

Tumu Consulting		Page 1
20 East Sands	Character Area 5	
Burbage Marlborough	Ageas Bowl	
Wiltshire SN8 3AN	Network 3	
Date 01/07/2022	Designed by JE	
File 19320-CHARACTERAREA5	Checked by AC	
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)	100	PIMP (%)	100
M5-60 (mm)	19.800	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 Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.183	4-8	0.084

Total Area Contributing (ha) = 0.267

Total Pipe Volume (m³) = 4.573

Network Design Table for Storm

- Indicates pipe length does not match coordinates

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	57.948	2.432	23.8	0.083	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	10.600	0.098	108.2	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	32.851	0.329	99.9	0.050	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	13.222#	1.691	7.8	0.081	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.002	8.318	0.084	99.0	0.053	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	79.114	3.570	22.2	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)	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	5.47	48.940	0.083	0.0	0.0	0.0	2.07	36.6	11.2
1.001	50.00	5.58	46.508	0.083	0.0	0.0	0.0	1.51	106.8	11.2
2.000	50.00	5.54	48.539	0.050	0.0	0.0	0.0	1.01	17.8	6.8
2.001	50.00	5.61	48.210	0.131	0.0	0.0	0.0	3.63	64.1	17.7
2.002	50.00	5.69	46.494	0.184	0.0	0.0	0.0	1.58	111.7	24.9
1.002	50.00	6.31	46.410	0.267	0.0	0.0	0.0	2.15	38.0	36.2

Tumu Consulting		Page 2
20 East Sands Burbage Marlborough Wiltshire SN8 3AN	Character Area 5 Ageas Bowl Network 3	
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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	0.083	0.083	0.083
1.001	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.050	0.050	0.050
2.001	-	-	100	0.081	0.081	0.081
2.002	-	-	100	0.053	0.053	0.053
1.002	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.267	0.267	0.267

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)
1.002		43.140	42.840	0.000	0	0

Tumu Consulting		Page 3
20 East Sands	Character Area 5	
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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S48, DS/PN: 1.002, Volume (m³): 2.0

Unit Reference MD-SHE-0071-2000-0740-2000
Design Head (m) 0.740
Design Flow (l/s) 2.0
Flush-Flo™ Calculated
Objective Minimise upstream storage
Application Surface
Sump Available Yes
Diameter (mm) 71
Invert Level (m) 46.410
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)	0.740	2.0	Kick-Flo®	0.471	1.6
Flush-Flo™	0.220	2.0	Mean Flow over Head Range	-	1.7

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	1.8	0.800	2.1	2.000	3.2	4.000	4.4	7.000	5.7
0.200	2.0	1.000	2.3	2.200	3.3	4.500	4.6	7.500	5.8
0.300	2.0	1.200	2.5	2.400	3.4	5.000	4.8	8.000	6.0
0.400	1.8	1.400	2.7	2.600	3.6	5.500	5.1	8.500	6.2
0.500	1.7	1.600	2.8	3.000	3.8	6.000	5.3	9.000	6.4
0.600	1.8	1.800	3.0	3.500	4.1	6.500	5.5	9.500	6.6

Tumu Consulting		Page 4
20 East Sands Burbage Marlborough Wiltshire SN8 3AN	Character Area 5 Ageas Bowl Network 3	
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Micro Drainage	Network 2018.1	

Storage Structures for Storm

Porous Car Park Manhole: S48, DS/PN: 1.002

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	23.0
Membrane Percolation (mm/hr)	1000	Length (m)	50.0
Max Percolation (l/s)	319.4	Slope (1:X)	0.0
Safety Factor	1.5	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	46.410	Membrane Depth (mm)	0

Volume Summary (Static)

Length Calculations based on True Length

Pipe Number	USMH Name	Manhole Volume (m ³)	Pipe Volume (m ³)	Storage Structure Volume (m ³)	Total Volume (m ³)
1.000	S46	0.797	1.003	0.000	1.800
1.001	S47	1.122	0.664	0.000	1.786
2.000	S42	1.527	0.559	0.000	2.086
2.001	S43	2.022	0.212	0.000	2.235
2.002	S50	1.025	0.503	0.000	1.528
1.002	S48	0.837	1.387	255.300	257.524
Total		7.330	4.330	255.300	266.959

Tumu Consulting		Page 5
20 East Sands	Character Area 5	
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30 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 Offline Controls 0 Number of Time/Area Diagrams 0
 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR M5-60 (mm) 19.800 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 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) 30
 Climate Change (%) 40

PN	US/MH		Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level	Surcharged Depth	Flooded Volume
	Name	Storm							(m)	(m)	(m ³)
1.000	S46	15 Winter	30	+40%	30/15 Winter				49.093	0.003	0.000
1.001	S47	480 Winter	30	+40%					46.782	-0.026	0.000
2.000	S42	15 Winter	30	+40%	30/15 Summer				48.867	0.178	0.000
2.001	S43	15 Winter	30	+40%	30/15 Summer				48.376	0.016	0.000
2.002	S50	15 Summer	30	+40%	30/15 Summer				46.804	0.010	0.000
1.002	S48	480 Winter	30	+40%	30/15 Winter				46.781	0.221	0.000

Pipe

PN	US/MH		Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Level
	Name						Exceeded
1.000	S46	1.00		35.8	SURCHARGED		
1.001	S47	0.06		4.6	OK		
2.000	S42	1.22		20.9	SURCHARGED		
2.001	S43	0.96		56.3	SURCHARGED		
2.002	S50	1.12		81.5	SURCHARGED		
1.002	S48	0.05		2.0	SURCHARGED		