

BuroHappold Ltd		Page 1
Camden Mill Lower Bristol Road Bath	Dewsbury Riverside Highways Phase 2 Drainage MicroDrainage Results	
Date 02/11/2022 File 221102 Highways Drainag...	Designed by SG Checked by AH	
Innovyze	Network 2020.1.3	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Highways Phase 2

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	5	PIMP (%)	100
M5-60 (mm)	20.000	Add Flow / Climate Change (%)	30
Ratio R	0.300	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	550	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	0.900
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	1.000	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Highways Phase 2

- Indicates pipe length does not match coordinates
« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S1.000	13.937	1.046	13.3	0.015	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	13.042	0.995	13.1	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.002	16.189	1.346	12.0	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	23.477	0.885	26.5	0.049	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	14.004	0.169	82.9	0.012	0.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	22.616	0.839	27.0	0.014	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.005	23.011	0.767	30.0	0.074	0.00	0.0	0.600	o	300	Pipe/Conduit	
S1.006	13.430	0.480	28.0	0.008	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.000	77.82	5.08	60.947	0.015	0.0	0.0	1.3	2.78	49.0	5.5
S1.001	77.37	5.16	59.900	0.029	0.0	0.0	2.4	2.80	49.5	10.6
S1.002	76.85	5.25	58.905	0.037	0.0	0.0	3.1	2.92	51.6	13.3
S1.003	75.99	5.41	57.484	0.086	0.0	0.0	7.1	2.55	101.4	30.7
S1.004	75.11	5.57	56.599	0.098	0.0	0.0	8.0	1.44	57.1	34.7
S2.000	77.19	5.19	57.344	0.014	0.0	0.0	1.2	1.95	34.4	5.2
S1.005	74.40	5.70	56.355	0.187	0.0	0.0	15.0	2.88	203.7	65.2
S1.006	74.01	5.78	55.588	0.195	0.0	0.0	15.6	2.98	210.8	67.7



Network Design Table for Highways Phase 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section	Type	Auto Design
S1.007	14.929	0.533	28.0	0.026	0.00	0.0	0.600	o	300	Pipe/Conduit		
S1.008	32.882	1.140	28.8	0.031	0.00	0.0	0.600	o	300	Pipe/Conduit		
S3.000	14.889	1.118	13.3	0.015	5.00	0.0	0.600	o	150	Pipe/Conduit		
S3.001	15.534	1.196	13.0	0.017	0.00	0.0	0.600	o	150	Pipe/Conduit		
S3.002	12.215	1.043	11.7	0.004	0.00	0.0	0.600	o	150	Pipe/Conduit		
S3.003	23.862	0.987	24.2	0.045	0.00	0.0	0.600	o	225	Pipe/Conduit		
S3.004	13.942	0.093	150.0	0.017	0.00	0.0	0.600	o	225	Pipe/Conduit		
S3.005	23.450	0.782	30.0	0.056	0.00	0.0	0.600	o	300	Pipe/Conduit		
S3.006	16.801	0.560	30.0	0.008	0.00	0.0	0.600	o	300	Pipe/Conduit		
S3.007	10.712	0.357	30.0	0.028	0.00	0.0	0.600	o	300	Pipe/Conduit		
S3.008	32.892	1.134	29.0	0.031	0.00	0.0	0.600	o	300	Pipe/Conduit		
S3.009	13.250	0.090	147.2	0.003	0.00	0.0	0.600	o	300	Pipe/Conduit		
S1.009	13.458	0.360	37.4	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit		
S1.010	2.415#	0.035	70.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit		
S4.000	7.963	0.407	19.6	0.007	5.00	0.0	0.600	o	150	Pipe/Conduit		
S4.001	20.261	1.036	19.6	0.009	0.00	0.0	0.600	o	150	Pipe/Conduit		
S4.002	13.250	0.132	100.4	0.008	0.00	0.0	0.600	o	150	Pipe/Conduit		
S5.000	10.159	0.454	22.4	0.012	5.00	0.0	0.600	o	150	Pipe/Conduit		

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S1.007	73.59	5.86	55.108	0.220	0.0	0.0	17.6	2.98	210.8	76.2
S1.008	72.65	6.05	54.575	0.251	0.0	0.0	19.8	2.94	207.7	85.6
S3.000	77.79	5.09	60.945	0.015	0.0	0.0	1.3	2.78	49.0	5.4
S3.001	77.26	5.18	59.827	0.032	0.0	0.0	2.7	2.81	49.7	11.7
S3.002	76.87	5.25	58.631	0.036	0.0	0.0	3.0	2.96	52.3	13.1
S3.003	76.03	5.40	57.513	0.082	0.0	0.0	6.7	2.67	106.2	29.2
S3.004	74.85	5.62	56.526	0.099	0.0	0.0	8.0	1.07	42.4	34.7
S3.005	74.14	5.75	56.358	0.154	0.0	0.0	12.4	2.88	203.7	53.7
S3.006	73.64	5.85	55.576	0.163	0.0	0.0	13.0	2.88	203.7	56.3
S3.007	73.33	5.91	55.016	0.191	0.0	0.0	15.1	2.88	203.7	65.6
S3.008	72.40	6.10	54.659	0.222	0.0	0.0	17.4	2.93	207.2	75.5
S3.009	71.58	6.27	53.525	0.225	0.0	0.0	17.4	1.29	91.4	75.5
S1.009	71.22	6.35	53.360	0.476	0.0	0.0	36.7	2.97	328.2	159.1
S1.010	71.13	6.36	52.000	0.476	0.0	0.0	36.7	2.17	239.5	159.1
S4.000	77.97	5.06	53.403	0.007	0.0	0.0	0.6	2.29	40.4	2.7
S4.001	77.12	5.21	52.996	0.016	0.0	0.0	1.4	2.29	40.4	5.9
S4.002	75.89	5.43	51.960	0.024	0.0	0.0	2.0	1.00	17.7	8.6
S5.000	77.85	5.08	53.420	0.012	0.0	0.0	1.0	2.14	37.8	4.3

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Network Design Table for Highways Phase 2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
S5.001	22.473	1.138	19.7	0.022	0.00	0.0	0.600	o	150	Pipe/Conduit	
S4.003	8.530	0.498	17.1	0.020	0.00	0.0	0.600	o	225	Pipe/Conduit	
S4.004	7.801	0.155	50.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.011	20.950	1.091	19.2	0.123	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.012	5.569	0.254	21.9	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
S5.001	76.90	5.24	52.966	0.034	0.0	0.0	2.8	2.28	40.2	12.1
S4.003	75.64	5.47	51.753	0.078	0.0	0.0	6.4	3.18	126.3	27.7
S4.004	75.26	5.54	51.255	0.078	0.0	0.0	6.4	1.85	73.5	27.7
S1.011	70.59	6.48	51.100	0.677	0.0	0.0	51.7	3.00	119.3<	224.2
S1.012	70.44	6.51	50.009	0.677	0.0	0.0	51.7	2.81	111.6<	224.2

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Manhole Schedules for Highways Phase 2

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam., L*W (mm)	PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
S10	61.997	1.050	Junction		S1.000	60.947	150				
S11	60.950	1.050	Junction		S1.001	59.900	150	S1.000	59.900	150	
S12	59.955	1.050	Open Manhole	1200	S1.002	58.905	150	S1.001	58.905	150	
S13	58.609	1.125	Open Manhole	1200	S1.003	57.484	225	S1.002	57.559	150	
S14	57.724	1.125	Open Manhole	1200	S1.004	56.599	225	S1.003	56.599	225	
S18	58.394	1.050	Open Manhole	1200	S2.000	57.344	150				
S15	57.654	1.299	Open Manhole	1200	S1.005	56.355	300	S1.004	56.430	225	
								S2.000	56.505	150	
S16	57.297	1.709	Open Manhole	1200	S1.006	55.588	300	S1.005	55.588	300	
S17	56.974	1.866	Open Manhole	1200	S1.007	55.108	300	S1.006	55.108	300	
S10	56.360	1.785	Open Manhole	1200	S1.008	54.575	300	S1.007	54.575	300	
S1	61.995	1.050	Junction		S3.000	60.945	150				
S2	60.877	1.050	Junction		S3.001	59.827	150	S3.000	59.827	150	
S3	59.681	1.050	Open Manhole	1200	S3.002	58.631	150	S3.001	58.631	150	
S4	58.638	1.125	Open Manhole	1200	S3.003	57.513	225	S3.002	57.588	150	
S5	57.651	1.125	Open Manhole	1200	S3.004	56.526	225	S3.003	56.526	225	
S6	57.589	1.231	Open Manhole	1200	S3.005	56.358	300	S3.004	56.433	225	
S7	57.371	1.795	Open Manhole	1200	S3.006	55.576	300	S3.005	55.576	300	
S8	56.883	1.867	Open Manhole	1200	S3.007	55.016	300	S3.006	55.016	300	
S9	56.397	1.737	Open Manhole	1200	S3.008	54.659	300	S3.007	54.659	300	
S20	54.735	1.210	Open Manhole	1200	S3.009	53.525	300	S3.008	53.525	300	
S20	54.734	1.374	Open Manhole	1350	S1.009	53.360	375	S1.008	53.435	300	
								S3.009	53.435	300	
S11	54.446	2.446	Open Manhole	1350	S1.010	52.000	375	S1.009	53.000	375	1000
S25	54.593	1.190	Open Manhole	1200	S4.000	53.403	150				
S26	54.165	1.169	Junction		S4.001	52.996	150	S4.000	52.996	150	
S27	53.077	1.117	Open Manhole	1200	S4.002	51.960	150	S4.001	51.960	150	
S29	54.611	1.191	Open Manhole	1200	S5.000	53.420	150				
S30	54.134	1.168	Junction		S5.001	52.966	150	S5.000	52.966	150	
S28	53.078	1.325	Open Manhole	1200	S4.003	51.753	225	S4.002	51.828	150	
								S5.001	51.828	150	
S29	52.600	1.345	Open Manhole	1200	S4.004	51.255	225	S4.003	51.255	225	
S12	52.600	1.500	Open Manhole	1350	S1.011	51.100	225	S1.010	51.966	375	1016
								S4.004	51.100	225	
S13	51.375	1.366	Open Manhole	1200	S1.012	50.009	225	S1.011	50.009	225	
S	51.411	1.656	Open Manhole	0		OUTFALL		S1.012	49.755	225	

Camden Mill
Lower Bristol Road
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Dewsbury Riverside
Highways Phase 2 Drainage
MicroDrainage Results



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Manhole Schedules for Highways Phase 2

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S10	423172.259	419420.575			No Entry	
S11	423185.077	419426.048			No Entry	
S12	423197.708	419429.295	423197.708	419429.295	Required	
S13	423212.054	419436.798	423212.054	419436.798	Required	
S14	423233.968	419428.374	423233.968	419428.374	Required	
S18	423254.291	419413.124	423254.291	419413.124	Required	
S15	423246.611	419434.397	423246.611	419434.397	Required	
S16	423254.828	419455.890	423254.828	419455.890	Required	
S17	423267.616	419459.995	423267.616	419459.995	Required	
S10	423280.659	419467.259	423280.659	419467.259	Required	
S1	423167.013	419432.742			No Entry	
S2	423180.660	419438.697			No Entry	
S3	423194.227	419446.264	423194.227	419446.264	Required	
S4	423205.954	419449.681	423205.954	419449.681	Required	
S5	423214.503	419471.959	423214.503	419471.959	Required	

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Lower Bristol Road
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Manhole Schedules for Highways Phase 2

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S6	423227.348	419477.381	423227.348	419477.381	Required	
S7	423249.270	419469.052	423249.270	419469.052	Required	
S8	423264.277	419476.606	423264.277	419476.606	Required	
S9	423274.643	419479.307	423274.643	419479.307	Required	
S20	423304.846	419492.333	423304.846	419492.333	Required	
S20	423310.766	419480.479	423310.766	419480.479	Required	
S11	423316.779	419468.440	423316.779	419468.440	Required	
S25	423307.194	419493.548	423307.194	419493.548	Required	
S26	423314.048	419497.602			No Entry	
S27	423329.733	419510.429	423329.733	419510.429	Required	
S29	423313.105	419481.662	423313.105	419481.662	Required	
S30	423321.832	419486.861			No Entry	
S28	423339.184	419501.143	423339.184	419501.143	Required	
S29	423345.269	419495.164	423345.269	419495.164	Required	
S12	423352.882	419496.865	423352.882	419496.865	Required	

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Manhole Schedules for Highways Phase 2

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
S13	423361.458	419515.980	423361.458	419515.980	Required	
S	423366.962	419515.132			No Entry	

PIPELINE SCHEDULES for Highways Phase 2

Upstream Manhole

- Indicates pipe length does not match coordinates

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	o	150	S10	61.997	60.947	0.900	Junction	
S1.001	o	150	S11	60.950	59.900	0.900	Junction	
S1.002	o	150	S12	59.955	58.905	0.900	Open Manhole	1200
S1.003	o	225	S13	58.609	57.484	0.900	Open Manhole	1200
S1.004	o	225	S14	57.724	56.599	0.900	Open Manhole	1200
S2.000	o	150	S18	58.394	57.344	0.900	Open Manhole	1200
S1.005	o	300	S15	57.654	56.355	0.999	Open Manhole	1200
S1.006	o	300	S16	57.297	55.588	1.409	Open Manhole	1200
S1.007	o	300	S17	56.974	55.108	1.566	Open Manhole	1200
S1.008	o	300	S10	56.360	54.575	1.485	Open Manhole	1200
S3.000	o	150	S1	61.995	60.945	0.900	Junction	
S3.001	o	150	S2	60.877	59.827	0.900	Junction	
S3.002	o	150	S3	59.681	58.631	0.900	Open Manhole	1200
S3.003	o	225	S4	58.638	57.513	0.900	Open Manhole	1200
S3.004	o	225	S5	57.651	56.526	0.900	Open Manhole	1200
S3.005	o	300	S6	57.589	56.358	0.931	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S1.000	13.937	13.3	S11	60.950	59.900	0.900	Junction	
S1.001	13.042	13.1	S12	59.955	58.905	0.900	Open Manhole	1200
S1.002	16.189	12.0	S13	58.609	57.559	0.900	Open Manhole	1200
S1.003	23.477	26.5	S14	57.724	56.599	0.900	Open Manhole	1200
S1.004	14.004	82.9	S15	57.654	56.430	0.998	Open Manhole	1200
S2.000	22.616	27.0	S15	57.654	56.505	0.998	Open Manhole	1200
S1.005	23.011	30.0	S16	57.297	55.588	1.409	Open Manhole	1200
S1.006	13.430	28.0	S17	56.974	55.108	1.566	Open Manhole	1200
S1.007	14.929	28.0	S10	56.360	54.575	1.485	Open Manhole	1200
S1.008	32.882	28.8	S20	54.734	53.435	0.999	Open Manhole	1350
S3.000	14.889	13.3	S2	60.877	59.827	0.900	Junction	
S3.001	15.534	13.0	S3	59.681	58.631	0.900	Open Manhole	1200
S3.002	12.215	11.7	S4	58.638	57.588	0.900	Open Manhole	1200
S3.003	23.862	24.2	S5	57.651	56.526	0.900	Open Manhole	1200
S3.004	13.942	150.0	S6	57.589	56.433	0.931	Open Manhole	1200
S3.005	23.450	30.0	S7	57.371	55.576	1.495	Open Manhole	1200

PIPELINE SCHEDULES for Highways Phase 2

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S3.006	o	300	S7	57.371	55.576	1.495	Open Manhole	1200
S3.007	o	300	S8	56.883	55.016	1.567	Open Manhole	1200
S3.008	o	300	S9	56.397	54.659	1.437	Open Manhole	1200
S3.009	o	300	S20	54.735	53.525	0.910	Open Manhole	1200
S1.009	o	375	S20	54.734	53.360	0.999	Open Manhole	1350
S1.010	o	375	S11	54.446	52.000	2.071	Open Manhole	1350
S4.000	o	150	S25	54.593	53.403	1.040	Open Manhole	1200
S4.001	o	150	S26	54.165	52.996	1.019	Junction	
S4.002	o	150	S27	53.077	51.960	0.967	Open Manhole	1200
S5.000	o	150	S29	54.611	53.420	1.041	Open Manhole	1200
S5.001	o	150	S30	54.134	52.966	1.018	Junction	
S4.003	o	225	S28	53.078	51.753	1.100	Open Manhole	1200
S4.004	o	225	S29	52.600	51.255	1.120	Open Manhole	1200
S1.011	o	225	S12	52.600	51.100	1.275	Open Manhole	1350
S1.012	o	225	S13	51.375	50.009	1.141	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
S3.006	16.801	30.0	S8	56.883	55.016	1.567	Open Manhole	1200
S3.007	10.712	30.0	S9	56.397	54.659	1.437	Open Manhole	1200
S3.008	32.892	29.0	S20	54.735	53.525	0.910	Open Manhole	1200
S3.009	13.250	147.2	S20	54.734	53.435	0.999	Open Manhole	1350
S1.009	13.458	37.4	S11	54.446	53.000	1.071	Open Manhole	1350
S1.010	2.415#	70.0	S12	52.600	51.966	0.260	Open Manhole	1350
S4.000	7.963	19.6	S26	54.165	52.996	1.019	Junction	
S4.001	20.261	19.6	S27	53.077	51.960	0.967	Open Manhole	1200
S4.002	13.250	100.4	S28	53.078	51.828	1.100	Open Manhole	1200
S5.000	10.159	22.4	S30	54.134	52.966	1.018	Junction	
S5.001	22.473	19.7	S28	53.078	51.828	1.100	Open Manhole	1200
S4.003	8.530	17.1	S29	52.600	51.255	1.120	Open Manhole	1200
S4.004	7.801	50.3	S12	52.600	51.100	1.275	Open Manhole	1350
S1.011	20.950	19.2	S13	51.375	50.009	1.141	Open Manhole	1200
S1.012	5.569	21.9	S	51.411	49.755	1.431	Open Manhole	0

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Area Summary for Highways Phase 2

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	Classification	Road, Foot and Cycle Path	100	0.008	0.008	0.008
	Classification	Road, Foot and Cycle Path	100	0.003	0.003	0.011
	Classification	Swales	100	0.004	0.004	0.015
1.001	Classification	Swales	100	0.004	0.004	0.004
	Classification	Road, Foot and Cycle Path	100	0.008	0.008	0.012
	Classification	Road, Foot and Cycle Path	100	0.003	0.003	0.014
1.002	Classification	Road, Foot and Cycle Path	100	0.008	0.008	0.008
1.003	Classification	Swales	100	0.012	0.012	0.012
	Classification	Road, Foot and Cycle Path	100	0.020	0.020	0.031
	Classification	Road, Foot and Cycle Path	100	0.018	0.018	0.049
	Classification	Green	100	0.011	0.011	0.060
1.004	Classification	Road, Foot and Cycle Path	100	0.007	0.007	0.007
	Classification	Road, Foot and Cycle Path	100	0.005	0.005	0.012
2.000	Classification	Road, Foot and Cycle Path	100	0.014	0.014	0.014
1.005	Classification	Road, Foot and Cycle Path	100	0.029	0.029	0.029
	Classification	Swales	100	0.012	0.012	0.041
	Classification	Green	100	0.011	0.011	0.051
	Classification	Road, Foot and Cycle Path	100	0.033	0.033	0.085
1.006	Classification	Road, Foot and Cycle Path	100	0.008	0.008	0.008
1.007	Classification	Road, Foot and Cycle Path	100	0.021	0.021	0.021
	Classification	Swales	100	0.004	0.004	0.026
1.008	Classification	Road, Foot and Cycle Path	100	0.017	0.017	0.017
	Classification	Road, Foot and Cycle Path	100	0.006	0.006	0.023
	Classification	Swales	100	0.008	0.008	0.031
3.000	Classification	Road, Foot and Cycle Path	100	0.008	0.008	0.008
	Classification	Road, Foot and Cycle Path	100	0.003	0.003	0.011
	Classification	Swales	100	0.004	0.004	0.015
3.001	Classification	Swales	100	0.005	0.005	0.005
	Classification	Road, Foot and Cycle Path	100	0.010	0.010	0.014
	Classification	Road, Foot and Cycle Path	100	0.003	0.003	0.017
3.002	Classification	Road, Foot and Cycle Path	100	0.004	0.004	0.004
3.003	Classification	Swales	100	0.012	0.012	0.012
	Classification	Road, Foot and Cycle Path	100	0.016	0.016	0.028
	Classification	Road, Foot and Cycle Path	100	0.018	0.018	0.045
	Classification	Green	100	0.011	0.011	0.056
3.004	Classification	Road, Foot and Cycle Path	100	0.017	0.017	0.017
3.005	Classification	Swales	100	0.012	0.012	0.012
	Classification	Road, Foot and Cycle Path	100	0.039	0.039	0.050
	Classification	Green	100	0.011	0.011	0.061
	Classification	Road, Foot and Cycle Path	100	0.005	0.005	0.066
3.006	Classification	Road, Foot and Cycle Path	100	0.008	0.008	0.008
3.007	Classification	Road, Foot and Cycle Path	100	0.024	0.024	0.024
	Classification	Swales	100	0.003	0.003	0.028
3.008	Classification	Road, Foot and Cycle Path	100	0.017	0.017	0.017
	Classification	Road, Foot and Cycle Path	100	0.006	0.006	0.023
	Classification	Swales	100	0.008	0.008	0.031
3.009	Classification	Swales	100	0.003	0.003	0.003
1.009	-	-	100	0.000	0.000	0.000
1.010	-	-	100	0.000	0.000	0.000
4.000	Classification	Road, Foot and Cycle Path	100	0.002	0.002	0.002
	Classification	Road, Foot and Cycle Path	100	0.005	0.005	0.007

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Area Summary for Highways Phase 2

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
4.001	Classification	Swales	100	0.005	0.005	0.005
	Classification	Road, Foot and Cycle Path	100	0.004	0.004	0.009
4.002	Classification	Swales	100	0.002	0.002	0.002
	Classification	Road, Foot and Cycle Path	100	0.002	0.002	0.003
	Classification	Road, Foot and Cycle Path	100	0.004	0.004	0.008
5.000	Classification	Road, Foot and Cycle Path	100	0.003	0.003	0.003
	Classification	Road, Foot and Cycle Path	100	0.006	0.006	0.009
	Classification	Road, Foot and Cycle Path	100	0.003	0.003	0.012
5.001	Classification	Swales	100	0.005	0.005	0.005
	Classification	Road, Foot and Cycle Path	100	0.012	0.012	0.017
	Classification	Road, Foot and Cycle Path	100	0.005	0.005	0.022
4.003	Classification	Swales	100	0.002	0.002	0.002
	Classification	Road, Foot and Cycle Path	100	0.011	0.011	0.014
	Classification	Road, Foot and Cycle Path	100	0.002	0.002	0.015
	Classification	Road, Foot and Cycle Path	100	0.005	0.005	0.020
4.004	-	-	100	0.000	0.000	0.000
1.011	Classification	Basin	100	0.123	0.123	0.123
	Classification	Green	100	0.137	0.137	0.259
1.012	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.856	0.856	0.856

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Online Controls for Highways Phase 2

Hydro-Brake® Optimum Manhole: S12, DS/PN: S1.011, Volume (m³): 2.5

Unit Reference	MD-SHE-0079-3000-1200-3000
Design Head (m)	1.200
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	79
Invert Level (m)	51.100
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	3.0
Flush-Flo™	0.348	2.9
Kick-Flo®	0.707	2.4
Mean Flow over Head Range	-	2.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)						
0.100	2.3	1.200	3.0	3.000	4.6	7.000	6.8
0.200	2.8	1.400	3.2	3.500	4.9	7.500	7.0
0.300	2.9	1.600	3.4	4.000	5.2	8.000	7.3
0.400	2.9	1.800	3.6	4.500	5.5	8.500	7.5
0.500	2.8	2.000	3.8	5.000	5.8	9.000	7.7
0.600	2.7	2.200	4.0	5.500	6.1	9.500	7.9
0.800	2.5	2.400	4.1	6.000	6.3		
1.000	2.8	2.600	4.3	6.500	6.6		

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Storage Structures for Highways Phase 2

Tank or Pond Manhole: S12, DS/PN: S1.011

Invert Level (m) 51.100

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	410.0	1.500	796.6

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Highways Phase 2

Simulation Criteria

Areal Reduction Factor 1.000	Additional Flow - % of Total Flow 0.000	
Hot Start (mins) 0	MADD Factor * 10m ³ /ha Storage 2.000	
Hot Start Level (mm) 0	Inlet Coefficient 0.800	
Manhole Headloss Coeff (Global) 0.500	Flow per Person per Day (l/per/day) 0.000	
Foul Sewage per hectare (l/s) 0.000		

Number of Input Hydrographs 0	Number of Storage Structures 1
Number of Online Controls 1	Number of Time/Area Diagrams 0
Number of Offline Controls 0	Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R 0.300
Region England and Wales	Cv (Summer) 1.000	
M5-60 (mm)	20.000	Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0	DVD Status OFF
Analysis Timestep	Fine Inertia Status OFF
DTS Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	30, 30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S10	15 Summer	1	+30%					60.971
S1.001	S11	15 Summer	1	+30%					59.934
S1.002	S12	15 Summer	1	+30%					58.943
S1.003	S13	15 Summer	1	+30%					57.546
S1.004	S14	15 Summer	1	+30%	30/15 Summer				56.692
S2.000	S18	15 Summer	1	+30%					57.374
S1.005	S15	15 Summer	1	+30%					56.443
S1.006	S16	15 Summer	1	+30%					55.680
S1.007	S17	15 Summer	1	+30%					55.205
S1.008	S10	15 Summer	1	+30%	100/15 Summer				54.674
S3.000	S1	15 Summer	1	+30%					60.970
S3.001	S2	15 Summer	1	+30%					59.863
S3.002	S3	15 Summer	1	+30%					58.670
S3.003	S4	15 Summer	1	+30%					57.572
S3.004	S5	15 Summer	1	+30%	30/15 Summer				56.637
S3.005	S6	15 Summer	1	+30%					56.436
S3.006	S7	15 Summer	1	+30%					55.659
S3.007	S8	15 Summer	1	+30%	100/15 Summer				55.113
S3.008	S9	15 Summer	1	+30%	100/15 Summer				54.752

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Highways Phase 2

PN	US/MH Name	Surcharged Flooded			Half Drain Pipe		Status	Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Overflow Cap. (l/s)	Time (mins)	Flow (l/s)		
S1.000	S10	-0.125	0.000	0.06		3.1	OK*	
S1.001	S11	-0.116	0.000	0.11		5.6	OK*	
S1.002	S12	-0.112	0.000	0.14		6.9	OK	
S1.003	S13	-0.163	0.000	0.17		15.6	OK	
S1.004	S14	-0.132	0.000	0.35		17.6	OK	
S2.000	S18	-0.119	0.000	0.09		3.0	OK	
S1.005	S15	-0.212	0.000	0.19		33.4	OK	
S1.006	S16	-0.208	0.000	0.20		35.0	OK	
S1.007	S17	-0.203	0.000	0.22		39.5	OK	
S1.008	S10	-0.201	0.000	0.24		44.9	OK	
S3.000	S1	-0.125	0.000	0.06		3.1	OK*	
S3.001	S2	-0.115	0.000	0.12		6.2	OK*	
S3.002	S3	-0.112	0.000	0.14		6.9	OK	
S3.003	S4	-0.166	0.000	0.15		14.8	OK	
S3.004	S5	-0.114	0.000	0.48		17.7	OK	
S3.005	S6	-0.222	0.000	0.15		27.3	OK	
S3.006	S7	-0.217	0.000	0.17		28.9	OK	
S3.007	S8	-0.203	0.000	0.23		33.8	OK	
S3.008	S9	-0.207	0.000	0.21		39.2	OK	

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1 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Highways Phase 2

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water
									Level (m)
S3.009	S20	15	Summer	1	+30%	30/15	Summer		53.680
S1.009	S20	15	Summer	1	+30%	30/15	Summer		53.515
S1.010	S11	15	Summer	1	+30%	30/15	Summer		52.252
S4.000	S25	15	Summer	1	+30%				53.423
S4.001	S26	15	Summer	1	+30%				53.024
S4.002	S27	15	Summer	1	+30%	100/15	Summer		52.014
S5.000	S29	15	Summer	1	+30%				53.447
S5.001	S30	15	Summer	1	+30%				53.006
S4.003	S28	15	Summer	1	+30%	30/480	Summer		51.810
S4.004	S29	1440	Summer	1	+30%	1/360	Summer		51.543
S1.011	S12	1440	Summer	1	+30%	1/60	Summer		51.543
S1.012	S13	600	Summer	1	+30%				50.038

PN	US/MH Name	Surcharged Flooded			Half Drain Pipe		Status	Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Time (mins)		
S3.009	S20	-0.145	0.000	0.53			39.7	OK
S1.009	S20	-0.220	0.000	0.36			84.5	OK
S1.010	S11	-0.123	0.000	0.78			84.1	OK
S4.000	S25	-0.130	0.000	0.04			1.6	OK
S4.001	S26	-0.122	0.000	0.08			3.1	OK*
S4.002	S27	-0.096	0.000	0.28			4.5	OK
S5.000	S29	-0.123	0.000	0.07			2.5	OK
S5.001	S30	-0.110	0.000	0.16			6.3	OK*
S4.003	S28	-0.168	0.000	0.14			14.2	OK
S4.004	S29	0.063	0.000	0.03			1.8	SURCHARGED
S1.011	S12	0.218	0.000	0.03			2.9	SURCHARGED
S1.012	S13	-0.196	0.000	0.04			2.9	OK

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Highways Phase 2

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coefficient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

Number of Input Hydrographs 0 Number of Storage Structures 1
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.300
Region England and Wales Cv (Summer) 1.000
M5-60 (mm) 20.000 Cv (Winter) 1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
Analysis Timestep Fine Inertia Status OFF
DTS Status ON

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600,
720, 960, 1440, 2160, 2880, 4320, 5760,
7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 30, 30, 30

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S10	15 Summer	30	+30%					60.986
S1.001	S11	15 Summer	30	+30%					59.959
S1.002	S12	15 Summer	30	+30%					58.973
S1.003	S13	15 Summer	30	+30%					57.600
S1.004	S14	15 Summer	30	+30%	30/15 Summer				56.854
S2.000	S18	15 Summer	30	+30%					57.392
S1.005	S15	15 Summer	30	+30%					56.520
S1.006	S16	15 Summer	30	+30%					55.762
S1.007	S17	15 Summer	30	+30%					55.295
S1.008	S10	15 Summer	30	+30%	100/15 Summer				54.769
S3.000	S1	15 Summer	30	+30%					60.985
S3.001	S2	15 Summer	30	+30%					59.889
S3.002	S3	15 Summer	30	+30%					58.699
S3.003	S4	15 Summer	30	+30%					57.622
S3.004	S5	15 Summer	30	+30%	30/15 Summer				56.859
S3.005	S6	15 Summer	30	+30%					56.506
S3.006	S7	15 Summer	30	+30%					55.732
S3.007	S8	15 Summer	30	+30%	100/15 Summer				55.207
S3.008	S9	15 Summer	30	+30%	100/15 Summer				54.839

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Highways Phase 2

PN	US/MH Name	Surcharged		Flooded	Flow / Overflow Cap. (l/s)	Half Drain Pipe		Status	Level Exceeded
		Depth (m)	Volume (m ³)	Time (mins)		Flow (l/s)			
S1.000	S10	-0.110	0.000	0.16		7.7		OK*	
S1.001	S11	-0.092	0.000	0.32		15.8		OK*	
S1.002	S12	-0.082	0.000	0.42		20.1		OK	
S1.003	S13	-0.109	0.000	0.52		48.5		OK	
S1.004	S14	0.030	0.000	1.09		54.5		SURCHARGED	
S2.000	S18	-0.102	0.000	0.23		7.4		OK	
S1.005	S15	-0.135	0.000	0.57		103.5		OK	
S1.006	S16	-0.126	0.000	0.62		107.1		OK	
S1.007	S17	-0.113	0.000	0.68		120.6		OK	
S1.008	S10	-0.106	0.000	0.72		136.8		OK	
S3.000	S1	-0.111	0.000	0.16		7.6		OK*	
S3.001	S2	-0.088	0.000	0.35		17.6		OK*	
S3.002	S3	-0.082	0.000	0.42		19.9		OK	
S3.003	S4	-0.116	0.000	0.47		46.0		OK	
S3.004	S5	0.108	0.000	1.49		55.1		SURCHARGED	
S3.005	S6	-0.152	0.000	0.48		86.5		OK	
S3.006	S7	-0.144	0.000	0.52		90.4		OK	
S3.007	S8	-0.110	0.000	0.70		105.1		OK	
S3.008	S9	-0.121	0.000	0.64		121.5		OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1)
for Highways Phase 2

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S3.009	S20	15 Summer	30	+30%	30/15 Summer				54.029
S1.009	S20	15 Summer	30	+30%	30/15 Summer				53.793
S1.010	S11	15 Summer	30	+30%	30/15 Summer				52.760
S4.000	S25	15 Summer	30	+30%					53.436
S4.001	S26	15 Summer	30	+30%					53.044
S4.002	S27	1440 Winter	30	+30%	100/15 Summer				52.067
S5.000	S29	15 Summer	30	+30%					53.463
S5.001	S30	15 Summer	30	+30%					53.038
S4.003	S28	1440 Winter	30	+30%	30/480 Summer				52.066
S4.004	S29	1440 Winter	30	+30%	1/360 Summer				52.066
S1.011	S12	1440 Winter	30	+30%	1/60 Summer				52.066
S1.012	S13	30 Winter	30	+30%					50.038

PN	US/MH Name	Surcharged Flooded			Half Drain Pipe		Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap. (l/s)	Time (mins)				
S3.009	S20	0.204	0.000	1.63		122.6	SURCHARGED		
S1.009	S20	0.058	0.000	1.10		258.9	SURCHARGED		
S1.010	S11	0.385	0.000	2.39		256.3	SURCHARGED		
S4.000	S25	-0.117	0.000	0.11		3.8	OK		
S4.001	S26	-0.102	0.000	0.22		8.9	OK*		
S4.002	S27	-0.043	0.000	0.05		0.7	OK		
S5.000	S29	-0.107	0.000	0.18		6.0	OK		
S5.001	S30	-0.078	0.000	0.46		18.5	OK*		
S4.003	S28	0.088	0.000	0.02		2.4	SURCHARGED		
S4.004	S29	0.586	0.000	0.04		2.3	SURCHARGED		
S1.011	S12	0.741	0.000	0.03		2.9	SURCHARGED		
S1.012	S13	-0.196	0.000	0.04		2.9	OK		

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Highways Phase 2

PN	US/MH Name	Surcharged Flooded		Flow / Overflow Cap. (l/s)	Half Drain Pipe		Status	Level Exceeded
		Depth (m)	Volume (m ³)		Time (mins)	Flow (l/s)		
S1.000	S10	-0.104	0.000	0.20		9.9	OK*	
S1.001	S11	-0.083	0.000	0.41		20.4	OK*	
S1.002	S12	-0.071	0.000	0.54		26.0	OK	
S1.003	S13	-0.089	0.000	0.67		62.7	OK	
S1.004	S14	0.172	0.000	1.42		70.5	SURCHARGED	
S2.000	S18	-0.094	0.000	0.29		9.5	OK	
S1.005	S15	-0.104	0.000	0.74		134.0	OK	
S1.006	S16	-0.092	0.000	0.80		138.6	OK	
S1.007	S17	-0.051	0.000	0.88		155.0	OK	
S1.008	S10	0.077	0.000	0.91		172.6	SURCHARGED	
S3.000	S1	-0.104	0.000	0.20		9.8	OK*	
S3.001	S2	-0.079	0.000	0.46		22.8	OK*	
S3.002	S3	-0.071	0.000	0.54		25.8	OK	
S3.003	S4	-0.098	0.000	0.61		59.5	OK	
S3.004	S5	0.251	0.000	1.92		70.8	SURCHARGED	
S3.005	S6	-0.127	0.000	0.62		111.2	OK	
S3.006	S7	-0.116	0.000	0.67		116.1	OK	
S3.007	S8	0.010	0.000	0.88		132.4	SURCHARGED	
S3.008	S9	0.113	0.000	0.78		148.1	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Highways Phase 2

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S3.009	S20	15 Summer	100	+30%	30/15 Summer				54.384
S1.009	S20	15 Summer	100	+30%	30/15 Summer				54.028
S1.010	S11	15 Summer	100	+30%	30/15 Summer				52.992
S4.000	S25	15 Summer	100	+30%					53.441
S4.001	S26	15 Summer	100	+30%					53.051
S4.002	S27	1440 Winter	100	+30%	100/15 Summer				52.298
S5.000	S29	15 Summer	100	+30%					53.469
S5.001	S30	15 Summer	100	+30%					53.050
S4.003	S28	1440 Winter	100	+30%	30/480 Summer				52.297
S4.004	S29	1440 Winter	100	+30%	1/360 Summer				52.297
S1.011	S12	1440 Winter	100	+30%	1/60 Summer				52.297
S1.012	S13	1440 Winter	100	+30%					50.038

PN	US/MH Name	Surcharged Flooded			Half Drain Pipe		Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Overflow Cap. (l/s)	Time (mins)				
S3.009	S20	0.559	0.000	1.99		149.6	SURCHARGED		
S1.009	S20	0.293	0.000	1.35		317.1	SURCHARGED		
S1.010	S11	0.617	0.000	2.98		319.4	SURCHARGED		
S4.000	S25	-0.112	0.000	0.14		5.0	OK		
S4.001	S26	-0.095	0.000	0.29		11.5	OK*		
S4.002	S27	0.188	0.000	0.06		0.9	SURCHARGED		
S5.000	S29	-0.101	0.000	0.23		7.8	OK		
S5.001	S30	-0.066	0.000	0.59		23.9	OK*		
S4.003	S28	0.319	0.000	0.03		2.9	SURCHARGED		
S4.004	S29	0.817	0.000	0.05		2.9	SURCHARGED		
S1.011	S12	0.972	0.000	0.03		3.0	SURCHARGED		
S1.012	S13	-0.196	0.000	0.04		3.0	OK		