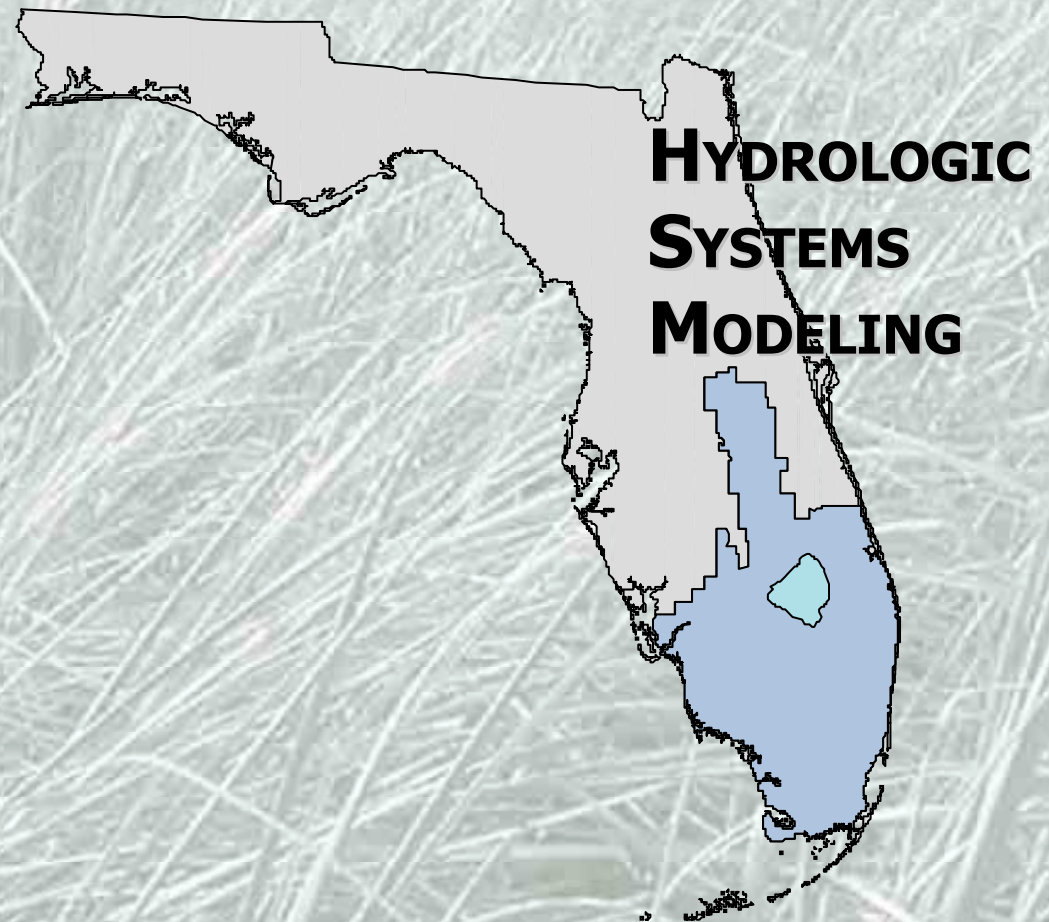


Regional Modeling for EAA Storage Reservoir CERP Project

presented to
**Alternative Plan
Development Team**

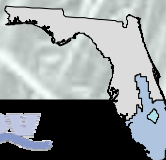
by
Lehar M. Brion
and
Ken C. Tarboton
Office of Modeling

October 3, 2003



Outline

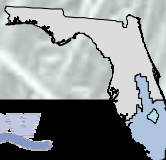
- **Modeling Done in the Restudy**
 - Alt D13R
 - Scenarios
- **Performance Measures for Regional Evaluation**
- **Modeling Done after the Restudy**
 - LEC Regional Water Supply Plan (LECRWSP)
 - ECP Basin Specific Feasibility Study (BSFS)
- **Design Suggestions**



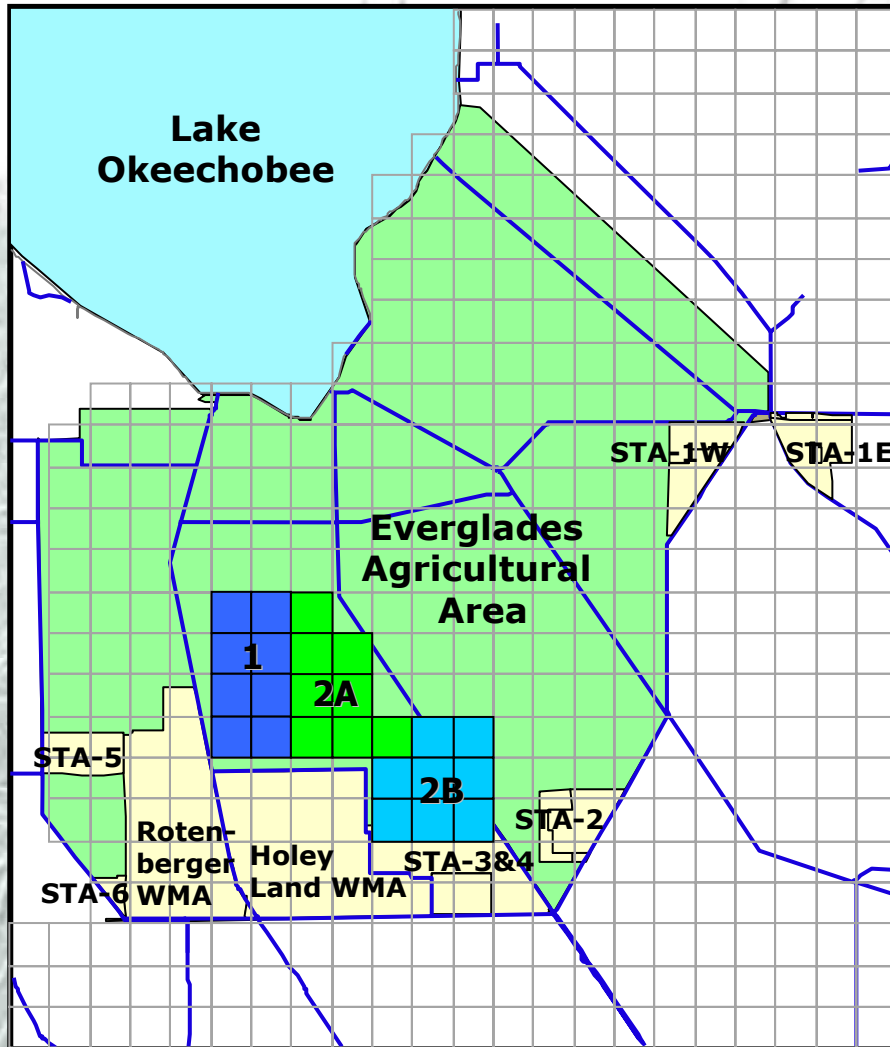
Modeling Done in the RESTUDY

EAA Reservoirs in Alt 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 2A & 2B (each 120,000 ac-ft)**

→ used to meet environmental demands as a priority

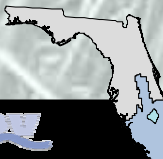
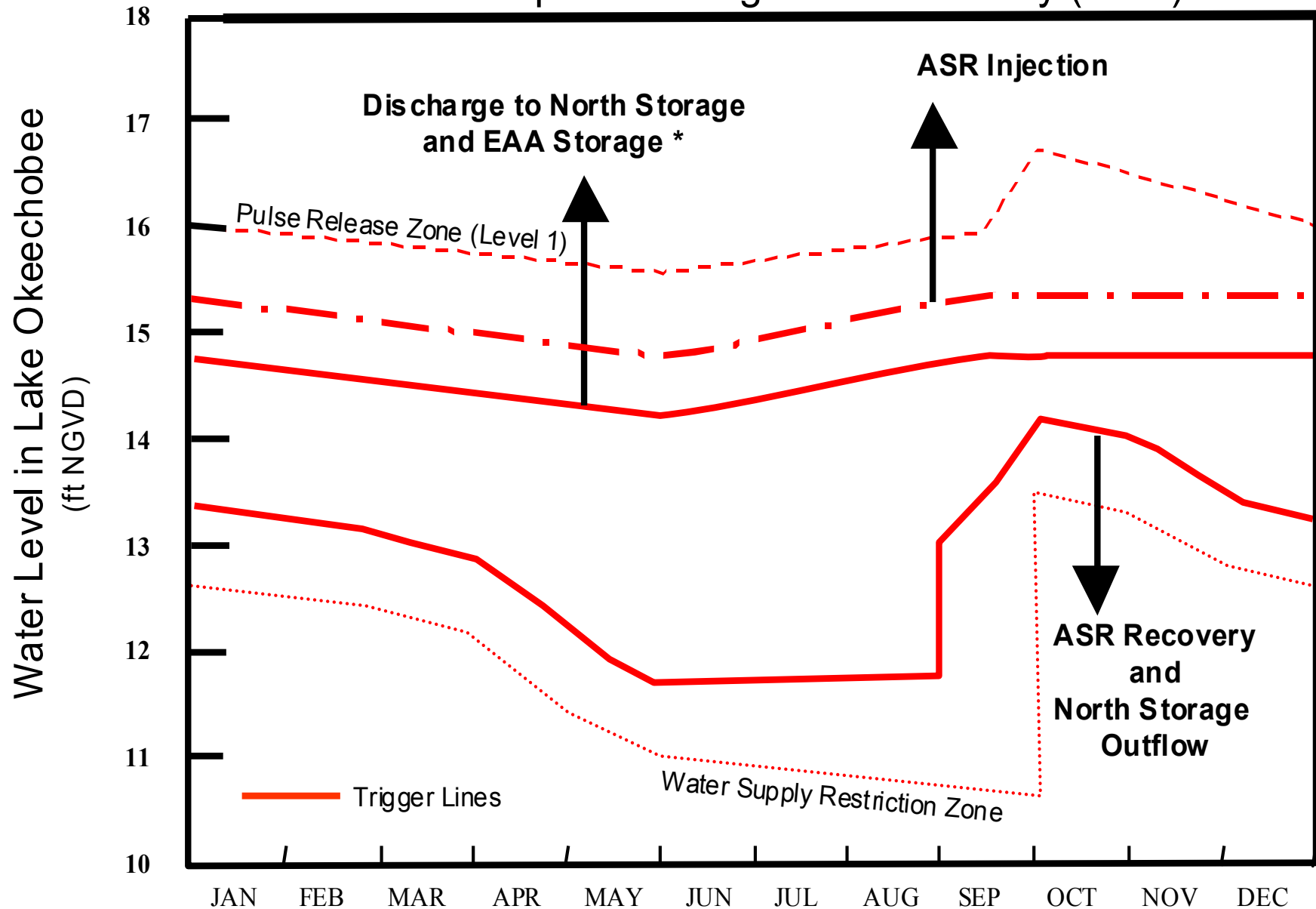
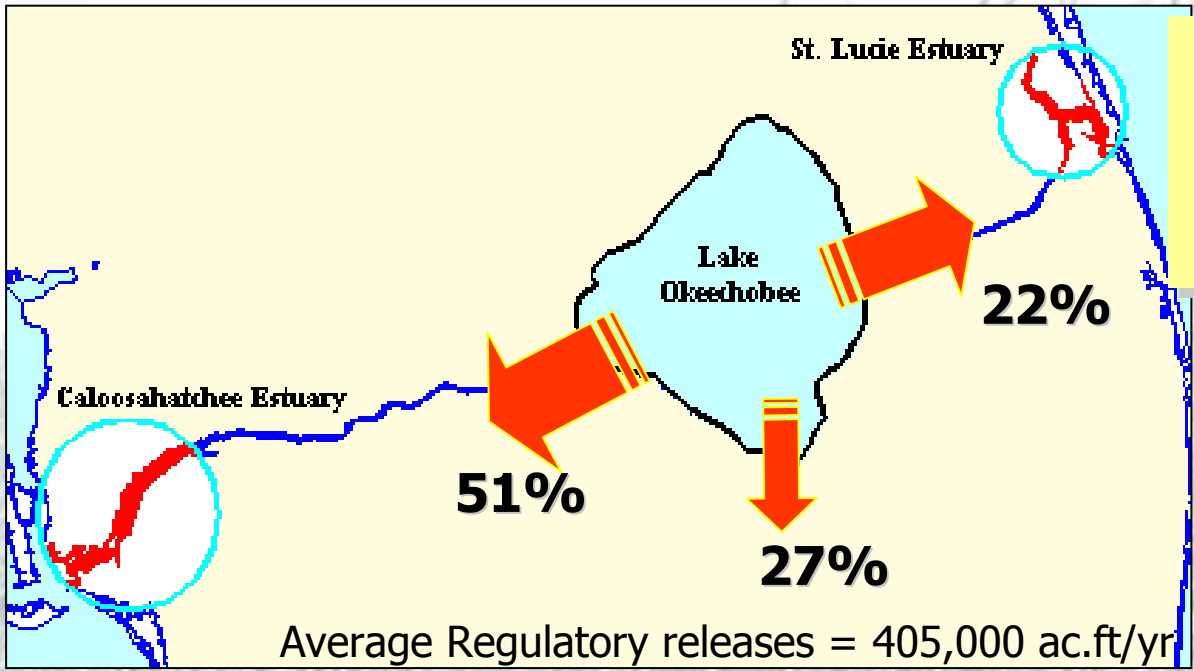


Figure 1. Trigger Lines for North of Lake Okeechobee Storage and Lake Okeechobee Aquifer Storage and Recovery (ASR)



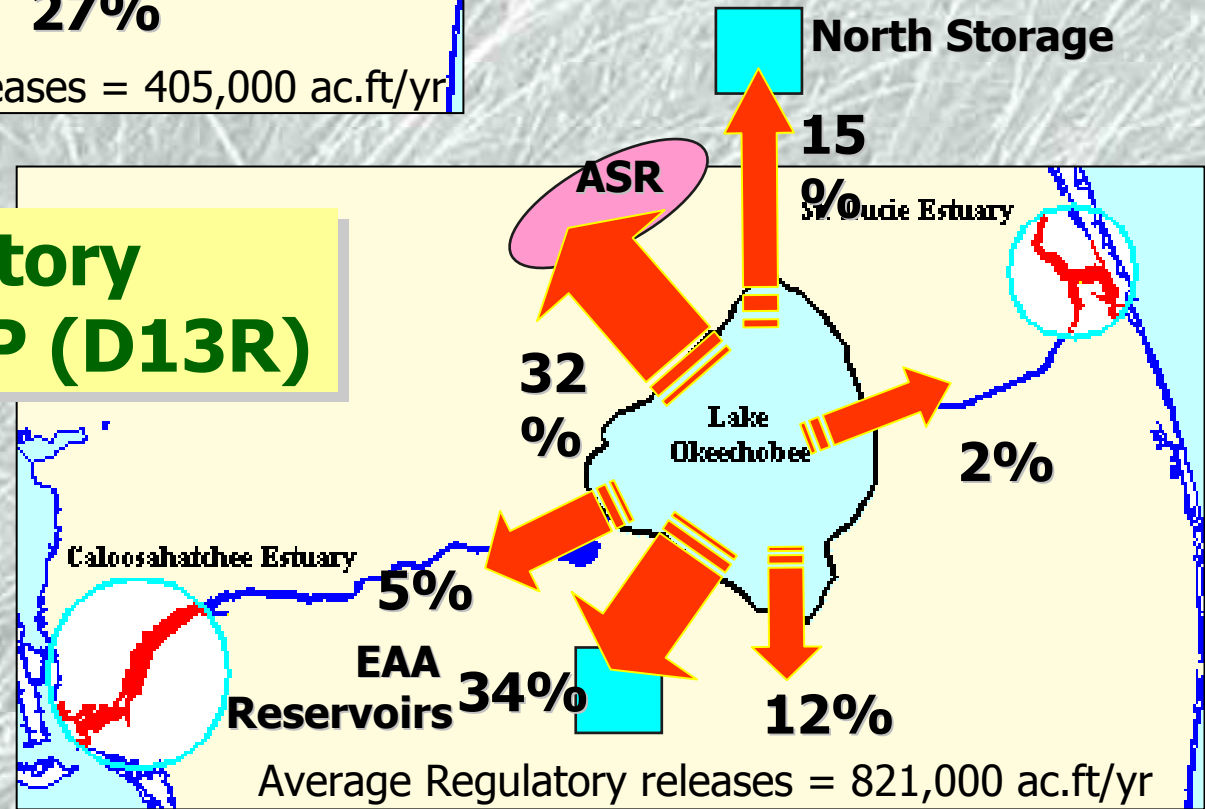
* Discharge to North and EAA Storage if Lake Okeechobee stage is forecasted to be above "Discharge to ...Storage" line, or if stage is above Pulse Release Zone (level 1) line.

What do EAA Reservoirs do for System ?



Future Regulatory Releases without project (50 Base)

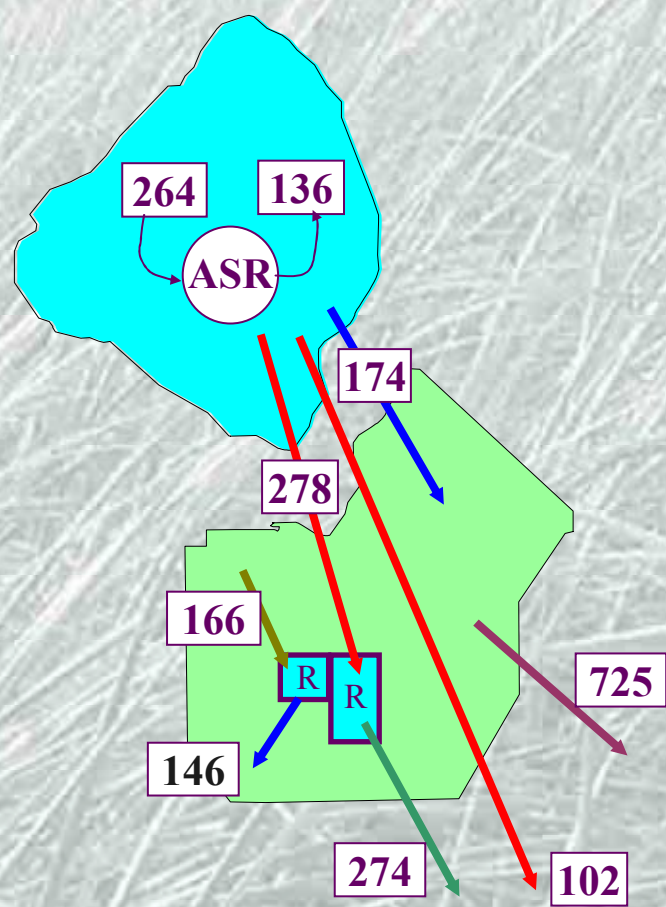
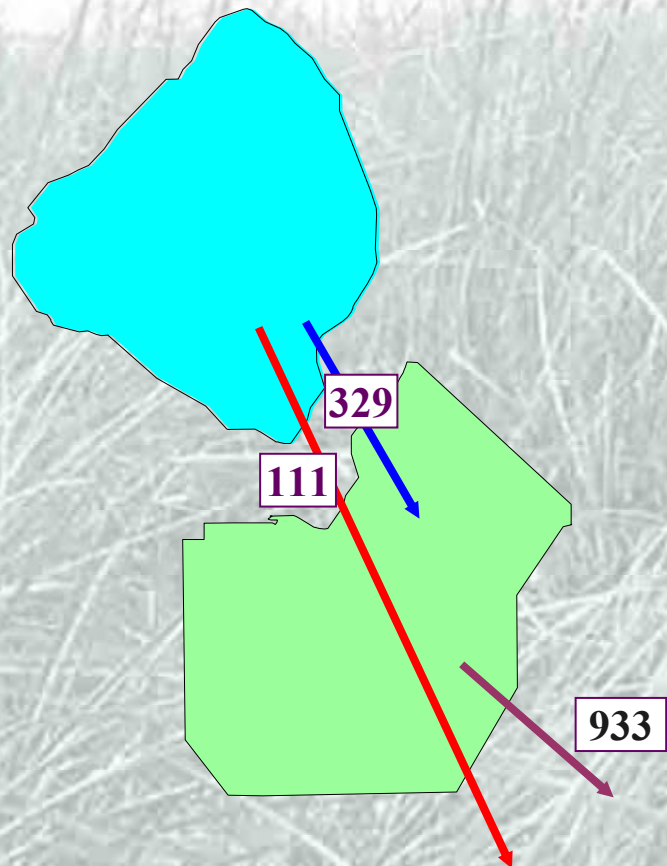
Future Regulatory Releases with CERP (D13R)



What do EAA Reservoirs do for System ?

Future without project (50 Base)

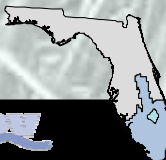
Future with CERP (D13R)



Units - Thousand Acre Feet per Year

EAA Reservoir Related Model Input Requirements

- Reservoir Configuration
 - number of compartments
 - storage capacity (footprint & depth)
- Operational Criteria
 - sources & destination of flows
 - pump/structure capacities
 - operating rules (e.g., trigger levels)



EAA Reservoir Scenarios in Restudy

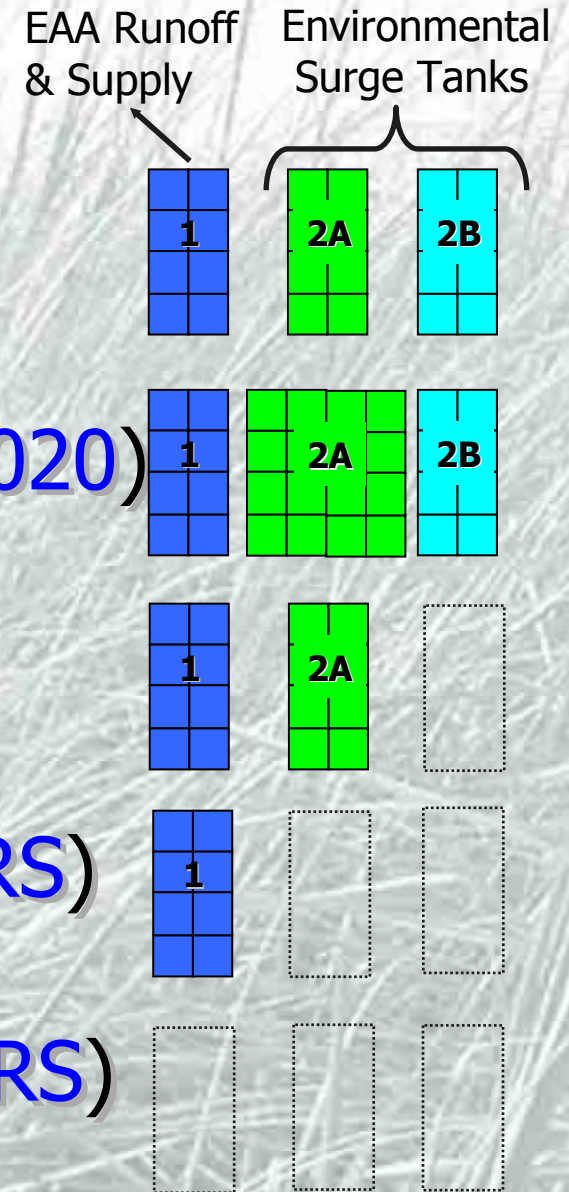
- Base Case (**D13R**)

- Double Size of Reservoir 2A (**SGT4020**)

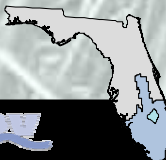
- Remove Reservoir 2B (**SGT1x20**)

- Remove Reservoirs 2A & 2B (**EAARS**)

- Remove All EAA Reservoirs (**NEAARS**)



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



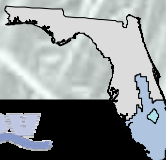
Double Size of Reservoir 2A

(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%)



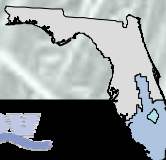
Remove Reservoir 2B

(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:

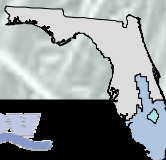
- ☹️ Lake Okeechobee is below 12' for 2% more time than D13R (11% vs 9%)



Remove Reservoirs 2A & 2B



(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)

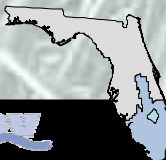
-  → 28,000 ac-ft less through SRS transect (1,082,000 vs 1,110,000)

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

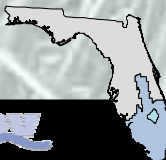
-  → 7 fewer months of cutbacks in NPB, SA1, and SA3 (7 vs 14 for NPB & SA1; 12 vs 19 for SA3)
-  → 6 fewer months of cutbacks in SA2 (14 vs 20)



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: (**NEARS**)

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

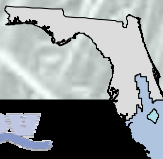
☹️ → 4% more time where IR19 stage is above 2.5' (23 vs 19)

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).



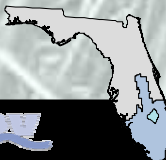
System-wide performance: (NEAARS)

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)



Performance Measures for Regional Evaluation

- Quantitative indicators of how well (or poorly) an alternative meets a specific objective

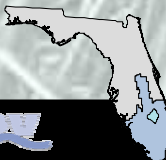


Figure 4. Lake Okeechobee Stage Duration Curves

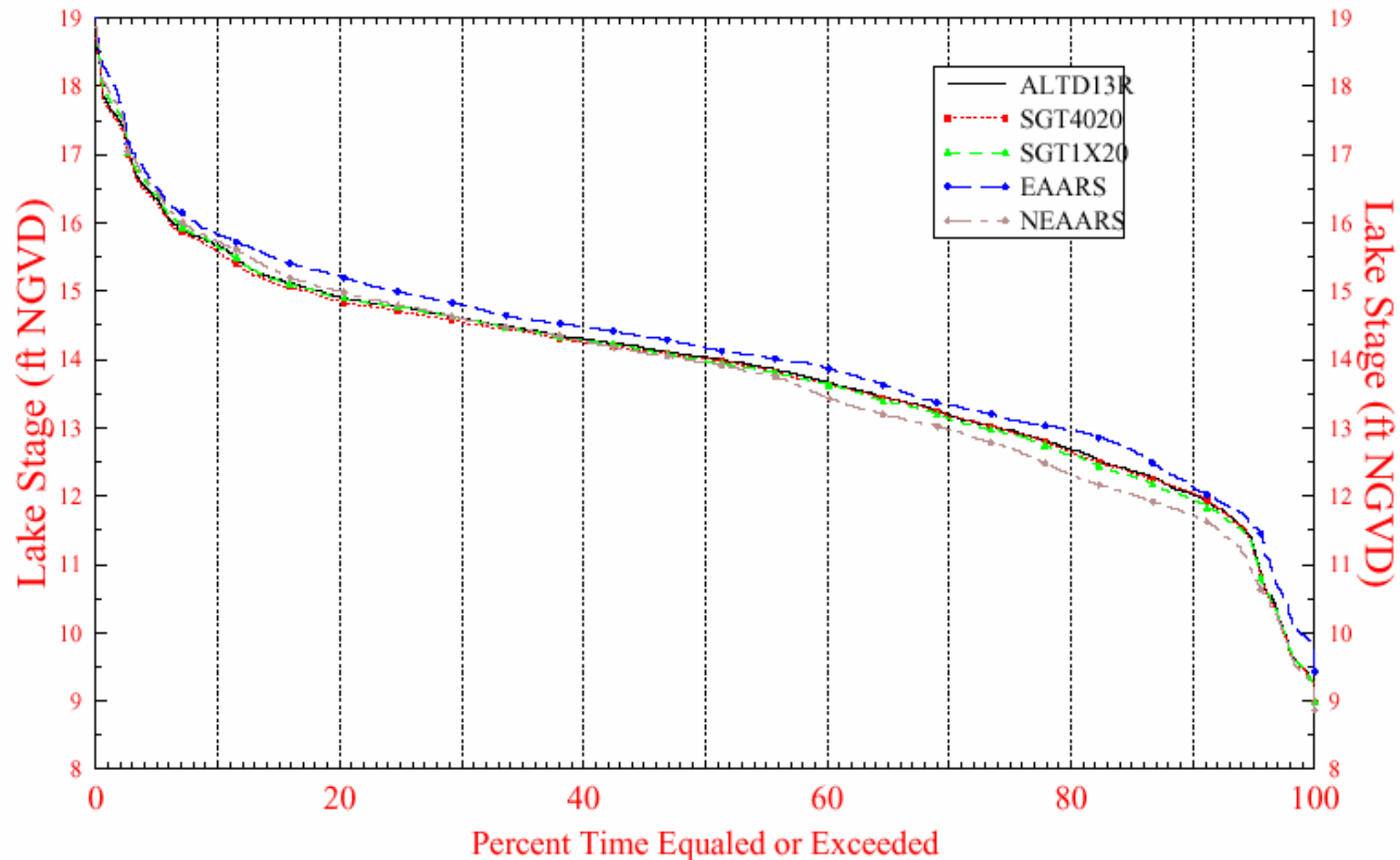


Figure 8. Number of Undesireable Lake Okeechobee Stage Events

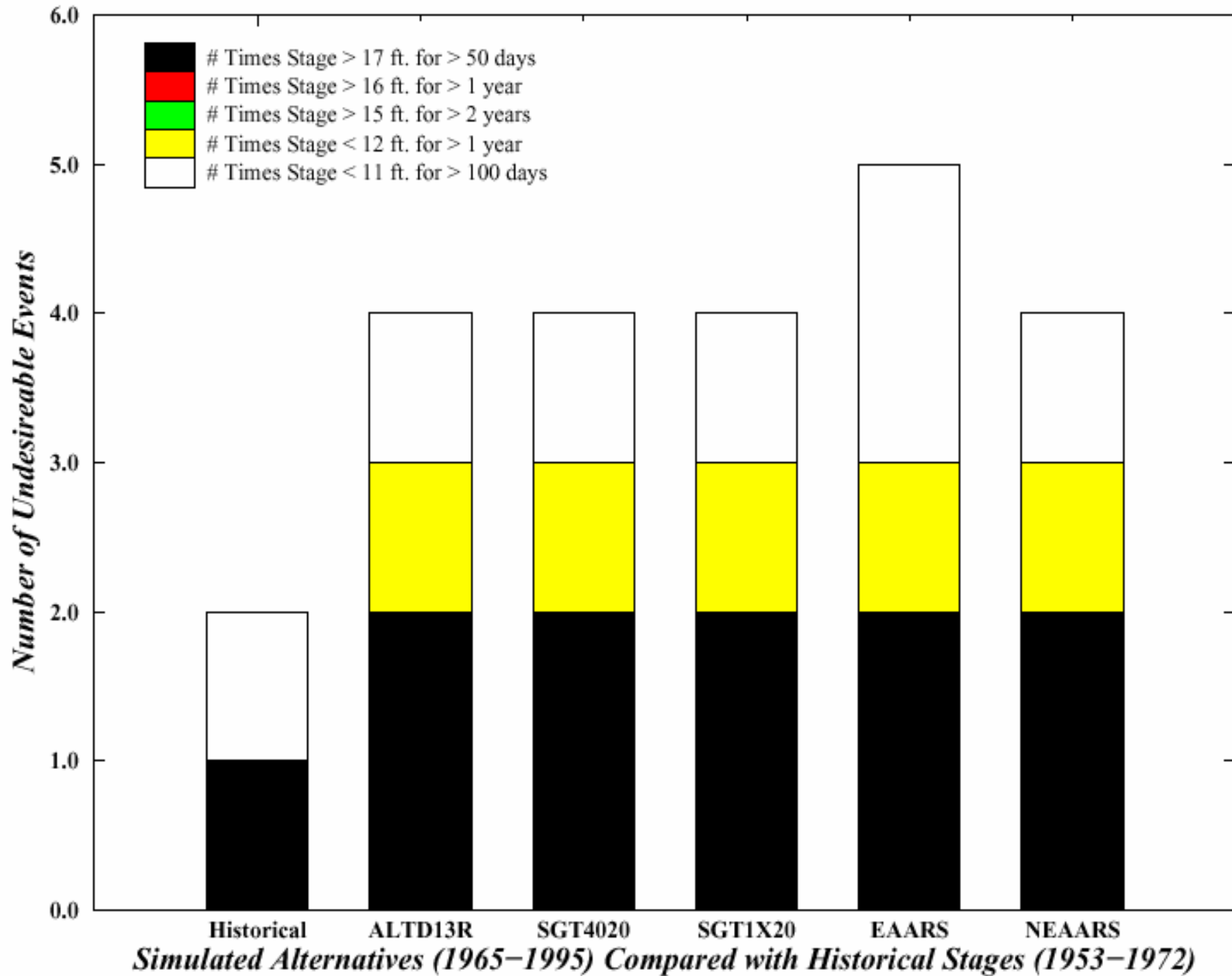
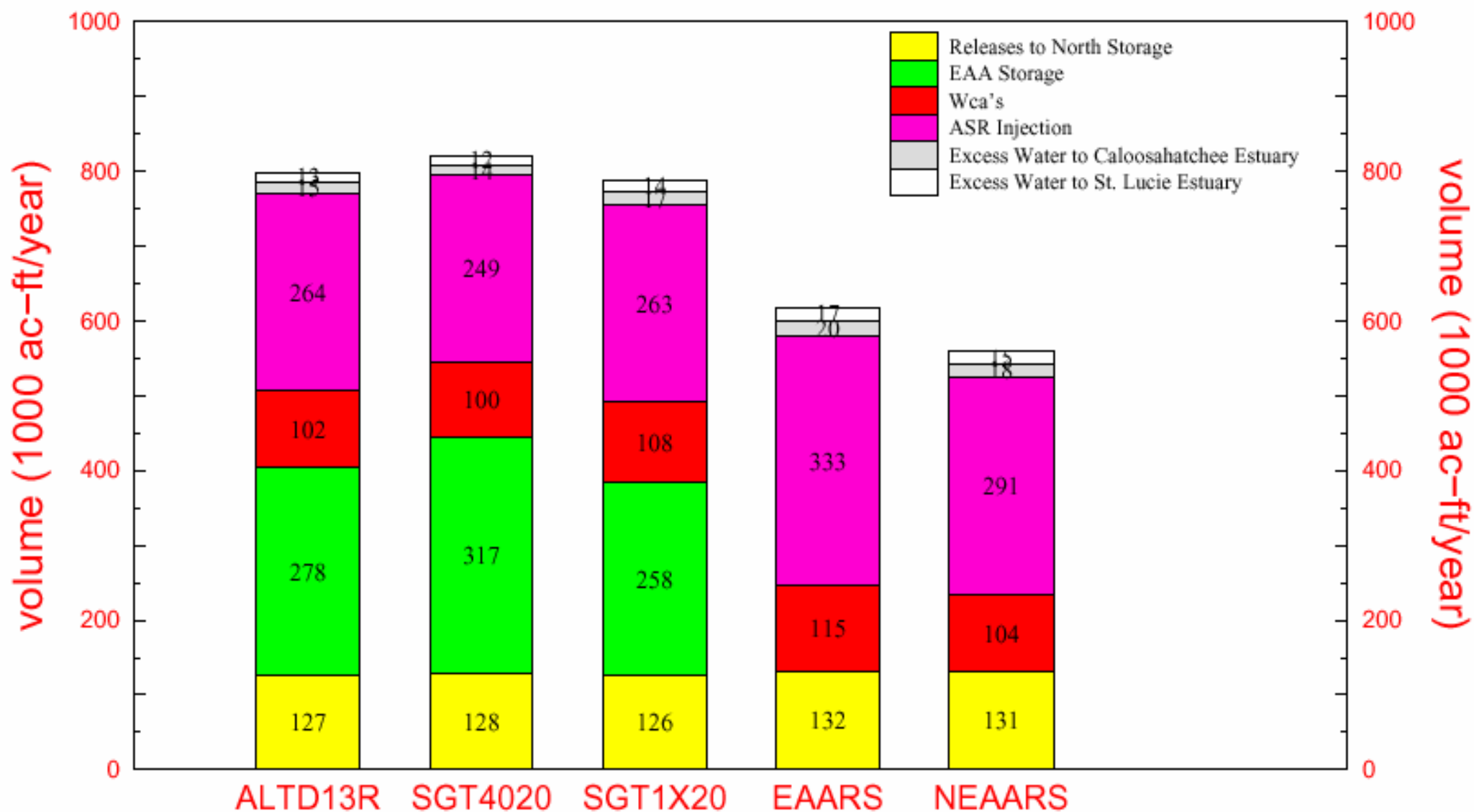
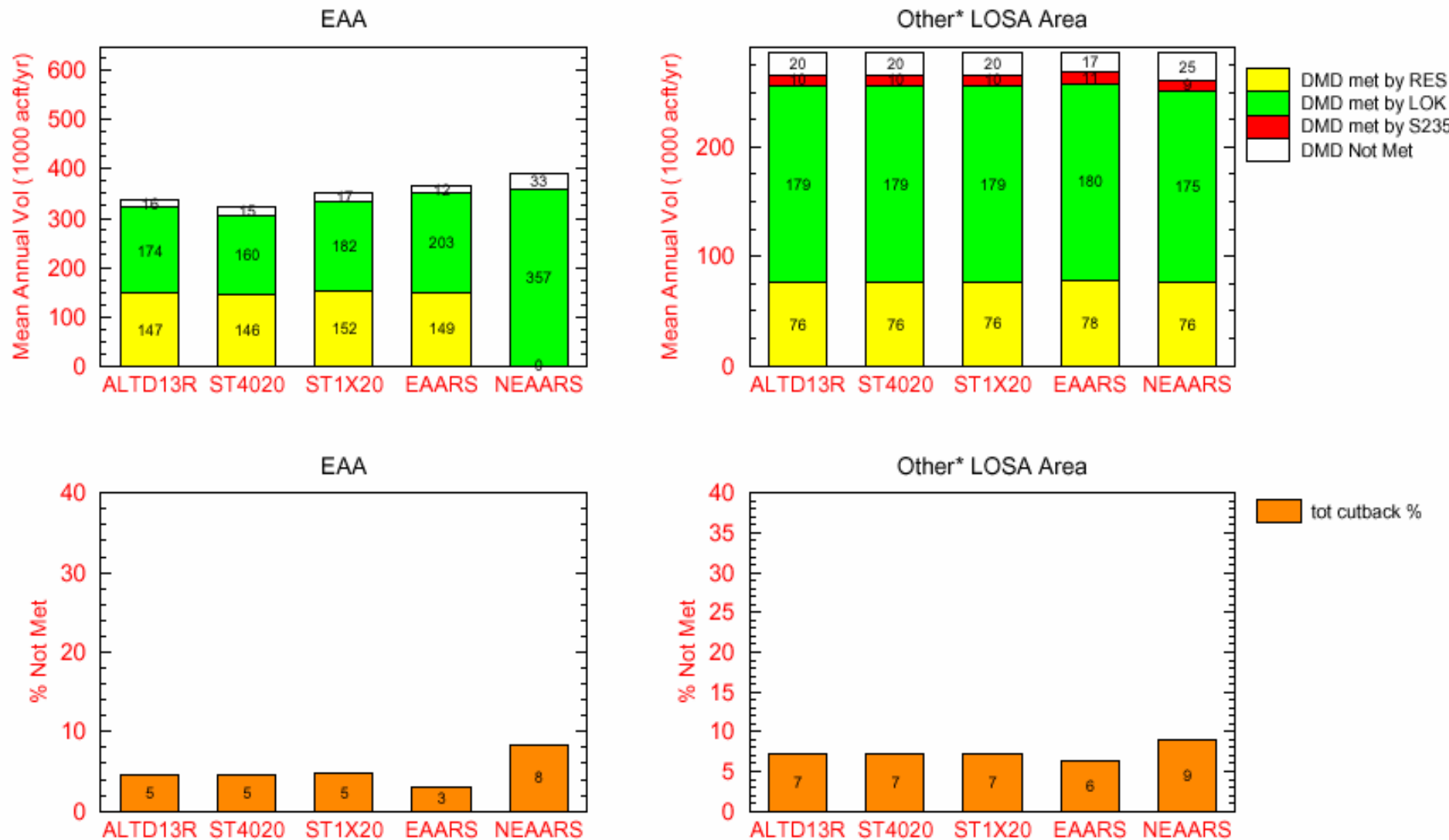


Figure 9. Mean Annual Flood Control Releases from Lake Okeechobee for the 31 yr (1965 – 1995) Simulation



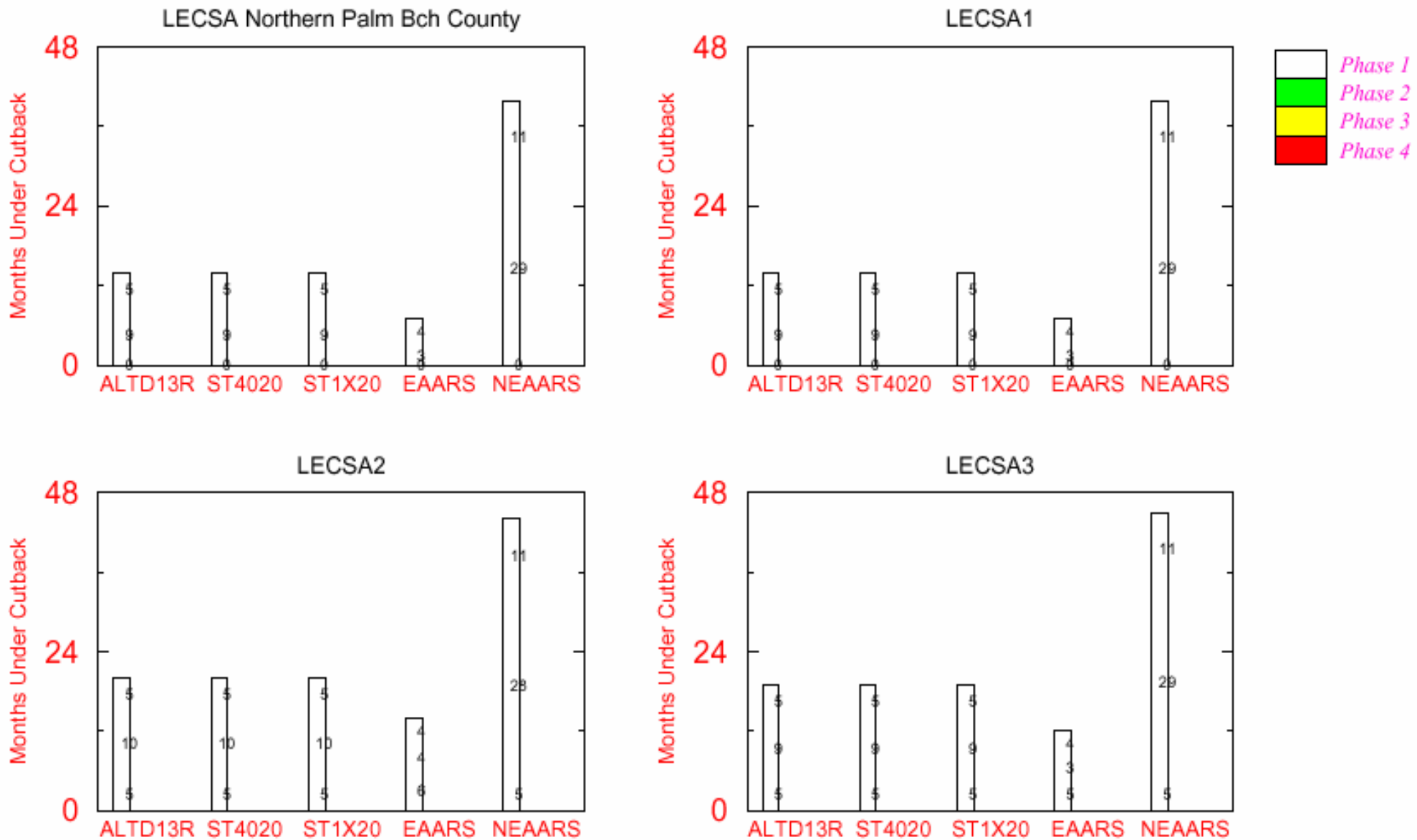
Note: Although regulatory (flood control) discharges are summarized here in mean annual values, they do not occur every year. Typically they occur in 2-4 consecutive years and may not occur for up to 7 consecutive years.

Figure 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)).

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).

Run date: 08/12/98 09:43:48
 For Planning Purposes Only

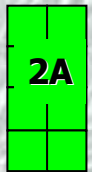
Modeling Done after the RESTUDY

EAA Reservoirs in LECRWSP

- Compartment 1 increased to 30,000 acres



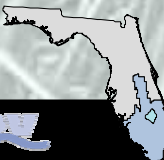
- Compartment 2A remains 20,000 acres



- Compartment 2B decreased to 10,000 acres



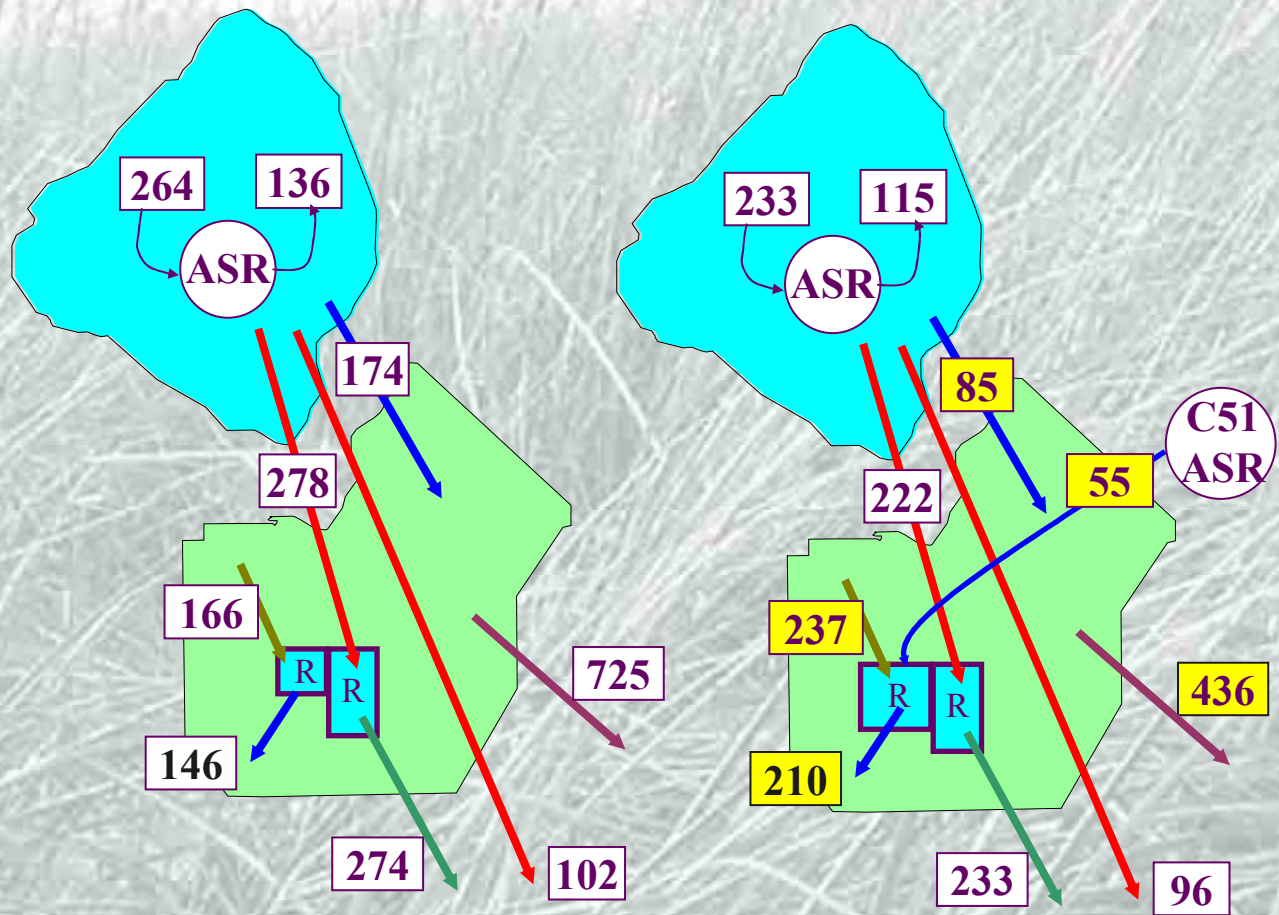
- Interbasin transfers to better utilize compartment 1



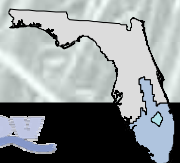
What do EAA Reservoirs do for System ?

**Future with CERP
(D13R)**

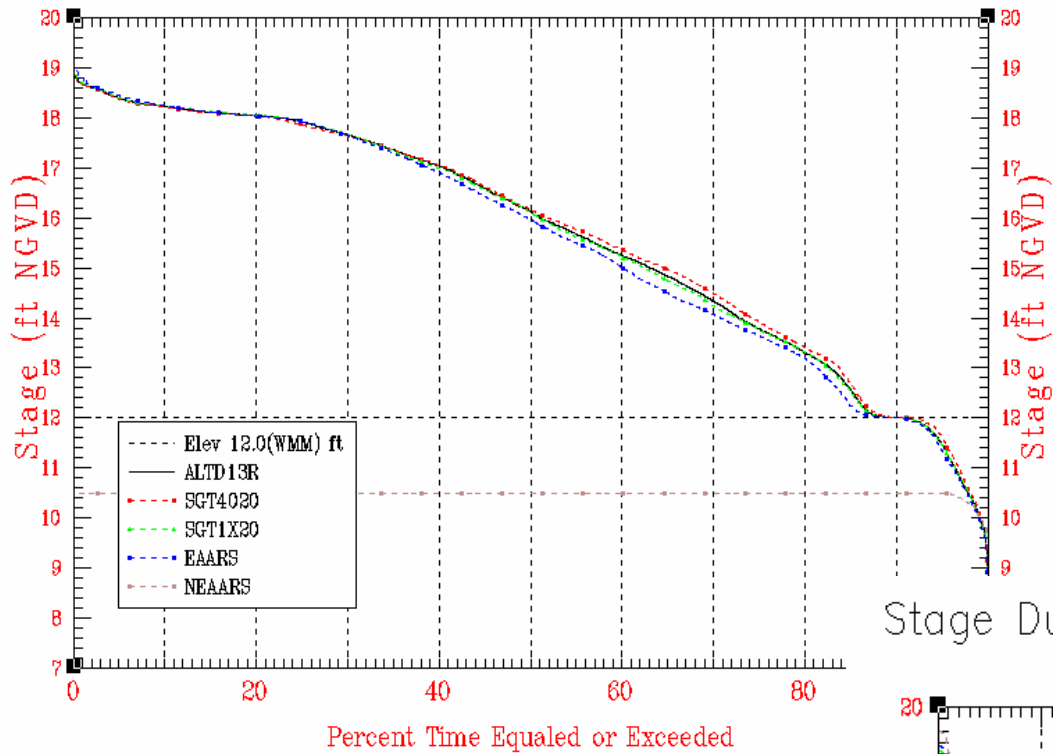
**LECRWSP
2020**



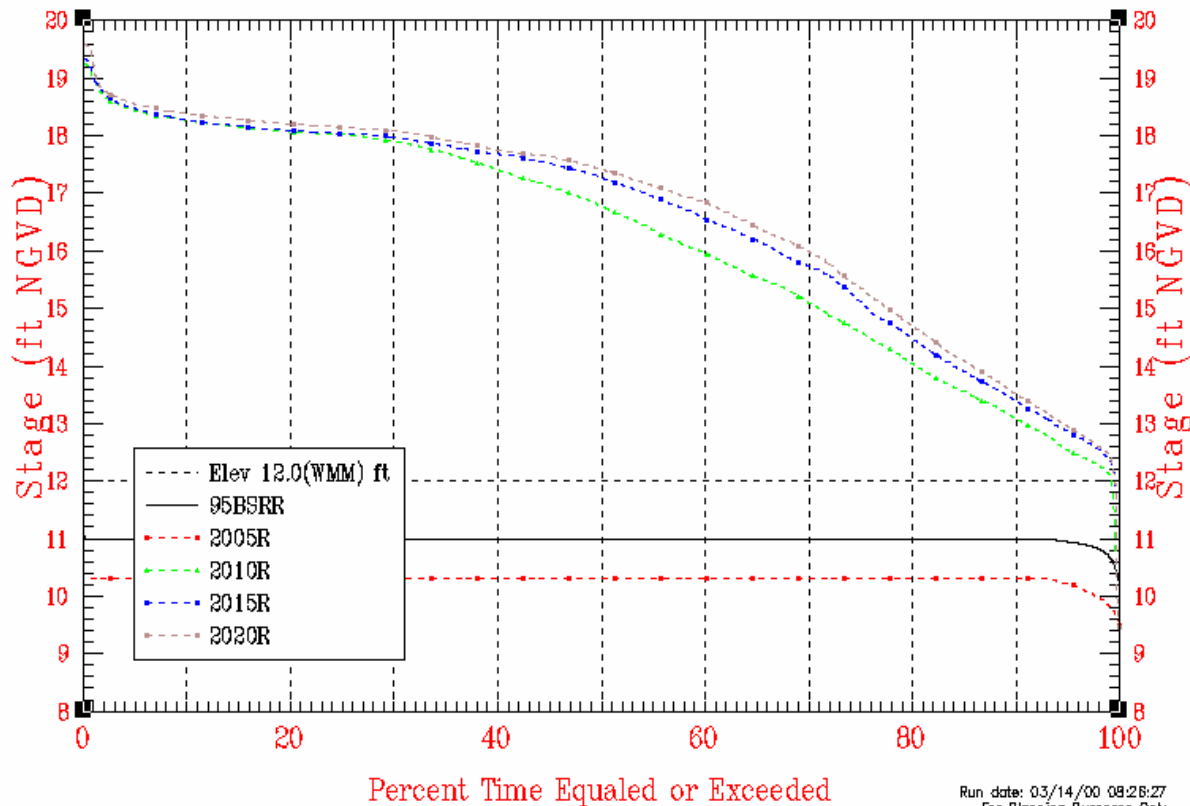
Units - Thousand Acre Feet per Year



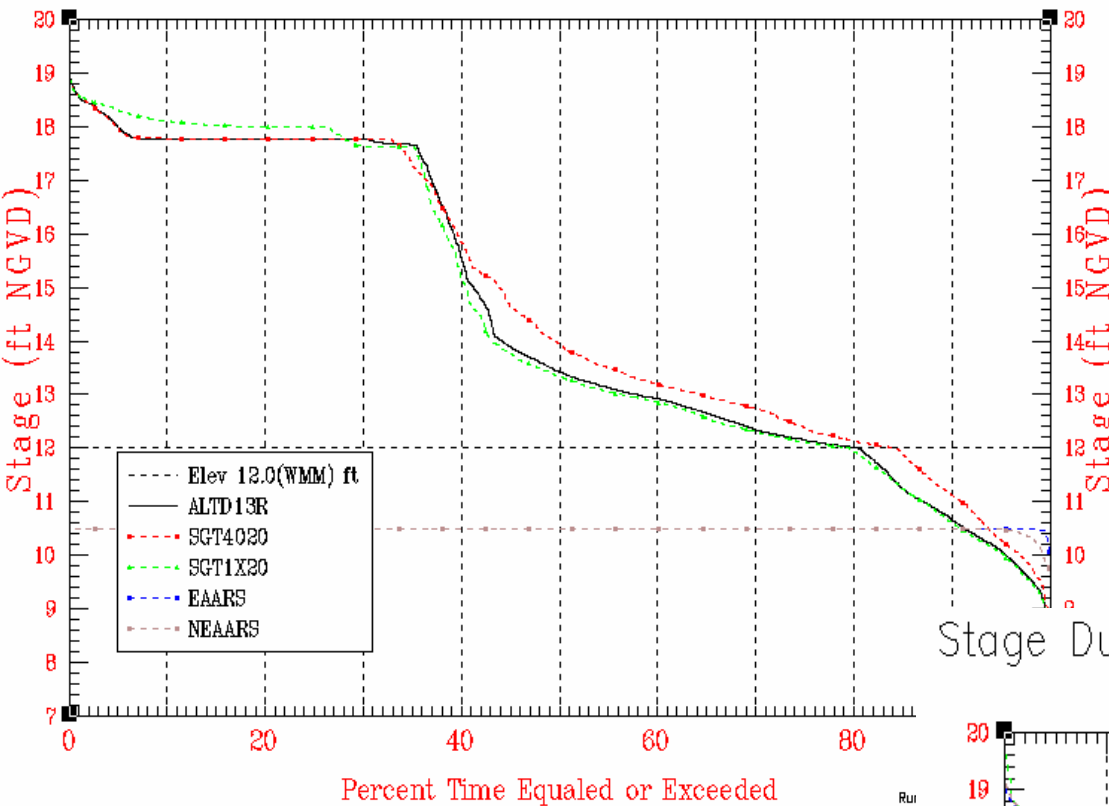
Stage Duration Curves at EAA Compartment 1 Reservoir



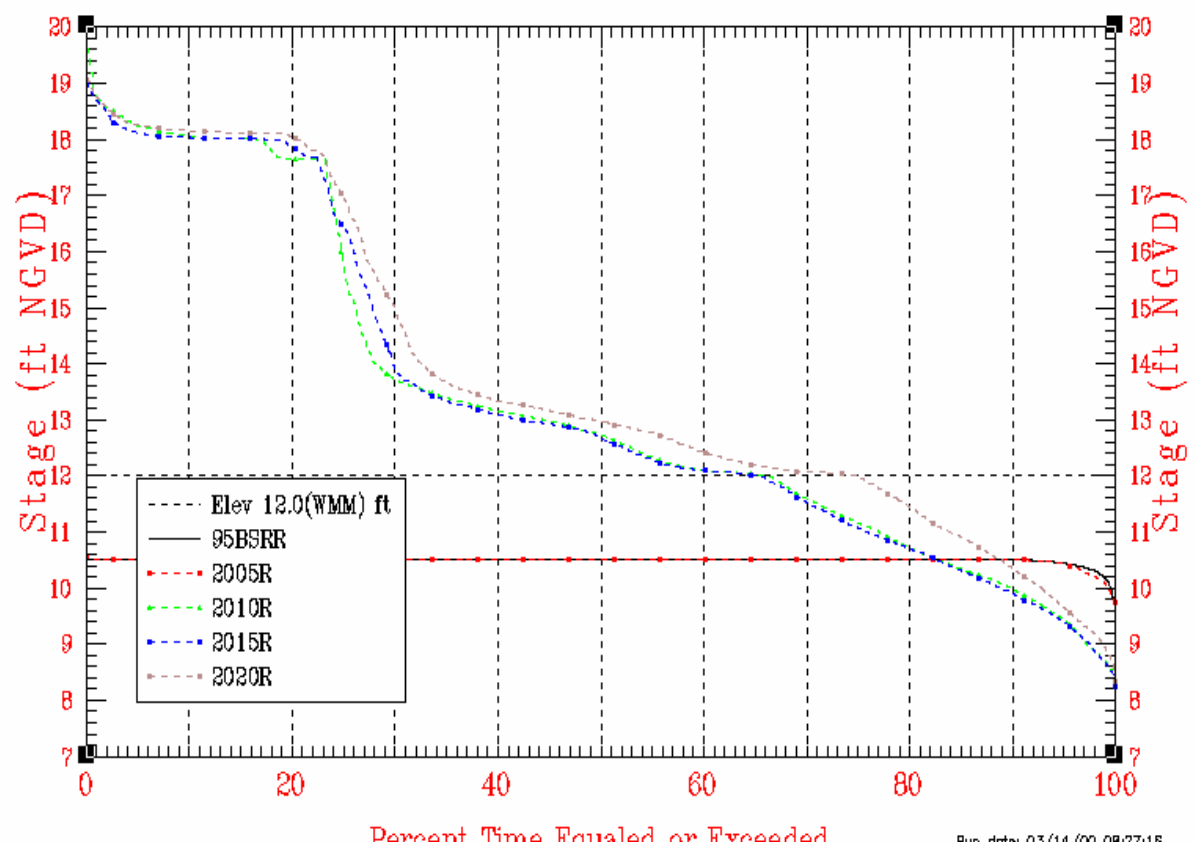
Stage Duration Curves at EAA Compartment 1 Reservoir



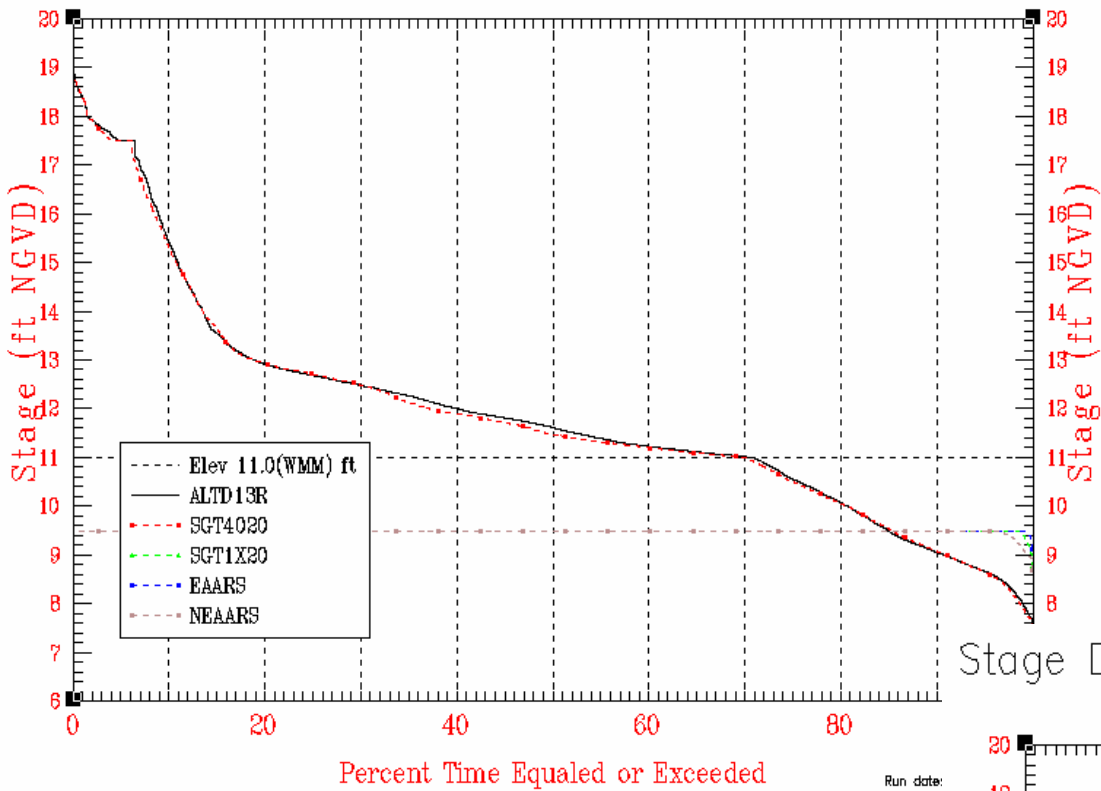
Stage Duration Curves at EAA Compartment 2A Reservoir



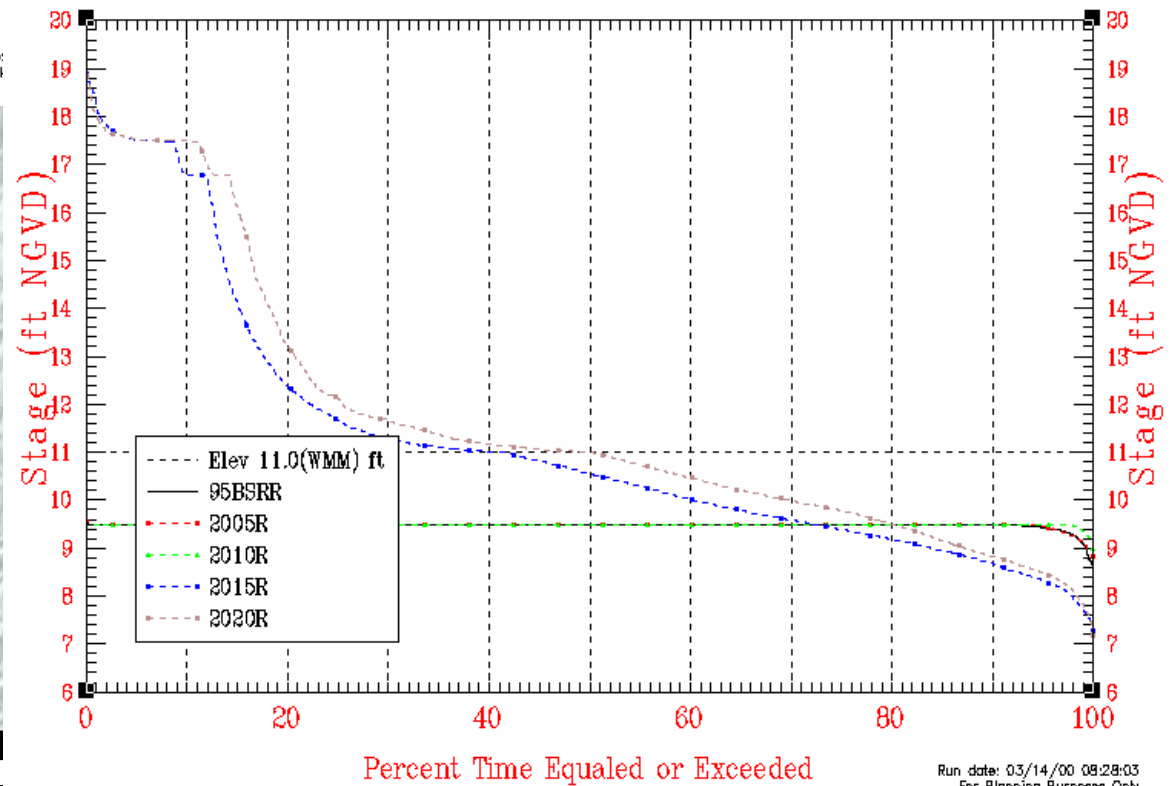
Stage Duration Curves at EAA Compartment 2A Reservoir



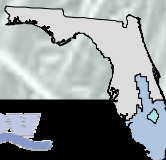
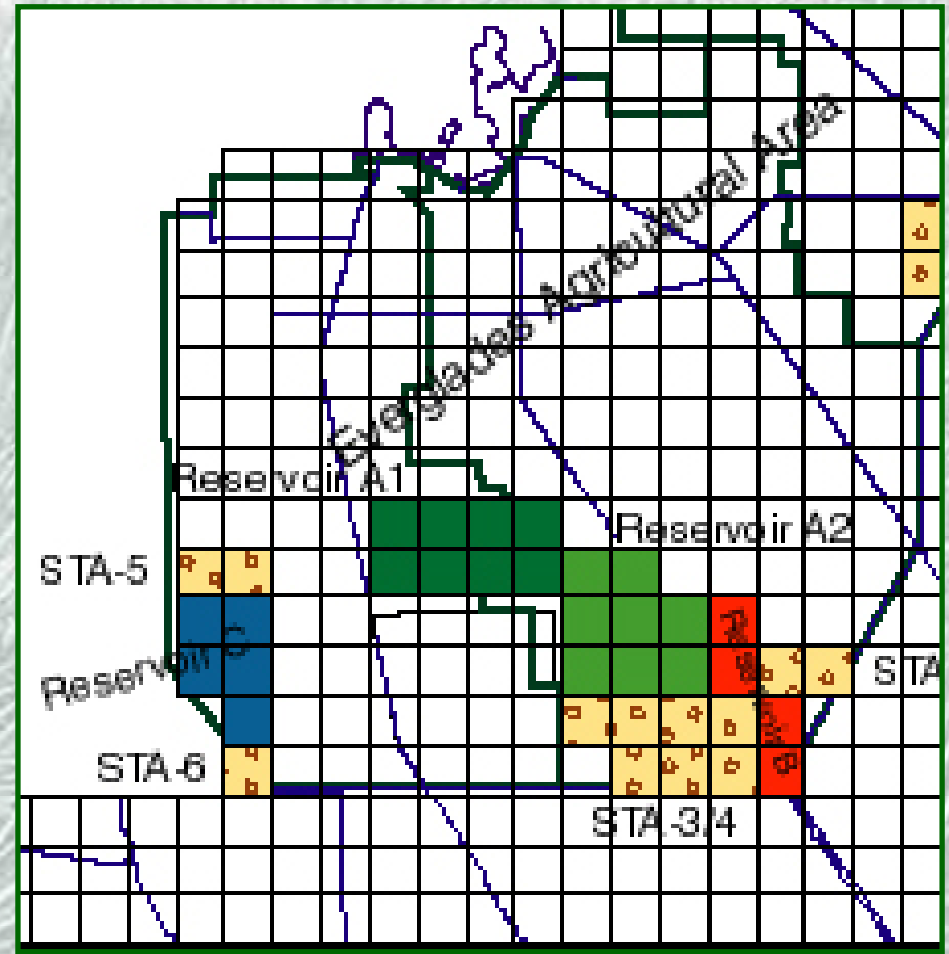
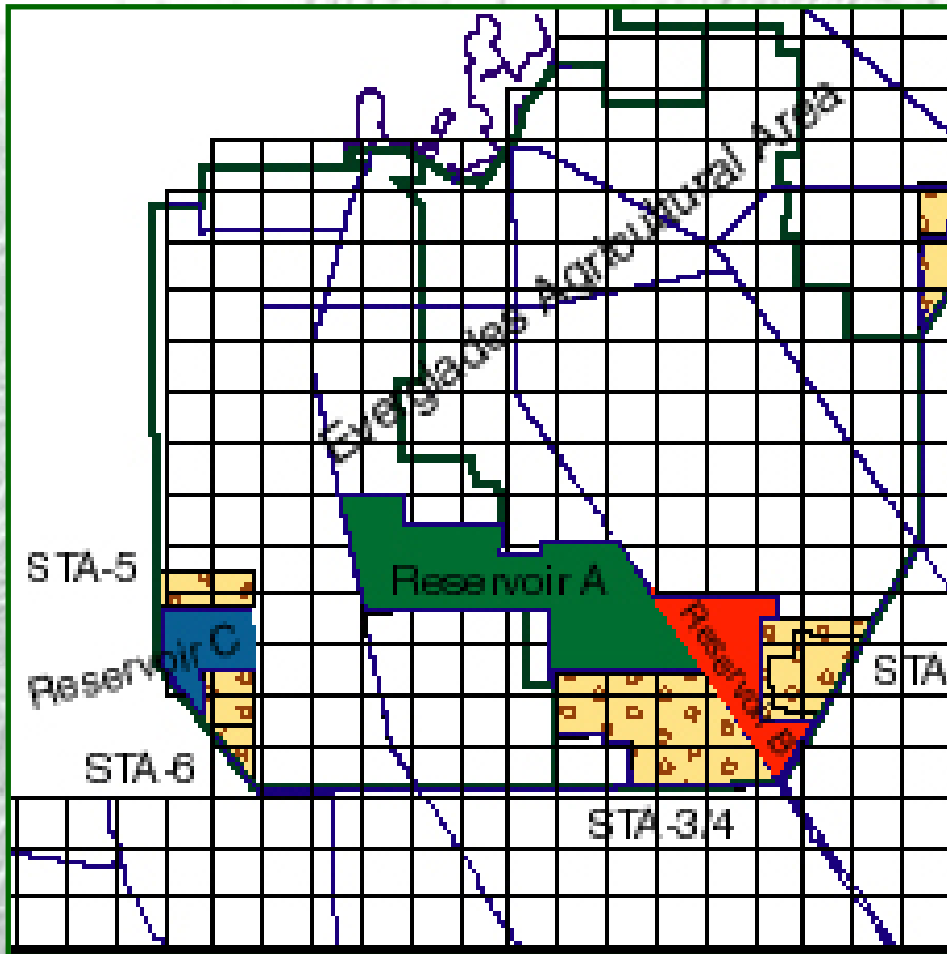
Stage Duration Curves at EAA Compartment 2B Reservoir



Stage Duration Curves at EAA Compartment 2B Reservoir

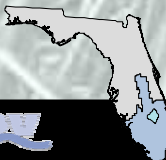
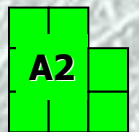
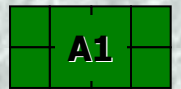


EAA Configuration in ECP Basin Specific Feasibility Study (BSFS)



EAA Configuration in ECP Basin Specific Feasibility Study (BSFS)

- Updated available footprint for the EAA reservoir/s (total of 59,901 acres)
- Compartment A1 is 20,000 acres; operated the same way as Compartment 1 in Restudy
- Compartment A2 is 21,495 acres; operated the same way as Compartment 2A in Restudy
- Compartment B is 9,522 acres; operated the same way as Compartment 2B in Restudy
- Compartment C is 8,884 acres; geographically separate from the other compartments and operated as a surge tank

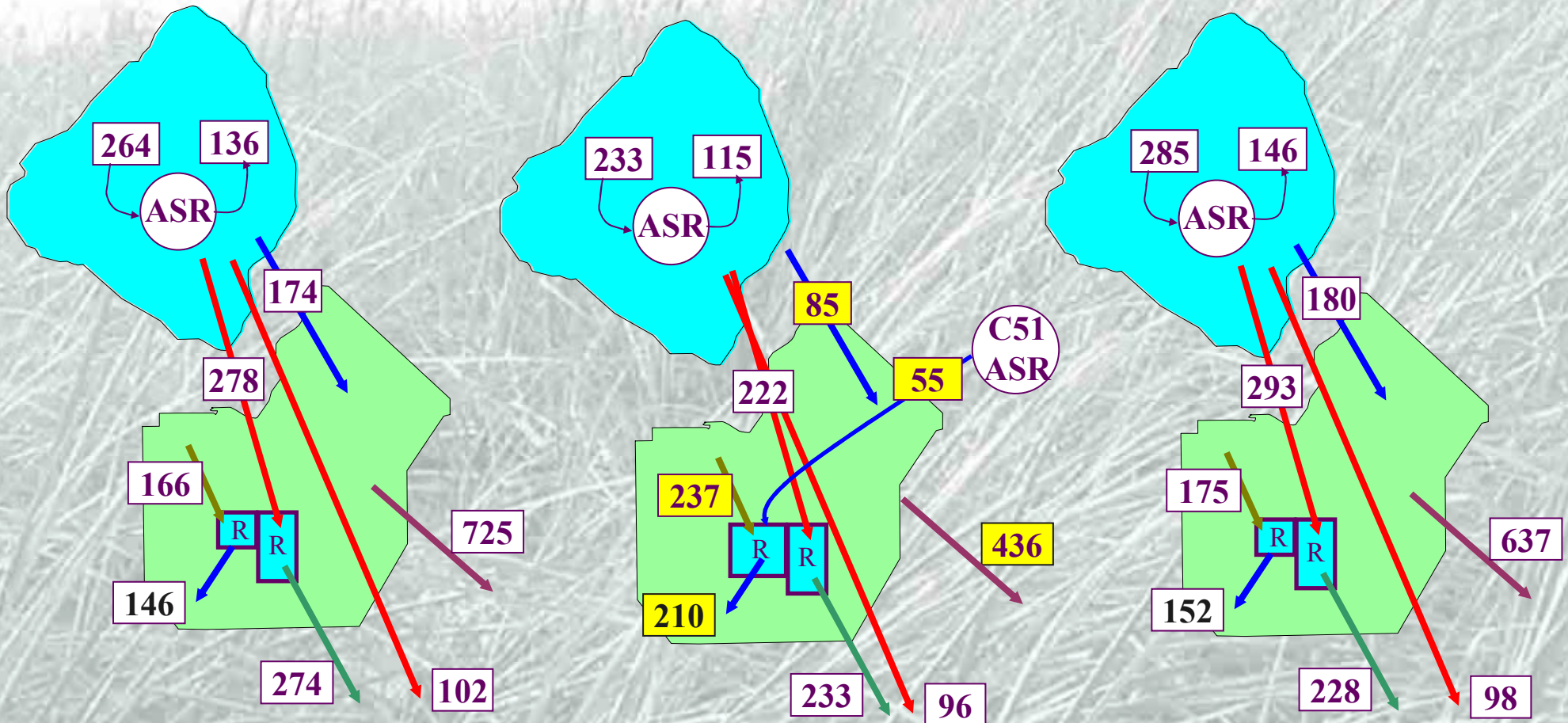


What do EAA Reservoirs do for System ?

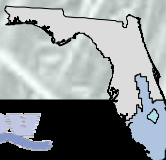
**Future with CERP
(D13R)**

**LECRWSP
2020**

ECP BSFS

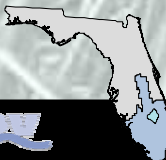


Units - Thousand Acre Feet per Year



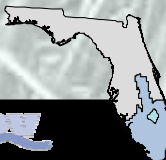
Design Suggestions

- CERP (Alt D13R) is a good starting point, not the perfect plan
- Identify existing and/or create performance measures that address specific project goals and objectives
- Look for opportunities to optimize local design for system-wide benefits



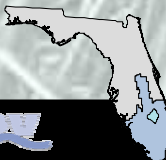
Design Suggestions (con't)

- Apply lessons learned from other modeling (D13R scenarios, LECRWSP, ECP BSFS)
- Ensure optimization of components that work with EAA Reservoirs, through RECOVER
- Utilize modeling results from ICU and other related modeling efforts, e.g., ASR contingency



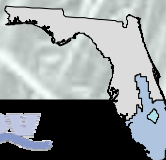
Resources

- **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.**
- **Scenario Simulations for Reservoirs in the EAA.**
Memorandum from R. Santee & L. Cadavid to C. Neidrauer,
September 4, 1998.
- **Lower East Coast Regional Water Supply Plan, SFWMD, May 2000.**



Resources

- **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.
- **ECP Base Simulation and 2050 with Project Simulation Using the South Florida Water Management Model.** Memorandum from L. Brion and A. Ali to G. Goforth & T. Piccone, April 15, 2002.



Thank you !