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Surface Water and SuDS Assessment Rev0

12 Canning Crescent,
London,
N22 5SR

15 December 2024

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Prepared by	Checked by	Date
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1. Introduction

This Surface Water and SuDS Assessment has been prepared to support the planning application for revised proposals at 12 Canning Crescent, London.

Existing Site Description

The site is currently occupied by an existing residential building.

Development Proposals

Permission was recently granted for the demolition of the existing building, and the construction of a new block comprising six flats, with associated hard and soft landscaped areas.

S revised scheme is now proposed. The revisions involve modifications to the internal floor heights of the approved application, as well as the addition of two more levels (a lower ground level and an additional storey in the centre, which raises the mansard level by one floor).

The current proposed drawings are provided in **Appendix A**.

Figure 1 - Site Location

2. Planning Policy - Surface Water Management

The London Plan 2021

Policy SI 13 Sustainable drainage:

A Lead Local Flood Authorities should identify – through their Local Flood Risk Management Strategies and Surface Water Management Plans – areas where there are particular surface water management issues and aim to reduce these risks. Increases in surface water run-off outside these areas also need to be identified and addressed.

B 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:

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.

C Development proposals for impermeable surfacing should normally be resisted unless they can be shown to be unavoidable, including on small surfaces such as front gardens and driveways.

D Drainage should be designed and implemented in ways that promote multiple benefits including increased water use efficiency, improved water quality, and enhanced biodiversity, urban greening, amenity and recreation.

9.13.1 London is at particular risk from surface water flooding, mainly due to the large extent of impermeable surfaces. Lead Local Flood Authorities have responsibility for managing surface water drainage through the planning system, as well as ensuring that appropriate maintenance arrangements are put in place. Local Flood Risk Management Strategies and Surface Water Management Plans should ensure they address flooding from multiple sources including surface water, groundwater and small watercourses that occurs as a result of heavy rainfall.

9.13.2 Development proposals should aim to get as close to greenfield run-off rates as possible depending on site conditions. The well-established drainage hierarchy set out in this policy helps to reduce the rate and volume of surface water run-off**. Rainwater should be managed as close to the top of the hierarchy as possible. There should be a preference for green over grey features, and drainage by gravity over pumped systems**. A blue roof is an attenuation tank at roof or podium level; the combination of a blue and green roof is particularly beneficial, as the attenuated water is used to irrigate the green roof.

9.13.3 For many sites, **it may be appropriate to use more than one form of drainage**, for example a proportion of rainwater can be managed by more sustainable methods, with residual rainwater managed lower down the hierarchy. In some cases, direct discharge into the watercourse is an appropriate approach, for example rainwater discharge into the tidal Thames or a dock. This should include suitable pollution prevention filtering measures, ideally by using soft engineering or green infrastructure.

In addition, if direct discharge is to a watercourse where the outfall is likely to be affected by tide-locking, suitable storage should be designed into the system. However, in other cases direct discharge will not be appropriate, for example discharge into a small stream at the headwaters of a catchment, which may cause flooding. This will need to be assessed on a case-by-case basis, taking into account the location, scale and quality of the discharge and the receiving watercourse. The maintenance of identified drainage measures should also be considered in development proposals.

9.13.4 The London Sustainable Drainage Action Plan complements this policy. It contains a series of actions to make the drainage system work in a more natural way with a particular emphasis on retrofitting

Haringey Council

Local SuDS Standards

Haringey Council Local SuDS Standards document states:

SuDS Principles

LS1a *Sustainable drainage systems are to be designed to control surface water run off close to where it falls as rainfall and mimic natural drainage as closely as possible in accordance with National Planning Practice Policy.*

LS1b *Proposals for SuDS must result in capture for reuse, discharge into the ground, to a surface water body or, where these are demonstrated to be not achievable, to the storm sewer or combined sewer where no storm sewer is available. The destination of runoff for proposed SuDS must be justified using a methodology acceptable to Haringey.*

LS1c *Storage and treatment of surface runoff should be provided through provision of a management train.*

Peak flow control

LS2a *For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event should never exceed the peak greenfield runoff rate for the same event.*

LS2b *The design of the drainage system accounts for the likely impacts of climate change and potential changes in impermeable area over the design life of the development.*

LS3a *For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event and the 1 in 100 year rainfall event must be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.*

LS3b *Where Greenfield rates cannot be achieved Haringey request that 50% of the Greenfield runoff rate attenuation volume be provided and outflows controlled to Greenfield runoff rates.*

LS3c *For developments which were previously developed, the design of the drainage system accounts for the likely impacts of climate change and potential changes in impermeable area over the design life of the development.*

Volume control

LS4 *To ensure no increase in flood risk elsewhere, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event should never exceed the greenfield runoff volume for the same event.*

LS5 *To make provision for reduction in catchment floodrisk, for developments which have been previously developed, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100 year, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event. Haringey will seek to ensure that all means of volume reduction have been fully explored.*

LS6 *Where it is not reasonably practicable to constrain the volume of runoff to any drain, sewer or surface water body in accordance with* ***S4*** *or* ***S5*** *above, the runoff volume must be discharged at a rate that does not adversely affect flood risk. Haringey will request this rate to be a maximum discharge rate of Qbar for the 1 in 100 year rainfall event with allowance made for climate change and application of urban creep where appropriate. Where development proposals do not meet these proposals Haringey will request that detailed hydraulic modelling be provided to demonstrate that there is no increased flood risk elsewhere in the receiving catchment.*

Flood risk within the development

LS7 *The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur on any part of the site for a 1 in 30 year rainfall event.*

LS8 *The drainage system must be designed so that, unless an area is designated to hold and/or convey water as part of the design, flooding does not occur during a 1 in 100 year rainfall event in any part of: a building (including a basement); or in any utility plant susceptible to water (e.g. pumping station or electricity substation) within the development.*

LS9a *The design of the site must ensure that, so far as is reasonably practicable, flows resulting from rainfall in excess of a 1 in 100 year rainfall event are managed in exceedance routes that minimise the risks to people and property.*

LS9b *SuDS design to ensure resilience to blockage and provide for exceedance. Drainage design proposals should be examined for the likelihood and consequences of any potential failure scenarios (e.g. structural failure, blockage of inlets or outlets, blockage of pipes, impediments along conveyance routes), and the associated flood risks reduced where possible.*

LS9c *Where development proposals do not meet these proposals Haringey will request that detailed hydraulic modelling be provided to demonstrate the risk of flooding within the development is manageable and that there is no increased flood risk elsewhere in the receiving catchment.*

Structural integrity

LS10 *Components must be designed to ensure structural integrity of the drainage system and any adjacent structures or infrastructure under anticipated loading conditions over the design life of the development taking into account the requirement for reasonable levels of maintenance.*

LS11 *The materials, including products, components, fittings or naturally occurring materials, which are specified by the designer must be of a suitable nature and quality for their intended use.*

Designing for maintenance considerations

LS12 *Pumping should only be used to facilitate drainage for those parts of the site where it is not reasonably practicable to drain water by gravity. Designs should ensure accordance with* ***S1a*** *before pumping is considered.*

Construction

LS13 *The mode of construction of any communication with an existing sewer or drainage system must be such that the making of the communication would not be prejudicial to the structural integrity and functionality of the sewerage or drainage system.*

LS14 *Damage to the drainage system resulting from associated construction activities must be minimised and must be rectified before the drainage system is considered to be completed.*

Water Quality

LS15 *For greenfield developments, the frequency of runoff from the development to any highway drain, sewer or surface water body should not be increased. The surface water runoff should be managed to prevent any discharge of surface water from the site for rainfall events less than 5mm in depth and prevent runoff from the first 5mm of rainfall for larger events. This should be achieved for the majority of all rainfall events that take throughout the year. S1a should be adhered to, otherwise the design should demonstrate that there is no runoff from 80% of rainfall events during summer events and 50% for winter rainfall events using time series rainfall hydraulic modelling analysis.*

LS16 *Where surface water is likely to be contaminated, effective management is required to reduce contaminant loads and concentrations in the runoff to acceptable levels, in order minimise the risk of pollution of receiving waterbodies and/or protect receiving sewers.*

Non-Statutory Technical Standards for SuDS

The Non-Statutory Technical Standards for SuDS, (and accompanying Local Authority SuDS Officer Organisation (LASOO) Practice Guidance) sets out the details which should be addressed within a SuDS Report, including:

- *Flood Risk Outside of the Development*
- *Peak Flow Control and Volume Control*
- *Flood Risk Within the Development*
- *Runoff Destinations*
- *Structural Integrity*
- *Designing for Maintenance Considerations*
- *Construction*

3. Surface Water and SuDS

The whole site comprises approximately 260m^2.

The existing site is predominately comprised of hardstanding areas.

The proposed site areas are broken down as follows:

- Roof areas - ~160m^2
- Hardstanding (paving) - ~24m^2
- Landscaped areas - ~76m^2

As previously noted, Policy 9.13.2 of the London Plan 2021 states: *Development proposals should aim to get as close to greenfield run-off rates as possible depending on site conditions. The well-established drainage hierarchy set out in this policy helps to reduce the rate and volume of surface water run-off.*

As such, in the first instance the **ICP SuDS** method within Micro Drainage has been used to calculate flow rates from the total site (as detailed in **Appendix B** and shown in **Table 1**).

Table 1 – ICP SuDS – Total Site Greenfield Runoff Rates (l/s)

Return Period	Flow Rate from 260m^2 (l/s)
Qbar	0.1
1 in 30 year	0.2
1 in 100 year	0.3

The London Plan 2021 Hierarchy

The following outlines the most feasible ways to manage surface water runoff in line with the London Plan hierarchy.

1) Rainwater use as a resource (for example rainwater harvesting, blue roofs for irrigation)

There is the potential for simple rainwater harvesting. See the following section of this report.

2) Rainwater infiltration to ground at or close to source

At the time of writing, no site / ground investigation or infiltration testing (to BRE Digest 365) has been undertaken to confirm the underlying ground conditions.

As such, reference has been made to the Soilscapes Maps provided by Cranfield University. These indicate that the soils at the site and surrounding areas are 'Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils' with impeded drainage.

The BGS geology maps indicate that the site is underlain by London Clay.

On this basis, and without further investigative works, we would not recommend a SuDS strategy based on infiltration of surface water.

It is also important to note that under Approved Document Part H, infiltration SuDS must not be located within 5m of a building or road, and therefore the constraints of the site boundaries and layout means that infiltration SuDS are not suitable

3) Rainwater attenuation in green infrastructure features for gradual release (for example green roofs, rain gardens)

There will be areas of plating across the site which will be used to naturally convey surface water.

4) Rainwater discharge direct to a watercourse (unless not appropriate)

There are no watercourses in the immediate vicinity of the site.

5) Controlled rainwater discharge to a surface water sewer or drain

An excerpt of the Thames Water public sewer records for the existing site is shown overleaf.

This indicates that there is surface water sewer along the eastern boundary of the site, which enters the 229mm surface water sewer in Newnham Road.

It is therefore proposed that surface water runoff from the redeveloped site continues to connect into the public sewer system, via attenuation storage with a controlled outlet.

Thames Water will be consulted in due course, to confirm capacity and agree connection.

6) Controlled rainwater discharge to a combined sewer.

See above.

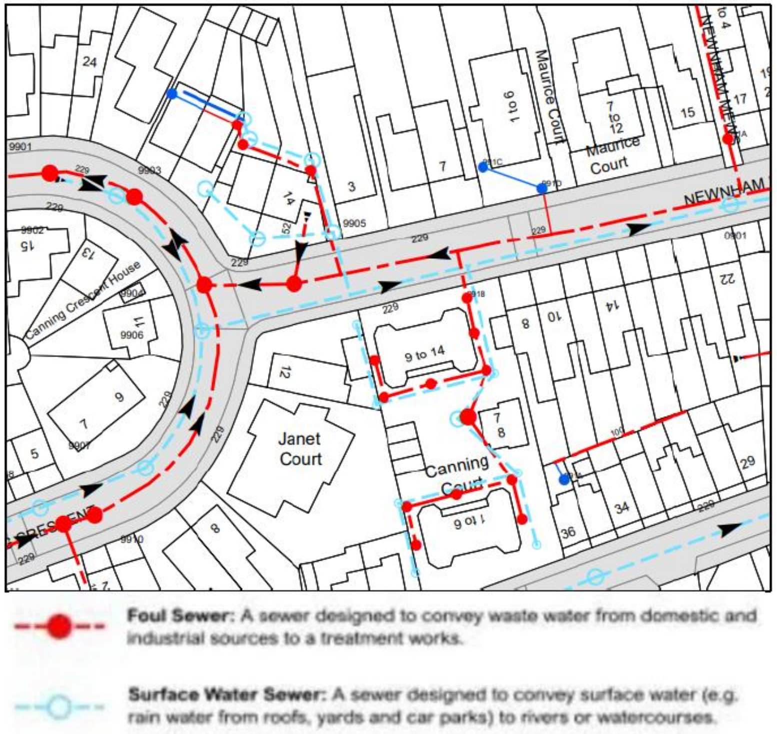


Figure 2 - Thames Water Public Sewer Record

SuDS Options

SuDS aim to mimic natural drainage and can achieve multiple objectives such as removing pollutants from urban runoff at source, controlling surface water runoff from developments, ensuring that flood risk is not increased further downstream and combining water management with green space which can increase amenity and biodiversity value. When selecting SuDS, consideration needs to be given to a range of factors including the ground conditions, type of proposals, and the constraints of the site.

Based on the review of the London Plan 2021 drainage hierarchy, and given the scale and nature of the proposals, the following SuDS are proposed to manage flows from new roof (~160m^2) and hardstanding areas (~24m^2) which total ~ 184m^2:

- Simple rainwater recycling (water butt)
- Planting for the natural conveyance of surface water
- Attenuation storage with a controlled outlet into the public surface water sewer

Water Butts

In order to provide a level of rainwater recycling, water butts will be provided. Water butts afford the opportunity to reduce the impact on already stretched potable water supply by enabling future occupants to reuse water collected in the water butt, for example when watering the garden/or washing cars etc. If this supply is used frequently this may also ensure that some additional storage is available during an extreme rainfall event.

Attenuation Storage with Controlled Outlet

Micro Drainage has been used to give an indication of the storage volume for surface water runoff from the new roof (~160m^2) and hardstanding areas (~24m^2) which total ~ 184m^2, in up to the 1 in 100 year plus 40% allowance for climate change.

Flows have been restricted to 0.3l/s; this is the existing 1 in 100 year greenfield rate of runoff (see **Table 1**).

As shown in **Appendix C**, a total storage volume of 8.9m^3 would be required.

The storage has been designed at a depth of 1.5m, filling to 1.0m and with a 0.5m freeboard provided, should any excess flows be received.

The site layout affords the opportunity for the storage to be provided beneath a Type C permeable paving (non-infiltration), or cellular storage / attenuation tank.

It is important to note that the SuDS strategy and calculations are based on the desktop study of underlying ground conditions, along with our understanding of the site layout. The recommendations and advice of Building Control, and the SuDS manufacturer / installer should be followed.

SuDS Maintenance

Operation and maintenance schedules are provided below (taken from Ciria C753 The SuDS Manual): these, or similar schedules, will be adopted by the management company.

Water Butt

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	*The water butt should be routinely checked for litter – leaves can become trapped in the water butt which could lead to blockage of the taps and overflow*	*Monthly*
	Where appropriate, and if safe to do so, the water butt should be cleaned annually to prevent smells associated with stagnant water, and to remove any algae.	*Annually*

Attenuation Storage

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where is may cause risks to performance)	Monthly
	Remove sediment from pre-treatment structures and/or internal forebays	Annually, or as required
Remedial Actions	Repair/ rehabilitate inlets, outlet, overflow, and vents	As required
Monitoring	Inspect/ check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build up and remove if necessary	Every five years, or as required

Pipe System

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required take remedial action.	Monthly for 3 months then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly

	Remove sediment from pre-treatment inlet structures and inspection chambers.	Annually or as required
	Maintain vegetation to designed limits within the vicinity of below ground drainage pipes and tanks to avoid damage to system	Monthly or as required
Remedial Actions	Repair physical damage if necessary	As required
Monitoring	Inspect all inlets, outlets and vents to ensure that they are in good condition and operating as designed.	Annually
	Survey inside of pipe runs for sediment build up and remove if necessary.	Every 5 years or as required

Hydrobrake

Hydro International Warranty, Maintenance Statement

The following has been provided by Hydro International:

> *Normally, little maintenance is required as there are no moving parts within the Flow Control. Experience has shown that if blockages occur they do so at the intake, and the cause on such occasions has been due to a lack of attention to engineering detail such as approach velocities being too low, inadequate benching, or the use of units below the minimum recommended size.*
>
> *The Flow Control (where applicable) is fitted with a pivoting bypass door, which allows the manhole chamber to be drained down should blockage occur. The smaller conical units, below the minimum recommended size, are also supplied with rodding facilities or vortex suppressor pipes as standard.*

Following installation of the Flow Control it is vitally important that any extraneous material i.e. building materials are removed from the unit and the chamber.

After the system is made live, and assuming that the chamber design is satisfactory, it is recommended that each unit be inspected monthly for three months and thereafter at six monthly intervals with hose down if required.

4. Conclusions

This Surface Water and SuDS Assessment has been prepared to support the planning application for the proposed redevelopment of 12 Canning Crescent, London.

The site is currently occupied by an existing residential building.

Proposals are for the demolition of the existing building, and the construction of a new block comprising six flats, with associated hard and soft landscaped areas.

Based on the review of the London Plan 2021 drainage hierarchy, and given the scale and nature of the proposals, the following SuDS are proposed:

- Simple rainwater recycling (water butt)
- Planting for the natural conveyance of surface water
- Attenuation storage with a controlled outlet into the public surface water sewer.

  Micro Drainage has been used to give an indication of the storage volume for surface water runoff from the new roof and hardstanding areas (~240m^2) in up to the 1 in 100 year plus 40% allowance for climate change.

  Flows have been restricted to 0.3l/s; this is the existing 1 in 100 year greenfield rate of runoff (see **Table 1**).

  On this basis, a total storage volume of 8.9m^3 would be required.

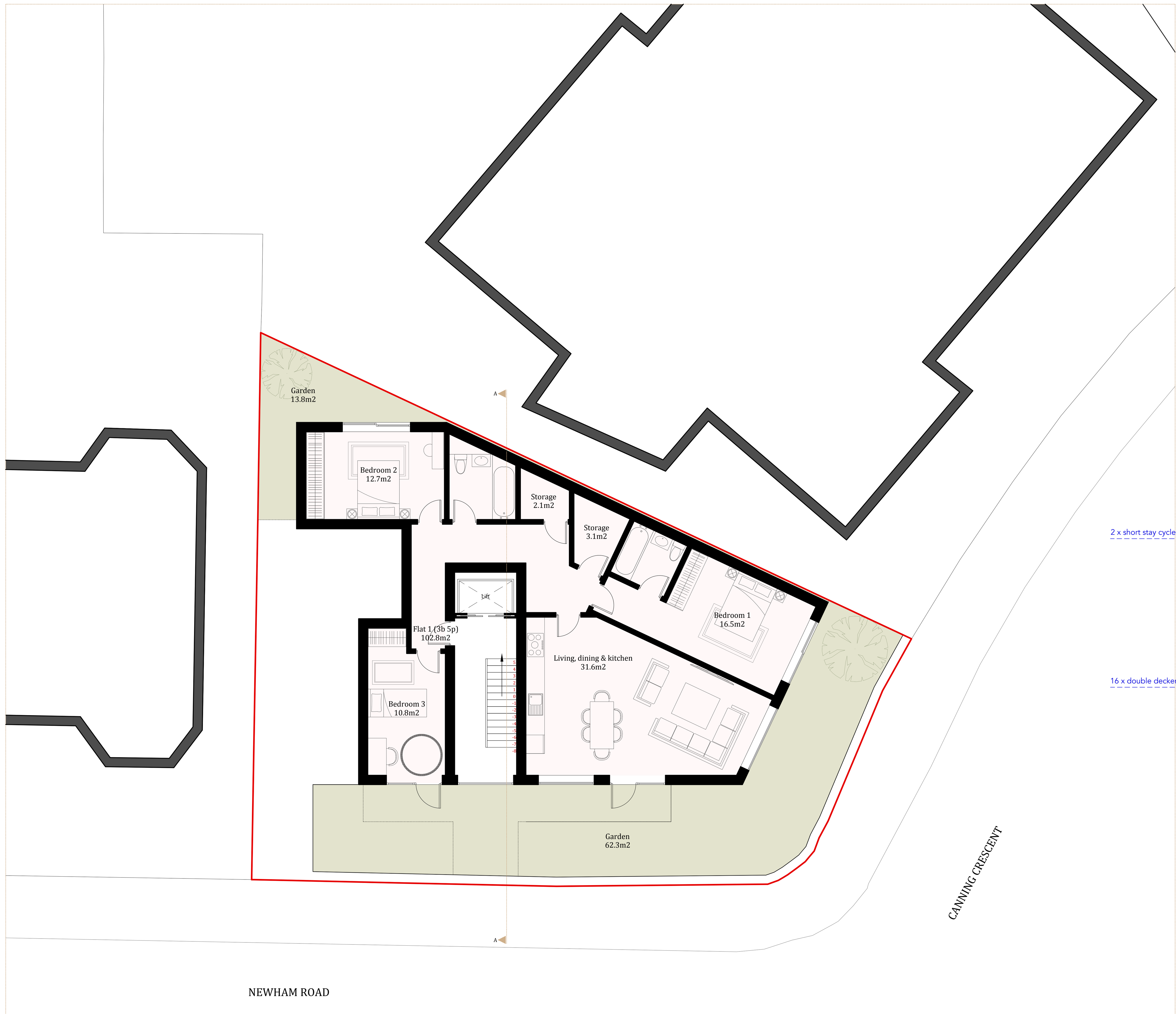
  The site layout affords the opportunity for the storage to be provided beneath a Type C permeable paving (non-infiltration), or cellular storage / attenuation tank.

It is important to note that the SuDS strategy and calculations are based on the desktop study of underlying ground conditions, along with our understanding of the site layout. The recommendations and advice of Building Control, and the SuDS manufacturer / installer should be followed.

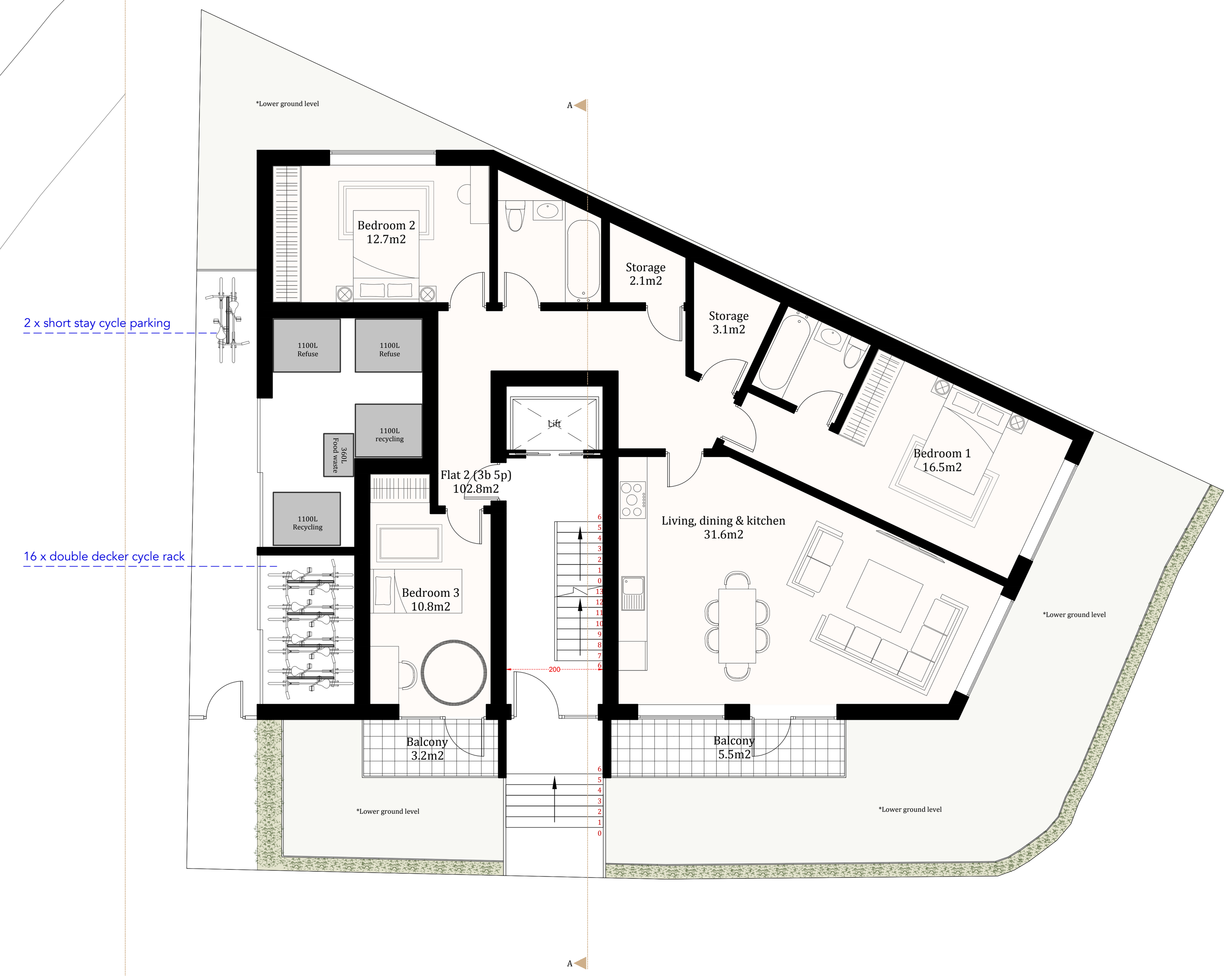
Operation and maintenance schedules have been provided (taken from Ciria C753 The SuDS Manual): these, or similar schedules, will be adopted by the management company.

Appendices

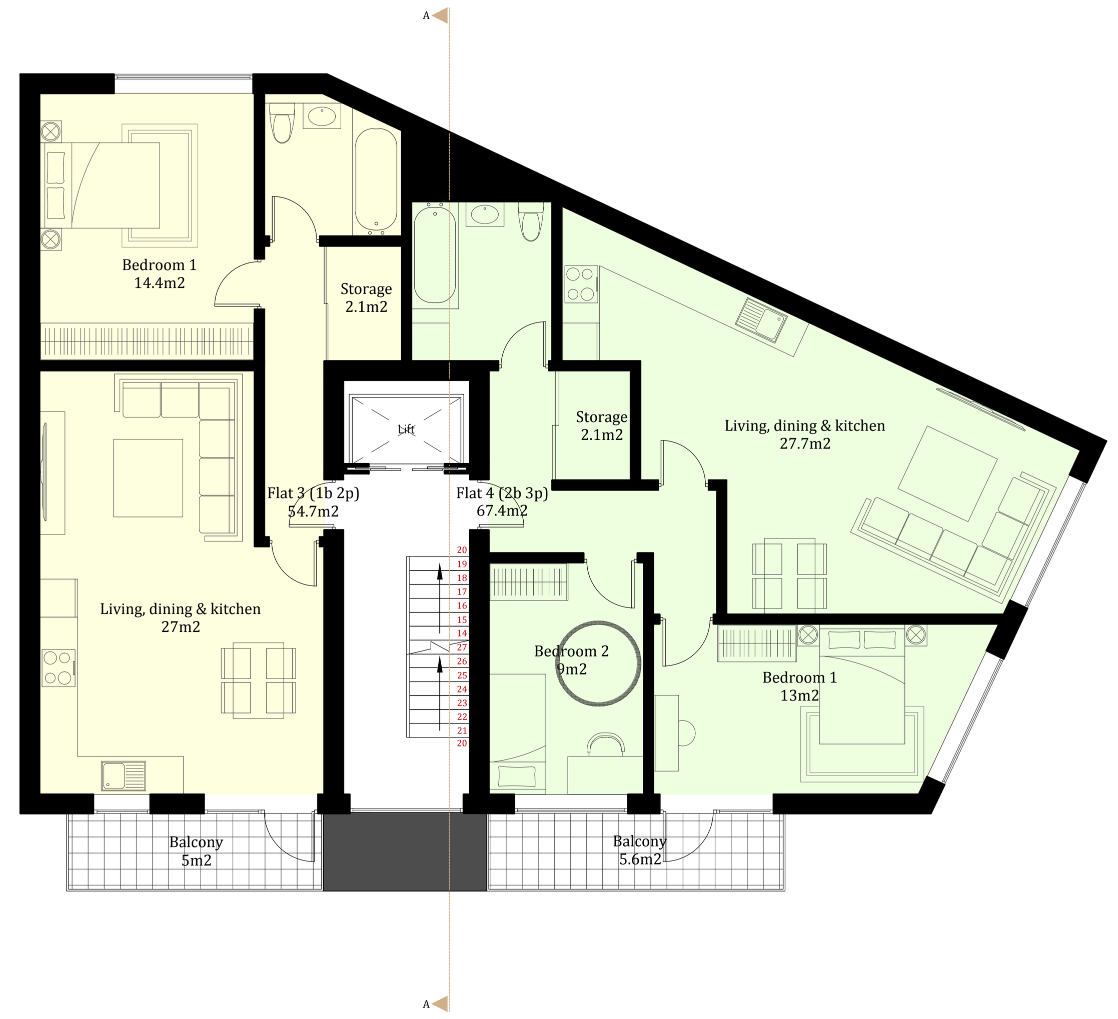
Appendix A - Proposed Site Layout Plans



Proposed lower ground floor plan in context
Scale 1:100

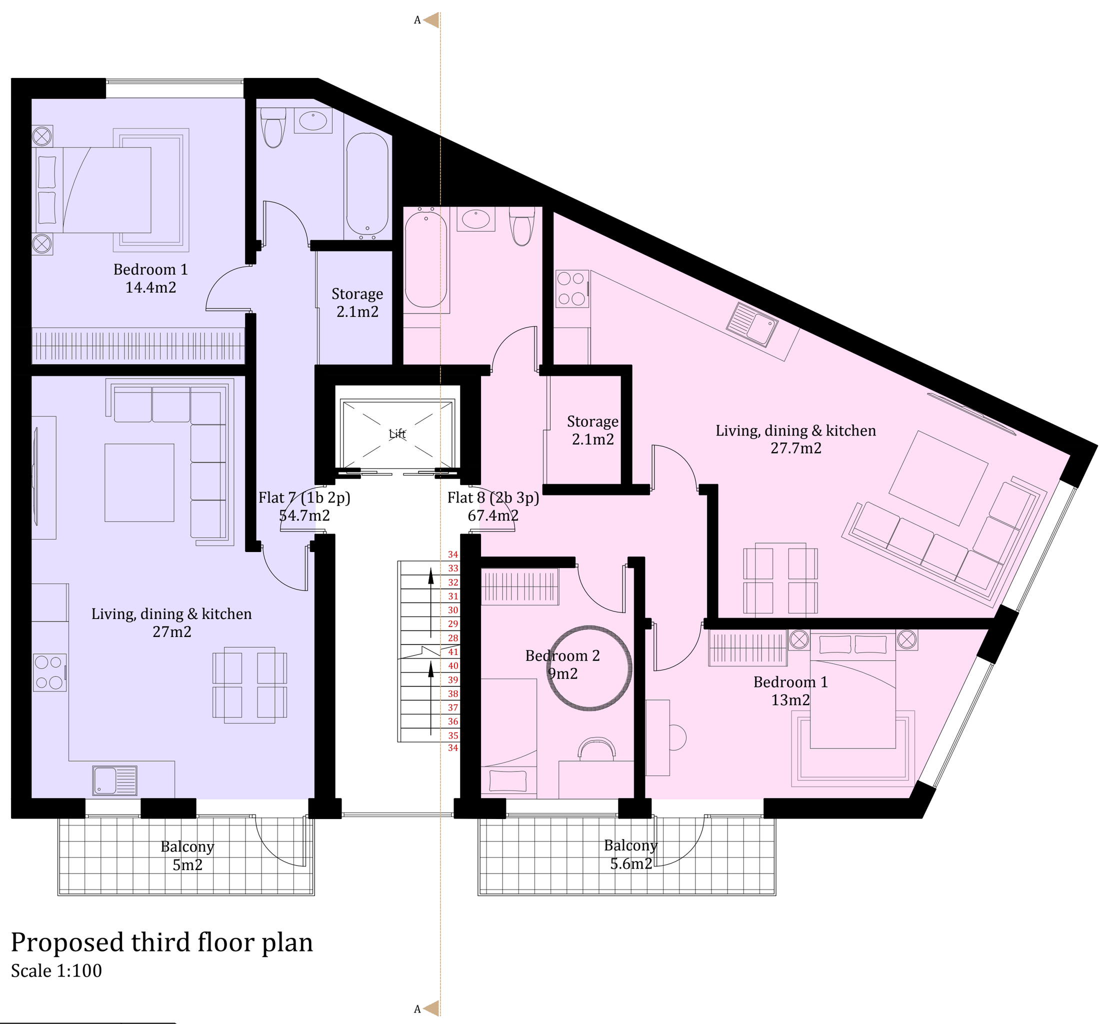


Proposed ground floor plan
Scale 1:100

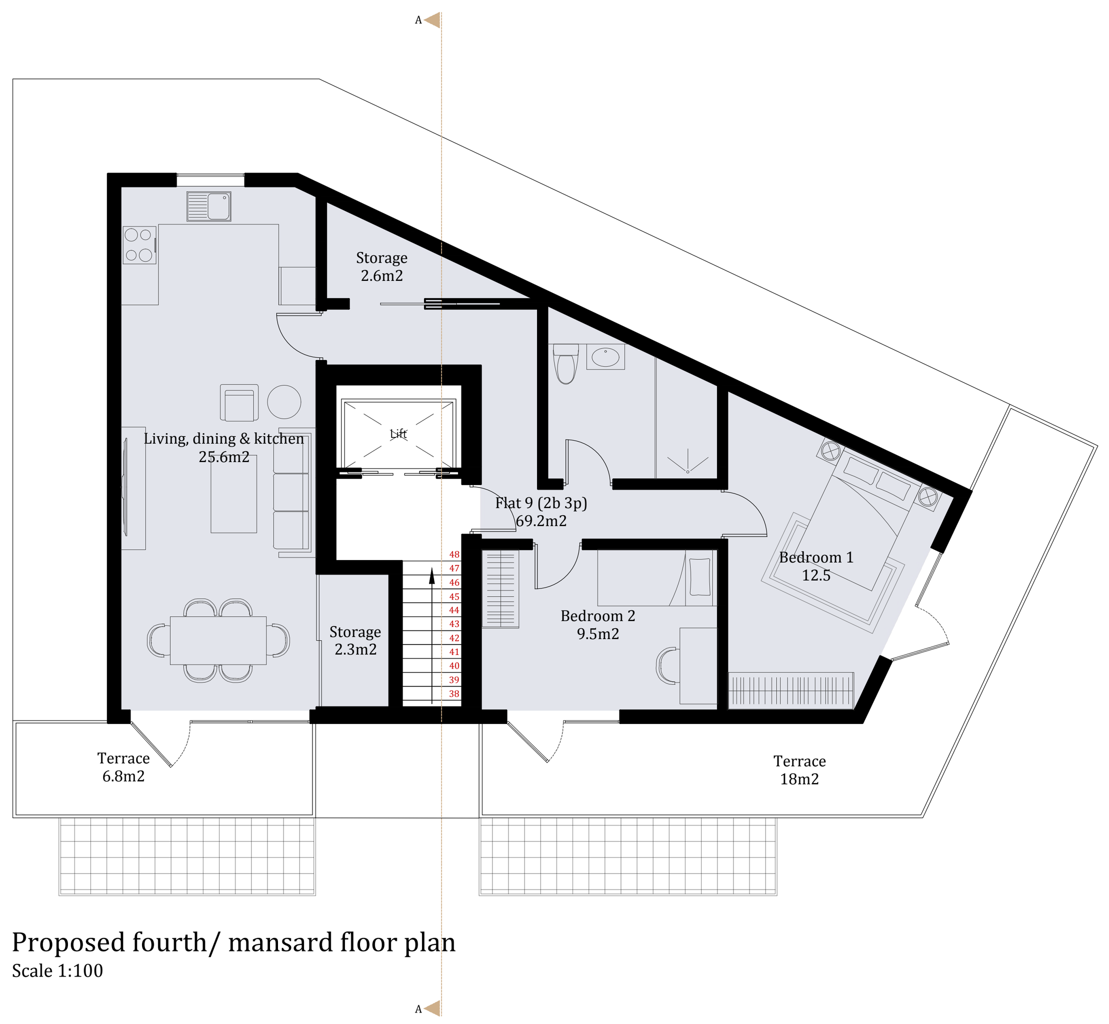


Proposed first floor plan
Scale 1:100

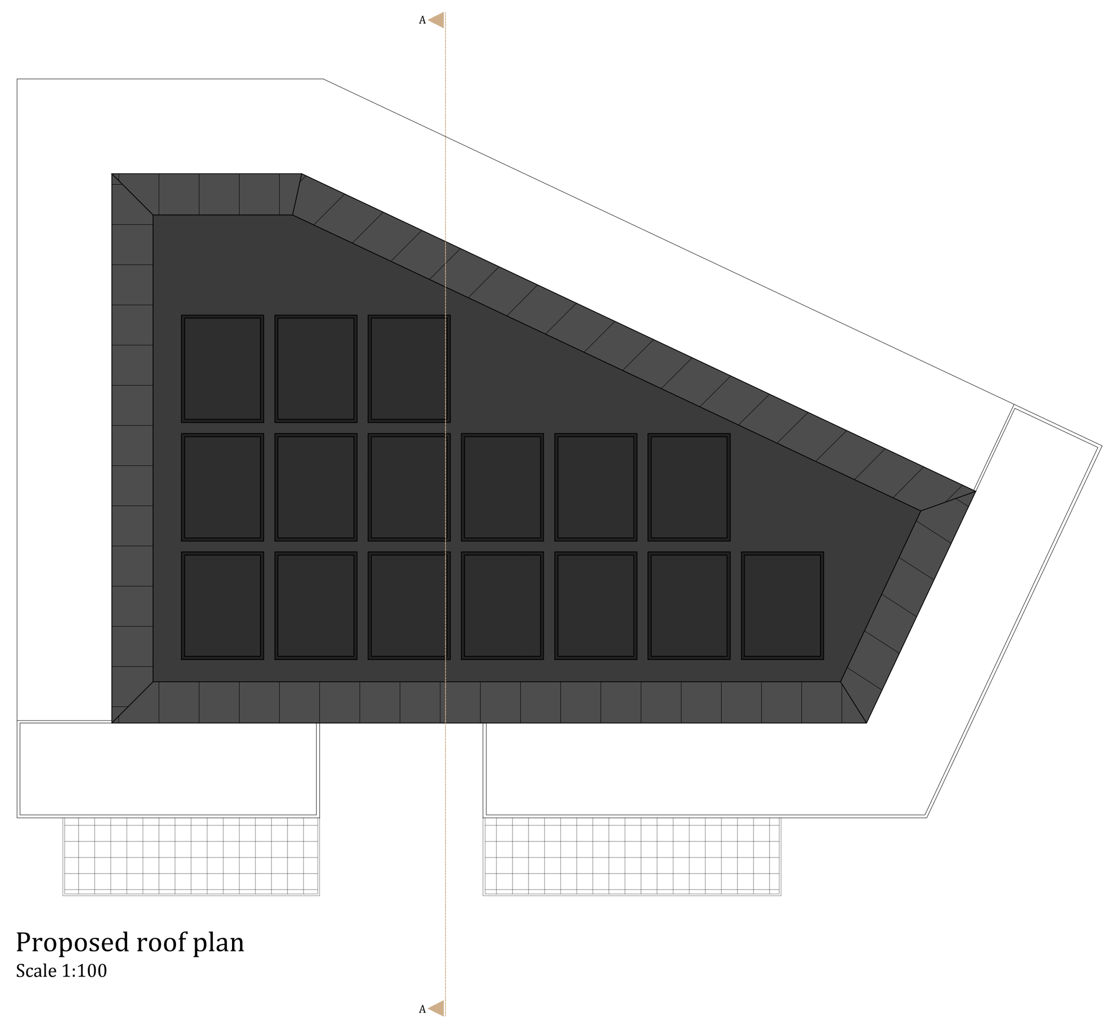
Proposed second floor plan
Scale 1:100



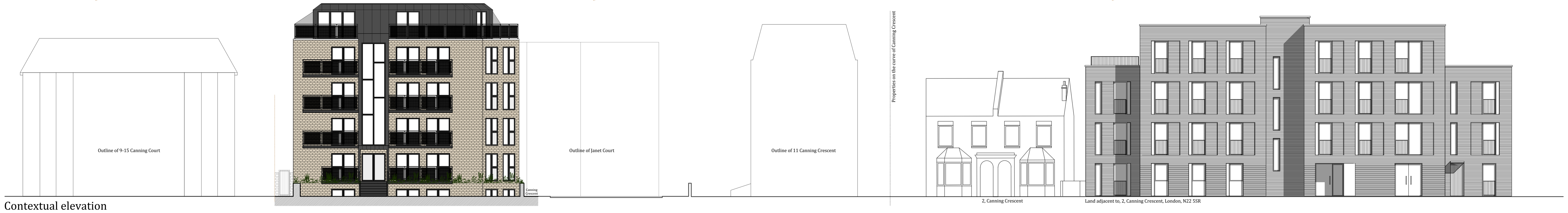
Proposed third floor plan
Scale 1:100



Proposed fourth/ mansard floor plan
Scale 1:100



Proposed roof plan
Scale 1:100



Contextual elevation
Scale 1:200

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Project Title
12 Canning Crescent, London, N22 5SR

Sheet Title
Proposed plans & contextual elevation

Scale
1:100/1:200 @ A1

Drawn By
AYGUL BOYRAZ

Reference Number
113A_PL04B

Date
26/08/2024

Notes:
This drawing is not to be copied, altered or changed without permission.

While this drawing can be used as a base drawing for construction purposes, it is VERY IMPORTANT that all dimensions are checked carefully and on site before any work commences or any materials are ordered.

This drawing can be used as part of a planning application, although the planning officer may ask for more specific information about some aspects of the design.

The drawing intends to illustrate the general arrangement of the project proposals. As it stands this drawing does not include all of the detail necessary for a full plans building regulations application.

Aygul Boyraz LTD. is only in charge of the planning application process and we hold no responsibility in the construction phase.

Appendix B - Greenfield Runoff Calculation

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.450
Area (ha)	0.026	Urban	0.000
SAAR (mm)	626	Region Number	Region 6

Results	**l/s**
QBAR Rural	0.1
QBAR Urban	0.1
Q100 years	0.3
Q1 year	0.1
Q30 years	0.2
Q100 years	0.3

Appendix C - Micro Drainage Storage Calculations

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	0.528	0.528	0.2	4.5	O K
30 min Summer	0.673	0.673	0.3	5.8	O K
60 min Summer	0.799	0.799	0.3	6.9	O K
120 min Summer	0.882	0.882	0.3	7.6	O K
180 min Summer	0.895	0.895	0.3	7.7	O K
240 min Summer	0.883	0.883	0.3	7.6	O K
360 min Summer	0.849	0.849	0.3	7.3	O K
480 min Summer	0.816	0.816	0.3	7.0	O K
600 min Summer	0.784	0.784	0.3	6.7	O K
720 min Summer	0.753	0.753	0.3	6.5	O K
960 min Summer	0.698	0.698	0.3	6.0	O K
1440 min Summer	0.600	0.600	0.2	5.2	O K
2160 min Summer	0.479	0.479	0.2	4.1	O K
2880 min Summer	0.382	0.382	0.2	3.3	O K
4320 min Summer	0.227	0.227	0.2	2.0	O K
5760 min Summer	0.100	0.100	0.2	0.9	O K
7200 min Summer	0.058	0.058	0.2	0.5	O K
8640 min Summer	0.044	0.044	0.2	0.4	O K
10080 min Summer	0.037	0.037	0.1	0.3	O K
15 min Winter	0.594	0.594	0.2	5.1	O K
30 min Winter	0.758	0.758	0.3	6.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	141.688	0.0	4.8	26
30 min Summer	91.882	0.0	6.2	40
60 min Summer	56.713	0.0	7.7	68
120 min Summer	33.838	0.0	9.1	124
180 min Summer	24.703	0.0	10.0	182
240 min Summer	19.656	0.0	10.6	216
360 min Summer	14.176	0.0	11.5	278
480 min Summer	11.248	0.0	12.1	344
600 min Summer	9.394	0.0	12.7	414
720 min Summer	8.104	0.0	13.1	482
960 min Summer	6.416	0.0	13.9	620
1440 min Summer	4.610	0.0	14.9	888
2160 min Summer	3.308	0.0	16.1	1284
2880 min Summer	2.611	0.0	16.9	1672
4320 min Summer	1.869	0.0	18.2	2432
5760 min Summer	1.473	0.0	19.1	3016
7200 min Summer	1.224	0.0	19.8	3680
8640 min Summer	1.052	0.0	20.4	4408
10080 min Summer	0.925	0.0	21.0	5136
15 min Winter	141.688	0.0	5.4	26
30 min Winter	91.882	0.0	6.9	40

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	0.904	0.904	0.3	7.8	O K
120 min Winter	1.007	1.007	0.3	8.7	O K
180 min Winter	1.031	1.031	0.3	8.9	O K
240 min Winter	1.024	1.024	0.3	8.8	O K
360 min Winter	0.982	0.982	0.3	8.4	O K
480 min Winter	0.942	0.942	0.3	8.1	O K
600 min Winter	0.898	0.898	0.3	7.7	O K
720 min Winter	0.855	0.855	0.3	7.4	O K
960 min Winter	0.774	0.774	0.3	6.7	O K
1440 min Winter	0.633	0.633	0.2	5.4	O K
2160 min Winter	0.466	0.466	0.2	4.0	O K
2880 min Winter	0.335	0.335	0.2	2.9	O K
4320 min Winter	0.093	0.093	0.2	0.8	O K
5760 min Winter	0.045	0.045	0.2	0.4	O K
7200 min Winter	0.035	0.035	0.1	0.3	O K
8640 min Winter	0.029	0.029	0.1	0.3	O K
10080 min Winter	0.026	0.026	0.1	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
60 min Winter	56.713	0.0	8.6	68
120 min Winter	33.838	0.0	10.2	124
180 min Winter	24.703	0.0	11.2	178
240 min Winter	19.656	0.0	11.9	232
360 min Winter	14.176	0.0	12.9	292
480 min Winter	11.248	0.0	13.6	368
600 min Winter	9.394	0.0	14.2	446
720 min Winter	8.104	0.0	14.7	522
960 min Winter	6.416	0.0	15.5	670
1440 min Winter	4.610	0.0	16.7	954
2160 min Winter	3.308	0.0	18.0	1364
2880 min Winter	2.611	0.0	18.9	1764
4320 min Winter	1.869	0.0	20.3	2380
5760 min Winter	1.473	0.0	21.4	2936
7200 min Winter	1.224	0.0	22.2	3648
8640 min Winter	1.052	0.0	22.9	4408
10080 min Winter	0.925	0.0	23.5	5056

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.430	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.018

Time From:	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**	**Time From:**	**(mins) To:**	**Area (ha)**
0	4	0.005	4	8	0.005	8	12	0.008

Model Details

Storage is Online Cover Level (m) 1.500

Tank or Pond Structure

Invert Level (m) 0.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	8.6	0.700	8.6	1.400	8.6	2.100	8.6
0.100	8.6	0.800	8.6	1.500	8.6	2.200	8.6
0.200	8.6	0.900	8.6	1.600	8.6	2.300	8.6
0.300	8.6	1.000	8.6	1.700	8.6	2.400	8.6
0.400	8.6	1.100	8.6	1.800	8.6	2.500	8.6
0.500	8.6	1.200	8.6	1.900	8.6		
0.600	8.6	1.300	8.6	2.000	8.6		

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0024-3000-1000-3000
Design Head (m)	1.000
Design Flow (l/s)	0.3
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	24
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	0.3
Flush-Flo™	0.106	0.2
Kick-Flo®	0.218	0.2
Mean Flow over Head Range	-	0.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.2	1.200	0.3	3.000	0.5	7.000	0.7
0.200	0.2	1.400	0.3	3.500	0.5	7.500	0.7
0.300	0.2	1.600	0.4	4.000	0.5	8.000	0.7
0.400	0.2	1.800	0.4	4.500	0.6	8.500	0.8
0.500	0.2	2.000	0.4	5.000	0.6	9.000	0.8
0.600	0.2	2.200	0.4	5.500	0.6	9.500	0.8
0.800	0.3	2.400	0.4	6.000	0.7		
1.000	0.3	2.600	0.5	6.500	0.7		