Basement Impact Assessment

in connection with proposed development at

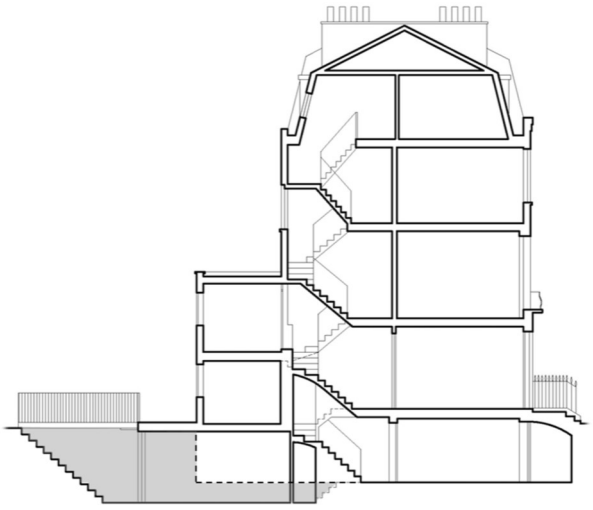
No. 64 Delancey Street
Camden
London
NW1 7RY

for

Dr Pooja Shah & Dr Samit Shah

LBH4576 ver. 1.0

April 2019



LBH WEMBLEY

ENGINEERING

Document Control

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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 construct a rear basement extension, set approximately 1m lower than the existing basement, with stepped access up to the rear garden. The existing terrace at basement level will also be lowered by approximately 1m.

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 but there is to be a 25% decrease in the amount of impermeable surfacing. Nevertheless, 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 predicted building damage levels resulting from ground movements associated with the development have been analysed and found to be acceptable.

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 construct a rear basement extension, set approximately 1m lower than the existing basement, with stepped access up to the rear garden. The existing terrace at basement level will also be lowered by approximately 1m.

As part of the development, an additional storey will be added to the existing ground floor extension.

1.2 Brief

LBH WEMBLEY have been appointed by Dr Pooja Shah and Dr Samit Shah 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.

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 Davies Architecture Ltd, (DEL64-EX-GA-06, 01), dated April 2018
- Drawings of Proposed Scheme by Davies Architecture Ltd, (DEL64-PL2-GA-00, 01, 02, 03, 04, 05, 06, 07, 08, 09), dated February 2019

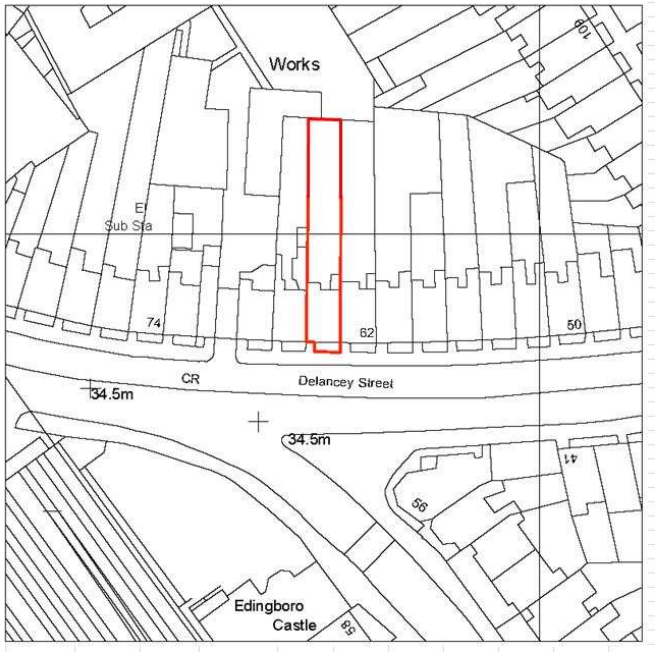
2. The Site

2.1 Site Location

The site is situated on the northern side of Delancey Street, opposite the junction with Mornington Terrace, within the Camden Town Conservation Area.

The approach to London Euston Station runs in a nearby cutting, approximately 40m to the southwest of the site. The portal to the HS2 tunnel will be constructed within these approaches due west of the site.

The site may be located approximately by postcode NW1 7RY or by National Grid Reference 528795, 183585.

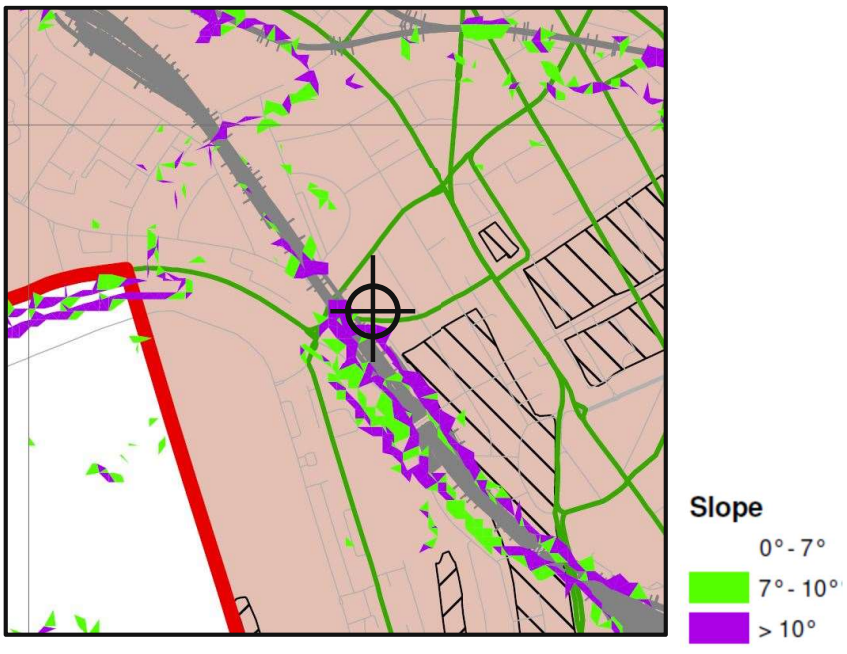


Location plan

2.2 Topographical Setting

The site lies on a relatively gentle slope (of less than 7°) falling to the southeast towards the valley of the now culverted River Fleet.

It is noted that Figure 16 (below) has incorrectly indicated the railway approaches to lie within a cutting with slopes exceeding 10°, whereas retaining walls are actually present along this section of the railway.



Extract from Figure 16 of the CGHHS

2.3 Site Description

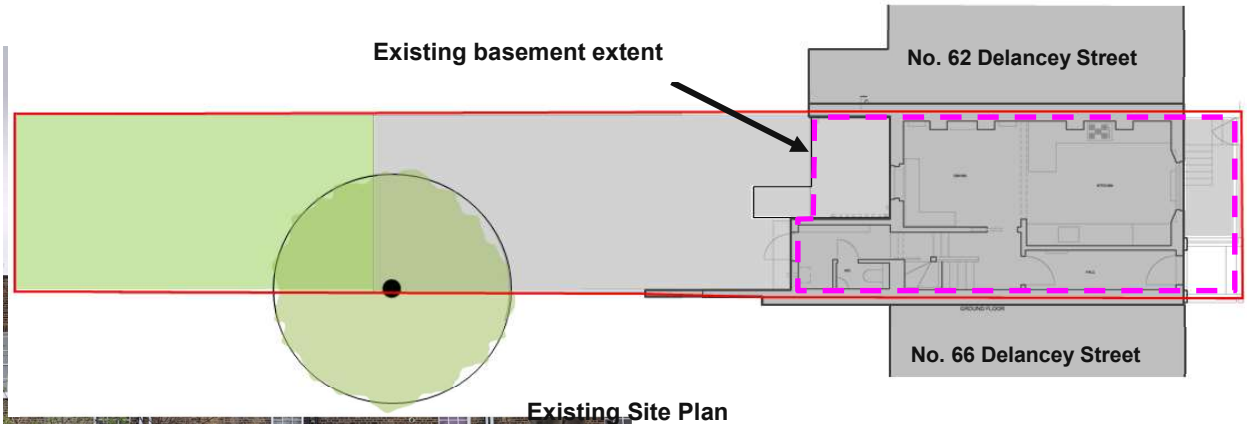
The site is occupied by an early 19th Century Grade II listed three storey terraced house.

The building also includes a mansard roof and a single storey basement beneath the entire building footprint. A rear extension is also present at basement and ground floor level.

A front lightwell is present giving access to the basement level, as well as a small patio area to the rear. A staircase leading up to the rear garden, set at ground floor level, has recently been blocked.

The ground floor of the building is placed approximately 0.5m above the street level, at approximately +35m OD.

The building shares party walls with the neighbouring properties of No. 66 Delancey Street to the west and No. 62 Delancey Street to the east. Both of the neighbouring properties feature basements set at a similar depth to No. 64.



Existing Site Plan

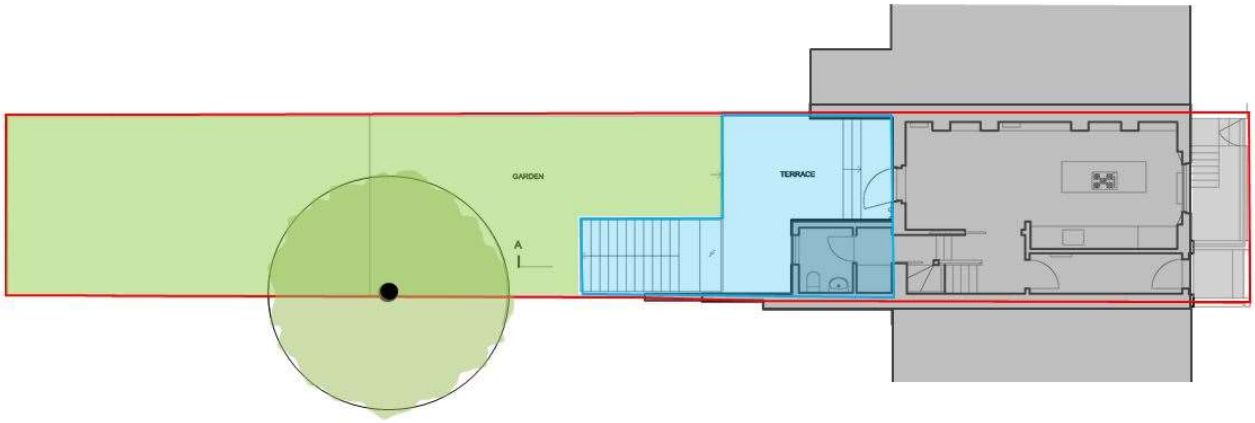
The rear garden comprises a patio with a lawn at the rear. A semi-mature sycamore tree is present along the border with No. 66. It is noted that this tree has been pruned heavily in the past.

The property boundaries are marked by wooden fencing, together with brick garden walls within the extent of the basement patio areas.

The rear boundary is formed by a former television studio that has recently been developed in to a private residential property.

2.4 Proposed Development

It is proposed to deepen the rear patio area of the existing basement by up to approximately 1m and to extend the basement floor into the rear patio. The basement extending outside of the basement footprint will also comprise a ground floor terrace.



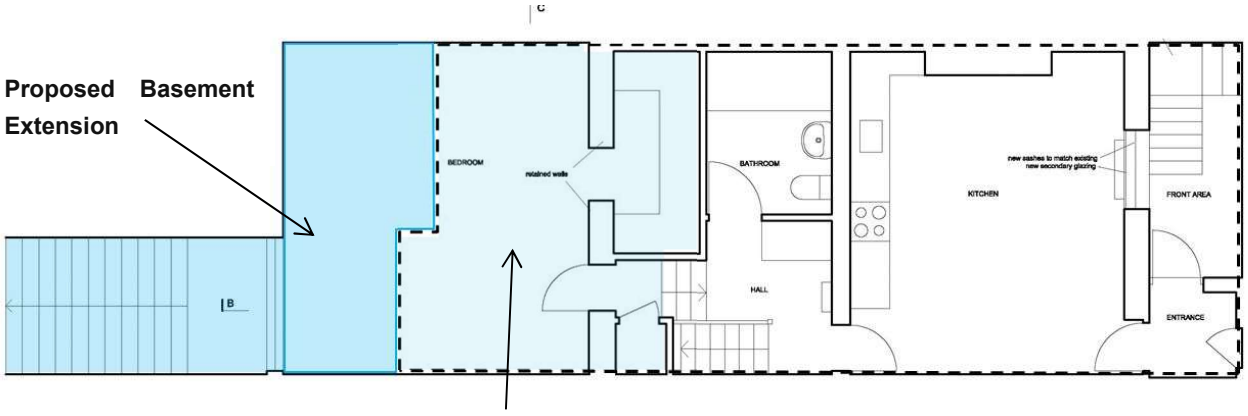
Proposed Site Plan at Ground floor Level (basement extension tinted blue)

It is proposed to construct a rear basement extension, set approximately 1m lower than the existing basement. As part of this extension, the existing basement terrace will be lowered by approximately 1m to match the proposed level and provide a large open plan room.

An additional storey will also be added to the existing ground floor extension.

A new staircase will be constructed to give access to the rear garden, set at ground floor level.

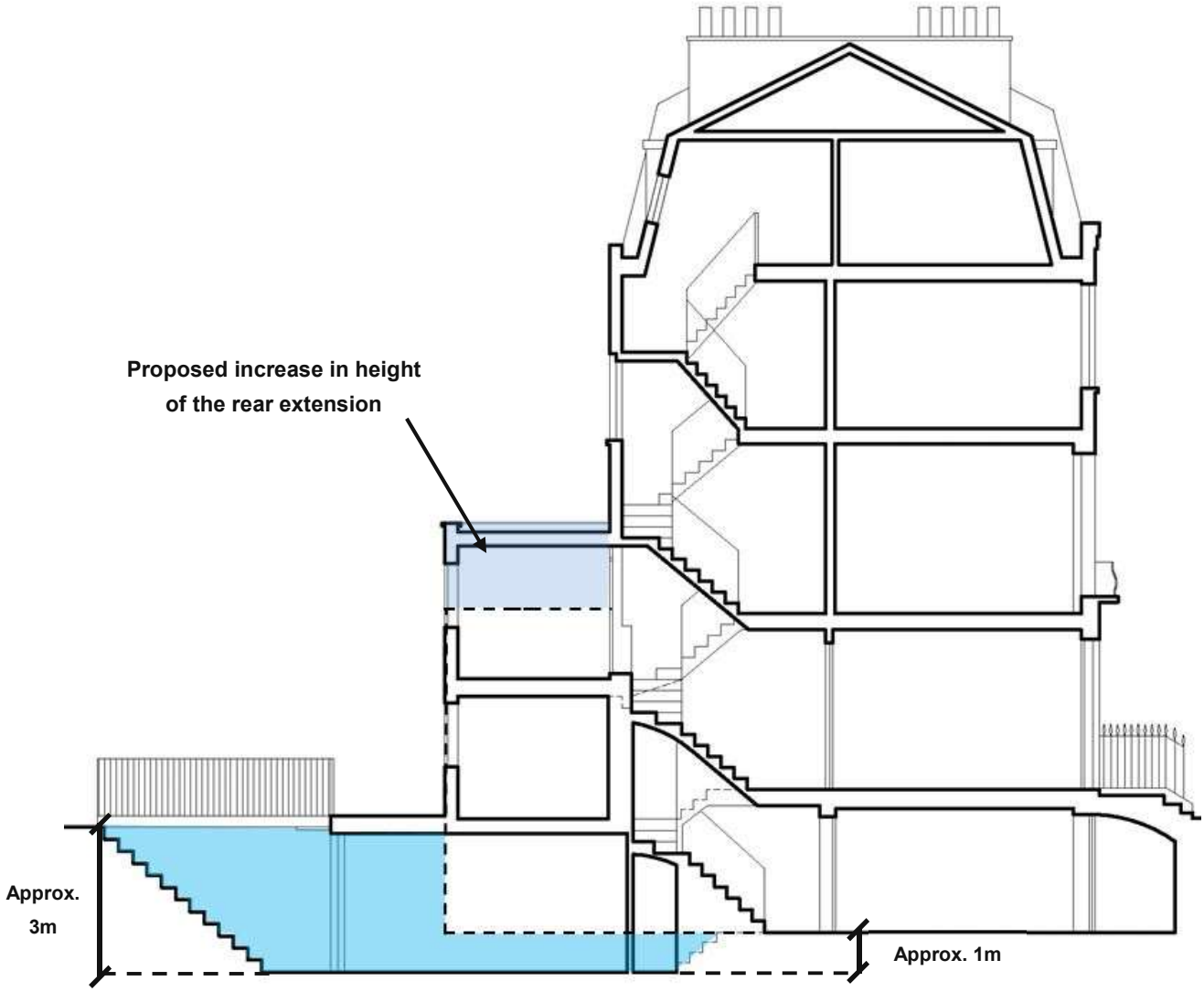
No alterations to the front of the property are proposed.



Existing basement lowered by 1m

Proposed Basement plan (basement extension tinted blue)

Existing areas at basement level are shown within the dashed line



Proposed Section Drawing (basement excavations tinted blue)

3. Desk Study

3.1 Site History

The site remained undeveloped land lying between Camden Town and Regent's Park until the early to mid-19th Century; at which time Delancey Street and the surrounding roads were established, following the construction of the London and Birmingham Railway leading from Euston Station (now part of the West Coast Main Line), which opened in 1837.

To the rear of the site, land bordered by properties fronting Delancey Street, Gloucester Street and Parkway was occupied by two industrial yards: Parkway Yard, accessed from 77-79 Parkway, and Stanhope Yard, accessed from 68a Delancey Street.

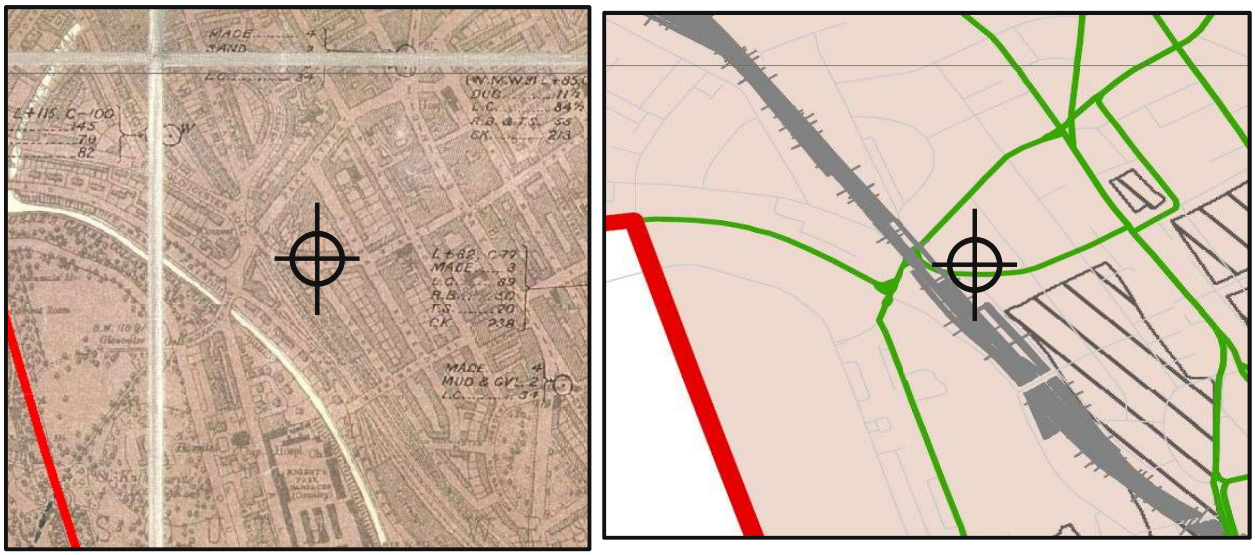
Parkway Yard, once comprising a piano factory and sheet music printers, was converted during the 1970s in to commercial offices.

Stanhope Yard, formerly stables and later engineering works, was developed into television studios for Monty Python during the 1980s. These have since been developed in to a private residential property.

The property itself was split into apartments during the 1970s but has subsequently been reconverted, under planning reference 2013/3726/P.

3.2 Geological Information

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



Extracts of Figure 2 (left) and Figure 3 (right)
(CGHHS, 2010)

3.3 Hydrogeological Information

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

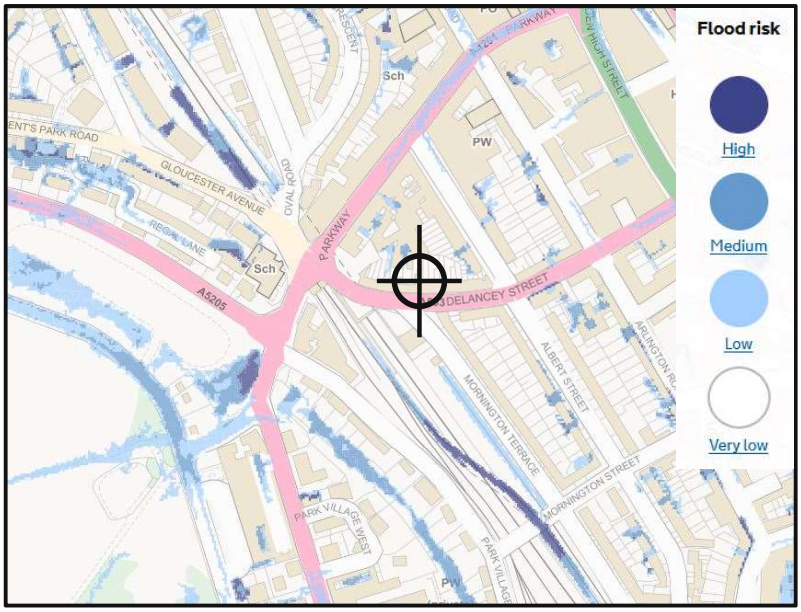
Due to the impermeability of the clay, no significant groundwater flow is possible beneath the site.

3.4 Hydrological Information

The nearest surface water feature to the site is the Regent's Canal, located approximately 450m to the west of the site.

It is also noted that the former Cumberland Basin, a branch of the Regent's Canal backfilled during World War Two, is present approximately 150m to the southwest of the site.

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 any Local Flood Risk Zones, but within the Group 3_003 Critical Drainage Area.



Extract of EA surface water flood risk map

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.

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 culverted River Fleet, approximately 600m to the east of the site.
Is the site within the catchment of the pond chains on Hampstead Heath?	**No**	The site lies outside the catchment of the pond chains on Hampstead Heath and indeed outside the scope of Figure 14 of the CGHHS.
Will the proposed development result in a change in the area of hard-surfaced/paved areas?	**Yes**	There will be a net reduction in the area of hard-surfacing, as a result of the landscaping proposals.
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)?	**Yes**	The existing sewer drainage arrangement will be maintained but it is proposed to remove impermeable surfacing to part of 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**	No ponds are present nearby the site.

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**	The site lies outside the catchment of the pond chains on Hampstead Heath and indeed outside the scope of Figure 14 of the CGHHS.
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 to divert some drainage from the sewer discharge.
Will the proposed basement development result in a change in the proportion of hard-surfaced/paved areas?	**Yes**	There will be a net reduction in the area of hard-surfacing, as a result of the landscaping proposals.
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?	**No**	Figure 16 of the CGHHS indicates that the site does not lie within a slope greater than 7 degrees.
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?	**No**	A railway cutting is present approximately 40m away to the southwest of the site.
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**	No trees are proposed to be removed as part of the development. However, an existing sycamore tree is present in the rear garden of the site.
Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	**No**	No evidence of seasonal movement was observed during a site inspection.
Is the site within 100m of a watercourse of a potential spring line?	**No**	The nearest watercourse is the culverted River Fleet, approximately 600m to the east 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 by 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 2.8km away from the Hampstead Heath.
Is the site within 5m of a highway or pedestrian right of way?	**No**	Although the front of the site is adjacent to the pavement to Delancey Street, there are no works planned in this area.
Will the proposed basement significantly increase the differential depth of foundations relative to the neighbouring properties?	**Yes**	The proposed floor level will lie deeper (approx. 1m) than the basements to the adjacent properties at No. 62 and No. 66 Delancey Street.
Is the site over (or within the exclusion zone of) tunnels, e.g. railway lines?	**No**	The site is not within the exclusion zone of any tunnels, although a railway tunnel is present approximately 50m to the southwest. It is also noted that a deep Thames Water combined sewer crosses beneath the rear garden at around 20m depth.

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 (e.g. 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

- **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.

- **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 intrusive ground investigation comprising a window sampler borehole was undertaken in March 2019, in order to assess the ground conditions and recover samples for subsequent laboratory testing.

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 basement extension will require a 3m deep excavation, while the limited excavation beneath the existing basement terrace will reach up to 1m deep.

It is understood that both of the adjoining properties at Nos. 66 and 62 Delancey Street comprise basements set an approximately similar level to the existing basement at No. 64. These properties also include basement level terraces extending laterally to a similar distance to the rear.

It is assumed that the party walls are supported by shallow strip foundations. Hence up to 1m of conventional 'hit and miss' underpinning will be required to lower the existing basement terrace.

Similarly, 'hit and miss' techniques will be employed to construct the perimeter walls of the rear basement extension, although it may be possible to batter the rear wall of the proposed basement.

Underpinning of the garden wall shared with No. 66 will also be necessary.

During the works, propping will be installed to ensure that lateral ground movements are minimised. As a precursor to main excavations, it is envisaged full width propping will be provided to restrain the newly constructed and underpinned walls during the basement excavation.

In the permanent situation the reinforced concrete underpins and hit and miss sections will connect to the basement slab to form a rigid concrete box to transfer the loading to the underlying soils.

6.1.1 Waterproofing

There is some potential for water to collect around the perimeter of the basement extension 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 existing garden level would be prudent for the purposes of assessing hydrostatic pressures.

6.1.2 Basement Heave

The proposed excavations will result in 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.

6.2 Underpinning

Underpinning sections will be excavated in short widths not exceeding 1000mm.

The sequence of the underpinning will be in an extended 1, 3, 5, 2, 4 & 6 type numbering sequence, such that any given underpin will be completed, dry packed, and a minimum period of 48 hours lapsed before and adjacent excavation is commenced to form another underpin.

Each pin excavation will be undertaken only under the direct supervision of a suitably experienced and competent person. In the event that the vertical soil face to an underpin is judged to be potentially unstable, face support and lateral propping will be provided by perforated plywood sheeting supported by timber walings held by adjustable steel trench "acrow" props.

6.3 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

6.4 Effect of trees

A semi-mature sycamore tree is present within the rear garden, approximately 5m to the rear of the proposed basement access steps. Although the London Clay soils are of high volume potential, the basement excavation depth in conjunction with the distance from the tree should obviate any potential risks of structure damage due to swelling of the clay.

6.5 Underground Infrastructure

A tunnel, associated with the West Coast Main Railway Line to London Euston Station, lies approximately 40m southwest of the site. It is also noted that there are proposed works along this section of the Euston approaches as part of the HS2 development.

However, given the separation distance involved, the proposed basement development will not have any adverse effect on the railway tunnel or future planned works.

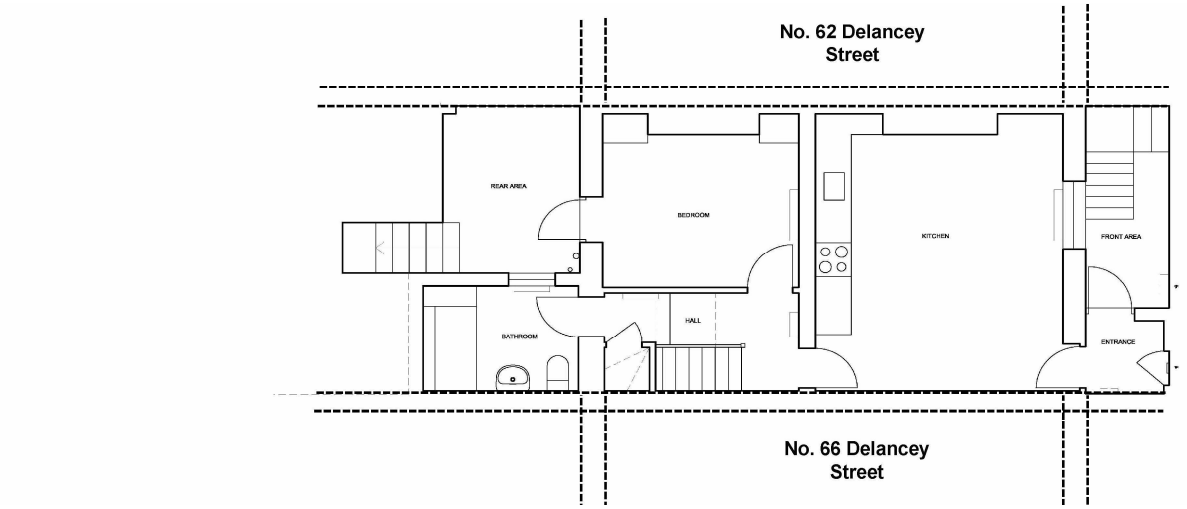
A Thames Water combined sewer crosses the rearmost section of the garden, approximately 15m from the proposed basement extension. The sewer is understood to be some 2,134mm in diameter, and approximately 20m depth below ground.

This is thought to be a section of the Middle Level Sewer No. 2.

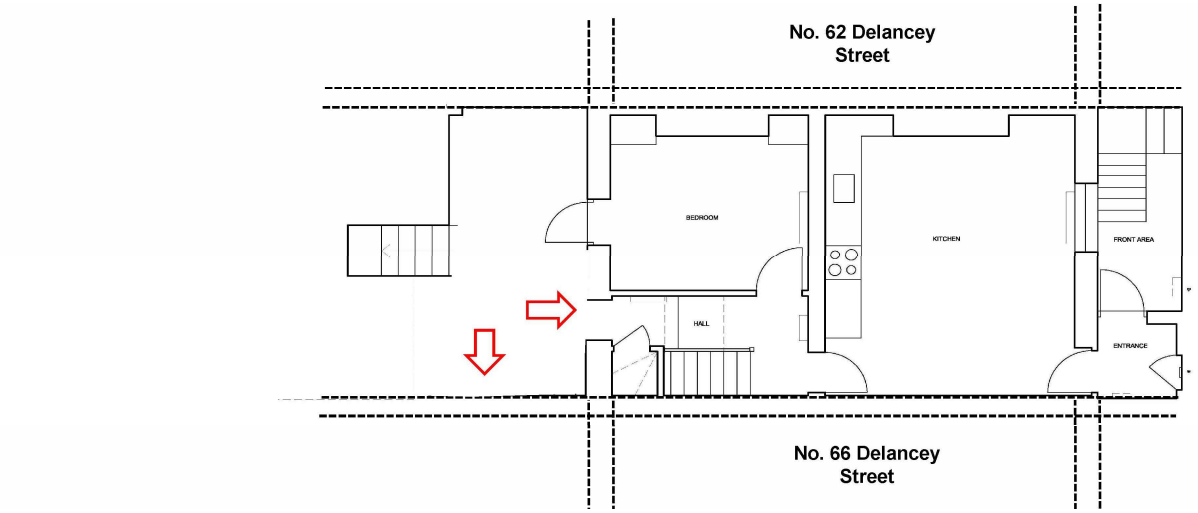
Given the limited extent of the proposed basement excavation together with the separation distance and depth of the sewer, the proposed basement development will again not have any adverse effect.

6.6 Construction Sequence

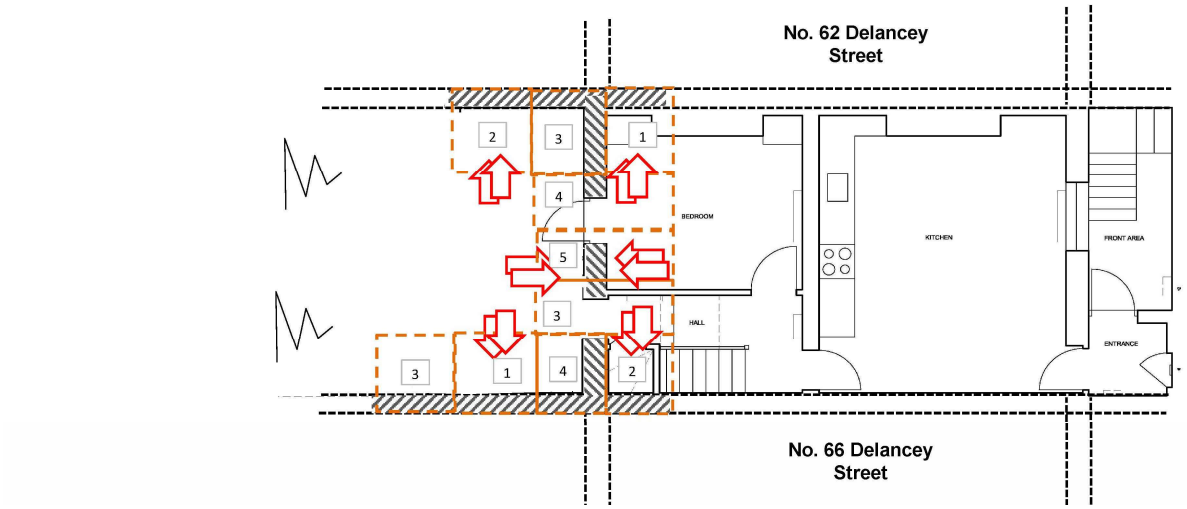
The following indicative construction sequence is proposed, and will be subject to detailed design by a structural engineer:



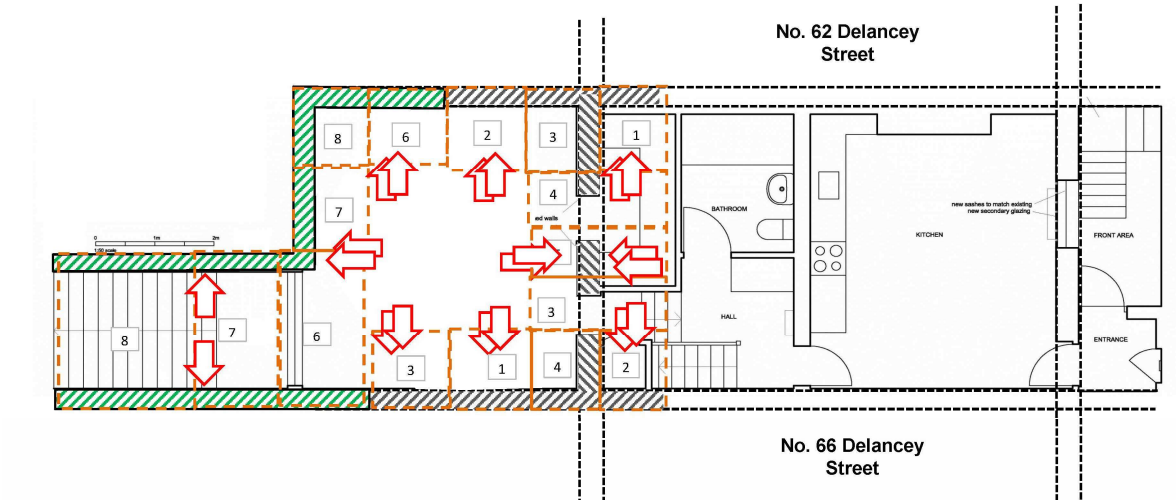
1. Carefully remove the existing rear extension aside from the party wall with No. 66, maintaining support to the latter and to the rear elevation as necessary.



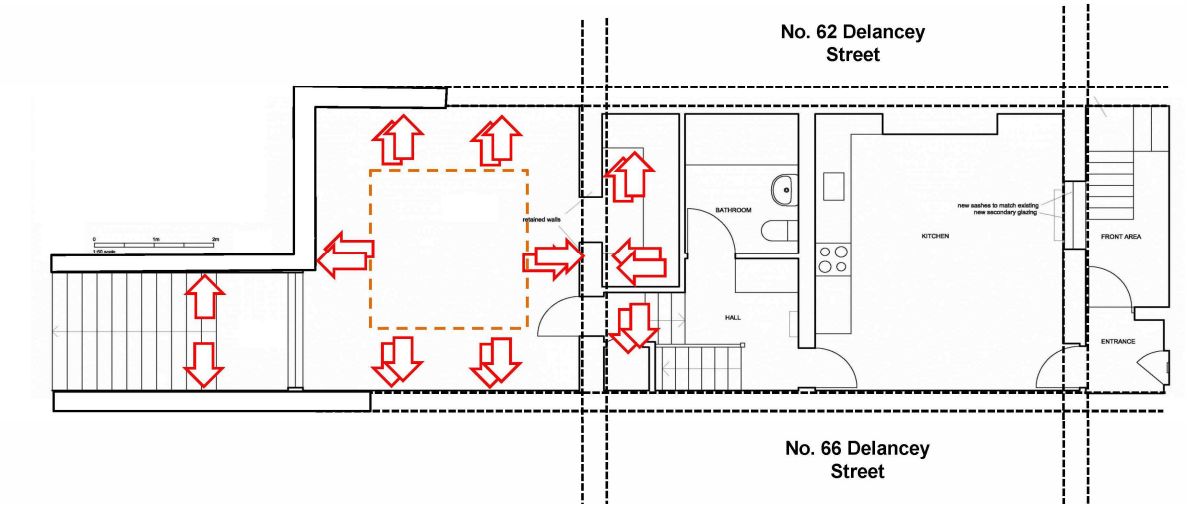
2. Install temporary ground level propping and underpin the rear elevation wall and the party walls to No. 62 and No. 66, installing basement level propping.



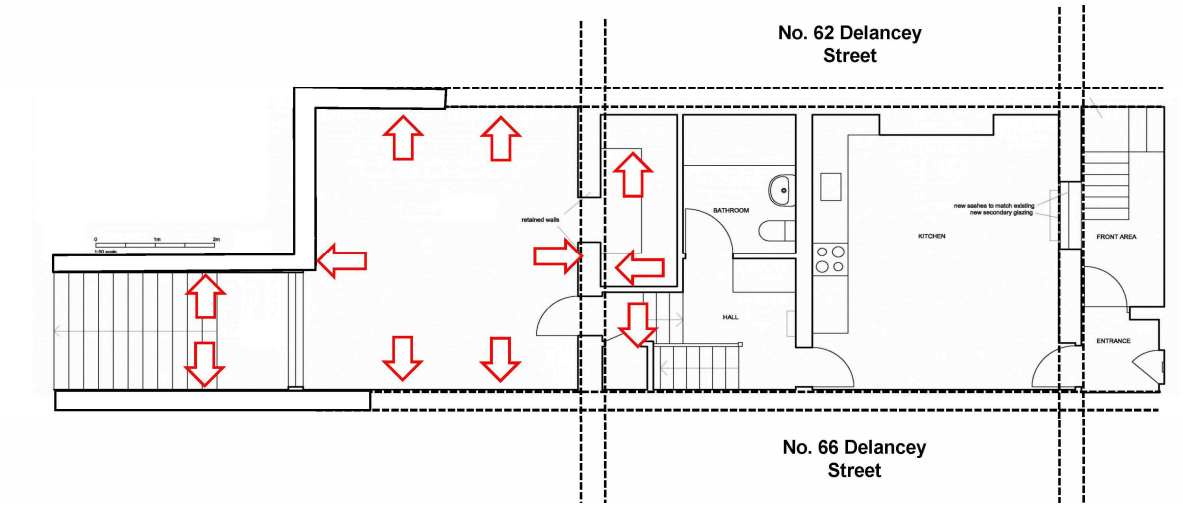
3. Construct new basement extension walls within the rear garden using 'hit and miss' techniques, installing temporary ground level and basement level propping.



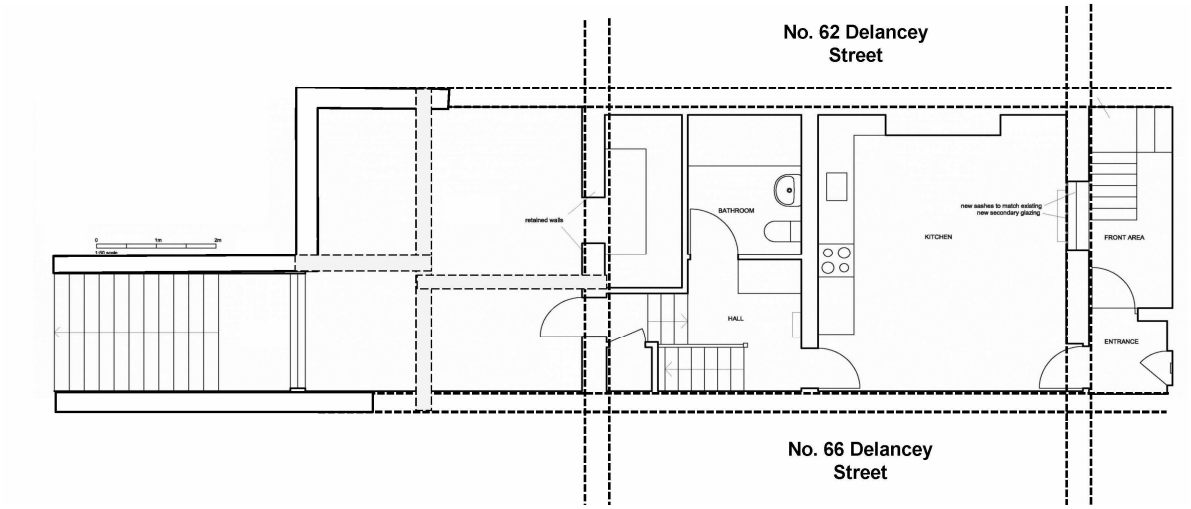
4. Excavate remainder of basement, install any below-slab drainage, cast remaining basement slab.



5. Remove low level temporary propping.



6. Construct basement waterproofing/lining/drainage/insulation/screed.



7. Construct ground floor slab, incorporating beams to transfer the rear extension loads down to the boundary walls, and remove high level propping.

8. Construct the rear extension superstructure.

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

The property shares party walls with both No. 62 and No. 66; both of which include a basement set at the same level.

In consideration of a worst case scenario, the foundations supporting the party walls are assumed to be at basement level and will therefore require up to 1m of conventional underpinning.

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	28,350kN/m^2 at surface increasing linearly to 123,830kN/m^2 at 30m depth	19,850kN/m^2 at surface increasing linearly to 86,680kN/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 three 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, then secondly elastic heave of the ground within the new excavation as a direct response to the unloading of the weight of soil removed and finally the settlement due to reloading of the soil with new structural loading.

Up to 3m of excavation will be required to create the basement extension and the potential effect may be may be considered by application of unloading of up to -60kN/m^2 due to soil removal.

Excavation of up to 1m will be required beneath the footprint of the existing basement terrace, resulting in -20kN/m^2 unloading due to soil removal.

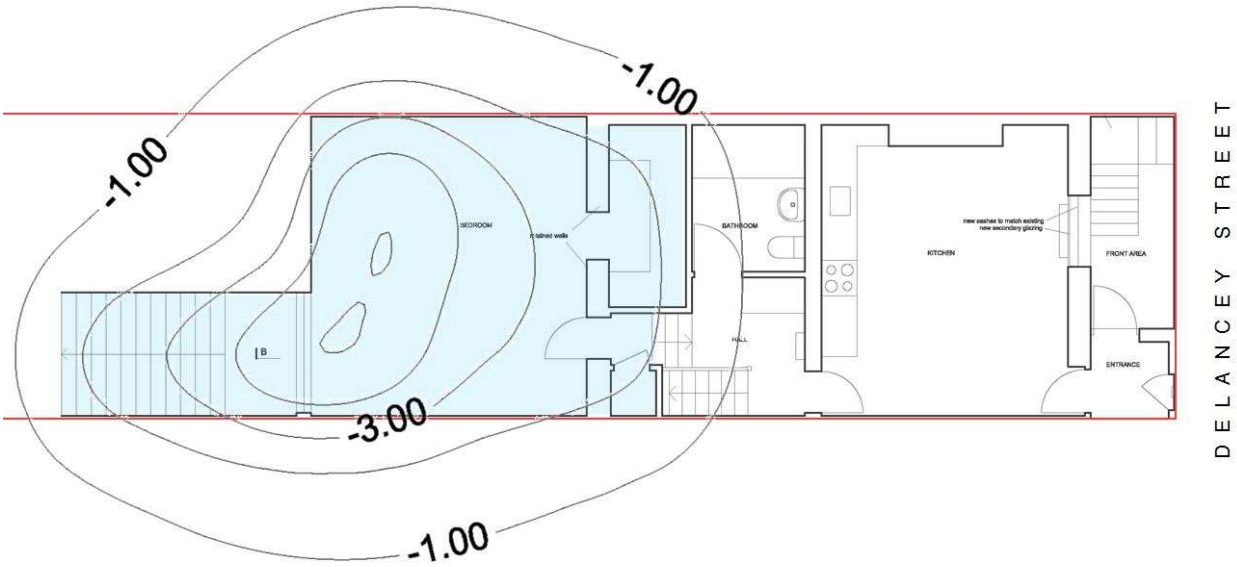
7.3.1 Short Term Movement due to Underpinning

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 1m; 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 1m = 3.5m behind the wall.

7.3.2 Short Term Movements due to Excavation heave



Plan showing theoretical approximate short-term heave contours (mm) with proposed excavation extent tinted blue

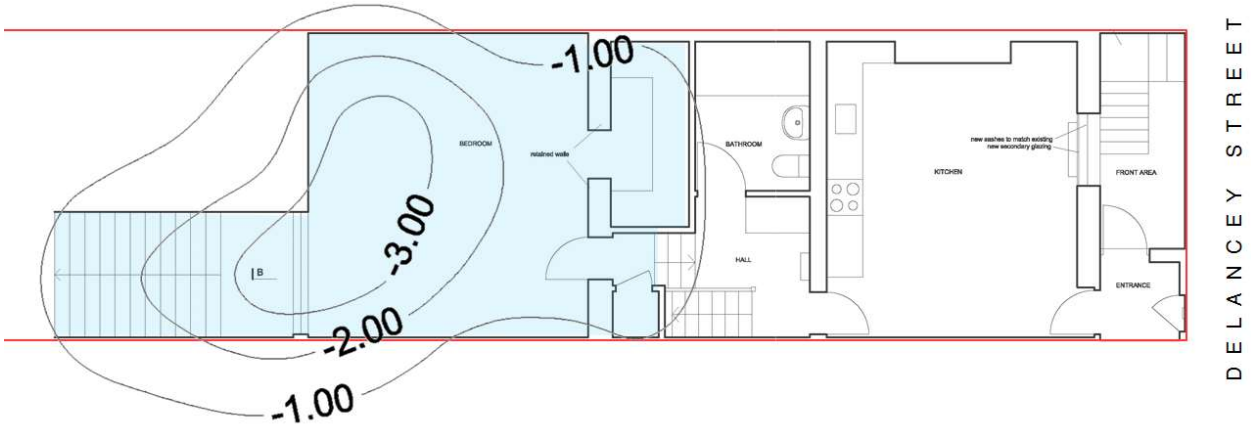
Up to 5mm of short term soil heave is predicted within the proposed extension.

7.4 Post-Construction Vertical Movements

The post-construction ground movement analysis was carried out to include modelling of any redistribution of existing loading and new structural loadings resultant from the proposed development.

Given the proposed open plan layout within the basement extension, the new structural loads are expected to be redistributed to be applied at the boundary / party wall foundations.

The results of 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 5mm within the basement extension.



Plan showing theoretical approximate post construction heave contours (mm) with proposed excavation extent tinted blue

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 1m = 4m 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.

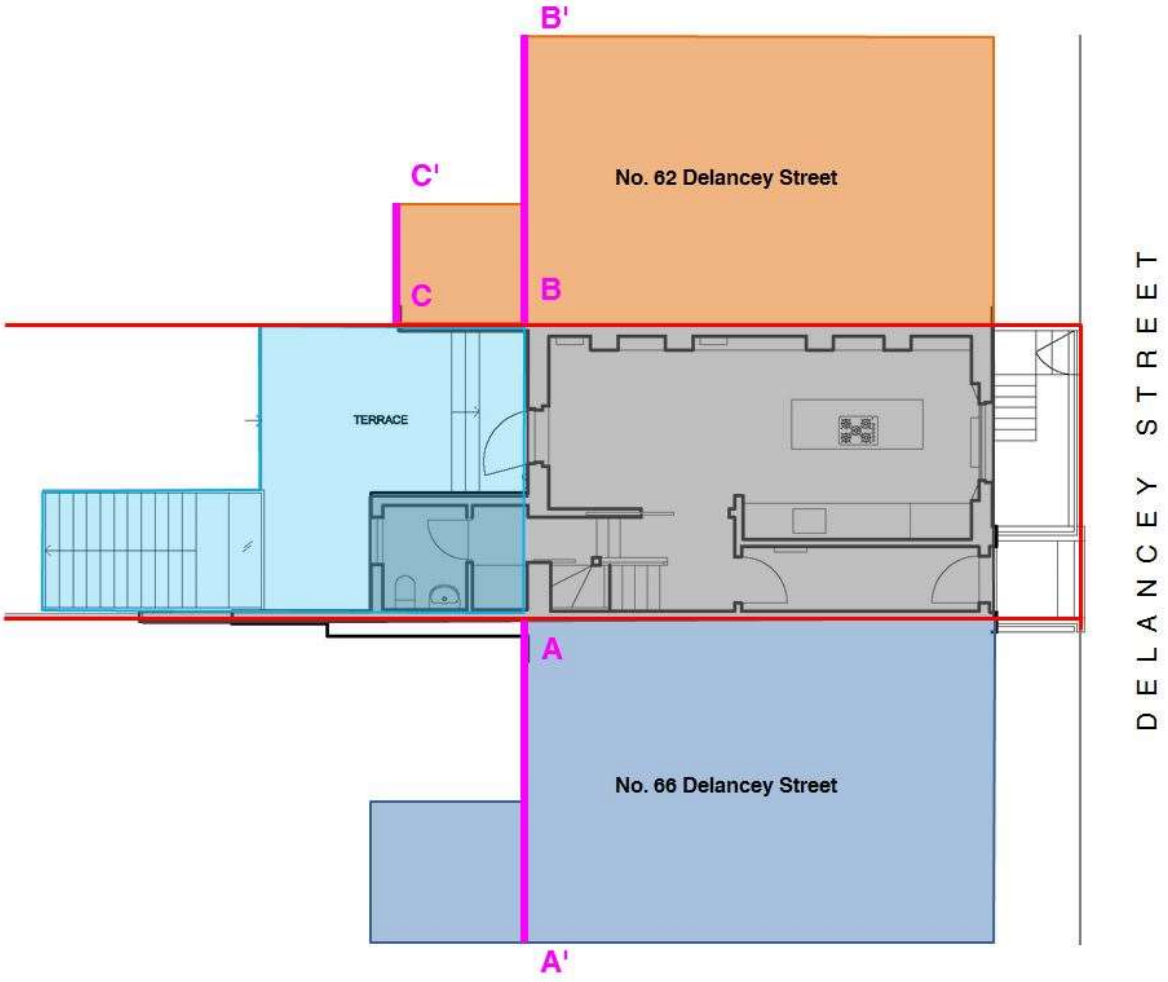
7.6 Impact on Neighbouring Structures

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 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 lines of sections used for damage category assessment

No. 62 and No. 66 Delancey Street (Sections A-A' and B-B')

Both section A-A' and B-B' have been assessed to have a wall height (H) of 11m and a length (L) of at least 10m, due to the continuity of the rear wall to the terraced properties'.

On the basis of the movements described above a maximum horizontal strain, εh (Δh / L) of 0.050% is assessed, producing a maximum deflection ratio Δ / L = -0.022, within a limiting tensile strain of 0.065%, and a resultant Burland Category 1 "Very Slight" condition.

No. 62 Delancey Street (Section C-C')

Section C-C' has been assessed to have a wall height (H) of 5m and a length (L) of 2.5m.

On the basis of the movements described above a maximum horizontal strain, εh (Δh / L) of 0.048% is assessed, producing a maximum deflection ratio Δ / L = -0.04, within a limiting tensile strain of 0.070%, and a resultant Burland Category 1 "Very Slight" condition.

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 increase 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 (LBH4576suds).

8.3 Stability Impact Assessment

8.3.1 London Clay

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

The depth of the proposed extension in relation to the garden level will obviate concerns regarding seasonal shrink-swell movement of the clay.

8.3.2 Trees

The Sycamore tree is sufficiently remote from the proposed excavation to be an issue.

8.3.3 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.

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 rear elevation and the party walls to Nos. 62 and 66 Delancey Street.

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.