



Bailey Johnson Hayes
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Project	Link 9, Skimmingdish Lane Bicester.	Project No. S1230	Sheet No. D-1
	Section	Surface Water Drainage	Drawing No.
By P.A.B.			Date Aug 2017
		Checked	Date

Calculations

PROPOSED DEVELOPMENT,

LINK 9. SKIMMINGDISH LANE, BICESTER.

SURFACE WATER DRAINAGE CALCULATIONS

1.0 INTRODUCTION

The following calculations have been prepared to justify the design of a below-ground drainage system to serve the above development site.

The drainage scheme for the site is developed upon principles agreed with Oxfordshire CC to attenuate surface water outflows from the proposed development site to Langford Brook to a peak figure of 17 litres/second.

2.0 BACKGROUND

It is agreed with Oxfordshire CC that a peak outflow figure from the development into Langford Brook of **17 l/sec** is to be adopted for calculation purposes.

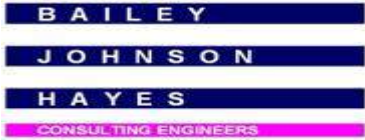
In general terms it is proposed to construct a series of retention basins fitted with Hydrobrake flow control devices to attenuate flows to the watercourse as necessary.

3.0 DRAINAGE DESIGN PHILOSOPHY

Reference to the site plan indicates the proposal to subdivide the development site to create three large plots to accommodate a series of industrial/commercial buildings, including associated external service yards, access roads, and car parking.

Four retention basins are to be constructed within the landscaped areas surrounding the development plots. The basins are to have side slopes no steeper than 1:3. Drawings of each basin are appended. Geocellular storage tanks are to be incorporated to the scheme.

The drainage is designed using the Microdrainage WinDes software package and adopting FEH design rainfall.

 <p>Bailey Johnson Hayes Grange House, John Dalton Street Manchester. M2 6FW Tel: 0161 279 7777 Fax: 0161 236 3552 Web: www.bjh.co.uk</p>	Project	Link 9, Skimmingdish Lane Bicester.	Project No. S1230	Sheet No. D-2
	Section	Surface Water Drainage	Drawing No.	Rev. 1
			By P.A.B.	Date Aug 2017
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Calculations

Appended to these calculations are drawings as follows:

- S1230-DD01 Drained areas.
- S1230-DD02 Drainage design key.
- S1230-DD03 Basins 1 and 2.
- S1230-DD04 Basin 3.
- S1230-DD05 Basin 4.

The below-ground drainage system is modelled in the System 1 module of WinDes, and then exported into the Simulation module where the retention basins, cellular storage tanks, and Hydrobrake flow controls are included.

4.0 DRAINAGE DESIGN RESULTS

The site has a total drained area of circa 9.5ha. This figure conservatively includes an area for each of the retention basins and disregards any infiltration.

4.1 Quick Storage Estimate

The introductory Quick Storage Estimate predicts that for 100yr+30%CC storm events, a storage volume between 8195 and 10436 m³ will be required for an outflow restriction of 17 litres/second.

4.2 Source Control 100yr+30%CC storms

In order to establish the critical storm event a simple model is created within the Source Control module of Windes using a 95m x 95m x1m deep pond fitted with an Hydrobrake flow control device to restrict outflows to 17 l/sec.

Microdrainage pages 1-4 indicate that the critical storm is a 2880 minute winter event.

4.3 Simulation 100yr+30%CC 2880min winter storm

Microdrainage pages 5-17 model a 100yr+30% CC 2880minute winter storm.

A water level in Basin 1 of 70.232 is predicted.

A water level in Basin 2 of 70.232 is predicted.

A water level in Basin 3 of 69.463 is predicted.

A water level in Basin 4 of 70.397 is predicted.

Zero flooding is predicted to occur. Flow to outfall is 17 l/sec.



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Project
Link 9, Skimmingdish Lane
Bicester.

Project No.
S1230

Sheet No.
D-3

Drawing No.

Rev.
1

Section
Surface Water Drainage

By
P.A.B.

Date
Aug 2017

Checked

Date

Calculations

4.3 Simulation 100yr 2880min winter storm

Microdrainage pages 18-19 model the results of a 100yr 2880minute winter storm.

A water level in Basin 1 of 69.975 is predicted.

A water level in Basin 2 of 69.975 is predicted.

A water level in Basin 3 of 70.128 is predicted.

A water level in Basin 4 of 69.291 is predicted.

Zero flooding is predicted to occur. Flow to outfall is 17 l/sec.

4.4 Simulation 30yr 2880min winter storm

Microdrainage pages 20-21 model the results of a 30yr 2880minute winter storm.

A water level in Basin 1 of 69.772 is predicted.

A water level in Basin 2 of 69.769 is predicted.

A water level in Basin 3 of 69.118 is predicted.

A water level in Basin 4 of 69.918 is predicted.

Zero flooding is predicted to occur. Flow to outfall is 17 l/sec.

4.5 Exceedance events

To safeguard the loading dock areas in Plots 2 and 3 from excessive flooding in the event of exceedance, it is proposed to fit weir overflow walls within the Hydrobrake chambers at the ends of Basins 2 and 3. The top of these weir walls will be 70.200 and 70.700 respectively i.e. 100mm below dock level.

The water level in Langford Brook is predicted to rise to circa 69.750 in a 100year storm event; at this point the southern edge of the service yard to Plot 1, and Basin 4, will be submerged, such that any surplus floodwater will naturally return to the watercourse.

5.0 PHASE 1 (PLOT 3 PLUS 50% ACCESS ROAD) DRAINAGE DESIGN

The initial phase of construction work will involve creating Basins 1 & 2, complete with the Hydrobrake flow control on Basin 2, and building sufficient of the central access road to serve Plot 3, which will be the first plot to be developed.

The critical storm is modelled to appraise this condition.

Microdrainage pages 22-27 model a 100yr+30% CC 2880minute winter storm.

A water level in Basin 1 of 69.676 is predicted.

A water level in Basin 2 of 69.683 is predicted.

Zero flooding is predicted to occur. Flow to outfall is 4 l/sec.

BAILEY JOHNSON HAYES DRAWINGS

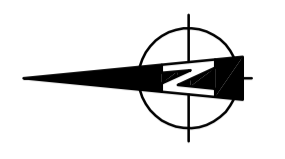
S1230-DD01 – Drained Areas

S1230-DD02 – SW drainage design key

S1230-DD03 – Basins 1 & 2

S1230-DD04 – Basin 3

S1230-DD05 – Basin 4



Rev	Date	Revision Description
Revision Schedule		

INFORMATION

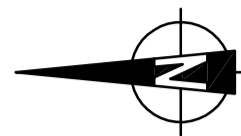
**LINK 9. SKIMMINGDISH LANE.
BICESTER.**

Client:
ALBION LAND (2013) LTD

Site Plan - Drained Areas

BAILEY JOHNSON HAYES
Consulting Engineers
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ST ALBANS: Phoenix House, 63 Campfield Road. Tel 01727 841172 Fax 01727 841085

Scale	1:1000 at A1	Project Ref.	S1230	Drawing No.	DD01	Rev.	.
Date	Aug 2017						
Dm	BJH	Chkd	BJH				



Rev	Date	Revision Description

Revision Schedule

INFORMATION

**LINK 9. SKIMMINGDISH LANE.
BICESTER.**

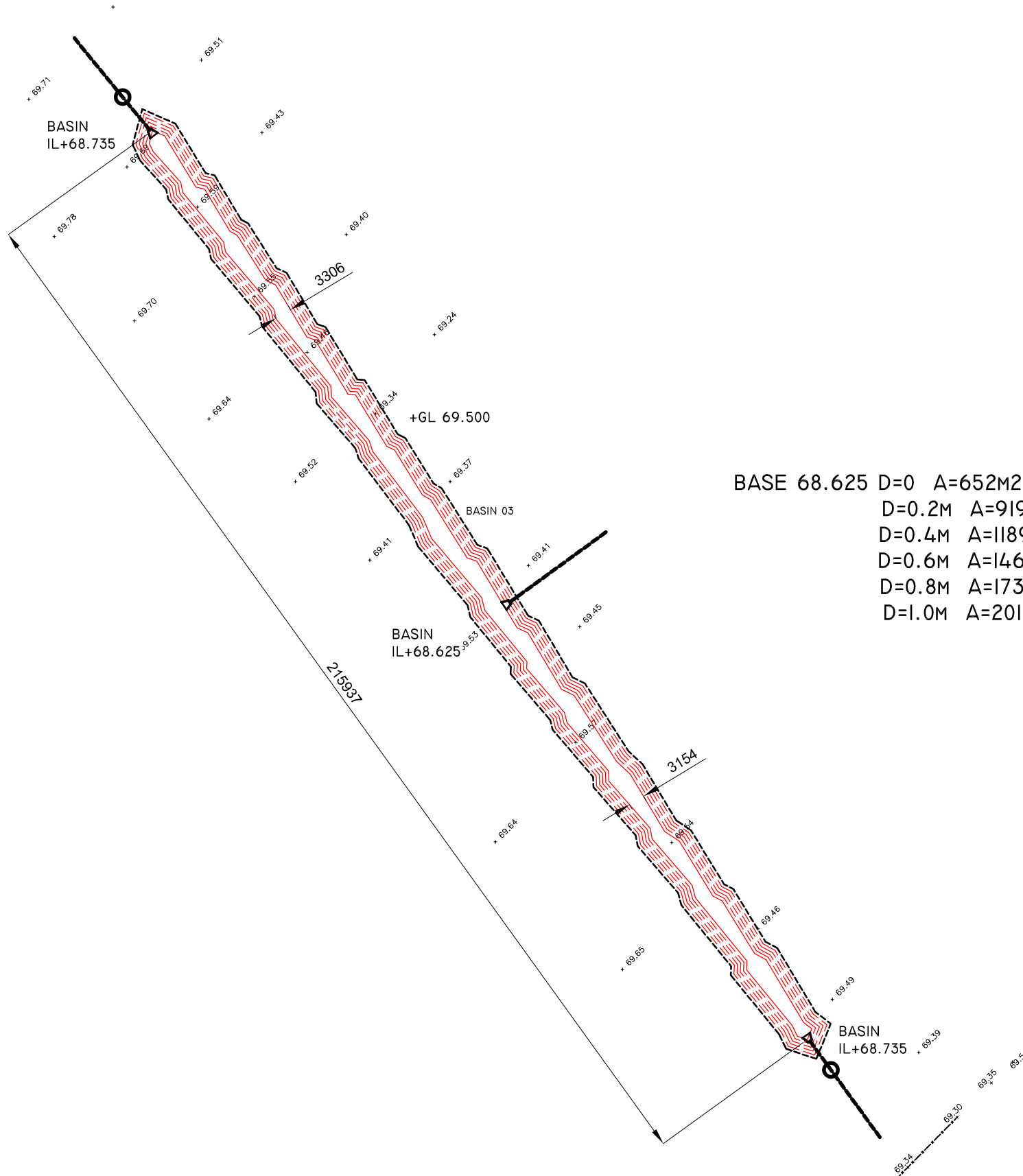
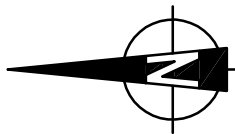
Client:
ALBION LAND (2013) LTD

Drainage Design Model Key

BAILEY JOHNSON HAYES
Consulting Engineers

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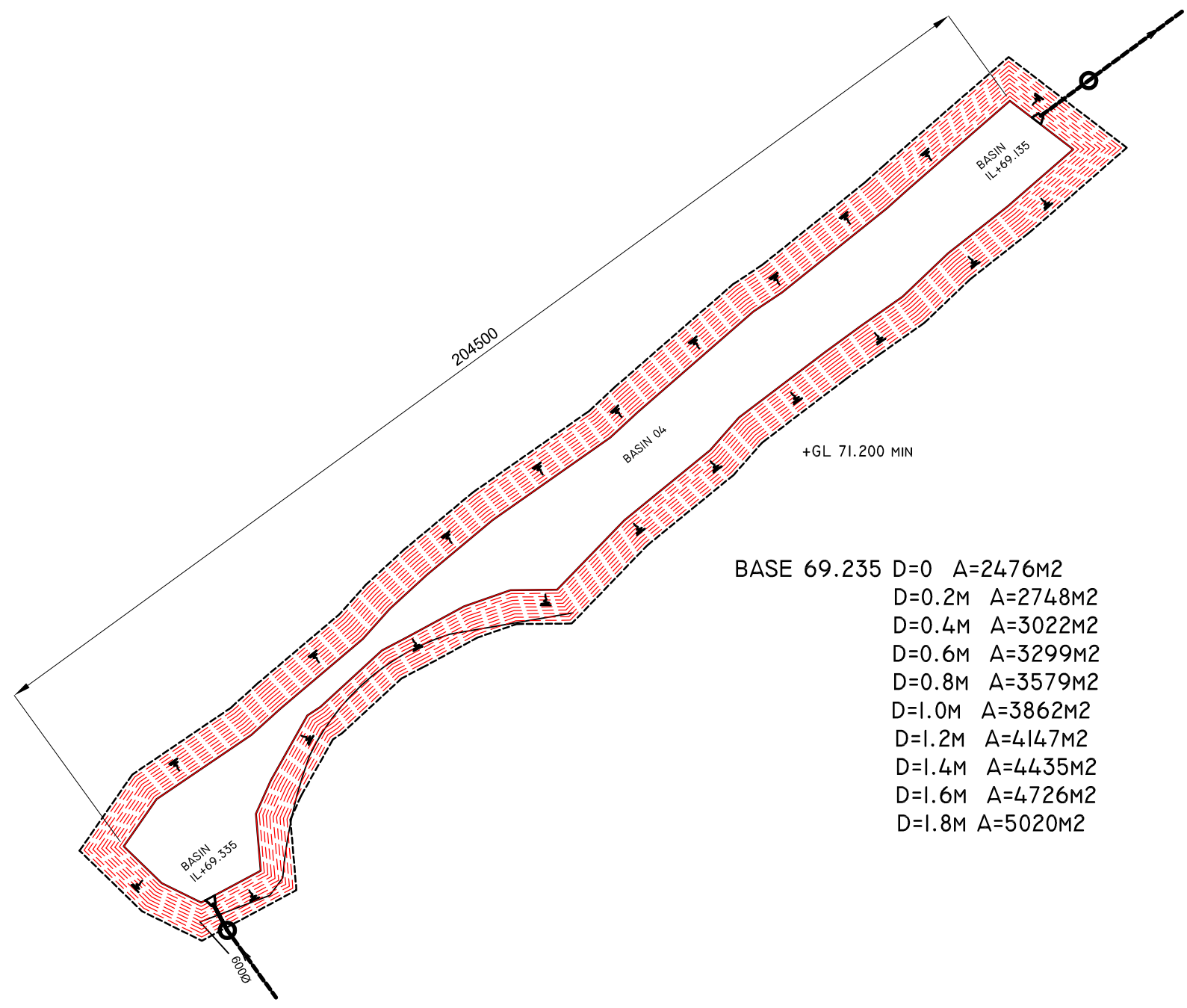
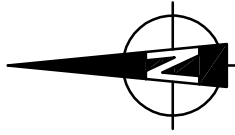
Scale	1:1000 at A1	Project Ref.		Drawing No.		Rev.	
Date	Aug.2017			S1230	DD02		
Dm	BJH	Chkd	BJH				



BASE 68.625	D=0	A=652M2
	D=0.2M	A=919M2
	D=0.4M	A=1189M2
	D=0.6M	A=1461M2
	D=0.8M	A=1736M2
	D=1.0M	A=2013M2

SKIMMINGDISH LANE LINK 9 BICESTER	
Client: ALBION LAND (2013) LTD	
BASIN 03 DETAILS	
BAILEY JOHNSON HAYES Consulting Engineers	
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Scale:	1:1000 at A3	S1230-DD04
Date:	July 2017	
Drawn:		



BASE 69.235

D=0	A=2476M2
D=0.2M	A=2748M2
D=0.4M	A=3022M2
D=0.6M	A=3299M2
D=0.8M	A=3579M2
D=1.0M	A=3862M2
D=1.2M	A=4147M2
D=1.4M	A=4435M2
D=1.6M	A=4726M2
D=1.8M	A=5020M2

SKIMMINGDISH LANE LINK 9 BICESTER	
Client: ALBION LAND (2013) LTD	
BASIN 04 DETAILS	
BAILEY JOHNSON HAYES Consulting Engineers	
<small>MANCHESTER: Orange House, John Dalton St. Tel 0161 278 7777 Fax 0161 238 3382 ST ALBANS: Phoenix House, 83 Campfield Road. Tel 01727 841172 Fax 01727 841085</small>	
Scale: 1:500 at A3	S1230-DD05
Date: July 2017	
Drawn:	

MICRODRAINAGE CALCULATIONS

Quick Storage Estimate

Pages 1-4 – 100yr+30% Source Control

Pages 5-17 – 100yr+30% 2880min storm Sim

Pages 18-19 – 100yr 2880min storm Sim

Pages 20-21 – 30yr 2880min storm Sim

Pages 22-27 – Phase 1 only

100yr+30% 2880min storm Sim

Quick Storage Estimate

Micro Drainage

Variables

FEH Rainfall		Cv (Summer)	0.750
Return Period (years)	100	Cv (Winter)	0.840
Version	1999	Impermeable Area (ha)	9.500
Site	460200 223700 SP 60200 23700	Maximum Allowable Discharge (l/s)	17.0
C (1km)	-0.022	D3 (1km)	0.244
D1 (1km)	0.324	E (1km)	0.290
D2 (1km)	0.320	F (1km)	2.477
		Infiltration Coefficient (m/hr)	0.00000
		Safety Factor	2.0
		Climate Change (%)	30

Analyse OK Cancel Help

Enter Area between 0.000 and 999.999

Quick Storage Estimate

Micro Drainage


Results

Global Variables require approximate storage of between 8195 m³ and 10436 m³.

These values are estimates only and should not be used for design purposes.

Analyse OK Cancel Help


Enter Area between 0.000 and 999.999

Bailey Johnson Hayes		Page 1
Grange House John Dalton St Manchester M2 6FW	Link 9 Skimmingdish Lane Bicester	
Date 18/08/2017 14:03 File Source Control 100yr+30...	Designed by P.A.B. Checked by	
Micro Drainage	Source Control 2017.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	68.964	0.339	17.0	3058.1	O K
30 min Summer	69.020	0.395	17.0	3562.2	O K
60 min Summer	69.084	0.459	17.0	4142.5	O K
120 min Summer	69.157	0.532	17.0	4802.9	O K
180 min Summer	69.204	0.579	17.0	5225.7	O K
240 min Summer	69.239	0.614	17.0	5540.3	O K
360 min Summer	69.290	0.665	17.0	6000.9	O K
480 min Summer	69.327	0.702	17.0	6336.9	Flood Risk
600 min Summer	69.356	0.731	17.0	6597.6	Flood Risk
720 min Summer	69.379	0.754	17.0	6806.8	Flood Risk
960 min Summer	69.413	0.788	17.0	7114.1	Flood Risk
1440 min Summer	69.455	0.830	17.0	7491.6	Flood Risk
2160 min Summer	69.484	0.859	17.0	7754.9	Flood Risk
2880 min Summer	69.493	0.868	17.0	7831.0	Flood Risk
4320 min Summer	69.453	0.828	17.0	7476.1	Flood Risk
5760 min Summer	69.418	0.793	17.0	7156.2	Flood Risk
7200 min Summer	69.384	0.759	17.0	6854.0	Flood Risk
8640 min Summer	69.352	0.727	17.0	6559.5	Flood Risk
10080 min Summer	69.318	0.693	17.0	6255.3	O K
15 min Winter	69.005	0.380	17.0	3426.5	O K
30 min Winter	69.067	0.442	17.0	3992.2	O K


Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	172.576	0.0	1430.2	27
30 min Summer	100.698	0.0	1442.2	42
60 min Summer	58.757	0.0	2810.6	72
120 min Summer	34.284	0.0	2846.7	132
180 min Summer	25.017	0.0	2811.6	190
240 min Summer	20.005	0.0	2770.4	250
360 min Summer	14.597	0.0	2684.1	370
480 min Summer	11.673	0.0	2595.1	490
600 min Summer	9.814	0.0	2520.1	610
720 min Summer	8.518	0.0	2461.8	728
960 min Summer	6.803	0.0	2376.3	968
1440 min Summer	4.956	0.0	2279.0	1446
2160 min Summer	3.611	0.0	4860.4	2164
2880 min Summer	2.884	0.0	4679.5	2880
4320 min Summer	2.037	0.0	4320.5	3756
5760 min Summer	1.592	0.0	9509.5	4488
7200 min Summer	1.315	0.0	9102.3	5256
8640 min Summer	1.125	0.0	8642.9	6056
10080 min Summer	0.985	0.0	8262.0	6864
15 min Winter	172.576	0.0	1446.3	27
30 min Winter	100.698	0.0	1442.4	41

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Date 18/08/2017 14:03 File Source Control 100yr+30...	Designed by P.A.B. Checked by	
Micro Drainage	Source Control 2017.1	

Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
60 min Winter	69.140	0.515	17.0	4643.4	O K
120 min Winter	69.222	0.597	17.0	5387.3	O K
180 min Winter	69.275	0.650	17.0	5865.2	O K
240 min Winter	69.314	0.689	17.0	6222.5	O K
360 min Winter	69.373	0.748	17.0	6746.6	Flood Risk
480 min Winter	69.415	0.790	17.0	7125.7	Flood Risk
600 min Winter	69.447	0.822	17.0	7420.1	Flood Risk
720 min Winter	69.473	0.848	17.0	7657.6	Flood Risk
960 min Winter	69.513	0.888	17.0	8010.8	Flood Risk
1440 min Winter	69.562	0.937	17.0	8456.9	Flood Risk
2160 min Winter	69.599	0.974	17.0	8792.6	Flood Risk
2880 min Winter	69.614	0.989	17.1	8923.7	Flood Risk
4320 min Winter	69.574	0.949	17.0	8568.1	Flood Risk
5760 min Winter	69.527	0.902	17.0	8136.4	Flood Risk
7200 min Winter	69.486	0.861	17.0	7767.5	Flood Risk
8640 min Winter	69.444	0.819	17.0	7391.5	Flood Risk
10080 min Winter	69.402	0.777	17.0	7008.7	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
60 min Winter	58.757	0.0	2869.4	70
120 min Winter	34.284	0.0	2827.1	130
180 min Winter	25.017	0.0	2767.2	188
240 min Winter	20.005	0.0	2701.9	248
360 min Winter	14.597	0.0	2592.6	366
480 min Winter	11.673	0.0	2528.1	482
600 min Winter	9.814	0.0	2487.3	600
720 min Winter	8.518	0.0	2462.0	718
960 min Winter	6.803	0.0	2444.1	954
1440 min Winter	4.956	0.0	2424.3	1420
2160 min Winter	3.611	0.0	4976.1	2108
2880 min Winter	2.884	0.0	4883.2	2792
4320 min Winter	2.037	0.0	4620.8	4068
5760 min Winter	1.592	0.0	9804.7	4672
7200 min Winter	1.315	0.0	9370.8	5552
8640 min Winter	1.125	0.0	8923.9	6488
10080 min Winter	0.985	0.0	8476.8	7376

Grange House John Dalton St Manchester M2 6FW	Link 9 Skimmingdish Lane Bicester	
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Date 18/08/2017 14:03 File Source Control 100yr+30...	Designed by P.A.B. Checked by	
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Micro Drainage	Source Control 2017.1
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Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	1999
Site Location	460200 223700 SP 60200 23700
C (1km)	-0.022
D1 (1km)	0.324
D2 (1km)	0.320
D3 (1km)	0.244
E (1km)	0.290
F (1km)	2.477
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+30

Time Area Diagram

Total Area (ha) 9.500

Time (mins)	Area	Time (mins)	Area	Time (mins)	Area
From:	To:	From:	To:	From:	To:
0	4	4	8	8	12
3.167	3.167	3.167	3.167	3.167	3.167

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Grange House John Dalton St Manchester M2 6FW	Link 9 Skimmingdish Lane Bicester	
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Micro Drainage	Source Control 2017.1	

Model Details

Storage is Online Cover Level (m) 69.625

Tank or Pond Structure

Invert Level (m) 68.625

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	9025.0	0.400	9025.0	0.800	9025.0
0.200	9025.0	0.600	9025.0	1.000	9025.0


Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0185-1700-0975-1700
Design Head (m)	0.975
Design Flow (l/s)	17.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	185
Invert Level (m)	68.625
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.975	17.0
Flush-Flo™	0.325	17.0
Kick-Flo®	0.696	14.5
Mean Flow over Head Range	-	14.3

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	6.5	1.200	18.7	3.000	29.1	7.000	43.7
0.200	16.3	1.400	20.2	3.500	31.3	7.500	45.2
0.300	16.9	1.600	21.5	4.000	33.4	8.000	46.7
0.400	16.8	1.800	22.7	4.500	35.3	8.500	48.1
0.500	16.5	2.000	23.9	5.000	37.2	9.000	49.4
0.600	15.9	2.200	25.0	5.500	38.9	9.500	50.7
0.800	15.5	2.400	26.1	6.000	40.6		
1.000	17.2	2.600	27.1	6.500	42.2		

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Grange House John Dalton St Manchester M2 6FW	Link 9 Skimmingdish Lane Bicester	
Date 18/08/2017 13:57 File 100yr+30% 2880 min wint...	Designed by P.A.B. Checked by	
Micro Drainage	Network 2017.1	

Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)	Section Type
1.000	111.600	0.360	310.0	0.242	5.00	0.600	o	375	Pipe/Conduit
1.001	29.700	0.140	212.1	0.000	0.00	0.600	o	375	Pipe/Conduit
1.002	22.700	0.100	227.0	0.121	0.00	0.600	o	450	Pipe/Conduit
1.003	22.700	0.100	227.0	0.121	0.00	0.600	o	450	Pipe/Conduit
2.000	23.600	0.200	118.0	0.123	5.00	0.600	o	225	Pipe/Conduit
2.001	25.400	0.075	338.7	0.136	0.00	0.600	o	375	Pipe/Conduit
3.000	25.000	0.150	166.7	0.056	5.00	0.600	oo	225	Double Pipe
2.002	61.200	0.175	349.7	0.328	0.00	0.600	o	450	Pipe/Conduit
4.000	10.000	0.050	200.0	0.091	5.00	0.600	o	225	Pipe/Conduit
2.003	10.200	0.050	204.0	0.000	0.00	0.600	o	450	Pipe/Conduit
2.004	10.200	0.050	204.0	0.000	0.00	0.600	o	450	Pipe/Conduit
5.000	111.600	0.650	171.7	0.242	5.00	0.600	o	375	Pipe/Conduit
1.004	5.000	0.010	500.0	0.000	0.00	0.600	o	600	Pipe/Conduit
1.005	27.500	0.055	500.0	0.049	0.00	0.600	o	600	Pipe/Conduit


PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)
1.000	1	71.300	69.900	1.025	71.300	69.540	1.385		1350
1.001	2	71.300	69.540	1.385	71.300	69.400	1.525		1350
1.002	3	71.300	69.400	1.450	71.300	69.300	1.550		1350
1.003	4	71.300	69.300	1.550	71.200	69.200	1.550		1350
2.000	5	71.300	69.800	1.275	70.750	69.600	0.925		1200
2.001	6	70.750	69.600	0.775	70.750	69.525	0.850		1350
3.000	7	70.300	69.675	0.400	70.750	69.525	1.000		1350
2.002	8	70.750	69.525	0.775	71.200	69.350	1.400		1350
4.000	9	71.200	69.400	1.575	71.200	69.350	1.625		1200
2.003	10	71.200	69.350	1.400	71.200	69.300	1.450		1350
2.004	11	71.200	69.250	1.525	71.200	69.200	1.575		1350
5.000	12	71.300	69.850	1.075	71.200	69.200	1.625		1350
1.004	12	71.200	69.200	1.400	71.500	69.190	1.710		1500
1.005	13	71.500	69.190	1.710	71.500	69.135	1.765		1500

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Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)	Section	Type
1.006	50.000	0.100	500.0	0.000	0.00	0.600	o	600	Pipe/Conduit	
6.000	200.000	0.915	218.6	1.680	5.00	0.600	o	600	Pipe/Conduit	
1.007	50.000	0.100	500.0	0.297	0.00	0.600	o	600	Pipe/Conduit	
1.008	100.000	0.200	500.0	0.000	0.00	0.600	o	600	Pipe/Conduit	
7.000	200.000	1.215	164.6	0.730	5.00	0.600	o	600	Pipe/Conduit	
8.000	150.000	1.105	135.7	0.837	5.00	0.600	o	600	Pipe/Conduit	
9.000	44.500	0.300	148.3	0.022	5.00	0.600	o	225	Pipe/Conduit	
9.001	94.100	0.400	235.3	0.191	0.00	0.600	o	300	Pipe/Conduit	
9.002	79.800	0.200	399.0	0.113	0.00	0.600	o	375	Pipe/Conduit	
9.003	40.000	0.100	400.0	0.016	0.00	0.600	o	375	Pipe/Conduit	
9.004	71.500	0.150	476.7	0.113	0.00	0.600	o	375	Pipe/Conduit	
9.005	41.000	0.090	455.6	0.074	0.00	0.600	o	375	Pipe/Conduit	
10.000	37.500	0.615	61.0	0.117	5.00	0.600	o	225	Pipe/Conduit	
9.006	40.000	0.060	666.7	0.000	0.00	0.600	o	450	Pipe/Conduit	


PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)
1.006	14	71.500	69.135	1.765	71.500	69.035	1.865		1500
6.000	15	70.850	69.950	0.300	71.500	69.035	1.865		1500
1.007	16	71.500	69.035	1.865	71.000	68.935	1.465		1500
1.008	17	71.000	68.935	1.465	69.500	68.735	0.165	Hydro-Brake®	1500
7.000	19	70.850	69.840	0.410	69.500	68.625	0.275		1500
8.000	20	70.800	69.840	0.360	69.500	68.735	0.165		1500
9.000	21	71.800	71.000	0.575	71.800	70.700	0.875		1200
9.001	22	71.800	70.700	0.800	71.700	70.300	1.100		1200
9.002	23	71.700	70.300	1.025	71.700	70.100	1.225		1350
9.003	24	71.700	70.100	1.225	71.700	70.000	1.325		1350
9.004	25	71.700	70.000	1.325	71.700	69.850	1.475		1350
9.005	26	71.700	69.850	1.475	71.700	69.760	1.565		1350
10.000	27	71.800	70.375	1.200	71.700	69.760	1.715		1200
9.006	28	71.700	69.760	1.490	71.700	69.700	1.550		1350

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Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)	Section Type
11.000	45.000	0.300	150.0	0.024	5.00	0.600	o	225	Pipe/Conduit
11.001	70.000	0.675	103.7	0.121	0.00	0.600	o	225	Pipe/Conduit
9.007	55.000	0.250	220.0	0.024	0.00	0.600	o	450	Pipe/Conduit
12.000	40.000	0.925	43.2	0.121	5.00	0.600	o	225	Pipe/Conduit
9.008	46.500	0.065	715.4	0.000	0.00	0.600	o	450	Pipe/Conduit
9.009	5.000	0.010	500.0	0.000	0.00	0.600	o	450	Pipe/Conduit
13.000	92.000	0.270	340.7	0.654	5.00	0.600	o	450	Pipe/Conduit
14.000	26.000	0.110	236.4	0.014	5.00	0.600	o	225	Pipe/Conduit
14.001	38.000	0.160	237.5	0.240	0.00	0.600	o	375	Pipe/Conduit
13.001	29.000	0.085	341.2	0.000	0.00	0.600	o	600	Pipe/Conduit
15.000	16.000	0.100	160.0	0.048	5.00	0.600	o	225	Pipe/Conduit
13.002	48.000	0.145	331.0	0.096	0.00	0.600	o	600	Pipe/Conduit


PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)
11.000	29	71.800	70.675	0.900	71.800	70.375	1.200		1200
11.001	30	71.800	70.375	1.200	71.700	69.700	1.775		1200
9.007	31	71.700	69.700	1.550	71.800	69.450	1.900		1350
12.000	32	71.800	70.375	1.200	71.800	69.450	2.125		1200
9.008	33	71.800	69.450	1.900	71.600	69.385	1.765		1350
9.009	34	71.600	69.385	1.765	71.600	69.375	1.775		1350
13.000	35	71.650	70.500	0.700	71.700	70.230	1.020		1350
14.000	36	70.800	70.500	0.075	71.700	70.390	1.085		1200
14.001	37	71.700	70.390	0.935	71.700	70.230	1.095		1350
13.001	38	71.700	70.230	0.870	71.700	70.145	0.955		1500
15.000	39	71.700	70.245	1.230	71.700	70.145	1.330		1200
13.002	40	71.700	70.145	0.955	71.700	70.000	1.100		1500

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PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)	Section Type
16.000	10.000	0.100	100.0	0.068	5.00	0.600	o	225	Pipe/Conduit
13.003	30.000	0.150	200.0	0.000	0.00	0.600	o	600	Pipe/Conduit
17.000	26.000	0.175	148.6	0.017	5.00	0.600	o	225	Pipe/Conduit
17.001	34.000	0.175	194.3	0.313	0.00	0.600	o	375	Pipe/Conduit
18.000	10.000	0.100	100.0	0.000	5.00	0.600	o	225	Pipe/Conduit
13.004	5.000	0.050	100.0	0.000	0.00	0.600	o	600	Pipe/Conduit
13.005	5.000	0.050	100.0	0.000	0.00	0.600	o	600	Pipe/Conduit
13.006	5.000	0.325	15.4	0.000	0.00	0.600	o	600	Pipe/Conduit
9.010	20.000	0.040	500.0	0.000	0.00	0.600	o	600	Pipe/Conduit
9.011	10.000	0.100	100.0	0.160	0.00	0.600	o	600	Pipe/Conduit
19.000	21.000	0.150	140.0	0.015	5.00	0.600	o	225	Pipe/Conduit
19.001	53.000	0.425	124.7	0.071	0.00	0.600	o	300	Pipe/Conduit
19.002	46.000	0.375	122.7	0.086	0.00	0.600	o	375	Pipe/Conduit
19.003	49.000	0.375	130.7	0.022	0.00	0.600	o	375	Pipe/Conduit

PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)
16.000	41	71.700	70.100	1.375	71.700	70.000	1.475		1200
13.003	42	71.700	70.000	1.100	71.600	69.850	1.150		1500
17.000	43	70.800	70.200	0.375	71.500	70.025	1.250		1200
17.001	44	71.500	70.025	1.100	71.600	69.850	1.375		1350
18.000	45	71.500	69.950	1.325	71.600	69.850	1.525		1200
13.004	46	71.600	69.850	1.150	71.600	69.800	1.200		1500
13.005	47	71.600	69.750	1.200	71.600	69.700	1.250		1500
13.006	48	71.600	69.700	1.300	71.600	69.375	1.625		1500
9.010	49	71.600	69.375	1.625	71.600	69.335	1.665		1500
9.011	50	71.600	69.335	1.665	71.500	69.235	1.665		1500
19.000	51	71.800	70.975	0.600	71.800	70.825	0.750		1200
19.001	52	71.800	70.825	0.675	71.800	70.400	1.100		1200
19.002	53	71.800	70.400	1.025	71.700	70.025	1.300		1350
19.003	54	71.700	70.025	1.300	71.700	69.650	1.675		1350

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Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)	Section Type
20.000	49.000	0.490	100.0	0.071	5.00	0.600	o	300	Pipe/Conduit
20.001	48.000	0.480	100.0	0.086	0.00	0.600	o	375	Pipe/Conduit
19.004	6.000	0.085	70.6	0.000	0.00	0.600	o	375	Pipe/Conduit
19.005	53.000	0.265	200.0	1.268	0.00	0.600	o	600	Pipe/Conduit
19.006	13.000	0.065	200.0	0.000	0.00	0.600	o	600	Pipe/Conduit
9.012	10.000	0.100	100.0	0.160	0.00	0.600	o	600	Pipe/Conduit
9.013	200.000	0.400	500.0	0.000	0.00	0.600	o	600	Pipe/Conduit
9.014	10.000	0.100	100.0	0.120	0.00	0.600	o	600	Pipe/Conduit
1.009	110.000	0.225	488.9	0.000	0.00	0.600	\/	-5	Pipe/Conduit

PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)
20.000	55	71.800	70.620	0.880	71.800	70.130	1.370		1200
20.001	56	71.800	70.130	1.295	71.700	69.650	1.675		1350
19.004	57	71.700	69.650	1.675	71.700	69.565	1.760		1350
19.005	58	71.700	69.565	1.535	71.500	69.300	1.600		1500
19.006	59	71.500	69.300	1.600	71.500	69.235	1.665		1500
9.012	60	71.500	69.235	1.665	71.500	69.135	1.765		1500
9.013	61	71.500	69.135	1.765	69.700	68.735	0.365	Hydro-Brake®	1500
9.014	62	69.700	68.735	0.365	69.500	68.635	0.265		1500
1.009	63	69.500	68.625	0.275	0.000	68.400	0.000	Hydro-Brake®	10000

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)
1.009		0.000	68.400	0.000	0	0

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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Additional Flow - % of Total Flow	30.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /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)	5760
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	24

Number of Input Hydrographs	0	Number of Storage Structures	9
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	1999
Site Location	460200 223700 SP 60200 23700
C (1km)	-0.022
D1 (1km)	0.324
D2 (1km)	0.320
D3 (1km)	0.244
E (1km)	0.290
F (1km)	2.477
Summer Storms	No
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	2880

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Online Controls for Storm

Hydro-Brake® Optimum Manhole: 17, DS/PN: 1.008, Volume (m³): 17.4

Unit Reference MD-SHE-0096-4000-0900-4000
Design Head (m) 0.900
Design Flow (l/s) 4.0
Flush-Flo™ Calculated
Objective Minimise upstream storage
Application Surface
Sump Available Yes
Diameter (mm) 96
Invert Level (m) 68.935
Minimum Outlet Pipe Diameter (mm) 150
Suggested Manhole Diameter (mm) 1200


Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	4.0
Flush-Flo™	0.266	4.0
Kick-Flo®	0.578	3.3
Mean Flow over Head Range	-	3.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.1	1.200	4.6	3.000	7.0	7.000	10.5
0.200	3.9	1.400	4.9	3.500	7.5	7.500	10.8
0.300	4.0	1.600	5.2	4.000	8.0	8.000	11.2
0.400	3.9	1.800	5.5	4.500	8.5	8.500	11.5
0.500	3.7	2.000	5.8	5.000	8.9	9.000	11.8
0.600	3.3	2.200	6.1	5.500	9.3	9.500	12.1
0.800	3.8	2.400	6.3	6.000	9.7		
1.000	4.2	2.600	6.6	6.500	10.1		

Hydro-Brake® Optimum Manhole: 61, DS/PN: 9.013, Volume (m³): 6.6

Unit Reference MD-SHE-0112-7000-1800-7000
Design Head (m) 1.800
Design Flow (l/s) 7.0
Flush-Flo™ Calculated
Objective Minimise upstream storage
Application Surface
Sump Available Yes
Diameter (mm) 112
Invert Level (m) 69.135
Minimum Outlet Pipe Diameter (mm) 150
Suggested Manhole Diameter (mm) 1200

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Hydro-Brake® Optimum Manhole: 61, DS/PN: 9.013, Volume (m³): 6.6

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.800	7.0
Flush-Flo™	0.487	6.7
Kick-Flo®	0.996	5.3
Mean Flow over Head Range	-	6.0

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.9	1.200	5.8	3.000	8.9	7.000	13.3
0.200	5.9	1.400	6.2	3.500	9.6	7.500	13.7
0.300	6.4	1.600	6.6	4.000	10.2	8.000	14.2
0.400	6.6	1.800	7.0	4.500	10.8	8.500	14.6
0.500	6.7	2.000	7.3	5.000	11.3	9.000	15.0
0.600	6.6	2.200	7.7	5.500	11.9	9.500	15.4
0.800	6.3	2.400	8.0	6.000	12.4		
1.000	5.3	2.600	8.3	6.500	12.8		


Hydro-Brake® Optimum Manhole: 63, DS/PN: 1.009, Volume (m³): 192.3

Unit Reference	MD-SHE-0186-1700-0900-1700
Design Head (m)	0.900
Design Flow (l/s)	17.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	186
Invert Level (m)	68.625
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	17.0
Flush-Flo™	0.312	17.0
Kick-Flo®	0.654	14.6
Mean Flow over Head Range	-	14.2

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	6.5	0.300	17.0	0.500	16.4	0.800	16.1
0.200	16.4	0.400	16.8	0.600	15.6	1.000	17.9


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Hydro-Brake® Optimum Manhole: 63, DS/PN: 1.009, Volume (m³): 192.3

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
1.200	19.5	2.400	27.1	5.000	38.7	8.000	48.5
1.400	21.0	2.600	28.2	5.500	40.5	8.500	50.0
1.600	22.4	3.000	30.2	6.000	42.2	9.000	51.4
1.800	23.7	3.500	32.5	6.500	43.9	9.500	52.6
2.000	24.9	4.000	34.7	7.000	45.5		
2.200	26.0	4.500	36.7	7.500	47.1		

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Storage Structures for Storm

Cellular Storage Manhole: 5, DS/PN: 2.000

Invert Level (m) 69.800 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	230.0	0.0	0.400	230.0	0.0
0.200	230.0	0.0	0.401	0.0	0.0

Cellular Storage Manhole: 9, DS/PN: 4.000

Invert Level (m) 69.400 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	330.0	0.0	0.400	330.0	0.0
0.200	330.0	0.0	0.401	0.0	0.0

Tank or Pond Manhole: 14, DS/PN: 1.006

Invert Level (m) 69.135

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	488.0	0.400	796.0	0.800	1114.0	1.200	1444.0
0.200	640.0	0.600	954.0	1.000	1278.0		

Tank or Pond Manhole: 17, DS/PN: 1.008


Invert Level (m) 68.935

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1143.0	0.400	1412.0	0.800	1690.0	1.200	1979.0
0.200	1276.0	0.600	1550.0	1.000	1834.0		

Cellular Storage Manhole: 35, DS/PN: 13.000

Invert Level (m) 70.500 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	105.0	0.0	0.400	105.0	0.0
0.200	105.0	0.0	0.401	0.0	0.0

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Date 18/08/2017 13:57 File 100yr+30% 2880 min wint...	Designed by P.A.B. Checked by	
Micro Drainage	Network 2017.1	

Cellular Storage Manhole: 39, DS/PN: 15.000

Invert Level (m) 70.245 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	105.0	0.0	0.300	105.0	0.0
0.100	105.0	0.0	0.400	105.0	0.0
0.200	105.0	0.0	0.401	0.0	0.0

Cellular Storage Manhole: 45, DS/PN: 18.000

Invert Level (m) 69.950 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	120.0	0.0	0.400	120.0	0.0
0.200	120.0	0.0	0.401	0.0	0.0

Tank or Pond Manhole: 60, DS/PN: 9.012


Invert Level (m) 69.235

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	2476.0	0.600	3299.0	1.200	4147.0	1.800	5020.0
0.200	2748.0	0.800	3579.0	1.400	4435.0	2.000	5317.0
0.400	3022.0	1.000	3862.0	1.600	4726.0		

Tank or Pond Manhole: 63, DS/PN: 1.009

Invert Level (m) 68.625


Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	652.0	0.400	1189.0	0.800	1736.0
0.200	919.0	0.600	1461.0	1.000	2013.0

Bailey Johnson Hayes		Page 16
Grange House John Dalton St Manchester M2 6FW	Link 9 Skimmingdish Lane Bicester	
Date 18/08/2017 13:57 File 100yr+30% 2880 min wint...	Designed by P.A.B. Checked by	
Micro Drainage	Network 2017.1	

Summary of Results for 2880 minute 100 year Winter (Storm)


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

PN	US/MH Name	Water	Surcharged	Flooded	Pipe		Status
		Level (m)	Depth (m)	Volume (m ³)	Flow / Cap.	Overflow (l/s)	
1.000	1 70.232	-0.043	0.000	0.04		4.1	OK
1.001	2 70.232	0.317	0.000	0.03		3.8	SURCHARGED
1.002	3 70.232	0.382	0.000	0.03		5.7	SURCHARGED
1.003	4 70.232	0.482	0.000	0.04		7.6	SURCHARGED
2.000	5 70.233	0.208	0.000	0.05		2.1	SURCHARGED
2.001	6 70.233	0.258	0.000	0.05		4.2	SURCHARGED
3.000	7 70.233	0.333	0.000	0.01		0.9	FLOOD RISK
2.002	8 70.233	0.258	0.000	0.06		10.3	SURCHARGED
4.000	9 70.233	0.608	0.000	0.05		1.4	SURCHARGED
2.003	10 70.233	0.433	0.000	0.06		9.8	SURCHARGED
2.004	11 70.233	0.533	0.000	0.06		9.8	SURCHARGED
5.000	12 70.232	0.007	0.000	0.03		4.1	SURCHARGED
1.004	12 70.232	0.432	0.000	0.10		20.7	SURCHARGED
1.005	13 70.232	0.442	0.000	0.09		21.4	SURCHARGED
1.006	14 70.232	0.497	0.000	0.02		5.4	SURCHARGED
6.000	15 70.232	-0.318	0.000	0.06		28.6	OK
1.007	16 70.232	0.597	0.000	0.13		34.5	SURCHARGED
1.008	17 70.231	0.696	0.000	0.02		4.4	SURCHARGED
7.000	19 69.903	-0.537	0.000	0.02		12.4	OK
8.000	20 69.904	-0.536	0.000	0.03		14.2	OK
9.000	21 71.010	-0.215	0.000	0.01		0.4	OK
9.001	22 70.744	-0.256	0.000	0.05		3.6	OK
9.002	23 70.400	-0.275	0.000	0.06		5.5	OK
9.003	24 70.400	-0.075	0.000	0.06		5.8	OK
9.004	25 70.400	0.025	0.000	0.09		7.7	SURCHARGED
9.005	26 70.400	0.175	0.000	0.10		8.9	SURCHARGED
10.000	27 70.401	-0.199	0.000	0.03		2.0	OK
9.006	28 70.399	0.189	0.000	0.10		10.6	SURCHARGED
11.000	29 70.686	-0.214	0.000	0.01		0.4	OK
11.001	30 70.407	-0.193	0.000	0.05		2.5	OK
9.007	31 70.399	0.249	0.000	0.07		13.0	SURCHARGED
12.000	32 70.400	-0.200	0.000	0.03		2.1	OK
9.008	33 70.399	0.499	0.000	0.14		14.7	SURCHARGED
9.009	34 70.399	0.564	0.000	0.13		14.6	SURCHARGED
13.000	35 70.576	-0.374	0.000	0.07		11.1	OK
14.000	36 70.508	-0.217	0.000	0.01		0.2	FLOOD RISK
14.001	37 70.436	-0.329	0.000	0.04		4.3	OK
13.001	38 70.399	-0.431	0.000	0.05		15.5	OK
15.000	39 70.399	-0.071	0.000	0.02		0.8	OK
13.002	40 70.399	-0.346	0.000	0.05		17.9	OK
16.000	41 70.399	0.074	0.000	0.03		1.2	SURCHARGED
13.003	42 70.399	-0.201	0.000	0.05		19.1	OK
17.000	43 70.399	-0.026	0.000	0.01		0.3	OK

Bailey Johnson Hayes		Page 17
Grange House John Dalton St Manchester M2 6FW	Link 9 Skimmingdish Lane Bicester	
Date 18/08/2017 13:57 File 100yr+30% 2880 min wint...	Designed by P.A.B. Checked by	
Micro Drainage	Network 2017.1	

Summary of Results for 2880 minute 100 year Winter (Storm)


PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status
17.001	44	70.399	-0.001	0.000	0.04	5.6	OK
18.000	45	70.399	0.224	0.000	0.00	0.2	SURCHARGED
13.004	46	70.399	-0.051	0.000	0.07	24.6	OK
13.005	47	70.399	0.049	0.000	0.07	24.5	SURCHARGED
13.006	48	70.399	0.099	0.000	0.04	24.5	SURCHARGED
9.010	49	70.399	0.424	0.000	0.19	39.0	SURCHARGED
9.011	50	70.398	0.463	0.000	0.12	41.5	SURCHARGED
19.000	51	70.982	-0.218	0.000	0.01	0.3	OK
19.001	52	70.847	-0.278	0.000	0.02	1.5	OK
19.002	53	70.431	-0.344	0.000	0.02	2.9	OK
19.003	54	70.398	-0.002	0.000	0.02	3.3	OK
20.000	55	70.636	-0.284	0.000	0.01	1.2	OK
20.001	56	70.398	-0.107	0.000	0.01	2.7	OK
19.004	57	70.398	0.373	0.000	0.05	5.7	SURCHARGED
19.005	58	70.398	0.233	0.000	0.06	27.0	SURCHARGED
19.006	59	70.398	0.498	0.000	0.08	26.6	SURCHARGED
9.012	60	70.397	0.562	0.000	0.02	7.1	SURCHARGED
9.013	61	70.408	0.673	0.000	0.02	6.7	SURCHARGED
9.014	62	69.463	0.128	0.000	0.02	7.6	FLOOD RISK
1.009	63	69.462	0.237	0.000	0.01	17.0	FLOOD RISK

Bailey Johnson Hayes		Page 18
Grange House John Dalton St Manchester M2 6FW	Link 9 Skimmingdish Lane Bicester	
Date 15/08/2017 16:33 File 100yr 2880 min winter.mdx	Designed by P.A.B. Checked by	
Micro Drainage	Network 2017.1	

Summary of Results for 2880 minute 100 year Winter (Storm)


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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap.	Overflow (l/s)	Pipe	Status
							Flow (l/s)	
1.000	1	69.975	-0.300	0.000	0.03		3.2	OK
1.001	2	69.975	0.060	0.000	0.03		3.1	SURCHARGED
1.002	3	69.975	0.125	0.000	0.03		4.6	SURCHARGED
1.003	4	69.975	0.225	0.000	0.03		6.0	SURCHARGED
2.000	5	69.975	-0.050	0.000	0.04		1.6	OK
2.001	6	69.975	0.000	0.000	0.04		3.4	SURCHARGED
3.000	7	69.975	0.075	0.000	0.01		0.7	SURCHARGED
2.002	8	69.975	0.000	0.000	0.05		8.3	SURCHARGED
4.000	9	69.975	0.350	0.000	0.03		0.9	SURCHARGED
2.003	10	69.975	0.175	0.000	0.04		7.1	SURCHARGED
2.004	11	69.975	0.275	0.000	0.04		7.1	SURCHARGED
5.000	12	69.975	-0.250	0.000	0.02		3.2	OK
1.004	12	69.975	0.175	0.000	0.07		14.2	SURCHARGED
1.005	13	69.975	0.185	0.000	0.06		14.8	SURCHARGED
1.006	14	69.975	0.240	0.000	0.04		9.7	SURCHARGED
6.000	15	70.035	-0.515	0.000	0.05		22.0	OK
1.007	16	69.975	0.340	0.000	0.13		34.3	SURCHARGED
1.008	17	69.974	0.439	0.000	0.01		4.1	SURCHARGED
7.000	19	69.892	-0.548	0.000	0.02		9.6	OK
8.000	20	69.895	-0.545	0.000	0.02		11.0	OK
9.000	21	71.008	-0.217	0.000	0.01		0.3	OK
9.001	22	70.738	-0.262	0.000	0.04		2.8	OK
9.002	23	70.351	-0.324	0.000	0.05		4.3	OK
9.003	24	70.153	-0.322	0.000	0.05		4.5	OK
9.004	25	70.132	-0.243	0.000	0.07		6.0	OK
9.005	26	70.132	-0.093	0.000	0.08		6.9	OK
10.000	27	70.399	-0.201	0.000	0.02		1.5	OK
9.006	28	70.132	-0.078	0.000	0.08		8.4	OK
11.000	29	70.683	-0.217	0.000	0.01		0.3	OK
11.001	30	70.403	-0.197	0.000	0.04		1.9	OK
9.007	31	70.131	-0.019	0.000	0.05		10.4	OK
12.000	32	70.397	-0.203	0.000	0.02		1.6	OK
9.008	33	70.130	0.230	0.000	0.11		11.6	SURCHARGED
9.009	34	70.130	0.295	0.000	0.10		11.4	SURCHARGED
13.000	35	70.566	-0.384	0.000	0.05		8.6	OK
14.000	36	70.506	-0.219	0.000	0.01		0.2	FLOOD RISK
14.001	37	70.432	-0.333	0.000	0.03		3.3	OK
13.001	38	70.309	-0.521	0.000	0.04		11.9	OK
15.000	39	70.264	-0.206	0.000	0.02		0.6	OK
13.002	40	70.223	-0.522	0.000	0.04		13.8	OK
16.000	41	70.130	-0.195	0.000	0.02		0.9	OK
13.003	42	70.130	-0.470	0.000	0.04		14.6	OK
17.000	43	70.206	-0.219	0.000	0.01		0.2	OK

Bailey Johnson Hayes		Page 19
Grange House John Dalton St Manchester M2 6FW	Link 9 Skimmingdish Lane Bicester	
Date 15/08/2017 16:33 File 100yr 2880 min winter.mdx	Designed by P.A.B. Checked by	
Micro Drainage		Network 2017.1

Summary of Results for 2880 minute 100 year Winter (Storm)


PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap. (l/s)	Overflow (l/s)	Pipe Flow (l/s)	Status
17.001	44	70.130	-0.270	0.000	0.03		4.3	OK
18.000	45	70.130	-0.045	0.000	0.00		0.2	OK
13.004	46	70.130	-0.320	0.000	0.06		19.0	OK
13.005	47	70.130	-0.220	0.000	0.06		19.0	OK
13.006	48	70.129	-0.171	0.000	0.03		18.9	OK
9.010	49	70.129	0.154	0.000	0.14		29.9	SURCHARGED
9.011	50	70.129	0.194	0.000	0.09		31.7	SURCHARGED
19.000	51	70.980	-0.220	0.000	0.00		0.2	OK
19.001	52	70.842	-0.283	0.000	0.01		1.1	OK
19.002	53	70.424	-0.351	0.000	0.01		2.3	OK
19.003	54	70.131	-0.269	0.000	0.02		2.5	OK
20.000	55	70.633	-0.287	0.000	0.01		0.9	OK
20.001	56	70.150	-0.355	0.000	0.01		2.1	OK
19.004	57	70.131	0.106	0.000	0.04		4.5	SURCHARGED
19.005	58	70.131	-0.034	0.000	0.05		20.7	OK
19.006	59	70.128	0.228	0.000	0.06		20.2	SURCHARGED
9.012	60	70.128	0.293	0.000	0.02		6.8	SURCHARGED
9.013	61	70.151	0.416	0.000	0.02		6.7	SURCHARGED
9.014	62	69.291	-0.044	0.000	0.02		7.6	OK
1.009	63	69.287	0.062	0.000	0.01		17.0	FLOOD RISK

Bailey Johnson Hayes		Page 20
Grange House John Dalton St Manchester M2 6FW	Link 9 Skimmingdish Lane Bicester	
Date 15/08/2017 16:43 File 30yr 2880 min winter.mdx	Designed by P.A.B. Checked by	
Micro Drainage	Network 2017.1	

Summary of Results for 2880 minute 30 year Winter (Storm)


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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Cap.	Overflow (l/s)	Pipe	Status
							Flow (l/s)	
1.000	1	69.938	-0.337	0.000	0.02		2.5	OK
1.001	2	69.772	-0.143	0.000	0.02		2.5	OK
1.002	3	69.772	-0.078	0.000	0.02		3.6	OK
1.003	4	69.772	0.022	0.000	0.03		4.7	SURCHARGED
2.000	5	69.825	-0.200	0.000	0.03		1.2	OK
2.001	6	69.773	-0.202	0.000	0.03		2.6	OK
3.000	7	69.773	-0.127	0.000	0.01		0.6	OK
2.002	8	69.773	-0.202	0.000	0.04		6.5	OK
4.000	9	69.773	0.148	0.000	0.02		0.6	SURCHARGED
2.003	10	69.773	-0.027	0.000	0.04		6.5	OK
2.004	11	69.772	0.072	0.000	0.04		6.4	SURCHARGED
5.000	12	69.880	-0.345	0.000	0.02		2.5	OK
1.004	12	69.772	-0.028	0.000	0.06		12.8	OK
1.005	13	69.772	-0.018	0.000	0.05		13.2	OK
1.006	14	69.769	0.034	0.000	0.03		8.3	SURCHARGED
6.000	15	70.025	-0.525	0.000	0.04		17.1	OK
1.007	16	69.769	0.134	0.000	0.08		22.5	SURCHARGED
1.008	17	69.768	0.233	0.000	0.01		4.0	SURCHARGED
7.000	19	69.881	-0.559	0.000	0.01		7.4	OK
8.000	20	69.883	-0.557	0.000	0.02		8.5	OK
9.000	21	71.006	-0.219	0.000	0.01		0.2	OK
9.001	22	70.734	-0.266	0.000	0.03		2.2	OK
9.002	23	70.345	-0.330	0.000	0.04		3.3	OK
9.003	24	70.147	-0.328	0.000	0.04		3.5	OK
9.004	25	70.056	-0.319	0.000	0.05		4.6	OK
9.005	26	69.926	-0.299	0.000	0.06		5.4	OK
10.000	27	70.395	-0.205	0.000	0.02		1.2	OK
9.006	28	69.925	-0.285	0.000	0.06		6.6	OK
11.000	29	70.681	-0.219	0.000	0.01		0.2	OK
11.001	30	70.400	-0.200	0.000	0.03		1.5	OK
9.007	31	69.925	-0.225	0.000	0.04		8.3	OK
12.000	32	70.392	-0.208	0.000	0.02		1.2	OK
9.008	33	69.925	0.025	0.000	0.09		9.4	SURCHARGED
9.009	34	69.925	0.090	0.000	0.08		9.1	SURCHARGED
13.000	35	70.558	-0.392	0.000	0.04		6.7	OK
14.000	36	70.505	-0.220	0.000	0.00		0.1	FLOOD RISK
14.001	37	70.428	-0.337	0.000	0.02		2.6	OK
13.001	38	70.300	-0.530	0.000	0.03		9.3	OK
15.000	39	70.259	-0.211	0.000	0.01		0.5	OK
13.002	40	70.215	-0.530	0.000	0.03		10.7	OK
16.000	41	70.117	-0.208	0.000	0.02		0.7	OK
13.003	42	70.067	-0.533	0.000	0.03		11.4	OK
17.000	43	70.205	-0.220	0.000	0.00		0.2	OK

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Grange House John Dalton St Manchester M2 6FW	Link 9 Skimmingdish Lane Bicester	
Date 15/08/2017 16:43 File 30yr 2880 min winter.mdx	Designed by P.A.B. Checked by	
Micro Drainage	Network 2017.1	

Summary of Results for 2880 minute 30 year Winter (Storm)


PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Overflow Cap. (l/s)	Pipe Flow (l/s)	Status
17.001	44	70.065	-0.335	0.000	0.03	3.4	OK
18.000	45	69.950	-0.225	0.000	0.00	0.0	OK
13.004	46	69.930	-0.520	0.000	0.04	14.8	OK
13.005	47	69.925	-0.425	0.000	0.04	14.8	OK
13.006	48	69.925	-0.375	0.000	0.03	14.8	OK
9.010	49	69.924	-0.051	0.000	0.12	23.8	OK
9.011	50	69.922	-0.013	0.000	0.07	25.3	OK
19.000	51	70.979	-0.221	0.000	0.00	0.2	OK
19.001	52	70.838	-0.287	0.000	0.01	0.9	OK
19.002	53	70.419	-0.356	0.000	0.01	1.8	OK
19.003	54	70.047	-0.353	0.000	0.01	2.0	OK
20.000	55	70.630	-0.290	0.000	0.01	0.7	OK
20.001	56	70.145	-0.360	0.000	0.01	1.6	OK
19.004	57	69.919	-0.106	0.000	0.03	3.6	OK
19.005	58	69.919	-0.246	0.000	0.04	16.4	OK
19.006	59	69.919	0.019	0.000	0.05	16.1	SURCHARGED
9.012	60	69.918	0.083	0.000	0.02	6.7	SURCHARGED
9.013	61	69.942	0.207	0.000	0.02	6.7	SURCHARGED
9.014	62	69.118	-0.217	0.000	0.02	7.5	OK
1.009	63	69.117	-0.108	0.000	0.01	17.0	OK

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Grange House John Dalton St Manchester M2 6FW	Phase 1. Link 9. Skimmingdish Lane. Bicester	
Date 18/08/2017 14:42 File Plot 3 100yr+30% 2880 m...	Designed by P.A.B. Checked by	
Micro Drainage	Network 2017.1	

Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)	Section Type
1.000	111.600	0.360	310.0	0.242	5.00	0.600	o	375	Pipe/Conduit
1.001	29.700	0.140	212.1	0.000	0.00	0.600	o	375	Pipe/Conduit
1.002	22.700	0.100	227.0	0.121	0.00	0.600	o	450	Pipe/Conduit
1.003	22.700	0.100	227.0	0.121	0.00	0.600	o	450	Pipe/Conduit
2.000	23.600	0.200	118.0	0.123	5.00	0.600	o	225	Pipe/Conduit
2.001	25.400	0.075	338.7	0.136	0.00	0.600	o	375	Pipe/Conduit
3.000	25.000	0.150	166.7	0.056	5.00	0.600	oo	225	Double Pipe
2.002	61.200	0.175	349.7	0.328	0.00	0.600	o	450	Pipe/Conduit
4.000	10.000	0.050	200.0	0.091	5.00	0.600	o	225	Pipe/Conduit
2.003	10.200	0.050	204.0	0.000	0.00	0.600	o	450	Pipe/Conduit
2.004	10.200	0.050	204.0	0.000	0.00	0.600	o	450	Pipe/Conduit
5.000	111.600	0.650	171.7	0.242	5.00	0.600	o	375	Pipe/Conduit
1.004	5.000	0.010	500.0	0.000	0.00	0.600	o	600	Pipe/Conduit
1.005	27.500	0.055	500.0	0.049	0.00	0.600	o	600	Pipe/Conduit

PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)
1.000	1	71.300	69.900	1.025	71.300	69.540	1.385		1350
1.001	2	71.300	69.540	1.385	71.300	69.400	1.525		1350
1.002	3	71.300	69.400	1.450	71.300	69.300	1.550		1350
1.003	4	71.300	69.300	1.550	71.200	69.200	1.550		1350
2.000	5	71.300	69.800	1.275	70.750	69.600	0.925		1200
2.001	6	70.750	69.600	0.775	70.750	69.525	0.850		1350
3.000	7	70.300	69.675	0.400	70.750	69.525	1.000		1350
2.002	8	70.750	69.525	0.775	71.200	69.350	1.400		1350
4.000	9	71.200	69.400	1.575	71.200	69.350	1.625		1200
2.003	10	71.200	69.350	1.400	71.200	69.300	1.450		1350
2.004	11	71.200	69.250	1.525	71.200	69.200	1.575		1350
5.000	12	71.300	69.850	1.075	71.200	69.200	1.625		1350
1.004	12	71.200	69.200	1.400	71.500	69.190	1.710		1500
1.005	13	71.500	69.190	1.710	71.500	69.135	1.765		1500

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Micro Drainage	Network 2017.1	

Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)	Section Type
1.006	50.000	0.100	500.0	0.000	0.00	0.600	o	600	Pipe/Conduit
6.000	200.000	0.915	218.6	0.000	5.00	0.600	o	600	Pipe/Conduit
1.007	50.000	0.100	500.0	0.297	0.00	0.600	o	600	Pipe/Conduit
1.008	100.000	0.200	500.0	0.000	0.00	0.600	o	600	Pipe/Conduit
1.009	110.000	0.225	488.9	0.000	0.00	0.600	\/	-5	Pipe/Conduit

PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)
1.006	14	71.500	69.135	1.765	71.500	69.035	1.865		1500
6.000	15	70.850	69.950	0.300	71.500	69.035	1.865		1500
1.007	16	71.500	69.035	1.865	71.000	68.935	1.465		1500
1.008	17	71.000	68.935	1.465	69.500	68.735	0.165	Hydro-Brake®	1500
1.009	63	69.500	68.735	0.165	0.000	68.510	0.000		10000

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)
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1.009		0.000	68.510	0.000	0	0
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Simulation Criteria for Storm

Volumetric Runoff Coeff	0.840	Additional Flow - % of Total Flow	30.000
Areal Reduction Factor	1.000	MADD Factor * 10m ³ /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)	5760
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	24

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 FEH
Return Period (years) 100
FEH Rainfall Version 1999

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Synthetic Rainfall Details

Site Location	460200 223700 SP 60200 23700
C (1km)	-0.022
D1 (1km)	0.324
D2 (1km)	0.320
D3 (1km)	0.244
E (1km)	0.290
F (1km)	2.477
Summer Storms	No
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Storm Duration (mins)	2880

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Online Controls for Storm


Hydro-Brake® Optimum Manhole: 17, DS/PN: 1.008, Volume (m³): 17.4

Unit Reference	MD-SHE-0096-4000-0900-4000
Design Head (m)	0.900
Design Flow (l/s)	4.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	96
Invert Level (m)	68.935
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	0.900	4.0
Flush-Flo™	0.266	4.0
Kick-Flo®	0.578	3.3
Mean Flow over Head Range	-	3.5

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

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	3.1	1.200	4.6	3.000	7.0	7.000	10.5
0.200	3.9	1.400	4.9	3.500	7.5	7.500	10.8
0.300	4.0	1.600	5.2	4.000	8.0	8.000	11.2
0.400	3.9	1.800	5.5	4.500	8.5	8.500	11.5
0.500	3.7	2.000	5.8	5.000	8.9	9.000	11.8
0.600	3.3	2.200	6.1	5.500	9.3	9.500	12.1
0.800	3.8	2.400	6.3	6.000	9.7		
1.000	4.2	2.600	6.6	6.500	10.1		

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Storage Structures for Storm

Cellular Storage Manhole: 5, DS/PN: 2.000

Invert Level (m) 69.800 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	230.0	0.0	0.300	230.0	0.0
0.100	230.0	0.0	0.400	230.0	0.0
0.200	230.0	0.0	0.401	0.0	0.0

Cellular Storage Manhole: 9, DS/PN: 4.000

Invert Level (m) 69.400 Safety Factor 2.0
 Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
 Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	330.0	0.0	0.300	330.0	0.0
0.100	330.0	0.0	0.400	330.0	0.0
0.200	330.0	0.0	0.401	0.0	0.0

Tank or Pond Manhole: 14, DS/PN: 1.006


Invert Level (m) 69.135

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	488.0	0.400	796.0	0.800	1114.0	1.200	1444.0
0.200	640.0	0.600	954.0	1.000	1278.0		

Tank or Pond Manhole: 17, DS/PN: 1.008

Invert Level (m) 68.935

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	1143.0	0.400	1412.0	0.800	1690.0	1.200	1979.0
0.200	1276.0	0.600	1550.0	1.000	1834.0		

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Summary of Results for 2880 minute 100 year Winter (Storm)

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

PN	US/MH Name	Water Level (m)	Surcharged Depth (m)	Flooded Volume (m ³)	Flow / Overflow Cap.	Pipe Flow (l/s)	Pipe Flow (l/s)	Status
1.000	1	69.947	-0.328	0.000	0.04		4.1	OK
1.001	2	69.675	-0.240	0.000	0.03		4.1	OK
1.002	3	69.675	-0.175	0.000	0.03		6.2	OK
1.003	4	69.675	-0.075	0.000	0.05		8.1	OK
2.000	5	69.831	-0.194	0.000	0.05		2.1	OK
2.001	6	69.676	-0.299	0.000	0.05		4.4	OK
3.000	7	69.692	-0.208	0.000	0.01		1.0	OK
2.002	8	69.676	-0.299	0.000	0.07		10.9	OK
4.000	9	69.676	0.051	0.000	0.35		10.7	SURCHARGED
2.003	10	69.676	-0.124	0.000	0.09		13.7	OK
2.004	11	69.677	-0.023	0.000	0.08		12.0	OK
5.000	12	69.891	-0.334	0.000	0.03		4.1	OK
1.004	12	69.675	-0.125	0.000	0.11		23.9	OK
1.005	13	69.676	-0.114	0.000	0.11		26.0	OK
1.006	14	69.692	-0.043	0.000	0.06		16.8	OK
6.000	15	69.950	-0.600	0.000	0.00		0.0	OK
1.007	16	69.683	0.048	0.000	0.08		20.9	SURCHARGED
1.008	17	69.680	0.145	0.000	0.01		4.0	SURCHARGED
1.009	63	68.738	-0.597	0.000	0.00		4.0	OK