Lamorna, Dartmouth Park Road
NW5 1SU

Drainage Strategy
& Flood Risk Assessment

January 2025

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1. INTRODUCTION

1.1 This document has been prepared in support of a planning application for development at Lamorna, Dartmouth Park Road, NW5 1SU. The location of the site is shown below.

Figure 1. Location Plan

1.2 The site is currently occupied by a two-storey single-family dwelling.

1.3 It is proposed to demolish the existing dwelling and construct a new five-storey plus basement residential building consisting of six self-contained flats. Drawings of the proposed development are included in Appendix A.

1.4 The surface water management strategy will adhere to the principles set out in DEFRA's Non-Statutory Technical Standards for Sustainable Drainage Systems.

1.5 Options for disposal of surface water are described in this report. The following table provides a summary.

Disposal Method	Comment
1.Capture rainwater for re-use.	Proposed.
2. Discharge to a water body that is capable of receiving the runoff without increasing flood risk elsewhere.	There are no such water bodies in the vicinity of the site.
3. Use infiltration techniques.	The combination of the proximity of the site to other buildings and likely unfavourable ground conditions (London Clay) means that infiltration is not considered feasible.
4. Attenuate rainwater in ponds or open surface water features.	Not feasible due to limited footprint of site.
5. Attenuate rainwater by storing in tanks for gradual release.	A combined rainwater harvesting and attenuation tank is proposed.
6. Discharge rainwater direct to a watercourse.	There are no suitable watercourses in the vicinity of the site.
7. Discharge rainwater to a surface water sewer.	The overflow from the harvesting/attenuation tank will discharge to the public combined water sewer.
8. Discharge to a highway drain.	Not required.
9. Discharge rainwater to a combined sewer.	Not required.

Table 1.1 – Summary of the Drainage Hierarchy

2. INFILTRATION

2.1 A ground investigation has yet to be carried out. However, given the small footprint of the site and the requirement for soakaways to be located at least 5m from structures and 2.5m from boundaries it is reasonable to conclude that infiltration will not be feasible. In addition, the British Geological Society's 1:50,000 maps indicate that the site is likely underlain by London Clay (a very low permeability soil) with no superficial deposits.

3. EXISTING AND GREENFIELD RUNOFF RATES AND VOLUMES

3.1 The site extends to approximately 190m^2. The greenfield runoff rates from this area have been estimated using the HR Wallingford Greenfield Runoff Rate Estimator. The calculation is included in Appendix B and the results are summarised below.

Return Period (years)	Runoff Rate (l/s)
Qbar	0.08
1	0.07
30	0.19
100	0.26

Table 2.1 – Greenfield Runoff Rates

3.2 The volume of runoff from the greenfield site for the 100yr-6hr rainfall event has been estimated using the Flow software suite. From Calculation 2 in Appendix B it can be seen that the volume is approximately 8m^3.

3.3 The existing site comprises a single dwelling with mainly paved/concreted spaces to the front and rear. From the topographic survey in Appendix A it can be seen that the total area of planted/permeable surfaces within the site is approximately 10m^2.

3.4 The runoff rates from the existing site have been estimated using a simple notional Flow hydraulic model (see Appendix B). The results are summarised below.

Return Period (years)	Runoff Rate (l/s)
2	2.6
30	8.0
100	10.6

Table 2.2 – Existing Runoff Rates

3.5 The volume of runoff from the existing site for the 100yr-6hr rainfall event has been estimated using the Flow software suite. From Calculation 3 in Appendix B it can be seen that the volume is approximately 14m^3.

4. PROPOSED SURFACE WATER DRAINAGE

4.1 The existing drainage arrangements are yet to be confirmed. However, given the topography of the area it is considered likely that the existing discharge is to the public combined sewer at the location shown below.

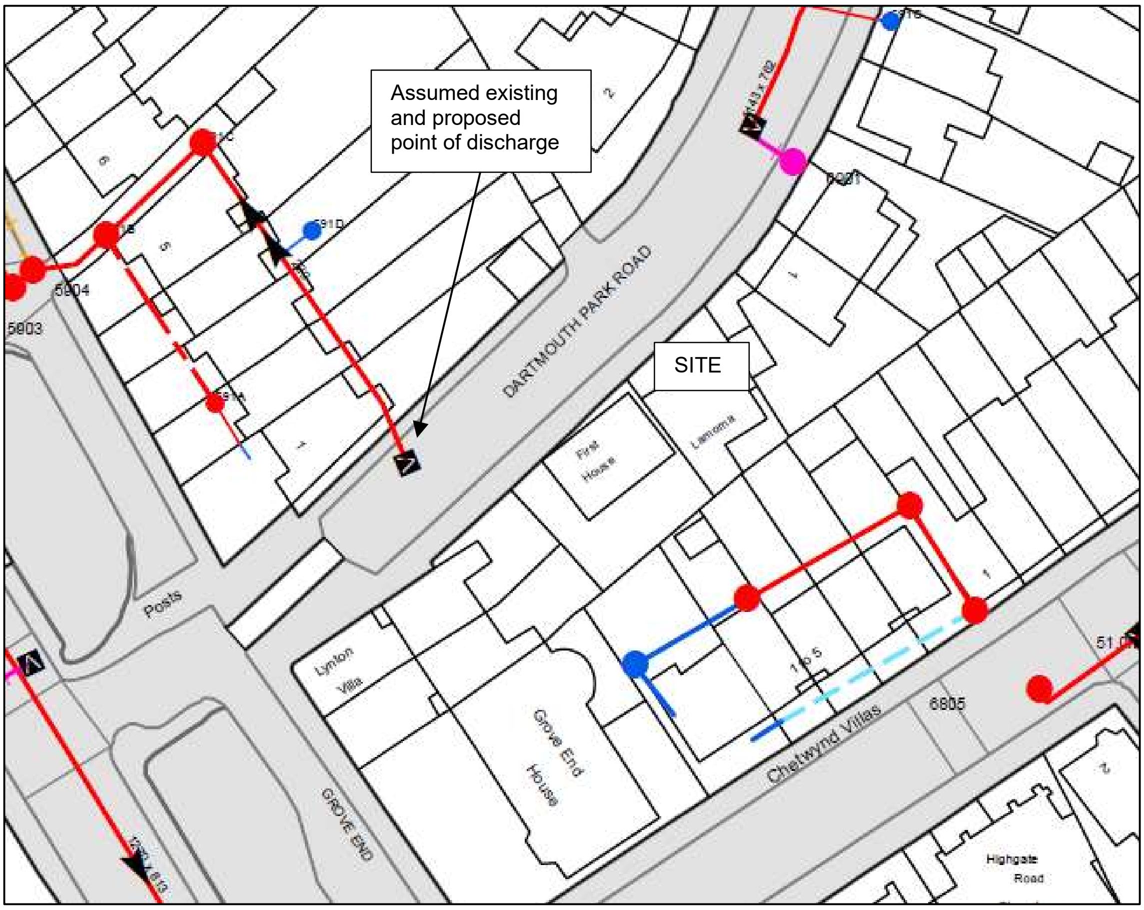


Figure 2 – Proposed Point of Discharge

4.2 The drainage strategy has been developed in accordance with the drainage hierarchy shown in Section 1 above and will incorporate the following SuDS features:

- Rainwater from roof areas will be captured for re-use.
- Green roofs will be provided where practicable.
- Geocellular attenuation tank.

4.3 The green roofs will provide water quality benefits, biodiversity benefits and amenity benefits by contributing to a reduction in the 'heat island effect'.

4.4 An indicative Flow hydraulic model has been used to estimate the rate of runoff from the proposed site. The model is included in Appendix B and the results are summarised in the following table.

Return Period (years)	Runoff Rate (l/s)	Reduction in Runoff Rate
2	1.3	50%
30	2.0	75%
100	2.0	81%
100+40%	2.0	-

Table 2.1 – Proposed Runoff Rates

4.5 Drawing DR-001 in Appendix A shows the proposed surface water strategy.

4.6 The MicroDrainage software suite has been used to estimate the size of combined rainwater harvesting/attenuation tank required. From Calculation 6 in Appendix B it can be seen that the tank will require a combined volume of approximately 6m^3.

4.7 In addition to a rainwater harvesting tank 8m^3 of geocellular storage has been provided to attenuate runoff to a maximum of 2l/s for all rainfall events up to the 100yr +40% cc storm event.

4.8 The Flow model printout in Calculation 4 of Appendix B confirms that there will be no flooding on the site for rainfall events up to the 1000yr return period or the 100yr plus a 40% allowance for the potential impact of climate change. It should be noted that this is based on a free discharge to the public sewer. The location and level of the proposed point of connection should be confirmed prior to construction to establish if a pumping station will be required. Thames Water has agreed in principal to the connection. Refer to appendix D for correspondence.

4.9 The flow model printouts in calculations 3 and 5 show there is no difference in discharged volumes between the existing and proposed 100 yr 6h hour events. The discharged volume is approx. 14m^3

5. MAINTENANCE

5.1 A management company will be responsible for ensuring the surface water drainage system is properly maintained.

5.2 Maintenance schedules for the various components of the system are shown in the following tables.

Maintenance schedule	Required action	Typical frequency
Regular inspections	Inspect all components including soil substrate, vegetation, drains, irrigation systems (if applicable), membranes and roof structure for proper operation, integrity of waterproofing and structural stability	Annually and after severe storms
	Inspect soil substrate for evidence of erosion channels and identify any sediment sources	Annually and after severe storms
	Inspect drain inlets to ensure unrestricted runoff from the drainage layer to the conveyance or roof drain system	Annually and after severe storms
	Inspect underside of roof for evidence of leakage	Annually and after severe storms
Regular maintenance	Remove debris and litter to prevent clogging 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)
	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, prune shrubs and manage other planting (if appropriate) as required – clippings should be removed and not allowed to accumulate	Six monthly or as required
Remedial actions	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

Table 5.1 – Maintenance Schedule for Green Roofs © CIRIA

Maintenance schedule	Required action	Typical frequency
Regular maintenance	Inspection of the tank for debris and sediment build-up, inlets/outlets/withdrawal devices, overflow areas, pumps, filters	Annually (and following poor performance)
	Cleaning of tank, inlets, outlets, gutters, withdrawal devices and roof drain filters of silts and other debris	Annually (and following poor performance)
Occasional maintenance	Cleaning and/or replacement of any filters	Three monthly (or as required)
Remedial actions	Repair of overflow erosion damage or damage to tank	As required
	Pump repairs	As required

Table 5.2 – Maintenance Schedule for Rainwater Harvesting System

6. EXCEEDANCE FLOWPATHS

6.1 In the event of a blockage or failure of the system runoff will pool in the terrace areas of the basement dwelling.

6.2 It is recommended that a pump be provided to convey exceedance flows to the public sewer.

7. RESIDUAL FLOOD RISK

7.1 The Camden Flood Risk Management Strategy (2022-2027) indicates that the site lies within the York Rise Local Flood Risk Zone. The following sections review the flood risk arising from various sources.

Watercourses

7.2 The extract of the EA's flood map shown in Figure 3 indicates that the site is at very low risk of flooding from watercourses.

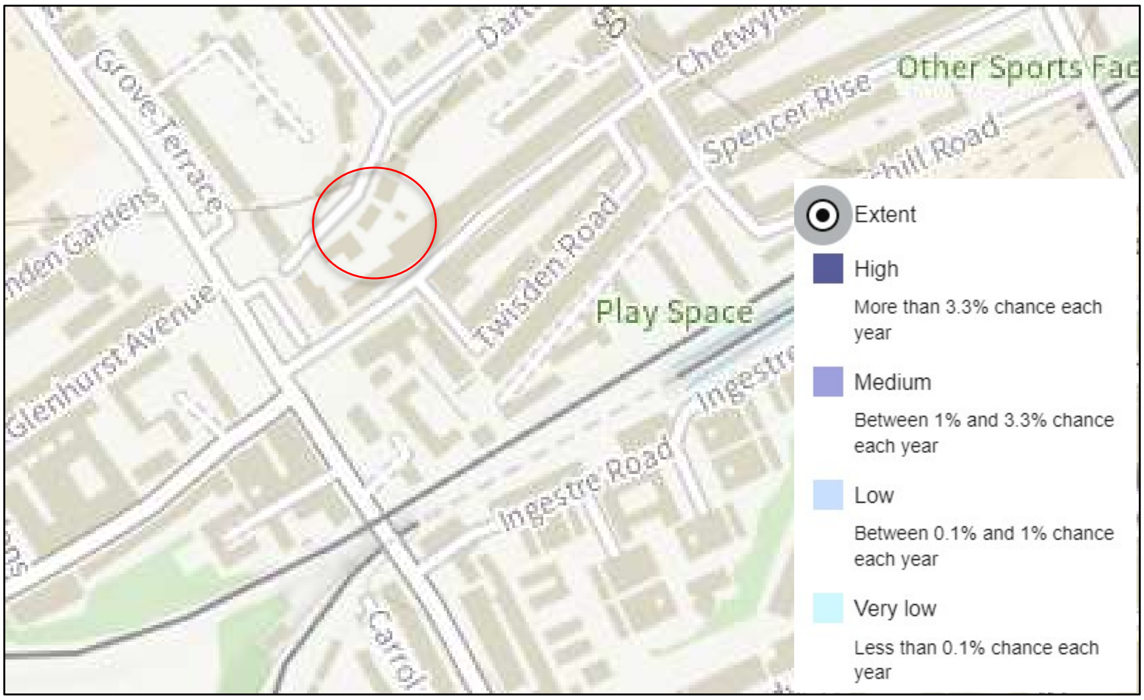


Figure 3. Risk of Flooding from Watercourses (Source: www.gov.uk)

Surface Water Flooding

7.3 The extract from the EA's flood map shown in Figure 4 indicates that the site is not at risk of flooding from surface water runoff during the 100year return period rainfall event.

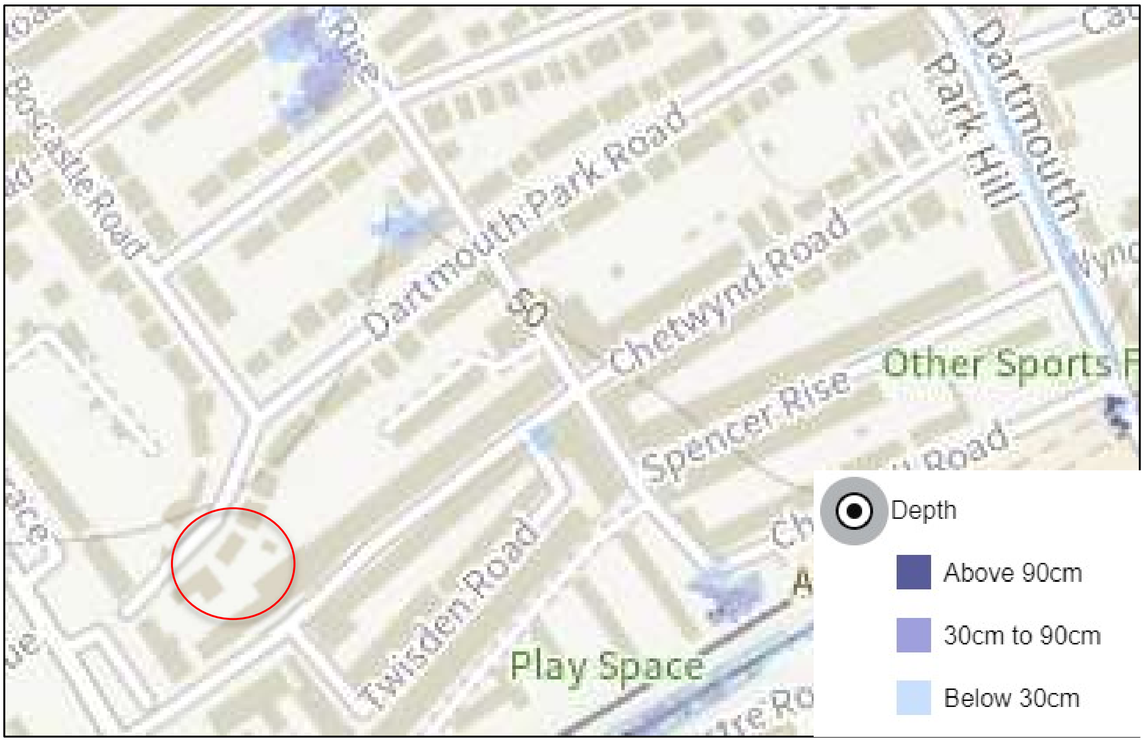


Figure 4. Risk of Flooding from Surface Water – Medium Risk Scenario (Source: www.gov.uk)

7.4 The extract from the EA's flood map shown in Figure 5 indicates that the area to the rear of the existing site is at risk of flooding to depths of up to 300mm from surface water runoff during the 1000 year return period rainfall event.

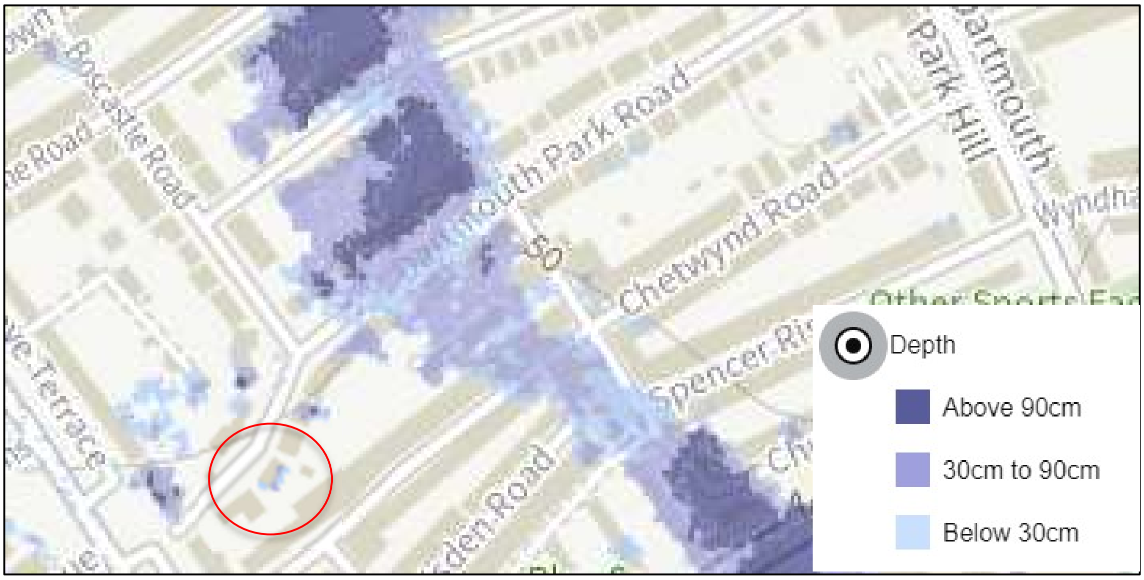


Figure 5. Risk of Flooding from Surface Water – Low Risk Scenario (Source: www.gov.uk)

<u>Groundwater</u>

7.5 The Gov.uk website indicates that flooding from groundwater is unlikely. This is confirmed in the Basement Impact Assessment Screening Report (Talon Consulting – September 2024).

Sewers

7.6 Figure 5a of The London Borough of Camden's SFRA indicates that the site does not lie within an area with a high frequency of flooding from sewers.

Artificial Sources

7.7 The Gov.uk website advises that "flooding from reservoirs is "unlikely in this area".

Summary of Flood Risk

7.8 The most significant source of flood risk arises from a failure of the proposed surface water drainage system. The following mitigation measures are recommended:

- All parts of the drainage system are regularly inspected and maintained in accordance with the Schedules in Section 5 above.
- A pumping station be provided for the management of exceedance flows. Subject to confirmation of the location and level of the point of discharge it is possible the pumping station will also be required to convey runoff from the drainage system to the public sewer.
- A maintenance agreement is adopted for the management of the pumping station.
- An uninterruptable power supply is provided for the pumps.
- The development is constructed in accordance with the principles set out in the document Improving the Flood Performance of New Building, Flood Resilient Construction (DEFRA, May 2007).
- Occupants of the lower ground floor dwelling should prepare a personal flood management plan in accordance with the template provided in Appendix C.

APPENDIX A
DRAWINGS

Topographic Survey
Roof Plan
Ground Floor Plan
Lower Ground Floor Plan
DR-001 Surface Water Drainage Strategy

1 Existing site plan

1 : 50

Measured Survey PRO

+44 (0) 203 538 8176

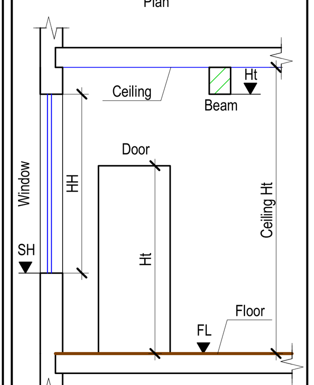
+44 (0) 739 901 1771

hello@measuredsurveypro.co.uk

https://measuredsurvey365.co.uk

Reference symbol

Plan



- Beam on plan view
- Fireplace
- Built-in storage
- Shower
- Ceiling hole, Ceiling level change

Elevation

- Roof

Section

- Ceiling
- Floor

Site plan

- Outline of a neighboring bld.
- Fence
- Landscaping
- Manhole

Abbreviations

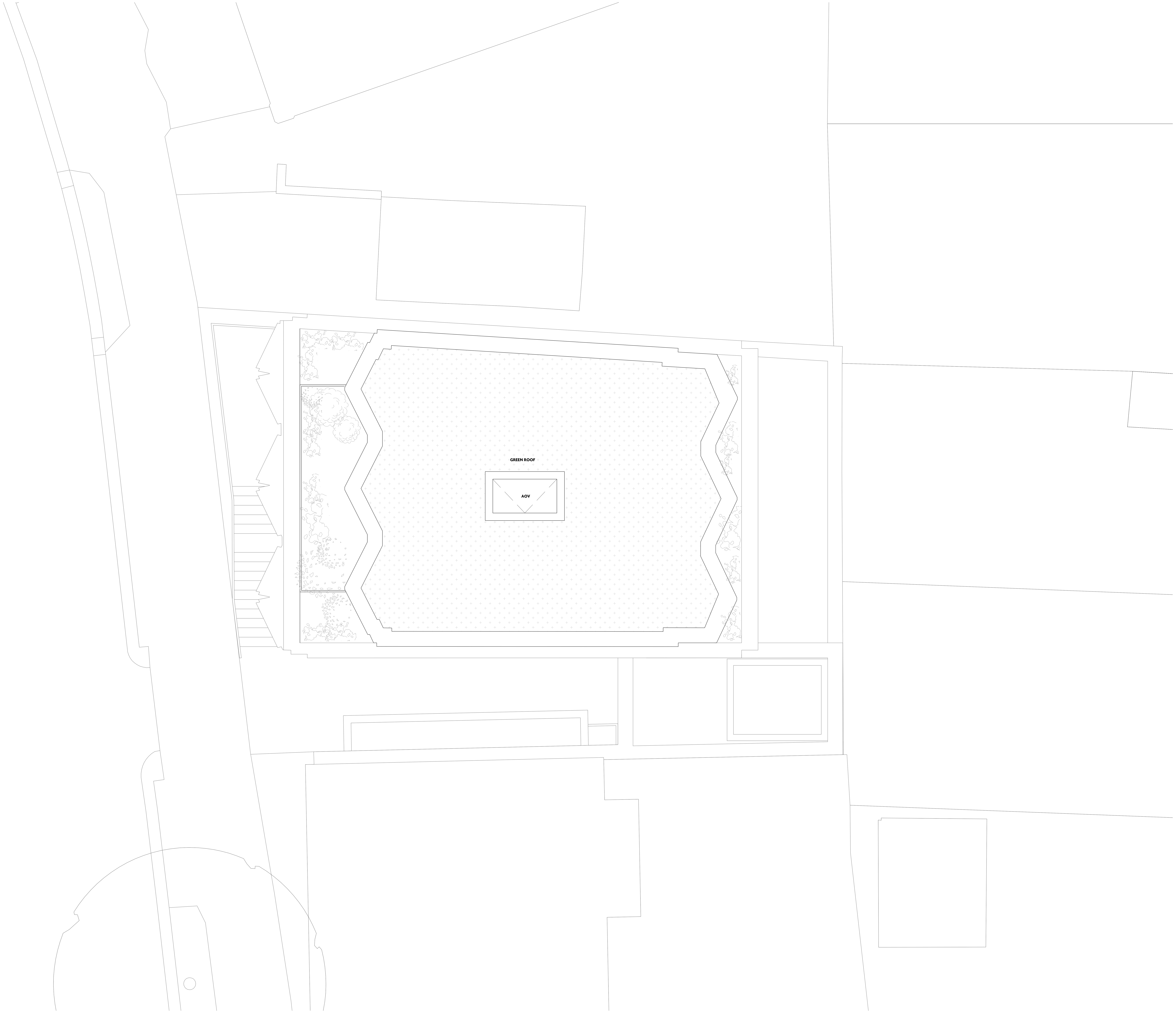
FL - Floor Level
HT - Leaf Height (Door)
HT - Bottom Level (Beam)
SH - Window Sill Level
HH - Window Height
TL - Top Level
BL - Bottom Level

Section Number
1
3
Sheet Number

Notes

- All information contained in this drawing should be checked and verified prior to any fabrication or construction.
- Any discrepancies between this drawing and any other information should be reported to Measured Survey Pro within 60 days after the native CAD DWG drawings are released.

Project number	MS - 152020 - 12708
Project adress	Lamorna, Dartmouth Park Road, London, NW5 1SU
Description	Existing site plan
Drawn	S K
Checked	C P
Scale bar	0 1 2 3
Scale	1:50
Format	A0
Sheet №	1



1. PROPOSED ROOF PLAN

0 1 2 5

N

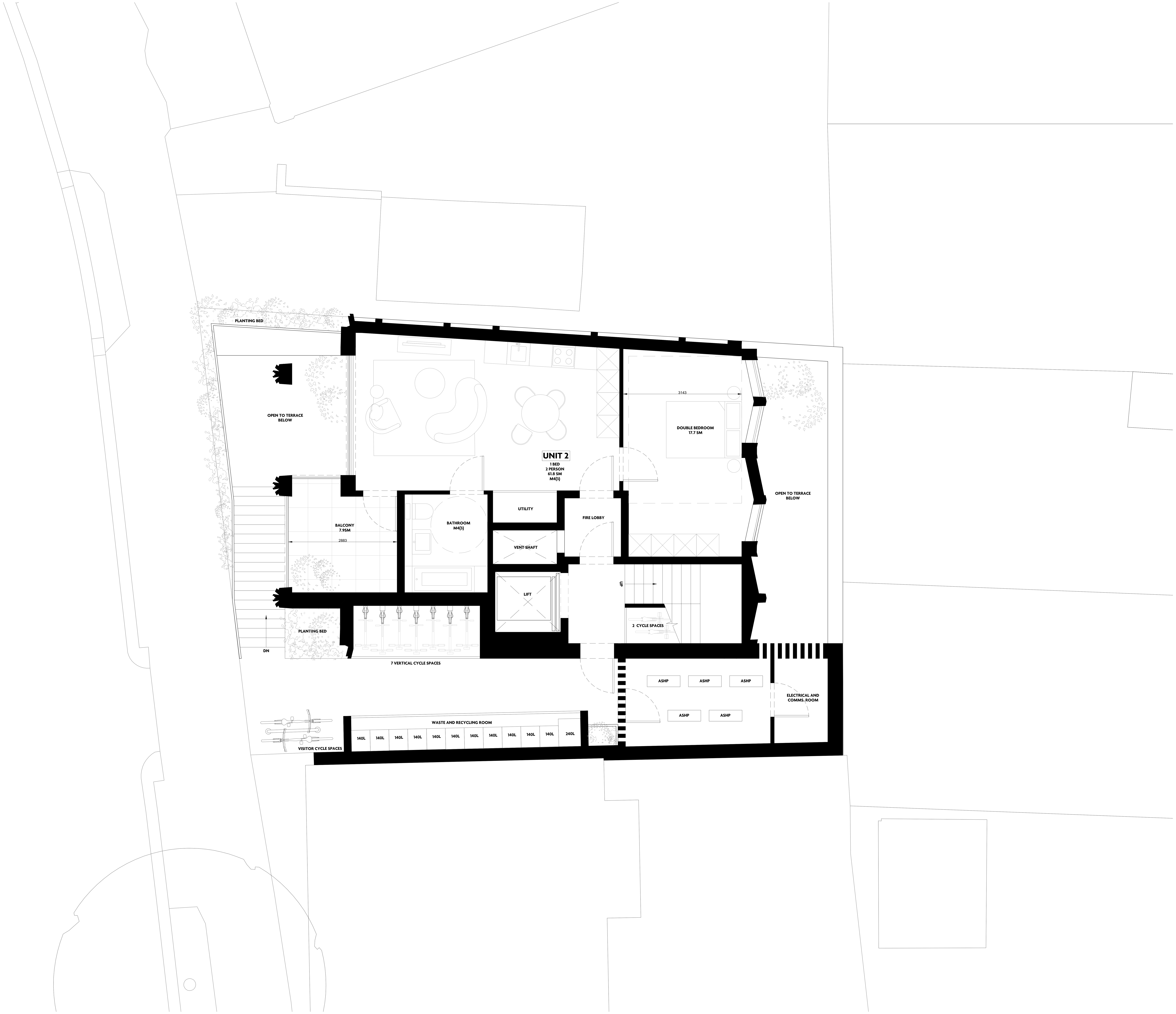
bureau de change
Unit 4
6 Hoxton Square
N1 6NU, London

KEY PLAN:

REVISION:

NOTES:

PROJECT **112_LAM**	
DRAWING TITLE **PROPOSED ROOF PLAN**	
A116	
PURPOSE OF ISSUE **PLANNING**	
SCALE **1:100 @ A3 / 1:50 @ A1**	DATE **JULY 2024**
DRAWN BY **CO / EL**	REVISION **P1**



1. PROPOSED GROUND FLOOR PLAN

0 1 2 5

N

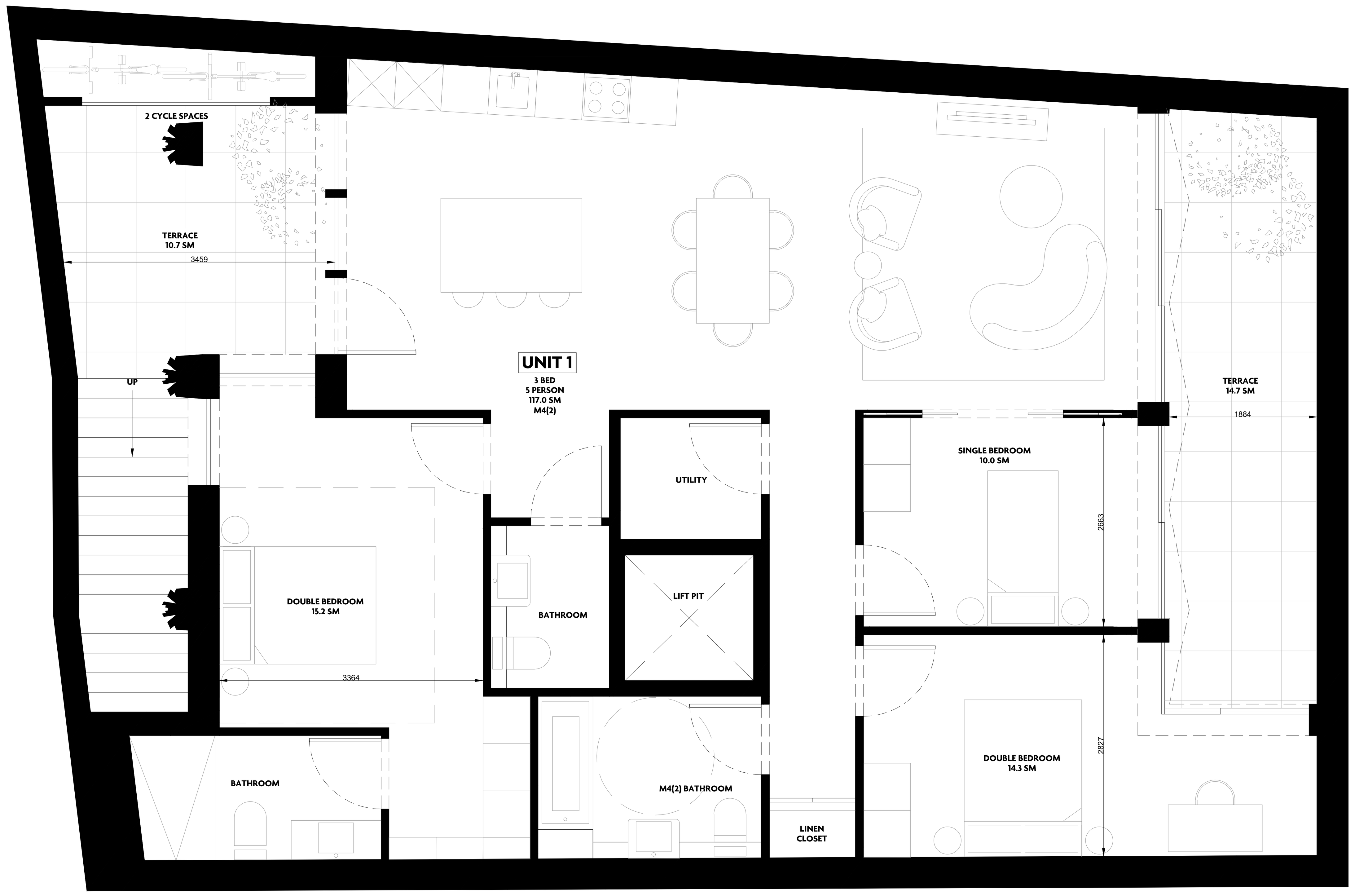
bureau de change
Unit 4
6 Hoxton Square
N1 6NU, London

KEY PLAN:

REVISION:

NOTES:

PROJECT	
112_LAM	
DRAWING TITLE	
PROPOSED GROUND FLOOR PLAN	
A111	
PURPOSE OF ISSUE	
PLANNING	
SCALE	DATE
1:100 @ A3 / 1:50 @ A1	JULY 2024
DRAWN BY	REVISION
CO / EL	P1



1. PROPOSED LOWER GROUND FLOOR PLAN

bureau de change
Unit 4
6 Hoxton Square
N1 6NU, London

KEY PLAN:

REVISION:

NOTES:

PROJECT 112_LAM	
DRAWING TITLE PROPOSED LOWER GROUND FLOOR PLAN	
A110	
PURPOSE OF ISSUE PLANNING	
SCALE 1:100 @ A3 / 1:50 @ A1	DATE JULY 2024
DRAWN BY CO / EL	REVISION P1

APPENDIX B
CALCULATIONS

1. **Greenfield Runoff Rates**
2. **Flow Model for Existing System 2, 30, 100yr events**
3. **Flow Model for Existing System 100yr 6hr event**
4. **Flow Model for Proposed System**
5. **Flow Model for Proposed System – 100yr 6hr event**
6. **Proposed Rainwater Harvesting/Attenuation Tank**

1. Greenfield Runoff Rates

hrwallingford

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Karl Pitman
Site name:	Lamorna
Site location:	NW5 1SU

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:	51.55743° N
Longitude:	0.14594° W
Reference:	433777058
Date:	Sep 11 2024 14:01

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 1

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):	641	641
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):	4.36	4.36
1 in 1 year (l/s):	3.7	3.7
1 in 30 years (l/s):	10.02	10.02
1 in 100 year (l/s):	13.89	13.89
1 in 200 years (l/s):	16.29	16.29

Pro-rata for 190m^2
Qbar = 0.08l/s
1yr = 0.07/s
30yr = 0.19l/s
100yr = 0.26l/s

2. Flow Model for Existing System 2, 30, 100yr events

The following model is based on a notional single piped discharge from the existing site.

Design Settings

Rainfall Methodology	FEH-22
Return Period (years)	100
Additional Flow (%)	40
CV	0.750
Time of Entry (mins)	5.00
Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	50.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Soffits
Minimum Backdrop Height (m)	0.200
Preferred Cover Depth (m)	1.200
Include Intermediate Ground	✓
Enforce best practice design rules	✓

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)
374	1200
499	1350
749	1500
900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)
1.500	1050
99.999	1200

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.019	5.00	-2.900	1200	0.000	0.000	1.350
2			-3.000	1200	-20.000	-20.000	1.726

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	1	2	28.284	0.600	-4.250	-4.726	0.476	59.4	150	5.36	50.0

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	1.307	23.1	3.6	1.200	1.576	0.019	0.0	40	0.955

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1	28.284	59.4	150	Circular	-2.900	-4.250	1.200	-3.000	-4.726	1.576

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	0.000	0.000	-2.900	1.350	1200	0	1	-4.250	150
2	-20.000	-20.000	-3.000	1.726	1200	1	1	-4.726	150

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	2 year (l/s)	0.1
Rainfall Events	Singular	Drain Down Time (mins)	240	30 year (l/s)	0.2
Summer CV	0.750	Additional Storage (m³/ha)	0.0	100 year (l/s)	0.3
Winter CV	0.840	Starting Level (m)		Check Discharge Volume	✓
Analysis Speed	Normal	Check Discharge Rate(s)	✓	100 year 360 minute (m³)	8

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	0	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	2.40
Greenfield Method	IH124	Growth Factor 100 year	3.19
Positively Drained Area (ha)	0.019	Betterment (%)	0
SAAR (mm)	641	QBar	0.1
Soil Index	4	Q 2 year (l/s)	0.1
SPR	0.47	Q 30 year (l/s)	0.2
Region	6	Q 100 year (l/s)	0.3
Growth Factor 2 year	0.88		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	0.019	Storm Duration (mins)	360
Soil Index	4	Betterment (%)	0
SPR	0.47	PR	0.464
CWI	96.444	Runoff Volume (m³)	8

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	-4.216	0.034	2.6	0.0387	0.0000	OK
15 minute winter	2	10	-4.692	0.034	2.6	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	1	1	2	2.6	0.859	0.111	0.0845	1.2

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	-4.187	0.063	8.1	0.0707	0.0000	OK
15 minute winter	2	10	-4.665	0.061	8.0	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	1	1	2	8.0	1.174	0.347	0.1929	3.8

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
15 minute winter	1	10	-4.177	0.073	10.7	0.0831	0.0000	OK
15 minute winter	2	10	-4.655	0.071	10.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)	Discharge Vol (m^3)
15 minute winter	1	1	2	10.6	1.259	0.458	0.2374	4.9

3. Flow Model for Existing System 100yr 6hr event

The following model is based on a notional single piped discharge from the existing site.

Design Settings

Rainfall Methodology	FEH-22
Return Period (years)	100
Additional Flow (%)	40
CV	0.750
Time of Entry (mins)	5.00
Maximum Time of Concentration (mins)	30.00
Maximum Rainfall (mm/hr)	50.0
Minimum Velocity (m/s)	1.00
Connection Type	Level Soffits
Minimum Backdrop Height (m)	0.200
Preferred Cover Depth (m)	1.200
Include Intermediate Ground	✓
Enforce best practice design rules	✓

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	749	1500
499	1350	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.019	5.00	-2.900	1200	0.000	0.000	1.350
2			-3.000	1200	-20.000	-20.000	1.726

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	1	2	28.284	0.600	-4.250	-4.726	0.476	59.4	150	5.36	50.0

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	1.307	23.1	3.6	1.200	1.576	0.019	0.0	40	0.955

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1	28.284	59.4	150	Circular	-2.900	-4.250	1.200	-3.000	-4.726	1.576

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	0.000	0.000	-2.900	1.350	1200	0	1	-4.250	150
2	-20.000	-20.000	-3.000	1.726	1200	1	1	-4.726	150

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	2 year (l/s)	0.1
Rainfall Events	Singular	Drain Down Time (mins)	240	30 year (l/s)	0.2
Summer CV	0.750	Additional Storage (m^3/ha)	0.0	100 year (l/s)	0.3
Winter CV	0.840	Starting Level (m)		Check Discharge Volume	✓
Analysis Speed	Detailed	Check Discharge Rate(s)	✓	100 year 360 minute (m^3)	8

Storm Durations

360

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

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	2.40
Greenfield Method	IH124	Growth Factor 100 year	3.19
Positively Drained Area (ha)	0.019	Betterment (%)	0
SAAR (mm)	641	QBar	0.1
Soil Index	4	Q 2 year (l/s)	0.1
SPR	0.47	Q 30 year (l/s)	0.2
Region	6	Q 100 year (l/s)	0.3
Growth Factor 2 year	0.88		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	0.019	Storm Duration (mins)	360
Soil Index	4	Betterment (%)	0
SPR	0.47	PR	0.464
CWI	96.444	Runoff Volume (m^3)	8

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	1	184	-4.218	0.032	2.2	0.0357	0.0000	OK
360 minute summer	2	184	-4.695	0.031	2.2	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)
360 minute summer	1	1	2	2.2	0.821	0.095	0.0754	12.1

4. Flow Model for Proposed System

The following model is based on a notional single piped discharge from the existing site. N.B. a precautionary approach has been adopted, and it has been assumed that the rainwater harvesting tank will be full at the time of each rainfall event.

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	40	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	749	1500
499	1350	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.019	5.00	-2.900	1200	0.000	0.000	1.500
2			-3.000	1200	-20.000	-20.000	1.876

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	1	2	28.284	0.600	-4.400	-4.876	0.476	59.4	150	5.36	50.0

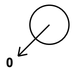
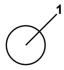
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1	1.307	23.1	3.6	1.350	1.726	0.019	0.0	40	0.955

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1	28.284	59.4	150	Circular	-2.900	-4.400	1.350	-3.000	-4.876	1.726

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
1	0.000	0.000	-2.900	1.500	1200		0	1	-4.400	150
2	-20.000	-20.000	-3.000	1.876	1200		1	1	-4.876	150

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	2 year (l/s)	0.1
Rainfall Events	Singular	Drain Down Time (mins)	240	30 year (l/s)	0.2
Summer CV	0.750	Additional Storage (m³/ha)	0.0	100 year (l/s)	0.3
Winter CV	0.840	Starting Level (m)		Check Discharge Volume	✓
Analysis Speed	Normal	Check Discharge Rate(s)	✓	100 year 360 minute (m³)	8

Storm Durations

15	60	180	360	600	960	2160
30	120	240	480	720	1440	2880

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	0	0
30	0	0	0
100	0	0	0
100	40	0	0
1000	0	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	2.40
Greenfield Method	IH124	Growth Factor 100 year	3.19
Positively Drained Area (ha)	0.019	Betterment (%)	0
SAAR (mm)	641	QBar	0.1
Soil Index	4	Q 2 year (l/s)	0.1
SPR	0.47	Q 30 year (l/s)	0.2
Region	6	Q 100 year (l/s)	0.3
Growth Factor 2 year	0.88		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	0.019	Storm Duration (mins)	360
Soil Index	4	Betterment (%)	0
SPR	0.47	PR	0.464
CWI	96.444	Runoff Volume (m³)	8

Node 1 Online Hydroslide Control

Flap Valve	x	Design Depth (m)	1.350	Diameter (m)	0.100
Replaces Downstream Link	x	Design Flow (l/s)	2.0	Max Head (m)	1.350
Invert Level (m)	-4.400	Model	CTL VS	Min Node Dia (mm)	1200

Node 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	-4.400
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	23

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	7.0	0.0	1.200	7.0	0.0	1.201	0.0	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	13	-4.313	0.087	2.6	0.6736	0.0000	OK
15 minute winter	2	14	-4.852	0.024	1.3	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	1	1	2	1.3	0.699	0.054	0.0509	1.2

Results for 30 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	1	25	-4.067	0.333	6.2	2.5885	0.0000	SURCHARGED
15 minute summer	2	13	-4.846	0.030	2.0	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	1	1	2	2.0	0.800	0.087	0.0707	4.8

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	1	26	-3.906	0.494	8.1	3.8420	0.0000	SURCHARGED
15 minute summer	2	12	-4.846	0.030	2.0	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	1	1	2	2.0	0.800	0.087	0.0707	6.3

Results for 100 year +40% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
30 minute winter	1	29	-3.622	0.778	11.4	6.0574	0.0000	SURCHARGED
15 minute summer	2	11	-4.846	0.030	2.0	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	1	1	2	2.0	0.800	0.087	0.0707	8.9

Results for 1000 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
30 minute winter	1	30	-3.493	0.907	12.8	7.0606	0.0000	SURCHARGED
15 minute summer	2	11	-4.846	0.030	2.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)	Discharge Vol (m^3)
30 minute winter	1	1	2	2.0	0.800	0.087	0.0707	10.0

5. Flow Model for Proposed System – 100yr 6hr event

The following model is based on a notional single piped discharge from the existing site. N.B. a precautionary approach has been adopted, and it has been assumed that the rainwater harvesting tank will be full at the time of each rainfall event.

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	40	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	749	1500
499	1350	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.019	5.00	-2.900	1200	0.000	0.000	1.500
2			-3.000	1200	-20.000	-20.000	1.876

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	1	2	28.284	0.600	-4.400	-4.876	0.476	59.4	150	5.36	50.0

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	1.307	23.1	3.6	1.350	1.726	0.019	0.0	40	0.955

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1	28.284	59.4	150	Circular	-2.900	-4.400	1.350	-3.000	-4.876	1.726

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
1	0.000	0.000	-2.900	1.500	1200	0	1	-4.400	150
2	-20.000	-20.000	-3.000	1.876	1200	1	1	-4.876	150

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	2 year (l/s)	0.1
Rainfall Events	Singular	Drain Down Time (mins)	240	30 year (l/s)	0.2
Summer CV	0.750	Additional Storage (m³/ha)	0.0	100 year (l/s)	0.3
Winter CV	0.840	Starting Level (m)		Check Discharge Volume	✓
Analysis Speed	Normal	Check Discharge Rate(s)	✓	100 year 360 minute (m³)	8

Storm Durations

360

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

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	2.40
Greenfield Method	IH124	Growth Factor 100 year	3.19
Positively Drained Area (ha)	0.019	Betterment (%)	0
SAAR (mm)	641	QBar	0.1
Soil Index	4	Q 2 year (l/s)	0.1
SPR	0.47	Q 30 year (l/s)	0.2
Region	6	Q 100 year (l/s)	0.3
Growth Factor 2 year	0.88		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)	0.019	Storm Duration (mins)	360
Soil Index	4	Betterment (%)	0
SPR	0.47	PR	0.464
CWI	96.444	Runoff Volume (m³)	8

Node 1 Online Hydroslide Control

Flap Valve	x	Design Depth (m)	1.350	Diameter (m)	0.100
Replaces Downstream Link	x	Design Flow (l/s)	2.0	Max Head (m)	1.350
Invert Level (m)	-4.400	Model	CTL VS	Min Node Dia (mm)	1200

Node 1 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	-4.400
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	0

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	7.0	0.0	1.200	7.0	0.0	1.201	0.0	0.0

Results for 100 year Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	1	192	-4.271	0.129	2.2	1.0076	0.0000	OK
360 minute summer	2	192	-4.846	0.030	2.0	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)
360 minute summer	1	1	2	2.0	0.799	0.086	0.0705	12.1

6. Proposed Rainwater Harvesting/Attenuation Tank

The following calculation assumes runoff from approximately 110m^2 of roof area will be captured in a harvesting tank, which will also be used for surface water attenuation. It shows that a combined volume of 6m^3 is required.

Rainwater Harvesting

Annual Demand

Daily requirement per person (l)	50.0
Number of persons	11

Annual Yield

Collection area (m^2)	110
Runoff Coefficient	0.600
AAR (mm)	641
Hydraulic Filter Efficiency	0.90
Depression Storage (mm)	4.0
Number of Rainfall Events/Year	150

Feasibility

Annual non-potable water demand (l)	200750.0
Annual rainfall yield (l)	2435.4

Demand exceeds rainfall yield, rainwater harvesting is feasible for storm water control under BS8515:2009+A1:2013 detailed design approach.

Volume

Return Period (years)	100
Region	England and Wales
M5-60 (mm)	21.000
Ratio R	0.439
Storm Duration (mins)	360
Normal rainwater harvesting (%)	5.0

Results

Total Rainfall Depth (mm)	57
CS	1.000
Additional Rainfall Depth Allowance (Ad)	0.548
Effective proportion of additional storage available for increasing tank size from 1m3 (CP50)	1.000
Rainfall depth for 1m^3 of storage tank (sP50)	9.091
Total Storage Volume (m^3)	6.282

Available Stormwater Control Storage Volume (m^3)	5.968

APPENDIX C
PERSONAL FLOOD PLAN TEMPLATE

Personal flood plan

Name

Environment Agency

Are you signed up to receive flood warnings? ☐
If not call Floodline on 0345 988 1188 to see if your area receives free flood warnings.

Let us know when you've completed your flood plan by calling Floodline on **0345 988 1188.**
This will help us learn more about how people are preparing for flooding.

General contact list	Company name	Contact name	Telephone
Floodline	Environment Agency		0345 988 1188
Electricity provider			
Gas provider			
Water company			
Telephone provider			
Insurance company and policy number			
Local council			
Local radio station			
Travel/weather info			

Key locations

Service cut-off	Description of location
Electricity	
Gas	
Water	

Who can help/who can you help?

Relationship	Name	Contact details	How can they/you help?
Relative			
Friend or neighbour			

Be prepared for flooding. Act now

Personal flood plan

What can I do NOW?

Environment Agency

- [ ] Put important documents out of flood risk and protect in polythene
- [ ] Check your insurance covers you for flooding
- [ ] Look at the best way of stopping floodwater entering your property
- [ ] Make a flood plan and prepare a flood kit
- [ ] Find out where you can get sandbags
- [ ] Identify who can help you/ who you can help
- [ ] Identify what you would need to take with you if you had to leave your home
- [ ] Understand the flood warning codes

What can you do if a flood is expected in your area?

Actions	Location
Home	
• Move furniture and electrical items to safety	
• Put flood boards, polythene and sandbags in place	
• Make a list now of what you can move away from the risk	
• Turn off electricity, water and gas supplies	
• Roll up carpets and rugs	
• Unless you have time to remove them hang curtains over rods	
• Move sentimental items to safety	
• Put important documents in polythene bags and move to safety	
Garden and outside	
• Move your car out of the flood risk area	
• Move any large or loose items or weigh them down	
Business	
• Move important documents, computers and stock	
• Alert staff and request their help	
• Farmers move animals and livestock to safety	
Evacuation - Prepare a flood kit in advance	
• Inform your family or friends that you may need to leave your home	
• Get your flood kit together and include a torch, warm and waterproof clothing, water, food, medication, toys for children and pets, rubber gloves and wellingtons	

There are a range of flood protection products on the market to help you protect your property from flood damage. A directory of these is available from the **National Flood Forum** at **www.bluepages.org.uk**

Be prepared for flooding. Act now

GEHO0709BQPU-E-E

APPENDIX D
CORRESPONDENCE WITH THAMES WATER

RE: Lamorna, NW5 1SU - Pre-Capacity enquiry

DEVELOPER.SERVICES@THAMESWATER.CO.U <DEVELOPER.SERVICES@
To kp@pitmanassociates.com
16/10/2024

You replied to this message on 16/10/2024 15:42.

Dear Karl,

Site Address: Lamorna, Dartmouth Park Road, London, NW5 1SU
Wastewater Pre-Planning Ref: DS6126619

Our asset planners have assed your application and have advised we have capacity concerns with your current proposal, we would need to see your proposed discharge rate reduced from 6.2 l/s to 2 l/s which are the SW greenfield run of rates for the size of your development.

Please can you confirm a reduction to 2 l/s is viable and I can re-consult with the asset planners, failing this you will then need to follow the SW hierarchy below and aim for soakaways or discharge into controlled waters or a ditch.

Surface Water

In accordance with the Building Act 2000 Clause H3.3, positive connection of surface water to a public sewer will only be consented when it can be demonstrated that the hierarchy of disposal methods have been examined and proven to be impracticable. Before we can consider your surface water needs, you'll need written approval from the lead local flood authority that you have followed the sequential approach to the disposal of surface water and considered all practical means.

When developing a site, policy SI 13 of the London Plan states "Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:Development proposals should aim to achieve greenfield run-off rates and ensure that surface water run-off is managed as close to its source as possible. There should also be a preference for green over grey features, in line with the following drainage hierarchy:"

The disposal hierarchy being:

1) rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)
2) rainwater infiltration to ground at or close to source
3) rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)
4) rainwater discharge direct to a watercourse (unless not appropriate)
5) controlled rainwater discharge to a surface water sewer or drain
6) controlled rainwater discharge to a combined sewer.

Where connection to the public sewerage network is required to manage surface water flows we will accept these flows at a discharge rate in line with CIRIA's best practice guide on SuDS or that stated within the sites planning approval.

If you've any further questions, please do not hesitate to contact me.

Kind Regards

Abdul Afzal

Adoptions & Waste Pre-Planning Engineer

Adoption Team - Developer Services

Thames Water - Developer Services - Ground Floor West - Clearwater Court - Vastern Road