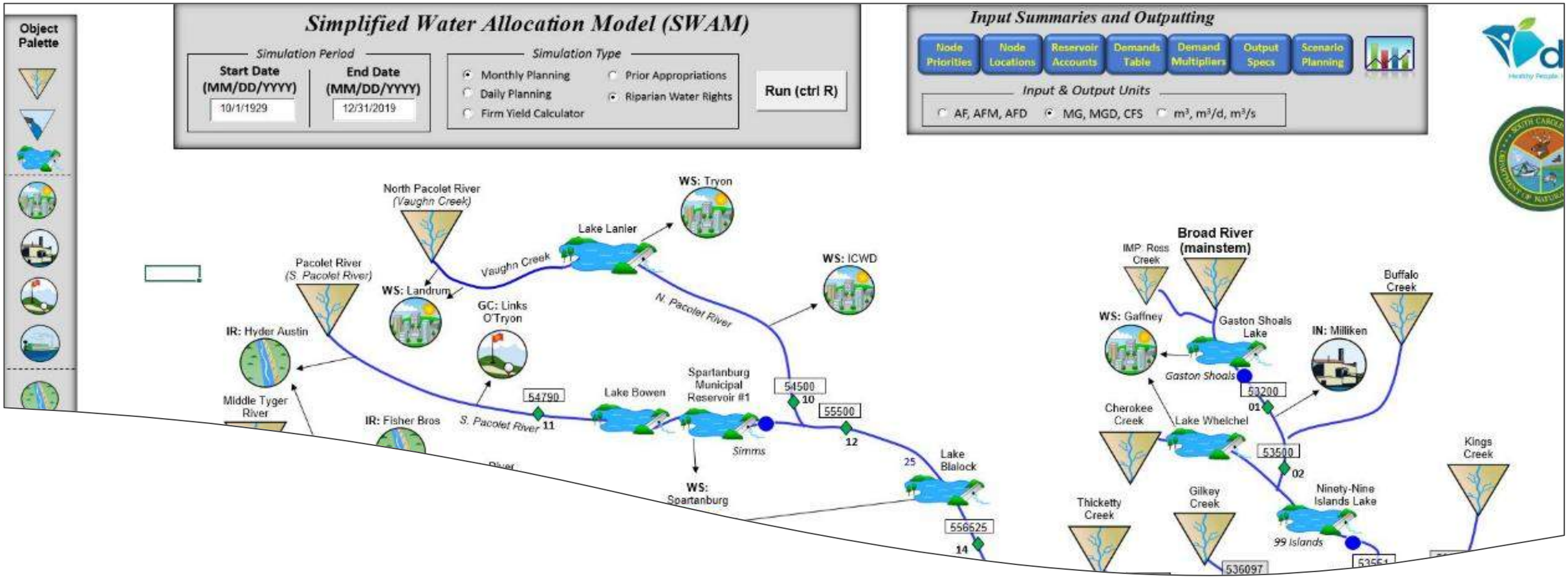
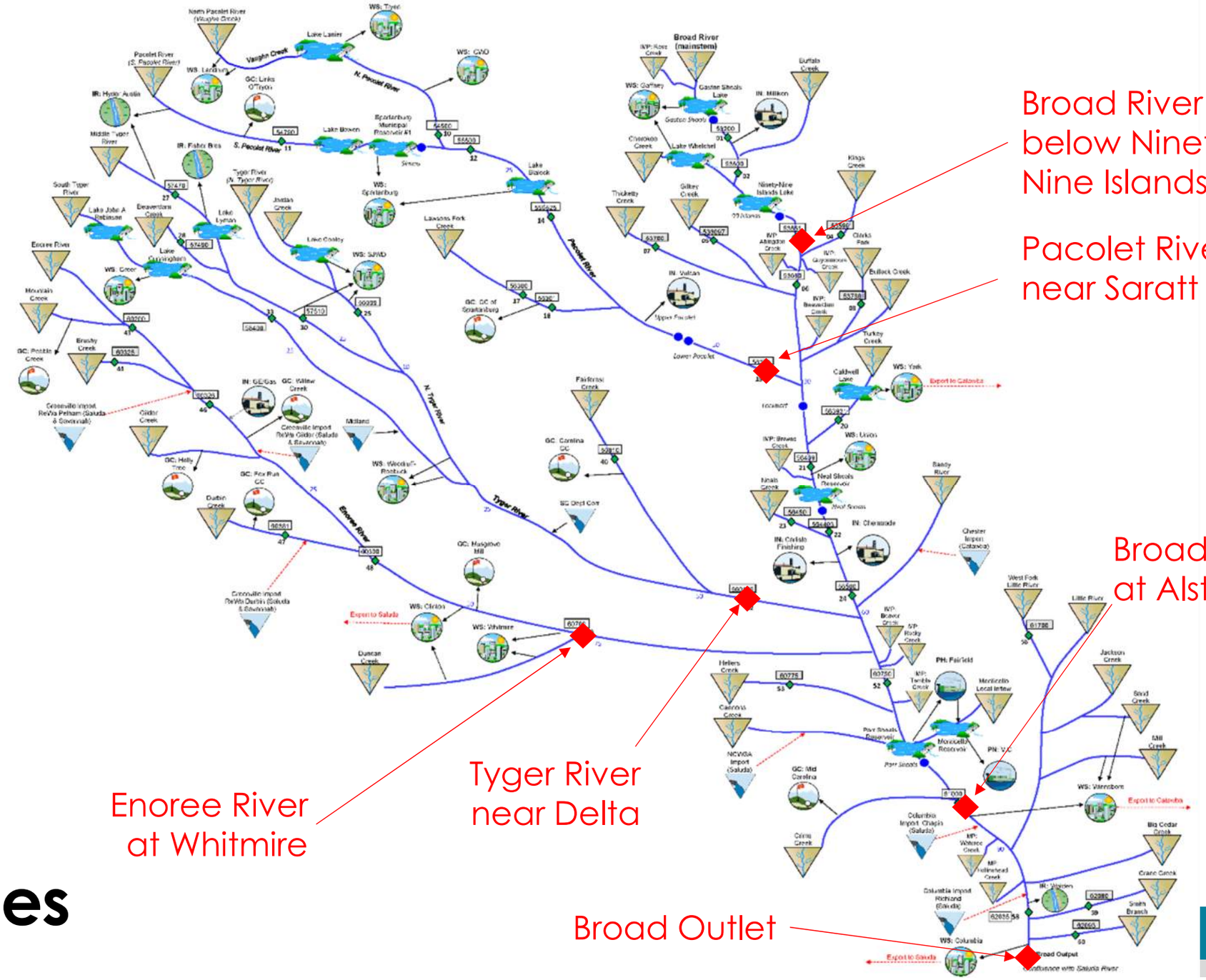


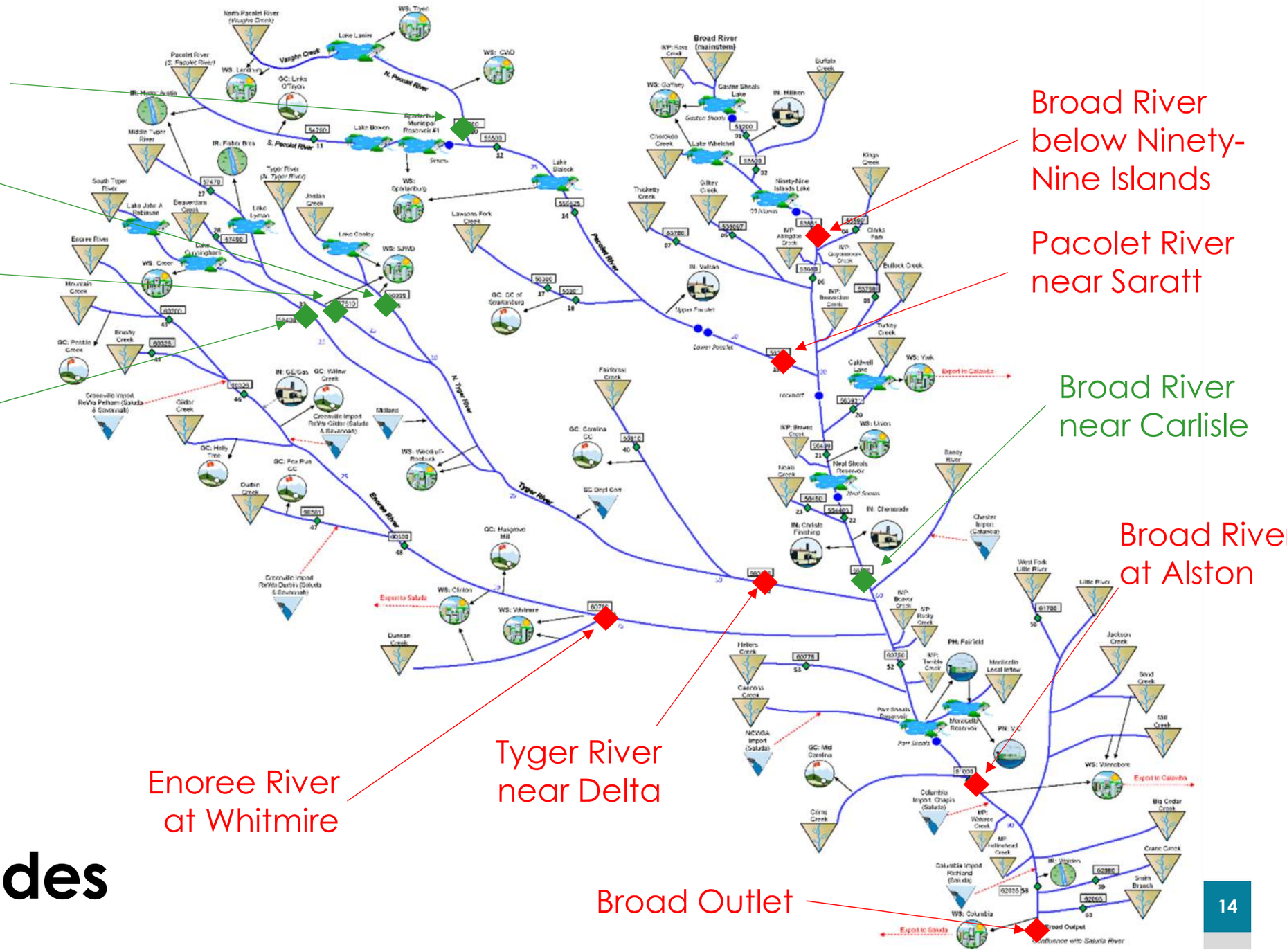
Surface Water Modeling Topics

Agenda Item 4

Strategic Nodes



Strategic Nodes



Simulated Flows at Strategic Nodes

Not all Strategic Nodes Shown

Performance Measure	BRD03 Broad River below Ninety-Nine Island Reservoir	BRD54 Broad River at Alston	Broad River Output Flow	BRD19 Pacolet River near Saratt	BRD42 Tyger River near Delta	BRD50 Enoree River at Whitmire
	All values in CFS					
UIF Scenario						
mean flow	2,365	5,680	6,123	704	804	475
median flow	2,011	4,747	5,029	602	666	387
25th percentile flow	1,434	3,263	3,433	415	447	258
10th percentile flow	997	2,240	2,345	292	298	177
5th percentile flow	800	1,786	1,907	234	229	143
Current Use Scenario						
mean flow	2,323	5,439	5,836	654	777	487
median flow	1,968	4,534	4,748	548	636	400
25th percentile flow	1,385	2,963	3,091	364	418	270
10th percentile flow	945	1,997	2,061	231	269	187
5th percentile flow	744	1,537	1,580	182	197	153
Moderate Demand Scenario						
mean flow	2,288	5,374	5,754	632	758	501
median flow	1,929	4,463	4,698	523	617	413
25th percentile flow	1,363	2,886	3,004	334	399	283
10th percentile flow	911	1,917	1,973	221	245	199
5th percentile flow	723	1,505	1,554	174	177	165
High Demand Scenario						
mean flow	2,271	5,300	5,640	610	737	502
median flow	1,905	4,375	4,550	498	595	416
25th percentile flow	1,341	2,810	2,893	313	370	284
10th percentile flow	906	1,863	1,863	213	224	201
5th percentile flow	700	1,427	1,448	163	162	165

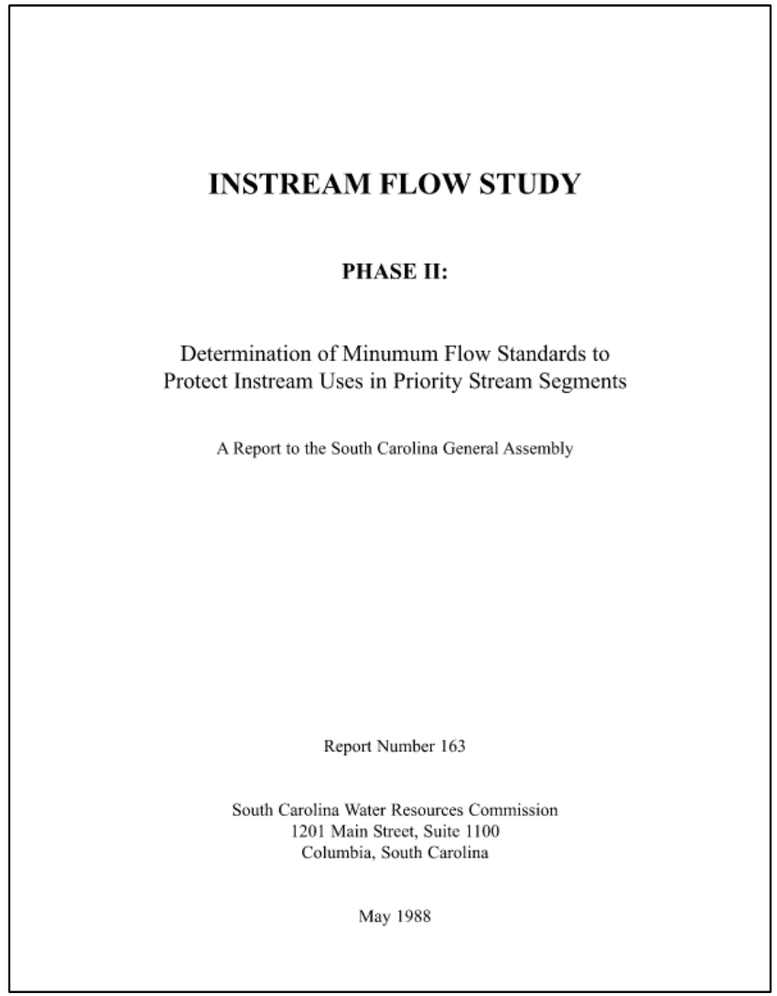
Simulated Difference in Flows at Strategic Nodes from Current Use Scenario

Not all Strategic Nodes Shown

Performance Measure	BRD03 Broad River below Ninety-Nine Island Reservoir	BRD54 Broad River at Alston	Broad River Output Flow	BRD19 Pacolet River near Saratt	BRD42 Tyger River near Delta	BRD50 Enoree River at Whitmire
	All values in CFS					
UIF Scenario minus Current Use Scenario						
mean flow	42	241	287	50	27	-12
median flow	44	213	281	54	30	-13
25th percentile flow	49	300	342	52	30	-12
10th percentile flow	51	243	284	61	29	-10
5th percentile flow	55	249	327	53	32	-10
Current Use Scenario Flows						
mean flow	2,323	5,439	5,836	654	777	487
median flow	1,968	4,534	4,748	548	636	400
25th percentile flow	1,385	2,963	3,091	364	418	270
10th percentile flow	945	1,997	2,061	231	269	187
5th percentile flow	744	1,537	1,580	182	197	153
Moderate Demand Scenario minus Current Use Scenario						
mean flow	-35	-65	-82	-22	-19	13
median flow	-39	-70	-50	-25	-19	13
25th percentile flow	-23	-77	-87	-30	-19	13
10th percentile flow	-34	-80	-89	-11	-24	13
5th percentile flow	-21	-32	-26	-8	-20	12
High Demand Scenario minus Current Use Scenario						
mean flow	-52	-139	-196	-44	-40	15
median flow	-63	-158	-199	-50	-41	16
25th percentile flow	-45	-153	-198	-50	-47	14
10th percentile flow	-39	-134	-198	-19	-45	14
5th percentile flow	-44	-109	-131	-19	-35	12

1988 Instream Flow Study

- In 1983 the Water Resource Commission was directed to
  - **Phase 1:** Identify streams in need of low flow protection (1985)
  - **Phase II:** Make recommendations of MIF requirements to protect instream uses (1988)
- Determined MIF for 33 study sites based on 6 instream uses with different instream flow approaches
- MIF to protect fisheries resources determined by
  - Tennant Method
  - Wetted Perimeter
  - Usable Width
- Instream flows should be determined for 3 periods to maintain natural seasonal variability (higher flows in spring, lower in summer).
- SC Wildlife and Marine Resources Dept. used study to develop MIF for fisheries as 20-30-40



INSTREAM FLOW STUDY

PHASE II:

Determination of Minumum Flow Standards to
Protect Instream Uses in Priority Stream Segments

A Report to the South Carolina General Assembly

Report Number 163

South Carolina Water Resources Commission
1201 Main Street, Suite 1100
Columbia, South Carolina

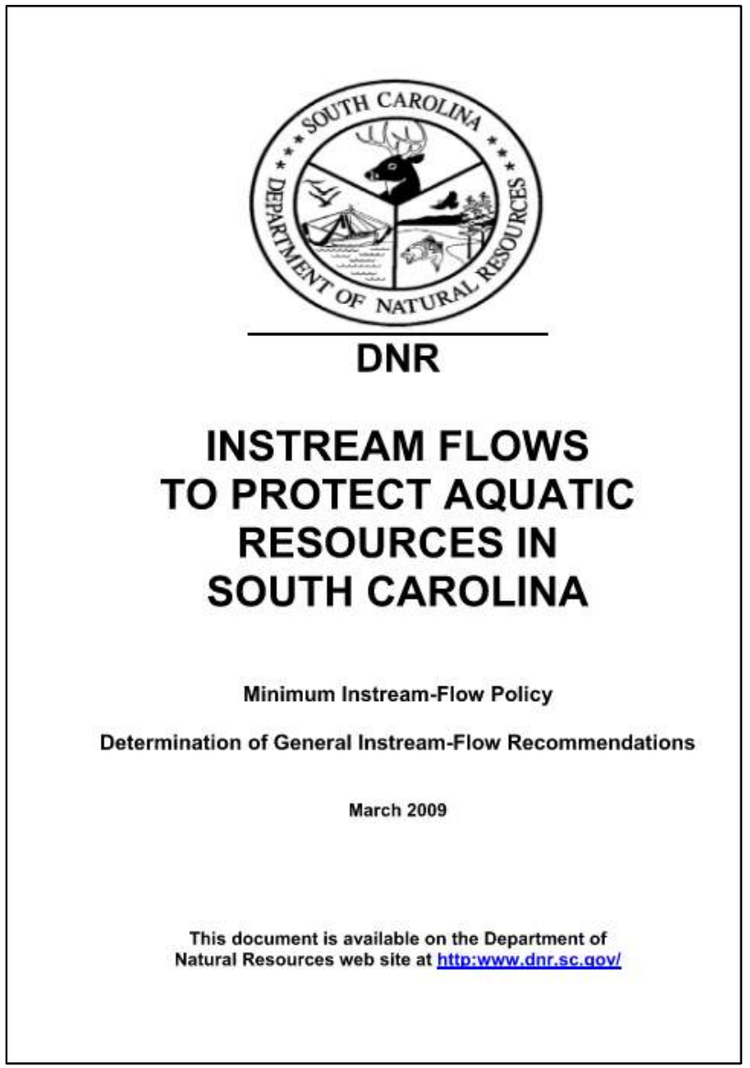
May 1988

2009 SCDNR Instream Flow Policy

- Adopted results of 1988 study
  - Seasonal variability in flows
  - Fisheries requirements as limiting
- Based on variation in fish habitat needs in the Piedmont vs the Coastal Plain, DNR recommended MIFs vary
- DNR will request MIFs below proposed or existing dams be maintained at minimum levels noted in the table

Table VI. DNR recommended minimum acceptable instream flows.

Region	Period	Minimum Recommended Instream-Flow
Coastal Plain	July – November	20% of mean annual daily flow
	January – April	60% of mean annual daily flow
	May, June & December	40%' of mean annual daily flow
Piedmont	July – November	20% of mean annual daily flow
	January – April	40% of mean annual daily flow
	May, June & December	30% of mean annual daily flow



Minimum Instream Flows in the SW Regulations

The South Carolina Surface Water Withdrawal, Permitting, Use, and Reporting Act defines the Minimum Instream Flow as:

"… the flow that provides an adequate supply of water at the surface water withdrawal point to maintain the biological, chemical, and physical integrity of the stream taking into account the needs of downstream users, recreation, and navigation and that flow is set at forty percent of the mean annual daily flow for the months of January, February, March, and April; thirty percent of the mean annual daily flow for the months of May, June, and December; and twenty percent of the mean annual daily flow for the months of July through November for surface water withdrawers as described in Section 49 4 150(A)(1).

For surface water withdrawal points located on a surface water segment downstream of and influenced by a licensed or otherwise flow controlled impoundment, "minimum instream flow" means the flow that provides an adequate supply of water at the surface water withdrawal point to maintain the biological, chemical, and physical integrity of the stream taking into account the needs of downstream users, recreation, and navigation and that flow is set in Section 49 4 150(A)(3)." (*which says that MIF shall be the flow specified in the license by the appropriate governmental agency*)

Comparison to Minimum Instream Flows

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

N. Tyger River below Wellford	
UIF	14
Current	8
2070 Mod	12
2070 HD	2
P&R	1

N. Pacolet River near Fingerville	
UIF	75
Current	66
2070 Mod	57
2070 HD	49
P&R	53

S. Tyger River below Duncan	
UIF	50
Current	35
2070 Mod	26
2070 HD	27
P&R	26

Middle Tyger River near Lyman	
UIF	32
Current	22
2070 Mod	6
2070 HD	0.1
P&R	0.1

Pacolet River near Saratt	
UIF	234
Current	182
2070 Mod	174
2070 HD	163
P&R	133

Broad below Ninety-Nine Islands	
UIF	800
Current	744
2070 Mod	723
2070 HD	700
P&R	704

Broad near Carlise	
UIF	1,173
Current	1.053
2070 Mod	1.013
2070 HD	970
P&R	957

Broad near Alston	
UIF	1,786
Current	1,537
2070 Mod	1,505
2070 HD	1,427
P&R	1,331

Broad Outlet	
UIF	1,907
Current	1,580
2070 Mod	1,554
2070 HD	1,448
P&R	1,260

Enoree River near Whitmire	
UIF	143
Current	153
2070 Mod	165
2070 HD	165
P&R	132

Tyger River near Delta	
UIF	229
Current	197
2070 Mod	177
2070 HD	162
P&R	141

Comparison of 5th Percentile Flows

Flows at each strategic node listed in the tables are in cubic feet per second (cfs)

Strategic Nodes for Flow-Ecology Evaluation