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Date 12/05/2022 09:07 File 30544 PROPOSED SW DRAIN...	Designed by SAP Checked by	
Micro Drainage	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)	18.000	Add Flow / Climate Change (%)	0
Ratio R	0.388	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	100	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 Soffits

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
1.000	29.010	0.195	148.8	0.089	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	31.200	0.208	150.0	0.024	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	25.660	0.171	150.1	0.079	5.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	19.900	0.133	149.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.002	5.970	0.040	149.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	2.050	0.014	146.4	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	2.000	0.013	153.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	9.000	0.185	48.6	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)
1.000	59.99	5.45	56.750	0.089	0.0	0.0	0.0	1.07	42.5	14.5
1.001	57.76	5.94	56.555	0.113	0.0	0.0	0.0	1.07	42.4	17.7
2.000	60.24	5.40	56.691	0.079	0.0	0.0	0.0	1.07	42.3	12.9
2.001	58.78	5.71	56.520	0.079	0.0	0.0	0.0	1.07	42.4	12.9
2.002	58.36	5.81	56.387	0.079	0.0	0.0	0.0	1.07	42.5	12.9
1.002	57.62	5.97	56.347	0.192	0.0	0.0	0.0	1.08	42.9	30.0
1.003	57.49	6.00	55.758	0.192	0.0	0.0	0.0	1.05	41.8	30.0
1.004	57.14	6.08	55.745	0.192	0.0	0.0	0.0	1.88	74.7	30.0

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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)	Pipe Out Diameter (mm)	PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
7	57.700	0.950	Open Manhole	1050	1.000	56.750	225				
6	57.700	1.145	Open Manhole	1050	1.001	56.555	225	1.000	56.555	225	
5	57.780	1.089	Open Manhole	1050	2.000	56.691	225				
4	57.700	1.180	Open Manhole	1050	2.001	56.520	225	2.000	56.520	225	
5	57.600	1.213	Open Manhole	1050	2.002	56.387	225	2.001	56.387	225	
2	57.660	1.313	Open Manhole	1200	1.002	56.347	225	1.001	56.347	225	
								2.002	56.347	225	
0	57.700	1.942	Open Manhole	450	1.003	55.758	225	1.002	56.333	225	575
1	57.700	1.955	Open Manhole	1500	1.004	55.745	225	1.003	55.745	225	
	57.700	2.140	Open Manhole	1200		OUTFALL		1.004	55.560	225	

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 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 Profile Type Summer
 Return Period (years) 2 Cv (Summer) 0.750
 Region England and Wales Cv (Winter) 0.840
 M5-60 (mm) 18.000 Storm Duration (mins) 30
 Ratio R 0.388

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 0, DS/PN: 1.003, Volume (m³): 0.4

Unit Reference MD-SHE-0134-9600-1600-9600
Design Head (m) 1.600
Design Flow (l/s) 9.6
Flush-Flo™ Calculated
Objective Minimise upstream storage
Application Surface
Sump Available Yes
Diameter (mm) 134
Invert Level (m) 55.758
Minimum Outlet Pipe Diameter (mm) 150
Suggested Manhole Diameter (mm) 1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.600	9.6
Flush-Flo™	0.469	9.6
Kick-Flo®	0.984	7.6
Mean Flow over Head Range	-	8.4

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	4.8	1.200	8.4	3.000	12.9	7.000	19.4
0.200	8.5	1.400	9.0	3.500	13.9	7.500	20.0
0.300	9.3	1.600	9.6	4.000	14.8	8.000	20.6
0.400	9.5	1.800	10.1	4.500	15.7	8.500	21.3
0.500	9.6	2.000	10.7	5.000	16.5	9.000	21.8
0.600	9.5	2.200	11.2	5.500	17.2	9.500	22.4
0.800	9.0	2.400	11.6	6.000	18.0		
1.000	7.7	2.600	12.1	6.500	18.7		

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Storage Structures for Storm

Cellular Storage Manhole: 0, DS/PN: 1.003

Invert Level (m) 55.758 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)
0.000	40.0	0.0	1.201	0.0	0.0
1.200	40.0	0.0			

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

PN	US/MH Name	Surcharged		Flooded		Pipe		Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)			
2.002	5	-0.108	0.000	0.31		9.3		OK	
1.002	2	-0.076	0.000	0.77		22.3		OK	
1.003	0	-0.010	0.000	0.26		7.6		OK	
1.004	1	-0.172	0.000	0.12		7.6		OK	

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

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Pipe Flow	Status	Level Exceeded
		Depth (m)	Volume (m ³)	Cap.	(l/s)	(l/s)		
2.002	5	0.083	0.000	0.70		20.9	SURCHARGED	
1.002	2	0.105	0.000	1.75		50.5	SURCHARGED	
1.003	0	0.409	0.000	0.33		9.6	SURCHARGED	
1.004	1	-0.166	0.000	0.16		9.6	OK	

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Walkden
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Micro Drainage

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100 year Return Period 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 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 0.388
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 18.000 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status ON
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
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	7	15 Winter	100	+40%	100/15 Summer				57.469
1.001	6	60 Winter	100	+40%	30/15 Winter				57.289
2.000	5	60 Winter	100	+40%	100/15 Summer				57.295
2.001	4	60 Winter	100	+40%	100/15 Summer				57.286
2.002	5	60 Winter	100	+40%	30/15 Summer				57.278
1.002	2	60 Winter	100	+40%	30/15 Summer				57.274
1.003	0	60 Winter	100	+40%	30/15 Summer				57.271
1.004	1	15 Summer	100	+40%					55.804

		Surcharged		Flooded			Pipe		
PN	US/MH Name	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded	
1.000	7	0.494	0.000	1.03		40.8	FLOOD RISK		
1.001	6	0.509	0.000	0.79		31.4	SURCHARGED		
2.000	5	0.379	0.000	0.59		23.0	SURCHARGED		
2.001	4	0.541	0.000	0.58		22.4	SURCHARGED		

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

PN	US/MH Name	Surcharged Flooded		Flow / Overflow		Pipe Flow	Status	Level Exceeded
		Depth (m)	Volume (m ³)	Cap.	(l/s)	(l/s)		
2.002	5	0.666	0.000	0.74		22.2	SURCHARGED	
1.002	2	0.702	0.000	1.85		53.2	SURCHARGED	
1.003	0	1.288	0.000	0.33		9.6	SURCHARGED	
1.004	1	-0.166	0.000	0.16		9.6	OK	