Job Number: 140513
Date: 11 March 2015

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Basement Structural Method Statement

Property Details:

27 Oakhill Avenue
Camden
NW3 7RD

Client:

London Basement Design Studio
Suite 17
Maple Court
SL6 3LW

Structural Design Reviewed by	Above Ground Drainage Reviewed by	Hydrology Reviewed by	Land Stability Reviewed by
Chris Tomlin MEng CEng MIStructE	Phil Henry MEng CEng MICE	Dr Stephen Buss MA, MSc, CGeol Ambiental	Jon Smithson BSc MSc C Geol, FGS Ground and Project Consultants Ltd

Revision	Date	Comment
-	02/07/14	First Issue for Comment
1	17/11/14	Sections 2, 9 and 11 altered; Appendices B, C and D altered.
2	16/02/15	Cover page updated
3	11/03/15	Land stability sections altered following Chartered Geologist's comments. Letter appended from Chartered Geologist confirming professional details and review.
4	11/03/15	Letter appended from hyrogeologist and Chartered Geologist confirming relevant qualifications and review of groundwater flow.

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1. Camden Planning Guidance (CPG4)

The London Borough of Camden requires a Basement Impact Assessment (BIA) to be prepared for developments including basements and light wells within its area of responsibility. CGP4 – Basements and Light wells details the requirements for a BIA undertaken in support of proposed developments; in summary the Council will only allow basement construction to proceed if it does not:

- Cause harm to the built environment and local amenity;
- Result in flooding;
- Lead to ground instability.

In order to comply with the above clauses a BIA must undertake 5 stages detailed in CPG 4:

Stage 1 – Screening
This stage should identify any areas for concern and therefore focus effort for further investigation.

Stage 2 – Scoping
Identifies the potential impacts of the areas of concern highlighted in the Screening phase.

Stage 3 – Site investigation and study
Allows greater understanding of the issues previously identified to be developed through focussed site investigation and data collection

Stage 4 – Impact assessment
Evaluation of impact, both direct and indirect, of the proposed scheme by comparison with the current situation

Stage 5 – Review and decision making
An audit of the information contained in the submitted BIA and a decision taken by the London Borough of Camden

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2. Design Information - Structural

Structural Summary

Existing Property

The existing building is a three-storey semi-detached house, which has been converted into flats. The floors of the building are costructed from timber. The external walls are constructed from brickwork. Some of the internal walls are also constructed from masonry and these are assumed to be load-bearing. Structural steelwork is also assumed to exist within the building. There is a front yard and a rear garden. The property concerned is the ground floor flat. With the exception of the communal entrance at the front, this takes up the whole of the ground floor. There is a ground floor extension to the rear of the main building. Below part of this there is a cellar.

Figure 1: Street plan

Figure 2: Birdseye View from south

Proposed works

The proposed works require the insertion of a new basement under the rear garden. Part of the new basement will extend below the existing rear extension.
It should be noted from the photo above and the appended drawings, that the basement will be a significant distance away from the wall of the main building; the new development is therefore not expected to have any significant structural impact on this.

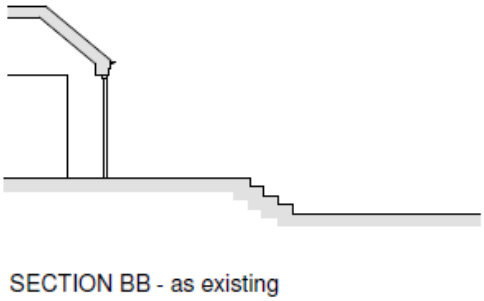

Figure2a: Architect's section (existing)

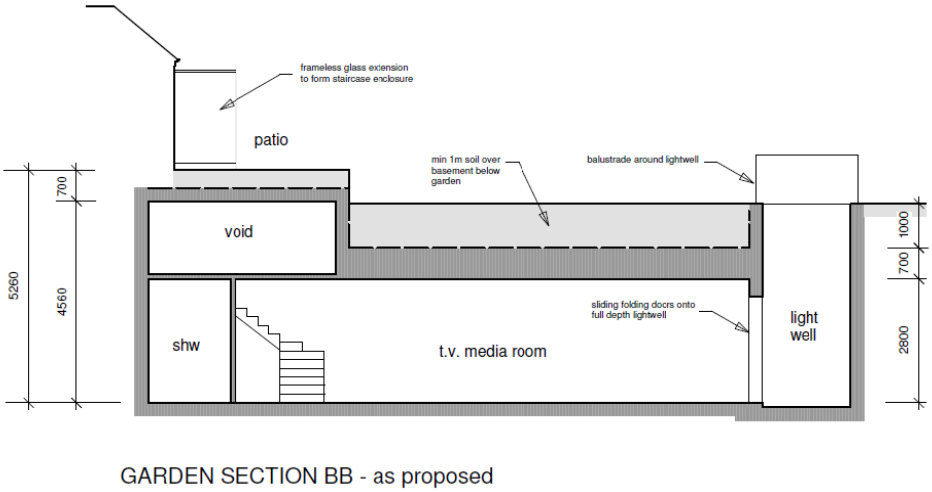

Figure2b: Architect's section (proposed)

Croft Structural Engineers Ltd Structural Engineers has extensive knowledge of inserting new basements. Over the last 5 years we have completed over 200 basements in and around the local area. The method developed is:

1. Excavate to allow for conveyor to be inserted.

2. Construct cantilevered retaining walls

3. Slowly work along the perimeter of the building, constructing 1000mm long cantilevered retaining walls sequentially.

4. Cast ground slab

5. Waterproof internal space with a drained cavity system.

A more detailed method statement is proposed in Appendix D. This

Intended use of structure and user requirements	includes details, with supporting calculations, of temporary propping to prevent damaging ground movements. **Structural Defects Noted** No defects were noted during the Chartered Engineers first visit. Family/domestic use

DP27 A	**Maintain Structural Stability of the building & Neighbouring Properties.** The appended drawings show the reinforcement and construction required by maintain stability of the building, and the neighbouring properties. Calculations results are shown in the Stage 4 – Impact Assessment
B	**Avoid Adversely Affecting drainage and Run off.** There will be a minor increase in the area of hard standing, due to the rear light-well. The runoff will not be altered significantly. The property will not affect the main aquifer See Screening Stage information
C	**Avoid Cumulative Impact upon Structural Stability or the water environment.** See Scoping stage, which indicates location in relation to water courses and Hampstead heath catchment. See Stage 4 Impact Assessment and drawings. Additional drainage layer has been placed under the building (hardcore and sand below). The structure is designed to take account of Hydrostatic head on the basement.
D	**Harm the Amenity of Neighbours** Noise and nuisance has been considered in Stage 4
E	**Loss of Open Space or Trees** There is no loss of open space. There are two trees close by, a copper beech and an ash. The basement is unlikely to be cutting into the root zones, however, root protection barriers will be required

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3. Basement Impact: Stage 1 - Screening

Groundwater flow

The questions below are taken from the Camden CPG 4 – Basements and Lightwells.

Questions have been taken from Appendix E of the Arup Hydrology report

Figure 1 – Subterranean flow screening chart

1a. Is the site located directly above an aquifer?

No. The Environment Agency maps do not show the site to lie above a principal aquifer or groundwater source protection zone. However, studies from these maps show the presence of a secondary aquifer below.

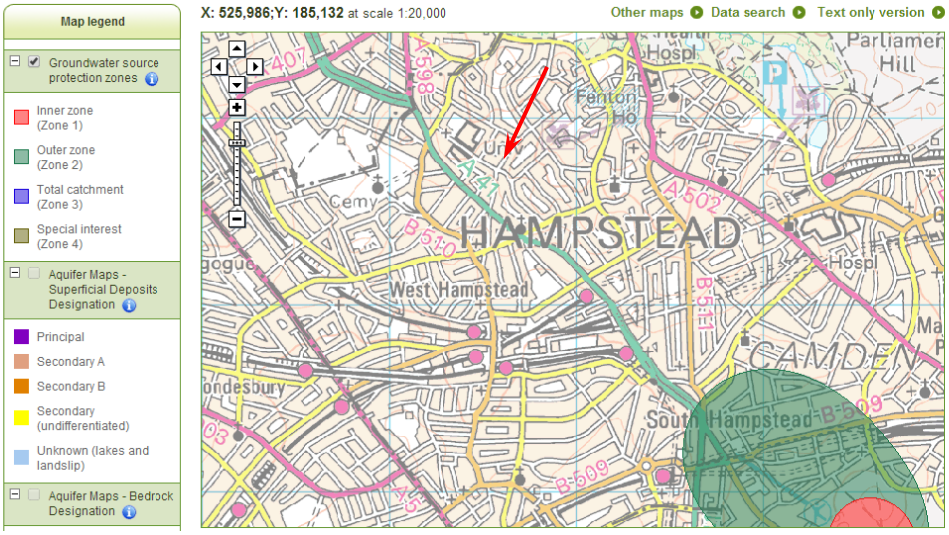


Figure 3: Environment Agency Map showing Groundwater Protection Areas

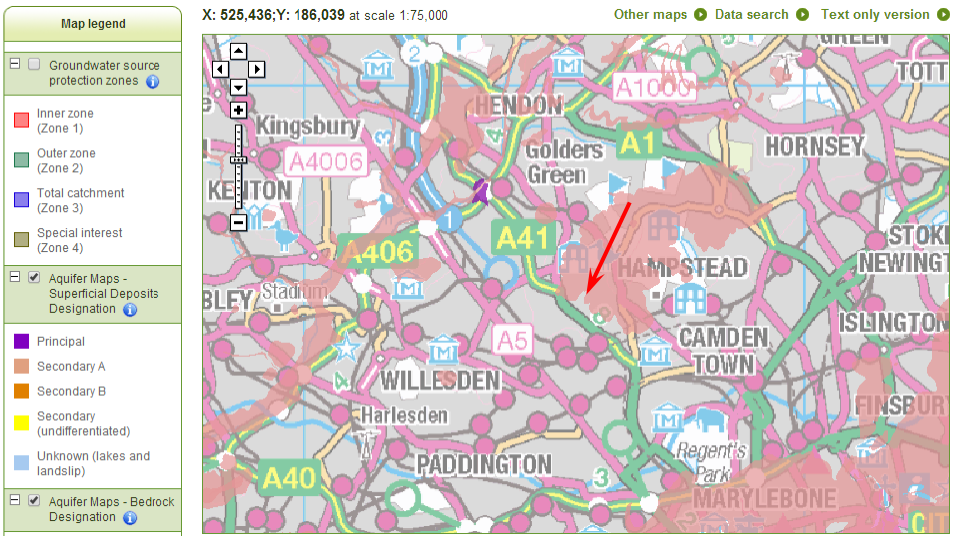


Figure 4: Environment Agency Map showing secondary aquifers in the bedrock

1b. Will the proposed basement extend beneath the water table surface?
No. Geological maps indicate that the site lies on London Clay. This deposit is of low permeability and will not support significant flows of water.

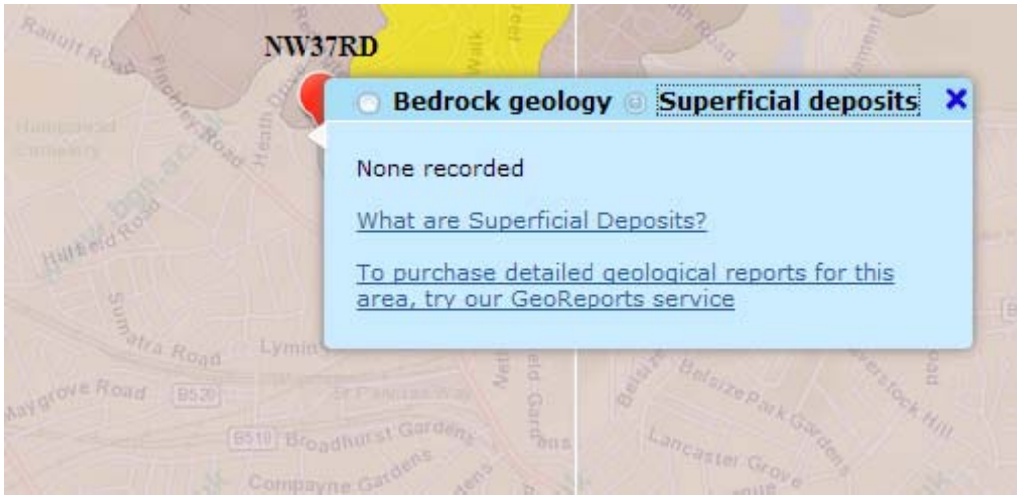


Figure 5: BGS viewer with details of superficial deposits

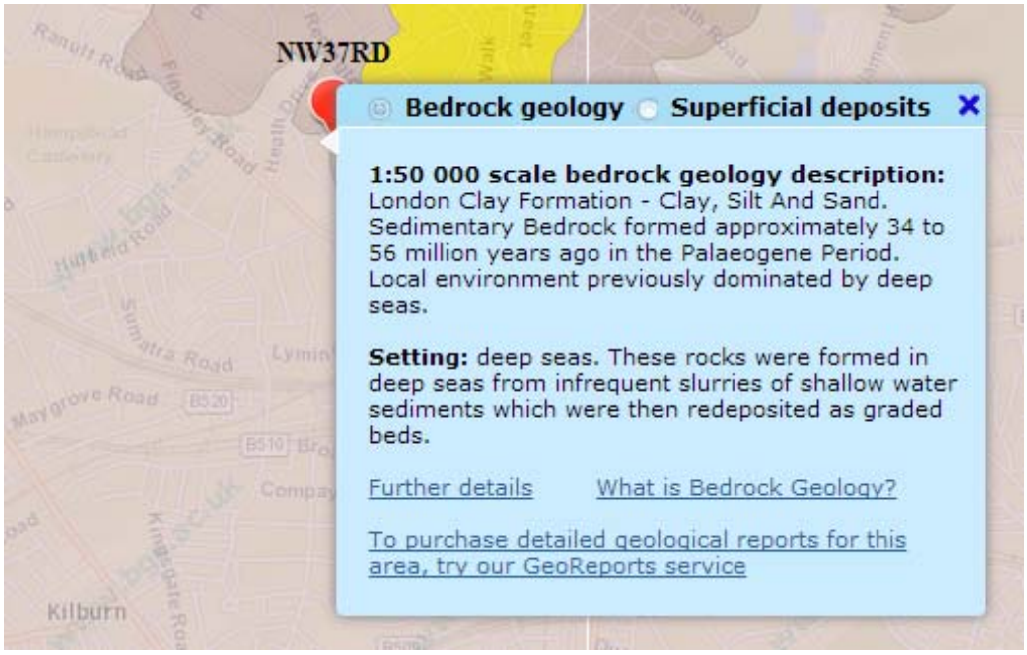


Figure 6: BGS viewer with details of bedrock

Carry forward to scoping stage.

2. Is the site within 100m is a watercourse, well used/disused or potential spring line?
Yes. OS maps and local walkover survey show no wells or watercourses close by. However, as shown on the BGS viewer, the site is within 100m of the boundary of the London Clay and the overlying Claygate Beds (which are

more permeable). This boundary may act as a potential spring line.

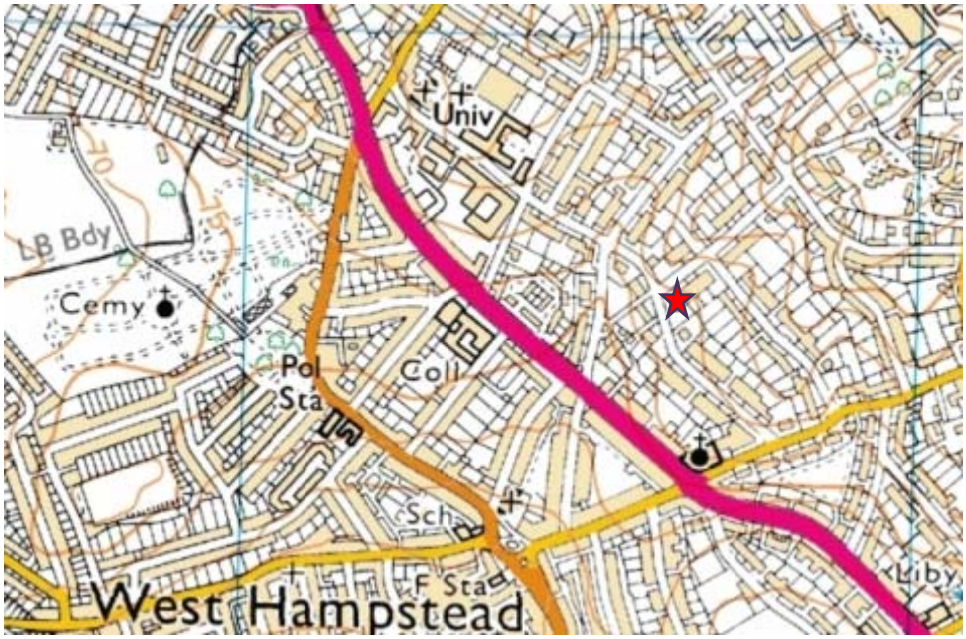


Figure 7: OS map

Carry forward to scoping stage.

3. Is the site within the catchment of the pond chains on Hampstead Heath?

No. The site lies outside the areas which feed into the pond chains on Hampstead Heath, as shown in Figure 14 of The Guidance for subterranean development (Arup, November 2010).

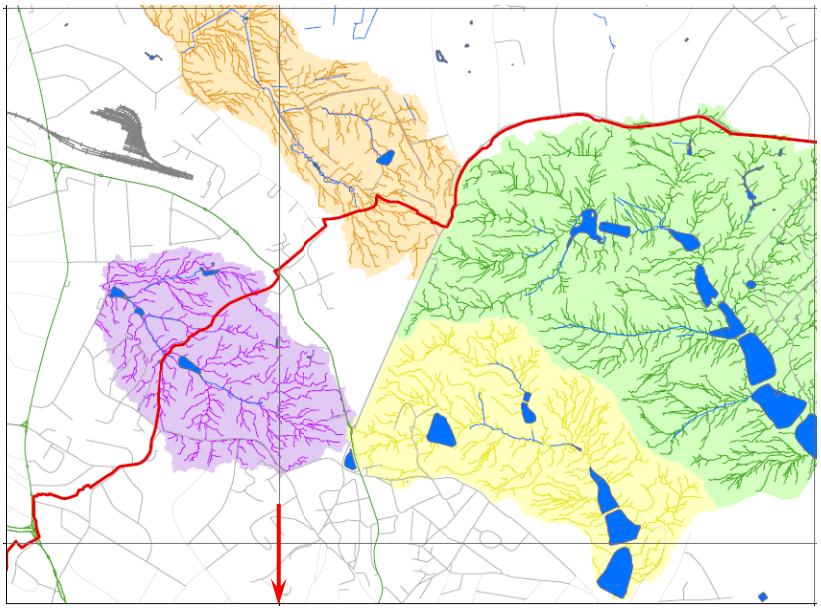


Figure 8: Figure 14 of Arup's report showing surface water catchments (site off map)

	4. Will the proposed basement development result in a change in the proportion of hard surfaced/ paved areas? **Yes**. There will be a minor increase in the area of hard surfaces to the rear. Carry forward to scoping stage. **5. As part of the 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 roof Drainage will run into the existing drainage system. Surface water will still discharge to ground. **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 and local pond (not just the pond chains on Hampstead Heath) or spring line?** **Yes**. From walkover and OS maps, there are no local ponds or springs of significance. However, the site is close to the London Clay and Claygate boundary which may produce a spring line. Carry forward to scoping stage.
Slope Stability	**Figure 2 – Slope Stability screening flowchart** **1. Does the existing site include slopes, natural or man-made greater than 7° (approximately 1 in 8)?** No, Figure 16 from Arup's report shows that the difference in height between the rear garden and front is less than 1 in 8 slope (approximately flat). 

Figure 9: Extract from Figure 16 of Arup's report showing slope angle

2. Will the proposed re profiling of landscaping at site change slopes at the property boundary to more than 7° (approximately 1in 8)?
No. The proposed profile at the boundary of the property will remain unchanged.

3. Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7° (approximately 1 in 8)?
No. From inspection of the above figure, the slope of the adjacent properties appears to match the site.

4. Is the site within a wider hillside setting in which the general slope is greater than 7° (approximately 1 in 8)?
No. The slope of the wider hillside setting is as per the property, less than 7°. From Figure 16 the slope angle is shown less than 7° and assessment of OS maps suggests local slopes are approximately 1 in 20.

5. Is the London Clay the shallowest strata on site?
Yes. The site sits on the London Clay formation. The boundary with the overlying Claygate Beds is indicated close by to the north east. The Ground investigation at the neighbouring house (no. 25) also encountered clay deposits. These have been interpreted as Claygate beds but it is likely that this is also London Clay.
Carry forward to scoping stage.

6. Will any tree/s be felled as part of the proposed development and/or are any of the works proposed within any tree protection zones where trees are to be retained?
No. No local trees are to be felled. However the impact of the basement on trees close to the development should be considered

Carry forward to scoping stage.

7. Is there a history of seasonal shrink-swell subsidence in the local area, and/

	or evidence of such effects at the site? **No**. From the walk over survey Subsidence was not considered as an issue on this site. The site is on shrinkable ground and as such has an increased risk to subsidence. The basement and all foundations will be designed to take account of the ground conditions. The basement construction places the loads of the property on to deep ground. The depth further protects the building from the seasonal changes in the ground. **8. Is the site within 100m of a watercourse or a potential spring line?** **Yes.** OS maps and local walkover survey show no wells or watercourses. However, the site is within 100m of the boundary of the Claygate and London Clay interface. Carry forward to scoping stage: Soil investigation to be completed. **9. Is the site within an area of previously worked ground?** **No**. From the historical maps, the site has been residential for the past 100 years. Prior to this the site was undeveloped. Carry forward to scoping stage: Soil investigation to be completed to confirm the ground conditions. **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 Environment Agency maps do not show the site to lie above an aquifer.

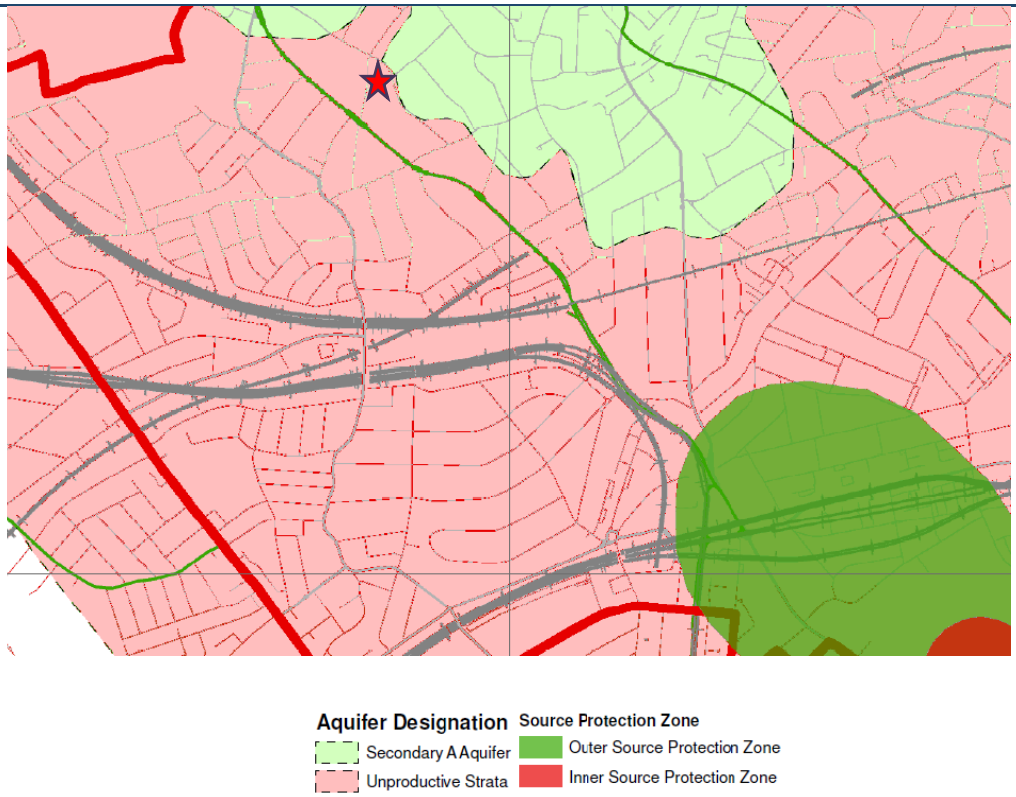


Figure 10: Extract from Camden Aquifer Designation Map(Arup's report, Fig 8)

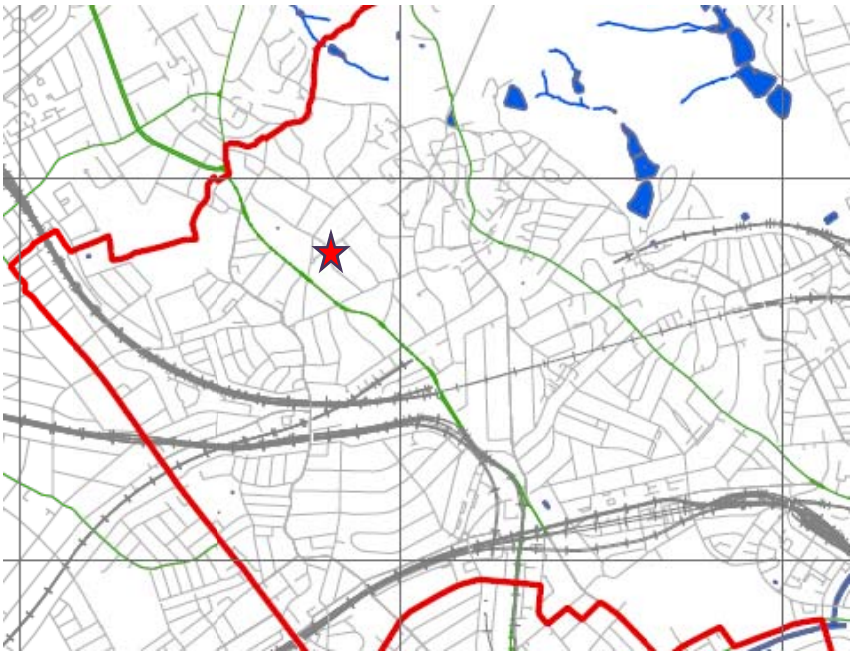
However the Arups report shows the site to be close to a secondary A Aquifer (Claygate Beds). This is perched water on top of the permeable clays.

Carry forward to scoping stage: Soil investigation to be completed.

11. Is the site within 50m of the Hampstead Heath ponds?'

No.

(Arup Report Figure 12)



Surface flow and flooding	*Figure 11: Extract from Camden Surface water features map (Arup's report, Fig 12)* **12. Is the site within 5m of a highway or pedestrian footway?** **No**. The site will below part of the rear extension only. It will not be within 5m of a pedestrian footway. **13. Will the proposed basement significantly increase the differential depth of foundations relative to the neighbouring properties?** **Yes**. The differential depth will increase by about 3000. This is based on the assumption there are no floors below the ground level of the adjacent properties. <u>Carry forward to scoping stage. Overall design to be considered.</u> **14. Is the site over (or within the exclusion zone) of any tunnels, e.g. railway lines?** **No**. The nearest LUL Line is approximately 400m away from the site. **Figure 3 – Surface flow and flooding screening flowchart** **1. Is the site within a catchment of the pond chains on Hampstead Heath?** **No.** The site lies outside the catchment areas of the Hampstead heath ponds, as shown previously on Figure 14 of Camden Hydrological Study. **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**. The development will not result in a material change of the surface water flows into the existing sewers. **3. Will the proposed basement development result in a change to the hard surfaced /paved external areas?** **Yes.** The amount of hard standing will increase slightly, by approximately 6m^2. **4. Will the proposed basement result in changes to the inflows (instantaneous and long term of surface water being received by adjacent properties or downstream watercourses?** **No**. The proposed development will enter the current drainage system. **5. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?** **No**. The quality of water received by adjacent properties is unlikely to be altered. **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 lever of a nearby surface water feature? The data from the EA website shows that the site is not within a zone at risk of flooding from rivers. On Figure 15 of the Camden Geological, Hydrogeological and Hydrological Study (Arup), the street is not noted to have flooded in 1975 and 2002. The basement may be below the static water level and investigation is required. In CPG4 (page 29), Oakhill Avenue is not identified as being at risk of surface water flooding.

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4. Basement Impact: Stage 2 – Scoping

Requirements	The scoping stage of the BIA requires you to identify the potential impacts of the proposed scheme as set out in Chapter 5 of the Camden Geological, Hydrogeological and Hydrological Study which are shown by the screening process to need further investigation. This stage is used to identify the potential impacts for each of the matters of concern identified in the previous screening stage.
Groundwater flow	**Subterranean flow** There is a need to find establish groundwater conditions at site to assess impacts of the basement on groundwater flow. This will be an objective of the Ground Investigation. Ground investigation to be completed comprising one borehole.
Slope Stability	The site is over 200m away from the nearest railway tunnels. The London Clay is expected to be the uppermost strata, although to lower surface of the Claygate beds is indicated close by on the geological maps, so its presence at site cannot be discounted until the Ground Investigation has been carried out. . This will be established by the Ground Investigation.. It is possible that some cover of made ground will be found on site and this can be assessed during the Ground Investigation.
Surface flow and flooding	This proposal is not considered to be in an area at risk of flooding. The flow of surface water from the rear lightwell is minimal and will be incorporated into the basement drainage. The flow of surface water above the basement (top 1m of soil) will need to be considered.

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5. Desk Study and Walkover Survey

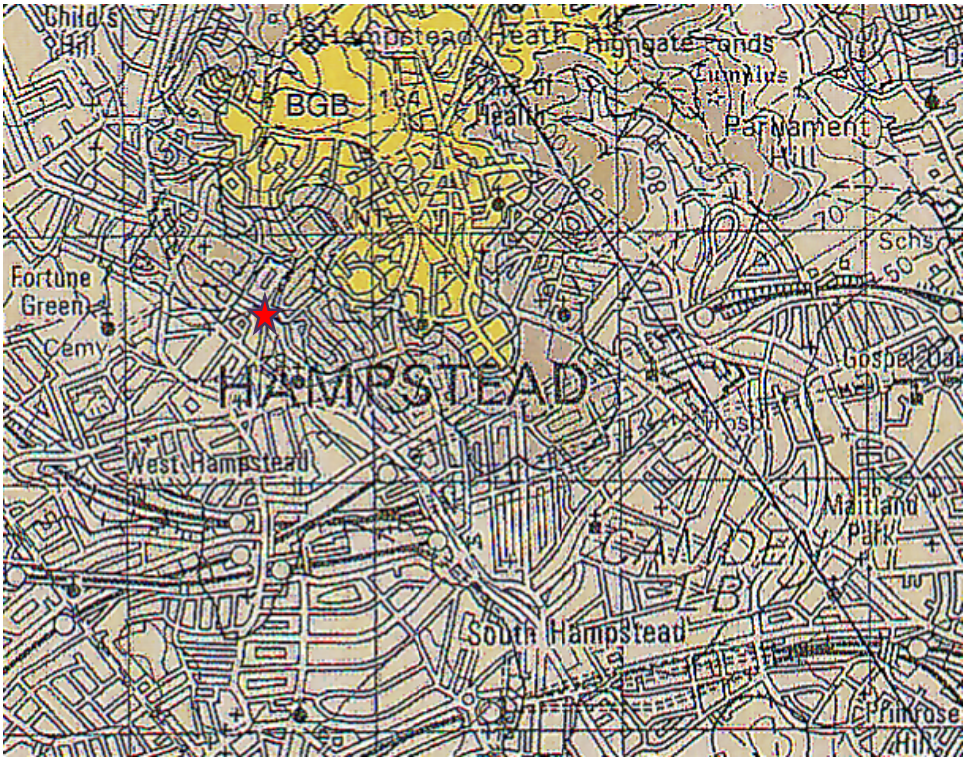
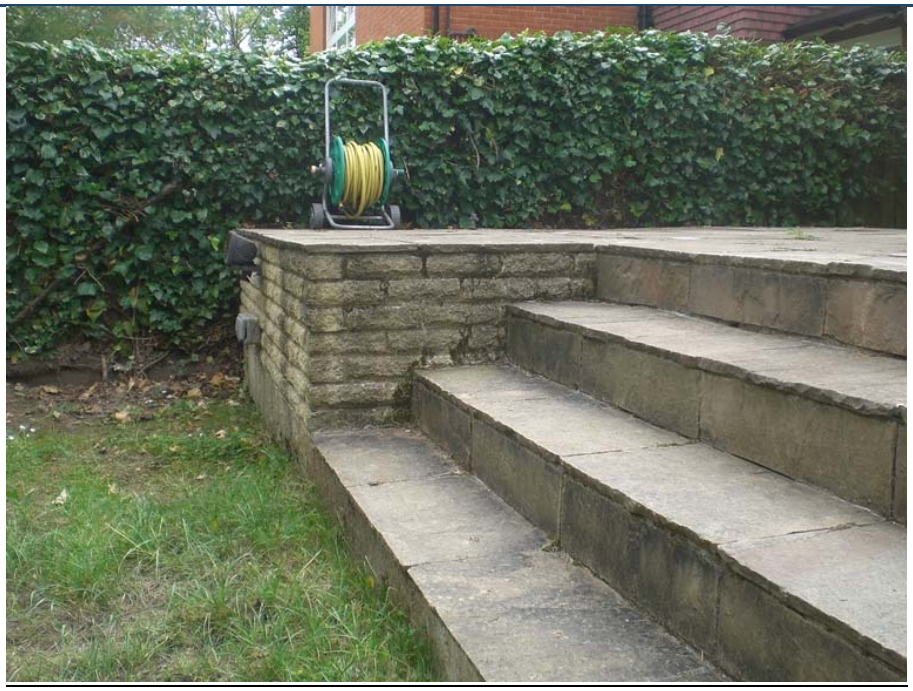
Subsoil conditions	A Ground Investigation has been commissioned to determine the soil conditions and establish groundwater conditions. The North London Geological Maps Indicates the site is underlain by London Clay.  *Figure 12: Extract From North London Drift Sheet*
Walk over Survey	

Figure 13: Rear elevation of existing property

Figure 14: Boundary with No 25

	 *Figure 15: Boundary with No 50 Bracknell Gardens* Note adjacent properties. The existing building did not exhibit any signs of subsidence or movement. The basement is not immediately adjacent to any neighbouring structures, however the effects of the development on the main building, which houses multiple dwellings will need to be considered.
Vicinity of Trees	The nearest tree is a semi-mature copper beach to the rear, approximately 2m away from the proposed basement
Drainage effects on Structure	No build over agreements known.
Underground	Online maps indicate that the site is approximately 400m south from the nearest railway lines belonging to Network Rail and London Underground. The locations of the site is outside of their area of concern.
Sources of Contaminates	From the Historic Maps it can be seen that past ground use is highly unlikely to have led to ground contamination issues. During the walk over survey there were no obvious indications of land contamination.
Water Course	From inspection of current OS maps, no natural water courses or wells exist nearby.

No water course is shown passing through the site on the historic map shown in Figure 11 of the Guidance for subterranean development (Arup's report) although a 'lost' river, presumably culverted, is indicated around 50m away.

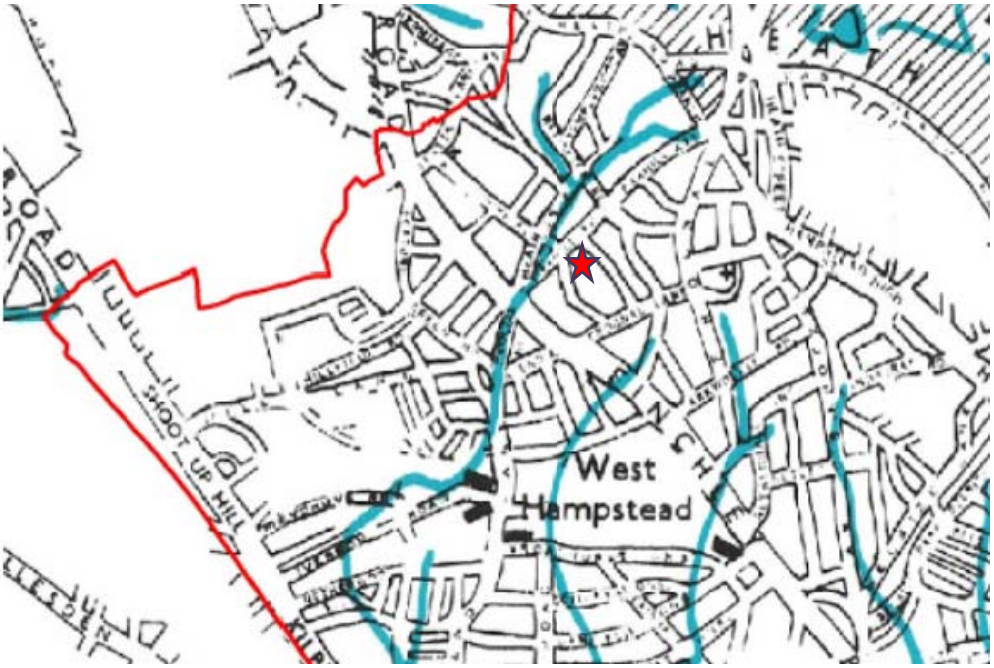


Figure 16: Locations of lost rivers (Fig 11 of Arup's report)

As mentioned previously, the site is not shown within the areas of recent local flooring in the Arup's report.

The site is not within the Hampstead pond catchment area as shown in the Arup's report.

The site is not within any open water course.

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6. Historic Maps

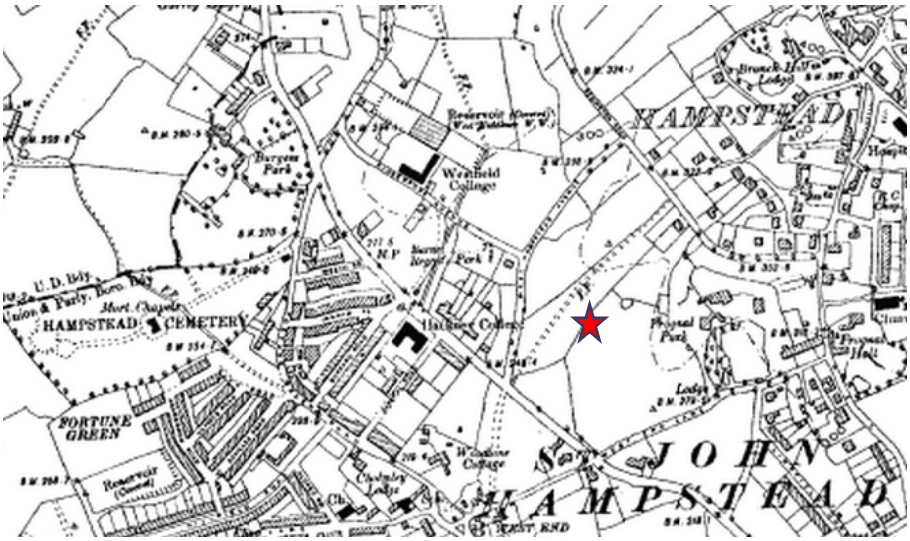

Figure 17: Extract from 1896 map.

Figure 18: Extract from 1920 map.

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7. Flood Risk Assessment

In accordance with guidance from CIRIA and the National Planning Policy Framework, the basement will be designed to be sustainable in terms of the risk of flooding. Amongst other considerations, the design will include provisions to minimise the adverse impacts of flooding on the operation of the building, the users, the surroundings and the occupants of nearby properties. This must be preceded by a Flood Risk Assessment (FRA), and is staged as follows:

- A screening study to identify potential sources of flooding.
- A subsequent scoping study to consider further the identified sources, assessing the risks proposing measures to mitigate them.

7.1. Site Location

The site is approximately 500m² in size. It is located in a densely built-up area. The site itself appears to lie on relatively flat ground. From inspection of OS contours, Oakhill Avenue slopes down from north-east to south-west, by approximately 1 in 15 to 1 in 20. Residential houses exist either side of the site. The adjacent buildings are at different levels: No. 25 Oakhill Avenue is higher, No. 50 Bracknell Gardens is lower. There are gardens to the front and rear of the site.
The nearest known water course is over 500m away.
The EA has not identified any flood risks associated with the nearby water courses.

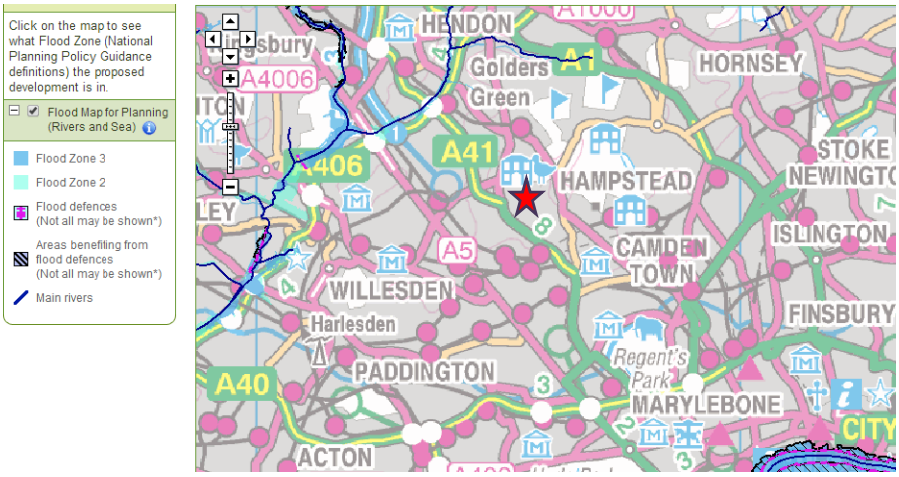

Figure 19: Flood map for planning (Environment Agency)

The site is within Zone 1, a low probability flood risk area.

7.2. Proposed Basement

The proposed basement will be beneath the front half of the existing building. This will include a lightwell to the rear.

7.3. Screening

The potential sources of flooding are summarised below:

Potential Source	**Potential Flood Risk at Site?**	**Justification**
Fluvial flooding	No	EA Flood Mapping shows Flood Zone 1. Distance from nearest surface watercourse >1km
Tidal flooding	No	Site location is 'inland' and topography > 40mAOD.
Flooding from rising / high groundwater	No	Site is located on low permeability London Clay.
Surface water (pluvial) flooding	No	The site is not recorded as being flooded in1975 or 2002
Flooding from infrastructure failure	Yes	Drainage at or near the site could potentially become blocked or cracked and overflow or leak. Drainage of the basement may rely on pumping.
Flooding from reservoirs, canals and other artificial sources	No	There are no reservoirs, canals or other artificial sources in the vicinity of the site that could give rise to a flood risk.

7.4. Scoping Study

It is evident from the screening study that the only significant flood risks are due to failure of existing sewers in the vicinity of the site. Croft has obtained further information to clarify the risks and propose mitigation measures.

7.5 Potential flooding from infrastructure failure

Blockage or failure of the local sewer and site drainage may result in the flooding of the basement.

A pumping mechanism will be installed for the proposed basement. There is a likelihood that this may fail and allow excess water to accumulate. If this were to occur, the build-up of water would be gradual and noticeable before it becomes a significant life-threatening hazard.

7.6 Mitigation measures

We would recommend the following measures to reduce the risks mentioned above:

- Construct an upstand around the front lightwells to form a barrier against excess flow.
- Install a dual pumping system to maintain operation in the event of a failure. This should include a battery backup and a suitable alarm system for warning purposes.
- Install mechanical and electrical service runs at high level, to reduce the likelihood of these been affected by local flooding.

7.7 Summary

The location of the site does not increase the risks of flooding from excess surface water. There is a risk of flooding due to the failure of the pumping system but this can be reduced to acceptable levels with appropriate design and installation measures.

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9. Stage 3 - Site Investigation

Monitoring and Reporting	Chelmer Site Investigations completed a borehole investigation. From the Scoping stage we developed the following for the brief: • A borehole to a depth of 6 metres. • In-situ site testing to determine soil parameters. • Factual Report on soil type and conditions. • The Historic maps and walk over survey did not highlight any obvious potential for contaminated soils, therefore no chemical testing of the ground was carried out. Refer to Appendix E for the Ground Investigation Report. At detailed designed stage, a ground investigation with an extended brief and detailed interpretative geotechnical report should be completed. The Investigation encountered a thin cover of turf/topsoil overlying Made Ground (probably arising from the house construction) to a depth of 0.7m. This was found to overlie a Firm brown silty CLAY with claystone nodules and crystals (probably selenite). This was assessed to become stiff at 1.5m and very stiff at 3.6m. Hand shear vane tests confirm the assessed undrained shear strength. This deposit is interpreted to be London Clay. The borehole was terminated at 6mbgl. The borehole was dry at completion and no ingress of groundwater was noted.

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9. OS Map extract showing location of Railway

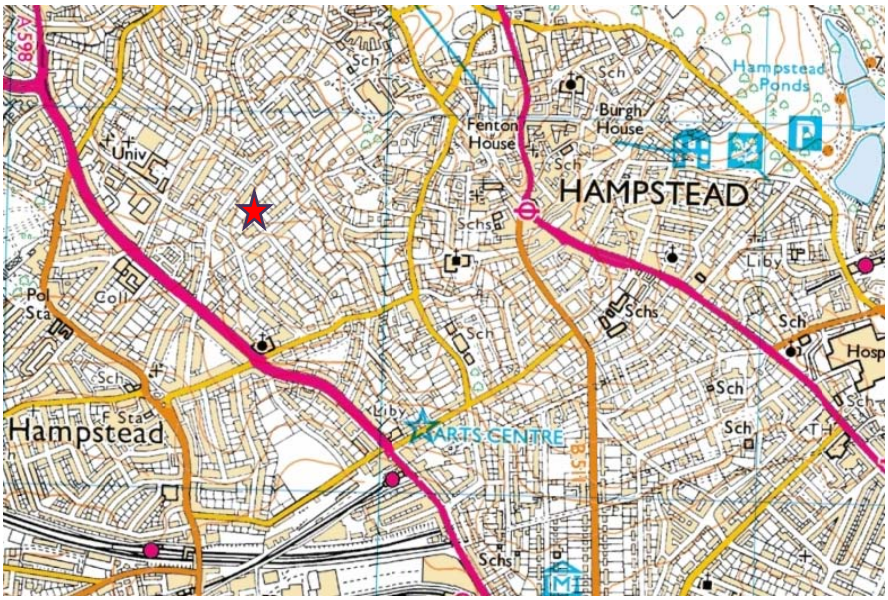

Figure 20: Extract from OS map showing proximity to nearest railways

Refer to Section 5 for more details.

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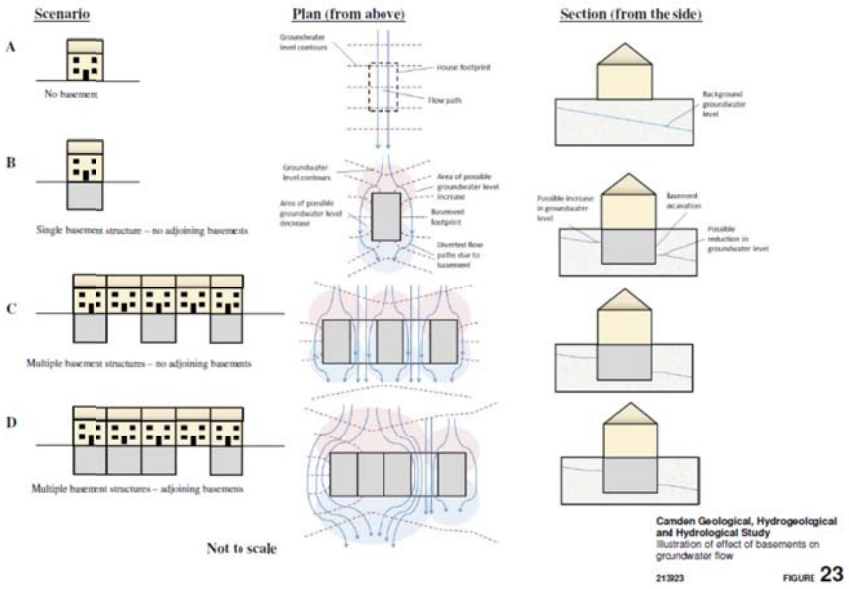
10. Stage 4 - Impact Assessment

Subterranean flow	The site is not within the catchment of the Hampstead Heath Ponds. It is a considerable distance from the ponds and other standing water bodies in the area. The development will not have an impact on the Hampstead heath ponds nor their catchement. The proposed development depth is expected to be at 4.5m below external ground floor level. The ground below the proposed basement and lightwell is London Clay. This is of low permeability and therefore significant groundwater flows are not expected. The site investigation did not encounter groundwater, although its presence in the Clay cannot be entirely discounted.. The local affect of the basement may be to divert any flowing ground water away from the footprint of the building. Given the absent or very low flows and the installation of free draining material adjacent to the proposed basement walls, it is considered that the impact of the basement on groundwater levels and flow will be negligible or minimal.  ***The basement design will allow for variationsts in groundwater levels. The retaining walls must be designed to provide lateral resistance to water up to 1m from the top of the wall. The design must follow the***

	recommendations as noted in BS8102. ***A comprehensive hydrology report is considered unnecessary for this type of development.*** ***To allow for through flow of ground water, drawing SL10 shows compacted Type 1 beneath the central slab. This will facilitate the through flow of any ground water that may build up around the edge of the building.*** ***<u>Camden Council require a Chartered Hydrogeologist to complete a report for the assessment of the subterranean (groundwater) flow.</u>***
Slope Stability	From the walk over survey, the OS map and the Arups report the slopes around the site are less than 7º. It is therefore considered that there is no potentail for general slope failure arising from the basement construction. The retaining walls must be designed to accommodate the lateral pressures from the soils.
Foundation type	Reinforced concrete propped cantilevered retaining walls The designs for the retaining walls have been calculated using software. The software is specifically designed for retaining walls and ensures the design is kept to a limit to prevent damage to the adjacent property. **Wall stability calculations and deflections of walls are in Appendix C** The overall stability of the walls are designed using K_a & K_p values, while the design of the wall uses K_o values. This represents a robust approach and seeks to minimise the level of movement of the basement walls. The Investigations did not encounter groundwater. However without long term monitoring the presence of groundwater cannot be ruled out. Therefore the walls will be designed to account for hydrostatic pressure equivalent to a water table 1m below the top of the wall. This will also account for accidental groundwater rises arising from for example a burst main. The Design also considers floatation as a risk. The design of has considered the weight of the building and the uplift forces from the water. The weight of the building is greater than the uplift resulting in a

stable structure. Heave has also been accounted for. Calculations for uplift and heave are included at the end of Appendix C.

Below are the design pressures and loadings for the wall closest to Number 25 Oakhill Avenue.

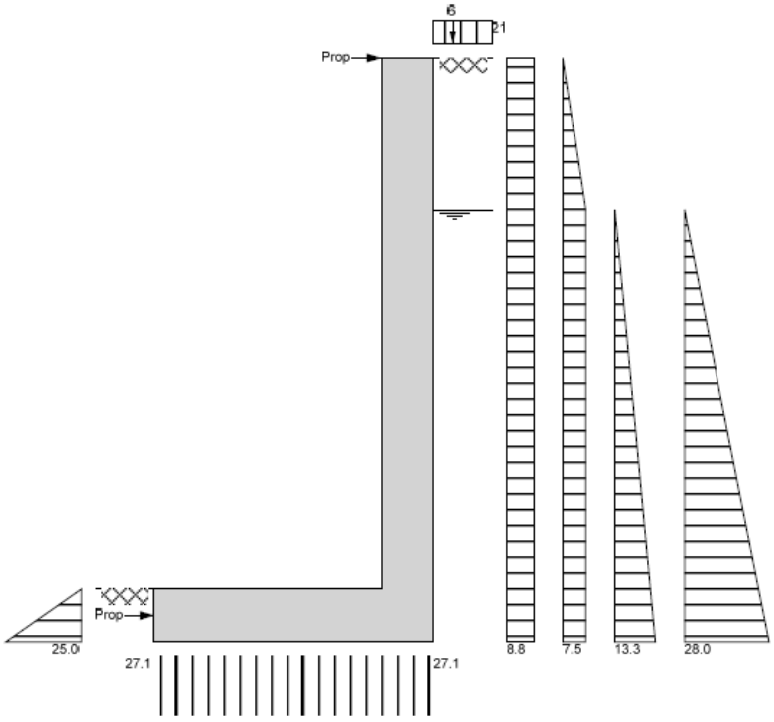


Figure 21 Loadings and Lateral stress patterns

Detailed calculations and designs of additional walls are contained within Appendix C.

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<table>
<tr><td>Vicinity of Trees</td><td></td></tr>
<tr><td>Special precautions due to trees</td><td>Design using NHBC guidance

Given the depth of the basement, the bottom of the foundations will be lower and beyond the area of the soil that will be affected by the influence of trees.

The current trees roots will be limited by the foundations. The new basements excavations will not significantly affect the root protection zones of the neighbouring trees.</td></tr>
<tr><td>Drainage effects on Structure</td><td>No build over agreements known of.

Flooding. The site is not in an area of high risk flooding.</td></tr>
<tr><td>Roads</td><td>The building does not undermine the highway.

Garden Surcharge 2.5kN/m²

Surcharge for adjacent property 1.5kN/m² + 4kN/m² for concrete ground bearing slab</td></tr>
<tr><td>Intended use of structure and user requirements</td><td>Family/domestic use</td></tr>
<tr><td>Loading Requirements (EC1-1)</td><td><table><tr><th></th><th>UDL kN/m²</th><th>Concentrated Loads kN</th></tr><tr><td>Domestic Single Dwellings</td><td>1.5</td><td>2.0</td></tr></table>The basement does not line within a 45º angle of the highway. Therefore Highways HA loading is not required to be applied.</td></tr>
<tr><td>Number of Storeys</td><td>1: only a corner of the existing rear extension will be above the basement.
Is Live Load Reduction included in design No</td></tr>
</table>

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Progressive Collapse	The main building is four storeys high and contains multiple dwellings. However it is not directly above the proposed basement; the main building will not be significantly affected by the proposed works.
Is the Building Multi Occupancy?	Yes
Part A3 Progressive collapse	EN 1991-1-7:1996 Table A1

Class 1	Single occupancy houses not exceeding 4 storeys

Progressive collapse Change of use	To NHBC guidance compliance is only required to other floors if a material change of use occurs to the property.

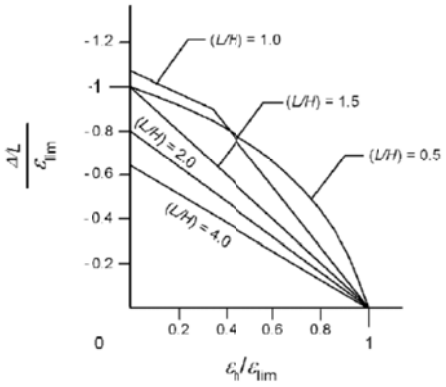
Proposed Building Class	1
If class has changed material change has occurred	N/A

Additional Design Requirements to Comply with Progressive Collapse	**Class1 – Design to satisfy EN 1990 to EN 1999 stability requirements**

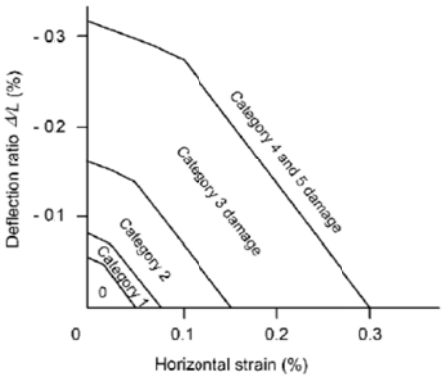
Lateral Stability Exposure and wind loading conditions	Basic wind speed Vb = 21 m/s to EC1-2 Site level +75.000 m above sea level. Topography not considered significant.
Stability Design	The propped cantilevered walls are suitable to carry the lateral loading applied from above
Lateral Actions	The soil loads apply a lateral load on the retaining walls. Hydrostatic pressure will be applied to the wall Imposed loading will surcharge the wall.

Adjacent Properties	***Any ground works pose an elevated risk to adjacent properties. The proposed works undermines the adjacent property along the party wall line:*** The works must be carried out in accordance with the Party Wall Act and condition surveys will be necessary at the beginning and end of the works. Drawings showing the proximity to the neighbouring properties are included in Appendix B. The method statement provided in Appendix D of this report has been formulated with our experience of over 200 basements completed without error. At the end of this method statement, temporary propping details, with supporting calculations are included. The design of the retaining walls is completed to K_O lateral design stress values. This increases the design stresses on the concrete retaining walls and limits the overall deflection of the retaining wall. It is not expected that any cracking will occurring during the works. However our experience informs us that there is a risk of movement to the neighbours. To reduce the risk the development: • Employ a reputable firm for extensive knowledge of basement works. • Employ suitably qualified consultants. Croft Structural engineer has completed over 200 basements in the last 4 years. • Provide method statements for the contractors to follow and closely supervise the works. • Investigate the ground, now completed. • Record and monitor the external properties. This is completed by a condition survey on under the Party Wall Act before and after the works are completed. See end of Method Statement. • Allow for unforeseen ground conditions: Loose ground is always a concern. The method statement and drawings show the use of precast lintels to areas of soft ground; this follows the guidance by the underpinning association. With the above, the maximum level of cracking anticipated is Hairline cracking which can be repaired with decorative repairs. Under the

Party Wall Act damage is allowed (although unwanted) to occur to a neighbouring property as long as repairs are suitability undertaken to rectify this. To mitigate this risk The Party Wall Act is to be followed and a Party Wall Surveyor will be appointed.



(b) Influence of horizontal strain on $\Delta L / \varepsilon_{lim}$ (after Burland, 2001)



(c) Relationship between damage category and deflection ratio and horizontal tensile strain for hogging for (L/H) = 1.0 (after Burland, 2001)

Extract from The Institution of Structural Engineers "Subsidence of Low-Rise Buildings"

Table 6.2 Classification of visible damage to walls with particular reference to type of repair, and rectification consideration

Category of Damage	Approximate crack width	Limiting Tensile strain	Definitions of cracks and repair types/considerations
0	**Up to 0.1**	0.0-0.05	**HAIRLINE – Internally cracks can be filled or covered by wall covering, and redecorated. Externally, cracks rarely visible and remedial works rarely justified.**
1	0.2 to 2	0.05-0.075	FINE – Internally cracks can be filled or covered by wall covering, and redecorated. Externally, cracks may be visible, sometimes repairs required for weather tightness or aesthetics. NOTE: Plaster cracks may, in time, become visible again if not covered by a wall covering.
2	2 to 5	0.075-0.015	MODERATE – Internal cracks are likely to need raking out and repairing to a recognised specification. May need to be chopped back, and repaired with expanded metal/plaster, then redecorated. The crack will inevitably become visible again in time if these measures are not carried out. External cracks will require raking out and repointing, cracked bricks may require replacement.
3	5 to 15	0.15-0.3	SERIOUS – Internal cracks repaired as for MODERATE, plus perhaps reconstruction if seriously cracked. Rebonding will be required.

			External cracks may require reconstruction perhaps of panels of brickwork. Alternatively, specialist resin bonding techniques may need to be employed and/or joint reinforcement.
4	15 to 25	>0.3	SEVERE Major reconstruction works to both internal and external wall skins are likely to be required. Realignment of windows and doors may be necessary.
5	Greater than 25		VERY SEVERE –Major reconstruction works, plus possibly structural lifting or sectional demolition and rebuild may need to be considered. Replacement of windows and doors, plus other structural elements, possibly necessary. NOTE – Building & CDM Regulations will probably apply to this category of work, see sections 10.4, 10.6 and Appendix F.

Monitoring and Predicted Category of Damage

Monitoring - In order to safeguard the existing structures during underpinning and new basement construction, movement monitoring is to be undertaken. Surveying studs are to be attached to the adjacent structures.

The surveying points on the adjacent structures are to be set up using an EDM prior to commencement of the works and to be read daily and reported against the following control values.

Limits on ground and adjacent structures movement during underpinning and throughout the construction works.

Movement of survey points must not exceed:

Settlement:
Action values: 5mm (stop work)
Trigger values: 65% of action values (submit proposals for ensuring action values are not exceeded)

Lateral displacement:
Action values: 6mm (stop work)
Trigger values: 65% of action values (submit proposals for ensuring action values are not exceeded)

Movement approaching critical values:
Trigger: Submit proposals for ensuring action values are not exceeded
Action: Stop work

	The reporting format will be in the form of a table. **Predicted Category of Damage** The predicted category of damage is likely to be within BRE Category Slight, with possible localised crack widths 2mm to 5mm Classification Aesthetic.
Drainage and Damp proofing	Assumed that drainage and damp proofing is by others: Details are not provided within our brief. Our recommendation is that drained cavity systems are used to habitable basements with pumped sumps. This is a specialist contractor's design item. Concrete is not designed BS 8007. But where possible BS 8007 detailing is observed to help limit crack widths of concrete
Party Wall	Underpinning basement works has a risk associated to it. To mitigate these risks a Party Wall Surveyor must be appointed
Temporary Works	Temporary works are the contractor's responsibility. Loads can be provided on request. Foundations; All trenches deeper than 1.0m must be shored. Where works undermine existing foundations contractor must allow for additional support. The Method Statement lays out the process for constructing the basement
Noise and Nuisance	The Contractor is to follow the good working practices and guidance laid down in the "Considerate Constructors Scheme". The hours of working will be limited to those allowed; 8am to 5pm Monday to Friday and Saturday Morning 8am to 1pm. None of the practices cause undue noise that one would typically

	expect from a construction site. The conveyor belt typically runs at around 70dB. The site has car parking to the front to which the skip will be stored. The site will be hoarded with soil 8' site hoarding to prevent unauthorised access. The hours of working will further be defined within the Party Wall Act. The site is to be hoarded to minimise the level of direct noise from the site. While working in the basement the work generally requires hand tools to be used. The level of noise generally will be no greater than that of digging of soil. The noise is reduced and muffled by the works being undertaken underground. The level of noise from a basement is lower than typical ground level construction due to this.