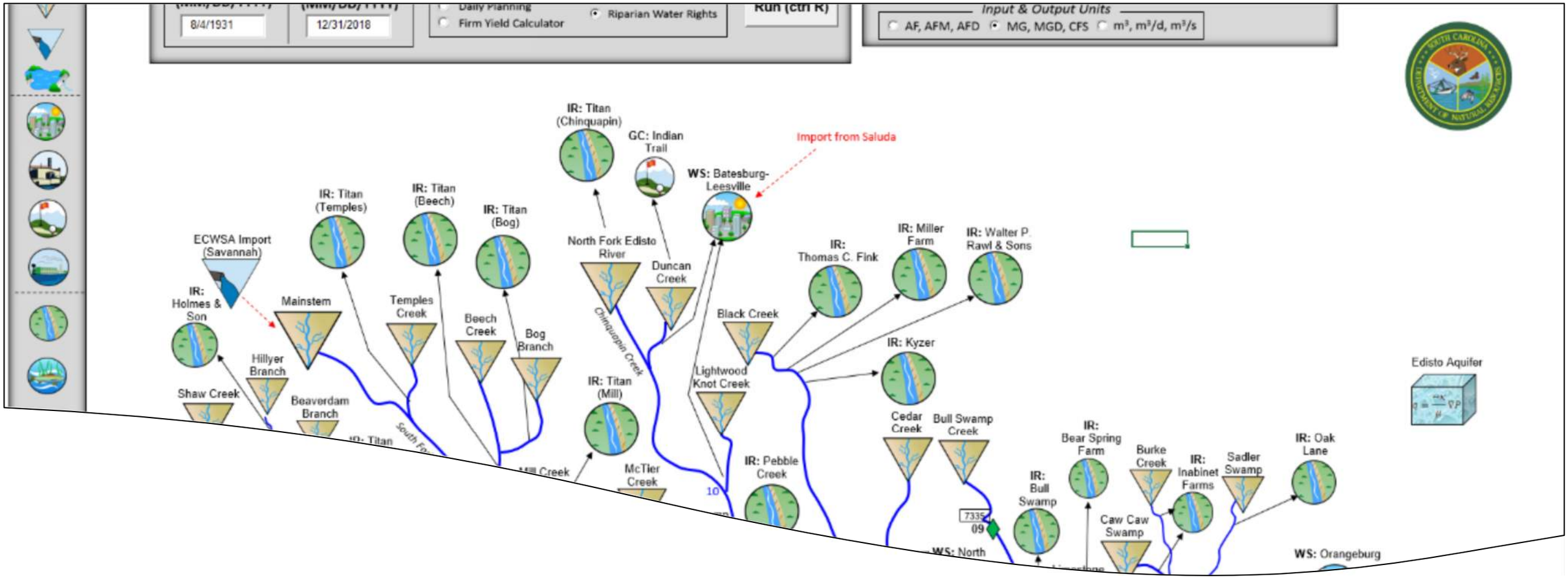


Discussion of Low Flow Strategy and other Surface Water Strategies

Agenda Item #7

Framework for Discussion

1. Review of surface water modeling results
2. Discuss and confirm issues to address
3. Review in-place and planned strategies
4. Identify additional strategies to address issues
5. Select strategies for screening and/or model evaluation
6. December Meeting - Report on Strategy Effectiveness

Framework for Discussion

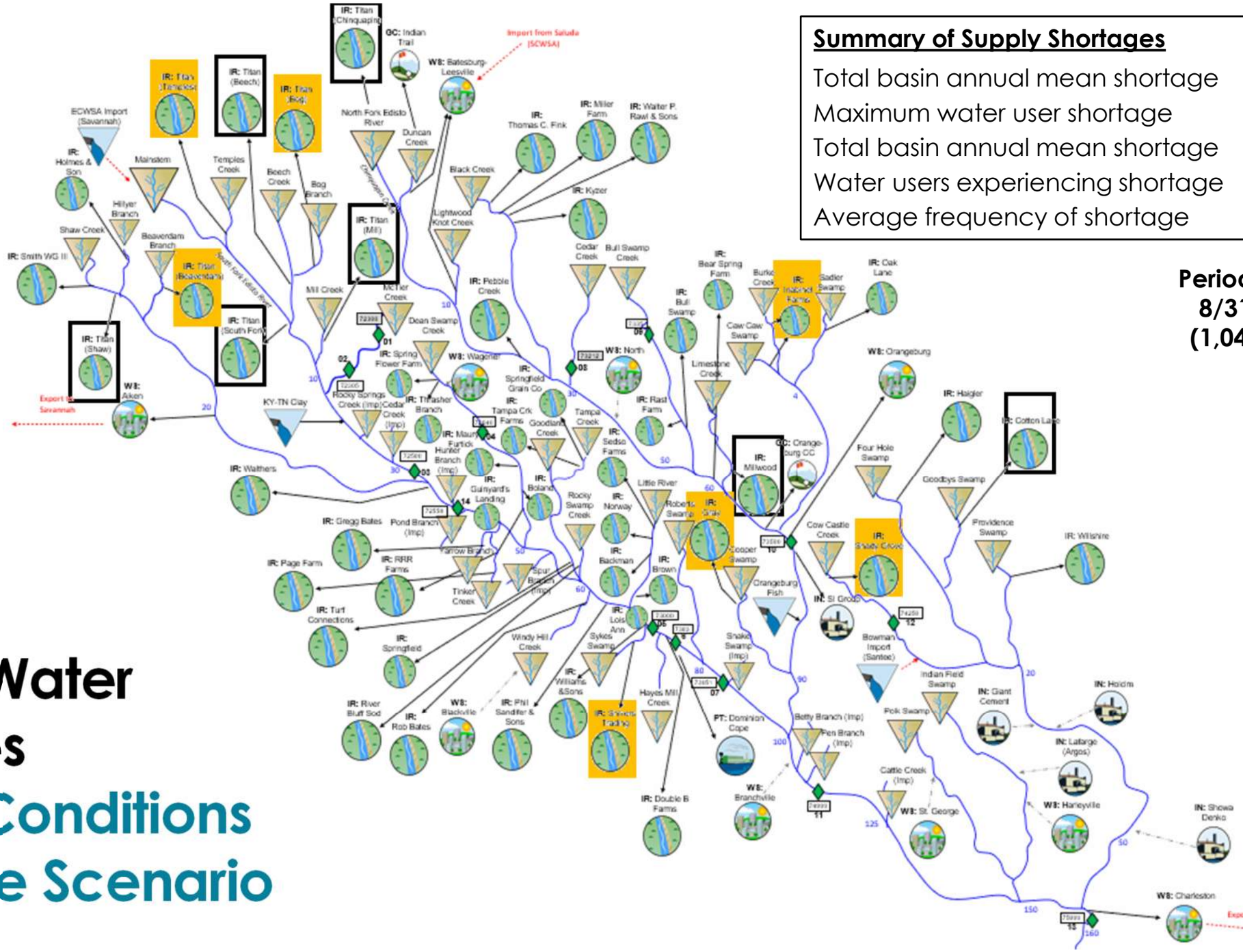
1. **Review of surface water modeling results**
   A. **Shortages, low flows, flow-ecological health relationships and comparison to Minimum Instream Flows (MIF)**
2. Discuss and confirm issues to address
3. Review in-place and planned strategies
4. Identify additional strategies to address issues
5. Select strategies for screening and/or model evaluation
6. December Meeting - Report on Strategy Effectiveness

Frequency of Shortage

< 10%

10-50%

> 50%



Summary of Supply Shortages

Total basin annual mean shortage	1.5 MGD
Maximum water user shortage	4.1 MGD
Total basin annual mean shortage	1.7%
Water users experiencing shortage	17.6%
Average frequency of shortage	16.7%

Period of record: 8/31 to 12/18 (1,049 months)

Surface Water Shortages

Current Conditions Water Use Scenario

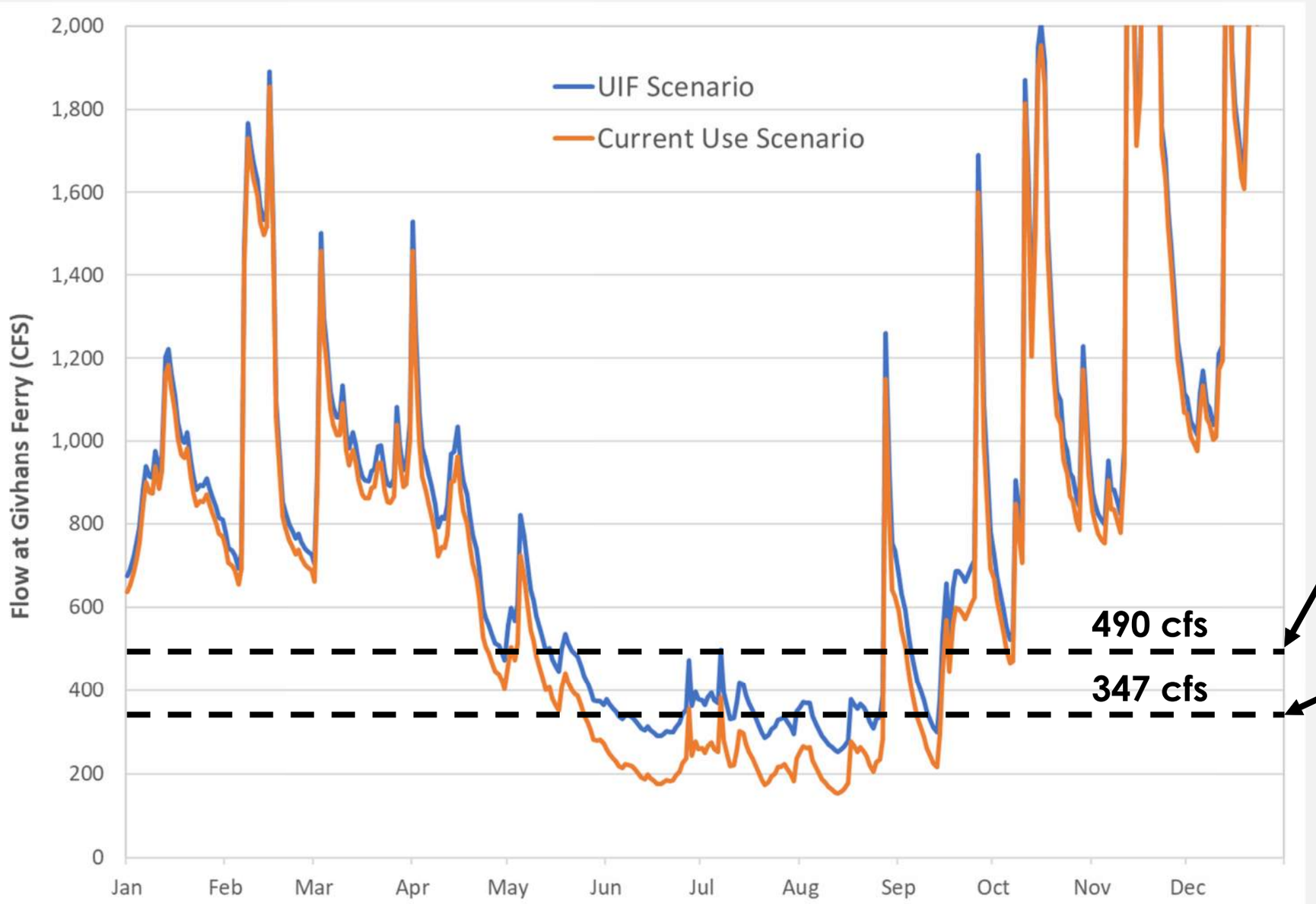
Surface Water Shortages

Current Conditions Water Use Scenario

Water User Name	User Type	Source Water	Location (mi)	Average Annual Demand (MGD)	Minimum Physically Available Flow (MGD)	Average Shortage (MGD)	Maximum Shortage (MGD)	Frequency of Shortage (%)
IR: Titan - South Fork	Ag water user	Mainstem	6	1.53	3.43	0.00	0.07	0.1%
IR: Titan - Temples	Ag water user	Temples Creek	2	1.97	0.41	0.51	3.49	35.1%
IR: Titan - Bog	Ag water user	Bog Branch	1	1.78	0.22	0.67	3.66	38.8%
IR: Titan - Beech	Ag water user	Beech Creek	5	0.79	1.11	0.01	0.91	2.2%
IR: Titan - Mill	Ag water user	Mill Creek	1	0.66	0.71	0.01	0.61	3.3%
IR: Titan - Beaverdam	Ag water user	Beaverdam Branch	1	0.22	0.18	0.04	0.68	17.9%
IR: Titan - Shaw	Ag water user	Shaw Creek	6	0.38	2.35	< 0.00	< 0.00	8.3%
IR: Shivers Trading	Ag water user	Sykes Swamp	0	0.23	0.15	0.03	0.35	19.1%
IR: Millwood	Ag water user	Limestone Creek	6	2.74	2.04	0.12	4.11	6.7%
IR: Inabinet Farms	Ag water user	Caw Caw Swamp	1	0.29	4.69	< 0.00	< 0.00	14.5%
IR: Gray	Ag water user	Cooper Swamp	2	0.12	0.50	0.04	0.21	25.0%
IR: Titan - Chinquapin	Ag water user	North Fork Edisto R	1	0.50	0.86	0.01	0.88	4.0%
IR: Cotton Lane	Ag water user	Goodbys Swamp	2	0.14	0.13	< 0.00	0.20	1.7%
IR: Shady Grove	Ag water user	Cow Castle Creek	0	0.44	0.02	0.12	0.59	46.2%

Notes: If a water user is not listed, then it was not simulated to have a shortage.
Water Users shaded orange are those that have intakes more than 2 miles from the modeled location of the tributary's headwater.

2002 (Drought of Record) Modeled Daily Flows at Givhans Ferry



Minimum Instream Flow (MIF) based on 20% mean

7Q10 (as of 2009)

Current Use Scenario Summary

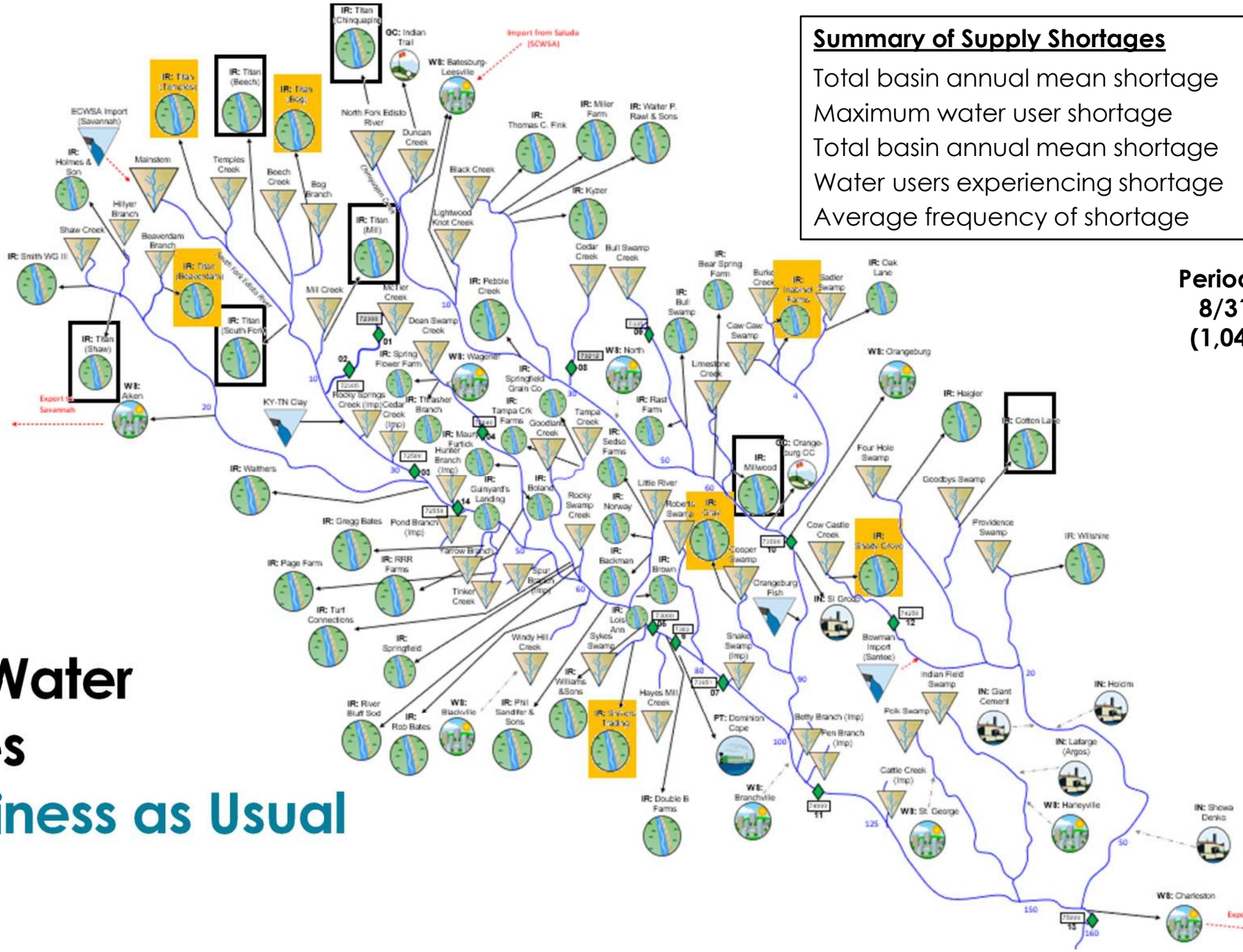
1. **Shortages**
    a. Several Ag water user shortages; however, modeling limitations suggest most of these are not likely true shortages
2. **Low Flows**
    a. Flows at Givhans Ferry drop below the **MIF 6.7% of the time** and the **7Q10 2.2% of the time**

Frequency of Shortage

< 10%

10-50%

> 50%



Summary of Supply Shortages

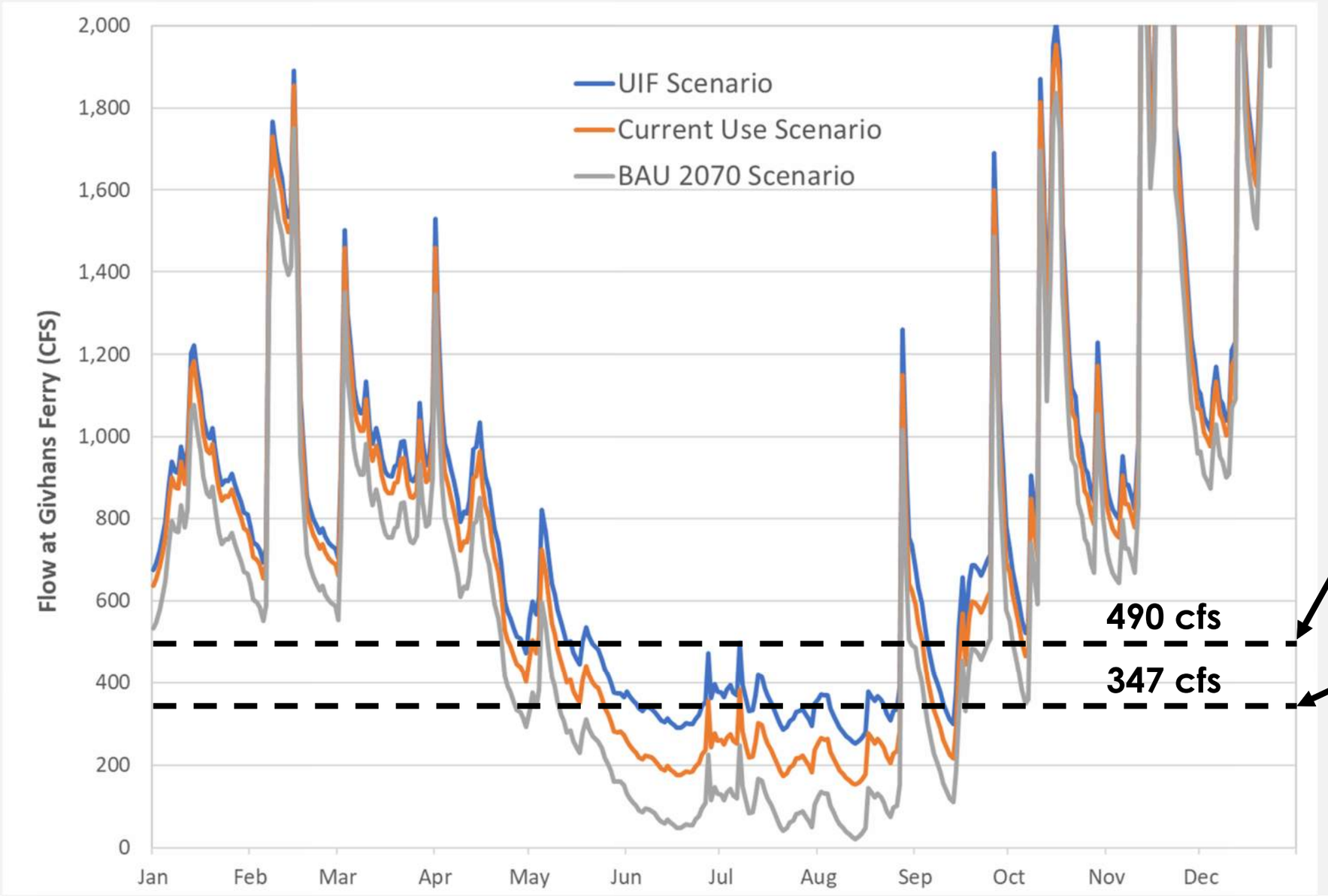
Total basin annual mean shortage	1.5 MGD
Maximum water user shortage	4.1 MGD
Total basin annual mean shortage	1.0%
Water users experiencing shortage	15.8%
Average frequency of shortage	16.7%

Period of record: 8/31 to 12/18 (1,049 months)

Surface Water Shortages

2070 Business as Usual Scenario

2002 (Drought of Record) Modeled Daily Flows at Givhans Ferry



2070 Business as Usual Scenario Summary

1. **Shortages**
    a. The shortages observed for Ag water users are virtually identical to the **Current Use Scenario** since Ag demands remain the same for each registered Ag user and only 10 of 50 Ag users are located on the North and South Fork Edisto River, where new Ag withdrawals were applied.
2. **Low Flows**
    a. Flows at Givhans Ferry drop below the **MIF 10.9% of the time** and the **7Q10 6.1% of the time**

Frequency of Shortage

< 10%

10-50%

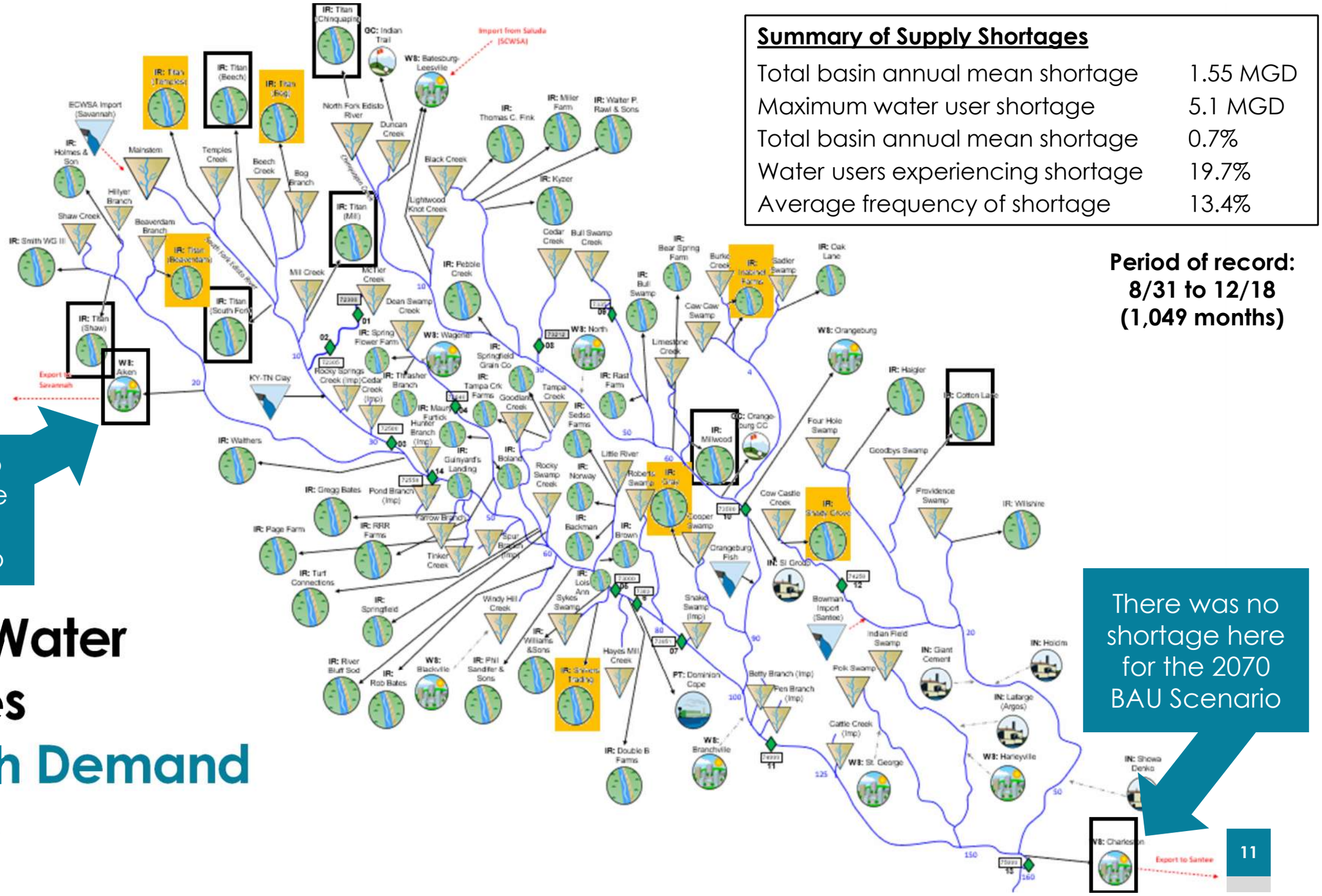
> 50%

Summary of Supply Shortages

Total basin annual mean shortage	1.55 MGD
Maximum water user shortage	5.1 MGD
Total basin annual mean shortage	0.7%
Water users experiencing shortage	19.7%
Average frequency of shortage	13.4%

Period of record: 8/31 to 12/18 (1,049 months)

There was no shortage here for the 2070 BAU Scenario



There was no shortage here for the 2070 BAU Scenario

Surface Water Shortages

2070 High Demand Scenario

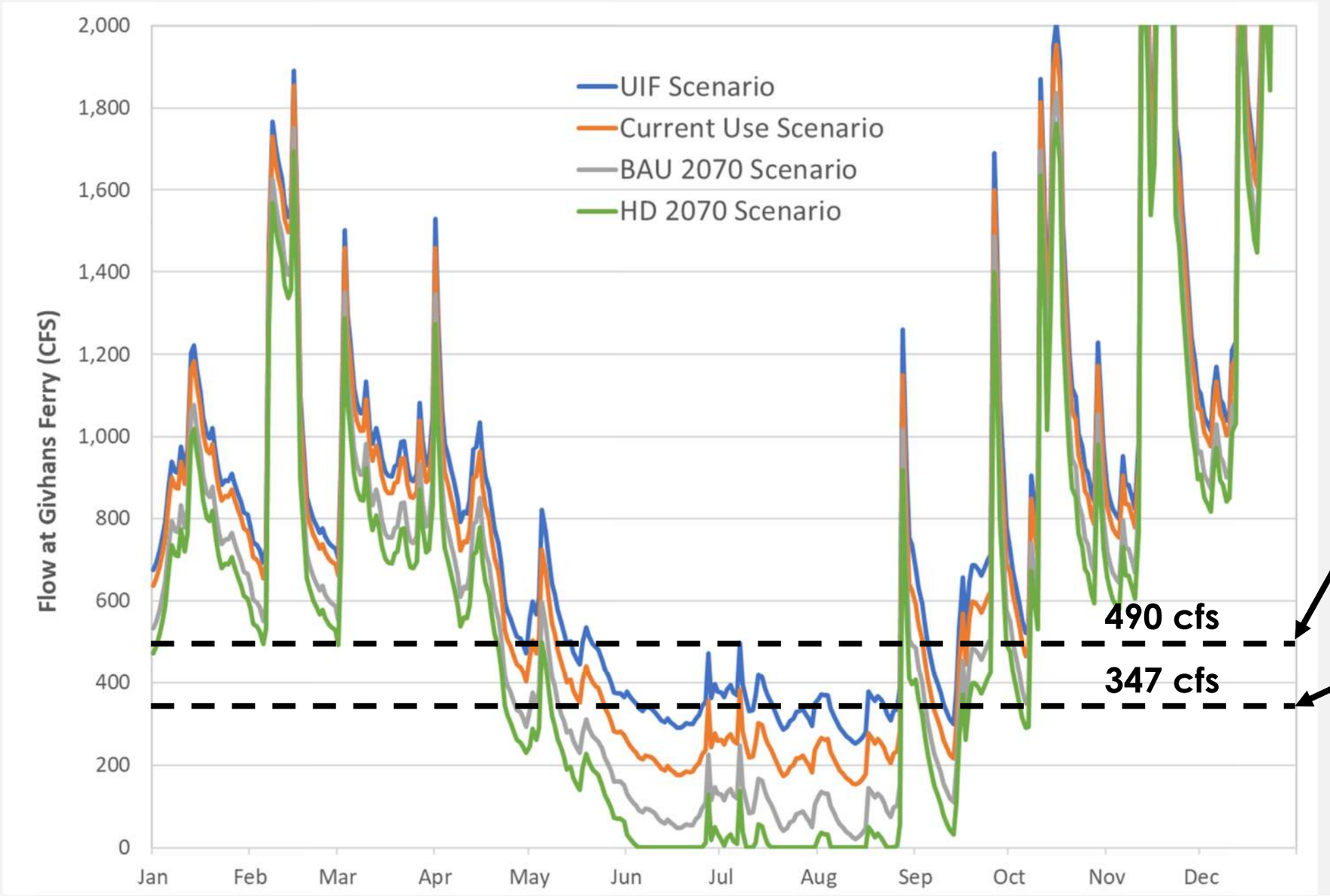
Surface Water Shortages

High Demand 2070 Water Use Scenario

Water User Name	User Type	Source Water	Location (mi)	Average Annual Demand (MGD)	Minimum Physically Available Flow (MGD)	Average Shortage (MGD)	Maximum Shortage (MGD)	Frequency of Shortage (%)
WS: Charleston	M&I water user	Mainstem	159	133	142	0.010	5.15	0.2%
WS: Aiken	M&I water user	Shaw Creek	19	13	8	0.0003	0.35	0.1%

Note: If a water user is not listed, then it was not simulated to have a shortage.

2002 (Drought of Record) Modeled Daily Flows at Givhans Ferry



Minimum Instream Flow (MIF) based on 20% mean

7Q10 (as of 2009)

2070 High Demand Scenario Summary

1. **Shortages**
   a. Same Ag water user shortages as **Current Use** and **Business as Usual Scenarios**
   b. Aiken and CWS experience shortages of ~1 to 2 months

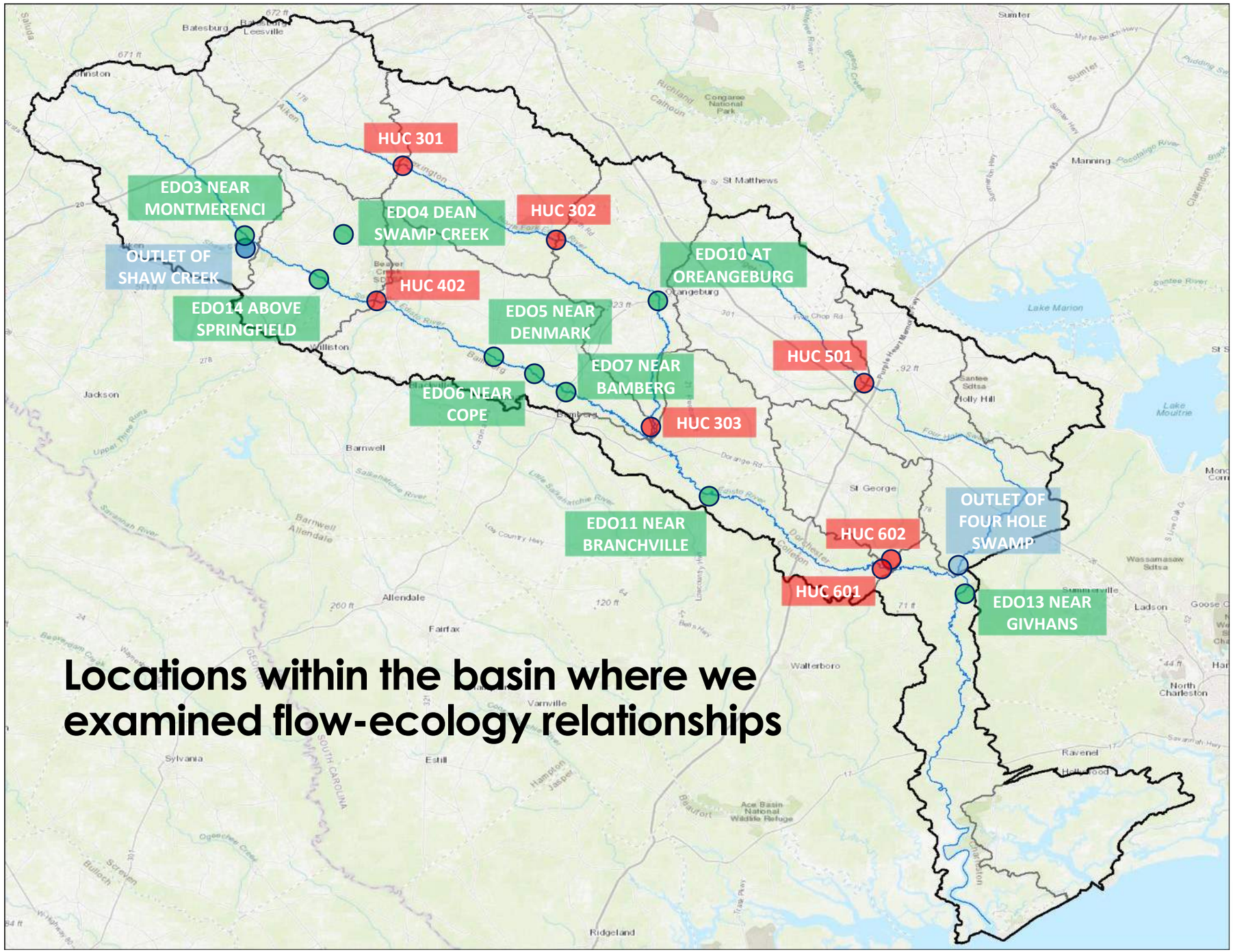
2. **Low Flows**
   a. Flows at Givhans Ferry drop below the **MIF 14.9% of the time** and the **7Q10 9.1% of the time**

Strategic Nodes

HUC 10 Outlet

USGS Gage

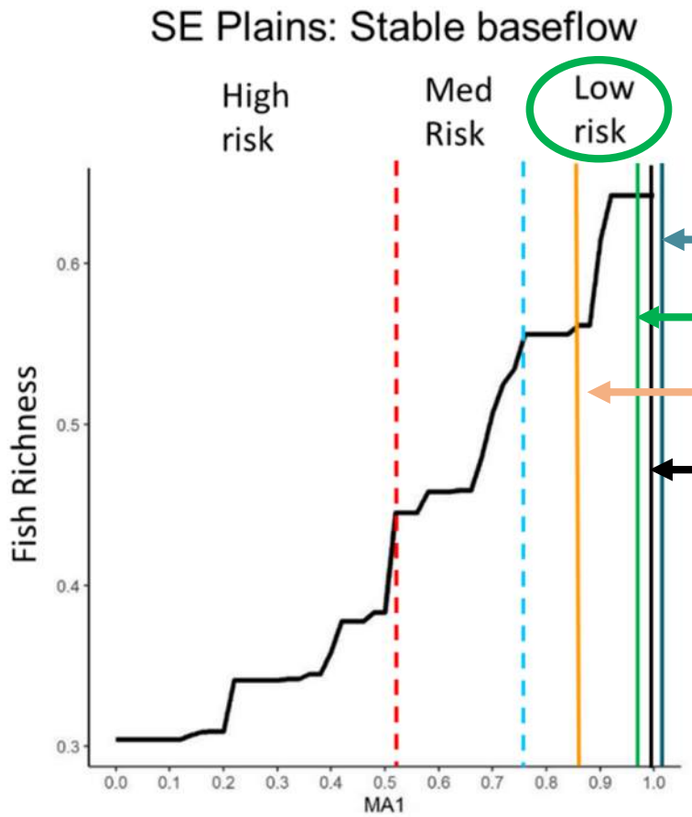
Other Strategic Nodes



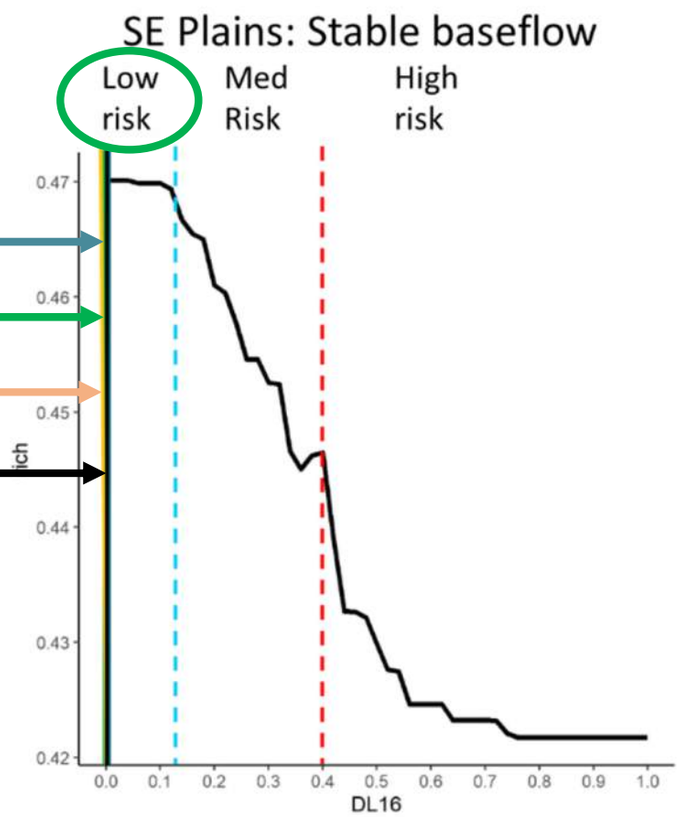
Flow-Ecology Relationships – All Scenarios

1. Example Results – EDO10 on North Fork

Mean Daily Flow



Duration of Low Flow



UIF

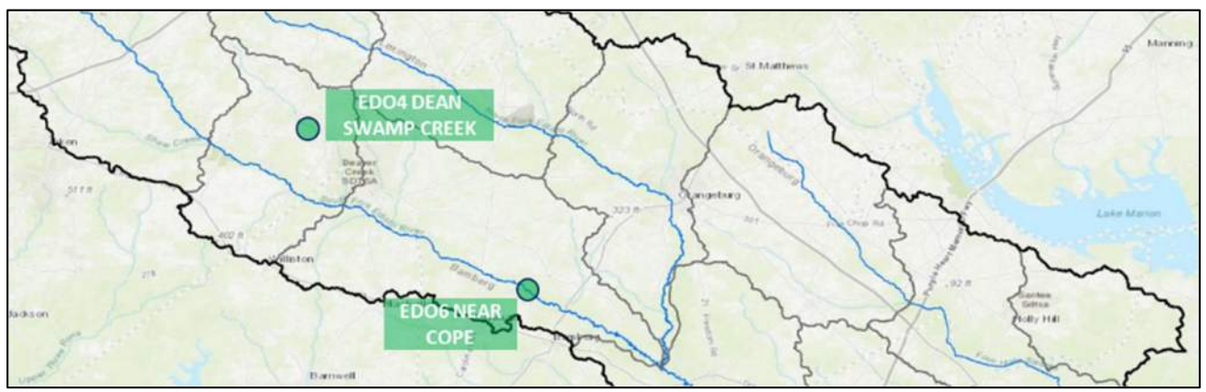
HD 2070

Full

BAU

Flow-Ecology Relationships – All Scenarios

1. Mean Daily Flow, Duration of Low Flow, and Timing of Low Flow remained in the "Low Risk" range for all scenarios, except the Full Allocation Scenario
2. For Full Allocation Scenario,
    1. Medium Risk for Mean Daily Flow metric at EDO6 on South Fork
    2. High Risk for Mean Daily Flow metric at EDO4 on Dean Swamp



Frequency of Days Below MIFs at Select Strategic Nodes for Each Planning Scenario

Strategic Node	Scenario	Frequency (%) of Days below MIFs											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
EDO05 (S. Fork Edisto near Denmark)	Unimpaired Flow (UIF)	0	0	0	1	1	4	0	1	0	0	0	0
	Current Use	0	0	0	1	3	10	2	1	0	0	0	0
	Business as Usual (2070)	0	0	0	1	4	13	3	2	1	0	0	0
	High Demand (2070)	0	0	0	1	7	16	7	3	2	0	0	0
	Full Allocation	15	15	8	23	41	54	45	45	52	47	31	17
Outlet of Shaw Creek	Unimpaired Flow (UIF)	0	0	0	1	1	4	0	1	0	0	0	0
	Current Use	0	0	0	1	3	9	1	1	0	0	0	0
	Business as Usual (2070)	0	0	0	1	6	12	4	2	2	0	0	0
	High Demand (2070)	0	1	0	2	9	17	10	6	4	2	0	1
	Full Allocation	2	2	0	3	9	17	10	7	8	4	1	1
EDO03 (South Fork Edisto near Montmorenci)	Unimpaired Flow (UIF)	0	0	0	1	0	2	0	0	0	0	0	0
	Current Use	0	0	0	1	2	6	1	1	0	0	0	0
	Business as Usual (2070)	0	0	0	1	2	6	1	1	0	0	0	0
	High Demand (2070)	0	0	0	1	2	6	1	1	0	0	0	0
	Full Allocation	0	1	0	1	2	7	1	1	1	0	0	0
EDO13 (Edisto near Givhans)	Unimpaired Flow (UIF)	4	2	1	7	13	19	10	9	8	4	2	3
	Current Use	5	3	1	9	20	27	17	16	14	8	3	4
	Business as Usual (2070)	7	4	3	13	28	37	25	25	23	15	6	7
	High Demand (2070)	8	5	4	16	33	44	33	31	31	22	9	8
	Full Allocation	24	19	15	31	56	67	62	60	66	67	55	33
Outlet of Four Hole Swamp	Unimpaired Flow (UIF)	23	16	14	32	48	57	45	42	54	52	38	28
	Current Use	21	13	12	29	44	55	41	39	49	46	32	25
	Business as Usual (2070)	22	15	14	31	47	56	44	41	52	51	36	27
	High Demand (2070)	22	15	13	31	46	56	43	41	51	50	35	26
	Full Allocation	23	15	14	31	47	56	42	41	51	49	36	28

Frequency of Days Below MIFs at Select Strategic Nodes for Each Planning Scenario

Strategic Node	Scenario	Frequency (%) of Days below MIFs											
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
HUC 303 (Lower North Fork Edisto)	Unimpaired Flow (UIF)	0	0	0	1	0	2	0	0	0	0	0	0
	Current Use	0	0	0	1	1	5	0	0	0	0	0	0
	Business as Usual (2070)	0	0	0	1	1	5	0	0	0	0	0	0
	High Demand (2070)	0	0	0	1	2	7	1	1	0	0	0	0
	Full Allocation	1	1	0	1	4	9	2	2	2	1	0	1
EDO11 (Edisto nr Branchville)	Unimpaired Flow (UIF)	0	0	0	1	0	3	0	0	0	0	0	0
	Current Use	0	0	0	1	1	5	0	0	0	0	0	0
	Business as Usual (2070)	0	0	0	1	2	7	1	1	0	0	0	0
	High Demand (2070)	0	0	0	1	3	9	2	2	0	0	0	0
	Full Allocation	5	3	1	8	18	25	17	16	14	9	5	4
HUC 301 (Upper North Fork Edisto)	Unimpaired Flow (UIF)	0	0	0	1	0	2	0	0	0	0	0	0
	Current Use	0	0	0	1	1	3	0	0	0	0	0	0
	Business as Usual (2070)	0	0	0	1	1	4	0	0	0	0	0	0
	High Demand (2070)	0	0	0	1	1	5	0	0	0	0	0	0
	Full Allocation	0	0	0	1	1	4	0	0	0	0	0	0
EDO10 (N. Fork Edisto at Orangeburg)	Unimpaired Flow (UIF)	0	0	0	1	0	1	0	0	0	0	0	0
	Current Use	0	0	0	1	1	4	0	0	0	0	0	0
	Business as Usual (2070)	0	0	0	1	1	4	0	0	0	0	0	0
	High Demand (2070)	0	0	0	1	1	5	0	1	0	0	0	0
	Full Allocation	3	2	0	3	8	14	7	6	6	3	1	1

Framework for Discussion

1. Review of surface water modeling results
2. **Discuss and confirm issues to address**
3. Review in-place and planned strategies
4. Identify additional strategies to address issues
5. Select strategies for screening and/or model evaluation
6. December Meeting - Report on Strategy Effectiveness

Review of Goals Established by the RBC

1. **Develop water use strategies, policies, and legislative recommendations for the Edisto River Basin in order to:**
    a. Ensure water resources are maintained to support current and future human and ecosystem needs.
    b. Improve the resiliency of the water resources and help minimize disruptions within the basin.
    c. Promote future development in areas with adequate water resources.
    d. Encourage responsible land use practices.
2. **Develop and implement a communication plan to promote the strategies, policies and recommendations developed for the Edisto River Basin.**

Discussion of Surface Water Issues to Address

1. Surface water shortages for Aiken and CWS in the 2070 High Demand Scenario
2. Low Flows during drought – For all Scenarios, flow at Givhans Ferry and other locations drops below Minimum Instream Flow (20%, 30% and 40% of Mean Daily Flow)
3. Other Issues?

Framework for Discussion

1. Review of surface water modeling results
2. Shortages, low flows, and ecological flow results
3. Discuss and confirm issues to address
4. **Review in-place and planned strategies**
5. Identify additional strategies to address issues
6. Select strategies for screening and/or model evaluation
7. December Meeting - Report on Strategy Effectiveness

Existing Water Management Strategies

1. **Aiken –** Ability to temporarily augment flows in Shaw Creek through releases from Masons Branch Reservoir
2. **CWS –** Alternate surface water sources in the Santee Basin
3. **Orangeburg –** Emergency interconnection to Lake Marion Regional Water System (Santee Basin)and ASR wells
4. **Municipal water system's** Drought Management Plans and Response Ordinances meant to reduce demand by 15% to 25% depending on drought severity
5. **Agriculture -** Irrigation efficiency measures, cover cropping and some conjunctive use capabilities (ability to use both groundwater and surface water)

Planned Water Management Strategies

1. Dominion Energy's Cope Station

- Moving from 100% groundwater to a combination of surface and groundwater by 2028
- Eventually will withdrawal ~90% from surface water and ~10% from groundwater when river conditions allow
- During low flow conditions, all water use at the station will be groundwater

Framework for Discussion

1. Review of surface water modeling results
2. Discuss and confirm issues to address
3. Review in-place and planned strategies
4. **Identify additional strategies to address issues**
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What Additional Water Management Strategies Does the RBC Want to Consider to Address the Identified Issues?

1. Low Flow Management Strategy (already proposed)

a. **Purpose** – Address identified shortage at CWS Intake during High Demand Scenario and allow for some water to remain in river (environmental flow)

b. **Approach –** Trigger incremental shifts to other sources for upstream surface withdrawers able to do so and/or temporarily reduce demand where possible

c. Some may shift more than others based off their ability to do so and the condition of the other water source

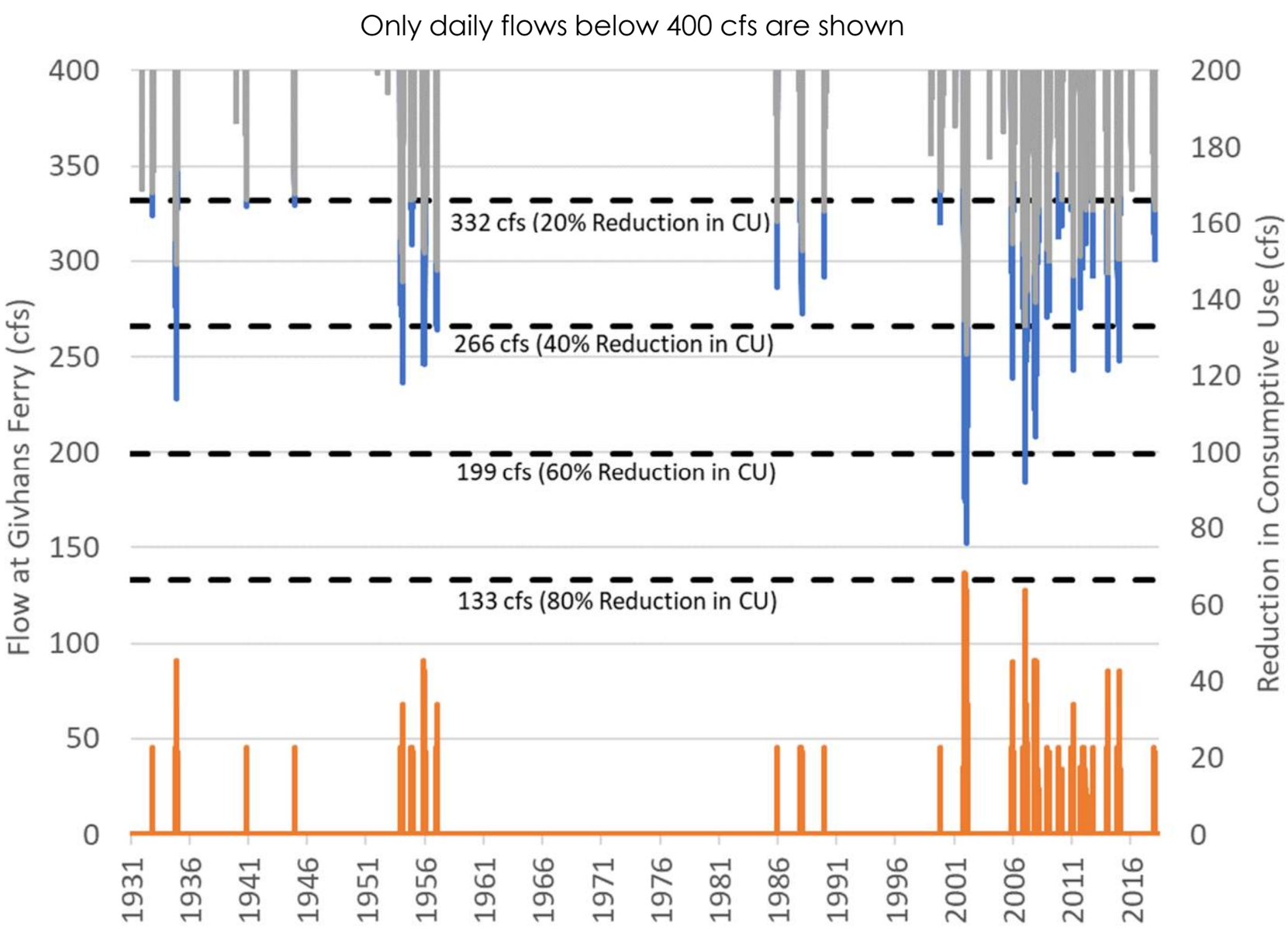
d. Includes establishment of a Surface Condition of 332 cfs at Givhans Ferry (20% of median flow)

Proposed Low Flow Management Strategy

20% Increments Percent Below MIF	River Flow Range (cfs) Lower	Upper	Basin-wide % Reduction in SW Withdrawals
0 - 20%	266	332	20%
20 - 40%	199	266	40%
40 - 60%	133	199	60%
60 - 80%	66	133	80%
80 - 100%	0	66	100%

Here, MIF is set at 20% of the median daily flow, which is 332 cfs at Givhans Ferry

Impact of Proposed Low Flow Strategy at Givhans Ferry



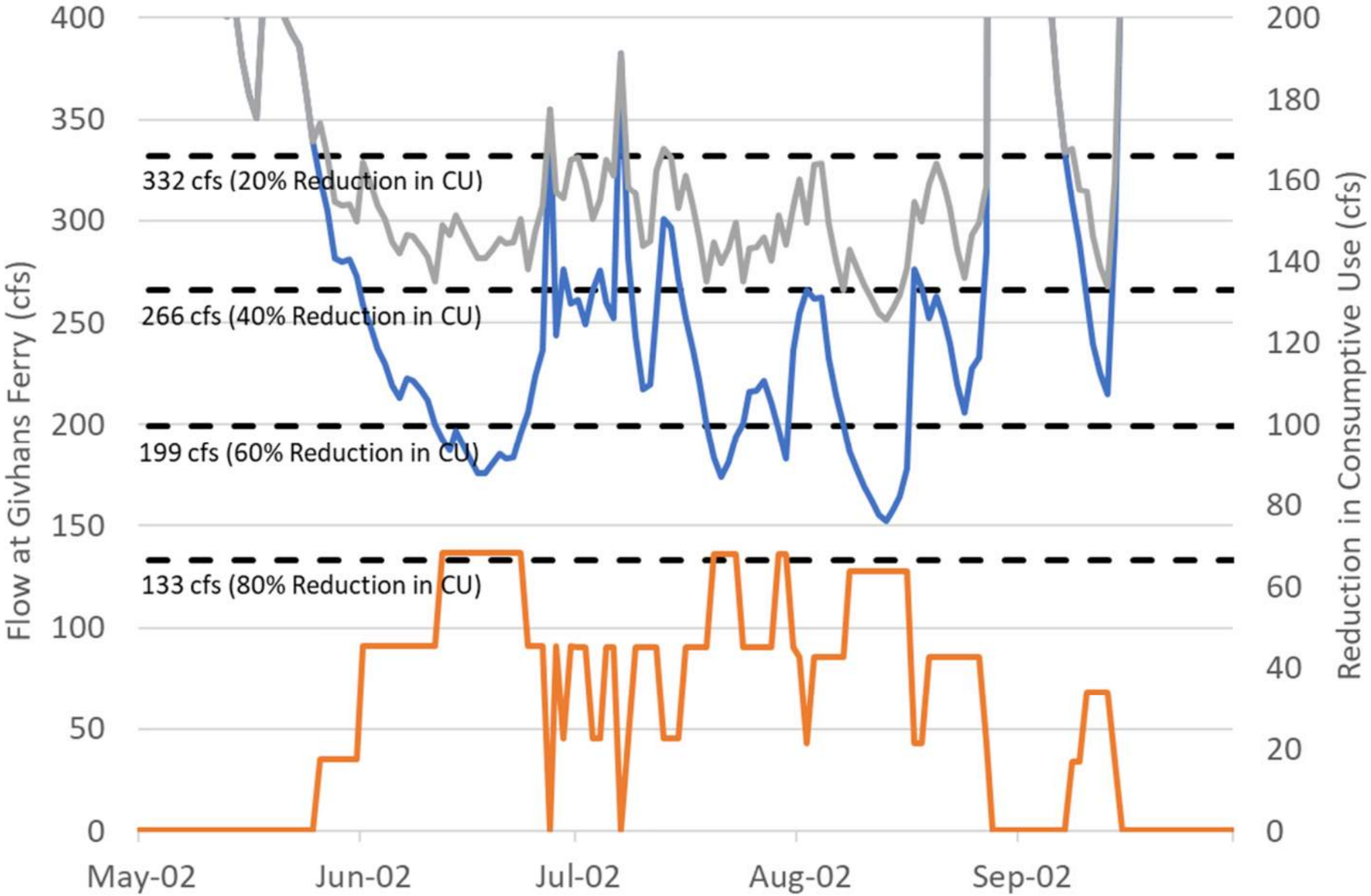
Current Use Scenario

1931 – 2018 Hydrology

- Flow
- Flow under Low Flow Strategy
- Reduction in Withdrawals under Low Flow Strategy

Impact of Proposed Low Flow Strategy at Givhans Ferry

Only daily flows below 400 cfs are shown



Current Use Scenario

2002 Hydrology

- Flow
- Flow under Low Flow Strategy
- Reduction in Withdrawals under Low Flow Strategy

How Effective is the Low Flow Management Strategy?

Frequency of Days Below **332 cfs** (**20% of Median Daily Flow)** at EDO13 (Givhans Ferry) for **UIF** and **Current Use scenarios**.

No Low Flow Strategy

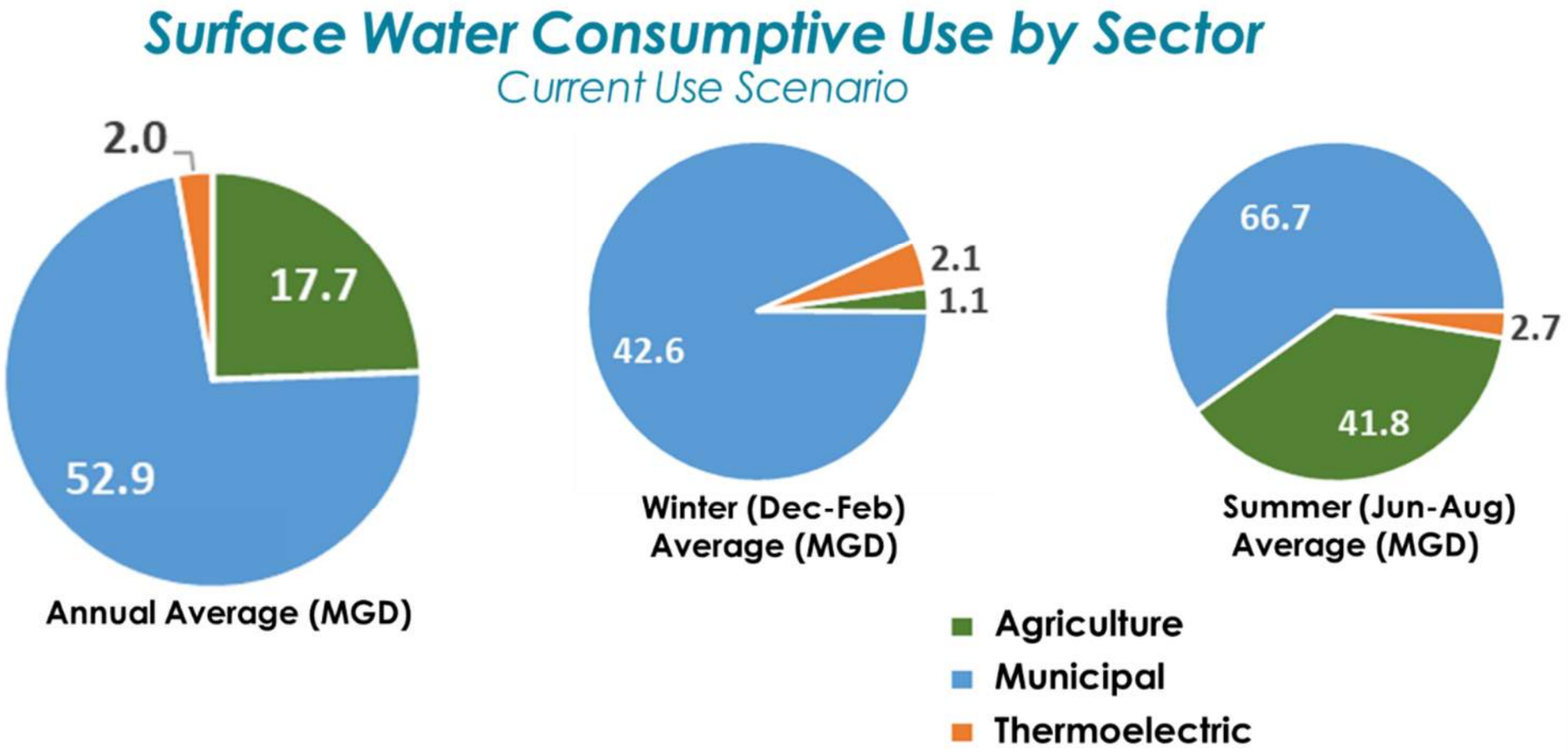
Strategic Node	Scenario	Frequency (%) of Days below 20% of Median Daily Flow												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
EDO13 (Givhans Ferry)	Unimpaired Flow (UIF)	0	0	0	0	0	0.7	0.6	0.9	0.2	0.4	0	0	0.2
	Current Use	0	0	0	0	0.8	4.0	7	5	3.7	1.4	0.1	0	1.9
	Business as Usual (2070)													
	High Demand (2070)													
	Full Allocation													

With the Proposed Low Flow Strategy

Strategic Node	Scenario	Frequency (%) of Days below 20% of Median Daily Flow												
		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
EDO13 (Givhans Ferry)	Unimpaired Flow (UIF)	0	0	0	0	0	0.7	0.6	0.9	0.2	0.4	0	0	0.2
	Current Use	0	0	0	0	0.3	2.9	2.8	3.4	2.6	0.8	0	0	1.1
	Business as Usual (2070)													
	High Demand (2070)													
	Full Allocation													

What Additional Water Management Strategies Does the RBC Want to Consider to Address the Identified Issues?

Where are the Opportunities in the Edisto Basin?



What Additional Water Management Strategies Does the RBC Want to Consider to Address the Identified Issues?

1. Strategies to reduce demands? Some examples…

a. Water loss control programs

b. Low flow fixtures and appliances

c. Pricing structures

d. Ag water audits and irrigation efficiency measures

e. Soil moisture sensor/smart irrigation

What Additional Water Management Strategies Does the RBC Want to Consider to Address the Identified Issues?

1. Strategies to increase supply? Some examples…

a. New impoundments, ponds, reservoirs, tanks

b. Dredging (pond deepening)

c. Aquifer storage and recovery

d. Conjunctive use

e. Water reuse systems

f. Interbasin transfer

Framework for Discussion

1. Review of surface water modeling results
2. Discuss and confirm issues to address
3. Review in-place and planned strategies
4. Identify additional strategies to address issues
5. **Select strategies for screening and/or model evaluation**
6. December Meeting - Report on Strategy Effectiveness

Selected strategies for screening and/or model evaluation

Based on RBC discussion, CDM Smith will investigate the effectiveness of already in-place strategies and various demand-side strategies using the SWAM model, prior to the December RBC meeting. Supply-side strategies will be identified by the RBC at a subsequent meeting, and those, along with a proposed Low Flow Strategy will then be evaluated using the model.

Framework for Discussion

1. Review of surface water modeling results
2. Discuss and confirm issues to address
3. Review in-place and planned strategies
4. Identify additional strategies to address issues
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6. December Meeting - Report on Strategy Effectiveness

Next Edisto RBC Meeting

Wed, December 15

Informational Topic

- Groundwater Scenario Results - Comparison and Discussion
- Results of Surface Water Management Strategy Effectiveness

RBC Discussion

- Begin to consider trigger levels and/or desired future conditions for groundwater
- Consider and discuss effectiveness of surface water management strategies, and select strategies for feasibility study