Basement Impact Assessment

in connection with proposed development at

No. 9 Nassington Road
Camden
London
NW3 2TX

for

Monique Branchmoore

LBH4572 ver. 1.1

April 2019

LBH WEMBLEY

ENGINEERING

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Foreword-Guidance Notes

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THIRD PARTY INFORMATION

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Non-Technical Summary

It is proposed to deepen the existing lower ground floor beneath the footprint of the existing house as necessary to achieve a full habitable height. This floor will also be extended to the front and to rear of the existing building, albeit owing to the natural ground slope, while the front extension will be subterranean the rear extension will be at garden level.

This report provides an assessment of the potential impacts that the basement development may have upon the surrounding area, neighbouring structures and the local environment.

Hydrogeological Impacts

The site is underlain by essentially impermeable London Clay and hence there is no shallow groundwater table and no scope for any adverse hydrogeological impacts to be caused by the proposed basement construction.

Hydrological Impacts

The proposed basement will extend outside the footprint of the existing building, which will lead to a net increase in the amount of impermeable surfacing. However, SuDS attenuation is to be included within the development and there will be no increased flood risk at this property or to neighbouring properties.

Stability Impacts

The proposed development will improve the overall stability of the building due to underpinning of the existing foundations.

The predicted building damage levels resulting from ground movements associated with the development have been analysed and found to be acceptable.

The proposed front lightwell is to be constructed near a tree, but the depth of the proposed excavation will obviate any associated issues regarding stability.

The foundations and flooring of the rear extension will, however, need to be designed with due regard to the trees to be retained in the rear garden.

Conclusion

The assessment concludes that no adverse residual or cumulative stability, hydrological or hydrogeological impacts should occur to either neighbouring structures or the wider environment as a result of this development.

1. Introduction

1.1 Background

It is proposed to deepen the existing basement at No. 9 Nassington Road and laterally extend to both the front and rear.

1.2 Brief

LBH WEMBLEY have been appointed by Monique Branchmoore to complete a Basement Impact Assessment (BIA) in support of a forthcoming planning application to be submitted to the London Borough of Camden, in order to satisfy the specific requirements of the 2018 Camden Planning Guidance on Basements, and associated 2010 Camden Geological, Hydrogeological and Hydrological Study.

1.3 Planning Policy

The 2017 Camden Local Plan Policy A5 Basements reads as follows:

"The Council will only permit basement development where it is demonstrated to its satisfaction that the proposal would not cause harm to:

a) neighbouring properties;
b) the structural, ground, or water conditions of the area;
c) the character and amenity of the area;
d) the architectural character of the building; and
e) the significance of heritage assets.
In determining proposals for basements and other underground development, the Council will require an assessment of the scheme's impact on drainage, flooding, groundwater conditions and structural stability in the form of a Basement Impact Assessment and where appropriate, a Basement Construction Plan.

The siting, location, scale and design of basements must have minimal impact on, and be subordinate to, the host building and property. Basement development should:

f) not comprise of more than one storey;
g) not be built under an existing basement;
h) not exceed 50% of each garden within the property;
i) be less than 1.5 times the footprint of the host building in area;
j) extend into the garden no further than 50% of the depth of the host building measured from the principal rear elevation;
k) not extend into or underneath the garden further than 50% of the depth of the garden;
l) be set back from neighbouring property boundaries where it extends beyond the footprint of the host building; and
m) avoid the loss of garden space or trees of townscape or amenity value.

Exceptions to f. to k. above may be made on large comprehensively planned sites.

The Council will require applicants to demonstrate that proposals for basements:

n. do not harm neighbouring properties, including requiring the provision of a Basement Impact Assessment which shows that the scheme poses a risk of damage to neighbouring properties no higher than Burland Scale 1 'very slight';
o. avoid adversely affecting drainage and run-off or causing other damage to the water environment;
p. avoid cumulative impacts;
q. do not harm the amenity of neighbours;
r. provide satisfactory landscaping, including adequate soil depth;
s. do not harm the appearance or setting of the property or the established character of the surrounding area;
t. protect important archaeological remains; and
u. do not prejudice the ability of the garden to support trees where they are part of the character of the area.

The Council will not permit basement schemes which include habitable rooms and other sensitive uses in areas prone to flooding.

We will generally require a Construction Management Plan for basement developments.

Given the complex nature of basement development, the Council encourages developers to offer security for expenses for basement development to adjoining neighbours."

The following policies in the Local Plan are also relevant to basement development and will be taken into account when assessing basement schemes:

- "Policy A2 Open space";
- "Policy A3 Biodiversity";
- "Policy D1 Design";
- "Policy D2 Heritage"; and
- "Policy CC3 Water and flooding".

In addition to the Local Plan Policy Camden publishes Camden Planning Guidance. These CPG documents do not carry the same weight as the main Camden Development Plan documents (including the above Policy A5) but they are important supporting documents.

It is noted that the CPG Basements (March 2018) replaces the earlier 2015 CPG4.

1.4 Report Structure

The report commences with a desk study and characterisation of the site, before progressing to BIA screening and scoping assessments, whereby consideration is given to identifying the potential hydrogeological, hydrological and stability impacts to be associated with the proposed development.

A ground model is then developed, which is followed by an assessment of the potential ground movements affecting the neighbouring structures.

Finally, an assessment of the potential impacts of the proposed scheme is presented.

1.5 Supporting Documents

The following documents have been consulted during the preparation of this document:

- Drawings of Existing building by Ultra Violet Architects, (EX(00)001,2,3,4, EX(00)010, 020, 021) dated September 2018
- Drawings of Proposed Scheme by Ultra Violet Architects, (AL(00)001A,2A,3A,4A, AL(00),010A, 011A, 020A, 021A) dated March 2019
- Arboricultural Impact Assessment by Advanced Tree Services (ATS), dated November 2018
- Drawings of Trial Hole by Richard Tant Associates (4811SK01,2,3,4,5) dated February 2019

2. The Site

2.1 Site Location

The site is situated on the southern side of Nassington Road, within the South Hill Park Estate Conservation Area, approximately 300m to the northeast of the Hampstead Heath Rail Station.

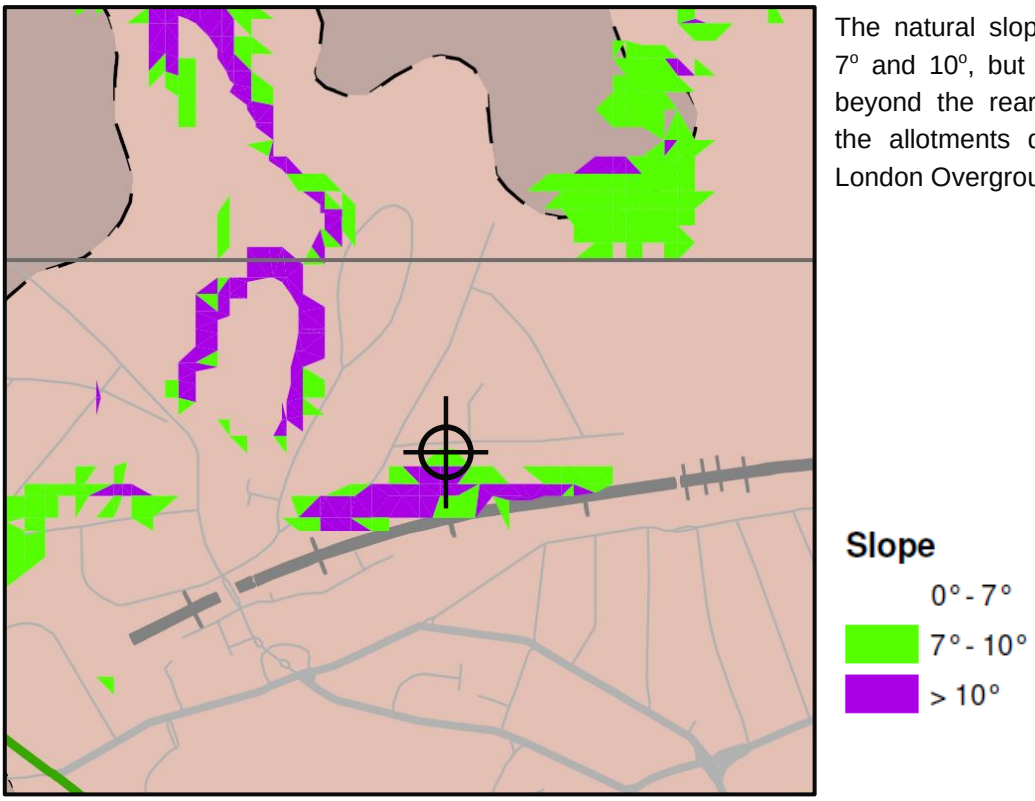
The London Overground railway runs through a cutting, approximately 60m to the south of the site, beyond some allotment gardens.

The site may be located approximately by postcode NW3 2TX or by National Grid Reference 527585, 185770.

Location plan

2.2 Topographical Setting

The site lies on the southern slopes of Parliament Hill on Hampstead Heath, falling southwards towards the valley of the now culverted River Fleet.



Extract from Figure 16 of the CGHHS

The natural slope lies at between 7° and 10°, but falls more steeply beyond the rear boundary across the allotments down towards the London Overground railway.

2.3 Site Description

The site is occupied by a late 19th Century four storey semi-detached house with a ground floor level set at the street level of approximately +72m OD. Cellars are present beneath the front of the property but at the rear there are two full height rooms that open out to a patio set approximately 3m lower than street level.

Plan showing the existing building

Rear elevation of No. 9 & No. 11Nassington Road

The rear elevation of the building is noted to bow outwards and an array of steel ties is present to counteract this. It is understood that a 2nd World War bomb landed across the road from No.9, destroying a building where Oakford Court now stands. Hence, the bowing could perhaps be attributed to blast damage.

Beyond the patio the rear garden slopes down towards the rear boundary, beyond which are the allotments.

Several fruit trees are present along the eastern boundary of the rear garden.

A silver birch tree is present to the front of the property on the pavement of Nassington Road.

The building shares a party wall to the east with its pair at No. 11 Nassington Road. Although No. 11 is a similar building, the cellars here have already been converted to full depth with the addition of a front light well.

The neighbouring No. 7 Nassington Road is separated from No. 9 by a distance of some 2m, occupied by two stepped alleyways on either side of a boundary wall. Although the lower ground floor of No. 7 is situated approximately 1.2m higher than that of No. 9, the rearmost part of No. 7 is situated over a cellar that extends down below the garden level of No.9.

Photo showing the alleyways between No. 9 and No. 7 Nassington Road

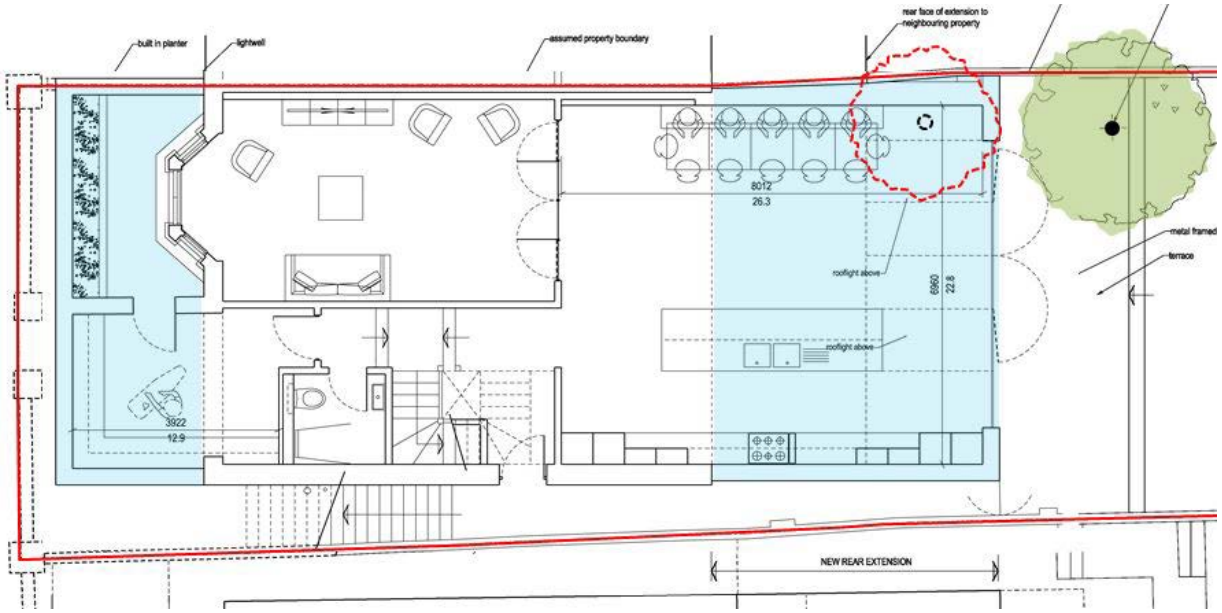
2.4 Proposed Development

It is proposed to deepen the existing basement at the property as shown below to provide headroom for habitable space; which will require excavation of approximately 2m to the front and 1m to the rear beneath the existing footprint. The existing side passage will also be lowered to provide access to the proposed basement level.

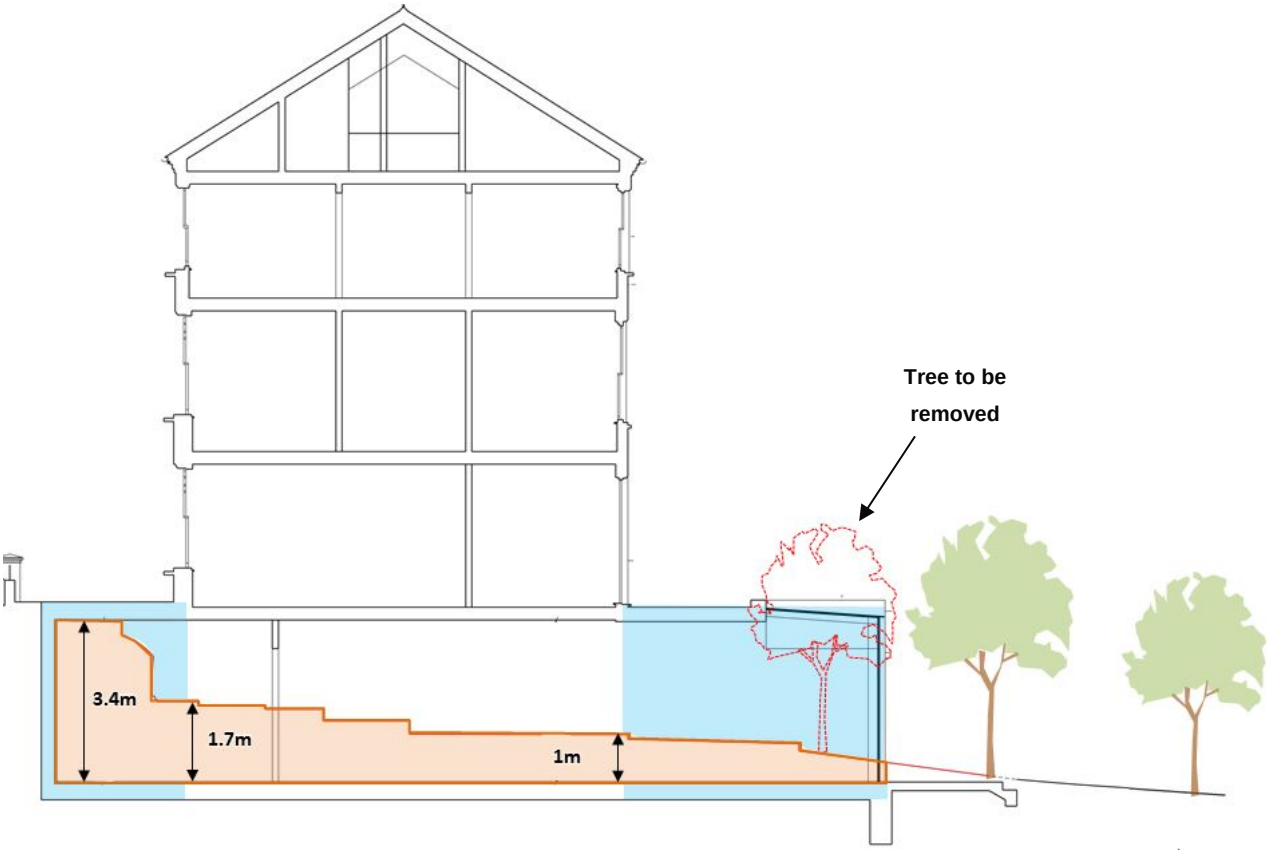
A front extension and lightwell will be created, requiring up to 4m of excavation.

A single storey rear extension will also be constructed as indicated below, necessitating the removal of a pear tree.

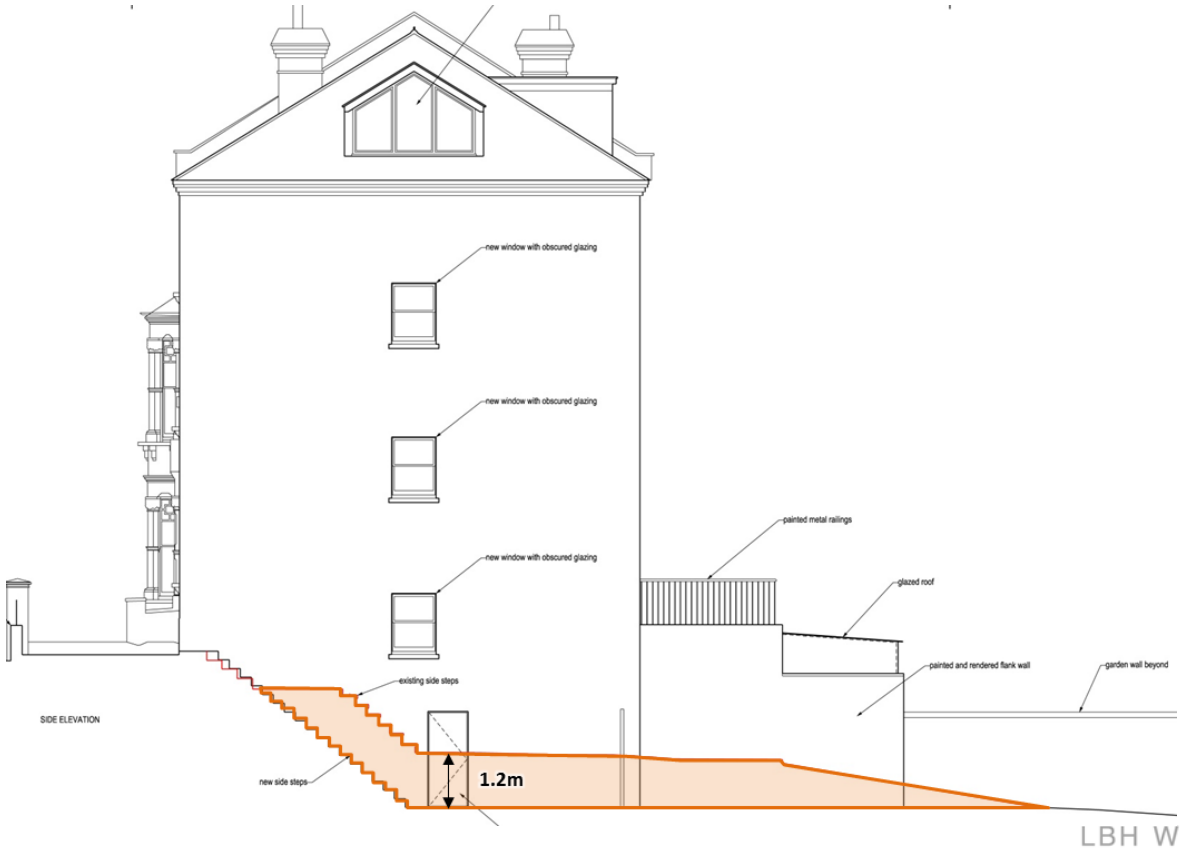
It is understood that, as part of the development, the rear bowed elevation will be demolished and rebuilt.



Proposed lower ground floor plan showing the proposed front and rear extensions



Sections showing the existing ground profile and the proposed development



3. Desk Study

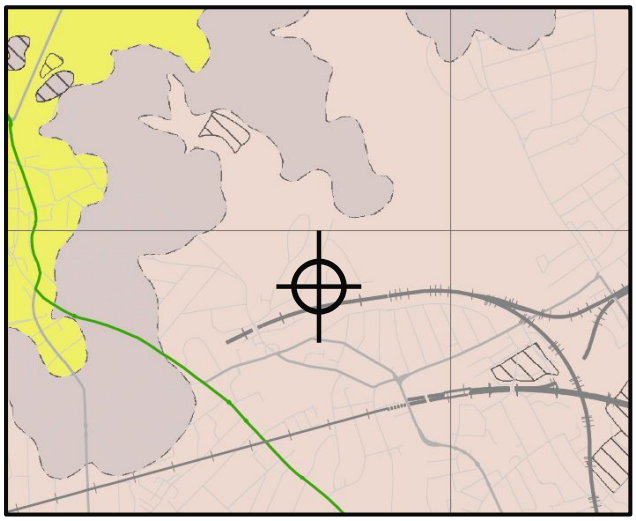
3.1 Site History

The site and surrounding area remained open land to the east of the Hampstead Ponds chain on the southern slopes of Hampstead Heath until the 19th Century.

A railway cutting was created for the North London Line to the south of the site in mid-19th Century; following which Nassington Road and surrounding streets, collectively known as South Hill Park Estate, were laid out in the late 19th Century.

The slopes of the railway cutting have been used for allotment gardens since the War.

Extracts of Figure 2 (above) and Figure 3 (below) (CGHHS, 2010)



3.2 Geological Information

The British Geological Survey (BGS) records indicate that the site is directly underlain by the London Clay Formation.

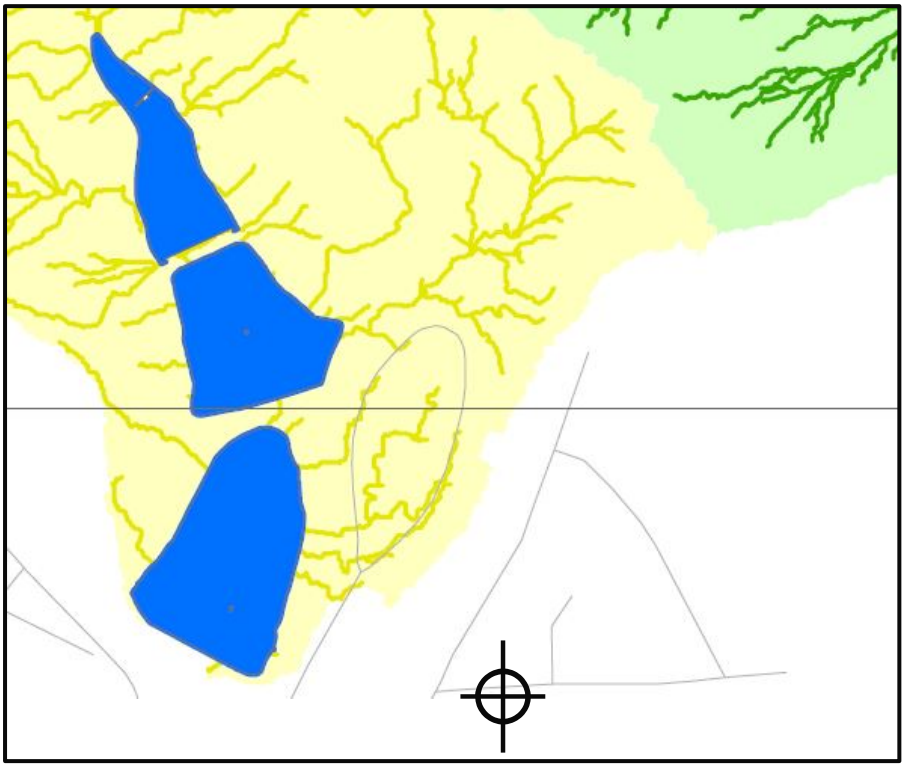
3.3 Hydrogeological Information

The Environment Agency (EA) classifies the London Clay Formation as Unproductive Strata.

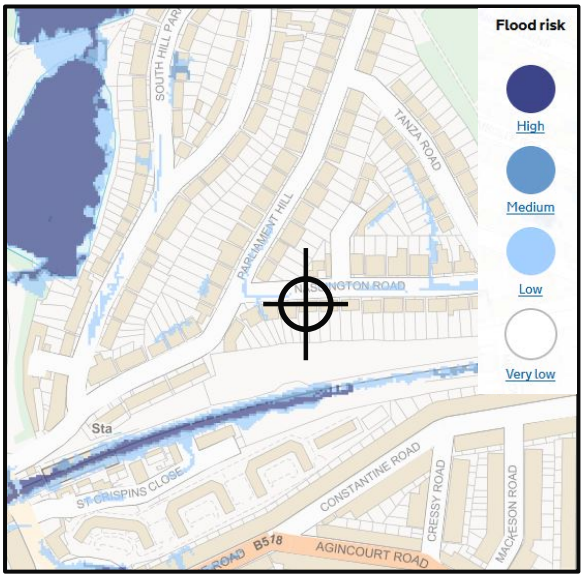
Due to the impermeability of the clay, no significant groundwater flow is possible beneath the site.

3.4 Hydrological Information

The nearest surface water feature to the site is the Hampstead No. 1 Pond, located approximately 200m to the northwest of the site.



Extract from Figure 14 of the CGHHS showing that the site is located outside of the Hampstead Heath Ponds catchment area



Extract of EA surface water flood risk map

The Environment Agency (EA) indicates that the site is at a very low risk of surface water flooding, while Figure 6 of the Camden SFRA indicates that the site is located outside of the Critical Drainage Areas and Local Flood Risk Zones.

4. Screening & Scoping Assessments

The Screening & Scoping Assessments have been undertaken with reference to Appendices E and F of the CGHSS, which is a process for determining whether or not a BIA is usually required. The relevant extracts from figures presented in the CGHHS are shown in the Desk Study section or the Appendix to this report.

4.1 Screening Assessment

The Screening Assessment consists of a series of checklists that identifies any matters of concern relating to the following:

- Subterranean (groundwater) flow
- Surface flow and flooding
- Slope stability

4.1.1 Screening Checklist for Subterranean (Groundwater) Flow

Question	Response	Justification
Is the site is located directly above an aquifer?	**No**	Figure 8 of the CGHHS indicates that the site is not underlain by an aquifer.
Will the proposed basement extend beneath the water table surface?	**No**	
Is the site within 100m of a watercourse, well (used/disused) or potential spring line?	**No**	The nearest watercourse is the River Fleet, approximately 250m to the west of the site.
Is the site within the catchment of the pond chains on Hampstead Heath?	**No**	Figure 14 of the CGHHS indicates that the site lies outside the catchment of the pond chains on Hampstead Heath.
Will the proposed development result in a change in the area of hard-surfaced/paved areas?	**Yes**	The proposed development will extend into the existing front and rear garden areas.
Will more surface water (e.g. rainfall and run-off) than at present will be discharged to the ground (e.g. via soakaways and/or SUDS)?	**Yes**	The existing sewer drainage arrangement will be maintained but it is proposed to discharge the roof drainage via SuDS into the garden area
Is the lowest point of the proposed excavation (allowing for any drainage and foundation space under the basement floor) close to or lower than the mean water level in any local pond?	**No**	The proposed excavations will be entirely above the level of Hampstead Pond No. 1.

4.1.2 Screening Checklist for Surface Flow and Flooding

Question	Response	Justification
Is the site within the catchment area of the pond chains on Hampstead Heath?	**No**	Figure 14 of the CGHHS indicates that the site lies outside the catchment of the pond chains on Hampstead Heath.
As part of the site drainage, will surface water flows (e.g. rainfall and run-off) be materially changed from the existing route?	**Yes**	SuDS features are to be introduced discharging to the rear garden.
Will the proposed basement development result in a change in the proportion of hard-surfaced/paved areas?	**Yes**	The proposed development will extend into the existing front and rear garden areas.
Will the proposed basement result in changes to the profile of the inflows (instantaneous and long-term) of surface-water being received by adjacent properties or downstream watercourses?	**No**	SuDS features will be designed to prevent any increase in surface water run-off
Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	**No**	SuDS features will be designed to prevent any pollution
Is the site in an area known to be at risk from surface water flooding, or is it at risk from flooding for example because the proposed basement is below the static water level of a nearby surface water feature?	**No**	Environment Agency (EA) maps indicate that the site is at a very low risk of surface water flooding.

4.1.3 Screening Checklist for Stability

Question	Response	Justification
Does the existing site include slopes, natural or manmade, greater than 7 degrees?	**Yes**	The site slopes at an angle greater than 7° towards the rear of the site.
Does the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7 degrees?	**No**	No re-profiling is planned at the site.
Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees?	**Yes**	The land falls more steeply (10 degrees) beyond the rear boundary due to a railway cutting.
Is the site within a wider hillside setting in which the general slope is greater than 7 degrees?	**No**	Figure 16 of the CGHHS indicates that, aside from the railway cutting, the general slope of the wider hillside is less than 7°.

Is London Clay the shallowest strata at the site?	**Yes**	The British Geological Survey (BGS) records indicate the shallow stratum to be London Clay Formation.
Will trees be felled as part of the proposed development and/or are works proposed within tree protection zones where trees are to be retained?	**Yes**	A pear tree is to be felled in the rear garden to accommodate the rear extension and the front extension may just clip the root protection zone of a silver birch situated in the pavement to Nassington Road.
Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	**No**	The past structural movement of the rear wall is attributed to wartime last damage.
Is the site within 100m of a watercourse of a potential spring line?	**No**	The nearest watercourse is the River Fleet, approximately 250m to the west of the site.
Is the site within an area of previously worked ground?	**No**	Figure 3 of the CGHHS indicates that the site is not underlain by worked ground.
Is the site within an aquifer?	**No**	The Environment Agency (EA) maps indicate that the site is not underlain an aquifer.
Will the proposed basement extend beneath the water table such that dewatering may be required during construction?	**No**	
Is the site within 50m of the Hampstead Heath ponds?	**No**	The site lies approximately 200m away from Hampstead Pond No.1.
Is the site within 5m of a highway or pedestrian right of way?	**Yes**	The proposed front basement extension will lie adjacent to the rear edge of the pavement to Nassington Road.
Will the proposed basement significantly increase the differential depth of foundations relative to the neighbouring properties?	**Yes**	The proposed floor level will lie slightly deeper (approx. 500mm) than the adjacent property at No. 11 but the front excavation may locally extend up to 2m deeper than the foundations to No. 7.
Is the site over (or within the exclusion zone of) tunnels, e.g. railway lines?	**No**	The site is not within any exclusion zones or over tunnels.

4.2 Scoping Assessment

Where the checklist is answered with a “yes” or “unknown” to any of the questions posed in the flowcharts, these matters are carried forward to the scoping stage of the BIA process. The other potential concerns considered within the screening process have been demonstrated to be not applicable or not significant when applied to the proposed development.

The scoping produces a statement which defines further the matters of concern identified in the screening stage. This defining should be in terms of ground processes, in order that a site specific BIA can be designed and executed (Section 6.3 of the CGHHS).

4.2.1 Scoping for Subterranean (Groundwater) Flow

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

The guidance advises that the sealing off of the ground surface by pavements and buildings to rainfall will result in decreased recharge to the underlying ground. In areas underlain by an aquifer, this may impact upon the groundwater flow or levels. In areas of non-aquifer (i.e. on the London Clay), this may mean changes in the degree of wetness which in turn may affect stability. The guidance advises that a change in the in proportion of hard surfaced or paved areas of a property will affect the way in which rainfall and surface water are transmitted away from a property. This includes changes to the surface water received by the underlying aquifers, adjacent properties and nearby watercourses. Changes could result in decreased flow, which may affect ecosystems or reduce amenity, or increased flow which may additionally increase the risk of flooding.

- **More surface water (e.g. rainfall and run-off) than at present will be discharged to the ground (e.g. via soakaways and/or SUDS).**

The guidance advises that in areas underlain by an aquifer, this may impact upon the groundwater flow or levels – this would then have similar impacts to those listed in 1b) and 2). In areas of non-aquifer (i.e. on the London Clay), this may mean changes in the degree of wetness which in turn may affect stability.

4.2.2 Scoping for Surface Flow and Flooding

- **As part of the site drainage, surface water flows (e.g. rainfall and run-off) will be materially changed from the existing route.**

The guidance advises that basement development may increase the load on the sewer and drainage systems if it leads to increased occupancy of dwellings. In turn this may increase the risk of flooding should the sewer and drainage systems become overwhelmed. Constructing a basement, either beneath or adjacent to an existing building will typically remove the permeable shallow ground that previously occupied the site footprint. This reduces the capacity of the ground to allow rainfall to be stored in the ground (which in essence acts as a natural SUDS, or sustainable urban drainage system). This runoff must then be managed by other means (eg through construction of SUDS), to ensure that it doesn't impact on adjoining properties or downstream watercourses. For sites in the catchments of the pond chains the potential impacts listed above under (1) apply if the resulting changes in drainage affect the flow to the ponds.

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

The guidance advises that a change in the proportion of hard surfaced or paved areas of a property will affect the way in which rainfall and surface water are transmitted away from a property. This includes changes to the surface water received by the underlying aquifers, adjacent properties and nearby watercourses. Changes could result in decreased flow, which may affect ecosystems or reduce amenity, or increased flow which may additionally increase the risk of flooding.

4.2.3 Scoping for Stability

- **Does the existing site include slopes, natural or manmade, greater than 7 degrees?**

The guidance advises that there is potential for local slope instability within the site.

- **Does the development neighbour land, including railway cuttings and the like, with a slope greater than 7 degrees?**

The guidance advises that there is potential for slope instability within the neighbouring land.

- **Is the London Clay the shallowest strata at the site?**

The guidance advises that of the at-surface soil strata present in LB Camden, the London Clay is the most prone to seasonal shrink-swell (subsidence and heave).

- **Will any tree/s be felled as part of the proposed development and/or are any works proposed within any tree protection zones where trees are to be retained?**

The guidance advises that the soil moisture deficit associated with felled tree will gradually recover. In high plasticity clay soils (such as London Clay) this will lead to gradual swelling of the ground until it reaches a new value. This may reduce the soil strength which could affect the slope stability. Additionally the binding effect of tree roots can have a beneficial effect on stability and the loss of a tree may cause loss of stability.

- **Is the site within 5m of a highway or pedestrian right of way?**

The guidance advises that excavation for a basement may result in damage to the road, pathway or any underground services buried in trenches beneath the road or pathway.

- **Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties?**

The guidance advises that excavation for a basement may result in structural damage to neighbouring properties if there is a significant differential depth between adjacent foundations.

5. Site Investigation

An investigation comprising a series of trial pits was carried out in February 2019, in order to assess the ground conditions and expose the configuration of the existing foundations.

The trial pit records are appended.

5.1 Ground Conditions

Beneath a limited thickness of made ground, the site is directly underlain by the London Clay Formation, comprising typical firm, becoming firm to stiff, pale brown mottled grey fissured silty clay with scattered selenite crystals.

The London Clay soils are assessed to be of high volume change potential.

5.2 Groundwater

A shallow groundwater table is not present beneath the site.

6. Basement Construction

6.1 Excavation

The front extension and lightwell will require a 4m deep excavation, while the excavation beneath the existing footprint will vary between 2m at the front to less than 1m at the back.

It is understood the adjoining No. 11 Nassington Road comprises a lower ground floor level set at a similar level to the existing lower ground floor of No. 9. The lower ground floor level at No. 7 is situated approximately 1.2m above this but it is understood that the rearmost part is constructed with deep foundations and includes a cellar below the lower ground floor.

The existing property is supported by traditional strip footings bearing upon the London Clay.

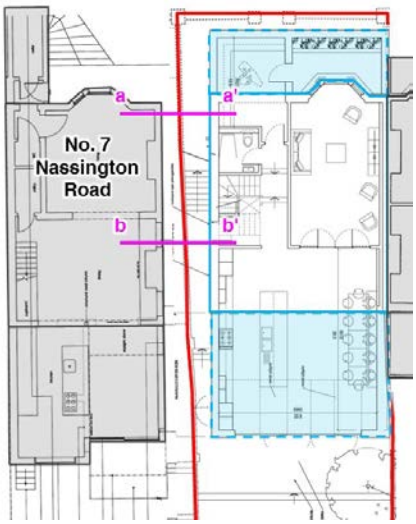
The new basement perimeter walls will be formed by a combination of existing walls and up to around 2m of conventional “hit and miss” underpinning. Similarly, “hit & miss” techniques will be employed to construct the walls of the front extension and lightwell.

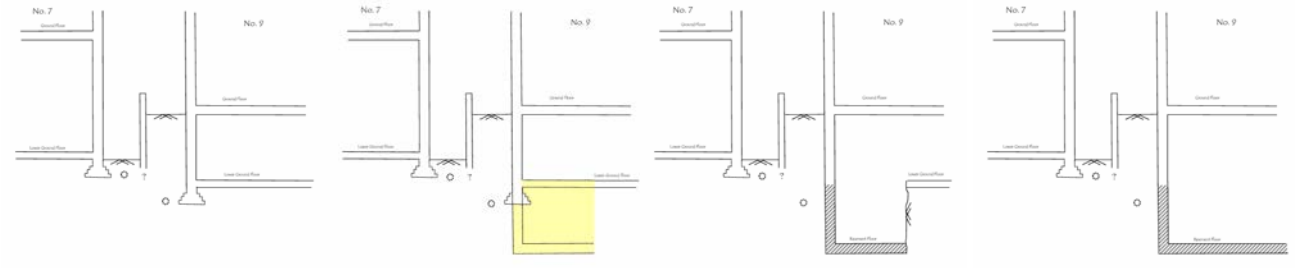
New foundations placed in firm London Clay Formation and may be designed to apply an assessed net allowable bearing pressure of 120kN/m^2.

6.2 Side Passage

The front, northernmost section of the side passage to No. 9 is shown as Section a-a’ below. In this section the flank wall to No. 9 will require underpinning as indicated in the sketch sequence.

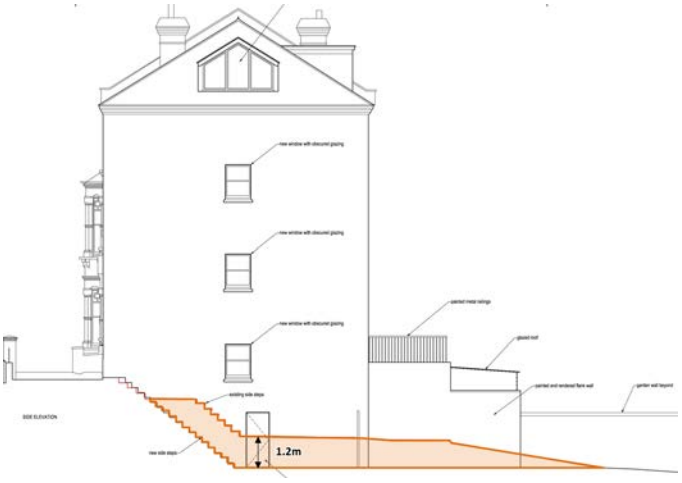
The assumed approximate position of the drainage is indicated on these sections and it is envisaged that this can remain undisturbed.



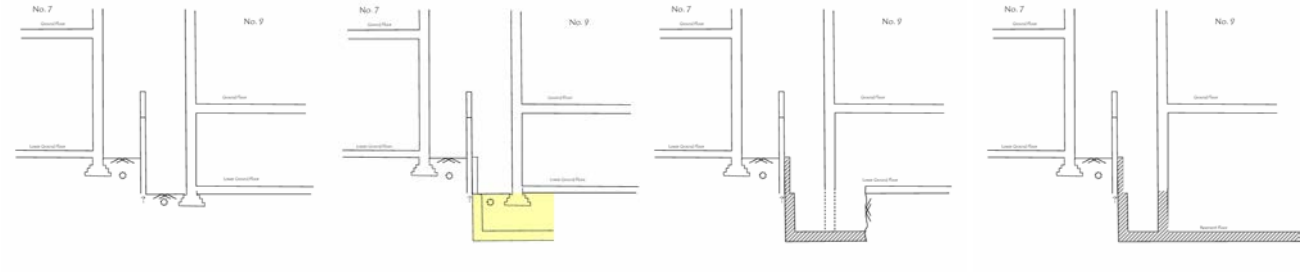


Section a-a’

To the rear of the existing steps in the side passage to No. 9 the side passage is to be lowered to the new basement level. As indicated by Section b-b' below, this boundary wall is a retaining wall.



It is therefore suggested that, following diversion of the existing drain as described in the following section, hit and miss pin excavations should be opened up (yellow tint) to the required depth in the passage and extended below both the boundary retaining wall and the house flank wall to allow the placement of a cast in situ L-shaped section of new reinforced concrete retaining wall in front of the existing retaining wall.



Section b-b'

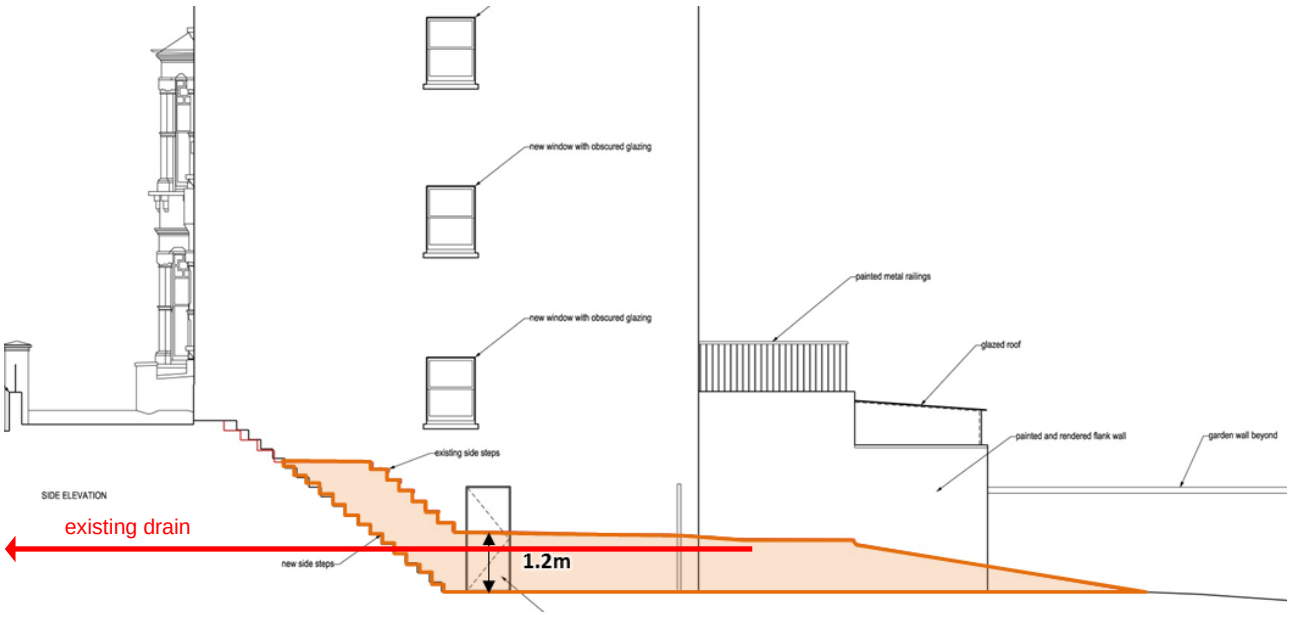
Sufficient temporary and permanent propping musty be installed to ensure that any lateral movement of the foundations of No 7 and the suspected high level drainage route is prevented.

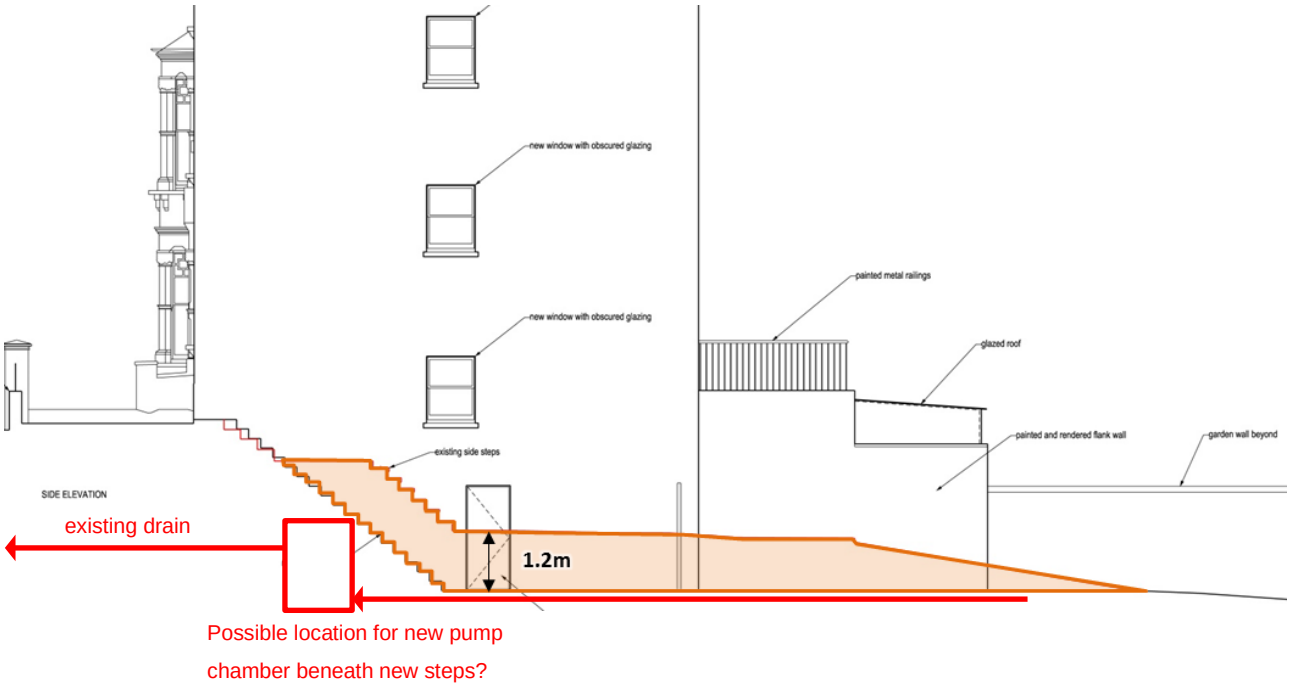
6.2.1 Existing Drainage

Deepening of the side passage will inevitably impact the existing drainage running at a shallow depth beneath the side passage.

Aside from the northernmost section, the existing drainage will therefore need to be abandoned prior to basement excavations.

In order to maintain the existing connection to the sewer beneath Nassington Road, it may be possible to install a new pump chamber as suggested below beneath the front section of the side passage.





6.3 Waterproofing

There is some potential for water to collect around the front sections of the basement in the long term. Hence, it is recommended that the basement should be fully waterproofed and designed to withstand hydrostatic pressures in accordance with Guidance provided in BS8102:2009, Code of Practice for the Protection of Below-Ground Structures against Water from the Ground. An assumed groundwater level at 1m depth below external existing ground level would be prudent for the purposes of assessing hydrostatic pressures.

6.4 Basement Heave

Excavation of the front lightwell will result in some local unloading of the clay leading to theoretical heave movement of the underlying soil in both the short and long term.

An assessment of the likely extent of any long term uplift is made in Section 7 of this report.

6.5 Retaining Walls

The following parameters would be appropriate for the design of the basement retaining walls:-

Suggested Retaining Wall Design Parameters			
Stratum	**Bulk Unit Weight**	**Effective Cohesion**	**Effective Friction Angle**
	(kN/m^3)	(c' - kN/m^2)	(ϕ'- degrees)
London Clay	20	Zero	25

6.6 Effect of trees

The front extension and lightwell will be constructed within the potential zone of influence of a silver birch tree.

Although the London Clay soils are of high volume change potential, the basement excavation in this section (4m) is expected to remove any affected clay that may result in additional forces being exerted on the structure due to possible swelling.

A single 6m tall pear tree is to be removed in order to allow the construction of the rear extension, albeit the extension is also to be constructed within the anticipated zone of influence of several trees to be retained.

The foundations of the rear extension will therefore need to be designed in accordance with the guidance provided by the NHBC in regards to building near trees. It is envisaged that a deepened founding depth of up to 2m and fully suspended flooring may need to be adopted for those parts of the rear extension that are affected.

It is understood that the boundary wall between No. 9 and No. 11 was underpinned to approximately 1.8m depth during the construction of the rear extension of No. 11; which is presumably also as a result of the trees along this boundary.

6.7 Land Stability

The proposed developed will tend to increase the stability of the both the surrounding slope and the building once completed, by virtue of the proposed underpinning and deepening of the existing foundations and the formation of a more rigid below-ground structure.

7. Ground Movements to Neighbouring Properties

Camden Council seeks to ensure that harm will not be caused to neighbouring properties by basement development.

Camden Local Plan (June 2017) states that the BIA must demonstrate that the proposed basement scheme has a risk of damage to the neighbouring properties no higher than Burland Scale 1 'Very Slight'.

7.1 Structures Assessed for Ground Movement

No. 7 Nassington Road

No. 7 is located 2m distance from No. 9 and the front section of the property is set approximately 2m above the proposed floor level.

No. 11 Nassington Road

No. 11 shares a party wall with No. 9 that has already been deepened to accommodate a basement, set approximately 1m above the proposed floor level.

7.2 Modelled Ground Conditions

An analysis of the vertical movements has been carried out using the soil stiffness parameters detailed in the table below.

For design purposes a conservative undrained strength profile has been adopted, assuming an average Cu of 50kN/m^2 at the surface of the London Clay Formation, increasing by 6.7kN/m^2 per m depth.

The Undrained Modulus of Elasticity (Eu) has been based upon an empirical relationship of Eu = 500 x undrained cohesion (Cu), and the Drained Modulus of Elasticity (E') has been based upon an empirical relationship of 350 x Cu.

Stratum:	**Undrained Elastic Modulus Eu (kN/m^2)**	**Drained Elastic Modulus E' (kN/m^2)**
London Clay Formation	37,800kN/m^2 at surface increasing linearly to 146,400kN/m^2 at 30m depth	25,200kN/m^2 at surface increasing linearly to 97,600kN/m^2 at 30m depth

Poisson's Ratios of 0.5 and 0.1 have been used for short term (undrained) and long term (drained) conditions respectively.

The analysis uses the above parameters for stratified homogeneity and with the introduction of an assumed rigid boundary at approximately 30m depth.

7.3 Short Term Vertical Movements

There are two components of short term movement that will interact to affect the neighbouring structures.

These components are firstly progressive sagging movements of the underpinned party walls due to imperfections in the underpinning process itself and then secondly elastic heave of the ground within the new excavation as a direct response to the unloading of the weight of soil removed.

4m of excavation will be required to create the front lightwell and the potential effect may be may be considered by application of unloading of up to -80kN/m^2 due to soil removal.

Excavation beneath the existing building will be 2m at the very front, becoming progressively less towards the rear of the building where less than 1m of excavation will be required.

7.3.1 Short Term Movement due to Underpinning

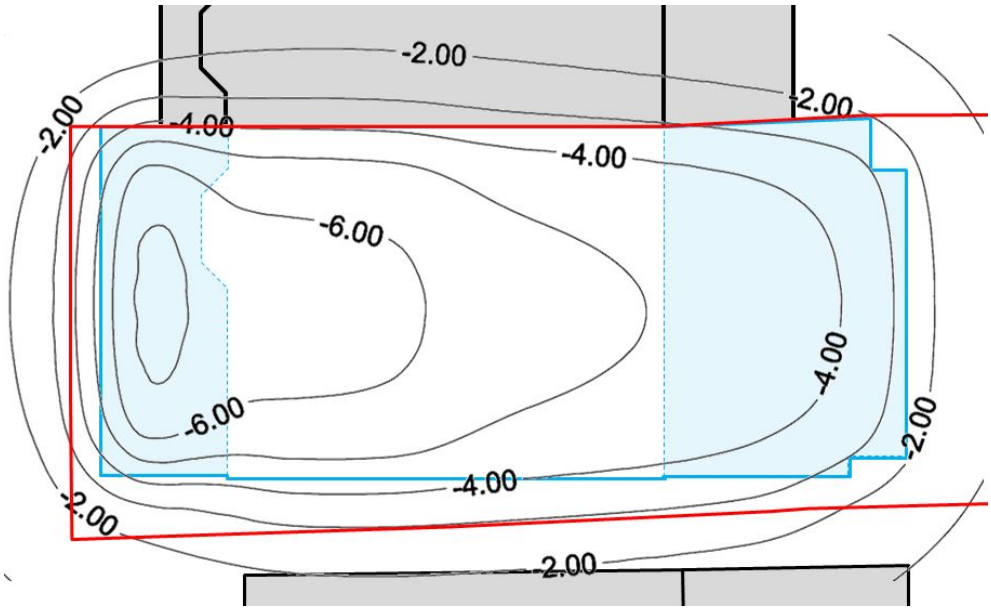
It is not possible to rigorously model the extent of party wall settlement arising from underpinning and experience indicates that amount of any movements are very much dependent on workmanship. However, it is suggested that given dry conditions and good workmanship, the amount of vertical movement of the party walls can reasonably be expected to be a maximum of 5mm per stage of underpinning.

For modelling purposes, the depth of underpinning is assumed to be up to approximately 2m; hence one stage of underpinning will be utilised.

As a first approximation, the magnitude of the vertical movement is assumed to reduce to zero at a distance of 3.5 x 1.5m = 5.25m behind the wall.

7.3.2 Short Term Movements due to Excavation heave

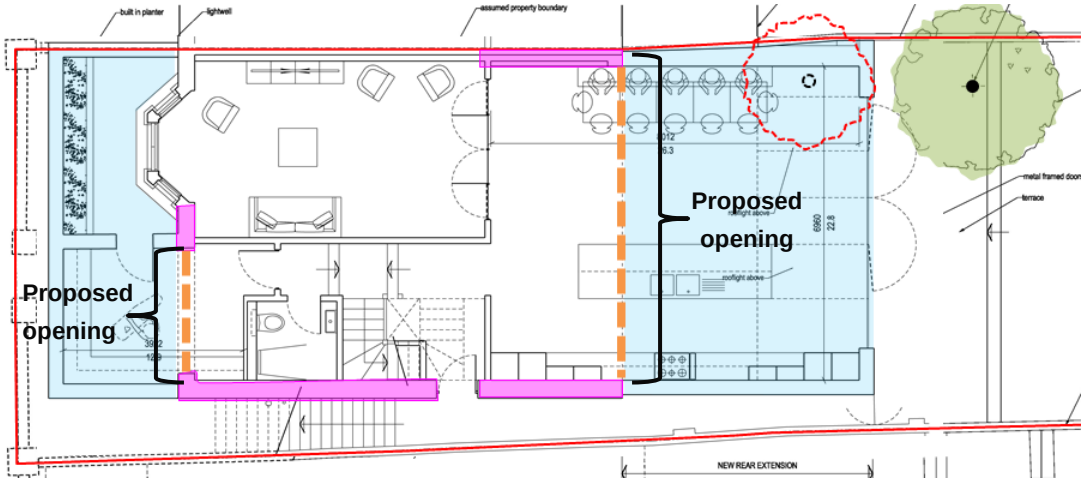
Less than 10mm of short term soil heave is predicted within the proposed lightwell, reducing to less than 5mm towards the rear of the property.



Plan showing theoretical approximate short term heave contours (mm)

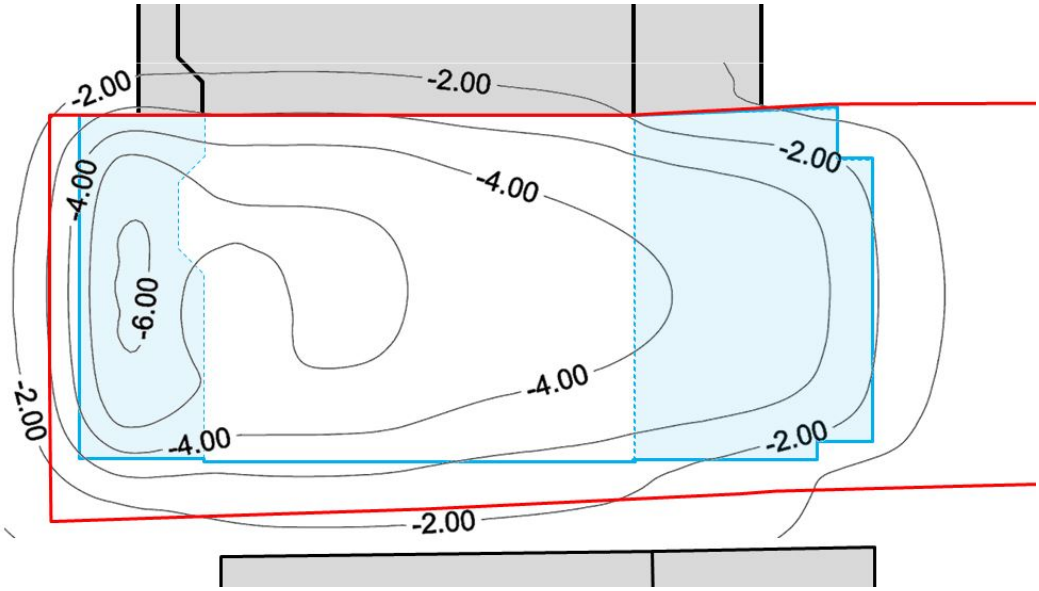
7.4 Post Construction Vertical Movements

In addition to potential heave movements the post-construction ground movement analysis takes account of the proposed load takedown resulting from the development. The existing loads will be redistributed as a result of the proposed openings to the front and rear elevations, as shown below.



Plan indicating areas receiving additional loading due to redistribution of loads (shaded pink)

The results of a heave analysis, as presented on the plan shown below, suggest that the scale of any additional long term heave will again potentially amount to less than 10mm within the front lightwell, reducing to less than 5mm towards the rear.



Plan showing theoretical approximate post-construction heave contours (mm)

7.5 Horizontal Movements

Horizontal soil movements are expected to occur due to yielding of the soil behind the underpinned wall during the basement excavation. For embedded retaining walls, this yielding has been found to extend to a distance approximately equivalent to four times the depth of excavation in front of the wall.

As a first approximation, the magnitude of the horizontal movement at the underpinned party wall is assumed to be 5mm, which is equal to the vertical movement at the wall.

This horizontal movement is assumed to reduce to zero at a maximum distance of 4 x 1.5 = 6m behind the wall.

It is essential that lateral propping is provided both at ground level (high level) prior to any excavation and also at or just above the basement level (low level) as soon as is possible in order to prevent lateral movements of the new underpinning. This propping must remain in place and only be removed once some other permanent system, such as a suitably designed reinforced concrete basement or ground floor, has been installed.

7.6 Impact on Neighbouring Structures

In practice, although the various movements described above will interact so that the soil basement heave effects will tend to counteract the underpinning wall settlement movements, it is considered prudent to consider the worst case situation. Thus, the analysis of potential damage to neighbouring structures is based upon movement predictions that ignore basement soil heave.

The effect of these predicted vertical and horizontal deflections have been assessed using the Burland damage category assessment process, which is based upon consideration of a theoretical masonry panel of a given length (L) and height (H).

The potential degree of the predicted ground movements on the assessed structures can be estimated by the correlation of maximum horizontal strain, εh, with the maximum deflection ratio, Δ/L, where Δ is the vertical distortion over a the wall length under assessment (where the wall length L is actually less than the distance to the point at which zero vertical movement is assumed, a minimum distortion of 1mm is assumed).

The potential degree of damage due to the proposed basement construction has been assessed for each neighbouring property using lines of sections and a summary for each property is shown below.

Plan showing line of sections used for damage category assessment

No. 11 Nassington Road (Section A-A' and B-B')

Given the previous underpinning of the party wall, up to 1.5m of additional underpinning will be required. A damage category assessment can therefore be provided for sections A-A' and B-B' on the basis of a single stage of underpinning. The length of these sections (L) is taken as 8m and the wall height (H) as 10m.

On the basis of the movements described above a maximum horizontal strain, εh (Δh / L) of 0.0625% is assessed, producing a maximum deflection ratio Δ / L = -0.015, within a limiting tensile strain of 0.075%, and a resultant Burland Category 1 "Very Slight" condition.

No. 7 Nassington Road

The damage category assessment for sections C-C' and D-D' is based upon up to 1.5m of underpinning of the garden wall, set approximately 1m distant from No. 7. The length of these sections (L) is taken as 8m and the wall height (H) as 10m.

On the basis of the movements described above a maximum horizontal strain, εh (Δh / L) of 0.0547% is assessed, producing a maximum deflection ratio Δ / L = -0.01375, within a limiting tensile strain of 0.065%, and a resultant Burland Category 1 "Very Slight" condition.

7.6.1 Public Highway

The pavement to Nassington Road lies immediately adjacent to the western boundary of the proposed basement, where there is expected to be excavation of around 4m.

Given reasonable standards of workmanship and temporary propping during the ‘hit and miss’ lightwell construction works, negligible movement (<5mm settlement) is anticipated and this may be counteracted in practice by some small amounts of heave.

8. Impact Assessment

The screening and scoping stages have identified potential effects of the development on those attributes or features of the geological, hydrogeological and hydrological environment.

This stage is concerned with evaluating the direct and indirect implications of each of these potential impacts.

8.1 Hydrogeological Impact Assessment

This site is underlain by clay soils and there is consequently no shallow groundwater table at this site.

It is therefore considered that the development will not have any impact upon groundwater flow and there is additionally no scope for any cumulative impact.

8.2 Hydrological Impact Assessment

Although there will be a net reduction in the amount of soft landscaping, it is considered that there will be no change to the flood risk at the site or neighbouring sites.

Nevertheless, there will be a need to maintain the present water discharge regime and provide Sustainable Drainage Systems (SuDS) to meet the planning policy requirements.

An Outline SuDS Strategy is presented as a separate report (LBH4572suds).

8.3 Stability Impact Assessment

8.3.1 Slope stability

The proposed development will increase the stability of the both the surrounding slope and the building once completed, by virtue of the proposed underpinning and deepening of the existing foundations and the formation of a more rigid below-ground structure.

8.3.2 London Clay

The London Clay soils are assessed to be of high volume change potential.

Although there is no evidence of seasonal shrink/swell movements affecting this property, given that the adjacent semi-detached property has already been underpinning the proposed basement will serve to improve the stability.

8.3.3 Trees

The depth of the proposed excavation to the front extension will obviate any issues regarding potential stability effects associated with the nearby tree.

The foundations and flooring of the rear extension will be designed with due regard to both the tree that is to be removed and the nearby trees that are to remain in the rear garden.

8.3.4 Ground Movements

The Local Plan states that the proposed basement should pose a risk of damage to neighbouring properties no higher than Burland scale Category 1 'Very Slight', and mitigation measures should be incorporated if the assessed damage is not acceptable.

The predicted building damage levels resulting from ground movements associated with the proposed development have been analysed and found to be acceptable.

In addition, no significant movement to the public highway due to the proposed basement development is predicted.

8.4 Residual Impacts

The proposed basement will have no residual unacceptable impacts upon the surrounding structures, infrastructure and environment. No cumulative impacts are envisaged.

9. Outline Structural Monitoring Plan

The ground movement assessment suggests that up to Burland Scale Category 1 (very slight) damage may be expected to the neighbouring properties.

Nevertheless, structural monitoring should be undertaken to ensure the movements remain within acceptable limits and to enable mitigation to be effectively implemented in the event of agreed trigger values for movement being exceeded.

Monitoring positions should be located along the front façade, the party wall to No. 11 Nassington Road and the flank wall to No 9.

Before any excavation or construction works commence, monitoring is to be undertaken in order to establish a baseline situation.

During all underpinning works and basement excavation works, monitoring should be undertaken daily at the start and end of every work shift. At other times monitoring should be undertaken weekly to cover a period prior to commencement of any works and ceasing after completion of the works, by agreement of all interested parties.

Precise survey equipment should be used to record all vertical and horizontal components of movement (in three perpendicular directions) to a minimum accuracy of 1mm.

A detailed monitoring scheme should be developed in due course.

9.1 Criteria for assessment of Monitoring data and Comparison with Predicted Movements

The cumulative movements in any direction of any monitoring point are to be compared with the predicted movements at any stage and using the following decision table:

MONITORING CRITERIA		
Total movement less than 5mm in any direction		Green
Total movement in excess of 5mm in any direction or additional movement of 5mm in any direction	Notify Structural Engineer and Party Wall Surveyor	Red

9.2 Contingent Actions

Contingency actions should be undertaken using the following decision table:

CONTINGENT ACTIONS	
Green	None
Red	Cease work and Notify Structural Engineer and Party Wall Surveyor immediately. Commence backfilling / installation of additional propping. Undertake repeated monitoring as necessary to ensure that movement has ceased. Works to commence only once a revised construction methodology has been agreed with the Structural Engineer

10. Conclusion

The assessment has demonstrated that no adverse residual or cumulative stability, hydrological or hydrogeological impacts are expected to either neighbouring structures or the wider environment as a result of this development.