DS_0707_15

DRAINAGE CALCULATION REPORT

FOR

RESIDENTIAL DEVELOPMENT
LAND WEST OF LIDSEY ROAD
WOODGATE, WEST SUSSEX

Rev. A

WILSONDEE LTD
HARBOROUGH INNOVATION CENTRE,
AIRFIELD BUSINESS PARK, LEICESTER ROAD,
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[redacted]

	Name	Position	Signature
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Revision

Revision	Date	Reason for issue
/	02.11.2024	Discharge of Reserved Matters Planning Condition.
A	18.12.2024	Drainage amended to suit revised Phase 1 site layout

1.0 INTRODUCTION

The objective of this report is to prepare a SuDS Maintenance Plan to identify the necessary maintenance activities required, detail those responsible for these activities, and suggest the frequency these activities should be undertaken to ensure all SuDS features incorporated within the surface water design remain functional for the lifetime of the development. This will enable a continued reduction in local flood risk through the attenuation of on-site surface water run-off.

1.1
Wilsondee Limited was commissioned by BDW Southampton, to produce a SW and FW Drainage Design Strategy for their proposed development at land west of Lidsey Road (A29), Woodgate. The drainage design we have produced follows and builds on the principles set out in the outline planning drainage strategy, the "Flood Risk and Drainage Statement" (Phase 1) produced by FortRidge Consulting Limited dated September 2021 and the "Flood Risk and Drainage Statement" (Phase 2) produced by FortRidge Consulting Limited dated April 2023.

1.2
The requirements and policies of Arun District Council (ADC), West Sussex County Council as Lead Local Flood Authority (WSCC) and the Environment Agency (EA) have been considered when considering our Drainage Design for this site.

1.3
Arun District Council is the Local Planning Authority (LPA), controlling flood risk and water environment issues, through policies and guidance presented in the ADC Strategic Flood Risk Assessment, Final report dated August 2016.

1.4
WSCC, in its role as Lead Local Flood Authority (LLFA), are a statutory consultee for all major applications. Guidance published by WSCC (Revised November 2018) and ADC have been adhered to within our designs.

1.5
Southern Water is the sewerage undertaker for the site.

1.6
The purpose of this Drainage Report is to show that our designs comply with the principles of the Flood Risk and Drainage Statements and Drainage Strategy from the Outline Consent for support of BDW Southampton's reserved matters planning application for this development.

2.0 SITE DESCRIPTION

2.1
The site is located adjacent to the settlement of Woodgate, to the west of A29, Lidsey Road. The ordnance survey reference for the site is OS X (Eastings) 493694 and OS Y (Northings) 103881.
The nearest Post Code is PO20 3SU.

The site is split into two phases, Phase 1 (DECISION NOTICE Application Ref: AL/129/21/OUT) and Phase 2 (DECISION NOTICE Application Ref: AL/70/23/OUT)

2.2
PHASE 1
2.2.1
Outline planning application with all matters reserved (except access) for residential development with up to 95no. dwellings (Use Class C3), informal and formal public open space, landscaping, drainage and other associated works. This application is a Departure from the Development Plan.

2.2.2
The overall site area is approximately 3.53 hectares including open space provisions.

2.2.3
PHASE 1 TOPOGRAGHY
The site is relatively flat with levels varying from 9.66mAOD in the north of the site to 8.2mAOD in the east of the site adjacent to Lidsey Road, excluding ditch bed levels.
The land falls in an easterly direction towards Lidsey Road with part of the site falling in a westerly direction.
The site is bounded on all sides by drainage ditches that are characteristic of the area.

2.3
PHASE 2
2.3.1
Outline planning application with all matters reserved except access for residential development of the site with up to 155 dwellings (Use Class C3), informal and formal public open space, landscaping, drainage, and other associated works.

2.3.2
The overall site application area is approximately 8.5 hectares including open space and access provisions.

2.3.3
PHASE 2 TOPOGRAGHY
The site is relatively flat with levels varying from 9.5mAOD in the north of the site to 8.0mAOD in the west of the site, excluding ditch bed levels.
The land generally falls in a westerly direction towards arterial watercourse west of the site.

3.0 DRAINAGE DESIGN PRINCIPLES

3.1 DESIGN GUIDANCE

The Surface Water sewers have been designed in accordance with Design and Construction Guidance v.2.2, 29th June 2022 and the requirements of the Building Regulations (Approved Document H).

3.2 DESIGN ASSUMPTIONS – SURFACE WATER SEWERS

The minimum size of an adoptable surface water sewer is given in clause C7.2.3 of DCG v.2.2 as 150mm. Adoptable storm sewers beneath the proposed highway and main lateral connections have been included in the model.

3.3 DETAILED STORM WATER DRAINAGE DESIGN

The Storm Water drainage system has been designed based on recommendations within the FRA and in line with the site Drainage Strategy.

The designs are in accordance with current Building Regulations, Design and Construction Guidance and drainage design best practice.

Surface water for the site has been split into three separate networks with three separate outfalls with varying discharge rates.

Network 3 is for phase 1 and has a restricted discharge rate of 3 l/s controlled by a proposed Hydro-Brake or similar flow control devise. The outfall is into an existing ditch course that runs through the site. All surface water from the plots and estate roads drains to the attenuation pond via a piped system and during the 1 in 100yr storm event surface water will be attenuated.

Networks 1 and 2 are for phase 2 of the development. Network 2 also has a restricted discharge rate of 3 l/s and as with network 3 there is an attenuation basin to attenuated flows during the 1 in 100yr storm events. There is also a separate overflow basin to cater for the volume water that requires storage. The outfall for this network is into the same ditch course running through the site as network 3 but further downstream.
Network 1 has a larger restricted discharge rate of 5 l/s as it caters for a higher percentage of the development. There are two separate attenuation basins within this network with the smaller one's discharge being controlled by a Hydro-Brake restricted to 10 l/s to avoid over capacitation of the larger attenuation basin downstream. Swales have also been utilised within this network to convey some of the water to the pond.

All discharge rates have been obtained from the FRA's.

All adoptable drainage and attenuation basins have been sized to accommodate the 1 in 100 year return period storm event including a 45% allowance for climate change and 10% for urban creep.

The site has been designed in accordance with Sustainable Drainage Systems (SUDS) techniques and in accordance with standards set out in CIRIA SuDS Manual (2015).

The SUDS Manual (CIRIA C697) states that "Sedimentation is one of the primary removal mechanisms in SUDS. Most pollution in runoff is attached to sediment particles and therefore removal of sediment results in a significant reduction in pollutant loads".
In order to remove sedimentation, the surface water drainage design utilises deep seal trapped gullies throughout and with catchpit manholes for Highway Drainage.

3.4 DETAILED FOUL WATER DRAINAGE DESIGN

It has been proposed that the foul water will drain to the existing foul main sewer network that serves Woodgate House to the north of the site. Gravity sewers will serve the part of the site closest to the existing sewer with the remainder of the site needing to be pumped from a proposed foul pumping station located within phase 1 of the development.

CONTENTS

APPENDIX A

STORM WATER AND FOUL WATER DRAINAGE LAYOUT

BARRATT HOMES

FOR CONTINUATION SEE INSET BELOW

FOR CONTINUATION SEE MAIN DRAWING ABOVE

ARUN DISTRICT COUNCIL AL/143/24/RES

Key:

- Foul water gravity sewer to be adopted under S104 agreement
- Storm water gravity sewer to be adopted under S104 agreement
- Foul water rising main to be adopted under S104 agreement
- Existing public foul water gravity sewer
- Proposed sewer / rising main easement
- Adoptable SW Hydro-brake chamber
- Proposed attenuation tank (shown in key NTS)

600Ø 1/50 13.025m 1.007
- sewer diameter
- sewer gradient
- pipe length
- drainage model pipe reference

Rev.	Date	Description of issue	Rev/Chkd
B	17.12.2024	Drawing amended to latest site layout.	PDB/AJM
A	31.10.2024	Drawing amended to latest site layout.	PDB/AJM
/	23.10.2024	-	PDB/AJM

Revisions:

Issue Purpose:
PRELIMINARY

Project
Barratt Homes
Land West of Lidsey Road,
Woodgate, West Sussex

Drawing Title:
Storm Water and Foul Water Drainage Strategy

Designer's Risk Assessment Reference:
DS_0707_15/DRA/Civils

Specification Reference:

Drawn By:	Checked By:
PDB	AJM
Scale:	Date:
1:500@A0	October 2024

Drawing No.: DS_0707_15/INF/500 Rev.: B

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WILSONDRAKE

For purpose only, do not scale off the drawing

Scale 1:2 50mm 100mm 150mm 200mm 250mm
Scale 1:500 5m 10m 15m 20m 25m

APPENDIX B

CALCULATION FOR FOUL WATER NETWORK

FOUL SEWERAGE DESIGN

Design Criteria for Foul Network 1

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Flow Per Person (l/per/day)	222.00	Maximum Backdrop Height (m)	1.500
Persons per House	3.00	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul Network 1

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	34.971	0.240	145.7	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.001	15.876	0.110	144.3	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.002	57.540	0.390	147.5	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
2.000	48.189	1.590	30.3	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.003	54.787	0.370	148.1	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.004	25.772	0.172	150.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
3.000	21.338	0.468	45.6	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
3.001	26.409	0.177	149.3	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
3.002	21.254	0.153	139.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
3.003	12.021	0.080	150.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
3.004	36.571	1.204	30.4	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.005	44.945	0.300	150.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.006	46.679	0.311	150.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.007	69.819	0.465	150.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	7.150	0.000	0.0	0	0.0	0	0.00	0.72	12.8	0.0
1.001	6.910	0.000	0.0	0	0.0	0	0.00	0.73	12.9	0.0
1.002	6.800	0.000	0.0	0	0.0	0	0.00	0.72	12.7	0.0
2.000	8.000	0.000	0.0	0	0.0	0	0.00	1.60	28.2	0.0
1.003	6.410	0.000	0.0	0	0.0	0	0.00	0.72	12.7	0.0
1.004	6.040	0.000	0.0	0	0.0	0	0.00	0.71	12.6	0.0
3.000	7.950	0.000	0.0	0	0.0	0	0.00	1.30	23.0	0.0
3.001	7.482	0.000	0.0	0	0.0	0	0.00	0.72	12.6	0.0
3.002	7.305	0.000	0.0	0	0.0	0	0.00	0.74	13.1	0.0
3.003	7.152	0.000	0.0	0	0.0	0	0.00	0.71	12.6	0.0
3.004	7.072	0.000	0.0	0	0.0	0	0.00	1.59	28.2	0.0
1.005	5.868	0.000	0.0	0	0.0	0	0.00	0.71	12.6	0.0
1.006	5.569	0.000	0.0	0	0.0	0	0.00	0.71	12.6	0.0
1.007	5.257	0.000	0.0	0	0.0	0	0.00	0.71	12.6	0.0

Network Design Table for Foul Network 1

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.008	6.570	0.044	150.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.009	29.694	0.198	150.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.010	18.679	0.125	150.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
4.000	22.313	0.149	150.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
4.001	21.003	0.140	150.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
4.002	45.604	0.304	150.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
4.003	61.212	0.408	150.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
4.004	25.426	0.170	150.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
4.005	21.651	0.144	150.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
4.006	17.836	1.441	12.4	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
4.007	7.218	0.722	10.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.011	6.262	0.042	150.0	0.000	0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.008	4.732	0.000	0.0	0	0.0	0	0.00	0.71	12.6	0.0
1.009	4.748	0.000	0.0	0	0.0	0	0.00	0.71	12.6	0.0
1.010	4.550	0.000	0.0	0	0.0	0	0.00	0.71	12.6	0.0
4.000	7.503	0.000	0.0	0	0.0	0	0.00	0.71	12.6	0.0
4.001	7.754	0.000	0.0	0	0.0	0	0.00	0.71	12.6	0.0
4.002	7.614	0.000	0.0	0	0.0	0	0.00	0.71	12.6	0.0
4.003	7.910	0.000	0.0	0	0.0	0	0.00	0.71	12.6	0.0
4.004	6.302	0.000	0.0	0	0.0	0	0.00	0.71	12.6	0.0
4.005	6.732	0.000	0.0	0	0.0	0	0.00	0.71	12.6	0.0
4.006	6.588	0.000	0.0	0	0.0	0	0.00	2.50	44.2	0.0
4.007	5.147	0.000	0.0	0	0.0	0	0.00	2.78	49.1	0.0
1.011	4.426	0.000	0.0	0	0.0	0	0.00	0.71	12.6	0.0

Manhole Schedules for Foul Network 1

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
F2.1	8.904	1.754	Open Manhole	1350	1.000	7.150	150				
F2.2	9.196	2.286	Open Manhole	1200	1.001	6.910	150	1.000	6.910	150	
F2.3	9.102	2.302	Open Manhole	1200	1.002	6.800	150	1.001	6.800	150	
F2.4	9.653	1.653	Open Manhole	1350	2.000	8.000	150				
F2.5	9.096	2.686	Open Manhole	1200	1.003	6.410	150	1.002	6.410	150	
								2.000	6.410	150	
F2.6	8.918	2.878	Open Manhole	1200	1.004	6.040	150	1.003	6.040	150	
F2.7	9.306	1.356	Open Manhole	1350	3.000	7.950	150				
F2.8	9.170	1.688	Open Manhole	1200	3.001	7.482	150	3.000	7.482	150	
F4	9.605	2.300	Open Manhole	1200	3.002	7.305	150	3.001	7.305	150	
F2.9	9.792	2.640	Open Manhole	1200	3.003	7.152	150	3.002	7.152	150	
F3	9.692	2.620	Open Manhole	1200	3.004	7.072	150	3.003	7.072	150	
F2.10	9.234	3.366	Open Manhole	1200	1.005	5.868	150	1.004	5.868	150	
								3.004	5.868	150	
F2.11	9.000	3.431	Open Manhole	1200	1.006	5.569	150	1.005	5.569	150	
F2.13	9.020	3.762	Open Manhole	1200	1.007	5.257	150	1.006	5.257	150	
F7	9.920	5.128	Open Manhole	1200	1.008	4.792	150	1.007	4.792	150	
F8	9.867	5.119	Open Manhole	1200	1.009	4.748	150	1.008	4.748	150	
F9	9.366	4.816	Open Manhole	1200	1.010	4.550	150	1.009	4.550	150	
F2.15	10.114	2.211	Open Manhole	1200	4.000	7.903	150				
F5	10.212	2.458	Open Manhole	1200	4.001	7.754	150	4.000	7.754	150	
F2.16	9.984	2.370	Open Manhole	1200	4.002	7.614	150	4.001	7.614	150	
F2.17	9.410	2.100	Open Manhole	1350	4.003	7.310	150	4.002	7.310	150	
F2.18	9.601	2.699	Open Manhole	1200	4.004	6.902	150	4.003	6.902	150	
F2.19	9.854	3.122	Open Manhole	1200	4.005	6.732	150	4.004	6.732	150	
F2.20	9.762	3.174	Open Manhole	1200	4.006	6.588	150	4.005	6.588	150	
F2.21	9.160	4.013	Open Manhole	1200	4.007	5.147	150	4.006	5.147	150	
F2.22	9.480	5.054	Open Manhole	1200	1.011	4.426	150	1.010	4.426	150	
								4.007	4.426	150	
PumpStation	9.800	5.416	Open Manhole	1500		OUTFALL		1.011	4.384	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F2.1	493558.078	103630.679	493558.078	103630.679	Required	
F2.2	493523.274	103634.093	493523.274	103634.093	Required	
F2.3	493507.905	103638.075	493507.905	103638.075	Required	
F2.4	493510.733	103743.766	493510.733	103743.766	Required	

Manhole Schedules for Foul Network 1

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F2.5	493509.721	103695.587	493509.721	103695.587	Required	
F2.6	493564.476	103693.720	493564.476	103693.720	Required	
F2.7	493681.118	103646.206	493681.118	103646.206	Required	
F2.8	493679.895	103667.509	493679.895	103667.509	Required	
F4	493653.515	103666.278	493653.515	103666.278	Required	
F2.9	493632.266	103666.725	493632.266	103666.725	Required	
F3	493622.919	103674.285	493622.919	103674.285	Required	
F2.10	493590.012	103690.242	493590.012	103690.242	Required	
F2.11	493607.479	103731.654	493607.479	103731.654	Required	
F2.13	493640.320	103764.827	493640.320	103764.827	Required	
F7	493705.447	103739.662	493705.447	103739.662	Required	
F8	493711.333	103742.580	493711.333	103742.580	Required	
F9	493714.195	103772.136	493714.195	103772.136	Required	
F2.15	493521.804	103831.824	493521.804	103831.824	Required	
F5	493542.755	103839.500	493542.755	103839.500	Required	
F2.16	493563.712	103840.896	493563.712	103840.896	Required	
F2.17	493609.008	103835.605	493609.008	103835.605	Required	
F2.18	493669.772	103828.210	493669.772	103828.210	Required	

Manhole Schedules for Foul Network 1

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F2.19	493693.444	103818.933	493693.444	103818.933	Required	
F2.20	493714.874	103815.841	493714.874	103815.841	Required	
F2.21	493713.916	103798.031	493713.916	103798.031	Required	
F2.22	493714.043	103790.814	493714.043	103790.814	Required	
PumpStation	493707.781	103790.792			No Entry	

PIPELINE SCHEDULES for Foul Network 1

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	F2.1	8.964	7.150	1.604	Open Manhole	1350
1.001	o	150	F2.2	9.136	6.910	2.136	Open Manhole	1200
1.002	o	150	F2.3	8.102	6.800	2.152	Open Manhole	1200
2.000	o	150	F2.4	8.653	8.000	1.503	Open Manhole	1350
1.003	o	150	F2.5	8.096	6.410	2.536	Open Manhole	1200
1.004	o	150	F2.6	8.918	6.040	2.728	Open Manhole	1200
3.000	o	150	F2.7	8.306	7.350	1.206	Open Manhole	1350
3.001	o	150	F2.8	9.170	7.482	1.538	Open Manhole	1200
3.002	o	150	F4	9.605	7.305	2.150	Open Manhole	1200
3.003	o	150	F2.9	8.792	7.152	2.490	Open Manhole	1200
3.004	o	150	F3	8.692	7.072	2.470	Open Manhole	1200
1.005	o	150	F2.10	9.234	5.868	3.216	Open Manhole	1200
1.006	o	150	F2.11	8.850	5.569	3.281	Open Manhole	1200
1.007	o	150	F2.13	8.020	5.257	2.612	Open Manhole	1200
1.008	o	150	F7	8.920	4.792	4.978	Open Manhole	1200
1.009	o	150	F8	8.867	4.748	4.969	Open Manhole	1200
1.010	o	150	F9	9.356	4.550	4.656	Open Manhole	1200
4.000	o	150	F2.15	10.114	7.908	2.061	Open Manhole	1200
4.001	o	150	F5	10.212	7.754	2.308	Open Manhole	1200
4.002	o	150	F2.16	9.984	7.614	2.220	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	34.971	145.7	F2.2	9.136	6.910	2.136	Open Manhole	1200
1.001	15.876	144.3	F2.3	8.102	6.800	2.152	Open Manhole	1200
1.002	57.540	147.5	F2.5	8.096	6.410	2.536	Open Manhole	1200
2.000	48.189	30.3	F2.5	8.096	6.410	2.536	Open Manhole	1200
1.003	54.787	148.1	F2.6	8.918	6.040	2.728	Open Manhole	1200
1.004	25.772	150.0	F2.10	9.234	5.868	3.216	Open Manhole	1200
3.000	21.338	45.6	F2.8	9.170	7.482	1.538	Open Manhole	1200
3.001	26.409	149.3	F4	9.605	7.305	2.150	Open Manhole	1200
3.002	21.254	139.0	F2.9	8.792	7.152	2.490	Open Manhole	1200
3.003	12.021	150.0	F3	8.692	7.072	2.470	Open Manhole	1200
3.004	36.571	30.4	F2.10	9.234	5.868	3.216	Open Manhole	1200
1.005	44.945	150.0	F2.11	8.850	5.569	3.281	Open Manhole	1200
1.006	46.679	150.0	F2.13	8.020	5.257	2.612	Open Manhole	1200
1.007	69.819	150.0	F7	8.920	4.792	4.978	Open Manhole	1200
1.008	6.570	150.0	F8	8.867	4.748	4.969	Open Manhole	1200
1.009	29.694	150.0	F9	8.366	4.550	4.666	Open Manhole	1200
1.010	18.679	150.0	F2.22	8.480	4.426	4.904	Open Manhole	1200
4.000	22.313	150.0	F5	10.212	7.754	2.308	Open Manhole	1200
4.001	21.003	150.0	F2.16	9.984	7.614	2.220	Open Manhole	1200
4.002	45.604	150.0	F2.17	8.410	7.310	1.950	Open Manhole	1350

PIPELINE SCHEDULES for Foul Network 1

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.003	o	150	F2.17	9.410	7.310	1.950	Open Manhole	1350
4.004	o	150	F2.18	9.601	6.902	2.549	Open Manhole	1200
4.005	o	150	F2.19	9.854	6.732	2.972	Open Manhole	1200
4.006	o	150	F2.20	9.762	6.588	3.024	Open Manhole	1200
4.007	o	150	F2.21	9.160	5.147	3.863	Open Manhole	1200
1.011	o	150	F2.22	9.480	4.426	4.904	Open Manhole	1200

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
4.003	61.212	150.0	F2.18	9.601	6.902	2.549	Open Manhole	1200
4.004	25.426	150.0	F2.19	9.854	6.732	2.972	Open Manhole	1200
4.005	21.651	150.0	F2.20	9.762	6.588	3.024	Open Manhole	1200
4.006	17.836	12.4	F2.21	9.160	5.147	3.863	Open Manhole	1200
4.007	7.218	10.0	F2.22	9.480	4.426	4.904	Open Manhole	1200
1.011	6.262	150.0	PumpStation	9.800	4.384	5.266	Open Manhole	1500

Free Flowing Outfall Details for Foul Network 1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.011	PumpStation	9.800	4.384	0.000	1500	0

FOUL SEWERAGE DESIGN

Design Criteria for Foul Network 2

Pipe Sizes STANDARD Manhole Sizes STANDARD

Industrial Flow (l/s/ha)	0.00	Add Flow / Climate Change (%)	0
Industrial Peak Flow Factor	0.00	Minimum Backdrop Height (m)	0.200
Flow Per Person (l/per/day)	222.00	Maximum Backdrop Height (m)	1.500
Persons per House	3.00	Min Design Depth for Optimisation (m)	1.200
Domestic (l/s/ha)	0.00	Min Vel for Auto Design only (m/s)	1.00
Domestic Peak Flow Factor	6.00	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Foul Network 2

PN	Length (m)	Fall (m)	Slope (1:X)	Area (ha)	Houses	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	28.116	0.190	147.6	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.001	56.155	0.356	157.5	0.000	0	0.0	1.500	o	150	Pipe/Conduit	
1.002	20.453	0.360	56.8	0.000	0	0.0	1.500	o	150	Pipe/Conduit	

Network Results Table

PN	US/IL (m)	Σ Area (ha)	Σ Base Flow (l/s)	Σ Hse	Add Flow (l/s)	P.Dep (mm)	P.Vel (m/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	8.227	0.000	0.0	0	0.0	0	0.00	0.72	12.7	0.0
1.001	8.036	0.000	0.0	0	0.0	0	0.00	0.70	12.3	0.0
1.002	7.680	0.000	0.0	0	0.0	0	0.00	1.16	20.6	0.0

Manhole Schedules for Foul Network 2

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	Pipe Out PN	Pipe Out Invert Level (m)	Pipe Out Diameter (mm)	Pipes In PN	Pipes In Invert Level (m)	Pipes In Diameter (mm)	Backdrop (mm)
F1.1	9.863	1.636	Open Manhole	1350	1.000	8.227	150				
F1.2	9.970	1.933	Open Manhole	1350	1.001	8.036	150	1.000	8.036	150	
F1.3	9.121	1.441	Open Manhole	1350	1.002	7.680	150	1.001	7.680	150	
Ex.MH.7903	9.171	1.851	Open Manhole	1500		OUTFALL		1.002	7.320	150	

MH Name	Manhole Easting (m)	Manhole Northing (m)	Intersection Easting (m)	Intersection Northing (m)	Manhole Access	Layout (North)
F1.1	493681.725	103905.782	493681.725	103905.782	Required	
F1.2	493686.199	103933.540	493686.199	103933.540	Required	
F1.3	493742.354	103933.603	493742.354	103933.603	Required	
Ex.MH.7903	493744.117	103953.979			No Entry	

PIPELINE SCHEDULES for Foul Network 2

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	150	F1.1	9.863	8.227	1.486	Open Manhole	1350
1.001	o	150	F1.2	9.970	8.036	1.783	Open Manhole	1350
1.002	o	150	F1.3	9.121	7.680	1.291	Open Manhole	1350

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	28.116	147.6	F1.2	9.970	8.036	1.783	Open Manhole	1350
1.001	56.155	157.5	F1.3	9.121	7.680	1.291	Open Manhole	1350
1.002	20.453	56.8	Ex.MH.7903	9.171	7.320	1.701	Open Manhole	1500

Free Flowing Outfall Details for Foul Network 2

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.002	Ex.MH.7903	9.171	7.320	0.000	1500	0

APPENDIX C

STORM WATER NETWORK DETAILS

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 1

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	19.200	Add Flow / Climate Change (%)	0
Ratio R	0.343	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Surface Network 1

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.052	4-8	0.923	8-12	0.838	12-16	0.031

Total Area Contributing (ha) = 1.844

Total Pipe Volume (m³) = 200.939

Network Design Table for Surface Network 1

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	23.950	0.168	142.6	0.083	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.001	22.023	0.058	380.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	12.976	0.034	381.6	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	33.487	0.088	380.5	0.080	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	56.453	0.149	378.9	0.128	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.005	22.407	0.059	379.8	0.149	0.00	0.0	0.600	o	450	Pipe/Conduit	
2.000	37.903	0.550	68.9	0.138	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.006	23.346	0.055	424.5	0.039	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)
1.000	47.47	5.30	8.007	0.083	0.0	0.0	0.0	1.31	92.9	10.7
1.001	45.80	5.76	7.839	0.083	0.0	0.0	0.0	0.80	56.6	10.7
1.002	44.88	6.03	7.781	0.083	0.0	0.0	0.0	0.80	56.5	10.7
1.003	42.70	6.73	7.747	0.163	0.0	0.0	0.0	0.80	56.5	18.8
1.004	40.20	7.64	7.598	0.291	0.0	0.0	0.0	1.04	165.2	31.7
1.005	39.30	8.00	7.359	0.440	0.0	0.0	0.0	1.04	165.0	46.8
2.000	47.36	5.33	8.000	0.138	0.0	0.0	0.0	1.90	134.1	17.7
1.006	38.37	8.39	7.300	0.617	0.0	0.0	0.0	0.98	155.9	64.1

Network Design Table for Surface Network 1

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
3.000	18.871	0.105	179.7	0.086	5.00	0.0	0.600	o	300	Pipe/Conduit	
1.007	52.308	0.105	498.2	0.059	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.008	22.613	0.045	502.5	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.009	62.373	0.125	499.0	0.154	0.00	0.0	0.600	o	600	Pipe/Conduit	
4.000	85.858	0.210	408.8	0.229	5.00	0.0	0.600	o	450	Pipe/Conduit	
5.000	15.799	0.440	35.9	0.054	5.00	0.0	0.600	o	300	Pipe/Conduit	
4.001	25.022	0.070	357.5	0.061	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.002	11.772	0.040	294.3	0.126	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.003	19.633	0.030	654.4	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
6.000	30.774	0.130	236.7	0.068	5.00	0.0	0.600	o	300	Pipe/Conduit	
6.001	16.841	0.070	240.6	0.050	0.00	0.0	0.600	o	300	Pipe/Conduit	
7.000	28.483	0.120	237.4	0.105	5.00	0.0	0.600	o	300	Pipe/Conduit	
6.002	51.236	0.130	394.1	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.003	11.004	0.030	366.8	0.069	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.004	12.275	0.040	306.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.004	12.605	0.025	500.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
4.005	99.868	0.230	434.2	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)
3.000	47.60	5.27	7.500	0.086	0.0	0.0	0.0	1.17	82.7	11.1
1.007	36.62	9.20	7.095	0.762	0.0	0.0	0.0	1.08	306.6	75.6
1.008	35.92	9.55	6.990	0.762	0.0	0.0	0.0	1.08	305.2	75.6
1.009	34.14	10.51	6.945	0.916	0.0	0.0	0.0	1.08	306.3	84.7
4.000	43.60	6.43	7.550	0.229	0.0	0.0	0.0	1.00	158.9	27.0
5.000	48.26	5.10	7.939	0.054	0.0	0.0	0.0	2.63	186.1	7.1
4.001	42.43	6.82	7.340	0.344	0.0	0.0	0.0	1.07	170.1	39.5
4.002	41.95	6.99	7.270	0.470	0.0	0.0	0.0	1.18	187.7	53.4
4.003	40.99	7.33	7.230	0.470	0.0	0.0	0.0	0.94	267.0	53.4
6.000	46.72	5.50	7.750	0.068	0.0	0.0	0.0	1.02	71.9	8.6
6.001	45.73	5.78	7.620	0.118	0.0	0.0	0.0	1.01	71.3	14.6
7.000	46.86	5.47	7.670	0.105	0.0	0.0	0.0	1.02	71.8	13.3
6.002	43.02	6.62	7.400	0.223	0.0	0.0	0.0	1.02	161.9	26.0
6.003	42.51	6.79	7.270	0.292	0.0	0.0	0.0	1.06	167.9	33.6
6.004	42.00	6.97	7.240	0.292	0.0	0.0	0.0	1.16	183.7	33.6
4.004	40.48	7.53	7.200	0.762	0.0	0.0	0.0	1.08	306.0	83.5
4.005	37.11	8.96	7.170	0.762	0.0	0.0	0.0	1.16	328.6	83.5

Network Design Table for Surface Network 1

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
4.006	11.032	0.025	450.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
8.000	15.377	0.300	51.3	0.050	5.00	0.0	0.600	o	300	Pipe/Conduit	
4.007	21.535	0.046	473.3	0.116	0.00	0.0	0.600	o	600	Pipe/Conduit	
4.008	27.429	0.050	548.6	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.010	9.894	0.020	494.7	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.011	16.172	0.060	269.5	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.012	117.468	0.250	469.9	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.013	20.908	0.080	261.3	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)
4.006	36.77	9.12	6.940	0.762	0.0	0.0	0.0	1.14	322.7	83.5
8.000	48.19	5.12	7.500	0.050	0.0	0.0	0.0	2.20	155.6	6.5
4.007	36.12	9.44	6.916	0.928	0.0	0.0	0.0	1.11	314.6	90.8
4.008	35.26	9.89	6.870	0.928	0.0	0.0	0.0	1.03	292.0	90.8
1.010	33.88	10.66	6.820	1.844	0.0	0.0	0.0	1.09	307.6	169.2
1.011	33.57	10.84	6.800	1.844	0.0	0.0	0.0	1.48	418.0	169.2
1.012	31.03	12.59	6.740	1.844	0.0	0.0	0.0	1.12	315.8	169.2
1.013	30.57	12.95	6.490	1.844	0.0	0.0	0.0	0.37	60.4*	169.2

PIPELINE SCHEDULES for Surface Network 1

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	300	S3.1	9.283	8.007	0.336	Open Manhole	1350
1.001	o	300	S7	9.645	7.839	1.506	Open Manhole	1200
1.002	o	300	S3.2	9.783	7.781	1.702	Open Manhole	1350
1.003	o	300	S1	9.708	7.747	1.661	Open Manhole	1350
1.004	o	450	S3.4	9.287	7.508	1.329	Open Manhole	1350
1.005	o	450	S4.14	8.785	7.359	0.976	Open Manhole	1350
2.000	o	300	S4.13	9.547	8.000	1.247	Open Manhole	1350
1.006	o	450	S4.15	9.075	7.300	1.325	Open Manhole	1350
3.000	o	300	S4.16	9.000	7.500	1.200	Open Manhole	1350
1.007	o	600	S4.17	8.841	7.095	1.146	Open Manhole	1350
1.008	o	600	S4.18	8.500	6.990	0.910	Open Manhole	1350
1.009	o	600	HW4.5	8.500	6.945	0.955	Junction	
4.000	o	450	S4.1	9.119	7.550	1.119	Open Manhole	1350
5.000	o	300	S4.2	9.406	7.930	1.176	Open Manhole	1350
4.001	o	450	S4.3	9.166	7.340	1.376	Open Manhole	1350
4.002	o	450	S4.4	8.987	7.270	1.267	Open Manhole	1350
4.003	o	600	HW4.1	9.000	7.230	1.170	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	23.950	142.6	S7	9.645	7.839	1.506	Open Manhole	1200
1.001	22.023	380.0	S3.2	9.783	7.781	1.702	Open Manhole	1350
1.002	12.976	381.6	S1	9.708	7.747	1.661	Open Manhole	1350
1.003	33.487	380.5	S3.4	9.287	7.659	1.328	Open Manhole	1350
1.004	56.453	378.9	S4.14	8.785	7.359	0.976	Open Manhole	1350
1.005	22.407	379.8	S4.15	9.075	7.300	1.325	Open Manhole	1350
2.000	37.903	68.9	S4.15	9.075	7.450	1.325	Open Manhole	1350
1.006	23.346	424.5	S4.17	8.841	7.245	1.146	Open Manhole	1350
3.000	18.871	179.7	S4.17	8.841	7.395	1.146	Open Manhole	1350
1.007	52.308	498.2	S4.18	8.500	6.990	0.910	Open Manhole	1350
1.008	22.613	502.5	HW4.5	8.500	6.945	0.955	Junction	
1.009	62.373	499.0	HW4.6	8.730	6.820	1.310	Junction	
4.000	85.858	408.8	S4.3	9.166	7.340	1.376	Open Manhole	1350
5.000	15.799	35.9	S4.3	9.166	7.490	1.376	Open Manhole	1350
4.001	25.022	357.5	S4.4	8.987	7.270	1.267	Open Manhole	1350
4.002	11.772	294.3	HW4.1	9.000	7.230	1.320	Junction	
4.003	19.633	654.4	HW4.3	9.000	7.200	1.200	Junction	

PIPELINE SCHEDULES for Surface Network 1

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
6.000	o	300	S4.5	9.392	7.750	1.342	Open Manhole	1350
6.001	o	300	S4.6	9.262	7.620	1.342	Open Manhole	1350
7.000	o	300	S4.7	9.449	7.670	1.479	Open Manhole	1350
6.002	o	450	S4.8	9.277	7.400	1.427	Open Manhole	1350
6.003	o	450	S4.9	9.000	7.270	1.280	Open Manhole	1350
6.004	o	450	HW4.2	9.000	7.240	1.310	Junction	
4.004	o	600	HW4.3	9.000	7.200	1.200	Junction	
4.005	o	600	HB4.1	9.000	7.170	1.230	Open Manhole	2400
4.006	o	600	S4.10	9.098	6.940	1.558	Open Manhole	1500
8.000	o	300	S4.11	9.364	7.500	1.564	Open Manhole	1350
4.007	o	600	S4.12	9.181	6.916	1.665	Open Manhole	1500
4.008	o	600	HW4.4	8.453	6.870	0.383	Junction	
1.010	o	600	HW4.6	8.730	6.820	1.310	Junction	
1.011	o	600	HB4.2	8.700	6.800	1.300	Open Manhole	2400
1.012	o	600	HW4.7	8.500	6.740	1.160	Junction	
1.013	o	300	HW4.8	7.500	6.490	0.710	Junction	

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
6.000	30.774	236.7	S4.6	9.262	7.620	1.342	Open Manhole	1350
6.001	16.841	240.6	S4.8	9.277	7.550	1.427	Open Manhole	1350
7.000	28.483	237.4	S4.8	9.277	7.550	1.427	Open Manhole	1350
6.002	51.236	394.1	S4.9	9.000	7.270	1.280	Open Manhole	1350
6.003	11.004	366.8	HW4.2	9.000	7.240	1.310	Junction	
6.004	12.275	306.9	HW4.3	9.000	7.200	1.350	Junction	
4.004	12.605	500.0	HB4.1	9.000	7.175	1.225	Open Manhole	2400
4.005	99.868	434.2	S4.10	9.098	6.940	1.558	Open Manhole	1500
4.006	11.032	450.0	S4.12	9.181	6.915	1.665	Open Manhole	1500
8.000	15.377	51.3	S4.12	9.181	7.200	1.681	Open Manhole	1500
4.007	21.535	473.3	HW4.4	8.453	6.870	0.983	Junction	
4.008	27.429	548.6	HW4.6	8.730	6.820	1.310	Junction	
1.010	9.894	494.7	HB4.2	8.700	6.800	1.300	Open Manhole	2400
1.011	16.172	269.5	HW4.7	8.500	6.740	1.160	Junction	
1.012	117.468	469.9	HW4.8	7.500	6.490	0.410	Junction	
1.013	20.908	261.3	outfall4	7.500	6.410	0.790	Junction	

Free Flowing Outfall Details for Surface Network 1

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.013	outfall4	7.500	6.410	0.000	0	0

Simulation Criteria for Surface Network 1

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.200	Storm Duration (mins)	30
Ratio R	0.343		

Online Controls for Surface Network 1

Hydro-Brake® Optimum Manhole: HB4.1, DS/PN: 4.005, Volume (m³): 11.5

Unit Reference	MD-SHE-0143-1000-1200-1000
Design Head (m)	1.200
Design Flow (l/s)	10.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	143
Invert Level (m)	7.170
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	10.0	Kick-Flo®	0.778	8.2
Flush-Flo™	0.357	10.0	Mean Flow over Head Range	-	8.7

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	5.1	1.200	10.0	3.000	15.4	7.000	23.2
0.200	9.4	1.400	10.8	3.500	16.6	7.500	23.9
0.300	9.9	1.600	11.5	4.000	17.7	8.000	24.7
0.400	10.0	1.800	12.1	4.500	18.7	8.500	25.4
0.500	9.8	2.000	12.7	5.000	19.7	9.000	26.1
0.600	9.5	2.200	13.3	5.500	20.6	9.500	26.8
0.800	8.3	2.400	13.9	6.000	21.5		
1.000	9.2	2.600	14.4	6.500	22.3		

Hydro-Brake® Optimum Manhole: HB4.2, DS/PN: 1.011, Volume (m³): 11.1

Unit Reference	MD-SHE-0095-5000-1700-5000
Design Head (m)	1.700
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	95
Invert Level (m)	6.800
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)	1.700	5.0	Kick-Flo®	0.851	3.6
Flush-Flo™	0.417	4.5	Mean Flow over Head Range	-	4.1

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	3.1	0.200	4.2	0.300	4.5	0.400	4.5

Hydro-Brake® Optimum Manhole: HB4.2, DS/PN: 1.011, Volume (m³): 11.1

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.500	4.5	1.800	5.1	4.000	7.5	7.500	10.1
0.600	4.4	2.000	5.4	4.500	7.9	8.000	10.4
0.800	3.9	2.200	5.6	5.000	8.3	8.500	10.7
1.000	3.9	2.400	5.9	5.500	8.7	9.000	11.0
1.200	4.3	2.600	6.1	6.000	9.0	9.500	11.3
1.400	4.6	3.000	6.5	6.500	9.4		
1.600	4.9	3.500	7.0	7.000	9.7		

Storage Structures for Surface Network 1

Tank or Pond Manhole: HW4.3, DS/PN: 4.004

Invert Level (m) 7.200

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	97.1	0.500	169.3	1.000	251.9	1.500	344.7	2.000	447.6
0.100	110.5	0.600	185.0	1.100	269.7	1.600	364.5		
0.200	124.6	0.700	201.2	1.200	287.8	1.700	384.7		
0.300	139.1	0.800	217.7	1.300	306.4	1.800	405.2		
0.400	154.0	0.900	234.6	1.400	325.3	1.900	426.2		

Tank or Pond Manhole: HW4.6, DS/PN: 1.010

Invert Level (m) 6.820

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	480.0	0.500	603.6	1.000	741.3	1.500	893.1	2.000	1059.1
0.100	503.6	0.600	630.0	1.100	770.5	1.600	925.2	2.100	1094.0
0.200	527.7	0.700	657.0	1.200	800.3	1.700	957.8	2.133	1105.6
0.300	552.4	0.800	684.5	1.300	830.7	1.800	991.0		
0.400	577.7	0.900	712.6	1.400	861.6	1.900	1024.8		

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 2

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	19.300	Add Flow / Climate Change (%)	0
Ratio R	0.339	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Surface Network 2

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.408	4-8	0.553	8-12	0.014

Total Area Contributing (ha) = 0.975

Total Pipe Volume (m³) = 66.147

Network Design Table for Surface Network 2

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	24.886	0.080	311.1	0.097	5.00	0.0	0.600	o	450	Pipe/Conduit	
1.001	32.515	0.080	406.4	0.117	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.002	48.966	0.130	376.7	0.105	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.003	76.197	0.198	384.8	0.126	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.004	6.164	0.012	513.7	0.096	0.00	0.0	0.600	o	450	Pipe/Conduit	
2.000	14.024	0.029	483.6	0.102	5.00	0.0	0.600	o	300	Pipe/Conduit	
2.001	17.891	0.038	470.8	0.041	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.002	20.680	0.044	470.0	0.138	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.003	48.097	0.116	414.6	0.063	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)
1.000	47.22	5.36	8.000	0.097	0.0	0.0	0.0	1.15	182.5	12.4
1.001	45.30	5.90	7.920	0.214	0.0	0.0	0.0	1.00	159.4	26.3
1.002	42.82	6.69	7.840	0.319	0.0	0.0	0.0	1.04	165.6	37.0
1.003	39.50	7.92	7.710	0.445	0.0	0.0	0.0	1.03	163.9	47.6
1.004	39.22	8.03	7.512	0.541	0.0	0.0	0.0	0.89	141.6	57.5
2.000	47.34	5.33	8.127	0.102	0.0	0.0	0.0	0.71	50.1	13.1
2.001	45.83	5.75	8.098	0.143	0.0	0.0	0.0	0.72	50.8	17.8
2.002	44.23	6.22	8.060	0.281	0.0	0.0	0.0	0.72	50.8	33.7
2.003	41.82	7.03	7.868	0.344	0.0	0.0	0.0	0.99	157.8	39.0

Network Design Table for Surface Network 2

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
3.000	11.710	0.050	234.2	0.000	5.00	0.0	0.600	o	600	Pipe/Conduit	
4.000	10.783	0.067	160.3	0.000	5.00	0.0	0.600	o	150	Pipe/Conduit	
2.004	15.909	0.032	497.2	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
2.005	46.926	0.070	670.4	0.090	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.005	11.461	0.023	500.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.006	6.431	0.037	173.3	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
3.000	48.13	5.12	7.650	0.000	0.0	0.0	0.0	1.59	448.7	0.0
4.000	47.73	5.23	8.117	0.000	0.0	0.0	0.0	0.79	14.0	0.0
2.004	41.14	7.28	7.606	0.344	0.0	0.0	0.0	1.09	306.9	39.0
2.005	39.02	8.12	7.570	0.434	0.0	0.0	0.0	0.93	263.8	45.9
1.005	38.61	8.29	7.500	0.975	0.0	0.0	0.0	1.08	306.0	101.9
1.006	38.36	8.40	7.477	0.975	0.0	0.0	0.0	0.99	39.4*	101.9

PIPELINE SCHEDULES for Surface Network 2

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	450	S2.1	9.368	8.000	0.318	Open Manhole	1350
1.001	o	450	S2.2	9.692	7.920	1.322	Open Manhole	1350
1.002	o	450	S2.3	10.082	7.840	1.792	Open Manhole	1350
1.003	o	450	S2.4	9.421	7.710	1.261	Open Manhole	1350
1.004	o	450	HW2.1	8.500	7.512	0.538	Junction	
2.000	o	300	S2.6	9.520	8.127	1.093	Open Manhole	1350
2.001	o	300	S8	9.807	8.098	1.409	Open Manhole	1350
2.002	o	300	S2.7	10.170	8.060	1.810	Open Manhole	1200
2.003	o	450	S2.8	9.952	7.866	1.636	Open Manhole	1350
3.000	o	600	HW2.2	9.300	7.650	1.050	Junction	
4.000	o	150	S2	9.239	8.117	0.372	Open Manhole	1350
2.004	o	600	S2.9	9.360	7.600	1.160	Open Manhole	1500
2.005	o	600	HW2.3	9.150	7.570	0.380	Junction	
1.005	o	600	HW2.4	9.300	7.500	1.200	Junction	
1.006	o	225	HB2	9.000	7.477	1.298	Open Manhole	2400

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	24.886	311.1	S2.2	9.692	7.920	1.322	Open Manhole	1350
1.001	32.515	406.4	S2.3	10.082	7.840	1.792	Open Manhole	1350
1.002	48.966	376.7	S2.4	9.421	7.710	1.261	Open Manhole	1350
1.003	76.197	384.8	HW2.1	8.500	7.512	0.538	Junction	
1.004	6.164	513.7	HW2.4	8.300	7.500	1.350	Junction	
2.000	14.024	483.6	S8	9.807	8.098	1.409	Open Manhole	1350
2.001	17.891	470.8	S2.7	10.170	8.060	1.810	Open Manhole	1200
2.002	20.680	470.0	S2.8	9.952	8.016	1.636	Open Manhole	1350
2.003	48.097	414.6	S2.9	9.360	7.750	1.160	Open Manhole	1500
3.000	11.710	234.2	S2.9	9.360	7.600	1.160	Open Manhole	1500
4.000	10.783	160.3	S2.9	9.360	8.050	1.160	Open Manhole	1500
2.004	15.909	497.2	HW2.3	9.150	7.568	0.982	Junction	
2.005	46.926	670.4	HW2.4	9.300	7.500	1.200	Junction	
1.005	11.461	500.0	HB2	9.000	7.477	0.923	Open Manhole	2400
1.006	6.431	173.3	outfall2	8.973	7.440	1.308	Junction	

Free Flowing Outfall Details for Surface Network 2

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.006	outfall2	8.973	7.440	0.000	0	0

Simulation Criteria for Surface Network 2

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.200	Storm Duration (mins)	30
Ratio R	0.343		

Online Controls for Surface Network 2

Hydro-Brake® Optimum Manhole: HB2, DS/PN: 1.006, Volume (m³): 9.8

Unit Reference	MD-SHE-0079-3000-1200-3000
Design Head (m)	1.200
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	79
Invert Level (m)	7.477
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)	1.200	3.0	Kick-Flo®	0.707	2.4
Flush-Flo™	0.348	2.9	Mean Flow over Head Range	-	2.6

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	2.3	1.200	3.0	3.000	4.6	7.000	6.8
0.200	2.8	1.400	3.2	3.500	4.9	7.500	7.0
0.300	2.9	1.600	3.4	4.000	5.2	8.000	7.3
0.400	2.9	1.800	3.6	4.500	5.5	8.500	7.5
0.500	2.8	2.000	3.8	5.000	5.8	9.000	7.7
0.600	2.7	2.200	4.0	5.500	6.1	9.500	7.9
0.800	2.5	2.400	4.1	6.000	6.3		
1.000	2.8	2.600	4.3	6.500	6.6		

Storage Structures for Surface Network 2

Tank or Pond Manhole: HW2.2, DS/PN: 3.000

Invert Level (m) 7.650

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	122.1	0.300	236.9	0.600	360.1	0.900	490.8	1.200	629.1
0.100	159.0	0.400	277.1	0.700	402.8	1.000	536.0	1.300	676.8
0.200	197.5	0.500	318.2	0.800	446.4	1.100	582.1	1.350	701.0

Tank or Pond Manhole: HW2.4, DS/PN: 1.005

Invert Level (m) 7.500

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	103.0	0.400	266.8	0.800	446.3	1.200	640.5
0.100	142.0	0.500	310.3	0.900	493.4	1.300	691.4
0.200	182.7	0.600	354.7	1.000	541.5	1.400	743.1
0.300	224.3	0.700	400.0	1.100	590.5	1.500	795.9

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Surface Network 3

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	1	PIMP (%)	100
M5-60 (mm)	19.300	Add Flow / Climate Change (%)	0
Ratio R	0.339	Minimum Backdrop Height (m)	0.200
Maximum Rainfall (mm/hr)	50	Maximum Backdrop Height (m)	1.500
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Surface Network 3

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.437	4-8	0.868	8-12	0.023

Total Area Contributing (ha) = 1.328

Total Pipe Volume (m³) = 100.283

Network Design Table for Surface Network 3

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	25.062	0.050	501.2	0.090	5.00	0.0	0.600	o	450	Pipe/Conduit	
1.001	44.499	0.089	500.0	0.222	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.002	60.355	0.121	498.8	0.198	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.003	48.199	0.096	502.1	0.104	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.004	19.135	0.019	1000.0	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
2.000	22.045	0.049	449.9	0.130	5.00	0.0	0.600	o	450	Pipe/Conduit	
2.001	45.198	0.090	502.2	0.149	0.00	0.0	0.600	o	450	Pipe/Conduit	
2.002	12.235	0.024	509.8	0.163	0.00	0.0	0.600	o	600	Pipe/Conduit	
2.003	47.164	0.030	1572.1	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)
1.000	46.84	5.46	8.465	0.090	0.0	0.0	0.0	0.90	143.3	11.4
1.001	44.04	6.29	8.415	0.312	0.0	0.0	0.0	0.90	143.5	37.2
1.002	41.32	7.21	8.176	0.510	0.0	0.0	0.0	1.08	306.4	57.1
1.003	39.40	7.96	8.055	0.614	0.0	0.0	0.0	1.08	305.3	65.5
1.004	38.41	8.38	7.959	0.614	0.0	0.0	0.0	0.76	215.4	65.5
2.000	47.13	5.39	8.133	0.130	0.0	0.0	0.0	0.95	151.4	16.6
2.001	44.24	6.22	8.084	0.279	0.0	0.0	0.0	0.90	143.2	33.4
2.002	43.64	6.41	7.994	0.442	0.0	0.0	0.0	1.07	303.0	52.2
2.003	40.01	7.71	7.970	0.442	0.0	0.0	0.0	0.61	171.1	52.2

Network Design Table for Surface Network 3

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
3.000	29.235	0.065	449.8	0.092	5.00	0.0	0.600	o	450	Pipe/Conduit	
3.001	26.370	0.069	382.2	0.092	0.00	0.0	0.600	o	450	Pipe/Conduit	
3.002	12.105	0.057	212.4	0.088	0.00	0.0	0.600	o	450	Pipe/Conduit	
3.003	33.208	0.030	1106.9	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.005	15.567	0.020	778.3	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.006	15.102	0.070	215.7	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)
3.000	46.66	5.51	8.141	0.092	0.0	0.0	0.0	0.95	151.4	11.6
3.001	45.18	5.94	8.076	0.184	0.0	0.0	0.0	1.03	164.4	22.5
3.002	44.70	6.08	8.007	0.272	0.0	0.0	0.0	1.39	221.3	32.9
3.003	42.34	6.85	7.970	0.272	0.0	0.0	0.0	0.72	204.5	32.9
1.005	37.74	8.68	7.940	1.328	0.0	0.0	0.0	0.86	244.6	135.7
1.006	37.23	8.91	7.926	1.328	0.0	0.0	0.0	1.07	75.4*	135.7

PIPELINE SCHEDULES for Surface Network 3

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	450	S1.1	10.298	8.465	1.383	Open Manhole	1350
1.001	o	450	S1.2	9.927	8.415	1.062	Open Manhole	1350
1.002	o	600	S1.3	9.969	8.176	1.193	Open Manhole	1500
1.003	o	600	S1.5	9.531	8.055	0.876	Open Manhole	1500
1.004	o	600	HW1.1	9.300	7.959	0.741	Junction	
2.000	o	450	S1.6	9.488	8.133	0.905	Open Manhole	1350
2.001	o	450	S1.7	9.729	8.084	1.195	Open Manhole	1350
2.002	o	600	S1.9	9.328	7.994	0.734	Open Manhole	1500
2.003	o	600	HW1.2	9.300	7.970	0.730	Junction	
3.000	o	450	S3	9.794	8.141	1.193	Open Manhole	1350
3.001	o	450	S4	9.985	8.076	1.459	Open Manhole	1350
3.002	o	450	S5	9.663	8.007	1.206	Open Manhole	1350
3.003	o	600	S6	9.300	7.970	0.730	Junction	
1.005	o	600	HW1.3	9.300	7.940	0.760	Junction	
1.006	o	900	HB1	9.300	7.920	1.080	Open Manhole	2400

Downstream Manhole

PN	Length (m)	Slope (1:X)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	25.062	501.2	S1.2	9.927	8.415	1.062	Open Manhole	1350
1.001	44.499	500.0	S1.3	9.969	8.326	1.193	Open Manhole	1500
1.002	60.355	498.8	S1.5	9.531	8.055	0.876	Open Manhole	1500
1.003	48.199	502.1	HW1.1	9.300	7.959	0.741	Junction	
1.004	19.135	1000.0	HW1.3	9.300	7.940	0.760	Junction	
2.000	22.045	449.9	S1.7	9.729	8.084	1.195	Open Manhole	1350
2.001	45.198	502.2	S1.9	9.328	7.994	0.384	Open Manhole	1500
2.002	12.235	509.8	HW1.2	9.300	7.970	0.730	Junction	
2.003	47.164	1572.1	HW1.3	9.300	7.940	0.760	Junction	
3.000	29.235	449.8	S4	9.985	8.076	1.459	Open Manhole	1350
3.001	26.370	382.2	S5	9.663	8.007	1.206	Open Manhole	1350
3.002	12.105	212.4	S6	9.300	7.950	0.300	Junction	
3.003	33.208	1106.9	HW1.3	9.300	7.940	0.760	Junction	
1.005	15.567	778.3	HB1	9.200	7.920	0.780	Open Manhole	2400
1.006	15.102	215.7	outfall1	9.000	7.850	0.850	Junction	

Free Flowing Outfall Details for Surface Network 3

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.006	outfall1	9.000	7.850	0.000	0	0

Simulation Criteria for Surface Network 3

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
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 Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	1	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.200	Storm Duration (mins)	30
Ratio R	0.343		

Online Controls for Surface Network 3

Hydro-Brake® Optimum Manhole: HB1, DS/PN: 1.006, Volume (m³): 10.3

Unit Reference	MD-SHE-0082-3000-1000-3000
Design Head (m)	1.000
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	82
Invert Level (m)	7.920
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)	1.000	3.0	Kick-Flo®	0.623	2.4
Flush-Flo™	0.297	3.0	Mean Flow over Head Range	-	2.6

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	2.4	1.200	3.3	3.000	5.0	7.000	7.4
0.200	2.9	1.400	3.5	3.500	5.4	7.500	7.7
0.300	3.0	1.600	3.7	4.000	5.7	8.000	7.9
0.400	2.9	1.800	3.9	4.500	6.0	8.500	8.2
0.500	2.8	2.000	4.1	5.000	6.3	9.000	8.4
0.600	2.5	2.200	4.3	5.500	6.6	9.500	8.6
0.800	2.7	2.400	4.5	6.000	6.9		
1.000	3.0	2.600	4.7	6.500	7.2		

Storage Structures for Surface Network 3

Tank or Pond Manhole: HW1.3, DS/PN: 1.005

Invert Level (m) 7.940

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	961.0	0.400	1123.4	0.800	1295.5	1.200	1476.6	1.600	1666.6
0.100	1000.2	0.500	1165.6	0.900	1340.0	1.300	1523.2	1.700	1715.4
0.200	1040.7	0.600	1208.4	1.000	1384.9	1.400	1570.4	1.800	1764.9
0.300	1081.8	0.700	1251.7	1.100	1430.5	1.500	1618.2	1.860	1794.8

APPENDIX D

CALCULATION FOR STORM WATER NETWORK

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 19.300	Cv (Summer) 0.750
Region	England and Wales	Ratio R 0.336	Cv (Winter) 0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 45

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Pipe Flow (l/s)	Status
1.000	S3.1	15 minute 1 year Winter I+0%	9.243	8.078	-0.229	0.000	10.4	OK
1.001	S7	15 minute 1 year Winter I+0%	9.645	7.939	-0.200	0.000	10.3	OK
1.002	S3.2	15 minute 1 year Winter I+0%	9.783	7.896	-0.185	0.000	10.1	OK
1.003	S1	15 minute 1 year Winter I+0%	9.708	7.869	-0.178	0.000	17.9	OK
1.004	S3.4	15 minute 1 year Winter I+0%	9.287	7.649	-0.309	0.000	29.3	OK
1.005	S4.14	15 minute 1 year Winter I+0%	8.785	7.559	-0.250	0.000	42.7	OK
2.000	S4.13	15 minute 1 year Winter I+0%	9.547	8.075	-0.225	0.000	17.3	OK
1.006	S4.15	15 minute 1 year Winter I+0%	9.075	7.514	-0.236	0.000	59.0	OK
3.000	S4.16	15 minute 1 year Winter I+0%	9.000	7.578	-0.222	0.000	10.8	OK
1.007	S4.17	15 minute 1 year Winter I+0%	8.841	7.319	-0.376	0.000	70.6	OK
1.008	S4.18	960 minute 1 year Winter I+0%	8.500	7.277	-0.313	0.000	8.5	OK
1.009	HW4.5	960 minute 1 year Winter I+0%	8.500	7.277	-0.268	0.000	10.1	OK*
4.000	S4.1	15 minute 1 year Winter I+0%	9.119	7.685	-0.315	0.000	26.4	OK
5.000	S4.2	15 minute 1 year Winter I+0%	9.406	7.970	-0.260	0.000	6.8	OK
4.001	S4.3	120 minute 1 year Winter I+0%	9.166	7.532	-0.258	0.000	14.7	OK
4.002	S4.4	120 minute 1 year Winter I+0%	8.987	7.530	-0.190	0.000	19.5	OK
4.003	HW4.1	120 minute 1 year Winter I+0%	9.000	7.529	-0.301	0.000	19.0	OK*
6.000	S4.5	15 minute 1 year Winter I+0%	9.392	7.822	-0.228	0.000	8.4	OK
6.001	S4.6	15 minute 1 year Winter I+0%	9.262	7.717	-0.203	0.000	13.8	OK
7.000	S4.7	15 minute 1 year Winter I+0%	9.449	7.762	-0.208	0.000	13.1	OK
6.002	S4.8	120 minute 1 year Winter I+0%	9.277	7.531	-0.319	0.000	10.2	OK
6.003	S4.9	120 minute 1 year Winter I+0%	9.000	7.529	-0.191	0.000	11.3	OK
6.004	HW4.2	120 minute 1 year Winter I+0%	9.000	7.528	-0.162	0.000	10.7	OK*
4.004	HW4.3	120 minute 1 year Winter I+0%	9.000	7.528	-0.272	0.000	11.2	OK*
4.005	HB4.1	120 minute 1 year Winter I+0%	9.000	7.525	-0.245	0.000	10.0	OK
4.006	S4.10	960 minute 1 year Winter I+0%	9.098	7.278	-0.262	0.000	7.8	OK
8.000	S4.11	15 minute 1 year Winter I+0%	9.364	7.542	-0.258	0.000	6.3	OK

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Pipe Flow (l/s)	Status
4.007	S4.12	960 minute 1 year Winter I+0%	9.181	7.278	-0.238	0.000	9.5	OK
4.008	HW4.4	960 minute 1 year Winter I+0%	8.453	7.277	-0.193	0.000	9.2	OK*
1.010	HW4.6	960 minute 1 year Winter I+0%	8.730	7.277	-0.143	0.000	6.6	OK*
1.011	HB4.2	960 minute 1 year Winter I+0%	8.700	7.276	-0.124	0.000	4.5	OK
1.012	HW4.7	480 minute 1 year Winter I+0%	8.500	6.781	-0.559	0.000	4.5	OK*
1.013	HW4.8	480 minute 1 year Winter I+0%	7.500	6.540	-0.250	0.000	4.5	OK*

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 19.300	Cv (Summer) 0.750
Region	England and Wales	Ratio R 0.336	Cv (Winter) 0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 45

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Pipe Flow (l/s)	Status
1.000	S3.1	15 minute 30 year Winter I+0%	9.243	8.122	-0.185	0.000	25.4	OK
1.001	S7	15 minute 30 year Winter I+0%	9.645	8.022	-0.117	0.000	24.6	OK
1.002	S3.2	15 minute 30 year Winter I+0%	9.783	7.991	-0.090	0.000	25.5	OK
1.003	S1	15 minute 30 year Winter I+0%	9.708	7.969	-0.078	0.000	44.5	OK
1.004	S3.4	15 minute 30 year Winter I+0%	9.287	7.881	-0.077	0.000	70.5	OK
1.005	S4.14	15 minute 30 year Winter I+0%	8.785	7.813	0.004	0.000	102.4	SURCHARGED
2.000	S4.13	15 minute 30 year Winter I+0%	9.547	8.122	-0.178	0.000	42.2	OK
1.006	S4.15	1440 minute 30 year Winter I+0%	9.075	7.765	0.015	0.000	10.7	SURCHARGED
3.000	S4.16	1440 minute 30 year Winter I+0%	9.000	7.765	-0.035	0.000	1.5	OK
1.007	S4.17	1440 minute 30 year Winter I+0%	8.841	7.765	0.070	0.000	13.0	SURCHARGED
1.008	S4.18	1440 minute 30 year Winter I+0%	8.500	7.765	0.175	0.000	12.1	SURCHARGED
1.009	HW4.5	1440 minute 30 year Winter I+0%	8.500	7.545	0.000	0.000	14.4	SURCHARGED*
4.000	S4.1	120 minute 30 year Winter I+0%	9.119	8.000	0.000	0.000	23.9	OK
5.000	S4.2	15 minute 30 year Winter I+0%	9.406	7.995	-0.235	0.000	16.8	OK
4.001	S4.3	180 minute 30 year Winter I+0%	9.166	7.992	0.202	0.000	27.1	SURCHARGED
4.002	S4.4	180 minute 30 year Winter I+0%	8.987	7.990	0.270	0.000	35.4	SURCHARGED
4.003	HW4.1	480 minute 30 year Winter I+0%	9.000	7.830	0.000	0.000	16.1	SURCHARGED*
6.000	S4.5	180 minute 30 year Winter I+0%	9.392	7.994	-0.056	0.000	5.5	OK
6.001	S4.6	180 minute 30 year Winter I+0%	9.262	7.993	0.073	0.000	9.2	SURCHARGED
7.000	S4.7	180 minute 30 year Winter I+0%	9.449	7.993	0.023	0.000	8.5	SURCHARGED
6.002	S4.8	180 minute 30 year Winter I+0%	9.277	7.991	0.141	0.000	16.6	SURCHARGED
6.003	S4.9	180 minute 30 year Winter I+0%	9.000	7.989	0.269	0.000	21.8	SURCHARGED
6.004	HW4.2	2160 minute 30 year Winter I+0%	9.000	7.690	0.000	0.000	3.3	SURCHARGED*
4.004	HW4.3	180 minute 30 year Winter I+0%	9.000	7.988	0.188	0.000	12.9	SURCHARGED*
4.005	HB4.1	180 minute 30 year Winter I+0%	9.000	7.992	0.222	0.000	10.0	SURCHARGED
4.006	S4.10	1440 minute 30 year Winter I+0%	9.098	7.765	0.225	0.000	7.4	SURCHARGED
8.000	S4.11	1440 minute 30 year Winter I+0%	9.364	7.765	-0.035	0.000	0.9	OK

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 1

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Pipe Flow (l/s)	Status
4.007	S4.12	1440 minute 30 year Winter I+0%	9.181	7.765	0.250	0.000	9.3	SURCHARGED
4.008	HW4.4	5760 minute 30 year Summer I+0%	8.453	7.470	0.000	0.000	5.7	SURCHARGED*
1.010	HW4.6	1440 minute 30 year Winter I+0%	8.730	7.765	0.345	0.000	6.9	SURCHARGED*
1.011	HB4.2	1440 minute 30 year Winter I+0%	8.700	7.771	0.371	0.000	4.5	SURCHARGED
1.012	HW4.7	10080 minute 30 year Summer I+0%	8.500	6.781	-0.559	0.000	4.5	OK*
1.013	HW4.8	10080 minute 30 year Winter I+0%	7.500	6.540	-0.250	0.000	4.5	OK*

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 2 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 19.300	Cv (Summer) 0.750
Region	England and Wales	Ratio R 0.336	Cv (Winter) 0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 45

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Pipe Flow (l/s)	Status
1.000	S3.1	15 minute 100 year Winter I+45%	9.243	8.737	0.430	0.000	42.5	SURCHARGED
1.001	S7	15 minute 100 year Winter I+45%	9.645	8.638	0.499	0.000	41.6	SURCHARGED
1.002	S3.2	15 minute 100 year Winter I+45%	9.783	8.576	0.495	0.000	43.2	SURCHARGED
1.003	S1	15 minute 100 year Winter I+45%	9.798	8.546	0.439	0.000	78.3	SURCHARGED
1.004	S3.4	2160 minute 100 year Winter I+45%	9.287	8.511	0.553	0.000	6.9	SURCHARGED
1.005	S4.14	2160 minute 100 year Winter I+45%	8.785	8.511	0.702	0.000	10.4	FLOOD RISK
2.000	S4.13	2160 minute 100 year Winter I+45%	9.547	8.511	0.211	0.000	3.3	SURCHARGED
1.006	S4.15	2160 minute 100 year Winter I+45%	9.075	8.511	0.761	0.000	14.3	SURCHARGED
3.000	S4.16	2160 minute 100 year Winter I+45%	9.000	8.510	0.710	0.000	2.0	SURCHARGED
1.007	S4.17	2160 minute 100 year Winter I+45%	8.841	8.510	0.815	0.000	17.5	SURCHARGED
1.008	S4.18	2160 minute 100 year Winter I+45%	8.500	8.510	0.920	10.433	17.4	FLOOD
1.009	HW4.5	15 minute 100 year Summer I+45%	8.500	7.945	0.000	0.000	325.3	SURCHARGED*
4.000	S4.1	240 minute 100 year Winter I+45%	9.119	8.783	0.783	0.000	27.9	SURCHARGED
5.000	S4.2	240 minute 100 year Winter I+45%	9.406	8.781	0.551	0.000	6.2	SURCHARGED
4.001	S4.3	240 minute 100 year Winter I+45%	9.166	8.781	0.991	0.000	41.1	SURCHARGED
4.002	S4.4	240 minute 100 year Winter I+45%	8.987	8.779	1.059	0.000	56.1	FLOOD RISK
4.003	HW4.1	15 minute 100 year Summer I+45%	9.000	7.830	0.000	0.000	200.4	SURCHARGED*
6.000	S4.5	240 minute 100 year Winter I+45%	9.392	8.782	0.732	0.000	8.0	SURCHARGED
6.001	S4.6	240 minute 100 year Winter I+45%	9.262	8.781	0.861	0.000	13.7	SURCHARGED
7.000	S4.7	240 minute 100 year Winter I+45%	9.449	8.781	0.811	0.000	12.6	SURCHARGED
6.002	S4.8	240 minute 100 year Winter I+45%	9.277	8.780	0.930	0.000	25.8	SURCHARGED
6.003	S4.9	240 minute 100 year Winter I+45%	9.000	8.778	1.058	0.000	33.8	FLOOD RISK
6.004	HW4.2	15 minute 100 year Summer I+45%	9.000	7.690	0.000	0.000	118.5	SURCHARGED*
4.004	HW4.3	240 minute 100 year Winter I+45%	9.000	8.776	0.976	0.000	13.0	FLOOD RISK*
4.005	HB4.1	240 minute 100 year Winter I+45%	9.000	8.781	1.011	0.000	10.0	FLOOD RISK
4.006	S4.10	2160 minute 100 year Winter I+45%	9.098	8.511	0.971	0.000	8.2	SURCHARGED
8.000	S4.11	2160 minute 100 year Winter I+45%	9.364	8.511	0.711	0.000	1.1	SURCHARGED

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

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Pipe Flow (l/s)	Status
4.007	S4.12	2160 minute 100 year Winter I+45%	9.181	8.511	0.995	0.000	11.9	SURCHARGED
4.008	HW4.4	10080 minute 100 year Summer I+45%	8.453	7.470	0.000	0.000	5.7	SURCHARGED*
1.010	HW4.6	2160 minute 100 year Winter I+45%	8.730	8.510	1.090	0.000	6.0	FLOOD RISK*
1.011	HB4.2	2160 minute 100 year Winter I+45%	8.700	8.516	1.116	0.000	5.0	FLOOD RISK
1.012	HW4.7	2160 minute 100 year Winter I+45%	8.500	6.785	-0.555	0.000	5.0	OK*
1.013	HW4.8	2160 minute 100 year Winter I+45%	7.500	6.543	-0.247	0.000	5.0	OK*

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	19.300
Region	England and Wales	Ratio R	0.336
Cv (Summer)	0.750		
Cv (Winter)	0.840		

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 45

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Pipe Flow (l/s)	Status
1.000	S2.1	15 minute 1 year Winter I+0%	9.368	8.099	-0.351	0.000	12.0	OK
1.001	S2.2	15 minute 1 year Winter I+0%	9.692	8.056	-0.314	0.000	23.5	OK
1.002	S2.3	15 minute 1 year Winter I+0%	10.082	7.985	-0.305	0.000	33.1	OK
1.003	S2.4	480 minute 1 year Winter I+0%	9.421	7.891	-0.269	0.000	8.2	OK
1.004	HW2.1	480 minute 1 year Winter I+0%	8.500	7.891	-0.071	0.000	9.1	OK*
2.000	S2.6	15 minute 1 year Winter I+0%	9.520	8.296	-0.131	0.000	12.5	OK
2.001	S8	15 minute 1 year Winter I+0%	9.807	8.278	-0.120	0.000	16.3	OK
2.002	S2.7	15 minute 1 year Winter I+0%	10.170	8.253	-0.107	0.000	30.5	OK
2.003	S2.8	15 minute 1 year Winter I+0%	9.952	8.021	-0.295	0.000	36.5	OK
3.000	HW2.2	480 minute 1 year Winter I+0%	9.300	7.891	-0.359	0.000	1.6	OK*
4.000	S2	15 minute 1 year Summer I+0%	9.239	8.117	-0.150	0.000	0.0	OK
2.004	S2.9	480 minute 1 year Winter I+0%	9.360	7.891	-0.309	0.000	3.3	OK
2.005	HW2.3	480 minute 1 year Winter I+0%	9.150	7.891	-0.279	0.000	4.3	OK*
1.005	HW2.4	480 minute 1 year Winter I+0%	9.300	7.891	-0.209	0.000	4.7	OK*
1.006	HB2	600 minute 1 year Winter I+0%	9.000	7.894	0.192	0.000	2.9	SURCHARGED

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm)	19.300
Region	England and Wales	Ratio R	0.336
Cv (Summer)	0.750		
Cv (Winter)	0.840		

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 45

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Pipe Flow (l/s)	Status
1.000	S2.1	120 minute 30 year Winter I+0%	9.368	8.267	-0.183	0.000	10.4	OK
1.001	S2.2	120 minute 30 year Winter I+0%	9.692	8.264	-0.106	0.000	22.2	OK
1.002	S2.3	120 minute 30 year Winter I+0%	10.082	8.241	-0.049	0.000	31.5	OK
1.003	S2.4	960 minute 30 year Winter I+0%	9.421	8.234	0.074	0.000	10.4	SURCHARGED
1.004	HW2.1	5760 minute 30 year Winter I+0%	8.500	7.962	0.000	0.000	3.1	SURCHARGED*
2.000	S2.6	15 minute 30 year Winter I+0%	9.520	8.553	0.126	0.000	31.4	SURCHARGED
2.001	S3	15 minute 30 year Winter I+0%	9.807	8.524	0.126	0.000	44.2	SURCHARGED
2.002	S2.7	15 minute 30 year Winter I+0%	10.170	8.480	0.120	0.000	85.8	SURCHARGED
2.003	S2.8	960 minute 30 year Winter I+0%	9.952	8.234	-0.082	0.000	8.2	OK
3.000	HW2.2	960 minute 30 year Winter I+0%	9.300	8.234	-0.016	0.000	1.2	OK*
4.000	S2	960 minute 30 year Winter I+0%	9.239	8.234	-0.034	0.000	0.0	OK
2.004	S2.9	960 minute 30 year Winter I+0%	9.360	8.234	0.034	0.000	1.8	SURCHARGED
2.005	HW2.3	2160 minute 30 year Winter I+0%	9.150	8.170	0.000	0.000	2.3	SURCHARGED*
1.005	HW2.4	960 minute 30 year Winter I+0%	9.300	8.234	0.134	0.000	5.4	SURCHARGED*
1.006	HB2	960 minute 30 year Winter I+0%	9.000	8.238	0.535	0.000	2.9	SURCHARGED

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 2

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 2 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 19.300	Cv (Summer) 0.750
Region	England and Wales	Ratio R 0.336	Cv (Winter) 0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 45

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Pipe Flow (l/s)	Status
1.000	S2.1	15 minute 100 year Winter I+45%	9.368	8.707	0.257	0.000	52.0	SURCHARGED
1.001	S2.2	15 minute 100 year Winter I+45%	9.692	8.688	0.318	0.000	110.4	SURCHARGED
1.002	S2.3	1440 minute 100 year Winter I+45%	10.082	8.681	0.391	0.000	10.3	SURCHARGED
1.003	S2.4	1440 minute 100 year Winter I+45%	9.421	8.681	0.521	0.000	14.2	SURCHARGED
1.004	HW2.1	15 minute 100 year Summer I+45%	8.500	7.962	0.000	0.000	202.8	SURCHARGED*
2.000	S2.6	15 minute 100 year Winter I+45%	9.520	9.163	0.736	0.000	98.5	SURCHARGED
2.001	S8	15 minute 100 year Winter I+45%	9.807	9.108	0.710	0.000	80.9	SURCHARGED
2.002	S2.7	15 minute 100 year Winter I+45%	10.170	8.979	0.619	0.000	156.8	SURCHARGED
2.003	S2.8	1440 minute 100 year Winter I+45%	9.952	8.680	0.364	0.000	11.1	SURCHARGED
3.000	HW2.2	1440 minute 100 year Winter I+45%	9.300	8.680	0.430	0.000	1.6	SURCHARGED*
4.000	S2	1440 minute 100 year Winter I+45%	9.239	8.680	0.413	0.000	0.0	SURCHARGED
2.004	S2.9	1440 minute 100 year Winter I+45%	9.360	8.681	0.481	0.000	1.9	SURCHARGED
2.005	HW2.3	10080 minute 100 year Summer I+45%	9.150	8.170	0.000	0.000	2.5	SURCHARGED*
1.005	HW2.4	1440 minute 100 year Winter I+45%	9.300	8.681	0.581	0.000	5.8	SURCHARGED*
1.006	HB2	1440 minute 100 year Winter I+45%	9.000	8.685	0.983	0.000	3.0	SURCHARGED

1 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 19.300	Cv (Summer) 0.750
Region	England and Wales	Ratio R 0.336	Cv (Winter) 0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 45

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Pipe Flow (l/s)	Status
1.000	S1.1	15 minute 1 year Winter I+0%	10.298	8.595	-0.320	0.000	11.1	OK
1.001	S1.2	15 minute 1 year Winter I+0%	9.927	8.573	-0.292	0.000	34.6	OK
1.002	S1.3	15 minute 1 year Winter I+0%	9.969	8.369	-0.407	0.000	52.3	OK
1.003	S1.5	15 minute 1 year Winter I+0%	9.531	8.277	-0.378	0.000	55.7	OK
1.004	HW1.1	15 minute 1 year Winter I+0%	9.300	8.217	-0.343	0.000	53.5	OK*
2.000	S1.6	15 minute 1 year Winter I+0%	9.488	8.283	-0.300	0.000	15.9	OK
2.001	S1.7	15 minute 1 year Winter I+0%	9.729	8.263	-0.271	0.000	29.8	OK
2.002	S1.9	15 minute 1 year Winter I+0%	9.328	8.214	-0.380	0.000	44.8	OK
2.003	HW1.2	1440 minute 1 year Winter I+0%	9.300	8.169	-0.401	0.000	3.8	OK*
3.000	S3	15 minute 1 year Winter I+0%	9.784	8.249	-0.342	0.000	11.3	OK
3.001	S4	15 minute 1 year Winter I+0%	9.985	8.208	-0.318	0.000	20.1	OK
3.002	S5	1440 minute 1 year Winter I+0%	9.663	8.169	-0.288	0.000	2.4	OK
3.003	S6	1440 minute 1 year Winter I+0%	9.300	8.169	-0.401	0.000	2.3	OK*
1.005	HW1.3	1440 minute 1 year Winter I+0%	9.300	8.169	-0.371	0.000	4.8	OK*
1.006	HB1	1440 minute 1 year Winter I+0%	9.300	8.172	-0.048	0.000	3.0	OK

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 19.300	Cv (Summer) 0.750
Region	England and Wales	Ratio R 0.336	Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 45

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Pipe Flow (l/s)	Status
1.000	S1.1	15 minute 30 year Winter I+0%	10.298	8.744	-0.171	0.000	27.5	OK
1.001	S1.2	15 minute 30 year Winter I+0%	9.927	8.714	-0.151	0.000	94.6	OK
1.002	S1.3	15 minute 30 year Winter I+0%	9.969	8.532	-0.244	0.000	138.6	OK
1.003	S1.5	15 minute 30 year Winter I+0%	9.531	8.469	-0.186	0.000	143.4	OK
1.004	HW1.1	1440 minute 30 year Winter I+0%	9.300	8.441	-0.118	0.000	10.0	OK*
2.000	S1.6	15 minute 30 year Winter I+0%	9.488	8.504	-0.079	0.000	38.3	OK
2.001	S1.7	15 minute 30 year Winter I+0%	9.729	8.460	-0.074	0.000	77.3	OK
2.002	S1.9	1440 minute 30 year Winter I+0%	9.328	8.441	-0.153	0.000	7.3	OK
2.003	HW1.2	1440 minute 30 year Winter I+0%	9.300	8.441	-0.129	0.000	7.2	OK*
3.000	S3	1440 minute 30 year Winter I+0%	9.784	8.441	-0.150	0.000	1.6	OK
3.001	S4	1440 minute 30 year Winter I+0%	9.985	8.441	-0.085	0.000	3.0	OK
3.002	S5	1440 minute 30 year Winter I+0%	9.663	8.441	-0.016	0.000	4.4	OK
3.003	S6	1440 minute 30 year Winter I+0%	9.300	8.441	-0.129	0.000	4.3	OK*
1.005	HW1.3	1440 minute 30 year Winter I+0%	9.300	8.441	-0.099	0.000	3.8	OK*
1.006	HB1	1440 minute 30 year Winter I+0%	9.300	8.443	0.223	0.000	3.0	SURCHARGED

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Surface Network 3

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FSR	M5-60 (mm) 19.300	Cv (Summer) 0.750
Region	England and Wales	Ratio R 0.336	Cv (Winter) 0.840

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

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	1, 30, 100
Climate Change (%)	0, 0, 45

PN	US/MH Name	Event	US/CL (m)	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Pipe Flow (l/s)	Status
1.000	S1.1	15 minute 100 year Winter I+45%	10.298	8.985	0.070	0.000	50.7	SURCHARGED
1.001	S1.2	15 minute 100 year Winter I+45%	9.927	8.964	0.039	0.000	175.4	SURCHARGED
1.002	S1.3	2880 minute 100 year Winter I+45%	9.969	8.938	0.162	0.000	9.2	SURCHARGED
1.003	S1.5	2880 minute 100 year Winter I+45%	9.531	8.938	0.283	0.000	11.0	SURCHARGED
1.004	HW1.1	10080 minute 100 year Summer I+45%	9.300	8.559	0.000	0.000	5.5	SURCHARGED*
2.000	S1.6	2880 minute 100 year Winter I+45%	9.488	8.938	0.355	0.000	2.4	SURCHARGED
2.001	S1.7	2880 minute 100 year Winter I+45%	9.729	8.938	0.404	0.000	5.3	SURCHARGED
2.002	S1.9	2880 minute 100 year Winter I+45%	9.328	8.938	0.344	0.000	8.3	SURCHARGED
2.003	HW1.2	15 minute 100 year Summer I+45%	9.300	8.570	0.000	0.000	224.7	SURCHARGED*
3.000	S3	2880 minute 100 year Winter I+45%	9.784	8.938	0.347	0.000	1.7	SURCHARGED
3.001	S4	2880 minute 100 year Winter I+45%	9.985	8.938	0.412	0.000	3.5	SURCHARGED
3.002	S5	2880 minute 100 year Winter I+45%	9.663	8.938	0.481	0.000	5.1	SURCHARGED
3.003	S6	10080 minute 100 year Summer I+45%	9.300	8.570	0.000	0.000	2.4	SURCHARGED*
1.005	HW1.3	2880 minute 100 year Winter I+45%	9.300	8.938	0.398	0.000	9.5	SURCHARGED*
1.006	HB1	2880 minute 100 year Winter I+45%	9.300	8.980	0.760	0.000	3.0	SURCHARGED