

The Old Chapel
Station Road, Hugglescote
Leicestershire LE67 2GB

Bicester
Parcel H
SWS NET 5

Date 01/08/2018
File 23431 parcel H5.mdx

Designed by as
Checked by



XP Solutions

Network 2015.1

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 5

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	1
Site Location GB 457850 220300 SP 57850 20300	
C (1km)	-0.023
D1 (1km)	0.309
D2 (1km)	0.343
D3 (1km)	0.255
E (1km)	0.288
F (1km)	2.462
Maximum Rainfall (mm/hr)	50
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	0.750
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
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 Surface Network 5

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.152	4-8	0.076

Total Area Contributing (ha) = 0.228

Total Pipe Volume (m³) = 10.654

Network Design Table for Surface Network 5

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
1.000	41.385	0.414	100.0	0.025	5.00	0.0	0.600	o	150	
1.001	9.792	0.116	84.4	0.000	0.00	0.0	0.600	o	150	
1.002	58.969	0.602	98.0	0.121	0.00	0.0	0.600	o	300	
1.003	56.012	0.569	98.5	0.037	0.00	0.0	0.600	o	300	

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	5.69	78.500	0.025	0.0	0.0	0.0	1.01	17.8	3.4
1.001	50.00	5.84	78.086	0.025	0.0	0.0	0.0	1.09	19.3	3.4
1.002	50.00	6.45	77.850	0.146	0.0	0.0	0.0	1.59	112.3	19.8
1.003	50.00	7.04	77.248	0.183	0.0	0.0	0.0	1.58	112.0	24.8

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Network Design Table for Surface Network 5

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Auto Design
2.000	7.806	0.195	40.0	0.030	5.00	0.0	0.600	o	150	
2.001	7.918	0.670	11.8	0.000	0.00	0.0	0.600	o	150	
1.004	7.238	0.076	95.2	0.015	0.00	0.0	0.600	o	300	
1.005	11.780	0.082	144.0	0.000	0.00	0.0	0.600	o	300	

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)
2.000	50.00	5.08	77.850	0.030	0.0	0.0	0.0	1.60	28.2	4.1
2.001	50.00	5.13	77.500	0.030	0.0	0.0	0.0	2.95	52.1	4.1
1.004	50.00	7.12	76.680	0.228	0.0	0.0	0.0	1.61	113.9	30.9
1.005	50.00	7.27	76.604	0.228	0.0	0.0	0.0	1.31	92.5	30.9

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Area Summary for Surface Network 5

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.025	0.025	0.025
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.121	0.121	0.121
1.003	-	-	100	0.037	0.037	0.037
2.000	-	-	100	0.030	0.030	0.030
2.001	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.015	0.015	0.015
1.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.228	0.228	0.228

Free Flowing Outfall Details for Surface Network 5

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D, L (mm)	W (mm)
1.005	SH1	79.703	76.522	0.000	1500	0

Simulation Criteria for Surface Network 5

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /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 3 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	E (1km)	0.288
Return Period (years)	1	F (1km)	2.462
Site Location	GB 457850 220300 SP 57850 20300	Summer Storms	Yes
C (1km)	-0.023	Winter Storms	Yes
D1 (1km)	0.309	Cv (Summer)	0.750
D2 (1km)	0.343	Cv (Winter)	0.840
D3 (1km)	0.255	Storm Duration (mins)	30

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Online Controls for Surface Network 5

Garastor Manhole: S502, DS/PN: 1.001, Volume (m³): 1.4

Invert Level (m) 78.086 Model 400mm Overflow

Garastor Manhole: S506, DS/PN: 2.001, Volume (m³): 0.8

Invert Level (m) 77.500 Model 400mm Overflow

Complex Manhole: S507FC, DS/PN: 1.004, Volume (m³): 25.4

Hydro-Brake Optimum®

Unit Reference MD-SHE-0072-3000-1800-3000
 Design Head (m) 1.800
 Design Flow (l/s) 3.0
 Flush-Flo™ Calculated
 Objective Minimise upstream storage
 Diameter (mm) 72
 Invert Level (m) 76.680
 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)	1.800	3.0	Kick-Flo®	0.646	1.9
Flush-Flo™	0.319	2.3	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)	Depth (m)	Flow (l/s)
0.100	1.9	0.800	2.1	2.000	3.1	4.000	4.3	7.000	5.6
0.200	2.2	1.000	2.3	2.200	3.3	4.500	4.6	7.500	5.8
0.300	2.3	1.200	2.5	2.400	3.4	5.000	4.8	8.000	6.0
0.400	2.3	1.400	2.7	2.600	3.6	5.500	5.0	8.500	6.2
0.500	2.2	1.600	2.8	3.000	3.8	6.000	5.3	9.000	6.4
0.600	2.0	1.800	3.0	3.500	4.1	6.500	5.5	9.500	6.5

Weir

Discharge Coef 0.544 Width (m) 0.150 Invert Level (m) 79.757

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Storage Structures for Surface Network 5

Tank or Pond Manhole: S501, DS/PN: 1.000

Invert Level (m) 78.500

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	45.0	1.200	0.0	2.400	0.0	3.600	0.0	4.800	0.0
0.200	45.0	1.400	0.0	2.600	0.0	3.800	0.0	5.000	0.0
0.400	45.0	1.600	0.0	2.800	0.0	4.000	0.0		
0.600	45.0	1.800	0.0	3.000	0.0	4.200	0.0		
0.800	45.0	2.000	0.0	3.200	0.0	4.400	0.0		
1.000	0.0	2.200	0.0	3.400	0.0	4.600	0.0		

Tank or Pond Manhole: S505, DS/PN: 2.000

Invert Level (m) 78.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	45.0	1.200	45.0	2.400	0.0	3.600	0.0	4.800	0.0
0.200	45.0	1.400	0.0	2.600	0.0	3.800	0.0	5.000	0.0
0.400	45.0	1.600	0.0	2.800	0.0	4.000	0.0		
0.600	45.0	1.800	0.0	3.000	0.0	4.200	0.0		
0.800	45.0	2.000	0.0	3.200	0.0	4.400	0.0		
1.000	45.0	2.200	0.0	3.400	0.0	4.600	0.0		

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10 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 5

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 3 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH D3 (1km) 0.255
 Site Location GB 457850 220300 SP 57850 20300 E (1km) 0.288
 C (1km) -0.023 F (1km) 2.462
 D1 (1km) 0.309 Cv (Summer) 0.750
 D2 (1km) 0.343 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, 240, 360, 480, 960, 1440
 Return Period(s) (years) 10, 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 Surcharged	
									Level (m)	Depth (m)
1.000	S501	15 Winter	10	+0%	100/15 Summer				78.545	-0.105
1.001	S502	30 Winter	10	+0%	10/15 Summer				78.498	0.262
1.002	S503	60 Winter	10	+0%	10/15 Winter				78.268	0.118
1.003	S504	60 Winter	10	+0%	10/15 Summer	100/15 Winter			78.254	0.706
2.000	S505	120 Winter	10	+0%	10/15 Summer				78.244	0.244
2.001	S506	120 Winter	10	+0%	10/15 Summer				78.243	0.593
1.004	S507FC	120 Winter	10	+0%	10/15 Summer	100/15 Summer			78.245	1.265
1.005	S508	120 Winter	10	+0%					76.642	-0.262

PN	US/MH Name	Flooded		Pipe		Level Exceeded
		Volume (m ³)	Flow / Cap. (l/s)	Flow (l/s)	Status	
1.000	S501	0.000	0.19	3.3	OK	
1.001	S502	0.000	0.18	3.1	SURCHARGED	
1.002	S503	0.000	0.15	16.4	SURCHARGED	
1.003	S504	0.000	0.14	14.3	SURCHARGED	1
2.000	S505	0.000	0.10	2.4	SURCHARGED	
2.001	S506	0.000	0.05	2.4	SURCHARGED	
1.004	S507FC	0.000	0.04	2.8	SURCHARGED	4
1.005	S508	0.000	0.04	2.8	OK	

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30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 5

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 3 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH D3 (1km) 0.255
 Site Location GB 457850 220300 SP 57850 20300 E (1km) 0.288
 C (1km) -0.023 F (1km) 2.462
 D1 (1km) 0.309 Cv (Summer) 0.750
 D2 (1km) 0.343 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, 240, 360, 480, 960, 1440
 Return Period(s) (years) 10, 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 Surcharged	
									Level (m)	Depth (m)
1.000	S501	30 Winter	30	+0%	100/15 Summer				78.588	-0.062
1.001	S502	30 Winter	30	+0%	10/15 Summer				78.641	0.405
1.002	S503	30 Winter	30	+0%	10/15 Winter				78.654	0.504
1.003	S504	30 Winter	30	+0%	10/15 Summer	100/15 Winter			78.629	1.081
2.000	S505	120 Winter	30	+0%	10/15 Summer				78.517	0.517
2.001	S506	120 Winter	30	+0%	10/15 Summer				78.517	0.867
1.004	S507FC	30 Winter	30	+0%	10/15 Summer	100/15 Summer			78.599	1.619
1.005	S508	30 Winter	30	+0%					76.644	-0.260

PN	US/MH Name	Flooded		Pipe		Level Exceeded
		Volume (m³)	Flow / Cap. (l/s)	Flow (l/s)	Status	
1.000	S501	0.000	0.32	5.5	OK	
1.001	S502	0.000	0.32	5.4	SURCHARGED	
1.002	S503	0.000	0.31	32.8	SURCHARGED	
1.003	S504	0.000	0.28	29.8	SURCHARGED	1
2.000	S505	0.000	0.12	2.8	SURCHARGED	
2.001	S506	0.000	0.06	2.8	SURCHARGED	
1.004	S507FC	0.000	0.04	3.1	SURCHARGED	4
1.005	S508	0.000	0.04	3.1	OK	

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100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 5

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 3 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FEH D3 (1km) 0.255
 Site Location GB 457850 220300 SP 57850 20300 E (1km) 0.288
 C (1km) -0.023 F (1km) 2.462
 D1 (1km) 0.309 Cv (Summer) 0.750
 D2 (1km) 0.343 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, 240, 360, 480, 960, 1440
 Return Period(s) (years) 10, 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 Surcharged	
									Level (m)	Depth (m)
1.000	S501	240 Winter	100	+40%	100/15 Summer				79.148	0.498
1.001	S502	15 Winter	100	+40%	10/15 Summer				79.758	1.522
1.002	S503	15 Winter	100	+40%	10/15 Winter				80.036	1.886
1.003	S504	15 Winter	100	+40%	10/15 Summer	100/15 Winter			79.946	2.398
2.000	S505	240 Winter	100	+40%	10/15 Summer				79.140	1.140
2.001	S506	240 Winter	100	+40%	10/15 Summer				79.140	1.490
1.004	S507FC	15 Winter	100	+40%	10/15 Summer	100/15 Summer			79.726	2.747
1.005	S508	15 Winter	100	+40%					76.648	-0.256

PN	US/MH Name	Flooded		Pipe		Level Exceeded
		Volume (m ³)	Flow / Cap. (l/s)	Flow (l/s)	Status	
1.000	S501	0.000	0.13	2.2	SURCHARGED	
1.001	S502	0.000	0.56	9.6	SURCHARGED	
1.002	S503	0.000	0.65	69.4	SURCHARGED	
1.003	S504	0.062	0.76	80.1	FLOOD	1
2.000	S505	0.000	0.07	1.7	SURCHARGED	
2.001	S506	0.000	0.04	1.7	SURCHARGED	
1.004	S507FC	5.419	0.06	3.8	FLOOD	4
1.005	S508	0.000	0.05	3.8	OK	