Hydrology and Earth System Sciences

Supplementary Information for:

Integrating social, economic, and environmental risk into flood management of aging dam infrastructure by combining cost-benefit and multi-criteria decision analyses

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Supplementary Table S1: Parameter values for Addicks HEC-HMS subbasins using SCS Curve Number loss methodology. Values in ()† indicate changes to the curve number and percentage of impervious coverage in each subbasin for Alternative A5 – Proposed Buyouts along the Buffalo Bayou.

Subbasin	Curve Number (buyouts)†	% Impervious (buyouts)†	Subbasin	Curve Number (buyouts)†	% Impervious (buyouts)†
U101A	56.08	14.99	U106A	57.18	46.93
U101B	55.91	17.62	U106B	57.67	45.87
U101C	55.76	17.83	U106C	57.42	52.39
U101D	56.23	36.28	U106D	58.13 (51.63)	52.54 (46.66)
U101E	55.79	35.24	U120A	56.22	44.87
U101F	57.65	52.33	U129A	56.15	8.40
U101G	57.89	52.94	U129B	57.06	39.85
U101H	58.12 (55.12)	54.45 (51.64)	U129C	57.47	50.24
U101I	58.81 (54.77)	40.36 (37.59)	U129D	57.56	54.18
U102A	56.28	18.42	U129E	57.94 (52.01)	58.67 (52.67)
U102B	55.41	20.87	U129F	60.33 (57.81)	57.13 (47.07)
U102C	56.60	45.70	W167C	63.13	30.19
U102D	58.30	43.11	W167D	57.01	42.38
U102E	58.31 (57.44)	44.37 (43.71)	W167E	59.21	56.04
U102F	59.49 (58.43)	31.49 (30.93)	W167F	59.64	58.78

Supplementary Table S2: Parameter values for Buffalo Bayou HEC-HMS subbasins using Green & Ampt loss methodology. Values in ()† indicate changes to the percentage of impervious coverage in each subbasin for Alternative A5 – Proposed Buyouts along the Buffalo Bayou.

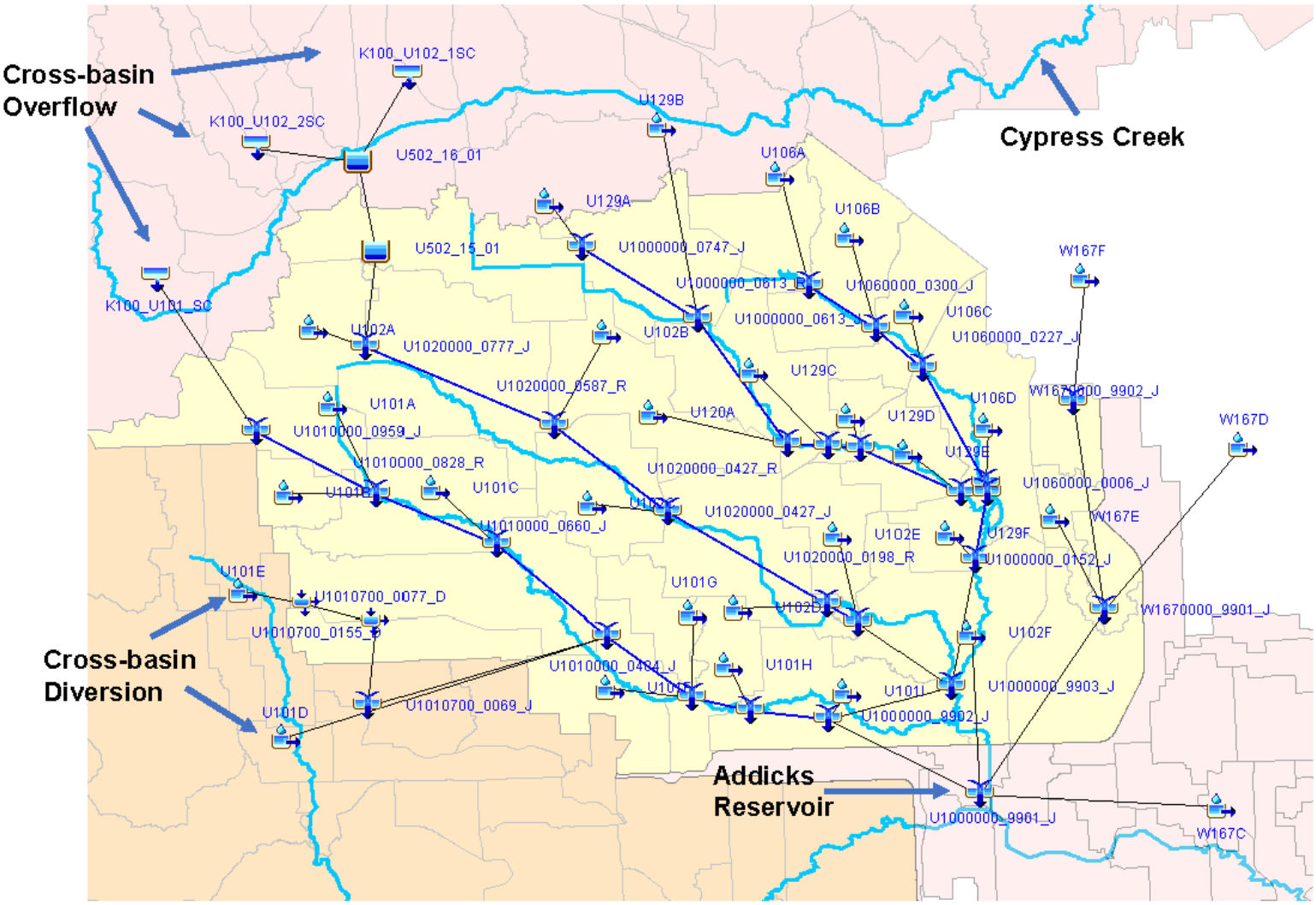
Subbasin	Initial Content	Saturated Content	Suction (in)	Conductivity (in/hr)	% Impervious (buyouts)†
W100A	0.01	0.46	10.45	0.33	35 (34.98)
W100B	0.03	0.46	9.52	0.49	35
W100C	0.01	0.48	8.3	0.37	45 (44.82)
W100D	0.01	0.46	12.45	0.74	45 (44.88)
W100E	0.01	0.46	12.45	0.74	45 (44.88)
W100F	0.01	0.48	12.45	0.81	45 (44.92)
W100G	0.01	0.48	12.45	0.81	45 (44.77)
W100H	0.03	0.46	10.03	0.37	40 (39.86)
W100I	0.03	0.46	10.03	0.37	45 (44.88)
W100J	0.03	0.46	10.03	0.37	40 (39.87)
W100K	0.03	0.46	10.03	0.37	45 (44.97)
W100L	0.03	0.46	10.03	0.37	45 (44.98)
W100M	0.03	0.46	10.03	0.37	40 (39.98)
W100N	0.03	0.46	10.03	0.37	50
W100O	0.03	0.46	10.03	0.37	45
W129A	0.03	0.46	10.03	0.37	50
W138A	0.03	0.46	10.03	0.37	50
W139A	0.03	0.46	10.03	0.37	50
W140A	0.03	0.46	10.03	0.37	45.18
W140B	0.03	0.46	10.03	0.37	45
W140C	0.03	0.46	10.03	0.37	45
W140D	0.03	0.46	10.03	0.37	45
W140E	0.03	0.46	10.03	0.37	45
W141A	0.03	0.46	10.03	0.37	45.23
W142A	0.03	0.46	10.03	0.37	55
W145A	0.03	0.46	10.03	0.37	55
W147A	0.01	0.48	12.45	0.81	55
W151A	0.01	0.48	12.45	0.81	50.4 (50.32)
W156A	0.01	0.46	12.45	0.74	55
W156B	0.01	0.46	12.45	0.74	55
W167A	0.01	0.46	9.1	0.37	52.47
W167B	0.01	0.46	9.1	0.37	45
W170A	0.04	0.46	6.8	0.34	43.26
W190A	0.05	0.46	3.31	0.41	4.57
W190B	0.05	0.46	3.31	0.41	3.11
W190C	0.05	0.46	3.31	0.41	16.43

Supplementary Table S3: Values used to convert the HEC-HMS peak flow outputs at select junction nodes for each Alternative (A1-A8) into steady-state flow data for corresponding HEC-RAS cross-sections (XS). (Top: Addicks Reservoir Watershed, Bottom: Buffalo Bayou Watershed).

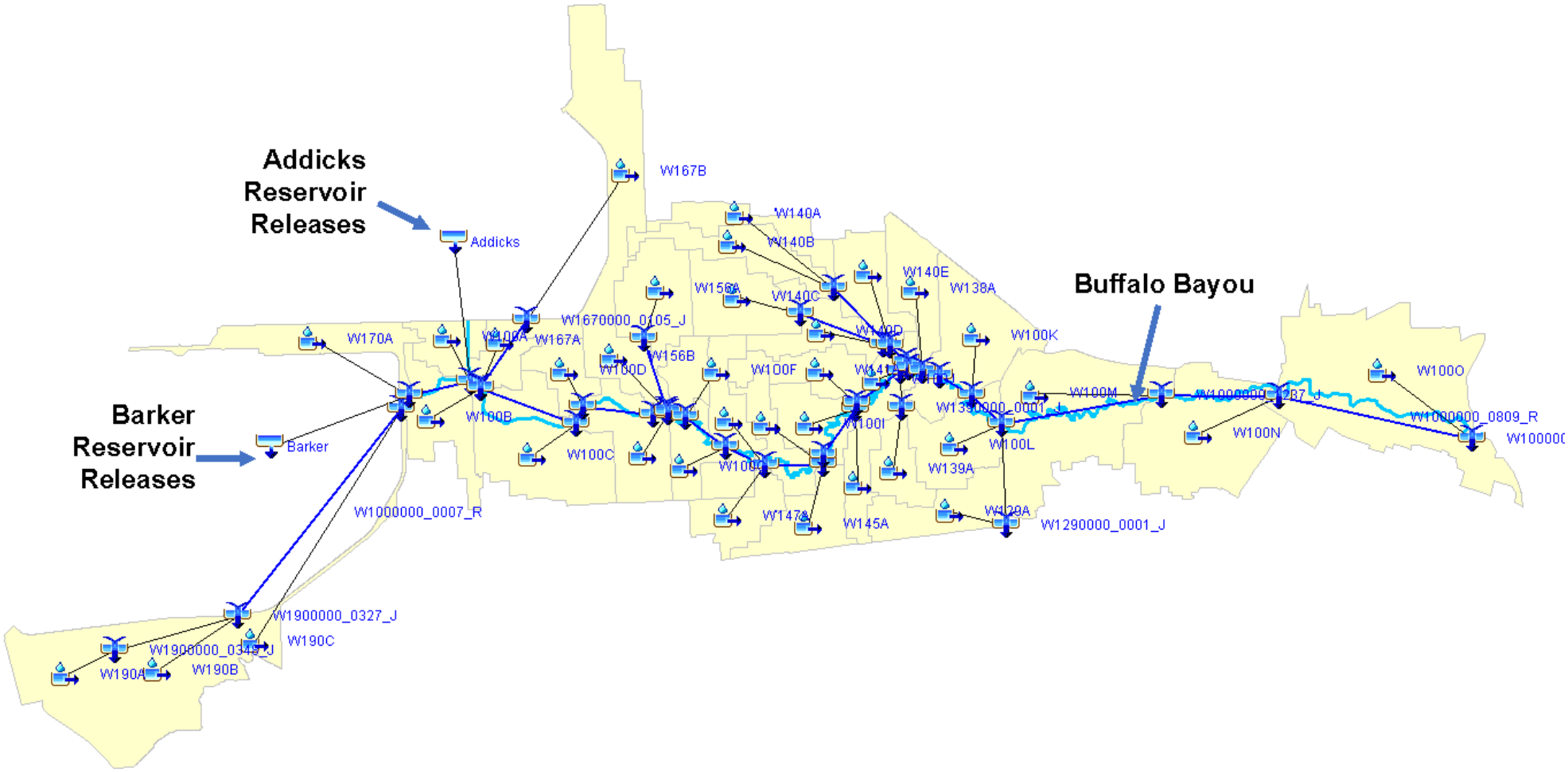
			PEAK FLOW (cfs)			
RAS River	**RAS XS**	**HMS Junction**	**A1**	**A2**	**A3**	**A4**
U100-00-00	89149.7	U1000000_0747_J	3205.2	3205.2	3205.2	3205.2
U100-00-00	62234.7	U1000000_0613_J	5918.9	5918.9	5918.9	5918.9
U100-00-00	41734.5	U1000000_0408_J	12090.8	12090.8	12090.8	12090.8
U100-00-00	39144.7	U1000000_0386_J	12660.8	12660.8	12660.8	12660.8
U100-00-00	28751.6	U1000000_0288_J	13795	13795	13771	13795
U100-00-00	27102.1	U1000000_0219_J	22486.8	22486.8	22407.6	22486.8
U100-00-00	19514.7	U1000000_0152_J	22995.6	22995.6	21961.7	22995.6
U101-00-00	101835.6	U1010000_0959_J	22593.8	4000	22593.8	5648.4
U101-00-00	82695.4	U1010000_0828_J	25035.7	3670.2	25035.7	8393.7
U101-00-00	67829.7	U1010000_0660_J	27615.1	7072.7	27615.1	11456.5
U101-00-00	49146.2	U1010000_0484_J	31481.7	11975.9	31481.7	16164.8
U101-00-00	36113.6	U1010000_0361_J	33537.8	15216.7	33537.8	19233
U101-00-00	33216.3	U1010000_0306_J	34623	16650	34613.9	20610.5
U101-00-00	26243.5	U1000000_9902_J	72745.8	56300.5	72605	60625.8
U102-00-00	77737.9	U1020000_0777_J	10048.3	4007	10048.3	4277.5
U102-00-00	58715.1	U1020000_0587_J	12346.8	8820	12346.8	9101.4
U102-00-00	43042.76	U1020000_0427_J	13335.2	10933.7	13335.2	11188.5
U102-00-00	19755.1	U1020000_0198_J	14901.4	13660.9	14817.2	13911.1
U106-00-00	32133.5	U1060000_0300_J	1504.7	1504.7	1504.7	1504.7
U106-00-00	22728	U1060000_0227_J	4751	4751	4751	4751
U106-00-00	17601.8	U1060000_0176_J	7219.4	7219.4	7219.4	7219.4
U106-00-00	6400.5	U1060000_0006_J	10139.8	10139.8	9927.2	10139.8

			PEAK FLOW (cfs)				
RAS River	**RAS XS**	**HMS Junction**	**A1**	**A5**	**A6**	**A7**	**A8**
W100-00-00	248647.7	W1000000_2411_J	6300	6300	3576.3	6300	3694.4
W100-00-00	241079	W1000000_0020_J	13300	13300	3800	13300	6984.3
W100-00-00	232681.7	W1000000_2271_J	16700	16700	4000	16700	8611.2
W100-00-00	239993.6	W1000000_2340_J	16700	16700	6374.6	16700	6359.9
W100-00-00	214669.3	W1000000_2147_J	19000	19000	11703.4	19000	11371.5
W100-00-00	211631.3	W1000000_2116_J	19000	19000	12029.7	19000	11659.9
W100-00-00	205679.6	W1000000_2037_J	19000	19000	12340.6	19000	11928.1
W100-00-00	199440.6	W1000000_1985_J	19000	19000	13626.1	19000	13195.7
W100-00-00	196182.3	W1000000_1879_J	17000	17000	13626.1	17000	14929.5
W100-00-00	128104.6	W1000000_1237_J	24000	24000	13626.1	24000	27523.8
W100-00-00	188903.7	W1000000_1865_J	24000	24000	15401.7	24000	14923.5
W100-00-00	175675.6	W1000000_1757_J	24000	24000	17501.3	24000	17028
W100-00-00	166558.2	W1000000_1663_J	24000	24000	24028	24000	17526.3
W100-00-00	162811.9	W1000000_1646_J	24000	24000	24852	24000	23320.7

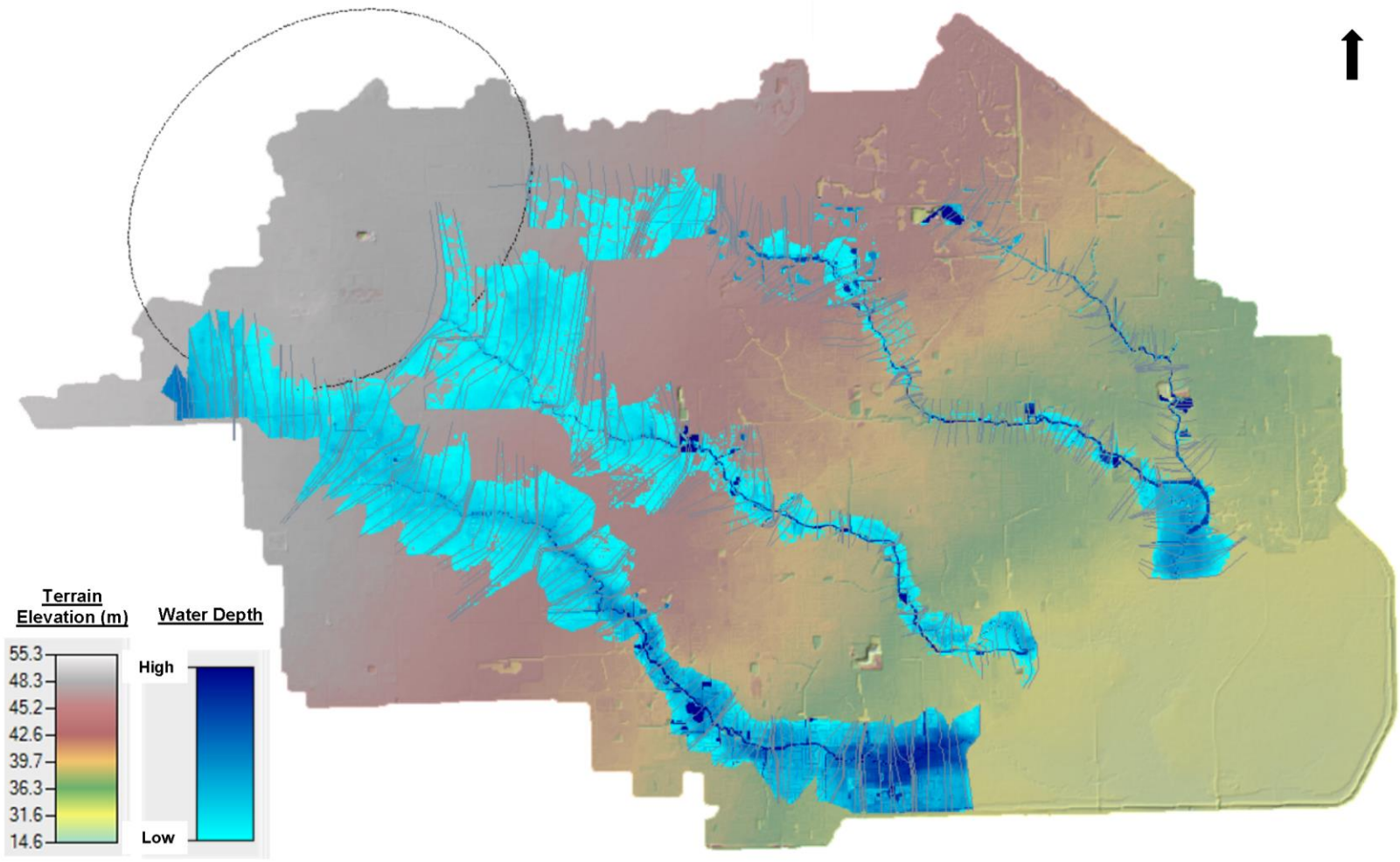
Supplementary Figures



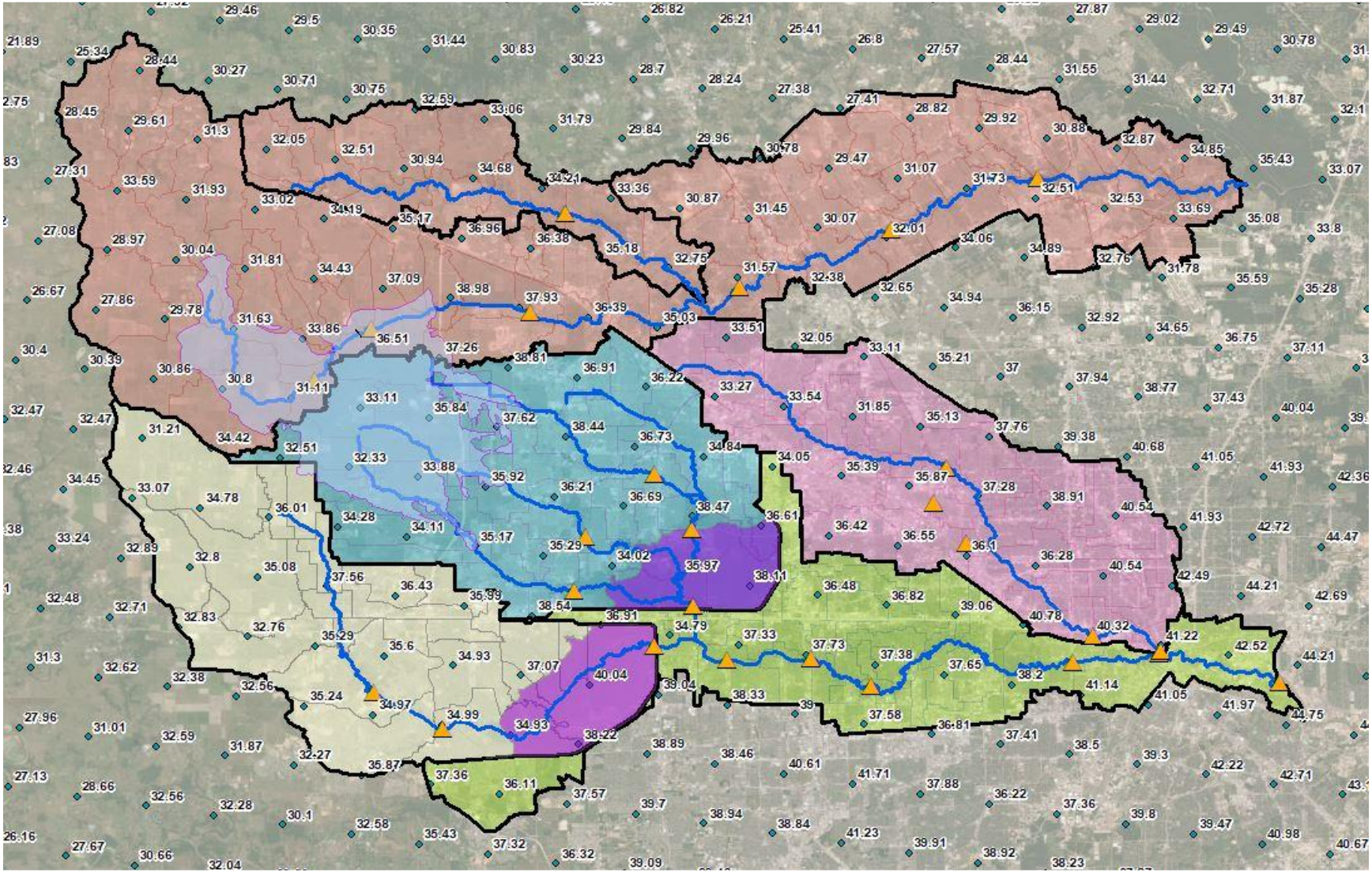
Supplementary Figure S1: HEC-HMS schematic for Addicks watershed model, showcasing how the cross-basin overflow from Cypress Creek was integrated into model through diversion nodes.



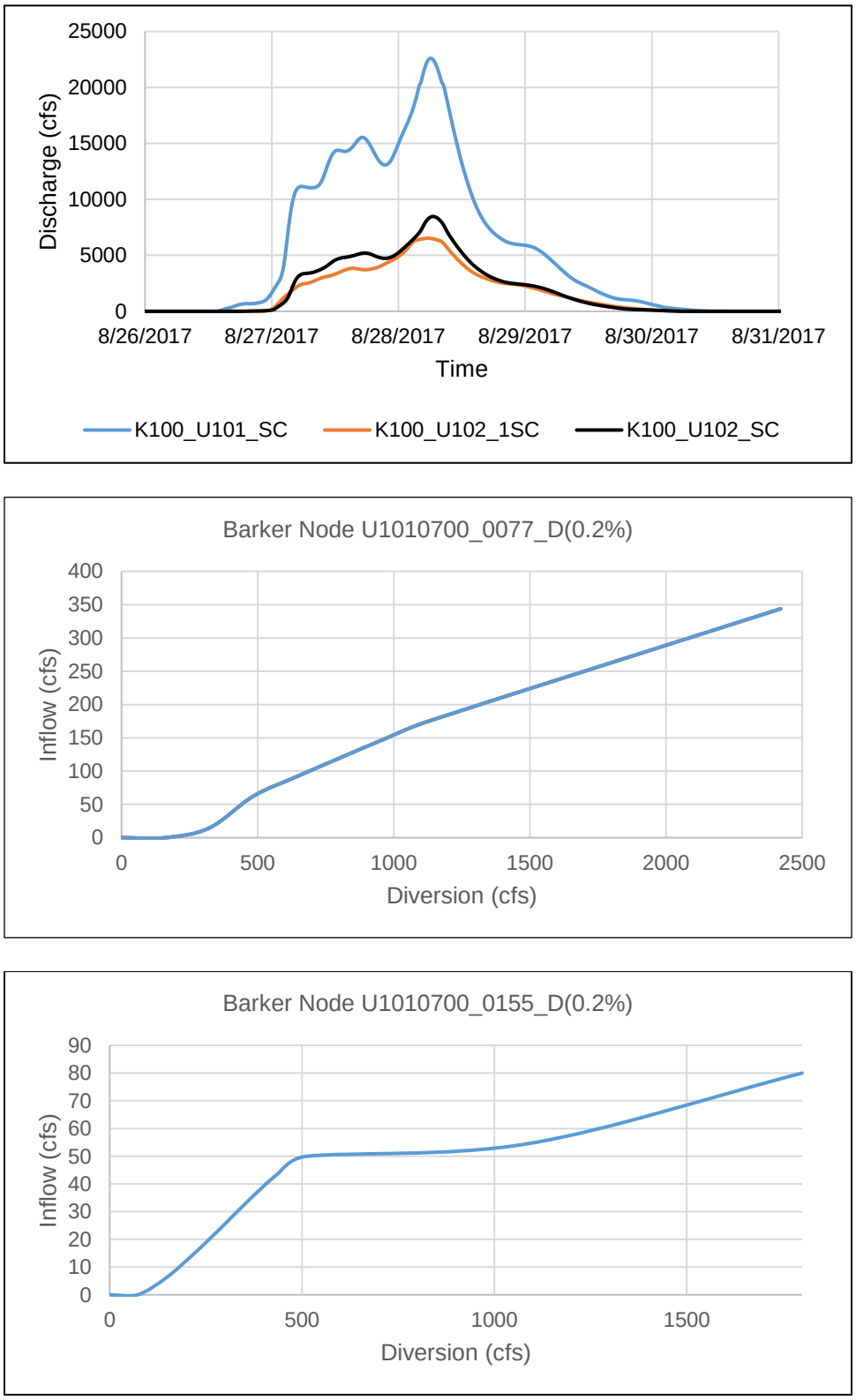
Supplementary Figure S2: HEC-HMS schematic for Buffalo Bayou watershed model, showcasing how the Addicks and Barker reservoir releases were integrated into the Buffalo Bayou watershed model through source discharge gages.



Supplementary Figure S3: HEC-RAS schematic for Addicks watershed model, showcasing how the various streams within the basin were combined within a single model to estimate flood inundation bounds and water depth under Hurricane Harvey conditions.



Supplementary Figure S4: Gridded rainfall maximum values for Hurricane Harvey conditions in the ABRS inter-connected watershed system, from National Oceanic Atmospheric Administration (NOAA, 2017a) for August 24, 2017 21:00 to August 29, 2017 23:00.



Supplementary Figure S5: Discharge and diversion node values used to link the Cypress Creek overflow conditions with the Addicks watershed HEC-HMS model.