BISCAYNE BAY AND SOUTHEASTERN EVERGLADES ECOSYSTEM RESTORATION (BBSEER)

Project Delivery Team Meeting

1:00 PM to 4:00 PM
February 1, 2023

U.S.ARMY

US Army Corps of Engineers®

HOUSEKEEPING

- Please enter your name and affiliation into the chat to track attendance.
- Please mute yourself when you are not speaking.
- Please utilize the chat function to ask questions and make comments.
- During feedback and comment times, please state your name and affiliation.
- Please be aware that this meeting will be recorded for note-taking purposes.

MEETING AGENDA

- Welcome and FACA Reminder
- Revised Round 2 Alternatives
  - PDT Comment/Public Comment
- Break
- Future Without Project Baseline
  - Review SLC Strategy
  - IMC Presentation of FWO2085 Intermediate SLR Curve
- Ecological Performance Measures Update
  - PDT Comment/Public Comment
- Next Steps and Closing Remarks

STATEMENT OF INTENT
PER FEDERAL ADVISORY COMMITTEE ACT (FACA) AND SIMILAR CONSIDERATIONS

- The intent of this forum is to allow federal, state and local agencies, and tribal governments to exchange views, information, or advice relating to planning for the Biscayne Bay Southeastern Everglades Restoration study (BBSEER).
- This meeting is not a forum for official policy discussion or policy formulation.
- The Project Delivery Team (PDT) performs technical staff functions. Members are encouraged to participate and share their technical skills and knowledge.
- Comments from the public will be accepted at a designated time that is separate from the interagency discussions.

PUBLIC ENGAGEMENT OPPORTUNITIES

- **1 Feb 2023** **IMC Presentation of FWO2085 Intermediate SLR Curve**

Project Contacts:

USACE PM
April Patterson: (904) 549-3803

USACE Planning
Brad Foster: (904) 232-2110
Jennifer John: (904) 232-1133

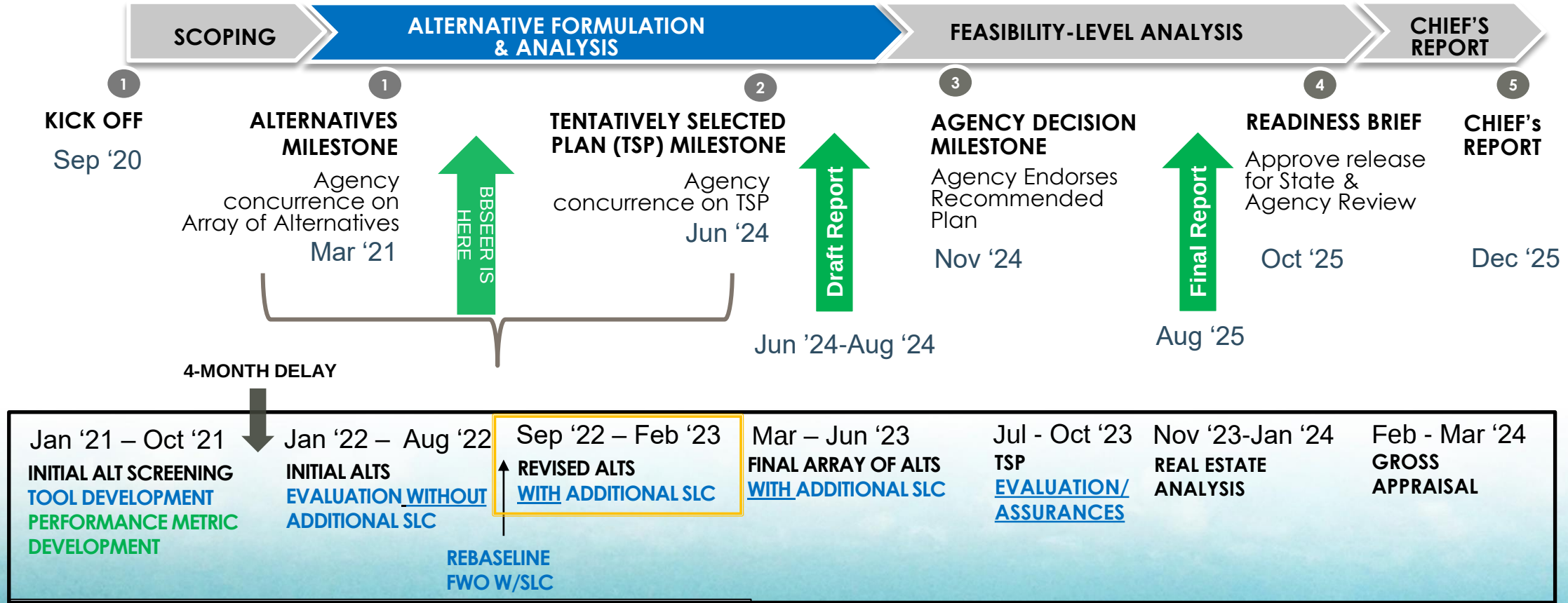
SFWMD PM
Brenda Mills: (561) 682-6536
Nicole Niemeyer: (561) 682-2108

Project Email: bbseercomments@usace.army.mil

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

PLANNING PROCESS TIMELINE

SMART PLANNING PROCESS



ALTERNATIVE EVALUATION NEXT STEPS

Kickoff to Alternatives Milestone Meeting (AMM) to Tentatively Selected Plan (TSP)

Kickoff, Start 15 Sep 2020

✓ water budget, HH Tool develop, MM screen PM develop

Management Measures

Screen & eval; Non-model tools

NEPA Scoping
Agency & Public Charette
Task Force Sponsored Workshop

AMM

June to Aug 2022

Early Alternatives

model baselines ECB, Pre-FWO

Round 1 model Early Alts and YB

Develop FWO w/ SLC

Sept to Nov 2022

Evaluate/ Compare

Nov 2022 to Jan 2023

Screen, revise recombine

2023

Jan to Mar 2023

Round 2. Model Revised Alts w/SLC

Evaluate/ Compare

revise, develop Final Alts

Round 3. Model & optimize Final Alts (1-2 plans / prelim TSP)

Compare (revise, if needed)

TSP & Assurances. SLC & climate change, assurances & savings (1 or 2 plans / prelim TSP)

2024

Evaluate/ Confirm TSP

TSP Milestone

Eco PMs | Environmental Justice | Cost

Engineering | CE/ICA Cost Effectiveness/Incremental Cost Analysis | Water Quality

Real Estate | Water Supply | Flood Protection | Climate Change

BBSEER

ROUND 2 ALTERNATIVES

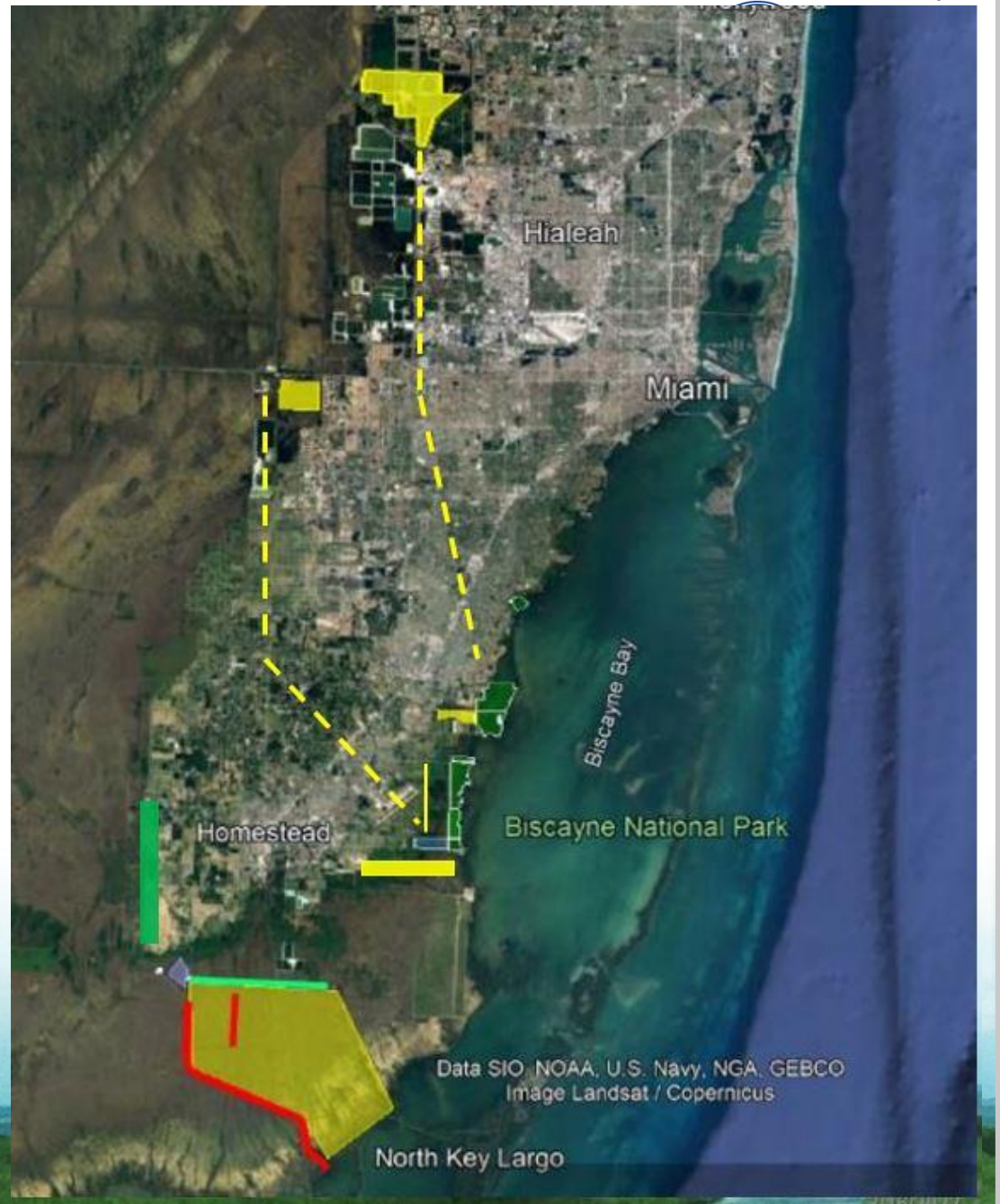
YELLOW BOOK ALTERNATIVE

Yellow Book Components Included:

- North Lake Belt Storage Reservoirs
- West Miami-Dade Wastewater Reuse
- South Miami-Dade Wastewater Reuse
- Biscayne Bay Coastal Wetlands
- Biscayne Bay Coastal Canals (operational)
- C-111N Project

Yellow Book Alternative Strategy:

- Model will depict 1999 Restudy feature components with authorized feature modifications for BBCW1 and C-111 SCW



SOURCES OF NORTHWEST WATER

Sources identified from North Lake Belt Yellow Book Component:

- C-6 Canal
- C-9 Canal
- C-9, C-11 Reservoirs (ref. BCWPA PIR)

Additional Sources Identified:

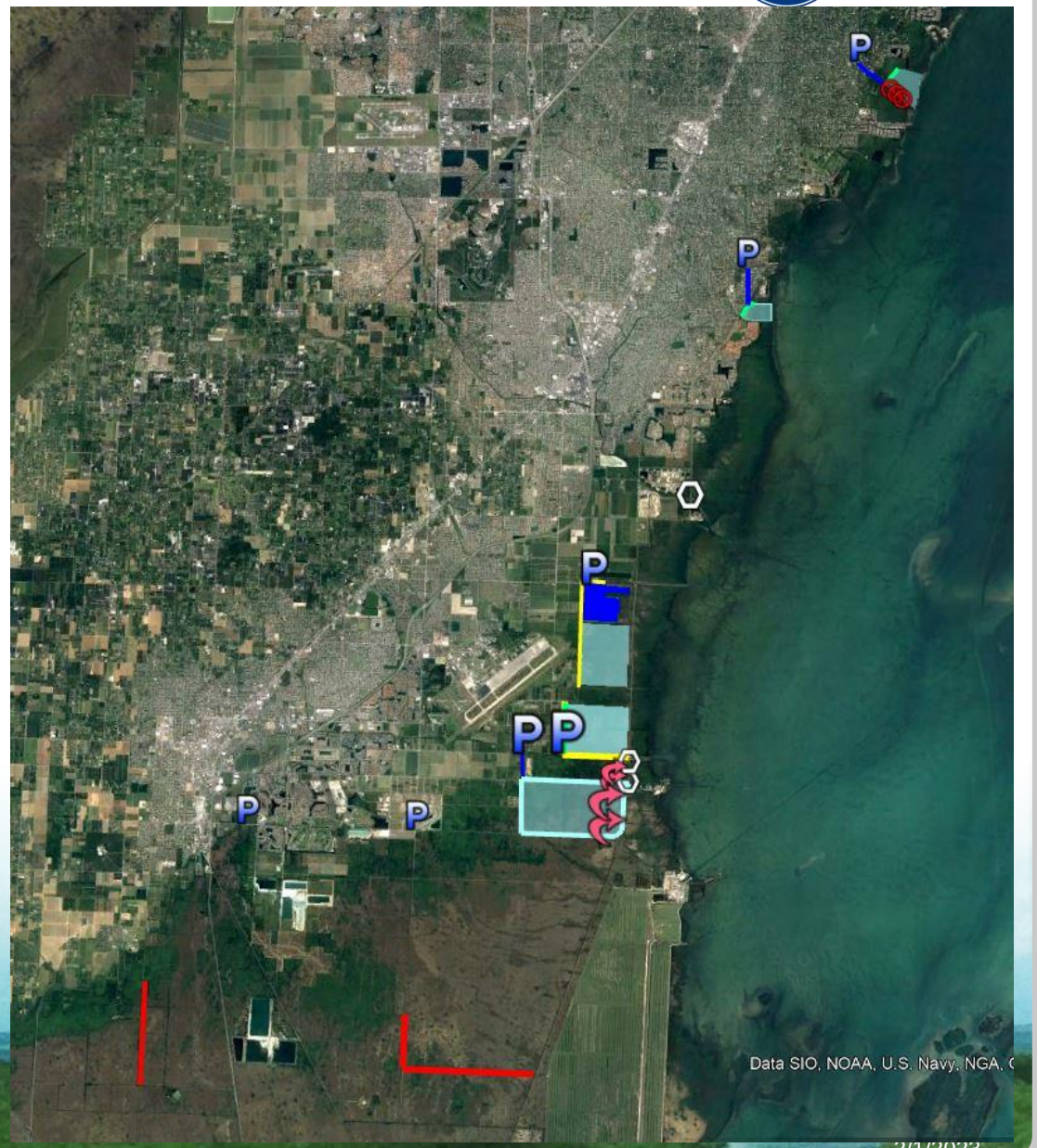
- Seepage from L-30, L-31N basins
- Groundwater seepage from East Coast Buffer Area.
- Stormwater Runoff backpumping from C-1W and L-31N.
- C-4 runoff

LEGEND

- Culvert Plug
- Storage
- New Structure
- Operational change at existing structure
- Remove structure
- Pump
- New Culvert
- Inverted Siphon
- Operational change at structure in conveyance canal
- Seepage Management
- Backfill, plug canal
- Shallow canal
- New Pipeline
- Spreader Canal
- Lined Spreader Canal
- New Canal
- Existing canal, used for conveyance

MEASURES IN ALL ROUND 2 ALTERNATIVES

- Hardy Matheson (Source: C-2 Canal)
- North Cutler (Source: C-100 Canal)
- South Cutler (Overflow Weir or similar structure)
- C-102 to Military Rehydrate (Source: C-102 Canal)
- Military to C-103 Spreader (Source: C-103)
- Plug/Backfill Model Lands North Canal
- Plug/Backfill 1 mile of Tallahassee Rd Borrow canal
- Plug/Backfill multiple mosquito ditches in wetlands
- 2 pump stations in Florida City Canal, moving water to northern Model Lands
- Culverts on west side of L-31E from North Canal wetlands
- New Structure on L-31E south of C-103
- New Structure on L-31E north of North Canal
- Plugs in upper C-110 Canal



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BBSEER ALTERNATIVES BY GEOGRAPHIC AREA

Northwest: North Lake Belt and Pennsuco

Northwest: Bird Drive Basin and Kendall Mine

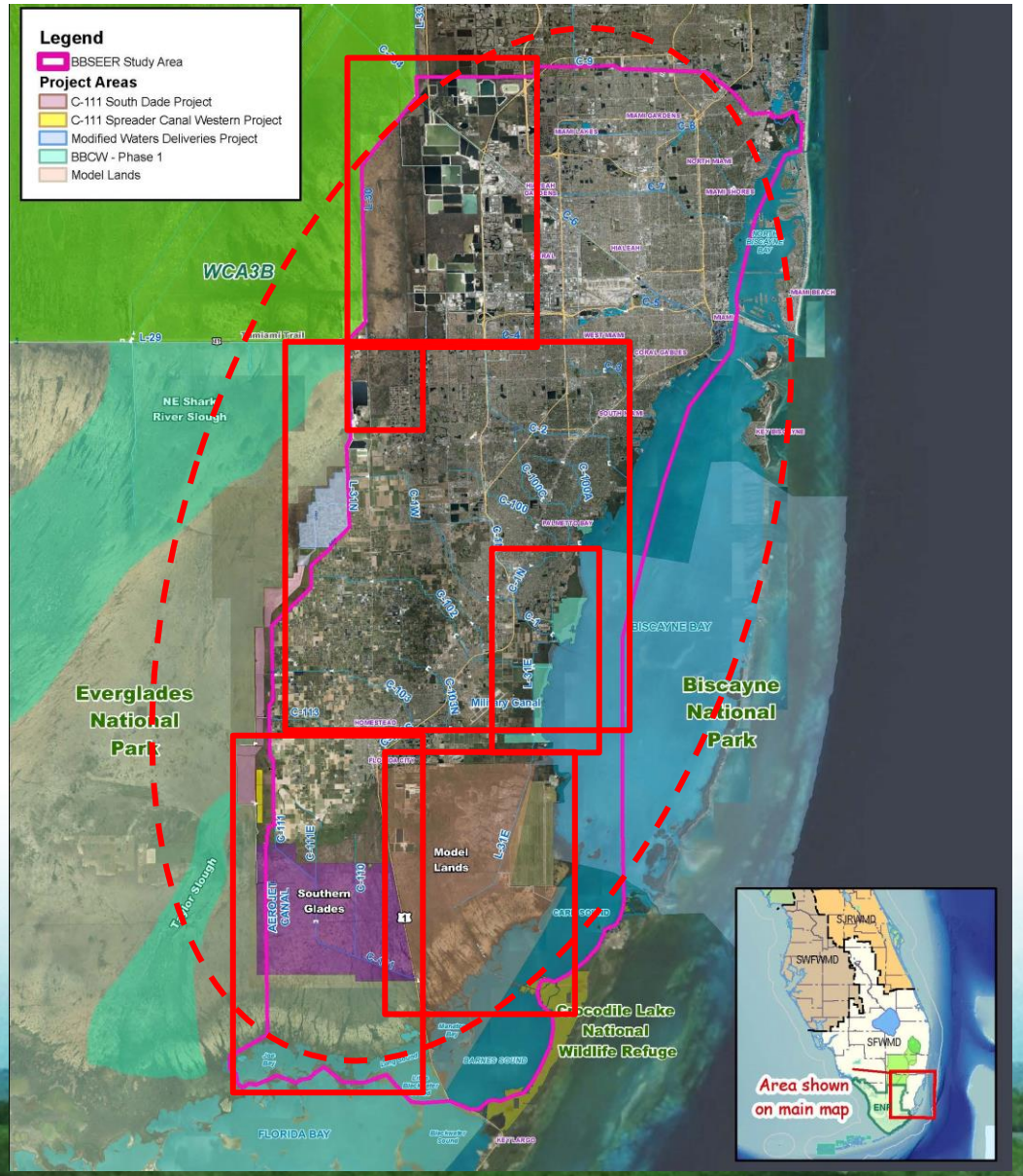
Conveyance Pathways

Coastal Wetlands

Southern Glades and C-111 Basin

Model Lands

Operations



NORTH LAKE BELT AND PENNSUCO

ALT21

- Pumps from C-9 and C-6 canals to Lake Belt
- Pumps to Pennsuco and DBLE canal.
- Modify canal along east Pennsuco with hanging curtain wall.
- Seepage mgmt. along western corner.
- Remove mud levee and canal in Pennsuco.
- Inverted siphons and culvert becomes weir.

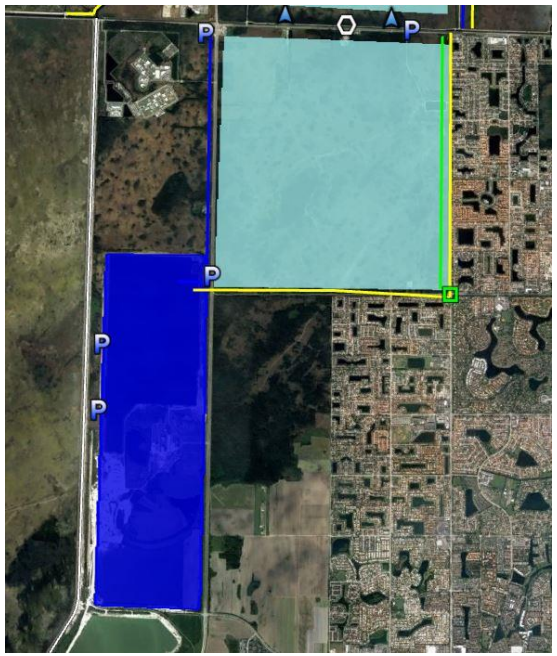
ALT22

- Pumps from C-9 and C-6 canals.
- **C-9 water rerouted west to C-6 canal. C-6 water rerouted along turnpike.**
- New canal along FL turnpike.
- Connection to C-2 canal.

ALT23

- Pumps from C-9 and C-6 canals.
- Pump from Lake Belt to Pennsuco.
- 2 pumps from Pennsuco to L-30 canal.
- Inverted siphons and culvert becomes weir.
- **Keep the Pennsuco mud levee and canal, remove curtain wall.**

BIRD DRIVE BASIN AND KENDALL

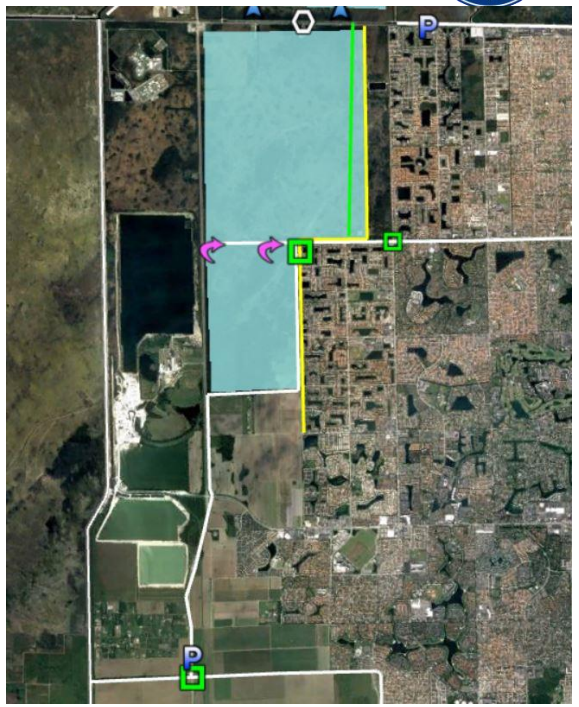


ALT21

- Pump on C-4 canal to Bird Drive Basin.
- Pump and new connection from C-4 to Kendall.
- Pump from L-31N to Kendall.
- **Pump from BDB to Kendall.**
- **Pump from Kendall to L-31N**
- Spreader canal east of BDB.
- **Seepage collection from Bird Drive spreader, seepage to Kendall.**
- New structure on Bird Drive Basin canal at eastern border of BDB.

ALT22

- Pump from L-31N to Kendall, Kendall as groundwater recharge.
- New structure on Bird Drive Basin canal at eastern border of BDB.



ALT23

- Pump on C-4 canal to Bird Drive Basin.
- **Seepage management and spreader canal ~0.5 miles west of BDB.**
- Culverts under BD canal to move water south.
- Conveyance out of BDB through BD canal to C-2, new structure.
- **Conveyance out of BDB south through new canal, pump to move water east to C-1 or west to L-31N.**

CONVEYANCE PATHWAYS

ALT21

L-31N, C-1, C-102, C-103, C-111

ALT22

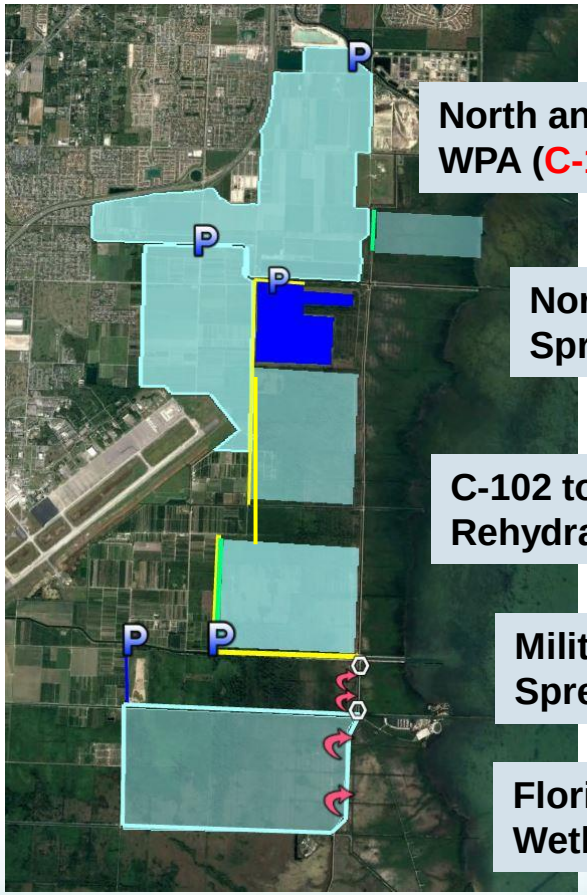
Turnpike canal to C-2 canal, C-100, C-1, C-102, C-103, C-111

ALT23

L-30 canal to L-31N, C-4, BDB Canal to C-2, **BDB to C-1W**, C-1, C-100, connection of C-100 to C-1, C-102, C-103, C-111

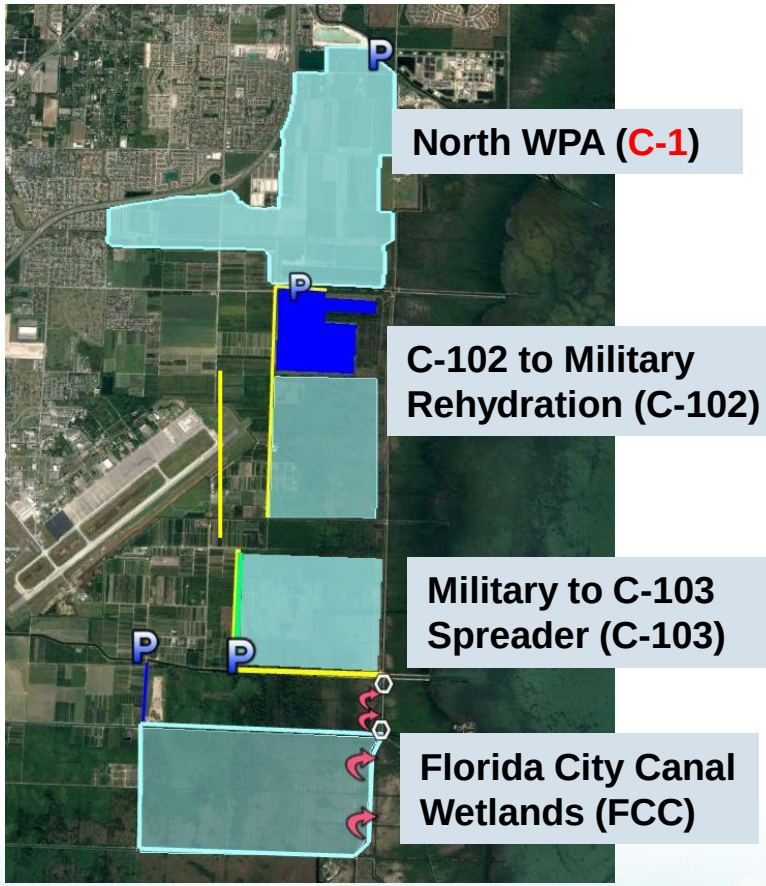
BBSEER

COASTAL WETLANDS



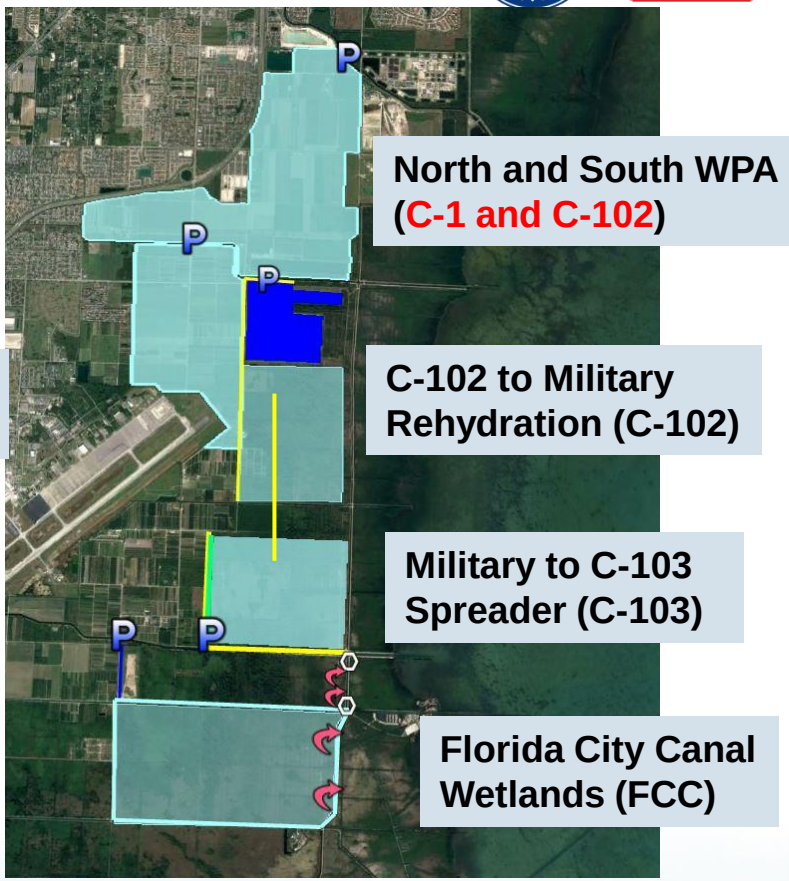
ALT21

Includes all four redistribution features north/south of Military Canal and two coastal WPAs



ALT22

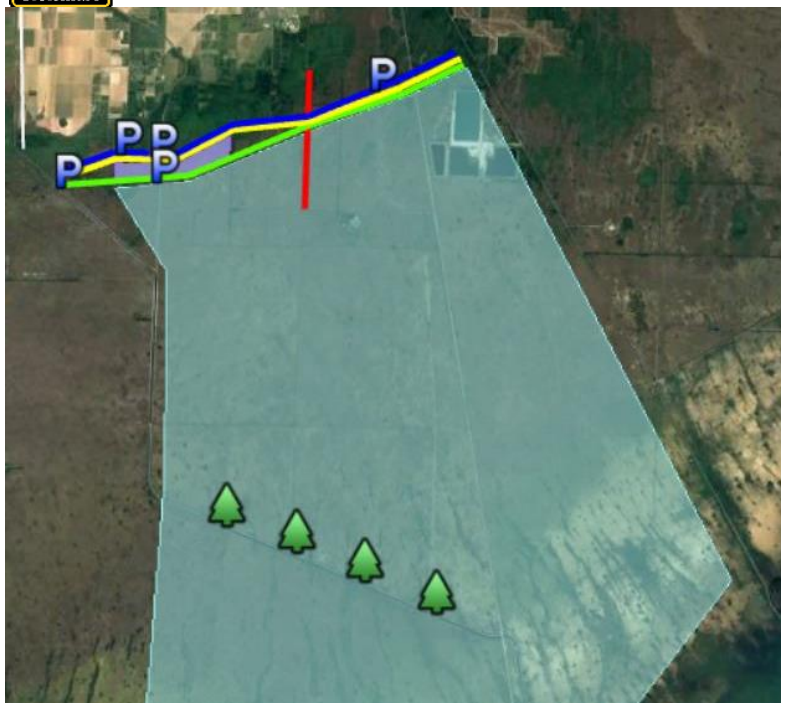
Includes three redistribution features north/south of Military Canal and one coastal WPA

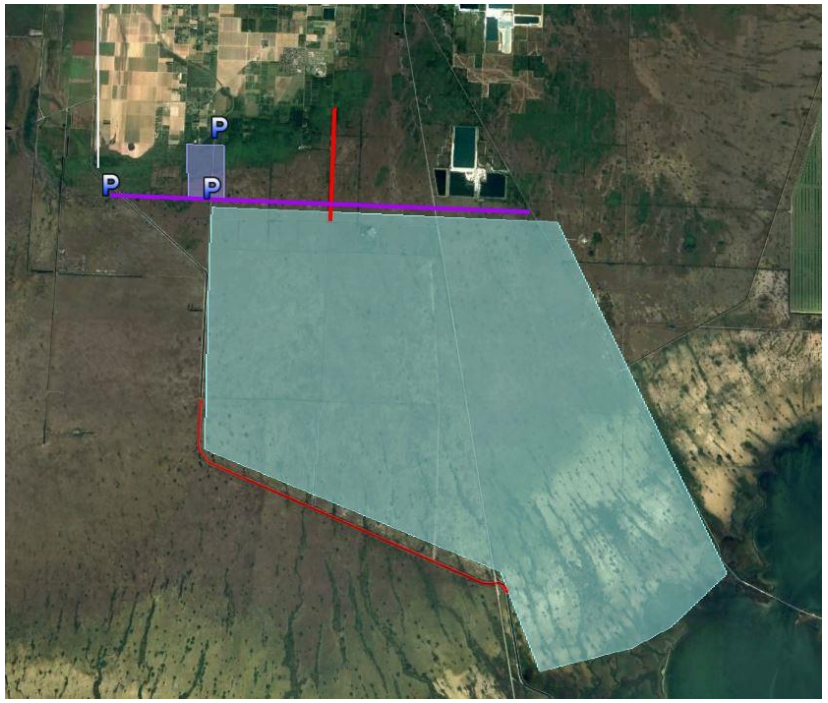


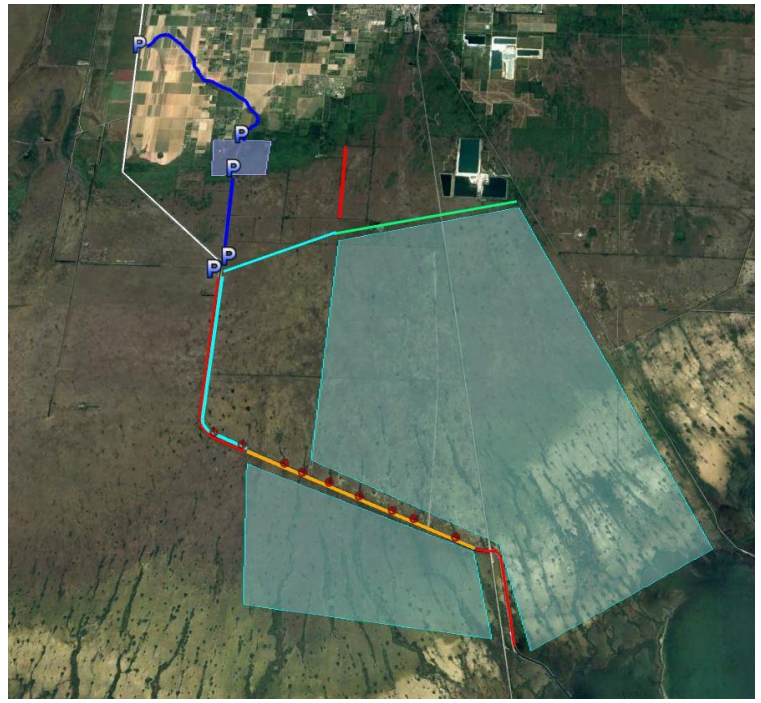
ALT23

Includes three redistribution features north/south of Military Canal and **two coastal WPAs**

C-111 BASIN & SOUTHERN GLADES







ALT21

- Levee + Cutoff Wall at boundary between Southern Glades and development. STA on C-111E and spreader south of levee.
- Engineered vegetated hammock plugs in lower C-111 canal.

ALT22

- Lined spreader moves water from C-111 and C-111E STA.
- **Spreader is extended to capture water directly from C-111 canal.**
- **Remove Bypass from C-111 to C-111E.**
- Backfill of C-111 from S-18C to S-197

ALT23

- Pipeline south, opens at lower C-111. STA on C-111E and pipeline angled SW to NE to spreader across Southern Glades.
- **2 pump stations at start of pipelines.**
- Remove culverts in 9 ditches.
- **Backfill N-S portion of C-111 adjacent to new pipeline.**
- **Include bypass through C-111E canal.**
- Shallow C-111 canal, backfill north of S-197 to Marina.

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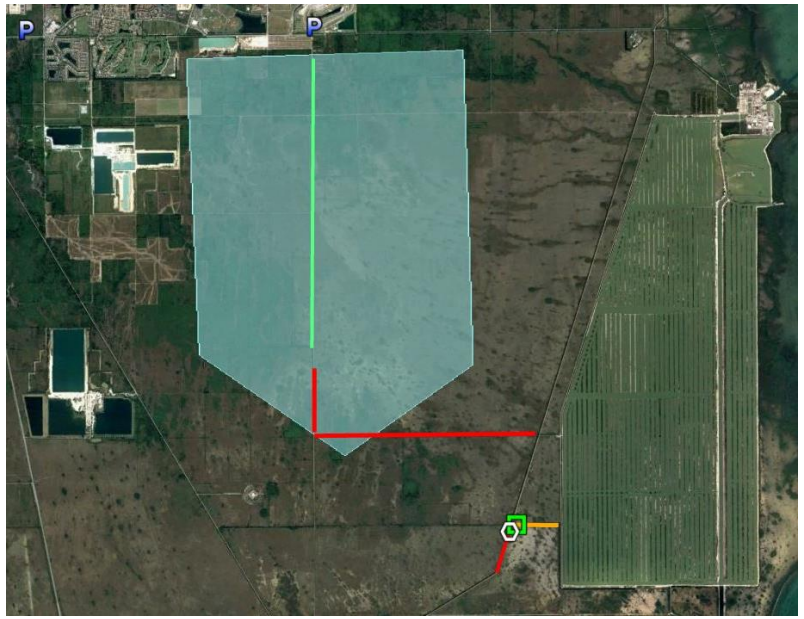
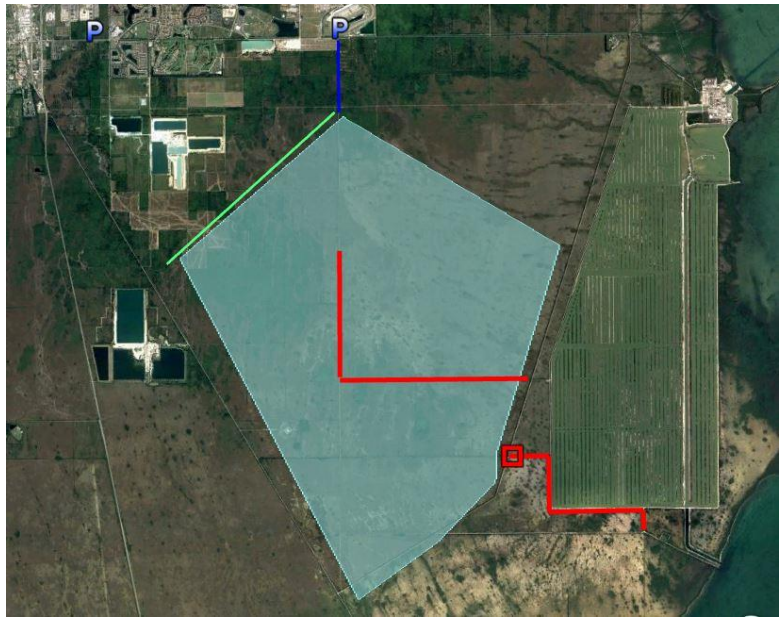
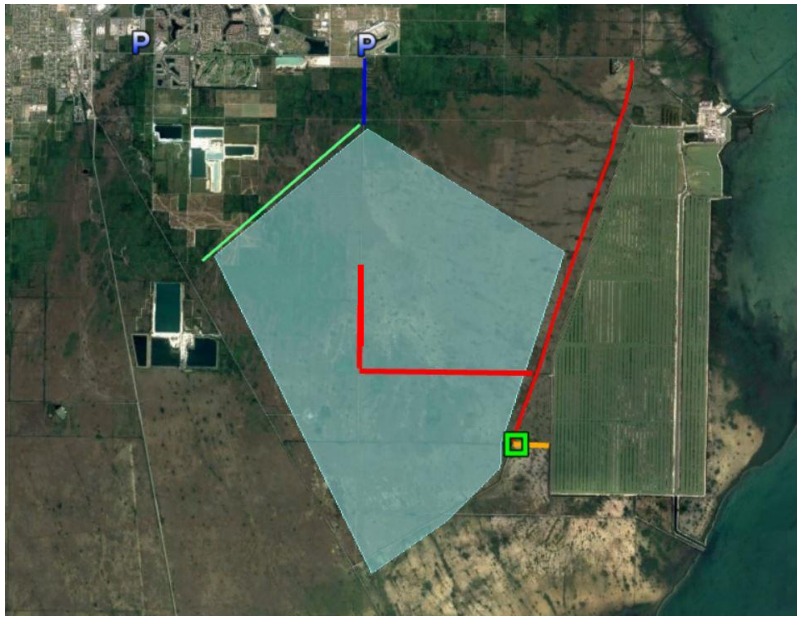
MODEL LANDS







ALT21

- North-south spreader in Tallahassee Rd. Borrow Canal.
- Increase stage triggers at S-20 Structure.
- Shallow S-20 Getaway Canal to 5-6 feet.
- Backfill portion of L-31E from S-20 to FPL culverts.
- Add culvert from L-31E to wetlands adjacent to Cooling Canals

ALT22

- Northeast-Southwest angled spreader in Model Lands.
- Add connection from middle pump in FCC to spreader.
- Remove S-20 Structure.
- Backfill S-20 Getaway Canal.

ALT23

- **Northeast-southwest angled spreader in Model Lands.**
- Increase stage triggers at S-20 Structure
- Backfill L-31E Canal from S-20 to Palm Dr.
- Shallow S-20 Getaway Canal to 5-6 feet.

BBSEER OPERATIONS

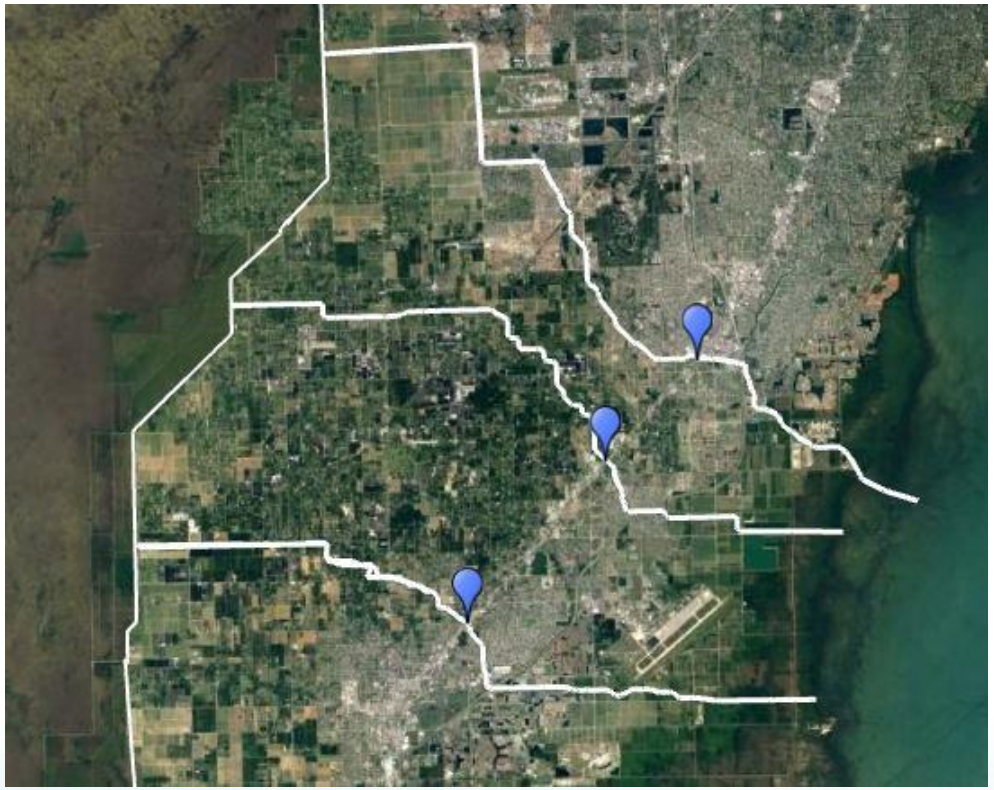
BBSEER Operations Goal: Increase freshwater flows in the dry season. Operational refinements will be worked on in the Plan Formulation sub-team with IMC.

Operational refinements carried forward from Round 1:

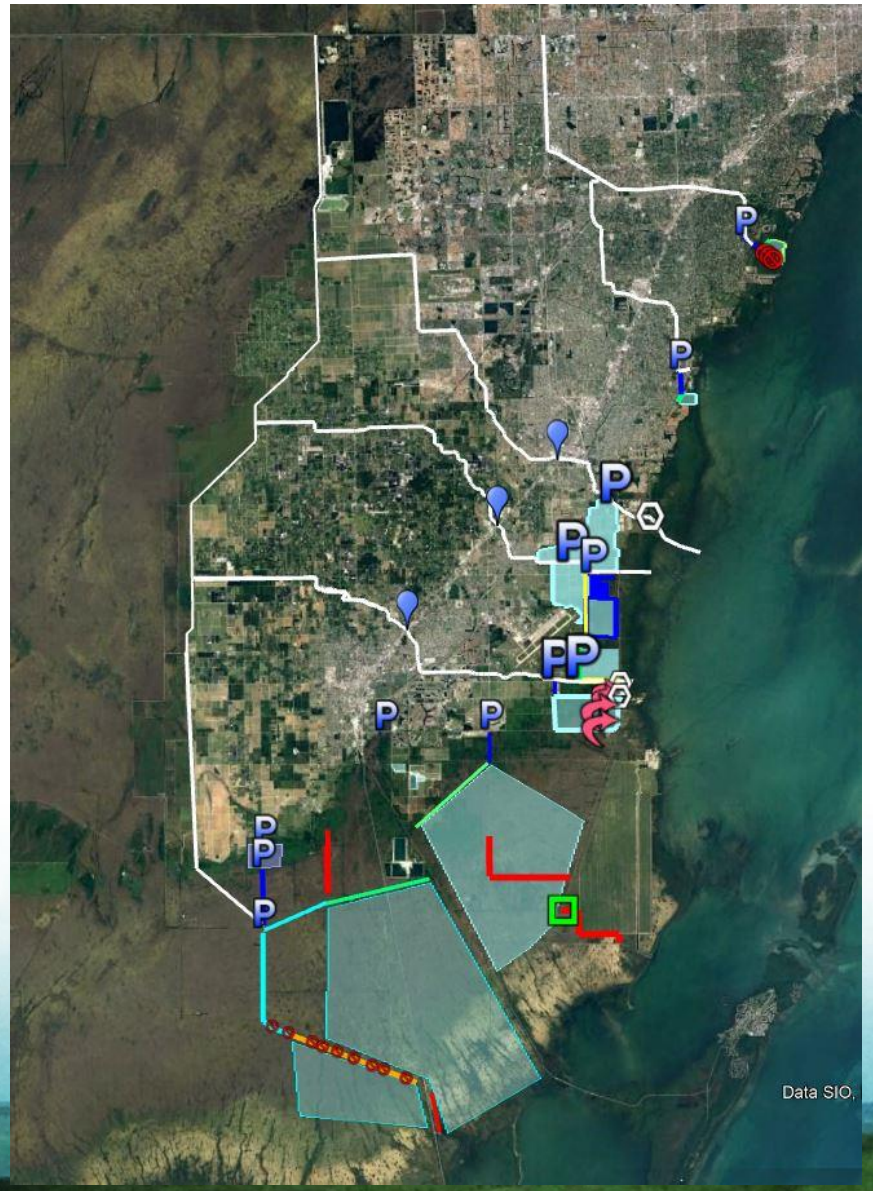
- Decrease stages at coastal ridge structures on C-1, C-102, and C-103 canals to encourage eastern flow of water to Biscayne Bay.

Other operational refinements include:

- Seasonality of flows into the coastal WPAs and releases during the dry season. Outflow on east side to Biscayne Bay.
- Maintain deliveries at S-18C, and then prioritize flows east to the Southern Glades.



ALT24- NEW ADDITION



Alternative Purpose:

- We want to show what we would lose if we do not include Northwest storage and water.
- Does not include storage or sources of water in the Northwest.
- Uses existing water through existing canal to achieve project objectives.
- Includes redistribution of freshwater flows in BBSEER natural areas.

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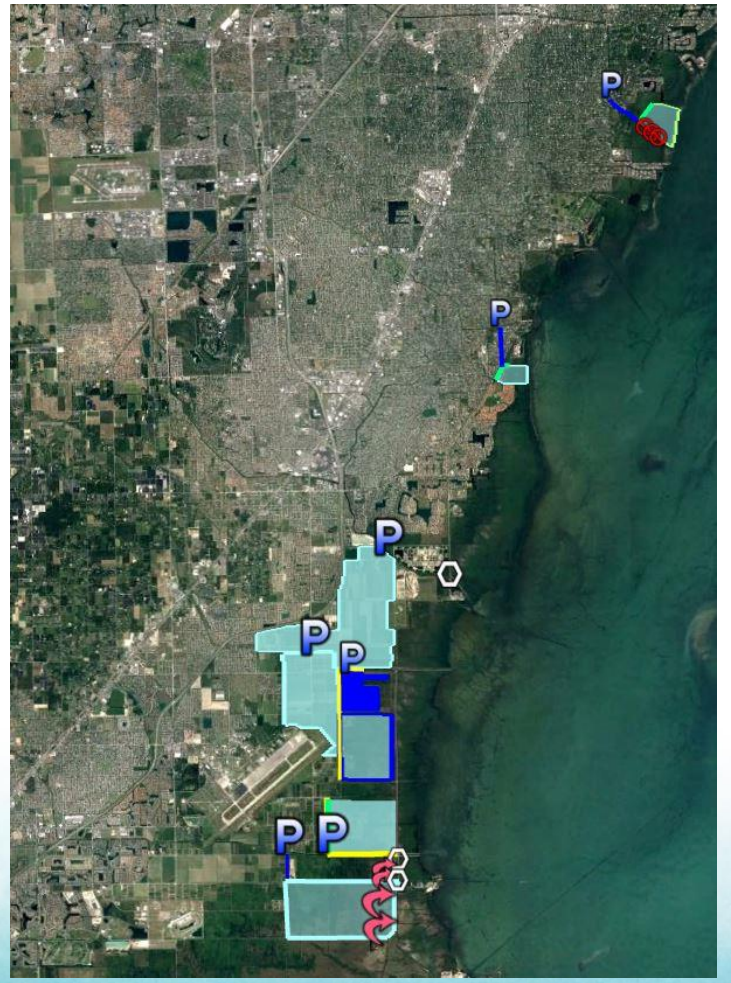
ALT24 MEASURES

Conveyance Paths

- C-4 canal to C-2 and C-100 canals.
- L-31N, C-1, C-102, C-103, and C-111
- Lowers stages at intermediate structures on C-1, C-102, and C-103 canals to encourage eastward flow of freshwater

Coastal Wetlands

- Hardy Matheson Preserve
- North Cutler and South of Cutler
- Northern and Southern coastal WPAs
- C-102 to Military and Military to C-103 wetland rehydration
- Florida City Canal wetlands
- New structures in L-31E south of C-103 and north of North Canal
- 2 culverts west of L-31E adjacent to North Canal wetlands



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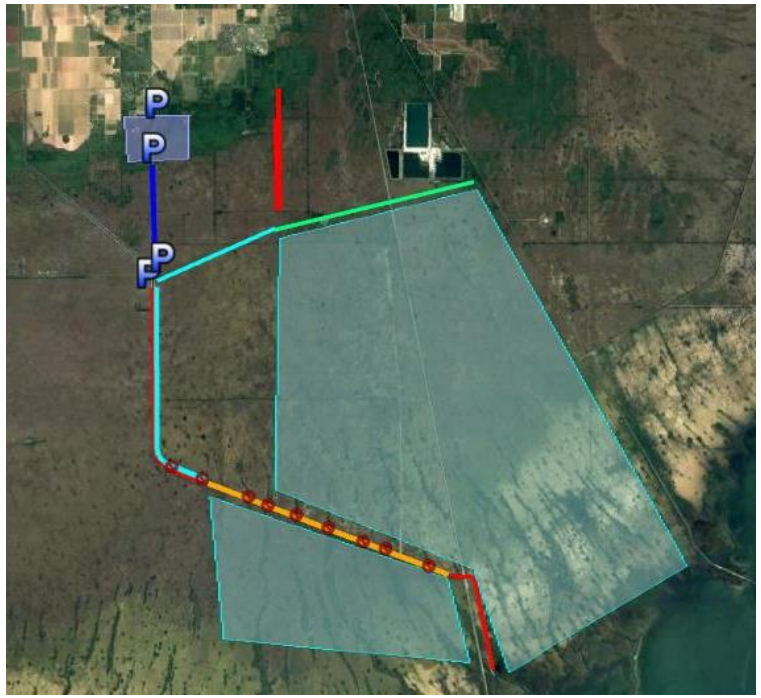
ALT24 MEASURES



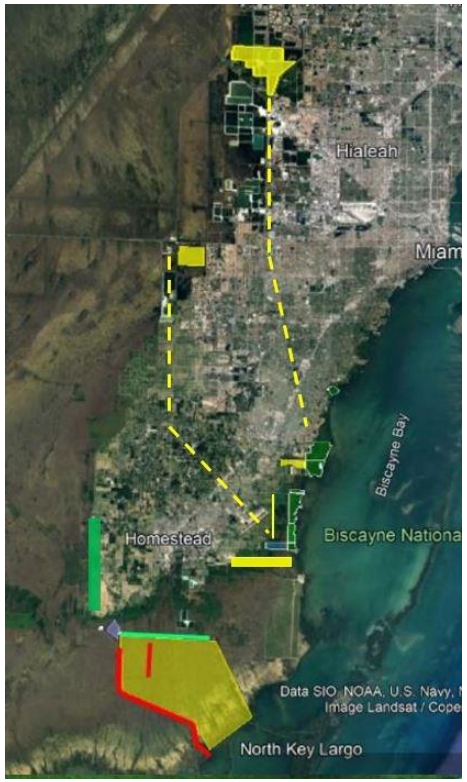
Southern Glades

- Same pipeline delivery version that is included in ALT23.
- Does not include bypass through C-111E canal.

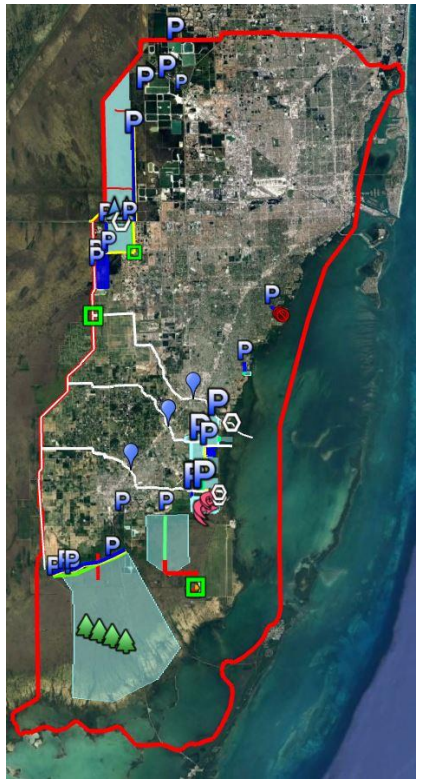
Model Lands

- Same spreader canal that is included in ALT22 and ALT23.
- Increase stage triggers at S-20 Structure and fill Tallahassee Rd Borrow Canal and ML N Canal.
- Backfills S-20 getaway canal.

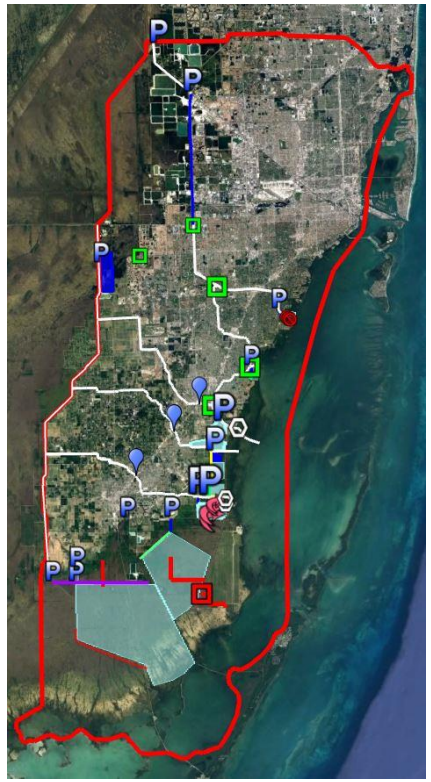
BBSEER ROUND 2 ALTERNATIVES



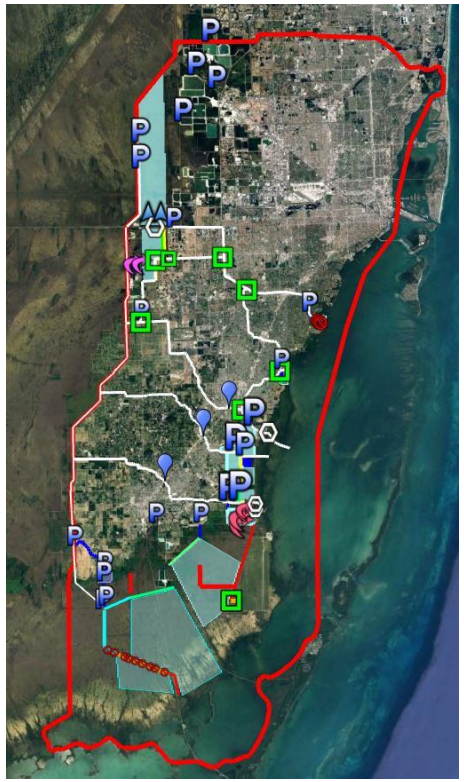
ALTYB
(Conceptual)



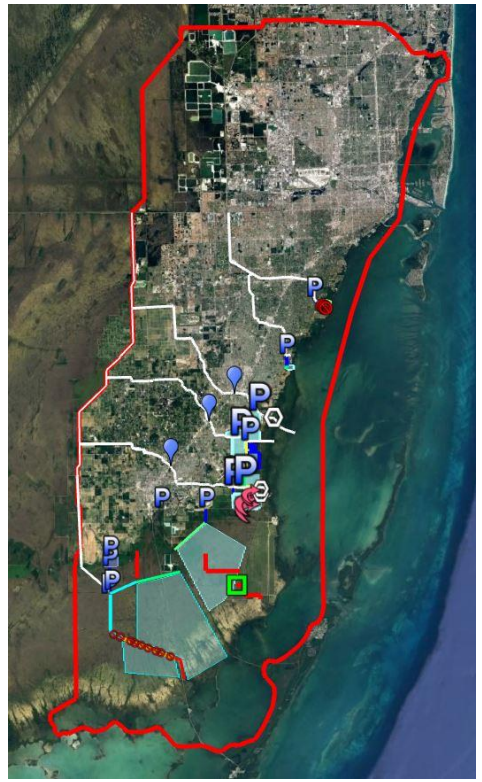
ALT21



ALT22

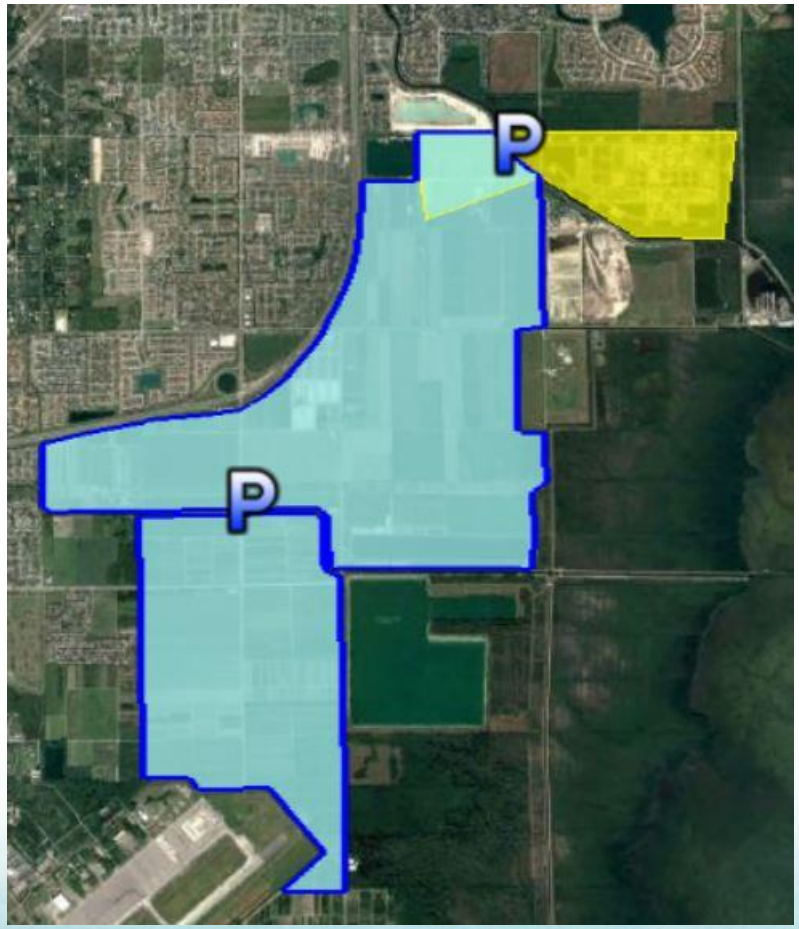


ALT23



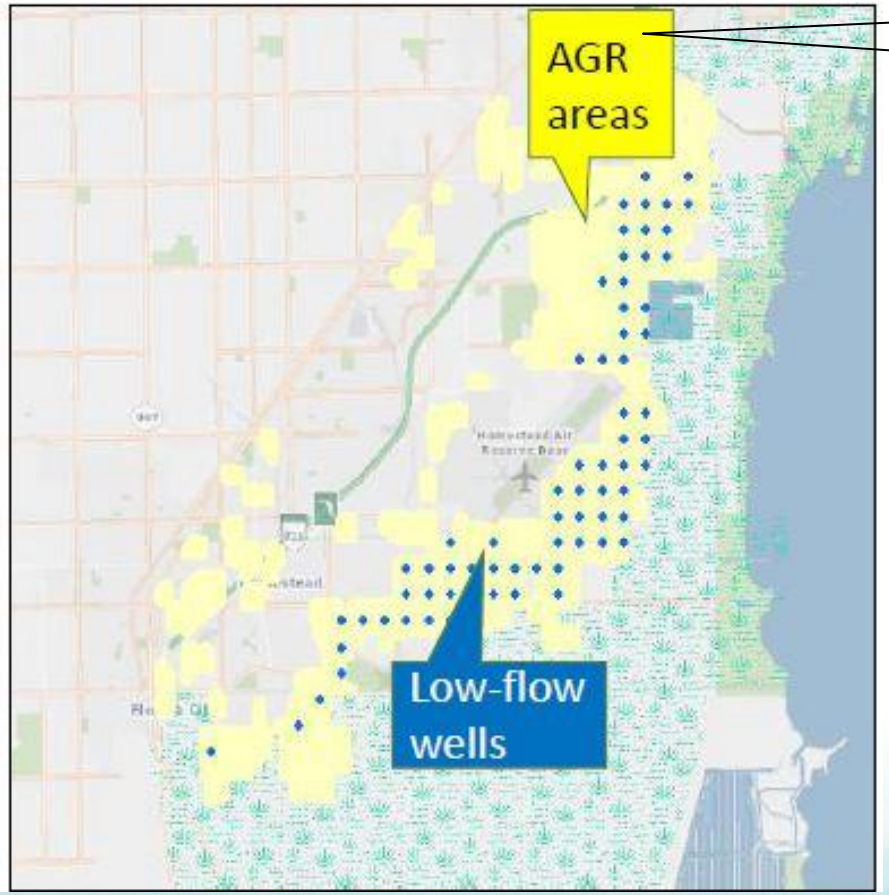
ALT24

ALT21 ASSOCIATED SENSITIVITY RUNS



Sensitivity Run 21A: South Dade Reuse to North and South coastal WPA. Includes advanced water treatment facility construction, pipeline construction from advanced facility to coastal WPAs.

ALT22 ASSOCIATED SENSITIVITY RUNS



AGR = agriculture, with dewatering wells, not aquifer storage and recovery

Sensitivity Run 22A: Dewatering wells (small low-flow production wells) in the coastal agricultural lands to reduce the surface/groundwater levels without changing the saltwater front. Remove current seasonal drawdown operations on the coastal structures on C-102 and C-103 canals.

ALT23 ASSOCIATED SENSITIVITY RUNS

Sensitivity Run 23A: Add Aquifer Storage and Recovery (ASR) wells south of the Lake Belt region for late dry-season freshwater deliveries south and east.

**Precise location of ASR wells still in development.

ALT23 ASSOCIATED SENSITIVITY RUNS

Sensitivity Run 23B: Add Aquifer Storage and Recovery (ASR) wells in the coastal agricultural areas for late dry-season freshwater deliveries to the coastal wetlands and Biscayne Bay nearshore.

**Precise location of ASR wells still in development.

PDT COMMENT PERIOD

BBSEER

PUBLIC COMMENT PERIOD

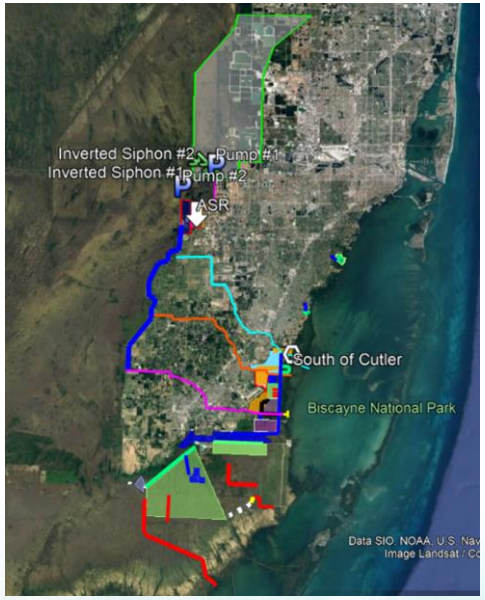
BBSEER

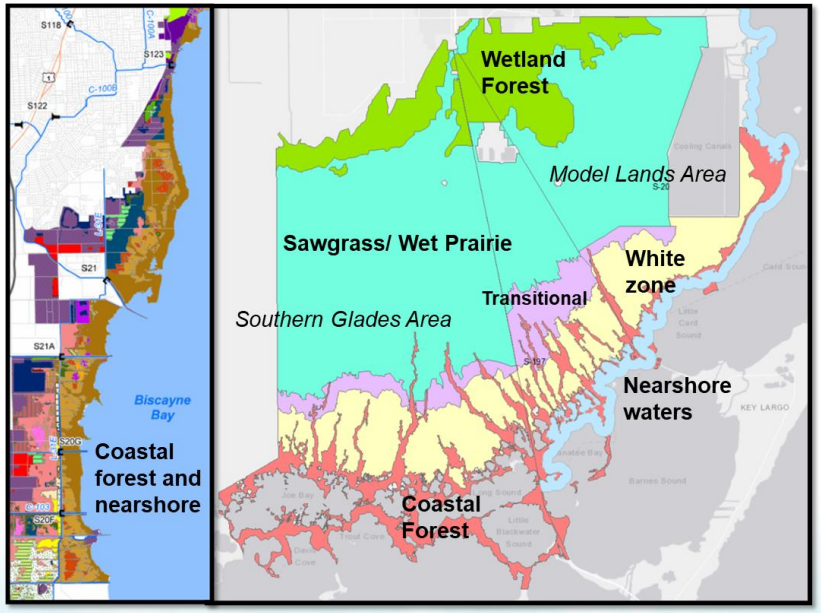
ECOLOGICAL PERFORMANCE MEASURE UPDATES

PERFORMANCE MEASURES, HABITAT UNITS AND PLANNING

We are here

Develop Project Ecological PM's with targets/scoring rubric enabling ecological evaluation of ALT conditions → **Identify Hydrologic Model Alternatives** → ***Use PM's to evaluate Performance***
Round 1 – test and refine PM's
Round 2 - Calculate non-monetary output unit called Habitat Units
(HU's = Improvement in quality X footprint in acres). → **Evaluate Additional Environmental Effects and System wide Analysis – JEM Models summer 2023**





STEPS TO TSP

- ***Environmental Effects***
- **Water Supply**
- **Flood Protection**
- **Real Estate**
- **Economics**

} Savings Clause

Habitat Units – One Piece of the Puzzle

BBSEER

FUTURE WITHOUT PROJECT BASELINE (INCLUDING SEA LEVEL CHANGE)

CONSIDERING SEA LEVEL CHANGE IN BBSEER

Goal:

Define BBSEER project features that will be robust to sea level change projections.

Strategy:

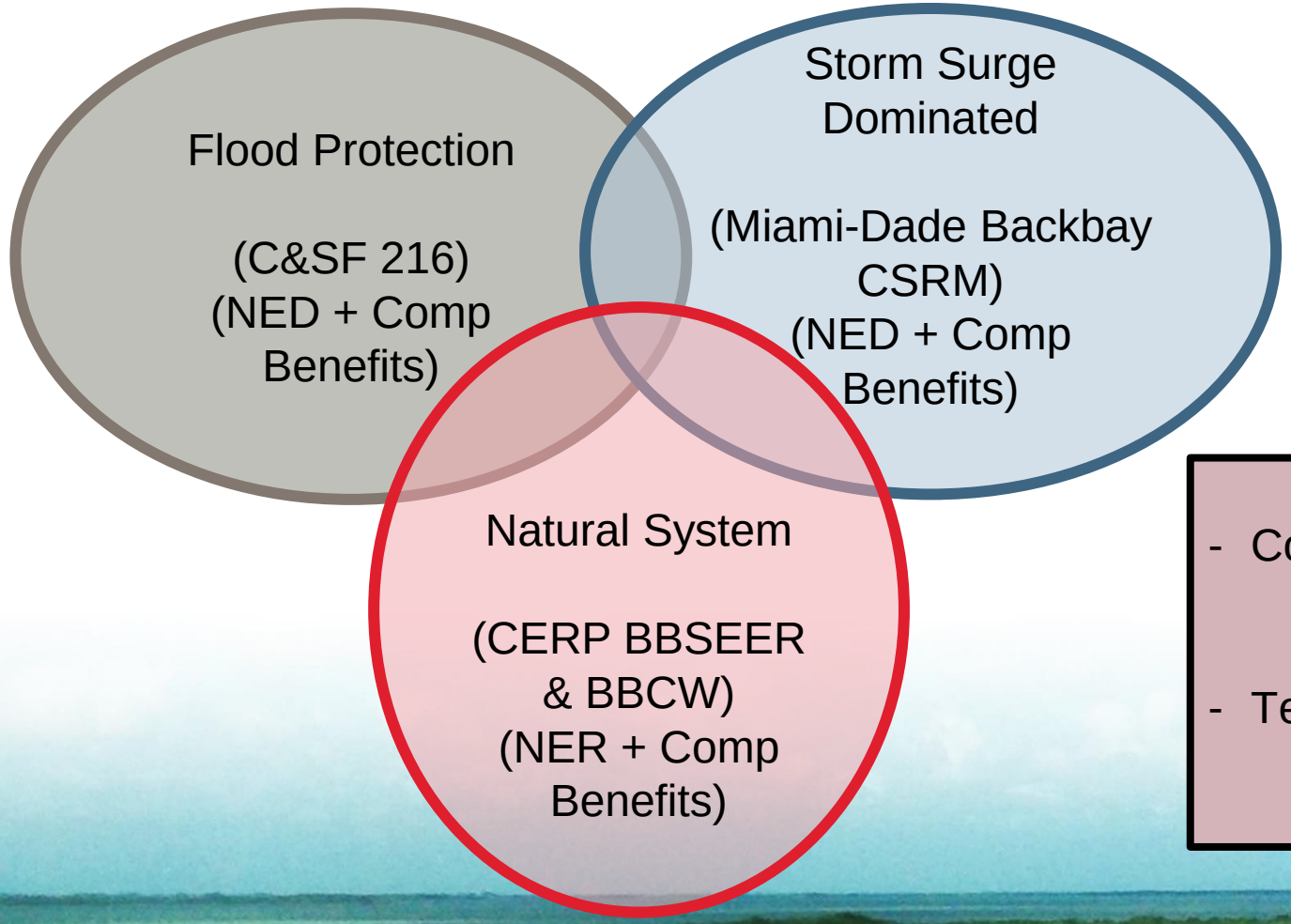
- **Formulate and select project features considering the 2085 "Intermediate" sea level change (+1.6 ft above existing condition)**
- **Once a set of features is identified that achieves desired project benefits, "stress test" this plan to:**
  1) **Ensure that it will work well if "high" sea level change is realized (address SLC uncertainty) and**
  2) **Investigate the implementation / succession strategy over time between now and 2085.**
- **Try to "stay in the lane" for BBSEER – we want our project features to work with a future system that adapts to sea level change, but BBSEER is one effort among many that realize this goal.**
- **Account for the efforts of other programs that adapt to sea level changes in our assumptions.**

ADDITIONAL CONTEXT FOR BBSEER WITH SLC

- First Comprehensive Everglades Restoration Plan (CERP) planning study to incorporate quantitative sea level change to the plan formulation alternatives modeling.
- Sea level change projections applied to the modeling will follow USACE Climate Change and Sea Level Change guidance (ER 1100-2-8162, USACE 2019)
- The BBSEER Plan Formulation, Modeling, and Climate Change/Sea level Change Subteams have coordinated with the USACE Climate Change Community of Practice (CoP) to use the Intermediate Curve projections at Vaca Key, FL.
- **Plan Formulation and Modeling Subteams have coordinated assumptions for the C&SF System that are consistent with overall CERP regional Planning efforts.**
- Today's presentation provides an update and overview for the DRAFT BBSEER Future Without RSMGL model scenario results using the USACE Intermediate SLC curve at year 2085 (FWOI) – once finalized, this run will be the baseline and starting point for BBSEER Round 2 alternatives modeling.

BBSEER INTEGRATION

BBSEER Study – One part of an integrated approach

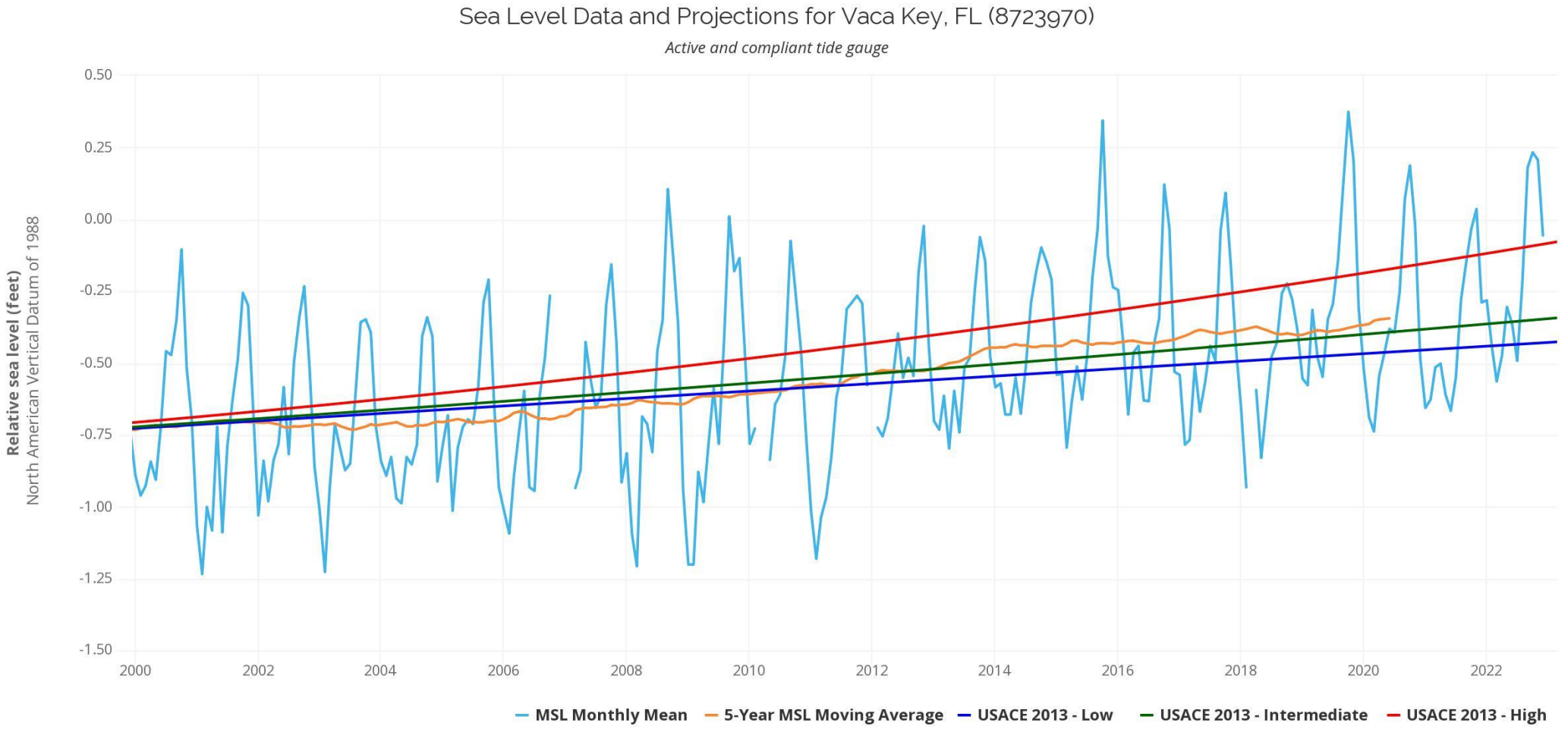


Integration Themes:

- Communication
  - Internal
  - External
- Technical
  - During Formulation
  - After Formulation

SEA LEVEL TRACKER

https://climate.sec.usace.army.mil/slr_app/



USACE Sea Level Change Predictions for Vaca Key, FL (8723970) using the NAVD88 datum.
Timeframe: Jan, 2000 - Jan, 2023 (23 years, 1 months).
Timeframe contains 275 missing points; the longest gap is 0 years, 4 months.
Rate of Sea Level Change: 0.013 ft/yr (2021) .

USACE INTERMEDIATE SLC CURVE AT VACA KEY, FL

- USACE Sea Level Change Intermediate Curve assuming 50-year period of economic analysis to year 2085, which results in sea level increase to 1.2 ft. NAVD88, using NOAA 2021 SLC linear trend of 0.013 ft/yr (3.95 mm/yr).
- Existing Condition Baseline (ECB) modeled with 2022 sea level condition of -0.4 ft NAVD88
- Future Without with Intermediate Curve (FWOI) modeled with 2085 sea level condition of 1.2 ft NAVD88 (+1.6 feet relative to the 2022 ECB)

SLC curve	1992 Elevation ft-NAVD88	2022 Elevation ft-NAVD88	2085 Elevation ft-NAVD88
USACE Intermediate	-0.8	-0.4	1.2

Note: Displayed values were developed on the Sea Level Calculator.

KEY SLC MODELING ASSUMPTIONS

1. 2085 Future with SLC will apply +1.6 ft offset to ECB22 (2022 current) tidal boundaries
   - Recall that tidal boundary condition for RSMGL have already been updated to reflect a more "realistic" signal & retain higher observed variability
   - i.e. Harmonics/signal analyses developed by IMC (and coordinated through NOAA) create tidal boundaries that accommodate both harmonic and residual behavior
2. Coastal Structures will be modeled to continue to function as they do today and maintain ECB22 discharge capacity despite increased tailwater due to SLC.
   - This is a modeling technique used in planning to account for specific infrastructure adaptations that have yet to be identified (this avoids BBSEER from having to formulate those features)
   - Other programs and projects will be responsible for implementing changes to coastal spillway structures and operations to achieve this assumed performance.
   - It is important to note that while hydraulic capacities will be maintained, simulated performance will still change in response to canal / headwater changes.
3. Land use changes w/r to developed areas to remain static, same as existing condition

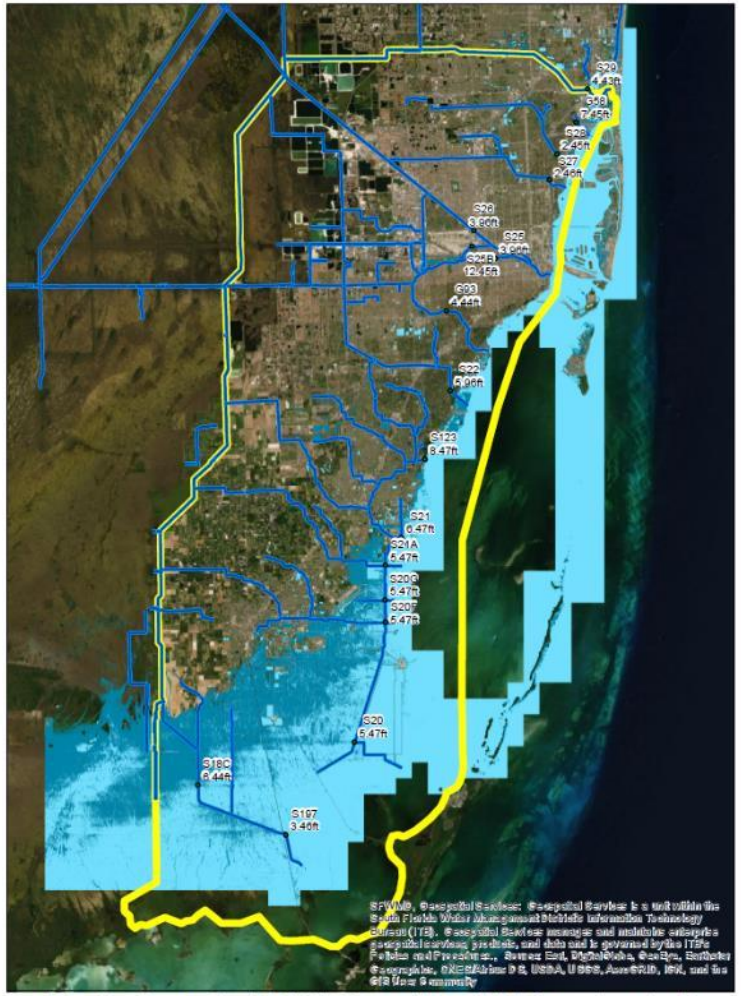
KEY SLC MODELING ASSUMPTIONS (CONT)

4. Assume that land cover, vegetation & topography in natural systems will change in response to sea level change
   - Land cover migration will be informed by historic trends.
   - Accretion rates will be derived from the Adaptive Foundation Resilience (AFR) Performance Measure which performed a comprehensive literature review of what is possible.
   - This set of assumptions will help to illustrate in the modeling a realistic future and the potential restoration resilience provided by the BBSEER project (i.e. conversely, assuming no changes would just illustrate a "worst case" scenario of sea level incursion)
   - Application of the AFR performance measure during evaluation will "close the loop" by testing the assumed accretion hypothesis to ensure that BBSEER can create the necessary hydrology and porewater salinity conditions that promote the expected accretion.

Adaptive Foundational Resilience Eco Performance Measure

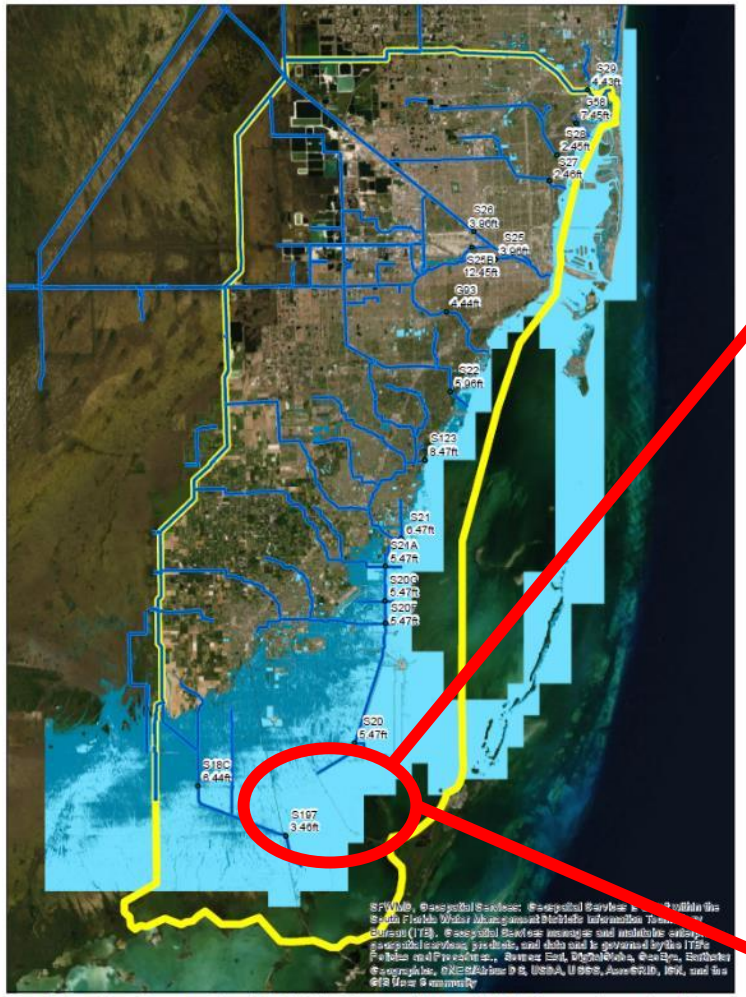
- Topography, and the ability to build topography resulting from actions in project alternatives, is a measure of resilience.

- Today's Goal --- Describe and discuss the assumptions for the inclusion of a topography adjustment in the 2085 FWOP run of the model.



Inundation Map Representing USACE SLC Intermediate and High Curves Assuming 50-year Planning Horizon to Year 2080, Absolute Elevations of 0.67 ft. and 2.85 ft. NAVD88, Respectively. Coastal Structures with Bypass Elevation (ft. NAVD88) for Reference.

Applying a Mangrove Transition Projection to BBSEER



Inundation Map Representing USACE SLC Intermediate and High Curves Assuming 50-year Planning Horizon to Year 2080, Absolute Elevations of 0.67 ft. and 2.85 ft. NAVD88, Respectively. Coastal Structures with Bypass Elevation (ft. NAVD88) for Reference.

Mangrove Transition

Adaptive Foundational Resilience is the ability of the foundational vegetation (marsh and mangrove) to <u>adapt</u> to sea level rise by building elevation as a function of water depth, water quality and flow.

Mangrove Transition

BBSEER

BACKGROUND

SKLAR, FH, C. CARLSON, C, CORONADO-MOLINA AND A.C. MARAN. 2021. COASTAL ECOSYSTEM VULNERABILITY AND SEA LEVEL RISE (SLR) IN SOUTH FLORIDA: A MANGROVE TRANSITION PROJECTION. FRONT. ECOL. EVOL. 9:646083. DOI: 10.3389/FEVO.2021.646083

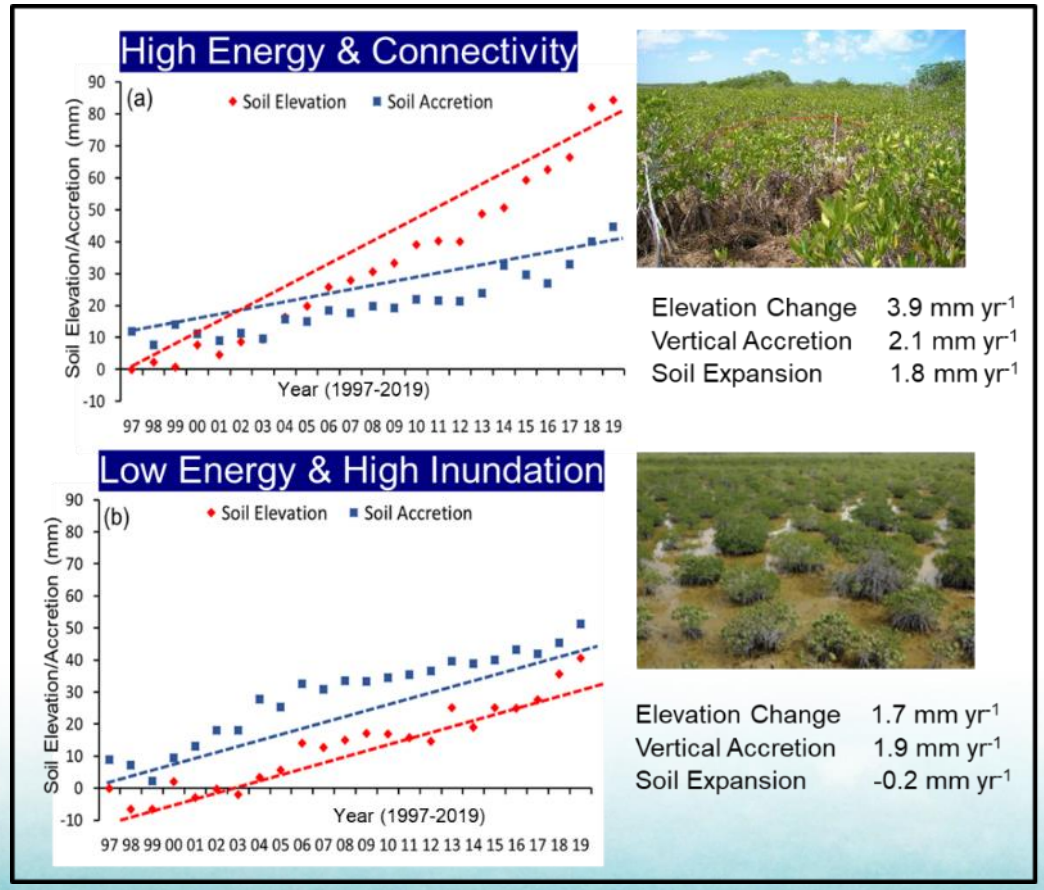


Table 4. Raster-based habitat transition depth thresholds assume that increasing depths are the result of saltwater intrusion and SLR. Wetland habitats can transition to mangroves before transitioning to estuarine open water.

Land Cover Classification	Transition #1 Water Depth Change (ft)	Transition #1 Wetland Type	Transition #2 Water Depth Change (ft)	Transition #2 Wetland Type
Agriculture	1.0	Estuarine Water		
Barren Land	1.0	Estuarine Water		
Mangrove Swamp	2.5	Estuarine Water		
Saltwater Marshes	2.5	Estuarine Water		
Estuarine Water		No Change		
Saltwater Ponds		No Change		
Tidal Flats		No Change		
Marine		No Change		
Open Water		No Change		
Palustrine Cypress	1.0	Mangrove Swamp	2.5	Estuarine Water
Palustrine Marsh	1.0	Mangrove Swamp	2.5	Estuarine Water
Palustrine Swamp	1.0	Mangrove Swamp	2.5	Estuarine Water
Terrestrial	1.0	Estuarine Water		
Urban		No Change		

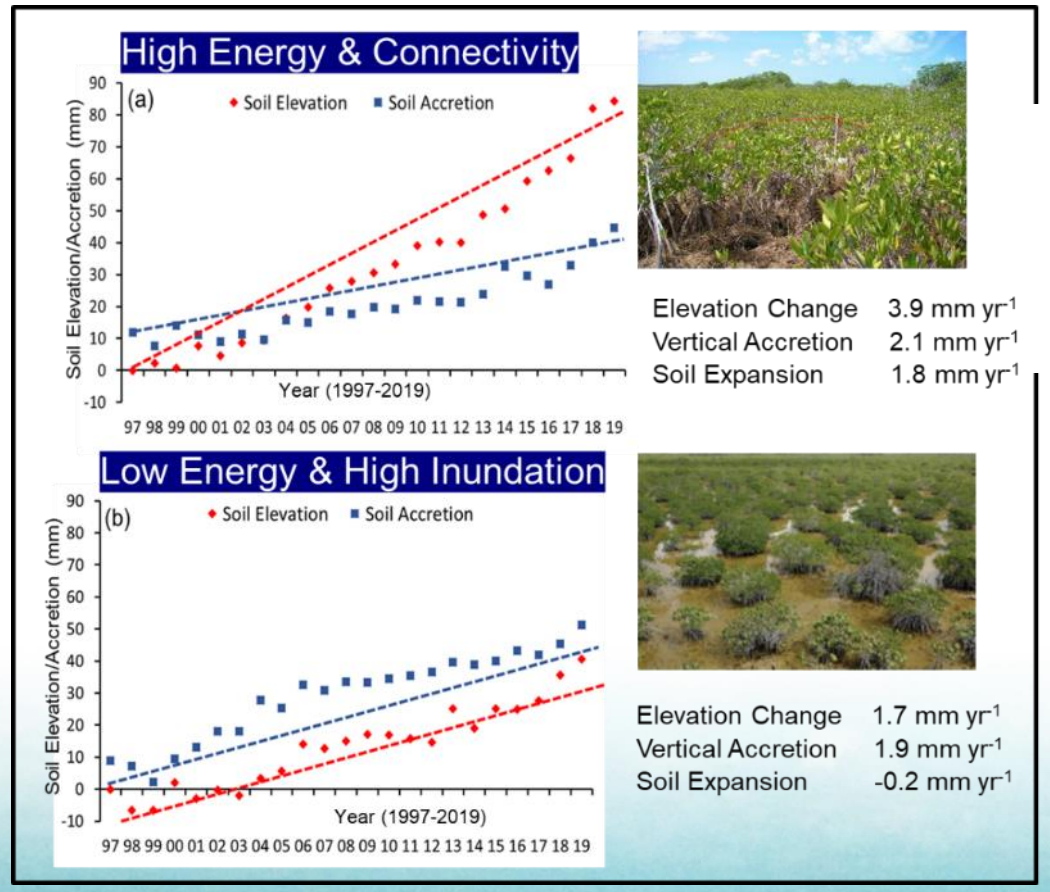
Increased freshwater inflows in Taylor Slough (a) has created accretion rates that range between 3.7 mm/yr and 4.2 mm/yr, which is significantly higher than in areas that are outside the influence of Taylor Slough, such as Highway Creek (b) (From Sklar et al. 2021). It is assumed that much of the BBSEER mangrove footprint where Adaptive Foundational Resilience needs to be applied has accretion rates similar to the rates seen in (b) but to "survive" SLR, the area needs to function more like (a).

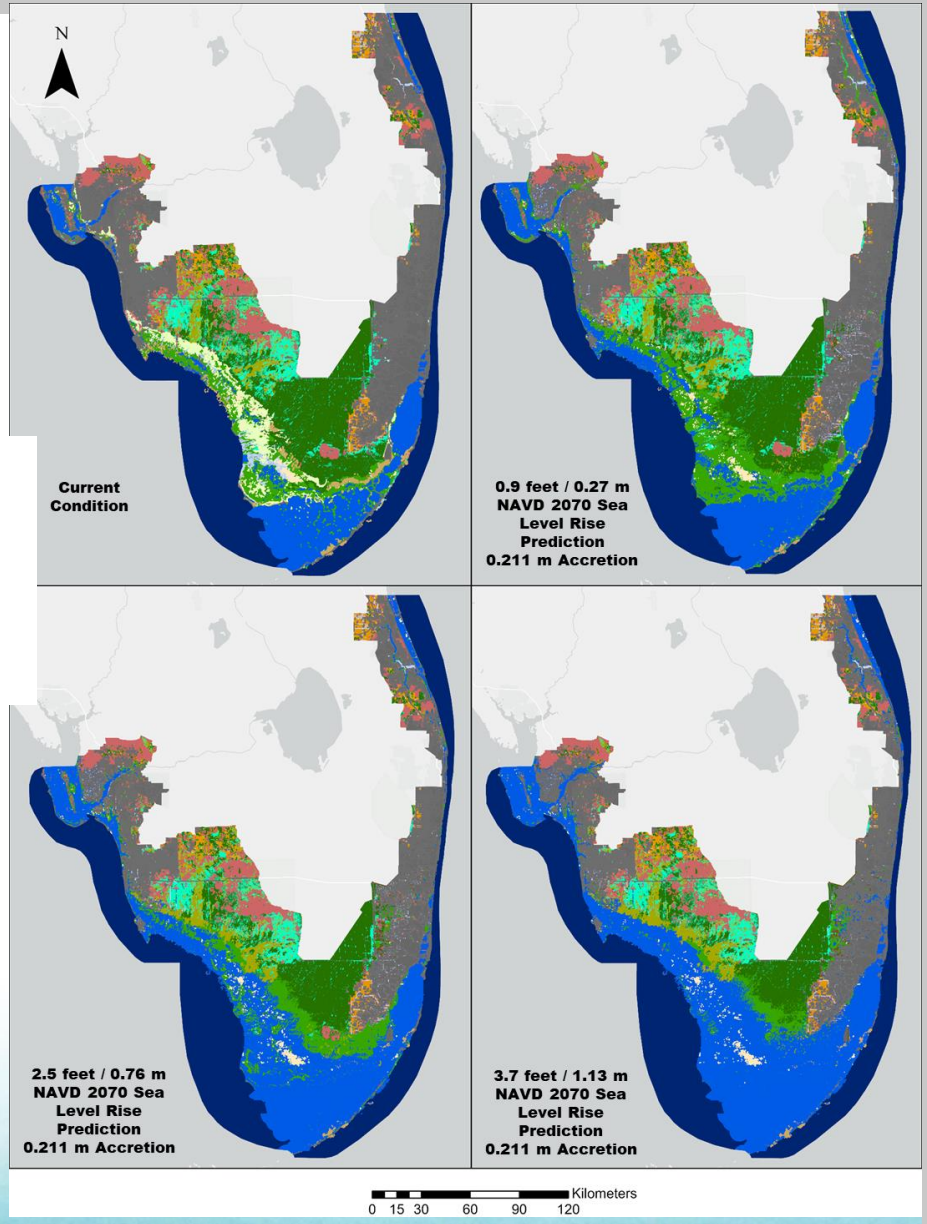
BBSEER

BACKGROUND

SKLAR, FH, C.

CARLSON, C, CORONADO-MOLINA AND A.C. MARAN. 2021. COASTAL ECOSYSTEM VULNERABILITY AND SEA LEVEL RISE (SLR) IN SOUTH FLORIDA: A MANGROVE TRANSITION PROJECTION. FRONT. ECOL. EVOL. 9:646083. DOI: 10.3389/FEVO.2021.646083





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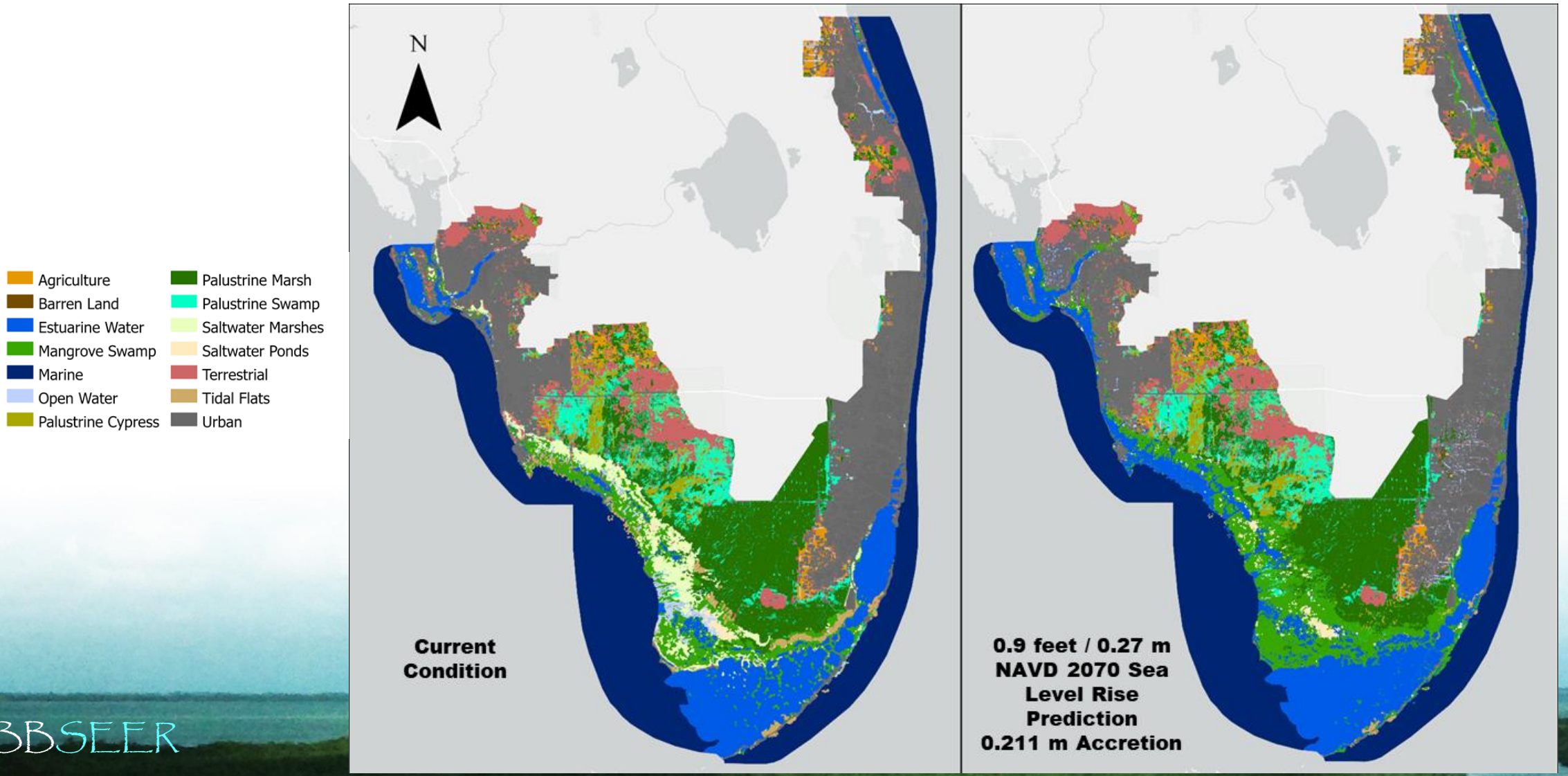
BBSEER

BACKGROUND

SKLAR, FH, C. CARLSON, C, CORONADO-MOLINA AND A.C. MARAN. 2021. COASTAL ECOSYSTEM VULNERABILITY AND SEA LEVEL RISE (SLR) IN SOUTH FLORIDA: A MANGROVE TRANSITION PROJECTION. FRONT. ECOL. EVOL. 9:646083. DOI: 10.3389/FEVO.2021.646083



BBSEER

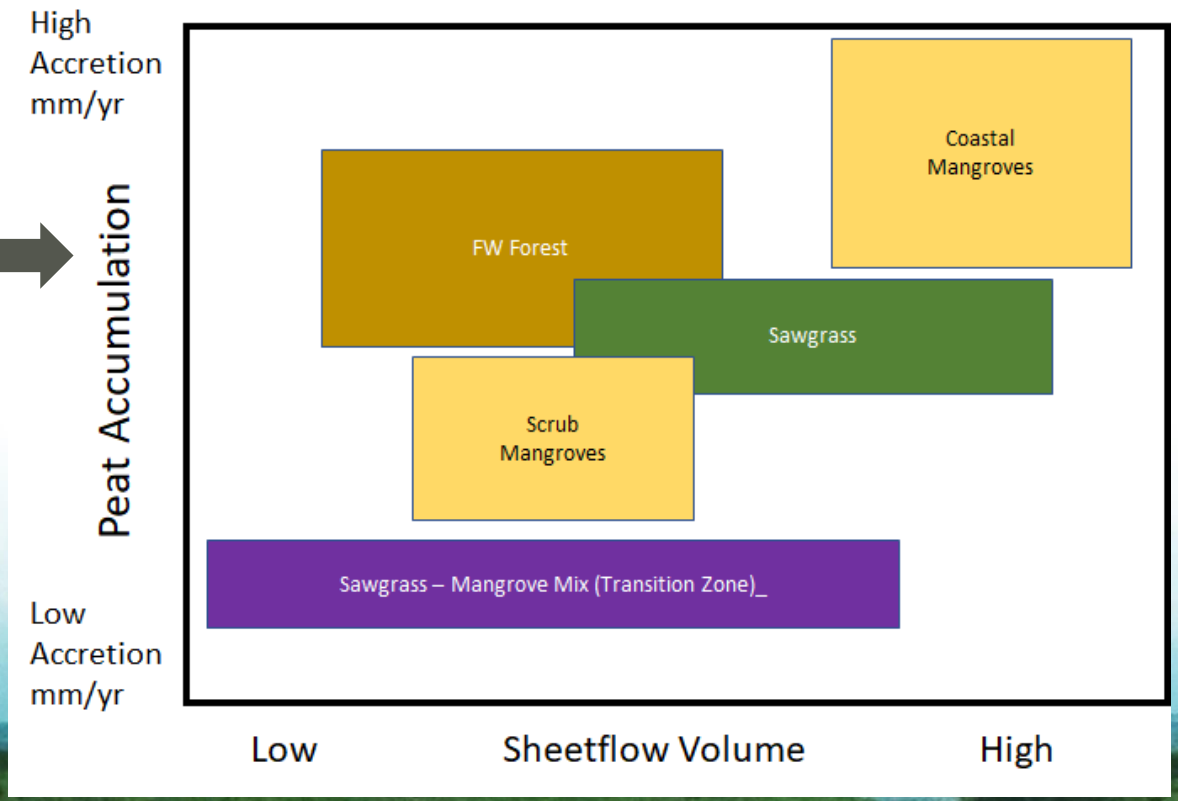
Ecological Assumptions of the AFR as of Jan 31, 2023

1. Coastal wetland productivity is not genetically constrained and can rapidly adapt to changing environmental factors.

2. Ecological functions such as, productivity, trophic complexity, native biodiversity and elevation stability are critical BBSEER restoration goals.

3. Each coastal habitat has a suite of environmental parameters, known in ecology as its "niche space" that can be used to predict a habitat's potential response to sea level rise (e.g., soil accretion).

4. Coastal habitats in Southern Florida will transgress upslope and freshwater habitats will transition into mangrove or open water habitats as a function of sea level rise and habitat availability.



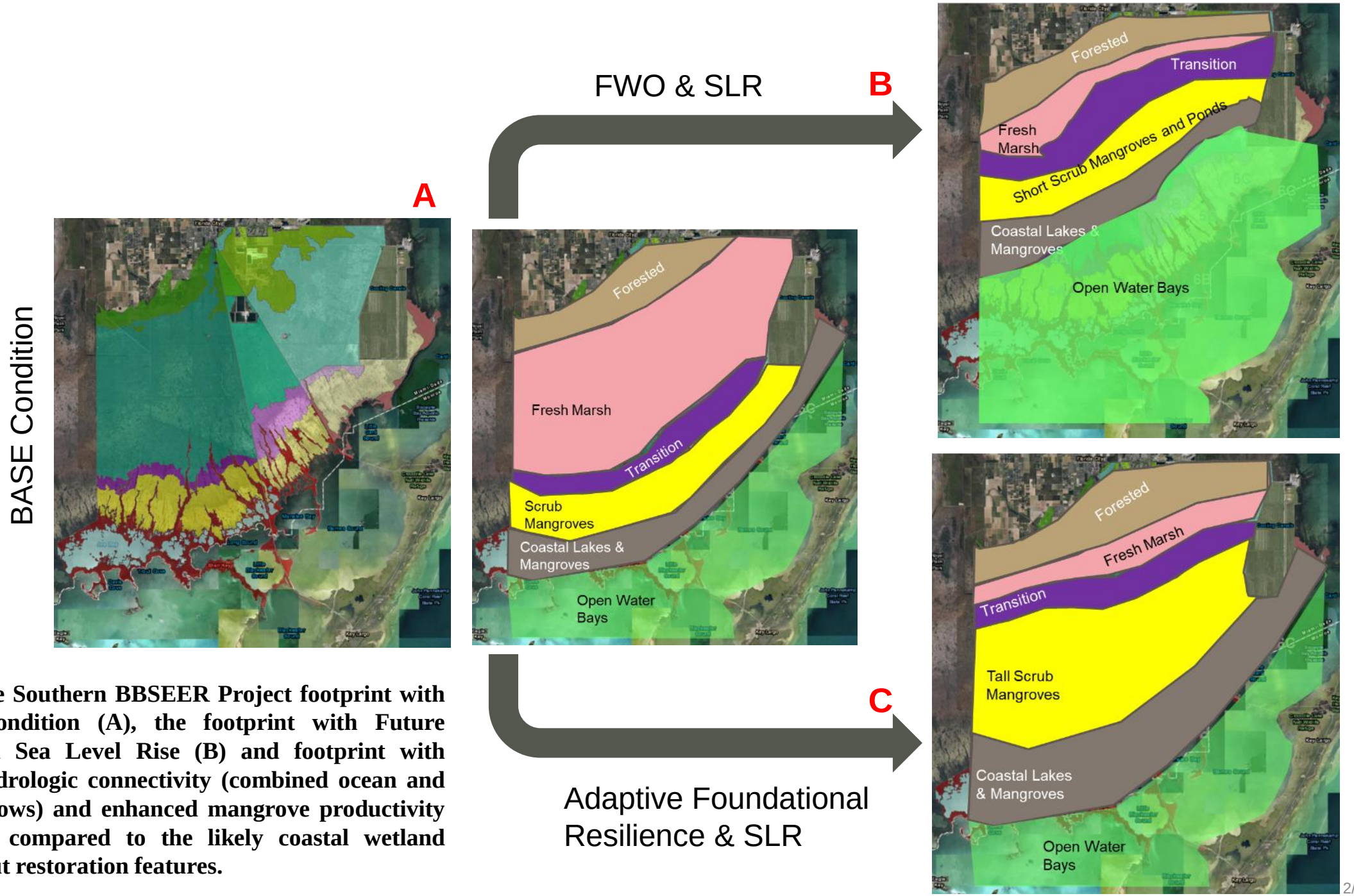
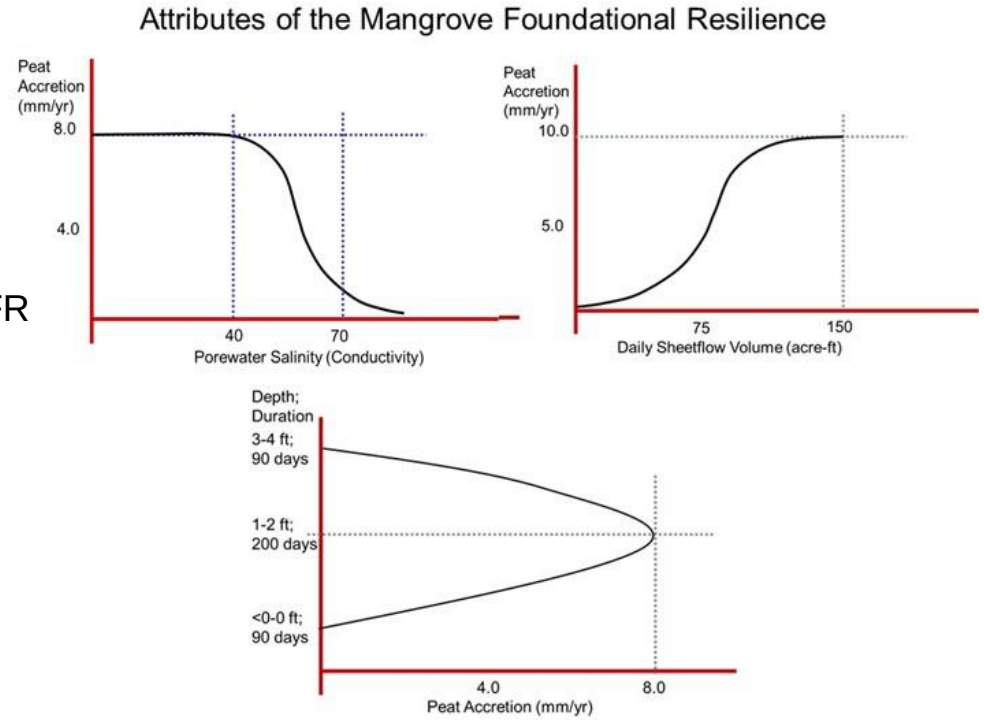


Figure 7. The Southern BBSEER Project footprint with the Base Condition (A), the footprint with Future Without and Sea Level Rise (B) and footprint with increased hydrologic connectivity (combined ocean and freshwater flows) and enhanced mangrove productivity (C). Figures compared to the likely coastal wetland extent without restoration features.

CALCULATION OF UPDATED ACCRETION OFFSETS TO TOPOGRAPHY

High Biomass



Modified: Mangrove AFR PM

(8 mm/y + 10 mm/y + 8 mm/y) / 3 = ~8.67 mm/yr

8.67 mm/y * 50 y = 433.5 mm = 1.42 ft

Initialization: Apply rate to 50 year USACE Planning Window (2035-2085) and convert units

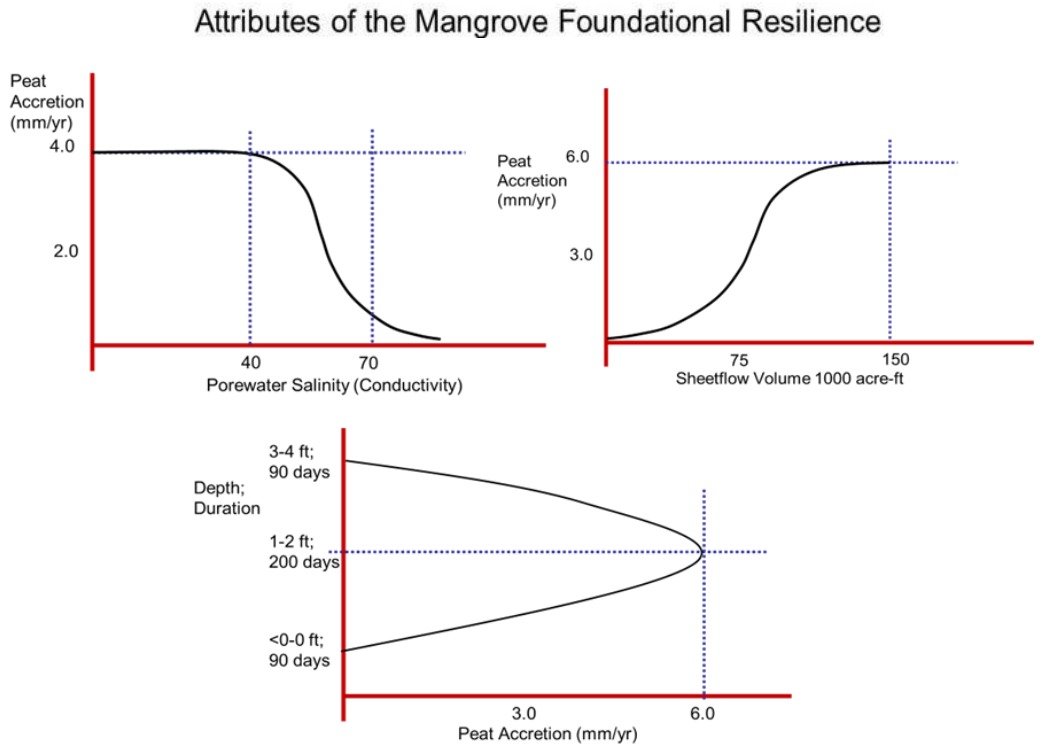
High Biomass Harney River Mangroves

High Biomass ENP Mangroves

CALCULATION OF UPDATED ACCRETION OFFSETS TO TOPOGRAPHY

Modified Mangrove AFR PM

Low Biomass



(4 mm/y + 6 mm/y + 6 mm/y) / 3 = 5.3 mm/yr

5.3 mm/y * 50 y = 265 mm = 0.87 ft

Initialization: Apply rate to 50-year USACE Planning Window (2035-2085) and convert units

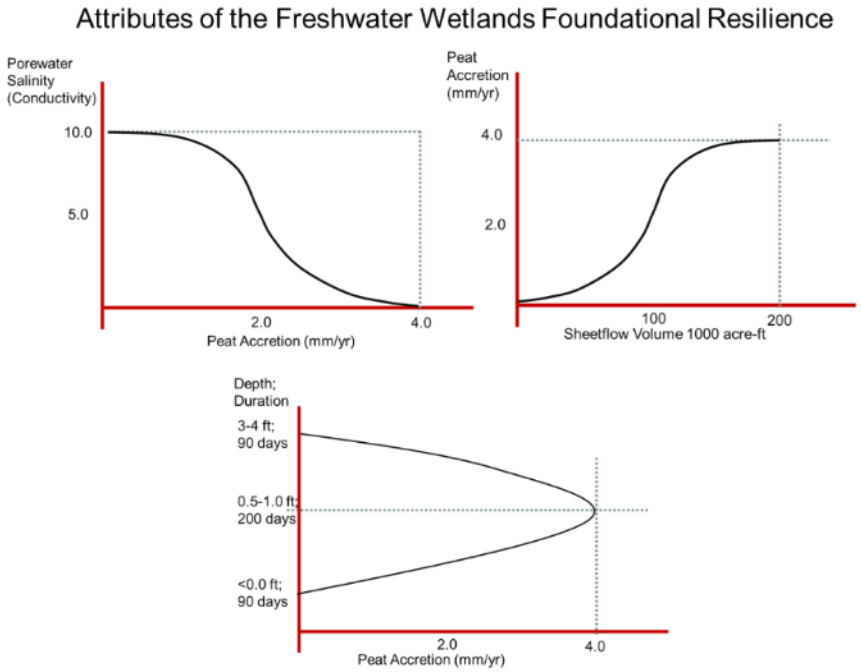
Low Biomass Model Land Mangroves

Low Biomass Taylor Slough Mangroves

CALCULATION OF UPDATED ACCRETION OFFSETS TO TOPOGRAPHY

Dense Freshwater Marsh

Modified Freshmarsh AFR PM



(4 mm/y + 4 mm/y + 4 mm/y) / 3 = 4.0 mm/yr

4.0 mm/y * 50 y = 200 mm = 0.66 ft

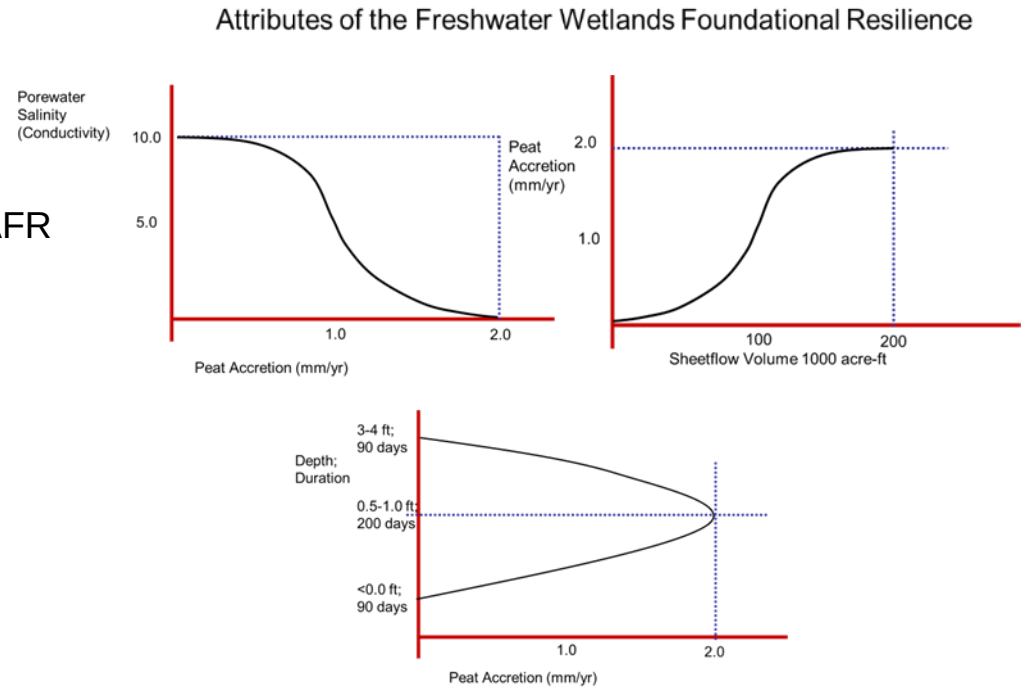
Initialization: Apply rate to 50 year USACE Planning Window (2035-2085) and convert units

Dense Model Land Marsh

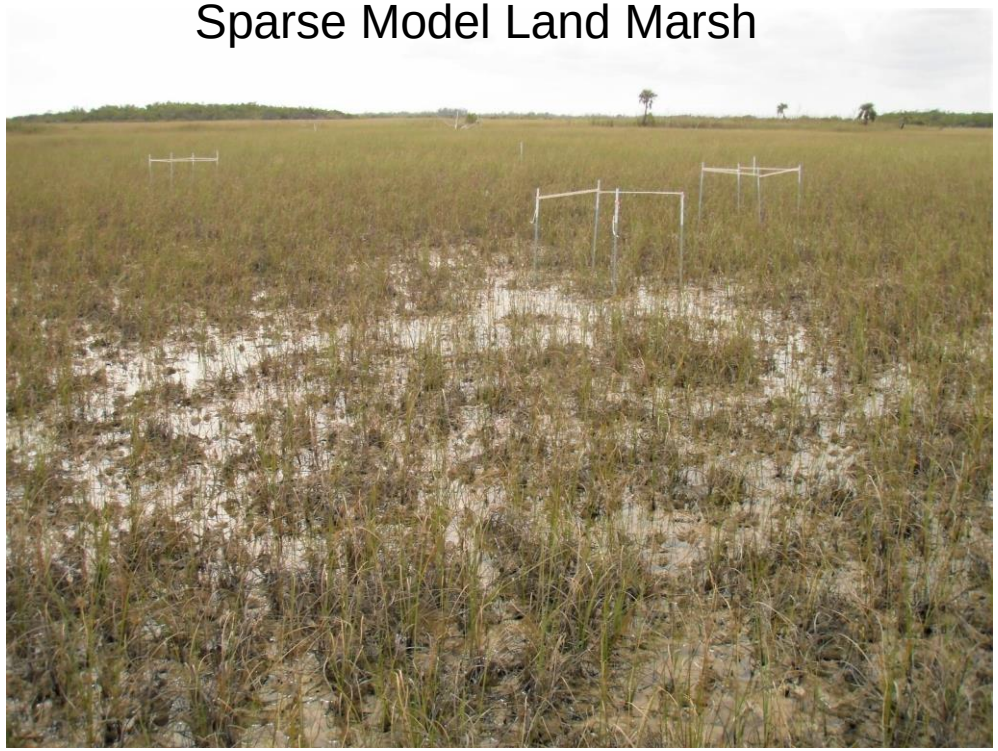
CALCULATION OF UPDATED ACCRETION OFFSETS TO TOPOGRAPHY

Sparse Marsh

Modified Freshmarsh AFR PM



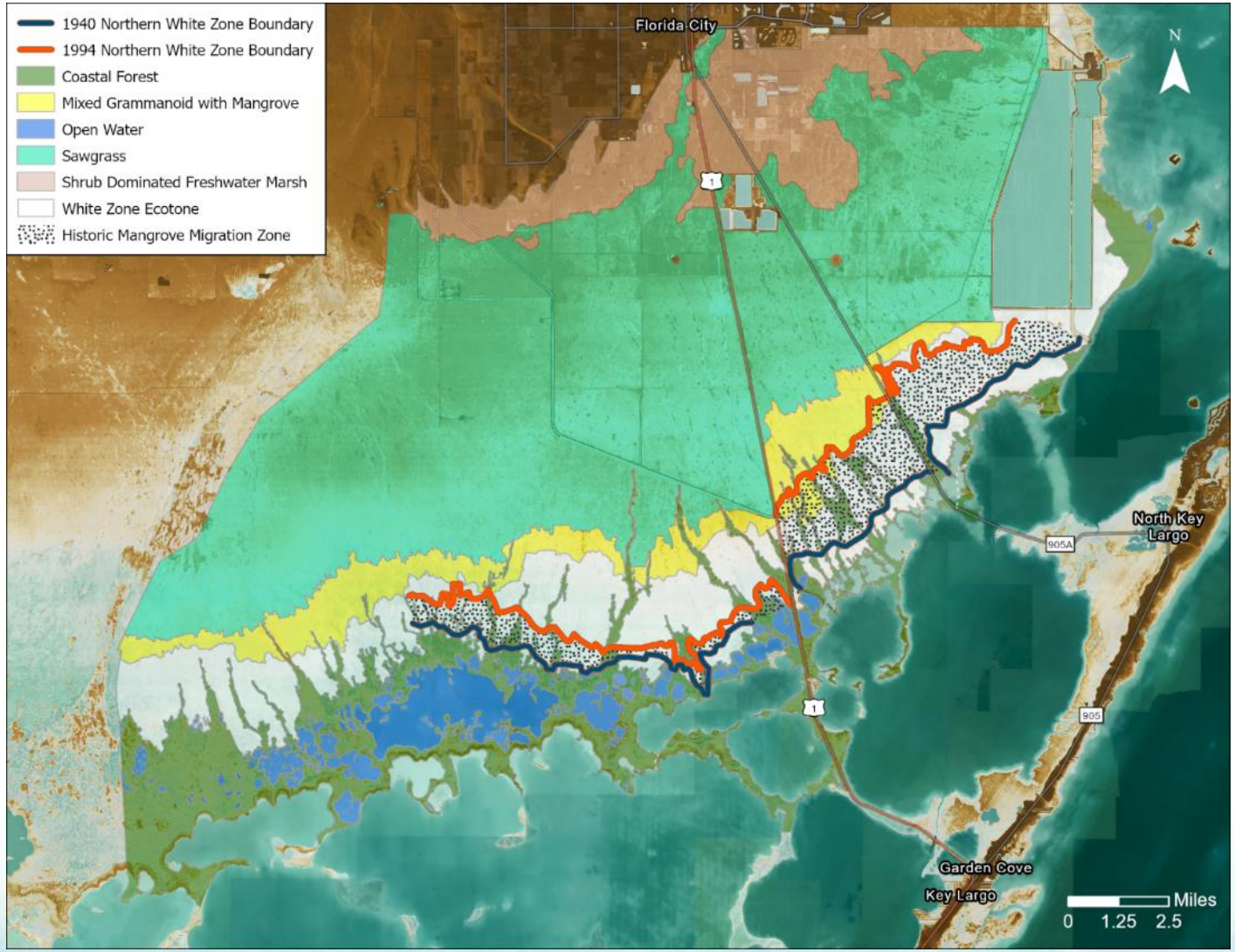
Sparse Model Land Marsh



Initialization: Apply rate to 50 year USACE Planning Window (2035-2085) and convert units

(2 mm/y + 2 mm/y + 2 mm/y) / 3 = 2.0 mm/yr

2.0 mm/y * 50 y = 100 mm = 0.33 ft



Location	Frequency (no. of transects)	Minimum (Transect) Length (in feet)	Mean (Transect) Length (in feet)	Maximum (Transect) Length (in feet)
East of U.S. 1	19	2613.89	6807.65	10279.76
West of U.S. 1	26	799.76	2726.61	7196.07

Between the mid-1940s and the early 1990's, the boundary of the mixed graminoid-mangrove and sawgrass communities shifted inland. The interior boundary of a low-productivity zone has moved inland by up to 10279.76 feet (3.13 kilometers) and 6807.65 feet (2.01 km) on average to the east of US-1 and 7196.07 feet (2.19 kilometers) and 2726.61 feet (0.8 kilometers) on average to the west of US-1 as shown here and listed in the table below. The smaller shift was observed in the west side of US-1 because the area receives more freshwater flows from the water management system, while greater change occurred in areas cut off from upstream water sources by roads or levees on the east side of US-1. These large-scale vegetation shifts are the combined result of changes to natural water flow in the Everglades and sea level rise.

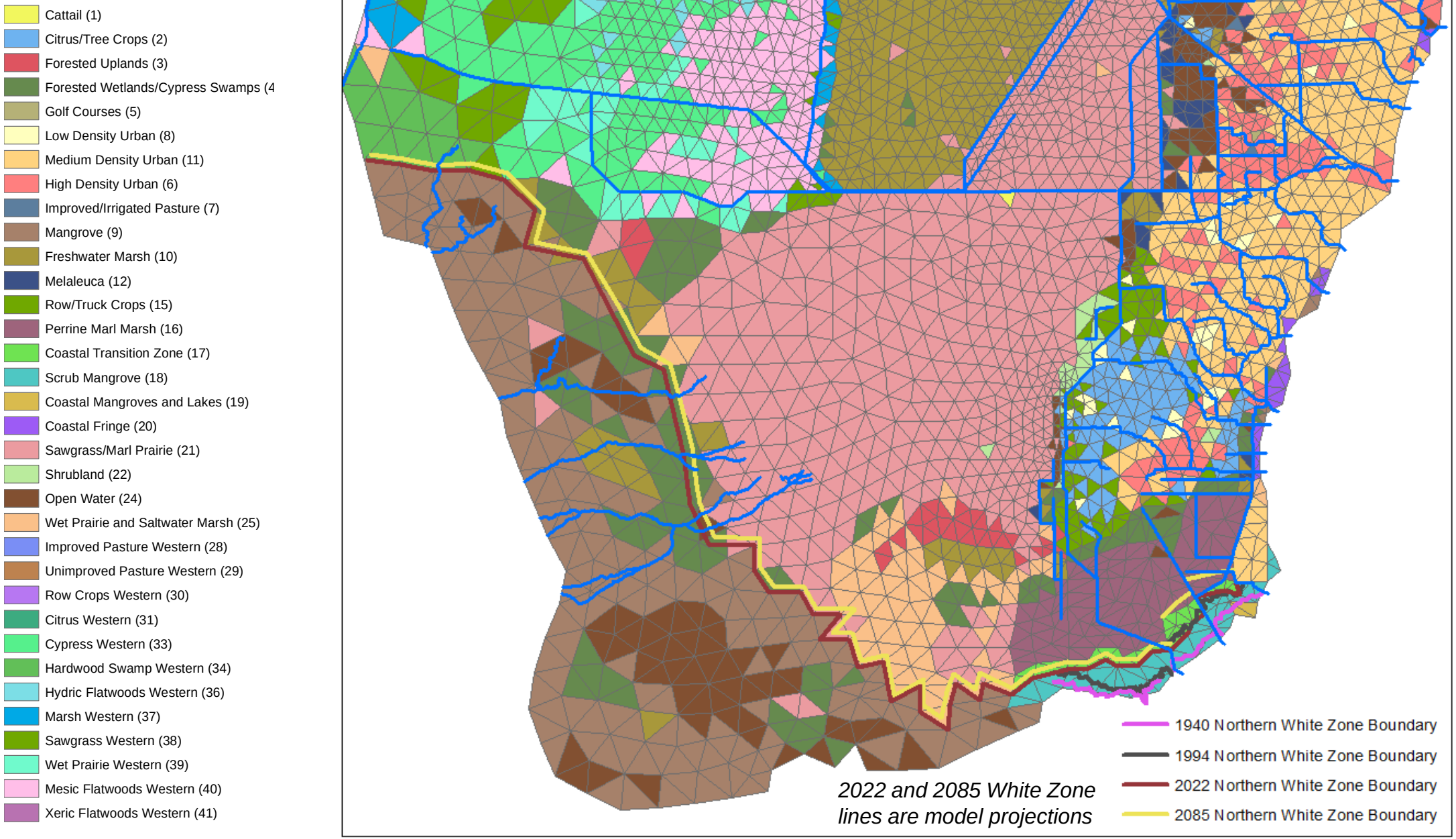
(Ross, M. S., J. F. Meeder, J. P. Sah, P. L. Ruiz, & G. J. Telesnicki. 2000. The Southeast Saline Everglades revisited: a half-century of coastal vegetation change. Journal of Vegetation Science 11:101-112)

Adaptive Foundational Resilience Land Use and Accretion: Modeling Assumptions as of Jan 26, 2023

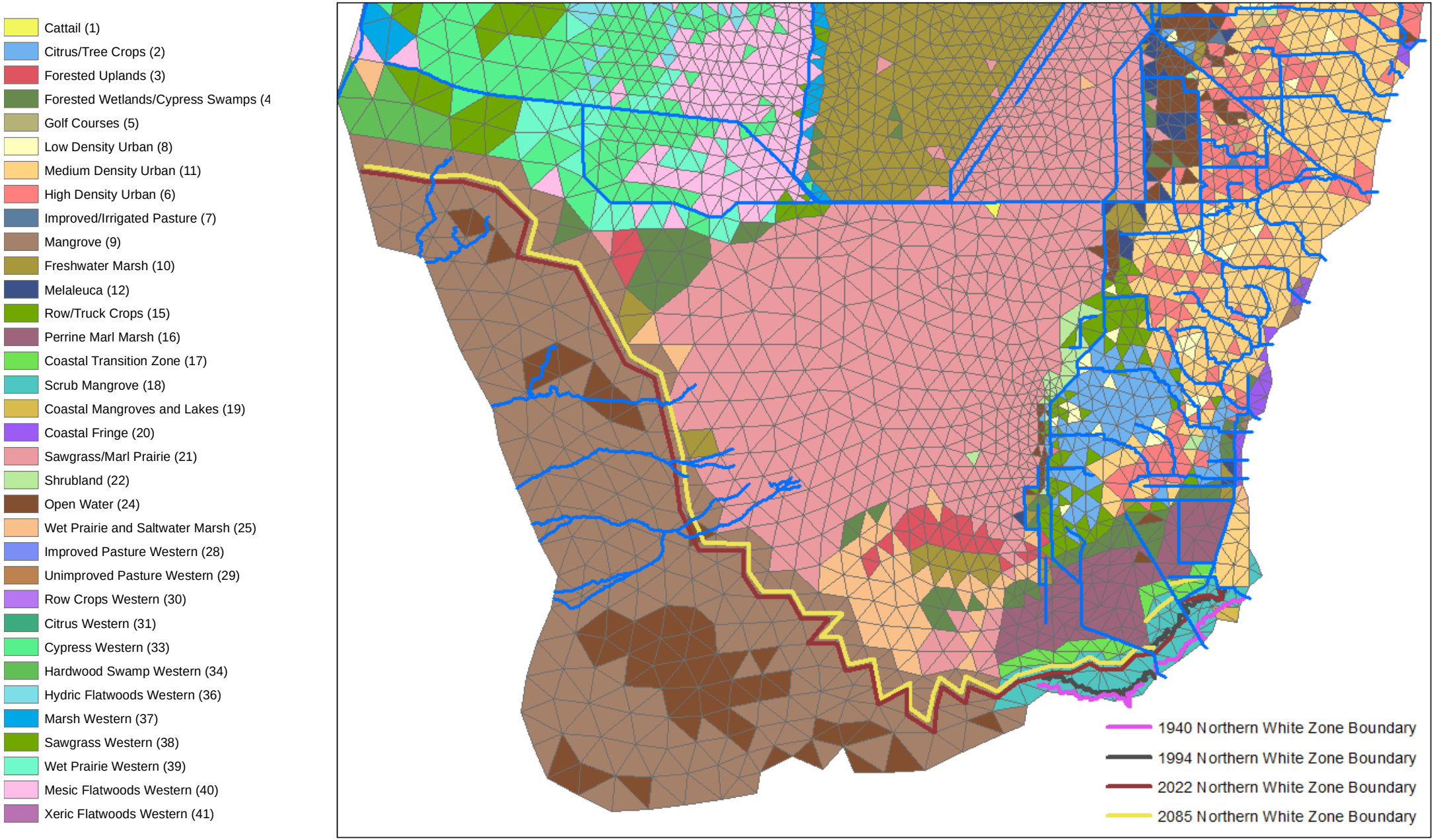
Feedback & Revisions Solicited & Welcome!

1) Using the Historical Northern White Zone boundaries from 1940 to 1994 a distance was calculated based on sample lines drawn in the direction of flow, these lines were used to determine a rate of movement of the model transition zone (LU=17) that was then projected to 2085 from the 2022 Existing Condition model dataset
2) Calculated distances from this exercise:
    1) Zone A west through Everglades National Park = 2,500 feet
    2) Zone B = 10,000 feet
    3) Zone C = 7,500 feet
3) Draw new model projections for the move from 2022 to 2085 and select the cells most representative of the new transition zone
4) Take into consideration the effect of canals/levees/roads or other barriers to flow, these will stop the movement of the transition zone further inland so the cells upstream of the barrier become the projected transition zone
    1) Removal of barriers in Alternatives will allow this transition zone to move further inland if the projected distance is beyond the original barriers
5) Consider potential movement between Zones (e.g. Zone B can affect Zone C due to groundwater flow direction)
6) Create new land use values for the LU=17 (Coastal Transition) cells with downstream cells determined as LU = 18 (Scrub Mangrove) within the BBSEER Zones; For ENP assume that mangrove has taken over the cells downstream of this line
7) Accretion rates were calculated based on location for mangrove and location/topography for marsh and projected for 50 years:
    1) Zone A mangrove (west of Taylor Slough boundary), increase of 1.42 feet (8.67 mm/y)
    2) Zone B mangrove (within and east of Taylor Slough boundary to east coast), increase of 0.87 feet (5.3 mm/y)
    3) Zone 1 marsh (marsh land use south of Tamiami Trail and within BBSEER footprint < 2.90 feet NGVD, increase of 0.66 feet (4.0 mm/y)
    4) Zone 2 marsh (marsh land use south of Tamiami Trail and within BBSEER footprint < 5.0 and >= 2.9 feet NGVD, increase of 0.33 feet (2.0 mm/y)
8) Add accretion values listed above to updated land use codes; currently using same values in Model Lands / Southern Glades, Biscayne Bay wetlands and ENP – subject to change based on further AFR team input.

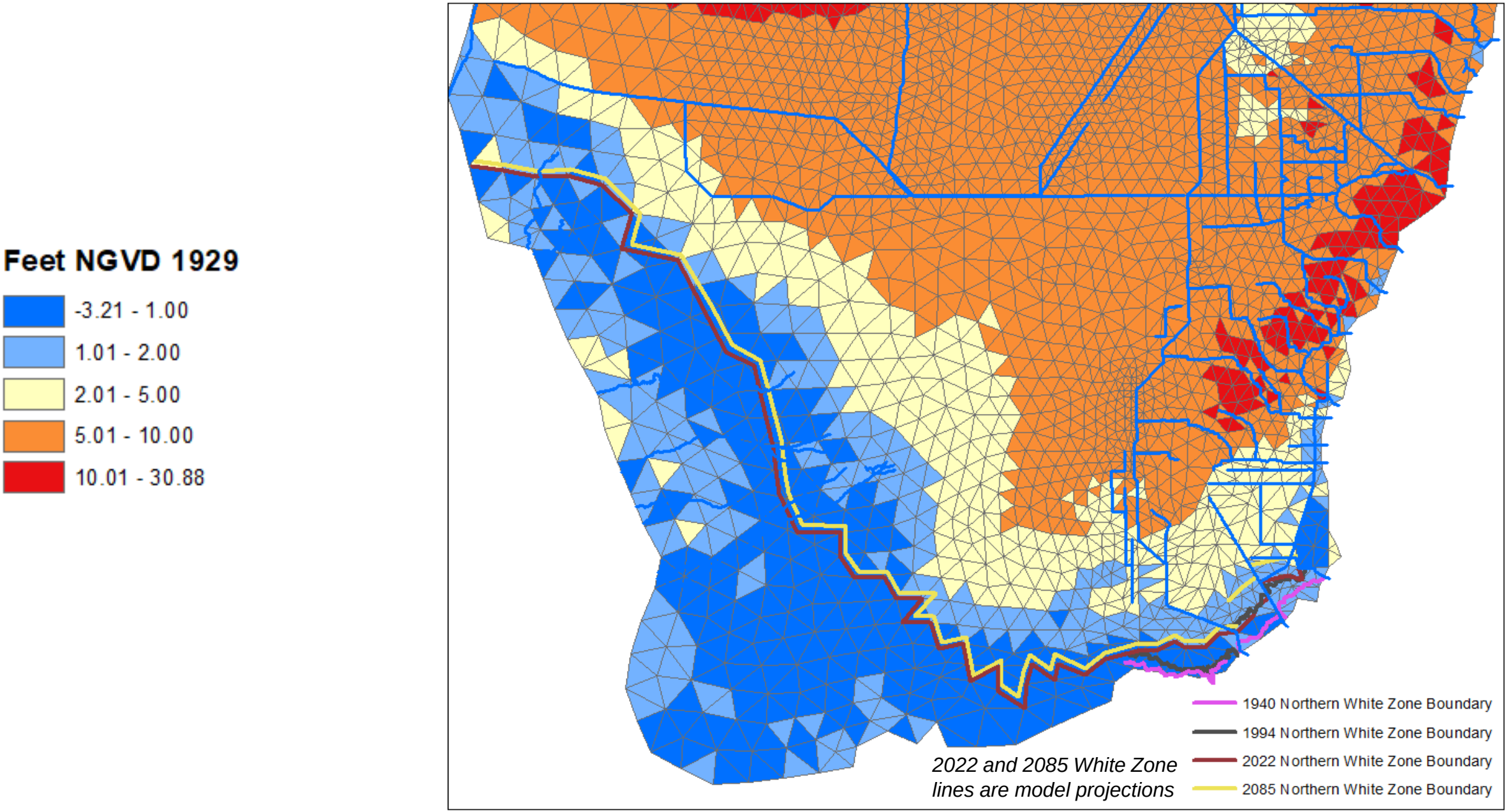
RSMGL LANDCOVER ASSUMING NO CHANGE IN THE FUTURE



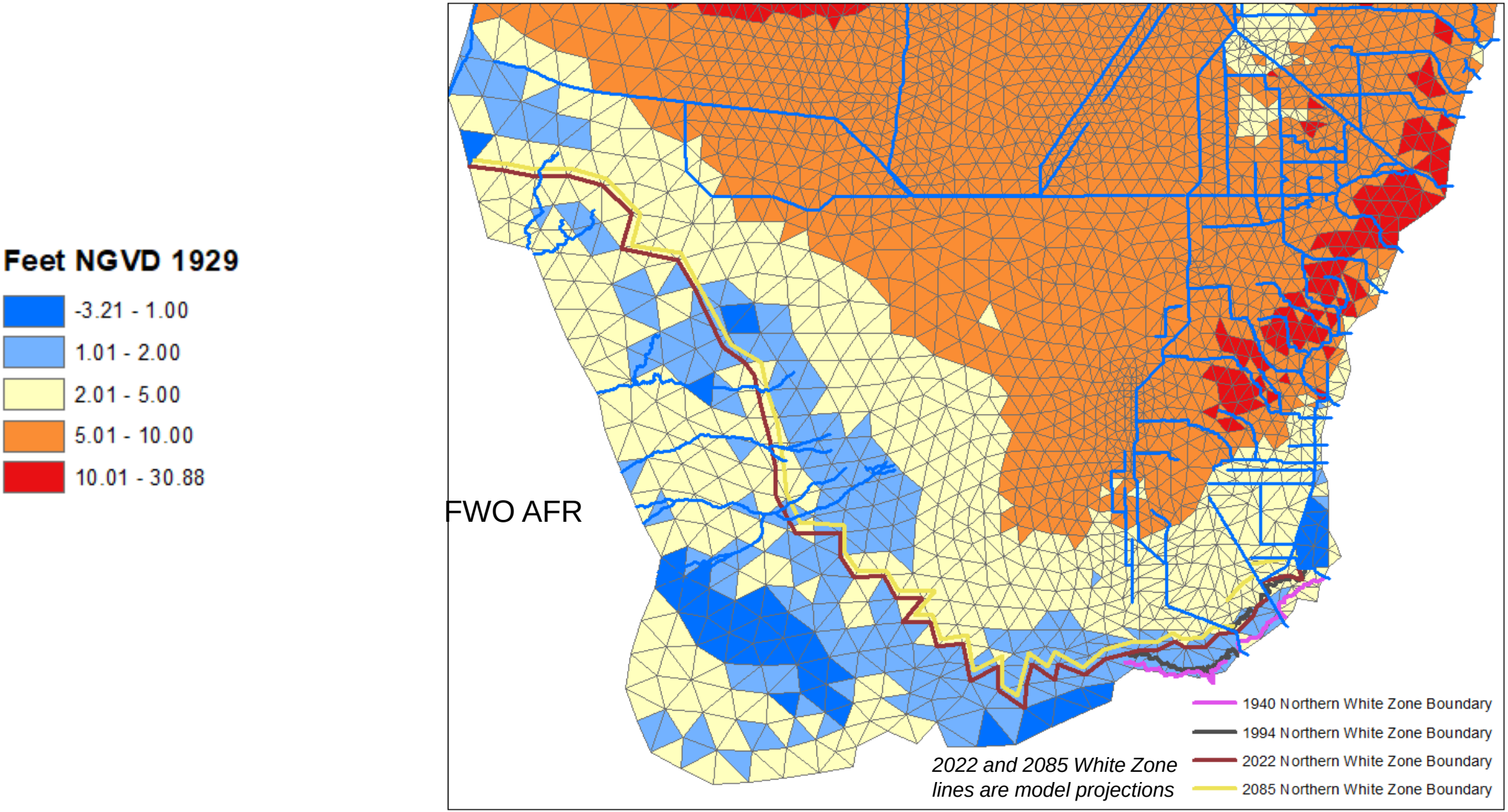
RSMGL LANDCOVER ASSUMING AFR CHANGES IN THE FUTURE



RSMGL TOPOGRAPHY ASSUMING NO CHANGE IN THE FUTURE



RSMGL TOPOGRAPHY ASSUMING AFR CHANGES IN THE FUTURE

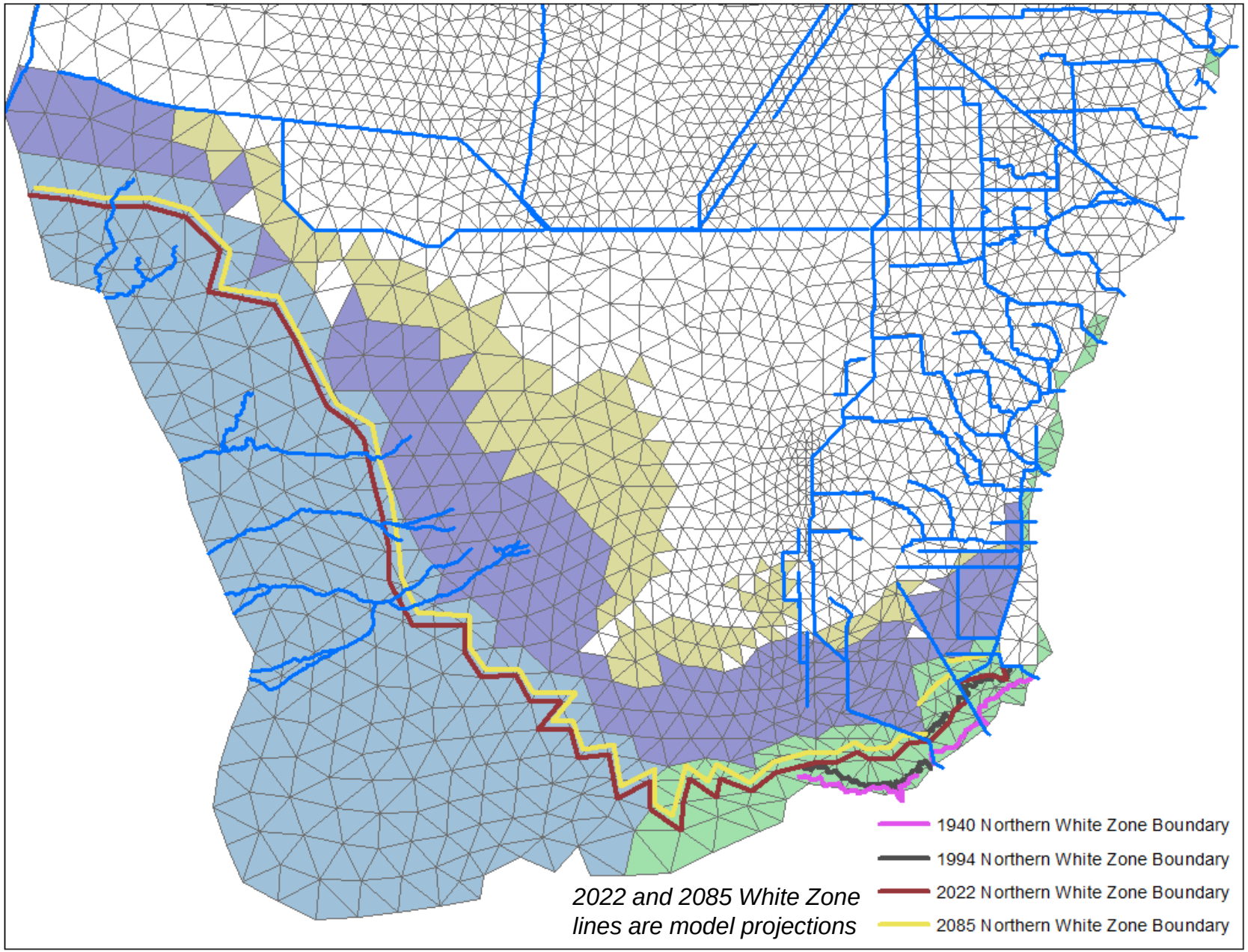


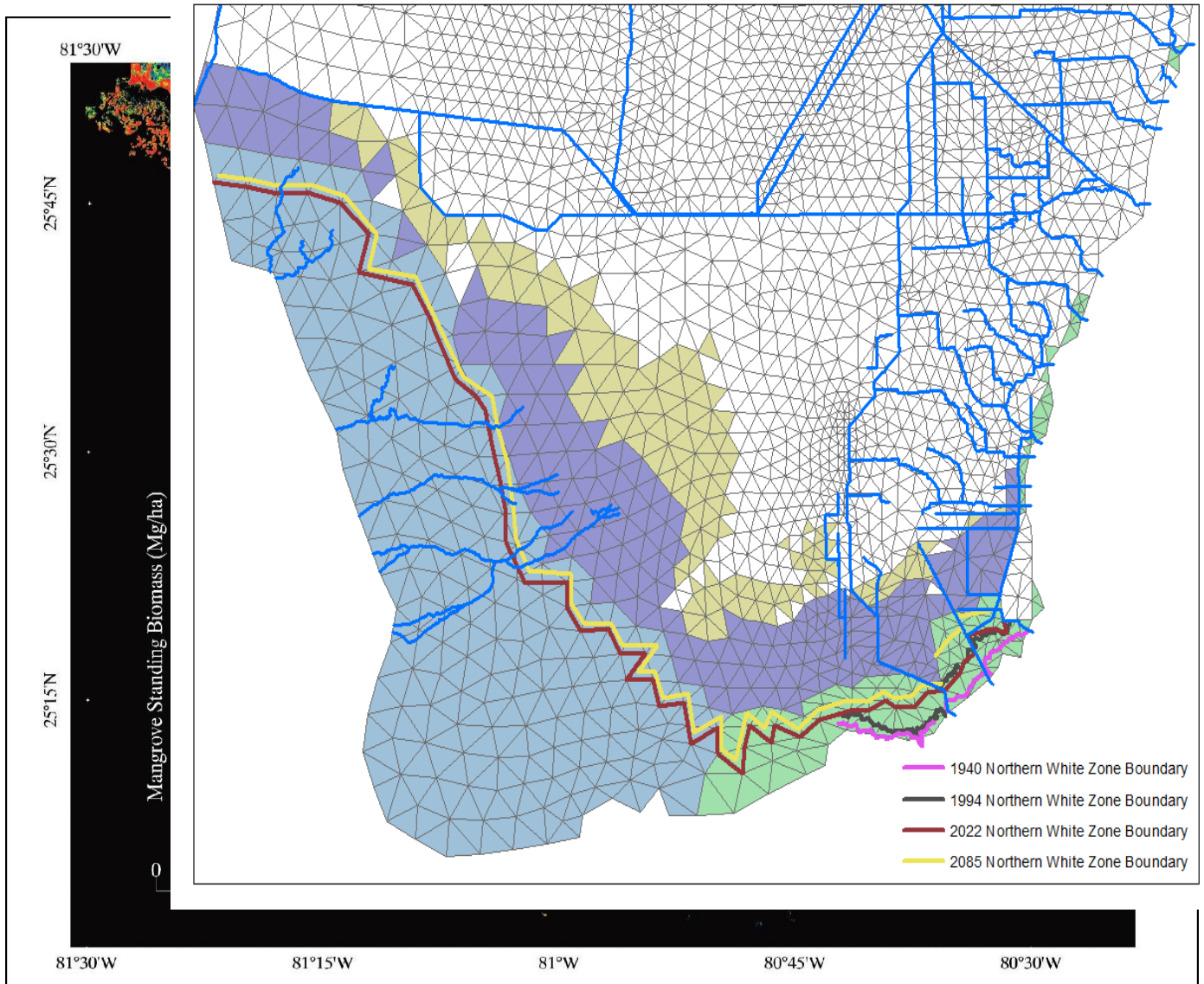
RSMGL TOPOGRAPHY DIFFERENCE WITH AFR CHANGES IN THE FUTURE

FWO AFR minus
FWO without AFR

Feet

- +0.33 feet
- +0.66 feet
- +0.87 feet
- +1.42 feet





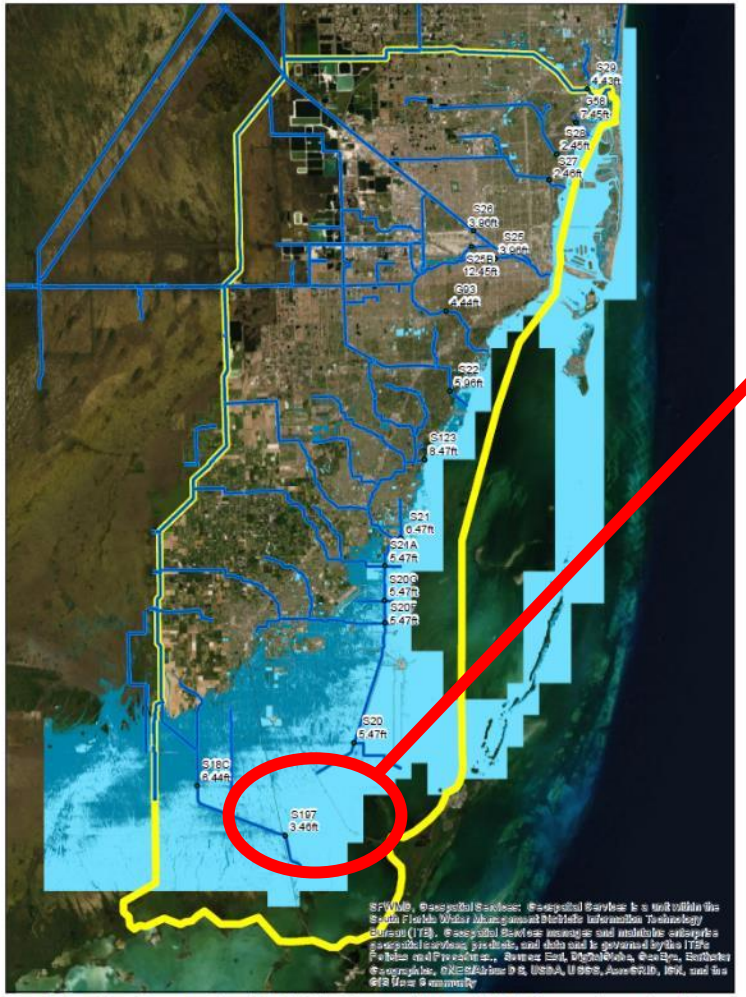
(8 mm/y + 10 mm/y + 8 mm/y) / 3 = ~8.67 mm/y
8.67 mm/y * 50 y = 433.5 mm = 1.42 ft

Mapping Height and Biomass of Mangrove Forests in Everglades National Park with SRTM Elevation Data

Marc Simard, Keqi Zhang, Victor H. Rivera-Monroy, Michael S. Ross, Pablo L. Ruiz, Edward Castañeda-Moya, Robert R. Twilley, and Ernesto Rodriguez

Photogrammetric Engineering & Remote Sensing Vol. 72, No. 3, March 2006, pp. 299–311.

In Conclusion: AFR will provide the *relative* ecological improvement expected from rising sea levels in combination with BBSEER restoration alternatives.



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Mangrove Transgression and Marsh Transition

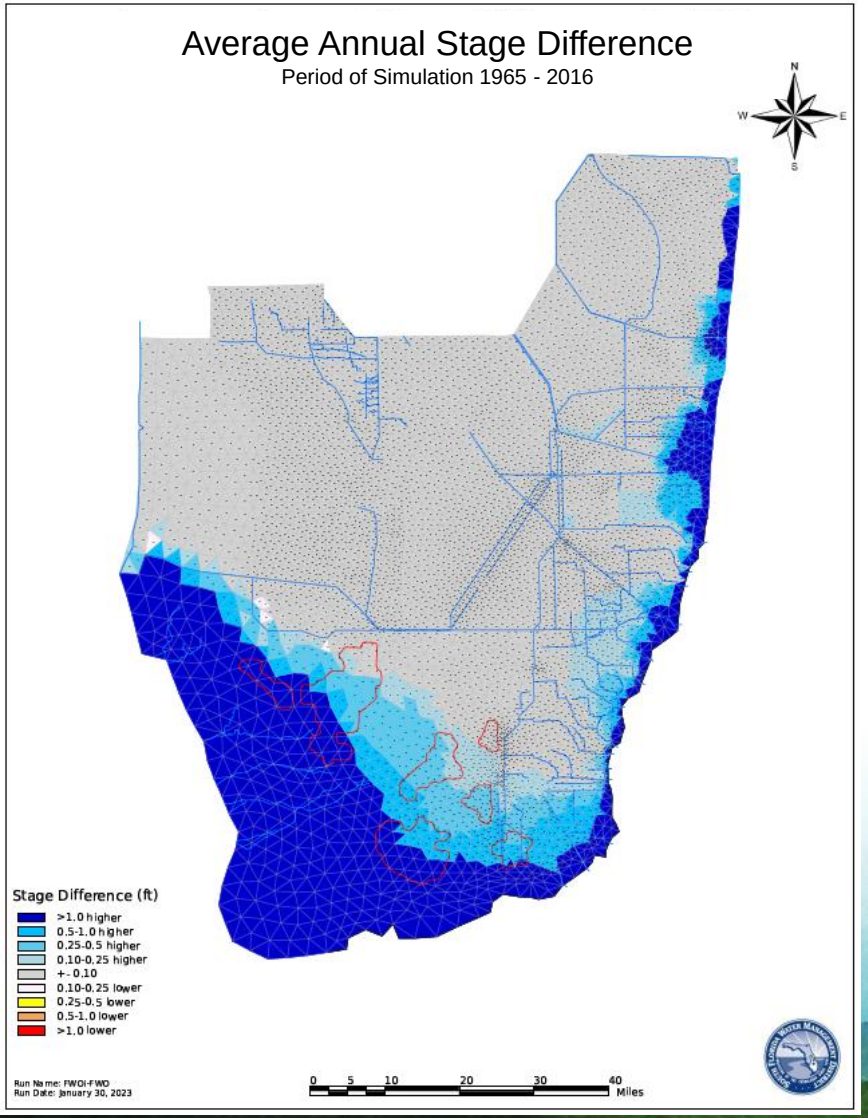
High AFR performance in the Triangle Area of BBSEER will allow dense red mangrove to transgress upstream

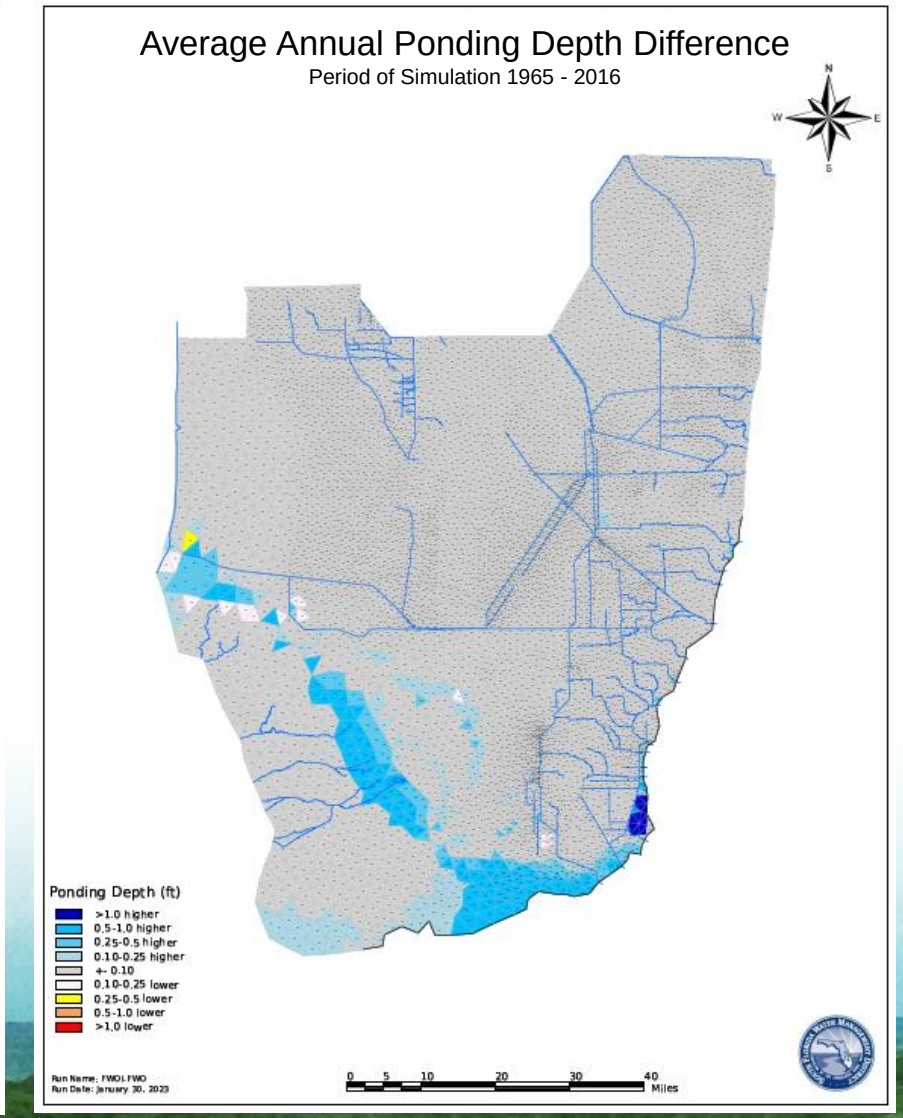
BBSEER

INITIAL RESULTS: FWOI

2085 WITH INTERMEDIATE SEA LEVEL CHANGE

FWOP 2085 W/ USACE INT. SLC, MEAN ANNUAL





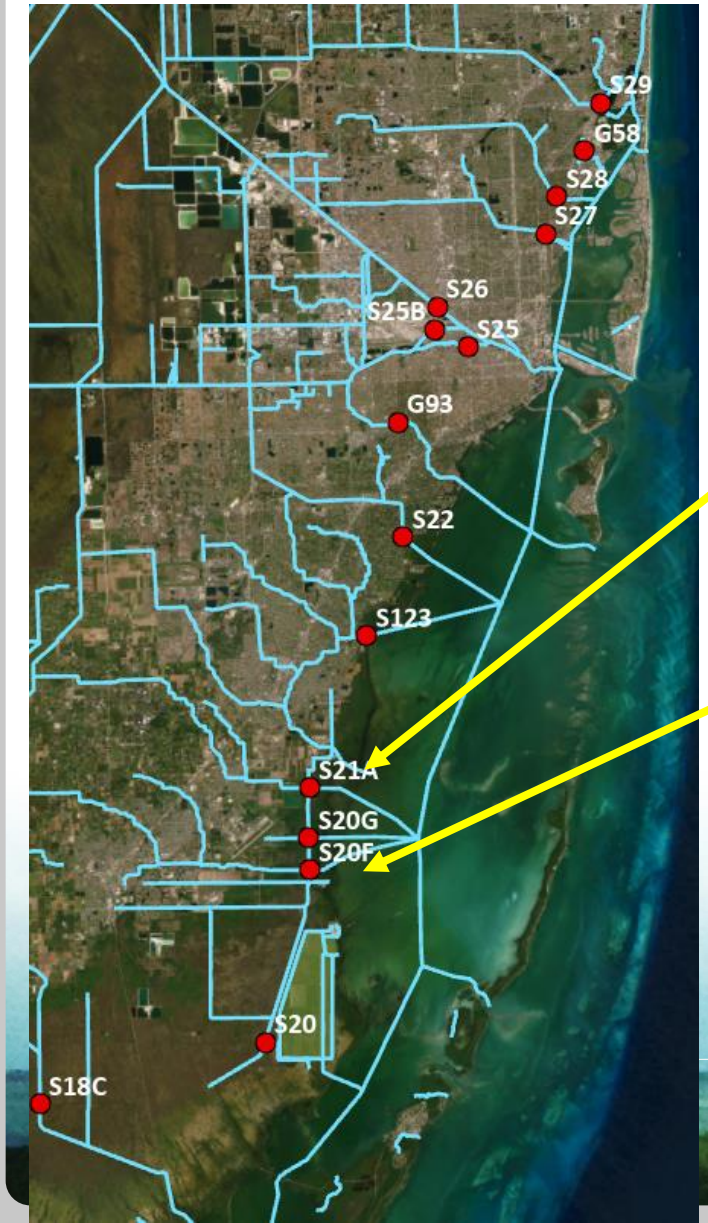
DRAFT RESULTS

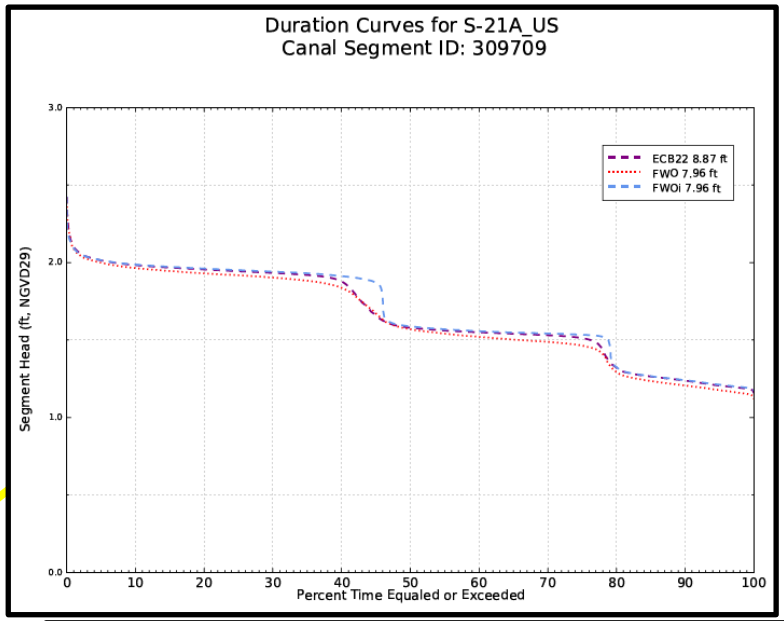
FWOI minus FWO

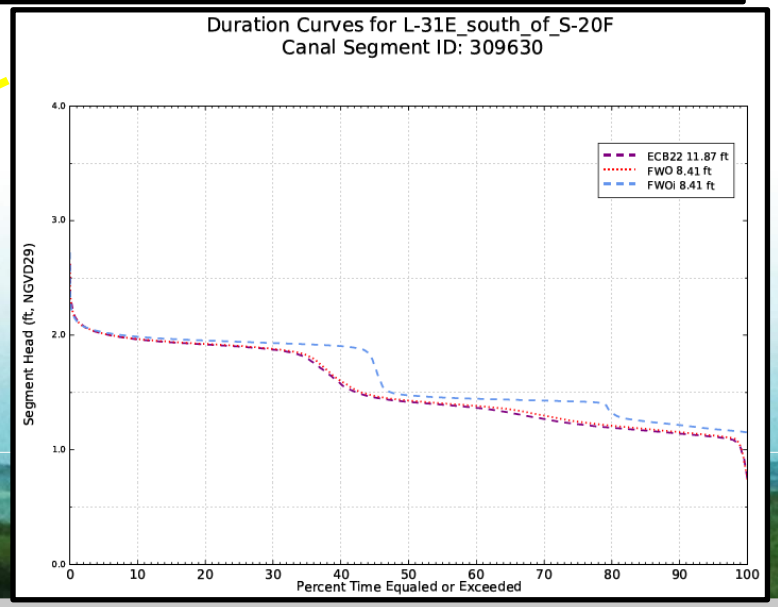
Period of simulation 1965 – 2016

- Stage represents groundwater and surface water elevations.
- Ponding depth represents water surface elevation minus ground surface elevation.

FWOP 2085 W/ USACE INT SLC, COASTAL STRUCTURES STAGE & FLOW







DRAFT RESULTS

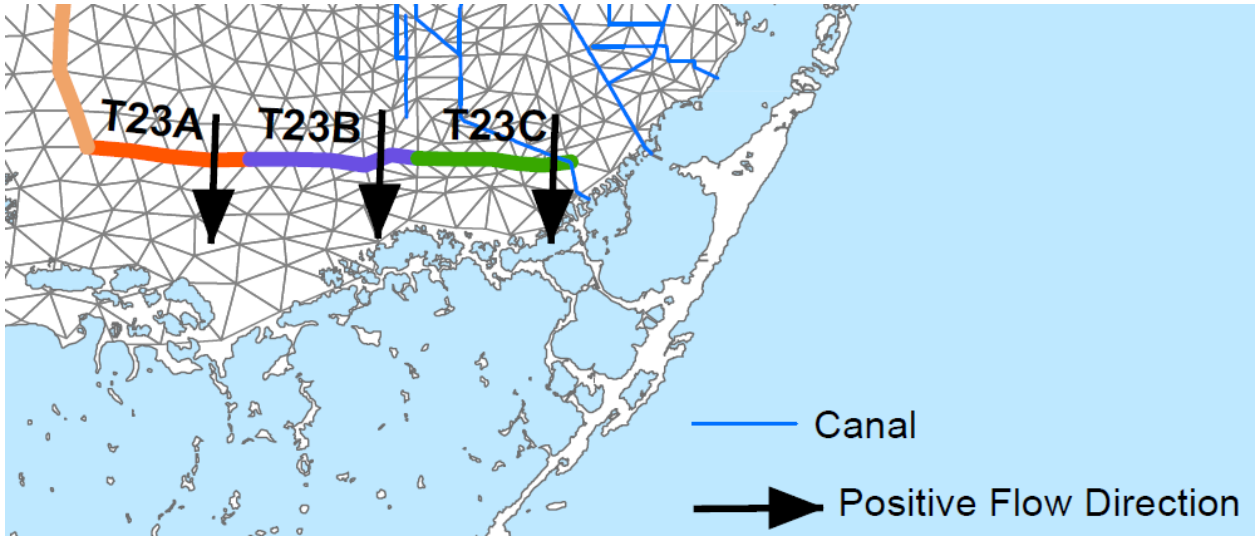
Period of simulation 1965 - 2016

Table 8. CoastalStructures

	ECB22	FWO	FWOi
S29	134.9	158.0	240.0
G58	0.1	0.1	19.8
S28	55.1	56.0	85.9
S27	66.2	68.9	105.4
S26	39.6	64.0	73.3
S25	4.0	4.3	16.0
S25B	56.4	58.6	82.0
G93	14.9	16.2	21.3
S22	59.1	62.9	85.3
S123	1.3	1.4	2.8
S21	73.5	48.7	58.0
S21A	87.6	57.2	99.6
S20G	3.4	9.6	25.2
S20F	97.2	107.2	194.4
S20	4.9	0.3	19.0

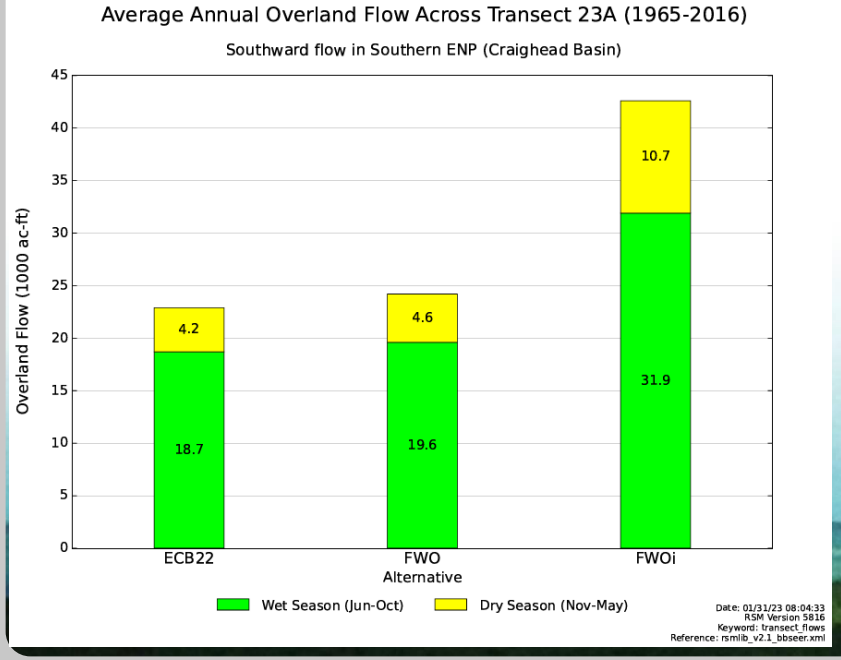
Average Annual Volume in K-acft

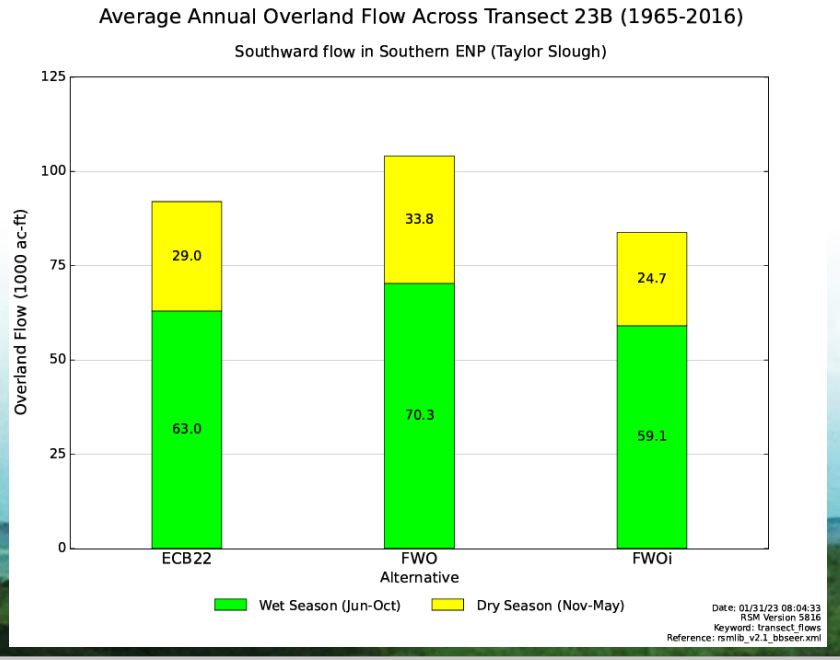
FWOP 2085 W/ SLC, TRANSECT FLOWS

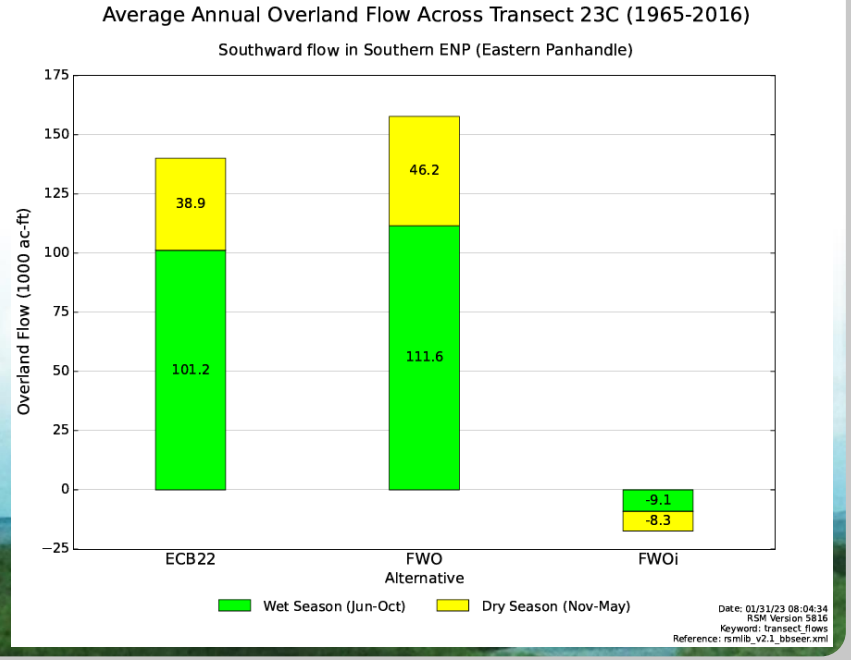


DRAFT RESULTS

Period of simulation 1965 - 2016







ACCESSING MODELING RESULTS DISCUSSED IN THIS MEETING

LINK TO FTP SITE:

ftp://ftppub.sfwmd.gov/outgoing/BBSEER/20230201

IMPORTANT note on accessing the ftp site:

Due to current computer system security protocols, simply double-clicking on the link will NOT work. In order to successfully access the files, do the following:

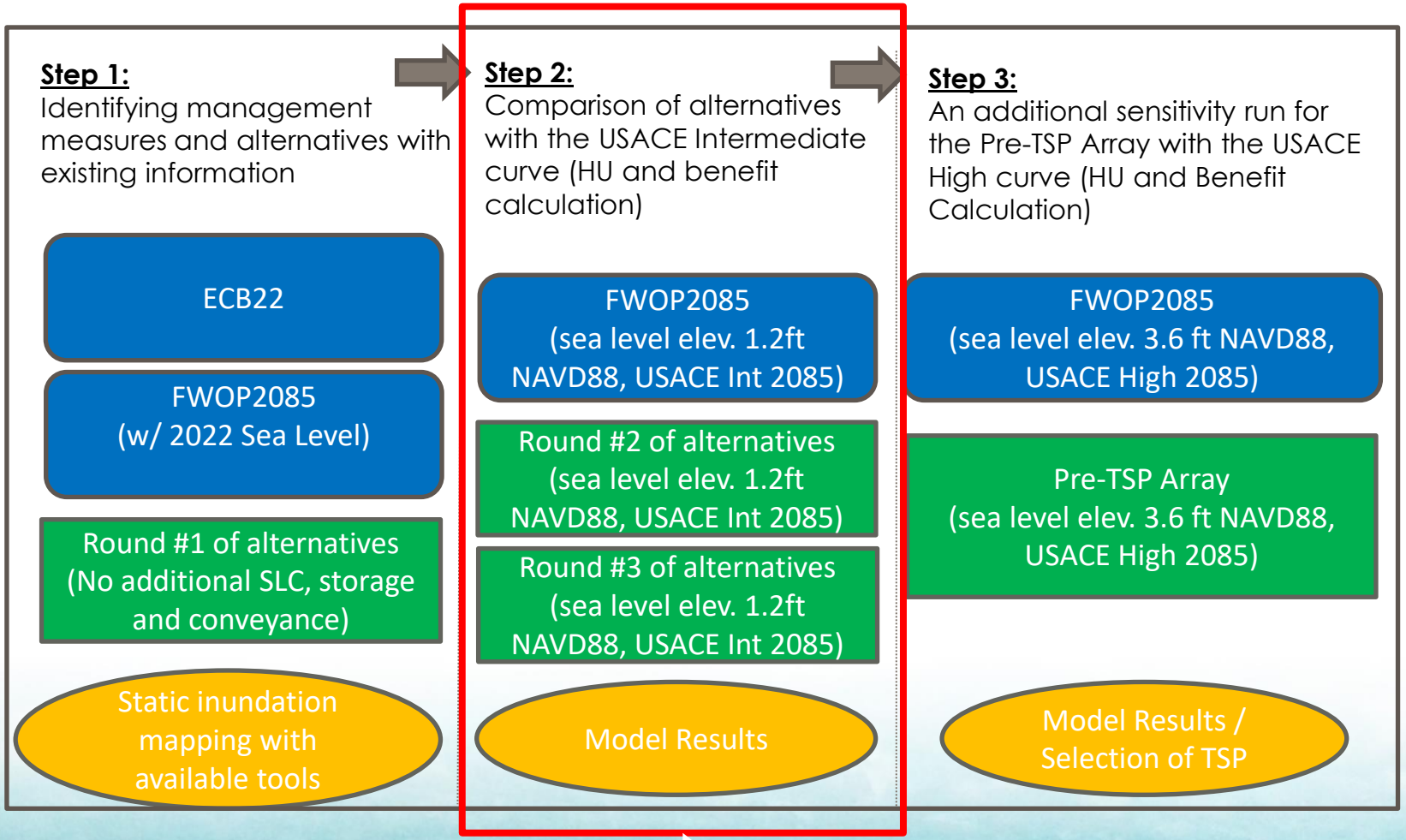
1. **be sure to be connected to the internet,**
2. **copy the ftp link, and**
3. **paste it in the address bar of your file or directory browser, NOT into an internet browser such as Microsoft Edge or Google Chrome.**

INITIAL OBSERVATIONS OF FWOI

- BBSEER assumes that coastal structures will continue to function as designed and discharges will be maintained despite increased tailwater conditions due to increased sea level. Ongoing and future non-BBSEER flood risk management and operational projects/studies are assumed to achieve this assumption (C&SF Flood Resiliency Study, etc.).
- With +2.0 ft of sea level change (rel. 1992), the regional Central & South Florida (C&SF) system is able to operate as intended, following the operation driven rules defined by water management, with the assumption from first bullet; significant changes in structure flows are observed.
- Increased stages and backwater effects can be observed in the C&SF system.
- Natural areas show stage & ponding differences that vary locally/geographically.
- Ponding differences due to increased SLC within the C&SF system for developed areas are not as extensive as in natural lands, assuming C&SF design discharges will be maintained..
- Changes in surface and groundwater flow transects are observed.

BBSEER SLC STRATEGY & NEXT STEPS

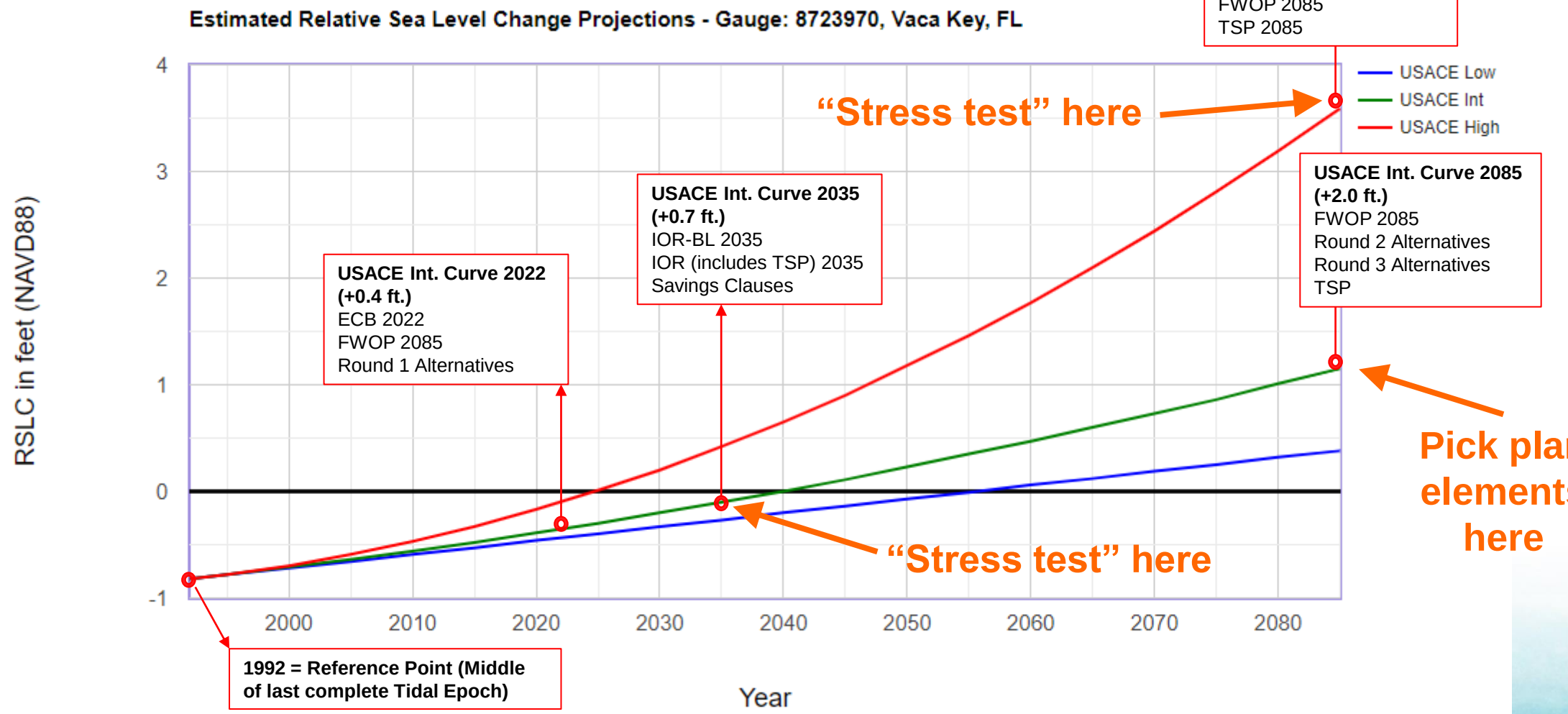
Sea Level Change Strategy Overview



WE ARE HERE: Immediate focus is reviewing the DRAFT FWOI & preparing Round 2 Alternatives to identify highly performing project elements

BBSEER

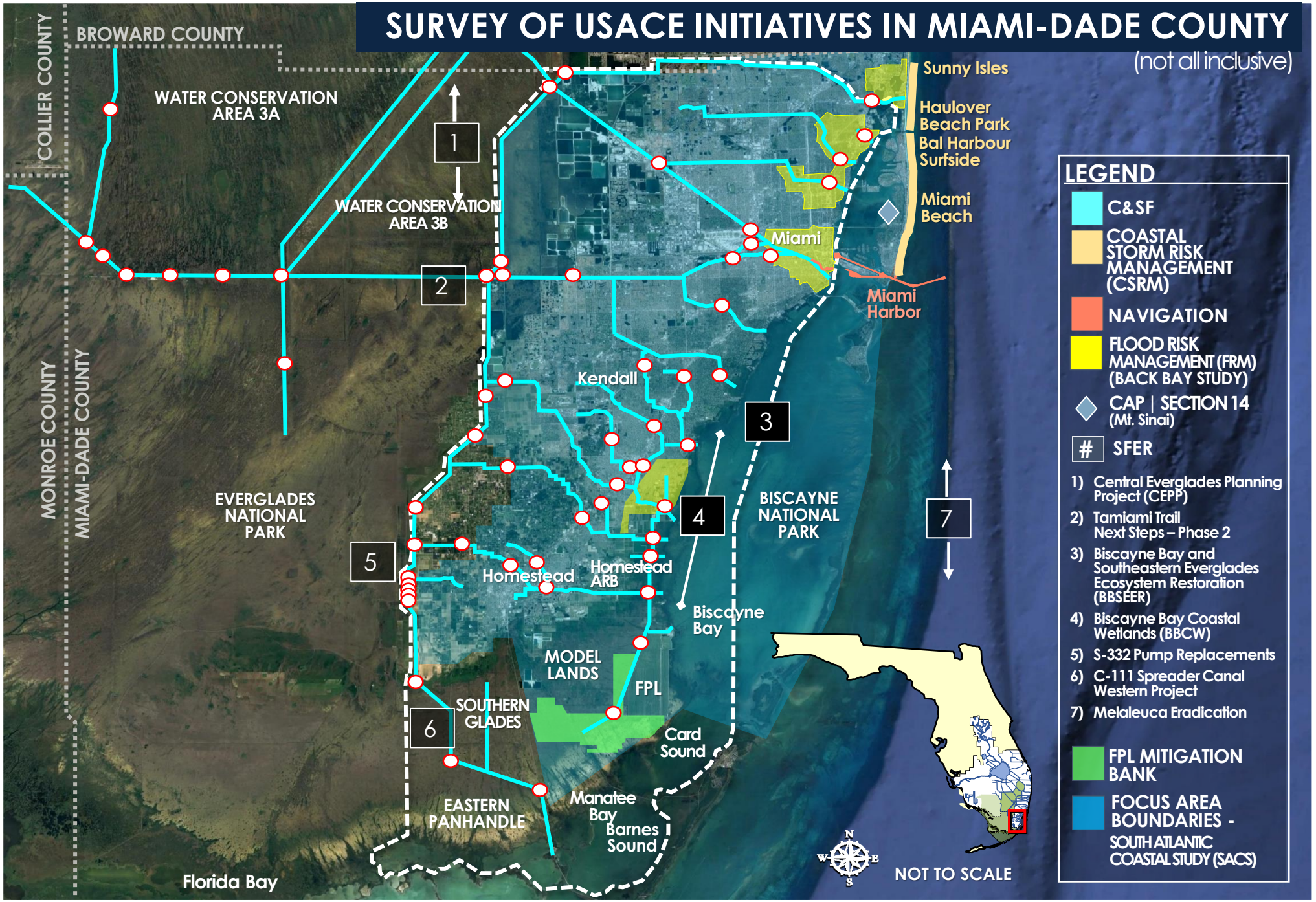
MODELING & SLC – LATER STEPS



https://cwbi-app.sec.usace.army.mil/rccslc/slcc_calc.html

SURVEY OF USACE INITIATIVES IN MIAMI-DADE COUNTY

(not all inclusive)



PDT COMMENT PERIOD

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PUBLIC COMMENT PERIOD

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WRAP UP, ACTION ITEMS, NEXT STEPS

- 6 February — Initial BBSM Emulator Development w/ Round 1 Test
- TBD — Initial BISECT Emulator Development w/ Round 1 Test
- 14 March — Round 2 Alts w/ SLC - Modeling Results to PDT
- Late March — Round 2 Alts w/ SLC - PDT Meeting
- Late April — Round 2 Alts w/ SLC - In-person Workshop

THANK YOU!!!

BBSEER