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
“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)

Average Regulatory releases = 405,000 ac.ft/yr

Future Regulatory Releases with CERP (D13R)

Average Regulatory releases = 821,000 ac.ft/yr
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) vs. 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)

Double size of Reservoir 2 (SGT4020)

| #1 | #2 | #3 |

- 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

(EMARS

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
Figure 4: RECOVER project evaluation process.
Figure 4. Lake Okeechobee Stage Duration Curves
Figure 8. Number of Undesirable Lake Okeechobee Stage Events

- # Times Stage > 17 ft. for > 50 days
- # Times Stage > 16 ft. for > 1 year
- # Times Stage > 15 ft. for > 2 years
- # Times Stage < 12 ft. for > 1 year
- # Times Stage < 11 ft. for > 100 days

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)).

Run date: 08/12/98 09:26:46
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).
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

Hydrologic Systems Modeling
Stage Duration Curves at EAA Compartment 1 Reservoir

[Graph showing stage duration curves with various labels and data points.]

Percent Time Equaled or Exceeded

Stage (ft NGVD)
Stage Duration Curves at EAA Compartment 2A Reservoir

% Time Equaled or Exceeded

Elev 12.0 (WMD) ft
ALTD1SR
SGT4320
SGT1X39
EAAR5
NEAR5
Stage Duration Curves at EAA Compartment 2B Reservoir

Hydrologic Systems Model
Phase 1 - EAA Storage Reservoir

Component A - available - 31 March 2005

Component B - portion available in 28 Feb 2007

Component C - available in March 31 2007
ECP Design
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.


- 2010 Case Study with EAA Reservoir Storage Volume Doubled, Novoa and Tarboton, 2001,
  

- Modeling of EAA Storage Reservoirs in SFWMM D13R Restudy Run. Memorandum from Raul Novoa to Victor Powell, July 9, 2001