

**80% Flow-By
vs.
20% 7Q10**

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Ecological Flow Science Advisory Board

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Disclaimer

- **DWR is not assuming that the “80% Flow-By” approach will be the SAB’s final recommendation.**
- **Goal of analysis is to test a potential ecologic integrity planning criteria.**
- **The purpose of this presentation is to provide an example of “one” approach that could be used to implement a Flow-By approach.**

How is 20% 7Q10 used?

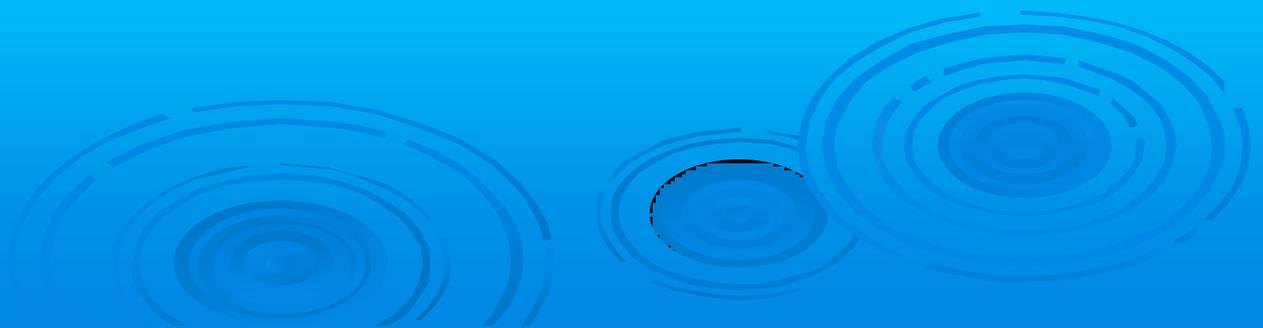
- **20% 7Q10 is a SEPA minimum criteria for additional study.**
 - **If the maximum instantaneous with is less than 20% 7Q10 then no additional analysis is needed.**
- **20% 7Q10 has frequency been misapplied as the safe yield.**

Implementation Problem With 20% 7Q10

- **Best application is a single isolated run-of-river withdrawal.**
- **Does not work for withdrawals from reservoirs.**
- **How to apply to multiple near by withdrawals?**
- **Does not provide a metric to assess the accumulative upstream impacts.**
 - **Only applies to run-of-river nodes with a withdrawal.**

Trial Implementation of 80% Flow-By

- **Need an approach that will work for single, multiple near-by, and reservoir withdrawals.**
- **Needs to be able to assess the accumulative upstream impacts at all flow nodes, work at nodes with or without withdrawals.**



Starting Point

➤ SL 2010-143 Definitions

- "**Ecological integrity**" means the ability of an aquatic system to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization **comparable to prevailing ecological conditions** and, when subject to disruption, to recover and continue to provide the natural goods and services that normally accrue from the system.
- "**Prevailing ecological conditions**" means the ecological conditions determined by reference to the applicable period of record of the United States Geological Survey stream gauge data, **including data reflecting the ecological conditions that exist after the construction and operation of existing flow modification devices, such as dams**, but excluding data collected when stream flow is temporarily affected by in-stream construction activity.

➤ Analysis Assumption

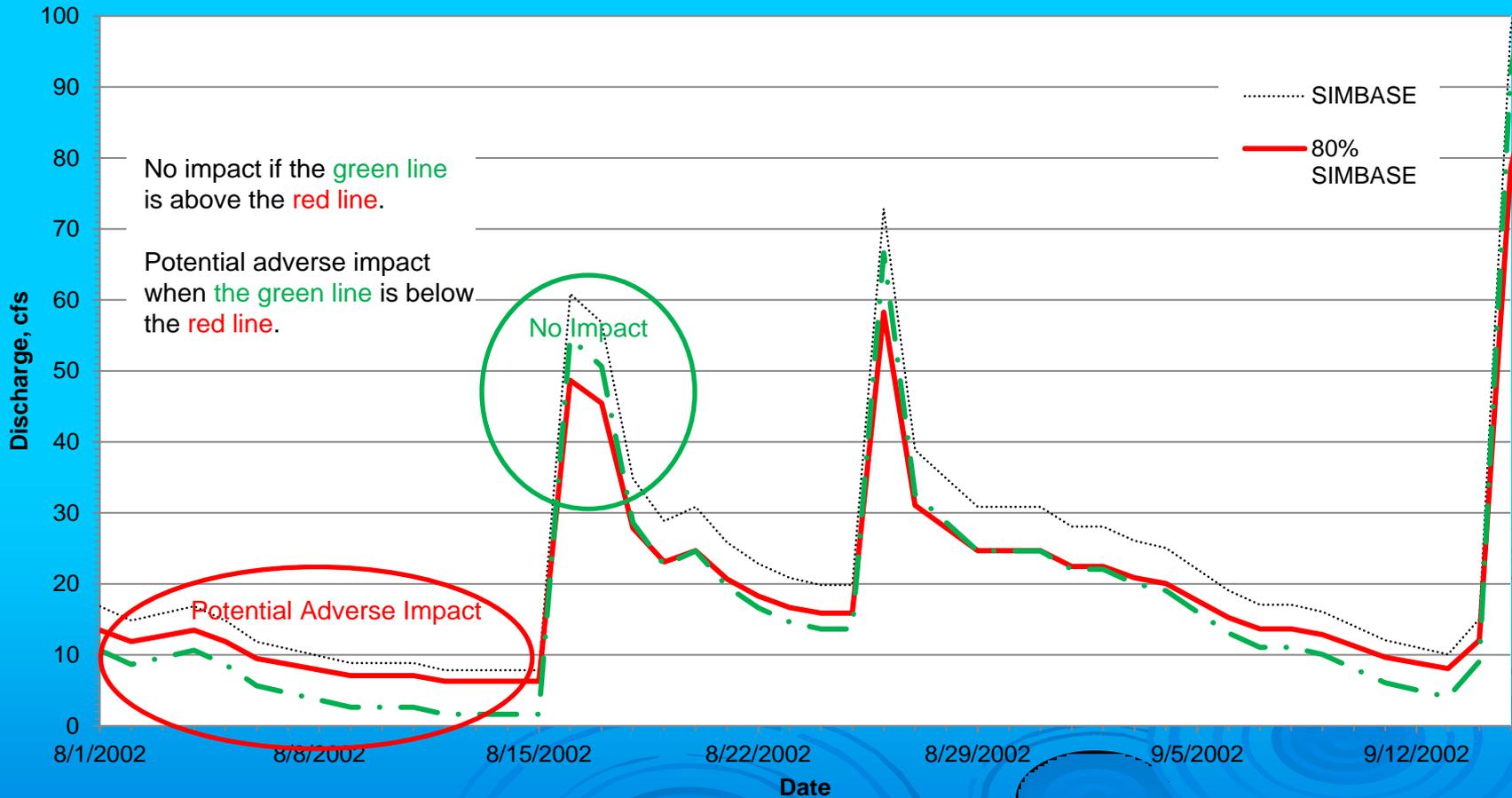
- Assume the **SIMBASE** modeling scenario represents "Prevailing ecological conditions". SIMBASE is the model scenario that represents current conditions, withdrawals, discharges, reservoir operations, drought plans, etc.

80% Flow-By Analysis Approach

- **Create an 80% BASELINE using SIMBASE and compare scenarios to the baseline. When a scenario flow is below the BASELINE, that represents a potential adverse ecological impact.**
- **Analysis steps:**
 1. For each day (29,493 days)
 $\text{BASELINE} = 80\% * \text{SIMBASE (outflow from the arc)}$
 2. Compare each day (29,493 days)
IF scenario < BASELINE then that days is a potential adverse ecological impact day.
 3. Looking for guidance on how to assess if a node is adversely impacted based on number of days, time of year, etc.

80% Flow-By Example

Cleveland County Intake 2060 Scenario



Trial Balloon

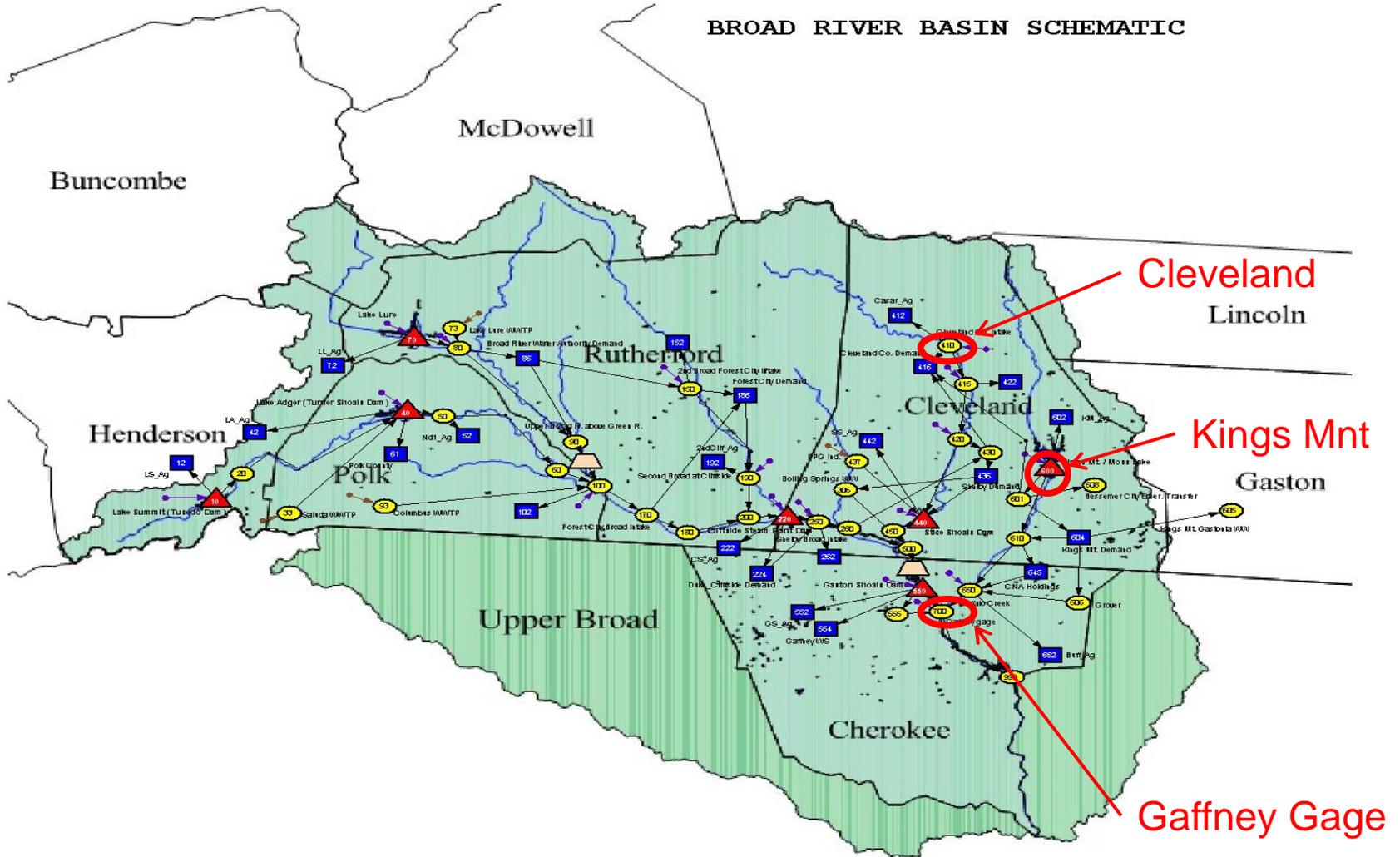
➤ Broad River Basin

- Only certified model
- One of the smaller and simpler basins.
- Has a mix of withdrawals both run-of-river and reservoir.
- Analyzed 27 river nodes, this include the reservoir release nodes with a modeling record of 1/1/1930 to 12/31/2009.

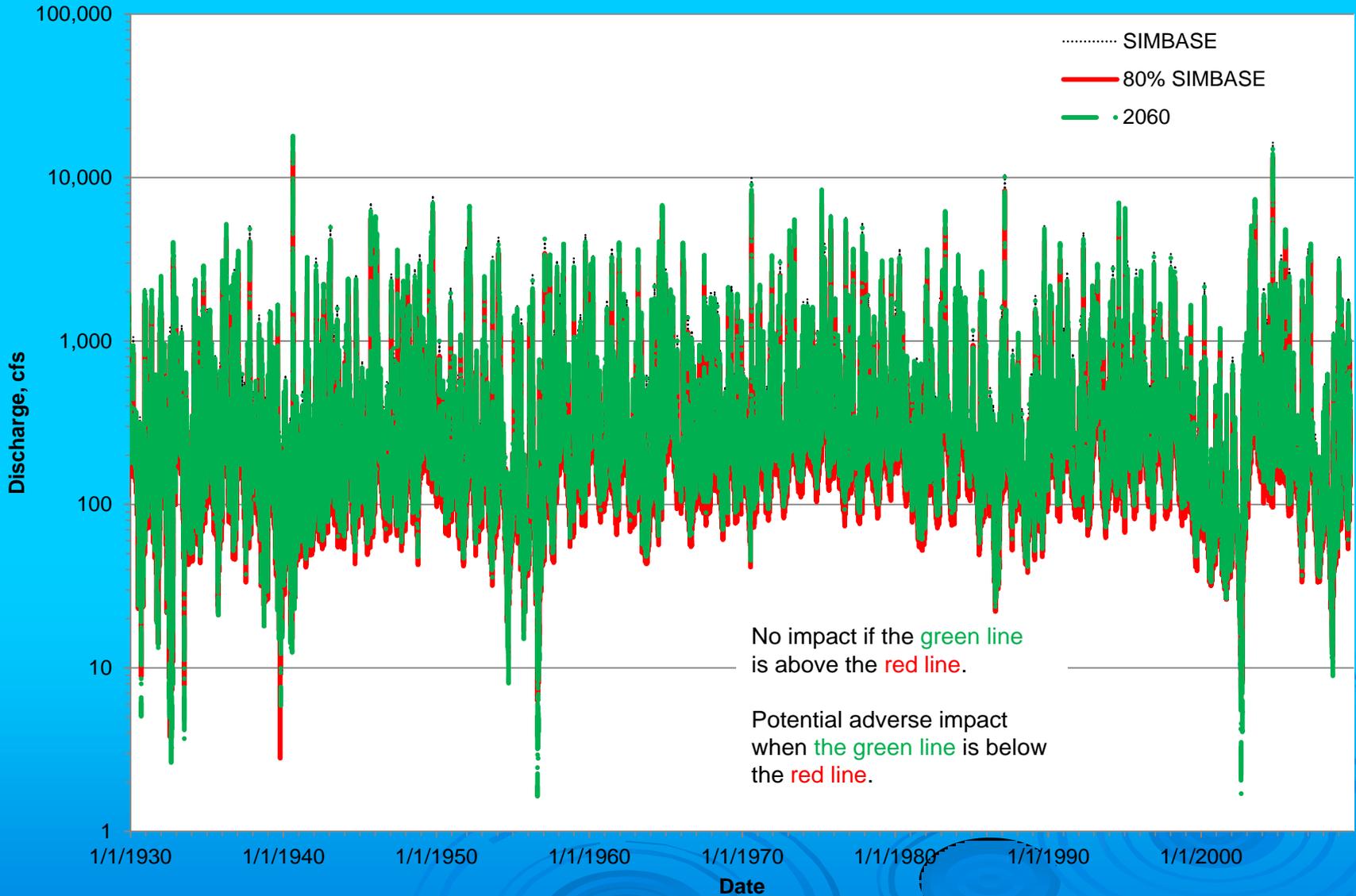


Broad River Basin Model

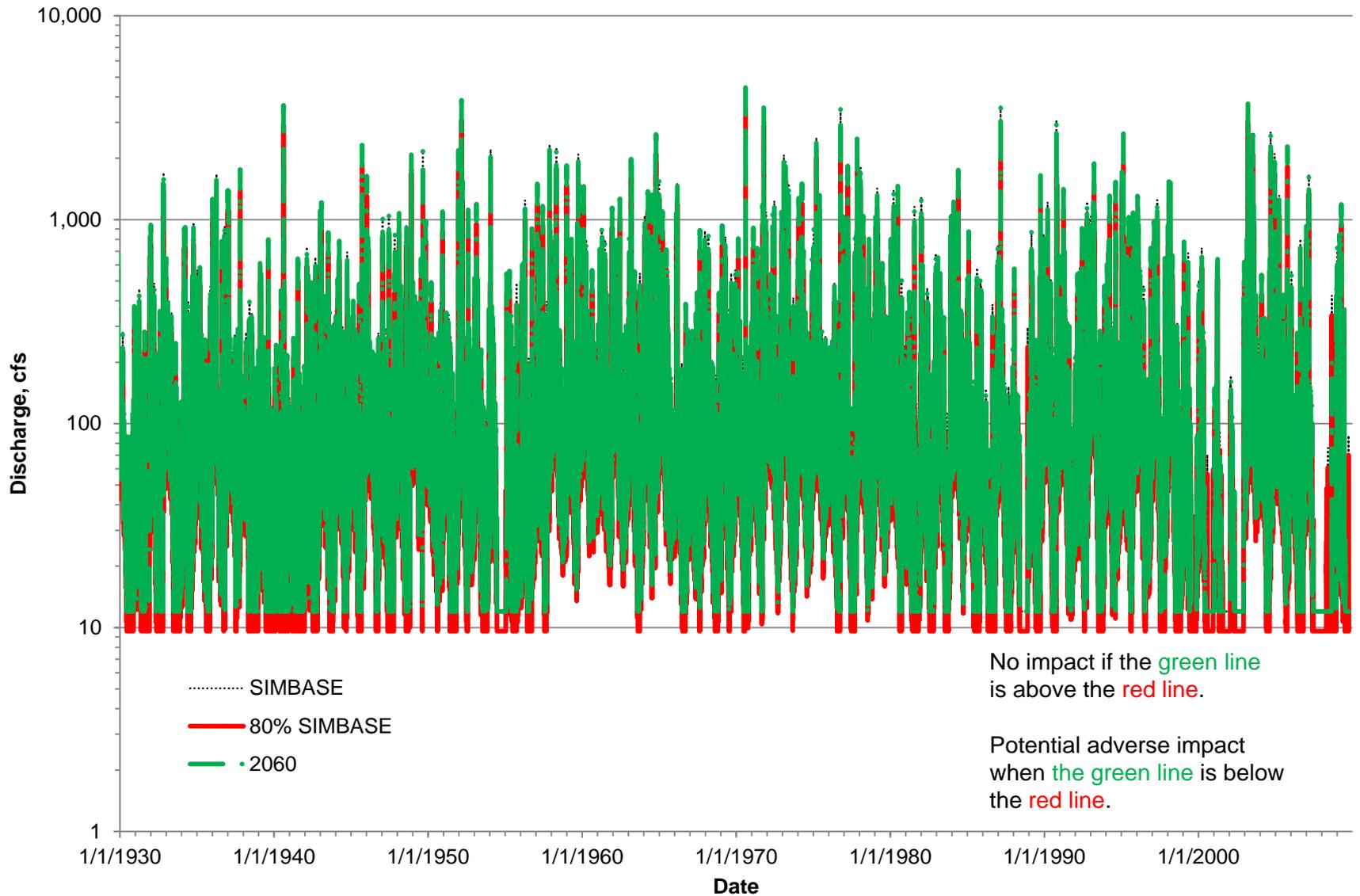
BROAD RIVER BASIN SCHEMATIC



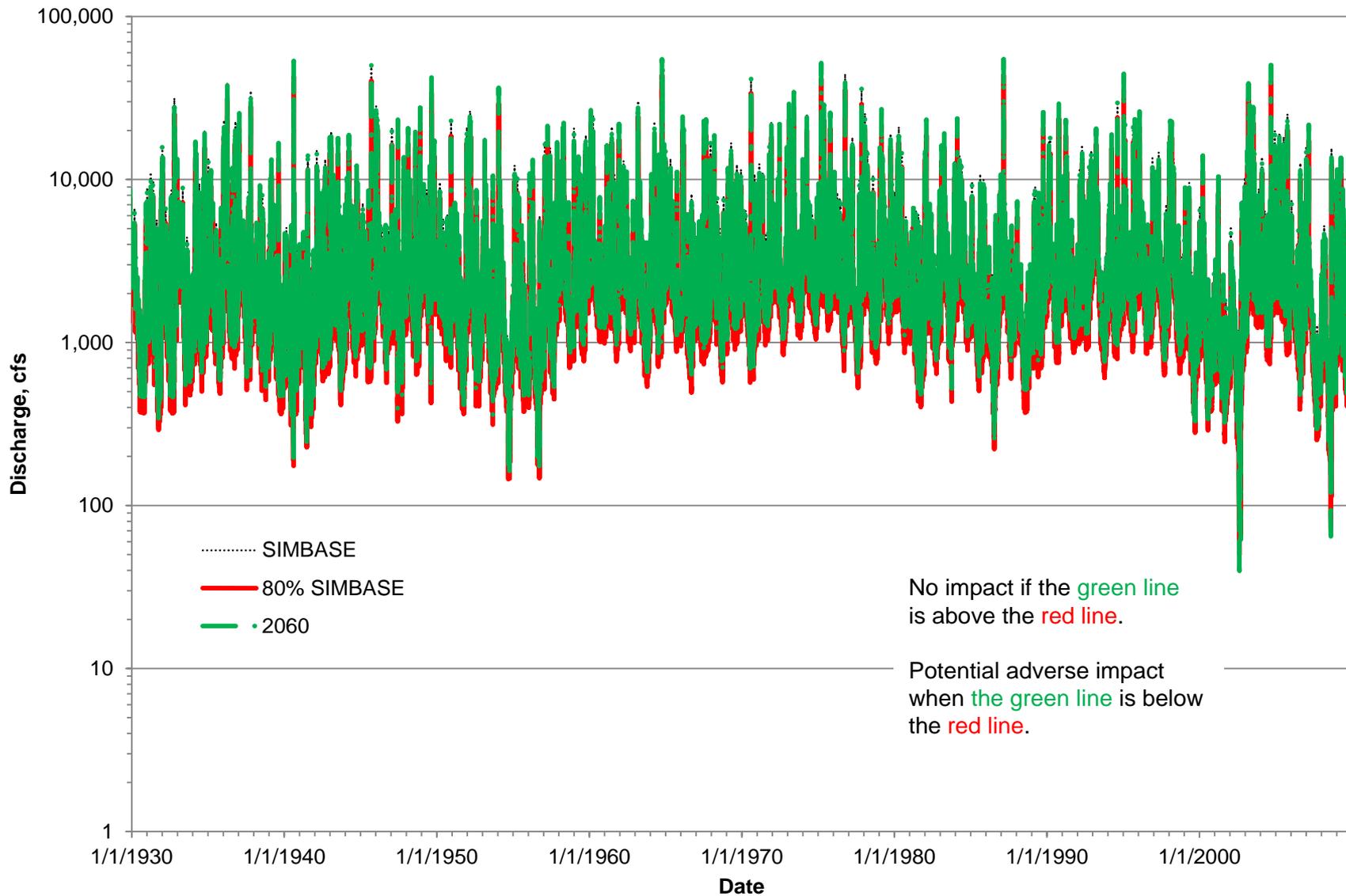
Cleveland County Intake 2060 Scenario



Kings Mnt Reservoir Release 2060 Scenario



Gaffney Gage 2060 Scenario



Broad River Basin - 2060 Scenario Node Summary

Arc Node	Description of the Node	80% of Flow-By	
		Number of days with potential adverse impacts	Percent of days
010.020	Lake Summit Release	0	0.00%
020.040	Green River to Lake Adger	0	0.00%
040.050	Lake Adger Release	168	0.57%
050.060	Green River to Ken Miller	168	0.57%
060.100	Green River to Broad Confluence	168	0.57%
070.080	Lake Lure Release	0	0.00%
080.090	Upper Broad	30	0.10%
090.100	Upper Broad to Broad Confluence	24	0.08%
100.170	Broad River to Forest City Intake	4	0.01%
150.190	2nd Broad	18	0.06%
190.200	2nd Broad Cliffside	0	0.00%
170.180	Forest City Intake (2nd Broad)	4	0.01%
180.200	Upper Cliffside	4	0.01%
200.220	2nd Broad Confluence	0	0.00%
220.250	Cliffside Dam Release	25	0.08%
250.260	Boiling Spring Gage	4	0.01%
410.415	Cleveland Intake	159	0.54%
415.420	Lawndale Gage	116	0.39%
420.440	Shelby Intake (1st Broad)	131	0.44%
440.450	Gaston Shoals Dam Release	0	0.00%
450.500	First Broad Confluence	0	0.00%
500.550	Lower Broad	4	0.01%
550.700	Gaston Shoals Dam Release	104	0.35%
600.610	Kings Mountain Reservoir Release	290	0.98%
610.650	Kings Mountain WTP Discharge	163	0.55%
650.700	Buffalo Creek Confluence	50	0.17%
700.999	Gaffney Gage	26	0.09%

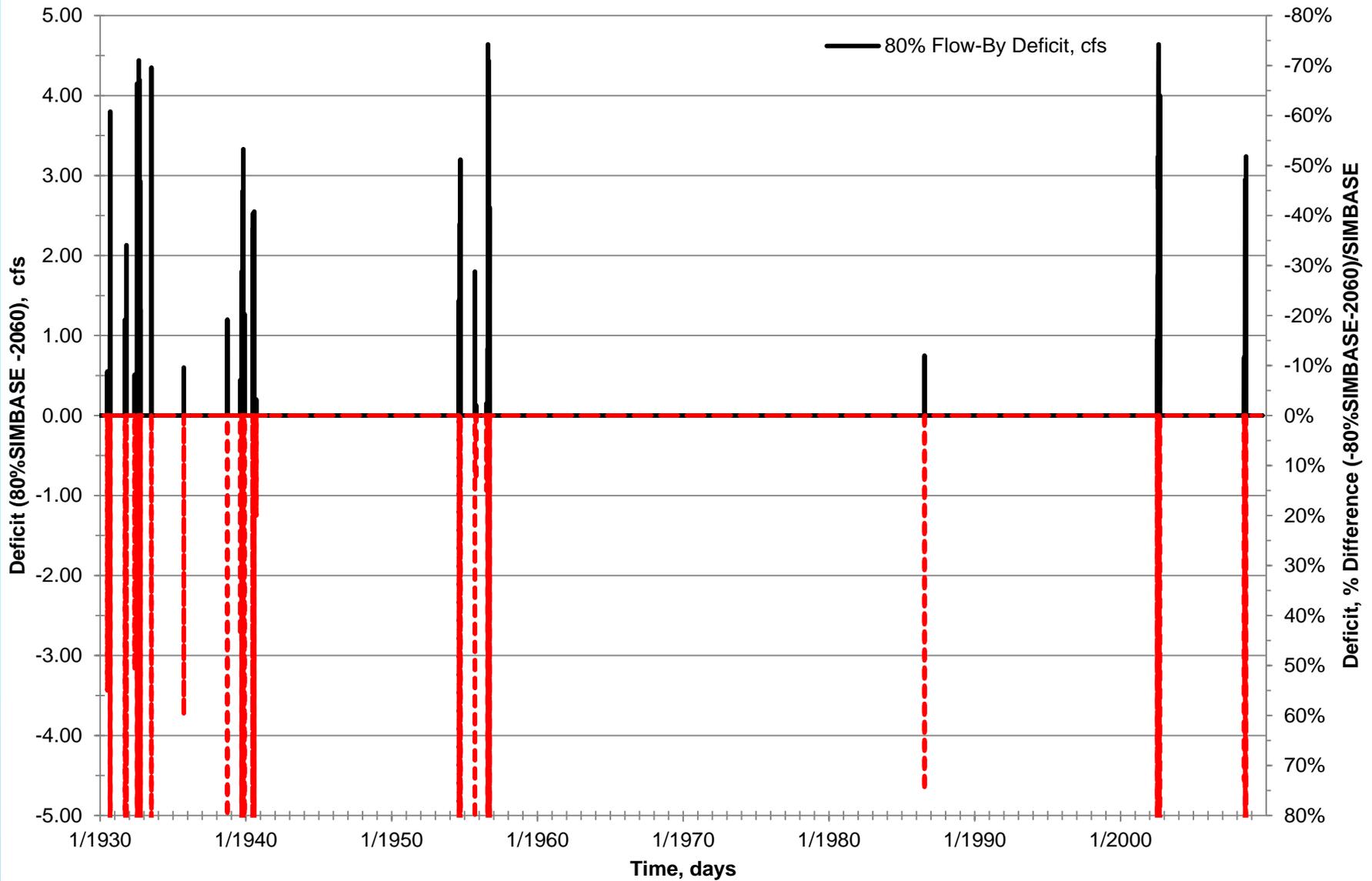
74% of the nodes (20 out of 27) with 1 or more days with potential impacts. Potential impacts occur less than 1% of the time.

Broad River Basin - 2060 Scenario

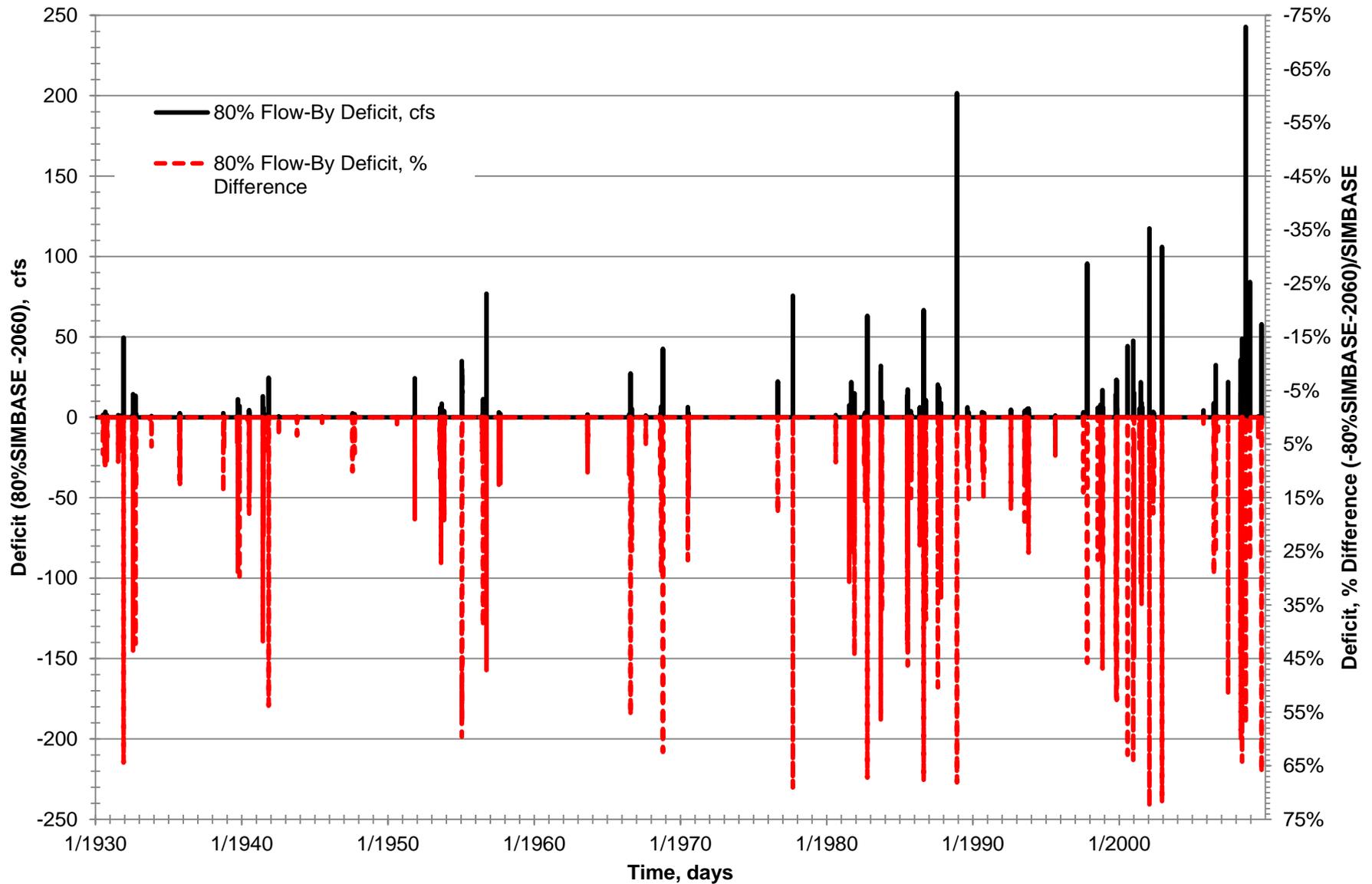
80% of Flow-By Summary

Arc Node	Description of the Node	Days Potential Impact		Difference (2060-80%SIMBASE), cfs			
		Number of days	Percent of days	Minimum	Average	Median	Maximum
410.415	Cleveland Intake	159	0.54%	0.00	0.01	0.00	4.64
600.610	Kings Mountain Reservoir Release	290	0.98%	0	0.11	0	242.83
700.999	Gaffney Gage	26	0.09%	0.00	0.01	0.00	32.61
	Average of the 27 Nodes	61	0.21%				
				Difference (2060-80%SIMBASE), cfs			
				Minimum	Average	Median	Maximum
410.415	Cleveland Intake			0.00%	0.08%	0.00%	80.00%
600.610	Kings Mountain Reservoir Release			0.00%	0.20%	0.00%	72.59%
700.999	Gaffney Gage			0.00%	0.01%	0.00%	16.46%

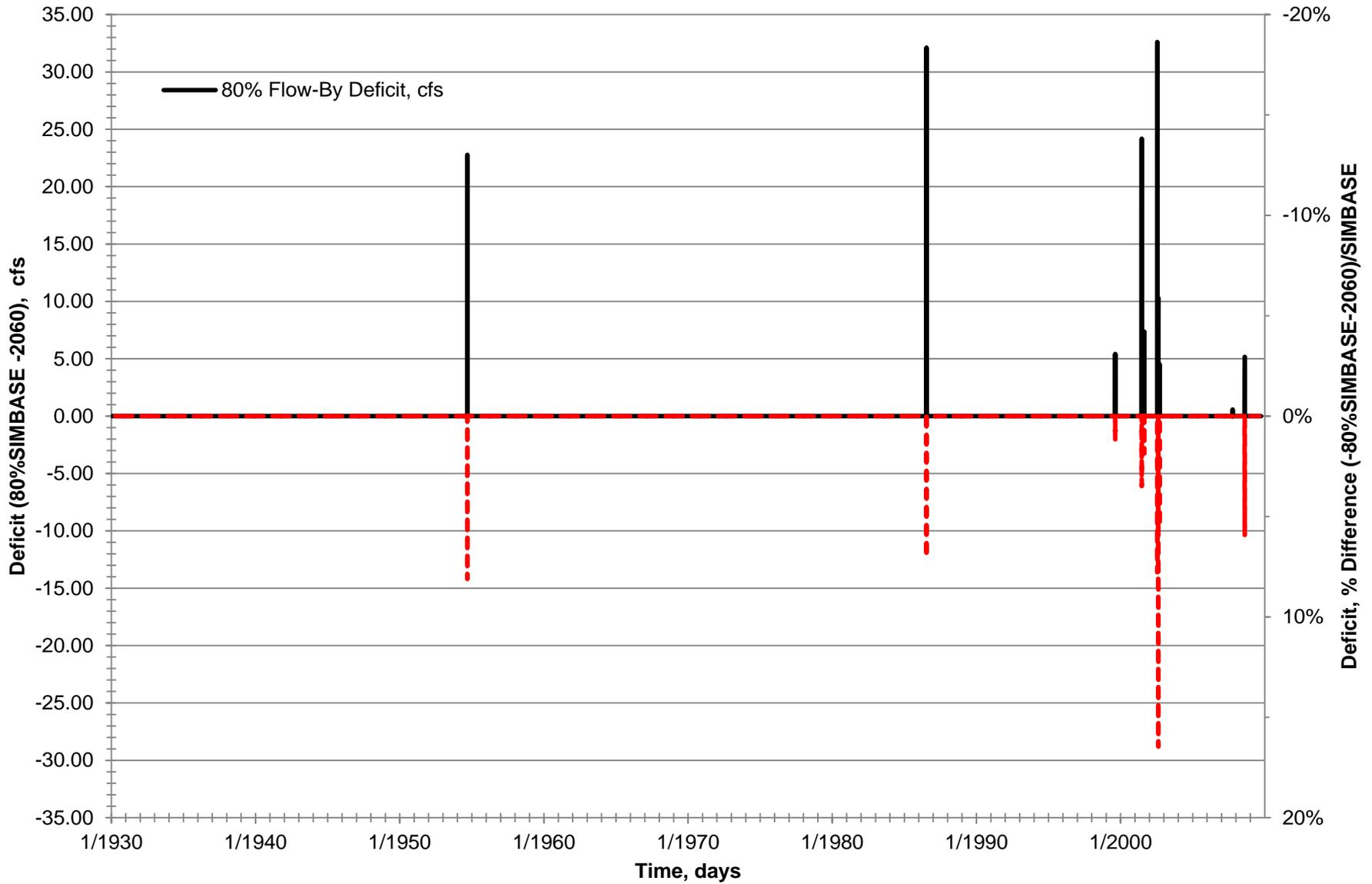
Cleveland County Intake- 2060



Kings Mnt Reservoir Release - 2060



Gaffney Gage - 2060



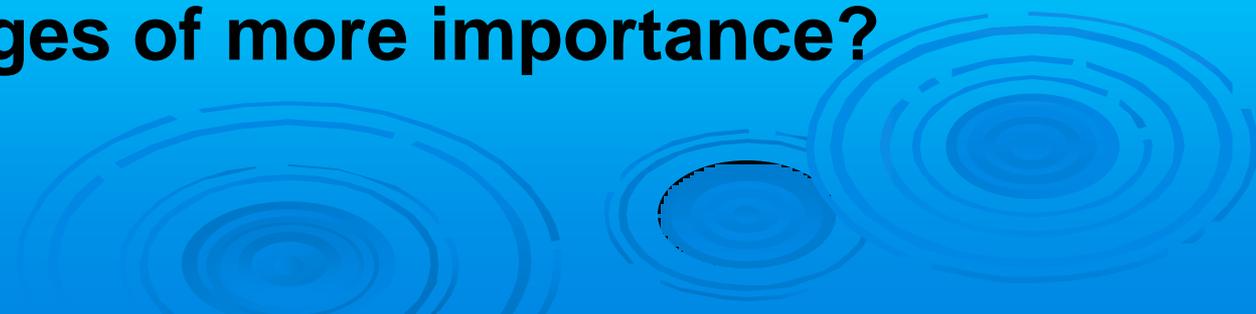
Broad River Basin - 2060 Scenario - 80% of Flow-By Frequency Analysis

Non-Exceedence Percent	Cleveland Intake cfs		Kings Mountain Reservoir Release cfs		Gaffney Gage cfs	
	80%SIMBASE	2060	80%SIMBASE	2060	80%SIMBASE	2060
0.003%	2.81	0.00	9.60	12.00	50.05	39.76
0.500%	23.80	23.44	9.60	12.00	278.08	323.90
1.000%	30.46	32.06	9.60	12.00	364.80	442.81
2.000%	38.46	42.13	9.60	12.00	396.62	485.32
5.000%	50.28	56.89	9.60	12.00	561.44	682.26
10.000%	66.46	77.13	9.60	12.00	720.60	876.10
15.000%	78.07	91.89	11.84	12.14	831.03	1,015.71
20.000%	87.00	102.98	16.20	18.27	933.17	1,144.17
25.000%	94.86	112.89	20.02	23.12	1,025.51	1,259.31
30.000%	103.01	123.14	23.41	27.49	1,115.89	1,373.37
35.000%	112.13	134.44	26.96	32.15	1,207.28	1,487.16
40.000%	121.40	146.09	30.60	36.56	1,292.03	1,593.01
45.000%	130.48	157.30	34.28	41.23	1,385.76	1,709.70
50.000%	140.08	169.34	38.61	46.72	1,487.14	1,837.53
55.000%	150.48	182.30	43.05	52.22	1,598.96	1,977.31
60.000%	162.19	197.09	48.16	58.59	1,719.80	2,128.53
65.000%	174.99	213.09	53.65	65.52	1,843.28	2,283.46
70.000%	190.48	232.28	59.81	73.28	1,996.54	2,474.56
75.000%	209.73	256.98	67.17	82.35	2,183.80	2,707.04
80.000%	235.79	289.23	77.16	94.89	2,432.98	3,019.67
85.000%	272.83	335.27	92.75	114.22	2,790.52	3,466.91
90.000%	334.48	412.28	118.64	146.41	3,393.62	4,220.36
95.000%	497.03	615.52	187.26	231.59	4,886.97	6,088.46
98.000%	868.27	1,080.09	369.03	458.72	7,920.52	9,881.02
99.000%	1,339.84	1,669.31	568.70	709.43	11,190.51	13,968.40
99.500%	1,938.71	2,417.33	828.56	1,034.32	14,958.05	18,676.93
99.997%	14,402.30	17,996.62	3,558.96	4,446.98	43,746.91	54,661.96

Red cells are 2060 flows a potential adverse impact.

We Need Help With -

- **How do we implement your recommendation?**
 - **If a flow-by approach is used, is the analysis on the right path?**
 - **Is SIMBASE the correct starting point?**
 - **Do all flows need to be $\geq 80\%$ of SIMBASE?**
 - **Are certain times of the year or specific flow ranges of more importance?**
 - **?**



Questions

80% flow-by is a trial balloon DWR is open willing to consider all recommendations from the SAB, including variations on the 80% theme.

Contact Information

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