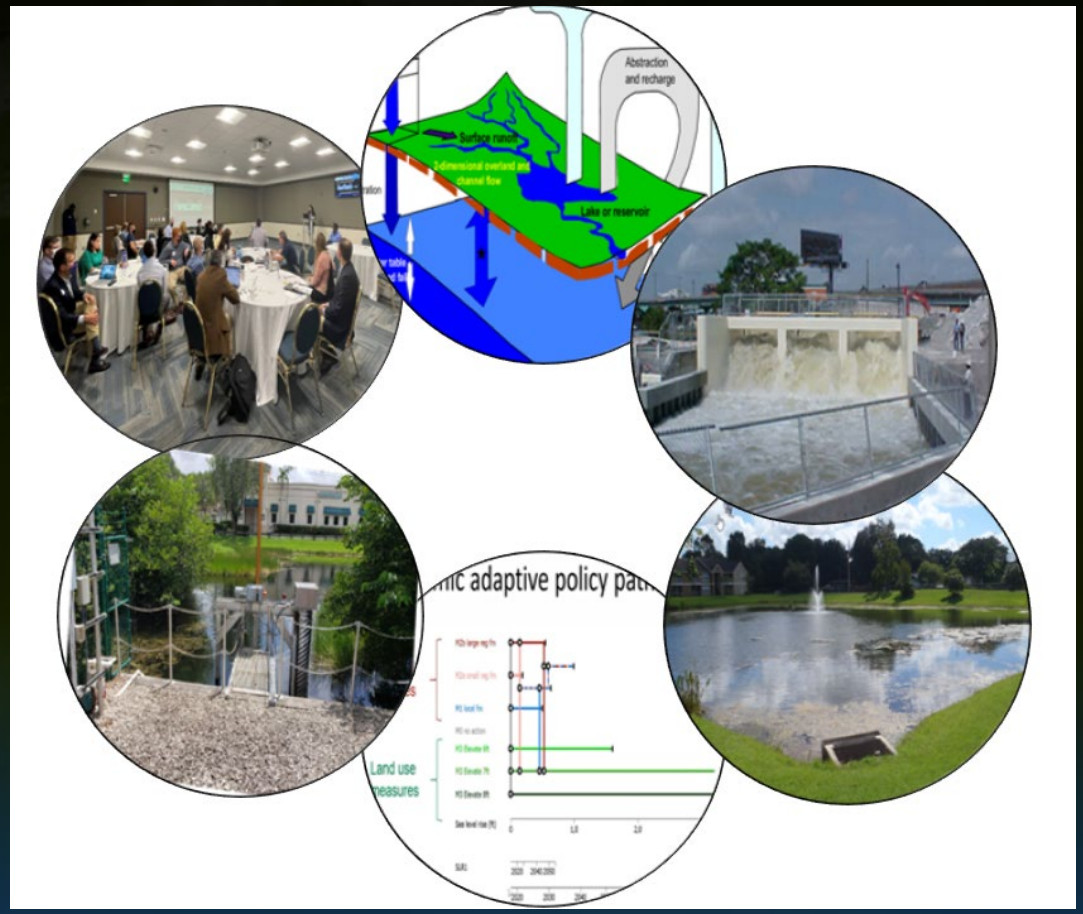
NNBS at W.H. Turner High



Presenter: Hongying Zhao

Building Flood Resilience for C7 Watershed

- Collaboration is key – In planning and even more so in implementation
- Basin-wide coordinated approach: understanding local and regional priority needs
- Hybrid approach: both grey and green infrastructures and nature-based solutions
- No regret action in the short term but that are robust, adaptable and evolvable



Presenter: Hongying Zhao

Questions?

C-7 Watershed Survey and Municipal Efforts

Ongoing

Lynette Cardoch, Ph.D.
Director, Resilience & Adaptation
Moffatt & Nichol

C-7 Survey and Municipal Efforts

- https://www.surveymonkey.com/r/YKMZ2FJ
- Intent: continue to collect your experiences with flood and adaptation planning.
- Today's workshop will spur more ideas.
- Survey link shall remain open until April 23, 2024.

Presenter: Lynette Cardoch

C-7 Survey and Municipal Efforts

1. What is your involvement in flood mitigation and adaptation planning?
2. Have you observed significant changes in flooding conditions in the recent 5-10 years? Do you have any documentation?
3. What do you believe are the major limitations of the existing flood control system at the C-7 Basin?
   Do you have a plan and preferred actions to address these limitations?
4. How are future conditions (e.g. sea level rise or increased rainfall) considered as part of project planning/design?

Presenter: Lynette Cardoch

C-7 Survey and Municipal Efforts

5. Are you currently implementing or do you have plans to use any green infrastructure or technology for flood mitigation and/ Please describe any projects or initiatives.
6. Are there specific locations or open spaces within your area that could accommodate additional green infrastructure projects for flood mitigation (eg. parks and recreational areas, vacant lots, roadside areas/medians, waterfronts, community gardens, rooftops on municipal /commercial buildings)?
7. What are your primary expectations from the C-7 FPLOS Study?
8. Are there any existing flood mitigation projects or initiatives in your area that you believe have been particularly effective? Please provide details.

C-7 Survey and Municipal Efforts

Presenter: Lynette Cardoch

- Adaptation Action Areas
- City of North Miami Good Neighbor Stormwater Park
- Install stormwater pumps
- Stormwater maintenance routines increased
- Information "clearinghouse"

Photos Courtesy of Dept. LLC
https://www.dept.llc/work/good-neighbor-stormwater-park

Before

After

Community Park

C-7 Watershed Flood Protection Level of Service

Assessments and Results to Date

Michael DelCharco, PE
Vice President of Water Resources
Taylor Engineering

C-7 FPLOS Assessment Overview

- Focus on primary system
- Evaluating effects of changes in SLR, storm surge, and land use on FPLOS
- Model Calibration and Validation
- Current Condition Assessment (4 return periods and storm surge)
- Future Condition Assessment
  - 4 return periods and storm surge
  - Sea level rise (+1, +2, +3 ft)
  - Future rainfall
  - Groundwater levels
  - Future land use and project

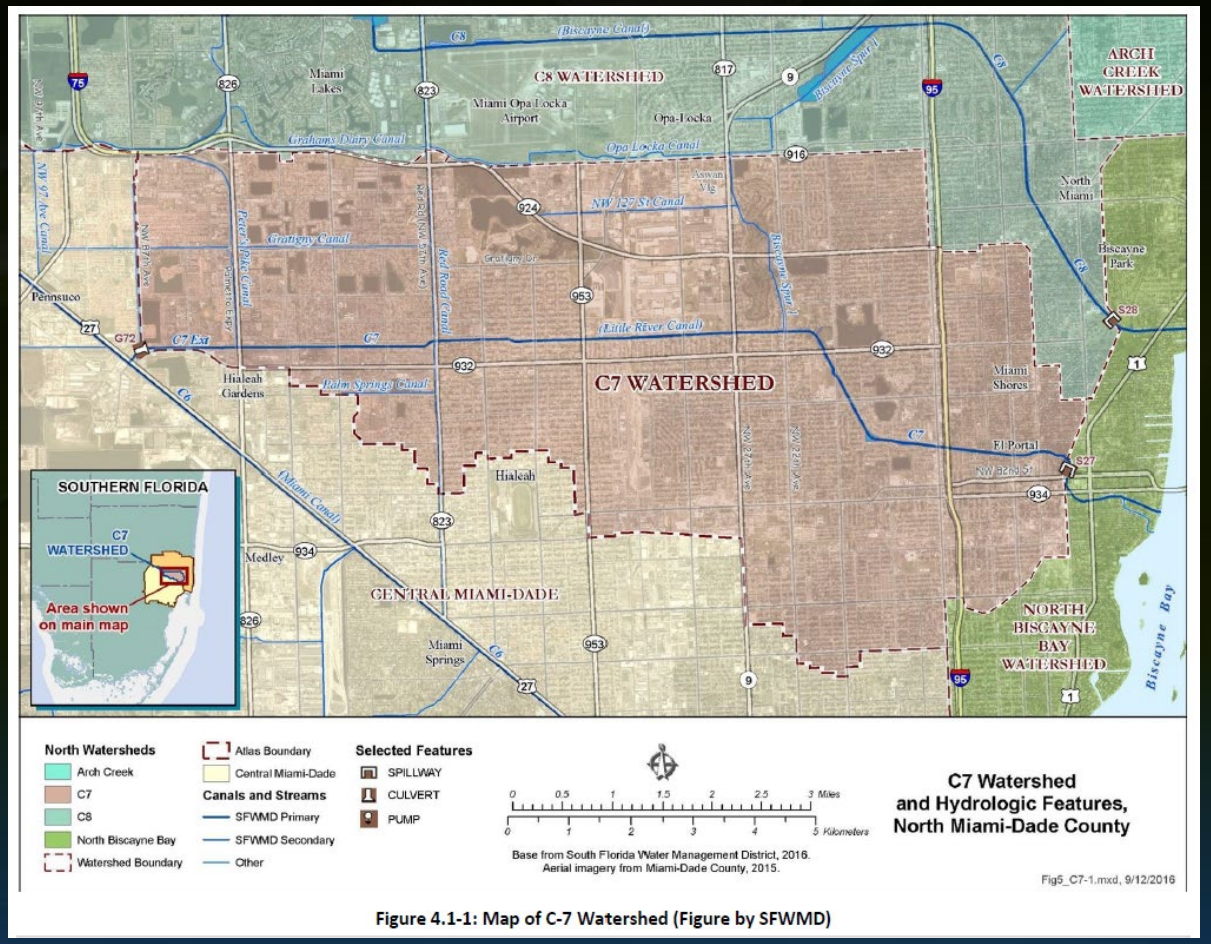


Figure 4.1-1: Map of C-7 Watershed (Figure by SFWMD)

Presenter: Michael DelCharco

C-7 FPLOS Study

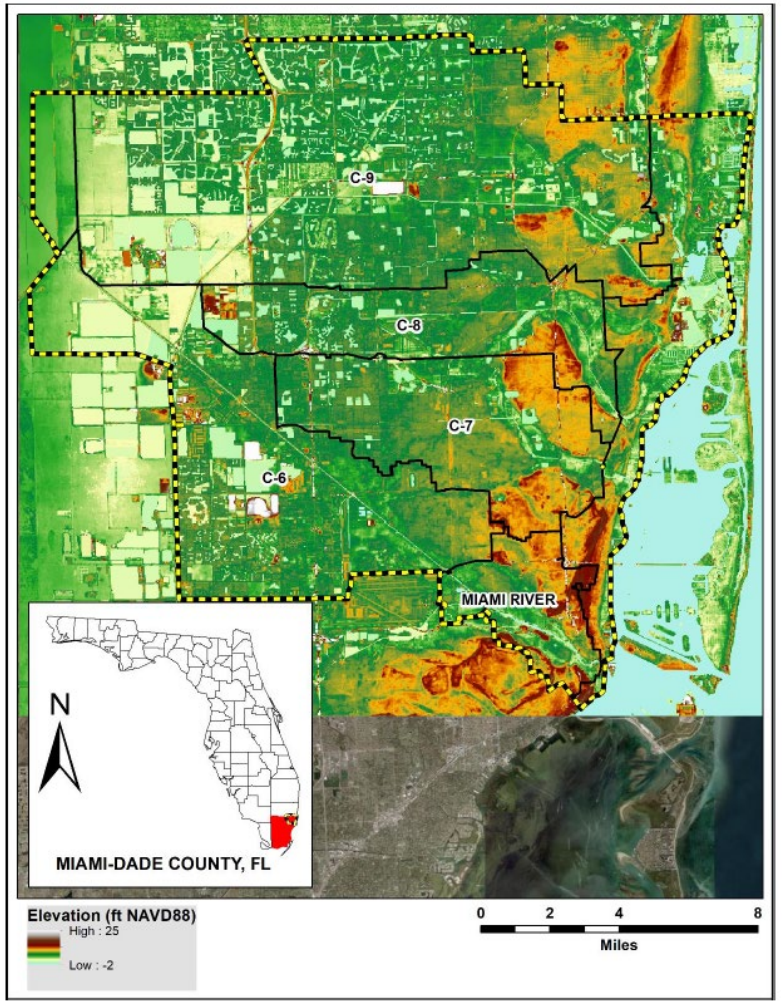


Figure 6.1-1: 125-ft Model Topography DEM, NAVD88

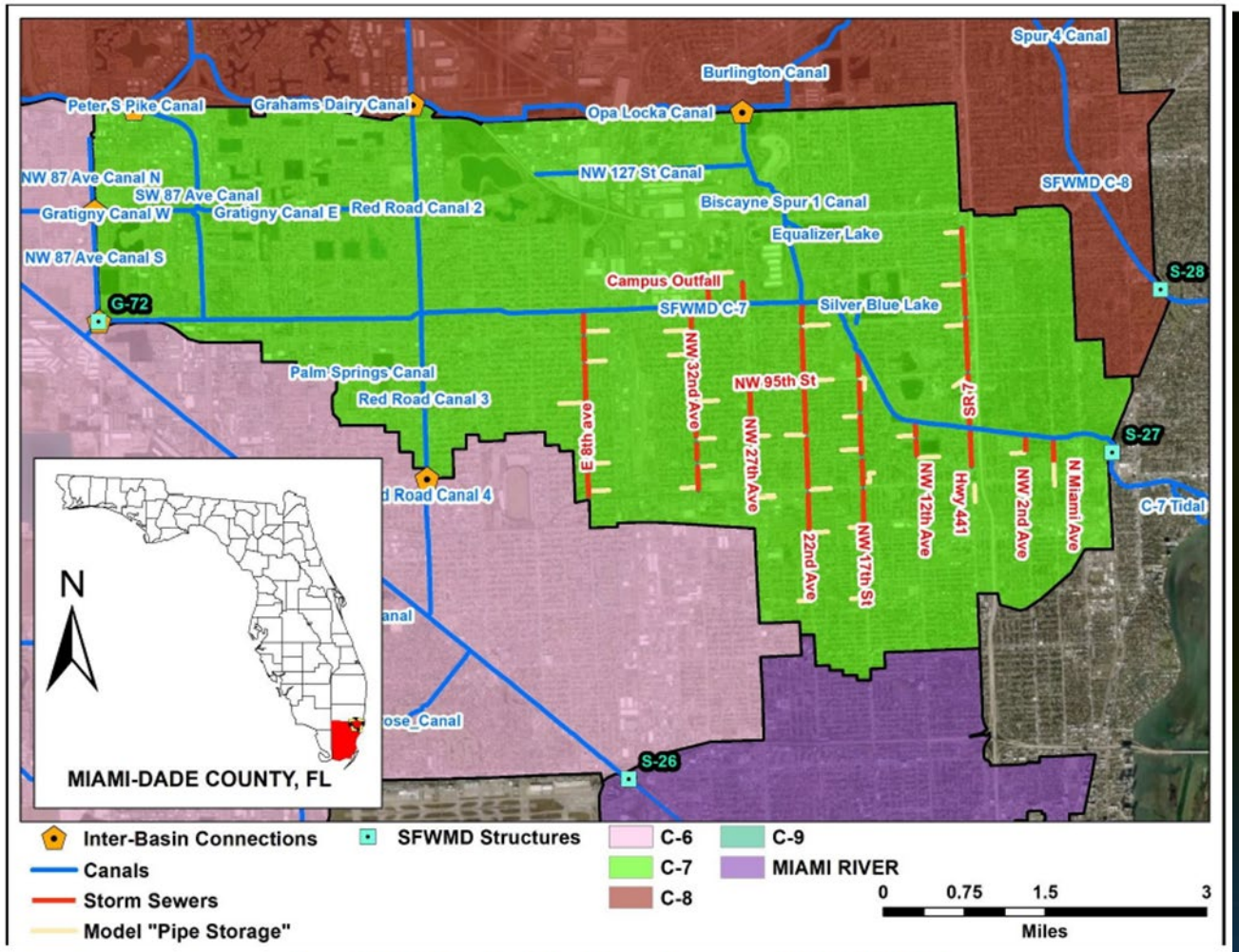


Figure 8.1-1: 1D Canal and Pipe Network represented in MIKE HYDRO

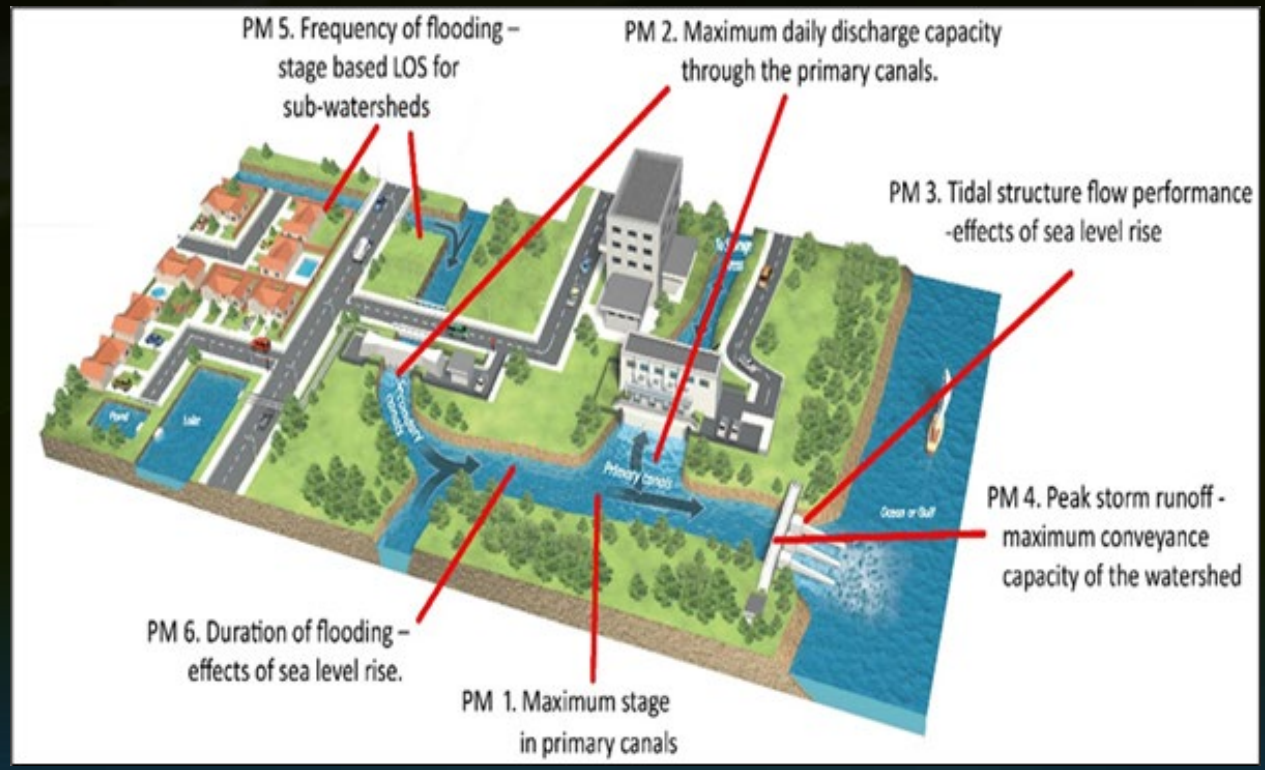
Three FPLOS Performance Metrics

Canal

- Maximum stage profiles (PM1)

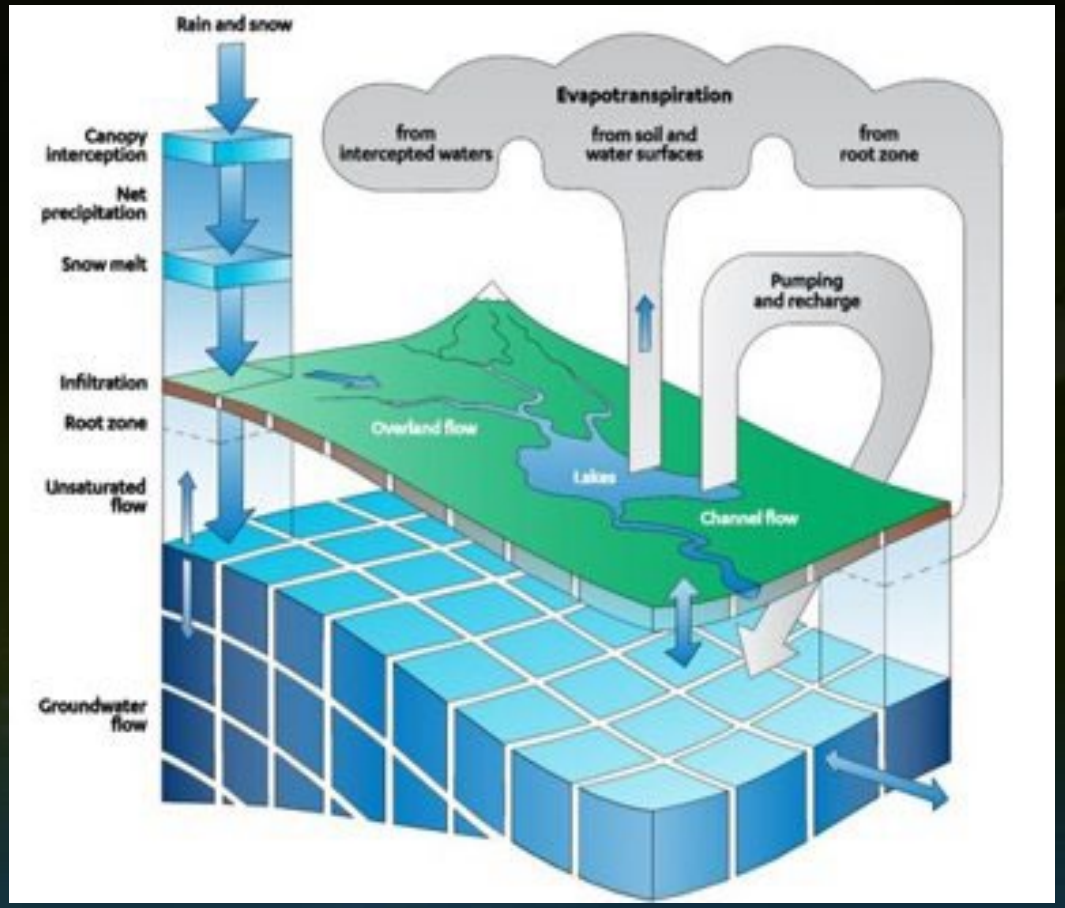
Land

- Maximum flood depth map (PM5)
- Flood duration map (PM6)



Presenter: Michael DelCharco

Model Tool Selection



Model Tools Selected for C-7 Watershed

- Physics-based spatially distributed model tools
- Simulate
  - Overland flow
  - Unsaturated flow
  - Groundwater flow
  - And fully dynamic channel flow
  - Including all their complex feedbacks and interactions
- MIKE SHE and MIKE HYDRO

Model Setup

- Calibrated to Sept 2017 Hurricane Irma
- Validated using June 2022 Tropical Storm Alex and May 2020 No-Name event
- Input data
  - NOAA Atlas 14 gridded rainfall
  - Storm surge boundary conditions
  - USGS 2009 “end of wet season” groundwater elevation map
- Existing Conditions
  - 5, 10, 25, and 100-yr recurrence frequency events
  - Rules based gate operations for S-27

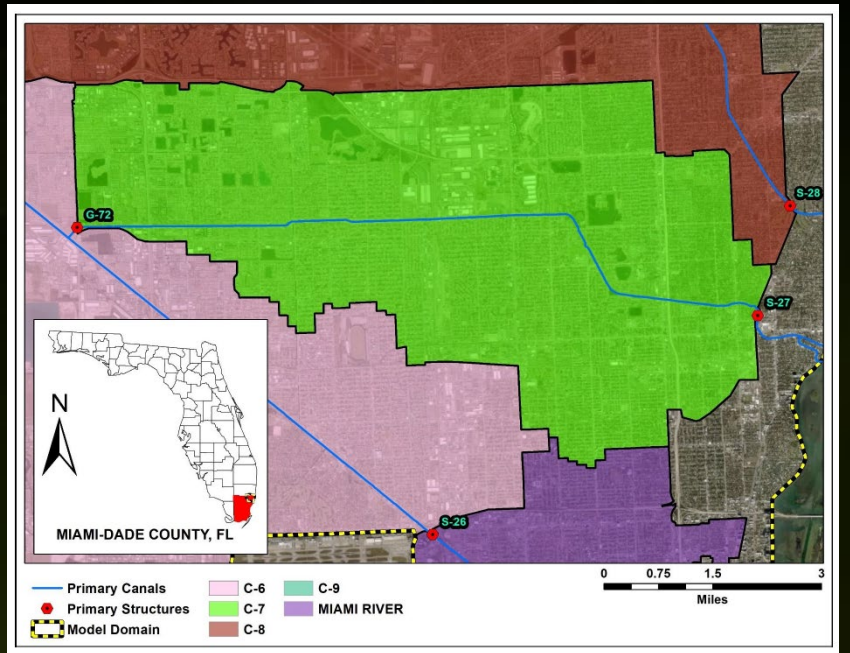


Figure 2.1-1: Location of Primary SFWMD Structures for C-7 Watershed

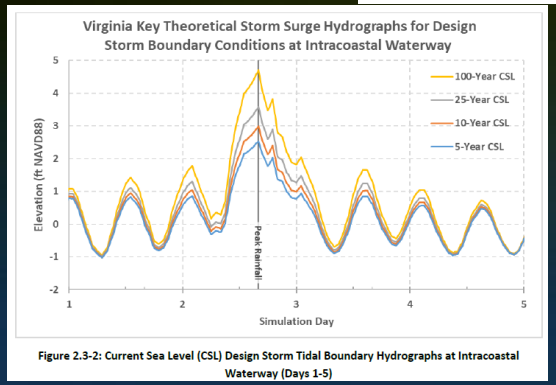


Figure 2.3-2: Current Sea Level (CSL) Design Storm Tidal Boundary Hydrographs at Intracoastal Waterway (Days 1-5)

Presenter: Michael DelCharco

C-7 Basin FPLOS Assessment – PM 1 (Peak Stage Profile)

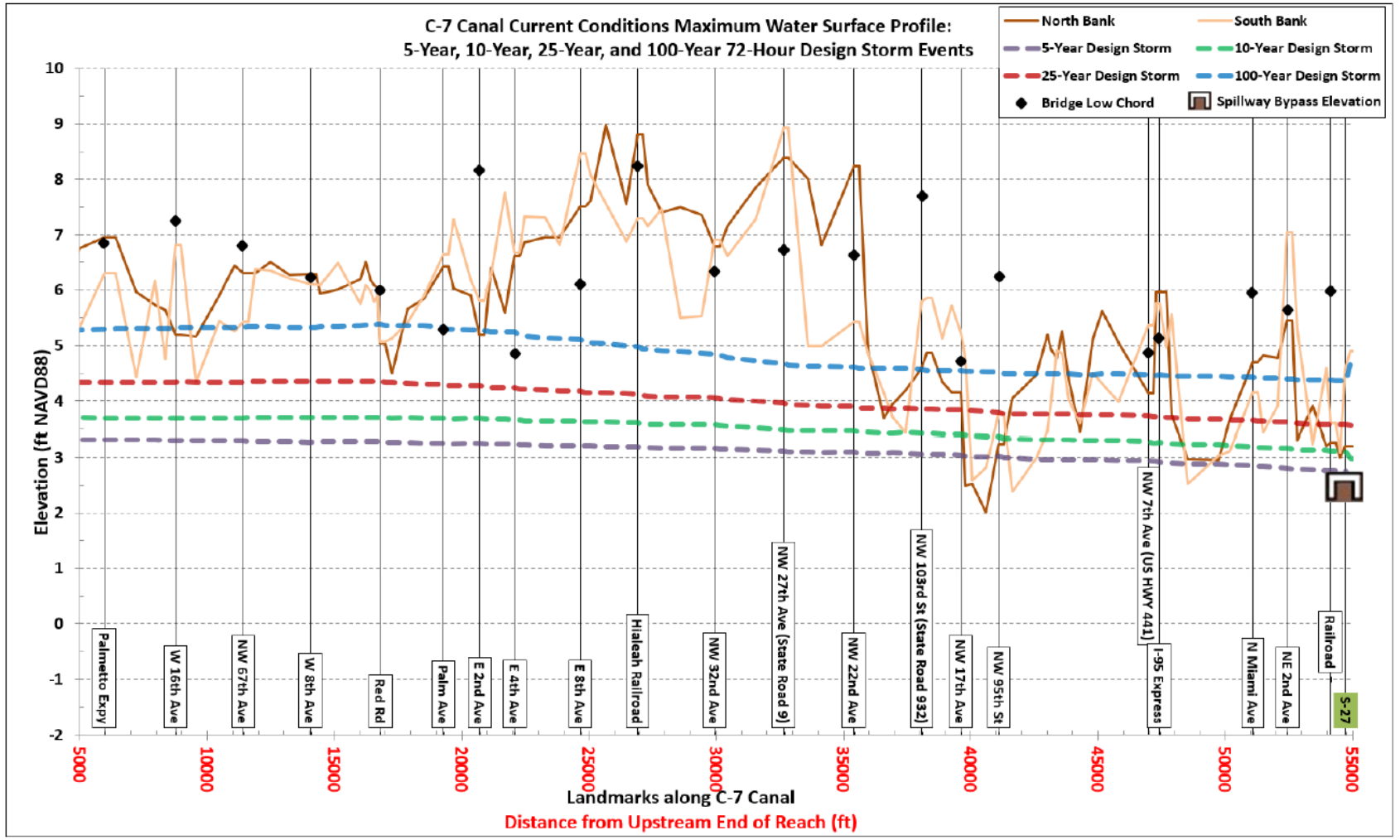


Figure 4.1-2: C-7 Canal Peak Stage Profiles for Current Condition Design Storms

Presenter: Michael DelCharco

C-7 Basin FPLOS Assessment – PM 1

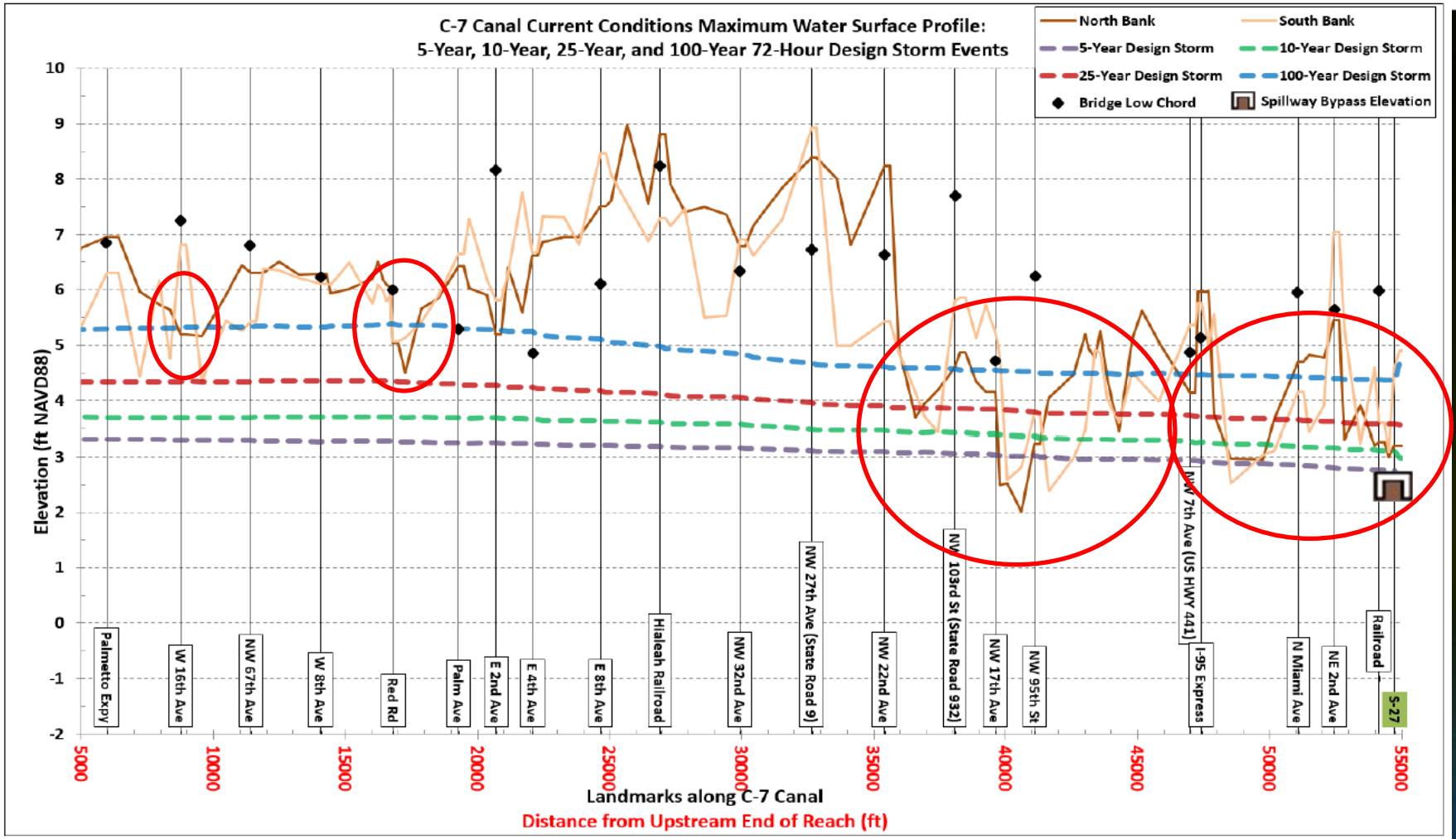
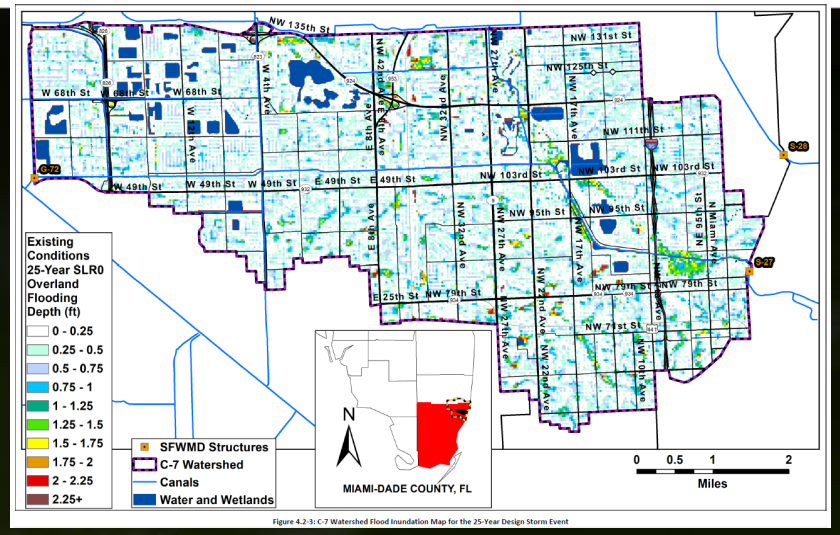


Figure 4.1-2: C-7 Canal Peak Stage Profiles for Current Condition Design Storms

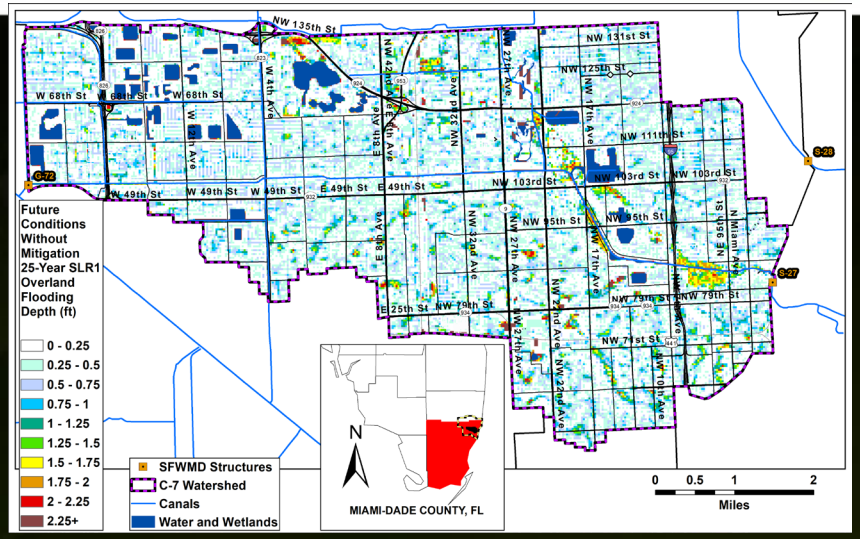
Presenter: Michael DelCharco

C-7 Watershed FPLOS Assessment – PM 5 (Flood Depth)

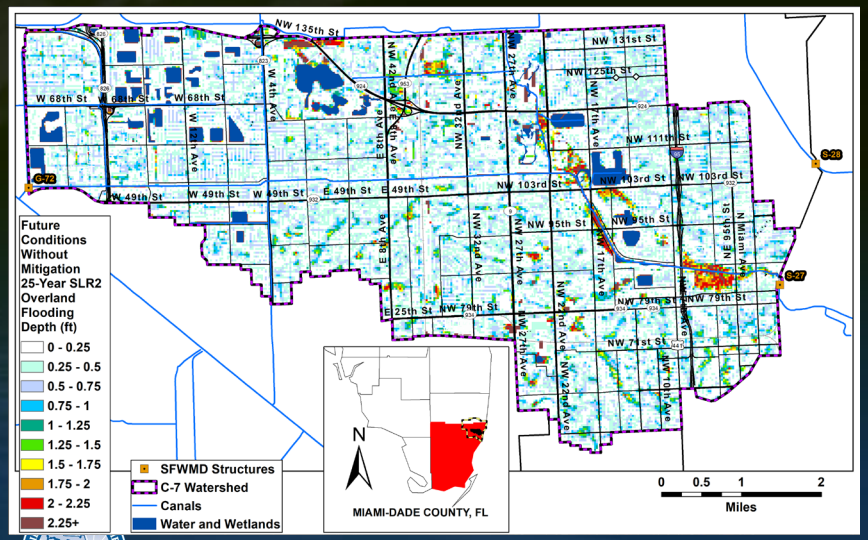
•25-yr with SLR = 0



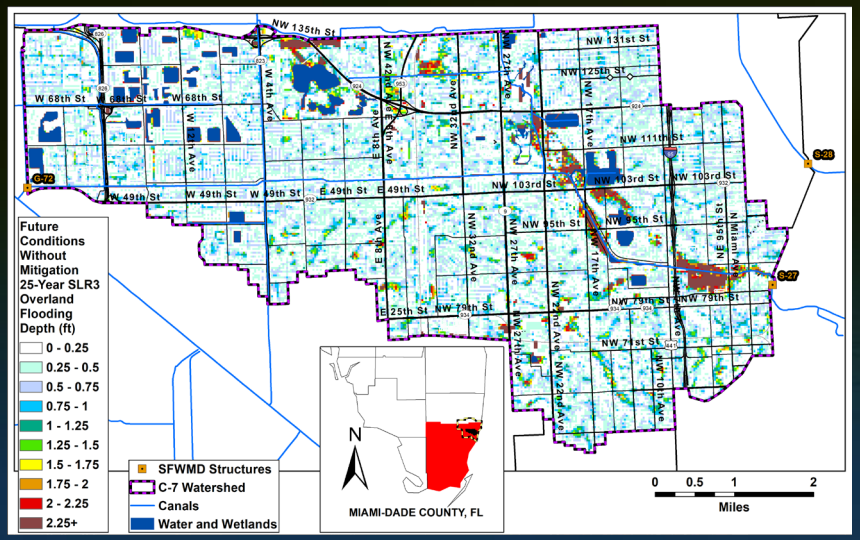
•25-yr with SLR = 1ft



•25-yr with SLR = 2ft



•25-yr with SLR = 3ft



Presenter: Michael DelCharco

C-7 Basin FPLOS Assessment – PM 5 Alternative GW comparison

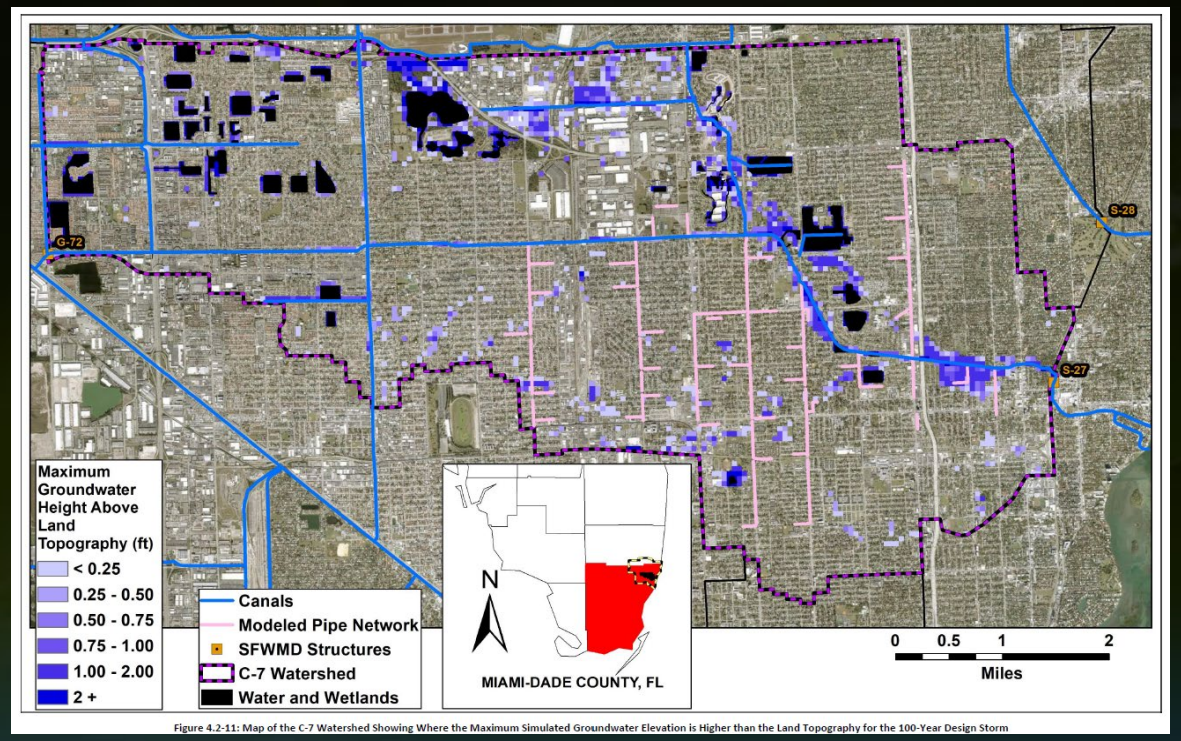
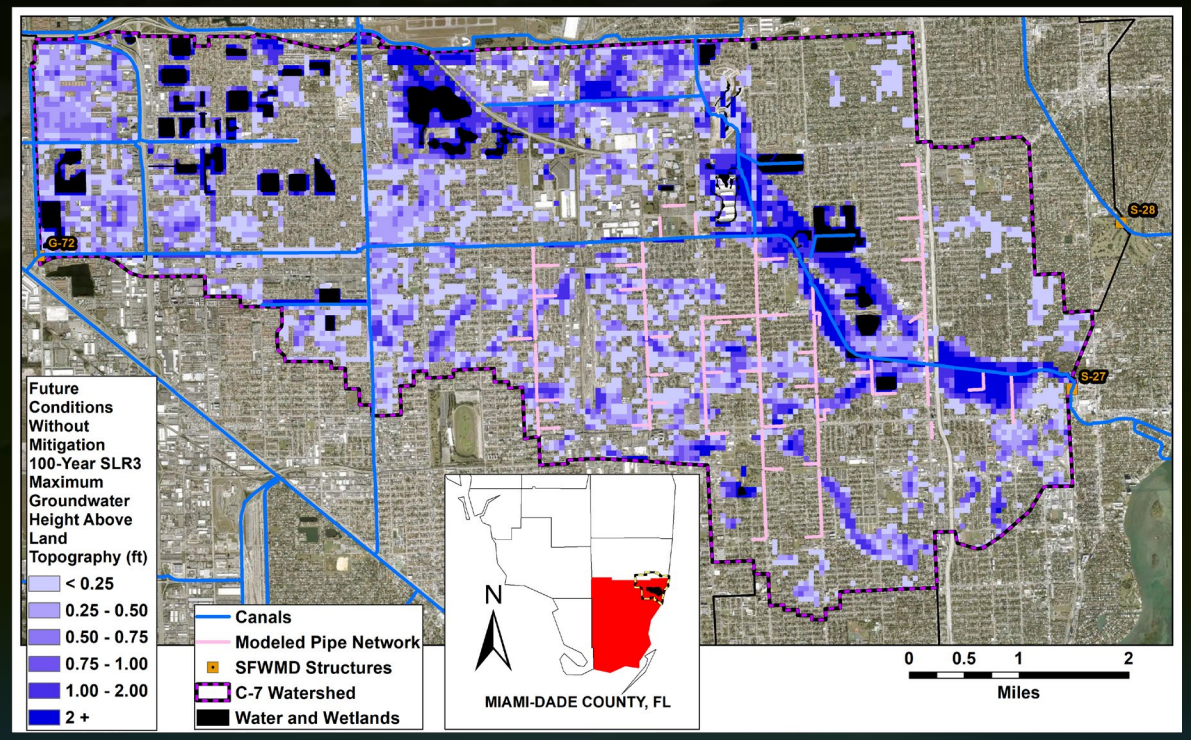


Figure 4.2-11: Map of the C-7 Watershed Showing Where the Maximum Simulated Groundwater Elevation is Higher than the Land Topography for the 100-Year Design Storm



Current Conditions:

Max groundwater above land surface

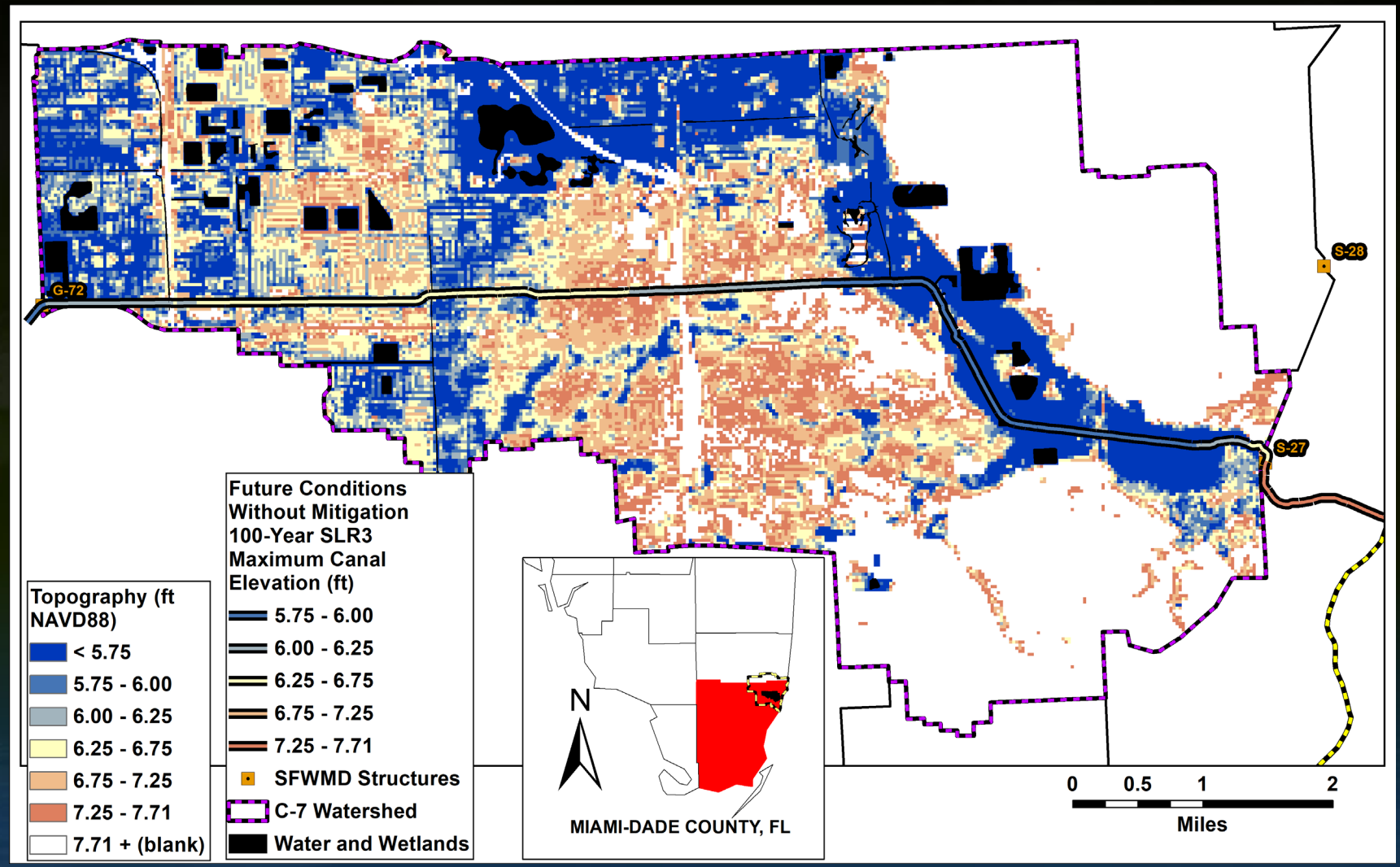
Future Conditions – 100 yr SLR 3

Max groundwater above land surface

Presenter: Michael DelCharco

C-7 Watershed FPLOS Assessment – PM 5 Alternative

- Future Conditions 100-yr with SLR 3
- Max Canal stages and topography indicates some drainage issues getting water to the canals



Presenter: Michael DelCharco

C-7 Watershed FPLOS Assessment– Flood Duration (PM 6) Comparison

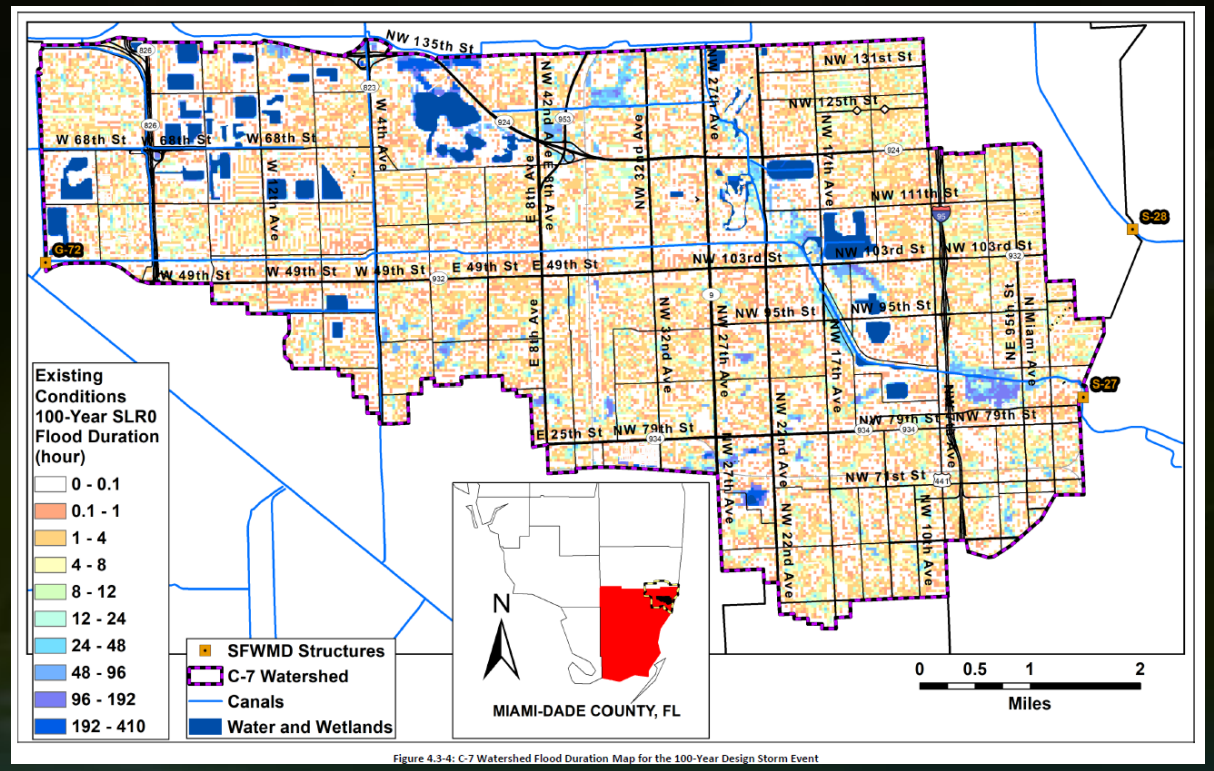
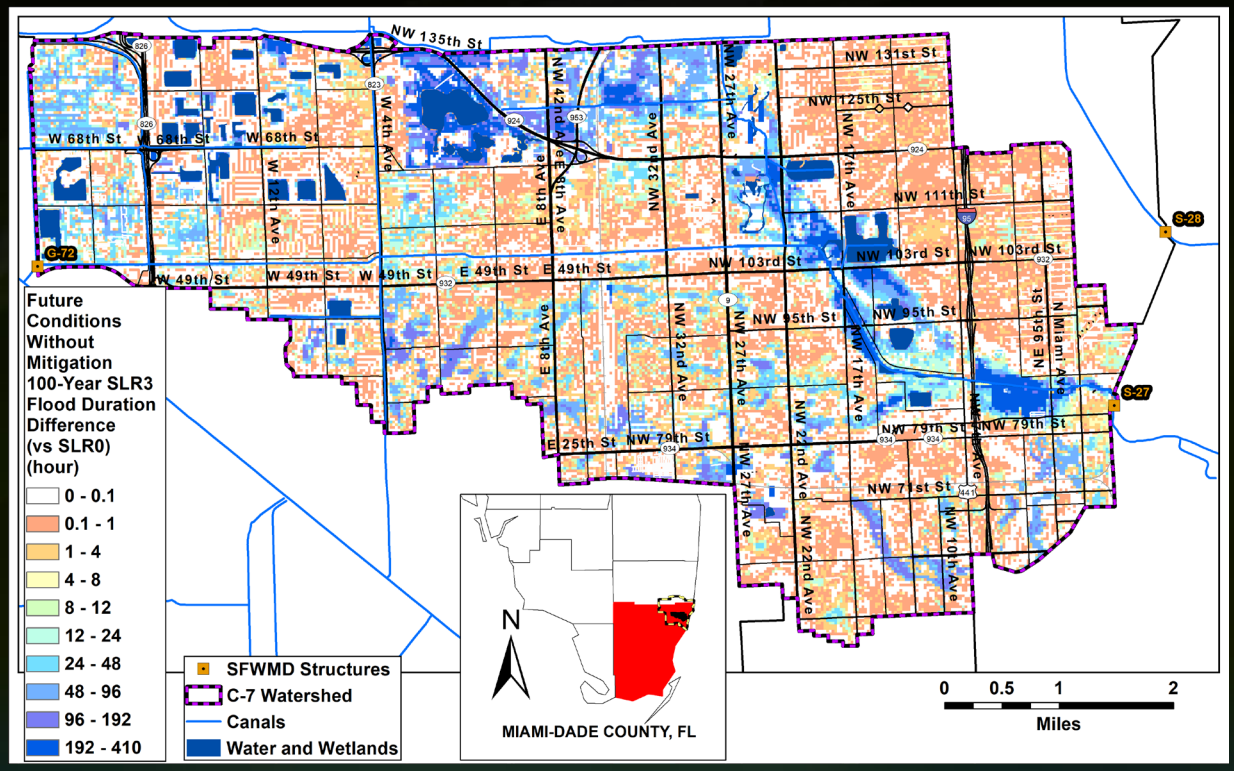


Figure 4.3-4: C-7 Watershed Flood Duration Map for the 100-Year Design Storm Event



Existing Conditions for 100-yr event and SLR0

Future Conditions for 100-yr event and SLR3

Presenter: Michael DelCharco

C-7 Watershed FPLOS Assessment Summary

- The C-7 Canal is predicted to be overtopped at three canal segments during the 5-year storm event
- The S-27 is unable to maintain water levels at the control elevation for any of the storm events and is predicted to be overtopped during all storm events
- Many areas in the watershed have land surfaces above the peak elevation of the canal but still flood, indicating they are likely impacted by localized deficiencies

C-7 Assessment FPLOS Adaptation and Mitigation Planning Projects Study – Phase II

- Objectives: To develop basin wide flood adaptation strategies and mitigation projects for the C-7 watershed to maintain or improve the level of flood protection in anticipation of future conditions including SLR, land use changes, and increased ground water.
- The development and implementation of the strategies will be a collaborated effort from the District, USACE, counties, local drainage districts and other stakeholders.

Examples of Potential Mitigation Strategies

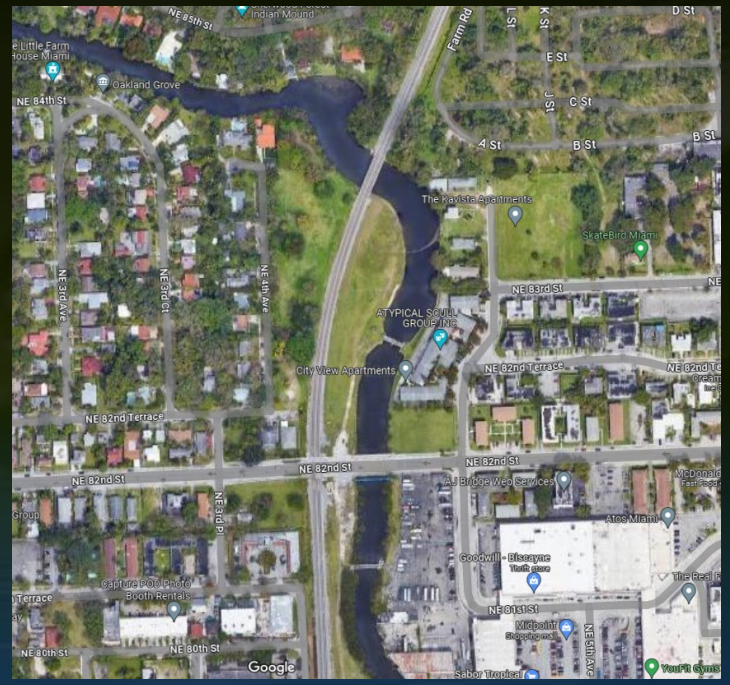
C-7 Watershed:

What are you all doing to address flood mitigation?

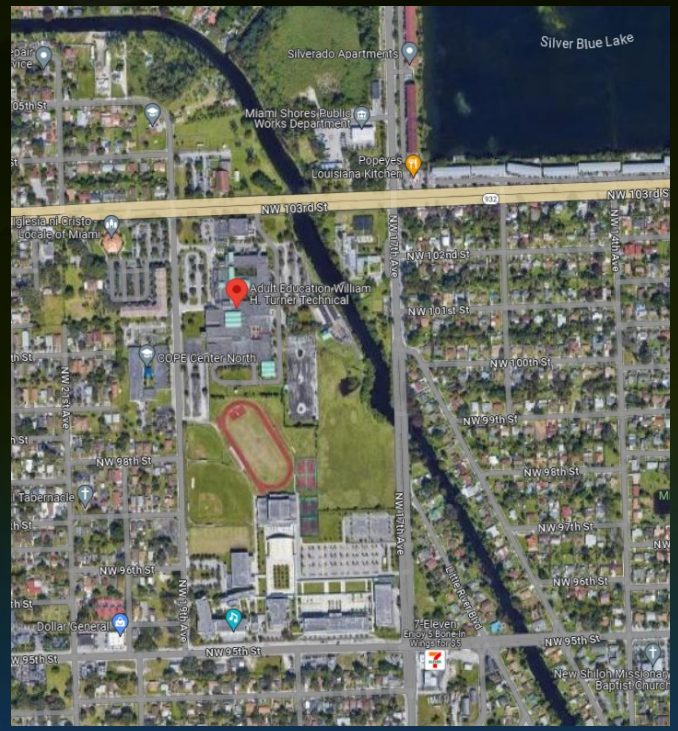
We've been brainstorming!

Examples of Potential Mitigation Options

- Canal Conveyance Improvements
- S-27 Structure Improvements
- Raise Levees along C-7 Canal and add Gates/Pumps on Secondary Branches



- **W.H. Turner HS – Flow way/Storage**
  - **Improves water quality**
  - **Environmental benefits**



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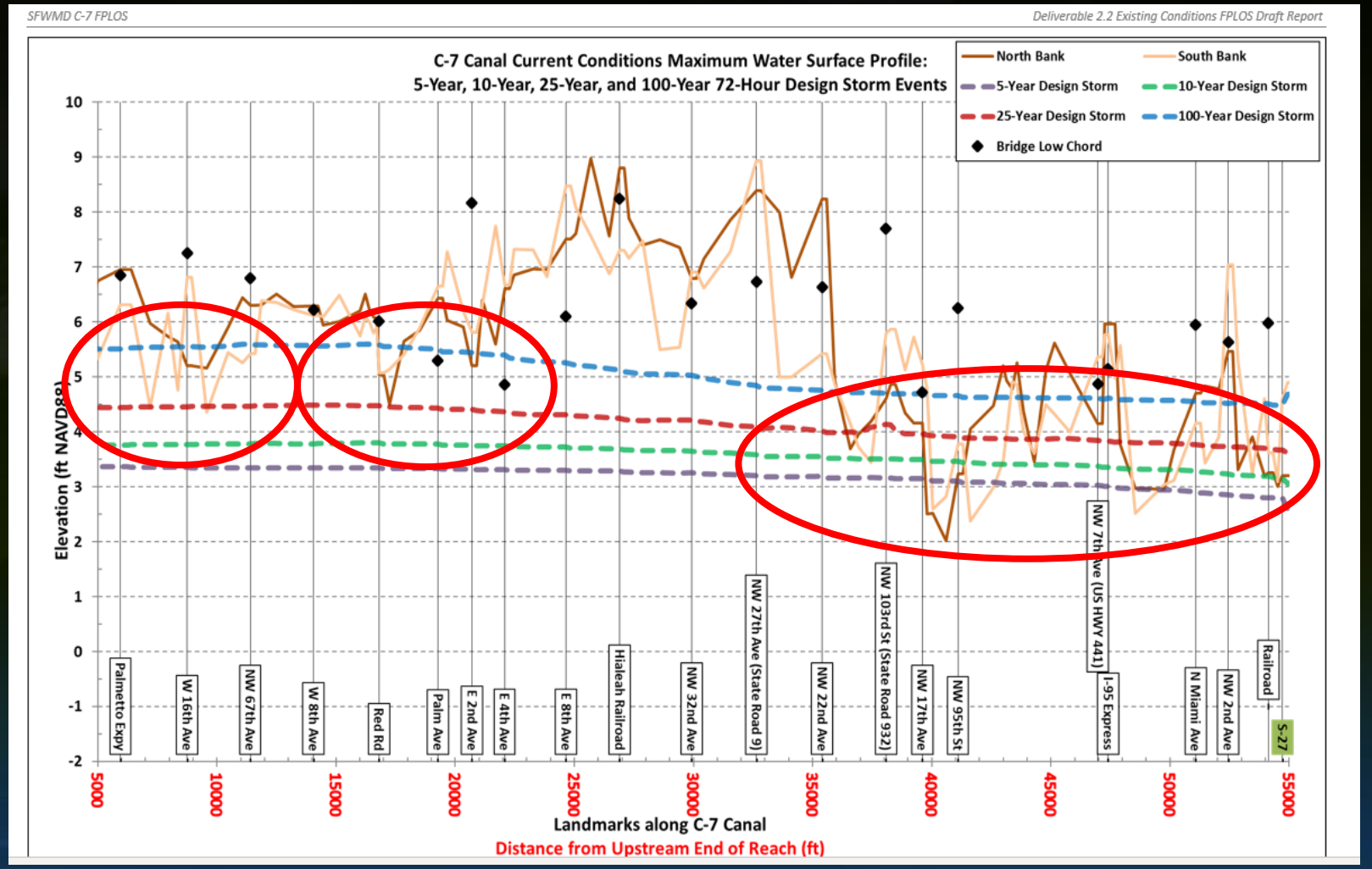
Examples of Potential Mitigation Options

Raise canal banks:

- Address overtopping and flooding
- Only at areas overtopped



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Inter-basin Connections

- Look into existing connections
- Expand connections (increase channels/culverts)
- Possible pumps to move water
- This does not include G-72, which is a separate alternative

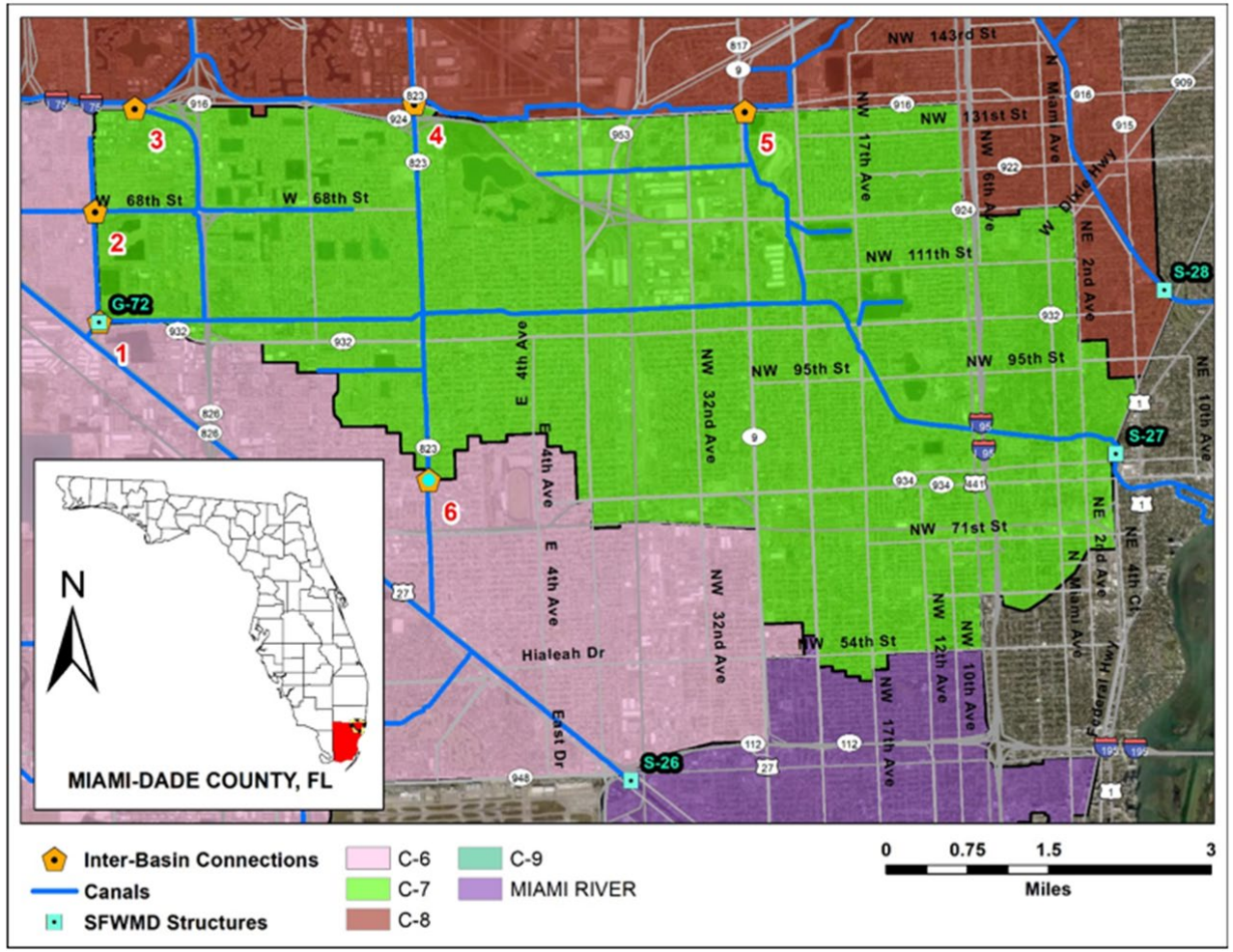

Figure 4.4-1: Location of Inter-Basin Connections for the C-7 Watershed

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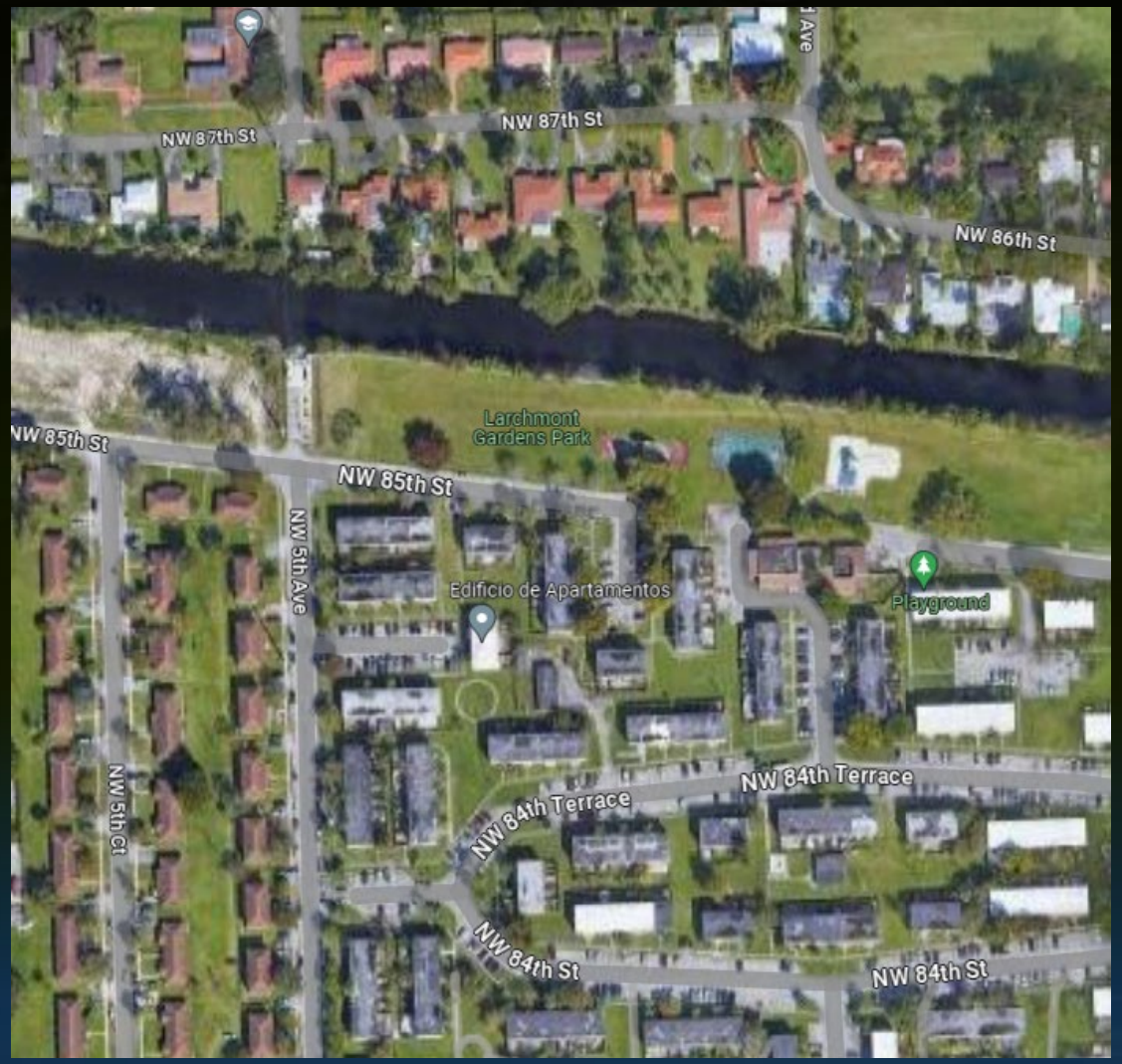
Internal Living Shorelines

- Environmental benefits
- Example at Larchmont Gardens Park



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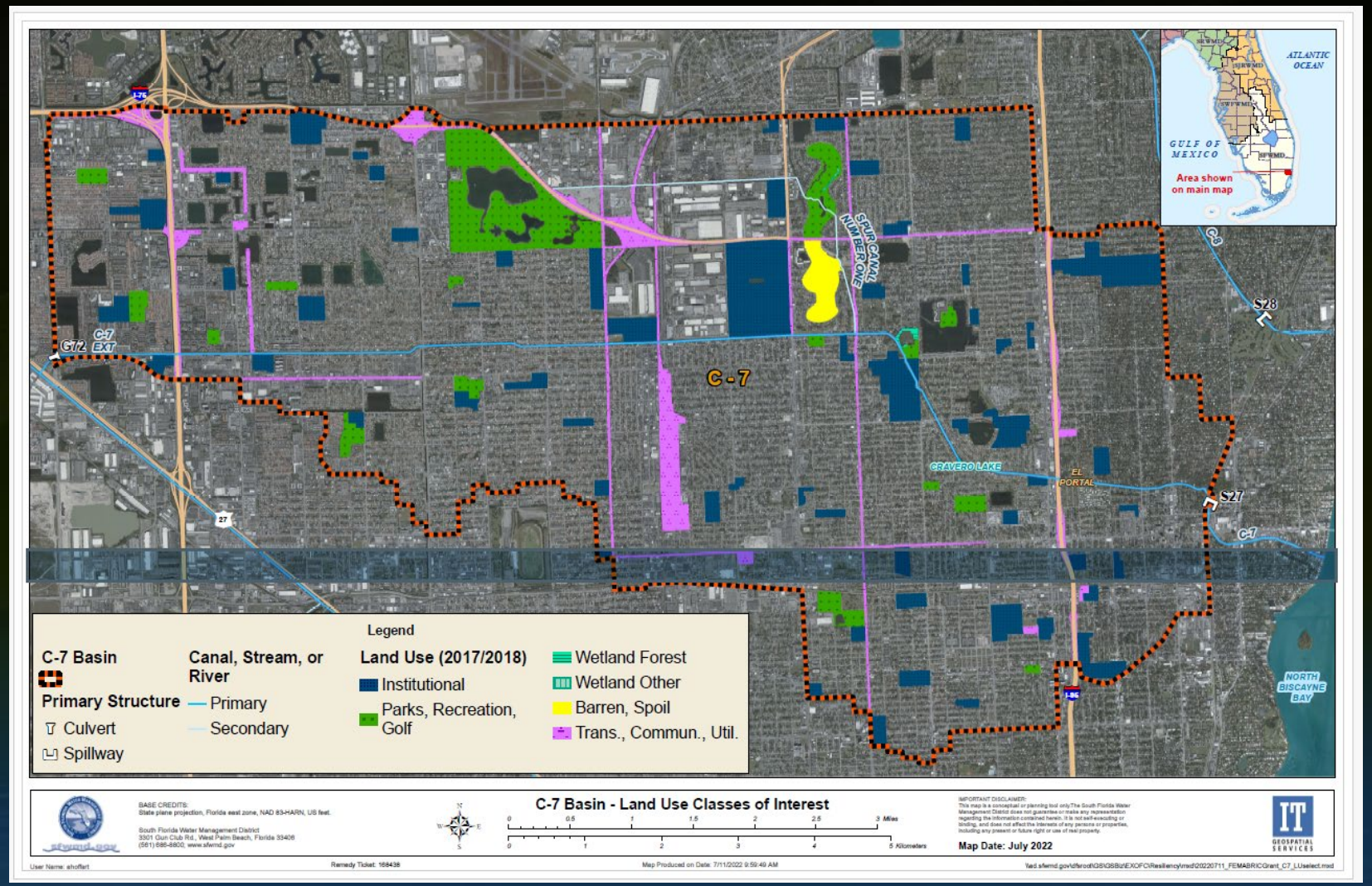
Additional Storage - Open Land Storage

- Amelia Earhart Park – water storage
- Park adjacent to I-95
- Wetland north of S27 restoration
- Store water upstream of S-27
- Golf Courses



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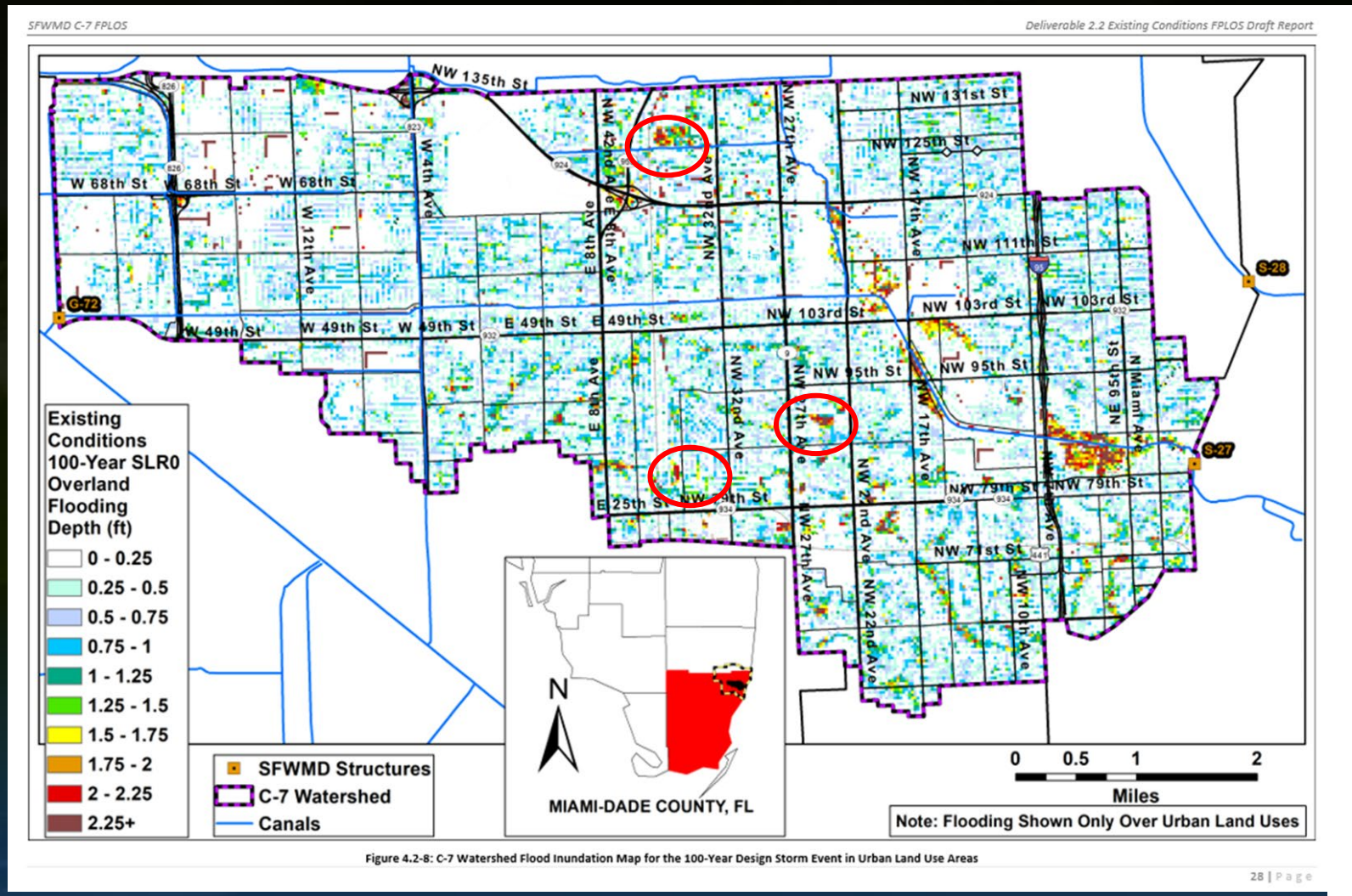
Local Drainage Improvements

- Identify low/flooded areas in PM 5 maps
- Drainage improvement to move that water from low areas
- Would need connections to canals
- We circled three areas – there are many more possible locations



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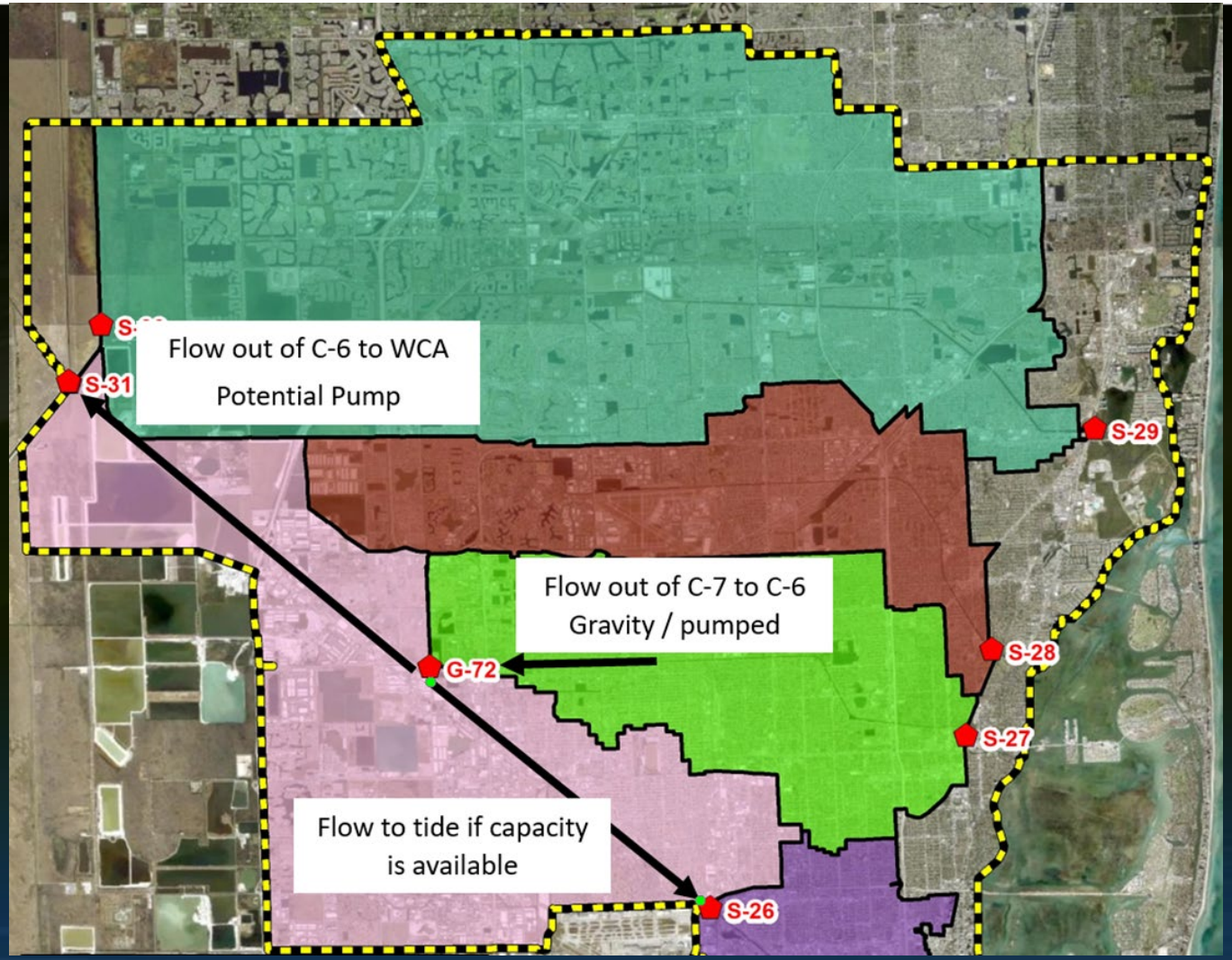
G-72 or Hialeah Gardens Pump

- Existing connections and pump station
- Move water to west of basin to C-6 and S-31 pump
- Could possibly move water to STAs



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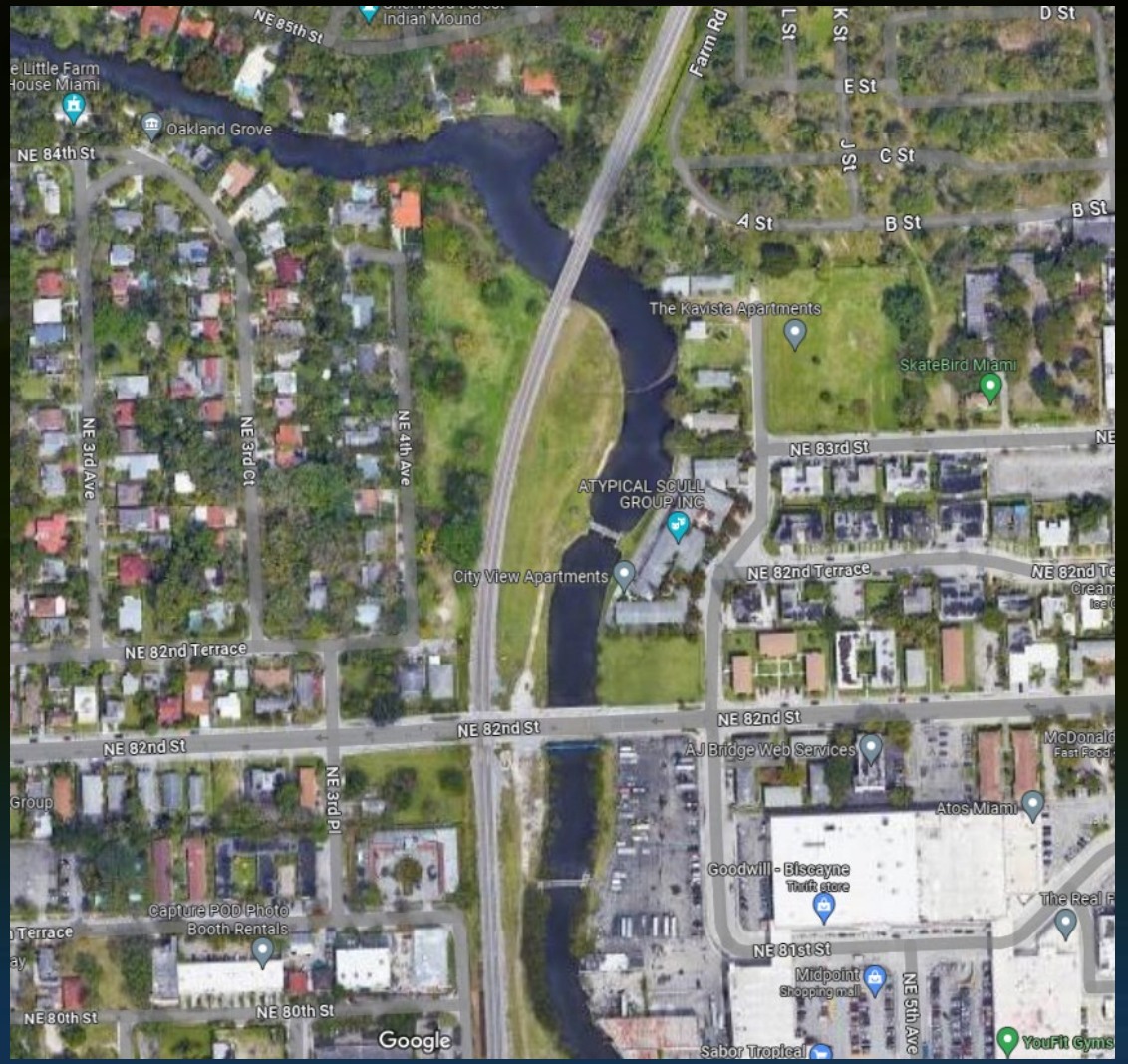
S-27 Operational Changes

- Update Operations
- Update drawdowns



Presenter: Michael DelCharco

Elevating Buildings

- All buildings elevated to the maximum 100-year flood levels under scenario SLR3
- All roads to the 10-year flood level under scenario SLR3
- Could identify repetitive loss areas

Presenter: Michael DelCharco

Green Infrastructure

- Reduce roadway paved width in neighborhoods
  - Reduced runoff
- Convert to one-way streets and save space as bioswales
  - Storage
  - Water quality benefit
  - Groundwater recharge

Bioswale example from Sarasota County

Presenter: Michael DelCharco

Questions and Comments

Photo: Miamidade.gov

Presenter: Michael DelCharco

C-7 Watershed Adaptation and Mitigation Strategies Discussion

Leas by: Lynette Cardoch, Ph.D.
Director, Resilience & Adaptation
Moffatt & Nichol

Questions and Mitigation Strategies Discussion

- Flood hotspots
- Specific locations or open spaces
- Stormwater infrastructure projects
- Natural and Nature based solutions
- Green Infrastructures
- Partner projects

Moderator: Lynette Cardoch

C-7 Watershed FPLOS

Adaptation and Mitigation Planning Projects Study

Next Steps

Ann Springston, PE
Project Manager
South Florida Water Management District

Next Steps

- Collate and Formulate Mitigation Strategies
- Reminder that the survey link will remain open until April 23, 2024
- Modeling and Non-modeling analyses of Mitigation Strategy combinations

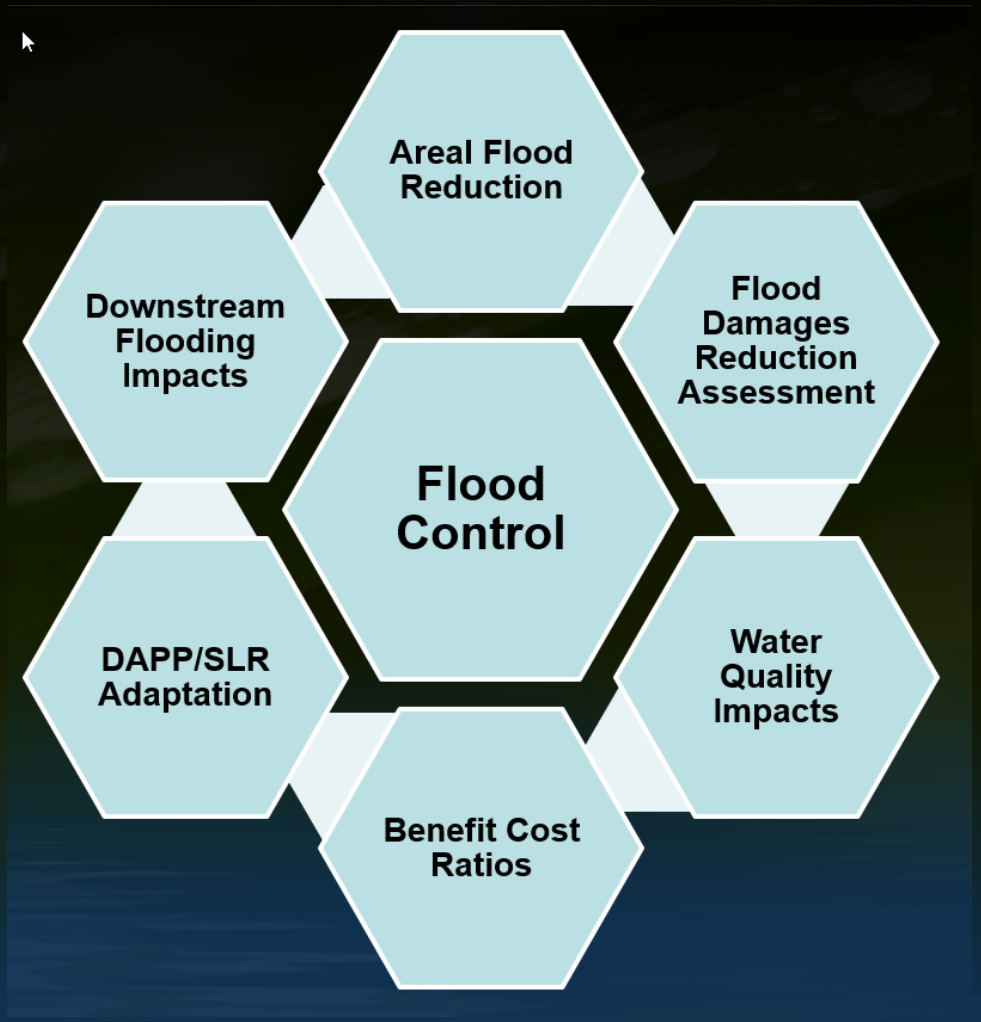
Presenter: Ann Springston

Next Steps

- Bi-weekly working meetings to discuss interim results and path forward
- We invite the stakeholders to join us in our bi-weekly meetings
  - Please email asprings@swfmd.gov with POC name and email address
- Continued coordination with other studies and sharing of information
- Recommendation of Adaptation & Mitigation Strategy for the C-7 Basin

Next Steps

- H&H modeling & Other analyses – Flood Reduction
- Flood Damages Reduction Assessment
- Recommendation of Adaptation & Mitigation Strategy for C-7 Basin
- Cost/Benefit Assessment
- Downstream Impact of recommended strategy
- Water Quality Impact of recommended strategy
- Project sequencing using Adaptation Pathway Planning Approach



Presenter: Ann Springston

Closing Comments

Matahel Ansar, PhD, PE

Interim Bureau Chief, Hydrology and Hydraulics Bureau