DRAINAGE IMPACT ASSESSMENT

for

Proposed Residential Development
Land at Havelock Street
Canterbury
Kent, CT1 1NY

on behalf of

Townscape Havelock Ltd

Document Control Sheet

Project Title Proposed Residential Development

Land at Havelock Street, Canterbury

Document Title Drainage Impact Assessment

Job No. EMC-2015-128

Revision 2.2

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1.0	Client	1st Draft	12.08.15
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2.1	Client	Final updated	13.12.16
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tridax
Consultant Civil Engineers
Sustainable Drainage
Infrastructure Design

Paul Lavender
T: 01304 820777
M: 07850 160124
E: paul@tridax.co.uk
W: www.tridax.co.uk
Suite 3, Honeywood House,
Honeywood Road,
Whitfield, Dover, Kent,
CT16 3EH

CONTENTS

1.0 STATUS

1.1 This Report is prepared for the sole use of Townscape Havelock Ltd and their agents in connection with the proposed forthcoming planning application. No responsibility can be assumed for the Report if used by others.

1.2 For the purposes of the Contracts (Rights of Third Parties) Act 1999, nothing in this Report shall confer on any third party any right to enforce or benefit from any term of this Report

1.3 This Assessment has been updated to reflect the current proposals being considered.

2.0 INTRODUCTION

Background

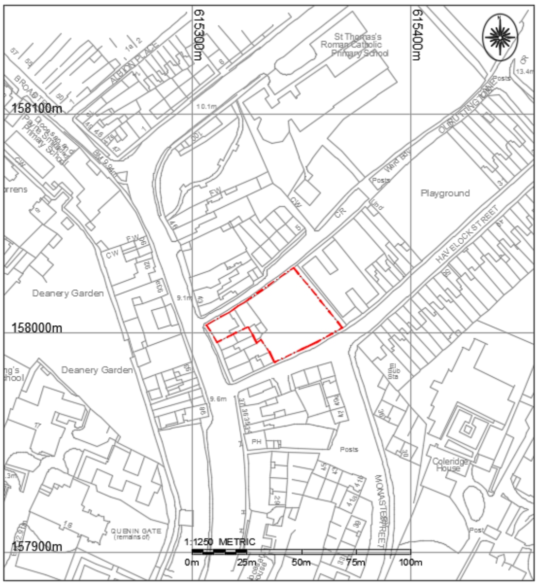
2.1 Tridax Ltd have been commissioned by Townscape Havelock Ltd and requested to update the previously prepared Drainage Impact Assessment for the current revised application for the Residential Development on land at Havelock Street, Canterbury.

2..2 This Report is in accordance with the requirements of the Canterbury City Council 'Drainage Impact Assessment for Development Proposals Guidance Notes' dated March 2003 and the Technical Guidance to the National Planning Policy Framework (NPPF).

2.3 The Report details the observations, calculates the probable flows that may be generated by the development and makes recommendations for the disposal of the foul and surface water.

Site Location

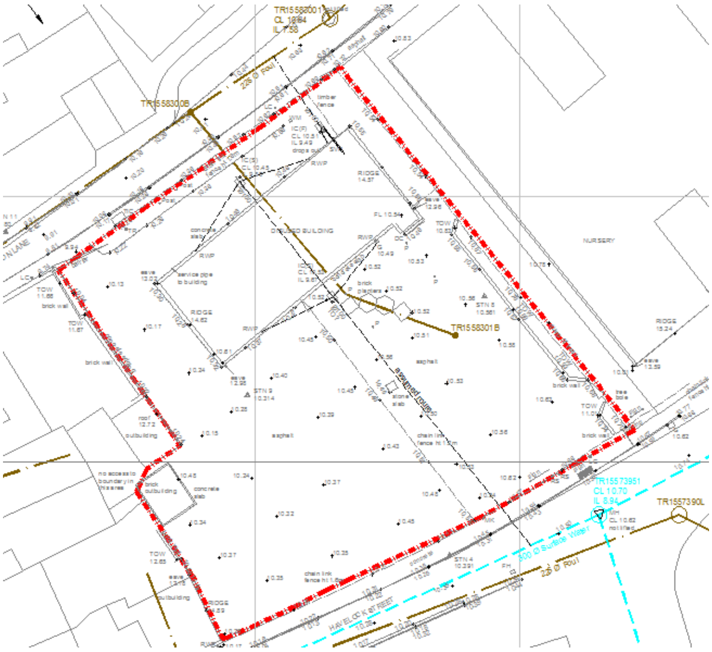
2.4 The development is located within the urban centre of Canterbury on land at Havelock Street, as indicated on the site location drawing EMC-2015-128-01 enclosed in Appendix A and the extract as Frame 1 below. The total site area is approximately 1,256m² and is centred at Ordnance Survey reference (615325mE, 158014mN) on sheet TR1558.



Frame 1 – Site Location Plan Extract

Existing Site Layout

2.5 The location of the proposed development is a ‘Brownfield’ site that is currently occupied by a single storey pre-fabricated hall to the rear, that was until recently been used as a nursery school. The remainder of the site is hard-paved and finished in asphalt. A topographical survey of the site has been commissioned by the Client and used to prepare the existing drainage plan as drawing EMC-2015-128-02 enclosed within Appendix A and the extract as frame 2 below.



Frame 2 – Existing Site

2.6 Inspection of the sewer records indicates that there are 225mm Ø public foul water sewers to the front and rear of the site. There is also 300mm Ø surface water sewer to the front of the site within Havelock Street. It can be noted that the sewer records indicate a public foul water sewer within the site, although is not located exactly as per the actual surveyed drainage layout.

2.7 A study of the relevant geological survey map, sheet 289 Canterbury – Solid & Drift Edition, indicates that the site to be underlain by **Thanet Formation**, consisting of Sand, Silt And Clay.

Proposed Development

2.8 The proposed development is for 21No self-contained student studio apartments fronting Havelock Street with a redesign for private residential dwellings facing Old Ruttington Lane comprising 1No 3 bedroomed house, 2No 4 bedroomed houses, and a 3 bedroomed apartment. Refer to the Architects planning drawings and the extract of the proposed site plan as Frame 3 below.

Frame 3 – Proposed Site Plan Extract

3.0 FOUL WATER DRAINAGE

Existing Discharge

3.1 The existing building on the site is derelict and boarded up preventing entry to establish the existing number of sanitary fitting within the building that discharge via the existing lateral to the public foul water sewer within Old Ruttington Lane. Assuming a minimum of say 2No WC's and a kitchen sink, a conservative existing peak discharge in order of 1.7 litre/second could be expected (Q=(0.7)kDU√(∑(6.0)DU)).

3.2 The existing roof-water from the site has a positive drainage system and discharges to the public surface water sewer in Havelock Street and is discussed in Section 4.0. However, the remainder of the site is laid to asphalt and has no positive drainage with the site falling from the Southeast corner of the site (10.66m AOD front right hand corner of Havelock Street) to the northwest corner of the site (9.74m AOD rear left hand corner of Old Ruttington Lane). Surface water from this impermeable area of 832m² currently flows onto the public highway and enters the foul sewer via the gullies. Using the Modified Rational Method ~ Butler & Davies Urban Drainage 2nd Edition, provides the following peak flows to the sewer; see Appendix B for Brownfield run-off calculation sheet.

$$Q_P = 2.78CiA$$

2 year return ~ 13.4 l/s

5 year return ~ 19.0 l/s

10 year return ~ 23.9 l/s

20 year return ~ 29.9 l/s

50 year return ~ 39.9 l/s

100 year return ~ 49.5 l/s

3.3 The existing peak discharge to the foul water sewer taking a 5 year return period is approximately **20.7 litres/second.**

Proposed Discharge

3.4 The proposed peak foul water discharge from the residential development calculated in accordance with BS EN 752: Part 4 is **5.5 litres/second,** as per the table below;

Peak Flow Rates
to BS EN 752: Part 4

kDU frequency factor (0.5 for dwellings)

	Sanitary Appliance	No of Features	DU	∑DU
21 No Flats	WC's	21 x 1	1.20	25.2
	Washbasin	21 x 1	0.30	6.3
	Showers	21 x 1	0.30	6.3
	Kitchen Sink	21 x 1	0.80	16.8
	Washing Machine	21 x 1	1.50	31.5
4No Houses	WC's	4 x 3	1.20	14.4
	Washbasin	4 x 3	0.30	3.6
	Showers	4 x 2	0.30	2.4
	Baths	4 x 1	0.80	3.2
	Kitchen Sink	4 x 1	0.80	3.2
	Washing Machine	4 x 1	1.50	6.0
				118.9

$Q = kDU\sqrt{(\sum DU)}$

Q= 5.5 l/s

3.5 The design flow from the proposed development using 'sewers for adoption' 7th Edition is calculated as 0.5 litres/second as below;

$$6DWF = \frac{\text{4,000 litres/dwelling/day x 25No Dwellings}}{\text{24hours}} = 1.15 \text{ l/s}$$

3.6 The demolition of the existing building and removal of the existing discharge will significantly reduce the existing discharge to the public foul water sewer (existing discharge 20.7 l/s less 5.5l/s proposed discharge = 15.2l/s reduction). An outline drainage strategy drawing EMC-2015-128-03 is enclosed within Appendix A.

Consents

3.7 A Section 106 Water Industry Act application to connect to the public foul water sewer will be required to be made to and approved by Southern Water Services. It should also be noted that a Section 185 Sewer Diversion application will also be required to remove the existing lateral from the public sewer records.

4.0 SURFACE WATER DRAINAGE

Existing Discharge

4.1 The requirement of NPPF is that the run-off from the development proposals replicates the natural drainage characteristics of the pre-developed site. In the case of 'Brownfield' development, the drainage proposal will be measured against the existing performance of the site, although it is preferable for solutions to provide characteristics similar to 'Greenfield' development wherever possible.

4.2 The existing site characteristics are summarised as below;

Total Site Area	0.098 hectares
Current Site Condition	Brownfield
Existing Impermeable Area	985m²
Proposed Impermeable Area	985m²
Existing Surface Water Discharge Method	153m² to surface water sewer 832m² run-off to foul sewer (Section 3.0)

4.3 Enclosed within Appendix B are the results from MicroDrainage Windes for the existing surface water system from the roof drainage of the existing site indicating the following peak discharges;

2 year return ~ 2.4 l/s

30 year return ~ 5.0 l/s

100 year return ~ 6.4 l/s

Proposed Discharge

4.4 Considering the underlying geology, it is unlikely that the surface water will not be able to discharge on-site via filtration and the intention will be meet the aspirations of NPPF and reduce the ‘Brownfield’ run-off from the pre-development performance by providing an attenuated discharge to the public surface water controlled to **5.0 litre/second.**

4.5 Enclosed within Appendix B are MicroDrainage Windes outline design calculations demonstrating that a 3m x 9m x 1.2m ‘Stormcrate’ attenuation tank (31m^3 of storage) with a 43mm Ø orifice plate to control the flows to 5.0 l/s would be adequate to cater for a 1in100 year return period with a 30% allowance for climate change.

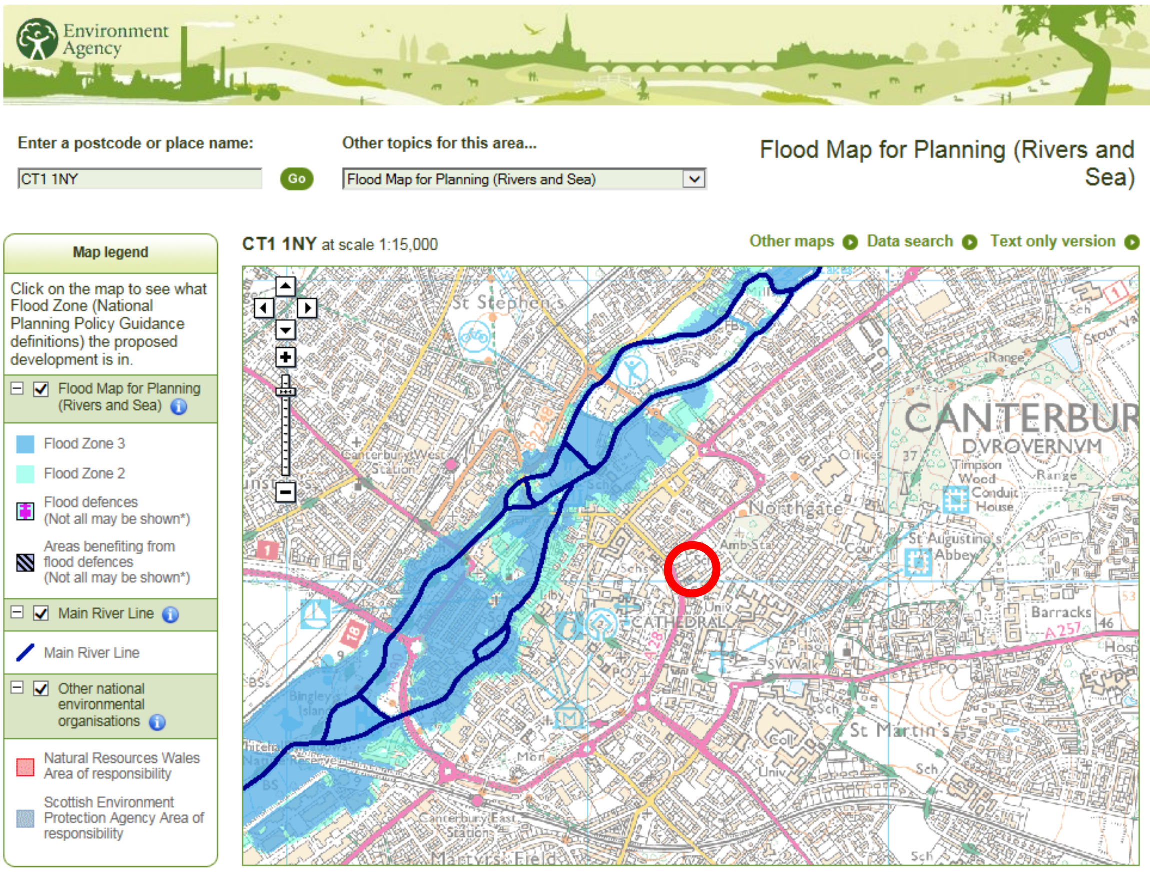
4.6 An outline drainage strategy drawing EMC-2015-128-03 is enclosed within Appendix A

Consents

4.7 A Section 106 Water Industry Act application to connect to the public surface water sewer will be required to be made to and approved by Southern Water Services The responsibility for the management and maintenance will remain with the property owners and will need to meet the requirements of the Flood and Water Management Act.

5.0 FLOOD RISK

5.1 Inspection of the Environment Agency Website identifies the proposed site to be within the extent of the Flood Zone 1 (Low Probability). This zone comprises land assessed as having a less than 1in1000 annual probability of river or sea flooding (<0.1%). All uses of land are appropriate within this zone.



Frame 4 - Extract of Environment Agency Flood Map

5.2 Reference to Table 1 of the NPPF states the policy aim to reduce the overall level of flood risk by the appropriate application of sustainable drainage systems.

6.0 CONCLUSION

6.1 Tridax Ltd have been commissioned by Townscape Havelock Ltd and requested to update the previously prepared Drainage Impact Assessment for the current revised application for the Residential Development on land at Havelock Street, Canterbury.

6.2 The demolition of the existing building and removal of the existing discharge will significantly reduce the existing discharge to the public foul water sewer (existing discharge 20.7 l/s less 5.5l/s proposed discharge = 15.2l/s reduction).

6.3 The intention will be meet the aspirations of NPPF and reduce the 'Brownfield' run-off from the pre-development performance by providing an attenuated discharge to the public surface water controlled to **5.0 litre/second.** Outline design calculations suggest that 31m³ of storage will be required with a 43mm Ø orifice plate flow control device would be adequate to cater for a 1in100 year return period with a 30% allowance for climate change.

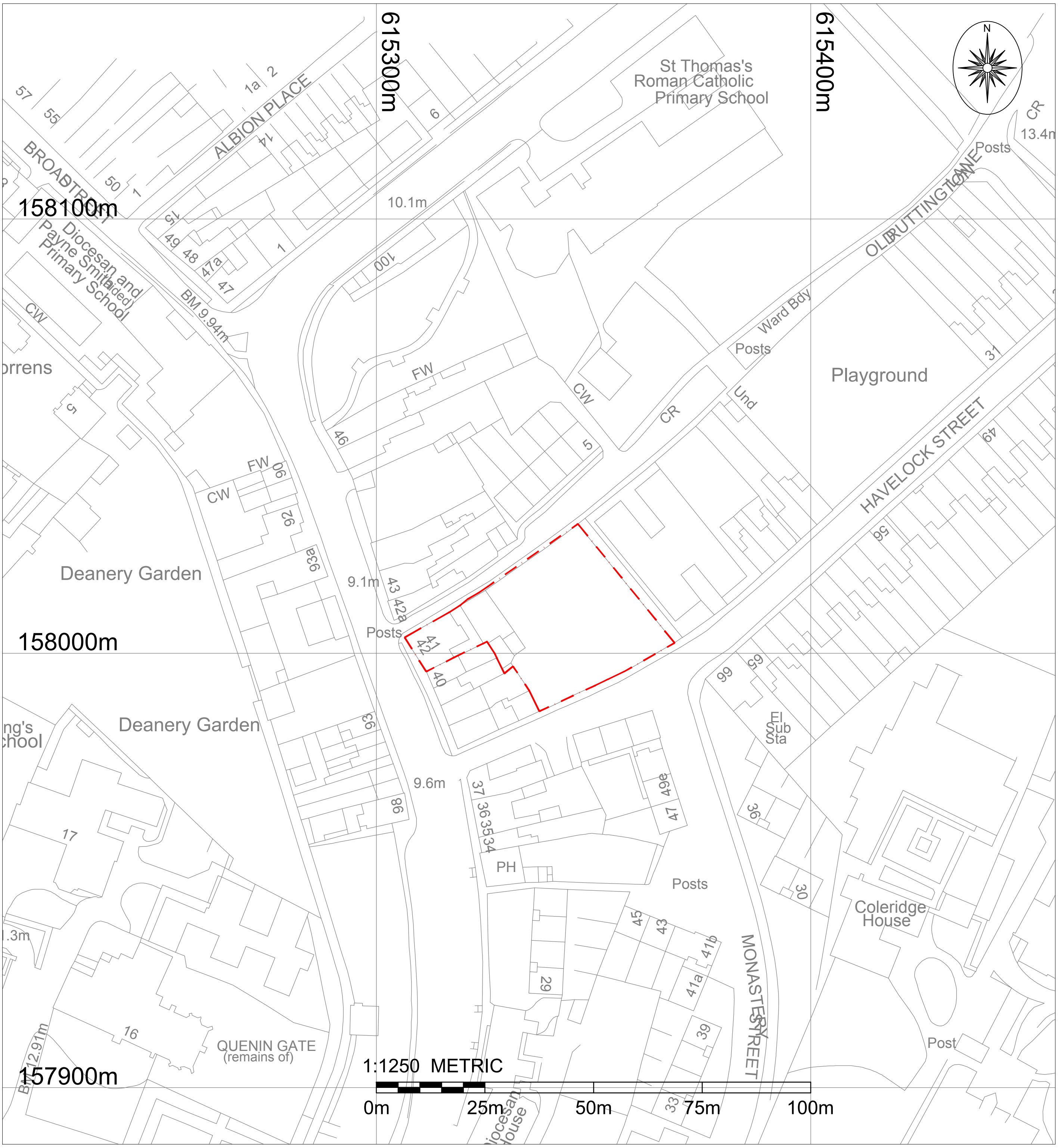
6.4 An outline drainage strategy drawing EMC-2015-128-03 is enclosed within Appendix A

6.5 The site is indicated to be within the extent of the Flood Zone 1 (Low Probability). This zone comprises land assessed as having a less than 1in1000 annual probability of river or sea flooding (<0.1%). All uses of land are appropriate within this zone

6.6 In accordance with the requirements of the Canterbury City Council 'Drainage Impact Assessment for Development Proposals Guidance Notes' and the Technical Guidance to the National Planning Policy Framework (NPPF), we conclude that the site can be adequately drained and is not at risk from flooding or increase the risk of flooding elsewhere.

APPENDIX A

Tridax Drawings
EMC-2015-128-01 – Site Location
EMC-2015-128-02 – Existing Site Drainage
EMC-2015-128-03 – Proposed Drainage Strategy



01	revised to current proposal	01/06/2017
00	First Issue	12/08/2015
Rev	Description	Date

PROJECT
Proposed Residential Development
Land at Havelock Street
Canterbury, Kent, CT1 1NY

CLIENT
Townscape Havelock Ltd

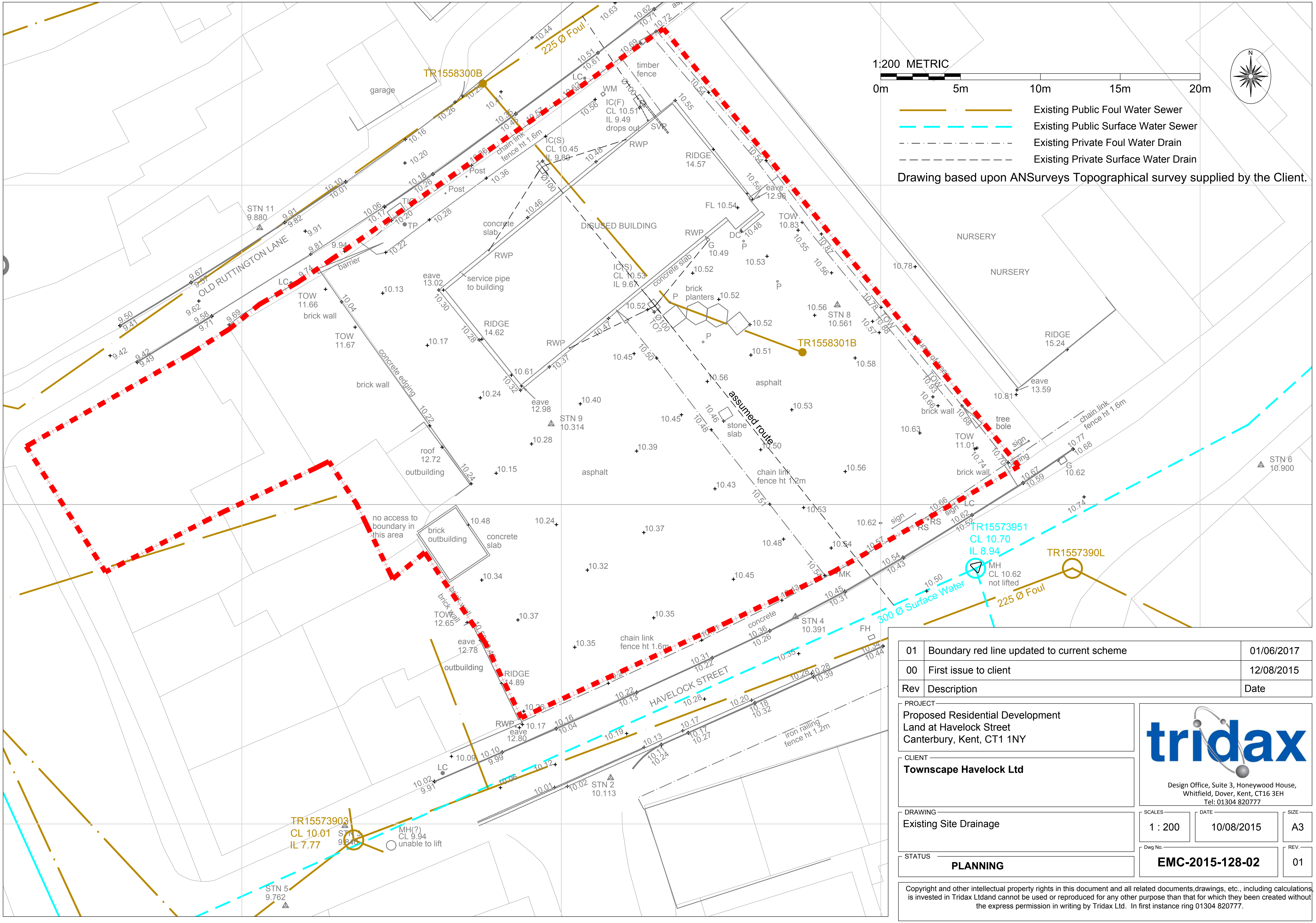
DRAWING
Site Location

STATUS
PLANNING

tridax
Design Office, Suite 3, Honeywood House,
Whitfield, Dover, Kent, CT16 3EH
Tel: 01304 820777

SCALES: 1 : 1,250
DATE: 10/08/2015
SIZE: A4

Dwg No.: **EMC-2015-128-01**
REV.: 01



Rev	Description	Date
01	Boundary red line updated to current scheme	01/06/2017
00	First issue to client	12/08/2015

PROJECT
Proposed Residential Development
Land at Havelock Street
Canterbury, Kent, CT1 1NY

tridax

Design Office, Suite 3, Honeywood House,
Whitfield, Dover, Kent, CT16 3EH
Tel: 01304 820777

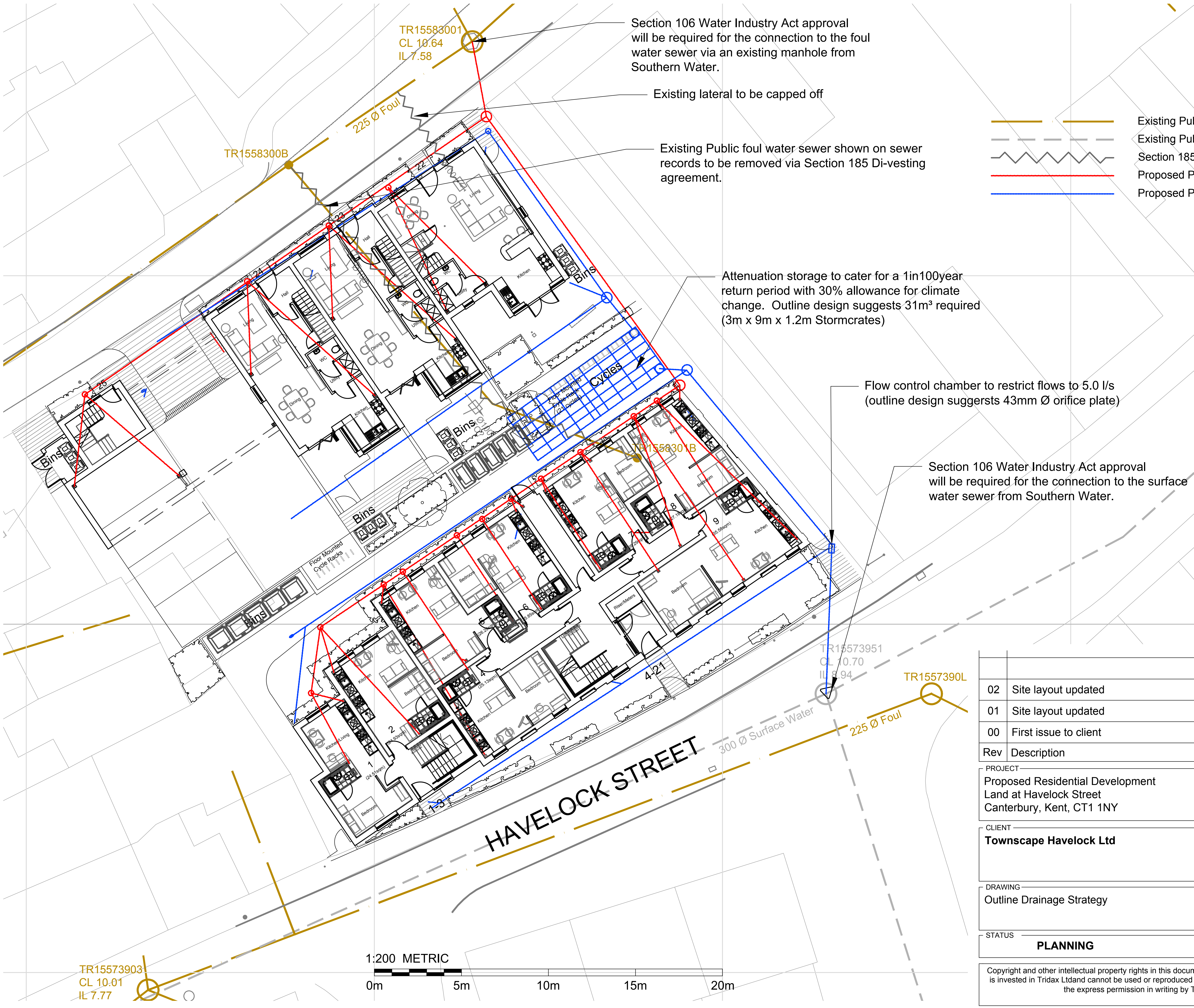
CLIENT
Townscape Havelock Ltd

DRAWING
Existing Site Drainage

SCALES: 1 : 200
DATE: 10/08/2015
SIZE: A3

STATUS: **PLANNING**

Dwg No.: **EMC-2015-128-02**
REV.: 01



Rev	Description	Date
02	Site layout updated	01/06/2017
01	Site layout updated	13/12/2016
00	First issue to client	12/08/2015

PROJECT
Proposed Residential Development
Land at Havelock Street
Canterbury, Kent, CT1 1NY

CLIENT
Townscape Havelock Ltd

tridax

Design Office, Suite 3, Honeywood House, Whitfield, Dover, Kent, CT16 3EH
Tel: 01304 820777

DRAWING
Outline Drainage Strategy

SCALES	DATE	SIZE
1 : 200	10/08/2015	A3

STATUS
PLANNING

Dwg No. **EMC-2015-128-03**
REV. 02

APPENDIX B

Calculations
Brownfield Run-off rate ~ Modified Rational Method
Existing Surface Discharge to Sewer ~ Windes Simulation
Outline Surface Water Disposal Design ~ Windes Sheets

Runoff rate calculations

Methodology

Using the Modified Rational Method, the surface runoff rate has been calculated with the proposed buildings, surrounding roads and car parks accounting for the impermeable surface within the proposed development.

Ref: Butler, D and Davies, J. (2006), Urban Drainage, 2nd ed., SPON

$$Q_P = 2.78CiA$$

where

$$C = C_V C_R \quad \text{and} \quad C_V = \frac{PIMP}{PR}$$

PIMP = Percentage of impermeable area to total area

Note the form of the formulae is corrected for the following units Q_p in l/s, *i* in mm/hr, and *area* in ha

Data

Rainfall

	Return Period					
	2	5	10	20	50	100
Duration (hrs)	Rainfall depth in mm/hr					
1	13.38	18.99	23.94	29.90	39.88	49.49
2	8.24	11.53	14.39	17.81	23.46	28.84
4	5.06	6.98	8.62	10.57	13.75	16.75
6	3.80	5.19	6.38	7.78	10.05	12.18
8	3.10	4.21	5.15	6.26	8.04	9.71

Area

	Area in m^2	Area in ha
Hardstanding	832	0.08
Buildings	0	0.00
Total impermeable area	832	0.08
Total Area	832	0.08

PR (Percentage Runoff, %) = 100% Assumed

Existing runoff rate

PIMP 1.002409639

C_R 0.95 Taken from Butler & Davies

C_V 1.002409639

Discharge

	Return Period						
	2	5	10	20	50	100	100 + 20%
Duration	Discharge in l/s						
1	2.94	4.17	5.26	6.57	8.76	10.87	13.05
2	1.81	2.53	3.16	3.91	5.15	6.34	7.60
4	1.11	1.53	1.89	2.32	3.02	3.68	4.42
6	0.84	1.14	1.40	1.71	2.21	2.68	3.21
8	0.68	0.93	1.13	1.37	1.77	2.13	2.56

Existing Network Details for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	k (mm)	HYD SECT	DIA (mm)
1.000	11.230	0.130	86.4	0.008	2.00	0.600	o	100
1.001	23.950	0.278	86.2	0.008	0.00	0.600	o	100

PN	US/MH Name	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl	US/MH (mm)
1.000	1	10.450	9.670	0.680	10.520	9.540	0.880		1200
1.001	2	10.520	9.540	0.880	10.500	9.262	1.138		1200

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.377
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.800 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	30 Summer	2	0%					
1.001	30 Summer	2	0%	100/30 Summer				

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	1	9.703	-0.067	0.000	0.23	0.0	1.4	OK
1.001	2	9.583	-0.057	0.000	0.37	0.0	2.4	OK

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.377
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.800 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	30 Summer	30	0%					
1.001	30 Summer	30	0%	100/30 Summer				

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	1	9.718	-0.052	0.000	0.44	0.0	2.7	OK
1.001	2	9.609	-0.031	0.000	0.80	0.0	5.0	OK

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

Simulation Criteria

Areal Reduction Factor 1.000 Additional Flow - % of Total Flow 0.000
Hot Start (mins) 0 MADD Factor * 10m³/ha Storage 2.000
Hot Start Level (mm) 0 Inlet Coeffiecient 0.800
Manhole Headloss Coeff (Global) 0.500 Flow per Person per Day (l/per/day) 0.000
Foul Sewage per hectare (l/s) 0.000

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

Synthetic Rainfall Details

Rainfall Model FSR Ratio R 0.377
Region England and Wales Cv (Summer) 0.750
M5-60 (mm) 19.800 Cv (Winter) 0.840

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

Profile(s) Summer and Winter
Duration(s) (mins) 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440
Return Period(s) (years) 2, 30, 100
Climate Change (%) 0, 0, 0

PN	Storm	Return Period	Climate Change	First X Surcharge	First Y Flood	First Z Overflow	O/F Act.	Lvl Exc.
1.000	30 Summer	100	0%					
1.001	30 Summer	100	0%	100/30 Summer				

PN	US/MH Name	Water Level (m)	Surch'ed Depth (m)	Flooded Volume (m³)	Flow / Cap.	O'flow (l/s)	Pipe Flow (l/s)	Status
1.000	1	9.727	-0.043	0.000	0.58	0.0	3.6	OK
1.001	2	9.643	0.003	0.000	1.01	0.0	6.4	SURCHARGED

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

Half Drain Time : 63 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	9.458	0.758	0.0	4.3	4.3	19.4	O K
30 min Summer	9.624	0.924	0.0	4.6	4.6	23.7	O K
60 min Summer	9.696	0.996	0.0	4.7	4.7	25.6	O K
120 min Summer	9.665	0.965	0.0	4.6	4.6	24.8	O K
180 min Summer	9.605	0.905	0.0	4.5	4.5	23.2	O K
240 min Summer	9.539	0.839	0.0	4.4	4.4	21.5	O K
360 min Summer	9.417	0.717	0.0	4.2	4.2	18.4	O K
480 min Summer	9.309	0.609	0.0	4.0	4.0	15.6	O K
600 min Summer	9.214	0.514	0.0	3.8	3.8	13.2	O K
720 min Summer	9.132	0.432	0.0	3.7	3.7	11.1	O K
960 min Summer	8.998	0.298	0.0	3.4	3.4	7.6	O K
1440 min Summer	8.821	0.121	0.0	3.0	3.0	3.1	O K
2160 min Summer	8.703	0.003	0.0	2.7	2.7	0.1	O K
2880 min Summer	8.700	0.000	0.0	2.2	2.2	0.0	O K
4320 min Summer	8.700	0.000	0.0	1.6	1.6	0.0	O K
5760 min Summer	8.700	0.000	0.0	1.2	1.2	0.0	O K
7200 min Summer	8.700	0.000	0.0	1.0	1.0	0.0	O K
8640 min Summer	8.700	0.000	0.0	0.9	0.9	0.0	O K
10080 min Summer	8.700	0.000	0.0	0.8	0.8	0.0	O K
15 min Winter	9.564	0.864	0.0	4.5	4.5	22.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	124.395	0.0	23.2	17
30 min Summer	82.482	0.0	30.6	31
60 min Summer	52.120	0.0	38.8	52
120 min Summer	31.793	0.0	47.2	84
180 min Summer	23.469	0.0	52.1	120
240 min Summer	18.796	0.0	55.9	154
360 min Summer	13.728	0.0	61.0	220
480 min Summer	10.977	0.0	65.1	286
600 min Summer	9.222	0.0	68.4	350
720 min Summer	7.994	0.0	71.3	412
960 min Summer	6.376	0.0	75.8	530
1440 min Summer	4.627	0.0	82.4	766
2160 min Summer	3.352	0.0	89.6	1100
2880 min Summer	2.664	0.0	94.9	0
4320 min Summer	1.923	0.0	102.8	0
5760 min Summer	1.525	0.0	108.7	0
7200 min Summer	1.273	0.0	113.4	0
8640 min Summer	1.098	0.0	117.4	0
10080 min Summer	0.969	0.0	120.9	0
15 min Winter	124.395	0.0	25.9	17

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	9.765	1.065	0.0	4.8	4.8	27.3	O K
60 min Winter	9.860	1.160	0.0	4.9	4.9	29.8	O K
120 min Winter	9.823	1.123	0.0	4.9	4.9	28.8	O K
180 min Winter	9.725	1.025	0.0	4.7	4.7	26.3	O K
240 min Winter	9.625	0.925	0.0	4.6	4.6	23.7	O K
360 min Winter	9.442	0.742	0.0	4.3	4.3	19.0	O K
480 min Winter	9.286	0.586	0.0	4.0	4.0	15.0	O K
600 min Winter	9.156	0.456	0.0	3.7	3.7	11.7	O K
720 min Winter	9.047	0.347	0.0	3.5	3.5	8.9	O K
960 min Winter	8.881	0.181	0.0	3.1	3.1	4.6	O K
1440 min Winter	8.702	0.002	0.0	2.7	2.7	0.1	O K
2160 min Winter	8.700	0.000	0.0	2.0	2.0	0.0	O K
2880 min Winter	8.700	0.000	0.0	1.6	1.6	0.0	O K
4320 min Winter	8.700	0.000	0.0	1.1	1.1	0.0	O K
5760 min Winter	8.700	0.000	0.0	0.9	0.9	0.0	O K
7200 min Winter	8.700	0.000	0.0	0.7	0.7	0.0	O K
8640 min Winter	8.700	0.000	0.0	0.6	0.6	0.0	O K
10080 min Winter	8.700	0.000	0.0	0.6	0.6	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	82.482	0.0	34.2	31
60 min Winter	52.120	0.0	43.4	56
120 min Winter	31.793	0.0	52.7	92
180 min Winter	23.469	0.0	58.4	130
240 min Winter	18.796	0.0	62.6	166
360 min Winter	13.728	0.0	68.5	236
480 min Winter	10.977	0.0	72.9	302
600 min Winter	9.222	0.0	76.7	368
720 min Winter	7.994	0.0	79.7	428
960 min Winter	6.376	0.0	84.8	548
1440 min Winter	4.627	0.0	92.3	738
2160 min Winter	3.352	0.0	100.3	0
2880 min Winter	2.664	0.0	106.3	0
4320 min Winter	1.923	0.0	115.2	0
5760 min Winter	1.525	0.0	121.7	0
7200 min Winter	1.273	0.0	127.0	0
8640 min Winter	1.098	0.0	131.5	0
10080 min Winter	0.969	0.0	135.4	0

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)	19.800	Shortest Storm (mins)	15
Ratio R	0.378	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.099

Time From:	**(mins) To:**	**Area (ha)**
0	4	0.099

Model Details

Storage is Online Cover Level (m) 10.500

Cellular Storage Structure

Invert Level (m) 8.700 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	27.0	27.0	1.201	0.0	55.8
1.200	27.0	55.8			

Orifice Outflow Control

Diameter (m) 0.043 Discharge Coefficient 0.600 Invert Level (m) 8.200