

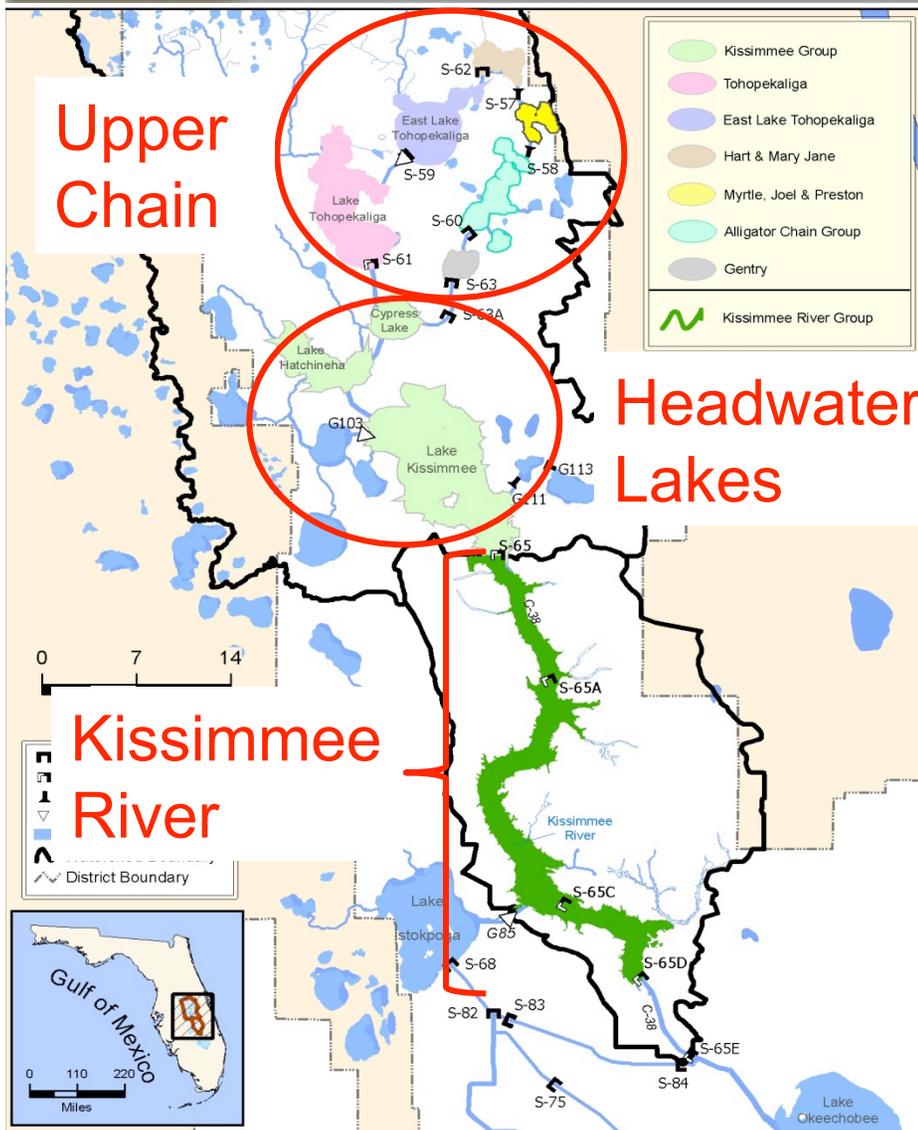


Kissimmee Basin Water Reservations: Policy Considerations

Lawrence Glenn, Kissimmee Director
September 9, 2009 Workshop Item #10



Reservation Water Bodies: Kissimmee River and the Chain of Lakes

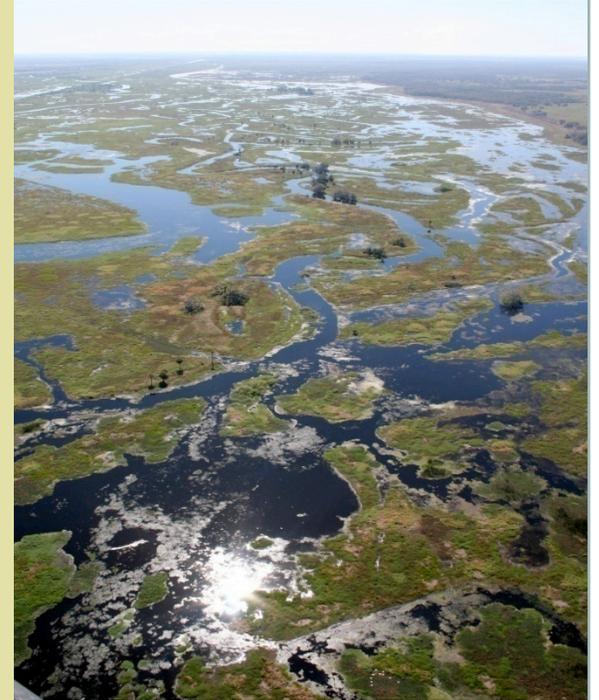


- Restored Kissimmee River and floodplain (S-65 to S-65E)
 - 103 miles of River and floodplain
 - 27,000 acres wetland habitat
- 7 lake management areas (19 lakes)



Why now?

- Kissimmee River Restoration = Billion dollar project + Federal Partner





Why now?

- Significant Fish & Wildlife resources in Kissimmee Chain of Lakes have largely gone ignored

“Harder to restore than preserve or maintain”

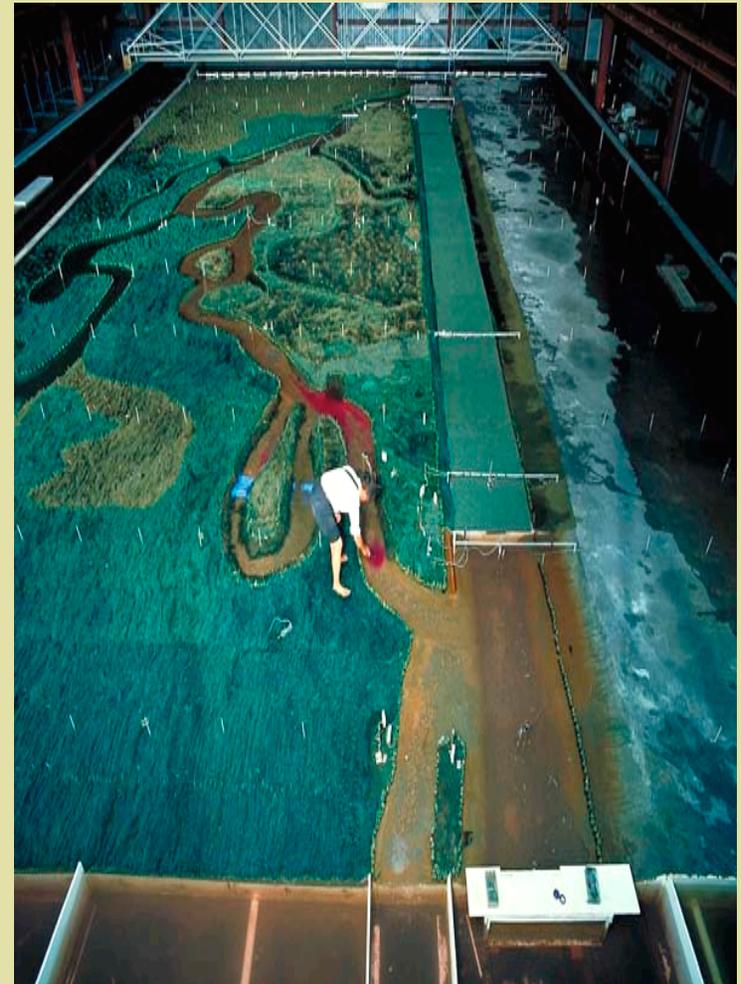




Moving Parts for Addressing Fish & Wildlife Requirements in the Kissimmee Basin

5 River Restoration Criteria 2013

- Continuous flow with duration and variability comparable to pre-channelization periods
- Average flow velocities between 0.8-1.8 ft per second, when flow within bank
- Stage discharge relationship resulting in overbank flow >1400 ft²/sec and >2000 ft²/sec
- Stage recession rates on floodplain <1 ft/month
- Floodplain inundation comparable to historic hydrographs



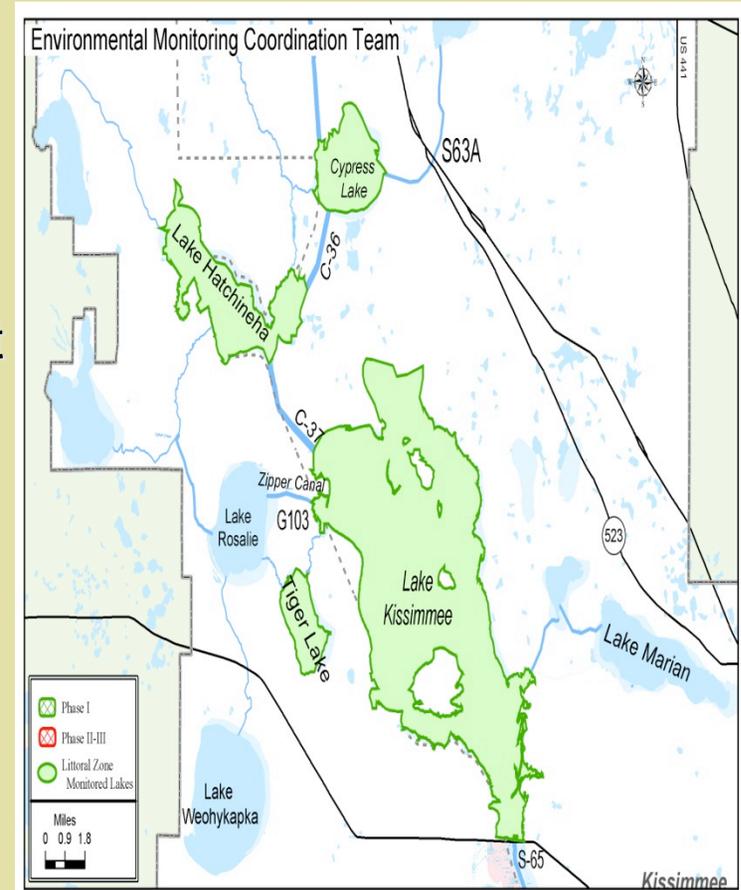


Moving Parts for Addressing Fish & Wildlife Requirements in the Kissimmee Basin

Headwaters Revitalization 2013

(Lakes Kissimmee, Hatchineha, Cypress, Tiger)

- Changes how S-65 structure is operated at south end of Lake Kissimmee – 1996 Project Environmental Impact Statement
- Incorporates operations strategies that meet the needs of the Kissimmee River
- Provide greater and more natural lake level fluctuations
 - Expand existing peripheral marsh habitats (~7200 acres)





Moving Parts for Addressing Fish & Wildlife Requirements in the Kissimmee Basin

Kissimmee Basin Modeling and Operations Study

Record of Decision – October 2011

- Assess how existing operating criteria for water control structures can be modified to achieve a more acceptable balance between resources in upper and lower Kissimmee basins.





Moving Parts for Addressing Fish & Wildlife Requirements in the Kissimmee Basin

- Kissimmee Chain of Lakes Long-Term Management Plan – Watershed Management Plan – 2009 Draft
- Basin & Unified Stormwater Rule - July 2010
 - Regional stormwater retention opportunities
- Total Maximum Daily Loads - September 2010
 - Basin Management Action Plans
- Potential infrastructure modifications/additions
- **ALL several years from initiation/completion**
 - **What protection for Fish & Wildlife is available now?**





Concurrent Water Supply Implications

- Increased water supply demands in Kissimmee Chain of Lakes occurring at same time as reservations development





Initiate development of Water Reservations for Kissimmee Basin

- Move forward with best available data and tools now
 - Lake targets as thresholds
 - Lake stage variability accounted for beneath threshold values
- Revisit reservations at completion of new operations associated with KBMOS
 - Explicit lake stage variability, but not complete at onset of reservations development





Fish and Wildlife in Lakes

Greater habitat
diversity

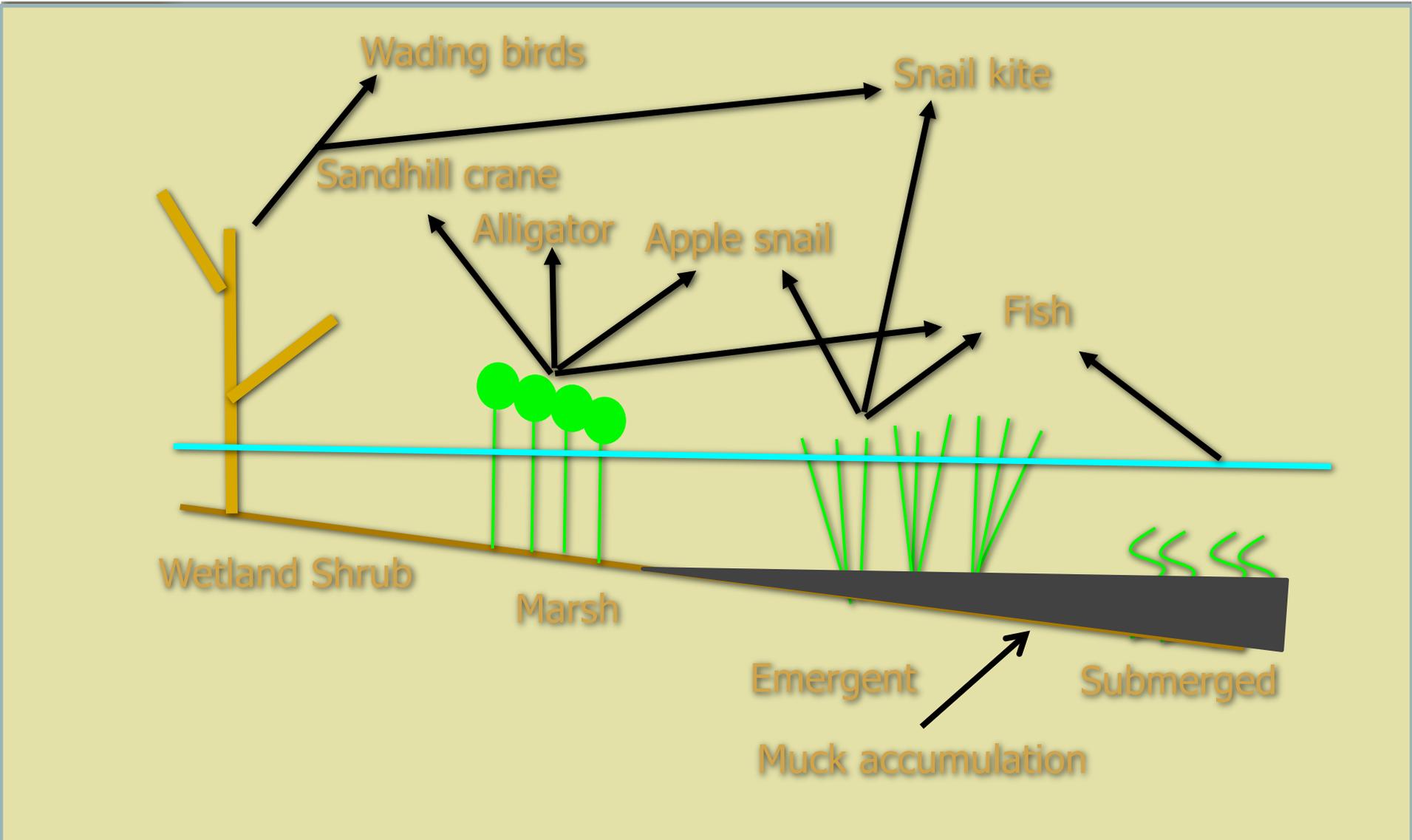


Greater fish and
wildlife diversity

Achieved through
variable hydrologic
conditions

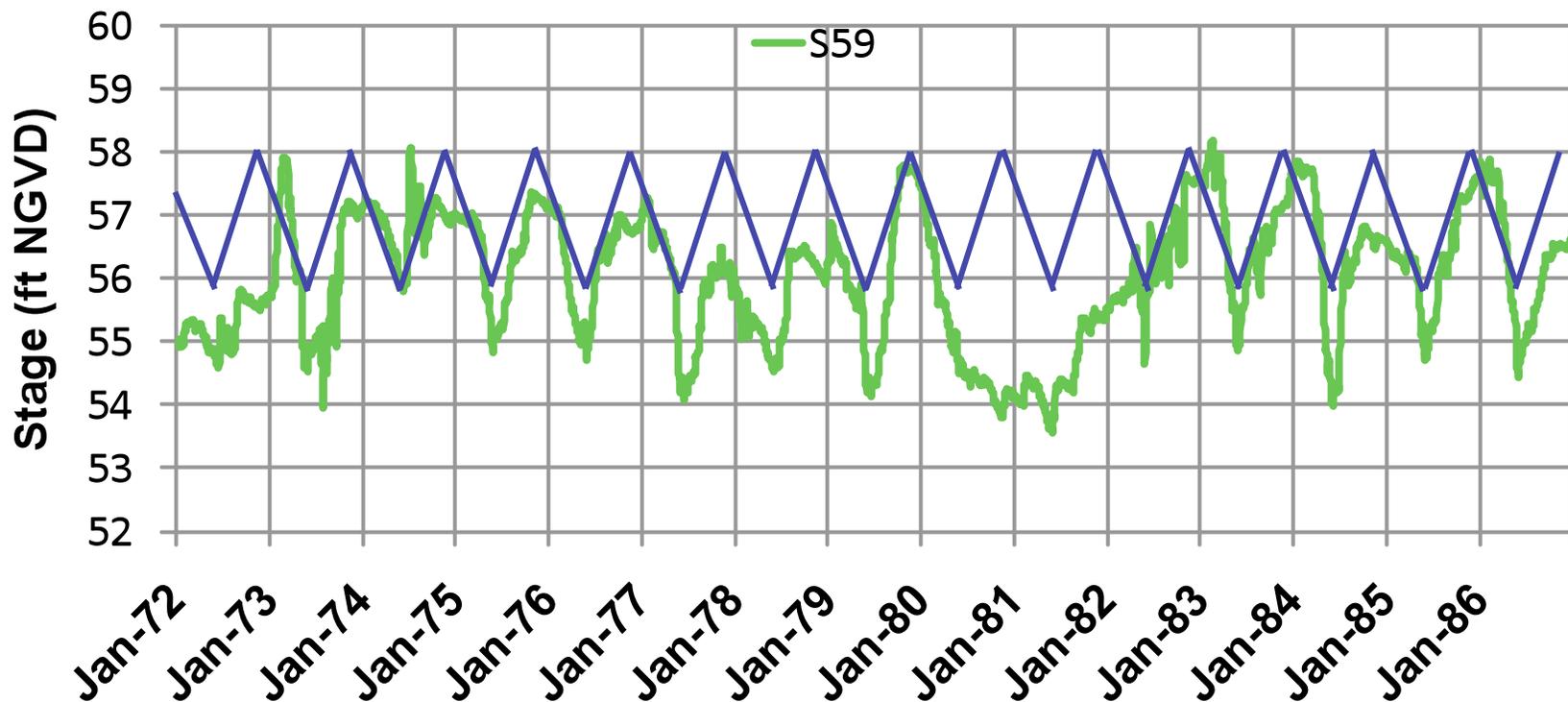


Fish and Wildlife in Lakes





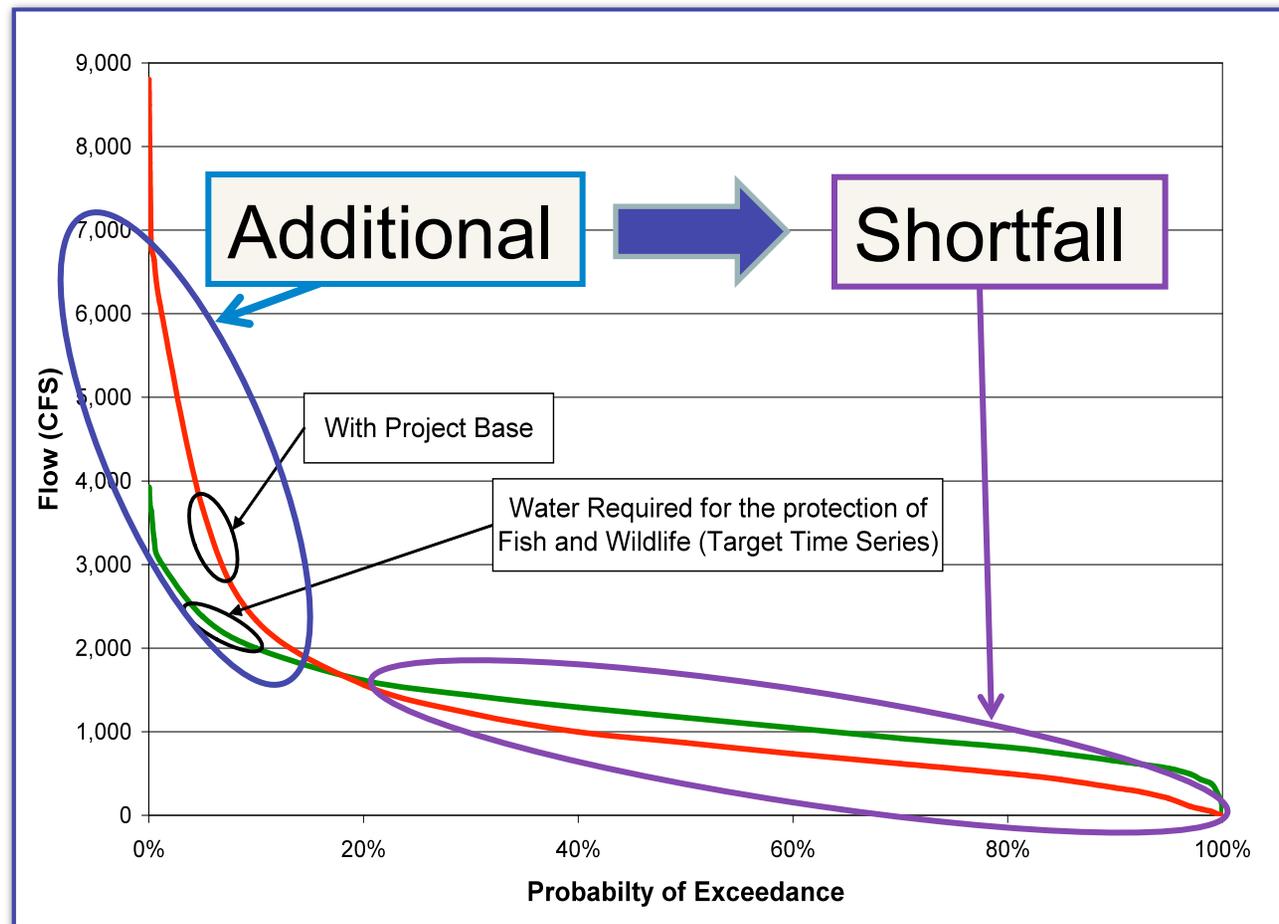
Thresholds preserve variability of low water levels





Limitations of Threshold-based Duration curves

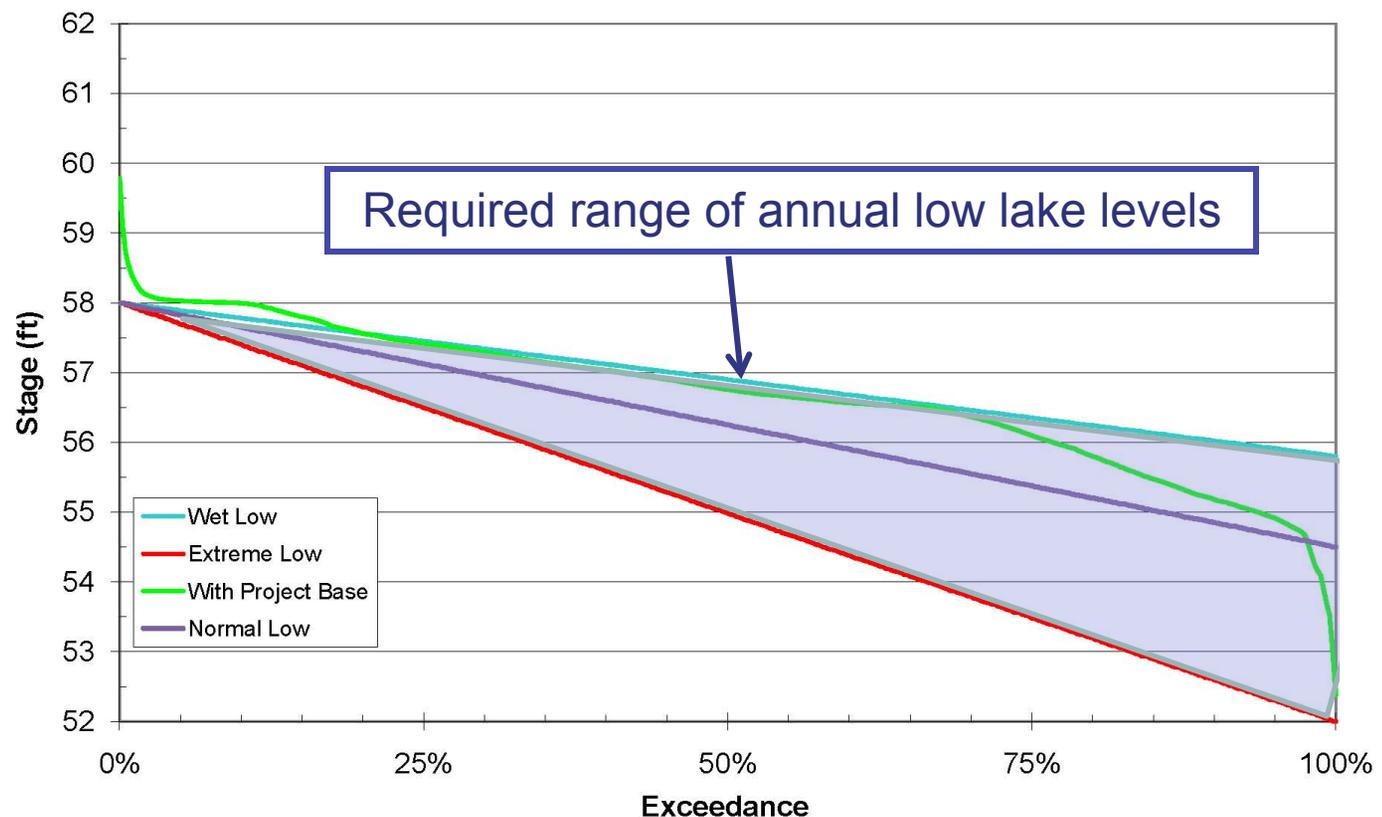
- Not as simple as applying additional water to shortfall





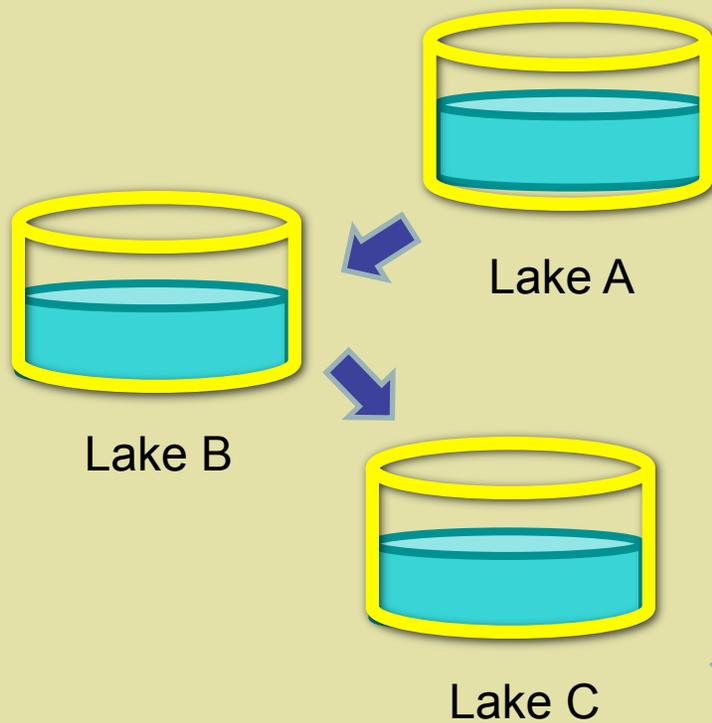
First Layer of Complexity

- Shortfall volume is not static
- Instead it is a range of low lake stages required to maintain diverse littoral vegetation communities that provide habitat to fish and wildlife

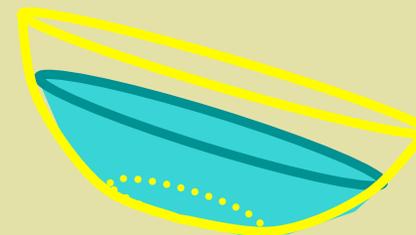




Reservation Water Bodies Analyzed Independently



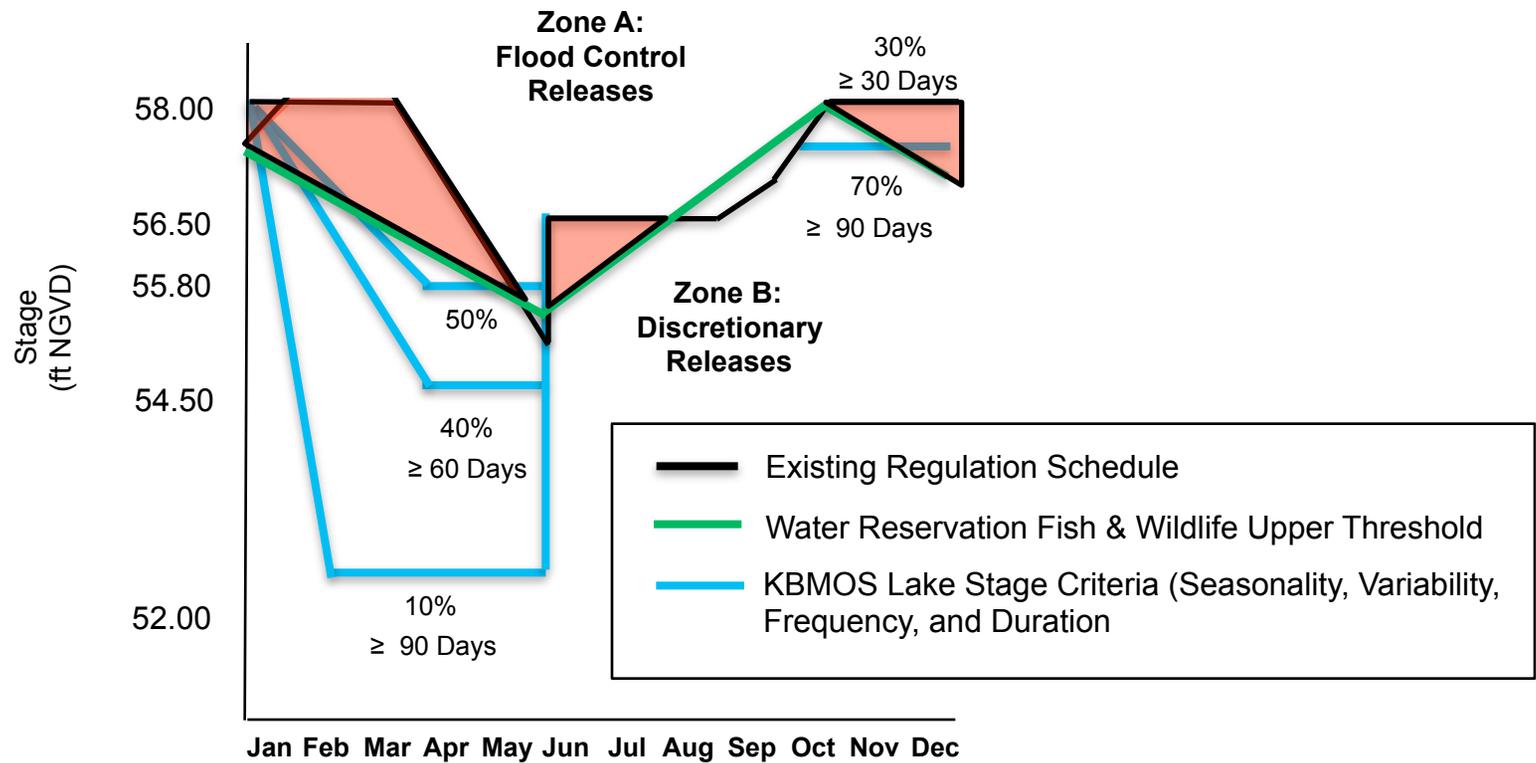
- Additional water or shortfalls determined for individual reservation water bodies
- KBMOS will **operationally** move water between water bodies to meet fish & wildlife requirements



River-floodplain



Second Layer of Complexity





Water in addition to Fish and Wildlife requirements

Threshold	Frequency of Events					
	5%	10%	15%	20%	25%	30%
Lakes Myrtle Joel and Preston Lakes Hart (acre-feet)						
Upper	241	106	None	None	None	None
Lower	460	347	261	188	153	None





Water in addition to Fish & Wildlife requirements

Threshold	Frequency of Events									
	5%	10%	15%	20%	25%	30%	35%	40%	45%	50%
Lakes Myrtle Joel and Preston Lakes Hart (acre-feet)										
Upper	241	106	None	None	None	None	None	None	None	None
Lower	460	347	261	188	153	None	None	None	None	None
Lakes Hart and Mary Jane (acre-feet)										
Upper	2,212	1,507	1,038	342	None	None	None	None	None	None
Lower	2,212	1,507	1,050	647	334	None	None	None	None	None
East Lake Tohopekaliga (acre-feet)										
Upper	16,244	12,708	10,167	7,654	5,007	3,591	1,259	None	None	None
Lower	22,192	18,814	15,936	13,536	10,958	8,946	7,037	5,660	3,820	2,475
Lake Tohopekaliga (acre-feet)										
Upper	21,288	15,200	9,962	5,977	2,019	None	None	None	None	None
Lower	21,532	17,128	12,157	8,051	4,160	2,033	None	None	None	None
Alligator Chain of Lakes (acre-feet)										
Upper	4,889	2,167	636	None	None	None	None	None	None	None
Lower	5,540	2,959	1,314	None	None	None	None	None	None	None
Lake Gentry (acre-feet)										
Upper	1,219	688	349	None	None	None	None	None	None	None
Lower	1,624	1,146	720	382	164	None	None	None	None	None
Lakes Kissimmee Cypress and Hatchineha (acre-feet)										
Upper	17,290	None	None	None	None	None	None	None	None	None
Lower	72,510	54,756	35,386	19,171	5,629	None	None	None	None	None





What is different about East Lake Toho?

- **Bathymetry**
 - Deeper/steeper than other lakes in KCOL
 - Extent of littoral wetlands not as greatly influenced by stage
- **Inflows**
 - Boggy Creek provides year-round inflow greater than lakes upstream
- **Outflows**
 - Limited outlet capacity at S-59





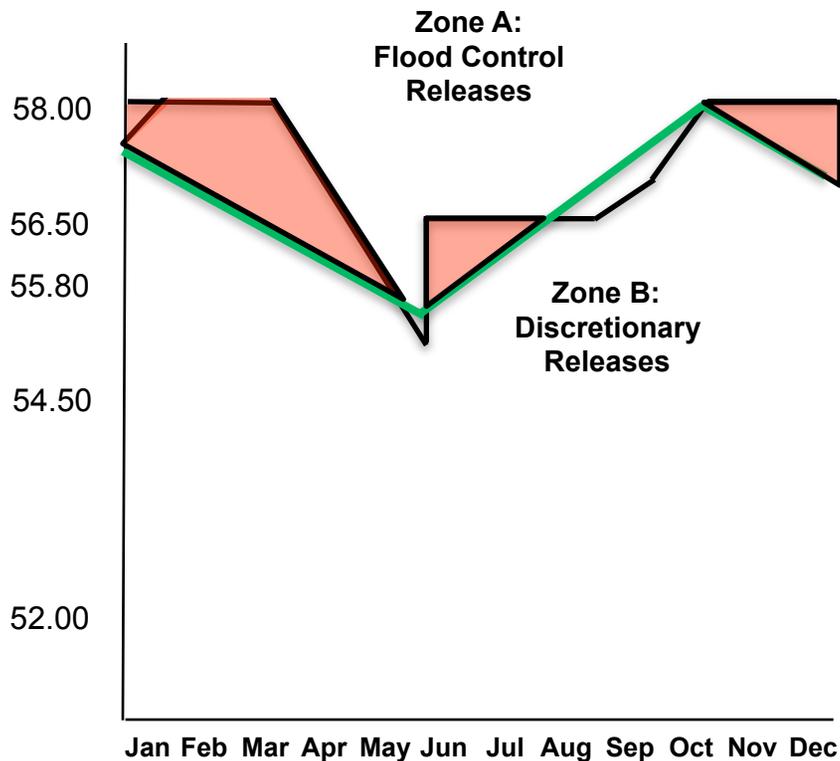
Hypothetical Withdrawal Exercise: Assumptions

- Reserved all water except in East Lake Toho
 - Preserve flexibility to implement KBMOS in future
- Used KBMOS performance measures to evaluate East Lake Toho's environmental performance
 - Simulate natural variability
- Evaluated Lake and River performance downstream
- Two different withdrawal scenarios
 - Harvesting and Continuous Withdrawal





Harvesting Scenarios



- Withdrawals made above water reservation threshold
- One scenario for each of the seasonal low threshold lines
- Two pump capacities (160 cfs, 500 cfs)
- Withdrawal rules vary during wet season
- Poor results; reduced range of wet season variability

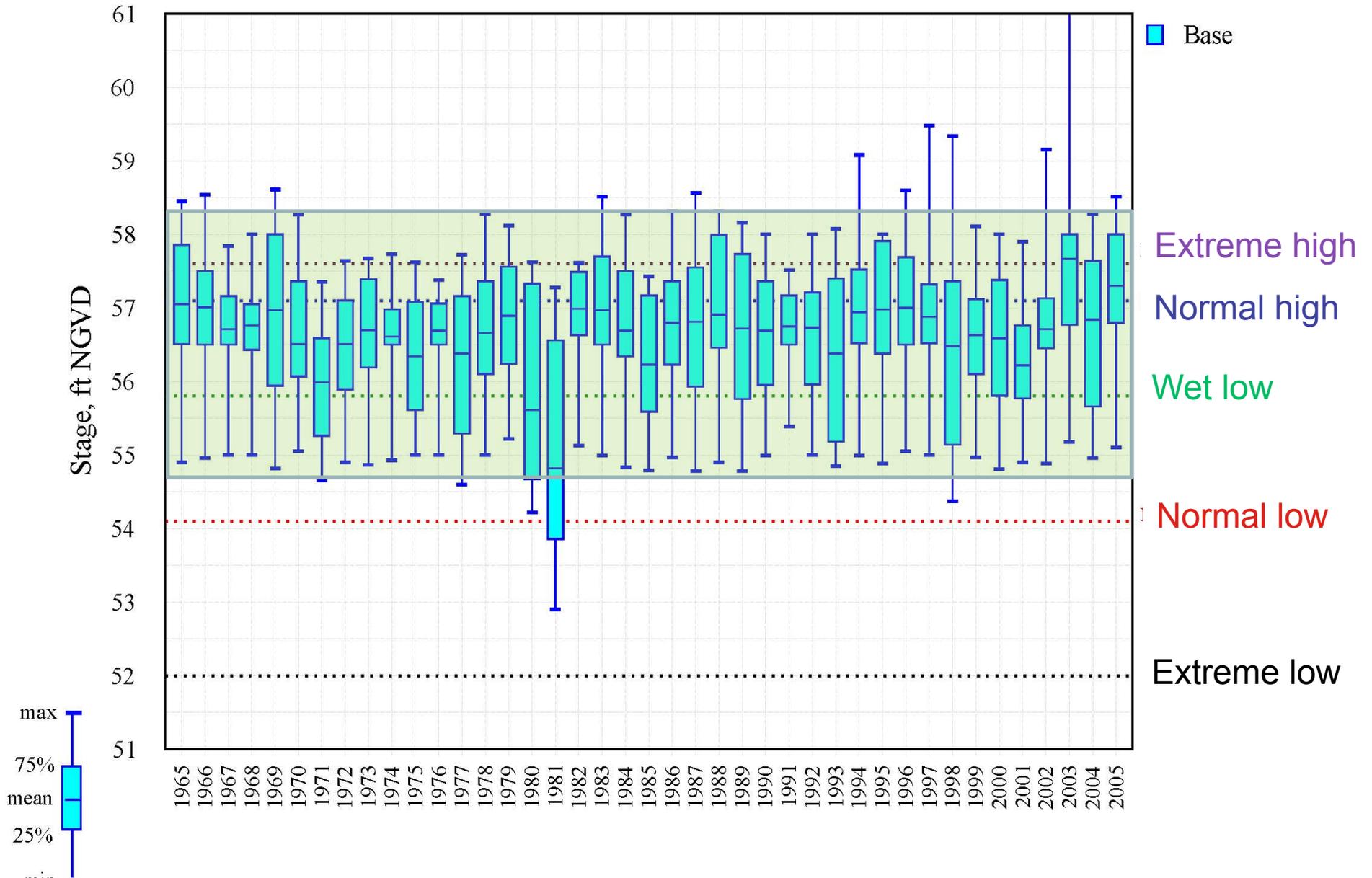


Continuous Withdrawal Scenarios

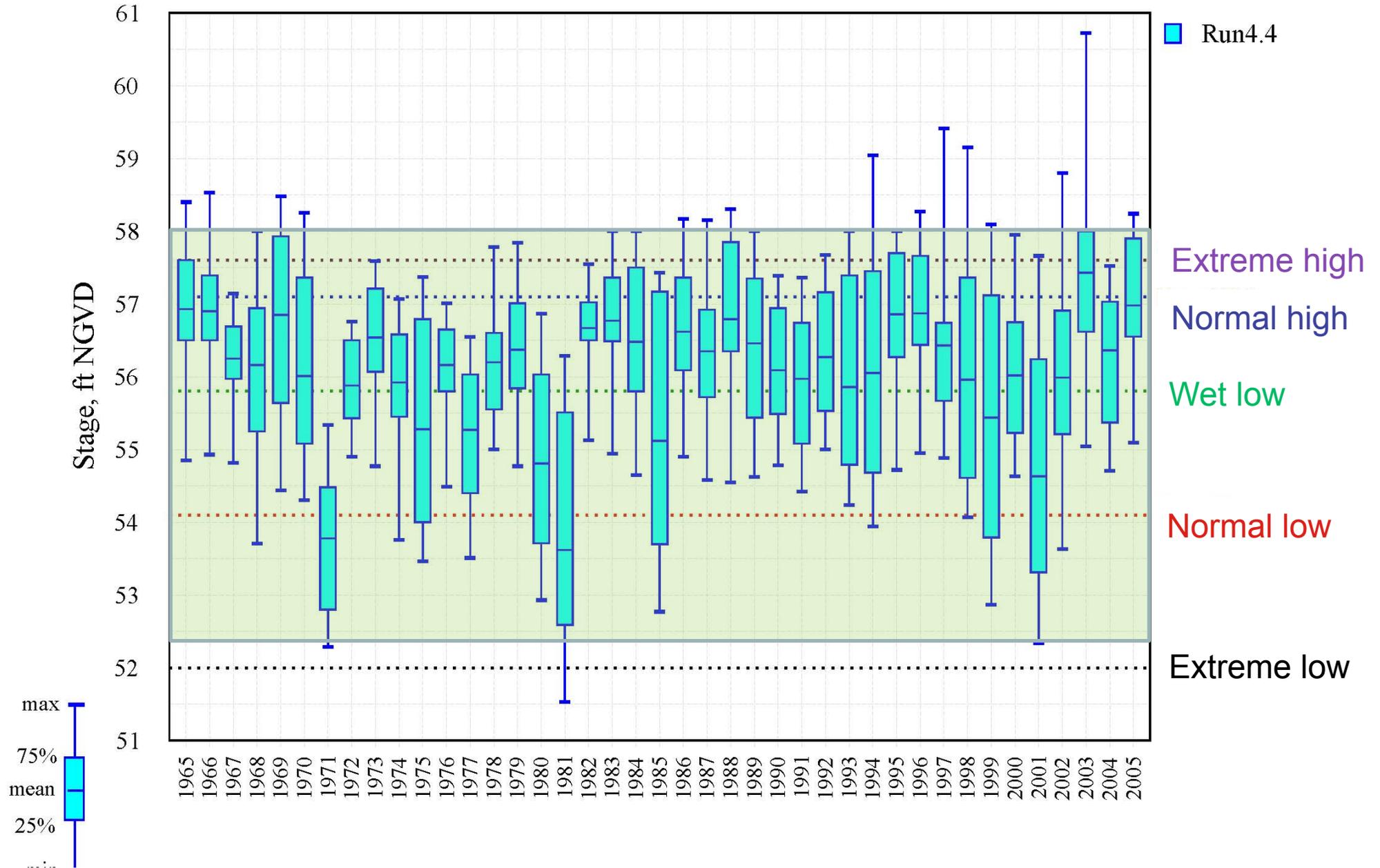
- 4 scenarios
- Continuous withdrawals
 - 25 to 35 mgd
 - With various low stage -based withdrawal constraints



With-Project Base Condition in East Lake Toho



Constant Withdrawal Scenario #4 in East Lake Toho





Environmentally Preferred Withdrawal Alternative

- Scenario Type:
 - Base Flow with Stage Triggers
- Withdrawal Capacity:
 - 30 mgd
- Average Pumping Days per year:
 - 320 days
- Average Day Withdrawal:
 - 26 mgd
- Reliability of Average Day Withdrawal without off-lake storage:
 - 83%
- Storage required for 100% Reliability of Average Day Withdrawal:
 - 85,000 acre-feet
 - ½ size of A-1 reservoir





Environmental Results of Preferred Withdrawal Scenario

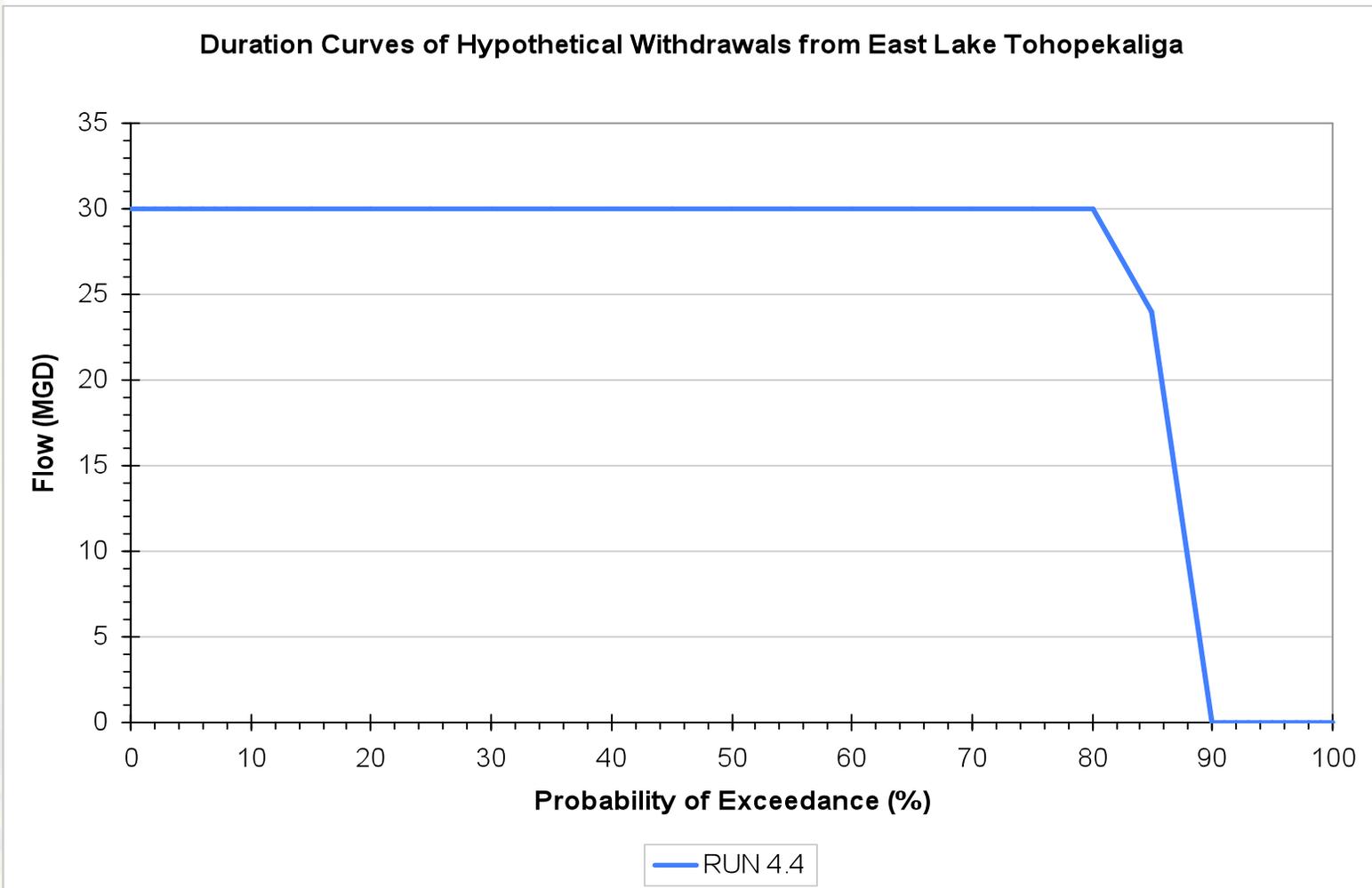
- Ability for gravity fed extreme drawdown
 - No need have to lower Toho, Kissimmee, Cypress, Hatchineha
- Increased inter-annual variability
 - Reflects natural systems
- 1 additional extreme low event in Kissimmee lake management area
- Limited impact to Kissimmee River broadleaf marsh
 - Reduction in required hydroperiod by days
 - Reduction in 1 year over 41 year period of record





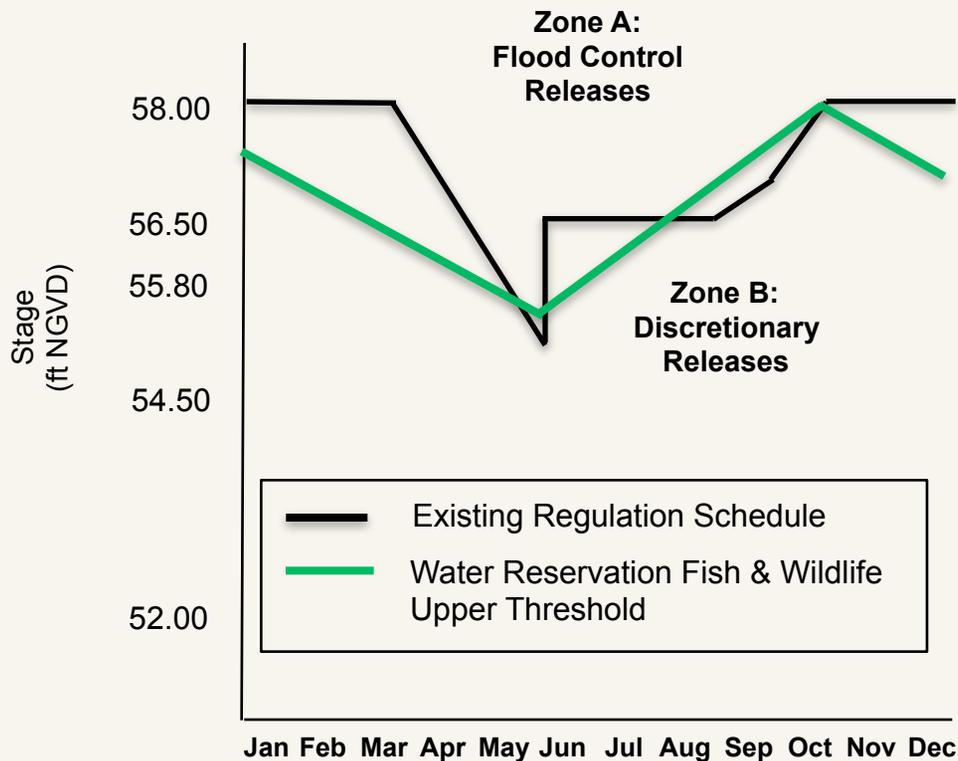
Reliability of Environmentally Preferred withdrawal

Duration Curves of Hypothetical Withdrawals from East Lake Tohopekaliga





Options for discussion in October

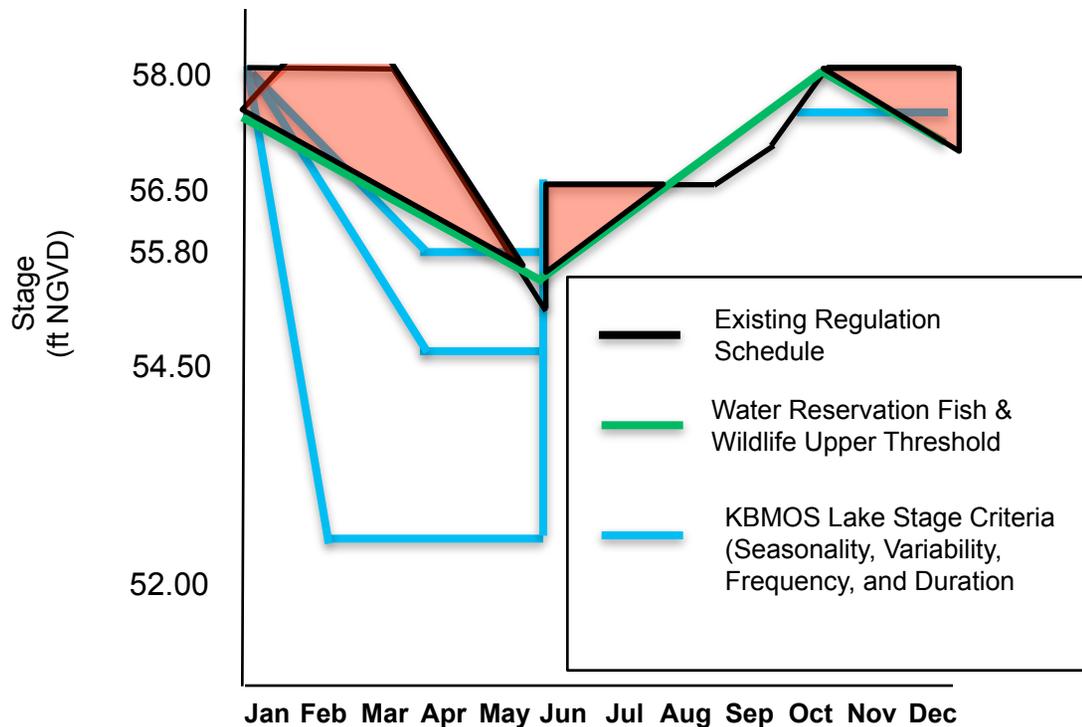


Option #1

- Reserve water consistent with Fish & Wildlife requirement target time series
 - Thresholds for lakes
 - Variable time series for river
- Equivalent to all water beneath green line



Options for discussion in October



Option #2

- Reserve water consistent with Fish and Wildlife requirement target time series
 - Option #1

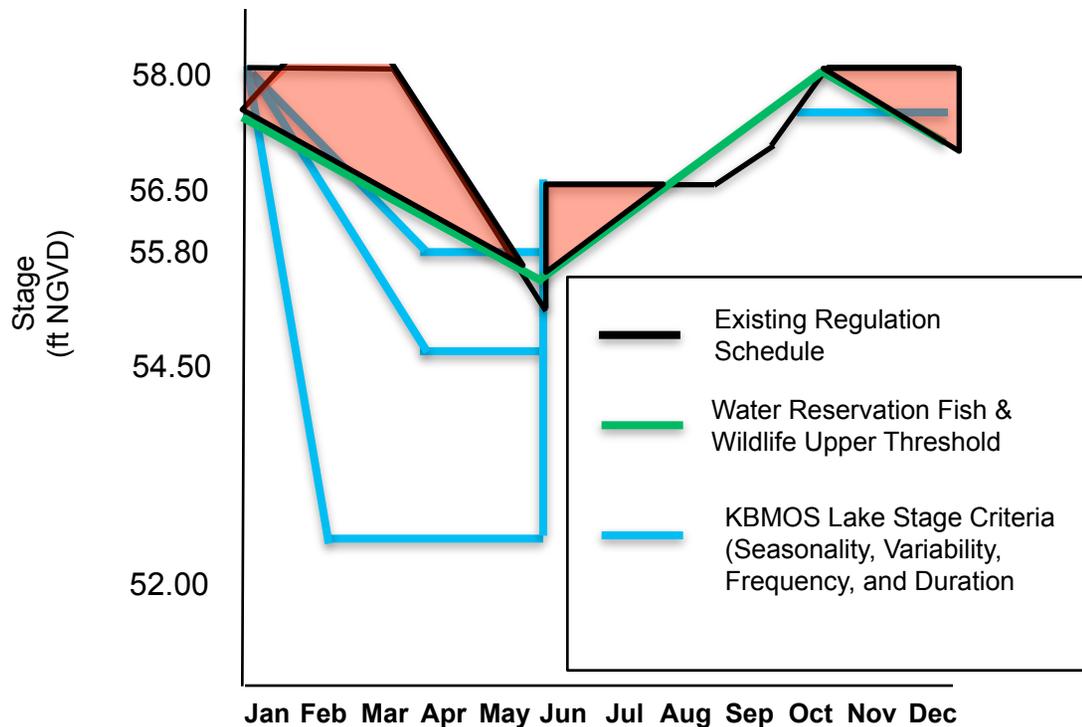
PLUS

- Set aside all water in addition to Fish & Wildlife requirements for use in KBMOS
- Equivalent to all water in the system



Options for discussion in October

Staff Recommendation



Option #3

- Reserve water consistent with Fish and Wildlife requirement target time series
 - Option #1

PLUS

- Set aside all water in addition to Fish & Wildlife requirements for use in KBMOS (Option #2), except in East Lake Toho
- Equivalent to all water in the system, except for water in addition to Fish & Wildlife needs in East Lake Toho



Thank You