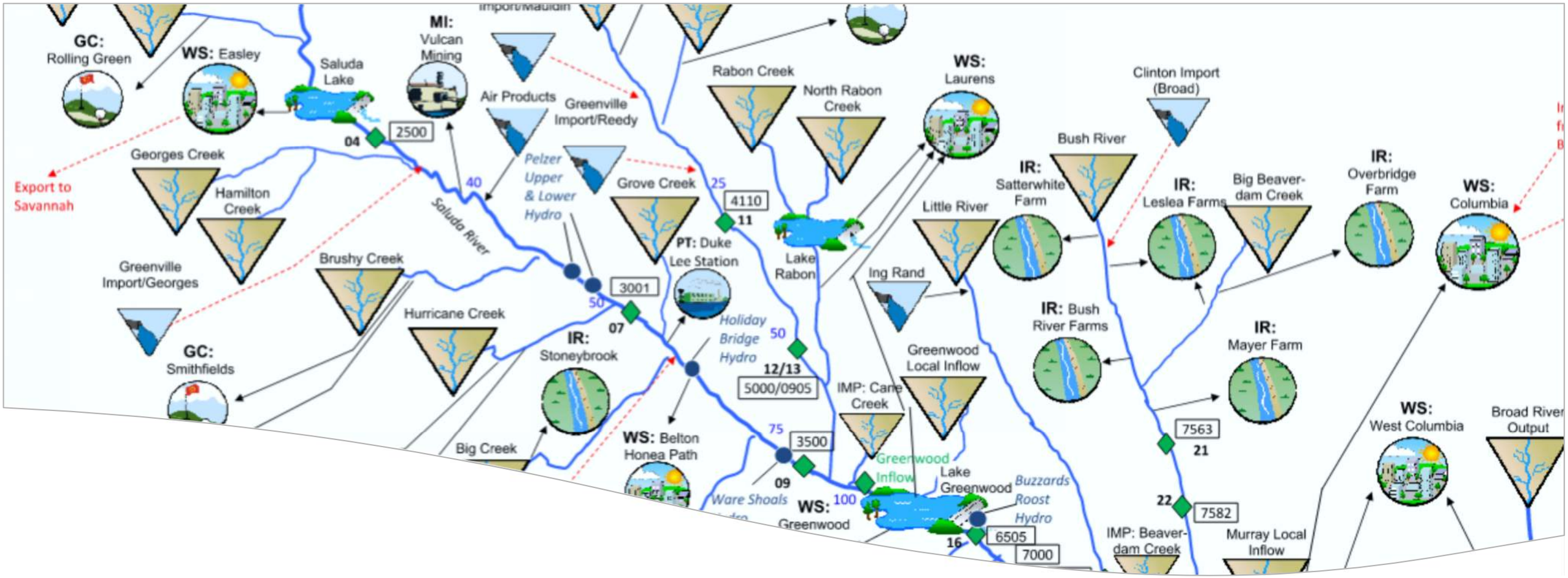


Surface Water Availability Modeling Results of Initial Planning Scenarios

John Boyer

Agenda Item 6

River Basin Planning Process

Phase 2	- **Evaluate current and future water availability issues** - Identify and quantify shortages, select surface water conditions, reaches of interest and groundwater areas of concerns
Phase 3	- Develop and evaluate **water management strategies** - Recommend and prioritize strategies

Surface Water Scenarios

Base Scenarios

- Current Surface Water Use Scenario
  - *Uses most recent 10-yr average withdrawals (as reported by month) in most cases*
- Permitted and Registered (P&R) Surface Water Use Scenario
  - *Uses current fully-permitted and registered amounts*
- Moderate Water Demand Projection Scenario
  - *Future water demand projection based on moderate growth and normal climate*
- High Water Demand Projection Scenario
  - *Future water demand projection based on high growth and hot/dry climate*

Additional Scenarios

- Unimpaired Flow (UIF) Scenario
  - *Naturalized conditions (no surface water withdrawals, discharges, or reservoirs)*

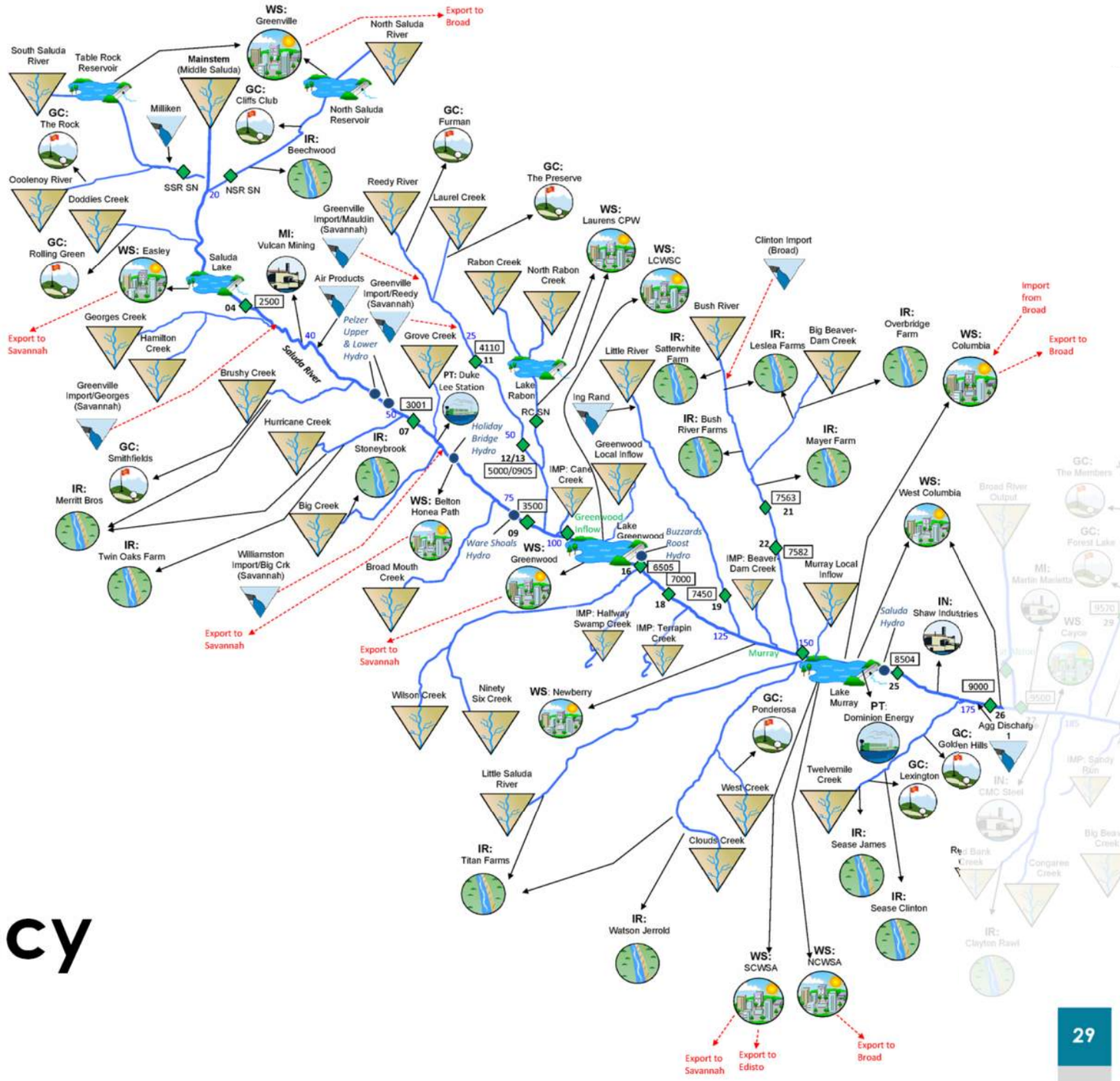
Summary of Average Annual Surface Water Demands by Scenario (in MGD)

Surface Water Use Sector	Current Use	Permitted and Registered (P&R)	Current Use as a Percent of P&R
Mining	0.1	0.5	14%
Agriculture	2.7	15.2	18%
Golf Courses	0.6	10.1	6%
Industrial/Manufacturing	24.9	44.9	55%
Public Water Supply	142.6	525.1	27%
Thermoelectric[1]	171.2	502.0	34%
Total all Sectors*	342	1,098	31%
Total without Thermoelectric*	171	596	29%

** Rounded to nearest MGD*

[1] Approximately 76% of the thermoelectric withdrawals are returned

Preliminary Planning Scenario Model Results (monthly timestep)

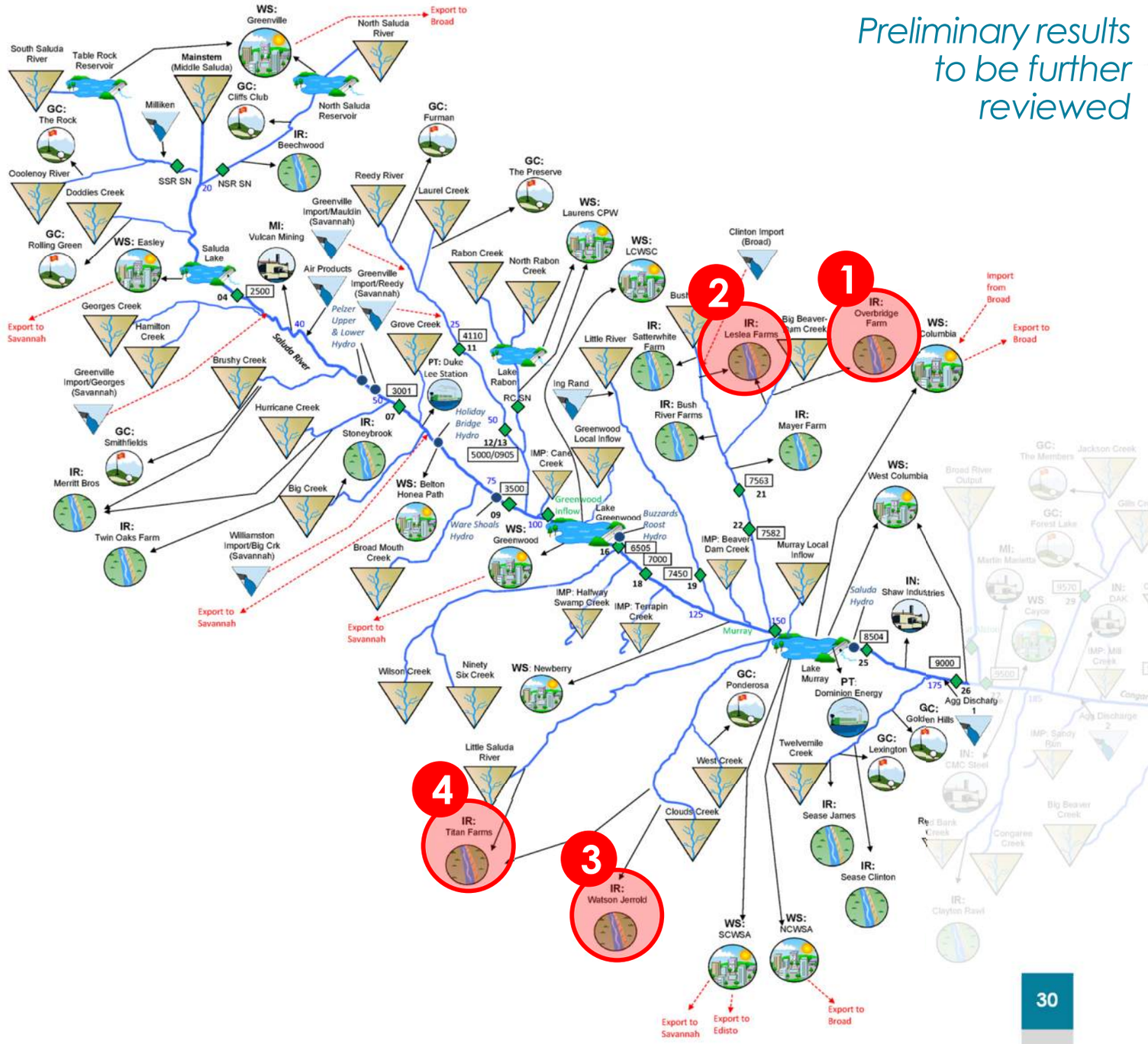


Where do we see simulated shortages and at what frequency and magnitude?

Current Use Scenario

Preliminary results to be further reviewed

1 **Physical Shortage**

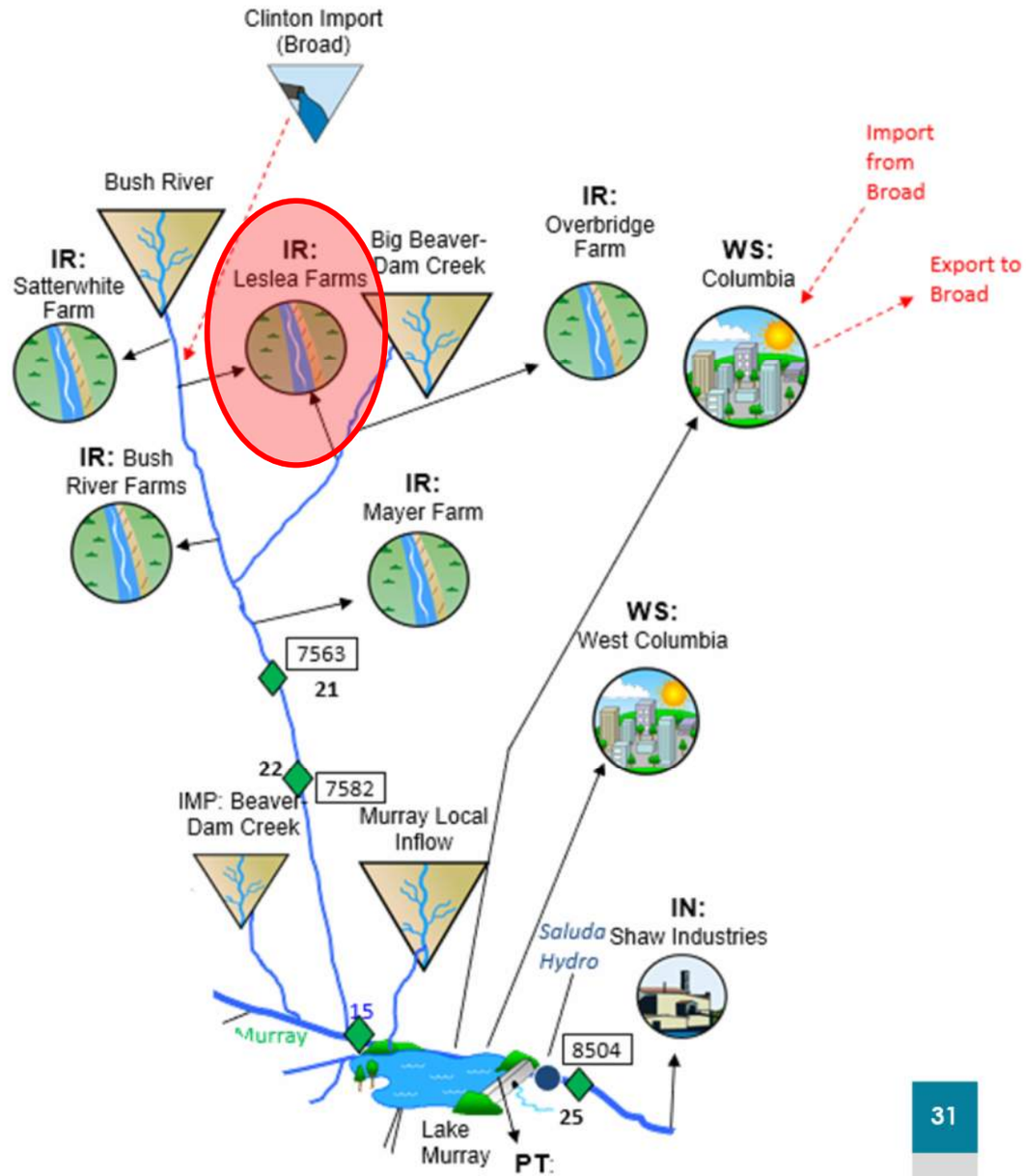


Surface Water Shortage Table

Map ID	Water User	Max Shortage (MGD)	Frequency of Shortage
1	IR: Overbridge Farm	0.03	0.2%
2	IR: Leslea Farms	0.02	0.1%
3	IR: Watson Jerrold Farm	0.9	14%
4	IR: Titan Farms	1.5	9%

IR: Leslea Farms
Impoundments totaling 9 acres

Surface water user with storage not included in the model

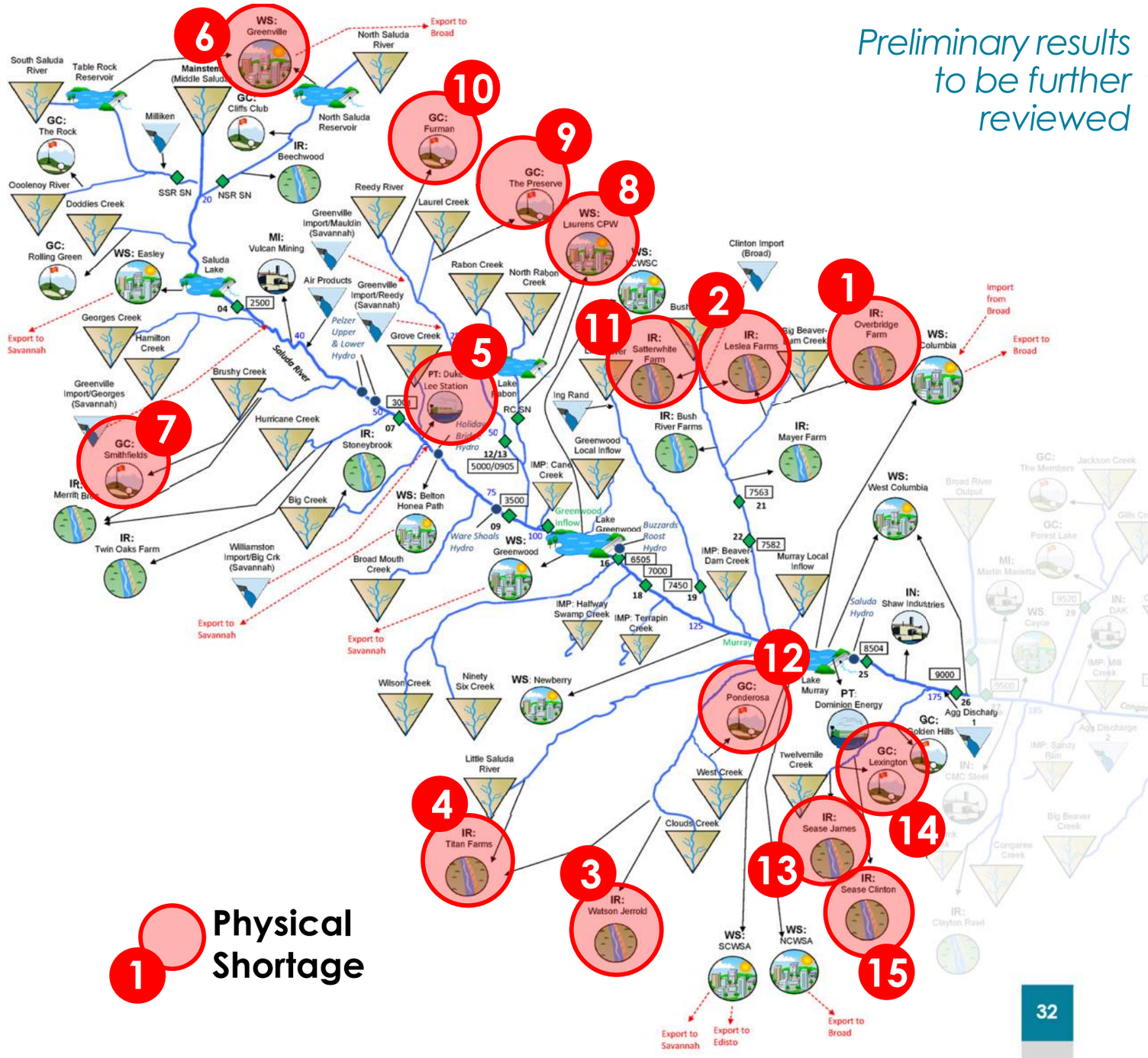


Permitted & Registered Scenario

Preliminary results to be further reviewed

Surface Water Shortage Table

Map ID	Water User	Max Shortage (MGD)	Frequency of Shortage
1	IR: Overbridge Farm	0.3	5%
2	IR: Leslea Farms	0.5	9%
3	IR: Watson Jerrold	5.9	76%
4	IR: Titan Farms	3.0	40%
5	PT: Duke Lee Station	295	38%
6	WS: Greenville	123	94%
7	GC: Smithfields	1.4	6%
8	WS: Laurens CPW	65	70%
9	GC: The Preserve	1.3	8%
10	GC: Furman	1.3	6%
11	IR: Satterwhite Farm	0.1	0.1%
12	GC: Ponderosa	0.6	0.2%
13	IR: Sease James	0.9	0.9%
14	GC: Lexington	0.03	0.1%
15	IR: Sease Clinton	0.7	0.9%



Summary of Water Supply Shortages

Supply Shortage Metric	Current Use	Permitted & Registered
Total basin annual mean shortage (MGD)	0.09	121.2
Maximum water user shortage (MGD)	1.5	295.1
Total basin annual mean shortage as a percentage of total water demand	0.03%	11%
Percentage of surface water users experiencing a shortage	10.5%	39%
Average frequency of shortage (%)	0.6%	10%

This is Table 3 of the memo

Strategic Nodes

South Saluda River (SSR SN)

North Saluda River (NSR SN)

SLD11 Reedy River above Fork Shoals

Rabon Creek (RC SN)

SLD04 Saluda River near Greenville

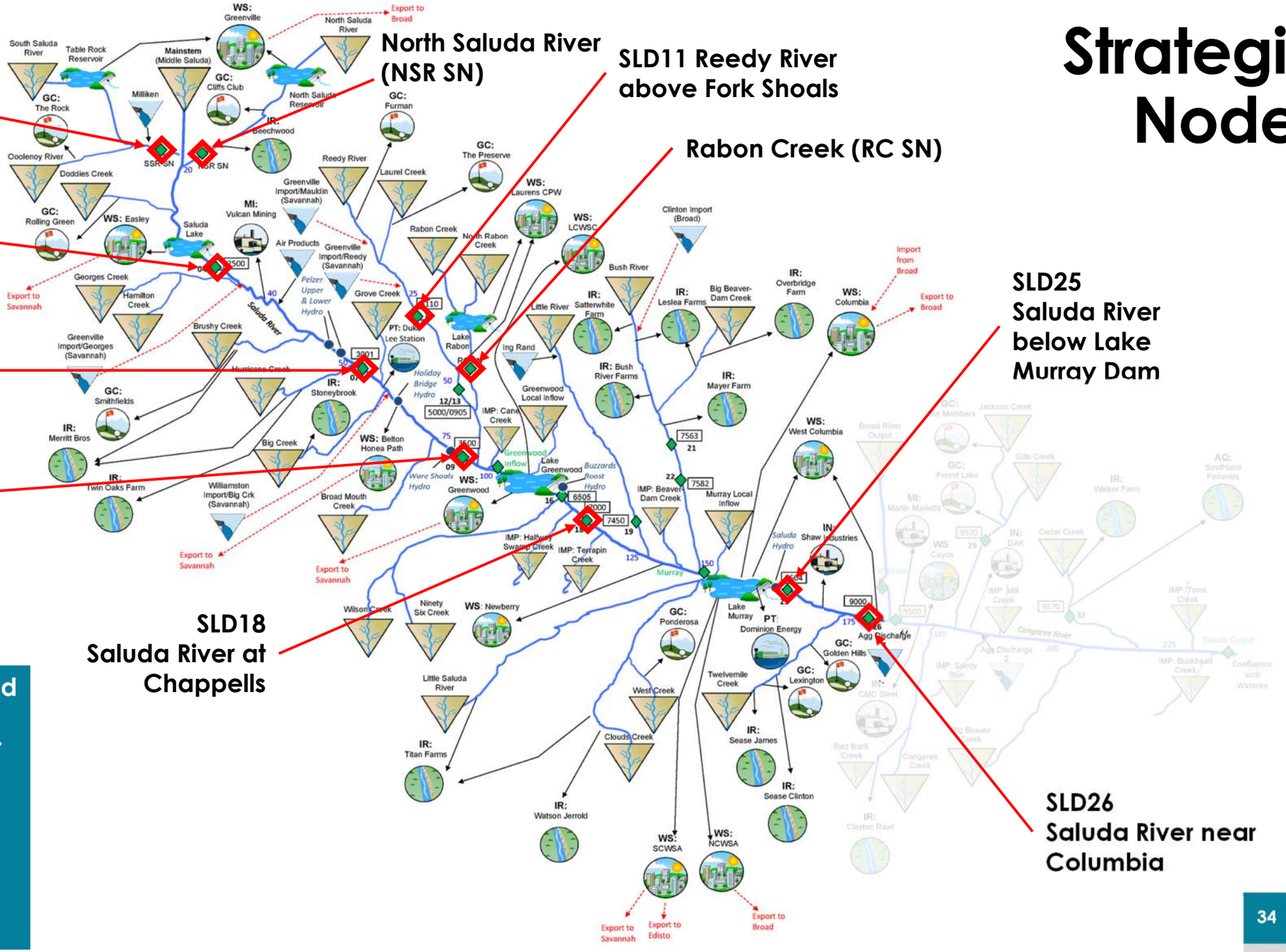
SLD07 Saluda River near Williamston

SLD09 Saluda River near Ware Shoals

SLD18 Saluda River at Chappells

SLD25 Saluda River below Lake Murray Dam

SLD26 Saluda River near Columbia



Strategic nodes are located on all major streams and rivers, downstream of most withdrawals and discharges. For wadable streams, they also they represent potential locations to evaluate flow-ecology relationships.

Hydrologic Performance Measures at Strategic Nodes

Performance Measure	SLD04 Saluda River Near Greenville	SLD07 Saluda River Near Williamston	SLD09 Saluda River Near Ware Shoals	SLD18 Saluda River at Chappells	SLD25 Saluda River Below Lake Murray Dam Near Columbia	SLD26 Saluda River Near Columbia	South Saluda River Strategic Node	North Saluda River Strategic Node	Rabon Creek Strategic Node	SLD11 Reedy River Above Fork Shoals
	All values in CFS									
Unimpaired Flow (UIF) Scenario										
minimum flow	101	125	148	255	302	317	40	26	3.3	33
mean flow	661	827	994	1,793	3,020	3,106	269	164	105	198
median flow	568	717	848	1,458	2,196	2,261	231	142	79	158
25th percentile flow	391	491	586	963	1,405	1,456	159	98	43	100
10th percentile flow	287	357	424	672	971	1,014	114	71	26	68
5th percentile flow	231	287	340	527	754	783	93	60	21	53
Current Use Scenario										
minimum flow	71	100	116	231	501	516	30	21	0.1	43
mean flow	589	761	922	1,668	2,600	2,687	218	157	100	210
median flow	491	645	773	1,373	1,792	1,859	175	134	75	170
25th percentile flow	325	429	522	858	956	1,004	118	90	39	111
10th percentile flow	232	303	361	567	701	746	84	62	21	79
5th percentile flow	180	240	288	428	701	733	70	48	16	63
Permitted and Registered (P&R) Scenario										
minimum flow	24	60	29	63	501	514	30	19	0.04	33
mean flow	495	678	444	1,080	1,894	1,976	199	126	30	217
median flow	417	574	254	691	858	914	169	109	2.5	177
25th percentile flow	267	381	98	408	701	744	117	75	1.5	111
10th percentile flow	180	261	68	229	501	538	83	54	0.9	72
5th percentile flow	131	201	56	133	501	528	70	45	0.6	55

This is Table 4 of the memo

Difference in Simulated Flows for Current Use and UIF Scenarios at Strategic Nodes

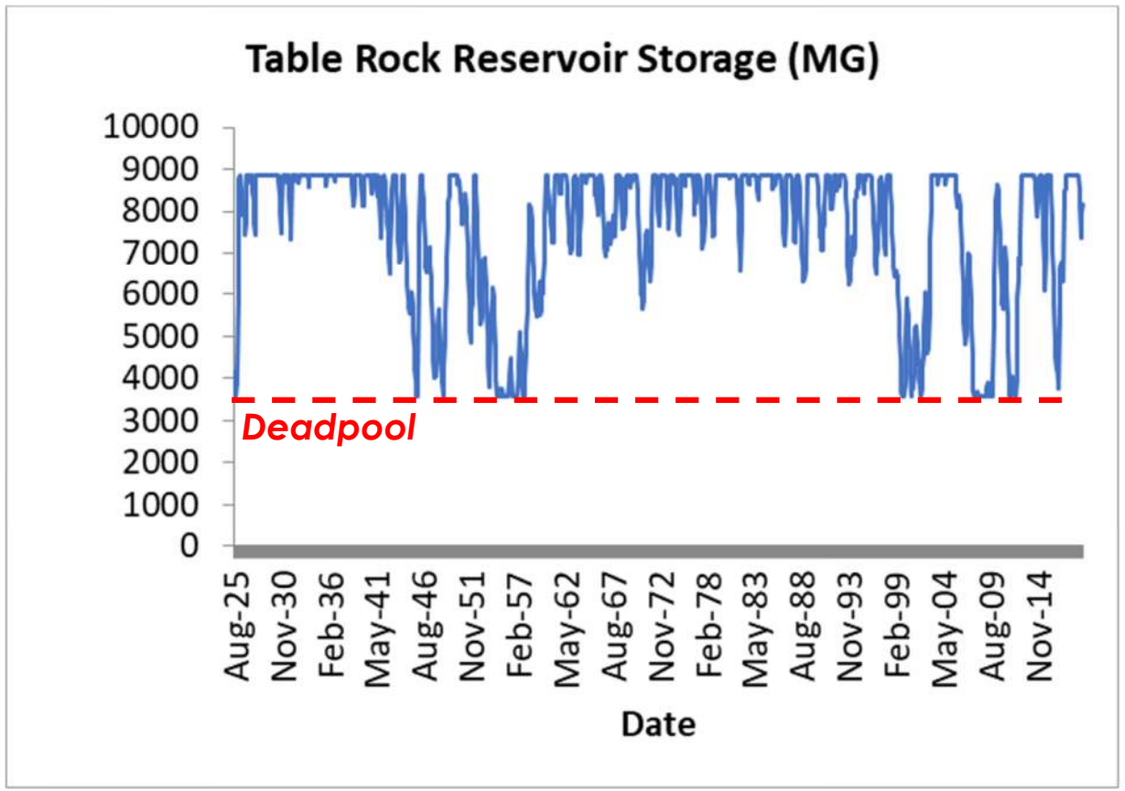
Performance Measure	SLD04 Saluda River Near Greenville	SLD07 Saluda River Near Williamston	SLD09 Saluda River Near Ware Shoals	SLD18 Saluda River at Chappells	SLD25 Saluda River Below Lake Murray Dam Near Columbia	SLD26 Saluda River Near Columbia	South Saluda River Strategic Node	North Saluda River Strategic Node	Rabon Creek Strategic Node	SLD11 Reedy River Above Fork Shoals
Unimpaired Flow (UIF) Scenario										
minimum flow	101	125	148	255	302	317	40	26	3	33
mean flow	661	827	994	1,793	3,020	3,106	269	164	105	198
median flow	568	717	848	1,458	2,196	2,261	231	142	79	158
25th percentile flow	391	491	586	963	1,405	1,456	159	98	43	100
10th percentile flow	287	357	424	672	971	1,014	114	71	26	68
5th percentile flow	231	287	340	527	754	783	93	60	21	53
Current Use Scenario flow minus UIF Scenario flow (cfs)										
minimum flow	-31	-25	-33	-24	198	199	-10	-5	-3	10
mean flow	-71	-65	-71	-125	-419	-419	-50	-7	-4	11
median flow	-76	-72	-75	-85	-404	-402	-55	-7	-5	12
25th percentile flow	-66	-62	-64	-105	-449	-452	-41	-8	-4	11
10th percentile flow	-55	-54	-63	-105	-270	-268	-30	-9	-5	11
5th percentile flow	-51	-48	-53	-99	-53	-50	-23	-12	-6	11
Percent Difference between Current Use Scenario flow and UIF Scenario flow										
minimum flow	-43%	-25%	-28%	-10%	40%	39%	-32%	-23%	-2636%	24%
mean flow	-12%	-9%	-8%	-8%	-16%	-16%	-23%	-4%	-4%	5%
median flow	-15%	-11%	-10%	-6%	-23%	-22%	-32%	-5%	-6%	7%
25th percentile flow	-20%	-14%	-12%	-12%	-47%	-45%	-35%	-9%	-11%	10%
10th percentile flow	-24%	-18%	-18%	-18%	-39%	-36%	-36%	-14%	-24%	14%
5th percentile flow	-28%	-20%	-18%	-23%	-8%	-7%	-33%	-26%	-36%	17%

Negative percent differences indicate lower flow in the Current Use or P&R Scenario, compared to the UIF Scenario

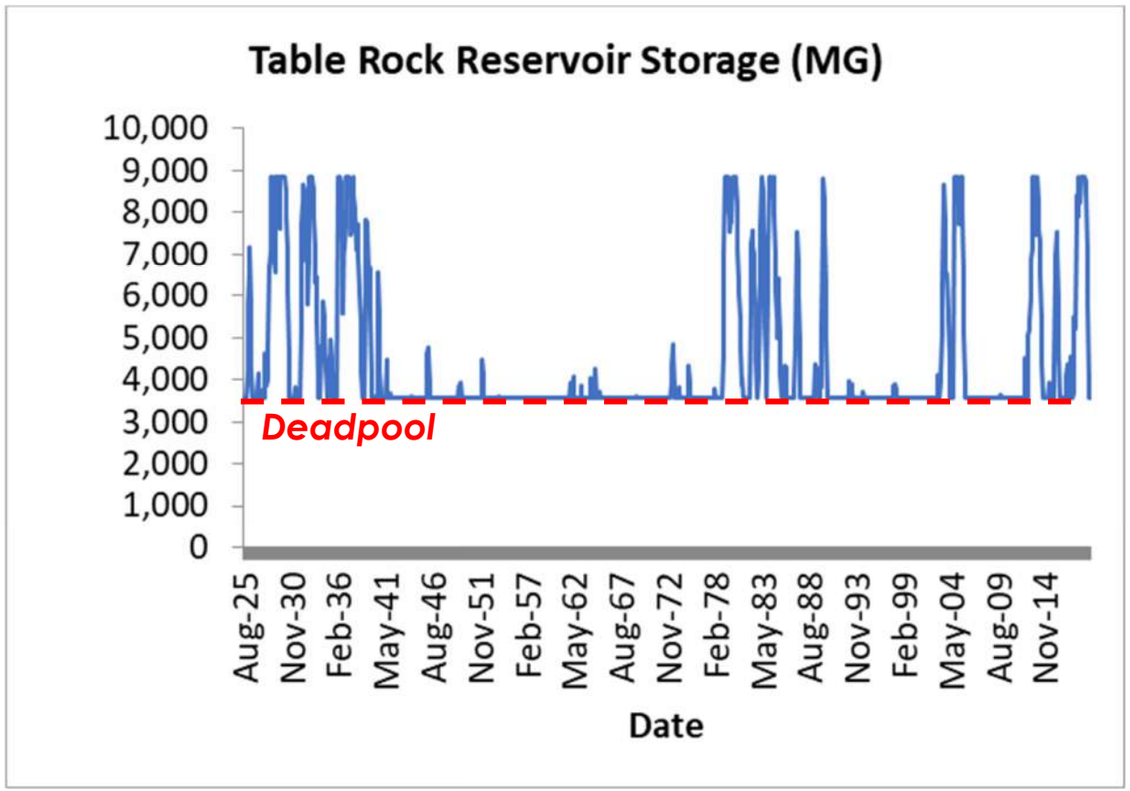
This is a portion of Table 5 of the memo

Reservoir Storage – Table Rock Lake

Current Use Scenario

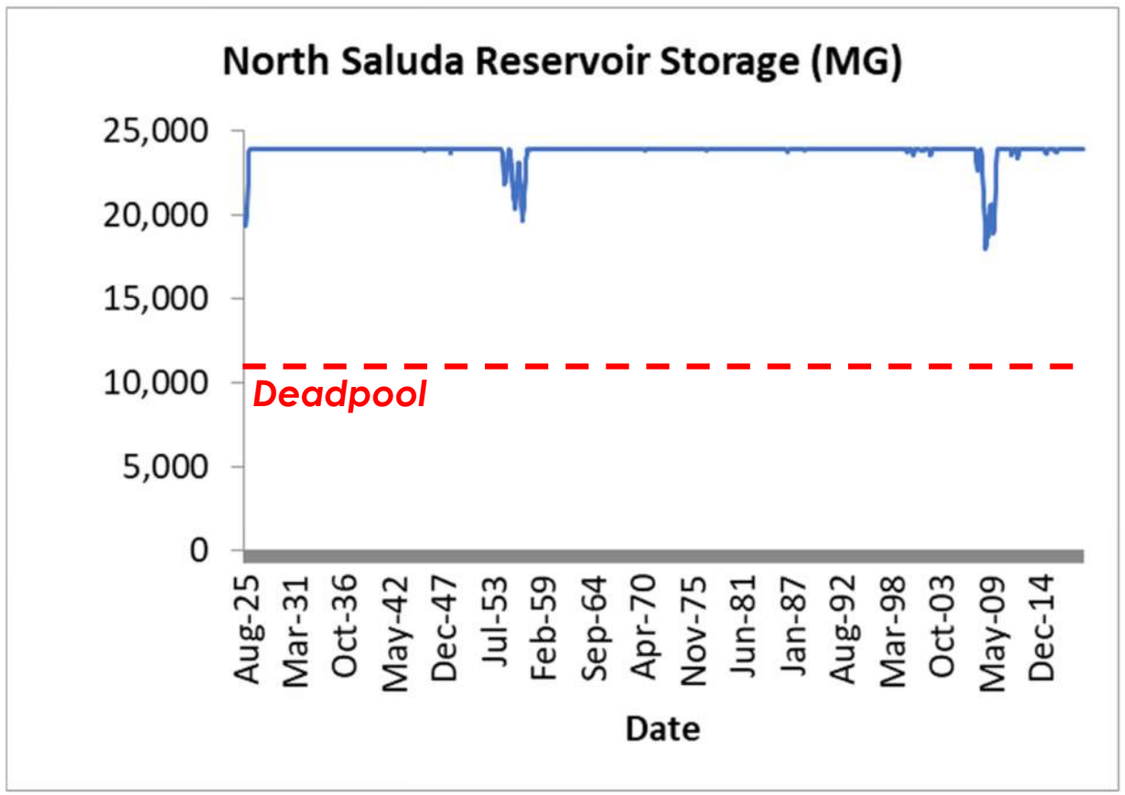


P&R Scenario

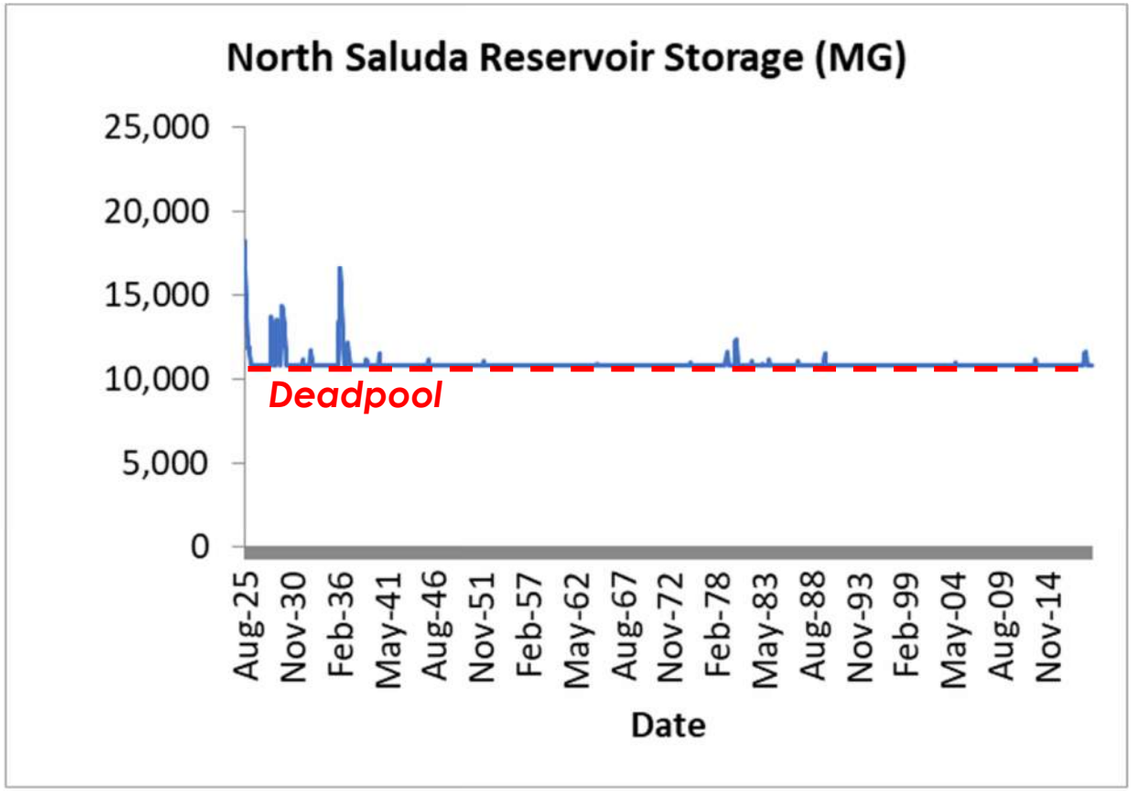


Reservoir Storage – North Saluda Reservoir

Current Use Scenario

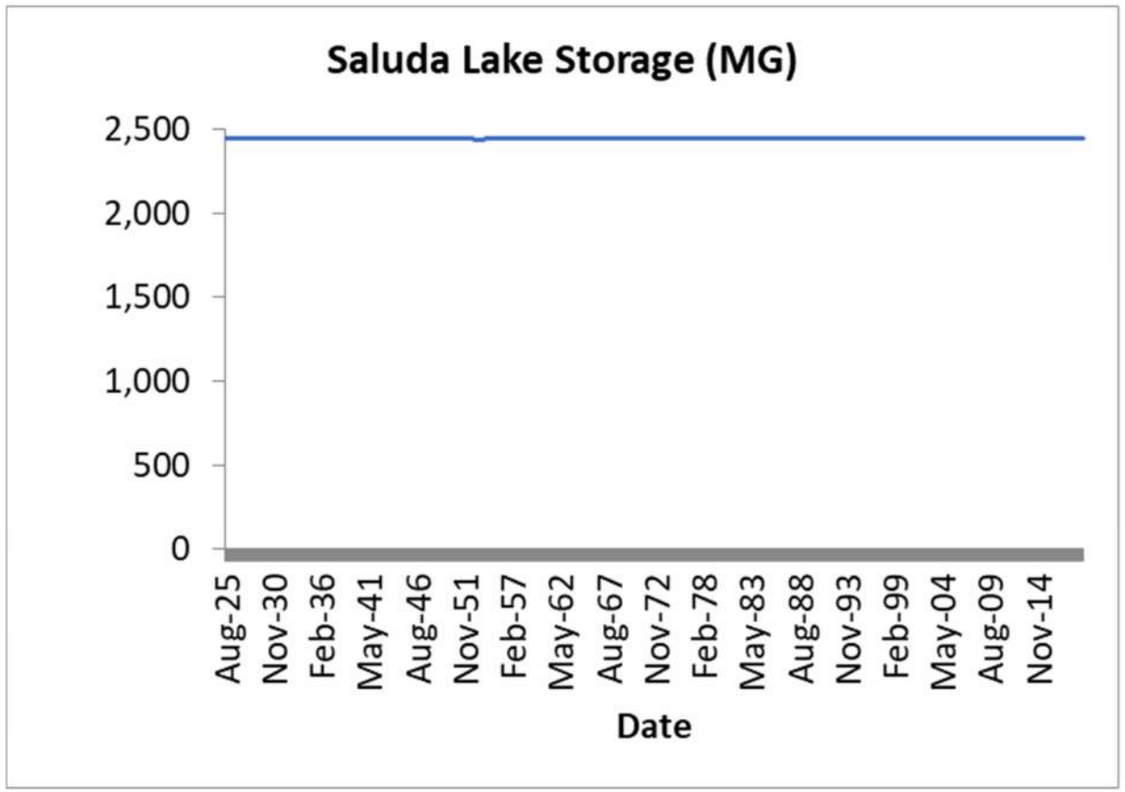


P&R Scenario

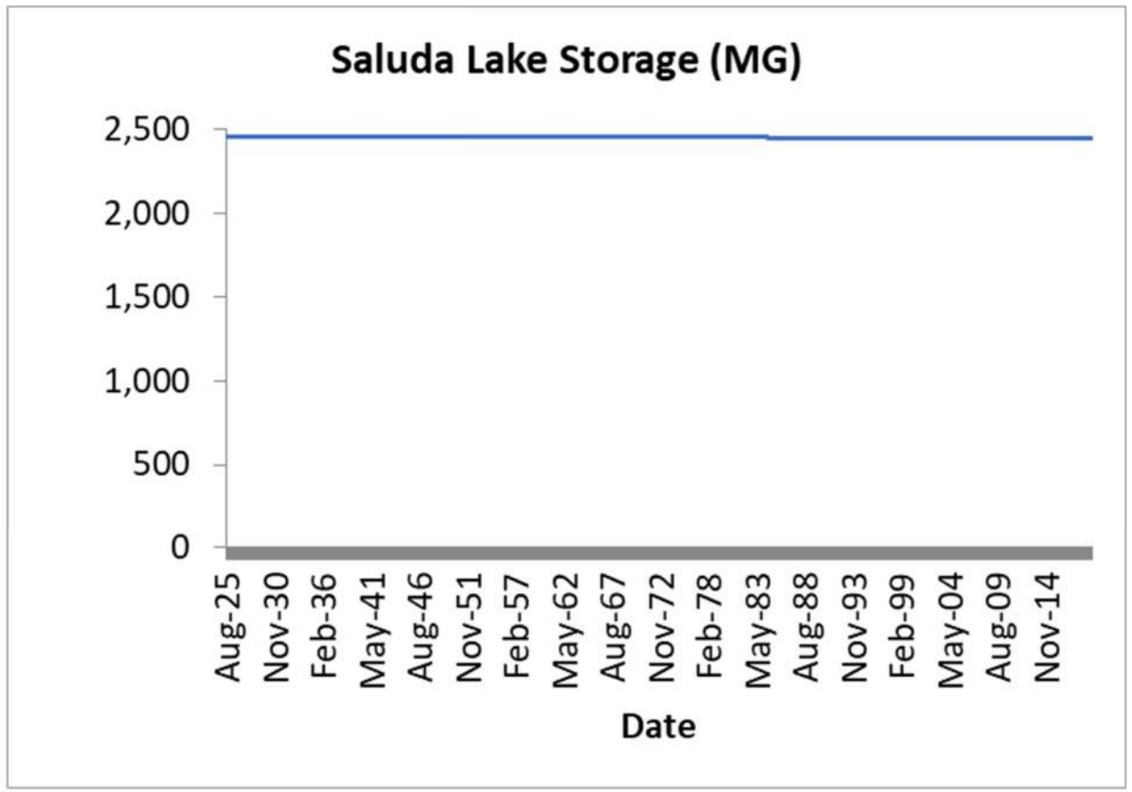


Reservoir Storage –Saluda Lake

Current Use Scenario



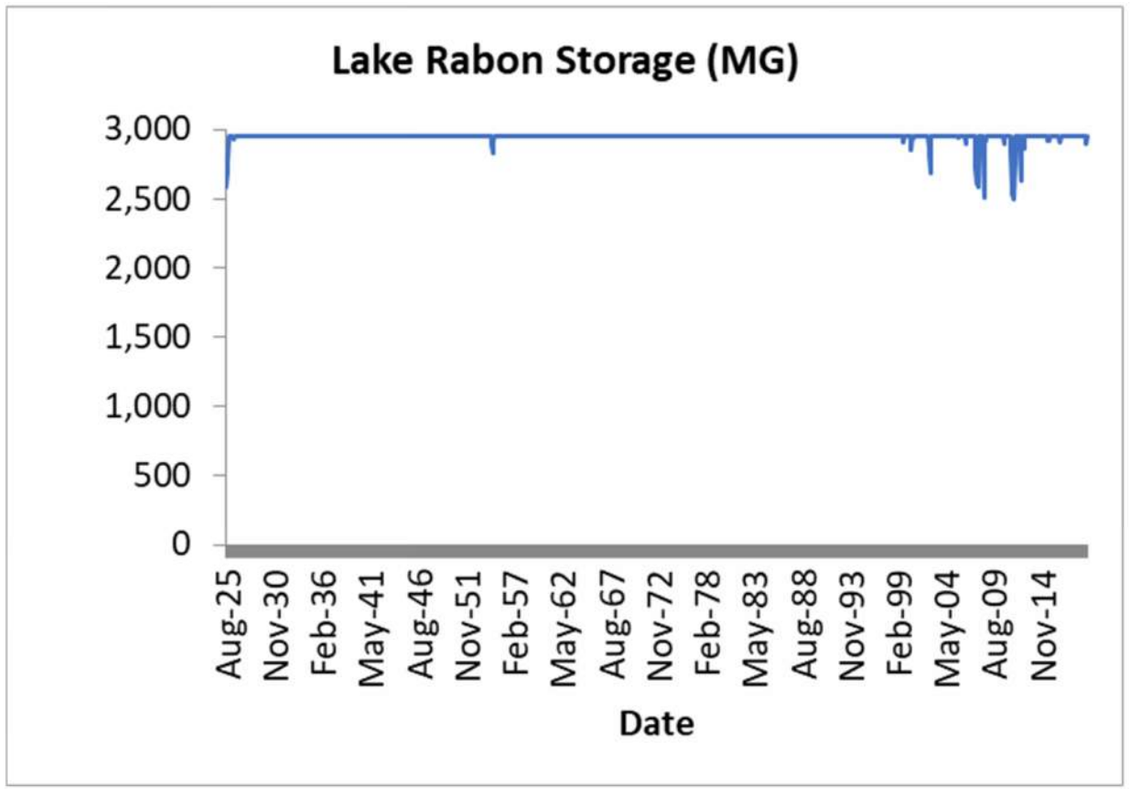
P&R Scenario



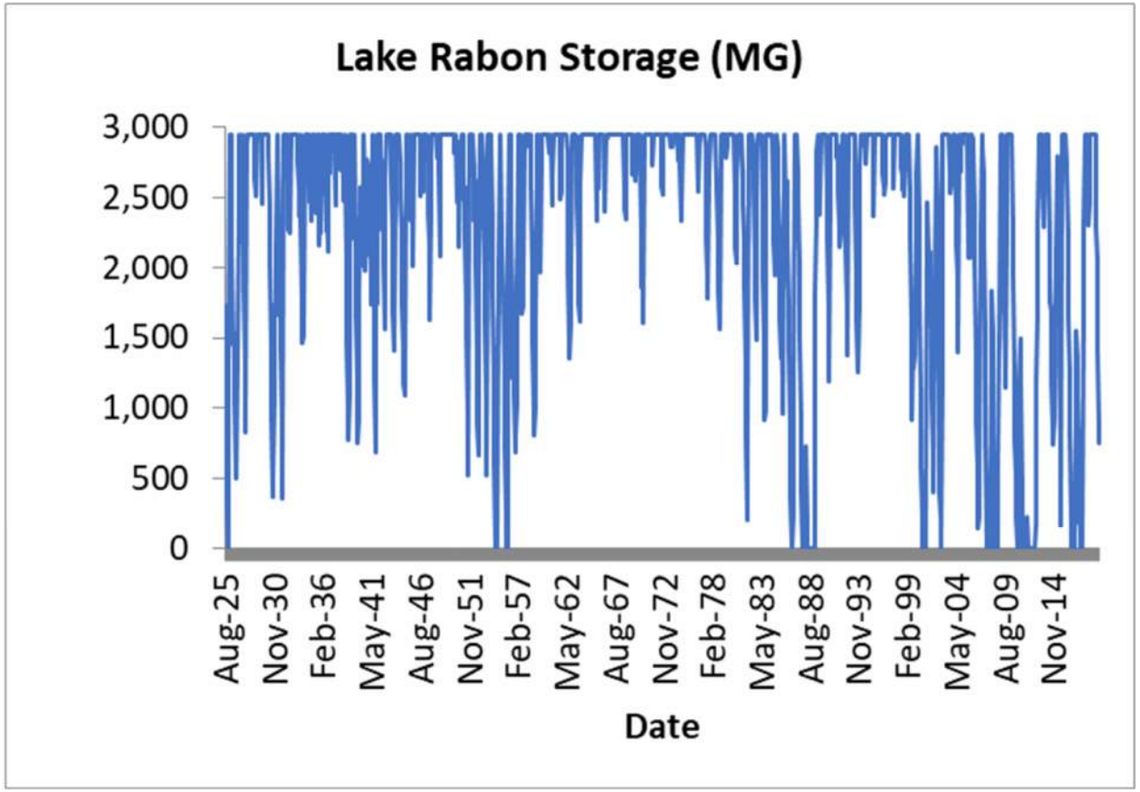
Deadpool storage level was not known

Reservoir Storage – Rabon Lake

Current Use Scenario



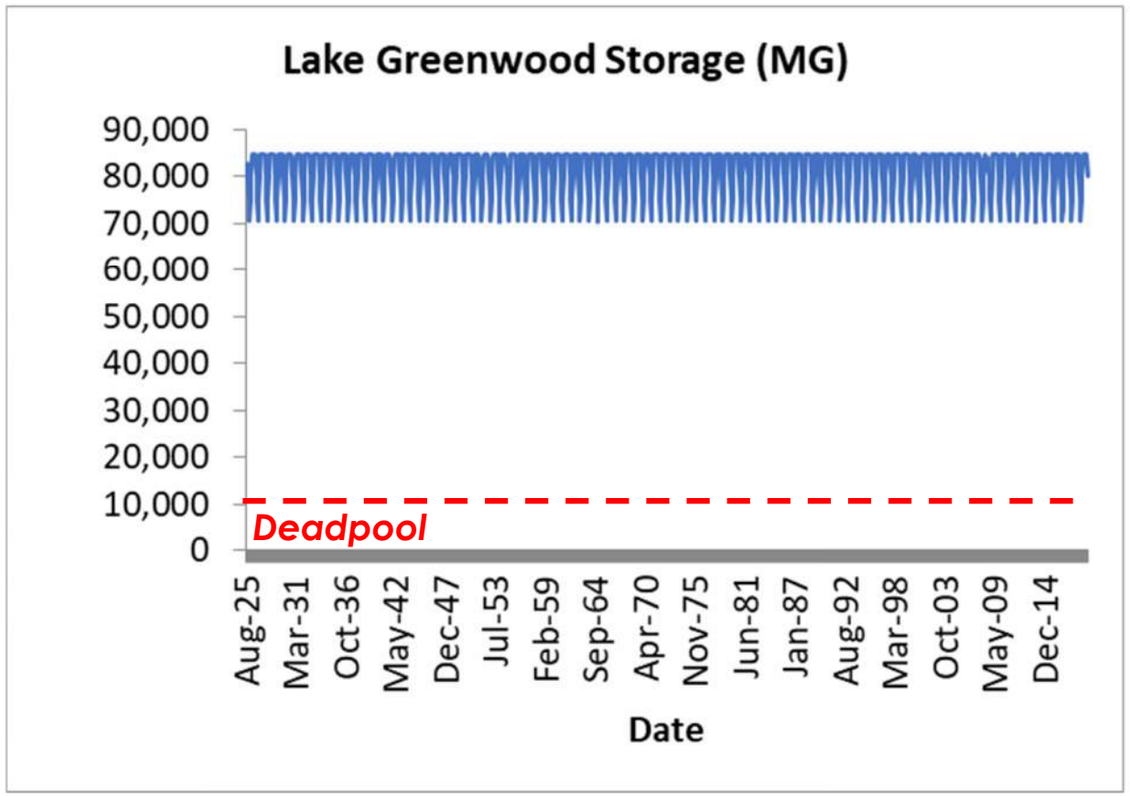
P&R Scenario



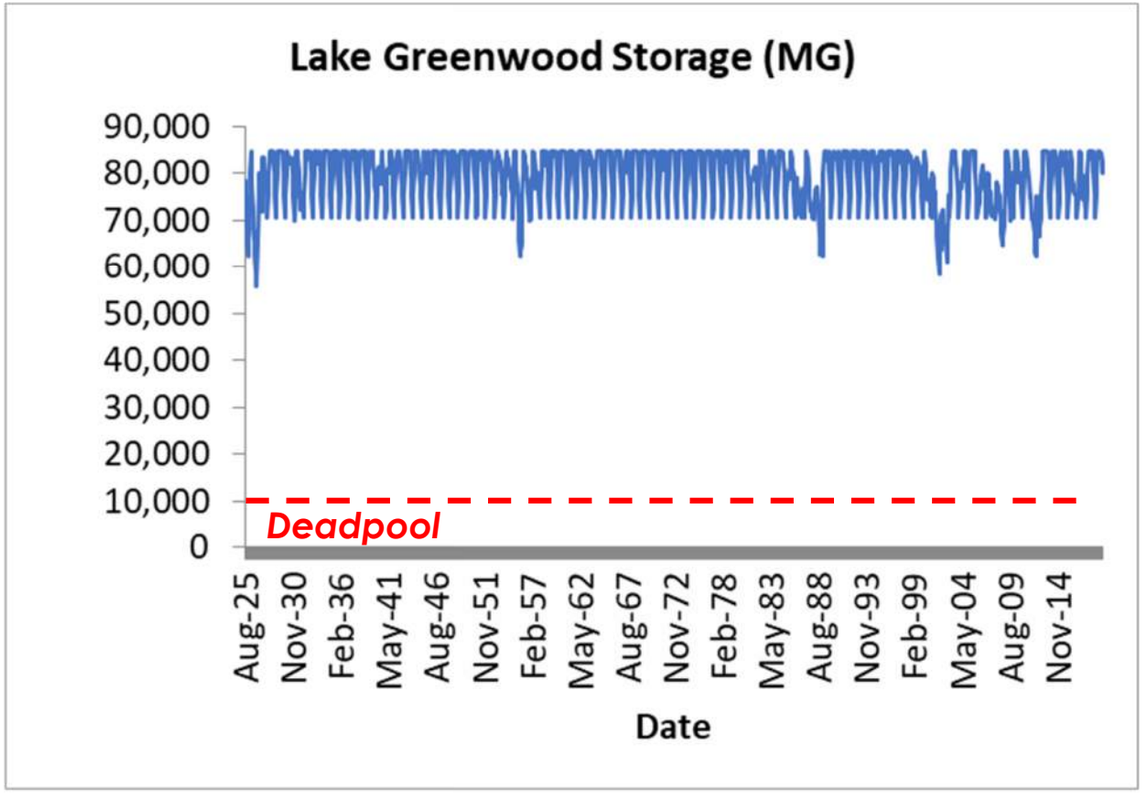
Deadpool storage level was not known

Reservoir Storage – Lake Greenwood

Current Use Scenario

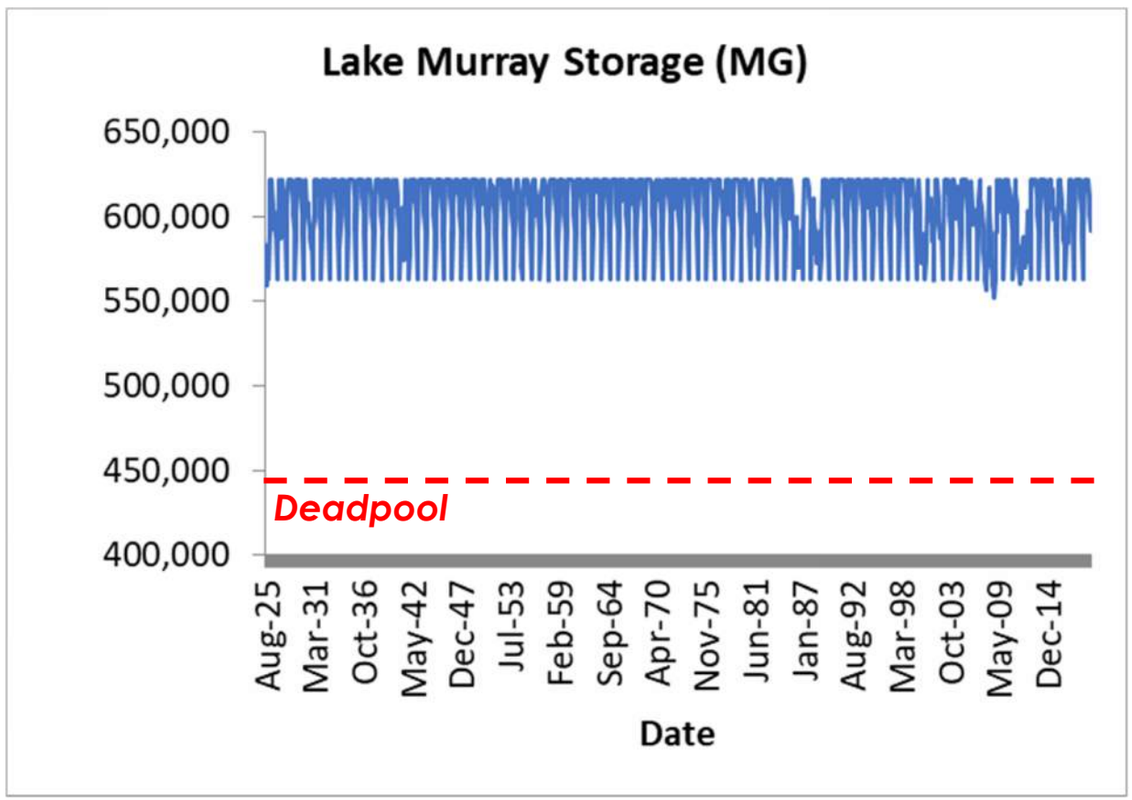


P&R Scenario

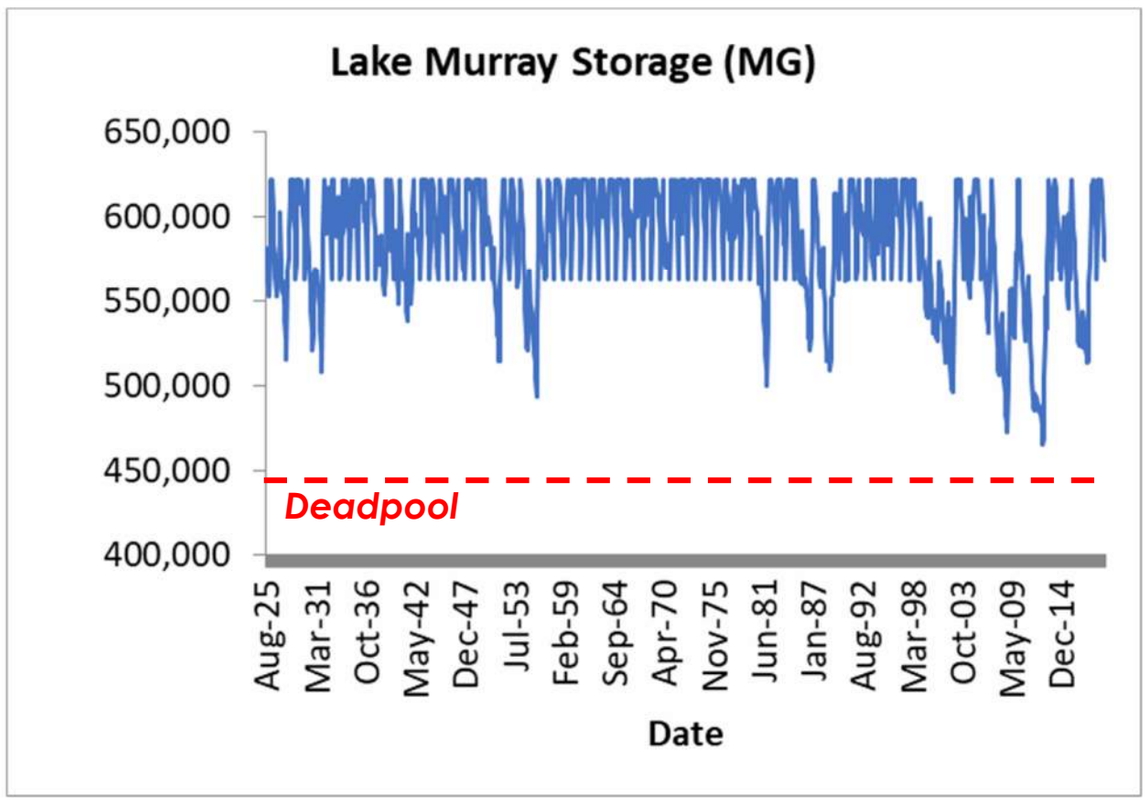


Reservoir Storage – Lake Murray

Current Use Scenario



P&R Scenario



RBC Considerations Moving Forward

- Would the RBC like to revise or add to the list of **Strategic Nodes**… i.e. evaluate flows at different points in the basin?
- Would the RBC like to see how often simulated flows under each scenario drop below the **Minimum Recommended Instream Flows** (**MIFs**) (even though most water users in the basin are not subject to them).
- As additional information is presented, the RBC should continue to consider if there is reason to establish a **Surface Water Condition** at any location.
- As additional information is presented, the RBC should continue to consider if there is reason to establish one or more **Reaches of Interest**.
- Consider whether any additional scenarios should be evaluted?

Comparison to Minimum Instream Flows

Broad River Basin Example

N. Tyger River below Wellford (15 yrs)	
UIF	0.5
Current	5.5
2070 Mod	3.4
2070 HD	12.9
P&R	70.2

N. Pacolet River near Fingerville (92 yrs)	
UIF	0
Current	0.3
2070 Mod	1.6
2070 HD	3.3
P&R	1.9

S. Tyger River below Duncan (21 yrs)	
UIF	0.5
Current	4.9
2070 Mod	8.4
2070 HD	8.4
P&R	10.7

Middle Tyger River near Lyman (22 yrs)	
UIF	1.5
Current	6.3
2070 Mod	19.8
2070 HD	40.3
P&R	47.8

Years of gage data used to calculate the MIF

Pacolet River near Saratt (10 yrs)	
UIF	4.4
Current	9.9
2070 Mod	9.2
2070 HD	9.9
P&R	17.9

Percent of days below MIF for the location

Enoree River near Whitmire (49 yrs)	
UIF	6.6
Current	4.5
2070 Mod	3.5
2070 HD	3.4
P&R	7.0

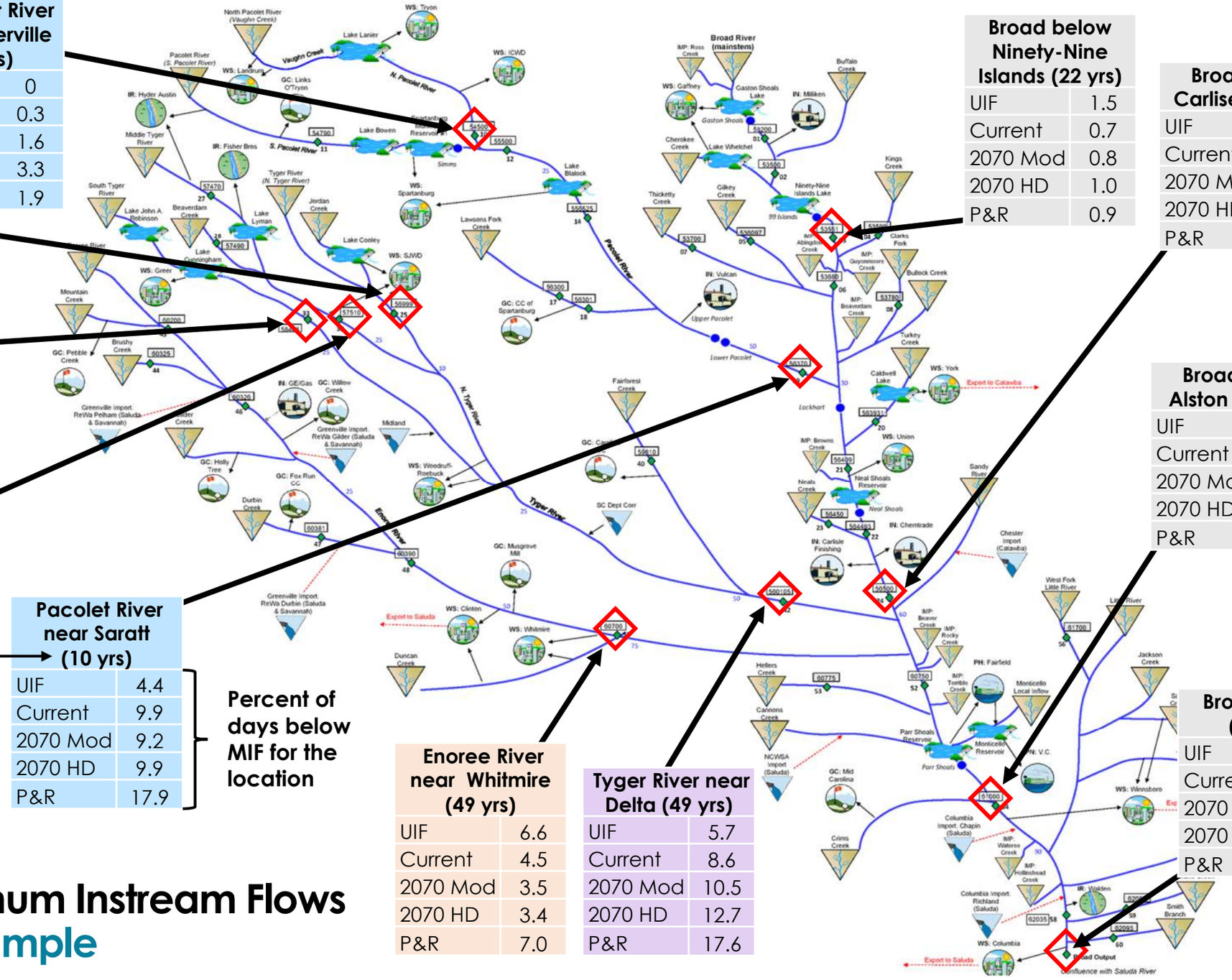
Tyger River near Delta (49 yrs)	
UIF	5.7
Current	8.6
2070 Mod	10.5
2070 HD	12.7
P&R	17.6

Broad below Ninety-Nine Islands (22 yrs)	
UIF	1.5
Current	0.7
2070 Mod	0.8
2070 HD	1.0
P&R	0.9

Broad near Carlise (84 yrs)	
UIF	4.0
Current	6.1
2070 Mod	6.6
2070 HD	7.2
P&R	7.9

Broad near Alston (42 yrs)	
UIF	3.7
Current	6.7
2070 Mod	7.1
2070 HD	7.7
P&R	9.3

Broad Outlet (11 yrs)	
UIF	2.9
Current	5.8
2070 Mod	6.4
2070 HD	7.6
P&R	10.5



Next Steps

- Continue to review the preliminary modeling scenario results (CDM Smith, RBC, and SCDNR)
- Incorporate **Moderate** and **High Demand Projections** and present these Scenario Results at the November RBC Meeting.
- Select locations to apply **flow-ecology metrics** then evaluate them using SWAM model daily timestep results for each planning scenario (RBC, CDM Smith, TNC, Clemson)
- Other actions, as identified by RBC