

Lake Okeechobee System Operating Manual

**Iteration 3 - Phase 1 Technical
Evaluation**

Sanibel-Captiva Conservation Foundation

Conservancy of Southwest Florida

DRAFT - October 11, 2021

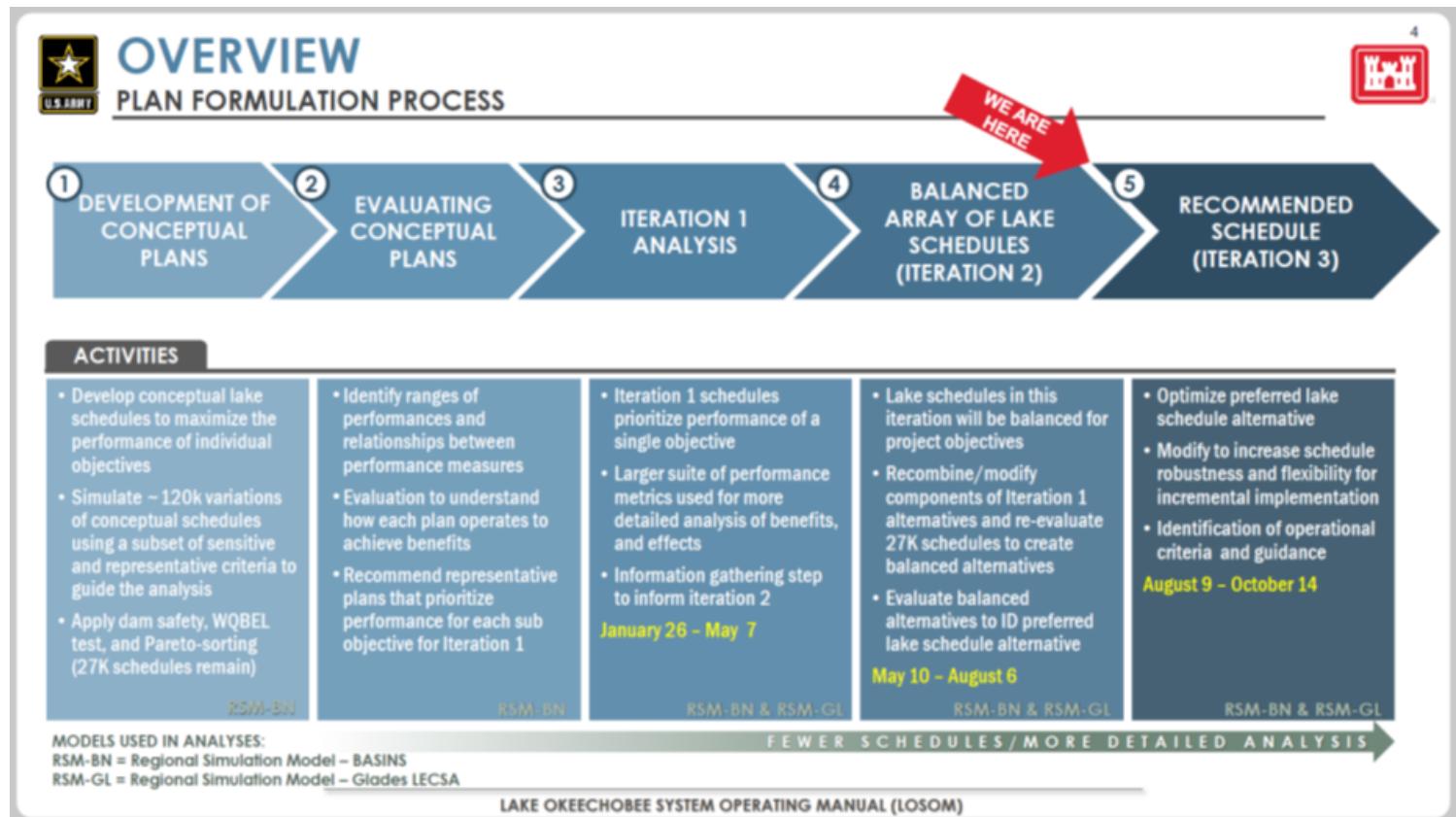


Use cursor keys for navigation, press "**O**" for a slide Overview

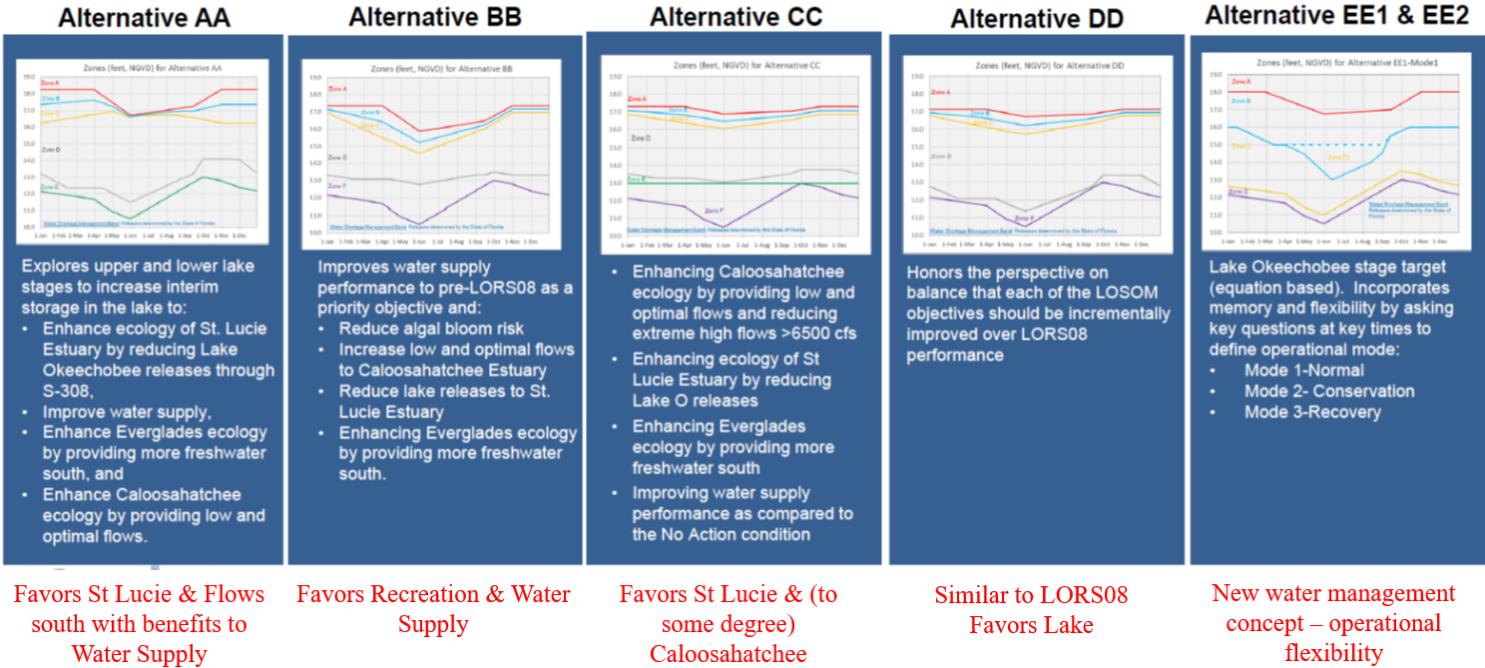
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LOSOM Process and Timeline

- LOSOM process started with Scoping Meetings - Feb 2019
- LOSOM Public Workshops – Sept 2019



Iteration 2 - Model Alternative

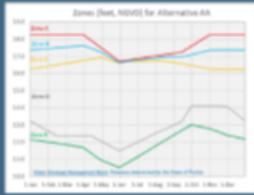
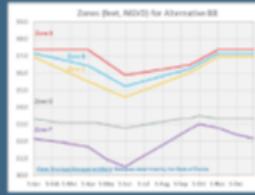
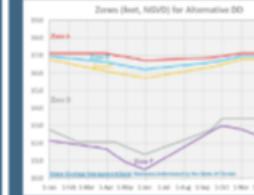
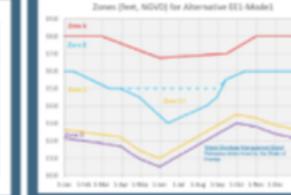


From SFWMD 08 July 2021 Governing Board meeting presentation

Iteration 2 - Model Alternative

FINAL ARRAY OF ALTERNATIVES
HONOR DIFFERENT PERSPECTIVES ON BALANCING THE CONGRESSIONALLY AUTHORIZED
PROJECT PURPOSES AND THE STATED GOAL AND OBJECTIVES OF LOSOM

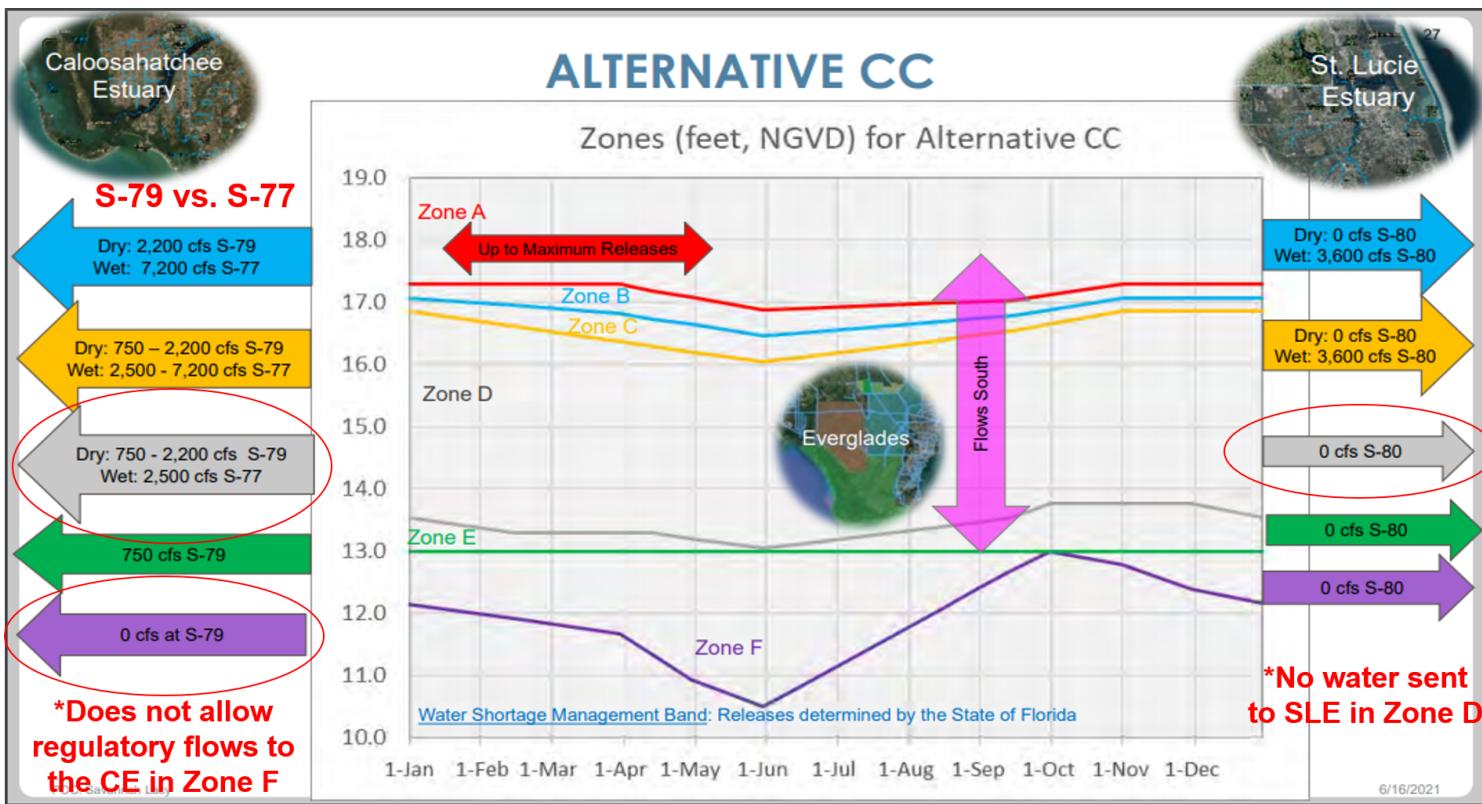
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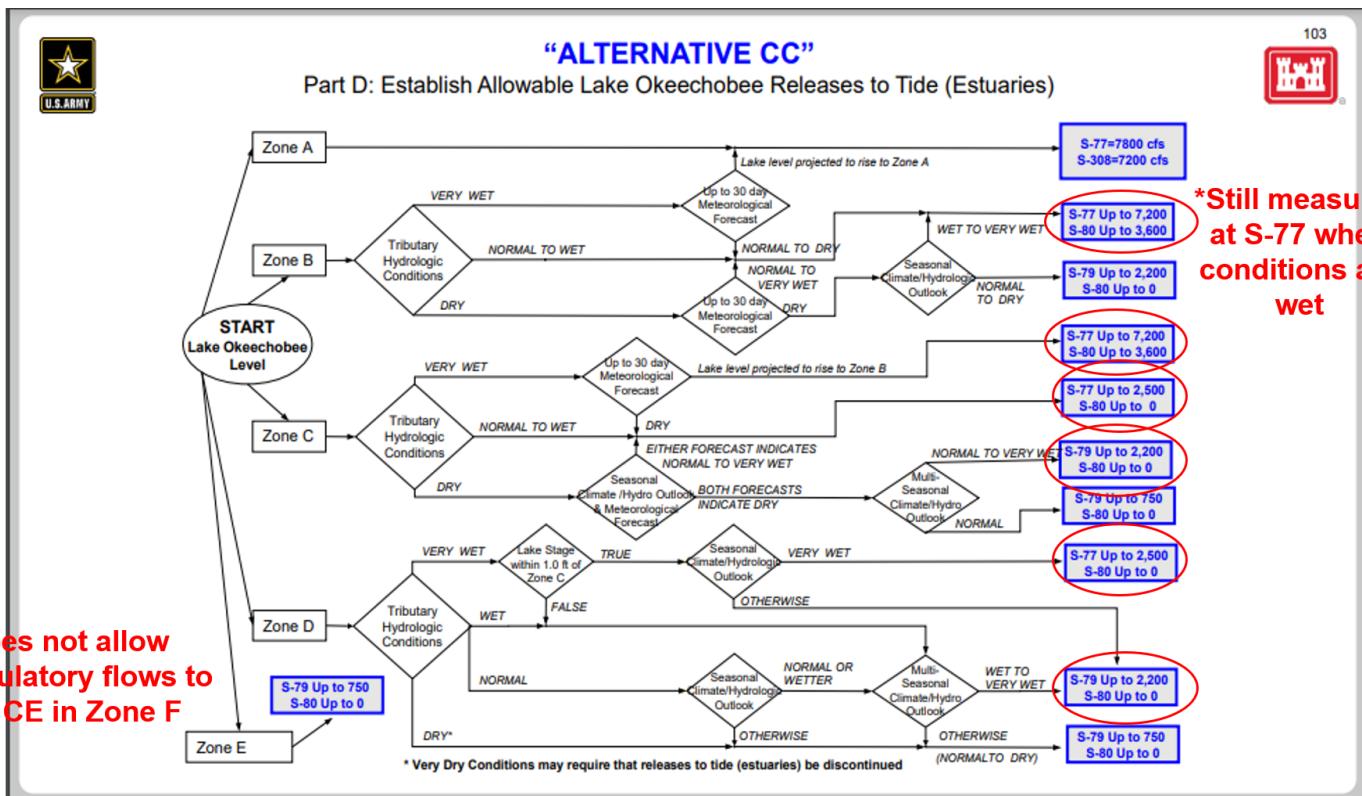
Alternative AA	Alternative BB	Alternative CC	Alternative DD	Alternative EE1/EE2
				
<p>Pros: Best performance for both flows south and reduction of lake releases to SLE</p> <p>Cons: Water supply (2nd worst) and lake ecology performance (3rd worst)</p>	<p>Pros: Significantly best performance for water supply, Navigation, and CRE Algal Bloom Risk performances</p> <p>Cons: Worst SLE and S. Florida ecology performance</p>	<p>Pros: Top 3 performance for 10 out of 11 sub-objectives</p> <p>Cons: Moderate increases in performance when compared to other alts, increases stress flows to CRE</p>	<p>Pros: Best for lake ecology, 2nd best water supply performance</p> <p>Cons: Worst for CRE ecology and CRE algal bloom risk, 2nd worst for SLE performance</p>	<p>Pros: Best overall CRE performance, 2nd best reducing CRE algal bloom risk</p> <p>Cons: Water supply performance (EE2 is worst), most increases in >17 ft lake stages</p>

From USACE PDT 19 July 2021 meeting presentation

Concerns with Alternative CC

- Water supply & flood control constraints put pressure on the estuaries as the primary outlet for CS&F Project
- Alternative CC redistributes harmful regulatory flows from the SLE to CE
- Flows to CE are measured at S-77 when conditions are wet – does not take into account watershed runoff when making release decisions (flows always measured at S-80 in SLE)
- Does not allow beneficial dry season flows to CE & Everglades in Zone F
- Increases total regulatory flows to CE by 9%, TN & TP loading increases by 10 & 12%, respectively; reduces regulatory flows to SLE by 62% & reduces TN & TP by 62 & 63%, respectively
- Only decreases lake-triggered damaging events to CE by 16% and increases stressful flows (2,100-2,600 cfs) by 58%, while St. Lucie gets 88-91% reduction in lake-triggered RECOVER damaging & stressful flow events
- Caloosahatchee & south are the only outlets in Zone D – Lake O recovery periods could increase releases to CE in Zone D
- Allows back flowing of water & nutrients into the lake from C-44 & EAA (C-44 backflow ~60%).

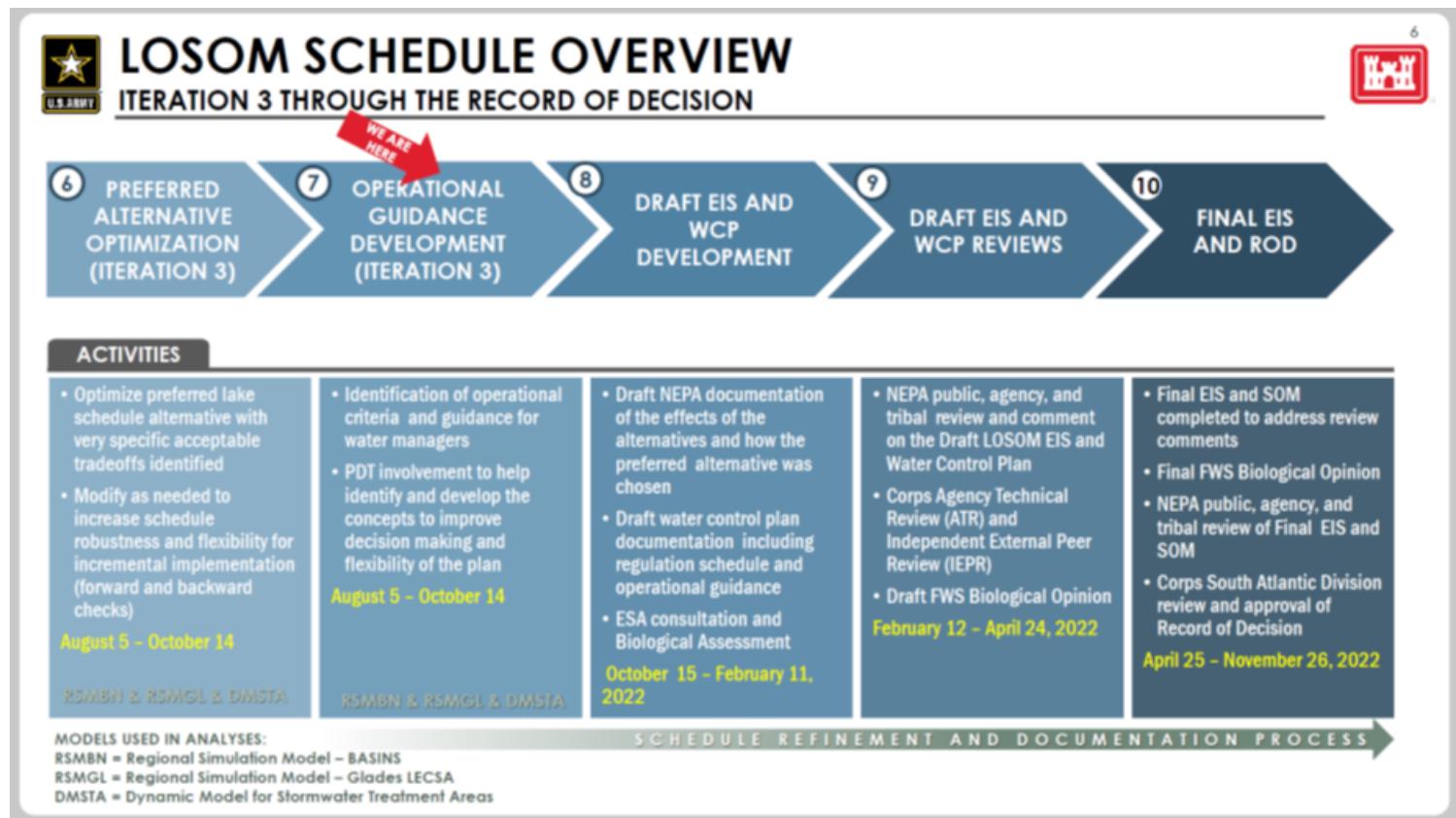




Modifications Needed to Optimize CC

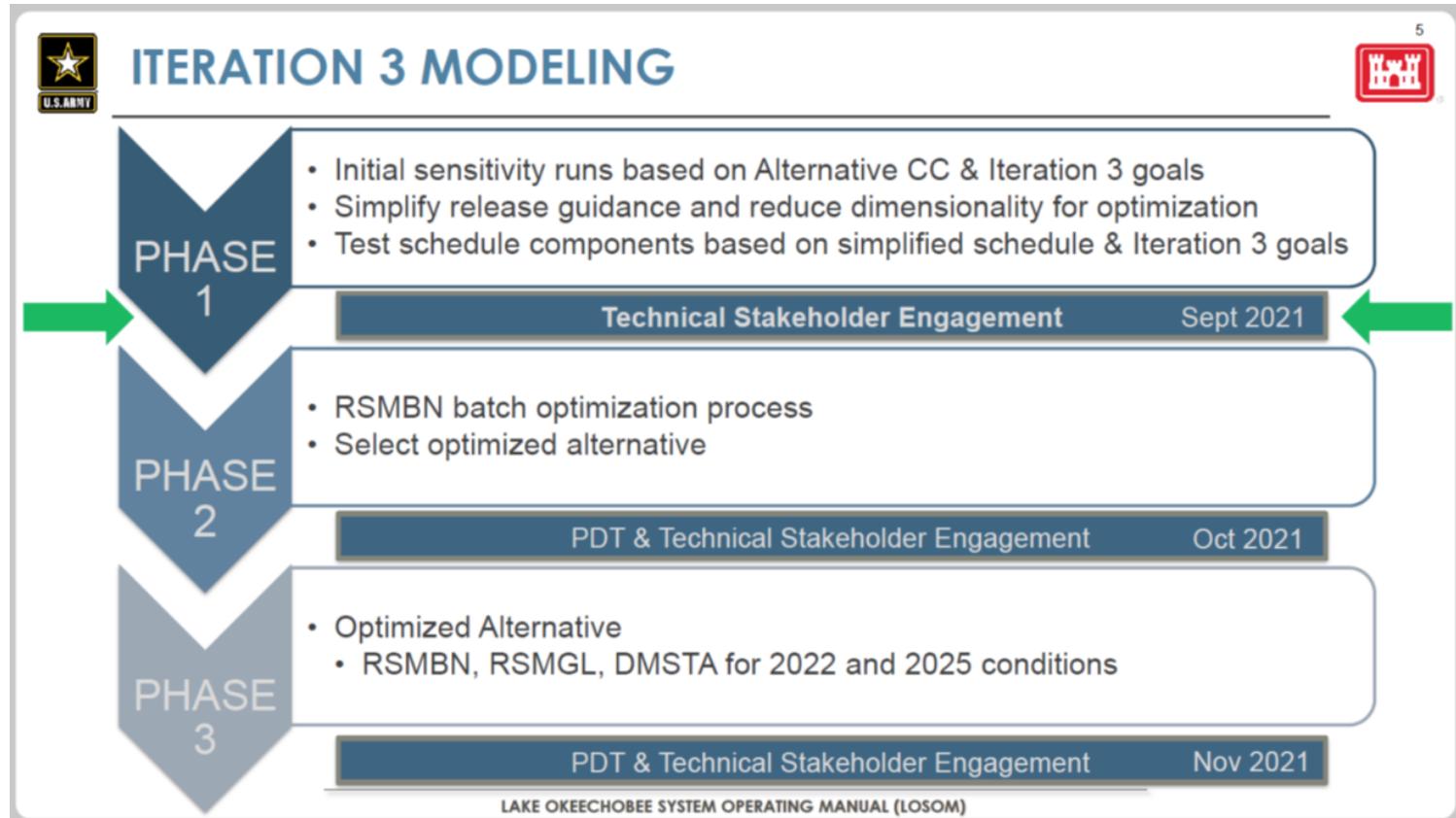
- Measure *all* discharges to Caloosahatchee Estuary at the Franklin Lock (S-79)
- Cap regulatory discharges to CE in Zone D to maximum of 2,100 cfs at S-79 - consistent with the ecological performance targets for the Caloosahatchee estuary
- If flows are not capped at 2,100 in Zone D, equitably distribute flows across all outlets —south, east, & west—when conditions are wet
- Allow for beneficial dry season releases to the Caloosahatchee & Everglades in all zones Reduce total volume of water & nutrient loading to CE below NA25 (targeting stressful & damaging flow ranges)
- Minimize or eliminate back flowing of nutrient-rich water from the Everglades Agricultural Area (EAA) & C-44 basins into the lake

Next Steps in the LOSOM Process



From USACE PDT 25 Aug 2021 meeting presentation

Iteration 3 - Modeling



From USACE Technical Stakeholder Engagement - 16-17 Sept 2021 meeting presentation

Iteration 3 Modeling Data Analysis

Iteration 3 - Modeling

- Requested all output data (i.e. .dss files for each alternative) from SFWMD/IMC

Phase 1

- Initial sensitivity runs based on Alternative CC & Iteration 3 goals
- Simplify release guidance and reduce dimensionality for optimization
- Test schedule components based on simplified schedule & Iteration 3 goals

Notes

Alternative Naming (in USACE presentation 16-17 Sept 2021)

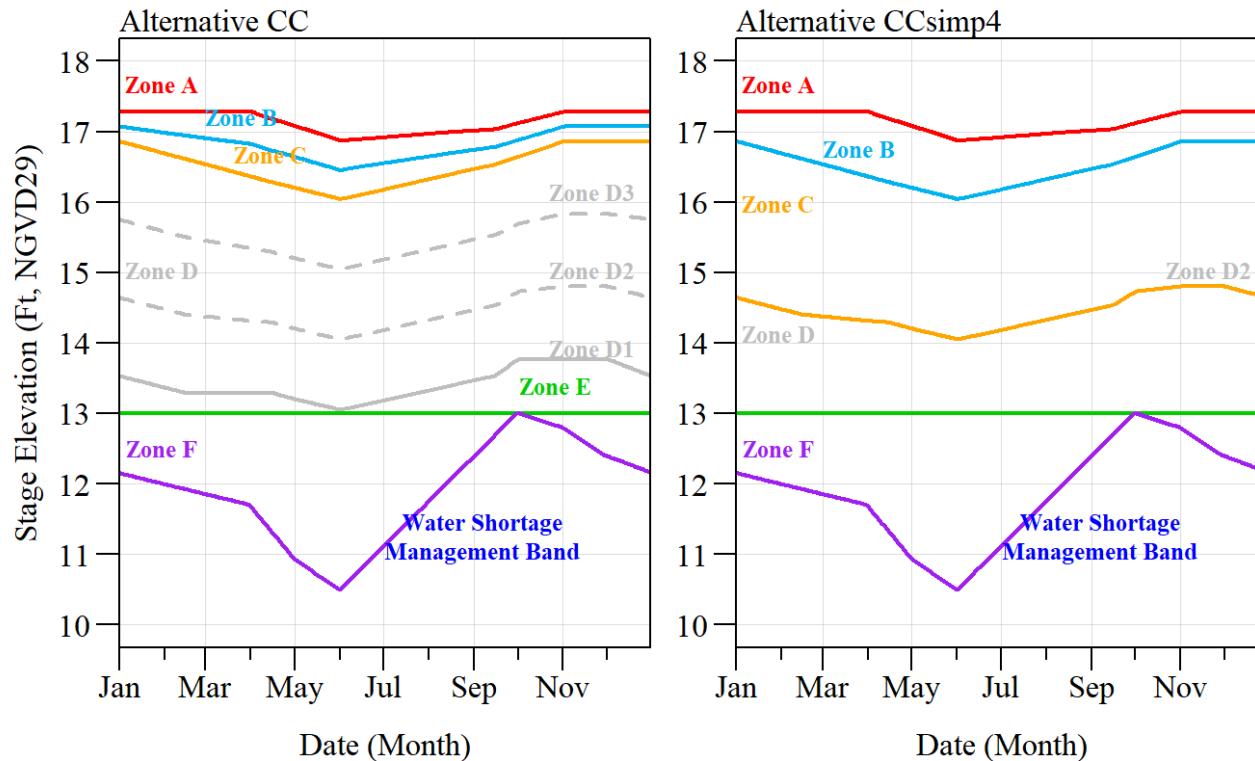
- CC == CCTSP
- CCsimp4 == simp4
- 2 versions of CCsimp4 - After simp4s1 (*Phase 1 - Test Flows to St Lucie Estuary*) was run it was renamed as CCsimp4. Therefore in this presentation the second CCsimp4 was renamed to CCsimp4(2).

Phase 1 - Initial Sensitivity Runs

- **S1:** Preserve opportunity to send water out of the lake for longer which addresses the goal of increasing flexibility in the lower portions of the schedule.
- **S2:** Regulate CRE releases by using flows at S-79 in all conditions in all zones except in Zone A
- **S3:** Reduce stress to CRE by incorporating friendly estuary release concepts from 4BC-1
- **S4:** Reduce stress to CRE by incorporating alternating estuary release concept from 4BC-2
- **S3-4:** Combination of friendly estuary release concepts and alternating estuary release concepts
- **S5:** Reduce stress to CRE by reducing maximum up to flows in Zone D
- **S6:** Combine zones B & C
- **S7:** Address algae by incorporating no releases to the Northern Estuaries in the months June –August except in Zone A

Phase 1 - Simplify Release Guidance

- Combine zones, simplify release guidance flowcharts
- Add complexity where it is needed to meet the goals of Iteration 3 optimization



CC and 'CCsimp4' simplified regulation schedule.

Phase 1 - Test Schedule Components – CCsimp4

- Flows to St. Lucie Estuary (simp4 and simp4s1)
- Increased flexibility in lower portion of the schedule (smp4ZFS, smp4ZFW, smp4ZFSW)
 - smp4ZFS - Flow to LOWSM line (removal of Zone F) for flows south only
 - smp4ZFW - Flow to LOWSM line (removal of Zone F) for flows west only
 - smp4ZFSW - Flow to LOWSM line (removal of Zone F) for flows south and west
- Opportunity to send desirable dry season flows to Lake Worth Lagoon (271DS, 271DSZC)
 - 271DS - S271 sends 200 cfs when S155A 14-day moving average is ≤ 100 during dry season
 - S71DSZC - Same as S271DS but flood control level is above Zone C line.
- Zone B regulation point for CRE (S77 vs S79) (ZB_S77)

Phase 1 - Test Schedule Components – CCR1

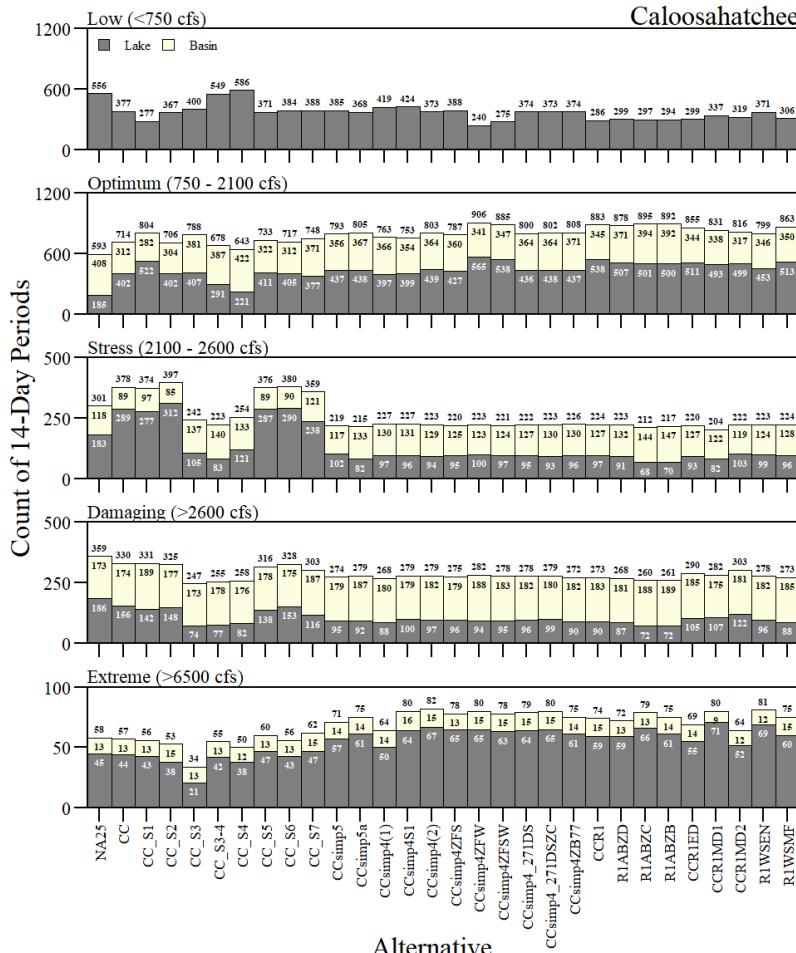
- CCR1 used CCsimp4 as base and incorporated features from smp4ZFSW, 271DS and ZB_S77
 - ZFSW logic - flow south and west to LOWSM line
 - 271DS logic - S271 sends 200 cfs when S155A 14-day moving average is ≤ 100 during dry season
 - ZB_S77 - Zone B regulation point for CRE - S77 instead of S79

Evaluated:

- Opportunities to reduce algal bloom risk in the northern estuaries (R1ABZD, R1ABZC, R1ABZB)
 - all reg releases in June, July, August set to 0 in Zone D, C and B and lower (R1ABZD, R1ABZC, R1ABZB, respectively)
- Opportunities to improve lake health by incorporating extreme and moderate recovery operations (CCR1ED, CCR1MD1, CCRMD2)
 - Takes into account El Niño forecast, recovery envelope counts and <11 Ft stage threshold
- Opportunities to address water supply performance by modifying operations in lower portions of the schedule (R1WSEN, R1WSMF)
 - Full flows being ~750 cfs west and up to max south
 - R1WSMF - Lake forecasted to enter into WSM band
 - R1WSEN - Cutbacks during ENSO conditions

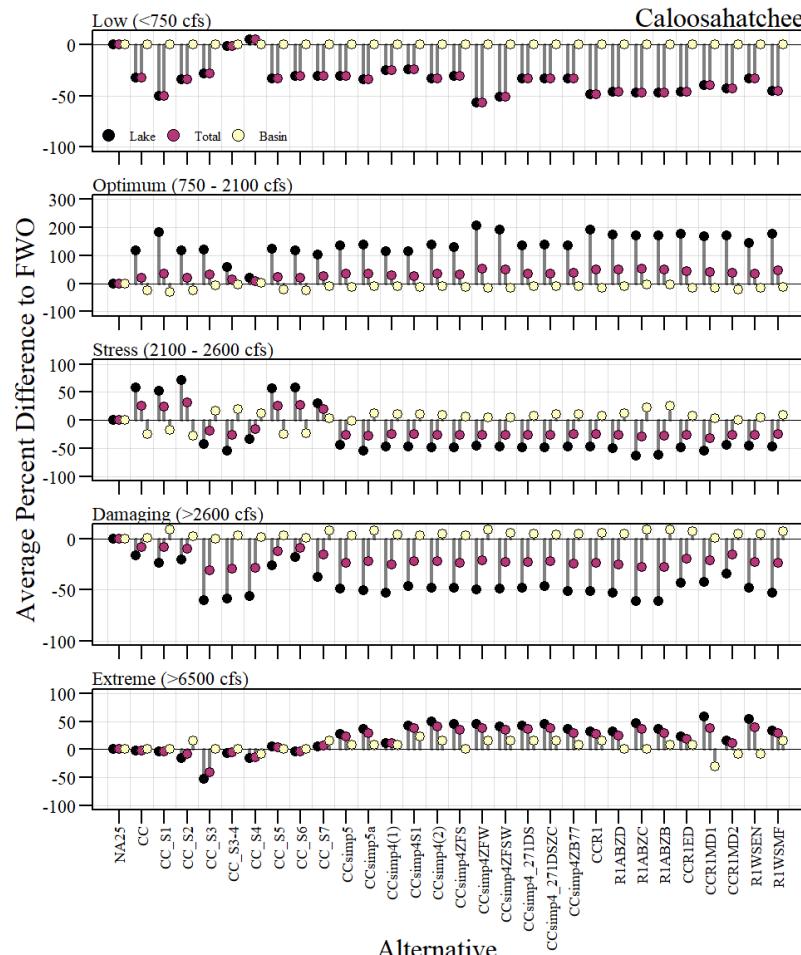
CRE RECOVER metrics

RECOVER
salinity envelope
evaluation during
the simulation
period of record
for
Caloosahatchee
with Lake (LOK)
and Basin
contributions
delineated.



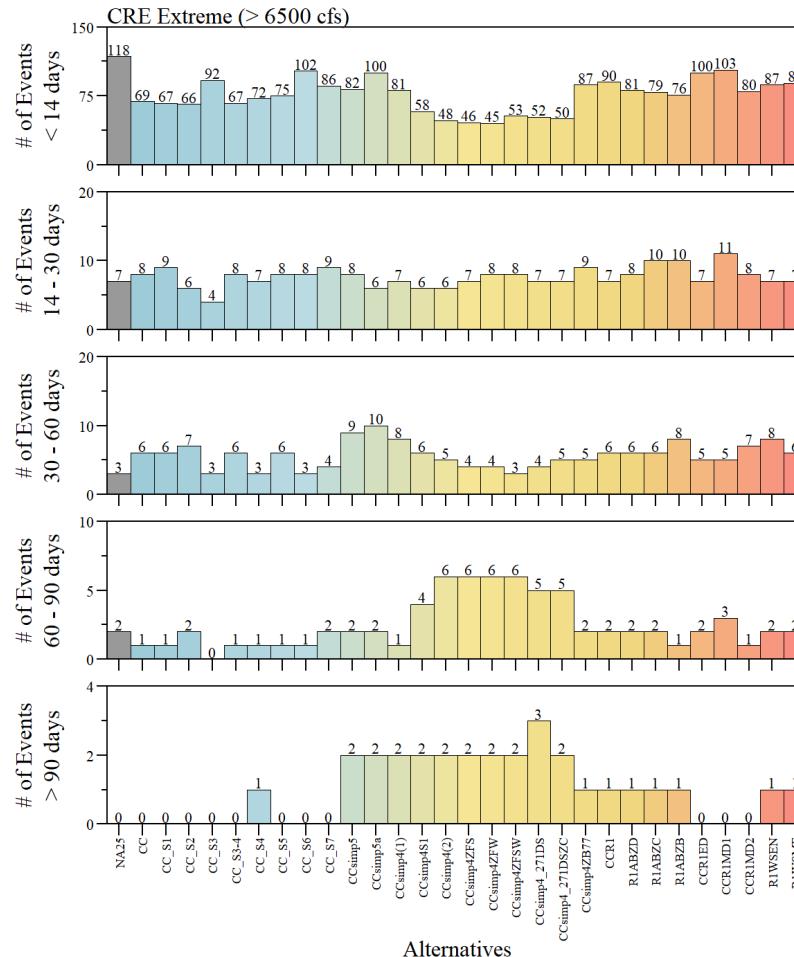
CRE RECOVER metrics

RECOVER
salinity envelope
evaluation relative
to FWO (NA25)
during the
simulation period
of record for
Caloosahatchee
specific to Lake,
Basin and total
counts.



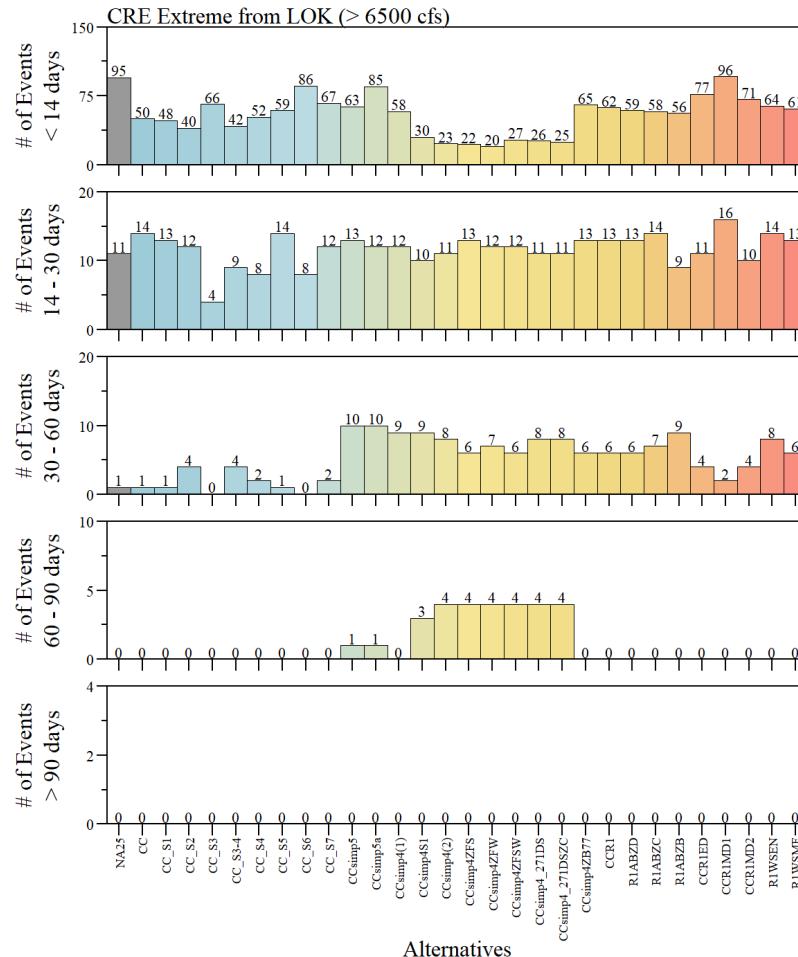
CRE Extreme Flow Events

Number of events
and duration of
events of extreme
flow events
(>6500 cfs) for
the
Caloosahatchee
(all flows;
Basin+LOK).

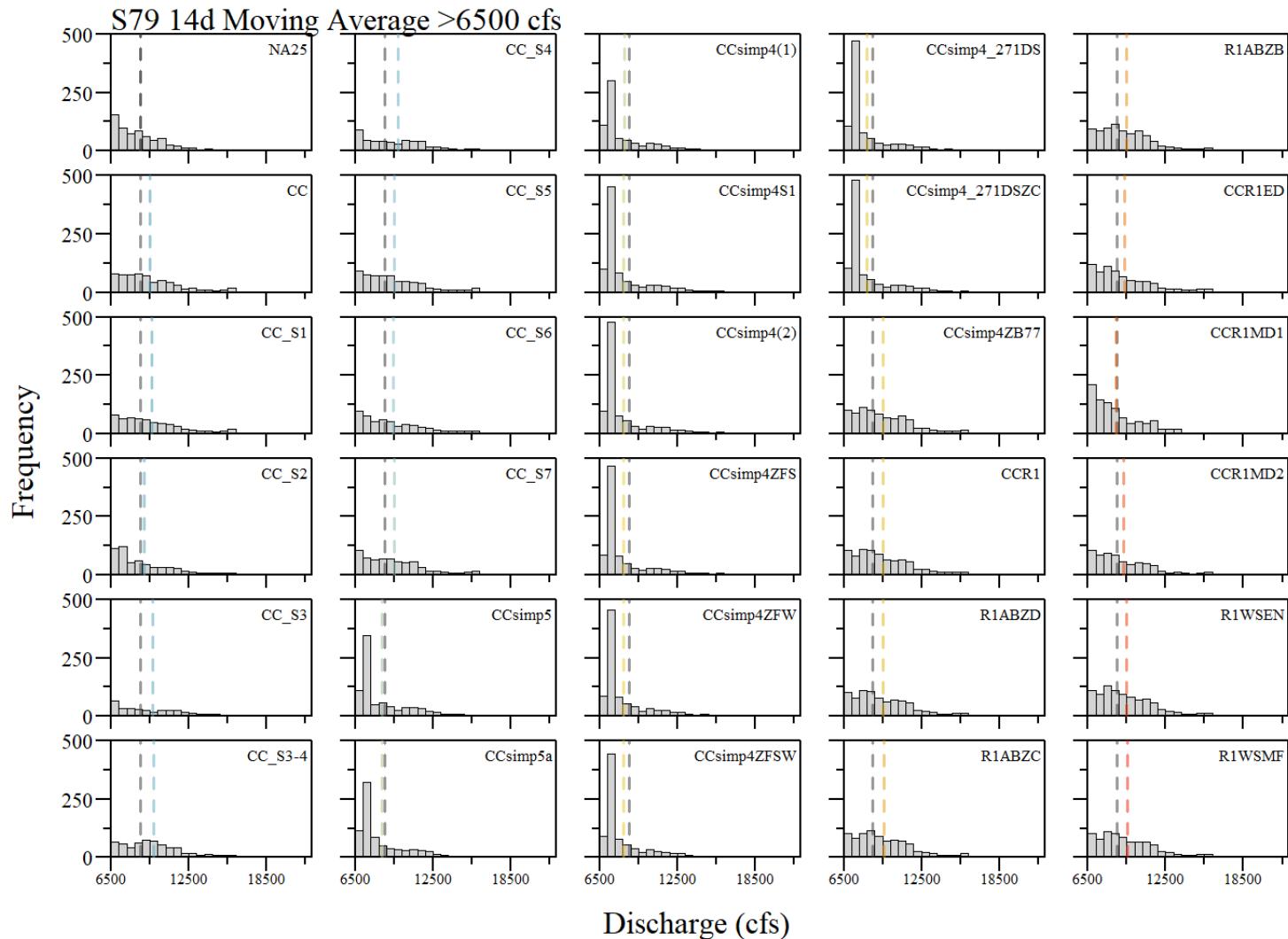


CRE Extreme Flow Events

Number of events
and duration of
events of extreme
flow events
(>6500 cfs) for
the
Caloosahatchee
from Lake
Okeechobee.



CRE Extreme Flow Events



CRE Discharge

Mean annual total S-79 discharge during the period of simulation

Alternative	S-79 (x1000 Ac-Ft Y ⁻¹)	S-79 (% Diff FWO)	Alternative	S-79 (x1000 Ac-Ft Y ⁻¹)	S-79 (% Diff FWO)
NA25	1294	0.0	CCsimp4ZFS	1331	2.9
CC	1347	4.1	CCsimp4ZFW	1377	6.4
CC_S1	1352	4.5	CCsimp4ZFSW	1355	4.7
CC_S2	1319	1.9	CCsimp4_271DS	1351	4.4
CC_S3	1183	-8.5	CCsimp4_271DSZC	1353	4.6
CC_S3-4	1168	-9.7	CCsimp4ZB77	1375	6.3
CC_S4	1123	-13.2	CCR1	1374	6.2
CC_S5	1342	3.7	R1ABZD	1369	5.8
CC_S6	1333	3.0	R1ABZC	1361	5.2
CC_S7	1318	1.9	R1ABZB	1349	4.3
CCsimp5	1258	-2.8	CCR1ED	1361	5.2
CCsimp5a	1244	-3.9	CCR1MD1	1330	2.8
CCsimp4(1)	1307	1.0	CCR1MD2	1350	4.3
CCsimp4S1	1348	4.2	R1WSEN	1364	5.5
CCsimp4(2)	1353	4.6	R1WSMF	1373	6.1

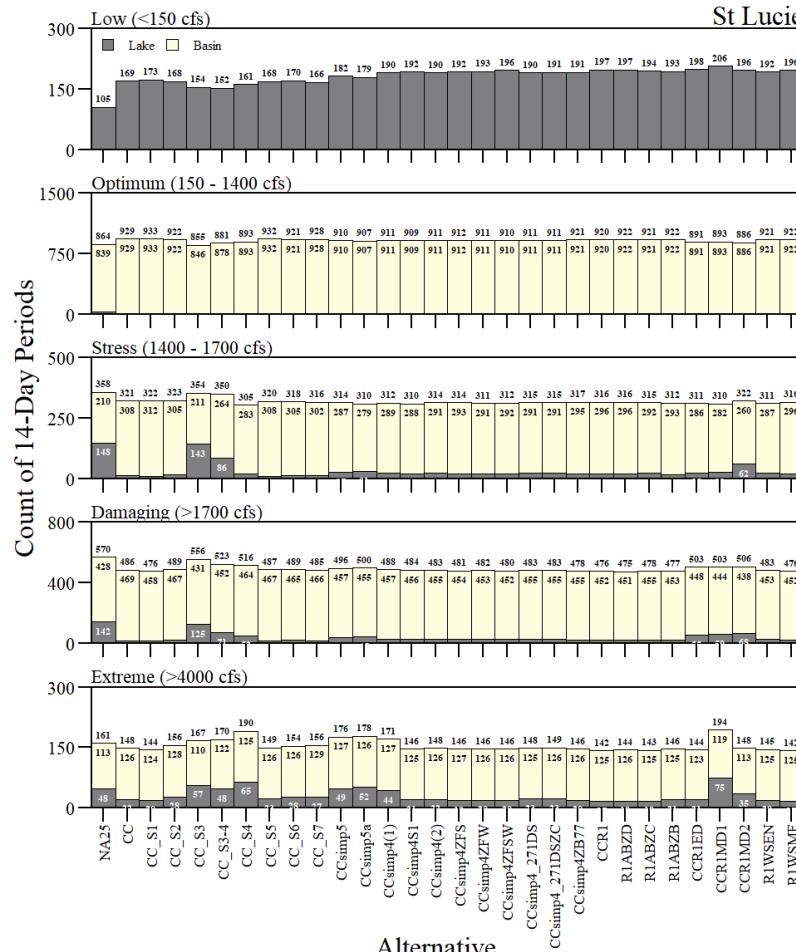
CRE Discharge

Mean annual total S-77 regulatory (flood protection) discharge during the period of simulation

Alternative	S-77 Reg Q (x1000 Ac-Ft Y ⁻¹)	S-77 Reg Q (% Diff FWO)	Alternative	S-77 Reg Q (x1000 Ac-Ft Y ⁻¹)	S-77 Reg Q (% Diff FWO)
NA25	528	0.0	CCsimp4ZFS	569	7.8
CC	578	9.5	CCsimp4ZFW	615	16.5
CC_S1	595	12.7	CCsimp4ZFSW	598	13.4
CC_S2	548	3.9	CCsimp4_271DS	583	10.5
CC_S3	414	-21.5	CCsimp4_271DSZC	586	11.0
CC_S3-4	391	-26.0	CCsimp4ZB77	608	15.1
CC_S4	344	-34.7	CCR1	618	17.1
CC_S5	572	8.4	R1ABZD	613	16.1
CC_S6	565	7.0	R1ABZC	604	14.4
CC_S7	547	3.6	R1ABZB	592	12.2
CCsimp5	485	-8.1	CCR1ED	610	15.6
CCsimp5a	468	-11.3	CCR1MD1	583	10.4
CCsimp4(1)	537	1.8	CCR1MD2	596	12.8
CCsimp4S1	580	9.9	R1WSEN	599	13.4
CCsimp4(2)	586	11.0	R1WSMF	614	16.4

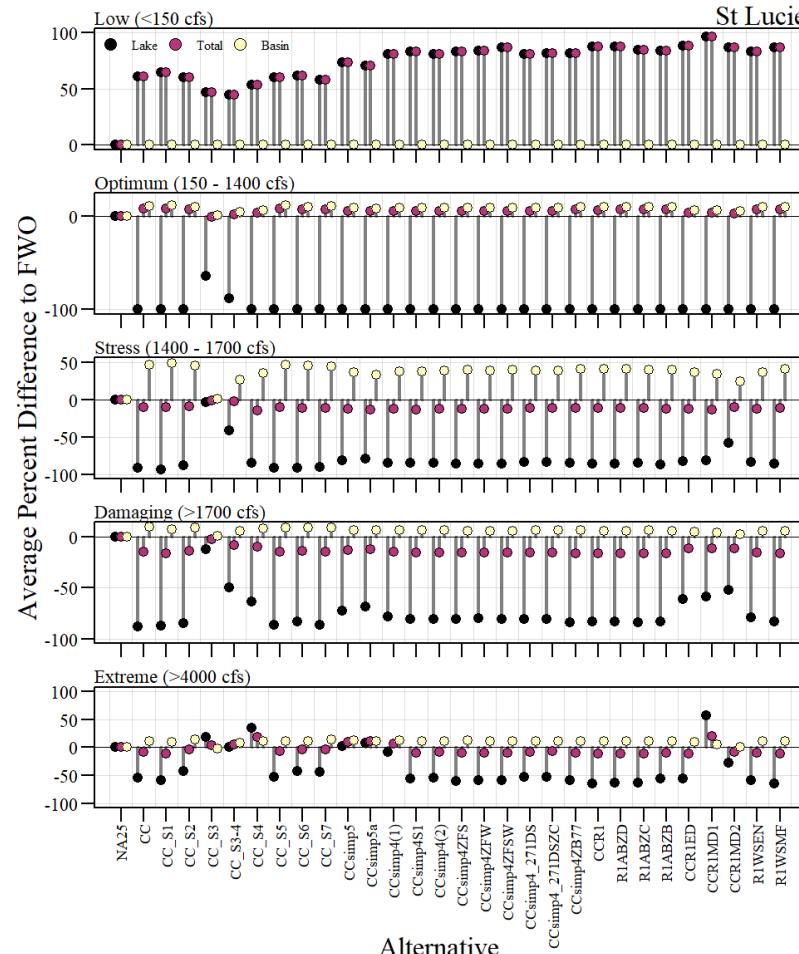
SLE RECOVER metrics

RECOVER
salinity envelope
evaluation during
the simulation
period of record
for St Lucie with
Lake (LOK) and
Basin
contributions
delineated.



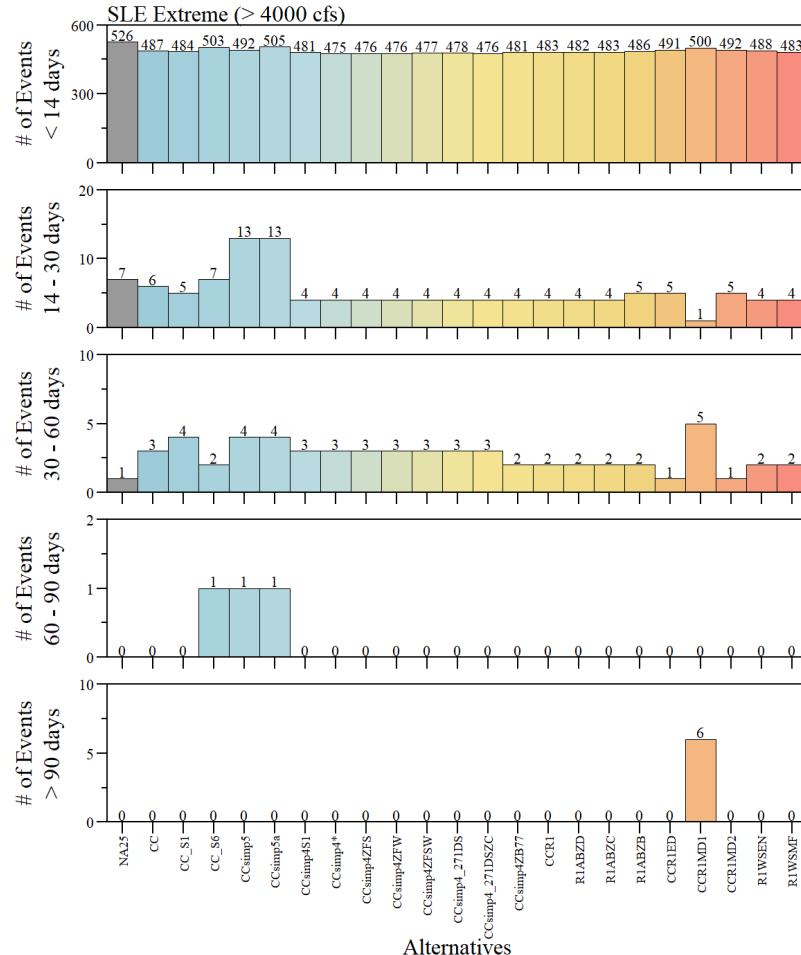
SLE RECOVER metrics

RECOVER
salinity envelope
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to FWO (NA25)
during the
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of record for St
Lucie specific to
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total counts.



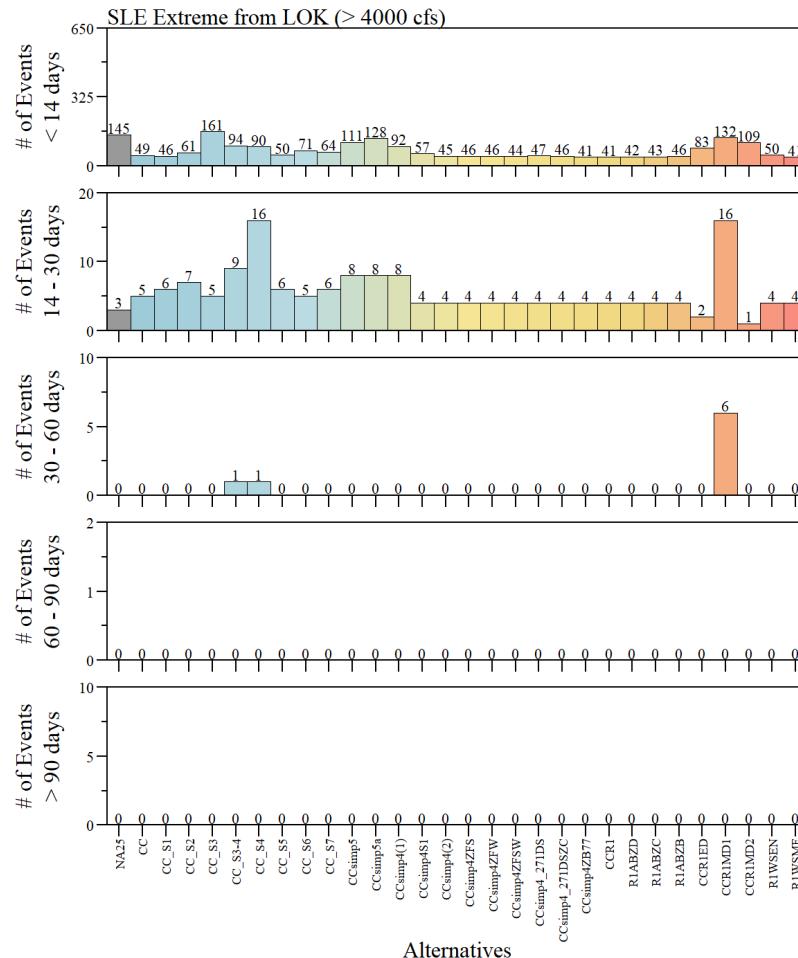
SLE Extreme Flow Events

Number of events
and duration of
events of extreme
flow events
(>4000 cfs) for
the St Lucie (all
flows;
Basin+LOK).



SLE Extreme Flow Events

Number of events
and duration of
events of extreme
flow events
(>4000 cfs) for
the St Lucie from
Lake Okeechobee.



SLE Discharge

Mean annual total S-80 discharge during the period of simulation

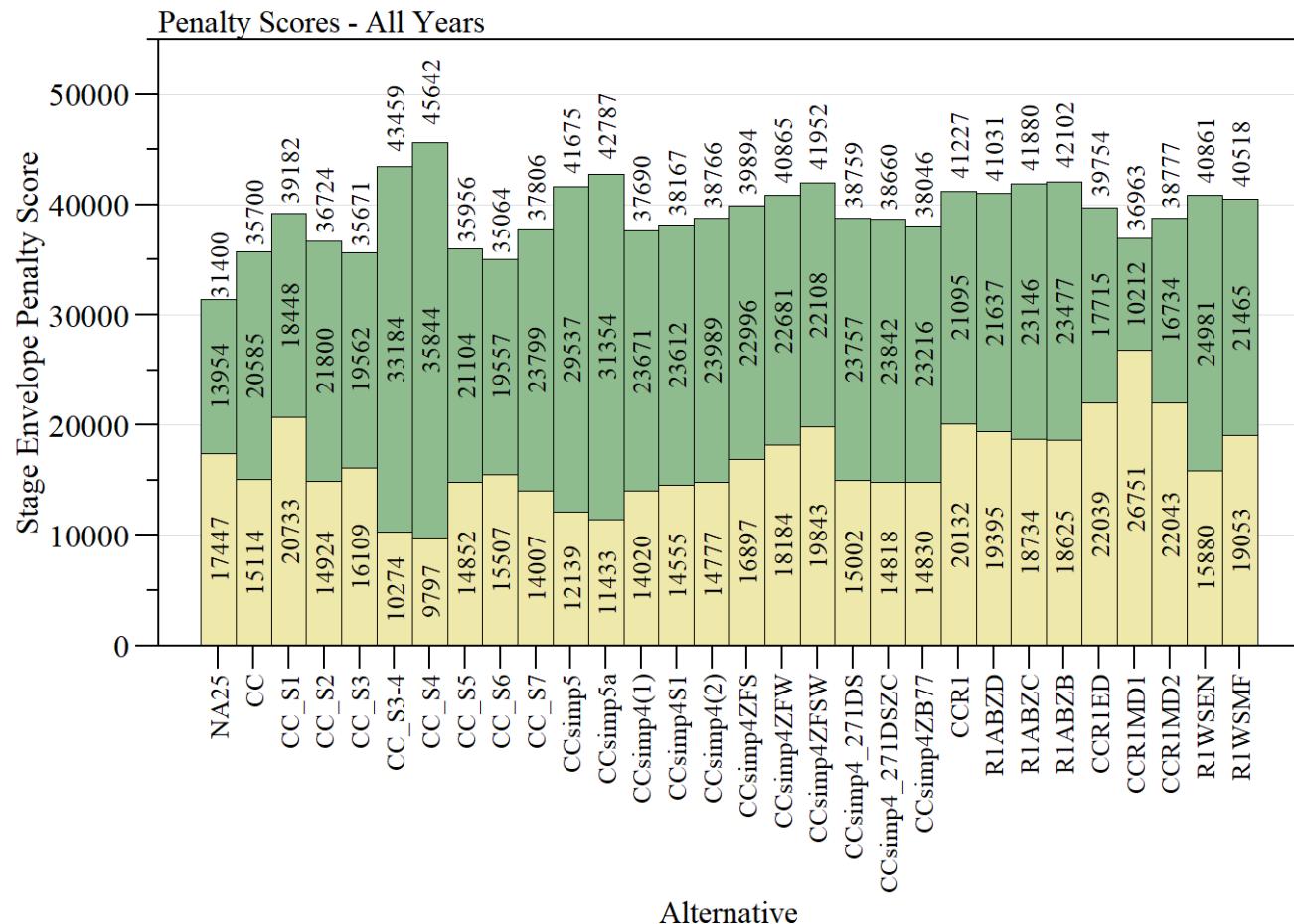
Alternative	S-80 (x1000 Ac-Ft Y ⁻¹)	S-80 (% Diff FWO)	Alternative	S-80 (x1000 Ac-Ft Y ⁻¹)	S-80 (% Diff FWO)
NA25	276	0.0	CCsimp4ZFS	139	-49.7
CC	153	-44.5	CCsimp4ZFW	137	-50.4
CC_S1	143	-48.2	CCsimp4ZFSW	135	-51.3
CC_S2	177	-36.0	CCsimp4_271DS	143	-48.2
CC_S3	286	3.5	CCsimp4_271DSZC	144	-48.0
CC_S3-4	274	-0.8	CCsimp4ZB77	124	-55.2
CC_S4	322	16.6	CCR1	116	-58.2
CC_S5	156	-43.4	R1ABZD	117	-57.8
CC_S6	171	-38.1	R1ABZC	121	-56.3
CC_S7	172	-37.8	R1ABZB	132	-52.4
CCsimp5	211	-23.7	CCR1ED	141	-49.1
CCsimp5a	220	-20.6	CCR1MD1	228	-17.4
CCsimp4(1)	184	-33.4	CCR1MD2	160	-42.1
CCsimp4S1	146	-47.2	R1WSEN	124	-55.3
CCsimp4(2)	143	-48.4	R1WSMF	117	-57.8

SLE Discharge

Mean annual total S-308 regulatory (flood protection) discharge during the period of simulation

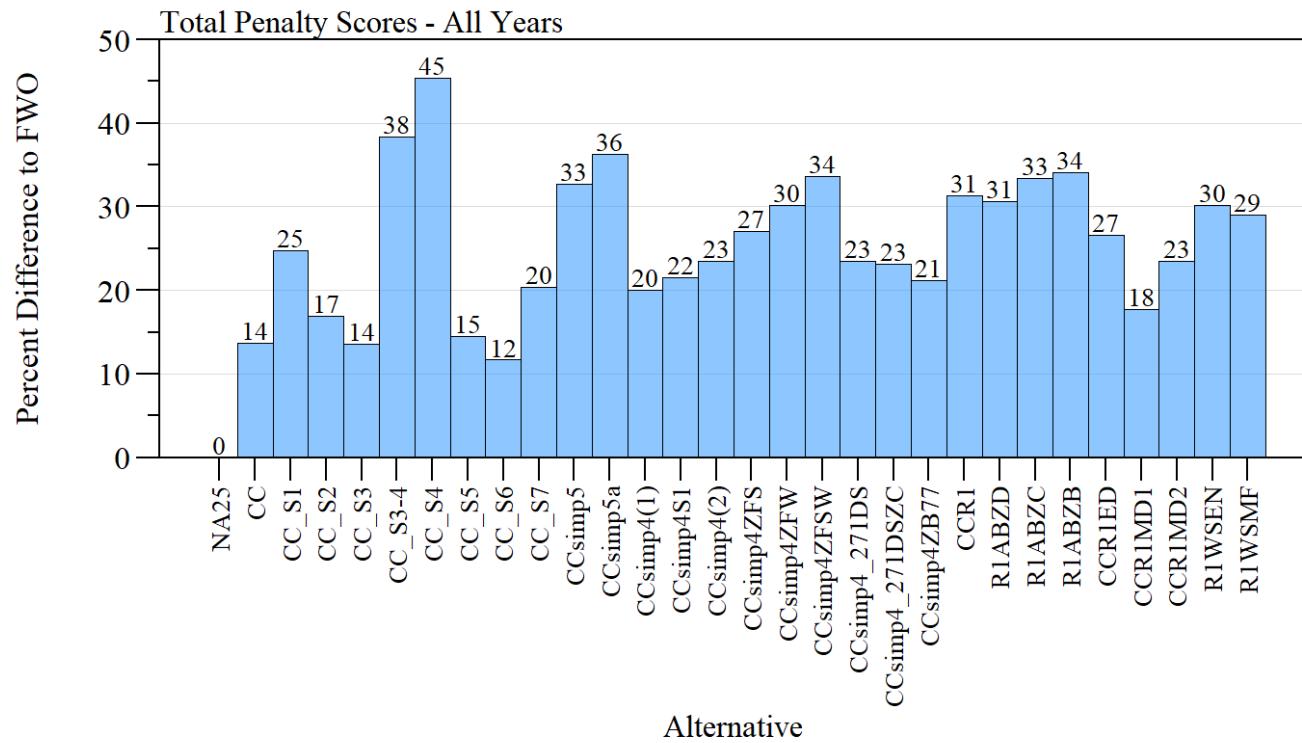
Alternative	S-308 Reg Q (x1000 Ac-Ft Y ⁻¹)	S-308 Reg Q (% Diff FWO)	Alternative	S-308 Reg Q (x1000 Ac-Ft Y ⁻¹)	S-308 Reg Q (% Diff FWO)
NA25	187	0.0	CCsimp4ZFS	74	-60.7
CC	72	-61.7	CCsimp4ZFW	73	-61.0
CC_S1	68	-63.8	CCsimp4ZFSW	72	-61.3
CC_S2	95	-49.3	CCsimp4_271DS	76	-59.7
CC_S3	202	8.0	CCsimp4_271DSZC	76	-59.7
CC_S3-4	187	-0.1	CCsimp4ZB77	56	-70.3
CC_S4	232	23.7	CCR1	54	-71.3
CC_S5	75	-60.1	R1ABZD	54	-71.0
CC_S6	90	-52.2	R1ABZC	57	-69.7
CC_S7	88	-52.8	R1ABZB	68	-63.9
CCsimp5	138	-26.2	CCR1ED	82	-56.2
CCsimp5a	145	-22.9	CCR1MD1	179	-4.7
CCsimp4(1)	116	-38.3	CCR1MD2	99	-46.9
CCsimp4S1	78	-58.1	R1WSEN	60	-68.2
CCsimp4(2)	74	-60.3	R1WSMF	54	-71.1

Lake Okeechobee Stage Envelope



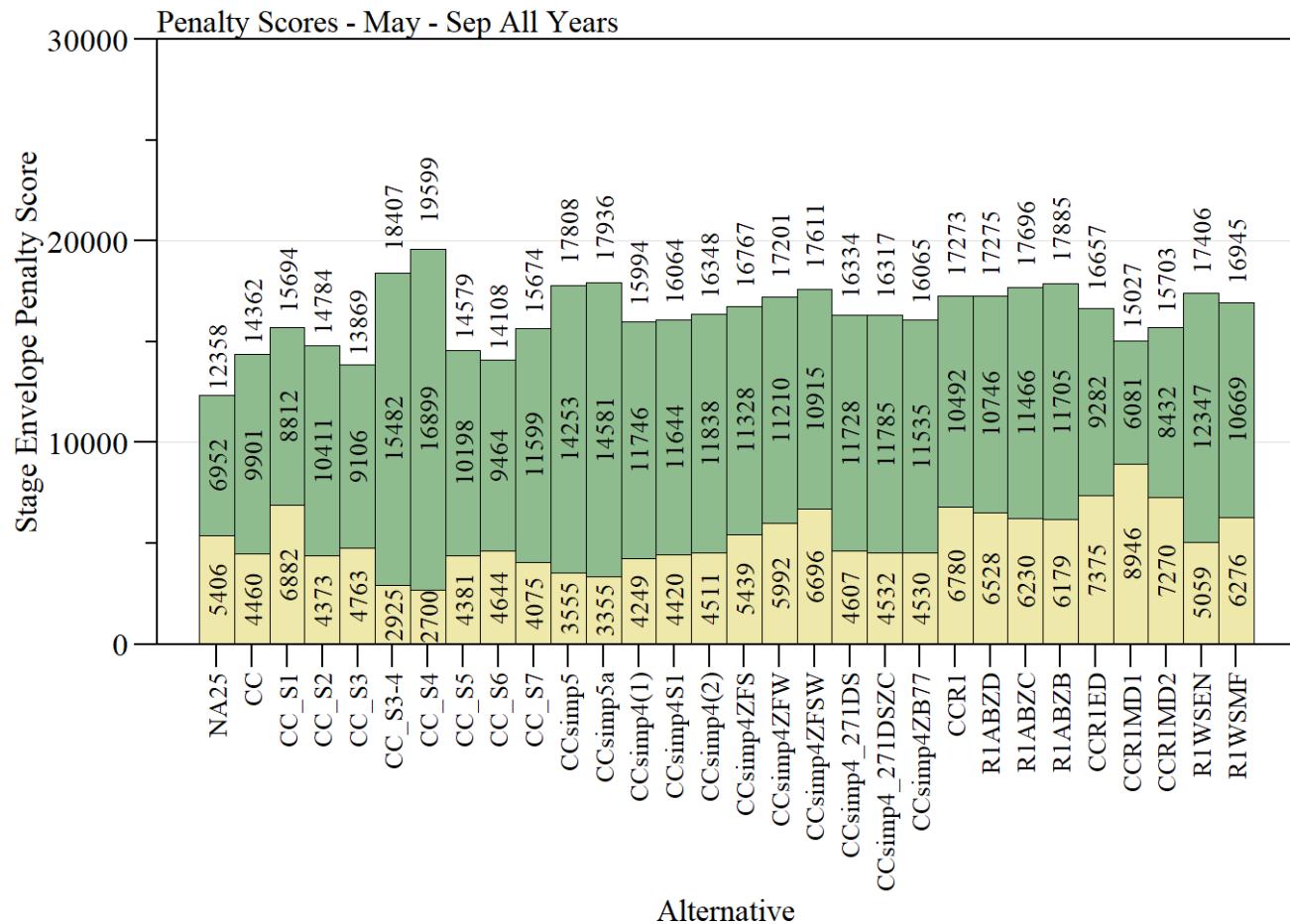
Annual lake stage envelope scores (below, above and total).

Lake Okeechobee Stage Envelope



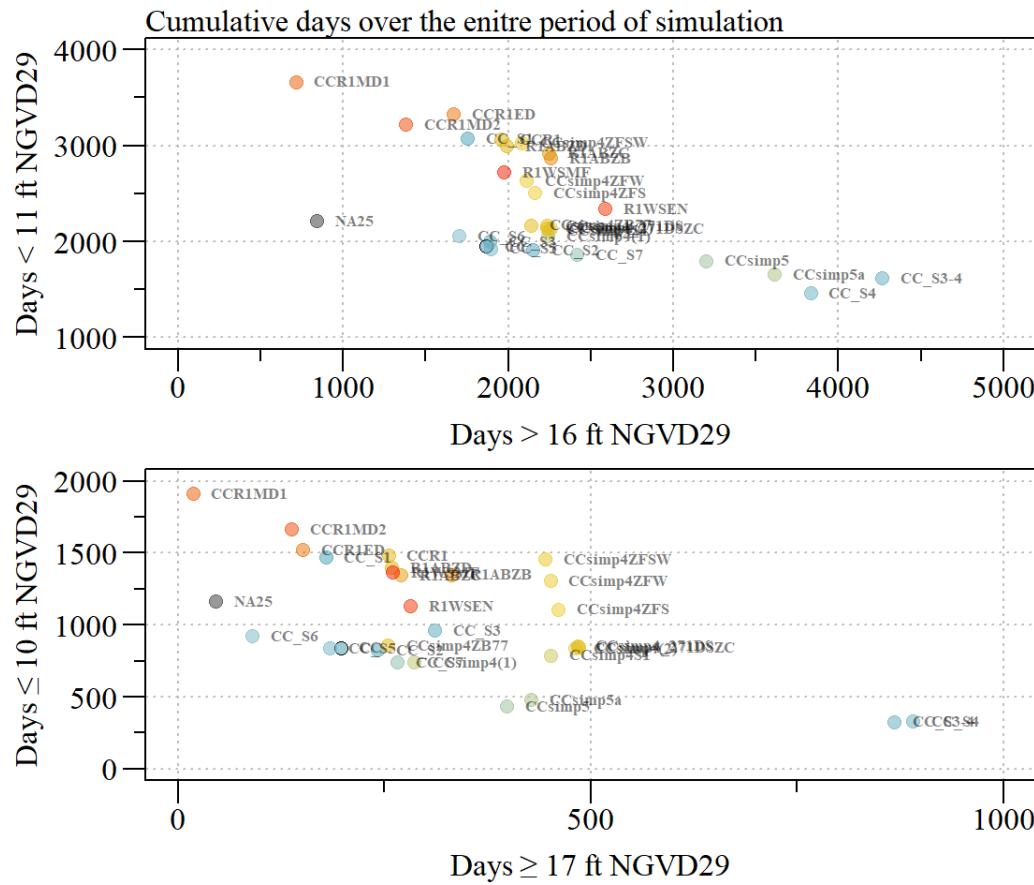
Total score percent difference to FWO.

Lake Okeechobee Stage Envelope



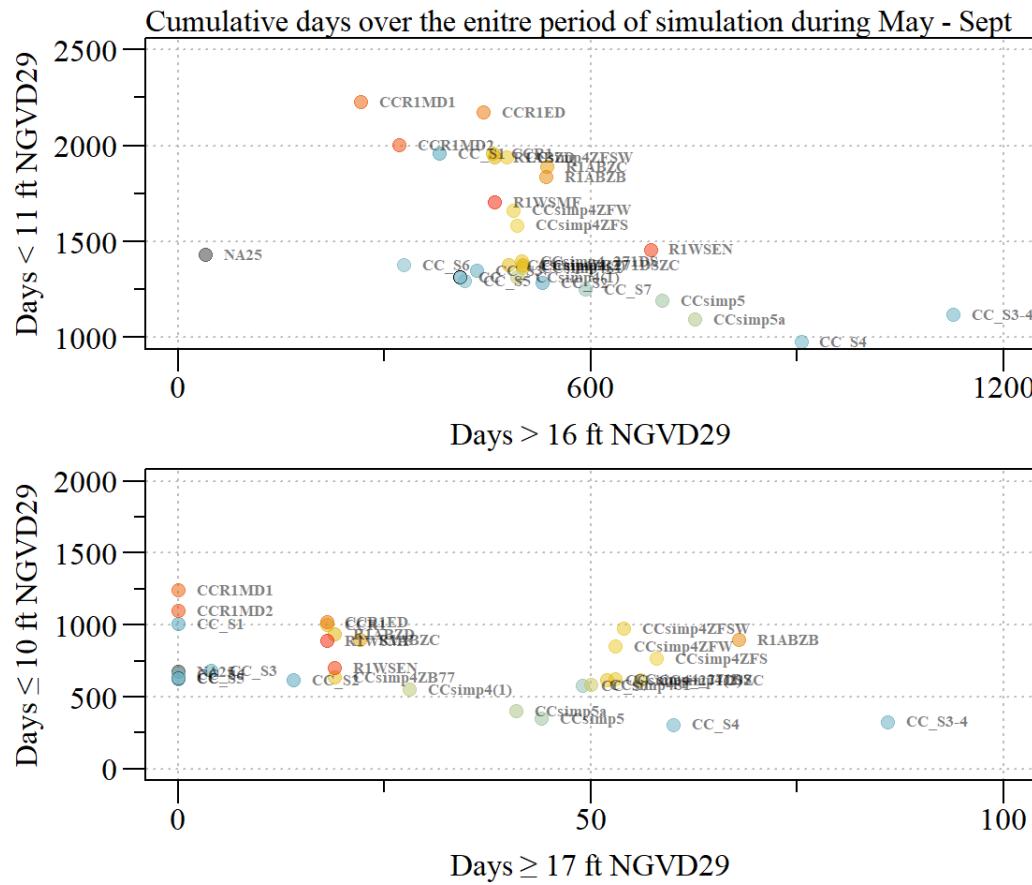
May to September lake stage envelope scores (below, above and total).

Lake Okeechobee Stage Envelope



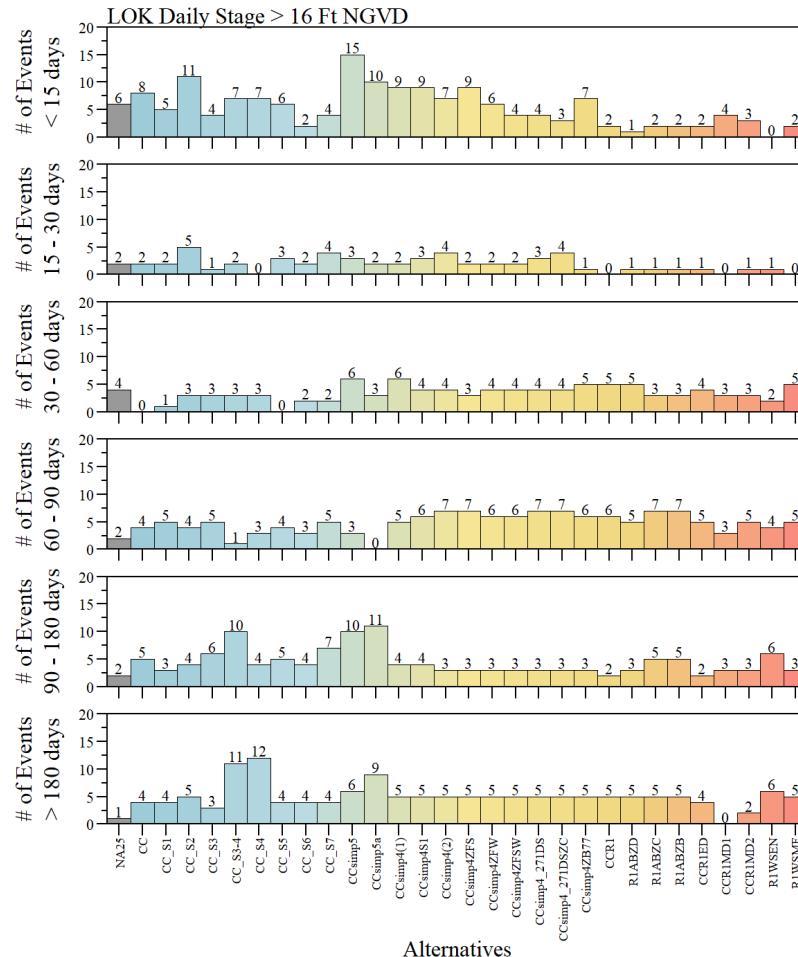
Frequency of high and low stages across alternatives.

Lake Okeechobee Stage Envelope



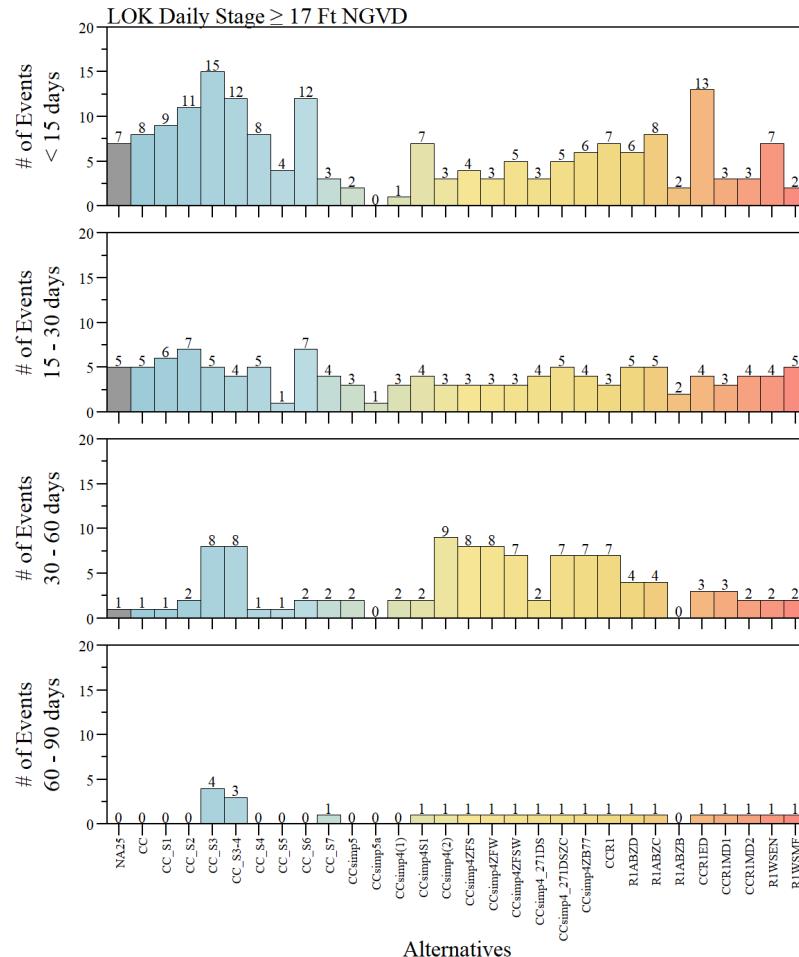
Lake High Stage Events

Number and duration of events with stage elevations >16 Ft NGVD29.

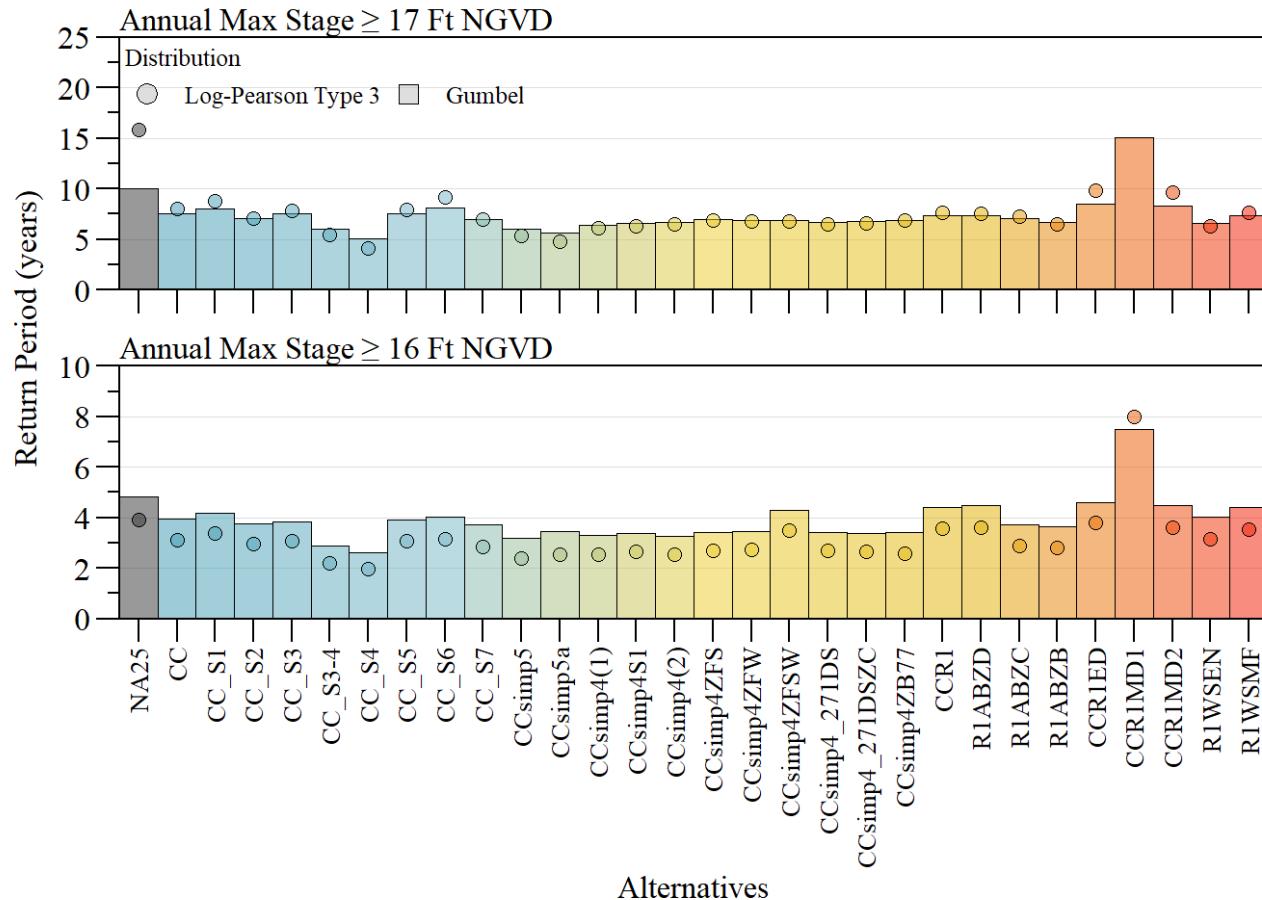


Lake High Stage Events

Number and duration of events with stage elevations ≥ 17 Ft NGVD29.



Lake High Stage Return Period



Return/recurrence period of annual maximum stage for each alternative.