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20 East Sands		19320	
Burbage Marlborough		Ageas bowl	
Wiltshire SN8 3AN		CA5.2	
Date 22/06/2023		Designed by Robbie Parnham	
File 13920 - AGAES BOWL - CHA...		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)	1	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)	0.75
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

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
S1.000	12.515	0.500	25.0	0.005	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	34.233	0.500	68.5	0.006	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.002	30.937	3.500	8.8	0.019	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.003	14.180	0.095	149.3	0.010	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.004	13.911	0.095	146.4	0.010	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.005	11.469	0.080	143.4	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.006	9.144	0.230	39.8	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
S1.007	7.528	0.000	0.0	0.120	0.00	0.0	0.600	o	150	Pipe/Conduit	
S1.008	23.132	1.000	23.1	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)
S1.000	50.00	5.08	55.500	0.005	0.0	0.0	0.0	2.63	104.4	0.7
S1.001	48.88	5.44	55.000	0.011	0.0	0.0	0.0	1.58	62.9	1.5
S1.002	48.43	5.56	54.500	0.030	0.0	0.0	0.0	4.43	176.1	3.9
S1.003	47.61	5.78	51.000	0.040	0.0	0.0	0.0	1.07	42.5	5.2
S1.004	46.84	5.99	50.905	0.050	0.0	0.0	0.0	1.08	42.9	6.3
S1.005	46.23	6.17	50.810	0.055	0.0	0.0	0.0	1.09	43.3	6.9
S1.006	45.98	6.24	50.730	0.060	0.0	0.0	0.0	2.08	82.7	7.5
S1.007	41.90	7.59	50.500	0.180	0.0	0.0	0.0	0.09	1.6«	20.4
S1.008	41.41	7.78	50.500	0.180	0.0	0.0	0.0	2.10	37.2	20.4

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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)
SS45	56.000	0.500	Open Manhole	1200	S1.000	55.500	225				
SS46	56.000	1.000	Open Manhole	1200	S1.001	55.000	225	S1.000	55.000	225	
SS47	55.000	0.500	Open Manhole	1200	S1.002	54.500	225	S1.001	54.500	225	
SS48	53.000	2.000	Open Manhole	1200	S1.003	51.000	225	S1.002	51.000	225	
SS49	52.000	1.095	Open Manhole	1200	S1.004	50.905	225	S1.003	50.905	225	
SS50	51.500	0.690	Open Manhole	1200	S1.005	50.810	225	S1.004	50.810	225	
SS51	51.500	0.770	Open Manhole	1200	S1.006	50.730	225	S1.005	50.730	225	
SPCP3	51.500	1.000	Open Manhole	1200	S1.007	50.500	150	S1.006	50.500	225	
SS52	51.500	1.000	Open Manhole	1200	S1.008	50.500	150	S1.007	50.500	150	
SS53	50.000	0.500	Open Manhole	1200	S1.009	49.500	150	S1.008	49.500	150	
SS54	50.000	0.598	Open Manhole	1200	S1.010	49.402	150	S1.009	49.402	150	
S	50.000	0.615	Open Manhole	0		OUTFALL		S1.010	49.385	150	

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd	Diam	MH	C.Level	I.Level	D.Depth	MH	MH DIAM., L*W
	Sect	(mm)	Name	(m)	(m)	(m)	Connection	(mm)
S1.000	o	225	SS45	56.000	55.500	0.275	Open Manhole	1200
S1.001	o	225	SS46	56.000	55.000	0.775	Open Manhole	1200
S1.002	o	225	SS47	55.000	54.500	0.275	Open Manhole	1200
S1.003	o	225	SS48	53.000	51.000	1.775	Open Manhole	1200
S1.004	o	225	SS49	52.000	50.905	0.870	Open Manhole	1200
S1.005	o	225	SS50	51.500	50.810	0.465	Open Manhole	1200
S1.006	o	225	SS51	51.500	50.730	0.545	Open Manhole	1200
S1.007	o	150	SPCP3	51.500	50.500	0.850	Open Manhole	1200
S1.008	o	150	SS52	51.500	50.500	0.850	Open Manhole	1200
S1.009	o	150	SS53	50.000	49.500	0.350	Open Manhole	1200
S1.010	o	150	SS54	50.000	49.402	0.448	Open Manhole	1200

Downstream Manhole

PN	Length	Slope	MH	C.Level	I.Level	D.Depth	MH	MH DIAM., L*W
	(m)	(1:X)	Name	(m)	(m)	(m)	Connection	(mm)
S1.000	12.515	25.0	SS46	56.000	55.000	0.775	Open Manhole	1200
S1.001	34.233	68.5	SS47	55.000	54.500	0.275	Open Manhole	1200
S1.002	30.937	8.8	SS48	53.000	51.000	1.775	Open Manhole	1200
S1.003	14.180	149.3	SS49	52.000	50.905	0.870	Open Manhole	1200
S1.004	13.911	146.4	SS50	51.500	50.810	0.465	Open Manhole	1200
S1.005	11.469	143.4	SS51	51.500	50.730	0.545	Open Manhole	1200
S1.006	9.144	39.8	SPCP3	51.500	50.500	0.775	Open Manhole	1200
S1.007	7.528	0.0	SS52	51.500	50.500	0.850	Open Manhole	1200
S1.008	23.132	23.1	SS53	50.000	49.500	0.350	Open Manhole	1200
S1.009	14.694	149.9	SS54	50.000	49.402	0.448	Open Manhole	1200
S1.010	2.534	149.1	S	50.000	49.385	0.465	Open Manhole	0

Free Flowing Outfall Details for Storm

Outfall	Outfall	C. Level	I. Level	Min	D,L	W
Pipe Number	Name	(m)	(m)	I. Level	(mm)	(mm)
				(m)		
S1.010	S	50.000	49.385	0.000	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 * 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 1
 Number of Storage Structures 1
 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.800	Storm Duration (mins)	30
Ratio R	0.350		

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Online Controls for Storm

Orifice Manhole: SPCP3, DS/PN: S1.007, Volume (m³): 1.4

Diameter (m) 0.032 Discharge Coefficient 0.600 Invert Level (m) 50.500

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Storage Structures for Storm

Porous Car Park Manhole: SPCP3, DS/PN: S1.007

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	15.0
Membrane Percolation (mm/hr)	1000	Length (m)	36.0
Max Percolation (l/s)	150.0	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	50.500	Membrane Depth (mm)	150

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

		Surcharged		Flooded		Pipe			
	US/MH	Depth	Volume	Flow /	Overflow	Flow		Level	
PN	Name	(m)	(m ³)	Cap.	(l/s)	(l/s)	Status	Exceeded	
S1.000	SS45	-0.217	0.000	0.01		0.7		OK	
S1.001	SS46	-0.202	0.000	0.02		1.3		OK	
S1.002	SS47	-0.202	0.000	0.02		3.4		OK	
S1.003	SS48	-0.173	0.000	0.12		4.5		OK	
S1.004	SS49	-0.167	0.000	0.15		5.6		OK	
S1.005	SS50	-0.163	0.000	0.17		6.1		OK	
S1.006	SS51	-0.178	0.000	0.10		6.7		OK	
S1.007	SPCP3	0.064	0.000	0.07		0.5	SURCHARGED		
S1.008	SS52	-0.141	0.000	0.01		0.5		OK	
S1.009	SS53	-0.132	0.000	0.04		0.5		OK	
S1.010	SS54	-0.130	0.000	0.04		0.5		OK	

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Micro Drainage

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 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 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	Ratio R	0.350
Region England and Wales	Cv (Summer)		0.750
M5-60 (mm)	19.800	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm) 300.0

Analysis Timestep 2.5 Second Increment (Extended)

DTS Status OFF

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) 1, 30, 100

Climate Change (%) 0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	SS45	15 Winter	30	+40%					55.524
S1.001	SS46	15 Winter	30	+40%					55.045
S1.002	SS47	15 Winter	30	+40%					54.545
S1.003	SS48	15 Winter	30	+40%	100/480 Winter				51.115
S1.004	SS49	960 Winter	30	+40%	100/240 Winter				51.063
S1.005	SS50	960 Winter	30	+40%	30/480 Winter				51.062
S1.006	SS51	960 Winter	30	+40%	30/240 Winter				51.062
S1.007	SPCP3	960 Winter	30	+40%	1/240 Winter				51.061
S1.008	SS52	960 Winter	30	+40%					50.519
S1.009	SS53	960 Winter	30	+40%					49.532
S1.010	SS54	960 Winter	30	+40%					49.438

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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		Pipe		Status	Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)			
S1.000	SS45	-0.201	0.000	0.03		2.3		OK	
S1.001	SS46	-0.180	0.000	0.09		5.1		OK	
S1.002	SS47	-0.180	0.000	0.09		14.2		OK	
S1.003	SS48	-0.110	0.000	0.51		19.0		OK	
S1.004	SS49	-0.067	0.000	0.04		1.7		OK	
S1.005	SS50	0.027	0.000	0.05		1.8	SURCHARGED		
S1.006	SS51	0.107	0.000	0.03		1.9	SURCHARGED		
S1.007	SPCP3	0.411	0.000	0.20		1.4	SURCHARGED		
S1.008	SS52	-0.131	0.000	0.04		1.4		OK	
S1.009	SS53	-0.118	0.000	0.10		1.4		OK	
S1.010	SS54	-0.114	0.000	0.13		1.4		OK	

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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 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	Ratio R 0.350
Region England and Wales Cv (Summer)	0.750	
M5-60 (mm)	19.800 Cv (Winter)	0.840

Margin for Flood Risk Warning (mm) 300.0
Analysis Timestep 2.5 Second Increment (Extended)
DTS Status OFF
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)	1, 30, 100
Climate Change (%)	0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	SS45	15 Winter	100	+45%					55.527
S1.001	SS46	15 Winter	100	+45%					55.051
S1.002	SS47	15 Winter	100	+45%					54.551
S1.003	SS48	960 Winter	100	+45%	100/480 Winter				51.251
S1.004	SS49	960 Winter	100	+45%	100/240 Winter				51.251
S1.005	SS50	960 Winter	100	+45%	30/480 Winter				51.250
S1.006	SS51	960 Winter	100	+45%	30/240 Winter				51.249
S1.007	SPCP3	960 Winter	100	+45%	1/240 Winter				51.248
S1.008	SS52	960 Winter	100	+45%					50.521
S1.009	SS53	960 Winter	100	+45%					49.535
S1.010	SS54	960 Winter	100	+45%					49.441

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PN	US/MH Name	Surcharged		Flooded		Pipe		Status	Level Exceeded
		Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	Flow (l/s)			
S1.000	SS45	-0.198	0.000	0.03		3.0		OK	
S1.001	SS46	-0.174	0.000	0.12		6.8		OK	
S1.002	SS47	-0.174	0.000	0.12		19.1		OK	
S1.003	SS48	0.026	0.000	0.05		1.8	SURCHARGED		
S1.004	SS49	0.121	0.000	0.06		2.1	SURCHARGED		
S1.005	SS50	0.215	0.000	0.06		2.2	FLOOD RISK		
S1.006	SS51	0.294	0.000	0.03		2.3	FLOOD RISK		
S1.007	SPCP3	0.598	0.000	0.24		1.7	FLOOD RISK		
S1.008	SS52	-0.129	0.000	0.05		1.7		OK	
S1.009	SS53	-0.115	0.000	0.13		1.7		OK	
S1.010	SS54	-0.111	0.000	0.15		1.7		OK	