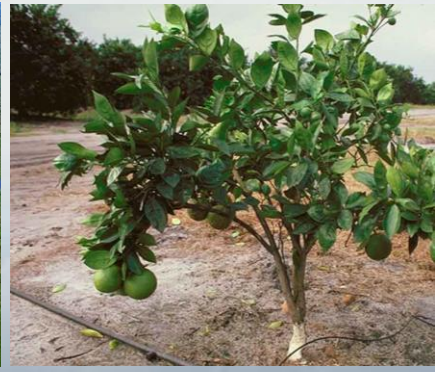
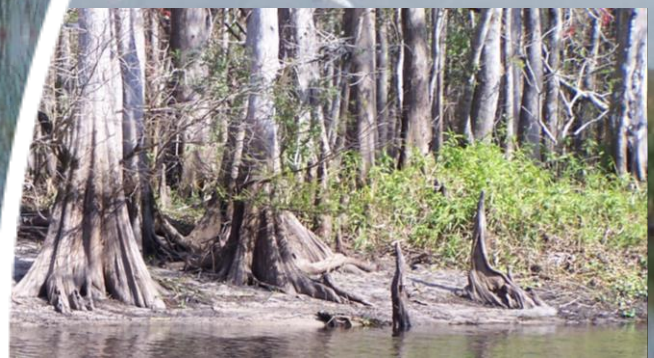
LAKE OKEECHOBEE WATERSHED PROJECT

Modeling Sub-Team

Initial Alternative Array

March 15, 2017





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Lake Okeechobee Watershed Project
Ongoing Progress

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- The Lake Okeechobee Watershed Project (LOWP) performed extensive screening-level modeling using RESOPS in late 2016 to identify feasible features (reservoirs, aquifer storage & recovery and deep injection wells) and sizes that could meet project objectives of improving Lake Okeechobee, L.O. watershed (e.g. wetland restoration) and Northern Estuary conditions.
- Detailed hydrologic modeling using RSMBN is currently underway in support of LOWP.
- Detailed RSMBN model baseline scenarios representing the Existing Condition (ECB) and Future Without LOWP (FWO) were released on February 2, 2017.
- A first round of three alternatives with potential LOWP project features was released on March 8, 2017 and a summary presentation made to the Project Delivery Team (PDT) on March 15, 2017 (today's presentation).
- It is anticipated that subsequent modeling will be performed incorporating Project Delivery Team feedback and refinements after the first round of results is fully evaluated.

Background:
Regional Modeling Approach

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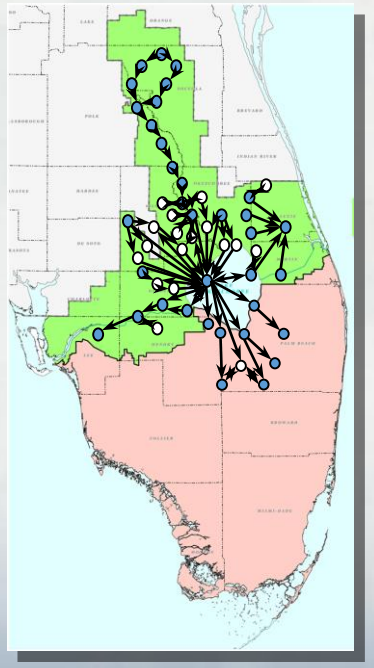
Scenario

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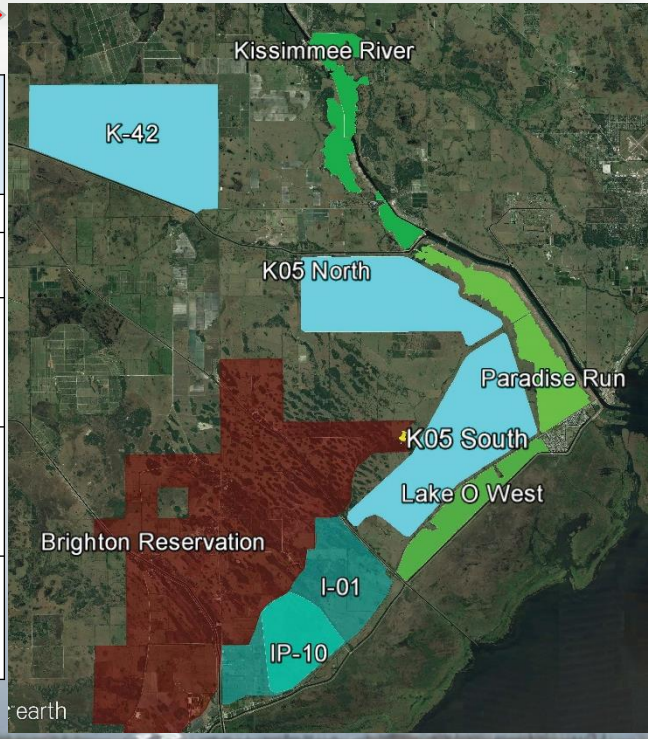
1st round of modeling and benefits calculation to optimize water storage and recovery for improvement in high and low lake stages and estuary releases,

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



Note: Estimated reservoir storage capacity will be updated as additional engineering detail becomes available

Evaluated in 1st Round of Modeling

ALT1 Assumes:
258 kac-ft storage at K05 Reservoir locations +
110 ASR as shown (60 ASR co-located at K05)

K05 North 7,605 ac
K05 South 9,625 ac

Reservoirs assumed 15 ft maximum depth

Alternative 1

L-63N
6 ASR

Paradise Run
10 ASR

S-191
10 ASR

TC West
6 ASR

Lakeside Ranch
4 ASR

C-40
10 ASR

C-41
4 ASR

Brighton Reservation

Lake Okeechobee

LAKE OKEECHOBEE

Okeechobee Waterway/Rim Canal

Moore Haven

Pahokee

Note: Each ASR is assumed to be 5 MGD capacity

Alternative 2

ALT2 Assumes:
408 kac-ft storage at K05 and K42
Reservoir locations + 110 ASR as shown (60 ASR co-located at K05)

K42 9,984 ac
K05 North 7,605 ac
K05 South 9,625 ac

Reservoirs assumed 15 ft maximum depth

L-63N
6 ASR

Paradise Run
10 ASR

S-191
10 ASR

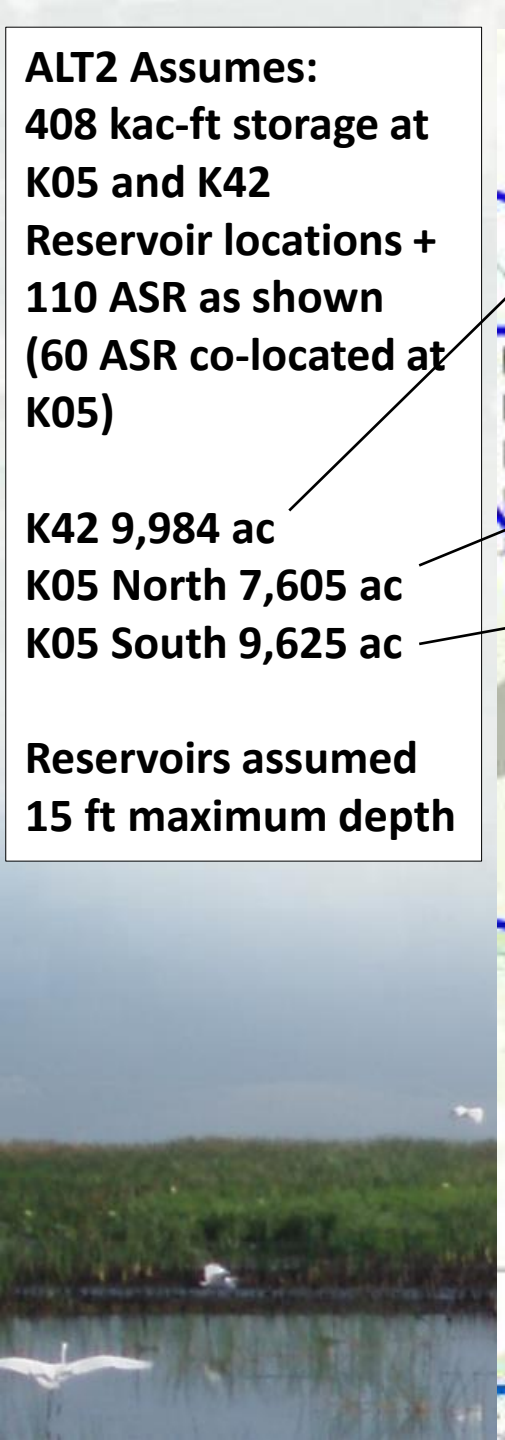
TC West
6 ASR

Lakeside Ranch
4 ASR

C-40
10 ASR

C-41
4 ASR

Note: Each ASR is assumed to be 5 MGD capacity



Alternative 3

ALT3 Assumes:
254 kac-ft storage at K42 and I01 Reservoir locations +
112 ASR as shown (40 ASR co-located at I01)

K42 9,984 ac
I01 6,965 ac

Reservoirs assumed 15 ft maximum depth

L-63N
6 ASR

Paradise Run
10 ASR

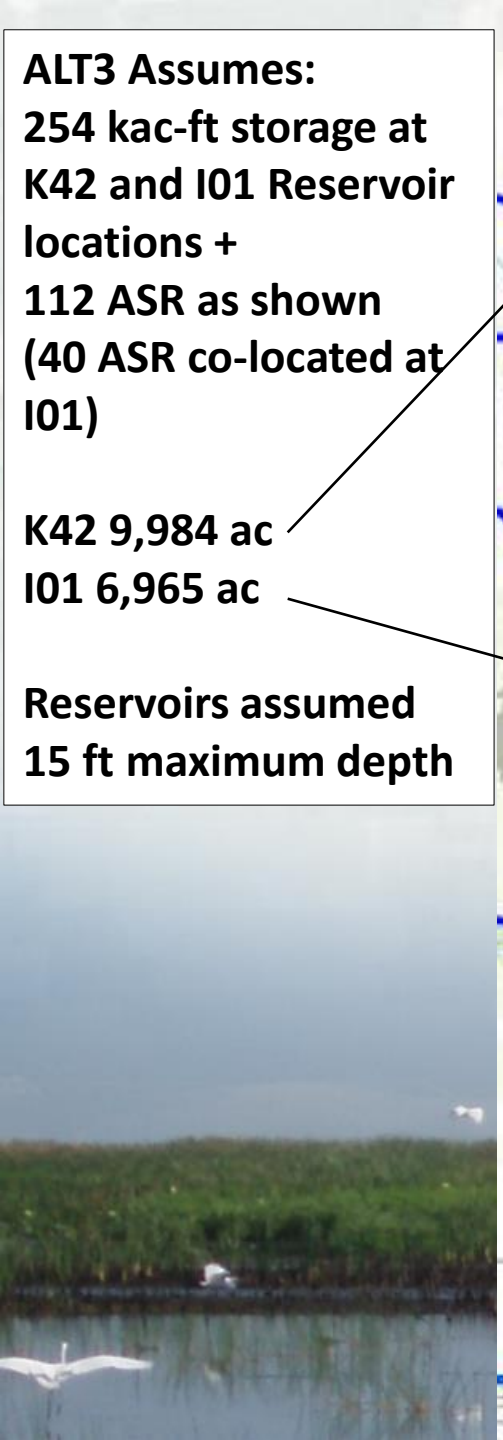
S-191
10 ASR

TC West
6 ASR

KR ASR Expansion
24 ASR

C-40
10 ASR

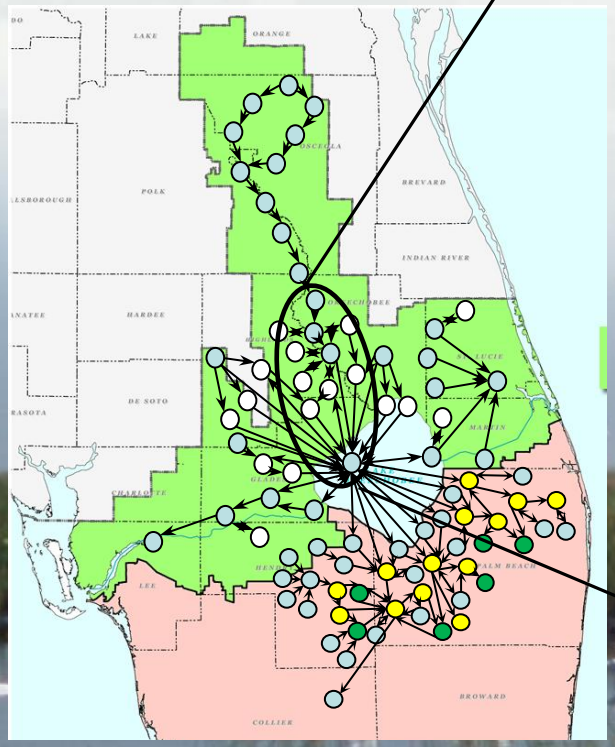
C-41
6 ASR

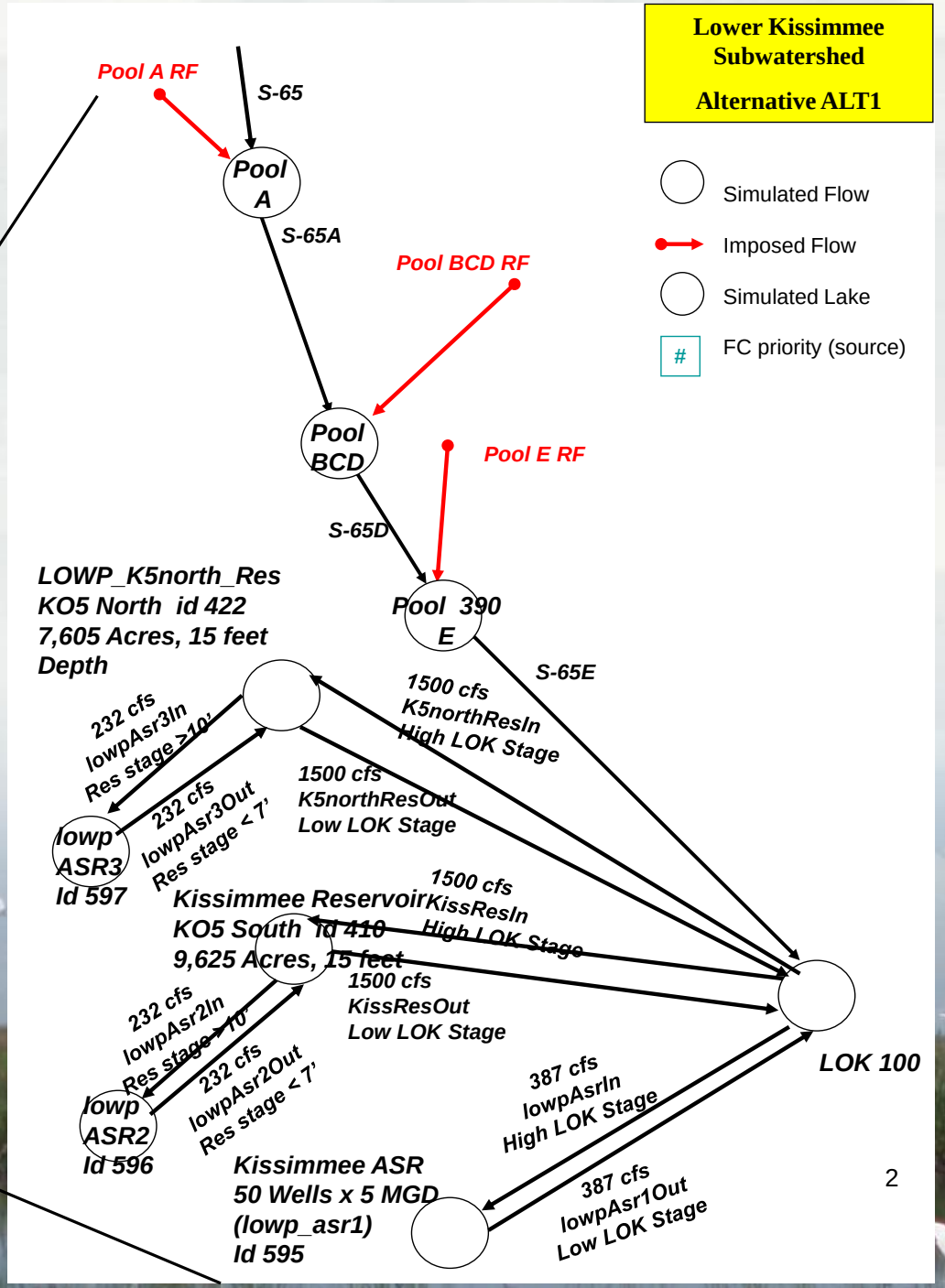


Note: Each ASR is assumed to be 5 MGD capacity

Example Modeling Detail Showing Assumed Lower Kissimmee Basin & Lake Okeechobee Inflow Routing for ALT1 Scenario

RSMBN





Operational Considerations in LOWP

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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.

  Note: The Yellow Book contemplated schedule changes for the same reasons

Lake Okeechobee Regulation Schedule in the RESTUDY (Yellow Book or D13R)

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Component F3

Geographic Region: Lake Okeechobee

Component Title: Lake Okeechobee Regulation Schedule (same as Alternatives 3, 4 and 5)

Purpose: Operating criteria for Lake Okeechobee that includes flood control, water supply (including releases to the Water Conservation Areas to meet estimated natural system needs), and Lake littoral zone and estuary protection.

Operation: Use current regulation schedule with the design modifications made in components A and GG and with the exception of eliminating all St. Lucie and Caloosahatchee regulatory discharges (except emergency releases - zone A, from Run 25).

Design: Operational changes only. Modify the regulation schedule by eliminating all but emergency discharges to both the St. Lucie and Caloosahatchee Estuaries.

Location: Within existing boundary of Lake Okeechobee
Counties: Glades, Hendry, Martin, Okeechobee and Palm Beach

Assumptions and related considerations:

1) It is assumed that the implementation of other project components will reduce the frequency of high Lake stage events therefore reducing the need for regulatory releases to the St. Lucie and Caloosahatchee Estuaries.

Note: RESTUDY planning done with Run25 Lake Schedule which had a higher Zone A / High Lake Band than LORS08

Operations Optimization for LOWP ALTs

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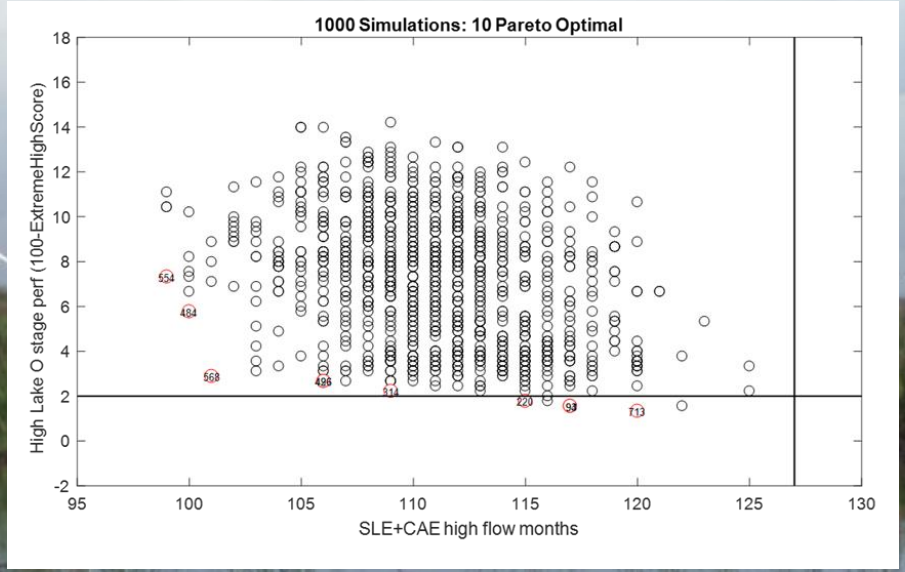
- Operational criteria for Storage (Reservoir and ASR) and Lake Okeechobee Regulatory releases were optimized to work with improved infrastructure contemplated by LOWP.
- Approximately 30 parameters affecting the Lake Okeechobee decision outcomes (e.g. “up-to” limits, classification of tributary conditions, etc…) along with a variety of storage diversion and recovery lines were analyzed.
- Constrained and unconstrained Latin Hypercube sampling techniques were used to explore up to 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.



Operations Optimization for LOWP ALTs

For Example (~ 30 parameters): 2008 LORS

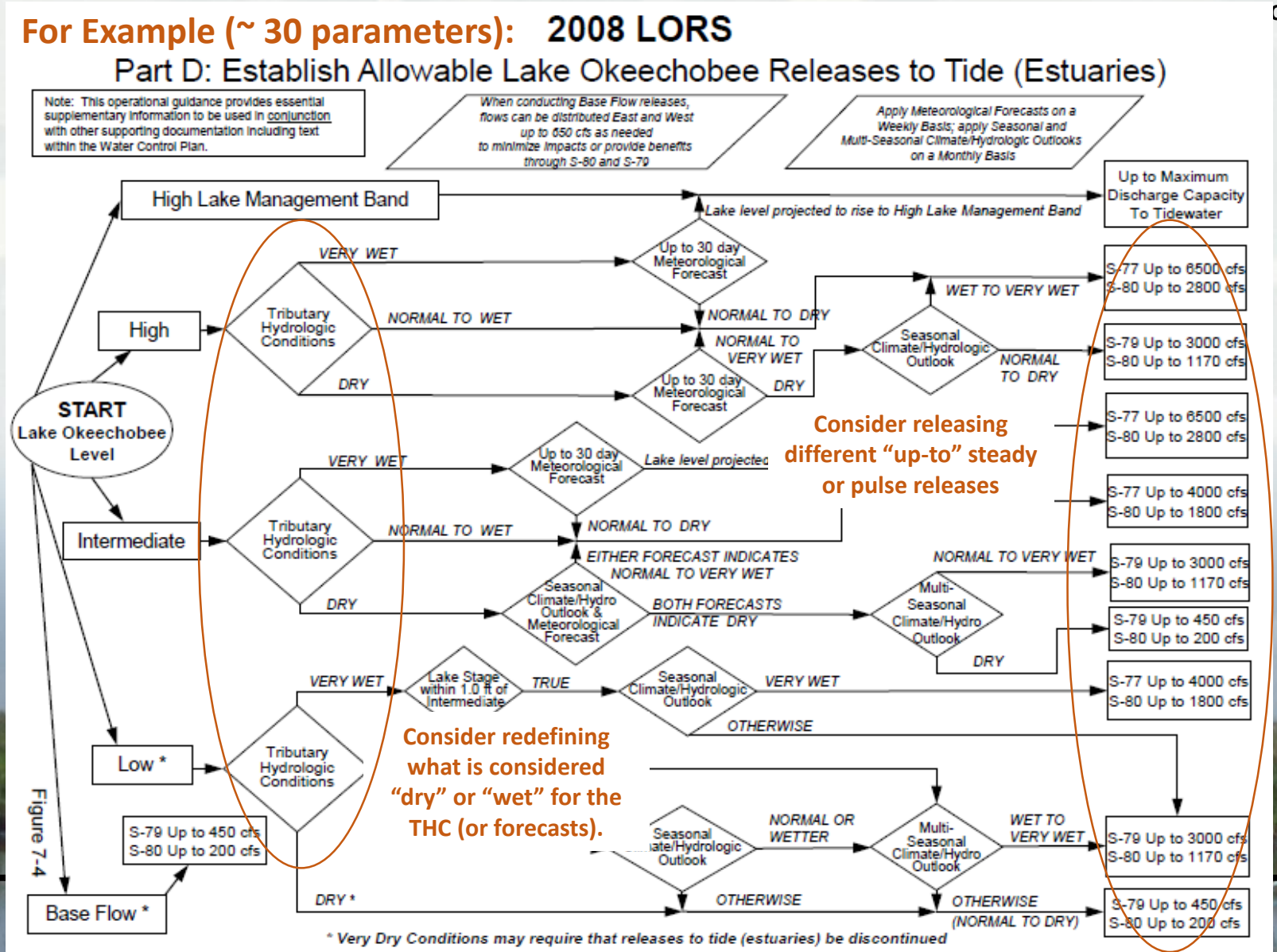


Figure 7-4

Optimization Methodology

Procedure for Finding the Best-performing Operations

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Select key model input parameters & ranges

Generate 1000's of parameter sets (PARsets) via Latin Hypercube Sampling (LHS)

Without LHS, there would be ~ 2.4 x 10^57 sets to analyze

RSMBN Model

Simulated Perform-ance Measure Sets (PMsets)

One PMset for each PARset

RSMBN: Regional Simulation Model - Basins
PARset: one combination of input parameters for a single RSM-BN simulation
PMset: Performance Measure output set corresponding to a single PARset
MAPL: Minimum Acceptable Performance Level

Non-Dominated Sorting

Pareto-Optimal Solutions

Satisficing to meet MAPLs

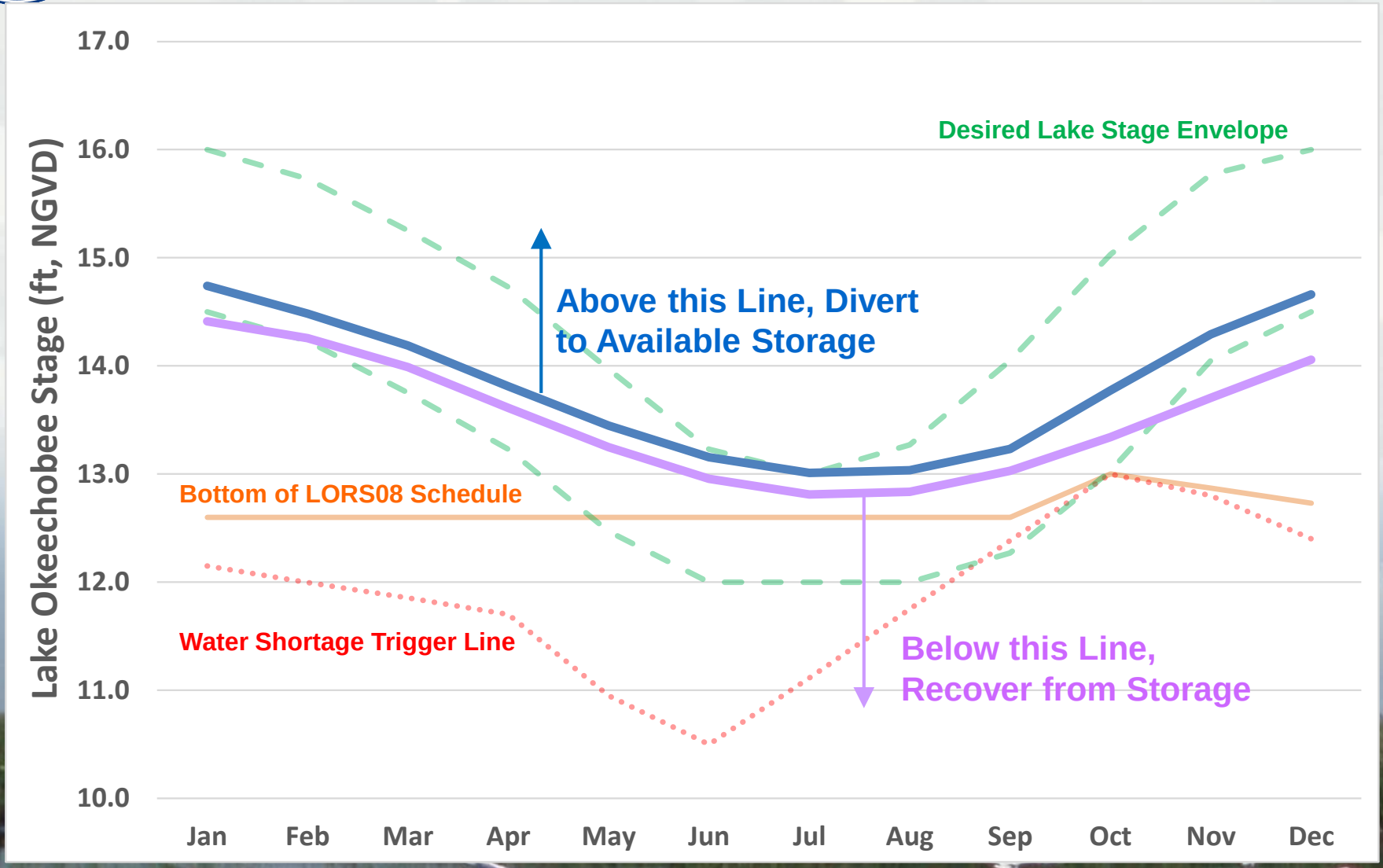
Final Subset of Pareto-Optimal Solutions meeting MAPLs

Priority to Estuary PMs

"Best" Solution

2	1175 of 2000 (groups f & g) simulations were Pareto Optimal (from Matlab script RMS_PM_ParetoSort.m [C. Neidrauer])																							
3	111 of those 523 Runs meet all 10 MAPLs (all but 3 from group f)																							
4	MAPL				24	20		59	22				0.18	70	60	90	90								
5	Index	Group	Sim	Phi	SLE1_Scor	SLE2_Scor	SLE_AvgA	CAE1_Sco	CAE2_Sco	CAE_Avg	8_Worst	2001_Cut	LOK_Hi_S	LOK_Lo_S	LOK_Extr	LOK_Extr	SAV_Scor	Chara_Sc	Cyanoba	Epiphyte	Epipelon				
38	7254	f	54	46.47781	25	18	100222.9	56	16	115287.3	0.072137	0.178739	77.85273	69.76958	91.79602	98.0488	1.7	1.175	1.2	1.475	0.875				
39	7255	f	55	180.7148	22	20	97141.65	60	14	112538.9	0.069743	0.171719	75.83458	72.11811	89.80045	98.8618	1.7	1.175	1.2	1.4125	0.8375				
40	7256	f	56	101.7667	24	19	97803.09	56	17	112028.2	0.072562	0.173222	77.51757	70.1273	91.79602	98.6992	1.7	1.175	1.2	1.45	0.8625				
41	7262	f	62	280.6276	23	21	100556.4	59	14	112155.7	0.07157	0.180534	77.17698	70.67841	89.57872	98.2114	1.7	1.175	1.2	1.45	0.85				
42	7264	f	64	179.4217	23	20	96052.38	58	15	107355.9	0.070476	0.171719	76.68616	71.58768	91.57429	98.8618	1.7	1.175	1.2	1.3875	0.8375				
43	7266	f	66	179.4217	24	20	104468.9	59	14	111620.3	0.070188	0.178739	77.72616	70.54349	91.57429	98.2114	1.7	1.175	1.2	1.45	0.875				
44	7267	f	67	46.76961	24	18	98393.38	58	16	114789.7	0.0728	0.172907	77.92644	69.49436	91.35256	98.6992	1.7	1.175	1.225	1.475	0.8625				
45	7271	f	71	102.0585	23	19	102712.3	58	14	107775	0.071123	0.180221	77.39877	70.60285	91.35256	98.2114	1.7	1.175	1.2	1.4625	0.8375				
46	7272	f	72	102.2103	24	19	99821.3	59	14	108993	0.0697	0.171719	76.72442	71.98072	91.13083	98.8618	1.7	1.175	1.2	1.425	0.8375				
47	7278	f	78	45.81707	28	18	100831.2	57	17	109095.9	0.071845	0.171719	77.85273	70.14029	92.90466	98.6992	1.7	1.175	1.2	1.4375	0.85				
48	7279	f	79	13.55505	25	17	100401.4	59	15	108031.6	0.069842	0.17049	76.67678	71.60993	91.57429	99.0244	1.7	1.175	1.2	1.425	0.825				
49	7280	f	80	45.69672	28	18	106572.6	58	16	107713.2	0.071575	0.180221	78.00725	69.87949	93.12639	98.2114	1.7	1.175	1.2	1.45	0.8625				
50	7281	f	81	101.1059	27	19	100365.6	60	17	113732.3	0.072198	0.171719	78.45505	70.3071	92.90466	98.6992	1.7	1.175	1.2	1.45	0.8625				
51	7283	f	83	180.368	24	20	100037.9	58	14	109884.2	0.069642	0.1689	76.52447	71.11498	90.24391	99.0244	1.7	1.175	1.2	1.4125	0.825				
52	7284	f	84	179.2778	24	20	98976.05	58	16	114381.8	0.072316	0.180221	77.58042	70.49518	91.79602	98.2114	1.7	1.175	1.2	1.45	0.875				
53	7285	f	85	47.91487	25	18	97613.31	58	13	113129	0.070376	0.178479	76.1735	71.10751	89.80045	98.2114	1.7	1.175	1.2	1.4375	0.85				
54	7288	f	88	13.55506	26	17	103259.7	58	17	116374	0.07354	0.185566	78.3727	68.85687	91.57429	98.0488	1.7	1.175	1.2	1.475	0.8875				

Example Outcome: Operational Triggers for LOWP Storage Components



Parameter Sensitivity Matrix

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Performance Measures

Optimization Parameters

	SLE1_Score	SLE2_Score	E_AvgAnn	AE1_Scor	AE2_Scor	E_AvgAnn	st_Cutbac	l_Cutback_	Hi_SS_Sc	Lo_SS_Sc	Extreme	_Extreme	SAV_Score	hara_Scor	obacteria_	iphyte_Sc	ipelon_Sc	anfish_Sco	6ECO_Sum	ECO_Score
p1	-0.03821	-0.0552	0.113861	-0.07462	-0.18013	-0.11751	-0.003	0.106929	0.110711	-0.05189	0.013425	-0.02883	-0.0826	0.041487	0.05664	0.136711	0.005939	0.125563	0.099731	0.100062
p1a	0.070545	0.019074	-0.11717	0.203662	0.275199	0.210103	0.110799	-0.13709	-0.07045	-0.03223	0.034243	-0.05896	0.09903	0.061957	-0.04911	-0.14954	0.138919	-0.13139	-0.05502	-0.05554
p1b	-0.04954	-0.09112	0.161227	-0.1492	-0.3192	-0.1996	-0.05583	0.180469	0.123672	-0.03349	-0.02359	0.008001	-0.11547	0.002284	0.077261	0.20375	-0.0768	0.160645	0.112158	0.112549
p2	0.113801	-0.19552	0.279895	-0.04379	-0.36037	-0.08913	0.028055	0.281638	0.231613	-0.14946	-0.0673	-0.06242	-0.38489	0.153809	0.262303	0.399559	0.021362	0.163494	0.237753	0.237897
p3	-0.02232	-0.04391	0.030178	-0.00144	-0.07224	-0.02865	0.015956	0.060475	0.073454	-0.01505	0.007393	-0.02861	-0.03748	0.021802	0.102667	0.075447	-0.00625	0.060393	0.06974	0.069858
p3a	-0.05345	0.023376	0.054595	-0.12526	-0.12769	-0.11575	-0.08701	0.029366	-0.00087	0.061405	-0.02788	0.062152	-0.0178	-0.06449	-0.01284	0.030841	-0.09771	0.047283	-0.01043	-0.01014
p3b	0.028288	-0.09649	0.033283	0.06038	-0.06852	0.028383	0.063013	0.091412	0.078252	-0.07764	-0.01274	-0.06621	-0.09431	0.043127	0.128181	0.118906	0.022931	0.031792	0.084642	0.084775
pp	-0.07803	-0.12375	0.122127	-0.05268	-0.19199	-0.11177	0.022623	0.218387	0.146927	-0.08632	-0.023	-0.06233	-0.21897	0.1112	0.177747	0.245908	-0.03128	0.084865	0.140426	0.140667
pi_1	-0.04532	0.04477	-0.11808	0.087131	0.145042	0.09504	0.043782	-0.09158	-0.1183	0.008007	-0.02967	-0.0247	0.084114	-0.00534	-0.09299	-0.12722	0.037227	-0.09126	-0.08011	-0.08014
pi_2	-0.05064	-0.02574	0.097468	-0.17466	-0.23821	-0.16507	-0.13072	0.063548	0.018293	0.061607	-0.05028	0.088979	-0.0566	-0.09933	0.005005	0.099756	-0.15382	0.071728	0.003592	0.003913
pi_3	-0.00518	0.013206	-0.01774	0.014375	0.041046	-0.00977	0.006336	-0.02555	0.019789	0.001237	0.027696	-0.01367	0.035262	0.015487	0.007718	-0.01908	0.026764	0.014219	0.011814	0.011811
lokni_3	-0.11068	-0.04373	0.085938	-0.16243	-0.35625	-0.20805	-0.14813	0.16127	-0.02259	0.071901	-0.12862	0.105136	-0.09234	-0.14398	-0.00226	0.124174	-0.25871	0.016609	-0.04173	-0.04144
lokni_2	0.078197	-0.01924	-0.06929	0.135281	0.115936	0.141602	0.071697	-0.06768	-0.05648	-0.04163	-0.01741	-0.03551	0.025017	0.013984	-0.02703	-0.06057	0.062172	-0.11202	-0.04541	-0.04578
lokni_1	0.095833	-0.00555	-0.13574	0.271455	0.317356	0.286351	0.188041	-0.11399	-0.04783	-0.10922	0.061197	-0.12528	0.073017	0.116067	-0.01459	-0.12865	0.197102	-0.1446	-0.0257	-0.0263
seas_1	0.018469	-0.05243	0.084598	-0.08049	-0.20221	-0.08561	-0.07772	0.10212	-0.00562	0.01521	-0.0919	0.05838	-0.04327	-0.06662	0.019751	0.104573	-0.11407	-0.00742	-0.00103	-0.00091
seas_2	-0.0701	-0.20523	-0.01787	-0.10818	-0.31634	-0.18801	-0.12765	0.090091	-0.22193	0.099903	-0.57875	0.110205	-0.05407	-0.21546	-0.03642	0.022733	-0.22508	-0.14639	-0.1395	-0.1394
seas_3	1.50E-02	0.075371	0.062979	-0.01484	-0.08742	-0.03067	0.004381	-0.00695	-0.07562	0.012065	-0.03446	0.009411	0.00414	-0.01132	-0.05388	-0.05317	-0.02275	-0.09256	-0.06827	-0.06834
mseas_1	-0.00243	-0.04678	0.155657	-0.15735	-0.28898	-0.18116	-0.09745	0.143311	4.04E-02	0.013814	-0.08264	0.053619	-0.09073	-0.06946	0.058262	0.160851	-0.1418	0.071953	0.041457	0.04172
mseas_2	-0.34523	0.009672	-0.1411	2.35E-02	0.030013	0.098657	-0.15621	-0.1223	-0.16878	0.130612	-0.08816	0.173486	0.079763	-0.12731	-0.13059	-0.11775	-0.17231	-0.10009	-0.15203	-0.15211
sdf	0.078274	-0.02301	-0.0632	0.441792	0.27503	0.169508	0.500834	0.060518	0.325006	-0.50695	0.206562	-0.4604	-0.16028	0.423697	0.341087	0.173039	0.448474	0.073547	0.309804	0.309723
sd_1	0.023292	-0.31779	-0.52655	0.491417	0.606053	0.579643	0.177398	-0.15389	0.054732	-0.10229	0.211404	-0.12308	0.151484	0.206293	-0.00285	-0.13339	0.242393	-0.06412	0.036379	0.035938
sd_2	-0.00915	-0.16802	-0.23387	0.387889	0.203983	0.305415	0.11151	-0.01509	0.118235	-0.11626	0.078737	-0.0926	0.013826	0.160471	0.116946	0.05708	0.145709	0.040906	0.121989	0.121796
sd_3	-0.05742	-0.17687	-0.21927	0.498851	0.457135	0.582236	0.636115	0.117815	0.181066	-0.64375	0.078642	-0.52594	-0.31722	0.316737	0.251297	0.217457	0.598012	-0.00014	0.272289	0.271902
sd_4	0.053103	-0.01485	-0.16353	0.219492	0.318799	0.256194	0.135	-0.13115	-0.01923	-0.07058	0.063896	-0.09758	0.098826	0.100504	-0.01387	-0.12274	0.186241	-0.09098	-0.00779	-0.008
sd_5	0.357619	0.177724	0.341753	-0.06467	-0.14825	-0.11956	0.026809	0.057206	0.043023	-0.06516	0.028655	-0.01454	-0.00432	0.04059	0.030305	0.072775	0.013042	-0.01214	0.038856	0.038675
sd_6	0.215672	0.101658	0.295261	-0.08126	-0.05737	-0.12501	0.02096	0.000993	0.11817	-0.03535	0.068788	-0.04023	0.005305	0.087272	0.088826	0.062118	0.05521	0.102357	0.104089	0.104212
sd_7	-0.01275	0.023156	-0.05359	0.031427	0.081697	0.037908	0.002406	-0.06823	-0.03062	0.034714	0.014983	0.004699	0.051899	0.008803	-0.05208	-0.07518	0.021449	-0.02252	-0.0344	-0.0344
sd_8	0.018872	0.014208	0.057002	-0.05471	-0.05212	-0.06935	-0.02879	0.011877	0.008208	0.015894	-0.01375	0.021269	-0.01002	-0.02233	0.003551	0.022156	-0.02242	0.031468	0.009066	0.009034
sd_9	-0.03877	-0.09539	-0.0279	-0.14135	-0.18743	-0.16061	-0.04974	0.085699	0.068371	0.003741	0.017459	0.020664	-0.04837	0.005509	0.035583	0.09556	-0.06481	0.076116	0.048638	0.048795
div01	0.250613	0.369754	0.296819	0.154758	0.44642	0.359926	0.296264	-0.77935	-0.24098	0.216796	0.041319	-0.33752	-0.03293	0.240034	-0.40945	-0.62378	0.263969	-0.59331	-0.43746	-0.43747
div02	0.228773	0.383933	0.285578	0.134899	0.458754	0.337013	0.290255	-0.79097	-0.22519	0.228131	0.059955	-0.33619	-0.02142	0.244777	-0.40797	-0.62976	0.272635	-0.56174	-0.42478	-0.42472
div03	0.219818	0.394786	0.280881	0.135944	0.459948	0.335462	0.277507	-0.79316	-0.23627	0.239507	0.061579	-0.32115	-0.02091	0.245113	-0.42097	-0.64386	0.266919	-0.5539	-0.43068	-0.4307
div04	0.219198	0.406574	0.279938	0.158912	0.449734	0.353826	0.249584	-0.78959	-0.28338	0.255237	0.043112	-0.28252	-0.03136	0.239716	-0.45007	-0.67346	0.240504	-0.57645	-0.46202	-0.46222
div05	0.241905	0.368951	0.276247	0.228611	0.374186	0.405781	0.192286	-0.69893	-0.38009	0.240771	-0.03217	-0.19277	-0.07322	0.203322	-0.47168	-0.66469	0.157549	-0.63687	-0.50925	-0.50994
div06	0.207133	0.294601	0.222912	0.252662	0.261773	0.384026	0.099012	-0.52827	-0.42374	0.198304	-0.10066	-0.06385	-0.11104	0.151001	-0.40885	-0.56923	0.057331	-0.61527	-0.48463	-0.48556
div07	0.167234	0.280086	0.191238	0.226387	0.247137	0.340768	0.074447	-0.49171	-0.40137	0.184769	-0.10088	-0.03433	-0.11521	0.147646	-0.35621	-0.52676	0.04739	-0.58161	-0.44987	-0.45062
div08	0.187816	0.109133	0.145598	0.270004	0.056475	0.333183	0.01037	-0.20143	-0.39826	0.079661	-0.18524	0.057184	-0.13949	0.043282	-0.2718	-0.32786	-0.07195	-0.51073	-0.37436	-0.37561
div09	0.212185	0.043846	0.14366	0.279222	0.006627	0.334818	0.023118	-0.12233	-0.37259	0.03027	-0.20682	0.04476	-0.14428	0.01541	-0.22912	-0.25275	-0.09039	-0.50293	-0.34327	-0.34458
div10	0.264576	0.056114	0.19373	0.278364	0.074505	0.372399	0.119062	-0.22419	-0.33767	0.015046	-0.1924	-0.06702	-0.15049	0.057388	-0.22091	-0.27219	-0.01281	-0.58448	-0.35741	-0.35836
div11	0.291167	0.033833	0.211097	0.270544	0.072661	0.374951	0.154495	-0.22008	-0.29748	-0.0052	-0.18109	-0.11355	-0.14036	0.055946	-0.20351	-0.2384	0.009312	-0.57484	-0.33336	-0.33418
div12	0.324915	0.240938	0.304574	0.247485	0.316033	0.435228	0.279531	-0.60272	-0.30661	0.126061	-0.07356	-0.28418	-0.09637	0.178125	-0.36734	-0.51147	0.175502	-0.68339	-0.45088	-0.45136
div13	0.29006	0.328039	0.310656	0.198966	0.403065	0.404193	0.295863	-0.72544	-0.27556	0.188024	-0.00377	-0.32134	-0.0608	0.221525	-0.40834	-0.59321	0.236298	-0.64057	-0.45309	-0.45332
div14	0.247271	0.377313	0.295425	0.162027	0.444499	0.366348	0.285084	-0.77777	-0.25641	0.225788	0.037759	-0.32037	-0.03768	0.240521	-0.42379	-0.6337	0.259344	-0.59113	-0.44435	-0.44445
rec01	0.118443	0.373976	0.240433	0.034269	0.43285	0.187027	0.290179	-0.74357	-0.01462	0.236372	0.219563	-0.39259	-0.00354	0.306117	-0.26742	-0.45611	0.337542	-0.32231	-0.22274	-0.22245
rec02	0.101653	0.370186	0.229605	0.020546	0.429001	0.168697	0.280623	-0.73087	-0.00066	0.231329	0.223284	-0.38293	-0.00278	0.304514	-0.25087	-0.44263	0.33717	-0.3013	-0.20762	-0.20725
rec03	0.081242	0.368114	0.216451	0.003175	0.424834	0.146135	0.268311	-0.7149	0.01655	0.225861	0.229302	-0.36882	0.00123	0.300925	-0.23369	-0.42658	0.334645	-0.27121	-0.18874	-0.18828
rec04	0.075975	0.375912	0.214198	-0.00337	0.428654	0.13999	0.265555	-0.71614	0.02136	0.228642	0.235946	-0.36365	0.008799	0.299353	-0.23701	-0.42747	0.33298	-0.25599	-0.18439	-0.18391
rec05	0.101092	0.395013	0.232673	0.019525	0.436159	0.170611	0.275097	-0.73695	-0.00424	0.243621	0.237137	-0.36822	0.01485	0.29972	-0.27843	-0.45492	0.325744	-0.27479	-0.20965	-0.20938
rec06	0.101601	0.375409	0.210729	0.008082	0.402914	0.151861	0.251823	-0.66373	-0.00209	0.22397	0.22302	-0.32125	0.052063	0.248466	-0.27874	-0.41529	0.276282	-0.21078	-0.18691	-0.18668
rec07	0.049169	0.26701	0.121784	-0.04482	0.278885	0.056919	0.163963	-0.41192	0.048436	0.12926	0.171369	-0.18473	0.092739	0.131106	-0.1771	-0.23997	0.163928	-0.03905	-0.0791	-0.07868
rec08	0.147763	0.237095	0.171954	0.055257	0.248281	0.167341	0.196442	-0.41348	-0.04615	0.129854	0.113743	-0.21451	0.05937	0.122399	-0.24149	-0.27419	0.138524	-0.17624	-0.15999	-0.16018
rec09	0.190658	0.250148	0.208226	0.083402	0.283849	0.214208	0.243908	-0.49041	-0.06956	0.145948	0.110747	-0.27835	0.04425	0.152006	-0.26818	-0.32372	0.176241	-0.26485	-0.20377	-0.20399
rec10	0.211095	0.302949	0.251091	0.091615	0.360137	0.248276	0.301252	-0.62752	-0.07051	0.183141	0.142566	-0.36278	0.026862	0.216426	-0.29772	-0.40177	0.250339	-0.34652	-0.24443	-0.24454
rec11	0.249962	0.303848	0.284103	0.13953	0.361971	0.304663	0.324289	-0.65849	-0.10717	0.189354	0.128424	-0.39082	-0.00608	0.237748	-0.32562	-0.42915	0.260967	-0.42594	-0.28478	-0.28515
rec12	0.20868	0.357648	0.292723	0.113947	0.420539	0.285018	0.334685	-0.75562	-0.07782	0.225863	0.178407	-0.42771	-0.02768	0.302821	-0.32015	-0.4775	0.325242	-0.43509	-0.28467	-0.28481
rec13	0.167276	0.368036	0.271243	0.079349	0.430056	0.242839	0.316474	-0.75883	-0.05029	0.234156	0.198986	-0.41623	-0.02096	0.310441	-0.29735	-0.4731	0.336619	-0.39028	-0.25925	-0.2592
rec14	0.136782	0.369769	0.252836	0.050346	0.432906	0.208127	0.303074	-0.74974	-0.02416	0.231944	0.211466	-0.40431	-0.01308	0.309991	-0.27366	-0.45856	0.341127	-0.35003	-0.23404	-0.23381

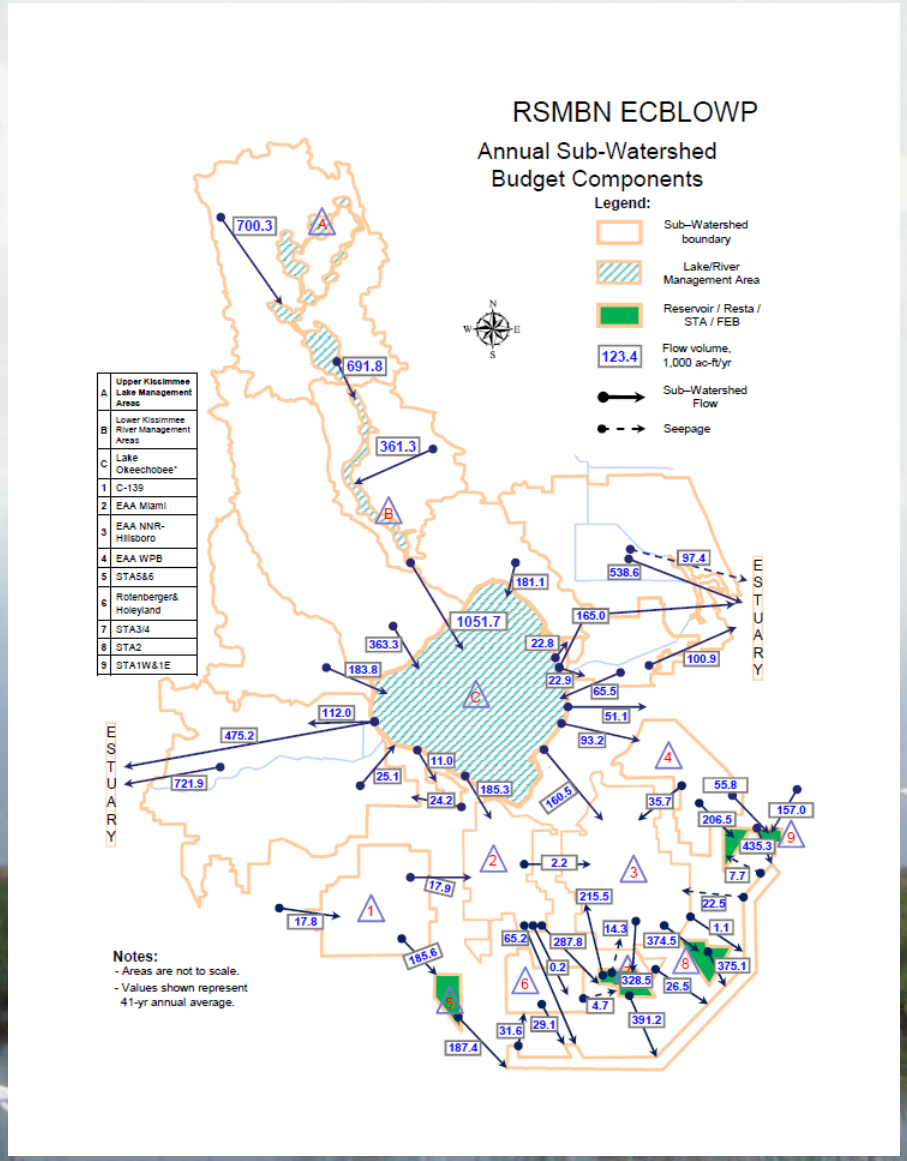
Demonstrates that ALT performance is most dependent on identification of appropriate storage diversion and recovery lines.

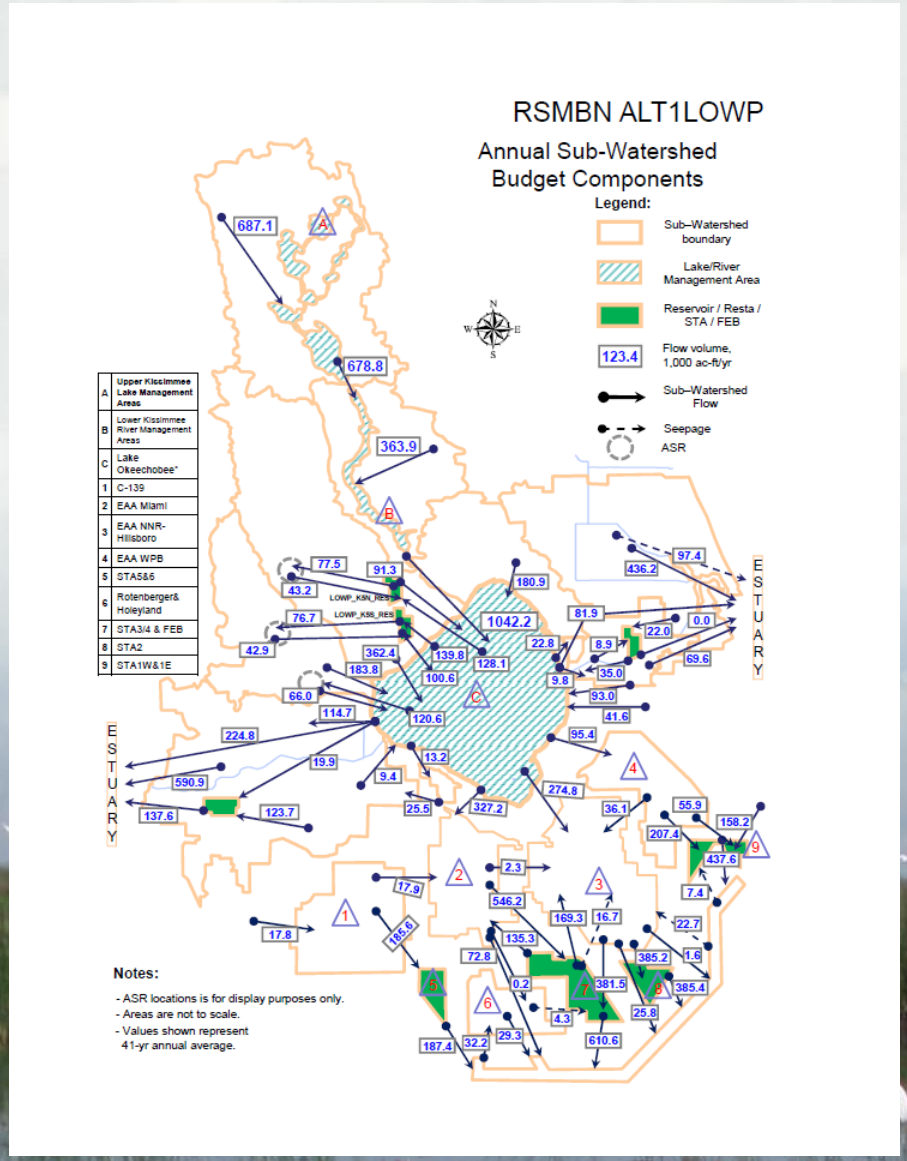
Lake schedule “up-to” release rates are also important.

Model Results Summary

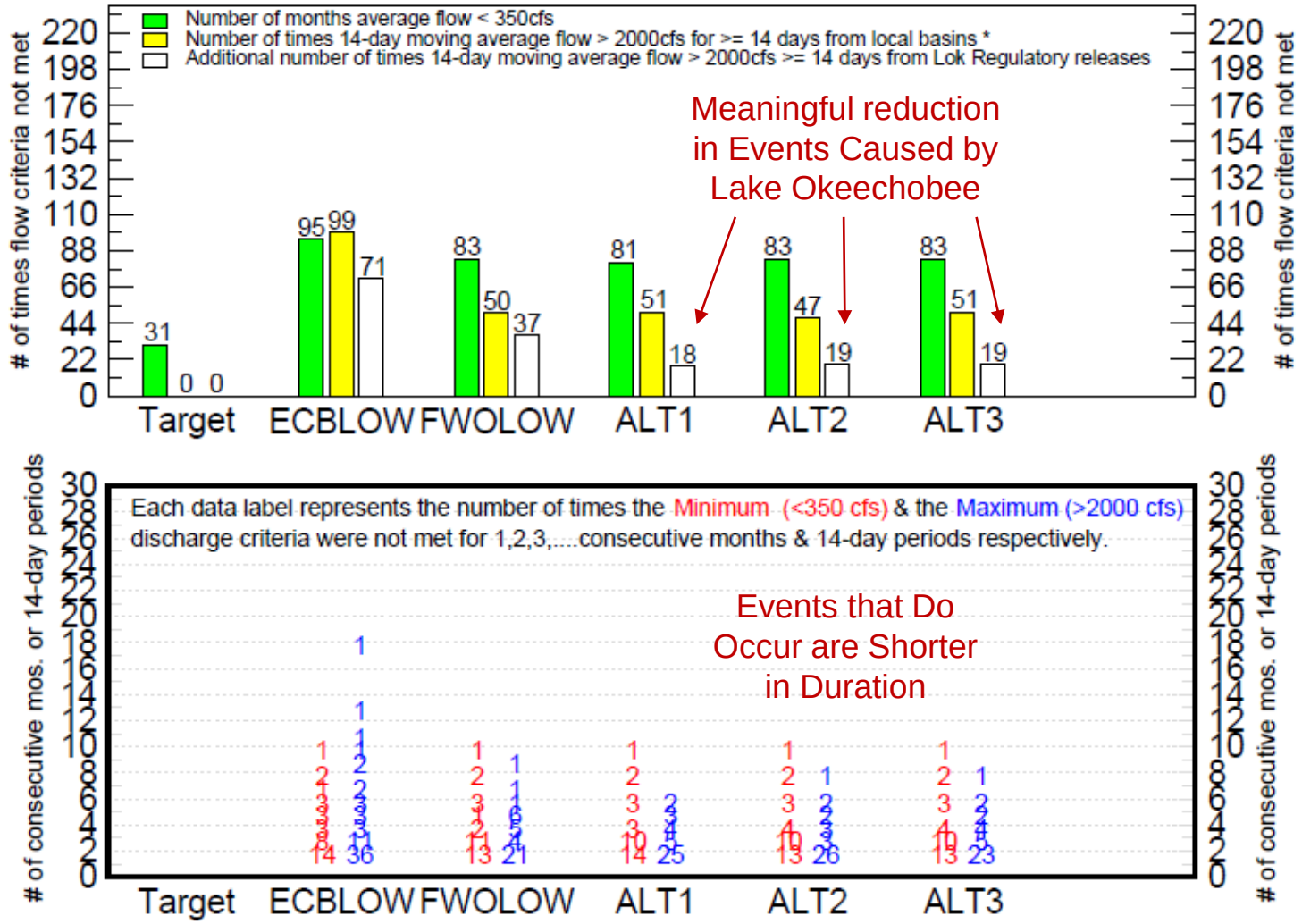
Examples of Available Water Budget Maps

BUILDING STRONG





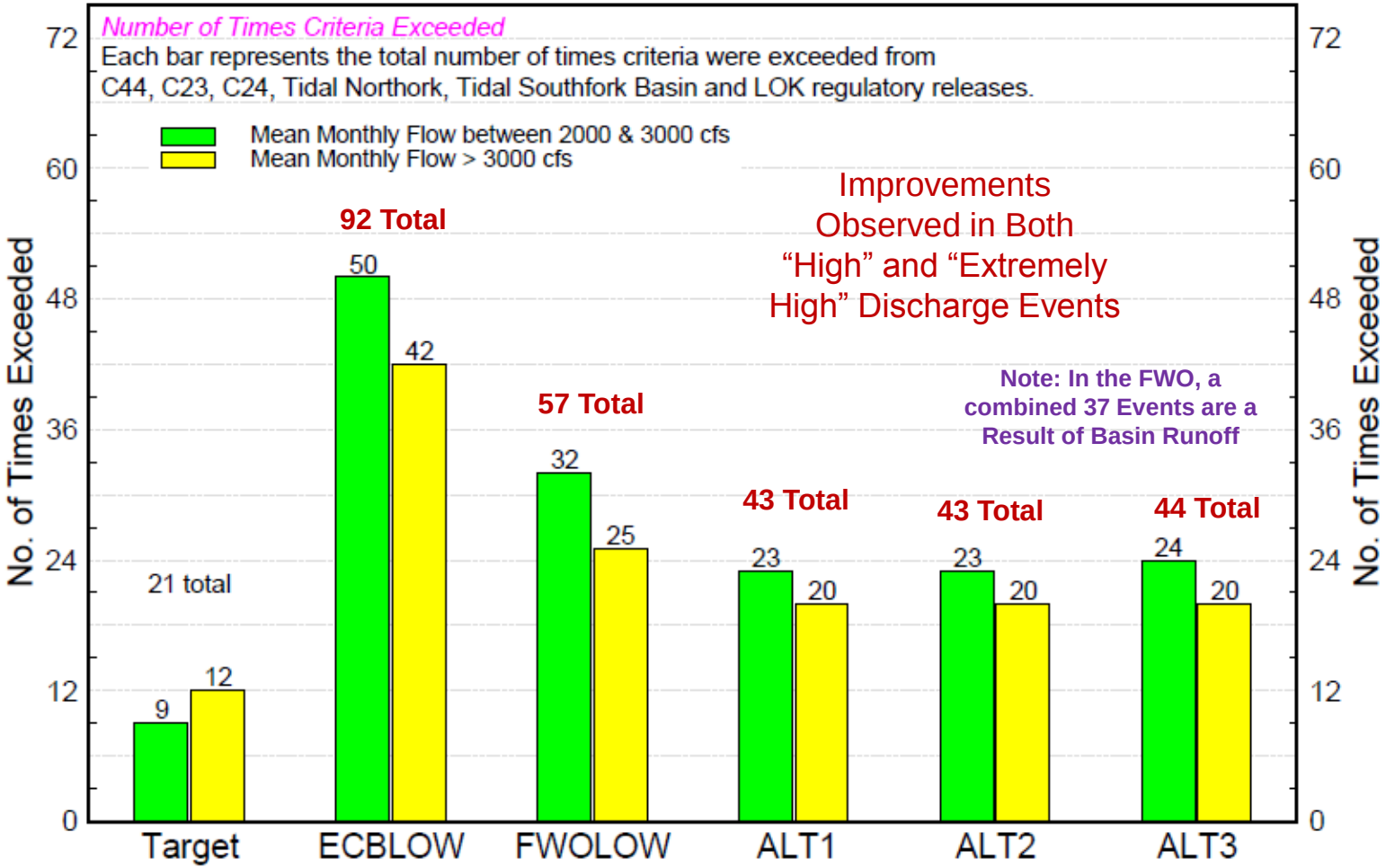
Number of times Salinity Envelope Criteria NOT Met for the St. Lucie Estuary (mean monthly flows 1965 - 2005)



RECOVER Performance Measure

Run date: 03/07/17 11:10:36
RSMBN
Script used: estuary.scr, ID496
Filename: stluc_salinity_flow_bar.out.agr

Number of Times St. Lucie High Discharge Criteria Exceeded
(mean monthly flows > 2000 cfs from 1965 - 2005)

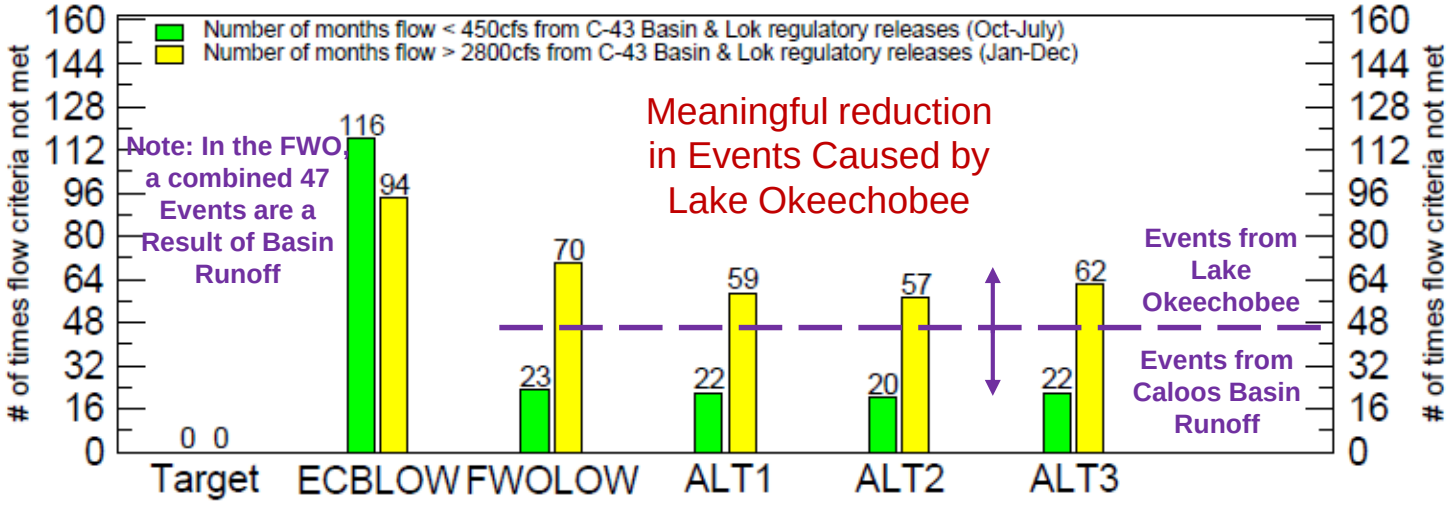


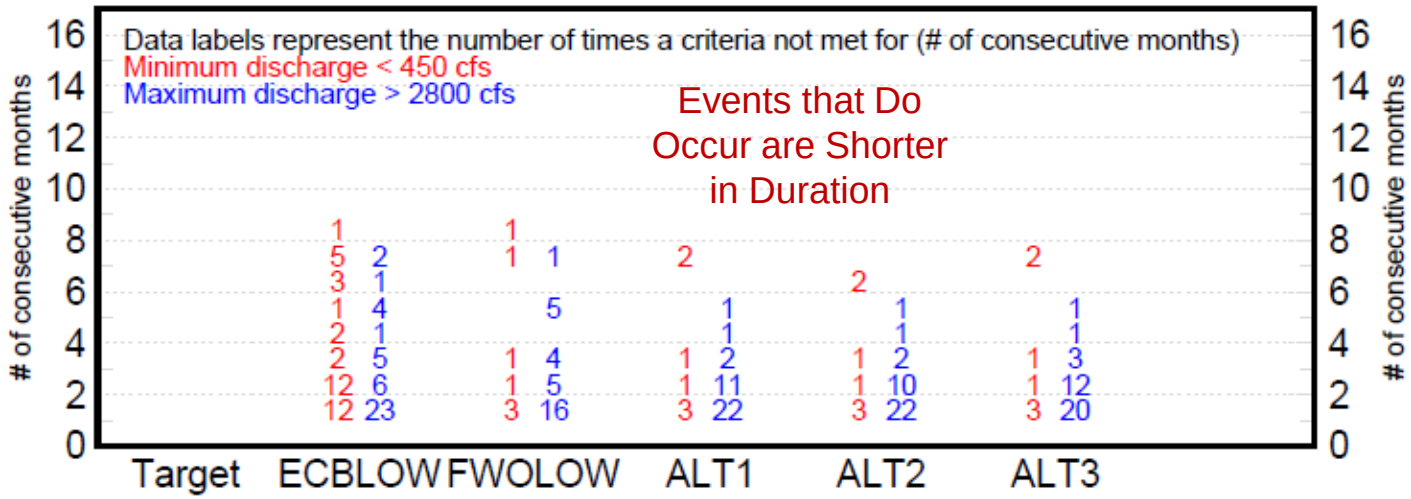
Note: A favorable maximum monthly flow was developed for the estuary (2000 cfs) that will theoretically provide suitable salinity conditions which promote the development of important benthic communities (eg. oysters & shoalgrass). Mean monthly flows above 3000 cfs result in freshwater conditions throughout the entire estuary causing severe impacts to estuarine biota.

RECOVER Performance Measure

Run date: 03/07/17 11:10:36
RSMBN
Script used: estuary.scr, ID496
Filename: stluc_2000_flow_bar.out.agr

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

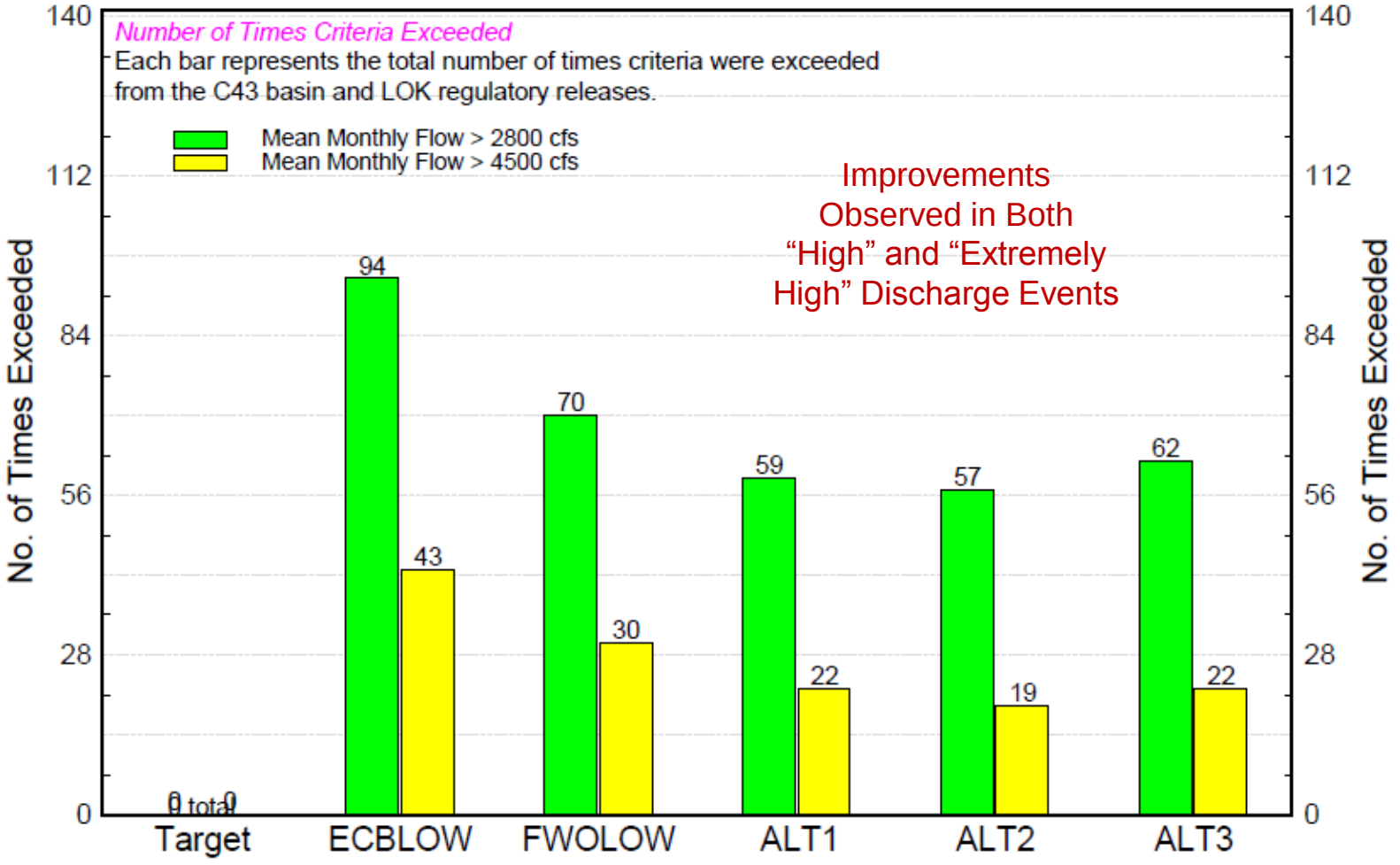




RECOVER Performance Measure

Run date: 03/07/17 11:10:36
RSMBN
Script used: estuary.scr, ID496
Filename: caloos_salinity_flow_bar.out.agr

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



Run date: 03/07/17 11:10:36
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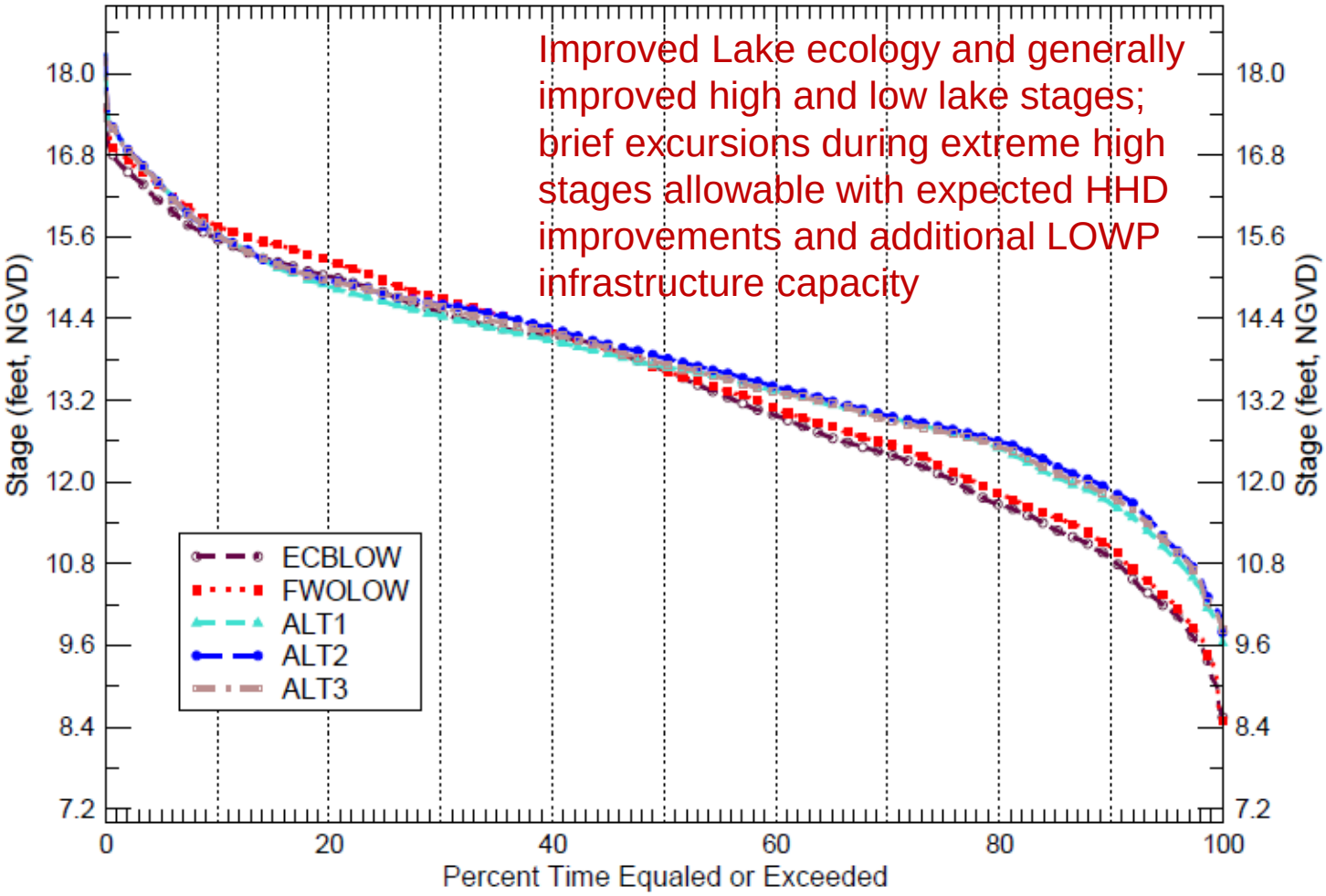
Script used: estuary.scr, ID496
Filename: caloos_2800_4500_flow_bar.out.agr

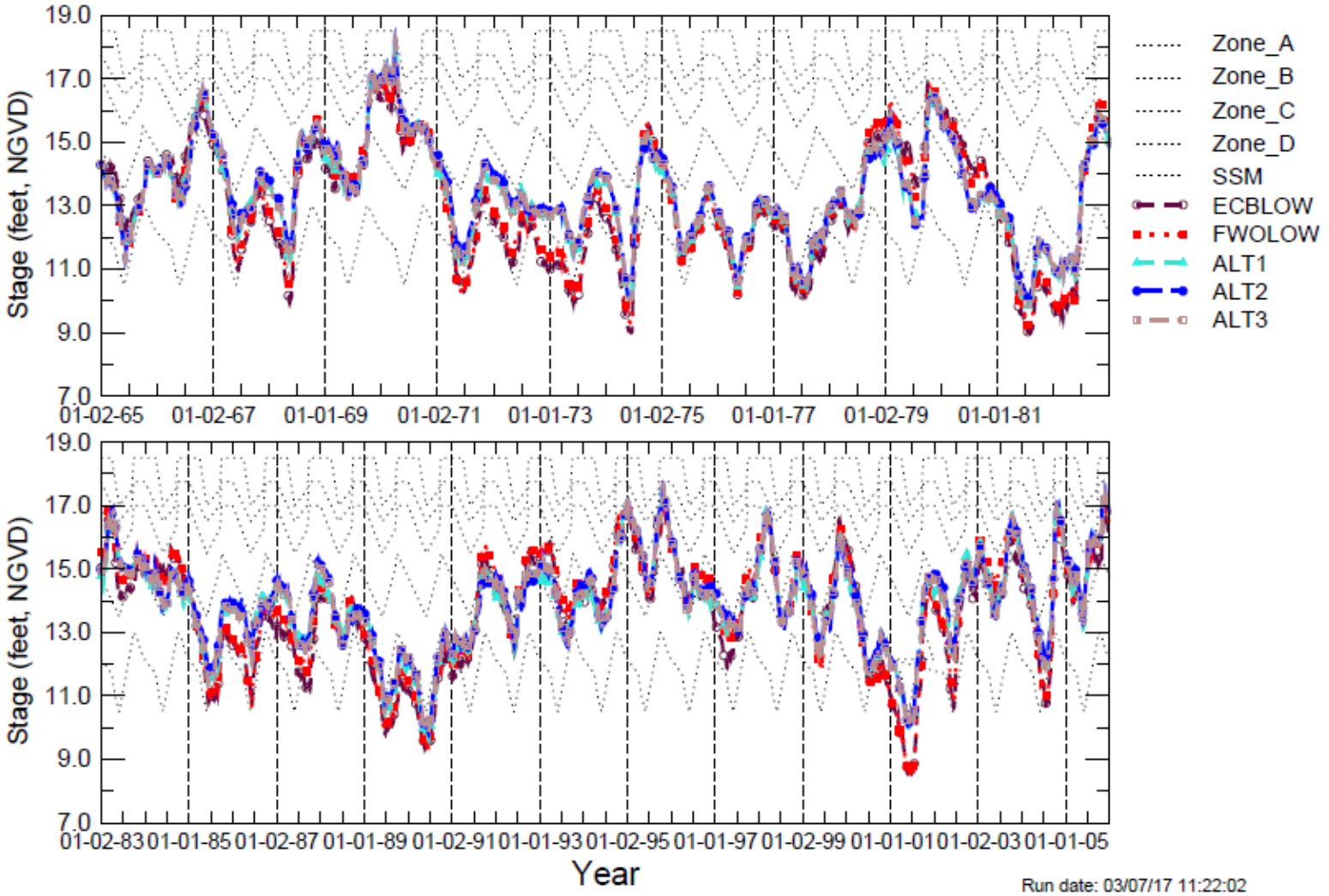
Stage Duration Curves for Lake Okeechobee



RSMBN P.O.S. 1965 - 2005

Run date: 03/07/17 11:22:04
RSMBN
Script used: hyd_dur.scr, ID456
Filename: lok_dai_stgdur.agr

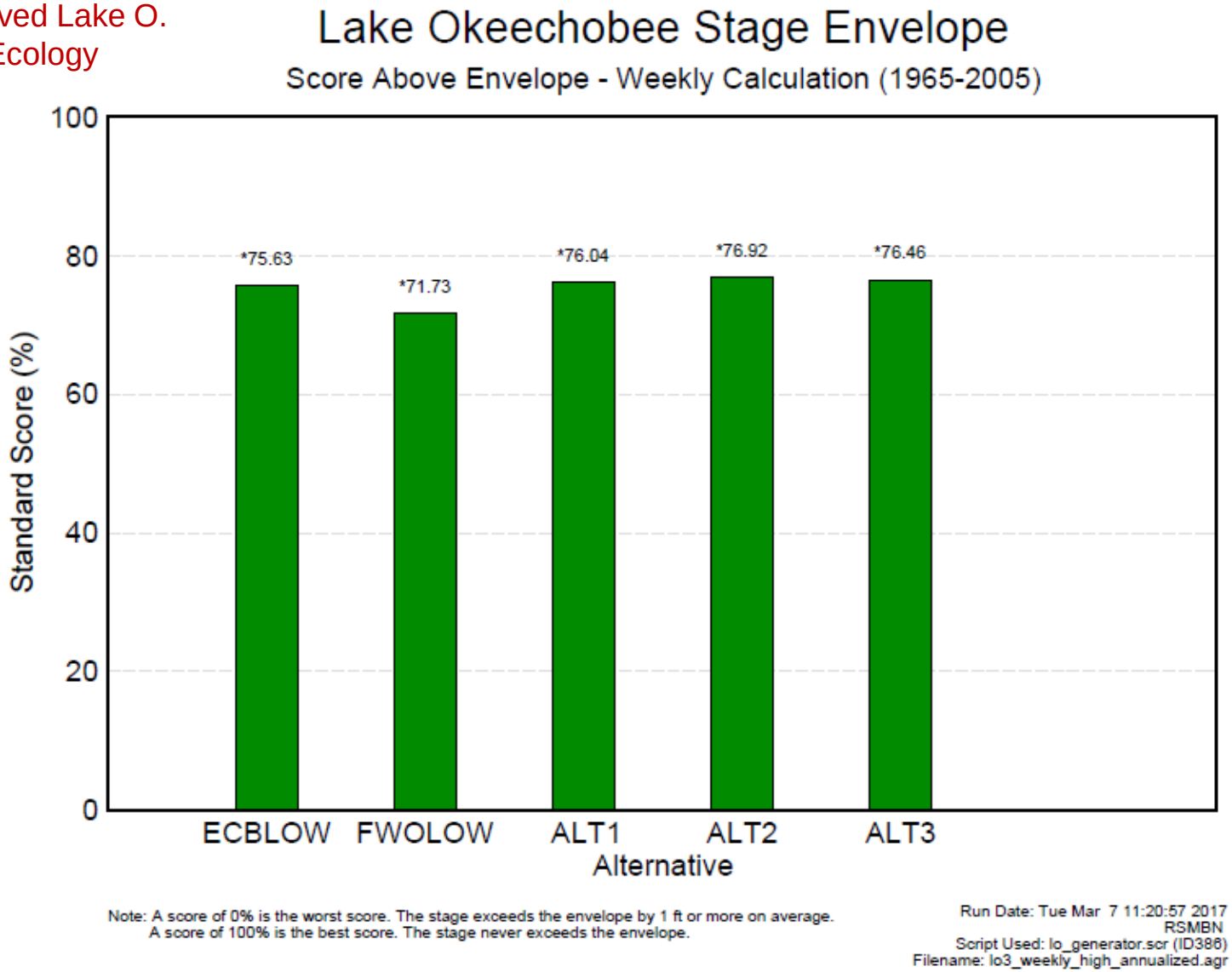
Stage Hydrographs for Lake Okeechobee



Run date: 03/07/17 11:22:02
RSMBN
Script used: hyd_dur.scr, ID456
Filename: lok_dai_stg.agr

RSMBN P.O.S. 1965 - 2005

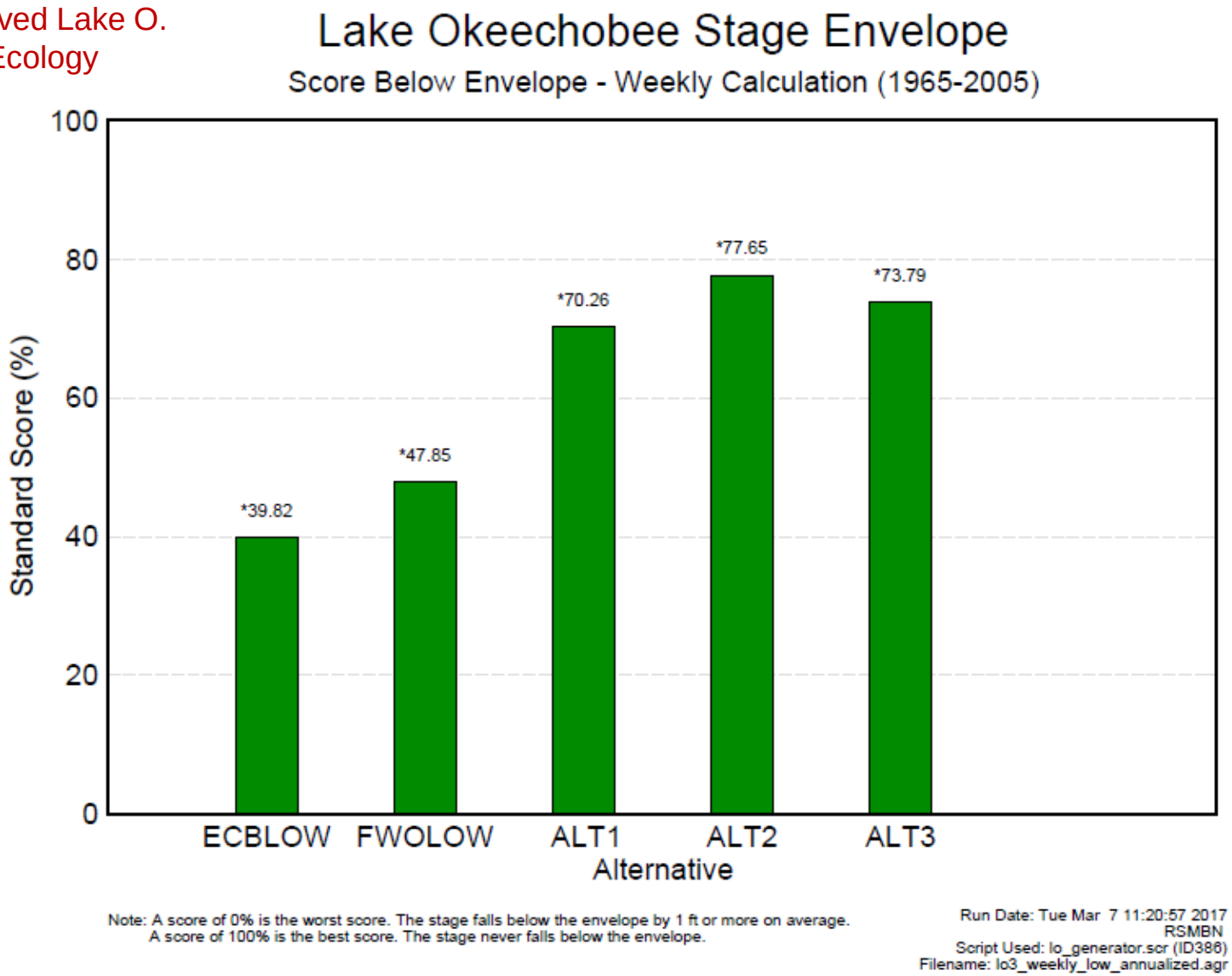
Higher Scores = Improved Lake O. Ecology



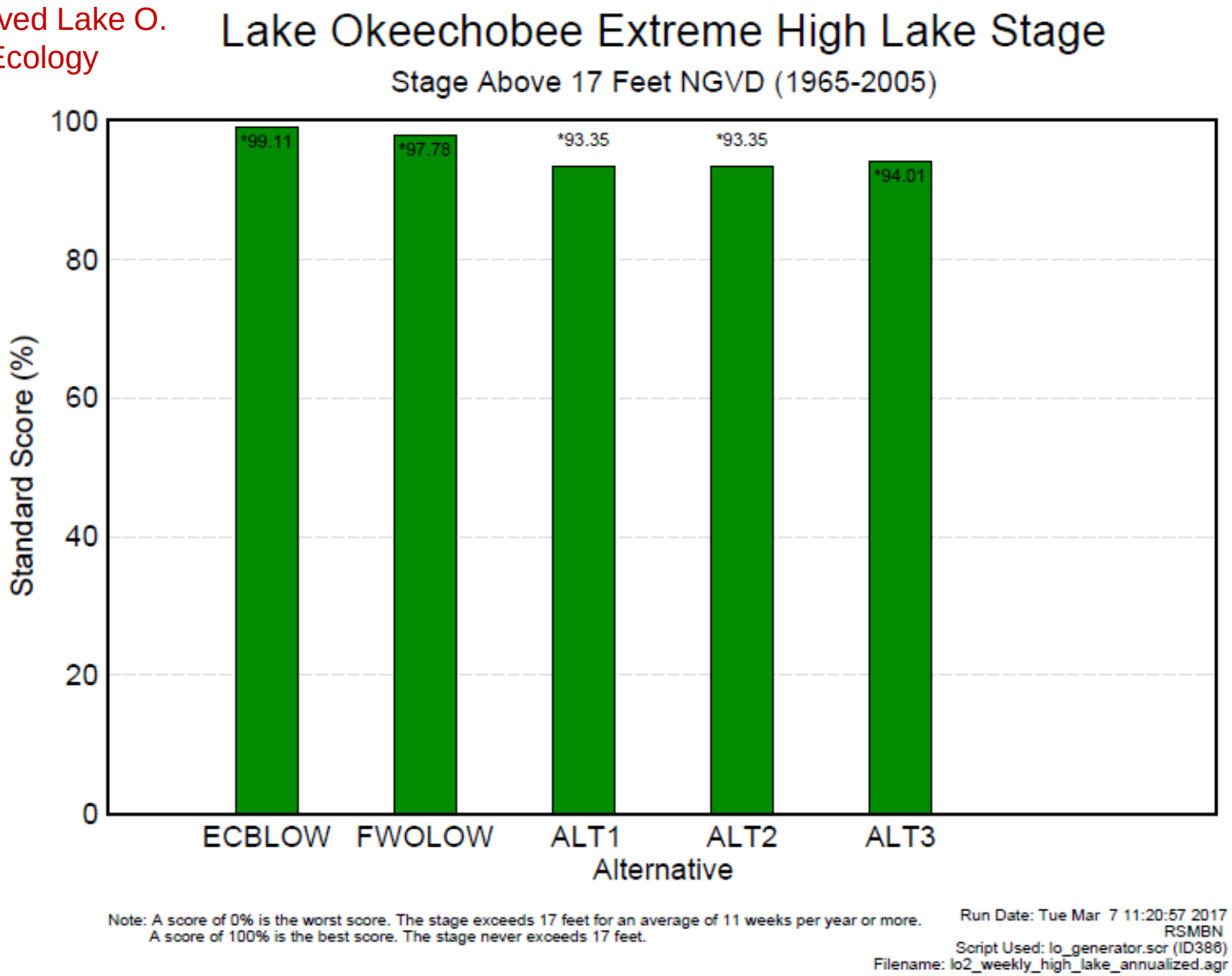
Note: A score of 0% is the worst score. The stage exceeds the envelope by 1 ft or more on average.
A score of 100% is the best score. The stage never exceeds the envelope.

Run Date: Tue Mar 7 11:20:57 2017
RSMBN
Script Used: lo_generator.scr (ID386)
Filename: lo3_weekly_high_annualized.agr

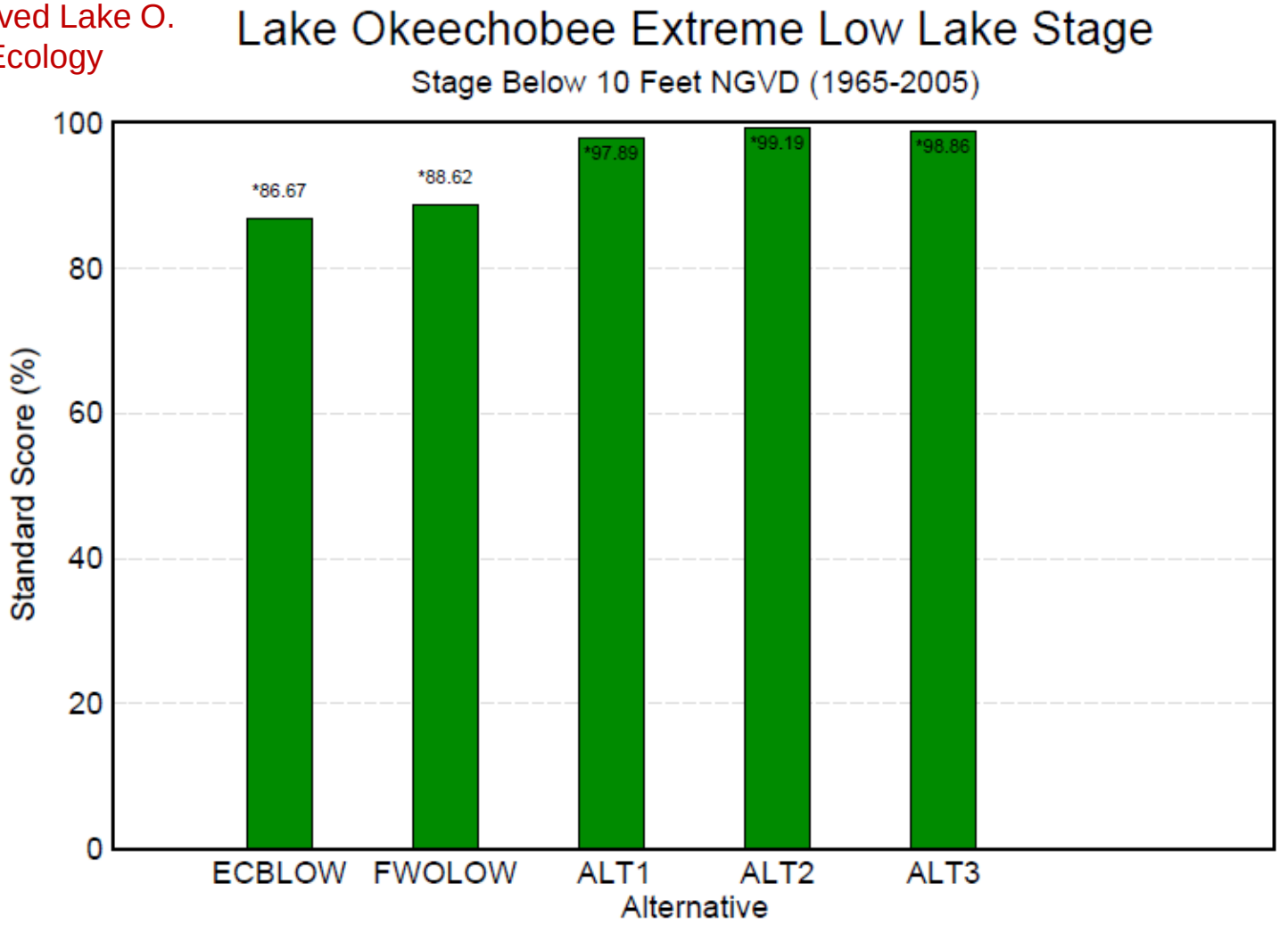
Higher Scores = Improved Lake O. Ecology



Higher Scores = Improved Lake O. Ecology



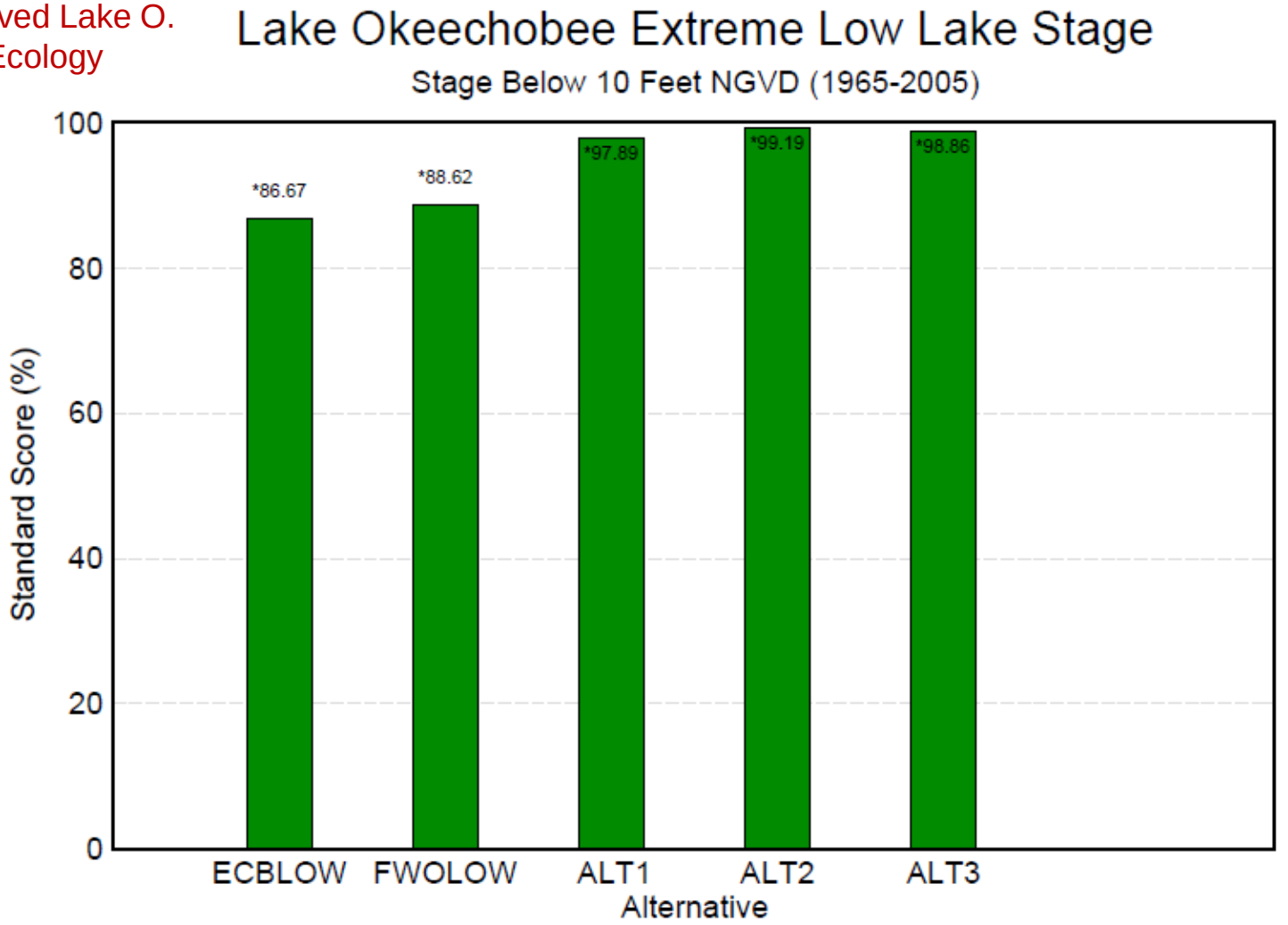
Higher Scores = Improved Lake O. Ecology



Note: A score of 0% is the worst score. The stage falls below 10 feet for an average of 15 weeks per year or more. A score of 100% is the best score. The stage never falls below 10 feet.

Run Date: Tue Mar 7 11:20:57 2017
RSMBN
Script Used: lo_generator.scr (ID386)
Filename: lo1_weekly_low_lake_annualized.agr

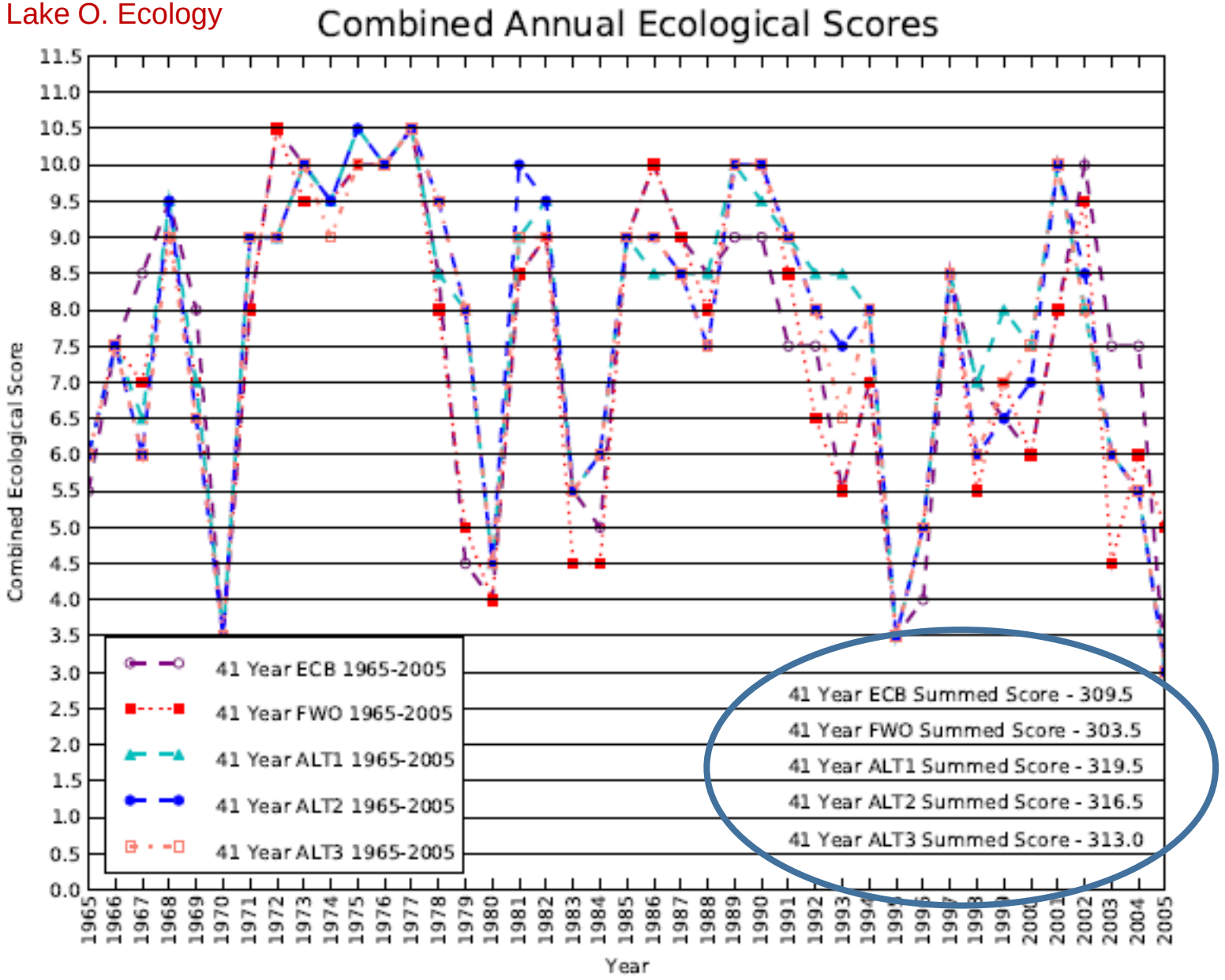
Higher Scores = Improved Lake O. Ecology



Note: A score of 0% is the worst score. The stage falls below 10 feet for an average of 15 weeks per year or more. A score of 100% is the best score. The stage never falls below 10 feet.

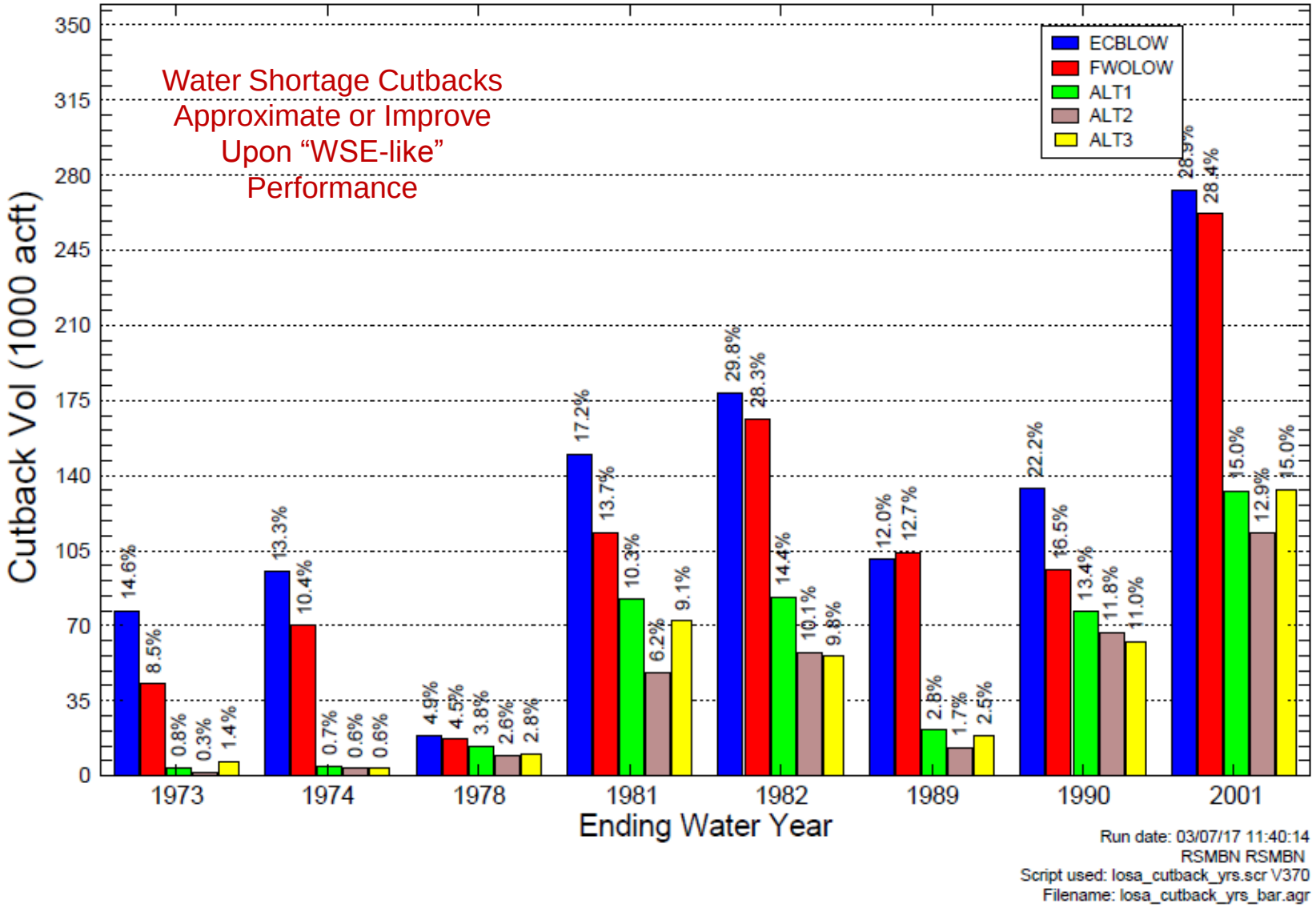
Run Date: Tue Mar 7 11:20:57 2017
RSMBN
Script Used: lo_generator.scr (ID386)
Filename: lo1_weekly_low_lake_annualized.agr

Higher Scores = Improved Lake O. Ecology



Water Year (Oct-Sep) LOSA Demand Cutback Volumes

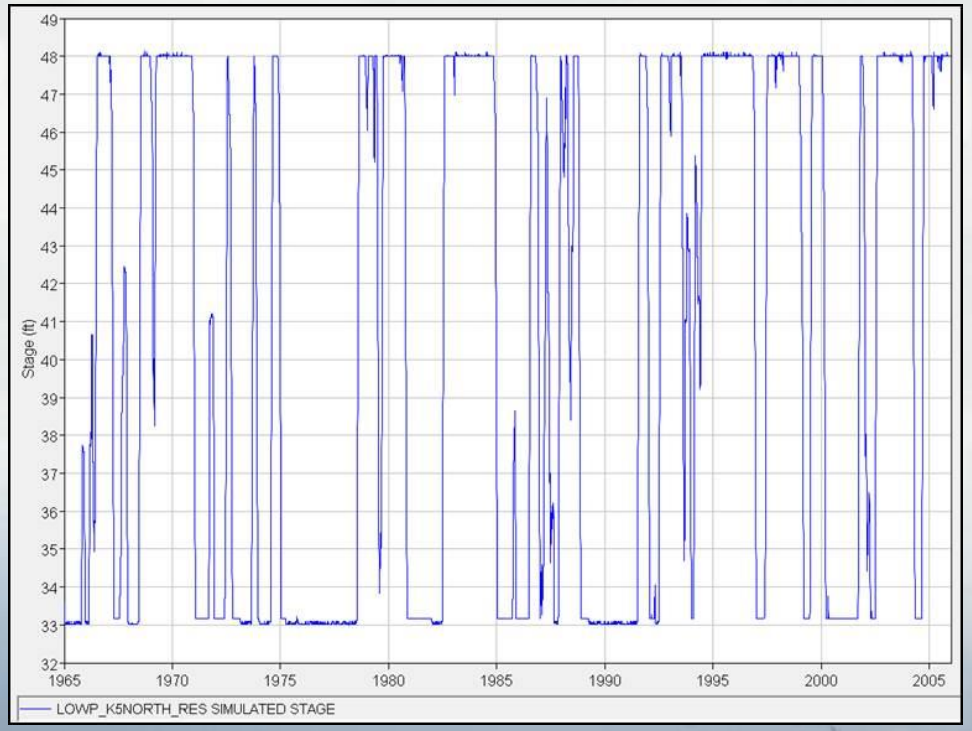
for the 8 Years in Simulation Period with Largest Cutbacks



Run date: 03/07/17 11:40:14
RSMBN RSMBN
Script used: losa_cutback_yrs.scr V370
Filename: losa_cutback_yrs_bar.agr

Example Performance of K05N Above Ground Reservoir for ALT1

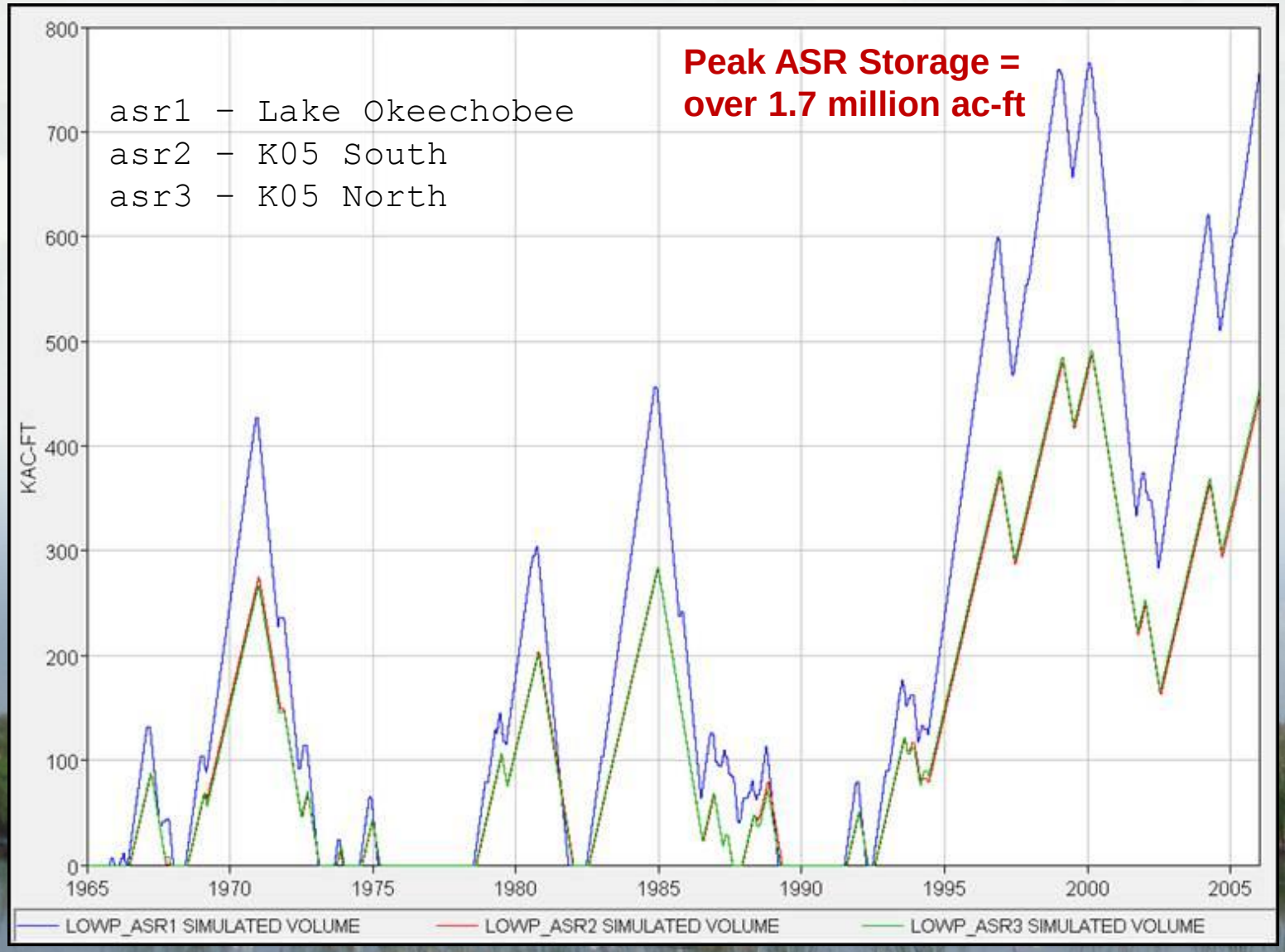
BUILDING STRONG



Frequent use of the above ground reservoir storage is evident across the RSMBN 1965-2005 simulation period.

Example Aquifer Storage & Recovery Performance for ALT1

BUILDING STRONG



Northern Estuaries Benefits Summary

BUILDING STRONG

	Average Annual Lake O Regulatory Discharge (kac-ft)	% Estuary Regulatory Flow Reduction (relative to ECB)	Number of Years Lake O Causes a Damaging Event	% Estuary "Years with Impact" Reduction (relative to ECB)	Number of Months Lake O Causes a Damaging Event	% Estuary "Months with Impact" Reduction (relative to ECB)
St Lucie Estuary						
ECB	165		15		31	
FWO	126	24%	11	27%	20	35%
ALT1	82	50%	7	53%	9	71%
ALT2	80	52%	6	60%	10	68%
ALT3	84	49%	7	53%	10	68%
Caloosahatchee Estuary						
ECB	416		18		38	
FWO	257	38%	14	22%	23	39%
ALT1	140	66%	6	67%	9	76%
ALT2	136	67%	5	72%	7	82%
ALT3	139	67%	9	50%	12	68%

Results based on RSMBN modeling using a 41 year, 1965-2005 Period of Simulation

Note: Outcomes equal or exceed expectations from RESOPS Screening Analysis

How to Access Model Data

Available LOWP Modeling Data

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March 8th Release of LOWP Initial Alternatives Array

- ECB vs FWO vs ALT1 vs ALT2 vs ALT3 Performance Measures for RSMBN (e.g. Lake O., Northern Estuaries, LOSA)
- Other Indicators (e.g. water budgets,) for RSMBN
- ALT1, ALT2, ALT3 model output for RSMBN
- Minor updates to ECB and FWO from Feb 2, 2017 release
- DMSTA validation that flows south to Everglades meet water quality planning targets
- Spreadsheets summarizing operations optimization

Available LOWP Modeling Data (cont)

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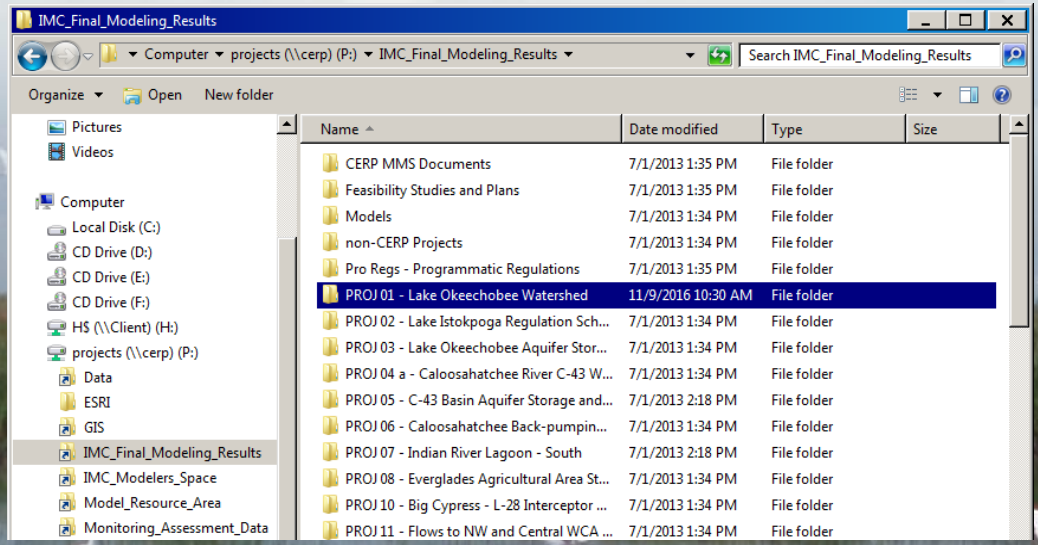
- LOWP Modeling data is permanently archived and available on the CERPZone Data Archival Storage and Recovery (DASR) system.
  - Step by step instructions previously provided to PDT or available upon request.
- For a short time, data is also available via ftp at:

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



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Discussion