

**Design Settings**

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	75.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	19.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	4.00	Enforce best practice design rules	x

**Nodes**

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.123	4.00	91.183	1500	420127.033	423345.789	1.433
2	0.067	4.00	89.183	1200	420113.787	423372.706	1.508
3	0.035	4.00	88.068	1350	420104.870	423390.825	1.814
4	0.092	4.00	87.817	1350	420109.015	423402.749	1.721
5	0.019	4.00	88.311	1350	420138.230	423417.141	2.432
6	0.102	4.00	88.601	1350	420153.862	423403.030	2.806
7	0.000		88.034	1350	420182.256	423417.004	2.366
8	0.119	4.00	87.982	1350	420183.366	423420.270	2.328
9	0.000		87.644	2100	420202.208	423429.543	2.124
10	0.000		87.507		420211.666	423435.361	2.087

**Links**

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	1	2	30.000	0.600	89.750	87.750	2.000	15.0	225	4.15	56.3
1.001	2	3	20.194	0.600	87.675	86.329	1.346	15.0	300	4.23	55.8
1.002	3	4	12.624	0.600	86.254	86.096	0.158	80.0	375	4.33	55.3
1.003	4	5	32.568	0.600	86.096	85.879	0.217	150.0	375	4.70	53.4
1.004	5	6	21.059	0.600	85.879	85.795	0.084	250.0	375	5.01	52.0
1.005	6	7	31.646	0.600	85.795	85.668	0.127	250.0	375	5.47	50.0
1.006	7	8	3.449	0.600	85.668	85.654	0.014	250.0	375	5.52	49.8
1.007	8	9	21.000	0.600	85.654	85.570	0.084	250.0	375	5.83	48.6
1.008	9	10	11.104	0.600	85.520	85.420	0.100	111.0	225	5.98	48.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	3.395	135.0	18.8	1.208	1.208	0.123	0.0	57	2.415
1.001	4.079	288.3	28.7	1.208	1.439	0.190	0.0	64	2.640
1.002	2.027	223.9	33.7	1.439	1.346	0.225	0.0	98	1.475
1.003	1.477	163.1	45.9	1.346	2.057	0.317	0.0	136	1.276
1.004	1.141	126.0	47.4	2.057	2.431	0.336	0.0	159	1.063
1.005	1.141	126.0	59.4	2.431	1.991	0.438	0.0	181	1.125
1.006	1.141	126.0	59.1	1.991	1.953	0.438	0.0	181	1.123
1.007	1.141	126.0	73.3	1.953	1.699	0.557	0.0	205	1.182
1.008	1.240	49.3	72.5	1.899	1.862	0.557	0.0	225	1.263

### Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	30.000	15.0	225	Circular_Default Sewer Type	91.183	89.750	1.208	89.183	87.750	1.208
1.001	20.194	15.0	300	Circular_Default Sewer Type	89.183	87.675	1.208	88.068	86.329	1.439
1.002	12.624	80.0	375	Circular_Default Sewer Type	88.068	86.254	1.439	87.817	86.096	1.346
1.003	32.568	150.0	375	Circular_Default Sewer Type	87.817	86.096	1.346	88.311	85.879	2.057
1.004	21.059	250.0	375	Circular_Default Sewer Type	88.311	85.879	2.057	88.601	85.795	2.431
1.005	31.646	250.0	375	Circular_Default Sewer Type	88.601	85.795	2.431	88.034	85.668	1.991
1.006	3.449	250.0	375	Circular_Default Sewer Type	88.034	85.668	1.991	87.982	85.654	1.953
1.007	21.000	250.0	375	Circular_Default Sewer Type	87.982	85.654	1.953	87.644	85.570	1.699
1.008	11.104	111.0	225	Circular_Default Sewer Type	87.644	85.520	1.899	87.507	85.420	1.862

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1500	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1350	Manhole	Adoptable
1.002	3	1350	Manhole	Adoptable	4	1350	Manhole	Adoptable
1.003	4	1350	Manhole	Adoptable	5	1350	Manhole	Adoptable
1.004	5	1350	Manhole	Adoptable	6	1350	Manhole	Adoptable
1.005	6	1350	Manhole	Adoptable	7	1350	Manhole	Adoptable
1.006	7	1350	Manhole	Adoptable	8	1350	Manhole	Adoptable
1.007	8	1350	Manhole	Adoptable	9	2100	Manhole	Adoptable
1.008	9	2100	Manhole	Adoptable	10		Junction	

### Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	✓
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	19.000	Additional Storage (m <sup>3</sup> /ha)	20.0
Ratio-R	0.400	Check Discharge Rate(s)	✓
Summer CV	0.750	Check Discharge Volume	✓
Winter CV	0.840	100 year 360 minute (m <sup>3</sup> )	
Analysis Speed	Normal		

### Storm Durations

15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	0	0	0
100	45	0	0

### Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

**Pre-development Discharge Volume**

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m <sup>3</sup> )	

**Node 9 Online Hydro-Brake® Control**

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	85.520	Product Number	CTL-SHE-0149-1100-1200-1100
Design Depth (m)	1.200	Min Outlet Diameter (m)	0.225
Design Flow (l/s)	11.0	Min Node Diameter (mm)	1200

**Node 9 Depth/Area Storage Structure**

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	85.700
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	220

Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )	Inf Area (m <sup>2</sup> )
0.000	180.0	0.0	1.100	180.0	0.0	1.150	0.0	0.0

**Results for 1 year Critical Storm Duration. Lowest mass balance: 99.11%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute winter	1	10	89.806	0.056	17.4	0.1936	0.0000	OK
15 minute winter	2	10	87.739	0.064	26.9	0.1290	0.0000	OK
15 minute summer	3	10	86.358	0.104	31.8	0.1882	0.0000	OK
15 minute summer	4	10	86.235	0.139	44.8	0.3482	0.0000	OK
15 minute winter	5	10	86.052	0.173	47.6	0.2748	0.0000	OK
15 minute winter	6	11	85.988	0.193	60.7	0.4166	0.0000	OK
15 minute winter	7	11	85.905	0.237	60.1	0.3391	0.0000	OK
15 minute winter	8	11	85.876	0.222	74.6	0.5455	0.0000	OK
30 minute winter	9	30	85.832	0.312	56.6	24.9646	0.0000	<b>SURCHARGED</b>
15 minute summer	10	1	85.420	0.000	10.9	0.0000	0.0000	OK

  

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	1	1.000	2	17.4	2.322	0.129	0.2248	
15 minute winter	2	1.001	3	26.9	2.525	0.093	0.2150	
15 minute summer	3	1.002	4	31.8	1.030	0.142	0.3909	
15 minute summer	4	1.003	5	45.0	1.039	0.276	1.4114	
15 minute winter	5	1.004	6	46.4	0.873	0.368	1.1198	
15 minute winter	6	1.005	7	60.1	0.922	0.477	2.0655	
15 minute winter	7	1.006	8	60.2	0.851	0.478	0.2439	
15 minute winter	8	1.007	9	74.8	1.171	0.593	1.3410	
30 minute winter	9	Hydro-Brake®	10	11.0				44.7

**Results for 30 year Critical Storm Duration. Lowest mass balance: 99.11%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute winter	1	10	89.840	0.090	42.6	0.3128	0.0000	OK
15 minute winter	2	10	87.777	0.102	65.8	0.2057	0.0000	OK
15 minute winter	3	11	86.510	0.256	77.7	0.4660	0.0000	OK
15 minute winter	4	11	86.487	0.391	109.5	0.9783	0.0000	SURCHARGED
15 minute winter	5	11	86.400	0.521	109.0	0.8270	0.0000	SURCHARGED
15 minute winter	6	11	86.324	0.529	132.6	1.1417	0.0000	SURCHARGED
60 minute winter	7	59	86.178	0.510	71.4	0.7302	0.0000	SURCHARGED
60 minute winter	8	59	86.178	0.524	89.2	1.2857	0.0000	SURCHARGED
60 minute winter	9	60	86.178	0.658	87.0	88.3337	0.0000	SURCHARGED
15 minute summer	10	1	85.420	0.000	11.0	0.0000	0.0000	OK

  

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	1	1.000	2	42.6	2.960	0.316	0.4319	
15 minute winter	2	1.001	3	65.6	3.101	0.228	0.6306	
15 minute winter	3	1.002	4	77.7	1.200	0.347	1.2035	
15 minute winter	4	1.003	5	102.4	1.174	0.628	3.5922	
15 minute winter	5	1.004	6	102.4	0.929	0.813	2.3227	
15 minute winter	6	1.005	7	132.1	1.198	1.048	3.4905	
60 minute winter	7	1.006	8	69.1	0.763	0.548	0.3804	
60 minute winter	8	1.007	9	87.0	0.938	0.690	2.3162	
60 minute winter	9	Hydro-Brake®	10	11.0				136.8

**Results for 100 year Critical Storm Duration. Lowest mass balance: 99.11%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute winter	1	10	89.854	0.104	55.1	0.3634	0.0000	OK
15 minute summer	2	9	87.788	0.113	85.3	0.2284	0.0000	OK
15 minute winter	3	11	87.004	0.750	101.0	1.3635	0.0000	SURCHARGED
15 minute winter	4	11	86.962	0.866	129.1	2.1669	0.0000	SURCHARGED
15 minute winter	5	11	86.799	0.920	133.4	1.4614	0.0000	SURCHARGED
15 minute winter	6	11	86.667	0.872	172.4	1.8817	0.0000	SURCHARGED
120 minute winter	7	116	86.412	0.744	53.5	1.0654	0.0000	SURCHARGED
120 minute winter	8	116	86.413	0.759	69.2	1.8616	0.0000	SURCHARGED
120 minute winter	9	116	86.412	0.892	67.8	131.3529	0.0000	SURCHARGED
15 minute summer	10	1	85.420	0.000	11.0	0.0000	0.0000	OK

  

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	1	1.000	2	55.2	3.159	0.409	0.5243	
15 minute summer	2	1.001	3	85.3	3.060	0.296	0.9498	
15 minute winter	3	1.002	4	90.0	1.206	0.402	1.3924	
15 minute winter	4	1.003	5	126.1	1.206	0.773	3.5922	
15 minute winter	5	1.004	6	133.3	1.209	1.058	2.3227	
15 minute winter	6	1.005	7	172.1	1.560	1.365	3.4905	
120 minute winter	7	1.006	8	53.7	0.664	0.426	0.3804	
120 minute winter	8	1.007	9	67.8	0.697	0.538	2.3162	
120 minute winter	9	Hydro-Brake®	10	11.0				215.2

**Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 99.11%**

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m <sup>3</sup> )	Flood (m <sup>3</sup> )	Status
15 minute winter	1	9	89.880	0.130	80.0	0.4531	0.0000	OK
15 minute winter	2	11	88.184	0.509	123.7	1.0280	0.0000	SURCHARGED
15 minute winter	3	11	87.908	1.654	136.5	3.0051	0.0000	FLOOD RISK
15 minute winter	4	11	87.817	1.721	184.2	4.3042	1.5963	FLOOD
15 minute winter	5	11	87.560	1.681	175.6	2.6693	0.0000	SURCHARGED
15 minute winter	6	11	87.350	1.555	235.0	3.3548	0.0000	SURCHARGED
120 minute winter	7	118	87.329	1.661	79.0	2.3767	0.0000	SURCHARGED
120 minute winter	8	118	87.329	1.675	101.5	4.1099	0.0000	SURCHARGED
120 minute winter	9	118	87.328	1.808	100.3	208.8521	0.0000	SURCHARGED
15 minute summer	10	1	85.420	0.000	11.0	0.0000	0.0000	OK

  

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m <sup>3</sup> )	Discharge Vol (m <sup>3</sup> )
15 minute winter	1	1.000	2	80.1	3.411	0.593	0.9327	
15 minute winter	2	1.001	3	113.7	3.020	0.394	1.4220	
15 minute winter	3	1.002	4	133.1	1.213	0.595	1.3924	
15 minute winter	4	1.003	5	163.2	1.480	1.001	3.5922	
15 minute winter	5	1.004	6	171.4	1.554	1.360	2.3227	
15 minute winter	6	1.005	7	225.6	2.045	1.790	3.4905	
120 minute winter	7	1.006	8	78.3	0.710	0.621	0.3804	
120 minute winter	8	1.007	9	100.3	0.909	0.796	2.3162	
120 minute winter	9	Hydro-Brake®	10	13.4				221.7