C3 Hydrological Assessment

File Note

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Project title	Hendre Lakes	Job number	252199
cc		File reference	
Prepared by	Sion Williams	Date	6 January 2020
Subject	Hendre Lakes - Hydrological Assessment		

1 Introduction

This technical note outlines the hydrological calculations undertaken to determine the Greenfield Runoff Rate (GRR) for the Cardiff Hendre Lakes proposals.

To calculate the attenuation volumes required for the scheme, the GRR for the 1, 30 and 100-year return period events are required as well as estimating the mean annual mean average annual flood flow (Qbar).

To calculate these, hydrological analysis has been undertaken on the existing catchments of the reen network. Three calculation methods were considered to derive the GRR for the site which consisted of the FEH Statistical, ReFH rainfall-runoff (Version 2.2) and IH124 methods. Owing to the size of the development (approx. 34Ha), its location in relation to gauged river catchments and reen network catchments, the FEH Statistical method has been discounted. The parameters used and results from each of the other analysis are detailed in the sections below.

2 IH124 Method

To undertake the IH124 Method, the source control module within Microdrainage was used.

The standard annual average runoff (SAAR) value of 992mm was applied using the interactive map within the microdrainage software. Other parameters that were defined included:

- Proportion of area urbanised, expressed as a decimal: Urban = 0
- Soil index of the catchment from Flood Studies Report (FSR) Figure I.4.18 or Wallingford Procedure Volume 3 Soil of 0.3
- Region number of the catchment based on FSR Figure I.2.4. is Region 9

The area of the reen catchment contained within the planning application boundary was measured to be 43Ha (note: estimates below have been derived using a 50Ha catchment area and then adjusted

on a pro rata basis). The peak GRR has been calculated for the 1 year, 30 year and 100-year return period events and was subsequently scaled by the area to give the GRR per hectare:

- 1 in 1 year rainfall event: 2.4 l/s/Ha
- 1 in 30 year rainfall event: 4.8 l/s/Ha
- 1 in 100 year rainfall event: 6.0 l/s/Ha

A mean average annual flood flow (Qbar) was also estimated to be 117l/s, equivalent to 2.7l/s/Ha Refer to Figure 1 for further details.

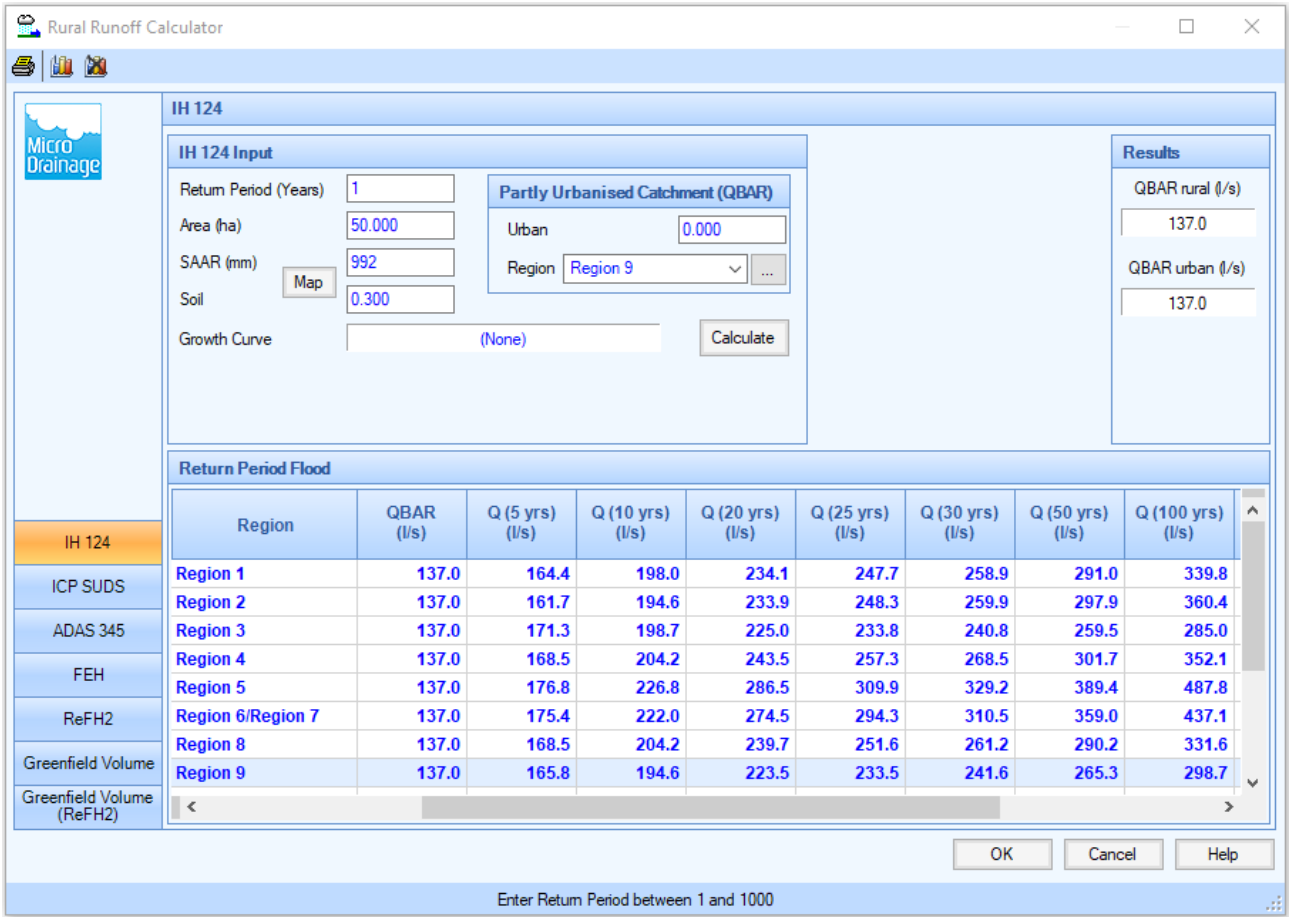


Figure 1: IH124 Calculation Results.

3 ReFH Version 2.2

The catchment descriptors purchased from the FEH Online service were imported into the ReFH2 software (version 2.2) for the particular site. Within the software, the FEH13 DDF rainfall model was applied.

The default storm duration recommended by ReFH2 was used to calculate the GRR. This corresponded to the 2 hour 15 minute storm event. A timestep of 15 minutes was applied. The 1, 30 and 100-year peak flow outputs were scaled by the subject catchment area to obtain GRR per

hectare and are shown in Table 1 below. Both the winter and summer seasonal values have been provided. Refer to Appendix A for further details.

Table 1: Derived GRR from the ReFH2 Analysis		
Return Period	Winter (l/s/Ha)	Summer (l/s/Ha)
1 in 1 Year	1.9	2.8
1 in 30 Year	4.9	7.2
1 in 100 Year	6.7	9.8

A Qbar was also estimated which is approximately 1.07 times the median annual flow rate (1 in 2 year rerun period / Qmed). This was estimated by multiplying the Qmed by 1.07. Table 2 summarises the results.

Table 2: Derived Qbar from the ReFH2 Analysis			
	Qmed (l/s)	**Qbar (l/s)**	**Qbar (l/s/Ha)**
Winter	100	**107**	**2.5**
Summer	130	**139**	**3.2**

It is important that the critical storm event is used to inform the drainage strategy. This is to ensure they as far as reasonably practicable replicate the existing conditions on-site. Since the GRR was calculated was lower for the winter seasonality, and these are similar to those derived using the IH124 method, the winter GRR values will be applied to inform the proposed drainage network design. If the Qbar was to be used as the proposed allowable discharge from the site, then the average value would be adopted between the summer and winter values i.e. 2.85l/s/Ha. This would reduce the risk of blockages occurring within the drainage network when compared to the lower GRR winter value (i.e. allowable discharge rates <5l/s) and provides a substantial betterment to the existing conditions when compared to the 1 in 30 and 1 in 100 year return periods. This value is also similar to that derived using the IH124 method.

4 Conclusion

A hydrological study of the site has been undertaken using the IH124 and ReFH2 methods.

The GRR estimates calculated using the IH124 and ReFH2 methods for the summer values are similar. The Qbar values for the IH124 method and the average Qbar derived using ReFH2 are also similar. As such, it is proposed that the estimates summarised in Table 3 below will be adopted to inform the drainage strategy for the proposed development. This also considers the potential risk of blockages occurring within the drainage network.

Table 3: Derived GRR and GRR Values adopted to inform Drainage Strategy	
Return Period	(l/s/Ha)
1 in 1 Year	2.4
1 in 30 Year	4.8
1 in 100 Year	6.0
Qbar	2.85

File Note

252199 6 January 2020

Please note, where culverts are proposed to convey flows below roads etc. these will be sized using CIRIA C689 Guide to ensure adequate sizing of proposed culverts.

A1 ReFH Version 2.2 Output

UK Design Flood Estimation

Generated on Friday, January 3, 2020 9:27:01 AM by Rob.Varley
Printed from the ReFH Flood Modelling software package, version 2.2.7059.19021

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: 325A-2B97

Site name: Cardiff Parkway

Easting: 325055

Northing: 181076

Country: England, Wales or Northern Ireland

Catchment Area (km^2): 0.43 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 1 year

Summary of results

Rainfall - FEH 2013 (mm):	16.25	Total runoff (ML):	0.81
Total Rainfall (mm):	15.29	Total flow (ML):	2.50
Peak Rainfall (mm):	5.42	Peak flow (m^3/s):	0.12

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	02:15:00	No
Timestep (hh:mm:ss)	00:15:00	No
SCF (Seasonal correction factor)	0.96	No
ARF (Areal reduction factor)	0.98	No
Seasonality	Summer	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	72.81	No
Cmax (mm)	653.19	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	1.13 [1.08]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0.01	No
BL (hr)	42.85 [42.36]	Yes
BR	2.09	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	0.4518	0.0000	0.0505	0.0000	0.0116	0.0116
00:15:00	0.7396	0.0000	0.0834	0.0004	0.0116	0.012
00:30:00	1.2761	0.0000	0.1458	0.0018	0.0115	0.0133
00:45:00	2.4689	0.0000	0.2892	0.0050	0.0115	0.0165
01:00:00	5.4201	0.0000	0.6676	0.0115	0.0115	0.023
01:15:00	2.4689	0.0000	0.3190	0.0252	0.0117	0.0369
01:30:00	1.2761	0.0000	0.1686	0.0453	0.0121	0.0573
01:45:00	0.7396	0.0000	0.0988	0.0670	0.0127	0.0796
02:00:00	0.4518	0.0000	0.0608	0.0869	0.0135	0.1
02:15:00	0.0000	0.0000	0.0000	0.1004	0.0146	0.115
02:30:00	0.0000	0.0000	0.0000	0.1004	0.0157	0.116
02:45:00	0.0000	0.0000	0.0000	0.0924	0.0168	0.109
03:00:00	0.0000	0.0000	0.0000	0.0806	0.0177	0.0983
03:15:00	0.0000	0.0000	0.0000	0.0674	0.0185	0.0859
03:30:00	0.0000	0.0000	0.0000	0.0552	0.0192	0.0743
03:45:00	0.0000	0.0000	0.0000	0.0452	0.0197	0.0649
04:00:00	0.0000	0.0000	0.0000	0.0365	0.0201	0.0566
04:15:00	0.0000	0.0000	0.0000	0.0285	0.0203	0.0488
04:30:00	0.0000	0.0000	0.0000	0.0212	0.0205	0.0417
04:45:00	0.0000	0.0000	0.0000	0.0144	0.0206	0.035
05:00:00	0.0000	0.0000	0.0000	0.0084	0.0206	0.029
05:15:00	0.0000	0.0000	0.0000	0.0040	0.0206	0.0246
05:30:00	0.0000	0.0000	0.0000	0.0018	0.0205	0.0223
05:45:00	0.0000	0.0000	0.0000	0.0007	0.0204	0.0211
06:00:00	0.0000	0.0000	0.0000	0.0002	0.0203	0.0205
06:15:00	0.0000	0.0000	0.0000	0.0000	0.0202	0.0202
06:30:00	0.0000	0.0000	0.0000	0.0000	0.02	0.02
06:45:00	0.0000	0.0000	0.0000	0.0000	0.0199	0.0199
07:00:00	0.0000	0.0000	0.0000	0.0000	0.0198	0.0198
07:15:00	0.0000	0.0000	0.0000	0.0000	0.0197	0.0197
07:30:00	0.0000	0.0000	0.0000	0.0000	0.0196	0.0196
07:45:00	0.0000	0.0000	0.0000	0.0000	0.0195	0.0195
08:00:00	0.0000	0.0000	0.0000	0.0000	0.0194	0.0194
08:15:00	0.0000	0.0000	0.0000	0.0000	0.0192	0.0192
08:30:00	0.0000	0.0000	0.0000	0.0000	0.0191	0.0191

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
08:45:00	0.0000	0.0000	0.0000	0.0000	0.019	0.019
09:00:00	0.0000	0.0000	0.0000	0.0000	0.0189	0.0189
09:15:00	0.0000	0.0000	0.0000	0.0000	0.0188	0.0188
09:30:00	0.0000	0.0000	0.0000	0.0000	0.0187	0.0187
09:45:00	0.0000	0.0000	0.0000	0.0000	0.0186	0.0186
10:00:00	0.0000	0.0000	0.0000	0.0000	0.0185	0.0185
10:15:00	0.0000	0.0000	0.0000	0.0000	0.0184	0.0184
10:30:00	0.0000	0.0000	0.0000	0.0000	0.0183	0.0183
10:45:00	0.0000	0.0000	0.0000	0.0000	0.0182	0.0182
11:00:00	0.0000	0.0000	0.0000	0.0000	0.018	0.018
11:15:00	0.0000	0.0000	0.0000	0.0000	0.0179	0.0179
11:30:00	0.0000	0.0000	0.0000	0.0000	0.0178	0.0178
11:45:00	0.0000	0.0000	0.0000	0.0000	0.0177	0.0177
12:00:00	0.0000	0.0000	0.0000	0.0000	0.0176	0.0176
12:15:00	0.0000	0.0000	0.0000	0.0000	0.0175	0.0175
12:30:00	0.0000	0.0000	0.0000	0.0000	0.0174	0.0174
12:45:00	0.0000	0.0000	0.0000	0.0000	0.0173	0.0173
13:00:00	0.0000	0.0000	0.0000	0.0000	0.0172	0.0172
13:15:00	0.0000	0.0000	0.0000	0.0000	0.0171	0.0171
13:30:00	0.0000	0.0000	0.0000	0.0000	0.017	0.017
13:45:00	0.0000	0.0000	0.0000	0.0000	0.0169	0.0169
14:00:00	0.0000	0.0000	0.0000	0.0000	0.0168	0.0168
14:15:00	0.0000	0.0000	0.0000	0.0000	0.0167	0.0167
14:30:00	0.0000	0.0000	0.0000	0.0000	0.0166	0.0166
14:45:00	0.0000	0.0000	0.0000	0.0000	0.0165	0.0165
15:00:00	0.0000	0.0000	0.0000	0.0000	0.0164	0.0164
15:15:00	0.0000	0.0000	0.0000	0.0000	0.0163	0.0163
15:30:00	0.0000	0.0000	0.0000	0.0000	0.0162	0.0162
15:45:00	0.0000	0.0000	0.0000	0.0000	0.0162	0.0162
16:00:00	0.0000	0.0000	0.0000	0.0000	0.0161	0.0161
16:15:00	0.0000	0.0000	0.0000	0.0000	0.016	0.016
16:30:00	0.0000	0.0000	0.0000	0.0000	0.0159	0.0159
16:45:00	0.0000	0.0000	0.0000	0.0000	0.0158	0.0158
17:00:00	0.0000	0.0000	0.0000	0.0000	0.0157	0.0157
17:15:00	0.0000	0.0000	0.0000	0.0000	0.0156	0.0156
17:30:00	0.0000	0.0000	0.0000	0.0000	0.0155	0.0155

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
17:45:00	0.0000	0.0000	0.0000	0.0000	0.0154	0.0154
18:00:00	0.0000	0.0000	0.0000	0.0000	0.0153	0.0153
18:15:00	0.0000	0.0000	0.0000	0.0000	0.0152	0.0152
18:30:00	0.0000	0.0000	0.0000	0.0000	0.0151	0.0151
18:45:00	0.0000	0.0000	0.0000	0.0000	0.0151	0.0151
19:00:00	0.0000	0.0000	0.0000	0.0000	0.015	0.015
19:15:00	0.0000	0.0000	0.0000	0.0000	0.0149	0.0149
19:30:00	0.0000	0.0000	0.0000	0.0000	0.0148	0.0148
19:45:00	0.0000	0.0000	0.0000	0.0000	0.0147	0.0147
20:00:00	0.0000	0.0000	0.0000	0.0000	0.0146	0.0146
20:15:00	0.0000	0.0000	0.0000	0.0000	0.0145	0.0145
20:30:00	0.0000	0.0000	0.0000	0.0000	0.0145	0.0145
20:45:00	0.0000	0.0000	0.0000	0.0000	0.0144	0.0144
21:00:00	0.0000	0.0000	0.0000	0.0000	0.0143	0.0143
21:15:00	0.0000	0.0000	0.0000	0.0000	0.0142	0.0142
21:30:00	0.0000	0.0000	0.0000	0.0000	0.0141	0.0141
21:45:00	0.0000	0.0000	0.0000	0.0000	0.014	0.014
22:00:00	0.0000	0.0000	0.0000	0.0000	0.014	0.014
22:15:00	0.0000	0.0000	0.0000	0.0000	0.0139	0.0139
22:30:00	0.0000	0.0000	0.0000	0.0000	0.0138	0.0138
22:45:00	0.0000	0.0000	0.0000	0.0000	0.0137	0.0137
23:00:00	0.0000	0.0000	0.0000	0.0000	0.0136	0.0136
23:15:00	0.0000	0.0000	0.0000	0.0000	0.0136	0.0136
23:30:00	0.0000	0.0000	0.0000	0.0000	0.0135	0.0135
23:45:00	0.0000	0.0000	0.0000	0.0000	0.0134	0.0134
24:00:00	0.0000	0.0000	0.0000	0.0000	0.0133	0.0133
24:15:00	0.0000	0.0000	0.0000	0.0000	0.0132	0.0132
24:30:00	0.0000	0.0000	0.0000	0.0000	0.0132	0.0132
24:45:00	0.0000	0.0000	0.0000	0.0000	0.0131	0.0131
25:00:00	0.0000	0.0000	0.0000	0.0000	0.013	0.013
25:15:00	0.0000	0.0000	0.0000	0.0000	0.0129	0.0129
25:30:00	0.0000	0.0000	0.0000	0.0000	0.0129	0.0129
25:45:00	0.0000	0.0000	0.0000	0.0000	0.0128	0.0128
26:00:00	0.0000	0.0000	0.0000	0.0000	0.0127	0.0127
26:15:00	0.0000	0.0000	0.0000	0.0000	0.0126	0.0126
26:30:00	0.0000	0.0000	0.0000	0.0000	0.0126	0.0126

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
26:45:00	0.0000	0.0000	0.0000	0.0000	0.0125	0.0125
27:00:00	0.0000	0.0000	0.0000	0.0000	0.0124	0.0124
27:15:00	0.0000	0.0000	0.0000	0.0000	0.0124	0.0124
27:30:00	0.0000	0.0000	0.0000	0.0000	0.0123	0.0123
27:45:00	0.0000	0.0000	0.0000	0.0000	0.0122	0.0122
28:00:00	0.0000	0.0000	0.0000	0.0000	0.0121	0.0121
28:15:00	0.0000	0.0000	0.0000	0.0000	0.0121	0.0121
28:30:00	0.0000	0.0000	0.0000	0.0000	0.012	0.012
28:45:00	0.0000	0.0000	0.0000	0.0000	0.0119	0.0119
29:00:00	0.0000	0.0000	0.0000	0.0000	0.0119	0.0119
29:15:00	0.0000	0.0000	0.0000	0.0000	0.0118	0.0118
29:30:00	0.0000	0.0000	0.0000	0.0000	0.0117	0.0117

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.71	No
PROPWET (mm)	0.47	No
SAAR (mm)	999	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Thursday, January 2, 2020 3:10:42 PM by Rob.Varley
Printed from the ReFH Flood Modelling software package, version 2.2.7059.19021

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: E0D7-263B

Site name: Cardiff Parkway

Easting: 325055

Northing: 181076

Country: England, Wales or Northern Ireland

Catchment Area (km^2): 0.43 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 1 year

Summary of results

Rainfall - FEH 2013 (mm):	16.25	Total runoff (ML):	0.58
Total Rainfall (mm):	11.25	Total flow (ML):	1.79
Peak Rainfall (mm):	3.06	Peak flow (m^3/s):	0.08

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	02:15:00	No
Timestep (hh:mm:ss)	00:15:00	No
SCF (Seasonal correction factor)	0.71	No
ARF (Areal reduction factor)	0.98	No
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	72.81	No
Cmax (mm)	653.19	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	1.13 [1.08]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0.01	No
BL (hr)	42.85 [42.36]	Yes
BR	2.09	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	0.3215	0.0000	0.0359	0.0000	0.0106	0.0106
00:15:00	0.6032	0.0000	0.0678	0.0003	0.0106	0.0109
00:30:00	1.1215	0.0000	0.1276	0.0013	0.0105	0.0119
00:45:00	2.0487	0.0000	0.2380	0.0039	0.0105	0.0144
01:00:00	3.0594	0.0000	0.3674	0.0093	0.0105	0.0198
01:15:00	2.0487	0.0000	0.2540	0.0192	0.0106	0.0298
01:30:00	1.1215	0.0000	0.1418	0.0330	0.0109	0.0439
01:45:00	0.6032	0.0000	0.0770	0.0481	0.0113	0.0594
02:00:00	0.3215	0.0000	0.0413	0.0616	0.0119	0.0736
02:15:00	0.0000	0.0000	0.0000	0.0702	0.0126	0.0829
02:30:00	0.0000	0.0000	0.0000	0.0711	0.0134	0.0845
02:45:00	0.0000	0.0000	0.0000	0.0659	0.0142	0.0801
03:00:00	0.0000	0.0000	0.0000	0.0577	0.0148	0.0726
03:15:00	0.0000	0.0000	0.0000	0.0485	0.0154	0.0639
03:30:00	0.0000	0.0000	0.0000	0.0397	0.0158	0.0556
03:45:00	0.0000	0.0000	0.0000	0.0324	0.0162	0.0486
04:00:00	0.0000	0.0000	0.0000	0.0261	0.0165	0.0425
04:15:00	0.0000	0.0000	0.0000	0.0204	0.0166	0.037
04:30:00	0.0000	0.0000	0.0000	0.0151	0.0168	0.0319
04:45:00	0.0000	0.0000	0.0000	0.0103	0.0168	0.0271
05:00:00	0.0000	0.0000	0.0000	0.0061	0.0168	0.023
05:15:00	0.0000	0.0000	0.0000	0.0031	0.0168	0.0199
05:30:00	0.0000	0.0000	0.0000	0.0014	0.0167	0.0181
05:45:00	0.0000	0.0000	0.0000	0.0005	0.0166	0.0171
06:00:00	0.0000	0.0000	0.0000	0.0001	0.0165	0.0166
06:15:00	0.0000	0.0000	0.0000	0.0000	0.0164	0.0164
06:30:00	0.0000	0.0000	0.0000	0.0000	0.0163	0.0163
06:45:00	0.0000	0.0000	0.0000	0.0000	0.0162	0.0162
07:00:00	0.0000	0.0000	0.0000	0.0000	0.0161	0.0161
07:15:00	0.0000	0.0000	0.0000	0.0000	0.0161	0.0161
07:30:00	0.0000	0.0000	0.0000	0.0000	0.016	0.016
07:45:00	0.0000	0.0000	0.0000	0.0000	0.0159	0.0159
08:00:00	0.0000	0.0000	0.0000	0.0000	0.0158	0.0158
08:15:00	0.0000	0.0000	0.0000	0.0000	0.0157	0.0157
08:30:00	0.0000	0.0000	0.0000	0.0000	0.0156	0.0156

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
08:45:00	0.0000	0.0000	0.0000	0.0000	0.0155	0.0155
09:00:00	0.0000	0.0000	0.0000	0.0000	0.0154	0.0154
09:15:00	0.0000	0.0000	0.0000	0.0000	0.0153	0.0153
09:30:00	0.0000	0.0000	0.0000	0.0000	0.0152	0.0152
09:45:00	0.0000	0.0000	0.0000	0.0000	0.0151	0.0151
10:00:00	0.0000	0.0000	0.0000	0.0000	0.0151	0.0151
10:15:00	0.0000	0.0000	0.0000	0.0000	0.015	0.015
10:30:00	0.0000	0.0000	0.0000	0.0000	0.0149	0.0149
10:45:00	0.0000	0.0000	0.0000	0.0000	0.0148	0.0148
11:00:00	0.0000	0.0000	0.0000	0.0000	0.0147	0.0147
11:15:00	0.0000	0.0000	0.0000	0.0000	0.0146	0.0146
11:30:00	0.0000	0.0000	0.0000	0.0000	0.0145	0.0145
11:45:00	0.0000	0.0000	0.0000	0.0000	0.0145	0.0145
12:00:00	0.0000	0.0000	0.0000	0.0000	0.0144	0.0144
12:15:00	0.0000	0.0000	0.0000	0.0000	0.0143	0.0143
12:30:00	0.0000	0.0000	0.0000	0.0000	0.0142	0.0142
12:45:00	0.0000	0.0000	0.0000	0.0000	0.0141	0.0141
13:00:00	0.0000	0.0000	0.0000	0.0000	0.014	0.014
13:15:00	0.0000	0.0000	0.0000	0.0000	0.014	0.014
13:30:00	0.0000	0.0000	0.0000	0.0000	0.0139	0.0139
13:45:00	0.0000	0.0000	0.0000	0.0000	0.0138	0.0138
14:00:00	0.0000	0.0000	0.0000	0.0000	0.0137	0.0137
14:15:00	0.0000	0.0000	0.0000	0.0000	0.0136	0.0136
14:30:00	0.0000	0.0000	0.0000	0.0000	0.0136	0.0136
14:45:00	0.0000	0.0000	0.0000	0.0000	0.0135	0.0135
15:00:00	0.0000	0.0000	0.0000	0.0000	0.0134	0.0134
15:15:00	0.0000	0.0000	0.0000	0.0000	0.0133	0.0133
15:30:00	0.0000	0.0000	0.0000	0.0000	0.0132	0.0132
15:45:00	0.0000	0.0000	0.0000	0.0000	0.0132	0.0132
16:00:00	0.0000	0.0000	0.0000	0.0000	0.0131	0.0131
16:15:00	0.0000	0.0000	0.0000	0.0000	0.013	0.013
16:30:00	0.0000	0.0000	0.0000	0.0000	0.0129	0.0129
16:45:00	0.0000	0.0000	0.0000	0.0000	0.0129	0.0129
17:00:00	0.0000	0.0000	0.0000	0.0000	0.0128	0.0128
17:15:00	0.0000	0.0000	0.0000	0.0000	0.0127	0.0127
17:30:00	0.0000	0.0000	0.0000	0.0000	0.0126	0.0126

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
17:45:00	0.0000	0.0000	0.0000	0.0000	0.0126	0.0126
18:00:00	0.0000	0.0000	0.0000	0.0000	0.0125	0.0125
18:15:00	0.0000	0.0000	0.0000	0.0000	0.0124	0.0124
18:30:00	0.0000	0.0000	0.0000	0.0000	0.0123	0.0123
18:45:00	0.0000	0.0000	0.0000	0.0000	0.0123	0.0123
19:00:00	0.0000	0.0000	0.0000	0.0000	0.0122	0.0122
19:15:00	0.0000	0.0000	0.0000	0.0000	0.0121	0.0121
19:30:00	0.0000	0.0000	0.0000	0.0000	0.0121	0.0121
19:45:00	0.0000	0.0000	0.0000	0.0000	0.012	0.012
20:00:00	0.0000	0.0000	0.0000	0.0000	0.0119	0.0119
20:15:00	0.0000	0.0000	0.0000	0.0000	0.0119	0.0119
20:30:00	0.0000	0.0000	0.0000	0.0000	0.0118	0.0118
20:45:00	0.0000	0.0000	0.0000	0.0000	0.0117	0.0117
21:00:00	0.0000	0.0000	0.0000	0.0000	0.0116	0.0116
21:15:00	0.0000	0.0000	0.0000	0.0000	0.0116	0.0116
21:30:00	0.0000	0.0000	0.0000	0.0000	0.0115	0.0115
21:45:00	0.0000	0.0000	0.0000	0.0000	0.0114	0.0114
22:00:00	0.0000	0.0000	0.0000	0.0000	0.0114	0.0114
22:15:00	0.0000	0.0000	0.0000	0.0000	0.0113	0.0113
22:30:00	0.0000	0.0000	0.0000	0.0000	0.0112	0.0112
22:45:00	0.0000	0.0000	0.0000	0.0000	0.0112	0.0112
23:00:00	0.0000	0.0000	0.0000	0.0000	0.0111	0.0111
23:15:00	0.0000	0.0000	0.0000	0.0000	0.0111	0.0111
23:30:00	0.0000	0.0000	0.0000	0.0000	0.011	0.011
23:45:00	0.0000	0.0000	0.0000	0.0000	0.0109	0.0109
24:00:00	0.0000	0.0000	0.0000	0.0000	0.0109	0.0109
24:15:00	0.0000	0.0000	0.0000	0.0000	0.0108	0.0108
24:30:00	0.0000	0.0000	0.0000	0.0000	0.0107	0.0107

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.71	No
PROPWET (mm)	0.47	No
SAAR (mm)	999	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Thursday, January 2, 2020 4:07:13 PM by Rob.Varley
Printed from the ReFH Flood Modelling software package, version 2.2.7059.19021

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: 76DF-6AD4

Site name: Cardiff Parkway

Easting: 325055

Northing: 181076

Country: England, Wales or Northern Ireland

Catchment Area (km^2): 0.43 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 2 year

Summary of results

Rainfall - FEH 2013 (mm):	18.56	Total runoff (ML):	0.94
Total Rainfall (mm):	17.47	Total flow (ML):	2.89
Peak Rainfall (mm):	6.19	Peak flow (m^3/s):	0.13

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	02:15:00	No
Timestep (hh:mm:ss)	00:15:00	No
SCF (Seasonal correction factor)	0.96	No
ARF (Areal reduction factor)	0.98	No
Seasonality	Summer	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	72.81	No
Cmax (mm)	653.19	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	1.13 [1.08]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0.01	No
BL (hr)	42.85 [42.36]	Yes
BR	2.09	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	0.5161	0.0000	0.0577	0.0000	0.0116	0.0116
00:15:00	0.8448	0.0000	0.0954	0.0004	0.0116	0.012
00:30:00	1.4577	0.0000	0.1672	0.0021	0.0115	0.0136
00:45:00	2.8203	0.0000	0.3326	0.0057	0.0115	0.0172
01:00:00	6.1914	0.0000	0.7730	0.0132	0.0116	0.0247
01:15:00	2.8203	0.0000	0.3715	0.0289	0.0117	0.0407
01:30:00	1.4577	0.0000	0.1968	0.0521	0.0122	0.0643
01:45:00	0.8448	0.0000	0.1156	0.0772	0.0129	0.0901
02:00:00	0.5161	0.0000	0.0711	0.1004	0.0139	0.114
02:15:00	0.0000	0.0000	0.0000	0.1161	0.0151	0.131
02:30:00	0.0000	0.0000	0.0000	0.1163	0.0164	0.133
02:45:00	0.0000	0.0000	0.0000	0.1071	0.0177	0.125
03:00:00	0.0000	0.0000	0.0000	0.0935	0.0188	0.112
03:15:00	0.0000	0.0000	0.0000	0.0782	0.0197	0.0979
03:30:00	0.0000	0.0000	0.0000	0.0640	0.0205	0.0845
03:45:00	0.0000	0.0000	0.0000	0.0525	0.0211	0.0736
04:00:00	0.0000	0.0000	0.0000	0.0424	0.0215	0.0639
04:15:00	0.0000	0.0000	0.0000	0.0331	0.0219	0.055
04:30:00	0.0000	0.0000	0.0000	0.0246	0.0221	0.0467
04:45:00	0.0000	0.0000	0.0000	0.0167	0.0222	0.0389
05:00:00	0.0000	0.0000	0.0000	0.0097	0.0222	0.032
05:15:00	0.0000	0.0000	0.0000	0.0047	0.0222	0.0269
05:30:00	0.0000	0.0000	0.0000	0.0021	0.0221	0.0242
05:45:00	0.0000	0.0000	0.0000	0.0008	0.022	0.0228
06:00:00	0.0000	0.0000	0.0000	0.0002	0.0219	0.0221
06:15:00	0.0000	0.0000	0.0000	0.0000	0.0218	0.0218
06:30:00	0.0000	0.0000	0.0000	0.0000	0.0216	0.0216
06:45:00	0.0000	0.0000	0.0000	0.0000	0.0215	0.0215
07:00:00	0.0000	0.0000	0.0000	0.0000	0.0214	0.0214
07:15:00	0.0000	0.0000	0.0000	0.0000	0.0213	0.0213
07:30:00	0.0000	0.0000	0.0000	0.0000	0.0211	0.0211
07:45:00	0.0000	0.0000	0.0000	0.0000	0.021	0.021
08:00:00	0.0000	0.0000	0.0000	0.0000	0.0209	0.0209
08:15:00	0.0000	0.0000	0.0000	0.0000	0.0208	0.0208
08:30:00	0.0000	0.0000	0.0000	0.0000	0.0206	0.0206

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
08:45:00	0.0000	0.0000	0.0000	0.0000	0.0205	0.0205
09:00:00	0.0000	0.0000	0.0000	0.0000	0.0204	0.0204
09:15:00	0.0000	0.0000	0.0000	0.0000	0.0203	0.0203
09:30:00	0.0000	0.0000	0.0000	0.0000	0.0202	0.0202
09:45:00	0.0000	0.0000	0.0000	0.0000	0.02	0.02
10:00:00	0.0000	0.0000	0.0000	0.0000	0.0199	0.0199
10:15:00	0.0000	0.0000	0.0000	0.0000	0.0198	0.0198
10:30:00	0.0000	0.0000	0.0000	0.0000	0.0197	0.0197
10:45:00	0.0000	0.0000	0.0000	0.0000	0.0196	0.0196
11:00:00	0.0000	0.0000	0.0000	0.0000	0.0195	0.0195
11:15:00	0.0000	0.0000	0.0000	0.0000	0.0194	0.0194
11:30:00	0.0000	0.0000	0.0000	0.0000	0.0192	0.0192
11:45:00	0.0000	0.0000	0.0000	0.0000	0.0191	0.0191
12:00:00	0.0000	0.0000	0.0000	0.0000	0.019	0.019
12:15:00	0.0000	0.0000	0.0000	0.0000	0.0189	0.0189
12:30:00	0.0000	0.0000	0.0000	0.0000	0.0188	0.0188
12:45:00	0.0000	0.0000	0.0000	0.0000	0.0187	0.0187
13:00:00	0.0000	0.0000	0.0000	0.0000	0.0186	0.0186
13:15:00	0.0000	0.0000	0.0000	0.0000	0.0185	0.0185
13:30:00	0.0000	0.0000	0.0000	0.0000	0.0184	0.0184
13:45:00	0.0000	0.0000	0.0000	0.0000	0.0183	0.0183
14:00:00	0.0000	0.0000	0.0000	0.0000	0.0182	0.0182
14:15:00	0.0000	0.0000	0.0000	0.0000	0.018	0.018
14:30:00	0.0000	0.0000	0.0000	0.0000	0.0179	0.0179
14:45:00	0.0000	0.0000	0.0000	0.0000	0.0178	0.0178
15:00:00	0.0000	0.0000	0.0000	0.0000	0.0177	0.0177
15:15:00	0.0000	0.0000	0.0000	0.0000	0.0176	0.0176
15:30:00	0.0000	0.0000	0.0000	0.0000	0.0175	0.0175
15:45:00	0.0000	0.0000	0.0000	0.0000	0.0174	0.0174
16:00:00	0.0000	0.0000	0.0000	0.0000	0.0173	0.0173
16:15:00	0.0000	0.0000	0.0000	0.0000	0.0172	0.0172
16:30:00	0.0000	0.0000	0.0000	0.0000	0.0171	0.0171
16:45:00	0.0000	0.0000	0.0000	0.0000	0.017	0.017
17:00:00	0.0000	0.0000	0.0000	0.0000	0.0169	0.0169
17:15:00	0.0000	0.0000	0.0000	0.0000	0.0168	0.0168
17:30:00	0.0000	0.0000	0.0000	0.0000	0.0167	0.0167

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
17:45:00	0.0000	0.0000	0.0000	0.0000	0.0166	0.0166
18:00:00	0.0000	0.0000	0.0000	0.0000	0.0165	0.0165
18:15:00	0.0000	0.0000	0.0000	0.0000	0.0164	0.0164
18:30:00	0.0000	0.0000	0.0000	0.0000	0.0163	0.0163
18:45:00	0.0000	0.0000	0.0000	0.0000	0.0163	0.0163
19:00:00	0.0000	0.0000	0.0000	0.0000	0.0162	0.0162
19:15:00	0.0000	0.0000	0.0000	0.0000	0.0161	0.0161
19:30:00	0.0000	0.0000	0.0000	0.0000	0.016	0.016
19:45:00	0.0000	0.0000	0.0000	0.0000	0.0159	0.0159
20:00:00	0.0000	0.0000	0.0000	0.0000	0.0158	0.0158
20:15:00	0.0000	0.0000	0.0000	0.0000	0.0157	0.0157
20:30:00	0.0000	0.0000	0.0000	0.0000	0.0156	0.0156
20:45:00	0.0000	0.0000	0.0000	0.0000	0.0155	0.0155
21:00:00	0.0000	0.0000	0.0000	0.0000	0.0154	0.0154
21:15:00	0.0000	0.0000	0.0000	0.0000	0.0153	0.0153
21:30:00	0.0000	0.0000	0.0000	0.0000	0.0152	0.0152
21:45:00	0.0000	0.0000	0.0000	0.0000	0.0152	0.0152
22:00:00	0.0000	0.0000	0.0000	0.0000	0.0151	0.0151
22:15:00	0.0000	0.0000	0.0000	0.0000	0.015	0.015
22:30:00	0.0000	0.0000	0.0000	0.0000	0.0149	0.0149
22:45:00	0.0000	0.0000	0.0000	0.0000	0.0148	0.0148
23:00:00	0.0000	0.0000	0.0000	0.0000	0.0147	0.0147
23:15:00	0.0000	0.0000	0.0000	0.0000	0.0146	0.0146
23:30:00	0.0000	0.0000	0.0000	0.0000	0.0145	0.0145
23:45:00	0.0000	0.0000	0.0000	0.0000	0.0145	0.0145
24:00:00	0.0000	0.0000	0.0000	0.0000	0.0144	0.0144
24:15:00	0.0000	0.0000	0.0000	0.0000	0.0143	0.0143
24:30:00	0.0000	0.0000	0.0000	0.0000	0.0142	0.0142
24:45:00	0.0000	0.0000	0.0000	0.0000	0.0141	0.0141
25:00:00	0.0000	0.0000	0.0000	0.0000	0.014	0.014
25:15:00	0.0000	0.0000	0.0000	0.0000	0.014	0.014
25:30:00	0.0000	0.0000	0.0000	0.0000	0.0139	0.0139
25:45:00	0.0000	0.0000	0.0000	0.0000	0.0138	0.0138
26:00:00	0.0000	0.0000	0.0000	0.0000	0.0137	0.0137
26:15:00	0.0000	0.0000	0.0000	0.0000	0.0136	0.0136
26:30:00	0.0000	0.0000	0.0000	0.0000	0.0136	0.0136

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
26:45:00	0.0000	0.0000	0.0000	0.0000	0.0135	0.0135
27:00:00	0.0000	0.0000	0.0000	0.0000	0.0134	0.0134
27:15:00	0.0000	0.0000	0.0000	0.0000	0.0133	0.0133
27:30:00	0.0000	0.0000	0.0000	0.0000	0.0132	0.0132
27:45:00	0.0000	0.0000	0.0000	0.0000	0.0132	0.0132
28:00:00	0.0000	0.0000	0.0000	0.0000	0.0131	0.0131
28:15:00	0.0000	0.0000	0.0000	0.0000	0.013	0.013
28:30:00	0.0000	0.0000	0.0000	0.0000	0.0129	0.0129
28:45:00	0.0000	0.0000	0.0000	0.0000	0.0129	0.0129
29:00:00	0.0000	0.0000	0.0000	0.0000	0.0128	0.0128
29:15:00	0.0000	0.0000	0.0000	0.0000	0.0127	0.0127
29:30:00	0.0000	0.0000	0.0000	0.0000	0.0126	0.0126
29:45:00	0.0000	0.0000	0.0000	0.0000	0.0126	0.0126
30:00:00	0.0000	0.0000	0.0000	0.0000	0.0125	0.0125
30:15:00	0.0000	0.0000	0.0000	0.0000	0.0124	0.0124
30:30:00	0.0000	0.0000	0.0000	0.0000	0.0124	0.0124
30:45:00	0.0000	0.0000	0.0000	0.0000	0.0123	0.0123
31:00:00	0.0000	0.0000	0.0000	0.0000	0.0122	0.0122
31:15:00	0.0000	0.0000	0.0000	0.0000	0.0121	0.0121
31:30:00	0.0000	0.0000	0.0000	0.0000	0.0121	0.0121
31:45:00	0.0000	0.0000	0.0000	0.0000	0.012	0.012
32:00:00	0.0000	0.0000	0.0000	0.0000	0.0119	0.0119
32:15:00	0.0000	0.0000	0.0000	0.0000	0.0119	0.0119
32:30:00	0.0000	0.0000	0.0000	0.0000	0.0118	0.0118
32:45:00	0.0000	0.0000	0.0000	0.0000	0.0117	0.0117

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.71	No
PROPWET (mm)	0.47	No
SAAR (mm)	999	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Thursday, January 2, 2020 3:06:42 PM by Rob.Varley
Printed from the ReFH Flood Modelling software package, version 2.2.7059.19021

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: E0D7-263B

Site name: Cardiff Parkway

Easting: 325055

Northing: 181076

Country: England, Wales or Northern Ireland

Catchment Area (km^2): 0.43 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 2 year

Summary of results

Rainfall - FEH 2013 (mm):	18.56	Total runoff (ML):	0.67
Total Rainfall (mm):	12.85	Total flow (ML):	2.06
Peak Rainfall (mm):	3.49	Peak flow (m^3/s):	0.10

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	02:15:00	No
Timestep (hh:mm:ss)	00:15:00	No
SCF (Seasonal correction factor)	0.71	No
ARF (Areal reduction factor)	0.98	No
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	72.81	No
Cmax (mm)	653.19	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	1.13 [1.08]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0.01	No
BL (hr)	42.85 [42.36]	Yes
BR	2.09	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	0.3672	0.0000	0.0410	0.0000	0.0106	0.0106
00:15:00	0.6890	0.0000	0.0776	0.0003	0.0106	0.0109
00:30:00	1.2811	0.0000	0.1461	0.0015	0.0105	0.0121
00:45:00	2.3402	0.0000	0.2734	0.0045	0.0105	0.015
01:00:00	3.4947	0.0000	0.4239	0.0106	0.0105	0.0212
01:15:00	2.3402	0.0000	0.2943	0.0220	0.0107	0.0327
01:30:00	1.2811	0.0000	0.1647	0.0379	0.011	0.0489
01:45:00	0.6890	0.0000	0.0896	0.0554	0.0115	0.0668
02:00:00	0.3672	0.0000	0.0481	0.0710	0.0122	0.0832
02:15:00	0.0000	0.0000	0.0000	0.0810	0.013	0.094
02:30:00	0.0000	0.0000	0.0000	0.0820	0.0139	0.096
02:45:00	0.0000	0.0000	0.0000	0.0762	0.0148	0.091
03:00:00	0.0000	0.0000	0.0000	0.0667	0.0156	0.0823
03:15:00	0.0000	0.0000	0.0000	0.0560	0.0163	0.0723
03:30:00	0.0000	0.0000	0.0000	0.0459	0.0168	0.0627
03:45:00	0.0000	0.0000	0.0000	0.0375	0.0172	0.0547
04:00:00	0.0000	0.0000	0.0000	0.0302	0.0175	0.0477
04:15:00	0.0000	0.0000	0.0000	0.0235	0.0177	0.0413
04:30:00	0.0000	0.0000	0.0000	0.0175	0.0179	0.0353
04:45:00	0.0000	0.0000	0.0000	0.0119	0.0179	0.0299
05:00:00	0.0000	0.0000	0.0000	0.0071	0.0179	0.0251
05:15:00	0.0000	0.0000	0.0000	0.0036	0.0179	0.0215
05:30:00	0.0000	0.0000	0.0000	0.0016	0.0178	0.0194
05:45:00	0.0000	0.0000	0.0000	0.0006	0.0177	0.0183
06:00:00	0.0000	0.0000	0.0000	0.0001	0.0176	0.0178
06:15:00	0.0000	0.0000	0.0000	0.0000	0.0175	0.0175
06:30:00	0.0000	0.0000	0.0000	0.0000	0.0174	0.0174
06:45:00	0.0000	0.0000	0.0000	0.0000	0.0173	0.0173
07:00:00	0.0000	0.0000	0.0000	0.0000	0.0172	0.0172
07:15:00	0.0000	0.0000	0.0000	0.0000	0.0171	0.0171
07:30:00	0.0000	0.0000	0.0000	0.0000	0.017	0.017
07:45:00	0.0000	0.0000	0.0000	0.0000	0.0169	0.0169
08:00:00	0.0000	0.0000	0.0000	0.0000	0.0168	0.0168
08:15:00	0.0000	0.0000	0.0000	0.0000	0.0167	0.0167
08:30:00	0.0000	0.0000	0.0000	0.0000	0.0166	0.0166

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
08:45:00	0.0000	0.0000	0.0000	0.0000	0.0166	0.0166
09:00:00	0.0000	0.0000	0.0000	0.0000	0.0165	0.0165
09:15:00	0.0000	0.0000	0.0000	0.0000	0.0164	0.0164
09:30:00	0.0000	0.0000	0.0000	0.0000	0.0163	0.0163
09:45:00	0.0000	0.0000	0.0000	0.0000	0.0162	0.0162
10:00:00	0.0000	0.0000	0.0000	0.0000	0.0161	0.0161
10:15:00	0.0000	0.0000	0.0000	0.0000	0.016	0.016
10:30:00	0.0000	0.0000	0.0000	0.0000	0.0159	0.0159
10:45:00	0.0000	0.0000	0.0000	0.0000	0.0158	0.0158
11:00:00	0.0000	0.0000	0.0000	0.0000	0.0157	0.0157
11:15:00	0.0000	0.0000	0.0000	0.0000	0.0156	0.0156
11:30:00	0.0000	0.0000	0.0000	0.0000	0.0155	0.0155
11:45:00	0.0000	0.0000	0.0000	0.0000	0.0154	0.0154
12:00:00	0.0000	0.0000	0.0000	0.0000	0.0153	0.0153
12:15:00	0.0000	0.0000	0.0000	0.0000	0.0153	0.0153
12:30:00	0.0000	0.0000	0.0000	0.0000	0.0152	0.0152
12:45:00	0.0000	0.0000	0.0000	0.0000	0.0151	0.0151
13:00:00	0.0000	0.0000	0.0000	0.0000	0.015	0.015
13:15:00	0.0000	0.0000	0.0000	0.0000	0.0149	0.0149
13:30:00	0.0000	0.0000	0.0000	0.0000	0.0148	0.0148
13:45:00	0.0000	0.0000	0.0000	0.0000	0.0147	0.0147
14:00:00	0.0000	0.0000	0.0000	0.0000	0.0146	0.0146
14:15:00	0.0000	0.0000	0.0000	0.0000	0.0146	0.0146
14:30:00	0.0000	0.0000	0.0000	0.0000	0.0145	0.0145
14:45:00	0.0000	0.0000	0.0000	0.0000	0.0144	0.0144
15:00:00	0.0000	0.0000	0.0000	0.0000	0.0143	0.0143
15:15:00	0.0000	0.0000	0.0000	0.0000	0.0142	0.0142
15:30:00	0.0000	0.0000	0.0000	0.0000	0.0141	0.0141
15:45:00	0.0000	0.0000	0.0000	0.0000	0.0141	0.0141
16:00:00	0.0000	0.0000	0.0000	0.0000	0.014	0.014
16:15:00	0.0000	0.0000	0.0000	0.0000	0.0139	0.0139
16:30:00	0.0000	0.0000	0.0000	0.0000	0.0138	0.0138
16:45:00	0.0000	0.0000	0.0000	0.0000	0.0137	0.0137
17:00:00	0.0000	0.0000	0.0000	0.0000	0.0137	0.0137
17:15:00	0.0000	0.0000	0.0000	0.0000	0.0136	0.0136
17:30:00	0.0000	0.0000	0.0000	0.0000	0.0135	0.0135

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
17:45:00	0.0000	0.0000	0.0000	0.0000	0.0134	0.0134
18:00:00	0.0000	0.0000	0.0000	0.0000	0.0133	0.0133
18:15:00	0.0000	0.0000	0.0000	0.0000	0.0133	0.0133
18:30:00	0.0000	0.0000	0.0000	0.0000	0.0132	0.0132
18:45:00	0.0000	0.0000	0.0000	0.0000	0.0131	0.0131
19:00:00	0.0000	0.0000	0.0000	0.0000	0.013	0.013
19:15:00	0.0000	0.0000	0.0000	0.0000	0.013	0.013
19:30:00	0.0000	0.0000	0.0000	0.0000	0.0129	0.0129
19:45:00	0.0000	0.0000	0.0000	0.0000	0.0128	0.0128
20:00:00	0.0000	0.0000	0.0000	0.0000	0.0127	0.0127
20:15:00	0.0000	0.0000	0.0000	0.0000	0.0127	0.0127
20:30:00	0.0000	0.0000	0.0000	0.0000	0.0126	0.0126
20:45:00	0.0000	0.0000	0.0000	0.0000	0.0125	0.0125
21:00:00	0.0000	0.0000	0.0000	0.0000	0.0124	0.0124
21:15:00	0.0000	0.0000	0.0000	0.0000	0.0124	0.0124
21:30:00	0.0000	0.0000	0.0000	0.0000	0.0123	0.0123
21:45:00	0.0000	0.0000	0.0000	0.0000	0.0122	0.0122
22:00:00	0.0000	0.0000	0.0000	0.0000	0.0121	0.0121
22:15:00	0.0000	0.0000	0.0000	0.0000	0.0121	0.0121
22:30:00	0.0000	0.0000	0.0000	0.0000	0.012	0.012
22:45:00	0.0000	0.0000	0.0000	0.0000	0.0119	0.0119
23:00:00	0.0000	0.0000	0.0000	0.0000	0.0119	0.0119
23:15:00	0.0000	0.0000	0.0000	0.0000	0.0118	0.0118
23:30:00	0.0000	0.0000	0.0000	0.0000	0.0117	0.0117
23:45:00	0.0000	0.0000	0.0000	0.0000	0.0117	0.0117
24:00:00	0.0000	0.0000	0.0000	0.0000	0.0116	0.0116
24:15:00	0.0000	0.0000	0.0000	0.0000	0.0115	0.0115
24:30:00	0.0000	0.0000	0.0000	0.0000	0.0115	0.0115
24:45:00	0.0000	0.0000	0.0000	0.0000	0.0114	0.0114
25:00:00	0.0000	0.0000	0.0000	0.0000	0.0113	0.0113
25:15:00	0.0000	0.0000	0.0000	0.0000	0.0113	0.0113
25:30:00	0.0000	0.0000	0.0000	0.0000	0.0112	0.0112
25:45:00	0.0000	0.0000	0.0000	0.0000	0.0111	0.0111
26:00:00	0.0000	0.0000	0.0000	0.0000	0.0111	0.0111
26:15:00	0.0000	0.0000	0.0000	0.0000	0.011	0.011
26:30:00	0.0000	0.0000	0.0000	0.0000	0.0109	0.0109

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
26:45:00	0.0000	0.0000	0.0000	0.0000	0.0109	0.0109
27:00:00	0.0000	0.0000	0.0000	0.0000	0.0108	0.0108
27:15:00	0.0000	0.0000	0.0000	0.0000	0.0107	0.0107

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.71	No
PROPWET (mm)	0.47	No
SAAR (mm)	999	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Friday, January 3, 2020 9:52:45 AM by Rob.Varley
Printed from the ReFH Flood Modelling software package, version 2.2.7059.19021

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: 325A-2B97

Site name: Cardiff Parkway

Easting: 325055

Northing: 181076

Country: England, Wales or Northern Ireland

Catchment Area (km^2): 0.43 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 30 year

Summary of results

Rainfall - FEH 2013 (mm):	39.87	Total runoff (ML):	2.26
Total Rainfall (mm):	37.52	Total flow (ML):	5.99
Peak Rainfall (mm):	13.30	Peak flow (m^3/s):	0.31

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	02:15:00	No
Timestep (hh:mm:ss)	00:15:00	No
SCF (Seasonal correction factor)	0.96	No
ARF (Areal reduction factor)	0.98	No
Seasonality	Summer	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	72.81	No
Cmax (mm)	653.19	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	1.13 [1.08]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0.01	No
BL (hr)	42.85 [42.36]	Yes
BR	2.09	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	1.1085	0.0000	0.1245	0.0000	0.0116	0.0116
00:15:00	1.8143	0.0000	0.2078	0.0010	0.0116	0.0125
00:30:00	3.1307	0.0000	0.3705	0.0045	0.0116	0.016
00:45:00	6.0569	0.0000	0.7594	0.0124	0.0116	0.024
01:00:00	13.2969	0.0000	1.8641	0.0290	0.0118	0.0408
01:15:00	6.0569	0.0000	0.9389	0.0653	0.0123	0.0776
01:30:00	3.1307	0.0000	0.5073	0.1203	0.0133	0.134
01:45:00	1.8143	0.0000	0.3009	0.1810	0.0151	0.196
02:00:00	1.1085	0.0000	0.1863	0.2382	0.0175	0.256
02:15:00	0.0000	0.0000	0.0000	0.2786	0.0206	0.299
02:30:00	0.0000	0.0000	0.0000	0.2815	0.0238	0.305
02:45:00	0.0000	0.0000	0.0000	0.2609	0.027	0.288
03:00:00	0.0000	0.0000	0.0000	0.2288	0.0298	0.259
03:15:00	0.0000	0.0000	0.0000	0.1918	0.0322	0.224
03:30:00	0.0000	0.0000	0.0000	0.1571	0.0341	0.191
03:45:00	0.0000	0.0000	0.0000	0.1289	0.0357	0.165
04:00:00	0.0000	0.0000	0.0000	0.1042	0.0369	0.141
04:15:00	0.0000	0.0000	0.0000	0.0817	0.0378	0.12
04:30:00	0.0000	0.0000	0.0000	0.0611	0.0384	0.0995
04:45:00	0.0000	0.0000	0.0000	0.0419	0.0388	0.0807
05:00:00	0.0000	0.0000	0.0000	0.0247	0.039	0.0637
05:15:00	0.0000	0.0000	0.0000	0.0120	0.039	0.051
05:30:00	0.0000	0.0000	0.0000	0.0055	0.0389	0.0443
05:45:00	0.0000	0.0000	0.0000	0.0021	0.0387	0.0408
06:00:00	0.0000	0.0000	0.0000	0.0005	0.0385	0.039
06:15:00	0.0000	0.0000	0.0000	0.0000	0.0383	0.0383
06:30:00	0.0000	0.0000	0.0000	0.0000	0.038	0.038
06:45:00	0.0000	0.0000	0.0000	0.0000	0.0378	0.0378
07:00:00	0.0000	0.0000	0.0000	0.0000	0.0376	0.0376
07:15:00	0.0000	0.0000	0.0000	0.0000	0.0374	0.0374
07:30:00	0.0000	0.0000	0.0000	0.0000	0.0372	0.0372
07:45:00	0.0000	0.0000	0.0000	0.0000	0.037	0.037
08:00:00	0.0000	0.0000	0.0000	0.0000	0.0367	0.0367
08:15:00	0.0000	0.0000	0.0000	0.0000	0.0365	0.0365
08:30:00	0.0000	0.0000	0.0000	0.0000	0.0363	0.0363

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
08:45:00	0.0000	0.0000	0.0000	0.0000	0.0361	0.0361
09:00:00	0.0000	0.0000	0.0000	0.0000	0.0359	0.0359
09:15:00	0.0000	0.0000	0.0000	0.0000	0.0357	0.0357
09:30:00	0.0000	0.0000	0.0000	0.0000	0.0355	0.0355
09:45:00	0.0000	0.0000	0.0000	0.0000	0.0353	0.0353
10:00:00	0.0000	0.0000	0.0000	0.0000	0.0351	0.0351
10:15:00	0.0000	0.0000	0.0000	0.0000	0.0349	0.0349
10:30:00	0.0000	0.0000	0.0000	0.0000	0.0347	0.0347
10:45:00	0.0000	0.0000	0.0000	0.0000	0.0345	0.0345
11:00:00	0.0000	0.0000	0.0000	0.0000	0.0343	0.0343
11:15:00	0.0000	0.0000	0.0000	0.0000	0.0341	0.0341
11:30:00	0.0000	0.0000	0.0000	0.0000	0.0339	0.0339
11:45:00	0.0000	0.0000	0.0000	0.0000	0.0337	0.0337
12:00:00	0.0000	0.0000	0.0000	0.0000	0.0335	0.0335
12:15:00	0.0000	0.0000	0.0000	0.0000	0.0333	0.0333
12:30:00	0.0000	0.0000	0.0000	0.0000	0.0331	0.0331
12:45:00	0.0000	0.0000	0.0000	0.0000	0.0329	0.0329
13:00:00	0.0000	0.0000	0.0000	0.0000	0.0327	0.0327
13:15:00	0.0000	0.0000	0.0000	0.0000	0.0325	0.0325
13:30:00	0.0000	0.0000	0.0000	0.0000	0.0323	0.0323
13:45:00	0.0000	0.0000	0.0000	0.0000	0.0321	0.0321
14:00:00	0.0000	0.0000	0.0000	0.0000	0.0319	0.0319
14:15:00	0.0000	0.0000	0.0000	0.0000	0.0317	0.0317
14:30:00	0.0000	0.0000	0.0000	0.0000	0.0316	0.0316
14:45:00	0.0000	0.0000	0.0000	0.0000	0.0314	0.0314
15:00:00	0.0000	0.0000	0.0000	0.0000	0.0312	0.0312
15:15:00	0.0000	0.0000	0.0000	0.0000	0.031	0.031
15:30:00	0.0000	0.0000	0.0000	0.0000	0.0308	0.0308
15:45:00	0.0000	0.0000	0.0000	0.0000	0.0307	0.0307
16:00:00	0.0000	0.0000	0.0000	0.0000	0.0305	0.0305
16:15:00	0.0000	0.0000	0.0000	0.0000	0.0303	0.0303
16:30:00	0.0000	0.0000	0.0000	0.0000	0.0301	0.0301
16:45:00	0.0000	0.0000	0.0000	0.0000	0.03	0.03
17:00:00	0.0000	0.0000	0.0000	0.0000	0.0298	0.0298
17:15:00	0.0000	0.0000	0.0000	0.0000	0.0296	0.0296
17:30:00	0.0000	0.0000	0.0000	0.0000	0.0294	0.0294

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
17:45:00	0.0000	0.0000	0.0000	0.0000	0.0293	0.0293
18:00:00	0.0000	0.0000	0.0000	0.0000	0.0291	0.0291
18:15:00	0.0000	0.0000	0.0000	0.0000	0.0289	0.0289
18:30:00	0.0000	0.0000	0.0000	0.0000	0.0288	0.0288
18:45:00	0.0000	0.0000	0.0000	0.0000	0.0286	0.0286
19:00:00	0.0000	0.0000	0.0000	0.0000	0.0284	0.0284
19:15:00	0.0000	0.0000	0.0000	0.0000	0.0283	0.0283
19:30:00	0.0000	0.0000	0.0000	0.0000	0.0281	0.0281
19:45:00	0.0000	0.0000	0.0000	0.0000	0.0279	0.0279
20:00:00	0.0000	0.0000	0.0000	0.0000	0.0278	0.0278
20:15:00	0.0000	0.0000	0.0000	0.0000	0.0276	0.0276
20:30:00	0.0000	0.0000	0.0000	0.0000	0.0274	0.0274
20:45:00	0.0000	0.0000	0.0000	0.0000	0.0273	0.0273
21:00:00	0.0000	0.0000	0.0000	0.0000	0.0271	0.0271
21:15:00	0.0000	0.0000	0.0000	0.0000	0.027	0.027
21:30:00	0.0000	0.0000	0.0000	0.0000	0.0268	0.0268
21:45:00	0.0000	0.0000	0.0000	0.0000	0.0267	0.0267
22:00:00	0.0000	0.0000	0.0000	0.0000	0.0265	0.0265
22:15:00	0.0000	0.0000	0.0000	0.0000	0.0263	0.0263
22:30:00	0.0000	0.0000	0.0000	0.0000	0.0262	0.0262
22:45:00	0.0000	0.0000	0.0000	0.0000	0.026	0.026
23:00:00	0.0000	0.0000	0.0000	0.0000	0.0259	0.0259
23:15:00	0.0000	0.0000	0.0000	0.0000	0.0257	0.0257
23:30:00	0.0000	0.0000	0.0000	0.0000	0.0256	0.0256
23:45:00	0.0000	0.0000	0.0000	0.0000	0.0254	0.0254
24:00:00	0.0000	0.0000	0.0000	0.0000	0.0253	0.0253
24:15:00	0.0000	0.0000	0.0000	0.0000	0.0251	0.0251
24:30:00	0.0000	0.0000	0.0000	0.0000	0.025	0.025
24:45:00	0.0000	0.0000	0.0000	0.0000	0.0248	0.0248
25:00:00	0.0000	0.0000	0.0000	0.0000	0.0247	0.0247
25:15:00	0.0000	0.0000	0.0000	0.0000	0.0246	0.0246
25:30:00	0.0000	0.0000	0.0000	0.0000	0.0244	0.0244
25:45:00	0.0000	0.0000	0.0000	0.0000	0.0243	0.0243
26:00:00	0.0000	0.0000	0.0000	0.0000	0.0241	0.0241
26:15:00	0.0000	0.0000	0.0000	0.0000	0.024	0.024
26:30:00	0.0000	0.0000	0.0000	0.0000	0.0239	0.0239

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
26:45:00	0.0000	0.0000	0.0000	0.0000	0.0237	0.0237
27:00:00	0.0000	0.0000	0.0000	0.0000	0.0236	0.0236
27:15:00	0.0000	0.0000	0.0000	0.0000	0.0234	0.0234
27:30:00	0.0000	0.0000	0.0000	0.0000	0.0233	0.0233
27:45:00	0.0000	0.0000	0.0000	0.0000	0.0232	0.0232
28:00:00	0.0000	0.0000	0.0000	0.0000	0.023	0.023
28:15:00	0.0000	0.0000	0.0000	0.0000	0.0229	0.0229
28:30:00	0.0000	0.0000	0.0000	0.0000	0.0228	0.0228
28:45:00	0.0000	0.0000	0.0000	0.0000	0.0226	0.0226
29:00:00	0.0000	0.0000	0.0000	0.0000	0.0225	0.0225
29:15:00	0.0000	0.0000	0.0000	0.0000	0.0224	0.0224
29:30:00	0.0000	0.0000	0.0000	0.0000	0.0222	0.0222
29:45:00	0.0000	0.0000	0.0000	0.0000	0.0221	0.0221
30:00:00	0.0000	0.0000	0.0000	0.0000	0.022	0.022
30:15:00	0.0000	0.0000	0.0000	0.0000	0.0219	0.0219
30:30:00	0.0000	0.0000	0.0000	0.0000	0.0217	0.0217
30:45:00	0.0000	0.0000	0.0000	0.0000	0.0216	0.0216
31:00:00	0.0000	0.0000	0.0000	0.0000	0.0215	0.0215
31:15:00	0.0000	0.0000	0.0000	0.0000	0.0214	0.0214
31:30:00	0.0000	0.0000	0.0000	0.0000	0.0212	0.0212
31:45:00	0.0000	0.0000	0.0000	0.0000	0.0211	0.0211
32:00:00	0.0000	0.0000	0.0000	0.0000	0.021	0.021
32:15:00	0.0000	0.0000	0.0000	0.0000	0.0209	0.0209
32:30:00	0.0000	0.0000	0.0000	0.0000	0.0207	0.0207
32:45:00	0.0000	0.0000	0.0000	0.0000	0.0206	0.0206
33:00:00	0.0000	0.0000	0.0000	0.0000	0.0205	0.0205
33:15:00	0.0000	0.0000	0.0000	0.0000	0.0204	0.0204
33:30:00	0.0000	0.0000	0.0000	0.0000	0.0203	0.0203
33:45:00	0.0000	0.0000	0.0000	0.0000	0.0201	0.0201
34:00:00	0.0000	0.0000	0.0000	0.0000	0.02	0.02
34:15:00	0.0000	0.0000	0.0000	0.0000	0.0199	0.0199
34:30:00	0.0000	0.0000	0.0000	0.0000	0.0198	0.0198
34:45:00	0.0000	0.0000	0.0000	0.0000	0.0197	0.0197
35:00:00	0.0000	0.0000	0.0000	0.0000	0.0196	0.0196
35:15:00	0.0000	0.0000	0.0000	0.0000	0.0194	0.0194
35:30:00	0.0000	0.0000	0.0000	0.0000	0.0193	0.0193

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
35:45:00	0.0000	0.0000	0.0000	0.0000	0.0192	0.0192
36:00:00	0.0000	0.0000	0.0000	0.0000	0.0191	0.0191
36:15:00	0.0000	0.0000	0.0000	0.0000	0.019	0.019
36:30:00	0.0000	0.0000	0.0000	0.0000	0.0189	0.0189
36:45:00	0.0000	0.0000	0.0000	0.0000	0.0188	0.0188
37:00:00	0.0000	0.0000	0.0000	0.0000	0.0187	0.0187
37:15:00	0.0000	0.0000	0.0000	0.0000	0.0186	0.0186
37:30:00	0.0000	0.0000	0.0000	0.0000	0.0185	0.0185
37:45:00	0.0000	0.0000	0.0000	0.0000	0.0183	0.0183
38:00:00	0.0000	0.0000	0.0000	0.0000	0.0182	0.0182
38:15:00	0.0000	0.0000	0.0000	0.0000	0.0181	0.0181

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.71	No
PROPWET (mm)	0.47	No
SAAR (mm)	999	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Thursday, January 2, 2020 3:11:42 PM by Rob.Varley
Printed from the ReFH Flood Modelling software package, version 2.2.7059.19021

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: E0D7-263B

Site name: Cardiff Parkway

Easting: 325055

Northing: 181076

Country: England, Wales or Northern Ireland

Catchment Area (km^2): 0.43 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 30 year

Summary of results

Rainfall - FEH 2013 (mm):	39.87	Total runoff (ML):	1.57
Total Rainfall (mm):	27.60	Total flow (ML):	4.40
Peak Rainfall (mm):	7.51	Peak flow (m^3/s):	0.21

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	02:15:00	No
Timestep (hh:mm:ss)	00:15:00	No
SCF (Seasonal correction factor)	0.71	No
ARF (Areal reduction factor)	0.98	No
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	72.81	No
Cmax (mm)	653.19	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	1.13 [1.08]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0.01	No
BL (hr)	42.85 [42.36]	Yes
BR	2.09	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	0.7887	0.0000	0.0884	0.0000	0.0106	0.0106
00:15:00	1.4797	0.0000	0.1684	0.0007	0.0106	0.0113
00:30:00	2.7513	0.0000	0.3220	0.0033	0.0105	0.0139
00:45:00	5.0259	0.0000	0.6182	0.0097	0.0106	0.0203
01:00:00	7.5054	0.0000	0.9952	0.0234	0.0107	0.0341
01:15:00	5.0259	0.0000	0.7146	0.0491	0.0111	0.0601
01:30:00	2.7513	0.0000	0.4076	0.0858	0.0118	0.0976
01:45:00	1.4797	0.0000	0.2240	0.1268	0.0131	0.14
02:00:00	0.7887	0.0000	0.1208	0.1644	0.0147	0.179
02:15:00	0.0000	0.0000	0.0000	0.1893	0.0168	0.206
02:30:00	0.0000	0.0000	0.0000	0.1932	0.019	0.212
02:45:00	0.0000	0.0000	0.0000	0.1804	0.0212	0.202
03:00:00	0.0000	0.0000	0.0000	0.1586	0.0231	0.182
03:15:00	0.0000	0.0000	0.0000	0.1335	0.0248	0.158
03:30:00	0.0000	0.0000	0.0000	0.1094	0.0261	0.136
03:45:00	0.0000	0.0000	0.0000	0.0893	0.0271	0.116
04:00:00	0.0000	0.0000	0.0000	0.0720	0.028	0.1
04:15:00	0.0000	0.0000	0.0000	0.0564	0.0286	0.0849
04:30:00	0.0000	0.0000	0.0000	0.0421	0.029	0.0711
04:45:00	0.0000	0.0000	0.0000	0.0289	0.0293	0.0582
05:00:00	0.0000	0.0000	0.0000	0.0174	0.0294	0.0468
05:15:00	0.0000	0.0000	0.0000	0.0089	0.0294	0.0383
05:30:00	0.0000	0.0000	0.0000	0.0039	0.0293	0.0332
05:45:00	0.0000	0.0000	0.0000	0.0014	0.0291	0.0306
06:00:00	0.0000	0.0000	0.0000	0.0003	0.029	0.0293
06:15:00	0.0000	0.0000	0.0000	0.0000	0.0288	0.0288
06:30:00	0.0000	0.0000	0.0000	0.0000	0.0286	0.0286
06:45:00	0.0000	0.0000	0.0000	0.0000	0.0285	0.0285
07:00:00	0.0000	0.0000	0.0000	0.0000	0.0283	0.0283
07:15:00	0.0000	0.0000	0.0000	0.0000	0.0281	0.0281
07:30:00	0.0000	0.0000	0.0000	0.0000	0.028	0.028
07:45:00	0.0000	0.0000	0.0000	0.0000	0.0278	0.0278
08:00:00	0.0000	0.0000	0.0000	0.0000	0.0277	0.0277
08:15:00	0.0000	0.0000	0.0000	0.0000	0.0275	0.0275
08:30:00	0.0000	0.0000	0.0000	0.0000	0.0273	0.0273

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
08:45:00	0.0000	0.0000	0.0000	0.0000	0.0272	0.0272
09:00:00	0.0000	0.0000	0.0000	0.0000	0.027	0.027
09:15:00	0.0000	0.0000	0.0000	0.0000	0.0269	0.0269
09:30:00	0.0000	0.0000	0.0000	0.0000	0.0267	0.0267
09:45:00	0.0000	0.0000	0.0000	0.0000	0.0265	0.0265
10:00:00	0.0000	0.0000	0.0000	0.0000	0.0264	0.0264
10:15:00	0.0000	0.0000	0.0000	0.0000	0.0262	0.0262
10:30:00	0.0000	0.0000	0.0000	0.0000	0.0261	0.0261
10:45:00	0.0000	0.0000	0.0000	0.0000	0.0259	0.0259
11:00:00	0.0000	0.0000	0.0000	0.0000	0.0258	0.0258
11:15:00	0.0000	0.0000	0.0000	0.0000	0.0256	0.0256
11:30:00	0.0000	0.0000	0.0000	0.0000	0.0255	0.0255
11:45:00	0.0000	0.0000	0.0000	0.0000	0.0253	0.0253
12:00:00	0.0000	0.0000	0.0000	0.0000	0.0252	0.0252
12:15:00	0.0000	0.0000	0.0000	0.0000	0.025	0.025
12:30:00	0.0000	0.0000	0.0000	0.0000	0.0249	0.0249
12:45:00	0.0000	0.0000	0.0000	0.0000	0.0248	0.0248
13:00:00	0.0000	0.0000	0.0000	0.0000	0.0246	0.0246
13:15:00	0.0000	0.0000	0.0000	0.0000	0.0245	0.0245
13:30:00	0.0000	0.0000	0.0000	0.0000	0.0243	0.0243
13:45:00	0.0000	0.0000	0.0000	0.0000	0.0242	0.0242
14:00:00	0.0000	0.0000	0.0000	0.0000	0.024	0.024
14:15:00	0.0000	0.0000	0.0000	0.0000	0.0239	0.0239
14:30:00	0.0000	0.0000	0.0000	0.0000	0.0238	0.0238
14:45:00	0.0000	0.0000	0.0000	0.0000	0.0236	0.0236
15:00:00	0.0000	0.0000	0.0000	0.0000	0.0235	0.0235
15:15:00	0.0000	0.0000	0.0000	0.0000	0.0234	0.0234
15:30:00	0.0000	0.0000	0.0000	0.0000	0.0232	0.0232
15:45:00	0.0000	0.0000	0.0000	0.0000	0.0231	0.0231
16:00:00	0.0000	0.0000	0.0000	0.0000	0.0229	0.0229
16:15:00	0.0000	0.0000	0.0000	0.0000	0.0228	0.0228
16:30:00	0.0000	0.0000	0.0000	0.0000	0.0227	0.0227
16:45:00	0.0000	0.0000	0.0000	0.0000	0.0225	0.0225
17:00:00	0.0000	0.0000	0.0000	0.0000	0.0224	0.0224
17:15:00	0.0000	0.0000	0.0000	0.0000	0.0223	0.0223
17:30:00	0.0000	0.0000	0.0000	0.0000	0.0222	0.0222

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
17:45:00	0.0000	0.0000	0.0000	0.0000	0.022	0.022
18:00:00	0.0000	0.0000	0.0000	0.0000	0.0219	0.0219
18:15:00	0.0000	0.0000	0.0000	0.0000	0.0218	0.0218
18:30:00	0.0000	0.0000	0.0000	0.0000	0.0216	0.0216
18:45:00	0.0000	0.0000	0.0000	0.0000	0.0215	0.0215
19:00:00	0.0000	0.0000	0.0000	0.0000	0.0214	0.0214
19:15:00	0.0000	0.0000	0.0000	0.0000	0.0213	0.0213
19:30:00	0.0000	0.0000	0.0000	0.0000	0.0211	0.0211
19:45:00	0.0000	0.0000	0.0000	0.0000	0.021	0.021
20:00:00	0.0000	0.0000	0.0000	0.0000	0.0209	0.0209
20:15:00	0.0000	0.0000	0.0000	0.0000	0.0208	0.0208
20:30:00	0.0000	0.0000	0.0000	0.0000	0.0207	0.0207
20:45:00	0.0000	0.0000	0.0000	0.0000	0.0205	0.0205
21:00:00	0.0000	0.0000	0.0000	0.0000	0.0204	0.0204
21:15:00	0.0000	0.0000	0.0000	0.0000	0.0203	0.0203
21:30:00	0.0000	0.0000	0.0000	0.0000	0.0202	0.0202
21:45:00	0.0000	0.0000	0.0000	0.0000	0.0201	0.0201
22:00:00	0.0000	0.0000	0.0000	0.0000	0.0199	0.0199
22:15:00	0.0000	0.0000	0.0000	0.0000	0.0198	0.0198
22:30:00	0.0000	0.0000	0.0000	0.0000	0.0197	0.0197
22:45:00	0.0000	0.0000	0.0000	0.0000	0.0196	0.0196
23:00:00	0.0000	0.0000	0.0000	0.0000	0.0195	0.0195
23:15:00	0.0000	0.0000	0.0000	0.0000	0.0194	0.0194
23:30:00	0.0000	0.0000	0.0000	0.0000	0.0193	0.0193
23:45:00	0.0000	0.0000	0.0000	0.0000	0.0191	0.0191
24:00:00	0.0000	0.0000	0.0000	0.0000	0.019	0.019
24:15:00	0.0000	0.0000	0.0000	0.0000	0.0189	0.0189
24:30:00	0.0000	0.0000	0.0000	0.0000	0.0188	0.0188
24:45:00	0.0000	0.0000	0.0000	0.0000	0.0187	0.0187
25:00:00	0.0000	0.0000	0.0000	0.0000	0.0186	0.0186
25:15:00	0.0000	0.0000	0.0000	0.0000	0.0185	0.0185
25:30:00	0.0000	0.0000	0.0000	0.0000	0.0184	0.0184
25:45:00	0.0000	0.0000	0.0000	0.0000	0.0183	0.0183
26:00:00	0.0000	0.0000	0.0000	0.0000	0.0182	0.0182
26:15:00	0.0000	0.0000	0.0000	0.0000	0.0181	0.0181
26:30:00	0.0000	0.0000	0.0000	0.0000	0.018	0.018

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
26:45:00	0.0000	0.0000	0.0000	0.0000	0.0179	0.0179
27:00:00	0.0000	0.0000	0.0000	0.0000	0.0178	0.0178
27:15:00	0.0000	0.0000	0.0000	0.0000	0.0176	0.0176
27:30:00	0.0000	0.0000	0.0000	0.0000	0.0175	0.0175
27:45:00	0.0000	0.0000	0.0000	0.0000	0.0174	0.0174
28:00:00	0.0000	0.0000	0.0000	0.0000	0.0173	0.0173
28:15:00	0.0000	0.0000	0.0000	0.0000	0.0172	0.0172
28:30:00	0.0000	0.0000	0.0000	0.0000	0.0171	0.0171
28:45:00	0.0000	0.0000	0.0000	0.0000	0.017	0.017
29:00:00	0.0000	0.0000	0.0000	0.0000	0.0169	0.0169
29:15:00	0.0000	0.0000	0.0000	0.0000	0.0168	0.0168
29:30:00	0.0000	0.0000	0.0000	0.0000	0.0167	0.0167
29:45:00	0.0000	0.0000	0.0000	0.0000	0.0166	0.0166
30:00:00	0.0000	0.0000	0.0000	0.0000	0.0166	0.0166
30:15:00	0.0000	0.0000	0.0000	0.0000	0.0165	0.0165
30:30:00	0.0000	0.0000	0.0000	0.0000	0.0164	0.0164
30:45:00	0.0000	0.0000	0.0000	0.0000	0.0163	0.0163
31:00:00	0.0000	0.0000	0.0000	0.0000	0.0162	0.0162
31:15:00	0.0000	0.0000	0.0000	0.0000	0.0161	0.0161
31:30:00	0.0000	0.0000	0.0000	0.0000	0.016	0.016
31:45:00	0.0000	0.0000	0.0000	0.0000	0.0159	0.0159
32:00:00	0.0000	0.0000	0.0000	0.0000	0.0158	0.0158
32:15:00	0.0000	0.0000	0.0000	0.0000	0.0157	0.0157
32:30:00	0.0000	0.0000	0.0000	0.0000	0.0156	0.0156
32:45:00	0.0000	0.0000	0.0000	0.0000	0.0155	0.0155
33:00:00	0.0000	0.0000	0.0000	0.0000	0.0154	0.0154
33:15:00	0.0000	0.0000	0.0000	0.0000	0.0153	0.0153
33:30:00	0.0000	0.0000	0.0000	0.0000	0.0153	0.0153
33:45:00	0.0000	0.0000	0.0000	0.0000	0.0152	0.0152
34:00:00	0.0000	0.0000	0.0000	0.0000	0.0151	0.0151
34:15:00	0.0000	0.0000	0.0000	0.0000	0.015	0.015
34:30:00	0.0000	0.0000	0.0000	0.0000	0.0149	0.0149
34:45:00	0.0000	0.0000	0.0000	0.0000	0.0148	0.0148
35:00:00	0.0000	0.0000	0.0000	0.0000	0.0147	0.0147
35:15:00	0.0000	0.0000	0.0000	0.0000	0.0146	0.0146
35:30:00	0.0000	0.0000	0.0000	0.0000	0.0146	0.0146

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
35:45:00	0.0000	0.0000	0.0000	0.0000	0.0145	0.0145
36:00:00	0.0000	0.0000	0.0000	0.0000	0.0144	0.0144
36:15:00	0.0000	0.0000	0.0000	0.0000	0.0143	0.0143
36:30:00	0.0000	0.0000	0.0000	0.0000	0.0142	0.0142
36:45:00	0.0000	0.0000	0.0000	0.0000	0.0141	0.0141
37:00:00	0.0000	0.0000	0.0000	0.0000	0.0141	0.0141
37:15:00	0.0000	0.0000	0.0000	0.0000	0.014	0.014
37:30:00	0.0000	0.0000	0.0000	0.0000	0.0139	0.0139
37:45:00	0.0000	0.0000	0.0000	0.0000	0.0138	0.0138
38:00:00	0.0000	0.0000	0.0000	0.0000	0.0137	0.0137
38:15:00	0.0000	0.0000	0.0000	0.0000	0.0137	0.0137

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.71	No
PROPWET (mm)	0.47	No
SAAR (mm)	999	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Friday, January 3, 2020 9:52:23 AM by Rob.Varley
Printed from the ReFH Flood Modelling software package, version 2.2.7059.19021

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: 325A-2B97

Site name: Cardiff Parkway

Easting: 325055

Northing: 181076

Country: England, Wales or Northern Ireland

Catchment Area (km^2): 0.43 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 100 year

Summary of results

Rainfall - FEH 2013 (mm):	52.02	Total runoff (ML):	3.14
Total Rainfall (mm):	48.95	Total flow (ML):	7.89
Peak Rainfall (mm):	17.35	Peak flow (m^3/s):	0.42

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	02:15:00	No
Timestep (hh:mm:ss)	00:15:00	No
SCF (Seasonal correction factor)	0.96	No
ARF (Areal reduction factor)	0.98	No
Seasonality	Summer	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	72.81	No
Cmax (mm)	653.19	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	1.13 [1.08]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0.01	No
BL (hr)	42.85 [42.36]	Yes
BR	2.09	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	1.4464	0.0000	0.1628	0.0000	0.0116	0.0116
00:15:00	2.3674	0.0000	0.2734	0.0012	0.0116	0.0128
00:30:00	4.0849	0.0000	0.4920	0.0058	0.0116	0.0174
00:45:00	7.9031	0.0000	1.0244	0.0163	0.0116	0.0279
01:00:00	17.3500	0.0000	2.5842	0.0384	0.0119	0.0503
01:15:00	7.9031	0.0000	1.3299	0.0877	0.0126	0.1
01:30:00	4.0849	0.0000	0.7249	0.1631	0.014	0.177
01:45:00	2.3674	0.0000	0.4318	0.2474	0.0164	0.264
02:00:00	1.4464	0.0000	0.2680	0.3276	0.0198	0.347
02:15:00	0.0000	0.0000	0.0000	0.3852	0.0241	0.409
02:30:00	0.0000	0.0000	0.0000	0.3909	0.0286	0.42
02:45:00	0.0000	0.0000	0.0000	0.3635	0.033	0.396
03:00:00	0.0000	0.0000	0.0000	0.3193	0.037	0.356
03:15:00	0.0000	0.0000	0.0000	0.2681	0.0403	0.308
03:30:00	0.0000	0.0000	0.0000	0.2197	0.0431	0.263
03:45:00	0.0000	0.0000	0.0000	0.1802	0.0452	0.225
04:00:00	0.0000	0.0000	0.0000	0.1458	0.0469	0.193
04:15:00	0.0000	0.0000	0.0000	0.1146	0.0482	0.163
04:30:00	0.0000	0.0000	0.0000	0.0858	0.0492	0.135
04:45:00	0.0000	0.0000	0.0000	0.0591	0.0498	0.109
05:00:00	0.0000	0.0000	0.0000	0.0351	0.0501	0.0852
05:15:00	0.0000	0.0000	0.0000	0.0172	0.0501	0.0673
05:30:00	0.0000	0.0000	0.0000	0.0078	0.0499	0.0578
05:45:00	0.0000	0.0000	0.0000	0.0030	0.0497	0.0527
06:00:00	0.0000	0.0000	0.0000	0.0008	0.0495	0.0502
06:15:00	0.0000	0.0000	0.0000	0.0000	0.0492	0.0492
06:30:00	0.0000	0.0000	0.0000	0.0000	0.0489	0.0489
06:45:00	0.0000	0.0000	0.0000	0.0000	0.0486	0.0486
07:00:00	0.0000	0.0000	0.0000	0.0000	0.0483	0.0483
07:15:00	0.0000	0.0000	0.0000	0.0000	0.048	0.048
07:30:00	0.0000	0.0000	0.0000	0.0000	0.0478	0.0478
07:45:00	0.0000	0.0000	0.0000	0.0000	0.0475	0.0475
08:00:00	0.0000	0.0000	0.0000	0.0000	0.0472	0.0472
08:15:00	0.0000	0.0000	0.0000	0.0000	0.0469	0.0469
08:30:00	0.0000	0.0000	0.0000	0.0000	0.0467	0.0467

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
08:45:00	0.0000	0.0000	0.0000	0.0000	0.0464	0.0464
09:00:00	0.0000	0.0000	0.0000	0.0000	0.0461	0.0461
09:15:00	0.0000	0.0000	0.0000	0.0000	0.0458	0.0458
09:30:00	0.0000	0.0000	0.0000	0.0000	0.0456	0.0456
09:45:00	0.0000	0.0000	0.0000	0.0000	0.0453	0.0453
10:00:00	0.0000	0.0000	0.0000	0.0000	0.045	0.045
10:15:00	0.0000	0.0000	0.0000	0.0000	0.0448	0.0448
10:30:00	0.0000	0.0000	0.0000	0.0000	0.0445	0.0445
10:45:00	0.0000	0.0000	0.0000	0.0000	0.0443	0.0443
11:00:00	0.0000	0.0000	0.0000	0.0000	0.044	0.044
11:15:00	0.0000	0.0000	0.0000	0.0000	0.0438	0.0438
11:30:00	0.0000	0.0000	0.0000	0.0000	0.0435	0.0435
11:45:00	0.0000	0.0000	0.0000	0.0000	0.0432	0.0432
12:00:00	0.0000	0.0000	0.0000	0.0000	0.043	0.043
12:15:00	0.0000	0.0000	0.0000	0.0000	0.0427	0.0427
12:30:00	0.0000	0.0000	0.0000	0.0000	0.0425	0.0425
12:45:00	0.0000	0.0000	0.0000	0.0000	0.0422	0.0422
13:00:00	0.0000	0.0000	0.0000	0.0000	0.042	0.042
13:15:00	0.0000	0.0000	0.0000	0.0000	0.0418	0.0418
13:30:00	0.0000	0.0000	0.0000	0.0000	0.0415	0.0415
13:45:00	0.0000	0.0000	0.0000	0.0000	0.0413	0.0413
14:00:00	0.0000	0.0000	0.0000	0.0000	0.041	0.041
14:15:00	0.0000	0.0000	0.0000	0.0000	0.0408	0.0408
14:30:00	0.0000	0.0000	0.0000	0.0000	0.0406	0.0406
14:45:00	0.0000	0.0000	0.0000	0.0000	0.0403	0.0403
15:00:00	0.0000	0.0000	0.0000	0.0000	0.0401	0.0401
15:15:00	0.0000	0.0000	0.0000	0.0000	0.0399	0.0399
15:30:00	0.0000	0.0000	0.0000	0.0000	0.0396	0.0396
15:45:00	0.0000	0.0000	0.0000	0.0000	0.0394	0.0394
16:00:00	0.0000	0.0000	0.0000	0.0000	0.0392	0.0392
16:15:00	0.0000	0.0000	0.0000	0.0000	0.0389	0.0389
16:30:00	0.0000	0.0000	0.0000	0.0000	0.0387	0.0387
16:45:00	0.0000	0.0000	0.0000	0.0000	0.0385	0.0385
17:00:00	0.0000	0.0000	0.0000	0.0000	0.0383	0.0383
17:15:00	0.0000	0.0000	0.0000	0.0000	0.038	0.038
17:30:00	0.0000	0.0000	0.0000	0.0000	0.0378	0.0378

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
17:45:00	0.0000	0.0000	0.0000	0.0000	0.0376	0.0376
18:00:00	0.0000	0.0000	0.0000	0.0000	0.0374	0.0374
18:15:00	0.0000	0.0000	0.0000	0.0000	0.0372	0.0372
18:30:00	0.0000	0.0000	0.0000	0.0000	0.0369	0.0369
18:45:00	0.0000	0.0000	0.0000	0.0000	0.0367	0.0367
19:00:00	0.0000	0.0000	0.0000	0.0000	0.0365	0.0365
19:15:00	0.0000	0.0000	0.0000	0.0000	0.0363	0.0363
19:30:00	0.0000	0.0000	0.0000	0.0000	0.0361	0.0361
19:45:00	0.0000	0.0000	0.0000	0.0000	0.0359	0.0359
20:00:00	0.0000	0.0000	0.0000	0.0000	0.0357	0.0357
20:15:00	0.0000	0.0000	0.0000	0.0000	0.0355	0.0355
20:30:00	0.0000	0.0000	0.0000	0.0000	0.0353	0.0353
20:45:00	0.0000	0.0000	0.0000	0.0000	0.0351	0.0351
21:00:00	0.0000	0.0000	0.0000	0.0000	0.0349	0.0349
21:15:00	0.0000	0.0000	0.0000	0.0000	0.0346	0.0346
21:30:00	0.0000	0.0000	0.0000	0.0000	0.0344	0.0344
21:45:00	0.0000	0.0000	0.0000	0.0000	0.0342	0.0342
22:00:00	0.0000	0.0000	0.0000	0.0000	0.034	0.034
22:15:00	0.0000	0.0000	0.0000	0.0000	0.0338	0.0338
22:30:00	0.0000	0.0000	0.0000	0.0000	0.0337	0.0337
22:45:00	0.0000	0.0000	0.0000	0.0000	0.0335	0.0335
23:00:00	0.0000	0.0000	0.0000	0.0000	0.0333	0.0333
23:15:00	0.0000	0.0000	0.0000	0.0000	0.0331	0.0331
23:30:00	0.0000	0.0000	0.0000	0.0000	0.0329	0.0329
23:45:00	0.0000	0.0000	0.0000	0.0000	0.0327	0.0327
24:00:00	0.0000	0.0000	0.0000	0.0000	0.0325	0.0325
24:15:00	0.0000	0.0000	0.0000	0.0000	0.0323	0.0323
24:30:00	0.0000	0.0000	0.0000	0.0000	0.0321	0.0321
24:45:00	0.0000	0.0000	0.0000	0.0000	0.0319	0.0319
25:00:00	0.0000	0.0000	0.0000	0.0000	0.0317	0.0317
25:15:00	0.0000	0.0000	0.0000	0.0000	0.0316	0.0316
25:30:00	0.0000	0.0000	0.0000	0.0000	0.0314	0.0314
25:45:00	0.0000	0.0000	0.0000	0.0000	0.0312	0.0312
26:00:00	0.0000	0.0000	0.0000	0.0000	0.031	0.031
26:15:00	0.0000	0.0000	0.0000	0.0000	0.0308	0.0308
26:30:00	0.0000	0.0000	0.0000	0.0000	0.0307	0.0307

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
26:45:00	0.0000	0.0000	0.0000	0.0000	0.0305	0.0305
27:00:00	0.0000	0.0000	0.0000	0.0000	0.0303	0.0303
27:15:00	0.0000	0.0000	0.0000	0.0000	0.0301	0.0301
27:30:00	0.0000	0.0000	0.0000	0.0000	0.0299	0.0299
27:45:00	0.0000	0.0000	0.0000	0.0000	0.0298	0.0298
28:00:00	0.0000	0.0000	0.0000	0.0000	0.0296	0.0296
28:15:00	0.0000	0.0000	0.0000	0.0000	0.0294	0.0294
28:30:00	0.0000	0.0000	0.0000	0.0000	0.0293	0.0293
28:45:00	0.0000	0.0000	0.0000	0.0000	0.0291	0.0291
29:00:00	0.0000	0.0000	0.0000	0.0000	0.0289	0.0289
29:15:00	0.0000	0.0000	0.0000	0.0000	0.0287	0.0287
29:30:00	0.0000	0.0000	0.0000	0.0000	0.0286	0.0286
29:45:00	0.0000	0.0000	0.0000	0.0000	0.0284	0.0284
30:00:00	0.0000	0.0000	0.0000	0.0000	0.0282	0.0282
30:15:00	0.0000	0.0000	0.0000	0.0000	0.0281	0.0281
30:30:00	0.0000	0.0000	0.0000	0.0000	0.0279	0.0279
30:45:00	0.0000	0.0000	0.0000	0.0000	0.0278	0.0278
31:00:00	0.0000	0.0000	0.0000	0.0000	0.0276	0.0276
31:15:00	0.0000	0.0000	0.0000	0.0000	0.0274	0.0274
31:30:00	0.0000	0.0000	0.0000	0.0000	0.0273	0.0273
31:45:00	0.0000	0.0000	0.0000	0.0000	0.0271	0.0271
32:00:00	0.0000	0.0000	0.0000	0.0000	0.027	0.027
32:15:00	0.0000	0.0000	0.0000	0.0000	0.0268	0.0268
32:30:00	0.0000	0.0000	0.0000	0.0000	0.0266	0.0266
32:45:00	0.0000	0.0000	0.0000	0.0000	0.0265	0.0265
33:00:00	0.0000	0.0000	0.0000	0.0000	0.0263	0.0263
33:15:00	0.0000	0.0000	0.0000	0.0000	0.0262	0.0262
33:30:00	0.0000	0.0000	0.0000	0.0000	0.026	0.026
33:45:00	0.0000	0.0000	0.0000	0.0000	0.0259	0.0259
34:00:00	0.0000	0.0000	0.0000	0.0000	0.0257	0.0257
34:15:00	0.0000	0.0000	0.0000	0.0000	0.0256	0.0256
34:30:00	0.0000	0.0000	0.0000	0.0000	0.0254	0.0254
34:45:00	0.0000	0.0000	0.0000	0.0000	0.0253	0.0253
35:00:00	0.0000	0.0000	0.0000	0.0000	0.0251	0.0251
35:15:00	0.0000	0.0000	0.0000	0.0000	0.025	0.025
35:30:00	0.0000	0.0000	0.0000	0.0000	0.0248	0.0248

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
35:45:00	0.0000	0.0000	0.0000	0.0000	0.0247	0.0247
36:00:00	0.0000	0.0000	0.0000	0.0000	0.0246	0.0246
36:15:00	0.0000	0.0000	0.0000	0.0000	0.0244	0.0244
36:30:00	0.0000	0.0000	0.0000	0.0000	0.0243	0.0243
36:45:00	0.0000	0.0000	0.0000	0.0000	0.0241	0.0241
37:00:00	0.0000	0.0000	0.0000	0.0000	0.024	0.024
37:15:00	0.0000	0.0000	0.0000	0.0000	0.0239	0.0239
37:30:00	0.0000	0.0000	0.0000	0.0000	0.0237	0.0237
37:45:00	0.0000	0.0000	0.0000	0.0000	0.0236	0.0236
38:00:00	0.0000	0.0000	0.0000	0.0000	0.0234	0.0234
38:15:00	0.0000	0.0000	0.0000	0.0000	0.0233	0.0233

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.71	No
PROPWET (mm)	0.47	No
SAAR (mm)	999	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

UK Design Flood Estimation

Generated on Thursday, January 2, 2020 3:53:15 PM by Rob.Varley
Printed from the ReFH Flood Modelling software package, version 2.2.7059.19021

Summary of estimate using the Flood Estimation Handbook revitalised flood hydrograph method (ReFH)

Site details Checksum: E0D7-263B

Site name: Cardiff Parkway

Easting: 325055

Northing: 181076

Country: England, Wales or Northern Ireland

Catchment Area (km^2): 0.43 [0.5]*

Using plot scale calculations: Yes

Site description: None

Model run: 100 year

Summary of results

Rainfall - FEH 2013 (mm):	52.02	Total runoff (ML):	2.15
Total Rainfall (mm):	36.01	Total flow (ML):	5.66
Peak Rainfall (mm):	9.79	Peak flow (m^3/s):	0.29

Parameters

Where the user has overriden a system-generated value, this original value is shown in square brackets after the value used.
** Indicates that the user locked the duration/timestep*

Rainfall parameters (Rainfall - FEH 2013 model)

Name	Value	User-defined?
Duration (hh:mm:ss)	02:15:00	No
Timestep (hh:mm:ss)	00:15:00	No
SCF (Seasonal correction factor)	0.71	No
ARF (Areal reduction factor)	0.98	No
Seasonality	Winter	n/a

Loss model parameters

Name	Value	User-defined?
Cini (mm)	72.81	No
Cmax (mm)	653.19	No
Use alpha correction factor	No	No
Alpha correction factor	n/a	No

Routing model parameters

Name	Value	User-defined?
Tp (hr)	1.13 [1.08]	Yes
Up	0.65	No
Uk	0.8	No

Baseflow model parameters

Name	Value	User-defined?
BF0 (m^3/s)	0.01	No
BL (hr)	42.85 [42.36]	Yes
BR	2.09	No

Urbanisation parameters

Name	Value	User-defined?
Urban area (km^2)	0	No
Urbext 2000	0	No
Impervious runoff factor	0.7	No
Imperviousness factor	0.3	No
Tp scaling factor	0.5	No
Sewered area (km^2)	0.00	Yes
Sewer capacity (m^3/s)	0.00	Yes

Time series data

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
00:00:00	1.0291	0.0000	0.1155	0.0000	0.0106	0.0106
00:15:00	1.9307	0.0000	0.2211	0.0009	0.0106	0.0115
00:30:00	3.5900	0.0000	0.4263	0.0044	0.0106	0.0149
00:45:00	6.5579	0.0000	0.8297	0.0128	0.0106	0.0234
01:00:00	9.7931	0.0000	1.3616	0.0308	0.0108	0.0416
01:15:00	6.5579	0.0000	0.9939	0.0654	0.0113	0.0767
01:30:00	3.5900	0.0000	0.5720	0.1152	0.0123	0.128
01:45:00	1.9307	0.0000	0.3158	0.1713	0.014	0.185
02:00:00	1.0291	0.0000	0.1706	0.2233	0.0163	0.24
02:15:00	0.0000	0.0000	0.0000	0.2584	0.0192	0.278
02:30:00	0.0000	0.0000	0.0000	0.2648	0.0222	0.287
02:45:00	0.0000	0.0000	0.0000	0.2480	0.0252	0.273
03:00:00	0.0000	0.0000	0.0000	0.2184	0.0279	0.246
03:15:00	0.0000	0.0000	0.0000	0.1839	0.0302	0.214
03:30:00	0.0000	0.0000	0.0000	0.1508	0.032	0.183
03:45:00	0.0000	0.0000	0.0000	0.1231	0.0335	0.157
04:00:00	0.0000	0.0000	0.0000	0.0993	0.0346	0.134
04:15:00	0.0000	0.0000	0.0000	0.0779	0.0355	0.113
04:30:00	0.0000	0.0000	0.0000	0.0583	0.0361	0.0944
04:45:00	0.0000	0.0000	0.0000	0.0402	0.0365	0.0767
05:00:00	0.0000	0.0000	0.0000	0.0244	0.0367	0.0611
05:15:00	0.0000	0.0000	0.0000	0.0125	0.0367	0.0492
05:30:00	0.0000	0.0000	0.0000	0.0056	0.0366	0.0422
05:45:00	0.0000	0.0000	0.0000	0.0020	0.0364	0.0385
06:00:00	0.0000	0.0000	0.0000	0.0005	0.0362	0.0367
06:15:00	0.0000	0.0000	0.0000	0.0000	0.036	0.036
06:30:00	0.0000	0.0000	0.0000	0.0000	0.0358	0.0358
06:45:00	0.0000	0.0000	0.0000	0.0000	0.0356	0.0356
07:00:00	0.0000	0.0000	0.0000	0.0000	0.0354	0.0354
07:15:00	0.0000	0.0000	0.0000	0.0000	0.0352	0.0352
07:30:00	0.0000	0.0000	0.0000	0.0000	0.035	0.035
07:45:00	0.0000	0.0000	0.0000	0.0000	0.0348	0.0348
08:00:00	0.0000	0.0000	0.0000	0.0000	0.0346	0.0346
08:15:00	0.0000	0.0000	0.0000	0.0000	0.0344	0.0344
08:30:00	0.0000	0.0000	0.0000	0.0000	0.0342	0.0342

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
08:45:00	0.0000	0.0000	0.0000	0.0000	0.034	0.034
09:00:00	0.0000	0.0000	0.0000	0.0000	0.0338	0.0338
09:15:00	0.0000	0.0000	0.0000	0.0000	0.0336	0.0336
09:30:00	0.0000	0.0000	0.0000	0.0000	0.0334	0.0334
09:45:00	0.0000	0.0000	0.0000	0.0000	0.0332	0.0332
10:00:00	0.0000	0.0000	0.0000	0.0000	0.033	0.033
10:15:00	0.0000	0.0000	0.0000	0.0000	0.0328	0.0328
10:30:00	0.0000	0.0000	0.0000	0.0000	0.0326	0.0326
10:45:00	0.0000	0.0000	0.0000	0.0000	0.0324	0.0324
11:00:00	0.0000	0.0000	0.0000	0.0000	0.0323	0.0323
11:15:00	0.0000	0.0000	0.0000	0.0000	0.0321	0.0321
11:30:00	0.0000	0.0000	0.0000	0.0000	0.0319	0.0319
11:45:00	0.0000	0.0000	0.0000	0.0000	0.0317	0.0317
12:00:00	0.0000	0.0000	0.0000	0.0000	0.0315	0.0315
12:15:00	0.0000	0.0000	0.0000	0.0000	0.0313	0.0313
12:30:00	0.0000	0.0000	0.0000	0.0000	0.0311	0.0311
12:45:00	0.0000	0.0000	0.0000	0.0000	0.031	0.031
13:00:00	0.0000	0.0000	0.0000	0.0000	0.0308	0.0308
13:15:00	0.0000	0.0000	0.0000	0.0000	0.0306	0.0306
13:30:00	0.0000	0.0000	0.0000	0.0000	0.0304	0.0304
13:45:00	0.0000	0.0000	0.0000	0.0000	0.0303	0.0303
14:00:00	0.0000	0.0000	0.0000	0.0000	0.0301	0.0301
14:15:00	0.0000	0.0000	0.0000	0.0000	0.0299	0.0299
14:30:00	0.0000	0.0000	0.0000	0.0000	0.0297	0.0297
14:45:00	0.0000	0.0000	0.0000	0.0000	0.0296	0.0296
15:00:00	0.0000	0.0000	0.0000	0.0000	0.0294	0.0294
15:15:00	0.0000	0.0000	0.0000	0.0000	0.0292	0.0292
15:30:00	0.0000	0.0000	0.0000	0.0000	0.029	0.029
15:45:00	0.0000	0.0000	0.0000	0.0000	0.0289	0.0289
16:00:00	0.0000	0.0000	0.0000	0.0000	0.0287	0.0287
16:15:00	0.0000	0.0000	0.0000	0.0000	0.0285	0.0285
16:30:00	0.0000	0.0000	0.0000	0.0000	0.0284	0.0284
16:45:00	0.0000	0.0000	0.0000	0.0000	0.0282	0.0282
17:00:00	0.0000	0.0000	0.0000	0.0000	0.028	0.028
17:15:00	0.0000	0.0000	0.0000	0.0000	0.0279	0.0279
17:30:00	0.0000	0.0000	0.0000	0.0000	0.0277	0.0277

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
17:45:00	0.0000	0.0000	0.0000	0.0000	0.0276	0.0276
18:00:00	0.0000	0.0000	0.0000	0.0000	0.0274	0.0274
18:15:00	0.0000	0.0000	0.0000	0.0000	0.0272	0.0272
18:30:00	0.0000	0.0000	0.0000	0.0000	0.0271	0.0271
18:45:00	0.0000	0.0000	0.0000	0.0000	0.0269	0.0269
19:00:00	0.0000	0.0000	0.0000	0.0000	0.0268	0.0268
19:15:00	0.0000	0.0000	0.0000	0.0000	0.0266	0.0266
19:30:00	0.0000	0.0000	0.0000	0.0000	0.0265	0.0265
19:45:00	0.0000	0.0000	0.0000	0.0000	0.0263	0.0263
20:00:00	0.0000	0.0000	0.0000	0.0000	0.0261	0.0261
20:15:00	0.0000	0.0000	0.0000	0.0000	0.026	0.026
20:30:00	0.0000	0.0000	0.0000	0.0000	0.0258	0.0258
20:45:00	0.0000	0.0000	0.0000	0.0000	0.0257	0.0257
21:00:00	0.0000	0.0000	0.0000	0.0000	0.0255	0.0255
21:15:00	0.0000	0.0000	0.0000	0.0000	0.0254	0.0254
21:30:00	0.0000	0.0000	0.0000	0.0000	0.0252	0.0252
21:45:00	0.0000	0.0000	0.0000	0.0000	0.0251	0.0251
22:00:00	0.0000	0.0000	0.0000	0.0000	0.025	0.025
22:15:00	0.0000	0.0000	0.0000	0.0000	0.0248	0.0248
22:30:00	0.0000	0.0000	0.0000	0.0000	0.0247	0.0247
22:45:00	0.0000	0.0000	0.0000	0.0000	0.0245	0.0245
23:00:00	0.0000	0.0000	0.0000	0.0000	0.0244	0.0244
23:15:00	0.0000	0.0000	0.0000	0.0000	0.0242	0.0242
23:30:00	0.0000	0.0000	0.0000	0.0000	0.0241	0.0241
23:45:00	0.0000	0.0000	0.0000	0.0000	0.024	0.024
24:00:00	0.0000	0.0000	0.0000	0.0000	0.0238	0.0238
24:15:00	0.0000	0.0000	0.0000	0.0000	0.0237	0.0237
24:30:00	0.0000	0.0000	0.0000	0.0000	0.0235	0.0235
24:45:00	0.0000	0.0000	0.0000	0.0000	0.0234	0.0234
25:00:00	0.0000	0.0000	0.0000	0.0000	0.0233	0.0233
25:15:00	0.0000	0.0000	0.0000	0.0000	0.0231	0.0231
25:30:00	0.0000	0.0000	0.0000	0.0000	0.023	0.023
25:45:00	0.0000	0.0000	0.0000	0.0000	0.0229	0.0229
26:00:00	0.0000	0.0000	0.0000	0.0000	0.0227	0.0227
26:15:00	0.0000	0.0000	0.0000	0.0000	0.0226	0.0226
26:30:00	0.0000	0.0000	0.0000	0.0000	0.0225	0.0225

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
26:45:00	0.0000	0.0000	0.0000	0.0000	0.0223	0.0223
27:00:00	0.0000	0.0000	0.0000	0.0000	0.0222	0.0222
27:15:00	0.0000	0.0000	0.0000	0.0000	0.0221	0.0221
27:30:00	0.0000	0.0000	0.0000	0.0000	0.0219	0.0219
27:45:00	0.0000	0.0000	0.0000	0.0000	0.0218	0.0218
28:00:00	0.0000	0.0000	0.0000	0.0000	0.0217	0.0217
28:15:00	0.0000	0.0000	0.0000	0.0000	0.0216	0.0216
28:30:00	0.0000	0.0000	0.0000	0.0000	0.0214	0.0214
28:45:00	0.0000	0.0000	0.0000	0.0000	0.0213	0.0213
29:00:00	0.0000	0.0000	0.0000	0.0000	0.0212	0.0212
29:15:00	0.0000	0.0000	0.0000	0.0000	0.0211	0.0211
29:30:00	0.0000	0.0000	0.0000	0.0000	0.0209	0.0209
29:45:00	0.0000	0.0000	0.0000	0.0000	0.0208	0.0208
30:00:00	0.0000	0.0000	0.0000	0.0000	0.0207	0.0207
30:15:00	0.0000	0.0000	0.0000	0.0000	0.0206	0.0206
30:30:00	0.0000	0.0000	0.0000	0.0000	0.0205	0.0205
30:45:00	0.0000	0.0000	0.0000	0.0000	0.0203	0.0203
31:00:00	0.0000	0.0000	0.0000	0.0000	0.0202	0.0202
31:15:00	0.0000	0.0000	0.0000	0.0000	0.0201	0.0201
31:30:00	0.0000	0.0000	0.0000	0.0000	0.02	0.02
31:45:00	0.0000	0.0000	0.0000	0.0000	0.0199	0.0199
32:00:00	0.0000	0.0000	0.0000	0.0000	0.0198	0.0198
32:15:00	0.0000	0.0000	0.0000	0.0000	0.0196	0.0196
32:30:00	0.0000	0.0000	0.0000	0.0000	0.0195	0.0195
32:45:00	0.0000	0.0000	0.0000	0.0000	0.0194	0.0194
33:00:00	0.0000	0.0000	0.0000	0.0000	0.0193	0.0193
33:15:00	0.0000	0.0000	0.0000	0.0000	0.0192	0.0192
33:30:00	0.0000	0.0000	0.0000	0.0000	0.0191	0.0191
33:45:00	0.0000	0.0000	0.0000	0.0000	0.019	0.019
34:00:00	0.0000	0.0000	0.0000	0.0000	0.0189	0.0189
34:15:00	0.0000	0.0000	0.0000	0.0000	0.0187	0.0187
34:30:00	0.0000	0.0000	0.0000	0.0000	0.0186	0.0186
34:45:00	0.0000	0.0000	0.0000	0.0000	0.0185	0.0185
35:00:00	0.0000	0.0000	0.0000	0.0000	0.0184	0.0184
35:15:00	0.0000	0.0000	0.0000	0.0000	0.0183	0.0183
35:30:00	0.0000	0.0000	0.0000	0.0000	0.0182	0.0182

Time (hh:mm:ss)	Rain (mm)	Sewer Loss (mm)	Net Rain (mm)	Runoff (m^3/s)	Baseflow (m^3/s)	Total Flow (m^3/s)
35:45:00	0.0000	0.0000	0.0000	0.0000	0.0181	0.0181
36:00:00	0.0000	0.0000	0.0000	0.0000	0.018	0.018
36:15:00	0.0000	0.0000	0.0000	0.0000	0.0179	0.0179
36:30:00	0.0000	0.0000	0.0000	0.0000	0.0178	0.0178
36:45:00	0.0000	0.0000	0.0000	0.0000	0.0177	0.0177
37:00:00	0.0000	0.0000	0.0000	0.0000	0.0176	0.0176
37:15:00	0.0000	0.0000	0.0000	0.0000	0.0175	0.0175
37:30:00	0.0000	0.0000	0.0000	0.0000	0.0174	0.0174
37:45:00	0.0000	0.0000	0.0000	0.0000	0.0173	0.0173
38:00:00	0.0000	0.0000	0.0000	0.0000	0.0172	0.0172
38:15:00	0.0000	0.0000	0.0000	0.0000	0.0171	0.0171

Appendix

Catchment descriptors *

Name	Value	User-defined value used?
BFIHOST	0.71	No
PROPWET (mm)	0.47	No
SAAR (mm)	999	No

Values in square brackets are the original values loaded from the FEH Web Service or FEH CD-ROM

File Note

252199 6 January 2020

DOCUMENT CHECKING (not mandatory for File Note)

	Prepared by	Checked by	Approved by
Name	Sion Williams	Sion Williams	John Smith
Signature			

C4 Microdrainage Results

Ove Arup & Partners International Ltd		Page 1
The Arup Campus Blyth Gate Solihull B90 8AE	Hendre Lakes	
Date 17/04/2020 09:28 File Catchment A.MDX	Designed by Daniel.Thomas Checked by Sion Williams	
XP Solutions	Network 2019.1	

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Catchment A

Pipe Sizes Storm Pl Manhole Sizes SfA 7

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.306	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)	0.900
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 Catchment A

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	36.602	0.163	224.6	0.137	4.00	0.0	0.600		o	350	Pipe/Conduit	
2.000	80.576	0.394	204.5	0.076	4.00	0.0	0.600		o	350	Pipe/Conduit	
2.001	55.403	0.429	129.1	0.075	0.00	0.0	0.600		o	350	Pipe/Conduit	
1.001	53.277	0.238	223.9	0.159	0.00	0.0	0.600		o	350	Pipe/Conduit	
1.002	24.824	0.071	349.6	0.063	0.00	0.0	0.600		o	350	Pipe/Conduit	
1.003	18.543	0.005	3708.6	0.035	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
3.000	58.778	0.157	375.0	0.123	4.00	0.0	0.600		o	375	Pipe/Conduit	
3.001	64.639	0.180	359.1	0.194	0.00	0.0	0.600		o	375	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	4.53	5.204	0.137	0.0	0.0	0.0	1.15	111.0	18.6
2.000	50.00	5.11	5.864	0.076	0.0	0.0	0.0	1.21	116.3	10.3
2.001	50.00	5.72	5.470	0.151	0.0	0.0	0.0	1.52	146.7	20.4
1.001	50.00	6.49	5.041	0.447	0.0	0.0	0.0	1.16	111.1	60.6
1.002	50.00	6.93	4.803	0.510	0.0	0.0	0.0	0.92	88.7	69.1
1.003	50.00	7.23	4.732	0.546	0.0	0.0	0.0	1.03	13405.0	73.9
3.000	50.00	5.05	5.064	0.123	0.0	0.0	0.0	0.93	102.7	16.6
3.001	50.00	6.19	4.907	0.317	0.0	0.0	0.0	0.95	105.0	42.9

Network Design Table for Catchment A

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
4.000	41.245	0.183	225.4	0.093	4.00	0.0	0.600		o	225	Pipe/Conduit	
1.004	36.103	0.005	7220.6	0.051	0.00	0.0		0.017	|_|	-2	Pipe/Conduit	
5.000	36.643	0.163	224.8	0.066	4.00	0.0	0.600		o	225	Pipe/Conduit	
1.005	36.103	0.005	7220.6	0.000	0.00	0.0		0.017	|_|	-2	Pipe/Conduit	
6.000	49.538	0.165	300.2	0.115	4.00	0.0	0.600		o	300	Pipe/Conduit	
6.001	64.209	0.214	300.0	0.079	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.006	25.782	0.005	5156.4	0.076	0.00	0.0		0.017	|_|	-2	Pipe/Conduit	
7.000	24.340	0.082	296.8	0.076	4.00	0.0	0.600		o	300	Pipe/Conduit	
1.007	47.431	0.005	9486.2	0.000	0.00	0.0		0.017	|_|	-2	Pipe/Conduit	
8.000	66.682	0.372	179.3	0.098	4.00	0.0	0.600		o	300	Pipe/Conduit	
9.000	66.612	0.305	218.4	0.053	4.00	0.0	0.600		o	225	Pipe/Conduit	
9.001	23.565	0.360	65.5	0.074	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)
4.000	50.00	4.79	4.910	0.093	0.0	0.0	0.0	0.87	34.5	12.5
1.004	50.00	8.37	4.727	1.006	0.0	0.0	0.0	0.53	1923.9	136.2
5.000	50.00	4.70	4.885	0.066	0.0	0.0	0.0	0.87	34.5	9.0
1.005	50.00	9.50	4.722	1.072	0.0	0.0	0.0	0.53	1923.9	145.2
6.000	50.00	4.92	5.096	0.115	0.0	0.0	0.0	0.90	63.8	15.6
6.001	50.00	6.10	4.931	0.195	0.0	0.0	0.0	0.90	63.8	26.4
1.006	50.00	10.19	4.717	1.343	0.0	0.0	0.0	0.63	2276.6	181.8
7.000	50.00	4.45	4.794	0.076	0.0	0.0	0.0	0.91	64.1	10.3
1.007	50.00	11.89	4.712	1.419	0.0	0.0	0.0	0.46	1678.5	192.1
8.000	50.00	4.95	5.094	0.098	0.0	0.0	0.0	1.17	82.8	13.3
9.000	50.00	5.26	5.387	0.053	0.0	0.0	0.0	0.88	35.0	7.1
9.001	50.00	5.50	5.082	0.127	0.0	0.0	0.0	1.62	64.4	17.2

Network Design Table for Catchment A

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
8.001	42.354	0.005	8470.8	0.116	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
10.000	31.632	0.105	301.3	0.169	4.00	0.0	0.600		o	300	Pipe/Conduit	
8.002	70.921	0.005	14184.2	0.093	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
11.000	38.751	0.502	77.2	0.095	4.00	0.0	0.600		o	300	Pipe/Conduit	
11.001	35.921	0.140	256.6	0.062	0.00	0.0	0.600		o	300	Pipe/Conduit	
12.000	60.965	0.529	115.2	0.093	4.00	0.0	0.600		o	300	Pipe/Conduit	
12.001	40.597	0.343	118.4	0.069	0.00	0.0	0.600		o	300	Pipe/Conduit	
12.002	39.148	0.301	130.1	0.066	0.00	0.0	0.600		o	300	Pipe/Conduit	
12.003	19.290	0.064	301.4	0.085	0.00	0.0	0.600		o	300	Pipe/Conduit	
11.002	10.549	0.005	2109.8	0.060	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
8.003	16.414	0.005	3282.8	0.000	0.00	0.0	0.600		o	375	Pipe/Conduit	
13.000	25.783	0.086	299.8	0.067	4.00	0.0	0.600		o	300	Pipe/Conduit	
1.008	34.725	0.005	6945.0	0.000	0.00	0.0		0.017	|_|	-1	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)
8.001	50.00	6.54	4.722	0.341	0.0	0.0	0.0	0.68	8869.7	46.2
10.000	50.00	4.59	4.822	0.169	0.0	0.0	0.0	0.90	63.7	22.9
8.002	50.00	8.79	4.717	0.603	0.0	0.0	0.0	0.53	6854.4	81.6
11.000	50.00	4.36	5.364	0.095	0.0	0.0	0.0	1.79	126.6	12.9
11.001	50.00	4.97	4.862	0.157	0.0	0.0	0.0	0.98	69.1	21.2
12.000	50.00	4.69	5.954	0.093	0.0	0.0	0.0	1.46	103.5	12.6
12.001	50.00	5.16	5.425	0.161	0.0	0.0	0.0	1.44	102.1	21.9
12.002	50.00	5.64	5.082	0.228	0.0	0.0	0.0	1.38	97.3	30.8
12.003	50.00	5.99	4.781	0.313	0.0	0.0	0.0	0.90	63.6	42.3
11.002	50.00	6.12	4.717	0.529	0.0	0.0	0.0	1.36	17772.6	71.7
8.003	50.00	9.68	4.712	1.132	0.0	0.0	0.0	0.31	33.9«	153.3
13.000	50.00	4.48	4.793	0.067	0.0	0.0	0.0	0.90	63.8	9.1
1.008	50.00	12.66	4.707	2.618	0.0	0.0	0.0	0.75	9795.7	354.6

Network Design Table for Catchment A

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
14.000	59.064	0.199	296.8	0.017	4.00	0.0	0.600		o	300	Pipe/Conduit	
14.001	16.070	0.054	297.6	0.065	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.009	18.519	0.005	3703.8	0.066	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
15.000	26.934	0.489	55.1	0.081	4.00	0.0	0.600		o	300	Pipe/Conduit	
1.010	14.263	0.005	2852.6	0.000	0.00	0.0		0.012	|_|	-1	Pipe/Conduit	
1.011	27.393	0.091	301.0	0.000	0.00	0.0	0.600		o	300	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)
14.000	50.00	5.08	5.000	0.017	0.0	0.0	0.0	0.91	64.1	2.2
14.001	50.00	5.38	4.801	0.081	0.0	0.0	0.0	0.91	64.1	11.0
1.009	50.00	12.97	4.702	2.766	0.0	0.0	0.0	1.03	13413.7	374.5
15.000	50.00	4.21	5.186	0.081	0.0	0.0	0.0	2.12	150.1	10.9
1.010	50.00	13.11	4.697	2.847	0.0	0.0	0.0	1.66	21653.0	385.5
1.011	50.00	13.62	4.692	2.847	0.0	0.0	0.0	0.90	63.7«	385.5

Conduit Sections for Catchment A

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m^2)
-1	|_|	9000	1450	90.0		4.387	13.050
-2	|_|	2500	1450	90.0		2.685	3.625

Free Flowing Outfall Details for Catchment A

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.011		6.000	4.601	4.500	0	0

Simulation Criteria for Catchment A

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 Coeffiecient	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

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)	19.000	Storm Duration (mins)	30
Ratio R	0.306		

Online Controls for Catchment A

Hydro-Brake® Optimum Manhole: 39, DS/PN: 1.011, Volume (m³): 179.9

Unit Reference	MD-SHE-0126-8100-1450-8100
Design Head (m)	1.450
Design Flow (l/s)	8.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	126
Invert Level (m)	4.692
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.450	8.1	Kick-Flo®	0.894	6.5
Flush-Flo™	0.423	8.1	Mean Flow over Head Range	-	7.1

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	4.5	1.200	7.4	3.000	11.4	7.000	17.1
0.200	7.4	1.400	8.0	3.500	12.3	7.500	17.7
0.300	7.9	1.600	8.5	4.000	13.1	8.000	18.2
0.400	8.1	1.800	9.0	4.500	13.8	8.500	18.8
0.500	8.1	2.000	9.4	5.000	14.6	9.000	19.3
0.600	7.9	2.200	9.9	5.500	15.2	9.500	19.8
0.800	7.2	2.400	10.3	6.000	15.9		
1.000	6.8	2.600	10.7	6.500	16.5		

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

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	1	+0%	100/15 Summer				5.302
2.000	2	15 Winter	1	+0%	100/15 Summer				5.934
2.001	3	15 Winter	1	+0%	100/15 Summer				5.551
1.001	4	15 Winter	1	+0%	100/15 Summer				5.210
1.002	5	960 Winter	1	+0%	100/15 Summer				5.045
1.003	6	960 Winter	1	+0%					5.044
3.000	7	15 Winter	1	+0%	100/15 Summer				5.166
3.001	8	15 Winter	1	+0%	100/15 Summer				5.058
4.000	9	960 Winter	1	+0%	100/15 Summer				5.045
1.004	10	960 Winter	1	+0%					5.044
5.000	11	960 Winter	1	+0%	100/15 Summer				5.044
1.005	12	960 Winter	1	+0%					5.044
6.000	13	15 Winter	1	+0%	100/15 Summer				5.197
6.001	14	15 Winter	1	+0%	100/15 Summer				5.055
1.006	15	960 Winter	1	+0%					5.044
7.000	16	960 Winter	1	+0%	100/15 Summer				5.044
1.007	17	960 Winter	1	+0%					5.045
8.000	18	15 Winter	1	+0%	100/120 Summer				5.174
9.000	19	15 Winter	1	+0%	100/240 Winter				5.455

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.252	0.000	0.17		17.4	OK	
2.000	2	-0.280	0.000	0.08		9.1	OK	
2.001	3	-0.269	0.000	0.12		16.5	OK	
1.001	4	-0.181	0.000	0.46		47.5	OK	
1.002	5	-0.108	0.000	0.08		6.1	OK	
1.003	6	-1.138	0.000	0.00		6.4	OK	
3.000	7	-0.273	0.000	0.15		14.8	OK	
3.001	8	-0.224	0.000	0.32		31.7	OK	
4.000	9	-0.090	0.000	0.03		1.1	OK	
1.004	10	-1.133	0.000	0.00		10.4	OK	
5.000	11	-0.066	0.000	0.02		0.8	OK	
1.005	12	-1.128	0.000	0.00		10.1	OK	
6.000	13	-0.199	0.000	0.23		14.0	OK	
6.001	14	-0.176	0.000	0.34		20.6	OK	
1.006	15	-1.123	0.000	0.00		12.2	OK	
7.000	16	-0.050	0.000	0.02		0.9	OK	
1.007	17	-1.117	0.000	0.00		12.4	OK	
8.000	18	-0.220	0.000	0.15		11.9	OK	
9.000	19	-0.157	0.000	0.18		6.3	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
9.001	20	15 Winter	1	+0%	100/15 Summer				5.156
8.001	21	960 Winter	1	+0%					5.046
10.000	22	960 Winter	1	+0%	100/15 Summer				5.047
8.002	23	960 Winter	1	+0%					5.046
11.000	24	15 Winter	1	+0%	100/360 Winter				5.429
11.001	25	960 Winter	1	+0%	100/15 Summer				5.046
12.000	26	15 Winter	1	+0%					6.023
12.001	27	15 Winter	1	+0%	100/15 Summer				5.515
12.002	28	15 Winter	1	+0%	100/15 Summer				5.189
12.003	29	960 Winter	1	+0%	100/15 Summer				5.047
11.002	30	960 Winter	1	+0%					5.046
8.003	31	960 Winter	1	+0%	100/15 Summer				5.046
13.000	32	960 Winter	1	+0%	100/15 Summer				5.045
1.008	33	960 Winter	1	+0%					5.045
14.000	34	960 Winter	1	+0%	100/60 Summer				5.045
14.001	35	960 Winter	1	+0%	100/15 Summer				5.045
1.009	36	960 Winter	1	+0%					5.045
15.000	37	15 Summer	1	+0%	100/120 Winter				5.241
1.010	38	960 Winter	1	+0%					5.045
1.011	39	960 Winter	1	+0%	1/240 Summer				5.045

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
9.001	20	-0.151	0.000	0.23		13.8	OK	
8.001	21	-1.126	0.000	0.00		4.0	OK	
10.000	22	-0.075	0.000	0.03		2.0	OK	
8.002	23	-1.121	0.000	0.00		3.0	OK	
11.000	24	-0.235	0.000	0.10		12.3	OK	
11.001	25	-0.116	0.000	0.03		1.9	OK	
12.000	26	-0.231	0.000	0.12		11.6	OK	
12.001	27	-0.210	0.000	0.19		18.5	OK	
12.002	28	-0.193	0.000	0.27		24.7	OK	
12.003	29	-0.034	0.000	0.07		3.7	OK	
11.002	30	-1.121	0.000	0.00		6.1	OK	
8.003	31	-0.041	0.000	0.11		4.7	OK*	
13.000	32	-0.048	0.000	0.01		0.8	OK	
1.008	33	-1.112	0.000	0.00		12.9	OK	
14.000	34	-0.255	0.000	0.00		0.2	OK	
14.001	35	-0.056	0.000	0.02		0.8	OK	
1.009	36	-1.107	0.000	0.00		10.9	OK	
15.000	37	-0.245	0.000	0.08		10.4	OK	
1.010	38	-1.102	0.000	0.00		9.8	OK	
1.011	39	0.053	0.000	0.14		8.1	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment A

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	100	+40%	100/15 Summer				6.290
2.000	2	15 Winter	100	+40%	100/15 Summer				6.362
2.001	3	15 Winter	100	+40%	100/15 Summer				6.325
1.001	4	15 Winter	100	+40%	100/15 Summer				6.239
1.002	5	2160 Winter	100	+40%	100/15 Summer				5.953
1.003	6	2160 Winter	100	+40%					5.952
3.000	7	2160 Winter	100	+40%	100/15 Summer				5.952
3.001	8	2160 Winter	100	+40%	100/15 Summer				5.952
4.000	9	2160 Winter	100	+40%	100/15 Summer				5.952
1.004	10	2160 Winter	100	+40%					5.952
5.000	11	2160 Winter	100	+40%	100/15 Summer				5.952
1.005	12	2160 Winter	100	+40%					5.952
6.000	13	2160 Winter	100	+40%	100/15 Summer				5.952
6.001	14	2160 Winter	100	+40%	100/15 Summer				5.952
1.006	15	2160 Winter	100	+40%					5.952
7.000	16	2160 Winter	100	+40%	100/15 Summer				5.952
1.007	17	2160 Winter	100	+40%					5.952
8.000	18	2160 Winter	100	+40%	100/120 Summer				5.953
9.000	19	2160 Winter	100	+40%	100/240 Winter				5.954

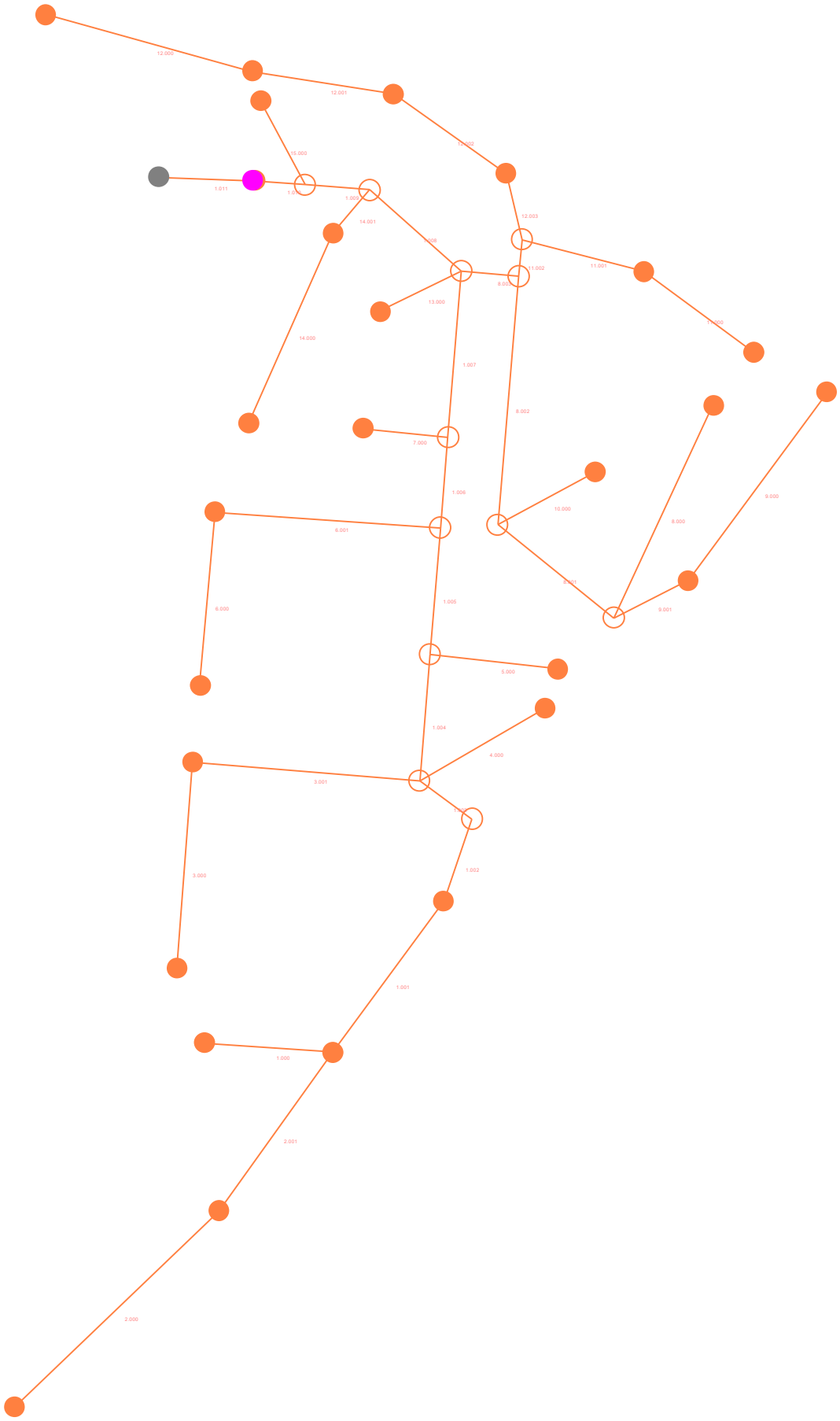
100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment A

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.736	0.000	0.64		64.9	SURCHARGED	
2.000	2	0.148	0.000	0.35		38.6	SURCHARGED	
2.001	3	0.505	0.000	0.52		71.1	SURCHARGED	
1.001	4	0.848	0.000	1.65		171.0	SURCHARGED	
1.002	5	0.800	0.000	0.15		11.5	SURCHARGED	
1.003	6	-0.230	0.000	0.00		12.3	FLOOD RISK*	
3.000	7	0.513	0.000	0.03		2.9	SURCHARGED	
3.001	8	0.670	0.000	0.07		7.3	SURCHARGED	
4.000	9	0.817	0.000	0.07		2.2	SURCHARGED	
1.004	10	-0.225	0.000	0.00		18.8	FLOOD RISK*	
5.000	11	0.842	0.000	0.05		1.5	SURCHARGED	
1.005	12	-0.220	0.000	0.00		17.9	FLOOD RISK*	
6.000	13	0.556	0.000	0.04		2.7	SURCHARGED	
6.001	14	0.721	0.000	0.07		4.5	SURCHARGED	
1.006	15	-0.215	0.000	0.01		21.9	FLOOD RISK*	
7.000	16	0.858	0.000	0.03		1.8	FLOOD RISK	
1.007	17	-0.210	0.000	0.00		22.0	FLOOD RISK*	
8.000	18	0.559	0.000	0.03		2.3	SURCHARGED	
9.000	19	0.342	0.000	0.04		1.3	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment A

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
9.001	20	2160 Winter	100	+40%	100/15 Summer				5.954
8.001	21	2160 Winter	100	+40%					5.953
10.000	22	2160 Winter	100	+40%	100/15 Summer				5.954
8.002	23	2160 Winter	100	+40%					5.953
11.000	24	2160 Winter	100	+40%	100/360 Winter				5.953
11.001	25	2160 Winter	100	+40%	100/15 Summer				5.953
12.000	26	15 Winter	100	+40%					6.111
12.001	27	15 Winter	100	+40%	100/15 Summer				5.969
12.002	28	2160 Winter	100	+40%	100/15 Summer				5.955
12.003	29	2160 Winter	100	+40%	100/15 Summer				5.954
11.002	30	2160 Winter	100	+40%					5.953
8.003	31	2160 Winter	100	+40%	100/15 Summer				5.953
13.000	32	2160 Winter	100	+40%	100/15 Summer				5.952
1.008	33	2160 Winter	100	+40%					5.952
14.000	34	2160 Winter	100	+40%	100/60 Summer				5.952
14.001	35	2160 Winter	100	+40%	100/15 Summer				5.952
1.009	36	2160 Winter	100	+40%					5.952
15.000	37	2160 Winter	100	+40%	100/120 Winter				5.952
1.010	38	2160 Winter	100	+40%					5.952
1.011	39	2160 Winter	100	+40%	1/240 Summer				5.952

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
9.001	20	0.647	0.000	0.05		2.8	SURCHARGED	
8.001	21	-0.219	0.000	0.00		7.7	FLOOD RISK*	
10.000	22	0.832	0.000	0.07		3.9	FLOOD RISK	
8.002	23	-0.214	0.000	0.00		4.4	FLOOD RISK*	
11.000	24	0.289	0.000	0.02		2.3	SURCHARGED	
11.001	25	0.791	0.000	0.06		3.6	FLOOD RISK	
12.000	26	-0.143	0.000	0.52		51.4	OK	
12.001	27	0.244	0.000	0.77		73.4	SURCHARGED	
12.002	28	0.573	0.000	0.06		5.2	SURCHARGED	
12.003	29	0.873	0.000	0.13		7.2	FLOOD RISK	
11.002	30	-0.214	0.000	0.00		12.1	FLOOD RISK*	
8.003	31	0.866	0.000	0.09		4.1	FLOOD RISK*	
13.000	32	0.859	0.000	0.03		1.5	FLOOD RISK	
1.008	33	-0.205	0.000	0.00		18.4	FLOOD RISK*	
14.000	34	0.652	0.000	0.01		0.4	FLOOD RISK	
14.001	35	0.851	0.000	0.03		1.9	FLOOD RISK	
1.009	36	-0.200	0.000	0.00		13.6	FLOOD RISK*	
15.000	37	0.466	0.000	0.01		1.9	SURCHARGED	
1.010	38	-0.195	0.000	0.00		11.3	FLOOD RISK*	
1.011	39	0.960	0.000	0.14		8.1	FLOOD RISK	



STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Catchment B

Pipe Sizes Storm Pl Manhole Sizes SfA 7

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.306	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)	0.900
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 Catchment B

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	28.442	0.190	149.7	0.062	4.00	0.0	0.600		o	300	Pipe/Conduit	
1.001	69.940	0.499	140.2	0.161	0.00	0.0	0.600		o	300	Pipe/Conduit	
2.000	19.510	0.402	48.5	0.038	4.00	0.0		0.040	\/	-2	Pipe/Conduit	
3.000	22.233	0.158	140.7	0.098	4.00	0.0	0.600		o	225	Pipe/Conduit	
2.001	14.523	0.389	37.3	0.000	0.00	0.0		0.040	\/	-2	Pipe/Conduit	
4.000	25.163	0.166	151.6	0.000	4.00	0.0		0.040	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	4.37	5.239	0.062	0.0	0.0	0.0	1.28	90.7	8.4
1.001	50.00	5.25	5.049	0.223	0.0	0.0	0.0	1.33	93.7	30.2
2.000	50.00	4.12	5.502	0.038	0.0	0.0	0.0	2.82	18551.7	5.2
3.000	50.00	4.34	5.297	0.098	0.0	0.0	0.0	1.10	43.7	13.3
2.001	50.00	4.41	5.139	0.136	0.0	0.0	0.0	3.22	21160.2	18.5
4.000	50.00	5.84	4.958	0.000	0.0	0.0	0.0	0.23	4.0	0.0

Network Design Table for Catchment B

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
2.002	35.211	0.086	408.1	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.002	48.963	0.005	9792.6	0.247	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
5.000	70.952	0.621	114.3	0.207	4.00	0.0	0.600		o	300	Pipe/Conduit	
1.003	16.609	0.005	3321.8	0.000	0.00	0.0	0.600		o	575	Pipe/Conduit	
6.000	20.935	0.387	54.1	0.100	4.00	0.0		0.040	\/	-3	Pipe/Conduit	
7.000	17.022	0.108	157.6	0.056	4.00	0.0	0.600		o	150	Pipe/Conduit	
8.000	27.316	0.191	143.0	0.163	4.00	0.0	0.600		o	225	Pipe/Conduit	
6.001	18.605	0.364	51.1	0.000	0.00	0.0		0.040	\/	-3	Pipe/Conduit	
9.000	23.128	0.160	144.6	0.000	4.00	0.0		0.040	o	150	Pipe/Conduit	
6.002	32.490	0.081	401.1	0.033	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.004	62.326	0.005	12465.2	0.123	0.00	0.0		0.017	|_|	-1	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)
2.002	50.00	6.60	4.750	0.136	0.0	0.0	0.0	0.77	54.6	18.5
1.002	50.00	7.91	4.550	0.607	0.0	0.0	0.0	0.63	7717.5	82.2
5.000	50.00	4.80	5.166	0.207	0.0	0.0	0.0	1.47	103.9	28.0
1.003	50.00	8.60	4.545	0.814	0.0	0.0	0.0	0.40	104.3«	110.2
6.000	50.00	4.12	5.501	0.100	0.0	0.0	0.0	2.86	24194.3	13.6
7.000	50.00	4.36	5.502	0.056	0.0	0.0	0.0	0.80	14.1	7.6
8.000	50.00	4.42	5.513	0.163	0.0	0.0	0.0	1.09	43.4	22.0
6.001	50.00	4.52	5.114	0.319	0.0	0.0	0.0	2.95	24890.1	43.2
9.000	50.00	5.65	4.953	0.000	0.0	0.0	0.0	0.23	4.1	0.0
6.002	50.00	6.35	4.750	0.352	0.0	0.0	0.0	0.78	55.1	47.7
1.004	50.00	10.47	4.540	1.289	0.0	0.0	0.0	0.55	6840.3	174.6

Network Design Table for Catchment B

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
10.000	54.927	0.183	300.1	0.245	4.00	0.0	0.600		o	450	Pipe/Conduit	
11.000	32.122	0.441	72.8	0.316	4.00	0.0	0.600		o	375	Pipe/Conduit	
10.001	35.787	0.208	172.1	0.149	0.00	0.0	0.600		o	450	Pipe/Conduit	
1.005	32.635	0.005	6527.0	0.208	0.00	0.0		0.012	|_|	-1	Pipe/Conduit	
12.000	23.609	0.349	67.6	0.060	4.00	0.0		0.040	\/	-3	Pipe/Conduit	
13.000	25.030	0.192	130.4	0.139	4.00	0.0	0.600		o	225	Pipe/Conduit	
14.000	27.109	0.244	111.1	0.117	4.00	0.0	0.600		o	225	Pipe/Conduit	
12.001	20.566	0.397	51.8	0.000	0.00	0.0		0.040	\/	-3	Pipe/Conduit	
12.002	30.521	0.078	391.0	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.006	30.643	0.005	6128.6	0.000	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
15.000	74.311	0.823	90.3	0.277	4.00	0.0	0.600		o	300	Pipe/Conduit	
1.007	23.728	0.005	4745.6	0.000	0.00	0.0		0.017	|_|	-1	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)
10.000	50.00	4.78	4.926	0.245	0.0	0.0	0.0	1.17	185.8	33.1
11.000	50.00	4.25	5.184	0.316	0.0	0.0	0.0	2.13	234.7	42.8
10.001	50.00	5.17	4.743	0.710	0.0	0.0	0.0	1.55	246.0	96.1
1.005	50.00	10.97	4.535	2.207	0.0	0.0	0.0	1.09	13391.7	298.8
12.000	50.00	4.15	5.496	0.060	0.0	0.0	0.0	2.56	21635.4	8.2
13.000	50.00	4.36	5.339	0.139	0.0	0.0	0.0	1.14	45.5	18.8
14.000	50.00	4.36	5.391	0.117	0.0	0.0	0.0	1.24	49.3	15.9
12.001	50.00	4.48	5.147	0.316	0.0	0.0	0.0	2.93	24719.3	42.8
12.002	50.00	5.13	4.750	0.316	0.0	0.0	0.0	0.79	55.8	42.8
1.006	50.00	11.61	4.530	2.523	0.0	0.0	0.0	0.79	9755.4	341.7
15.000	50.00	4.75	5.358	0.277	0.0	0.0	0.0	1.66	117.0	37.5
1.007	50.00	12.05	4.525	2.800	0.0	0.0	0.0	0.90	11086.1	379.2

Network Design Table for Catchment B

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.008	32.513	0.005	6502.5	0.000	0.00	0.0	0.600		o	500	Pipe/Conduit	
16.000	75.048	0.536	140.0	0.133	4.00	0.0	0.600		o	225	Pipe/Conduit	
17.000	27.343	0.429	63.7	0.076	4.00	0.0		0.040	\/	-2	Pipe/Conduit	
18.000	18.300	0.206	88.8	0.113	4.00	0.0	0.600		o	225	Pipe/Conduit	
17.001	19.433	0.370	52.5	0.000	0.00	0.0		0.040	\/	-2	Pipe/Conduit	
17.002	43.541	0.235	185.3	0.000	0.00	0.0	0.600		o	375	Pipe/Conduit	
1.009	40.629	0.005	8125.8	0.000	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
19.000	18.941	0.084	225.5	0.037	4.00	0.0	0.600		o	225	Pipe/Conduit	
19.001	36.427	0.097	375.0	0.183	0.00	0.0	0.600		o	375	Pipe/Conduit	
20.000	24.335	0.167	145.7	0.149	4.00	0.0	0.600		o	300	Pipe/Conduit	
20.001	27.782	0.317	87.6	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
19.002	45.147	0.260	173.6	0.157	0.00	0.0	0.600		o	375	Pipe/Conduit	
21.000	55.773	0.406	137.4	0.212	4.00	0.0	0.600		o	300	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	14.14	4.520	2.800	0.0	0.0	0.0	0.26	51.0«	379.2
16.000	50.00	5.13	5.051	0.133	0.0	0.0	0.0	1.10	43.9	18.0
17.000	50.00	4.19	5.549	0.076	0.0	0.0	0.0	2.46	16188.6	10.3
18.000	50.00	4.22	5.326	0.113	0.0	0.0	0.0	1.39	55.2	15.4
17.001	50.00	4.34	5.120	0.189	0.0	0.0	0.0	2.71	17833.5	25.7
17.002	50.00	4.89	4.750	0.189	0.0	0.0	0.0	1.33	146.7	25.7
1.009	50.00	15.12	4.515	3.122	0.0	0.0	0.0	0.69	8472.1	422.8
19.000	50.00	4.36	5.101	0.037	0.0	0.0	0.0	0.87	34.5	4.9
19.001	50.00	5.02	4.867	0.219	0.0	0.0	0.0	0.93	102.7	29.7
20.000	50.00	4.31	5.329	0.149	0.0	0.0	0.0	1.30	91.9	20.1
20.001	50.00	4.59	5.162	0.149	0.0	0.0	0.0	1.68	118.8	20.1
19.002	50.00	5.57	4.770	0.525	0.0	0.0	0.0	1.37	151.5	71.1
21.000	50.00	4.69	4.916	0.212	0.0	0.0	0.0	1.34	94.7	28.7

Network Design Table for Catchment B

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.010	14.982	0.005	2996.4	0.169	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
1.011	25.187	0.105	239.9	0.000	0.00	0.0	0.600		o	525	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)
1.010	50.00	15.34	4.510	4.029	0.0	0.0	0.0	1.13	13951.7	545.5
1.011	50.00	15.64	4.505	4.029	0.0	0.0	0.0	1.44	312.1«	545.5

Conduit Sections for Catchment B

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m^2)
-1	|_|	8500	1450	90.0		4.325	12.325
-2	\/	1500	1250	18.4		2.791	6.572
-3	\/	3000	1250	18.4		3.094	8.447

Free Flowing Outfall Details for Catchment B

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.011		6.000	4.400	0.000	0	0

Simulation Criteria for Catchment B

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 Coeffiecient	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

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)	19.000	Storm Duration (mins)	30
Ratio R	0.306		

Online Controls for Catchment B

Hydro-Brake® Optimum Manhole: 42, DS/PN: 1.011, Volume (m³): 178.1

Unit Reference	MD-SHE-0149-1150-1450-1150
Design Head (m)	1.450
Design Flow (l/s)	11.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	149
Invert Level (m)	4.505
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.450	11.5	Kick-Flo®	0.918	9.3
Flush-Flo™	0.429	11.5	Mean Flow over Head Range	-	10.0

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	5.4	1.200	10.5	3.000	16.2	7.000	24.3
0.200	10.5	1.400	11.3	3.500	17.5	7.500	25.2
0.300	11.2	1.600	12.0	4.000	18.6	8.000	26.0
0.400	11.5	1.800	12.7	4.500	19.7	8.500	26.7
0.500	11.5	2.000	13.4	5.000	20.7	9.000	27.5
0.600	11.3	2.200	14.0	5.500	21.7	9.500	28.2
0.800	10.5	2.400	14.6	6.000	22.6		
1.000	9.6	2.600	15.2	6.500	23.5		

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

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	1	+0%	100/15 Summer				5.302
1.001	2	15 Winter	1	+0%	100/15 Summer				5.156
2.000	3	15 Winter	1	+0%					5.505
3.000	4	15 Winter	1	+0%	100/15 Summer				5.384
2.001	5	15 Summer	1	+0%					5.150
4.000	6	120 Winter	1	+0%	100/30 Summer				4.958
2.002	6	960 Winter	1	+0%	100/15 Summer				4.950
1.002	7	960 Winter	1	+0%					4.951
5.000	8	15 Winter	1	+0%	100/15 Summer				5.271
1.003	9	960 Winter	1	+0%	100/30 Summer				4.951
6.000	10	15 Winter	1	+0%					5.506
7.000	11	15 Winter	1	+0%	100/15 Summer				5.581
8.000	12	15 Winter	1	+0%	100/15 Summer				5.629
6.001	13	15 Winter	1	+0%					5.129
9.000	14	120 Winter	1	+0%	100/15 Summer				4.953
6.002	14	960 Winter	1	+0%	100/15 Summer				4.951
1.004	15	960 Winter	1	+0%	100/2160 Winter				4.950

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.237	0.000	0.10		8.0	OK	
1.001	2	-0.193	0.000	0.26		23.6	OK	
2.000	3	-1.247	0.000	0.00		5.0	OK	
3.000	4	-0.138	0.000	0.32		12.7	OK	
2.001	5	-1.239	0.000	0.00		17.6	OK	
4.000	6	-0.150	0.000	0.00		0.0	OK	
2.002	6	-0.100	0.000	0.03		1.6	OK*	
1.002	7	-1.049	0.000	0.00		7.0	OK	
5.000	8	-0.195	0.000	0.26		25.5	OK	
1.003	9	-0.169	0.000	0.03		4.4	OK*	
6.000	10	-1.245	0.000	0.00		13.0	OK	
7.000	11	-0.071	0.000	0.55		7.2	OK	
8.000	12	-0.109	0.000	0.52		21.0	OK	
6.001	13	-1.235	0.000	0.00		41.0	OK	
9.000	14	-0.150	0.000	0.00		0.0	OK	
6.002	14	-0.099	0.000	0.08		4.2	OK*	
1.004	15	-1.040	0.000	0.00		8.7	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
10.000	16	15 Winter	1	+0%	100/15 Summer				5.056
11.000	17	15 Winter	1	+0%	100/15 Summer				5.296
10.001	18	960 Winter	1	+0%	100/15 Summer				4.951
1.005	19	960 Winter	1	+0%					4.950
12.000	20	15 Winter	1	+0%					5.499
13.000	21	15 Winter	1	+0%	100/15 Summer				5.442
14.000	22	15 Winter	1	+0%	100/15 Summer				5.480
12.001	23	15 Summer	1	+0%					5.162
12.002	24	960 Winter	1	+0%	100/15 Summer				4.951
1.006	25	960 Winter	1	+0%					4.950
15.000	26	15 Winter	1	+0%	100/15 Summer				5.474
1.007	27	960 Winter	1	+0%					4.949
1.008	28	960 Winter	1	+0%	100/15 Summer				4.949
16.000	29	15 Winter	1	+0%	100/15 Summer				5.150
17.000	30	15 Winter	1	+0%					5.557
18.000	31	15 Summer	1	+0%	100/15 Summer				5.410
17.001	32	15 Summer	1	+0%					5.138
17.002	33	960 Winter	1	+0%	100/30 Summer				4.941
1.009	34	960 Winter	1	+0%					4.941
19.000	35	15 Winter	1	+0%	100/15 Summer				5.159
19.001	36	15 Winter	1	+0%	100/15 Summer				5.002
20.000	37	15 Winter	1	+0%	100/15 Summer				5.427
20.001	38	15 Winter	1	+0%	100/15 Summer				5.247
19.002	39	960 Winter	1	+0%	100/15 Summer				4.941
21.000	40	15 Winter	1	+0%	100/15 Summer				5.029
1.010	41	960 Winter	1	+0%					4.940
1.011	42	960 Winter	1	+0%	100/15 Summer				4.939

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
10.000	16	-0.320	0.000	0.18		29.9	OK	
11.000	17	-0.263	0.000	0.20		40.8	OK	
10.001	18	-0.242	0.000	0.04		8.6	OK	
1.005	19	-1.035	0.000	0.00		11.8	OK	
12.000	20	-1.247	0.000	0.00		7.8	OK	
13.000	21	-0.122	0.000	0.43		17.9	OK	
14.000	22	-0.136	0.000	0.33		15.2	OK	
12.001	23	-1.235	0.000	0.00		40.9	OK	
12.002	24	-0.099	0.000	0.07		3.8	OK*	
1.006	25	-1.030	0.000	0.00		12.0	OK	
15.000	26	-0.184	0.000	0.30		34.2	OK	
1.007	27	-1.026	0.000	0.00		10.5	OK	
1.008	28	-0.071	0.000	0.08		8.9	OK*	
16.000	29	-0.126	0.000	0.37		15.9	OK	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
17.000	30	-1.242	0.000	0.00		9.8	OK	
18.000	31	-0.141	0.000	0.30		14.7	OK	
17.001	32	-1.232	0.000	0.00		24.6	OK	
17.002	33	-0.184	0.000	0.02		2.2	OK*	
1.009	34	-1.024	0.000	0.00		9.9	OK	
19.000	35	-0.167	0.000	0.15		4.7	OK	
19.001	36	-0.240	0.000	0.25		22.8	OK	
20.000	37	-0.202	0.000	0.23		19.2	OK	
20.001	38	-0.215	0.000	0.18		18.9	OK	
19.002	39	-0.204	0.000	0.05		6.4	OK	
21.000	40	-0.187	0.000	0.29		26.4	OK	
1.010	41	-1.020	0.000	0.00		13.5	OK	
1.011	42	-0.091	0.000	0.05		11.5	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment B

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	2160 Winter	100	+40%	100/15 Summer				5.996
1.001	2	2160 Winter	100	+40%	100/15 Summer				5.996
2.000	3	2160 Winter	100	+40%					5.994
3.000	4	2160 Winter	100	+40%	100/15 Summer				5.995
2.001	5	2160 Winter	100	+40%					5.994
4.000	6	2160 Winter	100	+40%	100/30 Summer				5.994
2.002	6	2160 Winter	100	+40%	100/15 Summer				5.994
1.002	7	2160 Winter	100	+40%					5.994
5.000	8	2160 Winter	100	+40%	100/15 Summer				5.992
1.003	9	2160 Winter	100	+40%	100/30 Summer				5.990
6.000	10	2160 Winter	100	+40%					5.991
7.000	11	15 Winter	100	+40%	100/15 Summer				6.097
8.000	12	15 Winter	100	+40%	100/15 Summer				6.420
6.001	13	2160 Winter	100	+40%					5.992
9.000	14	2160 Winter	100	+40%	100/15 Summer				5.992
6.002	14	2160 Winter	100	+40%	100/15 Summer				5.992
1.004	15	2160 Winter	100	+40%	100/2160 Winter				5.990

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment B

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.457	0.000	0.02		1.5	SURCHARGED	
1.001	2	0.647	0.000	0.06		5.2	SURCHARGED	
2.000	3	-0.758	0.000	0.00		0.9	OK	
3.000	4	0.473	0.000	0.06		2.3	SURCHARGED	
2.001	5	-0.395	0.000	0.00		2.7	OK	
4.000	6	0.886	0.000	0.00		0.0	FLOOD RISK	
2.002	6	0.944	0.000	0.04		2.1	FLOOD RISK*	
1.002	7	-0.006	0.000	0.00		11.2	FLOOD RISK*	
5.000	8	0.526	0.000	0.05		4.9	SURCHARGED	
1.003	9	0.870	0.000	0.05		6.5	FLOOD RISK*	
6.000	10	-0.760	0.000	0.00		2.4	OK	
7.000	11	0.445	0.000	2.25		29.5	SURCHARGED	
8.000	12	0.682	0.000	2.13		85.7	FLOOD RISK	
6.001	13	-0.372	0.000	0.00		6.5	OK	
9.000	14	0.889	0.000	0.00		0.0	FLOOD RISK	
6.002	14	0.942	0.000	0.11		6.0	FLOOD RISK*	
1.004	15	0.000	0.000	0.00		13.0	FLOOD RISK*	

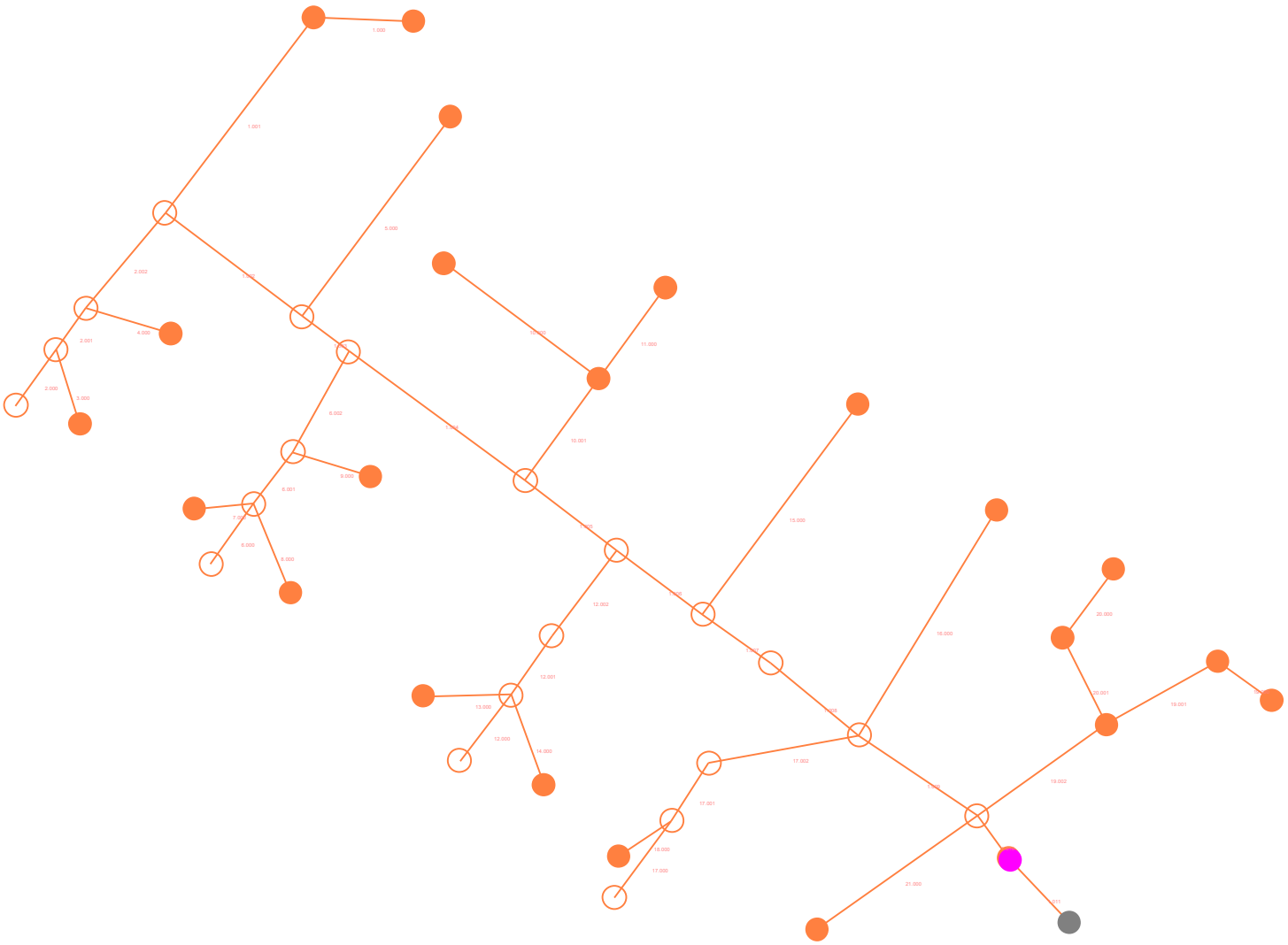
100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment B

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
10.000	16	2160 Winter	100	+40%	100/15 Summer				5.986
11.000	17	2160 Winter	100	+40%	100/15 Summer				5.987
10.001	18	2160 Winter	100	+40%	100/15 Summer				5.986
1.005	19	2160 Winter	100	+40%					5.985
12.000	20	2160 Winter	100	+40%					5.981
13.000	21	15 Winter	100	+40%	100/15 Summer				6.012
14.000	22	2160 Winter	100	+40%	100/15 Summer				5.982
12.001	23	2160 Winter	100	+40%					5.981
12.002	24	2160 Winter	100	+40%	100/15 Summer				5.981
1.006	25	2160 Winter	100	+40%					5.980
15.000	26	15 Winter	100	+40%	100/15 Summer				6.178
1.007	27	2160 Winter	100	+40%					5.975
1.008	28	2160 Winter	100	+40%	100/15 Summer				5.968
16.000	29	15 Winter	100	+40%	100/15 Summer				6.159
17.000	30	2160 Winter	100	+40%					5.965
18.000	31	2160 Winter	100	+40%	100/15 Summer				5.966
17.001	32	2160 Winter	100	+40%					5.965
17.002	33	2160 Winter	100	+40%	100/30 Summer				5.965
1.009	34	2160 Winter	100	+40%					5.965
19.000	35	2160 Winter	100	+40%	100/15 Summer				5.953
19.001	36	2160 Winter	100	+40%	100/15 Summer				5.953
20.000	37	15 Winter	100	+40%	100/15 Summer				6.011
20.001	38	2160 Winter	100	+40%	100/15 Summer				5.953
19.002	39	2160 Winter	100	+40%	100/15 Summer				5.953
21.000	40	2160 Winter	100	+40%	100/15 Summer				5.952
1.010	41	2160 Winter	100	+40%					5.952
1.011	42	2160 Winter	100	+40%	100/15 Summer				5.942

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
10.000	16	0.610	0.000	0.03		5.8	FLOOD RISK	
11.000	17	0.428	0.000	0.04		7.4	SURCHARGED	
10.001	18	0.793	0.000	0.08		16.4	FLOOD RISK	
1.005	19	0.000	0.000	0.00		14.3	FLOOD RISK*	
12.000	20	-0.765	0.000	0.00		1.5	OK	
13.000	21	0.448	0.000	1.79		75.1	SURCHARGED	
14.000	22	0.366	0.000	0.06		2.8	SURCHARGED	
12.001	23	-0.416	0.000	0.00		6.6	OK	
12.002	24	0.931	0.000	0.10		5.5	FLOOD RISK*	
1.006	25	0.000	0.000	0.00		12.4	FLOOD RISK*	
15.000	26	0.520	0.000	1.24		139.2	SURCHARGED	
1.007	27	0.000	0.000	0.00		12.8	FLOOD RISK*	
1.008	28	0.948	0.000	0.09		10.0	FLOOD RISK*	
16.000	29	0.883	0.000	1.45		61.8	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment B

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
17.000	30	-0.834	0.000	0.00		1.8	OK	
18.000	31	0.415	0.000	0.05		2.7	SURCHARGED	
17.001	32	-0.405	0.000	0.00		4.0	OK	
17.002	33	0.840	0.000	0.02		3.3	FLOOD RISK*	
1.009	34	0.000	0.000	0.00		12.7	FLOOD RISK*	
19.000	35	0.627	0.000	0.03		0.8	FLOOD RISK	
19.001	36	0.711	0.000	0.05		5.1	SURCHARGED	
20.000	37	0.382	0.000	0.88		72.0	SURCHARGED	
20.001	38	0.491	0.000	0.03		3.4	SURCHARGED	
19.002	39	0.808	0.000	0.09		12.0	FLOOD RISK	
21.000	40	0.736	0.000	0.06		4.9	SURCHARGED	
1.010	41	-0.008	0.000	0.00		15.5	FLOOD RISK*	
1.011	42	0.912	0.000	0.05		11.5	FLOOD RISK	



STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Catchment C

Pipe Sizes Storm Pl Manhole Sizes SfA 7

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.306	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)	0.900
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 Catchment C

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	53.413	0.417	128.1	0.091	4.00	0.0		0.040	\/	-1	Pipe/Conduit	
2.000	26.117	0.174	150.0	0.035	4.00	0.0	0.600		o	150	Pipe/Conduit	
1.001	13.152	0.107	122.9	0.057	0.00	0.0		0.040	\/	-1	Pipe/Conduit	
3.000	23.447	0.105	223.3	0.000	4.00	0.0	0.600		o	225	Pipe/Conduit	
1.002	31.351	0.109	287.6	0.019	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.003	5.717	0.043	132.9	0.030	0.00	0.0		0.040	\/	-1	Pipe/Conduit	
4.000	21.906	0.074	296.0	0.022	4.00	0.0	0.600		o	375	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	4.49	5.570	0.091	0.0	0.0	0.0	1.82	14428.9	12.4
2.000	50.00	4.53	5.390	0.035	0.0	0.0	0.0	0.82	14.5	4.7
1.001	50.00	4.65	5.153	0.183	0.0	0.0	0.0	1.86	14729.3	24.8
3.000	50.00	4.45	5.193	0.000	0.0	0.0	0.0	0.87	34.6	0.0
1.002	50.00	5.22	5.061	0.202	0.0	0.0	0.0	0.92	65.2	27.4
1.003	50.00	5.27	4.952	0.232	0.0	0.0	0.0	1.79	14162.9	31.4
4.000	50.00	4.35	4.982	0.022	0.0	0.0	0.0	1.05	115.7	2.9

Network Design Table for Catchment C

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.004	6.307	0.066	95.6	0.017	0.00	0.0		0.040	\/	-1	Pipe/Conduit	
5.000	21.391	0.055	388.9	0.031	4.00	0.0	0.600		o	450	Pipe/Conduit	
1.005	6.209	0.024	258.7	0.000	0.00	0.0		0.040	\/	-1	Pipe/Conduit	
1.006	23.951	0.229	104.6	0.000	0.00	0.0	0.600		o	300	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)
1.004	50.00	5.32	4.909	0.270	0.0	0.0	0.0	2.11	16705.5	36.6
5.000	50.00	4.35	4.942	0.031	0.0	0.0	0.0	1.02	163.0	4.2
1.005	50.00	5.40	4.843	0.302	0.0	0.0	0.0	1.28	10152.8	40.8
1.006	50.00	5.66	4.819	0.302	0.0	0.0	0.0	1.54	108.7	40.8

Conduit Sections for Catchment C

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m^2)
-1	\/	3000	1200	18.4		2.991	7.929

Free Flowing Outfall Details for Catchment C

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.006		6.000	4.590	0.000	0	0

Simulation Criteria for Catchment C

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 Coeffiecient	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

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)	19.000	Storm Duration (mins)	30
Ratio R	0.306		

Online Controls for Catchment C

Hydro-Brake® Optimum Manhole: 12, DS/PN: 1.006, Volume (m³): 45.9

Unit Reference	MD-SHE-0043-9000-1100-9000
Design Head (m)	1.100
Design Flow (l/s)	0.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	43
Invert Level (m)	4.819
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)	1.100	0.9	Kick-Flo®	0.385	0.6
Flush-Flo™	0.190	0.7	Mean Flow over Head Range	-	0.7

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)
0.100	0.6	1.200	0.9	3.000	1.4	7.000	2.1
0.200	0.7	1.400	1.0	3.500	1.5	7.500	2.1
0.300	0.7	1.600	1.1	4.000	1.6	8.000	2.2
0.400	0.6	1.800	1.1	4.500	1.7	8.500	2.3
0.500	0.6	2.000	1.2	5.000	1.8	9.000	2.3
0.600	0.7	2.200	1.2	5.500	1.9	9.500	2.4
0.800	0.8	2.400	1.3	6.000	1.9		
1.000	0.9	2.600	1.3	6.500	2.0		

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

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	1	+0%					5.577
2.000	3	15 Winter	1	+0%	100/15 Summer				5.449
1.001	4	1440 Winter	1	+0%					5.320
3.000	5	1440 Winter	1	+0%	100/30 Summer				5.320
1.002	6	1440 Winter	1	+0%	100/15 Summer				5.320
1.003	7	1440 Winter	1	+0%					5.320
4.000	8	1440 Winter	1	+0%	100/15 Summer				5.320
1.004	9	1440 Winter	1	+0%					5.320
5.000	10	1440 Winter	1	+0%	100/15 Winter				5.320
1.005	11	1440 Winter	1	+0%					5.320
1.006	12	1440 Winter	1	+0%	1/15 Winter				5.321

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-1.193	0.000	0.00		11.8	OK	
2.000	3	-0.091	0.000	0.32		4.5	OK	
1.001	4	-1.033	0.000	0.00		1.6	OK	
3.000	5	-0.098	0.000	0.00		0.0	OK	
1.002	6	-0.041	0.000	0.02		1.6	OK*	
1.003	7	-0.832	0.000	0.00		1.7	OK	
4.000	8	-0.037	0.000	0.00		0.2	OK	
1.004	9	-0.789	0.000	0.00		1.4	OK	
5.000	10	-0.072	0.000	0.00		0.3	OK	
1.005	11	-0.723	0.000	0.00		1.1	OK	
1.006	12	0.202	0.000	0.01		0.7	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment C

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

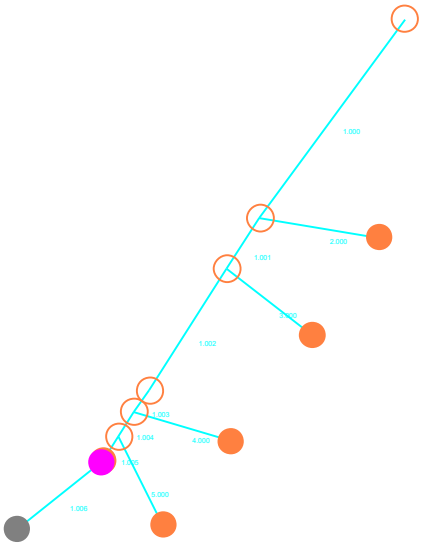
Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	2160 Winter	100	+40%					5.856
2.000	3	2160 Winter	100	+40%	100/15 Summer				5.857
1.001	4	2160 Winter	100	+40%					5.856
3.000	5	2160 Winter	100	+40%	100/30 Summer				5.856
1.002	6	2160 Winter	100	+40%	100/15 Summer				5.856
1.003	7	2160 Winter	100	+40%					5.856
4.000	8	2160 Winter	100	+40%	100/15 Summer				5.856
1.004	9	2160 Winter	100	+40%					5.856
5.000	10	2160 Winter	100	+40%	100/15 Winter				5.856
1.005	11	2160 Winter	100	+40%					5.856
1.006	12	2160 Winter	100	+40%	1/15 Winter				5.856

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment C

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.914	0.000	0.00		2.2	OK	
2.000	3	0.317	0.000	0.06		0.8	SURCHARGED	
1.001	4	-0.497	0.000	0.00		1.6	OK	
3.000	5	0.438	0.000	0.00		0.0	SURCHARGED	
1.002	6	0.495	0.000	0.02		1.2	SURCHARGED*	
1.003	7	-0.296	0.000	0.00		1.3	FLOOD RISK*	
4.000	8	0.499	0.000	0.01		0.5	SURCHARGED	
1.004	9	-0.253	0.000	0.00		1.5	FLOOD RISK*	
5.000	10	0.464	0.000	0.01		0.7	FLOOD RISK	
1.005	11	-0.187	0.000	0.00		1.5	FLOOD RISK*	
1.006	12	0.737	0.000	0.01		0.9	FLOOD RISK	



STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Catchment D

Pipe Sizes Storm Pl Manhole Sizes SfA 7

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.306	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)	0.900
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 Catchment D

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	46.425	0.250	185.7	0.098	4.00	0.0		0.040	\/	-1	Pipe/Conduit	
2.000	51.292	0.171	300.0	0.087	4.00	0.0		0.040	o	300	Pipe/Conduit	
3.000	52.980	0.177	300.0	0.104	4.00	0.0	0.600		o	300	Pipe/Conduit	
1.001	21.503	0.125	172.0	0.106	0.00	0.0		0.040	\/	-1	Pipe/Conduit	
4.000	51.869	0.237	218.9	0.074	4.00	0.0		0.040	o	300	Pipe/Conduit	
5.000	48.241	0.180	268.0	0.057	4.00	0.0		0.040	o	300	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	4.47	5.444	0.098	0.0	0.0	0.0	1.63	16791.7	13.3
2.000	50.00	7.33	5.590	0.087	0.0	0.0	0.0	0.26	18.1	11.8
3.000	50.00	4.98	5.388	0.104	0.0	0.0	0.0	0.90	63.8	14.1
1.001	50.00	7.54	5.194	0.396	0.0	0.0	0.0	1.70	17446.4	53.6
4.000	50.00	6.88	5.381	0.074	0.0	0.0	0.0	0.30	21.2	10.1
5.000	50.00	6.96	5.249	0.057	0.0	0.0	0.0	0.27	19.2	7.8

Network Design Table for Catchment D

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.002	32.001	0.070	457.2	0.000	0.00	0.0	0.600		o	375	Pipe/Conduit	
1.003	34.740	0.187	185.8	0.286	0.00	0.0		0.040	\/	-2	Pipe/Conduit	
6.000	55.582	0.185	300.0	0.054	4.00	0.0	0.600		o	300	Pipe/Conduit	
7.000	50.851	0.170	299.1	0.042	4.00	0.0	0.600		o	375	Pipe/Conduit	
1.004	10.882	0.066	164.9	0.146	0.00	0.0		0.040	\/	-2	Pipe/Conduit	
1.005	24.439	0.114	214.4	0.000	0.00	0.0	0.600		o	525	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)
1.002	50.00	8.18	5.069	0.527	0.0	0.0	0.0	0.84	92.9	71.4
1.003	50.00	8.50	4.957	0.814	0.0	0.0	0.0	1.78	28185.4	110.2
6.000	50.00	5.03	5.025	0.054	0.0	0.0	0.0	0.90	63.8	7.3
7.000	50.00	4.81	4.956	0.042	0.0	0.0	0.0	1.04	115.1	5.7
1.004	50.00	8.60	4.770	1.055	0.0	0.0	0.0	1.89	29918.2	142.9
1.005	50.00	8.86	4.704	1.055	0.0	0.0	0.0	1.53	330.3	142.9

Conduit Sections for Catchment D

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m²)
-1	\/	4000	1300	18.4		3.360	10.280
-2	\/	8250	1300	18.4		3.835	15.805

Free Flowing Outfall Details for Catchment D

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.005		6.000	4.590	0.000	0	0

Simulation Criteria for Catchment D

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 Coeffiecient	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

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)	19.000	Storm Duration (mins)	30
Ratio R	0.306		

Online Controls for Catchment D

Hydro-Brake® Optimum Manhole: 12, DS/PN: 1.005, Volume (m³): 161.1

Unit Reference	MD-SHE-0078-3000-1300-3000
Design Head (m)	1.300
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	78
Invert Level (m)	4.704
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)	1.300	3.0	Kick-Flo®	0.695	2.2
Flush-Flo™	0.341	2.8	Mean Flow over Head Range	-	2.5

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	2.2	1.200	2.9	3.000	4.4	7.000	6.6
0.200	2.7	1.400	3.1	3.500	4.7	7.500	6.8
0.300	2.8	1.600	3.3	4.000	5.0	8.000	7.0
0.400	2.8	1.800	3.5	4.500	5.3	8.500	7.2
0.500	2.7	2.000	3.7	5.000	5.6	9.000	7.4
0.600	2.6	2.200	3.8	5.500	5.9	9.500	7.6
0.800	2.4	2.400	4.0	6.000	6.1		
1.000	2.7	2.600	4.1	6.500	6.3		

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

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	1	+0%					5.451
2.000	2	15 Winter	1	+0%	100/15 Summer				5.762
3.000	3	15 Winter	1	+0%	100/120 Winter				5.484
1.001	4	15 Winter	1	+0%					5.255
4.000	5	15 Winter	1	+0%	100/15 Summer				5.523
5.000	6	15 Winter	1	+0%	100/15 Summer				5.378
1.002	7	15 Winter	1	+0%	100/15 Winter				5.250
1.003	8	960 Winter	1	+0%					5.224
6.000	9	960 Winter	1	+0%	100/15 Winter				5.224
7.000	10	960 Winter	1	+0%	100/15 Winter				5.224
1.004	11	960 Winter	1	+0%					5.224
1.005	12	960 Winter	1	+0%	100/15 Summer				5.224

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-1.293	0.000	0.00		12.7	OK	
2.000	2	-0.128	0.000	0.62		11.1	OK	
3.000	3	-0.204	0.000	0.22		13.0	OK	
1.001	4	-1.239	0.000	0.00		39.3	OK	
4.000	5	-0.158	0.000	0.42		8.9	OK	
5.000	6	-0.171	0.000	0.36		6.9	OK	
1.002	7	-0.194	0.000	0.47		44.0	OK*	
1.003	8	-1.033	0.000	0.00		9.6	OK	
6.000	9	-0.101	0.000	0.01		0.6	OK	
7.000	10	-0.107	0.000	0.00		0.5	OK	
1.004	11	-0.846	0.000	0.00		5.2	OK	
1.005	12	-0.005	0.000	0.01		2.8	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment D

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

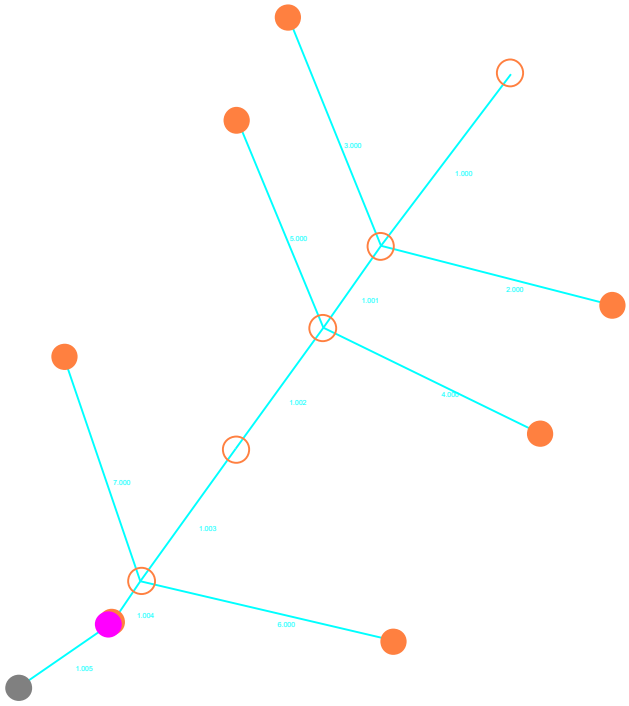
Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	2160 Winter	100	+40%					6.019
2.000	2	15 Winter	100	+40%	100/15 Summer				6.709
3.000	3	2160 Winter	100	+40%	100/120 Winter				6.019
1.001	4	2160 Winter	100	+40%					6.019
4.000	5	15 Winter	100	+40%	100/15 Summer				6.230
5.000	6	2160 Winter	100	+40%	100/15 Summer				6.020
1.002	7	2160 Winter	100	+40%	100/15 Winter				6.019
1.003	8	2160 Winter	100	+40%					6.018
6.000	9	2160 Winter	100	+40%	100/15 Winter				6.018
7.000	10	2160 Winter	100	+40%	100/15 Winter				6.018
1.004	11	2160 Winter	100	+40%					6.018
1.005	12	2160 Winter	100	+40%	100/15 Summer				6.018

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment D

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.725	0.000	0.00		2.3	OK	
2.000	2	0.819	0.000	2.42		43.6	FLOOD RISK	
3.000	3	0.331	0.000	0.04		2.4	SURCHARGED	
1.001	4	-0.475	0.000	0.00		5.6	OK	
4.000	5	0.549	0.000	1.72		36.4	SURCHARGED	
5.000	6	0.471	0.000	0.07		1.3	SURCHARGED	
1.002	7	0.575	0.000	0.07		6.2	SURCHARGED*	
1.003	8	-0.239	0.000	0.00		11.7	FLOOD RISK*	
6.000	9	0.693	0.000	0.02		1.2	FLOOD RISK	
7.000	10	0.687	0.000	0.01		1.0	FLOOD RISK	
1.004	11	-0.052	0.000	0.00		5.7	FLOOD RISK*	
1.005	12	0.789	0.000	0.01		3.0	FLOOD RISK	



STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Catchment E

Pipe Sizes Storm Pl Manhole Sizes SfA 7

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.306	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)	0.900
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 Catchment E

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
5.000	26.330	0.173	152.2	0.104	4.00	0.0		0.040	\/	-1	Pipe/Conduit	
6.000	35.276	0.235	150.0	0.028	4.00	0.0	0.600		o	150	Pipe/Conduit	
7.000	44.133	0.196	225.2	0.038	4.00	0.0	0.600		o	225	Pipe/Conduit	
5.001	41.701	0.239	174.5	0.158	0.00	0.0		0.040	\/	-1	Pipe/Conduit	
8.000	38.221	0.184	208.2	0.036	4.00	0.0	0.600		o	225	Pipe/Conduit	
9.000	44.589	0.207	215.1	0.040	4.00	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)
5.000	50.00	4.26	5.557	0.104	0.0	0.0	0.0	1.67	13237.2	14.0
6.000	50.00	4.72	5.853	0.028	0.0	0.0	0.0	0.82	14.5	3.8
7.000	50.00	4.85	5.778	0.038	0.0	0.0	0.0	0.87	34.5	5.2
5.001	50.00	5.29	5.384	0.328	0.0	0.0	0.0	1.56	12363.0	44.5
8.000	50.00	4.71	5.550	0.036	0.0	0.0	0.0	0.90	35.9	4.9
9.000	50.00	4.84	5.516	0.040	0.0	0.0	0.0	0.89	35.3	5.5

Network Design Table for Catchment E

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
10.000	29.771	0.199	149.3	0.000	4.00	0.0	0.600		o	150	Pipe/Conduit	
11.000	36.158	0.238	152.1	0.000	4.00	0.0	0.600		o	150	Pipe/Conduit	
5.002	27.747	0.103	269.4	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
5.003	23.935	0.148	161.7	0.160	0.00	0.0		0.040	\/	-2	Pipe/Conduit	
12.000	35.966	0.096	376.2	0.023	4.00	0.0	0.600		o	375	Pipe/Conduit	
13.000	41.594	0.116	358.6	0.034	4.00	0.0	0.600		o	375	Pipe/Conduit	
5.004	11.594	0.073	158.8	0.092	0.00	0.0		0.040	\/	-2	Pipe/Conduit	
5.005	25.431	0.231	110.1	0.000	0.00	0.0	0.600		o	525	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)
10.000	50.00	4.60	5.419	0.000	0.0	0.0	0.0	0.82	14.5	0.0
11.000	50.00	4.74	5.418	0.000	0.0	0.0	0.0	0.81	14.4	0.0
5.002	50.00	5.78	5.145	0.405	0.0	0.0	0.0	0.95	67.4	54.9
5.003	50.00	6.00	5.042	0.565	0.0	0.0	0.0	1.81	24107.8	76.5
12.000	50.00	4.65	5.006	0.023	0.0	0.0	0.0	0.93	102.5	3.2
13.000	50.00	4.73	5.030	0.034	0.0	0.0	0.0	0.95	105.0	4.6
5.004	50.00	6.11	4.894	0.714	0.0	0.0	0.0	1.83	24326.9	96.7
5.005	50.00	6.30	4.821	0.714	0.0	0.0	0.0	2.13	462.0	96.7

Conduit Sections for Catchment E

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m^2)
-1	\/	3000	1200	18.4		2.991	7.929
-2	\/	7500	1200	18.4		3.530	13.329

Free Flowing Outfall Details for Catchment E

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
5.005		6.000	4.590	0.000	0	0

Simulation Criteria for Catchment E

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 Coeffiecient	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

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)	19.000	Storm Duration (mins)	30
Ratio R	0.306		

Online Controls for Catchment E

Hydro-Brake® Optimum Manhole: 14, DS/PN: 5.005, Volume (m³): 146.7

Unit Reference	MD-SHE-0066-2000-1100-2000
Design Head (m)	1.100
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	66
Invert Level (m)	4.821
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)	1.100	2.0	Kick-Flo®	0.584	1.5
Flush-Flo™	0.289	1.8	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)
0.100	1.6	1.200	2.1	3.000	3.2	7.000	4.7
0.200	1.8	1.400	2.2	3.500	3.4	7.500	4.9
0.300	1.8	1.600	2.4	4.000	3.6	8.000	5.0
0.400	1.8	1.800	2.5	4.500	3.8	8.500	5.1
0.500	1.7	2.000	2.6	5.000	4.0	9.000	5.3
0.600	1.5	2.200	2.7	5.500	4.2	9.500	5.4
0.800	1.7	2.400	2.9	6.000	4.4		
1.000	1.9	2.600	3.0	6.500	4.5		

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

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	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	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.000	1	15 Winter	1	+0%					5.566
6.000	2	15 Winter	1	+0%	100/15 Summer				5.905
7.000	3	15 Winter	1	+0%	100/1440 Winter				5.836
5.001	4	15 Winter	1	+0%					5.411
8.000	5	15 Winter	1	+0%	100/240 Winter				5.605
9.000	6	15 Winter	1	+0%	100/120 Winter				5.575
10.000	7	120 Winter	1	+0%	100/60 Summer				5.419
11.000	8	120 Winter	1	+0%	100/60 Summer				5.418
5.002	9	960 Winter	1	+0%	100/15 Summer				5.304
5.003	10	960 Winter	1	+0%					5.303
12.000	11	960 Winter	1	+0%	100/15 Summer				5.303
13.000	12	960 Winter	1	+0%	100/15 Winter				5.303
5.004	13	960 Winter	1	+0%					5.303
5.005	14	960 Winter	1	+0%	100/15 Summer				5.303

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
5.000	1	-1.191	0.000	0.00		13.4	OK	
6.000	2	-0.098	0.000	0.26		3.6	OK	
7.000	3	-0.167	0.000	0.15		4.9	OK	
5.001	4	-1.173	0.000	0.00		37.2	OK	
8.000	5	-0.170	0.000	0.14		4.7	OK	
9.000	6	-0.166	0.000	0.15		5.2	OK	
10.000	7	-0.150	0.000	0.00		0.0	OK	
11.000	8	-0.150	0.000	0.00		0.0	OK	
5.002	9	-0.141	0.000	0.07		4.8	OK*	
5.003	10	-0.939	0.000	0.00		6.6	OK	
12.000	11	-0.078	0.000	0.00		0.3	OK	
13.000	12	-0.102	0.000	0.00		0.4	OK	
5.004	13	-0.791	0.000	0.00		3.9	OK	
5.005	14	-0.043	0.000	0.00		1.8	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment E

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

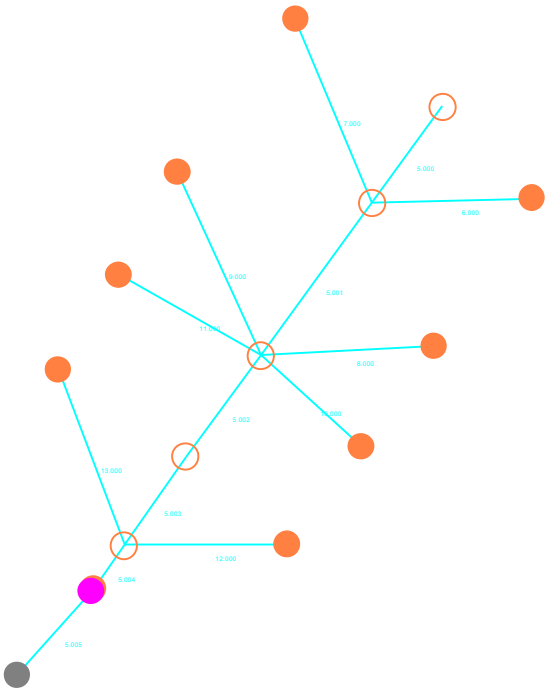
Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	OFF
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.000	1	2160 Winter	100	+40%					6.021
6.000	2	15 Winter	100	+40%	100/15 Summer				6.053
7.000	3	2160 Winter	100	+40%	100/1440 Winter				6.021
5.001	4	2160 Winter	100	+40%					6.021
8.000	5	2160 Winter	100	+40%	100/240 Winter				6.021
9.000	6	2160 Winter	100	+40%	100/120 Winter				6.021
10.000	7	2160 Winter	100	+40%	100/60 Summer				6.021
11.000	8	2160 Winter	100	+40%	100/60 Summer				6.021
5.002	9	2160 Winter	100	+40%	100/15 Summer				6.021
5.003	10	2160 Winter	100	+40%					6.019
12.000	11	2160 Winter	100	+40%	100/15 Summer				6.019
13.000	12	2160 Winter	100	+40%	100/15 Winter				6.019
5.004	13	2160 Winter	100	+40%					6.019
5.005	14	2160 Winter	100	+40%	100/15 Summer				6.019

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment E

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
5.000	1	-0.736	0.000	0.00		2.4	OK	
6.000	2	0.050	0.000	1.10		15.4	SURCHARGED	
7.000	3	0.018	0.000	0.03		0.9	SURCHARGED	
5.001	4	-0.563	0.000	0.00		6.2	OK	
8.000	5	0.246	0.000	0.02		0.8	SURCHARGED	
9.000	6	0.280	0.000	0.03		0.9	SURCHARGED	
10.000	7	0.452	0.000	0.00		0.0	SURCHARGED	
11.000	8	0.453	0.000	0.00		0.0	SURCHARGED	
5.002	9	0.576	0.000	0.06		4.2	SURCHARGED*	
5.003	10	-0.223	0.000	0.00		6.7	FLOOD RISK*	
12.000	11	0.638	0.000	0.01		0.5	FLOOD RISK	
13.000	12	0.614	0.000	0.01		0.8	FLOOD RISK	
5.004	13	-0.075	0.000	0.00		4.5	FLOOD RISK*	
5.005	14	0.673	0.000	0.01		2.1	FLOOD RISK	



STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Catchment F

Pipe Sizes Storm Pl Manhole Sizes SfA 7

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.306	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)	0.900
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 Catchment F

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
5.000	31.609	0.274	115.4	0.061	4.00	0.0		0.040	\/	-1	Pipe/Conduit	
6.000	41.834	0.186	224.9	0.034	4.00	0.0	0.600		o	225	Pipe/Conduit	
5.001	33.107	0.175	189.2	0.059	0.00	0.0		0.040	\/	-1	Pipe/Conduit	
7.000	29.282	0.222	131.9	0.034	4.00	0.0	0.600		o	225	Pipe/Conduit	
5.002	29.042	0.138	210.4	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
5.003	18.483	0.099	186.7	0.072	0.00	0.0		0.040	\/	-2	Pipe/Conduit	
8.000	36.789	0.164	225.0	0.044	4.00	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)
5.000	50.00	4.30	5.633	0.061	0.0	0.0	0.0	1.76	10267.6	8.3
6.000	50.00	4.80	5.510	0.034	0.0	0.0	0.0	0.87	34.5	4.6
5.001	50.00	5.20	5.359	0.154	0.0	0.0	0.0	1.38	8017.8	20.9
7.000	50.00	4.43	5.406	0.034	0.0	0.0	0.0	1.14	45.2	4.6
5.002	50.00	5.74	5.184	0.189	0.0	0.0	0.0	0.90	35.7	25.5
5.003	50.00	5.96	5.046	0.260	0.0	0.0	0.0	1.46	10043.4	35.3
8.000	50.00	4.71	5.190	0.044	0.0	0.0	0.0	0.87	34.5	6.0

Network Design Table for Catchment F

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
5.004	23.694	0.103	230.0	0.017	0.00	0.0		0.040	\/	-2	Pipe/Conduit	
9.000	40.086	0.267	150.1	0.019	4.00	0.0		0.040	o	150	Pipe/Conduit	
5.005	9.869	0.067	147.3	0.039	0.00	0.0		0.040	\/	-2	Pipe/Conduit	
5.006	26.517	0.187	141.8	0.000	0.00	0.0	0.600		o	375	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)
5.004	50.00	6.26	4.947	0.322	0.0	0.0	0.0	1.31	9047.9	43.6
9.000	50.00	6.92	5.205	0.019	0.0	0.0	0.0	0.23	4.0	2.6
5.005	50.00	7.02	4.844	0.380	0.0	0.0	0.0	1.64	11307.0	51.5
5.006	50.00	7.31	4.777	0.380	0.0	0.0	0.0	1.52	167.8	51.5

Conduit Sections for Catchment F

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m^2)
-1	\/	1250	1200	18.4		2.633	5.829
-2	\/	1500	1250	18.4		2.848	6.885

Free Flowing Outfall Details for Catchment F

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
5.006		6.000	4.590	0.000	0	0

Simulation Criteria for Catchment F

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 Coeffiecient	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

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)	19.000	Storm Duration (mins)	30
Ratio R	0.306		

Online Controls for Catchment F

Hydro-Brake® Optimum Manhole: 12, DS/PN: 5.006, Volume (m³): 67.9

Unit Reference	MD-SHE-0047-1100-1200-1100
Design Head (m)	1.200
Design Flow (l/s)	1.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	4.777
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)	1.200	1.1	Kick-Flo®	0.418	0.7
Flush-Flo™	0.207	0.8	Mean Flow over Head Range	-	0.8

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	1.1	3.000	1.7	7.000	2.5
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.3	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.8
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.6	6.500	2.4		

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

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.000	1	15 Winter	1	+0%					5.643
6.000	2	15 Winter	1	+0%	100/240 Summer				5.564
5.001	3	15 Winter	1	+0%					5.391
7.000	5	15 Winter	1	+0%	100/60 Winter				5.454
5.002	6	1440 Winter	1	+0%	100/15 Summer				5.352
5.003	7	1440 Winter	1	+0%					5.351
8.000	8	1440 Winter	1	+0%	100/15 Winter				5.351
5.004	9	1440 Winter	1	+0%					5.351
9.000	10	1440 Winter	1	+0%	100/15 Summer				5.352
5.005	11	1440 Winter	1	+0%					5.351
5.006	12	1440 Winter	1	+0%	1/30 Summer				5.351

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
5.000	1	-1.190	0.000	0.00		7.9	OK	
6.000	2	-0.171	0.000	0.13		4.2	OK	
5.001	3	-1.168	0.000	0.00		17.9	OK	
7.000	5	-0.177	0.000	0.10		4.4	OK	
5.002	6	-0.057	0.000	0.05		1.7	OK*	
5.003	7	-0.945	0.000	0.00		2.3	OK	
8.000	8	-0.064	0.000	0.01		0.4	OK	
5.004	9	-0.846	0.000	0.00		2.2	OK	
9.000	10	-0.003	0.000	0.04		0.2	OK	
5.005	11	-0.743	0.000	0.00		1.5	OK	
5.006	12	0.199	0.000	0.00		0.8	SURCHARGED*	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment F

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

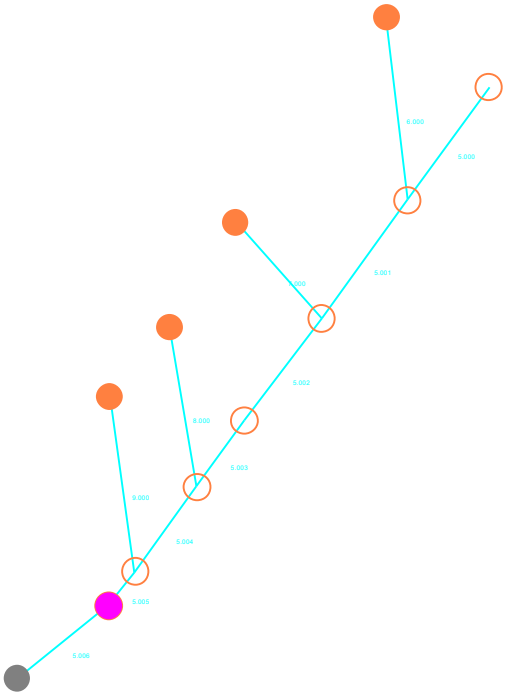
Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	ON

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.000	1	2160 Winter	100	+40%					5.939
6.000	2	2160 Winter	100	+40%	100/240 Summer				5.939
5.001	3	2160 Winter	100	+40%					5.939
7.000	5	2160 Winter	100	+40%	100/60 Winter				5.939
5.002	6	2160 Winter	100	+40%	100/15 Summer				5.939
5.003	7	2160 Winter	100	+40%					5.938
8.000	8	2160 Winter	100	+40%	100/15 Winter				5.938
5.004	9	2160 Winter	100	+40%					5.938
9.000	10	15 Winter	100	+40%	100/15 Summer				6.045
5.005	11	2160 Winter	100	+40%					5.938
5.006	12	2160 Winter	100	+40%	1/30 Summer				5.938

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment F

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
5.000	1	-0.894	0.000	0.00		1.5	OK	
6.000	2	0.204	0.000	0.02		0.8	SURCHARGED	
5.001	3	-0.620	0.000	0.00		2.7	OK	
7.000	5	0.308	0.000	0.02		0.8	SURCHARGED	
5.002	6	0.530	0.000	0.05		2.0	SURCHARGED*	
5.003	7	-0.358	0.000	0.00		3.2	OK	
8.000	8	0.523	0.000	0.03		1.0	SURCHARGED	
5.004	9	-0.259	0.000	0.00		2.9	FLOOD RISK*	
9.000	10	0.690	0.000	1.66		6.7	FLOOD RISK	
5.005	11	-0.156	0.000	0.00		2.0	FLOOD RISK*	
5.006	12	0.786	0.000	0.01		1.1	FLOOD RISK*	



STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Catchment G

Pipe Sizes Storm Pl Manhole Sizes SfA 7

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.306	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)	0.900
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 Catchment G

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
6.000	49.496	0.220	225.0	0.064	4.00	0.0	0.600		o	300	Pipe/Conduit	
6.001	50.087	0.223	224.6	0.049	0.00	0.0	0.600		o	300	Pipe/Conduit	
6.002	62.285	0.272	229.0	0.069	0.00	0.0	0.600		o	300	Pipe/Conduit	
7.000	41.111	0.183	224.7	0.059	4.00	0.0	0.600		o	225	Pipe/Conduit	
7.001	57.223	0.191	300.0	0.115	0.00	0.0	0.600		o	300	Pipe/Conduit	
6.003	33.292	0.050	665.8	0.062	0.00	0.0		0.040	\/	-1	Pipe/Conduit	
8.000	42.007	0.187	225.0	0.084	4.00	0.0	0.600		o	225	Pipe/Conduit	
6.004	32.466	0.050	649.3	0.071	0.00	0.0		0.040	\/	-2	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)
6.000	50.00	4.79	5.575	0.064	0.0	0.0	0.0	1.04	73.8	8.7
6.001	50.00	5.59	5.355	0.113	0.0	0.0	0.0	1.04	73.9	15.3
6.002	50.00	6.59	5.132	0.182	0.0	0.0	0.0	1.03	73.1	24.6
7.000	50.00	4.79	5.309	0.059	0.0	0.0	0.0	0.87	34.5	8.0
7.001	50.00	5.85	5.051	0.174	0.0	0.0	0.0	0.90	63.8	23.6
6.003	50.00	7.30	4.680	0.418	0.0	0.0	0.0	0.79	5678.6	56.6
8.000	50.00	4.81	5.071	0.084	0.0	0.0	0.0	0.87	34.5	11.3
6.004	50.00	7.94	4.670	0.572	0.0	0.0	0.0	0.84	7251.7	77.5

Network Design Table for Catchment G

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
9.000	39.189	0.167	234.7	0.055	4.00	0.0	0.600		o	300	Pipe/Conduit	
10.000	35.902	0.179	200.6	0.271	4.00	0.0	0.600		o	375	Pipe/Conduit	
10.001	36.301	0.176	206.3	0.112	0.00	0.0	0.600		o	375	Pipe/Conduit	
9.001	45.148	0.181	249.4	0.075	0.00	0.0	0.600		o	375	Pipe/Conduit	
6.005	29.055	0.050	581.1	0.085	0.00	0.0		0.040	\/	-3	Pipe/Conduit	
11.000	45.560	0.237	192.2	0.120	4.00	0.0	0.600		o	300	Pipe/Conduit	
11.001	27.354	0.091	300.0	0.112	0.00	0.0	0.600		o	300	Pipe/Conduit	
6.006	30.589	0.050	611.8	0.142	0.00	0.0		0.040	\/	-4	Pipe/Conduit	
6.007	45.691	0.050	913.8	0.000	0.00	0.0	0.600		o	600	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)
9.000	50.00	4.64	5.223	0.055	0.0	0.0	0.0	1.02	72.2	7.5
10.000	50.00	4.47	5.336	0.271	0.0	0.0	0.0	1.28	140.9	36.7
10.001	50.00	4.95	5.157	0.383	0.0	0.0	0.0	1.26	138.9	51.8
9.001	50.00	5.61	4.981	0.513	0.0	0.0	0.0	1.14	126.2	69.4
6.005	50.00	8.45	4.660	1.170	0.0	0.0	0.0	0.95	10881.2	158.4
11.000	50.00	4.67	5.117	0.120	0.0	0.0	0.0	1.13	79.9	16.3
11.001	50.00	5.18	4.880	0.232	0.0	0.0	0.0	0.90	63.8	31.4
6.006	50.00	8.92	4.650	1.543	0.0	0.0	0.0	1.09	30850.6	209.0
6.007	50.00	9.88	4.640	1.543	0.0	0.0	0.0	0.80	225.5	209.0

Conduit Sections for Catchment G

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m^2)
-1	\/	1500	1320	18.4		2.927	7.218
-2	\/	2500	1330	18.4		3.164	8.643
-3	\/	4500	1340	18.4		3.519	11.428
-4	\/	17000	1350	18.4		4.450	28.429

Free Flowing Outfall Details for Catchment G

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
6.007		6.000	4.590	0.000	0	0

Simulation Criteria for Catchment G

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 Coeffiecient	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

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)	19.000	Storm Duration (mins)	30
Ratio R	0.306		

Online Controls for Catchment G

Hydro-Brake® Optimum Manhole: 16, DS/PN: 6.007, Volume (m³): 850.7

Unit Reference	MD-SHE-0094-4400-1350-4400
Design Head (m)	1.350
Design Flow (l/s)	4.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	94
Invert Level (m)	4.640
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.350	4.4	Kick-Flo®	0.834	3.5
Flush-Flo™	0.409	4.4	Mean Flow over Head Range	-	3.9

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	3.0	1.200	4.2	3.000	6.4	7.000	9.5
0.200	4.0	1.400	4.5	3.500	6.9	7.500	9.8
0.300	4.3	1.600	4.8	4.000	7.3	8.000	10.1
0.400	4.4	1.800	5.0	4.500	7.7	8.500	10.4
0.500	4.4	2.000	5.3	5.000	8.1	9.000	10.7
0.600	4.3	2.200	5.5	5.500	8.5	9.500	11.0
0.800	3.7	2.400	5.7	6.000	8.9		
1.000	3.8	2.600	6.0	6.500	9.2		

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

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
6.000	1	15 Winter	1	+0%					5.644
6.001	2	15 Winter	1	+0%	100/360 Winter				5.443
6.002	5	15 Winter	1	+0%	100/15 Summer				5.239
7.000	4	15 Winter	1	+0%	100/15 Summer				5.382
7.001	5	15 Winter	1	+0%	100/15 Summer				5.167
6.003	4	960 Winter	1	+0%					5.029
8.000	7	15 Winter	1	+0%	100/15 Summer				5.160
6.004	5	960 Winter	1	+0%					5.029
9.000	8	15 Winter	1	+0%	100/15 Summer				5.288
10.000	3	15 Winter	1	+0%	100/15 Summer				5.470
10.001	4	15 Winter	1	+0%	100/15 Summer				5.314
9.001	9	15 Winter	1	+0%	100/15 Summer				5.170
6.005	6	960 Winter	1	+0%					5.029
11.000	11	15 Winter	1	+0%	100/15 Summer				5.209
11.001	12	960 Winter	1	+0%	100/15 Summer				5.029
6.006	7	960 Winter	1	+0%					5.028
6.007	16	960 Winter	1	+0%	100/30 Winter				5.028

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
6.000	1	-0.231	0.000	0.11		7.9	OK	
6.001	2	-0.212	0.000	0.18		12.5	OK	
6.002	5	-0.193	0.000	0.27		19.0	OK	
7.000	4	-0.152	0.000	0.22		7.3	OK	
7.001	5	-0.184	0.000	0.32		19.1	OK	
6.003	4	-0.971	0.000	0.00		5.0	OK	
8.000	7	-0.136	0.000	0.33		10.7	OK	
6.004	5	-0.971	0.000	0.00		5.7	OK	
9.000	8	-0.235	0.000	0.10		6.9	OK	
10.000	3	-0.241	0.000	0.27		34.4	OK	
10.001	4	-0.218	0.000	0.36		45.1	OK	
9.001	9	-0.186	0.000	0.51		58.6	OK	
6.005	6	-0.971	0.000	0.00		11.2	OK	
11.000	11	-0.208	0.000	0.20		15.0	OK	
11.001	12	-0.151	0.000	0.05		2.8	OK	
6.006	7	-0.972	0.000	0.00		13.2	OK	
6.007	16	-0.212	0.000	0.02		4.4	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment G

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

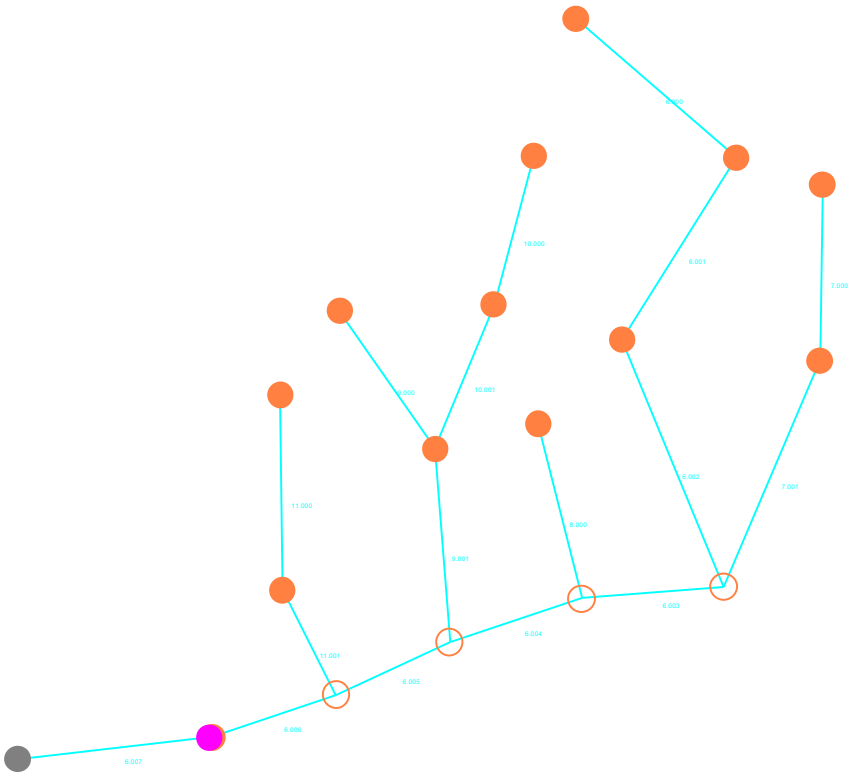
Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
6.000	1	2160 Winter	100	+40%					5.867
6.001	2	2160 Winter	100	+40%	100/360 Winter				5.867
6.002	5	2160 Winter	100	+40%	100/15 Summer				5.867
7.000	4	2160 Winter	100	+40%	100/15 Summer				5.867
7.001	5	2160 Winter	100	+40%	100/15 Summer				5.867
6.003	4	2160 Winter	100	+40%					5.867
8.000	7	2160 Winter	100	+40%	100/15 Summer				5.868
6.004	5	2160 Winter	100	+40%					5.867
9.000	8	15 Winter	100	+40%	100/15 Summer				5.978
10.000	3	15 Winter	100	+40%	100/15 Summer				6.429
10.001	4	15 Winter	100	+40%	100/15 Summer				6.253
9.001	9	15 Winter	100	+40%	100/15 Summer				5.899
6.005	6	2160 Winter	100	+40%					5.867
11.000	11	2160 Winter	100	+40%	100/15 Summer				5.867
11.001	12	2160 Winter	100	+40%	100/15 Summer				5.867
6.006	7	2160 Winter	100	+40%					5.866
6.007	16	2160 Winter	100	+40%	100/30 Winter				5.864

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment G

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
6.000	1	-0.008	0.000	0.02		1.5	OK	
6.001	2	0.212	0.000	0.04		2.7	SURCHARGED	
6.002	5	0.435	0.000	0.06		4.3	SURCHARGED	
7.000	4	0.333	0.000	0.04		1.4	SURCHARGED	
7.001	5	0.516	0.000	0.07		4.0	SURCHARGED	
6.003	4	-0.133	0.000	0.00		9.5	FLOOD RISK*	
8.000	7	0.572	0.000	0.06		1.9	SURCHARGED	
6.004	5	-0.133	0.000	0.00		8.7	FLOOD RISK*	
9.000	8	0.455	0.000	0.36		24.2	SURCHARGED	
10.000	3	0.718	0.000	0.99		125.7	FLOOD RISK	
10.001	4	0.721	0.000	1.39		173.7	FLOOD RISK	
9.001	9	0.543	0.000	1.97		227.9	FLOOD RISK	
6.005	6	-0.133	0.000	0.00		16.9	FLOOD RISK*	
11.000	11	0.450	0.000	0.04		2.9	SURCHARGED	
11.001	12	0.687	0.000	0.09		5.5	FLOOD RISK	
6.006	7	-0.134	0.000	0.00		19.4	FLOOD RISK*	
6.007	16	0.624	0.000	0.02		4.4	FLOOD RISK	



STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Catchment H

Pipe Sizes Storm Pl Manhole Sizes SfA 7

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	70
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.306	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)	0.900
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 Catchment H

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	61.805	0.394	156.9	0.030	4.00	0.0	0.600		o	300	Pipe/Conduit	
1.001	32.861	0.113	291.3	0.104	0.00	0.0	0.600		o	300	Pipe/Conduit	
2.000	36.012	0.240	150.1	0.067	4.00	0.0	0.600		o	225	Pipe/Conduit	
2.001	37.199	0.221	168.3	0.071	0.00	0.0	0.600		o	225	Pipe/Conduit	
3.000	55.120	0.385	143.2	0.048	4.00	0.0	0.600		o	225	Pipe/Conduit	
4.000	36.120	0.434	83.2	0.314	4.00	0.0	0.600		o	375	Pipe/Conduit	
3.001	36.835	0.219	168.2	0.068	0.00	0.0	0.600		o	375	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	4.82	4.973	0.030	0.0	0.0	0.0	1.25	88.6	4.0
1.001	50.00	5.42	4.579	0.134	0.0	0.0	0.0	0.92	64.7	18.2
2.000	50.00	4.56	4.927	0.067	0.0	0.0	0.0	1.07	42.3	9.1
2.001	50.00	5.18	4.687	0.138	0.0	0.0	0.0	1.00	40.0	18.7
3.000	50.00	4.84	5.085	0.048	0.0	0.0	0.0	1.09	43.4	6.6
4.000	50.00	4.30	5.134	0.314	0.0	0.0	0.0	1.99	219.5	42.5
3.001	50.00	5.28	4.700	0.430	0.0	0.0	0.0	1.39	154.0	58.2

Network Design Table for Catchment H

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
3.002	32.067	0.005	6413.4	0.043	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
5.000	42.715	0.314	136.0	0.299	4.00	0.0	0.600		o	450	Pipe/Conduit	
5.001	63.367	0.268	236.4	0.400	0.00	0.0	0.600		o	450	Pipe/Conduit	
6.000	20.697	0.226	91.6	0.096	4.00	0.0	0.600		o	225	Pipe/Conduit	
7.000	31.274	0.369	84.8	0.131	4.00	0.0	0.600		o	225	Pipe/Conduit	
6.001	26.199	0.098	267.3	0.031	0.00	0.0	0.600		o	300	Pipe/Conduit	
3.003	17.471	0.005	3494.2	0.044	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
8.000	36.876	0.252	146.3	0.067	4.00	0.0	0.600		o	300	Pipe/Conduit	
8.001	19.171	0.104	184.3	0.029	0.00	0.0	0.600		o	300	Pipe/Conduit	
3.004	13.628	0.005	2725.7	0.049	0.00	0.0	0.600		|_|	-1	Pipe/Conduit	
3.005	34.044	0.005	6808.8	0.002	0.00	0.0	0.600		o	600	Pipe/Conduit	
1.002	29.578	0.005	5915.6	0.020	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
9.000	102.650	0.366	280.5	0.375	4.00	0.0	0.600		o	375	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)
3.002	50.00	5.91	4.481	0.473	0.0	0.0	0.0	0.85	16916.6	64.1
5.000	50.00	4.41	5.058	0.299	0.0	0.0	0.0	1.74	277.0	40.5
5.001	50.00	5.21	4.744	0.699	0.0	0.0	0.0	1.32	209.6	94.6
6.000	50.00	4.25	4.875	0.096	0.0	0.0	0.0	1.37	54.3	13.0
7.000	50.00	4.37	5.018	0.131	0.0	0.0	0.0	1.42	56.5	17.7
6.001	50.00	4.82	4.574	0.258	0.0	0.0	0.0	0.96	67.6	35.0
3.003	50.00	6.17	4.476	1.474	0.0	0.0	0.0	1.15	22918.4	199.6
8.000	50.00	4.47	4.827	0.067	0.0	0.0	0.0	1.30	91.7	9.1
8.001	50.00	4.75	4.575	0.096	0.0	0.0	0.0	1.15	81.6	13.0
3.004	50.00	6.30	4.471	1.619	0.0	0.0	0.0	1.68	33564.1	219.3
3.005	50.00	8.29	4.466	1.621	0.0	0.0	0.0	0.29	80.7«	219.6
1.002	50.00	8.85	4.461	1.913	0.0	0.0	0.0	0.88	17614.0	259.0
9.000	50.00	5.59	4.822	0.375	0.0	0.0	0.0	1.08	118.9	50.8

Network Design Table for Catchment H

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
10.000	18.195	0.194	93.8	0.044	4.00	0.0	0.600		o	300	Pipe/Conduit	
1.003	25.092	0.005	5018.4	0.030	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
11.000	94.992	0.549	173.0	0.281	4.00	0.0	0.600		o	300	Pipe/Conduit	
12.000	18.094	0.199	90.9	0.039	4.00	0.0	0.600		o	225	Pipe/Conduit	
1.004	11.397	0.005	2279.4	0.018	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
1.005	17.914	0.046	389.4	0.005	0.00	0.0	0.600		o	500	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)
10.000	50.00	4.19	4.650	0.044	0.0	0.0	0.0	1.62	114.8	6.0
1.003	50.00	9.28	4.456	2.363	0.0	0.0	0.0	0.96	19123.9	319.9
11.000	50.00	5.33	5.000	0.281	0.0	0.0	0.0	1.19	84.3	38.1
12.000	50.00	4.22	4.650	0.039	0.0	0.0	0.0	1.37	54.5	5.2
1.004	50.00	9.42	4.451	2.700	0.0	0.0	0.0	1.42	28375.8	365.6
1.005	50.00	9.69	4.446	2.705	0.0	0.0	0.0	1.09	214.9«	366.3

Conduit Sections for Catchment H

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m²)
-1	|_|	13000	1534	90.0		4.964	19.942

Free Flowing Outfall Details for Catchment H

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.005	11	6.000	4.400	0.000	0	0

Simulation Criteria for Catchment H

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 Coeffiecient	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

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)	19.000	Storm Duration (mins)	30
Ratio R	0.306		

Online Controls for Catchment H

Hydro-Brake® Optimum Manhole: 26, DS/PN: 1.005, Volume (m³): 227.3

Unit Reference	MD-SHE-0122-7700-1500-7700
Design Head (m)	1.500
Design Flow (l/s)	7.7
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	122
Invert Level (m)	4.446
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	7.7	Kick-Flo®	0.922	6.1
Flush-Flo™	0.442	7.7	Mean Flow over Head Range	-	6.7

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)
0.100	4.3	1.200	6.9	3.000	10.7	7.000	16.0
0.200	6.9	1.400	7.4	3.500	11.5	7.500	16.5
0.300	7.5	1.600	7.9	4.000	12.2	8.000	17.0
0.400	7.7	1.800	8.4	4.500	12.9	8.500	17.5
0.500	7.7	2.000	8.8	5.000	13.6	9.000	18.0
0.600	7.6	2.200	9.2	5.500	14.2	9.500	18.5
0.800	7.0	2.400	9.6	6.000	14.8		
1.000	6.4	2.600	10.0	6.500	15.4		

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

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	1	+0%	100/120 Summer				5.014
1.001	2	960 Winter	1	+0%	100/15 Summer				4.858
2.000	3	15 Winter	1	+0%	100/15 Summer				4.998
2.001	4	960 Winter	1	+0%	100/15 Summer				4.859
3.000	5	15 Winter	1	+0%	100/15 Summer				5.143
4.000	6	15 Winter	1	+0%	100/15 Summer				5.249
3.001	7	15 Winter	1	+0%	100/15 Summer				4.861
3.002	8	960 Winter	1	+0%					4.859
5.000	9	15 Winter	1	+0%	100/15 Summer				5.176
5.001	10	15 Winter	1	+0%	100/15 Summer				4.944
6.000	11	15 Winter	1	+0%	100/15 Summer				4.951
7.000	12	15 Winter	1	+0%	100/15 Summer				5.105
6.001	13	960 Winter	1	+0%	100/15 Summer				4.860
3.003	14	960 Winter	1	+0%					4.859
8.000	15	15 Winter	1	+0%	100/60 Summer				4.891
8.001	16	960 Winter	1	+0%	100/15 Summer				4.859
3.004	17	960 Winter	1	+0%					4.859

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.259	0.000	0.04		3.7	OK	
1.001	2	-0.021	0.000	0.03		1.5	OK	
2.000	3	-0.154	0.000	0.21		8.5	OK	
2.001	4	-0.053	0.000	0.04		1.6	OK	
3.000	5	-0.167	0.000	0.14		5.9	OK	
4.000	6	-0.260	0.000	0.21		40.5	OK	
3.001	7	-0.214	0.000	0.38		52.4	OK	
3.002	8	-1.156	0.000	0.00		5.6	OK	
5.000	9	-0.332	0.000	0.15		38.3	OK	
5.001	10	-0.250	0.000	0.39		75.9	OK	
6.000	11	-0.149	0.000	0.25		12.4	OK	
7.000	12	-0.138	0.000	0.32		16.8	OK	
6.001	13	-0.014	0.000	0.05		3.1	OK	
3.003	14	-1.151	0.000	0.00		12.1	OK	
8.000	15	-0.236	0.000	0.10		8.6	OK	
8.001	16	-0.016	0.000	0.02		1.1	OK	
3.004	17	-1.146	0.000	0.00		10.7	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
3.005	18	960 Winter	1	+0%	100/30 Summer				4.859
1.002	19	960 Winter	1	+0%					4.858
9.000	20	15 Winter	1	+0%	100/15 Summer				4.992
10.000	21	960 Winter	1	+0%	100/15 Winter				4.857
1.003	22	960 Winter	1	+0%					4.857
11.000	23	15 Winter	1	+0%	100/15 Summer				5.140
12.000	24	960 Winter	1	+0%	100/15 Summer				4.857
1.004	25	960 Winter	1	+0%					4.857
1.005	26	960 Winter	1	+0%	100/15 Winter				4.857

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
3.005	18	-0.207	0.000	0.05		8.2	OK*	
1.002	19	-1.137	0.000	0.00		11.1	OK	
9.000	20	-0.205	0.000	0.38		43.3	OK	
10.000	21	-0.093	0.000	0.01		0.5	OK	
1.003	22	-1.133	0.000	0.00		10.7	OK	
11.000	23	-0.160	0.000	0.41		33.2	OK	
12.000	24	-0.018	0.000	0.01		0.4	OK	
1.004	25	-1.128	0.000	0.00		9.8	OK	
1.005	26	-0.089	0.000	0.04		7.6	OK*	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment H

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	2160 Winter	100	+40%	100/120 Summer				5.991
1.001	2	2160 Winter	100	+40%	100/15 Summer				5.991
2.000	3	2160 Winter	100	+40%	100/15 Summer				5.992
2.001	4	2160 Winter	100	+40%	100/15 Summer				5.992
3.000	5	2160 Winter	100	+40%	100/15 Summer				5.996
4.000	6	2160 Winter	100	+40%	100/15 Summer				5.997
3.001	7	2160 Winter	100	+40%	100/15 Summer				5.996
3.002	8	2160 Winter	100	+40%					5.995
5.000	9	2160 Winter	100	+40%	100/15 Summer				5.996
5.001	10	2160 Winter	100	+40%	100/15 Summer				5.996
6.000	11	2160 Winter	100	+40%	100/15 Summer				5.996
7.000	12	2160 Winter	100	+40%	100/15 Summer				5.997
6.001	13	2160 Winter	100	+40%	100/15 Summer				5.996
3.003	14	2160 Winter	100	+40%					5.995
8.000	15	2160 Winter	100	+40%	100/60 Summer				5.993
8.001	16	2160 Winter	100	+40%	100/15 Summer				5.993
3.004	17	2160 Winter	100	+40%					5.993

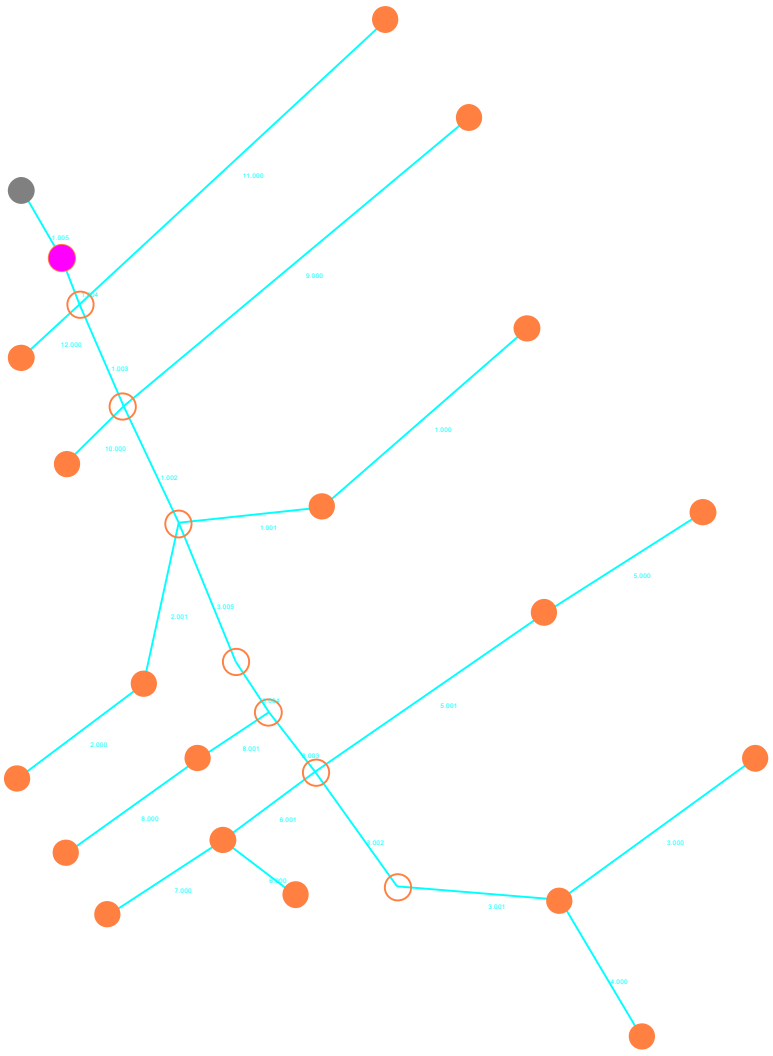
100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment H

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.718	0.000	0.01		0.7	SURCHARGED	
1.001	2	1.112	0.000	0.05		3.1	FLOOD RISK	
2.000	3	0.840	0.000	0.04		1.5	FLOOD RISK	
2.001	4	1.080	0.000	0.08		3.2	FLOOD RISK	
3.000	5	0.686	0.000	0.03		1.1	SURCHARGED	
4.000	6	0.488	0.000	0.04		7.3	SURCHARGED	
3.001	7	0.921	0.000	0.07		9.8	FLOOD RISK	
3.002	8	-0.020	0.000	0.00		10.8	FLOOD RISK*	
5.000	9	0.488	0.000	0.03		7.0	SURCHARGED	
5.001	10	0.802	0.000	0.08		16.1	FLOOD RISK	
6.000	11	0.896	0.000	0.04		2.2	FLOOD RISK	
7.000	12	0.754	0.000	0.06		3.0	FLOOD RISK	
6.001	13	1.122	0.000	0.10		5.9	FLOOD RISK	
3.003	14	-0.015	0.000	0.00		27.5	FLOOD RISK*	
8.000	15	0.866	0.000	0.02		1.5	FLOOD RISK	
8.001	16	1.118	0.000	0.03		2.2	FLOOD RISK	
3.004	17	-0.012	0.000	0.00		29.6	FLOOD RISK*	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment H

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
3.005	18	2160 Winter	100	+40%	100/30 Summer				5.992
1.002	19	2160 Winter	100	+40%					5.991
9.000	20	15 Winter	100	+40%	100/15 Summer				5.983
10.000	21	2160 Winter	100	+40%	100/15 Winter				5.983
1.003	22	2160 Winter	100	+40%					5.983
11.000	23	15 Winter	100	+40%	100/15 Summer				6.398
12.000	24	2160 Winter	100	+40%	100/15 Summer				5.975
1.004	25	2160 Winter	100	+40%					5.975
1.005	26	2160 Winter	100	+40%	100/15 Winter				5.971

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
3.005	18	0.926	0.000	0.16		28.2	FLOOD RISK*	
1.002	19	-0.004	0.000	0.00		31.4	FLOOD RISK*	
9.000	20	0.786	0.000	1.60		182.7	SURCHARGED	
10.000	21	1.033	0.000	0.01		1.0	FLOOD RISK	
1.003	22	-0.007	0.000	0.00		22.0	FLOOD RISK*	
11.000	23	1.098	0.000	1.63		132.7	FLOOD RISK	
12.000	24	1.100	0.000	0.02		0.9	FLOOD RISK	
1.004	25	-0.010	0.000	0.00		14.0	FLOOD RISK*	
1.005	26	1.025	0.000	0.04		7.8	FLOOD RISK*	



STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Catchment I

Pipe Sizes Storm Pl Manhole Sizes SfA 7

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	70
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.306	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)	0.900
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 Catchment I

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
5.000	89.386	0.311	287.4	0.226	4.00	0.0	0.600		o	375	Pipe/Conduit	
5.001	46.644	0.159	293.4	0.094	0.00	0.0	0.600		o	375	Pipe/Conduit	
5.002	27.922	0.022	1269.2	0.054	0.00	0.0		0.040	\/	-1	Pipe/Conduit	
6.000	70.188	0.294	238.7	0.206	4.00	0.0	0.600		o	300	Pipe/Conduit	
6.001	38.682	0.162	238.8	0.083	0.00	0.0	0.600		o	300	Pipe/Conduit	
5.003	32.426	0.030	1080.9	0.050	0.00	0.0		0.040	\/	-2	Pipe/Conduit	
7.000	38.025	0.187	203.3	0.067	4.00	0.0	0.600		o	300	Pipe/Conduit	
7.001	41.048	0.208	197.3	0.154	0.00	0.0	0.600		o	300	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)
5.000	50.00	5.40	5.265	0.226	0.0	0.0	0.0	1.06	117.5	30.6
5.001	50.00	6.14	4.954	0.320	0.0	0.0	0.0	1.05	116.3	43.3
5.002	50.00	6.84	4.795	0.373	0.0	0.0	0.0	0.67	9643.6	50.6
6.000	50.00	5.15	5.229	0.206	0.0	0.0	0.0	1.01	71.6	27.8
6.001	50.00	5.79	4.935	0.289	0.0	0.0	0.0	1.01	71.6	39.1
5.003	50.00	7.58	4.773	0.712	0.0	0.0	0.0	0.73	10839.9	96.5
7.000	50.00	4.58	5.238	0.067	0.0	0.0	0.0	1.10	77.7	9.0
7.001	50.00	5.19	5.051	0.220	0.0	0.0	0.0	1.12	78.9	29.9

Network Design Table for Catchment I

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
5.004	32.682	0.024	1361.8	0.043	0.00	0.0		0.040	\/	-2	Pipe/Conduit	
8.000	42.620	0.181	235.5	0.023	4.00	0.0	0.600		o	375	Pipe/Conduit	
9.000	59.670	0.159	375.0	0.169	4.00	0.0	0.600		o	375	Pipe/Conduit	
8.001	58.421	0.156	375.0	0.083	0.00	0.0	0.600		o	375	Pipe/Conduit	
10.000	53.083	0.222	239.1	0.107	4.00	0.0	0.600		o	375	Pipe/Conduit	
10.001	33.898	0.098	345.9	0.190	0.00	0.0	0.600		o	375	Pipe/Conduit	
8.002	34.441	0.092	375.0	0.016	0.00	0.0	0.600		o	375	Pipe/Conduit	
5.005	16.266	0.020	813.3	0.045	0.00	0.0		0.040	\/	-3	Pipe/Conduit	
5.006	71.949	0.266	270.5	0.000	0.00	0.0	0.600		o	500	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)
5.004	50.00	8.41	4.747	0.976	0.0	0.0	0.0	0.65	9657.4	132.2
8.000	50.00	4.60	5.284	0.023	0.0	0.0	0.0	1.18	129.9	3.1
9.000	50.00	5.07	5.262	0.169	0.0	0.0	0.0	0.93	102.7	22.8
8.001	50.00	6.12	5.103	0.274	0.0	0.0	0.0	0.93	102.7	37.2
10.000	50.00	4.76	5.267	0.107	0.0	0.0	0.0	1.17	128.9	14.5
10.001	50.00	5.34	5.045	0.297	0.0	0.0	0.0	0.97	107.0	40.3
8.002	50.00	6.73	4.947	0.588	0.0	0.0	0.0	0.93	102.7	79.7
5.005	50.00	8.73	4.723	1.610	0.0	0.0	0.0	0.86	13624.1	217.9
5.006	50.00	9.64	4.703	1.610	0.0	0.0	0.0	1.32	258.4	217.9

Conduit Sections for Catchment I

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m²)
-1	\/	7500	1275	18.4		3.710	14.449
-2	\/	7500	1300	18.4		3.770	14.830
-3	\/	8000	1325	18.4		3.874	15.878

Free Flowing Outfall Details for Catchment I

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
5.006		5.500	4.437	0.000	0	0

Simulation Criteria for Catchment I

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 Coeffiecient	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

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)	19.000	Storm Duration (mins)	30
Ratio R	0.306		

Online Controls for Catchment I

Hydro-Brake® Optimum Manhole: 17, DS/PN: 5.006, Volume (m³): 248.7

Unit Reference	MD-SHE-0097-4600-1325-4600
Design Head (m)	1.325
Design Flow (l/s)	4.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	97
Invert Level (m)	4.703
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.325	4.6	Kick-Flo®	0.813	3.7
Flush-Flo™	0.394	4.6	Mean Flow over Head Range	-	4.0

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	3.1	1.200	4.4	3.000	6.7	7.000	10.1
0.200	4.3	1.400	4.7	3.500	7.2	7.500	10.4
0.300	4.5	1.600	5.0	4.000	7.7	8.000	10.7
0.400	4.6	1.800	5.3	4.500	8.2	8.500	11.0
0.500	4.5	2.000	5.6	5.000	8.6	9.000	11.3
0.600	4.4	2.200	5.8	5.500	9.0	9.500	11.6
0.800	3.8	2.400	6.1	6.000	9.3		
1.000	4.0	2.600	6.3	6.500	9.7		

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

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.000	1	15 Winter	1	+0%	100/15 Summer				5.394
5.001	2	960 Winter	1	+0%	100/15 Summer				5.119
5.002	3	960 Winter	1	+0%					5.119
6.000	4	15 Winter	1	+0%	100/15 Summer				5.358
6.001	5	960 Winter	1	+0%	100/15 Summer				5.120
5.003	6	960 Winter	1	+0%					5.119
7.000	7	15 Winter	1	+0%	100/15 Summer				5.307
7.001	8	15 Winter	1	+0%	100/15 Summer				5.169
5.004	9	960 Winter	1	+0%					5.119
8.000	10	15 Winter	1	+0%	100/15 Summer				5.324
9.000	11	15 Winter	1	+0%	100/15 Summer				5.382
8.001	12	15 Winter	1	+0%	100/15 Summer				5.246
10.000	13	15 Winter	1	+0%	100/15 Summer				5.351
10.001	14	15 Winter	1	+0%	100/15 Summer				5.204
8.002	15	15 Winter	1	+0%	100/15 Summer				5.158
5.005	16	960 Winter	1	+0%					5.119
5.006	17	960 Winter	1	+0%	100/15 Summer				5.119

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
5.000	1	-0.246	0.000	0.24		26.4	OK	
5.001	2	-0.210	0.000	0.04		3.9	OK	
5.002	3	-0.951	0.000	0.00		4.2	OK	
6.000	4	-0.171	0.000	0.36		24.6	OK	
6.001	5	-0.115	0.000	0.05		3.5	OK	
5.003	6	-0.954	0.000	0.00		5.2	OK	
7.000	7	-0.231	0.000	0.12		8.4	OK	
7.001	8	-0.182	0.000	0.33		23.9	OK	
5.004	9	-0.928	0.000	0.00		4.5	OK	
8.000	10	-0.335	0.000	0.02		2.9	OK	
9.000	11	-0.255	0.000	0.21		20.3	OK	
8.001	12	-0.232	0.000	0.29		27.8	OK	
10.000	13	-0.291	0.000	0.11		13.1	OK	
10.001	14	-0.216	0.000	0.31		29.9	OK	
8.002	15	-0.164	0.000	0.60		55.6	OK	
5.005	16	-0.929	0.000	0.00		6.8	OK	
5.006	17	-0.084	0.000	0.02		4.6	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment I

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

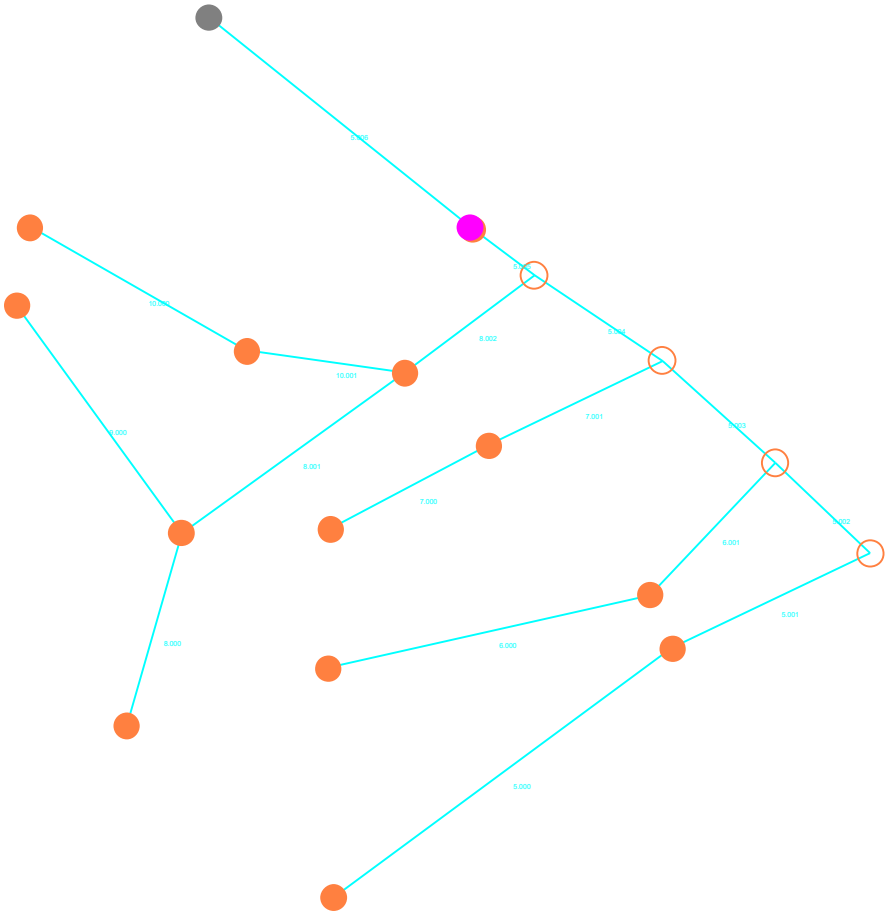
Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	OFF
DTS Status	OFF		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.000	1	2160 Winter	100	+40%	100/15 Summer				6.006
5.001	2	2160 Winter	100	+40%	100/15 Summer				6.006
5.002	3	2160 Winter	100	+40%					6.006
6.000	4	15 Winter	100	+40%	100/15 Summer				6.313
6.001	5	2160 Winter	100	+40%	100/15 Summer				6.007
5.003	6	2160 Winter	100	+40%					6.006
7.000	7	2160 Winter	100	+40%	100/15 Summer				6.006
7.001	8	2160 Winter	100	+40%	100/15 Summer				6.006
5.004	9	2160 Winter	100	+40%					6.005
8.000	10	15 Winter	100	+40%	100/15 Summer				6.044
9.000	11	15 Winter	100	+40%	100/15 Summer				6.132
8.001	12	15 Winter	100	+40%	100/15 Summer				6.037
10.000	13	15 Winter	100	+40%	100/15 Summer				6.086
10.001	14	2160 Winter	100	+40%	100/15 Summer				6.006
8.002	15	2160 Winter	100	+40%	100/15 Summer				6.006
5.005	16	2160 Winter	100	+40%					6.004
5.006	17	2160 Winter	100	+40%	100/15 Summer				6.003

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment I

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
5.000	1	0.366	0.000	0.05		5.3	SURCHARGED	
5.001	2	0.677	0.000	0.07		7.2	FLOOD RISK	
5.002	3	-0.064	0.000	0.00		8.4	FLOOD RISK*	
6.000	4	0.784	0.000	1.38		94.5	FLOOD RISK	
6.001	5	0.772	0.000	0.10		6.7	FLOOD RISK	
5.003	6	-0.067	0.000	0.00		8.1	FLOOD RISK*	
7.000	7	0.468	0.000	0.02		1.5	SURCHARGED	
7.001	8	0.655	0.000	0.07		5.1	FLOOD RISK	
5.004	9	-0.042	0.000	0.00		5.0	FLOOD RISK*	
8.000	10	0.385	0.000	0.08		10.1	SURCHARGED	
9.000	11	0.495	0.000	0.78		74.8	SURCHARGED	
8.001	12	0.559	0.000	1.09		104.5	SURCHARGED	
10.000	13	0.444	0.000	0.39		46.3	SURCHARGED	
10.001	14	0.586	0.000	0.07		6.7	SURCHARGED	
8.002	15	0.684	0.000	0.14		13.0	FLOOD RISK	
5.005	16	-0.044	0.000	0.00		8.8	FLOOD RISK*	
5.006	17	0.800	0.000	0.02		4.6	FLOOD RISK	



STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Catchment J

Pipe Sizes Storm Pl Manhole Sizes SfA 7

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.306	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)	0.900
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 Catchment J

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	31.159	0.208	149.8	0.094	4.00	0.0	0.600		o	300	Pipe/Conduit	
1.001	20.976	0.530	39.6	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.002	20.346	0.005	4069.2	0.000	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
2.000	26.767	0.178	150.4	0.130	4.00	0.0	0.600		o	300	Pipe/Conduit	
2.001	19.015	0.127	149.7	0.034	0.00	0.0	0.600		o	300	Pipe/Conduit	
2.002	18.092	0.080	226.2	0.036	0.00	0.0	0.600		o	300	Pipe/Conduit	
2.003	15.077	0.475	31.7	0.035	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.003	25.269	0.005	5053.8	0.000	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
1.004	14.733	0.005	2946.6	0.048	0.00	0.0		0.017	o	500	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	4.40	5.231	0.094	0.0	0.0	0.0	1.28	90.6	12.8
1.001	50.00	4.54	5.023	0.094	0.0	0.0	0.0	2.51	177.2	12.8
1.002	50.00	4.93	4.493	0.094	0.0	0.0	0.0	0.87	6313.6	12.8
2.000	50.00	4.35	5.348	0.130	0.0	0.0	0.0	1.28	90.5	17.6
2.001	50.00	4.60	5.170	0.164	0.0	0.0	0.0	1.28	90.7	22.2
2.002	50.00	4.89	5.043	0.199	0.0	0.0	0.0	1.04	73.6	27.0
2.003	50.00	4.97	4.963	0.234	0.0	0.0	0.0	2.80	198.0	31.7
1.003	50.00	5.51	4.488	0.329	0.0	0.0	0.0	0.78	5665.3	44.5
1.004	50.00	6.42	4.483	0.376	0.0	0.0	0.0	0.27	53.2	51.0

Network Design Table for Catchment J

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
3.000	32.638	0.947	34.5	0.097	4.00	0.0		0.017	o	225	Pipe/Conduit	
4.000	29.693	0.298	99.6	0.071	4.00	0.0	0.600		o	225	Pipe/Conduit	
4.001	37.128	0.408	91.0	0.019	0.00	0.0	0.600		o	225	Pipe/Conduit	
4.002	16.392	0.269	60.9	0.099	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.005	22.752	0.005	4550.4	0.000	0.00	0.0		0.012	|_|	-1	Pipe/Conduit	
5.000	26.846	0.322	83.5	0.060	4.00	0.0	0.600		o	300	Pipe/Conduit	
5.001	19.305	0.231	83.6	0.034	0.00	0.0	0.600		o	300	Pipe/Conduit	
5.002	17.476	0.209	83.6	0.056	0.00	0.0	0.600		o	300	Pipe/Conduit	
5.003	9.836	0.117	84.1	0.022	0.00	0.0	0.600		o	300	Pipe/Conduit	
1.006	28.902	0.005	5780.4	0.000	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
6.000	31.102	0.470	66.2	0.038	4.00	0.0	0.600		o	150	Pipe/Conduit	
7.000	53.409	0.400	133.5	0.053	4.00	0.0	0.600		o	225	Pipe/Conduit	
7.001	42.237	0.300	140.8	0.058	0.00	0.0	0.600		o	225	Pipe/Conduit	
7.002	22.158	0.118	187.8	0.036	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)
3.000	50.00	4.37	5.125	0.097	0.0	0.0	0.0	1.47	58.5	13.1
4.000	50.00	4.38	5.453	0.071	0.0	0.0	0.0	1.31	52.1	9.6
4.001	50.00	4.83	5.155	0.090	0.0	0.0	0.0	1.37	54.5	12.2
4.002	50.00	4.99	4.747	0.189	0.0	0.0	0.0	1.68	66.7	25.6
1.005	50.00	6.75	4.478	0.662	0.0	0.0	0.0	1.17	8458.1	89.7
5.000	50.00	4.26	5.352	0.060	0.0	0.0	0.0	1.72	121.7	8.1
5.001	50.00	4.45	5.030	0.094	0.0	0.0	0.0	1.72	121.7	12.8
5.002	50.00	4.62	4.799	0.151	0.0	0.0	0.0	1.72	121.6	20.4
5.003	50.00	4.71	4.590	0.173	0.0	0.0	0.0	1.72	121.3	23.4
1.006	50.00	7.40	4.473	0.835	0.0	0.0	0.0	0.73	5297.3	113.1
6.000	50.00	4.42	5.193	0.038	0.0	0.0	0.0	1.24	21.9	5.2
7.000	50.00	4.79	5.466	0.053	0.0	0.0	0.0	1.13	44.9	7.2
7.001	50.00	5.43	5.066	0.111	0.0	0.0	0.0	1.10	43.7	15.1
7.002	50.00	5.82	4.766	0.148	0.0	0.0	0.0	0.95	37.8	20.0

Network Design Table for Catchment J

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
6.001	9.716	0.180	54.0	0.052	0.00	0.0	0.600		o	225	Pipe/Conduit	
8.000	34.169	0.622	54.9	0.129	4.00	0.0	0.600		o	225	Pipe/Conduit	
1.007	25.283	0.005	5056.6	0.049	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
9.000	10.450	0.272	38.4	0.043	4.00	0.0	0.600		o	150	Pipe/Conduit	
1.008	20.201	0.005	4040.2	0.000	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
1.009	11.272	0.005	2254.4	0.024	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
10.000	28.071	0.188	149.3	0.022	4.00	0.0	0.600		o	150	Pipe/Conduit	
10.001	39.349	0.262	150.2	0.018	0.00	0.0	0.600		o	150	Pipe/Conduit	
11.000	48.742	0.407	119.8	0.029	4.00	0.0	0.600		o	150	Pipe/Conduit	
10.002	27.764	0.123	225.7	0.028	0.00	0.0	0.600		o	225	Pipe/Conduit	
12.000	49.470	0.220	224.9	0.088	4.00	0.0	0.600		o	225	Pipe/Conduit	
10.003	10.129	0.034	300.0	0.047	0.00	0.0	0.600		o	350	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)
6.001	50.00	5.91	4.648	0.238	0.0	0.0	0.0	1.78	70.9	32.2
8.000	50.00	4.32	5.090	0.129	0.0	0.0	0.0	1.77	70.3	17.5
1.007	50.00	7.94	4.468	1.252	0.0	0.0	0.0	0.78	5663.7	169.5
9.000	50.00	4.11	4.735	0.043	0.0	0.0	0.0	1.63	28.8	5.9
1.008	50.00	8.33	4.463	1.295	0.0	0.0	0.0	0.87	6336.2	175.3
1.009	50.00	8.49	4.458	1.319	0.0	0.0	0.0	1.17	8482.3	178.6
10.000	50.00	4.57	5.303	0.022	0.0	0.0	0.0	0.82	14.5	3.0
10.001	50.00	5.37	5.115	0.041	0.0	0.0	0.0	0.82	14.4	5.5
11.000	50.00	4.89	5.260	0.029	0.0	0.0	0.0	0.92	16.2	3.9
10.002	50.00	5.91	4.778	0.098	0.0	0.0	0.0	0.87	34.4	13.2
12.000	50.00	4.95	4.875	0.088	0.0	0.0	0.0	0.87	34.5	11.9
10.003	50.00	6.08	4.580	0.233	0.0	0.0	0.0	1.00	95.8	31.5

Network Design Table for Catchment J

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.010	28.312	0.005	5662.4	0.008	0.00	0.0		0.017	|_|	-2	Pipe/Conduit	
1.011	7.891	0.005	1578.2	0.081	0.00	0.0		0.017	|_|	-2	Pipe/Conduit	
1.012	16.999	0.040	425.0	0.000	0.00	0.0	0.600		o	450	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)
1.010	50.00	9.05	4.453	1.559	0.0	0.0	0.0	0.85	12253.8	211.1
1.011	50.00	9.13	4.448	1.640	0.0	0.0	0.0	1.60	23210.8	222.1
1.012	50.00	9.42	4.443	1.640	0.0	0.0	0.0	0.98	155.8«	222.1

Conduit Sections for Catchment J

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m^2)
-1	|_|	5000	1450	90.0		3.671	7.250
-2	|_|	10000	1450	90.0		4.496	14.500

Area Summary for Catchment J

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	70	0.135	0.094	0.094
1.001	-	-	100	0.000	0.000	0.000
1.002	-	-	100	0.000	0.000	0.000
2.000	User	-	70	0.185	0.130	0.130
2.001	User	-	70	0.048	0.034	0.034
2.002	User	-	70	0.051	0.036	0.036
2.003	User	-	70	0.050	0.035	0.035
1.003	-	-	100	0.000	0.000	0.000
1.004	User	-	70	0.068	0.048	0.048
3.000	User	-	70	0.138	0.097	0.097
4.000	User	-	70	0.101	0.071	0.071
4.001	User	-	70	0.028	0.019	0.019
4.002	User	-	70	0.142	0.099	0.099
1.005	-	-	100	0.000	0.000	0.000
5.000	User	-	70	0.086	0.060	0.060
5.001	User	-	70	0.049	0.034	0.034
5.002	User	-	70	0.080	0.056	0.056
5.003	User	-	70	0.032	0.022	0.022
1.006	-	-	100	0.000	0.000	0.000
6.000	User	-	70	0.055	0.038	0.038
7.000	User	-	70	0.076	0.053	0.053
7.001	User	-	70	0.083	0.058	0.058
7.002	User	-	70	0.052	0.036	0.036
6.001	User	-	70	0.074	0.052	0.052
8.000	User	-	70	0.185	0.129	0.129
1.007	User	-	70	0.070	0.049	0.049
9.000	User	-	70	0.062	0.043	0.043
1.008	-	-	100	0.000	0.000	0.000
1.009	User	-	70	0.034	0.024	0.024
10.000	User	-	70	0.032	0.022	0.022
10.001	User	-	70	0.026	0.018	0.018
11.000	User	-	70	0.042	0.029	0.029
10.002	-	-	100	0.028	0.028	0.028
12.000	User	-	70	0.125	0.088	0.088
10.003	User	-	70	0.068	0.047	0.047
1.010	User	-	70	0.011	0.008	0.008
1.011	User	-	70	0.115	0.081	0.081
1.012	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				2.331	1.640	1.640

Free Flowing Outfall Details for Catchment J

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.012		5.500	4.403	0.000	0	0

Simulation Criteria for Catchment J

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 Coeffiecient	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

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)	19.000	Storm Duration (mins)	30
Ratio R	0.306		

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

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	1	+0%	100/360 Winter				5.307
1.001	2	15 Winter	1	+0%	100/120 Winter				5.079
1.002	3	960 Winter	1	+0%					4.837
2.000	4	15 Winter	1	+0%	100/15 Summer				5.440
2.001	5	15 Winter	1	+0%	100/15 Summer				5.273
2.002	6	15 Winter	1	+0%	100/15 Summer				5.170
2.003	7	15 Winter	1	+0%	100/120 Summer				5.044
1.003	8	960 Winter	1	+0%					4.837
1.004	9	960 Winter	1	+0%	100/30 Summer				4.837
3.000	10	15 Winter	1	+0%	100/15 Summer				5.196
4.000	11	15 Winter	1	+0%	100/15 Summer				5.519
4.001	12	15 Winter	1	+0%	100/15 Summer				5.226
4.002	13	15 Winter	1	+0%	100/15 Summer				4.840
1.005	14	960 Winter	1	+0%					4.836
5.000	15	15 Winter	1	+0%	100/480 Winter				5.404
5.001	16	15 Winter	1	+0%	100/120 Winter				5.095
5.002	17	15 Winter	1	+0%	100/30 Winter				4.880

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.224	0.000	0.15		12.1	OK	
1.001	2	-0.244	0.000	0.08		12.0	OK	
1.002	3	-1.106	0.000	0.00		1.1	OK	
2.000	4	-0.208	0.000	0.21		16.7	OK	
2.001	5	-0.197	0.000	0.25		19.9	OK	
2.002	6	-0.173	0.000	0.37		23.6	OK	
2.003	7	-0.219	0.000	0.16		27.0	OK	
1.003	8	-1.101	0.000	0.00		2.8	OK	
1.004	9	-0.146	0.000	0.03		2.2	OK*	
3.000	10	-0.154	0.000	0.22		12.5	OK	
4.000	11	-0.159	0.000	0.19		9.1	OK	
4.001	12	-0.154	0.000	0.21		10.9	OK	
4.002	13	-0.132	0.000	0.35		21.0	OK	
1.005	14	-1.092	0.000	0.00		5.0	OK	
5.000	15	-0.248	0.000	0.07		7.8	OK	
5.001	16	-0.235	0.000	0.11		11.3	OK	
5.002	17	-0.219	0.000	0.16		16.9	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.003	18	960 Winter	1	+0%	100/15 Summer				4.837
1.006	19	960 Winter	1	+0%					4.836
6.000	20	15 Winter	1	+0%	100/15 Summer				5.242
7.000	21	15 Winter	1	+0%	100/15 Summer				5.526
7.001	22	15 Winter	1	+0%	100/15 Summer				5.151
7.002	23	15 Winter	1	+0%	100/15 Summer				4.873
6.001	24	960 Winter	1	+0%	100/15 Summer				4.837
8.000	25	15 Winter	1	+0%	100/15 Summer				5.166
1.007	26	960 Winter	1	+0%					4.836
9.000	27	960 Winter	1	+0%	100/15 Summer				4.837
1.008	28	960 Winter	1	+0%					4.836
1.009	29	960 Winter	1	+0%					4.836
10.000	30	15 Winter	1	+0%	100/15 Summer				5.349
10.001	31	15 Winter	1	+0%	100/15 Summer				5.175
11.000	32	15 Winter	1	+0%	100/15 Summer				5.309
10.002	33	15 Winter	1	+0%	100/15 Summer				4.870
12.000	34	15 Winter	1	+0%	100/15 Summer				4.966
10.003	35	960 Winter	1	+0%	100/15 Summer				4.837
1.010	36	960 Winter	1	+0%					4.836
1.011	37	960 Winter	1	+0%					4.836
1.012	38	960 Winter	1	+0%	100/15 Summer				4.836

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
5.003	18	-0.053	0.000	0.02		2.1	OK	
1.006	19	-1.087	0.000	0.00		12.1	OK	
6.000	20	-0.101	0.000	0.23		4.9	OK	
7.000	21	-0.165	0.000	0.15		6.6	OK	
7.001	22	-0.140	0.000	0.30		12.3	OK	
7.002	23	-0.118	0.000	0.45		15.7	OK	
6.001	24	-0.036	0.000	0.05		2.9	OK	
8.000	25	-0.149	0.000	0.25		16.7	OK	
1.007	26	-1.082	0.000	0.00		19.6	OK	
9.000	27	-0.048	0.000	0.02		0.5	OK	
1.008	28	-1.077	0.000	0.00		21.9	OK	
1.009	29	-1.072	0.000	0.00		11.6	OK	
10.000	30	-0.104	0.000	0.20		2.8	OK	
10.001	31	-0.090	0.000	0.33		4.6	OK	
11.000	32	-0.101	0.000	0.23		3.7	OK	
10.002	33	-0.133	0.000	0.34		10.9	OK	
12.000	34	-0.134	0.000	0.32		10.7	OK	
10.003	35	-0.093	0.000	0.04		2.8	OK	
1.010	36	-1.067	0.000	0.00		9.7	OK	
1.011	37	-1.062	0.000	0.00		6.0	OK	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.012	38	-0.057	0.000	0.03		4.6	OK*	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment J

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	2160 Winter	100	+40%	100/360 Winter				5.846
1.001	2	2160 Winter	100	+40%	100/120 Winter				5.846
1.002	3	2160 Winter	100	+40%					5.846
2.000	4	2160 Winter	100	+40%	100/15 Summer				5.848
2.001	5	2160 Winter	100	+40%	100/15 Summer				5.848
2.002	6	2160 Winter	100	+40%	100/15 Summer				5.847
2.003	7	2160 Winter	100	+40%	100/120 Summer				5.847
1.003	8	2160 Winter	100	+40%					5.846
1.004	9	2160 Winter	100	+40%	100/30 Summer				5.846
3.000	10	2160 Winter	100	+40%	100/15 Summer				5.847
4.000	11	2160 Winter	100	+40%	100/15 Summer				5.848
4.001	12	2160 Winter	100	+40%	100/15 Summer				5.847
4.002	13	2160 Winter	100	+40%	100/15 Summer				5.847
1.005	14	2160 Winter	100	+40%					5.846
5.000	15	2160 Winter	100	+40%	100/480 Winter				5.846
5.001	16	2160 Winter	100	+40%	100/120 Winter				5.846
5.002	17	2160 Winter	100	+40%	100/30 Winter				5.846

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment J

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.315	0.000	0.03		2.3	SURCHARGED	
1.001	2	0.523	0.000	0.01		2.1	SURCHARGED	
1.002	3	-0.097	0.000	0.00		2.0	FLOOD RISK*	
2.000	4	0.200	0.000	0.04		3.1	SURCHARGED	
2.001	5	0.378	0.000	0.05		3.9	SURCHARGED	
2.002	6	0.504	0.000	0.07		4.7	SURCHARGED	
2.003	7	0.584	0.000	0.03		5.5	SURCHARGED	
1.003	8	-0.092	0.000	0.00		4.4	FLOOD RISK*	
1.004	9	0.863	0.000	0.04		2.8	FLOOD RISK*	
3.000	10	0.497	0.000	0.04		2.2	SURCHARGED	
4.000	11	0.170	0.000	0.03		1.7	SURCHARGED	
4.001	12	0.467	0.000	0.04		2.1	SURCHARGED	
4.002	13	0.875	0.000	0.07		4.3	SURCHARGED	
1.005	14	-0.082	0.000	0.00		8.3	FLOOD RISK*	
5.000	15	0.194	0.000	0.01		1.4	SURCHARGED	
5.001	16	0.516	0.000	0.02		2.1	SURCHARGED	
5.002	17	0.747	0.000	0.03		3.4	SURCHARGED	

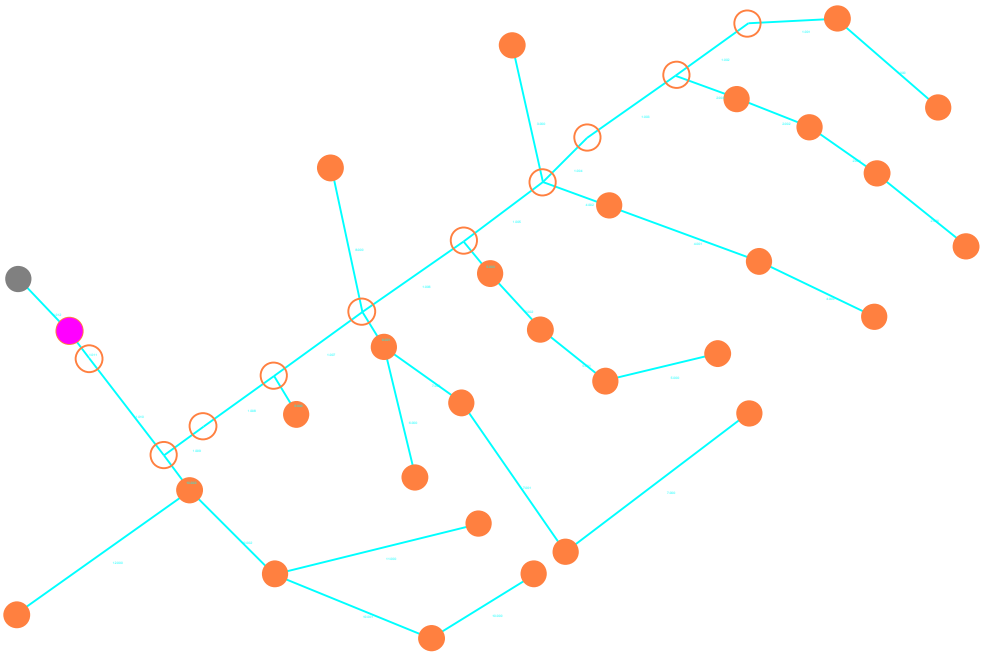
100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment J

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
5.003	18	2160 Winter	100	+40%	100/15 Summer				5.846
1.006	19	2160 Winter	100	+40%					5.846
6.000	20	2160 Winter	100	+40%	100/15 Summer				5.847
7.000	21	15 Winter	100	+40%	100/15 Summer				6.109
7.001	22	15 Winter	100	+40%	100/15 Summer				6.006
7.002	23	2160 Winter	100	+40%	100/15 Summer				5.847
6.001	24	2160 Winter	100	+40%	100/15 Summer				5.846
8.000	25	2160 Winter	100	+40%	100/15 Summer				5.846
1.007	26	2160 Winter	100	+40%					5.845
9.000	27	2160 Winter	100	+40%	100/15 Summer				5.845
1.008	28	2160 Winter	100	+40%					5.845
1.009	29	2160 Winter	100	+40%					5.844
10.000	30	2160 Winter	100	+40%	100/15 Summer				5.846
10.001	31	2160 Winter	100	+40%	100/15 Summer				5.846
11.000	32	2160 Winter	100	+40%	100/15 Summer				5.845
10.002	33	2160 Winter	100	+40%	100/15 Summer				5.845
12.000	34	2160 Winter	100	+40%	100/15 Summer				5.844
10.003	35	2160 Winter	100	+40%	100/15 Summer				5.844
1.010	36	2160 Winter	100	+40%					5.844
1.011	37	2160 Winter	100	+40%					5.843
1.012	38	2160 Winter	100	+40%	100/15 Summer				5.843

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
5.003	18	0.956	0.000	0.05		3.9	SURCHARGED	
1.006	19	-0.077	0.000	0.00		13.5	FLOOD RISK*	
6.000	20	0.504	0.000	0.04		0.9	SURCHARGED	
7.000	21	0.418	0.000	0.59		25.5	SURCHARGED	
7.001	22	0.715	0.000	1.08		44.8	SURCHARGED	
7.002	23	0.856	0.000	0.10		3.3	SURCHARGED	
6.001	24	0.973	0.000	0.09		5.3	SURCHARGED	
8.000	25	0.531	0.000	0.05		3.0	SURCHARGED	
1.007	26	-0.073	0.000	0.00		21.1	FLOOD RISK*	
9.000	27	0.960	0.000	0.04		1.0	SURCHARGED	
1.008	28	-0.068	0.000	0.00		23.4	FLOOD RISK*	
1.009	29	-0.064	0.000	0.00		11.3	FLOOD RISK*	
10.000	30	0.393	0.000	0.04		0.5	SURCHARGED	
10.001	31	0.581	0.000	0.06		0.9	SURCHARGED	
11.000	32	0.435	0.000	0.04		0.7	SURCHARGED	
10.002	33	0.842	0.000	0.07		2.1	SURCHARGED	
12.000	34	0.744	0.000	0.06		2.0	FLOOD RISK	
10.003	35	0.914	0.000	0.07		5.2	FLOOD RISK	
1.010	36	-0.059	0.000	0.00		12.9	FLOOD RISK*	
1.011	37	-0.055	0.000	0.00		6.7	FLOOD RISK*	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment J

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.012	38	0.950	0.000	0.03		4.6	SURCHARGED*	



STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Catchment K

Pipe Sizes Storm Pl Manhole Sizes SfA 7

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.306	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)	0.900
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 Catchment K

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	44.775	0.199	225.0	0.009	4.00	0.0	0.600		o	225	Pipe/Conduit	
1.001	52.797	0.368	143.5	0.028	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.002	20.415	0.109	187.3	0.000	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.003	19.268	0.005	3853.6	0.118	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
2.000	16.465	0.146	112.4	0.055	4.00	0.0	0.600		o	225	Pipe/Conduit	
2.001	18.386	0.164	112.1	0.028	0.00	0.0		0.017	o	225	Pipe/Conduit	
1.004	14.863	0.005	2972.6	0.163	0.00	0.0		0.017	|_|	-2	Pipe/Conduit	
3.000	45.157	0.169	267.2	0.021	4.00	0.0	0.600		o	300	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	4.86	5.300	0.009	0.0	0.0	0.0	0.87	34.5	1.2
1.001	50.00	5.67	5.101	0.037	0.0	0.0	0.0	1.09	43.3	5.0
1.002	50.00	6.03	4.733	0.037	0.0	0.0	0.0	0.95	37.9	5.0
1.003	50.00	6.34	4.510	0.155	0.0	0.0	0.0	1.04	18136.5	21.0
2.000	50.00	4.22	4.891	0.055	0.0	0.0	0.0	1.23	49.0	7.5
2.001	50.00	4.60	4.745	0.083	0.0	0.0	0.0	0.82	32.4	11.2
1.004	50.00	6.55	4.505	0.401	0.0	0.0	0.0	1.18	20649.9	54.3
3.000	50.00	4.79	4.963	0.021	0.0	0.0	0.0	0.96	67.6	2.8

Network Design Table for Catchment K

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
4.000	43.925	0.146	300.0	0.086	4.00	0.0	0.600		o	300	Pipe/Conduit	
3.001	44.421	0.148	300.0	0.083	0.00	0.0	0.600		o	300	Pipe/Conduit	
3.002	21.600	0.070	308.6	0.034	0.00	0.0		0.017	o	300	Pipe/Conduit	
1.005	4.215	0.005	843.0	0.089	0.00	0.0		0.017	|_|	-3	Pipe/Conduit	
1.006	44.117	0.069	639.4	0.000	0.00	0.0	0.600		o	500	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)
4.000	50.00	4.81	4.940	0.086	0.0	0.0	0.0	0.90	63.8	11.6
3.001	50.00	5.63	4.794	0.190	0.0	0.0	0.0	0.90	63.8	25.7
3.002	50.00	6.24	4.646	0.224	0.0	0.0	0.0	0.60	42.1	30.3
1.005	50.00	6.58	4.500	0.714	0.0	0.0	0.0	2.24	39807.9	96.7
1.006	50.00	7.44	4.495	0.714	0.0	0.0	0.0	0.85	167.2	96.7

Conduit Sections for Catchment K

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m²)
-1	|_|	12500	1400	90.0		4.575	17.500
-2	|_|	12500	1400	90.0		4.575	17.500
-3	|_|	12500	1424	90.0		4.639	17.800

Free Flowing Outfall Details for Catchment K

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.006		5.950	4.426	0.000	0	0

Simulation Criteria for Catchment K

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 Coeffiecient	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

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)	19.000	Storm Duration (mins)	30
Ratio R	0.306		

Online Controls for Catchment K

Hydro-Brake® Optimum Manhole: 13, DS/PN: 1.006, Volume (m³): 75.0

Unit Reference	MD-SHE-0061-2000-1450-2000
Design Head (m)	1.450
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	61
Invert Level (m)	4.495
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)	1.450	2.0	Kick-Flo®	0.549	1.3
Flush-Flo™	0.270	1.6	Mean Flow over Head Range	-	1.6

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	1.4	1.200	1.8	3.000	2.8	7.000	4.1
0.200	1.6	1.400	2.0	3.500	3.0	7.500	4.3
0.300	1.6	1.600	2.1	4.000	3.2	8.000	4.4
0.400	1.5	1.800	2.2	4.500	3.4	8.500	4.5
0.500	1.4	2.000	2.3	5.000	3.5	9.000	4.7
0.600	1.3	2.200	2.4	5.500	3.7	9.500	4.8
0.800	1.5	2.400	2.5	6.000	3.9		
1.000	1.7	2.600	2.6	6.500	4.0		

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

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	1	+0%					5.327
1.001	2	15 Winter	1	+0%					5.147
1.002	3	1440 Winter	1	+0%	100/15 Winter				4.893
1.003	4	1440 Winter	1	+0%	100/1440 Winter				4.893
2.000	5	15 Summer	1	+0%	100/15 Summer				4.952
2.001	6	1440 Winter	1	+0%	100/15 Summer				4.893
1.004	7	1440 Winter	1	+0%	100/1440 Winter				4.893
3.000	8	15 Winter	1	+0%	100/15 Summer				5.002
4.000	9	15 Winter	1	+0%	100/15 Summer				5.027
3.001	10	15 Winter	1	+0%	100/15 Summer				4.916
3.002	11	1440 Winter	1	+0%	100/15 Summer				4.894
1.005	12	1440 Winter	1	+0%	100/1440 Winter				4.893
1.006	13	1440 Winter	1	+0%	100/30 Summer				4.893

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.198	0.000	0.03		1.1	OK*	
1.001	2	-0.179	0.000	0.09		3.8	OK*	
1.002	3	-0.065	0.000	0.01		0.3	OK	
1.003	4	-1.017	0.000	0.00		1.4	OK	
2.000	5	-0.164	0.000	0.16		7.1	OK	
2.001	6	-0.077	0.000	0.02		0.8	OK	
1.004	7	-1.012	0.000	0.00		1.5	OK	
3.000	8	-0.261	0.000	0.04		2.5	OK	
4.000	9	-0.213	0.000	0.18		10.5	OK	
3.001	10	-0.178	0.000	0.34		20.1	OK	
3.002	11	-0.052	0.000	0.05		2.0	OK	
1.005	12	-1.031	0.000	0.00		2.2	OK	
1.006	13	-0.102	0.000	0.01		1.6	OK*	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment K

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

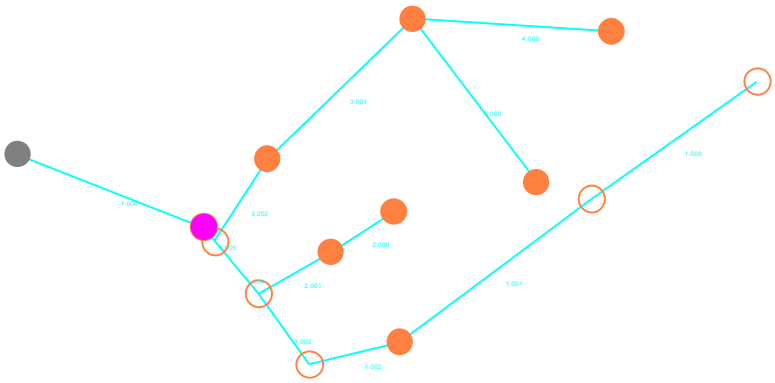
Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	240 Winter	100	+40%					5.525
1.001	2	120 Winter	100	+40%					5.326
1.002	3	2160 Winter	100	+40%	100/15 Winter				5.969
1.003	4	2160 Winter	100	+40%	100/1440 Winter				5.969
2.000	5	2160 Winter	100	+40%	100/15 Summer				5.970
2.001	6	2160 Winter	100	+40%	100/15 Summer				5.970
1.004	7	2160 Winter	100	+40%	100/1440 Winter				5.969
3.000	8	2160 Winter	100	+40%	100/15 Summer				5.970
4.000	9	2160 Winter	100	+40%	100/15 Summer				5.970
3.001	10	2160 Winter	100	+40%	100/15 Summer				5.970
3.002	11	2160 Winter	100	+40%	100/15 Summer				5.970
1.005	12	2160 Winter	100	+40%	100/1440 Winter				5.969
1.006	13	2160 Winter	100	+40%	100/30 Summer				5.969

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment K

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.000	0.000	0.03		1.1	SURCHARGED*	
1.001	2	0.000	0.000	0.17		7.4	SURCHARGED*	
1.002	3	1.011	0.000	0.02		0.7	FLOOD RISK	
1.003	4	0.059	0.000	0.00		3.3	FLOOD RISK*	
2.000	5	0.854	0.000	0.03		1.3	FLOOD RISK	
2.001	6	1.000	0.000	0.06		1.9	FLOOD RISK	
1.004	7	0.064	0.000	0.00		1.9	FLOOD RISK*	
3.000	8	0.707	0.000	0.01		0.5	FLOOD RISK	
4.000	9	0.730	0.000	0.03		2.0	FLOOD RISK	
3.001	10	0.876	0.000	0.07		4.3	FLOOD RISK	
3.002	11	1.024	0.000	0.13		5.1	FLOOD RISK	
1.005	12	0.045	0.000	0.00		3.2	FLOOD RISK*	
1.006	13	0.974	0.000	0.01		2.0	FLOOD RISK*	



STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Catchment L

Pipe Sizes Storm Pl Manhole Sizes SfA 7

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.306	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)	0.900
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 Catchment L

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	41.045	0.500	82.1	0.105	4.00	0.0	0.600		o	225	Pipe/Conduit	
2.000	71.356	0.425	167.9	0.195	4.00	0.0	0.600		o	300	Pipe/Conduit	
1.001	54.712	0.005	10942.4	0.288	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
1.002	21.213	0.110	192.8	0.000	0.00	0.0	0.600		o	375	Pipe/Conduit	
3.000	45.952	0.153	300.0	0.044	4.00	0.0	0.600		o	300	Pipe/Conduit	
3.001	27.542	0.387	71.2	0.000	0.00	0.0	0.600		o	300	Pipe/Conduit	
4.000	56.896	0.615	92.5	0.117	4.00	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)
1.000	50.00	4.47	5.075	0.105	0.0	0.0	0.0	1.44	57.4	14.3
2.000	50.00	4.98	5.000	0.195	0.0	0.0	0.0	1.21	85.6	26.4
1.001	50.00	6.60	4.575	0.588	0.0	0.0	0.0	0.57	5407.9	79.7
1.002	50.00	6.87	4.570	0.588	0.0	0.0	0.0	1.30	143.7	79.7
3.000	50.00	4.85	5.000	0.044	0.0	0.0	0.0	0.90	63.8	5.9
3.001	50.00	5.09	4.847	0.044	0.0	0.0	0.0	1.87	131.9	5.9
4.000	50.00	4.70	5.075	0.117	0.0	0.0	0.0	1.36	54.1	15.9

Network Design Table for Catchment L

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.003	77.939	0.010	7793.9	0.550	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
5.000	51.280	0.400	128.2	0.086	4.00	0.0	0.600		o	225	Pipe/Conduit	
6.000	42.130	0.500	84.3	0.102	4.00	0.0	0.600		o	225	Pipe/Conduit	
5.001	40.690	0.005	8138.0	0.192	0.00	0.0		0.017	|_|	-2	Pipe/Conduit	
7.000	41.233	0.230	179.3	0.165	4.00	0.0	0.600		o	300	Pipe/Conduit	
5.002	24.200	0.005	4840.0	0.000	0.00	0.0		0.017	|_|	-2	Pipe/Conduit	
5.003	17.625	0.115	153.3	0.000	0.00	0.0	0.600		o	375	Pipe/Conduit	
8.000	40.748	0.390	104.5	0.039	4.00	0.0	0.600		o	225	Pipe/Conduit	
8.001	28.424	0.235	121.0	0.040	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.004	29.162	0.005	5832.4	0.140	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
1.005	20.463	0.005	4092.6	0.105	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
1.006	5.045	0.005	1009.0	0.000	0.00	0.0	0.600		o	500	Pipe/Conduit	
9.000	69.081	0.230	300.4	0.192	4.00	0.0	0.600		o	350	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)
1.003	50.00	8.81	4.460	1.299	0.0	0.0	0.0	0.67	6407.8	175.9
5.000	50.00	4.74	4.975	0.086	0.0	0.0	0.0	1.15	45.9	11.6
6.000	50.00	4.49	5.075	0.102	0.0	0.0	0.0	1.43	56.7	13.8
5.001	50.00	5.87	4.575	0.380	0.0	0.0	0.0	0.60	3912.4	51.4
7.000	50.00	4.59	4.800	0.165	0.0	0.0	0.0	1.17	82.8	22.3
5.002	50.00	6.39	4.570	0.544	0.0	0.0	0.0	0.78	5073.1	73.7
5.003	50.00	6.59	4.565	0.544	0.0	0.0	0.0	1.46	161.4	73.7
8.000	50.00	4.53	5.150	0.039	0.0	0.0	0.0	1.28	50.8	5.2
8.001	50.00	4.93	4.760	0.079	0.0	0.0	0.0	1.19	47.2	10.7
1.004	50.00	9.44	4.450	2.063	0.0	0.0	0.0	0.77	7407.4	279.3
1.005	50.00	9.80	4.445	2.167	0.0	0.0	0.0	0.92	8842.8	293.5
1.006	50.00	9.93	4.440	2.167	0.0	0.0	0.0	0.68	132.6«	293.5
9.000	50.00	5.16	4.900	0.192	0.0	0.0	0.0	1.00	95.8	26.0

Network Design Table for Catchment L

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
10.000	48.066	0.280	171.7	0.174	4.00	0.0	0.600		o	350	Pipe/Conduit	
9.001	39.242	0.005	7848.4	0.000	0.00	0.0		0.017	|_|	-2	Pipe/Conduit	
11.000	34.507	0.115	300.1	0.168	4.00	0.0	0.600		o	300	Pipe/Conduit	
9.002	32.242	0.005	6448.4	0.000	0.00	0.0		0.017	|_|	-2	Pipe/Conduit	
9.003	20.379	0.245	83.2	0.246	0.00	0.0	0.600		o	450	Pipe/Conduit	
12.000	36.389	0.405	89.8	0.026	4.00	0.0	0.600		o	225	Pipe/Conduit	
12.001	24.600	0.235	104.7	0.015	0.00	0.0	0.600		o	225	Pipe/Conduit	
1.007	40.920	0.005	8184.0	0.197	0.00	0.0		0.017	|_|	-1	Pipe/Conduit	
1.008	18.799	0.024	768.4	0.000	0.00	0.0	0.600		o	600	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)
10.000	50.00	4.61	4.950	0.174	0.0	0.0	0.0	1.32	127.1	23.5
9.001	50.00	6.23	4.670	0.366	0.0	0.0	0.0	0.61	3983.9	49.5
11.000	50.00	4.64	4.780	0.168	0.0	0.0	0.0	0.90	63.8	22.8
9.002	50.00	7.03	4.665	0.534	0.0	0.0	0.0	0.67	4395.1	72.3
9.003	50.00	7.18	4.660	0.780	0.0	0.0	0.0	2.23	354.7	105.6
12.000	50.00	4.44	5.075	0.026	0.0	0.0	0.0	1.38	54.9	3.5
12.001	50.00	4.76	4.670	0.040	0.0	0.0	0.0	1.28	50.8	5.5
1.007	50.00	10.97	4.435	3.185	0.0	0.0	0.0	0.65	6253.2	431.3
1.008	50.00	11.33	4.430	3.185	0.0	0.0	0.0	0.87	246.2«	431.3

Conduit Sections for Catchment L

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m^2)
-1	|_|	6600	1450	90.0		4.029	9.570
-2	|_|	4500	1450	90.0		3.527	6.525

Free Flowing Outfall Details for Catchment L

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.008		6.000	4.406	0.000	0	0

Simulation Criteria for Catchment L

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 Coeffiecient	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

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)	19.000	Storm Duration (mins)	30
Ratio R	0.306		

Online Controls for Catchment L

Hydro-Brake® Optimum Manhole: 32, DS/PN: 1.008, Volume (m³): 391.6

Unit Reference	MD-SHE-0133-9100-1450-9100
Design Head (m)	1.450
Design Flow (l/s)	9.1
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	133
Invert Level (m)	4.430
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.450	9.1	Kick-Flo®	0.906	7.3
Flush-Flo™	0.429	9.1	Mean Flow over Head Range	-	7.9

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	4.8	1.200	8.3	3.000	12.8	7.000	19.2
0.200	8.3	1.400	8.9	3.500	13.8	7.500	19.9
0.300	8.9	1.600	9.5	4.000	14.7	8.000	20.5
0.400	9.1	1.800	10.1	4.500	15.6	8.500	21.1
0.500	9.1	2.000	10.6	5.000	16.4	9.000	21.7
0.600	8.9	2.200	11.1	5.500	17.1	9.500	22.3
0.800	8.2	2.400	11.5	6.000	17.8		
1.000	7.6	2.600	12.0	6.500	18.5		

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

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	15 Winter	1	+0%	100/15 Summer				5.151
2.000	2	15 Winter	1	+0%	100/15 Summer				5.114
1.001	3	960 Winter	1	+0%					4.897
1.002	4	960 Winter	1	+0%	100/15 Summer				4.897
3.000	5	15 Winter	1	+0%	100/60 Winter				5.062
3.001	6	960 Winter	1	+0%	100/30 Winter				4.896
4.000	7	15 Winter	1	+0%	100/15 Summer				5.157
1.003	8	960 Winter	1	+0%	100/960 Winter				4.896
5.000	10	15 Winter	1	+0%	100/15 Summer				5.051
6.000	11	15 Winter	1	+0%	100/15 Summer				5.150
5.001	12	960 Winter	1	+0%					4.897
7.000	13	15 Winter	1	+0%	100/15 Summer				4.907
5.002	14	960 Winter	1	+0%					4.897
5.003	15	960 Winter	1	+0%	100/15 Summer				4.897
8.000	16	15 Winter	1	+0%	100/120 Winter				5.198
8.001	17	960 Winter	1	+0%	100/15 Winter				4.897
1.004	18	960 Winter	1	+0%	100/960 Winter				4.896

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.149	0.000	0.25		13.5	OK	
2.000	2	-0.186	0.000	0.29		23.6	OK	
1.001	3	-1.128	0.000	0.00		7.0	OK	
1.002	4	-0.048	0.000	0.03		3.5	OK*	
3.000	5	-0.238	0.000	0.09		5.3	OK	
3.001	6	-0.251	0.000	0.00		0.5	OK	
4.000	7	-0.143	0.000	0.28		14.7	OK	
1.003	8	-1.014	0.000	0.00		11.5	OK	
5.000	10	-0.149	0.000	0.24		10.6	OK	
6.000	11	-0.150	0.000	0.24		13.0	OK	
5.001	12	-1.128	0.000	0.00		5.1	OK	
7.000	13	-0.193	0.000	0.27		20.8	OK	
5.002	14	-1.123	0.000	0.00		16.1	OK	
5.003	15	-0.043	0.000	0.03		3.8	OK*	
8.000	16	-0.177	0.000	0.10		4.9	OK	
8.001	17	-0.088	0.000	0.02		1.0	OK	
1.004	18	-1.004	0.000	0.00		45.7	OK	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.005	19	960 Winter	1	+0%	100/960 Winter				4.896
1.006	20	960 Winter	1	+0%	100/15 Summer				4.896
9.000	21	15 Winter	1	+0%	100/15 Summer				5.024
10.000	22	15 Winter	1	+0%	100/120 Summer				5.053
9.001	23	960 Winter	1	+0%					4.894
11.000	24	15 Winter	1	+0%	100/15 Summer				4.906
9.002	25	960 Winter	1	+0%					4.894
9.003	26	960 Winter	1	+0%	100/30 Summer				4.895
12.000	27	15 Winter	1	+0%	100/120 Summer				5.112
12.001	28	960 Winter	1	+0%	100/15 Summer				4.894
1.007	29	960 Winter	1	+0%	100/960 Winter				4.894
1.008	32	960 Winter	1	+0%	100/30 Summer				4.893

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.005	19	-0.999	0.000	0.01		60.7	OK	
1.006	20	-0.044	0.000	0.03		7.6	OK*	
9.000	21	-0.226	0.000	0.25		23.0	OK	
10.000	22	-0.247	0.000	0.19		21.8	OK	
9.001	23	-1.226	0.000	0.00		5.2	OK	
11.000	24	-0.174	0.000	0.36		20.9	OK	
9.002	25	-1.221	0.000	0.00		9.2	OK	
9.003	26	-0.215	0.000	0.03		7.9	OK*	
12.000	27	-0.188	0.000	0.06		3.3	OK	
12.001	28	-0.001	0.000	0.01		0.5	OK	
1.007	29	-0.991	0.000	0.00		13.7	OK	
1.008	32	-0.137	0.000	0.05		9.1	OK*	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment L

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	2160 Winter	100	+40%	100/15 Summer				5.991
2.000	2	2160 Winter	100	+40%	100/15 Summer				5.990
1.001	3	2160 Winter	100	+40%					5.990
1.002	4	2160 Winter	100	+40%	100/15 Summer				5.990
3.000	5	2160 Winter	100	+40%	100/60 Winter				5.989
3.001	6	2160 Winter	100	+40%	100/30 Winter				5.989
4.000	7	2160 Winter	100	+40%	100/15 Summer				5.990
1.003	8	2160 Winter	100	+40%	100/960 Winter				5.989
5.000	10	2160 Winter	100	+40%	100/15 Summer				5.990
6.000	11	2160 Winter	100	+40%	100/15 Summer				5.991
5.001	12	2160 Winter	100	+40%					5.990
7.000	13	2160 Winter	100	+40%	100/15 Summer				5.990
5.002	14	2160 Winter	100	+40%					5.990
5.003	15	2160 Winter	100	+40%	100/15 Summer				5.989
8.000	16	2160 Winter	100	+40%	100/120 Winter				5.989
8.001	17	2160 Winter	100	+40%	100/15 Winter				5.989
1.004	18	2160 Winter	100	+40%	100/960 Winter				5.989

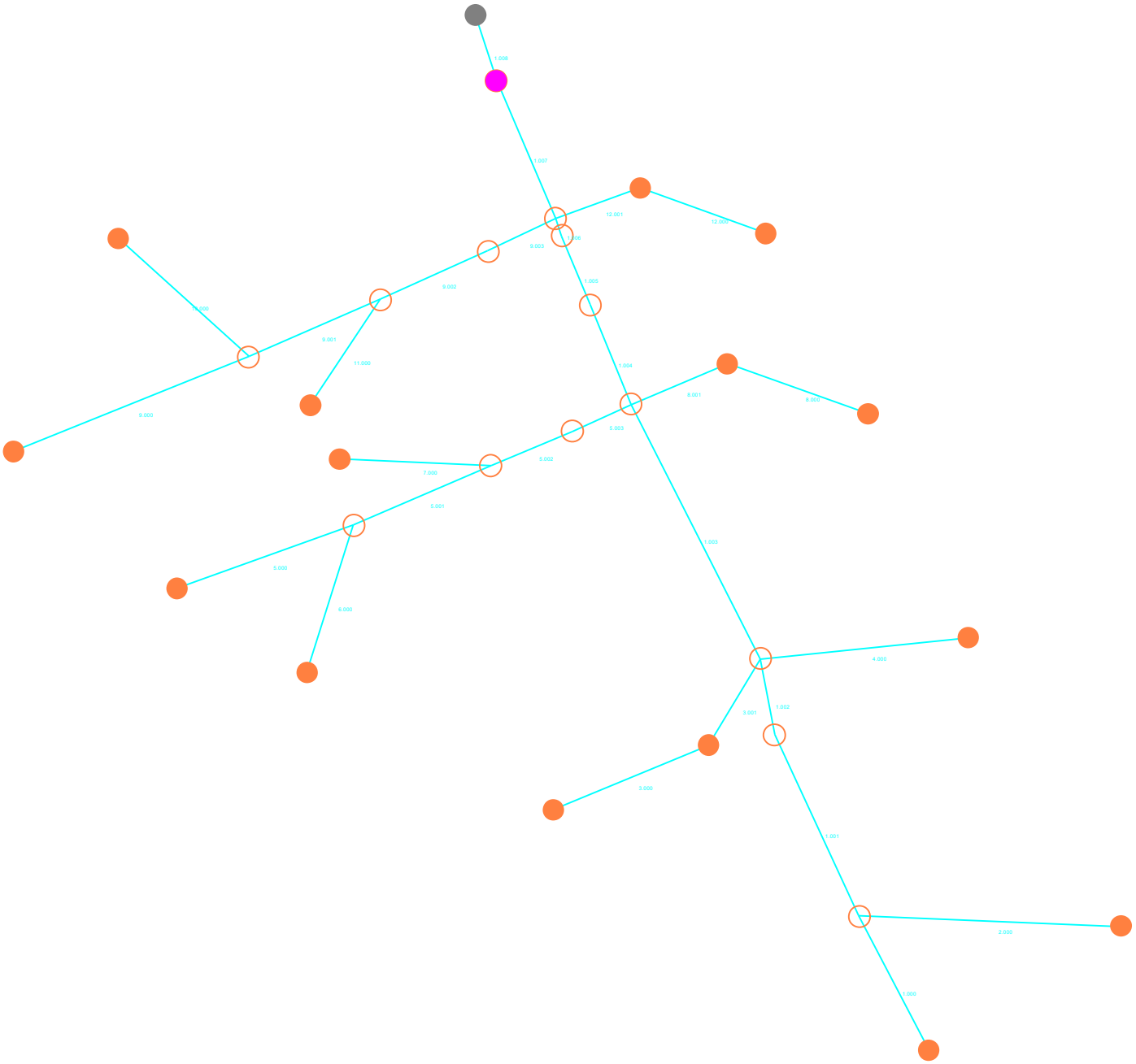
100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment L

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	0.691	0.000	0.04		2.4	SURCHARGED	
2.000	2	0.690	0.000	0.06		4.6	SURCHARGED	
1.001	3	-0.035	0.000	0.00		13.7	FLOOD RISK*	
1.002	4	1.045	0.000	0.03		4.5	FLOOD RISK*	
3.000	5	0.689	0.000	0.02		1.0	SURCHARGED	
3.001	6	0.842	0.000	0.01		1.0	FLOOD RISK	
4.000	7	0.690	0.000	0.05		2.7	SURCHARGED	
1.003	8	0.079	0.000	0.00		18.8	FLOOD RISK*	
5.000	10	0.790	0.000	0.05		2.0	SURCHARGED	
6.000	11	0.691	0.000	0.04		2.4	SURCHARGED	
5.001	12	-0.035	0.000	0.00		8.8	FLOOD RISK*	
7.000	13	0.890	0.000	0.05		3.8	FLOOD RISK	
5.002	14	-0.030	0.000	0.00		14.8	FLOOD RISK*	
5.003	15	1.049	0.000	0.04		5.4	FLOOD RISK*	
8.000	16	0.614	0.000	0.02		0.9	SURCHARGED	
8.001	17	1.004	0.000	0.04		1.8	FLOOD RISK	
1.004	18	0.089	0.000	0.00		47.4	FLOOD RISK*	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment L

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.005	19	2160 Winter	100	+40%	100/960 Winter				5.989
1.006	20	2160 Winter	100	+40%	100/15 Summer				5.989
9.000	21	2160 Winter	100	+40%	100/15 Summer				5.989
10.000	22	2160 Winter	100	+40%	100/120 Summer				5.989
9.001	23	2160 Winter	100	+40%					5.989
11.000	24	2160 Winter	100	+40%	100/15 Summer				5.989
9.002	25	2160 Winter	100	+40%					5.989
9.003	26	2160 Winter	100	+40%	100/30 Summer				5.989
12.000	27	2160 Winter	100	+40%	100/120 Summer				5.988
12.001	28	2160 Winter	100	+40%	100/15 Summer				5.988
1.007	29	2160 Winter	100	+40%	100/960 Winter				5.988
1.008	32	2160 Winter	100	+40%	100/30 Summer				5.988

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.005	19	0.094	0.000	0.01		62.5	FLOOD RISK*	
1.006	20	1.049	0.000	0.08		16.6	FLOOD RISK*	
9.000	21	0.739	0.000	0.05		4.5	SURCHARGED	
10.000	22	0.689	0.000	0.04		4.2	SURCHARGED	
9.001	23	-0.131	0.000	0.00		8.6	FLOOD RISK*	
11.000	24	0.909	0.000	0.07		3.9	FLOOD RISK	
9.002	25	-0.126	0.000	0.00		10.2	FLOOD RISK*	
9.003	26	0.879	0.000	0.05		15.1	SURCHARGED*	
12.000	27	0.688	0.000	0.01		0.6	SURCHARGED	
12.001	28	1.093	0.000	0.02		0.9	FLOOD RISK	
1.007	29	0.103	0.000	0.00		23.4	FLOOD RISK*	
1.008	32	0.958	0.000	0.05		9.1	FLOOD RISK*	



STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Catchment M1

Pipe Sizes Storm Pl Manhole Sizes SfA 7

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.306	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)	0.900
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 Catchment M1

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	39.142	0.005	7828.4	0.034	4.00	0.0		0.040	\/	-1	Pipe/Conduit	
1.001	2.337	0.005	467.4	0.003	0.00	0.0		0.040	\/	-1	Pipe/Conduit	
1.002	19.485	0.005	3897.0	0.015	0.00	0.0		0.040	\/	-1	Pipe/Conduit	
1.003	30.755	0.005	6151.0	0.026	0.00	0.0		0.040	\/	-1	Pipe/Conduit	
1.004	3.032	0.005	606.4	0.004	0.00	0.0		0.040	\/	-1	Pipe/Conduit	
1.005	3.205	0.005	641.0	0.006	0.00	0.0	0.600		\/	-1	Pipe/Conduit	
1.006	9.136	0.183	49.9	0.007	0.00	0.0	0.600		o	300	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	8.92	5.530	0.034	0.0	0.0	0.0	0.13	199.2	4.5
1.001	50.00	8.99	5.525	0.036	0.0	0.0	0.0	0.54	815.1	4.9
1.002	50.00	10.72	5.520	0.051	0.0	0.0	0.0	0.19	282.3	6.9
1.003	50.00	14.14	5.515	0.077	0.0	0.0	0.0	0.15	224.7	10.5
1.004	50.00	14.25	5.510	0.081	0.0	0.0	0.0	0.48	715.6	11.0
1.005	50.00	14.28	5.505	0.087	0.0	0.0	0.0	1.53	2304.5	11.8
1.006	50.00	14.35	5.500	0.094	0.0	0.0	0.0	2.23	157.7	12.8

Conduit Sections for Catchment M1

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m²)
-1	\/	1500	500	18.4		1.287	1.502

Free Flowing Outfall Details for Catchment M1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.006		6.000	5.317	0.000	0	0

Simulation Criteria for Catchment M1

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 Coeffiecient	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

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)	19.000	Storm Duration (mins)	30
Ratio R	0.306		

Online Controls for Catchment M1

Hydro-Brake® Optimum Manhole: 7, DS/PN: 1.006, Volume (m³): 4.5

Unit Reference	MD-SHE-0029-3000-0500-3000
Design Head (m)	0.500
Design Flow (l/s)	0.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	29
Invert Level (m)	5.500
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)	0.500	0.3	Kick-Flo®	0.256	0.2
Flush-Flo™	0.127	0.3	Mean Flow over Head Range	-	0.2

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	0.3	1.200	0.4	3.000	0.7	7.000	1.0
0.200	0.3	1.400	0.5	3.500	0.7	7.500	1.0
0.300	0.2	1.600	0.5	4.000	0.7	8.000	1.0
0.400	0.3	1.800	0.5	4.500	0.8	8.500	1.1
0.500	0.3	2.000	0.5	5.000	0.8	9.000	1.1
0.600	0.3	2.200	0.6	5.500	0.9	9.500	1.1
0.800	0.4	2.400	0.6	6.000	0.9		
1.000	0.4	2.600	0.6	6.500	0.9		

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment M1

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	960 Winter	1	+0%					5.647
1.001	2	960 Winter	1	+0%					5.647
1.002	3	960 Winter	1	+0%					5.647
1.003	4	960 Winter	1	+0%					5.648
1.004	5	960 Winter	1	+0%					5.649
1.005	6	960 Winter	1	+0%					5.655
1.006	7	960 Winter	1	+0%	100/120 Winter				5.655

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.383	0.000	0.00		0.4	OK	
1.001	2	-0.378	0.000	0.00		0.8	OK	
1.002	3	-0.373	0.000	0.00		0.5	OK	
1.003	4	-0.367	0.000	0.00		0.6	OK	

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment M1

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.004	5	-0.361	0.000	0.00		3.7	OK	
1.005	6	-0.350	0.000	0.00		1.9	OK	
1.006	7	-0.145	0.000	0.00		0.3	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment M1

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

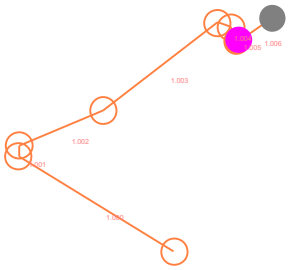
Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	2160 Winter	100	+40%					5.900
1.001	2	2160 Winter	100	+40%					5.900
1.002	3	2160 Winter	100	+40%					5.900
1.003	4	2160 Winter	100	+40%					5.901
1.004	5	2160 Winter	100	+40%					5.902
1.005	6	2160 Winter	100	+40%					5.904
1.006	7	2160 Winter	100	+40%	100/120 Winter				5.906

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.130	0.000	0.00		0.8	FLOOD RISK*	
1.001	2	-0.125	0.000	0.00		2.1	FLOOD RISK*	
1.002	3	-0.120	0.000	0.00		0.9	FLOOD RISK*	
1.003	4	-0.114	0.000	0.00		1.2	FLOOD RISK*	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment M1

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.004	5	-0.108	0.000	0.01		8.2	FLOOD RISK*	
1.005	6	-0.101	0.000	0.00		4.1	FLOOD RISK*	
1.006	7	0.106	0.000	0.00		0.3	FLOOD RISK	



STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Catchment M2

Pipe Sizes Storm Pl Manhole Sizes SfA 7

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.306	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)	0.900
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 Catchment M2

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	n	HYD SECT	DIA (mm)	Section Type	Auto Design
2.000	25.901	0.005	5180.2	0.026	4.00	0.0		0.040	\/	-1	Pipe/Conduit	
2.001	9.476	0.005	1895.2	0.012	0.00	0.0		0.040	\/	-1	Pipe/Conduit	
2.002	1.744	0.005	348.8	0.028	0.00	0.0		0.040	\/	-1	Pipe/Conduit	
2.003	45.600	0.005	9120.0	0.040	0.00	0.0		0.040	\/	-1	Pipe/Conduit	
2.004	9.336	0.062	150.6	0.000	0.00	0.0	0.600		o	300	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)
2.000	50.00	6.65	5.520	0.026	0.0	0.0	0.0	0.16	244.8	3.5
2.001	50.00	7.23	5.515	0.037	0.0	0.0	0.0	0.27	404.8	5.1
2.002	50.00	7.28	5.510	0.065	0.0	0.0	0.0	0.63	943.6	8.9
2.003	50.00	13.46	5.505	0.106	0.0	0.0	0.0	0.12	184.5	14.3
2.004	50.00	13.59	5.500	0.106	0.0	0.0	0.0	1.28	90.4	14.3

Conduit Sections for Catchment M2

NOTE: Diameters less than 66 refer to section numbers of hydraulic conduits. These conduits are marked by the symbols:- [] box culvert, \/ open channel, oo dual pipe, ooo triple pipe, O egg.

Section numbers < 0 are taken from user conduit table

Section Number	Conduit Type	Major Dimn. (mm)	Minor Dimn. (mm)	Side Slope (Deg)	Corner Splay (mm)	4*Hyd Radius (m)	XSect Area (m²)
-1	\/	1500	500	18.4		1.287	1.502

Free Flowing Outfall Details for Catchment M2

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
2.004		6.000	5.438	0.000	0	0

Simulation Criteria for Catchment M2

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 Coeffiecient	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

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)	19.000	Storm Duration (mins)	30
Ratio R	0.306		

Online Controls for Catchment M2

Hydro-Brake® Optimum Manhole: 12, DS/PN: 2.004, Volume (m³): 68.5

Unit Reference	MD-SHE-0029-3000-0500-3000
Design Head (m)	0.500
Design Flow (l/s)	0.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	29
Invert Level (m)	5.500
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)	0.500	0.3	Kick-Flo®	0.256	0.2
Flush-Flo™	0.127	0.3	Mean Flow over Head Range	-	0.2

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	0.3	1.200	0.4	3.000	0.7	7.000	1.0
0.200	0.3	1.400	0.5	3.500	0.7	7.500	1.0
0.300	0.2	1.600	0.5	4.000	0.7	8.000	1.0
0.400	0.3	1.800	0.5	4.500	0.8	8.500	1.1
0.500	0.3	2.000	0.5	5.000	0.8	9.000	1.1
0.600	0.3	2.200	0.6	5.500	0.9	9.500	1.1
0.800	0.4	2.400	0.6	6.000	0.9		
1.000	0.4	2.600	0.6	6.500	0.9		

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment M2

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 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

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
2.000	8	1440 Winter	1	+0%					5.676
2.001	9	1440 Winter	1	+0%					5.676
2.002	10	1440 Winter	1	+0%					5.676
2.003	11	1440 Winter	1	+0%					5.676
2.004	12	1440 Winter	1	+0%	100/120 Summer				5.676

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
2.000	8	-0.344	0.000	0.00		0.2	OK	
2.001	9	-0.339	0.000	0.00		0.2	OK	
2.002	10	-0.334	0.000	0.00		0.4	OK	
2.003	11	-0.329	0.000	0.00		0.7	OK	
2.004	12	-0.124	0.000	0.00		0.3	OK*	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment M2

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 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

Synthetic Rainfall Details

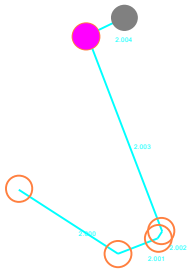
Rainfall Model	FSR	Ratio R	0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

Margin for Flood Risk Warning (mm)	300.0
Analysis Timestep	2.5 Second Increment (Extended)
DTS Status	OFF
DVD Status	ON
Inertia Status	OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
2.000	8	2160 Winter	100	+40%					5.978
2.001	9	2160 Winter	100	+40%					5.978
2.002	10	2160 Winter	100	+40%					5.978
2.003	11	2160 Winter	100	+40%					5.978
2.004	12	2160 Winter	100	+40%	100/120 Summer				5.978

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
2.000	8	-0.042	0.000	0.00		0.6	FLOOD RISK*	
2.001	9	-0.037	0.000	0.00		0.3	FLOOD RISK*	
2.002	10	-0.032	0.000	0.00		0.7	FLOOD RISK*	
2.003	11	-0.027	0.000	0.00		1.6	FLOOD RISK*	
2.004	12	0.178	0.000	0.00		0.3	FLOOD RISK*	



STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Catchment N

Pipe Sizes Storm Pl Manhole Sizes SfA 7

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.306	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)	0.900
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 Catchment N

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
5.000	30.689	0.522	58.8	0.016	4.00	0.0	0.600	o	225	Pipe/Conduit	
5.001	18.896	0.084	225.0	0.019	0.00	0.0	0.600	o	225	Pipe/Conduit	
5.002	29.166	0.334	87.3	0.032	0.00	0.0	0.600	o	225	Pipe/Conduit	
5.003	33.793	0.242	139.6	0.033	0.00	0.0	0.600	o	300	Pipe/Conduit	
6.000	47.261	0.644	73.4	0.051	4.00	0.0	0.600	o	225	Pipe/Conduit	
6.001	13.709	0.180	76.2	0.026	0.00	0.0	0.600	o	225	Pipe/Conduit	
6.002	17.627	0.078	226.0	0.028	0.00	0.0	0.600	o	300	Pipe/Conduit	
6.003	20.585	0.091	226.2	0.046	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.004	48.072	0.481	99.9	0.080	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.005	1.015	0.112	9.1	0.082	0.00	0.0	0.600	o	375	Pipe/Conduit	
5.006	21.803	0.073	298.7	0.000	0.00	0.0	0.600	o	375	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)
5.000	50.00	4.30	6.875	0.016	0.0	0.0	0.0	1.71	68.0	2.2
5.001	50.00	4.66	6.353	0.035	0.0	0.0	0.0	0.87	34.5	4.7
5.002	50.00	5.01	6.269	0.066	0.0	0.0	0.0	1.40	55.7	9.0
5.003	50.00	5.43	5.935	0.099	0.0	0.0	0.0	1.33	93.9	13.5
6.000	50.00	4.52	6.687	0.051	0.0	0.0	0.0	1.53	60.8	6.9
6.001	50.00	4.67	6.043	0.077	0.0	0.0	0.0	1.50	59.6	10.4
6.002	50.00	4.95	5.788	0.105	0.0	0.0	0.0	1.04	73.6	14.2
6.003	50.00	5.28	5.710	0.151	0.0	0.0	0.0	1.04	73.6	20.4
5.004	50.00	5.94	5.693	0.330	0.0	0.0	0.0	1.57	111.2	44.7
5.005	50.00	5.95	5.212	0.412	0.0	0.0	0.0	6.05	668.1	55.8
5.006	50.00	6.29	5.100	0.412	0.0	0.0	0.0	1.04	115.2	55.8

Free Flowing Outfall Details for Catchment N

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
5.006		6.000	5.027	0.000	0	0

Simulation Criteria for Catchment N

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 Coeffiecient	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	1
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

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)	19.000	Storm Duration (mins)	30
Ratio R	0.306		

Online Controls for Catchment N

Hydro-Brake® Optimum Manhole: 12, DS/PN: 5.006, Volume (m³): 2.3

Unit Reference	MD-SHE-0047-1200-1500-1200
Design Head (m)	1.500
Design Flow (l/s)	1.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	47
Invert Level (m)	5.100
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	1.2
Flush-Flo™	0.207	0.8
Kick-Flo®	0.417	0.7
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	1.1	3.000	1.6	7.000	2.4
0.200	0.8	1.400	1.2	3.500	1.8	7.500	2.5
0.300	0.8	1.600	1.2	4.000	1.9	8.000	2.6
0.400	0.7	1.800	1.3	4.500	2.0	8.500	2.7
0.500	0.7	2.000	1.4	5.000	2.1	9.000	2.7
0.600	0.8	2.200	1.4	5.500	2.2	9.500	2.8
0.800	0.9	2.400	1.5	6.000	2.3		
1.000	1.0	2.600	1.5	6.500	2.3		

Storage Structures for Catchment N

Tank or Pond Manhole: 12, DS/PN: 5.006

Invert Level (m) 5.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	150.0	1.617	450.0

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

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 Storage Structures	1
Number of Online Controls	1	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 0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
5.000	1	15 Winter	1	+0%			
5.001	2	15 Winter	1	+0%			
5.002	3	15 Winter	1	+0%			
5.003	5	15 Winter	1	+0%	100/15 Summer		
6.000	6	15 Winter	1	+0%			
6.001	7	15 Winter	1	+0%	100/15 Summer		
6.002	8	15 Winter	1	+0%	100/15 Summer		
6.003	9	15 Winter	1	+0%	100/15 Summer		
5.004	Inflow Headwall	15 Winter	1	+0%	100/15 Summer		
5.005	Outflow Headwall	2160 Winter	1	+0%	100/15 Summer		
5.006	12	2160 Winter	1	+0%	1/360 Winter		

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
5.000	1		6.901	-0.199	0.000	0.03		2.1
5.001	2		6.404	-0.174	0.000	0.11		3.9
5.002	3		6.323	-0.171	0.000	0.13		7.2

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

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
5.003	5		6.004	-0.231	0.000	0.12		10.4
6.000	6		6.737	-0.175	0.000	0.11		6.5
6.001	7		6.107	-0.161	0.000	0.18		9.1
6.002	8		5.882	-0.206	0.000	0.19		11.9
6.003	9		5.839	-0.171	0.000	0.25		16.1
5.004	Inflow Headwall		5.812	-0.181	0.000	0.33		34.0
5.005	Outflow Headwall		5.548	-0.039	0.000	0.02		2.9
5.006	12		5.548	0.073	0.000	0.01		0.8

PN	US/MH Name	Status	Level Exceeded
5.000	1	OK*	
5.001	2	OK*	
5.002	3	OK*	
5.003	5	OK	
6.000	6	OK	
6.001	7	OK	
6.002	8	OK	
6.003	9	OK	
5.004	Inflow Headwall	OK	
5.005	Outflow Headwall	OK	
5.006	12	SURCHARGED	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment N

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 Storage Structures	1
Number of Online Controls	1	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 0.306
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	19.000	Cv (Winter)	0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880
Return Period(s) (years)	1, 100
Climate Change (%)	0, 40

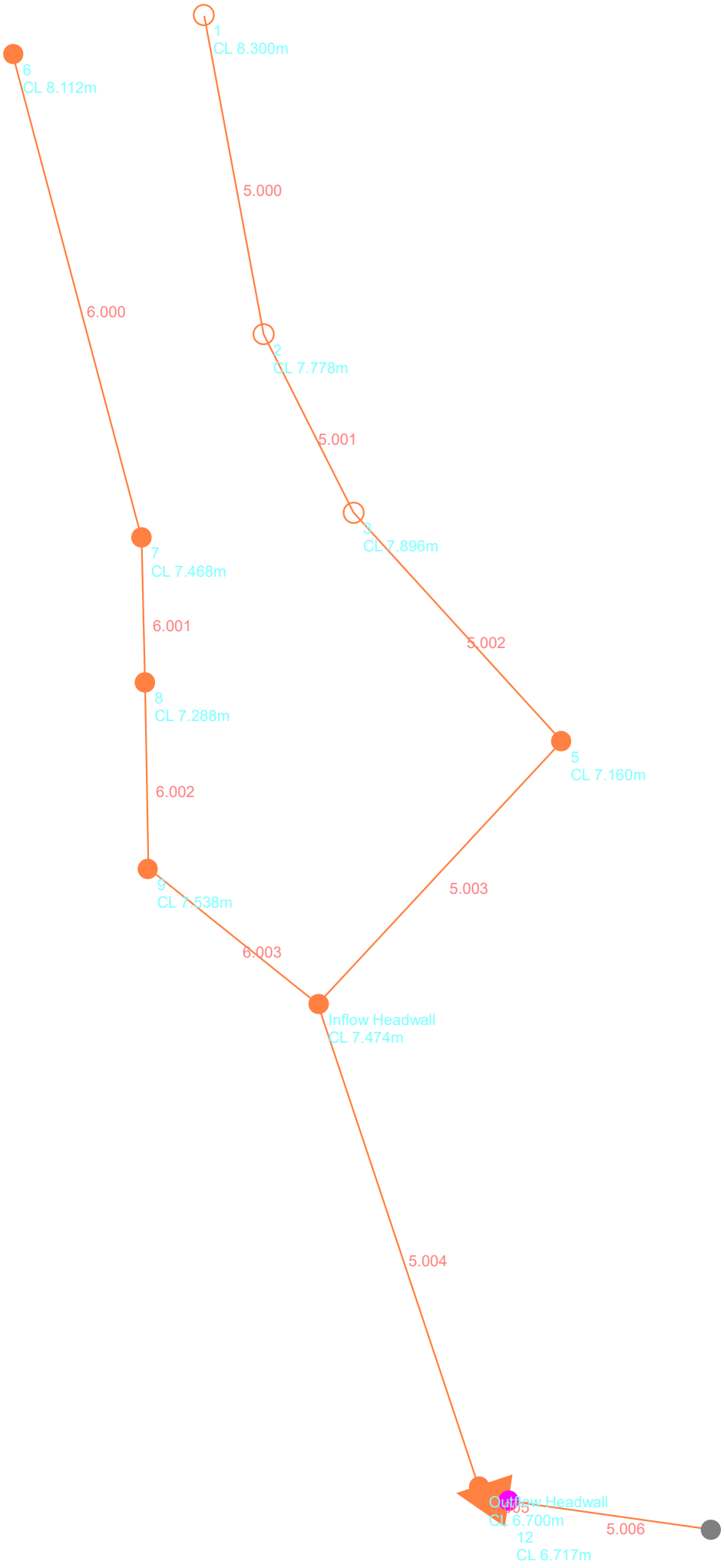
PN	US/MH Name		Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
5.000		1	15 Winter	100	+40%			
5.001		2	15 Winter	100	+40%			
5.002		3	2880 Winter	100	+40%			
5.003		5	15 Winter	100	+40%	100/15 Summer		
6.000		6	15 Winter	100	+40%			
6.001		7	15 Winter	100	+40%	100/15 Summer		
6.002		8	15 Winter	100	+40%	100/15 Summer		
6.003		9	15 Winter	100	+40%	100/15 Summer		
5.004	Inflow Headwall	2160	Winter	100	+40%	100/15 Summer		
5.005	Outflow Headwall	2160	Winter	100	+40%	100/15 Summer		
5.006		12	2160 Winter	100	+40%	1/360 Winter		

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
5.000		1	6.929	-0.171	0.000	0.13		9.1
5.001		2	6.578	0.000	0.000	0.51		17.7
5.002		3	6.494	0.000	0.000	0.02		1.3

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Catchment N

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
5.003		5	6.549	0.314	0.000	0.51		44.3
6.000		6	6.805	-0.107	0.000	0.50		28.8
6.001		7	6.704	0.436	0.000	0.69		35.7
6.002		8	6.634	0.546	0.000	0.74		46.7
6.003		9	6.590	0.580	0.000	1.00		64.6
5.004	Inflow Headwall		6.500	0.507	0.000	0.07		7.4
5.005	Outflow Headwall		6.499	0.912	0.000	0.07		9.3
5.006		12	6.498	1.023	0.000	0.01		1.2

PN	US/MH Name		Status	Level Exceeded
5.000		1	OK*	
5.001		2	SURCHARGED*	
5.002		3	SURCHARGED*	
5.003		5	SURCHARGED	
6.000		6	OK	
6.001		7	SURCHARGED	
6.002		8	SURCHARGED	
6.003		9	SURCHARGED	
5.004	Inflow Headwall		SURCHARGED	
5.005	Outflow Headwall		FLOOD RISK	
5.006		12	FLOOD RISK	


1
CL 8.300m
6
CL 8.112m
5.000
6.000
2
CL 7.778m
5.001
3
CL 7.896m
7
CL 7.468m
6.001
5.002
8
CL 7.288m
5
CL 7.160m
6.002
9
CL 7.538m
5.003
6.003
Inflow Headwall
CL 7.474m
5.004
Outflow Headwall
CL 6.700m
5.006
12
CL 6.717m

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	5.182	0.232	0.3	29.3	O K
30 min Summer	5.260	0.310	0.3	40.4	O K
60 min Summer	5.344	0.394	0.3	53.2	O K
120 min Summer	5.431	0.481	0.3	67.1	O K
180 min Summer	5.479	0.529	0.3	75.3	O K
240 min Summer	5.511	0.561	0.3	80.8	O K
360 min Summer	5.558	0.608	0.3	89.1	O K
480 min Summer	5.589	0.639	0.3	94.9	O K
600 min Summer	5.613	0.663	0.3	99.3	O K
720 min Summer	5.631	0.681	0.3	102.7	O K
960 min Summer	5.657	0.707	0.3	107.6	O K
1440 min Summer	5.684	0.734	0.3	113.0	O K
2160 min Summer	5.696	0.746	0.3	115.4	O K
2880 min Summer	5.694	0.744	0.3	114.8	O K
4320 min Summer	5.681	0.731	0.3	112.4	O K
5760 min Summer	5.667	0.717	0.3	109.6	O K
7200 min Summer	5.652	0.702	0.3	106.8	O K
8640 min Summer	5.638	0.688	0.3	103.9	O K
10080 min Summer	5.623	0.673	0.3	101.2	O K
15 min Winter	5.207	0.257	0.3	32.8	O K
30 min Winter	5.293	0.343	0.3	45.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	117.668	0.0	21.4	27
30 min Summer	81.346	0.0	20.2	42
60 min Summer	53.779	0.0	41.8	72
120 min Summer	34.260	0.0	43.0	130
180 min Summer	25.845	0.0	44.7	190
240 min Summer	20.993	0.0	46.2	250
360 min Summer	15.678	0.0	48.2	370
480 min Summer	12.719	0.0	49.4	488
600 min Summer	10.802	0.0	50.2	608
720 min Summer	9.447	0.0	50.7	728
960 min Summer	7.636	0.0	51.3	966
1440 min Summer	5.643	0.0	51.2	1444
2160 min Summer	4.158	0.0	100.4	2160
2880 min Summer	3.342	0.0	100.4	2624
4320 min Summer	2.453	0.0	97.1	3332
5760 min Summer	1.973	0.0	183.2	4104
7200 min Summer	1.667	0.0	179.5	4912
8640 min Summer	1.452	0.0	175.4	5792
10080 min Summer	1.293	0.0	170.4	6568
15 min Winter	117.668	0.0	21.0	27
30 min Winter	81.346	0.0	20.1	41

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	5.385	0.435	0.3	59.7	O K
120 min Winter	5.480	0.530	0.3	75.4	O K
180 min Winter	5.533	0.583	0.3	84.6	O K
240 min Winter	5.568	0.618	0.3	91.0	O K
360 min Winter	5.619	0.669	0.3	100.4	O K
480 min Winter	5.654	0.704	0.3	107.1	O K
600 min Winter	5.680	0.730	0.3	112.2	O K
720 min Winter	5.701	0.751	0.3	116.3	Flood Risk
960 min Winter	5.731	0.781	0.4	122.2	Flood Risk
1440 min Winter	5.765	0.815	0.4	129.2	Flood Risk
2160 min Winter	5.785	0.835	0.4	133.4	Flood Risk
2880 min Winter	5.787	0.837	0.4	133.9	Flood Risk
4320 min Winter	5.771	0.821	0.4	130.6	Flood Risk
5760 min Winter	5.755	0.805	0.4	127.2	Flood Risk
7200 min Winter	5.735	0.785	0.4	123.1	Flood Risk
8640 min Winter	5.714	0.764	0.3	118.8	Flood Risk
10080 min Winter	5.692	0.742	0.3	114.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	53.779	0.0	42.2	70
120 min Winter	34.260	0.0	44.7	130
180 min Winter	25.845	0.0	47.1	188
240 min Winter	20.993	0.0	48.5	246
360 min Winter	15.678	0.0	50.5	364
480 min Winter	12.719	0.0	51.7	482
600 min Winter	10.802	0.0	52.5	598
720 min Winter	9.447	0.0	53.0	716
960 min Winter	7.636	0.0	53.4	950
1440 min Winter	5.643	0.0	53.1	1412
2160 min Winter	4.158	0.0	105.4	2084
2880 min Winter	3.342	0.0	105.1	2740
4320 min Winter	2.453	0.0	101.2	3504
5760 min Winter	1.973	0.0	192.0	4392
7200 min Winter	1.667	0.0	190.3	5336
8640 min Winter	1.452	0.0	187.2	6232
10080 min Winter	1.293	0.0	181.7	7160

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.297	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.134

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.045	4	8	0.045	8	12	0.045

Model Details

Storage is Online Cover Level (m) 6.000

Tank or Pond Structure

Invert Level (m) 4.950

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	115.0	1.050	238.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0028-4000-1050-4000
Design Head (m)	1.050
Design Flow (l/s)	0.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	28
Invert Level (m)	4.950
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.050	0.4
Flush-Flo™	0.124	0.3
Kick-Flo®	0.252	0.2
Mean Flow over Head Range	-	0.3

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)
0.100	0.3	1.200	0.4	3.000	0.6	7.000	0.9
0.200	0.2	1.400	0.5	3.500	0.7	7.500	1.0
0.300	0.2	1.600	0.5	4.000	0.7	8.000	1.0
0.400	0.3	1.800	0.5	4.500	0.8	8.500	1.0
0.500	0.3	2.000	0.5	5.000	0.8	9.000	1.0
0.600	0.3	2.200	0.6	5.500	0.8	9.500	1.1
0.800	0.4	2.400	0.6	6.000	0.9		
1.000	0.4	2.600	0.6	6.500	0.9		

Summary of Results for 100 year Return Period (+40%)

Half Drain Time : 3160 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	4.689	0.189	0.0	0.0	0.0	136.1	O K
30 min Summer	4.739	0.239	0.0	0.0	0.0	188.2	O K
60 min Summer	4.789	0.289	0.0	0.6	0.6	248.3	O K
120 min Summer	4.838	0.338	0.0	1.7	1.7	312.6	Flood Risk
180 min Summer	4.864	0.364	0.0	1.8	1.8	350.5	Flood Risk
240 min Summer	4.882	0.382	0.0	1.8	1.8	376.8	Flood Risk
360 min Summer	4.908	0.408	0.0	1.8	1.8	416.7	Flood Risk
480 min Summer	4.925	0.425	0.0	1.8	1.8	445.5	Flood Risk
600 min Summer	4.939	0.439	0.0	1.8	1.8	467.8	Flood Risk
720 min Summer	4.950	0.450	0.0	1.8	1.8	485.8	Flood Risk
960 min Summer	4.965	0.465	0.0	1.8	1.8	513.0	Flood Risk
1440 min Summer	4.985	0.485	0.0	1.8	1.8	547.0	Flood Risk
2160 min Summer	4.998	0.498	0.0	1.8	1.8	571.5	Flood Risk
2880 min Summer	5.005	0.505	0.0	1.8	1.8	583.8	Flood Risk
4320 min Summer	5.012	0.512	0.0	1.8	1.8	598.0	Flood Risk
5760 min Summer	5.016	0.516	0.0	1.8	1.8	604.5	Flood Risk
7200 min Summer	5.016	0.516	0.0	1.8	1.8	604.8	Flood Risk
8640 min Summer	5.014	0.514	0.0	1.8	1.8	600.8	Flood Risk
10080 min Summer	5.010	0.510	0.0	1.8	1.8	593.9	Flood Risk
15 min Winter	4.705	0.205	0.0	0.0	0.0	152.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	117.668	0.0	0.0	27
30 min Summer	81.346	0.0	0.0	42
60 min Summer	53.779	0.0	34.3	72
120 min Summer	34.260	0.0	97.4	130
180 min Summer	25.845	0.0	135.8	190
240 min Summer	20.993	0.0	162.5	250
360 min Summer	15.678	0.0	201.9	368
480 min Summer	12.719	0.0	228.4	488
600 min Summer	10.802	0.0	245.8	608
720 min Summer	9.447	0.0	255.5	726
960 min Summer	7.636	0.0	256.4	966
1440 min Summer	5.643	0.0	232.7	1442
2160 min Summer	4.158	0.0	450.7	2144
2880 min Summer	3.342	0.0	462.5	2456
4320 min Summer	2.453	0.0	402.5	3204
5760 min Summer	1.973	0.0	661.4	4032
7200 min Summer	1.667	0.0	704.7	4832
8640 min Summer	1.452	0.0	735.9	5632
10080 min Summer	1.293	0.0	746.2	6456
15 min Winter	117.668	0.0	0.0	27

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	4.758	0.258	0.0	0.0	0.0	210.8	O K
60 min Winter	4.812	0.312	0.0	1.2	1.2	277.3	Flood Risk
120 min Winter	4.864	0.364	0.0	1.8	1.8	349.9	Flood Risk
180 min Winter	4.893	0.393	0.0	1.8	1.8	393.2	Flood Risk
240 min Winter	4.912	0.412	0.0	1.8	1.8	423.3	Flood Risk
360 min Winter	4.940	0.440	0.0	1.8	1.8	468.9	Flood Risk
480 min Winter	4.959	0.459	0.0	1.8	1.8	501.9	Flood Risk
600 min Winter	4.974	0.474	0.0	1.8	1.8	527.6	Flood Risk
720 min Winter	4.985	0.485	0.0	1.8	1.8	548.3	Flood Risk
960 min Winter	5.003	0.503	0.0	1.8	1.8	580.1	Flood Risk
1440 min Winter	5.024	0.524	0.0	1.8	1.8	620.8	Flood Risk
2160 min Winter	5.041	0.541	0.0	1.8	1.8	652.8	Flood Risk
2880 min Winter	5.048	0.548	0.0	1.8	1.8	666.8	Flood Risk
4320 min Winter	5.051	0.551	0.0	1.8	1.8	671.6	Flood Risk
5760 min Winter	5.050	0.550	0.0	1.8	1.8	671.4	Flood Risk
7200 min Winter	5.046	0.546	0.0	1.8	1.8	662.8	Flood Risk
8640 min Winter	5.039	0.539	0.0	1.8	1.8	648.8	Flood Risk
10080 min Winter	5.030	0.530	0.0	1.8	1.8	631.2	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	81.346	0.0	2.1	42
60 min Winter	53.779	0.0	61.8	70
120 min Winter	34.260	0.0	132.8	128
180 min Winter	25.845	0.0	174.6	188
240 min Winter	20.993	0.0	202.9	246
360 min Winter	15.678	0.0	242.2	362
480 min Winter	12.719	0.0	263.8	480
600 min Winter	10.802	0.0	271.5	598
720 min Winter	9.447	0.0	269.6	714
960 min Winter	7.636	0.0	257.9	948
1440 min Winter	5.643	0.0	233.4	1408
2160 min Winter	4.158	0.0	498.5	2084
2880 min Winter	3.342	0.0	474.0	2740
4320 min Winter	2.453	0.0	410.5	3500
5760 min Winter	1.973	0.0	762.3	4384
7200 min Winter	1.667	0.0	806.8	5328
8640 min Winter	1.452	0.0	829.4	6224
10080 min Winter	1.293	0.0	805.6	7064

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.297	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.617

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.217	4	8	0.200	8	12	0.200

Model Details

Storage is Online Cover Level (m) 5.100

Swale Structure

Infiltration Coefficient Base (m/hr)	0.00000	Length (m)	460.0
Infiltration Coefficient Side (m/hr)	0.00000	Side Slope (1:X)	3.0
Safety Factor	2.0	Slope (1:X)	0.0
Porosity	1.00	Cap Volume Depth (m)	0.000
Invert Level (m)	4.500	Cap Infiltration Depth (m)	0.000
Base Width (m)	1.0		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0071-1800-0500-1800
Design Head (m)	0.500
Design Flow (l/s)	1.8
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	71
Invert Level (m)	4.750
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.500	1.8
Flush-Flo™	0.148	1.8
Kick-Flo®	0.341	1.5
Mean Flow over Head Range	-	1.5

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	1.8	1.200	2.7	3.000	4.1	7.000	6.1
0.200	1.8	1.400	2.9	3.500	4.4	7.500	6.4
0.300	1.7	1.600	3.1	4.000	4.7	8.000	6.6
0.400	1.6	1.800	3.2	4.500	4.9	8.500	6.8
0.500	1.8	2.000	3.4	5.000	5.2	9.000	7.0
0.600	2.0	2.200	3.5	5.500	5.4	9.500	7.2
0.800	2.2	2.400	3.7	6.000	5.7		
1.000	2.5	2.600	3.8	6.500	5.9		

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	22.403	0.303	3.6	300.4	O K
30 min Summer	22.508	0.408	3.6	414.5	O K
60 min Summer	22.623	0.523	3.6	545.2	O K
120 min Summer	22.741	0.641	3.6	688.0	O K
180 min Summer	22.808	0.708	3.6	771.7	O K
240 min Summer	22.853	0.753	3.6	829.1	O K
360 min Summer	22.919	0.819	3.6	915.0	O K
480 min Summer	22.963	0.863	3.6	975.2	O K
600 min Summer	22.996	0.896	3.6	1020.2	O K
720 min Summer	23.022	0.922	3.6	1055.3	O K
960 min Summer	23.058	0.958	3.6	1105.8	O K
1440 min Summer	23.097	0.997	3.6	1161.1	O K
2160 min Summer	23.115	1.015	3.6	1186.6	O K
2880 min Summer	23.110	1.010	3.6	1178.7	O K
4320 min Summer	23.086	0.986	3.6	1145.4	O K
5760 min Summer	23.062	0.962	3.6	1111.0	O K
7200 min Summer	23.037	0.937	3.6	1076.2	O K
8640 min Summer	23.012	0.912	3.6	1041.3	O K
10080 min Summer	22.986	0.886	3.6	1006.2	O K
15 min Winter	22.437	0.337	3.6	336.8	O K
30 min Winter	22.553	0.453	3.6	464.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	117.668	0.0	252.0	27
30 min Summer	81.346	0.0	294.8	41
60 min Summer	53.779	0.0	518.4	72
120 min Summer	34.260	0.0	590.7	130
180 min Summer	25.845	0.0	589.6	190
240 min Summer	20.993	0.0	578.4	250
360 min Summer	15.678	0.0	551.5	370
480 min Summer	12.719	0.0	533.7	488
600 min Summer	10.802	0.0	521.6	608
720 min Summer	9.447	0.0	513.3	728
960 min Summer	7.636	0.0	504.0	966
1440 min Summer	5.643	0.0	503.1	1444
2160 min Summer	4.158	0.0	1046.4	2160
2880 min Summer	3.342	0.0	1016.1	2796
4320 min Summer	2.453	0.0	969.7	3460
5760 min Summer	1.973	0.0	1931.7	4224
7200 min Summer	1.667	0.0	1977.7	5048
8640 min Summer	1.452	0.0	1896.5	5880
10080 min Summer	1.293	0.0	1796.3	6760
15 min Winter	117.668	0.0	272.5	27
30 min Winter	81.346	0.0	301.0	41

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	22.679	0.579	3.6	611.8	O K
120 min Winter	22.809	0.709	3.6	773.1	O K
180 min Winter	22.883	0.783	3.6	868.5	O K
240 min Winter	22.933	0.833	3.6	933.7	O K
360 min Winter	23.004	0.904	3.6	1031.0	O K
480 min Winter	23.054	0.954	3.6	1099.9	O K
600 min Winter	23.091	0.991	3.6	1152.2	O K
720 min Winter	23.120	1.020	3.6	1193.5	O K
960 min Winter	23.162	1.062	3.6	1254.1	O K
1440 min Winter	23.209	1.109	3.6	1324.5	O K
2160 min Winter	23.237	1.137	3.6	1366.1	O K
2880 min Winter	23.239	1.139	3.6	1369.7	O K
4320 min Winter	23.212	1.112	3.6	1328.1	O K
5760 min Winter	23.182	1.082	3.6	1283.5	O K
7200 min Winter	23.148	1.048	3.6	1234.9	O K
8640 min Winter	23.112	1.012	3.6	1182.9	O K
10080 min Winter	23.075	0.975	3.6	1129.7	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	53.779	0.0	564.8	70
120 min Winter	34.260	0.0	592.3	130
180 min Winter	25.845	0.0	572.9	188
240 min Winter	20.993	0.0	555.1	246
360 min Winter	15.678	0.0	532.7	364
480 min Winter	12.719	0.0	521.0	482
600 min Winter	10.802	0.0	515.5	600
720 min Winter	9.447	0.0	514.5	716
960 min Winter	7.636	0.0	520.5	950
1440 min Winter	5.643	0.0	525.6	1414
2160 min Winter	4.158	0.0	1053.1	2100
2880 min Winter	3.342	0.0	1040.5	2764
4320 min Winter	2.453	0.0	1021.0	3944
5760 min Winter	1.973	0.0	2102.3	4496
7200 min Winter	1.667	0.0	2043.8	5408
8640 min Winter	1.452	0.0	1957.8	6392
10080 min Winter	1.293	0.0	1869.1	7272

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.297	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 1.378

Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)	Time From:	(mins) To:	Area (ha)
0	4	0.459	4	8	0.459	8	12	0.459

Model Details

Storage is Online Cover Level (m) 23.600

Tank or Pond Structure

Invert Level (m) 22.100

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	920.0	1.500	1725.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0086-3900-1500-3900
Design Head (m)	1.500
Design Flow (l/s)	3.9
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	86
Invert Level (m)	22.100
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

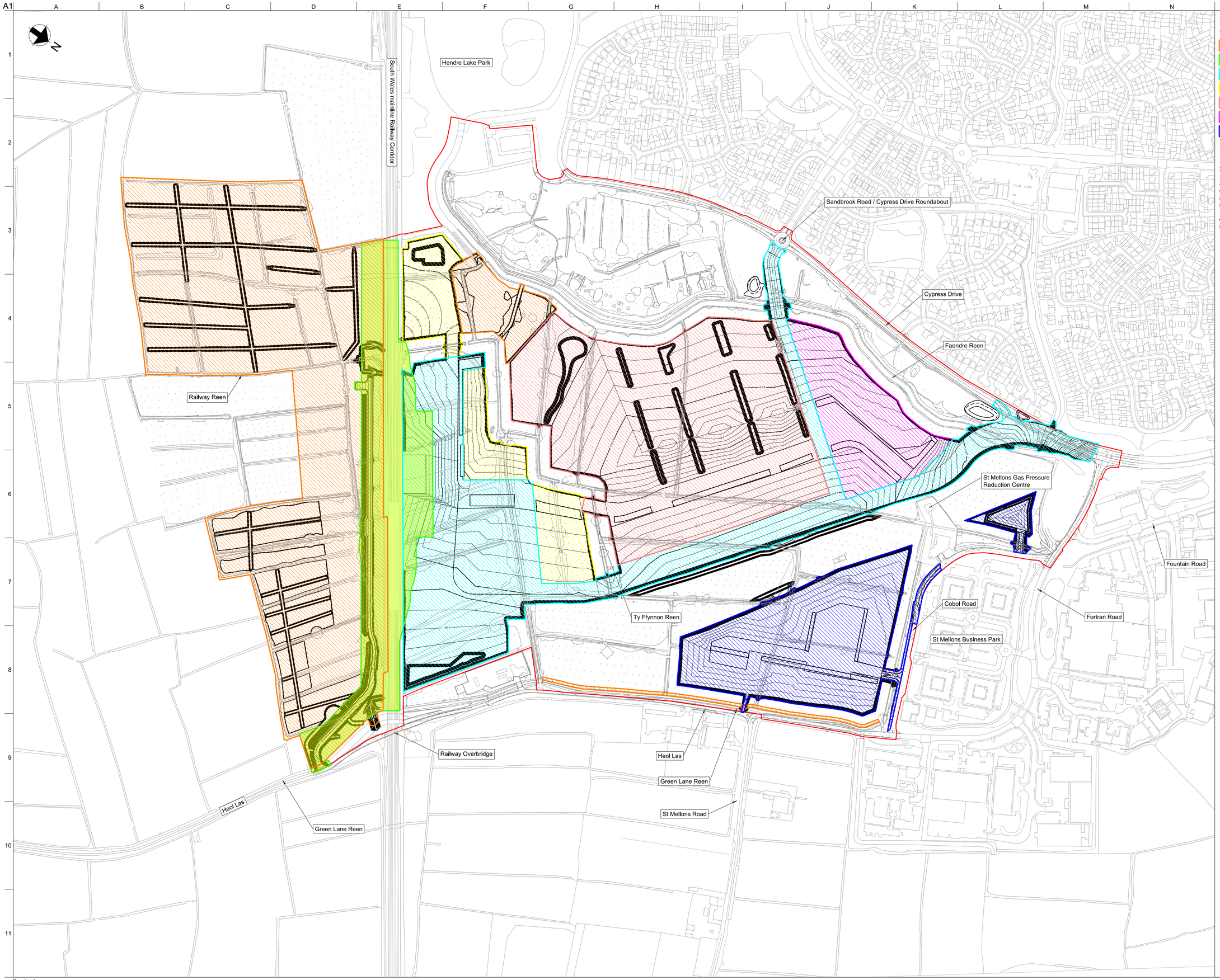
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	3.9
Flush-Flo™	0.377	3.6
Kick-Flo®	0.772	2.9
Mean Flow over Head Range	-	3.2

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	3.6	1.600	4.0	4.000	6.2	8.000	8.5
0.400	3.6	1.800	4.2	4.500	6.5	8.500	8.8
0.500	3.5	2.000	4.4	5.000	6.8	9.000	9.0
0.600	3.4	2.200	4.7	5.500	7.2	9.500	9.3
0.800	2.9	2.400	4.8	6.000	7.5		
1.000	3.2	2.600	5.0	6.500	7.7		

C5 Phasing Drawings

A1



Legend

- Site Boundary
- Phase 1A
- Phase 1B
- Phase 2A
- Phase 2B
- Phase 3
- Phase 4
- Phase 5

Notes

1. Do not scale from this drawing.
2. All dimensions are in metres unless stated otherwise.
3. The details shown on this drawing are based on a schematic design produced for the outline planning application. The details will need to be reviewed and revised during subsequent design stages.
4. The phasing boundaries shown are indicative and may change in subsequent design stages.

Issue	Date	By	Chkd	Appd
I1	15/05/20	SW	SW	SW
	Drawing Updated			
I0	01/05/20	DS	SW	JS
	Issued for Information			

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Client
Cardiff Parkway Developments Ltd

Project Title
Hendre Lakes

Drawing Title
Indicative Phasing Plan

Scale at A1 1:2500 | Role Infrastructure

Suitability For Information

Job No 252199-00 | Rev I1

Drawing No HDL-ARP-ZZ-SW-DRG-ECV-000003

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C6 Simple Index Approach

SIMPLE INDEX APPROACH: TOOL

1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

DROP DOWN LIST — RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP

USER ENTRY — USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL

STEP 1: Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

This step requires the user to select the appropriate land use type for the area from which the runoff is occurring

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index

- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

	Runoff Area Land Use Description	*Pollution Hazard*	*Pollution Hazard Indices* Total Suspended Solids	Metals	Hydrocarbons
Select land use type from the drop down list (or 'Other' if none applicable): →	Non-residential car parking with frequent change (eg hospitals, retail)	Medium	0.7	0.6	0.7
If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row:					
	Landuse Pollution Hazard Index	**Medium**	**0.7**	**0.6**	**0.7**

DESIGN CONDITIONS: 1 | 2

STEP 2A: Determine the Pollution Mitigation Index for the proposed SuDS components

This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component
If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B

This step should be applied to evaluate the water quality protection provided by proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

	SuDS Component Description	*Pollution Mitigation Indices* Total Suspended Solids	Metals	Hydrocarbons
Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: →	Bioretention system (where the system is not designed as an infiltration component)	0.8	0.8	0.8
Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: →	None			
Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: →	None			
If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows:				
	Aggregated Surface Water Pollution Mitigation Index	**0.8**	**0.8**	**0.8**

DESIGN CONDITIONS: 1 | 2 | 3

SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

Is the runoff now discharged to an infiltration component?

Yes ? Go to Step 2B
No ? Go to Step 2C

STEP 2B: Determine the Pollution Mitigation Index for the proposed Groundwater Protection

This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke and/or a proprietary product and not generically described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

		Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Select type of groundwater protection from the drop down list: →	None			
If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row:				
	Groundwater Protection Pollution Mitigation Index	**0**	**0**	**0**

DESIGN CONDITIONS: 1 | 2 | 3 | 4

STEP 2C: Determine the Combined Pollution Mitigation Indices for the Runoff Area

This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices

	Combined Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Combined Pollution Mitigation Indices for the Runoff Area	**0.8**	**0.8**	**0.8**

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

STEP 2D: Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

Sufficiency of Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Sufficient	**Sufficient**	**Sufficient**

DESIGN CONDITIONS: 1

Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see *Chapter 7 The SuDS design process*). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England

SIMPLE INDEX APPROACH: TOOL

1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

DROP DOWN LIST — RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP

USER ENTRY — USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL

STEP 1: Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

This step requires the user to select the appropriate land use type for the area from which the runoff is occurring

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index

- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

	Runoff Area Land Use Description	*Pollution Hazard*	*Pollution Hazard Indices* Total Suspended Solids	Metals	Hydrocarbons
Select land use type from the drop down list (or 'Other' if none applicable): →	Non-residential parking with infrequent change (e.g. schools, offices, < 300 traffic movements a day)	Low	0.5	0.4	0.4
If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row:					
Landuse Pollution Hazard Index		**Low**	**0.5**	**0.4**	**0.4**

DESIGN CONDITIONS: 1 | 2

STEP 2A: Determine the Pollution Mitigation Index for the proposed SuDS components

This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component
If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B

This step should be applied to evaluate the water quality protection provided by proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

	SuDS Component Description	*Pollution Mitigation Indices* Total Suspended Solids	Metals	Hydrocarbons
Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: →	Swale	0.5	0.6	0.6
Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: →	None			
Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: →	None			
If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows:				
Aggregated Surface Water Pollution Mitigation Index		**0.5**	**0.6**	**0.6**

DESIGN CONDITIONS: 1 | 2 | 3

SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

Is the runoff now discharged to an infiltration component?

Yes ? Go to Step 2B
No ? Go to Step 2C

STEP 2B: Determine the Pollution Mitigation Index for the proposed Groundwater Protection

This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke and/or a proprietary product and not generically described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

		Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Select type of groundwater protection from the drop down list: →	None			
If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row:				
Groundwater Protection Pollution Mitigation Index		**0**	**0**	**0**

DESIGN CONDITIONS: 1 | 2 | 3 | 4

STEP 2C: Determine the Combined Pollution Mitigation Indices for the Runoff Area

This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices

	Combined Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Combined Pollution Mitigation Indices for the Runoff Area	**0.5**	**0.6**	**0.6**

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

STEP 2D: Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

Sufficiency of Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Sufficient	**Sufficient**	**Sufficient**

DESIGN CONDITIONS: 1

Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see *Chapter 7 The SuDS design process*). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England

SIMPLE INDEX APPROACH: TOOL

1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

DROP DOWN LIST — RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP

USER ENTRY — USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL

STEP 1: Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

This step requires the user to select the appropriate land use type for the area from which the runoff is occurring

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index

- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

	Runoff Area Land Use Description	*Pollution Hazard*	*Pollution Hazard Indices* Total Suspended Solids	Metals	Hydrocarbons
Select land use type from the drop down list (or 'Other' if none applicable): →	Low traffic roads (e.g. residential roads and general access roads, < 300 traffic movements/day)	Low	0.5	0.4	0.4
If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row:					
	Landuse Pollution Hazard Index	**Low**	**0.5**	**0.4**	**0.4**

DESIGN CONDITIONS: 1 | 2

STEP 2A: Determine the Pollution Mitigation Index for the proposed SuDS components

This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component
If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B

This step should be applied to evaluate the water quality protection provided by proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

	SuDS Component Description	*Pollution Mitigation Indices* Total Suspended Solids	Metals	Hydrocarbons
Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: →	Swale	0.5	0.6	0.6
Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: →	None			
Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: →	None			
If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows:				
	Aggregated Surface Water Pollution Mitigation Index	**0.5**	**0.6**	**0.6**

DESIGN CONDITIONS: 1 | 2 | 3

SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

Is the runoff now discharged to an infiltration component?

Yes ? Go to Step 2B
No ? Go to Step 2C

STEP 2B: Determine the Pollution Mitigation Index for the proposed Groundwater Protection

This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke and/or a proprietary product and not generically described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

		Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Select type of groundwater protection from the drop down list: →	None			
If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row:				
	Groundwater Protection Pollution Mitigation Index	**0**	**0**	**0**

DESIGN CONDITIONS: 1 | 2 | 3 | 4

STEP 2C: Determine the Combined Pollution Mitigation Indices for the Runoff Area

This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices

	Combined Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Combined Pollution Mitigation Indices for the Runoff Area	**0.5**	**0.6**	**0.6**

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

STEP 2D: Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

Sufficiency of Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Sufficient	**Sufficient**	**Sufficient**

DESIGN CONDITIONS: 1

Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see *Chapter 7 The SuDS design process*). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England

SIMPLE INDEX APPROACH: TOOL

1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

DROP DOWN LIST — RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP

USER ENTRY — USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL

STEP 1: Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

This step requires the user to select the appropriate land use type for the area from which the runoff is occurring

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index

- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

	Runoff Area Land Use Description	*Pollution Hazard*	*Pollution Hazard Indices* Total Suspended Solids	Metals	Hydrocarbons
Select land use type from the drop down list (or 'Other' if none applicable): →	Roads (excluding low traffic roads, highly frequented lorry approaches to industrial estates, trunk roads/motorways)	Medium	0.7	0.6	0.7
If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row:					
Landuse Pollution Hazard Index		**Medium**	**0.7**	**0.6**	**0.7**

DESIGN CONDITIONS: 1 | 2

STEP 2A: Determine the Pollution Mitigation Index for the proposed SuDS components

This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component
If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B

This step should be applied to evaluate the water quality protection provided by proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

	SuDS Component Description	*Pollution Mitigation Indices* Total Suspended Solids	Metals	Hydrocarbons
Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: →	Bioretention system (where the system is not designed as an infiltration component)	0.8	0.8	0.8
Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: →	None			
Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: →	None			
If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows:				
Aggregated Surface Water Pollution Mitigation Index		**0.8**	**0.8**	**0.8**

DESIGN CONDITIONS: 1 | 2 | 3

SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

Is the runoff now discharged to an infiltration component?

Yes ? Go to Step 2B
No ? Go to Step 2C

STEP 2B: Determine the Pollution Mitigation Index for the proposed Groundwater Protection

This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke and/or a proprietary product and not generically described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

	Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Select type of groundwater protection from the drop down list: → None			
If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row:			
Groundwater Protection Pollution Mitigation Index	**0**	**0**	**0**

DESIGN CONDITIONS: 1 | 2 | 3 | 4

STEP 2C: Determine the Combined Pollution Mitigation Indices for the Runoff Area

This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices

	Combined Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Combined Pollution Mitigation Indices for the Runoff Area	**0.8**	**0.8**	**0.8**

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

STEP 2D: Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

Sufficiency of Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Sufficient	**Sufficient**	**Sufficient**

DESIGN CONDITIONS: 1

Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see *Chapter 7 The SuDS design process*). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England

SIMPLE INDEX APPROACH: TOOL

1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

DROP DOWN LIST — RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP

USER ENTRY — USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL

STEP 1: Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

This step requires the user to select the appropriate land use type for the area from which the runoff is occurring

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index

- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

	Runoff Area Land Use Description	*Pollution Hazard*	*Pollution Hazard Indices* Total Suspended Solids	Metals	Hydrocarbons
Select land use type from the drop down list (or 'Other' if none applicable): →	Commercial/Industrial roofing: Inert materials	Very low	0.3	0.2	0.05
If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row:					
	Landuse Pollution Hazard Index	**Very low**	**0.3**	**0.2**	**0.05**

DESIGN CONDITIONS

1	2

STEP 2A: Determine the Pollution Mitigation Index for the proposed SuDS components

This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component
If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B

This step should be applied to evaluate the water quality protection provided by proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

	SuDS Component Description	*Pollution Mitigation Indices* Total Suspended Solids	Metals	Hydrocarbons
Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: →	Filter drain (where the trench is not designed as an infiltration component)	0.4	0.4	0.4
Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: →	None			
Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: →	None			
If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows:				
	Aggregated Surface Water Pollution Mitigation Index	**0.4**	**0.4**	**0.4**

DESIGN CONDITIONS

1	2	3
SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B	Filter drains should be preceded by upstream component(s) that trap(s) silt, or designed specifically to retain sediment in a separate zone, easily accessible for maintenance, such that the sediment will not be re-suspended in subsequent events	

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

Is the runoff now discharged to an infiltration component?

Yes ? Go to Step 2B
No ? Go to Step 2C

STEP 2B: Determine the Pollution Mitigation Index for the proposed Groundwater Protection

This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke and/or a proprietary product and not generically described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

	Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Select type of groundwater protection from the drop down list: → None			
If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row:			
Groundwater Protection Pollution Mitigation Index	**0**	**0**	**0**

DESIGN CONDITIONS

1	2	3	4

STEP 2C: Determine the Combined Pollution Mitigation Indices for the Runoff Area

This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices

	Combined Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Combined Pollution Mitigation Indices for the Runoff Area	**0.4**	**0.4**	**0.4**

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

STEP 2D: Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

DESIGN CONDITIONS

1

Sufficiency of Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Sufficient	**Sufficient**	**Sufficient**

Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see *Chapter 7 The SuDS design process*). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England

SIMPLE INDEX APPROACH: TOOL

1. The steps set out in the tool should be applied for each inflow or 'runoff area' (ie each impermeable surface area separately discharging to a SuDS component).

2. The supporting 'Design Conditions' stated by the tool must be fully considered and implemented in all cases.

3. Relevant design examples are included in the SuDS Manual Appendix C.

4. Each of the steps below are part of the process set out in the flowchart on Sheet 3.

5. Sheet 4 summarises the selections made below and indicates the acceptability of the proposed SuDS components.

DROP DOWN LIST — RELEVANT INPUTS NEED TO BE SELECTED FROM THESE LISTS, FOR EACH STEP

USER ENTRY — USER ENTRY CELLS ARE ONLY REQUIRED WHERE INDICATED BY THE TOOL

STEP 1: Determine the Pollution Hazard Index for the runoff area discharging to the proposed SuDS scheme

This step requires the user to select the appropriate land use type for the area from which the runoff is occurring

If the land use varies across the 'runoff area', either:

- use the land use type with the highest Pollution Hazard Index

- apply the approach for each of the land use types to determine whether the proposed SuDS design is sufficient for all. If it is not, consider collecting more hazardous runoff separately and providing additional treatment.

If the generic land use types suggested are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in the row below the drop down lists.

	Runoff Area Land Use Description	*Pollution Hazard*	*Pollution Hazard Indices* Total Suspended Solids	Metals	Hydrocarbons
Select land use type from the drop down list (or 'Other' if none applicable): →	Commercial/Industrial roofing: High potential for metal leaching	High	0.3	0.8	0.05
If the generic land use types in the drop down list above are not applicable, select 'Other' and enter a description of the land use of the runoff area and agreed user defined indices in this row:					
Landuse Pollution Hazard Index		**High**	**0.3**	**0.8**	**0.05**

DESIGN CONDITIONS

1	2
This classification should be informed by an assessment of the leachability of metals from the adopted roofing materials. Particular risks are likely to be posed by materials that include copper and galvanised steel	

STEP 2A: Determine the Pollution Mitigation Index for the proposed SuDS components

This step requires the user to select the proposed SuDS components that will be used to treat runoff - before it is discharged to a receiving surface waterbody or downstream infiltration component
If the runoff is discharged directly to an infiltration component, without upstream treatment, select 'None' for each of the 3 SuDS components and move to Step 2B

This step should be applied to evaluate the water quality protection provided by proposed SuDS components for discharges to receiving surface waters or downstream infiltration components (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

If you have fewer than 3 components, select 'None' for the components that are not required

If the proposed component is bespoke and/or a proprietary treatment product and not generically described by the suggested components, then 'Proprietary treatment system' or 'User defined indices' should be selected and a description of the component and agreed user defined indices should be entered in the rows below the drop down lists

	SuDS Component Description	*Pollution Mitigation Indices* Total Suspended Solids	Metals	Hydrocarbons
Select SuDS Component 1 (i.e. the upstream SuDS component) from the drop down list: →	Bioretention system (where the system is not designed as an infiltration component)	0.8	0.8	0.8
Select SuDS Component 2 (i.e. the second SuDS component in a series) from the drop down list: →	None			
Select SuDS Component 3 (i.e. the third SuDS component in a series) from the drop down list: →	None			
If the proposed SuDS components are bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary treatment system' or 'User defined indices' and enter component descriptions and agreed user defined indices in these rows:				
Aggregated Surface Water Pollution Mitigation Index		**0.8**	**0.8**	**0.8**

DESIGN CONDITIONS

1	2	3
SuDS components can only be assumed to deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in the relevant technical component chapters of the SuDS Manual. See also checklists in Appendix B		

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

Is the runoff now discharged to an infiltration component?

Yes ? Go to Step 2B
No ? Go to Step 2C

STEP 2B: Determine the Pollution Mitigation Index for the proposed Groundwater Protection

This step requires the user to select the type of groundwater protection that is either part of the SuDS component or that lies between the component and the groundwater

This step should be applied where a SuDS component is specifically designed to infiltrate runoff (note: in England and Wales this will include components that allow any amount of infiltration, however small, even where infiltration is not specifically accounted for in the design).

'Groundwater protection' describes the proposed depth of soil or other material through which runoff will flow between the runoff surface and the underlying groundwater.

Where the discharge is to surface waters and risks to groundwater need not be considered, select 'None'

If the proposed groundwater protection is bespoke and/or a proprietary product and not generically described by the suggested measures, then a description of the protection and agreed user defined indices should be entered in the row below the drop down list

	Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Select type of groundwater protection from the drop down list: → None			
If the proposed groundwater protection is bespoke/proprietary and/or the generic indices above are not considered appropriate, select 'Proprietary product' or 'User defined indices' and enter a description of the protection and agreed user defined indices in this row:			
Groundwater Protection Pollution Mitigation Index	**0**	**0**	**0**

DESIGN CONDITIONS

1	2	3	4

STEP 2C: Determine the Combined Pollution Mitigation Indices for the Runoff Area

This is an automatic step which combines the proposed SuDS Pollution Mitigation Indices with any Groundwater Protection Pollution Mitigation Indices

	Combined Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Combined Pollution Mitigation Indices for the Runoff Area	**0.8**	**0.8**	**0.8**

Note: If the total aggregated mitigation index is > 1 (which is not a realistic outcome), then the outcome is fixed at ">0.95". In this scenario, the proposed components are likely to have a very high mitigation potential for reducing pollutant levels in the runoff and should be sufficient for any proposed land use (note: where risk assessment is required, this outcome would need more detailed verification).

STEP 2D: Determine Sufficiency of Pollution Mitigation Indices for Selected SuDS Components

This is an automatic step which compares the Combined Pollution Mitigation Indices with the Land Use Hazard Indices, to determine whether the proposed components are sufficient to manage each pollutant category type

When the combined mitigation index exceeds the land use pollution hazard index, then the proposed components are considered sufficient in providing pollution risk mitigation.

In England and Wales, where the discharge is to protected surface waters or groundwater, an additional treatment component (ie over and above that required for standard discharges), or other equivalent protection, is required that provides environmental protection in the event of an unexpected pollution event or poor system performance. Protected surface waters are those designated for drinking water abstraction. In England and Wales, protected groundwater resources are defined as Source Protection Zone 1. In Northern Ireland, a more precautionary approach may be required and this should be checked with the environmental regulator on a site by site basis.

DESIGN CONDITIONS

Sufficiency of Pollution Mitigation Indices Total Suspended Solids	Metals	Hydrocarbons
Sufficient	**Sufficient**	**Sufficient**

1
Reference to local planning documents should also be made to identify any additional protection required for sites due to habitat conservation (see *Chapter 7 The SuDS design process*). The implications of developments on or within close proximity to an area with an environmental designation, such as a Site of Special Scientific Interest (SSSI), should be considered via consultation with relevant conservation bodies such as Natural England