

White Young Green

Brigantine House
27-31 Cumberland Street
Bristol BS2 8NL

Date 30/07/2019 16:56
File SW NETWORK 1IN30.MDX

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Micro Drainage

Network 2018.1.1

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
1.008	13.022	0.271	48.0	0.000	0.00	0.0	0.600	o	225	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)
1.008	50.00	8.32	69.571	0.269	0.0	0.0	0.0	1.89	75.3	36.4

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Micro Drainage		Network 2018.1.1

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.030	0.030	0.030
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.053	0.053	0.053
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.067	0.067	0.067
1.006	-	-	100	0.050	0.050	0.050
1.007	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.069	0.069	0.069
2.001	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.269	0.269	0.269

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)
1.008		69.800	69.300	0.000	0	0

Simulation Criteria for Storm

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
Number of Online Controls		2	Number of Time/Area Diagrams
Number of Offline Controls		0	Number of Real Time Controls

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.800	Storm Duration (mins)	30
Ratio R	0.350		

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 8, DS/PN: 1.007, Volume (m³): 3.7

Unit Reference	MD-SHE-0086-3500-1200-3500
Design Head (m)	1.200
Design Flow (l/s)	3.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	86
Invert Level (m)	69.812
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	3.5
Flush-Flo™	0.367	3.5
Kick-Flo®	0.746	2.8
Mean Flow over Head Range	-	3.1

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	2.6	1.200	3.5	3.000	5.4	7.000	8.0
0.200	3.3	1.400	3.8	3.500	5.8	7.500	8.3
0.300	3.5	1.600	4.0	4.000	6.1	8.000	8.5
0.400	3.5	1.800	4.2	4.500	6.5	8.500	8.8
0.500	3.4	2.000	4.4	5.000	6.8	9.000	9.0
0.600	3.3	2.200	4.6	5.500	7.1	9.500	9.2
0.800	2.9	2.400	4.8	6.000	7.4		
1.000	3.2	2.600	5.0	6.500	7.7		

Hydro-Brake® Optimum Manhole: Tank 2, DS/PN: 2.001, Volume (m³): 3.0

Unit Reference	MD-SHE-0086-3500-1200-3500
Design Head (m)	1.200
Design Flow (l/s)	3.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	86
Invert Level (m)	70.600
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

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Storage Structures for Storm Tank or Pond Manhole: Tank 1, DS/PN: 1.006 Invert Level (m) 70.129 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>200.0</td><td>0.800</td><td>200.0</td><td>0.801</td><td>0.0</td></tr></tbody></table> Tank or Pond Manhole: Tank 2, DS/PN: 2.001 Invert Level (m) 70.600 <table><thead><tr><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th><th>Depth (m)</th><th>Area (m²)</th></tr></thead><tbody><tr><td>0.000</td><td>150.0</td><td>1.200</td><td>150.0</td><td>1.201</td><td>0.0</td></tr></tbody></table>			Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	200.0	0.800	200.0	0.801	0.0	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	0.000	150.0	1.200	150.0	1.201	0.0
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Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Flooded		Pipe		Status	Level Exceeded
		Depth (m)	Volume (m³)	Flow / Overflow Cap. (l/s)	Flow (l/s)		
1.005	6	0.742	0.000	2.06	34.5	SURCHARGED	
1.006	Tank 1	-0.018	0.000	0.17	6.7	OK	
1.007	8	0.479	0.000	0.09	3.5	SURCHARGED	
2.000	9	-0.145	0.000	0.27	21.1	OK	
2.001	Tank 2	-0.134	0.000	0.02	2.4	OK	
1.008	9	-0.181	0.000	0.09	5.5	OK	

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STORM SEWER DESIGN by the Modified Rational Method

Pipe Sizes STANDARD Manhole Sizes STANDARD

Designed with Level Soffits

« - Indicates pipe capacity < flow

Network Results Table

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Micro Drainage

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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
1.008	13.022	0.271	48.0	0.000	0.00	0.0	0.600	o	225	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)
1.008	50.00	8.32	69.571	0.269	0.0	0.0	0.0	1.89	75.3	36.4

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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	0.030	0.030	0.030
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.053	0.053	0.053
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.067	0.067	0.067
1.006	-	-	100	0.050	0.050	0.050
1.007	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.069	0.069	0.069
2.001	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.000	0.000	0.000
			Total	Total	Total	
				0.269	0.269	0.269

Surcharged Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.008		69.800	69.300	0.000	0	0
Datum (m) 69.300 Offset (mins) 0						

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
5	1.550	95	1.550	185	1.550	275	1.550	365	1.550	455	1.550
10	1.550	100	1.550	190	1.550	280	1.550	370	1.550	460	1.550
15	1.550	105	1.550	195	1.550	285	1.550	375	1.550	465	1.550
20	1.550	110	1.550	200	1.550	290	1.550	380	1.550	470	1.550
25	1.550	115	1.550	205	1.550	295	1.550	385	1.550	475	1.550
30	1.550	120	1.550	210	1.550	300	1.550	390	1.550	480	1.550
35	1.550	125	1.550	215	1.550	305	1.550	395	1.550	485	1.550
40	1.550	130	1.550	220	1.550	310	1.550	400	1.550	490	1.550
45	1.550	135	1.550	225	1.550	315	1.550	405	1.550	495	1.550
50	1.550	140	1.550	230	1.550	320	1.550	410	1.550	500	1.550
55	1.550	145	1.550	235	1.550	325	1.550	415	1.550	505	1.550
60	1.550	150	1.550	240	1.550	330	1.550	420	1.550	510	1.550
65	1.550	155	1.550	245	1.550	335	1.550	425	1.550	515	1.550
70	1.550	160	1.550	250	1.550	340	1.550	430	1.550	520	1.550
75	1.550	165	1.550	255	1.550	345	1.550	435	1.550	525	1.550
80	1.550	170	1.550	260	1.550	350	1.550	440	1.550	530	1.550
85	1.550	175	1.550	265	1.550	355	1.550	445	1.550	535	1.550
90	1.550	180	1.550	270	1.550	360	1.550	450	1.550	540	1.550

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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 Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
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Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
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Design Flow (l/s)	3.5
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Application	Surface
Sump Available	Yes
Diameter (mm)	86
Invert Level (m)	69.812
Minimum Outlet Pipe Diameter (mm)	100
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Control Points	Head (m)	Flow (l/s)
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0.300	3.5	1.600	4.0	4.000	6.1	8.000	8.5
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0.800	2.9	2.400	4.8	6.000	7.4		
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Flush-Flo™	0.367	3.5																																																																								
Kick-Flo®	0.746	2.8																																																																								
Mean Flow over Head Range	-	3.1																																																																								
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																																																																										
<table><tr><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td><td>Depth (m)</td><td>Flow (l/s)</td></tr><tr><td>0.100</td><td>2.6</td><td>1.200</td><td>3.5</td><td>3.000</td><td>5.4</td><td>7.000</td><td>8.0</td></tr><tr><td>0.200</td><td>3.3</td><td>1.400</td><td>3.8</td><td>3.500</td><td>5.8</td><td>7.500</td><td>8.3</td></tr><tr><td>0.300</td><td>3.5</td><td>1.600</td><td>4.0</td><td>4.000</td><td>6.1</td><td>8.000</td><td>8.5</td></tr><tr><td>0.400</td><td>3.5</td><td>1.800</td><td>4.2</td><td>4.500</td><td>6.5</td><td>8.500</td><td>8.8</td></tr><tr><td>0.500</td><td>3.4</td><td>2.000</td><td>4.4</td><td>5.000</td><td>6.8</td><td>9.000</td><td>9.0</td></tr><tr><td>0.600</td><td>3.3</td><td>2.200</td><td>4.6</td><td>5.500</td><td>7.1</td><td>9.500</td><td>9.2</td></tr><tr><td>0.800</td><td>2.9</td><td>2.400</td><td>4.8</td><td>6.000</td><td>7.4</td><td></td><td></td></tr><tr><td>1.000</td><td>3.2</td><td>2.600</td><td>5.0</td><td>6.500</td><td>7.7</td><td></td><td></td></tr></table>			Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	0.100	2.6	1.200	3.5	3.000	5.4	7.000	8.0	0.200	3.3	1.400	3.8	3.500	5.8	7.500	8.3	0.300	3.5	1.600	4.0	4.000	6.1	8.000	8.5	0.400	3.5	1.800	4.2	4.500	6.5	8.500	8.8	0.500	3.4	2.000	4.4	5.000	6.8	9.000	9.0	0.600	3.3	2.200	4.6	5.500	7.1	9.500	9.2	0.800	2.9	2.400	4.8	6.000	7.4			1.000	3.2	2.600	5.0	6.500	7.7		
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Brigantine House

27-31 Cumberland Street

Bristol BS2 8NL

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Micro Drainage

Network 2018.1.1

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 Storage Structures 2

Number of Online Controls 2

Number of Time/Area Diagrams 0

Number of Offline Controls 0

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) 18.800 Cv (Winter) 0.840

Margin for Flood Risk Warning (mm) 300.0

DVD Status ON

Analysis Timestep Fine

Inertia Status ON

DTS Status ON

Profile(s) Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440

Return Period(s) (years) 100

Climate Change (%) 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	30 Winter	100	+40%	100/15 Summer	100/15 Summer		
1.001	2	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
1.002	3	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
1.003	4	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
1.004	5	15 Summer	100	+40%	100/15 Summer			
1.005	6	15 Summer	100	+40%	100/15 Summer			
1.006	Tank 1	480 Winter	100	+40%	100/15 Summer			
1.007	8	360 Winter	100	+40%	100/15 Summer	100/360 Summer		
2.000	9	15 Winter	100	+40%				
2.001	Tank 2	480 Winter	100	+40%	100/360 Winter			
1.008	9	360 Winter	100	+40%	100/15 Summer			

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Pipe Flow / Cap. (l/s)	Overflow (l/s)	Status	Level Exceeded
1.000	1	73.005	0.905	4.908	2.17	12.7	FLOOD	6
1.001	2	73.000	1.079	0.186	0.80	13.4	FLOOD	5
1.002	3	73.000	1.275	0.183	0.97	14.9	FLOOD	5
1.003	4	73.003	1.356	3.244	1.56	26.4	FLOOD	5
1.004	5	72.967	1.583	0.000	1.69	26.2	FLOOD RISK	

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STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm Road

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	18.800	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

Network Design Table for Storm Road

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	27.095	0.181	149.7	0.026	5.00	0.0	0.600	o	225	Pipe/Conduit	
S1.001	14.108	0.094	150.1	0.000	0.00	0.0	0.600	o	225	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	5.42	70.610	0.026	0.0	0.0	0.0	1.07	42.4	3.5
S1.001	50.00	5.64	70.430	0.026	0.0	0.0	0.0	1.06	42.3	3.5

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Area Summary for Storm Road <table><thead><tr><th>Pipe Number</th><th>PIMP Type</th><th>PIMP Name</th><th>PIMP (%)</th><th>Gross Area (ha)</th><th>Imp. Area (ha)</th><th>Pipe Total (ha)</th></tr></thead><tbody><tr><td>1.000</td><td>-</td><td>-</td><td>100</td><td>0.026</td><td>0.026</td><td>0.026</td></tr><tr><td>1.001</td><td>-</td><td>-</td><td>100</td><td>0.000</td><td>0.000</td><td>0.000</td></tr><tr><td colspan="4"></td><td>Total</td><td>Total</td><td>Total</td></tr><tr><td colspan="4"></td><td>0.026</td><td>0.026</td><td>0.026</td></tr></tbody></table> Free Flowing Outfall Details for Storm Road <table><thead><tr><th>Outfall Pipe Number</th><th>Outfall Name</th><th>C. Level (m)</th><th>I. Level (m)</th><th>Min I. Level (m)</th><th>D,L (mm)</th><th>W (mm)</th></tr></thead><tbody><tr><td>S1.001</td><td>S</td><td>72.140</td><td>70.336</td><td>0.000</td><td>0</td><td>0</td></tr></tbody></table> Simulation Criteria for Storm Road <table><tbody><tr><td>Volumetric Runoff Coeff</td><td>0.750</td><td>Additional Flow - % of Total Flow</td><td>0.000</td></tr><tr><td>Areal Reduction Factor</td><td>1.000</td><td>MADD Factor * 10m³/ha Storage</td><td>2.000</td></tr><tr><td>Hot Start (mins)</td><td>0</td><td>Inlet Coefficient</td><td>0.800</td></tr><tr><td>Hot Start Level (mm)</td><td>0</td><td>Flow per Person per Day (l/per/day)</td><td>0.000</td></tr><tr><td>Manhole Headloss Coeff (Global)</td><td>0.500</td><td>Run Time (mins)</td><td>60</td></tr><tr><td>Foul Sewage per hectare (l/s)</td><td>0.000</td><td>Output Interval (mins)</td><td>1</td></tr><tr><td>Number of Input Hydrographs</td><td>0</td><td>Number of Storage Structures</td><td>0</td></tr><tr><td>Number of Online Controls</td><td>1</td><td>Number of Time/Area Diagrams</td><td>0</td></tr><tr><td>Number of Offline Controls</td><td>0</td><td>Number of Real Time Controls</td><td>0</td></tr></tbody></table> Synthetic Rainfall Details <table><tbody><tr><td>Rainfall Model</td><td>FSR</td><td>Profile Type</td><td>Summer</td></tr><tr><td>Return Period (years)</td><td>100</td><td>Cv (Summer)</td><td>0.750</td></tr><tr><td>Region</td><td>England and Wales</td><td>Cv (Winter)</td><td>0.840</td></tr><tr><td>M5-60 (mm)</td><td>18.800</td><td>Storm Duration (mins)</td><td>30</td></tr><tr><td>Ratio R</td><td>0.350</td><td></td><td></td></tr></tbody></table> ©1982-2018 Innovyze							Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)	1.000	-	-	100	0.026	0.026	0.026	1.001	-	-	100	0.000	0.000	0.000					Total	Total	Total					0.026	0.026	0.026	Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)	S1.001	S	72.140	70.336	0.000	0	0	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	0	Number of Online Controls	1	Number of Time/Area Diagrams	0	Number of Offline Controls	0	Number of Real Time Controls	0	Rainfall Model	FSR	Profile Type	Summer	Return Period (years)	100	Cv (Summer)	0.750	Region	England and Wales	Cv (Winter)	0.840	M5-60 (mm)	18.800	Storm Duration (mins)	30	Ratio R	0.350		
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Micro Drainage		Network 2018.1.1
<u>Online Controls for Storm Road</u> <u>Orifice Manhole: S2, DS/PN: S1.001, Volume (m³): 3.6</u> Diameter (m) 0.046 Discharge Coefficient 0.600 Invert Level (m) 70.430		
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