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The Stables High Cogges, Witney Oxfordshire, OX29 6UN		
Date 24/03/2026 15:50 File	Designed by Tim.Trotman Checked by	
Innovyze	Network 2020.1.3	

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)	20.600	Add Flow / Climate Change (%)	0
Ratio R	0.437	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 Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.126	4-8	0.051

Total Area Contributing (ha) = 0.177

Total Pipe Volume (m³) = 3.855

Network Design Table for Storm

« - 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
1.000	9.000	0.113	80.0	0.011	5.00	0.0	0.600	o	100	Pipe/Conduit	
1.001	10.000	0.125	80.0	0.006	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	10.000	0.125	80.0	0.003	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	9.500	0.119	80.0	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	15.500	0.194	80.0	0.015	0.00	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)
1.000	50.00	5.17	30.645	0.011	0.0	0.0	0.0	0.86	6.8	1.5
1.001	50.00	5.32	30.483	0.017	0.0	0.0	0.0	1.12	19.9	2.3
1.002	50.00	5.47	30.358	0.020	0.0	0.0	0.0	1.12	19.9	2.7
1.003	50.00	5.61	30.233	0.033	0.0	0.0	0.0	1.12	19.9	4.5
1.004	50.00	5.84	30.114	0.048	0.0	0.0	0.0	1.12	19.9	6.5

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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
2.000	21.500	0.215	100.0	0.027	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	20.000	0.123	162.0	0.024	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.002	3.000	0.015	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	11.500	0.058	200.0	0.025	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.006	9.500	0.048	200.0	0.012	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.007	2.000	0.010	200.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.008	10.000	0.020	500.0	0.012	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.009	2.700	0.027	100.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
3.000	10.600	0.177	60.0	0.008	5.00	0.0	0.600	o	100	Pipe/Conduit	
3.001	6.500	0.325	20.0	0.021	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.010	8.000	0.080	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	E I.Area (ha)	E Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.000	50.00	5.36	30.273	0.027	0.0	0.0	0.0	1.00	17.8	3.7
2.001	50.00	5.68	29.983	0.051	0.0	0.0	0.0	1.02	40.7	6.9
2.002	50.00	5.74	29.860	0.051	0.0	0.0	0.0	0.92	36.6	6.9
1.005	50.00	6.05	29.845	0.124	0.0	0.0	0.0	0.92	36.6	16.8
1.006	50.00	6.22	29.787	0.136	0.0	0.0	0.0	0.92	36.6	18.4
1.007	50.00	6.26	29.740	0.136	0.0	0.0	0.0	0.92	36.6	18.4
1.008	50.00	6.55	29.730	0.148	0.0	0.0	0.0	0.58	23.0	20.0
1.009	50.00	6.58	29.710	0.148	0.0	0.0	0.0	1.31	52.0	20.0
3.000	50.00	5.18	30.184	0.008	0.0	0.0	0.0	1.00	7.8	1.1
3.001	50.00	5.24	30.007	0.029	0.0	0.0	0.0	1.73	13.6	3.9
1.010	50.00	6.71	0.000	0.177	0.0	0.0	0.0	1.00	17.8«	24.0

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)
1.010		31.390	-0.080	0.000	0	0

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Innovyze		Network 2020.1.3
<u>Simulation Criteria for Storm</u> 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 2 Number of Online Controls 1 Number of Time/Area Diagrams 0 Number of Offline Controls 0 Number of Real Time Controls 0 <u>Synthetic Rainfall Details</u> 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) 20.600 Storm Duration (mins) 30 Ratio R 0.437		
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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 16, DS/PN: 1.010, Volume (m³): 35.6

Unit Reference	MD-SHE-0078-2600-0900-2600
Design Head (m)	0.900
Design Flow (l/s)	2.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	78
Invert Level (m)	29.682
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	2.6
Flush-Flo™	0.271	2.6
Kick-Flo®	0.569	2.1
Mean Flow over Head Range	-	2.3

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	2.2	1.200	3.0	3.000	4.5	7.000	6.8
0.200	2.6	1.400	3.2	3.500	4.9	7.500	7.0
0.300	2.6	1.600	3.4	4.000	5.2	8.000	7.2
0.400	2.5	1.800	3.6	4.500	5.5	8.500	7.4
0.500	2.4	2.000	3.8	5.000	5.8	9.000	7.6
0.600	2.2	2.200	3.9	5.500	6.0	9.500	7.8
0.800	2.5	2.400	4.1	6.000	6.3		
1.000	2.7	2.600	4.2	6.500	6.5		

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<u>Summary of Critical Results by Maximum Level (Rank 1) for Storm</u>									
<u>Simulation Criteria</u>									
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 2									
Number of Online Controls 1 Number of Time/Area Diagrams 0									
Number of Offline Controls 0 Number of Real Time Controls 0									
<u>Synthetic Rainfall Details</u>									
Rainfall Model FSR Ratio R 0.437									
Region England and Wales Cv (Summer) 0.750									
M5-60 (mm) 20.600 Cv (Winter) 0.840									
Margin for Flood Risk Warning (mm) 300.0									
Analysis Timestep 2.5 Second Increment (Extended)									
DTS Status ON									
DVD Status ON									
Inertia 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 (%) 0, 0, 45									
									Water
US/MH	Return	Climate	First (X)	First (Y)	First (Z)	Overflow	Level		
PN	Name	Storm	Period	Change	Surcharge	Flood	Overflow	Act.	(m)
1.000	1	15 Winter	100	+45%	100/15 Summer				30.853
1.001	2	15 Winter	100	+45%	100/15 Summer				30.742
1.002	3	15 Winter	100	+45%	100/15 Summer				30.707
1.003	4	15 Winter	100	+45%	100/15 Summer				30.661
1.004	5	15 Winter	100	+45%	100/15 Summer				30.534
2.000	6	15 Winter	100	+45%	100/15 Summer				30.454
2.001	7	360 Winter	100	+45%	100/120 Winter				30.304
2.002	8	360 Winter	100	+45%	100/15 Summer				30.303
1.005	9	360 Winter	100	+45%	30/15 Summer				30.302
1.006	10	360 Winter	100	+45%	30/15 Summer				30.300
1.007	11	360 Winter	100	+45%	30/15 Summer				30.298
1.008	12	360 Winter	100	+45%	30/15 Summer				30.297
1.009	13	360 Winter	100	+45%	100/15 Winter				30.295
3.000	14	15 Winter	100	+45%	100/15 Summer				30.508
3.001	15	15 Winter	100	+45%	100/15 Summer				30.428
1.010	16	360 Winter	100	+45%	1/15 Summer				30.303
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Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged		Flooded		Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)				
1.000	1	0.108	0.000	1.03			6.4	SURCHARGED	
1.001	2	0.110	0.000	0.56			10.0	SURCHARGED	
1.002	3	0.199	0.000	0.70			12.4	SURCHARGED	
1.003	4	0.278	0.000	1.04			18.3	SURCHARGED	
1.004	5	0.270	0.000	1.44			26.5	SURCHARGED	
2.000	6	0.031	0.000	1.07			18.0	SURCHARGED	
2.001	7	0.096	0.000	0.12			4.5	SURCHARGED	
2.002	8	0.218	0.000	0.11		244	3.1	SURCHARGED	
1.005	9	0.233	0.000	0.28			8.7	SURCHARGED	
1.006	10	0.288	0.000	0.32			9.5	SURCHARGED	
1.007	11	0.333	0.000	0.33			9.4	SURCHARGED	
1.008	12	0.342	0.000	0.69			10.3	SURCHARGED	
1.009	13	0.360	0.000	0.30		313	9.1	SURCHARGED	
3.000	14	0.224	0.000	0.80			5.8	SURCHARGED	
3.001	15	0.321	0.000	1.40			17.2	SURCHARGED	
1.010	16	30.153	0.000	0.17			2.6	SURCHARGED	

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