Calculation Package and Design Philosophy for Drainage

Langstone Technology Park,
Langstone Road,
Havant,
PO9 1SA.

25th October 2019

Ref: 8/1982

Prepared on Behalf of:

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SUPPLEMENTARY CALCULATION PACKAGE AND DRAINAGE DESIGN PHILOSOPHY
Langstone Technology Park, Langstone Road, Havant, PO9 1SA

Report Reference: 8/1982

Revision B

Date originated: 25th October 2019

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INTRODUCTION

Clancy Consulting Ltd has been instructed to undertaken drainage calculations in support of a proposed development on Langstone Technology Park, Havant, PO9 1SA.

SUPORTING DOCUMENTS

This document has been prepared to further support the Flood Risk Assessment and SuDS Strategy previously submitted as part of the planning application.

Additional documents to be read in conjunction with this document:

- 8/1982/FLOOD – 29th August 2019
- 8/1982/FLOOD2 – 7th October 2019
- 8/1982/LLFA – 23rd September 2019

EXISTING SURFACE WATER DRAINAGE PHILOSOPHY

The existing drainage on the site discharges in several ways. The majority of the site discharges to the watercourse found east of the site whilst the car parking areas found in the south of the site discharge off the site to a private drainage network, and finally select areas on the west of the site discharge into the existing Southern Water sewer assets.

PROPOSED DRAINAGE PHILOSOPHY

The proposed drainage will seek to mimic the existing in terms of discharge location, however the proposed drainage will be designed to a 1 in 100 year + 40% climate change adjustment and incorporate water quality improvements in line with guidance from the CIRIA SuDS Manual (C753).

Summary of design philosophy:

1. Conversations had with the Environment Agency (EA) indicated that an unrestricted flow was suitable for discharge into the main river located east of the development. Areas 3, 4a and 4b, as indicated on the supplied general arrangement drawings will discharge to the main river via a pumping station, as per the current arrangement.
2. Area 1 will discharge to the southern water asset in Langstone road as per the current arrangement. The current discharge is believed to be uncontrolled, the proposed arrangement will seek to limit the discharge to 7.5l/s in line with the greenfield run off rates for 1 in 1 year events.
3. Area 2 currently discharges south off the site to the drainage system serving the adjoining industrial estate. This area was originally owned by Langstone Technology Park but was transferred to new owners to allow development. A Land Transfer Agreement dated 13th December 1994 (found in Appendix C) states that:

   (a) to the free passage and running of surface water from the Property [LTP] over the land hatched blue on plan 5 (the 'Blue Land') (being the adjoining land to the southern boundary of the Property [LTP]);
   (b) of entry onto the unbuilt upon parts of the Blue Land on reasonable prior notice (except in emergency) to maintain inspect and clean the surface water media serving the Property. This right is subject to the person exercising it causing as little interference as possible and making good damage caused and complying with any management plan agreed between the owner of the Blue Land and the Council;

Therefore to reuse the existing connection is suitable for the development. The proposed development will improve the drainage characteristics and reduce the risk of flooding.

Area specific discussion

Area 1

The proposals are to expand the existing hardstanding car parking area. This will result in an impermeable area increase from ~780m^2 to 2044m^2. Topographic and GPR surveys undertaken indicated that the current car park drains to Southern Water assets west of the car park. The proposals are therefore to retain the existing connection point as the capacity of the private network connecting to the river east of the site is unknown but expected to be insufficient for additional flows.

The current surface water discharge rate is uncontrolled. It is proposed to discharge at the 1 in 1 year greenfield run off rate, as determined by the Wallingford procedure. This was found to be 7.5l/s (calculations provided in the prior submitted FRA). This is believed to be lower than the current discharge rate. The flows will be controlled using a sealed/tanked permeable paving system.

Area 2

Modelling of the existing drainage in area 2 was undertaken to ascertain the suitability of the existing connection, refer to Appendix B for modelling of the existing network. The existing network was found to flood in the 1 in 100 year + 40% climate change storm event and is therefore not suitable for current design requirements.

The current modelled flow rate through the final pipe run in area 2 was found to be 316.6l/s for a critical storm event, there will also be the presence of overland flooding further increasing the total run-off to an estimated ~600l/s.

The proposed system is modelled to not flood for the 1 in 100 year (+ climate change) critical storm event with a flow rate of 156.8l/s (~50% reduction on pipe flow and ~75% reduction in estimated peak run-off).

Area 3

Area 3 is currently permeable soft landscaping. Proposals are to add impermeable areas to allow new parking areas to be developed.

Water quality requirements are met in line with the SuDS manual (CIRIA C753) by the provision of a tanked permeable surfacing.

Using the Wallingford procedure to determine the greenfield run off rate, the rate was found to be below <5l/s. For the purposes of design a value of 5l/s has been assumed, this is a widely used industry standard to avoid unnecessary blockages. A tanked permeable paving system will be used to control flows, provide storage and improve water quality.

Area 4

Area 4a and 4b cover an already developed car park and the proposed car parking area on the footprint of the demolition of building 1000. There is also a small additional area of new impermeable areas adjacent to the river running north-south along the eastern boundary of the site.

After discussions with the Environment Agency (EA) the flow rate into the river is permitted to be uncontrolled, however water quality guidelines must be adhered to. The greater concern with the proposed design is the restricted capacity of the surface water drainage system downstream of area 4 in other locations on the technology park. The final run of the private system is a 450mm pipe to the pump station on the east side of the site with the current free capacity not modelled. Therefore, it has been proposed to limit the discharge to the current run off rate (1 in 1 year) which was found to be 80.5l/s using the Wallingford procedure (see calculations provided in the previously submitted FRA). We believe that this will offer significant improvement on the current unrestricted flows for greater events than the 1 in 1 year and reduce risk of flooding in areas not being developed by reducing the load on other areas of the surface water network.

Water quality guidelines as described in the SuDS manual (CIRIA C753) have been adhered to for design with the use of filter strips and permeable paving reducing hydrocarbons, suspended metals and other pollutants.

Foul Drainage

The proposed alterations to the site include the demolition of 5500m^2 of structure with the loss of floor space for 550 people.

The proposed development could generate the following:

The new development could generate the following;
B1 Offices 1:10 m2
B2 / B1(c) light industry 1:40 m2
B8 warehouse 1:70m2

Therefore;

Units 1-5 , B1 (c) = 92 people or as B8 = 68 people
Units 6 – 9, B1 (c) = 174 people or as B8 = 121 people
Units 10– 12, B1 (c) = 119 people or as B8 = 169 people.

Total people = 385 maximum.

Therefore, the development is reducing the population by 165 people and subsequent foul flows. There should be no requirement for foul infrastructure reinforcement or phased development other than the demolition of the existing space before the new is created.

REFERENCES

CIRIA SuDS Manual (C753)

Approved Document H

DESIGN SOFTWARE USED

MicroDrainage 2019.1

APPENDIX A

Drainage Calculations for Proposed Scheme

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)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Maximum Backdrop Height (m)	10.000
Maximum Time of Concentration (mins)	30	Min Design Depth for Optimisation (m)	1.200
Foul Sewage (l/s/ha)	0.000	Min Vel for Auto Design only (m/s)	1.00
Volumetric Runoff Coeff.	0.750	Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Network Design Table for Storm

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	32.283	0.323	99.9	0.019	1.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	13.965	0.218	64.1	0.035	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	31.399	0.921	34.1	0.040	1.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	14.203	0.071	200.0	0.012	0.00	0.0	0.600	o	300	Pipe/Conduit	
3.000	31.317	0.647	48.4	0.040	1.00	0.0	0.600	o	100	Pipe/Conduit	
1.003	13.697	0.046	297.8	0.035	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	19.989	0.123	162.5	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
4.000	5.000	0.565	8.8	0.019	1.00	0.0	0.600	o	100	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	0.00	1.41	4.090	0.019	0.0	0.0	0.0	1.31	52.0	0.0
1.001	0.00	1.55	3.767	0.054	0.0	0.0	0.0	1.64	65.1	0.0
2.000	0.00	1.23	4.470	0.040	0.0	0.0	0.0	2.25	89.4	0.0
1.002	0.00	1.77	3.474	0.106	0.0	0.0	0.0	1.11	78.3	0.0
3.000	0.00	1.47	4.250	0.040	0.0	0.0	0.0	1.11	8.7	0.0
1.003	0.00	2.02	3.403	0.181	0.0	0.0	0.0	0.91	64.0	0.0
1.004	0.00	2.29	3.357	0.181	0.0	0.0	0.0	1.23	87.0	0.0
4.000	0.00	1.03	4.000	0.019	0.0	0.0	0.0	2.61	20.5	0.0

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.005	5.875	0.020	293.8	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)
1.005	0.00	2.40	3.234	0.200	0.0	0.0	0.0	0.91	64.5	0.0

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
1	4.790	0.700	Open Manhole	600	1.000	4.090	225				
1.1	4.490	0.723	Open Manhole	600	1.001	3.767	225	1.000	3.767	225	
2	5.170	0.700	Open Manhole	600	2.000	4.470	225				
1.2	4.450	0.976	Open Manhole	600	1.002	3.474	300	1.001	3.549	225	
								2.000	3.549	225	
3	4.960	0.710	Open Manhole	450	3.000	4.250	100				
1.3	4.930	1.527	Open Manhole	600	1.003	3.403	300	1.002	3.403	300	
								3.000	3.603	100	
1.4	5.050	1.693	Open Manhole	600	1.004	3.357	300	1.003	3.357	300	
4	5.070	1.070	Open Manhole	450	4.000	4.000	100				
1.5	5.070	1.836	Open Manhole	600	1.005	3.234	300	1.004	3.234	300	
								4.000	3.435	100	1
	5.000	1.786	Open Manhole	375		OUTFALL		1.005	3.214	300	

No coordinates have been specified, layout information cannot be produced.

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	1	4.790	4.090	0.475	Open Manhole	600
1.001	o	225	1.1	4.490	3.767	0.498	Open Manhole	600
2.000	o	225	2	5.170	4.470	0.475	Open Manhole	600
1.002	o	300	1.2	4.450	3.474	0.676	Open Manhole	600
3.000	o	100	3	4.960	4.250	0.610	Open Manhole	450
1.003	o	300	1.3	4.930	3.403	1.227	Open Manhole	600
1.004	o	300	1.4	5.050	3.357	1.393	Open Manhole	600
4.000	o	100	4	5.070	4.000	0.970	Open Manhole	450
1.005	o	300	1.5	5.070	3.234	1.536	Open Manhole	600

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	32.283	99.9	1.1	4.490	3.767	0.498	Open Manhole	600
1.001	13.965	64.1	1.2	4.450	3.549	0.676	Open Manhole	600
2.000	31.399	34.1	1.2	4.450	3.549	0.676	Open Manhole	600
1.002	14.203	200.0	1.3	4.930	3.403	1.227	Open Manhole	600
3.000	31.317	48.4	1.3	4.930	3.603	1.227	Open Manhole	600
1.003	13.697	297.8	1.4	5.050	3.357	1.393	Open Manhole	600
1.004	19.989	162.5	1.5	5.070	3.234	1.536	Open Manhole	600
4.000	5.000	8.8	1.5	5.070	3.435	1.535	Open Manhole	600
1.005	5.875	293.8		5.000	3.214	1.486	Open Manhole	375

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.019	0.019	0.019
1.001	-	-	100	0.035	0.035	0.035
2.000	-	-	100	0.040	0.040	0.040
1.002	-	-	100	0.012	0.012	0.012
3.000	-	-	100	0.040	0.040	0.040
1.003	-	-	100	0.035	0.035	0.035
1.004	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.019	0.019	0.019
1.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.200	0.200	0.200

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	4
Number of Online Controls	1	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FSR	Profile Type	Summer
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	19.000	Storm Duration (mins)	30
Ratio R	0.350		

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 1.5, DS/PN: 1.005, Volume (m³): 1.9

Unit Reference	MD-SHE-0125-7500-1150-7500
Design Head (m)	1.150
Design Flow (l/s)	7.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	125
Invert Level (m)	3.234
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.150	7.5
Flush-Flo™	0.336	7.5
Kick-Flo®	0.732	6.1
Mean Flow over Head Range	-	6.5

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	4.5	1.200	7.6	3.000	11.8	7.000	17.7
0.200	7.2	1.400	8.2	3.500	12.7	7.500	18.2
0.300	7.5	1.600	8.8	4.000	13.5	8.000	18.8
0.400	7.5	1.800	9.3	4.500	14.3	8.500	19.4
0.500	7.3	2.000	9.7	5.000	15.0	9.000	19.9
0.600	7.0	2.200	10.2	5.500	15.7	9.500	20.4
0.800	6.3	2.400	10.6	6.000	16.4		
1.000	7.0	2.600	11.0	6.500	17.0		

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Storage Structures for Storm

Tank or Pond Manhole: 1, DS/PN: 1.000

Invert Level (m) 4.090

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	195.0	0.450	195.0

Tank or Pond Manhole: 2, DS/PN: 2.000

Invert Level (m) 4.470

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	297.0	0.450	297.0

Tank or Pond Manhole: 3, DS/PN: 3.000

Invert Level (m) 4.250

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	297.0	0.450	297.0

Tank or Pond Manhole: 4, DS/PN: 4.000

Invert Level (m) 4.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	181.0	0.450	181.0

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1 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 4
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	120 Winter	1	+0%					4.097
1.001	1.1	15 Winter	1	+0%	30/15 Winter				3.806
2.000	2	120 Winter	1	+0%					4.480
1.002	1.2	15 Winter	1	+0%	30/15 Winter				3.535
3.000	3	240 Winter	1	+0%					4.264
1.003	1.3	15 Winter	1	+0%	30/15 Winter				3.496
1.004	1.4	15 Winter	1	+0%	30/15 Winter				3.477
4.000	4	120 Winter	1	+0%	100/60 Winter				4.008
1.005	1.5	15 Winter	1	+0%	30/15 Winter				3.470

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	-0.218	0.000	0.01		0.3	OK	
1.001	1.1	-0.186	0.000	0.07		3.9	OK	
2.000	2	-0.215	0.000	0.01		0.8	OK	

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1 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
1.002	1.2	-0.239	0.000	0.09		5.7	OK	
3.000	3	-0.086	0.000	0.05		0.4	OK	
1.003	1.3	-0.207	0.000	0.18		9.4	OK	
1.004	1.4	-0.180	0.000	0.12		8.9	OK	
4.000	4	-0.092	0.000	0.02		0.3	OK	
1.005	1.5	-0.064	0.000	0.16		7.2	OK	

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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 4
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	60 Winter	30	+0%					4.112
1.001	1.1	30 Winter	30	+0%	30/15 Winter				4.178
2.000	2	60 Winter	30	+0%					4.493
1.002	1.2	30 Winter	30	+0%	30/15 Winter				4.178
3.000	3	120 Winter	30	+0%					4.278
1.003	1.3	30 Winter	30	+0%	30/15 Winter				4.178
1.004	1.4	30 Winter	30	+0%	30/15 Winter				4.169
4.000	4	60 Winter	30	+0%	100/60 Winter				4.029
1.005	1.5	30 Winter	30	+0%	30/15 Winter				4.162

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	-0.203	0.000	0.02		0.9	OK	
1.001	1.1	0.186	0.000	0.16		9.2	SURCHARGED	
2.000	2	-0.202	0.000	0.02		1.8	OK	

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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
1.002	1.2	0.404	0.000	0.17		10.8	FLOOD RISK	
3.000	3	-0.072	0.000	0.17		1.5	OK	
1.003	1.3	0.475	0.000	0.29		15.2	SURCHARGED	
1.004	1.4	0.512	0.000	0.15		11.6	SURCHARGED	
4.000	4	-0.071	0.000	0.15		2.6	OK	
1.005	1.5	0.628	0.000	0.17		7.5	SURCHARGED	

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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 4
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	120 Winter	100	+40%					4.185
1.001	1.1	15 Winter	100	+40%	30/15 Winter				4.441
2.000	2	60 Winter	100	+40%					4.507
1.002	1.2	15 Winter	100	+40%	30/15 Winter				4.445
3.000	3	60 Winter	100	+40%					4.300
1.003	1.3	15 Winter	100	+40%	30/15 Winter				4.485
1.004	1.4	15 Winter	100	+40%	30/15 Winter				4.474
4.000	4	180 Winter	100	+40%	100/60 Winter				4.147
1.005	1.5	15 Winter	100	+40%	30/15 Winter				4.449

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.130	0.000	0.06		3.2	OK	
1.001	1.1	0.449	0.000	0.26		14.9	FLOOD RISK	
2.000	2	-0.188	0.000	0.06		5.4	OK	

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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
1.002	1.2	0.671	0.000	0.24		15.5	FLOOD RISK	
3.000	3	-0.050	0.000	0.42		3.6	OK	
1.003	1.3	0.782	0.000	0.41		21.5	SURCHARGED	
1.004	1.4	0.817	0.000	0.25		19.1	SURCHARGED	
4.000	4	0.047	0.000	0.28		5.0	SURCHARGED	
1.005	1.5	0.915	0.000	0.17		7.5	SURCHARGED	

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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)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Maximum Backdrop Height (m)	10.000
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 Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.804	4-8	1.740

Total Area Contributing (ha) = 2.544

Total Pipe Volume (m³) = 89.856

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
1.000	66.914	0.112	600.0	0.593	1.00	0.0	0.600	o	600	Pipe/Conduit	
1.001	67.242	0.112	600.0	0.590	0.00	0.0	0.600	o	600	Pipe/Conduit	
2.000	56.848	0.224	253.8	0.605	1.00	0.0	0.600	o	600	Pipe/Conduit	
1.002	64.467	0.107	600.0	0.501	0.00	0.0	0.600	o	600	Pipe/Conduit	
1.003	21.050	0.035	600.0	0.100	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	0.00	2.13	3.000	0.593	0.0	0.0	0.0	0.99	279.0	0.0
1.001	0.00	3.27	2.888	1.183	0.0	0.0	0.0	0.99	279.0	0.0
2.000	0.00	1.62	3.000	0.605	0.0	0.0	0.0	1.52	430.9	0.0
1.002	0.00	4.35	2.776	2.289	0.0	0.0	0.0	0.99	279.0	0.0
1.003	0.00	4.71	2.669	2.389	0.0	0.0	0.0	0.99	279.0	0.0

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.004	5.324	0.013	409.5	0.155	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.005	68.064	0.170	400.4	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.004	0.00	4.80	2.633	2.544	0.0	0.0	0.0	1.00	158.8	0.0
1.005	0.00	5.92	2.620	2.544	0.0	0.0	0.0	1.01	160.6	0.0

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Manhole Schedules for Storm

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)
4.0	4.300	1.300	Open Manhole	1200	1.000	3.000	600			
4.1	4.550	1.662	Open Manhole	1200	1.001	2.888	600	1.000	2.888	600
5.0	4.880	1.880	Open Manhole	1200	2.000	3.000	600			
4.2	4.740	1.964	Open Manhole	1200	1.002	2.776	600	1.001	2.776	600
								2.000	2.776	600
4.3 flow control	4.670	2.001	Open Manhole	1200	1.003	2.669	600	1.002	2.669	600
4.5	4.400	1.767	Open Manhole	1200	1.004	2.633	450	1.003	2.633	600
4.6	4.140	1.520	Open Manhole	1200	1.005	2.620	450	1.004	2.620	450
	4.500	2.050	Open Manhole	375		OUTFALL		1.005	2.450	450

No coordinates have been specified, layout information cannot be produced.

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	600	4.0	4.300	3.000	0.700	Open Manhole	1200
1.001	o	600	4.1	4.550	2.888	1.062	Open Manhole	1200
2.000	o	600	5.0	4.880	3.000	1.280	Open Manhole	1200
1.002	o	600	4.2	4.740	2.776	1.364	Open Manhole	1200
1.003	o	600	4.3 flow control	4.670	2.669	1.401	Open Manhole	1200
1.004	o	450	4.5	4.400	2.633	1.317	Open Manhole	1200
1.005	o	450	4.6	4.140	2.620	1.070	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	66.914	600.0	4.1	4.550	2.888	1.062	Open Manhole	1200
1.001	67.242	600.0	4.2	4.740	2.776	1.364	Open Manhole	1200
2.000	56.848	253.8	4.2	4.740	2.776	1.364	Open Manhole	1200
1.002	64.467	600.0	4.3 flow control	4.670	2.669	1.401	Open Manhole	1200
1.003	21.050	600.0	4.5	4.400	2.633	1.167	Open Manhole	1200
1.004	5.324	409.5	4.6	4.140	2.620	1.070	Open Manhole	1200
1.005	68.064	400.4		4.500	2.450	1.600	Open Manhole	375

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.593	0.593	0.593
1.001	-	-	100	0.590	0.590	0.590
2.000	-	-	100	0.605	0.605	0.605
1.002	-	-	100	0.501	0.501	0.501
1.003	-	-	100	0.100	0.100	0.100
1.004	-	-	100	0.155	0.155	0.155
1.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				2.544	2.544	2.544

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)
1.005		4.500	2.450	2.500	375	0

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 4.3 flow control, DS/PN: 1.003, Volume (m³): 20.2

Unit Reference	MD-SHE-0443-1320-1000-1320
Design Head (m)	1.000
Design Flow (l/s)	132.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	443
Invert Level (m)	2.669
Minimum Outlet Pipe Diameter (mm)	500
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	131.9
Flush-Flo™	0.600	131.6
Kick-Flo®	0.874	123.6
Mean Flow over Head Range	-	97.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	11.7	1.200	144.1	3.000	225.5	7.000	341.9
0.200	42.5	1.400	155.4	3.500	243.2	7.500	353.7
0.300	84.3	1.600	165.8	4.000	259.7	8.000	365.1
0.400	125.1	1.800	175.7	4.500	275.1	8.500	376.2
0.500	130.3	2.000	184.9	5.000	289.8	9.000	386.9
0.600	131.6	2.200	193.8	5.500	303.7	9.500	397.3
0.800	127.4	2.400	202.2	6.000	316.9		
1.000	131.9	2.600	210.3	6.500	329.6		

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Storage Structures for Storm

Tank or Pond Manhole: 4.0, DS/PN: 1.000

Invert Level (m) 3.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	462.0	0.450	462.0

Tank or Pond Manhole: 4.2, DS/PN: 1.002

Invert Level (m) 2.776

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	462.0	0.450	462.0

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1 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 2
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
1.000	4.0	120 Winter	1	+0%	100/60 Winter		
1.001	4.1	15 Winter	1	+0%	100/30 Winter		
2.000	5.0	15 Winter	1	+0%	100/15 Winter		
1.002	4.2	120 Winter	1	+0%	100/15 Winter		
1.003	4.3 flow control	120 Winter	1	+0%	100/15 Winter		
1.004	4.5	120 Winter	1	+0%	100/30 Winter		
1.005	4.6	120 Winter	1	+0%	100/60 Winter		

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	4.0		3.106	-0.494	0.000	0.04		10.0	OK
1.001	4.1		3.080	-0.408	0.000	0.22		54.6	OK
2.000	5.0		3.206	-0.394	0.000	0.25		94.2	OK
1.002	4.2		3.036	-0.340	0.000	0.15		37.0	OK
1.003	4.3 flow control		3.010	-0.259	0.000	0.22		38.5	OK

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

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.004	4.5		2.822	-0.262	0.000	0.37		41.8	OK
1.005	4.6		2.782	-0.289	0.000	0.28		41.7	OK

PN	US/MH Name	Level Exceeded
1.000	4.0	
1.001	4.1	
2.000	5.0	
1.002	4.2	
1.003	4.3 flow control	
1.004	4.5	
1.005	4.6	

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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 2
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
1.000	4.0	120 Winter	30	+0%	100/60 Winter		
1.001	4.1	120 Winter	30	+0%	100/30 Winter		
2.000	5.0	15 Winter	30	+0%	100/15 Winter		
1.002	4.2	120 Winter	30	+0%	100/15 Winter		
1.003	4.3 flow control	60 Winter	30	+0%	100/15 Winter		
1.004	4.5	60 Winter	30	+0%	100/30 Winter		
1.005	4.6	60 Winter	30	+0%	100/60 Winter		

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.000	4.0		3.344	-0.256	0.000	0.10		25.0	OK
1.001	4.1		3.335	-0.153	0.000	0.24		59.3	OK
2.000	5.0		3.346	-0.254	0.000	0.58		222.2	OK
1.002	4.2		3.278	-0.098	0.000	0.29		72.5	OK
1.003	4.3 flow control		3.228	-0.041	0.000	0.44		79.0	OK

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

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status
1.004	4.5		2.942	-0.142	0.000	0.81		91.8	OK
1.005	4.6		2.876	-0.195	0.000	0.61		91.3	OK

PN	US/MH Name	Level Exceeded
1.000	4.0	
1.001	4.1	
2.000	5.0	
1.002	4.2	
1.003	4.3 flow control	
1.004	4.5	
1.005	4.6	

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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 2
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow
1.000	4.0	120 Winter	100	+40%	100/60 Winter		
1.001	4.1	120 Winter	100	+40%	100/30 Winter		
2.000	5.0	120 Winter	100	+40%	100/15 Winter		
1.002	4.2	120 Winter	100	+40%	100/15 Winter		
1.003	4.3 flow control	120 Winter	100	+40%	100/15 Winter		
1.004	4.5	60 Winter	100	+40%	100/30 Winter		
1.005	4.6	60 Winter	100	+40%	100/60 Winter		

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
1.000	4.0		3.723	0.123	0.000	0.12		29.9
1.001	4.1		3.719	0.231	0.000	0.33		83.7
2.000	5.0		3.826	0.226	0.000	0.30		114.6
1.002	4.2		3.701	0.325	0.000	0.53		132.5
1.003	4.3 flow control		3.745	0.476	0.000	0.73		130.0

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

PN	US/MH Name	Overflow Act.	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)
1.004		4.5	3.114	0.030	0.000	1.40		159.9
1.005		4.6	3.073	0.002	0.000	1.05		156.8

PN	US/MH Name	Status	Level Exceeded
1.000	4.0	SURCHARGED	
1.001	4.1	SURCHARGED	
2.000	5.0	SURCHARGED	
1.002	4.2	SURCHARGED	
1.003	4.3 flow control	SURCHARGED	
1.004	4.5	SURCHARGED	
1.005	4.6	SURCHARGED	

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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)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Maximum Backdrop Height (m)	10.000
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 Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.174	4-8	0.009

Total Area Contributing (ha) = 0.183

Total Pipe Volume (m³) = 8.560

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
1.000	23.620	0.236	100.1	0.019	1.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	12.808	0.253	50.6	0.016	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	22.743	0.489	46.5	0.035	1.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	7.741	0.077	100.5	0.016	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	14.455	0.145	99.7	0.016	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	0.00	1.30	4.750	0.019	0.0	0.0	0.0	1.31	52.0	0.0
1.001	0.00	1.42	4.514	0.035	0.0	0.0	0.0	1.84	73.3	0.0
2.000	0.00	1.20	4.750	0.035	0.0	0.0	0.0	1.92	76.5	0.0
1.002	0.00	1.52	4.261	0.086	0.0	0.0	0.0	1.30	51.8	0.0
1.003	0.00	1.67	4.109	0.102	0.0	0.0	0.0	1.57	111.3	0.0

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
3.000	31.222	0.502	62.2	0.037	1.00	0.0	0.600	o	225	Pipe/Conduit	
3.001	8.358	0.209	40.0	0.005	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	5.966	0.060	99.4	0.024	0.00	0.0	0.600	o	375	Pipe/Conduit	
4.000	25.777	0.771	33.4	0.015	1.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	14.670	0.049	300.0	0.000	0.00	0.0	0.600	o	375	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
3.000	0.00	1.31	4.750	0.037	0.0	0.0	0.0	1.66	66.1	0.0
3.001	0.00	1.38	4.248	0.042	0.0	0.0	0.0	2.07	82.5	0.0
1.004	0.00	1.72	3.889	0.168	0.0	0.0	0.0	1.82	200.7	0.0
4.000	0.00	1.19	4.750	0.015	0.0	0.0	0.0	2.27	90.3	0.0
1.005	0.00	1.96	3.829	0.183	0.0	0.0	0.0	1.04	115.0	0.0

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
6	5.200	0.450	Open Manhole	600	1.000	4.750	225				
6.1	5.200	0.686	Open Manhole	600	1.001	4.514	225	1.000	4.514	225	
7	5.200	0.450	Open Manhole	600	2.000	4.750	225				
6.2	5.200	0.939	Open Manhole	600	1.002	4.261	225	1.001	4.261	225	
								2.000	4.261	225	
6.3	5.200	1.091	Open Manhole	600	1.003	4.109	300	1.002	4.184	225	
8	5.200	0.450	Open Manhole	600	3.000	4.750	225				
8.1	5.200	0.952	Open Manhole	600	3.001	4.248	225	3.000	4.248	225	
6.4	5.200	1.311	Open Manhole	600	1.004	3.889	375	1.003	3.964	300	
								3.001	4.039	225	
9	5.200	0.450	Open Manhole	600	4.000	4.750	225				
6.10	5.200	1.371	Open Manhole	600	1.005	3.829	375	1.004	3.829	375	
								4.000	3.979	225	
	5.200	1.420	Open Manhole	375		OUTFALL		1.005	3.780	375	

No coordinates have been specified, layout information cannot be produced.

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	6	5.200	4.750	0.225	Open Manhole	600
1.001	o	225	6.1	5.200	4.514	0.461	Open Manhole	600
2.000	o	225	7	5.200	4.750	0.225	Open Manhole	600
1.002	o	225	6.2	5.200	4.261	0.714	Open Manhole	600
1.003	o	300	6.3	5.200	4.109	0.791	Open Manhole	600
3.000	o	225	8	5.200	4.750	0.225	Open Manhole	600
3.001	o	225	8.1	5.200	4.248	0.727	Open Manhole	600
1.004	o	375	6.4	5.200	3.889	0.936	Open Manhole	600
4.000	o	225	9	5.200	4.750	0.225	Open Manhole	600
1.005	o	375	6.10	5.200	3.829	0.996	Open Manhole	600

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	23.620	100.1	6.1	5.200	4.514	0.461	Open Manhole	600
1.001	12.808	50.6	6.2	5.200	4.261	0.714	Open Manhole	600
2.000	22.743	46.5	6.2	5.200	4.261	0.714	Open Manhole	600
1.002	7.741	100.5	6.3	5.200	4.184	0.791	Open Manhole	600
1.003	14.455	99.7	6.4	5.200	3.964	0.936	Open Manhole	600
3.000	31.222	62.2	8.1	5.200	4.248	0.727	Open Manhole	600
3.001	8.358	40.0	6.4	5.200	4.039	0.936	Open Manhole	600
1.004	5.966	99.4	6.10	5.200	3.829	0.996	Open Manhole	600
4.000	25.777	33.4	6.10	5.200	3.979	0.996	Open Manhole	600
1.005	14.670	300.0		5.200	3.780	1.045	Open Manhole	375

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.019	0.019	0.019
1.001	-	-	100	0.016	0.016	0.016
2.000	-	-	100	0.035	0.035	0.035
1.002	-	-	100	0.016	0.016	0.016
1.003	-	-	100	0.016	0.016	0.016
3.000	-	-	100	0.037	0.037	0.037
3.001	-	-	100	0.005	0.005	0.005
1.004	-	-	100	0.024	0.024	0.024
4.000	-	-	100	0.015	0.015	0.015
1.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.183	0.183	0.183

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)
1.005		5.200	3.780	1.890	375	0

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 6.10, DS/PN: 1.005, Volume (m³): 2.0

Unit Reference	MD-SHE-0100-5000-1400-5000
Design Head (m)	1.400
Design Flow (l/s)	5.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	100
Invert Level (m)	3.829
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	**Head (m)**	**Flow (l/s)**
Design Point (Calculated)	1.400	5.0
Flush-Flo™	0.416	5.0
Kick-Flo®	0.855	4.0
Mean Flow over Head Range	-	4.4

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	3.3	1.200	4.7	3.000	7.1	7.000	10.7
0.200	4.6	1.400	5.0	3.500	7.7	7.500	11.0
0.300	4.9	1.600	5.3	4.000	8.2	8.000	11.4
0.400	5.0	1.800	5.6	4.500	8.6	8.500	11.7
0.500	5.0	2.000	5.9	5.000	9.1	9.000	12.0
0.600	4.9	2.200	6.2	5.500	9.5	9.500	12.3
0.800	4.3	2.400	6.4	6.000	9.9		
1.000	4.3	2.600	6.7	6.500	10.3		

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Storage Structures for Storm

Tank or Pond Manhole: 6, DS/PN: 1.000

Invert Level (m) 4.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	174.0	0.450	174.0

Tank or Pond Manhole: 7, DS/PN: 2.000

Invert Level (m) 4.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	307.0	0.450	307.0

Tank or Pond Manhole: 8, DS/PN: 3.000

Invert Level (m) 4.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	339.0	0.450	339.0

Tank or Pond Manhole: 9, DS/PN: 4.000

Invert Level (m) 4.750

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	168.0	0.450	168.0

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1 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 4
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	6	120 Winter	1	+0%					4.758
1.001	6.1	15 Winter	1	+0%	30/15 Winter				4.540
2.000	7	120 Winter	1	+0%					4.759
1.002	6.2	15 Winter	1	+0%	30/15 Winter				4.309
1.003	6.3	30 Winter	1	+0%	30/15 Winter				4.215
3.000	8	180 Winter	1	+0%					4.759
3.001	8.1	15 Winter	1	+0%	30/15 Winter				4.262
1.004	6.4	30 Winter	1	+0%	30/15 Winter				4.213
4.000	9	60 Winter	1	+0%					4.755
1.005	6.10	30 Winter	1	+0%	1/15 Winter				4.211

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	6	-0.217	0.000	0.01		0.4	OK	
1.001	6.1	-0.199	0.000	0.03		1.9	OK	

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1 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
2.000	7	-0.216	0.000	0.01		0.6	OK	
1.002	6.2	-0.177	0.000	0.10		4.0	OK	
1.003	6.3	-0.194	0.000	0.05		5.0	OK	
3.000	8	-0.216	0.000	0.01		0.5	OK	
3.001	8.1	-0.211	0.000	0.01		0.8	OK	
1.004	6.4	-0.051	0.000	0.06		6.2	OK	
4.000	9	-0.220	0.000	0.00		0.4	OK	
1.005	6.10	0.007	0.000	0.05		5.0	SURCHARGED	

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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 4
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	6	60 Winter	30	+0%					4.775
1.001	6.1	30 Winter	30	+0%	30/15 Winter				4.826
2.000	7	120 Winter	30	+0%					4.776
1.002	6.2	30 Winter	30	+0%	30/15 Winter				4.825
1.003	6.3	30 Winter	30	+0%	30/15 Winter				4.824
3.000	8	120 Winter	30	+0%					4.775
3.001	8.1	30 Winter	30	+0%	30/15 Winter				4.819
1.004	6.4	30 Winter	30	+0%	30/15 Winter				4.821
4.000	9	60 Winter	30	+0%					4.769
1.005	6.10	30 Winter	30	+0%	1/15 Winter				4.820

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	6	-0.200	0.000	0.02		0.8	OK	
1.001	6.1	0.087	0.000	0.07		4.3	SURCHARGED	

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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
2.000	7	-0.199	0.000	0.02		1.2	OK	
1.002	6.2	0.339	0.000	0.19		7.4	SURCHARGED	
1.003	6.3	0.415	0.000	0.09		8.2	SURCHARGED	
3.000	8	-0.200	0.000	0.02		1.1	OK	
3.001	8.1	0.346	0.000	0.02		1.3	SURCHARGED	
1.004	6.4	0.557	0.000	0.07		7.7	SURCHARGED	
4.000	9	-0.206	0.000	0.01		0.9	OK	
1.005	6.10	0.616	0.000	0.05		5.0	SURCHARGED	

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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 4
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	6	120 Winter	100	+40%					4.820
1.001	6.1	15 Winter	100	+40%	30/15 Winter				5.000
2.000	7	120 Winter	100	+40%					4.819
1.002	6.2	15 Winter	100	+40%	30/15 Winter				5.015
1.003	6.3	15 Winter	100	+40%	30/15 Winter				5.038
3.000	8	180 Winter	100	+40%					4.815
3.001	8.1	15 Winter	100	+40%	30/15 Winter				5.006
1.004	6.4	15 Winter	100	+40%	30/15 Winter				5.031
4.000	9	120 Winter	100	+40%					4.812
1.005	6.10	15 Winter	100	+40%	1/15 Winter				5.025

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	6	-0.155	0.000	0.02		0.9	OK	
1.001	6.1	0.261	0.000	0.11		7.1	FLOOD RISK	

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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
2.000	7	-0.156	0.000	0.02		1.4	OK	
1.002	6.2	0.529	0.000	0.27		10.5	FLOOD RISK	
1.003	6.3	0.629	0.000	0.12		11.4	FLOOD RISK	
3.000	8	-0.160	0.000	0.02		1.4	OK	
3.001	8.1	0.533	0.000	0.02		1.4	FLOOD RISK	
1.004	6.4	0.767	0.000	0.13		14.0	FLOOD RISK	
4.000	9	-0.163	0.000	0.01		0.9	OK	
1.005	6.10	0.821	0.000	0.05		5.0	FLOOD RISK	

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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)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Maximum Backdrop Height (m)	10.000
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 Storm

Time (mins)	Area (ha)
0-4	0.064

Total Area Contributing (ha) = 0.064

Total Pipe Volume (m³) = 1.129

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
1.000	78.204	0.893	87.6	0.032	1.00	0.0	0.600	o	100	Pipe/Conduit	
2.000	30.334	0.303	100.1	0.032	1.00	0.0	0.600	o	100	Pipe/Conduit	
1.001	35.199	0.352	100.0	0.000	0.00	0.0	0.600	o	100	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	0.00	2.58	5.380	0.032	0.0	0.0	0.0	0.82	6.5	0.0
2.000	0.00	1.66	4.790	0.032	0.0	0.0	0.0	0.77	6.0	0.0
1.001	0.00	3.35	4.487	0.064	0.0	0.0	0.0	0.77	6.0	0.0

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
6	5.930	0.550	Open Manhole	450	1.000	5.380	100				
2	5.340	0.550	Open Manhole	450	2.000	4.790	100				
3	5.450	0.963	Open Manhole	450	1.001	4.487	100	1.000	4.487	100	
								2.000	4.487	100	
	5.000	0.865	Open Manhole	375		OUTFALL		1.001	4.135	100	

No coordinates have been specified, layout information cannot be produced.

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	100	6	5.930	5.380	0.450	Open Manhole	450
2.000	o	100	2	5.340	4.790	0.450	Open Manhole	450
1.001	o	100	3	5.450	4.487	0.863	Open Manhole	450

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	78.204	87.6	3	5.450	4.487	0.863	Open Manhole	450
2.000	30.334	100.1	3	5.450	4.487	0.863	Open Manhole	450
1.001	35.199	100.0		5.000	4.135	0.765	Open Manhole	375

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.032	0.032	0.032
2.000	-	-	100	0.032	0.032	0.032
1.001	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.064	0.064	0.064

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)
1.001		5.000	4.135	0.000	375	0

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Storage Structures for Storm

Tank or Pond Manhole: 6, DS/PN: 1.000

Invert Level (m) 5.380

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	323.0	0.450	323.0

Tank or Pond Manhole: 2, DS/PN: 2.000

Invert Level (m) 4.790

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	323.0	0.450	323.0

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1 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 2
Number of Online Controls 0 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	6	480 Winter	1	+0%					5.392
2.000	2	480 Winter	1	+0%					4.803
1.001	3	480 Winter	1	+0%					4.505

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	6	-0.088	0.000	0.04		0.2	OK	
2.000	2	-0.087	0.000	0.04		0.2	OK	
1.001	3	-0.082	0.000	0.08		0.5	OK	

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	6	180 Winter	30	+0%					5.403
2.000	2	240 Winter	30	+0%					4.814
1.001	3	240 Winter	30	+0%					4.522

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	6	-0.077	0.000	0.13		0.8	OK	
2.000	2	-0.076	0.000	0.13		0.8	OK	
1.001	3	-0.065	0.000	0.27		1.6	OK	

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	6	120 Winter	100	+40%					5.418
2.000	2	180 Winter	100	+40%					4.829
1.001	3	180 Winter	100	+40%					4.547

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	6	-0.062	0.000	0.31		2.0	OK	
2.000	2	-0.061	0.000	0.32		1.9	OK	
1.001	3	-0.040	0.000	0.66		3.9	OK	

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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)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Maximum Backdrop Height (m)	10.000
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 Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	1.050	4-8	0.110

Total Area Contributing (ha) = 1.160

Total Pipe Volume (m³) = 31.801

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
1.000	32.200	0.322	100.0	0.021	1.00	0.0	0.600	o	100	Pipe/Conduit	
1.001	11.047	0.624	17.7	0.073	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	32.569	0.326	99.9	0.021	1.00	0.0	0.600	o	100	Pipe/Conduit	
1.002	18.506	0.185	100.0	0.073	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	0.00	1.70	5.260	0.021	0.0	0.0	0.0	0.77	6.0	0.0
1.001	0.00	1.76	4.813	0.094	0.0	0.0	0.0	3.12	124.3	0.0
2.000	0.00	1.71	4.640	0.021	0.0	0.0	0.0	0.77	6.0	0.0
1.002	0.00	1.99	4.189	0.188	0.0	0.0	0.0	1.31	52.0	0.0

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
3.000	13.634	0.170	80.2	0.060	1.00	0.0	0.600	o	100	Pipe/Conduit	
3.001	46.597	0.582	80.1	0.019	0.00	0.0	0.600	o	100	Pipe/Conduit	
3.002	12.266	0.245	50.1	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit	
4.000	38.941	0.798	48.8	0.016	1.00	0.0	0.600	o	100	Pipe/Conduit	
3.003	14.081	1.073	13.1	0.067	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.003	56.323	0.563	100.0	0.073	0.00	0.0	0.600	o	300	Pipe/Conduit	
5.000	50.491	0.631	80.0	0.051	1.00	0.0	0.600	o	100	Pipe/Conduit	
5.001	10.385	0.173	60.0	0.012	0.00	0.0	0.600	o	100	Pipe/Conduit	
5.002	15.390	0.308	50.0	0.073	0.00	0.0	0.600	o	225	Pipe/Conduit	
5.003	4.275	0.107	40.0	0.073	0.00	0.0	0.600	o	225	Pipe/Conduit	
5.004	40.808	1.015	40.2	0.023	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	8.565	0.086	99.6	0.150	0.00	0.0	0.600	o	300	Pipe/Conduit	
6.000	85.000	2.470	34.4	0.160	1.00	0.0	0.600	o	450	Pipe/Conduit	
7.000	65.667	1.645	39.9	0.155	1.00	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	0.00	1.26	6.200	0.060	0.0	0.0	0.0	0.86	6.8	0.0
3.001	0.00	2.17	6.030	0.079	0.0	0.0	0.0	0.86	6.8	0.0
3.002	0.00	2.35	5.448	0.079	0.0	0.0	0.0	1.09	8.6	0.0
4.000	0.00	1.59	6.000	0.016	0.0	0.0	0.0	1.11	8.7	0.0
3.003	0.00	2.46	5.202	0.162	0.0	0.0	0.0	2.14	16.8	0.0
1.003	0.00	3.06	3.929	0.423	0.0	0.0	0.0	1.57	111.1	0.0
5.000	0.00	1.98	5.800	0.051	0.0	0.0	0.0	0.86	6.8	0.0
5.001	0.00	2.15	5.169	0.063	0.0	0.0	0.0	1.00	7.8	0.0
5.002	0.00	2.29	4.871	0.136	0.0	0.0	0.0	1.85	73.8	0.0
5.003	0.00	2.32	4.563	0.209	0.0	0.0	0.0	2.08	82.5	0.0
5.004	0.00	2.65	4.456	0.232	0.0	0.0	0.0	2.07	82.3	0.0
1.004	0.00	3.15	3.366	0.805	0.0	0.0	0.0	1.58	111.4	0.0
6.000	0.00	1.41	5.600	0.160	0.0	0.0	0.0	3.47	552.7	0.0
7.000	0.00	1.53	5.000	0.155	0.0	0.0	0.0	2.08	82.6	0.0

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Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
8.000	88.760	1.479	60.0	0.040	1.00	0.0	0.600	o	225	Pipe/Conduit	
8.001	9.841	0.666	14.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.005	7.190	0.072	99.9	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	
1.006	2.945	0.029	101.6	0.000	0.00	0.0	0.600	o	450	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
8.000	0.00	1.87	5.500	0.040	0.0	0.0	0.0	1.69	67.3	0.0
8.001	0.00	1.92	4.021	0.040	0.0	0.0	0.0	3.42	136.1	0.0
1.005	0.00	3.21	3.130	1.160	0.0	0.0	0.0	2.03	323.6	0.0
1.006	0.00	3.23	3.058	1.160	0.0	0.0	0.0	2.02	320.9	0.0

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
13	5.810	0.550	Open Manhole	450	1.000	5.260	100				
13.1	5.690	0.877	Open Manhole	600	1.001	4.813	225	1.000	4.938	100	
14	5.340	0.700	Open Manhole	450	2.000	4.640	100				
13.2	5.230	1.041	Open Manhole	600	1.002	4.189	225	1.001	4.189	225	
								2.000	4.314	100	
15	7.500	1.300	Open Manhole	450	3.000	6.200	100				
15.1	7.000	0.970	Open Manhole	450	3.001	6.030	100	3.000	6.030	100	
15.2	8.090	2.642	Open Manhole	450	3.002	5.448	100	3.001	5.448	100	
16	7.500	1.500	Open Manhole	450	4.000	6.000	100				
15.3	8.090	2.888	Open Manhole	450	3.003	5.202	100	3.002	5.203	100	1
								4.000	5.202	100	
13.3	8.030	4.101	Open Manhole	600	1.003	3.929	300	1.002	4.004	225	
								3.003	4.129	100	
12	7.750	1.950	Open Manhole	450	5.000	5.800	100				
12.1	7.850	2.681	Open Manhole	450	5.001	5.169	100	5.000	5.169	100	
12.2	7.850	2.979	Open Manhole	600	5.002	4.871	225	5.001	4.996	100	
12.3	7.790	3.227	Open Manhole	600	5.003	4.563	225	5.002	4.563	225	
12.4	7.790	3.334	Open Manhole	600	5.004	4.456	225	5.003	4.456	225	
12.5	7.990	4.624	Open Manhole	600	1.004	3.366	300	1.003	3.366	300	
								5.004	3.441	225	
18	8.500	2.900	Open Manhole	1200	6.000	5.600	450				
17	7.940	2.940	Open Manhole	450	7.000	5.000	225				
19	8.500	3.000	Open Manhole	600	8.000	5.500	225				
19.1	8.000	3.979	Open Manhole	600	8.001	4.021	225	8.000	4.021	225	
12.6	7.840	4.710	Open Manhole	1200	1.005	3.130	450	1.004	3.280	300	
								6.000	3.130	450	
								7.000	3.355	225	
								8.001	3.355	225	
12.7	7.500	4.442	Open Manhole	1200	1.006	3.058	450	1.005	3.058	450	
	5.000	1.971	Open Manhole	375		OUTFALL		1.006	3.029	450	

No coordinates have been specified, layout information cannot be produced.

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	100	13	5.810	5.260	0.450	Open Manhole	450
1.001	o	225	13.1	5.690	4.813	0.652	Open Manhole	600
2.000	o	100	14	5.340	4.640	0.600	Open Manhole	450
1.002	o	225	13.2	5.230	4.189	0.816	Open Manhole	600
3.000	o	100	15	7.500	6.200	1.200	Open Manhole	450
3.001	o	100	15.1	7.000	6.030	0.870	Open Manhole	450
3.002	o	100	15.2	8.090	5.448	2.542	Open Manhole	450
4.000	o	100	16	7.500	6.000	1.400	Open Manhole	450
3.003	o	100	15.3	8.090	5.202	2.788	Open Manhole	450
1.003	o	300	13.3	8.030	3.929	3.801	Open Manhole	600
5.000	o	100	12	7.750	5.800	1.850	Open Manhole	450
5.001	o	100	12.1	7.850	5.169	2.581	Open Manhole	450
5.002	o	225	12.2	7.850	4.871	2.754	Open Manhole	600
5.003	o	225	12.3	7.790	4.563	3.002	Open Manhole	600

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	32.200	100.0	13.1	5.690	4.938	0.652	Open Manhole	600
1.001	11.047	17.7	13.2	5.230	4.189	0.816	Open Manhole	600
2.000	32.569	99.9	13.2	5.230	4.314	0.816	Open Manhole	600
1.002	18.506	100.0	13.3	8.030	4.004	3.801	Open Manhole	600
3.000	13.634	80.2	15.1	7.000	6.030	0.870	Open Manhole	450
3.001	46.597	80.1	15.2	8.090	5.448	2.542	Open Manhole	450
3.002	12.266	50.1	15.3	8.090	5.203	2.787	Open Manhole	450
4.000	38.941	48.8	15.3	8.090	5.202	2.788	Open Manhole	450
3.003	14.081	13.1	13.3	8.030	4.129	3.801	Open Manhole	600
1.003	56.323	100.0	12.5	7.990	3.366	4.324	Open Manhole	600
5.000	50.491	80.0	12.1	7.850	5.169	2.581	Open Manhole	450
5.001	10.385	60.0	12.2	7.850	4.996	2.754	Open Manhole	600
5.002	15.390	50.0	12.3	7.790	4.563	3.002	Open Manhole	600
5.003	4.275	40.0	12.4	7.790	4.456	3.109	Open Manhole	600

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
5.004	o	225	12.4	7.790	4.456	3.109	Open Manhole	600
1.004	o	300	12.5	7.990	3.366	4.324	Open Manhole	600
6.000	o	450	18	8.500	5.600	2.450	Open Manhole	1200
7.000	o	225	17	7.940	5.000	2.715	Open Manhole	450
8.000	o	225	19	8.500	5.500	2.775	Open Manhole	600
8.001	o	225	19.1	8.000	4.021	3.754	Open Manhole	600
1.005	o	450	12.6	7.840	3.130	4.260	Open Manhole	1200
1.006	o	450	12.7	7.500	3.058	3.992	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)
5.004	40.808	40.2	12.5	7.990	3.441	4.324	Open Manhole	600
1.004	8.565	99.6	12.6	7.840	3.280	4.260	Open Manhole	1200
6.000	85.000	34.4	12.6	7.840	3.130	4.260	Open Manhole	1200
7.000	65.667	39.9	12.6	7.840	3.355	4.260	Open Manhole	1200
8.000	88.760	60.0	19.1	8.000	4.021	3.754	Open Manhole	600
8.001	9.841	14.8	12.6	7.840	3.355	4.260	Open Manhole	1200
1.005	7.190	99.9	12.7	7.500	3.058	3.992	Open Manhole	1200
1.006	2.945	101.6		5.000	3.029	1.521	Open Manhole	375

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.021	0.021	0.021
1.001	-	-	100	0.073	0.073	0.073
2.000	-	-	100	0.021	0.021	0.021
1.002	-	-	100	0.073	0.073	0.073
3.000	-	-	100	0.060	0.060	0.060
3.001	-	-	100	0.019	0.019	0.019
3.002	-	-	100	0.000	0.000	0.000
4.000	-	-	100	0.016	0.016	0.016
3.003	-	-	100	0.067	0.067	0.067
1.003	-	-	100	0.073	0.073	0.073
5.000	-	-	100	0.051	0.051	0.051
5.001	-	-	100	0.012	0.012	0.012
5.002	-	-	100	0.073	0.073	0.073
5.003	-	-	100	0.073	0.073	0.073
5.004	-	-	100	0.023	0.023	0.023
1.004	-	-	100	0.150	0.150	0.150
6.000	-	-	100	0.160	0.160	0.160
7.000	-	-	100	0.155	0.155	0.155
8.000	-	-	100	0.040	0.040	0.040
8.001	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				1.160	1.160	1.160

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		5.000	3.029	0.000	375	0

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 12.7, DS/PN: 1.006, Volume (m³): 6.0

Unit Reference	MD-SHE-0348-8050-2000-8050
Design Head (m)	2.000
Design Flow (l/s)	80.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	348
Invert Level (m)	3.058
Minimum Outlet Pipe Diameter (mm)	375
Suggested Manhole Diameter (mm)	Site Specific Design (Contact Hydro International)

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	80.2
Flush-Flo™	0.645	80.2
Kick-Flo®	1.392	67.3
Mean Flow over Head Range	-	68.3

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	10.1	1.200	74.7	3.000	97.6	7.000	147.5
0.200	35.2	1.400	67.5	3.500	105.2	7.500	152.6
0.300	64.5	1.600	72.0	4.000	112.3	8.000	157.5
0.400	77.2	1.800	76.2	4.500	118.9	8.500	162.2
0.500	79.3	2.000	80.2	5.000	125.2	9.000	166.8
0.600	80.1	2.200	84.0	5.500	131.1	9.500	171.3
0.800	79.6	2.400	87.6	6.000	136.8		
1.000	77.9	2.600	91.1	6.500	142.3		

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Storage Structures for Storm

Tank or Pond Manhole: 13, DS/PN: 1.000

Invert Level (m) 5.260

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	210.0	0.450	210.0

Tank or Pond Manhole: 14, DS/PN: 2.000

Invert Level (m) 4.640

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	210.0	0.450	210.0

Tank or Pond Manhole: 15, DS/PN: 3.000

Invert Level (m) 6.200

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	58.0	0.450	58.0

Tank or Pond Manhole: 15.1, DS/PN: 3.001

Invert Level (m) 6.030

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	196.0	0.450	196.0

Tank or Pond Manhole: 16, DS/PN: 4.000

Invert Level (m) 6.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	158.0	0.450	158.0

Tank or Pond Manhole: 15.3, DS/PN: 3.003

Invert Level (m) 5.202

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	67.0	0.450	67.0

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Tank or Pond Manhole: 12, DS/PN: 5.000

Invert Level (m) 5.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	505.0	0.450	505.0

Tank or Pond Manhole: 12.1, DS/PN: 5.001

Invert Level (m) 5.169

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	113.0	0.450	113.0

Tank or Pond Manhole: 12.4, DS/PN: 5.004

Invert Level (m) 4.581

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	226.0	0.450	226.0

Tank or Pond Manhole: 12.5, DS/PN: 1.004

Invert Level (m) 3.566

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	202.0	0.450	202.0

Tank or Pond Manhole: 18, DS/PN: 6.000

Invert Level (m) 5.600

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	6.3	0.097	6.3

Tank or Pond Manhole: 17, DS/PN: 7.000

Invert Level (m) 5.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	8.2	0.097	8.2

Tank or Pond Manhole: 12.6, DS/PN: 1.005

Invert Level (m) 3.480

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Tank or Pond Manhole: 12.6, DS/PN: 1.005

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	9.3	0.097	9.3

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1 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 13
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	13	360 Winter	1	+0%					5.271
1.001	13.1	15 Winter	1	+0%	100/15 Winter				4.854
2.000	14	360 Winter	1	+0%					4.651
1.002	13.2	15 Winter	1	+0%	30/15 Winter				4.280
3.000	15	30 Winter	1	+0%	30/15 Winter				6.248
3.001	15.1	180 Winter	1	+0%					6.060
3.002	15.2	180 Winter	1	+0%					5.475
4.000	16	240 Winter	1	+0%					6.010
3.003	15.3	30 Winter	1	+0%	100/15 Winter				5.238
1.003	13.3	15 Winter	1	+0%	100/15 Winter				4.029
5.000	12	600 Winter	1	+0%					5.814
5.001	12.1	600 Winter	1	+0%					5.184
5.002	12.2	15 Winter	1	+0%	100/15 Winter				4.923
5.003	12.3	15 Winter	1	+0%	30/15 Winter				4.654
5.004	12.4	15 Winter	1	+0%					4.530
1.004	12.5	15 Winter	1	+0%	30/15 Winter				3.580
6.000	18	15 Winter	1	+0%					5.664
7.000	17	15 Winter	1	+0%	100/15 Winter				5.086

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1 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	13	-0.089	0.000	0.03		0.2	OK	
1.001	13.1	-0.184	0.000	0.07		7.9	OK	
2.000	14	-0.089	0.000	0.03		0.2	OK	
1.002	13.2	-0.134	0.000	0.34		15.7	OK	
3.000	15	-0.052	0.000	0.46		3.0	OK	
3.001	15.1	-0.070	0.000	0.20		1.3	OK	
3.002	15.2	-0.073	0.000	0.16		1.3	OK	
4.000	16	-0.090	0.000	0.02		0.2	OK	
3.003	15.3	-0.064	0.000	0.28		4.5	OK	
1.003	13.3	-0.200	0.000	0.24		25.2	OK	
5.000	12	-0.086	0.000	0.05		0.3	OK	
5.001	12.1	-0.085	0.000	0.05		0.4	OK	
5.002	12.2	-0.173	0.000	0.12		7.9	OK	
5.003	12.3	-0.134	0.000	0.34		15.6	OK	
5.004	12.4	-0.151	0.000	0.23		18.1	OK	
1.004	12.5	-0.086	0.000	0.79		57.9	OK	
6.000	18	-0.386	0.000	0.05		24.2	OK	
7.000	17	-0.139	0.000	0.29		23.6	OK	

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1 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)
8.000	19	15 Winter	1	+0%					5.547
8.001	19.1	15 Winter	1	+0%	100/30 Winter				4.054
1.005	12.6	15 Winter	1	+0%	30/15 Winter				3.554
1.006	12.7	15 Winter	1	+0%	1/15 Winter				3.511

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
8.000	19	-0.178	0.000	0.09		5.9	OK	
8.001	19.1	-0.192	0.000	0.05		5.9	OK	
1.005	12.6	-0.026	0.000	0.47		79.1	OK	
1.006	12.7	0.003	0.000	0.52		77.1	SURCHARGED	

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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 13
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	13	180 Winter	30	+0%					5.282
1.001	13.1	15 Winter	30	+0%	100/15 Winter				4.886
2.000	14	180 Winter	30	+0%					4.662
1.002	13.2	15 Winter	30	+0%	30/15 Winter				4.421
3.000	15	30 Winter	30	+0%	30/15 Winter				6.307
3.001	15.1	120 Winter	30	+0%					6.089
3.002	15.2	120 Winter	30	+0%					5.500
4.000	16	120 Winter	30	+0%					6.019
3.003	15.3	15 Winter	30	+0%	100/15 Winter				5.275
1.003	13.3	15 Winter	30	+0%	100/15 Winter				4.133
5.000	12	240 Winter	30	+0%					5.826
5.001	12.1	240 Winter	30	+0%					5.197
5.002	12.2	15 Winter	30	+0%	100/15 Winter				4.966
5.003	12.3	15 Winter	30	+0%	30/15 Winter				4.790
5.004	12.4	15 Winter	30	+0%					4.585
1.004	12.5	30 Winter	30	+0%	30/15 Winter				3.879
6.000	18	15 Winter	30	+0%					5.704
7.000	17	15 Winter	30	+0%	100/15 Winter				5.149

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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	13	-0.078	0.000	0.11		0.6	OK	
1.001	13.1	-0.152	0.000	0.23		24.3	OK	
2.000	14	-0.078	0.000	0.11		0.6	OK	
1.002	13.2	0.007	0.000	1.01		47.3	SURCHARGED	
3.000	15	0.007	0.000	1.04		6.6	SURCHARGED	
3.001	15.1	-0.041	0.000	0.65		4.3	OK	
3.002	15.2	-0.048	0.000	0.53		4.3	OK	
4.000	16	-0.081	0.000	0.08		0.7	OK	
3.003	15.3	-0.027	0.000	0.88		14.0	OK	
1.003	13.3	-0.096	0.000	0.77		81.1	OK	
5.000	12	-0.074	0.000	0.15		1.0	OK	
5.001	12.1	-0.072	0.000	0.17		1.3	OK	
5.002	12.2	-0.130	0.000	0.37		24.3	OK	
5.003	12.3	0.002	0.000	1.05		48.4	SURCHARGED	
5.004	12.4	-0.096	0.000	0.62		48.8	OK	
1.004	12.5	0.213	0.000	1.01		74.4	SURCHARGED	
6.000	18	-0.346	0.000	0.11		58.8	OK	
7.000	17	-0.076	0.000	0.72		57.5	OK	

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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.	Water Level (m)
8.000	19	15 Winter	30	+0%					5.575
8.001	19.1	15 Winter	30	+0%	100/30 Winter				4.075
1.005	12.6	30 Winter	30	+0%	30/15 Winter				3.835
1.006	12.7	30 Winter	30	+0%	1/15 Winter				3.771

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
8.000	19	-0.150	0.000	0.22		14.4	OK	
8.001	19.1	-0.171	0.000	0.13		14.4	OK	
1.005	12.6	0.255	0.000	0.48		81.2	SURCHARGED	
1.006	12.7	0.263	0.000	0.54		80.0	SURCHARGED	

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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 13
Number of Online Controls 1 Number of Time/Area Diagrams 0
Number of Offline Controls 0 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	13	120 Winter	100	+40%					5.296
1.001	13.1	15 Winter	100	+40%	100/15 Winter				5.242
2.000	14	30 Winter	100	+40%					4.676
1.002	13.2	15 Winter	100	+40%	30/15 Winter				5.164
3.000	15	30 Winter	100	+40%	30/15 Winter				6.419
3.001	15.1	120 Winter	100	+40%					6.124
3.002	15.2	60 Winter	100	+40%					5.528
4.000	16	60 Winter	100	+40%					6.031
3.003	15.3	30 Winter	100	+40%	100/15 Winter				5.378
1.003	13.3	15 Winter	100	+40%	100/15 Winter				4.756
5.000	12	180 Winter	100	+40%					5.843
5.001	12.1	180 Winter	100	+40%					5.215
5.002	12.2	15 Winter	100	+40%	100/15 Winter				5.213
5.003	12.3	15 Winter	100	+40%	30/15 Winter				5.055
5.004	12.4	15 Winter	100	+40%					4.625
1.004	12.5	60 Winter	100	+40%	30/15 Winter				4.455
6.000	18	15 Winter	100	+40%					5.743
7.000	17	15 Winter	100	+40%	100/15 Winter				5.615

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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
1.000	13	-0.064	0.000	0.28		1.6	OK	
1.001	13.1	0.204	0.000	0.37		39.0	SURCHARGED	
2.000	14	-0.064	0.000	0.28		1.7	OK	
1.002	13.2	0.750	0.000	1.50		70.3	FLOOD RISK	
3.000	15	0.119	0.000	1.32		8.4	SURCHARGED	
3.001	15.1	-0.006	0.000	1.00		6.7	OK	
3.002	15.2	-0.020	0.000	0.82		6.7	OK	
4.000	16	-0.069	0.000	0.21		1.8	OK	
3.003	15.3	0.076	0.000	0.95		15.1	SURCHARGED	
1.003	13.3	0.527	0.000	1.15		120.9	SURCHARGED	
5.000	12	-0.057	0.000	0.38		2.6	OK	
5.001	12.1	-0.054	0.000	0.43		3.2	OK	
5.002	12.2	0.117	0.000	0.67		43.5	SURCHARGED	
5.003	12.3	0.267	0.000	1.88		86.8	SURCHARGED	
5.004	12.4	-0.056	0.000	0.78		61.2	OK	
1.004	12.5	0.789	0.000	0.97		70.9	SURCHARGED	
6.000	18	-0.307	0.000	0.21		107.0	OK	
7.000	17	0.390	0.000	0.98		78.0	SURCHARGED	

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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)
8.000	19	15 Winter	100	+40%					5.604
8.001	19.1	60 Winter	100	+40%	100/30 Winter				4.414
1.005	12.6	60 Winter	100	+40%	30/15 Winter				4.410
1.006	12.7	60 Winter	100	+40%	1/15 Winter				4.337

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
8.000	19	-0.121	0.000	0.40		26.0	OK	
8.001	19.1	0.168	0.000	0.11		12.5	SURCHARGED	
1.005	12.6	0.830	0.000	0.48		81.5	SURCHARGED	
1.006	12.7	0.829	0.000	0.54		80.0	SURCHARGED	

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APPENDIX B

Drainage Calculations for the current discharge from Area 2 of the site

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)	19.000	Add Flow / Climate Change (%)	0
Ratio R	0.350	Minimum Backdrop Height (m)	0.000
Maximum Rainfall (mm/hr)	0	Maximum Backdrop Height (m)	10.000
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 Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	2.125	4-8	0.507

Total Area Contributing (ha) = 2.632

Total Pipe Volume (m³) = 23.161

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Manhole Schedules for Storm

MH Name	MH CL (m)	MH Depth (m)	MH Connection	MH Diam.,L*W (mm)	PN	Pipe Out Invert Level (m)	Diameter (mm)	PN	Pipes In Invert Level (m)	Diameter (mm)	Backdrop (mm)
13	4.880	0.680	Open Manhole	450	1.000	4.200	225				
2	4.570	0.760	Open Manhole	1200	1.001	3.810	300	1.000	3.885	225	
3	4.500	0.795	Open Manhole	1200	1.002	3.705	300	1.001	3.705	300	
4	4.480	0.680	Open Manhole	1200	2.000	3.800	225				
5	4.430	0.815	Open Manhole	1200	1.003	3.615	300	1.002	3.615	300	
								2.000	3.690	225	
6	4.460	0.858	Open Manhole	1200	1.004	3.602	300	1.003	3.602	300	
7	4.360	0.700	Open Manhole	1200	3.000	3.660	225				
8	4.530	0.976	Open Manhole	1200	3.001	3.554	300	3.000	3.629	225	
9	4.390	0.924	Open Manhole	1200	1.005	3.466	300	1.004	3.466	300	
								3.001	3.466	300	
10	4.900	0.900	Open Manhole	1200	4.000	4.000	150				
11	4.850	1.046	Open Manhole	1200	4.001	3.804	150	4.000	3.804	150	
12	4.730	1.398	Open Manhole	1200	1.006	3.332	300	1.005	3.332	300	
								4.001	3.482	150	
13	4.520	1.223	Open Manhole	1200	1.007	3.297	300	1.006	3.297	300	
14	4.770	0.770	Open Manhole	1200	5.000	4.000	150				
15	4.640	0.841	Open Manhole	1200	5.001	3.799	150	5.000	3.799	150	
16	4.420	1.060	Open Manhole	1200	6.000	3.360	150				
17	4.500	1.247	Open Manhole	1200	6.001	3.253	150	6.000	3.253	150	
18	4.540	1.476	Open Manhole	1200	1.008	3.064	300	1.007	3.064	300	
								5.001	3.214	150	
								6.001	3.214	150	
19	4.470	0.670	Open Manhole	1200	7.000	3.800	150				
20	4.350	0.650	Open Manhole	1200	8.000	3.700	150				
21	4.410	0.880	Open Manhole	1200	8.001	3.530	150	8.000	3.530	150	
22	4.520	1.150	Open Manhole	1200	9.000	3.370	150				
23	4.470	1.320	Open Manhole	1200	8.002	3.150	225	8.001	3.225	150	
								9.000	3.225	150	
24	4.290	1.204	Open Manhole	1200	8.003	3.086	225	8.002	3.086	225	
25	4.470	1.682	Open Manhole	1350	1.009	2.788	375	1.008	2.863	300	
								7.000	3.013	150	
								8.003	2.938	225	
26	4.210	1.467	Open Manhole	1350	1.010	2.743	375	1.009	2.743	375	
	4.140	1.589	Open Manhole	375		OUTFALL		1.010	2.551	375	

No coordinates have been specified, layout information cannot be produced.

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
1.000	o	225	13	4.880	4.200	0.455	Open Manhole	450
1.001	o	300	2	4.570	3.810	0.460	Open Manhole	1200
1.002	o	300	3	4.500	3.705	0.495	Open Manhole	1200
2.000	o	225	4	4.480	3.800	0.455	Open Manhole	1200
1.003	o	300	5	4.430	3.615	0.515	Open Manhole	1200
1.004	o	300	6	4.460	3.602	0.558	Open Manhole	1200
3.000	o	225	7	4.360	3.660	0.475	Open Manhole	1200
3.001	o	300	8	4.530	3.554	0.676	Open Manhole	1200
1.005	o	300	9	4.390	3.466	0.624	Open Manhole	1200
4.000	o	150	10	4.900	4.000	0.750	Open Manhole	1200
4.001	o	150	11	4.850	3.804	0.896	Open Manhole	1200
1.006	o	300	12	4.730	3.332	1.098	Open Manhole	1200
1.007	o	300	13	4.520	3.297	0.923	Open Manhole	1200
5.000	o	150	14	4.770	4.000	0.620	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	26.824	85.2	2	4.570	3.885	0.460	Open Manhole	1200
1.001	31.510	300.1	3	4.500	3.705	0.495	Open Manhole	1200
1.002	26.950	299.4	5	4.430	3.615	0.515	Open Manhole	1200
2.000	17.898	162.7	5	4.430	3.690	0.515	Open Manhole	1200
1.003	3.927	302.1	6	4.460	3.602	0.558	Open Manhole	1200
1.004	13.790	101.4	9	4.390	3.466	0.624	Open Manhole	1200
3.000	9.159	295.5	8	4.530	3.629	0.676	Open Manhole	1200
3.001	25.651	291.5	9	4.390	3.466	0.624	Open Manhole	1200
1.005	40.180	299.9	12	4.730	3.332	1.098	Open Manhole	1200
4.000	29.337	149.7	11	4.850	3.804	0.896	Open Manhole	1200
4.001	24.920	77.4	12	4.730	3.482	1.098	Open Manhole	1200
1.006	10.633	303.8	13	4.520	3.297	0.923	Open Manhole	1200
1.007	22.449	96.3	18	4.540	3.064	1.176	Open Manhole	1200
5.000	30.117	149.8	15	4.640	3.799	0.691	Open Manhole	1200

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PIPELINE SCHEDULES for Storm

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH Name	C.Level (m)	I.Level (m)	D.Depth (m)	MH Connection	MH DIAM., L*W (mm)
5.001	o	150	15	4.640	3.799	0.691	Open Manhole	1200
6.000	o	150	16	4.420	3.360	0.910	Open Manhole	1200
6.001	o	150	17	4.500	3.253	1.097	Open Manhole	1200
1.008	o	300	18	4.540	3.064	1.176	Open Manhole	1200
7.000	o	150	19	4.470	3.800	0.520	Open Manhole	1200
8.000	o	150	20	4.350	3.700	0.500	Open Manhole	1200
8.001	o	150	21	4.410	3.530	0.730	Open Manhole	1200
9.000	o	150	22	4.520	3.370	1.000	Open Manhole	1200
8.002	o	225	23	4.470	3.150	1.095	Open Manhole	1200
8.003	o	225	24	4.290	3.086	0.979	Open Manhole	1200
1.009	o	375	25	4.470	2.788	1.307	Open Manhole	1350
1.010	o	375	26	4.210	2.743	1.092	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)
5.001	19.122	32.7	18	4.540	3.214	1.176	Open Manhole	1200
6.000	16.090	150.4	17	4.500	3.253	1.097	Open Manhole	1200
6.001	5.804	148.8	18	4.540	3.214	1.176	Open Manhole	1200
1.008	17.599	87.6	25	4.470	2.863	1.307	Open Manhole	1350
7.000	14.573	18.5	25	4.470	3.013	1.307	Open Manhole	1350
8.000	25.545	150.3	21	4.410	3.530	0.730	Open Manhole	1200
8.001	26.281	86.2	23	4.470	3.225	1.095	Open Manhole	1200
9.000	21.752	150.0	23	4.470	3.225	1.095	Open Manhole	1200
8.002	12.888	201.4	24	4.290	3.086	0.979	Open Manhole	1200
8.003	29.611	200.1	25	4.470	2.938	1.307	Open Manhole	1350
1.009	15.799	350.0	26	4.210	2.743	1.092	Open Manhole	1350
1.010	1.724	9.0		4.140	2.551	1.214	Open Manhole	375

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Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.205	0.205	0.205
1.001	-	-	100	0.081	0.081	0.081
1.002	-	-	100	0.122	0.122	0.122
2.000	-	-	100	0.086	0.086	0.086
1.003	-	-	100	0.126	0.126	0.126
1.004	-	-	100	0.058	0.058	0.058
3.000	-	-	100	0.066	0.066	0.066
3.001	-	-	100	0.066	0.066	0.066
1.005	-	-	100	0.058	0.058	0.058
4.000	-	-	100	0.180	0.180	0.180
4.001	-	-	100	0.148	0.148	0.148
1.006	-	-	100	0.089	0.089	0.089
1.007	-	-	100	0.000	0.000	0.000
5.000	-	-	100	0.107	0.107	0.107
5.001	-	-	100	0.097	0.097	0.097
6.000	-	-	100	0.098	0.098	0.098
6.001	-	-	100	0.061	0.061	0.061
1.008	-	-	100	0.000	0.000	0.000
7.000	-	-	100	0.204	0.204	0.204
8.000	-	-	100	0.127	0.127	0.127
8.001	-	-	100	0.120	0.120	0.120
9.000	-	-	100	0.150	0.150	0.150
8.002	-	-	100	0.100	0.100	0.100
8.003	-	-	100	0.126	0.126	0.126
1.009	-	-	100	0.000	0.000	0.000
1.010	-	-	100	0.157	0.157	0.157
				Total	Total	Total
				2.632	2.632	2.632

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)
1.010		4.140	2.551	2.550	375	0

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	13	15 Winter	1	+0%	30/15 Winter	30/15 Winter			4.330
1.001	2	15 Winter	1	+0%	1/15 Winter	30/15 Winter			4.127
1.002	3	15 Winter	1	+0%	1/15 Winter	30/15 Winter			4.112
2.000	4	15 Winter	1	+0%	1/15 Winter	30/15 Winter			4.091
1.003	5	15 Winter	1	+0%	1/15 Winter	30/15 Winter			4.085
1.004	6	15 Winter	1	+0%	1/15 Winter	100/15 Winter			4.044
3.000	7	15 Winter	1	+0%	1/15 Winter	30/15 Winter			3.932
3.001	8	15 Winter	1	+0%	1/15 Winter				3.928
1.005	9	15 Winter	1	+0%	1/15 Winter	30/15 Winter			3.920
4.000	10	15 Winter	1	+0%	1/15 Winter	30/15 Winter			4.445
4.001	11	15 Winter	1	+0%	1/15 Winter	30/15 Winter			4.329
1.006	12	15 Winter	1	+0%	1/15 Winter				3.817
1.007	13	15 Winter	1	+0%	1/15 Winter				3.705
5.000	14	15 Winter	1	+0%	1/15 Winter	30/15 Winter			4.170
5.001	15	15 Winter	1	+0%	30/15 Winter	30/15 Winter			3.906
6.000	16	15 Winter	1	+0%	1/15 Winter	30/15 Winter			3.590
6.001	17	15 Winter	1	+0%	1/15 Winter	100/15 Winter			3.570
1.008	18	15 Winter	1	+0%	1/15 Winter				3.546

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1 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	13	-0.095	0.000	0.60		31.1	OK	4
1.001	2	0.017	0.000	0.63		36.9	SURCHARGED	10
1.002	3	0.107	0.000	0.67		38.5	SURCHARGED	11
2.000	4	0.066	0.000	0.35		12.7	SURCHARGED	8
1.003	5	0.170	0.000	0.96		46.7	SURCHARGED	11
1.004	6	0.142	0.000	0.52		47.9	SURCHARGED	6
3.000	7	0.047	0.000	0.41		10.0	SURCHARGED	9
3.001	8	0.074	0.000	0.21		12.0	SURCHARGED	
1.005	9	0.154	0.000	0.89		52.7	SURCHARGED	6
4.000	10	0.295	0.000	1.26		17.5	SURCHARGED	11
4.001	11	0.375	0.000	1.26		24.2	SURCHARGED	8
1.006	12	0.185	0.000	1.69		84.4	SURCHARGED	
1.007	13	0.108	0.000	0.85		84.9	SURCHARGED	
5.000	14	0.020	0.000	1.04		14.4	SURCHARGED	6
5.001	15	-0.043	0.000	0.85		24.8	OK	5
6.000	16	0.080	0.000	0.97		12.9	SURCHARGED	6
6.001	17	0.167	0.000	1.39		16.8	SURCHARGED	
1.008	18	0.182	0.000	1.08		110.2	SURCHARGED	

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1 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)
7.000	19	15 Winter	1	+0%	30/15 Winter	30/15 Winter			3.908
8.000	20	15 Winter	1	+0%	1/15 Winter	30/15 Winter			3.988
8.001	21	15 Winter	1	+0%	1/15 Winter	30/15 Winter			3.960
9.000	22	15 Winter	1	+0%	1/15 Winter	30/15 Winter			3.764
8.002	23	15 Winter	1	+0%	1/15 Winter	100/15 Winter			3.686
8.003	24	15 Winter	1	+0%	1/15 Winter	30/15 Winter			3.604
1.009	25	15 Winter	1	+0%	1/15 Winter				3.310
1.010	26	15 Winter	1	+0%	1/15 Winter				3.127

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
7.000	19	-0.042	0.000	0.81		30.9	OK	6
8.000	20	0.138	0.000	1.04		14.3	SURCHARGED	10
8.001	21	0.280	0.000	0.96		17.5	SURCHARGED	8
9.000	22	0.244	0.000	1.21		16.5	SURCHARGED	8
8.002	23	0.311	0.000	1.18		37.3	SURCHARGED	2
8.003	24	0.293	0.000	1.40		47.9	SURCHARGED	5
1.009	25	0.147	0.000	2.06		168.3	SURCHARGED	
1.010	26	0.009	0.000	1.06		181.9	SURCHARGED	

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	13	15 Winter	30	+0%	30/15 Winter	30/15 Winter			4.881
1.001	2	15 Winter	30	+0%	1/15 Winter	30/15 Winter			4.576
1.002	3	30 Winter	30	+0%	1/15 Winter	30/15 Winter			4.512
2.000	4	15 Winter	30	+0%	1/15 Winter	30/15 Winter			4.481
1.003	5	30 Winter	30	+0%	1/15 Winter	30/15 Winter			4.469
1.004	6	30 Winter	30	+0%	1/15 Winter	100/15 Winter			4.459
3.000	7	30 Winter	30	+0%	1/15 Winter	30/15 Winter			4.372
3.001	8	15 Winter	30	+0%	1/15 Winter				4.403
1.005	9	15 Winter	30	+0%	1/15 Winter	30/15 Winter			4.396
4.000	10	30 Winter	30	+0%	1/15 Winter	30/15 Winter			4.914
4.001	11	15 Winter	30	+0%	1/15 Winter	30/15 Winter			4.857
1.006	12	15 Winter	30	+0%	1/15 Winter				4.383
1.007	13	15 Winter	30	+0%	1/15 Winter				4.306
5.000	14	15 Winter	30	+0%	1/15 Winter	30/15 Winter			4.772
5.001	15	15 Winter	30	+0%	30/15 Winter	30/15 Winter			4.642
6.000	16	15 Winter	30	+0%	1/15 Winter	30/15 Winter			4.422
6.001	17	15 Winter	30	+0%	1/15 Winter	100/15 Winter			4.386
1.008	18	15 Winter	30	+0%	1/15 Winter				4.169

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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	13	0.456	0.567	0.99		51.5	FLOOD	4
1.001	2	0.466	5.772	0.82		47.7	FLOOD	10
1.002	3	0.507	12.430	0.82		47.3	FLOOD	11
2.000	4	0.456	0.850	0.55		20.1	FLOOD	8
1.003	5	0.554	38.682	1.31		63.8	FLOOD	11
1.004	6	0.557	0.000	0.70		63.9	FLOOD RISK	6
3.000	7	0.487	11.791	1.39		34.5	FLOOD	9
3.001	8	0.549	0.000	0.60		34.7	FLOOD RISK	
1.005	9	0.630	5.722	1.30		77.0	FLOOD	6
4.000	10	0.764	13.510	1.77		24.5	FLOOD	11
4.001	11	0.903	6.781	1.65		31.7	FLOOD	8
1.006	12	0.751	0.000	2.05		102.1	SURCHARGED	
1.007	13	0.709	0.000	1.02		102.3	FLOOD RISK	
5.000	14	0.622	2.399	1.46		20.3	FLOOD	6
5.001	15	0.693	1.521	1.08		31.6	FLOOD	5
6.000	16	0.912	1.832	1.40		18.7	FLOOD	6
6.001	17	0.983	0.000	2.43		29.3	FLOOD RISK	
1.008	18	0.805	0.000	1.33		135.3	SURCHARGED	

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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.	Water Level (m)
7.000	19	15 Winter	30	+0%	30/15 Winter	30/15 Winter			4.473
8.000	20	30 Winter	30	+0%	1/15 Winter	30/15 Winter			4.368
8.001	21	15 Winter	30	+0%	1/15 Winter	30/15 Winter			4.418
9.000	22	30 Winter	30	+0%	1/15 Winter	30/15 Winter			4.526
8.002	23	15 Winter	30	+0%	1/15 Winter	100/15 Winter			4.445
8.003	24	15 Winter	30	+0%	1/15 Winter	30/15 Winter			4.293
1.009	25	15 Winter	30	+0%	1/15 Winter				3.789
1.010	26	15 Winter	30	+0%	1/15 Winter				3.443

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Pipe Flow (l/s)	Status	Level Exceeded
7.000	19	0.523	2.942	1.03		39.4	FLOOD	6
8.000	20	0.518	18.358	1.69		23.3	FLOOD	10
8.001	21	0.738	7.561	1.34		24.4	FLOOD	8
9.000	22	1.006	5.901	1.83		25.1	FLOOD	8
8.002	23	1.070	0.000	1.64		51.8	FLOOD RISK	2
8.003	24	0.982	3.270	2.01		68.7	FLOOD	5
1.009	25	0.626	0.000	2.91		237.5	SURCHARGED	
1.010	26	0.325	0.000	1.65		282.8	SURCHARGED	

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.350
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.000 Cv (Winter) 0.840

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

Profile(s) Winter
Duration(s) (mins) 15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 1, 30, 100
Climate Change (%) 0, 0, 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
1.000	13	15 Winter	100	+40%	30/15 Winter	30/15 Winter		
1.001	2	30 Winter	100	+40%	1/15 Winter	30/15 Winter		
1.002	3	60 Winter	100	+40%	1/15 Winter	30/15 Winter		
2.000	4	120 Winter	100	+40%	1/15 Winter	30/15 Winter		
1.003	5	120 Winter	100	+40%	1/15 Winter	30/15 Winter		
1.004	6	60 Winter	100	+40%	1/15 Winter	100/15 Winter		
3.000	7	60 Winter	100	+40%	1/15 Winter	30/15 Winter		
3.001	8	15 Winter	100	+40%	1/15 Winter			
1.005	9	30 Winter	100	+40%	1/15 Winter	30/15 Winter		
4.000	10	60 Winter	100	+40%	1/15 Winter	30/15 Winter		
4.001	11	30 Winter	100	+40%	1/15 Winter	30/15 Winter		
1.006	12	15 Winter	100	+40%	1/15 Winter			
1.007	13	15 Winter	100	+40%	1/15 Winter			
5.000	14	30 Winter	100	+40%	1/15 Winter	30/15 Winter		
5.001	15	30 Winter	100	+40%	30/15 Winter	30/15 Winter		
6.000	16	30 Winter	100	+40%	1/15 Winter	30/15 Winter		
6.001	17	15 Winter	100	+40%	1/15 Winter	100/15 Winter		
1.008	18	15 Winter	100	+40%	1/15 Winter			

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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	13	4.896	0.471	15.702	1.00		52.3	FLOOD	4
1.001	2	4.598	0.488	27.876	0.81		47.3	FLOOD	10
1.002	3	4.543	0.538	42.982	0.96		54.9	FLOOD	11
2.000	4	4.499	0.474	19.486	0.48		17.5	FLOOD	8
1.003	5	4.497	0.582	66.722	1.65		80.7	FLOOD	11
1.004	6	4.484	0.582	24.191	0.88		80.5	FLOOD	6
3.000	7	4.398	0.513	37.597	1.47		36.4	FLOOD	9
3.001	8	4.429	0.575	0.000	0.63		36.2	FLOOD RISK	
1.005	9	4.415	0.649	24.812	1.41		83.5	FLOOD	6
4.000	10	4.944	0.794	44.499	1.78		24.8	FLOOD	11
4.001	11	4.875	0.921	25.055	1.66		31.9	FLOOD	8
1.006	12	4.449	0.817	0.000	2.13		106.1	FLOOD RISK	
1.007	13	4.339	0.742	0.000	1.06		106.1	FLOOD RISK	
5.000	14	4.785	0.635	15.450	1.83		25.4	FLOOD	6
5.001	15	4.652	0.703	11.769	1.13		33.1	FLOOD	5
6.000	16	4.436	0.926	16.145	1.87		25.0	FLOOD	6
6.001	17	4.473	1.070	0.022	2.66		32.0	FLOOD	
1.008	18	4.208	0.844	0.000	1.35		137.1	SURCHARGED	

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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.
7.000	19	30 Winter	100	+40%	30/15 Winter	30/15 Winter		
8.000	20	120 Winter	100	+40%	1/15 Winter	30/15 Winter		
8.001	21	30 Winter	100	+40%	1/15 Winter	30/15 Winter		
9.000	22	30 Winter	100	+40%	1/15 Winter	30/15 Winter		
8.002	23	15 Winter	100	+40%	1/15 Winter	100/15 Winter		
8.003	24	15 Winter	100	+40%	1/15 Winter	30/15 Winter		
1.009	25	15 Winter	100	+40%	1/15 Winter			
1.010	26	15 Winter	100	+40%	1/15 Winter			

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
7.000	19	4.492	0.542	21.592	1.05		40.0	FLOOD	6
8.000	20	4.403	0.553	52.762	1.71		23.5	FLOOD	10
8.001	21	4.436	0.756	26.470	1.36		24.9	FLOOD	8
9.000	22	4.547	1.027	26.900	2.12		29.0	FLOOD	8
8.002	23	4.472	1.097	2.339	1.70		53.5	FLOOD	2
8.003	24	4.309	0.998	18.585	2.10		71.9	FLOOD	5
1.009	25	3.888	0.725	0.000	2.93		239.4	SURCHARGED	
1.010	26	3.555	0.437	0.000	1.85		316.6	SURCHARGED	

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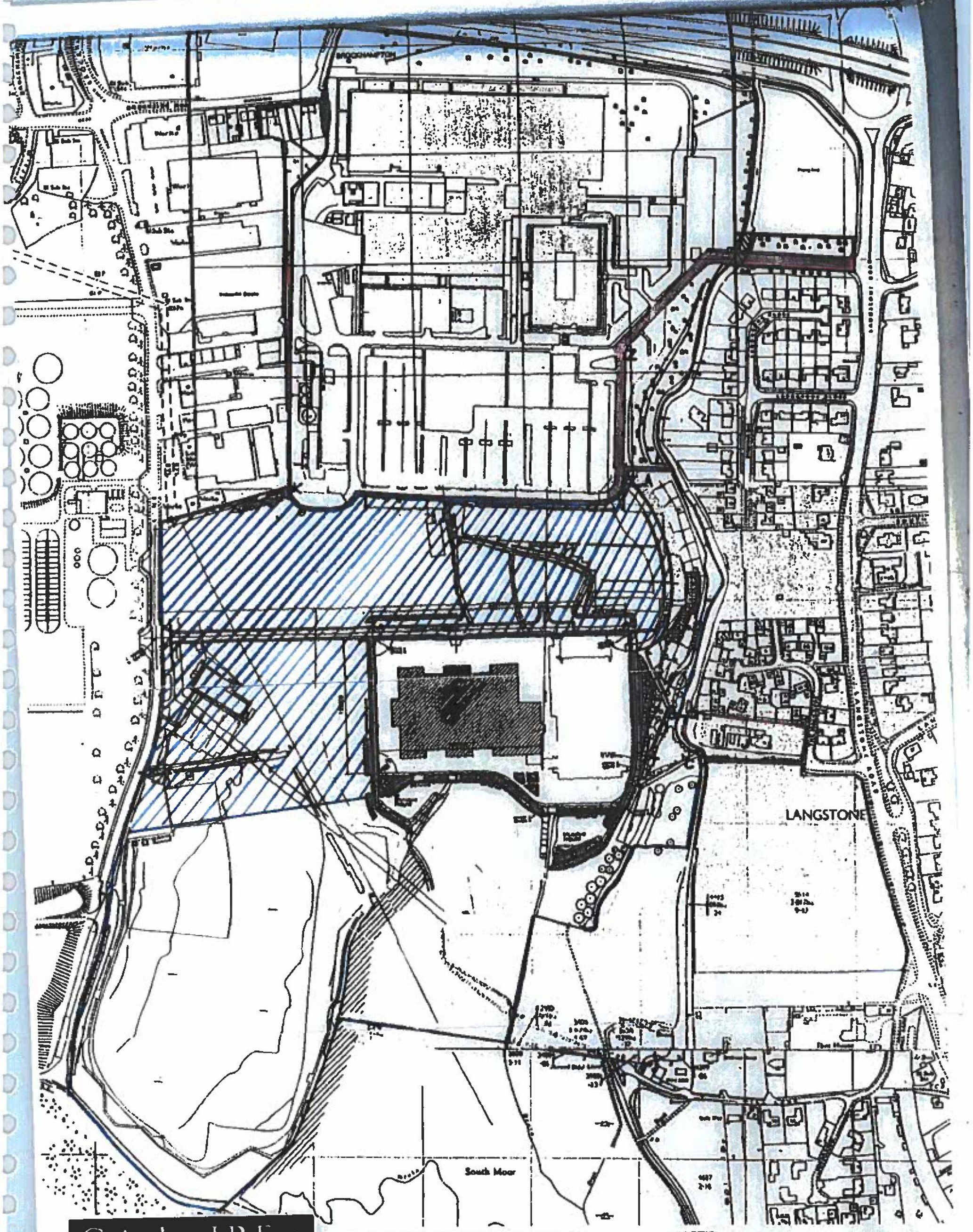
APPENDIX C

Land Transfer Agreement



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IBM UNITED KINGDOM Ltd
HAVANT

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30 NOVEMBER 1994

LAND TO BE TRANSFERRED INITIALLY

LAND TO BE TRANSFERRED WITH RESTRICTIONS ON DEVELOPMENT

RETAINED LAND

Plan 5

APPENDIX D

Clancy Consulting Risk Register

Job No: **8/1982** LANGSTONE TECHNOLOGY PARK, HAVANT - FRA

Client: London office Clancy Consulting Ltd

Hazard	Element	Notes	Status	Created	
03 Lifting, lowering loads	03 Access: Movement of personnel, vehicles, plant, materials	When moving manholes for example, care should be taken as the pieces of equipment are large and will need the assistance of plant to manoeuvre, while working in tandem with grounds workers who will help guide the plant. Therefore there will need to be a good level of communication between the plant operator and the grounds workers, to avoid accident.	Known to a competent contractor	17/10/19	Current
04 Collapse of insufficiently supported sides of excavation	05 Excavation for Foundations and Trenches: Trenches for services, drainage	Sides of excavations must be properly supported to prevent internal collapse at all times.	Known to a competent contractor	17/10/19	Current
06 Personnel falling into open excavations	05 Excavation for Foundations and Trenches: Trenches for services, drainage	Sufficient edge protection must be in place to prevent grounds workers falling into open excavations.	Known to a competent contractor	17/10/19	Current
07 Plant/vehicles falling into open excavation.	05 Excavation for Foundations and Trenches: Trenches for services, drainage	Plant should be positioned so that it is not in an area where it may be susceptible to falling into an open excavation.	Known to a competent contractor	17/10/19	Current
10 Hitting live services	05 Excavation for Foundations and Trenches: Trenches for services, drainage	The GPR survey should be closely reviewed prior to excavation. The contractor should satisfy themselves prior to dig that all necessary actions have been taken to prevent service strike. Use of a CAT scanner is also recommended.	Residual Risk	17/10/19	Current
10 Hitting live services	05 Excavation for Foundations and Trenches: Trenches for services, drainage	High voltage cables are identified on site. The contractor is to use insulated shovels and hand dig in areas they are believed to be positioned.	Residual Risk	17/10/19	Current
23 Hazardous materials	01 Site Clearance & Demolition: Waste removal	The site used to house a waste treatment plant in it's South East corner, resulting in potentially unknown contaminants being present on site. Refer to Clancy Consulting Geo-Environmental report. The contractor should satisfy themselves that safe working can be conducted.	Residual Risk	17/10/19	Current
Live Traffic	All Works	The Technology Park is a 'live' site. As such there is the possibility of vehicular movement adjacent to working areas.	Residual Risk	17/10/19	Current
Unexploded Ordnance	05 Excavation for Foundations and Trenches: Trenches for services, drainage	There is a risk that there may be unexploded ordnance present on site. If the contractor identifies any suspicious objects they should contact the police or a UXO engineer.	Residual Risk	17/10/19	Current