

36 AVENUE ROAD
LONDON BOROUGH OF
CAMDEN

SURFACE WATER AND FLOOD RISK ASSESSMENT

Interior Architecture Landscape

ISSUE DATE: MARCH 2015

PROJECT NUMBER: 15016

REVISION: FINAL



Water Environment Limited
Highland House
165 The Broadway
Wimbledon
London
SW19 1NE

Tel: 020 8544 8067
Fax: 020 8544 8068

www.WaterEnvironment.co.uk

This Surface Water and Flood Risk Assessment was commissioned by Interior Architecture Landscape Ltd in February 2015 to investigate the risks and assess the consequences of flooding of the proposed development at 36 Avenue Road, Camden.

**Prepared
by:**

Laura Sleightholme
MSc DIC, BSc (Hons) Geol
MCIWEM, FGS



**Checked
by:**

Guy Laister
MScEng BScEng (Civil)
CEng CEnv C.WEM MCIWEM



**Reviewed
by:**

Guy Laister
Director



for and on behalf of Water Environment Limited

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EXECUTIVE SUMMARY

The site located at 36 Avenue Road is currently occupied by a detached dwelling and associated driveway and gardens. Proposals are to demolish the existing building on site, and replace with a new dwelling over five floors. A two storey basement will be constructed, extending out beneath the existing rear garden.

The Environment Agency flood zone maps indicate that the site is located in Flood Zone 1 (Low Risk). In accordance with the technical guidance document to the National Planning Policy Framework (NPPF), this zone comprises land assessed as having a less than 1 in 1000 annual probability of fluvial or tidal flooding (<0.1%). Local planning guidance on basement developments specifies that all new basement developments located in borough-defined "primary" or "secondary" areas at risk of surface water flooding need to be accompanied by a Flood Risk Assessment.

The site is located in a "secondary area" and therefore this surface flow and flood risk assessment has been prepared to assess the level of risk from all sources. The London Borough of Camden experienced flooding in 1975 and 2002, which was attributed to both overland flow and sewer flooding.

Avenue Road is recorded as having flooded in the 2002 event from surface water. However, the site itself is raised above surrounding road levels in Avenue Road, and levels fall along Avenue Road away from the site. Therefore the risk of flooding to the site as a result of surface flooding within Avenue Road is considered to be low. The Environment Agency's surface water maps indicate that there is a natural flow path draining flow from Primrose Hill, past the site in a south westerly direction towards Avenue Road. However, the site is surrounded by high brick walls which minimises the risk of overflow flow from Primrose Hill reaching the site.

In order to provide protection from surface water flooding, either as a result of overland flow or a surcharge of the onsite drainage system, it is recommended threshold levels are raised by a minimum of 150mm above surrounding ground levels. Skylights to the basement at the rear of the building should be sealed and open lightwells should be defended. Therefore the risks of surface water and sewer flooding to the site are considered to be low.

All other sources of flooding have been assessed in accordance with the NPPF and are considered to pose a low risk to the site.

The proposed development with basement extension is at low risk of flooding from all sources and is considered acceptable in the context of flood risk. Although the impermeable areas on site will increase following development, underground storage and a flow restrictor will be introduced to attenuate surface water runoff from all these areas. The development will therefore not increase surface water runoff rates from the site thereby ensuring no increase in risk from this source. There will be no increase in vulnerability of the development on site, nor any increase in the risk of flooding to the site or elsewhere.

1 INTRODUCTION

General Information

- 1.1 The site is located at 36 Avenue Road in the London Borough of Camden, and is currently occupied by a single, detached dwelling. The site is less than 1 ha in size and currently comprises of the building footprint and associated driveway and gardens.
- 1.2 The Environment Agency flood zone maps indicate that the site is located in Flood Zone 1. This zone comprises land assessed as having a less than 1 in 1000 annual probability of fluvial or tidal flooding (<0.1%).
- 1.3 The London Borough of Camden policy dictates that surface water flow and flood risk is considered in this case, primarily due to basement construction. This Surface Water and Flooding Impact Assessment has therefore been produced to assess the risks of flooding from other potential sources such as overland flow, groundwater, artificial water bodies and underground sewers. The impact of the proposed development on surface water infrastructure is considered, and this report will form part of the Basement Impact Assessment for submission with the planning application.

Scope of Study

1.1 The main objectives of this study are to:

- Provide a surface water and flood risk assessment of the site, compliant with the guidelines set out in the National Planning Policy Framework (NPPF) and Camden Planning Guidance (CPG4¹) to accompany any application for planning permission.
- Complete the Stage 1 Surface Flow and Flooding screening assessment, using the flow chart included within CPG4 and carry forward to scoping stage if required.
- Provide advice and guidance on the management of surface water runoff at the site to ensure the risk of surface water flooding on the site and on nearby sites does not increase following development.

Location

- 1.2 The site is situated on Avenue Road in the London Borough of Camden as shown in Figure 1. Primrose Hill is located to the north-east of the site, and the property is bordered on the eastern edge by Radlett Place.

¹ London Borough of Camden – Camden Planning Guidance (CPG4) Basements and Lightwells.

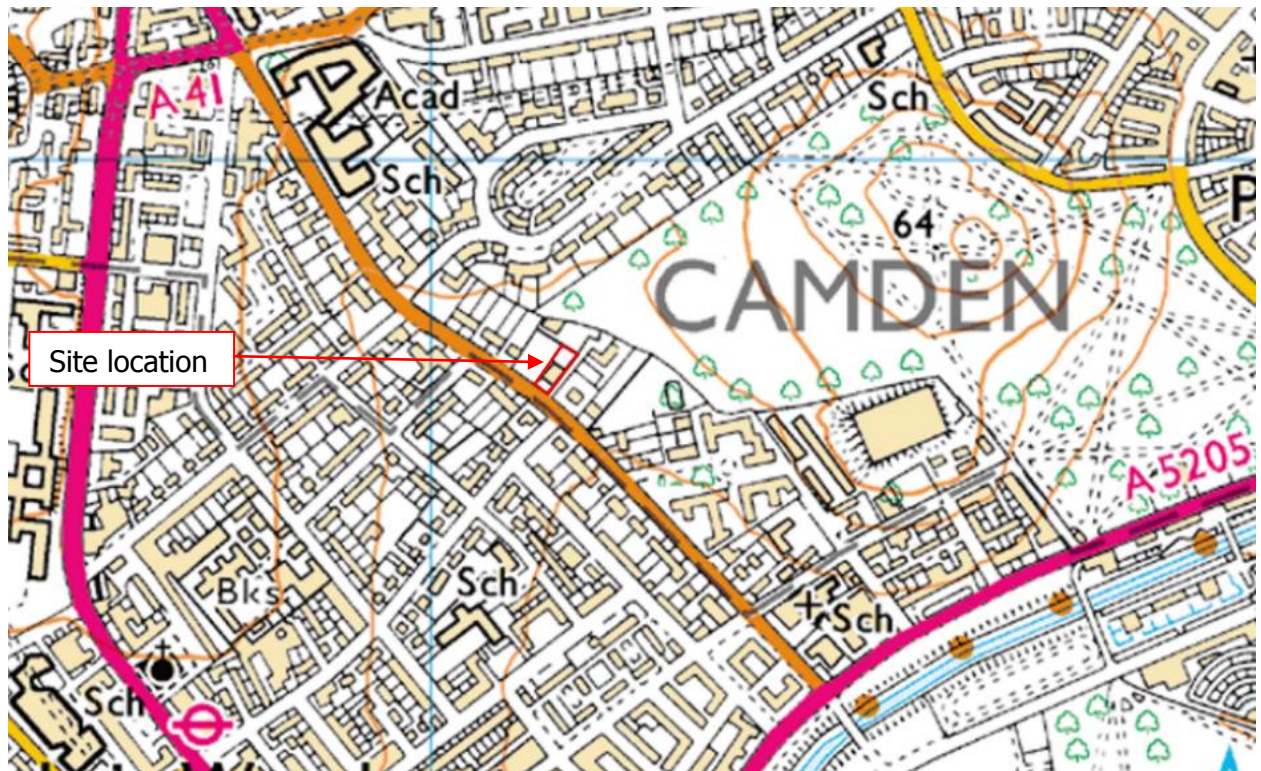


Figure 1 – Location of proposed development site²

Existing Development

- 1.3 The existing site has an area of 1,244m² (0.12ha) which comprises of a residential dwelling, driveway and associated gardens.
- 1.4 A topographic survey of the site has been carried out by Matrix Surveys, and was undertaken in March 2014. The survey is included as Drawing 1. The survey indicates that the site is largely flat, falling very slightly in a southerly direction towards Avenue Road, from 42.14m AOD at the rear of the garden, to 41.21m AOD close to the front gate.

Proposed Development

- 1.5 Proposals are to demolish the existing building on site, and replace with a new dwelling over five floors. A two storey basement will be constructed under the building, extending out beneath the existing rear garden.
- 1.6 The first basement floor level below ground will consist of a car lift, staff quarters, games room, bar area, gym and swimming pool. The lower basement level will contain; sauna, stream room, salon and associated changing rooms, along with a wine store, cinema, professional kitchen and laundry. The proposed development is shown in Drawing 2.

² © Crown copyright and database rights 2012 Ordnance Survey 100049945

- 1.7 The new development will consist of a landscaped rear garden over the proposed basement extension area and lightwells to the front of the property to illuminate the lower level staff accommodation. All rooms situated within the basement levels have internal access to higher floors.

Planning Policy

- 1.8 As part of the Local Development Framework (LDF), Camden adopted the Core Strategy and Development Policies in November 2010. Policy CS13 relates to flood risk and states:

"Water and surface water flooding [...] We will make Camden a water efficient borough and minimise the potential for surface water flooding by:

- protecting our existing drinking water and foul water infrastructure, including Barrow Hill Reservoir, Hampstead Heath Reservoir, Highgate Reservoir and Kidderpore Reservoir;
- making sure development incorporates efficient water and foul water infrastructure;
- requiring development to avoid harm to the water environment, water quality or drainage systems and prevents or mitigates local surface water and down-stream flooding, especially in areas up-hill from, and in, areas known to be at risk from surface water flooding such as South and West Hampstead, Gospel Oak and King's Cross."

- 1.9 The Development Policies also include a policy specific to basements as follows:

DP27 – Basements and Lightwells: "...The Council will only permit basement and other underground development that does not cause harm to the built and natural environment and local amenity and does not result in flooding or ground instability...."

- 1.10 The London Borough of Camden has strict policies with regards to basement development within the Borough, therefore they have provided guidelines for "New basement developments and extensions to existing basement accommodation³". Formal planning guidance has also been released, in the form of CPG4, setting out specific criteria for assessing the impact of basement construction. As part of the Basement Impact Assessment (BIA), it is necessary to consider "surface flow and flooding". A screening flowchart (Drawing 3) addresses individual sources of potential flooding, and where a risk of flooding is present, a scoping and impact assessment need to be undertaken as appropriate. This report covers this component of the BIA.

³ London Borough of Camden, Shaping Camden – Guidelines – New Basement Development and Extensions to Existing Basement Accommodation, February 2009

- 1.11 In conjunction with ARUP, the London Borough of Camden produced a "Geological, Hydrogeological and Hydrological Study" for guidance on subterranean development⁴.

⁴ ARUP Geological, Hydrogeological and Hydrological Study – Guidance for Subterranean Development, November 2010

2 SURFACE FLOW AND FLOODING ASSESSMENT

Stage 1: Screening

2.1 CPG4 includes a surface flow and flooding screening flowchart for assessing the impact of potential sources of flooding, as well as the impact of the development on flood risk elsewhere.

2.2 The flow chart is set out with six questions, which are addressed with reference to the site and proposed development at 36 Avenue Road as follows:

- **Question 1:** Is the site within the catchment of the pond chains on Hampstead Heath?

Answer: No – The site is more than 2km from Hampstead Heath and not shown within the catchment area of the pond chains.

- **Question 2:** As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak runoff) be materially changed from the existing route?

Answer: No – The current proposal is to re-use the existing connections to the Thames Water combined public sewer located in Avenue Road.

- **Question 3:** Will the proposed basement development result in a change in the proportion of hard surfaced/paved external areas?

Answer: Yes – The proposed development will have an increase in the impermeable area post-development.

- **Question 4:** Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface water being received by adjacent properties or downstream watercourse?

Answer: No – The proposed development is deemed not to affect the profile of inflows to adjacent properties.

- **Question 5:** Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?

Answer: No – The proposed basement will not result in any changes to the quality of surface water being received by adjacent properties or downstream watercourses.

2.3 According to CPG4, it is necessary to carry forward to the scoping stage of the Basement Impact Assessment those matters of concern where the response is “yes”. Therefore, as Question 3 has a response of “yes”, the scoping stage is required.

2.4 In addition:

- **Question 6:** Is the site in an area known to be at risk from surface water flooding, such as South Hampstead, West Hampstead, Gospel Oak and King’s Cross, or is it at

risk from flooding, for example because the proposed basement is below the static water level of a nearby surface water feature?

Reference: The principles outlined in the NPPF should be followed to ensure that flood risk is not increased.

Answer: Yes – see chapter 3 for details. **Developer to undertake a Flood Risk Assessment in accordance with the NPPF.**

Stage 2: Scoping

- 2.1 Increasing the area of hard standing on site as a result of development will increase the volume and peak flow rate of surface water generated. In order to ensure that development does not increase flood risk elsewhere, mitigation needs to be provided in the form of SUDS on site to attenuate the peak rate and volume of surface water runoff.
- 2.1 A full CCTV survey of the existing surface water drainage system has been undertaken to inform the proposed drainage design. Runoff from the existing property, side patio and front driveway collects via a series of downpipes and drains to a manhole close to the western entrance gate. This manhole connects directly to the combined sewer in Avenue Road. Following development of the property, the site will continue to drain to Avenue Road as per the existing connection and with a similar, albeit replaced, drainage system to the existing site (Drawing 4).
- 2.2 Drainage calculations for the site have been undertaken to accompany this application. The development will result in a minor increase in formally drained, hardstanding area; from 754m² on the existing site to 811m². This equates to an increase in impermeable area of the site from 61% to 65%. It is proposed to reduce flows from the proposed site to the existing runoff rate of 10.5 l/s.
- 2.3 Flows will be restricted using an onsite flow control and attenuated within a drainage tank beneath the front driveway. Preliminary drainage calculations provide an estimate of storage required to be 13–25 m³. Full drainage calculations will be completed at detailed design stage, however the system will ensure that the peak rate of runoff does not increase following development and the development will therefore not increase flood risk elsewhere.

3 POTENTIAL FLOODING ON SITE

Historic Information

- 3.1 No records have been found of the site flooding in the past from any of the sources identified in the NPPF.
- 3.2 It is noted in the North London SFRA⁵ that a large area in the north of Camden was affected by surface water flooding in August 2002, which was the result of heavy rainfall inundating the public sewer system. A similar region of Camden was affected by surface water/sewer flooding in 1975. In both instances, the floods that occurred are understood to have been the result of high intensity rainfall inundating the main sewer and causing manholes and gullies to surcharge.
- 3.3 Map 22 of the SFRA, and Figure 15 of the ARUP study show that Avenue Road has been recorded to have flooded in 2002.

Tidal and Fluvial Flooding

- 3.4 In October 2004, the Environment Agency released updated floodplain maps for the UK based on the 'JFLOW' project, a two-dimensional hydraulic modelling project. Figure 2 shows the latest 'Flood Zone Map' for the River Thames in central London.
- 3.5 The site is located in Flood Zone 1 and is approximately 5km north of the River Thames at its nearest location. As stated in the NPPF, "this zone comprises land assessed as having a less than 1 in 1000 annual probability of fluvial and tidal flooding (<0.1%)". Therefore the risk of flooding from tidal and fluvial sources is considered low.

⁵ North London Strategic Flood Risk Assessment, (August 2008)

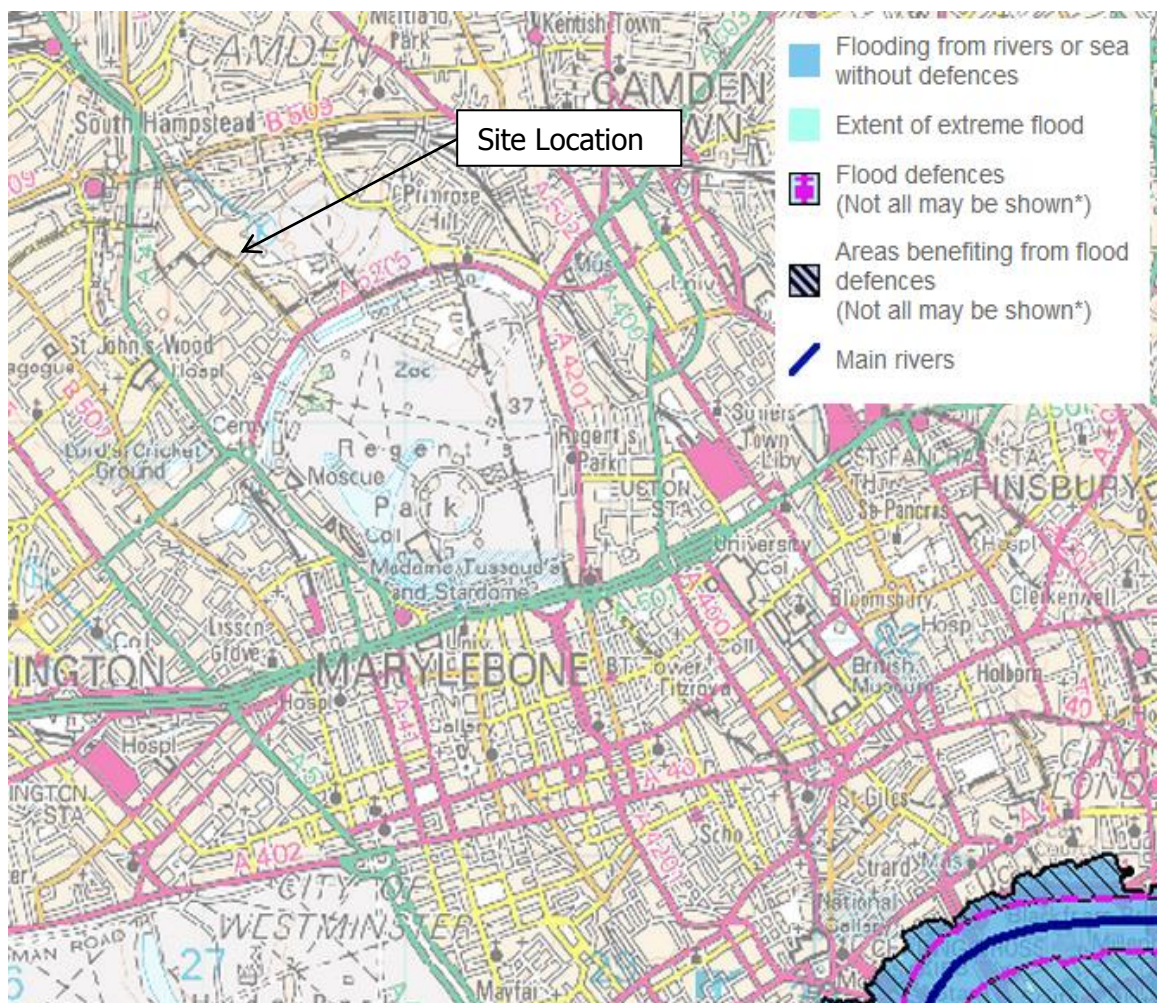


Figure 2 – Environment Agency flood zone map

Flooding from Sewers and Overland Flow

- 3.6 Surface water flooding is typically the result of high intensity rainfall that is unable to infiltrate into the ground or enter the drainage system, ultimately following overland flow paths. In an urban environment such as Camden, surface water runoff is disposed of almost entirely via formal drainage systems, and consequently sewer flooding and surface water flooding (overland flow) need to be considered in tandem in this instance.
- 3.7 It is reasonable to assume that adopted sewers have been designed to the 1 in 30 year return period (in accordance with Sewers for Adoption⁶), which is considerably lower than the 100 year standard considered for fluvial flooding. As such, sewer flooding is often more frequent but less severe than fluvial flooding.
- 3.8 The North London SFRA has collected data from flooding events in 1975 and 2002 which have been used by Camden to map areas of the borough that are more

⁶ WRc7 plc (August 2012) Sewers for Adoption – A Design and Construction Guide for Developers. 7th Edition.

susceptible to surface water flooding. This information was subsequently used to inform Camden's supplementary guidance document on basement developments⁷. In this document, roads having flooded in 1975 and 2002 are known as "primary areas" and those that flooded in only the 1975 or 2002 are known as "secondary areas". Any proposals for a basement development located in a primary or secondary area must include a flood risk assessment to accompany the basement impact assessment.

- 3.9 Avenue Road is recorded as having flooded in the 2002 event, and the site is therefore located in a "secondary area". However the records are not detailed and entire roads have been highlighted without reference to specific locations or to which (if any) properties were flooded on these roads.

Surface Water

- 3.10 The locally agreed dataset for surface water flooding is the Environment Agency's Flood Map for Surface Water (FMfSW). In December 2013 the updated FMfSW was published online by the Environment Agency taking into account additional local information. The Environment Agency online maps for surface water flooding are the most up-to-date data available on rainfall flooding modelling and are presented in Figure 3.

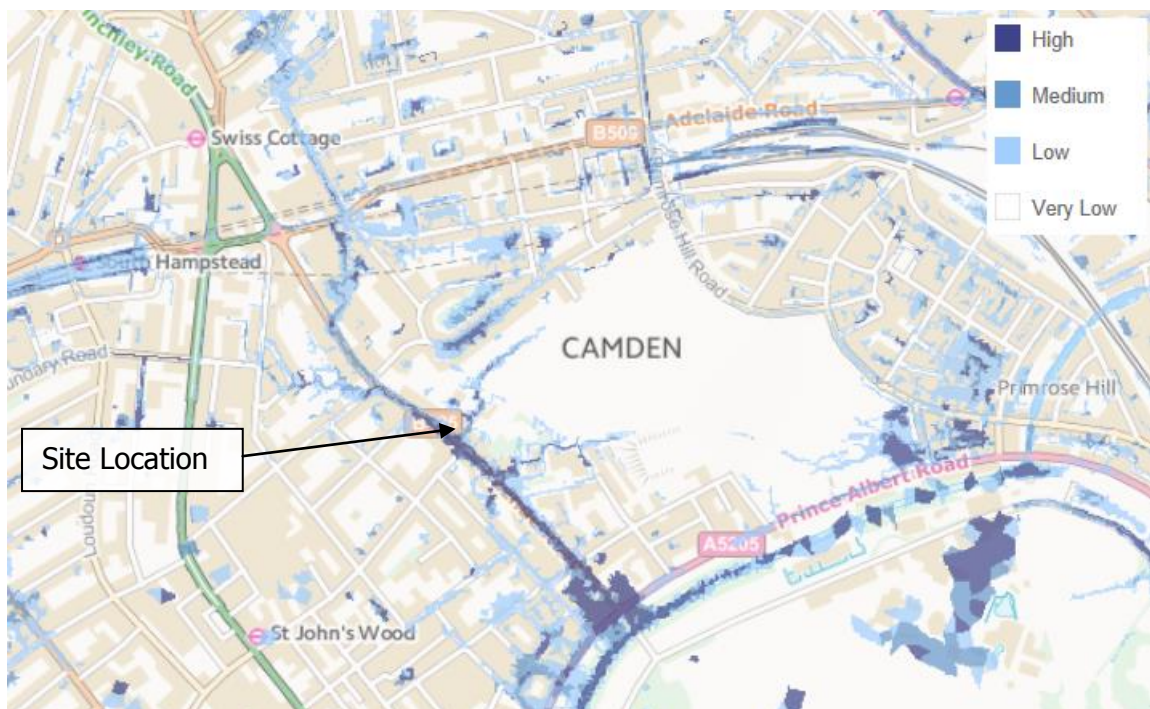


Figure 3 - Environment Agency Surface Water Risk Map

- 3.1 The dark blue shaded areas are areas of high surface water flood risk which have a 3.3% (1 in 30) chance of flooding. While the lighter blue areas are of medium

⁷ London Borough of Camden, Shaping Camden – Guidelines – New Basement Development and Extensions to Existing Basement Accommodation, February 2009

risk of surface water flooding which have a 1% (1 in 100) chance and the pale blue areas are of low risk of surface water flooding has a 0.1% (1 in 1000) chance of occurring. Areas not highlighted in blue are classed at very low risk of surface water flooding with a less than 0.1% (1 in 1000) chance of occurring.

- 3.2 Surface water flooding is generally associated with topographic depressions and natural valleys. The modelled surface water flood map indicates that there is a natural flow path draining flow from Primrose Hill, past the site in a south westerly direction towards Avenue Road. The map then indicates flooding along the length of Avenue Road, which would be consistent with historical records.
- 3.3 The site is also located within close proximity to the original route of a tributary of the River Tyburn, one of London's "lost rivers". The precise location of the original watercourse is unknown and the route differs slightly between historical sources, however an excerpt from "Lost Rivers of London" (Figure 4) indicates that the natural route of the river drains from the north-east, across the corner of Primrose Hill and past the site towards Avenue Road.



Figure 4 - Excerpt from Figure 11, Camden Geological, Hydrogeological and Hydrological Study. Source – Barton, Lost Rivers of London.

- 3.1 These lost rivers are now incorporated into the local underground sewer network and no longer flow at the surface. A survey of the site does not indicate the presence of either an open channel or specific drain across the site. Overland flow may still following natural flow paths, as per the surface water maps indicated by Figure 3.
- 3.2 Based on available information, although it appears that the site is located just outside of the area at risk of surface water flooding, overland flow is shown to drain towards the site from Primrose Hill and along Radlett Place along the edge of the property.
- 3.3 The site is surrounded by high walls which minimises the likelihood of overland flow reaching the site. Nevertheless, it is recommended that the basement skylights at the rear of the property are fully sealed to prevent ingress of any surface water within the rear garden. At the front of the property, lightwells to the staff accommodation should also be defended. If these lightwells are intended to be open, it is recommended that a low level wall is included within the design, a minimum of 150mm above surrounding ground levels. This will provide protection from any localised surface water ponding onsite.

Sewers

- 3.4 Thames Water asset plans have been obtained for the area and these confirm that the site is connected directly to the combined public sewer located in Avenue Road. This sewer is a main trunk sewer (1372 x 914), known as the "King's Scholar Pond Sewer", which drains combined flows from the area in a south-easterly direction along Avenue Road. In addition, a surface water drain is identified which passes beneath No. 38, on the western side of the site, and appears to collect overland flow from Primrose Hill via an inlet close to Radlett House. There is no separate sewer identified for the River Tyburn tributary, and therefore it is assumed that this is incorporated into the main combined sewer network along Elsworthy Road to the north of the site. Any excess overland flow is likely to be intercepted by the surface water drain, reducing the likely risk of surface water flooding to the site. The asset plan for the area is shown in Drawing 5.
- 3.5 The nearest public manhole to the site is no. 1707; however there is no recorded cover or invert levels within the Thames Water asset information. Ground levels in Avenue Road fall from north-west of the site (approximately 41.40m AOD in the road) to the south east (approximately 41.05m AOD). Levels increase from the road up to the site entrances, from 41.18m to 41.47m and from 40.95m to 41.18m, at the western and eastern entrances respectively.
- 3.6 A full CCTV survey of the existing surface water drainage system has been undertaken to inform the proposed drainage design. Runoff from the existing property, side patio and front driveway collects via a series of downpipes and drains to a manhole close to the western entrance gate. The cover level for this manhole is 41.55m AOD. This manhole connects directly to the combined sewer in Avenue Road.
- 3.7 Following development of the property, the site will continue to drain to Avenue Road as per the existing connection and with a similar drainage system to the

existing site. Flows will be attenuated to limit to existing rates, using an attenuation tank under the front driveway. As a result, there will be no increase in the runoff rate leaving the site, and no change in the risk of sewer flooding.

- 3.8 Sewer flooding typically occurs where there is incapacity or a blockage within the surface water or combined drainage system. Levels on site are higher than within Avenue Road, and as a result any flow which does surcharge the local drainage system is likely to be retained within the road and drain to the south-east away from the site. The proposed onsite drainage system will be adequately designed to ensure that there is sufficient capacity within the network, however the residual risk of a blockage in the system cannot be categorically ruled out.
- 3.9 It is recommended that finished floor levels and entrance thresholds are set a minimum of 150mm above surrounding ground levels, in accordance with CIRIA guidance⁸ or where level access is required, drains incorporated in to the design to intercept runoff. As per the surface water advice, skylights and lightwells should be sealed or defended in order to prevent ingress of flooding in the unlikely event of a surcharged manhole on site. The proposed rear patio area will include slot drains along the northern edge, away from the building, ensuring this area is positively drained. This presents an improvement on the existing situation, where rainfall onto the lower rear patio is not collected and as a result could enter the property.
- 3.10 In summary, despite the record of flooding on Avenue Road in 2002, provided adequate mitigation is included within the design in the form of raised thresholds, protected lightwells and fully sealed skylights, the risk of flooding from sewers and overland flow is considered to be low.

Flooding from Groundwater

- 3.11 The online 1:50,000 BGS map indicates the site and wider area to be underlain by the London Clay formation. The mapping indicates that there are typically no superficial head deposits present within this area. The Environment Agency's online groundwater mapping indicates that the site is not located within a groundwater vulnerability zone. The map confirms that there are no aquifers; bedrock or superficial beneath the site.
- 3.12 The online groundwater map shows that the site sites on an area which is considered to be within source protection zone (SPZ) 2, the "outer zone". This is shown in Figure 5. Source protection zones were defined by the Environment Agency in order to protect wells, boreholes and springs used for public drinking water supply. These zones indicate areas from which pollutants could reach the water supply, and the outer zone is defined by a 400 day travel time.
- 3.13 Water supply for London is obtained from deep aquifer, via boreholes into the Chalk. This bedrock aquifer is found deep beneath the surface, confined beneath impermeable rock types, including the London Clay, across most of London. The London Clay is an extensive layer, which the Environment Agency's "Management

⁸ CIRIA (C635), Designing for Exceedence in Urban Drainage – Good Practice, London 2006

of the London Basin Chalk Aquifer” 2014 status report confirms is approximately 30-90m thick. The report states that “the low permeability nature of the London Clay overlying these aquifer units prevents the water table reaching the surface”. It is noted that this can cause artesian pressure to build up; however, groundwater beneath London is actively managed to ensure that levels are stable.

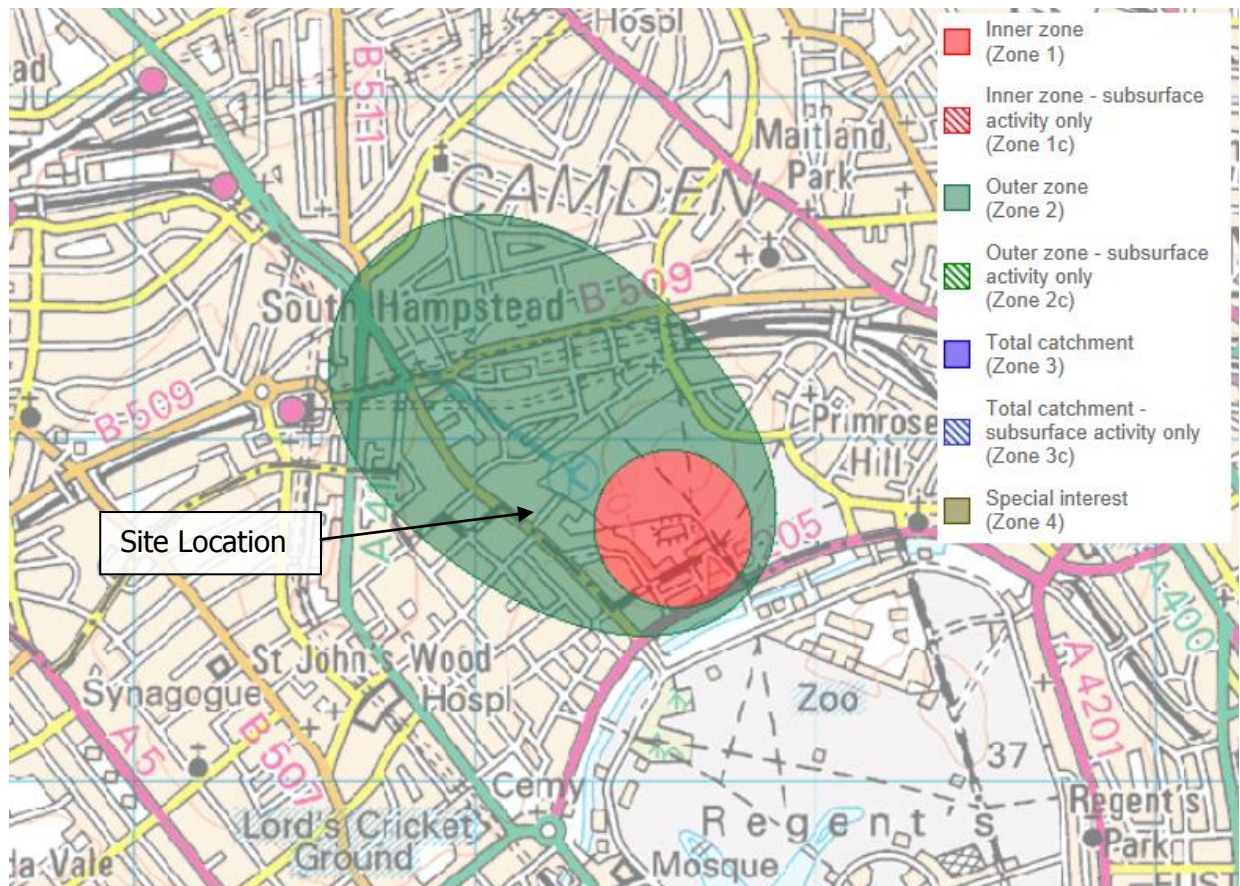


Figure 5 - Environment Agency Source Protection Zone Map

- 3.14 A site investigation⁹ was undertaken in January 2015. Several boreholes and trial pits were tested, which revealed ground conditions generally consistent with geological records. Borehole revealed a typical succession of Made Ground, up to 1.3m thickness, above localised Superficial Head, with the London Clay Formation at depth. The London Clay, weathered nearer the surface and becoming very stiff with depth, was seen to 20m deep where drilling ceased.
- 3.15 Groundwater was not encountered during drilling or excavation of trial pits, and soils remained dry throughout. Three standpipes were installed, to 10m deep, and monitored over a period of six months between June and December 2014. No groundwater was recorded during this time and it is therefore considered that “typical” groundwater levels are more than 10m below ground level.

⁹ Site Analytical Services Ltd, Ground Investigation Report, Ref No. 14/22225, January 2015

- 3.16 Soakage tests were undertaken during the site investigation. These indicate that infiltration rates are poor and therefore near surface soakaways are unlikely to prove satisfactory.
- 3.17 The North London SFRA also notes that there have been very few recorded incidents of groundwater flooding in North London, none of which are located in Camden. Based on available information and the results of the ground investigation, the risk of flooding as a result of groundwater emerging at the surface is therefore considered to be low. The proposed basement will be built using appropriate tanked construction to prevent groundwater ingress should groundwater levels fluctuate locally.

Flooding from Reservoirs, Canals and Other Artificial Sources

- 3.18 The Regent's Canal and Regent's Park Lake are the nearest artificial water bodies to the site (reference Figure 12 of the ARUP Study). However at both locations water is not retained above natural ground level and flooding as a result of infrastructure failure is therefore not possible.
- 3.19 Figure 14 of the ARUP study shows the Hampstead Heath Surface Water Catchments and Drainage including the pond chains, in greater detail. The site is not located within the catchment of the pond chains on Hampstead Heath.
- 3.20 The risk of flooding from artificial water bodies is therefore considered low.

4 CONCLUSIONS AND RECOMMENDATIONS

- 4.1 The site is located at 36 Avenue Road in the London Borough of Camden and is currently occupied by a detached dwelling and associated driveway and gardens. Proposals are to demolish the existing building on site, and replace with a new dwelling over five floors. A two storey basement will be constructed, extending out beneath the existing rear garden.
- 4.2 The Environment Agency flood zone maps indicate that the site is located in Flood Zone 1 (Low Risk). In accordance with the technical guidance document to the National Planning Policy Framework (NPPF), this zone comprises land assessed as having a less than 1 in 1000 annual probability of fluvial or tidal flooding (<0.1%).
- 4.3 The North London SFRA has collected data from flooding events in 1975 and 2002 which have been used by Camden to map areas of the borough that are more susceptible to surface water flooding. This information was subsequently used to inform Camden's supplementary guidance document on basement developments.
- 4.4 Avenue Road is recorded as having flooded in the 2002 event from surface water and the site is located in a "secondary area". Therefore this surface flow and flood risk assessment has been prepared to assess the level of risk from all sources. The site itself is raised above surrounding road levels in Avenue Road, and levels fall along Avenue Road away from the site. Therefore the risk of flooding to the site as a result of surface flooding within Avenue Road is considered to be low.
- 4.5 The Environment Agency's surface water maps indicate that there is a natural flow path draining flow from Primrose Hill, past the site in a south westerly direction towards Avenue Road.
- 4.6 The site is located close to the original route of a tributary of the River Tyburn; one of London's "lost rivers". This watercourse is now incorporated into the local sewer network and any overland flow will follow natural drainage routes. No evident of an open channel nor specific drainage infrastructure associated with this lost river was found onsite during site investigation or survey. It is therefore considered unlikely that there is any additional risk to the site.
- 4.7 In order to provide protection from surface water flooding either as a result of overland flow or a surcharge of the onsite drainage system, it is recommended threshold levels are raised by a minimum of 150mm above surrounding ground levels and/or drains incorporated into the design to intercept runoff. Skylights to the basement at the rear of the building should be sealed and open lightwells should be defended. Therefore the risk of surface water and sewer flooding to the site are considered to be low.
- 4.8 All other sources of flooding have been assessed in accordance with the NPPF and are considered to pose a low risk to the site.

- 4.9 There is a small increase in impermeable area on site following development, which equates to an increase in the rate of runoff from the site. Preliminary drainage calculations have been undertaken and this excess flow will be restricted and attenuated on site. Runoff rates from the site will be limited to existing and drainage mechanisms will remain unchanged. The development will therefore not increase surface water runoff rates from the site thereby ensuring no increase in risk from this source.

APPENDIX

Drawing 1 - Topographic Survey

Matrix Surveys, March 2014, Drawing Number 01

This drawing shows a topographic survey of the existing site.

Drawing 2 - Proposed Development

KSR Architects, Proposed Section, Drawing Number AVA-PA-4-200

This drawing shows the proposed development in side elevation.

Drawing 3 - Surface Flow and Flooding Screening Flowchart

ARUP, Job No. 213923/KM

This flowchart is a guidance tool from the Camden geological, hydrogeological and hydrological study on subterranean development on how to complete a surface flow and flooding assessment.

Drawing 4 – Proposed Drainage Strategy

Elliott Wood, Preliminary Drainage Strategy Drawing, Drawing No. SK D/01, P1

This mark-up indicates the proposed drainage strategy for the site, with attention tank and surface water runoff calculations.

Drawing 5 - Asset Location Map

Thames Water, Ref No. 2015 2972517

This map shows the Thames Water asset locations near the site.

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DO NOT SCALE FROM DRAWING
ALL DIMENSIONS TO BE CHECKED ON SITE

NOTES:

ALL MEASUREMENTS TAKEN TO EXISTING
SURFACE FINISHES UNLESS STATED OTHERWISE

ALL LEVELS IN METRES

ALL ARROWS POINT UP
SURVEY GRID & LEVELS RELATED TO OS
BY GPS OBSERVATION

LEGEND:

20.00F	FLOOR LEVEL
20.00H	WINDOW HEAD LEVEL
20.00S	WINDOW SILL LEVEL
20.00C	CEILING LEVEL
20.00SC	SUSPENDED CEILING LEVEL
20.00B	BEAM LEVEL
20.00D	DOOR HEAD LEVEL

AB
B

BH	HEIGHT TO BEAM
BW	BRICK WALL
CD	CABLE TELECOM
CAV	CABLE TV
CB	CABLED
CC	CONCRETE PAVING SLABS
CK	DROP KERB
CR	CRACK
CS	CRUSHED BED
FB	FIRE HYDRANT
FW	FOUL WATER
GV	GULLY
GV	GAS VALVE
IC	INSPECTION CHAMBER
IN	INLET LEVEL
LP	LAND POST
P	POST
RE	ROOFSIDE EYE
RGS	ROAD GULLY
RSG	ROAD SINK
RS	RUN WATER PIPE
RS	SOIL AND RIFT PIPE
SW	SURFACE WATER
T	TRAFFIC LIGHT
TL	TOP OF WALL LEVEL
TOW	TOP OF WALL LEVEL
TP	TELEGRAPH POLE
V	VENT
V	VENT PIPE
WP	WATER METER
WP	WASTE PIPE
WSV	WATER STOP VALVE

FENCE TYPES	
BW Barbed Wire	CW Chicken Wire
CB Close Board	IW Interwoven
CI Corrugated Iron	IR Iron Rolling
CL Chain Link	OB Openboard
CPL Conc Panel	PR Post and Rail
CP Chestnut Paling	PW Post and Wire

VISIONS	DATE	BY
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FILE

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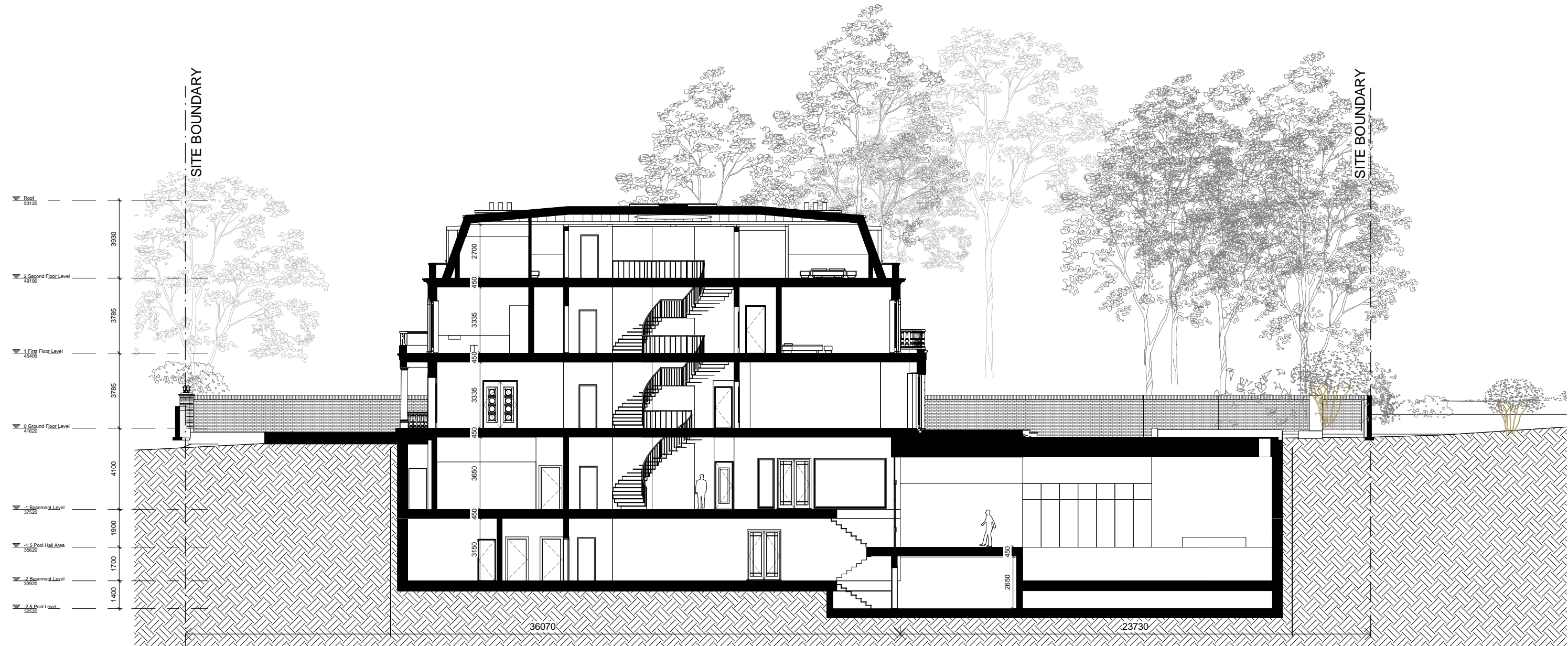
TOPOGRAPHICAL SURVEY

AS EXISTING

SALE	1/100@A0	DATE	MARCH 2014
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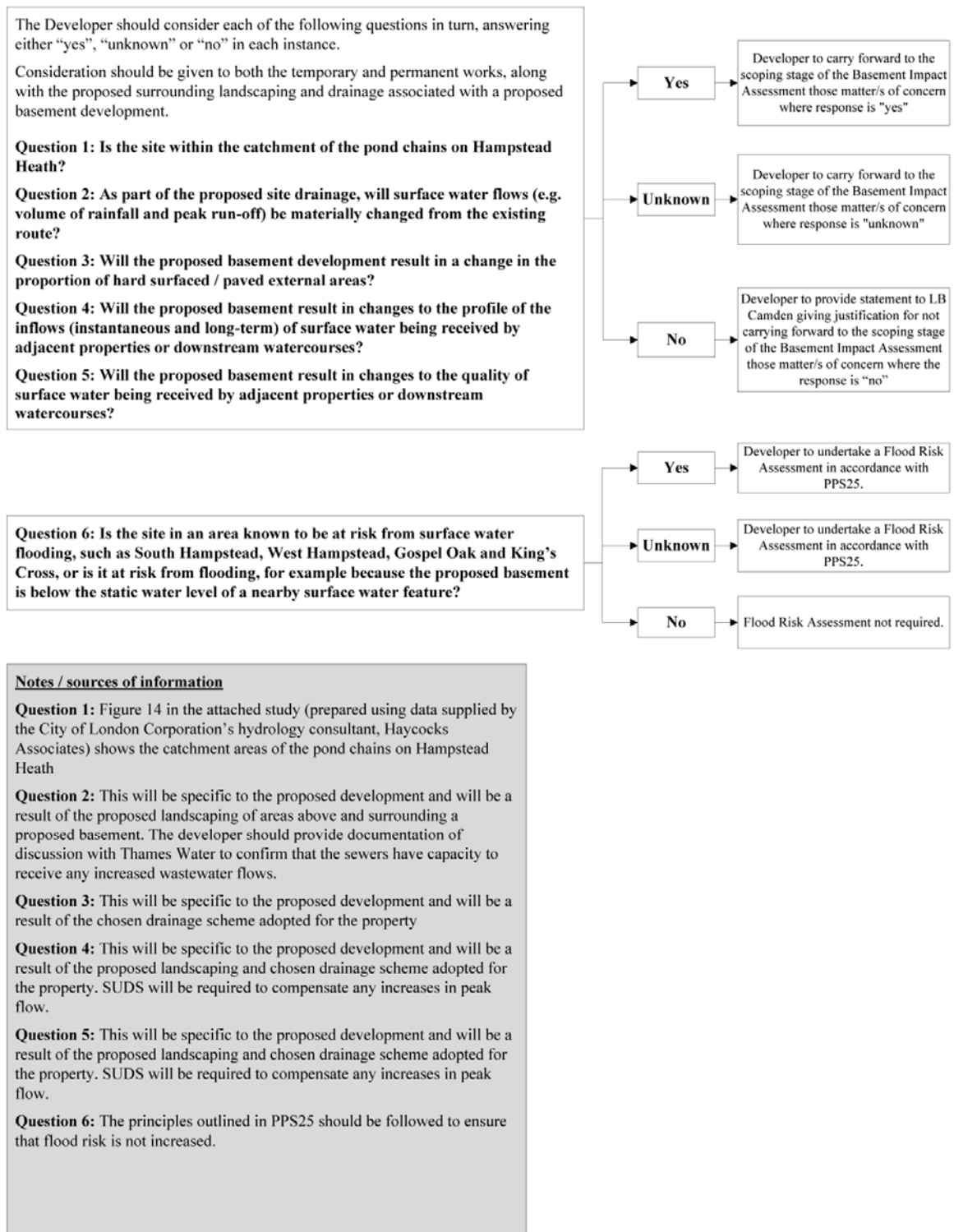
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Rev		Notes		d1 mm yy		By		Chkd		Date: NOV 14		Drawn By: DC	
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										Scale: 1 : 100		Drawing No: AVA - PA-4-200	
												Revision:	

Figure 3. Surface flow and flooding screening flowchart



LEGEND

- COMBINED SEWER
- APPROXIMATE BASEMENT LOCATION
- SURFACE WATER NETWORK
- SURFACE WATER MANHOLE
- ATTENUATION TANK
- FLOW CONTROL DEVICE
- CHANNEL DRAIN

ROOT MASS 90 %
POSSIBLE COLLAPSE
REMEDIAL WORK REQUIRED
NOTE:- AS PIPE IS OUTSIDE PROPERTY
BOUNDARY THAMES WATER IS
RESPONSIBLE FOR ALL REPAIR
WORKS

TW MH 1707
EXISTING TW SEWER (1312 x 914)
EXISTING 150 Ø PIPE
Avenue Road

EXISTING INTERCEPTOR
TRAP TO BE RETAINED

FLOW CONTROL TO
LIMIT THE
FLOW TO EXISTING
RATE

ATTENUATION
TANK

EXISTING MANHOLE TO BE RETAINED
CL 41-55
IL 39-75

APPROXIMATE LOCATION
OF BASEMENT BELOW

Radlett Place

SITE	HARDSTANDING AREA (M ²)
EXISTING	754
PROPOSED	811

SURFACE WATER RUN OFF RATE FROM EXISTING HARDSTANDING AREAS = 10.5 L/s (BASED ON RAINFALL INTENSITY OF 50mm/hr.
TO LIMIT THE SURFACE RUN OFF RATE TO EXISTING RATE OF 10.5 L/s VOLUME OF ATTENUATION REQUIRED IN 1 IN 100 YEAR RETURN PERIOD + 30% FOR CLIMATE CHANGE = 13-25 M³
NOTE:- THE EXISTING UNDERLYING GROUND CONDITION CONSIST OF LONDON CLAY WHICH IS NOT SUITABLE FOR INFILTRATION.

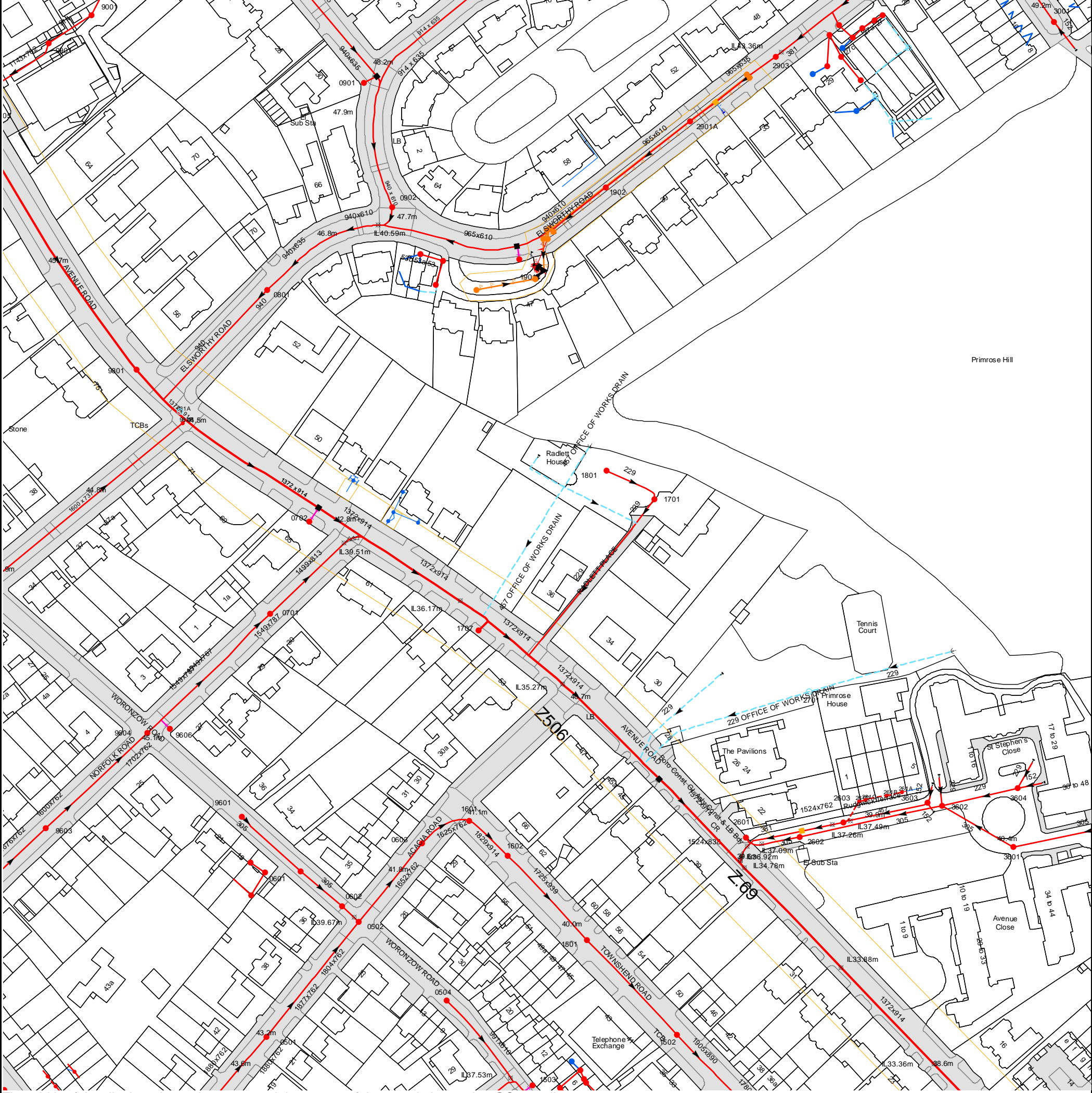
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elliottwood
Elliott Wood Partnership LLP, 241 The Broadway, London SW19 1SD
Consulting Structural and Civil Engineers. www.elliottwood.co.uk
tel: (020) 8544 0033 fax: (020) 8544 0036 info@elliottwood.co.uk

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