

FLOOD RISK ASSESSMENT ADDENDUM

# Mead Realisations Ltd

Lynchmead Farm, Weston-Super-Mare

February 2021

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Flood Risk Assessment

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## Report control

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Project: Lynchmead Farm, Weston-Super-Mare  
Client: Mead Realisations Ltd  
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## Document checking

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2			
3			

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## Appendices

- Appendix A – Preliminary Surface Water Drainage Layout
- Appendix B – Surface Water Drainage Calculations

## **1 Introduction**

- 1.1 Vectos were appointed by Mead Realisations Ltd to provide a Flood Risk Assessment (FRA) to support the outline planning application for the proposed residential scheme of 75 dwellings at Lynchmead Farm, Weston-Super-Mare.
- 1.2 The FRA was submitted along with the planning application in July 2020. North Somerset Council, who are the Lead Local Flood Authority (LLFA) for the area, have provided comments on the FRA which are provided and addressed as part of the FRA Addendum.

## 2 LLFA Comments

- 2.1 To address the LLFA comments, a MicroDrainage network model had to be developed for each development parcel. This would allow the various Sustainable Drainage System (SuDS) to interact appropriately, including the ability to back up between features from the flow control at the outfall. It also allowed for a surcharged outfall to be assessed.
- 2.2 LLFA Comment: Plan(s) of a proposed surface water drainage strategy indicating the proposed surface water drainage features, proposed attenuation volumes, dimensions, indicative cover and invert levels and a suitable outfall location.**
- 2.3 Vectos Response: A preliminary surface water drainage layout has been prepared to provide further information requested by the LLFA (see Appendix A). It should be noted that this is an outline application and the information presented is preliminary and indicative.
- 2.4 The preliminary surface water drainage layout shows the how SuDS features including permeable paving, swales and attenuation basins could be integrated into the site.
- 2.5 LLFA Comment: A contributing catchment plan demonstrating the impermeable area which is attenuated by each permeable paving and swale, taking into consideration creep in the contributing areas.**
- 2.6 Vectos Response: The preliminary surface water drainage layout identifies impermeable areas, split into 5 parcels, which will be attenuated by swales and permeable paving. Attenuation volumes have also been shown on this layout (see appendix A). A 10% urban creep factor has been applied to the impermeable development areas.
- 2.7 LLFA Comment: To demonstrate the performance of the surface water drainage system up to and including the 1 in 100 year plus climate change return period, including calculation of existing and proposed discharge rates and attenuation storage requirements, with consideration of development creep and potential for a surcharged outfall.**
- 2.8 Vectos Response: The site has been split into 5 development parcels, identified on the preliminary surface water drainage layout. The impermeable area for each was measured and the associated QBAR greenfield runoff rate was calculated using the FEH method to be 2.83 l/s/ha (see summary sheet in Appendix B). The greenfield discharge rates were small. Given that impermeable areas are also small, so too are associated QBAR discharge rates. The LLFA have advised that their minimum discharge rate, to prevent blockages at the flow control device is 2 l/s. Therefore, this was adopted for all development parcels. A 10% urban creep factor was applied to the impermeable area, as requested by the LLFA.
- 2.9 Table 1 summarises the key parameters used in the MicroDrainage model for each development parcel.

**Table 1: MicroDrainage Parameters**

Development Parcel	Future Development Impermeable Area (ha) <sup>1</sup>	Greenfield Runoff Rate (l/s)	Adopted Runoff Rate (l/s)
1	0.278	0.79	2.0
2	0.376	1.10	2.0
3	0.258	0.73	2.0
4	0.282	0.80	2.0
5	0.324	0.92	2.0

2.10 MicroDrainage simulations have been run using Flood Estimation Handbook (FEH) data for each parcel including a 40% climate change allowance. The results show that the proposed attenuation features are satisfactory for each parcel with a 300 mm freeboard available in the above ground storage. The calculations are enclosed in Appendix C. The total volume of attenuation storage required in each development parcel is summarised in Table 2. These volumes include the freeboard requirement in above ground storage structures.

**Table 2: MicroDrainage Results – Volume Requirements**

Development Parcel	Total Attenuation Volume (m3)
1	433
2	750
3	443
4	377
5	551

2.11 A surcharged outfall scenario has also been investigated for each development parcel, which was requested by the LLFA. The LLFA suggested that a 1 in 100+CC outfall level should be applied. No such flood levels were readily available. However, the surface water flood mapping for the site was reviewed, which suggested that the rhyne network was partially full in a 1 in 1000 year event. Therefore, as a conservative approach, an average bank top water level was applied as a surcharged outfall condition. This was equivalent to a level of 5.80 m (AOD). Simulation results for this surcharged outfall scenario show that water levels increase with the SuDS but is contained within the freeboard allowance. The calculations are enclosed in Appendix B.

<sup>1</sup> This includes a 10% urban creep allowance for the residential site

- 2.12 LLFA Comment: Plan(s) showing pre- and post development overland flow routes should an exceedance event (i.e. an event greater than the 1 in 100 year plus 40% climate change storm event) or failure within the surface water system occur.**
- 2.13 Vectos Response: Flood exceedance routes for existing and proposed scenarios have been included within the preliminary surface water drainage layout (Appendix A). Existing exceedance routes from the site will enter the surrounding rhyne network, as shown by the levels on the topographical survey which is also shown in the preliminary surface water drainage layout. The new proposal shows that the exceedance flows shall be directed into permeable paving, swales and basins before being discharged into an adjacent rhyne.

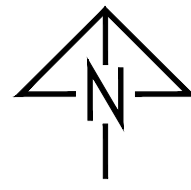
### 3 Conclusion

- 3.1 This response has been provided to address comments from the LLFA with regards to the proposed residential development at Lynchmead Farm, Weston-Super-Mare. We trust that the information is sufficient to demonstrate how the proposed site layout plan can accommodate the surface water drainage requirements and overcome the comments raised.



# Appendix A

Preliminary Surface Water Drainage Layout



- KEY**
- SITE BOUNDARY
  - PROPOSED SURFACE WATER NETWORK
  - PROPOSED HEADWALL
  - PROPOSED DISTRIBUTION TANK
  - PROPOSED FLOW CONTROL CHAMBER
  - EXISTING RHYNE/DITCH
  - PROPOSED FLOOD EXCEEDANCE ROUTE
  - EXISTING FLOW PATH ROUTE
  - PROPOSED ATTENUATION BASIN/SWALE
  - PROPOSED PERMEABLE SURFACE
  - PROPOSED IMPERMEABLE DEVELOPMENT AREA
  - PROPOSED IMPERMEABLE ROAD AREA
  - PROPOSED PARCEL NUMBER

- NOTES**
1. DRAWING TO BE READ IN CONJUNCTION WITH THE VECTOS FLOOD RISK ASSESSMENT ADDENDUM.
  2. IMPERMEABLE SURFACE AREA BY PARCEL INCLUDING URBAN CREEP:
    - PARCEL 1: 0.278HA
    - PARCEL 2: 0.376HA
    - PARCEL 3: 0.258HA
    - PARCEL 4: 0.282HA
    - PARCEL 5: 0.324HA
  3. INVERT AND COVER LEVELS SHOWN ARE INDICATIVE.

TOTAL PERMEABLE PAVING AREA: 810M<sup>2</sup>  
 DEPTH: 0.70M  
 TOTAL VOLUME AVAILABLE (BASED ON A 30% VOID RATIO AND 0.13M PAVING DEPTH): 139M<sup>3</sup>

TOTAL SWALE ATTENUATION VOLUME: 238M<sup>3</sup>  
 (INCLUDING FREEBOARD)  
 DEPTH 0.80M

FLOW CONTROL 04  
 DISCHARGE RATE: 2L/S  
 CL: 6.00M  
 IL: 5.10M

OUTFALL IL: 5.00M

OUTFALL IL: 5.20M

FLOW CONTROL 02  
 DISCHARGE RATE: 2L/S  
 CL: 6.00M  
 IL: 5.30M

TOTAL SWALE ATTENUATION VOLUME: 563M<sup>3</sup>  
 (INCLUDING FREEBOARD)  
 DEPTH: 0.60M

TOTAL PERMEABLE PAVING AREA: 745M<sup>2</sup>  
 DEPTH: 0.60M  
 TOTAL VOLUME AVAILABLE (BASED ON A 30% VOID RATIO AND 0.13M PAVING DEPTH): 105M<sup>3</sup>

TOTAL PERMEABLE PAVING AREA: 525M<sup>2</sup>  
 DEPTH: 0.65M  
 TOTAL VOLUME AVAILABLE (BASED ON A 30% VOID RATIO AND 0.13M PAVING DEPTH): 82M<sup>3</sup>

OUTFALL IL: 5.40M

FLOW CONTROL 01  
 DISCHARGE RATE: 2L/S  
 CL: 6.1M  
 IL: 5.45M

TOTAL SWALE ATTENUATION VOLUME: 267M<sup>3</sup>  
 (INCLUDING FREEBOARD)  
 DEPTH: 0.6M

TOTAL PERMEABLE PAVING AREA: 1066M<sup>2</sup>  
 DEPTH: 0.65M  
 TOTAL VOLUME AVAILABLE (BASED ON A 30% VOID RATIO AND 0.13M PAVING DEPTH): 166M<sup>3</sup>

TOTAL AREA  
 DEP  
 TOTAL  
 (BASED ON  
 RATIO)  
 DEP

REV	DETAILS	DRAWN	CHECKED	DATE
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STATUS:

**INFORMATION ONLY**

CLIENT:

MEAD REALISATIONS LTD

PROJECT:

LAND AT LYNCHMEAD FARM, EBDON ROAD

DRAWING TITLE:

PRELIMINARY SURFACE WATER DRAINAGE LAYOUT - SHEET 1

SCALES:

1:500 @ A1

DRAWN: HE CHECKED: NB DATE: FEBRUARY 2021

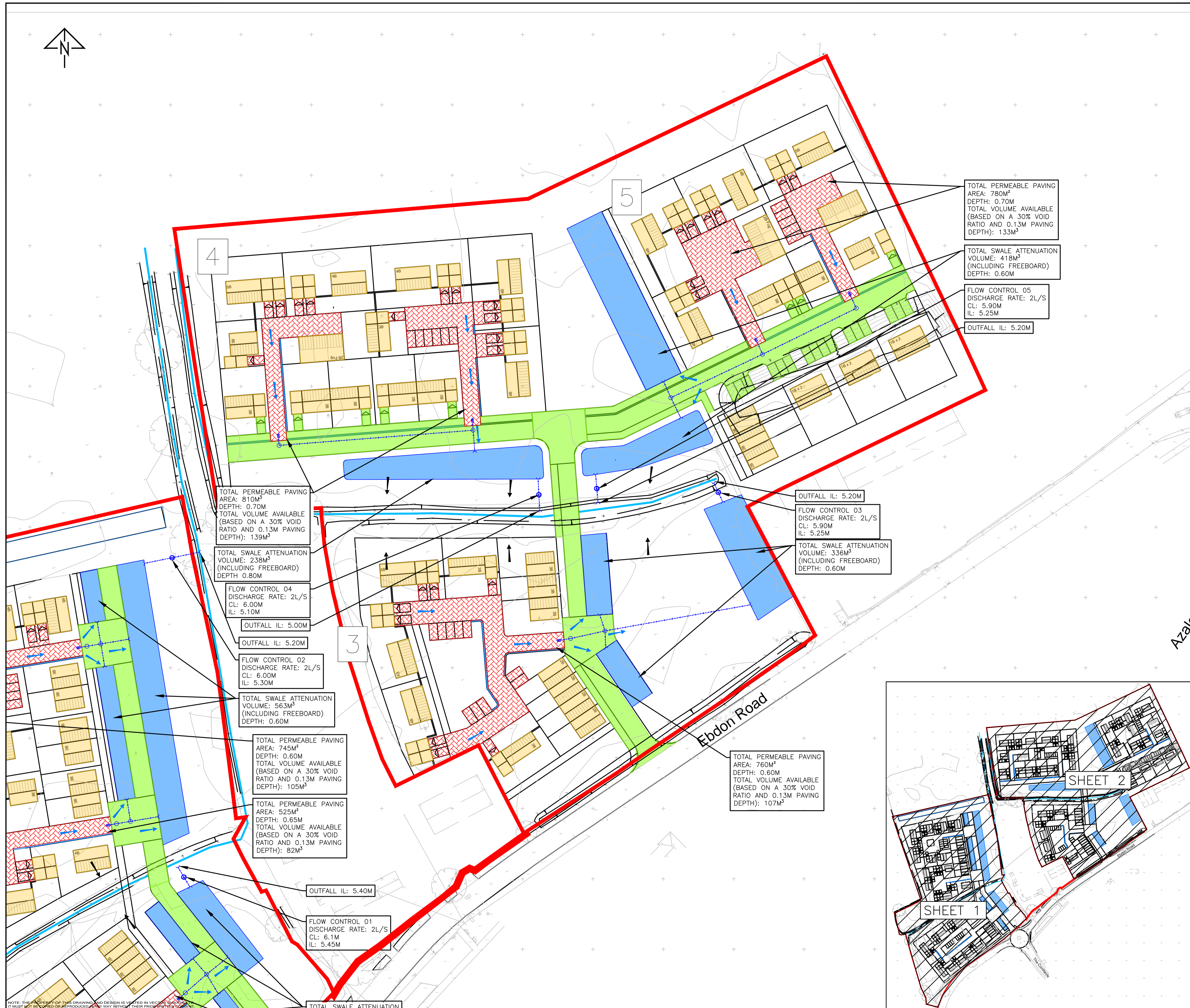
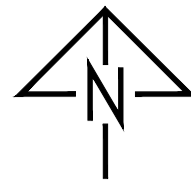


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- KEY**
- SITE BOUNDARY
  - PROPOSED SURFACE WATER NETWORK
  - PROPOSED HEADWALL
  - PROPOSED DISTRIBUTION TANK
  - PROPOSED FLOW CONTROL CHAMBER
  - EXISTING RHYNE/DITCH
  - PROPOSED FLOOD EXCEEDANCE ROUTE
  - EXISTING FLOW PATH ROUTE
  - PROPOSED ATTENUATION BASIN/SWALE
  - PROPOSED PERMEABLE SURFACE
  - PROPOSED IMPERMEABLE DEVELOPMENT AREA
  - PROPOSED IMPERMEABLE ROAD AREA
  - PROPOSED PARCEL NUMBER

- NOTES**
1. DRAWING TO BE READ IN CONJUNCTION WITH THE VECTOS FLOOD RISK ASSESSMENT ADDENDUM.
  2. IMPERMEABLE SURFACE AREA BY PARCEL INCLUDING URBAN CREEP:
    - PARCEL 1: 0.278HA
    - PARCEL 2: 0.376HA
    - PARCEL 3: 0.258HA
    - PARCEL 4: 0.282HA
    - PARCEL 5: 0.324HA
  3. INVERT AND COVER LEVELS SHOWN ARE INDICATIVE.

TOTAL PERMEABLE PAVING AREA: 810M<sup>2</sup>  
 DEPTH: 0.70M  
 TOTAL VOLUME AVAILABLE (BASED ON A 30% VOID RATIO AND 0.13M PAVING DEPTH): 139M<sup>3</sup>

TOTAL SWALE ATTENUATION VOLUME: 238M<sup>3</sup>  
 (INCLUDING FREEBOARD)  
 DEPTH 0.80M

FLOW CONTROL 04  
 DISCHARGE RATE: 2L/S  
 CL: 6.00M  
 IL: 5.10M

OUTFALL IL: 5.00M

OUTFALL IL: 5.20M

FLOW CONTROL 02  
 DISCHARGE RATE: 2L/S  
 CL: 6.00M  
 IL: 5.30M

TOTAL SWALE ATTENUATION VOLUME: 563M<sup>3</sup>  
 (INCLUDING FREEBOARD)  
 DEPTH: 0.60M

TOTAL PERMEABLE PAVING AREA: 745M<sup>2</sup>  
 DEPTH: 0.60M  
 TOTAL VOLUME AVAILABLE (BASED ON A 30% VOID RATIO AND 0.13M PAVING DEPTH): 105M<sup>3</sup>

TOTAL PERMEABLE PAVING AREA: 525M<sup>2</sup>  
 DEPTH: 0.65M  
 TOTAL VOLUME AVAILABLE (BASED ON A 30% VOID RATIO AND 0.13M PAVING DEPTH): 82M<sup>3</sup>

TOTAL PERMEABLE PAVING AREA: 780M<sup>2</sup>  
 DEPTH: 0.70M  
 TOTAL VOLUME AVAILABLE (BASED ON A 30% VOID RATIO AND 0.13M PAVING DEPTH): 133M<sup>3</sup>

TOTAL SWALE ATTENUATION VOLUME: 418M<sup>3</sup>  
 (INCLUDING FREEBOARD)  
 DEPTH: 0.60M

FLOW CONTROL 05  
 DISCHARGE RATE: 2L/S  
 CL: 5.90M  
 IL: 5.25M

OUTFALL IL: 5.20M

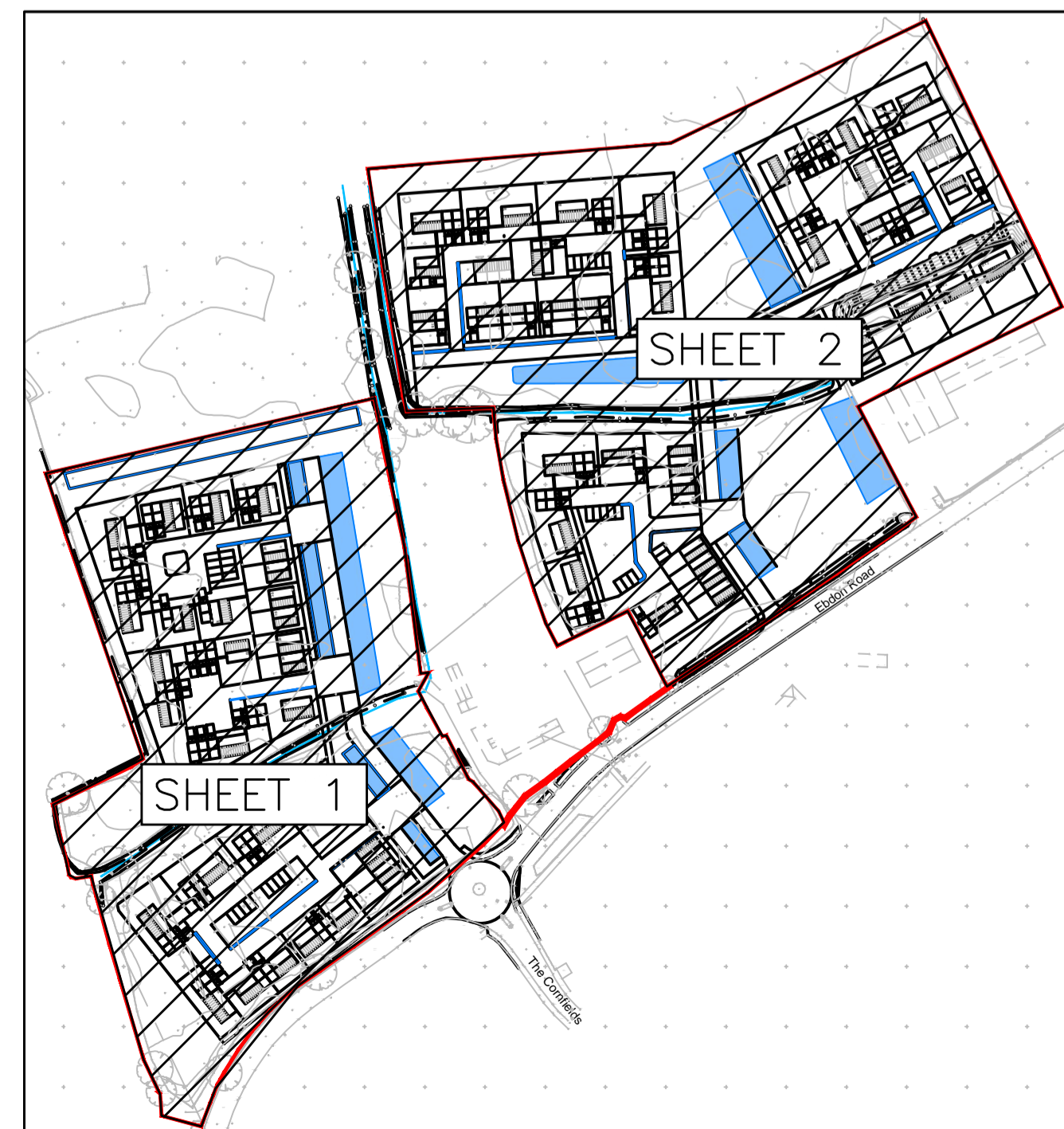
OUTFALL IL: 5.20M

FLOW CONTROL 03  
 DISCHARGE RATE: 2L/S  
 CL: 5.90M  
 IL: 5.25M

TOTAL SWALE ATTENUATION VOLUME: 336M<sup>3</sup>  
 (INCLUDING FREEBOARD)  
 DEPTH: 0.60M

TOTAL PERMEABLE PAVING AREA: 760M<sup>2</sup>  
 DEPTH: 0.60M  
 TOTAL VOLUME AVAILABLE (BASED ON A 30% VOID RATIO AND 0.13M PAVING DEPTH): 107M<sup>3</sup>

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STATUS: INFORMATION ONLY

CLIENT: MEAD REALISATIONS LTD

PROJECT: LAND AT LYNCHMEAD FARM, EBDON ROAD

DRAWING TITLE: PRELIMINARY SURFACE WATER DRAINAGE LAYOUT - SHEET 2

SCALES: 1:500 @ A1

DRAWN: HE CHECKED: NB DATE: FEBRUARY 2021



DRAWING NUMBER: 184199\_PDL\_02 REVISION: P01

# Appendix B

## Surface Water Drainage Calculations

Calculated by:

Site name:

Site location:

**Site Details**

Latitude:

Longitude:

Reference:

Date:

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

**Runoff estimation approach**

**Site characteristics**

Total site area (ha):

**Methodology**

Q<sub>MED</sub> estimation method:

BFI and SPR method:

HOST class:

BFI / BFIHOST:

Q<sub>MED</sub> (l/s):

Q<sub>BAR</sub> / Q<sub>MED</sub> factor:

**Notes**
**(1) Is Q<sub>BAR</sub> < 2.0 l/s/ha?**

When Q<sub>BAR</sub> is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

**(2) Are flow rates < 5.0 l/s?**

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

**Hydrological characteristics**

	Default	Edited
SAAR (mm):	818	818
Hydrological region:	8	8
Growth curve factor 1 year:	0.78	0.78
Growth curve factor 30 years:	1.95	1.95
Growth curve factor 100 years:	2.43	2.43
Growth curve factor 200 years:	2.78	2.78

**(3) Is SPR/SPRHOST ≤ 0.3?**

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

**Greenfield runoff rates**

	Default	Edited
Q <sub>BAR</sub> (l/s):	<input type="text"/>	2.83
1 in 1 year (l/s):	<input type="text"/>	2.21
1 in 30 years (l/s):	<input type="text"/>	5.52
1 in 100 year (l/s):	<input type="text"/>	6.87
1 in 200 years (l/s):	<input type="text"/>	7.86

This report was produced using the greenfield runoff tool developed by HR Wallingford and available at [www.uksuds.com](http://www.uksuds.com). The use of this tool is subject to the UK SuDS terms and conditions and licence agreement, which can both be found at [www.uksuds.com/terms-and-conditions.htm](http://www.uksuds.com/terms-and-conditions.htm). The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the users of this tool. No liability will be accepted by HR Wallingford, the Environment Agency, CEH, Hydrosolutions or any other organisation for the use of this data in the design or operational characteristics of any drainage scheme.

Unit 704  
The Paintworks  
Bristol BS4 3EH

Lynchmead Farm  
Parcel 1



Date 09/02/2021

Designed by HE

File Parcel 1 (21.01.2021).MDX

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XP Solutions


Network 2019.1

Time Area Diagram for Storm

<b>Time (mins)</b>	<b>Area (ha)</b>	<b>Time (mins)</b>	<b>Area (ha)</b>
0-4	0.257	4-8	0.021

Total Area Contributing (ha) = 0.278

Total Pipe Volume (m³) = 0.623

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Existing Network Details 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
S1.000	5.000	0.000	0.0	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit
S1.001	8.000	0.150	53.3	0.227	5.00	0.0	0.600	o	100	Pipe/Conduit
S1.002	10.000	0.175	57.1	0.051	0.00	0.0	0.600	o	225	Pipe/Conduit
S1.003	7.000	0.100	70.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
S1.000	6.400	0.000	0.0	0.00	0.0
S1.001	5.850	0.227	0.0	1.06	8.3
S1.002	5.675	0.278	0.0	1.73	68.9
S1.003	5.500	0.278	0.0	1.20	21.3

Unit 704  
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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	0.000	0.000	0.000
1.001	-	-	100	0.227	0.227	0.227
1.002	-	-	100	0.051	0.051	0.051
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.278	0.278	0.278

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)
S1.003	S	6.100	5.400	0.000	0	0


Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m <sup>3</sup> /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 335918 164222 ST 35918 64222
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30



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Online Controls for Storm

Orifice Manhole: S1, DS/PN: S1.001, Volume (m<sup>3</sup>): 1.0

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 5.850


Hydro-Brake® Optimum Manhole: S3, DS/PN: S1.003, Volume (m<sup>3</sup>): 1.2

Unit Reference	MD-SHE-0077-2000-0300-2000
Design Head (m)	0.300
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	77
Invert Level (m)	5.500
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.113	2.0
Kick-Flo®	0.228	1.8
Mean Flow over Head Range	-	1.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.0	1.200	3.8	3.000	5.8	7.000	8.8
0.200	1.9	1.400	4.1	3.500	6.2	7.500	9.1
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.4
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.7
0.500	2.5	2.000	4.8	5.000	7.4	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

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Storage Structures for Storm


Porous Car Park Manhole: S1, DS/PN: S1.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	32.6
Membrane Percolation (mm/hr)	1000	Length (m)	32.6
Max Percolation (l/s)	295.2	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	5.850	Membrane Depth (mm)	0

Tank or Pond Manhole: S3, DS/PN: S1.003

Invert Level (m) 5.500

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	377.9	0.600	512.1

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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 \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0    Inlet Coefficient 0.800  
Manhole Headloss Coeff (Global) 0.500    Flow per Person per Day (l/per/day) 0.000  
Foul Sewage per hectare (l/s) 0.000

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

Synthetic Rainfall Details


Rainfall Model FEH  
FEH Rainfall Version 2013  
Site Location GB 335918 164222 ST 35918 64222  
Data Type Point  
Cv (Summer) 0.750  
Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	SDummy	60 Winter	100	+40%				
S1.001	S1	480 Winter	100	+40%	100/15 Summer			
S1.002	S2	15 Winter	100	+40%				
S1.003	S3	1440 Winter	100	+40%	100/240 Winter			

PN	US/MH Name	Water			Surcharged		Flooded		Pipe		Level Exceeded
		Level (m)	Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status			
S1.000	SDummy	6.400	-0.100	0.000	0.00		0.0			OK	
S1.001	S1	6.293	0.343	0.000	0.44		3.4		FLOOD RISK	OK	
S1.002	S2	5.807	-0.093	0.000	0.65		37.1			OK	
S1.003	S3	5.788	0.138	0.000	0.11		2.0		SURCHARGED		

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Time Area Diagram for Storm

<b>Time (mins)</b>	<b>Area (ha)</b>	<b>Time (mins)</b>	<b>Area (ha)</b>
0-4	0.257	4-8	0.021

Total Area Contributing (ha) = 0.278

Total Pipe Volume (m<sup>3</sup>) = 0.623

Unit 704  
The Paintworks  
Bristol BS4 3EH

Lynchmead Farm  
Parcel 1  
Surcharged Outfall



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Existing Network Details 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
S1.000	5.000	0.000	0.0	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit
S1.001	8.000	0.150	53.3	0.227	5.00	0.0	0.600	o	100	Pipe/Conduit
S1.002	10.000	0.175	57.1	0.051	0.00	0.0	0.600	o	225	Pipe/Conduit
S1.003	7.000	0.100	70.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
S1.000	6.400	0.000	0.0	0.00	0.0
S1.001	5.850	0.227	0.0	1.06	8.3
S1.002	5.675	0.278	0.0	1.73	68.9
S1.003	5.500	0.278	0.0	1.20	21.3

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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	0.000	0.000	0.000
1.001	-	-	100	0.227	0.227	0.227
1.002	-	-	100	0.051	0.051	0.051
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.278	0.278	0.278

Surcharged Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.003	S	6.100	5.400	0.000	0	0
		Datum (m)	0.000	Offset (mins)	0	


Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
60	6.000	540	6.000	1020	6.000	1500	6.000	1980	6.000	2460	6.000
120	6.000	600	6.000	1080	6.000	1560	6.000	2040	6.000	2520	6.000
180	6.000	660	6.000	1140	6.000	1620	6.000	2100	6.000	2580	6.000
240	6.000	720	6.000	1200	6.000	1680	6.000	2160	6.000	2640	6.000
300	6.000	780	6.000	1260	6.000	1740	6.000	2220	6.000	2700	6.000
360	6.000	840	6.000	1320	6.000	1800	6.000	2280	6.000	2760	6.000
420	6.000	900	6.000	1380	6.000	1860	6.000	2340	6.000	2820	6.000
480	6.000	960	6.000	1440	6.000	1920	6.000	2400	6.000	2880	6.000

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m <sup>3</sup> /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0


Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 335918 164222 ST 35918 64222

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Synthetic Rainfall Details

Data Type Point  
 Summer Storms Yes  
 Winter Storms Yes  
 Cv (Summer) 0.750  
 Cv (Winter) 0.840  
 Storm Duration (mins) 30

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Online Controls for Storm

Orifice Manhole: S1, DS/PN: S1.001, Volume (m<sup>3</sup>): 1.0

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 5.850

Hydro-Brake® Optimum Manhole: S3, DS/PN: S1.003, Volume (m<sup>3</sup>): 1.2


Unit Reference	MD-SHE-0077-2000-0300-2000
Design Head (m)	0.300
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	77
Invert Level (m)	5.500
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.113	2.0
Kick-Flo®	0.228	1.8
Mean Flow over Head Range	-	1.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.0	1.200	3.8	3.000	5.8	7.000	8.8
0.200	1.9	1.400	4.1	3.500	6.2	7.500	9.1
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.4
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.7
0.500	2.5	2.000	4.8	5.000	7.4	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		



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Storage Structures for Storm


Porous Car Park Manhole: S1, DS/PN: S1.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	32.6
Membrane Percolation (mm/hr)	1000	Length (m)	32.6
Max Percolation (l/s)	295.2	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	5.850	Membrane Depth (mm)	0

Tank or Pond Manhole: S3, DS/PN: S1.003

Invert Level (m) 5.500

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	377.9	0.600	512.1

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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 \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0    Inlet Coefficient 0.800  
Manhole Headloss Coeff (Global) 0.500    Flow per Person per Day (l/per/day) 0.000  
Foul Sewage per hectare (l/s) 0.000

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

Synthetic Rainfall Details


Rainfall Model FEH  
FEH Rainfall Version 2013  
Site Location GB 335918 164222 ST 35918 64222  
Data Type Point  
Cv (Summer) 0.750  
Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	SDummy	60 Winter	100	+40%				
S1.001	S1	480 Winter	100	+40%	100/15 Summer			
S1.002	S2	1440 Winter	100	+40%	100/480 Winter			
S1.003	S3	1440 Winter	100	+40%	100/120 Winter			

PN	US/MH Name	Water			Surcharged		Flooded		Pipe		Level Exceeded
		Level (m)	Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status			
S1.000	SDummy	6.400	-0.100	0.000	0.00		0.0			OK	
S1.001	S1	6.293	0.343	0.000	0.44		3.4			FLOOD RISK	
S1.002	S2	6.029	0.129	0.000	0.08		4.3			SURCHARGED	
S1.003	S3	6.028	0.378	0.000	0.03		0.5			FLOOD RISK	


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Time Area Diagram for Storm

<b>Time (mins)</b>	<b>Area (ha)</b>	<b>Time (mins)</b>	<b>Area (ha)</b>
0-4	0.258	4-8	0.119

Total Area Contributing (ha) = 0.377

Total Pipe Volume (m<sup>3</sup>) = 6.346


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Existing Network Details 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
S1.000	5.000	0.000	0.0	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit
S1.001	3.999	0.075	53.3	0.140	0.00	0.0	0.600	o	225	Pipe/Conduit
S1.002	8.000	0.050	160.0	0.036	0.00	0.0	0.600	o	300	Pipe/Conduit
S1.003	51.144	0.175	292.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit
S2.000	5.000	0.000	0.0	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit
S2.001	3.999	0.025	160.0	0.165	0.00	0.0	0.600	o	150	Pipe/Conduit
S2.002	8.000	0.050	160.0	0.036	0.00	0.0	0.600	o	225	Pipe/Conduit
S1.004	20.000	0.075	266.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit
S1.005	16.000	0.200	80.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
S1.000	6.400	0.000	0.0	0.00	0.0
S1.001	5.850	0.140	0.0	1.80	71.4
S1.002	5.700	0.176	0.0	1.24	87.7
S1.003	5.650	0.176	0.0	0.91	64.6
S2.000	6.200	0.000	0.0	0.00	0.0
S2.001	5.700	0.165	0.0	0.79	14.0
S2.002	5.600	0.201	0.0	1.03	41.0
S1.004	5.475	0.377	0.0	0.96	67.7
S1.005	5.400	0.377	0.0	0.86	6.8

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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	0.000	0.000	0.000
1.001	-	-	100	0.140	0.140	0.140
1.002	-	-	100	0.036	0.036	0.036
1.003	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.000	0.000	0.000
2.001	-	-	100	0.165	0.165	0.165
2.002	-	-	100	0.036	0.036	0.036
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.377	0.377	0.377

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)
S1.005	S	6.000	5.200	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m <sup>3</sup> /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	3	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 335918 164222 ST 35918 64222
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Online Controls for Storm

Orifice Manhole: S1, DS/PN: S1.001, Volume (m³): 0.8

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 5.850

Orifice Manhole: S4, DS/PN: S2.001, Volume (m³): 0.7

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 5.700


Hydro-Brake® Optimum Manhole: S5, DS/PN: S1.005, Volume (m³): 2.0

Unit Reference	MD-SHE-0077-2000-0300-2000
Design Head (m)	0.300
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	77
Invert Level (m)	5.400
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.113	2.0
Kick-Flo®	0.228	1.8
Mean Flow over Head Range	-	1.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.0	1.200	3.8	3.000	5.8	7.000	8.8
0.200	1.9	1.400	4.1	3.500	6.2	7.500	9.1
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.4
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.7
0.500	2.5	2.000	4.8	5.000	7.4	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

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Storage Structures for Storm

Porous Car Park Manhole: S1, DS/PN: S1.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	22.9
Membrane Percolation (mm/hr)	1000	Length (m)	22.9
Max Percolation (l/s)	145.7	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	5.850	Membrane Depth (mm)	0

Porous Car Park Manhole: S4, DS/PN: S2.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	27.3
Membrane Percolation (mm/hr)	1000	Length (m)	27.3
Max Percolation (l/s)	207.0	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	5.700	Membrane Depth (mm)	0

Tank or Pond Manhole: S5, DS/PN: S1.005

Invert Level (m) 5.400

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	839.1	0.600	1034.1

Unit 704  
The Paintworks  
Bristol BS4 3EH

Lynchmead Farm  
Parcel 2  
Surcharged Outfall



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Time Area Diagram for Storm

<b>Time (mins)</b>	<b>Area (ha)</b>	<b>Time (mins)</b>	<b>Area (ha)</b>
0-4	0.258	4-8	0.119

Total Area Contributing (ha) = 0.377

Total Pipe Volume (m<sup>3</sup>) = 6.346




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Existing Network Details 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
S1.000	5.000	0.000	0.0	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit
S1.001	3.999	0.075	53.3	0.140	0.00	0.0	0.600	o	225	Pipe/Conduit
S1.002	8.000	0.050	160.0	0.036	0.00	0.0	0.600	o	300	Pipe/Conduit
S1.003	51.144	0.175	292.3	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit
S2.000	5.000	0.000	0.0	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit
S2.001	3.999	0.025	160.0	0.165	0.00	0.0	0.600	o	150	Pipe/Conduit
S2.002	8.000	0.050	160.0	0.036	0.00	0.0	0.600	o	225	Pipe/Conduit
S1.004	20.000	0.075	266.7	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit
S1.005	16.000	0.200	80.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
S1.000	6.400	0.000	0.0	0.00	0.0
S1.001	5.850	0.140	0.0	1.80	71.4
S1.002	5.700	0.176	0.0	1.24	87.7
S1.003	5.650	0.176	0.0	0.91	64.6
S2.000	6.200	0.000	0.0	0.00	0.0
S2.001	5.700	0.165	0.0	0.79	14.0
S2.002	5.600	0.201	0.0	1.03	41.0
S1.004	5.475	0.377	0.0	0.96	67.7
S1.005	5.400	0.377	0.0	0.86	6.8

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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	0.000	0.000	0.000
1.001	-	-	100	0.140	0.140	0.140
1.002	-	-	100	0.036	0.036	0.036
1.003	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.000	0.000	0.000
2.001	-	-	100	0.165	0.165	0.165
2.002	-	-	100	0.036	0.036	0.036
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.377	0.377	0.377

Surcharged Outfall Details for Storm


Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.005	S	6.000	5.200	0.000	0	0
		Datum (m)	0.000	Offset (mins)	0	

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
60	5.800	540	5.800	1020	5.800	1500	5.800	1980	5.800	2460	5.800
120	5.800	600	5.800	1080	5.800	1560	5.800	2040	5.800	2520	5.800
180	5.800	660	5.800	1140	5.800	1620	5.800	2100	5.800	2580	5.800
240	5.800	720	5.800	1200	5.800	1680	5.800	2160	5.800	2640	5.800
300	5.800	780	5.800	1260	5.800	1740	5.800	2220	5.800	2700	5.800
360	5.800	840	5.800	1320	5.800	1800	5.800	2280	5.800	2760	5.800
420	5.800	900	5.800	1380	5.800	1860	5.800	2340	5.800	2820	5.800
480	5.800	960	5.800	1440	5.800	1920	5.800	2400	5.800	2880	5.800

Simulation Criteria for Storm


Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m <sup>3</sup> /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	3
Number of Online Controls	3	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

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Date 09/02/2021	Designed by HE	
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Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 335918 164222 ST 35918 64222
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Online Controls for Storm

Orifice Manhole: S1, DS/PN: S1.001, Volume (m³): 0.8

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 5.850

Orifice Manhole: S4, DS/PN: S2.001, Volume (m³): 0.7

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 5.700


Hydro-Brake® Optimum Manhole: S5, DS/PN: S1.005, Volume (m³): 2.0

Unit Reference	MD-SHE-0077-2000-0300-2000
Design Head (m)	0.300
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	77
Invert Level (m)	5.400
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.113	2.0
Kick-Flo®	0.228	1.8
Mean Flow over Head Range	-	1.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.0	1.200	3.8	3.000	5.8	7.000	8.8
0.200	1.9	1.400	4.1	3.500	6.2	7.500	9.1
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.4
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.7
0.500	2.5	2.000	4.8	5.000	7.4	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

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Storage Structures for Storm

Porous Car Park Manhole: S1, DS/PN: S1.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	22.9
Membrane Percolation (mm/hr)	1000	Length (m)	22.9
Max Percolation (l/s)	145.7	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	5.850	Membrane Depth (mm)	0


Porous Car Park Manhole: S4, DS/PN: S2.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	27.3
Membrane Percolation (mm/hr)	1000	Length (m)	27.3
Max Percolation (l/s)	207.0	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	5.700	Membrane Depth (mm)	0

Tank or Pond Manhole: S5, DS/PN: S1.005

Invert Level (m) 5.400

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	839.1	0.600	1034.1

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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 \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0      Inlet Coefficient 0.800  
Manhole Headloss Coeff (Global) 0.500      Flow per Person per Day (l/per/day) 0.000  
Foul Sewage per hectare (l/s) 0.000

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

Synthetic Rainfall Details


Rainfall Model FEH  
FEH Rainfall Version 2013  
Site Location GB 335918 164222 ST 35918 64222  
Data Type Point  
Cv (Summer) 0.750  
Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	SDummy 1	60 Winter	100	+40%				
S1.001	S1	360 Winter	100	+40%	100/15 Winter			
S1.002	S2	15 Winter	100	+40%				
S1.003	S3	1440 Winter	100	+40%				
S2.000	SDummy 2	60 Winter	100	+40%				
S2.001	S4	480 Winter	100	+40%	100/15 Summer			
S2.002	S5	1440 Winter	100	+40%				
S1.004	S4	1440 Winter	100	+40%	100/960 Winter			
S1.005	S5	1440 Winter	100	+40%	100/120 Summer			

PN	US/MH Name	Water Surcharged Flooded			Pipe		Status	Level Exceeded
		Level (m)	Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap. (l/s)	Overflow (l/s)		
S1.000	SDummy 1	6.400	-0.100	0.000	0.00	0.0	OK	
S1.001	S1	6.312	0.237	0.000	0.09	3.4	FLOOD RISK	
S1.002	S2	5.839	-0.161	0.000	0.44	26.9	OK	
S1.003	S3	5.813	-0.137	0.000	0.06	3.7	OK	

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

PN	US/MH Name	Water			Surcharged		Flooded		Pipe	
		Level (m)	Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Level Exceeded	
S2.000	SDummy 2	6.200	-0.100	0.000	0.00		0.0		OK	
S2.001	S4	6.116	0.266	0.000	0.30		3.3	FLOOD RISK		
S2.002	S5	5.813	-0.012	0.000	0.12		3.7	OK		
S1.004	S4	5.813	0.038	0.000	0.13		7.4	SURCHARGED		
S1.005	S5	5.813	0.313	0.000	0.04		0.2	FLOOD RISK		

Unit 704  
The Paintworks  
Bristol BS4 3EH

Lynchmead Farm  
Parcel 3



Date 09/02/2021  
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Designed by HE  
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Time Area Diagram for Storm

<b>Time (mins)</b>	<b>Area (ha)</b>	<b>Time (mins)</b>	<b>Area (ha)</b>
0-4	0.210	4-8	0.048

Total Area Contributing (ha) = 0.258

Total Pipe Volume (m³) = 1.835




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Existing Network Details 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
S1.000	5.000	0.000	0.0	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit
S1.001	10.000	0.300	33.3	0.173	5.00	0.0	0.600	o	100	Pipe/Conduit
S1.002	42.000	0.375	112.0	0.085	0.00	0.0	0.600	o	225	Pipe/Conduit
S1.003	6.000	0.100	60.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
S1.000	6.600	0.000	0.0	0.00	0.0
S1.001	6.100	0.173	0.0	1.34	10.5
S1.002	5.675	0.258	0.0	1.23	49.1
S1.003	5.300	0.258	0.0	1.00	7.8

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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	0.000	0.000	0.000
1.001	-	-	100	0.173	0.173	0.173
1.002	-	-	100	0.085	0.085	0.085
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.258	0.258	0.258

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)
S1.003	S	5.900	5.200	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m <sup>3</sup> /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 335918 164222 ST 35918 64222
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Online Controls for Storm

Orifice Manhole: S1, DS/PN: S1.001, Volume (m<sup>3</sup>): 0.7

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 6.100


Hydro-Brake® Optimum Manhole: S3, DS/PN: S1.003, Volume (m<sup>3</sup>): 2.3

Unit Reference	MD-SHE-0077-2000-0300-2000
Design Head (m)	0.300
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	77
Invert Level (m)	5.300
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.113	2.0
Kick-Flo®	0.228	1.8
Mean Flow over Head Range	-	1.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.0	1.200	3.8	3.000	5.8	7.000	8.8
0.200	1.9	1.400	4.1	3.500	6.2	7.500	9.1
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.4
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.7
0.500	2.5	2.000	4.8	5.000	7.4	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

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Storage Structures for Storm


Porous Car Park Manhole: S1, DS/PN: S1.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	27.6
Membrane Percolation (mm/hr)	1000	Length (m)	27.6
Max Percolation (l/s)	211.6	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	6.100	Membrane Depth (mm)	0

Tank or Pond Manhole: S3, DS/PN: S1.003

Invert Level (m) 5.300

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	484.6	0.600	635.3

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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 \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0      Inlet Coefficient 0.800  
Manhole Headloss Coeff (Global) 0.500      Flow per Person per Day (l/per/day) 0.000  
Foul Sewage per hectare (l/s) 0.000

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

Synthetic Rainfall Details


Rainfall Model FEH  
FEH Rainfall Version 2013  
Site Location GB 335918 164222 ST 35918 64222  
Data Type Point  
Cv (Summer) 0.750  
Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	S1	60 Winter	100	+40%				
S1.001	S1	480 Winter	100	+40%	100/15 Summer			
S1.002	S2	15 Winter	100	+40%	100/15 Summer			
S1.003	S3	1440 Winter	100	+40%	100/120 Summer			

PN	US/MH Name	Water			Surcharged		Flooded		Pipe		Level Exceeded
		Level (m)	Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap. (l/s)	Overflow (l/s)	Flow (l/s)	Status			
S1.000	S1	6.600	-0.100	0.000	0.00		0.0			OK	
S1.001	S1	6.531	0.331	0.000	0.34		3.3			FLOOD RISK	
S1.002	S2	6.083	0.183	0.000	1.21		56.4			FLOOD RISK	
S1.003	S3	5.566	0.166	0.000	0.28		2.0			SURCHARGED	


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Time Area Diagram for Storm

<b>Time (mins)</b>	<b>Area (ha)</b>	<b>Time (mins)</b>	<b>Area (ha)</b>
0-4	0.210	4-8	0.048

Total Area Contributing (ha) = 0.258

Total Pipe Volume (m<sup>3</sup>) = 1.835


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Existing Network Details 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
S1.000	5.000	0.000	0.0	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit
S1.001	10.000	0.300	33.3	0.173	5.00	0.0	0.600	o	100	Pipe/Conduit
S1.002	42.000	0.375	112.0	0.085	0.00	0.0	0.600	o	225	Pipe/Conduit
S1.003	6.000	0.100	60.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
S1.000	6.600	0.000	0.0	0.00	0.0
S1.001	6.100	0.173	0.0	1.34	10.5
S1.002	5.675	0.258	0.0	1.23	49.1
S1.003	5.300	0.258	0.0	1.00	7.8

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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	0.000	0.000	0.000
1.001	-	-	100	0.173	0.173	0.173
1.002	-	-	100	0.085	0.085	0.085
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.258	0.258	0.258

Surcharged Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.003	S	5.900	5.200	0.000	0	0
		Datum (m)	0.000	Offset (mins)	0	

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
60	5.800	540	5.800	1020	5.800	1500	5.800	1980	5.800	2460	5.800
120	5.800	600	5.800	1080	5.800	1560	5.800	2040	5.800	2520	5.800
180	5.800	660	5.800	1140	5.800	1620	5.800	2100	5.800	2580	5.800
240	5.800	720	5.800	1200	5.800	1680	5.800	2160	5.800	2640	5.800
300	5.800	780	5.800	1260	5.800	1740	5.800	2220	5.800	2700	5.800
360	5.800	840	5.800	1320	5.800	1800	5.800	2280	5.800	2760	5.800
420	5.800	900	5.800	1380	5.800	1860	5.800	2340	5.800	2820	5.800
480	5.800	960	5.800	1440	5.800	1920	5.800	2400	5.800	2880	5.800


Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details


Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 335918 164222 ST 35918 64222



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Synthetic Rainfall Details

Data Type Point  
 Summer Storms Yes  
 Winter Storms Yes  
 Cv (Summer) 0.750  
 Cv (Winter) 0.840  
 Storm Duration (mins) 30

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Online Controls for Storm

Orifice Manhole: S1, DS/PN: S1.001, Volume (m<sup>3</sup>): 0.7

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 6.100


Hydro-Brake® Optimum Manhole: S3, DS/PN: S1.003, Volume (m<sup>3</sup>): 2.3

Unit Reference	MD-SHE-0077-2000-0300-2000
Design Head (m)	0.300
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	77
Invert Level (m)	5.300
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.113	2.0
Kick-Flo®	0.228	1.8
Mean Flow over Head Range	-	1.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.0	1.200	3.8	3.000	5.8	7.000	8.8
0.200	1.9	1.400	4.1	3.500	6.2	7.500	9.1
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.4
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.7
0.500	2.5	2.000	4.8	5.000	7.4	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

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Storage Structures for Storm


Porous Car Park Manhole: S1, DS/PN: S1.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	27.6
Membrane Percolation (mm/hr)	1000	Length (m)	27.6
Max Percolation (l/s)	211.6	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	6.100	Membrane Depth (mm)	0

Tank or Pond Manhole: S3, DS/PN: S1.003

Invert Level (m) 5.300

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	484.6	0.600	635.3

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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 \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0    Inlet Coefficient 0.800  
Manhole Headloss Coeff (Global) 0.500    Flow per Person per Day (l/per/day) 0.000  
Foul Sewage per hectare (l/s) 0.000

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

Synthetic Rainfall Details

Rainfall Model FEH  
FEH Rainfall Version 2013  
Site Location GB 335918 164222 ST 35918 64222  
Data Type Point  
Cv (Summer) 0.750  
Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	60 Winter	100	+40%					6.600
S1.001	S1	480 Winter	100	+40%	100/15 Summer				6.532
S1.002	S2	15 Winter	100	+40%	100/15 Summer				6.102
S1.003	S3	1440 Winter	100	+40%	100/60 Summer				5.809

PN	US/MH Name	Surcharged		Flooded		Pipe		Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	
S1.000	S1	-0.100	0.000	0.00		0.0	OK	
S1.001	S1	0.332	0.000	0.34		3.3	FLOOD RISK	
S1.002	S2	0.202	0.000	1.22		57.2	SURCHARGED	
S1.003	S3	0.409	0.000	0.03		0.2	FLOOD RISK	

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Bristol BS4 3EH

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Parcel 4



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Time Area Diagram for Storm

<b>Time (mins)</b>	<b>Area (ha)</b>	<b>Time (mins)</b>	<b>Area (ha)</b>
0-4	0.210	4-8	0.072

Total Area Contributing (ha) = 0.282

Total Pipe Volume (m<sup>3</sup>) = 1.326

Unit 704  
The Paintworks  
Bristol BS4 3EH

Lynchmead Farm  
Parcel 4



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Existing Network Details 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
S1.000	5.000	0.000	0.0	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit
S1.001	55.296	0.375	147.5	0.214	5.00	0.0	0.600	o	150	Pipe/Conduit
S1.002	6.000	0.150	40.0	0.068	0.00	0.0	0.600	o	225	Pipe/Conduit
S1.003	9.000	0.200	45.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
S1.000	6.400	0.000	0.0	0.00	0.0
S1.001	5.800	0.214	0.0	0.83	14.6
S1.002	5.350	0.282	0.0	2.07	82.5
S1.003	5.200	0.282	0.0	1.15	9.0

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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	0.000	0.000	0.000
1.001	-	-	100	0.214	0.214	0.214
1.002	-	-	100	0.068	0.068	0.068
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.282	0.282	0.282

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)
S1.003	S	5.900	5.000	5.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m <sup>3</sup> /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 335918 164222 ST 35918 64222
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Online Controls for Storm

Orifice Manhole: S1, DS/PN: S1.001, Volume (m<sup>3</sup>): 0.8

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 5.800

Hydro-Brake® Optimum Manhole: S3, DS/PN: S1.003, Volume (m<sup>3</sup>): 1.2


Unit Reference	MD-SHE-0073-2000-0600-2000
Design Head (m)	0.600
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	73
Invert Level (m)	5.200
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.600	2.0
Flush-Flo™	0.177	2.0
Kick-Flo®	0.397	1.7
Mean Flow over Head Range	-	1.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.9	1.200	2.7	3.000	4.2	7.000	6.3
0.200	2.0	1.400	2.9	3.500	4.5	7.500	6.5
0.300	1.9	1.600	3.1	4.000	4.8	8.000	6.7
0.400	1.7	1.800	3.3	4.500	5.1	8.500	6.9
0.500	1.8	2.000	3.5	5.000	5.3	9.000	7.1
0.600	2.0	2.200	3.6	5.500	5.6	9.500	7.3
0.800	2.3	2.400	3.8	6.000	5.8		
1.000	2.5	2.600	3.9	6.500	6.0		



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Storage Structures for Storm


Porous Car Park Manhole: S1, DS/PN: S1.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	28.4
Membrane Percolation (mm/hr)	1000	Length (m)	28.4
Max Percolation (l/s)	224.0	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	5.800	Membrane Depth (mm)	0

Tank or Pond Manhole: S3, DS/PN: S1.003

Invert Level (m) 5.200

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	213.0	0.900	316.3

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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 \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0      Inlet Coefficient 0.800  
Manhole Headloss Coeff (Global) 0.500      Flow per Person per Day (l/per/day) 0.000  
Foul Sewage per hectare (l/s) 0.000

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

Synthetic Rainfall Details

Rainfall Model FEH  
FEH Rainfall Version 2013  
Site Location GB 335918 164222 ST 35918 64222  
Data Type Point  
Cv (Summer) 0.750  
Cv (Winter) 0.840


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

Profile(s)      Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440  
Return Period(s) (years) 100  
Climate Change (%) 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	SDummy 1	60 Winter	100	+40%				
S1.001	S1	480 Winter	100	+40%	100/15 Summer			
S1.002	S2	1440 Winter	100	+40%	100/360 Summer			
S1.003	S3	1440 Winter	100	+40%	100/15 Winter			

PN	US/MH Name	Water			Surcharged		Flooded		Pipe	
		Level (m)	Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Level Exceeded	
S1.000	SDummy 1	6.400	-0.100	0.000	0.00		0.0		OK	
S1.001	S1	6.323	0.373	0.000	0.26		3.7	FLOOD RISK		
S1.002	S2	5.759	0.184	0.000	0.09		5.0	SURCHARGED		
S1.003	S3	5.757	0.457	0.000	0.23		1.9	SURCHARGED		

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Time Area Diagram for Storm

<b>Time (mins)</b>	<b>Area (ha)</b>	<b>Time (mins)</b>	<b>Area (ha)</b>
0-4	0.210	4-8	0.072

Total Area Contributing (ha) = 0.282

Total Pipe Volume (m<sup>3</sup>) = 1.326

Unit 704  
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Bristol BS4 3EH

Lynchmead Farm  
Parcel 4  
Surcharged Outfall



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Existing Network Details 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
S1.000	5.000	0.000	0.0	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit
S1.001	55.296	0.375	147.5	0.214	5.00	0.0	0.600	o	150	Pipe/Conduit
S1.002	6.000	0.150	40.0	0.068	0.00	0.0	0.600	o	225	Pipe/Conduit
S1.003	9.000	0.200	45.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
S1.000	6.400	0.000	0.0	0.00	0.0
S1.001	5.800	0.214	0.0	0.83	14.6
S1.002	5.350	0.282	0.0	2.07	82.5
S1.003	5.200	0.282	0.0	1.15	9.0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.214	0.214	0.214
1.002	-	-	100	0.068	0.068	0.068
1.003	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.282	0.282	0.282

Surcharged Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.003	S	5.900	5.000	5.000	0	0
		Datum (m) 0.000		Offset (mins) 0		


Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
60	5.800	540	5.800	1020	5.800	1500	5.800	1980	5.800
120	5.800	600	5.800	1080	5.800	1560	5.800	2040	5.800
180	5.800	660	5.800	1140	5.800	1620	5.800	2100	5.800
240	5.800	720	5.800	1200	5.800	1680	5.800	2160	5.800
300	5.800	780	5.800	1260	5.800	1740	5.800	2220	5.800
360	5.800	840	5.800	1320	5.800	1800	5.800	2280	5.800
420	5.800	900	5.800	1380	5.800	1860	5.800	2340	5.800
480	5.800	960	5.800	1440	5.800	1920	5.800	2400	5.800

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m <sup>3</sup> /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs		0	
Number of Storage Structures		2	
Number of Online Controls		2	
Number of Time/Area Diagrams		0	
Number of Offline Controls		0	
Number of Real Time Controls		0	


Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 335918 164222 ST 35918 64222

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Synthetic Rainfall Details

Data Type Point  
 Summer Storms Yes  
 Winter Storms Yes  
 Cv (Summer) 0.750  
 Cv (Winter) 0.840  
 Storm Duration (mins) 30

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Online Controls for Storm

Orifice Manhole: S1, DS/PN: S1.001, Volume (m<sup>3</sup>): 0.8

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 5.800


Hydro-Brake® Optimum Manhole: S3, DS/PN: S1.003, Volume (m<sup>3</sup>): 1.2

Unit Reference	MD-SHE-0073-2000-0600-2000
Design Head (m)	0.600
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	73
Invert Level (m)	5.200
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.600	2.0
Flush-Flo™	0.177	2.0
Kick-Flo®	0.397	1.7
Mean Flow over Head Range	-	1.7

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.9	1.200	2.7	3.000	4.2	7.000	6.3
0.200	2.0	1.400	2.9	3.500	4.5	7.500	6.5
0.300	1.9	1.600	3.1	4.000	4.8	8.000	6.7
0.400	1.7	1.800	3.3	4.500	5.1	8.500	6.9
0.500	1.8	2.000	3.5	5.000	5.3	9.000	7.1
0.600	2.0	2.200	3.6	5.500	5.6	9.500	7.3
0.800	2.3	2.400	3.8	6.000	5.8		
1.000	2.5	2.600	3.9	6.500	6.0		

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Storage Structures for Storm

Porous Car Park Manhole: S1, DS/PN: S1.001


Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	28.4
Membrane Percolation (mm/hr)	1000	Length (m)	28.4
Max Percolation (l/s)	224.0	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	5.800	Membrane Depth (mm)	0

Tank or Pond Manhole: S3, DS/PN: S1.003

Invert Level (m) 5.200

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	213.0	0.900	316.3



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Date 09/02/2021 File Parcel 4 (21.01.2021) w...	Designed by HE Checked by NB	
XP Solutions	Network 2019.1	

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

Simulation Criteria

Areal Reduction Factor 1.000    Additional Flow - % of Total Flow 0.000  
Hot Start (mins) 0    MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0    Inlet Coefficient 0.800  
Manhole Headloss Coeff (Global) 0.500    Flow per Person per Day (l/per/day) 0.000  
Foul Sewage per hectare (l/s) 0.000

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

Synthetic Rainfall Details

Rainfall Model FEH  
FEH Rainfall Version 2013  
Site Location GB 335918 164222 ST 35918 64222  
Data Type Point  
Cv (Summer) 0.750  
Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.
S1.000	SDummy 1	60 Winter	100	+40%				
S1.001	S1	480 Winter	100	+40%	100/15 Summer			
S1.002	S2	1440 Winter	100	+40%	100/240 Summer			
S1.003	S3	1440 Winter	100	+40%	100/15 Winter			

PN	US/MH Name	Water			Surcharged		Flooded		Pipe	
		Level (m)	Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap.	Overflow (l/s)	Flow (l/s)	Status	Level Exceeded	
S1.000	SDummy 1	6.400	-0.100	0.000	0.00		0.0		OK	
S1.001	S1	6.323	0.373	0.000	0.26		3.7	FLOOD RISK		
S1.002	S2	5.952	0.377	0.000	0.09		5.0	SURCHARGED		
S1.003	S3	5.951	0.651	0.000	0.23		1.9	FLOOD RISK		

Unit 704  
The Paintworks  
Bristol BS4 3EH

Lynchmead Farm  
Parcel 5



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Time Area Diagram for Storm

<b>Time (mins)</b>	<b>Area (ha)</b>	<b>Time (mins)</b>	<b>Area (ha)</b>
0-4	0.232	4-8	0.092

Total Area Contributing (ha) = 0.324

Total Pipe Volume (m<sup>3</sup>) = 2.032


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Existing Network Details 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
S1.000	5.000	0.000	0.0	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit
S1.001	29.662	0.225	131.8	0.214	0.00	0.0	0.600	o	150	Pipe/Conduit
S1.002	28.846	0.150	192.3	0.110	0.00	0.0	0.600	o	225	Pipe/Conduit
S1.003	6.500	0.050	130.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
S1.004	8.000	0.100	80.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
S1.000	6.400	0.000	0.0	0.00	0.0
S1.001	5.800	0.214	0.0	0.87	15.4
S1.002	5.500	0.324	0.0	0.94	37.3
S1.003	5.350	0.324	0.0	1.15	45.5
S1.004	5.300	0.324	0.0	0.86	6.8

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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	0.000	0.000	0.000
1.001	-	-	100	0.214	0.214	0.214
1.002	-	-	100	0.110	0.110	0.110
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.324	0.324	0.324

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)
S1.004	S	5.900	5.200	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	0.750	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m <sup>3</sup> /ha Storage	2.000
Hot Start (mins)	0	Inlet Coefficient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1
Number of Input Hydrographs	0	Number of Storage Structures	2
Number of Online Controls	2	Number of Time/Area Diagrams	0
Number of Offline Controls	0	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 335918 164222 ST 35918 64222
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Online Controls for Storm

Orifice Manhole: S1, DS/PN: S1.001, Volume (m<sup>3</sup>): 0.8

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 5.800

Hydro-Brake® Optimum Manhole: S7, DS/PN: S1.004, Volume (m<sup>3</sup>): 0.9

Unit Reference	MD-SHE-0077-2000-0300-2000
Design Head (m)	0.300
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	77
Invert Level (m)	5.300
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.113	2.0
Kick-Flo®	0.228	1.8
Mean Flow over Head Range	-	1.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.0	1.200	3.8	3.000	5.8	7.000	8.8
0.200	1.9	1.400	4.1	3.500	6.2	7.500	9.1
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.4
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.7
0.500	2.5	2.000	4.8	5.000	7.4	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

Unit 704  
The Paintworks  
Bristol BS4 3EH

Lynchmead Farm  
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Storage Structures for Storm


Porous Car Park Manhole: S1, DS/PN: S1.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	27.9
Membrane Percolation (mm/hr)	1000	Length (m)	27.9
Max Percolation (l/s)	216.2	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	5.800	Membrane Depth (mm)	0

Tank or Pond Manhole: S7, DS/PN: S1.004

Invert Level (m) 5.300

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	612.6	0.600	780.7

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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 \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0      Inlet Coefficient 0.800  
Manhole Headloss Coeff (Global) 0.500      Flow per Person per Day (l/per/day) 0.000  
Foul Sewage per hectare (l/s) 0.000

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

Synthetic Rainfall Details

Rainfall Model FEH  
FEH Rainfall Version 2013  
Site Location GB 335918 164222 ST 35918 64222  
Data Type Point  
Cv (Summer) 0.750  
Cv (Winter) 0.840


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

Profile(s)      Summer and Winter

Duration(s) (mins) 15, 30, 60, 120, 240, 360, 480, 960, 1440  
Return Period(s) (years) 100  
Climate Change (%) 40

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	60 Winter	100	+40%					6.400
S1.001	S1	480 Winter	100	+40%	100/15 Summer				6.339
S1.002	S2	15 Winter	100	+40%	100/15 Summer				6.331
S1.003	S3	15 Winter	100	+40%	100/15 Summer				5.740
S1.004	S7	1440 Winter	100	+40%	100/60 Winter				5.592

PN	US/MH Name	Surcharged Flooded			Pipe		Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap. (l/s)	Flow (l/s)			
S1.000	S1	-0.100	0.000	0.00	0.0	OK		
S1.001	S1	0.389	0.000	0.25	3.7	FLOOD RISK		
S1.002	S2	0.606	0.000	1.93	67.3	FLOOD RISK		
S1.003	S3	0.165	0.000	2.13	67.0	SURCHARGED		
S1.004	S7	0.192	0.000	0.32	2.0	SURCHARGED		

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Time Area Diagram for Storm

<b>Time (mins)</b>	<b>Area (ha)</b>	<b>Time (mins)</b>	<b>Area (ha)</b>
0-4	0.232	4-8	0.092

Total Area Contributing (ha) = 0.324

Total Pipe Volume (m<sup>3</sup>) = 2.032



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Unit 704 The Paintworks Bristol BS4 3EH	Lynchmead Farm Parcel 5 Surcharged Outfall	
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Existing Network Details 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
S1.000	5.000	0.000	0.0	0.000	5.00	0.0	0.600	o	100	Pipe/Conduit
S1.001	29.662	0.225	131.8	0.214	0.00	0.0	0.600	o	150	Pipe/Conduit
S1.002	28.846	0.150	192.3	0.110	0.00	0.0	0.600	o	225	Pipe/Conduit
S1.003	6.500	0.050	130.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit
S1.004	8.000	0.100	80.0	0.000	0.00	0.0	0.600	o	100	Pipe/Conduit

Network Results Table

PN	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Vel (m/s)	Cap (l/s)
S1.000	6.400	0.000	0.0	0.00	0.0
S1.001	5.800	0.214	0.0	0.87	15.4
S1.002	5.500	0.324	0.0	0.94	37.3
S1.003	5.350	0.324	0.0	1.15	45.5
S1.004	5.300	0.324	0.0	0.86	6.8

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.214	0.214	0.214
1.002	-	-	100	0.110	0.110	0.110
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.324	0.324	0.324

Surcharged Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
S1.004	S	5.900	5.200	0.000	0	0
		Datum (m) 0.000 Offset (mins) 0				

Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)	Time (mins)	Depth (m)
60	5.800	540	5.800	1020	5.800	1500	5.800	1980	5.800
120	5.800	600	5.800	1080	5.800	1560	5.800	2040	5.800
180	5.800	660	5.800	1140	5.800	1620	5.800	2100	5.800
240	5.800	720	5.800	1200	5.800	1680	5.800	2160	5.800
300	5.800	780	5.800	1260	5.800	1740	5.800	2220	5.800
360	5.800	840	5.800	1320	5.800	1800	5.800	2280	5.800
420	5.800	900	5.800	1380	5.800	1860	5.800	2340	5.800
480	5.800	960	5.800	1440	5.800	1920	5.800	2400	5.800


Simulation Criteria for Storm

Volumetric Runoff Coeff 0.750      Additional Flow - % of Total Flow 0.000  
Areal Reduction Factor 1.000      MADD Factor \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start (mins) 0      Inlet Coefficient 0.800  
Hot Start Level (mm) 0      Flow per Person per Day (l/per/day) 0.000  
Manhole Headloss Coeff (Global) 0.500      Run Time (mins) 60  
Foul Sewage per hectare (l/s) 0.000      Output Interval (mins) 1

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


Synthetic Rainfall Details

Rainfall Model FEH  
Return Period (years) 100  
FEH Rainfall Version 2013

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Synthetic Rainfall Details

Site Location	GB 335918 164222 ST 35918 64222
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	30

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Unit 704 The Paintworks Bristol BS4 3EH	Lynchmead Farm Parcel 5 Surcharged Outfall	
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Online Controls for Storm

Orifice Manhole: S1, DS/PN: S1.001, Volume (m<sup>3</sup>): 0.8

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 5.800

Hydro-Brake® Optimum Manhole: S7, DS/PN: S1.004, Volume (m<sup>3</sup>): 0.9

Unit Reference	MD-SHE-0077-2000-0300-2000
Design Head (m)	0.300
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	77
Invert Level (m)	5.300
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.300	2.0
Flush-Flo™	0.113	2.0
Kick-Flo®	0.228	1.8
Mean Flow over Head Range	-	1.6

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.0	1.200	3.8	3.000	5.8	7.000	8.8
0.200	1.9	1.400	4.1	3.500	6.2	7.500	9.1
0.300	2.0	1.600	4.3	4.000	6.7	8.000	9.4
0.400	2.3	1.800	4.6	4.500	7.1	8.500	9.7
0.500	2.5	2.000	4.8	5.000	7.4	9.000	10.0
0.600	2.7	2.200	5.0	5.500	7.8	9.500	10.3
0.800	3.1	2.400	5.2	6.000	8.2		
1.000	3.5	2.600	5.4	6.500	8.5		

Unit 704  
 The Paintworks  
 Bristol BS4 3EH

Lynchmead Farm  
 Parcel 5  
 Surcharged Outfall



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Storage Structures for Storm


Porous Car Park Manhole: S1, DS/PN: S1.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	27.9
Membrane Percolation (mm/hr)	1000	Length (m)	27.9
Max Percolation (l/s)	216.2	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	5.800	Membrane Depth (mm)	0

Tank or Pond Manhole: S7, DS/PN: S1.004

Invert Level (m) 5.300

Depth (m)	Area (m <sup>2</sup> )	Depth (m)	Area (m <sup>2</sup> )
0.000	612.6	0.600	780.7

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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 \* 10m<sup>3</sup>/ha Storage 2.000  
Hot Start Level (mm) 0    Inlet Coefficient 0.800  
Manhole Headloss Coeff (Global) 0.500    Flow per Person per Day (l/per/day) 0.000  
Foul Sewage per hectare (l/s) 0.000

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

Synthetic Rainfall Details

Rainfall Model FEH  
FEH Rainfall Version 2013  
Site Location GB 335918 164222 ST 35918 64222  
Data Type Point  
Cv (Summer) 0.750  
Cv (Winter) 0.840

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

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

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surchage	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
S1.000	S1	60 Winter	100	+40%					6.400
S1.001	S1	480 Winter	100	+40%	100/15 Summer				6.339
S1.002	S2	15 Winter	100	+40%	100/15 Summer				6.331
S1.003	S3	1440 Winter	100	+40%	100/15 Summer				5.809
S1.004	S7	1440 Winter	100	+40%	100/60 Summer				5.808

PN	US/MH Name	Surcharged Flooded			Pipe		Status	Level Exceeded
		Depth (m)	Volume (m <sup>3</sup> )	Flow / Cap. (l/s)	Flow (l/s)			
S1.000	S1	-0.100	0.000	0.00	0.0	OK		
S1.001	S1	0.389	0.000	0.25	3.7	FLOOD RISK		
S1.002	S2	0.606	0.000	1.93	67.3	FLOOD RISK		
S1.003	S3	0.234	0.000	0.20	6.4	SURCHARGED		
S1.004	S7	0.408	0.000	0.03	0.2	FLOOD RISK		

## Contact

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