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1912 Mill, Sunny Bank Mills Town Street, Farsley Leeds, LS28 5UJ		
Date 21/11/2018 11:17	Designed by Robert.Marshall	
File 2018 11 21 SW Crown 470.mdx	Checked by	
Innovyze	Network 2018.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	2	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	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	0.226	4-8	0.012

Total Area Contributing (ha) = 0.238

Total Pipe Volume (m³) = 5.285

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	22.000	0.142	154.9	0.087	3.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	8.000	0.027	296.3	0.021	0.00	0.0	0.600	o	300	Pipe/Conduit	
S2.000	51.800	0.280	185.0	0.130	3.00	0.0	0.600	o	225	Pipe/Conduit	
S3.000	14.000	0.070	200.0	0.000	3.00	0.0	0.600	o	300	Pipe/Conduit	
S1.002	20.000	0.133	150.4	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)
S1.000	50.00	3.35	6.259	0.087	0.0	0.0	0.0	1.05	41.7	11.8
S1.001	50.00	3.50	6.117	0.108	0.0	0.0	0.0	0.91	64.2	14.6
S2.000	50.00	3.90	6.370	0.130	0.0	0.0	0.0	0.96	38.1	17.6
S3.000	50.00	3.21	6.160	0.000	0.0	0.0	0.0	1.11	78.3	0.0
S1.002	50.00	4.21	6.090	0.238	0.0	0.0	0.0	1.06	42.3	32.2

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
S1	7.250	0.991	Open Manhole	1200	S1.000	6.259	225				
S2	7.100	0.983	Open Manhole	1200	S1.001	6.117	300	S1.000	6.117	225	
S3	7.360	0.990	Open Manhole	1200	S2.000	6.370	225				
S4	7.100	0.940	Open Manhole	1200	S3.000	6.160	300				
S5	7.370	1.280	Open Manhole	1500	S1.002	6.090	225	S1.001	6.090	300	
								S2.000	6.090	225	
								S3.000	6.090	300	
SDS - EX1	7.300	1.343	Open Manhole	0		OUTFALL		S1.002	5.957	225	

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.087	0.087	0.087
1.001	-	-	100	0.021	0.021	0.021
2.000	-	-	100	0.130	0.130	0.130
3.000	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.238	0.238	0.238

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)
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S1.002	SDS - EX1	7.300	5.957	5.500	0	0
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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 Coefficient	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 Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	2	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	2	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.350		

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Online Controls for Storm

Crown Vortex Valve® Manhole: S5, DS/PN: S1.002, Volume (m³): 5.6

Design Head (m) 0.860 Vortex Valve® Type R1 SW Only Invert Level (m) 6.090
Design Flow (l/s) 2.0 Diameter (mm) 60

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.8	0.800	1.9	2.000	3.0	4.000	4.3	7.000	5.6
0.200	1.0	1.000	2.1	2.200	3.2	4.500	4.5	7.500	5.8
0.300	1.2	1.200	2.3	2.400	3.3	5.000	4.8	8.000	6.0
0.400	1.3	1.400	2.5	2.600	3.4	5.500	5.0	8.500	6.2
0.500	1.5	1.600	2.7	3.000	3.7	6.000	5.2	9.000	6.4
0.600	1.6	1.800	2.9	3.500	4.0	6.500	5.4	9.500	6.6

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Storage Structures for Storm

Cellular Storage Manhole: S2, DS/PN: S1.001

Invert Level (m) 6.117 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.96
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	110.0	0.0	0.550	110.0	0.0	0.551	0.0	0.0

Cellular Storage Manhole: S4, DS/PN: S3.000

Invert Level (m) 6.160 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	1.1	0.0	0.440	230.0	0.0	0.911	0.0	0.0
0.439	1.1	0.0	0.910	230.0	0.0	0.940	0.0	0.0

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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 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 Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.000 Cv (Summer) 0.750
 Region England and Wales Ratio R 0.350 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
 Duration(s) (mins) 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		Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Surcharged	
	Name	Storm							Level (m)	Depth (m)
S1.000	S1	600 Winter	100	+40%	100/30 Summer				6.959	0.475
S1.001	S2	600 Winter	100	+40%	100/30 Summer				6.957	0.540
S2.000	S3	30 Summer	100	+40%	100/30 Summer				7.353	0.758
S3.000	S4	600 Winter	100	+40%	100/30 Summer				6.957	0.497
S1.002	S5	600 Winter	100	+40%	100/30 Summer				6.957	0.642

PN	US/MH Name	Flooded		Pipe		Level Exceeded
		Volume (m³)	Flow / Cap. (l/s)	Flow (l/s)	Status	
S1.000	S1	0.000	0.13	5.0	FLOOD RISK	
S1.001	S2	0.000	0.13	6.2	FLOOD RISK	
S2.000	S3	0.000	1.66	60.7	FLOOD RISK	
S3.000	S4	0.000	0.03	1.9	FLOOD RISK	
S1.002	S5	0.000	0.05	2.0	SURCHARGED	