Jordan Lake Water Supply Allocation Recommendations

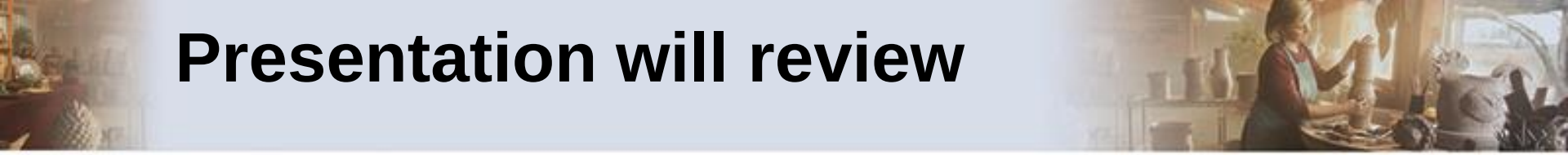
January 11, 2017

Department of Environmental Quality
Division of Water Resources

Purpose

Request the Water Allocation Committee's approval to present DWR's recommended Jordan Lake Water Supply allocations to the Environmental Management Commission tomorrow, January 12, 2017.

Presentation will review



- **EMC's statutory authority**
- **Administrative Rules**
- **Round 4 Timeline**
- **Analysis conducted**
- **Recommendations**
- **Complicating Factors**
  - **Western Intake construction**
  - **Raleigh's access to allocation**

EMC's Statutory Authority

- N.C. General Statute
- § 143-354. Ordinary powers and duties of the Commission.
- (a) Powers and Duties in General. - Except as otherwise specified in this Article, the powers and duties of the Commission shall be as follows:
  - (11) The Commission is authorized to assign or transfer to any county or municipality or other local government having a need for water supply storage in federal projects any interest held by the State in such storage, upon the assumption of repayment obligation therefor, or compensation to the State, by such local government. The Commission shall also have the authority to reassign or transfer interests in such storage held by local governments, if indicated by the investigation of needs made pursuant to subdivision (1) of subsection (a) of this section, subject to equitable adjustment of financial responsibility.

Administrative Code

- **N.C. Administrative Code**
- **15A NCAC 02G .0501 INTRODUCTION**
  - **The State, acting through the Environmental Management Commission, will assign to local governments having a need for water supply capacity any interest held by the State in such storage, with proportional payment by the user to the State for the state's associated capital, interest, administrative and operating costs.**
- **15A NCAC 02G .0504 ALLOCATION OF WATER SUPPLY STORAGE**
  - **(b) The Commission will assign Level I allocations of Jordan Lake water supply storage based on an intent to begin withdrawing water within five years of the effective date of allocation, on consideration of projected water supply needs for a period not to exceed 20 years, and on the design capacity of the associated withdrawal and treatment facilities.**
  - **(c) The Commission will make Level II allocations of Jordan Lake water supply to applicants based on projected water supply needs for a period not to exceed 30 years.**

Administrative Code

- **15A NCAC 02G .0504 ALLOCATION OF WATER SUPPLY STORAGE**
  - (h) To protect the yield of Jordan Lake for water supply and water quality purposes, the Commission will limit water supply allocations that will result in diversions out of the lake's watershed to 50 percent of the total water supply yield. The Commission may review and revise this limit based on experience in managing the lake and on the effects of changes in the lake's watershed that will affect its yield. For applicants whose discharge or intake represents a diversion pursuant to G.S. 153A-285 or 162A-7, the Commission will coordinate the review of the diversion with the review of the allocation request.
- **15A NCAC 02G.0505 NOTIFICATION AND PAYMENT**
  - (b) Recipients of Level I allocations are required to pay a proportional share of the state's total water supply storage capital and interest costs over a term suitable to the recipient and the Commission, but by 2012. Interest rates will vary with the payback term, and will be based on the state recovering the total federal capital and interest costs associated with water supply storage by 2012. After 2012, the Commission may review and adjust repayment requirements to assure equitable and efficient allocation of the resource. Level I recipients are also required to pay annually a proportional share of operating costs.

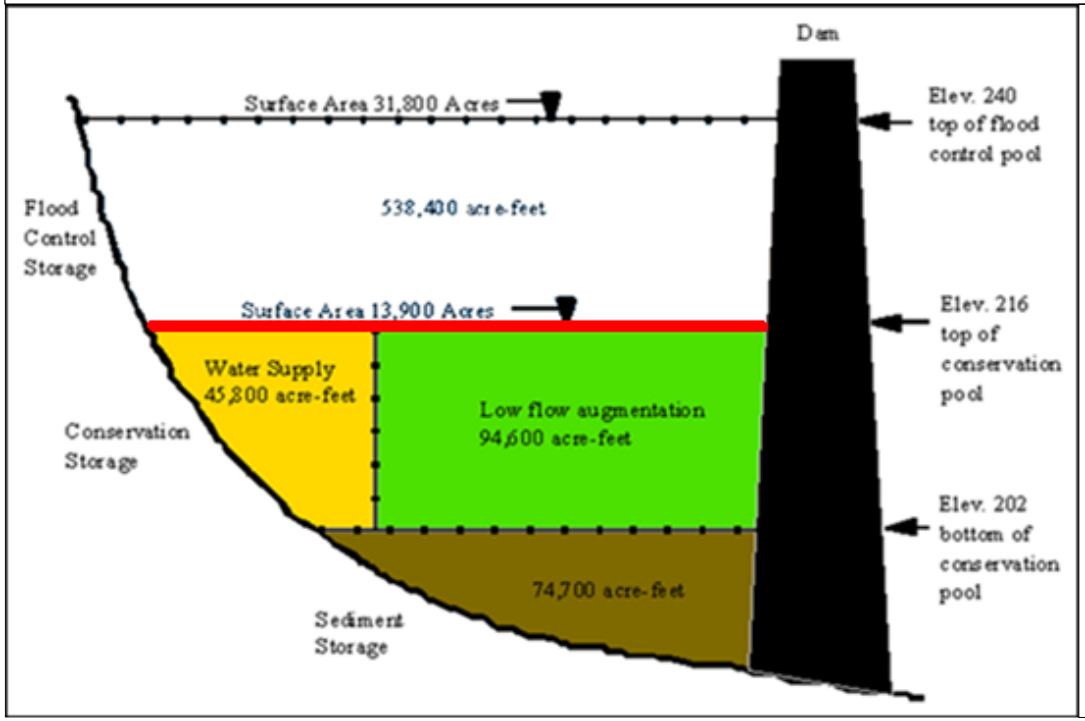
Allocating Water Supply Storage

Flood Control - manage downstream flows during high precipitation events

Water Supply – allocated by EMC

Flow Augmentation – maintain downstream flows for water quality

Sediment Storage – compensation for storage loss due to sedimentation



Flood Storage

100% **216-240 ft-msl**

Water Supply

32.62% **202-216 ft-msl**

Flow Augmentation

67.38% **202-216 ft-msl**

Sediment Storage

below 202 ft-msl

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Round 4 Timeline / Decision Criteria

- Round 4 Timeline
  - 2010 January - EMC authorizes Round 4
  - 2010-2014 Hydrologic Model revisions and application preparation
  - 2014 November – Applications submitted to DWR
  - 2016 January – Draft recommendations to Water Allocation Committee
  - 2016 Public review/comments and DWR revisions
  - 2017 January – Allocation recommendations to EMC

- Allocation Decisions
  - Based on need for water and commitment to reimburse costs
  - Limited to 30-year planning horizon (2045)
  - Limit diversions off the Jordan Lake watershed to 50% of yield
  - Allocations can be rescinded or reassigned by the EMC
  - If an allocation would lead to the need for an Interbasin Transfer Certificate the application for the IBT Certificate must be considered along with the allocation

Jordan Lake Water Supply Pool Yield Analysis

Estimated Jordan Lake Water Supply Yield									
Model Set Up	Return Flow Assumption			2010 Basecase Scenario			2060 Demand Scenario		
	%on Watershed	% Below Dam	%Out of Basin	Estimated Water Supply Yield (MGD)	Jordan Lake Minimum Elevation (ft-msl)	Minimum Water Supply Storage (%) 2/24/1934	Estimated Water Supply Yield (MGD)	Jordan Lake Minimum Elevation (ft-msl)	Minimum Water Supply Storage (%) 2/24/1934
1	0	0	100	104.06	202.65	0.65	112.92	203.03	0.79
2	100	0	0	156.94	204.30	1.07	169.66	204.06	1.18
3	0	100	0	104.98	203.55	0.74	113.84	203.36	1.60
4	50	50	0	125.44	203.88	2.69	136.69	203.67	0.96
5	50	0	50	124.19	202.69	0.86	134.86	203.07	0.87
6	0	50	50	104.00	202.65	0.71	112.92	203.03	0.73
7	25	75	0	114.63	203.70	1.17	124.81	203.50	0.81
8	25	0	75	113.25	202.67	0.73	122.91	203.05	0.85
9	75	25	0	140.31	204.07	0.95	151.45	203.86	0.97
10	0	25	75	103.99	202.65	0.75	112.92	203.03	0.77
11	75	0	25	137.56	202.71	0.89	149.55	203.04	1.02
12	0	75	25	104.00	202.65	0.70	112.92	203.03	0.71

Jordan Lake Flow Augmentation Analysis

Estimated Minimum Water Quality Pool Storage									
Model Set Up	Return Flow Assumption			2010 Basecase Scenario			2060 Demand Scenario		
	%on Watershed	% Below Dam	%Out of Basin	Minimum Water Quality Storage (%)	Date of Minimum Water Quality Storage	Number Days Water Quality = 0	Minimum Water Quality Storage (%)	Date of Minimum Water Quality Storage	Number Days Water Quality = 0
1	0	0	100	0.02	8/ 22/ 2002	0	0.00	8/ 9/ 2002	10
2	100	0	0	14.04	11/ 30/ 1953	0	9.94	2/ 24/ 1934	0
3	0	100	0	9.15	2/ 24/ 1934	0	4.08	2/ 24/ 1934	0
4	50	50	0	11.94	2/ 24/ 1934	0	7.03	2/ 24/ 1934	0
5	50	0	50	0.21	10/ 20/ 2007	0	0.11	8/ 22/ 2002	0
6	0	50	50	0.08	10/ 23/ 2007	0	0.00	8/ 21/ 2002	4
7	25	75	0	10.75	2/ 24/ 1934	0	5.99	2/ 24/ 1934	0
8	25	0	75	0.08	8/ 22/ 2002	0	0.03	8/ 22/ 2002	0
9	75	25	0	13.63	11/ 30/ 1953	0	8.43	2/ 24/ 1934	0
10	0	25	75	0.02	8/ 24/ 2002	0	0.00	8/ 14/ 2002	7
11	75	0	25	0.35	12/ 11/ 2007	0	0.26	8/ 29/ 2002	0
12	0	75	25	0.12	12/ 13/ 2007	0	0.08	12/ 11/ 2007	0

Requested Allocations

Allocations are defined as a percentage of storage in the water supply pool

63% water supply storage currently allocated

DWR received

- **10 applications for**
- **13 local governments**
- **105.9% of water supply pool requested**
- **95.9 % recommended allocations**

Round 4 Jordan Lake Water Supply Pool Allocation Requests			
Applicant	Current Allocation Percent	Requested Allocation Percent	DWR Recommended Allocation Percent December 2016
Cary,Apex,Morrisville,Wake Co.-RTP	39	46.2	46.2
Chatham Co.-North*	6	13	13.1
Durham*	10	16.5	16.5
Fayetteville PWC	0	10	0
Hillsborough	0	1	1
Holly Springs	2	2	2
Orange County	1	1.5	1.5
Orange WASA*	5	5	5
Pittsboro*	0	6	6
Raleigh	0	4.7	4.7
Total Percentage	63	105.9	95.9
*Western Intake Partners			

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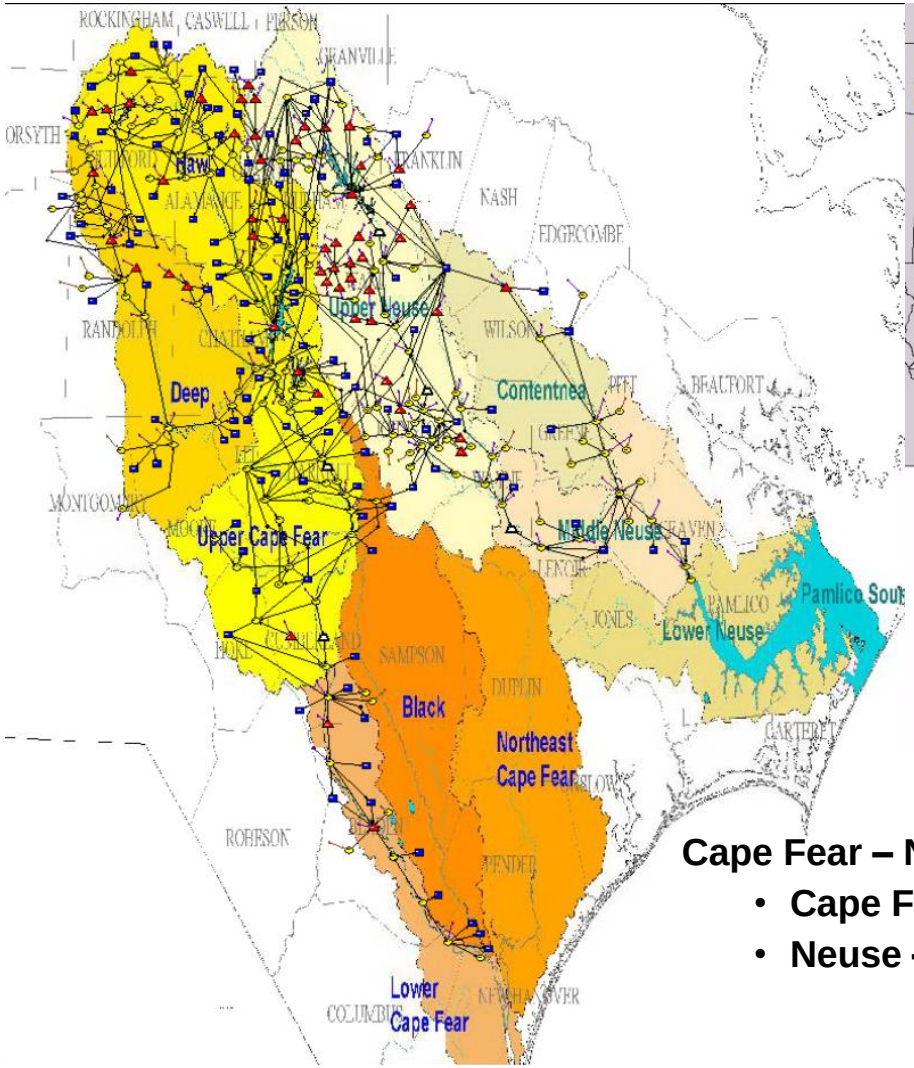
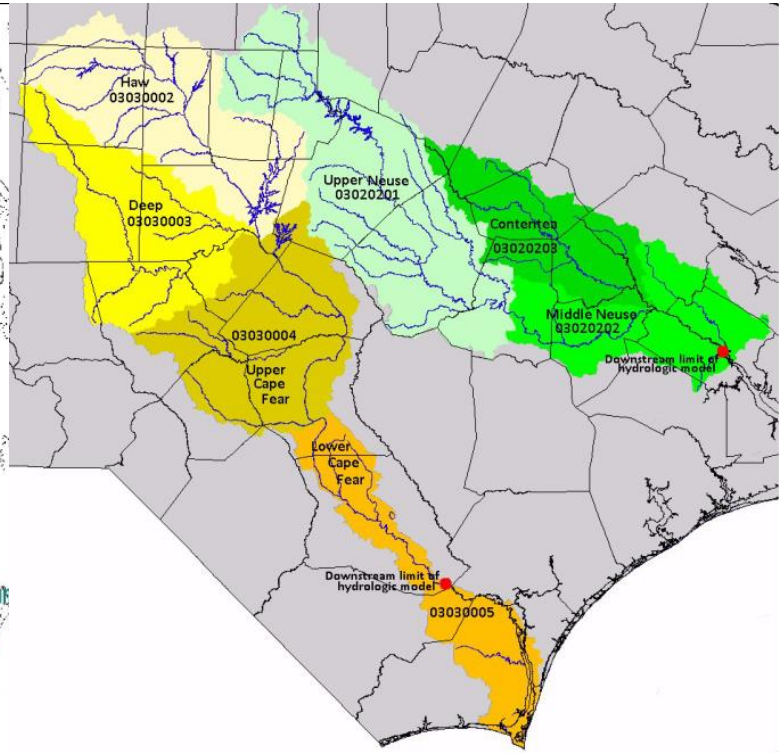
Applicant's 2045 Demands & Supply

Round 4 Jordan Lake Water Supply Allocation			DWR Recommendations			
	2045 Estimated Service Population	2045 Avg. Day Demand (mgd)	Current Jordan Lake Allocation (% storage)	2045 Non-Jordan Lake Supply (mgd)	Recommended Jordan Lake Allocation (% storage)	2045 Total Supply (mgd)
Cary, Apex, Morrisville, Wake Co.	344,150	45.82	39	0	46.2	46.2
Chatham County - North*	65,350	13.03	6	0	13	13
Durham*	393,924	39.98	10	27.9	16.5	44.4
Fayetteville PWC	398,380	65.41	0	105.7	0	105.7
Hillsborough	26,600	3.22	0	3.8	1	4.8
Holly Springs	68,371	6.23	2	10	2	12
Orange County	17,185	2.81	1	1.75	1.5	2.25
Orange Water and Sewer Authority*	129,950	11.32	5	12.6	5	17.6
Pittsboro*	83,500	9.92	0	6	6	12
Raleigh	1,048,700	97.02	0	77.3	4.7	82
Totals	2,576,110		63		95.9	
*Western Intake Partners						

Cape Fear-Neuse River Basins Hydrologic Model





Cape Fear – Neuse River Basins Hydrologic Model

- **Cape Fear – 30 SW withdrawals > 82 water systems**
- **Neuse – 13 SW withdrawals > 36 water systems**

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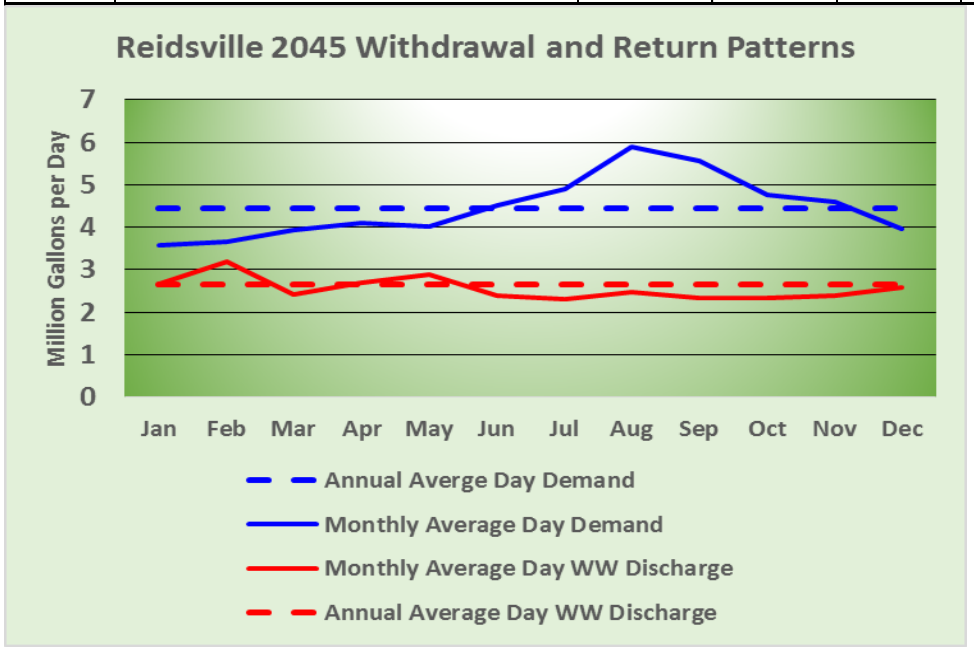
Modeling Withdrawals and Return Flows

Modeled Annual Average Surface Water Withdrawals and Return Flows in Million Gallons per Day (MGD)							
Model Node	Surface Water Withdrawer	Wastewater Proportion	2010 Current Conditions	2035 Estimated Demand	2045 Estimated Demand	2060 Estimated Demand	Estimate Type
31	Reidsville Demand_02-79-020		3.530	4.347	4.459	4.666	Demand
	Reidsville nc0046345 and nc0024881	0.594	2.097	2.582	2.649	2.772	WW Return
123	Greensboro Total Demand_02-41-010		35.240	48.485	55.312	67.399	Demand
	Lake Townsend nc0081671	0.132	4.652	6.400	7.301	8.897	WW Return
	North Buffalo Creek nc0024325	0.283	9.973	13.721	15.653	19.074	WW Return
	Ozborne nc0047384	0.737	25.972	35.733	40.765	49.673	WW Return
	Mitchell nc0081426	0.02	0.705	0.970	1.106	1.348	WW Return



- **Each water withdrawal is characterized by an individualized withdrawal and return flow pattern**
- **Municipal demand patterns vary by month**
- **Agricultural withdrawals vary by time of the year and precipitation**

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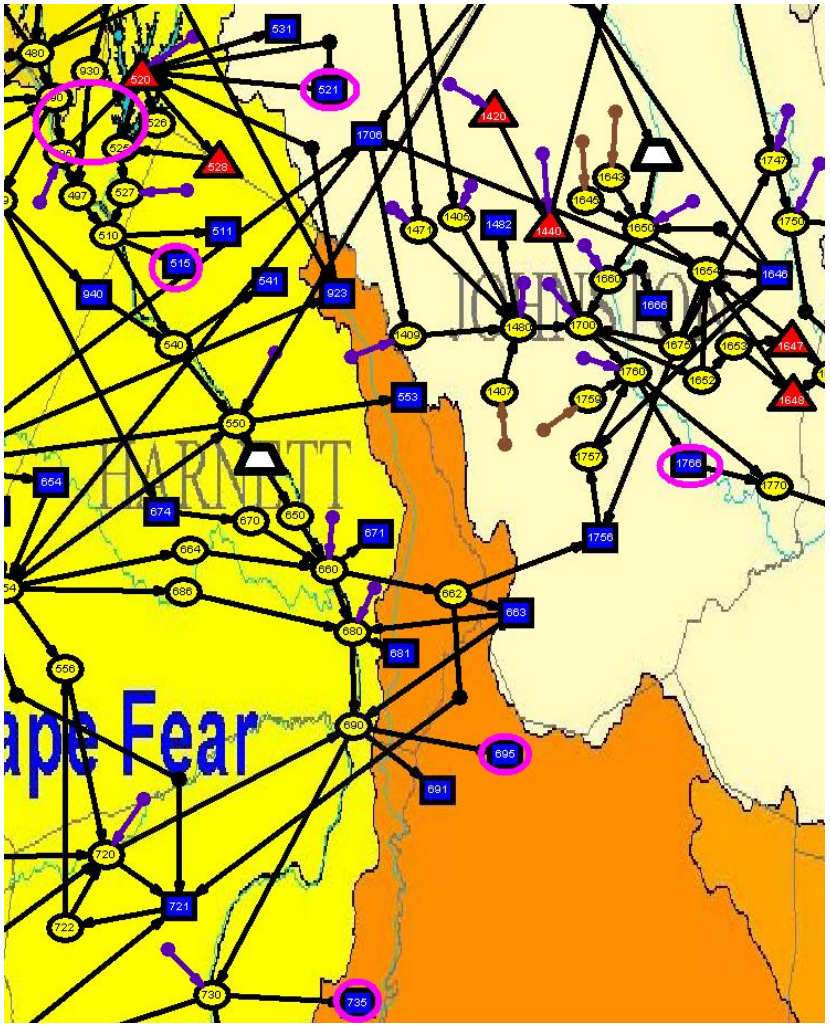
Model Additions for Electric Generation



Model revisions to address potential increases in net water withdrawals in 2045 to support increased electric generation capacity

- **Arc 495.520_Cape Fear River withdrawal to supplement Harris Lake**
- **35 mgd @ Node 521_Larger withdrawal for Harris Nuclear Station**
- **8 mgd @ Node 515_Possible Combined Cycle Station in Chatham County**
- **4 mgd @ Node 695_Possible Combined Cycle Station in Cumberland County**
- **8 mgd @ Node 735_Possible Combined Cycle Station in Southern Cumberland County**
- **4 mgd @ Node 1766_Possible Combined Cycle Station at HF Lee Energy Complex in Wayne County**

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Watershed Use Review

With the recommended allocations an estimated 44.2 % of the water supply pool withdrawals may not be returned to the Jordan Lake Watershed

Estimated Destination of Jordan Lake Water Use			
Applicant	Recommended Allocation Percent**	Percent of Water Supply Pool	
		On Jordan Lake Watershed	Off Jordan Lake Watershed
Cary,Apex,Morrisville,Wake Co.-R	46.2	13.2	33
Chatham Co.-North*	13	11	2**
Durham*	16.5	16.5	
Hillsborough	1		1
Holly Springs	2		2
Orange County	1.5		1.5
Orange WASA*	5	5	
Pittsboro*	6	6	
Raleigh	4.7		4.7
Fayetteville PWC	0		
Total Percentage	95.9	51.7	44.2
Estimated Percent of Water Supply Pool Off the Jordan Lake Watershed			44.2
*Western Intake Partners			
** Haw River Basin off Jordan Lake Watershed			

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Modeling Scenarios

Jordan Lake Water Supply Allocation Recommendations	
Model Scenario Descriptions	
Simbase_Current	This scenario models the baseline current conditons in 2010 based on available water supplies, infrastructure and customer demands at that time
0_Simbase_2045	Simbase indicates this scenario uses the quantity of water available to withdrawers in 2010 reported in local water supply plans and water withdrawal registration data submitted to DWR.
	2045 indicates this scenario is modeling the ability to meet the estimated water withdrawals needed to meet 2045 demands.
01_JLA_2045	JLA indicates this scenario uses the allocation amounts recommended in the Round 4 Jordan Lake Water Supply Allocation Recommendations_December 2016
	2045 indicates this scenario is modeling the ability to meet the estimated water withdrawals needed to meet 2045 demands. Demands for water systems not requesting an allocation from Jordan Lake are based on data provided in 2014 local water supply plans as well as data supplied as comments to the draft documents.
01_JLA_2045_Climate	JLA indicates this scenario uses the allocation amounts recommended in the Round 4 Jordan Lake Water Supply Allocation Recommendations_December 2016
	2045 indicates this scenario is modeling the ability to meet the estimated water withdrawals needed to meet 2045 demands. Demands for water systems not requesting an allocation from Jordan Lake are based on data provided in 2014 local water supply plans as well as data supplied as comments to the draft documents.
	Climate indicates the flow record used for this scenario was reduced by 10 percent for each day in the flow record.

Minimum Values Summary

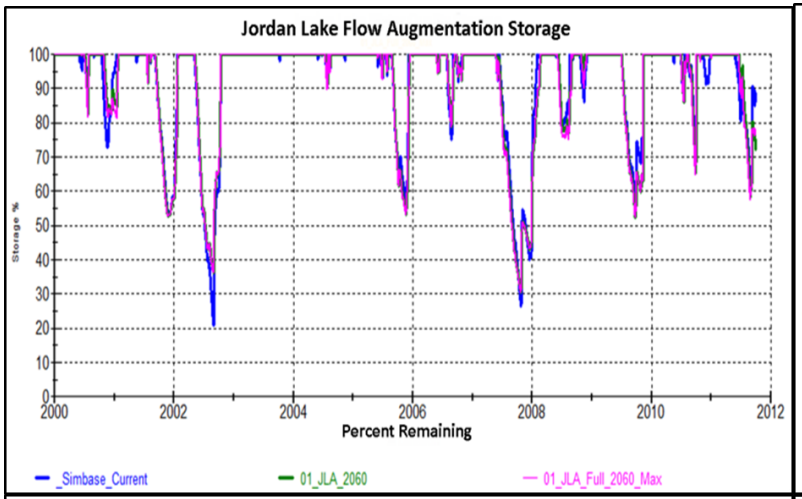
Jordan Lake Water Level and Water Supply Storage Minimums							
Model Scenario	Jordan Lake Water Level		Jordan Lake Water Supply Pool Critical Period (<100%)				
	Minimum Level, feet above mean sea level	Date of Minimum Water Level	Minimum Water Supply Storage %	Minimum Water Supply Period	Days in Minimum Supply Period	Longest Critical Period	Days in Critical Period
Simbase-current	209.7	8/30/2002	90.9	7/9/1953 - 12/9/1953	154	7/9/1953 - 12/9/1953	154
0_Simbase_2045	209.1	10/23/2007	63.5	5/2/2002 - 10/10/2002	162	5/17/1933 -2/26/1954	287
01_JLA_2045	207.9	12/1/1953	39.6	7/9/1953 - 1/16/1954	192	5/17/1933 - 3/7/1934	293
01_JLA_2045_Climate	207.5	10/23/2007	36.7	5/19/1933 - 3/19/1934	305	5/19/1933 - 3/19/1934	305

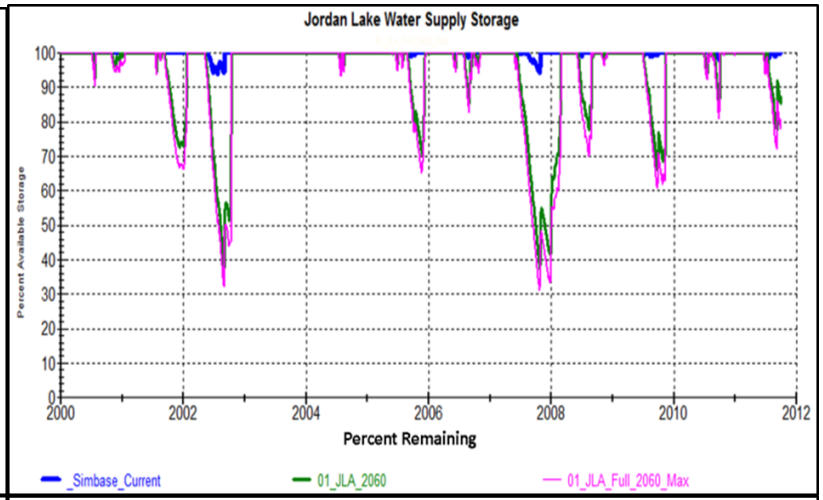
Minimums of Jordan Lake Flow Augmentation Pool and Streamflow at Lillington						
Model Scenario	Jordan Lake Flow Augmentation Pool		Streamflow at Lillington (cubic feet per second)			
	Minimum Storage, %	Date of Minimum	Lowest Daily Average Flow, cfs	Date	Years with Average Daily Flow <600cfs**	Days with Average Daily Flow <600cfs*
Simbase-current	20.82	8/30/2002	284.55	10/1/2007	61	4,274
0_Simbase_2045	25.98	10/23/2007	126.18	7/22/2002	65	5,191
01_JLA_2045	30.33	10/23/2007	168.87	8/19/2002	60	4,485
01_JLA_2045_Climate	27.72	10/23/2007	153.97	9/29/1968	64	5,123

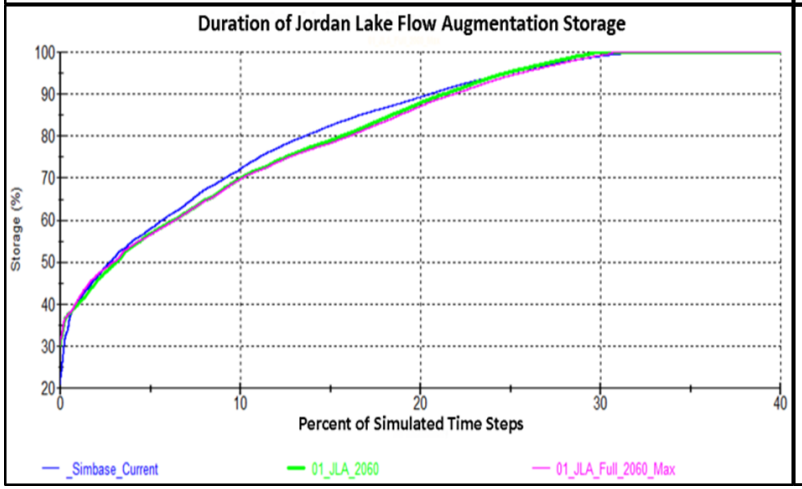
Note: * The flow record used for these model scenarios contains 29,858 days

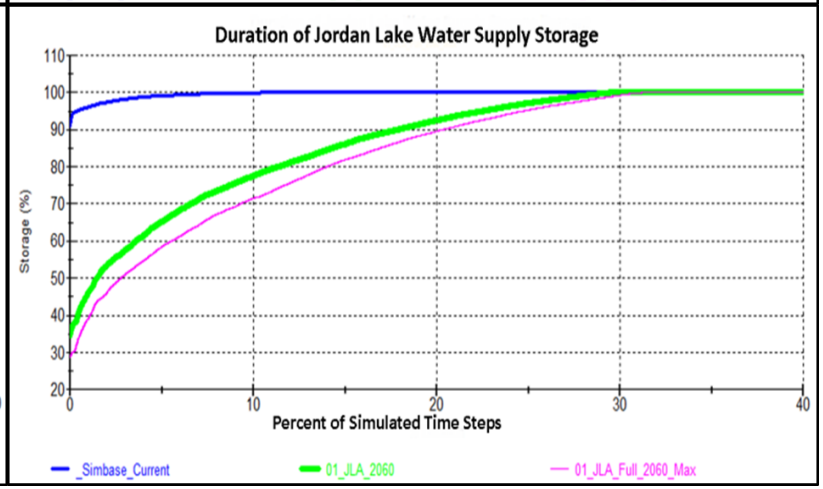
Note: ** The flow target at the Lillington streamgage is 600 ± 50 cubic feet per second. The counts of days when estimated flows may be below 600 cfs includes days when flows are estimated to be between 550 cfs and 600 cfs, not technically a violation of the flow target.

Changes in Conditions
Jordan Lake Storage Accounts









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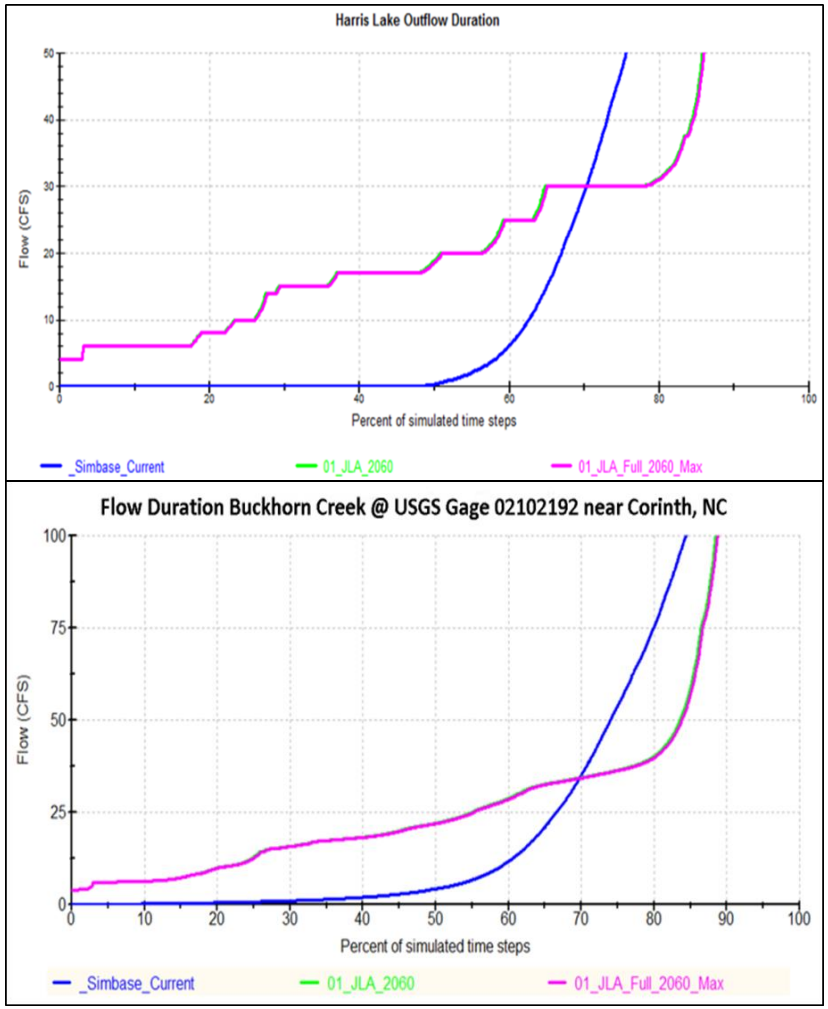
Harris Lake Outflow and Buckhorn Creek Flows



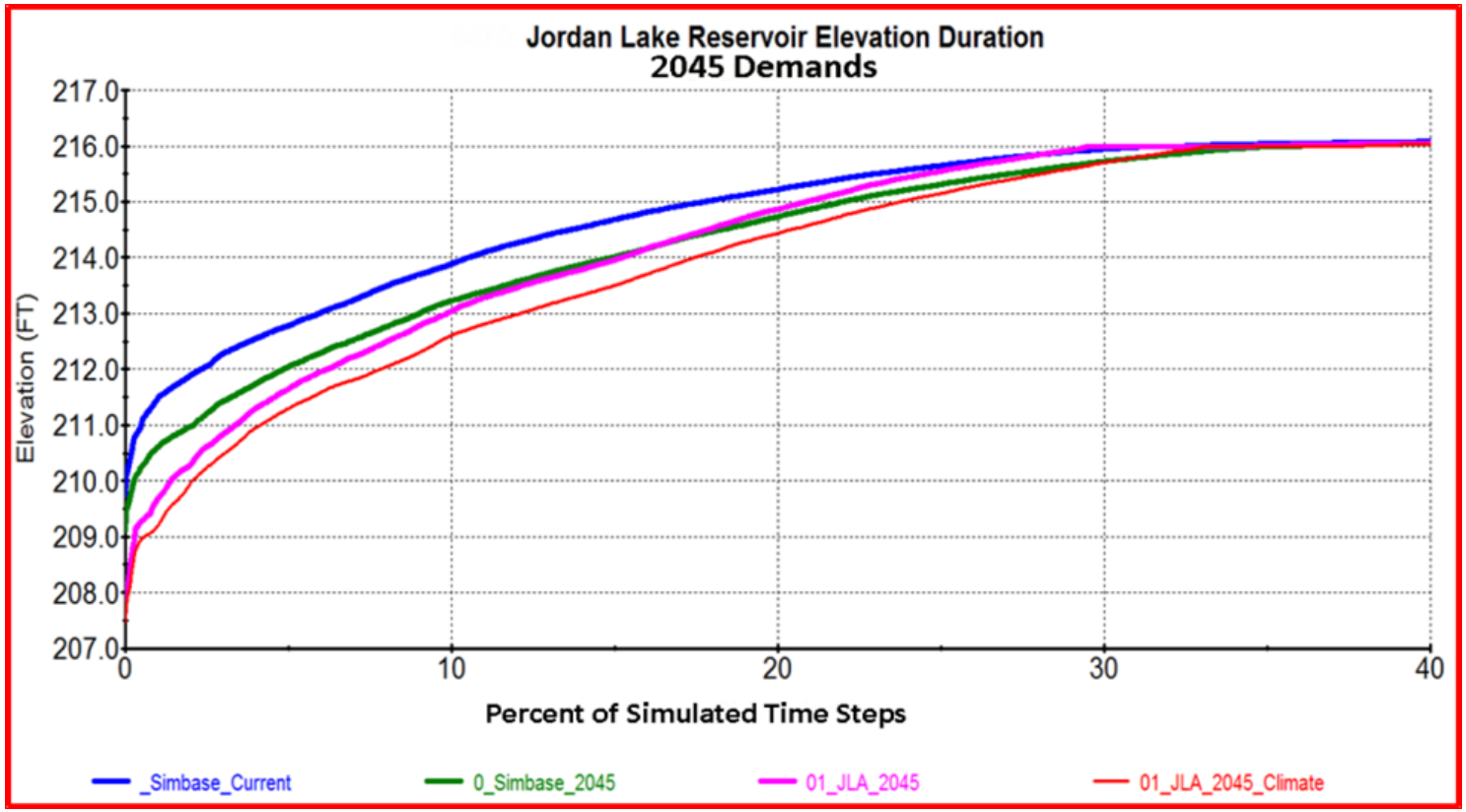
Before its acquisition by Duke Energy, Progress Energy proposed an increase to generating capacity at the Harris Nuclear Station in Wake County. Studies of that proposal identified needs to:

- **raise water level in the reservoir**
- **supplement inflow to Harris Lake using a withdrawal from the Cape Fear River**
- **require minimum releases from Harris Lake into Buckhorn Creek**

The revised hydrologic model used for the Cape Fear River Surface Water Supply Evaluation and the Jordan Lake Water Supply Allocation Recommendations includes these features

Jordan Lake Water Levels

Jordan Lake Water Levels for January to December over the 81-year period of record used in the modeling (ft-msl)



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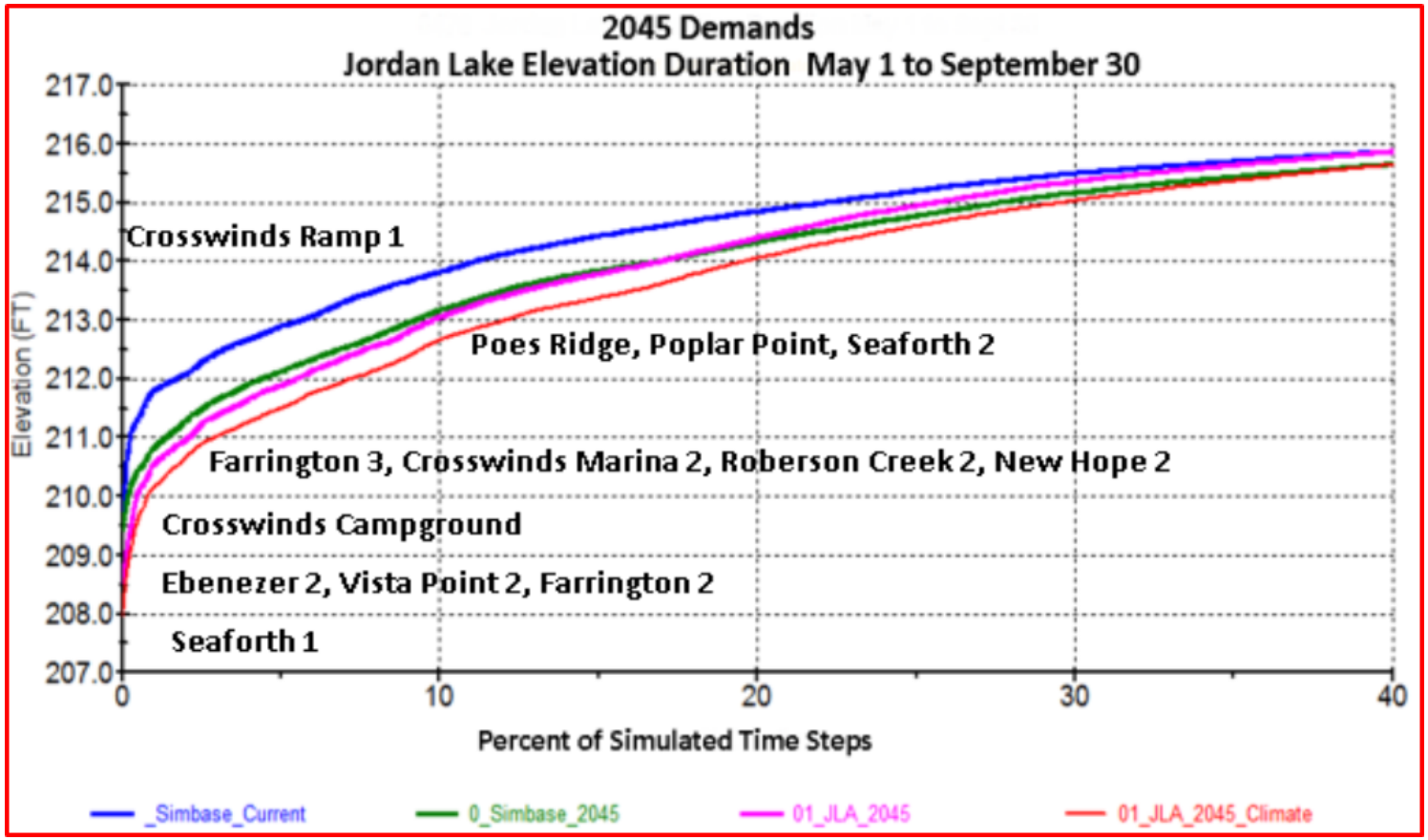
JL Recreation Season Water Levels

Jordan Lake Water Levels May1 to September30 with Boat Ramp Elevations



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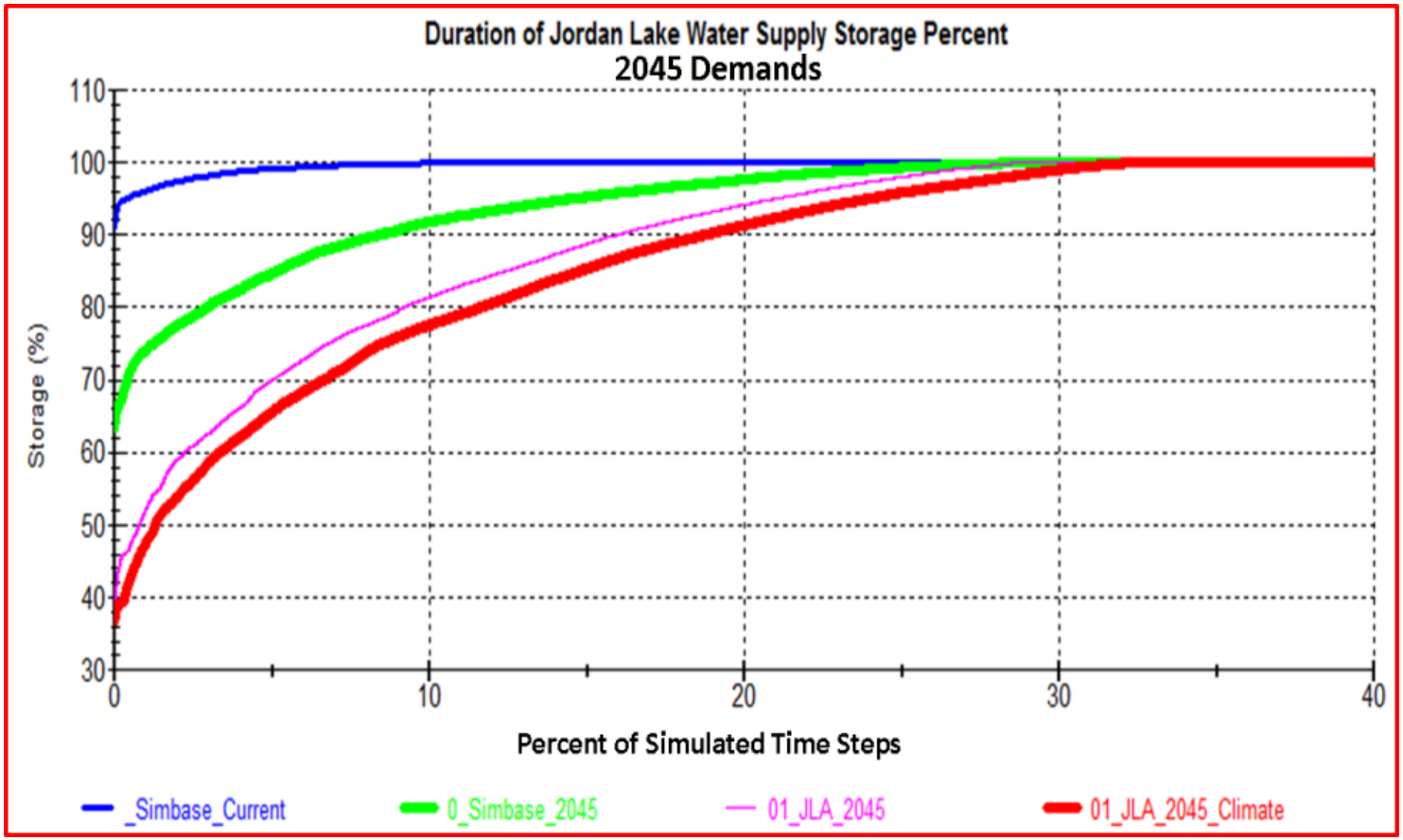
JL Water Supply Storage

Jordan Lake Water Supply Pool Percent of Storage



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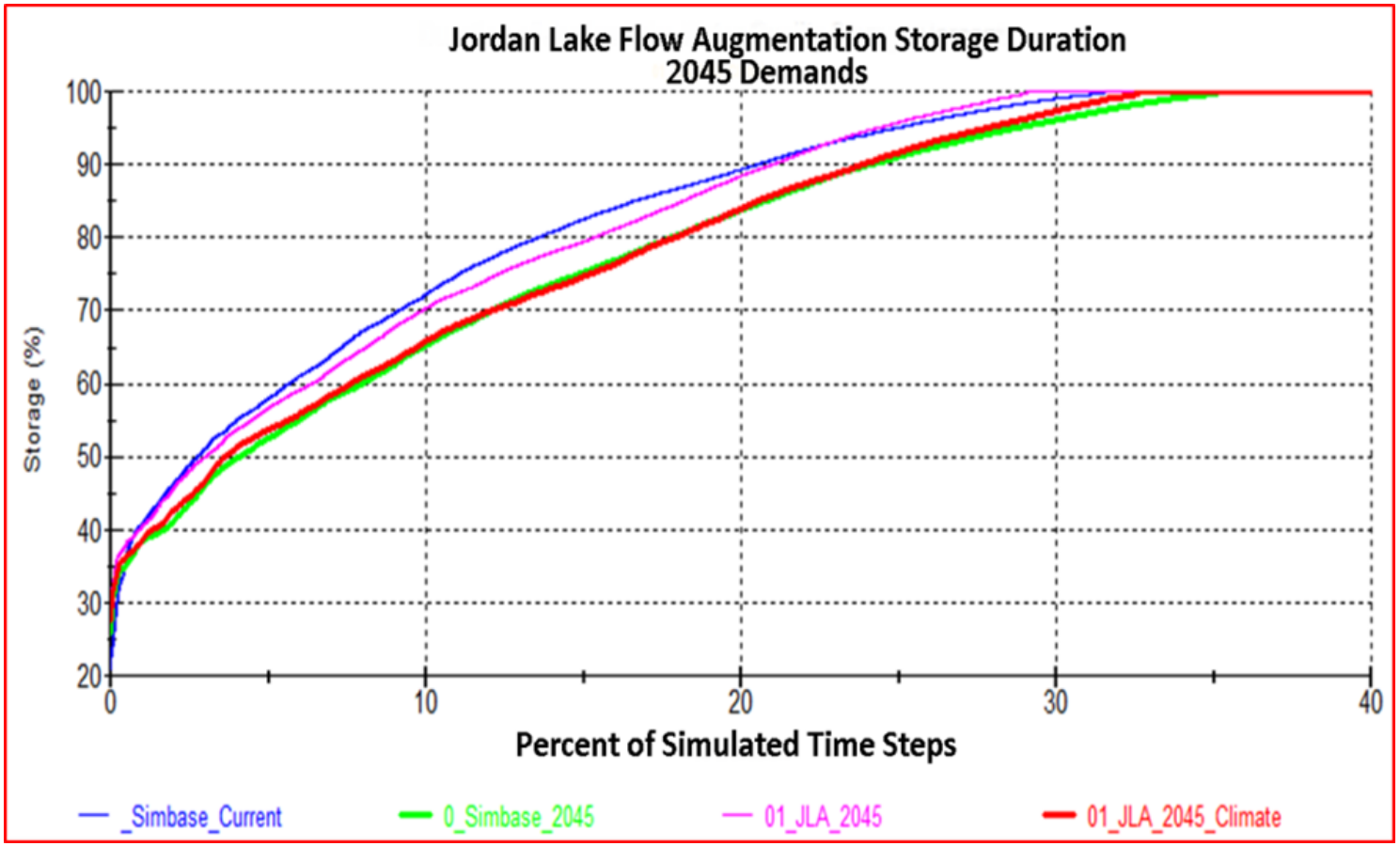
JL Flow Augmentation Storage

- Jordan Lake Flow Augmentation Pool Percent of Storage



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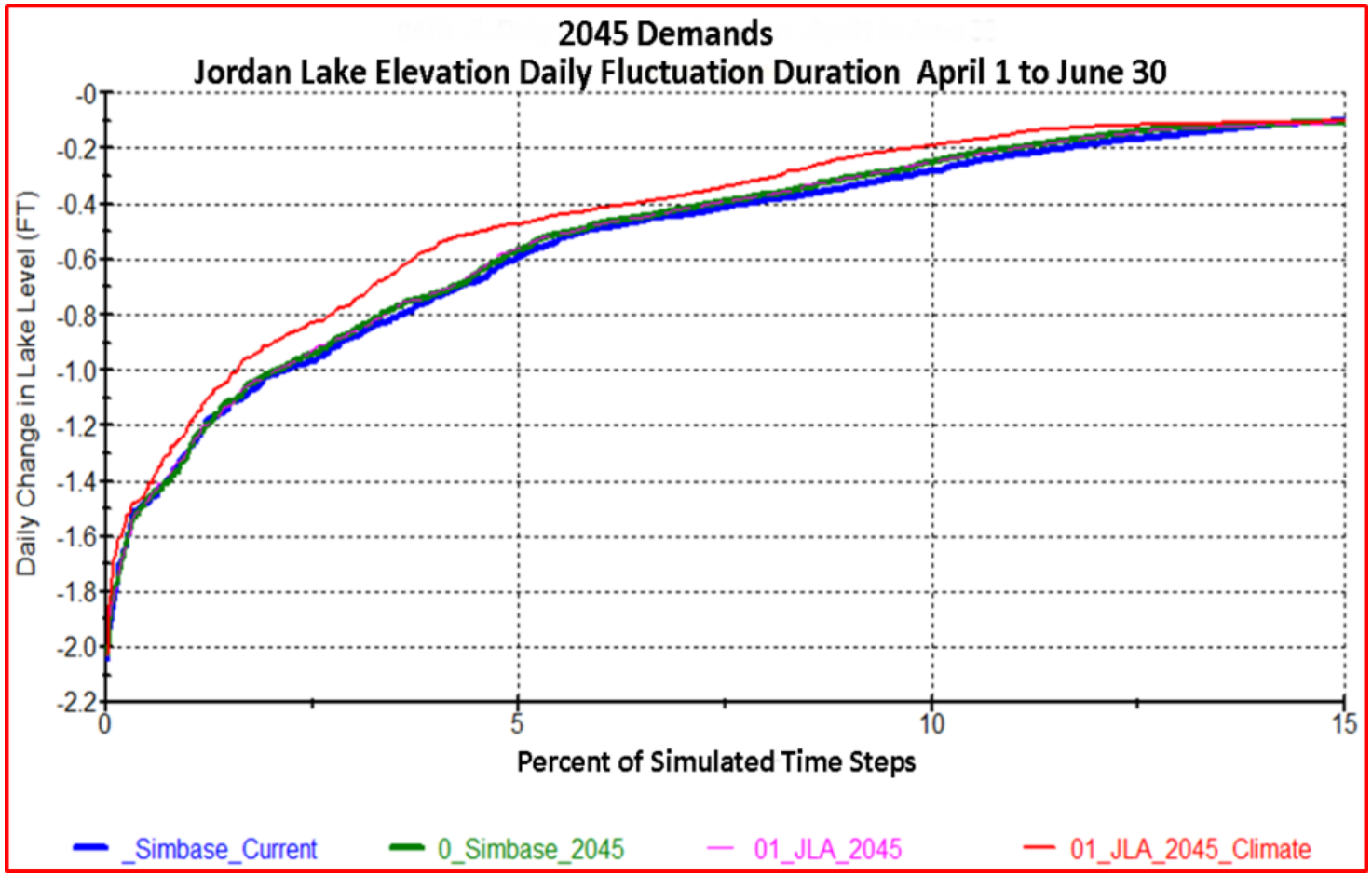
JL Daily Water Level Changes

Jordan Lake Daily Water Level Fluctuations April 1 to June 30



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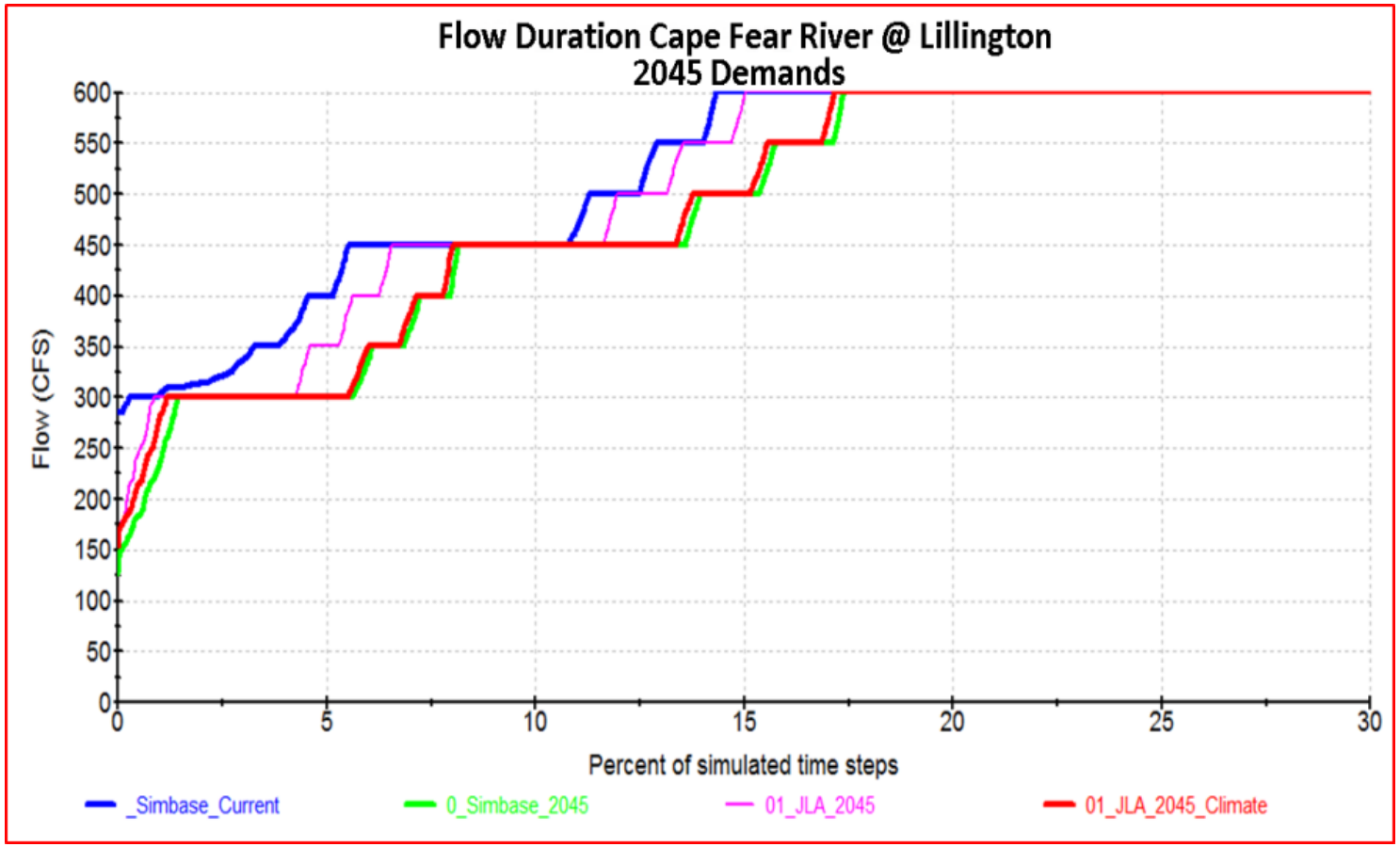
CFR Flow @ Lillington

Cape Fear River Flow @ Lillington



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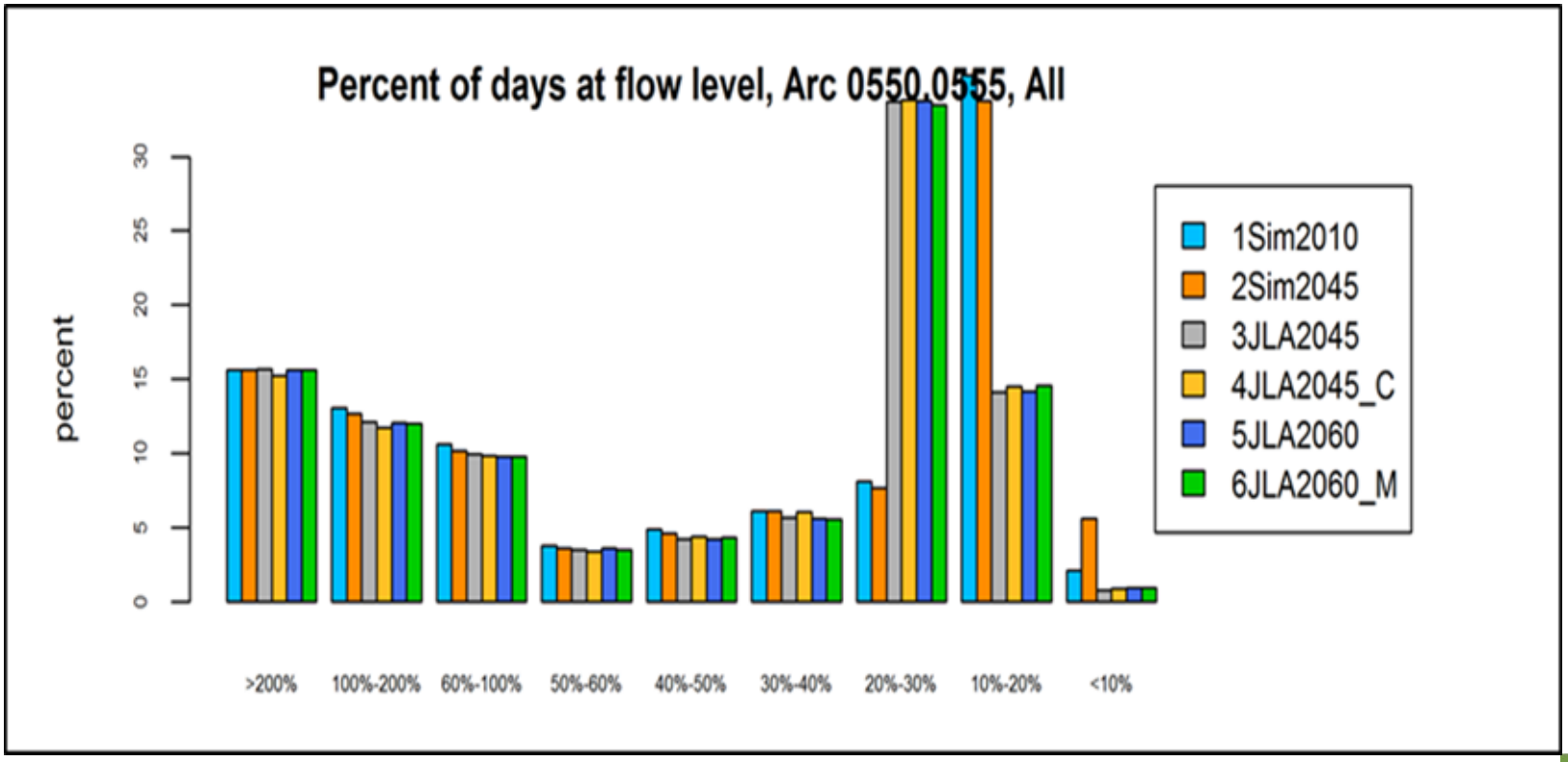
Cape Fear River at Lillington, NC. at USGS Gage 02102500

- **Percent of Mean Annual Flow**
  - **Current Conditions - 1 Sim2010 MAF = 3150 cfs**
  - **Recommended Allocations - 3 JLA2045 MAF = 2998 cfs**



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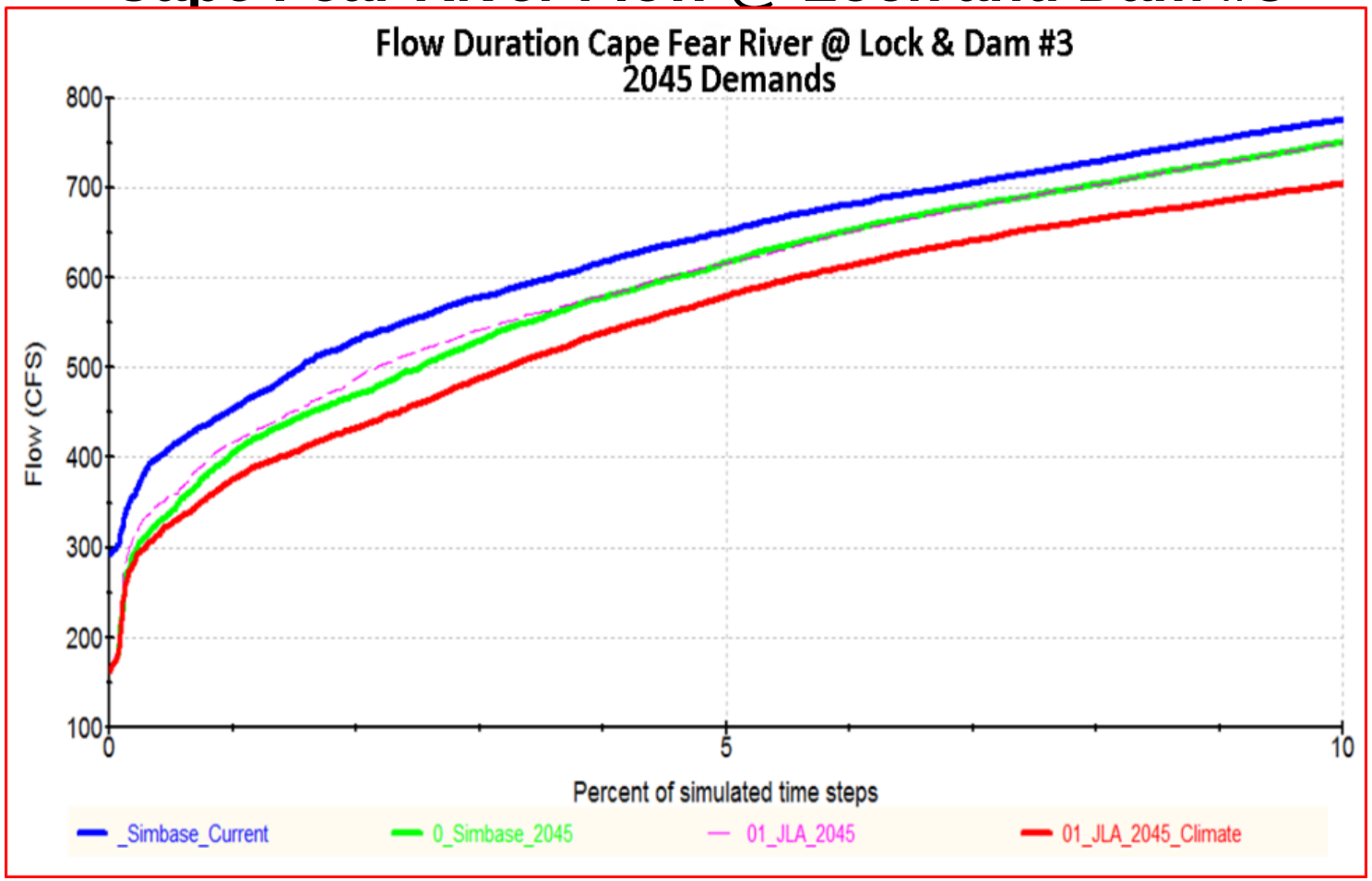
Cape Fear River Flow @ Lock and Dam #3



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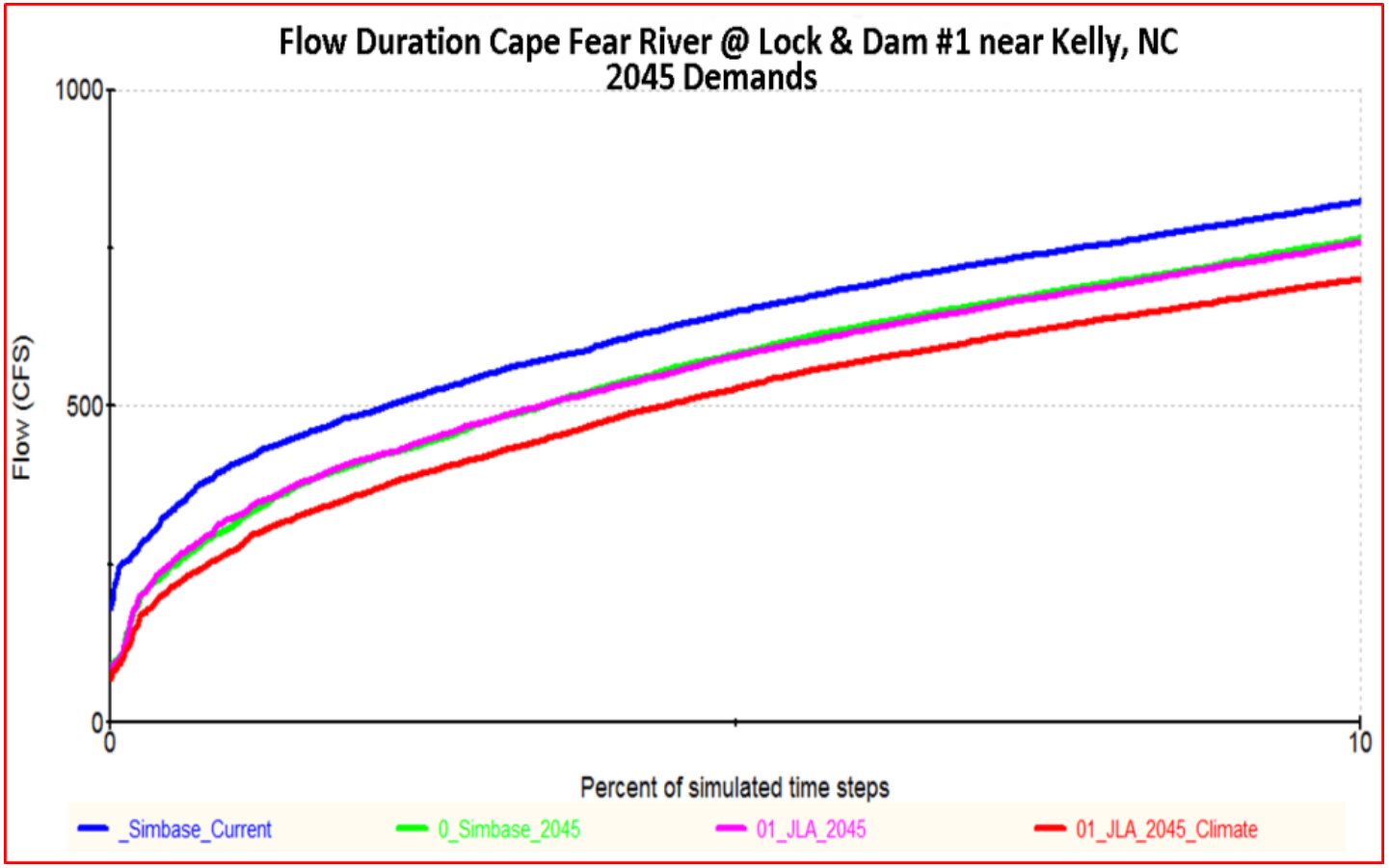
Cape Fear River Flow @ Lock and Dam #1 Hydrologic Model Terminal Node



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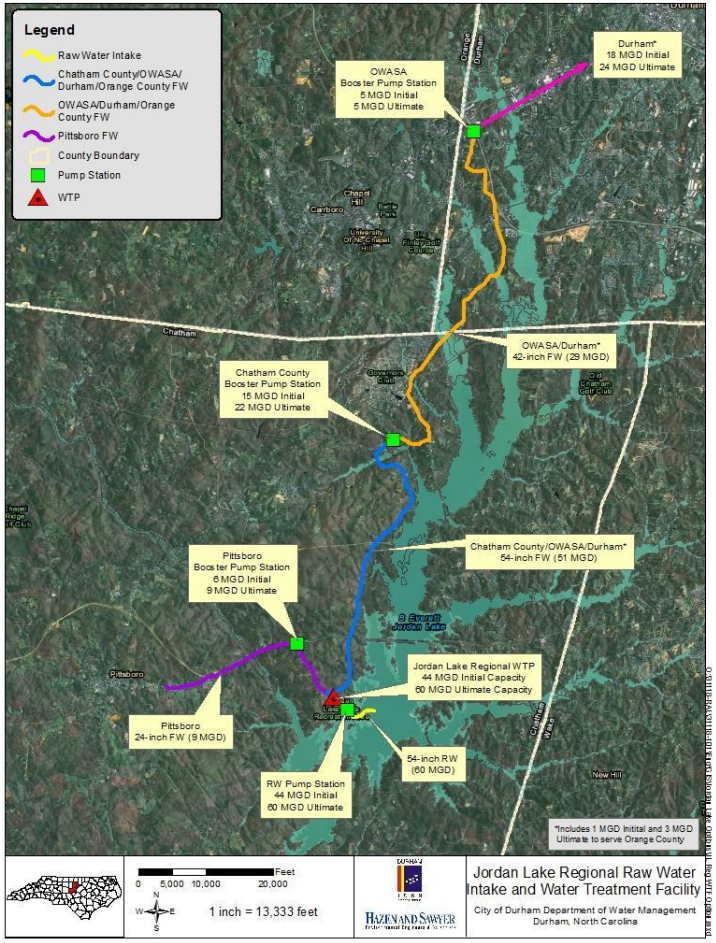
Western Jordan Lake Intake Proposal

- Western Jordan Lake Intake and Water Treatment Plant
- Partners
  - Durham
  - Orange Water and Sewer Authority
  - Pittsboro
  - Chatham County-North
- Construct Intake, WTP and transmission lines to access allocations if approved
- Optimizes use of water supply storage
  - Estimated yield > 100 mgd
  - Current raw water pumping capacity 80 mgd



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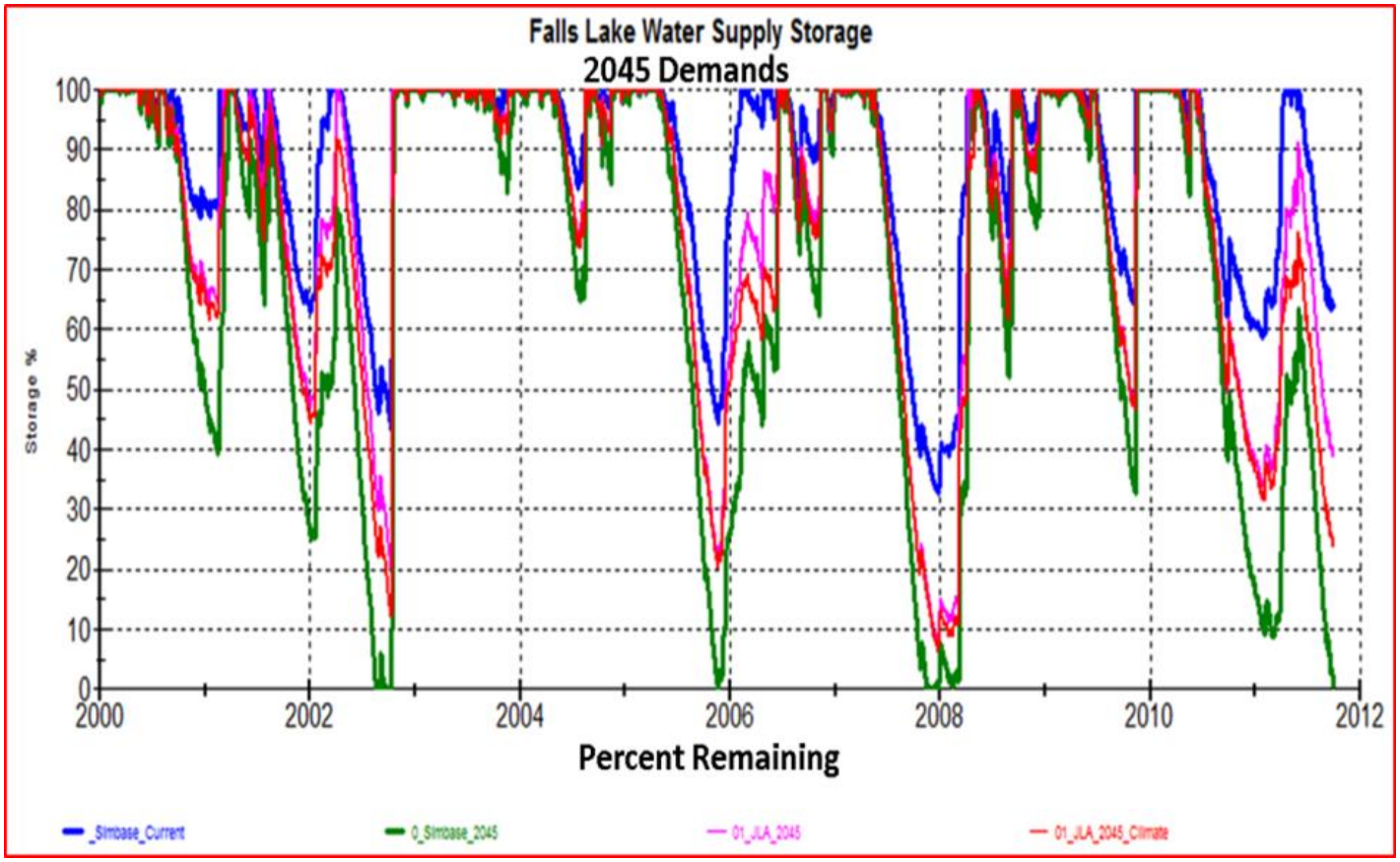
Falls Lake Water Supply Storage

2000-2012

Raleigh needs additional sources of water



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Conclusions

- The projections of future water supply sources includes increased use of water from the Jordan Lake water supply pool.
- The modeling results are inextricably linked to the wastewater return flows estimated in the model. If the wastewater return proportions vary from those modeled the conclusions will change.
- The model DOES NOT reserve water to protect ecological integrity. If this becomes a requirement in the future the modeling results and conclusions will change.
- Water Quality may present difficulties treating raw water to drinking water standards
- Presence of critical habitat my limit the ability to withdraw the desire amount of water
- Modeling indicates that except for the issues noted the water systems using surface water from the Deep River, Haw River, Cape Fear River, Neuse River and Contentnea Creek Subbasins are not expected to face flow related shortages over the range of flow conditions captured by the 81 years of historic data.

Allocation Recommendations

DWR requests approval of the following allocations of the Jordan Lake Water Supply Pool

Round 4 Jordan Lake Water Supply Pool Allocation Recommendations			
Applicant	Current Allocation Percent	Requested Allocation Percent	DWR Recommended Allocation Percent December 2016
Cary,Apex,Morrisville,Wake Co.-RTP	39	46.2	46.2
Chatham Co.-North*	6	13	13.1
Durham*	10	16.5	16.5
Fayetteville PWC	0	10	0
Hillsborough	0	1	1
Holly Springs	2	2	2
Orange County	1	1.5	1.5
Orange WASA*	5	5	5
Pittsboro*	0	6	6
Raleigh	0	4.7	4.7
Total Percentage	63	105.9	95.9
*Western Intake Partners			

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