stomor
CIVIL ENGINEERING CONSULTANTS

FLOOD RISK ASSESSMENT

GRID REF: 531027E,198137N

12 SPRING COURT ROAD,
ENFIELD, EN2 8JP

prepared for

AMARA PROPERTY INVESTMENTS

FEBRUARY 2024

REFERENCE: ST3517/2402-FRA
REVISION 0

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Revision	*Author*	*Checked by*	*Issue Date*
0	*SJB*	*KD*	*06.02.24*

CONTENTS

APPENDICES

1 Introduction

1.1.1 Stomor Ltd have been commissioned by Amara Property Investments to prepare a Flood Risk Assessment (FRA) associated with proposed development at 12 Spring Court Road, Enfield. A Site Location Plan is provided in **Appendix A**.

1.1.2 The overall area of the site is of 0.13 hectares (ha). The site is brownfield with an existing residential dwelling with associated garden and driveway.

1.1.3 Current development proposals for the site comprise the demolition of the existing dwelling with the construction of 4No. dwellings.

1.2 Policy Context

1.2.1 The FRA has been prepared in accordance with the relevant national, regional and local planning policy as follows:

- The National Planning Policy Framework (NPPF) published by Department for Communities and Local Government (DCLG), and the accompanying National Planning Practice Guidance (NPPG).
- Department for Environment, Food and Rural Affairs (DEFRA) and The Environment Agency (EA) published Guidance for Planning Applications: Assessing Flood Risk (March 2014, updated February 2017).
- The EA Flood Risk Standing Advice (FRSA) version 3.1 (April 2012, updated February 2022).
- The EA's Approach to Groundwater Protection (March 2017, updated October 2023).
- Enfield Local Plan and the New Enfield Local Plan.

1.2.2 Furthermore, the FRA follows the methodology prescribed in Construction Industry Research and Information Association (CIRIA) document C624: Development and Flood Risk (2004), Guidance for the Construction Industry.

1.3 Vulnerability and the NPPF Sequential Test

1.3.1 The NPPF follows a sequential risk-based approach in determining the suitability of land for development in flood risk areas, with the intention of steering all new development to the lowest flood risk areas.

1.3.2 The Indicative Floodplain Map obtained from the UK government website is provided in **Figure 1.1**. This shows that the application site is located within Flood Zone 1, land assessed to have a low probability of flooding.

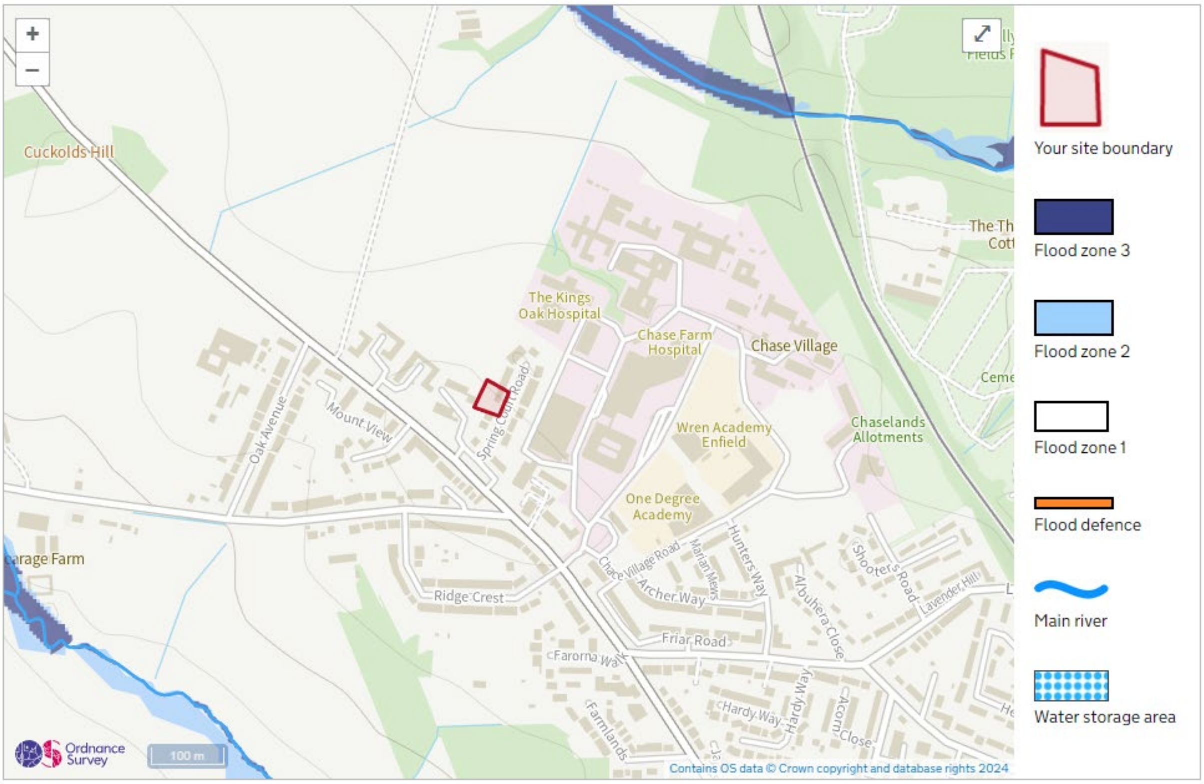


Figure 1.1 – UK Government Flood Map for Planning

1.3.3 The difference between Flood Zones 1, 2 and 3 are described in Table 1: Flood Zones from the Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government Flood Risk and Coastal Change guidance (updated August 2022), reproduced below:

Zone 1 Low Probability	Land assessed as having a less than 0.1% annual probability of river or sea flooding.
Zone 2 Medium Probability	Land assessed as having between a 1% and 0.1% annual probability of river flooding, or land having between a 0.5% and 0.1% annual probability of sea flooding.
Zone 3a High Probability	Land assessed as having a 1% or greater annual probability of river flooding, land having a 0.5% or greater annual probability of flooding from the sea.
Zone 3b The Functional Floodplain	Land where water from rivers or the sea has to flow or be stored in times of flood. Normally comprises land having a 3.3% or greater annual probability of flooding, or land designed to flood (such as a flood attenuation scheme).

1.3.4 The Flood Risk and Coastal Change Category (ID 7) of the NPPG and associated documents set out that for sites in Flood Zone 1, development proposals on sites comprising one hectare or above the vulnerability to flooding from other sources as well as from river and sea flooding, and the potential to increase flood risk elsewhere through the addition of hard surfaces and the effect of the new development on surface water runoff, should be incorporated into a flood risk assessment. This would only need to be brief unless the factors above or other local considerations require particular attention.

1.3.5 The Flood Risk and Coastal Change Category of the PPG and associated documents identifies that site-specific flood risk assessments should identify and assess the risks of all forms of flooding to and from the development and demonstrate how these flood risks will be managed so that the development remains safe throughout its lifetime, taking climate change into account.

1.3.6 The proposed development area of the site will be situated wholly within Flood Zone 1. PPG identifies that all uses of land are appropriate within this Flood Zone.

2 Site Location

2.1.1 The application site comprises approximately 0.13ha of brownfield land, currently comprising an existing residential dwelling with associated garden and driveway.

2.1.2 The site is located on the north-western side of Enfield, on the north-western side of Spring Court Road. Residential properties abut the site to the north, south and west, with an agricultural field located to the north-west.

2.1.3 Inspection of the topographical survey indicates that the site falls towards the north-west with levels ranging from approximately 71.00m AOD to approximately 70.35m AOD.

2.1.4 The nearest designated watercourse to the site is Turkey Brook, located approximately 500m to the north-east. A tributary of this watercourse runs north eastwards from a pond located approximately 200m to the north-east of the site, as shown in **Figure 2.1** below.

Figure 2.1: Extract from Enfield Borough Watercourse Map

2.1.5 Inspection of EA Catchment Data identifies that the site lies within the operational catchment area of Turkey Brook and Cuffley Brook Water Body, which contributes to the Thames River Basin catchment area.

3 Site Background

3.1.1 Historical maps identify that the site was formerly an agricultural field from at least 1892. The current site comprises a single residential dwelling with associated garden and hardstanding.

3.1.2 A Level 1 Strategic Flood Risk Assessment (SFRA) for the area was prepared by the London Borough of Enfield (LBE). The SFRA is used as a desk-based study to map all forms of flood risk to provide an evidence basis to locate new development primarily within low-risk areas. The information allows the planning authority to identify the level of detail required for the site-specific FRA.

3.1.3 The SFRA identifies that the Borough is susceptible to fluvial flooding due to the impermeable geology of the land and extensive man-made surfaces.

3.1.4 Inspection of the British Geological Survey (BGS) website identifies that the underlying ground conditions of the site comprise Dollis Hill Gravel Member at the superficial deposits strata, underlain by the London Clay Formation.

3.1.5 Infiltration testing has previously undertaken at the site as part of an earlier application (Richard Jackson Engineering Consultants: Flood Risk Assessment (Ref: 62279)). The tests could not confirm a usable infiltration rate due to an insignificant drop in water depth and that infiltration methods are not suitable for this site.

3.1.6 Inspection of the EA Groundwater Source Protection Zone maps identify that the overall site does not lie within or near a source catchment protection zone.

4 Existing Drainage

4.1 Surface Water Drainage

4.1.1 The previously prepared FRA for the site stated that surface water runoff currently is presumed to connect to the public surface water sewer located approximately 35m to the south, within Spring Court Road.

4.1.2 As stated above, Thames Water Utilities (TWU) sewer records show that there is a 225mm diameter public surface water sewer located approximately 35m to the south of the site. This sewer originates from an undefined end and runs southwards along Spring Court Road.

Figure 4.1: TWU Sewer Record Extract

4.1.3 Greenfield runoff rates have been calculated based upon the IH124 Method and a contributing impermeable area of 0.065ha. Geotechnical information from the WRAP map of the Wallingford Procedure indicate that the underlying soil conditions would reflect Winter Rain Acceptance Potential (WRAP) Soil Class 3, which results in the following flow rates:

Greenfield Runoff (l/s) (0.13ha)		
1 in 1 year	Q1	0.49 l/s
1 in 30 years	Q30	1.33 l/s
1 in 100 years	Q100	1.84 l/s

4.1.4 The greenfield runoff calculation sheets are provided in **Appendix B**.

4.2 Foul Drainage

4.2.1 The previously prepared FRA for the site stated that foul water is presumed to currently connect to the public foul water sewer located adjacent to the site in Spring Court Road, as shown in **Figure 4.1**.

5 Proposed Development

5.1.1 The proposed development of the site includes the demolition of the existing single dwelling and the construction of 4No. residential dwellings.

6 Proposed Site Drainage

6.1 Surface Water Drainage

6.1.1 The previously prepared FRA stated that surface water runoff from the site currently discharges to the public surface water sewer in Spring Court Road.

6.1.2 In accordance with EA Guidance, the order of consideration for the disposal of surface water runoff from a development should be as follows; infiltration methods, watercourses then public sewer network.

6.1.3 Soakaway testing was undertaken as part of the previous application proposals, which identified that infiltration methods would not be suitable for the site.

6.1.4 There are no identified watercourses within the immediate vicinity of the site which would be practicable for a potential surface water outfall from the proposed development.

6.1.5 Therefore, a connection to the public surface water sewer is proposed, utilising the existing connection if possible.

6.1.6 An Indicative Drainage Strategy was prepared by Richard Jackson Engineering Consultants as part of the previous application (Drawing Ref:62279-RJL-XX-XX-DR-C-1000-P1) and is provided in **Appendix C**. The strategy demonstrates how the proposed development can be effectively drained and the amount of storage required to avoid flooding within the site during all storms up to and including the 1 in 100-year storm event plus a 40% allowance for climate change. Copies of the associated modelling output files are provided in **Appendix D**.

6.1.7 The indicative drainage strategy incorporates SuDS features which will need to have clear, enforceable maintenance regimes in place so that they provide effective flood protection and water treatment for the long term.

6.1.8 The CIRIA SuDS Manual C753 promotes the use of the Simple Index Approach as a method of determining water quality risk management and is generally regarded as the accepted method within the industry.

6.1.9 Table 26.2 of the SuDS Manual gives pollution hazard indices for different land use classifications. A summarised version of this table is reproduced below:

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very Low	0.2	0.2	0.05
Residential driveways, low traffic roads and non-residential car parking with infrequent change (i.e. <300 traffic movements/day)	Low	0.5	0.4	0.4

6.1.10 Table 26.3 of the SuDS Manual provides typical treatments levels from various SuDS components discharging to surface waters. The following SuDS components will be included as part of the surface water drainage proposals for the development:

	Mitigation Indices		
Type Of SuDS Component	**TSS**	**Metals**	**Hydrocarbons**
Permeable Paving	0.7	0.6	0.7

6.1.11 To deliver adequate treatment, the selected SuDS components should have a total mitigation index that equals or is greater than the pollution hazard index. Where a single SuDS component is insufficient, additional components in a series would be required, where:

Total SuDS mitigation index = mitigation index$_1$ + 0.5 (mitigation index$_2$)

6.1.12 A factor of 0.5 is used to account for the reduced performance of secondary or tertiary components associated with already reduced inflow concentrations. In a series of multiple subsequent components, each is halved.

6.1.13 From the above tables the SuDS proposed on the development would provide an adequate level of water treatment for the potential pollution hazards generated by the land uses, as the total mitigation index is greater than the hazard index for all predicted contaminants.

6.2 Foul Drainage

6.2.1 Foul flows generated by the proposed development will discharge to the public foul water sewer located adjacent to the site in Spring Court Road, utilising the existing site connection if suitable.

7 Potential Sources of Flooding

7.1 Flooding from Rivers or Sea

7.1.1 The EA Indicative Floodplain Map, shown in **Figure 1.1**, identifies that the site lies within Flood Zone 1.

7.1.2 The primary source of fluvial flooding from the site would be from Turkey Brook located approximately 500m to the north.

7.1.3 It is considered that the site would not be at risk of flooding from rivers or sea.

7.2 Flooding from Land (Surface Water)

7.2.1 Flooding from land occurs when intense rainfall is unable to soak into the ground or enter drainage systems. Local topography and built form can have a strong influence on the direction and depth of flow.

7.2.2 The EA Indicative Surface Water Flood Map (**Figure 7.1**) indicates that the site is at a very low risk of surface water flooding. Very low risk means that this area has less than 0.1% annual chance of flooding.

Figure 7.1 – Environment Agency Indicative Surface Water Flood Map

7.2.3 On-site drainage systems will be designed to accommodate runoff volume from a 1 in 100 year plus 40% climate change rainfall event, so as to minimise overland flow routes during such storm events.

7.3 Flooding from Groundwater

7.3.1 Groundwater flooding occurs when water levels in the ground rise above surface elevations. Groundwater flooding events are most likely to occur in low lying areas underlain by permeable rocks (aquifers).

7.3.2 The SFRA has not identified any specific groundwater flooding incidents within or in the vicinity of the site. The extract below (**Figure 7.2**) shows the site location in relation to recorded groundwater flooding incidents (black), with the Borough's geology overlaid.

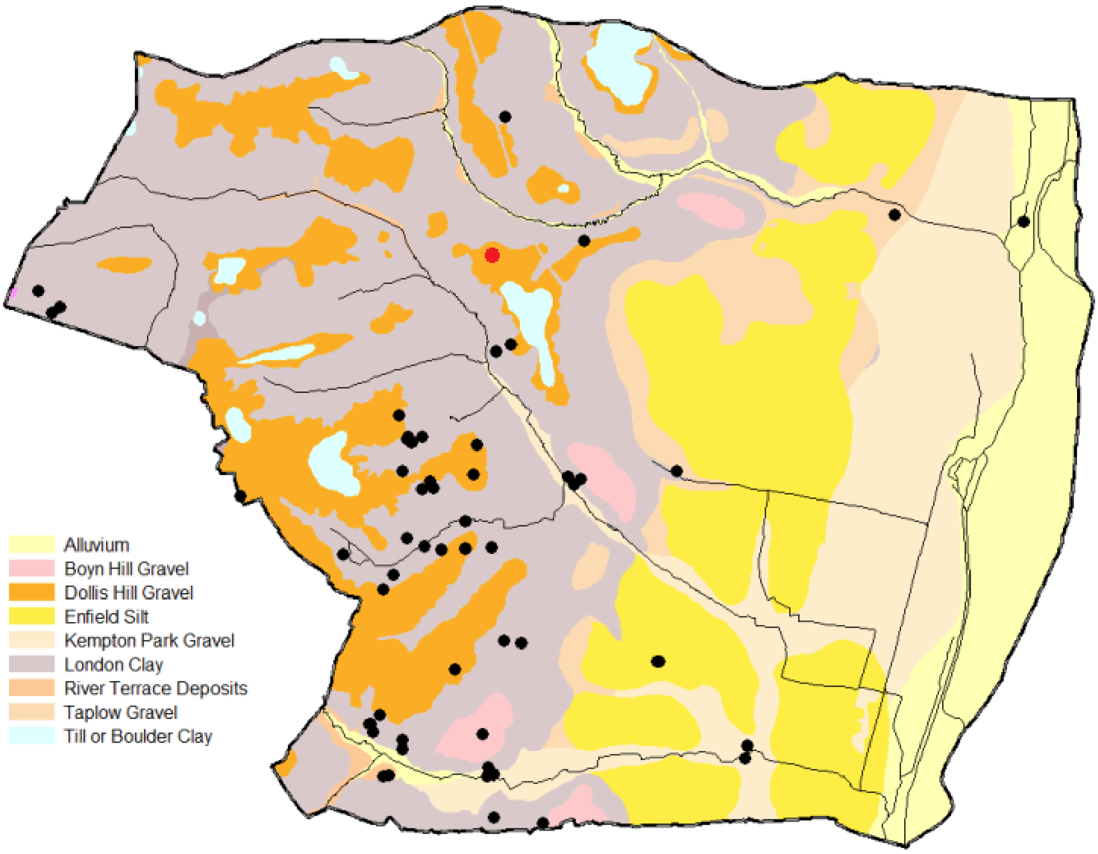


Figure 7.2 – SFRA Extract of Groundwater Flooding Incidents

7.3.3 The SFRA acknowledges that some recorded groundwater incidents may not be exclusively in relation to groundwater and may be a combination of other factors. The SFRA has also produced a grid-based map to identify the susceptibility of groundwater flooding across the Borough. As shown on the map below, the site lies within an are considered to have less than a 25% susceptibility of groundwater flooding.

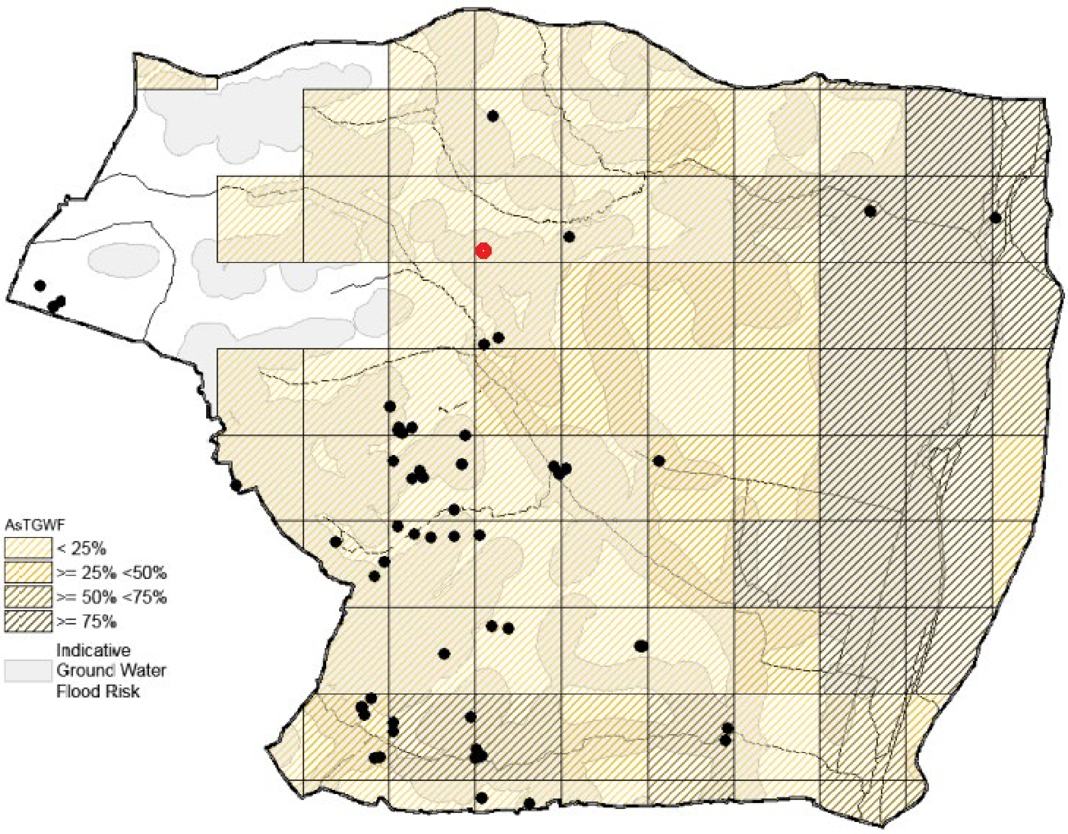


Figure 7.3 – SFRA Extract of Areas Susceptible to Groundwater Flooding

7.3.4 It is anticipated that groundwater flooding should not be an issue to the proposed development. However, overland flow routes will be taken into account in the design of levels for the proposed development and, should groundwater flooding occur on the site, flows will tend to run overland towards ponds situated at the low areas of the site.

7.4 Flooding from Sewers

7.4.1 The SFRA identified that there have been no historical recorded flooding events which can be related to sewers within the EN2 8 post code area.

7.4.2 The development layout will be designed with consideration of flood routing, to ensure that new buildings and occupants of the site will not be subject to detrimental impacts in the event of flooding from infrastructure failure within or upstream of the site.

7.5 Flooding from Reservoirs, Canals and Other Artificial Sources

7.5.1 Inspection of the EA flood maps confirms that there are no records of flooding due to reservoirs, canals or other artificial sources in the vicinity.

Maximum extent of flooding from reservoirs:

when river levels are normal | when there is also flooding from rivers | Location you selected

Figure 7.4 – EA Flooding from Reservoirs, Canals and Other Artificial Sources Map

7.5.2 No other non-natural or artificial sources of flooding where water is retained above natural ground level, operational and redundant industrial processes including mining, quarrying and sand and gravel extraction, would appear to be located in the vicinity of the site which may cause increase floodwater depths or velocities.

8 Summary and Recommendations

8.1.1 Stomor Ltd have been commissioned by Amara Property Investments to prepare a Flood Risk Assessment (FRA) associated with the proposed development at 12 Spring Court Road, Enfield.

8.1.2 The application site comprises approximately 0.13ha of brownfield land, currently comprising an existing residential dwelling with associated garden and driveway.

8.1.3 Development proposals comprise the demolition of an existing dwelling and construction of 4No. residential units, with a total area of approximately 0.13 hectares (ha).

8.1.4 An indicative drainage strategy has been prepared which demonstrates how the development can be effectively drained while providing sufficient storage to accommodate surface water runoff for all storm events up to and including the 1 in 100-year event, plus an allowance for climate change.

8.1.5 The proposed development would have a NPPF flood risk vulnerability classification of 'More Vulnerable'. NPPG identifies that 'More Vulnerable' uses of land are appropriate within Flood Zone 1 without the need for an Exception Test.

8.1.6 Soakage tests indicate that the site has poor infiltration potential.

8.1.7 The nearest designated watercourse to the site is Turkey Brook, located approximately 500m to the north-east. A tributary of this watercourse runs north eastwards from a pond located approximately 200m to the north-east of the site.

8.1.8 The site is located in Flood Zone 1, land assessed as having a low probability of river or sea flooding.

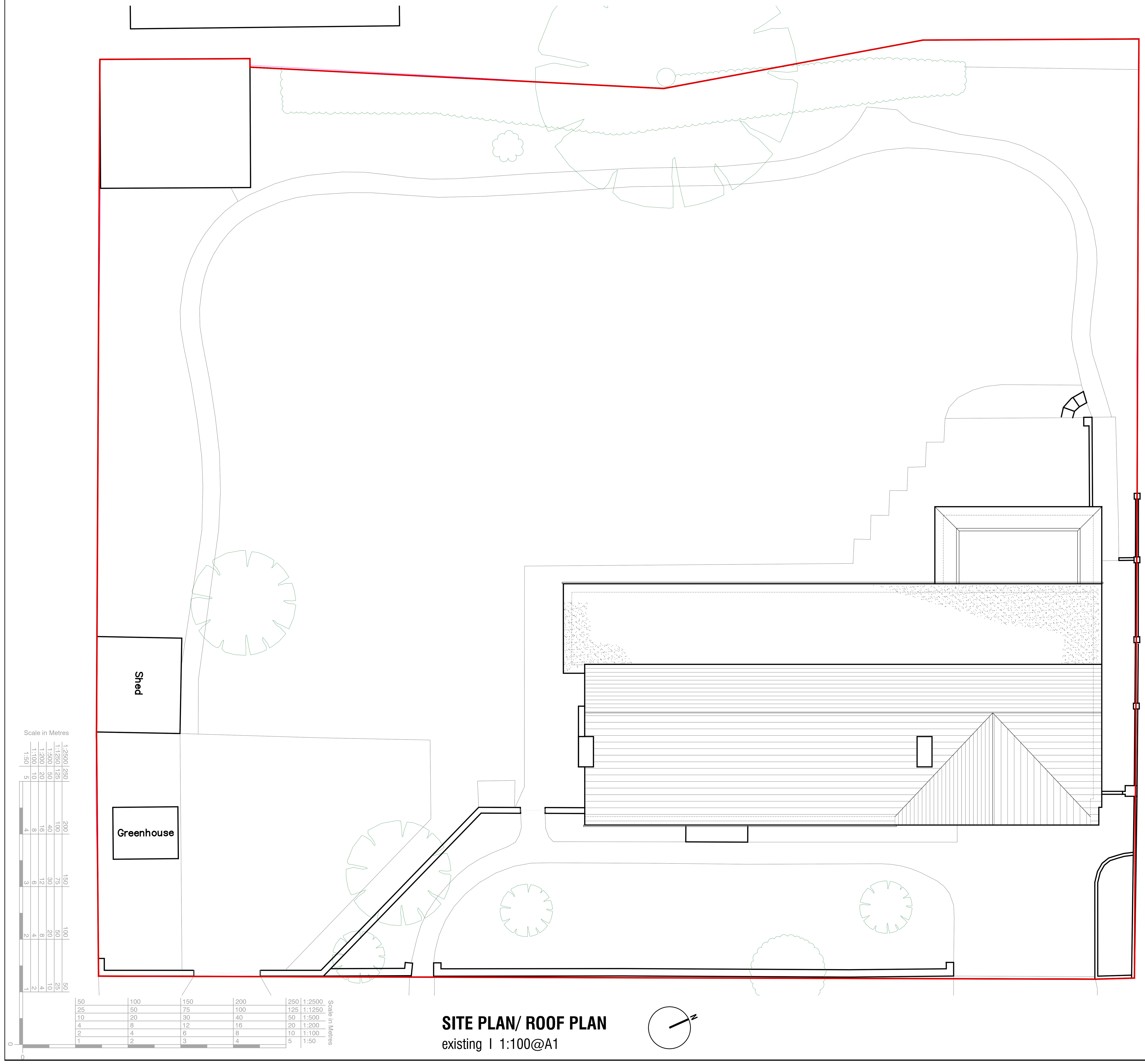
8.1.9 It is considered that the site is at a low risk of flooding from fluvial, surface water, groundwater, sewers and artificial sources.

8.1.10 Overland flow paths, exceedance routes and volume storage will be taken into account in design of levels for the proposed development to direct overland flows away from buildings and not impact the existing surface water flow path.

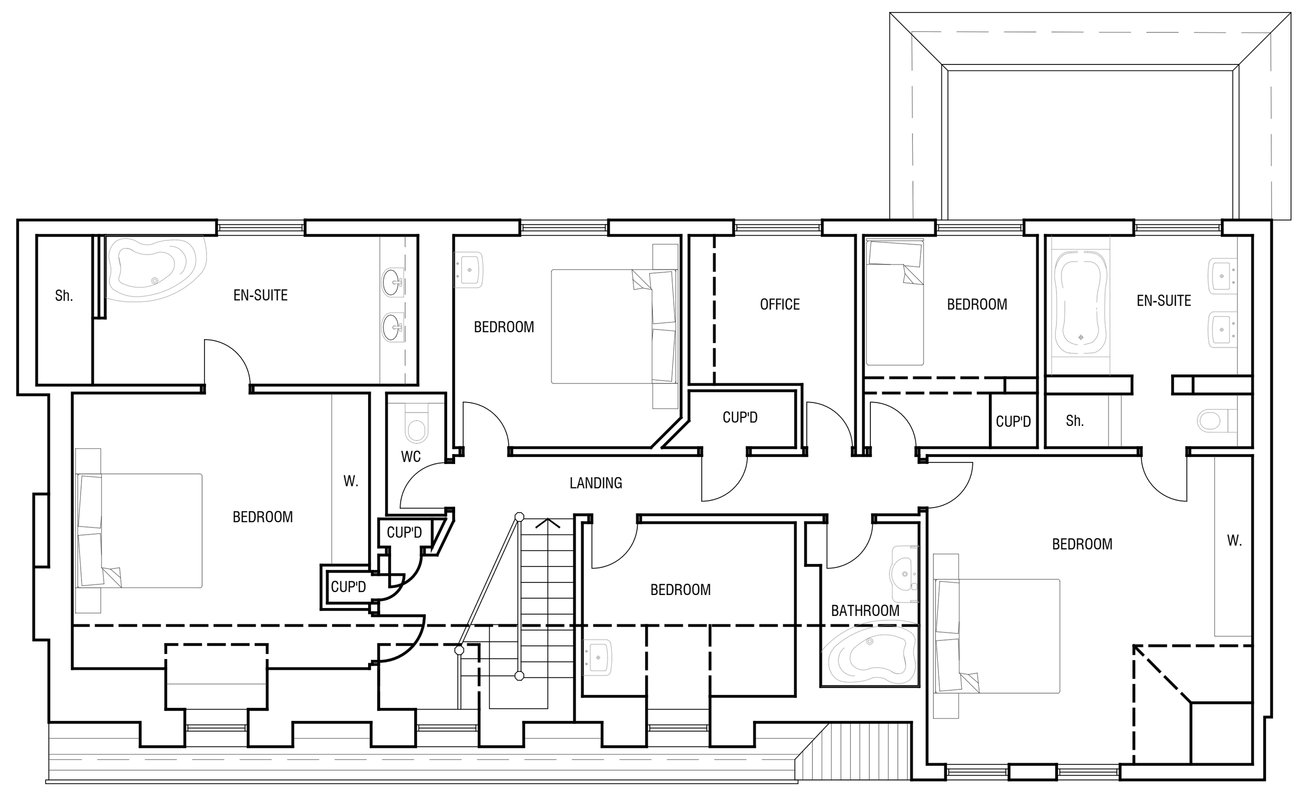
APPENDIX A

FRONT ELEVATION (EAST)
existing I 1:100@A1

REAR ELEVATION (WEST)
existing I 1:100@A1

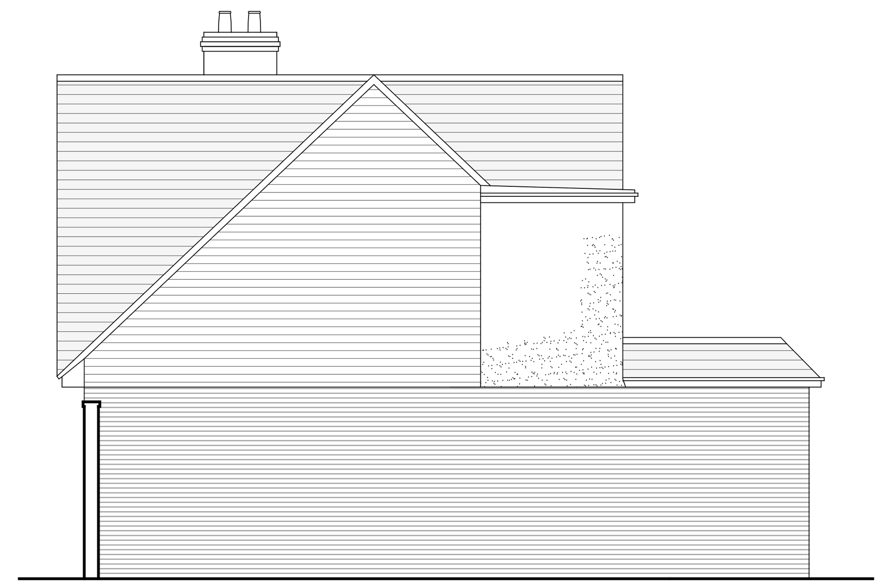


SITE PLAN/ ROOF PLAN
existing I 1:100@A1

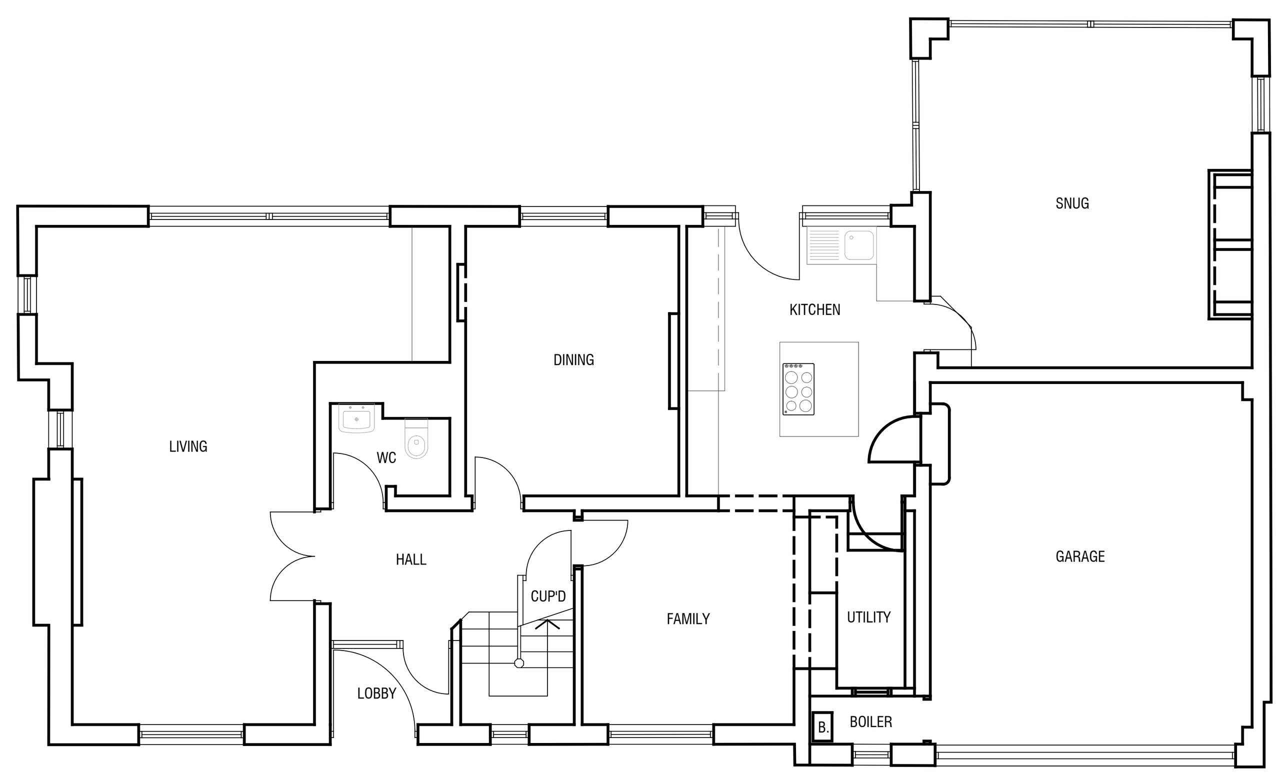


FIRST FLOOR PLAN
existing 1:100@A1

SIDE ELEVATION (SOUTH)
existing I 1:100@A1



SIDE ELEVATION (NORTH)
existing I 1:100@A1



GROUND FLOOR PLAN
existing 1:100@A1

SCHEDULE OF AREAS - GIA	
Gross internal Areas (measured to the internal face of the perimeter walls)	
Existing dwelling	
Ground Floor	165 sqm/ 1,776 sqft
First Floor	140 sqm/ 1,507 sqft
TOTAL	305 sqm/ 3,283 sqft
Existing outbuildings	
Outbuilding	24 sqm/ 258 sqft
Shed	11 sqm/ 118 sqft
Greenhouse	4 sqm/ 43 sqft
TOTAL SITE	344 sqm/ 3,702 sqft

No dimensions are to be scaled from this drawing

Rev. Date Description Name

12 Spring Court Road
Enfield EN2 8JP

Plans and Elevations
As existing

Kirby . Cove . Architects
Studio 10 Dimsdale House Hertford SG14 1BY 01992 538088

2389	100	REV
drawn AR	date 19/01/2023	chk A -	chk B -	scale 1:100 @A1

APPENDIX B

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Sam Briscoe
Site name:	3517
Site location:	Enfield

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

Site Details

Latitude:	51.66670° N
Longitude:	0.10673° W
Reference:	4132355635
Date:	Feb 06 2024 14:40

Runoff estimation approach: IH124

Site characteristics

Total site area (ha): .13

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	652	652
Hydrological region:	6	6
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

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

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

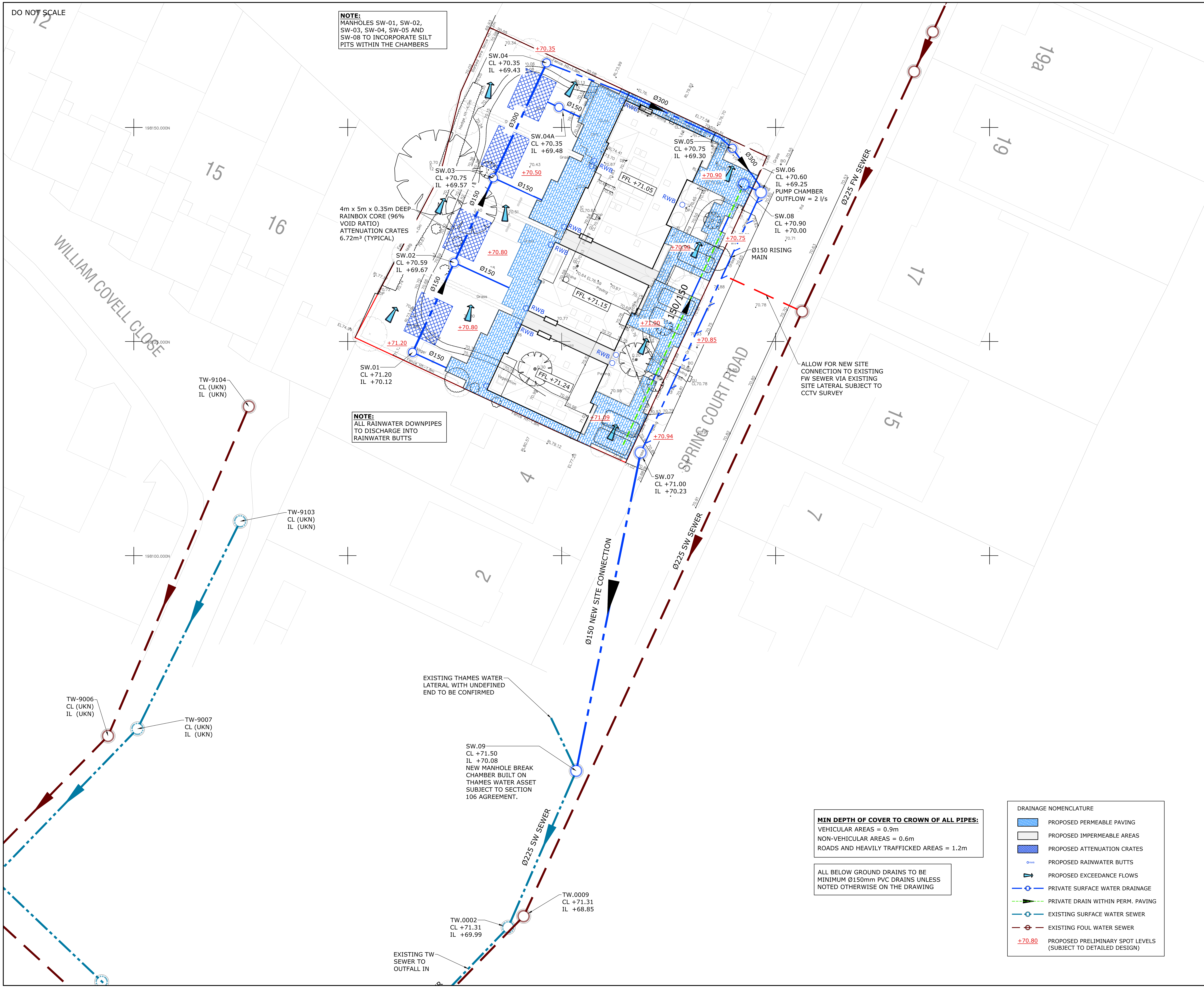
(3) Is SPR/SPRHOST ≤ 0.3?

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

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	0.58	0.58
1 in 1 year (l/s):	0.49	0.49
1 in 30 years (l/s):	1.33	1.33
1 in 100 year (l/s):	1.84	1.84
1 in 200 years (l/s):	2.16	2.16

APPENDIX C



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1.03 THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECT'S, SERVICE ENGINEER'S AND RJL's DRAWINGS AND SPECIFICATIONS.

2.00 DRAINAGE:

2.01 LEVELS RELATED TO ORDNANCE DATUM NEWLYN UNLESS NOTED OTHERWISE.

2.02 ALL DIMENSIONS IN MILLIMETRES UNLESS NOTED OTHERWISE.

2.03 REPORT ANY DISCREPANCIES TO RJL IMMEDIATELY AND SEEK ADVICE.

2.04 THE CONTRACTOR SHALL CHECK LEVELS & CONDITION OF ALL EXISTING DRAINAGE PRIOR TO CONSTRUCTION OF ANY NEW DRAINAGE, UNLESS OTHERWISE AGREED, TO ENSURE THE PROPOSED DESIGN MAY BE ACHIEVED.

2.05 THE CONTRACTOR SHALL CARRY OUT FURTHER SURVEYS TO CORRECTLY LOCATE ALL BURIED SERVICES

2.06 CONTRACTOR TO ALLOW FOR JET WASHING ALL LENGTHS OF SEWERS TO BE RETAINED.

2.07 ALL ADOPTABLE DRAINAGE WORKS TO BE CONSTRUCTED AS DETAILED IN THE DESIGN AND CONSTRUCTION GUIDANCE OR AS STIPULATED IN STATUTORY SEWER UNDERTAKER'S ADDENDUM.

2.08 SECTION 106 APPLICATION TO BE COMPLETED AND APPROVED BY THE STATUTORY WATER AUTHORITY PRIOR TO ANY CONNECTION MADE TO THE PUBLIC SEWER. CONTRACTOR TO ENSURE THAT A WATER AUTHORITY INSPECTOR IS PRESENT DURING CONNECTION TO THE PUBLIC SEWER.

2.09 ALL PRIVATE DRAINAGE WORKS TO BE IN ACCORDANCE WITH PART H OF THE CURRENT BUILDING REGULATIONS, BS EN 752 AND BS EN 12056.

2.10 THE WORKS DESCRIBED AND SPECIFIED ON THIS DRAWING AND ASSOCIATED DRAWINGS SHALL BE UNDERTAKEN IN ACCORDANCE WITH ALL CURRENT HEALTH AND SAFETY LEGISLATION. REFERENCE SHALL ALSO BE MADE TO THE PROJECT HEALTH & SAFETY PLAN PREPARED BY THE CDM COORDINATOR FOR THE PROJECT.

2.11 CONSTRUCTION OF SOME SEWERS MAY INVOLVE DEEP EXCAVATIONS AND WORKING IN HAZARDOUS CONFINED SPACE ATMOSPHERES.

REV	DATE	DESCRIPTION	DRAWN	CHKD
P1	20.06.23	PRELIMINARY ISSUE	SJA	KT

REVISIONS

This drawing is to be read in conjunction with all other Engineer's drawings and all other project information. Any discrepancy between the Engineer's drawings and other project information is to be reported to the Engineer immediately.

Project

12 SPRING COURT
ENFIELD

Title

PRELIMINARY DRAINAGE
SCHEME FOR PLANNING

Client

DIANE SMITH

RichardJackson Engineering Consultants
847 The Crescent, Colchester, Essex CO4 9YQ Tel: 01206 228800
Unit 06C130, 6th Floor, 1 St. Katherine's Way, London, E1W 1UN Tel: 020 7448 9910
5 Quern House, Mill Court, Great Shelford, Cambs CB22 5LD Tel: 01223 314794
4 The Old Church, St. Matthews Road, Norwich, Norfolk NR1 1SP Tel: 01603 230240
The Wheelhouse, Bonds Mill, Stonehouse, Gloucestershire GL10 3RF Tel: 01172 020070
Email Address: mail@rj.uk.com Website: http://www.rj.uk.com

Scale	Drawn	Date
1:500 @ A1	SJA	07/06/22
Project Manager	Checked	Approved
MJG	KT	KT

Status	Suitability Description	RJL Project No :
S2	FOR INFORMATION	62279

project	originator	zone	level	type	role	number	revision
62279	RJL	XX	XX	DR	C	1000	P1

A1

APPENDIX D

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	1	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	20.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.400	Preferred Cover Depth (m)	0.600
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

	Name	Area (ha)	T of E (mins)	Cover Level (m)	Manhole Type	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
✓	SW-01	0.012	5.00	71.200	Adoptable	1200	531007.590	198123.740	1.080
✓	SW-02	0.012	5.00	70.750	Adoptable	1200	531012.440	198134.220	1.080
✓	SW-03	0.012	5.00	70.450	Adoptable	1200	531017.020	198144.110	0.880
✓	SW-04	0.012	5.00	70.350	Adoptable	1200	531023.240	198157.530	0.920
✓	SW-04A		5.00	70.350	Adoptable	1200	531024.690	198152.350	0.870
✓	SW-05	0.011	5.00	70.750	Adoptable	1200	531044.950	198147.560	1.450
✓	SW-06			70.600	Adoptable	1500	531048.470	198142.790	1.350
✓	SW-07			71.350	Adoptable	1200	531033.970	198111.470	1.120
✓	SW-08	0.016	5.00	70.900	Adoptable	1200	531046.270	198143.350	0.900
✓	SW-09			71.500	Adoptable	1200	531026.700	198074.860	1.420
✓	TW-0002			71.310	Adoptable	1200	531018.750	198056.590	1.320

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	SW-01	SW-02	11.548	0.600	70.120	69.690	0.430	26.9	150	5.10	50.0
1.001	SW-02	SW-03	10.899	0.600	69.670	69.590	0.080	136.2	150	5.31	50.0
1.002	SW-03	SW-04	14.791	0.600	69.570	69.450	0.120	123.3	300	5.48	50.0
2.000_1	SW-04A	SW-04	5.379	0.600	69.480	69.430	0.050	107.6	150	5.09	50.0
1.003	SW-04	SW-05	23.890	0.600	69.430	69.320	0.110	217.2	300	5.86	50.0
1.004	SW-05	SW-06	5.928	0.600	69.300	69.250	0.050	118.6	300	5.93	50.0
1.005	SW-06	SW-07	34.514	0.600	69.250	70.230	-0.980	-35.2	150	6.50	48.4
1.006	SW-07	SW-09	37.325	0.600	70.230	70.080	0.150	248.8	150	7.49	46.5
2.000	SW-08	SW-06	2.237	0.600	70.000	69.980	0.020	111.9	150	5.04	50.0
1.007	SW-09	TW-0002	19.925	0.600	70.080	69.990	0.090	221.4	225	7.87	46.5

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.950	34.5	1.6	0.930	0.910	0.012	0.0	22	0.995
1.001	0.859	15.2	3.3	0.930	0.710	0.024	0.0	47	0.685
1.002	1.415	100.0	4.9	0.580	0.600	0.036	0.0	45	0.741
2.000_1	0.968	17.1	0.0	0.720	0.770	0.000	0.0	0	0.000
1.003	1.063	75.1	6.5	0.620	1.130	0.048	0.0	59	0.659
1.004	1.443	102.0	8.0	1.150	1.050	0.059	0.0	57	0.869
1.005	1.000	17.7	9.8	1.200	0.970	0.075	0.0	150	0.000
1.006	0.632	11.2	9.5	0.970	1.270	0.075	0.0	106	0.708
2.000	0.949	16.8	2.2	0.750	0.470	0.016	0.0	37	0.657
1.007	0.874	34.8	9.5	1.195	1.095	0.075	0.0	80	0.748

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)
1.000	11.548	26.9	150
1.001	10.899	136.2	150
1.002	14.791	123.3	300
2.000_1	5.379	107.6	150
1.003	23.890	217.2	300
1.004	5.928	118.6	300
1.005	34.514	-35.2	150
1.006	37.325	248.8	150
2.000	2.237	111.9	150
1.007	19.925	221.4	225

Link
1.000
1.001
1.002
2.000_1
1.003
1.004
1.005
1.006
2.000
1.007

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	MH Type	Connections	Link	IL (m)	Dia (mm)
SW-01	531007.590	198123.740	71.200	1.080	1200	Adoptable	0	1.000	70.120	150
SW-02	531012.440	198134.220	70.750	1.080	1200	Adoptable	1	1.000	69.690	150
							0	1.001	69.670	150
SW-03	531017.020	198144.110	70.450	0.880	1200	Adoptable	1	1.001	69.590	150
							0	1.002	69.570	300
SW-04	531023.240	198157.530	70.350	0.920	1200	Adoptable	1	2.000_1	69.430	150
							2	1.002	69.450	300
							0	1.003	69.430	300
SW-04A	531024.690	198152.350	70.350	0.870	1200	Adoptable	0	2.000_1	69.480	150
SW-05	531044.950	198147.560	70.750	1.450	1200	Adoptable	1	1.003	69.320	300
							0	1.004	69.300	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	MH Type	Connections	Link	IL (m)	Dia (mm)
SW-06	531048.470	198142.790	70.600	1.350	1500	Adoptable	1	2.000	69.980	150
							2	1.004	69.250	300
							0	1.005	69.250	150
SW-07	531033.970	198111.470	71.350	1.120	1200	Adoptable	1	1.005	70.230	150
							0	1.006	70.230	150
SW-08	531046.270	198143.350	70.900	0.900	1200	Adoptable	0	2.000	70.000	150
SW-09	531026.700	198074.860	71.500	1.420	1200	Adoptable	1	1.006	70.080	150
							0	1.007	70.080	225
TW-0002	531018.750	198056.590	71.310	1.320	1200	Adoptable	1	1.007	69.990	225

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	x
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	20.000	Additional Storage (m³/ha)	0.0
Ratio-R	0.400	Check Discharge Rate(s)	✓
Summer CV	0.750	Check Discharge Volume	✓
Winter CV	0.840	100 year 360 minute (m³)	14
Analysis Speed	Detailed		

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	40	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)	0.130	Betterment (%)	0
SAAR (mm)	652	QBar	0.6
Soil Index	4	Q 1 year (l/s)	0.5
SPR	0.47	Q 30 year (l/s)	1.1
Region	6	Q 100 year (l/s)	1.4
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	0.130	Storm Duration (mins)	360
Soil Index	4	Betterment (%)	0
SPR	0.47	PR	0.442
CWI	98.074	Runoff Volume (m³)	36

Node SW-06 Online Pump Control

Flap Valve	x	Design Depth (m)	0.980	Switch off depth (m)	0.850
Replaces Downstream Link	x	Design Flow (l/s)	2.0		
Invert Level (m)	69.250	Switch on depth (m)	0.900		

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.150	0.250	0.300	0.350	0.450	0.500	0.750	1.500	0.950	1.925
0.250	0.300	0.350	0.400	0.650	1.000	0.850	1.725	0.980	2.000

Node SW-01 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	70.120
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	8

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	20.0	0.0	0.350	20.0	0.0	0.351	0.0	0.0

Node SW-01 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	70.120
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	8

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	49.0	0.0	0.350	49.0	0.0	0.351	0.0	0.0

Node SW-02 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	69.670
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	20.0	0.0	0.350	20.0	0.0	0.351	0.0	0.0

Node SW-02 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	69.670
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	35.0	0.0	0.350	35.0	0.0	0.351	0.0	0.0

Node SW-03 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	69.570
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	20.0	0.0	0.350	20.0	0.0	0.351	0.0	0.0

Node SW-04 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	69.430
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	34.0	0.0	0.350	34.0	0.0	0.351	0.0	0.0

Node SW-04A Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	69.480
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	35.0	0.0	0.350	35.0	0.0	0.351	0.0	0.0

Node SW-05 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	69.300
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.30	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	11.0	0.0	0.350	11.0	0.0	0.351	0.0	0.0

Node SW-08 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	70.000	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)		Depth (m)	0.500
Safety Factor	2.0	Width (m)	12.000	Inf Depth (m)	
Porosity	0.30	Length (m)	14.500		

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 15 minute summer	109.521	30.991	1 year 180 minute winter	15.102	5.979
1 year 15 minute winter	76.857	30.991	1 year 240 minute summer	18.475	4.882
1 year 30 minute summer	71.439	20.215	1 year 240 minute winter	12.274	4.882
1 year 30 minute winter	50.133	20.215	1 year 360 minute summer	14.169	3.646
1 year 60 minute summer	48.435	12.800	1 year 360 minute winter	9.210	3.646
1 year 60 minute winter	32.179	12.800	1 year 480 minute summer	11.185	2.956
1 year 120 minute summer	30.053	7.942	1 year 480 minute winter	7.431	2.956
1 year 120 minute winter	19.966	7.942	1 year 600 minute summer	9.182	2.511
1 year 180 minute summer	23.233	5.979	1 year 600 minute winter	6.274	2.511

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)	Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
1 year 720 minute summer	8.203	2.199	30 year 960 minute winter	9.416	3.743
1 year 720 minute winter	5.513	2.199	30 year 1440 minute summer	10.161	2.723
1 year 960 minute summer	6.768	1.782	30 year 1440 minute winter	6.829	2.723
1 year 960 minute winter	4.483	1.782	100 year +40% CC 15 minute summer	488.233	138.153
1 year 1440 minute summer	4.949	1.326	100 year +40% CC 15 minute winter	342.620	138.153
1 year 1440 minute winter	3.326	1.326	100 year +40% CC 30 minute summer	320.551	90.705
30 year 15 minute summer	268.706	76.035	100 year +40% CC 30 minute winter	224.948	90.705
30 year 15 minute winter	188.566	76.035	100 year +40% CC 60 minute summer	214.603	56.713
30 year 30 minute summer	174.929	49.499	100 year +40% CC 60 minute winter	142.577	56.713
30 year 30 minute winter	122.757	49.499	100 year +40% CC 120 minute summer	129.587	34.246
30 year 60 minute summer	116.589	30.811	100 year +40% CC 120 minute winter	86.094	34.246
30 year 60 minute winter	77.459	30.811	100 year +40% CC 180 minute summer	97.729	25.149
30 year 120 minute summer	70.438	18.615	100 year +40% CC 180 minute winter	63.526	25.149
30 year 120 minute winter	46.797	18.615	100 year +40% CC 240 minute summer	75.977	20.078
30 year 180 minute summer	53.298	13.715	100 year +40% CC 240 minute winter	50.477	20.078
30 year 180 minute winter	34.645	13.715	100 year +40% CC 360 minute summer	56.677	14.585
30 year 240 minute summer	41.604	10.995	100 year +40% CC 360 minute winter	36.841	14.585
30 year 240 minute winter	27.641	10.995	100 year +40% CC 480 minute summer	43.979	11.622
30 year 360 minute summer	31.221	8.034	100 year +40% CC 480 minute winter	29.219	11.622
30 year 360 minute winter	20.295	8.034	100 year +40% CC 600 minute summer	35.604	9.738
30 year 480 minute summer	24.324	6.428	100 year +40% CC 600 minute winter	24.327	9.738
30 year 480 minute winter	16.160	6.428	100 year +40% CC 720 minute summer	31.433	8.424
30 year 600 minute summer	19.756	5.404	100 year +40% CC 720 minute winter	21.125	8.424
30 year 600 minute winter	13.498	5.404	100 year +40% CC 960 minute summer	25.432	6.697
30 year 720 minute summer	17.490	4.687	100 year +40% CC 960 minute winter	16.847	6.697
30 year 720 minute winter	11.754	4.687	100 year +40% CC 1440 minute summer	18.055	4.839
30 year 960 minute summer	14.215	3.743	100 year +40% CC 1440 minute winter	12.134	4.839

Results for 1 year Critical Storm Duration. Lowest mass balance: 95.67%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	SW-01	22	70.136	0.016	1.3	0.5429	0.0000	OK
60 minute winter	SW-02	42	69.698	0.028	1.5	0.8635	0.0000	OK
1440 minute winter	SW-03	1680	69.650	0.080	0.4	1.6125	0.0000	OK
1440 minute winter	SW-04	1620	69.650	0.220	0.5	7.3560	0.0000	OK
1440 minute winter	SW-04A	1680	69.650	0.170	0.1	1.9779	0.0000	SURCHARGED
1440 minute winter	SW-05	1680	69.650	0.350	0.2	1.5514	0.0000	SURCHARGED
1440 minute winter	SW-06	1680	69.650	0.400	0.1	0.7071	0.0000	SURCHARGED
15 minute summer	SW-07	1	70.230	0.000	0.0	0.0000	0.0000	OK
30 minute winter	SW-08	22	70.026	0.026	1.7	0.6344	0.0000	OK
15 minute summer	SW-09	1	70.080	0.000	0.0	0.0000	0.0000	OK
15 minute summer	TW-0002	1	69.990	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
30 minute winter	SW-01	1.000	SW-02	0.8	0.788	0.022	0.0110	
60 minute winter	SW-02	1.001	SW-03	1.1	0.499	0.074	0.0246	
1440 minute winter	SW-03	1.002	SW-04	0.3	0.311	0.003	0.4804	
1440 minute winter	SW-04	1.003	SW-05	-0.2	0.023	-0.002	1.5027	
1440 minute winter	SW-04A	2.000_1	SW-04	-0.1	-0.047	-0.008	0.0947	
1440 minute winter	SW-05	1.004	SW-06	-0.1	-0.013	-0.001	0.4174	
1440 minute winter	SW-06	1.005	SW-07	0.0	0.000	0.000	0.0000	
15 minute summer	SW-07	1.006	SW-09	0.0	0.000	0.000	0.0000	
30 minute winter	SW-08	2.000	SW-06	0.9	0.491	0.056	0.0043	
15 minute summer	SW-09	1.007	TW-0002	0.0	0.000	0.000	0.0000	0.0

Results for 30 year Critical Storm Duration. Lowest mass balance: 95.67%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW-01	13	70.148	0.028	4.2	0.9904	0.0000	OK
720 minute winter	SW-02	960	69.916	0.246	0.7	7.5478	0.0000	SURCHARGED
720 minute winter	SW-03	930	69.916	0.346	0.9	6.9743	0.0000	SURCHARGED
720 minute winter	SW-04	945	69.916	0.486	1.4	11.8713	0.0000	SURCHARGED
720 minute winter	SW-04A	945	69.917	0.437	0.4	4.1740	0.0000	SURCHARGED
720 minute winter	SW-05	945	69.917	0.617	0.7	1.8540	0.0000	SURCHARGED
720 minute winter	SW-06	945	69.917	0.667	0.4	1.1780	0.0000	SURCHARGED
15 minute summer	SW-07	1	70.230	0.000	0.0	0.0000	0.0000	OK
30 minute winter	SW-08	22	70.043	0.043	4.3	1.5299	0.0000	OK
15 minute summer	SW-09	1	70.080	0.000	0.0	0.0000	0.0000	OK
15 minute summer	TW-0002	1	69.990	0.000	0.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW-01	1.000	SW-02	2.6	1.119	0.077	0.0286	
720 minute winter	SW-02	1.001	SW-03	0.6	0.385	0.039	0.1919	
720 minute winter	SW-03	1.002	SW-04	0.6	0.317	0.006	1.0416	
720 minute winter	SW-04	1.003	SW-05	-0.7	0.076	-0.009	1.6823	
720 minute winter	SW-04A	2.000_1	SW-04	-0.4	-0.054	-0.021	0.0947	
720 minute winter	SW-05	1.004	SW-06	-0.4	-0.005	-0.004	0.4174	
720 minute winter	SW-06	1.005	SW-07	0.0	0.000	0.000	0.0000	
15 minute summer	SW-07	1.006	SW-09	0.0	0.000	0.000	0.0000	
30 minute winter	SW-08	2.000	SW-06	2.5	0.636	0.147	0.0087	
15 minute summer	SW-09	1.007	TW-0002	0.0	0.000	0.000	0.0000	0.0

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 95.67%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	SW-01	12	70.162	0.042	7.5	1.4506	0.0000	OK
960 minute winter	SW-02	615	70.151	0.481	2.9	10.8841	0.0000	SURCHARGED
960 minute winter	SW-03	615	70.151	0.581	2.0	7.3167	0.0000	FLOOD RISK
960 minute winter	SW-04	615	70.151	0.721	1.7	12.1368	0.0000	FLOOD RISK
960 minute winter	SW-04A	615	70.151	0.671	0.7	4.4394	0.0000	FLOOD RISK
960 minute winter	SW-05	615	70.151	0.851	1.9	2.1192	0.0000	SURCHARGED
720 minute winter	SW-06	690	70.151	0.901	1.8	1.5921	0.0000	SURCHARGED
960 minute winter	SW-07	630	70.272	0.042	1.8	0.0476	0.0000	OK
960 minute winter	SW-08	615	70.151	0.151	2.5	7.2989	0.0000	SURCHARGED
960 minute winter	SW-09	630	70.116	0.036	1.8	0.0402	0.0000	OK
960 minute winter	TW-0002	630	70.024	0.034	1.8	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	SW-01	1.000	SW-02	5.8	1.250	0.168	0.0641	
960 minute winter	SW-02	1.001	SW-03	-1.9	0.367	-0.123	0.1919	
960 minute winter	SW-03	1.002	SW-04	-1.5	0.317	-0.015	1.0416	
960 minute winter	SW-04	1.003	SW-05	1.5	0.075	0.021	1.6823	
960 minute winter	SW-04A	2.000_1	SW-04	-0.7	-0.054	-0.041	0.0947	
960 minute winter	SW-05	1.004	SW-06	1.9	0.106	0.019	0.4174	
720 minute winter	SW-06	1.005	SW-07	1.8	0.140	0.103	0.3733	
960 minute winter	SW-07	1.006	SW-09	1.8	0.538	0.163	0.1348	
960 minute winter	SW-08	2.000	SW-06	-1.9	0.433	-0.112	0.0394	
960 minute winter	SW-09	1.007	TW-0002	1.8	0.472	0.053	0.0772	18.1

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