39a, Fitzjohn's Avenue London, NW3 5JU

Flood Risk Assessment and Drainage Strategy Report

Prepared by: **Igor Armando BEng**
Reviewed by: **Mark Gordon CEng MIEI**
Job Number: **30845**

Date	Revision	Notes/Amendments/Issue Purpose
January, 2024	P01	For Planning
February, 2024	P02	For Planning

Consulting Engineers
37 Alfred Place
London WC1E 7DP

020 7631 5128
mail@pricemyers.com
www.pricemyers.com

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Appendices:

Acronyms	
AOD	Above Ordnance Datum
CDA	Critical Drainage Area
CIRIA	Construction Industry Research and Information Association
DCG	Design and Construction Guidance
DEFRA	Department for Environment, Food and Rural Affairs
EA	Environment Agency
FRA	Flood Risk Assessment
LLFA	Lead Local Flood Authority
NPPF	National Planning Policy Framework
TW	Thames Water
PPG	Planning Practice Guidance
SFRA	Strategic Flood Risk Assessment
SWMP	Surface Water Management Plan
LBC	London Borough of Camden

1 Introduction

Price & Myers have been commissioned to undertake a Flood Risk Assessment (FRA) for the proposed development at 39a, Fitzjohn's Avenue, London.

The National Planning Policy Framework (NPPF) states that an appropriate FRA will be required for all development proposals of 1 ha or greater in Flood Zone 1 and for any development within Flood Zones 2 or 3.

The EA's indicative floodplain map shows that the site is in Flood Zone 1and is less than 1ha, however the Local Authority has identified the area as a Critical Drainage Area (CDA) and the proposals include a new basement. This assessment will therefore focus on the flood risk from all sources including overland flows and groundwater.

This report will also outline the proposed drainage strategy for the site including a detailed SUDS assessment.

1.1 Relevant Policy

This FRA has been carried out in accordance with the NPPF and the accompanying Planning Practice Guidance (PPG) "*Flood Risk and Coastal Change*". This FRA also incorporates advice and guidance from the Environment Agency (EA), the London Borough of Camden (LBC) Strategic Flood Risk Assessment (SFRA, July 2014) and CIRIA documents.

The surface water drainage strategy is in accordance with:

- Building Regulations Part H (December, 2010).
- Camden Planning Guidance (CPG) – Water and Flooding (March, 2019).
- London Borough of Camden Level 1 Strategic Flood Risk Assessment (SFRA) (January, 2024).
- The London Plan Policy SI 13 - Sustainable Drainage (March, 2021).
- The Department for Environment, Flood and Rural Affairs (DEFRA) "*Climate Change Allowances*" (2019).

2 Site Description and Location

The site is located near the junction of Fitzjohn's Avenue and Nutley Terrace and is located approximately 0.4 km northeast of the Finchley Road underground station. An existing northern tube line is located approximately 23.70 meters underground at approximately 53.60m AOD under the development site.

The total area of the site is approximately 0.156 ha, where 0.114 ha is impermeable area which consist of an existing building tennis court and a carpark. The topographical survey (Appendix A) shows that the ground levels range from 77.17m AOD to 76.31m AOD, falling from the northwest to southeast of the site. The postcode is NW3 5JU and the grid reference is TQ26547 85013.

Figure 2.1: Existing site location, showing site boundary

2.1 Existing Drainage

The Thames Water asset map in Figure 2.2 shows an existing 1093x686 combined water sewer running beneath Fitzjohn's Avenue east of the site.
The existing drainage plan in Appendix B shows the arrangement of the existing site's drainage network (CCTV survey). This shows that the existing drainage network is a combined water network that connects from No.39A to the neighbouring 39 Fitzjohn's Avenue and discharges at the southeast of the site into the combined 1093 x 686mm public sewer system located on Fitzjohn's Avenue as shown in figure 2.3.

Figure 2.2: Site location, showing nearby public sewer etc.

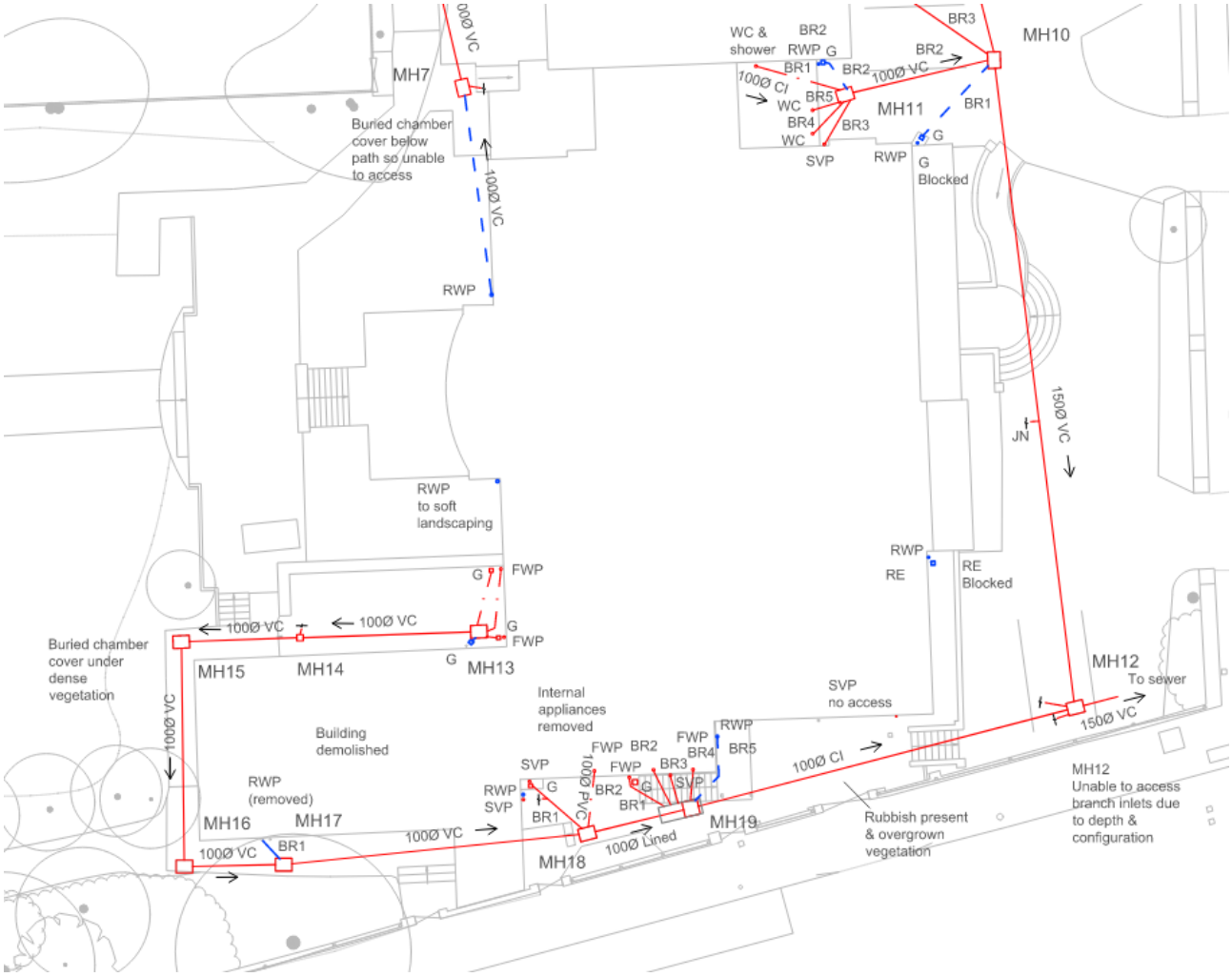


Figure 2.3: CCTV survey etc.

3 Development Proposal

It is proposed to demolish the existing building to construct three dwellings at No. 39a Fitzjohn's Avenue, which will include the construction of a basement beneath the full extent of the building that will also extend into the rear garden. A layout of the basement and ground floor can be found below in Figure 3.1. & 3.2.

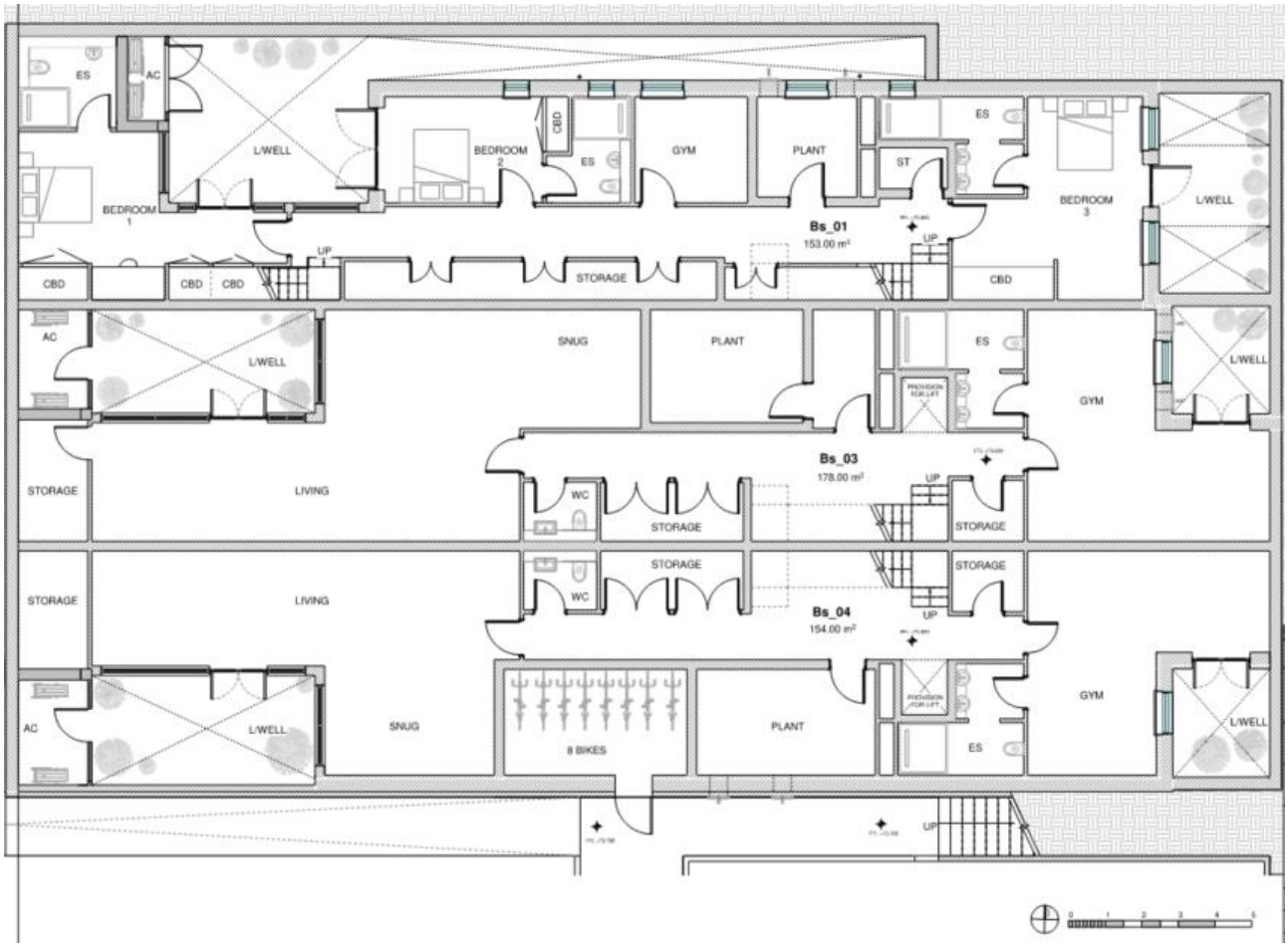


Figure 3.1: Proposed Basement Level layout

Figure 3.2: Proposed Ground Level Layout

4 Flood Risk Assessment

4.1 Flood Risk from Watercourses

The EA's flood map for planning shows that the site is located in Flood Zone 1 and is not at risk of flooding. Developments in this flood zone do not have any restrictions, provided they do not increase the risk of flooding elsewhere.

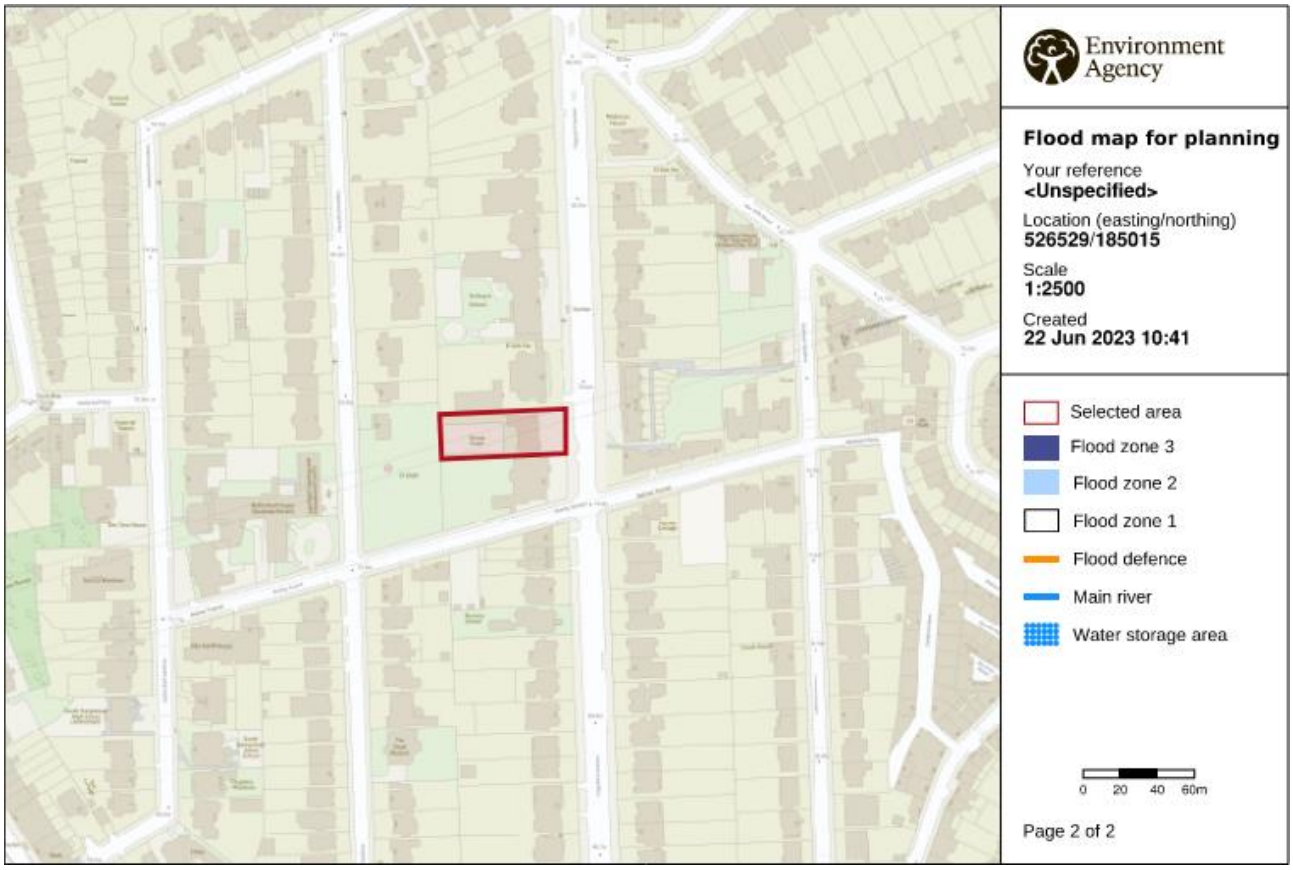


Figure 4.1: EA Flood Map for Planning

4.2 Flood Risk from Groundwater

Groundwater flooding occurs when water originating from sub-surface permeable strata emerges from the ground, typically after prolonged rainfall.

A ground investigation report was undertaken by GEA Consulting (December 2023, REF: J23003) and included field observations, in-situ testing and geotechnical laboratory analysis. The report noted that the ground conditions consisted of made ground to a depth of between 0.3m to 0.8m above *"stiff high strength fissured brown and light brown mottled orange-brown and grey silty slightly sandy clay with selenite crystals ad partings and pockets of fine orange-brown sand."* This was confirmed up to a depth of 15.00m.

The report also noted that "*groundwater was not encountered during the investigation*", the report goes on to say that *"the London clay is of low permeability, which will not typically support a continuous"* watertable *"or significant groundwater flows".* Therefore, it can be assumed from the ground investigation report and the historical flood records shown in figure 4.2 shows that the site is underlain by the London Clay formation and is at low risk of groundwater flooding.

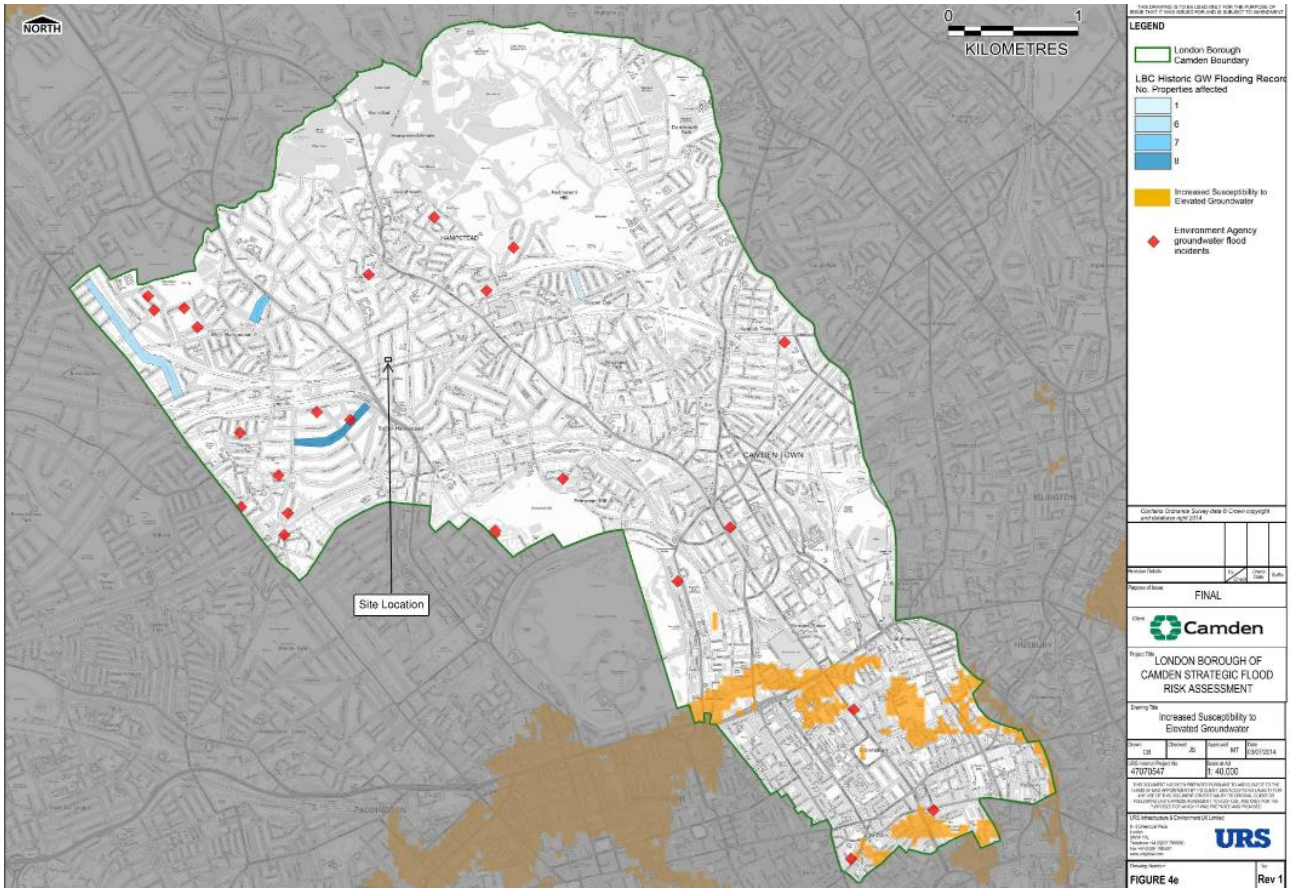


Figure 4.2: Camden Borough Council Historical Flood Records (SFRA, 2014).

4.2.1 Mitigation Measures for Groundwater Flooding

A cavity drainage system has been proposed for the basement with will capture and any groundwater ingress into the basement to pump out to the gravity drainage network.

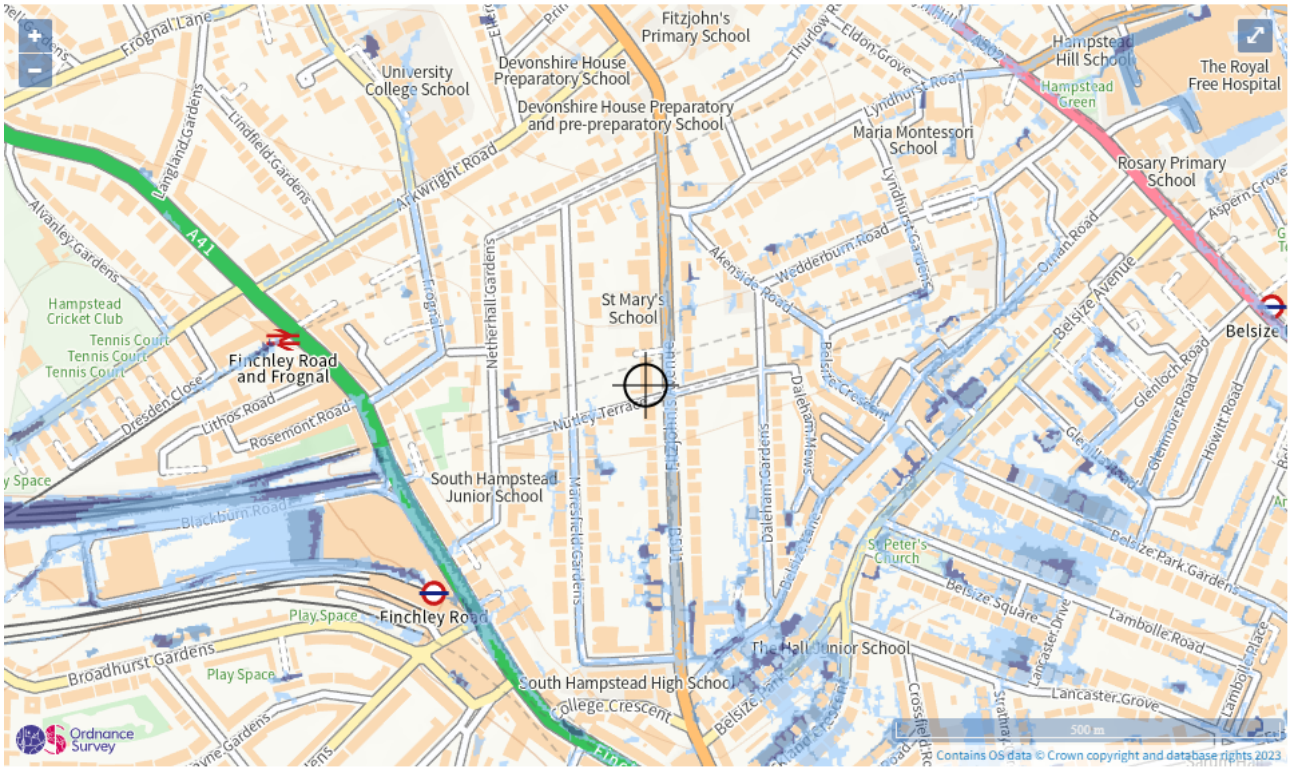
4.3 Flood Risk from Surface Water and Overland Flows

Surface water flooding occurs when intense rainfall is unable to soak into the ground or enter a drainage system due to blockages or the capacity of the system being exceeded. Overland flows can also be generated by burst water mains, failed dams and any failure in a system storing or transferring water.

The EA's indicative Surface Water Flooding Map, Figure 4.3, shows that the site is at very low risk of surface water flooding. The local topography shows that in the event of surface water flooding, water will flow eastwards towards Fitzjohn's Avenue, preventing flooding on site. The topographical survey

in Appendix A shows that the site slopes to the south-east therefore the local topography will encourage surface water to slope to the south-east and prevent local ponding. Surface water flooding is confined/contained by the kerbs of the existing highway. i.e. they won't flow into the site.

The LBC's SWMP shows that the site is within a Critical Drainage Area (CDA). The SWMP states that a CDA is "*a discrete geographic area (usually a hydrological catchment) where multiple and interlinked sources of flood risk (surface water, groundwater, sewer, main river and/or tidal) cause flooding in one or more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure*". The LBC's SFRA also states that a *"specific area within a CDA is not necessarily at higher risk from surface water than an area outside of a CDA".* It is considered that the development site is at low risk if flooding despite being in a CDA.



Extent of flooding from surface water

High Medium Low Very low Location you selected

Figure 4.3 Environment Agency Surface Water Flood Risk Map

4.3.1 Mitigation Measures for Surface Water and Overland Flows

The proposed levels fall away from the proposed building with an attenuation tank & permeable paving reducing the existing surface water run-off rate on site. The tank has been designed for a 1 in 100-year flood event plus 40% climate change.

Since a reduction of approximately 135 m^2 of impermeable area has been proposed, it is unlikely to have a negative impact in surface water flooding on the CDA.

4.4 Flood Risk from Reservoirs

The EA provides information on flood risk from reservoirs. The map showing the maximum extent of flooding from reservoirs was updated in 2021 and now shows the combined effects of flooding from reservoirs and rivers. The Figure 4.4 shows that the site is not at risk of reservoir flooding when river levels are normal.

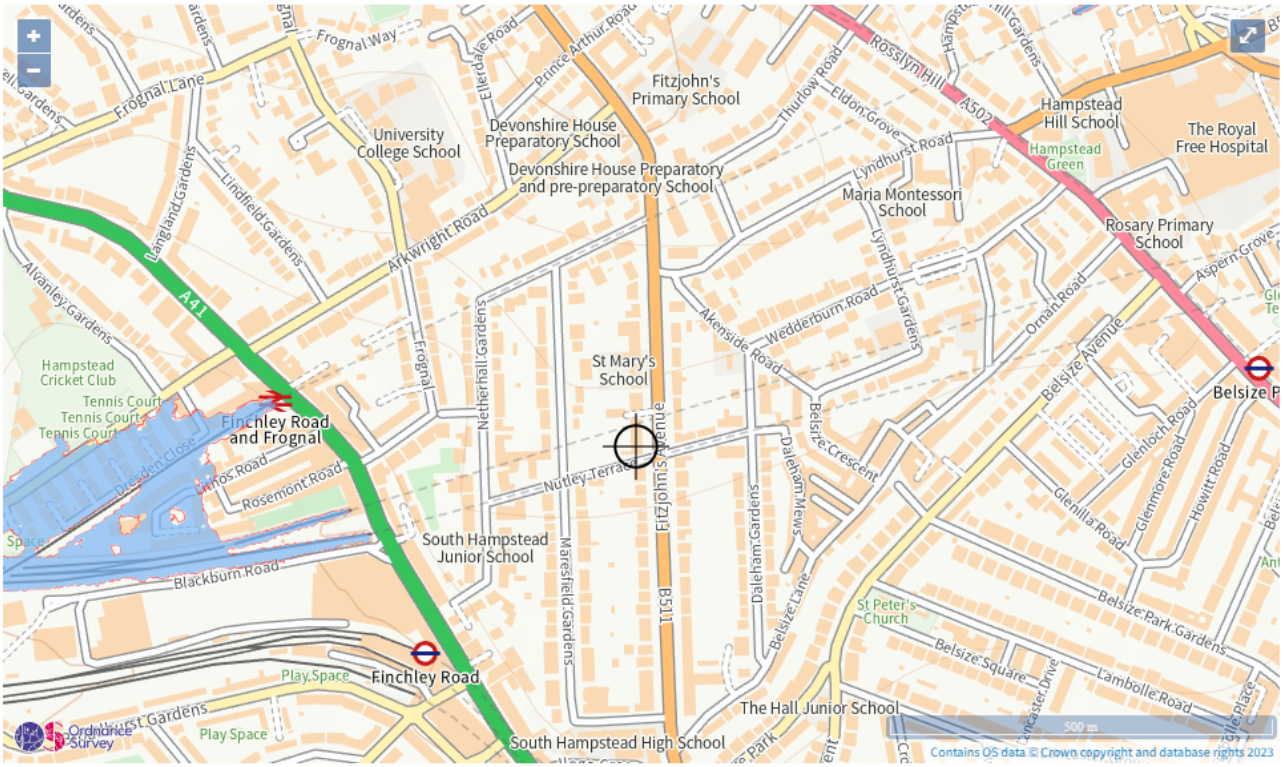


Figure 4.4 Environment Agency Risk of Reservoir Flooding Map

The EA's information states that reservoir flooding is extremely unlikely to happen and there has been no loss of life in the UK from reservoir flooding since 1925. The Reservoir Act of 1975 ensures that reservoirs are inspected regularly, and essential safety work is carried out. A CDA covers a large area where sites are at risk of flooding from various sources. However, some areas within these catchments are at low risk of flooding. The EA's flood map shows that the site is at low risk of flooding.

4.5 Flood Risk from Sewers

Sewer flooding occurs when the flow entering the sewerage network is greater than the capacity of the sewers. The SFRA states that sewer flooding happens when sewers are overwhelmed by heavy rainfall or when they become blocked. The chance of flooding depends on the capacity of the local sewerage system and the amount of rain that falls.

The water and sewerage undertaker responsible for managing the flood risk from public sewers in Camden is Thames Water Utilities Ltd (TW). TW has recognised the impact of more extreme rainfall events may have but have deemed the construction of sewers that can accommodate every extreme rainfall event not cost beneficial.

A review of the Thames Water DG5 Register Cumulative Sewer Flooding Incidents map indicates that the site location has a very low risk of sewer flooding, with 1 sewer flooding incident recorded within 4-digit postcode in the last 10years in the area.

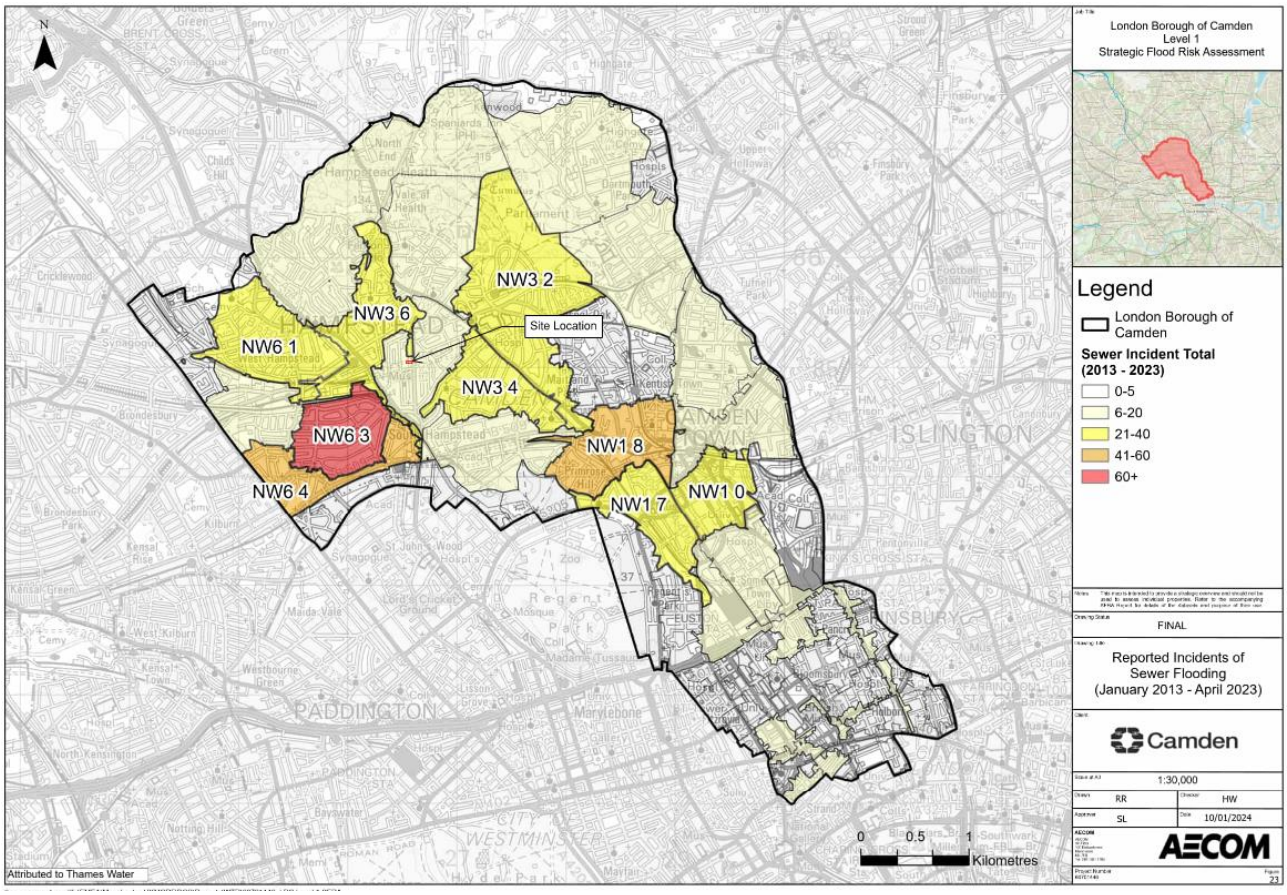


Figure 4.5: The London Borough of Camden SFRA External Sewer Flooding Map (SFRA, 2024).

Surface water attenuation has been proposed via an underground tank at ground level to reduce the public sewer impact. A surface water and foul water pumping station has been proposed at the basement level to prevent flood risk from surcharging into the development.

4.6 Summary of Flood Mitigation Measures

Flood Risk from:	Mitigation Measure
Watercourses and Tidal Flooding	EA Flood Risk Map for planning shows the site is located within Flood Zone 1, therefore the site is at low risk of flooding from watercourses and no mitigation measures have been proposed.
Groundwater Flooding	Based on GEA ground investigation report, the site is at low risk of groundwater flooding therefore a cavity drainage system has been proposed to protect the basement against any Groundwater Flooding.
Surface water and Overland Flows	The EA's indicative Surface water flooding map shows the site is at *'Very Low'* risk of surface water flooding. Levels have been proposed to fall away from the building. Permeable paving & an Attenuation tank has been designed for a flood event of 1 in 100 years plus 40% climate change.
Reservoir Flooding	The EA's information states that reservoir flooding is extremely unlikely to happen. The EA's map shows that the site is at low risk of reservoir flooding and no mitigations measures are proposed.
Flood Risk from Sewers	Surface water attenuation to reduce discharge rate into the public sewers and pumping stations for surface and foul water to prevent surcharging from the public sewers into the development.

5 Surface Water Run-off Assessment

5.1 Existing Run-off

The total 39a Fitzjohn's site area is approximately 1558m^2 or 0.156 ha of this approximately 1140 m^2 or 0.114 ha is impermeable. As described in Section 2.1, the site currently drains to the combined sewer at Fitzjohn's Avenue.

The existing run-off rate into the combined sewer at Fitzjohn's Avenue for the design storm events was calculated using the modified rational method as shown below:

$Qx_{ex} = 2.78 \times A \times i$

Where 'x' is the return period in years, 'A' is the catchment area in ha and 'i' is the rainfall intensity in mm/hr provided by the FEH method.

$Q1_{ex}$ = 2.78 × 0.114 × 33.5 = 10.62 l/s
$Q30_{ex}$ = 2.78 × 0.114 × 82.3 = 26.08 l/s
$Q100_{ex}$ = 2.78 × 0.114 × 107.1 = 33.94 l/s

5.2 Proposed Impermeable Area and Discharge Rates

The development is set to decrease the impermeable area by 135 m^2, with an approximate 305 m^2. of permeable paving proposed to attenuate and soft landscaping.

5.2.1 Proposed Discharge Rates

The London Plan states that developments should aim to achieve greenfield runoff rates. The discharge rate for the proposed development shall be restricted to as close the greenfield run-off rates as possible outlined below.

The greenfield run-off rates for storm events of several different return periods were calculated using the FEH method and are summarised below. Supporting documentation is contained in Appendix D.

$Q1_{Gr}$ = 0.56 l/s
$Q30_{Gr}$ = 1.5 l/s
$Q100_{Gr}$ = 2.08 l/s

The runoff rate for the proposed development shall be kept as close to Greenfield as reasonably possible. The existing greenfield runoff rate is not achievable, as it requires an outlet with a diameter of only 59 mm. This would not be practical since it would increase the risk of blockage. As stated in the Design and Construction Guidance (DCG) the design of flow control devices should include areas "*where debris can enter the control (e.g., where the upstream system is open or where the inlets are gullies), static controls should have a minimum opening size of 100 mm, or equivalent".* Therefore, the flow rate would increase to 2.7 litres per second as a result of the outlet size restriction.

It is proposed to install a 75 mm hydrobrake outlet on manhole FCMH1, in order to control surface water flows from the site.

5.2.2 Climate Change

The current EA guidance on climate change allowance states that new drainage systems must be designed to ensure that there is no increase in the rate of runoff discharged from the site for the "*Upper End*" allowance. The expected lifetime of this development is 100 years; therefore a 40% allowance must be used in the design.

5.3 Surface Water SUDS Strategy

The London Plan states that developments should ensure that surface water runoff is managed as close to its source as possible utilising sustainable methods (SUDS). There should be a preference for green over grey infrastructure in line with the following drainage hierarchy outlined in Policy SI 13 of the London Plan:

5.3.1 Rainwater Used as a Resource (e.g. Rainwater Harvesting)

Rainwater harvesting promotes the storage and re-use of rainwater collected from roofs and hard surfaced areas. The Camden Planning Guidance states that: *"'Grey water' (water that has already been used in hand basins, baths and showers) can be stored, filtered and disinfected, and then reused, for toilet flushing, garden watering".* This type of system contributes to the reduction of runoff rates and volumes within a development.

The capacity of rainwater harvesting systems to attenuate rainwater depends on the water use within the building. If there is no activity in the building or other water use and the harvester is full, no attenuation will be provided during a subsequent storm event. The provision of rainwater harvesting for landscape irrigation measures is to be considered for the development during detailed design stages. As a minimum, rainwater butts will be proposed in the rear of each plot to capture surface water run-off for re-use in line with Camden policy guidance.

5.3.2 Rainwater Infiltration to Ground at or Close to Source

The results of the ground investigation report show that the ground is not suitably permeable, and that the surface water run-off cannot be disposed of to the ground via infiltration.

5.3.3 Controlled Rainwater Discharge to a Combined Sewer

A below ground attenuation tank and permeable paving has proposed to create a below-ground void space for the temporary storage of surface water before controlled release to the sewers. The volume of 30m^3 has been designed to accommodate storms up to the 1 in 100-year rainfall event, including a 40% allowance for climate change.

The attenuation tank has been proposed to be situated at ground level in the parking area at the front of the site. Surface water from the lower levels will be pumped out of the basement to this attenuation tank at ground level with 24hr storage provided in each pump set. The hydrobrake (FCMH1) will discharge at a rate of 2.7 l/s and will outfall to the 1067 x 686 mm combined public sewer located on Fitzjohn's Avenue via the existing connection through the adjacent 39 Fitzjohn's Avenue or via a new direct connection to the sewer.

The permeable paving is proposed at the front of the development on the private drive by the east of the site. Surface water will be stored in the subbase of the private drive/driveway and will also discharge to manhole FCMH1.

6 Surface Water Maintenance Strategy

The successful implementation and operation of a SuDS system depends on a robust and clear maintenance strategy being implemented. The following measures should form part of the site's proposed management plan.

The SuDS will be maintained by the site owner and will form part of the overall maintenance regime for the site.

SuDS Element	Maintenance		
	Activity	**Required Action**	**Typical Frequency**
Permeable Paving	**Monitoring / Inspections**	Initial inspection	Monthly for three months after installation
		Inspect for evidence of poor operation and/or weed growth – if required, take remedial action	Three-monthly, 48 hours after large storms in first six months
		Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
		Monitor inspection chambers	Annually
	Regular Maintenance	Brushing and vacuuming -standard cosmetic sweep over whole surface	Once a year after autumn leaf fall
		Rubbish and litter removal	As required
	Remedial Actions	Remediate any landscaping which through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving.	As required
		Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	
		Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required
Attenuation Tank	**Monitoring / Inspections**	Inspect all inlets, outlets, vents, overflows and control structures to ensure they are working as they should	Annually or after severe storms
		Inspect and identify any elements that are not operating correctly.	Monthly for three months, then half yearly or as required.
	Regular Maintenance	Remove sediments / debris from catch pits / gullies and control structures	Annually, after severe storms or as required
	Remedial Actions	Repair inlets, outlets, vents, overflows and control structures.	As required

Table 6.1 SuDS Maintenance Strategy as taken from The SuDS Manual

Effective SuDS design must assess all foreseeable risks during construction and maintenance. These must be mitigated during the detailed design stages where effective design will aim to avoid, reduce, and mitigate risks.

This process will also require input from the principal contractor who will ensure the construction of SuDS components are carried out in a safe and sustainable manner.

7 Exceedance Routes and Overland Flows

Surface water exceedance and overland flows occur when intense rainfall is unable to either soak into the ground or enter a drainage system; due to blockages or the capacity of the system being exceeded. Although drainage systems are currently designed for extreme storm events, it is not economical or sustainable to build large, oversized drainage networks for all types of extreme rainfall or scenarios. As a result, there will be occasions when surface water runoff will exceed the capacity of drains as outlined in CIRA 635 document 'Designing for exceedance in urban drainage – good practice"':

> "*It is inevitable that as a result of extreme rainfall the capacities of sewers, covered watercourses and other drainage systems will be exceeded on occasion. Periods of exceedance occur when the rate of surface runoff exceeds the drainage system inlet capacity, when the pipe system becomes overloaded, or when the outfall becomes restricted due to flood levels in the receiving water.*"

Designing for exceedance aims to divert and control flood flows along routes where the risk of property flooding and the risk to health and safety is minimised and can be managed.

The following sections assess the overland flow routes for the existing and developed site. Proposed mitigation measures, where required, are then developed which will be incorporated into development proposals. These will route water away from vulnerable areas, avoid creating hazards to end users and also not increase flood risk on or off site.

7.1 Existing Exceedance and Overland Flow Routes

Any exceedance events occurring on site would follow existing topographical levels and fall towards Fitzjohn's Avenue at the front of the site. Levels at the rear of the site show that any exceedance flows would fall along the tennis court towards the existing soft landscaping.
Any exceedance flows within Fitzjohn's Ave Highway would follow the highway levels and be contained in the highway with site levels higher than the nearest channel level.

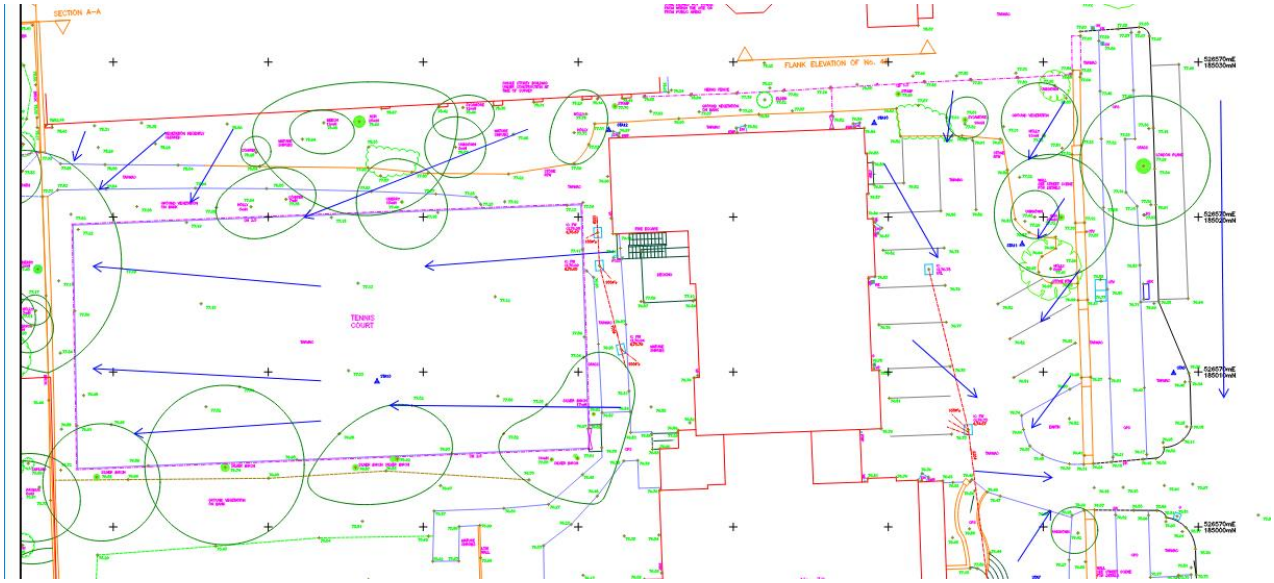


Figure 7.1: Pre-development exceedance/overland flow routes

7.2 Proposed Exceedance and Overland Flow Routes and Mitigation Measures

The proposed SUDS have been designed so that there is no flooding within the site for up to and including the 1 in 30-year rainfall event and the 1 in 100-year + 40% storm event which is in line with current Design and Construction Guidance (DCG) for sewers offered for adoption and local LLFA guidance. During extreme storm periods, e.g. exceeding a 1 in 100-year + 40% rainfall event, surface water sewers may surcharge and cause localised flooding at low points within the site. These areas are shown on Figure 7.2 for the development site.

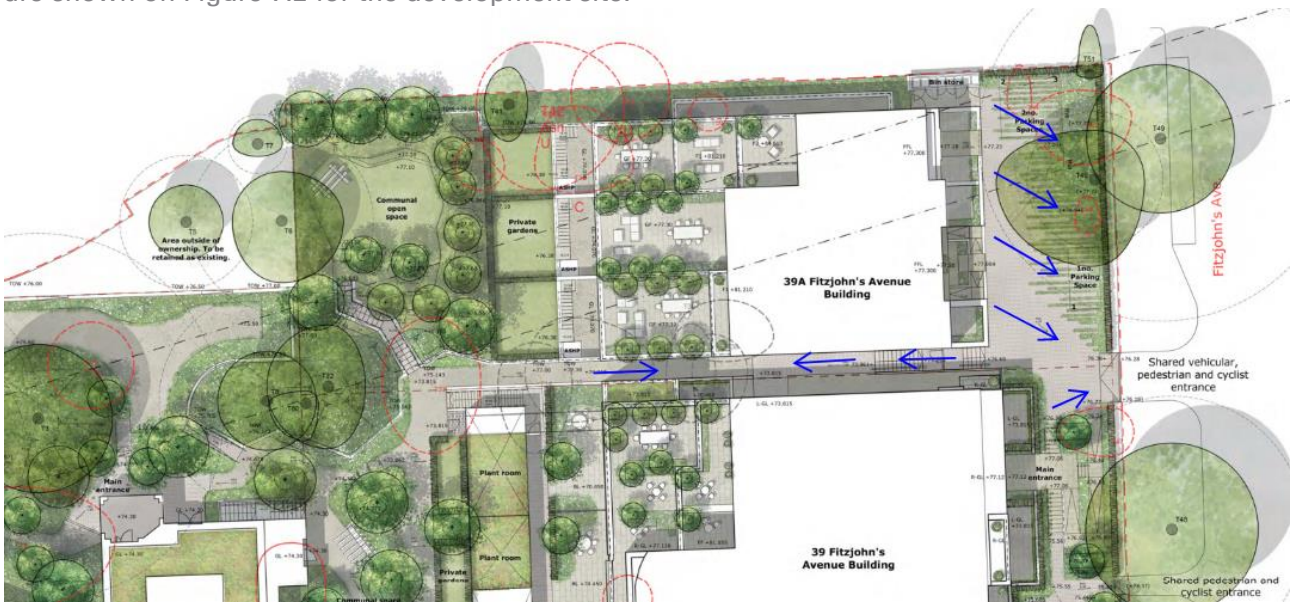


Figure 7.2: Proposed exceedance/overland flow routes

The development proposals show that surface water exceedance events can be captured and managed on-site should they occur by creating conveyance and storage areas for flood waters on-site.

8 Foul Water Assessment

As outlined in Section 2.1, the site has an existing combined drainage network serving the site which eventually outfalls to the public sewers in Fitzjohn's Avenue.

The development will include a new foul water pump which is located at the basement level. This foul water pump will serve each plot and outfall to the gravity foul water network at ground level. The pump will be sized to accommodate 24-hour emergency storage as required by Building Regulations Part H.

All proposed networks will be designed to Adoptable Standards as outlined in the Design and Construction Guidance (Appendix C of the Sewerage Sector Guidance in relation to the adoption of sewerage assets) (DCG) and in accordance with Build Regulations Part H.

The proposed peak foul water flows from the site are calculated using the figure of 4000 l/dwelling/day as outlined in the DCG.

The development will include the construction of 3 residential dwellings which, assuming total gravity connection, equates to a potential proposed peak foul water flow of:

3 l/dwelling/d x 4000 l/d = 0.14 l/s

The proposed foul water & surface water discharge is intended to link with the current combined water connection at 39a Fitzjohn's Avenue, extending to the neighbouring property at 39 Fitzjohn's Avenue. Should there be no development at 39, we can proceed with utilizing the existing connection. However, in the event of a development at 39, it would be necessary for them to redirect our connection into their system. In the event that connecting to 39 becomes unfeasible, an alternative proposal could involve establishing a new connection directly to the Public Sewer under Fitzjohn's Avenue.

We have submitted a 'Pre-development Enquiry' to Thames Water to verify the capacity in the receiving public sewers, and we are currently awaiting their response.

A Section 106 application will be made to the Water Authority for consent to connect to the public sewer at Stage 4.

9 Conclusions

- The flood risk to the site is low as the site is located in Flood Zone 1. The site is also at low flood risk from all other sources.

- Due to low risk of groundwater flooding and no ground water found on site a cavity drainage has been proposed to protect the site against groundwater flooding.

  Levels have been proposed to fall away from the building, permeable paving & an attenuation tank has been designed for a flood event of 1 in 100 years plus 40% climate change.

- Surface water to be attenuated to 2.7 l/s using an attenuation tank, permeable paving, and a flow control manhole for all design storms.

- Pumping stations for surface and foul water have been proposed at the basement level to prevent surcharging from the public sewers into the development.

- Surface & Foul water to outflow to a combined sewer in Fitzjohn's Avenue via an existing connection on neighbouring 39 Fitzjohn's Ave. Alternatively, a new drainage connection from the site will connect direct to the Public Sewer in Fitzjohn's Avenue.

- We have submitted a 'Pre-development Enquiry' to Thames Water to verify the capacity in the receiving public sewers, and we are currently awaiting their response.

- A Section 106 application will be made to the Thames Water for consent to connect to the public sewer, either directly or indirectly during Stage 3 design.

- As outlined in this report, the site is at low flood risk and will reduce post development peak surface water run-off rates from the site. The site is considered suitable and safe in terms of flood risk and surface water drainage and aligns with NPPF guidance.

Appendix A

Topographical Survey

GRID NORTH

526500mE 185040mN
526510mE 185040mN
526520mE 185040mN
526530mE 185040mN
526540mE 185040mN
526550mE 185040mN
526570mE 185040mN
526570mE 185030mN
526570mE 185020mN
526570mE 185010mN
526570mE 185000mN
526570mE 184990mN
526570mE 184980mN
526570mE 184970mN
526570mE 184960mN

No. 45
No. 39
No. 37c

SECTION A–A
SECTION B–B

FLANK ELEVATION OF No. 45

SOME DETAILS NOT VISIBLE FROM WITHIN THE SITE OR FROM PUBLIC AREAS

TENNIS COURT

FITZJOHNS AVENUE

Original Drawing Size: A0

NOTES:–
The accuracy and content of this drawing are dependent on the original specification and EDI should be consulted before use at other scales.

Where underground services are shown, all reasonable care has been taken within the spirit of the original specification and requirement. Before use of this information the user should consult EDI and satisfy themselves of the completeness and accuracy of such detail before undertaking any works. Due to the nature of this work and limitations imposed by ground conditions and the detection equipment no guarantee can be given that all services have been recorded. Trial holes should be dug at critical locations.

All reasonable care has been taken in the survey detail represented on this drawing but any discrepancies must be reported to EDI immediately.

Our aim is to produce the best possible results within the specification and cost constraints of our clients. Any comments are most welcome.

Levels shown at kerbs are channel level unless stated.

Control: All levels and co–ordinates are related to the datums described.
The horizontal and vertical control of this survey is based on the previous survey from 2011, EDI Ref 12632.

LEGEND

Features:
AV Air Valve
AB Air Brick
BH Bollard
BM Benchmark
BP Boundary Post
BS Bus Stop
BT British Telecom
CL Cover Level
COL Column
CTV Cable TV Cover
DCH Drainage Channel
DF Drinking Fountain
DIS Disused
DK Drop Kerb
DPC Damp proof Course
EIC Electricity IC
EJ Expansion Joint
ER Earth Rod
FH Fire Hydrant
FHR Fire Hose Reel
FS Flagstaff
G Gully
GV Gas Valve
IC Inspection Cover
IL Invert Level
JBX Junction Box
KIO Kerb Inlet Obl
LB Letter Box
LBN Litter Bin
LLP Low Level LP
LP Lamp Post
MP Marker Post
MS Mile Stone
MT Mercury Telecom
OHL Overhead Line
DN Drain
OP Overflow Pipe
PM Parking Meter
PP Power Pole
RAD Radiator
RE Reading Eye
RNP Road Name Plate
RS Road Sign
RSD Roller Shutter Door
RWP Rain Water Pipe
SD Service Duct
SV Stop Valve
TCB Telephone Call Box
TP Telegraph Pole
TS Traffic Signal
UB Universal Beam
UNK Unknown
UR Urinal
UTL Unable to lift
V Vent
VP Vent Pipe
WM Water Meter
WO Wash Out
WP Waste Pipe

Building Level Details:
D Door
EL Floor Level
FFL Floor Level
FRL Flat Roof Level
HL Head Level
PPL Parapet Level
RL Ridge Level
SL Sill Level
SP Springer of Arch
TA Top of Arch
W Window
12.34 Ceiling/Beam Soffit

Boundary Types:
BW Barbed Wire
CB Close Boarded
CH Chainlink
CI Corrugated Iron
CP Chestnut Paling
FW Foul water
IW Interwoven
LL Larch Lap
PAL Palisade
PR Post & Rail
PW Post & Wire
TNR Timber Knee Rail
RTW Retaining Wall
VSF Vehicle Safety Fence
WMF Wire Mesh Fence

Surfaces & Finishes:
B Brickwork
BB Breeze Block
C Concrete
CLT Ceiling Tiles
CP Carpet
CPS Concrete Paving Slabs
CPT Carpet Tiles
CR Concrete Render
CT Ceramic Tiles
FT Floor Tiles
HBD Hardboard
L Linoleum
P Plaster
PAV Brick Paviors
S Steel work
T Tarmac
TSP Textured Safety Paving
VT Vinyl Tiles

Services:
C CATV cables
CCTV cables
D Data cables
E Electric cables
F Foul water
G Gas pipes
H Heating duct
SD Service ducts
Storm water
Telecom cab.
Unidentified
W Water pipes
150ø Pipe Diameter/Flow
Overhead Lines

Survey Station
Fence
Gate
Painted Road Markings
Edge of Vegetation
Kerb/Drop Kerb
Tree
Top
Bottom
Banks
Building
Overhead Building Detail
Wall

Station Schedule

Station	Easting	Northing	Level	Type
A1	526513.431	184965.178	73.671	Hilti Nail
A2	526530.720	184980.914	73.829	Hilti Nail
A3	526547.492	184965.250	74.119	Hilti Nail
A4	526567.678	184980.882	74.854	Hilti Nail
A5	526568.408	185009.923	76.469	Hilti Nail
A6	526566.692	184940.928	72.822	Hilti Nail
A7	526559.061	184996.403	76.306	Hilti Nail
A8	526566.425	185035.796	77.687	Hilti Nail
A9	526554.460	184979.013	75.755	Hilti Nail
D6	526452.714	184949.885	72.669	Hilti Nail
D8	526451.072	185008.459	76.524	Hilti Nail
A10	526549.092	185026.054	76.842	Hilti Nail
A11	526558.639	185018.244	76.865	Temporary
A12	526531.966	185025.613	76.981	Hilti Nail
A13	526517.020	185009.376	77.042	Hilti Nail
A14	526515.483	184992.500	75.432	Peg
A15	526523.860	184974.759	74.613	Hilti Nail

SHEET LAYOUT

14837/T/01–02 | 14837/T/02–02

Rev.	Job No.	Date	Revision Detail	Surveyor	Chkd

CLIENT
Mr&Mrs Ambrose
thro'
The Charlton Brown Partnership
The Belvedere, 2 Back Lane
Hampstead NW3 1HL

PROJECT
Southwell House
39 Fitzjohn's Avenue
Hampstead
London
NW2

Job No.	Surveyor	Checked	Date	Scale
14837	A.Rose	GMP	March 2015	1:100

DRAWING No. 14837/T/02–02
REV.

EDI SURVEYS LTD
163–165 Ranelagh Road, Ipswich, Suffolk IP2 0AH
Telephone | 01473 211222 Fax | 01473 221660
Email | enquiries@edisurveys.co.uk
Our Services:– Topographic Surveys, Measured Building Surveys, GPS Surveying and Control, 3D laser Scanning, Utility Surveying and Drainage Investigation.
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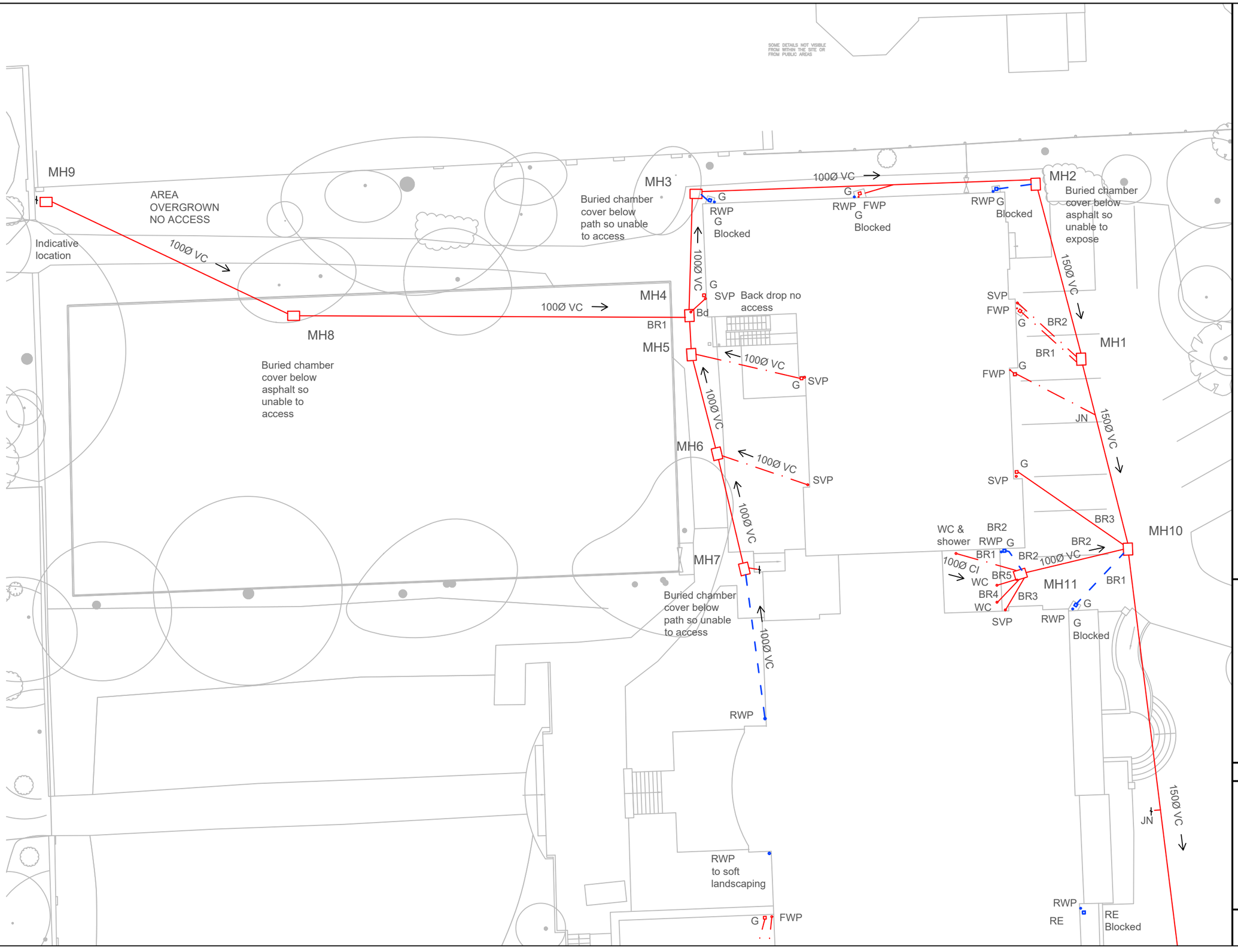
Appendix B
CCTV Survey



Key

- Surface water drain
- Foul water drain
- Combined drain
- Inspection chamber

N.B position indicated is cover position. Not chamber extents.

Critical dimensions to be checked prior to any works

SA	Survey abandoned
RWP	Rainwater downpipe
FWP	Foul waste connection
SVP	Soil vent pipe
G	Gully
UTL	Unable to lift
UTT	Unable to trace
BR	Branch reference
HL	High level
Bd	Backdrop

Rev 01 - 19/01/22

39 FITZJOHNS AVENUE

BELOW GROUND DRAINAGE LAYOUT SCHEMATIC GROUND LEVEL

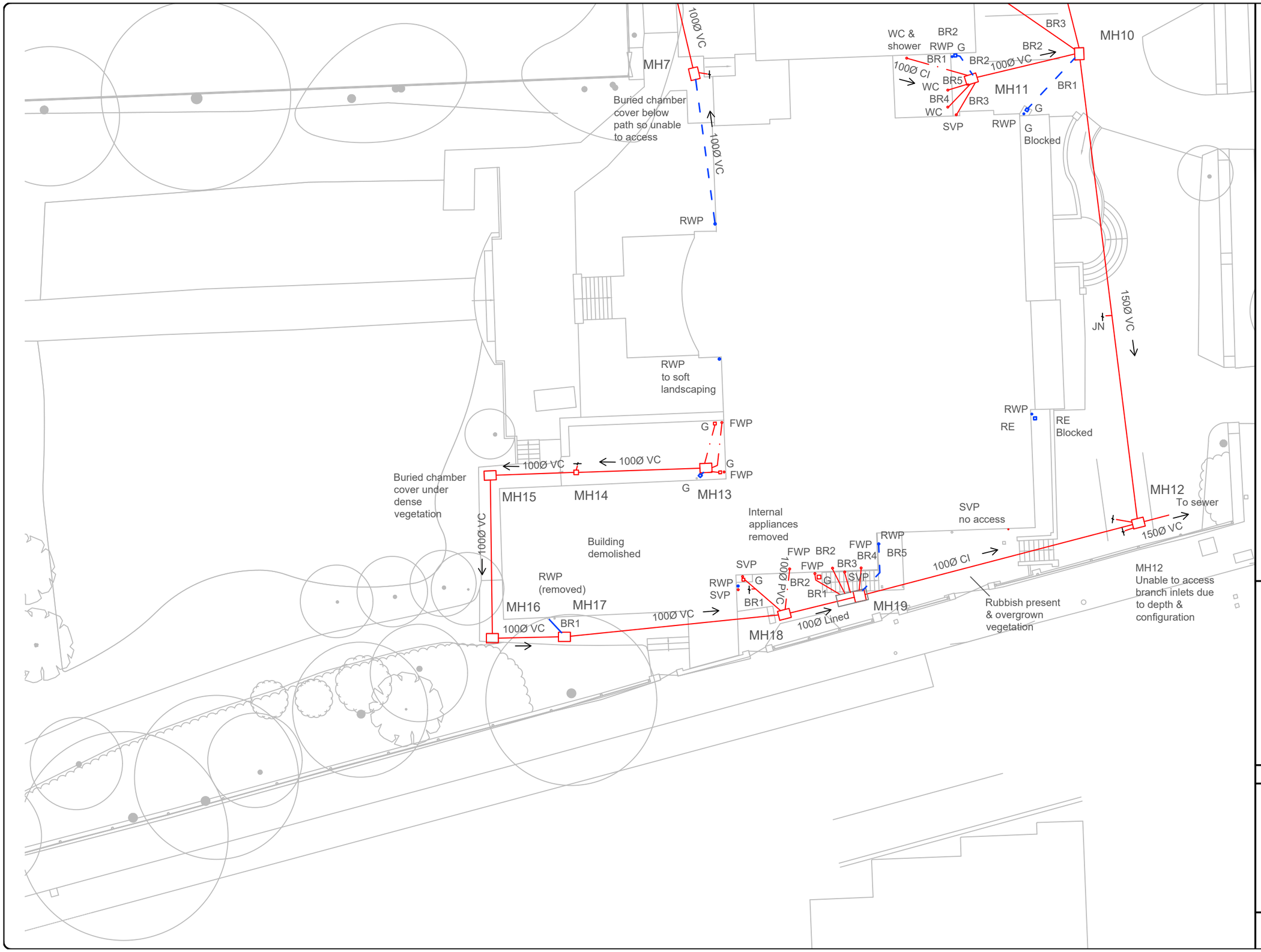
SHEET 1 OF 2

Scale 1:200 at A3

www.thedrainagelab.com

THE DRAINAGE LAB

Drawing 4106/01 rev. 01



Key

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- Foul water drain
- Combined drain
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N.B position indicated is cover position. Not chamber extents.

Critical dimensions to be checked prior to any works

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UTT	Unable to trace
BR	Branch reference
HL	High level
Bd	Backdrop

Rev 01 - 19/01/22

39 FITZJOHNS AVENUE

BELOW GROUND DRAINAGE LAYOUT SCHEMATIC GROUND LEVEL

SHEET 2 OF 2

Scale 1:200 at A3

www.thedrainagelab.com

THE DRAINAGE LAB

Drawing 4106/02 rev. 01

Appendix C
Borehole Logs

GEA

Geotechnical & Environmental Associates

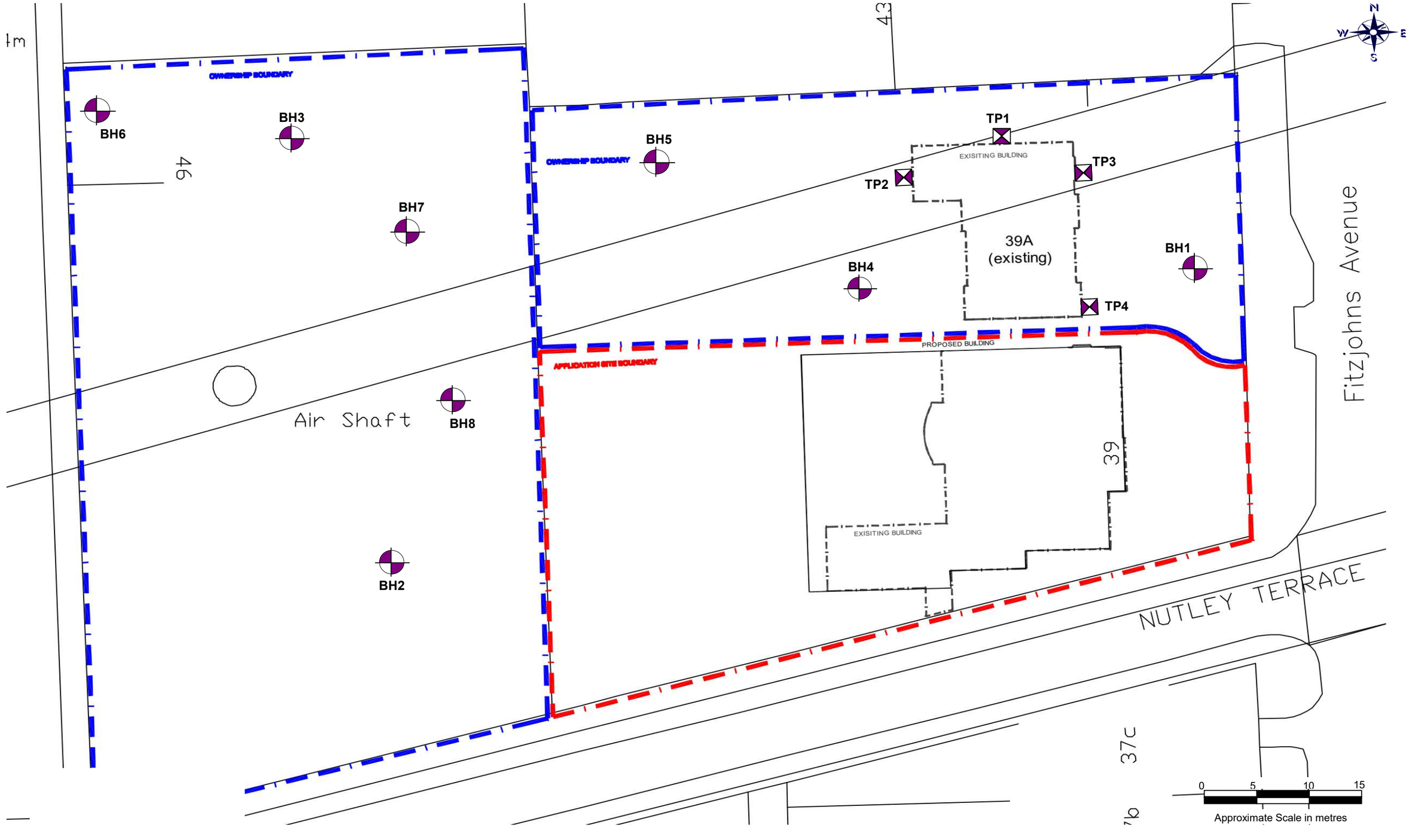
www.gea-ltd.co.uk

Site Plan

Site	39A Fitzjohns Avenue & 46 Maresfield Gardens, London NW3 5JU
Client	39 Fitzjohns Avenue Limited
Engineer	Price and Myers

Job Number J23003 & J23181

Sheet 1/1



GEA

Geotechnical & Environmental Associates

Project				BOREHOLE No
39a Fitzjohn's Avenue, London NW3 5JY				1
Job No	Date	Ground Level (m OD)	Co-Ordinates ()	
J23003	24-01-23 24-01-23	76.74		
Client	Engineer			Sheet
39 Fitzjohn's Avenue Limited	Price and Myers			1 of 2

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
0.30	D			76.14		(0.60) 0.60	MADE GROUND (dark brown clayey sandy gravelly silt with abundant brick and concrete fragments)	
0.50	D							
1.20-1.65	UT	2,2/3,3,3,4 N60 = 15 13 blows				(1.40)	Very stiff very high strength brown mottled orange-brown and grey silty slightly sandy slightly gravelly CLAY with roots and rootelts. Gravel is fine to medium angular to subrounded. DESICCATED SOIL	
1.75	D			74.74		2.00		
2.00-2.45	SPT						Stiff high strength fissured brown mottled orange-brown and grey silty slightly sandy CLAY with selenite crystals, occasional black flecks and partings and pockets of orange-brown fine sand. Rootlets to 3.00 m	
2.75	D							
3.00-3.45	UT	2,3/4,3,4,4 N60 = 17 15 blows				(3.00)		
3.75	D							
4.00-4.45	SPT							
4.75	D			71.74		5.00		
5.00-5.45	UT	3,3/4,4,5,4 N60 = 19 19 blows					Stiff high strength fissured dark grey silty CLAY with mica and pcokets of pale grey and pale brownish grey silt and fine sand and occasional pyrite nodules	
6.00	D							
6.50-6.95	SPT							
7.50	D							
8.00-8.45	UT	3,4/5,5,5,6 N60 = 23 22 blows						
9.00	D							
9.50-9.95	SPT							

Boring Progress and Water Observations

Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth

GENERAL REMARKS

Excavating services inspection pit from GL to 12.0 m for 1 hr.
Groundwater not encountered.
Groundwater monitoring standpipe installed to 6.00 m.

All dimensions in metres Scale 1:62.5	Method/ Plant Used Cable Percussion Drilling Rig	Logged By ML

Report ID: CABLE PERCUSSION || Project: J23003 LOGS.GPJ || Library: GEA LIBRARY.GLB || Date: 14 December 2023

GEA

Geotechnical & Environmental Associates

Project				BOREHOLE No
39a Fitzjohn's Avenue, London NW3 5JY				1
Job No	Date	Ground Level (m OD)	Co-Ordinates ()	
J23003	24-01-23 24-01-23	76.74		
Client		Engineer		Sheet
39 Fitzjohn's Avenue Limited		Price and Myers		2 of 2

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
						(10.00)	Stiff high strength fissured dark grey silty CLAY with mica and pcokets of pale grey and pale brownish grey silt and fine sand and occasional pyrite nodules(continued)	
10.50	D							
11.00-11.45	UT	4,4/5,5,6,6 N60 = 25 25 blows						
12.00	D							
12.50-12.95	SPT							
13.50	D							
14.00	D							
14.55-15.00	UT	4,5/6,6,7,7 N60 = 29 28 blows		61.74		15.00		

Boring Progress and Water Observations					
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth

GENERAL REMARKS

Excavating services inspection pit from GL to 12.0 m for 1 hr.
Groundwater not encountered.
Groundwater monitoring standpipe installed to 6.00 m.

All dimensions in metres Scale 1:62.5	Method/ Plant Used Cable Percussion Drilling Rig	Logged By ML

Report ID: CABLE PERCUSSION || Project: J23003 LOGS.GPJ || Library: GEA LIBRARY.GLB || Date: 14 December 2023

GEA

Geotechnical & Environmental Associates

Project				BOREHOLE No
39a Fitzjohn's Avenue, London NW3 5JY				4
Job No	Date	Ground Level (m OD)	Co-Ordinates ()	
J23003	24-01-23 24-01-23	77.06		
Client	Engineer			Sheet
39 Fitzjohn's Avenue Limited	Price and Myers			1 of 2

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
0.10	ES						MADE GROUND (dark greyish brown silty sandy gravelly clay with ash and fragments of brick, concrete and occasional clinker and roots)	
0.50	ES					(0.80)		
				76.26		0.80		
0.90	D	1,1/2,2,2,2 N60 = 9					Firm fissured light brown and brown mottled orange-brown and grey silty slightly sandy CLAY with selenite crystals, occasional partings and pockets of orange-brown fine sand. Rootlets to 1.50 m	
1.50	D							
1.90	D	2,2/2,2,3,3 N60 = 11				(2.30)		
2.40	D							
2.80	D							
		2,1/3,2,3,4 N60 = 14		73.96		3.10		
3.40	D						Stiff fissured brown mottled grey and orange-brown silty CLAY with selenite crsytals, partings of orange-brown silt	
3.85	D					(1.40)	3.80 - 3.90 .....CLAYSTONE	
		2,2/2,3,3,4 N60 = 14						
4.30	D			72.56		4.50		
4.70	D						Stiff fissured dark grey silty CLAY	

Boring Progress and Water Observations

Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth

GENERAL REMARKS

Groundwater not encountered.

All dimensions in metres Scale 1:31.25	Method/ Plant Used Opendrive Percussive Sampler	Logged By ML

Report ID: CABLE PERCUSSION || Project: J23003 LOGS.GPJ || Library: GEA LIBRARY.GLB || Date: 14 December 2023

GEA

Geotechnical & Environmental Associates

Project				BOREHOLE No
39a Fitzjohn's Avenue, London NW3 5JY				4
Job No	Date	Ground Level (m OD)	Co-Ordinates ()	
J23003	24-01-23 24-01-23	77.06		
Client		Engineer		Sheet
39 Fitzjohn's Avenue Limited		Price and Myers		2 of 2

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
		1,1/2,2,3,3 N60 = 11				(0.95)	Stiff fissured dark grey silty CLAY(continued)	
				71.61		5.45		

Boring Progress and Water Observations					
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth

GENERAL REMARKS

Groundwater not encountered.

All dimensions in metres Scale 1:31.25	Method/ Plant Used Opendrive Percussive Sampler	Logged By ML

Report ID: CABLE PERCUSSION || Project: J23003 LOGS.GPJ || Library: GEA LIBRARY.GLB || Date: 14 December 2023

GEA

Geotechnical & Environmental Associates

Project				BOREHOLE No
39a Fitzjohn's Avenue, London NW3 5JY				5
Job No	Date	Ground Level (m OD)	Co-Ordinates ()	
J23003	24-01-23 24-01-23	77.19		
Client	Engineer			Sheet
39 Fitzjohn's Avenue Limited	Price and Myers			1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument / Backfill
Depth	Type No	Test Result		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
				76.89		(0.30) 0.30	MADE GROUND (dark greyish brown gravelly sand with abundant ash and fragments of brick and occasional clinker)	
0.25	ES						Firm becoming stiff fissured light brown and brown mottled orange-brown and grey silty slightly sandy CLAY with selenite crystals, occasional partings and pockets of orange-brown fine sand. Rootelts to 1.40 m	
0.60	D							
0.90	D	2,1/2,3,2,3 N60 = 11						
1.50	D							
1.80	D					(3.20)		
2.10	D	2,1/2,3,2,3 N60 = 11						
2.70	D							
3.20	D	2,1/2,3,2,3 N60 = 11		73.69		3.50		
3.70	D						Stiff fissured dark brownish grey silty CLAY	
		2,1/3,3,3,4 N60 = 15				(0.95)		
				72.74		4.45		

Boring Progress and Water Observations					
Depth	Date	Time	Casing Depth	Casing Dia. mm	Water Depth

GENERAL REMARKS

Groundwater not encountered.

All dimensions in metres Scale 1:31.25	Method/ Plant Used Opendrive Percussive Sampler	Logged By ML

Report ID: CABLE PERCUSSION || Project: J23003 LOGS.GPJ || Library: GEA LIBRARY.GLB || Date: 14 December 2023

Appendix D
Greenfield Runoff Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Igor Armando
Site name:	39a Fitzjohn's Ave
Site location:	

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:	51.52510° N
Longitude:	0.17005° W
Reference:	3898275156
Date:	Dec 15 2023 10:44

Runoff estimation approach

IH124

Site characteristics

Total site area (ha):	.156

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):	620	620
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?

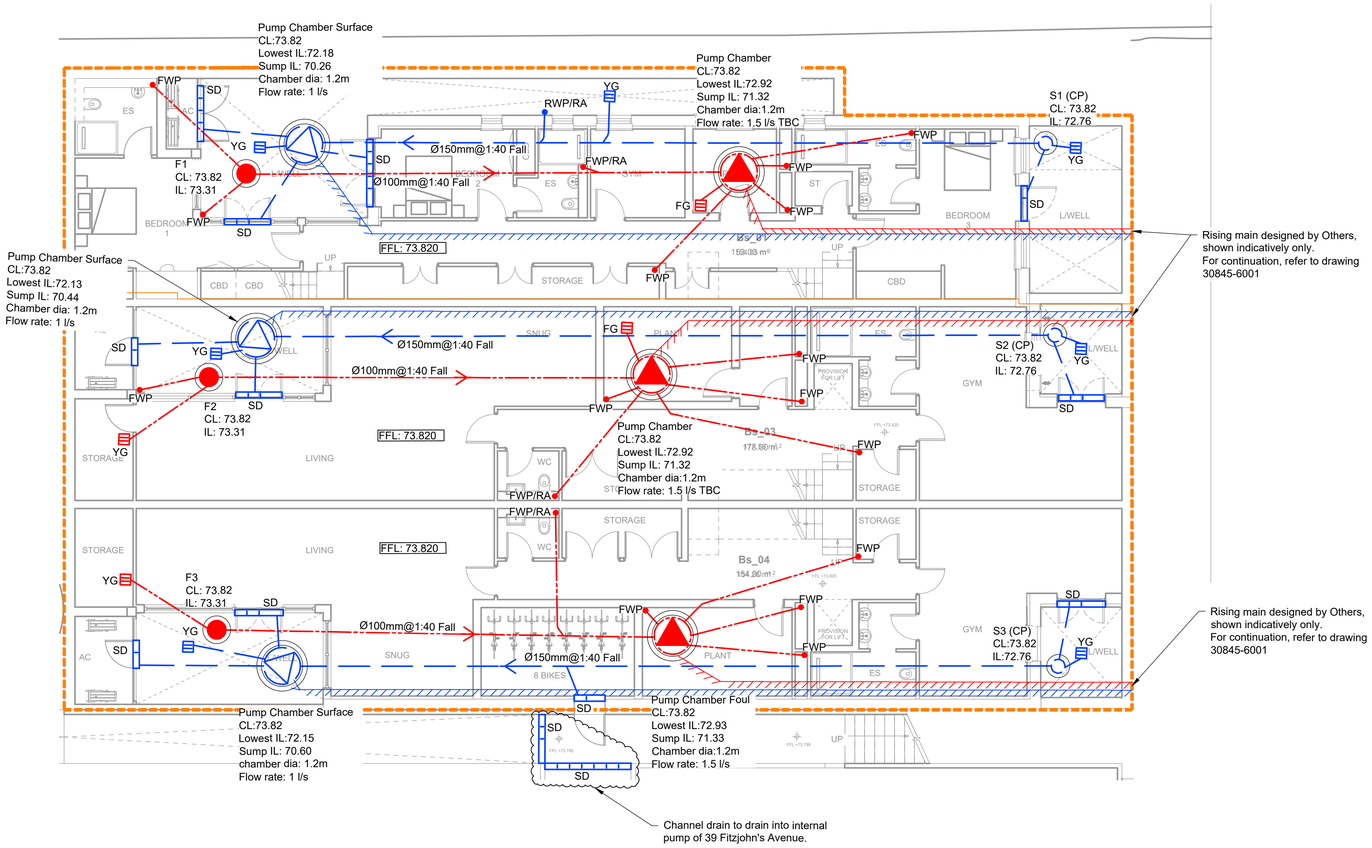
Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited

Q_{BAR} (l/s):	0.65	0.65
1 in 1 year (l/s):	0.56	0.56
1 in 30 years (l/s):	1.5	1.5
1 in 100 year (l/s):	2.08	2.08
1 in 200 years (l/s):	2.44	2.44

Appendix E
Drainage Design Strategy



Note:

Cavity drainage and high level drainage is to be design by others.

NOTES :

1. This drawing is to be read in conjunction with all relevant Architect's, Engineer's and specialists' drawings and specifications.
2. Do not scale from this drawing in either paper or digital form. Use written dimensions only. To check that this drawing has been printed to the intended scale this bar should be 50mm long @ A1 or 25mm long @ A3.
3. Health & Safety :
   All specific drawing notes are to be read in conjunction with the project "Information Pack" and "Site Rules".
4. All downpipe locations are indicative and to be confirmed by M&E.

DRAINAGE LEGEND

New FW Drain
New SW Drain
Rising Main
Basement Extents

DRAINAGE KEY

RWP	Rainwater Down Pipe
FWP	Foul Waste Pipe
YG	Yard Gully
FG	Floor Gully
S1	Surface Water Manhole Chamber
F1	Foul Water Manhole Chamber
S1 F1	Pumping Station Manhole Chamber

ABBREVIATIONS

IL - Invert Level
CL - Cover Level
RA - Above Ground Rodding Access

Rev	Date	Drawn	Eng	Amendment
P01	17.01.24	IA	MG	Issued for Information

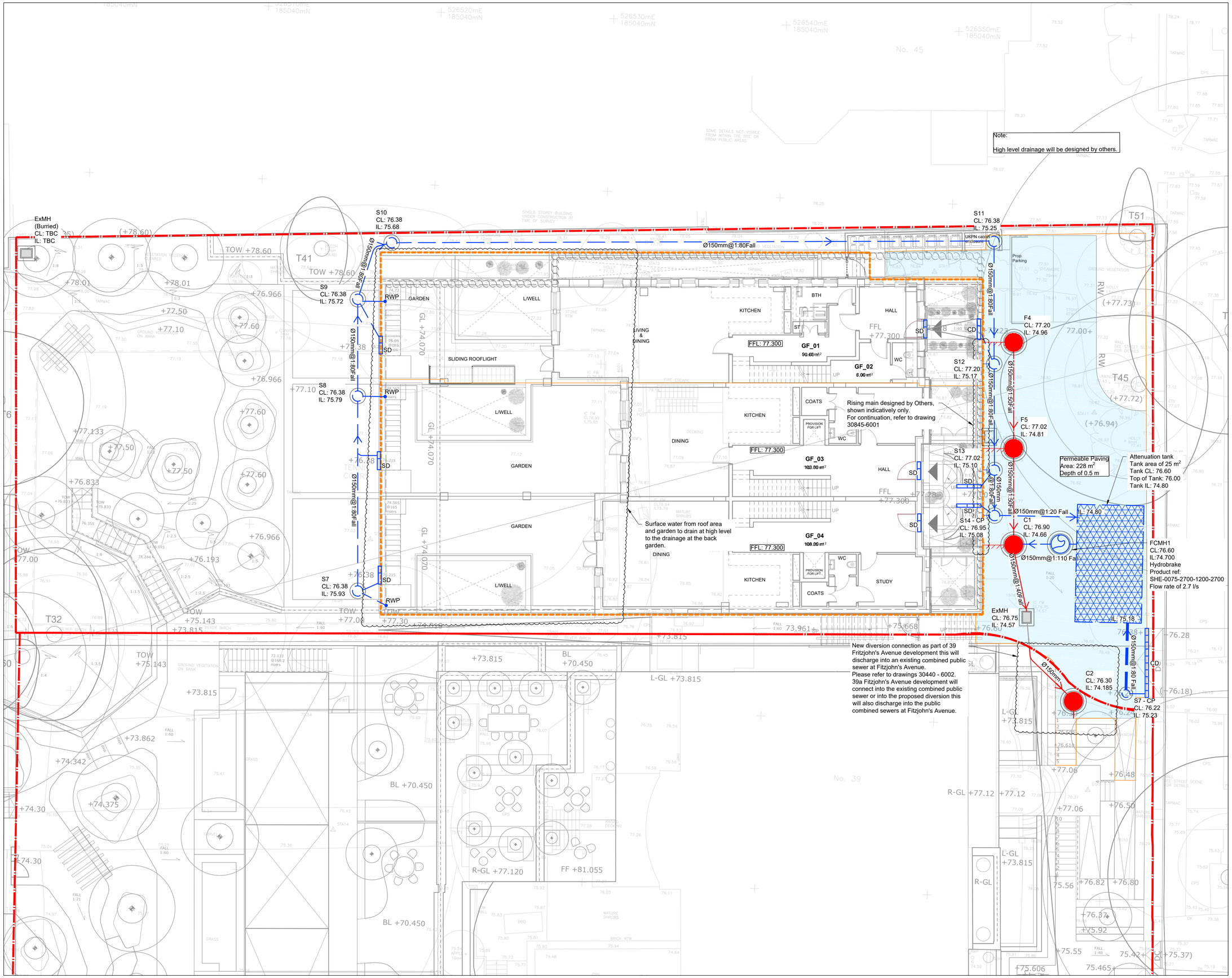
39A FITZJOHNS AVENUE, LONDON

PROPOSED BELOW GROUND DRAINAGE BASEMENT

Status
FOR INFORMATION
NOT FOR CONSTRUCTION

Drawn TP	Eng IA
Scales 1:100 at A1	1:200 at A3
Drawing No 30845/6000	Rev P01

PRICE & MYERS
Consulting Engineers
37 Alfred Place
London
WC1E 7DP
020 7631 5128
mail@pricemyers.com
www.pricemyers.com



NOTES :

1. This drawing is to be read in conjunction with all relevant Architect's, Engineer's and specialists' drawings and specifications.
2. Do not scale from this drawing in either paper or digital form. Use written dimensions only. To check that this drawing has been printed to the intended scale this bar should be 50mm long @ A1 or 25mm long @ A3.
3. Health & Safety :
   All specific drawing notes are to be read in conjunction with the project "Information Pack" and "Site Rules".
4. All downpipe locations are indicative and to be confirmed by M&E.

DRAINAGE LEGEND

- New FW Drain
- New SW Drain
- New Combined Sewer
- Rising Main
- Basement Extents

DRAINAGE KEY

RWP	Rainwater Down Pipe
FWP	Foul Waste Pipe
YG	Yard Gully
FG	Floor Gully
S1	Surface Water Manhole Chamber
F1	Foul Water Manhole Chamber
C1	Combined Water Manhole Chamber
	Storage or Attenuation Cells
	Permeable Paving for Attenuation

ABBREVIATIONS

IL	- Invert Level
CL	- Cover Level
RA	- Above Ground Rodding Access
REIL	- Rodding Eye Invert Level
BDIL	- Backdrop Invert Level

Rev	Date	Drawn	Eng	Amendment
P01	17.01.24	IA	MG	Issued for Information

39A FITZJOHNS AVENUE, LONDON

PROPOSED BELOW GROUND DRAINAGE GROUND LEVEL

Status
FOR INFORMATION
NOT FOR CONSTRUCTION

Drawn	TP	Eng	IA
Scales	1:100 at A1		1:200 at A3
Drawing No	30845/6001	Rev	P01

PRICE & MYERS
Consulting Engineers
37 Alfred Place
London
WC1E 7DP
020 7631 5128
mail@pricemyers.com
www.pricemyers.com