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Basement Structural Method Statement

6 Sumatra Road, London NW6 1PU

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Structural Design Reviewed by	Above Ground Drainage Reviewed by	Hydrology Reviewed by
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Revision	Date	Comment
	20.02.2015	First issue

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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

This report is for planning purposes only and is not for construction: The information, drawings, calculations, method statement and other information in this report are for planning purposes. Croft provide no design warranty or insurances for the final design. Further information and design considerations must be undertaken before building regulations submission. The information provided in this document is not for construction.

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2. Design Information - Structural

Structural Summary

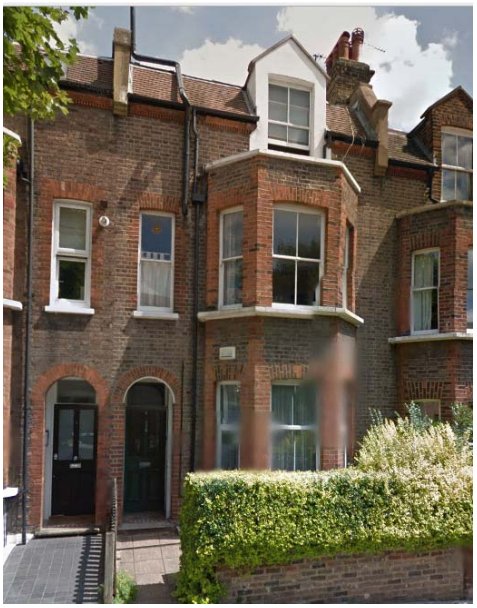

Figure 1 6 Sumatra Road - Front elevation

The property is a three storey brick built mid-terrace building. It extends to the rear with two storey and then one storey extension. There is an existing cellar (unfinished basement) beneath the three storey part.

The construction is typical Victorian construction with load-bearing external /Internal masonry walls and timber floors to the ground first and second floors. Timber floors spanning front to back. Timber roof atop.

There is an existing basement development at the adjacent terrace property at 4 Sumatra Road.

Proposed works

The proposed works require to extend the existing cellar to a depth of 2.5m below the footprint of the three storey part of the house. New lightwell to the front and the lightwell and the stairs up to the rear garden area.

Croft Structural Engineers Ltd Structural Engineers has extensive knowledge of inserting new basements. Over the last 4 years we have completed over 150 basements in and around the local area. The method developed is:

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1. Excavate front to allow for conveyor to be inserted.

2. Form lightwell with cantilevered retaining walls

3. Slowly work from the front to the rear inserting 1000 long cantilevered retaining walls sequentially.

4. Cast ground slab

5. Waterproof internal space with a drained cavity system.

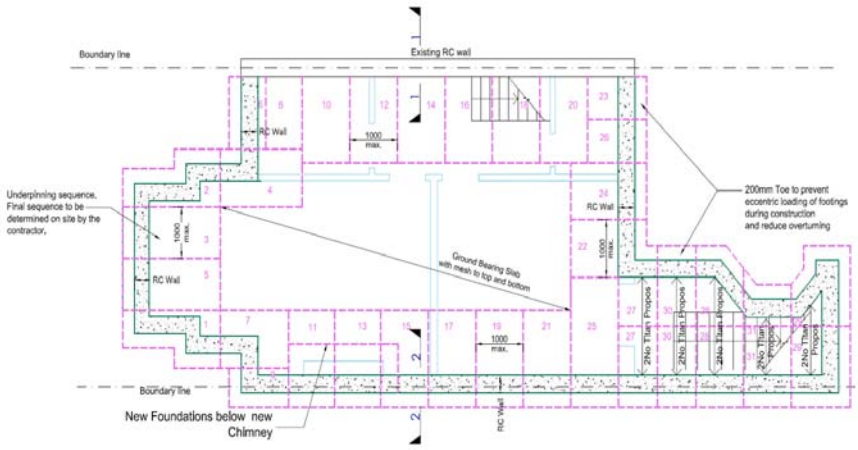
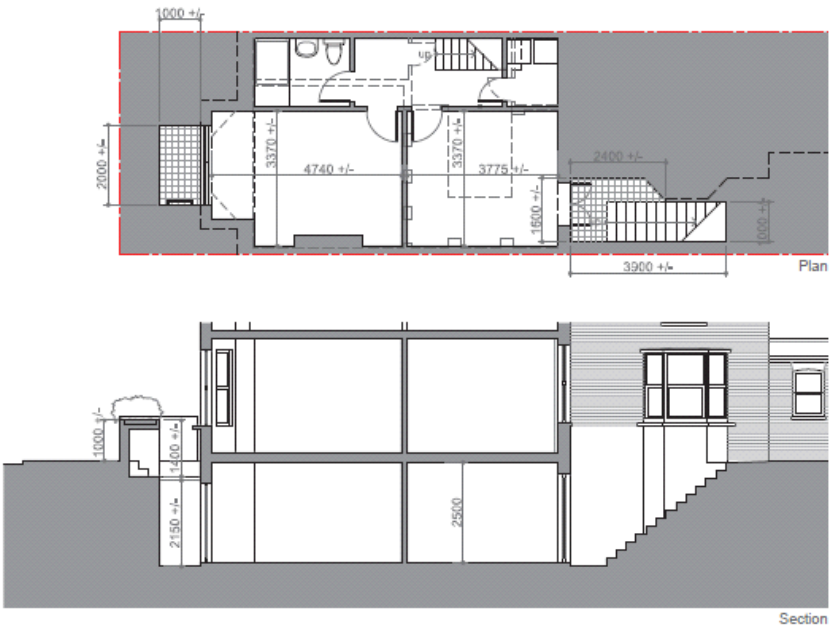


Figure 2 Proposed basement layout



Proposed Basement Level with Lightwells
Not to scale

Figure 3 Proposed Basement Level with Lightwells

Structural Defects Noted

Few cracks were noted on the plasterboard during the Chartered Engineers first visit. They were no construction cracks at the time of inspection. The cracking can be repaired through normal decoration.

Figure 4 Crack 1 - 2nd floor

Figure 5 Crack 2 first floor

Figure 6 Crack 3 front elevation

Figure 7 Crack 4 - below the beam

Intended use of structure and user requirements	Family/domestic use

DP27 A	**Maintain Structural Stability of the building & Neighbouring Properties**. The attached drawing shows the reinforcement and construction required by maintain stability of the property, the neighbouring buildings (The adjacent Garden Wall (timber fence) has also been considered), the road. Calculations results are shown in the **Appendix C – Impact Assessment**
B	**Avoid Adversely Affecting drainage and Run off.** The area of hard standing remains mostly unchanged and run off will not be altered. New lightwell will be added to the front and rear of the property to have direct access to natural light. 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 that indicates location in relations to water course and Hampstead heath catchment. See **Stage 4** Impact Assessment and drawings. Additional drainage layer has been placed under the building. 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

Figure 8 Sumatra Road - tree at the rear next to timber fence

There is no loss of open space.

No existing trees are going to be cut down. The current roots have been founded 2.0m bgl to the front (borehole 1). Neighbour's self-seeded tree is located next to the timber fence (boundary line) at the rear, approx. at the point where a new lightwell of the basement will be placed.

The current roots will be within the existing foundations (TBC during excavation) and therefore the new foundations will cut through the roots. The base of the foundation excavations must be extended at least 300mm into non-root penetrated soil.

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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 an aquifer.
See the map below from the Environment Agency and Arup report.

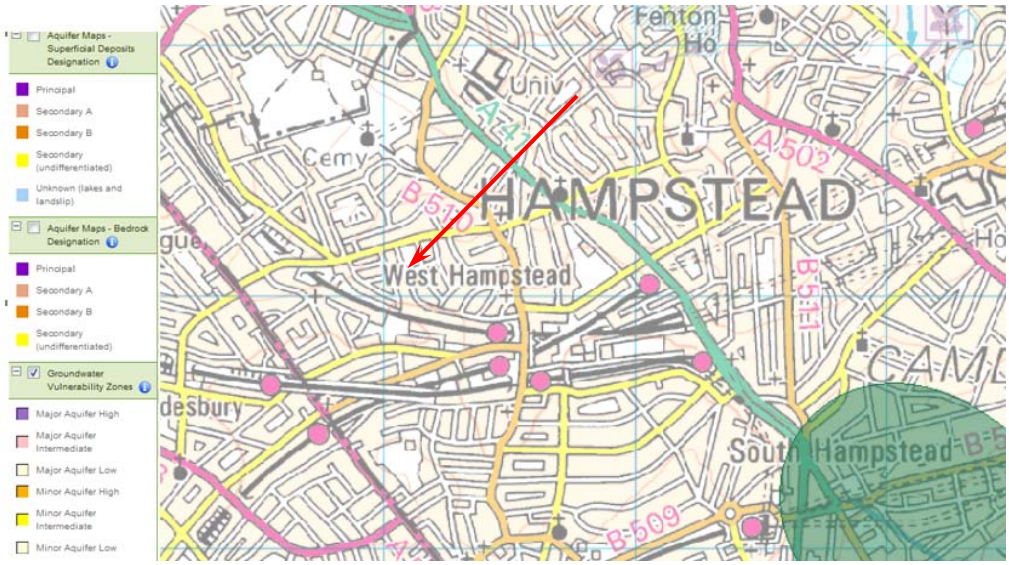

Figure 9 British Geological Survey Aquifer data

It is not within the secondary Aquifer, based on Arup report.
The building is not within a source protection zone of a public water supply.

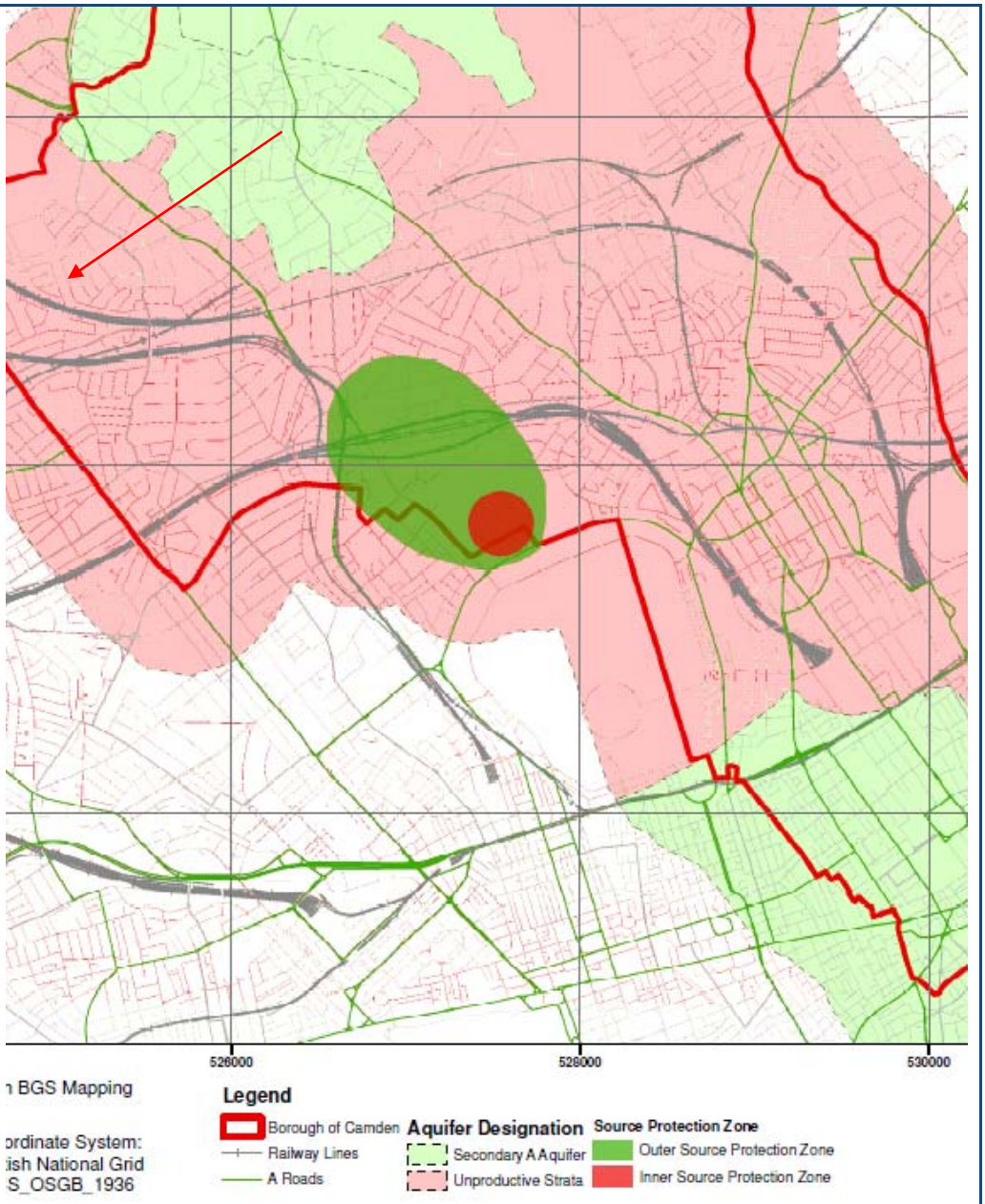

Figure 10 Arup report Aquifer map Figure8 showing unproductive strata

1b. Will the proposed basement extend beneath the water table surface? Unknown.

Proposed basement will extend to approximately 3.0 meters bgl.

Requires scoping assessment and investigation.

2. Is the site within 100m is a watercourse, well used/disused or potential spring line?

No. Figure 11 of the Arup report shows no surface water abstraction licenses within 500m of the site. There are no springs shown on OS mapping.

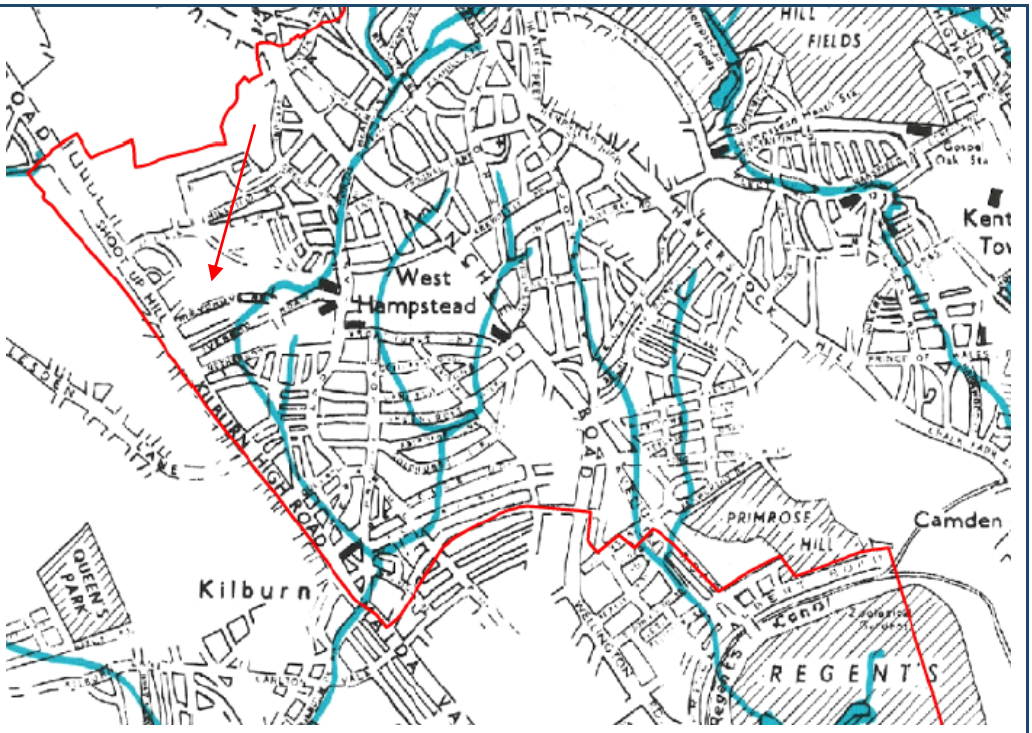

Figure 11 13 Arup Report figure 11

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 denoted by figure 14 of the Arup report and Google Map

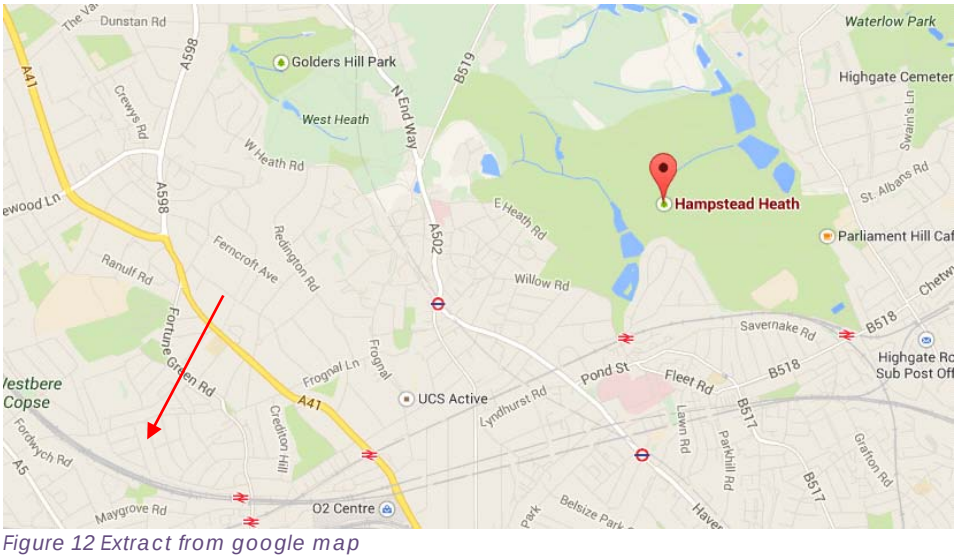

Figure 12 Extract from google map

Carry forward to scoping stage.

	4. Will the proposals basement development result in a change in the proportion of hard surfaced/ paved areas? **No**. The surfaces to the front & rear are to remain mostly unchanged. New lightwell will be added to the front and rear of the property to have direct access to natural light. 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?** **No**. From walkover and OS maps, there are no local ponds or springs of significance.
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.** Difference in height between the rear garden and front is less than 1 in 8 slope. There is a slight downward slope in the ground level. Locally the ground falls southeast and southwards from high point at Gondar Gardens, 260m northwest. The site is at approx. elevation of 58m OD, based on OS contours as show of Figure 15.

Figure 13 Slope - view front of the building

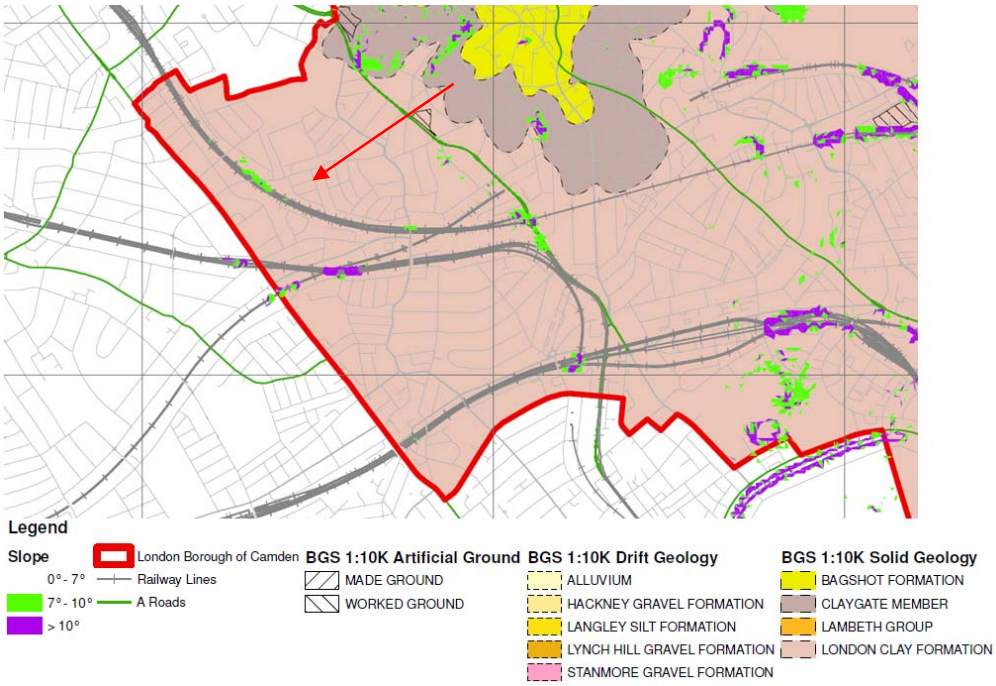

Figure 14 Arup report, Figure 16

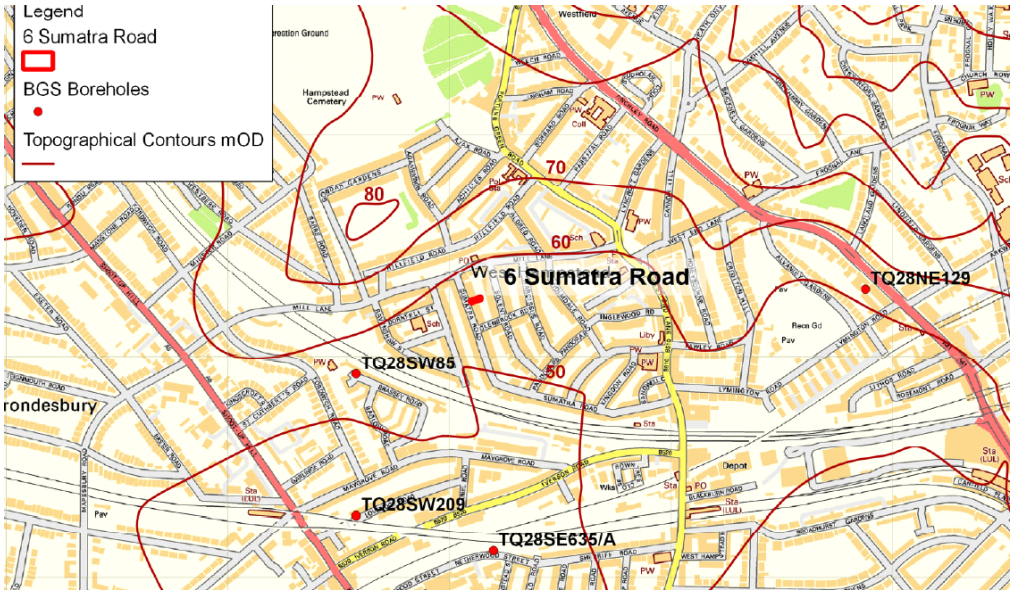

Figure 15 Site Location - Contains Ordnance Survey data

2. Will the proposed re profiling of landscaping at site change slopes at the property boundary to more than 7º (approximately 1in 8)?

No. Proposed landscaping does not affect the slope.

3. Does the development neighbour land including railway cuttings and the like with a slope greater than 7º (approximately 1 in 8)?

No. Proposed landscaping does not affect the slope and railway cutting.

4. Is the site within a wider hillside setting in which the general slope is greater than 7º (approximately 1 in 8)?

No. The slope of the wider hillside setting is as per the property, less than 7º. From Figure 16 the slope angle is shown less than 7º between front and rear part of the building.

5. Is the London Clay the shallowest strata on site?

Yes. The site sits on The London Clay formation. Please refer to borehole Log and Soil Investigation report attached in **Appendix E.**

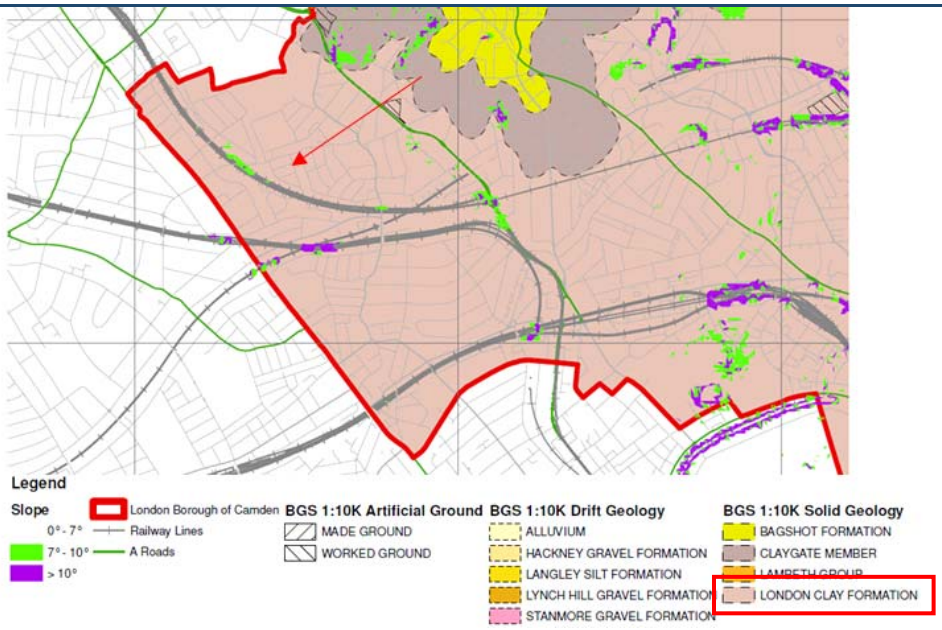

Figure 16 Arup report, Figure 16

Carry forward to scoping stage: Soil investigation completed to confirm the ground condition

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. Some shrubbery and general vegetation to be removed.

The impact of the basement from remaining trees should be considered (cutting through the roots - TBC during excavation)

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?

No. OS maps and local walkover survey show no wells, watercourses. Figure 11 of the Arup report shows no surface water abstraction licenses within 500m of the site. There are no springs shown in OS mapping, and no known local geological features that might give rise to springs.

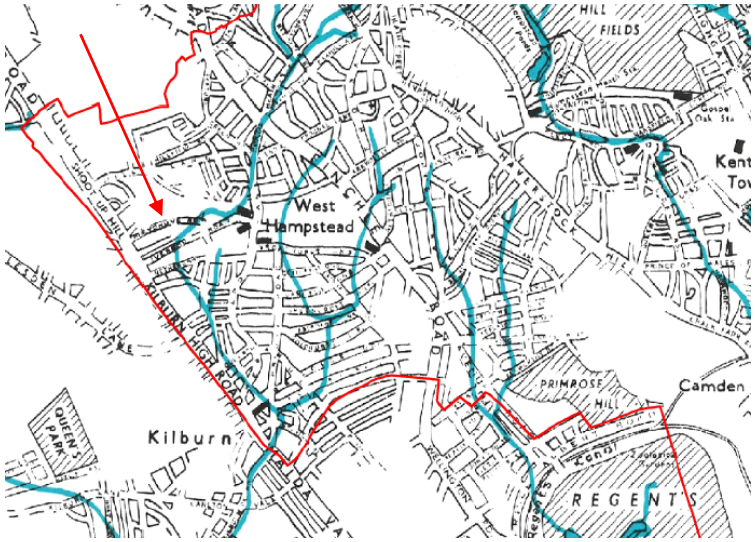

Figure 17 Arup Report, Figure 11

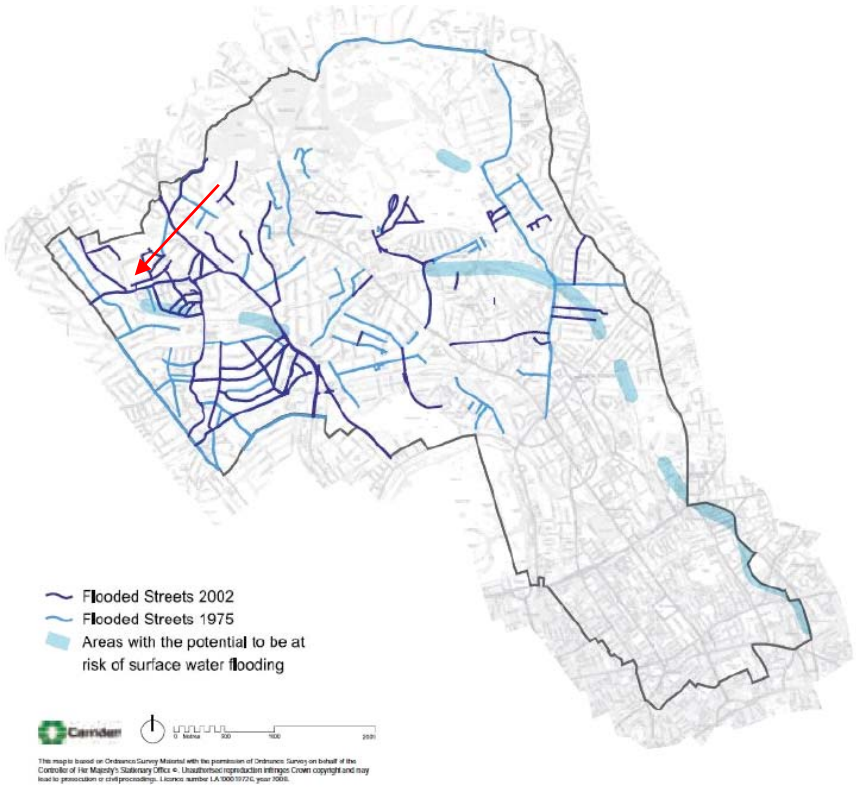

Figure 5 from Core Strategy, London Borough of Camden

Figure 18 Arup Report, Figure 15

Environmental Agency data (below) and CPG4 Basement and Lightwells shows that the site experienced flooding in 1975 and 2002. It is confirmed by the table attached in CPG4 Basement and Lightwells. The table shows the street has been flooded in 1975 and 2002.

Fairfax Road	2002	Parkhill Road	1975 and 2002
Fairhazel Gardens	1975 and 2002	Parliament Hill	2002
Fellows Road	1975	Platt's Lane	1975 and 2002
Ferncroft Avenue	1975	Primrose Hill Road	1975 and 2002
Finchley Road	2002	Prince of Wales Road	2002
Fleet Road	2002	Princess Road	1975
Fordwych Road	1975	Priory Road	2002
Frognal Gardens	1975	Priory Terrace	1975
Gaisford Street	2002	South End Road	2002
Glenhurst Avenue	2002	South Hill Park	2002
Gloucester Avenue	1975	South Hill Park Gardens	2002
Goldhurst Terrace	1975 and 2002	Sumatra Road	1975 and 2002
Gospel Oak Estate	1975	Swains Lan	1975
Greencroft Gardens	1975 and 2002	Tanza Road	2002
Hampstead Lane N6	1975	Templewood Avenue	2002
Harben Road	2002	Templewood Gardens	2002
Harley Road	1975	Wendling, Haverstock Road	2002
Hawley Road	1975	West End Lane	2002
Heath Street	1975	Westbere Road	2002

Figure 19 Extract from CPG4 Basements and light wells

However the area surrounding the site is not identified as having the potential to be at risk of surface water flooding

Carry forward to scoping stage: Soil investigation completed

9. Is the site within an area of previously worked ground?

No. From the historical maps, the site has been residential for at least 1890.

Figure 20 Extract from http://www.francisfrith.com/hampstead/historic-map-of-hampstead_hosm65588/personalise

Carry forward to scoping stage: Soil investigation 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. It is confirmed by Arups report, Figure 8.

The ground is London Clay, which is relatively impermeable; as such it is not an aquifer. (Soil investigation report is included in **Appendix E**)

Carry forward to scoping stage. Soil investigation completed.

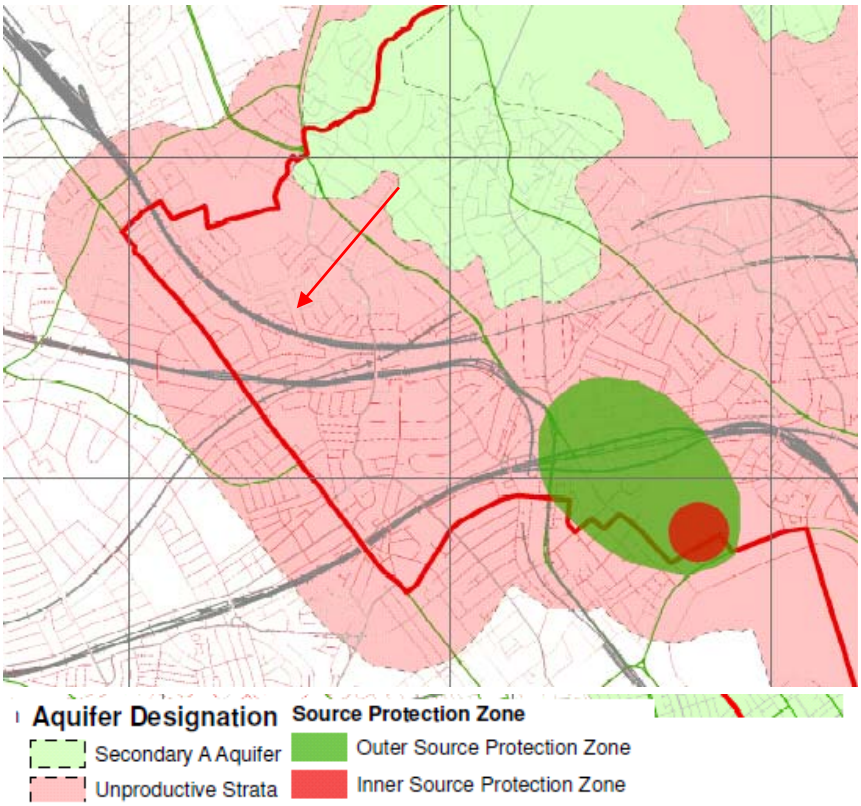

Figure 21 Extract Arup Report Figure 8

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

No. The site is located more than 50m from the Hampstead Heath ponds

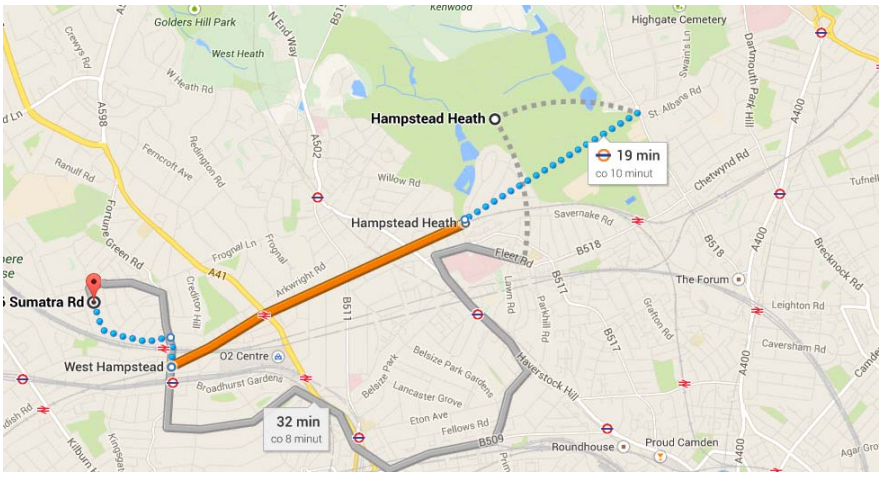

Figure 22 Extract from Google map

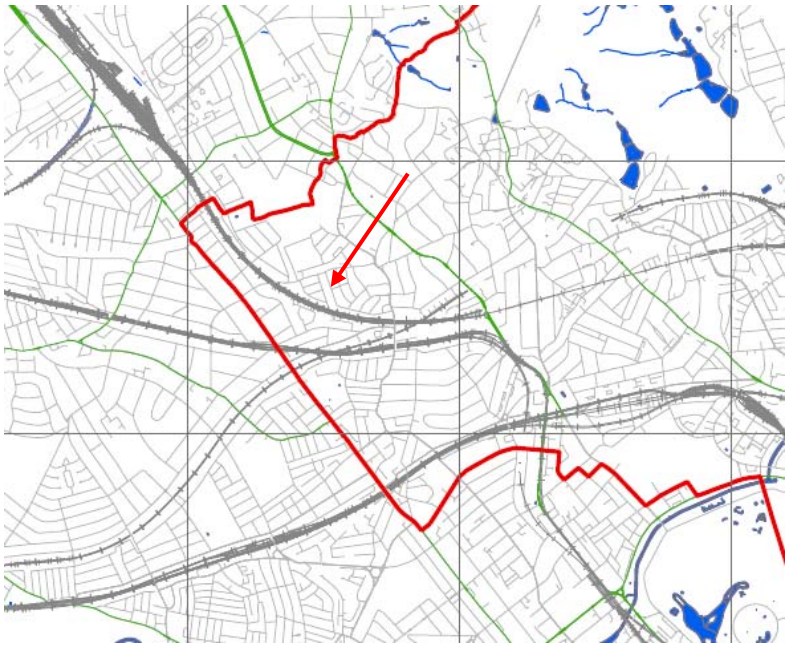

Figure 23 Extract from Arup Report, Figure 12

12. Is the site within 5m of a highway or pedestrian footway?

Yes. Site is within 5m of the footpath/alleyway. 10kN/m2 Surcharge loading will be applied.

Carry forward to scoping stage. The design will need to take account of the highway loading.

13. Will the proposed basement significantly increase the differential depth of foundations relative to the neighbouring properties?

No. Existing footings are expected to be corbelled masonry (refer to Soil Investigation, **Appendix E**, for details)
The differential depth will be increased by 2.0m for the shallow foundations to the front and 0.7m at the rear. The footings will be bearing on the Clays and no significant change will occur. Party walls will be underpinned

Carry forward to scoping stage.: Overall design to be considered.

14. Is the site over (or within the exclusion zone) of any tunnels, e.g. railway lines?

No. Nearest is the Metropolitan line around 50m from the site. Confirmation at design stage from Underground company is required to confirm their assets are not affected.

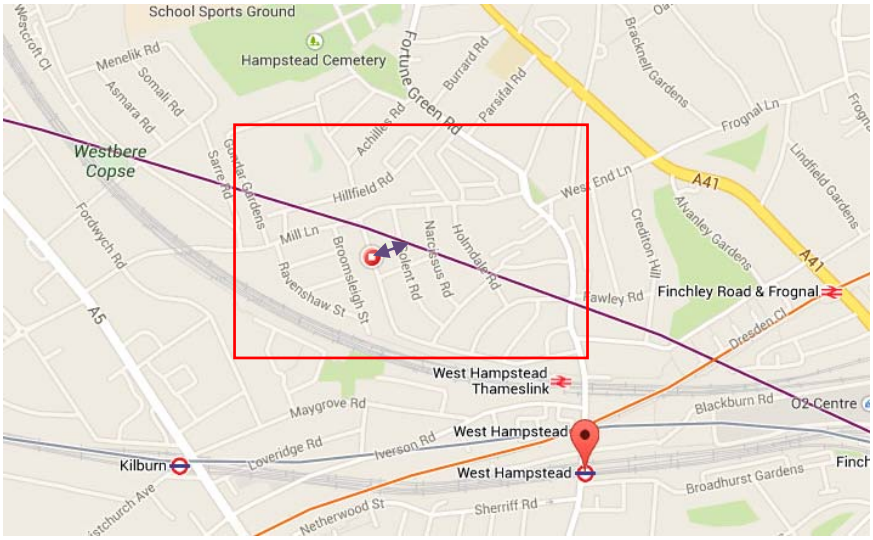

Figure 24 Extract from google map

Requires scoping and investigation

Surface flow and flooding

Figure 3 – Surface flow and flooding screening flowchart

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

The site lies outside the catchment areas of the Hampstead heath ponds as shown on figure 14 and 12 of the Camden Hydrological Study

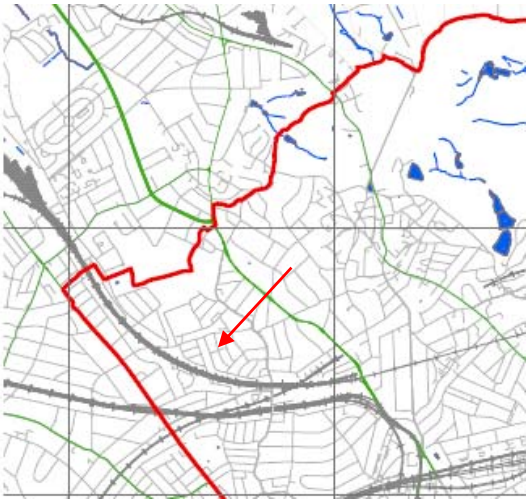

Figure 25 Extract from Arup Report Figure 12

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. The proposed development will enter the current drainage system.

3. Will the proposed basement development result in a change to the hard surfaced /paved external areas?

No. The amount of hard standing will remain unchanged.

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 (surface water) 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 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 the rivers.
On Figure 15 of Camden Geological, Hydrological and Hydrological Study (Arup), the street is noted to have flooded in 1975 and 2002. However the precise extent of this along the length of the rod is unknown.

Fig. 5.1 - Map of flooded roads in 1975 and 2002 floods

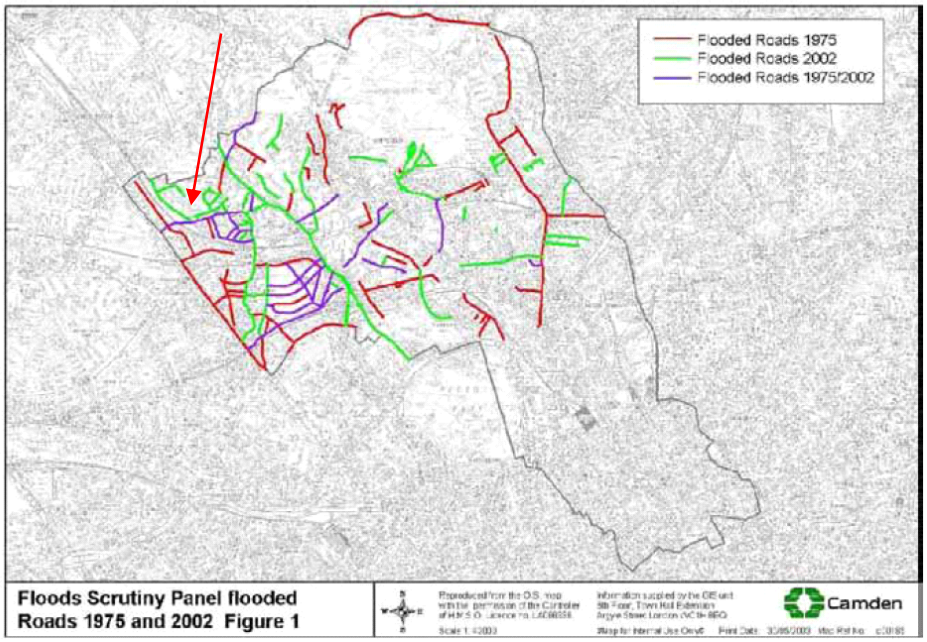

Figure 26 Extract from Camden Flood Risk Management Strategy (Cabinet Report Final)

In CPG4 (page 29), Sumatra Road is identified as being at risk of surface water flooding. The exact extent of the flooding along the street is unknown.

Carry forward to scoping stage.

The issues carried forward to the scoping stage are as follows:

- The high volume change potential of the soils.
- The site is within 5m of a pedestrian right of way and a highway
- The relative depth of the foundations of neighbouring properties is currently unknown

The site is located in an area identified within the Strategic Flood Risk Assessment and Environment Agency's Surface Water Flood Risk Maps

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4. Basement Impact: Screening Maps

	Maps supporting the Screening information are included in Appendix A

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5. 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** Soil investigation report is included **in Appendix E.** There is a need to find out groundwater table to see if basement will impact on the groundwater flow. This will be covered by a Soil Investigation. Soil investigation has been completed with a bore hole. Water was not encountered during drilling 7m borehole on the 9th January 2015. A return visit on the 9th January 2015 revealed the 4.8m deep well installed to be dry. Groundwater was measured at 2.54m bgl on 10 February 2015.
Slope Stability	The site is close to the LUL Tunnels (Metropolitan line) – 50m. Confirmation at design stage from TFL is required to confirm their assets are not affected. A Soil Investigation confirmed that the top layer is **the London Clay**. The slope stability of theses is in the region of 40°. The design of the RC retaining walls will take this into account. **Made ground** was found on site up to approximately 0.8m. The basement is within 5m of the footpath and highway, and will therefore be designed with a 10kN/m^2 surcharge. As party wall is to be underpinned and will leave the party wall with a deeper footing than the neighbours other walls, the design should look at the available bearing capacity. As part of the Party Wall agreement a pre-condition survey will be carried out. The design will consider the impact of the deeper footings.

Surface flow and flooding	This proposal is not considered to be in an area where there is a significant risk of flooding risk of flooding.

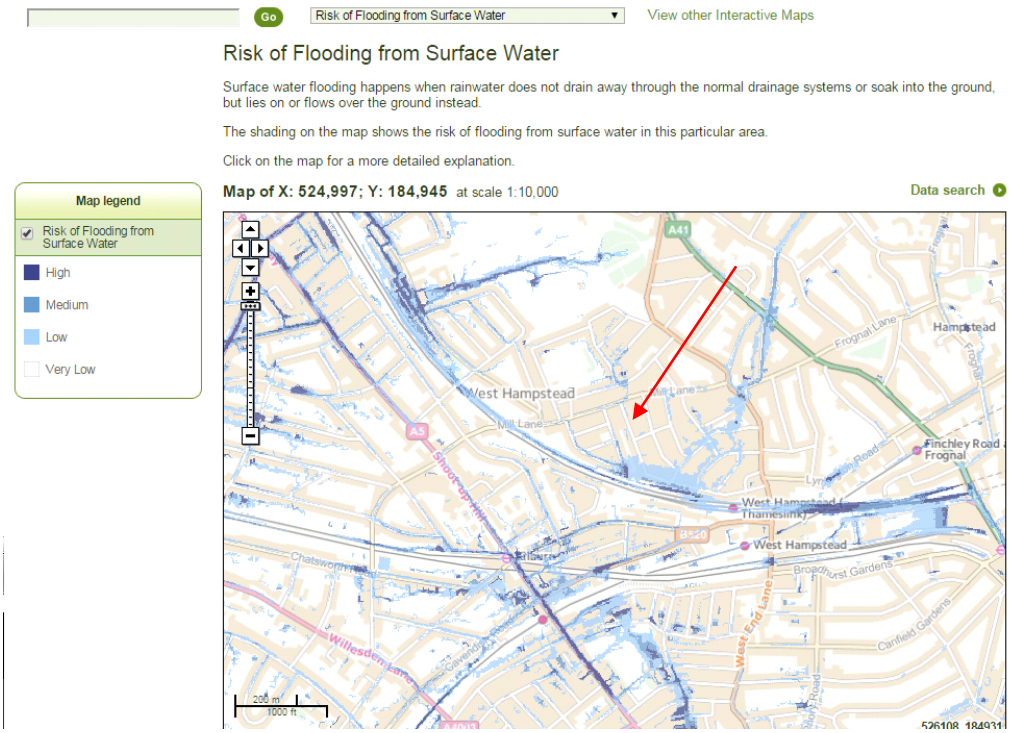


Figure 27 Extract from British Geological Survey web site

As described in Section 3, the risk of surface water flooding is unknown. The street has flooded in 1975 and 2002. Section 2.41 of CPG4 requires that due to this/these occurrence(s), a Flood Risk Assessment should be carried out at the planning application stage. This is included in Section 8.

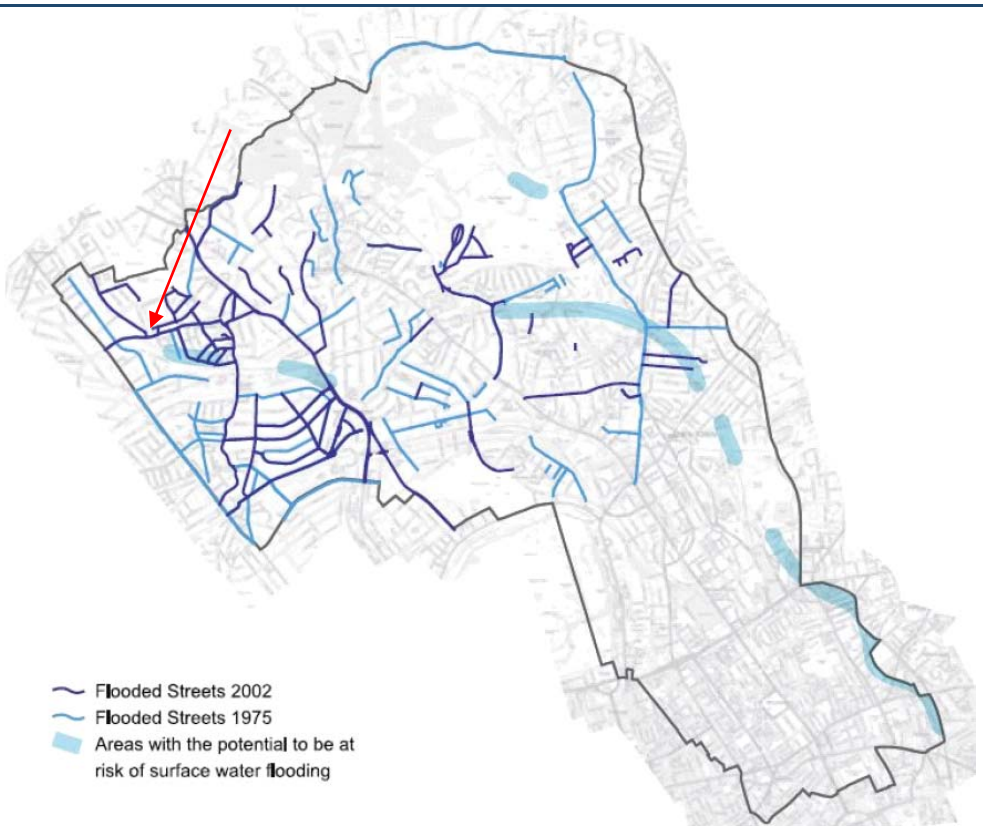


Figure 28 Arup report, figure 15

The flow of surface water above the basement (top 1m of soil) will not need to be considered. Basement is not extended below garden area.

6. Desk Study and Walkover Survey

Subsoil conditions

A soil investigation has been commission to determine the soil conditions and to confirm the water table.

Accordingly to the Geology of Britain viewer, the site is located on London Clay Formation. This is as expected in the area.

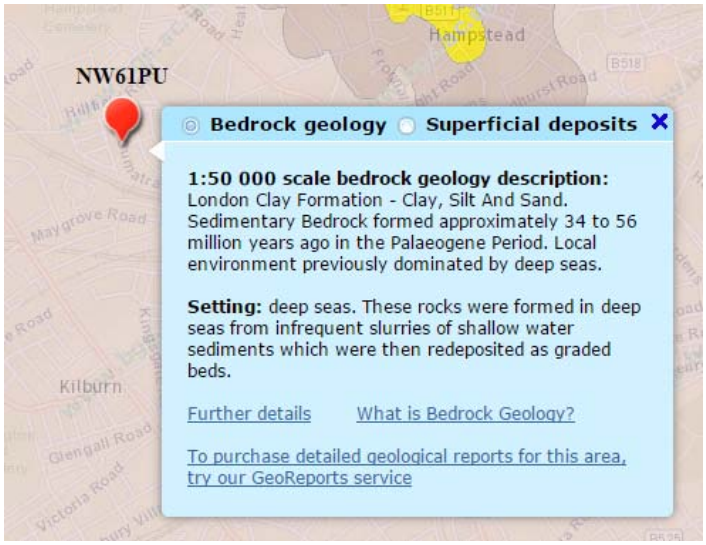


Figure 29 6 Sumatra Road on geology of Britain viewer

Soil investigation confirmed the ground conditions (see **Appendix E** for details). The ground water was not found at 7.0m on the 9th January 2015. A return visit on the 9th January 2015 revealed the 4.8m deep well installed to be dry. Groundwater was measured at 2.54m bgl on 10 February 2015.

Walk over Survey

Figure 30 6, 4 and 8 Sumatra Road

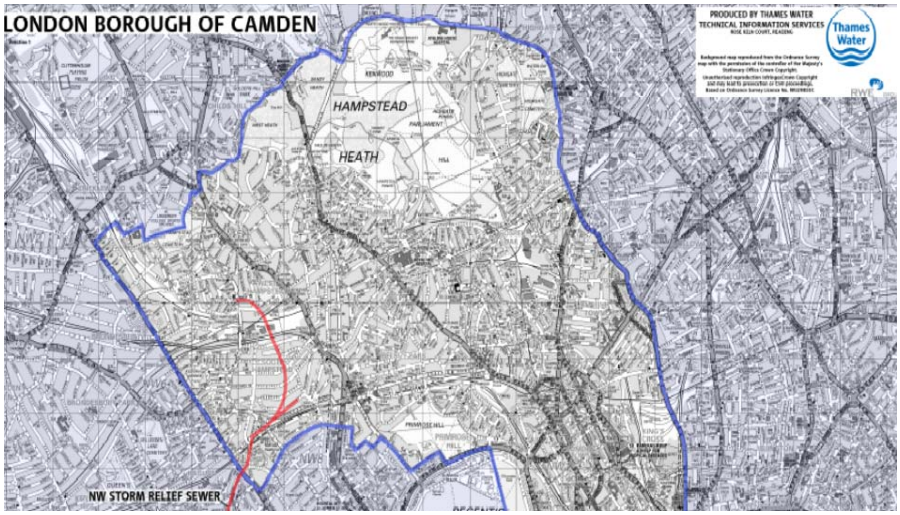
Figure 31 6, 4 and 8 Sumatra Road

Figure 32 6 Sumatra road - existing cellar next to 8 Sumatra Road

Figure 33 6 Sumatra road - existing cellar next to 4 Sumatra Road

The building is part of a terrace and the effects of the development on the adjacent properties will need to be considered.

	The existing building and neighbours did not exhibit any signs of subsidence nor movement. No. 8 and 4 are attached properties. Based on visual inspection undertaken on 15th January 2015 for the property and the neighbours, no signs of cracking / movement were noted to the front and rear elevation of the properties. The water course was not noted on the site at the time of the inspection. The boundaries were marked by a combination of timber fencing and solid walls. Potential movement calculations have been provided in **Appendix C** of BIA report. The calculated ground movements are used to undertake a Building Damage Category Assessment to assess the potential structural damage caused, if any, to neighbouring properties, and is essential at party walls or where adjacent foundations are in close proximity to the basement. The trees are located at the back of the garden and they are not going to be cut down. Neighbour's, self-seeded tree, is placed next to the area (timber fence), where the rear lightwell will be built to form new stairs. Some shrubbery and general vegetation to be removed.  *Figure 34 8 Sumatra Road - garden area* Root barrier protection can be required to protect new basement walls. The base of foundation excavations must extend at least 300mm into non-root penetrated soils.
Vicinity of Trees	No trees are going to be removed. Bushes are present in the front and rear of the property. Neighbour's self-seeded tree will be closed to the extended basement.

Drainage effects on Structure	No build over agreements known of
Under ground	Underground line approximately 50m away from the property.
Sources of Contaminates	From the Historic Maps it can be seen that the ground use has not been conducive to activities leading to poor ground. During the walk over survey no items were noted that may lead to contamination. The house is located close to the street. That may result in minor petrochemical pollutants.
Water Course	Figure 11 and 12 of the Arup report shows no potential water course within the area. The Sumatra Road was flooded in 1975 and 2002. Thames Water's evidence confirmed that the flooding was caused by its sewer system reaching maximum capacity very quickly so that the roads could not be drained at the rate the rain fell. (Based on Floods in Camden – Report of the floods security panel. June 2003). Further investigation will be required to determine the depth and location of the relief sewer.  *Figure 35 Location of Thames Water's North-West storm relief sewer* The site in not within the Hampstead pond catchment area as shown on Figure 14 of Arup's report. The site is not within the High and Medium risk of flooding from Surface water as shown on Figure 15 of Arup's report. No wells were noted on site The site is shown within the areas of recent local flooding 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 local watercourses noted in the Arup's report.

7. Historic Maps

Figure 36 http://www.francisfrith.com/hampstead/historic-map-of-hampstead_hosm65588/personalise - 1890

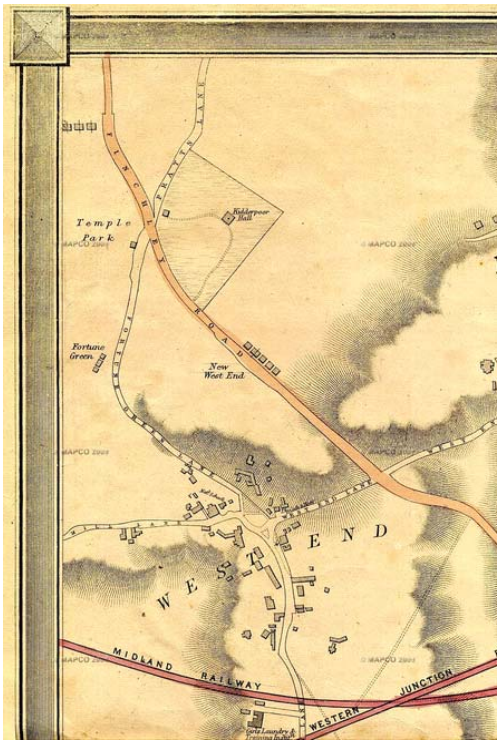


Figure 37 Map of London 1868, by Edward Weller

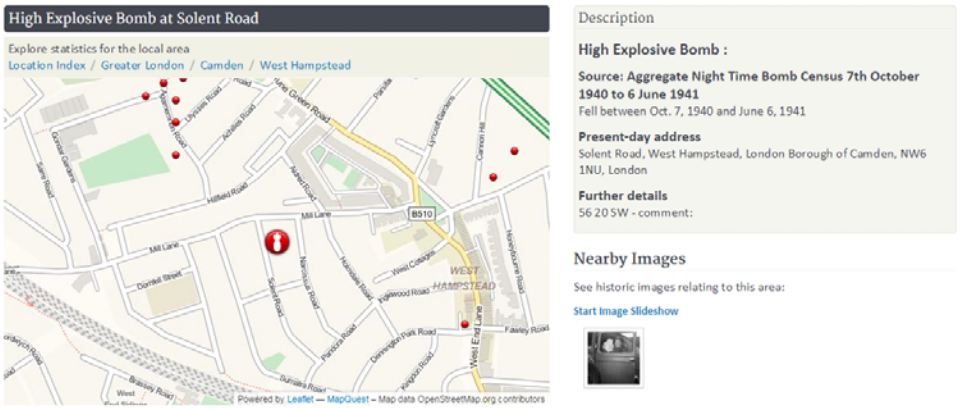


Figure 38 Extract from http://bombsight.org/bombs/31206/

The area close to 6 Sumatra Road was bombed in 1940-1941. The soil investigation report will confirm the ground conditions.

Is the building listed?

No. The site plan does not show the 6 Sumatra Road building is listed. Properties adjacent to 6 Sumatra Road are not listed either.

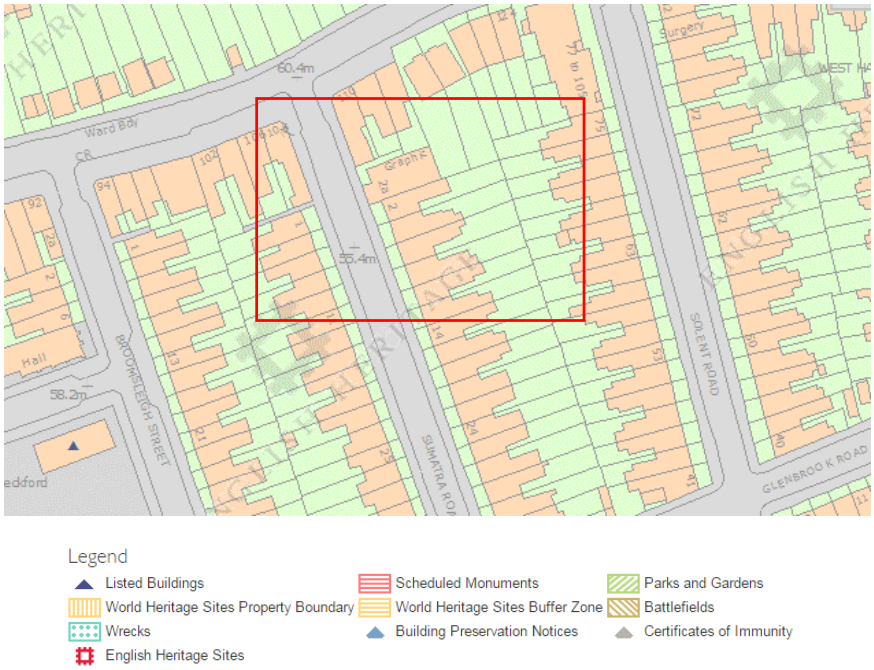


Figure 39 Extract from English Heritage web site

Is the building in conservation area?

No. 6 Sumatra is not within conservation area.

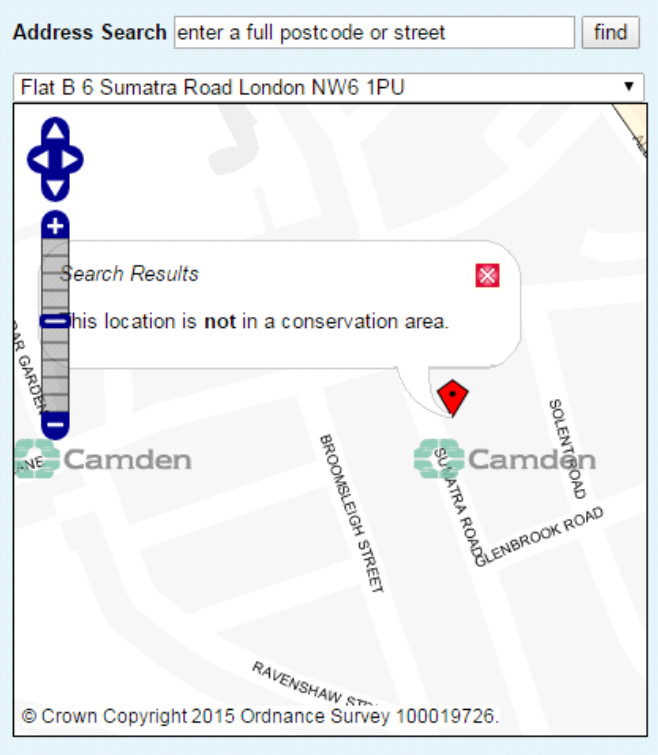


Figure 40 Extract from http://www.camden.gov.uk/ccm/content/environment/planning-and-built-environment/two/conservation-and-listed-buildings/conservation-areas/find-a-conservation-area-in-Camden/

8. 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.

8.1 Site Location

The site is approximately 155m2 in size. It is located in a densely built-up area. Topography in the surrounding area is dominated by high ground on Hampstead Heath, approximately 1.6 km to the north east. More locally, the ground falls southeast and southwards from a high point at Gondar Gardens, 260 m northwest. The site is at an approximate elevation of 58 m OD, based on OS contours. Local topography is shown on Figure 41 below. There is a slight downward slope in the ground level from north (4 Sumatra Road, higher) to south (8 Sumatra Road, lower).

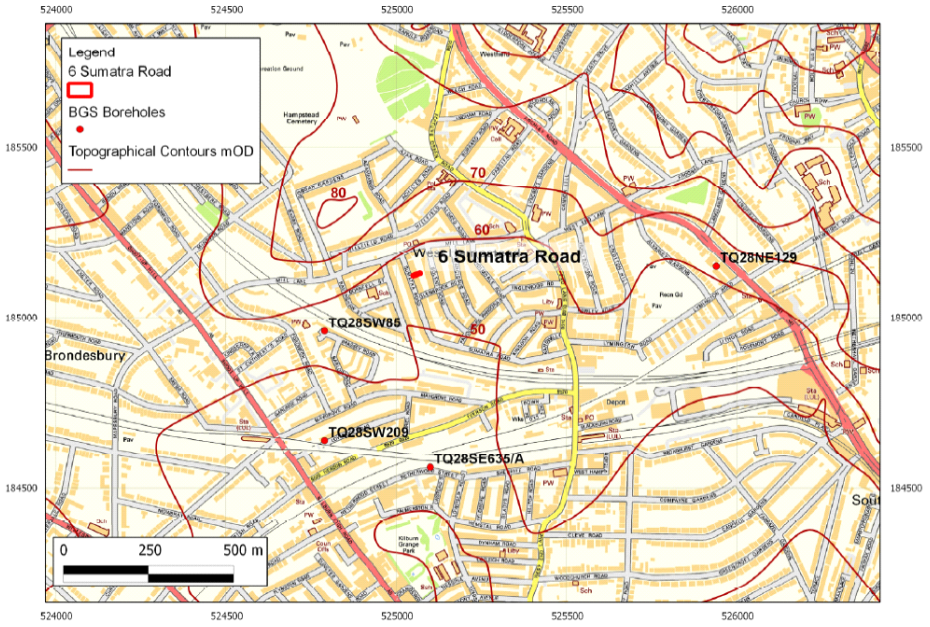


Figure 41 OS map

Residential houses exist either side of the site. These buildings are at the same level. There are gardens to the rear of the site. Sumatra Road runs to the front of the site.

The road slopes down from a high point of Gondar Gardens. The back of the property is relatively flat.

Figure 42 Slope down from Mill Lane Road

There is an existing basement development at the adjacent terrace property at 4 Sumatra Road.

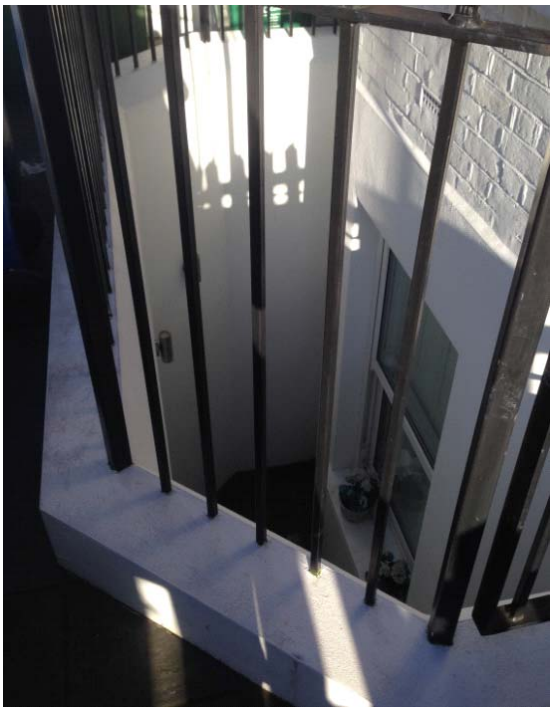


Figure 43 4 Sumatra road - existing basement

For the location of potential watercourse below the ground, please refer to Figure 11 below.

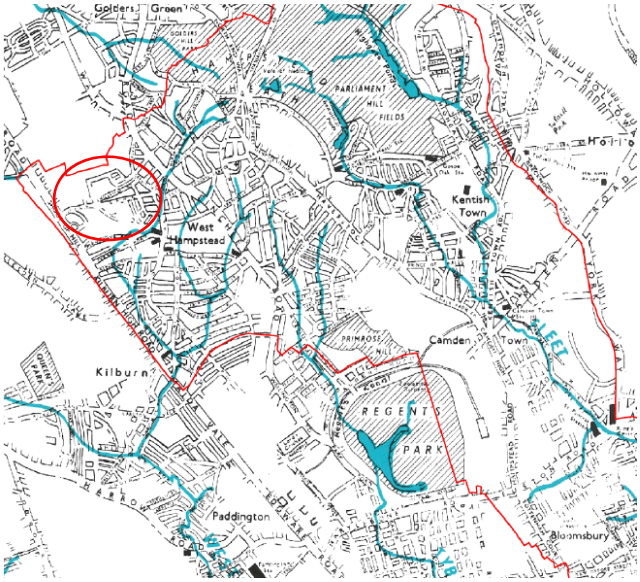


Figure 44 Arup report figure 11

The EA has not identified any flood risks associated with the nearby water courses.

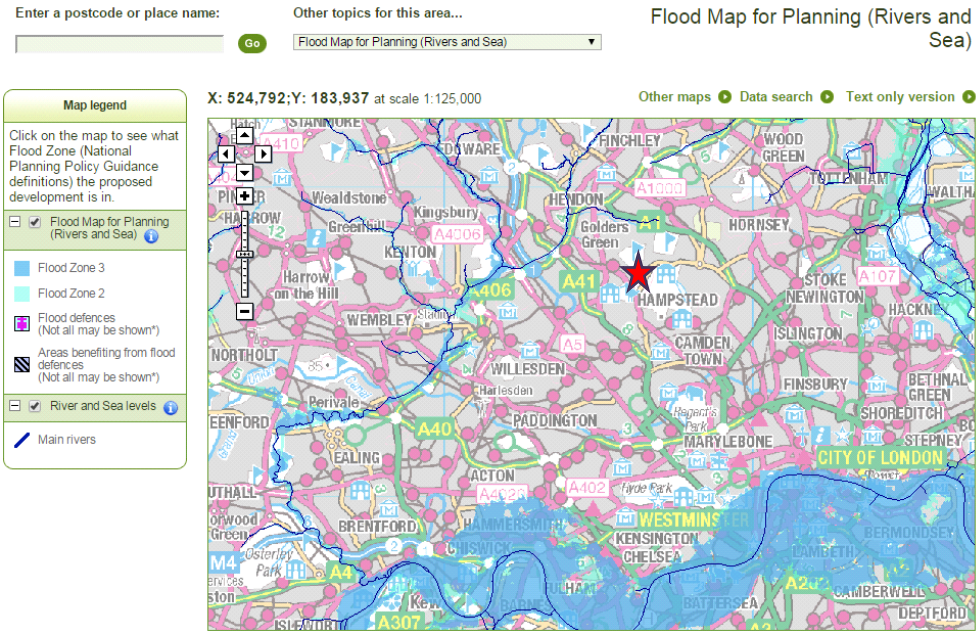


Figure 45 Flood map for planning (Environment Agency)

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

8.1.2 Proposed Basement

The proposed development is to extend the existing unfinished basement to a depth of 2.5m below the footprint of the three storey part of the house, with a lightwell to the front and a lightwell and stairs up to the rear garden.

8.2 Screening

As explained in Section 3, 4 and 5 the street was flooded in 1975 and 2002. Therefore a flood risk assessment is required

8.3 Scoping

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	Yes	Recorded in unspecified part of Sumatra Road in 1975 and 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 terrace areas 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.

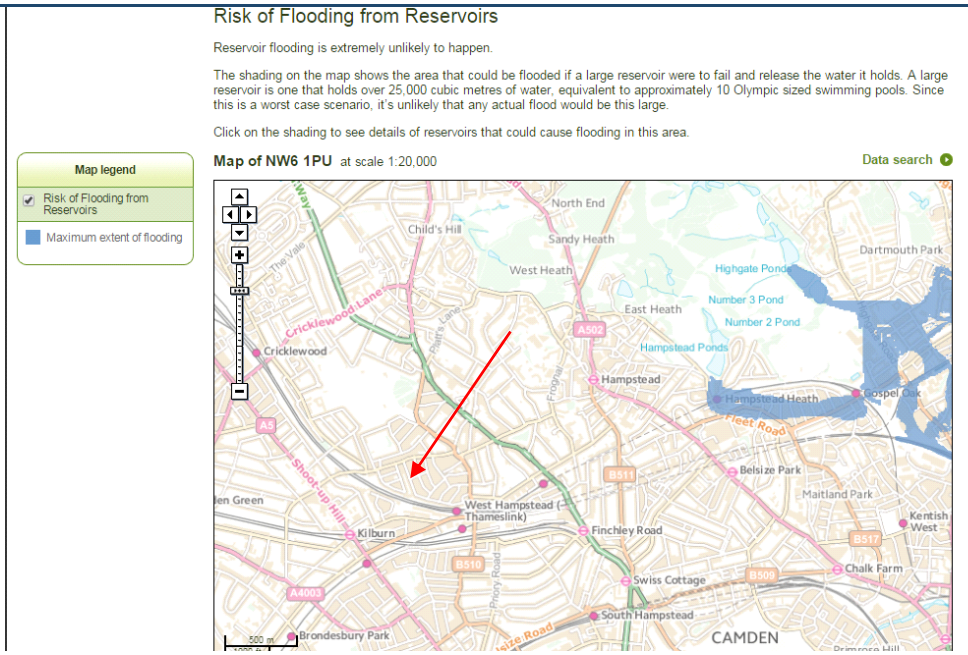


Figure 46 Extract from British Geological Survey web site

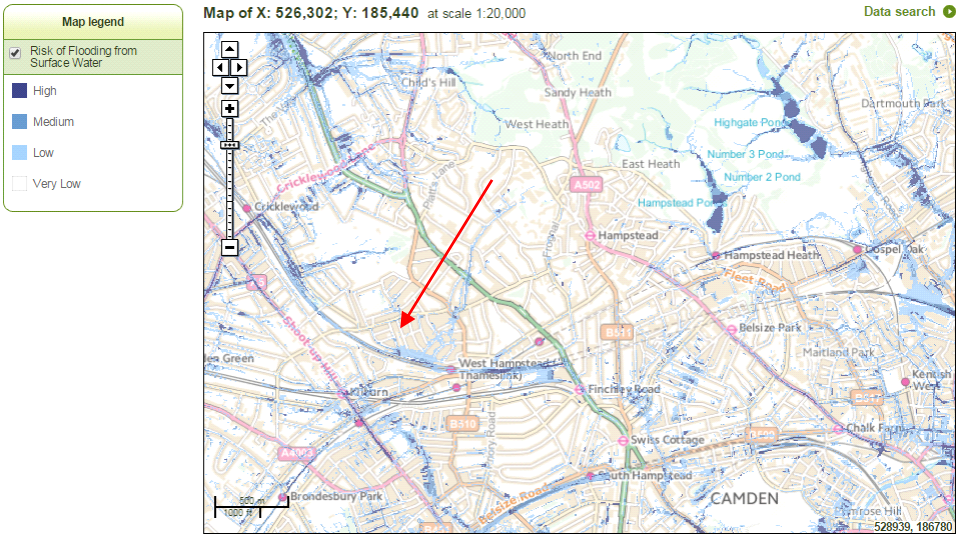


Figure 47 Extract from British Geological Survey web site

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

8.4 Further Assessment

8.4.1 Potential surface water (pluvial) flooding

6 Sumatra Road is a part of residential houses either side of the site, located at West part of the Camden. The road slopes down from a high point at Gondar Road. The back of the property is relatively flat. It is likely the bottom part of Sumatra Road would have been flooded in 1975 and 2002 (relatively flat). The top part of Sumatra road, where the building is located, is on the slope. Therefore it is unlikely the 6 Sumatra Road was flooded in the years above.

It is understood that this flooding was due to the Thames Water relief sewer being overloaded. It is also understood that Thames Water subsequently increased the capacity of this relief system: the likelihood of flooding of this nature is now significantly reduced.

6.4 Flood alleviation schemes in Camden West

The history of flooding in this area is significant with a number of areas in South and West Hampstead affected in both 1975 and 2002. However after the 2002 floods, Thames Water invested in significant new flood risk infrastructure as part of the West Hampstead Flood Relief Scheme. The project involved larger diameter sewers and a holding tank both of which have substantially reduced flood risk in the area.

An Initial Assessment was commissioned to look at potential flood risk locations in Camden West and assess those which required action. They identified two key locations around South Hampstead and West Hampstead.

Figure 48 Managing flood risk in Camden, The London Borough of Camden, flood risk management strategy

The below actions have been undertaken to reduce flood risk in Camden area.

Table 2.1 Actions for reducing flood risk in Camden North, South and West

Area	Action	Deadline
Camden North	Completion of review of risk from Hampstead Heath Ponds	March 2013 (Completed)
Camden North	Delivery of Project Appraisal Reports for Gospel Oak and Hampstead	April 2013 (Completed)
Camden North	Begin investigation of Royal Free Hospital flood risk	June 2013
Camden North/ South	Complete modelling of Thames Water sewer system in Highgate and South Camden	July 2013
Camden West	Complete Project Appraisal Report for West Camden	September 2013
Camden North	Complete consultation on preferred option of Hampstead Ponds	September 2013
Camden North	Submission of Detailed Planning Application for Hampstead Heath Ponds by City of London	February 2014
Camden North	Finish assessment of Royal Free Hospital flood risk	March 2014
Camden South	Maintenance of Primrose Hill siphon	On-going

Figure 49 Managing flood risk in Camden, The London Borough of Camden, flood risk management strategy

8.4.2 Potential flooding from infrastructure failure

In addition to the storm water relief sewer previously mentioned, there is believed to be a trunk sewer running along the Sumatra road. Blockage or failure of either of these may result in the following sequential events:

- Excess flow from Sumatra may accumulate in the area of road in front of the site,
- This flow would travel in the direction away from the front elevation of the property owing to the site being on a slightly higher level than the opposite side of the street, and the raised level of the pavement above the road (see photo below).

Figure 50 Street level view

The likelihood of flow into the front light wells is also reduced by the existing landscaped areas (existing and proposed) in the front: these would partially relieve any excess flow that would migrate towards the front of the building.

Figure 51 Front elevation of 6 Sumatra Road

In the unlikely event of surface water flooding in the vicinity, the likelihood of the water entering and accumulating in or the basement is low. This is because the site is on a slope and water will continue to flow downhill, away from the property.

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.

8.5 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,
- in terms of flood vulnerability, significant „betterment" can be achieved through the implementation of warning procedures and formalisation of a safe egress route to the upper floors of the building,
- During basement construction, it is recommended that rainwater entering the excavation from above be pumped out to the existing site surface water drainage system, with a settlement tank as necessary to remove excessive suspended fines,
- All electrical and communications services to be routed from ceiling down rather than floor up,
- Tiles are recommended rather than carpets for flooring in the basement rooms.

8.6 Summary

The risk of flooding from excess surface water is not considered significant. 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. It is considered that the development would not increase the risk of flooding elsewhere.

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9. Stage 3 - Site Investigation

Monitoring and Reporting	The Soil investigation was completed by (Soil investigation Company). From the Scoping stage we considered that their brief should cover: • Two trial pits have been done to confirm the existing building foundations. The purpose is to consider the effect of the works on the neighbouring properties and the find the ground conditions below the site. • It would have been preferred to complete two bore holes on this site, but due to access it was only possible for the rig to access to the front of the property. With the size of site, and our knowledge of the area it is not expect for there to be a large variation across the small site, therefore one borehole 7m deep was completed. • Stand pipe to be inserted to monitor ground water; record initial strike and the water level after 1 month. • Laboratory testing to confirm soil make up and properties. • The Historic maps and walk over survey did not highlight any significant contamination sources, therefore no site test of the ground has been requested. • Indication of soil type **See Appendix E for Soil report**

10. OS Map extract showing location of Railway

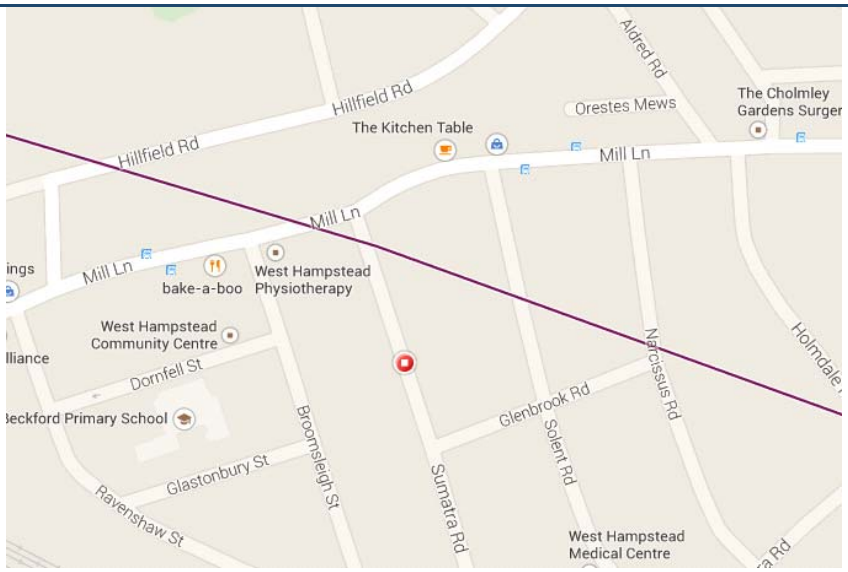

Figure 52 Extract from google map

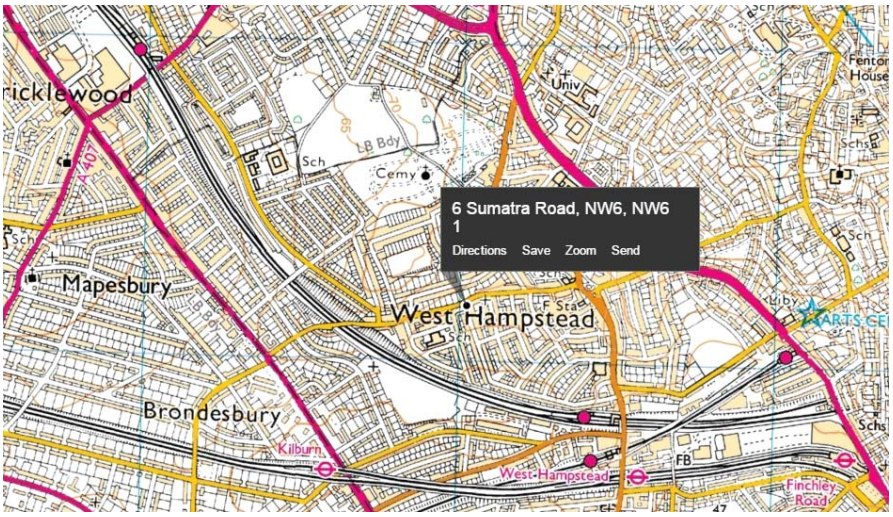

Figure 53 Extract from OS map showing proximity to nearest

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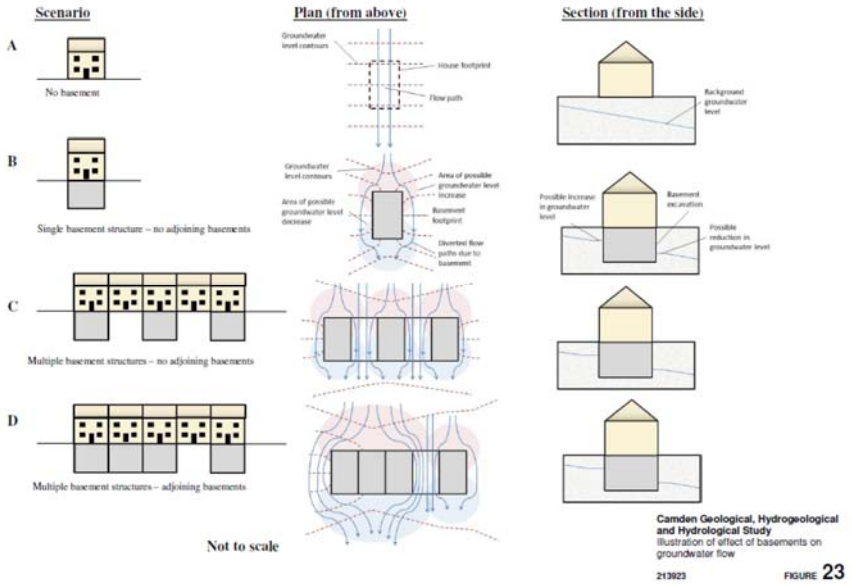
11. Stage 4 - Impact Assessment

Subterranean flow	The site is not within the catchment of the Hampstead Heath Ponds. It is a considerable distance from the ponds and standing water courses 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 3.0m below external ground floor level. Groundwater was not encountered during drilling on the 45th January 2015. A return site visit on the 9th January 2015 revealed the 4.8m deep well installed to be dry. Groundwater was measures 2.45m bgl on the 10th February 2015. The local affect of the basement will be to divert any flowing ground water away from the foot print of the building. To the front side and rear of the property large areas over 10m wide are present. With a large dispersal area for the flow to be diverted around the affects on the surrounding area will be minimal. 

	Without field testing in the neighbouring properties or along the road there is a low residual risk that the ground wall flow may affect the external ground. ***The basement design must allow for variants in ground water. 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.*** *For the level of development a full hydrology report is not suitable.*
Slope Stability	From the walk over survey, the OS map and the Arups report the general slope of the surrounding is less than 7º. Land slip is not a problem due to any circular failure patterns. The retaining walls must be designed to accommodate the lateral pressures from the soils.
Foundation type	Reinforced concrete cantilevered retaining walls The designs for the retaining walls have been calculated using software TEDDS. The software is specifically designed for retaining walls and ensures the design is kept to a limit to prevent damage to the adjacent property. **Attached printout of TEDDS calculations and Deflections of walls in Appendix C** The overall stability of the walls are design using K_a & K_p values, while the design of the wall uses K_o values. This approach minimise the level of movement from the concrete affecting the adjacent properties. The Investigations have highlight that water is a present. The walls are designed to cope with the hydrostatic pressure. The water table was low. The design of the walls however considers the long term items. It is possible that a water main may break causing local high water table. To account for this the wall is designed for water 1m from the top of the wall. 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.

Below are the design pressures and loadings.

RC wall Below Party walls

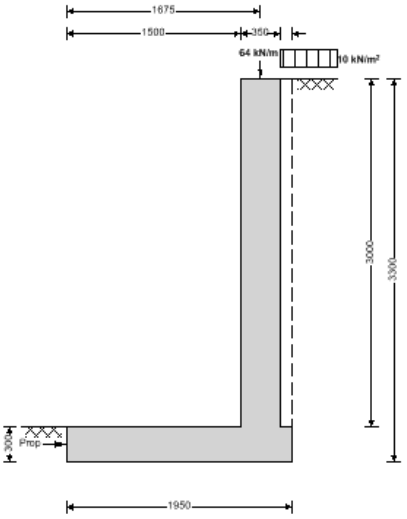


Figure 54 RC retaining wall structure – TW conditions

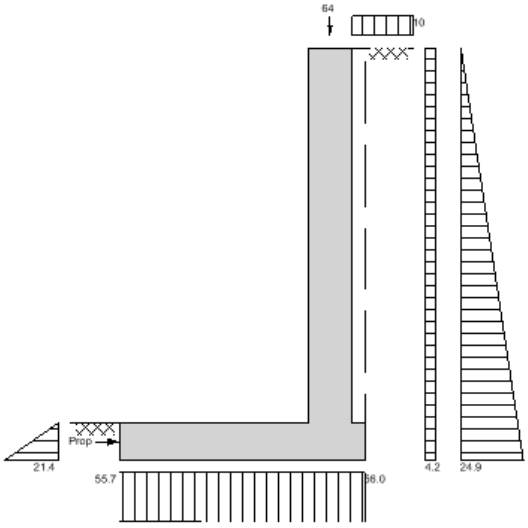


Figure 55 RC retaining wall structure , stresses – TW conditions

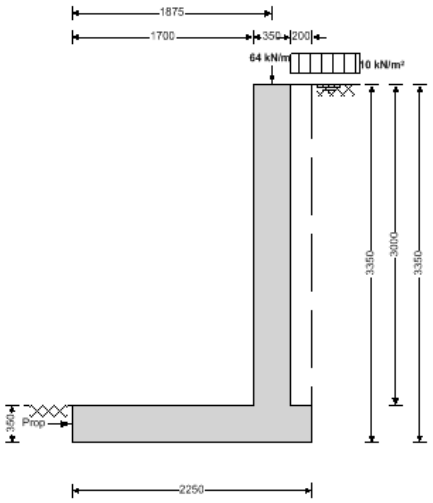


Figure 56 RC retaining wall structure – permanent conditions

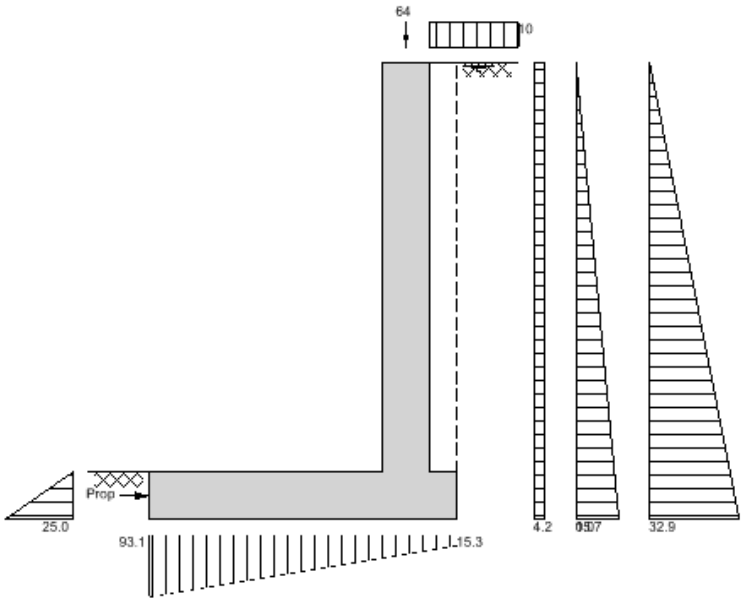


Figure 57 RC Retaining wall 1 stresses – permanent conditions

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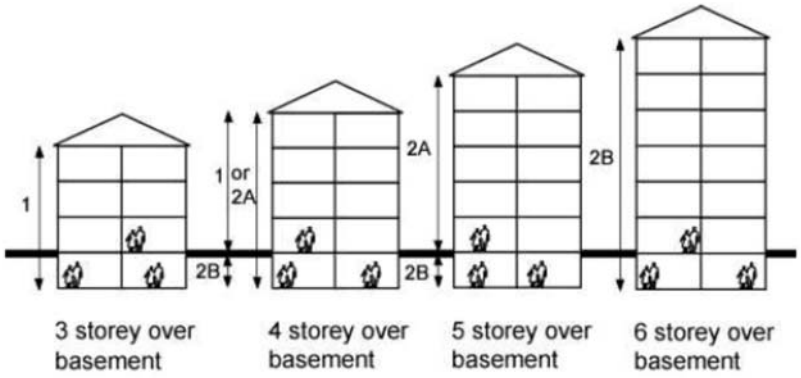
Vicinity of Trees	No trees are going to be removed.
Special precautions due to trees	Design using NHBC guidance Basement depth will allow for footings to be placed outside the effects of the trees. The current trees roots will be limited by the existing foundations. The new basements excavations will not significantly/ adversely affect the root protection zones of the neighbouring trees.
Drainage effects on Structure	No build over agreements known of. Flooding. The site is not in an area of high risk flooding.
Roads	The building does not undermine the highway, but car parking is present to the front of the property. It is possible for heavier goods vehicles to reverse on to the property to allow for this risk loadings are to be taken from the Highways loading code. <u>Highways loading allow:</u> 10kN/m² if within 45° of road 100kN point loads if under road or with in 1.5m 5kN/m² to front light well Garden Surcharge 2.5kN/m² Surcharge for adjacent property 1.5kN/m² + 4kN/m² for concrete ground bearing slab
Intended use of structure and user requirements	Family/domestic use
Loading Requirements (EC1-1)	

	UDL kN/m²	Concentrated Loads kN
Domestic Single Dwellings	1.5	2.0

The basement does line within a 45º angle of the highway. Therefore Highways HA loading is required to be applied.

Number of Storeys	3 storey + unfinished basement becoming 3 storey + completed basement (4) Is Live Load Reduction included in design No / %

Progressive Collapse	Design for consequences of localized failure in building from an unspecified cause
Is the Building Multi Occupancy?	No
Part A3 Progressive collapse	EN 1991-1-7:1996 Table A1



Class 1	Single occupancy houses not exceeding 4 storeys Agricultural buildings Buildings into which people rarely go, provided no part of the building is closer to another building, or area where people do go, than a distance of 1.5 times the building height

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	Yes / No

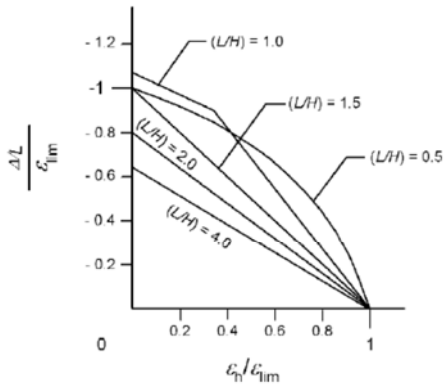
Additional Design Requirements to Comply with Progressive Collapse	**Class1 – Design to satisfy EN 1990 to EN 1999 stability requirements**

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 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.

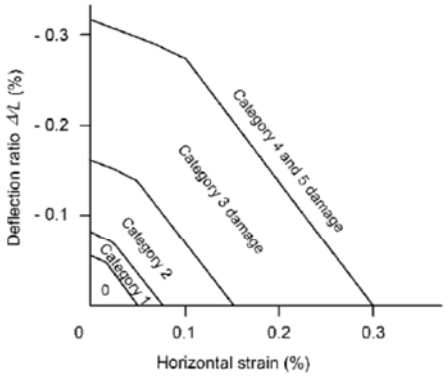
Adjacent Properties	***Any ground works pose an elevated risk to adjacent properties. The proposed works undermines the adjacent property along the party wall line:*** The party wall is to be underpinned. Underpinning the party wall will remove the risk of the movement to the adjacent property. The works 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. The method statement provided at the end of this report has been formulated with our experience of over 150 basements completed without error. 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 120 basements in the last 4 years. • Design the underpins to the stable without the need for elaborate temporary propping or needing the floor slab to be present. • Provide method statements for the contractors to follow • 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 cracking and 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 Δ/L / ε_{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 at ground, first, second and third floor levels at front and rear as shown on the attached sketch ML-1.

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 as attached.

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.

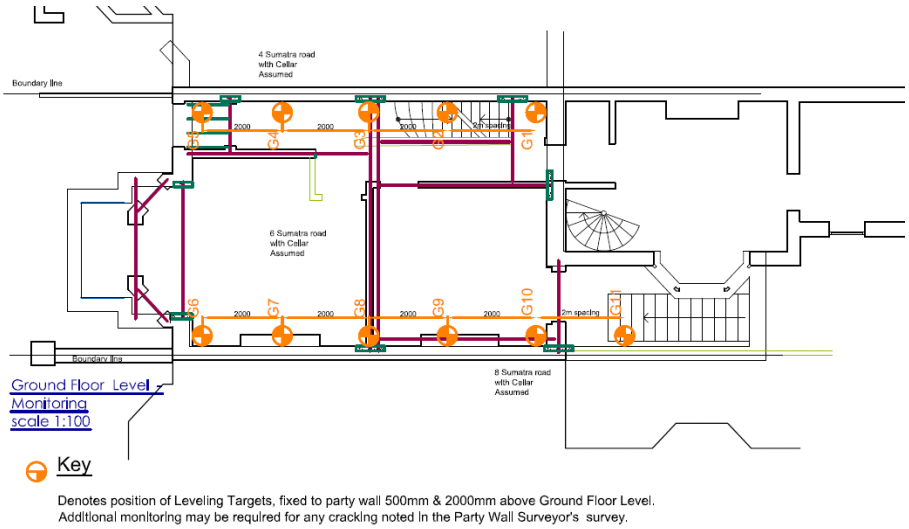


Figure 58 ML-1 - monitoring drawing

Monitoring Table

Location:	Date:						
	Initial:						Final:
G1							
G2							
G3							
G4							
G5							
G6							
G7							
G8							
G9							
G10							
G11							

Figure 59 Figure Monitoring M-10 drawing with the tables

Settlement limit along length of wall	Category	Action
0-2mm	Green	Carry on Works. Record values in table below.
2-5mm	Amber	Carry out a local structural review; Contract Croft Engineer and publish results to PWS. Preparation for the implementation of remedial measures should they be required.
>5mm	Red	Implement structural support as required; Cease works within a 5m zone of the affected section; Review monitoring data and implement revised method of works. Inform Croft Structural Engineers.

Basement Monitoring statement included in **Appendix F**

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 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 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. Ground floor slab is not being removed minimising the vibration and sound to adjacent properties. 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. A level of noise from a basement is lower than typical ground level construction due to this.