Supplementary materials

Table S1 Characteristics of sub-catchments in the Storm Water Management Model (SWMM).

Sub-catchment	Area (ha)	Impervious Area (ha)	Width (m)	Slope	N-Imperv	N-Perv	Dstore-Imperv (mm)	Dstore-Perv (mm)	MaxRate (mm/hr)	MinRate (mm/hr)	Decay Constant (hr)	Drying Time (days)
1	3.3	2.48	330	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
2	1.92	1.44	192	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
3	2.5	1.88	250	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
4	1.98	1.29	198	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
5	3.92	2.94	392	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
6	2.13	0.19	213	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
7	4.05	3.04	405	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
8	8.38	5.45	838	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
9	2.03	1.32	203	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
10	2.38	1.55	238	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
11	3.02	1.96	302	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
12	2.22	1.44	222	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
13	2.29	1.49	229	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
14	2.22	1.44	222	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
15	2.23	1.45	223	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
16	1.44	1.08	144	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
17	1.53	1.15	153	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
18	4.91	1.77	491	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
19	1.07	0.80	107	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
20	0.86	0.65	86	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
21	1.09	0.82	109	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
22	1.61	1.05	161	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
23	1.34	0.87	134	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
24	1.58	1.03	158	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
25	1.85	1.20	185	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
26	3.48	2.26	348	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
27	2.39	1.79	239	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
28	4.13	2.68	413	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
29	1.86	1.40	186	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
30	2.61	1.70	261	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
31	1.12	0.73	112	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
32	3.3	2.48	330	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
33	2	1.06	200	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
34	1.42	0.41	142	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
35	2.1	0.95	210	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
36	3.27	2.45	327	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7

37	1.94	0.62	194	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
38	1.83	1.19	183	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
39	1.71	1.11	171	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
40	2.01	1.31	201	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
41	1.89	1.23	189	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
42	2.31	1.73	231	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7
43	0.6	0.36	60	0.1	0.024	0.15	2.1	6.51	103.81	11.44	2.75	7

Table S2 Design parameters of permeable pavement (PP) and bioretention cells (BCs) in SWMM.

Layer	Parameter	PP	BC	Layer	Parameter	PP	BC
Surface layer	Berm height (mm)	-	450	Pavement	Thickness (mm)	100	-
	Vegetation volume fraction (m^3/m^3)	-	0.05		Void ration (voids/solids) (m3/m3)	0.15	-
	Surface roughness (Manning's n)	0.012	0.1		Impervious surface fraction	0	-
	Surface slope (percent)	0.5	0.5		Permeability (mm/h)	500	-
Soil layer	Thickness (mm)	-	900		Clogging factor	0	-
	Porosity (m3/m3)	-	0.5	Storage layer	Thickness (mm)	300	300
	Field capacity (volume fraction) (m3/m3)	-	0.15		Void ration (voids/solids) (m3/m3)	0.4	0.67
	Wilting point (volume fraction) (m3/m3)	-	0.08		Seepage rate to native soil (mm/h)	500	500
	Conductivity (mm/h)	-	50		Clogging factor	0	0
	Conductivity slope	-	10	Underdrain layer	Flow coefficient	2.5	2.5
	Suction head (mm)	-	80		Flow exponent	0.5	0.5
					Offset height (mm)	100	150

Fig. S1 Spatial representation and identification of network elements in optimized grey infrastructure-only (GREI-only) networks across varying degrees of decentralization (DDL). Key elements include pipe networks, flow outlets, and drainage configurations, highlighting structural adaptations under different DDL scenarios.

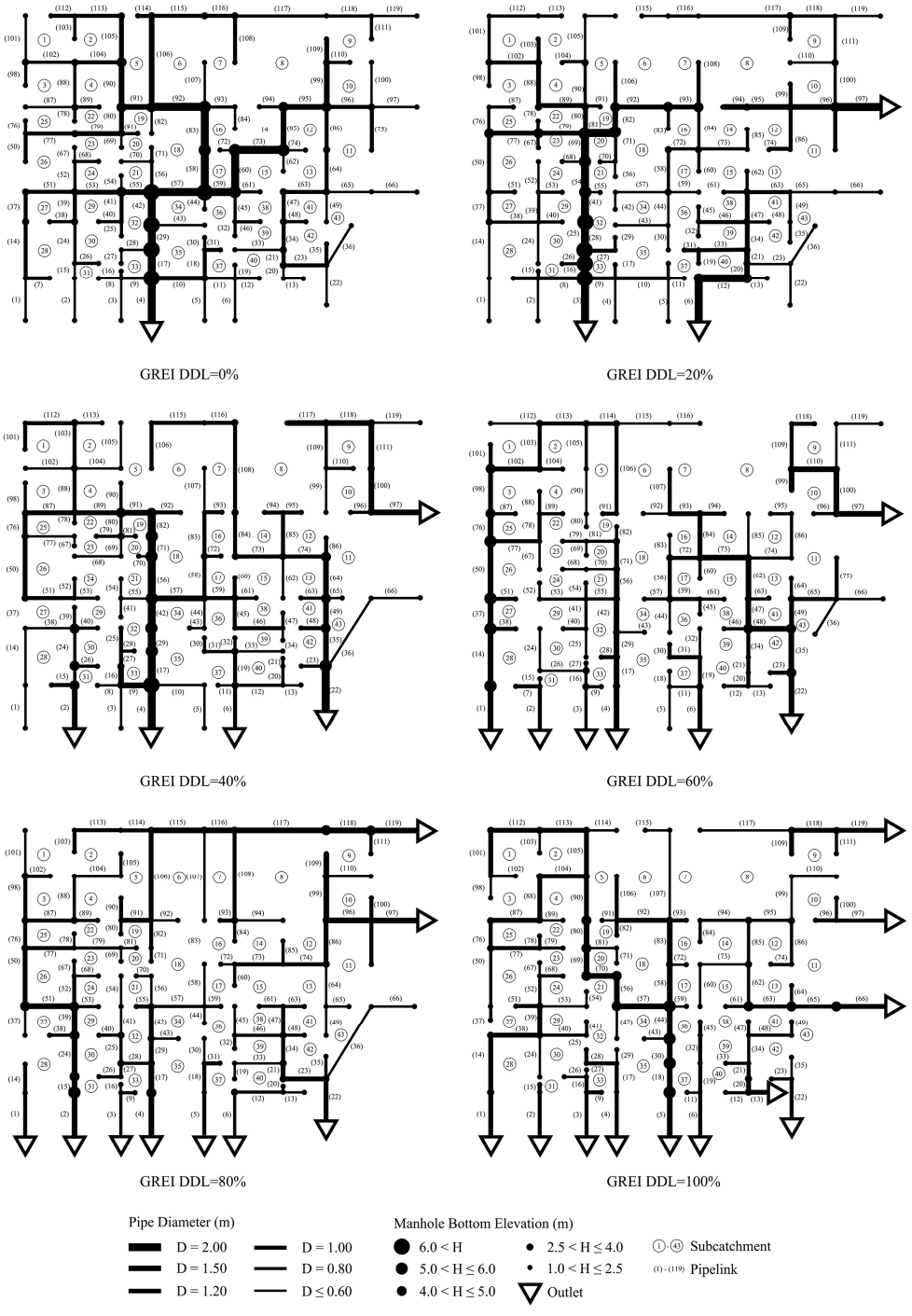


Fig. S2 Spatial arrangement of selected grey-green infrastructure (GGI) systems following trade-off optimization. The configurations illustrate the allocation of green infrastructure elements (e.g., bioretention cells and permeable pavements) integrated with optimized grey infrastructure networks to balance cost, resilience, and hydrological performance.

