STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Maximum Rainfall (mm/hr)	0
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	0.000
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.060	4-8	0.025

Total Area Contributing (ha) = 0.085

Total Pipe Volume (m³) = 38.670

Network Design Table for Storm

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	14.288	0.064	225.0	0.017	5.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	10.470	0.064	164.0	0.011	5.00	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)
S1.000	0.00	5.27	66.000	0.017	0.0	0.0	0.0	0.87	34.5	0.0
S2.000	0.00	5.17	66.000	0.011	0.0	0.0	0.0	1.02	40.5	0.0

Network Design Table for Storm

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
S1.001	3.386	0.015	225.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	13.805	0.061	225.0	0.011	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	2.130	0.009	225.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	14.361	0.064	225.0	0.017	5.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	4.172	0.064	65.0	0.005	5.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	6.429	0.087	74.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	10.397	0.021	495.1	0.009	0.00	0.0	0.600	[]	-2	Pipe/Conduit	
S1.005	6.265	0.042	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.006	11.303	1.006	11.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	7.280	0.032	225.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.008	13.184	0.520	25.4	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)
S1.001	0.00	5.34	65.936	0.033	0.0	0.0	0.0	0.87	34.5	0.0
S1.002	0.00	5.60	65.921	0.044	0.0	0.0	0.0	0.87	34.5	0.0
S1.003	0.00	5.65	65.860	0.049	0.0	0.0	0.0	0.87	34.5	0.0
S3.000	0.00	5.28	66.000	0.017	0.0	0.0	0.0	0.87	34.5	0.0
S4.000	0.00	5.04	66.000	0.005	0.0	0.0	0.0	1.62	64.6	0.0
S3.001	0.00	5.35	65.936	0.027	0.0	0.0	0.0	1.52	60.5	0.0
S1.004	0.00	5.73	64.456	0.085	0.0	0.0	0.0	2.14	7120.4	0.0
S1.005	0.00	5.85	64.435	0.085	0.0	0.0	0.0	0.82	14.5	0.0
S1.006	0.00	5.90	64.318	0.085	0.0	0.0	0.0	3.93	156.1	0.0
S1.007	0.00	6.04	63.312	0.085	0.0	0.0	0.0	0.87	34.5	0.0
S1.008	0.00	6.13	63.280	0.085	0.0	0.0	0.0	2.61	103.7	0.0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	S	64.520	62.760	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
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	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S6, DS/PN: S1.005, Volume (m³): 38.2

Unit Reference	MD-SHE-0088-4500-1900-4500
Design Head (m)	1.900
Design Flow (l/s)	4.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	88
Invert Level (m)	64.435
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.900	4.5	Kick-Flo®	0.784	3.0
Flush-Flo™	0.382	3.7	Mean Flow over Head Range	-	3.6

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.7	1.200	3.6	3.000	5.6	7.000	8.3
0.200	3.5	1.400	3.9	3.500	6.0	7.500	8.6
0.300	3.7	1.600	4.1	4.000	6.4	8.000	8.8
0.400	3.7	1.800	4.4	4.500	6.7	8.500	9.1
0.500	3.7	2.000	4.6	5.000	7.1	9.000	9.3
0.600	3.6	2.200	4.8	5.500	7.4	9.500	9.6
0.800	3.0	2.400	5.0	6.000	7.7		
1.000	3.3	2.600	5.2	6.500	8.0		

Summary of Critical Results by Maximum Level (Rank 1) for Storm

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 Coeffiecient	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	0
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	FEH
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

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)	2
Climate Change (%)	0

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	S1	15 Winter	2	+0%					66.047
S2.000	S2	15 Winter	2	+0%					66.035
S1.001	S2	15 Winter	2	+0%					66.005
S1.002	S3	15 Winter	2	+0%					65.994
S1.003	S4	15 Winter	2	+0%					65.938
S3.000	S6	15 Winter	2	+0%					66.046
S4.000	S7	15 Winter	2	+0%					66.023
S3.001	S7	15 Winter	2	+0%					65.985
S1.004	S5	15 Winter	2	+0%					64.756
S1.005	S6	15 Winter	2	+0%	2/15 Summer				64.756
S1.006	S7	15 Winter	2	+0%					64.343
S1.007	S8	15 Winter	2	+0%					63.367
S1.008	S9	15 Winter	2	+0%					63.309

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.178	0.000	0.09			2.8	OK	
S2.000	S2	-0.190	0.000	0.05			1.8	OK	
S1.001	S2	-0.156	0.000	0.20			5.3	OK	
S1.002	S3	-0.152	0.000	0.23			6.9	OK	
S1.003	S4	-0.147	0.000	0.26			7.5	OK	
S3.000	S6	-0.179	0.000	0.09			2.8	OK	
S4.000	S7	-0.202	0.000	0.02			0.8	OK	
S3.001	S7	-0.176	0.000	0.10			4.3	OK	
S1.004	S5	-1.300	0.000	0.01			12.9	OK	
S1.005	S6	0.171	0.000	0.31			3.7	SURCHARGED	
S1.006	S7	-0.200	0.000	0.03			3.7	OK	
S1.007	S8	-0.170	0.000	0.14			3.7	OK	
S1.008	S9	-0.196	0.000	0.04			3.7	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Maximum Rainfall (mm/hr)	0
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	0.000
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.060	4-8	0.025

Total Area Contributing (ha) = 0.085

Total Pipe Volume (m³) = 38.670

Network Design Table for Storm

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	14.288	0.064	225.0	0.017	5.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	10.470	0.064	164.0	0.011	5.00	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)
S1.000	0.00	5.27	66.000	0.017	0.0	0.0	0.0	0.87	34.5	0.0
S2.000	0.00	5.17	66.000	0.011	0.0	0.0	0.0	1.02	40.5	0.0

Network Design Table for Storm

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
S1.001	3.386	0.015	225.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	13.805	0.061	225.0	0.011	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	2.130	0.009	225.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	14.361	0.064	225.0	0.017	5.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	4.172	0.064	65.0	0.005	5.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	6.429	0.087	74.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	10.397	0.021	495.1	0.009	0.00	0.0	0.600	[]	-2	Pipe/Conduit	
S1.005	6.265	0.042	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.006	11.303	1.006	11.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	7.280	0.032	225.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.008	13.184	0.520	25.4	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)
S1.001	0.00	5.34	65.936	0.033	0.0	0.0	0.0	0.87	34.5	0.0
S1.002	0.00	5.60	65.921	0.044	0.0	0.0	0.0	0.87	34.5	0.0
S1.003	0.00	5.65	65.860	0.049	0.0	0.0	0.0	0.87	34.5	0.0
S3.000	0.00	5.28	66.000	0.017	0.0	0.0	0.0	0.87	34.5	0.0
S4.000	0.00	5.04	66.000	0.005	0.0	0.0	0.0	1.62	64.6	0.0
S3.001	0.00	5.35	65.936	0.027	0.0	0.0	0.0	1.52	60.5	0.0
S1.004	0.00	5.73	64.456	0.085	0.0	0.0	0.0	2.14	7120.4	0.0
S1.005	0.00	5.85	64.435	0.085	0.0	0.0	0.0	0.82	14.5	0.0
S1.006	0.00	5.90	64.318	0.085	0.0	0.0	0.0	3.93	156.1	0.0
S1.007	0.00	6.04	63.312	0.085	0.0	0.0	0.0	0.87	34.5	0.0
S1.008	0.00	6.13	63.280	0.085	0.0	0.0	0.0	2.61	103.7	0.0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	S	64.520	62.760	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
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	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S6, DS/PN: S1.005, Volume (m³): 38.2

Unit Reference	MD-SHE-0088-4500-1900-4500
Design Head (m)	1.900
Design Flow (l/s)	4.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	88
Invert Level (m)	64.435
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.900	4.5	Kick-Flo®	0.784	3.0
Flush-Flo™	0.382	3.7	Mean Flow over Head Range	-	3.6

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.7	1.200	3.6	3.000	5.6	7.000	8.3
0.200	3.5	1.400	3.9	3.500	6.0	7.500	8.6
0.300	3.7	1.600	4.1	4.000	6.4	8.000	8.8
0.400	3.7	1.800	4.4	4.500	6.7	8.500	9.1
0.500	3.7	2.000	4.6	5.000	7.1	9.000	9.3
0.600	3.6	2.200	4.8	5.500	7.4	9.500	9.6
0.800	3.0	2.400	5.0	6.000	7.7		
1.000	3.3	2.600	5.2	6.500	8.0		

Summary of Critical Results by Maximum Level (Rank 1) for Storm

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 Coeffiecient	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	0
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	FEH
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

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)	30
Climate Change (%)	0

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	S1	15 Winter	30	+0%					66.089
S2.000	S2	15 Winter	30	+0%					66.074
S1.001	S2	15 Winter	30	+0%					66.062
S1.002	S3	15 Winter	30	+0%					66.053
S1.003	S4	15 Winter	30	+0%					66.005
S3.000	S6	15 Winter	30	+0%					66.076
S4.000	S7	15 Winter	30	+0%					66.036
S3.001	S7	15 Winter	30	+0%					66.018
S1.004	S5	30 Winter	30	+0%					65.324
S1.005	S6	30 Winter	30	+0%	30/15 Summer				65.324
S1.006	S7	60 Winter	30	+0%					64.343
S1.007	S8	15 Winter	30	+0%					63.367
S1.008	S9	15 Winter	30	+0%					63.309

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.136	0.000	0.24			7.3	OK	
S2.000	S2	-0.151	0.000	0.14			4.8	OK	
S1.001	S2	-0.099	0.000	0.55			14.3	OK	
S1.002	S3	-0.093	0.000	0.63			18.9	OK	
S1.003	S4	-0.080	0.000	0.74			21.1	OK	
S3.000	S6	-0.149	0.000	0.24			7.3	OK	
S4.000	S7	-0.189	0.000	0.06			2.2	OK	
S3.001	S7	-0.143	0.000	0.28			11.7	OK	
S1.004	S5	-0.732	0.000	0.01			27.6	OK	
S1.005	S6	0.739	0.000	0.31			3.7	SURCHARGED	
S1.006	S7	-0.200	0.000	0.03			3.7	OK	
S1.007	S8	-0.170	0.000	0.14			3.7	OK	
S1.008	S9	-0.196	0.000	0.04			3.7	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Maximum Rainfall (mm/hr)	0
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	0.000
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.060	4-8	0.025

Total Area Contributing (ha) = 0.085

Total Pipe Volume (m³) = 38.670

Network Design Table for Storm

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	14.288	0.064	225.0	0.017	5.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	10.470	0.064	164.0	0.011	5.00	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)
S1.000	0.00	5.27	66.000	0.017	0.0	0.0	0.0	0.87	34.5	0.0
S2.000	0.00	5.17	66.000	0.011	0.0	0.0	0.0	1.02	40.5	0.0

Network Design Table for Storm

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
S1.001	3.386	0.015	225.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	13.805	0.061	225.0	0.011	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	2.130	0.009	225.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	14.361	0.064	225.0	0.017	5.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	4.172	0.064	65.0	0.005	5.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	6.429	0.087	74.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	10.397	0.021	495.1	0.009	0.00	0.0	0.600	[]	-2	Pipe/Conduit	
S1.005	6.265	0.042	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.006	11.303	1.006	11.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	7.280	0.032	225.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.008	13.184	0.520	25.4	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)
S1.001	0.00	5.34	65.936	0.033	0.0	0.0	0.0	0.87	34.5	0.0
S1.002	0.00	5.60	65.921	0.044	0.0	0.0	0.0	0.87	34.5	0.0
S1.003	0.00	5.65	65.860	0.049	0.0	0.0	0.0	0.87	34.5	0.0
S3.000	0.00	5.28	66.000	0.017	0.0	0.0	0.0	0.87	34.5	0.0
S4.000	0.00	5.04	66.000	0.005	0.0	0.0	0.0	1.62	64.6	0.0
S3.001	0.00	5.35	65.936	0.027	0.0	0.0	0.0	1.52	60.5	0.0
S1.004	0.00	5.73	64.456	0.085	0.0	0.0	0.0	2.14	7120.4	0.0
S1.005	0.00	5.85	64.435	0.085	0.0	0.0	0.0	0.82	14.5	0.0
S1.006	0.00	5.90	64.318	0.085	0.0	0.0	0.0	3.93	156.1	0.0
S1.007	0.00	6.04	63.312	0.085	0.0	0.0	0.0	0.87	34.5	0.0
S1.008	0.00	6.13	63.280	0.085	0.0	0.0	0.0	2.61	103.7	0.0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	S	64.520	62.760	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
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	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S6, DS/PN: S1.005, Volume (m³): 38.2

Unit Reference	MD-SHE-0088-4500-1900-4500
Design Head (m)	1.900
Design Flow (l/s)	4.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	88
Invert Level (m)	64.435
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.900	4.5	Kick-Flo®	0.784	3.0
Flush-Flo™	0.382	3.7	Mean Flow over Head Range	-	3.6

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.7	1.200	3.6	3.000	5.6	7.000	8.3
0.200	3.5	1.400	3.9	3.500	6.0	7.500	8.6
0.300	3.7	1.600	4.1	4.000	6.4	8.000	8.8
0.400	3.7	1.800	4.4	4.500	6.7	8.500	9.1
0.500	3.7	2.000	4.6	5.000	7.1	9.000	9.3
0.600	3.6	2.200	4.8	5.500	7.4	9.500	9.6
0.800	3.0	2.400	5.0	6.000	7.7		
1.000	3.3	2.600	5.2	6.500	8.0		

Summary of Critical Results by Maximum Level (Rank 1) for Storm

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 Coeffiecient	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	0
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	FEH
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

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)	100
Climate Change (%)	0

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	S1	15 Winter	100	+0%					66.112
S2.000	S2	15 Winter	100	+0%					66.101
S1.001	S2	15 Winter	100	+0%					66.092
S1.002	S3	15 Winter	100	+0%					66.081
S1.003	S4	15 Winter	100	+0%					66.036
S3.000	S6	15 Winter	100	+0%					66.089
S4.000	S7	15 Winter	100	+0%					66.045
S3.001	S7	15 Winter	100	+0%					66.032
S1.004	S5	120 Winter	100	+0%					65.705
S1.005	S6	120 Winter	100	+0%	100/15 Summer				65.705
S1.006	S7	600 Winter	100	+0%					64.343
S1.007	S8	15 Winter	100	+0%					63.368
S1.008	S9	30 Winter	100	+0%					63.309

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.113	0.000	0.32			9.7	OK	
S2.000	S2	-0.124	0.000	0.19			6.3	OK	
S1.001	S2	-0.069	0.000	0.72			18.8	OK	
S1.002	S3	-0.065	0.000	0.83			24.9	OK	
S1.003	S4	-0.048	0.000	0.97			27.7	OK	
S3.000	S6	-0.136	0.000	0.32			9.7	OK	
S4.000	S7	-0.180	0.000	0.08			2.9	OK	
S3.001	S7	-0.128	0.000	0.37			15.5	OK	
S1.004	S5	-0.351	0.000	0.01			15.6	OK	
S1.005	S6	1.120	0.000	0.31			3.7	SURCHARGED	
S1.006	S7	-0.200	0.000	0.03			3.7	OK	
S1.007	S8	-0.170	0.000	0.14			3.7	OK	
S1.008	S9	-0.196	0.000	0.04			3.7	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Maximum Rainfall (mm/hr)	0
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	0.000
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.060	4-8	0.025

Total Area Contributing (ha) = 0.085

Total Pipe Volume (m³) = 38.670

Network Design Table for Storm

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	14.288	0.064	225.0	0.017	5.00	0.0	0.600	o	225	Pipe/Conduit	
S2.000	10.470	0.064	164.0	0.011	5.00	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)
S1.000	0.00	5.27	66.000	0.017	0.0	0.0	0.0	0.87	34.5	0.0
S2.000	0.00	5.17	66.000	0.011	0.0	0.0	0.0	1.02	40.5	0.0

Network Design Table for Storm

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
S1.001	3.386	0.015	225.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	13.805	0.061	225.0	0.011	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	2.130	0.009	225.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	14.361	0.064	225.0	0.017	5.00	0.0	0.600	o	225	Pipe/Conduit	
S4.000	4.172	0.064	65.0	0.005	5.00	0.0	0.600	o	225	Pipe/Conduit	
S3.001	6.429	0.087	74.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	10.397	0.021	495.1	0.009	0.00	0.0	0.600	[]	-2	Pipe/Conduit	
S1.005	6.265	0.042	150.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.006	11.303	1.006	11.2	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	7.280	0.032	225.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.008	13.184	0.520	25.4	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)
S1.001	0.00	5.34	65.936	0.033	0.0	0.0	0.0	0.87	34.5	0.0
S1.002	0.00	5.60	65.921	0.044	0.0	0.0	0.0	0.87	34.5	0.0
S1.003	0.00	5.65	65.860	0.049	0.0	0.0	0.0	0.87	34.5	0.0
S3.000	0.00	5.28	66.000	0.017	0.0	0.0	0.0	0.87	34.5	0.0
S4.000	0.00	5.04	66.000	0.005	0.0	0.0	0.0	1.62	64.6	0.0
S3.001	0.00	5.35	65.936	0.027	0.0	0.0	0.0	1.52	60.5	0.0
S1.004	0.00	5.73	64.456	0.085	0.0	0.0	0.0	2.14	7120.4	0.0
S1.005	0.00	5.85	64.435	0.085	0.0	0.0	0.0	0.82	14.5	0.0
S1.006	0.00	5.90	64.318	0.085	0.0	0.0	0.0	3.93	156.1	0.0
S1.007	0.00	6.04	63.312	0.085	0.0	0.0	0.0	0.87	34.5	0.0
S1.008	0.00	6.13	63.280	0.085	0.0	0.0	0.0	2.61	103.7	0.0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.008	S	64.520	62.760	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
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	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S6, DS/PN: S1.005, Volume (m³): 38.2

Unit Reference	MD-SHE-0088-4500-1900-4500
Design Head (m)	1.900
Design Flow (l/s)	4.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	88
Invert Level (m)	64.435
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.900	4.5	Kick-Flo®	0.784	3.0
Flush-Flo™	0.382	3.7	Mean Flow over Head Range	-	3.6

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.7	1.200	3.6	3.000	5.6	7.000	8.3
0.200	3.5	1.400	3.9	3.500	6.0	7.500	8.6
0.300	3.7	1.600	4.1	4.000	6.4	8.000	8.8
0.400	3.7	1.800	4.4	4.500	6.7	8.500	9.1
0.500	3.7	2.000	4.6	5.000	7.1	9.000	9.3
0.600	3.6	2.200	4.8	5.500	7.4	9.500	9.6
0.800	3.0	2.400	5.0	6.000	7.7		
1.000	3.3	2.600	5.2	6.500	8.0		

Summary of Critical Results by Maximum Level (Rank 1) for Storm

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 Coeffiecient	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	0
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	FEH
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

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

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)	100
Climate Change (%)	40

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	S1	120 Winter	100	+40%	100/15 Summer				66.345
S2.000	S2	120 Winter	100	+40%	100/15 Summer				66.344
S1.001	S2	120 Winter	100	+40%	100/15 Summer				66.343
S1.002	S3	120 Winter	100	+40%	100/15 Summer				66.342
S1.003	S4	120 Winter	100	+40%	100/15 Summer				66.338
S3.000	S6	120 Winter	100	+40%	100/120 Winter				66.340
S4.000	S7	120 Winter	100	+40%	100/120 Winter				66.338
S3.001	S7	120 Winter	100	+40%	100/60 Winter				66.338
S1.004	S5	120 Winter	100	+40%	100/30 Winter				66.337
S1.005	S6	120 Winter	100	+40%	100/15 Summer				66.337
S1.006	S7	120 Winter	100	+40%					64.345
S1.007	S8	120 Winter	100	+40%					63.373
S1.008	S9	120 Winter	100	+40%					63.312

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.120	0.000	0.15			4.4	SURCHARGED	
S2.000	S2	0.119	0.000	0.08			2.9	SURCHARGED	
S1.001	S2	0.182	0.000	0.33			8.6	SURCHARGED	
S1.002	S3	0.196	0.000	0.38			11.5	SURCHARGED	
S1.003	S4	0.253	0.000	0.45			12.8	SURCHARGED	
S3.000	S6	0.115	0.000	0.15			4.4	SURCHARGED	
S4.000	S7	0.113	0.000	0.04			1.3	SURCHARGED	
S3.001	S7	0.177	0.000	0.17			7.0	SURCHARGED	
S1.004	S5	0.281	0.000	0.01			21.8	SURCHARGED	
S1.005	S6	1.751	0.000	0.37			4.5	SURCHARGED	
S1.006	S7	-0.198	0.000	0.03			4.5	OK	
S1.007	S8	-0.164	0.000	0.16			4.5	OK	
S1.008	S9	-0.193	0.000	0.05			4.5	OK	

Conduits

Section		Input	Depth (%)	Wetted Area (m²)	Wetted Perimeter (m)	Base X (m)	Coordinates Y (m)	Cover X (m)	Coordinates Y (m)
1	Symbol	[]	10	0.080000	2.080	0.000	0.400	0.000	0.400
	Width (mm)	2000	30	0.240000	2.240	0.001	0.000	2.000	0.400
	Height (mm)	400	50	0.400000	2.400	1.999	0.000		
	C.Height (mm)	400	70	0.560000	2.560	2.000	0.400		
	Side Angle (°)	90.0	90	0.720000	2.720				
	Splay (mm)	0	100	0.800000	4.800				
	Open Section	No							
2	Symbol	[]	10	0.332320	2.397	0.000	1.600	0.000	1.600
	Width (mm)	2077	30	0.996960	3.037	0.001	0.000	2.077	1.600
	Height (mm)	1600	50	1.661600	3.677	2.076	0.000		
	C.Height (mm)	1600	70	2.326240	4.317	2.077	1.600		
	Side Angle (°)	90.0	90	2.990880	4.957				
	Splay (mm)	0	100	3.323200	7.354				
	Open Section	No							
3	Symbol	[]	10	0.398880	2.813	0.000	1.600	0.000	1.600
	Width (mm)	2493	30	1.196640	3.453	0.001	0.000	2.493	1.600
	Height (mm)	1600	50	1.994400	4.093	2.492	0.000		
	C.Height (mm)	1600	70	2.792160	4.733	2.493	1.600		
	Side Angle (°)	90.0	90	3.589920	5.373				
	Splay (mm)	0	100	3.988800	8.186				
	Open Section	No							
4	Symbol	[]	10	0.484640	3.349	0.000	1.600	0.000	1.600
	Width (mm)	3029	30	1.453920	3.989	0.001	0.000	3.029	1.600
	Height (mm)	1600	50	2.423200	4.629	3.028	0.000		
	C.Height (mm)	1600	70	3.392480	5.269	3.029	1.600		
	Side Angle (°)	90.0	90	4.361760	5.909				
	Splay (mm)	0	100	4.846400	9.258				

Conduits

Section	Input	Depth (%)	Wetted Area (m²)	Wetted Perimeter (m)	Base X (m)	Coordinates Y (m)	Cover X (m)	Coordinates Y (m)
Open Section	No							

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Maximum Rainfall (mm/hr)	0
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	0.000
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.012	4-8	0.004

Total Area Contributing (ha) = 0.016

Total Pipe Volume (m³) = 5.039

Network Design Table for Storm

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	13.418	0.610	22.0	0.008	5.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	13.139	0.088	150.0	0.005	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)
S1.000	0.00	5.10	64.100	0.008	0.0	0.0	0.0	2.16	38.1	0.0
S2.000	0.00	5.27	63.573	0.005	0.0	0.0	0.0	0.82	14.5	0.0

Network Design Table for Storm

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
S3.000	8.769	0.058	150.0	0.001	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	4.000	0.008	500.0	0.002	0.00	0.0	0.600	[]	-2	Pipe/Conduit	
S1.002	5.000	0.032	156.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	8.220	0.037	225.0	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)
S3.000	0.00	5.18	63.544	0.001	0.0	0.0	0.0	0.82	14.5	0.0
S1.001	0.00	5.32	62.836	0.016	0.0	0.0	0.0	1.18	1181.0	0.0
S1.002	0.00	5.43	62.828	0.016	0.0	0.0	0.0	0.80	14.2	0.0
S1.003	0.00	5.59	62.796	0.016	0.0	0.0	0.0	0.87	34.5	0.0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.003	S	64.520	62.759	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
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	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S3, DS/PN: S1.002, Volume (m³): 6.8

Unit Reference	MD-SHE-0031-5000-1200-5000
Design Head (m)	1.200
Design Flow (l/s)	0.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	31
Invert Level (m)	62.828
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	0.5	Kick-Flo®	0.275	0.3
Flush-Flo™	0.137	0.3	Mean Flow over Head Range	-	0.4

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.3	1.200	0.5	3.000	0.7	7.000	1.1
0.200	0.3	1.400	0.5	3.500	0.8	7.500	1.1
0.300	0.3	1.600	0.6	4.000	0.9	8.000	1.2
0.400	0.3	1.800	0.6	4.500	0.9	8.500	1.2
0.500	0.3	2.000	0.6	5.000	0.9	9.000	1.2
0.600	0.4	2.200	0.7	5.500	1.0	9.500	1.3
0.800	0.4	2.400	0.7	6.000	1.0		
1.000	0.5	2.600	0.7	6.500	1.1		

Summary of Critical Results by Maximum Level (Rank 1) for Storm

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 Coeffiecient	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	0
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	FEH
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	OFF
Inertia Status	OFF

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)	2
Climate Change (%)	0

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	S1	15 Winter	2	+0%					64.119
S2.000	S2	15 Winter	2	+0%					63.598
S3.000	S3	15 Winter	2	+0%					63.553
S1.001	S2	120 Winter	2	+0%					63.094
S1.002	S3	120 Winter	2	+0%	2/15 Summer				63.094
S1.003	S4	360 Winter	2	+0%					62.808

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.131	0.000	0.04			1.3	OK	
S2.000	S2	-0.125	0.000	0.06			0.8	OK	
S3.000	S3	-0.141	0.000	0.01			0.2	OK	
S1.001	S2	-0.542	0.000	0.00			0.9	OK	
S1.002	S3	0.116	0.000	0.03			0.3	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.003	S4	-0.213	0.000	0.01			0.3	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Maximum Rainfall (mm/hr)	0
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	0.000
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.012	4-8	0.004

Total Area Contributing (ha) = 0.016

Total Pipe Volume (m³) = 5.039

Network Design Table for Storm

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	13.418	0.610	22.0	0.008	5.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	13.139	0.088	150.0	0.005	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)
S1.000	0.00	5.10	64.100	0.008	0.0	0.0	0.0	2.16	38.1	0.0
S2.000	0.00	5.27	63.573	0.005	0.0	0.0	0.0	0.82	14.5	0.0

Network Design Table for Storm

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
S3.000	8.769	0.058	150.0	0.001	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	4.000	0.008	500.0	0.002	0.00	0.0	0.600	[]	-2	Pipe/Conduit	
S1.002	5.000	0.032	156.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	8.220	0.037	225.0	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)
S3.000	0.00	5.18	63.544	0.001	0.0	0.0	0.0	0.82	14.5	0.0
S1.001	0.00	5.32	62.836	0.016	0.0	0.0	0.0	1.18	1181.0	0.0
S1.002	0.00	5.43	62.828	0.016	0.0	0.0	0.0	0.80	14.2	0.0
S1.003	0.00	5.59	62.796	0.016	0.0	0.0	0.0	0.87	34.5	0.0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.003	S	64.520	62.759	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
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	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S3, DS/PN: S1.002, Volume (m³): 6.8

Unit Reference	MD-SHE-0031-5000-1200-5000
Design Head (m)	1.200
Design Flow (l/s)	0.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	31
Invert Level (m)	62.828
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	0.5	Kick-Flo®	0.275	0.3
Flush-Flo™	0.137	0.3	Mean Flow over Head Range	-	0.4

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.3	1.200	0.5	3.000	0.7	7.000	1.1
0.200	0.3	1.400	0.5	3.500	0.8	7.500	1.1
0.300	0.3	1.600	0.6	4.000	0.9	8.000	1.2
0.400	0.3	1.800	0.6	4.500	0.9	8.500	1.2
0.500	0.3	2.000	0.6	5.000	0.9	9.000	1.2
0.600	0.4	2.200	0.7	5.500	1.0	9.500	1.3
0.800	0.4	2.400	0.7	6.000	1.0		
1.000	0.5	2.600	0.7	6.500	1.1		

Summary of Critical Results by Maximum Level (Rank 1) for Storm

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 Coeffiecient	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	0
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	FEH
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	OFF
Inertia Status	OFF

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)	30
Climate Change (%)	0

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	S1	15 Winter	30	+0%					64.132
S2.000	S2	15 Winter	30	+0%					63.614
S3.000	S3	15 Winter	30	+0%					63.562
S1.001	S2	120 Winter	30	+0%					63.550
S1.002	S3	120 Winter	30	+0%	30/15 Summer				63.551
S1.003	S4	120 Winter	30	+0%					62.811

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.118	0.000	0.10			3.5	OK	
S2.000	S2	-0.109	0.000	0.16			2.2	OK	
S3.000	S3	-0.132	0.000	0.03			0.4	OK	
S1.001	S2	-0.086	0.000	0.00			2.1	OK	
S1.002	S3	0.573	0.000	0.04			0.4	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.003	S4	-0.210	0.000	0.01			0.4	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Maximum Rainfall (mm/hr)	0
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	0.000
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.012	4-8	0.004

Total Area Contributing (ha) = 0.016

Total Pipe Volume (m³) = 5.039

Network Design Table for Storm

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	13.418	0.610	22.0	0.008	5.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	13.139	0.088	150.0	0.005	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)
S1.000	0.00	5.10	64.100	0.008	0.0	0.0	0.0	2.16	38.1	0.0
S2.000	0.00	5.27	63.573	0.005	0.0	0.0	0.0	0.82	14.5	0.0

Network Design Table for Storm

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
S3.000	8.769	0.058	150.0	0.001	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	4.000	0.008	500.0	0.002	0.00	0.0	0.600	[]	-2	Pipe/Conduit	
S1.002	5.000	0.032	156.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	8.220	0.037	225.0	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)
S3.000	0.00	5.18	63.544	0.001	0.0	0.0	0.0	0.82	14.5	0.0
S1.001	0.00	5.32	62.836	0.016	0.0	0.0	0.0	1.18	1181.0	0.0
S1.002	0.00	5.43	62.828	0.016	0.0	0.0	0.0	0.80	14.2	0.0
S1.003	0.00	5.59	62.796	0.016	0.0	0.0	0.0	0.87	34.5	0.0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.003	S	64.520	62.759	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
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	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S3, DS/PN: S1.002, Volume (m³): 6.8

Unit Reference	MD-SHE-0031-5000-1200-5000
Design Head (m)	1.200
Design Flow (l/s)	0.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	31
Invert Level (m)	62.828
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	0.5	Kick-Flo®	0.275	0.3
Flush-Flo™	0.137	0.3	Mean Flow over Head Range	-	0.4

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.3	1.200	0.5	3.000	0.7	7.000	1.1
0.200	0.3	1.400	0.5	3.500	0.8	7.500	1.1
0.300	0.3	1.600	0.6	4.000	0.9	8.000	1.2
0.400	0.3	1.800	0.6	4.500	0.9	8.500	1.2
0.500	0.3	2.000	0.6	5.000	0.9	9.000	1.2
0.600	0.4	2.200	0.7	5.500	1.0	9.500	1.3
0.800	0.4	2.400	0.7	6.000	1.0		
1.000	0.5	2.600	0.7	6.500	1.1		

Summary of Critical Results by Maximum Level (Rank 1) for Storm

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 Coeffiecient	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	0
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	FEH
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	OFF
Inertia Status	OFF

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)	100
Climate Change (%)	0

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	S1	15 Winter	100	+0%					64.136
S2.000	S2	180 Winter	100	+0%	100/120 Winter				63.858
S3.000	S3	180 Winter	100	+0%	100/60 Winter				63.857
S1.001	S2	180 Winter	100	+0%	100/60 Winter				63.857
S1.002	S3	180 Winter	100	+0%	100/15 Summer				63.857
S1.003	S4	180 Winter	100	+0%					62.814

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	-0.114	0.000	0.13			4.6	OK	
S2.000	S2	0.135	0.000	0.05			0.7	SURCHARGED	
S3.000	S3	0.163	0.000	0.01			0.1	SURCHARGED	
S1.001	S2	0.221	0.000	0.00			2.2	SURCHARGED	
S1.002	S3	0.879	0.000	0.04			0.5	SURCHARGED	

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.003	S4	-0.207	0.000	0.02			0.5	OK	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Maximum Rainfall (mm/hr)	0
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.000
Maximum Backdrop Height (m)	0.000
Min Design Depth for Optimisation (m)	0.000
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Inverts

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.012	4-8	0.004

Total Area Contributing (ha) = 0.016

Total Pipe Volume (m³) = 5.039

Network Design Table for Storm

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	13.418	0.610	22.0	0.008	5.00	0.0	0.600	o	150	Pipe/Conduit	
S2.000	13.139	0.088	150.0	0.005	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)
S1.000	0.00	5.10	64.100	0.008	0.0	0.0	0.0	2.16	38.1	0.0
S2.000	0.00	5.27	63.573	0.005	0.0	0.0	0.0	0.82	14.5	0.0

Network Design Table for Storm

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
S3.000	8.769	0.058	150.0	0.001	5.00	0.0	0.600	o	150	Pipe/Conduit	
S1.001	4.000	0.008	500.0	0.002	0.00	0.0	0.600	[]	-2	Pipe/Conduit	
S1.002	5.000	0.032	156.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.003	8.220	0.037	225.0	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)
S3.000	0.00	5.18	63.544	0.001	0.0	0.0	0.0	0.82	14.5	0.0
S1.001	0.00	5.32	62.836	0.016	0.0	0.0	0.0	1.18	1181.0	0.0
S1.002	0.00	5.43	62.828	0.016	0.0	0.0	0.0	0.80	14.2	0.0
S1.003	0.00	5.59	62.796	0.016	0.0	0.0	0.0	0.87	34.5	0.0

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.003	S	64.520	62.759	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Storage Structures	0
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	FEH
Return Period (years)	2
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

Online Controls for Storm

Hydro-Brake® Optimum Manhole: S3, DS/PN: S1.002, Volume (m³): 6.8

Unit Reference	MD-SHE-0031-5000-1200-5000
Design Head (m)	1.200
Design Flow (l/s)	0.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	31
Invert Level (m)	62.828
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	0.5	Kick-Flo®	0.275	0.3
Flush-Flo™	0.137	0.3	Mean Flow over Head Range	-	0.4

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)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.3	1.200	0.5	3.000	0.7	7.000	1.1
0.200	0.3	1.400	0.5	3.500	0.8	7.500	1.1
0.300	0.3	1.600	0.6	4.000	0.9	8.000	1.2
0.400	0.3	1.800	0.6	4.500	0.9	8.500	1.2
0.500	0.3	2.000	0.6	5.000	0.9	9.000	1.2
0.600	0.4	2.200	0.7	5.500	1.0	9.500	1.3
0.800	0.4	2.400	0.7	6.000	1.0		
1.000	0.5	2.600	0.7	6.500	1.1		

Summary of Critical Results by Maximum Level (Rank 1) for Storm

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 Coeffiecient	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	0
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	FEH
FEH Rainfall Version	2013
Site Location	GB 528957 186548 TQ 28957 86548
Data Type	Point
Cv (Summer)	0.750
Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	OFF
Inertia Status	OFF

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)	100
Climate Change (%)	40

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	S1	120 Winter	100	+40%	100/60 Winter				64.263
S2.000	S2	120 Winter	100	+40%	100/30 Summer				64.261
S3.000	S3	240 Winter	100	+40%	100/15 Winter				64.248
S1.001	S2	120 Winter	100	+40%	100/15 Winter				64.258
S1.002	S3	120 Winter	100	+40%	100/15 Summer				64.258
S1.003	S4	120 Winter	100	+40%					62.817

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.000	S1	0.013	0.000	0.06			2.1	SURCHARGED	
S2.000	S2	0.538	0.000	0.10			1.3	FLOOD RISK	
S3.000	S3	0.554	0.000	0.04			0.5	FLOOD RISK	
S1.001	S2	0.622	0.000	0.00			3.6	FLOOD RISK	
S1.002	S3	1.280	0.000	0.05			0.5	FLOOD RISK	

Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
S1.003	S4	-0.204	0.000	0.02			0.5	OK	

Conduits

Section		Input	Depth (%)	Wetted Area (m²)	Wetted Perimeter (m)	Base Coordinates X (m)	Base Coordinates Y (m)	Cover Coordinates X (m)	Cover Coordinates Y (m)
1	Symbol	[]	10	0.080000	2.080	0.000	0.400	0.000	0.400
	Width (mm)	2000	30	0.240000	2.240	0.001	0.000	2.000	0.400
	Height (mm)	800	50	0.400000	2.400	1.999	0.000		
	C.Height (mm)	800	70	0.560000	2.560	2.000	0.400		
	Side Angle (°)	90.0	90	0.720000	2.720				
	Splay (mm)	0	100	0.800000	4.800				
	Open Section	No							
2	Symbol	[]	10	0.100000	2.580	0.000	0.400	0.000	0.400
	Width (mm)	2500	30	0.300000	2.740	0.001	0.000	2.500	0.400
	Height (mm)	800	50	0.500000	2.900	2.499	0.000		
	C.Height (mm)	800	70	0.700000	3.060	2.500	0.400		
	Side Angle (°)	90.0	90	0.900000	3.220				
	Splay (mm)	0	100	1.000000	5.800				
	Open Section	No							
3	Symbol	[]	10	0.240000	3.160	0.000	0.800	0.000	0.800
	Width (mm)	3000	30	0.720000	3.480	0.001	0.000	3.000	0.800
	Height (mm)	800	50	1.200000	3.800	2.999	0.000		
	C.Height (mm)	800	70	1.680000	4.120	3.000	0.800		
	Side Angle (°)	90.0	90	2.160000	4.440				
	Splay (mm)	0	100	2.400000	7.600				
	Open Section	No							