



General notes

All setting out must be checked on site
 All levels must be checked on site and refer to
 Ordnance Datum Newlyn unless alternative Datum given
 All fixings and weathers must be checked on site
 All dimensions must be checked on site
 This drawing must not be scaled
 This drawing must be read in conjunction with all other
 relevant drawings, specification clauses and current design risk
 register
 This drawing must not be used for land transfer purposes
 Calculated areas in accordance with Assael Architecture's
 Definition of Areas for Schedule of Areas
 This drawing must not be used on site unless issued for
 construction
 Subject to survey, consultation and approval from all statutory
 Authorities

Revision Status:
 P-Preliminary
 C-Contract

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Drawing notes

Electronic file reference

Enter Source Filename ' Eg AA Title Block'

Status	R:	Revision	Date	DRN	CHK	CDM
18	For Information		01/07/20	MP	HB	
19	For Information		13/07/20	LP	HB	
20	Design Freeze		17/07/20	TP	HB	

Key

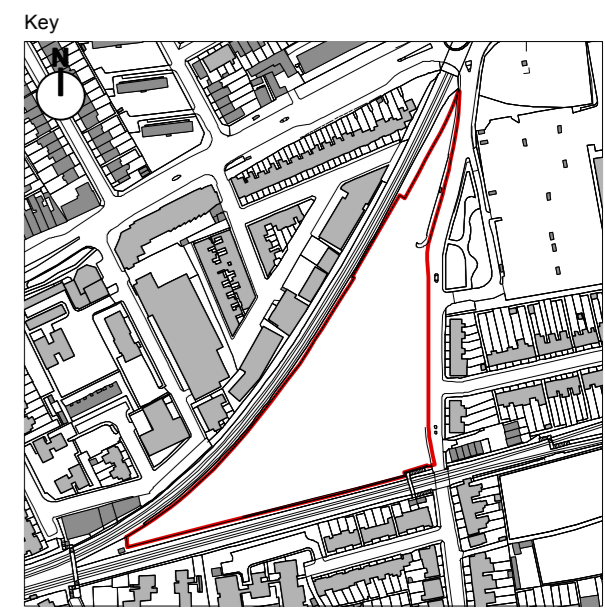
	Studio	1 Bed	2B3P	2B4P	3 Bed
Market					
Shared Ownership					
London Affordable Rent					
London Living Rent					
Plant/Refuse/Bike Store					
Commercial					

Purpose of information

The purpose of the information on this drawing is for:

Planning	<input type="checkbox"/>
Information	<input checked="" type="checkbox"/>
Comment	<input type="checkbox"/>
Client approval	<input type="checkbox"/>
Construction	<input type="checkbox"/>

All information on this drawing is not for construction unless it is marked for construction.



Client

Avanton

Project title

**A3004
 Manor Road Richmond**

Drawing title

**GA Plans Proposed
 Ground Floor**

Scale @ A1 size

1:500

Date

July '20

Drawing N°

MNR-AA-ALL-GF-DR-A-2000

Status & Revision

R20

Assael

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A.5 Surface Water Calculations

- Greenfield runoff rates
- Predevelopment brownfield runoff rates
- MicroDrainage quick storage estimates
- MicroDrainage infiltration simulation results

Greenfield Runoff	Job No.	126782	Calculated	KFM
	Date	11/10/2019	Checked	AC
Project	Manor Road, Richmond			

Site Location	TW9 1YB		Site Information
Site Area	1.842	ha	
Impermeable Area	1.842	ha	
% Impermeable	100	%	

Hydrological Region	6
SOIL Type	4

SAAR	600
SPR	0.3

A ₍₅₀₎	50
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Minum 50 hectares

Q _{BAR(50)}	76.08	
Q _{BAR}	2.80	l/s
Q _{BAR(site)/A_(site)}	1.52	l/s/ha

50 hectare equivalent

Qbar for site

Qbar per hectare of site

GC ₁	0.85
GC ₃₀	2.30
GC ₁₀₀	3.19

Growth curves for Hydrological Region

Total Q _{1yr}	1.3	l/s/ha
Total Q _{30yr}	3.5	l/s/ha
Total Q _{100yr}	4.9	l/s/ha

Total Q _{1yr}	2.4	l/s
Total Q _{30yr}	6.4	l/s
Total Q _{100yr}	8.9	l/s

Brownfield Runoff	Job No.	126782	Calculated	KFM
	Date	11/10/2018	Checked	AC
Project	Manor Road, Richmond			

Site Location	TW9 1YB		Site Information
Site Area	1.842	ha	
Impermeable Area	1.842	ha	
% Impermeable	100	%	
Climate Change Allowance	35	%	

M5 -60	20	mm	Storm Information
Ratio 'r'	0.4		
Storm Duration	5	Minutes	
Z1	0.37		
M5-Dmin	7.4	mm	

Z2	0.62		1 Year Runoff
M1-Dmin	4.6	mm	
i	55.1	mm/hr	
Runoff	281.9	l/s	


Z2	1.46		30 Year Runoff
M30-Dmin	10.8	mm	
i	129.6	mm/hr	
Runoff	663.9	l/s	

Z2	1.85		100 Year Runoff
M100-Dmin	13.7	mm	
i	164.28	mm/hr	
Runoff	841.2	l/s	

Z2	1.85		100 Year + Climate Change Runoff
M100-Dmin	13.7	mm	
i	221.8	mm/hr	
Runoff	1135.7	l/s	

Attenuation required for 100yr + 35% climate change storm at greenfield runoff rates	Job No.	126782	Calculated	KFM
	Date	17/07/2020	Checked	RP
Project	Manor Road, Richmond			

Quick Storage Estimate




Variables

FSR Rainfall		Cv (Summer)	0.750
Return Period (years)	100	Cv (Winter)	0.840
Region	England and Wales	Impermeable Area (ha)	1.842
Map	M5-60 (mm) 20.000	Maximum Allowable Discharge (l/s)	8.9
	Ratio R 0.414	Infiltration Coefficient (m/hr)	0.00000
		Safety Factor	1.0
		Climate Change (%)	35

Analyse OK Cancel Help

Enter Safety Factor between 1.0 and 50.0

Quick Storage Estimate



Results

Global Variables require approximate storage of between 1112 m³ and 1485 m³.

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

Analyse OK Cancel Help

Enter Safety Factor between 1.0 and 50.0

Attenuation required for 100yr + 35% climate change storm at greenfield runoff rates	Job No.	126782	Calculated	KFM
	Date	11/10/2019	Checked	AC
Project	Manor Road, Richmond			

SOAKAWAY 2

Quick Storage Estimate

Variables

FSR Rainfall: [Dropdown]

Return Period (years):

Region:

Map:

Ratio R:

Cv (Summer):

Cv (Winter):

Impemeable Area (ha):

Maximum Allowable Discharge (l/s):

Infiltration Coefficient (m/hr):

Safety Factor:

Climate Change (%):

Buttons: Analyse, OK, Cancel, Help

Enter Safety Factor between 1.0 and 50.0

Quick Storage Estimate

Results

Global Variables require approximate storage of between 309 m³ and 309 m³.

With Infiltration storage is reduced to between 16 m³ and 87 m³.

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

Buttons: Analyse, OK, Cancel, Help

Enter Safety Factor between 1.0 and 50.0

Attenuation required for 100yr + 35% climate change storm at greenfield runoff rates	Job No.	126782	Calculated	KFM
	Date	11/10/2019	Checked	AC
Project	Manor Road, Richmond			

SOAKAWAY 3

Quick Storage Estimate

Variables

FSR Rainfall: [dropdown]

Return Period (years): [100]

Region: [England and Wales]

M5-60 (mm): [20.000]

Ratio R: [0.414]

Cv (Summer): [0.750]

Cv (Winter): [0.840]

Impemeable Area (ha): [0.175]

Maximum Allowable Discharge (l/s): [0.0]

Infiltration Coefficient (m/hr): [0.50000]

Safety Factor: [1.0]

Climate Change (%): [35]

Buttons: [Analyse] [OK] [Cancel] [Help]

Enter Climate Change between -100 and 600

Quick Storage Estimate

Results

Global Variables require approximate storage of between 229 m³ and 229 m³.

With Infiltration storage is reduced to between 11 m³ and 64 m³.

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

Buttons: [Analyse] [OK] [Cancel] [Help]

Enter Climate Change between -100 and 600

Attenuation required for 100yr + 35% climate change storm at greenfield runoff rates	Job No.	126782	Calculated	KFM
	Date	11/10/2019	Checked	AC
Project	Manor Road, Richmond			

BLUE ROOF 2

Quick Storage Estimate

Variables

FSR Rainfall: [v]
 Return Period (years): 100
 Region: England and Wales [v]
 Map: M5-60 (mm) 20.000
 Ratio R: 0.414

Cv (Summer): 0.750
 Cv (Winter): 0.840
 Impemeable Area (ha): 0.157
 Maximum Allowable Discharge (l/s): 1.5
 Infiltration Coefficient (m/hr): 0.00000
 Safety Factor: 1.0
 Climate Change (%): 35

Buttons: Analyse, OK, Cancel, Help

Enter Area between 0.000 and 999.999

Quick Storage Estimate

Results

Global Variables require approximate storage of between 80 m³ and 108 m³.
 These values are estimates only and should not be used for design purposes.

Buttons: Analyse, OK, Cancel, Help

Enter Area between 0.000 and 999.999

Attenuation required for 100yr + 35% climate change storm at greenfield runoff rates	Job No.	126782	Calculated	KFM
	Date	11/10/2019	Checked	AC
Project	Manor Road, Richmond			

BLUE ROOF 3

Quick Storage Estimate

Variables

FSR Rainfall: [v]
 Return Period (years): 100
 Region: England and Wales [v]
 Map: M5-60 (mm) 20.000
 Ratio R: 0.414

Cv (Summer): 0.750
 Cv (Winter): 0.840
 Impemeable Area (ha): 0.098
 Maximum Allowable Discharge (l/s): 1.5
 Infiltration Coefficient (m/hr): 0.00000
 Safety Factor: 2.0
 Climate Change (%): 35

Buttons: Analyse, OK, Cancel, Help

Enter Climate Change between -100 and 600

Quick Storage Estimate

Results

Global Variables require approximate storage of between 44 m³ and 60 m³.

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

Buttons: Analyse, OK, Cancel, Help

Enter Climate Change between -100 and 600

Attenuation required for 100yr + 35% climate change storm at greenfield runoff rates	Job No.	126782	Calculated	KFM
	Date	11/10/2019	Checked	AC
Project	Manor Road, Richmond			

BLUE ROOF 4

Quick Storage Estimate

Variables

FSR Rainfall: [Dropdown]

Return Period (years):

Region: [Map]

M5-60 (mm):

Ratio R:

Cv (Summer):

Cv (Winter):

Impemeable Area (ha):

Maximum Allowable Discharge (l/s):

Infiltration Coefficient (m/hr): [Icon]

Safety Factor:

Climate Change (%):

[Analyse] [OK] [Cancel] [Help]

Select required Rainfall Model from the list

Quick Storage Estimate

Results

Global Variables require approximate storage of between 23 m³ and 32 m³.

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

[Analyse] [OK] [Cancel] [Help]

Select required Rainfall Model from the list

Attenuation required for 100yr + 35% climate change storm at greenfield runoff rates	Job No.	126782	Calculated	KFM
	Date	11/10/2019	Checked	AC
Project	Manor Road, Richmond			

BLUE ROOF 5

Quick Storage Estimate

Variables

FSR Rainfall

Return Period (years)

Region

Map M5-60 (mm)

Ratio R

Cv (Summer)

Cv (Winter)

Impemeable Area (ha)

Maximum Allowable Discharge (l/s)

Infiltration Coefficient (m/hr)

Safety Factor

Climate Change (%)

Analyse OK Cancel Help

Enter Area between 0.000 and 999.999

Quick Storage Estimate

Results

Global Variables require approximate storage of between 36 m³ and 49 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

Attenuation required for 100yr + 35% climate change storm at greenfield runoff rates	Job No.	126782	Calculated	KFM
	Date	11/10/2019	Checked	AC
Project	Manor Road, Richmond			

BLUE ROOF 6

Quick Storage Estimate

Variables

FSR Rainfall: [v]
 Return Period (years): 100
 Region: England and Wales [v]
 Map: M5-60 (mm): 20.000
 Ratio R: 0.414

Cv (Summer): 0.750
 Cv (Winter): 0.840
 Impermeable Area (ha): 0.079
 Maximum Allowable Discharge (l/s): 1.5
 Infiltration Coefficient (m/hr): 0.00000
 Safety Factor: 1.0
 Climate Change (%): 35

Buttons: Analyse, OK, Cancel, Help

Enter Climate Change between -100 and 600

Quick Storage Estimate

Results

Global Variables require approximate storage of between 33 m³ and 46 m³.
 These values are estimates only and should not be used for design purposes.

Buttons: Analyse, OK, Cancel, Help

Enter Climate Change between -100 and 600

Attenuation required for 100yr + 35% climate change storm at greenfield runoff rates	Job No.	126782	Calculated	KFM
	Date	11/10/2019	Checked	AC
Project	Manor Road, Richmond			

BLUE ROOF 7

Quick Storage Estimate

Micro Drainage

Variables

- FSR Rainfall: [Dropdown]
- Return Period (years):
- Region: [Map]
- M5-60 (mm):
- Ratio R:
- Cv (Summer):
- Cv (Winter):
- Impemeable Area (ha):
- Maximum Allowable Discharge (l/s):
- Infiltration Coefficient (m/hr): [Calculator]
- Safety Factor:
- Climate Change (%):

[Analyse] [OK] [Cancel] [Help]

Enter Climate Change between -100 and 600

Quick Storage Estimate

Micro Drainage

Results

Global Variables require approximate storage of between 78 m³ and 106 m³.

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

[Analyse] [OK] [Cancel] [Help]

Enter Climate Change between -100 and 600

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Date 14/07/2020
File SOAKAWAY 2.SRCX

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XP Solutions

Source Control 2019.1

Summary of Results for 100 year Return Period (+35%)

Half Drain Time : 53 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	6.165	0.565	12.6	48.8	O K
30 min Summer	6.263	0.663	12.6	57.3	O K
60 min Summer	6.279	0.679	12.6	58.7	O K
120 min Summer	6.224	0.624	12.6	53.9	O K
180 min Summer	6.151	0.551	12.6	47.6	O K
240 min Summer	6.076	0.476	12.6	41.1	O K
360 min Summer	5.938	0.338	12.6	29.3	O K
480 min Summer	5.829	0.229	12.6	19.8	O K
600 min Summer	5.747	0.147	12.6	12.7	O K
720 min Summer	5.691	0.091	12.6	7.9	O K
960 min Summer	5.648	0.048	12.2	4.2	O K
1440 min Summer	5.635	0.035	8.8	3.0	O K
2160 min Summer	5.625	0.025	6.4	2.2	O K
2880 min Summer	5.620	0.020	5.0	1.7	O K
4320 min Summer	5.614	0.014	3.6	1.2	O K
5760 min Summer	5.611	0.011	2.8	1.0	O K
7200 min Summer	5.610	0.010	2.5	0.8	O K
8640 min Summer	5.608	0.008	2.1	0.7	O K
10080 min Summer	5.607	0.007	1.8	0.6	O K
15 min Winter	6.246	0.646	12.6	55.9	O K
30 min Winter	6.372	0.772	12.6	66.7	O K
60 min Winter	6.399	0.799	12.6	69.0	O K
120 min Winter	6.317	0.717	12.6	62.0	O K
180 min Winter	6.204	0.604	12.6	52.2	O K
240 min Winter	6.087	0.487	12.6	42.1	O K
360 min Winter	5.881	0.281	12.6	24.3	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	134.830	0.0	17
30 min Summer	88.004	0.0	31
60 min Summer	54.688	0.0	50
120 min Summer	32.836	0.0	84
180 min Summer	24.046	0.0	116
240 min Summer	19.168	0.0	150
360 min Summer	13.875	0.0	214
480 min Summer	11.034	0.0	272
600 min Summer	9.231	0.0	328
720 min Summer	7.976	0.0	382
960 min Summer	6.328	0.0	490
1440 min Summer	4.560	0.0	734
2160 min Summer	3.281	0.0	1080
2880 min Summer	2.595	0.0	1468
4320 min Summer	1.863	0.0	2164
5760 min Summer	1.471	0.0	2896
7200 min Summer	1.224	0.0	3640
8640 min Summer	1.053	0.0	4264
10080 min Summer	0.927	0.0	5016
15 min Winter	134.830	0.0	17
30 min Winter	88.004	0.0	31
60 min Winter	54.688	0.0	56
120 min Winter	32.836	0.0	90
180 min Winter	24.046	0.0	128
240 min Winter	19.168	0.0	162
360 min Winter	13.875	0.0	224

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Summary of Results for 100 year Return Period (+35%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
480 min Winter	5.730	0.130	12.6	11.3	O K
600 min Winter	5.652	0.052	12.6	4.5	O K
720 min Winter	5.644	0.044	11.1	3.8	O K
960 min Winter	5.635	0.035	8.8	3.0	O K
1440 min Winter	5.625	0.025	6.4	2.2	O K
2160 min Winter	5.618	0.018	4.6	1.6	O K
2880 min Winter	5.614	0.014	3.6	1.3	O K
4320 min Winter	5.610	0.010	2.6	0.9	O K
5760 min Winter	5.608	0.008	2.1	0.7	O K
7200 min Winter	5.607	0.007	1.7	0.6	O K
8640 min Winter	5.606	0.006	1.6	0.5	O K
10080 min Winter	5.605	0.005	1.3	0.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
480 min Winter	11.034	0.0	278
600 min Winter	9.231	0.0	312
720 min Winter	7.976	0.0	368
960 min Winter	6.328	0.0	490
1440 min Winter	4.560	0.0	718
2160 min Winter	3.281	0.0	1076
2880 min Winter	2.595	0.0	1468
4320 min Winter	1.863	0.0	2200
5760 min Winter	1.471	0.0	2904
7200 min Winter	1.224	0.0	3616
8640 min Winter	1.053	0.0	4272
10080 min Winter	0.927	0.0	5144

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.414	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+35

Time Area Diagram

Total Area (ha) 0.236

Time (mins)		Area
From:	To:	(ha)
0	4	0.236

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Model Details

Storage is Online Cover Level (m) 7.000

Cellular Storage Structure

Invert Level (m) 5.600 Safety Factor 1.0
 Infiltration Coefficient Base (m/hr) 0.50000 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)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	91.0	91.0	0.800	91.0	123.0	0.801	0.0	123.0

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Summary of Results for 100 year Return Period (+35%)

Half Drain Time : 41 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
15 min Summer	6.461	0.461	11.1	35.0	O K
30 min Summer	6.531	0.531	11.1	40.4	O K
60 min Summer	6.535	0.535	11.1	40.7	O K
120 min Summer	6.478	0.478	11.1	36.3	O K
180 min Summer	6.407	0.407	11.1	31.0	O K
240 min Summer	6.337	0.337	11.1	25.6	O K
360 min Summer	6.216	0.216	11.1	16.4	O K
480 min Summer	6.130	0.130	11.1	9.9	O K
600 min Summer	6.077	0.077	11.1	5.8	O K
720 min Summer	6.051	0.051	11.1	3.9	O K
960 min Summer	6.041	0.041	9.1	3.1	O K
1440 min Summer	6.029	0.029	6.5	2.2	O K
2160 min Summer	6.021	0.021	4.7	1.6	O K
2880 min Summer	6.017	0.017	3.7	1.3	O K
4320 min Summer	6.012	0.012	2.7	0.9	O K
5760 min Summer	6.010	0.010	2.2	0.7	O K
7200 min Summer	6.008	0.008	1.8	0.6	O K
8640 min Summer	6.007	0.007	1.6	0.5	O K
10080 min Summer	6.006	0.006	1.4	0.5	O K
15 min Winter	6.529	0.529	11.1	40.2	O K
30 min Winter	6.621	0.621	11.1	47.2	Flood Risk
60 min Winter	6.625	0.625	11.1	47.5	Flood Risk
120 min Winter	6.537	0.537	11.1	40.8	O K
180 min Winter	6.425	0.425	11.1	32.3	O K
240 min Winter	6.317	0.317	11.1	24.1	O K
360 min Winter	6.143	0.143	11.1	10.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
15 min Summer	134.830	0.0	17
30 min Summer	88.004	0.0	30
60 min Summer	54.688	0.0	46
120 min Summer	32.836	0.0	80
180 min Summer	24.046	0.0	114
240 min Summer	19.168	0.0	146
360 min Summer	13.875	0.0	206
480 min Summer	11.034	0.0	264
600 min Summer	9.231	0.0	316
720 min Summer	7.976	0.0	368
960 min Summer	6.328	0.0	490
1440 min Summer	4.560	0.0	734
2160 min Summer	3.281	0.0	1092
2880 min Summer	2.595	0.0	1444
4320 min Summer	1.863	0.0	2164
5760 min Summer	1.471	0.0	2936
7200 min Summer	1.224	0.0	3632
8640 min Summer	1.053	0.0	4328
10080 min Summer	0.927	0.0	4952
15 min Winter	134.830	0.0	17
30 min Winter	88.004	0.0	30
60 min Winter	54.688	0.0	50
120 min Winter	32.836	0.0	88
180 min Winter	24.046	0.0	124
240 min Winter	19.168	0.0	156
360 min Winter	13.875	0.0	214

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Summary of Results for 100 year Return Period (+35%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m ³)	Status
480 min Winter	6.052	0.052	11.1	4.0	O K
600 min Winter	6.043	0.043	9.5	3.2	O K
720 min Winter	6.037	0.037	8.3	2.8	O K
960 min Winter	6.029	0.029	6.5	2.2	O K
1440 min Winter	6.021	0.021	4.7	1.6	O K
2160 min Winter	6.015	0.015	3.4	1.2	O K
2880 min Winter	6.012	0.012	2.7	0.9	O K
4320 min Winter	6.009	0.009	1.9	0.7	O K
5760 min Winter	6.007	0.007	1.6	0.5	O K
7200 min Winter	6.006	0.006	1.3	0.5	O K
8640 min Winter	6.005	0.005	1.2	0.4	O K
10080 min Winter	6.005	0.005	1.1	0.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Time-Peak (mins)
480 min Winter	11.034	0.0	252
600 min Winter	9.231	0.0	308
720 min Winter	7.976	0.0	370
960 min Winter	6.328	0.0	492
1440 min Winter	4.560	0.0	718
2160 min Winter	3.281	0.0	1064
2880 min Winter	2.595	0.0	1424
4320 min Winter	1.863	0.0	2168
5760 min Winter	1.471	0.0	2904
7200 min Winter	1.224	0.0	3560
8640 min Winter	1.053	0.0	4248
10080 min Winter	0.927	0.0	5080

135 Park Street
London
SE1 9EA

Manor Road
Richmond
Soakaway 3



Date 14/07/2020

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Source Control 2019.1

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.414	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+35

Time Area Diagram

Total Area (ha) 0.175

Time (mins)		Area
From:	To:	(ha)
0	4	0.175

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Model Details

Storage is Online Cover Level (m) 7.000

Cellular Storage Structure

Invert Level (m) 6.000 Safety Factor 1.0
Infiltration Coefficient Base (m/hr) 0.50000 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)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	80.0	80.0	0.800	80.0	108.8	0.801	0.0	108.8

A.6 Surface Water Drainage Strategy

- Fairhurst drawing 126782-C-4000