3 Belsize Crescent
LONDON BOROUGH OF CAMDEN

SURFACE WATER FLOW AND FLOOD RISK ASSESSMENT

XUL Architecture

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WATER | ENVIRONMENT

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This Surface Flow and Flood Risk Assessment was commissioned by XUL Architecure in November 2015 to investigate the risks and assess the consequences of flooding of the proposed development at 3 Belsize Crescent, Camden.

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EXECUTIVE SUMMARY

The site discussed in this report is located at 3 Belsize Crescent within the London Borough of Camden. The site is less than 1 hectare (ha) in size and currently comprises wholly of the building footprint. Proposals are to refurbish the building, extending the existing basement to allow creation of a number of flats within the building. The proposed basement extension will not extend past the footprint of the building. Local planning policy requires the proposed basement extension to undertake the Surface Water and Flooding Screening Flowchart. As a result, of this initial screening assessment, a flood risk assessment has been undertaken for the proposed development.

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%). The risk of flooding from rivers and the sea is therefore low.

The Environment Agency's surface water maps indicate that there is a natural flow path draining down Belsize Crescent on the opposite side of the road to the site. This surface water flow path runs into Belsize Lane and away from the site. Although the site is shown not to be at risk of surface water flooding, it is recommended that the development ensures that threshold levels are a minimum of 150mm above the surrounding ground levels to reduce the risk of surface water ingress. This recommendation is in line with CIRIA (C635), Designing for Exceedance in Urban Drainage – Good Practice document. In addition, the development should implement non-return valves on all foul outlets within the basement. This will reduce the risk of internally flooding in the event of any surcharge of the public sewer system in the road. With these two measures incorporated, the risks of surface water and sewer flooding to the site are considered to be low.

The onsite ground investigation concluded that the proposed basement extension is likely to be situated within a perched water table. It is therefore recommend that the basement extension includes an appropriate tanked system to prevent groundwater ingress into the basement and advised that de-watering methods may be required during construction of the basement extension. With these mitigation measures in place, the risk of groundwater ingress to the basement is low. The depth of basement extension is small and therefore it is not anticipated that this would displace any of the perched groundwater to result in any groundwater emergence at the surface. The adjacent properties do not have existing basements and there is no increase in risk to neighbouring properties. The risk of groundwater flooding at the surface is therefore considered to be low.

Impermeable areas on site will not increase post development and therefore there should be no increase in surface water runoff from all these areas (ignoring the effects of climate change). The development will therefore not increase surface water runoff rates from the site post development.

The proposed basement extension has been shown to be at a low risk of flooding from all sources and is considered acceptable in the context of flood risk, provided the mitigation measures detailed within this report are incorporated into the design. Despite an increase in vulnerability classification post development, there is not considered to be any risk to future residents of the site. The proposed development does not result in any increase in the risk of flooding to the site or elsewhere.

1 INTRODUCTION

General Information

1.1 The site is located at 3 Belsize Crescent in the London Borough of Camden. The site is less than 1 hectare (ha) in size and currently comprises wholly of the building footprint. There are no gardens or driveways associated with the site. The site is fully occupied by the building footprint of 3 Belsize Crescent.

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%). The site is also less than 1 ha and therefore a full Flood Risk Assessment is not normally required.

1.3 However, London Borough of Camden policy dictates that surface flow and flooding is considered in this case, primarily due to basement construction. This report has therefore been prepared to assess the risks of flooding from all other potential sources including; overland flow, groundwater, artificial water bodies and underground sewers. The impact of the proposed development on surface water infrastructure is also considered, and this report will form part of the Basement Impact Assessment for submission with the planning application.

Scope of Study

1.4 The main objectives of this study are to:

- Provide a surface water flow and flood risk assessment of the site, compliant with the guidelines set out in the National Planning Policy Framework (NPPF) and Camden Planning Guidance (CPG4[1]) 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; and,
- 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

1.5 The site is situated on Belsize Crescent in the London Borough of Camden as shown in Figure 1. Primrose Hill is located to the south of the site and Hampstead Heath is located to the north of the site.

[1] London Borough of Camden (July 2015) – Camden Planning Guidance (CPG4) Basements and Lightwells .

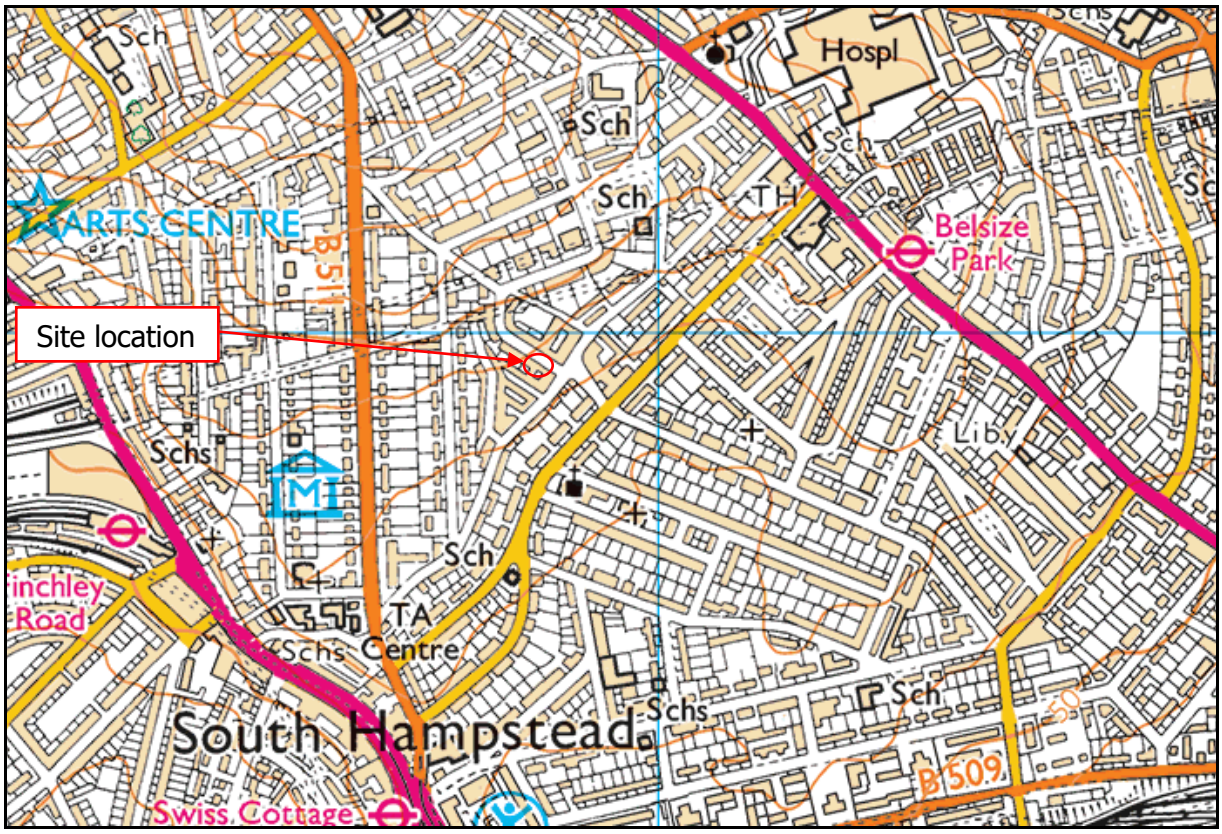

Figure 1[2] – Location of proposed development site

Existing Development

1.6 The existing site comprises wholly of the building footprint There are no driveways or gardens associated with the site. The site is therefore completely hard standing.

1.7 A topographic survey of the site has not been carried out however, the Thames Water asset plans gives manhole cover levels within the road. Ground levels from the Thames Water asset plans shows that Belsize Crescent falls in a south-easterly direction (71.70m AOD at the manhole to the north of the site) to the south east (67.60m AOD to the south of the site).

Proposed Development

1.8 Proposals are to extend the existing basement of the property. This will be constructed under the building and will not extend out beneath existing building footprint.

1.9 It is proposed to excavate the basement by an additional depth of 1000mm (excluding necessary foundations). This is to allow the basement to become habitable and allow creation of a 2 storey, split level flat across the basement and

[2] © Crown copyright and database rights 2016 Ordnance Survey 100049945

ground floor. The rest of the building is to be converted to flats. The proposed development layout is shown in Drawing 2.

1.10 Post-development, the site will be wholly comprised of residential accommodation. This is considered "more vulnerable" under the NPPF in terms of flood risk.

1.11 The new development will maintain the existing balance of hard standing areas on the site (100%). All rooms situated within the basement level have internal access to higher floors.

Planning Policy

1.12 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."*

1.13 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...."*

1.14 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 accommodation*[3]*".* 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*" and "subterranean (groundwater) flow". Screening flowcharts (Drawing 3) are used to address individual sources of potential flooding, and where a risk of flooding is present; a scoping and impact

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

assessment will need to be undertaken as appropriate. This report covers this component of the BIA.

1.15 In conjunction with ARUP, the London Borough of Camden produced a "*Geological, Hydrogeological and Hydrological Study*" for guidance on subterranean development[4].

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

2 SURFACE FLOW AND FLOODING ASSESSMENT

Stage 1: Screening

2.1 Camden Geological, Hydrogeological and Hydrological Study 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 3 Belsize Crescent as follows:

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

  Answer: No – The site is not located within the catchment area as shown on Figure 14 of the Camden Geological, Hydrogeological and Hydrological Study. The site is approximately 1km from Hampstead Heath.

- **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 Belsize Crescent.

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

  Answer: No – The proposed development will not increase the impermeable area post-development. The site is at present 100% hard standing and will remain so 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 Camden Geological, Hydrogeological and Hydrological Study, 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 all the responses are "No", the scoping stage is not 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 – Perched water table discovered in ground investigation, see Chapter 3 for details. **Developer is required undertake a Flood Risk Assessment in accordance with the NPPF.**

3 POTENTIAL FLOODING ON SITE

3.1 As the Surface Flow and Flooding Screening Flowchart answers "Yes" to Question 6, the development is require to undertake a Flood Risk Assessment in accordance with the NPPF. This chapter contains the Flood Risk Assessment for the site at 3 Belsize Crescent and the proposed basement extension.

Historic Information and Flood Risk Planning Policy

3.2 No records have been found of the site flooding in the past from any of the sources identified in the NPPF.

3.3 It is noted in the North London Strategic Flood Risk Assessment (SFRA)[5] and the Camden SFRA[6] notes 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.

3.4 The Surface Water Management Plan (SWMP)[7] records that within the NW3 5 postcode, which covers Belsize Crescent, there has been one record of a property flooding from external sewer flooding. The exact location of this sewer flooding event is unknown.

3.5 The SFRA maps indicate that the site is located within CDA Group3_005. Critical drainage areas are defined within the SWMP as "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 of more Local Flood Risk Zones during severe weather thereby affecting people, property or local infrastructure." The majority of the borough is located within a CDA and therefore, whilst a specific area is not necessarily at higher risk of surface water flooding, the location of an area within a CDA indicates that it is within a catchment area that contributes to a flooding hot spot. As a result, surface water management is a particular focus for new developments.

3.6 The two SFRAs, and Figure 15 of the ARUP study show that Belsize Crescent has not been recorded to have flooded in 2002.

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

[6] URS (July 2014) London Borough of Camden Strategic Flood Risk Assessment

[7] Halcrow (July 2011) London Borough of Camden Surface Water Management Plan

Tidal and Fluvial Flooding

3.7 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.

3.8 The site is located in Flood Zone 1 and is approximately 6km 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.

Figure 2[8] – Environment Agency flood zone map

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Flooding from Surface Water and Sewers

3.9 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.

3.10 It is reasonable to assume that adopted sewers have been designed to the 1 in 30 year return period (in accordance with Sewers for Adoption[9]), 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.

3.11 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. Belsize Crescent is not recorded as having flooded in the 2002 event

Surface Water

3.12 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.

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

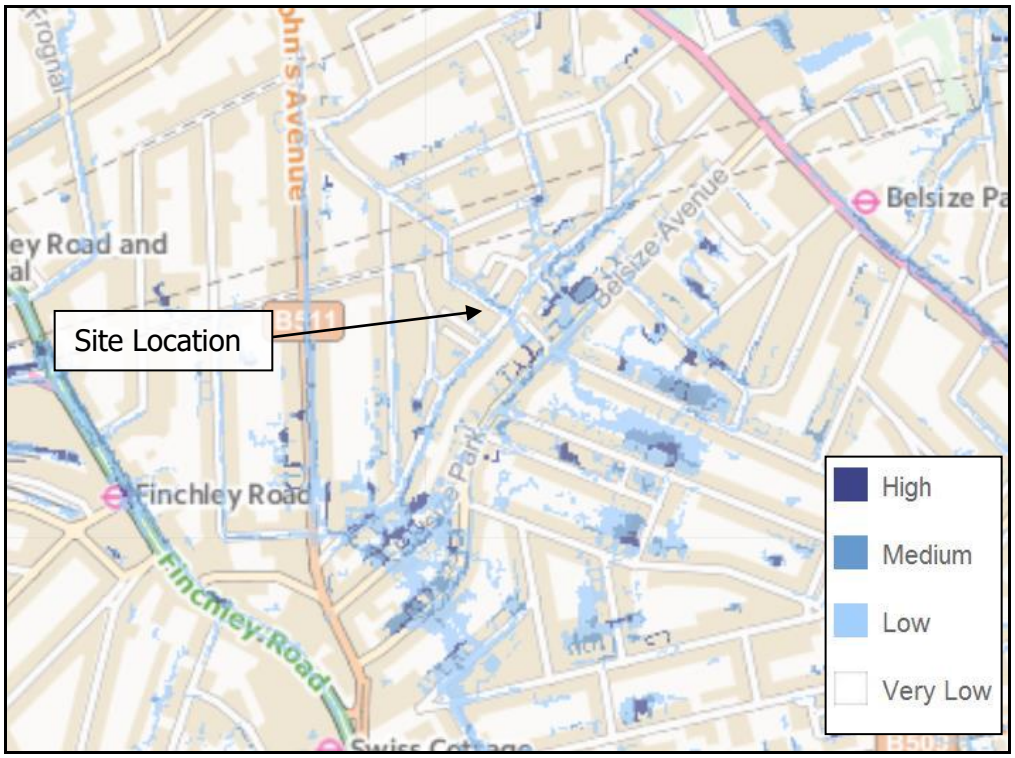

Figure 3[10]- Environment Agency Surface Water Risk Map

3.13 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 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.

3.14 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 down Belsize Crescent, past the site is in a south-easterly direction towards Belsize Lane and then south-westerly towards College Crescent. The mapping indicates flooding along the length of Belsize Crescent on the eastern side of the road. This is the opposite side of the road to the site.

3.15 The 2014 Camden SFRA has produced more detailed mapping of surface water flooding. This map highlights Critical Drainage Areas (CDAs), previously flooded streets and areas at risk of surface water flooding. Figure 4 shows the surface water flooding around the site.

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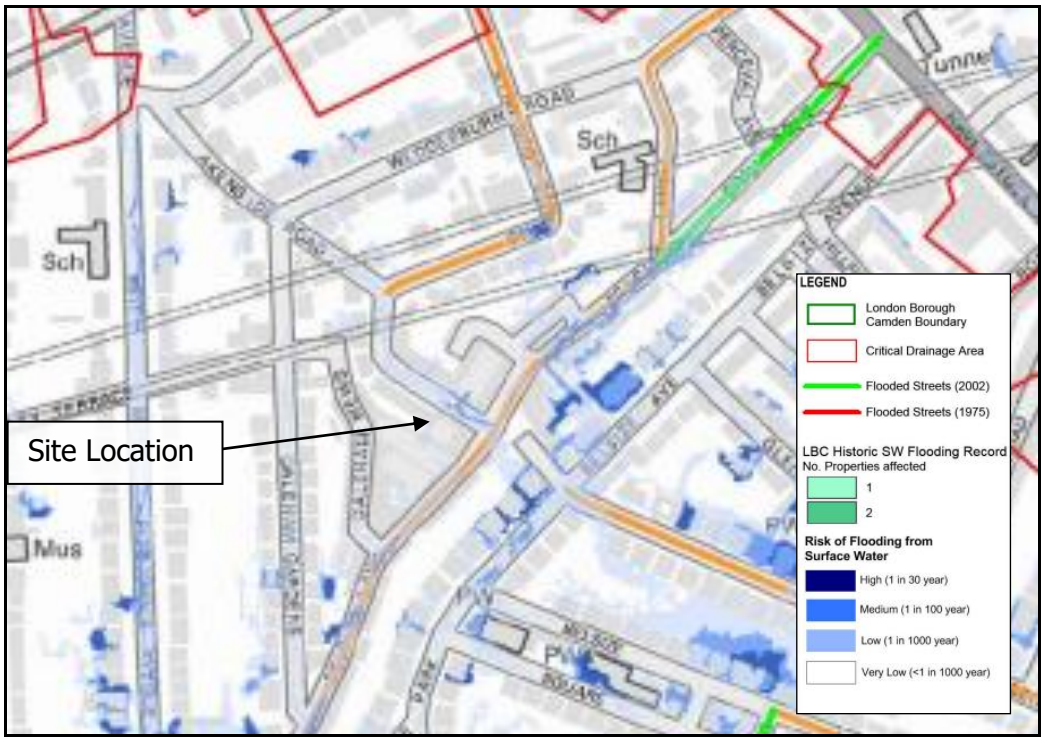

Figure 4[11] - SFRA Surface Water Flooding

3.16 Figure 4 shows that the road of Belsize Crescent is at a 'Medium' risk of flooding which represents a 1 in 100 year storm event, whilst the site itself is shown to be at a 'Very Low' risk of flooding (1 in 1000 year storm event).

3.17 Despite its location within a critical drainage area, the site should not be affected by surface water flooding in the design storm event (1 in 100 year storm event) due to the site thresholds being higher than the carriageway of the road and surrounding ground levels.

3.18 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 5) indicates that the natural route of the river within Camden.

[11] Excerpt from Updated Flood Maps for Surface Water (uFMfSW), Figure 3v Rev 1 of Camden (2014) SFRA

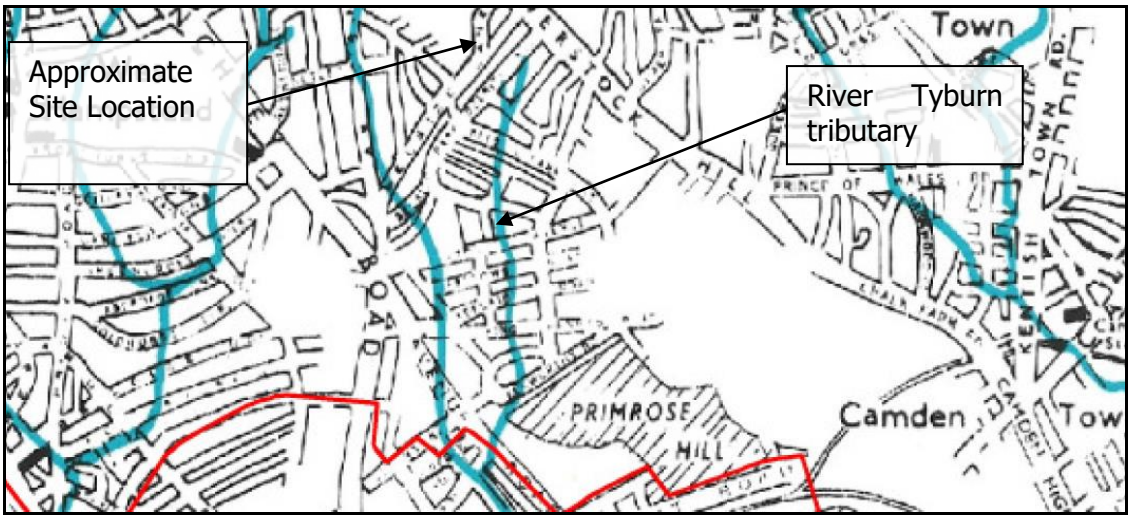

Figure 5 - Excerpt from Figure 11, Camden Geological, Hydrogeological and Hydrological Study. Source – Barton, Lost Rivers of London.

3.19 The site is shown to be upstream of the predicted natural flow of the River Tyburn but as mentioned the exact location of the original flow path is unknown. Nearly all lost rivers within London are now incorporated into the local underground sewer network and no longer flow at the surface. Overland flow may still following natural flow paths, as per the surface water maps indicated by Figure 3.

3.20 Based on available information it appears that the site is located outside of the area at risk of surface water flooding. Overland flow is shown to drain along Belsize Crescent past the site towards Belsize Lane.

3.21 The site is located above the carriageway of Belsize Crescent. Nevertheless, it is recommended at a minimum that threshold level of property are set 150mm above surrounding ground levels is provided. This will provide some protection from the ingress localised surface water ponding adjacent to the site.

Sewers

3.22 Sewer flooding typically occurs where there is incapacity or a blockage within the surface water or combined drainage system. The SFRA records indicate that there has been one incident of a property flooding from an exterior sewer within the NW3 5 postcode area. The location of this property is unknown and is not disclosed within the SFRA.

3.23 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 Belsize Crescent. This sewer is a main truck sewer (965 x 635mm) which is brick lined and egg shaped. This sewer drains combined flows from the area in a south-easterly direction along Belsize Crescent.

3.24 There are no separate surface water sewers shown on the Thames Water asset plans. In addition, 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. Any excess overland flow is likely to be intercepted by

the combined sewer system, reducing the likely risk of surface water flooding to the site. The asset plan for the area is shown in Drawing 5.

3.25 The nearest public manhole to the site is no. 7904; however, there is no recorded cover or invert levels within the Thames Water asset information. Ground levels from the Thames Water asset plans show that Belsize Crescent falls in a south-easterly direction (approximately 71.70m AOD to the north of the site) to the south east (approximately 67.6m AOD).

3.26 Following the extension of the property, the site will continue to drain to Belsize Crescent as per the existing connection and with a similar drainage system to the existing site. No CCTV survey of the existing drainage system has been undertaken. Flows off the site should not change post development, as there is no increase in hard standing on the site (ignoring climate change). As a result, there will be no increase in the runoff rate leaving the site, and no change in the risk of sewer flooding.

3.27 Levels on site are higher than within Belsize Crescent carriageway, 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. It is recommend that non-return valves are implemented within the proposed basement to reduce the risk of sewers surcharging into the property. However, the residual risk of a blockage in the system cannot be categorically ruled out.

3.28 As per the surface water advice, it is recommended that finished floor levels and entrance thresholds are set a minimum of 150mm above surrounding ground levels, in accordance with CIRIA guidance[12] or where level access is required, drains incorporated into the design to fully intercept runoff.

3.29 In summary, provided that the mitigation measures are included within the design in the form of raised thresholds and non-return valves, the risk of flooding from sewers and overland flow is considered to be low.

Flooding from Groundwater

3.30 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 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.

3.31 The online groundwater map shows that the site is within an area which is not considered to be in any Source Protection Zone (SPZ). This is shown in Figure 6. 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.

[12] CIRIA (C635), Designing for Exceedance in Urban Drainage – Good Practice, London 2006

3.32 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 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.

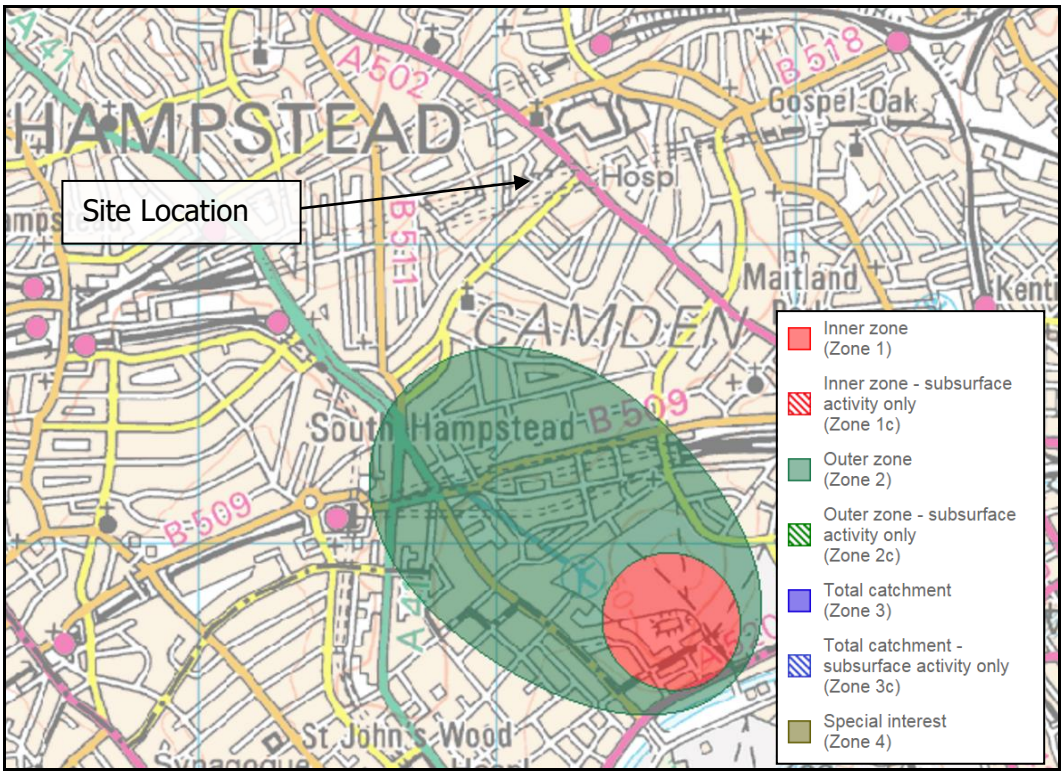

Figure 6[13] - Environment Agency Source Protection Zone Map

3.33 A site investigation[14] was undertaken in January 2016. One borehole and two trial pits were tested, which revealed ground conditions generally consistent with geological records. The borehole revealed a typical succession of Made Ground, up to 0.75m thickness below the existing basement level, with the London Clay Formation found until the end of the boreholes (2m below existing basement level) and trial pits (0.8m below basement level). The made ground in this location includes brick fragments, sands and sandy gravels.

3.34 The site investigation notes "very slight groundwater seepage" was encountered during trial pit at 0.73m below the basement level of the property. Furthermore,

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[14]Landscience, Phase I and Phase II Geotechnical Assessment, Ref No. LS1985 V1, January 2016

groundwater was located in the borehole at a depth of 1.88m. The ground investigation report concludes that this groundwater is anticipated to be a perched water table, located at the top of the London Clay formation.

3.35 The basement extension is to be constructed wholly within the London Clay, a typically low permeability strata with no continuous water table expected. A locally perched water table is shown to be present at the top of the London Clay within the sands and gravels of the made ground; however this is not expected to be extensive or connected to any larger groundwater bodies. Since the basement extension is small, 1m in depth (excluding foundations), the proposed extension is not expected to have any impact on groundwater flows.

3.36 The adjacent properties were investigated in order to determine whether the proposed basement extension could have an impact in terms of groundwater ingress or flooding within neighbouring basements. It was confirmed that there are no existing basements beneath these neighbouring properties and as a result, there is no increase in risk of groundwater flooding to these properties.

3.37 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. Groundwater seepage was encountered during the site investigation at 0.73m below the base of the existing basement. This perched water table within the made ground is unlikely to be displaced significantly enough by a small basement extension to emerge at the surface. In addition, the wider area is predominantly hard paved and therefore groundwater emerging at the surface is unlikely. Any groundwater which does emerge would drain overland and be collected by the local drainage network with surface water flows.

3.38 Nevertheless, it is assumed that the basement will be constructed within this perched water table. It is therefore required that the proposed basement is built and constructed using appropriate tanked construction to prevent groundwater ingress into the proposed basement. With the proposed mitigation measures to prevent the ingress of groundwater into the basement, the risk of internal groundwater flooding is low.

Flooding from Reservoirs, Canals and Other Artificial Sources

3.39 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.

3.40 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.

3.41 The risk of flooding from artificial water bodies is therefore considered low.

4 CONCLUSIONS AND RECOMMENDATIONS

4.1 The site is located at 3 Belsize Crescent in the London Borough of Camden and is currently occupied by the development on the site. Proposals are to covert the building to flats and extend the existing basement. The basement will be extended downwards but will not extend outside of the existing footprint of the building.

4.2 In accordance with local planning policy, the London Borough Camden Surface Flow and Flooding screening assessment has been undertaken. As a result, the site was required to undertake a flood risk assessment in accordance with the NPPF.

4.3 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%). There is therefore no risk of flooding to the site from rivers or the sea.

4.4 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 evidence of any open channel or specific drainage infrastructure associated with this lost river was found onsite during site investigation. It is therefore considered unlikely that there is any additional risk to the site.

4.5 The North London SFRA, and subsequent Camden 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. Belsize Crescent has not been recorded as having flooded in the 2002 event.

4.6 The Environment Agency's surface water maps indicate that there is a natural flow path draining down Belsize Crescent but on the opposite side of the road to the site. This flow of water is shown to flow past the site and into Belsize Lane. In order to provide protection from surface water flooding either as a result of overland flow or a surcharge of the onsite drainage system or the combined Thames Water sewer in the road, it is recommended threshold entrance levels are raised by a minimum of 150mm above surrounding ground levels and/or drains incorporated into the design to intercept runoff. In addition, it is recommended that the basement foul outlets have a non-return valves incorporated into the system to prevent internal flooding of the basement in the event of a blockage in the public sewer system. Therefore the risk of surface water and sewer flooding to the site are considered to be low.

4.7 On-site ground investigation on the site concluded that the geology below the existing basement comprised of made ground over the London Clay Formation. A window sample completed on the site reported slight groundwater seepage at a depth of 0.73m and groundwater at a depth of 1.88m on a return monitoring visit. The groundwater was considered to be a perched water table at the top of the London Clay. It is recommended that the basement extension is designed and constructed with appropriate tanked system to prevent groundwater ingress into the proposed basement. With these proposed mitigation measures the risk of

groundwater ingress is low. The perched water table is unlikely to be significantly displaced as a result of the small basement extension and therefore emergence of groundwater at the surface is considered to be unlikely. In addition, neighbouring properties do not have existing basements and therefore there is no increase in risk to adjacent properties.

4.8 There is a no increase in impermeable area on site following development, which subsequently means there is no increase in the rate of runoff from the site (ignoring any increases as a result of climate change). The development will therefore not increase surface water runoff rates from the site thereby ensuring no increase in risk from this source.

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

5 APPENDIX

Drawing 1 – Existing Development

XUL Architecture, 13th November 2015, Project Number 15_09, Drawing Number: EX-06

This drawing shows the existing site.

Drawing 2 - Proposed Development

XUL Architecture, 13th November 2015, Project Number 15_09, Drawing Number: PA-06

This drawing shows the proposed development in side elevation.

Drawing 3 - Surface Flow and Flooding Screening Flowcharts

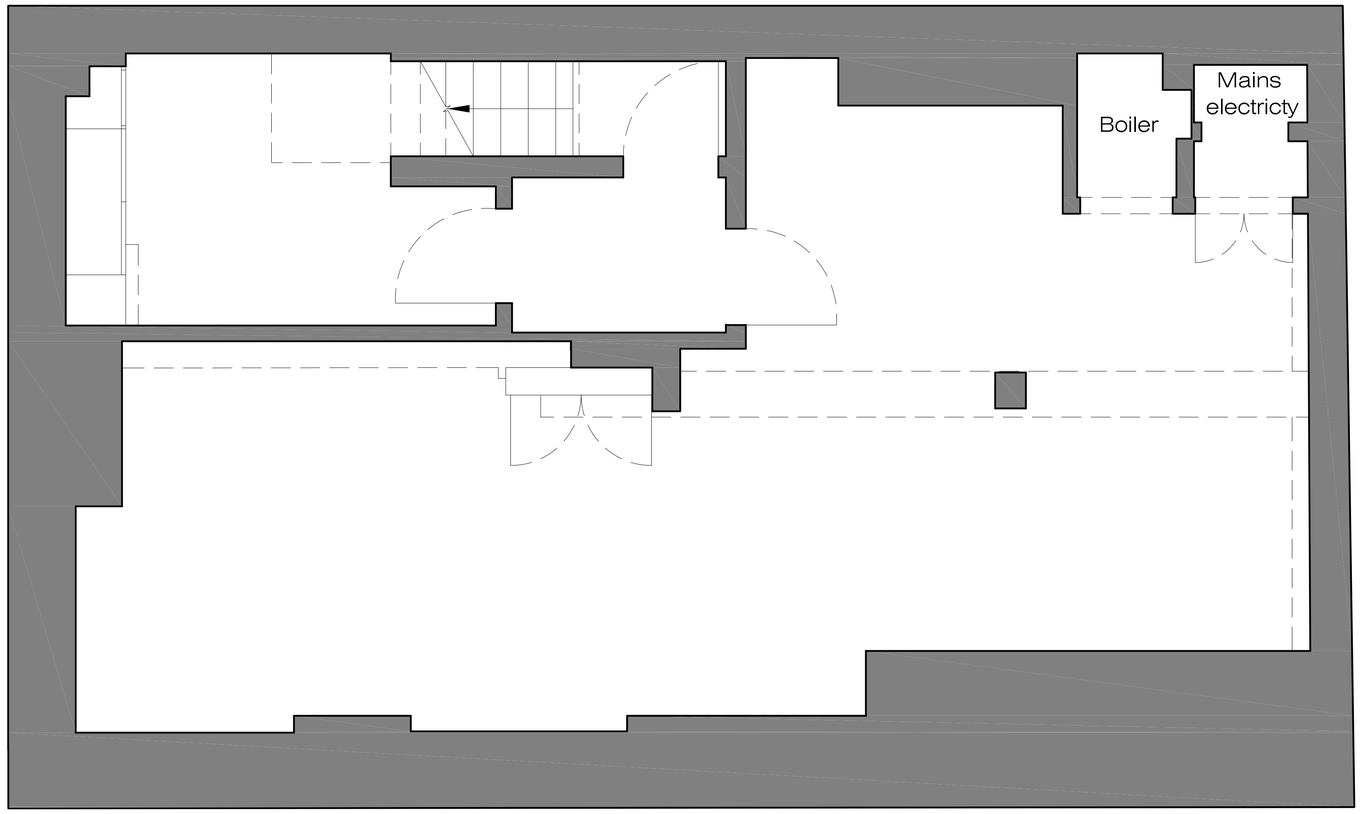
ARUP, Job No. 213923/KM

These flowcharts 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 - Asset Location Map

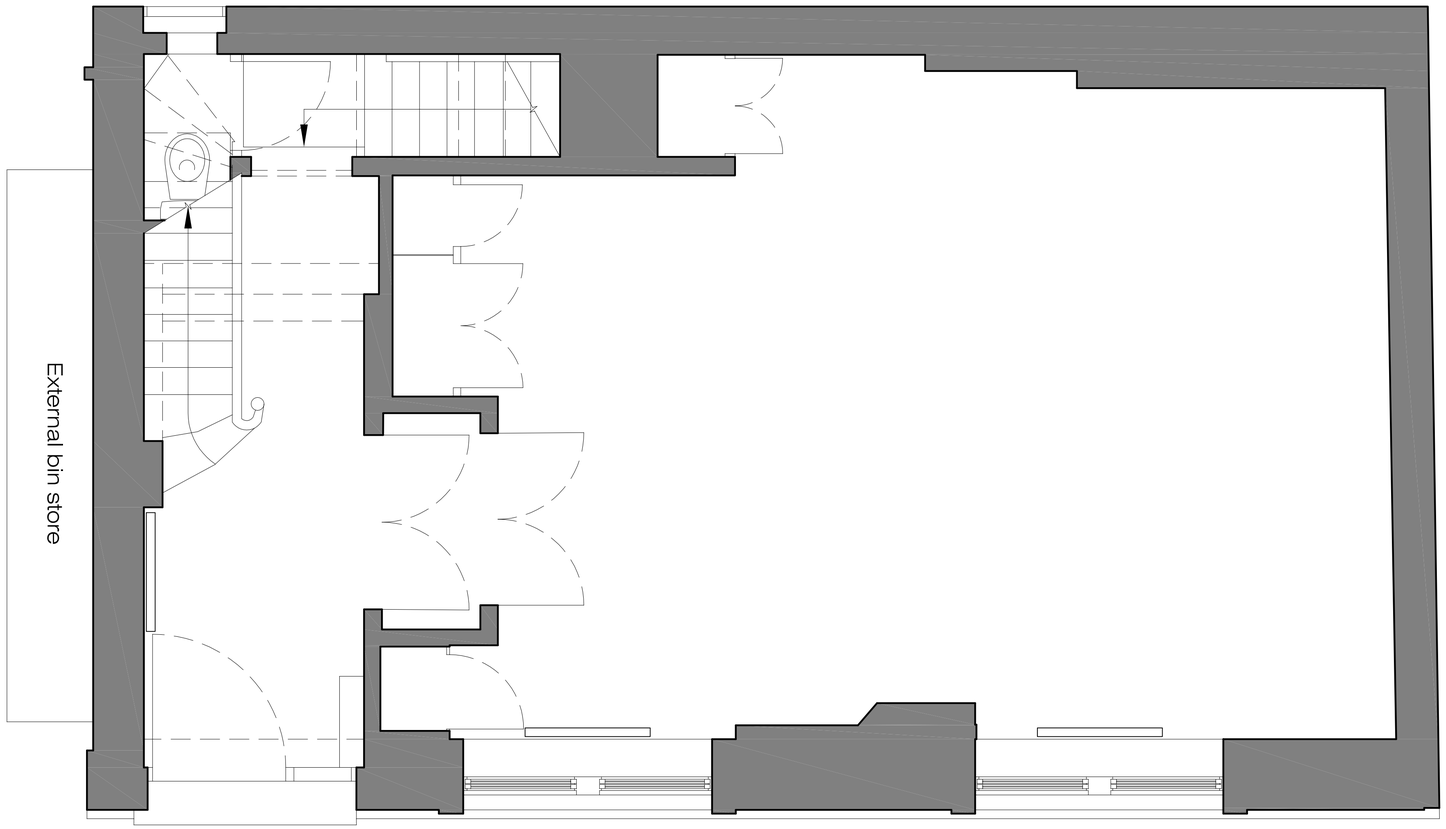
Thames Water, Ref No. 2016_3245596

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



0 1 2 3m

EXISTING
Basement Floor Plan
SCALE 1:50@A3 EX-01



EXISTING
Ground Floor Plan
SCALE 1:50@A3 EX-01

XUL ARCHITECTURE

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33 Belsize Lane
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No	Date	Description Issue For	issue By
00	13/11/15	Information	CC

Client
PRIVATE CLIENT

Project
3 Belsize Crescent
London NW3 5QY

Title
EXISTING
Basement & Ground Floor Plan

Scale	Dwg. No.	Rev.
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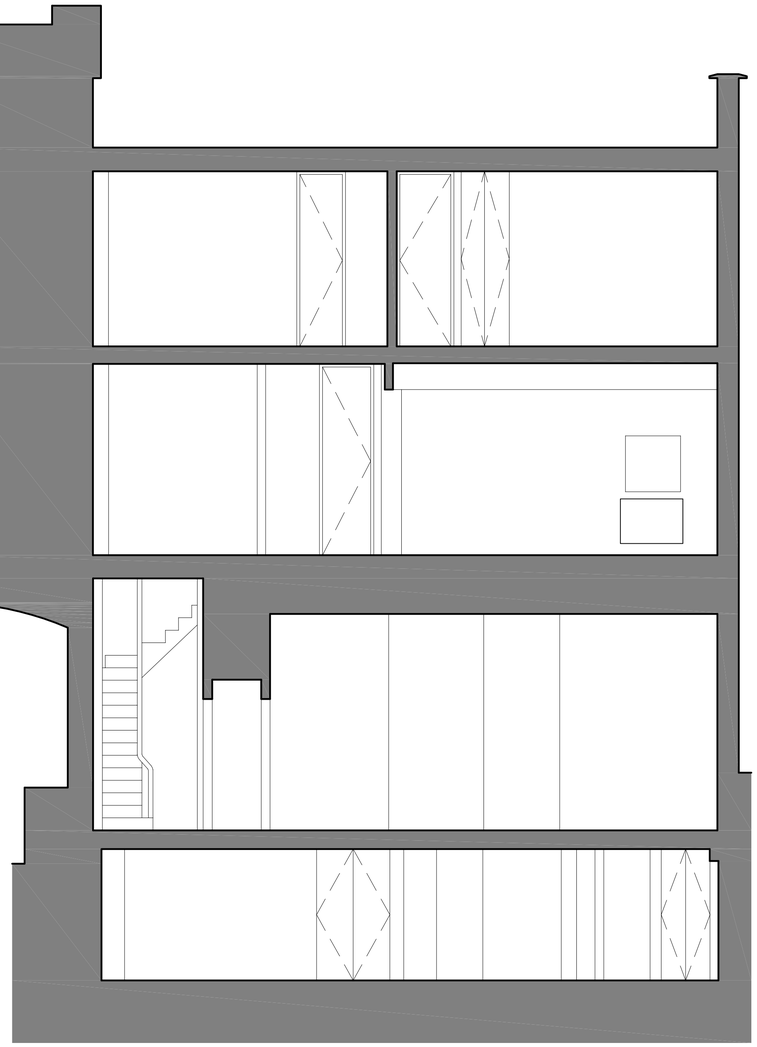
Date 13/11/15		
Drawn CC	Project Number 15_09	
Checked SS		



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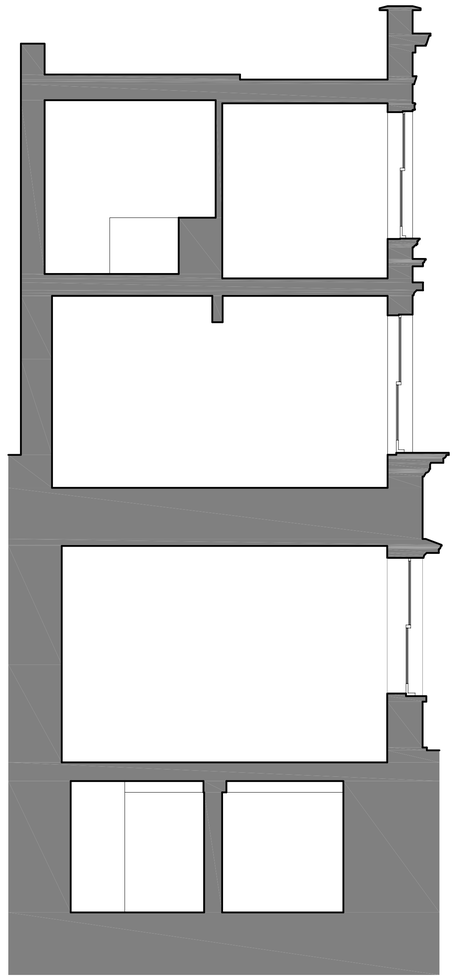

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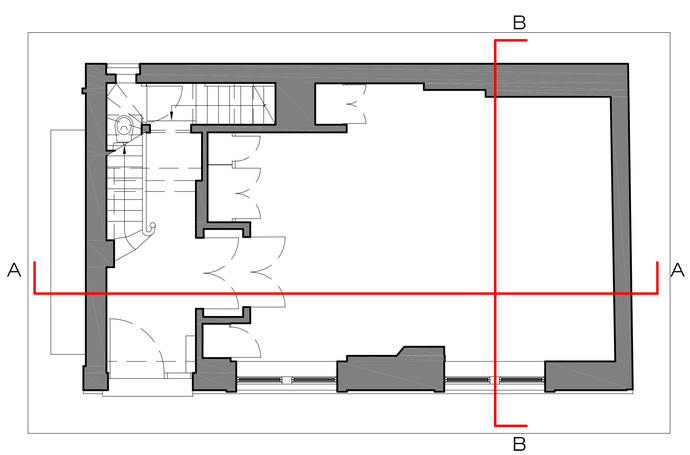

0 2 4 6 8 10m

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3 Belsize Crescent
London NW3 5QY

Title
EXISTING
Section A-A and B-B

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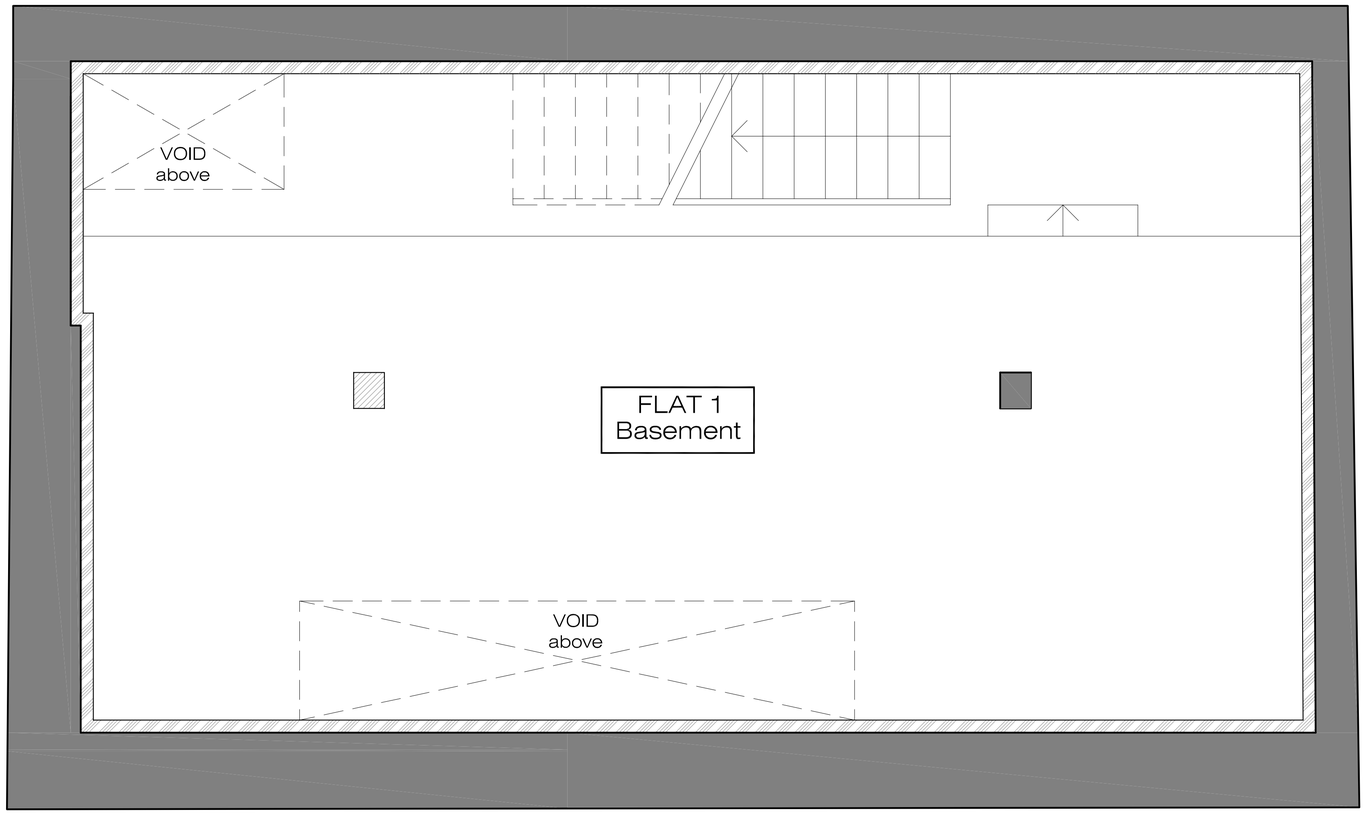
Drawn CC	Project Number 15_09	
Checked SS		



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PROPOSED
Basement Floor Plan
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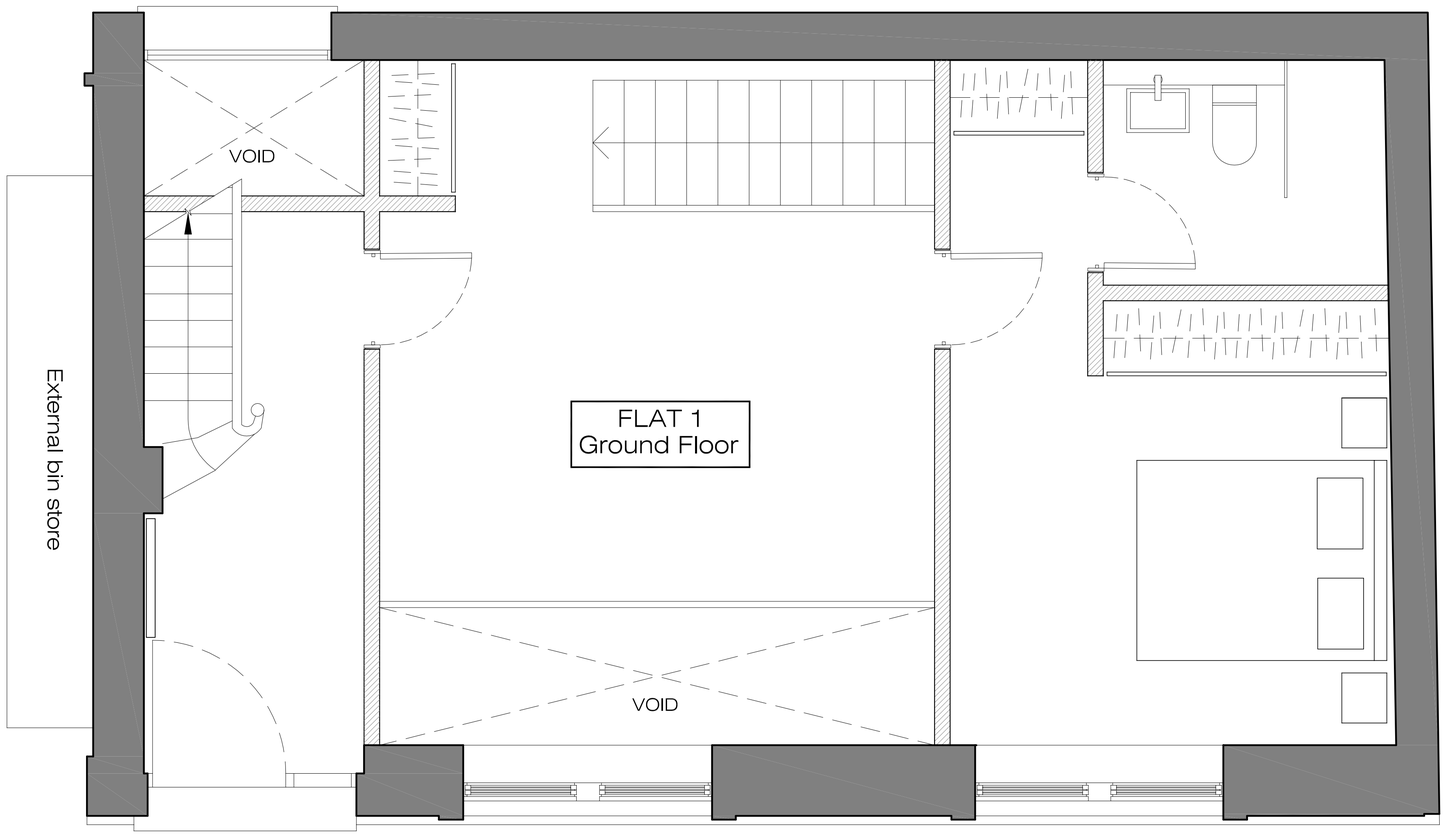

PROPOSED
Ground Floor Plan
SCALE 1:50@A3 PA-01

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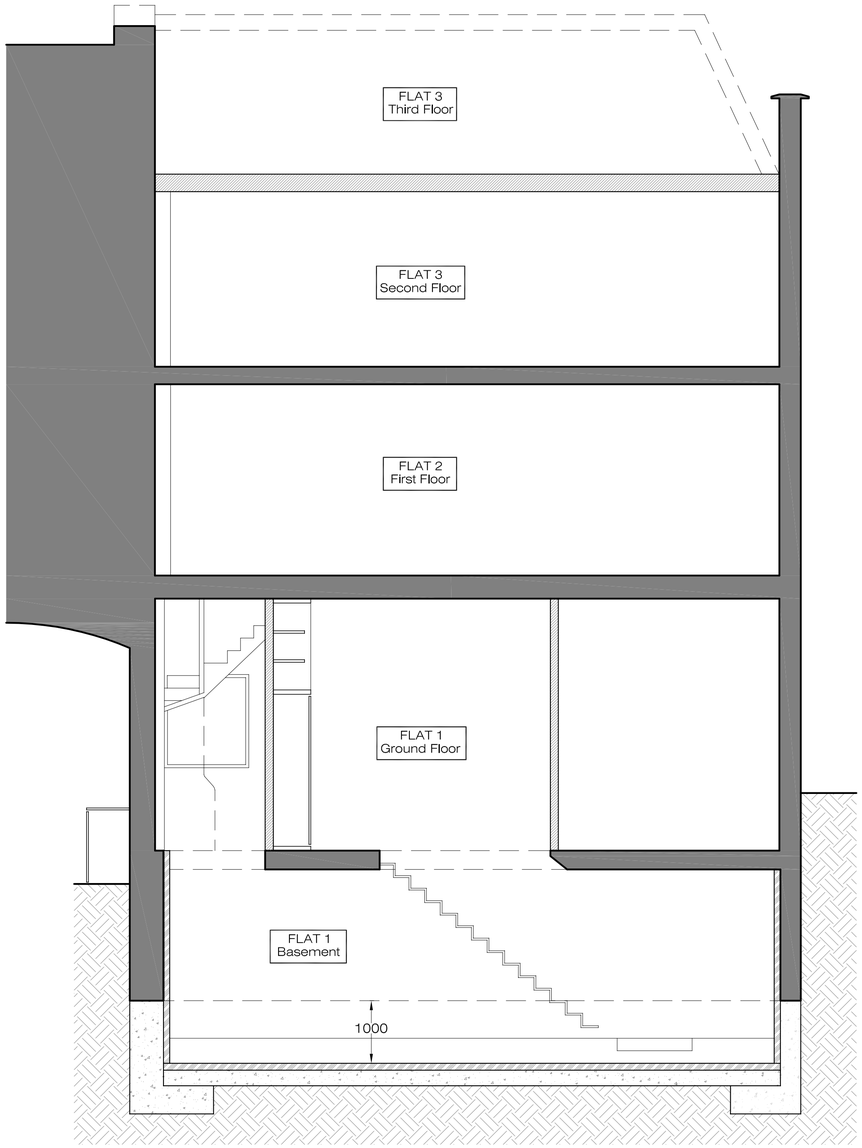
Basement & Ground Floor Plan

Scale	Dwg. No.	Rev.
1:50@A3	PA-01	00
Date 13/11/15		
Drawn CC	Project Number 15_09	
Checked SS		



PROPOSED
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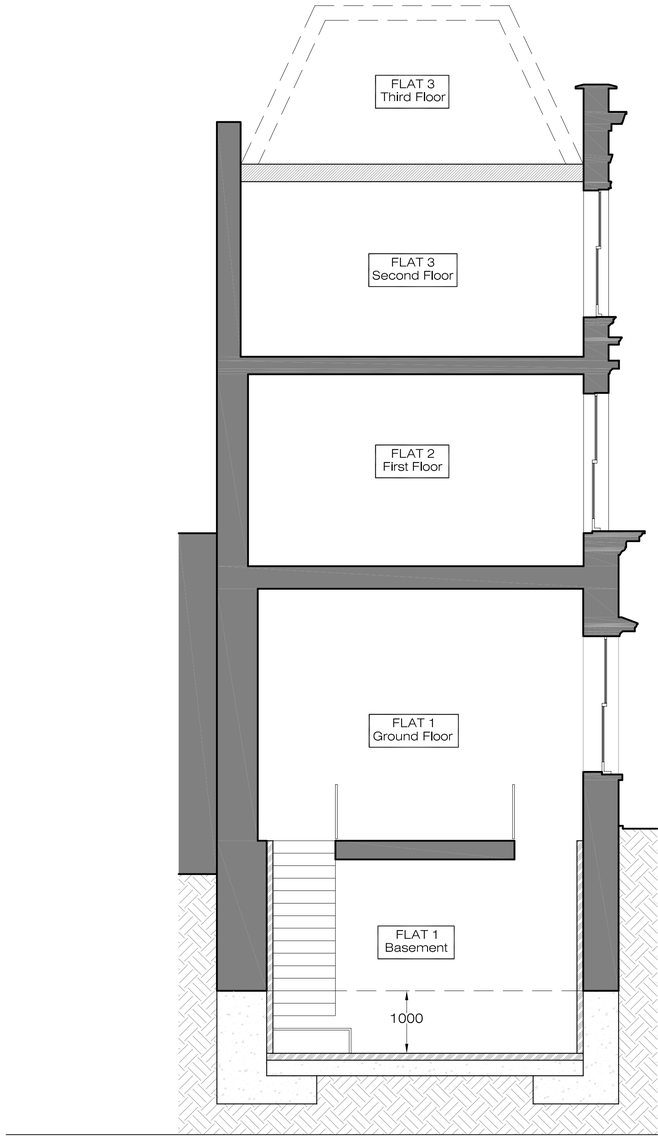
SCALE 1:100@A3 PA-06



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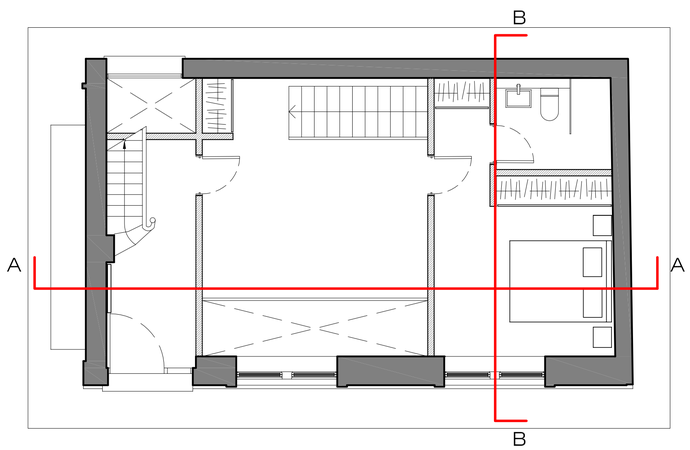

0 2 4 6 8 10m

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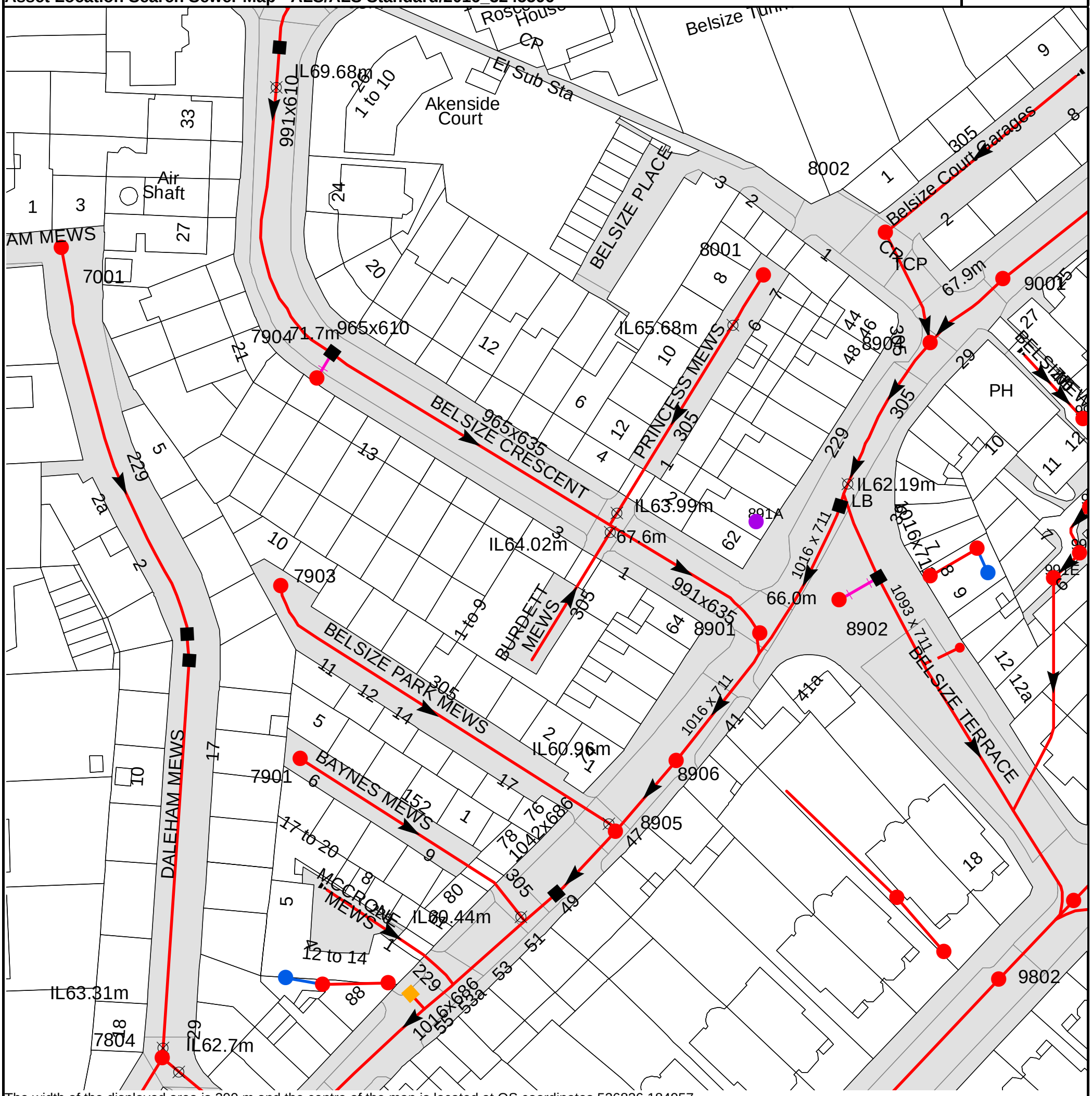
London NW3 5QY

Title
PROPOSED
Section A-A and B-B

Scale	Dwg. No.	Rev.
1:100@A3	PA-06	00
Date 13/11/15		
Drawn CC	Project Number 15_09	
Checked SS		

Asset Location Search Sewer Map - ALS/ALS Standard/2016_3245596



The width of the displayed area is 200 m and the centre of the map is located at OS coordinates 526826,184957

The position of the apparatus shown on this plan is given without obligation and warranty, and the accuracy cannot be guaranteed. Service pipes are not shown but their presence should be anticipated. No liability of any kind whatsoever is accepted by Thames Water for any error or omission. The actual position of mains and services must be verified and established on site before any works are undertaken.

NB. Levels quoted in metres Ordnance Newlyn Datum. The value -9999.00 indicates that no survey information is available

Manhole Reference	Manhole Cover Level	Manhole Invert Level
7001	73.07	70.63
7903	67.07	65.75
7901	65.73	64.96
7904	n/a	n/a
8905	n/a	n/a
8906	64.86	n/a
891A	n/a	n/a
8901	65.86	61.75
8001	69.28	n/a
8902	n/a	n/a
8002	68.53	64.49
88BF	n/a	n/a
89FC	n/a	n/a
8904	67.5	63.1
991F	n/a	n/a
99DF	n/a	n/a
99DG	n/a	n/a
9001	n/a	n/a
991E	n/a	n/a
9801	63.04	58.88
991D	n/a	n/a
991A	n/a	n/a
7804	65.37	n/a
78BG	n/a	n/a
78BH	n/a	n/a
78BI	n/a	n/a
88BG	n/a	n/a
9802	n/a	n/a

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FIELD DESCRIPTION		FIELD TESTING	SAMPLING	WATER	FILL
Carpet over concrete. (MADE GROUND)	0.00				
Brick. (MADE GROUND)	0.07				
Brown mottled grey/orange slightly sandy gravelly CLAY. Frequent brick and pottery fragments. (MADE GROUND)	0.15		0.30 - 0.30 D 0.50 - 0.50 D		
Brown mottled grey/orange silty CLAY, rare fine selenite crystals. (LONDON CLAY)	0.65		0.80 - 0.80 D 1.00 - 1.00 D 1.50 - 1.50 D		
Borehole complete at 2.00m	2.00		2.00 - 2.00 D		

REMARKS

Stability: No instability encountered

Groundwater: No groundwater encountered.

Chiselling: Not applicable

Casing/dia: Not applicable

Backfilling: 1.90m of pipe installed:Plain pipe from 0.00-0.90m, slotted pipe from 0.90-1.90m.

Notes: Hand excavated to 0.80mbgl.
TP1 incorporated in first 0.80m of WS1 log.

TITLE: **Window Sampler Log**		REFERENCE: **LS1985**	POSITION: **WS1**
PROJECT: **3 Belsize Crescent, London, NW3 5QU**		ELEVATION: **N/A**	CO-ORDINATES: **Not to scale**
CLIENT: **David Templer**		METHOD: **Archway "Dart" Windowless**	
DRILLED BY: **OSI**	LOGGED BY: **JB**	STARTED: **14/01/2016**	SCALE: **Not to scale**
INPUTTED BY: **JB**	CHECKED BY: **MR**	COMPLETED: **14/01/2016**	SHEET No: **Page: 1 of 1**

Land Science

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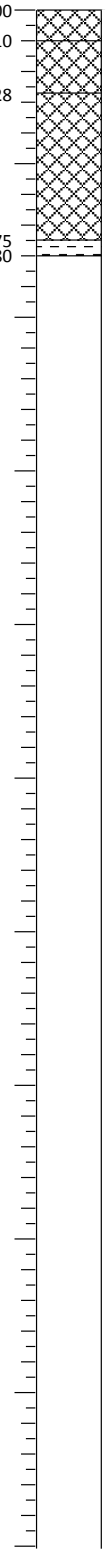
T: 0845 604 6494 **E:** brighton@landscience.co.uk

FIELD DESCRIPTION		FIELD TESTING	SAMPLING	WATER	FILL
Carpet over concrete (MADE GROUND)	0.00				
Grey very gravelly SAND, gravels comprised of brick and concrete fragments. (MADE GROUND)	0.10		0.20 - 0.20 D		
Brown / red clayey very sandy GRAVEL, abundant brick fragments. (MADE GROUND)	0.28		0.50 - 0.50 D	0.73	
Brown mottled grey/orange silty CLAY, rare fine selenite crystals. (LONDON CLAY)	0.75		0.80 - 0.80 D		
Trial pit complete at 0.80m	0.80				



DRAFT

REMARKS

Stability: No instability encountered

Groundwater: Seepage of water observed, standing at 0.73m.

Chiselling: Not applicable

Casing/dia: Not applicable

Backfilling: Position backfilled with arisings

Notes: Hand excavated to 0.80m

TITLE: **Hand Dug Pit**		REFERENCE: **LS1985**	POSITION: **TP2**
PROJECT: **3 Belsize Crescent, London, NW3 5QU**		ELEVATION: **N/A**	CO-ORDINATES: **Not to scale**
CLIENT: **David Templer**		METHOD: **Archway "Dart" Windowless**	
DRILLED BY: **OSI**	LOGGED BY: **JB**	STARTED: **14/01/2016**	SCALE: **Not to scale**
INPUTTED BY: **JB**	CHECKED BY: **MR**	COMPLETED: **14/01/2016**	SHEET No: **Page: 1 of 1**

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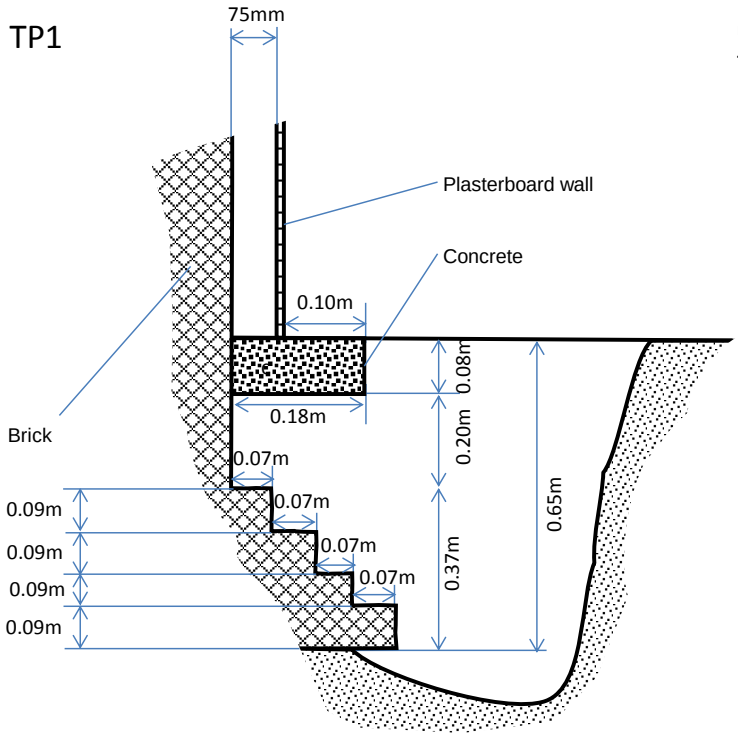
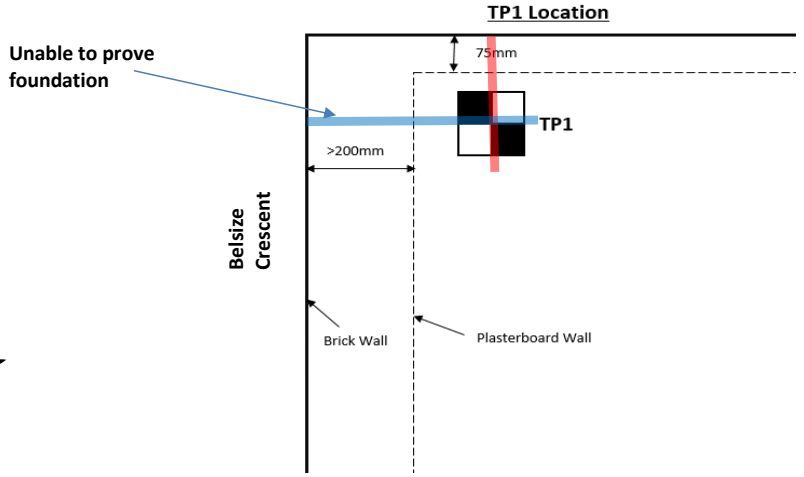
TP1





0.00-0.08m - Carpet over concrete (MADE GROUND)

0.08-0.15m - Brick (MADE GROUND)

0.15-0.65- Brown mottled grey/orange slightly sandy gravelly CLAY. Frequent brick and pottery fragments. (MADE GROUND)

0.65-0.80m-Brown mottled grey/orange silty CLAY, rare fine selenite crystals. (LONDON CLAY)

TITLE:	Foundation Exposures	**REF:**	LS1985	**PREPARED:**	JB
PROJECT:	3 Belsize Crescent, London, NW3 5QU	**VERSION:**	v1	**CHECKED:**	MR
CLIENT:	David Templer	**FIGURE:**	TP1	**DATE:**	15/01/2016

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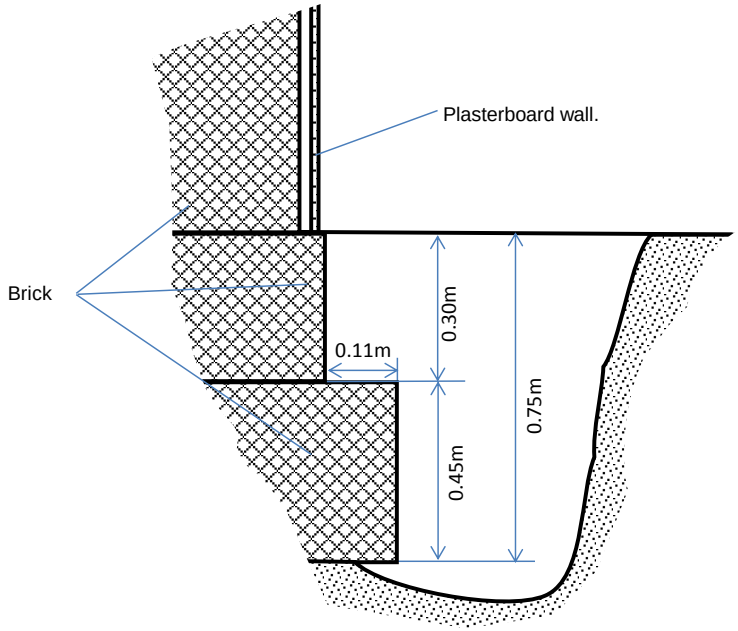
TP2



0.00-0.10 Carpet over concrete. (MADE GROUND)

0.10-0.28 Grey very gravelly SAND. (MADE GROUND)

0.28-0.75 Brown/ red clayey very sandy GRAVEL, abundant brick fragments. (MADE GROUND)

... Slow water seepage, standing at 0.73m

0.75-0.80 Brown mottled grey/orange silty CLAY, rare fine selenite crystals. (LONDON CLAY)

DRAFT

TITLE:	Foundation Exposures	**REF:**	LS 1985	**PREPARED:**	JB
PROJECT:	3 Belsize Crescent, London, NW3 5QU	**VERSION:**	v1	**CHECKED:**	MR
CLIENT:	David Templer	**FIGURE:**	TP2	**DATE:**	15/01/2016

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