217060

June 2018

PROPOSAL FOR STORM WATER DRAINAGE

DISCHARGE OF PLANNING CONDITION 7

PLANNING PERMISSION 2017/6418/P

AT

10A BELMONT STREET, LONDON
NW1 8HJ

Referred to as 8A Belmont Street at time of planning,
now addressed as 10a Belmont Street in this Report

ENGINUITY
ENGINEERING INGENUITY

Suite 12 Borough House Marlborough Road Banbury OX16 5TH T 01295 279719 F 01295 278977 E ingenuity@ianharban.com W www.ianharban.com

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2. **Description**
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1.0 Introduction

The purpose of this report is to consider storm water runoff proposals for 10a Belmont Street, NW1 8HJ, as required in Planning Permission 2017/6418/P.

2.0 Description

Development Site

The site is located on Belmont Street, north-west London within the London Borough of Camden. It lies within the curtilage of a former piano factory, currently an apartment complex. The existing structure was last used as a cold room and storage facility. The site boundary is limited to the outline of the building. The site is 0.0125 hectares in size with access from Belmont Street.

Proposed Development

The proposal is to convert the existing commercial unit into two new semi-detached houses across 3 floors, one lower ground floor, a ground and first floor. The building has a flat roof incorporating two large rooflights and four sections of green roof.

Existing Public Sewer

The existing roof runoff discharges directly into the combined sewer located in Belmont Street.

Geological Characteristics

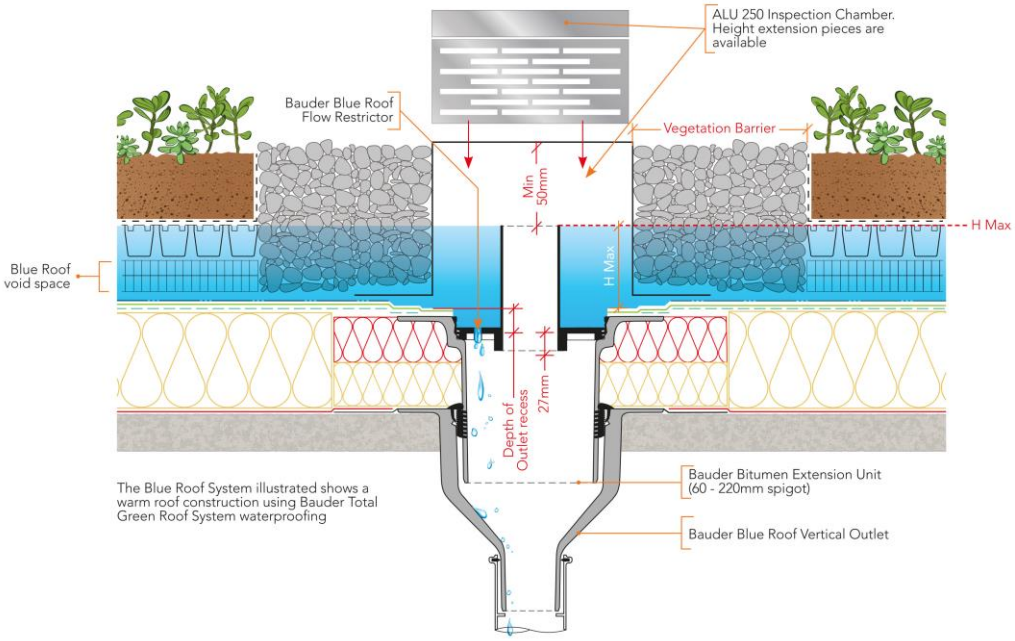
Underlying soils are described in the Ground Investigation Report (Ground and Water Ltd., March 2016) as representative of London Clay Formation with very low to negligible permeability. Therefore, soakaways are considered unlikely to prove satisfactory.

3.0 Proposed storm water drainage scheme

As cohesive soils have very low anticipated infiltration capacity, infiltration techniques are not considered as the adequate way of surface water disposal for the site. The next level in the sustainable drainage (SuDS) hierarchy is the attenuation of rainwater for gradual release to reduce the risk of off site flooding.

The proposed surface water drainage scheme is shown in Appendix A. Owing to the small size of the site and the green roof design, surface water is proposed to be collected and attenuated at roof level and to be released in a controlled manner. The proposed blue roof design includes a reservoir storage zone together with a void space below the growing medium, as shown on Figure 1 below.

Figure 1: Typical Blue Roof Detail



Green roofs act like permeable areas and reduce rainwater runoff volumes, however, during an extreme storm this reduction is likely to be small. Therefore, the whole roof area of the proposed building was considered as an ordinary impervious surface in the drainage calculations divided into sections according to Figure 2 and areas are summarised in Table 1.

Figure 2: Roof Sections

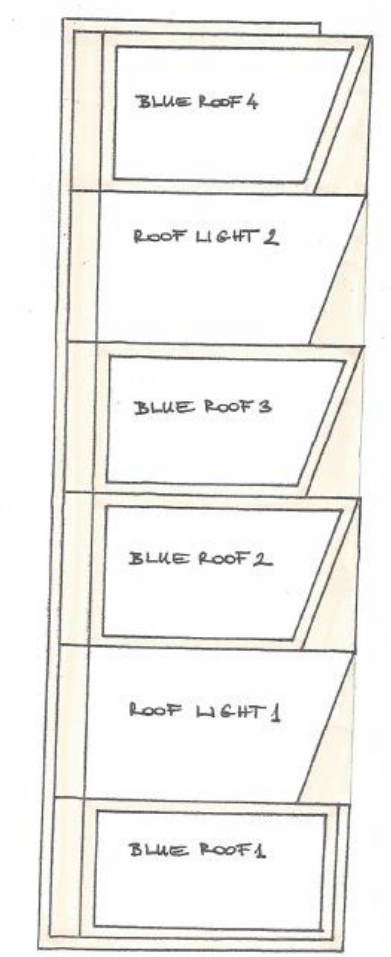


Table 1: Area Summary

Structure	Area
	m^2
Gutter, parapet walls, canopies (shown yellow on Figure 2)	46.03
Blue roof 1	11.28
Roof light 1	15.84
Blue roof 2	12.15
Blue roof 3	12.15
Roof light 2	15.84
Blue Roof 4	12.15
Total	**125.44**

Roof water is generally considered to be clean and green roofs further help to reduce the amount of pollution close to source. Rainwater outlets accept water from the drainage layer while preventing the entry of gross solids.
A flow restrictor at the outlets ensures that water is released at a controlled rate. As illustrated in Table 2 below, the total flow leaving the site is to be limited to 0.15l/s.

Table 2: Storage requirements to facilitate 50% reduction in peak off site runoff

Return period	**1 year**	**100 year**	**100 year + 30% CC**
Peak run off rate (l/s)	0.09	0.23	*0.30*
Flow control rate (l/s) (50% reduction in peak rate)	0.045	0.115	*0.15*
Attenuation volume required (m^3)	1.9	5.0	*6.5*

(This table shows data for the whole site area, 125.44m^2. Runoff and storage calculations are attached in Section Appendix B)

The storage capacity of the roof was designed based on current guidelines (CIRIA C753, 2015) to achieve 50% attenuation of all runoff for a 1 in 100 year + 30% climate change storm event, in accordance with Condition 7 of the Planning Permission. It provides storage spread across the area of the blue roof, assuming that:

- Gutters, parapet walls and canopies discharge runoff unrestricted. The peak runoff for this area (46.03 m^2) is 0.11l/s (Section 7 Appendix B).
- Roof light 1 discharges to Blue Roof 2
- Roof light 2 discharges to Blue Roof 4

Thus, from the equation
(50% reduced flow rate for the whole roof – unrestricted runoff from gutters and parapets) = (0.15-0.11) = 0.04l/s
that is the outflow rate from the blue roof sections in total.

Attenuation calculations are governed by the 1 in 100 year plus 30% climate change critical storm event. Calculations for Blue Roof 1-4 were carried out and attached in Section 11-13 Appendix B and summarised in Table 3.

Table 3: Blue Roof Storage Requirements Summary for 1in100 year + 30% climate change storm

Structure	Area	Catchment Area	Outflow Rate	Storage Required	Min Depth of Storage Zone	Proposed Depth of Storage Zone	Proposed Storage
	m^2	m^2	l/s	m^3	mm	mm	m^3
Blue Roof 1	11.28	11.28	0.005	0.7	63	150	1.69
Blue Roof 2	12.15	27.99	0.015	1.8	149	150	1.82
Blue Roof 3	12.15	12.15	0.005	0.8	66	150	1.82
Blue Roof 4	12.15	27.99	0.015	1.8	149	150	1.82
Total	**47.73**	**79.41**	**0.04**	**5.1**			**7.16**

If the rainfall exceeds the design event (predicted maximum for 1 in 100 year plus 30% climate change), runoff will be released through the overflow pipe as shown on Figure 1, until water level recedes to H max, that is 150mm.

4.0 Maintenance Plan

Those responsible for the maintenance of the building including the blue roof will be provided with a Maintenance Plan. The proposed maintenance plan is attached in Appendix C.

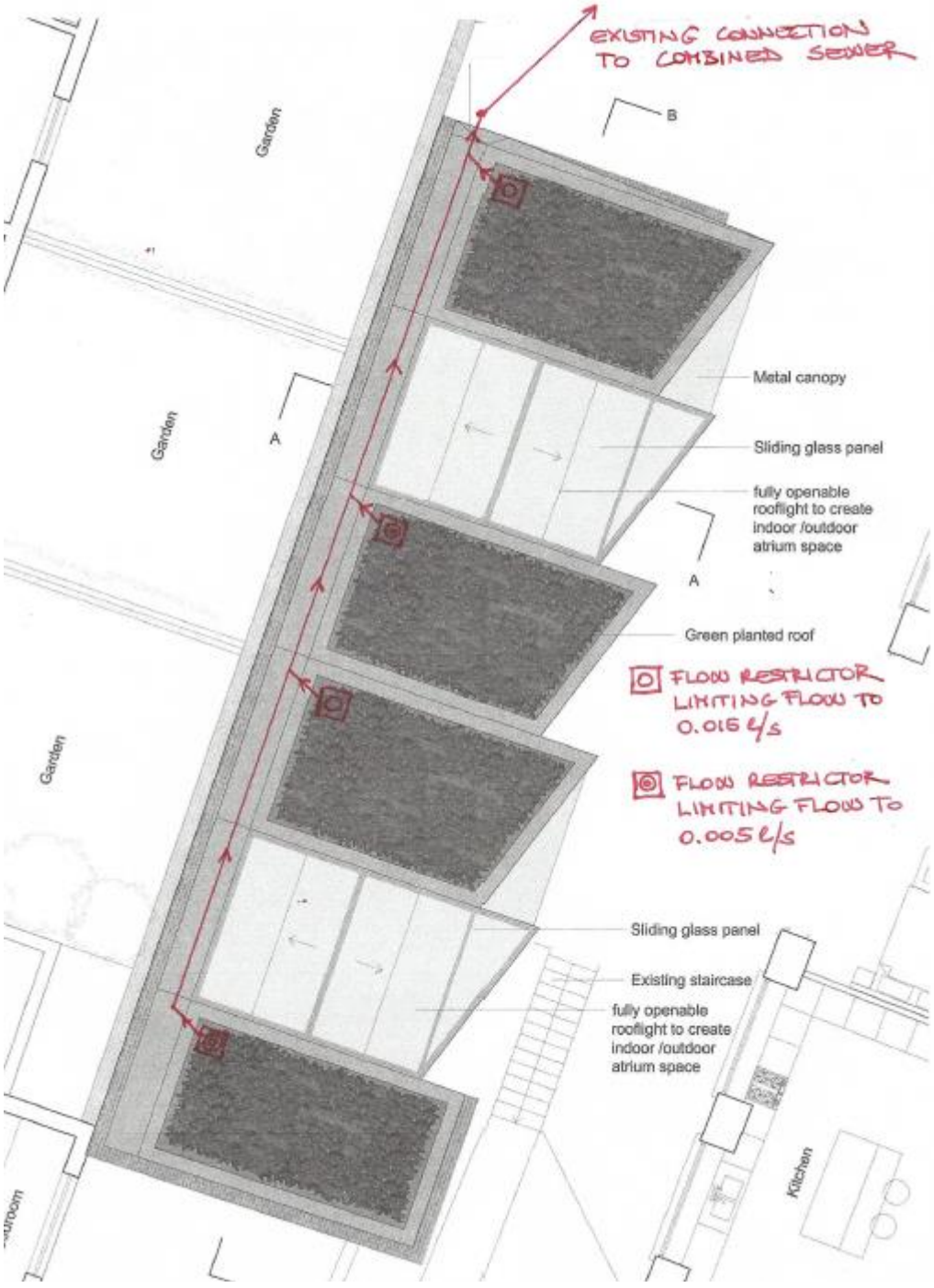
5.0 Conclusion

Surface water runoff generated by the site is to be cleared and attenuated to a controlled rate, achieving a minimum 50% reduction in runoff rate using the above mentioned SuDS components, and released from site to the public sewer.

APPENDICES

Appendix A	Proposed Storm Concept
Appendix B	Surface Water Drainage Sizing
Appendix C	Proposed Maintenance Plan

APPENDIX A Proposed Storm Concept



Ian Harban Consulting Engineers

Surface Water Drainage Sizing

for

10a Belmont Street

NW1 8HJ

Data produced from Masterdain Drainage design program on 22/06/18.

Index page for data sheets

Section 1 Hydrological Data

Section 2 Rainfall Intensities Normal

Section 3 Rainfall Intensities 30% Climate Change

Section 4 Runoff Calculations 1 in 1 Year Storm (whole site)

Section 5 Runoff Calculations 1 in 100 Year Storm (whole site)

Section 6 Runoff Calculations 1 in 100 Year + CC Storm (whole site)

Section 7 Runoff Calculations 1 in 100 Year + CC Storm (gutters, parapets)

Section 8 Storage Analysis 1 in 1 Year Storm (whole site)

Section 9 Storage Analysis 1 in 100 Year Storm (whole site)

Section 10 Storage Analysis 1 in 100 Year + CC Storm (whole site)

Section 11 Storage Analysis 1 in 100 Year + CC Storm (Blue Roof 1)

Section 12 Storage Analysis 1 in 100 Year + CC Storm (Blue Roof 2 and 4)

Section 13 Storage Analysis 1 in 100 Year + CC Storm (Blue Roof 3)

Hydrological Data

MasterDrain
HY 10.07

Ian Harban
Consulting Engineers
http://www.ianharban.com

Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	217060
Sheet no.	1
Date	22/06/18
Project	10a Belmont Street NW1 8HU
Title	Hydrological data for Belmont Street

By	Checked	Reviewed

Data:-

FSR values

Location	= Belmont Street	Grid reference	= TQ2884
M5-60 (mm)	= 21.0	SAAR (mm/yr)	= 645
r	= 0.44	Soil	= 0.45
Long reference	= 528184	Area	= England and Wales
Hydrological area	= 6	Hydrological zone	= 8

Soil classification for WRAP type 4
Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

FEH values

No FEH data available in this file.

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HY 10.07

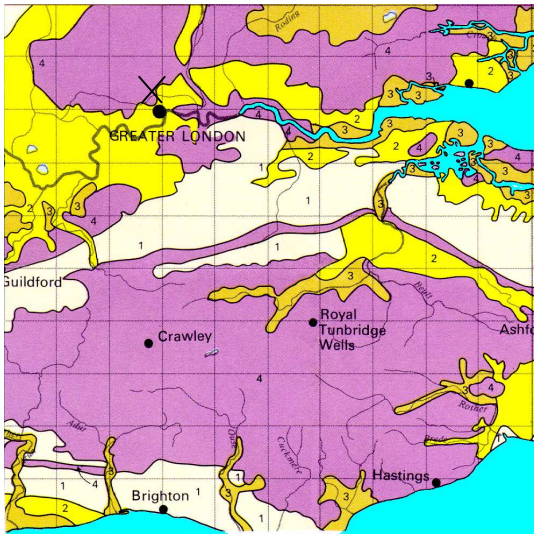
Ian Harban Consulting Engineers
http://www.ianharban.com

Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

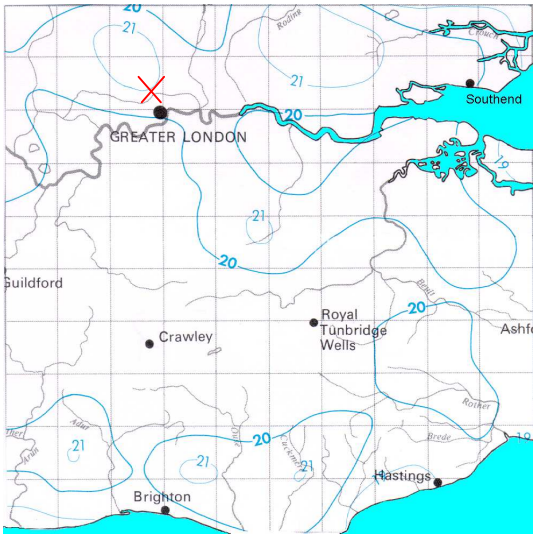
Job No.	217060
Sheet no.	2
Date	22/06/18

Project	By	Checked	Reviewed
10a Belmont Street NW1 8HU			

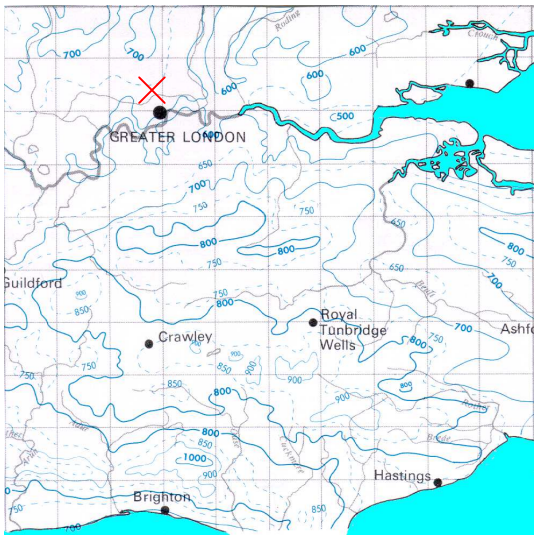
Title: **Hydrological data for Belmont Street**



<- Soil



M5-60 ->



<- SAAR

r x 100 ->

Map extracts reproduced by permission of H R Wallingford.

Rainfall Intensities Normal

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Ian Harban Consulting Engineers
http://www.ianharban.com

Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No. 217060
Sheet no. 1
Date 22/06/18

Project: 10a Belmont Street NW1 8HU

Title: FSR Rainfall intensities for Belmont_Street + 0%

By	Checked	Reviewed

Mins\Yrs	1	2	5	10	20	30	50	100	200	500
1	96.5	123.0	158.7	179.5	203.1	218.3	239.1	270.5	306.0	360.1
2	83.6	106.6	137.6	156.4	177.8	191.7	210.6	239.4	272.1	322.3
3	72.9	94.4	122.0	139.3	158.9	171.7	189.3	216.0	246.6	293.6
4	65.6	85.0	109.9	125.9	144.2	156.1	172.6	197.6	226.4	270.9
5	59.8	77.5	100.3	115.2	132.4	143.6	159.0	182.7	210.0	252.3
6	55.1	71.3	92.3	106.4	122.6	133.2	147.8	170.4	196.3	236.8
7	51.1	66.2	85.7	99.0	114.4	124.4	138.4	159.9	184.7	223.5
8	48.5	62.6	80.1	92.6	107.2	116.8	130.0	150.5	174.1	211.2
9	45.6	58.8	75.2	87.1	100.9	110.0	122.6	142.1	164.6	199.9
10	43.0	55.5	71.0	82.3	95.4	104.1	116.1	134.6	156.2	190.0
11	40.7	52.5	67.2	78.0	90.6	98.8	110.3	128.1	148.6	181.0
12	38.7	49.9	63.9	74.2	86.2	94.1	105.1	122.1	141.9	173.0
13	36.9	47.6	60.9	70.8	82.4	89.9	100.5	116.8	135.8	165.7
14	35.3	45.5	58.3	67.8	78.8	86.1	96.3	112.0	130.3	159.1
15	33.8	43.6	55.8	65.0	75.7	82.7	92.5	107.6	125.2	153.1
16	32.5	41.9	53.6	62.5	72.7	79.5	89.0	103.6	120.6	147.5
17	31.3	40.3	51.6	60.2	70.1	76.6	85.7	99.9	116.4	142.4
18	30.1	38.9	49.8	58.0	67.6	74.0	82.8	96.5	112.4	137.7
19	29.1	37.5	48.1	56.1	65.3	71.5	80.0	93.3	108.8	133.3
20	29.0	36.8	46.5	54.2	63.2	69.2	77.5	90.4	105.4	129.2
21	28.1	35.6	45.0	52.5	61.3	67.1	75.1	87.7	102.3	125.4
22	27.3	34.5	43.7	51.0	59.5	65.1	72.9	85.1	99.3	121.8
23	26.5	33.5	42.4	49.5	57.8	63.2	70.9	82.7	96.5	118.4
24	25.7	32.6	41.2	48.1	56.2	61.5	68.9	80.5	93.9	115.3
25	25.0	31.7	40.1	46.8	54.7	59.9	67.1	78.4	91.5	112.3
26	24.4	30.8	39.0	45.6	53.2	58.3	65.4	76.4	89.2	109.5
27	23.8	30.1	38.0	44.4	51.9	56.9	63.8	74.5	87.0	106.9
28	23.2	29.3	37.1	43.4	50.7	55.5	62.2	72.7	85.0	104.4
29	22.6	28.6	36.2	42.3	49.5	54.2	60.8	71.0	83.0	102.0
30	22.1	28.0	35.4	41.4	48.3	52.9	59.4	69.4	81.1	99.7
31	21.6	27.3	34.6	40.4	47.3	51.8	58.1	67.9	79.4	97.6
32	21.1	26.7	33.8	39.5	46.2	50.7	56.8	66.5	77.7	95.5
33	20.7	26.2	33.1	38.7	45.3	49.6	55.7	65.1	76.1	93.6
34	20.2	25.6	32.4	37.9	44.3	48.6	54.5	63.8	74.6	91.7
35	19.8	25.1	31.8	37.2	43.4	47.6	53.4	62.5	73.1	89.9
36	19.4	24.6	31.1	36.4	42.6	46.7	52.4	61.3	71.7	88.2
37	19.1	24.1	30.5	35.7	41.8	45.8	51.4	60.1	70.4	86.6
38	18.7	23.7	30.0	35.1	41.0	45.0	50.5	59.0	69.1	85.0
39	18.4	23.2	29.4	34.4	40.3	44.1	49.6	58.0	67.8	83.5
40	18.0	22.8	28.9	33.8	39.6	43.4	48.7	57.0	66.6	82.0
41	17.7	22.4	28.4	33.2	38.9	42.6	47.8	56.0	65.5	80.6
42	17.4	22.0	27.9	32.7	38.2	41.9	47.0	55.0	64.4	79.3
43	17.1	21.7	27.4	32.1	37.6	41.2	46.3	54.1	63.4	78.0
44	16.8	21.3	27.0	31.6	37.0	40.5	45.5	53.3	62.3	76.7
45	16.6	21.0	26.6	31.1	36.4	39.9	44.8	52.4	61.3	75.5
46	16.3	20.7	26.1	30.6	35.8	39.3	44.1	51.6	60.4	74.4
47	16.1	20.3	25.7	30.1	35.3	38.7	43.4	50.8	59.5	73.2
48	15.8	20.0	25.3	29.7	34.7	38.1	42.8	50.1	58.6	72.2
49	15.6	19.7	25.0	29.2	34.2	37.5	42.1	49.3	57.7	71.1
50	15.4	19.4	24.6	28.8	33.7	37.0	41.5	48.6	56.9	70.1
51	15.6	19.4	24.3	28.4	33.2	36.4	40.9	47.9	56.1	69.1
52	15.4	19.1	23.9	28.0	32.8	35.9	40.4	47.3	55.3	68.1
53	15.2	18.9	23.6	27.6	32.3	35.4	39.8	46.6	54.6	67.2
54	15.0	18.6	23.3	27.2	31.9	35.0	39.3	46.0	53.8	66.3
55	14.8	18.4	23.0	26.9	31.5	34.5	38.8	45.4	53.1	65.4
56	14.6	18.1	22.6	26.5	31.0	34.0	38.2	44.8	52.4	64.6
57	14.4	17.9	22.4	26.2	30.6	33.6	37.8	44.2	51.8	63.8
58	14.2	17.7	22.1	25.8	30.3	33.2	37.3	43.6	51.1	63.0
59	14.0	17.4	21.8	25.5	29.9	32.8	36.8	43.1	50.5	62.2
60	13.9	17.2	21.5	25.2	29.5	32.4	36.4	42.6	49.9	61.4
61	13.7	17.0	21.3	24.9	29.2	32.0	35.9	42.1	49.3	60.7
62	13.5	16.8	21.0	24.6	28.8	31.6	35.5	41.6	48.7	60.0
63	13.4	16.6	20.8	24.3	28.5	31.2	35.1	41.1	48.1	59.3
64	13.2	16.4	20.5	24.0	28.1	30.9	34.7	40.6	47.5	58.6
65	13.1	16.2	20.3	23.8	27.8	30.5	34.3	40.1	47.0	57.9
66	12.9	16.0	20.1	23.5	27.5	30.2	33.9	39.7	46.5	57.3
67	12.8	15.9	19.8	23.2	27.2	29.8	33.5	39.3	46.0	56.6

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Suite 12, Borough House
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Mins\Yrs	1	2	5	10	20	30	50	100	200	500
68	12.6	15.7	19.6	23.0	26.9	29.5	33.2	38.8	45.5	56.0
69	12.5	15.5	19.4	22.7	26.6	29.2	32.8	38.4	45.0	55.4
70	12.4	15.4	19.2	22.5	26.3	28.9	32.4	38.0	44.5	54.8
71	12.2	15.2	19.0	22.3	26.1	28.6	32.1	37.6	44.0	54.2
72	12.1	15.0	18.8	22.0	25.8	28.3	31.8	37.2	43.6	53.7
73	12.0	14.9	18.6	21.8	25.5	28.0	31.4	36.8	43.1	53.1
74	11.9	14.7	18.4	21.6	25.3	27.7	31.1	36.5	42.7	52.6
75	11.7	14.6	18.2	21.4	25.0	27.4	30.8	36.1	42.3	52.1
76	11.6	14.5	18.1	21.2	24.8	27.2	30.5	35.7	41.8	51.5
77	11.5	14.3	17.9	20.9	24.5	26.9	30.2	35.4	41.4	51.0
78	11.4	14.2	17.7	20.7	24.3	26.6	29.9	35.0	41.0	50.5
79	11.3	14.0	17.6	20.6	24.1	26.4	29.6	34.7	40.6	50.1
80	11.2	13.9	17.4	20.4	23.8	26.1	29.4	34.4	40.3	49.6
81	11.1	13.8	17.2	20.2	23.6	25.9	29.1	34.1	39.9	49.1
82	11.0	13.7	17.1	20.0	23.4	25.7	28.8	33.7	39.5	48.7
83	10.9	13.5	16.9	19.8	23.2	25.4	28.6	33.4	39.2	48.2
84	10.8	13.4	16.8	19.6	23.0	25.2	28.3	33.1	38.8	47.8
85	10.7	13.3	16.6	19.5	22.8	25.0	28.1	32.8	38.5	47.4
86	10.6	13.2	16.5	19.3	22.6	24.8	27.8	32.6	38.1	46.9
87	10.5	13.1	16.3	19.1	22.4	24.5	27.6	32.3	37.8	46.5
88	10.4	12.9	16.2	19.0	22.2	24.3	27.3	32.0	37.5	46.1
89	10.3	12.8	16.1	18.8	22.0	24.1	27.1	31.7	37.1	45.7
90	10.2	12.7	15.9	18.6	21.8	23.9	26.9	31.5	36.8	45.3
91	10.2	12.6	15.8	18.5	21.6	23.7	26.6	31.2	36.5	45.0
92	10.1	12.5	15.7	18.3	21.5	23.5	26.4	30.9	36.2	44.6
93	10.0	12.4	15.5	18.2	21.3	23.3	26.2	30.7	35.9	44.2
94	9.9	12.3	15.4	18.0	21.1	23.1	26.0	30.4	35.6	43.9
95	9.8	12.2	15.3	17.9	20.9	23.0	25.8	30.2	35.3	43.5
96	9.8	12.1	15.2	17.7	20.8	22.8	25.6	29.9	35.1	43.2
97	9.7	12.0	15.0	17.6	20.6	22.6	25.4	29.7	34.8	42.8
98	9.6	11.9	14.9	17.5	20.5	22.4	25.2	29.5	34.5	42.5
99	9.5	11.8	14.8	17.3	20.3	22.3	25.0	29.2	34.2	42.2
100	9.5	11.8	14.7	17.2	20.1	22.1	24.8	29.0	34.0	41.8
110	8.8	10.9	13.7	16.0	18.7	20.5	23.1	27.0	31.6	38.8
120	8.2	10.2	12.8	15.0	17.5	19.2	21.6	25.2	29.5	36.3
130	8.0	9.8	12.0	14.1	16.5	18.1	20.3	23.7	27.7	34.1
140	7.6	9.2	11.4	13.3	15.6	17.0	19.1	22.4	26.1	32.1
160	6.8	8.3	10.3	12.0	14.0	15.4	17.2	20.1	23.5	28.9
180	6.2	7.6	9.4	11.0	12.8	14.0	15.7	18.3	21.4	26.2
210	5.5	6.8	8.3	9.7	11.3	12.4	13.9	16.2	18.9	23.1
240	5.0	6.1	7.5	8.8	10.2	11.1	12.5	14.5	16.9	20.7
270	4.7	5.6	6.9	8.0	9.3	10.1	11.3	13.2	15.4	18.8
300	4.3	5.2	6.3	7.4	8.5	9.3	10.4	12.1	14.1	17.2
330	4.0	4.8	5.9	6.8	7.9	8.7	9.7	11.2	13.0	15.9
360	3.8	4.5	5.5	6.4	7.4	8.1	9.0	10.5	12.2	14.8
390	3.5	4.2	5.2	6.0	6.9	7.6	8.5	9.8	11.4	13.9
420	3.3	4.0	4.9	5.6	6.5	7.1	8.0	9.2	10.7	13.0

Rainfall depths for Belmont_Street at standard return periods in mm

Time\Yrs	1	2	5	10	20	30	50	100	200	500
3 min	3.6	4.7	6.1	7.0	7.9	8.6	9.5	10.8	12.3	14.7
30 min	11.0	14.0	17.7	20.7	24.2	26.5	29.7	34.7	40.6	49.9
1 hr	13.9	17.2	21.5	25.2	29.5	32.4	36.4	42.6	49.9	61.4
2 hr	16.5	20.5	25.6	30.0	35.0	38.4	43.1	50.4	59.0	72.6
5 hr	21.6	25.9	31.6	36.8	42.7	46.7	52.1	60.6	70.5	86.0
10 hr	25.2	30.2	36.8	42.6	49.3	53.7	59.8	69.1	80.0	96.9
24 hr	31.4	37.0	44.5	51.1	58.7	63.7	70.5	81.0	93.0	111.7
48 hr	38.4	44.0	51.7	58.9	67.3	72.7	80.1	91.4	104.3	124.2
5 day	46.8	53.6	62.8	71.0	80.2	86.2	94.3	106.6	120.4	141.6

The above figures are calculated in accordance with the protocol set out in the 'Wallingford Procedure' from data derived from the Wallingford maps :-

M5-60min	= 21.00	r	= 0.44
WRAP	= 4	SAAR	= 645
NG ref	= TQ2884	Soil index	= 0.45

Data printed on 22/06/18 from Masterdrain Hydrology program

Rainfall Intensities 30% Climate Change

Ian Harban
Consulting Engineers
http://www.ianharban.com

Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No. 217060
Sheet no. 1
Date 22/06/18

MasterDrain
HY 10.07

Project 10a Belmont Street NW1 8HU

Title FSR Rainfall intensities for Belmont_Street + 30%

By	Checked	Reviewed

Mins\Yrs	1	2	5	10	20	30	50	100	200	500
1	125.5	159.9	206.3	233.4	264.0	283.8	310.8	351.6	397.7	468.2
2	108.7	138.5	178.9	203.4	231.2	249.1	273.8	311.2	353.8	419.0
3	94.8	122.7	158.6	181.0	206.6	223.2	246.1	280.8	320.5	381.7
4	85.3	110.5	142.9	163.7	187.5	203.0	224.3	256.9	294.3	352.1
5	77.8	100.7	130.3	149.8	172.1	186.6	206.8	237.6	273.0	328.0
6	71.6	92.7	120.0	138.3	159.4	173.1	192.2	221.5	255.2	307.8
7	66.4	86.0	111.4	128.7	148.7	161.8	179.9	207.9	240.1	290.6
8	63.1	81.4	104.1	120.4	139.4	151.8	169.0	195.6	226.4	274.5
9	59.2	76.4	97.8	113.3	131.2	143.0	159.4	184.7	214.0	259.9
10	55.9	72.1	92.2	107.0	124.1	135.3	150.9	175.0	203.0	246.9
11	52.9	68.3	87.4	101.4	117.8	128.5	143.4	166.5	193.2	235.3
12	50.3	64.9	83.1	96.5	112.1	122.4	136.7	158.8	184.5	224.9
13	48.0	61.9	79.2	92.1	107.1	116.9	130.6	151.9	176.6	215.4
14	45.9	59.2	75.7	88.1	102.5	112.0	125.2	145.6	169.4	206.8
15	43.9	56.7	72.6	84.5	98.3	107.5	120.2	139.9	162.8	199.0
16	42.2	54.5	69.7	81.2	94.6	103.4	115.6	134.7	156.8	191.8
17	40.6	52.4	67.1	78.2	91.1	99.6	111.5	129.9	151.3	185.1
18	39.2	50.5	64.7	75.4	87.9	96.1	107.6	125.4	146.2	179.0
19	37.8	48.8	62.5	72.9	85.0	92.9	104.1	121.3	141.4	173.2
20	37.8	47.8	60.4	70.5	82.2	90.0	100.8	117.5	137.0	167.9
21	36.6	46.3	58.5	68.3	79.7	87.2	97.7	114.0	132.9	163.0
22	35.5	44.9	56.8	66.2	77.3	84.6	94.8	110.6	129.1	158.3
23	34.4	43.6	55.1	64.3	75.1	82.2	92.1	107.5	125.5	154.0
24	33.5	42.3	53.6	62.5	73.0	79.9	89.6	104.6	122.1	149.9
25	32.5	41.2	52.1	60.9	71.1	77.8	87.2	101.9	119.0	146.0
26	31.7	40.1	50.7	59.3	69.2	75.8	85.0	99.3	116.0	142.4
27	30.9	39.1	49.5	57.8	67.5	73.9	82.9	96.8	113.1	138.9
28	30.1	38.1	48.2	56.4	65.9	72.1	80.9	94.5	110.4	135.7
29	29.4	37.2	47.1	55.0	64.3	70.4	79.0	92.3	107.9	132.6
30	28.7	36.3	46.0	53.8	62.8	68.8	77.2	90.3	105.5	129.6
31	28.1	35.5	45.0	52.6	61.4	67.3	75.5	88.3	103.2	126.8
32	27.5	34.8	44.0	51.4	60.1	65.9	73.9	86.4	101.0	124.2
33	26.9	34.0	43.0	50.3	58.8	64.5	72.4	84.6	98.9	121.6
34	26.3	33.3	42.1	49.3	57.6	63.2	70.9	82.9	96.9	119.2
35	25.8	32.6	41.3	48.3	56.5	61.9	69.5	81.3	95.0	116.9
36	25.3	32.0	40.5	47.4	55.4	60.7	68.1	79.7	93.2	114.7
37	24.8	31.4	39.7	46.4	54.3	59.5	66.8	78.2	91.5	112.5
38	24.3	30.8	39.0	45.6	53.3	58.4	65.6	76.8	89.8	110.5
39	23.9	30.2	38.2	44.7	52.4	57.4	64.4	75.4	88.2	108.5
40	23.5	29.7	37.6	44.0	51.4	56.4	63.3	74.1	86.6	106.6
41	23.0	29.2	36.9	43.2	50.5	55.4	62.2	72.8	85.2	104.8
42	22.6	28.7	36.3	42.5	49.7	54.5	61.1	71.6	83.7	103.1
43	22.3	28.2	35.7	41.7	48.8	53.6	60.1	70.4	82.4	101.4
44	21.9	27.7	35.1	41.1	48.1	52.7	59.2	69.2	81.0	99.8
45	21.6	27.3	34.5	40.4	47.3	51.8	58.2	68.1	79.8	98.2
46	21.2	26.8	34.0	39.8	46.5	51.0	57.3	67.1	78.5	96.7
47	20.9	26.4	33.5	39.2	45.8	50.3	56.4	66.1	77.3	95.2
48	20.6	26.0	32.9	38.6	45.1	49.5	55.6	65.1	76.2	93.8
49	20.3	25.6	32.5	38.0	44.5	48.8	54.8	64.1	75.1	92.4
50	20.0	25.3	32.0	37.4	43.8	48.1	54.0	63.2	74.0	91.1
51	20.3	25.2	31.5	36.9	43.2	47.4	53.2	62.3	72.9	89.8
52	20.0	24.9	31.1	36.4	42.6	46.7	52.5	61.4	71.9	88.6
53	19.7	24.5	30.7	35.9	42.0	46.1	51.8	60.6	70.9	87.4
54	19.5	24.2	30.2	35.4	41.4	45.5	51.1	59.8	70.0	86.2
55	19.2	23.9	29.8	34.9	40.9	44.9	50.4	59.0	69.1	85.1
56	19.0	23.6	29.4	34.5	40.4	44.3	49.7	58.2	68.2	84.0
57	18.7	23.2	29.1	34.0	39.8	43.7	49.1	57.5	67.3	82.9
58	18.5	23.0	28.7	33.6	39.3	43.1	48.5	56.7	66.4	81.8
59	18.2	22.7	28.3	33.2	38.8	42.6	47.9	56.0	65.6	80.8
60	18.0	22.4	28.0	32.8	38.4	42.1	47.3	55.4	64.8	79.8
61	17.8	22.1	27.6	32.4	37.9	41.6	46.7	54.7	64.0	78.9
62	17.6	21.9	27.3	32.0	37.5	41.1	46.1	54.0	63.3	77.9
63	17.4	21.6	27.0	31.6	37.0	40.6	45.6	53.4	62.5	77.0
64	17.2	21.3	26.7	31.2	36.6	40.1	45.1	52.8	61.8	76.1
65	17.0	21.1	26.4	30.9	36.2	39.7	44.6	52.2	61.1	75.3
66	16.8	20.9	26.1	30.5	35.8	39.2	44.1	51.6	60.4	74.4
67	16.6	20.6	25.8	30.2	35.4	38.8	43.6	51.0	59.8	73.6

Ian Harban
Consulting Engineers
http://www.ianharban.com
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	Sheet no.	Date
217060	2	22/06/18

Project	By	Checked	Reviewed
10a Belmont Street NW1 8HU			

MasterDrain
HY 10.07

Title: FSR Rainfall intensities for Belmont_Street + 30%

Intensities increased by 30%

Mins\Yrs	1	2	5	10	20	30	50	100	200	500
68	16.4	20.4	25.5	29.9	35.0	38.4	43.1	50.5	59.1	72.8
69	16.2	20.2	25.2	29.6	34.6	38.0	42.6	49.9	58.5	72.0
70	16.1	20.0	25.0	29.2	34.2	37.6	42.2	49.4	57.8	71.3
71	15.9	19.8	24.7	28.9	33.9	37.2	41.7	48.9	57.2	70.5
72	15.7	19.6	24.5	28.6	33.5	36.8	41.3	48.4	56.6	69.8
73	15.6	19.4	24.2	28.3	33.2	36.4	40.9	47.9	56.1	69.1
74	15.4	19.2	24.0	28.1	32.9	36.0	40.5	47.4	55.5	68.4
75	15.3	19.0	23.7	27.8	32.5	35.7	40.1	46.9	54.9	67.7
76	15.1	18.8	23.5	27.5	32.2	35.3	39.7	46.5	54.4	67.0
77	15.0	18.6	23.3	27.2	31.9	35.0	39.3	46.0	53.9	66.4
78	14.8	18.4	23.0	27.0	31.6	34.6	38.9	45.6	53.3	65.7
79	14.7	18.3	22.8	26.7	31.3	34.3	38.5	45.1	52.8	65.1
80	14.6	18.1	22.6	26.5	31.0	34.0	38.2	44.7	52.3	64.5
81	14.4	17.9	22.4	26.2	30.7	33.7	37.8	44.3	51.8	63.9
82	14.3	17.7	22.2	26.0	30.4	33.4	37.5	43.9	51.4	63.3
83	14.2	17.6	22.0	25.7	30.1	33.1	37.1	43.5	50.9	62.7
84	14.0	17.4	21.8	25.5	29.9	32.8	36.8	43.1	50.4	62.1
85	13.9	17.3	21.6	25.3	29.6	32.5	36.5	42.7	50.0	61.6
86	13.8	17.1	21.4	25.1	29.3	32.2	36.1	42.3	49.6	61.0
87	13.7	17.0	21.2	24.9	29.1	31.9	35.8	42.0	49.1	60.5
88	13.5	16.8	21.0	24.6	28.8	31.6	35.5	41.6	48.7	60.0
89	13.4	16.7	20.9	24.4	28.6	31.4	35.2	41.2	48.3	59.5
90	13.3	16.6	20.7	24.2	28.4	31.1	34.9	40.9	47.9	59.0
91	13.2	16.4	20.5	24.0	28.1	30.8	34.6	40.5	47.5	58.5
92	13.1	16.3	20.4	23.8	27.9	30.6	34.3	40.2	47.1	58.0
93	13.0	16.1	20.2	23.6	27.7	30.3	34.1	39.9	46.7	57.5
94	12.9	16.0	20.0	23.4	27.4	30.1	33.8	39.6	46.3	57.0
95	12.8	15.9	19.9	23.3	27.2	29.8	33.5	39.2	45.9	56.6
96	12.7	15.8	19.7	23.1	27.0	29.6	33.3	38.9	45.6	56.1
97	12.6	15.6	19.6	22.9	26.8	29.4	33.0	38.6	45.2	55.7
98	12.5	15.5	19.4	22.7	26.6	29.2	32.7	38.3	44.9	55.2
99	12.4	15.4	19.3	22.5	26.4	28.9	32.5	38.0	44.5	54.8
100	12.3	15.3	19.1	22.4	26.2	28.7	32.2	37.7	44.2	54.4
110	11.4	14.2	17.8	20.8	24.3	26.7	30.0	35.1	41.0	50.5
120	10.7	13.3	16.6	19.5	22.8	25.0	28.0	32.8	38.3	47.2
130	10.4	12.7	15.7	18.3	21.4	23.5	26.3	30.8	36.0	44.3
140	9.8	12.0	14.8	17.3	20.2	22.2	24.9	29.1	34.0	41.8
160	8.9	10.8	13.4	15.6	18.2	20.0	22.4	26.2	30.6	37.5
180	8.1	9.9	12.2	14.2	16.6	18.2	20.4	23.8	27.8	34.1
210	7.2	8.8	10.8	12.6	14.7	16.1	18.0	21.0	24.5	30.1
240	6.5	7.9	9.8	11.4	13.3	14.5	16.2	18.9	22.0	26.9
270	6.1	7.3	8.9	10.4	12.1	13.2	14.7	17.2	20.0	24.4
300	5.6	6.7	8.2	9.6	11.1	12.1	13.6	15.8	18.3	22.4
330	5.2	6.3	7.6	8.9	10.3	11.2	12.6	14.6	17.0	20.7
360	4.9	5.9	7.1	8.3	9.6	10.5	11.7	13.6	15.8	19.2
390	4.6	5.5	6.7	7.8	9.0	9.8	11.0	12.8	14.8	18.0
420	4.3	5.2	6.3	7.3	8.5	9.3	10.4	12.0	13.9	16.9

Rainfall depths for Belmont_Street at standard return periods in mm with global warming factor of 1.3

Time\Yrs	1	2	5	10	20	30	50	100	200	500
3 min	4.7	6.1	7.9	9.1	10.3	11.2	12.3	14.0	16.0	19.1
30 min	14.4	18.2	23.0	26.9	31.4	34.4	38.6	45.1	52.7	64.8
1 hr	18.0	22.4	28.0	32.8	38.4	42.1	47.3	55.4	64.8	79.8
2 hr	21.4	26.6	33.3	38.9	45.5	49.9	56.0	65.6	76.7	94.4
5 hr	28.1	33.7	41.1	47.8	55.5	60.7	67.8	78.8	91.6	111.8
10 hr	32.8	39.3	47.9	55.4	64.1	69.8	77.7	89.9	104.0	126.0
24 hr	40.8	48.1	57.9	66.5	76.3	82.8	91.7	105.3	120.9	145.2
48 hr	50.0	57.2	67.2	76.6	87.4	94.5	104.1	118.8	135.6	161.4
5 day	60.9	69.7	81.7	92.3	104.3	112.0	122.6	138.5	156.6	184.1

The above figures are calculated in accordance with the protocol set out in the 'Wallingford Procedure' from data derived from the Wallingford maps :-

M5-60min	= 21.00	r	= 0.44
WRAP	= 4	SAAR	= 645
NG ref	= TQ2884	Soil index	= 0.45

Data printed on 22/06/18 from Masterdrain Hydrology program

Runoff Calculations 1 in 1 Year Storm (whole site)

MasterDrain SW

Ian Harban Consulting Engineers
http://www.ianharban.com

Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	217060
Sheet no.	1
Date	28/06/18

Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: **Hydrograph runoff calcs (Winter profile) for Belmont Street**

Data:-

Hydrology:-

Grid reference = TQ2884
Return period = 1
Climate change factor = 0%

Location = Belmont Street
Mean intensity = 1.3mm/hr for a 24 hour storm

FSR data

M5-60 = 21
Soil index = 0.45
WRAP value = 4

r = 0.44
SAAR = 645

FEH data

FEH data not available.

FSR data used to calculate rainfall rates.

Percentage runoff = 79.0% calculated from:-

Percentage runoff = (0.829*PIMP)+(25*SOIL)+(0.078*UCWI)-20.7

where

PIMP = ImpervArea*100/(ImpervArea+PervArea) = 0.0

UCWI = Calculated value for Wetness Index = 0.0

Imperv. area = 125 m²
Total area = 125 m²
Total runoff = 3.3 m³
Peak flow = 0.09 l/s

Pervious area = 0 m²
Equiv area = 99 m² (Tot. area x % runoff).
Total rainfall depth = 32.3 mm
Mean flow = 0.0 l/s

Calculations :-

Time (hrs)	%Mean intens	Rain mm/hr	Inflow (m3)	Cumulative (m3)
0.240	20.0	0.3	0.006	0.006
0.480	20.0	0.3	0.006	0.013
0.720	21.0	0.3	0.007	0.019
0.960	21.0	0.3	0.007	0.026
1.200	22.0	0.3	0.007	0.033
1.440	23.0	0.3	0.007	0.040
1.680	24.0	0.3	0.008	0.048
1.920	26.0	0.3	0.008	0.056
2.160	27.0	0.4	0.009	0.065
2.400	29.0	0.4	0.009	0.074
2.640	31.0	0.4	0.010	0.084
2.880	32.0	0.4	0.010	0.094
3.120	33.0	0.4	0.011	0.105
3.360	34.0	0.5	0.011	0.116
3.600	36.0	0.5	0.011	0.127
3.840	38.0	0.5	0.012	0.139
4.080	39.0	0.5	0.012	0.152
4.320	40.0	0.5	0.013	0.164
4.560	42.0	0.6	0.013	0.178
4.800	45.0	0.6	0.014	0.192
5.040	49.0	0.7	0.016	0.208
5.280	53.0	0.7	0.017	0.225
5.520	57.0	0.8	0.018	0.243
5.760	62.0	0.8	0.020	0.263
6.000	66.0	0.9	0.021	0.284
6.240	71.0	1.0	0.023	0.306
6.480	77.0	1.0	0.025	0.331
6.720	84.0	1.1	0.027	0.358
6.960	91.0	1.2	0.029	0.387
7.200	98.0	1.3	0.031	0.418
7.440	105.0	1.4	0.033	0.451
7.680	114.0	1.5	0.036	0.488
7.920	125.0	1.7	0.040	0.528
8.160	135.0	1.8	0.043	0.571

MasterDrain SW

Ian Harban Consulting Engineers
http://www.ianharban.com

Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	217060	
Sheet no.	2	
Date	28/06/18	
By	Checked	Reviewed

Project: 10a Belmont Street NW1 8HJ

Title: Hydrograph runoff calcs (Winter profile) for Belmont Street

Calculations (cont.) :-

Time (hrs)	%Mean intens	Rain mm/hr	Inflow (m3)	Cumulative (m3)
10.560	226.0	3.0	0.072	1.167
10.800	233.0	3.1	0.074	1.242
11.040	239.0	3.2	0.076	1.318
11.280	244.0	3.3	0.078	1.396
11.520	248.0	3.3	0.079	1.475
11.760	249.0	3.3	0.079	1.554
12.000	250.0	3.4	0.080	1.634
12.240	250.0	3.4	0.080	1.713
12.480	249.0	3.3	0.079	1.793
12.720	248.0	3.3	0.079	1.872
12.960	244.0	3.3	0.078	1.950
13.200	239.0	3.2	0.076	2.026
13.440	233.0	3.1	0.074	2.100
13.680	226.0	3.0	0.072	2.172
13.920	219.0	2.9	0.070	2.242
14.160	212.0	2.9	0.068	2.310
14.400	204.0	2.7	0.065	2.375
14.640	194.0	2.6	0.062	2.436
14.880	183.0	2.5	0.058	2.495
15.120	173.0	2.3	0.055	2.550
15.360	164.0	2.2	0.052	2.602
15.600	154.0	2.1	0.049	2.651
15.840	143.0	1.9	0.046	2.697
16.080	135.0	1.8	0.043	2.740
16.320	125.0	1.7	0.040	2.780
16.560	114.0	1.5	0.036	2.816
16.800	105.0	1.4	0.033	2.850
17.040	98.0	1.3	0.031	2.881
17.280	91.0	1.2	0.029	2.910
17.520	84.0	1.1	0.027	2.937
17.760	77.0	1.0	0.025	2.961
18.000	71.0	1.0	0.023	2.984
18.240	66.0	0.9	0.021	3.005
18.480	62.0	0.8	0.020	3.025
18.720	57.0	0.8	0.018	3.043
18.960	53.0	0.7	0.017	3.060
19.200	49.0	0.7	0.016	3.075
19.440	45.0	0.6	0.014	3.090
19.680	42.0	0.6	0.013	3.103
19.920	40.0	0.5	0.013	3.116
20.160	39.0	0.5	0.012	3.128
20.400	38.0	0.5	0.012	3.140
20.640	36.0	0.5	0.011	3.152
20.880	34.0	0.5	0.011	3.163
21.120	33.0	0.4	0.011	3.173
21.360	32.0	0.4	0.010	3.183
21.600	31.0	0.4	0.010	3.193
21.840	29.0	0.4	0.009	3.202
22.080	27.0	0.4	0.009	3.211
22.320	26.0	0.3	0.008	3.219
22.560	24.0	0.3	0.008	3.227
22.800	23.0	0.3	0.007	3.234
23.040	22.0	0.3	0.007	3.241
23.280	21.0	0.3	0.007	3.248
23.520	21.0	0.3	0.007	3.255
23.760	20.0	0.3	0.006	3.261
24.000	20.0	0.3	0.006	3.267

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http://www.ianharban.com

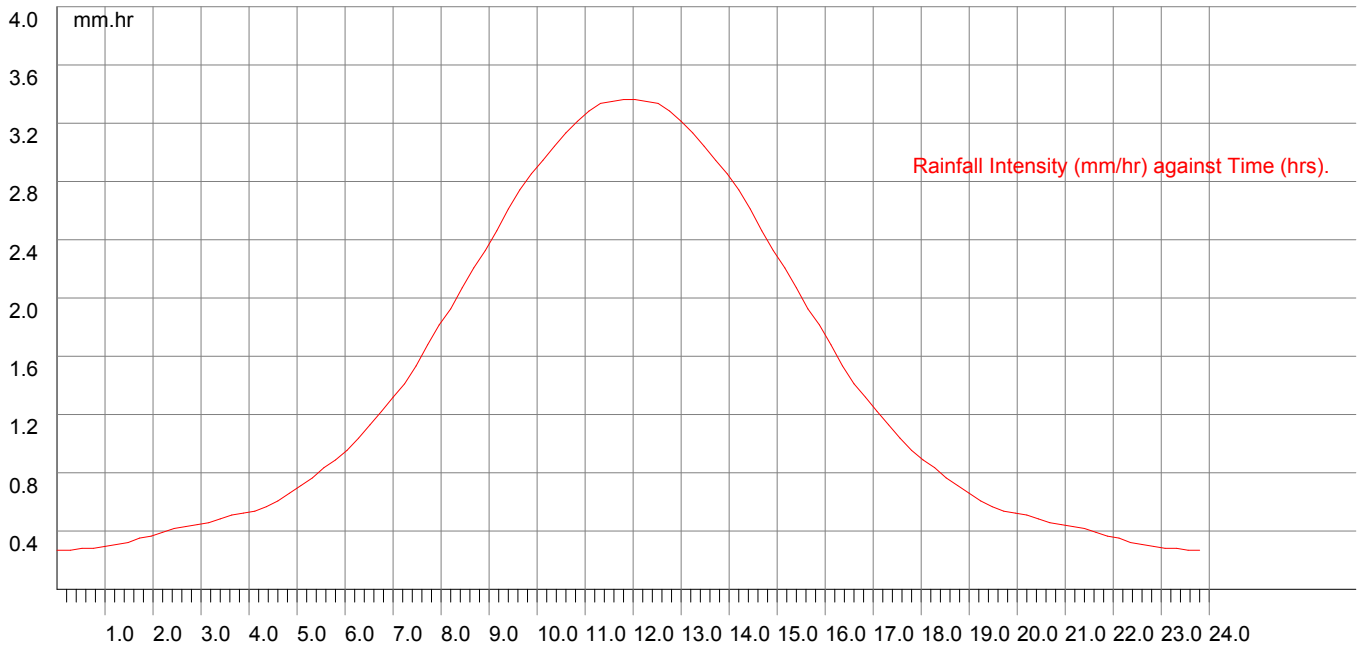
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

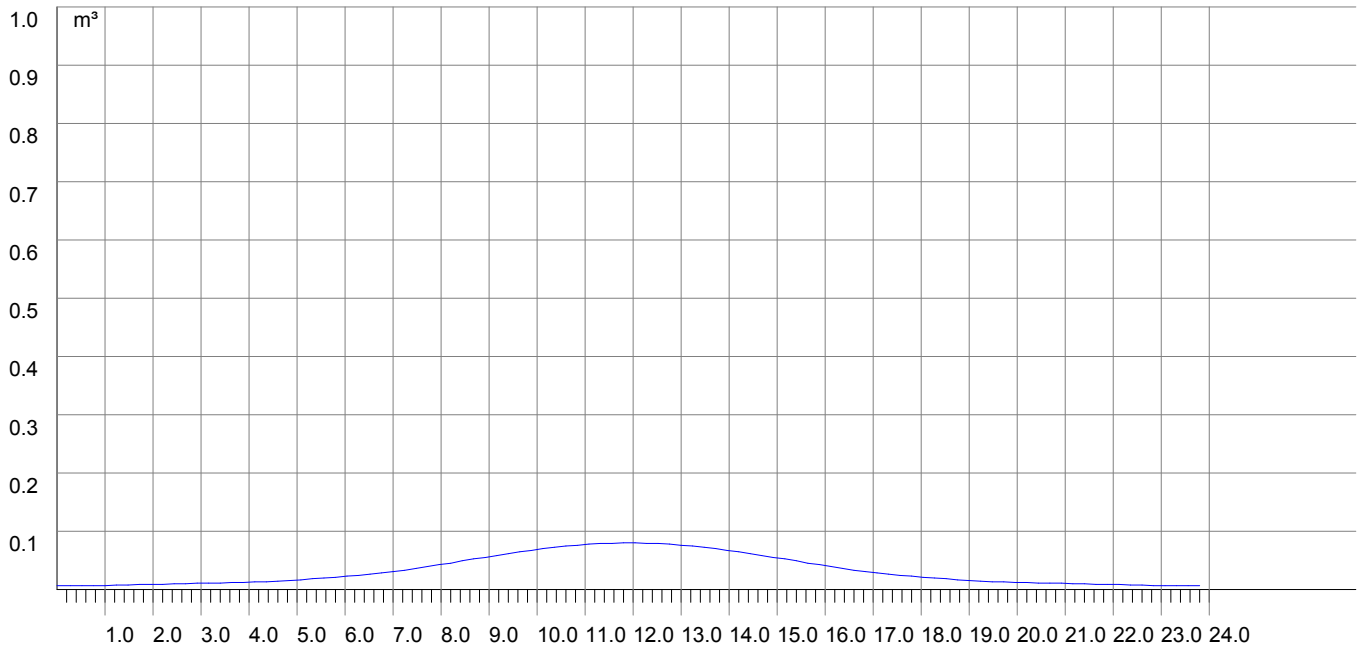
MasterDrain SW

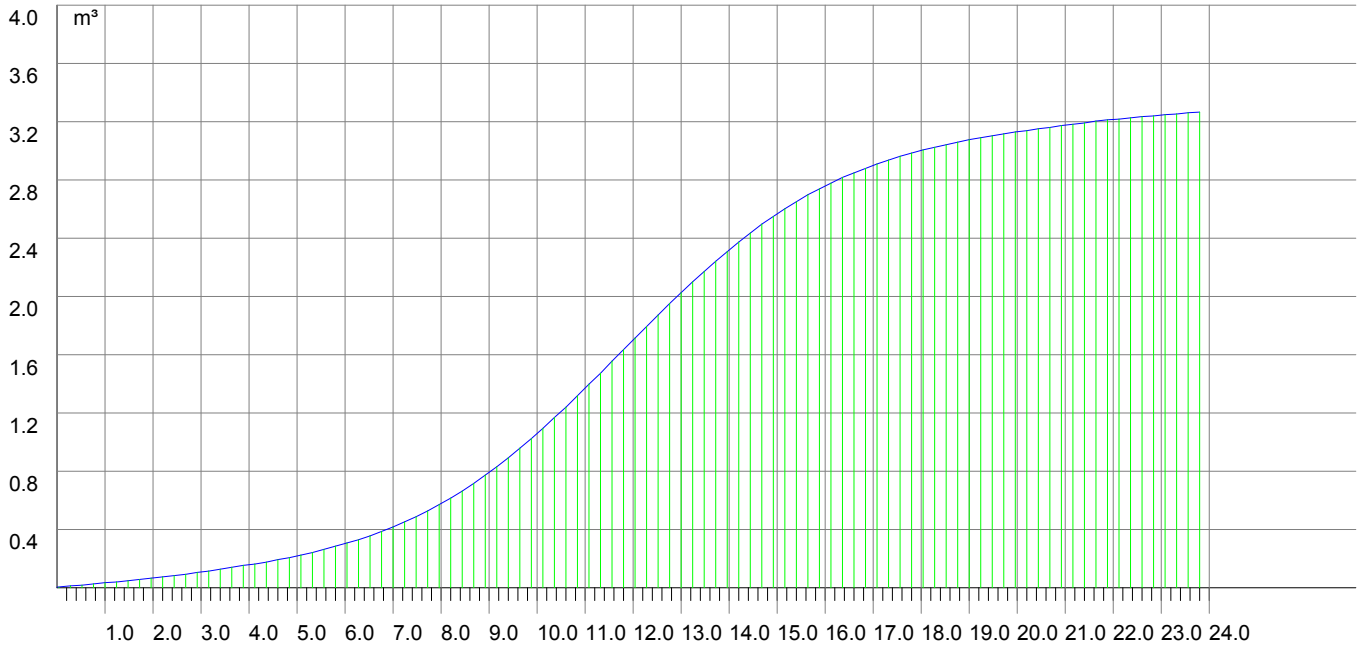
Job No.	217060
Sheet no.	3
Date	28/06/18

Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: **Hydrograph runoff calcs (Winter profile) for Belmont Street**







Runoff Calculations 1 in 100 Year Storm (whole site)

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Ian Harban Consulting Engineers
http://www.ianharban.com

Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	217060		
Sheet no.	1		
Date	28/06/18		
Project	10a Belmont Street NW1 8HJ	By	Checked / Reviewed
Title	Hydrograph runoff calcs (Winter profile) for Belmont Street		

Data:-

Hydrology:-

Grid reference = TQ2884
Return period = 100
Climate change factor = 0%

Location = Belmont Street
Mean intensity = 3.4mm/hr for a 24 hour storm

FSR data

M5-60 = 21
Soil index = 0.45
WRAP value = 4

r = 0.44
SAAR = 645

FEH data

FEH data not available.

FSR data used to calculate rainfall rates.

Percentage runoff = 79.0% calculated from:-

Percentage runoff = (0.829*PIMP)+(25*SOIL)+(0.078*UCWI)-20.7

where

PIMP = ImpervArea*100/(ImpervArea+PervArea) = 0.0

UCWI = Calculated value for Wetness Index = 0.0

Imperv. area = 125 m²
Total area = 125 m²
Total runoff = 8.2 m³
Peak flow = 0.23 l/s

Pervious area = 0 m²
Equiv area = 99 m² (Tot. area x % runoff).
Total rainfall depth = 81.0 mm
Mean flow = 0.1 l/s

Calculations :-

Time (hrs)	%Mean intens	Rain mm/hr	Inflow (m3)	Cumulative (m3)
0.240	20.0	0.7	0.016	0.016
0.480	20.0	0.7	0.016	0.032
0.720	21.0	0.7	0.017	0.049
0.960	21.0	0.7	0.017	0.066
1.200	22.0	0.7	0.018	0.083
1.440	23.0	0.8	0.018	0.102
1.680	24.0	0.8	0.019	0.121
1.920	26.0	0.9	0.021	0.142
2.160	27.0	0.9	0.022	0.163
2.400	29.0	1.0	0.023	0.186
2.640	31.0	1.0	0.025	0.211
2.880	32.0	1.1	0.026	0.237
3.120	33.0	1.1	0.026	0.263
3.360	34.0	1.1	0.027	0.290
3.600	36.0	1.2	0.029	0.319
3.840	38.0	1.3	0.030	0.350
4.080	39.0	1.3	0.031	0.381
4.320	40.0	1.3	0.032	0.413
4.560	42.0	1.4	0.034	0.446
4.800	45.0	1.5	0.036	0.482
5.040	49.0	1.7	0.039	0.522
5.280	53.0	1.8	0.042	0.564
5.520	57.0	1.9	0.046	0.610
5.760	62.0	2.1	0.050	0.659
6.000	66.0	2.2	0.053	0.712
6.240	71.0	2.4	0.057	0.769
6.480	77.0	2.6	0.062	0.830
6.720	84.0	2.8	0.067	0.897
6.960	91.0	3.1	0.073	0.970
7.200	98.0	3.3	0.078	1.049
7.440	105.0	3.5	0.084	1.133
7.680	114.0	3.8	0.091	1.224
7.920	125.0	4.2	0.100	1.324
8.160	135.0	4.6	0.108	1.432

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Ian Harban Consulting Engineers
http://www.ianharban.com

Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No. 217060
Sheet no. 2
Date 28/06/18

Project 10a Belmont Street NW1 8HJ

Title Hydrograph runoff calcs (Winter profile) for Belmont Street

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Calculations (cont.) :-

Time (hrs)	%Mean intens	Rain mm/hr	Inflow (m3)	Cumulative (m3)
10.560	226.0	7.6	0.181	2.929
10.800	233.0	7.9	0.186	3.115
11.040	239.0	8.1	0.191	3.307
11.280	244.0	8.2	0.195	3.502
11.520	248.0	8.4	0.198	3.700
11.760	249.0	8.4	0.199	3.899
12.000	250.0	8.4	0.200	4.099
12.240	250.0	8.4	0.200	4.299
12.480	249.0	8.4	0.199	4.498
12.720	248.0	8.4	0.198	4.697
12.960	244.0	8.2	0.195	4.892
13.200	239.0	8.1	0.191	5.083
13.440	233.0	7.9	0.186	5.270
13.680	226.0	7.6	0.181	5.450
13.920	219.0	7.4	0.175	5.625
14.160	212.0	7.2	0.170	5.795
14.400	204.0	6.9	0.163	5.958
14.640	194.0	6.5	0.155	6.113
14.880	183.0	6.2	0.146	6.260
15.120	173.0	5.8	0.138	6.398
15.360	164.0	5.5	0.131	6.529
15.600	154.0	5.2	0.123	6.653
15.840	143.0	4.8	0.114	6.767
16.080	135.0	4.6	0.108	6.875
16.320	125.0	4.2	0.100	6.975
16.560	114.0	3.8	0.091	7.066
16.800	105.0	3.5	0.084	7.150
17.040	98.0	3.3	0.078	7.228
17.280	91.0	3.1	0.073	7.301
17.520	84.0	2.8	0.067	7.368
17.760	77.0	2.6	0.062	7.430
18.000	71.0	2.4	0.057	7.487
18.240	66.0	2.2	0.053	7.540
18.480	62.0	2.1	0.050	7.589
18.720	57.0	1.9	0.046	7.635
18.960	53.0	1.8	0.042	7.677
19.200	49.0	1.7	0.039	7.716
19.440	45.0	1.5	0.036	7.752
19.680	42.0	1.4	0.034	7.786
19.920	40.0	1.3	0.032	7.818
20.160	39.0	1.3	0.031	7.849
20.400	38.0	1.3	0.030	7.880
20.640	36.0	1.2	0.029	7.908
20.880	34.0	1.1	0.027	7.936
21.120	33.0	1.1	0.026	7.962
21.360	32.0	1.1	0.026	7.988
21.600	31.0	1.0	0.025	8.012
21.840	29.0	1.0	0.023	8.036
22.080	27.0	0.9	0.022	8.057
22.320	26.0	0.9	0.021	8.078
22.560	24.0	0.8	0.019	8.097
22.800	23.0	0.8	0.018	8.115
23.040	22.0	0.7	0.018	8.133
23.280	21.0	0.7	0.017	8.150
23.520	21.0	0.7	0.017	8.167
23.760	20.0	0.7	0.016	8.183
24.000	20.0	0.7	0.016	8.199

Ian Harban Consulting Engineers
http://www.ianharban.com

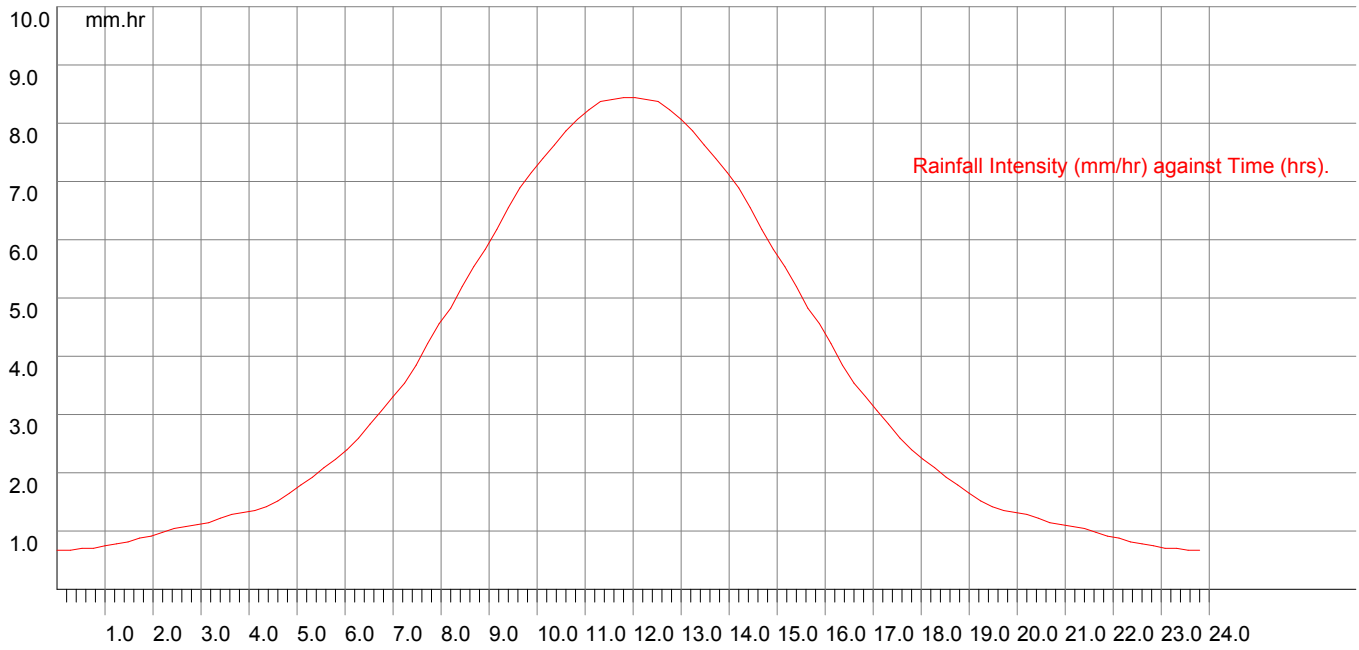
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

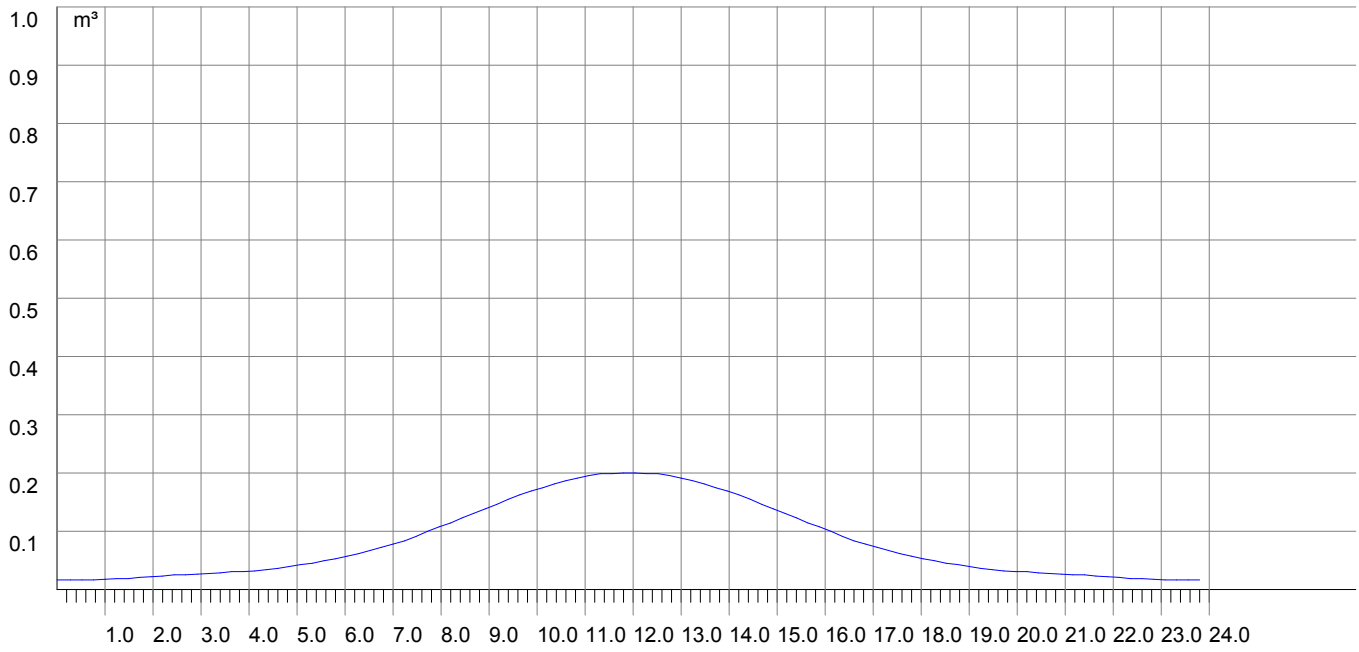
MasterDrain SW

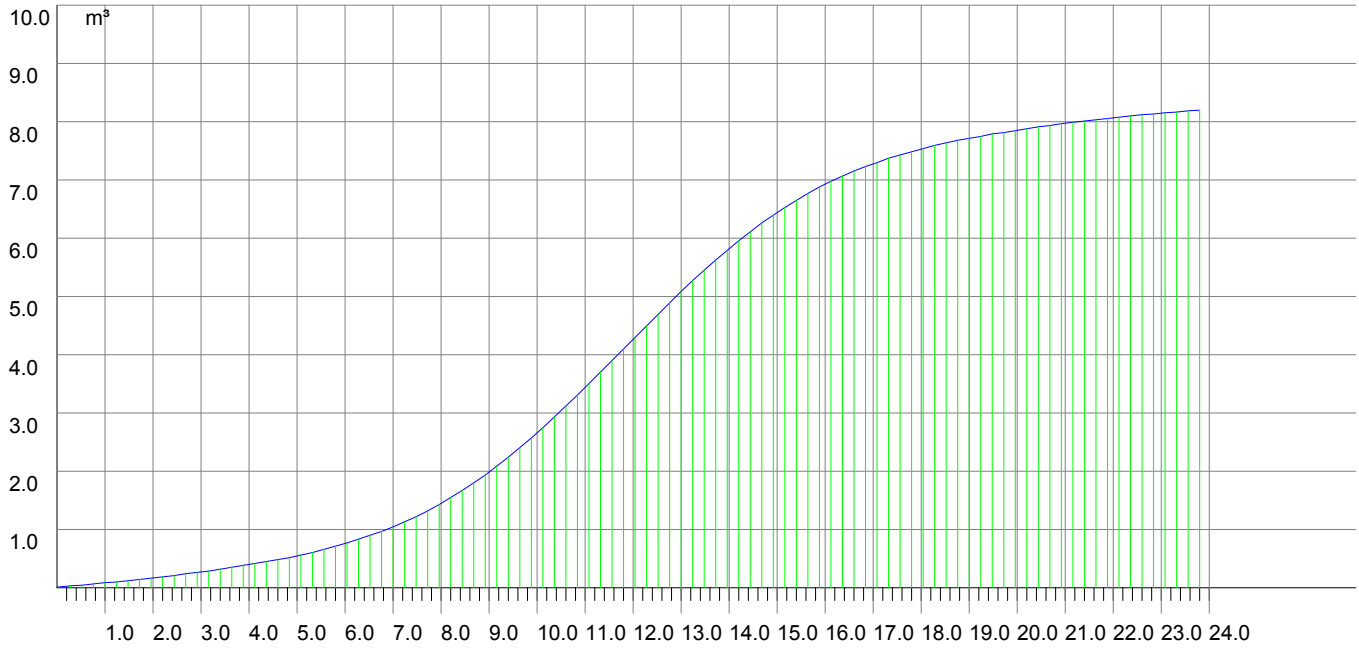
Job No.	217060
Sheet no.	3
Date	28/06/18

Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: **Hydrograph runoff calcs (Winter profile) for Belmont Street**







Runoff Calculations 1 in 100 Year + CC Storm (whole site)

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http://www.ianharban.com

Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	217060
Sheet no.	1
Date	28/06/18

Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: **Hydrograph runoff calcs (Winter profile) for Belmont Street**

Data:-

Hydrology:-

Grid reference = TQ2884
Location = Belmont Street
Return period = 100
Mean intensity = 4.4mm/hr for a 24 hour storm
Climate change factor = 30%

FSR data

M5-60 = 21
r = 0.44
Soil index = 0.45
SAAR = 645
WRAP value = 4

FEH data

FEH data not available.

FSR data used to calculate rainfall rates.

Percentage runoff = 79.0% calculated from:-

Percentage runoff = (0.829*PIMP)+(25*SOIL)+(0.078*UCWI)-20.7

where

PIMP = ImpervArea*100/(ImpervArea+PervArea) = 0.0

UCWI = Calculated value for Wetness Index = 0.0

Imperv. area = 125 m²
Pervious area = 0 m²
Total area = 125 m²
Equiv area = 99 m² (Tot. area x % runoff).
Total runoff = 10.7 m³
Total rainfall depth = 105.3 mm
Peak flow = 0.30 l/s
Mean flow = 0.1 l/s

Calculations :-

Time (hrs)	%Mean intens	Rain mm/hr	Inflow (m3)	Cumulative (m3)
0.240	20.0	0.9	0.021	0.021
0.480	20.0	0.9	0.021	0.042
0.720	21.0	0.9	0.022	0.063
0.960	21.0	0.9	0.022	0.085
1.200	22.0	1.0	0.023	0.108
1.440	23.0	1.0	0.024	0.132
1.680	24.0	1.1	0.025	0.157
1.920	26.0	1.1	0.027	0.184
2.160	27.0	1.2	0.028	0.212
2.400	29.0	1.3	0.030	0.242
2.640	31.0	1.4	0.032	0.275
2.880	32.0	1.4	0.033	0.308
3.120	33.0	1.4	0.034	0.342
3.360	34.0	1.5	0.035	0.377
3.600	36.0	1.6	0.037	0.415
3.840	38.0	1.7	0.040	0.454
4.080	39.0	1.7	0.041	0.495
4.320	40.0	1.8	0.042	0.537
4.560	42.0	1.8	0.044	0.580
4.800	45.0	2.0	0.047	0.627
5.040	49.0	2.1	0.051	0.678
5.280	53.0	2.3	0.055	0.733
5.520	57.0	2.5	0.059	0.792
5.760	62.0	2.7	0.064	0.857
6.000	66.0	2.9	0.069	0.925
6.240	71.0	3.1	0.074	0.999
6.480	77.0	3.4	0.080	1.079
6.720	84.0	3.7	0.087	1.167
6.960	91.0	4.0	0.095	1.261
7.200	98.0	4.3	0.102	1.363
7.440	105.0	4.6	0.109	1.472
7.680	114.0	5.0	0.119	1.591
7.920	125.0	5.5	0.130	1.721
8.160	135.0	5.9	0.140	1.861

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Ian Harban Consulting Engineers
http://www.ianharban.com

Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No. 217060
Sheet no. 2
Date 28/06/18

Project 10a Belmont Street NW1 8HJ

Title Hydrograph runoff calcs (Winter profile) for Belmont Street

By | Checked | Reviewed

Calculations (cont.) :-

Time (hrs)	%Mean intens	Rain mm/hr	Inflow (m3)	Cumulative (m3)
10.560	226.0	9.9	0.235	3.808
10.800	233.0	10.2	0.242	4.050
11.040	239.0	10.5	0.249	4.299
11.280	244.0	10.7	0.254	4.552
11.520	248.0	10.9	0.258	4.810
11.760	249.0	10.9	0.259	5.069
12.000	250.0	11.0	0.260	5.329
12.240	250.0	11.0	0.260	5.589
12.480	249.0	10.9	0.259	5.848
12.720	248.0	10.9	0.258	6.106
12.960	244.0	10.7	0.254	6.360
13.200	239.0	10.5	0.249	6.608
13.440	233.0	10.2	0.242	6.850
13.680	226.0	9.9	0.235	7.085
13.920	219.0	9.6	0.228	7.313
14.160	212.0	9.3	0.220	7.534
14.400	204.0	9.0	0.212	7.746
14.640	194.0	8.5	0.202	7.947
14.880	183.0	8.0	0.190	8.138
15.120	173.0	7.6	0.180	8.318
15.360	164.0	7.2	0.171	8.488
15.600	154.0	6.8	0.160	8.648
15.840	143.0	6.3	0.149	8.797
16.080	135.0	5.9	0.140	8.937
16.320	125.0	5.5	0.130	9.067
16.560	114.0	5.0	0.119	9.186
16.800	105.0	4.6	0.109	9.295
17.040	98.0	4.3	0.102	9.397
17.280	91.0	4.0	0.095	9.492
17.520	84.0	3.7	0.087	9.579
17.760	77.0	3.4	0.080	9.659
18.000	71.0	3.1	0.074	9.733
18.240	66.0	2.9	0.069	9.801
18.480	62.0	2.7	0.064	9.866
18.720	57.0	2.5	0.059	9.925
18.960	53.0	2.3	0.055	9.980
19.200	49.0	2.1	0.051	10.031
19.440	45.0	2.0	0.047	10.078
19.680	42.0	1.8	0.044	10.122
19.920	40.0	1.8	0.042	10.163
20.160	39.0	1.7	0.041	10.204
20.400	38.0	1.7	0.040	10.243
20.640	36.0	1.6	0.037	10.281
20.880	34.0	1.5	0.035	10.316
21.120	33.0	1.4	0.034	10.350
21.360	32.0	1.4	0.033	10.384
21.600	31.0	1.4	0.032	10.416
21.840	29.0	1.3	0.030	10.446
22.080	27.0	1.2	0.028	10.474
22.320	26.0	1.1	0.027	10.501
22.560	24.0	1.1	0.025	10.526
22.800	23.0	1.0	0.024	10.550
23.040	22.0	1.0	0.023	10.573
23.280	21.0	0.9	0.022	10.595
23.520	21.0	0.9	0.022	10.617
23.760	20.0	0.9	0.021	10.637
24.000	20.0	0.9	0.021	10.658

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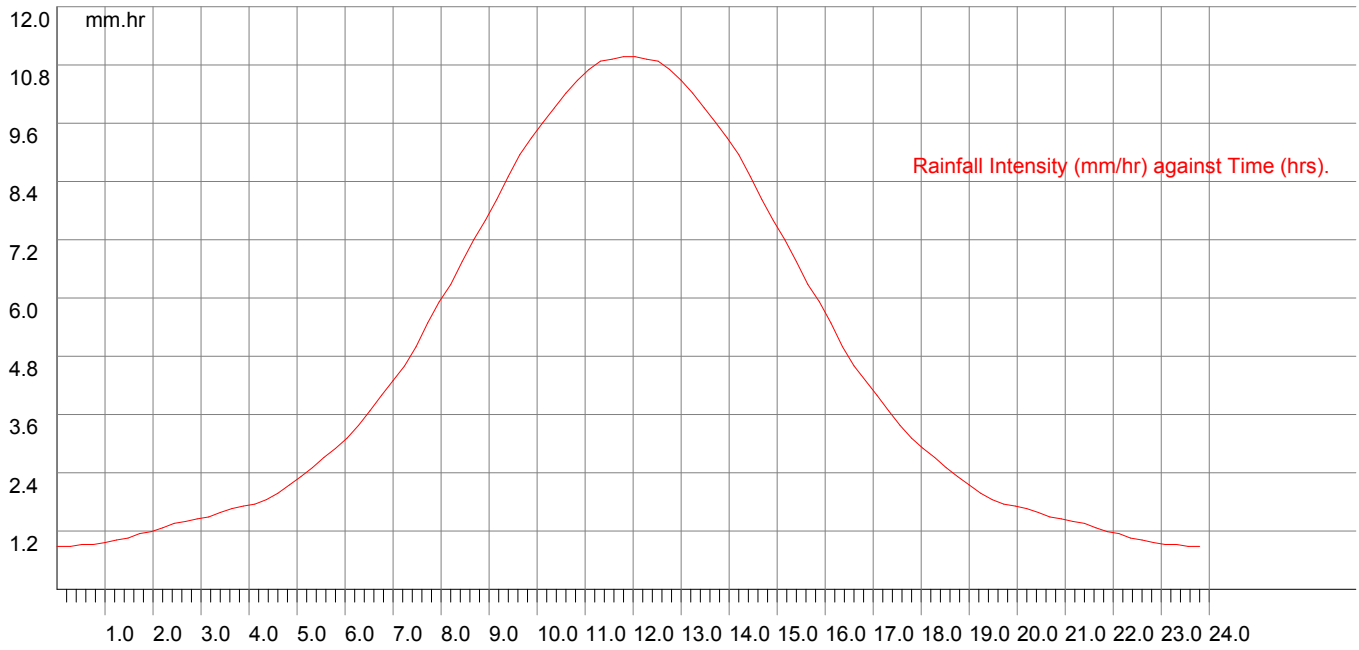
Ian Harban Consulting Engineers
http://www.ianharban.com

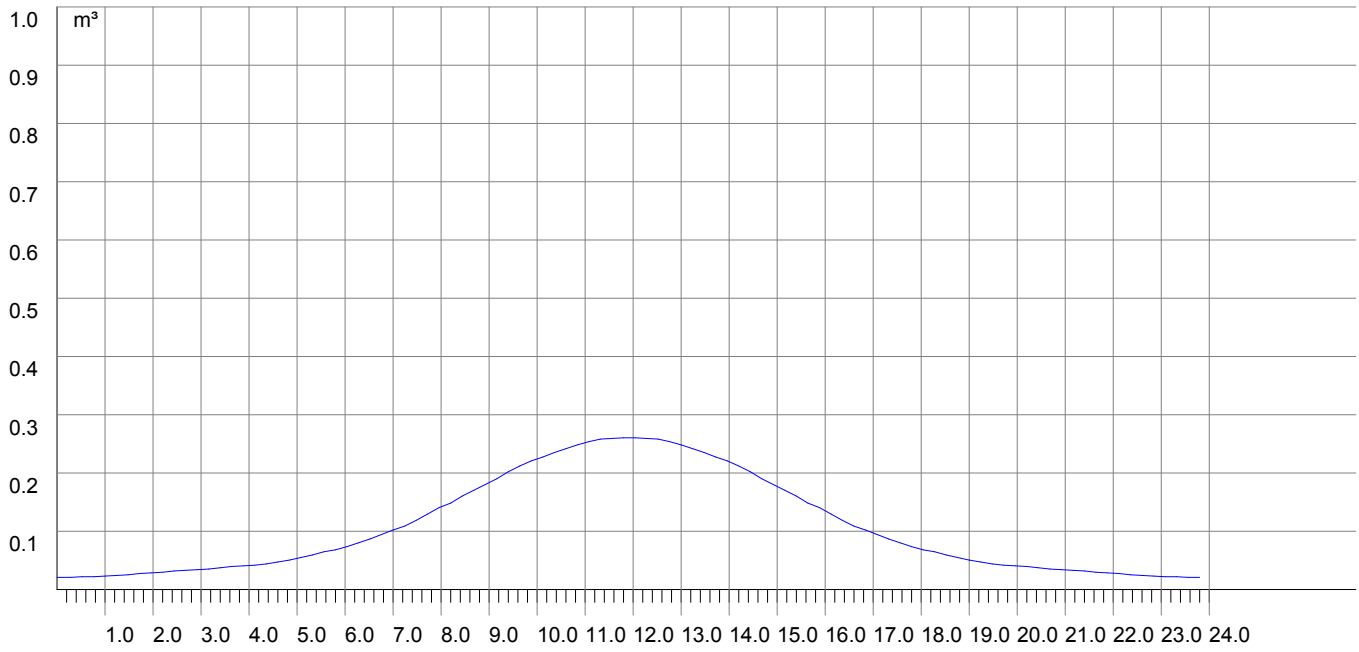
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

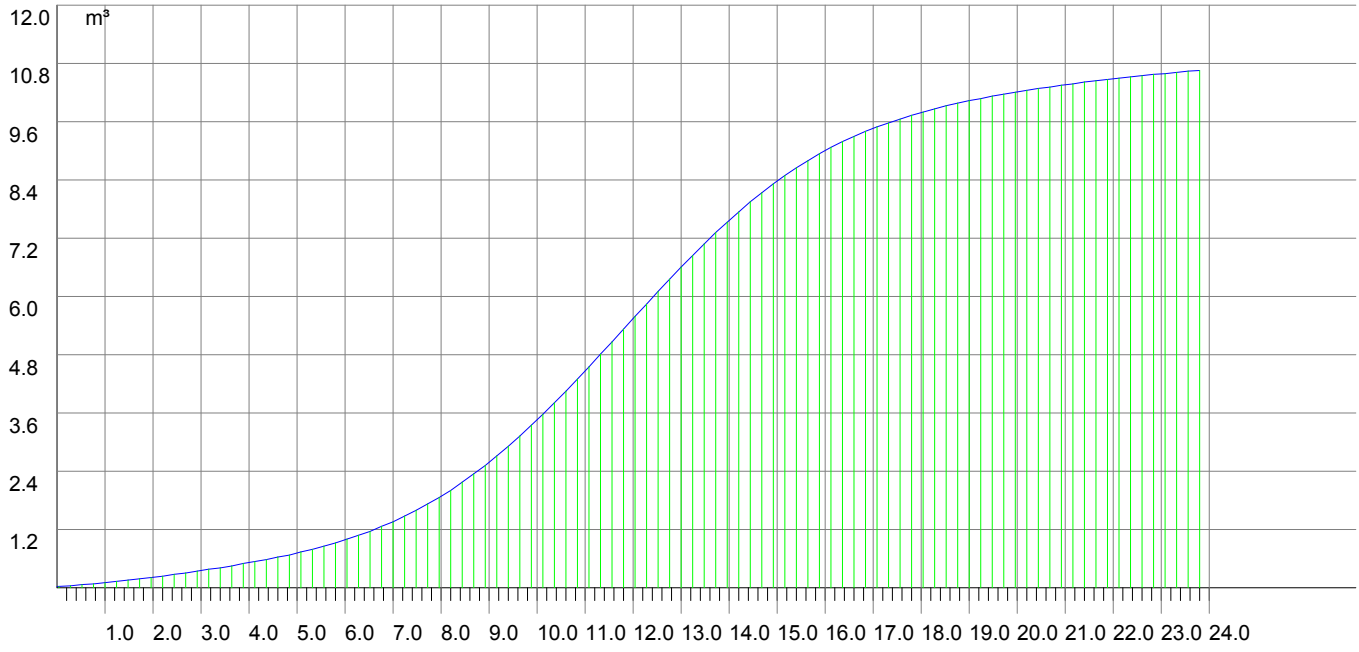
Job No.	Sheet no.	Date
217060	3	28/06/18

Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: **Hydrograph runoff calcs (Winter profile) for Belmont Street**







Runoff Calculations 1 in 100 Year + CC Storm (gutters, parapets)

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Ian Harban Consulting Engineers
http://www.ianharban.com

Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

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Sheet no.	1		
Date	27/06/18		
Project	10a Belmont Street NW1 8HJ	By	Checked / Reviewed
Title	Hydrograph runoff calcs (Winter profile) for Belmont Street		

Data:-

Hydrology:-

Grid reference = TQ2884
Return period = 100
Climate change factor = 30%

Location = Belmont Street
Mean intensity = 4.4mm/hr for a 24 hour storm

FSR data

M5-60 = 21
Soil index = 0.45
WRAP value = 4

r = 0.44
SAAR = 645

FEH data

FEH data not available.

FSR data used to calculate rainfall rates.

Percentage runoff = 79.0% calculated from:-

Percentage runoff = (0.829*PIMP)+(25*SOIL)+(0.078*UCWI)-20.7

where

PIMP = ImpervArea*100/(ImpervArea+PervArea) = 0.0

UCWI = Calculated value for Wetness Index = 0.0

Imperv. area = 46 m²
Total area = 46 m²
Total runoff = 3.9 m³
Peak flow = 0.11 l/s

Pervious area = 0 m²
Equiv area = 36 m² (Tot. area x % runoff).
Total rainfall depth = 105.3 mm
Mean flow = 0.0 l/s

Calculations :-

Time (hrs)	%Mean intens	Rain mm/hr	Inflow (m3)	Cumulative (m3)
0.240	20.0	0.9	0.008	0.008
0.480	20.0	0.9	0.008	0.015
0.720	21.0	0.9	0.008	0.023
0.960	21.0	0.9	0.008	0.031
1.200	22.0	1.0	0.008	0.040
1.440	23.0	1.0	0.009	0.049
1.680	24.0	1.1	0.009	0.058
1.920	26.0	1.1	0.010	0.068
2.160	27.0	1.2	0.010	0.078
2.400	29.0	1.3	0.011	0.089
2.640	31.0	1.4	0.012	0.101
2.880	32.0	1.4	0.012	0.113
3.120	33.0	1.4	0.013	0.126
3.360	34.0	1.5	0.013	0.139
3.600	36.0	1.6	0.014	0.153
3.840	38.0	1.7	0.015	0.167
4.080	39.0	1.7	0.015	0.182
4.320	40.0	1.8	0.015	0.197
4.560	42.0	1.8	0.016	0.214
4.800	45.0	2.0	0.017	0.231
5.040	49.0	2.1	0.019	0.249
5.280	53.0	2.3	0.020	0.270
5.520	57.0	2.5	0.022	0.292
5.760	62.0	2.7	0.024	0.315
6.000	66.0	2.9	0.025	0.341
6.240	71.0	3.1	0.027	0.368
6.480	77.0	3.4	0.029	0.397
6.720	84.0	3.7	0.032	0.429
6.960	91.0	4.0	0.035	0.464
7.200	98.0	4.3	0.038	0.502
7.440	105.0	4.6	0.040	0.542
7.680	114.0	5.0	0.044	0.585
7.920	125.0	5.5	0.048	0.633
8.160	135.0	5.9	0.052	0.685

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Ian Harban Consulting Engineers
http://www.ianharban.com

Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No. 217060
Sheet no. 2
Date 27/06/18

Project 10a Belmont Street NW1 8HJ

Title Hydrograph runoff calcs (Winter profile) for Belmont Street

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Calculations (cont.) :-

Time (hrs)	%Mean intens	Rain mm/hr	Inflow (m3)	Cumulative (m3)
10.560	226.0	9.9	0.086	1.401
10.800	233.0	10.2	0.089	1.490
11.040	239.0	10.5	0.091	1.582
11.280	244.0	10.7	0.093	1.675
11.520	248.0	10.9	0.095	1.770
11.760	249.0	10.9	0.095	1.865
12.000	250.0	11.0	0.096	1.961
12.240	250.0	11.0	0.096	2.057
12.480	249.0	10.9	0.095	2.152
12.720	248.0	10.9	0.095	2.247
12.960	244.0	10.7	0.093	2.340
13.200	239.0	10.5	0.091	2.432
13.440	233.0	10.2	0.089	2.521
13.680	226.0	9.9	0.086	2.607
13.920	219.0	9.6	0.084	2.691
14.160	212.0	9.3	0.081	2.772
14.400	204.0	9.0	0.078	2.850
14.640	194.0	8.5	0.074	2.925
14.880	183.0	8.0	0.070	2.995
15.120	173.0	7.6	0.066	3.061
15.360	164.0	7.2	0.063	3.124
15.600	154.0	6.8	0.059	3.183
15.840	143.0	6.3	0.055	3.237
16.080	135.0	5.9	0.052	3.289
16.320	125.0	5.5	0.048	3.337
16.560	114.0	5.0	0.044	3.380
16.800	105.0	4.6	0.040	3.421
17.040	98.0	4.3	0.038	3.458
17.280	91.0	4.0	0.035	3.493
17.520	84.0	3.7	0.032	3.525
17.760	77.0	3.4	0.029	3.555
18.000	71.0	3.1	0.027	3.582
18.240	66.0	2.9	0.025	3.607
18.480	62.0	2.7	0.024	3.631
18.720	57.0	2.5	0.022	3.652
18.960	53.0	2.3	0.020	3.673
19.200	49.0	2.1	0.019	3.692
19.440	45.0	2.0	0.017	3.709
19.680	42.0	1.8	0.016	3.725
19.920	40.0	1.8	0.015	3.740
20.160	39.0	1.7	0.015	3.755
20.400	38.0	1.7	0.015	3.770
20.640	36.0	1.6	0.014	3.783
20.880	34.0	1.5	0.013	3.796
21.120	33.0	1.4	0.013	3.809
21.360	32.0	1.4	0.012	3.821
21.600	31.0	1.4	0.012	3.833
21.840	29.0	1.3	0.011	3.844
22.080	27.0	1.2	0.010	3.855
22.320	26.0	1.1	0.010	3.864
22.560	24.0	1.1	0.009	3.874
22.800	23.0	1.0	0.009	3.882
23.040	22.0	1.0	0.008	3.891
23.280	21.0	0.9	0.008	3.899
23.520	21.0	0.9	0.008	3.907
23.760	20.0	0.9	0.008	3.915
24.000	20.0	0.9	0.008	3.922

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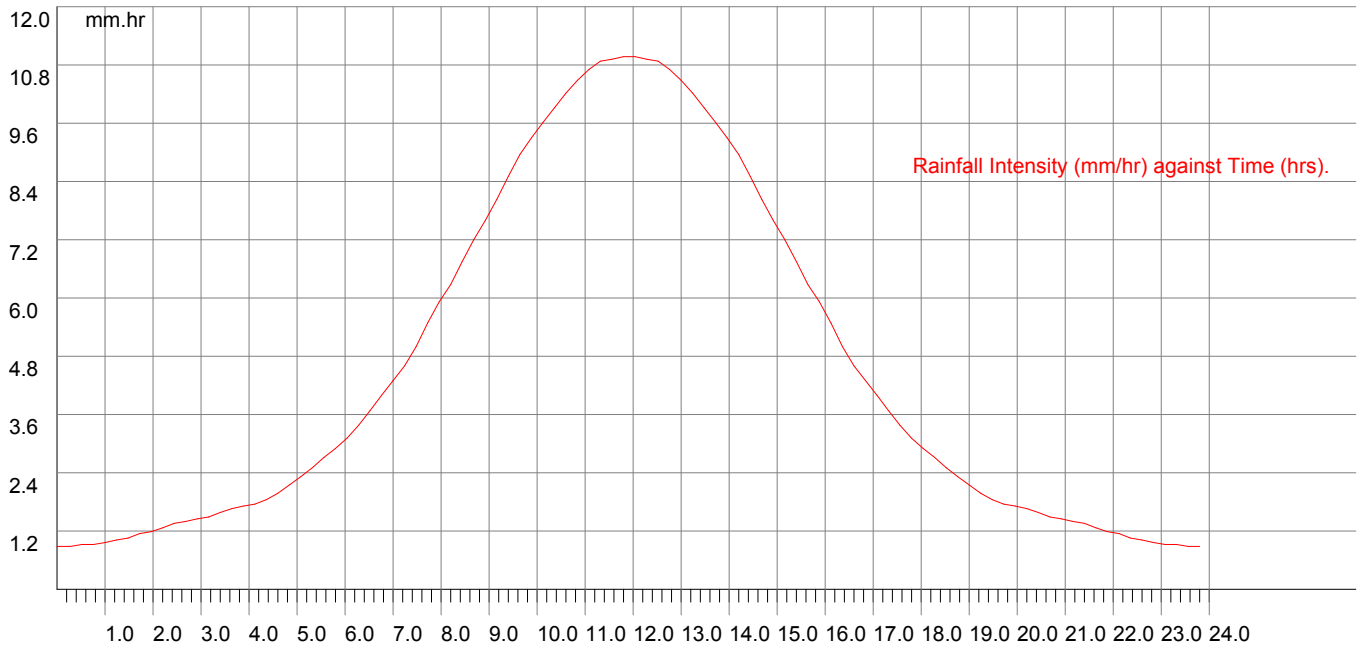
Ian Harban Consulting Engineers
http://www.ianharban.com

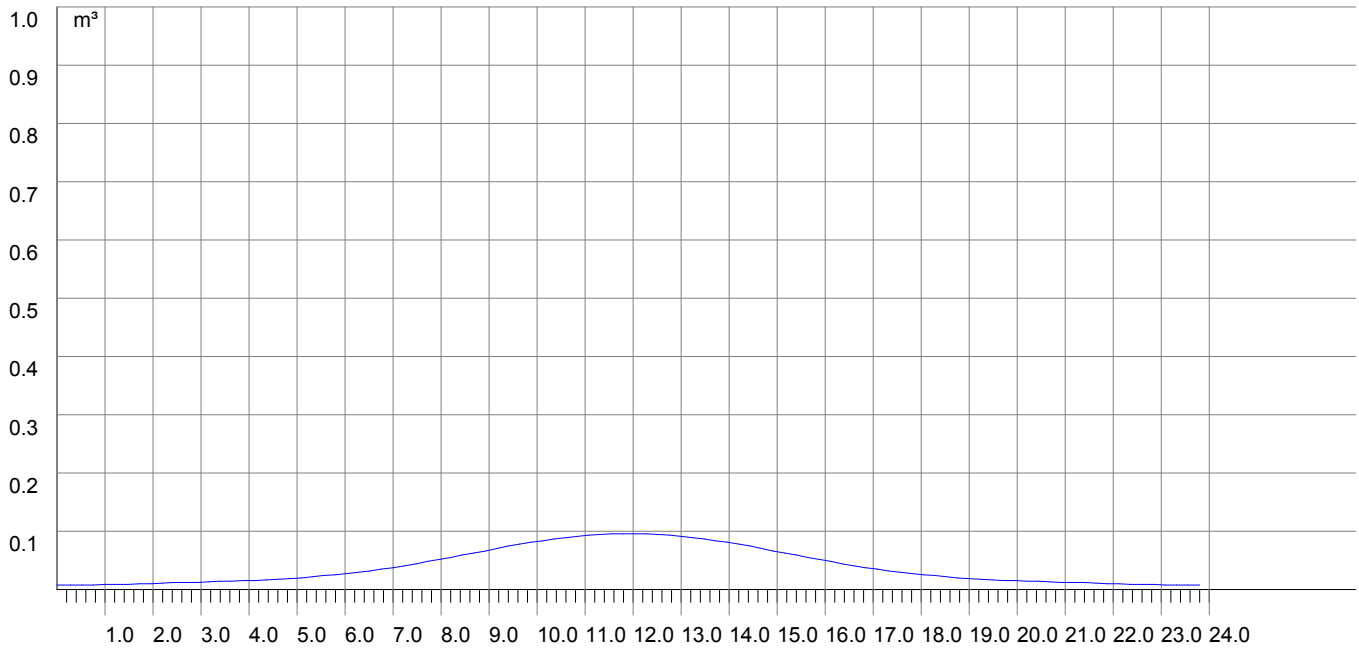
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

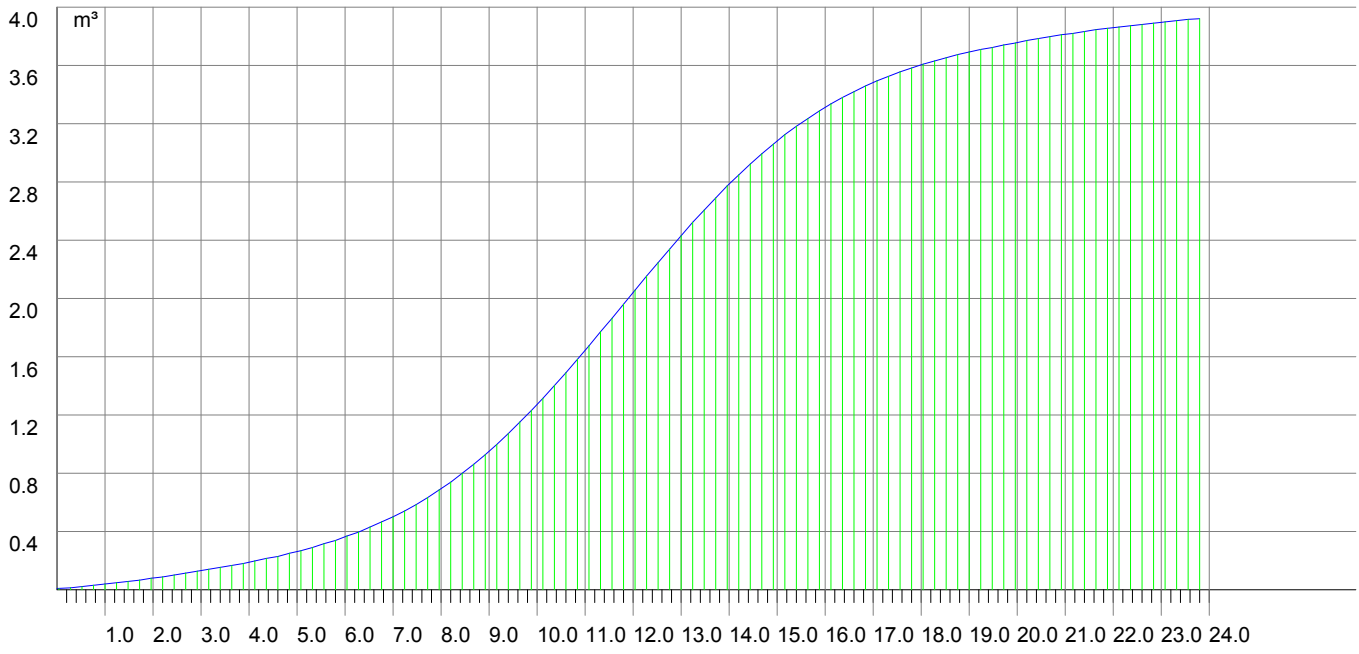
Job No.	Sheet no.	Date
217060	3	27/06/18

Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: **Hydrograph runoff calcs (Winter profile) for Belmont Street**







Storage Analysis 1 in 1 Year Storm (whole site)

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Ian Harban Consulting Engineers
http://www.ianharban.com
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	217060
Sheet no.	1
Date	28/06/18
Project	10a Belmont Street NW1 8HJ
Title	Hydrograph storage analysis (Winter profile) for Belmont Street

By	Checked	Reviewed

Data:-

Location = Belmont Street
M5-60 (mm) = 21
Soil index = 0.45
Return period = 1
UCWI = 0.0

Grid reference = TQ2884
r = 0.44
SAAR (mm/yr) = 645
WRAP = 4
Climate change = +0%

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Percentage runoff = 79.0% calculated from:-

Percentage runoff = (0.829*PIMP)+(25*SOIL)+(0.078*UCWI)-20.7

where

PIMP = ImpervArea*100/(ImpervArea+PervArea) = 0.0

UCWI = Calculated value for Wetness Index = 0.0

Imperv. area = 125 m²
Total area = 125 m²
Total runoff = 2.5 m³

Pervious area = 0 m²
Equiv area = 99 m² (Tot. area x % runoff).
Discharge rate = 0.045 l/s

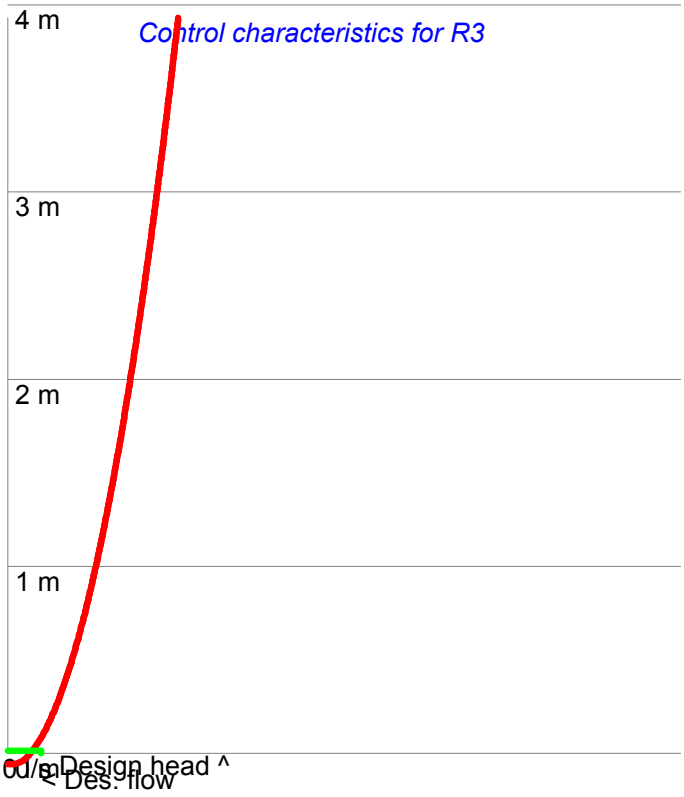
Design Head = 0.15m
Control device = R3
Max. calc. depth = 0.14 m

Peak flow = 0.04 l/s
Orifice diam = 9.5 mm
Available depth = 0.0 m³

Pipeline storage = 0.0 m³
Offline storage = 0.0 m³
Total storage = 1.9 m³

Available MH storage = 0.0 m³

Peak input flow =0.21 l/s



Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.01	0.01	2.01	0.16
0.05	0.03	2.05	0.17
0.10	0.04	2.10	0.17
0.15	0.05	2.15	0.17
0.20	0.05	2.20	0.17
0.25	0.06	2.25	0.17
0.30	0.06	2.30	0.18
0.35	0.07	2.35	0.18
0.40	0.07	2.40	0.18
0.45	0.08	2.45	0.18
0.50	0.08	2.50	0.18
0.55	0.09	2.55	0.19
0.60	0.09	2.60	0.19
0.65	0.09	2.65	0.19
0.70	0.10	2.70	0.19
0.75	0.10	2.75	0.19
0.80	0.10	2.80	0.19
0.85	0.11	2.85	0.20
0.90	0.11	2.90	0.20
0.95	0.11	2.95	0.20
1.00	0.12	3.00	0.20
1.05	0.12	3.05	0.20
1.10	0.12	3.10	0.20
1.15	0.12	3.15	0.21
1.20	0.13	3.20	0.21
1.25	0.13	3.25	0.21
1.30	0.13	3.30	0.21
1.35	0.14	3.35	0.21
1.40	0.14	3.40	0.21
1.45	0.14	3.45	0.22
1.50	0.14	3.50	0.22
1.55	0.14	3.55	0.22
1.60	0.15	3.60	0.22
1.65	0.15	3.65	0.22
1.70	0.15	3.70	0.22
1.75	0.15	3.75	0.23
1.80	0.16	3.80	0.23
1.85	0.16	3.85	0.23
1.90	0.16	3.90	0.23
1.95	0.16	3.95	0.23
2.00	0.16	4.00	0.23

Calculation data provided by Crown Water Ltd, SL5 7NT

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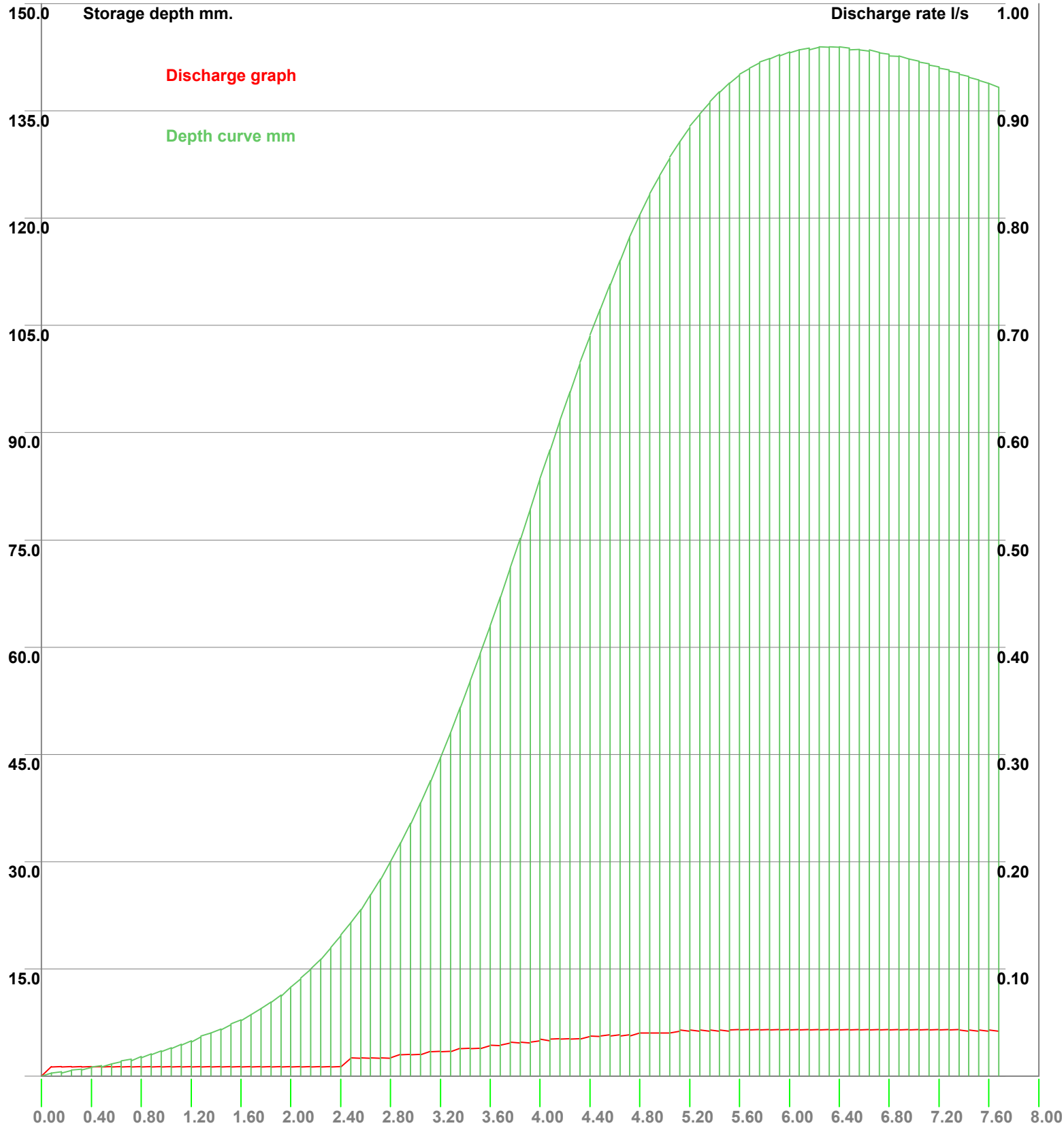
Ian Harban Consulting Engineers
http://www.ianharban.com

Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	217060
Sheet no.	2
Date	28/06/18
Project	10a Belmont Street NW1 8HJ
Title	Hydrograph storage analysis (Winter profile) for Belmont Street

By	Checked	Reviewed

Storage curves for a 8 hours storm.



Ian Harban Consulting Engineers
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Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
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Job No.	Sheet no.	Date
217060	3	28/06/18

Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: Hydrograph storage analysis (Winter profile) for Belmont Street

Incremental rainfall figures.

Storm Mins	Storage Depth mm	Control Flow l/s	Storm Mins	Storage Depth mm	Control Flow l/s
4.8	0.4	0.01	244.8	87.6	0.03
9.6	0.6	0.01	249.6	91.7	0.03
14.4	0.8	0.01	254.4	95.7	0.03
19.2	1.0	0.01	259.2	99.7	0.03
24.0	1.2	0.01	264.0	103.5	0.04
28.8	1.5	0.01	268.8	107.2	0.04
33.6	1.7	0.01	273.6	110.8	0.04
38.4	2.0	0.01	278.4	114.1	0.04
43.2	2.3	0.01	283.2	117.4	0.04
48.0	2.7	0.01	288.0	120.5	0.04
52.8	3.1	0.01	292.8	123.3	0.04
57.6	3.5	0.01	297.6	126.0	0.04
62.4	4.0	0.01	302.4	128.4	0.04
67.2	4.4	0.01	307.2	130.7	0.04
72.0	4.9	0.01	312.0	132.7	0.04
76.8	5.4	0.01	316.8	134.5	0.04
81.6	6.0	0.01	321.6	136.2	0.04
86.4	6.6	0.01	326.4	137.7	0.04
91.2	7.2	0.01	331.2	138.9	0.04
96.0	7.9	0.01	336.0	140.0	0.04
100.8	8.6	0.01	340.8	140.9	0.04
105.6	9.4	0.01	345.6	141.7	0.04
110.4	10.3	0.01	350.4	142.4	0.04
115.2	11.3	0.01	355.2	142.9	0.04
120.0	12.4	0.01	360.0	143.3	0.04
124.8	13.6	0.01	364.8	143.6	0.04
129.6	14.9	0.01	369.6	143.8	0.04
134.4	16.3	0.01	374.4	143.9	0.04
139.2	17.9	0.01	379.2	143.9	0.04
144.0	19.6	0.01	384.0	143.9	0.04
148.8	21.4	0.02	388.8	143.8	0.04
153.6	23.3	0.02	393.6	143.6	0.04
158.4	25.3	0.02	398.4	143.4	0.04
163.2	27.6	0.02	403.2	143.2	0.04
168.0	30.0	0.02	408.0	142.9	0.04
172.8	32.6	0.02	412.8	142.6	0.04
177.6	35.3	0.02	417.6	142.3	0.04
182.4	38.2	0.02	422.4	142.0	0.04
187.2	41.3	0.02	427.2	141.6	0.04
192.0	44.6	0.02	432.0	141.2	0.04
196.8	48.0	0.02	436.8	140.8	0.04
201.6	51.6	0.03	441.6	140.3	0.04
206.4	55.2	0.03	446.4	139.8	0.04
211.2	59.0	0.03	451.2	139.3	0.04
216.0	63.0	0.03	456.0	138.8	0.04
220.8	67.0	0.03	460.8	138.3	0.04
225.6	71.1	0.03	465.6	137.8	0.04
230.4	75.2	0.03	470.4	137.2	0.04
235.2	79.3	0.03	475.2	136.7	0.04
240.0	83.5	0.03	480.0	136.1	0.04

Using the Get Max button causes the program to step through a series of storm durations until a maximum volume is obtained.
Each duration is sampled 600 times and the results recorded. The storm durations (hrs) are:-

0.25, 0.5, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 18, 20, 24, 30, 36, 42, 48, 54, 60, 66, 72, 84, 96, 120, 150, 175, 200, 250, 300, 375, 500, 750, 1000, 1250, 1500, 1570, 2000, 2500, 3000, 3500, 4000

It should be noted that the six hour storm frequently requested rarely demonstrates the worst case for storage.

Ian Harban Consulting Engineers
http://www.ianharban.com
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	217060
Sheet no.	4
Date	28/06/18

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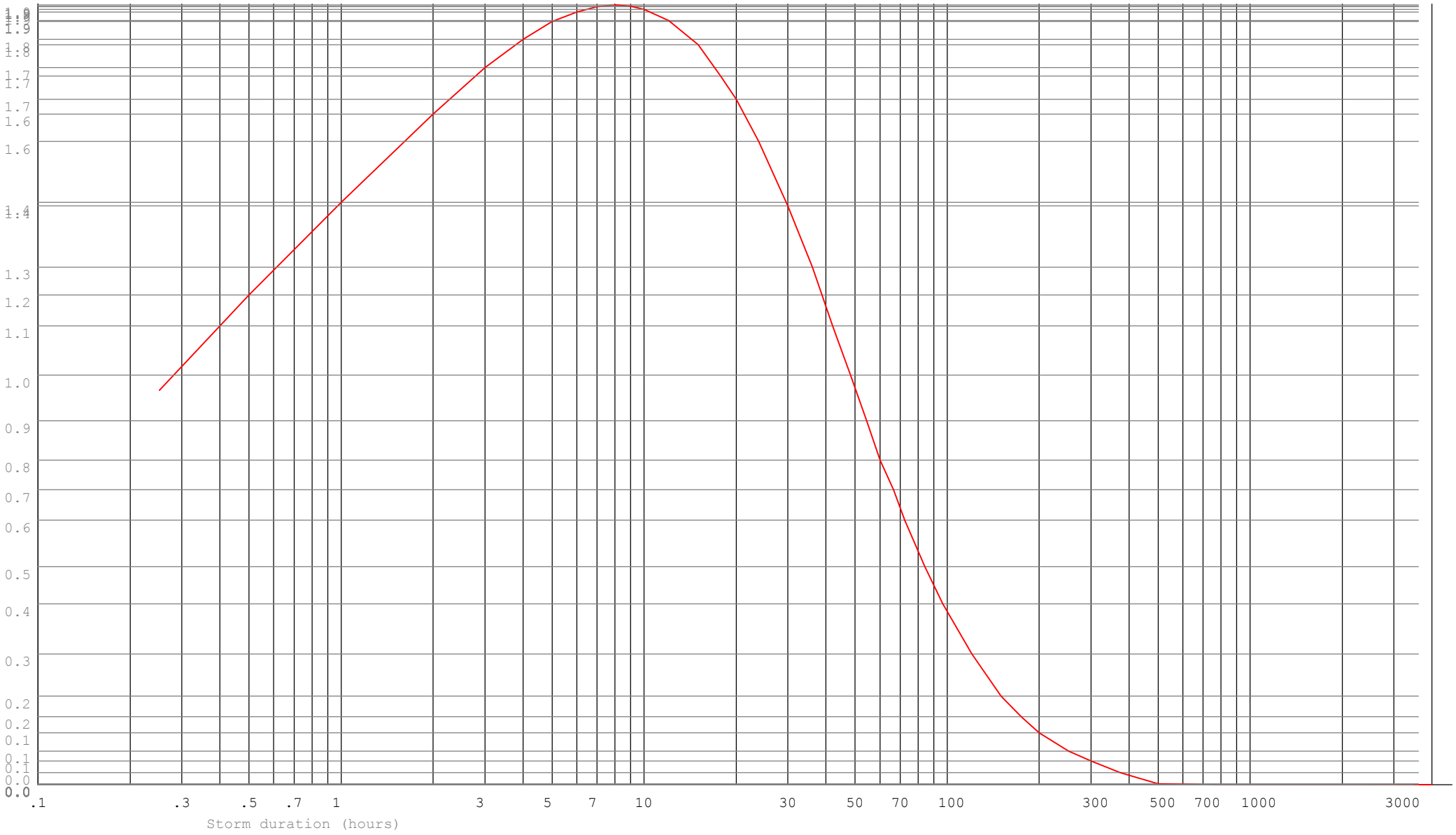
Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: **Hydrograph storage analysis (Winter profile) for Belmont Street**

Sequential storage volume at specific storm durations.



Storage Analysis 1 in 100 Year Storm (whole site)

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Ian Harban Consulting Engineers
http://www.ianharban.com

Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	217060
Sheet no.	1
Date	28/06/18

Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: **Hydrograph storage analysis (Winter profile) for Belmont Street**

Data:-

Location = Belmont Street
M5-60 (mm) = 21
Soil index = 0.45
Return period = 100
UCWI = 0.0

Grid reference = TQ2884
r = 0.44
SAAR (mm/yr) = 645
WRAP = 4
Climate change = +0%

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Percentage runoff = 79.0% calculated from:-

Percentage runoff = (0.829*PIMP)+(25*SOIL)+(0.078*UCWI)-20.7

where

PIMP = ImpervArea*100/(ImpervArea+PervArea) = 0.0

UCWI = Calculated value for Wetness Index = 0.0

Imperv. area = 125 m²
Total area = 125 m²
Total runoff = 6.4 m³

Pervious area = 0 m²
Equiv area = 99 m² (Tot. area x % runoff).
Discharge rate = 0.115 l/s

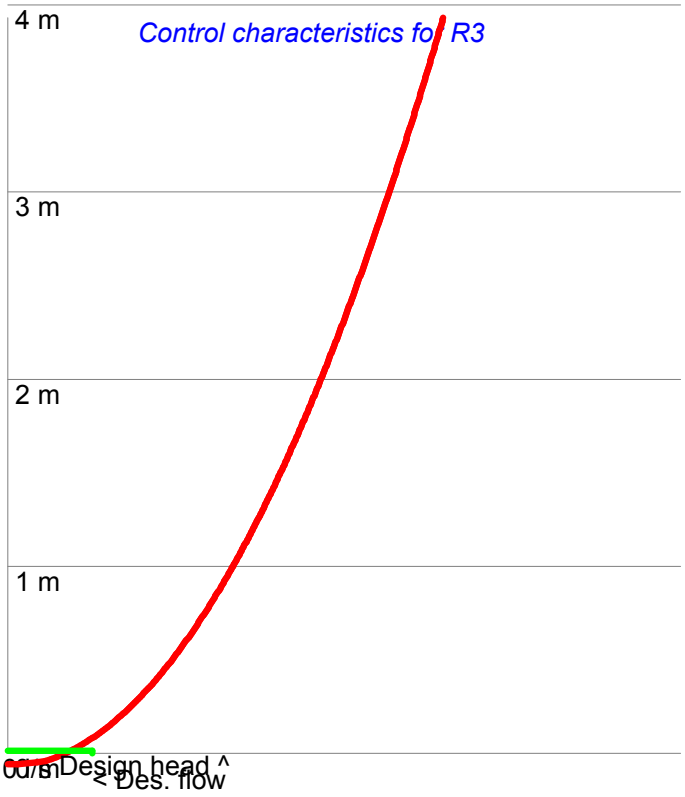
Design Head = 0.15m
Control device = R3
Max. calc. depth = 0.15 m

Peak flow = 0.11 l/s
Orifice diam = 15.2 mm
Available depth = 0.0 m³

Pipeline storage = 0.0 m³
Offline storage = 0.0 m³
Total storage = 5.0 m³

Available MH storage = 0.0 m³

Peak input flow =0.63 l/s



Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.01	0.01	2.01	0.42
0.05	0.07	2.05	0.43
0.10	0.09	2.10	0.43
0.15	0.12	2.15	0.44
0.20	0.13	2.20	0.44
0.25	0.15	2.25	0.45
0.30	0.16	2.30	0.45
0.35	0.18	2.35	0.46
0.40	0.19	2.40	0.46
0.45	0.20	2.45	0.46
0.50	0.21	2.50	0.47
0.55	0.22	2.55	0.47
0.60	0.23	2.60	0.48
0.65	0.24	2.65	0.48
0.70	0.25	2.70	0.49
0.75	0.26	2.75	0.49
0.80	0.27	2.80	0.50
0.85	0.27	2.85	0.50
0.90	0.28	2.90	0.51
0.95	0.29	2.95	0.51
1.00	0.30	3.00	0.51
1.05	0.30	3.05	0.52
1.10	0.31	3.10	0.52
1.15	0.32	3.15	0.53
1.20	0.33	3.20	0.53
1.25	0.33	3.25	0.54
1.30	0.34	3.30	0.54
1.35	0.34	3.35	0.54
1.40	0.35	3.40	0.55
1.45	0.36	3.45	0.55
1.50	0.36	3.50	0.56
1.55	0.37	3.55	0.56
1.60	0.38	3.60	0.56
1.65	0.38	3.65	0.57
1.70	0.39	3.70	0.57
1.75	0.39	3.75	0.57
1.80	0.40	3.80	0.58
1.85	0.40	3.85	0.58
1.90	0.41	3.90	0.59
1.95	0.41	3.95	0.59
2.00	0.42	4.00	0.59

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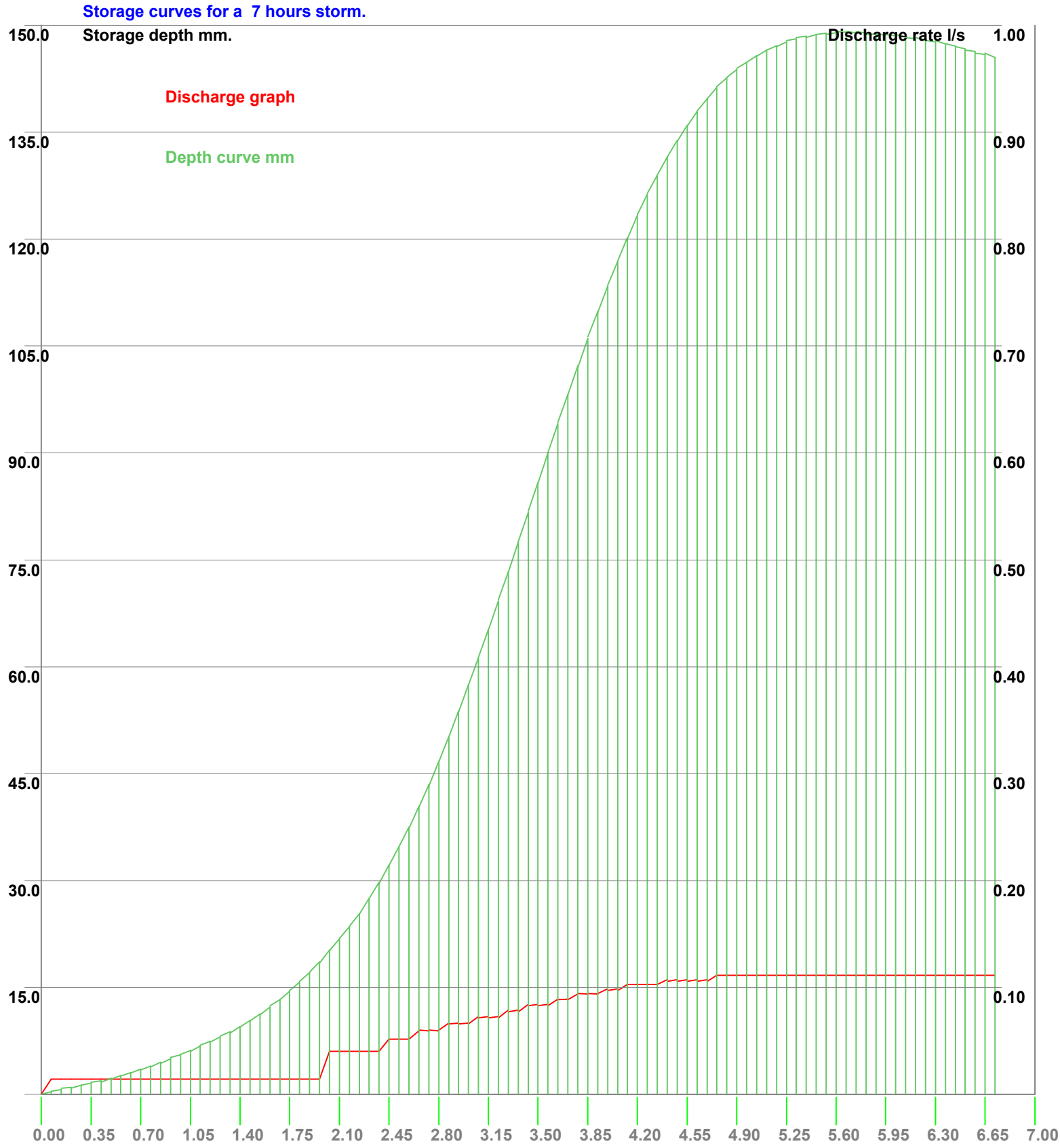
Ian Harban Consulting Engineers
http://www.ianharban.com

Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No. 217060			
Sheet no. 2			
Date 28/06/18			
Project 10a Belmont Street NW1 8HJ	By	Checked	Reviewed
Title Hydrograph storage analysis (Winter profile) for Belmont Street			



Ian Harban Consulting Engineers
http://www.ianharban.com
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	Sheet no.	Date
217060	3	28/06/18

Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: Hydrograph storage analysis (Winter profile) for Belmont Street

Incremental rainfall figures.

Storm Mins	Storage Depth mm	Control Flow l/s	Storm Mins	Storage Depth mm	Control Flow l/s
4.2	0.4	0.01	214.2	90.0	0.08
8.4	0.7	0.01	218.4	94.1	0.09
12.6	1.0	0.01	222.6	98.2	0.09
16.8	1.2	0.01	226.8	102.2	0.09
21.0	1.6	0.01	231.0	106.1	0.09
25.2	1.9	0.01	235.2	109.8	0.09
29.4	2.2	0.01	239.4	113.4	0.10
33.6	2.6	0.01	243.6	116.9	0.10
37.8	3.0	0.01	247.8	120.2	0.10
42.0	3.5	0.01	252.0	123.3	0.10
46.2	4.0	0.01	256.2	126.3	0.10
50.4	4.5	0.01	260.4	129.0	0.10
54.6	5.0	0.01	264.6	131.5	0.11
58.8	5.6	0.01	268.8	133.9	0.11
63.0	6.1	0.01	273.0	136.0	0.11
67.2	6.8	0.01	277.2	137.9	0.11
71.4	7.4	0.01	281.4	139.7	0.11
75.6	8.1	0.01	285.6	141.3	0.11
79.8	8.8	0.01	289.8	142.7	0.11
84.0	9.5	0.01	294.0	143.8	0.11
88.2	10.3	0.01	298.2	144.9	0.11
92.4	11.2	0.01	302.4	145.8	0.11
96.6	12.2	0.01	306.6	146.5	0.11
100.8	13.3	0.01	310.8	147.2	0.11
105.0	14.5	0.01	315.0	147.7	0.11
109.2	15.7	0.01	319.2	148.1	0.11
113.4	17.1	0.01	323.4	148.5	0.11
117.6	18.6	0.01	327.6	148.7	0.11
121.8	20.2	0.04	331.8	148.9	0.11
126.0	21.8	0.04	336.0	149.0	0.11
130.2	23.5	0.04	340.2	149.0	0.11
134.4	25.4	0.04	344.4	149.0	0.11
138.6	27.5	0.04	348.6	148.9	0.11
142.8	29.7	0.04	352.8	148.8	0.11
147.0	32.2	0.05	357.0	148.7	0.11
151.2	34.7	0.05	361.2	148.5	0.11
155.4	37.5	0.05	365.4	148.4	0.11
159.6	40.4	0.06	369.6	148.2	0.11
163.8	43.5	0.06	373.8	147.9	0.11
168.0	46.7	0.06	378.0	147.7	0.11
172.2	50.2	0.07	382.2	147.4	0.11
176.4	53.8	0.07	386.4	147.1	0.11
180.6	57.5	0.07	390.6	146.7	0.11
184.8	61.3	0.07	394.8	146.3	0.11
189.0	65.2	0.07	399.0	145.9	0.11
193.2	69.2	0.07	403.2	145.5	0.11
197.4	73.4	0.08	407.4	145.1	0.11
201.6	77.5	0.08	411.6	144.7	0.11
205.8	81.7	0.08	415.8	144.2	0.11
210.0	85.8	0.08	420.0	143.7	0.11

Using the Get Max button causes the program to step through a series of storm durations until a maximum volume is obtained.
Each duration is sampled 600 times and the results recorded. The storm durations (hrs) are:-

0.25, 0.5, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 18, 20, 24, 30, 36, 42, 48, 54, 60, 66, 72, 84, 96, 120, 150, 175, 200, 250, 300, 375, 500, 750, 1000, 1250, 1500, 1570, 2000, 2500, 3000, 3500, 4000

It should be noted that the six hour storm frequently requested rarely demonstrates the worst case for storage.

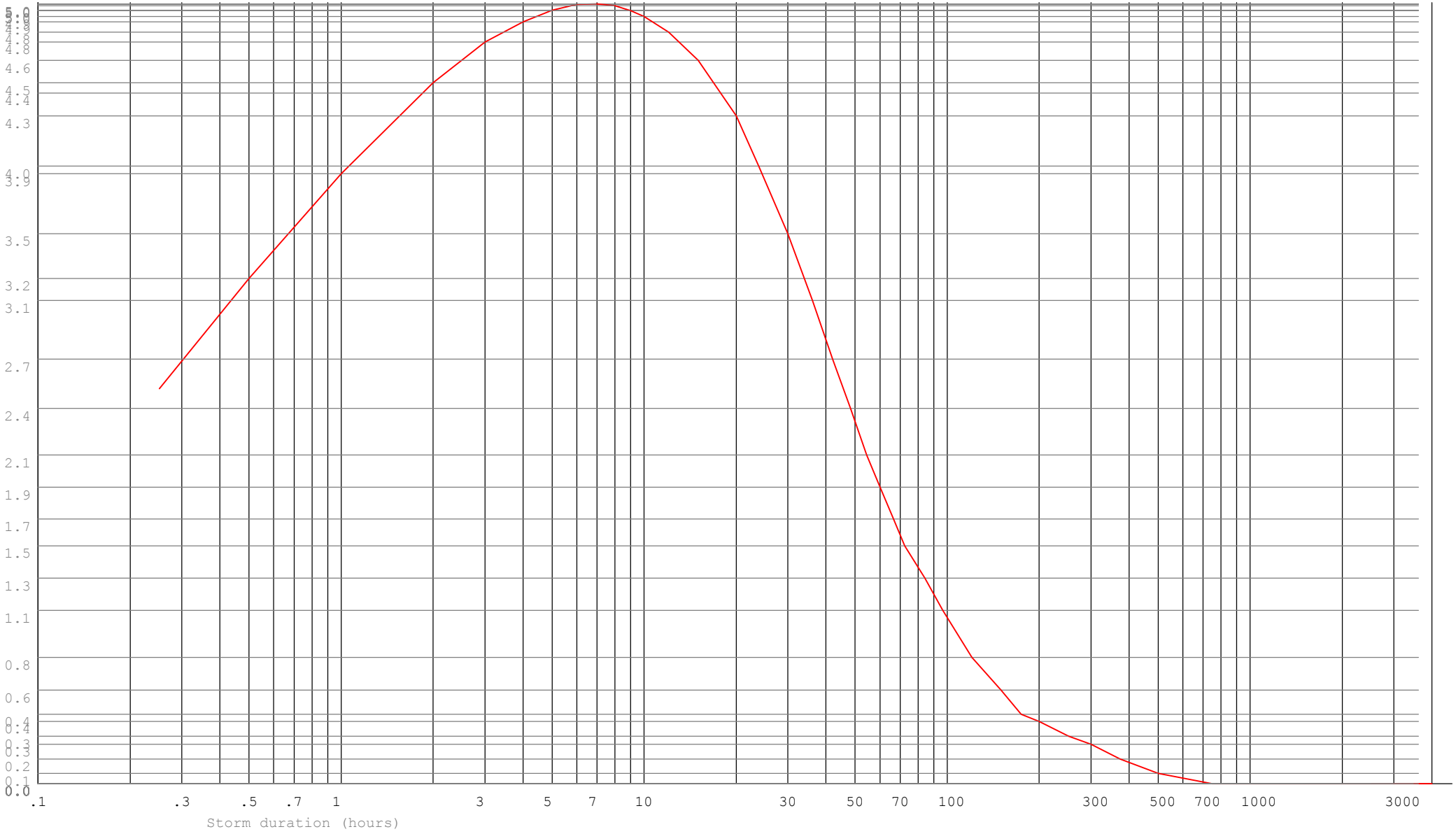
Ian Harban Consulting Engineers
http://www.ianharban.com
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	217060
Sheet no.	4
Date	28/06/18

MasterDrain SW

Project	10a Belmont Street NW1 8HJ	By	Checked / Reviewed
Title	Hydrograph storage analysis (Winter profile) for Belmont Street		

Sequential storage volume at specific storm durations.



Storage Analysis 1 in 100 Year + CC Storm (whole site)

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Ian Harban Consulting Engineers
http://www.ianharban.com

Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	217060
Sheet no.	1
Date	28/06/18

Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: **Hydrograph storage analysis (Winter profile) for Belmont Street**

Data:-

Location = Belmont Street
M5-60 (mm) = 21
Soil index = 0.45
Return period = 100
UCWI = 0.0

Grid reference = TQ2884
r = 0.44
SAAR (mm/yr) = 645
WRAP = 4
Climate change = +30%

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Percentage runoff = 79.0% calculated from:-

Percentage runoff = (0.829*PIMP)+(25*SOIL)+(0.078*UCWI)-20.7

where

PIMP = ImpervArea*100/(ImpervArea+PervArea) = 0.0

UCWI = Calculated value for Wetness Index = 0.0

Imperv. area = 125 m²
Total area = 125 m²
Total runoff = 8.3 m³

Pervious area = 0 m²
Equiv area = 99 m² (Tot. area x % runoff).
Discharge rate = 0.150 l/s

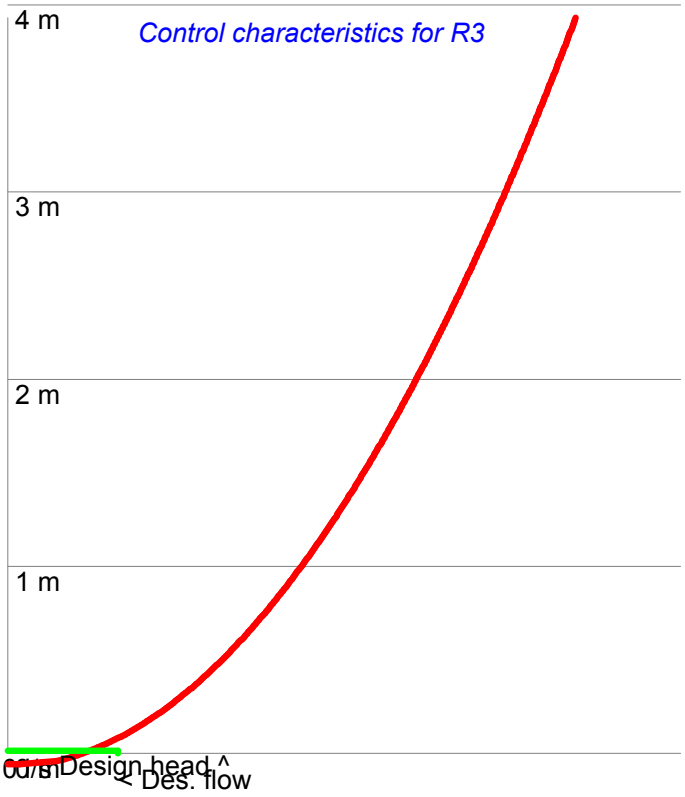
Design Head = 0.15m
Control device = R3
Max. calc. depth = 0.15 m

Peak flow = 0.14 l/s
Orifice diam = 17.4 mm
Available depth = 0.0 m³

Pipeline storage = 0.0 m³
Offline storage = 0.0 m³
Total storage = 6.5 m³

Available MH storage = 0.0 m³

Peak input flow =0.82 l/s



Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.01	0.02	2.01	0.55
0.05	0.09	2.05	0.55
0.10	0.12	2.10	0.56
0.15	0.15	2.15	0.57
0.20	0.17	2.20	0.57
0.25	0.19	2.25	0.58
0.30	0.21	2.30	0.59
0.35	0.23	2.35	0.59
0.40	0.24	2.40	0.60
0.45	0.26	2.45	0.61
0.50	0.27	2.50	0.61
0.55	0.29	2.55	0.62
0.60	0.30	2.60	0.62
0.65	0.31	2.65	0.63
0.70	0.32	2.70	0.64
0.75	0.34	2.75	0.64
0.80	0.35	2.80	0.65
0.85	0.36	2.85	0.65
0.90	0.37	2.90	0.66
0.95	0.38	2.95	0.67
1.00	0.39	3.00	0.67
1.05	0.40	3.05	0.68
1.10	0.41	3.10	0.68
1.15	0.42	3.15	0.69
1.20	0.42	3.20	0.69
1.25	0.43	3.25	0.70
1.30	0.44	3.30	0.70
1.35	0.45	3.35	0.71
1.40	0.46	3.40	0.71
1.45	0.47	3.45	0.72
1.50	0.47	3.50	0.72
1.55	0.48	3.55	0.73
1.60	0.49	3.60	0.73
1.65	0.50	3.65	0.74
1.70	0.50	3.70	0.74
1.75	0.51	3.75	0.75
1.80	0.52	3.80	0.75
1.85	0.53	3.85	0.76
1.90	0.53	3.90	0.76
1.95	0.54	3.95	0.77
2.00	0.55	4.00	0.77

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Ian Harban Consulting Engineers
http://www.ianharban.com

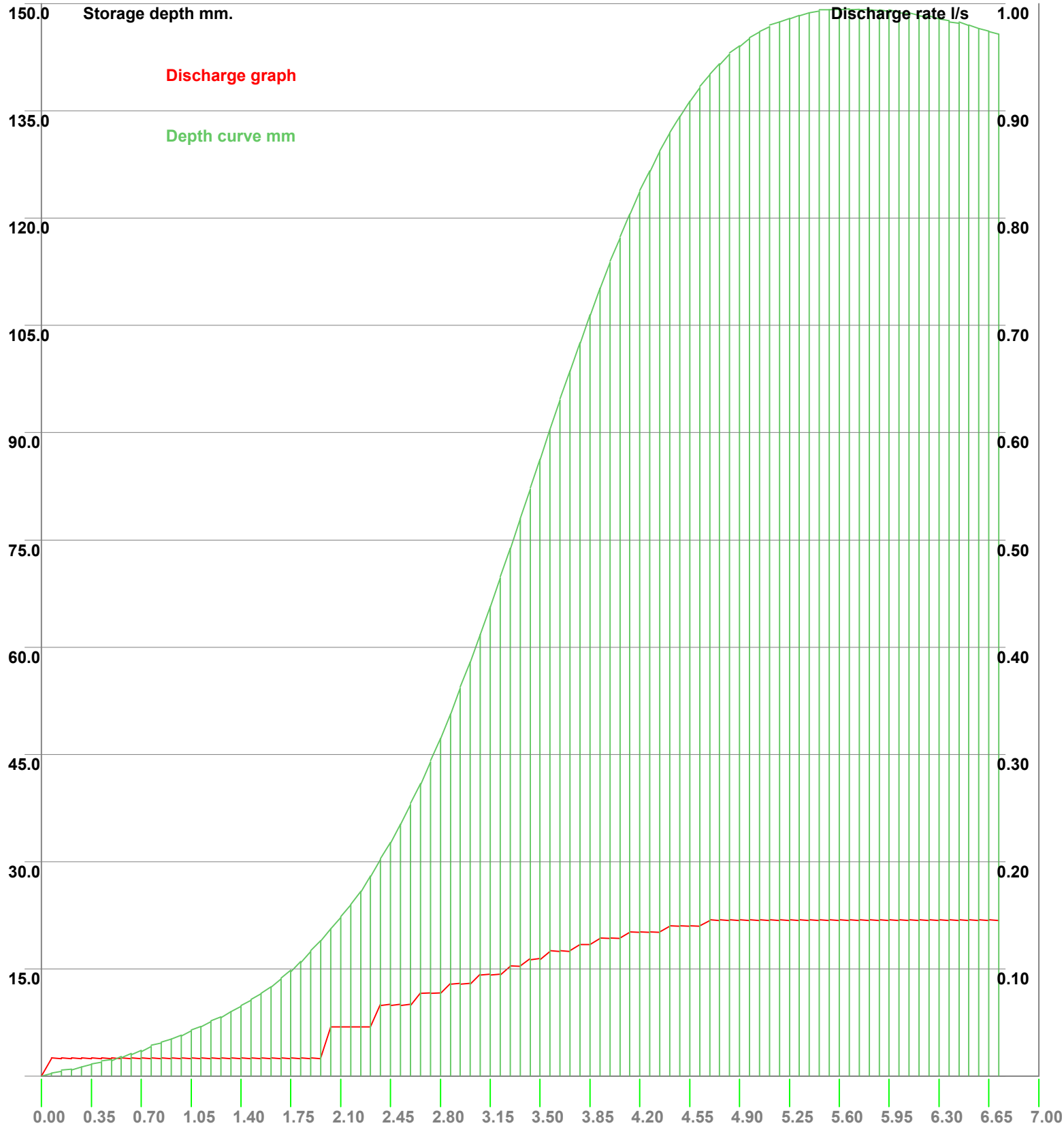
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	217060
Sheet no.	2
Date	28/06/18

Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: **Hydrograph storage analysis (Winter profile) for Belmont Street**

Storage curves for a 7 hours storm.



Ian Harban Consulting Engineers
http://www.ianharban.com
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	Sheet no.	Date	By	Checked	Reviewed
217060	3	28/06/18			

Project: 10a Belmont Street NW1 8HJ

Title: Hydrograph storage analysis (Winter profile) for Belmont Street

Incremental rainfall figures.

Storm Mins	Storage Depth mm	Control Flow l/s	Storm Mins	Storage Depth mm	Control Flow l/s
4.2	0.4	0.02	214.2	90.4	0.12
8.4	0.7	0.02	218.4	94.5	0.12
12.6	1.0	0.02	222.6	98.6	0.12
16.8	1.3	0.02	226.8	102.6	0.12
21.0	1.6	0.02	231.0	106.5	0.12
25.2	2.0	0.02	235.2	110.2	0.13
29.4	2.3	0.02	239.4	113.8	0.13
33.6	2.7	0.02	243.6	117.2	0.13
37.8	3.2	0.02	247.8	120.6	0.13
42.0	3.6	0.02	252.0	123.7	0.13
46.2	4.1	0.02	256.2	126.6	0.13
50.4	4.6	0.02	260.4	129.3	0.13
54.6	5.2	0.02	264.6	131.9	0.14
58.8	5.7	0.02	268.8	134.2	0.14
63.0	6.3	0.02	273.0	136.3	0.14
67.2	7.0	0.02	277.2	138.3	0.14
71.4	7.6	0.02	281.4	140.1	0.14
75.6	8.3	0.02	285.6	141.6	0.14
79.8	9.0	0.02	289.8	142.9	0.14
84.0	9.8	0.02	294.0	144.1	0.14
88.2	10.6	0.02	298.2	145.1	0.14
92.4	11.5	0.02	302.4	146.0	0.14
96.6	12.5	0.02	306.6	146.8	0.14
100.8	13.6	0.02	310.8	147.4	0.14
105.0	14.8	0.02	315.0	148.0	0.14
109.2	16.0	0.02	319.2	148.4	0.14
113.4	17.4	0.02	323.4	148.7	0.14
117.6	18.9	0.02	327.6	149.0	0.14
121.8	20.6	0.05	331.8	149.2	0.14
126.0	22.2	0.05	336.0	149.2	0.14
130.2	23.9	0.05	340.2	149.3	0.14
134.4	25.9	0.05	344.4	149.2	0.14
138.6	28.0	0.05	348.6	149.2	0.14
142.8	30.3	0.07	352.8	149.1	0.14
147.0	32.7	0.07	357.0	148.9	0.14
151.2	35.2	0.07	361.2	148.8	0.14
155.4	38.0	0.07	365.4	148.6	0.14
159.6	40.9	0.08	369.6	148.4	0.14
163.8	43.9	0.08	373.8	148.2	0.14
168.0	47.2	0.08	378.0	147.9	0.14
172.2	50.7	0.09	382.2	147.6	0.14
176.4	54.2	0.09	386.4	147.3	0.14
180.6	57.9	0.09	390.6	147.0	0.14
184.8	61.7	0.09	394.8	146.6	0.14
189.0	65.6	0.09	399.0	146.2	0.14
193.2	69.7	0.09	403.2	145.7	0.14
197.4	73.8	0.10	407.4	145.3	0.14
201.6	78.0	0.10	411.6	144.9	0.14
205.8	82.1	0.11	415.8	144.4	0.14
210.0	86.3	0.11	420.0	143.9	0.14

Using the Get Max button causes the program to step through a series of storm durations until a maximum volume is obtained.
Each duration is sampled 600 times and the results recorded. The storm durations (hrs) are:-

0.25, 0.5, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 18, 20, 24, 30, 36, 42, 48, 54, 60, 66, 72, 84, 96, 120, 150, 175, 200, 250, 300, 375, 500, 750, 1000, 1250, 1500, 1570, 2000, 2500, 3000, 3500, 4000

It should be noted that the six hour storm frequently requested rarely demonstrates the worst case for storage.

Ian Harban Consulting Engineers
http://www.ianharban.com
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	217060
Sheet no.	4
Date	28/06/18

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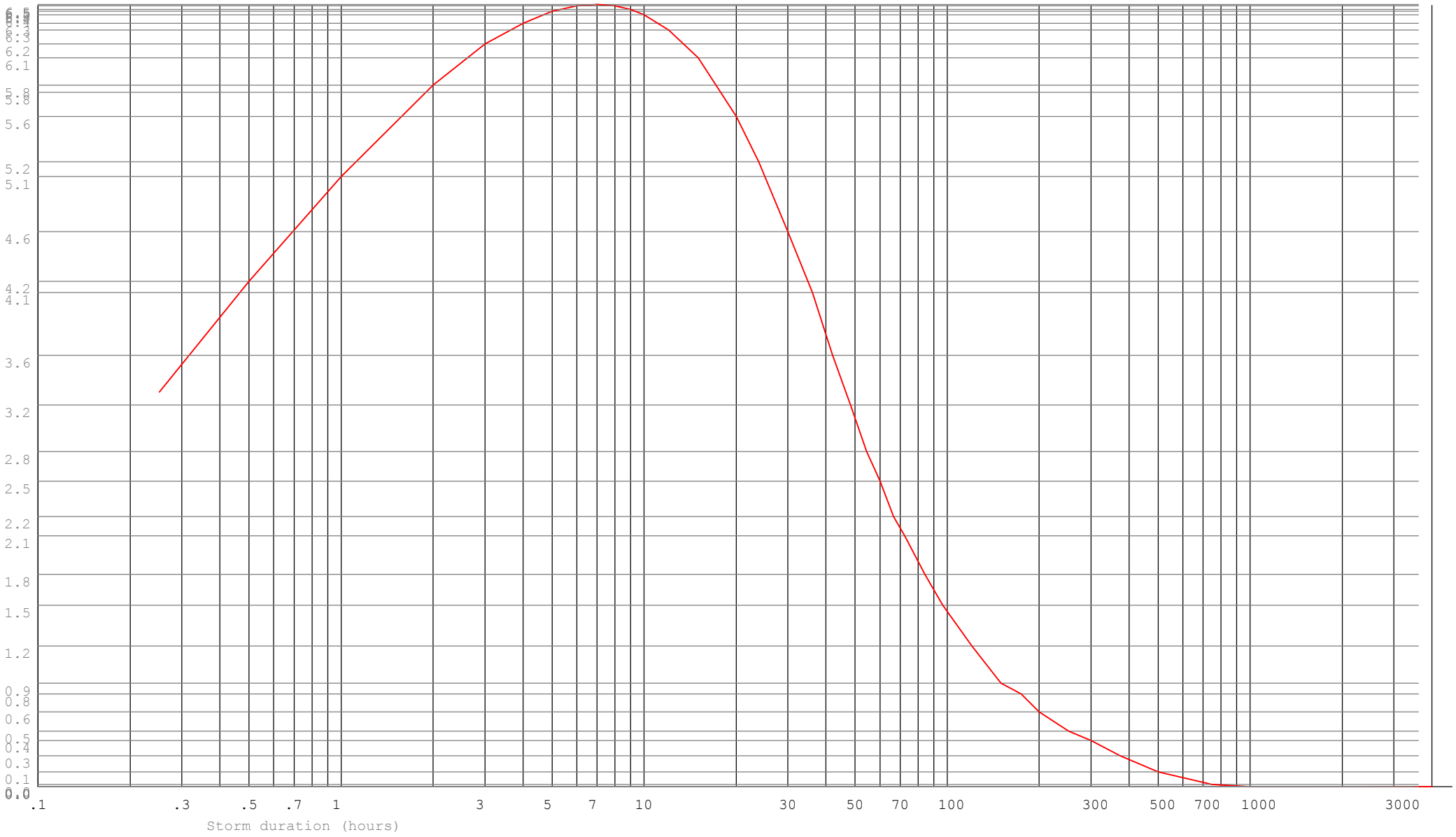
Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: **Hydrograph storage analysis (Winter profile) for Belmont Street**

Sequential storage volume at specific storm durations.



Storage Analysis 1 in 100 Year + CC Storm (Blue Roof 1)

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Ian Harban Consulting Engineers
http://www.ianharban.com
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	217060		
Sheet no.	1		
Date	28/06/18		
Project	10a Belmont Street NW1 8HJ	By	Checked / Reviewed
Title	Hydrograph storage analysis (Winter profile) for Belmont Street		

Data:-

Location = Belmont Street
M5-60 (mm) = 21
Soil index = 0.45
Return period = 100
UCWI = 0.0

Grid reference = TQ2884
r = 0.44
SAAR (mm/yr) = 645
WRAP = 4
Climate change = +30%

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Percentage runoff = 79.0% calculated from:-

Percentage runoff = (0.829*PIMP)+(25*SOIL)+(0.078*UCWI)-20.7

where

PIMP = ImpervArea*100/(ImpervArea+PervArea) = 0.0

UCWI = Calculated value for Wetness Index = 0.0

Imperv. area = 11 m²
Total area = 11 m²
Total runoff = 0.9 m³

Pervious area = 0 m²
Equiv area = 9 m² (Tot. area x % runoff).
Discharge rate = 0.005 l/s

Design Head = 0.15m
Control device = R3
Max. calc. depth = 0.15 m

Peak flow = 1.00 l/s
Orifice diam = 3.2 mm
Available depth = 0.0 m³

Pipeline storage = 0.0 m³
Offline storage = 0.0 m³
Total storage = 0.7 m³

Available MH storage = 0.0 m³

Peak input flow =0.03 l/s

Control characteristics for R3

Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.01	0.00	2.01	0.02
0.05	0.00	2.05	0.02
0.10	0.00	2.10	0.02
0.15	0.00	2.15	0.02
0.20	0.01	2.20	0.02
0.25	0.01	2.25	0.02
0.30	0.01	2.30	0.02
0.35	0.01	2.35	0.02
0.40	0.01	2.40	0.02
0.45	0.01	2.45	0.02
0.50	0.01	2.50	0.02
0.55	0.01	2.55	0.02
0.60	0.01	2.60	0.02
0.65	0.01	2.65	0.02
0.70	0.01	2.70	0.02
0.75	0.01	2.75	0.02
0.80	0.01	2.80	0.02
0.85	0.01	2.85	0.02
0.90	0.01	2.90	0.02
0.95	0.01	2.95	0.02
1.00	0.01	3.00	0.02
1.05	0.01	3.05	0.02
1.10	0.01	3.10	0.02
1.15	0.01	3.15	0.02
1.20	0.01	3.20	0.02
1.25	0.01	3.25	0.02
1.30	0.01	3.30	0.02
1.35	0.01	3.35	0.02
1.40	0.02	3.40	0.02
1.45	0.02	3.45	0.02
1.50	0.02	3.50	0.02
1.55	0.02	3.55	0.02
1.60	0.02	3.60	0.02
1.65	0.02	3.65	0.02
1.70	0.02	3.70	0.02
1.75	0.02	3.75	0.02
1.80	0.02	3.80	0.03
1.85	0.02	3.85	0.03
1.90	0.02	3.90	0.03
1.95	0.02	3.95	0.03
2.00	0.02	4.00	0.03

MasterDrain SW

Ian Harban Consulting Engineers
http://www.ianharban.com

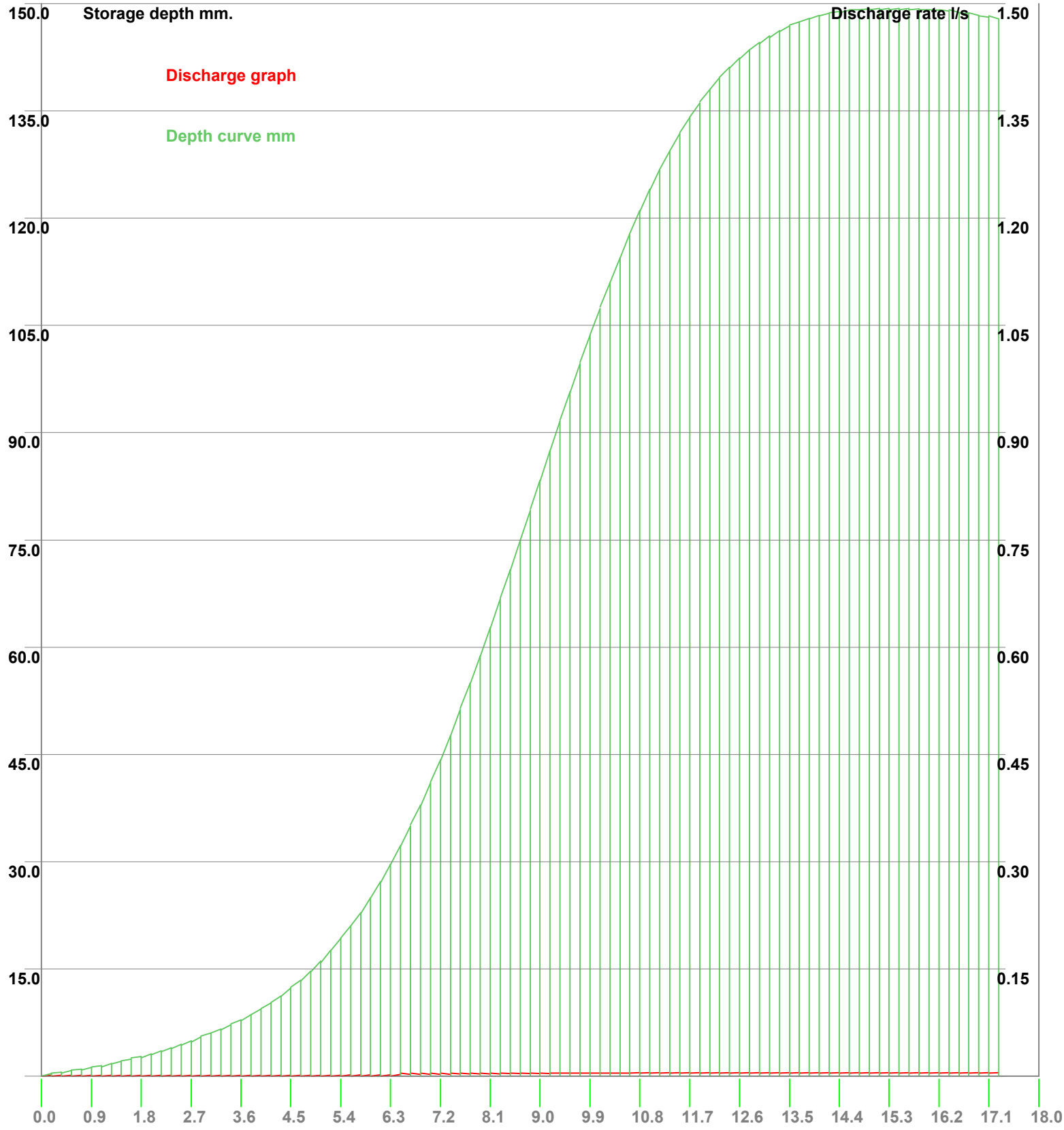
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	217060
Sheet no.	2
Date	28/06/18

Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: **Hydrograph storage analysis (Winter profile) for Belmont Street**

Storage curves for a 18 hours storm.



Ian Harban Consulting Engineers
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Job No.	Sheet no.	Date
217060	3	28/06/18

Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: Hydrograph storage analysis (Winter profile) for Belmont Street

Incremental rainfall figures.

Storm Mins	Storage Depth mm	Control Flow l/s	Storm Mins	Storage Depth mm	Control Flow l/s
10.8	0.4	0.00	550.8	87.5	0.00
21.6	0.6	0.00	561.6	91.6	0.00
32.4	0.8	0.00	572.4	95.7	0.00
43.2	1.0	0.00	583.2	99.7	0.00
54.0	1.2	0.00	594.0	103.6	0.00
64.8	1.5	0.00	604.8	107.4	0.00
75.6	1.7	0.00	615.6	111.0	0.00
86.4	2.0	0.00	626.4	114.5	0.00
97.2	2.4	0.00	637.2	117.9	0.00
108.0	2.7	0.00	648.0	121.1	0.00
118.8	3.1	0.00	658.8	124.1	0.00
129.6	3.5	0.00	669.6	126.8	0.00
140.4	4.0	0.00	680.4	129.4	0.00
151.2	4.4	0.00	691.2	131.9	0.00
162.0	4.9	0.00	702.0	134.1	0.00
172.8	5.5	0.00	712.8	136.1	0.00
183.6	6.0	0.00	723.6	138.0	0.00
194.4	6.6	0.00	734.4	139.7	0.00
205.2	7.2	0.00	745.2	141.1	0.00
216.0	7.8	0.00	756.0	142.4	0.00
226.8	8.6	0.00	766.8	143.6	0.00
237.6	9.4	0.00	777.6	144.6	0.00
248.4	10.3	0.00	788.4	145.5	0.00
259.2	11.2	0.00	799.2	146.3	0.00
270.0	12.3	0.00	810.0	146.9	0.00
280.8	13.4	0.00	820.8	147.5	0.00
291.6	14.7	0.00	831.6	148.0	0.00
302.4	16.1	0.00	842.4	148.3	0.00
313.2	17.6	0.00	853.2	148.7	0.00
324.0	19.2	0.00	864.0	148.9	0.00
334.8	21.0	0.00	874.8	149.1	0.00
345.6	22.9	0.00	885.6	149.2	0.00
356.4	24.9	0.00	896.4	149.3	0.00
367.2	27.2	0.00	907.2	149.3	0.00
378.0	29.6	0.00	918.0	149.4	0.00
388.8	32.2	0.00	928.8	149.4	0.00
399.6	35.0	0.00	939.6	149.3	0.00
410.4	37.9	0.00	950.4	149.3	0.00
421.2	41.0	0.00	961.2	149.2	0.00
432.0	44.2	0.00	972.0	149.1	0.00
442.8	47.7	0.00	982.8	149.0	0.00
453.6	51.3	0.00	993.6	148.8	0.00
464.4	55.0	0.00	1004.4	148.6	0.00
475.2	58.8	0.00	1015.2	148.4	0.00
486.0	62.7	0.00	1026.0	148.1	0.00
496.8	66.7	0.00	1036.8	147.9	0.00
507.6	70.8	0.00	1047.6	147.6	0.00
518.4	75.0	0.00	1058.4	147.3	0.00
529.2	79.1	0.00	1069.2	147.0	0.00
540.0	83.3	0.00	1080.0	146.7	0.00

Using the Get Max button causes the program to step through a series of storm durations until a maximum volume is obtained.
Each duration is sampled 600 times and the results recorded. The storm durations (hrs) are:-

0.25, 0.5, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 18, 20, 24, 30, 36, 42, 48, 54, 60, 66, 72, 84, 96, 120, 150, 175, 200, 250, 300, 375, 500, 750, 1000, 1250, 1500, 1570, 2000, 2500, 3000, 3500, 4000

It should be noted that the six hour storm frequently requested rarely demonstrates the worst case for storage.

Ian Harban Consulting Engineers
http://www.ianharban.com
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

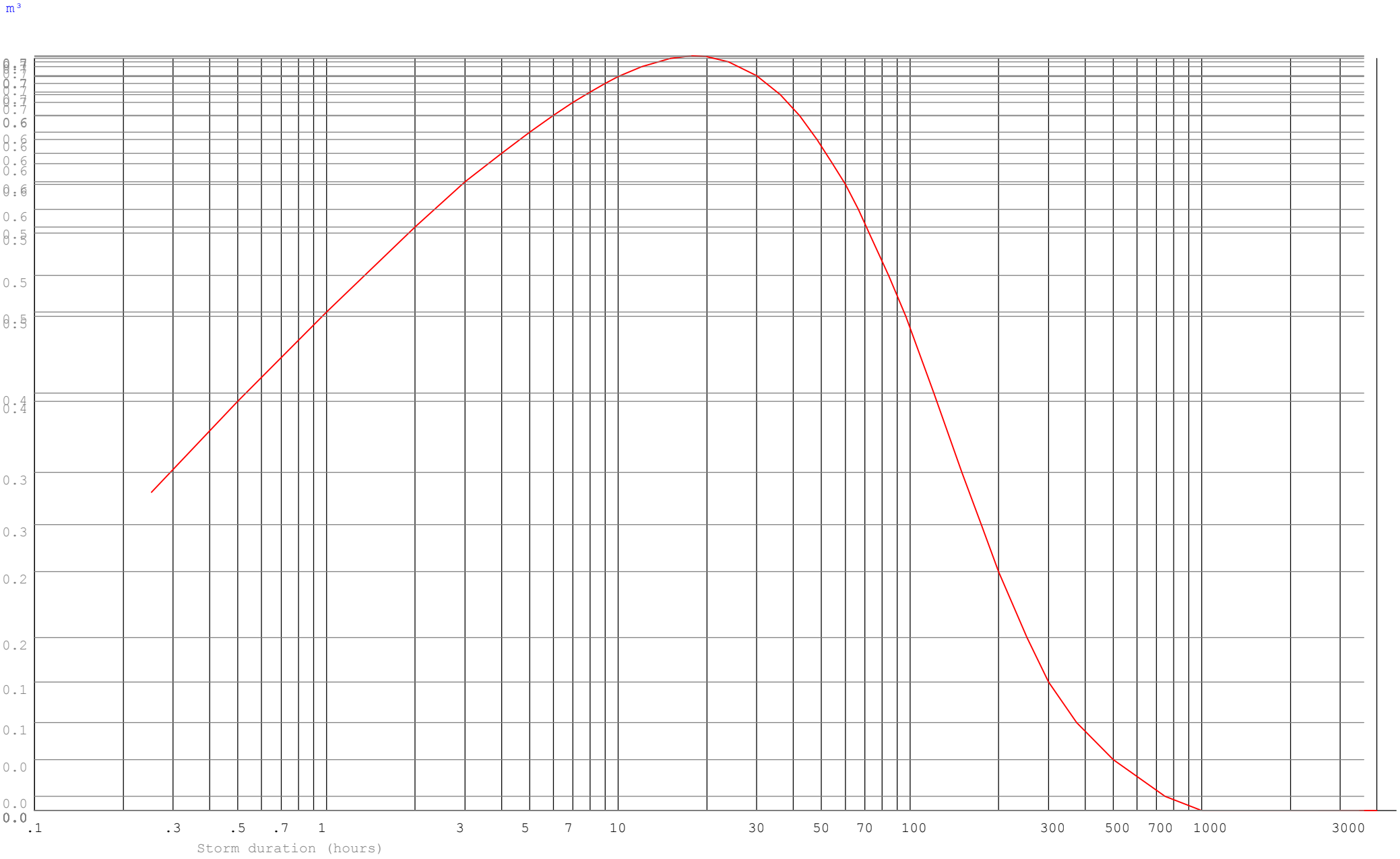
Job No.	Sheet no.	Date
217060	4	28/06/18

MasterDrain SW

Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: **Hydrograph storage analysis (Winter profile) for Belmont Street**

Sequential storage volume at specific storm durations.



Storage Analysis 1 in 100 Year + CC Storm (Blue Roof 2 and 4)

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Ian Harban Consulting Engineers
http://www.ianharban.com

Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	217060
Sheet no.	1
Date	28/06/18

Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: **Hydrograph storage analysis (Winter profile) for Belmont Street**

Data:-

Location = Belmont Street
M5-60 (mm) = 21
Soil index = 0.45
Return period = 100
UCWI = 0.0

Grid reference = TQ2884
r = 0.44
SAAR (mm/yr) = 645
WRAP = 4
Climate change = +30%

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Percentage runoff = 79.0% calculated from:-

Percentage runoff = (0.829*PIMP)+(25*SOIL)+(0.078*UCWI)-20.7

where

PIMP = ImpervArea*100/(ImpervArea+PervArea) = 0.0

UCWI = Calculated value for Wetness Index = 0.0

Imperv. area = 28 m²
Total area = 28 m²
Total runoff = 2.1 m³

Pervious area = 0 m²
Equiv area = 22 m² (Tot. area x % runoff).
Discharge rate = 0.015 l/s

Design Head = 0.15m
Control device = R3
Max. calc. depth = 0.14 m

Peak flow = 0.01 l/s
Orifice diam = 5.5 mm
Available depth = 0.0 m³

Pipeline storage = 0.0 m³
Offline storage = 0.0 m³
Total storage = 1.8 m³

Available MH storage = 0.0 m³

Peak input flow =0.10 l/s

Control characteristics for R3

Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.01	0.00	2.01	0.05
0.05	0.01	2.05	0.06
0.10	0.01	2.10	0.06
0.15	0.01	2.15	0.06
0.20	0.02	2.20	0.06
0.25	0.02	2.25	0.06
0.30	0.02	2.30	0.06
0.35	0.02	2.35	0.06
0.40	0.02	2.40	0.06
0.45	0.03	2.45	0.06
0.50	0.03	2.50	0.06
0.55	0.03	2.55	0.06
0.60	0.03	2.60	0.06
0.65	0.03	2.65	0.06
0.70	0.03	2.70	0.06
0.75	0.03	2.75	0.06
0.80	0.03	2.80	0.06
0.85	0.04	2.85	0.07
0.90	0.04	2.90	0.07
0.95	0.04	2.95	0.07
1.00	0.04	3.00	0.07
1.05	0.04	3.05	0.07
1.10	0.04	3.10	0.07
1.15	0.04	3.15	0.07
1.20	0.04	3.20	0.07
1.25	0.04	3.25	0.07
1.30	0.04	3.30	0.07
1.35	0.04	3.35	0.07
1.40	0.05	3.40	0.07
1.45	0.05	3.45	0.07
1.50	0.05	3.50	0.07
1.55	0.05	3.55	0.07
1.60	0.05	3.60	0.07
1.65	0.05	3.65	0.07
1.70	0.05	3.70	0.07
1.75	0.05	3.75	0.07
1.80	0.05	3.80	0.08
1.85	0.05	3.85	0.08
1.90	0.05	3.90	0.08
1.95	0.05	3.95	0.08
2.00	0.05	4.00	0.08

MasterDrain SW

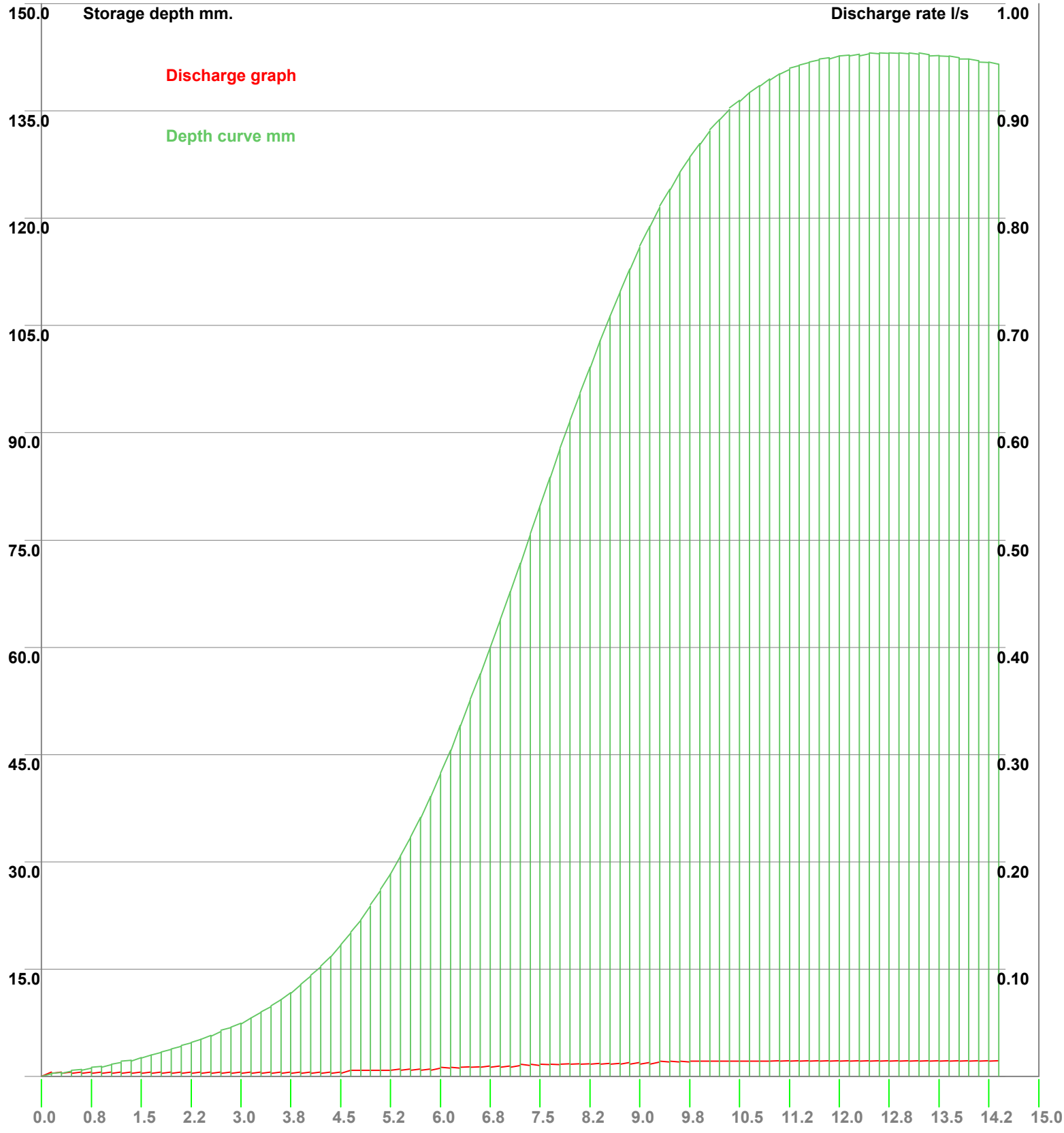
Ian Harban Consulting Engineers
http://www.ianharban.com

Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	217060
Sheet no.	2
Date	28/06/18
Project	10a Belmont Street NW1 8HJ
Title	Hydrograph storage analysis (Winter profile) for Belmont Street

By	Checked	Reviewed

Storage curves for a 15 hours storm.



Ian Harban Consulting Engineers
http://www.ianharban.com
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	Sheet no.	Date
217060	3	28/06/18

Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: Hydrograph storage analysis (Winter profile) for Belmont Street

Incremental rainfall figures.

Storm Mins	Storage Depth mm	Control Flow l/s	Storm Mins	Storage Depth mm	Control Flow l/s
9.0	0.4	0.00	459.0	83.7	0.01
18.0	0.5	0.00	468.0	87.7	0.01
27.0	0.7	0.00	477.0	91.6	0.01
36.0	0.9	0.00	486.0	95.5	0.01
45.0	1.2	0.00	495.0	99.2	0.01
54.0	1.4	0.00	504.0	102.8	0.01
63.0	1.6	0.00	513.0	106.3	0.01
72.0	1.9	0.00	522.0	109.7	0.01
81.0	2.2	0.00	531.0	112.9	0.01
90.0	2.6	0.00	540.0	116.0	0.01
99.0	3.0	0.00	549.0	118.9	0.01
108.0	3.4	0.00	558.0	121.5	0.01
117.0	3.8	0.00	567.0	124.0	0.01
126.0	4.2	0.00	576.0	126.3	0.01
135.0	4.7	0.00	585.0	128.5	0.01
144.0	5.2	0.00	594.0	130.4	0.01
153.0	5.7	0.00	603.0	132.2	0.01
162.0	6.2	0.00	612.0	133.8	0.01
171.0	6.8	0.00	621.0	135.2	0.01
180.0	7.4	0.00	630.0	136.5	0.01
189.0	8.1	0.00	639.0	137.6	0.01
198.0	8.9	0.00	648.0	138.6	0.01
207.0	9.8	0.00	657.0	139.5	0.01
216.0	10.7	0.00	666.0	140.2	0.01
225.0	11.7	0.00	675.0	140.8	0.01
234.0	12.8	0.00	684.0	141.3	0.01
243.0	14.0	0.00	693.0	141.8	0.01
252.0	15.3	0.00	702.0	142.2	0.01
261.0	16.8	0.00	711.0	142.5	0.01
270.0	18.3	0.00	720.0	142.7	0.01
279.0	20.0	0.01	729.0	142.8	0.01
288.0	21.8	0.01	738.0	142.9	0.01
297.0	23.8	0.01	747.0	143.0	0.01
306.0	26.0	0.01	756.0	143.0	0.01
315.0	28.3	0.01	765.0	143.1	0.01
324.0	30.8	0.01	774.0	143.0	0.01
333.0	33.4	0.01	783.0	143.0	0.01
342.0	36.2	0.01	792.0	142.9	0.01
351.0	39.2	0.01	801.0	142.9	0.01
360.0	42.3	0.01	810.0	142.8	0.01
369.0	45.6	0.01	819.0	142.6	0.01
378.0	49.0	0.01	828.0	142.5	0.01
387.0	52.6	0.01	837.0	142.3	0.01
396.0	56.2	0.01	846.0	142.0	0.01
405.0	60.0	0.01	855.0	141.8	0.01
414.0	63.8	0.01	864.0	141.5	0.01
423.0	67.8	0.01	873.0	141.3	0.01
432.0	71.8	0.01	882.0	141.0	0.01
441.0	75.7	0.01	891.0	140.7	0.01
450.0	79.7	0.01	900.0	140.4	0.01

Using the Get Max button causes the program to step through a series of storm durations until a maximum volume is obtained.
Each duration is sampled 600 times and the results recorded. The storm durations (hrs) are:-

0.25, 0.5, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 18, 20, 24, 30, 36, 42, 48, 54, 60, 66, 72, 84, 96, 120, 150, 175, 200, 250, 300, 375, 500, 750, 1000, 1250, 1500, 1570, 2000, 2500, 3000, 3500, 4000

It should be noted that the six hour storm frequently requested rarely demonstrates the worst case for storage.

Ian Harban Consulting Engineers
http://www.ianharban.com
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

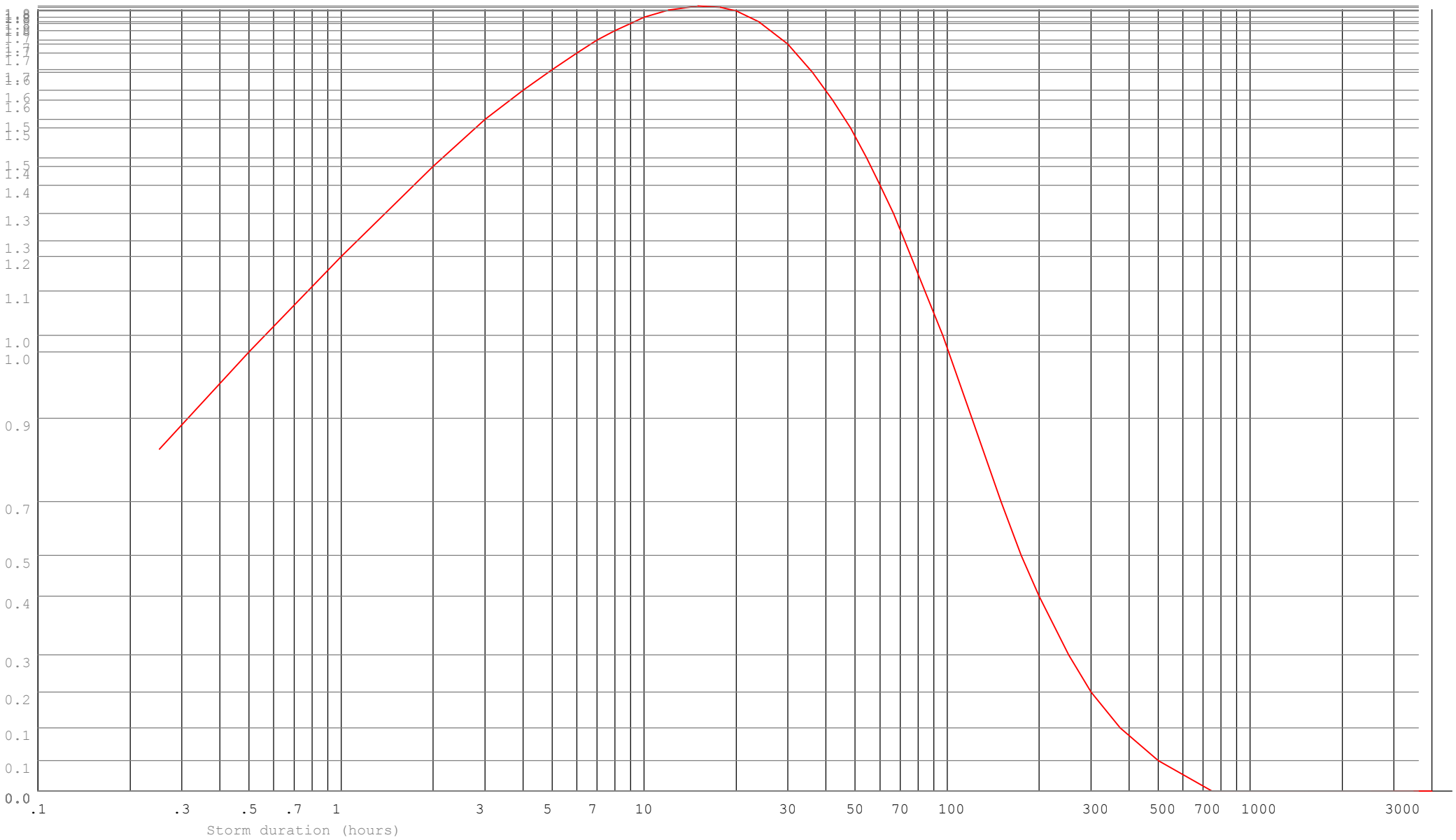
Job No.	217060
Sheet no.	4
Date	28/06/18

MasterDrain SW

Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: **Hydrograph storage analysis (Winter profile) for Belmont Street**

Sequential storage volume at specific storm durations.



Storage Analysis 1 in 100 Year + CC Storm (Blue Roof 3)

Ian Harban Consulting Engineers
http://www.ianharban.com
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

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Job No. 217060			
Sheet no. 1			
Date 28/06/18			
Project 10a Belmont Street NW1 8HJ	By	Checked	Reviewed
Title Hydrograph storage analysis (Winter profile) for Belmont Street			

Data:-

Location = Belmont Street
M5-60 (mm) = 21
Soil index = 0.45
Return period = 100
UCWI = 0.0

Grid reference = TQ2884
r = 0.44
SAAR (mm/yr) = 645
WRAP = 4
Climate change = +30%

Clayey, or loamy over clayey soils with an impermeable layer at shallow depth.

Percentage runoff = 79.0% calculated from:-

Percentage runoff = (0.829*PIMP)+(25*SOIL)+(0.078*UCWI)-20.7

where

PIMP = ImpervArea*100/(ImpervArea+PervArea) = 0.0

UCWI = Calculated value for Wetness Index = 0.0

Imperv. area = 12 m²
Total area = 12 m²
Total runoff = 1.0 m³

Pervious area = 0 m²
Equiv area = 9 m² (Tot. area x % runoff).
Discharge rate = 0.005 l/s

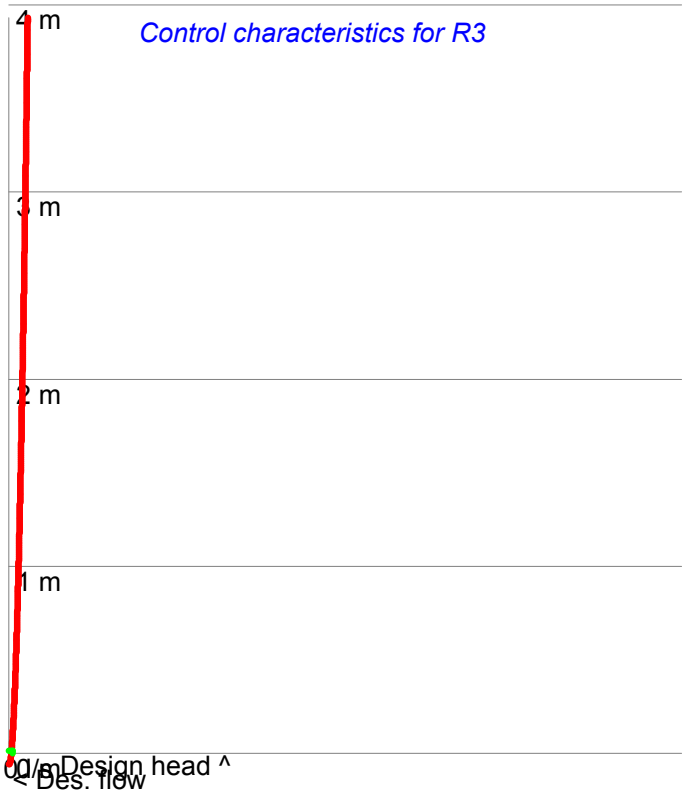
Design Head = 0.15m
Control device = R3
Max. calc. depth = 0.15 m

Peak flow = 0.00 l/s
Orifice diam = 3.2 mm
Available depth = 0.0 m³

Pipeline storage = 0.0 m³
Offline storage = 0.0 m³
Total storage = 0.8 m³

Available MH storage = 0.0 m³

Peak input flow =0.03 l/s



Control characteristics for R3

Head (m)	Flow (l/s)	Head (m)	Flow (l/s)
0.01	0.00	2.01	0.02
0.05	0.00	2.05	0.02
0.10	0.00	2.10	0.02
0.15	0.00	2.15	0.02
0.20	0.01	2.20	0.02
0.25	0.01	2.25	0.02
0.30	0.01	2.30	0.02
0.35	0.01	2.35	0.02
0.40	0.01	2.40	0.02
0.45	0.01	2.45	0.02
0.50	0.01	2.50	0.02
0.55	0.01	2.55	0.02
0.60	0.01	2.60	0.02
0.65	0.01	2.65	0.02
0.70	0.01	2.70	0.02
0.75	0.01	2.75	0.02
0.80	0.01	2.80	0.02
0.85	0.01	2.85	0.02
0.90	0.01	2.90	0.02
0.95	0.01	2.95	0.02
1.00	0.01	3.00	0.02
1.05	0.01	3.05	0.02
1.10	0.01	3.10	0.02
1.15	0.01	3.15	0.02
1.20	0.01	3.20	0.02
1.25	0.01	3.25	0.02
1.30	0.01	3.30	0.02
1.35	0.01	3.35	0.02
1.40	0.02	3.40	0.02
1.45	0.02	3.45	0.02
1.50	0.02	3.50	0.02
1.55	0.02	3.55	0.02
1.60	0.02	3.60	0.02
1.65	0.02	3.65	0.02
1.70	0.02	3.70	0.02
1.75	0.02	3.75	0.02
1.80	0.02	3.80	0.03
1.85	0.02	3.85	0.03
1.90	0.02	3.90	0.03
1.95	0.02	3.95	0.03
2.00	0.02	4.00	0.03

MasterDrain SW

Ian Harban Consulting Engineers
http://www.ianharban.com

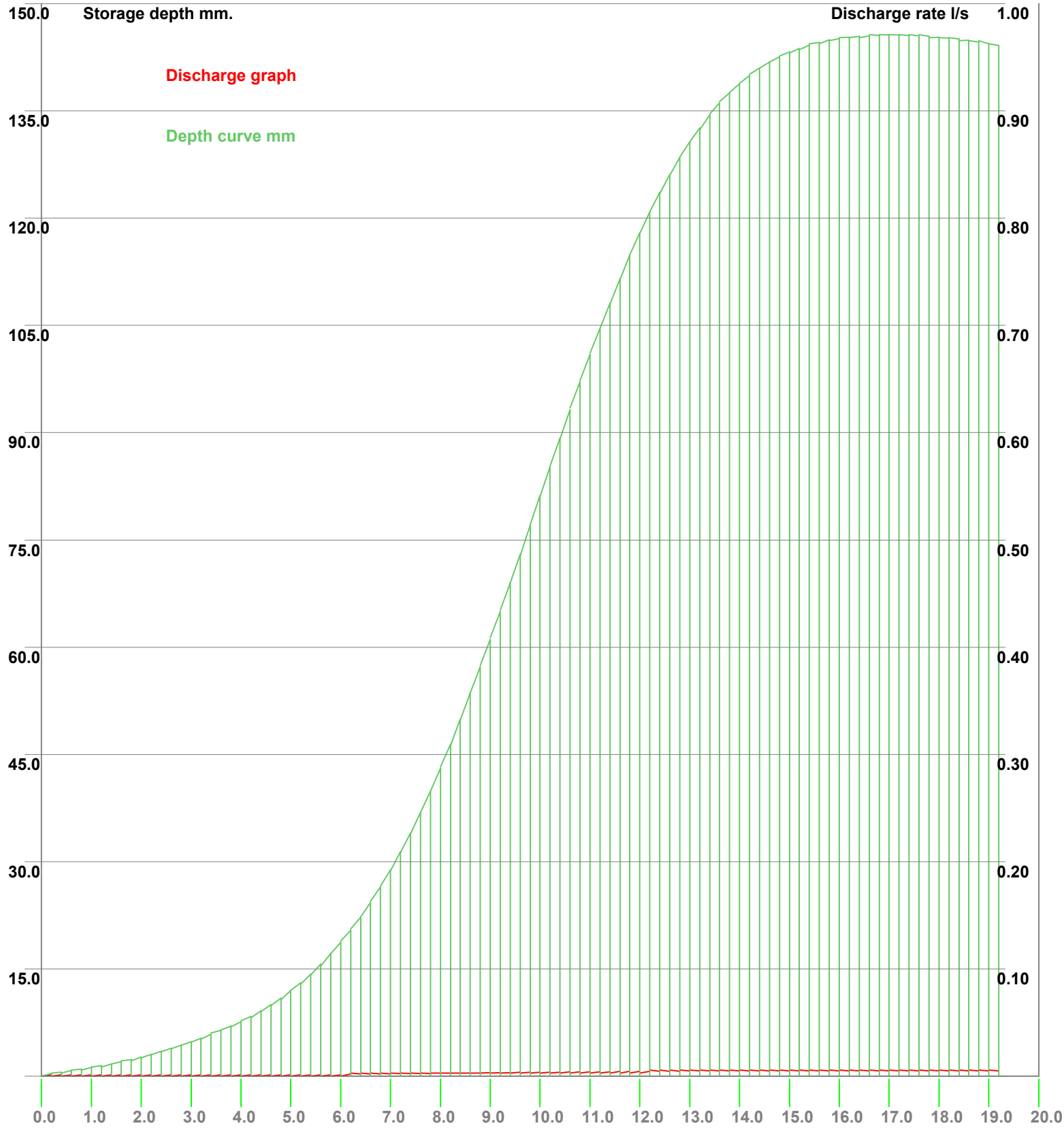
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	217060
Sheet no.	2
Date	28/06/18

Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: **Hydrograph storage analysis (Winter profile) for Belmont Street**

Storage curves for a 20 hours storm.



Ian Harban Consulting Engineers
http://www.ianharban.com
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	Sheet no.	Date	By	Checked	Reviewed
217060	3	28/06/18			

Project: 10a Belmont Street NW1 8HJ

Title: Hydrograph storage analysis (Winter profile) for Belmont Street

Incremental rainfall figures.

Storm Mins	Storage Depth mm	Control Flow l/s	Storm Mins	Storage Depth mm	Control Flow l/s
12.0	0.4	0.00	612.0	85.2	0.00
24.0	0.6	0.00	624.0	89.2	0.00
36.0	0.8	0.00	636.0	93.2	0.00
48.0	1.0	0.00	648.0	97.1	0.00
60.0	1.2	0.00	660.0	100.9	0.00
72.0	1.4	0.00	672.0	104.6	0.00
84.0	1.7	0.00	684.0	108.1	0.00
96.0	2.0	0.00	696.0	111.6	0.00
108.0	2.3	0.00	708.0	114.8	0.00
120.0	2.7	0.00	720.0	117.9	0.00
132.0	3.0	0.00	732.0	120.9	0.00
144.0	3.4	0.00	744.0	123.6	0.00
156.0	3.9	0.00	756.0	126.1	0.00
168.0	4.3	0.00	768.0	128.5	0.00
180.0	4.8	0.00	780.0	130.7	0.00
192.0	5.3	0.00	792.0	132.6	0.00
204.0	5.8	0.00	804.0	134.5	0.00
216.0	6.4	0.00	816.0	136.1	0.00
228.0	7.0	0.00	828.0	137.5	0.00
240.0	7.6	0.00	840.0	138.8	0.00
252.0	8.3	0.00	852.0	140.0	0.00
264.0	9.1	0.00	864.0	141.0	0.00
276.0	10.0	0.00	876.0	141.8	0.00
288.0	10.9	0.00	888.0	142.6	0.00
300.0	11.9	0.00	900.0	143.2	0.00
312.0	13.1	0.00	912.0	143.8	0.00
324.0	14.3	0.00	924.0	144.2	0.00
336.0	15.6	0.00	936.0	144.6	0.00
348.0	17.1	0.00	948.0	144.9	0.00
360.0	18.7	0.00	960.0	145.2	0.00
372.0	20.4	0.00	972.0	145.3	0.00
384.0	22.2	0.00	984.0	145.4	0.00
396.0	24.3	0.00	996.0	145.5	0.00
408.0	26.5	0.00	1008.0	145.6	0.00
420.0	28.8	0.00	1020.0	145.6	0.00
432.0	31.4	0.00	1032.0	145.6	0.00
444.0	34.0	0.00	1044.0	145.6	0.00
456.0	36.9	0.00	1056.0	145.5	0.00
468.0	39.9	0.00	1068.0	145.4	0.00
480.0	43.1	0.00	1080.0	145.3	0.00
492.0	46.4	0.00	1092.0	145.2	0.00
504.0	49.9	0.00	1104.0	145.1	0.00
516.0	53.5	0.00	1116.0	144.9	0.00
528.0	57.3	0.00	1128.0	144.7	0.00
540.0	61.1	0.00	1140.0	144.4	0.00
552.0	65.0	0.00	1152.0	144.2	0.00
564.0	69.0	0.00	1164.0	143.9	0.00
576.0	73.0	0.00	1176.0	143.6	0.00
588.0	77.1	0.00	1188.0	143.3	0.00
600.0	81.2	0.00	1200.0	143.0	0.00

Using the Get Max button causes the program to step through a series of storm durations until a maximum volume is obtained.
Each duration is sampled 600 times and the results recorded. The storm durations (hrs) are:-

0.25, 0.5, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 15, 18, 20, 24, 30, 36, 42, 48, 54, 60, 66, 72, 84, 96, 120, 150, 175, 200, 250, 300, 375, 500, 750, 1000, 1250, 1500, 1570, 2000, 2500, 3000, 3500, 4000

It should be noted that the six hour storm frequently requested rarely demonstrates the worst case for storage.

Ian Harban Consulting Engineers
http://www.ianharban.com
Suite 12, Borough House
Marlborough Rd,
Banbury OX16 5TH
Tel: 01295 279719
email: ingenuity@ianharban.com

Job No.	217060
Sheet no.	4
Date	28/06/18

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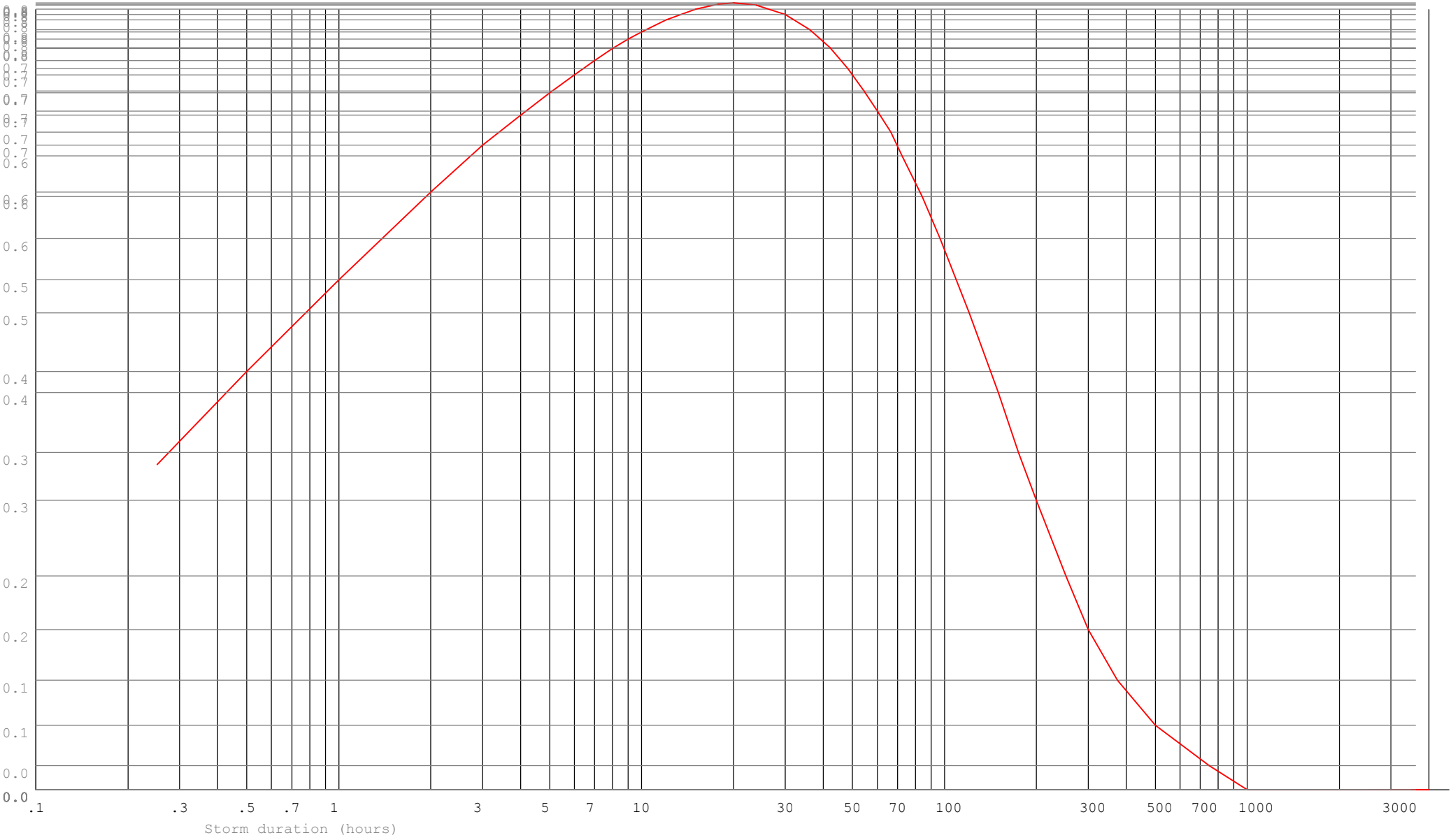
Project	By	Checked	Reviewed
10a Belmont Street NW1 8HJ			

Title: **Hydrograph storage analysis (Winter profile) for Belmont Street**

Sequential storage volume at specific storm durations.



SuDS Maintenance and Management Plan

GENERAL REQUIREMENTS

Maintenance activities comprise

- Regular Inspection
- Regular Maintenance
- Remedial Works

Generally

- Roof to be inspected at a minimum frequency of twice a year, in spring and autumn
- Also inspect following work on roof by others and after installation of new roof equipment
- Control access and maintain records
- Collect all litter or other debris and remove from roof at each visit
- Avoid use of weedkillers and pesticides to prevent chemical pollution

OPERATION AND MAINTENANCE REQUIREMENTS FOR BLUE ROOF

Regular Inspection		**Frequency**
	Inspect all components including soil substrate, vegetation, drains, membranes and roof structure for proper operation, integrity of waterproofing and structural stability	six monthly and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	six monthly and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the roof drain system	six monthly and after severe storms
	Inspect underside of roof for evidence of leakage (ie wet patches, stains etc.)	six monthly and after severe storms
	Inspect rooflights and other penetrations for any damage (ie cracks to glazing, missing vent tops), which could result in leakage or condensation	six monthly and after severe storms
Regular Maintenance		**Frequency**
	Remove debris and litter to prevent cloggings of inlet drains and interference with plant growth	six monthly and annually or as required
	During establishment (ie year one), replace dead plants as required	monthly (but usually responsibility of manufacturer)

APPENDIX C

	Regular Maintenance	**Frequency**
	Post establishment, replace dead plants as required (where >5% of coverage)	annually (in autumn)
	Remove fallen leaves and debris from deciduous plant foliage	six monthly or as required
	Remove nuisance and invasive vegetation, including weeds	six monthly or as required
	Mow grasses and manage other planting (if appropriate) as required - clippings should be removed and not allowed to accumulate	six monthly or as required
Remedial Works		**Frequency**
	If erosion channels are evident, these should be stabilised with extra soil substrate similar to the original material, and sources of erosion damage should be identified and controlled	as required
	If drain inlet has settled, cracked or moved, investigate and repair as appropriate	as required

I A N H A R B A N

C O N S U L T I N G E N G I N E E R S