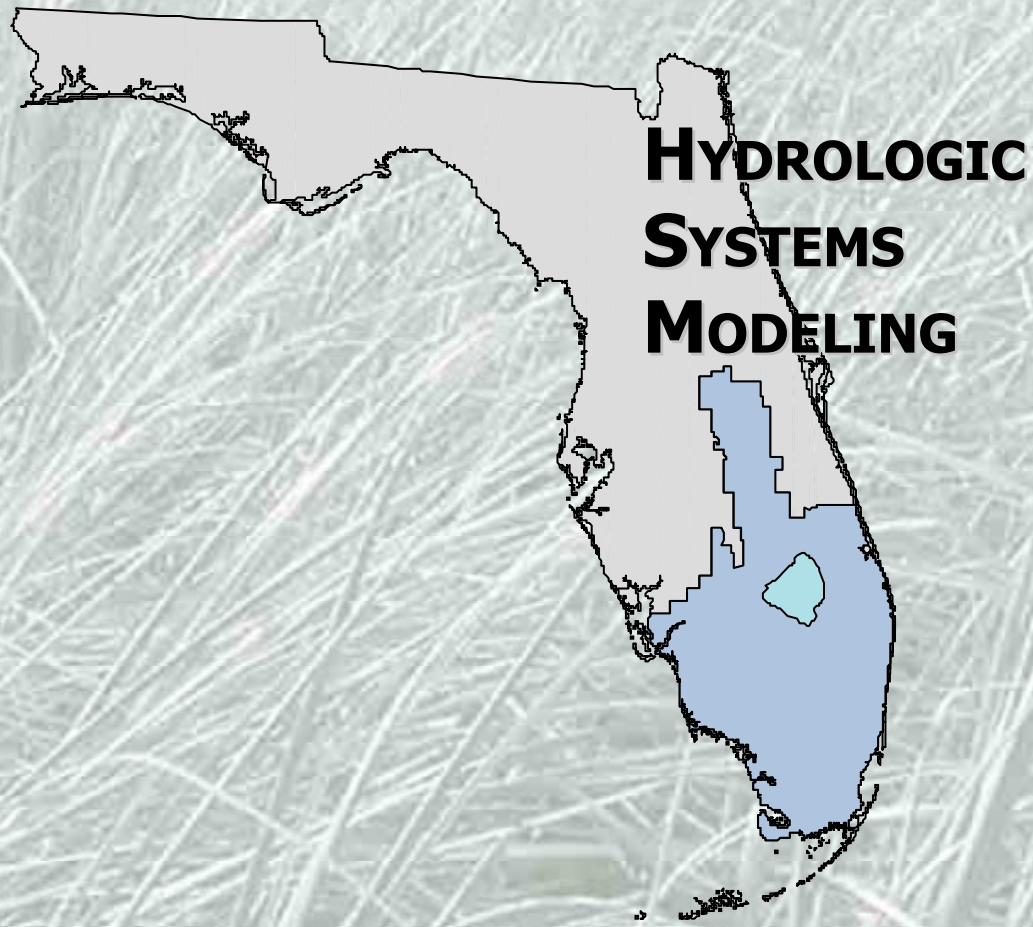
Regional Modeling of EAA Storage Reservoirs

For

EAA Project Delivery Team



By

Ken C. Tarboton, Ph.D., P.E.

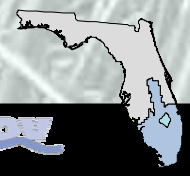
April 9, 2002

Outline

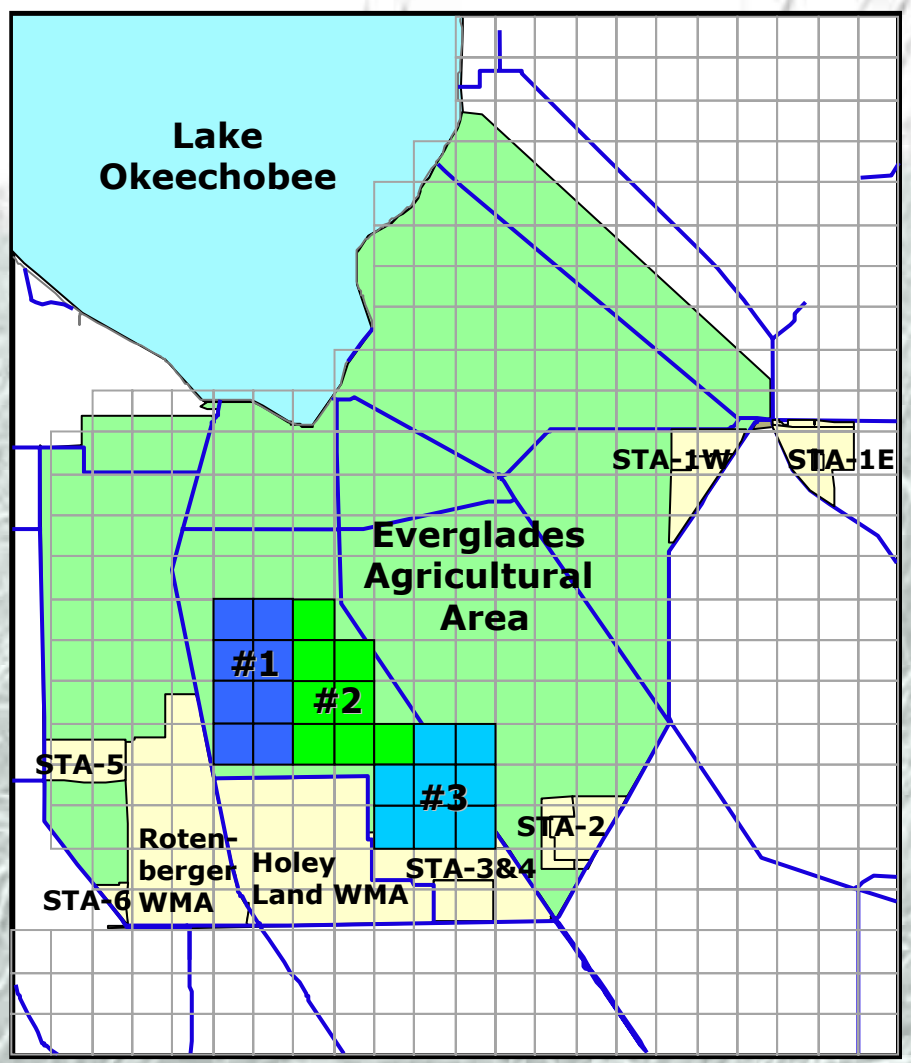
- **EAA Reservoirs Configurations and Purpose**
  - In Restudy - D13R
  - Scenarios
- **RECOVER evaluation**
  - Performance Measures/Indicators
- **LEC recommendations**
- **ECP design**
- **Design Suggestions**

EAA Reservoirs in D13R

"The initial design for the reservoirs assumed 60,000 acres, divided into three equally-sized compartments (1, 2A, 2B), with the water level fluctuating up to six feet above grade in each compartment. The final size, depth, and configuration of this facility will be determined through more detailed planning and design"



EAA Reservoirs in D13R

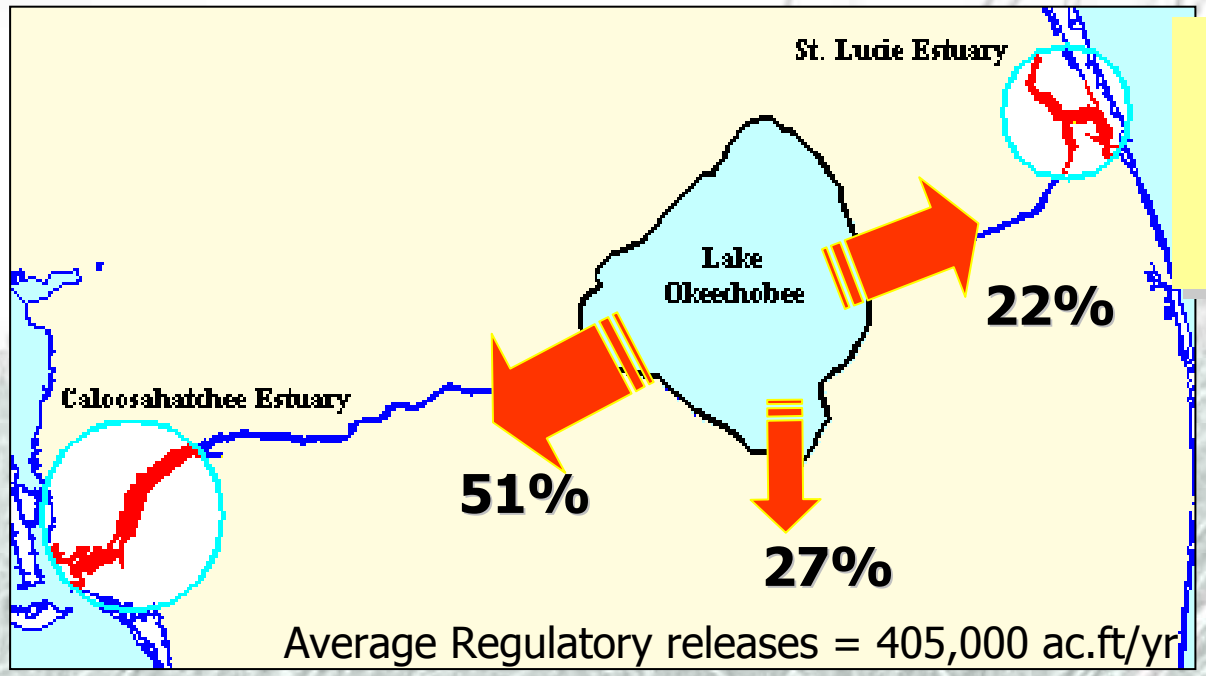


Total Storage (360,000 ac-ft)
Equivalent to 0.8 ft on LOK

- **Compartment #1 (120,000 ac-ft)**
  - ➔ used to meet Everglades Agricultural Area irrigation demands
- **Compartments #2&3 (each 120,000 ac-ft)**
  - ➔ used to meet environmental demands as a priority

What do EAA Reservoirs do for System ?

Future Regulatory Releases without project (50 Base)



Future Regulatory Releases with CERP (D13R)

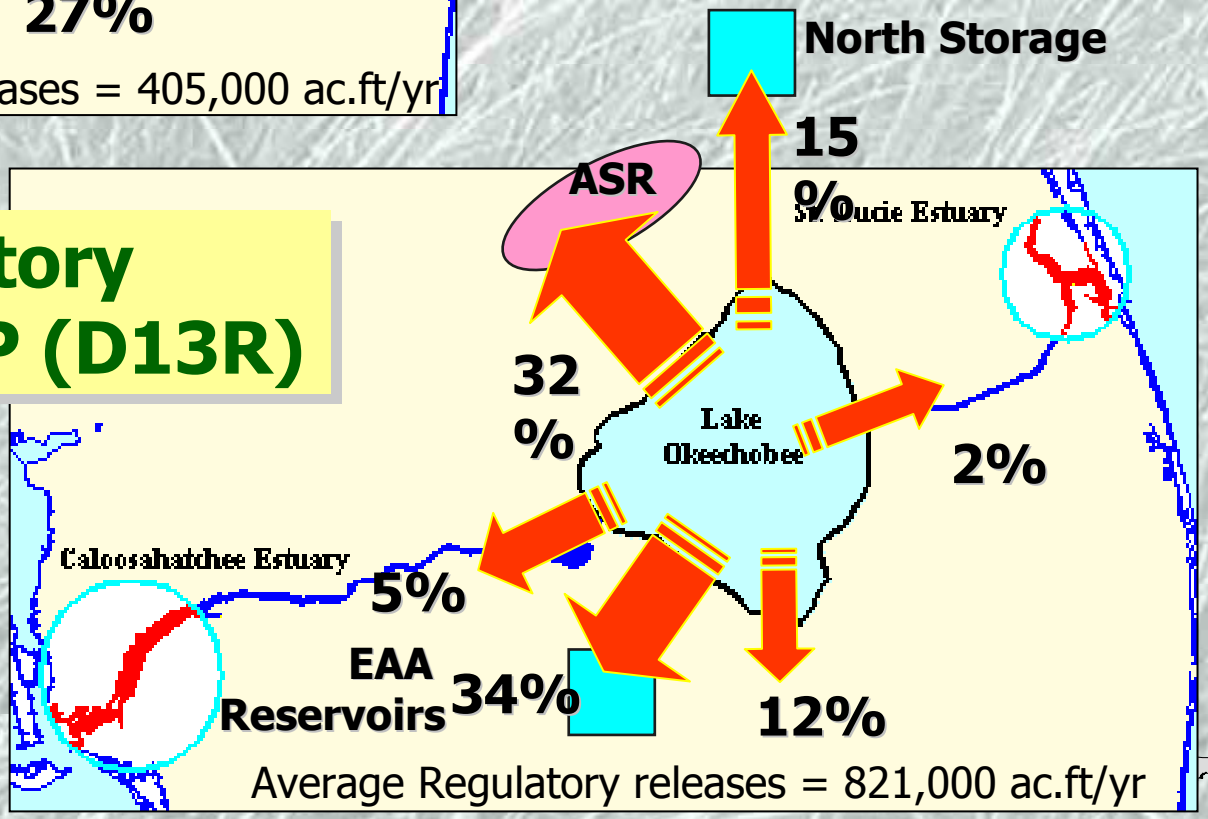
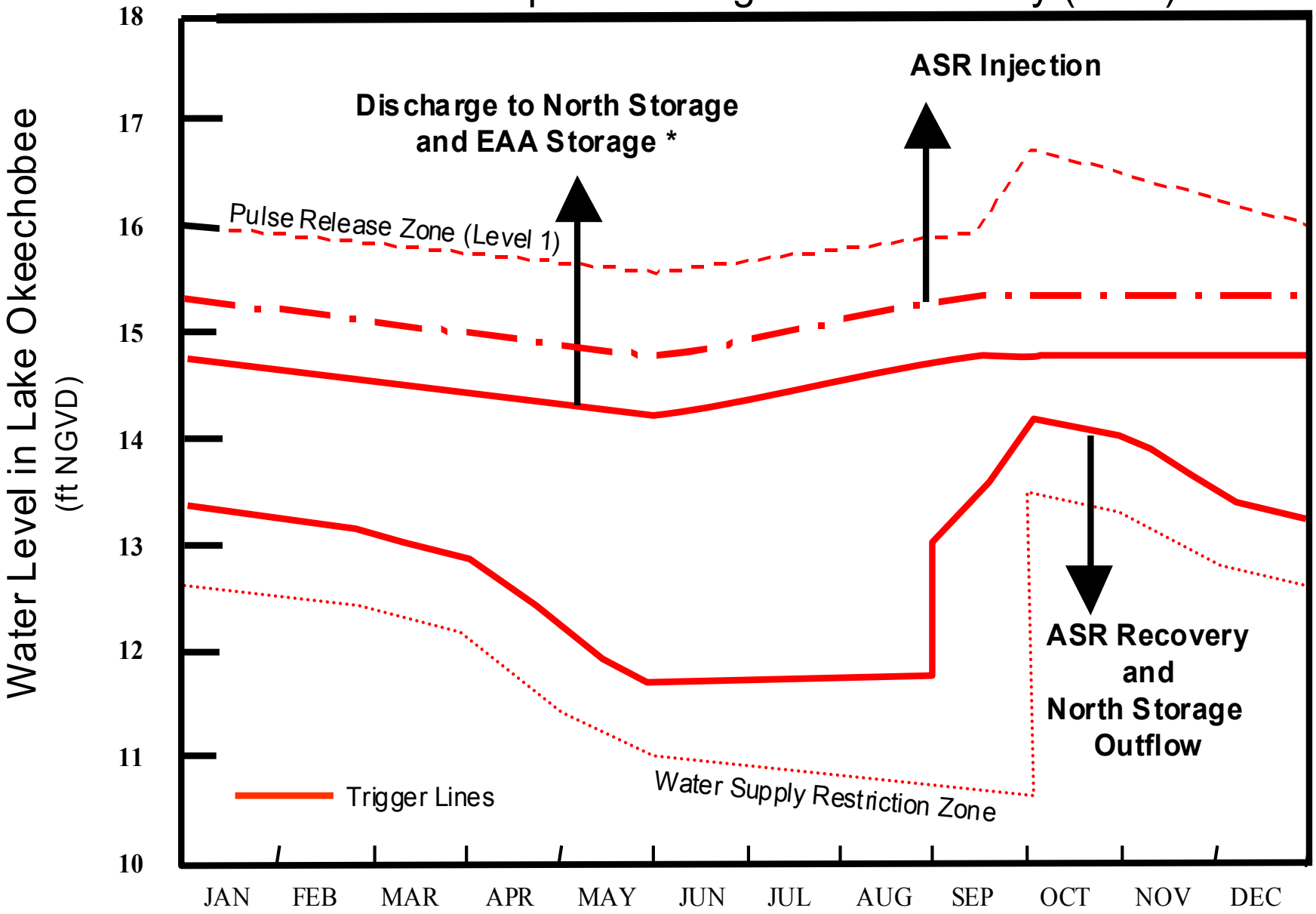


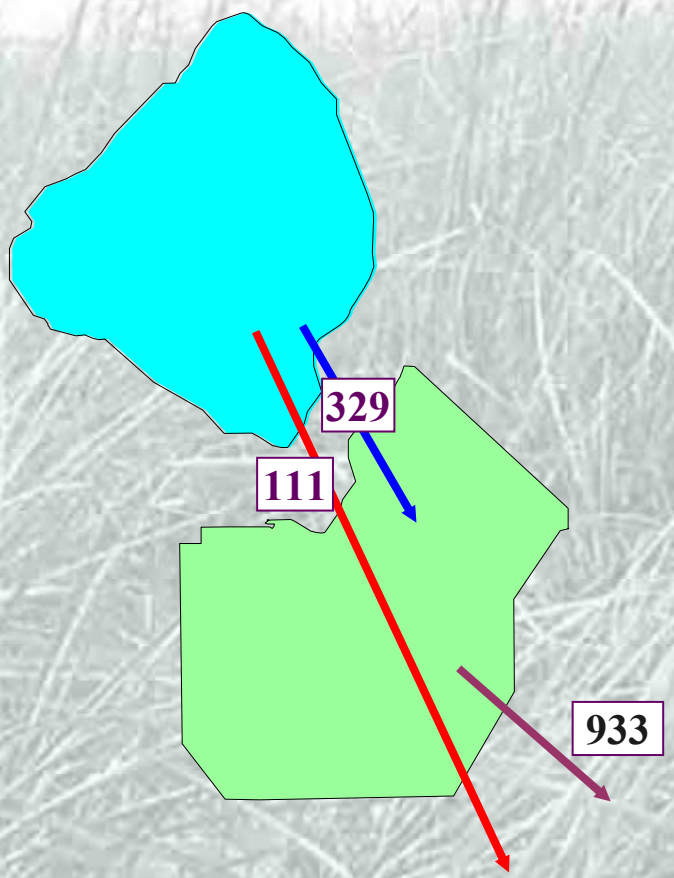
Figure 1. Trigger Lines for North of Lake Okeechobee Storage and Lake Okeechobee Aquifer Storage and Recovery (ASR)



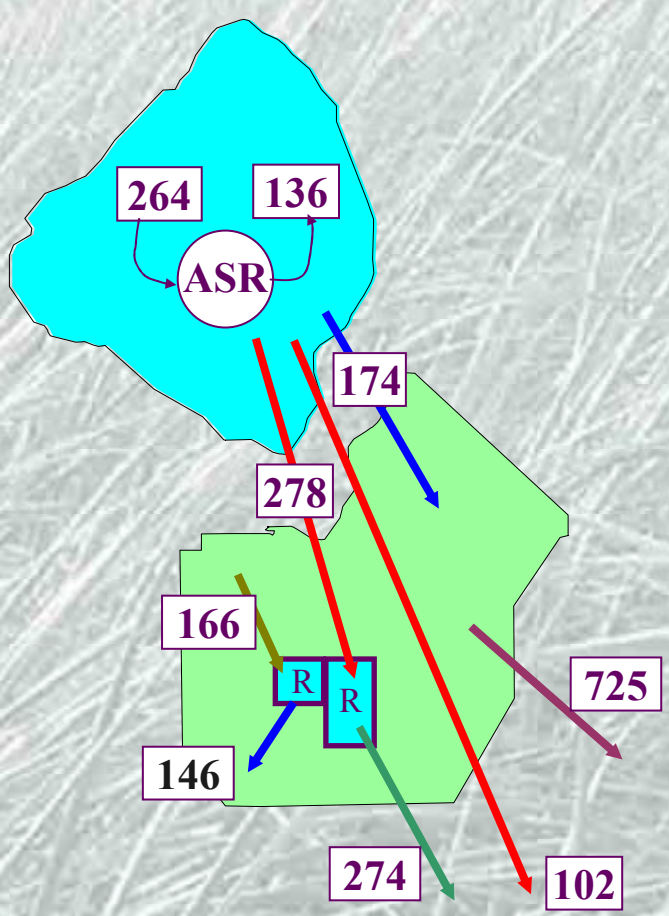
* Discharge to North and EAA Storage if Lake Okeechobee stage is forecasted to be above "Discharge to …Storage" line, or if stage is above Pulse Release Zone (level 1) line.

What do EAA Reservoirs do for System ?

Future without project (50 Base)



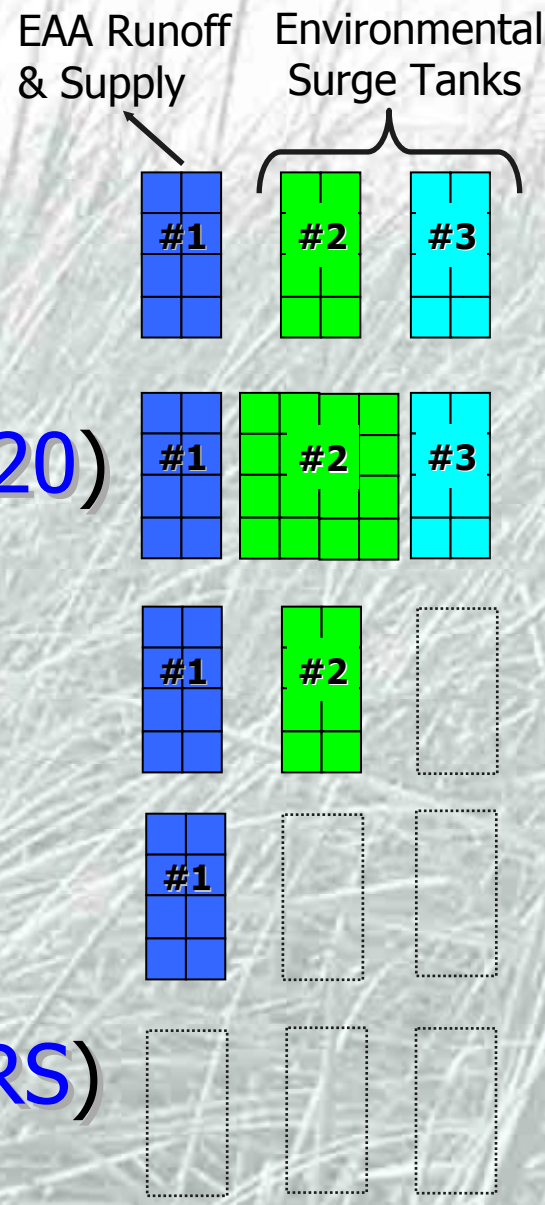
Future with CERP



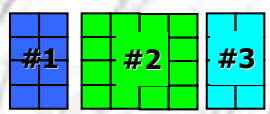
Units - Thousand Acre Feet per Year

EAA Reservoir Scenarios

- Based on CERP (D13R)
- Double size of Reservoir 2 (SGT4020)
- Remove Reservoir 3 (SGT1x20)
- Remove Reservoirs 2 & 3 (EAARS)
- Remove all EAA Reservoirs (NEAARS)



Described in Central and Southern Florida Project, Comprehensive Review Study, 1999, Appendix B-68,69,104-141

Double size of Reservoir 2 (SGT4020 

)

- Increased Everglades environmental needs met from EAA reservoirs
- Decrease in Env. water supply from LOK
- Decrease in EAA runoff south and decrease in LOK deliveries to meet EAA demands
- Decrease in injection to ASR

System-wide performance:

- Lake Okeechobee is above 15’ for 1% less time than D13R (17% vs 18%)

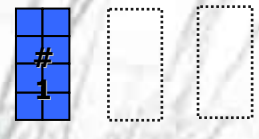
Remove Reservoir 3 (SGT1x20 

)

- Decrease in LOK regulatory releases to EAA Res.
- Increase in environmental water supply releases from LOK
- Increase in EAA runoff south and increase in Lok deliveries to meet EAA demands

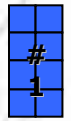
System-wide performance:

- Lake Okeechobee is below 12’ for 2% more time than D13R (11% vs 9%)

Remove Reservoirs 2 & 3 (EAARS 

)

- Higher LOK stages, hence
  - Increased injection to ASR
  - Decrease in LOSA demands not met
  - Reduced LOK induced cutbacks
- Significant increase in LOK water supply to environment
- Increased regulatory releases to Estuaries and WCA's

System-wide performance: (EAARS )

Lake Okeechobee

- →1% less time where lake is below 12' (8% vs 9%)
- →7% more time where lake is above 15' (25% vs 18%)

Everglades National Park (Shark River Slough)

- →28,000 ac-ft less through SRS transect (1,082,000 vs 1,110,000)

Water Supply - LOSA

- →2% less demands not met in EAA (3% vs 5%)
- →1% less demands not met in other LOSA (6% vs 7%)

Water Supply - LECSA

- →7 fewer months of cutbacks in NPB, SA1, and SA3 (7 vs 14 for NPB & SA1; 12 vs 19 for SA3)
- →6 fewer months of cutbacks in SA2 (14 vs 20)

Remove all EAA Reservoirs (NEAARS)

- Significant increase in EAA runoff south
- Significant increase in LOK water supply to environment
- Increase in LOSA demands not met. LOK becomes sole source
- Significant increase in LOK induced cutbacks

System-wide performance: (NEAARS)

Lake Okeechobee

- →5% more time where lake is below 12′ (14% vs 9%)
- →2% more time where lake is above 15′ (20% vs 18%)

Water Conservation Area 3A

- →4% more time where IR19 stage is above 2.5′ (23 vs 19)

Water Conservation Area 3B

- →2% more time where IR16 stage is above 2.5′ (7 vs 5)

Everglades National Park (Shark River Slough)

- →61,000 ac-ft more through SRS transect (1,171,000 vs 1,110,000).

System-wide performance: (NEAARS)

Water Supply - LOSA

- →3% more demands not met in EAA (8% vs 5%)
- →2% more demands not met in other LOSA (9% vs 7%)

Water Supply - LECSA

- →26 more months of cutbacks in NPB, SA1, and SA3 (40 vs 14 for NPB & SA1; 45 vs 19 for SA3)
- →24 more months of cutbacks in SA2 (44 vs 20)

RECOVER EVALUATION

Restoration

Coordination

Verification

- **Process and interaction with PDT's**
- **Performance measures**

'Typical' RECOVER Project Evaluation Process

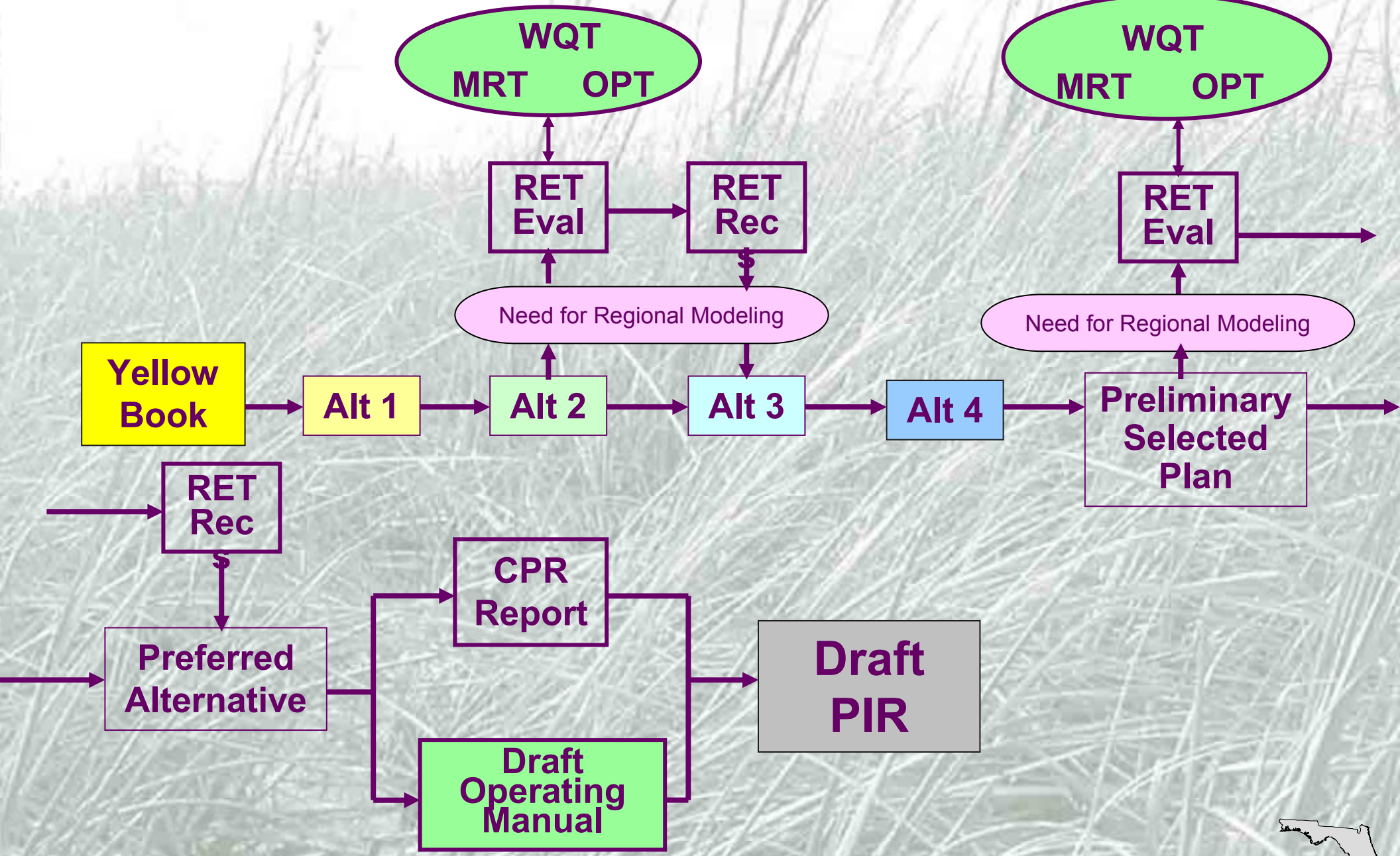


Figure4. RECOVER project evaluation process

Figure 4. Lake Okeechobee Stage Duration Curves

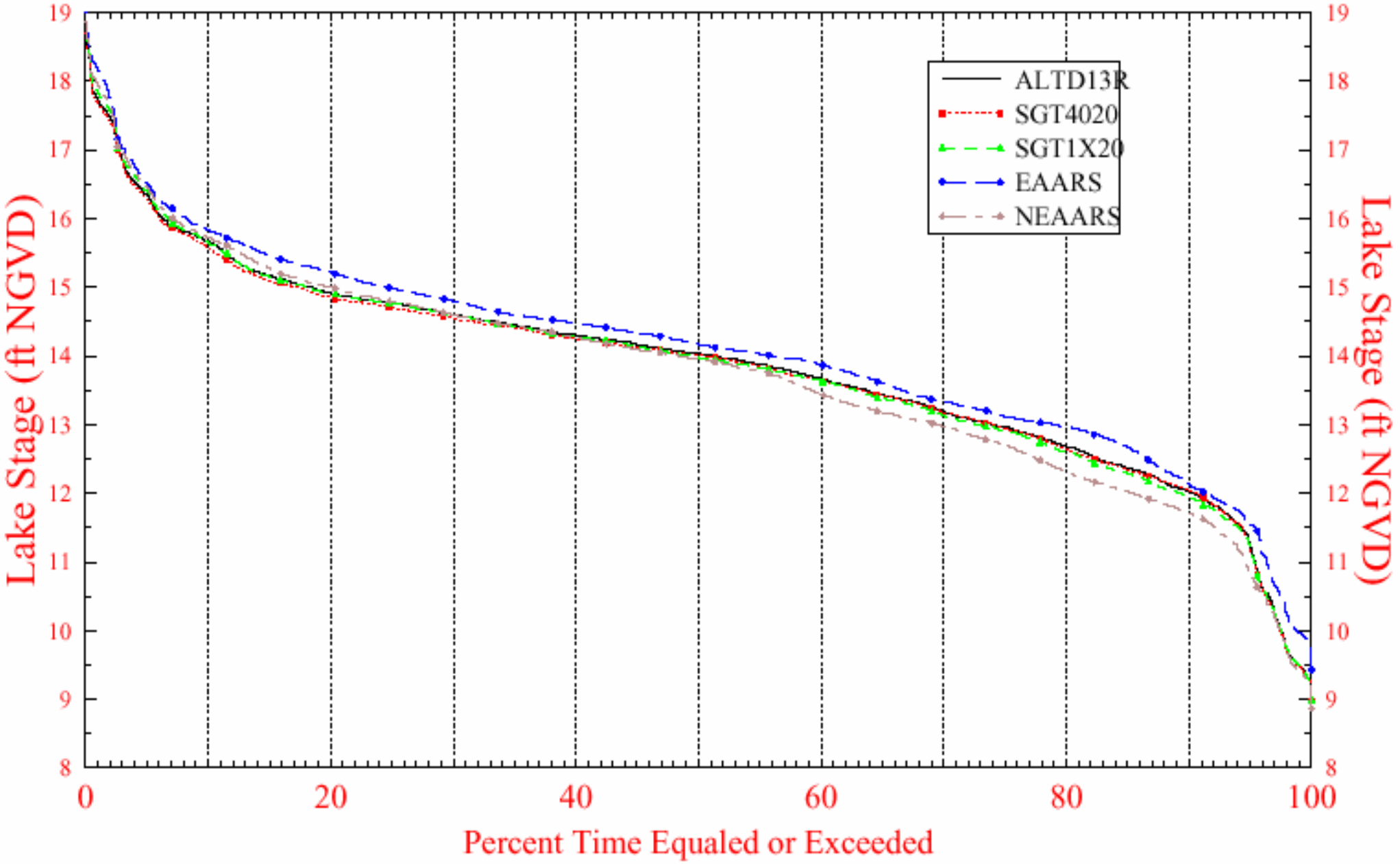


Figure 8. Number of Undesireable Lake Okeechobee Stage Events

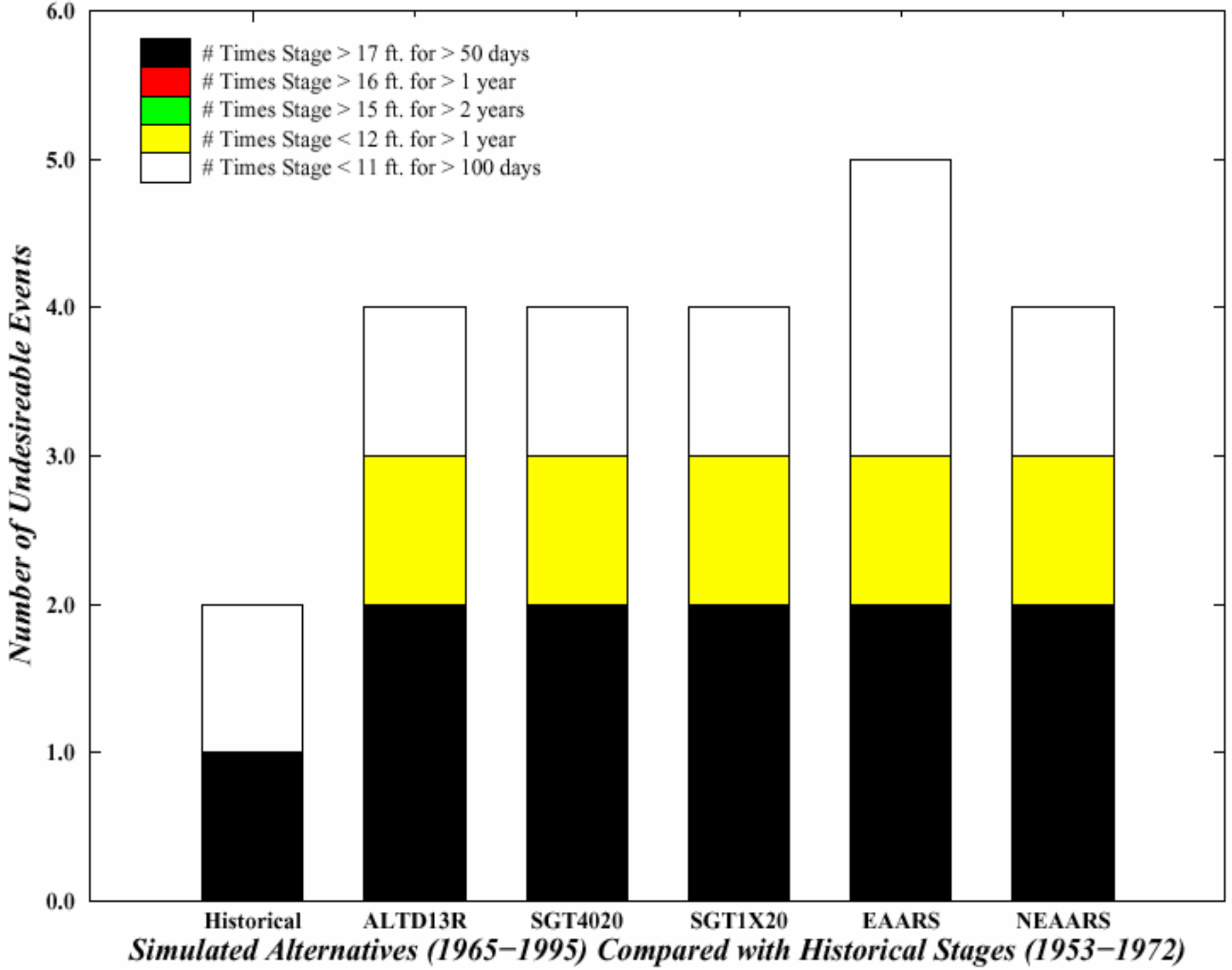
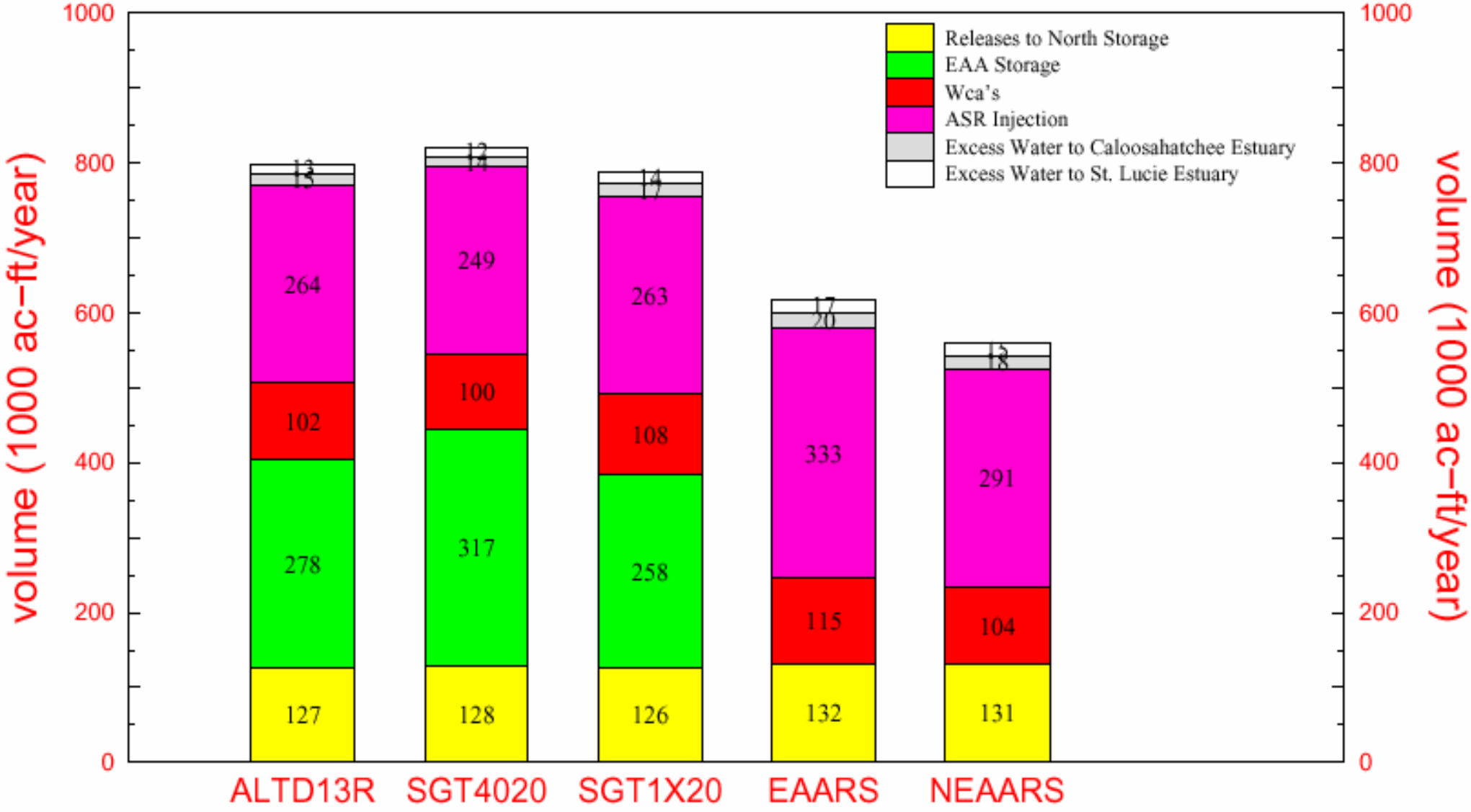


Figure 9. Mean Annual Flood Control Releases from Lake Okeechobee for the 31 yr (1965 – 1995) Simulation



Note: Although regulatory (flood control) discharges are summarized here in mean annual values, they do not occur every year. Typically they occur in 2–4 consecutive years and may not occur for up to 7 consecutive years.

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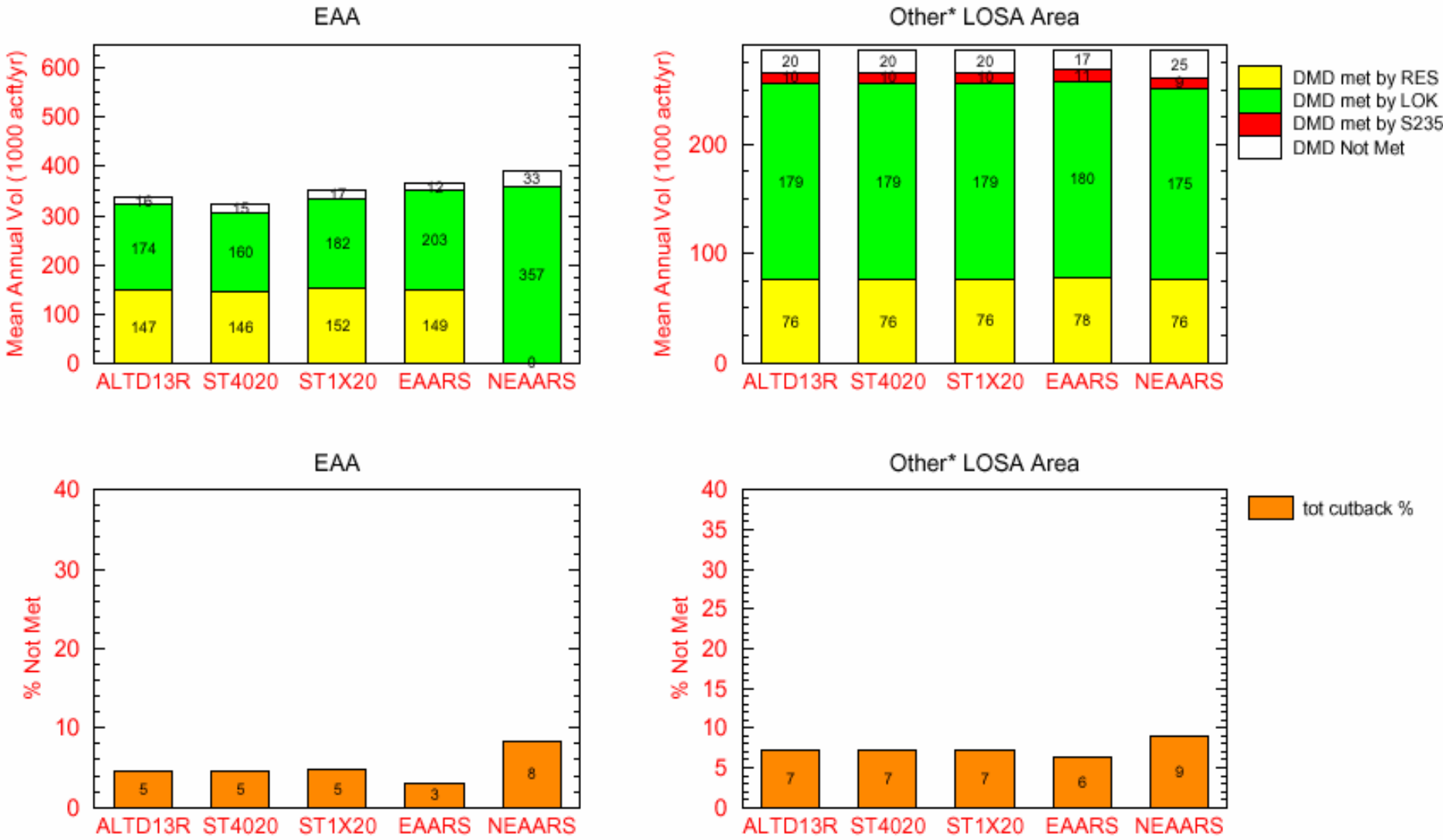
Fugure 11. Mean Annual EAA/LOSA Supplemental Irrigation: Demands and Demands Not Met

for the 1965 – 1995 Simulation Period



*Other Lake Service SubAreas (S236, S4, L8, C43, C44, and Seminole Indians (Brighton & Big Cypress)).

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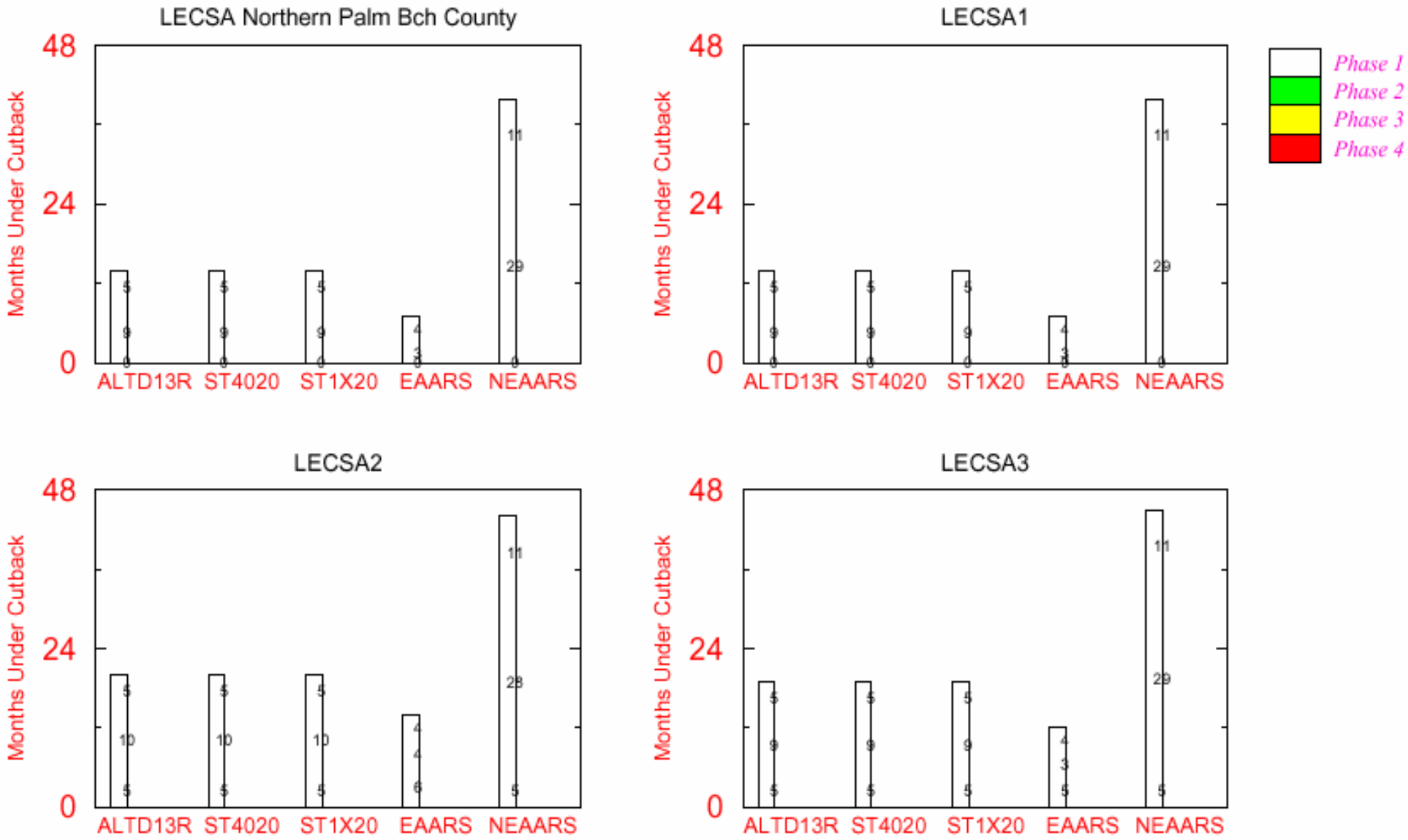
Figure 13. Number of Months of Simulated Water Supply Cutbacks for the 1965 − 1995 Simulation Period



Note: Phase 1 water restrictions could be induced by a) Lake stage in Supply Side Management Zone (indicated by upper data label), b) Local Trigger well stages (lower data label), and c) Dry season criteria (indicated by middle data label).

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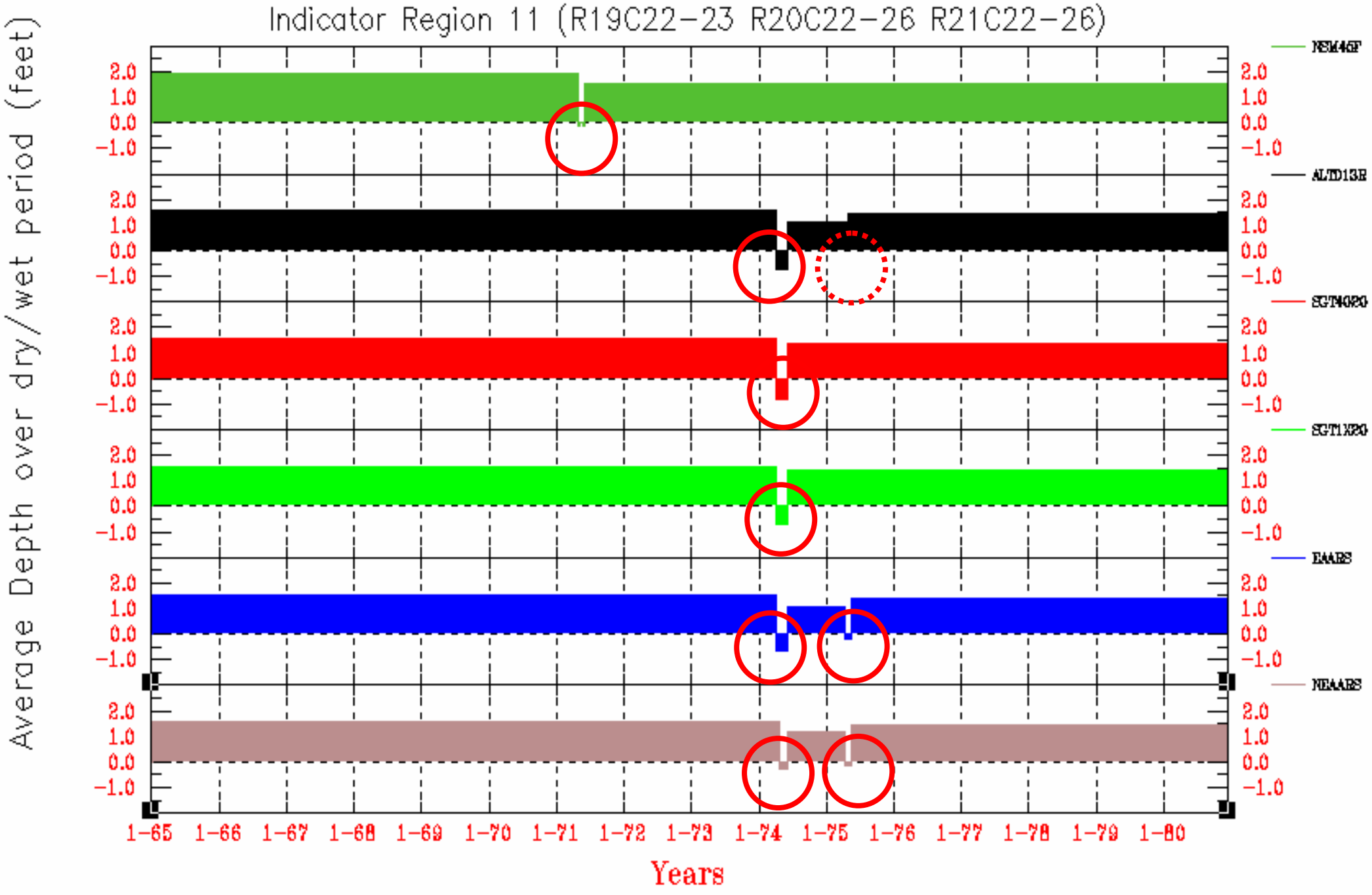
Inundation Pattern (1965–1980) NE Shark River Slough



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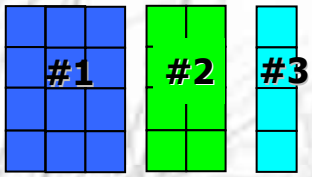
LEC recommendations



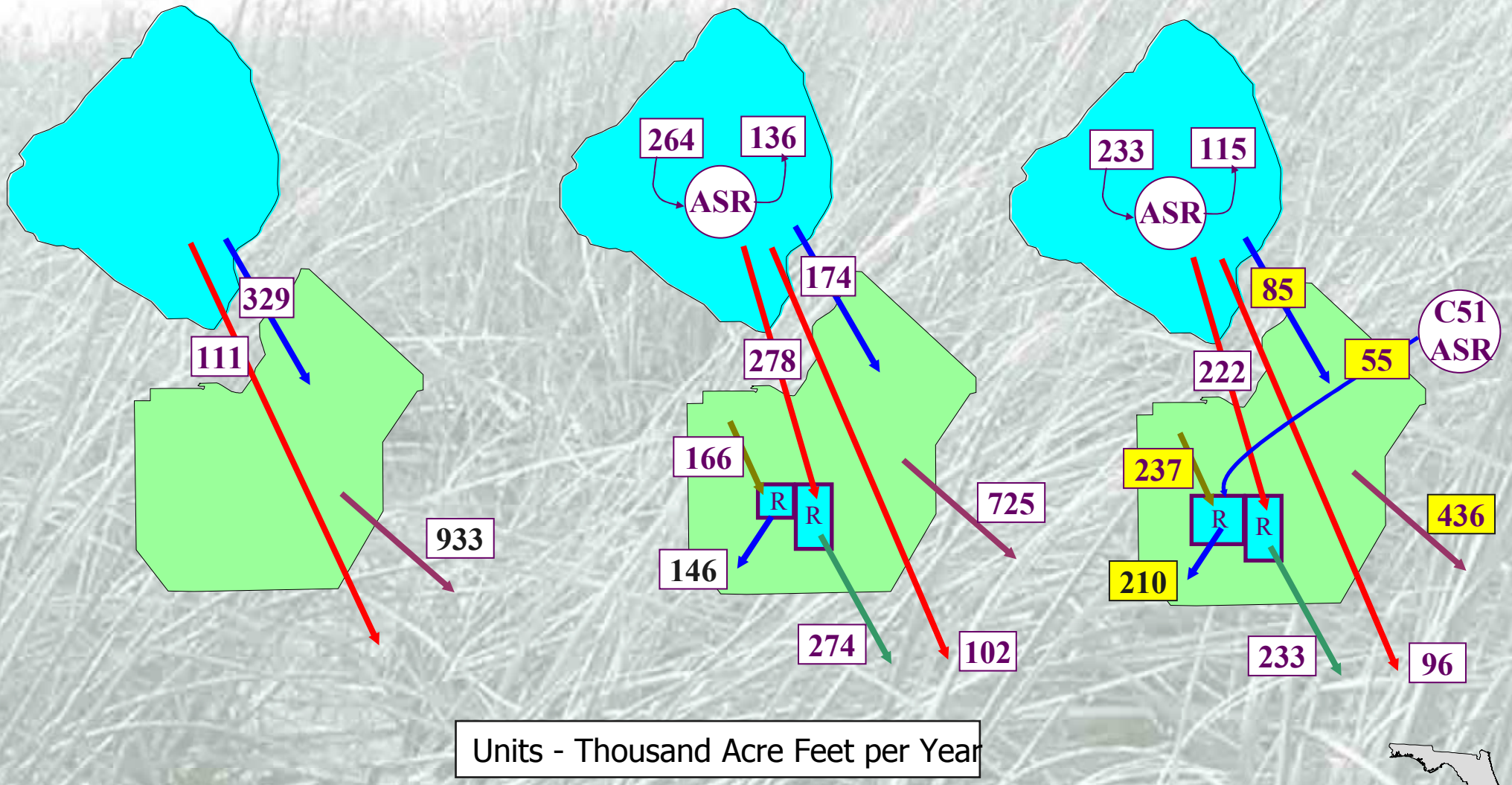
- Compartment 1 increased to 30,000 acres
- Compartment 2A remains 20,000 acres
- Compartment 2B decreased to 10,000 acres
- Runoff from Hillsboro Basin in EAA can be captured and routed to Compartment 1
- Compartment 1 can be used to meet demands in WPB canal basin as well as other EAA basin demands
- ASR facilities in LEC can be diverted to meet EAA demands

What do EAA Reservoirs do for System ?

Future without project (50 Base)

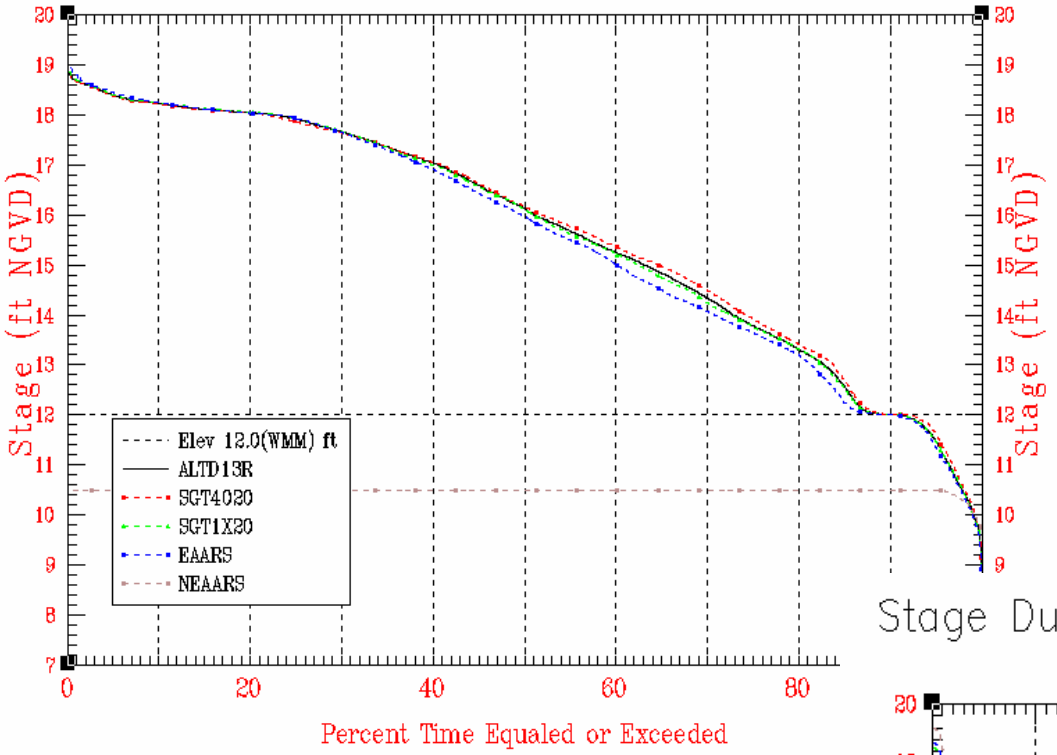
Future with CERP

LEC 2020

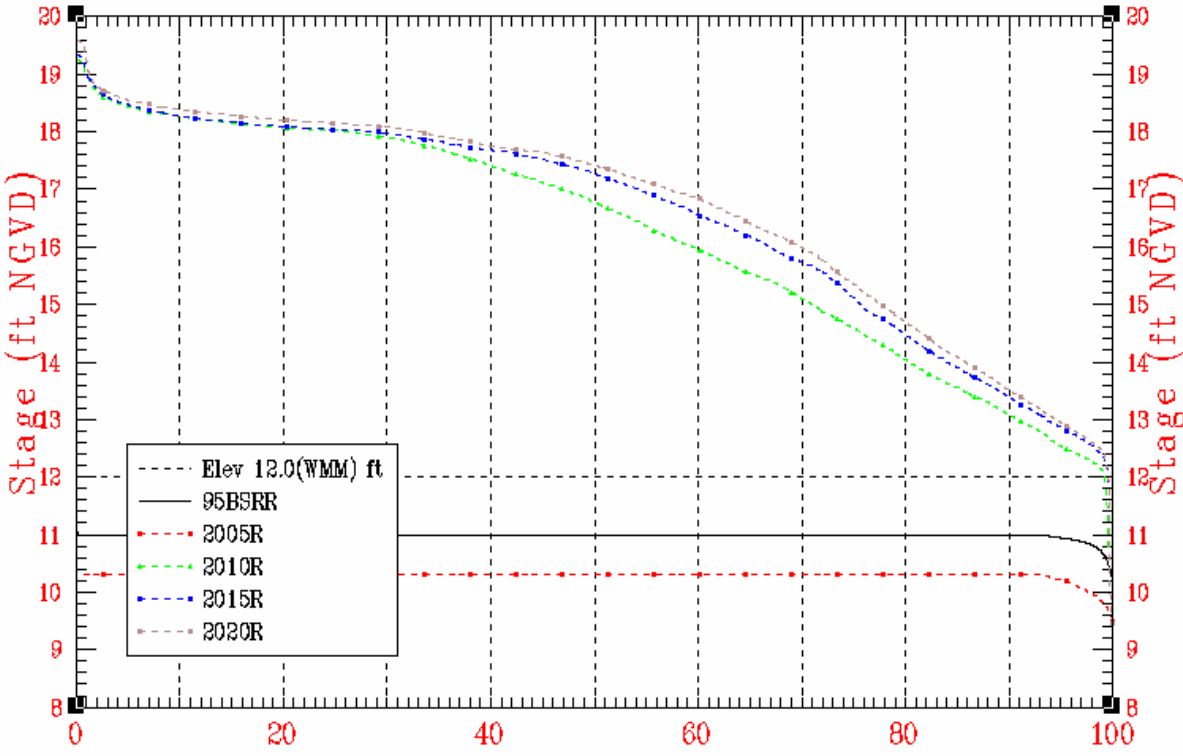


Units - Thousand Acre Feet per Year

Stage Duration Curves at EAA Compartment 1 Reservoir



Stage Duration Curves at EAA Compartment 1 Reservoir



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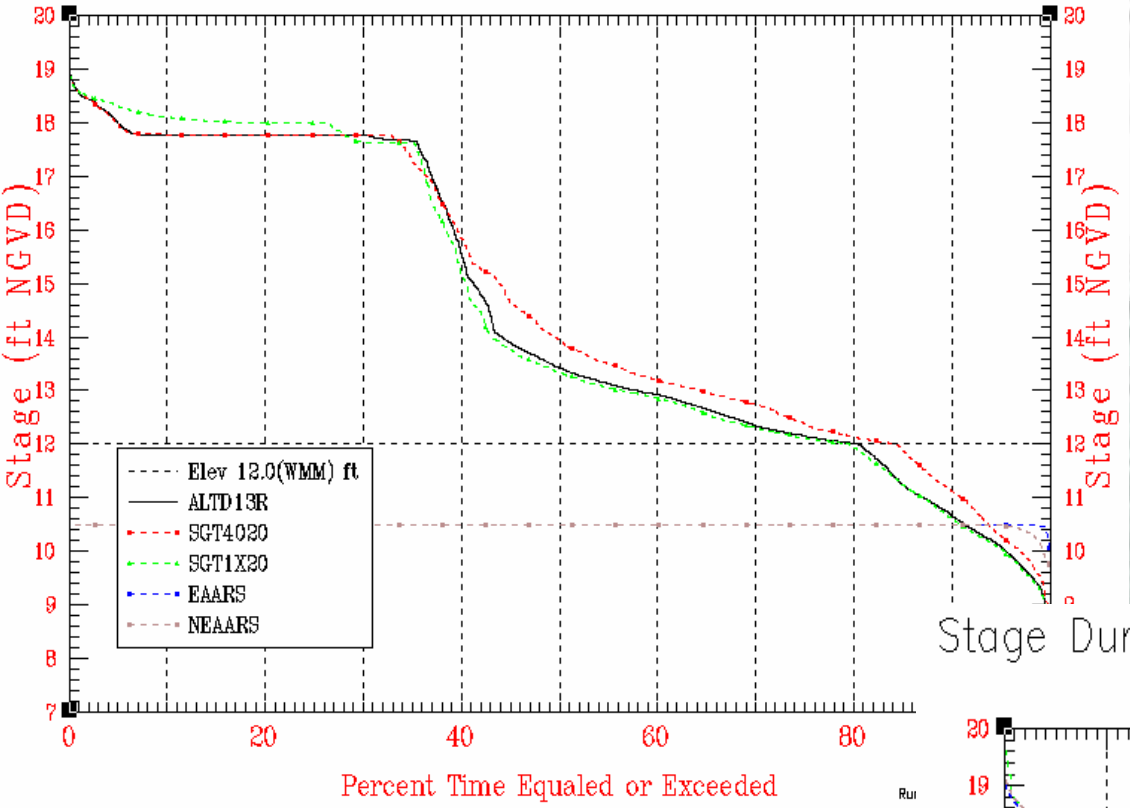
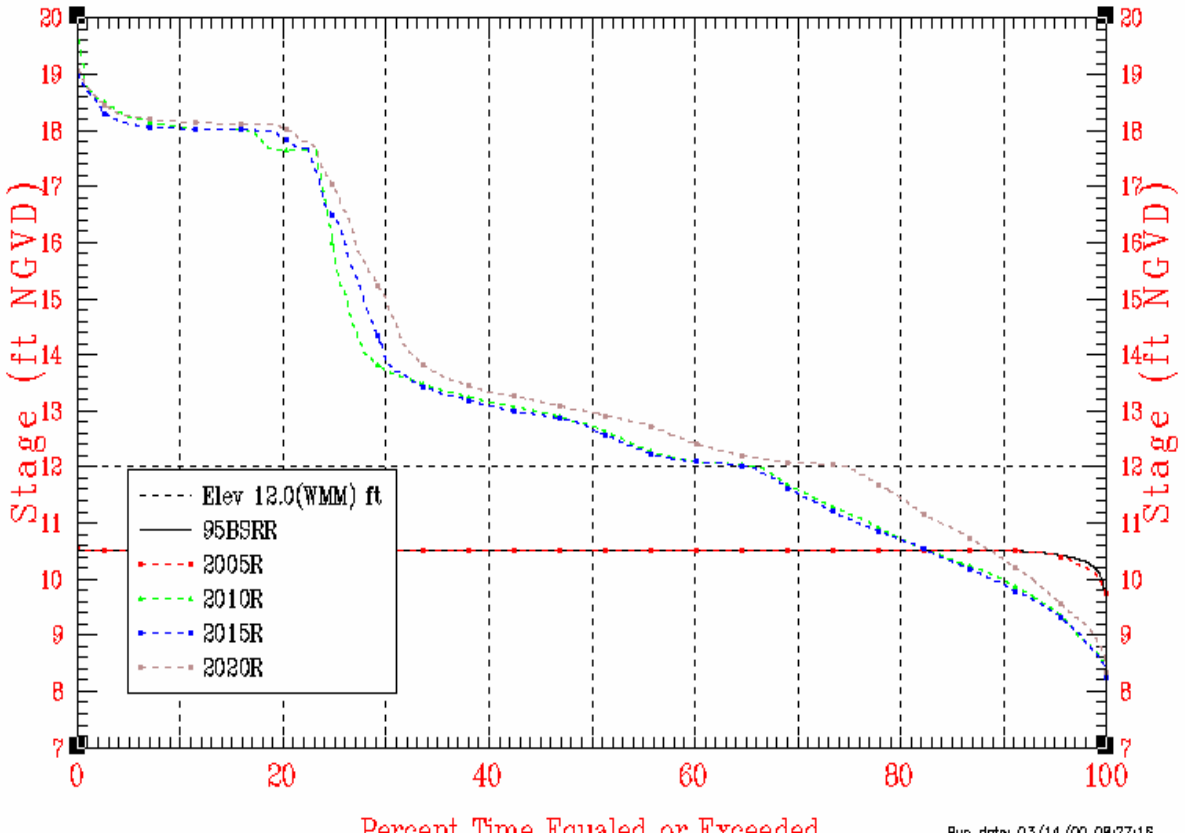
Stage Duration Curves at EAA Compartment 2A Reservoir

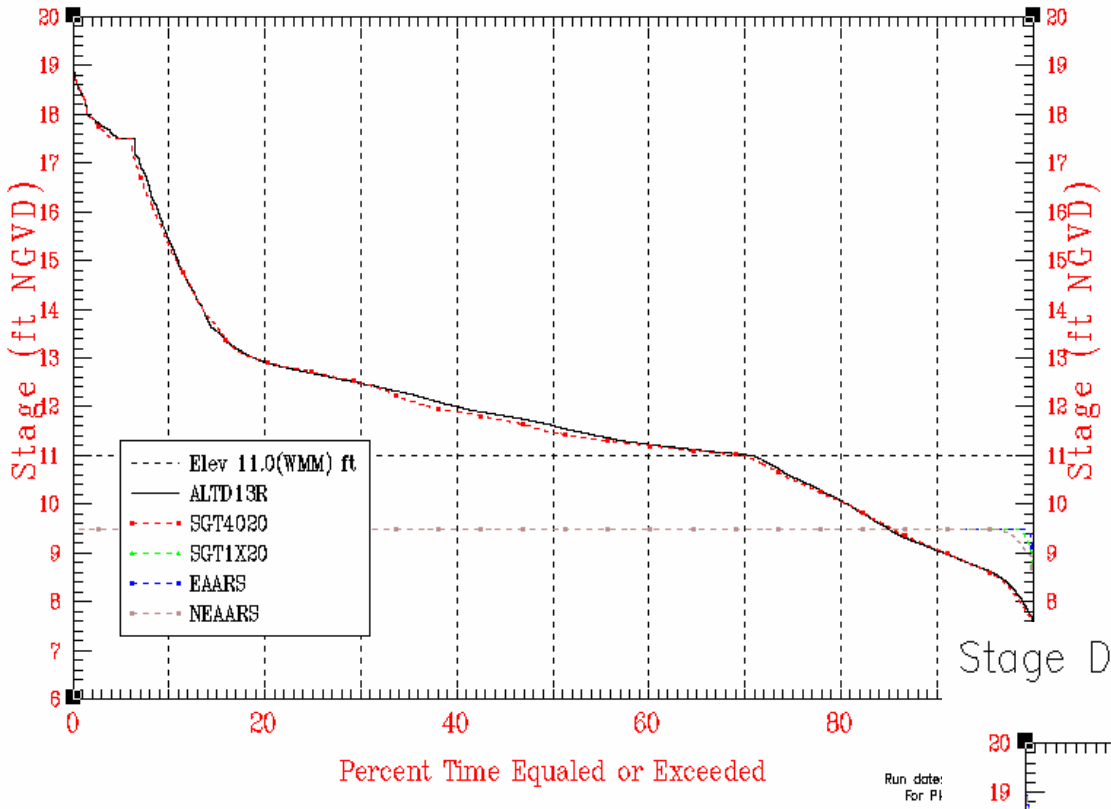


Stage Duration Curves at EAA Compartment 2A Reservoir

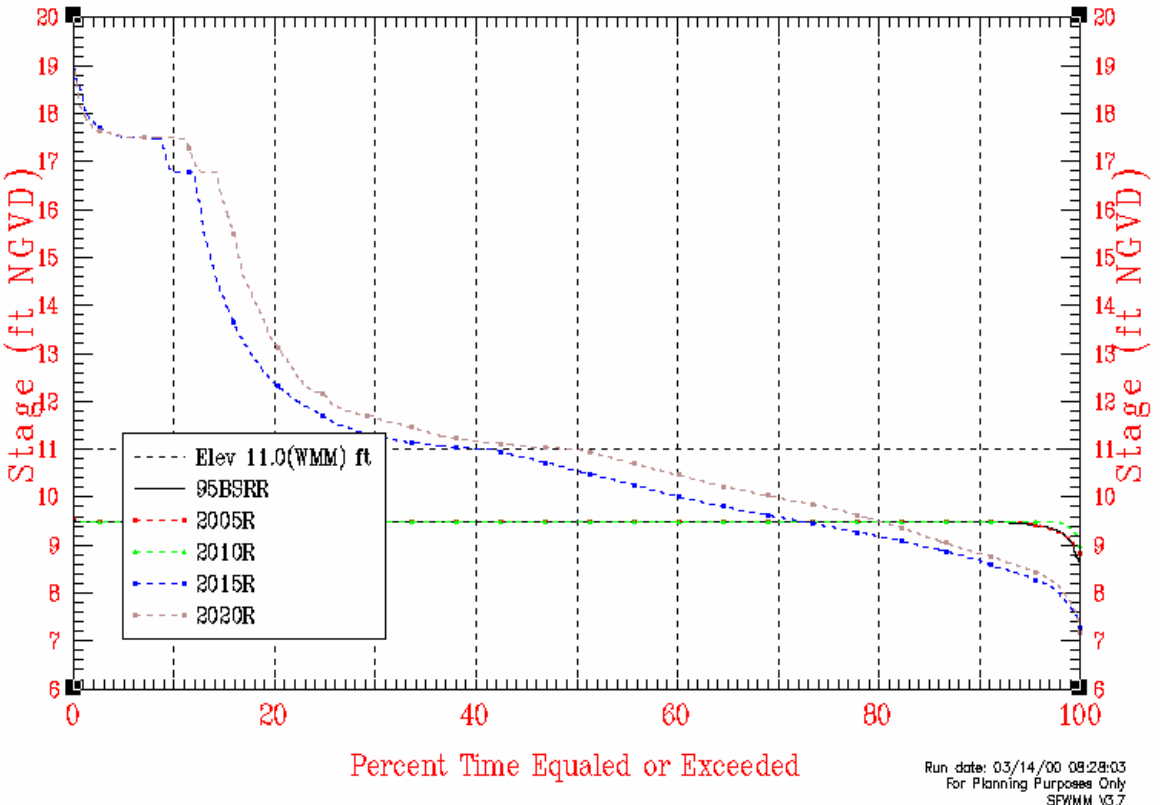


HYDROLOGIC SYSTEMS MO

Stage Duration Curves at EAA Compartment 2B Reservoir



Stage Duration Curves at EAA Compartment 2B Reservoir



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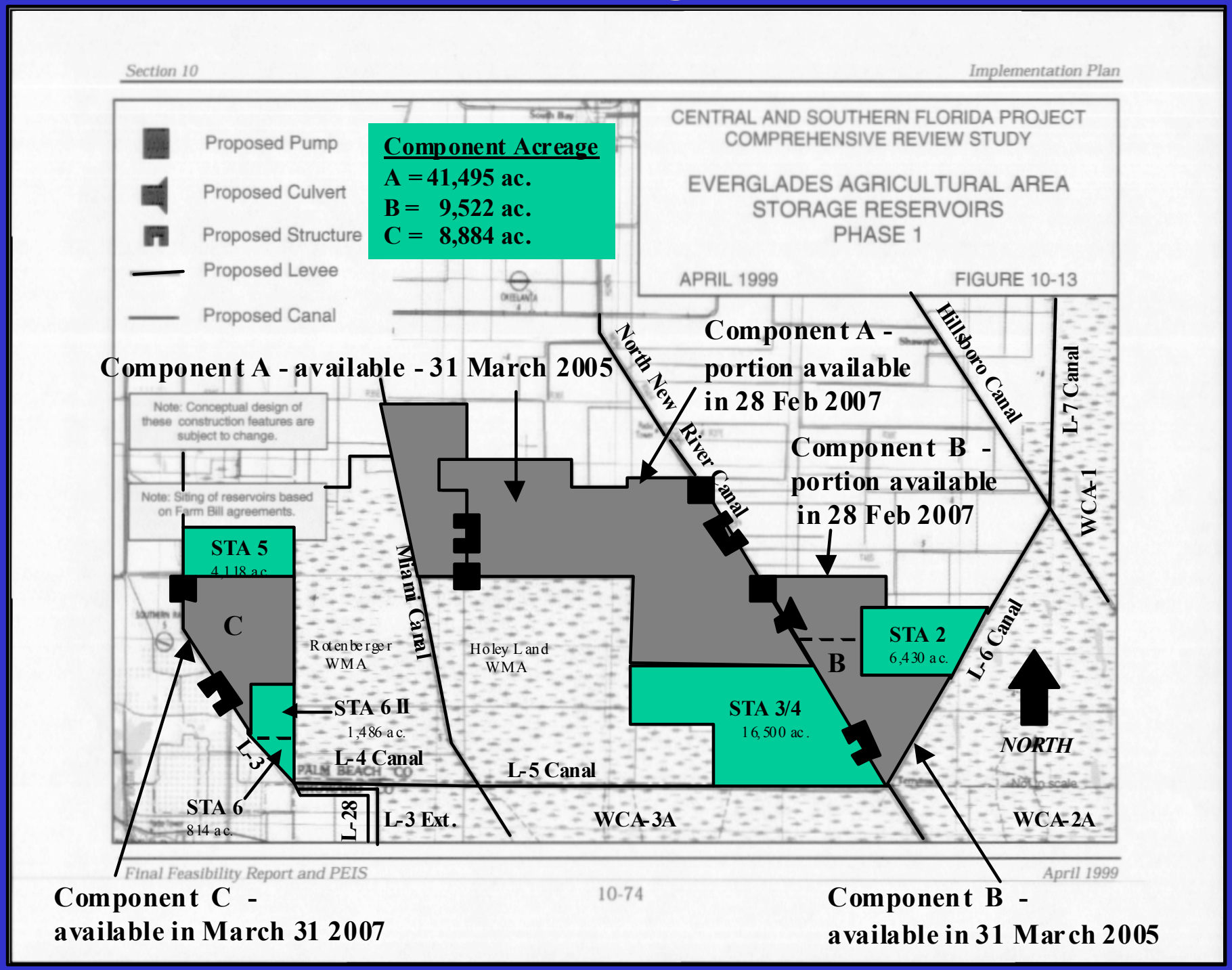
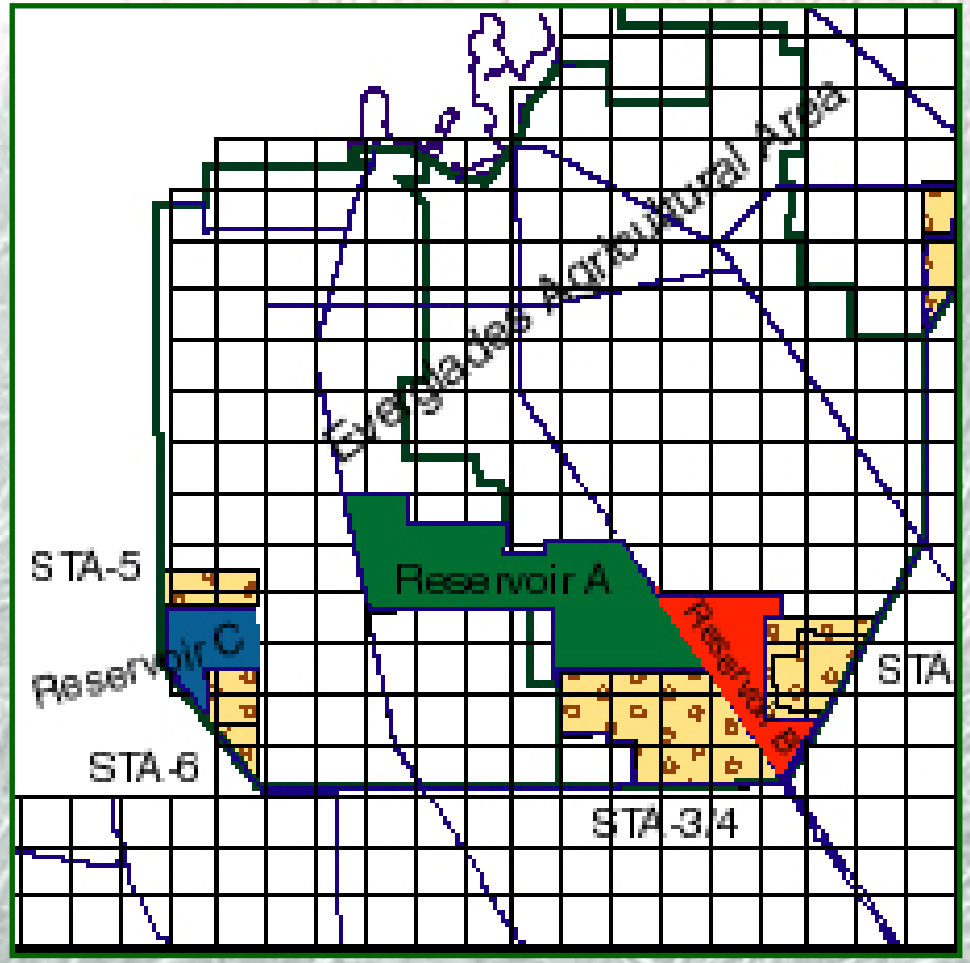
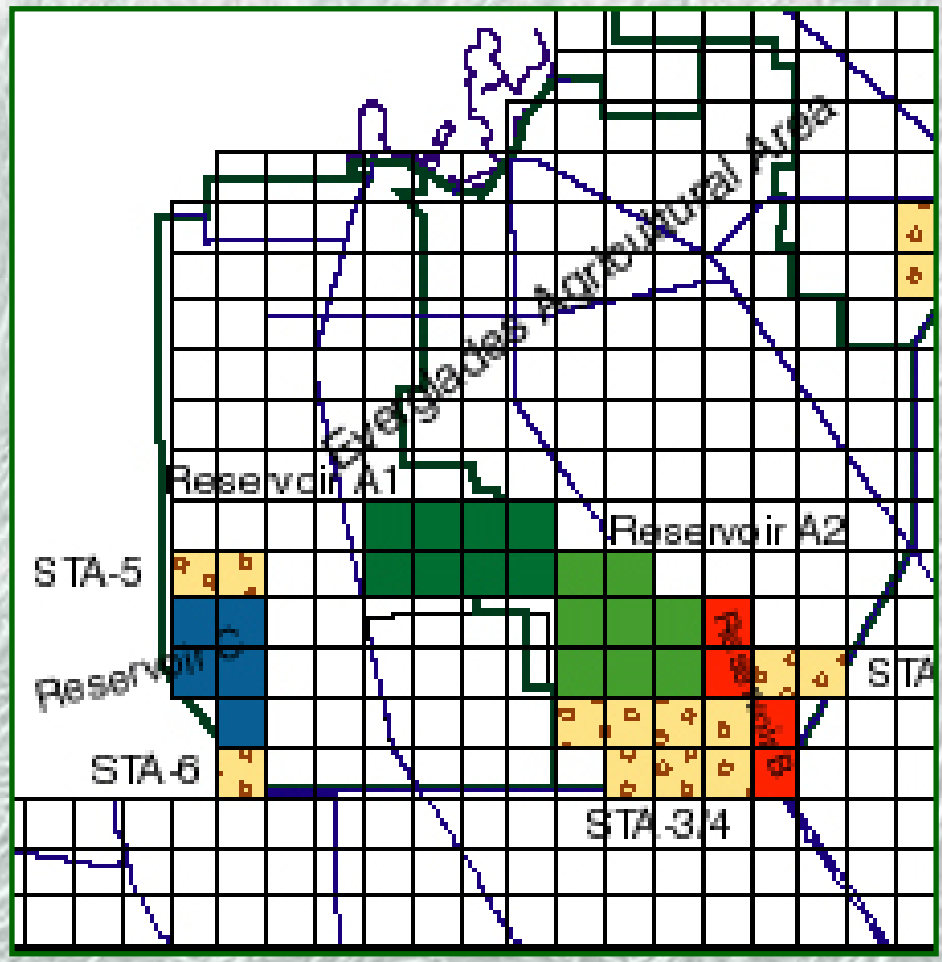
Phase 1 - EAA Storage Reservoir



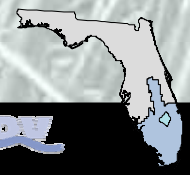
ECP Design


Everglades Agricultural Area
STA-5
Reservoir A
Reservoir C
STA-6
STA-3/4
STA


Everglades Agricultural Area
Reservoir A1
Reservoir A2
STA-5
Reservoir C
STA-6
STA-3/4
STA

Design Suggestions

- Yellow book is a good plan, not the perfect plan
- Look for opportunities to optimize local design for system-wide benefits.
- Strive for more efficient storage, especially Reservoir #3.
- Apply lessons learned from LEC
- Ensure optimization of components that work with EAA Reservoirs, through RECOVER
- Pay close attention to ICU and ASR contingency modeling



Resources

- C&SF Comprehensive Review Study, Hydrologic Performance Measures web Page

  http://www.sfwmd.gov/org/pld/restudy/hpm/

- C&SF Comprehensive Review Study, Hydrology and Hydraulics Modeling, Appendix B.
- Lower East Coast Regional Water Supply Plan, SFWMD, May 2000.
- 2010 Case Study with EAA Reservoir Storage Volume Doubled, Novoa and Tarboton, 2001, http://www.sfwmd.gov/org/pld/hsm/pubs/evals/eaarsx2_final_100101.pdf
- Modeling of EAA Storage Reservoirs in SFWMM D13R Restudy Run. Memorandum from Raul Novoa to Victor Powell, July 9 , 2001