

Review of Phase 5 Watershed Model Hydrologic Calibration

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Executive Summary

The hydrologic calibration of the phase 5 watershed model was evaluated through 9 published acceptable criteria used in HSPF Expert system. The specific flow characteristics evaluated are: Error in total volume; Error in low flow or base flow recession; Error in 50% lowest flow; Error in 10% highest flow; Error in storm volumes; Summer volume error; Winter volume error; Summer storm volume error; and Storm peaks simulated versus observed for selected storms in inches. One Phase 5 base flow statistic was also used.

The statistical evaluations were on two levels. The first was to examine these flow characteristics at the "fall line" calibration stations. The second level of evaluation was to look at all the individual calibrated segments for those outside criteria, those with multiple problems, and those with error significantly outside of the published criteria or a significant problem with stated flow characteristic. The statistics for both calibration and validation were evaluated.

The analysis indicates that the model performs well in terms of storm related factors, total and seasonal volumes, which are keys to correctly simulate total loadings. One of three low flow characteristics, error in lowest 50% flow, is the area of worst model performance. This is caused by different measures used to calculate the statistic in this review and Phase 5 model calibration, rather than a real indication of poor model calibration.

The hydrological calibration of the Chesapeake Bay Program's Phase 5 watershed model was conducted on 286 stations where observed flow data are available. The validation was on 33 stations where sufficient flow and water quality data are available. The calibration period is 1991 to 2000, while validation period is 2000 to 2005.

- **Evaluation Criteria**

The hydrologic calibration and validation of the Chesapeake Bay Program's Phase 5 watershed model were evaluated through various statistical measurements. Specifically, nine flow characteristics were evaluated - eight against the published acceptable absolute criteria typically used in HSPF Expert system, one specific Phase 5 model:

Characteristic evaluated	Criteria (+-)
Error in total volume	10%
Error in low flow or base flow recession	0.03
Error in 50% lowest flows	10%
Phase 5 base flow statistics	10%
Error in 10% highest flows	15%
Error in storm volumes	20%
Seasonal volume error supplied as summer and winter volumes by CBPO	30%
Summer storm volume error	50%
Storm peaks simulated versus observed for selected storms in inches	NA

Since the published criteria used were not developed with the same high level of complexity and scale as the Phase 5.1 watershed model, additional criteria were set to determine if a calibrated segment was significantly outside the established HSPF EXP criteria. The concept is to evaluate segments close to but outside the absolute error criteria differently than those considerably outside criteria. Below are criteria used to determine if a station was considered as significantly outside of the above listed criteria:

Characteristic evaluated	Criteria (+-)
Error in total volume	$\geq 20\%$
Error in low flow or base flow recession 2 orders of magnitude increase	≥ 0.06
Error in 50% lowest flows	$\geq 20\%$
Phase 5 base flow statistics	$\geq 20\%$
Error in 10% highest flows	$\geq 25\%$
Error in storm volumes	$\geq 30\%$
Summer volume error	$\geq 40\%$
Winter volume error	$\geq 40\%$
Summer storm volume error	$\geq 75\%$
Storm peaks simulated versus observed for selected storms in inches	$\geq 30\%$

- **Evaluation Process**

The evaluation was conducted on two levels. The first was to examine these flow characteristics at the "fall line" calibration stations because these stations in large part

d dictate hydrologic flows into the Water Quality Sediment Transport Model. The following are the "fall line" stations that were given special attention:

Potomac Basin Potomac River- PM7_4820_0001
Rappahannock Basin Rappahannock River- RU5_6030_0001
York Basin Mattaponi River YM4_6620_0003
York Basin Pamunkey River YP4_6720_6750
James Basin Appomattox River JA5_7480_0001
James Basin Chickahominy River JB3_6820_7053
James Basin James River JL7_6800_7070
Susquehanna Basin Susquehanna River SL9_2720_0001
Eastern Shore Basin Choptank River EM2_3980_0001
Western Maryland Shore Patuxent River XU3_4650_0001

The second level of evaluation was to look at all stations, downstream, and fall line calibrated segments for those with multiple violations of the published criteria, and those with multiple violations significantly outside of the published criteria or multiple significant problems with stated flow characteristics.

• Evaluation Results

The Phase 5 model was calibrated against flow statistics that are mostly different from what used in this review (Appendix 1). These statistics were used in the decision rules to guide and gauge model calibration, and final values are in reasonably good standing. One statistic, model efficiency, is not used in the calibration rule but considered as the ultimate gauge of overall model performance. Of 286 segments calibrated, 214 segments have model efficiency greater than 0.5, indicating the Phase 5 model is well calibrated with observed data.

The flow statistics used for this analysis were calculated for each station from model calibration results (Appendix 2). The results of the analysis are also shown in a geographic format (Appendix 3). Overall, the analysis indicates that the model performs well in terms of total volume and seasonal storm volume (Table 1). This is important because correctly simulated total volumes are a key to correct total loadings. Low flow characteristics, base flow recession and Phase 5 base flow statistic, are in good shape, while lowest 50% of flows is the area of worst model performance. The discrepancy can be explained by the fact that HSPEXP and phase 5 have different measures of base flow. HSPEXP takes the lowest 50% of flows for comparison, while Phase 5 uses the USGS PART program to do hydrograph separation and then minimizes the base flow bias relative to the total bias. It is conceivable that if lowest 50% rather than base flow statistic were used as calibration criterion, lowest 50% of flows can be as good as base flow statistic.

Table 1 Summary of number and percentage of stations violating criteria during calibration

Flow Characteristic	# of stations > criteria	# of stations significantly > criteria
Error in Total Volume	34 (12%)	9 (3%)
Error in Base flow Recession	5 (2%)	2 (1%)
Error in Lowest 50% of flows	193 (67%)	106 (37%)
Phase 5 base flow statistic	64 (22%)	24 (8%)
Error in Highest 10% of flows	34 (12%)	7 (2%)
Storm Peaks Error	70 (24%)	37 (13%)
Storm Volume Error	60 (21%)	28 (10%)
Summer Storm Volume Error	22 (8%)	6 (2%)
Summer Volume Error	7 (2%)	2 (1%)
Winter Volume Error	7 (2%)	3 (1%)

Of the 10 fall line station, only one is within listed criteria for all characteristics evaluated for the calibration, 3 with 1 characteristic outside the criteria and 6 with at least 2 criteria violated (Table 2). Three fall line stations, JA5_7480_0001, JB3_6820_7053, and YM4_6620_0003, have two characteristics significantly outside the criteria for calibration (Table 3).

Table 2 Number of Flow characteristics outside of criteria at fall line stations

Segment	totvol	bfr	L50	P5 bstat	h10	stmpk	stmvol	sstmvol	sumvol	winvol	Total
EM2_3980_0001	0	0	0	0	0	0	1	0	0	0	1
JA5_7480_0001	0	0	1	0	0	1	0	0	0	0	2
JB3_6820_7053	0	0	0	0	0	1	1	0	0	0	2
JL7_6800_7070	0	0	0	0	0	0	0	0	0	0	0
PM7_4820_0001	0	0	0	1	0	1	0	0	0	0	2
RU5_6030_0001	0	0	1	0	0	0	0	1	0	0	2
SL9_2720_0001	0	0	0	1	0	0	0	0	0	0	1
XU3_4650_0001	0	0	1	0	0	0	0	0	0	0	1
YM4_6620_0003	0	0	1	0	0	1	1	0	0	0	3
YP4_6720_6750	0	0	0	1	0	0	0	1	0	0	2

Table 3 Number of Flow characteristics significantly outside of criteria at fall line stations

Of 276 downstream stations, 233 segments (84%) with at least 1 characteristic outside criteria, 122 segments (44%) with 2 or more characteristic outside criteria and 65 segments (24%) with 3 or more characteristic outside criteria during calibration (Table 4). There are 20 segments with at least 5 characteristics outside criteria. The top three criteria most often violated are error in lowest 50% flow, error in storm peak, and Phase 5 base flow statistic.

Table 4 Number of Flow characteristics outside of criteria at downstream stations

Segment	totvol	bfr	L50	P5 bstat	h10	stmpk	stmvol	sstmvol	sumvol	winvol	Total
BS1_8730_8540	0	0	1	0	0	0	0	0	0	0	1
BS3_8350_8330	0	0	1	1	0	0	1	0	0	0	3
BS4_8440_0003	0	0	1	0	0	0	0	0	0	0	1
BS4_8540_8441	0	0	0	1	0	0	0	0	0	0	1
DE0_3791_0001	1	0	1	1	1	0	1	1	0	0	6
DE0_4231_0001	1	0	0	0	1	1	1	0	0	1	5
EL0_4562_0003	0	0	0	0	0	1	1	1	0	0	3
EL1_5430_0001	0	0	0	0	0	0	0	0	0	0	0
EL2_4400_4590	1	1	1	0	1	1	0	0	0	0	5
EL2_5110_5270	0	0	1	0	1	1	1	0	0	0	4
EU0_3830_0001	0	0	1	0	0	0	0	0	0	0	1
EU1_2650_0001	0	0	1	0	0	0	1	0	0	0	2
GY0_3800_3801	0	0	0	0	0	0	0	0	0	0	0
GY0_3950_3952	0	0	0	0	0	0	0	0	0	0	0
GY0_3951_3952	0	0	1	0	0	0	0	0	0	0	1
GY0_4531_4532	1	0	1	0	1	1	1	0	0	1	6
JA1_7600_7570	0	0	1	0	0	1	0	0	0	0	2
JA2_7550_7280	0	0	1	0	0	0	0	0	0	0	1
JA4_7280_7340	0	0	1	0	0	1	0	0	0	0	2
JL1_6560_6440	0	0	1	0	0	0	0	0	0	0	1
JL1_6760_6910	0	0	1	0	0	0	1	0	0	0	2
JL1_6770_6850	0	0	1	0	0	0	0	1	0	0	2
JL1_6940_7200	0	0	1	0	0	0	0	0	0	0	1
JL1_7080_7190	1	0	0	0	1	0	1	0	0	0	3
JL2_6240_6520	0	0	0	0	0	1	0	0	0	0	1
JL2_6441_6520	0	0	1	1	0	0	0	0	0	0	2
JL2_7110_7120	0	0	1	0	0	0	0	0	0	0	1
JL2_7240_7350	0	0	0	0	0	0	0	0	0	0	0
JL4_6520_6710	0	0	0	0	0	0	0	0	0	0	0
JL6_6890_6990	0	0	0	0	0	0	0	0	0	0	0
JL6_7160_7440	0	0	0	0	0	0	0	0	0	0	0
JL6_7430_7320	0	0	0	0	0	0	0	0	0	0	0
JL7_7100_7030	0	0	1	0	0	0	0	0	0	0	1
JU1_6290_6590	0	0	0	0	0	0	0	0	0	0	0
JU1_6300_6650	0	0	0	0	0	0	0	0	0	0	0
JU1_6590_6600	1	0	1	1	1	1	0	0	0	0	5
JU1_7630_7490	0	0	1	0	0	0	0	0	0	0	1
JU1_7750_7560	0	0	1	0	1	1	1	0	0	0	4

PS5_5240_5200	0	0	0	0	0	0	0	0	0	0	0
PU0_6080_5620	1	0	0	1	1	1	0	1	0	0	5
PU1_3100_3690	0	0	1	1	0	0	0	0	0	0	2
PU1_3850_4190	1	0	1	1	0	0	0	1	1	0	5
PU1_4190_4300	1	1	1	1	0	0	0	0	0	0	4
PU1_4840_4760	1	0	1	1	1	1	0	1	1	0	7
PU2_3090_4050	0	0	0	0	0	0	0	0	0	0	0
PU2_4220_3900	0	0	0	0	0	0	0	0	0	0	0
PU2_4360_4160	1	0	1	0	0	0	0	0	0	0	2
PU2_4720_4750	1	0	0	0	0	0	0	0	0	0	1
PU2_4730_4220	0	0	0	1	0	0	0	0	0	0	1
PU2_5190_4310	0	0	1	0	0	0	1	0	0	0	2
PU2_6050_5190	0	0	1	0	0	0	1	0	0	0	2
PU3_3290_3390	0	0	1	0	0	0	0	0	0	0	1
PU3_3680_3890	0	0	1	0	0	0	0	0	0	0	1
PU3_3860_3610	0	0	0	0	0	0	0	0	0	0	0
PU4_3890_3990	0	0	0	0	0	0	0	0	0	0	0
PU4_4310_4210	0	0	1	0	0	0	0	0	0	0	1
PU4_4440_0003	0	0	1	1	1	0	0	0	0	0	3
PU4_5050_0003	0	0	1	0	0	0	0	0	0	0	1
PU6_3610_3530	0	0	0	0	0	0	0	0	0	0	0
PU6_3752_4080	0	0	0	1	0	0	0	0	0	0	1
PU6_4020_3870	0	0	0	0	0	0	0	0	0	0	0
RL0_6540_0001	0	0	1	0	1	1	1	0	0	0	4
RL1_6180_0001	0	0	0	0	0	0	1	0	0	0	1
RU2_5940_6200	0	0	0	0	0	0	0	0	0	0	0
RU2_6090_6220	0	0	1	0	0	0	1	1	0	0	3
RU3_5610_0003	0	0	1	0	0	0	0	0	0	0	1
RU3_6170_6040	0	0	0	0	0	0	0	0	0	0	0
RU4_5640_0003	0	0	1	0	0	0	0	0	0	0	1
SJ2_2530_2820	0	0	1	0	0	0	0	0	0	0	1
SJ2_2580_2500	0	0	1	0	0	0	0	0	0	0	1
SJ3_2040_1980	1	0	0	0	0	0	0	0	0	0	1
SJ3_2250_2230	0	0	1	0	0	0	0	0	0	0	1
SJ4_2060_2010	0	0	0	0	0	0	0	0	0	0	0
SJ4_2360_2340	0	0	1	1	0	1	0	0	0	0	3
SJ4_2660_2360	0	0	1	0	0	0	0	0	0	0	1
SJ5_2210_2320	0	0	0	1	0	0	0	0	0	0	1
SJ6_2130_0003	0	0	0	0	0	0	0	0	0	0	0
SL0_2180_2220	0	0	1	0	1	1	1	0	0	0	4
SL1_1730_1700	0	0	0	0	0	1	0	0	0	0	1
SL1_2390_2420	0	0	1	0	0	1	0	0	0	0	2
SL1_2770_2730	0	0	1	0	0	0	0	0	0	0	1
SL1_2830_2760	0	0	1	0	0	0	1	0	0	0	2
SL2_1810_2030	1	0	1	1	0	0	0	0	0	0	3
SL2_1850_1990	0	0	0	0	0	1	0	0	0	0	1
SL2_1990_2070	0	0	1	0	0	0	0	0	0	0	1
SL2_2910_3060	0	0	1	0	0	0	1	0	0	0	2

SL3_1710_1740	0	0	1	0	0	0	0	0	0	0	1
SL3_2290_2260	0	0	1	0	0	0	0	0	0	0	1
SL3_2350_2470	0	0	1	0	0	0	0	0	0	0	1
SL3_2400_2440	0	0	0	0	0	0	0	0	0	0	0
SL3_2420_2700	1	0	1	0	0	0	0	0	0	0	2
SL3_2460_2430	0	0	1	1	0	1	0	0	0	0	3
SL3_2730_2550	1	0	1	0	0	0	1	0	0	0	3
SL4_2090_2100	0	0	1	1	1	1	1	0	0	0	5
SL4_2140_2240	0	0	1	0	1	0	0	0	0	0	2
SL4_2370_2330	0	0	1	0	0	0	0	0	0	0	1
SL8_1760_1780	0	0	1	0	0	0	0	0	0	0	1
SL9_2270_0003	0	0	1	0	0	0	0	0	0	0	1
SL9_2490_2520	0	0	1	0	0	0	0	0	0	0	1
SU1_0080_0210	0	0	1	0	1	0	0	1	0	0	3
SU1_0820_0740	1	0	1	1	0	0	0	0	0	0	3
SU2_0110_0240	0	0	1	0	1	1	0	0	0	0	3
SU2_0291_0320	1	1	1	1	1	1	1	0	0	0	7
SU2_0510_0570	0	0	0	0	0	1	0	0	0	0	1
SU2_0670_0810	0	0	0	0	0	0	1	0	0	0	1
SU2_0741_0690	1	0	1	1	0	0	0	0	0	0	3
SU2_0900_0870	0	0	1	0	0	0	0	0	0	0	1
SU2_0920_0830	1	0	0	0	1	0	0	0	0	0	2
SU3_0090_0170	0	0	1	0	0	0	0	0	0	0	1
SU3_0370_0490	0	0	0	0	0	0	0	0	0	0	0
SU3_0710_0910	0	0	1	0	0	0	0	0	0	0	1
SU3_0790_0770	0	0	1	1	0	0	0	0	0	0	2
SU3_0810_0970	0	0	0	0	0	0	0	0	0	0	0
SU3_0831_0790	0	0	1	1	0	0	0	0	0	0	2
SU3_0970_1120	1	0	1	0	0	0	0	0	0	1	3
SU3_1310_1280	0	0	1	0	0	0	0	0	0	0	1
SU4_0260_0003	0	0	1	0	0	0	0	0	0	0	1
SU4_0300_0310	0	0	1	0	0	0	0	0	0	0	1
SU4_0690_0650	0	0	1	1	0	0	0	1	0	0	3
SU5_0340_0310	0	0	1	0	0	0	0	0	0	0	1
SU5_0420_0003	0	0	1	0	0	0	0	0	0	0	1
SU5_0530_0003	0	0	1	1	0	0	0	0	0	0	2
SU5_0610_0600	0	0	1	1	0	0	0	0	0	0	2
SU5_0650_0003	0	0	1	1	0	0	0	0	0	0	2
SU6_0480_0520	0	0	1	0	0	0	0	0	0	0	1
SU7_0720_0003	0	0	1	0	0	0	0	0	0	0	1
SU7_0850_0730	0	0	1	0	0	0	0	0	0	0	1
SU7_0960_0003	0	0	1	0	0	0	0	0	0	0	1
SU7_1120_1140	0	0	1	0	0	0	0	0	0	0	1
SU8_1610_1530	0	0	1	0	0	0	0	0	0	0	1
SW0_1520_1600	0	0	1	0	0	0	0	0	0	0	1
SW1_1180_1190	0	0	0	0	0	0	0	0	0	0	0
SW1_1450_1510	0	0	0	0	0	0	0	0	0	0	0
SW1_1830_1690	0	0	1	0	1	1	1	0	0	0	4

SW1_1890_1830	1	0	1	0	1	1	1	0	0	1	6
SW1_1910_1890	1	0	0	0	0	1	1	0	0	0	3
SW2_1100_1130	0	0	0	0	0	0	0	0	0	0	0
SW3_1040_1220	0	0	1	0	0	0	0	0	0	0	1
SW3_1091_1380	0	0	1	1	0	0	0	0	0	0	2
SW3_1130_1390	0	0	1	0	0	0	0	0	0	0	1
SW3_1270_1370	1	0	1	0	0	0	0	0	0	0	2
SW3_1580_0003	0	0	1	1	1	0	1	0	0	0	4
SW3_1690_0003	0	0	0	1	0	1	0	0	0	0	2
SW3_1870_1800	0	0	1	0	0	0	1	0	0	0	2
SW3_1920_1750	0	0	0	0	0	0	0	0	0	0	0
SW4_1110_1150	0	0	1	0	0	1	0	0	0	0	2
SW4_1260_0003	0	0	1	0	0	0	0	0	0	0	1
SW4_1430_1490	0	0	1	0	0	0	0	0	0	0	1
SW4_1720_1650	0	0	1	0	0	0	0	0	0	0	1
SW4_1860_1720	0	0	1	0	0	0	0	0	0	0	1
SW4_1940_1860	0	0	1	0	0	0	0	0	0	0	1
SW5_1350_0003	0	0	1	0	0	1	0	0	0	0	2
SW5_1540_0003	0	0	0	0	0	0	0	0	0	0	0
SW6_1330_1230	0	0	1	0	0	0	0	0	0	0	1
SW7_1320_0003	0	0	1	0	0	0	0	0	0	0	1
SW7_1640_0003	0	0	1	0	0	0	0	0	0	0	1
TU2_8790_9070	0	0	0	0	0	0	0	0	0	0	0
TU2_8950_9040	0	0	0	0	0	0	1	0	0	0	1
TU3_8650_8800	0	0	1	0	0	1	0	0	0	0	2
TU3_9180_0003	0	0	0	0	0	0	0	0	0	0	0
TU3_9230_9260	0	0	1	0	0	0	0	0	0	0	1
TU4_8680_8810	0	0	1	0	0	0	0	0	0	0	1
TU5_9280_0003	0	0	1	0	0	0	0	0	0	0	1
WM1_3660_3910	0	0	1	0	0	0	0	0	0	0	1
WM3_3880_4060	0	0	1	0	0	0	0	0	0	0	1
WU1_3240_3331	0	0	0	0	0	0	0	0	0	0	0
WU1_3350_3490	0	0	1	0	0	0	1	0	0	0	2
WU2_3020_3320	1	0	1	0	1	1	1	0	1	0	6
XL0_5320_0001	0	0	0	0	0	0	1	0	0	0	1
XL1_4690_0001	0	0	0	0	0	0	1	0	0	0	1
XU0_4130_4070	0	0	1	0	0	1	0	0	0	0	2
XU2_4070_4330	0	0	0	1	0	1	0	0	0	0	2
XU2_4270_0003	0	0	0	0	0	0	1	0	0	0	1
XU2_4330_4480	0	0	1	1	0	1	0	0	0	0	3
YM2_6120_6430	0	0	0	0	0	0	0	0	0	0	0
YP0_6860_6840	0	0	1	0	0	0	0	0	0	0	1
YP1_6570_6680	0	0	1	0	0	1	0	1	0	0	3
YP2_6390_6330	0	0	0	1	0	0	0	1	0	0	2
YP3_6330_6700	0	0	1	1	0	0	0	0	0	0	2
YP3_6470_6690	0	0	1	0	0	1	1	0	0	0	3

The number of downstream segments significantly outside criteria is much lower for model calibration. 137 of the 276 segments (51%) have at least 1 characteristic significantly outside of criteria, 42 segments (15%) with 2 or more characteristics and 19 segments (7%) with 3 or more characteristic significantly outside criteria (Table 5). There are 5 segments with at least 5 characteristics significantly outside criteria. Again, the criterion most often violated is lowest 50% of flow, which is a result of different measures used in calculating low flow in this analysis and Phase 5 model calibration strategy.

Table 5 Number of Flow characteristics significantly outside of criteria at downstream stations

Segment	totvol	bfr	L50	P5	bstat	h10	stmpk	stmvol	sstmvol	sumvol	winvol	Total
BS1_8730_8540	0	0	1	0	0	0	0	0	0	0	0	1
BS3_8350_8330	0	0	1	0	0	0	0	0	0	0	0	1
BS4_8440_0003	0	0	1	0	0	0	0	0	0	0	0	1
BS4_8540_8441	0	0	0	0	0	0	0	0	0	0	0	0
DE0_3791_0001	0	0	0	0	0	0	0	0	0	0	0	0
DE0_4231_0001	1	0	0	0	1	1	1	0	0	0	1	5
EL0_4562_0003	0	0	0	0	0	1	0	0	0	0	0	1
EL1_5430_0001	0	0	0	0	0	0	0	0	0	0	0	0
EL2_4400_4590	1	0	1	0	0	1	0	0	0	0	0	3
EL2_5110_5270	0	0	1	0	0	0	0	0	0	0	0	1
EU0_3830_0001	0	0	0	0	0	0	0	0	0	0	0	0
EU1_2650_0001	0	0	1	0	0	0	0	1	0	0	0	2
GY0_3800_3801	0	0	0	0	0	0	0	0	0	0	0	0
GY0_3950_3952	0	0	0	0	0	0	0	0	0	0	0	0
GY0_3951_3952	0	0	0	0	0	0	0	0	0	0	0	0
GY0_4531_4532	1	0	0	0	1	1	1	0	0	0	1	5
JA1_7600_7570	0	0	0	0	0	0	0	0	0	0	0	0
JA2_7550_7280	0	0	1	0	0	0	0	0	0	0	0	1
JA4_7280_7340	0	0	1	0	0	1	0	0	0	0	0	2
JL1_6560_6440	0	0	0	0	0	0	0	0	0	0	0	0
JL1_6760_6910	0	0	1	0	0	0	0	0	0	0	0	1
JL1_6770_6850	0	0	1	0	0	0	0	0	0	0	0	1
JL1_6940_7200	0	0	1	0	0	0	0	0	0	0	0	1
JL1_7080_7190	0	0	0	0	0	0	0	0	0	0	0	0
JL2_6240_6520	0	0	0	0	0	0	0	0	0	0	0	0
JL2_6441_6520	0	0	0	0	0	0	0	0	0	0	0	0
JL2_7110_7120	0	0	1	0	0	0	0	0	0	0	0	1
JL2_7240_7350	0	0	0	0	0	0	0	0	0	0	0	0
JL4_6520_6710	0	0	0	0	0	0	0	0	0	0	0	0
JL6_6890_6990	0	0	0	0	0	0	0	0	0	0	0	0
JL6_7160_7440	0	0	0	0	0	0	0	0	0	0	0	0
JL6_7430_7320	0	0	0	0	0	0	0	0	0	0	0	0
JL7_7100_7030	0	0	0	0	0	0	0	0	0	0	0	0
JU1_6290_6590	0	0	0	0	0	0	0	0	0	0	0	0
JU1_6300_6650	0	0	0	0	0	0	0	0	0	0	0	0
JU1_6590_6600	0	0	1	1	0	1	0	0	0	0	0	3
JU1_7630_7490	0	0	1	0	0	0	0	0	0	0	0	1
JU1_7750_7560	0	0	1	0	0	1	0	0	0	0	0	2

SW4_1940_1860	0	0	0	0	0	0	0	0	0	0	0
SW5_1350_0003	0	0	1	0	0	0	0	0	0	0	1
SW5_1540_0003	0	0	0	0	0	0	0	0	0	0	0
SW6_1330_1230	0	0	0	0	0	0	0	0	0	0	0
SW7_1320_0003	0	0	0	0	0	0	0	0	0	0	0
SW7_1640_0003	0	0	0	0	0	0	0	0	0	0	0
TU2_8790_9070	0	0	0	0	0	0	0	0	0	0	0
TU2_8950_9040	0	0	0	0	0	0	0	0	0	0	0
TU3_8650_8800	0	0	0	0	0	0	0	0	0	0	0
TU3_9180_0003	0	0	0	0	0	0	0	0	0	0	0
TU3_9230_9260	0	0	1	0	0	0	0	0	0	0	1
TU4_8680_8810	0	0	0	0	0	0	0	0	0	0	0
TU5_9280_0003	0	0	1	0	0	0	0	0	0	0	1
WM1_3660_3910	0	0	1	0	0	0	0	0	0	0	1
WM3_3880_4060	0	0	1	0	0	0	0	0	0	0	1
WU1_3240_3331	0	0	0	0	0	0	0	0	0	0	0
WU1_3350_3490	0	0	0	0	0	0	0	0	0	0	0
WU2_3020_3320	0	0	1	0	0	1	1	0	1	0	4
XL0_5320_0001	0	0	0	0	0	0	0	0	0	0	0
XL1_4690_0001	0	0	0	0	0	0	1	0	0	0	1
XU0_4130_4070	0	0	0	0	0	0	0	0	0	0	0
XU2_4070_4330	0	0	0	1	0	0	0	0	0	0	1
XU2_4270_0003	0	0	0	0	0	0	0	0	0	0	0
XU2_4330_4480	0	0	0	1	0	0	0	0	0	0	1
YM2_6120_6430	0	0	0	0	0	0	0	0	0	0	0
YP0_6860_6840	0	0	0	0	0	0	0	0	0	0	0
YP1_6570_6680	0	0	0	0	0	1	0	0	0	0	1
YP2_6390_6330	0	0	0	1	0	0	0	1	0	0	2
YP3_6330_6700	0	0	1	1	0	0	0	0	0	0	2
YP3_6470_6690	0	0	1	0	0	1	1	0	0	0	3

With respect to model validation, the flow statistics were calculated for each of 33 stations and attached in Appendix 4. The storm related statistics are in generally good, but total volume shows higher percent (30%) of violating criterion than in calibration. The error in lowest 50% of flow is again the worst area of model performance due to different measures used here. Other two low flow statistics are significantly better so low flow simulation is overall reasonable. Only two criteria are significantly violated at more than 3 stations.

Table 6 Summary of number and percentage of stations violating criteria during validation

Flow Characteristic	# of stations > criteria	# of stations significantly > criteria
Error in Total Volume	10 (30%)	2 (6%)
Error in Base flow Recession	0 (0%)	0 (0%)
Error in Lowest 50% of flows	26 (79%)	12 (36%)
Phase 5 base flow statistic	9 (27%)	1 (3%)
Error in Highest 10% of flows	3 (9%)	1 (3%)
Storm Peaks Error	5 (15%)	2 (6%)
Storm Volume Error	6 (18%)	3 (9%)
Summer Storm Volume Error	7 (21%)	2 (6%)
Summer Volume Error	3 (9%)	1 (3%)
Winter Volume Error	0 (0%)	0 (0%)

Of 33 validation stations, each segment (100%) has at least 1 characteristic outside criteria, 18 segments (55%) with 2 or more characteristic outside criteria, and 9 segments (27%) with 3 or more characteristic outside criteria during calibration (Table 7). There are 4 segments with at least 5 characteristics outside criteria. As with the calibration, error in lowest 50% flow is the worst area of performance.

Table 7 Number of Flow characteristics outside of criteria at validation stations

Segment	totvol	bfr	L50	P5 bstat	h10	stmpk	stmvol	sstmvol	sumvol	winvol	Total
EM2_3980_0001	0	0	1	0	1	1	0	0	0	0	4
JA5_7480_0001	0	0	0	1	0	0	0	0	0	0	1
JL7_7100_7030	0	0	1	0	0	0	0	0	0	0	1
PL0_4510_0001	1	0	0	1	0	0	0	0	0	0	1
PL1_4460_4780	0	0	0	0	0	0	0	0	0	0	0
PM1_3120_3400	0	0	0	0	0	0	0	1	1	0	2
PM1_3510_4000	1	0	1	0	0	0	0	0	0	0	1
PM2_2860_3040	0	0	1	1	0	0	0	0	0	0	2
PM7_4820_0001	0	0	1	1	0	0	0	1	0	0	3
PU2_3090_4050	1	0	1	0	0	0	0	0	0	0	1
PU3_3290_3390	0	0	1	0	0	0	0	1	0	0	2
PU3_3680_3890	1	0	1	0	0	1	0	0	0	0	2
PU6_3610_3530	1	0	1	0	0	0	1	0	0	0	2
PU6_3752_4080	0	0	1	0	0	0	0	0	0	0	1
PU6_4020_3870	0	0	1	0	0	0	0	0	0	0	1
RU5_6030_0001	0	0	0	0	0	0	0	0	0	0	0
SL1_2390_2420	0	0	1	1	0	0	0	0	0	0	2
SL3_2290_2260	0	0	1	0	0	0	0	0	0	0	1
SL3_2420_2700	0	0	1	0	0	0	0	0	0	0	1
SL3_2460_2430	0	0	1	1	0	0	0	0	0	0	2
SL4_2140_2240	0	0	1	0	0	0	0	0	0	0	1
SL9_2490_2520	0	0	1	0	0	0	0	0	0	0	1
SL9_2720_0001	0	0	1	0	0	0	0	0	0	0	1
SU7_0850_0730	0	0	1	0	0	0	0	0	0	0	1
SU8_1610_1530	0	0	1	0	0	0	0	1	0	0	2
WM1_3660_3910	1	0	0	0	0	0	0	0	0	0	0
WM3_3880_4060	1	0	1	0	1	1	1	1	1	0	6
WU2_3020_3320	1	0	1	1	0	0	1	0	1	0	4
XL1_4690_0001	1	0	1	0	1	0	1	1	0	0	4
XU0_4130_4070	0	0	0	0	0	1	0	0	0	0	1
XU2_4330_4480	1	0	1	1	0	1	1	0	0	0	4
XU3_4650_0001	0	0	1	0	0	0	0	0	0	0	1
YP4_6720_6750	0	0	1	1	0	0	0	1	0	0	3

The number of segments significantly outside criteria is reduced to 18 (55%) with at least 1 characteristic, 5 segments (15%) with 2 or more characteristics and 2 segments (7%) with 3 or more characteristic (Table 8).

Table 8 Number of Flow characteristics significantly outside of criteria at validation stations

Segment	totvol	bfr	L50	P5	bstat	h10	stmpk	stmvol	sstmvol	sumvol	winvol	Total
EM2_3980_0001	0	0	1	0	0	0	0	0	0	0	0	1
JA5_7480_0001	0	0	0	0	0	0	0	0	0	0	0	0
JL7_7100_7030	0	0	0	0	0	0	0	0	0	0	0	0
PL0_4510_0001	0	0	0	0	0	0	0	0	0	0	0	0
PL1_4460_4780	0	0	0	0	0	0	0	0	0	0	0	0
PM1_3120_3400	0	0	0	0	0	0	0	0	0	0	0	0
PM1_3510_4000	0	0	1	0	0	0	0	0	0	0	0	1
PM2_2860_3040	0	0	1	0	0	0	0	0	0	0	0	1
PM7_4820_0001	0	0	0	0	0	0	0	0	0	0	0	0
PU2_3090_4050	0	0	0	0	0	0	0	0	0	0	0	0
PU3_3290_3390	0	0	0	0	0	0	0	0	0	0	0	0
PU3_3680_3890	0	0	1	0	0	1	0	0	0	0	0	2
PU6_3610_3530	0	0	1	0	0	0	0	0	0	0	0	1
PU6_3752_4080	0	0	1	0	0	0	0	0	0	0	0	1
PU6_4020_3870	0	0	0	0	0	0	0	0	0	0	0	0
RU5_6030_0001	0	0	0	0	0	0	0	0	0	0	0	0
SL1_2390_2420	0	0	1	0	0	0	0	0	0	0	0	1
SL3_2290_2260	0	0	1	0	0	0	0	0	0	0	0	1
SL3_2420_2700	0	0	0	0	0	0	0	0	0	0	0	0
SL3_2460_2430	0	0	0	0	0	0	0	0	0	0	0	0
SL4_2140_2240	0	0	1	0	0	0	0	0	0	0	0	1
SL9_2490_2520	0	0	0	0	0	0	0	0	0	0	0	0
SL9_2720_0001	0	0	0	0	0	0	0	0	0	0	0	0
SU7_0850_0730	0	0	1	0	0	0	0	0	0	0	0	1
SU8_1610_1530	0	0	1	0	0	0	0	0	0	0	0	1
WM1_3660_3910	0	0	0	0	0	0	0	0	0	0	0	0
WM3_3880_4060	1	0	0	0	1	1	1	0	0	0	0	3
WU2_3020_3320	0	0	1	0	0	0	1	0	0	1	0	3
XL1_4690_0001	0	0	0	0	0	0	1	1	1	0	0	2
XU0_4130_4070	0	0	0	0	0	0	0	0	0	0	0	0
XU2_4330_4480	1	0	0	1	0	0	0	0	0	0	0	1
XU3_4650_0001	0	0	0	0	0	0	0	0	0	0	0	0
YP4_6720_6750	0	0	0	0	0	0	0	0	1	0	0	1

APPENDIX 1 Summary of Phase 5 calibration statistics

Segment	Tbias	Wstat	Sstat	Qstat	Bstat	Total_E	Total_LE	Mon_eff	QaveRI	BaveRI	Pbias	VPbias	WBaveRI	SBaveRI	Io10bias
BS1_8730_8540	0.076	1.094	0.884	0.989	1.006	0.623	0.694	0.849	1.029	1.004	0.061	0.023	1.024	0.993	0.577
BS3_8350_8330	0.013	1.042	1.036	1.019	0.988	0.5	0.447	0.828	1.005	0.998	0.27	0.272	1.034	0.959	0.119
BS4_8440_0003	-0.054	1.063	0.988	0.909	1.081	0.593	0.718	0.829	0.973	1.007	-0.032	-0.098	1.031	0.991	0.893
BS4_8540_8441	0.031	1.092	0.842	0.792	1.174	0.311	0.183	0.667	0.794	1.06	0.032	-0.167	1.093	1.021	3.642
DE0_3791_0001	-0.111	1.089	0.908	0.83	1.103	0.617	0.771	0.799	0.929	1.031	-0.057	-0.246	1.029	1.031	1.42
DE0_4231_0001	0.28	1.163	0.801	1.423	0.923	-0.722	0.582	0.22	0.986	0.983	0.839	1.041	0.984	0.991	1.326
EL0_4562_0003	0.009	1.078	0.977	1.601	0.925	0.413	0.658	0.801	1.006	0.99	0.256	0.345	0.99	0.995	-0.066
EL1_5430_0001	0.006	1.013	0.984	1	1	0.648	0.81	0.849	1.014	0.994	-0.186	-0.13	1.018	0.965	-0.283
EL2_4400_4590	-0.203	1.049	0.925	0.892	1.04	0.559	0.607	0.771	1.205	0.982	-0.295	-0.245	0.994	0.977	0.016
EL2_5110_5270	-0.017	0.934	1.036	0.788	1.089	0.707	0.824	0.822	0.928	1.012	-0.212	-0.215	1.024	1.002	0.876
EM2_3980_0001	-0.043	1.03	1.006	1.009	0.996	0.693	0.789	0.863	0.952	0.997	-0.267	-0.249	0.994	1.005	0.695
EU0_3830_0001	-0.001	1.158	0.774	0.97	1.009	0.637	0.419	0.731	0.965	1.003	-0.181	-0.246	1.045	0.993	-0.072
EU1_2650_0001	-0.002	1.117	0.725	0.964	1.018	0.363	0.563	0.74	1.175	0.999	-0.074	0.286	1.008	0.999	-0.26
GY0_3800_3801	-0.047	0.968	1.028	0.966	1.018	0.516	0.8	0.825	1.114	1.002	0.157	-0.007	1.02	0.979	0.391
GY0_3950_3952	-0.047	0.952	0.922	0.992	1.004	0.443	0.667	0.764	0.944	0.989	0.14	-0.114	1.025	0.95	-0.149
GY0_3951_3952	-0.06	0.912	0.889	0.996	1.002	0.564	0.554	0.801	0.897	0.989	0.25	0.113	1.029	0.963	-0.088
GY0_4531_4532	-0.325	0.846	1.09	1.019	0.987	0.508	0.751	0.558	1.033	1.003	-0.252	-0.316	1.02	0.992	0.315
JA1_7600_7570	0.004	1.02	0.902	0.948	1.047	0.492	0.753	0.907	0.923	1.011	0.157	-0.085	1.017	1.015	1.257
JA2_7550_7280	0.016	1.006	0.818	0.966	1.025	0.64	0.555	0.836	1.046	0.999	0.001	-0.037	1.009	0.996	-0.247
JA4_7280_7340	-0.036	0.972	0.884	0.92	1.058	0.489	0.74	0.892	1.16	1	0.419	0.243	1.005	1.001	-0.178
JA5_7480_0001	-0.036	0.988	0.864	0.91	1.077	0.706	0.779	0.933	0.991	1.02	0.308	-0.06	1.008	1.027	0.433
JB3_6820_7053	0.002	1.042	1.023	0.81	1.098	0.295	0.703	0.868	0.85	1.001	-9	-9	0.999	0.994	4.239
JL1_6560_6440	-0.01	1.045	0.998	1.062	0.972	0.308	0.596	0.788	0.961	1.002	0.226	0.268	1.014	0.995	0.158
JL1_6760_6910	-0.059	1.03	0.958	0.972	1.013	0.454	0.593	0.865	1.082	0.997	0.181	0.291	1.014	0.986	-0.087
JL1_6770_6850	0.059	1.006	1.084	1.003	0.999	0.478	0.597	0.772	1.031	1.001	0.08	0.064	1.01	0.992	2.384
JL1_6940_7200	-0.027	0.974	1.183	1.071	0.976	0.483	0.648	0.776	0.996	0.999	0.031	-0.016	1.013	0.987	1.105
JL1_7080_7190	-0.152	0.98	1.167	1.12	0.963	0.369	0.679	0.711	0.924	1.001	-0.052	-0.238	1.014	0.991	1.178
JL2_6240_6520	-0.015	1.054	1.078	0.86	1.085	0.48	0.632	0.831	1.103	0.999	-0.255	-0.113	1.014	0.994	0.196
JL2_6441_6520	-0.036	1.054	0.94	0.86	1.103	0.225	0.659	0.766	0.841	1.023	0.236	0.225	1.029	1.03	0.744
JL2_7110_7120	-0.002	1.085	0.836	0.963	1.025	0.552	0.582	0.818	1.211	0.998	0.149	0.09	1.007	0.999	-0.307
JL2_7240_7350	0.03	0.976	1.057	0.945	1.018	0.594	0.718	0.892	1.127	1	0.044	0.155	1.009	0.993	-0.105

JL4_6520_6710	0.078	1.046	1.001	0.873	1.084	0.543	0.774	0.836	1.069	1.005	-0.048	0.125	1.013	1.001	0.207
JL6_6890_6990	0.01	1.041	0.945	0.902	1.06	0.764	0.771	0.911	0.977	0.997	0.003	-0.036	1.008	0.988	-0.131
JL6_7160_7440	0.032	1.044	0.959	0.922	1.052	0.798	0.754	0.896	0.936	0.998	-0.121	-0.12	1.013	0.986	-0.255
JL6_7430_7320	0.004	1.052	0.912	0.935	1.039	0.781	0.738	0.901	0.95	0.997	-0.122	-0.019	1.014	0.984	-0.194
JL7_6800_7070	0.027	1.003	1.007	0.885	1.068	0.792	0.84	0.925	1.026	1.001	-0.116	-0.028	1.006	0.997	-0.02
JL7_7100_7030	-0.041	1.027	0.937	0.892	1.068	0.825	0.793	0.94	0.984	0.998	-0.152	-0.102	1.009	0.987	-0.247
JU1_6290_6590	-0.065	0.935	1	1.132	0.903	0.574	0.703	0.818	0.928	0.999	0.035	-0.111	1.029	0.97	0.225
JU1_6300_6650	-0.027	1.055	0.964	1.077	0.963	0.498	0.567	0.827	1.03	1.005	0.035	-0.12	1.025	0.99	-0.243
JU1_6590_6600	-0.104	0.946	1.014	0.503	1.486	0.298	0.689	0.753	1.049	1.031	0.126	-0.271	1.04	1.042	0.75
JU1_7630_7490	-0.008	1.011	1.115	1.111	0.96	0.558	0.527	0.827	0.909	1.002	-0.11	-0.085	1.037	0.964	0.519
JU1_7750_7560	-0.001	1.1	1.02	0.854	1.097	0.337	0.526	0.75	0.989	1.006	-0.314	-0.328	1.016	0.995	1.69
JU2_6410_6640	0.012	0.952	1.128	0.882	1.115	0.615	0.686	0.789	1.028	1.002	-0.093	-0.185	1.026	0.979	0.668
JU2_6600_6810	-0.066	0.968	1.01	0.64	1.265	0.508	0.76	0.783	1.057	1.027	-0.247	-0.398	1.028	1.027	0.285
JU2_7140_7330	0.047	1.018	1.096	0.893	1.082	0.452	0.595	0.83	1.051	1.012	-0.097	-0.223	1.043	0.976	0.064
JU2_7450_7360	-0.015	1.093	0.93	1.131	0.942	0.558	0.313	0.838	0.999	0.996	-0.033	-0.176	1.034	0.956	-0.114
JU3_6380_6900	0.222	1.076	0.858	1.397	0.831	0.233	0.475	0.629	0.973	0.986	0.675	0.457	1.011	0.964	-0.001
JU3_6640_6790	-0.023	0.975	1.093	1.008	0.993	0.714	0.573	0.843	0.985	0.999	-0.017	-0.122	1.028	0.965	-0.344
JU3_6650_7300	0.043	1.037	1.015	0.913	1.062	0.72	0.7	0.854	1.079	1	-0.025	-0.103	1.027	0.978	-0.296
JU3_6900_6950	-0.02	0.99	1.019	0.383	1.315	0.432	0.489	0.701	1.215	1.008	-0.443	-0.59	1.041	0.975	0.303
JU3_7490_7400	0.015	1.026	1.036	0.839	1.091	0.645	0.589	0.847	1.095	0.999	-0.208	-0.111	1.027	0.971	0.043
JU4_7260_0003	0.028	0.996	1.014	1.091	0.952	0.698	0.678	0.895	1.014	1.001	0.218	0.104	1.025	0.982	-0.347
JU4_7330_0003	-0.094	1.073	0.862	0.712	1.145	0.534	0.515	0.797	0.971	0.997	-0.033	-0.127	1.019	0.988	-0.172
JU5_7300_0003	-0.071	1.077	0.908	0.878	1.082	0.714	0.69	0.865	0.945	0.995	0.048	-0.234	1.02	0.983	-0.222
JU5_7500_7420	-0.063	1.045	0.941	0.879	1.075	0.744	0.741	0.862	0.964	0.997	-0.163	-0.248	1.02	0.982	-0.167
MN0_8300_0001	0	0.976	1.222	0.837	1.183	0.38	0.387	0.82	1.001	1.06	-0.169	-0.231	1.038	1.147	37.466
MN1_7990_8100	0.033	1.028	0.8	0.777	1.261	0.362	0.644	0.711	1.139	1.014	-0.089	0.136	1.02	1.011	1.375
MN2_7720_7830	-0.006	1.052	0.942	0.937	1.058	0.444	0.739	0.842	0.941	1.01	0.356	-0.053	1.009	1.013	3.718
MN2_8530_8510	0.017	0.981	1.04	0.825	1.206	0.686	0.69	0.894	1.016	1.014	-0.104	-0.189	1.021	1.019	5.904
MN3_7540_7680	-0.005	1.009	1.119	0.905	1.044	0.747	0.569	0.889	0.988	1.004	-0.033	0.195	0.998	1.045	179.964
MN3_7770_7930	-0.003	1.089	0.79	1.045	0.966	0.539	0.651	0.839	1.112	0.993	0.394	0.048	0.997	0.999	0.063
MN3_7930_8010	-0.033	1.039	0.887	0.887	1.099	0.729	0.777	0.907	1.225	0.995	-0.001	-0.067	0.994	1.001	0.318
MN3_8190_8260	-0.01	1.024	0.902	0.766	1.237	0.71	0.751	0.895	1.387	0.993	-0.281	-0.135	0.998	0.996	0.342
MN4_8080_8110	0.006	0.99	1.012	1.181	0.949	0.819	0.665	0.936	0.975	1.004	0.081	0.761	0.991	1.043	21.74
MN4_8260_8400	-0.031	1.009	0.914	0.673	1.391	0.742	0.739	0.917	1.273	0.999	-0.187	-0.182	1.005	1.002	0.406

MN5_8161_0003	0.004	1.017	0.932	1.001	0.999	0.342	0.843	0.916	1.032	0.99	-9	-9	0.99	0.993	0.61
NR2_8210_8180	-0.039	1.042	1.072	1.167	0.935	0.696	0.575	0.846	0.992	0.998	-0.023	-0.02	1.037	0.972	-0.016
NR2_8600_8700	0.002	0.992	0.992	0.989	1.004	0.53	0.591	0.808	1.055	1.001	0.084	0.176	1.02	0.991	-0.362
NR3_8290_8170	0.032	1.04	1.08	0.952	1.025	0.649	0.667	0.831	1.102	1.001	-0.189	-0.107	1.029	0.978	-0.113
NR3_8420_8430	0.028	1.098	0.859	0.982	1.006	0.314	0.471	0.663	1.178	0.997	0.202	0.36	1.017	0.994	-0.121
NR3_8690_8500	-0.028	1.117	0.785	1.026	0.991	0.318	0.408	0.619	1.16	0.999	0.356	0.591	1.019	0.996	-0.136
NR3_9310_9240	-0.023	1.026	0.921	1.23	0.947	0.434	0.679	0.834	0.977	0.999	0.112	0.498	1.003	1.003	0.054
NR5_8870_0003	0.014	1.023	0.931	0.988	1.004	0.501	0.748	0.837	1.114	1.002	0.148	0.251	1.012	1	0.13
NR6_7820_0003	0.03	0.983	1.236	0.212	1.655	0.368	0.385	0.681	1.161	1.009	-0.573	-0.782	1.021	0.998	0.81
NR6_8051_8000	0.014	0.983	1.225	0.386	1.469	0.576	0.585	0.779	1.06	1.004	-0.403	-0.471	1.014	0.999	0.483
NR6_8500_0003	0.058	1.035	0.939	0.91	1.037	0.577	0.759	0.84	1.003	1.002	0.083	0.261	1.013	0.999	0.112
OD1_8910_8930	-0.032	1.099	0.832	1.017	0.995	0.45	0.594	0.764	1.076	1.001	0.134	0.225	1.006	1.002	0.076
OD2_8560_8630	0.057	0.999	0.883	0.694	1.484	0.479	0.645	0.742	1.136	0.592	-0.363	-0.612	0.571	0.601	0.473
OD2_8670_8890	-0.03	1.101	0.725	1.028	0.984	0.489	-0.075	0.739	1.066	0.996	-0.054	-0.012	1.004	0.995	-0.408
OD2_8830_8710	0	0.99	0.915	0.404	1.923	0.641	0.378	0.857	1.101	0.997	-0.376	-0.603	1.041	0.975	0.379
OD2_8840_9020	-0.004	1.102	0.813	0.826	1.05	0.441	0.358	0.729	0.898	0.997	0.151	0.241	1.005	0.996	-0.168
OD2_8920_8830	0.295	0.963	1.068	0.237	2.029	0.471	0.152	0.719	1.315	1.087	-0.508	-0.65	1.127	1.067	14.45
OD3_8340_8520	0.038	1.003	0.825	0.924	1.057	0.606	0.256	0.811	1.009	0.999	0.216	0.139	1.016	0.995	-0.315
OD3_8630_8720	-0.132	1.124	0.745	0.999	1.001	0.478	0.31	0.65	1.022	1.005	0.025	-0.02	1.01	1.001	0.115
OD3_8720_8900	-0.053	1.137	0.733	0.927	1.066	0.531	0.383	0.742	0.931	1.015	0.152	0.193	1.024	1.016	0.152
OD3_8850_8931	0.059	1.152	0.747	1.01	0.996	0.386	0.431	0.552	1.077	0.996	-0.013	0.102	1.001	0.997	0.017
OD4_9140_8990	0.025	1.004	0.917	0.905	1.051	0.655	0.711	0.861	1.044	1	-0.018	0.086	1.005	1	0.053
OD5_8770_0003	-0.042	1.082	0.859	0.894	1.072	0.8	0.656	0.921	0.954	0.996	-0.057	-0.075	1.004	0.996	-0.312
OD5_8780_8660	-0.013	1.013	0.861	0.846	1.102	0.764	0.724	0.864	0.942	1.002	0.065	0.069	1.006	1.001	-0.131
OR1_7700_7980	-0.005	1.078	0.751	0.996	1.002	0.616	0.285	0.711	1.273	0.995	-0.087	-0.001	1.001	0.996	-0.259
OR1_8280_8020	-0.059	1.078	0.973	0.866	1.053	0.556	0.663	0.876	1.027	1.013	-0.242	-0.257	1.028	1.004	-0.062
OR1_8320_8271	0.004	1.1	0.842	0.993	1.003	0.539	0.603	0.849	1.193	1.003	-0.087	0.057	1.009	1.008	-0.037
OR2_7610_7780	-0.044	1.022	0.905	1.004	0.998	0.571	0.745	0.871	1.021	1.002	-0.001	0.075	1.01	1.002	0.14
OR2_7650_8070	0.026	1.08	0.847	0.937	1.033	0.441	0.604	0.763	1.071	1.004	-0.075	-0.029	1.012	1.004	-0.081
OR2_7670_7840	-0.002	1.082	0.776	0.984	1.01	0.591	0.429	0.801	0.981	1.001	-0.04	0.031	1.008	1.001	-0.134
OR2_7900_7740	-0.006	1.055	0.982	0.954	1.025	0.726	0.484	0.914	0.95	0.997	-0.14	-0.103	1.015	0.987	-0.304
OR2_8020_8130	0.046	1.026	1.03	0.888	1.055	0.62	0.742	0.911	1.012	1.007	-0.05	-0.138	1.026	0.995	-0.013
OR2_8130_7900	-0.009	1.074	0.989	0.866	1.081	0.655	-0.103	0.888	1.016	0.989	-0.209	-0.287	1.01	0.982	-0.336
OR2_8460_8271	-0.011	1.097	0.829	0.945	1.029	0.501	0.362	0.736	1.152	0.996	-0.352	-0.056	1.002	0.997	-0.234

OR3_7740_8271	0.004	1.072	0.91	0.997	1.002	0.729	0.631	0.913	0.917	0.998	-0.161	-0.143	1.013	0.985	-0.254
OR4_8120_7890	0.091	1.134	0.802	0.841	1.116	0.568	0.344	0.781	0.94	0.999	0.533	0.049	1.009	0.99	0.575
OR5_7890_7970	0.031	1.118	0.815	0.852	1.096	0.735	0.489	0.862	0.977	0.995	0.152	-0.113	1.003	0.99	0.098
OR5_8200_8370	0.014	1.112	0.814	0.84	1.106	0.782	0.502	0.862	1.057	0.996	0.226	0.03	1.006	0.992	-0.132
PL0_4510_0001	0.131	1.106	0.847	0.964	1.043	0.716	0.654	0.659	1.225	0.987	0.002	0.169	0.996	0.986	0
PL0_5000_0001	0.165	1.13	0.837	1.055	0.903	0.507	0.496	0.434	0.879	1.001	0.247	0.382	1.015	0.995	-0.311
PL0_5010_5130	-0.006	1.162	0.843	0.924	1.171	0.698	0.693	0.827	1.212	1.003	-0.229	-0.102	0.999	1.005	0.627
PL0_5070_0001	-0.091	1.06	1.029	1.02	0.985	0.617	0.68	0.875	1.021	1.013	0.176	0.13	1.004	1.045	14.344
PL0_5540_5490	-0.006	1.052	1.001	0.769	1.284	0.528	0.529	0.804	1.051	1.014	-0.203	-0.148	1.019	0.998	8.752
PL0_5730_5690	0	1.072	0.937	0.983	1.015	0.384	0.666	0.784	0.974	1.007	0.13	0.117	1.009	1.006	3.046
PL0_5750_0001	0.055	1.086	0.879	0.984	1.011	0.54	0.649	0.747	1.086	1.024	0.171	0.208	1.009	1.046	4.915
PL1_4460_4780	0.043	1.147	0.771	1.099	0.92	0.744	0.672	0.72	0.78	1.006	0.112	0.367	1.015	1.002	-0.362
PL1_4540_0001	-0.029	1.109	0.851	1.002	0.997	0.673	0.497	0.857	1.086	0.996	-0.133	-0.093	1	0.994	-0.384
PL1_5230_0001	0.022	0.905	1.259	0.843	1.218	0.633	0.537	0.881	0.99	1.031	-0.007	-0.15	1.007	1.072	65.151
PL1_5370_5470	0.01	0.95	1.039	0.883	1.16	0.477	0.744	0.848	1.138	1.004	0.139	0.095	1.017	1.001	3.012
PL1_5910_0001	-0.057	1.068	0.833	0.973	1.021	0.662	0.69	0.744	0.909	1.024	-0.025	-0.035	1.044	1.017	0.443
PL2_5300_5630	-0.009	1.086	0.843	1.158	0.89	0.452	0.705	0.836	1.054	0.994	0.447	0.361	0.998	1.01	14.219
PM1_3120_3400	0	1.106	0.777	0.941	1.029	0.547	0.703	0.887	1.168	1	0.028	0.258	1.017	0.994	-0.139
PM1_3510_4000	-0.003	1.059	0.985	0.928	1.03	0.705	0.704	0.879	1.114	1.004	-0.122	-0.088	1.015	1	3.061
PM1_4250_4500	-0.14	1.128	0.831	0.794	1.117	0.658	0.727	0.794	1.026	1.003	-0.43	-0.365	1.001	1.004	-0.175
PM1_4430_4200	-0.001	1.015	1.005	0.865	1.083	0.499	0.718	0.841	1.071	1.004	-0.189	0.038	1.019	0.999	2.574
PM2_2860_3040	-0.002	0.963	0.949	0.942	1.08	0.774	0.827	0.925	1.007	1.015	-0.007	0.017	1.019	1.009	1.339
PM2_4860_4670	-0.008	1.08	0.951	1.196	0.909	0.43	0.63	0.815	0.945	1.004	0.059	0.225	1.011	1.003	11.446
PM3_4670_4660	-0.01	1.036	0.969	1.043	0.973	0.646	0.759	0.885	1.056	1	0.138	0.17	1.01	0.996	3.752
PM4_4040_0003	-0.013	1.048	0.881	0.984	1.011	0.789	0.867	0.93	1.126	1.001	-0.212	0.007	1.015	0.99	0.233
PM7_4200_0003	0.023	0.986	1.028	0.85	1.103	0.826	0.867	0.905	1.014	1.002	-0.045	-0.03	1.014	0.994	-0.1
PM7_4820_0001	-0.075	1.002	1.032	0.848	1.116	0.788	0.805	0.92	1.023	0.999	-0.317	-0.222	1.005	0.995	-0.188
PS0_6150_6160	0.846	1.225	0.921	1.065	0.934	-0.523	-0.228	-1.792	0.611	1.06	0.653	0.593	1.084	1.049	4.822
PS1_4790_4830	-0.057	1.007	1.037	1.032	0.98	0.373	0.583	0.836	1.007	0.999	0.018	-0.123	1.024	0.971	-0.25
PS2_5550_5560	-0.041	0.961	1.039	0.897	1.1	0.549	0.719	0.757	0.999	1	-0.026	-0.187	1.031	0.976	1.628
PS2_5560_5100	0.068	0.958	1.03	0.927	1.047	0.559	0.786	0.81	0.988	1.007	0.141	0.078	1.018	1.001	0.34
PS2_6490_6420	0.063	0.998	1.132	1.025	0.991	0.552	0.638	0.777	0.95	0.998	-0.135	-0.283	1.012	0.983	0.125
PS2_6660_6490	-0.072	1.063	1.01	0.978	1.008	0.488	0.633	0.752	0.949	0.998	-0.146	-0.25	1.009	0.982	-0.231
PS2_6730_6660	-0.017	1.016	1.116	1.044	0.985	0.544	0.615	0.762	0.98	1.004	-0.087	-0.239	1.018	0.989	0.089

PS3_5100_5080	0.117	0.96	0.946	0.998	1.001	0.553	0.699	0.757	1.086	0.999	-0.1	0.173	1.014	0.991	-0.092
PS3_6161_6280	-0.051	1.028	0.893	1.264	0.88	0.606	0.691	0.816	0.831	1	0.341	0.029	1.014	0.989	-0.016
PS3_6460_6230	0.171	0.977	1.059	0.991	1.004	0.569	0.61	0.814	1.198	0.998	-0.17	0.196	1.012	0.989	0.148
PS4_5840_5240	-0.014	0.993	1.027	0.971	1.014	0.74	0.749	0.889	1.018	0.999	-0.182	-0.098	1.01	0.989	-0.223
PS4_6360_5840	0.069	0.999	1.005	1.055	0.973	0.713	0.743	0.874	1.005	0.997	-0.016	-0.009	1.01	0.987	-0.087
PS5_4380_4370	0.004	0.974	1.002	0.957	1.019	0.807	0.779	0.904	1.066	0.999	-0.033	0.057	1.008	0.991	-0.202
PS5_5240_5200	0.014	0.99	1.017	0.98	1.009	0.761	0.705	0.885	1.037	0.998	-0.17	-0.058	1.008	0.987	-0.305
PU0_6080_5620	0.139	1.025	0.991	1.264	0.882	0.622	0.465	0.813	0.913	0.994	0.231	0.093	1.018	0.974	-0.388
PU1_3100_3690	-0.008	1.121	0.972	0.794	1.224	0.679	0.64	0.815	0.913	1.038	0.173	-0.02	1.032	1.048	16.337
PU1_3850_4190	0.178	1.004	1.186	0.844	1.106	0.512	0.706	0.765	0.995	1.01	0.216	0.068	1.031	0.98	1.799
PU1_4190_4300	0.104	0.923	1.005	0.662	1.11	0.344	0.462	0.682	1.148	1.085	0.287	0.024	1.083	1.093	0.407
PU1_4840_4760	0.134	1.063	1.203	0.556	1.384	0.379	0.455	0.723	0.939	1.012	-0.267	-0.246	1.033	0.988	3.606
PU2_3090_4050	-0.002	1.026	0.958	1.282	0.954	0.829	0.831	0.939	1.001	0.996	0.021	0.111	0.999	0.994	-0.183
PU2_4220_3900	-0.005	0.997	0.984	1.043	0.979	0.704	0.866	0.928	1.074	1	-0.018	0.165	1.009	0.991	0.006
PU2_4360_4160	0.189	1.057	1.075	0.966	1.012	0.631	0.727	0.808	0.971	1.009	0.071	0.125	1.032	0.991	1.792
PU2_4720_4750	-0.105	0.969	0.886	0.996	1.002	0.481	0.68	0.778	0.979	1.01	0.081	-0.103	1.017	1	0.463
PU2_4730_4220	0.063	0.984	0.947	0.877	1.104	0.392	0.72	0.881	1.177	1.014	0.051	0.135	1.032	0.989	0.159
PU2_5190_4310	-0.034	1.032	0.963	0.946	1.047	0.68	0.339	0.813	0.988	0.994	0.045	-0.245	1.028	0.965	-0.633
PU2_6050_5190	-0.041	0.985	1.018	0.903	1.088	0.471	0.678	0.79	0.979	1.01	0.116	-0.313	1.036	0.991	-0.21
PU3_3290_3390	-0.004	1.009	0.924	0.888	1.045	0.758	0.846	0.915	1.07	1.003	-0.014	-0.061	1.014	0.996	-0.015
PU3_3680_3890	0.01	0.954	1.016	1.008	0.995	0.525	0.422	0.832	0.991	0.997	0.03	-0.182	1.04	0.942	-0.412
PU3_3860_3610	0.007	1.007	0.985	0.989	1.006	0.574	0.475	0.811	1.138	1.001	-0.001	0.165	1.022	0.978	-0.473
PU4_3890_3990	-0.02	0.998	1.039	0.913	1.035	0.679	0.77	0.835	0.982	1.002	0.153	-0.105	1.01	0.99	0.047
PU4_4310_4210	0.04	1.01	1.03	0.928	1.054	0.734	0.721	0.855	1.039	0.999	-0.299	-0.237	1.022	0.984	-0.268
PU4_4440_0003	-0.003	0.975	1.154	0.642	1.133	0.586	0.637	0.781	1.046	1.014	0.04	0.004	1.017	1.007	0.577
PU4_5050_0003	-0.021	0.982	1.084	0.984	1.009	0.737	0.741	0.848	0.989	1.004	-0.007	-0.1	1.029	0.984	-0.258
PU6_3610_3530	0.025	1.005	1.009	0.901	1.066	0.77	0.83	0.868	1.051	1.002	-0.06	-0.035	1.015	0.993	-0.247
PU6_3752_4080	-0.06	1.034	0.998	0.835	1.102	0.815	0.825	0.916	1.056	1.005	-0.112	-0.106	1.014	0.998	-0.142
PU6_4020_3870	0	1.009	1.003	0.911	1.05	0.785	0.851	0.878	1	1.003	-0.103	-0.089	1.02	0.995	-0.152
RL0_6540_0001	-0.002	1.116	0.993	0.92	1.019	0.45	0.644	0.653	1.166	1.002	0.374	0.402	1	1.007	0.513
RL1_6180_0001	0	1.106	0.838	0.968	1.014	0.553	0.658	0.712	0.953	1.012	0.089	0.226	0.995	1.04	2.701
RU2_5940_6200	-0.017	1.078	1.014	0.931	1.031	0.434	0.646	0.725	1.09	1.001	-0.1	-0.161	1.006	1.002	0.776
RU2_6090_6220	-0.011	1.102	0.911	1.046	0.979	0.268	0.591	0.548	0.971	1.003	-0.228	-0.349	1.007	1.003	1.663
RU3_5610_0003	-0.029	1.085	1.029	1.007	0.997	0.224	0.677	0.747	1.07	1.004	0.187	0.184	1.002	1.012	2.355

RU3_6170_6040	0.014	1.051	0.988	1.008	0.996	0.459	0.712	0.784	1.082	1.004	-0.073	-0.029	1.01	1.001	0.812
RU4_5640_0003	-0.005	1.056	0.95	1.028	0.985	0.569	0.754	0.829	1.071	1.002	0.15	0.169	1.009	1.006	1.978
RU5_6030_0001	0.066	1.048	0.971	0.875	1.096	0.665	0.78	0.858	1.063	0.998	-0.056	-0.026	1.003	1.001	0.808
SJ2_2530_2820	-0.015	0.981	1.018	0.936	1.043	0.642	0.742	0.858	0.981	1.003	0.09	-0.072	1.033	0.971	0.105
SJ2_2580_2500	0.01	1.064	0.969	0.932	1.042	0.693	0.761	0.853	1.003	1.016	0.087	-0.045	1.035	1.003	1.247
SJ3_2040_1980	-0.12	1.043	0.943	1.058	0.983	0.702	0.774	0.829	0.907	1.003	0.01	-0.089	1.024	0.986	-0.028
SJ3_2250_2230	0.089	1.016	0.997	0.835	1.085	0.716	0.765	0.852	1.054	1.002	-0.013	-0.085	1.022	0.986	0.264
SJ4_2060_2010	0.023	1.056	0.833	1.047	0.982	0.629	0.739	0.852	1.024	0.991	-0.106	0.128	1.013	0.974	0.082
SJ4_2360_2340	0.043	0.99	1.015	0.535	1.285	0.632	0.753	0.828	1.018	1.013	-0.326	-0.53	1.032	0.982	0.459
SJ4_2660_2360	0.015	1.005	0.962	1.011	0.994	0.637	0.772	0.854	0.997	1.003	0.147	0.053	1.03	0.979	-0.143
SJ5_2210_2320	0.011	1.029	0.911	0.807	1.103	0.773	0.832	0.864	1.011	0.997	-0.121	-0.157	1.012	0.988	-0.006
SJ6_2130_0003	0.028	1.04	0.888	0.889	1.067	0.799	0.834	0.876	1.037	0.999	-0.069	0.018	1.015	0.987	0.034
SL0_2180_2220	0.044	1.111	0.805	1.51	0.921	0.329	0.436	0.743	0.928	0.995	0.503	0.632	0.996	0.998	-0.015
SL1_1730_1700	-0.037	1.109	0.9	1.627	0.944	0.524	0.546	0.791	0.957	0.992	0.435	0.568	0.991	0.991	0.219
SL1_2390_2420	0.091	1.066	0.881	0.891	1.038	0.577	0.638	0.782	0.823	1.001	-0.172	0.047	1.012	1.005	0.419
SL1_2770_2730	0.096	1.061	1.016	0.872	1.059	0.688	0.636	0.906	1.046	1.006	0.016	0.171	1.003	1.025	2.886
SL1_2830_2760	0.054	1.139	0.819	1.011	0.997	0.548	0.227	0.704	1.024	1.006	0.118	0.371	1.009	1.002	0.213
SL2_1810_2030	0.127	0.974	1.051	0.765	1.11	0.681	0.658	0.817	1.03	1.015	-0.131	-0.173	1.023	1.015	2.092
SL2_1850_1990	-0.003	0.998	0.792	1.177	0.935	0.592	0.675	0.853	0.975	0.992	0.177	0.103	1.009	0.982	0.45
SL2_1990_2070	-0.055	0.986	0.88	0.987	1.005	0.697	0.733	0.844	1.012	1.002	-0.135	-0.088	1.011	0.994	0.638
SL2_2910_3060	-0.007	1.146	0.727	1.14	0.963	0.356	0.5	0.687	1.005	0.989	-0.005	0.437	0.996	0.987	-0.124
SL3_1710_1740	-0.032	0.944	1.096	0.944	1.017	0.715	0.789	0.81	1.096	1.002	-0.141	-0.194	1.017	0.992	0.561
SL3_2290_2260	-0.001	1.005	0.964	0.953	1.023	0.608	0.69	0.844	0.994	1.003	-0.01	0.066	1.028	0.987	0.687
SL3_2350_2470	-0.012	1.035	0.913	0.869	1.055	0.713	0.852	0.872	1.034	1.006	-0.095	-0.025	1.007	1.01	0.499
SL3_2400_2440	0.002	1.01	1.006	1.133	0.977	0.68	0.822	0.902	0.906	0.999	0.328	0.4	1.004	0.998	-0.112
SL3_2420_2700	-0.111	1.051	0.868	1.006	0.998	0.736	0.789	0.885	1.05	0.994	-0.121	-0.037	0.999	0.995	-0.244
SL3_2460_2430	0.001	0.992	1.034	0.886	1.101	0.762	0.825	0.919	1.129	1.005	-0.237	-0.125	1.019	1.001	0.85
SL3_2730_2550	0.183	1.051	0.924	1.019	0.994	0.633	0.729	0.827	0.893	0.998	0.292	0.579	1.003	0.997	0.291
SL4_2090_2100	-0.074	0.944	1.02	0.817	1.106	0.687	0.77	0.829	1.077	1.008	-0.331	-0.332	1.018	1.003	0.99
SL4_2140_2240	-0.028	0.95	1.014	0.852	1.068	0.743	0.806	0.879	1.028	1.004	-0.131	-0.134	1.018	0.994	0.526
SL4_2370_2330	-0.013	1.03	0.958	0.854	1.064	0.78	0.844	0.932	1.079	1.004	-0.002	0.018	1.019	0.991	0.058
SL8_1760_1780	0.013	0.975	0.955	0.913	1.064	0.85	0.865	0.908	1.014	1.001	-0.025	0.051	1.01	0.997	0.508
SL9_2270_0003	0.037	0.985	0.944	0.91	1.063	0.86	0.873	0.913	1.011	0.999	-0.066	-0.1	1.008	0.992	0.292
SL9_2490_2520	-0.003	0.983	0.974	0.91	1.06	0.861	0.882	0.922	1.015	1.002	-0.109	-0.114	1.008	0.999	0.308

SL9_2720_0001	0.005	0.975	0.967	1.083	0.89	0.826	0.684	0.916	0.918	0.984	-0.103	-0.04	0.977	0.994	0.464
SU1_0080_0210	-0.066	1.077	1.098	1.022	0.994	0.653	0.732	0.855	0.905	1	-0.06	0.083	1.009	0.977	0.788
SU1_0820_0740	0.214	0.902	1.031	0.836	1.102	0.425	0.558	0.721	1.046	1.018	0.133	0.076	1.028	1.01	4.897
SU2_0110_0240	-0.082	0.986	1.013	0.902	1.042	0.655	0.764	0.842	1.097	1.005	-0.187	-0.218	1.019	0.97	0.693
SU2_0291_0320	-0.104	1.034	1.028	0.483	1.327	0.461	0.67	0.793	1.095	1.055	-0.364	-0.557	1.047	1.04	1.602
SU2_0510_0570	0.025	0.98	0.85	0.897	1.074	0.495	0.731	0.821	0.982	1.009	0.61	-0.037	1.023	0.991	0.08
SU2_0670_0810	-0.065	1.001	0.982	0.88	1.059	0.164	0.712	0.784	0.973	1.007	-9	-9	1.009	1.001	1.549
SU2_0741_0690	0.151	0.987	0.957	0.663	1.377	0.568	0.521	0.781	1.003	1.032	-0.111	-0.15	1.035	1.029	4.195
SU2_0900_0870	-0.003	0.948	0.988	0.985	1.01	0.568	0.791	0.821	1.005	1.005	-0.024	-0.041	1.025	0.981	1.068
SU2_0920_0830	-0.116	0.977	0.98	0.959	1.024	0.554	0.716	0.776	1.059	1.001	-0.086	-0.081	1.021	0.979	0.588
SU3_0090_0170	0.045	0.904	0.994	1.099	0.967	0.753	0.759	0.915	0.978	0.999	0.073	0.127	1.012	0.975	1.028
SU3_0370_0490	-0.05	1.003	0.983	1.081	0.962	0.632	0.805	0.822	0.977	1.004	0.315	0.077	1.016	0.991	0.572
SU3_0710_0910	0.097	0.98	1.002	0.923	1.046	0.686	0.755	0.844	1.083	0.999	0.016	-0.066	1.01	0.984	1.2
SU3_0790_0770	0.045	0.981	0.989	0.811	1.161	0.584	0.716	0.805	0.931	1.011	-0.106	0.006	1.008	1.009	1.013
SU3_0810_0970	-0.057	1.031	0.932	1.025	0.993	0.666	0.766	0.848	0.918	0.994	0.183	-0.002	1.003	0.983	0.276
SU3_0831_0790	0.089	0.981	0.953	0.819	1.153	0.555	0.689	0.801	0.952	1.021	-0.003	-0.033	1.016	1.029	1.368
SU3_0970_1120	0.271	1.031	1.004	0.84	1.071	0.678	0.653	0.715	0.985	1.003	0.126	0.024	1.011	0.999	1.638
SU3_1310_1280	-0.009	0.952	0.976	1	1	0.682	0.756	0.848	1.008	1	0.004	-0.132	1.012	0.994	1.064
SU4_0260_0003	0.004	0.943	1.042	1.063	0.977	0.634	0.743	0.841	0.994	0.998	0.002	-0.179	1.011	0.972	0.287
SU4_0300_0310	0.079	0.979	1.013	0.938	1.026	0.695	0.759	0.866	1.102	0.998	0.127	-0.19	1.011	0.973	0.772
SU4_0690_0650	0.054	0.962	1.011	0.748	1.187	0.67	0.724	0.854	0.917	1.007	-0.022	-0.121	1.015	0.999	1.028
SU5_0340_0310	0.012	0.996	1.077	1.057	0.975	0.632	0.759	0.831	0.989	1.001	0.141	0.043	1.009	0.989	0.939
SU5_0420_0003	0.032	0.962	1.004	1.007	0.996	0.755	0.813	0.897	0.959	1.001	0.236	0.057	1.012	0.977	0.47
SU5_0530_0003	0.028	1.01	0.953	0.87	1.106	0.695	0.796	0.851	0.998	1.001	0.152	0.045	1.01	0.992	0.671
SU5_0610_0600	0.018	1.022	0.95	0.836	1.133	0.755	0.812	0.862	1.005	1.002	-0.046	-0.02	1.013	0.992	0.631
SU5_0650_0003	0.057	1	0.961	0.806	1.189	0.678	0.767	0.843	0.992	1	0.132	0.119	1.009	0.99	0.904
SU6_0480_0520	0.013	1	1.016	0.958	1.019	0.768	0.818	0.883	1.027	0.998	0.139	-0.001	1.009	0.984	0.601
SU7_0720_0003	-0.024	0.995	0.992	0.975	1.013	0.808	0.834	0.896	1.019	1.006	-0.051	-0.155	1.015	0.994	0.72
SU7_0850_0730	-0.009	1.009	1.01	0.883	1.095	0.843	0.852	0.916	1.004	1.001	-0.153	-0.109	1.008	0.995	0.434
SU7_0960_0003	0.005	1.004	0.983	0.89	1.085	0.827	0.851	0.901	1.01	1	-0.066	-0.078	1.007	0.992	0.553
SU7_1120_1140	0.005	1.01	0.963	0.882	1.087	0.836	0.858	0.906	1.016	0.998	-0.059	-0.072	1.007	0.99	0.462
SU8_1610_1530	0.007	1.014	0.972	0.881	1.079	0.859	0.863	0.925	1.017	1	-0.08	-0.073	1.01	0.991	0.395
SW0_1520_1600	0.001	0.978	0.949	0.835	1.037	0.652	0.733	0.807	0.994	1.005	0.22	-0.102	1.021	0.999	1.704
SW1_1180_1190	-0.037	0.876	0.967	0.981	1.009	0.469	0.632	0.719	1.006	1.01	0.006	-0.019	1.024	1.003	1.962

SW1_1450_1510	0	0.994	0.801	0.874	1.098	0.561	0.595	0.786	1.061	1.024	0.112	-0.103	1.031	1.014	-0.076
SW1_1830_1690	0.02	1.022	0.823	1.793	0.94	0.194	0.418	0.541	0.897	0.988	0.704	0.809	0.991	0.988	-0.25
SW1_1890_1830	0.365	1.02	0.866	1.32	0.967	-0.011	0.464	0.136	0.998	0.996	0.746	0.688	0.998	0.996	0.415
SW1_1910_1890	0.119	1.004	0.87	1.216	0.969	0.445	0.708	0.699	0.89	0.996	0.47	0.396	1.002	0.992	0.07
SW2_1100_1130	-0.042	0.878	0.959	0.963	1.017	0.599	0.737	0.803	0.946	1.002	0.233	-0.088	1.022	0.986	1.358
SW3_1040_1220	-0.037	0.965	1.034	0.986	1.006	0.628	0.713	0.81	1.001	1.003	0.012	-0.028	1.019	0.983	0.955
SW3_1091_1380	-0.041	0.842	0.92	0.847	1.111	0.572	0.737	0.761	0.915	1.022	-0.077	0.157	1.03	1.009	1.721
SW3_1130_1390	0.013	0.894	0.969	0.846	1.072	0.617	0.749	0.818	0.895	1.012	-0.019	-0.012	1.029	1.002	1.708
SW3_1270_1370	0.15	0.863	0.978	0.931	1.047	0.509	0.713	0.618	0.963	1.013	0.286	0.17	1.028	1.004	2.275
SW3_1580_0003	-0.054	0.925	0.91	0.486	1.175	0.647	0.69	0.804	1.004	1.016	-0.153	-0.468	1.025	1.009	0.436
SW3_1690_0003	-0.05	0.964	1.015	0.63	1.117	0.606	0.76	0.798	1.174	1.002	-0.121	-0.218	1.011	0.993	-0.061
SW3_1690_1660	-0.032	0.921	0.875	0.409	1.317	0.399	0.418	0.674	1.152	1.031	-9	-9	1.037	1.012	0.499
SW3_1870_1800	0.06	0.905	0.981	0.991	1.004	0.646	0.737	0.8	1.109	1.003	0.241	0.286	1.019	0.99	0.858
SW3_1920_1750	-0.011	1.074	0.856	0.918	1.019	0.647	0.602	0.797	0.973	0.992	-0.088	-0.21	1.002	0.988	0.723
SW4_1110_1150	-0.026	0.936	0.956	1.089	0.956	0.662	0.769	0.84	0.975	1	0.324	-0.084	1.014	0.98	0.872
SW4_1260_0003	0.054	0.88	1.018	1.053	0.971	0.61	0.709	0.753	1.007	0.997	0.019	0.037	1.004	0.986	1.286
SW4_1430_1490	0.06	0.862	0.978	0.967	1.019	0.644	0.741	0.752	1.007	1.009	0.109	0.074	1.022	1.002	2.081
SW4_1720_1650	0.025	0.865	0.954	0.914	1.048	0.656	0.744	0.806	0.928	1.016	0.151	0.103	1.04	1.002	1.022
SW4_1860_1720	-0.029	0.854	0.958	0.885	1.076	0.63	0.726	0.805	0.931	1.02	-0.062	-0.049	1.041	1.005	0.82
SW4_1940_1860	-0.007	0.864	0.963	0.963	1.022	0.605	0.742	0.769	1.004	1.002	0.157	-0.001	1.022	0.988	0.699
SW5_1350_0003	0.023	0.93	0.998	1.088	0.96	0.663	0.743	0.831	0.944	1.001	0.148	-0.14	1.016	0.98	1.267
SW5_1540_0003	-0.067	0.937	0.906	1.111	0.955	0.742	0.782	0.847	1.026	1.001	0.016	-0.02	1.018	0.99	0.457
SW6_1330_1230	0.023	0.905	0.943	1.043	0.979	0.747	0.802	0.832	1.009	1.005	0.197	0.221	1.019	0.998	0.936
SW7_1320_0003	-0.008	0.925	0.961	1.014	0.992	0.785	0.837	0.862	1.012	1.003	-0.019	0.009	1.011	0.999	0.629
SW7_1640_0003	0.027	0.938	0.944	0.959	1.023	0.787	0.836	0.859	0.999	1.005	-0.063	-0.137	1.013	0.999	0.575
TU2_8790_9070	0.006	1.05	0.896	0.945	1.018	0.587	0.693	0.822	1.177	0.999	0.009	-0.081	1.014	0.992	-0.087
TU2_8950_9040	-0.011	1.048	0.928	1.033	0.99	0.512	0.651	0.785	0.975	1.002	0.038	-0.216	1.016	0.993	0.023
TU3_8650_8800	-0.012	0.994	1.014	0.818	1.098	0.615	0.773	0.831	0.999	1.006	-0.19	-0.179	1.029	0.992	0.205
TU3_9180_0003	-0.006	1.024	0.965	0.985	1.005	0.546	0.696	0.816	1.014	1.001	0.105	-0.087	1.017	0.995	0.08
TU3_9230_9260	-0.008	0.976	0.997	1.017	0.988	0.741	0.745	0.876	1.023	1.001	-0.024	-0.085	1.024	0.988	0.683
TU4_8680_8810	0.008	1.026	0.968	0.962	1.022	0.641	0.788	0.854	1.01	1.001	-0.035	-0.197	1.023	0.99	0.294
TU5_9280_0003	-0.009	1.057	0.896	0.884	1.083	0.753	0.834	0.838	0.98	1.005	0.007	-0.036	1.021	1.002	0.422
WM1_3660_3910	-0.02	1.087	0.851	1.012	0.99	0.706	0.452	0.753	1.087	1.006	-0.131	-0.04	1.012	1.003	-0.164
WM3_3880_4060	-0.065	1.24	0.8	0.958	1.016	0.608	0.638	0.662	1.048	0.992	-0.033	0.061	1	0.992	-0.079

WU1_3240_3331	0.002	1.095	0.816	0.94	1.025	0.383	0.605	0.686	1.037	1.007	-0.128	0.118	1.015	1.007	0.041
WU1_3350_3490	0.015	1.124	0.809	0.871	1.032	0.438	0.541	0.685	1.031	0.994	-0.062	0.213	1.003	0.993	-0.1
WU2_3020_3320	-0.124	1.329	0.569	1.559	0.91	-0.038	-1.787	0.056	0.689	0.989	0.216	0.763	0.993	0.991	0.102
XL0_5320_0001	0.001	1.147	0.825	0.98	1.008	0.565	0.652	0.764	0.971	1.012	0.083	0.29	0.997	1.044	3.861
XL1_4690_0001	0.083	1.129	0.77	0.976	1.023	0.606	0.744	0.802	1.177	0.987	0.024	0.313	0.998	0.97	-0.122
XU0_4130_4070	-0.063	1.125	0.839	0.873	1.045	0.735	0.764	0.881	1.073	1.003	-0.156	0.062	1.012	1	0.031
XU2_4070_4330	0.02	1.134	0.924	0.354	1.267	0.106	-0.125	0.412	1.066	1.083	-0.116	-0.405	1.052	1.099	4.224
XU2_4270_0003	0.052	1.086	0.839	0.995	1.003	0.767	0.795	0.807	1.082	1.001	0.003	0.25	1.001	1.004	-0.022
XU2_4330_4480	-0.058	1.064	0.813	0.396	1.268	0.505	0.301	0.78	1.113	1.065	-0.257	-0.421	1.112	1.058	0.651
XU3_4650_0001	-0.045	1.037	0.874	0.958	1.024	0.693	0.792	0.899	0.982	0.997	0.022	0.101	1	0.998	-0.22
YM2_6120_6430	-0.002	1.018	1.011	0.888	1.089	0.598	0.753	0.891	1.153	0.999	-0.245	-0.074	1.008	0.993	3.208
YM4_6620_0003	-0.011	1.045	0.957	0.979	1.009	0.37	0.808	0.84	0.994	1.005	-9	-9	0.995	1.016	0.558
YP0_6860_6840	-0.024	1.203	0.761	1.031	0.985	0.406	0.647	0.666	1.031	1.001	-0.106	-0.095	1.002	0.997	0.491
YP1_6570_6680	0.075	1.003	1.157	1	1	0.438	0.76	0.851	0.948	1.014	0.054	0.002	1.013	1.013	3.647
YP2_6390_6330	-0.054	1.008	0.96	0.701	1.437	0.696	0.656	0.926	0.97	1.048	-0.08	-0.08	1.066	1.048	0.569
YP3_6330_6700	0.026	1.035	1.003	0.696	1.289	0.75	0.784	0.908	1.136	1.021	-0.095	-0.022	1.02	1.021	0.392
YP3_6470_6690	-0.028	1.034	0.866	0.961	1.032	0.383	0.444	0.809	1.194	0.986	0.69	0.344	0.999	0.979	-0.455
YP4_6720_6750	-0.06	1.02	0.964	0.809	1.194	0.818	0.852	0.945	1.084	1.002	-0.058	-0.161	1.003	1.009	0.072

APPENDIX 2 Calculated review statistics for model calibration

Segment	Total Vol error	base flow recession error	Lowest 50% flow error	P5 base flow Stats	Highest 10% error	Storm Peak error	Storm Vol error	Summer Vol error	Summer Vol error	Winter Vol error
BS1_8730_8540	7.61%	-0.0115	20.03%	0.60%	4.47%	7.18%	3.31%	-32.04%	-4.83%	17.68%
BS3_8350_8330	1.34%	0.0103	23.13%	1.20%	-1.43%	11.82%	21.22%	8.56%	4.94%	5.60%
BS4_8440_0003	-5.37%	-0.0027	32.12%	8.10%	-13.75%	-11.24%	-7.87%	-8.39%	-6.48%	0.60%
BS4_8540_8441	3.13%	0.0237	5.05%	17.40%	-4.07%	-11.49%	1.61%	-14.19%	-13.20%	12.61%
DE0_3791_0001	-11.08%	0.0151	11.05%	10.30%	-18.22%	-1.81%	-23.36%	-50.90%	-19.26%	-3.21%
DE0_4231_0001	27.98%	-0.0273	3.57%	7.70%	52.26%	65.53%	83.96%	1.80%	2.56%	48.88%
EL0_4562_0003	0.91%	-0.0133	-1.92%	7.50%	10.63%	41.79%	21.41%	55.21%	-1.39%	8.81%
EL1_5430_0001	0.64%	-0.0017	-8.37%	0.10%	0.88%	-12.33%	-13.85%	-46.02%	-0.99%	1.91%
EL2_4400_4590	-20.32%	-0.0309	-26.31%	4.00%	-24.29%	-40.51%	-18.10%	-32.09%	-26.28%	-16.42%
EL2_5110_5270	-1.66%	0.0095	39.86%	8.90%	-18.16%	-21.92%	-21.14%	-3.83%	1.90%	-8.12%
EM2_3980_0001	-4.32%	-0.0134	7.54%	0.40%	-11.23%	-15.51%	-21.27%	44.24%	-3.79%	-1.48%
EU0_3830_0001	-0.10%	-0.0169	-17.22%	0.90%	4.86%	-6.61%	-16.05%	-17.41%	-22.72%	15.70%
EU1_2650_0001	-0.15%	-0.0066	-20.28%	1.80%	6.53%	-10.94%	34.59%	-32.60%	-27.64%	11.50%
GY0_3800_3801	-4.65%	0.0022	2.60%	1.80%	-1.63%	7.62%	7.77%	-4.08%	-1.94%	-7.74%
GY0_3950_3952	-4.70%	-0.0063	-1.68%	0.40%	-4.98%	8.23%	-6.39%	-24.40%	-12.14%	-9.31%
GY0_3951_3952	-6.03%	-0.0201	-16.12%	0.20%	0.57%	13.87%	8.51%	-18.77%	-16.50%	-14.34%
GY0_4531_4532	-32.46%	0.0008	-10.71%	1.30%	-36.42%	-35.20%	-33.19%	-19.71%	-26.37%	-42.84%
JA1_7600_7570	0.38%	0.0024	-11.71%	4.70%	2.39%	20.75%	-8.63%	-37.55%	-9.51%	2.42%
JA2_7550_7280	1.63%	-0.0122	-25.83%	2.50%	6.28%	13.99%	-0.40%	-17.02%	-16.82%	2.28%
JA4_7280_7340	-3.61%	-0.0091	-20.38%	5.80%	-2.00%	37.80%	11.13%	-37.40%	-14.76%	-6.32%
JA5_7480_0001	-3.56%	0.0151	-20.53%	7.70%	0.21%	32.69%	-6.01%	-19.12%	-16.68%	-4.71%
JB3_6820_7053	0.18%	-0.0149	0.97%	9.80%	2.40%	49.67%	-58.70%	-14.14%	2.53%	4.40%
JL1_6560_6440	-0.98%	-0.0026	-14.03%	2.80%	3.29%	5.13%	19.42%	-7.61%	-1.20%	3.44%
JL1_6760_6910	-5.87%	-0.0073	-22.76%	1.30%	-1.64%	12.55%	22.81%	7.46%	-9.79%	-3.04%
JL1_6770_6850	5.91%	0.0007	41.76%	0.10%	-8.27%	-9.53%	5.85%	74.23%	14.78%	6.54%
JL1_6940_7200	-2.73%	-0.0010	20.99%	2.40%	-12.25%	-10.65%	-4.29%	44.35%	15.12%	-5.22%
JL1_7080_7190	-15.23%	0.0035	6.88%	3.70%	-22.51%	-9.83%	-25.59%	6.03%	-1.11%	-16.93%
JL2_6240_6520	-1.53%	-0.0074	-0.86%	8.50%	-10.66%	-22.20%	-9.08%	-4.88%	6.17%	3.83%
JL2_6441_6520	-3.58%	0.0009	-12.18%	10.30%	-2.20%	-0.03%	16.00%	-4.70%	-9.34%	1.62%
JL2_7110_7120	-0.16%	-0.0106	-31.58%	2.50%	6.77%	10.96%	13.03%	-45.63%	-16.50%	8.32%
JL2_7240_7350	2.97%	-0.0033	-6.64%	1.80%	0.83%	-1.67%	13.37%	-23.06%	8.84%	0.55%

JL4_6520_6710	7.81%	-0.0081	0.29%	8.40%	6.03%	-9.90%	18.61%	-19.72%	7.95%	12.82%
JL6_6890_6990	1.02%	-0.0114	-2.34%	6.00%	-2.16%	-8.80%	-2.34%	1.82%	-4.59%	5.19%
JL6_7160_7440	3.24%	-0.0131	-0.90%	5.20%	-2.04%	-8.68%	-9.89%	18.26%	-1.01%	7.77%
JL6_7430_7320	0.36%	-0.0126	-9.35%	3.90%	1.76%	-8.58%	-2.00%	3.69%	-8.48%	5.60%
JL7_6800_7070	2.73%	-0.0081	2.92%	6.80%	-1.77%	-17.39%	0.85%	7.11%	3.43%	3.07%
JL7_7100_7030	-4.10%	-0.0128	-10.09%	6.80%	-5.54%	-11.21%	-7.63%	-38.75%	-10.13%	-1.49%
JU1_6290_6590	-6.53%	-0.0045	-6.49%	9.70%	2.38%	2.36%	-13.72%	13.20%	-6.55%	-12.58%
JU1_6300_6650	-2.66%	-0.0074	-7.92%	3.70%	-2.54%	8.05%	-12.62%	-4.95%	-6.20%	2.73%
JU1_6590_6600	-10.36%	0.0148	23.59%	48.60%	-23.43%	-68.16%	-12.21%	-24.00%	-9.06%	-15.20%
JU1_7630_7490	-0.83%	0.0092	49.83%	4.00%	-13.09%	-1.78%	-11.38%	49.25%	10.61%	0.29%
JU1_7750_7560	-0.08%	0.0034	45.62%	9.70%	-20.78%	-33.42%	-29.06%	-40.43%	1.90%	9.92%
JU2_6410_6640	1.25%	0.0052	46.81%	11.50%	-9.76%	-7.12%	-17.51%	-32.75%	14.19%	-3.65%
JU2_6600_6810	-6.65%	0.0091	8.05%	26.50%	-13.12%	-24.73%	-34.07%	-46.05%	-5.72%	-9.61%
JU2_7140_7330	4.67%	0.0131	30.33%	8.20%	-5.48%	10.70%	-20.84%	72.91%	14.73%	6.50%
JU2_7450_7360	-1.52%	0.0013	-0.49%	5.80%	-4.60%	7.53%	-18.00%	37.35%	-8.36%	7.68%
JU3_6380_6900	22.23%	-0.0241	-0.34%	16.90%	35.75%	50.58%	35.08%	39.87%	4.93%	31.50%
JU3_6640_6790	-2.30%	-0.0002	17.06%	0.70%	-5.64%	0.55%	-13.10%	-19.18%	6.77%	-4.73%
JU3_6650_7300	4.28%	-0.0108	13.68%	6.20%	-3.69%	-4.90%	-8.76%	-18.40%	5.80%	8.14%
JU3_6900_6950	-1.97%	-0.0116	1.48%	31.50%	-15.98%	-39.51%	-29.94%		-0.10%	-2.97%
JU3_7490_7400	1.50%	-0.0070	38.45%	9.10%	-15.98%	-27.49%	-9.44%	34.71%	5.16%	4.16%
JU4_7260_0003	2.78%	-0.0047	1.37%	4.80%	4.37%	22.09%	5.46%	-2.56%	4.18%	2.39%
JU4_7330_0003	-9.44%	-0.0099	-27.56%	14.50%	-10.05%	23.44%	-6.28%	-36.16%	-21.98%	-2.82%
JU5_7300_0003	-7.08%	-0.0162	-16.38%	8.20%	-10.53%	5.98%	-20.35%	-34.30%	-15.66%	0.12%
JU5_7500_7420	-6.34%	-0.0144	-6.49%	7.50%	-13.98%	-18.81%	-22.42%	-12.06%	-11.87%	-2.09%
MN0_8300_0001	0.04%	0.0360	392.99%	18.30%	-4.99%	4.31%	-20.03%	47.78%	22.24%	-2.31%
MN1_7990_8100	3.33%	0.0052	-0.13%	26.10%	-3.41%	-13.94%	19.44%	-21.05%	-17.33%	6.17%
MN2_7720_7830	-0.56%	-0.0008	14.62%	5.80%	-0.26%	35.93%	-6.14%	15.60%	-6.31%	4.60%
MN2_8530_8510	1.65%	-0.0004	41.34%	20.60%	-8.73%	-13.57%	-15.21%	90.74%	5.71%	-0.28%
MN3_7540_7680	-0.45%	-0.0166	38.45%	4.40%	-5.81%	13.15%	1.32%	33.47%	11.42%	0.40%
MN3_7770_7930	-0.35%	-0.0159	-29.61%	3.40%	9.82%	24.71%	4.07%	-39.70%	-21.26%	8.56%
MN3_7930_8010	-3.31%	-0.0141	-13.81%	9.90%	-1.56%	-1.59%	0.36%	-4.88%	-14.22%	0.42%
MN3_8190_8260	-1.03%	-0.0149	-6.49%	23.70%	-8.97%	-22.70%	-1.87%	-30.45%	-10.72%	1.35%
MN4_8080_8110	0.61%	-0.0106	48.73%	5.10%	-3.35%	22.52%	28.80%	-13.40%	1.85%	-0.35%
MN4_8260_8400	-3.11%	-0.0196	-5.39%	39.10%	-11.77%	-19.60%	-3.65%	-25.13%	-11.47%	-2.24%

MN5_8161_0003	0.44%	-0.0220	1.18%	0.10%	10.06%	36.86%	-17.21%	-21.42%	-6.41%	2.19%
NR2_8210_8180	-3.89%	-0.0001	0.47%	6.50%	-2.30%	-4.15%	-6.76%	-14.75%	3.08%	0.12%
NR2_8600_8700	0.18%	-0.0096	-13.50%	0.40%	2.31%	20.44%	13.22%	-12.94%	-0.65%	-0.60%
NR3_8290_8170	3.20%	-0.0074	17.83%	2.50%	-5.80%	-22.03%	-10.47%	3.57%	11.49%	7.30%
NR3_8420_8430	2.81%	-0.0141	-19.65%	0.60%	20.39%	8.62%	28.43%	-6.26%	-11.69%	12.88%
NR3_8690_8500	-2.75%	-0.0110	-22.44%	0.90%	18.63%	3.50%	45.34%	-35.54%	-23.66%	8.65%
NR3_9310_9240	-2.27%	0.0016	-10.09%	5.30%	13.52%	-2.14%	48.63%	-25.59%	-10.02%	0.32%
NR5_8870_0003	1.43%	-0.0082	-3.53%	0.40%	9.70%	14.18%	18.07%	-13.41%	-5.59%	3.78%
NR6_7820_0003	3.02%	-0.0101	16.46%	65.50%	-11.98%	-55.95%	-55.76%	75.74%	27.30%	1.24%
NR6_8051_8000	1.41%	-0.0085	14.02%	46.90%	-12.11%	-43.42%	-21.84%	-27.06%	24.22%	-0.36%
NR6_8500_0003	5.78%	-0.0111	-0.35%	3.70%	10.71%	8.22%	22.26%	13.25%	-0.65%	9.48%
OD1_8910_8930	-3.24%	-0.0036	-13.51%	0.50%	4.08%	5.73%	17.29%	-27.89%	-19.51%	6.31%
OD2_8560_8630	5.69%	-0.4039	18.83%	48.40%	-7.28%	-36.42%	-37.70%	-5.47%	-6.65%	5.62%
OD2_8670_8890	-3.04%	-0.0135	-40.51%	1.60%	5.73%	-5.27%	1.04%	-51.40%	-29.68%	6.75%
OD2_8830_8710	0.00%	-0.0192	45.51%	92.30%	-26.85%	-28.97%	-41.58%	-15.01%	-8.46%	-1.04%
OD2_8840_9020	-0.43%	-0.0109	-23.13%	5.00%	16.47%	8.26%	24.83%	-7.10%	-19.08%	9.77%
OD2_8920_8830	29.48%	0.0072	176.95%	102.90%	-18.48%	-53.21%	-45.49%	498.18%	38.29%	24.63%
OD3_8340_8520	3.76%	-0.0152	-30.61%	5.70%	13.11%	30.54%	17.91%	-59.15%	-14.40%	4.12%
OD3_8630_8720	-13.16%	-0.0048	-25.35%	0.10%	-6.13%	-0.49%	3.77%	-22.37%	-35.26%	-2.43%
OD3_8720_8900	-5.26%	-0.0063	-23.22%	6.60%	8.45%	10.50%	14.76%	-16.52%	-30.52%	7.70%
OD3_8850_8931	5.95%	-0.0097	-19.10%	0.40%	14.15%	-3.80%	13.37%	-26.93%	-20.81%	22.06%
OD4_9140_8990	2.55%	-0.0070	-11.47%	5.10%	5.70%	-6.16%	11.75%	0.83%	-6.00%	2.93%
OD5_8770_0003	-4.25%	-0.0082	-23.41%	7.20%	1.48%	-3.75%	-4.33%	-23.82%	-17.74%	3.65%
OD5_8780_8660	-1.32%	-0.0036	-19.66%	10.20%	6.93%	8.13%	10.43%	-4.81%	-15.08%	-0.02%
OR1_7700_7980	-0.46%	-0.0127	-35.24%	0.20%	9.99%	-7.10%	6.61%	-40.48%	-25.23%	7.27%
OR1_8280_8020	-5.95%	0.0020	-8.50%	5.30%	-10.62%	-19.92%	-21.23%	-26.78%	-8.48%	1.38%
OR1_8320_8271	0.39%	-0.0064	-14.25%	0.30%	5.14%	-8.94%	5.02%	-8.32%	-15.43%	10.48%
OR2_7610_7780	-4.37%	-0.0098	-13.79%	0.20%	0.51%	-5.16%	3.45%	-13.83%	-13.43%	-2.26%
OR2_7650_8070	2.63%	-0.0102	-13.83%	3.30%	2.74%	-11.26%	-2.39%	-6.67%	-13.02%	10.86%
OR2_7670_7840	-0.21%	-0.0090	-28.87%	1.00%	7.12%	-8.96%	4.96%	23.34%	-22.58%	8.00%
OR2_7900_7740	-0.62%	-0.0068	-3.04%	2.50%	-5.38%	-13.89%	-8.46%	-14.53%	-2.39%	4.84%
OR2_8020_8130	4.63%	-0.0039	13.46%	5.50%	-4.45%	-1.11%	-11.73%	-15.07%	7.77%	7.38%
OR2_8130_7900	-0.91%	-0.0111	-9.49%	8.10%	-10.69%	-20.50%	-22.62%	-8.56%	-1.99%	6.40%
OR2_8460_8271	-1.14%	-0.0130	-27.93%	2.90%	6.14%	-34.33%	-0.51%	-9.67%	-18.02%	8.42%

OR3_7740_8271	0.39%	-0.0121	-11.70%	0.20%	-2.42%	-15.92%	-11.13%	-10.76%	-8.62%	7.64%
OR4_8120_7890	9.07%	-0.0116	-18.46%	11.60%	12.69%	50.60%	7.20%	-31.06%	-12.56%	23.73%
OR5_7890_7970	3.11%	-0.0130	-21.41%	9.60%	5.02%	6.48%	-8.10%	-34.34%	-16.01%	15.27%
OR5_8200_8370	1.40%	-0.0118	-22.66%	10.60%	3.39%	11.35%	4.24%	-29.97%	-17.51%	12.78%
PL0_4510_0001	13.08%	-0.0193	-9.39%	4.30%	9.35%	-2.81%	26.60%	24.55%	-4.17%	25.04%
PL0_5000_0001	16.52%	-0.0129	-26.14%	9.70%	20.95%	23.30%	40.81%	-11.23%	-2.44%	31.67%
PL0_5010_5130	-0.65%	-0.0089	-12.39%	17.10%	-9.17%	-24.57%	-5.20%	-3.87%	-16.23%	15.41%
PL0_5070_0001	-9.09%	-0.0087	1.88%	1.50%	-8.60%	8.43%	8.69%	-18.05%	-6.44%	-3.63%
PL0_5540_5490	-0.59%	0.0100	38.92%	28.40%	-12.97%	-19.38%	-8.70%	-40.82%	-0.44%	4.63%
PL0_5730_5690	0.03%	-0.0049	-3.10%	1.50%	3.62%	6.82%	12.24%	-53.36%	-6.28%	7.26%
PL0_5750_0001	5.49%	0.0054	0.49%	1.10%	12.56%	15.95%	22.13%	-52.95%	-7.31%	14.52%
PL1_4460_4780	4.34%	-0.0074	-22.35%	8.00%	12.73%	10.33%	38.47%	-5.86%	-19.54%	19.63%
PL1_4540_0001	-2.91%	-0.0138	-27.70%	0.30%	-4.26%	-17.17%	-4.48%	7.41%	-17.39%	7.70%
PL1_5230_0001	2.19%	0.0133	99.46%	21.80%	-11.78%	-0.73%	-13.38%	196.67%	28.62%	-7.50%
PL1_5370_5470	1.01%	0.0036	33.85%	16.00%	-5.19%	6.64%	11.66%	-29.70%	4.92%	-4.01%
PL1_5910_0001	-5.66%	0.0094	-3.39%	2.10%	-12.67%	-5.41%	-3.15%	6.07%	-21.41%	0.77%
PL2_5300_5630	-0.94%	-0.0164	-16.37%	11.00%	12.96%	45.74%	24.38%	5.17%	-16.46%	7.61%
PM1_3120_3400	-0.02%	-0.0093	-9.56%	2.90%	0.48%	-3.39%	23.15%	-23.52%	-22.32%	10.57%
PM1_3510_4000	-0.35%	-0.0073	43.21%	3.00%	-13.71%	-16.73%	-10.19%	-4.83%	-1.83%	5.58%
PM1_4250_4500	-13.97%	-0.0120	-18.76%	11.70%	-22.33%	-39.67%	-28.05%	-37.93%	-28.51%	-2.98%
PM1_4430_4200	-0.07%	-0.0016	48.61%	8.30%	-14.55%	-22.99%	4.65%	1.83%	0.42%	1.38%
PM2_2860_3040	-0.21%	0.0060	38.14%	8.00%	-7.02%	-3.67%	-0.88%	-1.53%	-5.31%	-3.93%
PM2_4860_4670	-0.76%	-0.0090	31.30%	9.10%	-2.72%	2.22%	12.97%	35.35%	-5.57%	7.15%
PM3_4670_4660	-0.99%	-0.0109	29.63%	2.70%	-4.67%	7.85%	9.34%	-28.16%	-4.06%	2.59%
PM4_4040_0003	-1.26%	-0.0119	10.11%	1.10%	-5.90%	-17.80%	-3.23%	-16.86%	-13.03%	3.49%
PM7_4200_0003	2.25%	-0.0060	8.57%	10.30%	-3.05%	-5.50%	-1.66%	18.28%	5.16%	0.87%
PM7_4820_0001	-7.55%	-0.0075	1.58%	11.60%	-13.74%	-25.00%	-8.70%	1.83%	-4.62%	-7.37%
PS0_6150_6160	84.65%	0.0427	93.28%	6.60%	77.30%	62.66%	60.00%		70.08%	126.16%
PS1_4790_4830	-5.69%	-0.0012	-2.80%	2.00%	-8.88%	3.88%	-11.25%	28.34%	-2.18%	-5.06%
PS2_5550_5560	-4.13%	0.0112	37.17%	10.00%	-10.14%	-4.90%	-15.20%	-13.16%	-0.41%	-7.83%
PS2_5560_5100	6.83%	-0.0009	31.88%	4.70%	1.24%	8.68%	6.33%	-9.85%	10.02%	2.31%
PS2_6490_6420	6.28%	-0.0043	13.96%	0.90%	-3.50%	-5.34%	-27.68%	-8.37%	20.31%	6.07%
PS2_6660_6490	-7.18%	-0.0030	-3.85%	0.80%	-14.32%	-5.51%	-24.70%	-18.04%	-6.23%	-1.30%
PS2_6730_6660	-1.70%	0.0016	12.00%	1.50%	-11.47%	2.12%	-26.01%	-22.03%	9.68%	-0.11%

PS3_5100_5080	11.67%	-0.0103	10.95%	0.10%	12.37%	7.46%	17.65%	20.27%	5.65%	7.23%
PS3_6161_6280	-5.11%	-0.0078	-8.83%	12.00%	2.02%	32.71%	-4.87%	-28.46%	-15.27%	-2.47%
PS3_6460_6230	17.15%	-0.0078	15.51%	0.40%	13.46%	-20.62%	21.29%	14.06%	24.01%	14.49%
PS4_5840_5240	-1.43%	-0.0098	1.09%	1.40%	-6.56%	-18.01%	-9.00%	10.59%	1.26%	-2.13%
PS4_6360_5840	6.95%	-0.0110	6.72%	2.70%	5.23%	-5.29%	-2.03%	-4.59%	7.53%	6.84%
PS5_4380_4370	0.38%	-0.0085	-4.03%	1.90%	0.91%	-3.94%	6.34%	-6.38%	0.54%	-2.24%
PS5_5240_5200	1.44%	-0.0094	-4.83%	0.90%	0.71%	-14.69%	-2.79%	-3.84%	3.16%	0.45%
PU0_6080_5620	13.90%	-0.0139	0.33%	11.80%	20.35%	27.48%	3.74%	56.07%	12.84%	16.71%
PU1_3100_3690	-0.75%	0.0242	134.30%	22.40%	-13.87%	2.37%	-3.41%	-31.58%	-3.53%	11.26%
PU1_3850_4190	17.77%	0.0092	72.80%	10.60%	2.56%	18.35%	13.53%	84.76%	39.65%	18.28%
PU1_4190_4300	10.44%	0.0732	13.41%	11.00%	-8.67%	3.18%	7.57%	27.32%	10.98%	1.98%
PU1_4840_4760	13.38%	-0.0119	107.98%	38.40%	-18.13%	-45.74%	-0.86%	56.07%	36.39%	20.52%
PU2_3090_4050	-0.25%	-0.0098	-3.91%	4.60%	-2.35%	3.43%	-0.78%	7.01%	-4.44%	2.34%
PU2_4220_3900	-0.50%	-0.0074	5.26%	2.10%	-2.04%	-9.89%	11.71%	22.60%	-2.05%	-0.75%
PU2_4360_4160	18.86%	0.0053	82.32%	1.20%	5.47%	-2.40%	14.64%	42.08%	27.82%	25.65%
PU2_4720_4750	-10.52%	0.0027	-8.00%	0.20%	-8.67%	-8.33%	-8.90%	-30.05%	-20.76%	-13.33%
PU2_4730_4220	6.27%	0.0069	9.00%	10.40%	-2.05%	-2.34%	16.49%	16.17%	0.65%	4.58%
PU2_5190_4310	-3.39%	0.0018	-10.16%	4.70%	-6.78%	10.08%	-23.48%	-6.21%	-7.01%	-0.35%
PU2_6050_5190	-4.14%	0.0085	10.37%	8.80%	-10.95%	17.02%	-26.86%	-15.03%	-2.41%	-5.55%
PU3_3290_3390	-0.41%	-0.0085	17.30%	4.50%	-9.75%	-7.83%	-10.19%	33.49%	-7.99%	0.46%
PU3_3680_3890	0.97%	0.0063	14.40%	0.50%	-0.65%	14.16%	-15.52%	19.14%	2.60%	-3.69%
PU3_3860_3610	0.67%	-0.0024	-5.59%	0.60%	0.24%	3.89%	15.75%	-8.27%	-0.85%	1.35%
PU4_3890_3990	-1.99%	-0.0118	-1.81%	3.50%	-4.69%	15.92%	-8.18%	1.65%	1.84%	-2.22%
PU4_4310_4210	3.98%	-0.0038	13.62%	5.40%	-3.08%	-19.14%	-12.95%	23.26%	7.06%	4.96%
PU4_4440_0003	-0.28%	-0.0038	11.71%	13.30%	-15.26%	-16.22%	2.89%	3.71%	15.06%	-2.82%
PU4_5050_0003	-2.14%	-0.0035	18.14%	0.90%	-7.33%	2.88%	-13.20%	-22.15%	6.11%	-3.89%
PU6_3610_3530	2.49%	-0.0054	-1.04%	6.60%	-0.77%	-5.69%	2.20%	38.64%	3.41%	3.00%
PU6_3752_4080	-6.04%	-0.0041	-5.55%	10.20%	-12.50%	-12.02%	-4.26%	0.12%	-6.23%	-2.90%
PU6_4020_3870	0.03%	-0.0058	-1.12%	5.00%	-2.62%	-4.08%	-2.38%	20.41%	0.28%	0.93%
RL0_6540_0001	-0.17%	-0.0087	-13.90%	1.90%	15.62%	41.38%	34.02%	-29.34%	-0.89%	11.46%
RL1_6180_0001	-0.02%	-0.0073	-3.08%	1.40%	7.68%	6.50%	22.00%	-12.23%	-16.19%	10.54%
RU2_5940_6200	-1.74%	-0.0112	2.44%	3.10%	-5.09%	-10.09%	-14.32%	-38.44%	-0.35%	5.97%
RU2_6090_6220	-1.13%	-0.0082	11.50%	2.10%	-7.16%	-19.66%	-33.64%	57.04%	-9.95%	8.93%
RU3_5610_0003	-2.86%	-0.0093	12.97%	0.30%	-9.92%	-6.35%	5.79%	18.83%	-0.04%	5.38%

RU3_6170_6040	1.38%	-0.0099	9.27%	0.40%	0.94%	-6.82%	-4.08%	24.75%	0.18%	6.50%
RU4_5640_0003	-0.49%	-0.0096	11.20%	1.50%	-0.74%	2.88%	11.27%	11.43%	-5.48%	5.09%
RU5_6030_0001	6.56%	-0.0135	17.50%	9.60%	0.29%	-8.99%	0.35%	56.10%	3.47%	11.70%
SJ2_2530_2820	-1.50%	-0.0013	24.20%	4.30%	-8.86%	7.68%	-8.68%	-5.89%	0.28%	-3.35%
SJ2_2580_2500	0.98%	0.0064	55.36%	4.20%	-9.15%	2.81%	-3.38%	-32.03%	-2.10%	7.43%
SJ3_2040_1980	-11.97%	-0.0064	-5.40%	1.70%	-14.25%	5.94%	-9.86%	-35.82%	-16.99%	-8.22%
SJ3_2250_2230	8.87%	-0.0100	34.73%	8.50%	-3.49%	-3.26%	-3.30%	-19.62%	8.57%	10.63%
SJ4_2060_2010	2.34%	-0.0188	-2.71%	1.80%	4.18%	-8.72%	11.33%	4.46%	-14.79%	8.09%
SJ4_2360_2340	4.34%	-0.0066	20.15%	28.50%	-9.82%	-31.53%	-16.44%	-9.54%	5.87%	3.26%
SJ4_2660_2360	1.45%	-0.0086	14.17%	0.60%	-0.26%	14.50%	-1.73%	2.89%	-2.35%	1.93%
SJ5_2210_2320	1.14%	-0.0141	2.96%	10.30%	-3.66%	-12.14%	-1.20%	-17.98%	-7.85%	4.09%
SJ6_2130_0003	2.78%	-0.0073	8.40%	6.70%	-3.32%	-6.93%	2.49%	-4.33%	-8.72%	6.89%
SL0_2180_2220	4.40%	-0.0108	-12.07%	7.90%	17.03%	49.07%	24.89%	-19.17%	-15.99%	16.02%
SL1_1730_1700	-3.66%	-0.0089	-6.41%	5.60%	3.05%	38.97%	8.92%	-18.14%	-13.30%	6.84%
SL1_2390_2420	9.12%	0.0031	13.74%	3.80%	-1.24%	-22.68%	20.00%	-8.01%	-3.86%	16.28%
SL1_2770_2730	9.64%	-0.0142	41.49%	5.90%	-0.92%	-5.21%	11.69%	-16.60%	11.37%	16.38%
SL1_2830_2760	5.40%	-0.0076	-11.66%	0.30%	3.29%	1.72%	30.07%	-15.04%	-13.71%	20.07%
SL2_1810_2030	12.74%	0.0046	59.74%	11.00%	-6.15%	-16.85%	-12.87%	-40.52%	18.52%	9.78%
SL2_1850_1990	-0.30%	-0.0206	0.55%	6.50%	2.66%	20.05%	3.03%	-31.32%	-21.06%	-0.45%
SL2_1990_2070	-5.51%	-0.0129	15.65%	0.50%	-13.28%	-10.93%	-10.97%	-42.21%	-16.81%	-6.88%
SL2_2910_3060	-0.69%	-0.0195	-20.38%	3.70%	11.21%	2.26%	39.57%	-10.42%	-27.77%	13.76%
SL3_1710_1740	-3.23%	-0.0072	22.48%	1.70%	-14.76%	-13.67%	-15.09%	6.48%	6.06%	-8.64%
SL3_2290_2260	-0.12%	-0.0083	28.39%	2.30%	-10.12%	-15.30%	4.37%	16.63%	-3.68%	0.36%
SL3_2350_2470	-1.15%	0.0016	19.82%	5.50%	-12.13%	-12.90%	-4.33%	-36.80%	-9.78%	2.33%
SL3_2400_2440	0.24%	-0.0035	-1.22%	2.30%	-0.76%	19.22%	18.70%	-7.23%	0.85%	1.22%
SL3_2420_2700	-11.11%	-0.0073	-12.91%	0.20%	-13.57%	-15.92%	-6.82%	-41.49%	-22.83%	-6.61%
SL3_2460_2430	0.10%	-0.0058	32.24%	10.10%	-9.99%	-21.12%	-9.95%	3.62%	3.50%	-0.68%
SL3_2730_2550	18.28%	-0.0122	24.38%	0.60%	12.72%	18.60%	41.93%	1.06%	9.34%	24.34%
SL4_2090_2100	-7.37%	-0.0058	28.82%	10.60%	-22.88%	-26.98%	-30.46%	-5.17%	-5.56%	-12.58%
SL4_2140_2240	-2.79%	-0.0106	25.28%	6.80%	-15.86%	-17.47%	-16.74%	26.03%	-1.43%	-7.66%
SL4_2370_2330	-1.32%	-0.0073	11.12%	6.40%	-8.83%	-4.50%	1.53%	-24.33%	-5.50%	1.63%
SL8_1760_1780	1.29%	-0.0055	14.48%	6.40%	-5.22%	-11.17%	5.80%	-17.25%	-3.24%	-1.24%
SL9_2270_0003	3.68%	-0.0060	16.45%	6.30%	-4.97%	-10.73%	-6.65%	-14.42%	-2.16%	2.15%
SL9_2490_2520	-0.34%	-0.0027	16.16%	6.00%	-8.70%	-12.94%	-7.99%	6.62%	-2.93%	-2.05%

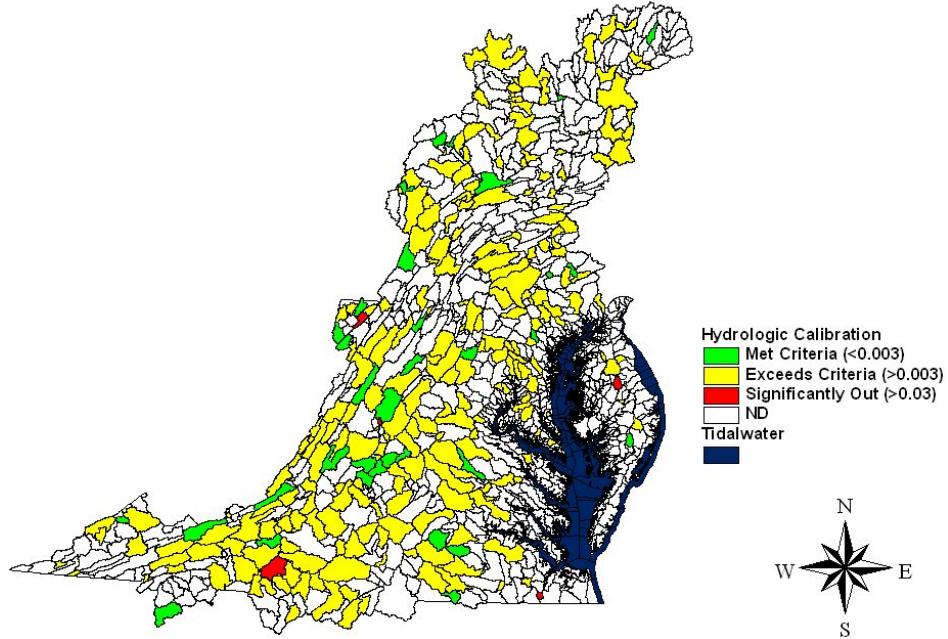
SL9_2720_0001	0.45%	-0.0131	5.82%	11.00%	-6.31%	-11.52%	-2.20%	-8.06%	-2.81%	-2.02%
SU1_0080_0210	-6.57%	-0.0002	24.91%	0.60%	-16.34%	-15.25%	-0.47%	74.63%	2.63%	0.64%
SU1_0820_0740	21.42%	0.0051	114.37%	10.20%	6.12%	2.18%	9.27%	9.92%	25.24%	9.49%
SU2_0110_0240	-8.17%	0.0040	20.48%	4.20%	-17.64%	-27.54%	-19.27%	-33.66%	-6.99%	-9.47%
SU2_0291_0320	-10.42%	0.0413	24.90%	32.70%	-24.51%	-44.36%	-38.55%	-44.00%	-7.93%	-7.38%
SU2_0510_0570	2.47%	-0.0079	6.09%	7.40%	0.52%	28.06%	9.93%	-18.47%	-12.92%	0.38%
SU2_0670_0810	-6.52%	-0.0061	5.98%	5.90%	-11.07%	10.49%	-21.11%	-22.69%	-8.23%	-6.39%
SU2_0741_0690	15.15%	0.0064	136.49%	37.70%	-8.54%	-15.03%	-6.89%	28.53%	10.24%	13.65%
SU2_0900_0870	-0.31%	0.0000	22.06%	1.00%	-5.23%	-10.66%	-7.59%	-23.43%	-1.51%	-5.48%
SU2_0920_0830	-11.61%	-0.0074	2.87%	2.40%	-15.95%	-18.59%	-8.22%	-13.59%	-13.38%	-13.63%
SU3_0090_0170	4.47%	-0.0084	19.67%	3.30%	2.63%	13.21%	3.30%	8.76%	3.88%	-5.55%
SU3_0370_0490	-5.02%	-0.0093	9.78%	3.80%	-7.52%	16.64%	-2.85%	9.13%	-6.67%	-4.72%
SU3_0710_0910	9.73%	-0.0101	36.29%	4.60%	1.65%	0.64%	-5.43%	1.74%	9.97%	7.51%
SU3_0790_0770	4.54%	-0.0146	45.14%	16.10%	-8.03%	-7.72%	4.98%	-24.08%	3.37%	2.58%
SU3_0810_0970	-5.71%	-0.0165	-2.88%	0.70%	-7.29%	16.46%	-0.82%	0.05%	-12.15%	-2.77%
SU3_0831_0790	8.85%	-0.0037	50.24%	15.30%	-1.81%	-2.24%	1.75%	-37.65%	3.72%	6.75%
SU3_0970_1120	27.05%	-0.0083	63.28%	7.10%	10.89%	11.66%	9.14%	5.02%	27.56%	31.01%
SU3_1310_1280	-0.86%	-0.0121	13.27%	0.10%	-5.91%	-2.60%	-10.29%	-12.90%	-3.19%	-5.61%
SU4_0260_0003	0.40%	-0.0055	17.55%	2.30%	-6.83%	-0.50%	-18.39%	-6.62%	4.57%	-5.35%
SU4_0300_0310	7.89%	-0.0066	29.77%	2.60%	-0.57%	9.15%	-7.95%	42.67%	9.26%	5.58%
SU4_0690_0650	5.37%	-0.0193	59.92%	18.70%	-11.32%	-9.83%	-12.34%	69.73%	6.52%	1.33%
SU5_0340_0310	1.17%	-0.0043	23.14%	2.50%	-1.75%	18.74%	0.19%	17.78%	8.98%	0.77%
SU5_0420_0003	3.19%	-0.0067	22.78%	0.40%	-2.67%	18.42%	-0.57%	-1.00%	3.63%	-0.72%
SU5_0530_0003	2.85%	-0.0160	36.74%	10.60%	-7.34%	1.89%	-0.19%	-1.08%	-2.01%	3.90%
SU5_0610_0600	1.83%	-0.0126	36.72%	13.30%	-8.66%	-7.68%	0.49%	-25.83%	-3.25%	4.02%
SU5_0650_0003	5.66%	-0.0191	48.74%	18.90%	-7.21%	0.03%	14.84%	13.49%	1.56%	5.65%
SU6_0480_0520	1.33%	-0.0084	22.95%	1.90%	-4.62%	5.97%	-2.63%	-2.26%	2.94%	1.30%
SU7_0720_0003	-2.36%	-0.0021	19.89%	1.30%	-8.43%	2.45%	-15.47%	21.61%	-3.14%	-2.80%
SU7_0850_0730	-0.91%	-0.0058	24.51%	9.50%	-8.21%	-7.57%	-12.68%	19.96%	0.05%	-0.05%
SU7_0960_0003	0.49%	-0.0100	24.47%	8.50%	-8.51%	-7.54%	-6.83%	27.59%	-1.18%	0.88%
SU7_1120_1140	0.46%	-0.0133	19.74%	8.70%	-7.80%	-5.99%	-9.08%	-9.54%	-3.27%	1.45%
SU8_1610_1530	0.69%	-0.0080	18.98%	7.90%	-5.10%	-5.58%	-2.67%	-6.69%	-2.12%	2.12%
SW0_1520_1600	0.09%	-0.0050	26.35%	3.70%	-6.84%	15.67%	-7.67%	-47.67%	-4.99%	-2.16%
SW1_1180_1190	-3.69%	0.0030	7.11%	0.90%	-6.95%	-15.94%	-3.61%	31.32%	-6.87%	-15.59%

SW1_1450_1510	0.00%	0.0100	-0.47%	9.80%	-4.70%	7.85%	-8.87%	-14.48%	-19.87%	-0.58%
SW1_1830_1690	2.01%	-0.0140	-18.95%	6.00%	28.25%	62.42%	43.98%	-14.75%	-16.01%	4.31%
SW1_1890_1830	36.54%	-0.0059	29.20%	3.30%	46.79%	67.54%	47.23%	6.01%	18.28%	39.26%
SW1_1910_1890	11.85%	-0.0082	6.24%	3.10%	14.50%	36.01%	22.17%	-8.33%	-2.72%	12.28%
SW2_1100_1130	-4.25%	-0.0086	6.86%	1.70%	-3.98%	15.13%	-9.54%	-13.19%	-8.22%	-15.91%
SW3_1040_1220	-3.73%	0.0035	20.47%	0.60%	-12.37%	-12.89%	-5.98%	-8.62%	-0.50%	-7.06%
SW3_1091_1380	-4.14%	-0.0004	13.03%	11.10%	-6.13%	-15.61%	10.12%	-15.76%	-11.76%	-19.31%
SW3_1130_1390	1.31%	-0.0063	20.77%	7.20%	-3.01%	-7.23%	0.51%	9.38%	-1.83%	-9.38%
SW3_1270_1370	14.99%	-0.0011	37.28%	4.70%	12.64%	19.52%	16.11%	-6.89%	12.50%	-0.81%
SW3_1580_0003	-5.39%	-0.0007	10.31%	17.50%	-16.44%	-18.91%	-28.37%	-25.16%	-13.93%	-12.50%
SW3_1690_0003	-5.00%	-0.0093	2.20%	11.70%	-15.16%	-23.75%	-8.27%	-24.13%	-3.60%	-8.46%
SW3_1690_1660	-3.16%	0.0060	-1.75%	31.70%	-13.20%	-29.93%	-7.87%	-34.62%	-15.28%	-10.82%
SW3_1870_1800	5.99%	-0.0138	23.01%	0.40%	1.96%	9.75%	21.19%	0.61%	3.95%	-4.10%
SW3_1920_1750	-1.09%	-0.0193	6.97%	1.90%	-9.62%	-9.19%	-15.37%	46.89%	-15.35%	6.21%
SW4_1110_1150	-2.57%	-0.0120	12.85%	4.40%	-2.80%	25.56%	-12.70%	-15.40%	-6.82%	-8.83%
SW4_1260_0003	5.42%	-0.0136	16.06%	2.90%	1.83%	-3.65%	6.34%	7.19%	7.34%	-7.25%
SW4_1430_1490	6.02%	-0.0029	24.76%	1.90%	3.38%	7.60%	10.55%	-0.12%	3.70%	-8.63%
SW4_1720_1650	2.52%	-0.0120	21.49%	4.80%	0.57%	15.76%	4.05%	-23.18%	-2.19%	-11.34%
SW4_1860_1720	-2.87%	-0.0018	12.94%	7.60%	-4.99%	-7.49%	3.11%	-24.67%	-6.98%	-17.04%
SW4_1940_1860	-0.68%	-0.0157	12.90%	2.20%	-2.97%	3.06%	-0.67%	-27.32%	-4.30%	-14.15%
SW5_1350_0003	2.27%	-0.0069	25.17%	4.00%	-2.95%	25.13%	-13.91%	-18.19%	2.05%	-4.91%
SW5_1540_0003	-6.73%	-0.0160	-1.91%	4.50%	-4.21%	7.15%	-3.07%	-20.92%	-15.46%	-12.65%
SW6_1330_1230	2.33%	-0.0101	14.95%	2.10%	1.67%	10.04%	17.24%	-1.73%	-3.49%	-7.38%
SW7_1320_0003	-0.79%	-0.0078	11.40%	0.80%	-4.68%	-9.78%	-2.37%	-14.91%	-4.70%	-8.20%
SW7_1640_0003	2.67%	-0.0070	13.04%	2.30%	-1.28%	-11.08%	-12.15%	-12.38%	-3.03%	-3.65%
TU2_8790_9070	0.57%	-0.0144	-3.55%	1.80%	-1.89%	5.02%	-10.99%	-11.91%	-9.85%	5.55%
TU2_8950_9040	-1.08%	-0.0121	-2.80%	1.00%	-3.33%	5.05%	-21.69%	-19.97%	-8.16%	3.71%
TU3_8650_8800	-1.18%	-0.0036	18.17%	9.80%	-11.30%	-22.01%	-15.21%	-26.45%	0.26%	-1.81%
TU3_9180_0003	-0.63%	-0.0114	0.59%	0.50%	-1.47%	4.55%	-11.06%	-30.48%	-4.11%	1.78%
TU3_9230_9260	-0.80%	-0.0104	27.84%	1.20%	-7.25%	-5.18%	-10.21%	-20.74%	-1.13%	-3.20%
TU4_8680_8810	0.82%	-0.0109	17.15%	2.20%	-3.22%	8.80%	-16.60%	-19.32%	-2.40%	3.47%
TU5_9280_0003	-0.87%	-0.0062	29.16%	8.30%	-8.63%	-11.73%	-4.95%	38.64%	-11.13%	4.82%
WM1_3660_3910	-2.01%	-0.0020	-30.55%	1.00%	-2.56%	-14.37%	1.08%	20.94%	-16.61%	6.53%
WM3_3880_4060	-6.47%	-0.0172	-20.54%	1.60%	-4.23%	-8.58%	0.13%	-26.53%	-25.16%	15.97%

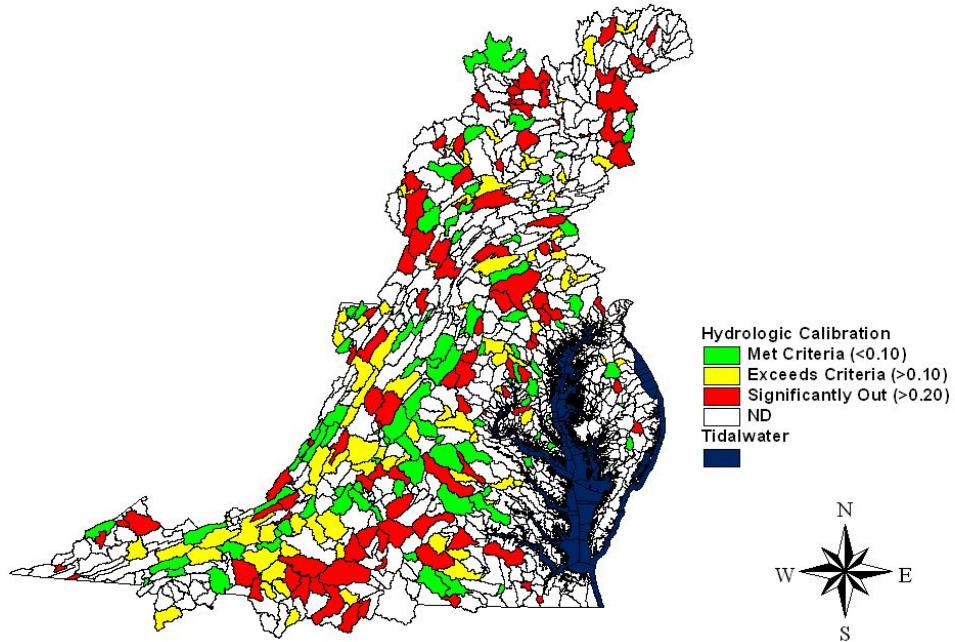
WU1_3240_3331	0.23%	-0.0031	-9.60%	2.50%	1.81%	-11.79%	15.75%	-23.43%	-18.26%	9.71%
WU1_3350_3490	1.53%	-0.0146	-16.02%	3.20%	7.55%	-12.10%	22.80%	7.77%	-17.90%	14.07%
WU2_3020_3320	-12.38%	-0.0233	-45.91%	9.00%	17.86%	34.01%	40.85%	-37.54%	-50.11%	16.43%
XL0_5320_0001	0.07%	-0.0098	4.41%	0.80%	6.83%	9.06%	28.77%	-32.44%	-17.46%	14.75%
XL1_4690_0001	8.33%	-0.0171	-7.07%	2.30%	6.86%	-6.20%	33.31%	-14.90%	-16.59%	22.36%
XU0_4130_4070	-6.34%	-0.0074	-11.54%	4.50%	-7.14%	-23.11%	11.30%	-10.96%	-21.43%	5.36%
XU2_4070_4330	1.96%	0.0143	2.91%	26.70%	-5.34%	-26.00%	5.95%	-16.92%	-5.79%	15.58%
XU2_4270_0003	5.22%	-0.0051	-9.75%	0.30%	8.05%	-1.71%	26.08%	-18.89%	-11.70%	14.29%
XU2_4330_4480	-5.79%	-0.0090	-14.63%	26.80%	-3.06%	-26.41%	-15.87%	0.00%	-23.39%	0.22%
XU3_4650_0001	-4.48%	-0.0065	-18.80%	2.40%	3.61%	8.94%	11.51%	-7.08%	-16.48%	-0.99%
YM2_6120_6430	-0.16%	-0.0092	-0.18%	8.90%	2.91%	-12.93%	-5.70%	-35.92%	0.94%	1.68%
YM4_6620_0003	-1.09%	-0.0106	-10.35%	0.90%	12.68%	56.29%	74.78%	-34.64%	-5.34%	3.34%
YP0_6860_6840	-2.40%	-0.0054	-18.63%	1.50%	5.21%	-0.68%	-5.15%	0.92%	-25.69%	17.40%
YP1_6570_6680	7.52%	0.0072	13.94%	0.10%	8.66%	37.72%	0.52%	-63.17%	24.43%	7.82%
YP2_6390_6330	-5.44%	0.0133	8.94%	43.70%	-10.84%	-11.89%	0.30%	-76.72%	-9.21%	-4.69%
YP3_6330_6700	2.64%	0.0015	21.85%	28.90%	-3.10%	-8.35%	7.24%	-4.90%	2.98%	6.20%
YP3_6470_6690	-2.79%	-0.0141	-24.80%	3.20%	6.74%	39.11%	40.46%	-31.21%	-15.80%	0.53%
YP4_6720_6750	-5.98%	-0.0105	-4.07%	19.40%	-8.70%	3.18%	-9.86%	-53.62%	-9.38%	-4.06%

APPENDIX 3 Spatial distribution of review statistics

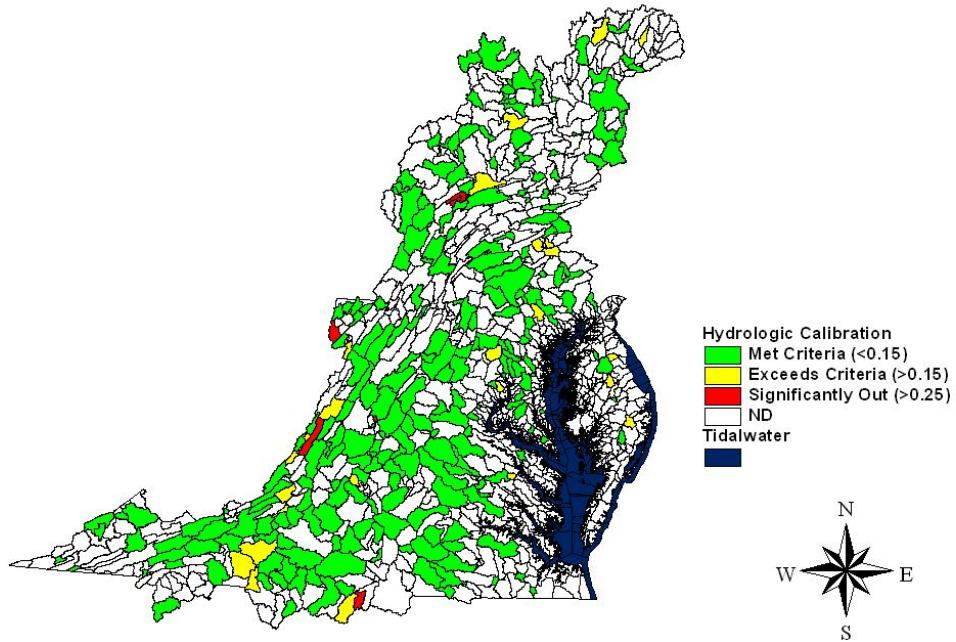
Phase 5.1 Baseflow Recession



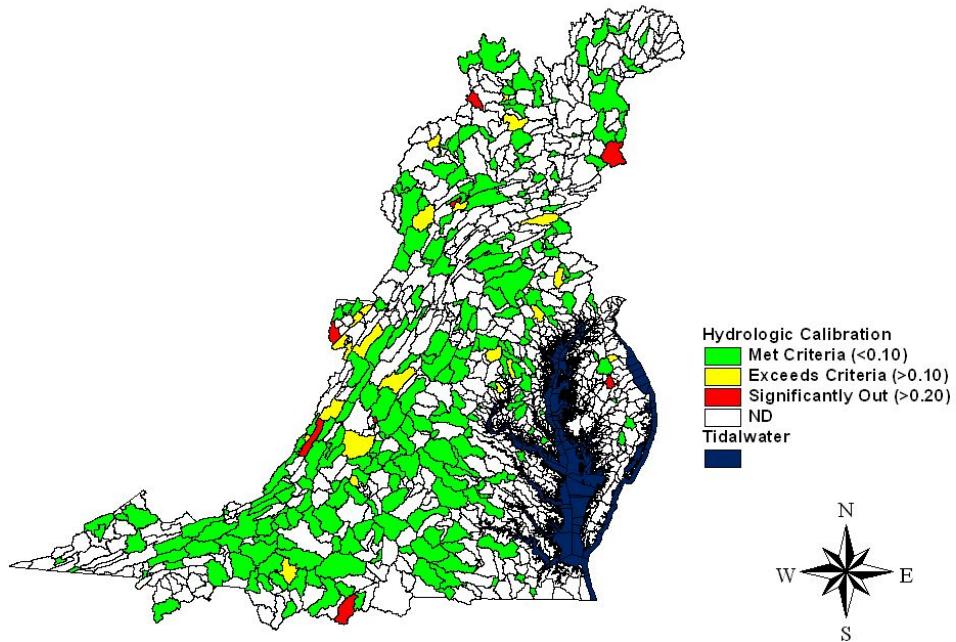
Phase 5.1 Lowest 50% of Flows



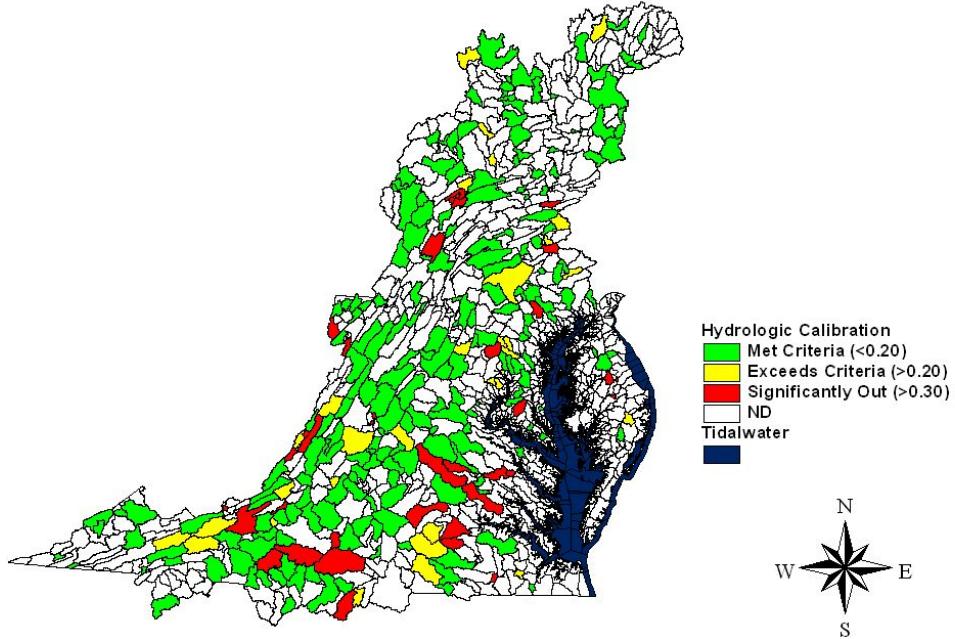
Phase 5.1 Highest 10% of Flows



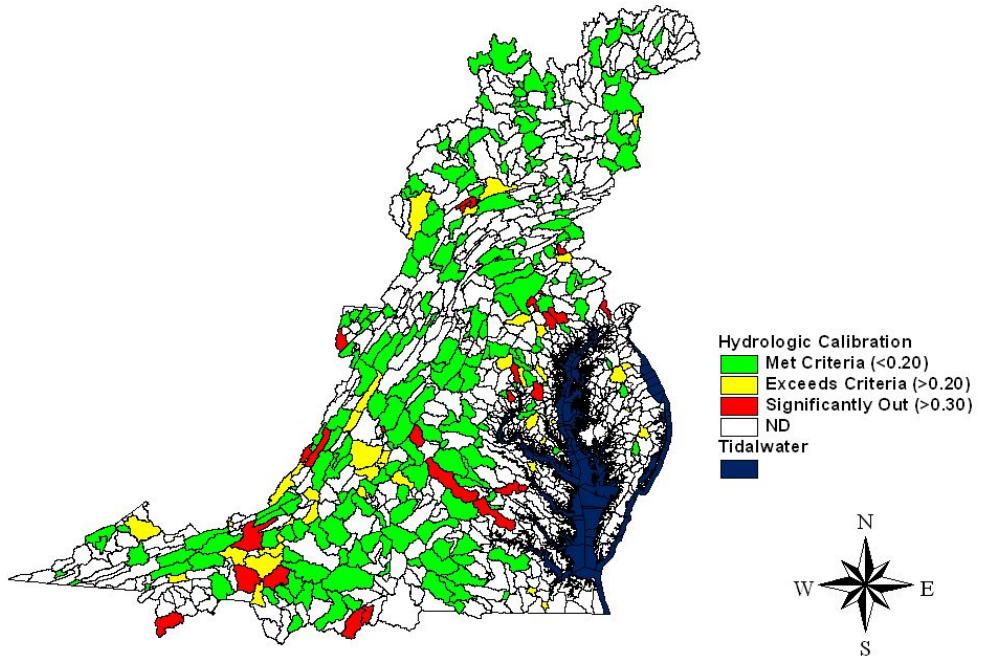
Phase 5.1 Total Volume



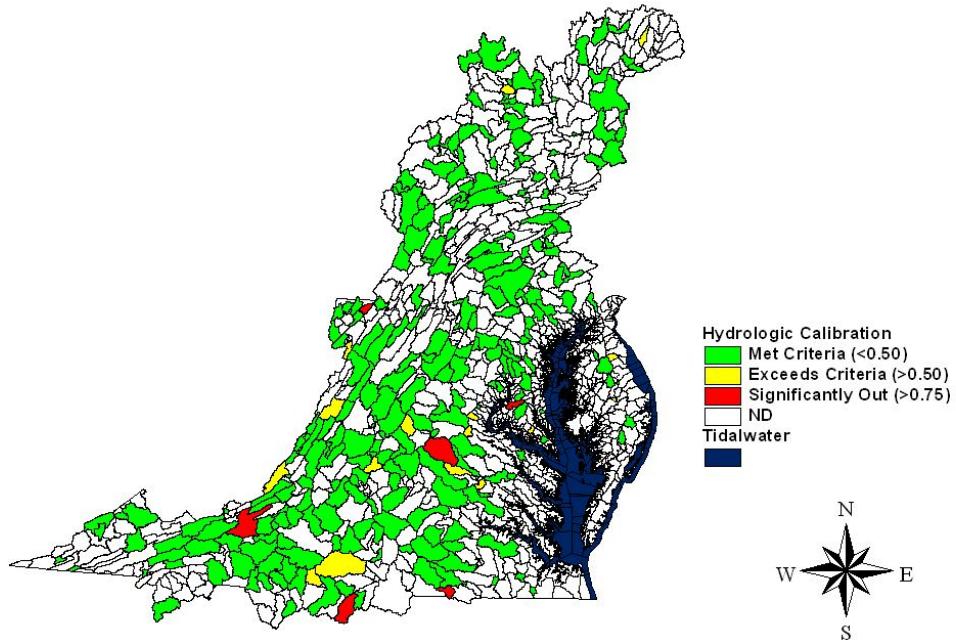
Phase 5.1 Storm Peaks



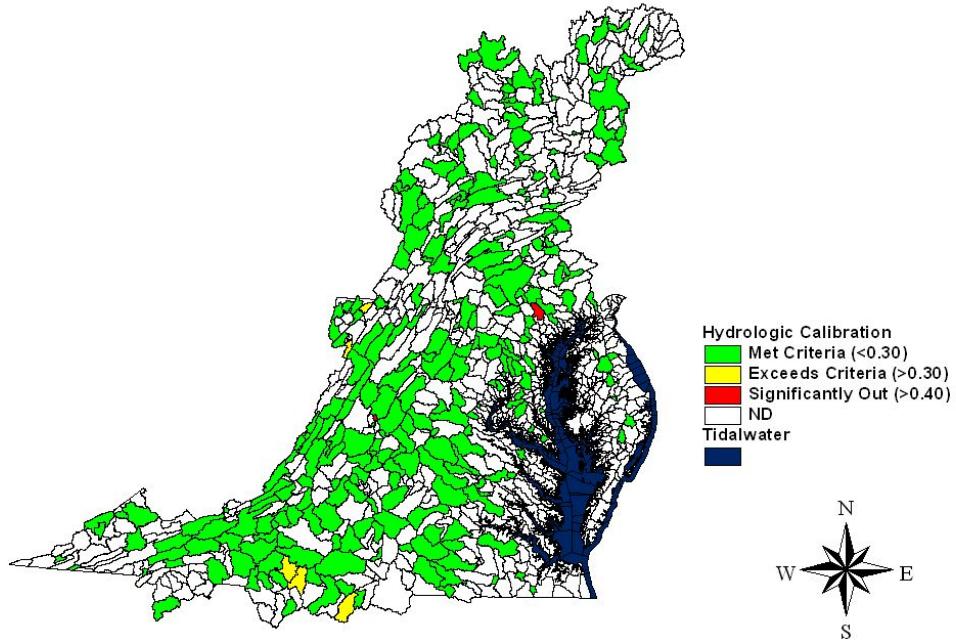
Phase 5.1 Storm Volume



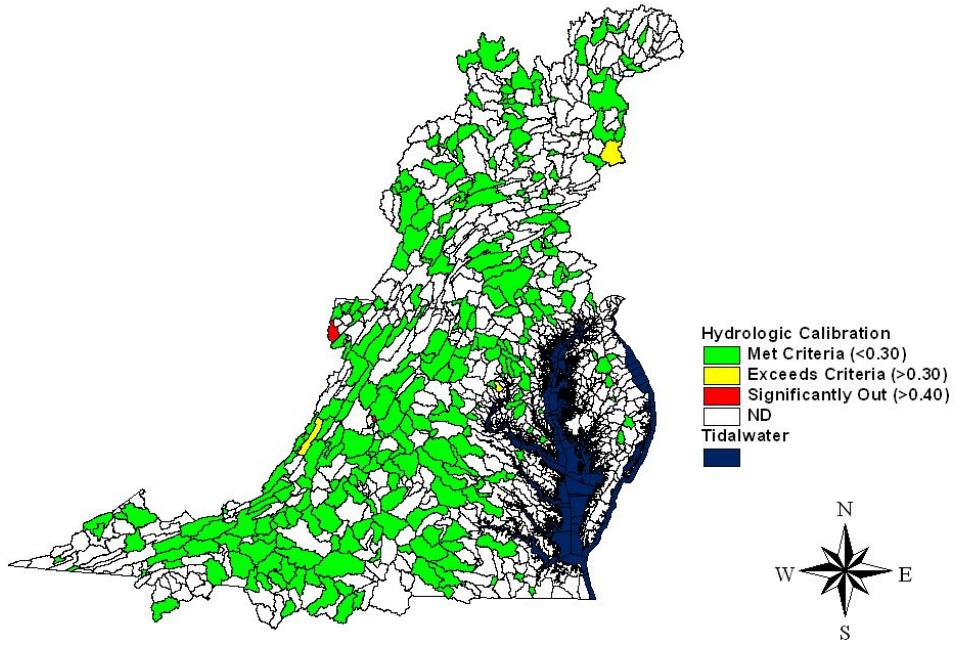
Phase 5.1 Summer Storm Volume



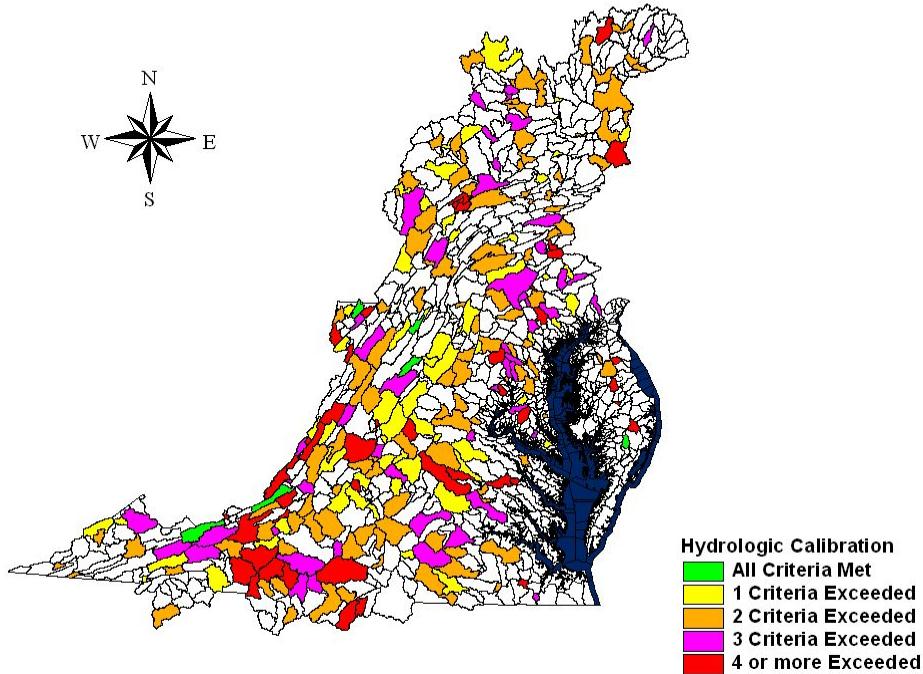
Phase 5.1 Summer Volume



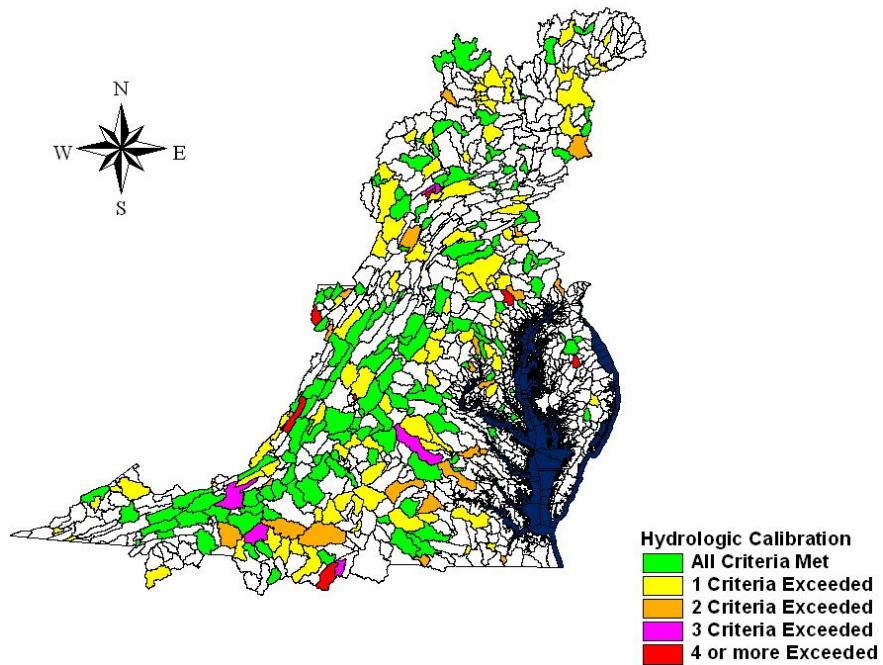
Phase 5.1 Winter Volume



Phase 5.1 Segments Meeting Criteria



Phase 5.1 Segments Significantly Out



APPENDIX 4 Calculated review statistics for model validation

	Total Vol	base flow recession	Lowest 50%	P5 base	Highest 10%	Storm Peak	Storm Vol	Summer Storm	Summer Vol	Winter Vol
Segment	error	error	flow error	flow Stats	error	error	error	Vol error	error	error
EM2_3980_0001	-7.01%	-0.0075	22.19%	2.20%	-20.21%	-29.30%	-26.81%	3.42%	-23.63%	3.19%
JA5_7480_0001	-5.75%	0.0078	-5.72%	14.90%	-4.56%	13.68%	-18.81%	-24.76%	-12.18%	-7.52%
JL7_7100_7030	7.07%	-0.0081	14.27%	-0.90%	6.65%	5.73%	13.86%	22.84%	5.18%	9.57%
PL0_4510_0001	11.17%	-0.0145	5.00%	12.20%	-0.08%	-19.47%	0.46%	-0.07%	-6.90%	24.73%
PL1_4460_4780	5.39%	0.0067	-9.65%	-8.90%	13.17%	14.02%	14.56%	-5.18%	-11.75%	19.05%
PM1_3120_3400	3.16%	-0.0036	1.29%	4.60%	-1.33%	-8.50%	4.48%	-51.80%	-33.44%	16.17%
PM1_3510_4000	12.39%	-0.0077	71.13%	-1.10%	1.73%	1.44%	13.07%	17.41%	12.82%	15.76%
PM2_2860_3040	3.71%	0.0144	45.27%	10.00%	-0.78%	4.99%	3.40%	-5.41%	-1.56%	5.85%
PM7_4820_0001	-0.36%	-0.0078	12.51%	10.90%	-7.51%	-15.98%	9.54%	69.30%	-2.08%	1.00%
PU2_3090_4050	10.62%	-0.0081	18.37%	-6.30%	3.56%	14.85%	14.47%	28.20%	8.96%	12.89%
PU3_3290_3390	3.69%	-0.0042	12.78%	-1.40%	0.27%	-1.88%	11.25%	-58.05%	-8.16%	13.35%
PU3_3680_3890	10.32%	0.0088	27.01%	-5.90%	7.01%	44.08%	11.38%	47.32%	17.59%	8.04%
PU6_3610_3530	12.46%	-0.0029	25.44%	0.80%	12.75%	9.11%	26.19%	39.55%	12.23%	11.70%
PU6_3752_4080	4.69%	0.0002	28.48%	5.40%	2.21%	3.72%	8.33%	35.18%	7.51%	2.46%
PU6_4020_3870	4.25%	-0.0024	14.88%	-5.20%	5.54%	9.98%	4.34%	-0.01%	2.84%	5.65%
RU5_6030_0001	-5.18%	-0.0112	9.87%	8.80%	-9.37%	-1.24%	-14.36%	33.65%	0.91%	-6.04%
SL1_2390_2420	9.82%	0.0034	23.47%	14.70%	-6.33%	-18.49%	16.87%	-9	-4.59%	0.06%
SL3_2290_2260	3.76%	-0.0063	25.16%	-0.40%	-2.90%	-6.98%	1.29%	-40.70%	0.15%	13.53%
SL3_2420_2700	-9.90%	-0.0112	-15.19%	-5.20%	-9.21%	-16.70%	-2.06%	0.55%	-27.72%	-0.55%
SL3_2460_2430	-1.58%	-0.0040	19.93%	11.50%	-11.19%	-19.31%	-0.14%	42.59%	-18.77%	9.65%
SL4_2140_2240	2.68%	-0.0038	29.11%	5.00%	-12.07%	-12.91%	-10.27%	21.99%	-3.14%	7.27%
SL9_2490_2520	3.26%	0.0015	15.01%	2.40%	-5.59%	-9.40%	-6.56%	-2.80%	-6.25%	3.37%
SL9_2720_0001	-0.08%	-0.0179	10.84%	8.40%	-6.30%	-10.50%	-3.76%	-11.65%	-7.98%	-2.07%
SU7_0850_0730	3.57%	-0.0092	25.30%	4.70%	-8.26%	1.38%	-9.28%	16.48%	-6.58%	3.73%
SU8_1610_1530	5.98%	-0.0131	24.58%	6.90%	-5.96%	-3.31%	2.44%	73.66%	-3.11%	4.78%
WM1_3660_3910	16.07%	0.0013	7.67%	-2.80%	5.92%	-7.18%	14.07%	-5.16%	13.26%	29.39%
WM3_3880_4060	-30.14%	-0.0090	-12.60%	-1.20%	-36.20%	-38.83%	-40.83%	-51.59%	-39.68%	-27.08%

WU2_3020_3320	-10.04%	-0.0207	-39.75%	-10.50%	14.86%	14.47%	51.22%	-34.13%	-45.59%	14.54%
XL1_4690_0001	10.08%	-0.0238	-11.32%	-4.20%	17.43%	-0.24%	36.37%	90.39%	-3.67%	20.16%
XU0_4130_4070	-8.43%	-0.0084	-3.81%	5.50%	-11.29%	-22.93%	-4.30%	17.88%	-21.10%	2.52%
XU2_4330_4480	21.13%	0.0228	11.45%	43.80%	-1.23%	-20.29%	-28.40%	-9	13.21%	25.59%
XU3_4650_0001	0.82%	-0.0067	-14.78%	2.30%	4.87%	8.70%	18.18%	-2.71%	-4.78%	6.35%
YP4_6720_6750	5.49%	-0.0073	15.50%	14.60%	4.31%	3.01%	8.65%	82.81%	9.48%	4.34%