INTRODUCTION

- Welcome to the 23 June 2017 PDT meeting for the Lake Okeechobee Watershed Restoration Project (LOWRP)
- Attendance – CERP Team and Public
- Housekeeping Items:
  - Callers, please keep phones on mute unless you are talking
  - Attendees in the room, please place your phones on mute
  - Please state your name and who you are representing before making a statement or asking a question
  - REMINDER: This is a CERP PDT meeting and follows FACA Requirements as outlined in CGM 011.02. A Public Comment period has been established at the end of our agenda.
  - Restroom location
- Agenda Overview

AGENDA

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Introduction (*Tim Gysan, USACE and Matt Morrison, SFWMD***)**	**10:00 – 10:10**
90 day look ahead and upcoming engagement opportunities (*Tim Gysan, USACE***)**	**10:10 – 10:20**
Summary of What We've Heard from Stakeholders (*Lisa Aley, USACE***)**	**10:20 – 10:50**
Deep Injection Well Updates (*Lisa Aley, USACE***)**	**10:50 – 11:10**
Initial Round 2 Modeling Results (*Walter Wilcox, SFWMD***)**	**11:10 – 11:45**
Public Comment Period	**11:45 – 12:00**
BREAK for lunch	**12:00 – 1:00**
Water Supply Update (*Chris Graham, USACE***)**	**1:00 – 1:15**
NEPA Analysis (*Gretchen Ehlinger, USACE***)**	**1:15 – 1:45**
Habitat Unit Calculations (*Gretchen Ehlinger, USACE and Steve Schubert, USFWS***)**	**1:45 – 2:15**
Adaptive management monitoring plan (*Gretchen Ehlinger, USACE***)**	**2:15 – 2:30**
Geotechnical Survey Overview (*Joel Gaillard, USACE***)**	**2:30 – 2:40**
Cultural Resources Survey Overview (*Robin Moore, USACE***)**	**2:40 – 2:50**
Tribal Perspectives - Open forum for comments and statements	**2:50 – 3:05**
Government/Agency Perspectives - Open forum for comments and statements	**3:05 – 3:25**
Public Comment Period	**3:25 – 3:55**
Closing remarks and Adjourn	**3:55 – 4:00**

90 DAY LOOK AHEAD

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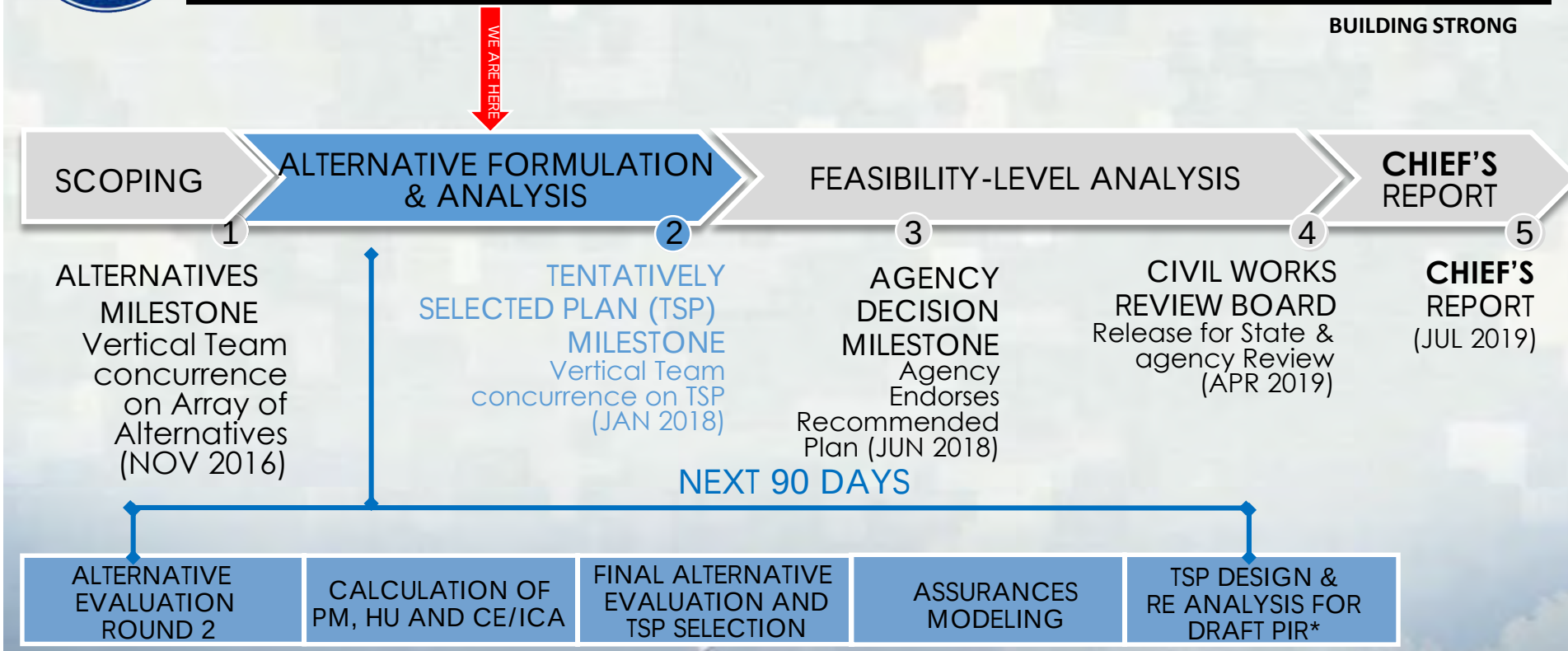

* Draft PIR scheduled to be available for internal PDT review 13 NOV 17

Upcoming Engagement Opportunities

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- SFWMD Governing Board – West Palm Beach July 13, 9am
- LOWRP Planning Workshop – Okeechobee July 27, 1 - 4pm
- LOWRP Planning Workshop – West Palm Beach July 28, 9am - 12pm
- SFWMD Governing Board – West Palm Beach August 3, 9am
- Water Resources Advisory Commission – West Palm Beach August 3, 9am
- LOWRP PDT TSP Selection Meeting – Okeechobee August 16, TBD

WHAT WE'VE HEARD

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Summary of comments received from letters, emails, sub-team coordination, and public comment from stakeholders

Include water supply for agriculture, industrial, municipal and tribal use as a project objective
- Florida Department of Agriculture and Consumer Services (FDACS)
- Seminole Tribe of Florida (STOF)
- Department of Interior (DOI)
- Florida Wildlife Federation
- United States Sugar Corporation (USCS)
- Florida Crystals Corporation

*NGOs- support water supply as an ***ancillary*** project benefit

Minimize private agricultural land taken out of production and maximize use of publicly owned lands
- Local landowners
- FDACS
- Florida Wildlife Federation
- Florida Farm Bureau Federation

Minimize impacts to fisheries at intake structures
- Florida Fish and Wildlife Conservation Commission (FWC)
- U.S. Fish and Wildlife Service (USFWS)

Include water quality treatment features
- Miccosukee Tribe of Indians
- Florida Wildlife Federation
- Public stakeholders via public comments and email

Support for Paradise Run Restoration
- Florida Wildlife Federation
- FWC

*National Parks Conservation Association, Conservancy of Southwest Florida, Friends of the Everglades, Audubon Florida, Florida Oceanographic Society, Everglades Law Center, Sierra Club, Everglades Foundation, Sanibel Captiva Conservation Foundation

WHAT WE'VE HEARD
Stakeholders, Agencies Public Comments

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Operational Considerations

- Optimize Lake Okeechobee Regulation Schedule to improve operational flexibility of the water management system with proposed LOWRP features
  - FDACS
  - Florida Crystals Corporation
- Concerns with lake level excursions above 17.25 feet shown in initial modeling results
  - *NGOs

*National Parks Conservation Association, Conservancy of Southwest Florida, Friends of the Everglades, Audubon Florida, Florida Oceanographic Society, Everglades Law Center, Sierra Club, Everglades Foundation, Sanibel Captiva Conservation Foundation

WHAT WE'VE HEARD
Seminole Tribe of Florida

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Water entitlements need to be met

- Want to consult on operational criteria assumptions in modeling
- Fewer cutbacks during drought operations

Concerns with all reservoir locations, especially K05 North and K05 South (directly adjacent to tribal lands)

- Concern with impacts to water entitlement
- Potential seepage from reservoirs and flooding of adjacent lands
- Concern over environmental impacts: displacement of endangered species from reservoir areas onto tribal lands, decrease in ecological connectivity, wetland impacts
- THPO -potential for cultural resources in project area
- Impacts to cultural activities (including hunting, fishing, and frogging)
- Look at other locations besides current proposed locations that are in close proximity of Brighton Reservation

Cumulative impacts with the LOWRP and other water storage projects

- Changes in habitat, land use, displacement of T&E species, entitlement, flood protection

Concerns with success of ASR within the project area and potential effects to biota

Water quality impacts

WHAT WE'VE HEARD

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Input from Miccosukee Tribe of Indians during Government to Government Consultation

- Do not support underground storage including ASR wells or Deep Injection Wells
- Supportive of above-ground water storage
- Water quality concerns
- Maximize wetland restoration
- Potential for cultural resources in project area

WHAT WE'VE HEARD
Stakeholder Comments

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Deep Injection Wells (DIWs)

Remove from Consideration

- Audubon Florida
- Everglades Foundation
- Florida Wildlife Federation
- National Parks Conservation Association
- Sanibel Captiva Conservation Foundation
- Florida Wildlife Federation
- Florida Oceanographic Society
- Everglades Law Center
- Sierra Club
- Public comments in PDTs and via email

Support Inclusion

- Florida Crystals Corporation
- Florida Farm Bureau Federation
- Florida Department of Agriculture and Consumer Services (FDACS)
- United States Sugar Corporation (USCS)
- Florida Fruit & Vegetable Association

DEEP INJECTION WELL FORMULATION

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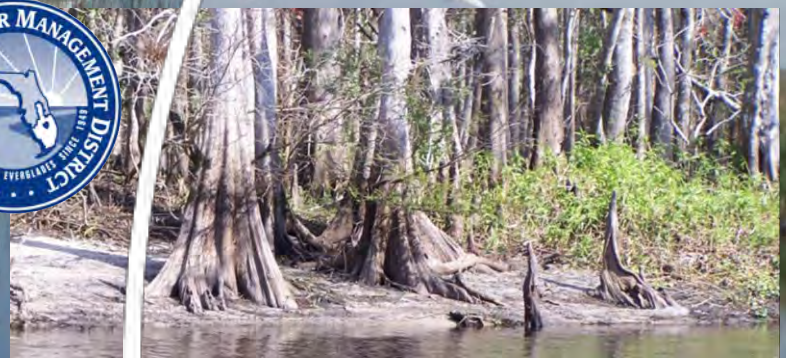
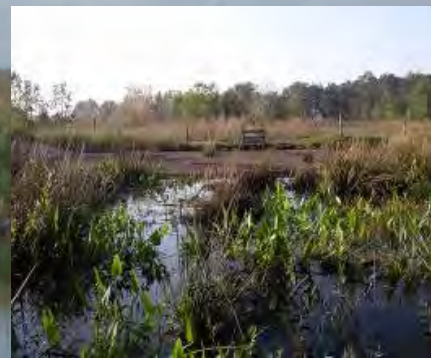
- DIWs were not a component in the evaluation in the 1999 Comprehensive Everglades Restoration Plan (CERP) PIR/EIS
- In order to evaluate the potential effects of DIWs within CERP and potential effects on other CERP Projects, a comprehensive regional analysis needs to be performed.
- This comprehensive regional analysis cannot be undertaken within the constraints of the LOWRP scope, schedule or budget to meet the Corps planning milestones.
- Due to these reasons as well as the need to understand how DIWs may perform within the context of ecosystem restoration, the Corps screened DIWs from further consideration within LOWRP.

LAKE OKEECHOBEE WATERSHED RESTORATION PROJECT

Modeling Sub-Team

Second Round Alternative Array
June 23, 2017





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SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Lake Okeechobee Watershed Restoration Project Ongoing Progress

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- The Lake Okeechobee Watershed Restoration Project (LOWRP) performed extensive screening-level modeling using RESOPS in late 2016 to identify feasible features and sizes that could meet project objectives of improving Lake Okeechobee, L.O. watershed and Northern Estuary conditions.
- Detailed hydrologic modeling using RSMBN is currently underway in support of LOWRP.
- Detailed RSMBN model baseline scenarios representing the Existing Condition (ECB) and Future Without LOWRP (FWO) were released on February 2, 2017.
- A first round of three alternatives with potential LOWRP project features modeled in RSMBN was released on March 8, 2017 and a summary presentation made to the Project Delivery Team (PDT) on March 15, 2017.
- A second round of four alternatives with potential LOWRP project features modeled in RSMBN was released on June 21, 2017 and a summary presentation made to the Project Delivery Team (PDT) on June 23, 2017 (today's presentation).
- It is anticipated that review and ecological & economic evaluation of these outcomes will help to inform identification of a Tentatively Selected Plan (TSP) by August.

Background:
Regional Modeling Approach

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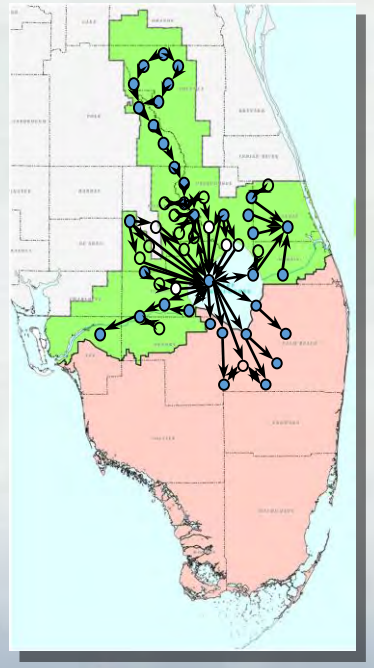
Scenario

- Climatic Input
  - Rainfall
  - ET
- Boundary Conditions

Period of record:
1965-2005



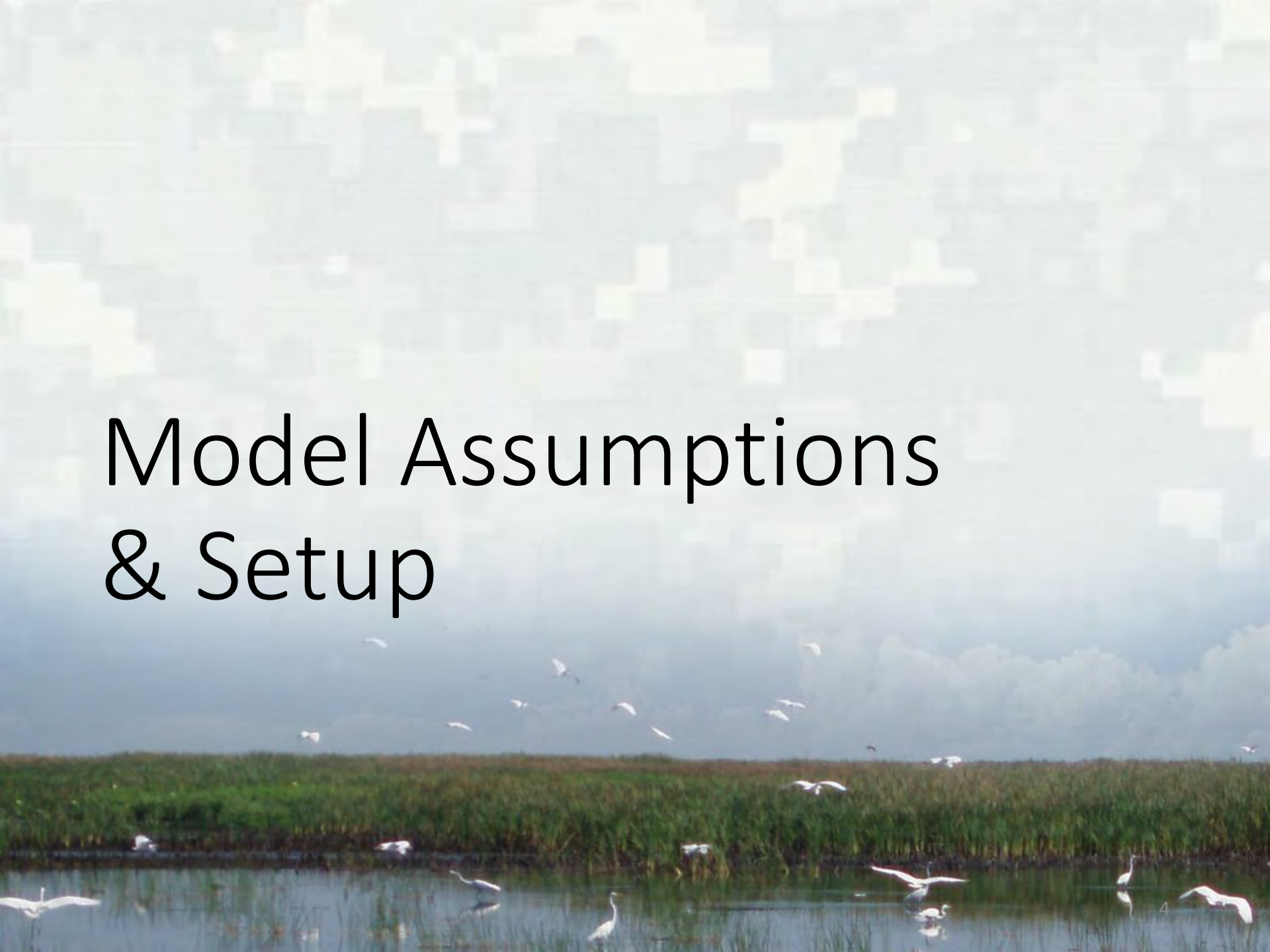
- Project Features
- Operating Criteria

Model Output

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

Evaluation (Environmental, Water Supply, etc…)

Model Assumptions & Setup



INITIAL ARRAY OF ALTERNATIVES

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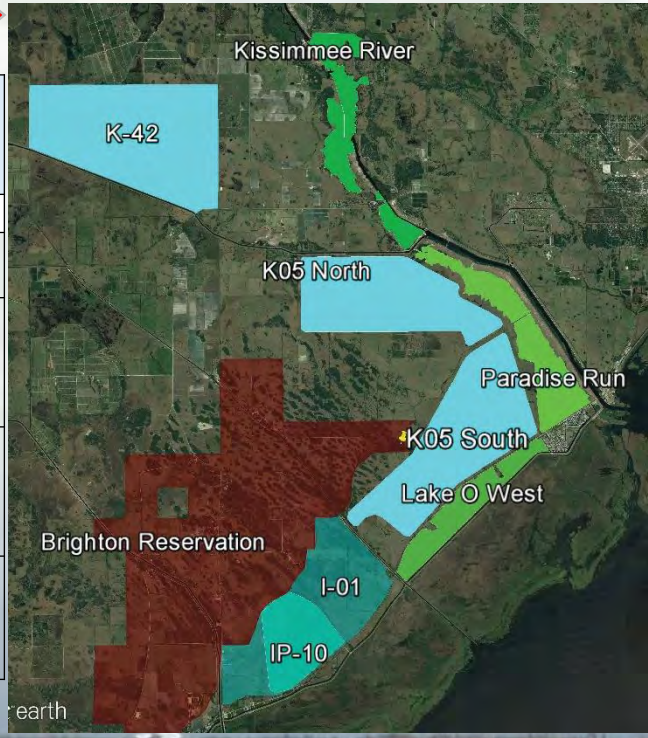
1st round of modeling and benefits calculation to optimize water storage and recovery for improvement in high and low lake stages and estuary releases,

2nd round of modeling and benefits calculation to optimize water management measures for improvement in undesirable regulatory discharges to northern estuaries along with wetland restoration measures

1ST ROUND OF MODELING

2ND ROUND OF MODELING

Alternative	Reservoir Component		ASR Component	DIW Component	Compatable Wetland Components
	Reservoir (s)	Storage Capacity (acre-feet)	# of ASR wells (assuming 5 mgd capacity)	# of DIWs (assuming 15 mgd capacity)	
No Action (FWO)					
Alternative 1	**K05 (North and South)**	**258K**	**110**	30-90	Kissimmee River Paradise Run
Alternative 2	**K-05 (North and South) and K-42**	**408K**	**110**	0	Kissimmee River Paradise Run Lake O West IP-10
Alternative 2b	K-05 North and K-42	264K	110	30-90	Kissimmee River Paradise Run Lake O West IP-10
Alternative 3	**K-42 and I-01**	**254K**	**112**	30-90	Kissimmee River Paradise Run Lake O West



Evaluated in 1st Round of Modeling

Second Round OF ALTERNATIVES

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2nd round of modeling and benefits calculation to optimize water management measures for improvement in undesirable regulatory discharges to northern estuaries along with wetland restoration measures

2ND ROUND OF MODELING

Alternative	Reservoir Component		ASR Component	
	Reservoir (s)	Storage Capacity (acre-feet)	# of ASR wells [UFA:APPZ]	Storage Capacity (acre-feet/yr)
No Action (FWO)				
Alternative 1b	**Revised K-05 (North and South)**	**190K**	**80 [50:30]**	**448K**
Alternative 2a	**Revised K-05 (North and South) and K-42**	**361K**	**110 [60:50]**	**616K**
Alternative 2b	**Revised K-05 North and K-42**	**276K**	**70 [50:20]**	**392K**
Alternative 2c	**K-42**	**171K**	**50 [40:10]**	**280K**

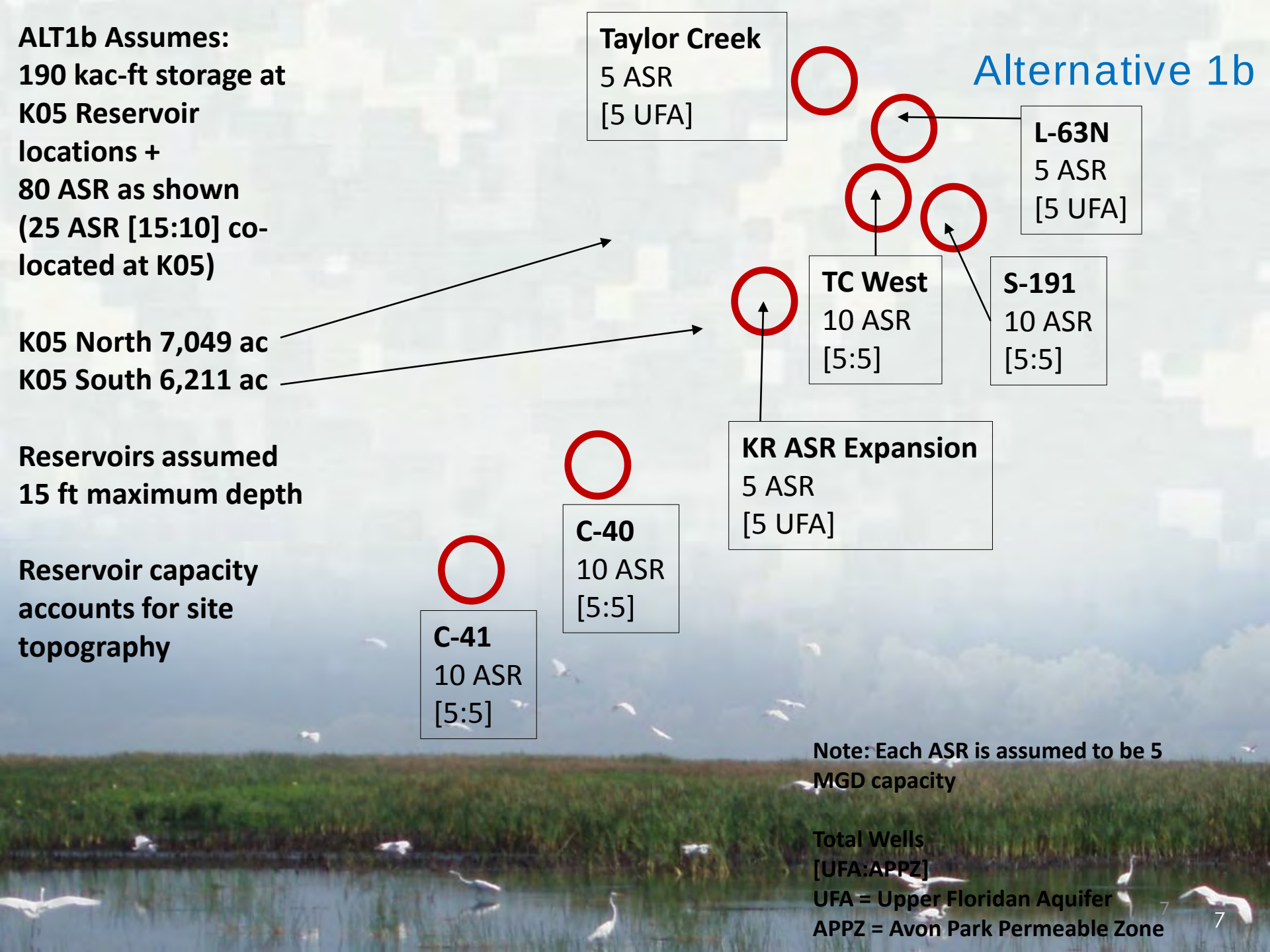
Alternative 1b

ALT1b Assumes:
190 kac-ft storage at K05 Reservoir locations +
80 ASR as shown (25 ASR [15:10] co-located at K05)

K05 North 7,049 ac
K05 South 6,211 ac

Reservoirs assumed 15 ft maximum depth

Reservoir capacity accounts for site topography



Note: Each ASR is assumed to be 5 MGD capacity

Total Wells [UFA:APPZ]
UFA = Upper Floridan Aquifer
APPZ = Avon Park Permeable Zone

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Alternative 2a

ALT2a Assumes:
361 kac-ft storage at K05 and K42
Reservoir locations + 110 ASR as shown (30 ASR [20:10] co-located at K05)

K42 11,339 ac
K05 North 7,049 ac
K05 South 6,211 ac

Reservoirs assumed 15 ft maximum depth

Reservoir capacity accounts for site topography

Taylor Creek
10 ASR
[5:5]

L-63N
10 ASR
[5:5]

TC West
10 ASR
[5:5]

S-191
10 ASR
[5:5]

Lakeside Ranch
10 ASR
[5:5]

C-40
10 ASR
[5:5]

C-41
10 ASR
[5:5]

KR ASR Expansion
10 ASR
[5:5]

Note: Each ASR is assumed to be 5 MGD capacity

Total Wells
[UFA:APPZ]
UFA = Upper Floridan Aquifer
APPZ = Avon Park Permeable Zone

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Alternative 2b

ALT2b Assumes:
276 kac-ft storage at K05 North and K42 Reservoir locations + 70 ASR as shown (10 ASR [10 UFA] co-located at K05)

K42 11,339 ac
K05 North 7,049 ac

Reservoirs assumed 15 ft maximum depth

Reservoir capacity accounts for site topography

Taylor Creek
5 ASR
[5 UFA]

L-63N
5 ASR
[5 UFA]

TC West
10 ASR
[5:5]

S-191
10 ASR
[5:5]

Lakeside Ranch
5 ASR
[5 UFA]

C-40
10 ASR
[5:5]

KR ASR Expansion
5 ASR
[5 UFA]

C-41
10 ASR
[5:5]

Note: Each ASR is assumed to be 5 MGD capacity

Total Wells
[UFA:APPZ]
UFA = Upper Floridan Aquifer
APPZ = Avon Park Permeable Zone

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Alternative 2c

ALT2c Assumes:
171 kac-ft storage at K42 Reservoir location +
50 ASR as shown

K42 11,339 ac

Reservoirs assumed 15 ft maximum depth

Reservoir capacity accounts for site topography

Taylor Creek
10 ASR
[5:5]

L-63N
5 ASR
[5 UFA]

TC West
5 ASR
[5 UFA]

S-191
5 ASR
[5 UFA]

Lakeside Ranch
5 ASR
[5 UFA]

KR ASR Expansion
10 ASR
[5:5]

C-40
5 ASR
[5 UFA]

C-41
5 ASR
[5 UFA]

Note: Each ASR is assumed to be 5 MGD capacity

Total Wells
[UFA:APPZ]
UFA = Upper Floridan Aquifer
APPZ = Avon Park Permeable Zone

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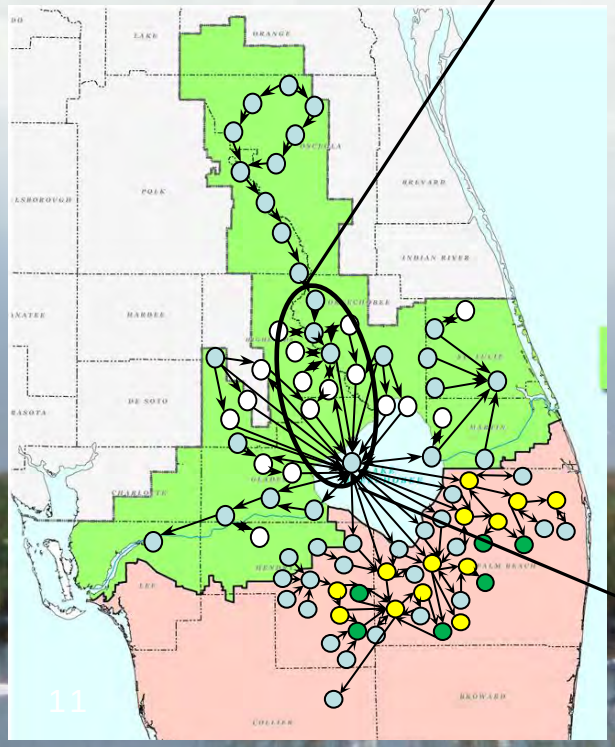
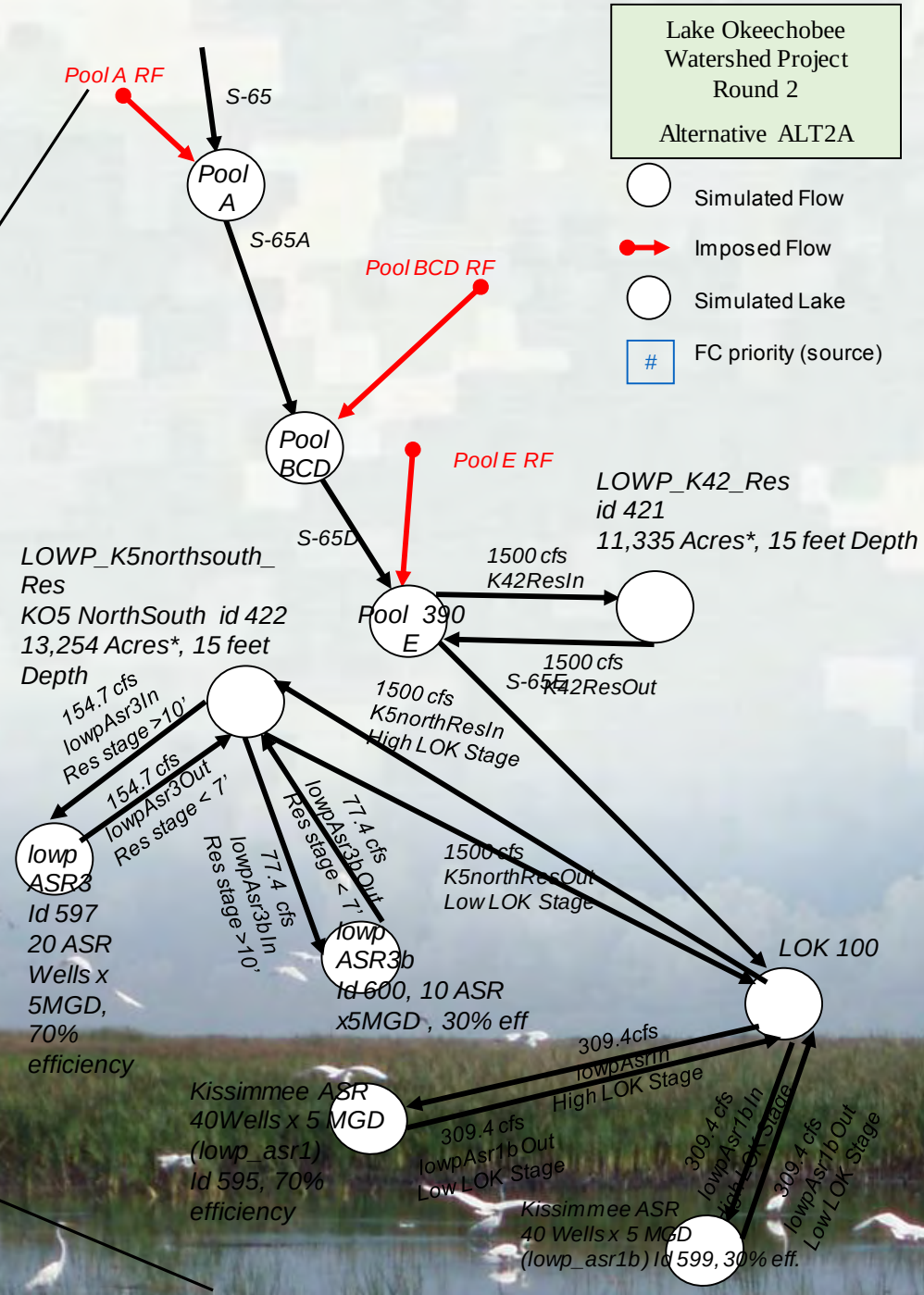
Example Modeling Detail Showing Assumed Lower Kissimmee Basin & Lake Okeechobee Inflow Routing for ALT1B Scenario





Operational Considerations in LOWRP

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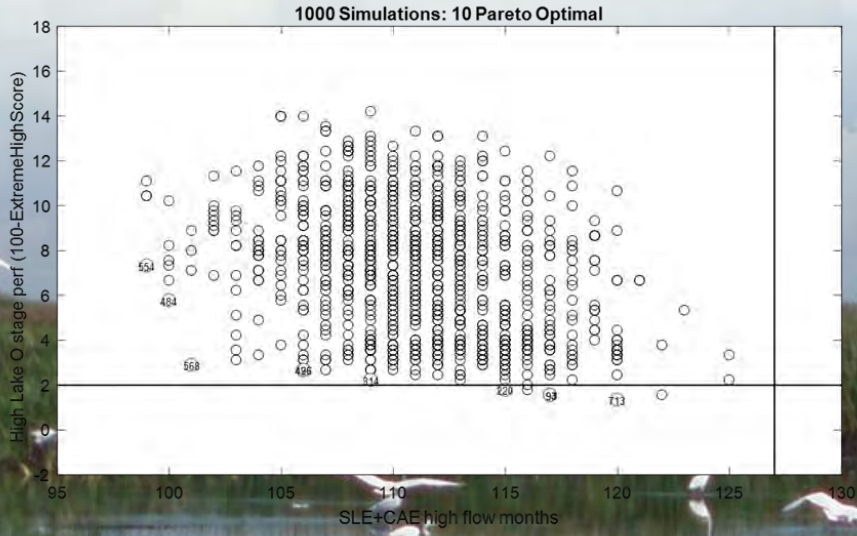
- In addition to infrastructure assumptions, there is a need to define rules for diverting water to and recovering water from reservoir and ASR storage.
- Also, as storage is added and system infrastructure capability is increased, it makes sense to develop optimized Lake Okeechobee schedule rules that work with storage and focus on the events beyond what storage or conveyance south can handle.
- Approximately 30 parameters affecting the Lake Okeechobee decision outcomes (e.g. “up-to” limits, classification of tributary conditions, etc…) along with a variety of storage diversion and recovery lines were analyzed.
- Constrained and unconstrained Latin Hypercube sampling techniques were used to explore 10,000 unique operational strategies per ALT.
- Selected operations were identified using acceptable performance criteria (e.g. Lake O and Estuary PMs) and Pareto analysis.



Model Results Summary

Examples of Available Water Budget Maps

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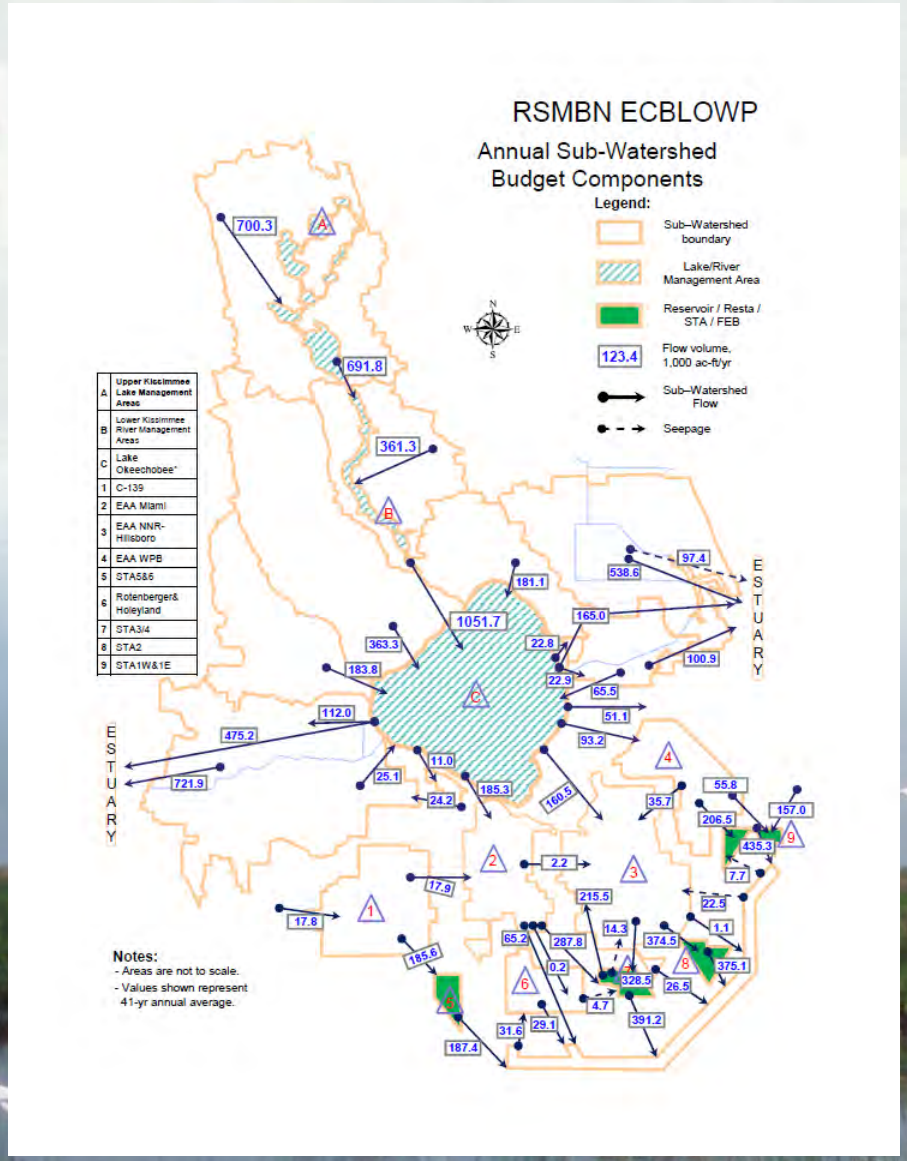
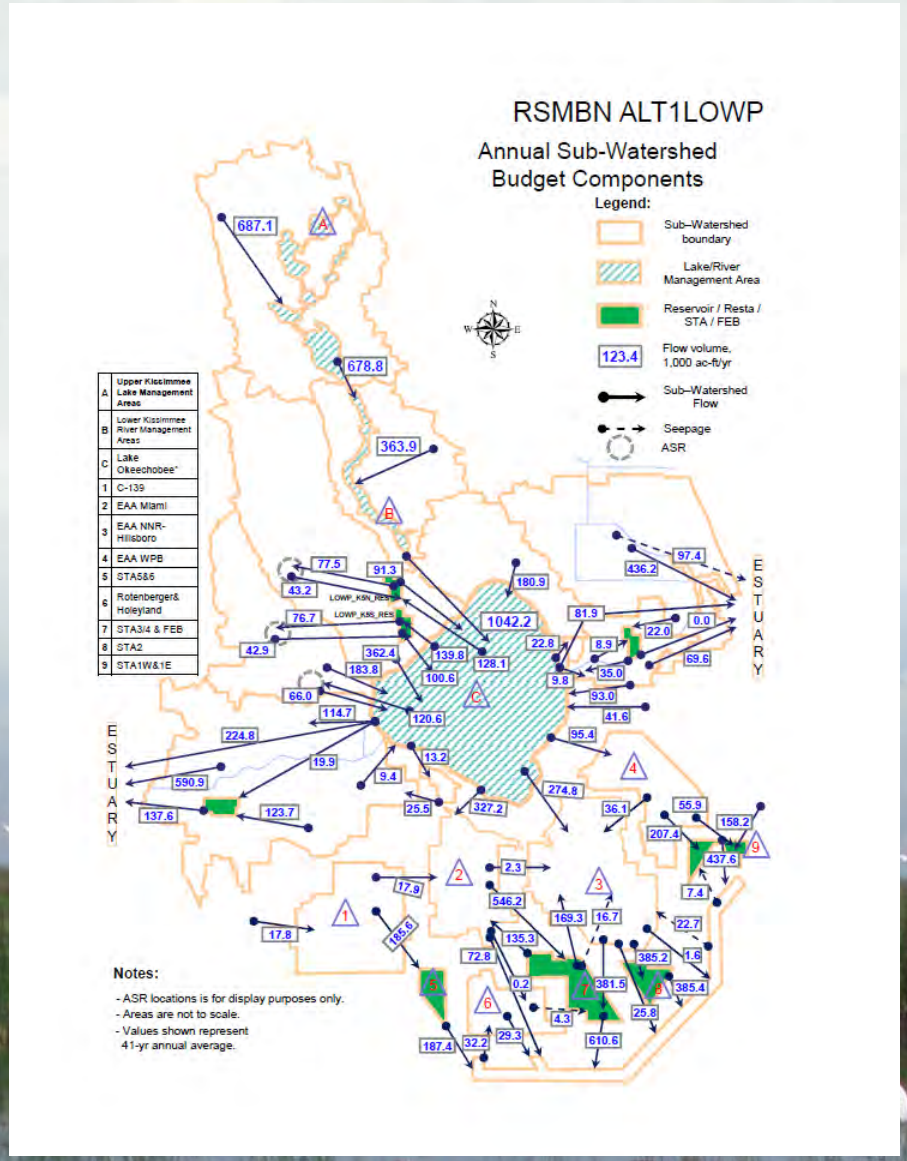
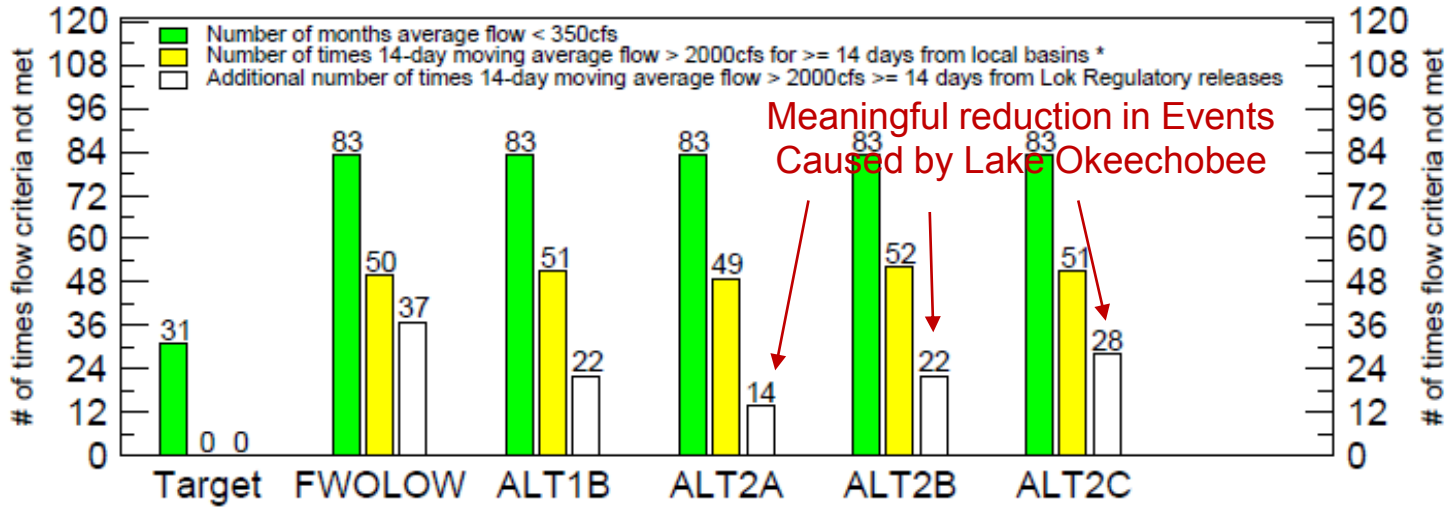
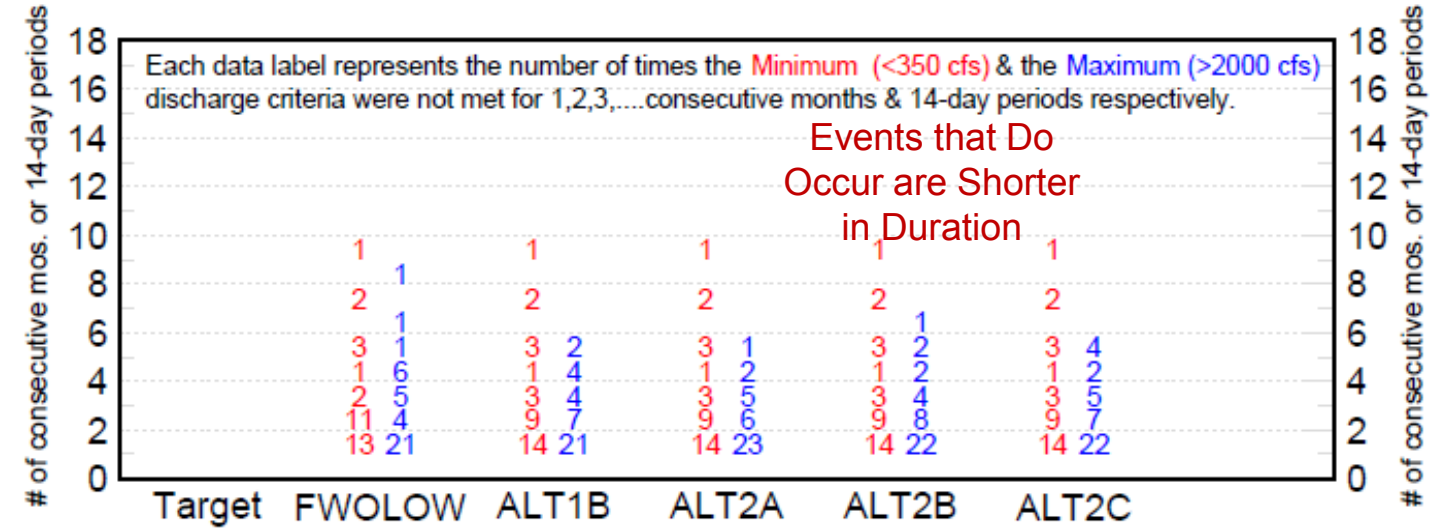




Number of times Salinity Envelope Criteria NOT Met for the St. Lucie Estuary (mean monthly flows 1965 - 2005)





RECOVER Performance Measure

Run date: 06/05/17 10:31:58
RSMBN
Script used: estuary.scr, ID496
Filename: stluc_salinity_flow_bar.out.agr

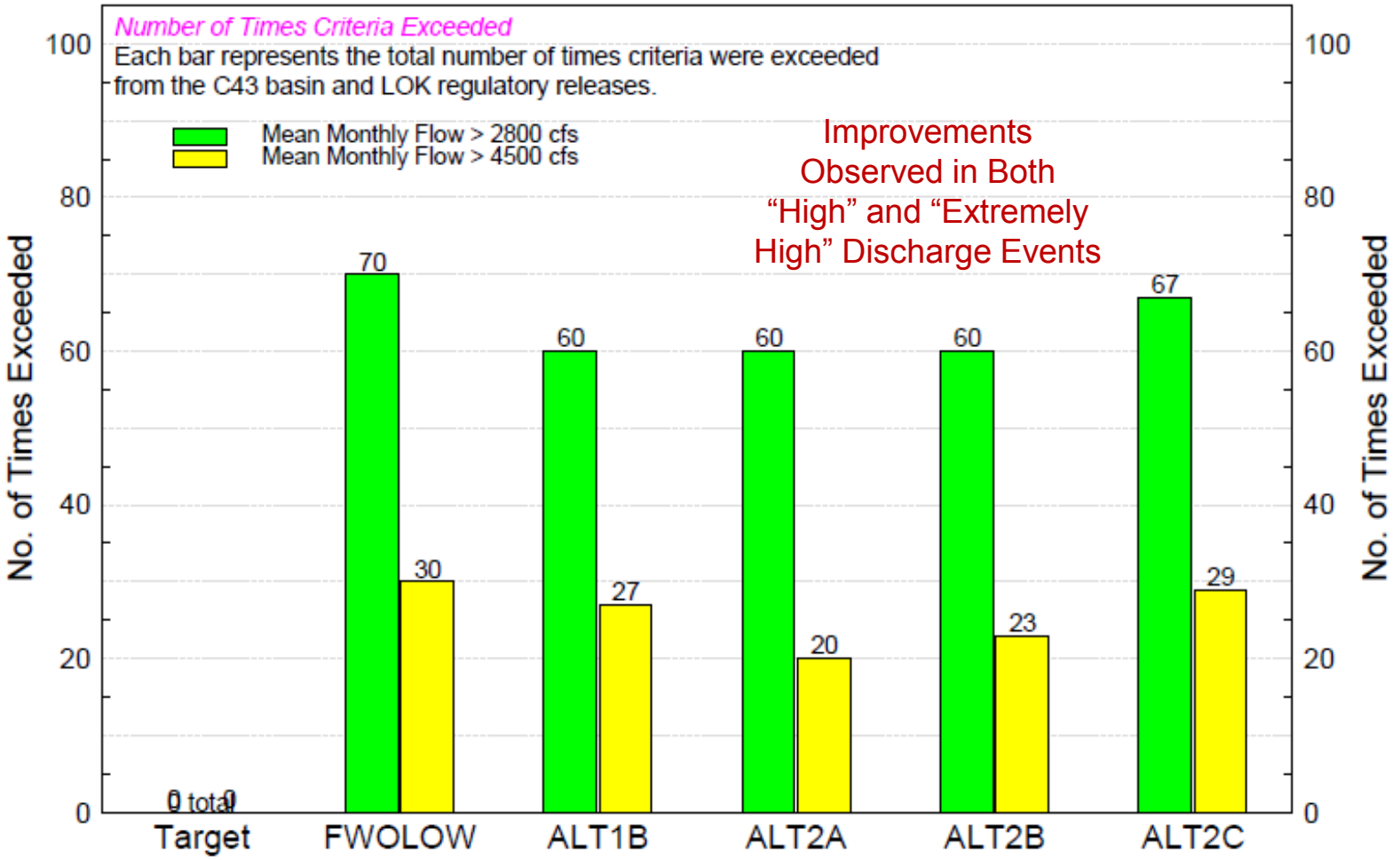

Improvements Observed in Both "High" and "Extremely High" Discharge Events
57 Total
51 Total
Note: In the FWO, a combined 37 Events are a Result of Basin Runoff
46 Total
41 Total
47 Total

Meaningful reduction in Events Caused by Lake Okeechobee

Note: In the FWO, a combined 47 Events are a Result of Basin Runoff

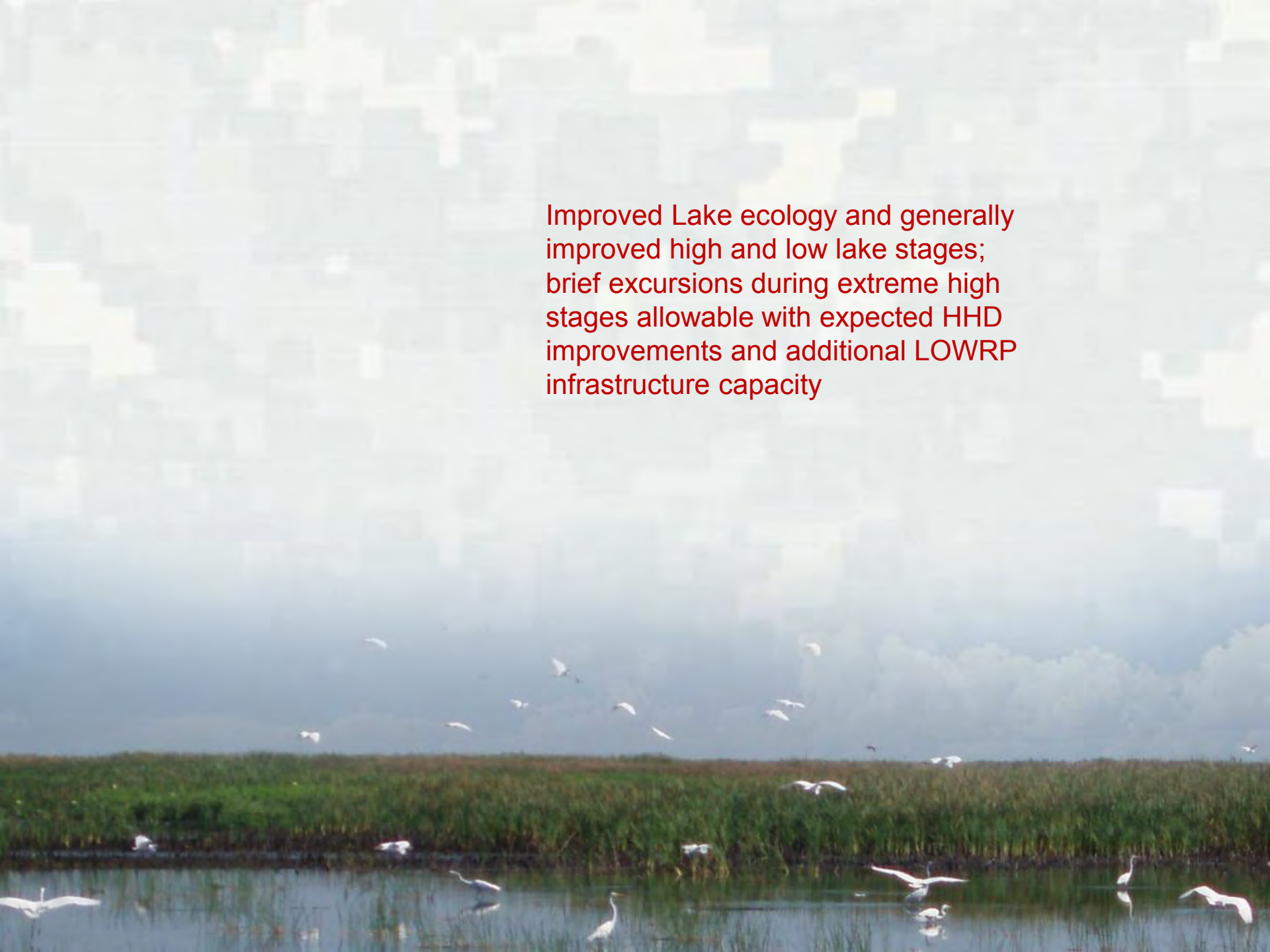
Events that Do Occur are Shorter in Duration

Number of Times Caloosahatchee Estuary High Discharge Criteria Exceeded
(mean monthly flows > 2800 & 4500 cfs from 1965 - 2005)



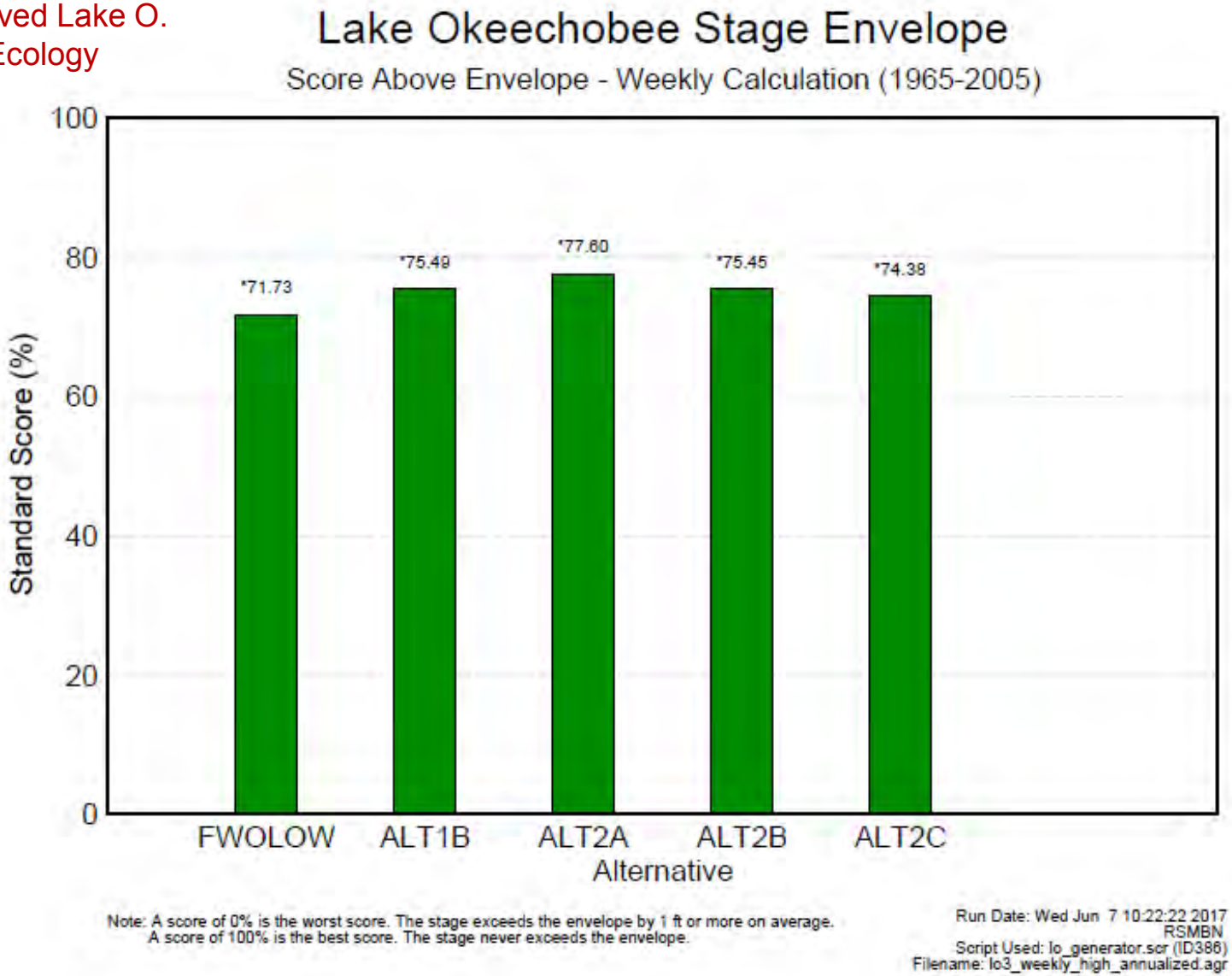
RECOVER Performance Measure

Run date: 06/05/17 10:31:59
RSMBN
Script used: estuary.scr, ID496
Filename: caloos_2800_4500_flow_bar.out.agr

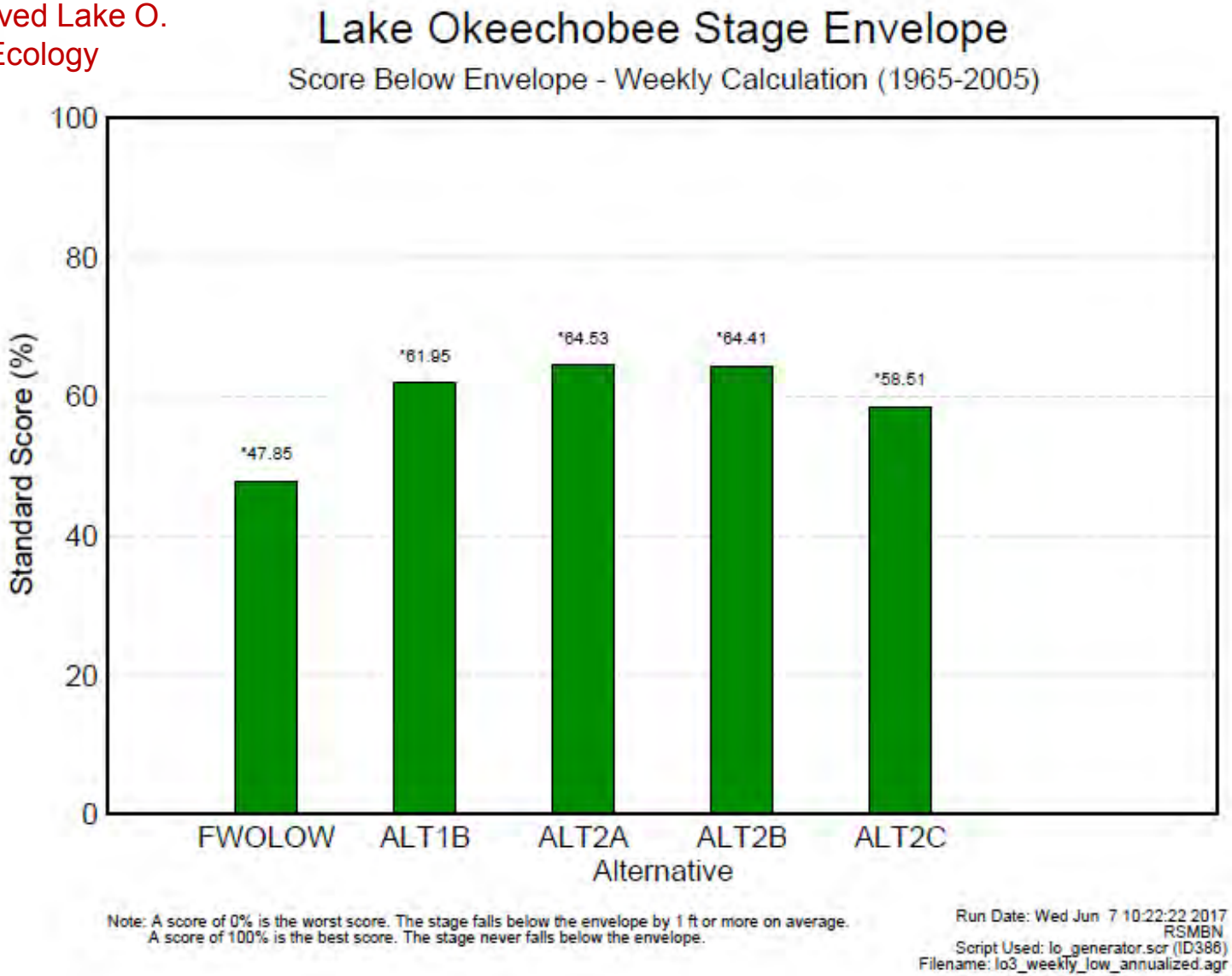


Improved Lake ecology and generally improved high and low lake stages; brief excursions during extreme high stages allowable with expected HHD improvements and additional LOWRP infrastructure capacity

Higher Scores = Improved Lake O. Ecology

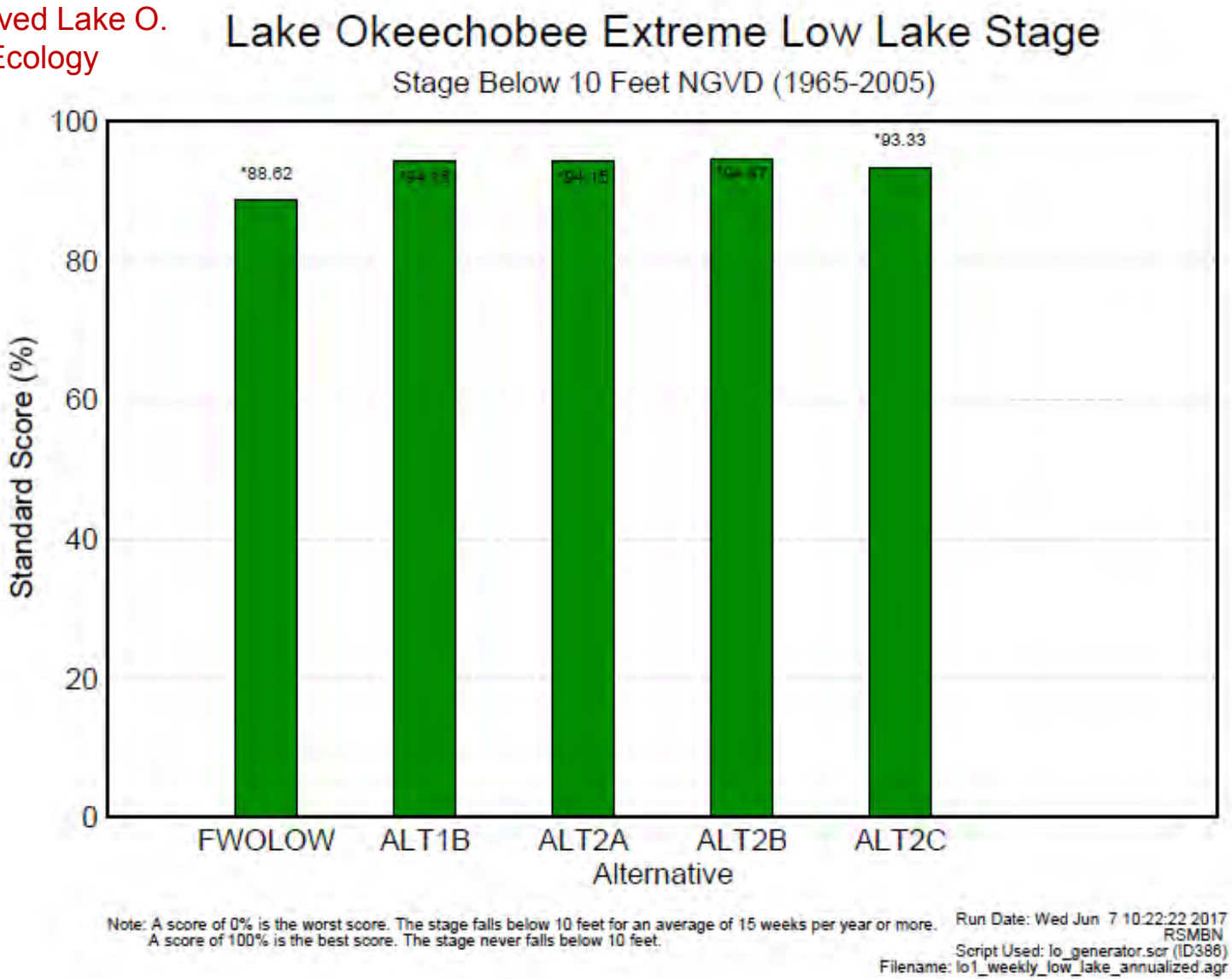


Higher Scores = Improved Lake O. Ecology

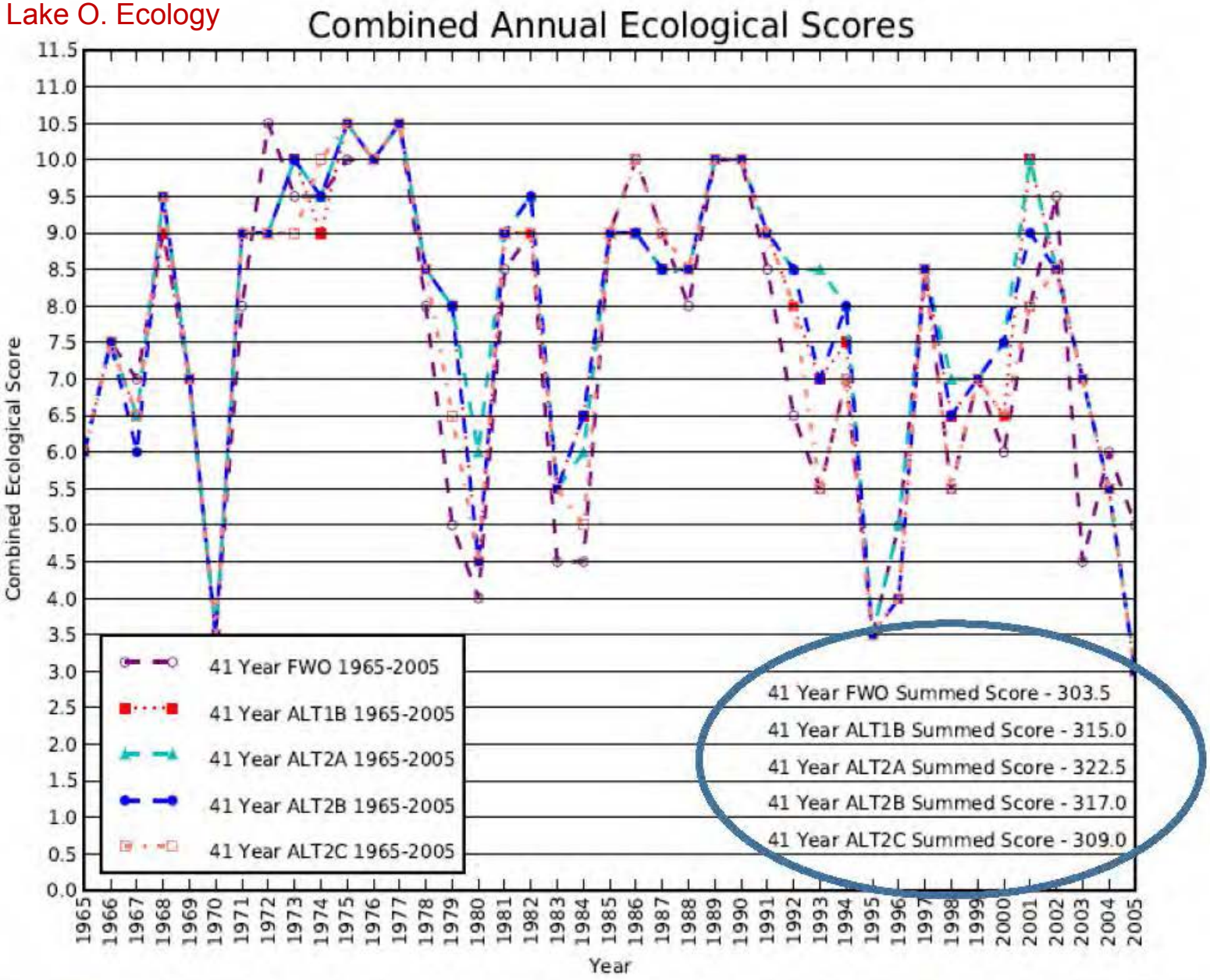


Higher Scores =
Improved Lake O.
Ecology

Higher Scores = Improved Lake O. Ecology

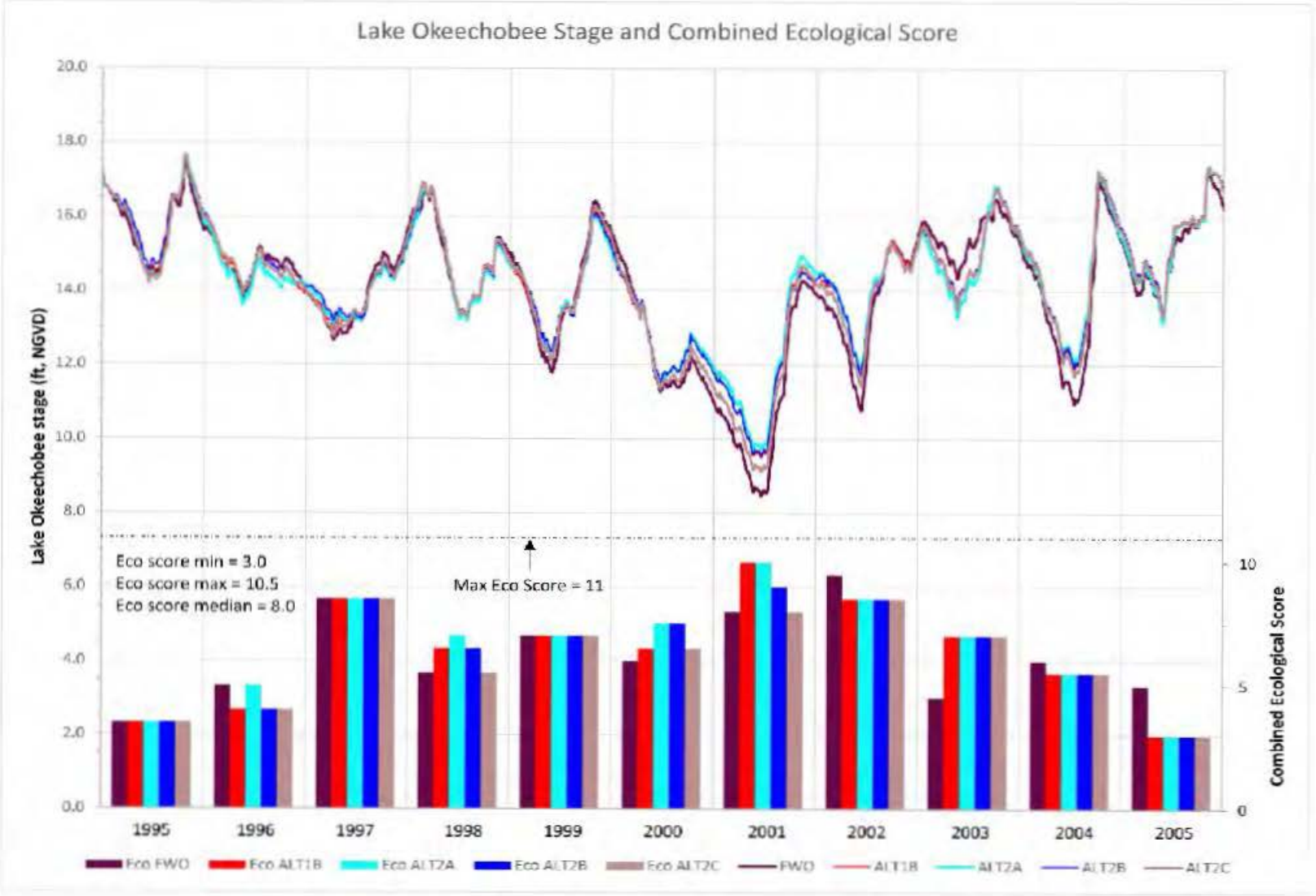


Higher Scores = Improved Lake O. Ecology



Additional Detail: Examining a Generally Wetter Period

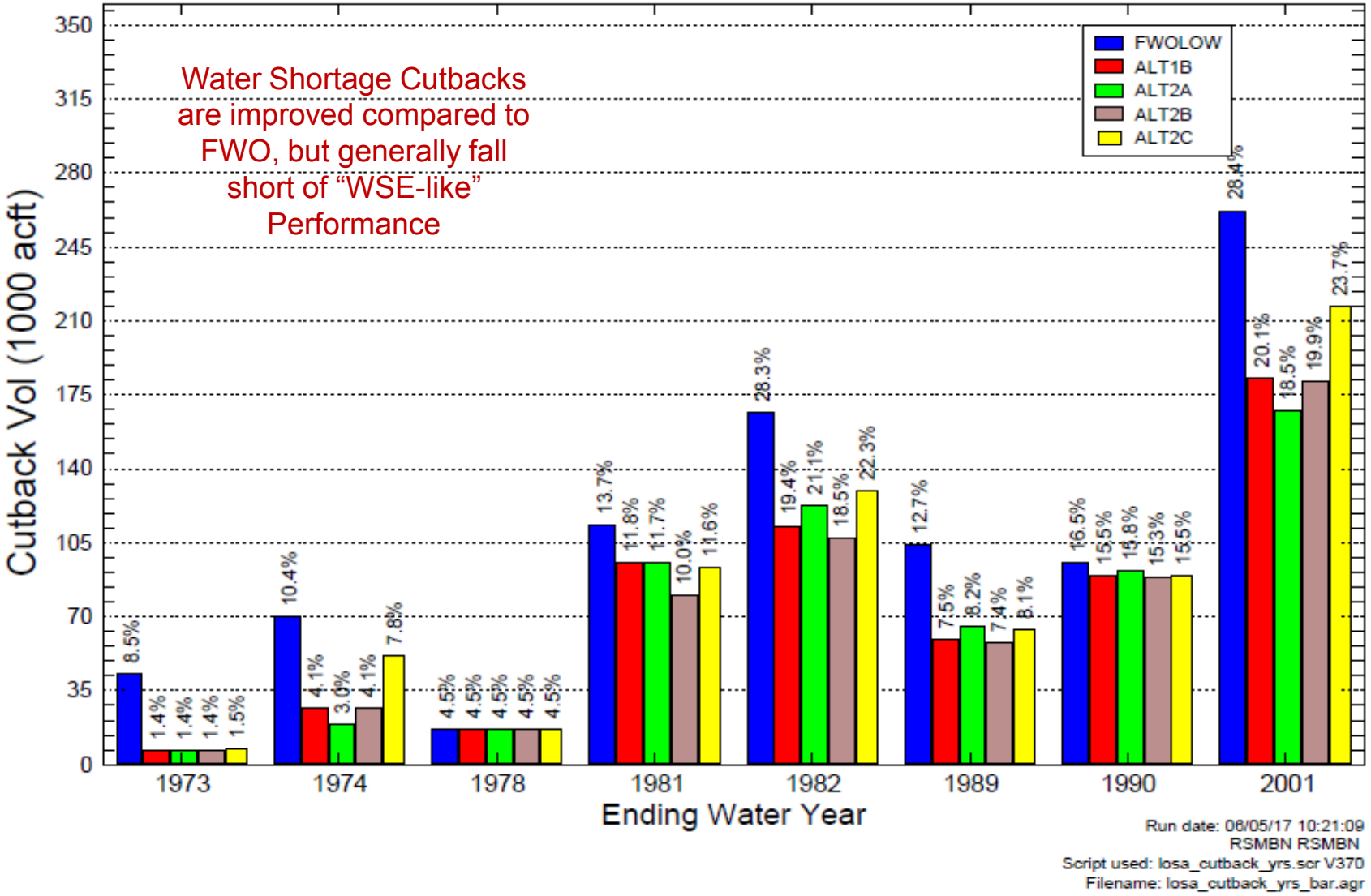
Higher Eco Scores = Improved Lake O. Ecology



Model: RSMBN
Run Date: June 2, 2017

Water Year (Oct-Sep) LOSA Demand Cutback Volumes

for the 8 Years in Simulation Period with Largest Cutbacks



Different Storage Features are Providing Different Benefits (Example)

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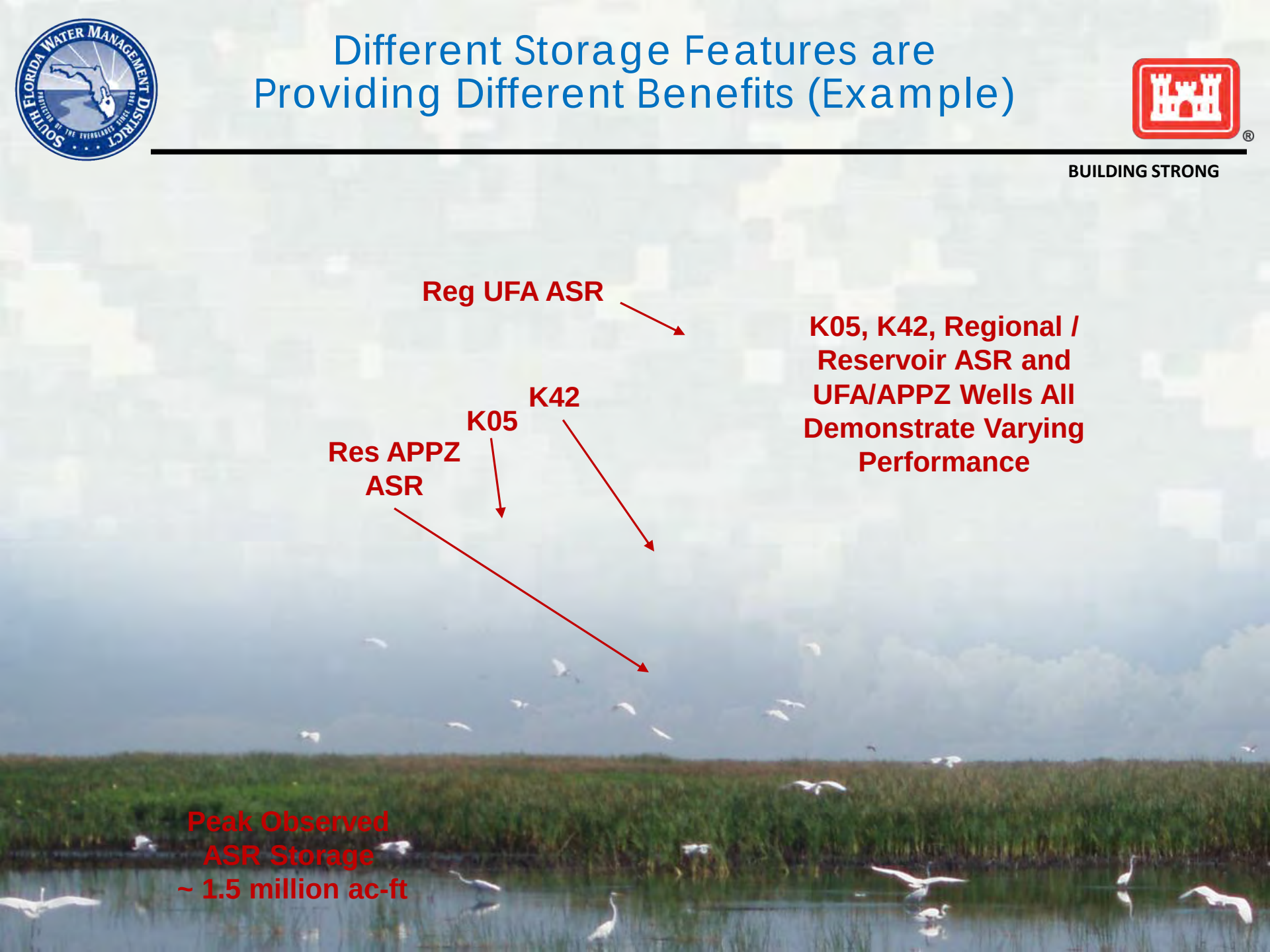

How to Access Model Data

Available LOWRP Modeling Data

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June 21st Release of LOWRP 2nd round Alternatives Array

- FWO vs ALT1b vs ALT2a vs ALT2b vs ALT2c Performance Measures for RSMBN (e.g. Lake O., Northern Estuaries, LOSA)
- Other Indicators (e.g. water budgets, hydrographs, etc…) for RSMBN
- ALT1b, ALT2a, ALT2b, ALT2c model output for RSMBN
- Spreadsheets summarizing operations optimization

Available LOWRP Modeling Data (cont)

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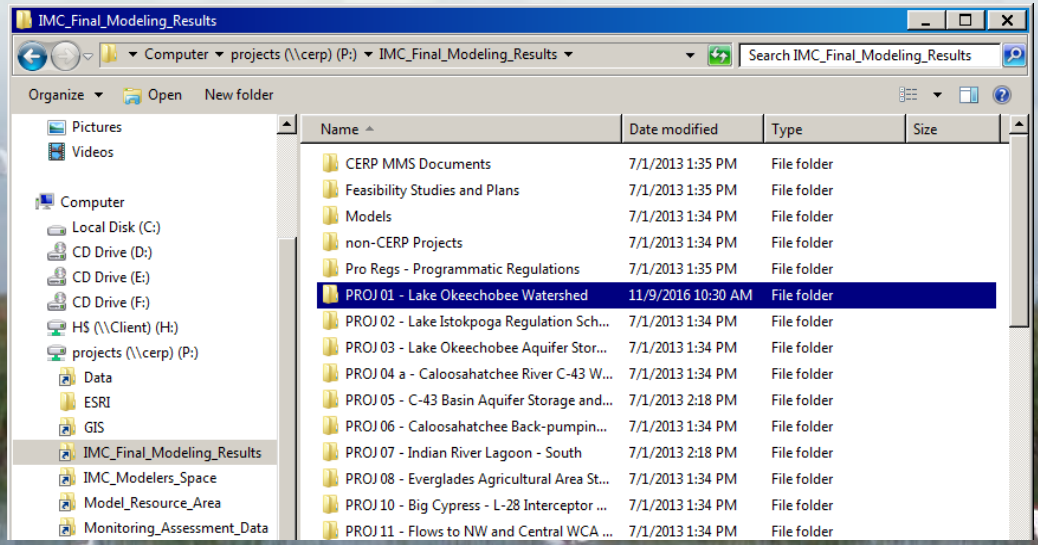
- LOWRP Modeling data is permanently archived and available on the CERPZone Data Archival Storage and Recovery (DASR) system.
  - Step by step instructions previously provided to PDT or available upon request.
- For a short time, data is also available via ftp at:

  ftp://ftp.sfwmd.gov/pub/LOWP/



Acknowledgements:
LOWRP Hydrologic Modeling Team

BUILDING STRONG

- Alaa Ali
- Clay Brown
- Sandeep Dabral
- Jaime Graulau-Santiago
- Harold Hennessey-Correa
- Veera Karri
- Fahmida Khatun
- Kenneth Konyha
- Cal Neidrauer
- Raul Novoa
- Randy VanZee
- Naiming Wang
- Walter Wilcox


Discussion

LAKE OKEECHOBEE WATERSHED RESTORATION PROJECT

Ecological Subteam Update

NEPA Environmental Quality Evaluation

Project Delivery Team Meeting

June 23, 2017

Trusted Partners Delivering Value Today for a Better Tomorrow

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Robust Public Process

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Project Delivery Team Meetings

Working Group Sponsored Public Workshops

- Enhance opportunities for meaningful public engagement
- Topic meetings to address particular issues

Regular Briefings

- SFWMD Governing Board
- Water Resources Advisory Commission
- SFWMD Projects and Lands Meeting
- Task Force
- Working Group/Science Coordination Group
- Quarterly Executive Team (QET) Meetings

NEPA Public Meetings

- Scoping
- Draft Project Implementation Report/Environmental Impact Statement

Environmental Coordination

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- Non-Federal Sponsor – South Florida Water Management District (SFWMD)
- Cooperating Agencies
  - Seminole Tribe of Florida
  - Bureau of Indian Affairs
- The following agencies act as members of the PDT, including informal reviews in advance of the public review period

- USFWS
- NPS
- DOI
- USGS
- USEPA
- NMFS
- NRCS
- FDEP
- FWC
- FDACS
- Seminole Tribe of Florida
- Miccosukee Tribe of Indians of Florida
- Okeechobee, Glades, Martin, Lee, Highlands, and St. Lucie Counties

NEPA Environmental Quality Evaluation

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- Existing Condition Baseline (ECB)
- Future Without Project (FWO) Condition – No Action Alternative
  - Action alternatives will be compared to and evaluated against the FWO
- Assessment of Environmental Effects
  - Describe changes to existing conditions with implementation of each LOWRP action alternative

NEPA Environmental Quality Evaluation

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- Intensity will be rated as follows:
  - Negligible-effect to the resource or discipline is barely perceptible and not measurable and con-fined to a small area
  - Minor-effect to the resource or discipline is perceptible and measurable and is localized
  - Moderate-effect is clearly detectable and could have appreciable effect on the resource or discipline; or the effect is perceptible and measurable throughout the project area
  - Major-effect would have a substantial, highly noticeable influence on the resource or discipline on a regional scale

NEPA Environmental Quality Evaluation

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- Duration: The duration of the effects in this analysis is defined as follows:
  - Short term-when effects last less than one year
  - Long term-effects that last longer than one year
  - No duration – no effect

NEPA Environmental Quality Evaluation

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- Climate
- Geology & Soils
- Hydrology
- Water Quality
- Flood Control
- Wetlands
- Vegetation
- Fish & Wildlife
- Protected Species
- Air Quality
- Noise
- Aesthetics
- Recreation
- Land Use
- Socioeconomics
- Agriculture
- Hazardous, Toxic & Radioactive Waste
- Cultural Resources
- Cumulative Effects
- Unavoidable Adverse Impacts
- Irreversible & Irretrievable Commitments of Resources
- Energy Requirements & Conservation Potential

Water Quality Analysis

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Model Objectives

- Keep it simple
- Evaluate the effect of the project on TP loads to Lake Okeechobee
- To maximize the likelihood that observed loads from the features to Lake Okeechobee will be less than predicted by this simple model conservative estimates will be used for
  - TP concentrations in ASR recovery water
  - Net settling in reservoirs
  - Minimum TP concentration in reservoir

Reservoir Modeling (TP)

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Rainfall (10 μg L^{-1})
four Local rain stations
(Ahn and James 2001)

Dry deposition
(54.6 g TP/ac/yr)
(3/4 of Lake Okeechobee TMDL deposition estimate; proportion from Ahn and James (2001)

inload

inflow * baseline concentration

Reservoir
(TP concentration does not drop below 16 μg L^{1})

outload

outflow * estimated reservoir concentration

recovery * recovery concentration estimate

recharge * estimated reservoir concentration

removal

1st order reaction depth-dependent on net settling (Smith and Hornung 2005).

ASR Wells

Ahn H, James RT. 2001. Variability, uncertainty, and sensitivity of phosphorus deposition load estimates in south Florida. Water, Air, and Soil Pollution. 126:37-51.

Smith and Hornung. 2005. Optimization Modeling of Phosphorus removal in reservoir and stormwater treatment areas. Florida Water Resources Journal. June 2005. 68-76

Reservoir Modeling

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- Keep it simple and conservative
- Daily time step
- Baseline concentration
  - Will compare results using a range of values from 40 to 100 µg TP L-1
- Concentration of water in reservoir cannot go below 16 µg L-1
  - 75th percentile of aerobic Equilibrium Phosphorus Concentration estimates reported in Belmont et al. 2009
- Settling rate 1 m/yr (accounts for sediment resuspension)

Existing Environmental Conditions

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- Threatened and Endangered (T&E) Species
  - 8 Federally listed T&E species under NMFS purview
  - 24 Federally listed T&E species under USFWS purview
- Critical Habitat
  - Everglades snail kite
  - Florida Manatee
  - Johnson's Seagrass
  - Smalltooth Sawfish

Environmental Compliance

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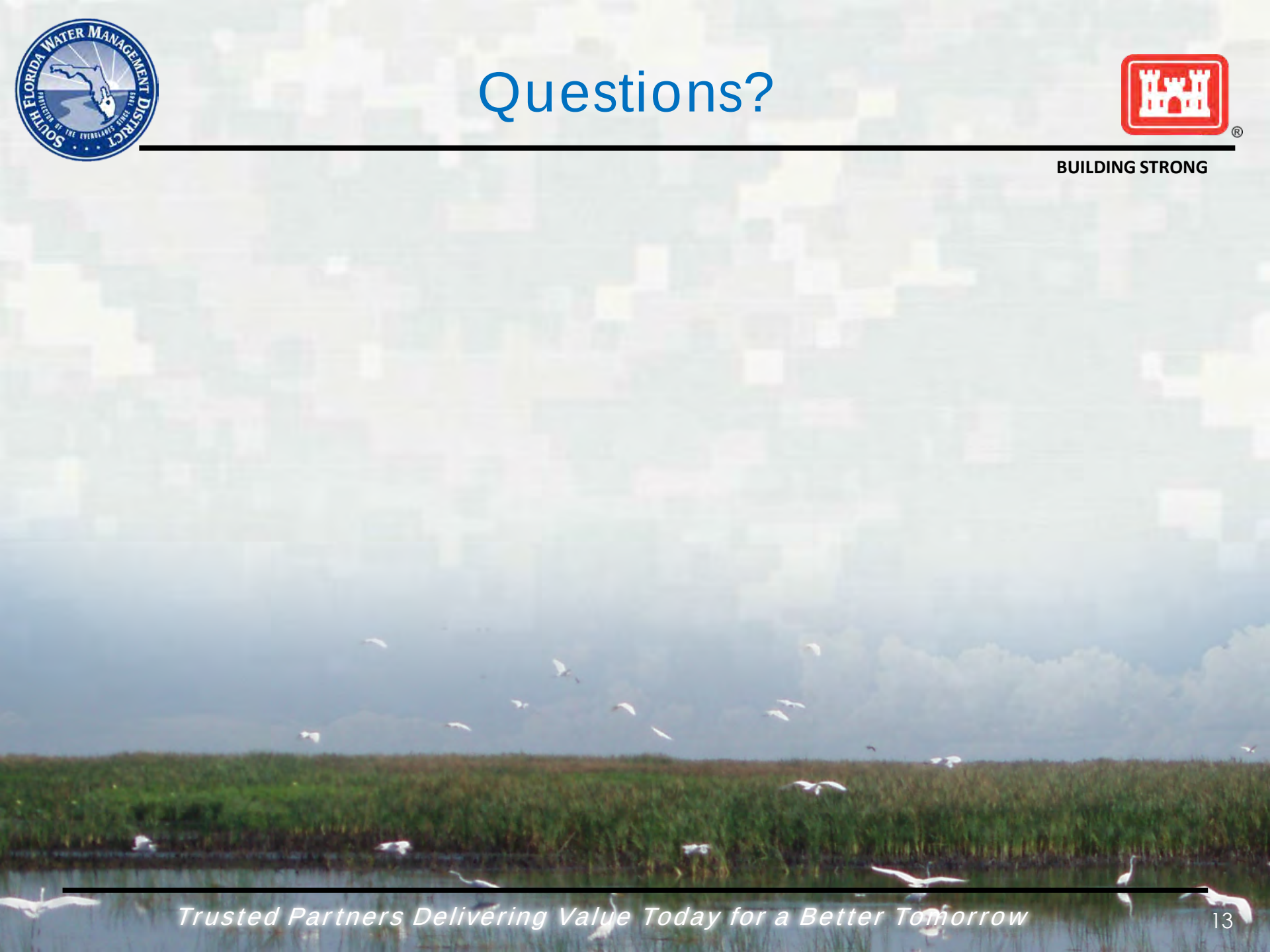
- Endangered Species Act Consultation
  - NMFS Programmatic Biological Assessment (BA)
  - USFWS BA
- Essential Fish Habitat (EFH)
  - Draft EFH Assessment
- Coastal Zone Management Act, Magnuson-Stevens Act, Marine Mammal Protection Act

Questions?



LAKE OKEECHOBEE WATERSHED RESTORATION PROJECT (LOWRP)

Ecological Subteam Update

Calculation of Habitat Units

Project Delivery Team Meeting

June 23, 2017

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LOWRP Performance Measures (PM)

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LOWRP Objective	PM 1 – Wetland Restoration	PM 2 – Lake Okeechobee Stage	PM 3 – Caloosahatchee Estuary Salinity	PM 4 – St. Lucie Estuary Salinity
1. Improve timing and distribution of flows into Lake Okeechobee to maintain ecologically desired lake stage ranges		√		
2. Reduce discharges from Lake Okeechobee to improve the salinity regime and the quality of oyster, SAV, and other estuarine community habitats in the northern estuaries			√	√
3. Increase spatial extent and functionality of aquatic and wildlife habitat within Lake Okeechobee and surrounding watershed	√			

LOWRP Performance Measures

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Wetland Restoration PMs (for initial screening)

PM 1.1 Wading Bird Support
PM 1.2 Connectivity
PM 1.3 Surface Water Connection
PM 1.4 Restoration Potential
PM 1.5 Public Access

Lake Okeechobee PMs (RECOVER Approved)

PM 2.1 Stage Envelope
PM 2.2 Ecological Indicator

Northern Estuaries PMs (RECOVER Approved)

Caloosahatchee Estuary

PM 3.1 Low Flow Targets
PM 3.2 High Flow Targets

St. Lucie Estuary

PM 4.1 Low Flow Targets
PM 4.2 High flow Targets

Calculation of Ecosystem Benefits

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Step 1
Normalize Performance Measures to Common Scale

Step 2
Combine Performance Measures and Calculate Zone Scores

Step 3
Calculate Zone HUs for Wetlands, Lake Okeechobee and Northern Estuaries

Step 4
Compare HU lift (Alternative HUs – FWO HUs) of Alternatives

Step 1:

- Raw performance measure sub-metrics are linearly re-scaled between 0 and 100.

Step 2:

- Within each zone, performance measure sub-metrics are combined for each project alternative to produce a net zone benefits score [Habitat Suitability Index (HSI)] between 0 and 1.

Step 3:

- The 0 to 1 benefits score for each zone is then multiplied by the acreage of the zone to generate a habitat unit (HU) value for the zone.
  - Wetlands
  - Lake Okeechobee
  - Northern Estuaries (2 zones)

Step 4:

- HU Lift = Alternative – Future Without Project (FWO) Condition

Wetland Habitat Unit Calculations

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- The 5 wetland performance measures were used to screen the top 4 wetland restoration sites
- Habitat Unit Calculation Methodology
  1. For all habitat types within the potential restoration sites we assign a quality factor (Restoration Potential Score) based on land use or land cover code (Land Use/Land Cover (LULC); from the 2015 SFWMD shapefile and Florida Land Use, Cover and Forms Classification System (FLUCCS)) using best professional judgment, supplemented by limited field evaluations
  2. LULCs that are more ecologically degraded receive lower scores, but more native or natural habitats receive higher scores (on a scale of 0.0 to 0.5)
  3. For Existing Conditions Baseline (ECB), using ArcGIS, the size of each LULC polygon was measured (acres) and multiplied by its quality factor to arrive at a HU for that polygon

     Habitat Units = Restoration Potential Score (0-1) * Acreage
  4. All polygons inside the wetland restoration site were then summed to calculate the total HUs for each wetland site
  5. **For the Future With Project (FWP), all sites will be fully restored so the quality score will be 1 and the habitat units will be equal to the acreage of the wetland site**

Wetland Design Overview

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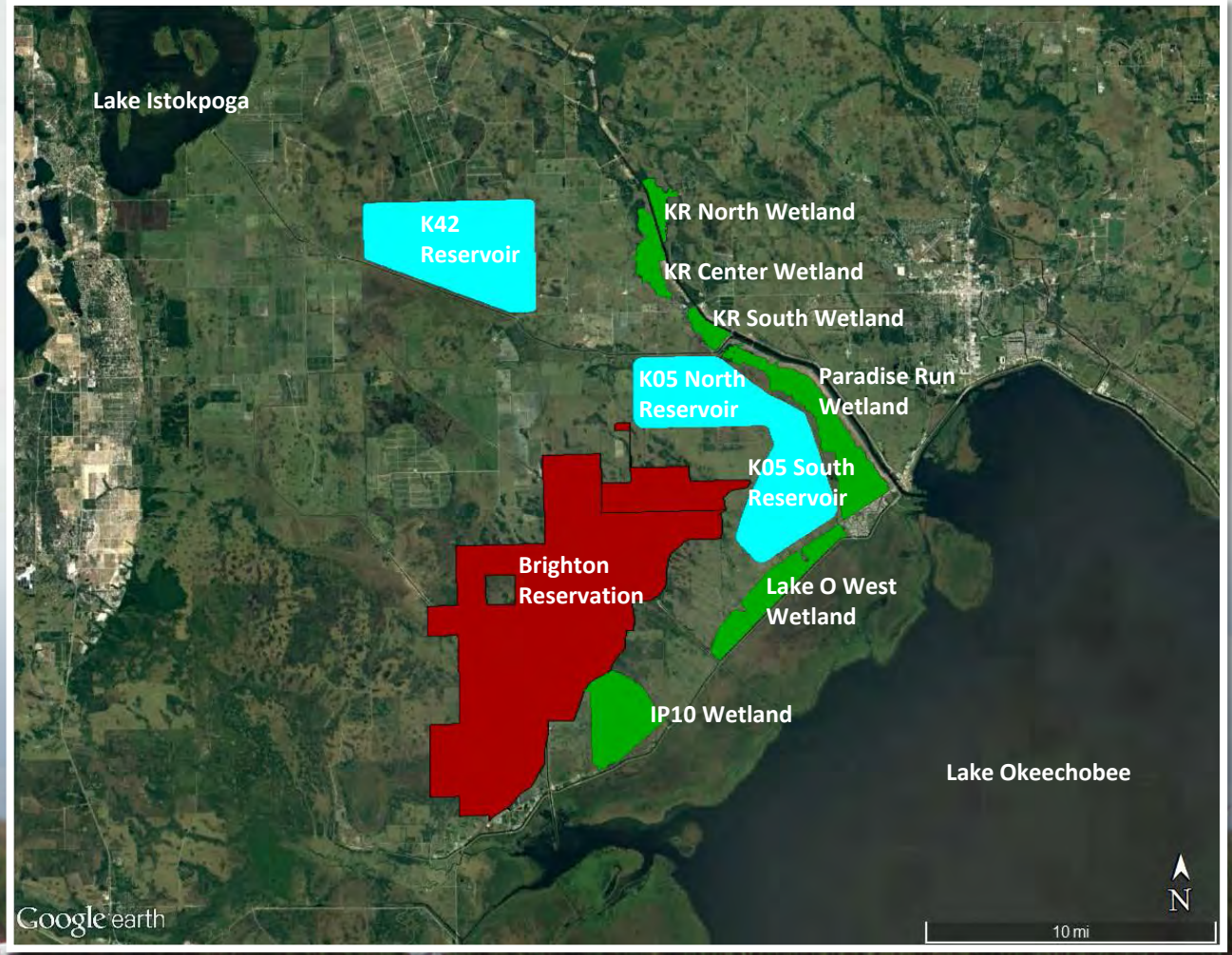
LOWRP Wetlands (green):

1) Kissimmee River – 2,556 or 2,275 acres
   a) North (KR-N) – 537 acres
   b) Center (KR-C) – 1,477 or 1,196 acres
   c) South (KR-S) – 542 acres

2) Paradise Run – 4,083 acres
   a) North (PR-N) – 1,547 acres
   b) South (PR-S) – 2,537 acres

3) IP-10 – 3,533 acres

4) Lake O West (LO-W) – 2,761 acres



Wetland Design Overview

BUILDING STRONG

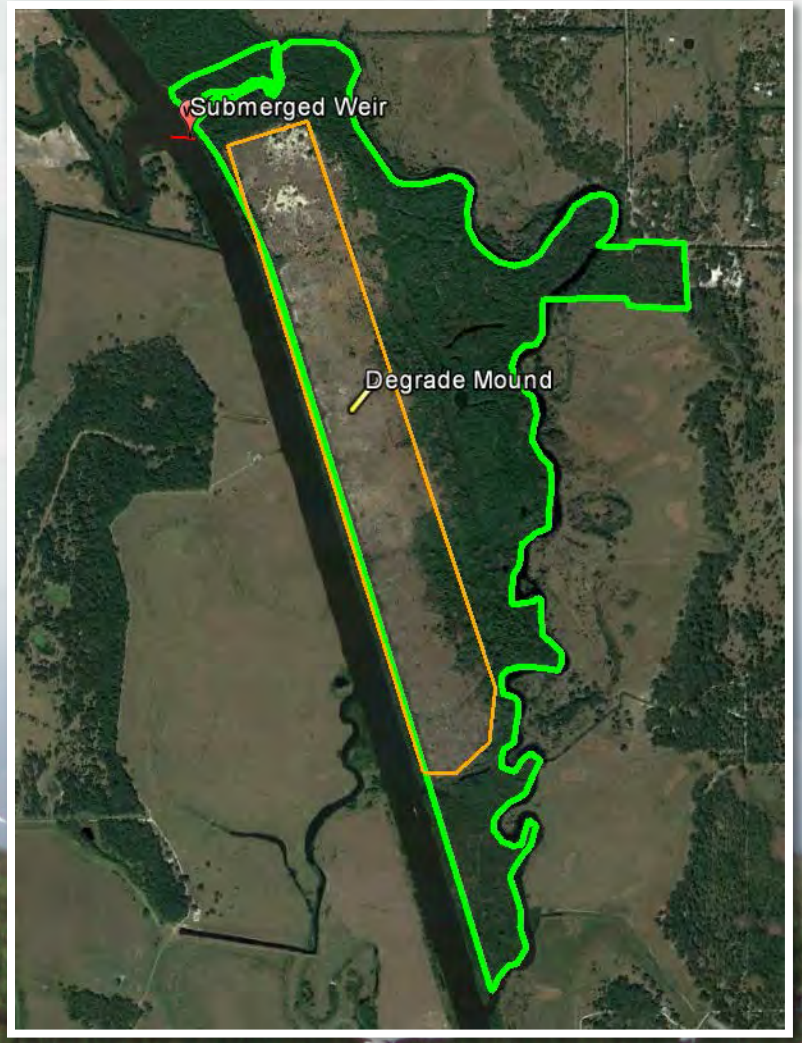
Kissimmee River - North

General:

- Area: 537 acres
- Land: 0% land acquisition, 100% publicly owned lands

Proposed features:

- Degrade spoil mound (approx. 225 acres)
- Install submerged weir within C-38 canal to divert water to the eastern bank



Watershed Assessment Model (WAM) Water Availability: Existing Conditions Results				
	Reach 106 (ac-ft/mo)	Reach 108 (ac-ft/mo)	Subtotal (ac-ft/mo)	Depth (inch)
Mon Avg	222.6	221.1	443.7	3.4
Ann Avg	2,671.2	2,653.3	5,324.5	41.2
Avg Wet Season	2,125.2	2,085.8	4,211.0	32.6
Avg Dry Season	545.9	567.5	1,113.4	8.6

As of:
POC:

Kissimmee River North HU Calculation

BUILDING STRONG

Habitat Units = Restoration Potential Score (0-1) * Acreage

FLUCCS Level 4 Code	FLUCCS Code Description	ECB Restoration Potential Score	Area (acres)	ECB HUs	FWP HUs
2110	Improved Pastures	0.2	0.63	0.13	0.63
3100	Herbaceous Rangeland	0.3	169.66	50.90	169.66
4200	Upland Hardwood Forest	0.4	6.93	2.77	6.93
4340	Hardwood Conifer Mixed	0.4	13.60	5.44	13.60
5110	Streams and Waterways	0.5	3.83	1.92	3.83
5120	Channelized waterways, canals	0.3	0.02	0.01	0.02
5600	Slough Waters	0.5	1.25	0.63	1.25
6170	Mixed Wetland Hardwoods	0.5	25.95	12.98	25.95
6172	Mixed Wetland Hardwoods - Mixed Shrubs	0.5	177.73	88.86	177.73
6180	Cabbage Palm Savannah	0.5	137.57	68.78	137.57
	TOTALS			**232.41**	**537.16**

Wetland Design Overview

BUILDING STRONG

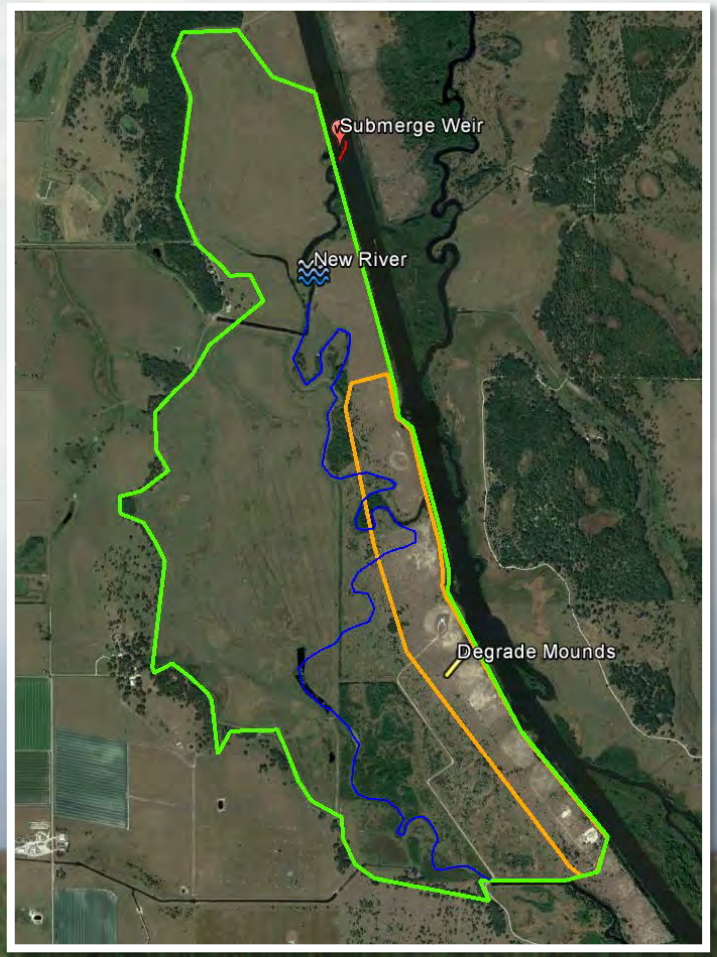
Kissimmee River – Center #1

General:

- Area: 1,477 acres
- Land: 97% land acquisition, 3% (50 acres) publicly owned lands

Proposed features:

- Degrade spoil mound (approx. 226 acres)
- Install submerged weir within C-38 canal to divert water to the western bank
- New river through the site to imitate historical water flow (21,500 Linear Feet (LF))



Watershed Assessment Model (WAM) Water Availability: Existing Conditions Results				
	Reach 95 (ac-ft/mo)	Reach 98 (ac-ft/mo)	Subtotal (ac-ft/mo)	Depth (inch)
Mon Avg	17.5	211.4	228.9	2.4
Ann Avg	210.1	2,537.3	2,747.4	28.8
Avg Wet Season	169.2	1,982.0	2,151.2	22.5
Avg Dry Season	40.9	555.2	596.2	6.2

Wetland Design Overview

BUILDING STRONG

Kissimmee River – Center #2

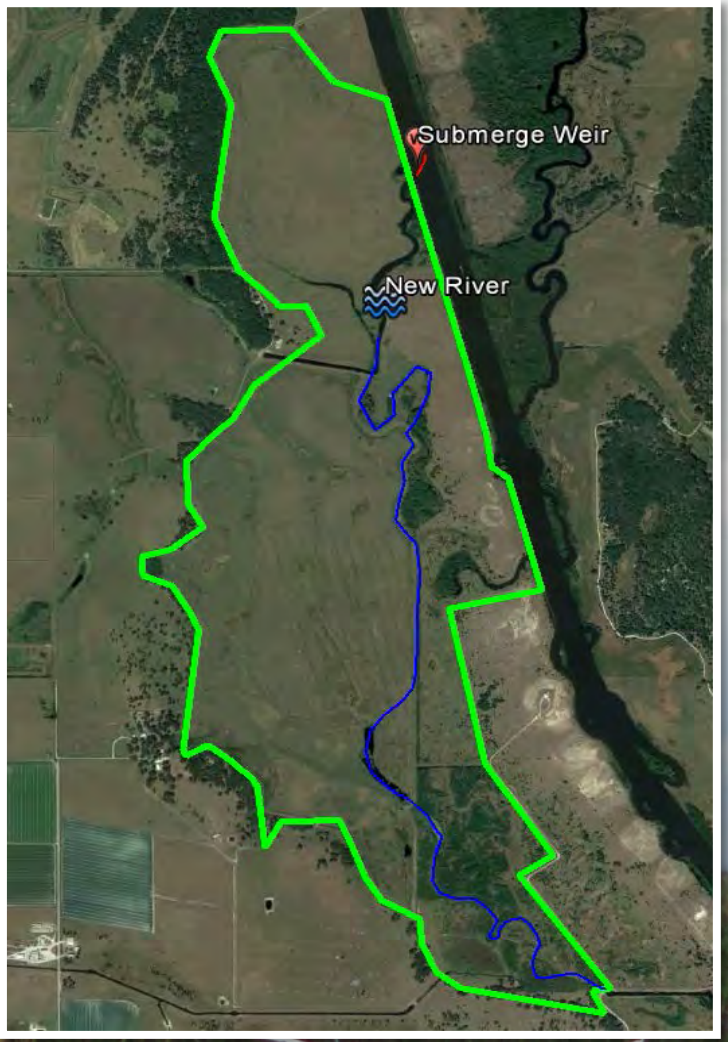
General:

- Area: 1,196 acres
- Land: 96% land acquisition, 4% (50 acres) publicly owned lands

Proposed features:

- Install submerged weir within C-38 canal to divert water to the western bank
- New river through the site to imitate historical water flow (16,939 LF)

Watershed Assessment Model (WAM) Water Availability: Existing Conditions Results				
	Reach 95 (ac-ft/mo)	Reach 98 (ac-ft/mo)	Subtotal (ac-ft/mo)	Depth (inch)
Mon Avg	17.5	211.4	228.9	2.4
Ann Avg	210.1	2,537.3	2,747.4	28.8
Avg Wet Season	169.2	1,982.0	2,151.2	22.5
Avg Dry Season	40.9	555.2	596.2	6.2



As of:
POC:

Kissimmee River Center HU Calculation

BUILDING STRONG

Habitat Units = Restoration Potential Score (0-1) * Acreage

FLUCCS Level 4 Code	FLUCCS Code Description	ECB Restoration Potential Score	Area (acres)	ECB HUs	FWP HUs
2110	Improved Pastures	0.2	795.96	159.19	795.96
2120	Unimproved Pastures	0.3	63.68	19.10	63.68
3100	Herbaceous Rangeland	0.3	3.40	1.02	3.40
4200	Upland Hardwood Forest	0.4	3.57	1.43	3.57
4270	Live Oak	0.4	3.05	1.22	3.05
4271	Oak - Cabbage Palm Forest	0.4	1.35	0.54	1.35
5110	Streams and Waterways	0.5	18.50	9.25	18.50
5120	Channelized waterways, canals	0.3	2.69	0.81	2.69
5300	Reservoirs	0.3	4.51	1.35	4.51
6172	Mixed Wetland Hardwoods - Mixed Shrubs	0.5	159.45	79.73	159.45
6180	Cabbage Palm Savannah	0.5	4.00	2.00	4.00
6410	Freshwater Marshes	0.5	55.21	27.60	55.21
6430	Wet Prairies	0.5	40.88	20.44	40.88
6440	Emergent Aquatic Vegetation	0.5	39.61	19.80	39.61
	TOTALS			**343.49**	**1195.86**

Kissimmee River Center Extra Piece HU Calculation

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Habitat Units = Restoration Potential Score (0-1) * Acreage

FLUCCS Level 4 Code	FLUCCS Code Description	ECB Restoration Potential Score	Area (acres)	ECB HUs	FWP HUs
2120	Unimproved Pastures	0.3	6.70	2.01	6.70
3100	Herbaceous Rangeland	0.3	118.94	35.68	118.94
5120	Channelized waterways, canals	0.3	0.02	0.01	0.02
6170	Mixed Wetland Hardwoods	0.5	35.09	17.55	35.09
6172	Mixed Wetland Hardwoods - Mixed Shrubs	0.5	54.09	27.05	54.09
7430	Spoil Areas	0.1	58.04	5.80	58.04
	TOTALS			**88.10**	**272.89**

Wetland Design Overview

BUILDING STRONG

Kissimmee River – South #1

General:

- Area: 542 acres
- Land: 0% land acquisition, 100% publicly owned lands

Proposed features:

- Install submerged weir within C-38 canal to divert water to the western bank
- New river within the southern portion of the easement to tie into C-38 canal (5,300 LF)

Watershed Assessment Model (WAM) Water Availability: Existing Conditions Results		
	Reach 89 (ac-ft/mo)	Depth (inch)
Mon Avg	64.5	1.2
Ann Avg	774.1	14.8
Avg Wet Season	620.6	11.9
Avg Dry Season	153.6	2.9

Wetland Design Overview

BUILDING STRONG

Kissimmee River – South #2

General:

- Area: 542 acres
- Land: 0% land acquisition, 100% publicly owned lands

Proposed features:

- Install submerged weir within C-38 canal to divert water to the western bank
- New culvert through HHD with gates to tie into C-41A canal

Watershed Assessment Model (WAM) Water Availability: Existing Conditions Results		
	Reach 89 (ac-ft/mo)	Depth (inch)
Mon Avg	64.5	1.2
Ann Avg	774.1	14.8
Avg Wet Season	620.6	11.9
Avg Dry Season	153.6	2.9

Kissimmee River South HU Calculation

BUILDING STRONG

Habitat Units = Restoration Potential Score (0-1) * Acreage

FLUCCS Level 4 Code	FLUCCS Code Description	ECB Restoration Potential Score	Area (acres)	ECB HUs	FWP HUs
2110	Improved Pastures	0.2	19.14	3.83	19.14
3100	Herbaceous Rangeland	0.3	0.28	0.08	0.28
5110	Streams and Waterways	0.5	41.94	20.97	41.94
6170	Mixed Wetland Hardwoods	0.5	23.60	11.80	23.60
6172	Mixed Wetland Hardwoods - Mixed Shrubs	0.5	41.34	20.67	41.34
6410	Freshwater Marshes	0.5	418.00	209.00	418.00
7430	Spoil Areas	0.1	8.86	0.89	8.86
	TOTALS			**267.24**	**553.17**

Wetland Design Overview

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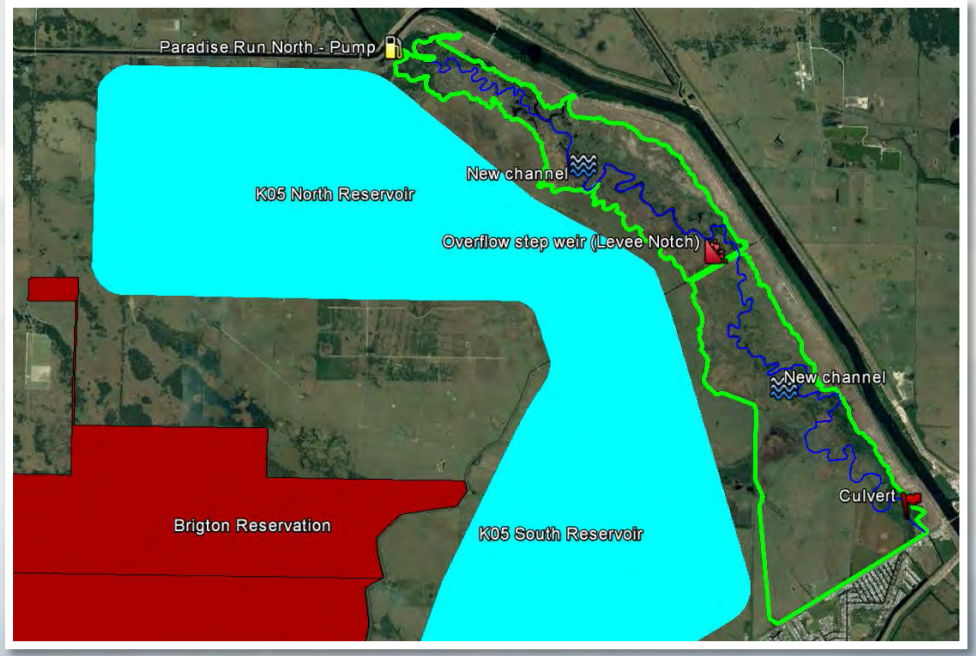
Paradise Run – North & South

General:

- Area: PRN-1,547 acres; PRS- 2,537 acres
- Land: PRN- 23% land acquisition, 77% (1,186 acres) publicly owned lands; PRS- 69% land acquisition, 31% (779 acres) publicly owned lands

Proposed features:

- New pump station to direct flow from C-41A into the wetland footprint
- New river through the site to imitate historical water flow (73,500 LF)
- Construct overflow/step weir (levee notch) to transport water from PR-north to PR-south
- New culvert through HHD with gates to tie into C-38 canal



Paradise Run North

Watershed Assessment Model (WAM) Water Availability: Existing Conditions Results					
	Reach 10 (ac-ft/mo)	Reach 28 (ac-ft/mo)	Reach 29 (ac-ft/mo)	Subtotal (ac-ft/mo)	Depth (inch)
Mon Avg	85.2	81.6	41.0	207.8	1.6
Ann Avg	1,022.2	978.9	492.4	2,493.6	19.3
Avg Wet Season	769.9	743.9	362.5	1,876.2	14.6
Avg Dry Season	252.4	235.0	129.9	617.3	4.8

Paradise Run South

Watershed Assessment Model (WAM) Water Availability: Existing Conditions Results				
	Reach 4 (ac-ft/mo)	Reach 13 (ac-ft/mo)	Subtotal (ac-ft/mo)	Depth (inch)
Mon Avg	185.5	54.9	240.5	1.1
Ann Avg	2,226.4	659.3	2,885.7	13.7
Avg Wet Season	1,427.7	517.8	1,945.5	9.2
Avg Dry Season	798.7	141.4	940.1	4.4

As of:
POC:

Paradise Run North HU Calculation

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Habitat Units = Restoration Potential Score (0-1) * Acreage

FLUCCS Level 4 Code	FLUCCS Code Description	ECB Restoration Potential Score	Area (acres)	ECB HUs	FWP HUs
2110	Improved Pastures	0.2	56.49	11.30	56.49
3100	Herbaceous Rangeland	0.3	16.31	4.89	16.31
3300	Mixed Rangeland	0.3	40.46	12.14	40.46
4200	Upland Hardwood Forest	0.4	35.31	14.12	35.31
4280	Cabbage Palm	0.4	3.50	1.40	3.50
5110	Streams and Waterways	0.5	76.33	38.17	76.33
5600	Slough Waters	0.5	48.14	24.07	48.14
6170	Mixed Wetland Hardwoods	0.5	31.64	15.82	31.64
6172	Mixed Wetland Hardwoods - Mixed Shrubs	0.5	11.98	5.99	11.98
6180	Cabbage Palm Savannah	0.5	1.29	0.65	1.29
6410	Freshwater Marshes	0.5	86.60	43.30	86.60
6430	Wet Prairies	0.5	243.44	121.72	243.44
6440	Emergent Aquatic Vegetation	0.5	885.09	442.55	885.09
7430	Spoil Areas	0.1	10.03	1.00	10.03
	TOTALS			**737.11**	**1546.61**

Paradise Run South HU Calculation

BUILDING STRONG

Habitat Units = Restoration Potential Score (0-1) * Acreage

FLUCCS Level 4 Code	FLUCCS Code Description	ECB Restoration Potential Score	Area (acres)	ECB HUs	FWP HUs
2110	Improved Pastures	0.2	1229.51	245.90	1229.51
3100	Herbaceous Rangeland	0.3	2.95	0.88	2.95
3200	Shrub and Brushland	0.3	16.55	4.97	16.55
5120	Channelized waterways, canals	0.3	1.56	0.47	1.56
5600	Slough Waters	0.5	97.40	48.70	97.40
6172	Mixed Wetland Hardwoods - Mixed Shrubs	0.5	172.09	86.05	172.09
6180	Cabbage Palm Savannah	0.5	14.09	7.05	14.09
6410	Freshwater Marshes	0.5	406.23	203.12	406.23
6430	Wet Prairies	0.5	596.31	298.16	596.31
7430	Spoil Areas	0.1	0.08	0.01	0.08
	TOTALS			**895.29**	**2536.78**

Wetland Design Overview

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Lake O West

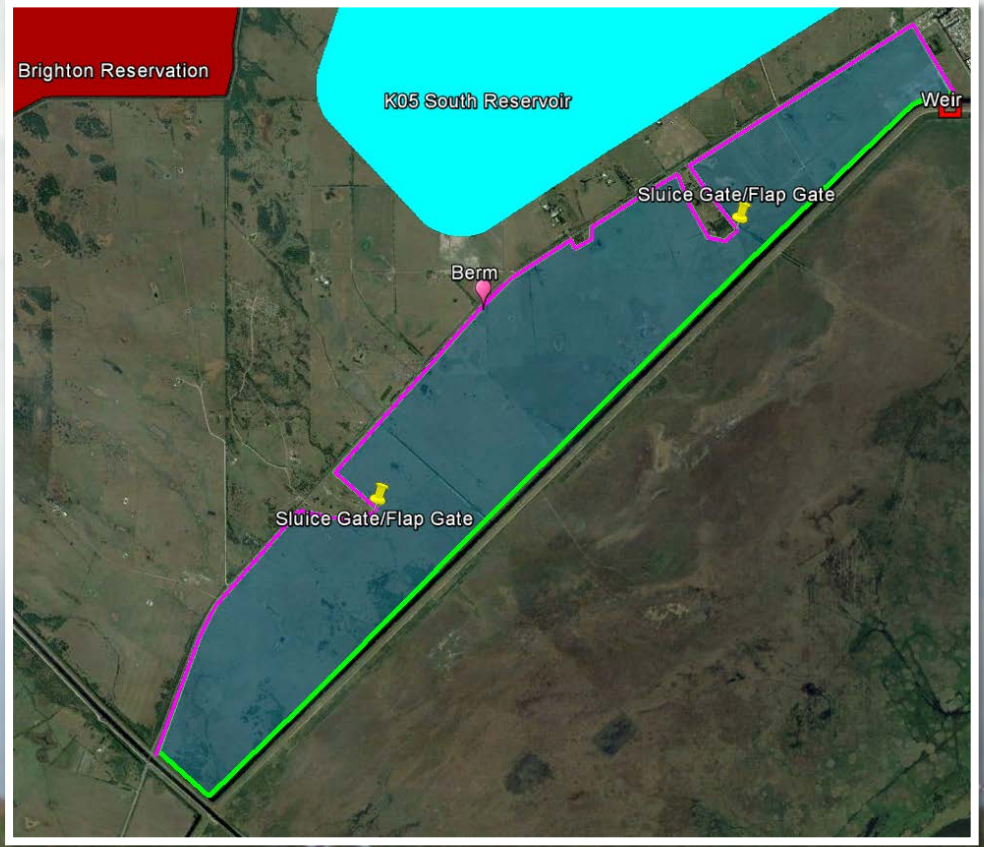
General:

- Area: 2,761 acres
- Land: 100% land acquisition, 0% publicly owned lands

Proposed features:

- New perimeter berm along the northern and eastern boundaries (43,000 LF) and install two culverts with gates
- Land smoothing to remove agricultural landscaping (700 ac)
- Install new above water weir to limit the flow of water in L-48 needed to inundate the wetland area

Watershed Assessment Model (WAM) Water Availability: Existing Conditions Results				
	Reach 36 (ac-ft/mo)	Reach 47 (ac-ft/mo)	Subtotal (ac-ft/mo)	Depth (inch)
Mon Avg	109.3	200.5	309.8	1.3
Ann Avg	1,311.7	2,405.6	3,717.3	15.9
Avg Wet Season	1,027.8	1,889.3	2,917.1	12.5
Avg Dry Season	283.9	516.3	800.1	3.4



As of:
POC:

Lake Okeechobee West HU Calculation

BUILDING STRONG

Habitat Units = Restoration Potential Score (0-1) * Acreage

FLUCCS Level 4 Code	FLUCCS Code Description	ECB Restoration Potential Score	Area (acres)	ECB HUs	FWP HUs
2110	Improved Pastures	0.2	2515.08	503.02	2515.08
2120	Unimproved Pastures	0.3	84.06	25.22	84.06
3200	Shrub and Brushland	0.3	7.77	2.33	7.77
4200	Upland Hardwood Forest	0.4	15.04	6.02	15.04
5120	Channelized waterways, canals	0.3	4.20	1.26	4.20
5300	Reservoirs	0.3	1.84	0.55	1.84
6172	Mixed Wetland Hardwoods - Mixed Shrubs	0.5	3.59	1.79	3.59
6410	Freshwater Marshes	0.5	127.02	63.51	127.02
6430	Wet Prairies	0.5	33.10	16.55	33.10
	TOTALS			**620.25**	**2791.70**

Wetland Design Overview

BUILDING STRONG

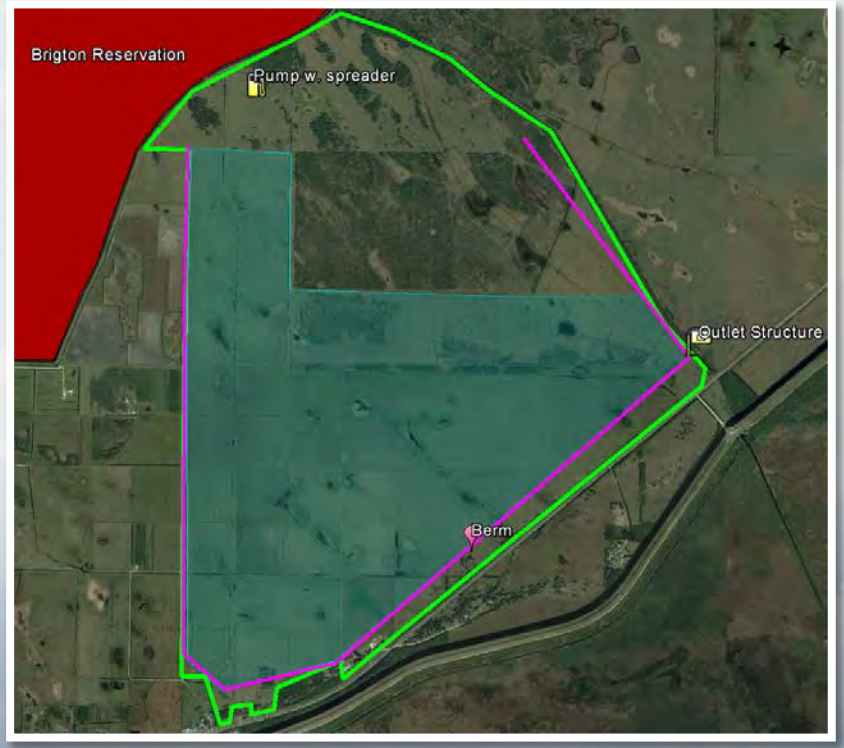
IP-10

General:

- Area: 3,533 acres
- Land: 100% land acquisition, 0% publicly owned lands

Proposed features:

- New pump station with spreader to direct flow from L-60 into the wetland footprint
- New perimeter berm along the southern, eastern, and western boundaries (36,000 LF)
- Land smoothing to remove agricultural landscaping (2,500 ac)
- New outlet structure in the eastern corner of the easement to move water offsite to L-48



Watershed Assessment Model (WAM) Water Availability: Existing Conditions Results				
	Reach 4 (ac-ft/mo)	Reach 10 (ac-ft/mo)	Subtotal (ac-ft/mo)	Depth (inch)
Mon Avg	64.1	67.8	131.9	0.5
Ann Avg	769.4	813.4	1,582.8	5.5
Avg Wet Season	589.8	615.4	1,205.3	4.2
Avg Dry Season	179.6	198.0	377.6	1.3

IP-10 HU Calculation

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Habitat Units = Restoration Potential Score (0-1) * Acreage

FLUCCS Level 4 Code	FLUCCS Code Description	ECB Restoration Potential Score	Area (acres)	ECB HUs	FWP HUs
1230	Mixed Units (Fixed and mobile home units)	0.01	0.63	0.01	0.63
2110	Improved Pastures	0.2	2513.66	502.73	2513.66
2120	Unimproved Pastures	0.3	715.11	214.53	715.11
2156	Field Crops - Sugar Cane	0.01	0.22	0.00	0.22
2210	Citrus Groves	0.1	0.08	0.01	0.08
3100	Herbaceous Rangeland	0.3	1.15	0.34	1.15
4220	Brazilian Pepper	0.01	10.40	0.10	10.40
4271	Oak - Cabbage Palm Forest	**0.4**	51.61	20.65	51.61
4280	Cabbage Palm	**0.4**	72.43	28.97	72.43
4340	Hardwood Conifer Mixed	**0.4**	1.57	0.63	1.57
5300	Reservoirs	0.3	1.02	0.30	1.02
6172	Mixed Wetland Hardwoods - Mixed Shrubs	**0.5**	0.00	0.00	0.00
6180	Cabbage Palm Savannah	**0.5**	0.14	0.07	0.14
6410	Freshwater Marshes	**0.5**	142.42	71.21	142.42
6430	Wet Prairies	**0.5**	14.86	7.43	14.86
6440	Emergent Aquatic Vegetation	**0.5**	6.88	3.44	6.88
	TOTALS			**850.43**	**3532.18**

Wetland Habitat Units

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Wetland Site	Acres	ECB HUs	FWO HUs	FWP HUs
Kissimmee River North HUs	537	232	182	537
Kissimmee River Central HUs	1,196	343	269	1,196
Kissimmee River Central - Extra Piece HUs	273	88	69	273
Kissimmee River South HUs	553	267	209	553
Paradise Run North HUs	1,547	737	577	1,547
Paradise Run South HUs	2,537	895	701	2,537
Lake Okeechobee West HUs	2,792	620	486	2,792
IP-10 HUs	3,532	850	666	3,532
Total Wetland Sites	**12,966**	**4,034**	**3,158**	**12,966**

- Florida 2070 Technical Report was used to predict what land use changes would occur under FWO conditions
  - Central Region development scenarios
    - Residential, Commercial, Urban will increase from 25.49% to 48.21 %
    - Ag lands will decrease from 35.13% to 23.67%
    - Protected lands will increase only slightly from 17.26% to 17.89%

Wetland Habitat Unit Lift

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Habitat Unit Lift = FWP Habitat Units – FWO Habitat Units

Wetland Site	FWO	FWP	FWP HU per acre
Kissimmee River North HU Lift	0	355	0.66
Kissimmee River Central HU Lift	0	927	0.78
Kissimmee River Central - Extra Piece HU Lift	0	204	0.75
Kissimmee River South HU Lift	0	344	0.62
Paradise Run North HU Lift	0	970	0.63
Paradise Run South HU Lift	0	1,836	0.72
Lake Okeechobee West HU Lift	0	2,306	0.83
IP-10 HU Lift	0	2,866	0.81

Wetland Sites Next Steps

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- Look at rough order magnitude (ROM) costs (July 7) and determine cost per habitat unit for each site
- Run the Institute of Water Resources (IWR) Plan to determine cost effectiveness
- Potential ranking of sites
  - Cost
  - Plan Formulation/Ecological Subteams to consider criteria/uncertainty
    - Proximity to reservoirs and/or ASR wells for hydrologic connections
    - Fish and Wildlife Utilization
    - Invasive/exotics
    - Type of potential wetland post-restoration
    - Topographic diversity

Lake Okeechobee Performance Measures

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Lake Stage Performance Measure (PM 2.1)

- Stage Envelope -Standard Scores based on the Length of time and distance above and below the ecologically beneficial stage envelope - 12.5 ft – 15.5 ft
- Extreme Lake Stage - Standard scores based on length of time and distance stage is >17 ft and <10 ft

Stage	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
19	3.5	4.0	4.5	5.0	6.0	6.5	6.5	6.0	5.0	4.0	3.5	3.5
18.5	3.0	3.5	4.0	4.5	5.5	6.0	6.0	5.5	4.5	3.5	3.0	3.0
18	2.5	3.0	3.5	4.0	5.0	5.5	5.5	5.0	4.0	3.0	2.5	2.5
17.5	2.0	2.5	3.0	3.5	4.5	5.0	5.0	4.5	3.5	2.5	2.0	2.0
17	1.5	2.0	2.5	3.0	4.0	4.5	4.5	4.0	3.0	2.0	1.5	1.5
16.5	1.0	1.5	2.0	2.5	3.5	4.0	4.0	3.5	2.5	1.5	1.0	1.0
16	0.5	1.0	1.5	2.0	3.0	3.5	3.5	3.0	2.0	1.0	0.5	0.5
15.5	0.0	0.5	1.0	1.5	2.5	3.0	3.0	2.5	1.5	0.5	0.0	0.0
15	0.0	0.0	0.5	1.0	2.0	2.5	2.5	2.0	1.0	0.0	0.0	0.0
14.5	0.0	0.0	0.0	0.5	1.5	2.0	2.0	1.5	0.5	0.0	0.0	0.0
14	0.5	0.0	0.0	0.0	1.0	1.5	1.5	1.0	0.0	0.0	0.5	0.5
13.5	1.0	0.5	0.0	0.0	0.5	1.0	1.0	0.5	0.0	0.0	1.0	1.0
13	1.5	1.0	0.5	0.0	0.0	0.5	0.5	0.0	0.0	0.5	1.5	1.5
12.5	2.0	1.5	1.0	0.5	0.0	0.0	0.0	0.0	0.0	1.0	2.0	2.0
12	2.5	2.0	1.5	1.0	0.0	0.0	0.0	0.0	0.5	1.5	2.5	2.5
11.5	3.0	2.5	2.0	1.5	0.5	0.5	0.5	0.5	1.0	2.0	3.0	3.0
11	3.5	3.0	2.5	2.0	1.0	1.0	1.0	1.0	1.5	2.5	3.5	3.5
10.5	4.0	3.5	3.0	2.5	1.5	1.5	1.5	1.5	2.0	3.0	4.0	4.0
10	4.5	4.0	3.5	3.0	2.0	2.0	2.0	2.0	2.5	3.5	4.5	4.5
9.5	5.0	4.5	4.0	3.5	2.5	2.5	2.5	2.5	3.0	4.0	5.0	5.0
9	5.5	5.0	4.5	4.0	3.0	3.0	3.0	3.0	3.5	4.5	5.5	5.5
8.5	6.0	5.5	5.0	4.5	3.5	3.5	3.5	3.5	4.0	5.0	6.0	6.0
8	6.5	6.0	5.5	5.0	4.0	4.0	4.0	4.0	4.5	5.5	6.5	6.5
7.5	7.0	6.5	6.0	5.5	4.5	4.5	4.5	4.5	5.0	6.0	7.0	7.0

A

B

Ecological Indicator Score PM

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- Based on strongest statistically significant correlations with Lake Stage based on long term environmental monitoring data sets
- Results used to develop indicator scoring:
  - Summer Chara : 2 pts (<12ft), 1 pt (12ft-15.5ft), 0 pt (>15.5ft)
  - Summer Cyanobacteria : 2 pts (<12ft), 1 pt (12ft-14ft), 0 pt (>14ft)
  - Epipelon Spring+Fall : 2 pts (<12ft), 1 pt (12ft-15ft), 0 pt (>15ft)
  - Epiphyte Spring+Fall : 2 pts (<14ft), 1 pt (14ft-15ft), 0 pt (>15ft)
  - Winter Panfish Creel Data: 2 pts (12ft-15ft), 1 pt (<12ft or 15ft-16ft), 0 pt (>16ft)
  - Summer Vascular SAV : 2 pts (12ft-15.5ft), 1 pt (10ft-<12ft or >15.5ft-<18ft), 0 pt (<10ft or ≥18ft)
- Issue of scoring when the lake is above 16 ft
  - It only scores one point because vascular SAV can start expanding in the littoral zone when the lake stage is that high
  - The other PMs would score a zero and the remaining two PM scores are based on months from the previous year, so it is not an overall positive score
  - It does not mean overall that the lake being over 16 ft will score better than being in the stage envelope

Lake Stage Habitat Unit Calculation

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- Habitat Unit Calculation is Based on a Maximum Score of 1
- Scoring is apportioned as follows:
  - 45% (0.45) stage envelope PM
  - 45% (0.45) Combined Ecological PM
  - 10% > 17 ft, <10 ft PM (7.5% (0.075) for excessive high, 2.5% (0.025) excessive low).
- HU percentages based on sensitivity analysis which indicated this distribution provided the combination of the greatest number of habitat acre units and the maximum lift
- Overall score is based on 247,500 acres, the combined area of the Lake Okeechobee littoral and nearshore zones

Lake Okeechobee Habitat Suitability Index Round 2 Modeling

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Metric #	PM Metric	ECB	FWO	ALT1B	ALT2A	ALT2B	ALT2C
2.2	Ecological Indicator	0.69	0.68	0.70	0.72	0.71	0.69
2.1	Stage Envelope	0.58	0.60	0.69	0.70	0.70	0.66
2.1	Extreme Stage	0.93	0.93	0.94	0.93	0.94	0.93

Lake Okeechobee Habitat Units and Habitat Unit Lift
Round 2 Modeling

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Habitat Units = Habitat Suitability Index (0-1) * Acreage

Lake Okeechobee Habitat Units	ECB	FWO	ALT1B	ALT2A	ALT2B	ALT2C	Max HU
Ecological PM HUs (acres)	108,675	107,100	110,250	113,400	111,825	108,675	157,500
Stage Envelope PM HUs (acres)	26,100	27,000	31,050	31,500	31,500	29,700	45,000
Extreme Stage PM HUs (acres)	41,850	41,850	42,300	41,850	42,300	41,850	45,000
Total Lake O Habitat Units (acres)	**176,625**	**175,950**	**183,600**	**186,750**	**185,625**	**180,225**	**247,500**

Habitat Unit Lift = Alt Habitat Units – FWO Habitat Units

Habitat Unit Lift	ECB	FWO	ALT1B	ALT2A	ALT2B	ALT2C	Max Lift
Ecological PM HU Lift	1,575	0	3,150	6,300	4,725	1,575	50,400
Stage Envelope PM HU Lift	-900	0	4,050	4,500	4,500	2,700	18,000
Extreme Stage PM HU Lift	0	0	450	0	450	0	3,150
Total Lake O HU Lift	**675**	**0**	**7,650**	**10,800**	**9,675**	**4,275**	**71,550**

Northern Estuaries Performance Measures

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Caloosahatchee Estuary

PM 3.1 Low Flow Target - no months during October to July when the mean monthly inflow from the Caloosahatchee watershed, as measured at S-79, falls below a low-flow limit of 450 cfs

PM 3.2 High Flow Target - no months with mean monthly flows greater than 2,800 cfs as measured at the S-79

Scoring

- Number of months flow < 450 cfs from Lake Okeechobee releases (Oct-July)
- Number of months flow > 2800 cfs from Lake Okeechobee releases (Jan - Dec)

Northern Estuaries Performance Measures

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St. Lucie Estuary

PM 4.1 Low Flow Target – 31 months where mean flow is less than 350 cubic feet per second (cfs).

PM 4.2 High Flow Target - 0 Lake Okeechobee regulatory discharge events (14 day moving averages > 2000 cfs)

<u>Scoring</u>

- Number of months where mean flow is less than 350 cfs
- Number of Lake Okeechobee regulatory discharge events (14 day moving averages > 2000 cfs)

Scaling Northern Estuaries Habitat Units

- Used the percentage of target from the oyster surveys presented in the 2007 System Status Report to set the ECB value (0 to 100 Scale)
  - Set ECB re-scaled score to 14 for the St. Lucie and 4 for the Caloosahatchee.
  - Extrapolated to determine the minimum or 0 value.
  - Alternatives can still score lower than the ECB
  - ECB No longer has 0 HU value

Estuary	Existing Oyster Acres	Restoration Target (acres)	% of Target
St. Lucie	117	834	14%
Caloosahatchee	18	500	4%

Rescaled Caloosahatchee Round 2 Score

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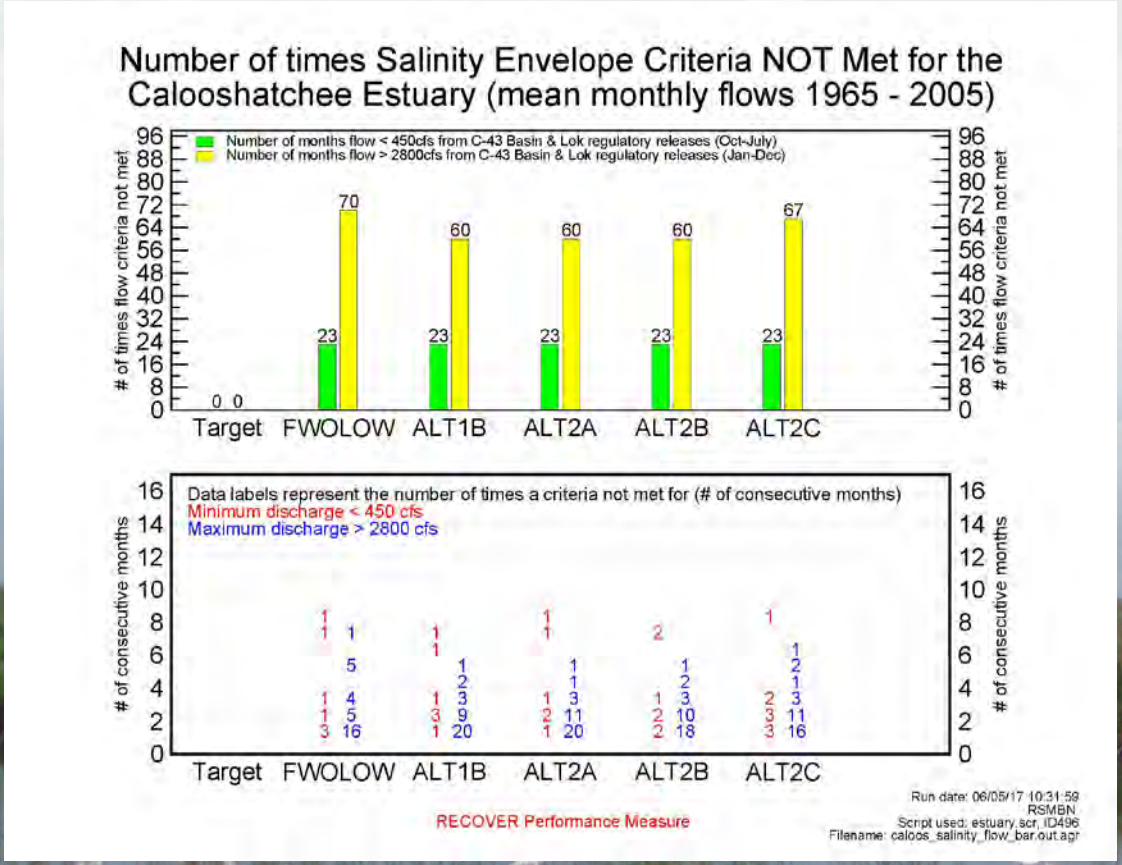
Caloosahatchee Normalized Scores 0-100

Metric #	PM Metric	ECB	FWO	ALT1B	ALT2A	ALT2B	ALT2C
3.1	Low Flow (< 450 cfs)	4	81	81	81	81	81
3.2	High Flow (>2800 cfs)	4	29	39	39	39	32



Caloosahatchee Round 2 Habitat Units

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Habitat Suitability Index (0-1) * Acreage = Habitat Units

Caloosahatchee Acreage = 70,979 acres

Metric #	PM Metric	ECB	FWO	ALT1B	ALT2A	ALT2B	ALT2C
3.1	Low Flow (< 450 cfs)	0.02	0.405	0.405	0.405	0.405	0.405
3.2	High Flow (>2800 cfs)	0.02	0.145	0.195	0.195	0.195	0.16
	Total	**0.04**	**0.55**	**0.6**	**0.6**	**0.6**	**0.57**
	Caloosahatchee Habitat Units	**2,839**	**39,038**	**42,587**	**42,587**	**42,587**	**40,458**

Rescaled St. Lucie Round 2 Scores

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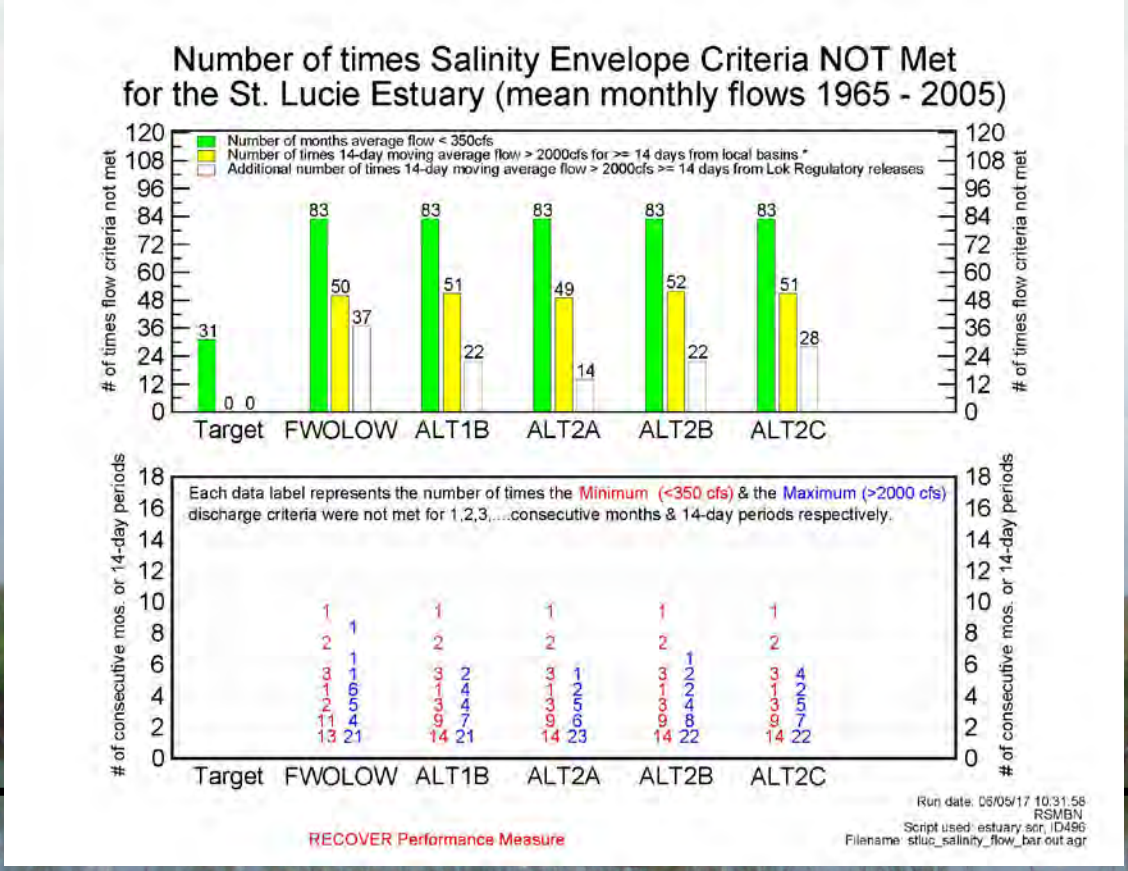
Normalized Scores 0-100

Metric #	PM Metric	ECB	FWO	ALT1B	ALT2A	ALT2B	ALT2C
4.1	Low Flow (< 350 cfs)	14	31	31	31	31	31
4.2	High Flow (>2000 cfs)	14	55	73	83	73	66



St. Lucie Round 2 Habitat Units

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Habitat Suitability Index (0-1) * Acreage = Habitat Units

St. Lucie Acreage = 14,994 acres

Metric #	PM Metric	ECB	FWO	ALT1B	ALT2A	ALT2B	ALT2C
4.1	Low Flow (< 350 cfs)	0.07	0.155	0.155	0.155	0.155	0.155
4.2	High Flow (>2000 cfs)	0.07	0.275	0.365	0.415	0.365	0.33
	Total	**0.14**	**0.43**	**0.52**	**0.57**	**0.52**	**0.49**
	St. Lucie Habitat Units	**2,099**	**6,447**	**7,797**	**8,547**	**7,797**	**7,347**

Northern Estuaries Habitat Units
Round 2 Modeling

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Habitat Units = Habitat Suitability Index (0-1) * Acreage

Northern Estuaries PMs	ECB	FWO	ALT1B	ALT2A	ALT2B	ALT2C	Max HU
Caloosahatchee Habitat Units (acres)	2,839	39,038	42,587	42,587	42,587	40,458	70,979
St. Lucie Habitat Units (acres)	2,099	6,447	7,797	8,547	7,797	7,347	14,994
Overall NE Habitat Units (acres)	**4,938**	**45,485**	**50,384**	**51,134**	**50,384**	**47,805**	**85,973**

Northern Estuaries Habitat Unit Lift Round 2 Modeling

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Habitat Unit Lift = Alt Habitat Units – FWO Habitat Units

Northern Estuaries PMs	ECB	FWO	ALT1B	ALT2A	ALT2B	ALT2C	Max Lift
Caloosahatchee Habitat Unit Lift	-36,199	0	3,549	3,549	3,549	1,420	31,941
St. Lucie Habitat Unit Lift	-4,348	0	1,350	2,100	1,350	900	8,547
Total NE Habitat Unit Lift	**-40,547**	**0**	**4,899**	**5,649**	**4,899**	**2,320**	**40,488**

Round 2 Modeling Habitat Units

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	ALT1B	ALT2A	ALT2B	ALT2C
Northern Estuaries				
Potential Lift	4,899	5,649	4,899	2,320
Lake O Potential Lift	7,650	10,800	9,675	4,275
Total Potential Lift	**12,549**	**16,449**	**14,574**	**6,595**

	KR-N	KR-C	KR-C Extra	KR-S	PR-N	PR-S	LO-W	IP-10
Wetland HU Lift	355	927	204	344	970	1,836	2,306	2,866

Acknowledgements

- Andy Rodusky
- Steve Schubert
- Eco Subteam

Lake Okeechobee Watershed Restoration Project

Monitoring and Adaptive Management Plan

Introduction for the PDT

Trusted Partners Delivering Value Today for a Better Tomorrow

U.S.ARMY

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

What is a Project's Monitoring and Adaptive Management Plan?

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The Plan is a combination of two required pieces of CERP Project Implementation Reports (PIRs):

- **A monitoring plan** specifies the data collection, analysis, and reporting that will inform project performance
- **An adaptive management plan** guides the use of collected data to:
  - Address uncertainties related to project performance
  - Maximize project benefits while reducing project costs
  - Help inform implementation sequencing of LOWRP
  - Understand how monitoring will determine if adjustments are needed in project implementation to improve performance

Plan Organization

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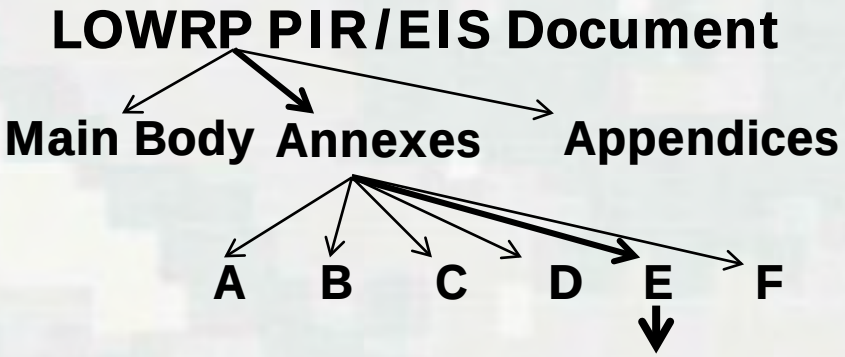

Monitoring and Adaptive Management Plan

Introduction

Part 1: Adaptive Management Plan (AM Plan)

- Includes AM-relevant uncertainties, strategies, and recommendations
- Refer to other monitoring where possible

AM Monitoring will support the AM uncertainties as well as confirm the benefits of the project.

Ecological Monitoring will confirm project benefits.

Part 2: Hydrometeorological Monitoring

Part 3: Water Quality Monitoring

3

How will the AM and Monitoring Plan be developed?

- Monitoring plans will be developed based on ecological, hydrological and water quality needs to determine project success
- AM plan development will be led by the Eco subteam and will coordinate with PDT, subteams (engineering, water quality, water supply, etc.), RECOVER, Science Coordination Group
- Starting point will include AM work already available from other projects, science programs, and LOWRP teams

AM Plan Development

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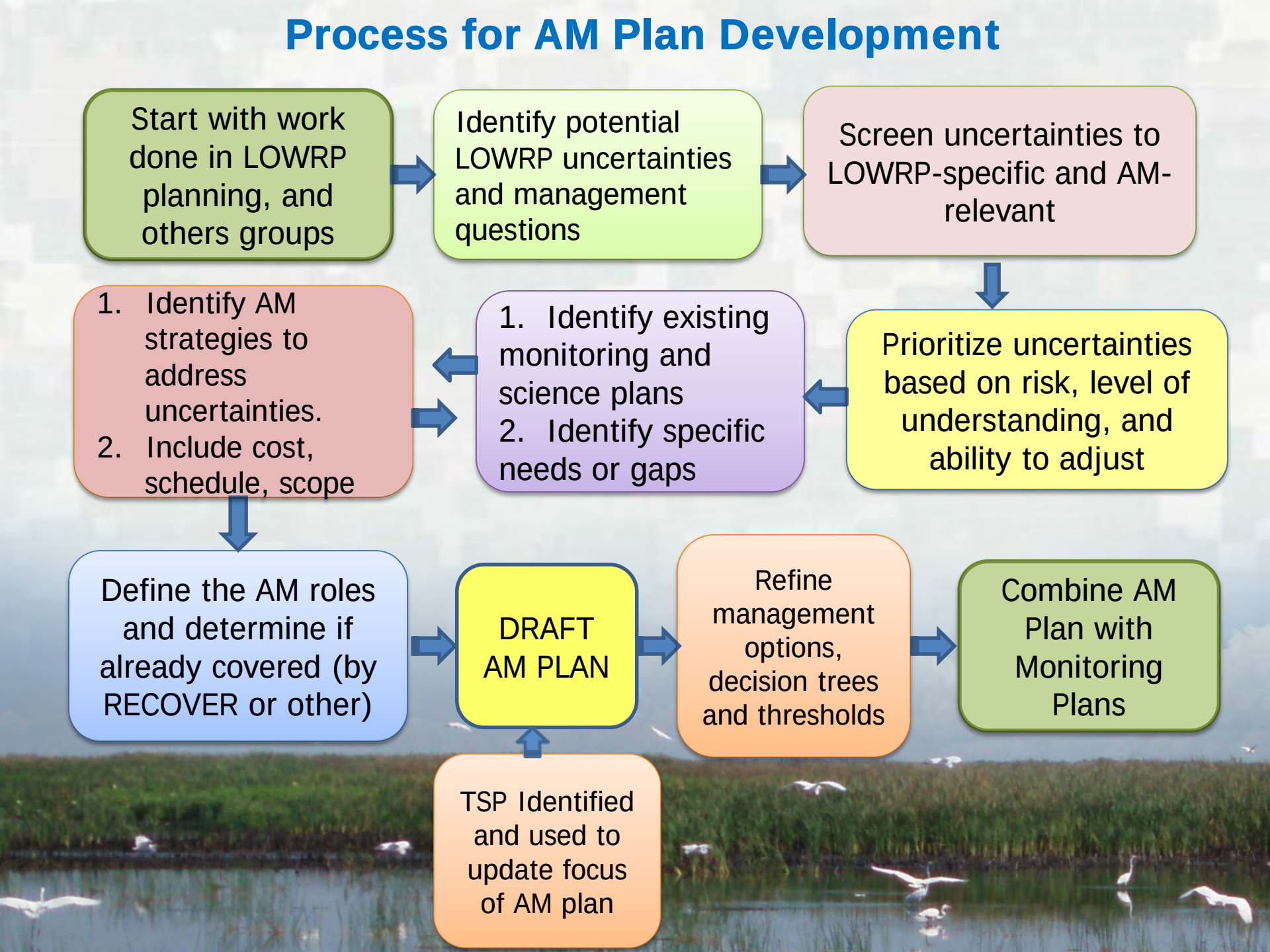
Adaptive management steps to be coordinated with the team and groups:

1. Identify and prioritize LOWRP uncertainties that can be addressed
2. Define strategies to address key uncertainties:
   - Maximize use of existing ecosystem monitoring and that listed in other sections of the LOWRP AM and Monitoring Plan and other monitoring
   - Testing of project features
3. Define how incoming data will be processed and reported for maximum use by project decision-makers over time
4. Process for informing project implementation
5. Finalize AM strategies with the tentatively selected plan (TSP) and determine costs

Process for AM Plan Development



Monitoring Plan Development

1. Identify current monitoring (RECOVER, Agencies, Counties, etc.)
2. Identify monitoring needed for AM Strategies, Ecological Monitoring, Water Quality and Hydrometeorological
3. Finalize monitoring with TSP and determine costs

Uncertainty Screening Criteria

- Affect LOWRP's ability to meet its goals and objectives and remain within its constraints
- Be at an appropriate LOWRP-scale spatially and temporally
- Have options for adaptive management actions such as potential project or operational adjustments
- Have a combination of high importance to LOWRP and high uncertainty that could be reduced by practical adaptive management

Criteria to Prioritize Uncertainties

Risk: What is the risk (high, medium, low) of not meeting LOWRP restoration goals if this uncertainty is not addressed?

Knowledge: What is the level of understanding (high, medium, low) of this uncertainty (i.e., how much is known about this uncertainty)?

Relevance to Adaptive Management for LOWRP: What is the level of confidence (high, medium, low) that anything could be done to address the uncertainty?

Draft LOWRP Uncertainties

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- Occurrence and management of invasive species and algal blooms
- Recruitment/re-establishment of wildlife populations
- Success of vegetation communities
- Effects on groundwater/drinking water supply
- Drought/severe weather events' impact to the project
- Effects of new structures and hydrologic regimes to upland species

Schedule for Monitoring and AM Plan Development

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May 2017:
- Kick off AM and Monitoring Plan activity – complete

June 2017:
- Identify and Prioritize uncertainties – in progress
- Review existing monitoring plans

July 2017:
- Develop AM Strategies

August 2017:
- Review AM Plan; will need to know TSP before finalizing
- Coordination with LOWRP subteams, PDT, scientists and experts

September 2017:
- Finalize items to include in Plan based on TSP
- Finalize AM strategies, decision trees, and implementation plan
- Present costs

October 2017:
- **Monitoring and Adaptive Management Plan Deadline**

Learn more about Adaptive Management in CERP

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The Adaptive Management Integration Guide

http://141.232.10.32/pm/pm_docs/adaptive_mgmt/062811_am_guide_final.pdf

CERP Program-Level AM Plan

http://www.saj.usace.army.mil/Portals/44/docs/Environmental/RECOVER/20151019_CERPPROGRAMAMPLAN_DCT_APPROVED.pdf

Geotechnical Data Collection

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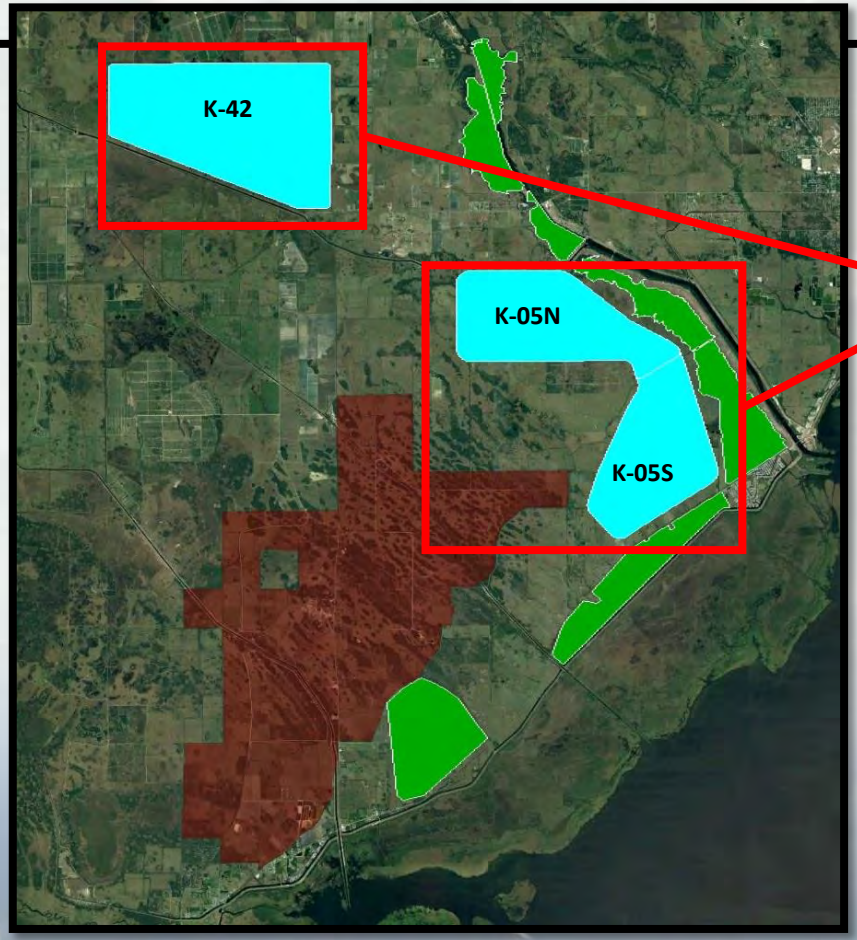
Geotechnical Exploration

- Exploration expected to begin in late July
- Exploration expected to take 4 weeks
- Performed by USACE drilling crews
- Lab analysis has not been scheduled



Geotechnical Data

- Number of SPT borings: 10
- Number of companion borings for constant head tests: 15
- Number of DRIs: 20
- Testing is for seepage and foundations analysis for high-hazard impoundment
- Testing is limited to publicly owned lands and rights of way within or near K-05 and K-42 proposed reservoir locations.

Geotechnical Test Locations

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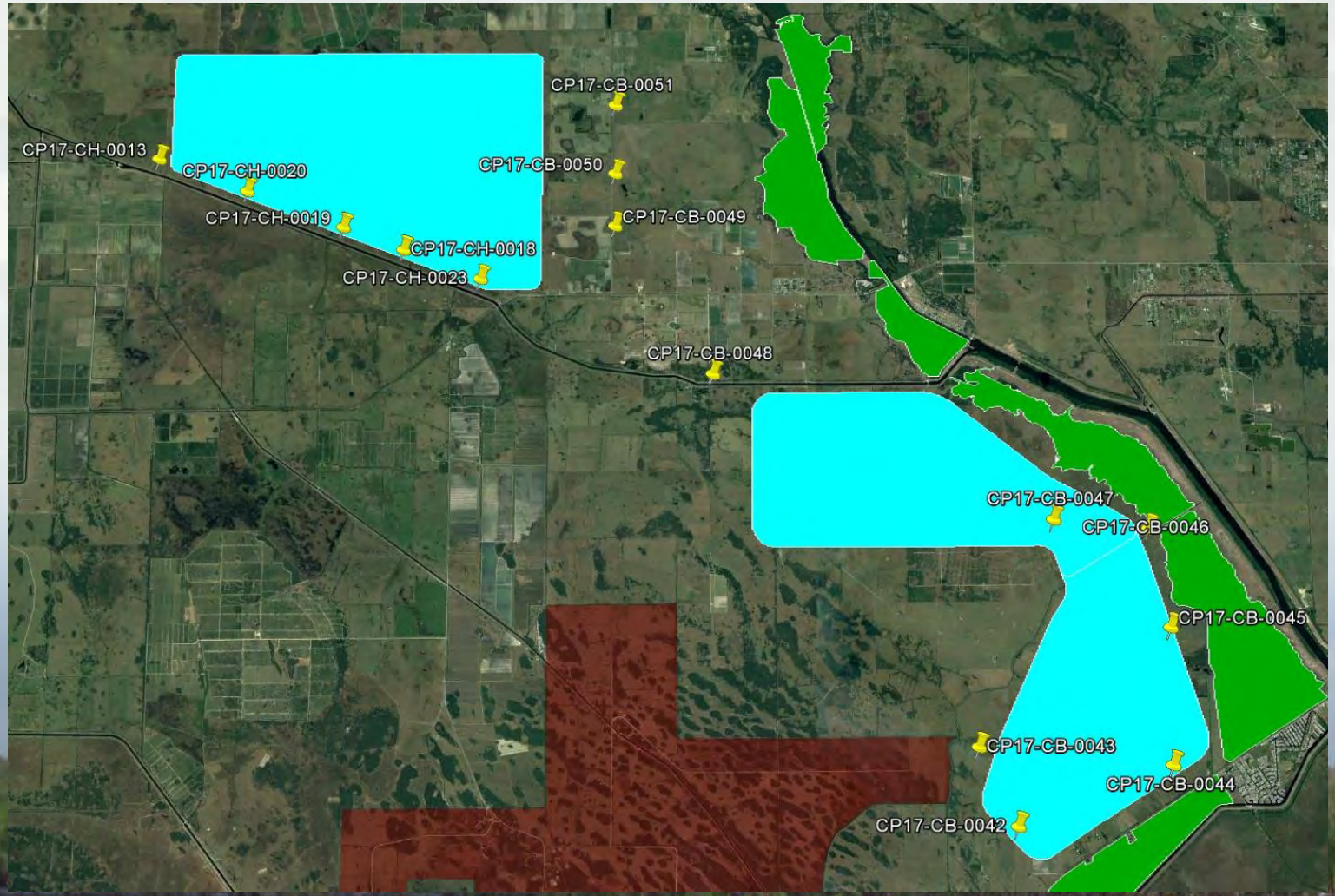

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As of: 3/16/17
POC: L.Aley

NED Impacts Resulting From Water Supply Delivery Modification

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What Is NED?
National Economic Development:

NED is one of the four accounts USACE employs in the Civil Works decision making process
- National Economic Development, National Ecosystem Restoration, Regional Economic Development, Other Social Effects

USACE Principals and Guidelines States:

"Contributions to national economic development (NED) are increases in the net value of the national output of goods and services, expressed in monetary units…"

"A plan recommending Federal action is to be the alternative plan with the greatest net economic benefit consistent with protecting the Nation's environment (the NED plan)…"

HOWEVER…

NED Impacts Resulting From Water Supply Delivery Modification

BUILDING STRONG

The Lake Okeechobee Watershed project is a National Ecosystem Restoration Effort
NED impacts are ancillary to the primary project purpose, NER

Water supply modification is regulated by the 'Savings Clause' of WRDA 2000

Section 601(h)(5) Savings Clause-
NO ELIMINATION OR TRANSFER- Until a new source of water supply of comparable quantity and quality as that available on the date of enactment of this Act is available to replace the water to be lost as a result of implementation of the Plan, the Secretary and the non-Federal sponsor shall not eliminate or transfer existing legal sources of water, including those for—

(i) An agriculture or urban water supply
(ii) Allocation or entitlement to the Seminole Indian Tribe of Florida under section 7 of the Seminole Land Claims Settlement Act of 1987
(iii) The Miccosukee Tribe of Indians of Florida
(iv) Water supply for ENP; or
(v) Water supply for fish and wildlife

NED Impacts Resulting From Water Supply Delivery Modification

BUILDING STRONG

Proposed Process For Analyzing Water Supply Impacts in LOW

Analysis to be performed jointly between SFWMD and USACE staff

- Initial water supply impacts/benefits identified through Alternative screening will be represented using percentage change from the existing level of water supply delivered. Each Service Area will be analyzed.

- For the Tentatively Selected Plan, monetary impacts/benefits from water supply efforts will be estimated using economic post processors which utilize data from the existing water management model.

- Process will allow the PDT to see what, if any, monetary impact/benefits occur to agricultural production as well as potential impacts to M&I as a result of water supply modification

- If the Lower East Coast is included in this analysis, Municipal and Industrial impacts in the LEC will be analyzed as well, using similar methods as the analysis used in the Service Areas.

NED Impacts Resulting From Water Supply Delivery Modification

BUILDING STRONG

NED/WSP Supply Team Path Forward

- Inclusion of recreation to the benefit analysis, post Tentatively Selected Plan announcement
- Potential discussion of Regional Economic Development impacts of water supply modification

Questions?