SOUTH FLORIDA WATER MANAGEMENT DISTRICT



Everglades Agricultural Area Storage Reservoir Feasibility Study

Matt Morrison Federal Bureau Chief Office of Everglades Policy & Coordination

October 31, 2017

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Meeting Agenda

- Welcome and Introductions
- Project Study, Scope and Schedule
- Project Features Under Consideration
- Evaluation Tools
- Project Planning Assumptions Baseline Conditions
- Next Steps
- Public Comment





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EAA Storage Reservoir Feasibility Study **PROJECT STUDY, SCOPE AND SCHEDULE**





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South Florida Ecosystem Restoration

NON-CERP & FOUNDATION PROJECTS

- Modified Water Deliveries to Everglades National Park
- Kissimmee River Restoration
- C-111 South Dade
- C-51/Storm Water Treatment Area (STA) 1E
- Storm Water Treatment Areas/Restoration Strategies
- Tamiami Trail Bridging & Roadway Modifications
- Herbert Hoover Dike (HHD)Rehabilitation
- Seminole Big Cypress Critical Project

CERP GENERATION 1 PROJECTS

- Indian River Lagoon (IRL) South
- Picayune Strand
- Site 1

ST. LUCIE

ESTUARY

BISCAYNE

LAKE

WCA

FLORID

CALOOSAHATCH

ESTUARY

SOUTH FLORIDA

ECOSYSTEM

RESTORATION

A NOT TO SCALE

Restoration Areas

Melaleuca Annex Facility

CERP GENERATION 2 PROJECTS

- C 43 Reservoir
- Broward County Water Preserve Areas (WPA)
- C-111 Spreader Canal Western Project
- Biscayne Bay Coastal Wetlands Phase 1

DECEMBER 2016 AUTHORIZATION

Central Everglades Planning Project (CEPP)

PLANNING EFFORTS

- Loxahatchee River Watershed Restoration
- Western Everglades Restoration
- Lake Okeechobee Watershed Restoration

EVERGLADES AGRICULTURAL AREA STORAGE RESERVOIR 💢

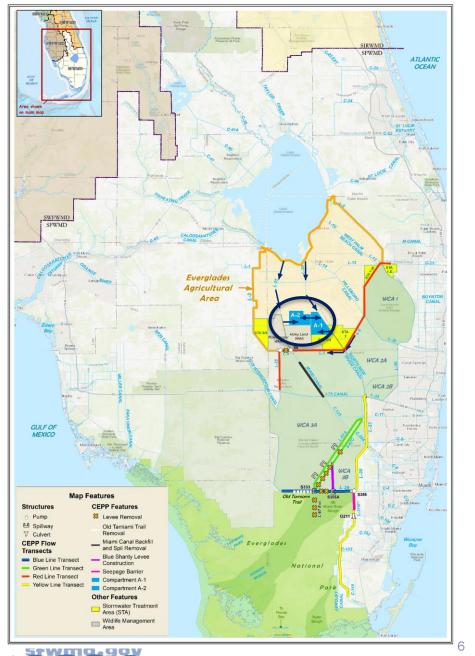


Moving Water South-Existing Conditions

- Water flows out of Lake Okeechobee to the south through the lake outlet structures to the major canals
 - L-8 Canal
 - West Palm Beach Canal
 - Hillsboro Canal
 - North New River Canal
 - Miami Canal







CEPP Recommended Plan ALT 4R2

- PPA New Water
 - A-2 Flow Equalization Basin (FEB)
 - Seepage Barrier, L-31N Levee
- PPA North
 - L-6 Canal Flow Diversion
 - L-5 Canal Conveyance Improvements
 - S-8 Pump Station Complex Modifications
 - L-4 Levee Degrade and Pump Station
 - Miami Canal Backfill
- PPA South
 - S-333 Spillway Modification
 - L-29 Canal Gated Spillway
 - L-67A Conveyance Structures
 - L-67C Levee Gap
 - L-67C Levee Degrade
 - Blue Shanty Levee, WCA 3B
 - L-29 Levee Degrade
 - L-67 Extension Levee Degrade and Canal Backfill
 - Old Tamiami Trail Removal
 - S-356 Pump Station Modifications
 - System-wide Operations Refinements



Project Opportunities and Objectives

- Reduce the high-volume freshwater discharges from Lake Okeechobee to the Northern Estuaries
- Identify storage, treatment and conveyance south of Lake
 Okeechobee to improve flows to the Everglades system
- Reduce ongoing ecological damage to the Northern Estuaries and Everglades system



St. Lucie Inlet





Constraints

WRDA 2000 Sec. 601(h)(5); Sec. 373.1501, F.S.

- Elimination or transfer of existing legal sources of water must be addressed
- Maintain existing level of flood protection
- Meet applicable water quality standards
 - Will not cause or contribute to a violation of state water quality standards, permit discharge limits or specific permit conditions
 - Reasonable assurances exist that adverse impacts
 on flora and fauna will not occur
- Remain within federal authorities (CERP)





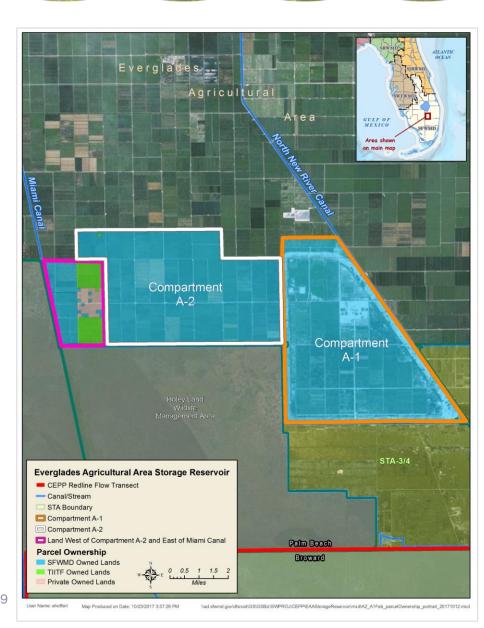
Florida State Law

Chapter 2017-10 Requirements as it Relates to Post-Authorization Change Report

- Engage landowners on a 'willing seller' basis
- 240,000 acre-feet of storage and necessary treatment on A-2 Parcel plus conveyance improvements
- 360,000 acre-feet of storage and necessary treatment on A-1 and A-2 Parcels plus conveyance improvements
- Report to State Legislature by January 9, 2018

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 Submit Post-Authorization Change Report to Congress for approval by October 1, 2018



Planning Process & Schedule

- Section 203 of the Water Resources Development Act (WRDA) of 1986, as amended
- Key Activities and Target Dates:
 - Update to Florida State Legislature by January 9, 2018
 - Draft Report complete by January 30, 2018
 - Final Report and submittal to Assistant Secretary of the Army for Civil Works – March 30, 2018
 - ASA(CW) submit report to Congress October 1, 2018
 - Anticipated Congressional authorization by December 31, 2019





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EAA Storage Reservoir Feasibility Study **PROJECT FEATURES UNDER CONSIDERATION**





Project Features

- Reservoirs
- Stormwater
 Treatment
 Areas (STAs)
- Conveyance
 Improvements







Reservoirs

- Designed to capture and store water
- Typically constructed above ground with perimeter embankments
- May include internal embankments









Stormwater Treatment Areas (STAs)

- Constructed freshwater treatment wetlands with a variety of plant species
- Remove and store nutrients through plant growth and the accumulation of dead plant material that is converted to soil
- 57,000 acres of STAs south of Lake Okeechobee currently operated by SFWMD
- STAs have treated 18.6 million acre-feet of water and have reduced phosphorus load by 77 percent









Conveyance Improvements – Canals

- Improvements to existing canals (e.g. widening, deepening, etc.)
- Construct new canals
 - Inflow and outflow canals
 - Seepage collection canals







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Conveyance Improvements – Water Control Structures

Spillways

Gated Box Culverts

- Gated Culverts
- Overflow Weirs







Conveyance Improvements – Pump Stations

- Designed to lift water upwards to higher elevations
- Used when gravity flow is not possible
- Includes pumps and related buildings, equipment, controls, etc.
- Can be powered by electric or diesel engines





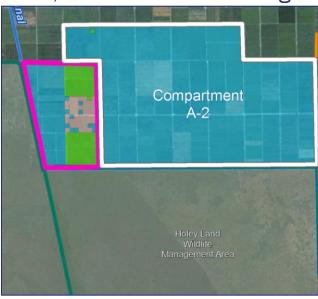


Discussion

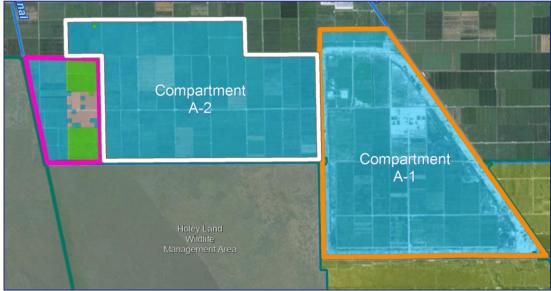
Features under consideration

- Reservoir
- STAs
- Conveyance

240,000 acre feet of storage



360,000 acre feet of storage





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EAA Storage Reservoir Feasibility Study **EVALUATION TOOLS**





Modeling Toolbox

Regional Hydrologic Models

 Primary modeling tools for EAA Storage Reservoir assessment. The models provide daily, detailed estimates of hydrology.

Sub-regional & Detailed Models

- Smaller scale, more detailed models to help analyze specific areas of interest (e.g. water quality, conveyance of water, etc...)
- For the EAA storage reservoir effort, some detailed work will precede and inform application of the regional models





Regional Hydrologic Modeling

Purpose:

 Simulate detailed daily rainfall-runoff processes and flow routing within the EAA / Central Everglades (CEPP) planning region as a function of existing infrastructure and proposed configurations.

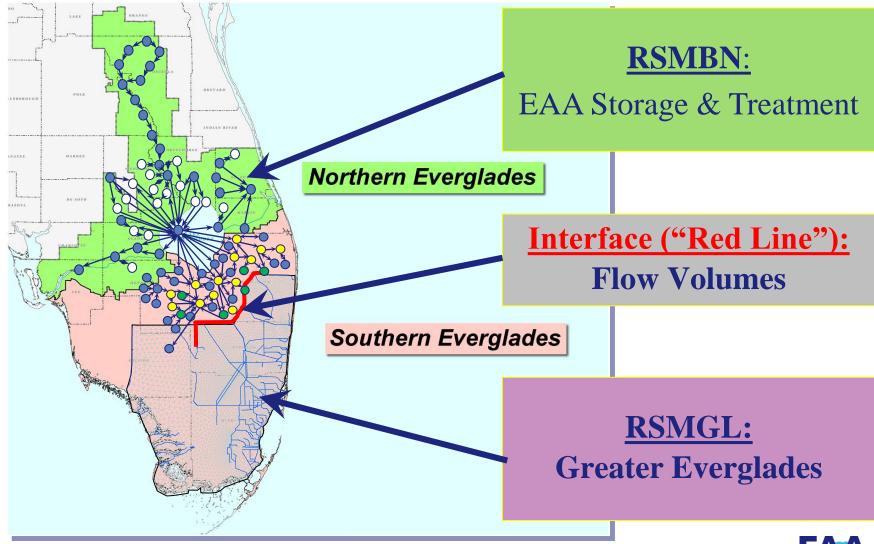
Strategy:

 Use a decoupled link-node model for the EAA, STAs and northern areas in combination with a detailed meshed model for the Everglades-Lower East Coast areas. Maintain consistency with CEPP.





Decoupled Regional Modeling Approach

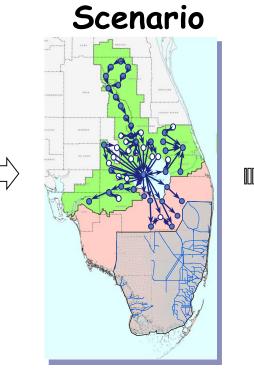




Regional Modeling Approach

- Climatic Input
 Rainfall
 - ET
 - Boundary Conditions

Period of record: 1965-2005



- Project Features
- Land Use/Land Cover
- Water Demands
- Operating Criteria

Model Output

- Daily time series of water levels, flows
- Demands not met

Evaluation (Environmental,

Water Supply, etc...)





Regional Simulation Model – Basins (RSMBN)

- A link-node application of the Regional Simulation Model (RSM) specific to Lake Okeechobee and basins in its vicinity, i.e., north of the "Red Line".
- Previously utilized for the Central Everglades (CEPP), Lake Okeechobee Watershed (LOWRP) and SFWMD Northern Everglades planning initiatives.
- Will provide hydrologic representation of Lake Okeechobee, the Kissimmee Basin, the EAA and other northern watersheds including the Caloosahatchee and St Lucie Estuaries.

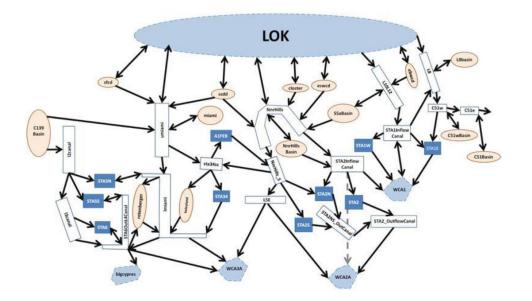




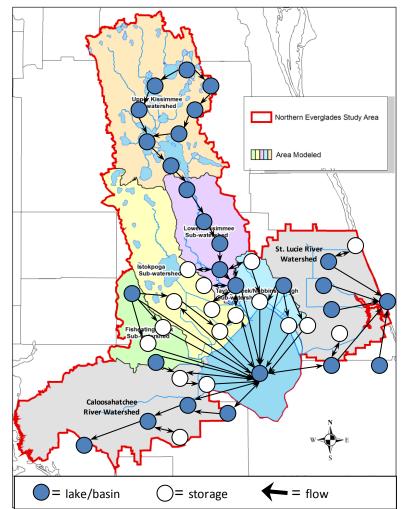
RSMBN (Basins)

<u>Node Information</u>: Total number of basins/lakes/canals represented: >100

Link Information: Total number of connections represented: >150



RSMBSN Link-Node Routing Diagram: Initial Operating Regime Baseline Simulation



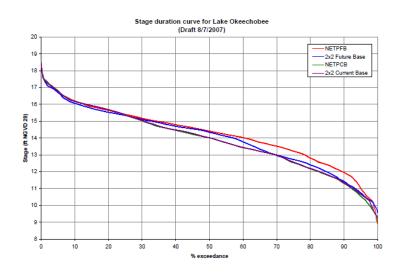
Domain Information: EAA area represented: ~690 sq. miles

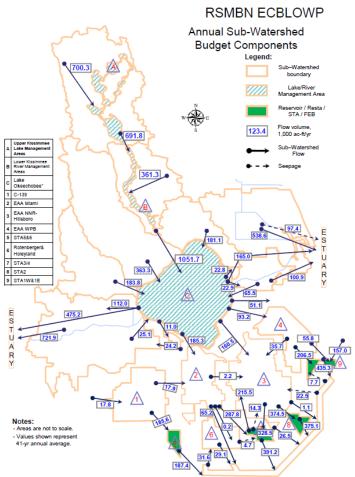




RSMBN Modeling Products

- Stages/Head
 - Hydrographs
 - Duration Frequency Curves
- Estuary Event Counts
- Basin Water Budgets
- Water shortage indicators









Evaluation of Project Benefits for RSMBN

- Evaluation of potential ecosystem benefits will follow a process similar to the CEPP as detailed in Appendix G of the CEPP Project Implementation Report.
- RSMBN outputs will be summarized into hydrologic and habitat unit outputs to evaluate potential effects







Regional Simulation Model – Glades-LECSA (RSMGL)

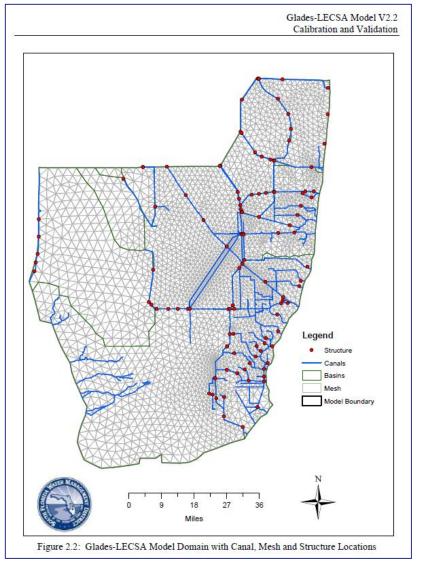
- A full mesh and canal network application of the Regional Simulation Model (RSM) specific to the Everglades and Lower East Coast service areas, i.e., south of the "Red Line"
- Previously utilized for the Central Everglades and CERP DECOMP projects
- Will provide detailed (cell-based) stage and flow information on a regional scale and account for current or proposed changes in southern system infrastructure and operations.



RSMGL (Glades-LECSA)

<u>Mesh Information</u>: Number of cells: ~ 6000 Average size: ~ 1 sq. mile Domain size: 5,825 sq. miles

<u>Canal Information</u>: Number of segments: ~1000 Average length: ~ 1 mile Total length: > 1,000 miles

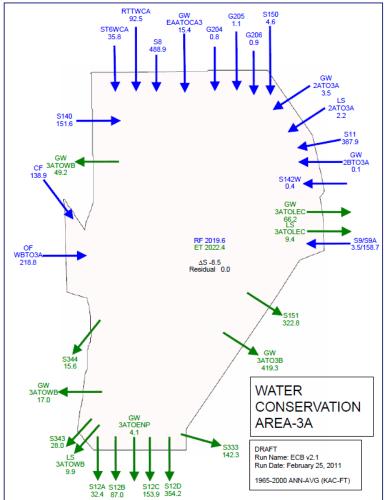






RSMGL Modeling Products

- Stages/Head
- Ponding Depths
- Hydroperiods
- Stage Duration Frequency Curves
- Hydrographs
- Groundwater Flow Vectors
- Overland Flow Vectors
- Transect Flows
- Basin Water Budgets

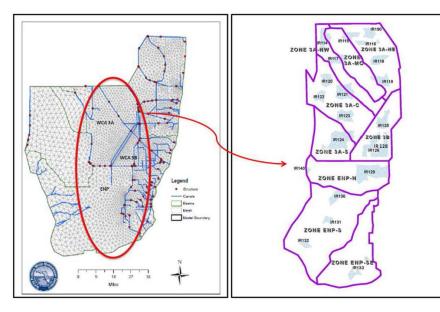






Evaluation of Project Benefits for RSMGL

- Evaluation of potential ecosystem benefits will follow a process similar to the CEPP as detailed in Appendix G of the CEPP Project Implementation Report.
- RSMGL outputs will be summarized into hydrologic and habitat unit outputs to evaluate potential effects



reater erglades	Hydrologic Surrogate for Soil Oxidation	Measure of cumulative drought intensity to reduce exposure of peat to oxidation
	Inundation Pattern in Greater Everglades Wetlands	Measure of the number and duration of inundation events used to calculate the percent period of record of inundation
	Number and Duration of Dry Events in Shark River Slough	Measure of the number of times and mean duration in weeks that water drops below ground
	Sheet flow in the Everglades Ridge and Slough Landscape	Measure of the timing, distribution and continuity of sheet flow across the landscape
	Slough Vegetation Suitability	Measure to evaluate the hydrologic suitability for slough vegetation (hydroperiod, dry-down, dry and wet season depths)





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Sub-regional & Detailed Models

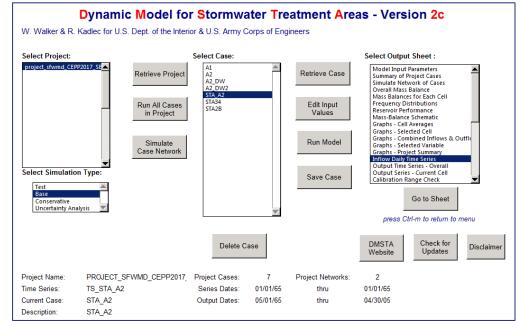
- While the regional models provide the primary hydrologic outputs for plan evaluation, additional models will need to be applied to provide more detail for analyzing system features.
- Examples of this type of model application will be shown for assessing water quality and conveyance of water.
- Outcomes from these efforts help size features and provide input back to the regional tools.





Example: Dynamic Model for Stormwater Treatment Areas (DMSTA, v2C)

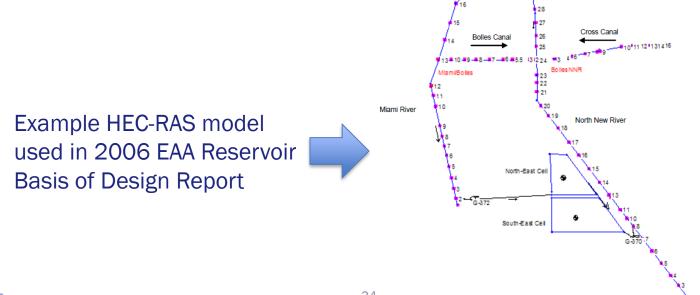
- Developed for the U.S. Department of the Interior and the U.S. Army Corps of Engineers (Walker and Kadlec 2005)
- Extensively used in south Florida to analyze Stormwater Treatment Area design, operation & management
- Projects supported include Central Everglades and Restoration Strategies





Example: HEC-RAS Hydraulic Tool

- Hydrologic Engineering Center River Analysis System (HEC-RAS)
 - Developed by the U.S. Army Corps of Engineers
 - Used nation-wide for design and analysis of conveyance systems







QUESTIONS AND DISCUSSION





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EAA Storage Reservoir Feasibility Study PROJECT PLANNING ASSUMPTIONS – BASELINE CONDITIONS





Baseline Modeling Assumptions

- Modeling of "Baseline" scenarios helps to provide reference points for comparison. These scenarios show how current conditions or "No Action" future conditions will perform so that the potential benefits of suggested infrastructure changes can be evaluated.
- Guiding principle in developing baseline modeling for the EAA Storage Reservoir planning effort:

Try to maintain consistency with Central Everglades Planning (CEPP)



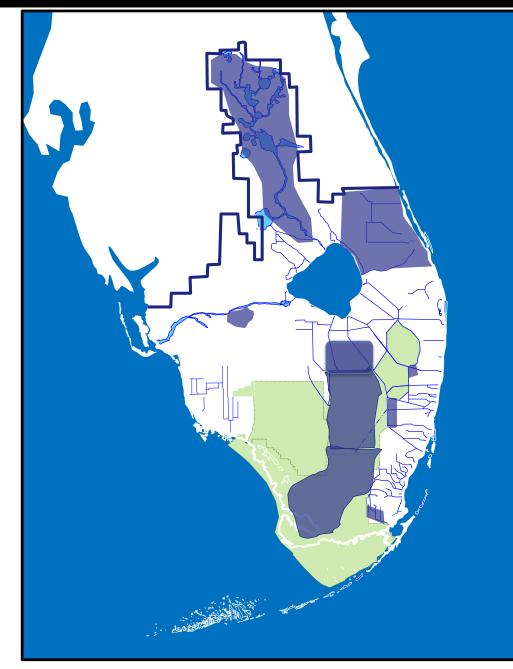


Baseline Modeling Assumptions (cont)

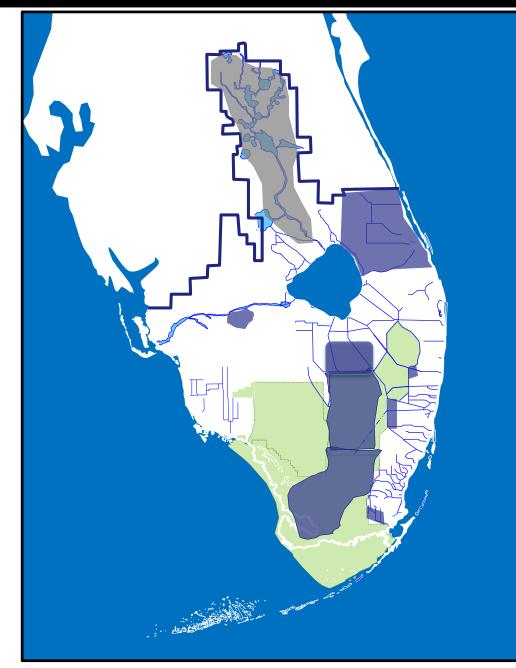
- Existing Condition Baseline (EARECB) attempts to represent onground conditions circa 2017
 - Assumptions per CEPP RSMBN ECB and IORBL1 simulations (depending on sub-basin) and CEPP RSMGL 2012EC (Scenarios defined in CEPP Project Implementation Report)
- Future Without Project Baseline (EARFWO) attempts to represent the projected future conditions circa 50 years in the future if there was no EAA Storage Reservoir Project
 - Assumptions per RSMBN ALT4R2 and RSMGL ALT4R2 (CEPP Selected Plan + Other Authorized Projects)







- Kissimmee Headwaters Revitalization
- Indian River Lagoon-South
- C-43 Phase 1 Reservoir
- Other 1st and 2nd Generation CERP & Foundation Projects
- Restoration Strategies / Central Everglades Project Features in the Everglades Agricultural Area
- Central Everglades Project Features in the Greater Everglades

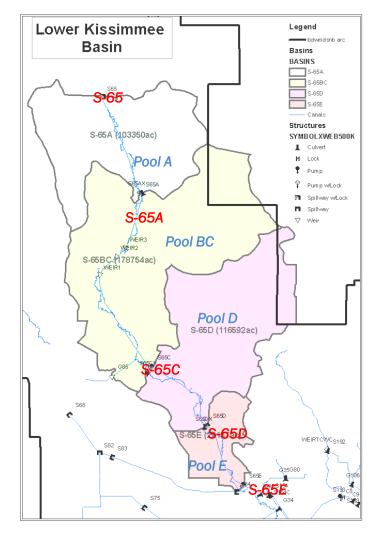


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Kissimmee River Restoration in RSMBN

EARECB & EARFWO

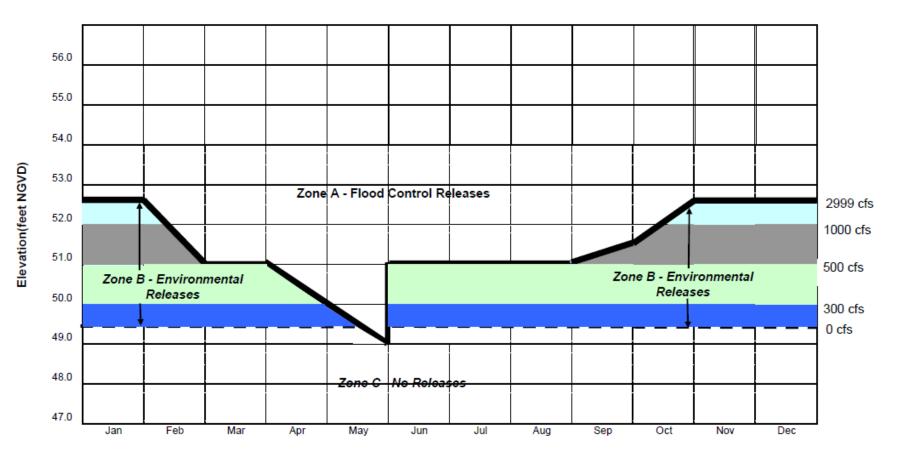
- The Lower Kissimmee Basin is partitioned into three major subwatersheds: Pools A, BCD (Pool BC & Pool D combined into Pool BCD), and E
- Stage-volume and stagearea relationships updated for Pool BCD
- Structure S-65C is removed

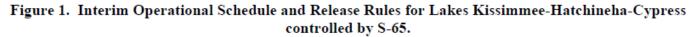






Upper Kissimmee Basin S65 Operational Schedule: Current System (EARECB)





Source: SFWMD. 2007 South Florida Environmental Report, Appendix 11-1





Upper Kissimmee Basin

S65 Operational Schedule: Headwaters Revitalization (EARFWO)

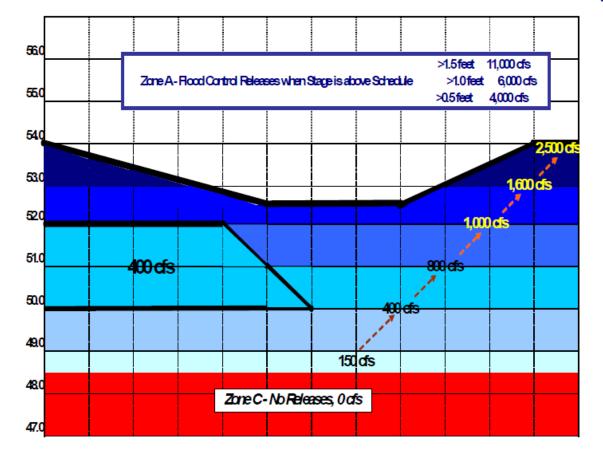
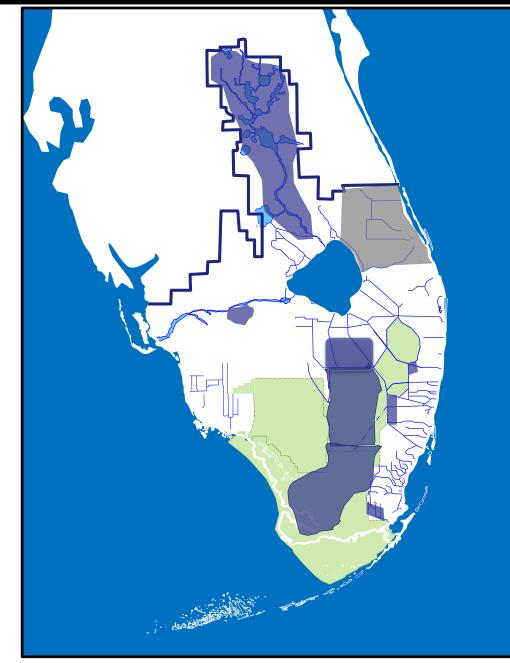


Figure 11-10. Revised regulation and operational schedule for the Upper Basin Kissimmee Chain of Lakes (KCOL) including lakes Kissimmee, Hatchineha, Cypress, and Tiger, controlled by S-65.

Source: SFWMD. 2007 South Florida Environmental Report, Chapter 11: Kissimmee River Restoration and Upper Basin Initiatives

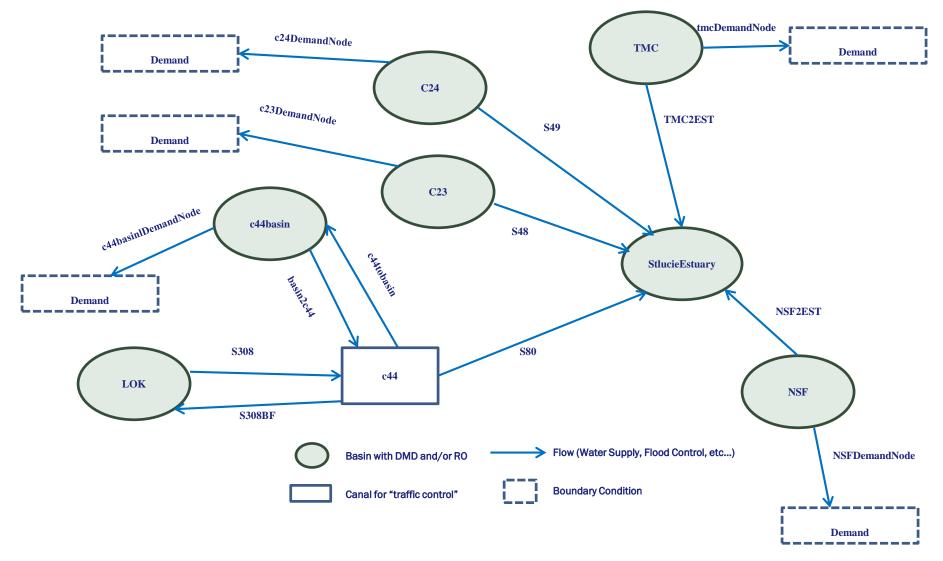


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Indian River Lagoon EARECB in RSMBN



EAAA STORAGE RESERVOIR



Indian River Lagoon EARECB in RSMBN C44 Basin

- S-80 discharges into the St. Lucie Estuary.
- C44 Basin runoff has potential to backflow into Lake Okeechobee when Lake stage is below 14.5 feet NGVD.
- C44 Basin supplemental demands for surface water irrigation are met by Lake Okeechobee.

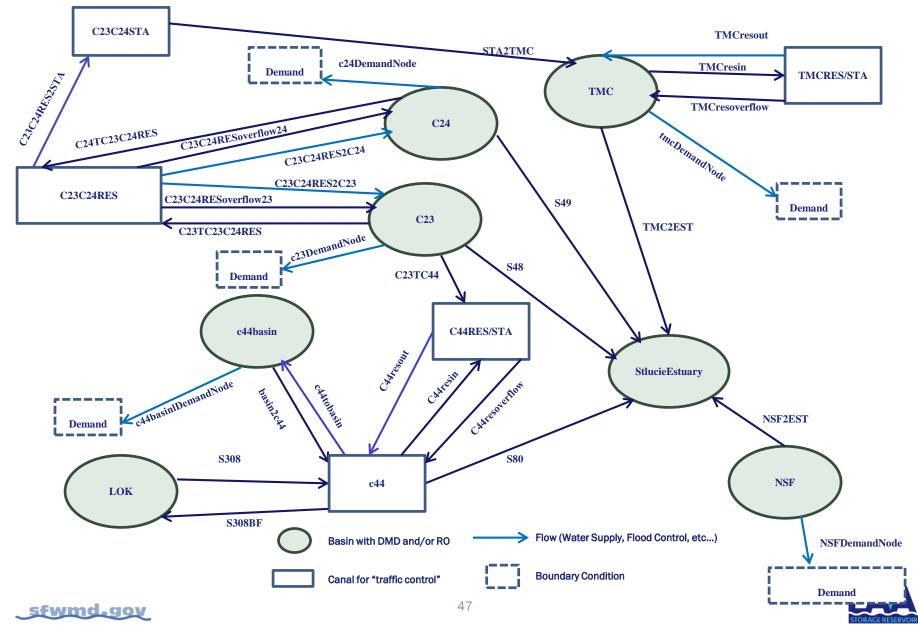
C23, C24, TMC and NF-SF-B456 (NSF) Sub-watersheds

- Three outlet structures discharge from each of the basins into the St. Lucie Estuary.
- Structure capacity is assumed to be limited only by available basin runoff.
- No regional deliveries to meet demands.





Indian River Lagoon EARFWO in RSMBN



Indian River Lagoon EARFWO in RSMBN

FWO Project Features

- Consistent with CERP Indian River Lagoon South DDRs updates to the authorized 2004 PIR.
- Includes operational intent (Opti6) per St Lucie River Watershed Protection Plan (January 2009).
- Basin demands can be met by project features.

C44 Reservoir and STA

- Storage capacity: 50,246 acre-feet
- Footprint: 12,125 acres (assumed 9700 effective acres / 80%)





Indian River Lagoon EARFWO in RSMBN (cont)

C23/24 Reservoir

- Storage capacity: 92,094 acre-feet
- Footprint: 8675 acres (assumed 6940 effective acres / 80%)

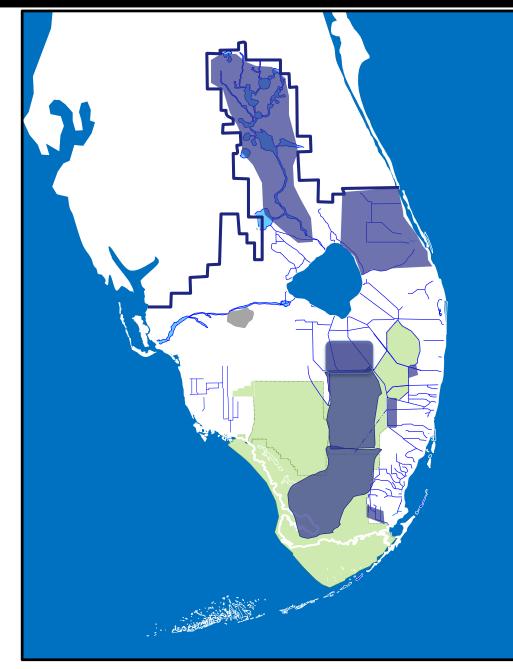
C23/C24 STA

- Storage capacity: 3852 acre-feet
- Footprint: 3323 acres (assumed 2568 effective acres / 80%)

Ten Mile Creek Reservoir and STA

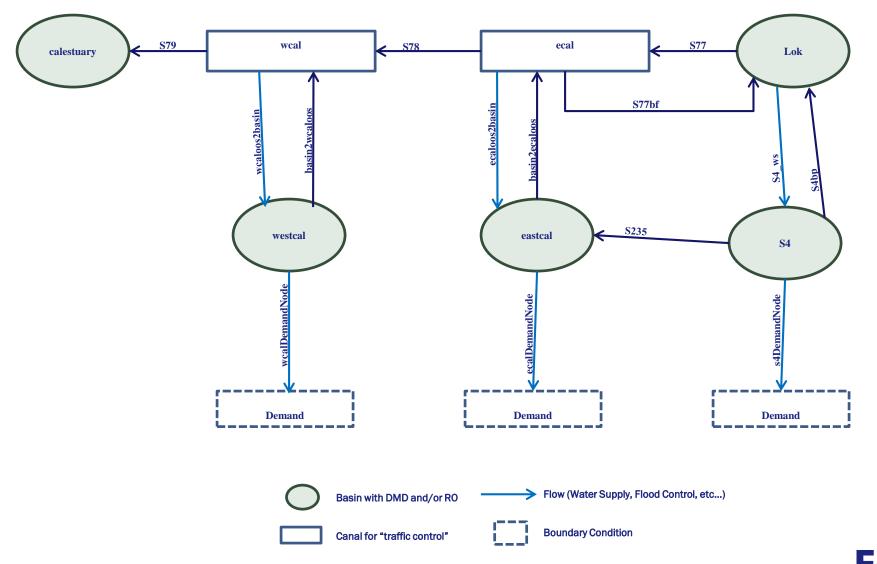
- Storage capacity: 7078 acre-feet
- Footprint: 820 acres (assumed 656 effective acres / 80%)





- Kissimmee Headwaters Revitalization
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Caloosahatchee Basin EARECB in RSMBN





Caloosahatchee EARECB in RSMBN

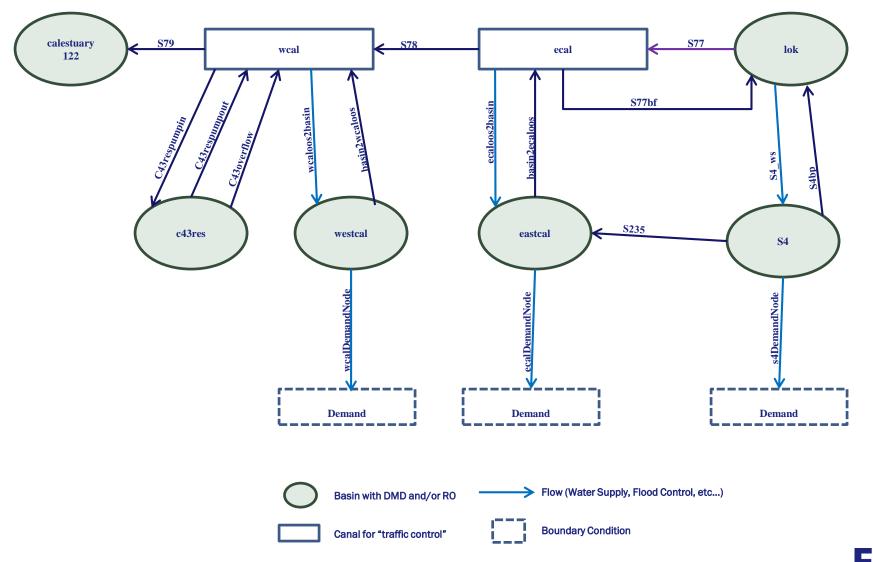
C43 Basin

- S-79 discharges into the Caloosahatchee Estuary.
- C43 Basin runoff has potential to backflow into Lake Okeechobee when Lake stage is below 11.1 feet NGVD.
- C43 Basin supplemental demands for surface water irrigation are met by Lake Okeechobee.





Caloosahatchee Basin EARFWO in RSMBN





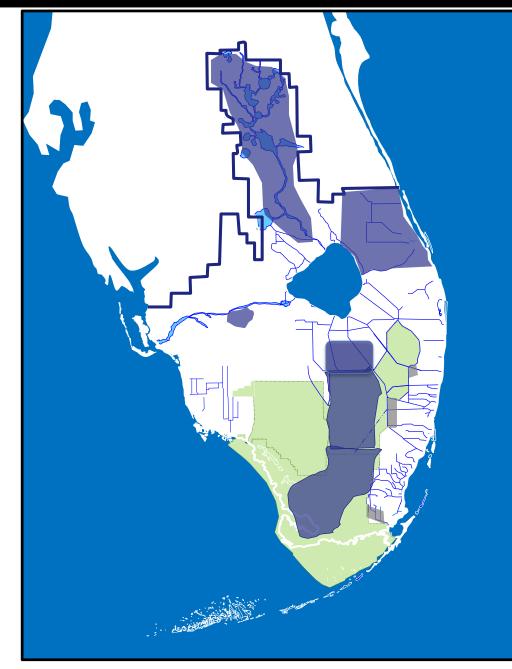
Caloosahatchee EARFWO in RSMBN

C43 Reservoir

- Modeled consistent with September 2007 PIR
- Storage capacity: 175,800 acre-feet
- Maximum footprint: 9,379 acres
- Operates to meet estuary environmental target time-series (EST05)







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Other 1st and 2nd Generation CERP & Foundation Projects

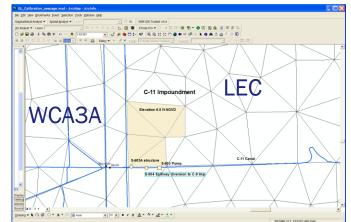
Modeled in a manner consistent with CEPP for EARFWO (examples)

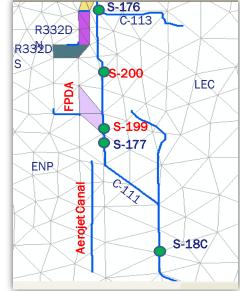
- Broward County WPAs: C11 = 1355 acres, C9 = 1970 acres
- Full construction of C111 South Dade
- S-200 inflow pumps
 - Three 75 cfs pumps divert water to Frog Pond Detention Area (590 Acres)
- S-199 inflow pumps
 - Three 75 cfs pumps divert water to Aerojet Canal

These features not included in EARECB

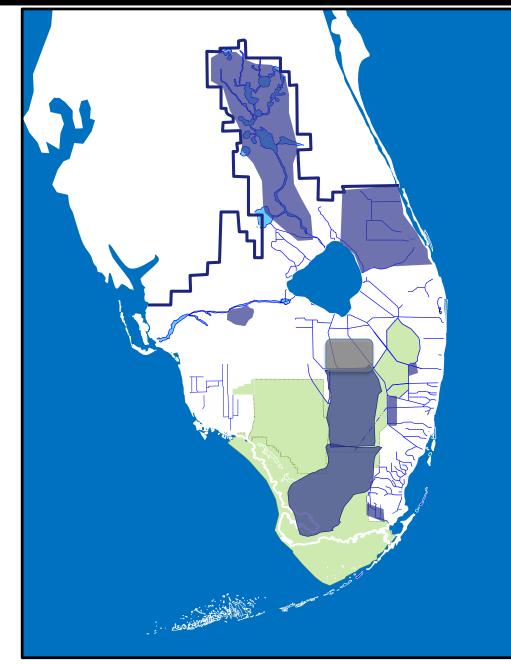
 Partial construction of C111 South Dade
 Stwmd-gov Example: C111 South Dade and C111 Spreader Canal Features

Example: C-11 Broward WPA

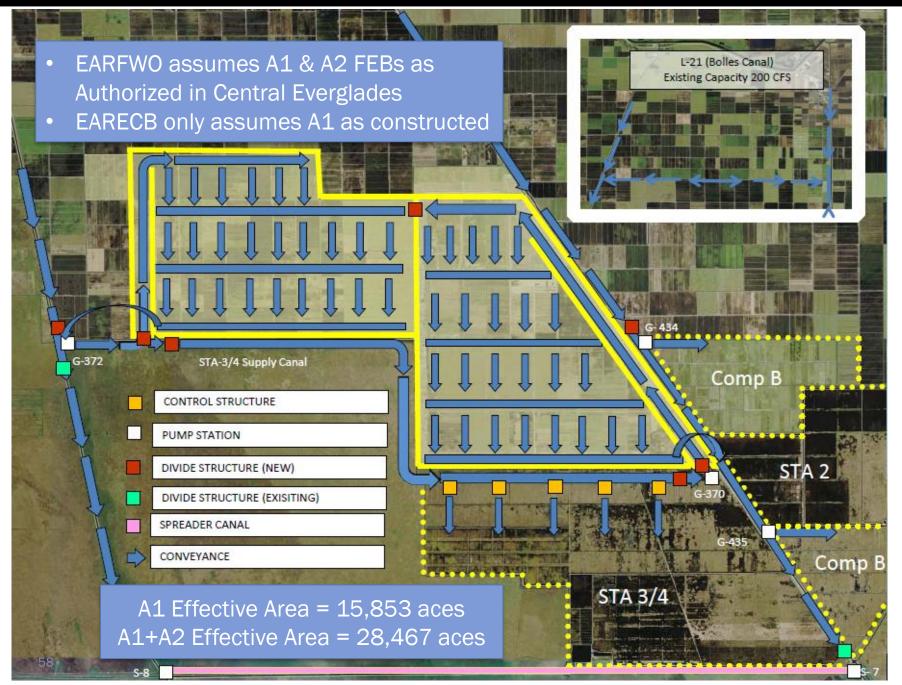




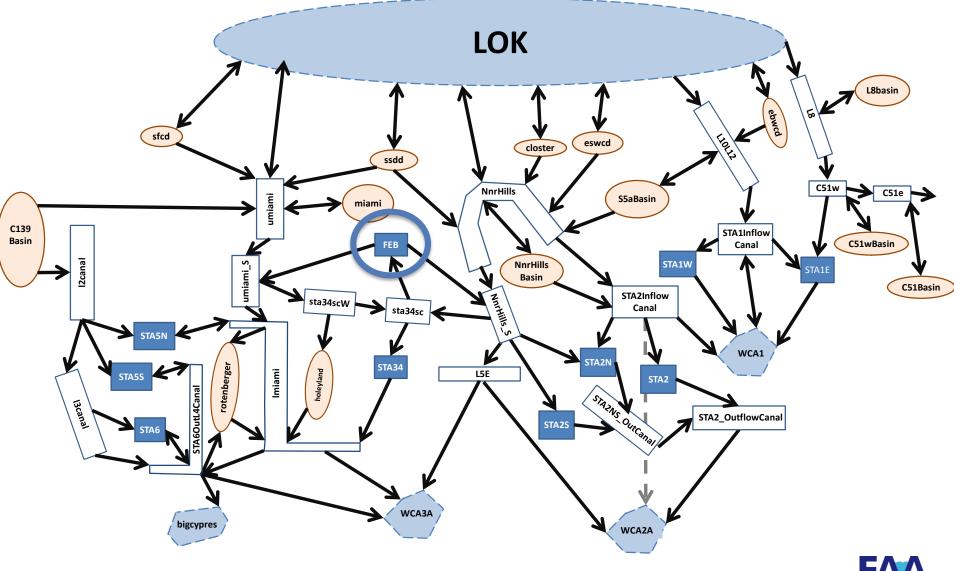




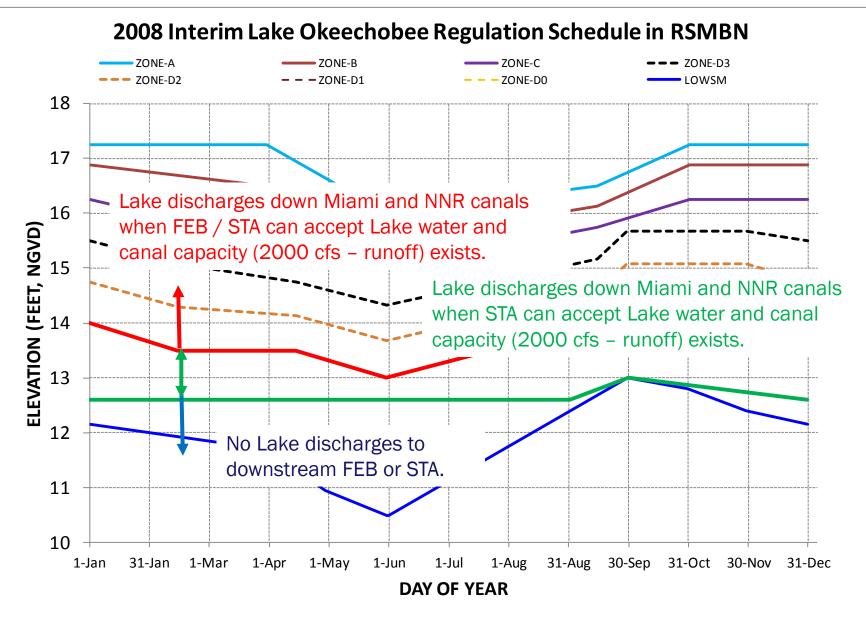
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Everglades Agricultural Area in RSMBN

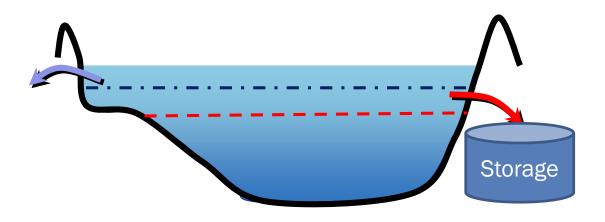








One Challenge to Consider



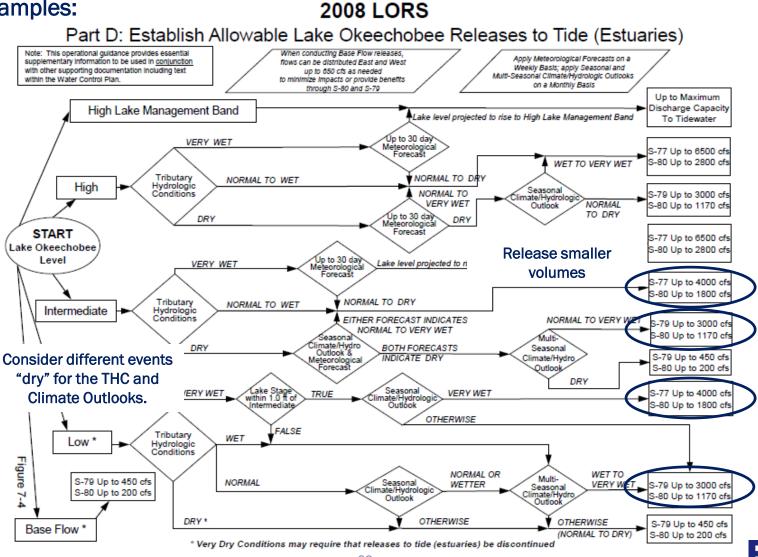
Existing Lake Okeechobee regulatory release protocols balance multiple objectives for Lake and system management. Simply adding discharges to storage in addition to existing regulatory protocols may over-drain the Lake and impact system performance.





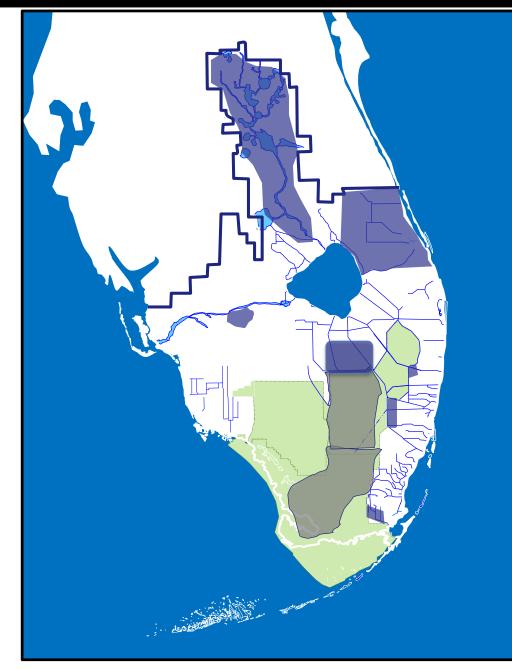
CEPP Utilizes Operational Flexibility within the Existing Lake Okeechobee Regulation Schedule:

Examples:



sfwmd.gov





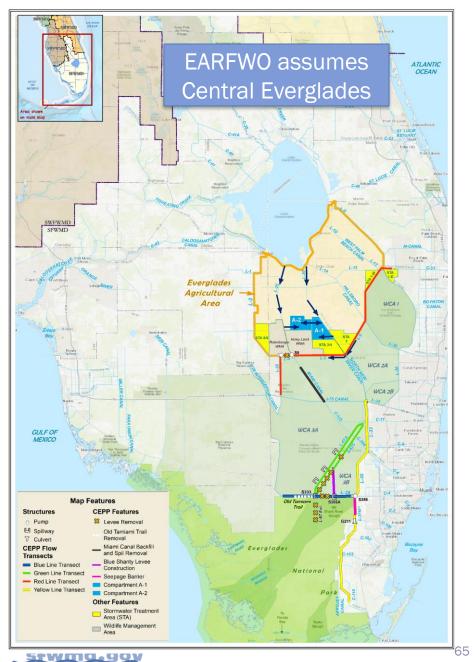
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 Features in the Everglades
 Agricultural Area
- Central Everglades Project Features in the Greater Everglades

Greater Everglades EARECB in RSMGL

- Assumptions Consistent with the CEPP 2012 Existing Condition (2012EC) Baseline
- Water Conservation Area 3A and Everglades National Park Inflow Operations per 2012 Everglades Restoration Transition Plan (ERTP)



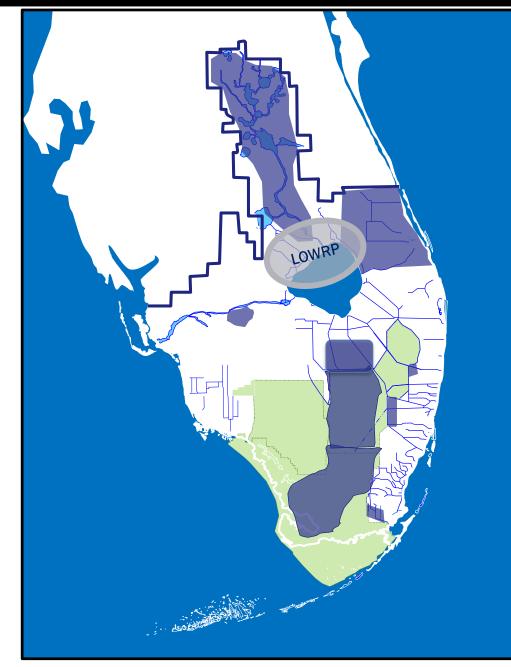




CEPP Recommended Plan ALT 4R2

- PPA New Water
 - A-2 Flow Equalization Basin (FEB)
 - Seepage Barrier, L-31N Levee
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 - S-8 Pump Station Complex Modifications
 - L-4 Levee Degrade and Pump Station
 - Miami Canal Backfill
- PPA South
 - S-333 Spillway Modification
 - L-29 Canal Gated Spillway
 - L-67A Conveyance Structures
 - L-67C Levee Gap
 - L-67C Levee Degrade
 - Blue Shanty Levee, WCA 3B
 - L-29 Levee Degrade
 - L-67 Extension Levee Degrade and Canal Backfill
 - Old Tamiami Trail Removal
 - S-356 Pump Station Modifications
 - System-wide Operations Refinements





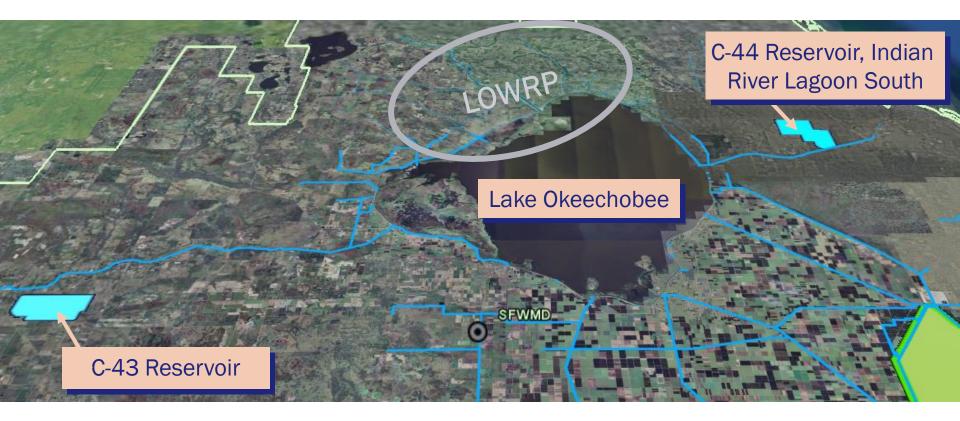
Key System Changes From ECB to FWO

- Kissimmee Headwaters Revitalization
- Indian River Lagoon-South
- C-43 Phase 1 Reservoir
- Other 1st and 2nd Generation CERP & Foundation Projects
- Restoration Strategies / Central Everglades Project Features in the Everglades Agricultural Area
- Central Everglades Project Features in the Greater Everglades

Additional Consideration:

 Lake Okeechobee Watershed Restoration Project (Not assumed in Baselines)

System Perspective



The Comprehensive Everglades Restoration Program (CERP) envisioned a 200 kac-ft above ground reservoir off of Kissimmee / Lake Okeechobee, Aquifer Storage & Recovery (ASR) wells in the Lake Okeechobee vicinity to complement and work with Storage South of Lake Okeechobee





Questions and Discussion





EAA Storage Reservoir Feasibility Study **NEXT STEPS**





Public Meetings

- Project Meetings:
 - November 6th –Plan formulation, modeling results for baseline conditions, array of alternatives
- Other Public Meetings:
 - November 2nd Water Resources Advisory Committee (WRAC) meeting - West Palm Beach
 - November 9th Governing Board Meeting Doral





Public Comment Opportunities

- Public Comments Cards
- Email Address <u>EAAreservoir@sfwmd.gov</u>
- Mailing address:

Mike Albert, Project Manager South Florida Water Management District 3301 Gun Club Road, MSC 8312 West Palm Beach, FL 33406

- Scoping comment period ends November 22, 2017
- Additional information available at <u>www.sfwmd.gov/EAAreservoir</u>





DISCUSSION

www.sfwmd.gov/EAAreservoir



