



Units 14 + 15, River Road Business Park,
33 River Road, Barking, Essex IG11 0EA

Directors: J. S. Warren, M.R.S.C., P. C. Warren, J. I. Pattinson, BSc (Hons), MSc
Consultants: G. Evans, BSc., M.Sc., P.G. Dip., FGS., MEnvSc. A. J. Kingston, BSc C.Eng. MIMM
F. J. Gibbs, F.I.B.M.S. F.I.F.S.T., F.R.S.H. K. J. Blanchette

Tel: 0208 594 8134
Fax: 0208 594 8072
E-Mail: services@siteanalytical.co.uk

Your Ref:

Our Ref:

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**14 ETON ROAD,
LONDON, NW3 4SS**

BASEMENT IMPACT ASSESSMENT

Prepared for

StructureMode

Acting on behalf of

Mr Robert Leeming



Reg. Office: Units 14 +15, River Road Business Park,
33 River Road, Barking, Essex IG11 0EA
Business Reg. No. 2255616





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1.0 NON-TECHNICAL SUMMARY

1.1 Project Objectives

At the request of StructureMode, working on behalf of Mr Robert Leeming, a Basement Impact Assessment has been carried out at 14 Eton Road, London, NW3 4SS in support of a planning application for a proposed development which includes the lowering of the existing garden house floor level. It is understood that the proposed floor level is at approximately 43.75mSD (0.70m below proposed ground level).

1.2 Desk Study Findings

From historical map evidence, it would appear that the site was first built on prior to 1871, with the garden room at the rear of the property being constructed between 1970 and 1972. The surrounding area has been residential throughout its history, although some industrial sites, including a garage and railways have been present within the area.

1.3 Ground Conditions

The boreholes and trial pits revealed ground conditions that were consistent with the geological records and known history of the area and comprised Made Ground up to 0.75m in thickness resting on deposits of the London Clay Formation. The Made Ground extended down to depths of between 0.13m and 0.75m (46.32mSD to 43.14mSD) in the boreholes and trial pits and the material generally comprised a surface pea shingle or concrete overlying silty sandy gravelly clay with brick fragments. The London Clay Formation was encountered below the Made ground and consisted of soft to firm then stiff becoming very stiff silty clay with occasional pockets and partings of silty fine sand and scattered gypsum crystals. These deposits extended down to the full depths of investigation of 6.00m below ground level in Boreholes 1, 2 and 3 (39.27 to 37.66mSD). Following drilling operations groundwater monitoring piezometers were installed in Boreholes 1, 2 and 3 to approximately 8.00m depth.

Water was encountered at respective depths of 3.89m (41.38mSD), 1.09m (43.95mSD) and 1.98m (41.68mSD) within Boreholes 1, 2 and 3 on the return monitoring visit, approximately five weeks after site works. Due to the nature of the geology on-site, this is likely to be surface water entering into the pipe, which is then unable to filter out into the impermeable clay.

1.4 Recommendations

A monitoring plan should be set out at design stage and should include a monitoring strategy, instrumentation and monitoring plans and action plans. Trigger levels on movements will need to be defined. Precise levelling or reflective survey targets should be installed at the garden walls and neighbouring buildings. It would be prudent to continue to monitor the standpipes for as long as possible in order to determine equilibrium level and the extent of any seasonal variations. The chosen contractor should also have a contingency plan in place to deal with any perched groundwater inflows as a precautionary measure.



2.0 INTRODUCTION

2.1 Project Objectives

At the request of StructureMode, working on behalf of Mr Robert Leeming, a Basement Impact Assessment has been carried out at the above site in support of a planning application.

The purpose of this assessment is to consider the effects of a proposed basement construction on the local slope stability, surface water and groundwater regime at the existing residential property.

The recommendations and comments given in this report are based on the information contained from the sources cited and may include information provided by the Client and other parties, including anecdotal information. It must be noted that there may be special conditions prevailing at the site which have not been disclosed by the investigation and which have not been taken into account in the report. No liability can be accepted for any such conditions.

This report does not constitute a full environmental audit of either the site or its immediate environs.

2.2 Planning Policy Context

The information contained within this BIA has been produced to meet the requirements set out by Camden Planning Guidance – Basements and Lightwells (CPG4) including Camden Development Policies DP27 – Basements and Lightwells (Ref. 1) in order to assist London Borough of Camden with their decision making process.

As recommended by the Guidance for Subterranean Development (Ref. 1) the BIA comprises the following steps

1. **Initial screening** to identify where there are matters of concern
2. **Scoping** to further define the matters of concern
3. **Site Investigation and study** to establish baseline conditions
4. **Impact Assessment** to determine the impact of the basement on baseline conditions
5. **Review and Decision Making** (to be undertaken by LBC)

Subject	Qualifications Required by CPG4	Relevant persons and qualifications/experience
Surface flow and flooding	<p>A hydrologist or a Civil Engineer specialising in flood risk management and surface water drainage, with either</p> <ul style="list-style-type: none"> • The 'CEng' (Chartered Engineer) qualification from the Engineering Council; or a Member of the Institution of Civil Engineers ('MICE') • The CWEM (Chartered Water and Environmental Manager) qualification from the Chartered Institution of Water and Environmental Management 	<p>Mr Andrew Penrose, a Chartered Structural Engineer (CEng) and Member of the Institution of Structural Engineers (MIStructE). (25+ years' experience in geotechnics and hydrogeology)</p> <p>Mr Andrew Smith, a Chartered Geologist (CGeol) and Member of the Chartered Institute of Water and Environmental Management (MCIWEM) (10 years of hydrogeological experience)</p> <p>Mr Thomas Murray MSc BSc (Hons) FGS (3.5+ years of hydrogeological experience)</p>
Subterranean (groundwater) flow	<p>A hydrogeologist with the 'CGeol' (Chartered Geologist) qualification from the Geological Society of London</p>	<p>Mr Andrew Smith, a Chartered Geologist (CGeol) and Member of the Chartered Institute of Water and Environmental Management (MCIWEM) (10 years of hydrogeological experience)</p> <p>Mr Thomas Murray MSc BSc (Hons) FGS (3.5+ years of hydrogeological experience)</p>
Land Stability	<p>A Civil Engineer with the 'CEng (Chartered Engineer) qualification from the Engineering Council or specialising in ground engineering; or A Member of the Institution of Civil Engineers ('MICE') and a Geotechnical Specialist as defined by the Site Investigation Steering Group</p>	<p>Mr Andrew Smith, a Chartered Geologist (CGeol) and Member of the Chartered Institute of Water and Environmental Management (MCIWEM) (10 years of hydrogeological experience)</p> <p>Mr Andrew Penrose, a Chartered Structural Engineer (CEng) and Member of the Institution of Structural Engineers (MIStructE). (25+ years' experience in geotechnics and hydrogeology)</p> <p>Mr Thomas Murray MSc BSc (Hons) FGS (3.5+ years of hydrogeological experience)</p>

Table A – Qualification Summary (note all relevant signatures are at the end of the BIA)

3.0 SITE DETAILS

(National Grid Reference: TQ 277 844)

3.1 Site Location

14 Eton Road is a residential property, located on the north-western side of Eton Road, Belsize Park at approximate postcode NW3 4SS. The residential dwelling has four levels of accommodation; lower ground, ground, first and second floor. The residential property also comprises a one storey garden room within the rear garden of the property. The site covers an approximate area of 0.05 Hectares with the general area being under the authority of the London Borough of Camden.

The site is located on the north-western side of Eton Road with residential properties to the north-east and west and a roadway to the south and east.

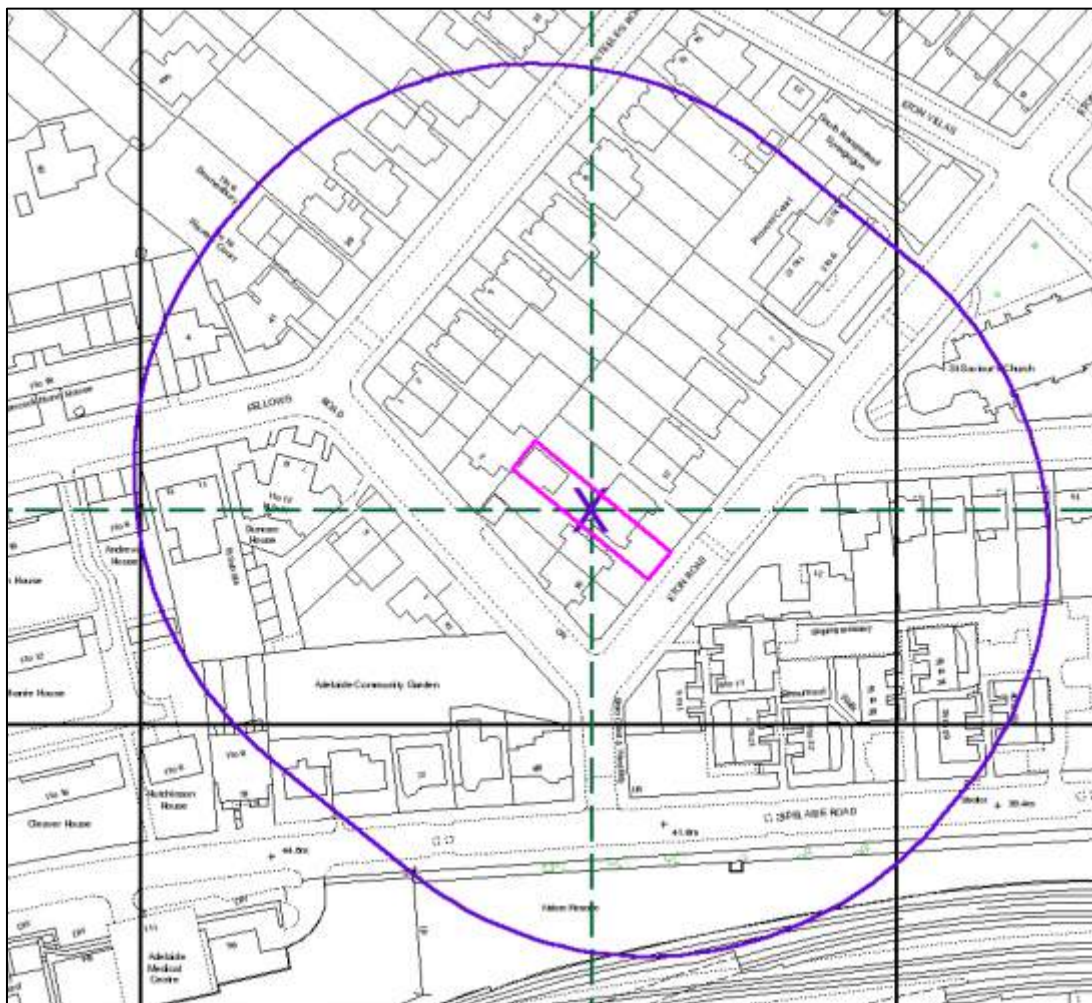


Figure 1. Site Location Plan

3.2 Site Layout and History

The site is accessed from Eton Road located to the south-east and comprises of a semi-detached two storey residential property and a one storey garden room within the rear garden.

The property is bound by Eton Road to the south-east, with residential properties to the north-east, north-west and south-west.

The property contains a brick paved driveway in front of the main property with a small grass lawn to the side, The rear of the site is covered by an AstroTurf lawn with a path along one side leading up to the summer house.

The site slopes very gently to the south east with levels of 45.20mSD recorded at the rear of the site and 43.95mOD recorded in the front of the property. The slope angle is less than 7 degrees. Also with reference to the Camden Geological, Hydrogeological and Hydrological Study, (Figure 2 below), the neighbouring properties also have slopes less than 7 degrees.

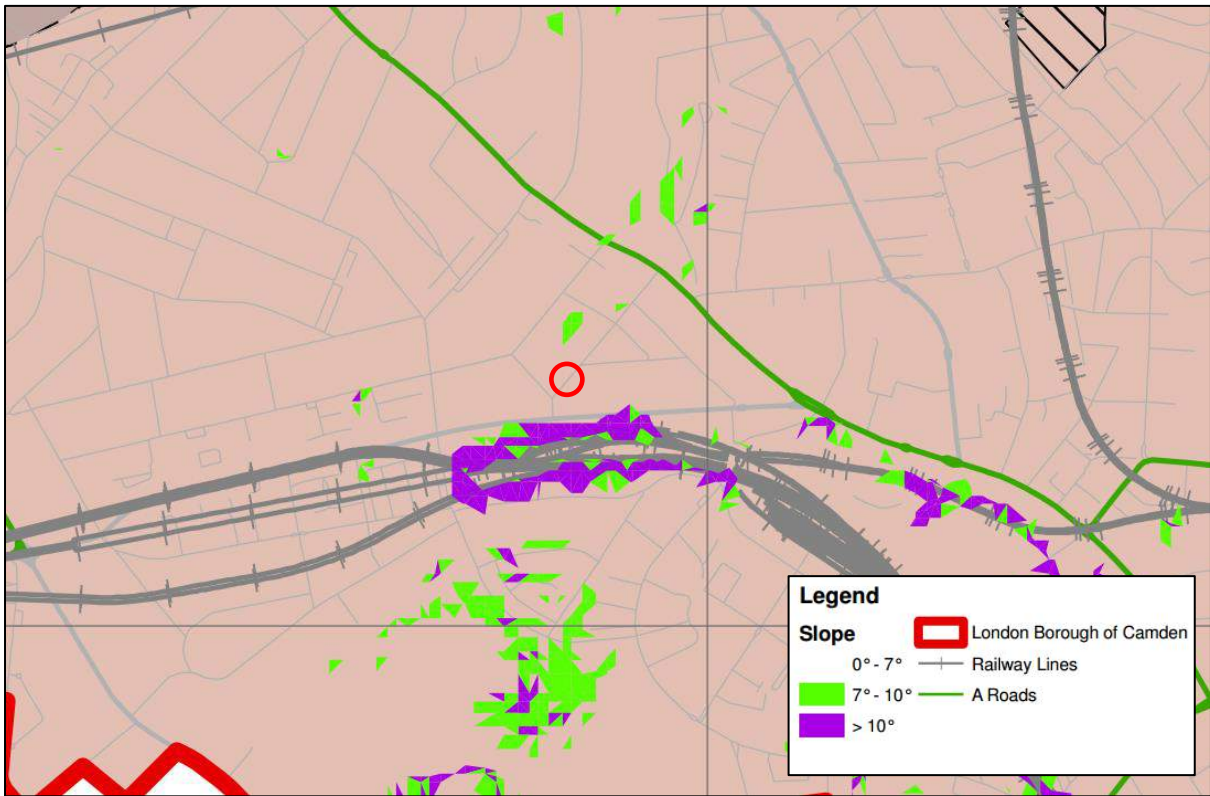


Figure 2. Exact from Figure 16 of the Camden CPG4 showing slope angles within the borough

From historical map evidence, it would appear that the site was first built on prior to 1871, with the garden room at the rear of the property being constructed between 1970 and 1972. The surrounding area has been residential throughout its history, although some industrial sites including a garage and railways have been present within the area.

3.3 Previous Reports

A Phase 1 Preliminary Risk Assessment (PRA) (SAS Report Ref: 17/27107) and a Site Investigation (SAS Report Ref: 17/27107-1) was undertaken across the site by Site Analytical Services Limited in July 2017 and the results are discussed in this BIA.

3.4 Geology

The 1:50000 Geological Survey of Great Britain (England and Wales) covering the area (Sheet 256, 'North London', Solid and Drift Edition) indicates the site to be underlain the London Clay Formation at depth.

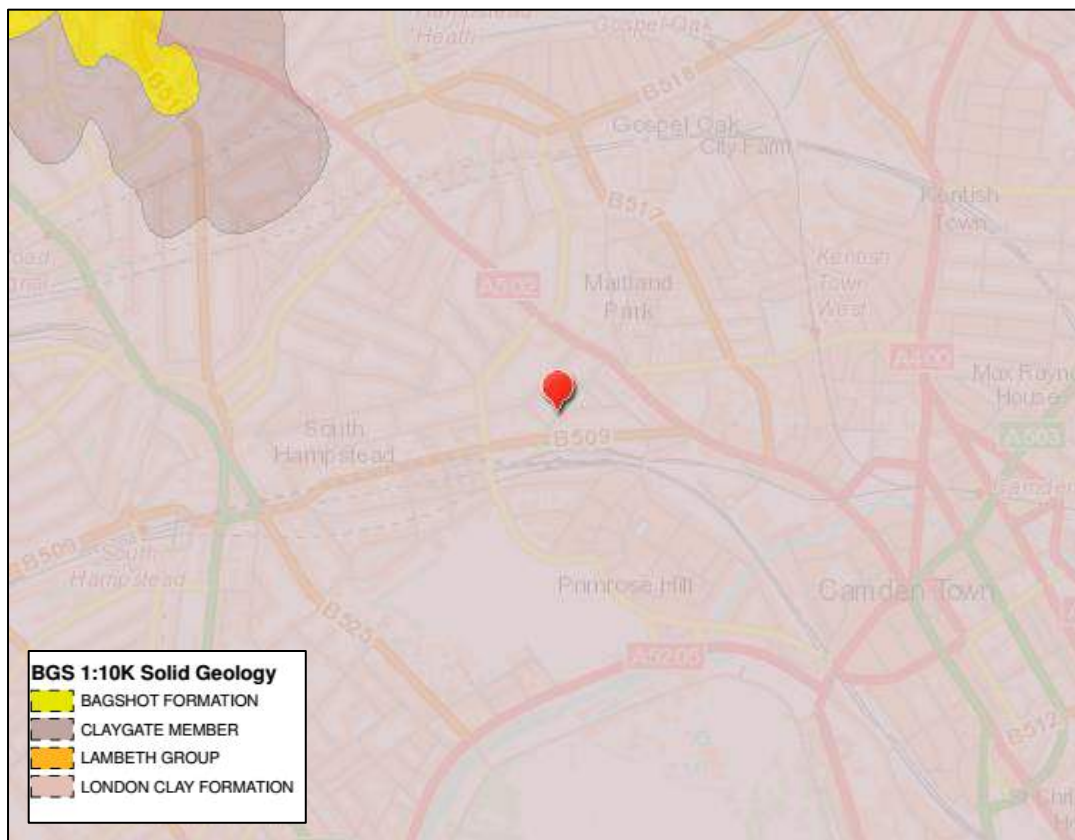


Figure 3. Geology of the Site (Ref. BGS Geoindex)

The British Geological Survey maintains an archive of historical exploratory borehole logs throughout the UK. SAS Limited has searched the database and has found that there is one borehole located within 150m of the site. This is located 75m to the south-east of the site and reveals Made Ground to a depth of 1.50m with the London Clay to the full depth of excavation at 10.0m.

According to records from the BGS the site is not in the vicinity of any recorded areas of worked ground (Figure 4).

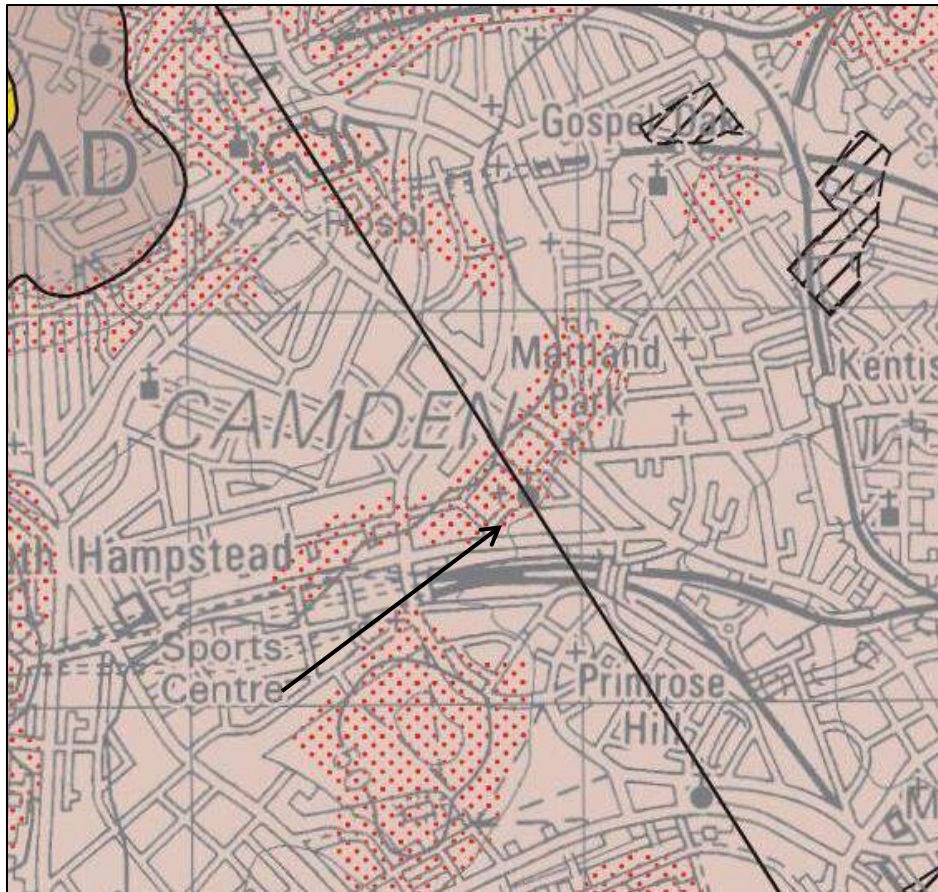


Figure 4. Worked Ground in relation to the site (Ref. BGS Map No. 256)

3.5 Hydrology and drainage

3.5.1 Surface Water

According to Mayes (1997) rainfall in the local area averages around 610mm/year and significantly less than the national average of around 900mm/year.

Evapotranspiration is typically 450mm/year resulting in about 160mm/year as 'hydrologically effective' rainfall which is available to infiltrate into the ground or run-off as surface water flow.

With reference to Camden Geological, Hydrogeological and Hydrological Study (1999), Talling (2011) and Barton (1992) one tributary of the 'lost rivers' River Tyburn was located approximately 800m west of the site respectively (Figure 5).

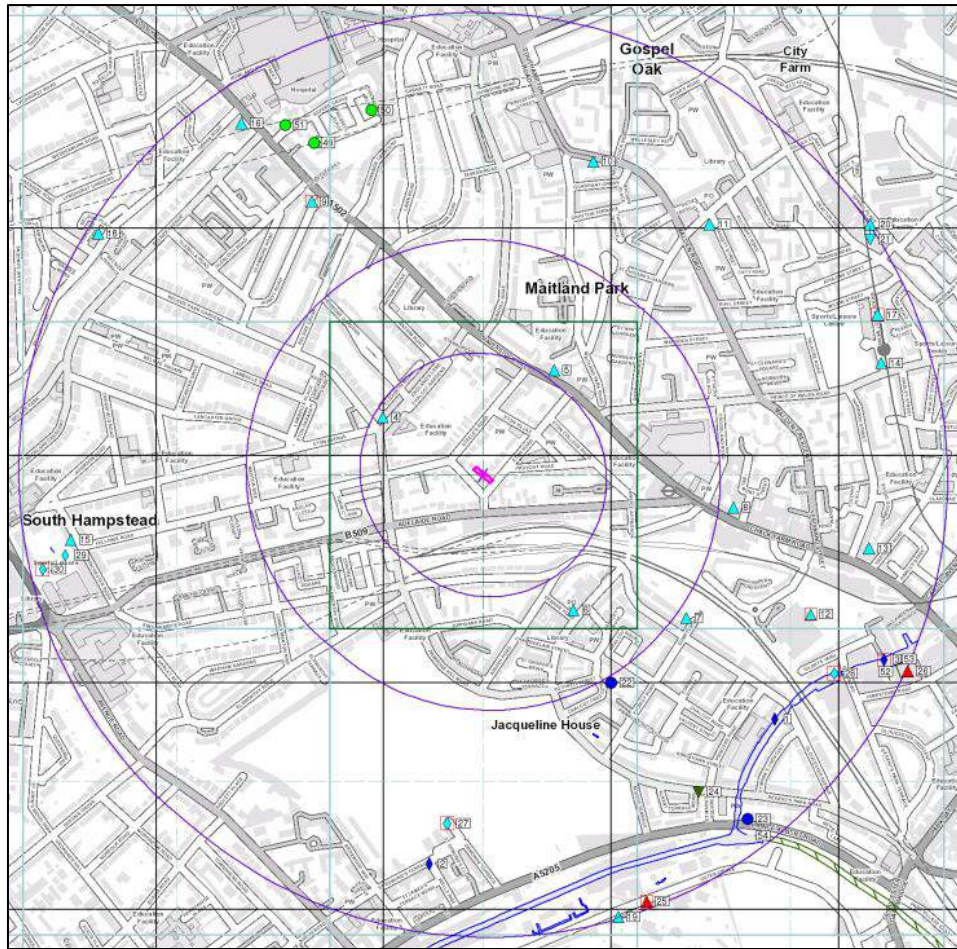


**Figure 5. Location of site (circled) relative to the ‘Lost Rivers’ of London
(Source: Barton, 1992)**

The River Tyburn flowed in a southerly direction from Shepherds Well (or Conduit Well) located to the south of Spring Path. From the well it flowed southwards down Fitzjohn’s Avenue, through Swiss Cottage and into Regent’s Park, where it entered into a large lake. From the lake it flowed southwards through the West End and the City of Westminster, before issuing into the River Thames close to Vauxhall Bridge.

The watercourses have since been largely lost through a culverting system as the urban extent of the borough has grown over time.

Envirocheck indicates that the closest surface water feature is a canal located 597m south-east of the site as indicated in Figure 6 below.



**Figure 6. Surface Water Feature Map
(Source: Envirocheck)**

The area located immediately around the site is highly developed with more than 80% of the surface covered with hardstanding. Most of the rainfall in the area will run-off hard surface areas and be collected by the local sewer network.

Surface drainage from the site is assumed to be directed to drains flowing downhill to the south-west along Eton Road.

The British Geological Society 'Geoindex' indicated the nearest water well is located approximately 530m north-east of the site (Figure 7).



Figure 7. Water Well Location Map
(Source: BGS 'Geoindex')

With reference to the Camden Geological, Hydrogeological and Hydrological Study, the site is not within the catchment of the pond chains on Hampstead, nor the Golder's Hill Chain (Figure 8).

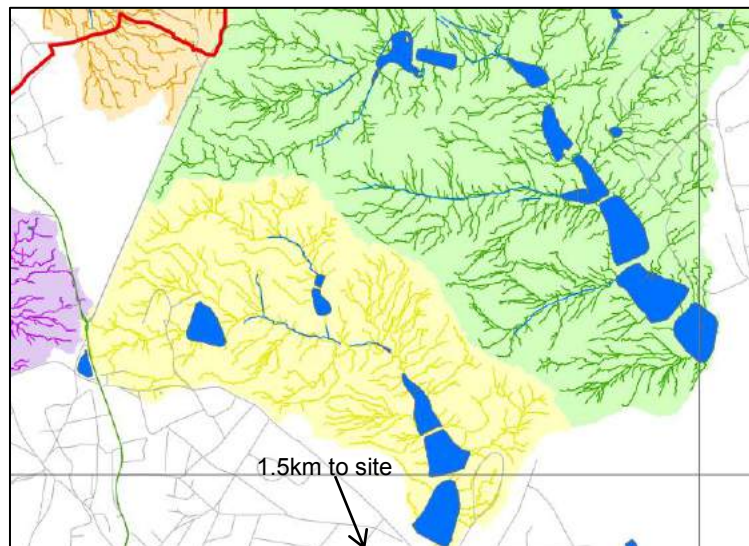


Figure 8. Hampstead Heath Surface Water Catchments and Drainage
(Source: Camden GHHS Figure 14)

3.5.2 Flood Risk

3.5.2.1 River or Tidal flooding

According to Environment Agency Flood maps there are no flood risk zones within 1 kilometre of the site. The EA's website also shows that this area does not fall within an area at risk of flooding from reservoirs. Based on this information a flood risk assessment will not be required.

3.5.2.2 Surface water flooding

Figure 9 shows that Eton Road didn't flood during either 1975 or 2002 event.



Figure 9. Exact from Figure 15 of the Camden CPG4 showing roads which flooded in 1975 (light blue), in 2002 (dark blue) and 'areas with potential to be at risk from surface water flooding' (wide light blue bands)

Further modelling of surface water flooding has been undertaken by the Environment Agency and was published on its website in January 2014; an extract from their model is presented in Figure 10. Whilst this map identifies four levels of risk (high, medium, low and very low) it is understood that it is based at least in part on depths of flooding. This modelling shows a 'Very Low' risk of flooding (the lowest category for the national background level of risk) for No.14 and the surrounding area.

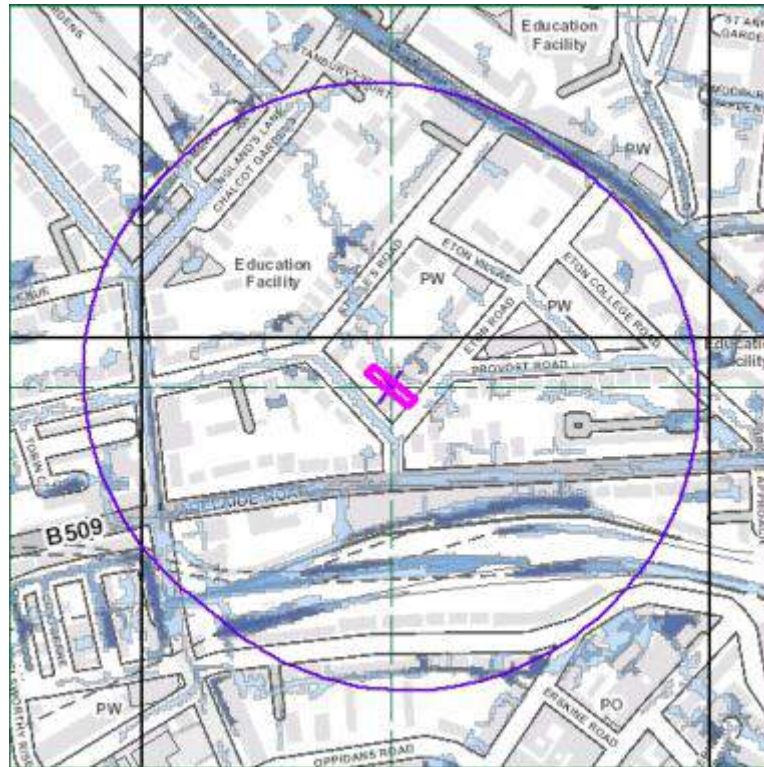


Figure 10. Extract from the Environment Agency’s ‘Risk of Flooding from Surface Water’. Ordnance Survey Crown copyright 2015. All rights reserved.

As detailed in Table 1 below, the scheme will result in an increase in permeable areas by 24.0m² (+ 86.0 m² including green roof).

Element	Existing (m ²)	Proposed (m ²)
Impermeable (hardstanding - building footprint, concrete areas)	266	242
Permeable (softscaping - grassed areas, (including green roof), permeable and porous paving)	158	182 + 86 (green roof)
Total (should be the site area and remain the same)	424	424 + 86

Table 1. Existing and Proposed Permeable Areas.

3.5.2.3 Sewer flooding

The London Regional Flood Risk Appraisal (2009) advises that foul sewer flooding is most likely to occur where properties are connected to the sewer system at a level below the hydraulic level of the sewage flow, which in general are often basement flats or premises in low lying areas. There is no record of sewer flooding having occurred at 14 Eton Road and therefore the risk of sewer flooding is considered low.

3.6 Hydrogeological setting

The Environment Agency Groundwater Protection Policy uses aquifer designations that are consistent with the Water Framework Directive. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) and also their role in supporting surface water flows and wetland ecosystems.

The Bedrock geology underlying the site (London Clay) has been classified as Unproductive Strata; rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Other hydrogeological data obtained from the Phase 1 Preliminary Risk Assessment (PRA) (SAS Report Ref: 17/27107) for the site include:

- The underlying soil classification of the site is of high leaching potential.
- A Zone II (Outer Protection Zone) is evident 150m to the south-west of the site.
- There are 11 water abstraction licences within 1 kilometre of the site. The closest is located 748m to the south of the site with the abstraction of water for Public Water Supply: Potable Water Supply - Direct from groundwater. The permitted start date for this licence is 1st April 2013.

3.7 Proposed Development

Proposals for the site include the renovation of the four-storey house, including the re-laying of the lower ground floor with a new build up, extensions to the side, front and rear and to demolish and rebuild the separate garden room so that it is approximately 700m lower than the ground level (43.75mSD).

Sections showing the proposed developments are detailed in Figure 11 below.



Figure 11. Sections of the proposed North and South Elevations of the property.

3.8 Results of Basement Impact Assessment Screening

A screening process has been undertaken for the site and the results are summarised in Table 2 below:

**Table 2: Summary of screening results**

Item	Description	Response	Comment
Sub-terranean (Ground water Flow)	1a. Is the site located directly above an aquifer.	No	The site has been classified as being situated above an unproductive (negligibly permeable) formation (London Clay) that is generally regarded as containing insignificant quantities of groundwater.
	1b. Will the proposed basement extend beneath the water table surface.	Unknown – to be confirmed by Ground Investigation	Given the presence of a non-aquifer below the site it is unlikely that groundwater will be encountered during any excavations for the proposed basement, however this will be confirmed by the ground investigation.
	2. Is the site within 100m of a watercourse, well (used / disused) or potential spring line.	No	Envirocheck indicates that the closest surface water feature is a canal located 597m south-east of the site. According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011) and Stanford (1868) one tributary of the 'lost rivers' River Tyburn was located approximately 800m west of the site respectively (Figure 5). From the British Geological Society 'Geoindex' the nearest water well is located approximately 530m north-east of the site.
	3. Is the site within the catchment of the pond chains on Hampstead Heath.	No	With reference to the Camden Geological, Hydrogeological and Hydrological Study, the site is not within the catchment of the pond chains on Hampstead, nor the Golder's Hill Chain.
	4. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas.	Yes	The amount of hardstanding on-site is expected to decrease and a green roof is to be installed and will provide attenuation of the water.
	5. As part of site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS).	No	Existing drainage paths are to be utilised where possible. Whether soakaways/SUDS are used on the proposed development is to be confirmed (beyond the scope of this report). An appropriately qualified engineer should be engaged to ensure mandatory requirements are met.
6. Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to, or lower than, the mean water level in any local pond or spring line.	No	Envirocheck indicates that the closest surface water feature is a canal located 597m south-east of the site. According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011) and Stanford (1868) one tributary of the 'lost rivers' River Tyburn was located approximately 800m west of the site respectively (Figure 5).	



			From the British Geological Society 'Geoindex' the nearest water well is located approximately 530m north-east of the site.
Slope Stability	1. Does the existing site include slopes, natural or man-made greater than 7 degrees (approximately 1 in 8).	No	There is a slight slope from north to south across the site, but is below 7 degrees.
	2. Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7 degrees (approximately 1 in 8).	No	Although there is proposed re-profiling of the site, there will be no changes on site that would increase slope angles to more than 7 degrees.
	3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees (approximately 1 in 8).	No	The surrounding area drops to the south-east, but from survey information and with reference to Figure 16 from Camden CPG 4, this is at angles of less than 7 degrees.
	4. Is the site within a wider hillside setting in which the general slope is greater than 7 degrees (approximately 1 in 8).	No	There is a general slope in the area towards the south down to the south-east, but from survey information and with reference to Figure 16 from Camden CPG 4, this is at angles of less than 7 degrees.
	5. Is the London Clay the shallowest strata at the site.	Yes	With reference to available BGS records, the London Clay Formation is expected to be encountered from ground level.
	6. Will any trees be felled as part of the development and/or are any works proposed within any tree protection zones where trees are to be retained.	Yes	It is understood that two trees are to be felled as part of the development.
	7. Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site.	Yes	The site lies above the London Clay Formation well known as having a high tendency to shrink and swell.
	8. Is the site within 100m of a watercourse or a potential spring line.	No	Envirocheck indicates that the closest surface water feature is a canal located 597m south-east of the site. According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011) and Stanford (1868) one tributary of the 'lost rivers' River Tyburn was located approximately 800m west of the site respectively (Figure 5).



	9. Is the site within an area of previously worked ground.	No	According to records from the BGS the site is not in the vicinity of any recorded areas of worked ground.
	10. Is the site within an aquifer. If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction.	No	The site has been classified as being situated above an unproductive (negligibly permeable) formation (London Clay) that is generally regarded as containing insignificant quantities of groundwater.
	11. Is the site within 50m of the Hampstead Heath Ponds	No	With reference to the Camden Geological, Hydrogeological and Hydrological Study, the site is not within the catchment of the pond chains on Hampstead, nor the Golder's Hill Chain.
	12. Is the site within 5m of a highway or pedestrian right of way.	No	Due to the nature of the proposed works, the proposed works take place to the rear of the property.
	13. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties.	Yes	The development will increase the depths of foundation at the site, although the foundation depths of adjacent properties are not known.
	14. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines.	Unknown / outside scope of report	A full statutory service search was outside the scope of this report and must be completed prior to any excavations.
Surface Water and Flooding	1. Is the site within the catchment of the ponds chains on Hampstead Heath	No	With reference to the Camden Geological, Hydrogeological and Hydrological Study, the site is not within the catchment of the pond chains on Hampstead, nor the Golder's Hill Chain.
	2. As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route.	No	No – As impermeable areas decrease, the site will have a higher capacity to cope with any surface water run-off.
	3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas.	Yes	Yes, there will be a decrease in impermeable areas on site leading to a net gain for any surface water run-off causing no negative impacts to the surface water regime within the area.



	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 watercourses.	No	As no changes are occurring above the ground at the location of the basement, surface water will not be impacted by the development.
	5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses.	No	The surface water quality will not be affected by the development, as in the permanent condition collected surface water will be generally be from roofs, domestic hard landscaping or collected from beneath the landscaping layer over the basement.
	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	No	Eton Road did not flood during either the 1975 or 2002 flood events. According to modelling by the Environment Agency, there is a 'Very Low' risk of surface water flooding (the lowest category for the national background level of risk) for No.14 and the surrounding area.