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The Ridge,
Haverhill Business Park

Plots SE2, NE1 and NE2
SW DRAINAGE STRATEGY

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APPENDICES

1.0 Introduction

The Drainage Strategy has been prepared in support of a Reserved Matters planning application at Haverhill Business Park.

The site currently has outline consent DC/15/2424/OUT for an industrial development. The Drainage Assessment for the Outline Application was described in Baynham Meikle Partnership report NSB/12070/FRA Dated 26th November 2015, which identified discharge rates and outfall locations to the local Anglian Water Adopted SW sewer network.

This Drainage Strategy covers the proposed drainage for Plots SE2, NE1 and NE2. Revision 2 of this document has been updated to suit revised unit layout on the NE2 plot.

In the preparation of this document, reference has been made to Suffolk Flood Risk Management Partnership document Sustainable Drainage Systems (SuDS) a Local Design Guide to determine allowable discharge rates.

2.0 Site Context

2.1 Site Location.

The site comprised 2 development plots north and south of Iceni Way, Haverhill at Grid Reference TL67844424. The sites are shown in Figure 1.

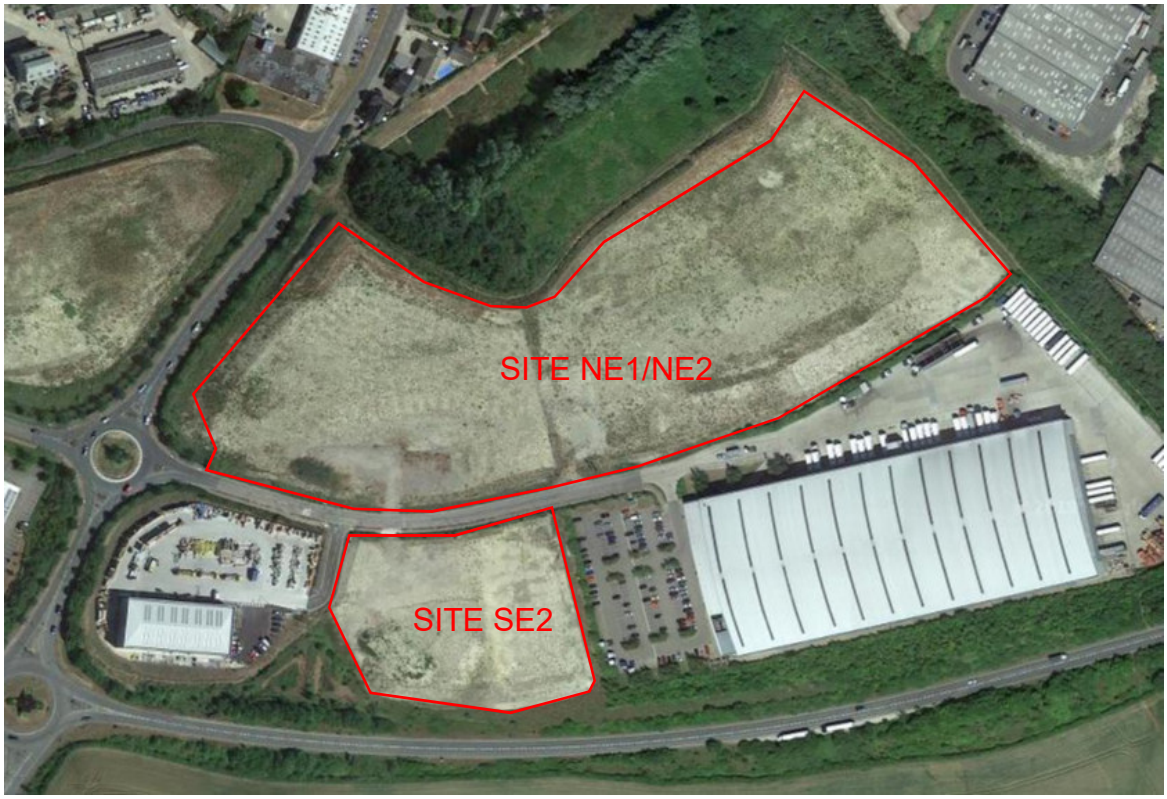

Figure 1 - SIte Boundary

Reference should be made to the Ground Investigation Report for historical and current land use.

In summary, the site forms part of a wider business park development. Development Plots SE2 and NE1/NE2 have been subject to previous earthworks and remediation. The site is now characterized by generally level plateaued ground with freshly exposed clayey soils at surface. Steep slopes bound the NE1/2 site to the north and west.

The NE1/NE2 site is bounded to the north by an ecological area, and the east by dense vegetation and footpath. To the west is Bumpstead Road with Iceni Way to the South.

SE2 plot is bounded to the north by Iceni Way, the west and east by previous phases of development and to the south by A1017 Haverhill Bypass.

2.2 Site Geology/ Hydrogeology

Reference should be made to the geo-environmental reports for details of the site geology.

In summary, the site comprises reworked natural fill comprising firm to stiff brown clays with varying degrees of sands and gravels. This is underlain by a natural strata of the Lowestoft Formation, a firm to stiff brown clay with varying degrees of sands and gravels, below which is the Lewes Nodular Chalk formation of the Seaford Nodular Chalk formation.

In terms of Groundwater Vulnerability, the underlying bedrock geology strata is classed as a ‘Principal Aquifer’.

The overlying Superficial Deposits is classed as Secondary A/ Secondary (undifferentiated).

The NE1/2 site is not within a Source Protection Zone. The SE2 site is in Groundwater Source Protection Zone 3.

3.0 Impermeable Area

Figure 2 shows the development proposals, with a total site area of 5.6Ha. The site current has no impermeable area.

Figure 2 - Site Plan

4.0 Drainage Strategy

4.1 Hierarchy of Disposal

Generally the aim should be to discharge surface water run-off as high up the following hierarchy of drainage options as reasonably practicable.

- Into the ground (infiltration).
- To a surface water body.
- To a surface water sewer, highway drain, or other drainage system.
- To a combined sewer.

Infiltration

As assessment of the potential suitability of the prevailing ground conditions for constructing soakaways to deal with surface water drainage has not been carried out to date. However, the described CLAY soils are likely to be encountered to significant depth.

The ground conditions would therefore suggest that soakaways are not a suitable option for dealing with surface water drainage.

Water Body

There are no accessible water bodies running through or adjacent to the site. However the network of Anglian Water surface water sewers running in Iceni Way and Bumpstead road discharges to a balancing pond in the ecological are to the north of the NE1/NE2 site.

Surface Water Sewer/Combined Sewer

Surface water sewers run along Iceni Way and Bumpstead Road.

Anglian Water have previously consented to the discharge of surface water from these development plots into the sewer network as part of the outline consent for the development of the business park. A developer enquiry will be made to confirm the proposed discharge rates presented in this report, which are lower than previously agreed.

Current proposals are therefore to connect to public sewers in Iceni Way and Bumpstead Road subject to a Section 106 application for connection.

4.2 Climate Change

The site will need to consider the potential future impacts of climate change on peak rainfall intensity to understand the effects of discharge from the site. The site drainage will therefore be designed in accordance with accommodate the 1 in 100 year event + climate change. The network has been modelled for the 100yr return period with a climate change allowance of 20%. The sensitivity of a 40% climate change allowance has also been assessed.

4.3 Discharge Rates

In accordance with Section 5 of the Suffolk Surface Water Drainage (SuDS) Guidance discharge rates from the site will be limited to Qbar or 2 l/s / Ha whichever is higher for all return periods up to the critical 100yr +CC.

Qbar calculations using ICP SuDS are included at Appendix A and summarized in Table 1.

Site SE2 Qbar (l/s)	3.0
Site NE1/2 Qbar (l/s)	13.1

Table 1 - Qbar Rates

Ordinarily, discharge rates less the 5l/s would be set at 5 l/s to minimize the risk of blockages. However, as part of the Reserved Matters application and consent for the Builders Merchant on the adjacent Plot SE1, Anglian Water have previously accepted a combined discharge rate of 7 l/s for SE1 and SE2. SE1 discharges 3.5 l/s with 3.5l /s reserved for plot SE2. It is therefore proposed to discharge surface water from SE at 3.5 l/s.

Plots NE1 and NE2 generally sit at 2 separate plateau levels. Each site therefore will have a separate flow control device with each unit having their own attenuation storage. The final outfall will be control by a Hydrobrake at 13.1l/s

4.4 Drainage Network

A preliminary drainage layout is shown on drawing 2018-294-121 P1 (Appendix B).

The 2 SW drainage networks have been designed in accordance with the design principles in Section 5 of the Suffolk Surface Water Drainage (SuDS) Guidance, i.e.

- Not increase flood risk off site (in all events up to 100 year return period);
- No flooding inside buildings in events up to a 100 year return period and no flooding in other areas (apart from designated flood paths /storage areas) in events up to 30 year return period

The principles of the design are to ensure that below ground attenuation tanks will store all surface water up to the 30 year return period. The loading docks will be utilised to temporarily contain water in excess of the 30 year return period with negligible flooding, other than in the loading docks, up to the 1 in 100 year return period.

Microdrainage Network Details and Simulation results are included at Appendix C1 and C2

For the SE2 plot, the results demonstrate

- No flooding for the 30 year return period.
- Negligible flooding for the 100 year return period within the porous paving
- For the 100 year return period plus 20% climate change there is 7m3 flooding at MH 14. Overland flow routing directs this away from the building and into the low point of Iceni Way. There will be sufficient capacity to contain this volume of water without risk to buildings. Additional Flooding at MH 10/11 (porous paving) will be contained within the car park

- For the 100 year plus 20% and 40% climate change events the principle flooding occurs near the outfall. Again, this is directed away from buildings to Iceni Way.

For NE1/2 Plots, the loading docks have been modelled as surface ponds and the simulation results demonstrate:

- No flooding for the 30 year return period.
- No flooding for the 100 year return period with surface water backing up into the loading docks.
- For the 100 return period with 20% and 40% climate change allowances flooding occurs generally across the site. Overland flow routes ensure that this flooding is directed to the car park areas and the additional capacity in loading docks and low points of service yards where it can be temporarily contained before draining back into the system.

5.0 Maintenance of SuDS Features

The maintenance regime of the drainage system, attenuation tank and oil separator will be provided to the end user in the form of Operation and Maintenance Manuals to ensure that the SuDS features continue to operate in the manner intended.

The attenuation tank will be subject to the maintenance schedule detailed in Table 2.

Monthly	Inspect upsteam catchpit for silt. Clean out if necessary using vacuum tanker.
Six monthly	Remove sediment from the inlet catchpit with a vacuum tanker twice a year as necessary, ideally at the start of Spring when general landscaping tidying up is carried out after winter damage and autumn leaf fall.
Annually	Annually inspect/check all sumps, inlets, outlets, vents to tanks to ensure that they are in good condition and operating as designed. Inspect distribution pipe by CCTV and if necessary clean out.
Remediation Inspection & tasks following significant storm events	Inspect upsteam and downstream manholes for silt and debris. Clean out as necessary using vacuum tanker.
Contingency plan details	Exceedance flows as defined in the Drainage Strategy Drawing.

Table 2 - Attenuation Tank Typical Maintenance Schedule

Permeable block paving will be subject to the maintenance schedule detailed in Table 3.

Six monthly	Brushing and vacuuming to manufacturer requirements. Re-grit where necessary after brushing.
Annually	Inspect infiltration surface for excessive siltation.
As Required	After significant storm events inspect / check surface and overflows (where specified) to ensure they are in good condition, free from blockages and operating as designed. Removal of weeds where required. Regularly Remove Leaf Fall in Autumn
Contingency plan details	Exceedance flows as defined in the Drainage Strategy Drawing.

Table 3 – Permeable Paving Typical Maintenance Schedule

Maintenance of the oil separator will be in accordance with the manufacturers' details to be incorporated in the Operation and Maintenance Manuals.

At the time of writing, no end user has been identified. Contact details for the person responsible for maintenance will be provided, when known.

6.0 Water Quality

Permeable paving has been used in parking areas to provide initial treatment. Water quality provision in service yards will be proved by class 1 full retention separators.

Both site discharge to the Anglian water surface water sewer network which in turn discharges to an existing balancing pond off site to the north. The final outfall from this pond is unknown.

In accordance with the simple index approach used in the SuDS Manual, the provision of permeable paving and oil separators on site as the initial treatment, together with the existing balancing pond off site ensures that the hazard mitigation index exceeds the hazard risk rating.

A summary of the Risk and Hazard ratings are shown below.

Hazard	Commercial Yard Hazard Index	Full Retention Separator Mitigation	Car Pak Hazard Index	Porous Subbase SuDS Mitigation Index	Balancing Pond
Total suspended solids (TSS)	0.7	-	0.5	0.7	0.7
Metals	0.6	-	0.4	0.6	0.7
Hydrocarbons	0.7		0.4	0.7	0.5

APPENDICES

Appendix A – Greenfield Rates
Appendix B – Drainage Strategy Plan
Appendix C – Microdrainage Calculations
1. Plot SE2
2. Plot NE1/2

Appendix A – Greenfield Rates

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.400
Area (ha)	1.060	Urban	0.000
SAAR (mm)	600	Region Number	Region 6

Results l/s

QBAR Rural	3.0
QBAR Urban	3.0
Q1 year	2.6
Q1 year	2.6
Q30 years	6.8
Q100 years	9.6

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.400
Area (ha)	4.600	Urban	0.000
SAAR (mm)	600	Region Number	Region 6

Results l/s

QBAR Rural	13.1
QBAR Urban	13.1
Q1 year	11.1
Q1 year	11.1
Q30 years	29.6
Q100 years	41.7

Appendix B – Drawings

- 2018-294-121 P2 100k Unit Drainage Strategy

N

Saguenay

31

37

Existing Balancing Pond

Footpath (unmade)

Dismantled Railway

Existing FOOTPATH

New public footpath 2.0m wide

New link footpath 2.0m wide

BUMPSTEAD ROAD

...IONS BUMPSTEAD ROAD

A1017 HAVERHILL BYPASS

A 1017

HOLMSWAY

Cellular Storage Tank 360m³

Flow Control 13.1 l/s

1in100+ 0%– 50m³– 222mm deep (Dock)
1in100+20%– 207m³– 571mm deep (Dock)
1in100+40%– 425m³– 918mm deep (Dock)
132mm deep (Yard)

Acs QMAX 150

Acs QMAX 225

Min 40m Service Yard with a 25m dia. Turning Circle

Siph

4 No Dock Levellers Loading Dock Providing Storage > 30 Yr Return Period

Waste/Recycle Store

2 No Level Access Doors

Unit 3

PLOT 3 IMPERMEABLE AREA 10289 m2

1in100+20%–1.3m³–21mm deep
1in100+40%–3.9m³–37mm deep

1st Floor office

Parking 99 + 4 Dis

1in100+20%–1.4m³–<3mm
1in100+40%–3.6m³–9mm

New 800Kva Substation

Unit 4

PLOT 4 IMPERMEABLE AREA 3902 m2

2 No Level Access Doors

Full Retention Interceptor

Parking 34 + 2 Dis

1in100+20%–0.2m³–7mm deep
1in100+40%–8m³– 78mm deep

Cellular Storage Tank 240m³

Unit 2

PLOT 2 IMPERMEABLE AREA 4320 m2

2 No Level Access Doors

1in100+40%–1m³–64mm deep

Parking 30 + 2 Dis

35m Service Yard with a 25m dia. Turning Circle

Cellular Storage Tank 103m³

NE2 Flow Control 4 l/s

New 800Kva Substation

New 300Kva Landlords Supply

1in100+20%–<1m³–19mm deep
1in100+40%–15m³–109mm deep

Parking 114 + 3 Dis

Cellular Storage Tank 70m³

Waste/Recycle Store

1in100+40%– 3m³–80mm deep

50m Service Yard with a 25m dia. Turning Circle

1in100+ 0%– 250m³– 302mm deep (Dock)
1in100+20%– 495m³– 494mm deep (Dock)
1in100+40%– 752m³– 662mm deep (Dock)

Level Access Door

Unit 1

PLOT 1 IMPERMEABLE AREA 16770 m2

8 No Dock Levellers

1st Floor office

Rear Unit 2
1in100+20%–<1m³
1in100+40%–3.9m³

1in100+20%– 4m³– 3mm deep (Landscaping)
1in100+40%– 15m³– 38mm deep (Landscaping)

Test Tower

Siph

Flow Control 3.5 l/s

Cellular Storage tank 450m³

1in100+20%–7.2m³
1in100+40%–88m³

1in100+20%– 5.5m³– 13mm deep
1in100+40%– 89m³– 36mm deep

Parking 89 + 3

Unit 5

PLOT 5 IMPERMEABLE AREA 8575 m2

3 No Level Access Doors

1in100+20%–1.7m³–25mm deep
1in100+40%–5m³–40mm deep

40m Service Yard with a 25m dia. Turning Circle

Waste/Recycle Store

Ponds

Drain

Lay-by

El Sub Sta

CL 81.850
IL 78.825

CL 81.67
IL 77.495

CL 79.71
IL 76.92

CL 79.77
IL 76.57

CL 79.47
IL 77.77

CL 80.18
IL 77.675

CL 80.45
IL 77.155

CL 79.78
IL 76.88

CL 80.06
IL 77.055

1500

0 10.0 20.0 30.0 40.0 50.0m
1:500

LEGEND:

- Existing Foul Manhole & Sewer
- Existing Surface Water Manhole & Sewer
- Proposed Foul Manhole & Sewer
- Proposed Surface Water Manhole & Sewer
- Bypass Interceptor
- Drainage Channel
- Gulley
- Permeable Paving
- Cellular Attenuation Tank
- 1 in 100yr flood Outline
- 1 in 100yr + 20% flood Outline
- 1 in 100yr + 40% flood outline
- Exceedance Flow Route

NOLAN ASSOCIATES

PRELIMINARY DRAWING

NOT TO BE USED FOR CONSTRUCTION

REV	DESCRIPTION	BY	CHKD	DATE
P2	General Update	...	KP	13.1.20
P1	PRELIMINARY	...	KP	16.12.19

The Ridge
Haverhill

Drainage Strategy 100k Scheme
General Arrangement

Trebor Developments

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Drawn by	Date	Plot Date	Scale
.	03.05.19	3.05.19	1:500@A0
Checked by	Project No		Dwg No
KP	2018–294		121 P2

Nolan Associates
consulting civil and structural engineers

Appendix C1 – Plot SE1 Microdrainage Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	100	PIMP (%)	100
M5-60 (mm)	20.500	Add Flow / Climate Change (%)	0
Ratio R	0.418	Minimum Backdrop Height (m)	2.000
Maximum Rainfall (mm/hr)	100	Maximum Backdrop Height (m)	2.000
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 Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	35.930	0.363	99.0	0.054	5.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	36.548	0.262	139.6	0.108	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	61.012	0.253	241.6	0.054	0.00	0.0	0.600	o	300	Pipe/Conduit	
2.000	1.715	0.007	241.6	0.212	5.00	0.0	0.600	o	300	Pipe/Conduit	
2.001	10.784	0.720	15.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.003	3.819	0.013	289.7	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
3.000	36.198	0.366	99.0	0.054	5.00	0.0	0.600	o	150	Pipe/Conduit	
3.001	36.757	0.525	70.0	0.108	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	100.00	5.59	80.650	0.054	0.0	0.0	0.0	1.01	17.8	14.6
1.001	100.00	6.14	80.212	0.162	0.0	0.0	0.0	1.10	43.9	43.9
1.002	100.00	7.15	79.875	0.216	0.0	0.0	0.0	1.01	71.2	58.5
2.000	100.00	5.03	80.350	0.212	0.0	0.0	0.0	1.01	71.2	57.4
2.001	100.00	5.07	80.343	0.212	0.0	0.0	0.0	4.08	288.6	57.4
1.003	100.00	7.21	79.548	0.428	0.0	0.0	0.0	1.06	117.0	115.9
3.000	100.00	5.60	80.650	0.054	0.0	0.0	0.0	1.01	17.8	14.6
3.001	100.00	5.99	80.209	0.162	0.0	0.0	0.0	1.56	62.2	43.9

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.004	9.740	0.029	333.7	0.054	0.00	0.0	0.600	o	450	Pipe/Conduit	
4.000	1.181	0.023	50.5	0.149	5.00	0.0	0.600	o	225	Pipe/Conduit	
5.000	2.323	0.023	99.3	0.040	5.00	0.0	0.600	o	150	Pipe/Conduit	
4.001	5.750	0.024	241.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	30.870	0.068	454.0	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
6.000	6.472	0.111	58.5	0.023	5.00	0.0	0.600	o	100	Pipe/Conduit	
1.006	16.849	0.862	19.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.004	100.00	7.36	79.460	0.644	0.0	0.0	0.0	1.11	176.1	174.4
4.000	100.00	5.01	80.150	0.149	0.0	0.0	0.0	1.85	73.4	40.4
5.000	100.00	5.04	80.225	0.040	0.0	0.0	0.0	1.01	17.8	10.8
4.001	100.00	5.13	80.052	0.189	0.0	0.0	0.0	1.01	71.1	51.2
1.005	100.00	7.90	78.600	0.833	0.0	0.0	0.0	0.95	150.7«	225.6
6.000	100.00	5.11	79.300	0.023	0.0	0.0	0.0	1.01	7.9	6.2
1.006	100.00	8.03	78.532	0.856	0.0	0.0	0.0	2.29	40.4«	231.8

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.006	16	79.780	77.670	76.880	1200	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet 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	3
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.500	Storm Duration (mins)	30
Ratio R	0.418		

Online Controls for Storm

Complex Manhole: 12, DS/PN: 4.001, Volume (m³): 1.5

Orifice

Diameter (m) 0.042 Discharge Coefficient 0.600 Invert Level (m) 80.052

Weir

Discharge Coef 0.544 Width (m) 1.200 Invert Level (m) 81.232

Hydro-Brake® Optimum Manhole: 15, DS/PN: 1.006, Volume (m³): 9.3

Unit Reference	MD-SHE-0084-3500-1300-3500
Design Head (m)	1.300
Design Flow (l/s)	3.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	84
Invert Level (m)	78.532
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.300	3.5
Flush-Flo™	0.368	3.4
Kick-Flo®	0.751	2.7
Mean Flow over Head Range	-	3.0

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	2.5	1.200	3.4	3.000	5.1	7.000	7.7
0.200	3.2	1.400	3.6	3.500	5.5	7.500	7.9
0.300	3.4	1.600	3.8	4.000	5.9	8.000	8.2
0.400	3.4	1.800	4.1	4.500	6.2	8.500	8.4
0.500	3.3	2.000	4.3	5.000	6.5	9.000	8.7
0.600	3.2	2.200	4.5	5.500	6.8	9.500	8.9
0.800	2.8	2.400	4.6	6.000	7.1		
1.000	3.1	2.600	4.8	6.500	7.4		

Storage Structures for Storm

Porous Car Park Manhole: 10, DS/PN: 4.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	4.8
Membrane Percolation (mm/hr)	1000	Length (m)	69.6
Max Percolation (l/s)	92.8	Slope (1:X)	2000.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	80.815	Membrane Depth (mm)	160

Porous Car Park Manhole: 11, DS/PN: 5.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	4.8
Membrane Percolation (mm/hr)	1000	Length (m)	16.8
Max Percolation (l/s)	22.4	Slope (1:X)	2000.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	80.815	Membrane Depth (mm)	160

Cellular Storage Manhole: 15, DS/PN: 1.006

Invert Level (m)	78.700	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	280.0	280.0	1.601	0.0	387.1
1.600	280.0	387.1			

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.418
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.500	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, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	30, 100
Climate Change (%)	0, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Winter	30	+0%	30/15 Summer	100/15 Summer		
1.001	2	15 Winter	30	+0%	30/15 Summer			
1.002	3	15 Winter	30	+0%	30/15 Summer			
2.000	4	15 Winter	30	+0%	30/15 Summer			
2.001	5	15 Winter	30	+0%				
1.003	6	15 Winter	30	+0%	30/15 Summer			
3.000	7	15 Winter	30	+0%	30/15 Summer			
3.001	8	15 Winter	30	+0%	30/15 Summer			
1.004	9	15 Winter	30	+0%	30/15 Summer			
4.000	10	120 Winter	30	+0%	30/15 Summer	100/30 Winter		
5.000	11	120 Winter	30	+0%	30/15 Summer	100/30 Winter		
4.001	12	120 Winter	30	+0%	30/15 Summer			
1.005	13	600 Winter	30	+0%	30/15 Summer			
6.000	14	600 Winter	30	+0%	30/15 Summer	100/720 Winter		
1.006	15	600 Winter	30	+0%	30/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	81.000	0.200	0.000	0.97		16.7	SURCHARGED	3
1.001	2	80.686	0.249	0.000	1.18		48.8	SURCHARGED	
1.002	3	80.337	0.161	0.000	0.92		62.1	SURCHARGED	
2.000	4	80.722	0.072	0.000	1.37		75.2	SURCHARGED	
2.001	5	80.467	-0.176	0.000	0.35		74.7	OK	
1.003	6	80.104	0.181	0.000	1.64		132.1	SURCHARGED	
3.000	7	80.844	0.044	0.000	1.04		18.0	SURCHARGED	
3.001	8	80.448	0.014	0.000	0.93		54.7	SURCHARGED	
1.004	9	79.990	0.080	0.000	1.73		200.1	SURCHARGED	
4.000	10	81.082	0.707	0.000	0.12		3.7	FLOOD RISK	7
5.000	11	81.081	0.706	0.000	0.09		1.0	FLOOD RISK	7
4.001	12	81.117	0.765	0.000	0.08		3.7	FLOOD RISK	
1.005	13	79.704	0.654	0.000	0.18		23.7	SURCHARGED	
6.000	14	79.702	0.302	0.000	0.10		0.7	SURCHARGED	2
1.006	15	79.702	1.020	0.000	0.09		3.4	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet 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	3
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.418
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.500	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, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	0

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Winter	100	+0%	100/15 Summer			
1.001	2	15 Winter	100	+0%	100/15 Summer			
1.002	3	15 Winter	100	+0%	100/15 Summer			
2.000	4	15 Winter	100	+0%	100/15 Summer			
2.001	5	15 Winter	100	+0%				
1.003	6	15 Winter	100	+0%	100/15 Summer			
3.000	7	15 Winter	100	+0%	100/15 Summer			
3.001	8	15 Winter	100	+0%	100/15 Summer			
1.004	9	15 Winter	100	+0%	100/15 Summer			
4.000	10	60 Winter	100	+0%	100/15 Summer	100/60 Winter		
5.000	11	60 Winter	100	+0%	100/15 Summer	100/60 Winter		
4.001	12	60 Winter	100	+0%	100/15 Summer			
1.005	13	720 Winter	100	+0%	100/15 Summer			
6.000	14	720 Winter	100	+0%	100/15 Summer			
1.006	15	720 Winter	100	+0%	100/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	81.537	0.737	0.000	1.24		21.3	FLOOD RISK	
1.001	2	81.139	0.702	0.000	1.40		58.1	SURCHARGED	
1.002	3	80.607	0.432	0.000	1.12		75.9	SURCHARGED	
2.000	4	80.787	0.137	0.000	1.77		97.2	SURCHARGED	
2.001	5	80.487	-0.156	0.000	0.46		97.2	OK	
1.003	6	80.251	0.329	0.000	2.08		166.9	SURCHARGED	
3.000	7	81.239	0.439	0.000	1.27		21.8	SURCHARGED	
3.001	8	80.701	0.267	0.000	1.09		64.2	SURCHARGED	
1.004	9	80.066	0.156	0.000	2.18		252.1	SURCHARGED	
4.000	10	81.275	0.900	0.054	0.51		15.2	FLOOD	1
5.000	11	81.275	0.900	0.034	0.39		4.2	FLOOD	1
4.001	12	81.270	0.919	0.000	0.40		19.4	FLOOD RISK	
1.005	13	80.039	0.989	0.000	0.20		26.1	SURCHARGED	
6.000	14	80.038	0.638	0.000	0.11		0.8	FLOOD RISK	
1.006	15	80.038	1.356	0.000	0.10		3.7	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet 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	3
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.418
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.500	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, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	30, 100
Climate Change (%)	0, 20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Winter	100	+20%	30/15 Summer	100/15 Summer		
1.001	2	15 Winter	100	+20%	30/15 Summer			
1.002	3	15 Winter	100	+20%	30/15 Summer			
2.000	4	15 Winter	100	+20%	30/15 Summer			
2.001	5	15 Winter	100	+20%				
1.003	6	15 Winter	100	+20%	30/15 Summer			
3.000	7	15 Winter	100	+20%	30/15 Summer			
3.001	8	15 Winter	100	+20%	30/15 Summer			
1.004	9	960 Winter	100	+20%	30/15 Summer			
4.000	10	60 Winter	100	+20%	30/15 Summer	100/30 Winter		
5.000	11	60 Winter	100	+20%	30/15 Summer	100/30 Winter		
4.001	12	60 Winter	100	+20%	30/15 Summer			
1.005	13	960 Winter	100	+20%	30/15 Summer			
6.000	14	960 Winter	100	+20%	30/15 Summer	100/720 Winter		
1.006	15	960 Winter	100	+20%	30/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	81.702	0.902	1.707	1.56		26.8	FLOOD	3
1.001	2	81.531	1.093	0.000	1.56		64.7	FLOOD RISK	
1.002	3	80.874	0.699	0.000	1.29		87.2	SURCHARGED	
2.000	4	80.856	0.206	0.000	2.11		116.1	SURCHARGED	
2.001	5	80.606	-0.037	0.000	0.55		116.2	OK	
1.003	6	80.408	0.485	0.000	2.47		198.7	SURCHARGED	
3.000	7	81.656	0.856	0.000	1.47		25.3	FLOOD RISK	
3.001	8	81.001	0.566	0.000	1.27		74.5	SURCHARGED	
1.004	9	80.342	0.432	0.000	0.19		21.7	SURCHARGED	
4.000	10	81.279	0.904	3.991	0.59		17.5	FLOOD	7
5.000	11	81.276	0.901	1.461	0.76		8.2	FLOOD	7
4.001	12	81.273	0.921	0.000	0.43		21.0	FLOOD RISK	
1.005	13	80.341	1.291	0.000	0.19		25.0	SURCHARGED	
6.000	14	80.308	0.908	7.809	0.39		2.8	FLOOD	2
1.006	15	80.338	1.656	0.000	0.11		4.1	SURCHARGED	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet 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	3
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.418
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.500	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, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
1.001	2	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
1.002	3	15 Winter	100	+40%	100/15 Summer			
2.000	4	15 Winter	100	+40%	100/15 Summer			
2.001	5	15 Winter	100	+40%	100/15 Summer			
1.003	6	600 Winter	100	+40%	100/15 Summer			
3.000	7	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
3.001	8	15 Winter	100	+40%	100/15 Summer			
1.004	9	600 Winter	100	+40%	100/15 Summer			
4.000	10	60 Winter	100	+40%	100/15 Summer	100/15 Winter		
5.000	11	60 Winter	100	+40%	100/15 Summer	100/15 Winter		
4.001	12	360 Winter	100	+40%	100/15 Summer			
1.005	13	600 Winter	100	+40%	100/15 Summer			
6.000	14	960 Winter	100	+40%	100/15 Summer	100/180 Winter		
1.006	15	600 Winter	100	+40%	100/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	81.705	0.905	5.491	1.83		31.5	FLOOD	4
1.001	2	81.701	1.263	0.526	1.59		66.1	FLOOD	2
1.002	3	81.057	0.881	0.000	1.39		94.1	SURCHARGED	
2.000	4	81.060	0.410	0.000	2.33		128.1	SURCHARGED	
2.001	5	80.798	0.155	0.000	0.60		127.3	SURCHARGED	
1.003	6	80.592	0.669	0.000	0.31		24.6	SURCHARGED	
3.000	7	81.702	0.902	1.723	1.73		29.8	FLOOD	3
3.001	8	81.305	0.871	0.000	1.43		83.9	SURCHARGED	
1.004	9	80.592	0.682	0.000	0.32		36.7	SURCHARGED	
4.000	10	81.284	0.909	9.395	0.68		20.5	FLOOD	17
5.000	11	81.279	0.904	3.898	0.99		10.8	FLOOD	17
4.001	12	81.323	0.972	0.000	0.33		15.9	FLOOD RISK	
1.005	13	80.592	1.542	0.000	0.31		40.4	SURCHARGED	
6.000	14	80.389	0.989	88.739	0.55		3.9	FLOOD	13
1.006	15	80.589	1.907	0.000	0.11		4.3	SURCHARGED	

Nolan Associates
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Appendix C2 – Plot NE1/2 Microdrainage Calculations

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FSR Rainfall Model - England and Wales

Return Period (years)	30	PIMP (%)	100
M5-60 (mm)	20.500	Add Flow / Climate Change (%)	0
Ratio R	0.418	Minimum Backdrop Height (m)	2.000
Maximum Rainfall (mm/hr)	75	Maximum Backdrop Height (m)	2.000
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 Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	31.479	0.309	101.9	0.107	5.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	31.687	0.172	184.7	0.214	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.002	46.065	0.133	345.8	0.107	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.003	57.032	0.133	428.1	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.004	31.587	0.445	70.9	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
2.000	17.043	0.439	38.8	0.437	5.00	0.0	0.600	o	300	Pipe/Conduit	
3.000	6.161	0.039	158.0	0.096	5.00	0.0	0.600	o	225	Pipe/Conduit	
2.001	19.697	0.253	77.8	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)
1.000	75.00	5.41	81.050	0.107	0.0	0.0	0.0	1.30	51.5	21.7
1.001	75.00	5.86	80.666	0.321	0.0	0.0	0.0	1.15	81.5	65.2
1.002	75.00	6.66	80.420	0.428	0.0	0.0	0.0	0.97	107.0	86.9
1.003	75.00	7.75	80.286	0.428	0.0	0.0	0.0	0.87	96.0	86.9
1.004	75.00	7.99	80.153	0.428	0.0	0.0	0.0	2.15	237.9	86.9
2.000	75.00	5.11	80.475	0.437	0.0	0.0	0.0	2.53	178.9	88.8
3.000	75.00	5.10	80.150	0.096	0.0	0.0	0.0	1.04	41.3	19.5
2.001	75.00	5.30	80.036	0.533	0.0	0.0	0.0	1.78	126.1	108.3

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.005	23.216	0.015	1595.0	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	
4.000	8.556	0.610	14.0	0.121	5.00	0.0	0.600	o	100	Pipe/Conduit	
5.000	7.658	0.510	15.0	0.108	5.00	0.0	0.600	o	100	Pipe/Conduit	
4.001	4.160	0.090	46.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
6.000	32.034	0.306	104.8	0.107	5.00	0.0	0.600	o	225	Pipe/Conduit	
6.001	31.713	0.055	578.6	0.214	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.006	32.127	0.070	459.0	0.107	0.00	0.0	0.600	o	675	Pipe/Conduit	
1.007	5.349	0.027	199.5	0.000	0.00	0.0	0.600	o	675	Pipe/Conduit	
1.008	24.025	0.093	259.6	0.039	0.00	0.0	0.600	o	675	Pipe/Conduit	
1.009	28.494	0.134	212.9	0.020	0.00	0.0	0.600	o	675	Pipe/Conduit	
7.000	8.145	0.844	9.7	0.168	5.00	0.0	0.600	o	150	Pipe/Conduit	
8.000	36.477	1.434	25.4	0.102	5.00	0.0	0.600	o	150	Pipe/Conduit	
8.001	38.344	0.228	168.2	0.102	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)
1.005	75.00	8.59	79.408	0.961	0.0	0.0	0.0	0.65	231.6	195.2
4.000	75.00	5.07	80.700	0.121	0.0	0.0	0.0	2.07	16.3«	24.6
5.000	75.00	5.06	80.600	0.108	0.0	0.0	0.0	2.00	15.7«	21.9
4.001	75.00	5.12	80.090	0.229	0.0	0.0	0.0	1.48	26.2«	46.5
6.000	75.00	5.42	80.950	0.107	0.0	0.0	0.0	1.28	50.8	21.7
6.001	75.00	6.13	80.494	0.321	0.0	0.0	0.0	0.75	82.4	65.2
1.006	75.00	9.03	79.500	1.618	0.0	0.0	0.0	1.22	435.4	328.6
1.007	75.00	9.08	79.430	1.618	0.0	0.0	0.0	1.85	662.8	328.6
1.008	75.00	9.33	79.403	1.657	0.0	0.0	0.0	1.62	580.4	336.6
1.009	75.00	9.59	79.311	1.677	0.0	0.0	0.0	1.79	641.4	340.6
7.000	75.00	5.04	80.232	0.168	0.0	0.0	0.0	3.26	57.6	34.1
8.000	75.00	5.30	81.050	0.102	0.0	0.0	0.0	2.00	35.4	20.7
8.001	75.00	5.83	79.466	0.204	0.0	0.0	0.0	1.21	85.5	41.4

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
7.001	20.042	0.049	406.1	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	
7.002	5.250	0.037	141.0	0.011	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.010	32.779	0.638	51.4	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
9.000	39.883	0.402	99.2	0.040	5.00	0.0	0.600	o	150	Pipe/Conduit	
9.001	19.018	0.221	86.1	0.049	0.00	0.0	0.600	o	150	Pipe/Conduit	
10.000	8.535	0.823	10.4	0.049	5.00	0.0	0.600	o	100	Pipe/Conduit	
9.002	14.873	0.171	87.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.011	24.830	0.713	34.8	0.032	0.00	0.0	0.600	o	150	Pipe/Conduit	
11.000	22.747	0.389	58.5	0.030	5.00	0.0	0.600	o	100	Pipe/Conduit	
11.001	5.975	0.060	99.2	0.030	0.00	0.0	0.600	o	150	Pipe/Conduit	
11.002	43.463	0.438	99.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
12.000	22.417	0.383	58.5	0.030	5.00	0.0	0.600	o	100	Pipe/Conduit	
12.001	5.895	0.504	11.7	0.030	0.00	0.0	0.600	o	100	Pipe/Conduit	
11.003	15.283	0.154	99.2	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)
7.001	75.00	6.21	79.163	0.372	0.0	0.0	0.0	0.89	98.6	75.6
7.002	75.00	6.26	79.114	0.383	0.0	0.0	0.0	1.52	168.3	77.8
1.010	75.00	9.98	79.177	2.060	0.0	0.0	0.0	1.41	24.9«	418.4
9.000	75.00	5.66	80.050	0.040	0.0	0.0	0.0	1.01	17.8	8.1
9.001	75.00	5.95	79.648	0.089	0.0	0.0	0.0	1.08	19.2	18.1
10.000	75.00	5.06	80.300	0.049	0.0	0.0	0.0	2.41	19.0	10.0
9.002	75.00	6.13	79.352	0.138	0.0	0.0	0.0	1.40	55.8	28.0
1.011	75.00	10.22	78.539	2.230	0.0	0.0	0.0	1.71	30.2«	453.0
11.000	75.00	5.38	78.800	0.030	0.0	0.0	0.0	1.01	7.9	6.1
11.001	75.00	5.47	78.361	0.060	0.0	0.0	0.0	1.01	17.8	12.2
11.002	75.00	6.19	78.301	0.060	0.0	0.0	0.0	1.01	17.8	12.2
12.000	75.00	5.37	78.800	0.030	0.0	0.0	0.0	1.01	7.9	6.1
12.001	75.00	5.41	78.417	0.060	0.0	0.0	0.0	2.27	17.8	12.2
11.003	75.00	6.39	77.788	0.120	0.0	0.0	0.0	1.31	52.2	24.4

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
13.000	13.398	1.242	10.8	0.132	5.00	0.0	0.600	o	150	Pipe/Conduit	
14.000	4.690	1.042	4.5	0.099	5.00	0.0	0.600	o	100	Pipe/Conduit	
11.004	16.692	0.069	241.6	0.032	0.00	0.0	0.600	o	375	Pipe/Conduit	
11.005	18.122	0.064	283.7	0.012	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.012	30.076	0.182	165.3	0.027	0.00	0.0	0.600	o	600	Pipe/Conduit	
15.000	36.320	0.366	99.2	0.059	5.00	0.0	0.600	o	150	Pipe/Conduit	
16.000	13.893	0.013	1068.7	0.073	5.00	0.0	0.600	o	100	Pipe/Conduit	
15.001	31.534	0.406	77.7	0.117	0.00	0.0	0.600	o	225	Pipe/Conduit	
17.000	2.115	0.672	3.1	0.090	5.00	0.0	0.600	o	100	Pipe/Conduit	
15.002	38.045	0.119	321.0	0.149	0.00	0.0	0.600	o	375	Pipe/Conduit	
1.013	59.543	0.443	134.4	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)
13.000	75.00	5.07	78.950	0.132	0.0	0.0	0.0	3.08	54.5	26.8
14.000	75.00	5.02	78.800	0.099	0.0	0.0	0.0	3.67	28.8	20.1
11.004	75.00	6.63	77.483	0.383	0.0	0.0	0.0	1.16	128.3	77.8
11.005	75.00	6.91	77.665	0.395	0.0	0.0	0.0	1.07	118.3	80.2
1.012	75.00	10.49	77.376	2.652	0.0	0.0	0.0	1.89	534.9«	538.7
15.000	75.00	5.60	78.850	0.059	0.0	0.0	0.0	1.01	17.8	12.0
16.000	75.00	6.02	78.800	0.073	0.0	0.0	0.0	0.23	1.8«	14.8
15.001	75.00	6.37	78.409	0.249	0.0	0.0	0.0	1.48	59.0	50.6
17.000	75.00	5.01	78.800	0.090	0.0	0.0	0.0	4.39	34.5	18.3
15.002	75.00	7.00	77.853	0.488	0.0	0.0	0.0	1.01	111.1	99.1
1.013	75.00	10.96	77.194	3.140	0.0	0.0	0.0	2.10	593.4«	637.8

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
18.000	19.911	0.186	107.1	0.106	5.00	0.0	0.600	o	300	Pipe/Conduit	
19.000	4.470	0.351	12.7	0.143	5.00	0.0	0.600	o	150	Pipe/Conduit	
18.001	5.772	0.024	241.9	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
18.002	23.350	0.100	233.5	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
20.000	36.507	0.368	99.2	0.059	5.00	0.0	0.600	o	150	Pipe/Conduit	
20.001	28.445	0.170	167.7	0.117	0.00	0.0	0.600	o	225	Pipe/Conduit	
20.002	29.699	0.123	241.6	0.059	0.00	0.0	0.600	o	300	Pipe/Conduit	
18.003	3.696	0.012	310.9	0.000	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.014	15.245	2.096	7.3	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.015	4.655	4.655	1.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.016	31.910	0.322	99.1	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
18.000	75.00	5.22	78.350	0.106	0.0	0.0	0.0	1.52	107.4	21.5
19.000	75.00	5.03	78.665	0.143	0.0	0.0	0.0	2.84	50.2	29.0
18.001	75.00	5.31	78.164	0.249	0.0	0.0	0.0	1.01	71.1	50.6
18.002	75.00	5.56	77.840	0.249	0.0	0.0	0.0	1.59	449.4	50.6
20.000	75.00	5.60	78.850	0.059	0.0	0.0	0.0	1.01	17.8	12.0
20.001	75.00	6.07	78.407	0.176	0.0	0.0	0.0	1.01	40.0	35.7
20.002	75.00	6.57	78.162	0.235	0.0	0.0	0.0	1.01	71.2	47.7
18.003	75.00	6.61	76.763	0.484	0.0	0.0	0.0	1.38	389.0	98.3
1.014	75.00	11.03	76.751	3.624	0.0	0.0	0.0	3.76	66.4«	736.1
1.015	75.00	11.03	74.655	3.624	0.0	0.0	0.0	10.16	179.6«	736.1
1.016	75.00	11.56	70.000	3.624	0.0	0.0	0.0	1.01	17.8«	736.1

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.107	0.107	0.107
1.001	-	-	100	0.214	0.214	0.214
1.002	-	-	100	0.107	0.107	0.107
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.437	0.437	0.437
3.000	-	-	100	0.096	0.096	0.096
2.001	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.121	0.121	0.121
5.000	-	-	100	0.108	0.108	0.108
4.001	-	-	100	0.000	0.000	0.000
6.000	-	-	100	0.107	0.107	0.107
6.001	-	-	100	0.214	0.214	0.214
1.006	-	-	100	0.107	0.107	0.107
1.007	-	-	100	0.000	0.000	0.000
1.008	-	-	100	0.039	0.039	0.039
1.009	-	-	100	0.020	0.020	0.020
7.000	-	-	100	0.168	0.168	0.168
8.000	-	-	100	0.102	0.102	0.102
8.001	-	-	100	0.102	0.102	0.102
7.001	-	-	100	0.000	0.000	0.000
7.002	-	-	100	0.011	0.011	0.011
1.010	-	-	100	0.000	0.000	0.000
9.000	-	-	100	0.040	0.040	0.040
9.001	-	-	100	0.049	0.049	0.049
10.000	-	-	100	0.049	0.049	0.049
9.002	-	-	100	0.000	0.000	0.000
1.011	-	-	100	0.032	0.032	0.032
11.000	-	-	100	0.030	0.030	0.030
11.001	-	-	100	0.030	0.030	0.030
11.002	-	-	100	0.000	0.000	0.000
12.000	-	-	100	0.030	0.030	0.030
12.001	-	-	100	0.030	0.030	0.030
11.003	-	-	100	0.000	0.000	0.000
13.000	-	-	100	0.132	0.132	0.132
14.000	-	-	100	0.099	0.099	0.099
11.004	-	-	100	0.032	0.032	0.032
11.005	-	-	100	0.012	0.012	0.012
1.012	-	-	100	0.027	0.027	0.027
15.000	-	-	100	0.059	0.059	0.059
16.000	-	-	100	0.073	0.073	0.073
15.001	-	-	100	0.117	0.117	0.117
17.000	-	-	100	0.090	0.090	0.090
15.002	-	-	100	0.149	0.149	0.149
1.013	-	-	100	0.000	0.000	0.000
18.000	-	-	100	0.106	0.106	0.106
19.000	-	-	100	0.143	0.143	0.143
18.001	-	-	100	0.000	0.000	0.000
18.002	-	-	100	0.000	0.000	0.000
20.000	-	-	100	0.059	0.059	0.059

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
20.001	-	-	100	0.117	0.117	0.117
20.002	-	-	100	0.059	0.059	0.059
18.003	-	-	100	0.000	0.000	0.000
1.014	-	-	100	0.000	0.000	0.000
1.015	-	-	100	0.000	0.000	0.000
1.016	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				3.624	3.624	3.624

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.016	68	71.100	69.678	69.050	1500	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet 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	11
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	30	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.500	Storm Duration (mins)	30
Ratio R	0.418		

Online Controls for Storm

Hydro-Brake® Optimum Manhole: 35, DS/PN: 1.010, Volume (m³): 14.4

Unit Reference	MD-SHE-0092-4000-1200-4000
Design Head (m)	1.200
Design Flow (l/s)	4.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	92
Invert Level (m)	79.177
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	4.0
Flush-Flo™	0.359	4.0
Kick-Flo®	0.743	3.2
Mean Flow over Head Range	-	3.5

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	2.9	1.200	4.0	3.000	6.1	7.000	9.1
0.200	3.8	1.400	4.3	3.500	6.6	7.500	9.4
0.300	4.0	1.600	4.6	4.000	7.0	8.000	9.7
0.400	4.0	1.800	4.8	4.500	7.4	8.500	10.0
0.500	3.9	2.000	5.1	5.000	7.8	9.000	10.3
0.600	3.8	2.200	5.3	5.500	8.2	9.500	10.6
0.800	3.3	2.400	5.5	6.000	8.5		
1.000	3.7	2.600	5.7	6.500	8.8		

Hydro-Brake® Optimum Manhole: 65, DS/PN: 1.014, Volume (m³): 22.3

Unit Reference	MD-SHE-0140-1310-2700-1310
Design Head (m)	2.700
Design Flow (l/s)	13.1
Flush-Flo™	User Defined
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	140
Invert Level (m)	76.751
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Hydro-Brake® Optimum Manhole: 65, DS/PN: 1.014, Volume (m³): 22.3

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.700	13.1
Flush-Flo™	0.609	11.5
Kick-Flo®	1.247	9.1
Mean Flow over Head Range	-	10.6

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	5.0	1.200	9.6	3.000	13.8	7.000	20.6
0.200	9.5	1.400	9.6	3.500	14.8	7.500	21.3
0.300	10.6	1.600	10.2	4.000	15.8	8.000	22.0
0.400	11.2	1.800	10.8	4.500	16.7	8.500	22.6
0.500	11.4	2.000	11.4	5.000	17.6	9.000	23.3
0.600	11.5	2.200	11.9	5.500	18.4	9.500	23.9
0.800	11.3	2.400	12.4	6.000	19.2		
1.000	10.8	2.600	12.9	6.500	19.9		

Storage Structures for Storm

Complex Manhole: 7, DS/PN: 3.000

Pipe

Diameter (m)	Conduit Section	Length (m)	69.000
Slope (1:X)	9999.000	Invert Level (m)	80.900

Section Number	-2	Minor Dimn (mm)	686	4 * Hyd Radius (mm)	1.845
Conduit Type	-2	Side Slope (Deg)		XSect Area (m²)	11.477
Major Dimn (mm)	24275	Corner Splay (mm)			

Porous Car Park Manhole: 10, DS/PN: 4.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	4.8
Membrane Percolation (mm/hr)	1000	Length (m)	91.2
Max Percolation (l/s)	121.6	Slope (1:X)	10000.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	81.320	Membrane Depth (mm)	130

Porous Car Park Manhole: 11, DS/PN: 5.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	9.6
Membrane Percolation (mm/hr)	1000	Length (m)	12.2
Max Percolation (l/s)	32.5	Slope (1:X)	1000.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	81.170	Membrane Depth (mm)	0

Cellular Storage Manhole: 17, DS/PN: 1.007

Invert Level (m)	79.500	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	583.0	583.0	1.201	0.0	698.9
1.200	583.0	698.9			

Cellular Storage Manhole: 34, DS/PN: 7.002

Invert Level (m)	79.500	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Cellular Storage Manhole: 34, DS/PN: 7.002

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	86.0	146.0	1.201	0.0	204.0
1.200	86.0	204.0			

Porous Car Park Manhole: 47, DS/PN: 14.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	33.5
Membrane Percolation (mm/hr)	1000	Length (m)	4.8
Max Percolation (l/s)	44.7	Slope (1:X)	10000.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	79.370	Membrane Depth (mm)	130

Cellular Storage Manhole: 49, DS/PN: 11.005

Invert Level (m)	77.700	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	300.0	180.0	0.801	0.0	223.0
0.800	300.0	222.9			

Porous Car Park Manhole: 52, DS/PN: 16.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	9.6
Membrane Percolation (mm/hr)	1000	Length (m)	26.4
Max Percolation (l/s)	70.4	Slope (1:X)	10000.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	79.470	Membrane Depth (mm)	130

Porous Car Park Manhole: 54, DS/PN: 17.000

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	86.4
Membrane Percolation (mm/hr)	1000	Length (m)	4.8
Max Percolation (l/s)	115.2	Slope (1:X)	10000.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	79.470	Membrane Depth (mm)	130

Complex Manhole: 57, DS/PN: 18.000

Pipe

Diameter (m)	Conduit Section	Length (m)	23.500
Slope (1:X)	9999.000	Invert Level (m)	78.700

Pipe

Section Number -2 Minor Dimn (mm) 686 4 * Hyd Radius (mm) 1.845
Conduit Type -2 Side Slope (Deg) XSect Area (m²) 11.477
Major Dimn (mm) 24275 Corner Splay (mm)

Cellular Storage Manhole: 64, DS/PN: 18.003

Invert Level (m) 76.900 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	300.0	260.0	1.201	0.0	337.4
1.200	300.0	337.4			

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Storage Structures	11
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.418
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.500	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, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	30, 100
Climate Change (%)	0, 0

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	30	+0%	30/15 Summer				81.443
1.001	2	15 Winter	30	+0%	30/15 Summer				81.305
1.002	3	15 Winter	30	+0%	30/15 Summer				81.010
1.003	4	15 Winter	30	+0%	30/15 Summer				80.774
1.004	5	960 Winter	30	+0%	30/360 Winter				80.634
2.000	6	15 Winter	30	+0%	30/15 Summer				81.107
3.000	7	15 Winter	30	+0%	30/15 Summer				80.835
2.001	8	15 Winter	30	+0%	30/15 Summer				80.774
1.005	9	960 Winter	30	+0%	30/15 Summer				80.633
4.000	10	15 Winter	30	+0%	30/15 Summer				81.364
5.000	11	15 Winter	30	+0%	30/15 Summer				81.285
4.001	12	960 Winter	30	+0%	30/15 Summer				80.634
6.000	13	15 Winter	30	+0%	100/15 Summer				81.130
6.001	15	15 Winter	30	+0%	30/15 Summer				80.937
1.006	16	960 Winter	30	+0%	30/15 Winter				80.633
1.007	17	960 Winter	30	+0%	30/60 Summer				80.632
1.008	18	960 Winter	30	+0%	30/30 Winter				80.633

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

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	0.168	0.000	0.70		34.0	SURCHARGED	
1.001	2	0.339	0.000	1.35		100.4	SURCHARGED	
1.002	3	0.215	0.000	1.29		127.0	SURCHARGED	
1.003	4	0.112	0.000	1.34		119.7	SURCHARGED	
1.004	5	0.105	0.000	0.04		9.4	SURCHARGED	
2.000	6	0.332	0.000	0.87		132.1	SURCHARGED	
3.000	7	0.460	0.000	0.98		29.3	SURCHARGED	
2.001	8	0.438	0.000	1.46		160.5	SURCHARGED	
1.005	9	0.550	0.000	0.14		21.1	SURCHARGED	
4.000	10	0.564	0.000	1.20		18.1	SURCHARGED	
5.000	11	0.585	0.000	1.25		17.9	SURCHARGED	
4.001	12	0.394	0.000	0.27		5.0	SURCHARGED	
6.000	13	-0.045	0.000	0.79		37.7	OK	
6.001	15	0.068	0.000	1.59		116.3	SURCHARGED	
1.006	16	0.458	0.000	0.10		35.4	SURCHARGED	
1.007	17	0.527	0.000	0.02		5.3	SURCHARGED	
1.008	18	0.554	0.000	0.01		5.4	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.009	19	960 Winter	30	+0%	30/30 Summer			
7.000	21	15 Winter	30	+0%	30/15 Summer			
8.000	22	15 Winter	30	+0%	30/15 Summer			
8.001	32	960 Winter	30	+0%	30/15 Summer			
7.001	33	960 Winter	30	+0%	30/15 Summer			
7.002	34	960 Winter	30	+0%	30/15 Summer			
1.010	35	960 Winter	30	+0%	30/15 Summer			
9.000	37	15 Winter	30	+0%	30/15 Summer			
9.001	38	15 Winter	30	+0%	30/15 Summer			
10.000	20	15 Winter	30	+0%	30/15 Winter			
9.002	27	15 Winter	30	+0%	30/15 Summer			
1.011	39	15 Winter	30	+0%	30/15 Summer			
11.000	40	15 Winter	30	+0%	30/15 Summer			
11.001	41	15 Winter	30	+0%	30/15 Summer			
11.002	42	15 Winter	30	+0%	30/15 Summer			
12.000	43	15 Winter	30	+0%	30/15 Summer			
12.001	44	15 Winter	30	+0%	30/15 Summer			
11.003	45	360 Winter	30	+0%	30/15 Winter			
13.000	46	15 Winter	30	+0%	100/15 Summer			
14.000	47	15 Winter	30	+0%	30/15 Summer			
11.004	48	360 Winter	30	+0%	30/15 Summer			
11.005	49	360 Winter	30	+0%	30/180 Winter			
1.012	50	480 Winter	30	+0%	30/120 Winter			
15.000	51	15 Winter	30	+0%	30/15 Summer			
16.000	52	15 Winter	30	+0%	30/15 Summer			
15.001	53	15 Winter	30	+0%	30/15 Summer			
17.000	54	15 Winter	30	+0%	30/15 Summer			
15.002	55	15 Winter	30	+0%	30/15 Summer			
1.013	56	480 Winter	30	+0%	30/30 Winter			
18.000	57	15 Winter	30	+0%	100/15 Summer			
19.000	58	15 Winter	30	+0%	30/15 Summer			
18.001	59	15 Winter	30	+0%	30/15 Summer			
18.002	60	360 Winter	30	+0%	100/180 Winter			
20.000	61	15 Winter	30	+0%	30/15 Summer			
20.001	62	15 Winter	30	+0%	30/15 Summer			
20.002	63	15 Winter	30	+0%	30/15 Summer			
18.003	64	360 Winter	30	+0%	30/15 Summer			
1.014	65	600 Winter	30	+0%	30/15 Summer			
1.015	66	2880 Winter	30	+0%				
1.016	67	4320 Summer	30	+0%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.009	19	80.633	0.647	0.000	0.01		4.9	SURCHARGED	
7.000	21	80.756	0.374	0.000	1.03		51.8	SURCHARGED	

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
8.000	22	81.286	0.086	0.000	0.96		32.8	SURCHARGED	
8.001	32	80.632	0.865	0.000	0.06		4.4	SURCHARGED	
7.001	33	80.632	1.093	0.000	0.10		8.0	SURCHARGED	
7.002	34	80.631	1.142	0.000	0.05		5.1	SURCHARGED	
1.010	35	80.632	1.305	0.000	0.18		4.4	SURCHARGED	
9.000	37	80.340	0.140	0.000	0.68		11.8	SURCHARGED	
9.001	38	80.181	0.383	0.000	1.38		24.8	SURCHARGED	
10.000	20	80.423	0.023	0.000	0.98		17.1	SURCHARGED	
9.002	27	79.840	0.264	0.000	0.75		36.6	SURCHARGED	
1.011	39	79.727	1.038	0.000	1.56		45.0	SURCHARGED	
11.000	40	79.103	0.203	0.000	1.17		9.0	SURCHARGED	
11.001	41	78.579	0.068	0.000	1.25		18.6	SURCHARGED	
11.002	42	78.487	0.036	0.000	1.04		18.1	SURCHARGED	
12.000	43	79.132	0.232	0.000	1.17		8.9	SURCHARGED	
12.001	44	78.649	0.133	0.000	1.12		17.8	SURCHARGED	
11.003	45	78.102	0.089	0.000	0.12		5.7	SURCHARGED	
13.000	46	79.066	-0.034	0.000	0.94		46.8	OK	
14.000	47	79.279	0.379	0.000	1.15		28.7	SURCHARGED	
11.004	48	78.101	0.243	0.000	0.17		18.2	SURCHARGED	
11.005	49	78.101	0.061	0.000	0.17		16.3	SURCHARGED	
1.012	50	78.128	0.152	0.000	0.06		23.6	SURCHARGED	
15.000	51	79.292	0.292	0.000	1.08		18.6	SURCHARGED	
16.000	52	79.508	0.608	0.000	5.73		11.9	SURCHARGED	
15.001	53	78.901	0.267	0.000	1.19		65.6	SURCHARGED	
17.000	54	79.282	0.382	0.000	1.20		27.3	SURCHARGED	
15.002	55	78.335	0.107	0.000	1.41		142.2	SURCHARGED	
1.013	56	78.120	0.326	0.000	0.07		38.4	SURCHARGED	
18.000	57	78.620	-0.030	0.000	0.39		36.3	OK	
19.000	58	79.096	0.281	0.000	1.24		46.1	SURCHARGED	
18.001	59	78.532	0.068	0.000	1.65		81.1	SURCHARGED	
18.002	60	78.134	-0.306	0.000	0.03		11.9	OK	
20.000	61	79.284	0.284	0.000	1.10		18.9	SURCHARGED	
20.001	62	78.877	0.245	0.000	1.49		55.5	SURCHARGED	
20.002	63	78.494	0.032	0.000	1.15		74.4	SURCHARGED	
18.003	64	78.131	0.768	0.000	0.04		9.2	SURCHARGED	
1.014	65	78.173	1.272	0.000	0.19		11.5	SURCHARGED	
1.015	66	74.684	-0.121	0.000	0.09		11.5	OK	
1.016	67	70.090	-0.060	0.000	0.67		11.5	OK	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet 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	11
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Ratio R	0.418
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.500	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, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	30, 100
Climate Change (%)	0, 0

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	+0%	30/15 Summer				81.994
1.001	2	15 Winter	100	+0%	30/15 Summer				81.768
1.002	3	15 Winter	100	+0%	30/15 Summer				81.299
1.003	4	960 Winter	100	+0%	30/15 Summer				81.210
1.004	5	960 Winter	100	+0%	30/360 Winter				81.209
2.000	6	15 Winter	100	+0%	30/15 Summer				81.583
3.000	7	960 Winter	100	+0%	30/15 Summer				81.202
2.001	8	960 Winter	100	+0%	30/15 Summer				81.205
1.005	9	960 Winter	100	+0%	30/15 Summer				81.207
4.000	10	15 Winter	100	+0%	30/15 Summer				81.400
5.000	11	15 Winter	100	+0%	30/15 Summer				81.389
4.001	12	960 Winter	100	+0%	30/15 Summer				81.209
6.000	13	15 Winter	100	+0%	100/15 Summer				81.330
6.001	15	960 Winter	100	+0%	30/15 Summer				81.208
1.006	16	960 Winter	100	+0%	30/15 Winter				81.207
1.007	17	960 Winter	100	+0%	30/60 Summer				81.207
1.008	18	960 Winter	100	+0%	30/30 Winter				81.207

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

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	0.719	0.000	0.93		44.7	FLOOD RISK	
1.001	2	0.802	0.000	1.62		120.4	SURCHARGED	
1.002	3	0.504	0.000	1.61		158.8	SURCHARGED	
1.003	4	0.549	0.000	0.13		12.0	SURCHARGED	
1.004	5	0.681	0.000	0.06		11.7	SURCHARGED	
2.000	6	0.808	0.000	1.17		177.9	FLOOD RISK	
3.000	7	0.827	0.000	0.16		4.8	SURCHARGED	
2.001	8	0.869	0.000	0.14		14.9	SURCHARGED	
1.005	9	1.124	0.000	0.17		26.1	SURCHARGED	
4.000	10	0.600	0.000	1.21		18.2	SURCHARGED	
5.000	11	0.689	0.000	1.30		18.7	FLOOD RISK	
4.001	12	0.969	0.000	0.34		6.3	SURCHARGED	
6.000	13	0.155	0.000	1.00		47.8	SURCHARGED	
6.001	15	0.339	0.000	0.12		9.0	SURCHARGED	
1.006	16	1.032	0.000	0.13		44.0	SURCHARGED	
1.007	17	1.102	0.000	0.02		6.8	SURCHARGED	
1.008	18	1.129	0.000	0.02		8.1	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.009	19	960 Winter	100	+0%	30/30 Summer				81.207
7.000	21	15 Winter	100	+0%	30/15 Summer				81.363
8.000	22	15 Winter	100	+0%	30/15 Summer				81.804
8.001	32	960 Winter	100	+0%	30/15 Summer				81.209
7.001	33	960 Winter	100	+0%	30/15 Summer				81.208
7.002	34	960 Winter	100	+0%	30/15 Summer				81.207
1.010	35	960 Winter	100	+0%	30/15 Summer				81.207
9.000	37	15 Winter	100	+0%	30/15 Summer				80.859
9.001	38	15 Winter	100	+0%	30/15 Summer				80.622
10.000	20	15 Winter	100	+0%	30/15 Winter				80.887
9.002	27	15 Winter	100	+0%	30/15 Summer				80.140
1.011	39	15 Winter	100	+0%	30/15 Summer				80.013
11.000	40	15 Winter	100	+0%	30/15 Summer				79.446
11.001	41	480 Winter	100	+0%	30/15 Summer				78.940
11.002	42	480 Winter	100	+0%	30/15 Summer				78.939
12.000	43	15 Winter	100	+0%	30/15 Summer				79.513
12.001	44	480 Winter	100	+0%	30/15 Summer				78.938
11.003	45	480 Winter	100	+0%	30/15 Winter				78.936
13.000	46	15 Winter	100	+0%	100/15 Summer				79.394
14.000	47	15 Winter	100	+0%	30/15 Summer				79.411
11.004	48	480 Winter	100	+0%	30/15 Summer				78.934
11.005	49	480 Winter	100	+0%	30/180 Winter				78.933
1.012	50	480 Winter	100	+0%	30/120 Winter				78.931
15.000	51	15 Winter	100	+0%	30/15 Summer				79.783
16.000	52	15 Winter	100	+0%	30/15 Summer				79.551
15.001	53	15 Winter	100	+0%	30/15 Summer				79.242
17.000	54	15 Winter	100	+0%	30/15 Summer				79.481
15.002	55	480 Winter	100	+0%	30/15 Summer				78.932
1.013	56	480 Winter	100	+0%	30/30 Winter				78.929
18.000	57	480 Winter	100	+0%	100/15 Summer				78.922
19.000	58	15 Winter	100	+0%	30/15 Summer				79.475
18.001	59	480 Winter	100	+0%	30/15 Summer				78.923
18.002	60	480 Winter	100	+0%	100/180 Winter				78.925
20.000	61	15 Winter	100	+0%	30/15 Summer				79.749
20.001	62	15 Winter	100	+0%	30/15 Summer				79.182
20.002	63	480 Winter	100	+0%	30/15 Summer				78.928
18.003	64	480 Winter	100	+0%	30/15 Summer				78.926
1.014	65	480 Winter	100	+0%	30/15 Summer				78.926
1.015	66	480 Winter	100	+0%					74.685
1.016	67	480 Winter	100	+0%					70.092

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.009	19	1.221	0.000	0.01		5.9	SURCHARGED	
7.000	21	0.981	0.000	1.28		64.0	SURCHARGED	

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

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
8.000	22	0.604	0.000	1.07		36.6	FLOOD RISK	
8.001	32	1.443	0.000	0.07		5.5	SURCHARGED	
7.001	33	1.670	0.000	0.12		10.1	SURCHARGED	
7.002	34	1.718	0.000	0.05		5.3	SURCHARGED	
1.010	35	1.880	0.000	0.21		5.1	SURCHARGED	
9.000	37	0.659	0.000	0.77		13.2	FLOOD RISK	
9.001	38	0.824	0.000	1.48		26.6	SURCHARGED	
10.000	20	0.487	0.000	1.01		17.7	SURCHARGED	
9.002	27	0.563	0.000	0.89		43.5	SURCHARGED	
1.011	39	1.324	0.000	1.68		48.5	SURCHARGED	
11.000	40	0.546	0.000	1.34		10.3	SURCHARGED	
11.001	41	0.429	0.000	0.20		2.9	SURCHARGED	
11.002	42	0.488	0.000	0.17		2.9	SURCHARGED	
12.000	43	0.613	0.000	1.33		10.2	FLOOD RISK	
12.001	44	0.422	0.000	0.19		2.9	SURCHARGED	
11.003	45	0.923	0.000	0.13		5.9	SURCHARGED	
13.000	46	0.294	0.000	1.07		53.5	SURCHARGED	
14.000	47	0.511	0.000	1.19		29.7	SURCHARGED	
11.004	48	1.076	0.000	0.18		18.8	SURCHARGED	
11.005	49	0.893	0.000	0.15		14.7	SURCHARGED	
1.012	50	0.955	0.000	0.06		25.3	SURCHARGED	
15.000	51	0.783	0.000	1.36		23.4	FLOOD RISK	
16.000	52	0.651	0.000	5.92		12.3	SURCHARGED	
15.001	53	0.608	0.000	1.39		76.7	SURCHARGED	
17.000	54	0.581	0.000	1.34		30.5	SURCHARGED	
15.002	55	0.704	0.000	0.24		23.9	SURCHARGED	
1.013	56	1.135	0.000	0.08		42.1	SURCHARGED	
18.000	57	0.272	0.000	0.10		9.3	SURCHARGED	
19.000	58	0.660	0.000	1.57		58.1	FLOOD RISK	
18.001	59	0.459	0.000	0.25		12.2	SURCHARGED	
18.002	60	0.485	0.000	0.04		12.2	SURCHARGED	
20.000	61	0.749	0.000	1.36		23.4	FLOOD RISK	
20.001	62	0.551	0.000	1.84		68.5	SURCHARGED	
20.002	63	0.465	0.000	0.18		11.5	SURCHARGED	
18.003	64	1.563	0.000	0.08		17.6	SURCHARGED	
1.014	65	2.025	0.000	0.19		11.8	SURCHARGED	
1.015	66	-0.120	0.000	0.09		11.8	OK	
1.016	67	-0.058	0.000	0.69		11.8	OK	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet 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	11
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.418
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.500	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, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	20

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Winter	100	+20%	100/15 Summer	100/15 Summer		
1.001	2	15 Winter	100	+20%	100/15 Summer			
1.002	3	15 Winter	100	+20%	100/15 Summer			
1.003	4	960 Winter	100	+20%	100/15 Summer			
1.004	5	960 Winter	100	+20%	100/15 Summer			
2.000	6	15 Winter	100	+20%	100/15 Summer	100/15 Summer		
3.000	7	1440 Winter	100	+20%	100/15 Summer			
2.001	8	960 Winter	100	+20%	100/15 Summer			
1.005	9	960 Winter	100	+20%	100/15 Summer			
4.000	10	15 Winter	100	+20%	100/15 Summer			
5.000	11	15 Winter	100	+20%	100/15 Summer			
4.001	12	960 Winter	100	+20%	100/15 Summer			
6.000	13	15 Winter	100	+20%	100/15 Summer			
6.001	15	960 Winter	100	+20%	100/15 Summer			
1.006	16	960 Winter	100	+20%	100/15 Summer			
1.007	17	960 Winter	100	+20%	100/15 Summer			
1.008	18	960 Winter	100	+20%	100/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	82.104	0.829	4.318	1.35		64.9	FLOOD	3
1.001	2	82.093	1.127	0.000	1.80		134.1	FLOOD RISK	
1.002	3	81.529	0.734	0.000	1.82		179.4	SURCHARGED	
1.003	4	81.404	0.743	0.000	0.15		13.7	FLOOD RISK	
1.004	5	81.402	0.874	0.000	0.06		12.9	FLOOD RISK	
2.000	6	81.607	0.832	6.760	1.20		183.0	FLOOD	3
3.000	7	81.394	1.019	0.000	0.16		4.8	FLOOD RISK	
2.001	8	81.397	1.061	0.000	0.16		17.4	SURCHARGED	
1.005	9	81.400	1.318	0.000	0.19		29.1	SURCHARGED	
4.000	10	81.433	0.633	0.000	1.21		18.1	SURCHARGED	
5.000	11	81.486	0.786	0.000	1.35		19.4	FLOOD RISK	
4.001	12	81.402	1.162	0.000	0.40		7.6	SURCHARGED	
6.000	13	81.538	0.363	0.000	1.20		57.3	SURCHARGED	
6.001	15	81.402	0.532	0.000	0.15		10.8	SURCHARGED	
1.006	16	81.400	1.225	0.000	0.14		49.9	SURCHARGED	
1.007	17	81.401	1.296	0.000	0.04		12.0	SURCHARGED	
1.008	18	81.400	1.322	0.000	0.02		10.8	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.009	19	960 Winter	100	+20%	100/15 Summer			
7.000	21	15 Winter	100	+20%	100/15 Summer	100/15 Winter		
8.000	22	15 Winter	100	+20%	100/15 Summer	100/15 Summer		
8.001	32	240 Winter	100	+20%	100/15 Summer			
7.001	33	240 Winter	100	+20%	100/15 Summer			
7.002	34	240 Winter	100	+20%	100/15 Summer			
1.010	35	960 Winter	100	+20%	100/15 Summer			
9.000	37	15 Winter	100	+20%	100/15 Summer	100/15 Summer		
9.001	38	15 Winter	100	+20%	100/15 Summer			
10.000	20	15 Winter	100	+20%	100/15 Summer			
9.002	27	15 Winter	100	+20%	100/15 Summer			
1.011	39	15 Winter	100	+20%	100/15 Summer			
11.000	40	15 Winter	100	+20%	100/15 Summer			
11.001	41	480 Winter	100	+20%	100/15 Summer			
11.002	42	480 Winter	100	+20%	100/15 Summer			
12.000	43	15 Winter	100	+20%	100/15 Summer	100/15 Winter		
12.001	44	480 Winter	100	+20%	100/15 Summer			
11.003	45	480 Winter	100	+20%	100/15 Summer			
13.000	46	15 Winter	100	+20%	100/15 Summer			
14.000	47	15 Winter	100	+20%	100/15 Summer			
11.004	48	480 Winter	100	+20%	100/15 Summer			
11.005	49	480 Winter	100	+20%	100/30 Summer			
1.012	50	480 Winter	100	+20%	100/15 Winter			
15.000	51	15 Winter	100	+20%	100/15 Summer	100/15 Summer		
16.000	52	15 Winter	100	+20%	100/15 Summer			
15.001	53	15 Winter	100	+20%	100/15 Summer			
17.000	54	15 Winter	100	+20%	100/15 Summer			
15.002	55	480 Winter	100	+20%	100/15 Summer			
1.013	56	480 Winter	100	+20%	100/15 Summer			
18.000	57	600 Winter	100	+20%	100/15 Summer			
19.000	58	15 Winter	100	+20%	100/15 Summer	100/15 Summer		
18.001	59	600 Winter	100	+20%	100/15 Summer			
18.002	60	480 Winter	100	+20%	100/60 Winter			
20.000	61	15 Winter	100	+20%	100/15 Summer	100/15 Summer		
20.001	62	15 Winter	100	+20%	100/15 Summer			
20.002	63	480 Winter	100	+20%	100/15 Summer			
18.003	64	480 Winter	100	+20%	100/15 Summer			
1.014	65	480 Winter	100	+20%	100/15 Summer			
1.015	66	480 Winter	100	+20%				
1.016	67	480 Winter	100	+20%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.009	19	81.400	1.414	0.000	0.01		6.0	SURCHARGED	
7.000	21	81.850	1.468	0.476	1.45		72.7	FLOOD	1

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
8.000	22	82.101	0.901	1.097	1.13		38.5	FLOOD	2
8.001	32	81.423	1.657	0.000	0.25		20.1	SURCHARGED	
7.001	33	81.412	1.873	0.000	0.43		35.7	SURCHARGED	
7.002	34	81.402	1.913	0.000	0.19		19.4	FLOOD RISK	
1.010	35	81.400	2.073	0.000	0.22		5.3	FLOOD RISK	
9.000	37	81.101	0.901	1.009	0.98		17.0	FLOOD	2
9.001	38	81.014	1.216	0.000	1.61		28.8	FLOOD RISK	
10.000	20	81.371	0.971	0.000	1.04		18.1	FLOOD RISK	
9.002	27	80.477	0.900	0.000	0.94		46.2	SURCHARGED	
1.011	39	80.334	1.645	0.000	1.81		52.1	SURCHARGED	
11.000	40	79.794	0.894	0.000	1.47		11.3	FLOOD RISK	
11.001	41	79.294	0.783	0.000	0.24		3.5	SURCHARGED	
11.002	42	79.293	0.842	0.000	0.20		3.5	SURCHARGED	
12.000	43	79.800	0.900	0.209	1.48		11.4	FLOOD	1
12.001	44	79.292	0.775	0.000	0.22		3.5	SURCHARGED	
11.003	45	79.289	1.276	0.000	0.15		6.8	SURCHARGED	
13.000	46	79.816	0.716	0.000	1.21		60.4	FLOOD RISK	
14.000	47	79.464	0.564	0.000	1.19		29.7	SURCHARGED	
11.004	48	79.287	1.429	0.000	0.21		21.9	SURCHARGED	
11.005	49	79.285	1.245	0.000	0.15		14.8	SURCHARGED	
1.012	50	79.283	1.307	0.000	0.06		25.8	SURCHARGED	
15.000	51	79.901	0.901	1.376	1.62		27.9	FLOOD	3
16.000	52	79.596	0.696	0.000	6.11		12.7	SURCHARGED	
15.001	53	79.514	0.880	0.000	1.53		84.6	SURCHARGED	
17.000	54	79.501	0.601	0.000	1.36		31.1	SURCHARGED	
15.002	55	79.284	1.056	0.000	0.28		28.5	SURCHARGED	
1.013	56	79.281	1.487	0.000	0.08		43.4	SURCHARGED	
18.000	57	79.271	0.621	0.000	0.10		9.5	FLOOD RISK	
19.000	58	79.716	0.901	0.667	1.76		65.4	FLOOD	2
18.001	59	79.273	0.809	0.000	0.25		12.3	FLOOD RISK	
18.002	60	79.275	0.835	0.000	0.04		14.4	FLOOD RISK	
20.000	61	79.901	0.901	1.268	1.62		27.9	FLOOD	2
20.001	62	79.478	0.846	0.000	2.12		79.1	SURCHARGED	
20.002	63	79.279	0.817	0.000	0.21		13.8	SURCHARGED	
18.003	64	79.277	1.914	0.000	0.13		28.4	FLOOD RISK	
1.014	65	79.277	2.376	0.000	0.21		12.7	SURCHARGED	
1.015	66	74.686	-0.119	0.000	0.09		12.7	OK	
1.016	67	70.096	-0.054	0.000	0.74		12.7	OK	

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

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	2.000
Hot Start Level (mm)	0	Inlet 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	11
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model		FSR	Ratio R 0.418
Region	England and Wales	Cv (Summer)	0.750
M5-60 (mm)	20.500	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, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	1	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
1.001	2	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
1.002	3	180 Winter	100	+40%	100/15 Summer			
1.003	4	180 Winter	100	+40%	100/15 Summer	100/120 Winter		
1.004	5	180 Winter	100	+40%	100/15 Summer	100/120 Winter		
2.000	6	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
3.000	7	1440 Winter	100	+40%	100/15 Summer			
2.001	8	1440 Winter	100	+40%	100/15 Summer			
1.005	9	180 Winter	100	+40%	100/15 Summer			
4.000	10	360 Winter	100	+40%	100/15 Summer			
5.000	11	360 Winter	100	+40%	100/15 Summer	100/120 Winter		
4.001	12	360 Winter	100	+40%	100/15 Summer			
6.000	13	15 Winter	100	+40%	100/15 Summer			
6.001	15	120 Winter	100	+40%	100/15 Summer			
1.006	16	120 Winter	100	+40%	100/15 Summer			
1.007	17	180 Winter	100	+40%	100/15 Summer			
1.008	18	180 Winter	100	+40%	100/15 Summer			

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	82.113	0.838	12.716	1.63		78.7	FLOOD	4
1.001	2	82.102	1.136	2.206	1.78		132.5	FLOOD	2
1.002	3	81.699	0.904	0.000	0.65		63.8	SURCHARGED	
1.003	4	81.614	0.953	14.076	0.69		61.7	FLOOD	5
1.004	5	81.594	1.066	0.000	0.26		55.0	FLOOD RISK	
2.000	6	81.617	0.842	17.264	1.20		182.9	FLOOD	4
3.000	7	81.562	1.187	0.000	0.16		4.8	FLOOD RISK	
2.001	8	81.566	1.230	0.000	0.13		13.9	SURCHARGED	
1.005	9	81.580	1.497	0.000	0.82		124.4	SURCHARGED	
4.000	10	81.589	0.789	0.000	0.68		10.2	FLOOD RISK	
5.000	11	81.603	0.903	3.058	0.63		9.0	FLOOD	5
4.001	12	81.586	1.346	0.000	1.00		18.8	FLOOD RISK	
6.000	13	81.775	0.600	0.000	1.40		66.6	FLOOD RISK	
6.001	15	81.614	0.745	0.000	0.89		65.3	SURCHARGED	
1.006	16	81.592	1.417	0.000	0.84		293.3	SURCHARGED	
1.007	17	81.596	1.491	0.000	0.25		79.3	SURCHARGED	
1.008	18	81.599	1.521	0.000	0.13		55.4	SURCHARGED	

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.009	19	180 Winter	100	+40%	100/15 Summer			
7.000	21	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
8.000	22	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
8.001	32	180 Winter	100	+40%	100/15 Summer			
7.001	33	180 Winter	100	+40%	100/15 Summer			
7.002	34	180 Winter	100	+40%	100/15 Summer	100/120 Winter		
1.010	35	180 Winter	100	+40%	100/15 Summer	100/120 Winter		
9.000	37	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
9.001	38	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
10.000	20	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
9.002	27	15 Winter	100	+40%	100/15 Summer			
1.011	39	15 Winter	100	+40%	100/15 Summer			
11.000	40	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
11.001	41	180 Winter	100	+40%	100/15 Summer			
11.002	42	180 Winter	100	+40%	100/15 Summer			
12.000	43	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
12.001	44	180 Winter	100	+40%	100/15 Summer			
11.003	45	360 Winter	100	+40%	100/15 Summer			
13.000	46	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
14.000	47	240 Winter	100	+40%	100/15 Summer			
11.004	48	480 Winter	100	+40%	100/15 Summer			
11.005	49	480 Winter	100	+40%	100/15 Winter			
1.012	50	480 Winter	100	+40%	100/15 Summer			
15.000	51	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
16.000	52	15 Winter	100	+40%	100/15 Summer			
15.001	53	15 Winter	100	+40%	100/15 Summer			
17.000	54	240 Winter	100	+40%	100/15 Summer			
15.002	55	480 Winter	100	+40%	100/15 Summer			
1.013	56	480 Winter	100	+40%	100/15 Summer			
18.000	57	600 Winter	100	+40%	100/15 Summer	100/240 Winter		
19.000	58	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
18.001	59	600 Winter	100	+40%	100/15 Summer	100/360 Winter		
18.002	60	600 Winter	100	+40%	100/30 Winter	100/360 Winter		
20.000	61	15 Winter	100	+40%	100/15 Summer	100/15 Summer		
20.001	62	15 Winter	100	+40%	100/15 Summer			
20.002	63	600 Winter	100	+40%	100/15 Summer			
18.003	64	600 Winter	100	+40%	100/15 Summer	100/360 Winter		
1.014	65	600 Winter	100	+40%	100/15 Summer			
1.015	66	600 Winter	100	+40%				
1.016	67	600 Winter	100	+40%				

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.009	19	81.602	1.617	0.000	0.04		18.1	SURCHARGED	
7.000	21	81.854	1.472	4.278	1.45		72.8	FLOOD	4

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
8.000	22	82.104	0.904	3.935	1.10		37.7	FLOOD	4
8.001	32	81.650	1.883	0.000	0.37		29.4	SURCHARGED	
7.001	33	81.626	2.087	0.000	0.63		52.2	FLOOD RISK	
7.002	34	81.611	2.122	11.107	0.28		29.4	FLOOD	5
1.010	35	81.607	2.280	6.667	0.21		5.1	FLOOD	5
9.000	37	81.104	0.904	4.108	1.23		21.2	FLOOD	4
9.001	38	81.100	1.303	0.495	1.65		29.6	FLOOD	2
10.000	20	81.501	1.101	0.977	1.17		20.4	FLOOD	2
9.002	27	80.686	1.109	0.000	0.94		46.2	SURCHARGED	
1.011	39	80.567	1.878	0.000	1.90		54.6	SURCHARGED	
11.000	40	79.801	0.901	0.912	1.58		12.2	FLOOD	4
11.001	41	79.580	1.069	0.000	0.60		9.0	FLOOD RISK	
11.002	42	79.571	1.120	0.000	0.52		9.0	FLOOD RISK	
12.000	43	79.801	0.901	1.313	1.64		12.6	FLOOD	4
12.001	44	79.570	1.053	0.000	0.56		9.0	FLOOD RISK	
11.003	45	79.546	1.534	0.000	0.21		9.7	FLOOD RISK	
13.000	46	80.002	0.902	1.527	1.27		63.2	FLOOD	2
14.000	47	79.550	0.650	0.000	0.47		11.8	FLOOD RISK	
11.004	48	79.565	1.706	0.000	0.24		25.4	FLOOD RISK	
11.005	49	79.560	1.520	0.000	0.15		14.8	SURCHARGED	
1.012	50	79.557	1.581	0.000	0.07		28.8	SURCHARGED	
15.000	51	79.904	0.904	3.655	1.75		30.2	FLOOD	4
16.000	52	79.646	0.746	0.000	6.32		13.1	FLOOD RISK	
15.001	53	79.691	1.057	0.000	1.59		88.2	FLOOD RISK	
17.000	54	79.526	0.626	0.000	0.47		10.7	SURCHARGED	
15.002	55	79.537	1.309	0.000	0.32		32.5	SURCHARGED	
1.013	56	79.548	1.754	0.000	0.10		51.0	FLOOD RISK	
18.000	57	79.514	0.864	113.697	0.12		11.2	FLOOD	7
19.000	58	79.719	0.904	3.743	1.78		66.0	FLOOD	4
18.001	59	79.513	1.049	13.334	0.29		14.4	FLOOD	5
18.002	60	79.513	1.073	13.082	0.04		14.6	FLOOD	5
20.000	61	79.904	0.904	3.869	1.77		30.6	FLOOD	4
20.001	62	79.760	1.128	0.000	2.35		87.4	FLOOD RISK	
20.002	63	79.515	1.053	0.000	0.21		13.6	SURCHARGED	
18.003	64	79.513	2.150	13.181	0.13		28.9	FLOOD	5
1.014	65	79.540	2.639	0.000	0.22		13.2	FLOOD RISK	
1.015	66	74.686	-0.119	0.000	0.10		13.2	OK	
1.016	67	70.099	-0.051	0.000	0.77		13.2	OK	