

2023 Lower East Coast Water Supply Plan Update



LEC Stakeholder Meeting 2

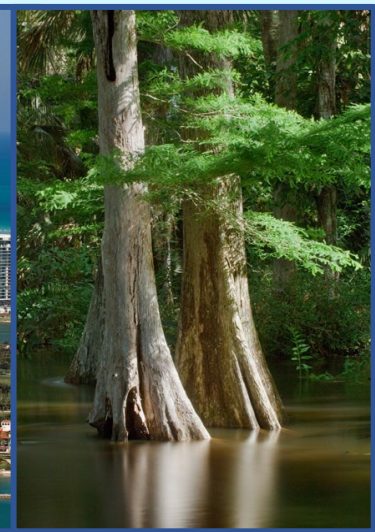
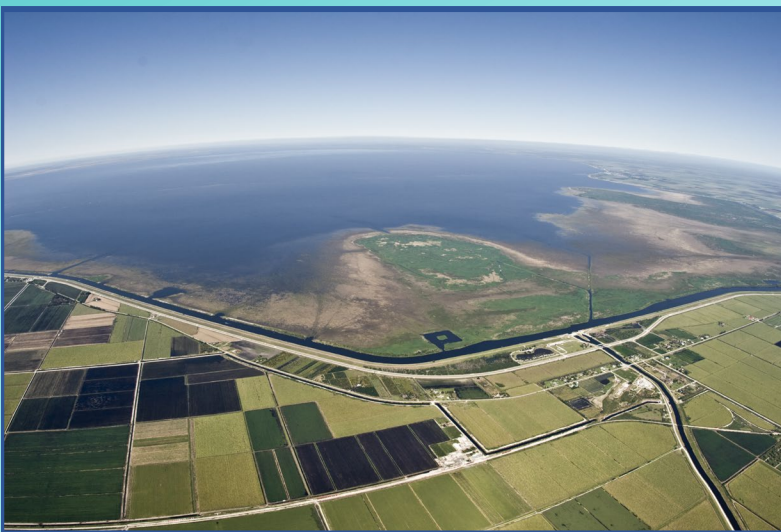
August 24, 2023



Agenda

- **Welcome and Opening Remarks** – *Tom Colios, SFWMD*
- **Water Resource Protection Measures** – *James Beerens, SFWMD*
- **Update on Everglades Restoration Projects** – *Leslye Waugh, SFWMD*
- **Regional LEC Groundwater Modeling and Saltwater Interface Mapping** – *Pete Kwiatkowski, SFWMD*
- **Resiliency Initiatives** – *Carolina Maran, SFWMD*
- **Next Steps** – *Nancy Demonstranti, SFWMD*
- **Adjourn**

Welcome and Opening Remarks



Tom Colios
Section Leader, Water Supply Planning
LEC Stakeholder Meeting 2
August 24, 2023



Lower East Coast Planning Area

➤ Includes:

- Palm Beach, Broward, Miami-Dade, part of Monroe County, and part of the eastern portions of Collier and Hendry counties
- Seminole Tribe of Florida reservations and Miccosukee Tribe of Indians of Florida reservations

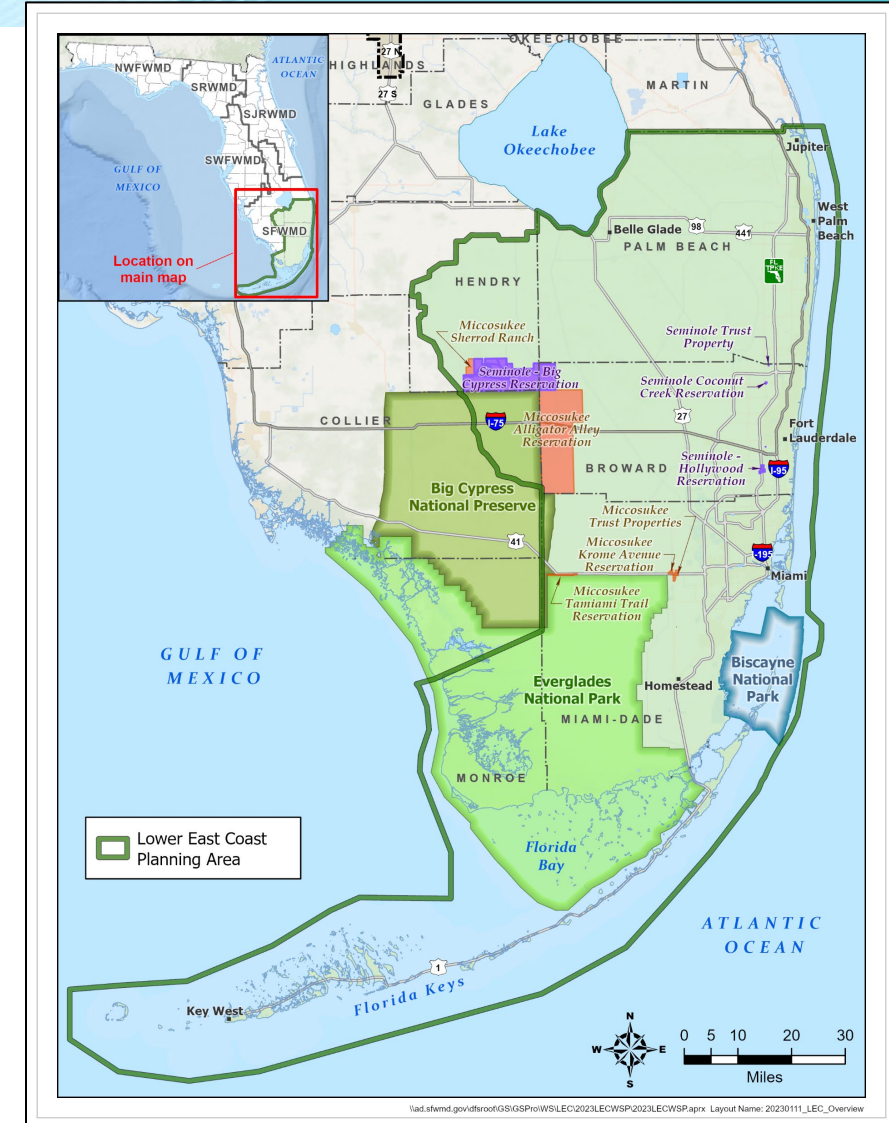
➤ Population:

- 2021 6,222,708
- 2045 7,294,265*

➤ Major agricultural industry

➤ Significant environmental features

*University of Florida (UF) Bureau of Economic and Business Research estimate.



Regional Water Supply Plan

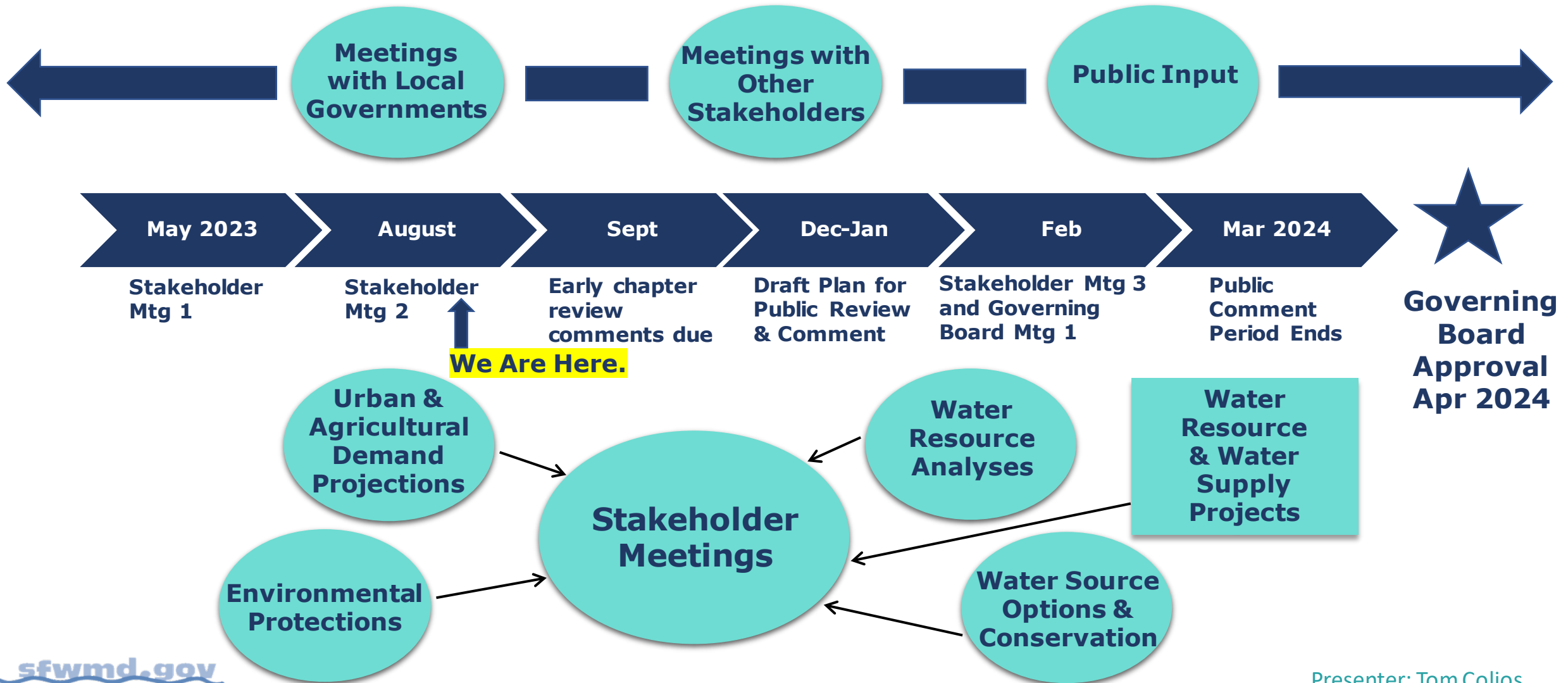
What It Does

- Provides a road map to meet future water needs while protecting water resources and natural systems
- Conducts a planning-level approach
- Projects future water demands
- Identifies and evaluates water source options

What It Does NOT Do

- Does not authorize consumptive use permits
- Does not establish MFLs
- Does not adopt rules
- Does not require water users to implement specific projects
- Does not address surface water quality issues (e.g., algal blooms)

Water Supply Plan Update Timeline

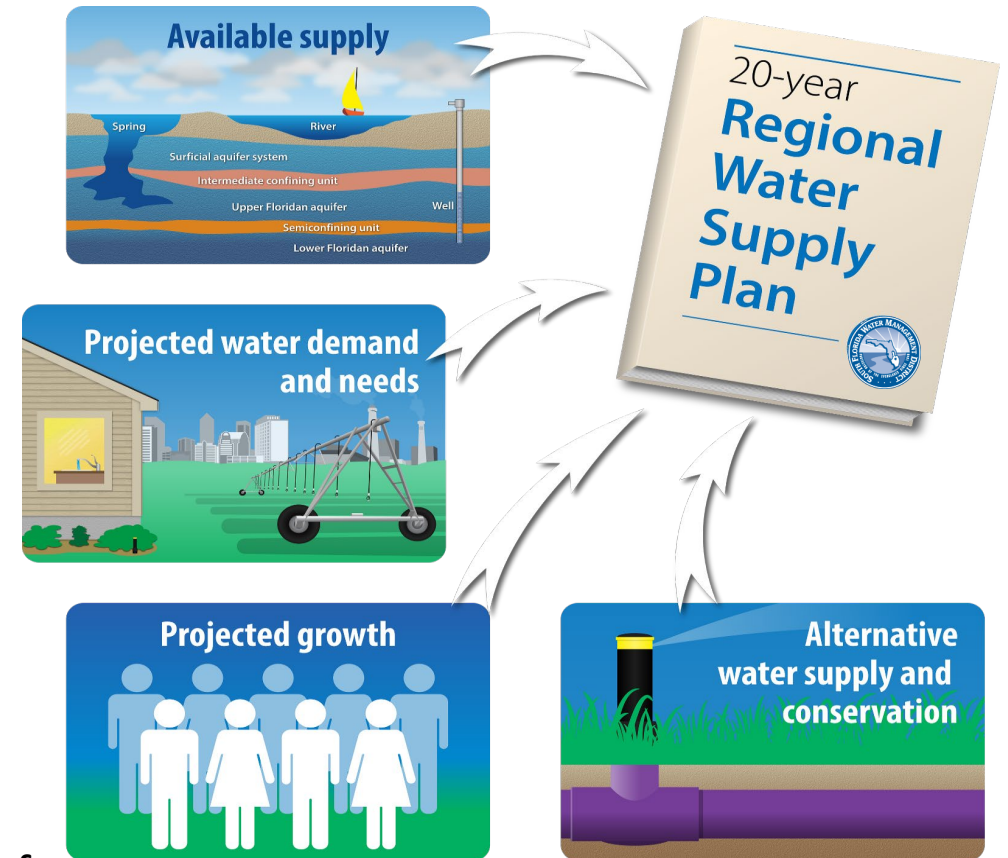


Major Efforts Since the First Meeting

➤ Preparing Draft Chapters/Appendices

- 1 – Introduction*
- 2 – Demand Estimates and Projections*
- 3 – Demand Management: Water Conservation*
- 4 – Water Resource Protection
- 5 – Water Source Options
- 6 – Water Resource Analyses
- 7 – Water Resource Development Projects
- 8 – Water Supply Development Projects
- 9 – Future Direction
- Appendix A – Water Demand Projections*
- Appendix B – Public Supply Utility Summaries
- Appendix C – MFLs and Recovery and Prevention Strategies
- Appendix D – Groundwater Monitoring
- Appendix E – Wastewater Treatment Facilities

* Signifies that these chapters are now available for public review (as of 8/10/23) and can be found here: [Lower East Coast Water Supply Plan](https://www.sfwmd.gov/2023/08/10/2023-Regional-Water-Supply-Plan-Public-Review/)



Questions and Public Comment

- If you are participating via Zoom:
 - Click the Reactions button to access the Raise Hand feature
- If you are participating via phone:
 - *9 raises hand
 - *6 mutes/unmutes your line
- When you are called on, please state your full name and affiliation prior to providing comments and/or questions



Biscayne Bay, Bill Baggs Cape State Park

Protecting Water Resources in the South Florida Water Management District

2023 LEC Stakeholder Meeting
August 24, 2023

James Beerens, PhD
Lead Scientist



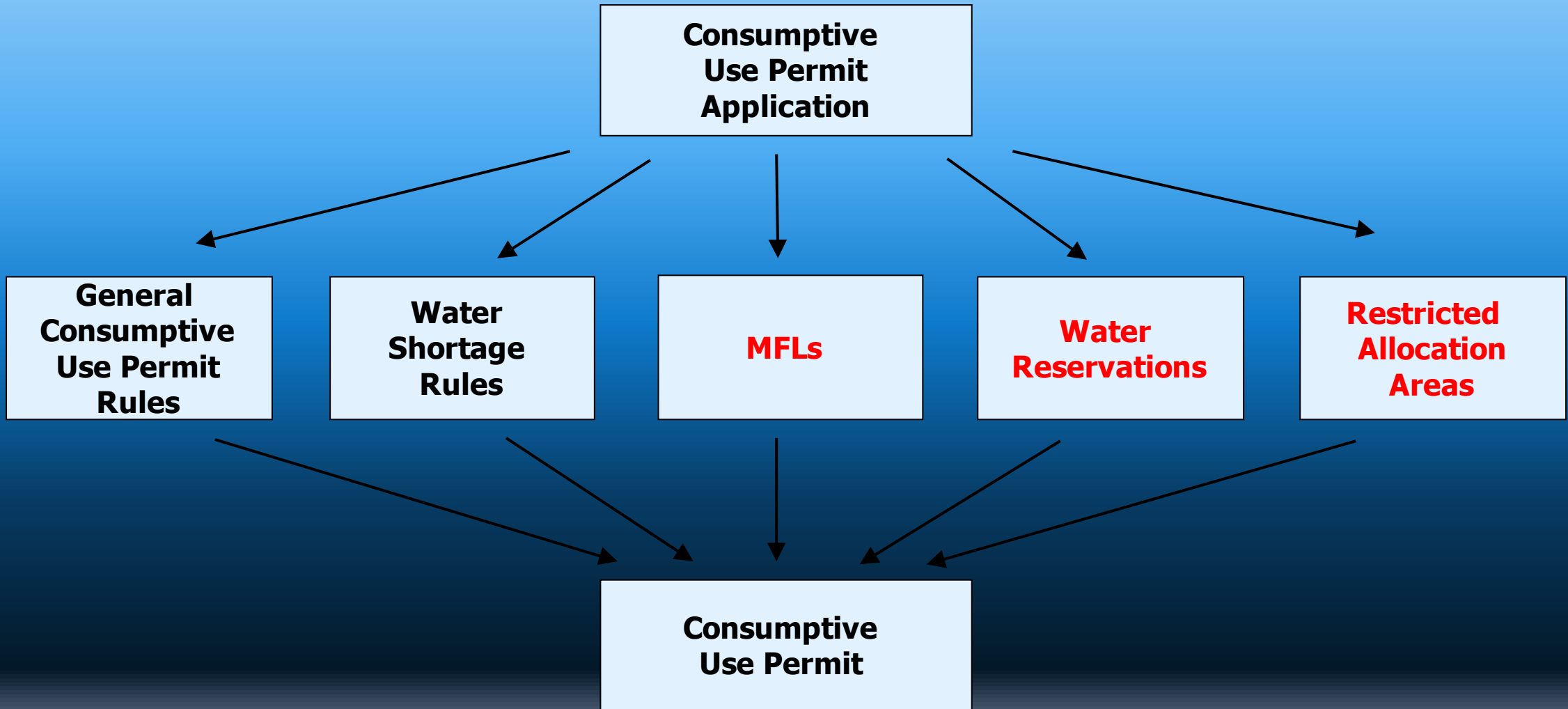
Water Resource Protection Tools

- Consumptive Use Permitting
- Minimum flows and minimum water levels (MFLs)
- Water reservations
- Restricted allocation areas (RAAs)
- All tools are adopted by rule in the Florida Administrative Code (F.A.C.)
- More than one tool can protect a waterbody

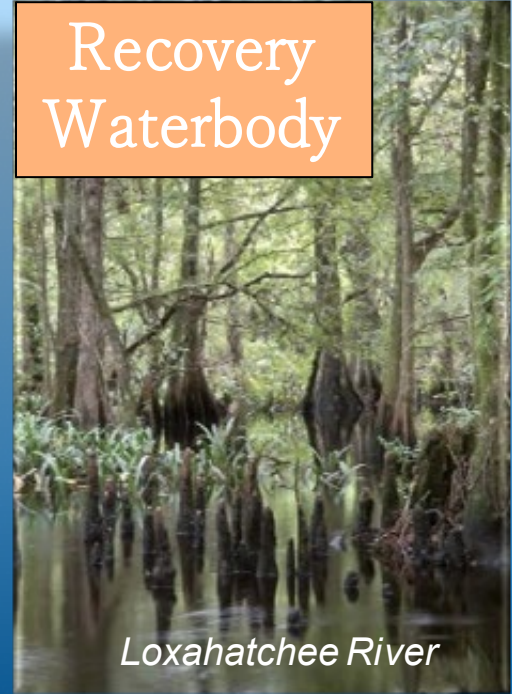
James Beerens, SFWMD

Loxahatchee National Wildlife Refuge

Factors Considered in Consumptive Use Permitting

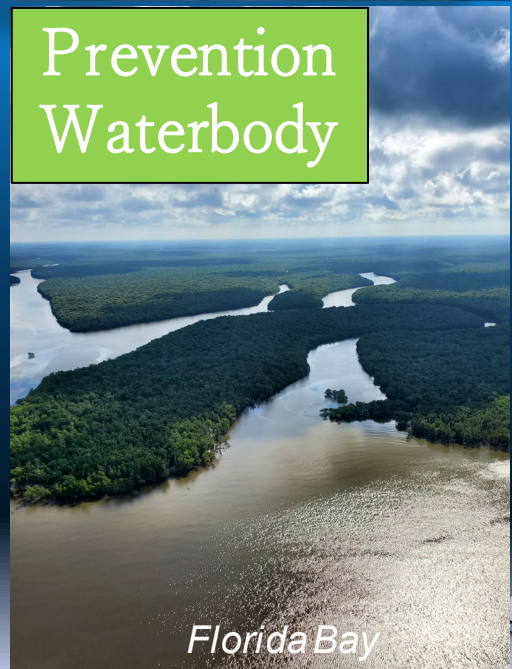


Recovery Waterbody



Loxahatchee River

Prevention Waterbody



Florida Bay

Minimum Flows and Minimum Water Levels

Defined in Chapter 40E-8, F.A.C.

- **MFLs** identify the point at which *further withdrawals* cause significant harm to the water resources
- **Significant harm:** Temporary loss of water resource functions that takes more than 2 years to recover but is less severe than serious harm
- May be adopted for surface waters or aquifers
- Established using “*best available information*”
 - Peer-reviewed science
- Annual MFL Priority Waterbody List

Conceptual Model from Chapter 40E-8 FAC

	Water Resource Protection Tools	Water Resource Protection Standards	Observed Impacts
Water Levels/Flow Decreasing	Permittable Water Reservation of Water	NO HARM (1-in-10 Level of Certainty*)	Normal Permitted Operations Environmental Restoration
	Phase I Water Shortage Phase II Water Shortage	HARM	Temporary loss of water resource functions taking 1 to 2 years to recover
	MINIMUM FLOWS & MINIMUM WATER LEVELS		
Drought Severity Increasing	Phase III Water Shortage	SIGNIFICANT HARM	Water resource functions require multiple years to recover (> 2 year)
	Phase IV Water Shortage	SERIOUS HARM	Permanent or irreversible loss of water resource functions

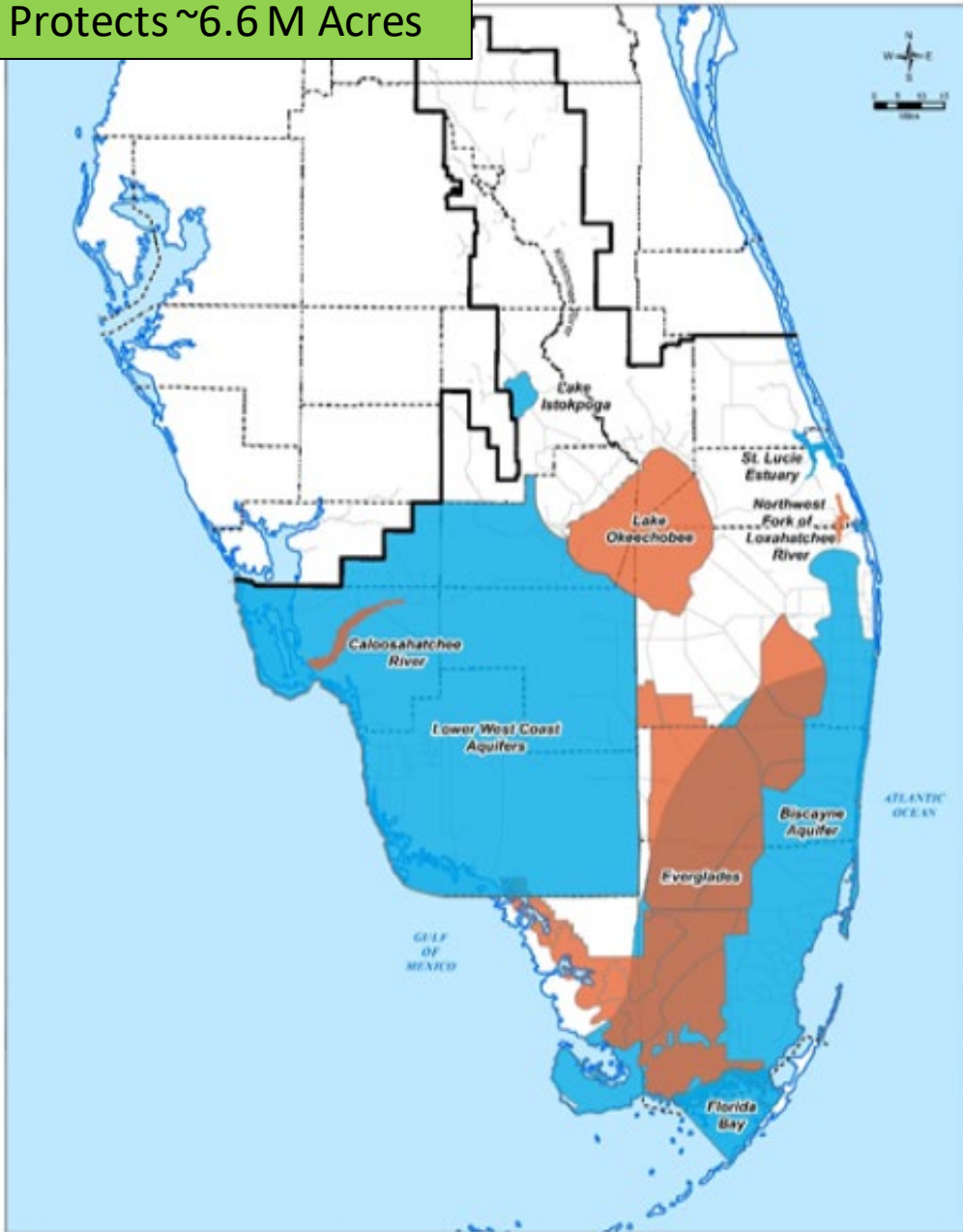
* 1-in-10 Level of Certainty – Reasonable assurance that the proposed use will not harm water resources or interfere with existing legal water users up to a 1-in-10-year drought condition (a drought condition that occurs only once in 10 years).

MFL Recovery and Prevention Strategies

Subsection 373.0421(2), F.S.

- **Recovery Strategy** for those not meeting the MFL at the time of adoption
 - Achieve recovery to the established MFL as soon as practicable
- **Prevention Strategy** for those that are meeting the MFL but not expected to meet it in 20 years
 - Prevent the existing flow or level from falling below the established MFL
- Adopted simultaneously with MFL rule adoption in the SFWMD
- Strategies are included in the water supply planning process

Protects ~6.6 M Acres



Minimum Flows and Minimum Water Levels

MFL Prevention Waterbodies

- Biscayne aquifer (2001)
- Lower West Coast aquifers (2001)
- St Lucie Estuary (2002)
- Lake Istokpoga (2006)
- Florida Bay (2006)

MFL Recovery Waterbodies

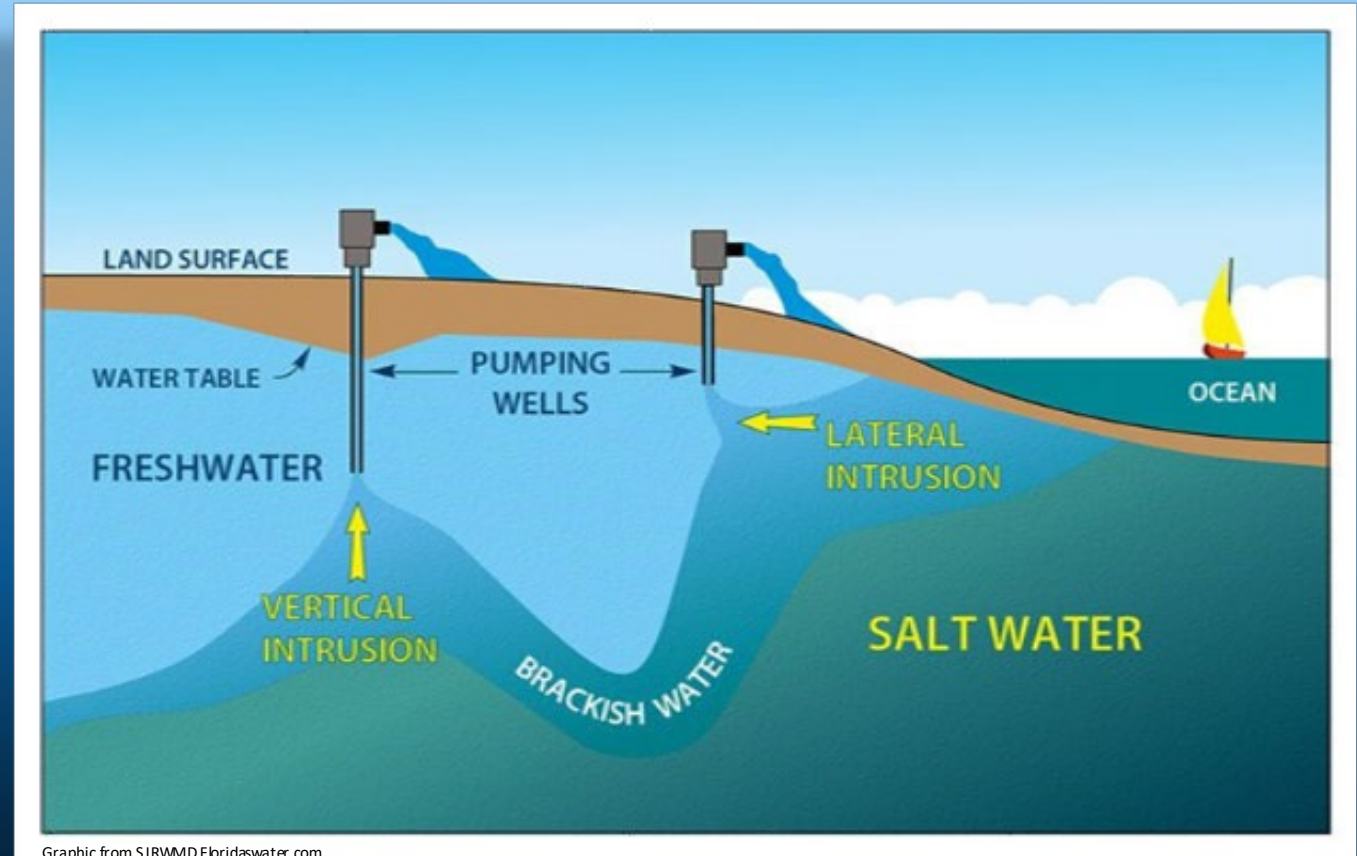
- Lake Okeechobee (2001), revised (2007)
- Everglades (2001)
- Caloosahatchee River (2001)
- Loxahatchee River (2003)

Biscayne Aquifer Adopted MFL

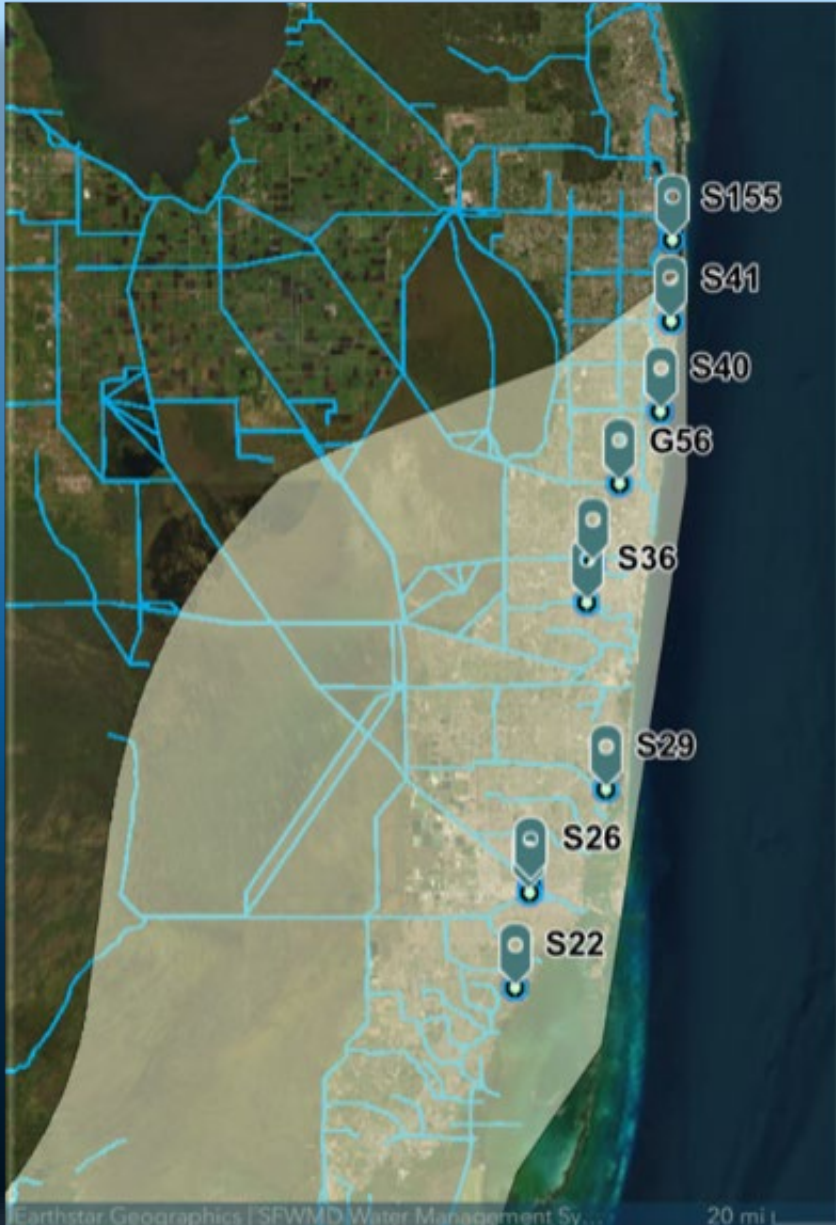
Section 40E-8.231, F.A.C.

MFL Criterion: “The minimum level for the Biscayne Aquifer is the level that results in movement of the saltwater interface landward to the extent that groundwater quality at an established withdrawal point is insufficient to serve as a water supply source”

Interpretation: Groundwater level needed in the aquifer to prevent saltwater intrusion from making the aquifer insufficient as a water supply source.



An MFL violation occurs when water level in the aquifer produces this degree of saltwater movement at any point in time.



Biscayne Aquifer Prevention Strategy

- Maintain coastal canal stages at least at the identified minimum operational levels
- Apply conditions for permit issuance to prevent harmful movement of saltwater interface
 - **Consumptive use permitting criteria in Rule 40E-2, F.A.C.**
- Maintain groundwater monitoring network and utilize data to initiate water shortage actions
 - **Pursuant to Rule 40E-8.441, F.A.C. and Chapters 40E-21 and 40E-22, F.A.C.**

Biscayne Aquifer Prevention Strategy (cont.)

- Construct and operate water resource and water supply development projects
 - 2008 regional water availability rule (promotes development of alternative water sources and conservation)
 - Countermeasures to saltwater intrusion through Everglades restoration (CERP)
- Conduct research in high-risk areas to identify where saltwater interface is adjacent to existing and future potable water sources
 - District periodically maps saltwater intrusion into coastal aquifers

Florida Bay Adopted MFL

Covers “Northeast Subregion of Florida Bay”

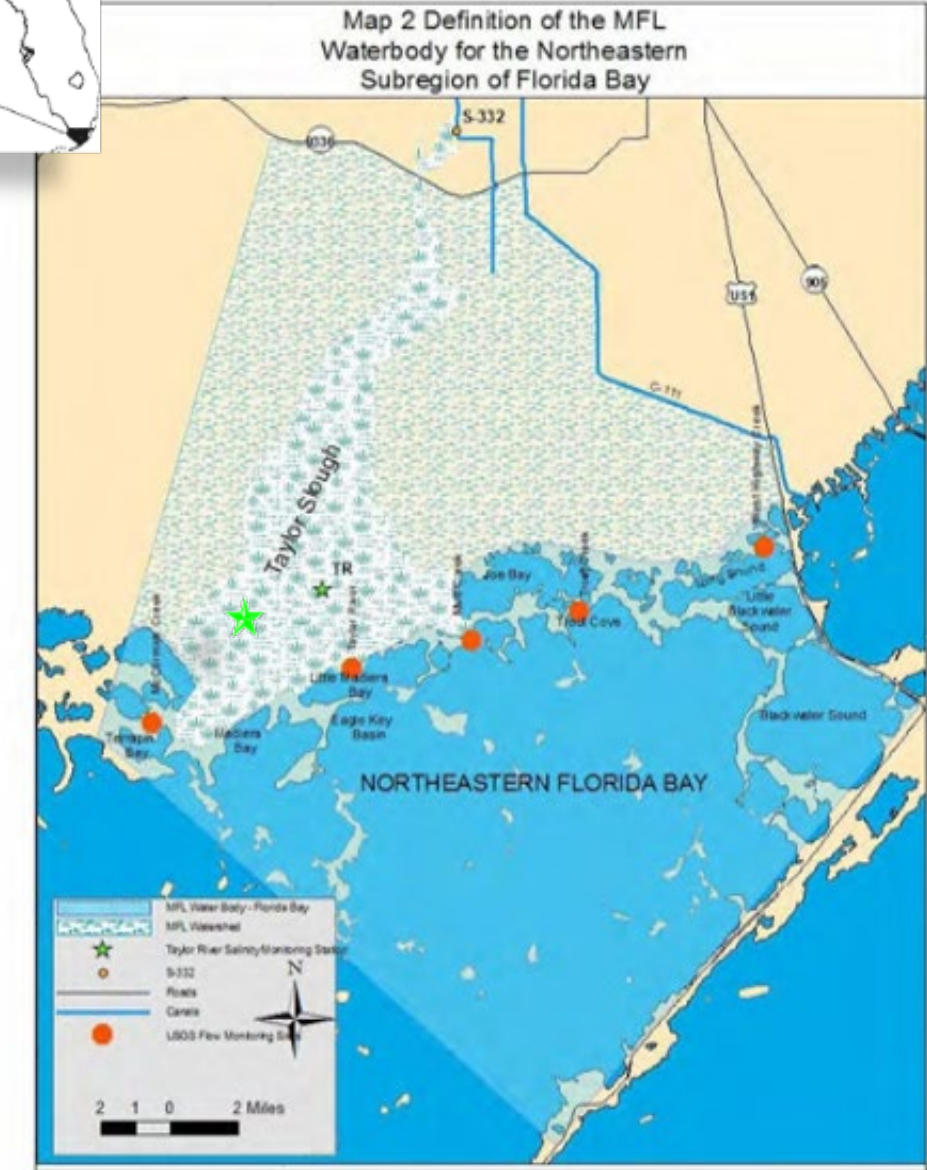
Subsection 40E-8.221(5), F.A.C.

MFL Criterion:

A net minicriterion with minimum flow into Florida Bay, over a 365-day period, of 105,000 acre-feet

- MFL is a flow a salinity performance indicator (e.g., flow needed to maintain a salinity of ≤ 30 at the Taylor River monitoring station)

2014 MFL Reevaluation: Concluded MFL criteria were adequate for preventing significant harm, zero violations since.



Florida Bay Adopted MFL

An MFL “exceedance” occurs when:

- The average salinity over ≥ 30 consecutive days is > 30 at the Taylor River salinity monitoring station (event)
- Multiple events occurring within a single calendar year are considered a single exceedance



An MFL violation occurs when an exceedance occurs during each of two consecutive years, more often than once in a 10-year period (return frequency)

Florida Bay Prevention Strategy

Subsection 40E-8.421(8), F.A.C.

- Projects for delivering more water to Florida Bay, specifically:
 - Modified Water Deliveries to Everglades National Park Project (ModWaters)
 - Comprehensive Everglades Restoration Plan (CERP) C-111 Spreader Canal Western Project
 - C-111 South Dade Project
- Other projects supporting the MFL and prevention strategy:
 - Central Everglades Planning Project (CEPP) *
- Continued field monitoring and research to assess salinity, water levels, and flow conditions, and biological resource responses in the region

** Includes six components of CEPP: Everglades Agricultural Storage Reservoirs; WCA 3 Decomartmentalization and Sheetflow Enhancement; S-356 Pump Station Modifications; L-31N Improvements for Seepage Management; System-wide Operational Changes– Everglades Rain-Driven Operations; and Flow to Northwest and Central WCA-3A.*

Everglades Adopted MFL

Subsection 40E-8.221(3), F.A.C

Includes the lands and waters of the Water Conservation Areas, the Holeyland/Rotenberger wildlife management areas, and the freshwater portions of Everglades National Park (brown area on map)



Everglades Adopted MFL

MFL Criteria:

- Based upon water levels in peat-forming and marl-forming wetlands in the Everglades
- Specify limits on the decline of water levels below ground during defined periods of time (worst case scenario)
- MFL compliance is assessed at the 20 Everglades sites listed in Table 1 of Rule 40E-8.221, F.A.C.

MFL Component	Peat-Forming Wetlands	Marl-Forming Wetlands	Status
Period (consecutive days water level has been below ground)	30 days	90 days	
MFL			
Depth	≥ 1 foot below ground	1.5 feet below ground	Exceedance (Significant Harm)
Duration	≥ 1 day	≥ 1 day	
Range of Site Specific Exceedance Return Frequencies*	1 exceedance in 2 to 10 years	1 exceedance in 2 to 5 years	Violation
* Listed in Table 1 of Rule 40E-8.221, F.A.C.			

Everglades Recovery Strategy

Subsection 40E-8.421(2), F.A.C.

- Implementing measures in the LEC Water Supply Plan and CERP to more closely approximate “pre-drainage” conditions
- Applying consumptive use and water shortage requirements
- Removing conveyance limitations
- Implementing revised Central and Southern Florida Project for Flood Control and Other Purposes (C&SF Project)
- Storing additional freshwater, reserving water for the protection of fish and wildlife, and developing alternative sources for water supply



James Beerens, SFWMD

Lake Okeechobee Adopted MFL

Subsection 40E-8.221(1), F.A.C

Lake level of 11' NGVD

An MFL “exceedance” occurs when:

- Lake level declines below 11', for > 80 consecutive or non-consecutive days, during an 18-month period
- 18-month period shall not include more than one wet season (May 31 through October 31)

An MFL violation occurs when an exceedance occurs more than once every 6 years (return interval)

Lake Okeechobee **Current** Recovery Strategy

Subsection 40E-8.421(2), F.A.C.

- Environmental Enhancement Projects
 - Native vegetation planting, sediment scraping, prescribed burns, etc.
- Lake Water Consumptive Use Constraints
 - Restricted Allocation Areas
- Water Restrictions
 - Phases 1 through 4 as needed
- Capital Projects to Improve Storage Capacity in and adjacent to lake
 - Lake Okeechobee Watershed Restoration Project
 - Herbert Hoover Dike (HHD) repair and revised Lake regulation schedule

NW Fork of Loxahatchee River Adopted MFL

Subsection 40E-8.221(4), F.A.C.

An MFL exceedance occurs when:

- Flows decline below 35 cfs for > 20 consecutive days; or
- Salinity, expressed as 20-day rolling average, is > 2 at river mile 9.2

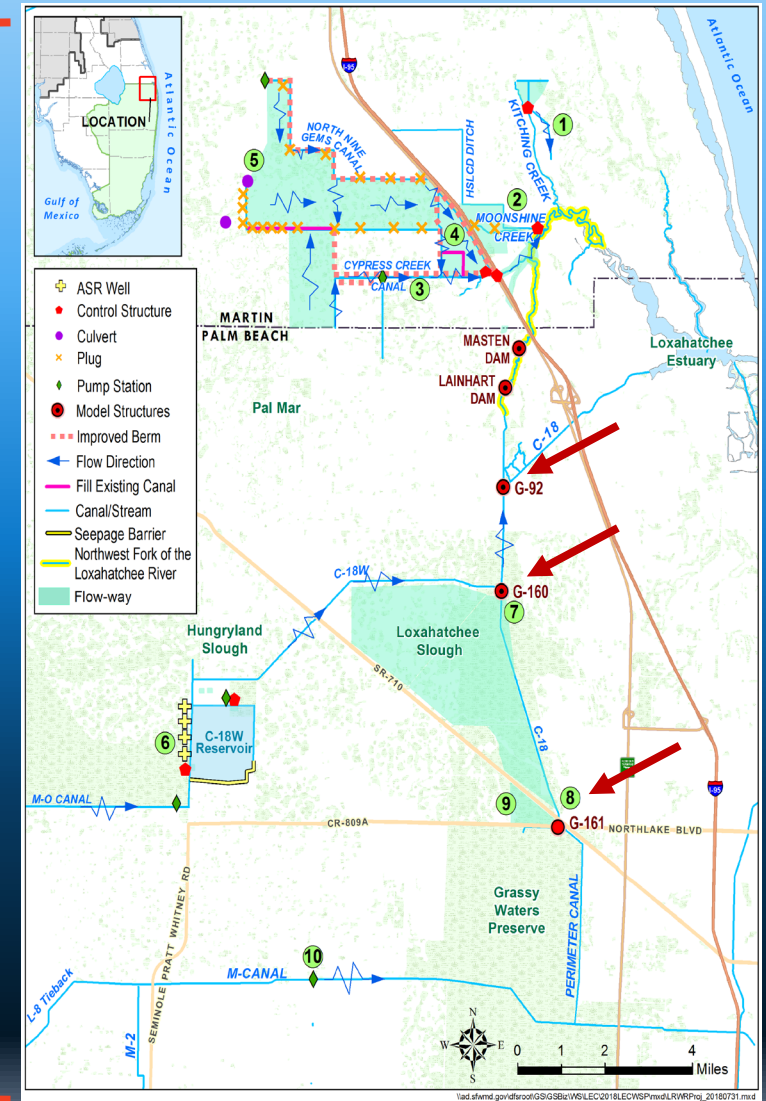
An MFL violation occurs when an exceedance occurs more than once in a 6-year period



NW Fork of Loxahatchee River Recovery Strategy

Subsection 40E-8.421(6), F.A.C.

- Structural Improvements to increase water storage and delivery capabilities
 - G-160 and G-161 Structure Projects
 - Loxahatchee River Watershed Restoration Project
- Operational Protocols at G-92 to provide flows ≥ 50 cfs at Lainhart Dam when supplies are available
- Regulatory Activities
 - SFWMD regulatory program, water shortage plans, and the North Palm Beach County / Loxahatchee River Watershed Restricted Allocation Area



Water Reservations

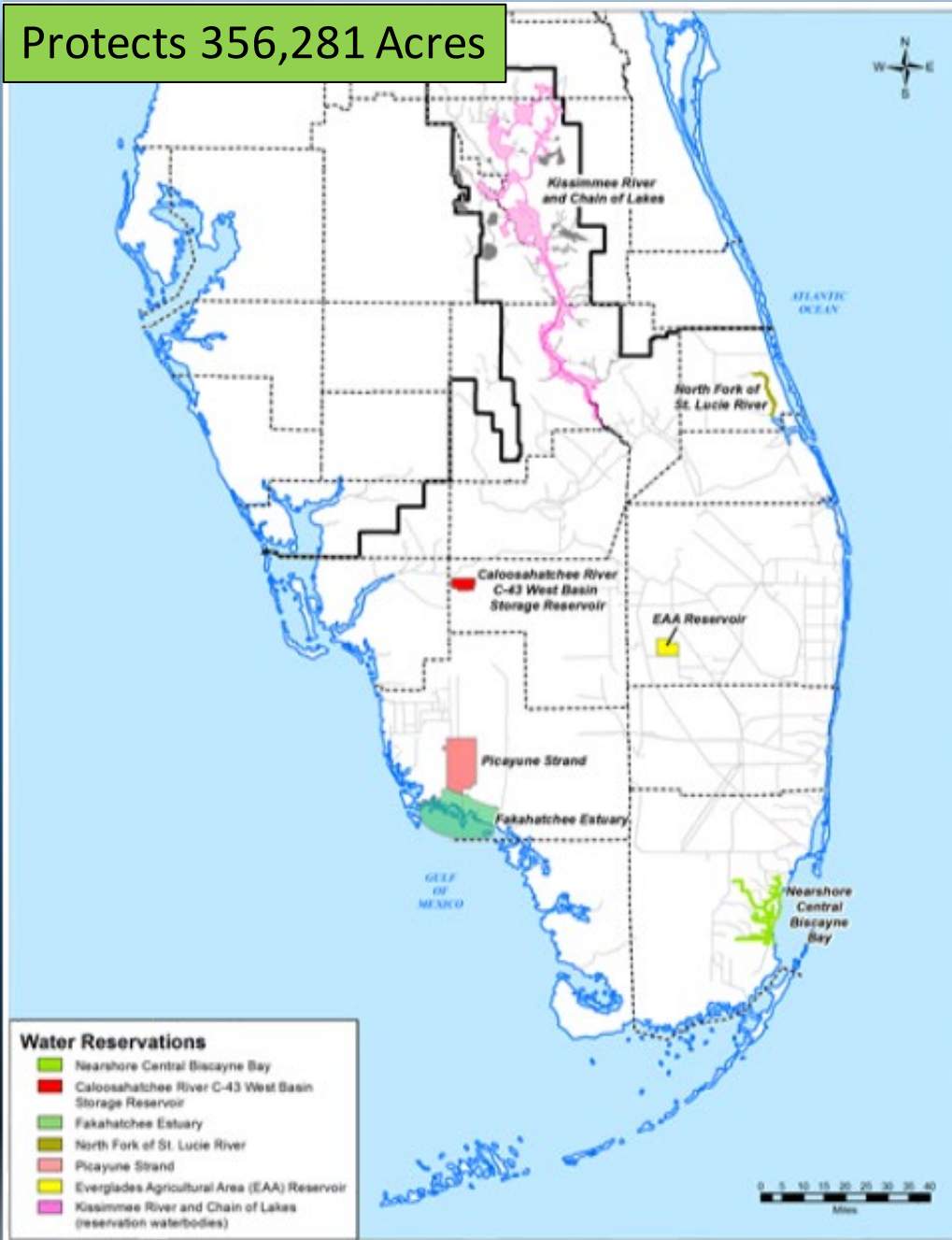
Sets aside water for the protection of fish and wildlife (or public health and safety)

- Based on scientifically defensible determination of water needed for protection of fish and wildlife
- Reserves water from allocation to consumptive uses
- Required for Comprehensive Everglades Restoration Plan (CERP) projects



Kissimmee River

Protects 356,281 Acres

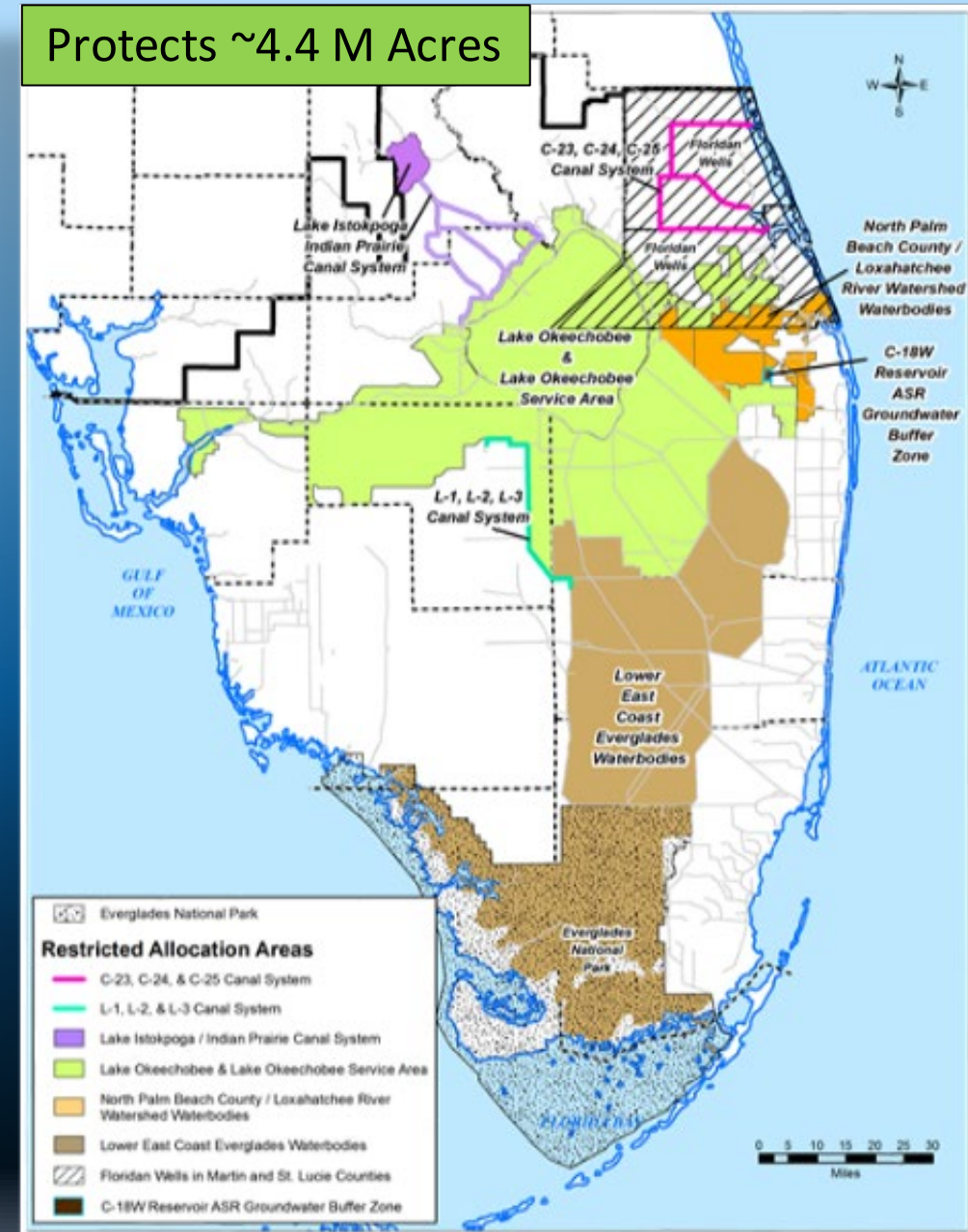


Water Reservations in the SFWMD

- Picayune Strand – 2009
- Fakahatchee Estuary – 2009
- North Fork of the St. Lucie River – 2010
- Nearshore Central Biscayne Bay – 2013
- Caloosahatchee River (C-43) West Basin Storage Reservoir – 2014
- EAA Reservoir – 2021
- Kissimmee River & Chain of Lakes – 2021

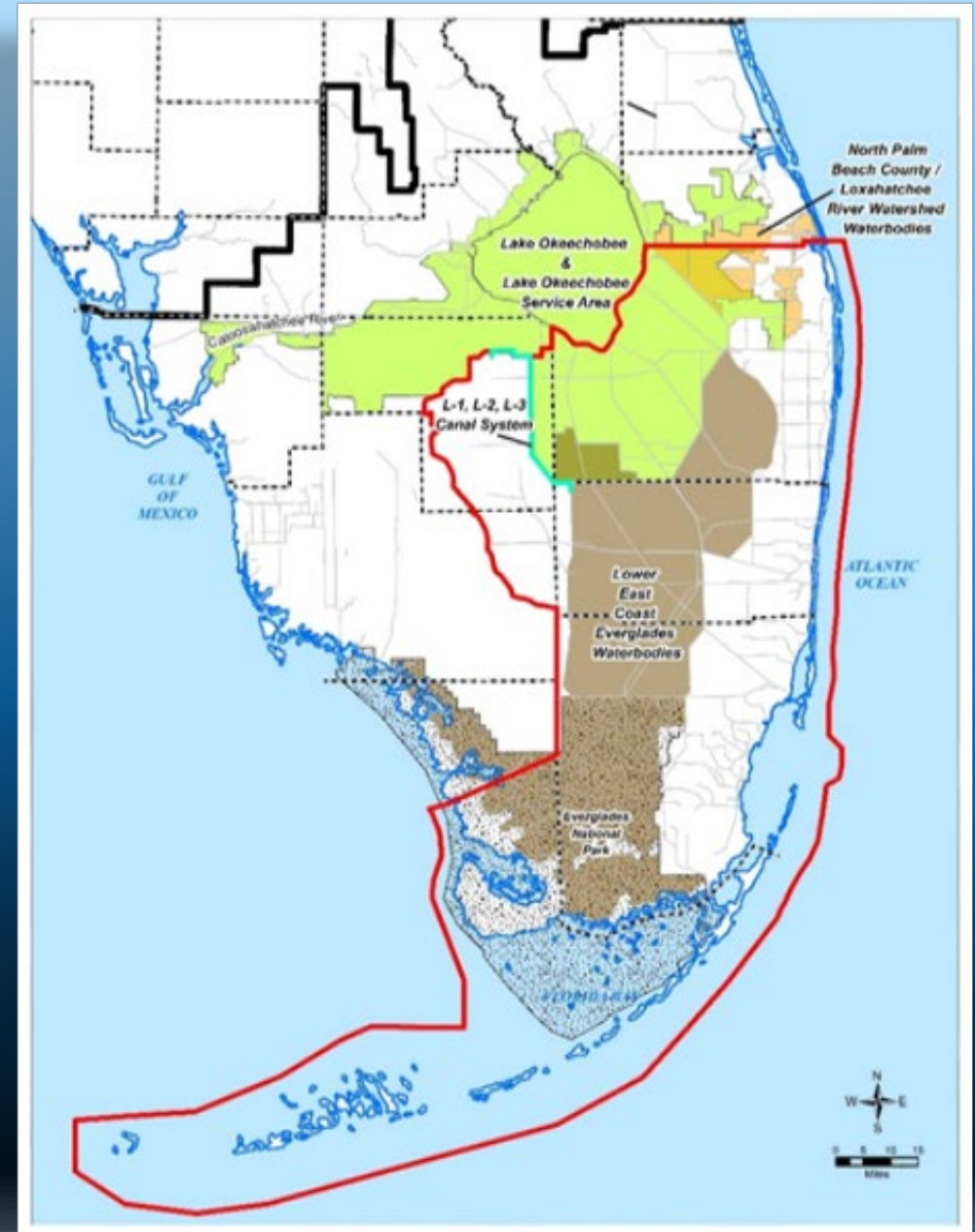
Restricted Allocation Areas (RAA)

- Implemented where there is a lack of water available to meet projected needs of the region
- Restricts new or increased consumptive use allocations
- Large geographic areas covering multiple ecosystems (Everglades, Lake Okeechobee, Loxahatchee)
- Public interest considerations by Governing Board determination
- Protects future water made available for natural system by CERP projects
- Listed in Section 3.2.1 of the *Applicant's Handbook*, incorporated by reference in Rule 40E-2.091, F.A.C.



RAA's in the Lower East Coast Planning Area

RAA	Water Allocations Are Limited To:
L-1, L-2 & L-3 Canal System	Existing allocations permitted at the time of RAA adoption (1981) with no increases in surface water pump capacity
Lower East Coast Everglades Waterbodies	Historic water use permitted as of April 1, 2006
North Palm Beach County / Loxahatchee River Watershed	Historic water use permitted as of April 1, 2006
Lake Okeechobee and Lake Okeechobee Service Area	Historic water use that occurred from April 1, 2001 to January 1, 2008



LEC Waterbodies Protected by Multiple Tools

Lake Okeechobee

- MFL
- Lake Okeechobee and LOSA Restricted Allocation Area

Everglades and Biscayne Aquifer

- MFL
- Lower East Coast Everglades Waterbodies Restricted Allocation Area

Northwest Fork of Loxahatchee River

- MFL
- North Palm Beach County/Loxahatchee River Watershed Restricted Allocation Area

These tools protect 7.4 million acres, or about 69%, of the SFWMD

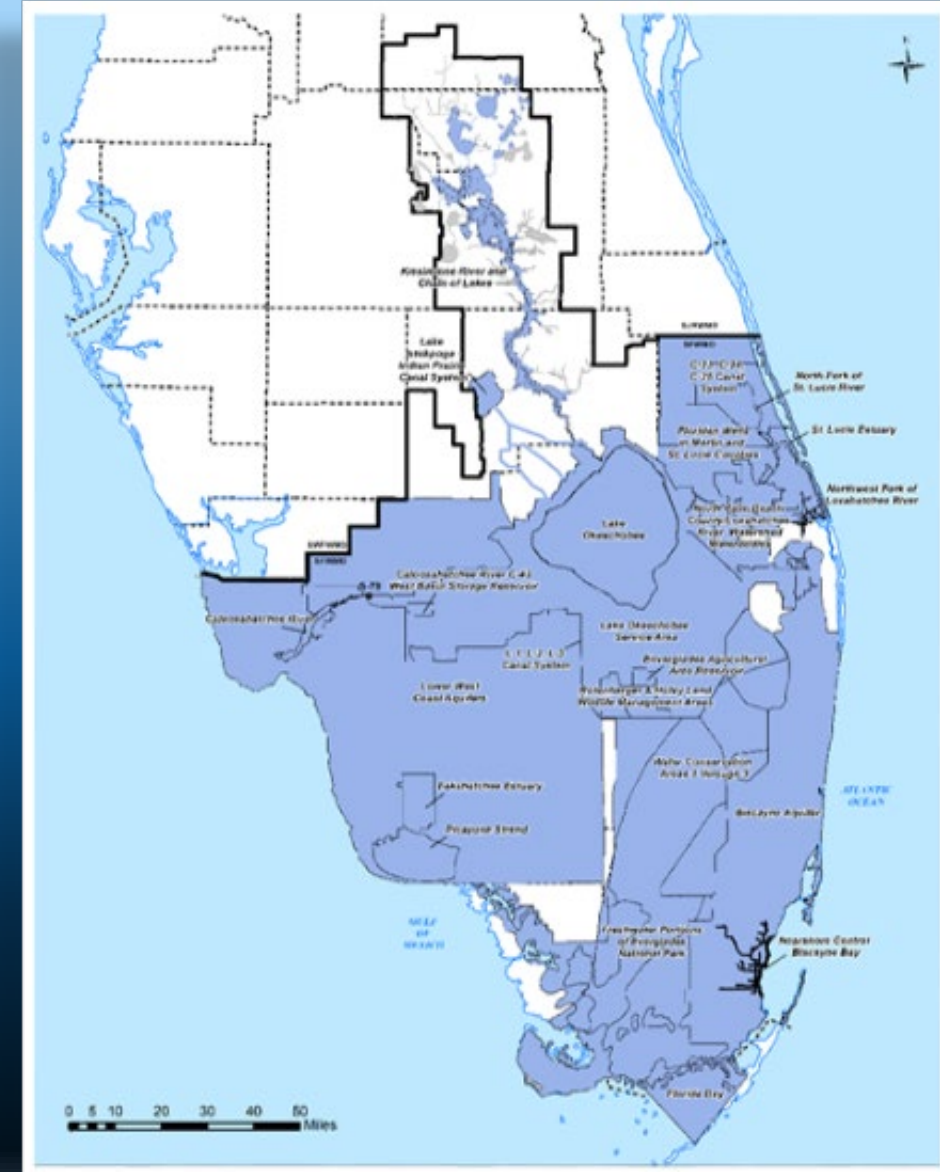
Composite of All Protection Tools

Minimum Flows and Levels 6,615,517 Acres

Water Reservations 356,281 Acres

Restricted Allocation Areas 4,391,433 Acres

Total Protected Area 10,435,063 Acres



Why Protect Against Water Withdrawals?

- MFL Perspective:
 - To prevent significant harm from occurring to MFL waterbodies
- Water Reservation Perspective:
 - To protect water needed for fish and wildlife before harm occurs
 - To ensure that the water is legally protected and available for CERP projects
- Restricted Allocation Area Perspective:
 - Protects against future harm when there is a lack of water available to meet projected demands in a region (e.g., Lake Okeechobee, Everglades, Loxahatchee).

Recovery

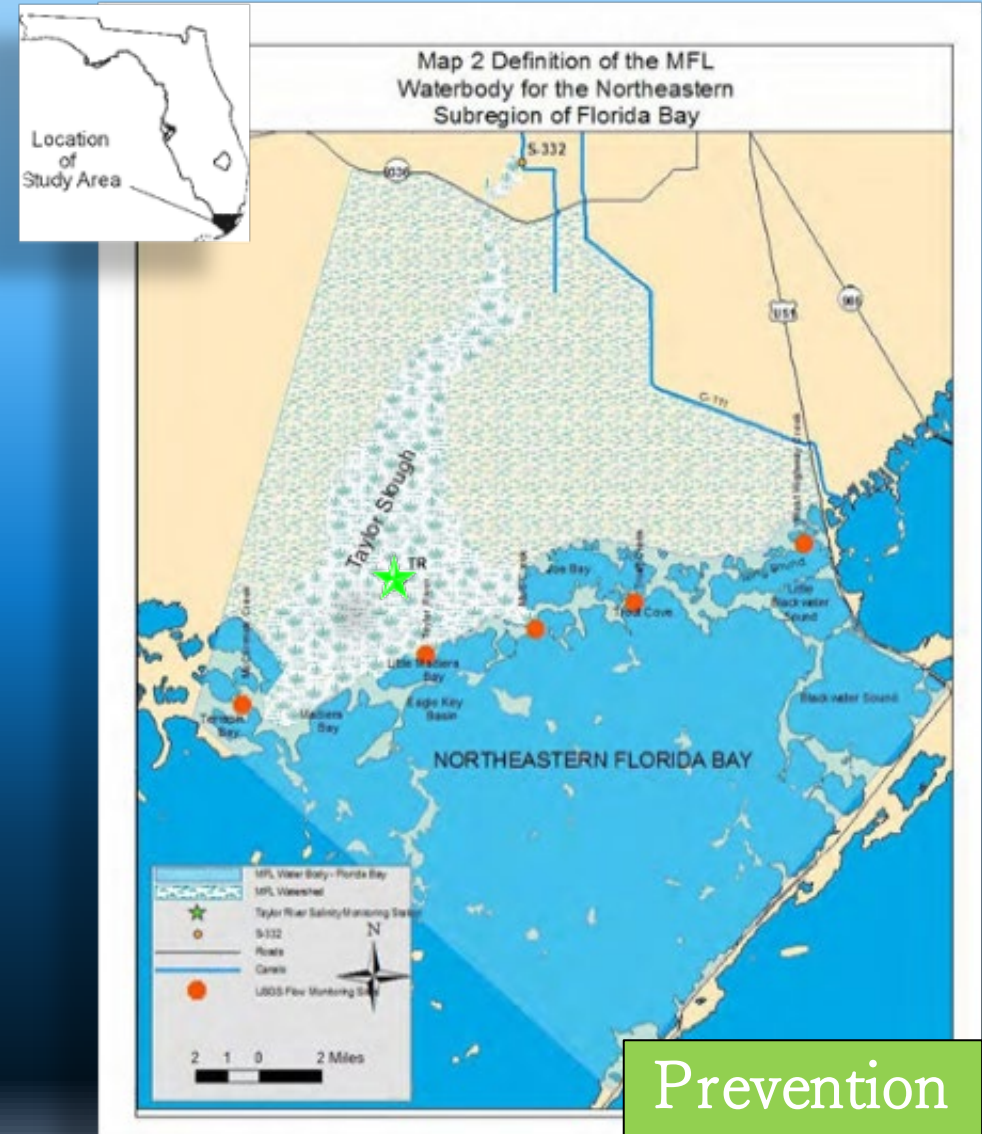


Loxahatchee River

Florida Bay MFL Monitoring

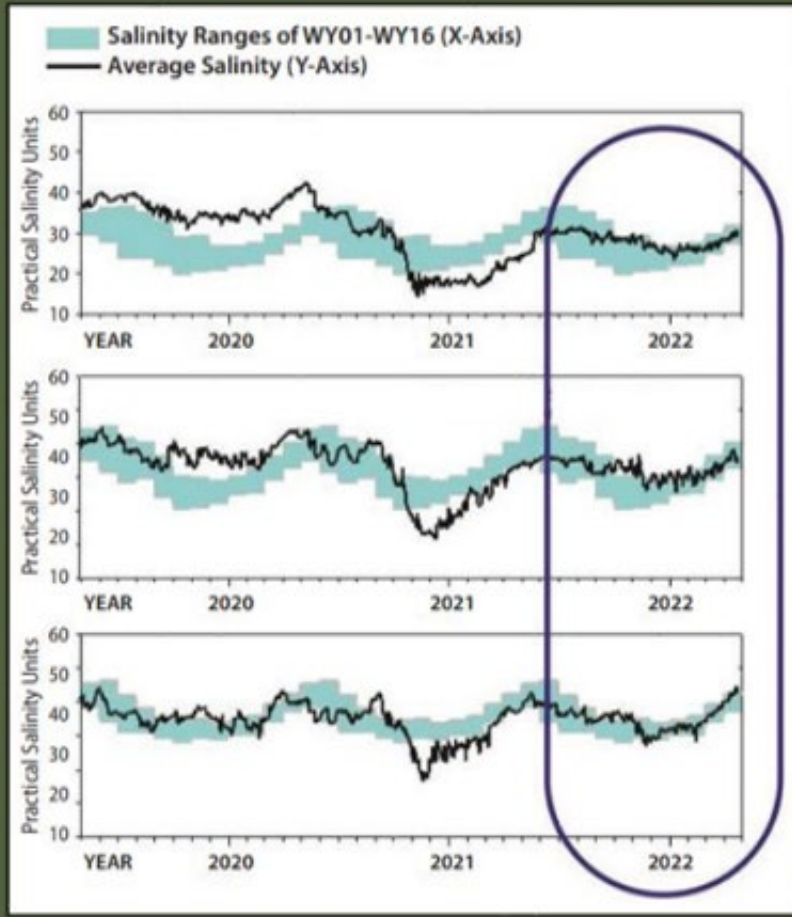
Area protected by MFL:

- Includes marsh, mangrove transition zone, open bay
- MFL Salinity Site at Taylor River (green star)
- *Ruppia* ecological indicator downstream
- Zero Violations since inception, however *Ruppia* percent cover has declined



Salinity Levels in Florida Bay Stabilize

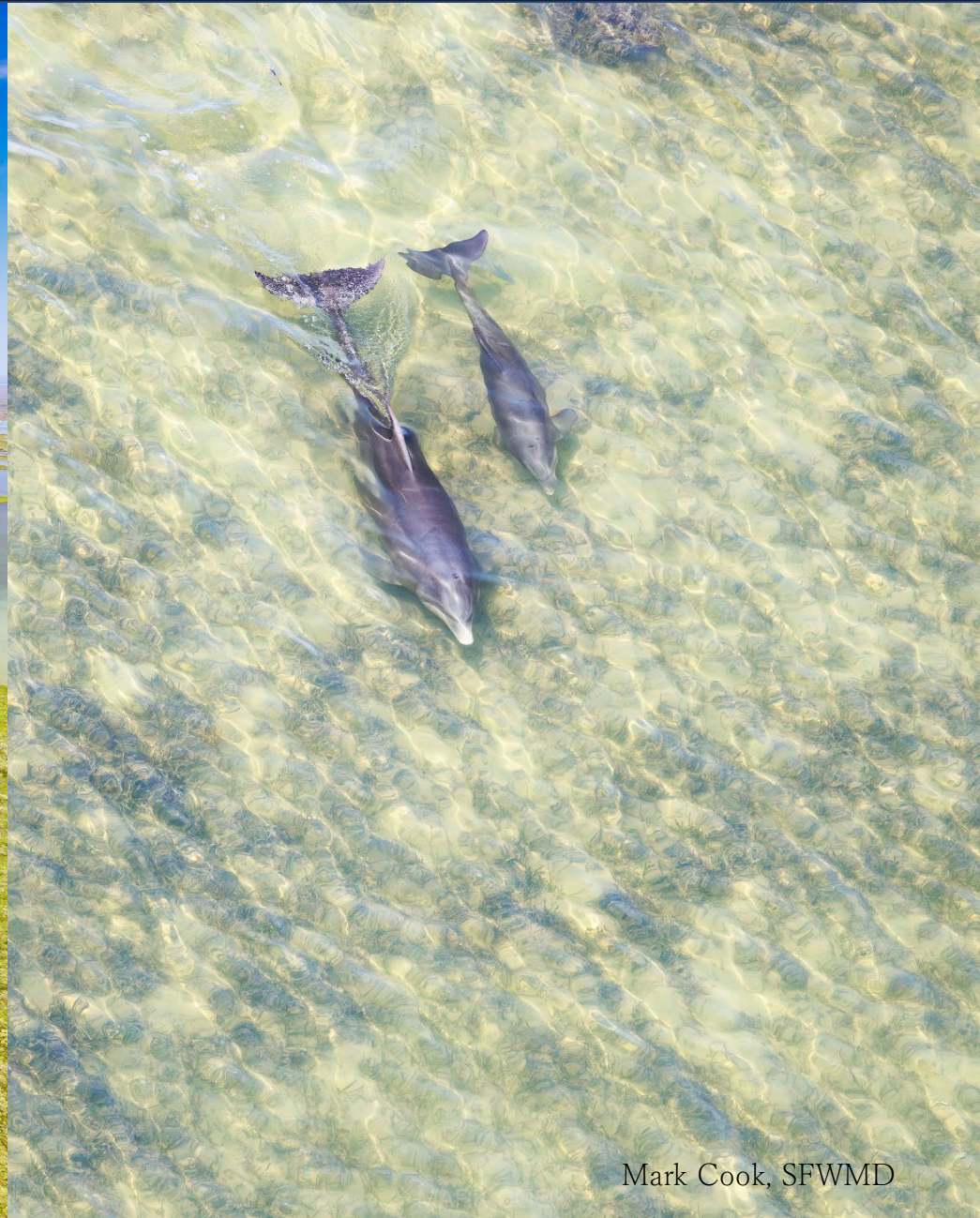
Record water flows and water depths in the Everglades coupled with rainfall demonstrated that restoration can support healthy salinity levels in Florida Bay. Balanced salinity supports sea grass and spawning fish.



Mark Cook, SFWMD

Questions and Public Comment

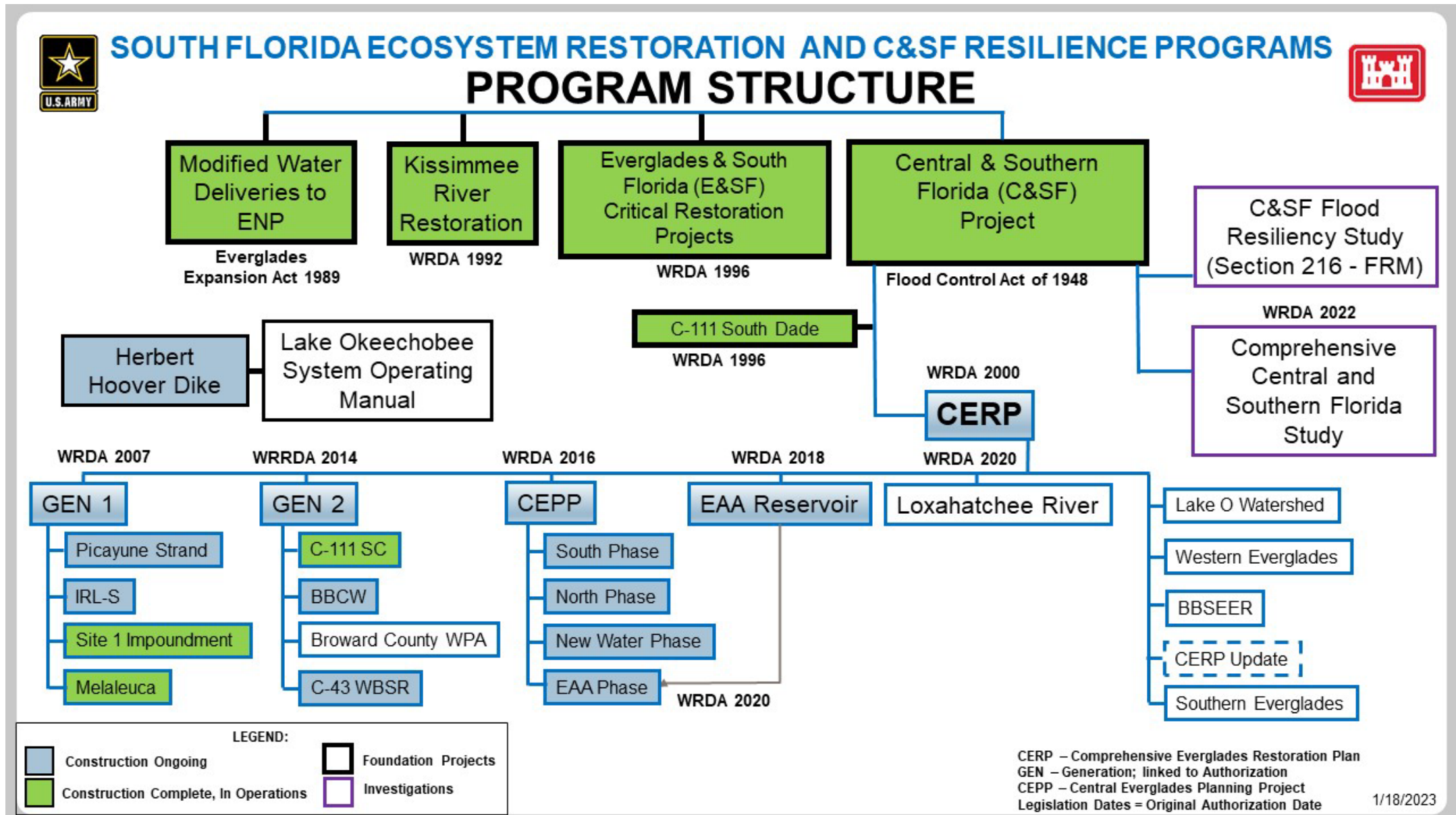
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Comprehensive Everglades Restoration Plan Project Updates



Leslye Waugh
Section Administrator
Ecosystem Restoration Planning & Project Management
South Florida Water Management District
Lower East Coast Water Supply Plan Stakeholder Meeting #2
August 24, 2023



Comprehensive Everglades Restoration Plan

Authorized Projects in Design & Construction

- Loxahatchee River Watershed Restoration Project (LRWRP)
- Broward County Water Preserve Areas (BCWPA)
- Central Everglades Planning Project (CEPP)
 - Everglades Agricultural Area (EAA) Phase
 - North Phase
 - South Phase
 - New Water Phase
- C-111 Spreader Canal Western Project (C-111)
- Biscayne Bay Coastal Wetlands Phase I (BBCW)



Loxahatchee River Watershed Restoration Project (LRWRP)

Project Purpose: Improve freshwater flows to the Northwest Fork of the Loxahatchee River, which is a nationally designated Wild and Scenic River, and to restore the hydrology and connectivity of wetlands and watersheds that form the historic headwaters of the river

Flow Way 3

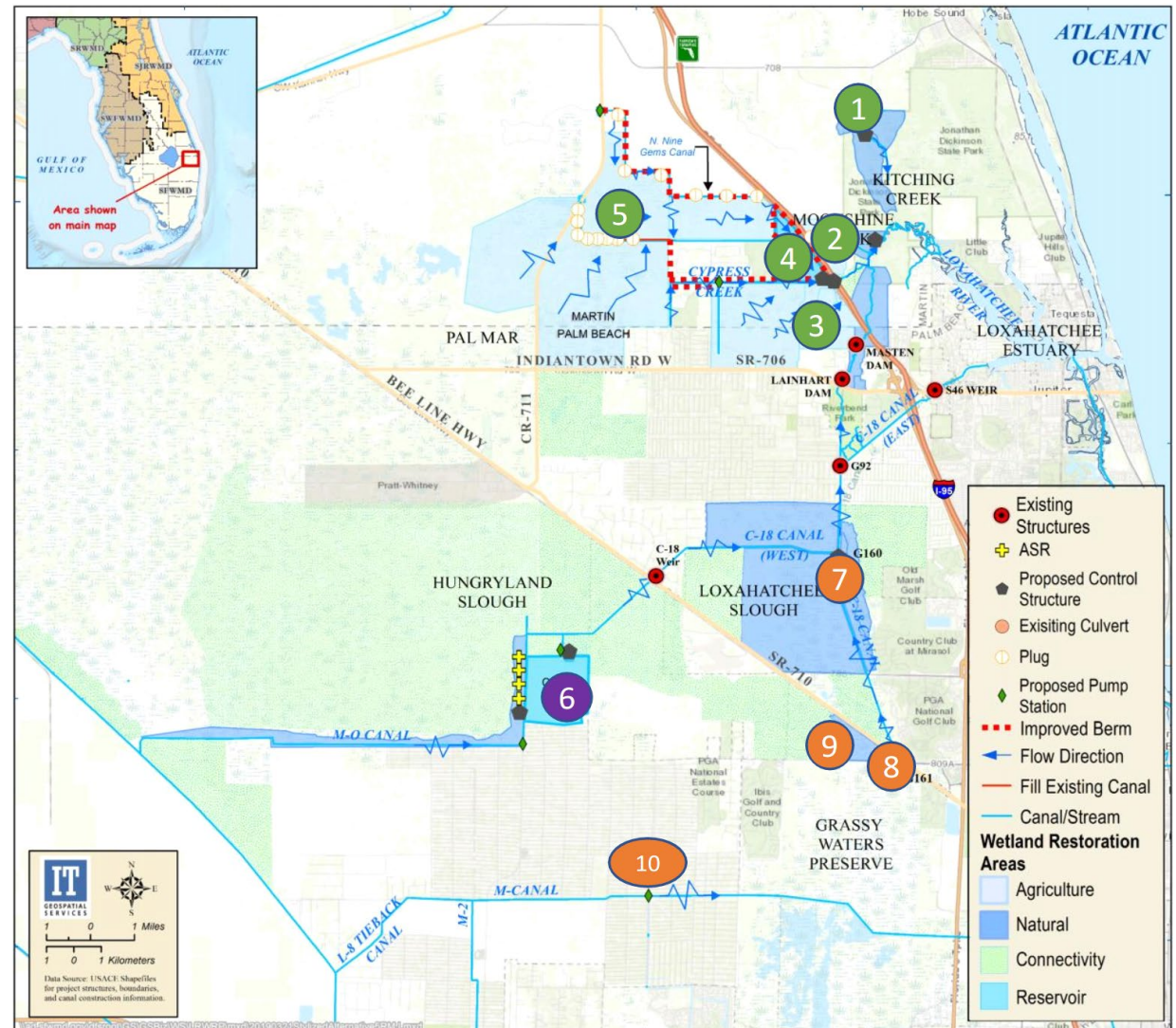
- 1 - Kitching Creek
- 2 - Moonshine Creek/Gulfstream East
- 3 - Cypress Creek Canal
- 4 - Gulfstream West
- 5 - Palmar East

Flow Way 2

- 6 - C-18W Impoundment (9,500 ac/ft & 4 ASR wells)

Flow Way 1

- 7 - G-160 Structure
- 8 - G-161 Structure
- 9 - Grassy Waters Triangle
- 10 - M-1 Pump Station



Broward County Water Preserve Areas (BCWPA)

➤ Project Components:

- C-11 Impoundment
- Seepage Management Area
- C-9 Impoundment

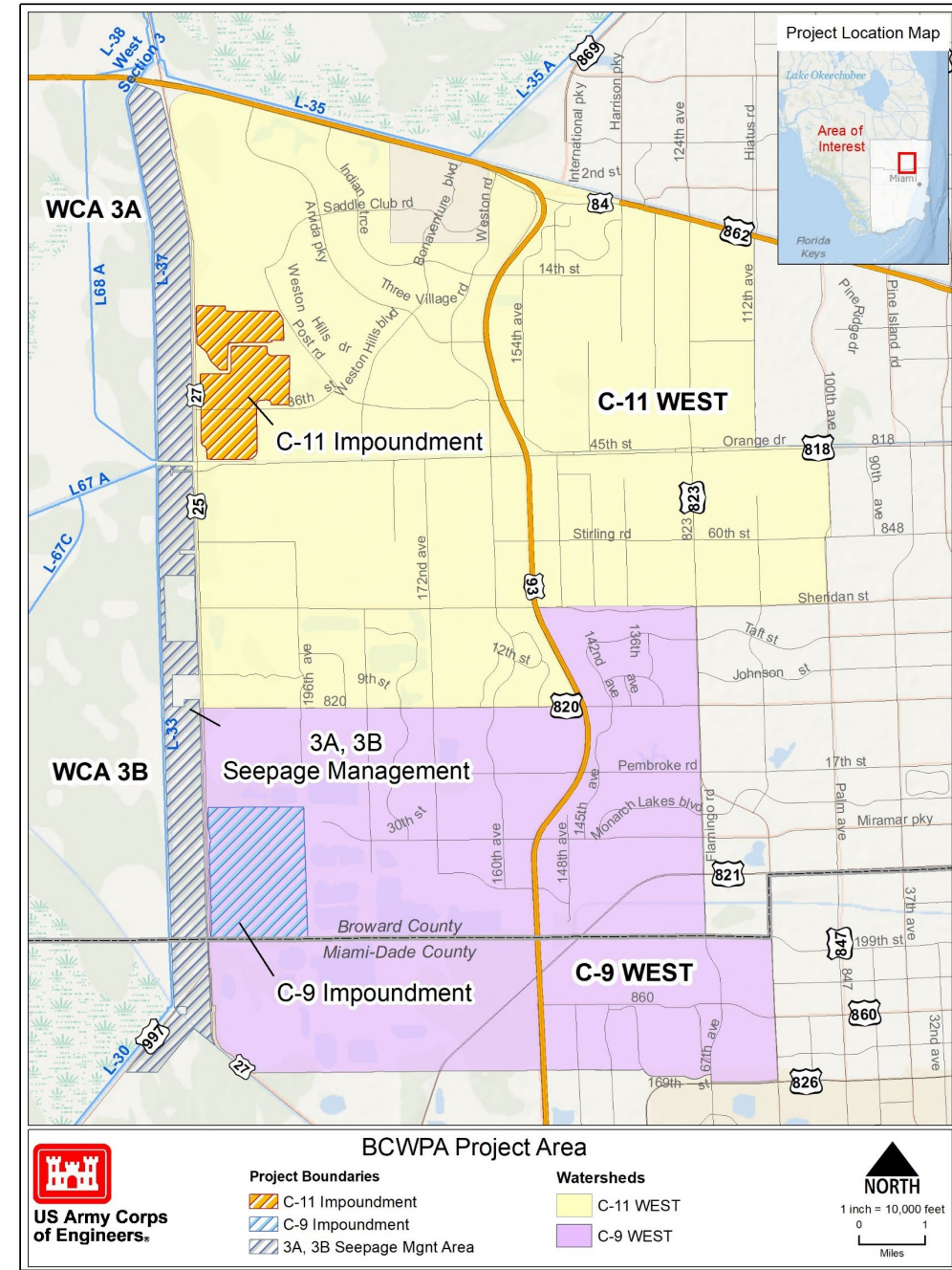
➤ Status:

- Signed Chief's Report – May 2012
- Authorization – WRDA 2014
- C-11 Impoundment expected to be awarded in mid-2024

➤ Purpose:

- Reduce seepage loss from Water Conservation Area (WCA) 3A/3B to the C-11 and C-9 basins
- Capture, store, and distribute surface water runoff from the western C-11 Basin that has been discharged into WCA 3A/3B.
- Maintain existing level of flood protection and improve groundwater recharge
- Increase spatial extent of wetlands
- Improve hydroperiods and hydropatterns in WCA 3A/3B

Contact Information: Elizabeth Caneja ecaneja@sfwmd.gov



Central Everglades Planning Project (CEPP)

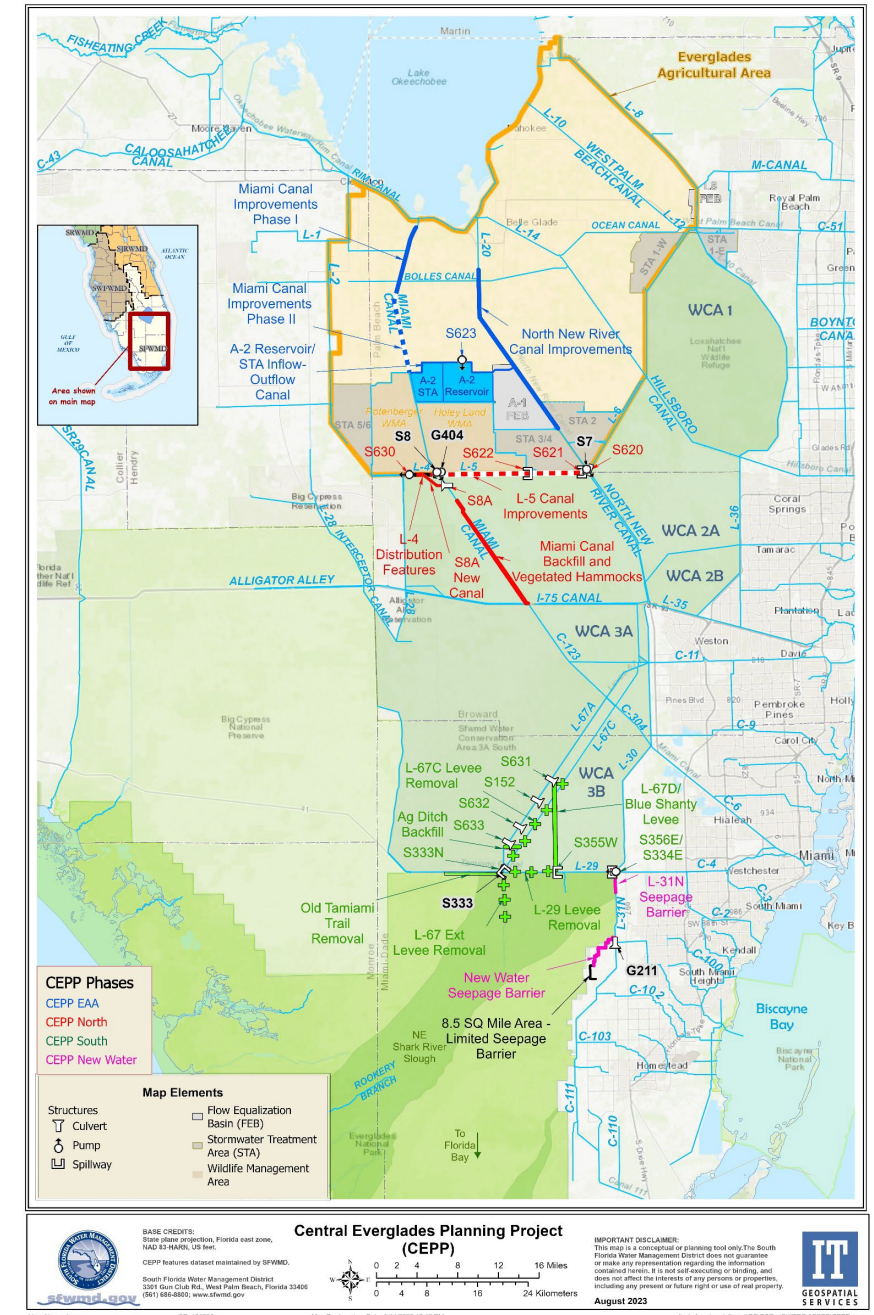
Project purpose

- Increase quantity, quality, timing and distribution of water to the Central Everglades

Four phases:

- Everglades Agricultural Area
- North
- South
- New Water

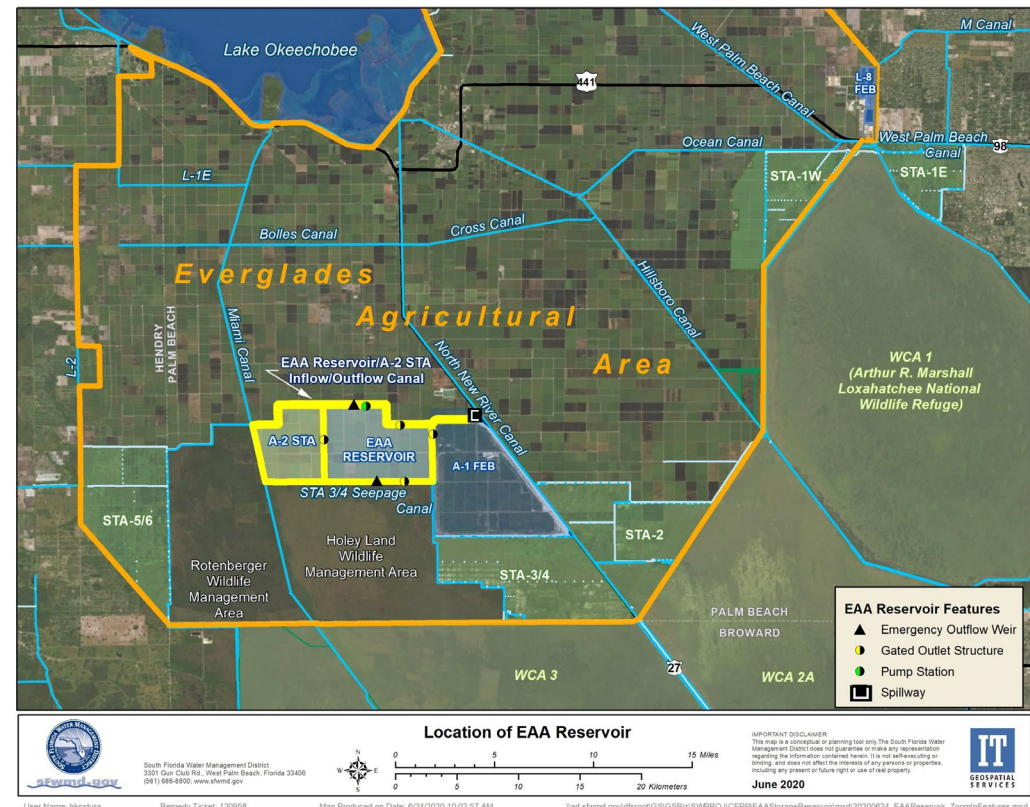
CEPP Public Informational Meeting
August 25, 2023 from 1pm-2:30pm



Central Everglades Planning Project (CEPP) Everglades Agricultural Area (EAA) Phase

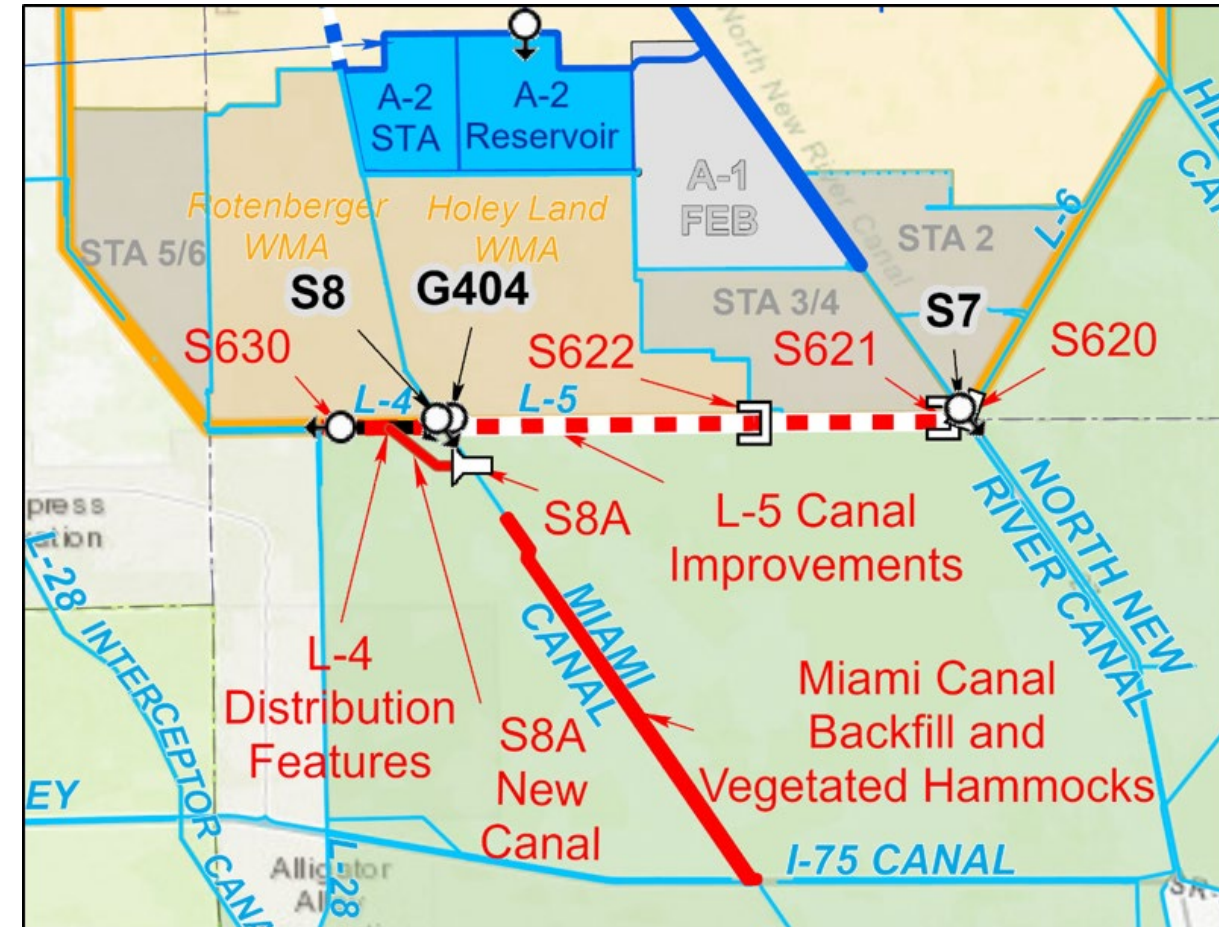
- Purpose: The 10,500-acre A-2 Reservoir will be capable of storing 240,000 acre-feet of water and will allow 370,000 ac-ft per year (on an annual average basis) which would otherwise be discharged to the estuaries, to flow south to the Central Everglades
- SFWMD has the lead on design and construction:
 - A-2 Stormwater Treatment Area (STA) 6,500 acres
 - A-2 STA portion of Inflow/Outflow Canal
 - S-636 Pump Station (reservoir inflow)
 - Conveyance improvements to Miami & North New River Canals
- USACE has the lead on design and construction:
 - A-2 Reservoir foundation and embankment
 - A-2 Reservoir portion of Inflow/Outflow Canal

Contact Information: John Shaffer jshaffe@sfwmd.gov



Central Everglades Planning Project (CEPP) North Phase

- Purpose: Conveyance of restoration flows south and to the northwest corner of Water Conservation Area 3A
- CEPP North Features Under Construction
 - S-620 500 cfs gated culvert
- CEPP North Features In Design
 - S-621 2,500 cfs gated spillway
 - S-622 500 cfs gated spillway
 - S-8A gated culverts and canal
 - S-630 360 cfs pump station
 - L-4 levee degrade
 - Miami Canal backfill and Vegetated Hammocks
 - L-5 Remnant Canal improvements
 - L-5 Canal improvements

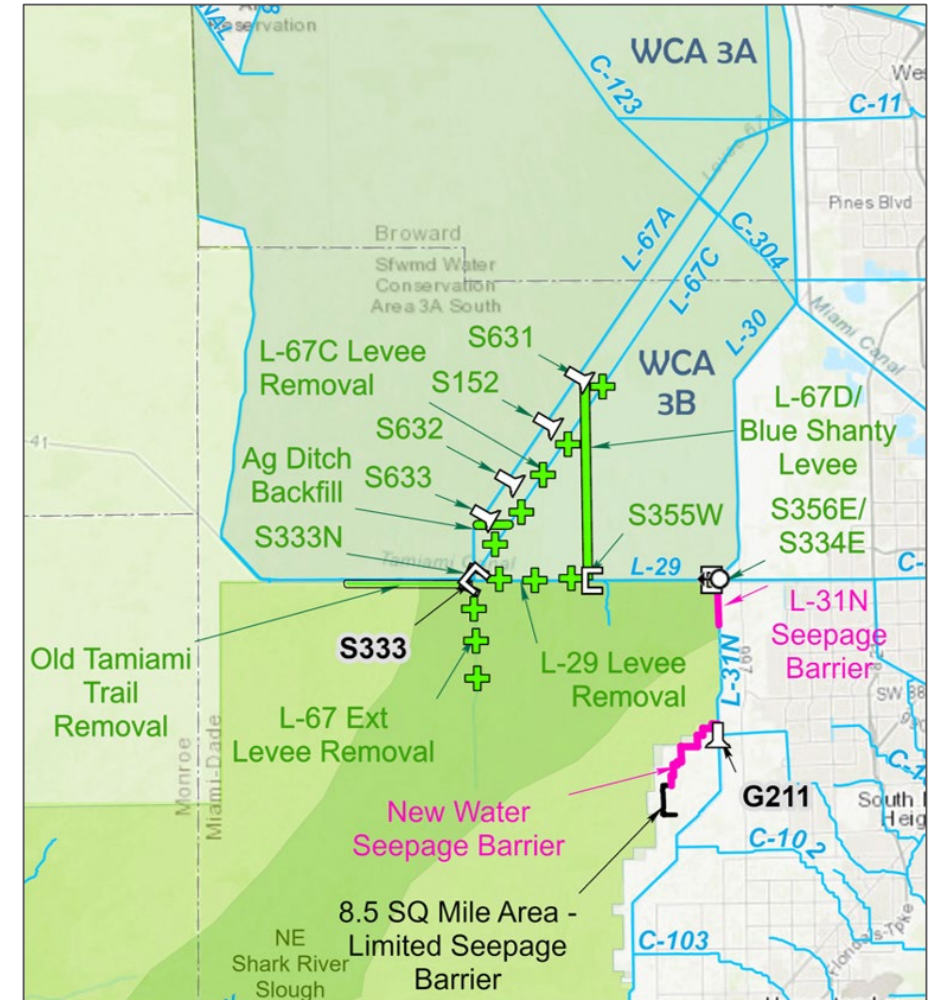


Contact Information: Alexandra Serna asernasa@sfwmd.gov

Central Everglades Planning Project (CEPP) South Phase

- Purpose: Create open connection between Water Conservation Areas 3A, 3B, and Everglades National Park
- CEPP South Features Complete:
 - Old Tamiami Trail Removal 5.45 miles
 - S-333N Spillway 1,150 cfs
- CEPP South Features Under Construction:
 - L-67A Culverts (S-631, S-632 & S-633) 500 cfs each
- CEPP South Features In Design:
 - S-355W Spillway 1,230 cfs
 - S-356E Pump Station 1,250 cfs
 - L-67C Levee Degrade 8 miles and Gap 6,000-ft
 - L-67D Blue Shanty Levee 8 miles
 - L-29 Levee Degrade 4 miles
 - L-67 Extension Levee Degrade and Canal Backfill 5.5 miles

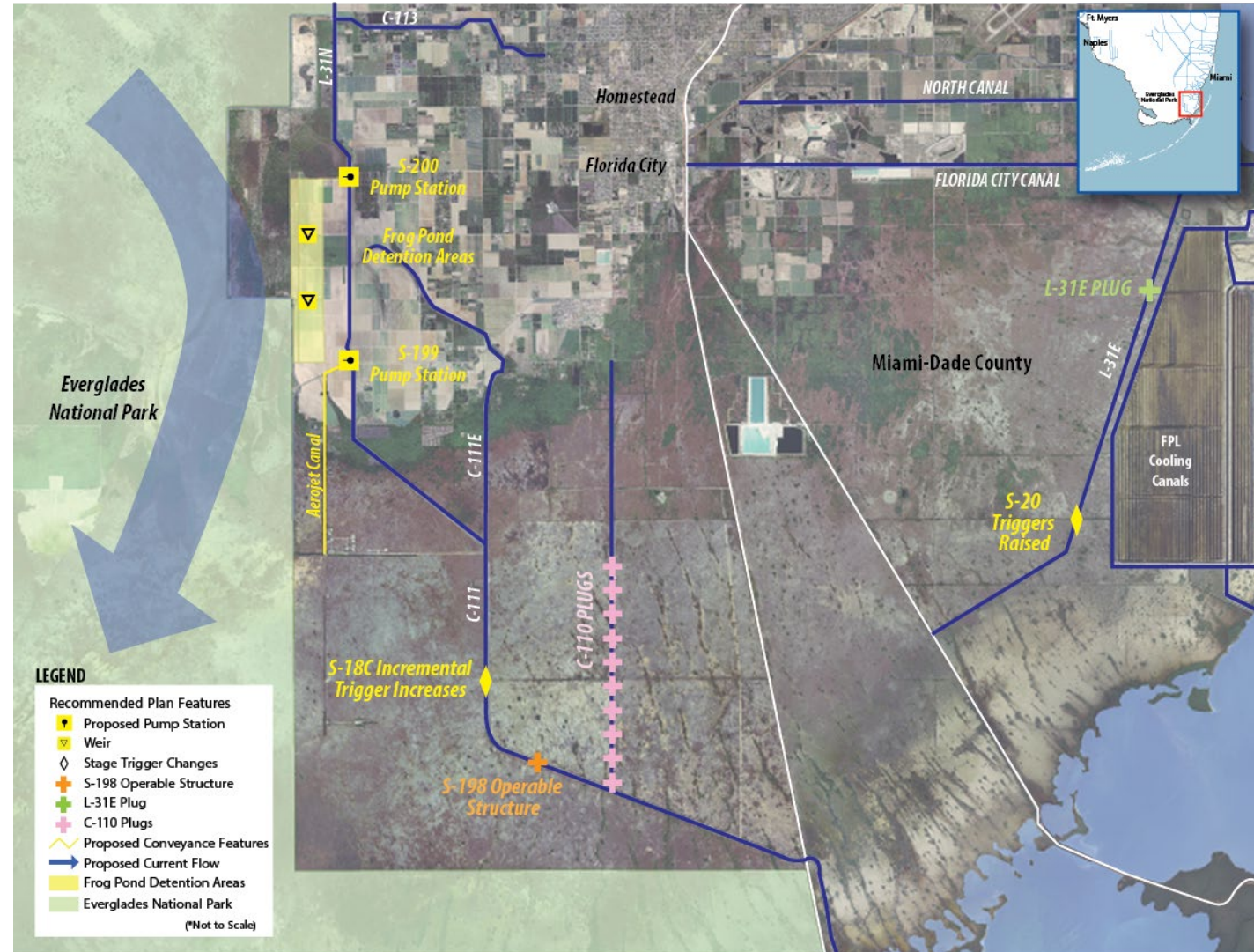
Contact Information: Michael Tompkins mtompkin@sfwmd.gov



C-111 Spreader Canal Western Project

- Approved by Congress in WRRDA 2014
- Project Objectives:
 - Improve hydrologic conditions in Everglades National Park
 - Increase flows to Taylor Slough
 - Improving timing, distribution, and quantity of water to Florida Bay
- Construction completed in 2012

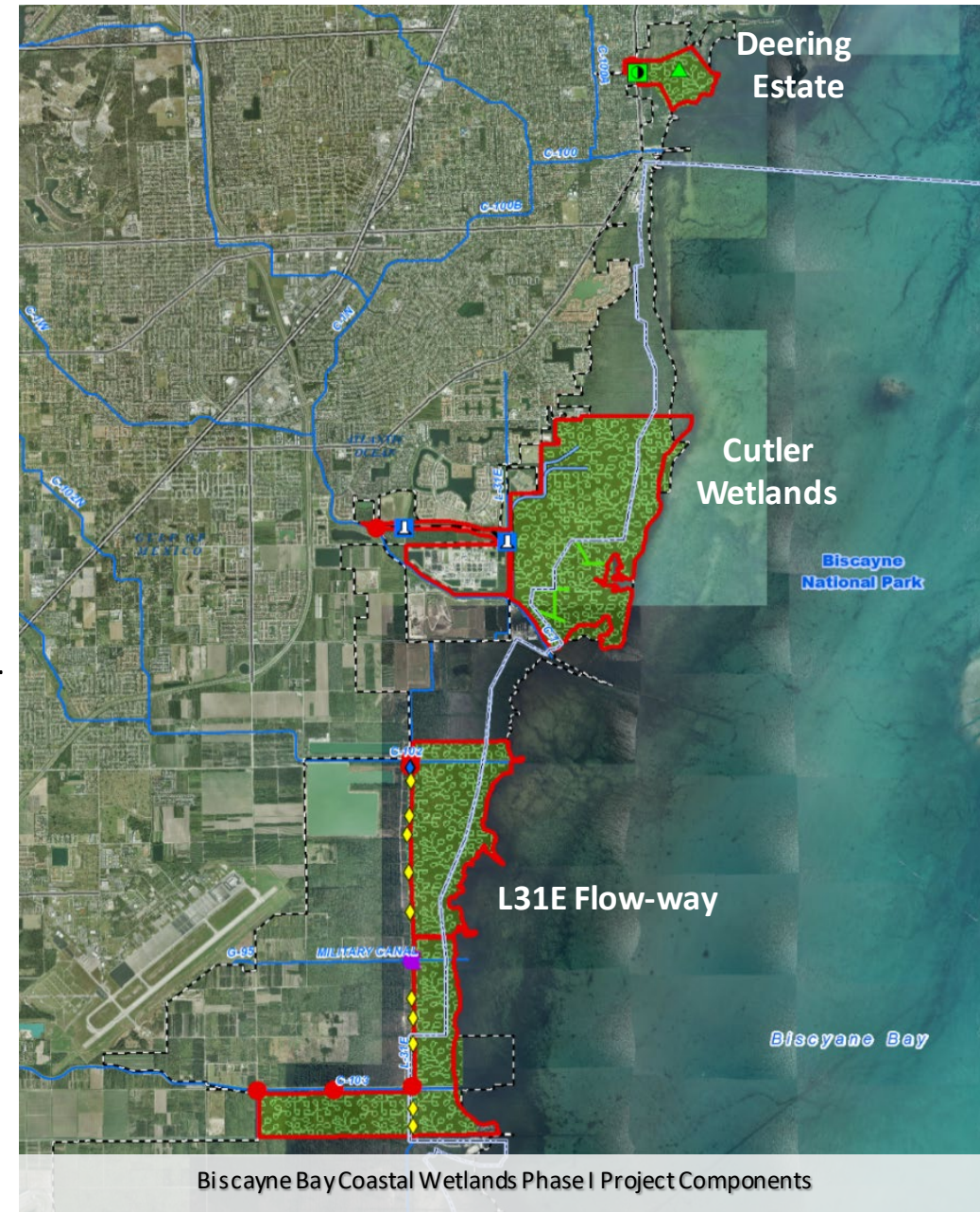
Contact Information:
Brenda Mills bmills@sfwmd.gov



Biscayne Bay Coastal Wetlands (BBCW) Phase I

- Approved by Congress in WRRDA 2014
- 3 Project Components:
 - **Deering Estate** - SFWMD completed construction in 2012. The project is operational, and the results are positive.
 - **Cutler Wetlands** - SFWMD starting construction of S-701 Pump Station in Oct. 2022. Anticipate construction for remainder of project to start Feb. 2024 with project completion summer of 2025.
 - **L-31E Flow way** - Culverts are in place, remaining features under construction by USACE and is expected to be complete in 2025.

Contact Information: Nicole Niemeyer nniemeye@sfwmd.gov



Comprehensive Everglades Restoration Plan

Planning Projects Update

- Lake Okeechobee Watershed Restoration Project (LOWRP)
- Lake Okeechobee Component A Reservoir (LOCAR)
- Biscayne Bay and Southeastern Everglades Ecosystem Restoration (BBSEER)
- Western Everglades Restoration Project (WERP)



Lake Okeechobee Watershed Restoration Project (LOWRP)

Components:

- Aquifer Storage and Recovery (ASR) Wells
- Wetland Restoration Sites
 - Restore hydrology of isolated, riverine wetlands
 - Paradise Run: ~4,700 acres
 - Kissimmee River Center: ~1,200 acres
 - Recreational facilities

Status:

- Preparation of Waiver Package for updated Recommended Plan with separable elements
- First Report: LOWRP Wetlands Restoration Report – Target WRDA 2024
- Second Report: LOWRP ASR – Pending additional science
- SFWMD continuing phased implementation of ASR and the Science Plan

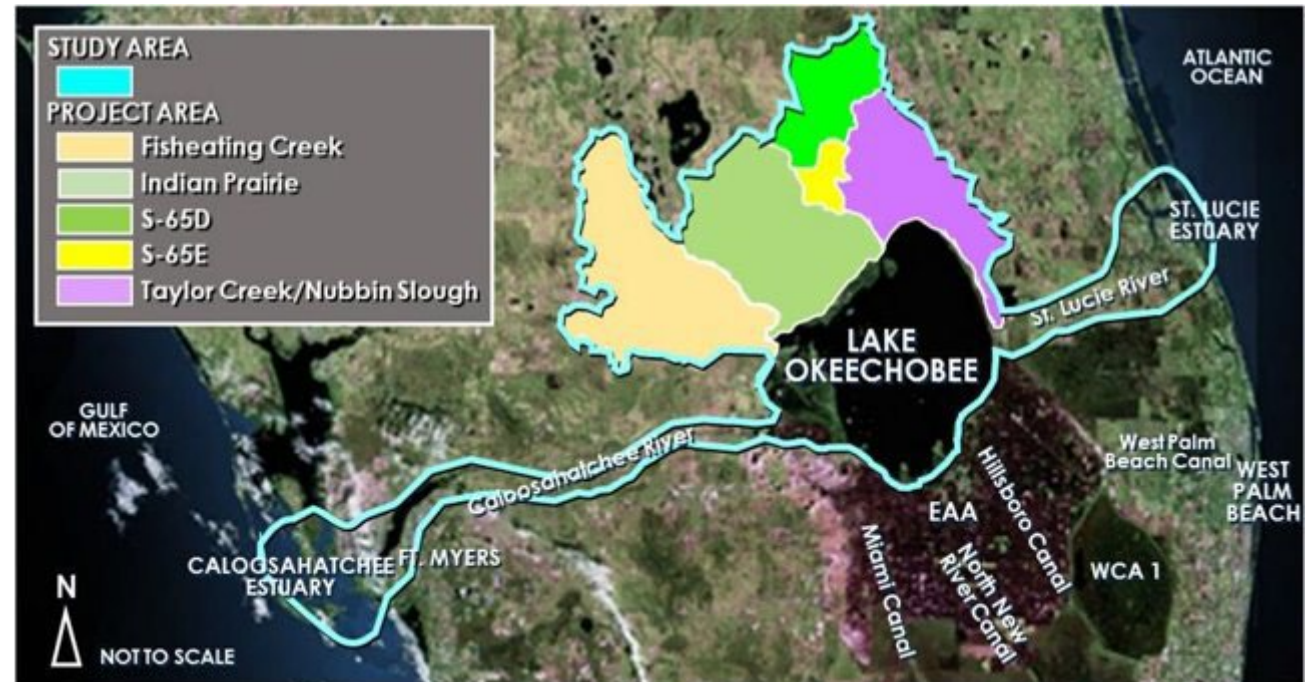


Contact Information: Elizabeth (Liz) Caneja ecaneja@sfwmd.gov

Lake Okeechobee Component A Reservoir (LOCAR)

- SFWMD is preparing a Feasibility Study under Section 203 of the Water Resources Development Act
- Evaluate Component A of CERP which proposed a 200,000 ac-ft above ground storage reservoir
- Purpose is to retain water during wet periods for later use during dry periods to benefit Lake Okeechobee
- Expect the public review of the Draft Environmental Impact Statement in October 2023
- Information regarding LOCAR project can be found at : www.sfwmd.gov/LOCAR

LOCAR Study Area



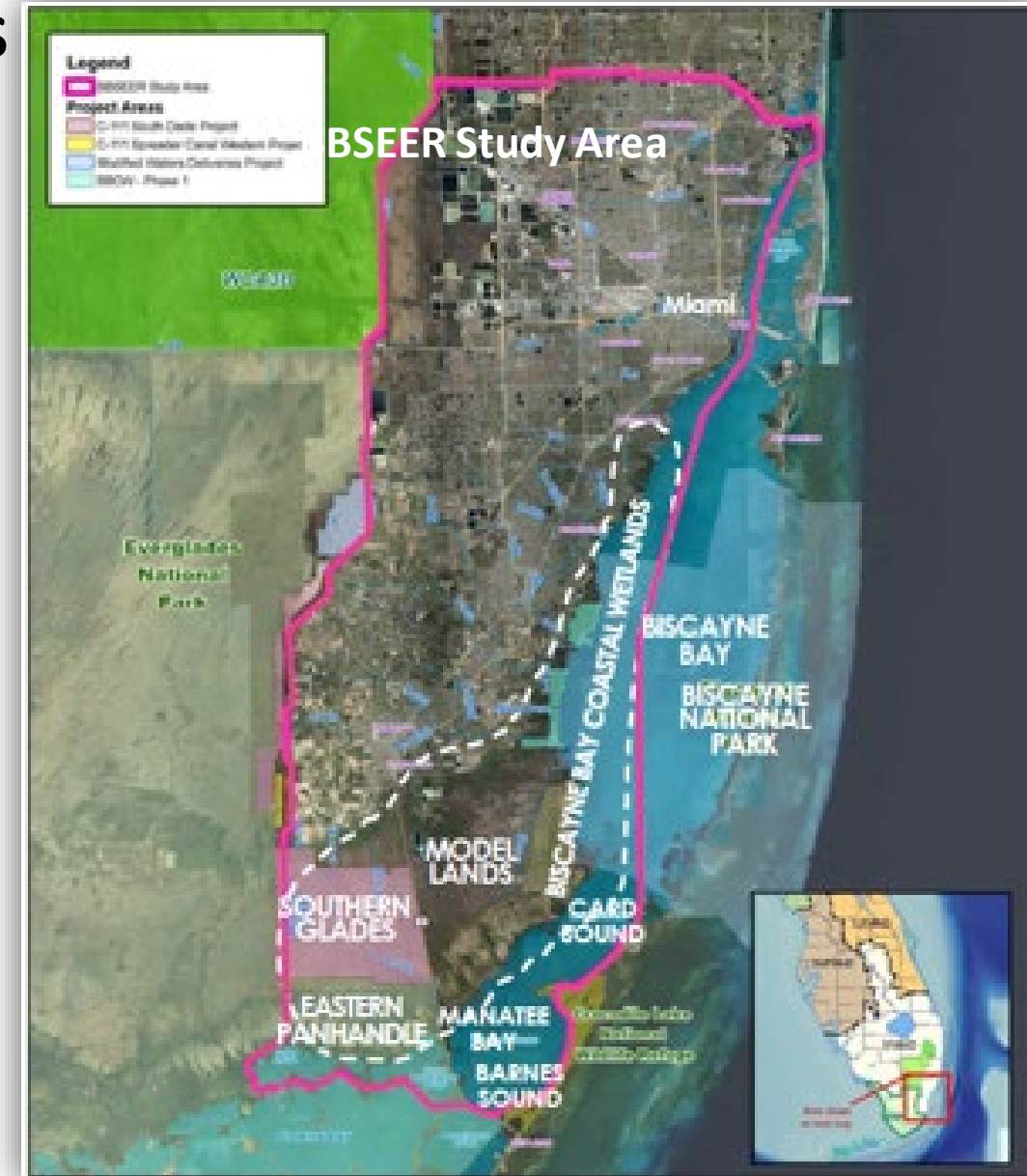
Contact Information: Elizabeth (Liz) Caneja ecaneja@sfwmd.gov

Biscayne Bay and Southeastern Everglades Ecosystem Restoration (BBSEER)

- Currently in the plan formulation and evaluation process
- Expect a Draft Project Implementation Report and Environmental Impact Statement in mid-2024
- Project Objectives:
 - Restore estuarine salinity regimes, minimize pulse canal releases
 - Restore freshwater wetland water depth, hydroperiods and flow timing
 - Restore ecological and hydrological connectivity
 - Sea level change resiliency

Website Information: <https://www.saj.usace.army.mil/BBSEER>

Contact Information: Nicole Niemeyer nniemeye@sfwmd.gov



Western Everglades Restoration Project (WERP)

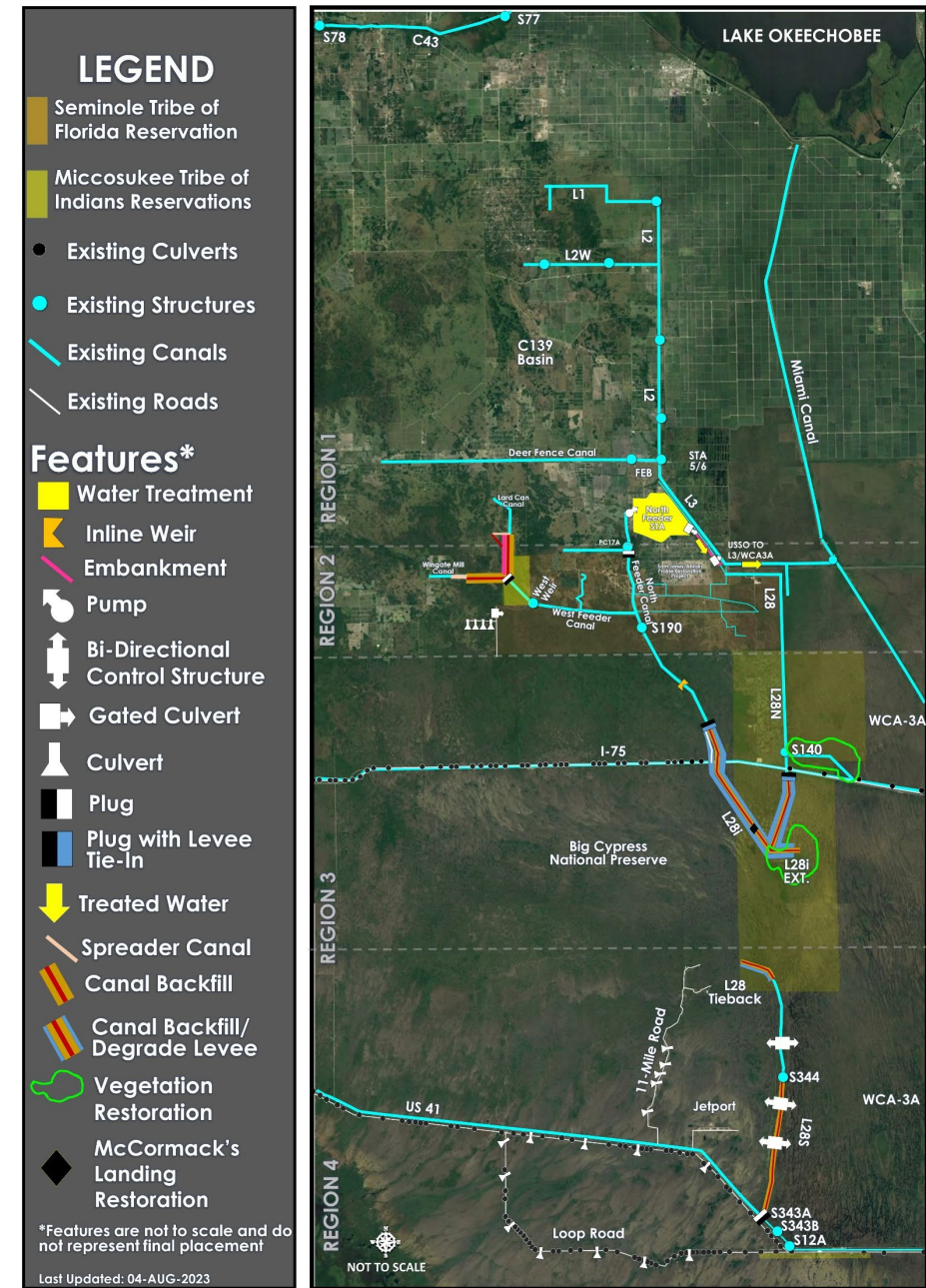
• WERP Study Objectives

1. Restore freshwater flow paths, flow volumes and timing, seasonal hydroperiods, and historic distributions of sheetflow to reestablish ecological connectivity and ecological resilience of the wetland/upland mosaic.
2. Restore water levels to reduce wildfires associated with altered hydrology, which damage the geomorphic and associated ecological conditions of the western Everglades.
3. Restore aquatic low nutrient (oligotrophic) conditions to reestablish and sustain native flora and fauna.

• WERP Project Delivery Team (PDT) meeting scheduled for August 31, 2023 from 1pm to 4pm in Immokalee and via WebEx

Contact Information: Amanda McKenzie ammckenz@sfwmd.gov

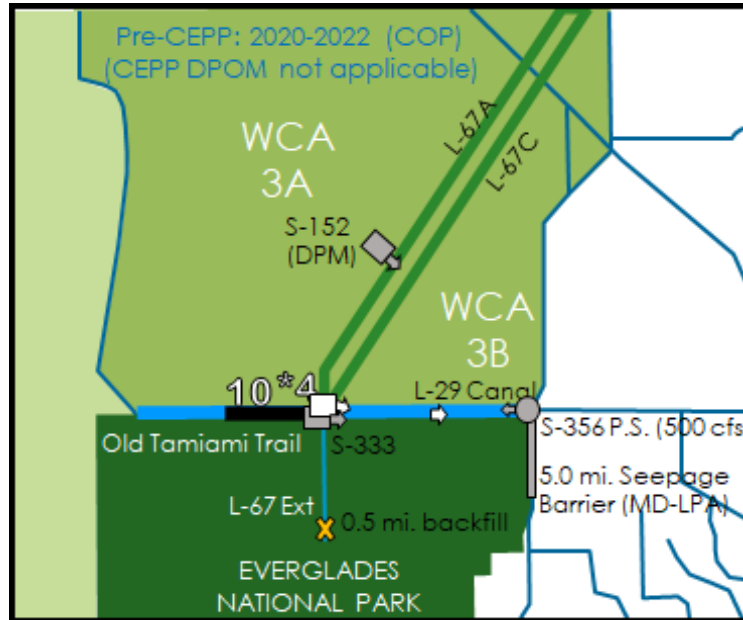
ALTERNATIVE HNFR: RESTORE RAIN-DRIVEN SYSTEM / EXISTING WATER / OPERATIONAL FLEXIBILITY



CEPP Operational Planning – Increment 1

CURRENT OPERATIONS

- 2020 Combined Operational Plan (COP)



Current Authorized Operations for Future CEPP Features

- 2014 CEPP Project Implementation Report and Environmental Impact Statement (PIR/EIS) Draft Project Operating Manual (DPOM)
- 2020 CEPP South EA DPOM



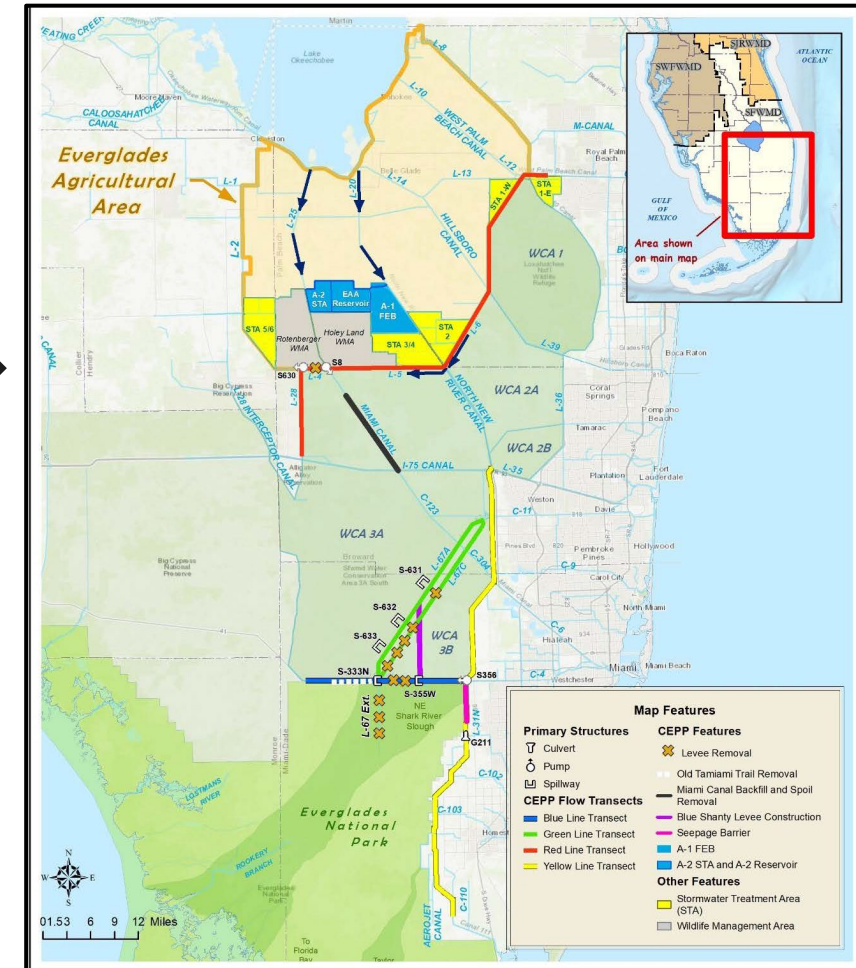
- Develop operating plans for CEPP infrastructure to incrementally progress towards CEPP benefits
- Increment 1 expected to be complete by 2026

For more information contact:

CEPPOperationalPlan@usace.army.mil

FUTURE OPERATIONS

2030+: Full CEPP Build-Out
Project Operating Manual



[illegible]

- <https://www.saj.usace.army.mil/IDS>

If you are participating via Zoom:

Click the Reactions button to access the Raise Hand feature

If you are participating via phone:

*9 raises hand

*6 mutes/unmutes your line

When you are called on, please state your full name and affiliation prior to providing comments and/or questions

Thank you!

Leslye Waugh

Section Administrator

Ecosystem Restoration Planning & Project Management

lwaugh@sfwmd.gov

561-682-6483

SFWMD Saltwater Intrusion Mapping And Modeling – An Update

LEC Stakeholder Meeting 2

August 24, 2023

Pete Kwiatkowski, PG

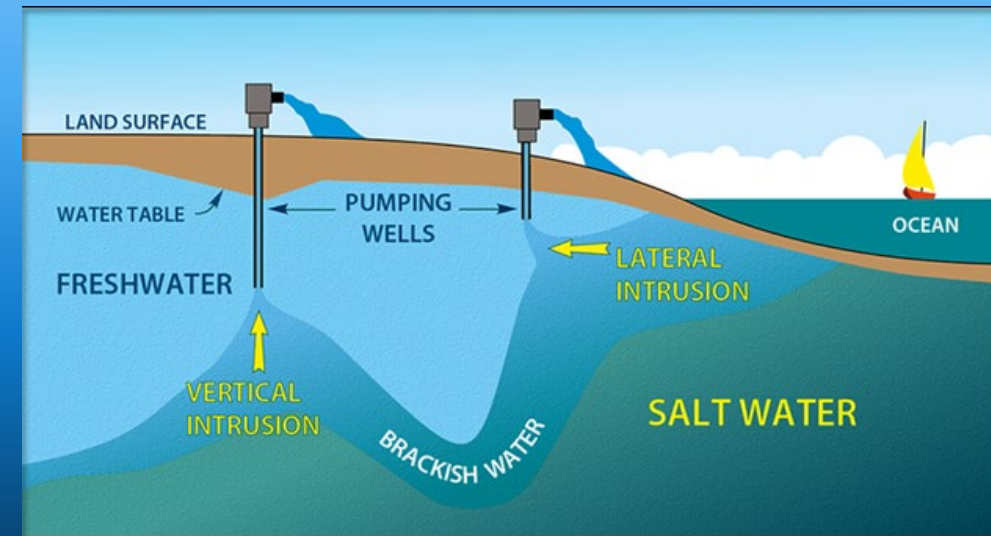
Section Administrator, Resource Evaluation
Water Supply Bureau, Water Resources Division

Presentation Overview

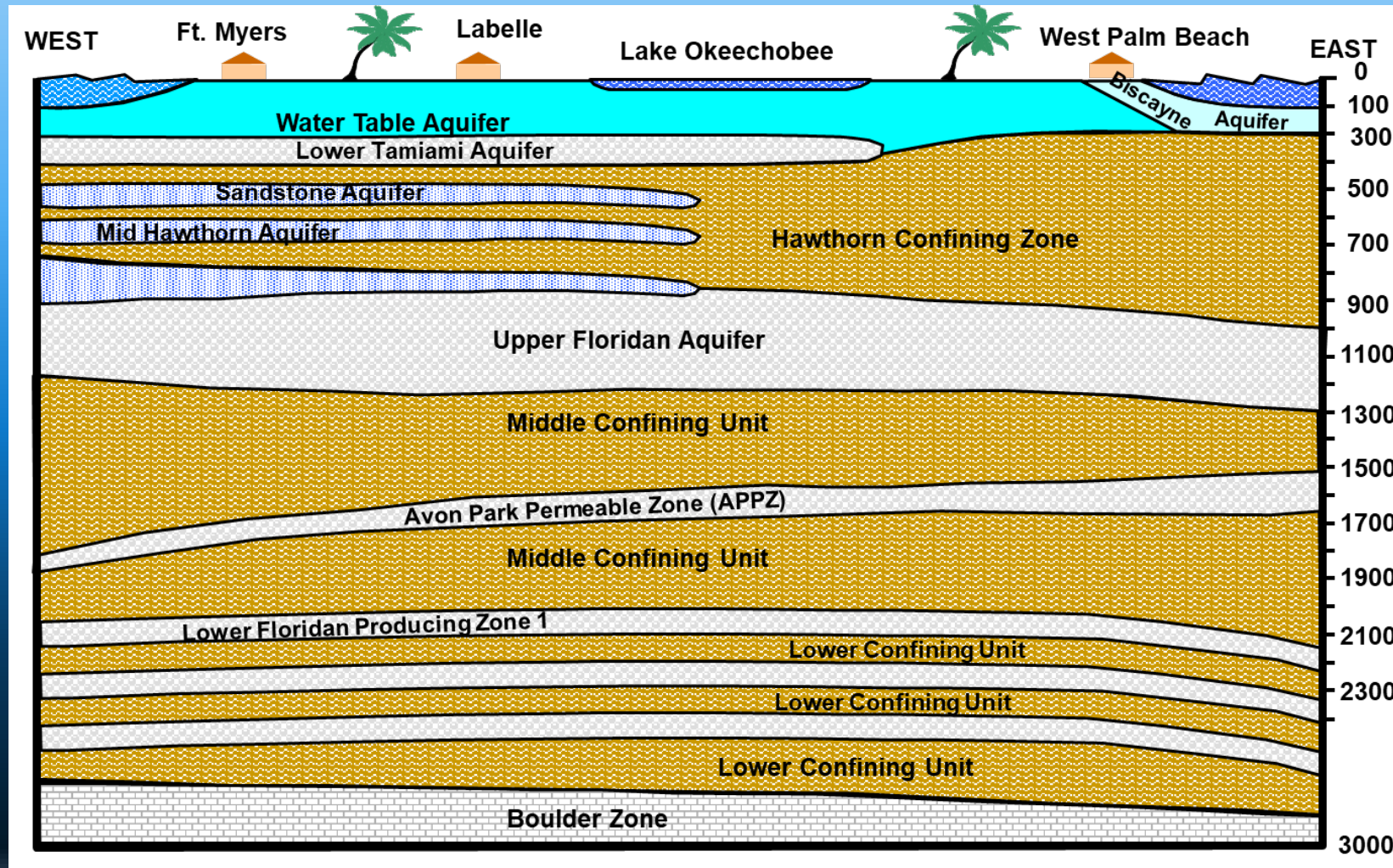
- Overview of Saltwater Intrusion, Aquifers, Wellfields
- Saltwater Intrusion Monitoring and Mapping Program
- Groundwater Modeling
- Schedule
- Questions and Discussion

Common Sources of Saltwater Intrusion

- Lateral intrusion from the coast
- Vertical Intrusion (upconing from saltwater below)
- Surface Infiltration – estuaries, boat basins, saltwater marshes, saltwater canals, etc.
- Ancient (relict) seawater trapped in low permeability aquifers



Generalized Hydrogeology of South Florida



Why is this Important?

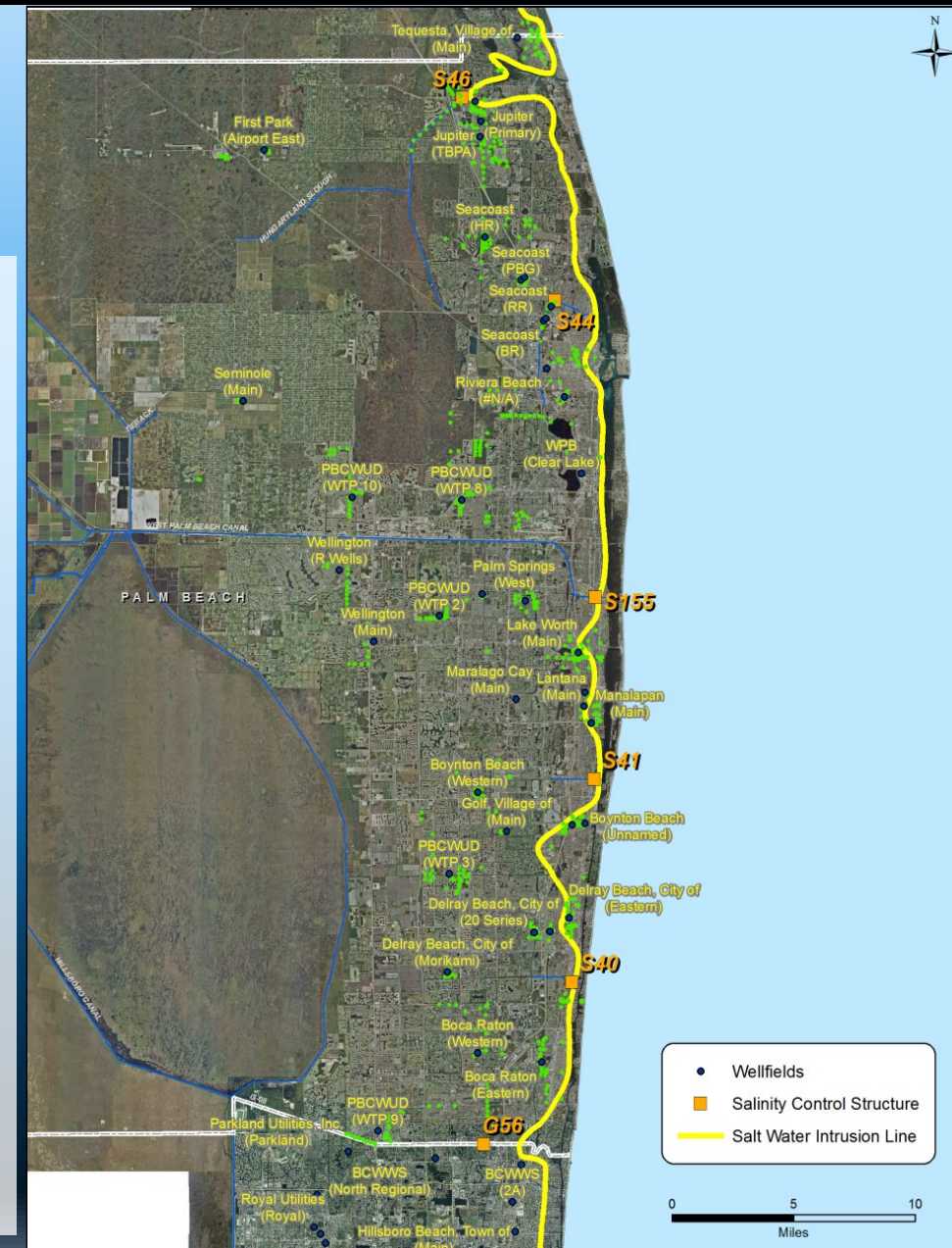
- Wellfields are a major water supply source – protect investment and the resource
- Once saltwater enters wells, very difficult – if not impossible – to reverse
- Very expensive to relocate wellfields and associated infrastructure (pipelines, treatment plants and processes, etc.)
- Other sources of water more expensive to treat (e.g., Floridan aquifer – reverse osmosis)

Public Supply Wellfields, Broward County



What factors affect the position of the saltwater interface?

- Surface Water Control Structures
 - Maintain canal stages to prevent inland saltwater movement
 - Help maintain groundwater levels to minimize inland movement of saltwater into aquifer
- Public Supply Wellfields
 - Well Locations
 - Well Depths
 - Pumping Rates
 - Proximity to Saltwater
 - Proximity to Canals (Recharge)
- Sea-Level Rise and Climate Change

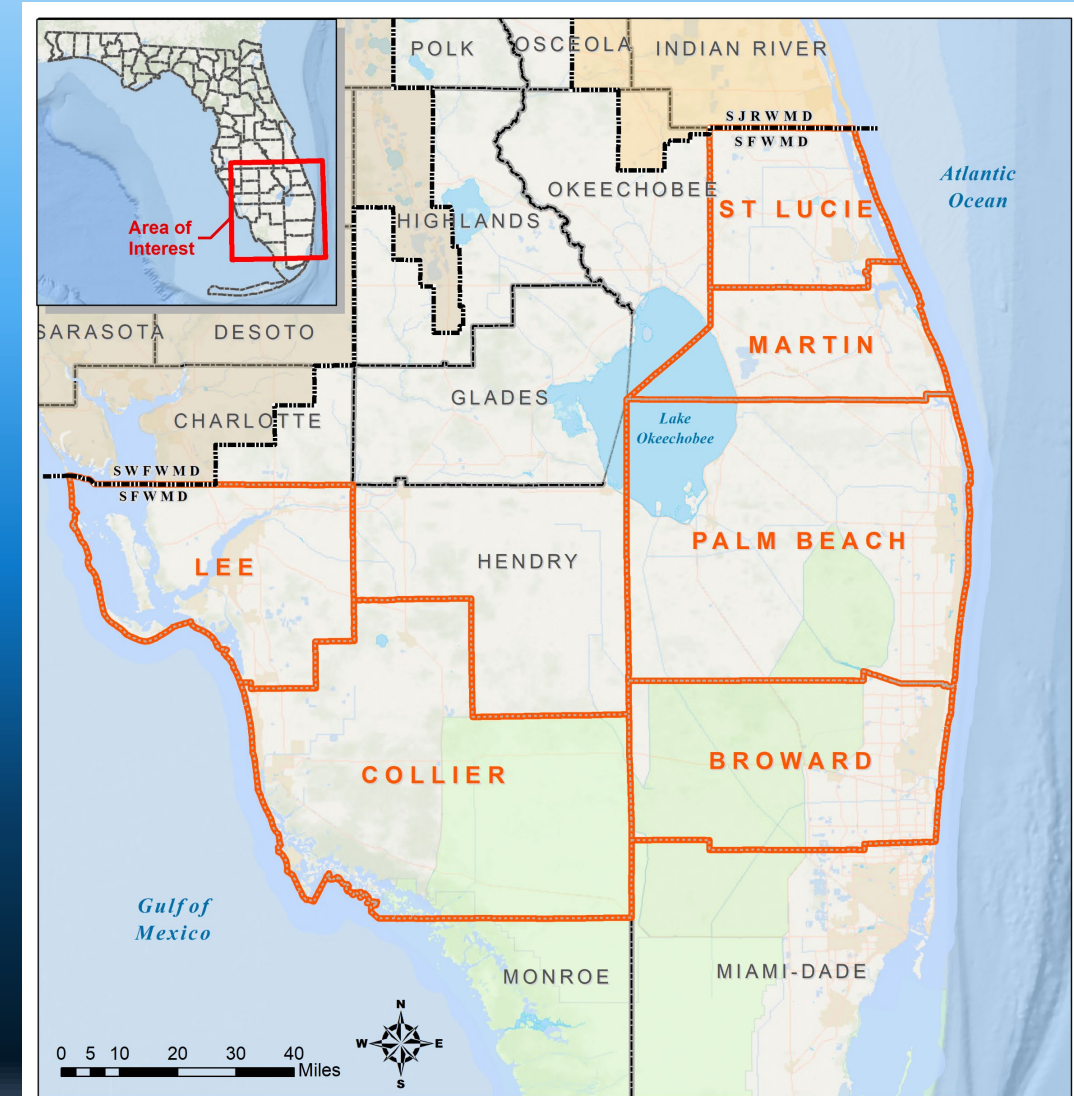


SFWMD Saltwater Interface Mapping Project

- Strategy – Compare interface positions (i.e., 2009, 2014, 2019), note areas of concern, and adjust monitoring as necessary
- Update maps every 5 years
- Use all available data (USGS, SFWMD, Counties, Water Use Permittees)
- Furthest inland extent – Dry season
- Maximum chloride value March/April/May (with some exceptions)
- 250 milligrams per liter (mg/L) chlorides – Primary drinking water standard
- Coastal aquifers: Water Table (Biscayne aquifer), Lower Tamiami, Sandstone, Mid-Hawthorn

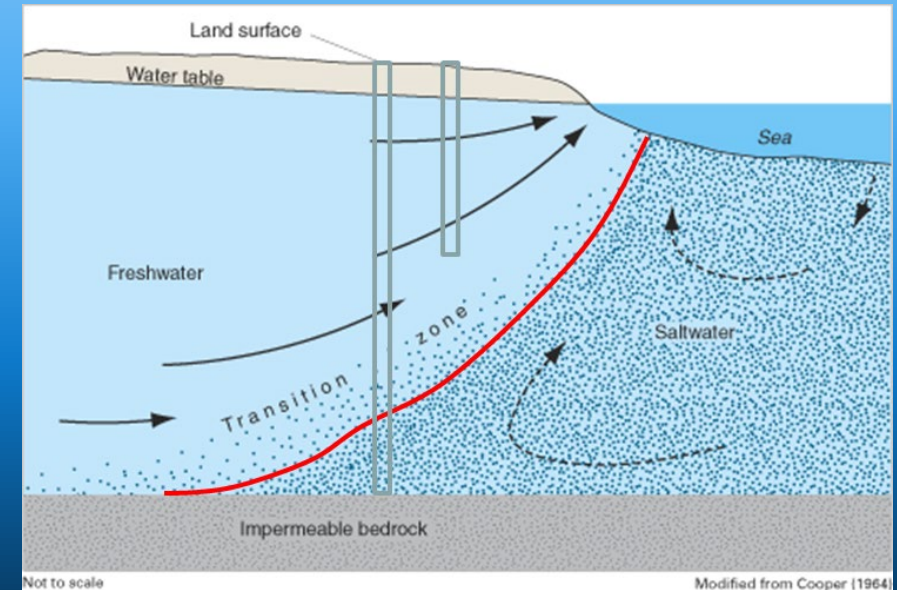
Location of SFWMD Coastal Counties

<u>COUNTY</u>	<u>Aquifer</u>	<u>2009</u>	<u>2014</u>	<u>2019</u>
Martin & St. Lucie	SAS	X	X	X
Palm Beach	SAS	X	X	X
Broward	SAS	X	X	X
Lee	WTA	X	X	X
Lee	MHA	X	X	-
Lee & Collier	SSA	X	X	X
Lee & Collier	LTA	X	X	X
Collier	WTA	X	X	X
Collier	MHA	X	X	-
Lee & Collier	MHA			X
<u>Notes:</u>				
Miami-Dade County mapping performed by USGS				
SAS	Surficial Aquifer System			
WTA	Water Table Aquifer			
MHA	Mid-Hawthorn Aquifer			
SSA	Sandstone Aquifer			
LTA	Lower Tamiami Aquifer			



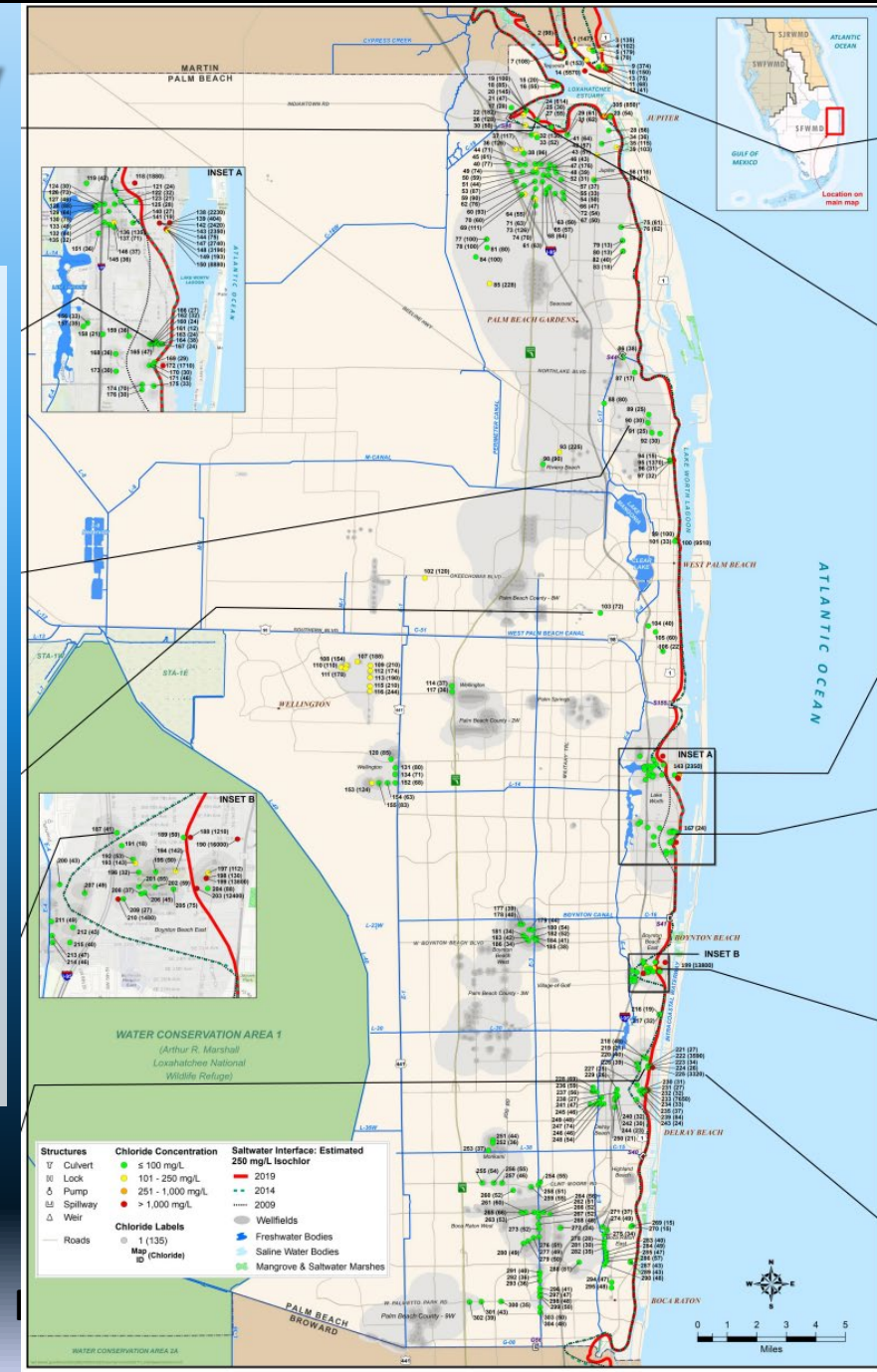
Mapping Challenges

- Representing a 3-D feature on a 2-D map
- Representing a dynamic interface with fixed-time snapshots
- Representing a diffuse front with a single line
- Mapping from data that may represent one of several saltwater intrusion pathways
- Some wells used in 2009 and 2014 were not available in 2019 (abandoned, destroyed, no longer monitored, etc.)
- New wells added to 2019 may alter interpretation of isochlor line.
- Use existing monitor wells with varying well depths, construction, and spacing



2019 Map, Palm Beach County

- In general, interface close to the coast
- Older wellfields close to the coast are more vulnerable to saltwater intrusion and are areas of concern
- Lake Worth Drainage District maintains surface water control elevations in southern half of County that help maintain groundwater elevations to fend off saltwater intrusion
- Western wellfields (e.g., PBCWUD) at much less risk of saltwater intrusion
- Floridan aquifer wellfields (e.g., Jupiter, LWB, etc.) reduce water demands on coastal wellfields



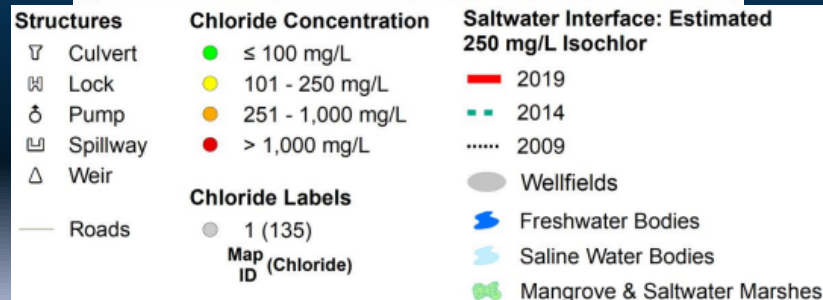
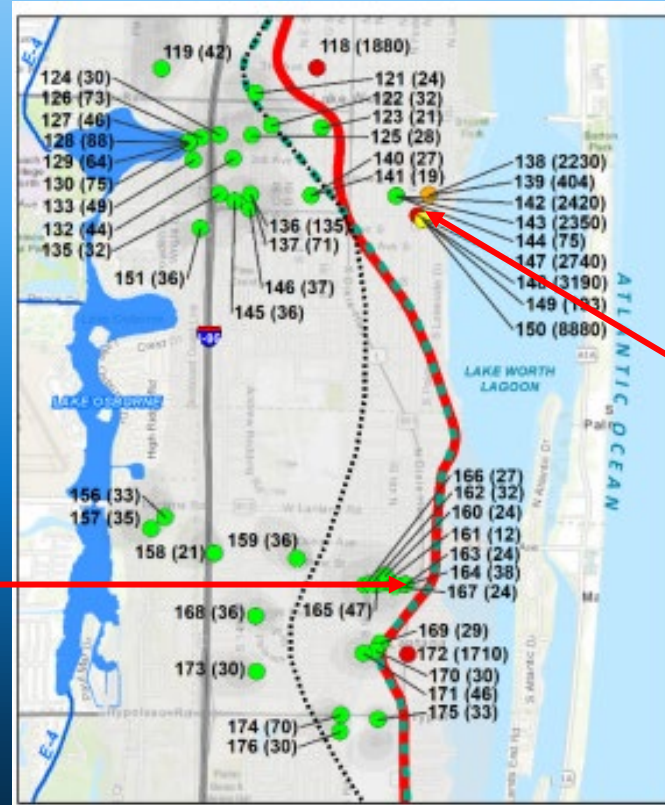
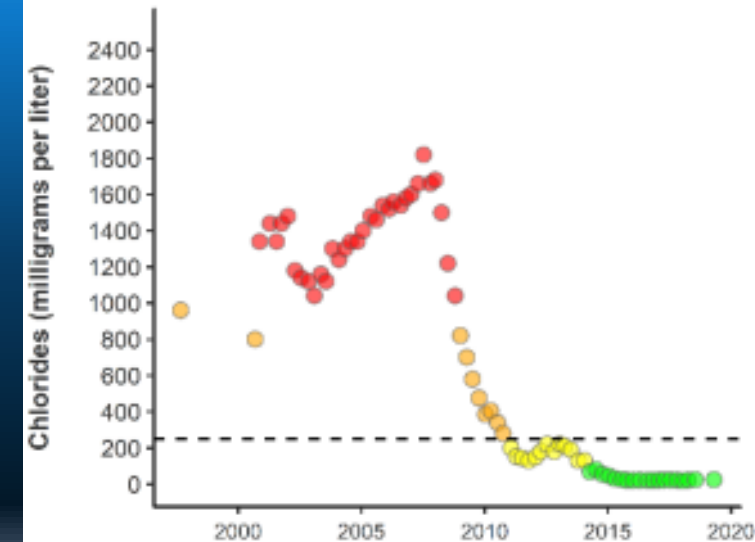
Lantana/Lake Worth Beach Area

- Interface retreated
- Reduced coastal pumping

- Chlorides increased and leveling off?

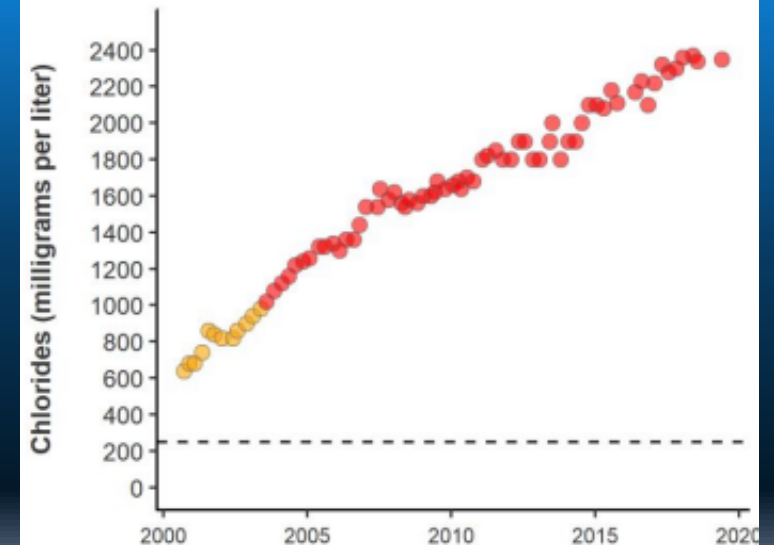
PB-1717

Total Depth= 200 ft
Casing Depth= 135 ft



PB-1723

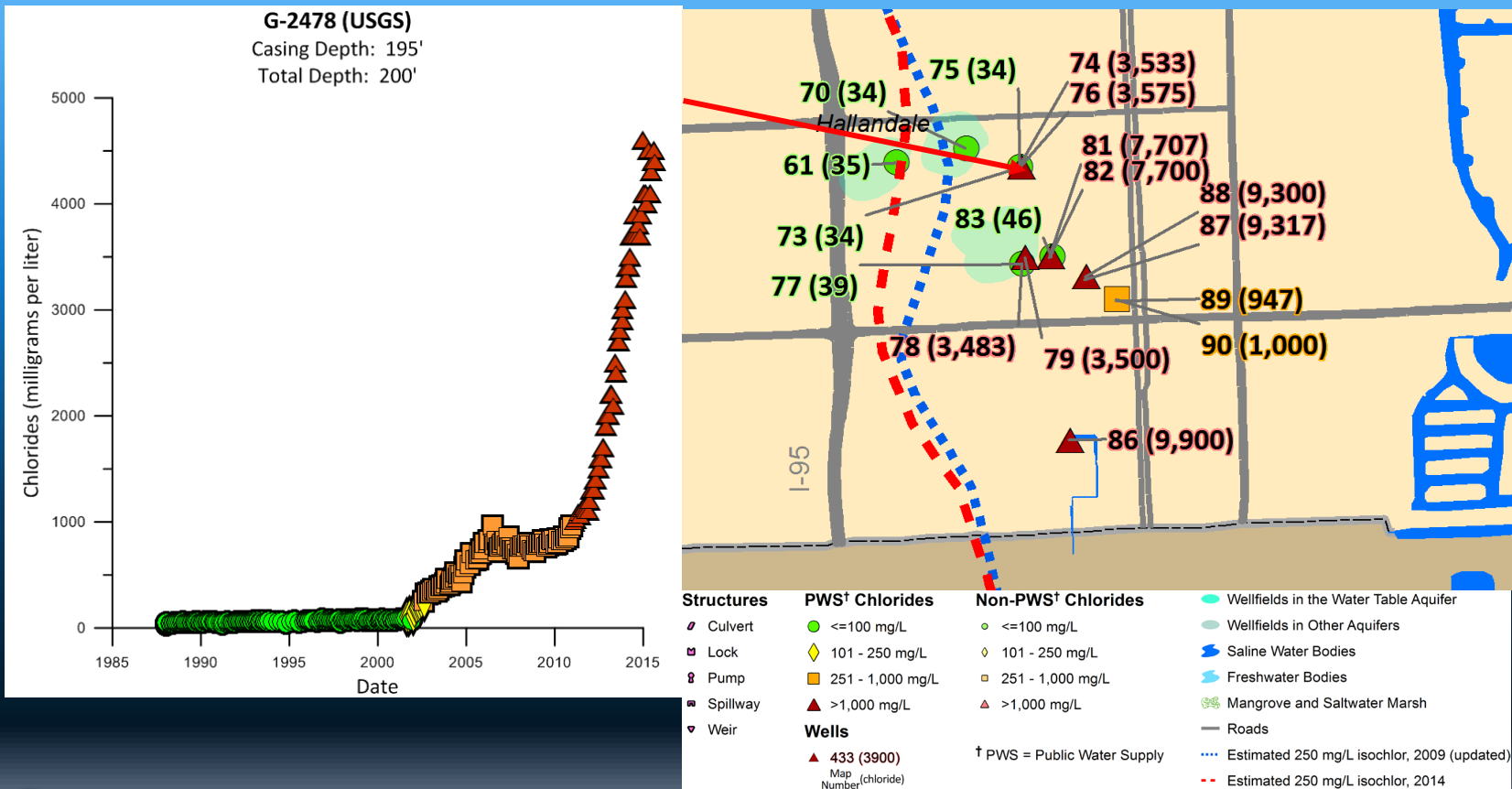
Total Depth= 318 ft
Casing Depth= 310 ft



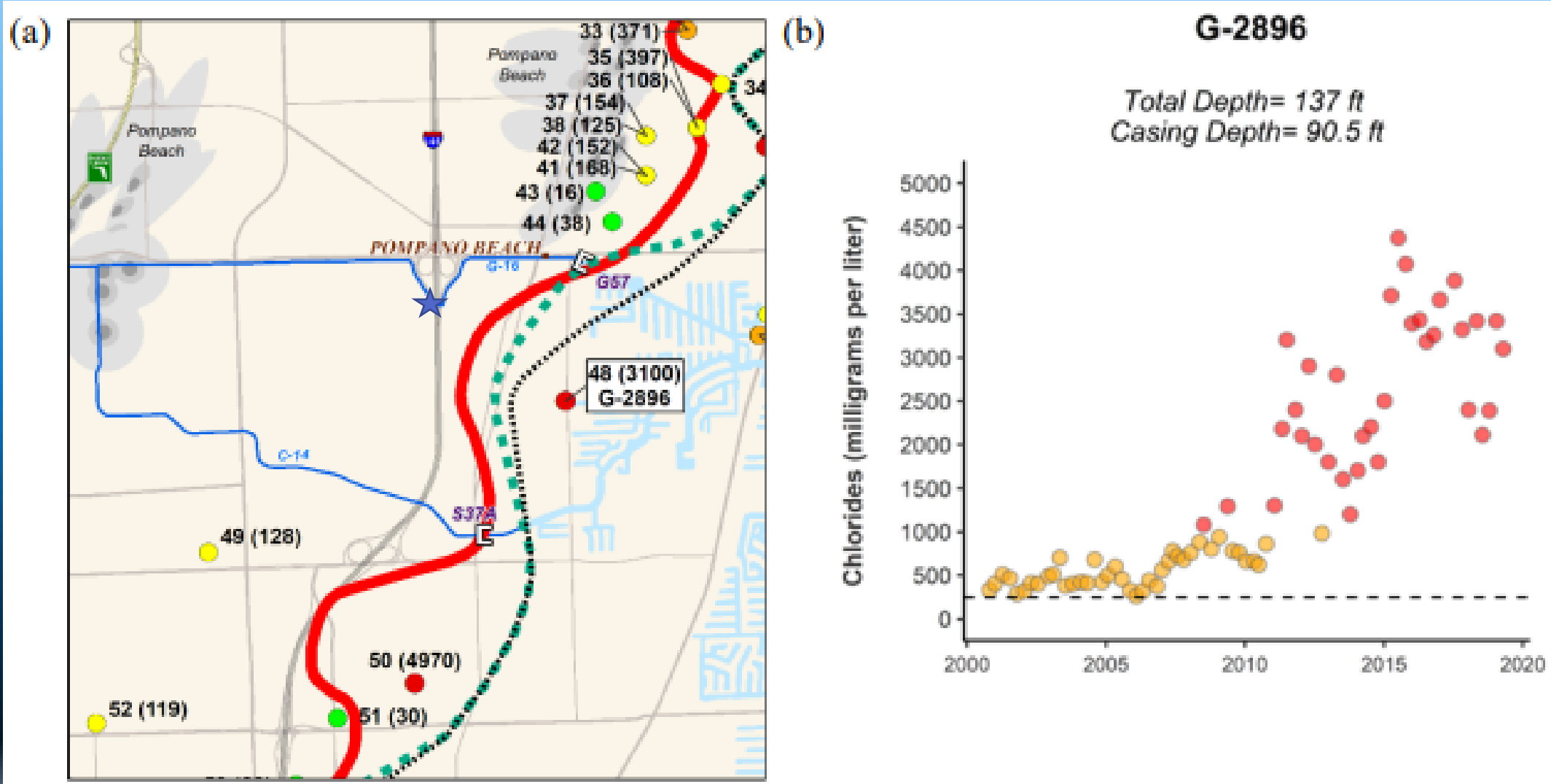
Presenter: Pete Kwiatkowski, P.G.

Hallandale Beach Area, 2009 vs. 2014

- G-2478 (Map # 76, Cl = 3,575 mg/L) -- Saltwater toe (195 to 200 feet depth) continued to advance inland
- G-2477 (Map # 75, Cl = 34 mg/L) -- Freshwater (75 to 80 feet depth) -- Upconing potential



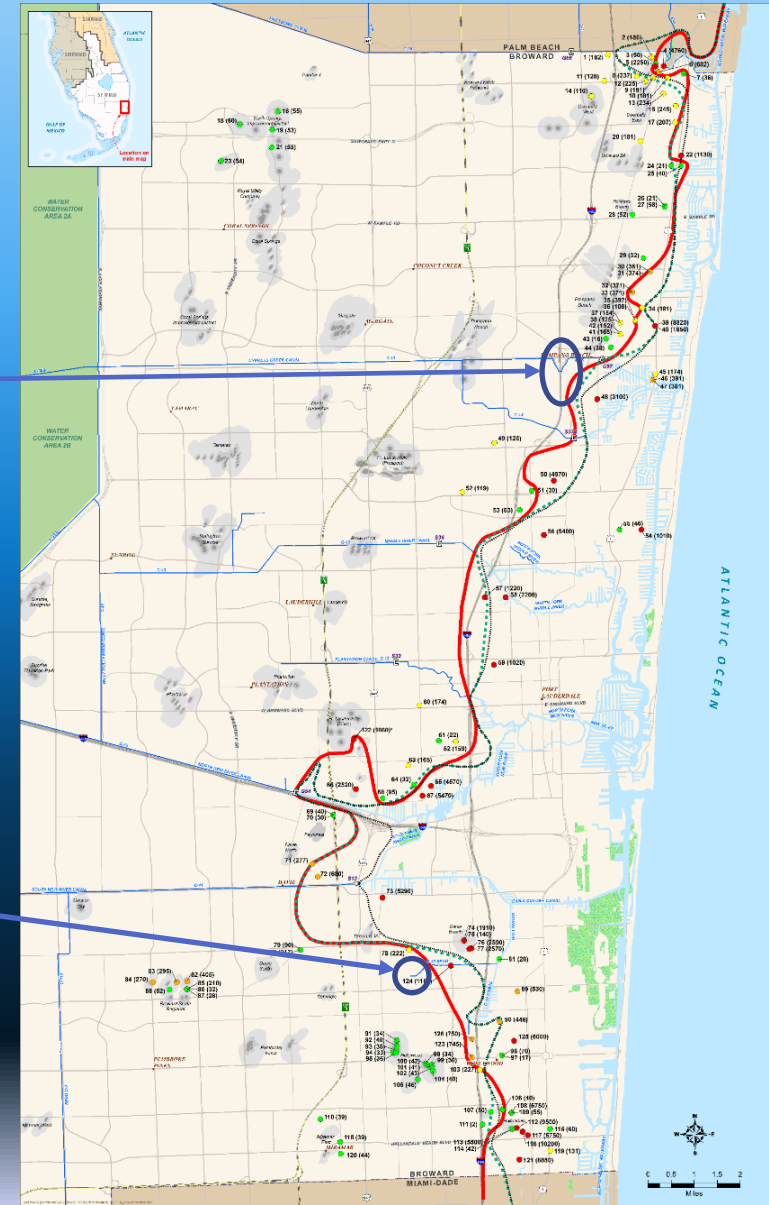
Pompano Beach Area



Two New Monitor Wells to Fill Data Gaps

Pompano Beach

C-10 Canal Spur



New SFWMD Saltwater Intrusion Monitor Well BS-2, Hollywood



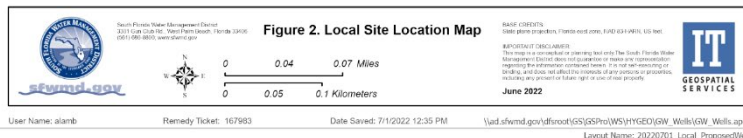
BS-2 Monitor Well

- Open-hole interval: 200 to 215 feet below land surface
- Sample Date: December 20, 2021
- Chlorides = 203 mg/L
- Specific Conductance = 1,179 umhos/cm

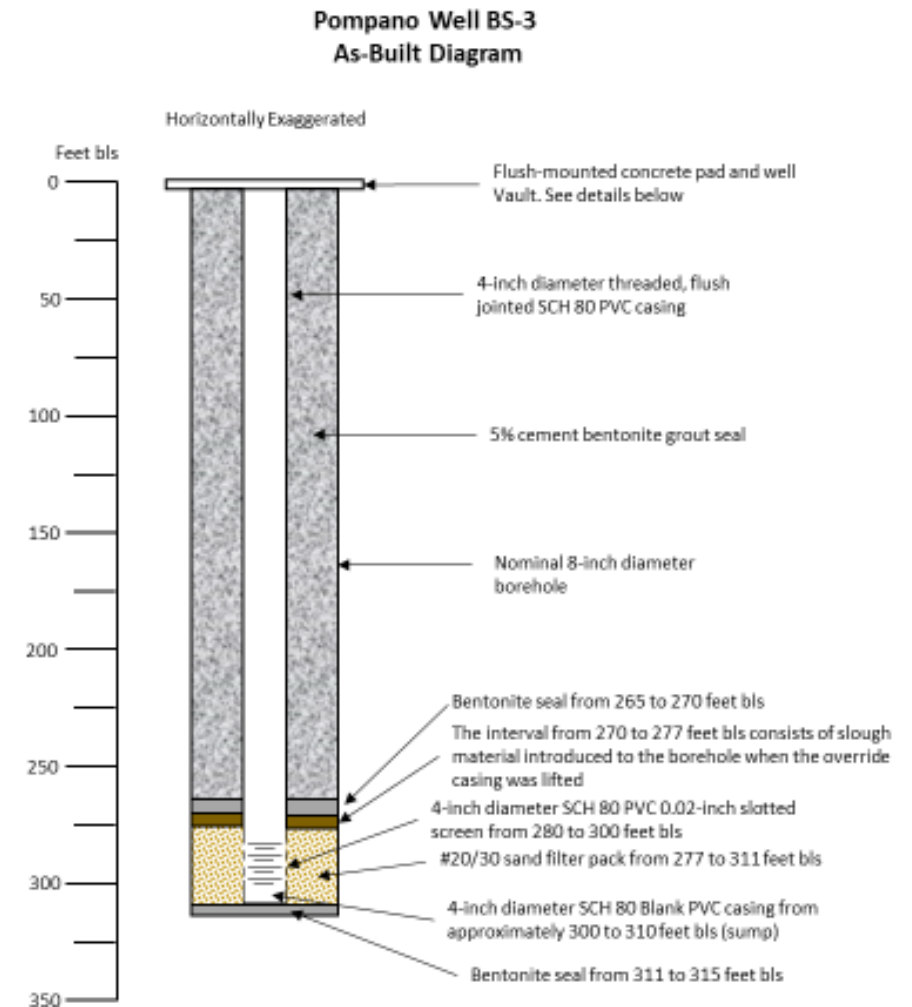
BS-2 Well Construction Diagram

Hollywood, Florida, Broward County
Approx. Lat/Long: 26.036875°, -80.190089°, Ground Surface Elev: ~2 ft msl
Well Completed on 12/10/2021. Total Depth 215 ft bls.

Depth, (ft)	Hydrogeologic Unit	Description	Well Diagram
0		12" Diameter Emco-Wheaton Flush-Mounted Well Vault Set in 30"x30" Concrete Pad. Expansion Well Cap	
20			
40			
60	Surficial Aquifer System		
80		Borehole cleared for utilities to 5 ft by hand. 8-inch diameter borehole drilled and continuously sampled from 5 ft bls to 200 ft bls using track-mounted Geoprobe 8150LS rig.	
100			
120			
140			
160			
180			
200		Approximate 3.5-inch diameter open-hole monitoring interval from 200 ft bls to 215 ft bls drilled and continuously sampled from 200 to 215 ft bls using track-mounted Geoprobe 8150LS rig.	
220			



- Open-hole interval: 280 to 300 feet below land surface
- Sample Date: April 12, 2023
- Chlorides = 24 mg/L
- TDS = 311 mg/L
- Specific Conductance = 526 umhos/cm



BS-3 Well Construction Diagram

Presenter: Pete Kwiatkowski, P.G.

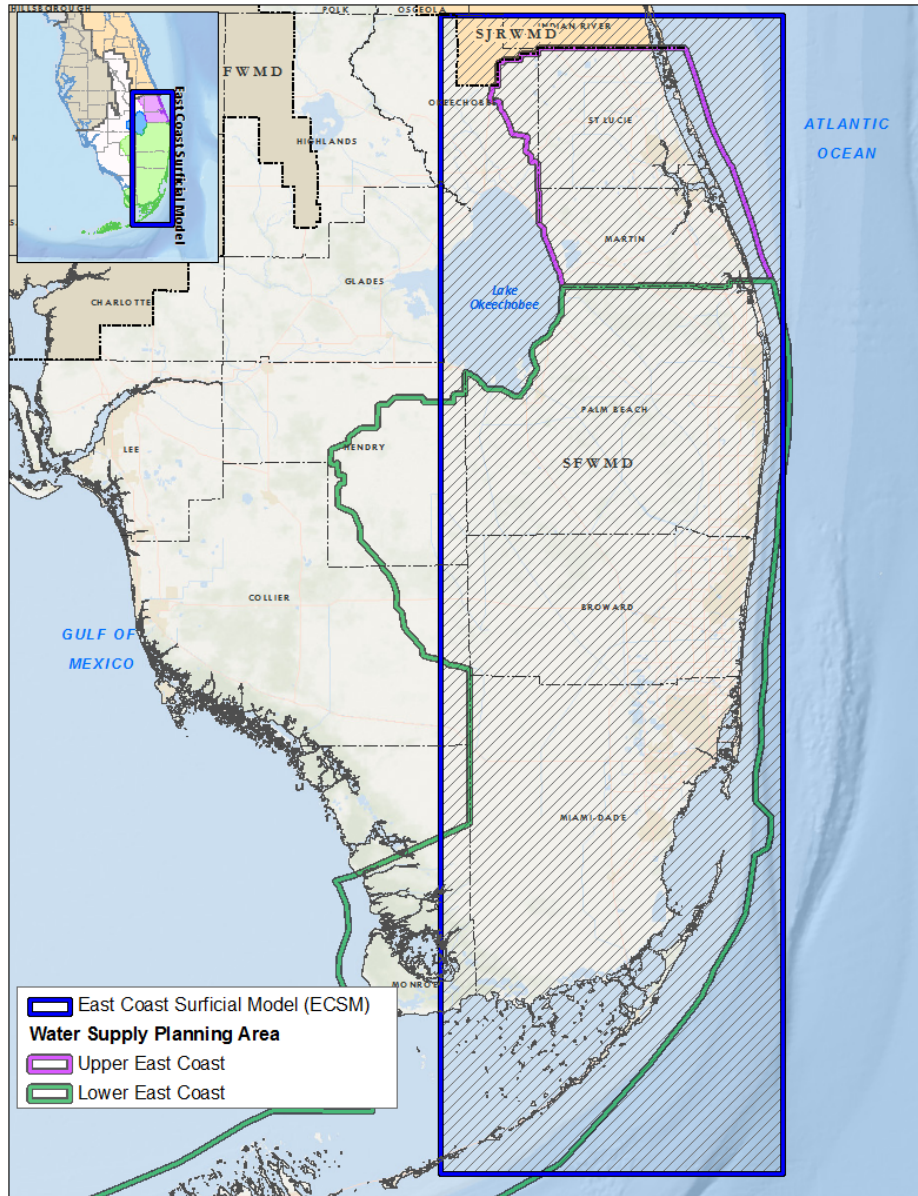
What Can We Do?

- Water conservation
- Reduce pumpage in coastal wellfields
- Prioritize withdrawals from western wellfields, provided they do not cause adverse effects on natural systems
- Increase groundwater recharge (canals, reclaimed water, etc.) to maintain and improve freshwater heads to counteract saltwater
- Use alternative water supplies (e.g., Floridan aquifer, reuse for irrigation, surface water storage, etc.) to reduce reliance on coastal wellfields
- Construct water supply and water resource development projects including CERP
- Maintain, enhance, and conduct monitoring of the saltwater intrusion monitoring network
- Conduct density-dependent groundwater modeling to simulate future saltwater intrusion as a result of future pumping, sea-level rise, and climate change

East Coast Surficial Model (ECSM)

Objectives:

- Evaluate if the water supply demands within the East Coast water supply planning regions can be met within a 20-year planning horizon without undue effects on existing legal users of water and natural systems
- Simulate and evaluate the effects of sea-level rise and climate change on the aquifer system as part of SFWMD's Water Supply Vulnerability Assessment

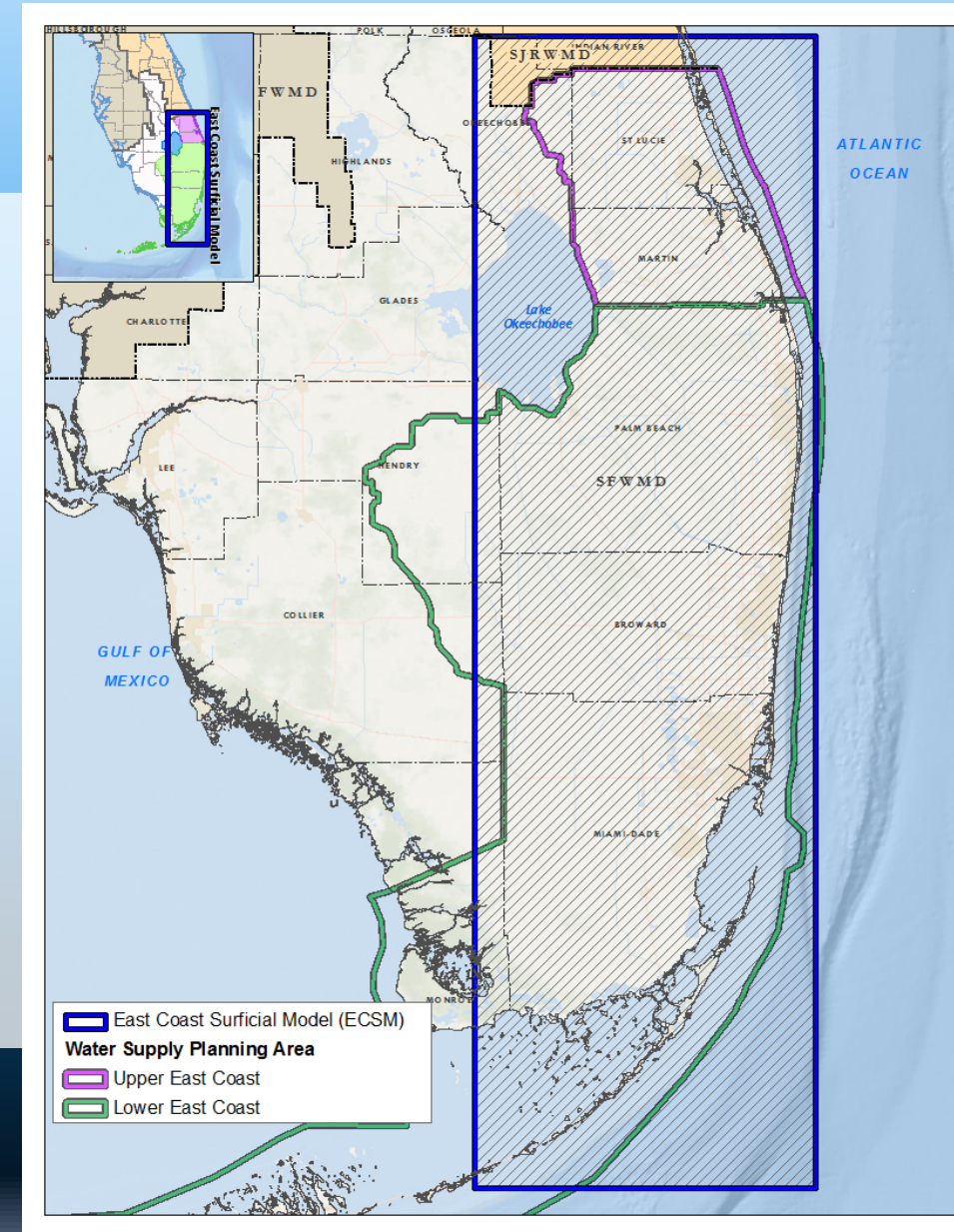


SEAWAT-2022

- SEAWAT-2000 is a coupled version of MODFLOW-2000 and MT3DMS [as published by the USGS] designed to simulate three-dimensional, variable-density groundwater flow and multi-species transport.
- SEAWAT-2022 is SFWMD's modified version of this code to accommodate the unique hydrologic features of South Florida
- Selected the SEAWAT-2022 computer code as the basis for development of SFWMD's East Coast Surficial Model (ECSM), a regional, density-dependent groundwater model -- currently being developed and peer-reviewed -- covering the Lower and Upper East Coast Planning Regions.

East Coast Surficial Model

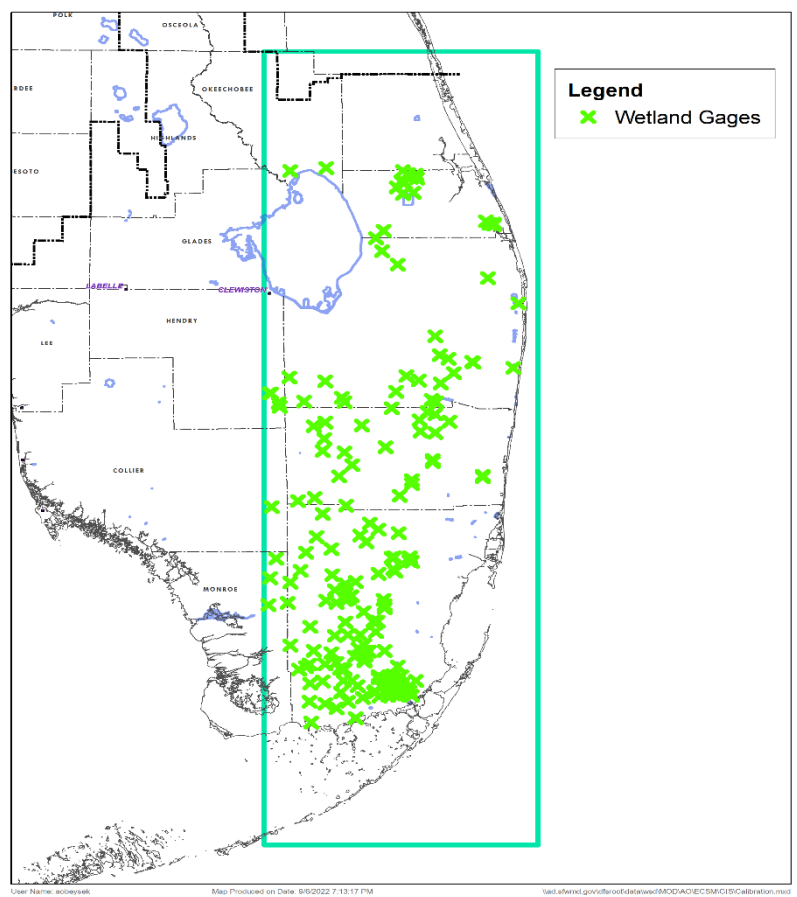
- SEAWAT model with code changes to accommodate SFWMD specialized packages
- Calibration period of record: 1985 – 2012
- Verification period of record: 2013 – 2016
- Daily stress period
- Cell size: 1,000 ft x 1,000 ft
- 5 model layers
- Calibrated to water levels and water quality (TDS) mg/L
- Boundaries



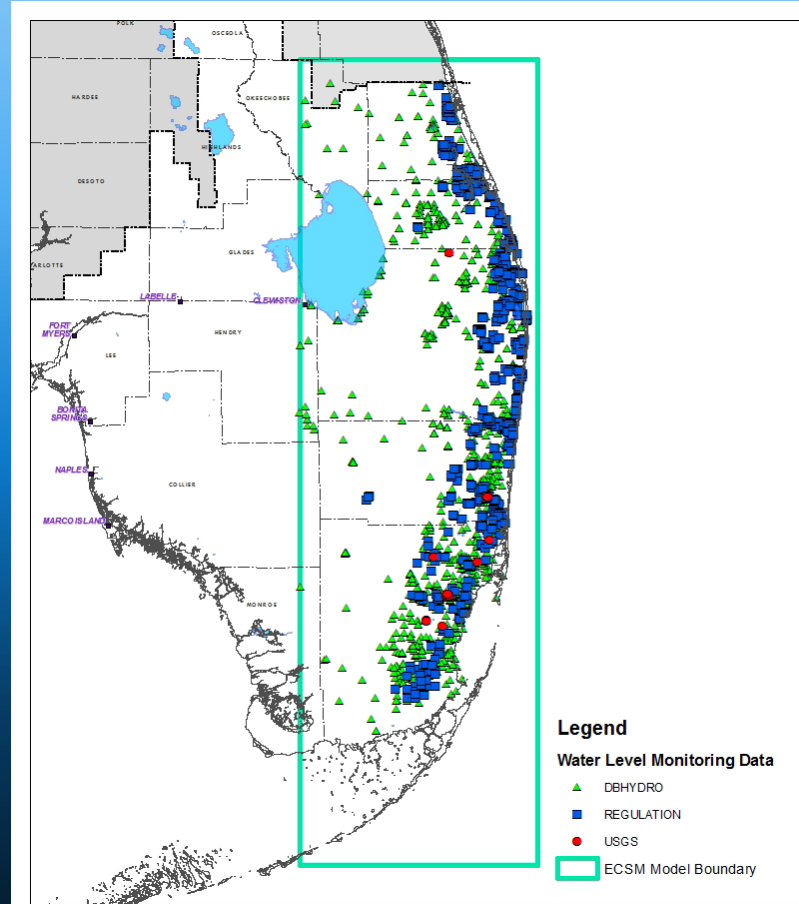
ECSM Layers

Age	Model Layer	Q Layer	Stratigraphy		Lithology	Hydrostratigraphy	
Holocene	Layer 1		Lake Flirt Marl, Undifferentiated Soil and Sand		Marl, peat, organic soil, and quartz sand	Surficial Aquifer System	Water Table Aquifer
Pleistocene		Q4, Q5	Pamlico Sand		Quartz sand		
			Miami Limestone		Oolitic limestone and fossiliferous limestone		
			Fort Thompson Formation		Marine limestone, gastropod-rich freshwater limestone, sandy limestone, and fossiliferous quartz sandstone		
	Layer 2	Q2, Q3	Key Largo Limestone		Coralline limestone and minor amounts of sandy limestone		
			Anastasia Formation		Coquina, shell, quartz sand, and sandy limestone		
	Layer 3	Q1	Caloosahatchee Formation		Sandy to shelly marl, clay, silt, and quartz sand		
Pliocene			Layer 4	Tamiami Formation	Pinecrest Sand Member		Quartz sand, bivalve-rich quartz sandstone and sandy limestone, shell, mudstone, and minor amounts of phosphate grains
	Layer 5	Ochopee Limestone Member			Bivalve-rich limestone, bivalve-rich quartz sand and sandstone, and moldic quartz sandstone		
							Biscayne Aquifer
							Semiconfining Unit
							Grey Limestone Aquifer

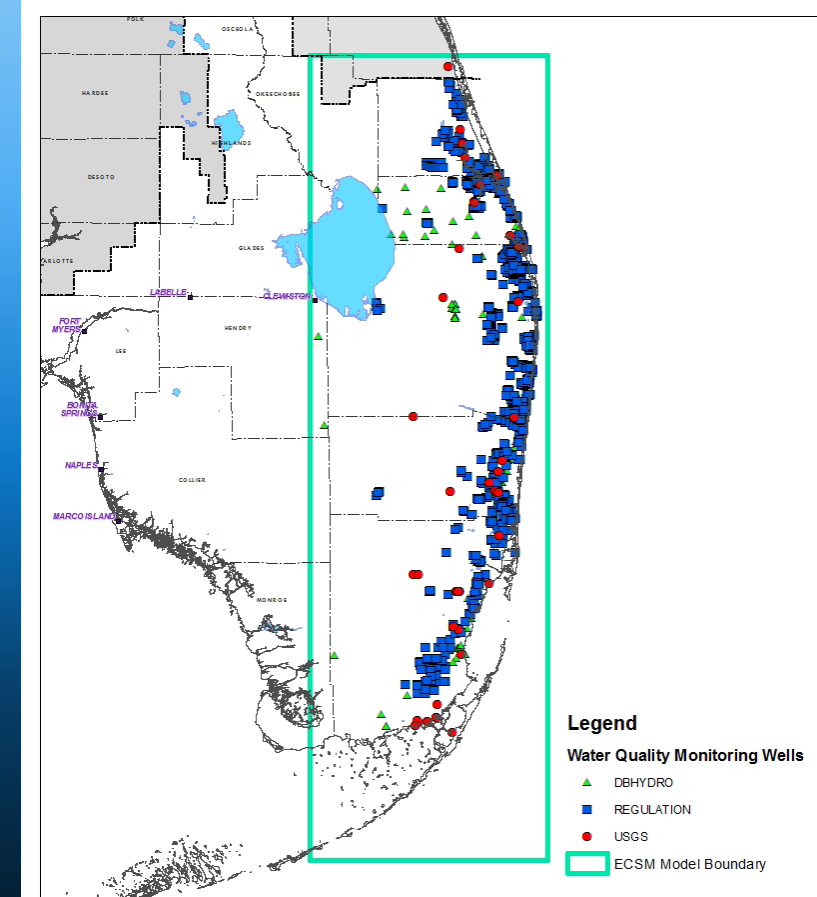
Monitoring Locations for Model Calibration



Wetland Gages
(Water Levels)



Groundwater Wells and
Surface Water Stations
(Water Levels)



Groundwater Monitoring Wells
(Water Quality)

Schedule

- **2023 – ECSM Calibration (Draft) and Peer Review**
- **2024 – Complete ECSM calibration, peer review, and conduct water supply planning application simulations**
- **2024 Dry Season – Conduct chloride sampling and compile water quality data from monitor wells in our network**
- **Fall 2024 – Publish 2024 Saltwater Interface Maps, SFWMD Coastal Aquifers**
- **2024/2025 – Model Application for Water Supply Vulnerability Assessment**

Maps and Related Links

2009, 2014 & 2019 maps available:

<https://www.sfwmd.gov/documents-by-tag/saltwaterinterface>

Merged Isochlor 2019: <https://geo-sfwmd.hub.arcgis.com/datasets/merged-isochlor-2019>

Chloride Data, 2019: <https://geo-sfwmd.hub.arcgis.com/datasets/chloride-data-2019>

pkwiat@sfwmd.gov

561-682-2547

Questions and Public Comment

- If you are participating via Zoom:
 - Click the Reactions button to access the Raise Hand feature
- If you are participating via phone:
 - *9 raises hand
 - *6 mutes/unmutes your line
- When you are called on, please state your full name and affiliation prior to providing comments and/or questions



Biscayne Bay

Resiliency Updates



Carolina Maran, P.E., Ph.D.


District Resiliency Officer

2023 LEC Stakeholder Meeting 2

August 24, 2023



Overview

- 
1. Understanding our resiliency through Data & Modeling
 2. District efforts that enhance the resiliency of our water supply
 3. Vision for the future

Water and Climate Resilience Metrics Hub

Water and Climate Resilience Metrics
Phase 1 - Long-Term Observed Trends


Search...

The South Florida Water Management District is strongly committed to addressing the impacts of sea level rise and a changing climate. The District's resilience efforts support its mission of safeguarding and restoring South Florida's water resources and ecosystems, protecting communities from flooding, and ensuring we are able to meet South Florida's water needs.

Objectives
As part of a series of District Resiliency initiatives to address changing conditions, the District is implementing a set of water and climate resilience metrics districtwide. These science-based metrics are being developed with the goal of tracking and documenting shifts and trends in District-managed water and climate observed data, supporting the assessment of current and future climate condition scenarios and related operational decisions, and informing District resiliency investment priorities. As part of the District's communication and public engagement priorities, this effort informs stakeholders, the general public, and partner agencies about the District's resilience efforts, while supporting local resiliency strategies. This Hub hosts the latest Water and Climate Resilience Metrics information and data analysis results, as well as related information that is relevant to the context of each metric discussion.


This page was designed as a living data hub and will be modified and updated as necessary. Check back frequently for updated data and resilience information.

Emerging Trends in Regional Resiliency



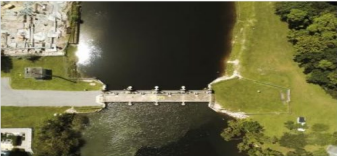
Regional Rainfall

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 Rise

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.



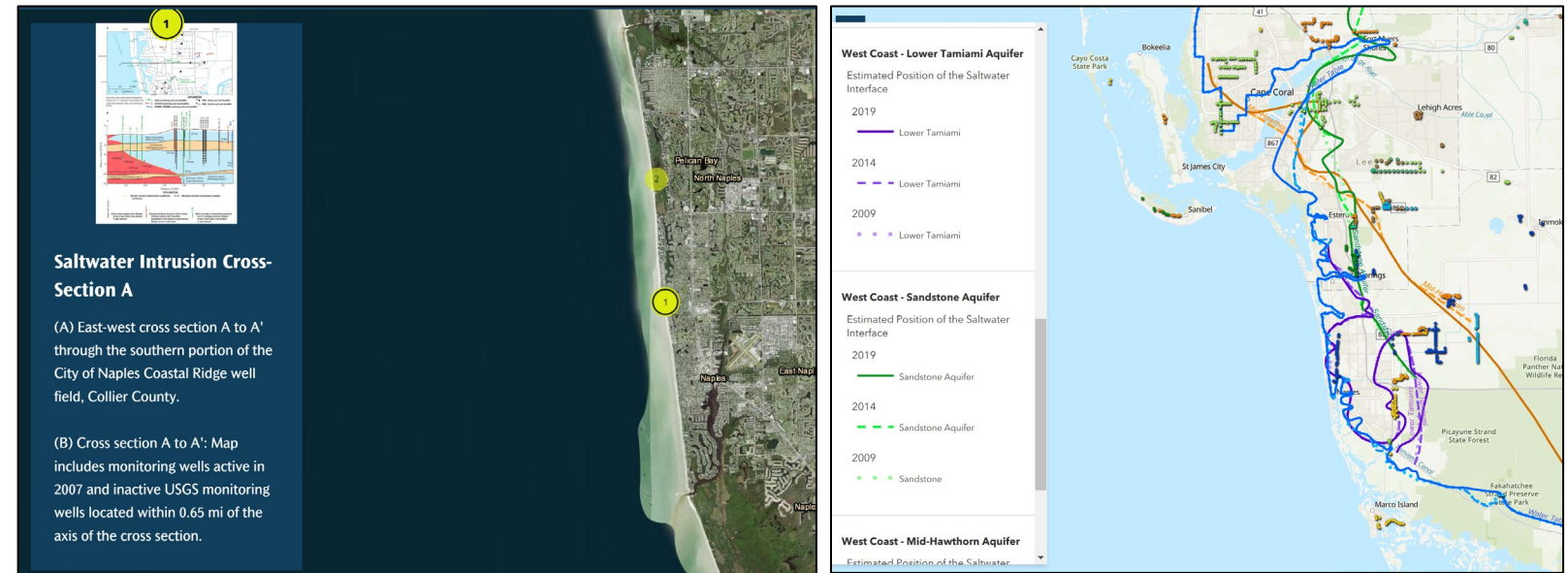
Salinity in the Everglades



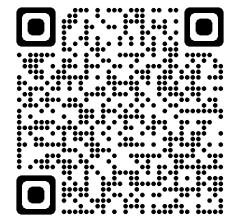
Estuarine and Mangrove Inland Migration



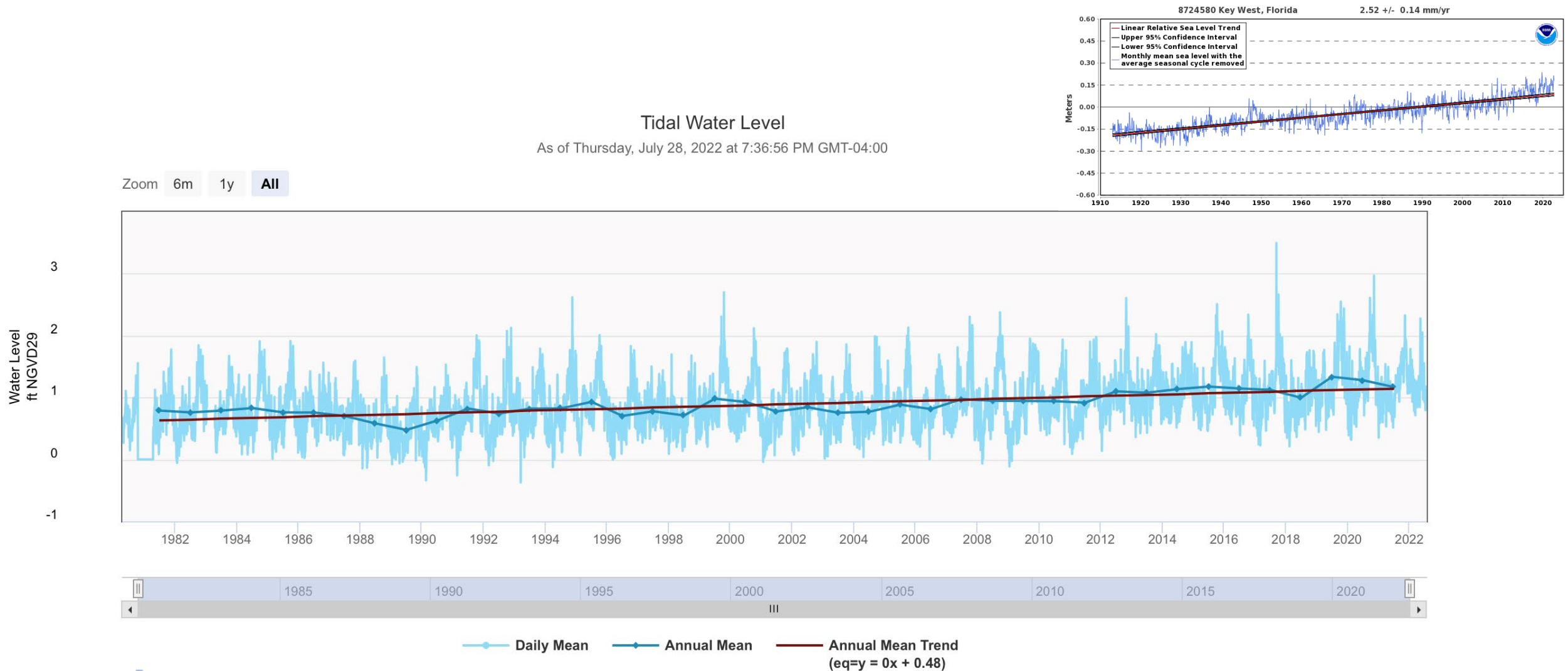
Soil Subsidence in South Florida



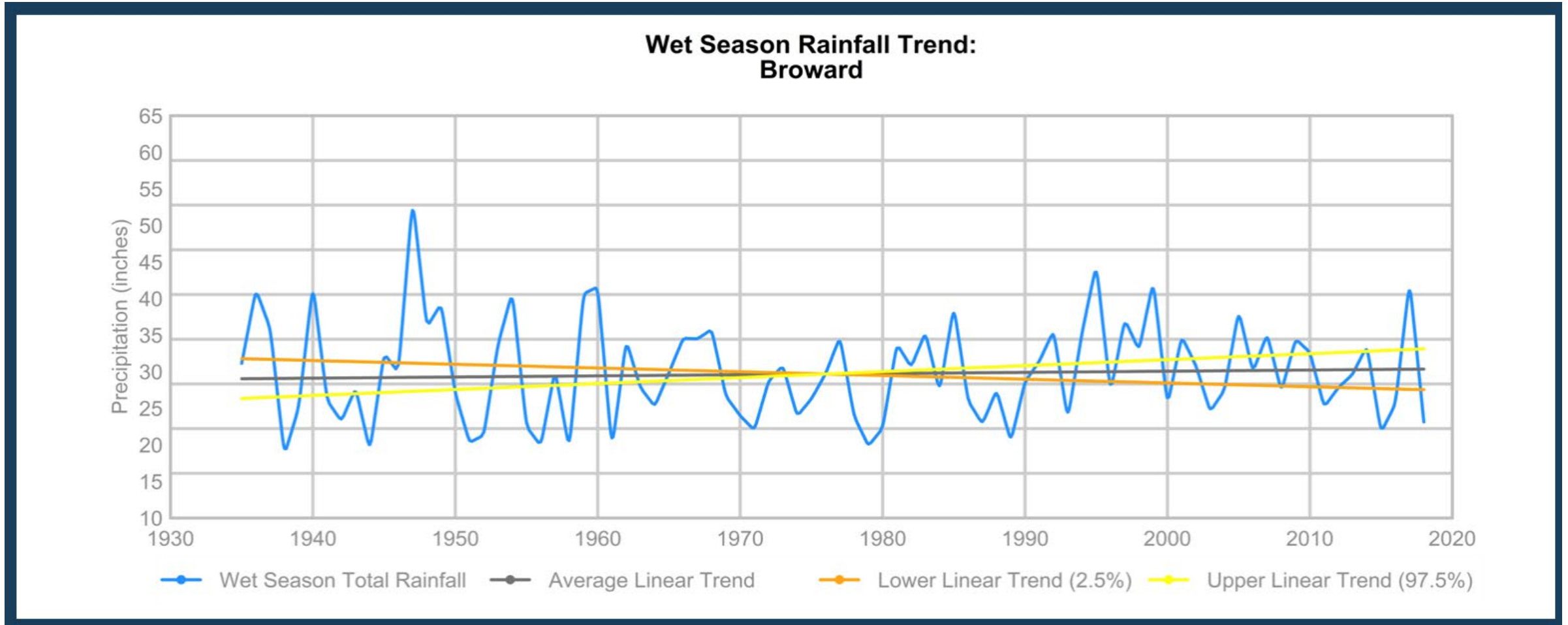
Saltwater intrusion cross-section and map featured on the [Water and Climate Resilience Metrics Hub](https://sfwmd.gov/our-work/water-and-climate-resilience-metrics)



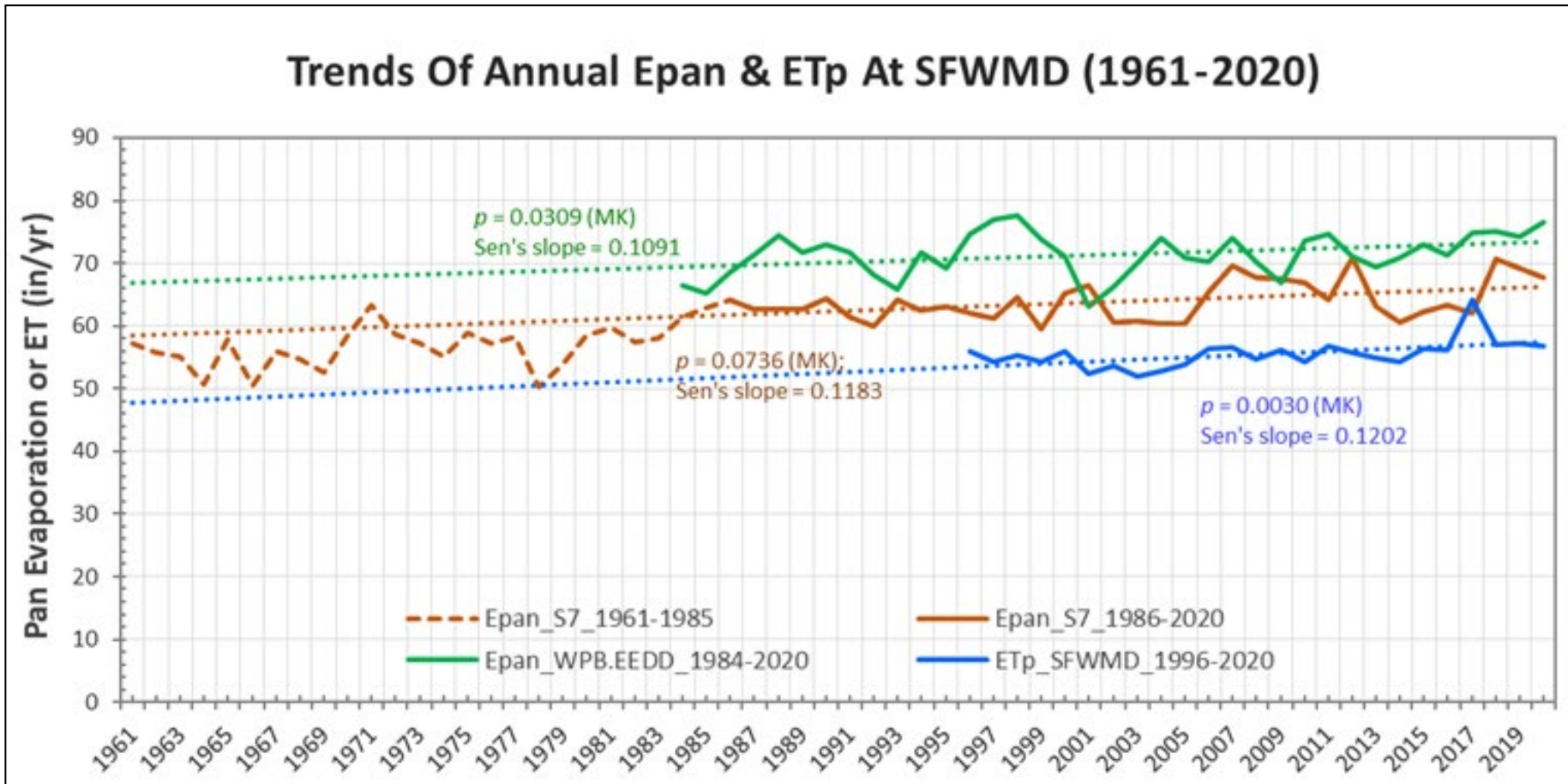
Observations- Tailwater Stages LEC



Observations – Average Wet Season Rainfall LEC



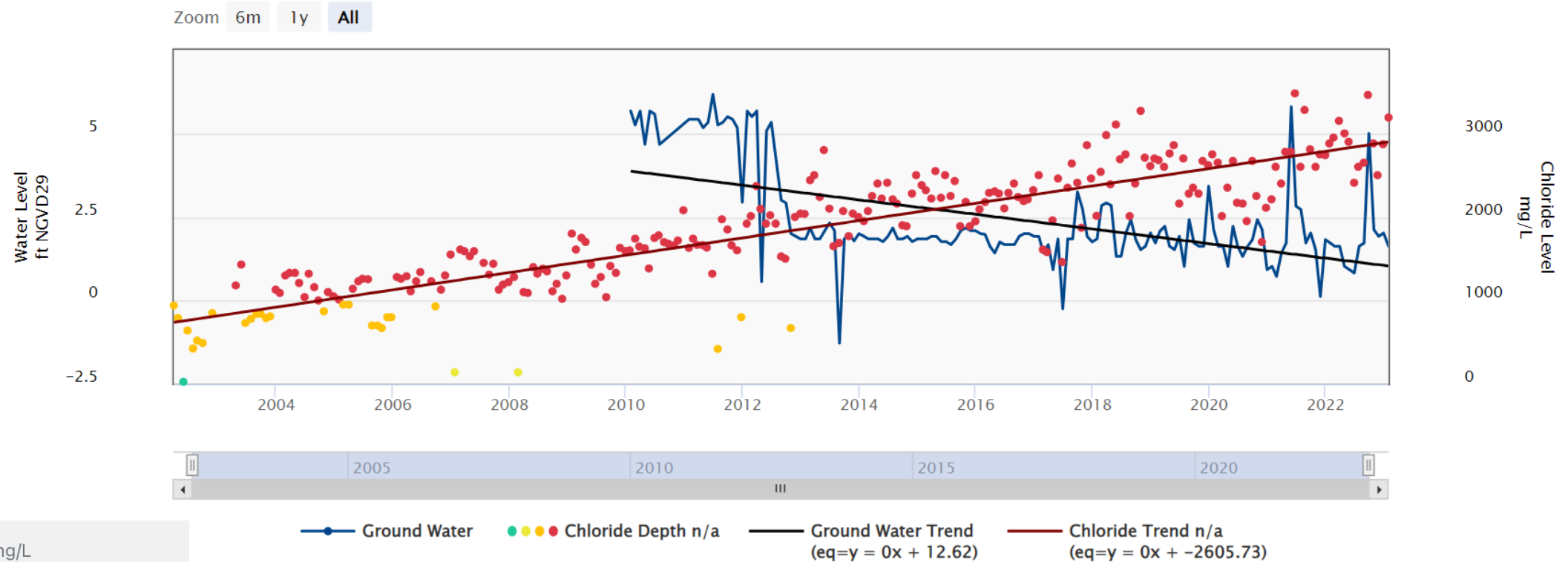
Observations- Evapotranspiration



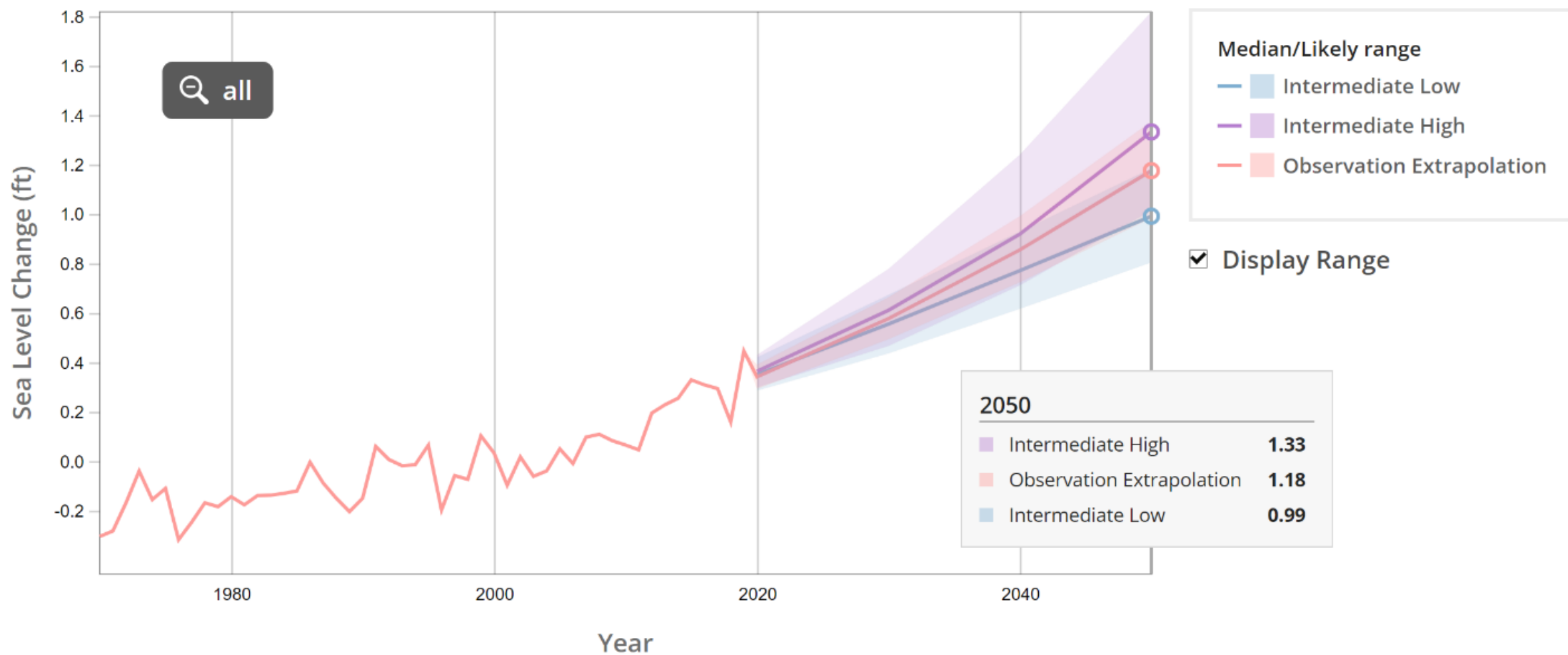
Observations- Groundwater Stages LEC

N MIAMI

As of Thursday, February 23, 2023 at 6:42:12 PM GMT-05:00



Projections- Sea Level Rise LEC

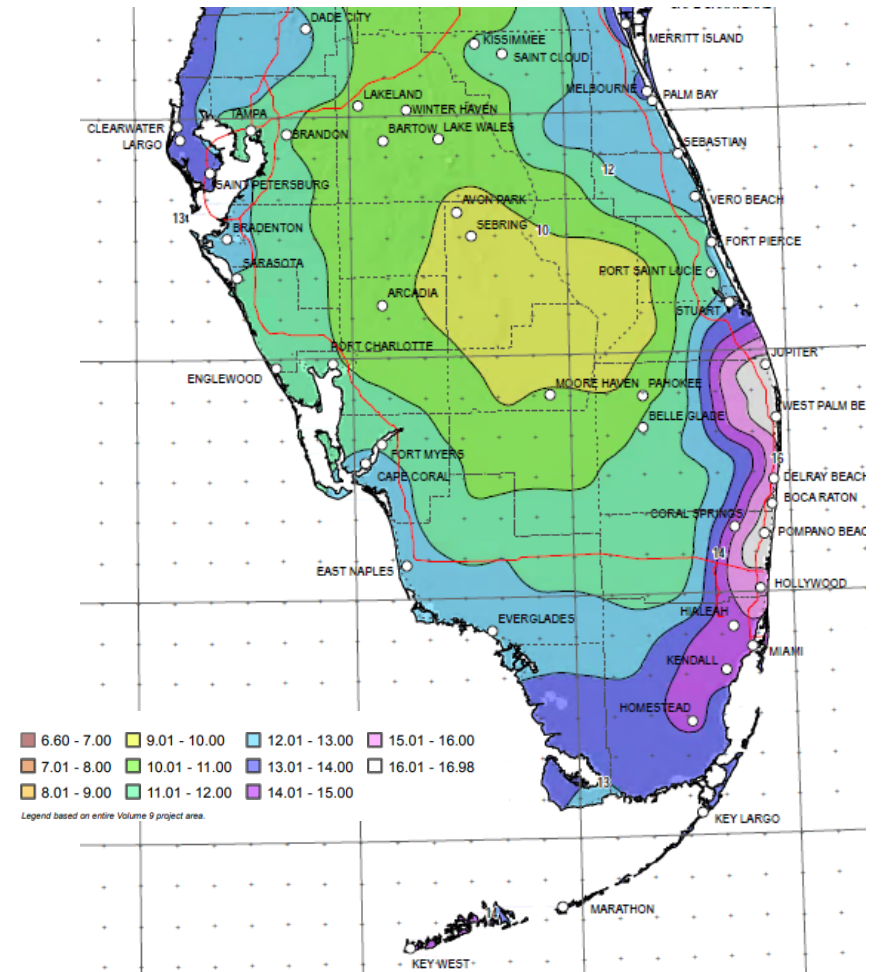


Estimating Future Rainfall

- SFWMD partnership with USGS & FIU
- Global climate model downscaling datasets
- Review of the latest science and refined evaluation of predicted rainfall
- Estimate **change factors in extreme rainfall** by 2070, districtwide, compared to NOAA Atlas 14 observations
- Develop **future intensity-duration-frequency curves** for the 16-counties area
- Strengthen District's planning capacity
- Currently being extended Statewide (including 2040 data)

Final Report Link:

[Development of Projected Depth-Duration-Frequency Curves \(2050–89\) for South Florida \(usgs.gov\)](https://www.usgs.gov/development-of-projected-depth-duration-frequency-curves-2050-89-for-south-florida)



NOAA Atlas 14, Volume 9, Version 2
Southeastern States



Prepared by U.S. DEPARTMENT OF COMMERCE
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
NATIONAL WEATHER SERVICE
OFFICE OF HYDROLOGIC DEVELOPMENT
HYDROMETEOROLOGICAL DESIGN STUDIES CENTER
April 2013

0 5 10 20 30 40 50
Miles
0 10 20 40 60 80 100
Kilometers

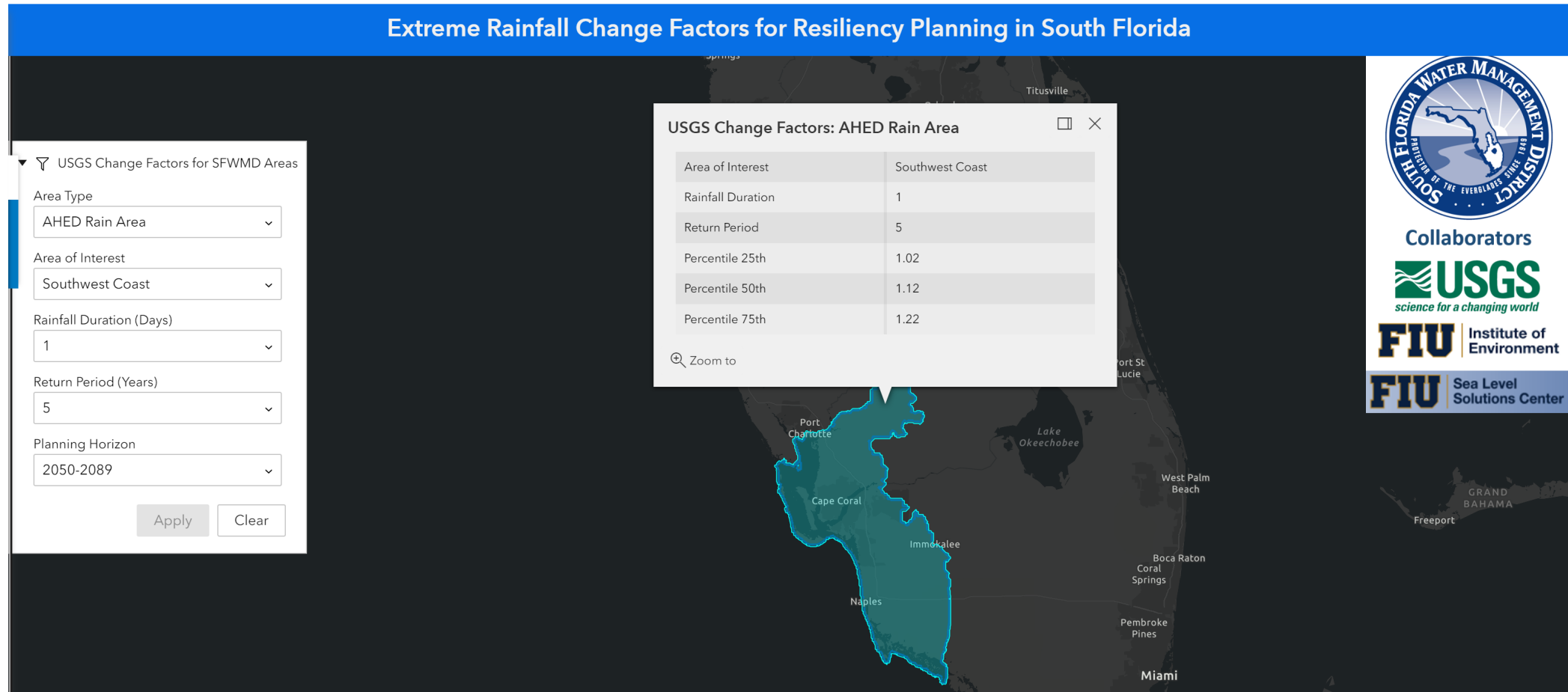
FLORIDA

Isopluvials of 100-year 24-hour precipitation in inches
SCALE 1:2,250,000

Projection: Lambert Conformal Conic, Datum: NAD83, Standard Parallels: 26°N and 30°N, Central Meridian: 84°W

Presenter: Carolina Maran

Projections – Extreme Rainfall



Web App Link:

[Future Extreme Rainfall Change Factors for Flood Resiliency Planning in South Florida Web Application | Resilience Metrics Hub \(arcgis.com\)](https://apps.sfwmd.gov/sfwmd/gsdocs/TPubs/2022_SFWM_TM_Adoption_of_Future_Extreme_Rainfall_Change_Factors_for_Resiliency_Planning_in_South_Florida_rev2.0.pdf)

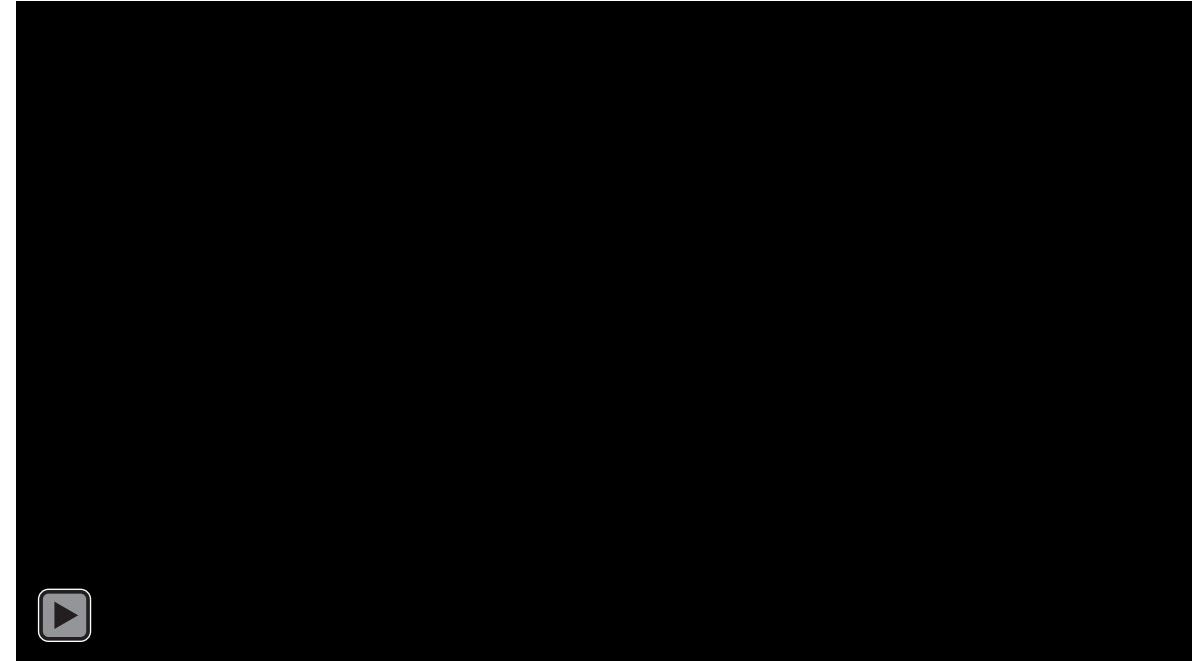
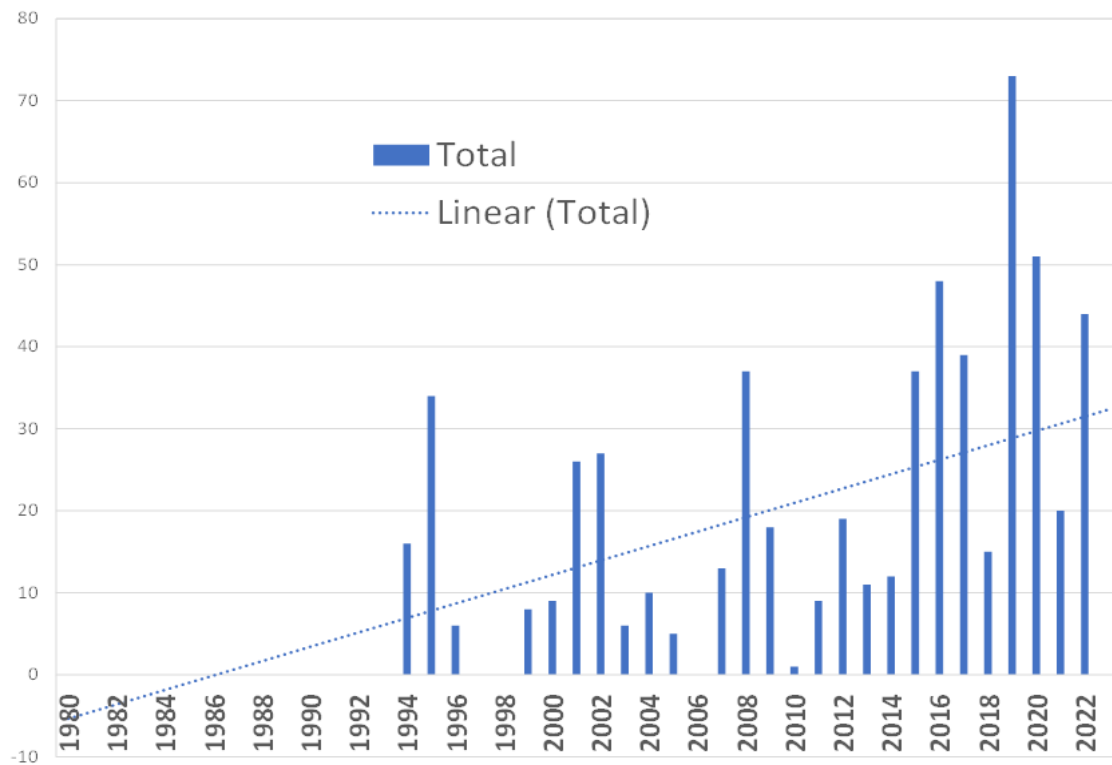
Technical Memorandum Link:

https://apps.sfwmd.gov/sfwmd/gsdocs/TPubs/2022_SFWM_TM_Adoption_of_Future_Extreme_Rainfall_Change_Factors_for_Resiliency_Planning_in_South_Florida_rev2.0.pdf

Presenter: Carolina Maran

Current Limitations from Changed Conditions

S28 - Number of Days in a Year where TW > HW



Coastal Structure Gate Overtop

(Saltwater moving inland, bypassing the top of the gate of the salinity coastal structure)

High Tide Season 2019

Planning for Climate Change Sea Level Rise

- Commitment to determine the best short- and long-term strategies for water resource management
- Continue to develop and improve data analysis, surface and ground water, coastal and inland, with focus on saltwater intrusion
- Advanced groundwater models being designed to support the evaluation of sea level rise and climate change scenarios, anticipate demand and availability impacts and simulate future saltwater inland movement.
- To be expanded to the Lower East Coast planning region for subsequent water supply plans
- Incorporation of future project recommendations as part of the District's Resiliency Plan

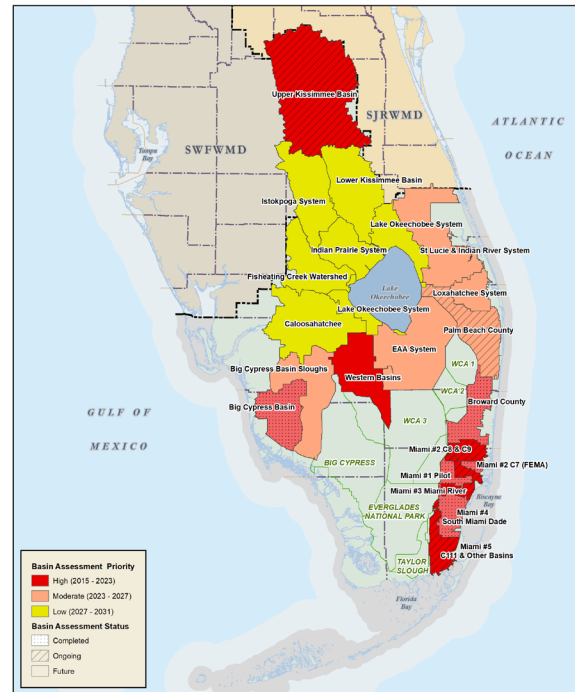


Flood Resiliency Studies

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

sfwmd.gov



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

www.sfwmd.gov/C&SF

Presenter: Carolina Maran 97

Water Supply Vulnerability Assessment

South Florida Water Management District

Water Supply Vulnerability Assessment Approach

Planning Assumptions and Scenario Recommendations for the Lower East Coast Region

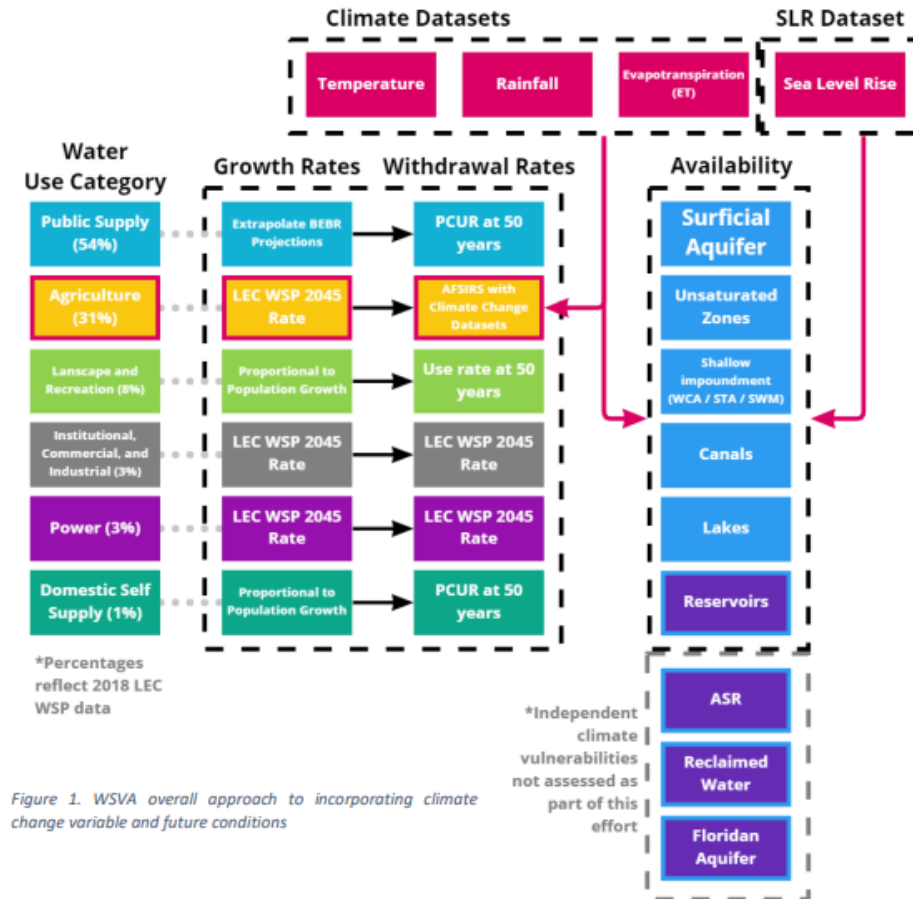


Figure 1. WSWA overall approach to incorporating climate change variable and future conditions

Our Resiliency Vision

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

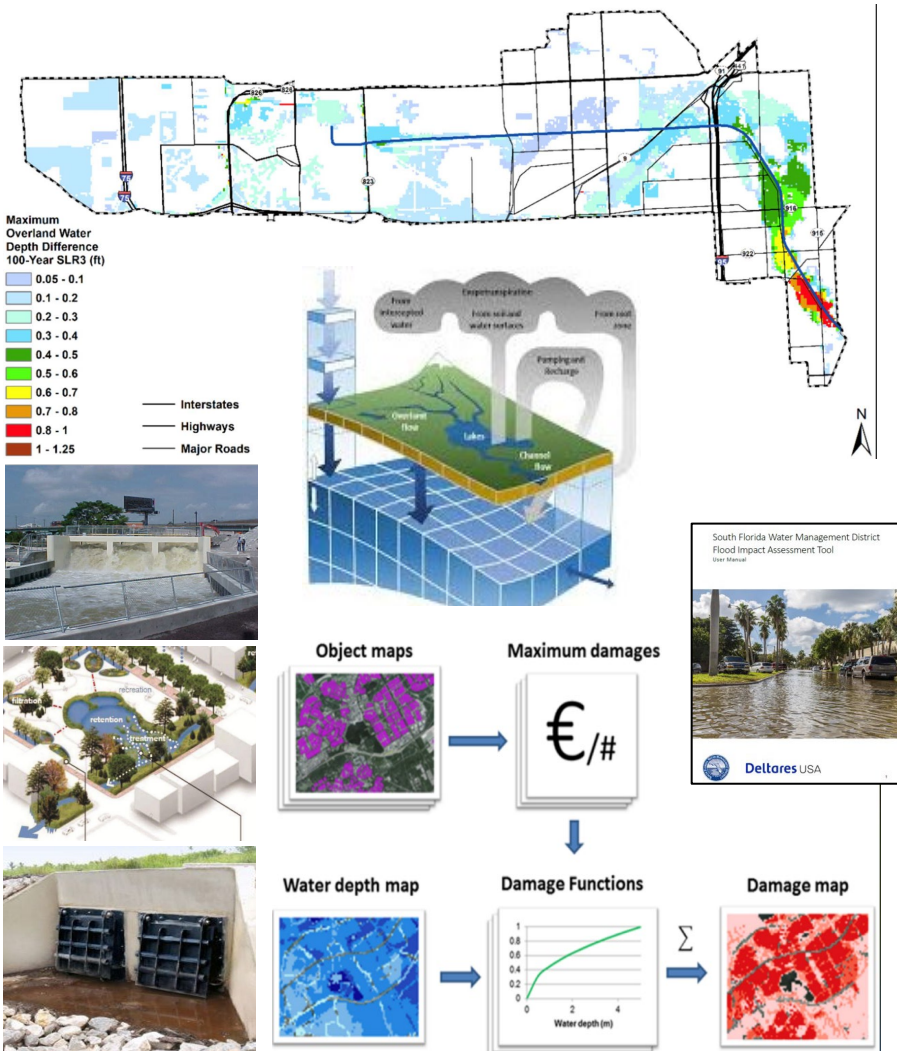


2023 SEA LEVEL RISE AND FLOOD RESILIENCY PLAN



Building Resilience and Mitigating Risks
to South Florida's Water Resources

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

Final Publication on September 1st



2023 SEA LEVEL RISE AND FLOOD RESILIENCY PLAN



Building Resilience and Mitigating Risks to South Florida's Water Resources

“...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.

Resiliency Initiatives Coordination

Integrating Inland and Coastal Flood Mitigation Strategies

Counties
Projects

Local
Municipalities
Projects

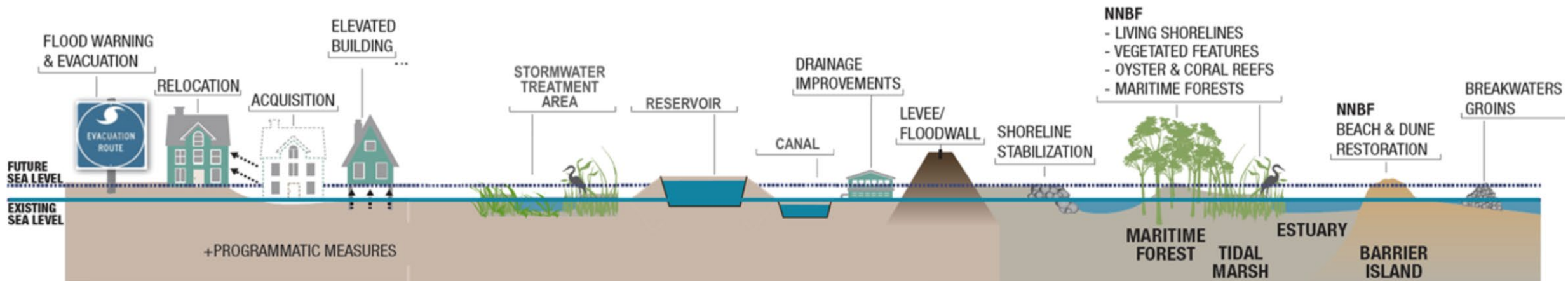
USACE
Studies/
Projects

Regional
Climate
Compacts

Other
Partners

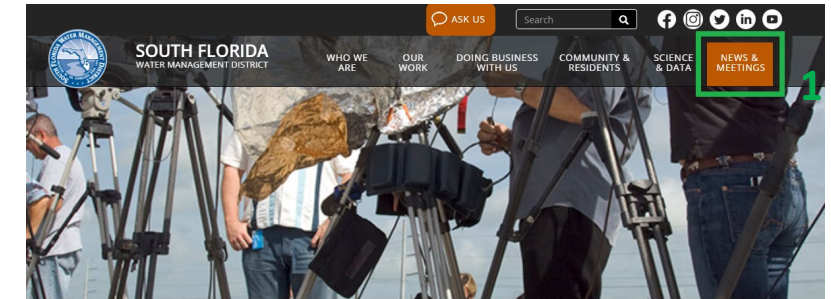
POTENTIAL MEASURES TO IMPROVE RESILIENCE AND SUSTAINABILITY

Graphic modified from https://ewn.el.erdc.dren.mil/nnbf/other/5_ERDC-NNBF_Brochure.pdf



How can you be involved?

- Sign-up for our updates by visiting <https://www.sfwmd.gov/news-events> and following these steps:
 - 1 - Click on the “Subscribe for Email” icon
 - 2 - Enter your email address
 - 3 - Select “District Resiliency”
under Subscription Topics / News
- Contribute on our initiatives and send us an email to resiliency@sfwmd.gov
- Visit www.sfwmd.gov/resiliency to get updated information
- Visit www.sfwmd.gov/meetings to attend and participate at District events



Quick Subscribe for ncortez@sfwmd.gov

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 - ☒ DBHydro Insights
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- ☐ Public Notices
 - ☒ Governing Board Meeting Notices

3



If you are participating via Zoom:
Click the Reactions button to access the Raise Hand feature

If you are participating via phone:

*9 raises hand

*6 mutes/unmutes your line

When you are called on, please state your full name and affiliation prior to providing comments and/or questions

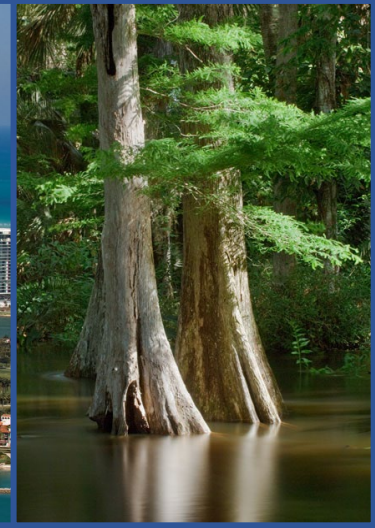
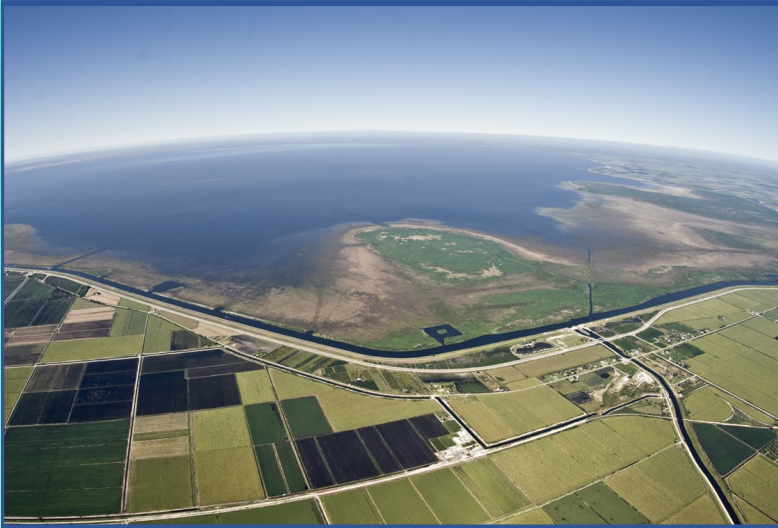
Thank You

Carolina Maran, P.E., Ph.D., SFWMD, District Resiliency Officer

cmaran@sfwmd.gov

www.sfwmd.gov/resiliency

Next Steps



Nancy Demonstranti, P.G.
LEC Water Supply Plan Manager
LEC Stakeholder Meeting 2
August 24, 2023

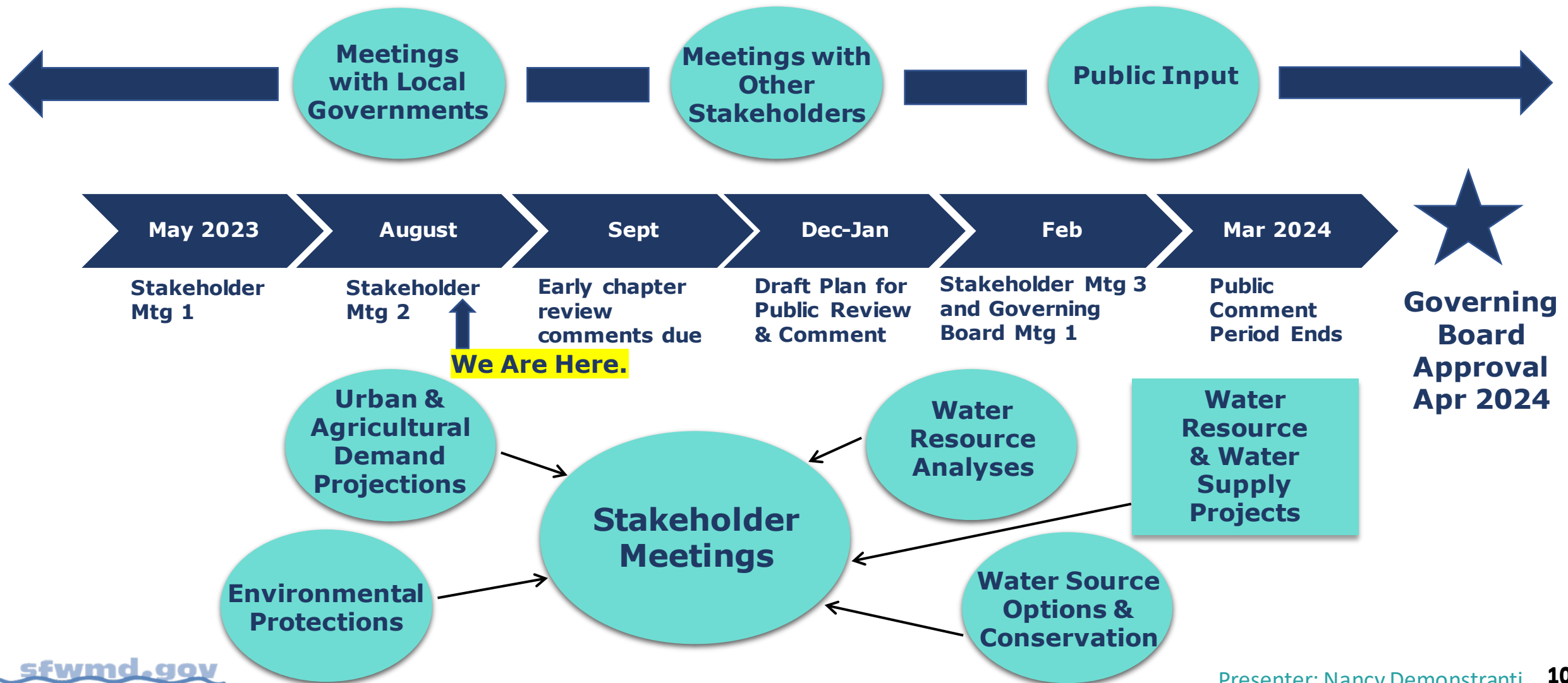


Draft Chapters Are Available for Public Comment

- Draft versions of Chapters 1, 2, 3 and Appendix A of the 2023 LEC Plan Update are now available for early viewing and comment at www.sfwmd.gov/lecplan.
- Please submit your written comments to Nancy Demonstranti, LEC Plan Manager, at ndemonst@sfwmd.gov by **September 29, 2023**.
- We strongly encourage your input and comments to ensure the plan update addresses the needs of the region.



Water Supply Plan Update Timeline



Questions and Public Comment

- If you are participating via Zoom:
 - Click the Reactions button to access the Raise Hand feature
- If you are participating via phone:
 - *9 raises hand
 - *6 mutes/unmutes your line
- When you are called on, please state your full name and affiliation prior to providing comments and/or questions
- Plan Information can be found at www.sfwmd.gov/lecplan
- Workshop announcements sent via email



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melsner@sfwmd.gov

Biscayne Bay