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4 Market Square Old Amersham Buckinghamshire, HP7 0DQ		Marland Service Station Surface Water Network Calculations									
Date 09/09/2022		Designed by MDS									
File SW Network Calcs.mdx		Checked by MDS									
Innovyze		Network 2020.1									
<u>STORM SEWER DESIGN by the Modified Rational Method</u>											
<u>Design Criteria for Storm</u>											
Pipe Sizes STANDARD Manhole Sizes STANDARD											
FEH Rainfall Model											
Return Period (years)			100								
FEH Rainfall Version			1999								
Site Location	GB 388050 411700 SD 88050 11700										
C (1km)			-0.026								
D1 (1km)			0.362								
D2 (1km)			0.441								
D3 (1km)			0.392								
E (1km)			0.302								
F (1km)			2.453								
Maximum Rainfall (mm/hr)			50								
Maximum Time of Concentration (mins)			30								
Foul Sewage (l/s/ha)			0.000								
Volumetric Runoff Coeff.			0.750								
PIMP (%)			100								
Add Flow / Climate Change (%)			40								
Minimum Backdrop Height (m)			0.000								
Maximum Backdrop Height (m)			0.000								
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											
<u>Time Area Diagram for Storm</u>											
Time (mins)	Area (ha)	Time (mins)	Area (ha)								
0-4	0.010	4-8	0.003								
Total Area Contributing (ha) = 0.013											
Total Pipe Volume (m³) = 1.023											
<u>Network Design Table for Storm</u>											
PN	Length	Fall	Slope	I.Area	T.E.	Base	k	HYD	DIA	Section Type	Auto
	(m)	(m)	(1:X)	(ha)	(mins)	Flow (l/s)	(mm)	SECT	(mm)		Design
<u>Network Results Table</u>											
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<u>Manhole Schedules for Storm</u>											
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)	
S1	128.750	1.535	Open Manhole	460	1.000	127.215	150				
S2	128.750	1.705	Open Manhole	460	1.001	127.045	150	1.000	127.045	150	
S3	128.650	1.775	Open Manhole	460	1.002	126.875	150	1.001	126.875	150	
S4	128.750	1.990	Open Manhole	460	1.003	126.760	150	1.002	126.760	150	
S5	128.750	2.000	Open Manhole	1200	2.000	126.750	150				
S6	128.550	1.820	Open Manhole	1200	1.004	126.730	150	1.003	126.730	150	
								2.000	126.730	150	
S7	128.280	1.650	Open Manhole	1200		OUTFALL		1.004	126.630	150	
No coordinates have been specified, layout information cannot be produced.											
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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	S1	128.750	127.215	1.385	Open Manhole	460
1.001	o	150	S2	128.750	127.045	1.555	Open Manhole	460
1.002	o	150	S3	128.650	126.875	1.625	Open Manhole	460
1.003	o	150	S4	128.750	126.760	1.840	Open Manhole	460
2.000	o	150	S5	128.750	126.750	1.850	Open Manhole	1200
1.004	o	150	S6	128.550	126.730	1.670	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	16.850	99.1	S2	128.750	127.045	1.555	Open Manhole	460
1.001	17.000	100.0	S3	128.650	126.875	1.625	Open Manhole	460
1.002	11.400	99.1	S4	128.750	126.760	1.840	Open Manhole	460
1.003	3.000	100.0	S6	128.550	126.730	1.670	Open Manhole	1200
2.000	2.000	100.0	S6	128.550	126.730	1.670	Open Manhole	1200
1.004	7.650	76.5	S7	128.280	126.630	1.500	Open Manhole	1200

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)
1.004	S7	128.280	126.630	0.000	1200	0

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Simulation Criteria for Storm Volumetric Runoff Coeff 0.840 Additional Flow - % of Total Flow 40.000 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 Offline Controls 0 Number of Time/Area Diagrams 2 Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0 Synthetic Rainfall Details Rainfall Model FEH Return Period (years) 100 FEH Rainfall Version 1999 Site Location GB 388050 411700 SD 88050 11700 C (1km) -0.026 D1 (1km) 0.362 D2 (1km) 0.441 D3 (1km) 0.392 E (1km) 0.302 F (1km) 2.453 Summer Storms No Winter Storms Yes Cv (Summer) 0.750 Cv (Winter) 0.840 Storm Duration (mins) 15		
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Online Controls for Storm

Hydro-Brake® Optimum Manhole: S6, DS/PN: 1.004, Volume (m³): 2.1

Unit Reference	MD-SHE-0049-1200-1210-1200
Design Head (m)	1.210
Design Flow (l/s)	1.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	49
Invert Level (m)	126.730
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.210	1.2	Kick-Flo®	0.439	0.8
Flush-Flo™	0.218	0.9	Mean Flow over Head Range	-	0.9

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	0.8	1.200	1.2	3.000	1.8	7.000	2.7
0.200	0.9	1.400	1.3	3.500	1.9	7.500	2.8
0.300	0.9	1.600	1.4	4.000	2.1	8.000	2.9
0.400	0.8	1.800	1.4	4.500	2.2	8.500	2.9
0.500	0.8	2.000	1.5	5.000	2.3	9.000	3.0
0.600	0.9	2.200	1.6	5.500	2.4	9.500	3.1
0.800	1.0	2.400	1.6	6.000	2.5		
1.000	1.1	2.600	1.7	6.500	2.6		

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Storage Structures for Storm Cellular Storage Manhole: S6, DS/PN: 1.004 Invert Level (m) 126.740 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95 Infiltration Coefficient Side (m/hr) 0.00000 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Inf. Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>24.0</td><td>0.0</td><td>2.600</td><td>0.0</td><td>0.0</td></tr><tr><td>0.200</td><td>24.0</td><td>0.0</td><td>2.800</td><td>0.0</td><td>0.0</td></tr><tr><td>0.400</td><td>24.0</td><td>0.0</td><td>3.000</td><td>0.0</td><td>0.0</td></tr><tr><td>0.600</td><td>24.0</td><td>0.0</td><td>3.200</td><td>0.0</td><td>0.0</td></tr><tr><td>0.800</td><td>24.0</td><td>0.0</td><td>3.400</td><td>0.0</td><td>0.0</td></tr><tr><td>1.000</td><td>24.0</td><td>0.0</td><td>3.600</td><td>0.0</td><td>0.0</td></tr><tr><td>1.200</td><td>24.0</td><td>0.0</td><td>3.800</td><td>0.0</td><td>0.0</td></tr><tr><td>1.400</td><td>0.0</td><td>0.0</td><td>4.000</td><td>0.0</td><td>0.0</td></tr><tr><td>1.600</td><td>0.0</td><td>0.0</td><td>4.200</td><td>0.0</td><td>0.0</td></tr><tr><td>1.800</td><td>0.0</td><td>0.0</td><td>4.400</td><td>0.0</td><td>0.0</td></tr><tr><td>2.000</td><td>0.0</td><td>0.0</td><td>4.600</td><td>0.0</td><td>0.0</td></tr><tr><td>2.200</td><td>0.0</td><td>0.0</td><td>4.800</td><td>0.0</td><td>0.0</td></tr><tr><td>2.400</td><td>0.0</td><td>0.0</td><td>5.000</td><td>0.0</td><td>0.0</td></tr></tbody></table>			Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	24.0	0.0	2.600	0.0	0.0	0.200	24.0	0.0	2.800	0.0	0.0	0.400	24.0	0.0	3.000	0.0	0.0	0.600	24.0	0.0	3.200	0.0	0.0	0.800	24.0	0.0	3.400	0.0	0.0	1.000	24.0	0.0	3.600	0.0	0.0	1.200	24.0	0.0	3.800	0.0	0.0	1.400	0.0	0.0	4.000	0.0	0.0	1.600	0.0	0.0	4.200	0.0	0.0	1.800	0.0	0.0	4.400	0.0	0.0	2.000	0.0	0.0	4.600	0.0	0.0	2.200	0.0	0.0	4.800	0.0	0.0	2.400	0.0	0.0	5.000	0.0	0.0
Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)																																																																																	
0.000	24.0	0.0	2.600	0.0	0.0																																																																																	
0.200	24.0	0.0	2.800	0.0	0.0																																																																																	
0.400	24.0	0.0	3.000	0.0	0.0																																																																																	
0.600	24.0	0.0	3.200	0.0	0.0																																																																																	
0.800	24.0	0.0	3.400	0.0	0.0																																																																																	
1.000	24.0	0.0	3.600	0.0	0.0																																																																																	
1.200	24.0	0.0	3.800	0.0	0.0																																																																																	
1.400	0.0	0.0	4.000	0.0	0.0																																																																																	
1.600	0.0	0.0	4.200	0.0	0.0																																																																																	
1.800	0.0	0.0	4.400	0.0	0.0																																																																																	
2.000	0.0	0.0	4.600	0.0	0.0																																																																																	
2.200	0.0	0.0	4.800	0.0	0.0																																																																																	
2.400	0.0	0.0	5.000	0.0	0.0																																																																																	
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Summary of Results for 30 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Water	Surcharged	Flooded	Flow / Cap.	Half Drain	Pipe	Status
		Level (m)	Depth (m)	Volume (m³)		Overflow (l/s)	Time (mins)	
1.000	S1	127.546	0.181	0.000	0.20		3.3	SURCHARGED
1.001	S2	127.543	0.348	0.000	0.62		10.3	SURCHARGED
1.002	S3	127.531	0.506	0.000	0.63		10.2	SURCHARGED
1.003	S4	127.526	0.616	0.000	0.94		10.1	SURCHARGED
2.000	S5	127.525	0.625	0.000	0.65		7.0	SURCHARGED
1.004	S6	127.525	0.645	0.000	0.06		1.0	SURCHARGED

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<u>Summary of Results for 60 minute 100 year Winter (Storm)</u> Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF Analysis Timestep Fine Inertia Status OFF DTS Status ON WARNING: Half Drain Time has not been calculated as the structure is too full.									
		Water	Surcharged	Flooded			Half Drain	Pipe	
	US/MH	Level	Depth	Volume	Flow /	Overflow	Time	Flow	
PN	Name	(m)	(m)	(m³)	Cap.	(l/s)	(mins)	(l/s)	Status
1.000	S1	127.655	0.290	0.000	0.17			2.9	SURCHARGED
1.001	S2	127.653	0.458	0.000	0.57			9.4	SURCHARGED
1.002	S3	127.645	0.620	0.000	0.58			9.3	SURCHARGED
1.003	S4	127.640	0.730	0.000	0.85			9.3	SURCHARGED
2.000	S5	127.639	0.739	0.000	0.40			4.3	SURCHARGED
1.004	S6	127.639	0.759	0.000	0.06			1.1	SURCHARGED
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Summary of Results for 120 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

WARNING: Half Drain Time has not been calculated as the structure is too full.

PN	US/MH Name	Water	Surcharged	Flooded	Flow / Cap.	Half Drain	Pipe	Status
		Level (m)	Depth (m)	Volume (m³)		Overflow (l/s)	Time (mins)	
1.000	S1	127.741	0.376	0.000	0.13		2.1	SURCHARGED
1.001	S2	127.740	0.545	0.000	0.43		7.1	SURCHARGED
1.002	S3	127.734	0.709	0.000	0.44		7.1	SURCHARGED
1.003	S4	127.729	0.819	0.000	0.65		7.0	SURCHARGED
2.000	S5	127.728	0.828	0.000	0.23		2.5	SURCHARGED
1.004	S6	127.728	0.848	0.000	0.06		1.1	SURCHARGED

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Summary of Results for 240 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

		Water	Surcharged	Flooded		Half Drain	Pipe	
	US/MH	Level	Depth	Volume	Flow / Overflow	Time	Flow	
PN	Name	(m)	(m)	(m³)	Cap. (l/s)	(mins)	(l/s)	Status
1.000	S1	127.750	0.385	0.000	0.08		1.4	SURCHARGED
1.001	S2	127.749	0.554	0.000	0.28		4.7	SURCHARGED
1.002	S3	127.746	0.721	0.000	0.29		4.6	SURCHARGED
1.003	S4	127.742	0.832	0.000	0.42		4.6	SURCHARGED
2.000	S5	127.741	0.841	0.000	0.14		1.5	SURCHARGED
1.004	S6	127.741	0.861	0.000	0.06	248	1.1	SURCHARGED

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Summary of Results for 360 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

		Water	Surcharged	Flooded		Half Drain	Pipe	
	US/MH	Level	Depth	Volume	Flow / Overflow	Time	Flow	
PN	Name	(m)	(m)	(m³)	Cap. (l/s)	(mins)	(l/s)	Status
1.000	S1	127.716	0.351	0.000	0.06		1.0	SURCHARGED
1.001	S2	127.715	0.520	0.000	0.21		3.5	SURCHARGED
1.002	S3	127.711	0.686	0.000	0.21		3.4	SURCHARGED
1.003	S4	127.708	0.798	0.000	0.31		3.4	SURCHARGED
2.000	S5	127.707	0.807	0.000	0.10		1.1	SURCHARGED
1.004	S6	127.707	0.827	0.000	0.06	294	1.1	SURCHARGED



Micro
Drainage

Summary of Results for 720 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm)	300.0	DVD Status	OFF
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	ON		

PN	US/MH Name	Water	Surcharged	Flooded	Flow / Cap.	Half Drain	Pipe	Status
		Level (m)	Depth (m)	Volume (m³)		Overflow (l/s)	Time (mins)	
1.000	S1	127.588	0.223	0.000	0.04		0.6	SURCHARGED
1.001	S2	127.587	0.392	0.000	0.12		2.1	SURCHARGED
1.002	S3	127.584	0.559	0.000	0.13		2.0	SURCHARGED
1.003	S4	127.580	0.670	0.000	0.19		2.0	SURCHARGED
2.000	S5	127.580	0.680	0.000	0.06		0.7	SURCHARGED
1.004	S6	127.579	0.699	0.000	0.06	348	1.0	SURCHARGED

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Summary of Results for 1440 minute 100 year Winter (Storm)

Margin for Flood Risk Warning (mm) 300.0 DVD Status OFF
 Analysis Timestep Fine Inertia Status OFF
 DTS Status ON

		Water	Surcharged	Flooded		Half Drain	Pipe		
PN	US/MH Name	Level (m)	Depth (m)	Volume (m³)	Flow / Cap.	Overflow (l/s)	Time (mins)	Flow (l/s)	Status
1.000	S1	127.408	0.043	0.000	0.02			0.4	SURCHARGED
1.001	S2	127.407	0.212	0.000	0.08			1.4	SURCHARGED
1.002	S3	127.404	0.379	0.000	0.08			1.3	SURCHARGED
1.003	S4	127.401	0.491	0.000	0.12			1.3	SURCHARGED
2.000	S5	127.401	0.501	0.000	0.04			0.4	SURCHARGED
1.004	S6	127.400	0.520	0.000	0.05		408	0.9	SURCHARGED