Basement Impact Assessment

in connection with proposed redevelopment at

133 Arlington Road
Camden
NW1 7ET

for

Grant Parkinson & Masha Feigelman

LBH4501 Ver 1.1

January 2018

LBH WEMBLEY

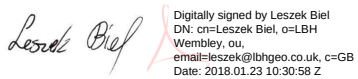
ENGINEERING

Project No: LBH4501

Report Ref: LBH4501 Ver 1.1

Date: 23rd January 2018

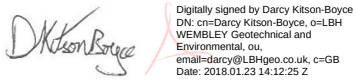
Report prepared by:



Leszek Biel

MEng (Hons) GMICE

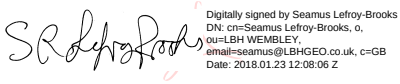
Report supervised by:



Darcy Kitson-Boyce

MEng (Hons) GMICE FGS FRGS

Report approved by:



Seamus R Lefroy-Brooks

BSc (Hons) MSc CEng MICE CGeol FGS CEnv MIEnvSc FRGS SiLC
RoGEP UK Registered Ground Engineering Adviser

LBH WEMBLEY ENGINEERING

12 Little Balmer

Buckingham Industrial Park

Buckingham

MK18 1TF

Tel: 01280 812310

email: enquiry@lbhgeo.co.uk

website: www.lbhgeo.co.uk

Contents

Foreword-Guidance Notes

GENERAL

This report has been prepared for a specific client and to meet a specific brief. The preparation of this report may have been affected by limitations of scope, resources or time scale required by the client. Should any part of this report be relied on by a third party, that party does so wholly at its own risk and LBH Wembley Engineering disclaims any liability to such parties.

The observations and conclusions described in this report are based solely upon the agreed scope of work. LBH Wembley Engineering has not performed any observations, investigations, studies or testing not specifically set out in the agreed scope of work and cannot accept any liability for the existence of any condition, the discovery of which would require performance of services beyond the agreed scope of work.

VALIDITY

Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances shall be at the client's sole and own risk. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should therefore not be relied upon in the future and any such reliance on the report in the future shall again be at the client's own and sole risk.

THIRD PARTY INFORMATION

The report may present an opinion based upon information received from third parties. However, no liability can be accepted for any inaccuracies or omissions in that information.

1. Introduction

1.1 Background

It is proposed to both deepen and extend the lower ground floor of 133 Arlington Road.

In order to facilitate a greater floor height it is proposed the existing lower ground floor level is deepened by approximately 400mm, following which both the ground and lower ground floors will be extended to the rear

This rear extension will involve excavation of the existing patio area in order to lower it to the level of the proposed lower ground floor.

The proposed redevelopment will also involve minor alterations to the internal layout of the building.

1.2 Brief

LBH WEMBLEY have been appointed by Grant Parkinson & Masha Feigelman to complete a BIA for submission to the London Borough of Camden in order to satisfy the specific requirements of the 2017 Camden Local Plan, Camden Planning Policy, Supplementary Planning Guidance CPG4 on Basements and Lightwells and associated Camden geological, hydrogeological and hydrological study 2010 (referred to as the 'Arup report').

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 on Basements and Lightwells. 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 current CPG4 Planning Guidance on Basements and Lightwells (2015) has not yet been updated to reflect the Local Plan and refers primarily to the now withdrawn Planning Policy DP27 on Basements and Lightwells.

1.4 Report Structure

The report commences with a comprehensive 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. Following this the findings of an intrusive ground investigation are reported and a ground model is developed, followed by a discussion of the geotechnical issues.

Finally, an Impact Assessment is presented, including an assessment of the ground movements associated with the proposed works, along with consideration of the potential damage to the host building and neighbouring structures.

1.5 Documents Consulted

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

1. Camden Local Plan – Adoption Version, 2017
2. Camden Planning Guidance 4 (CPG 4), Basements and Lightwells, 2015
3. Camden Development Policies DP27 – Basements and Lightwells, 2010
4. London Borough of Camden Geological, Hydrogeological and Hydrological Study (CGHHS), by Ove Arup & Partners Limited, dated 18th November 2010, Issue 01

2. The Site

2.1 Site Location

The site is situated on the eastern side of Arlington Road, placed approximately 250m south of the Camden Town London Underground Station.

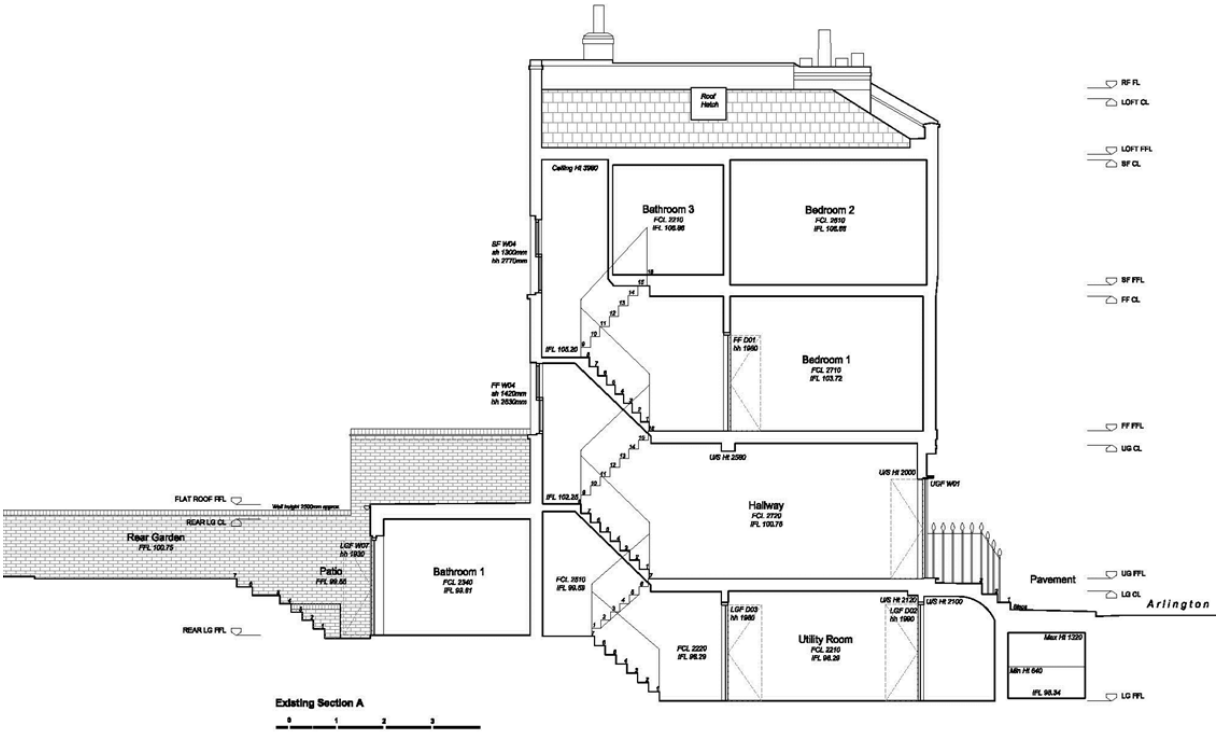
The site may be located approximately by postcode NW1 7ET, or by National Grid Reference 528970, 183510.

2.2 Topographical Setting

The site lies at approximately +31m OD on a relatively gentle slope falling to the northeast towards the valley of the River Fleet.

2.3 Site Description

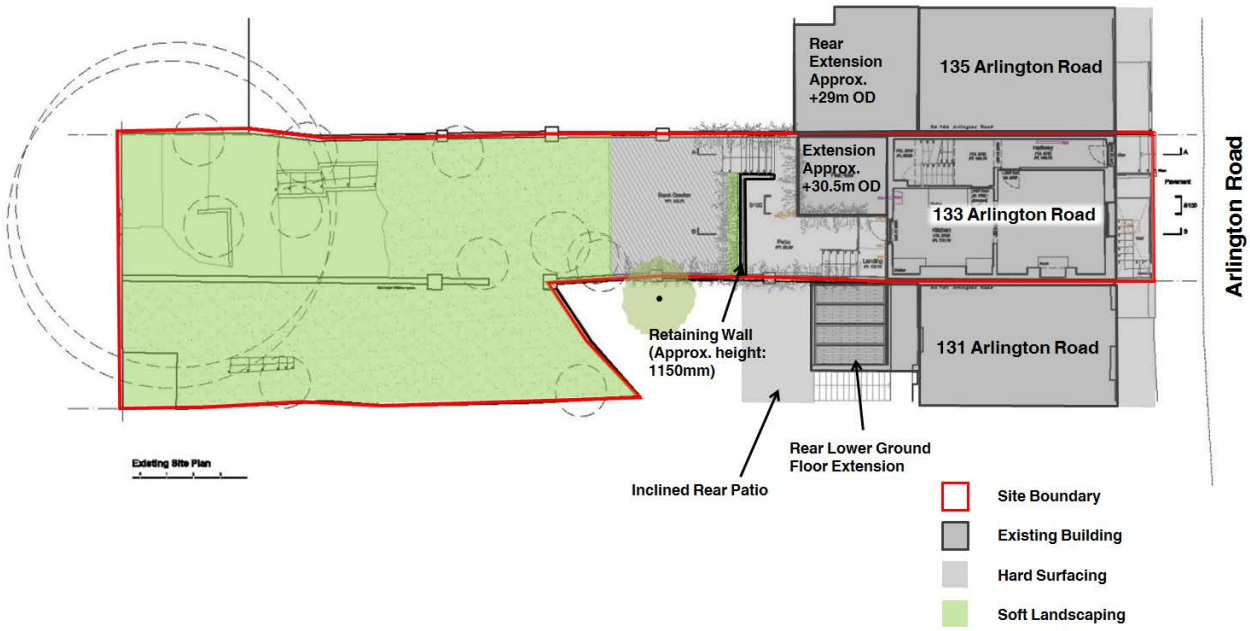
The site is currently occupied by a four-storey terrace house with ground floor and lower ground floor levels set at approximately +31.5m OD and +29m OD, respectively. An extension is present to the rear of the property at an intermediate level between the lower ground and ground floors, at approximately +30.5m OD. The extension comprises half the width of the property and consists of a single bathroom. A section drawing showing the current floor layout is shown below.



No 133 has evidently been constructed slightly differently to the adjacent buildings, having a different original layout to both the front and rear.

The rear garden of the property comprises a patio set at the intermediate floor level of the rear extension, from which steps lead up to a timber decking area at ground floor level.

Further to the rear, the remaining garden is soft landscaped. A soft landscaped, albeit overgrown, area to the southeast, formerly the garden of No 131, is now also part of the site.



Site plan showing existing features

The site is adjoined to the northwest and southeast by terraced houses at No 135 and No 131 Arlington Road, respectively. The adjacent No 135 includes a lower ground floor extension which is understood to be set at a similar level to the lower ground of No 133, as per the structural drawings and design statement submitted as part of a planning application (2008/4450/P).

A lower ground extension is also present to the rear of No 131 Arlington Road and appears to be set at a similar level to the existing lower ground floor of No 133. A patio, set at lower ground level, is also present behind the extension, extending to a similar distance to the rear as the patio at No 133.

A measured survey is to be completed in order to confirm the lower ground floor level at adjacent properties is at a similar elevation to the lower ground floor of No 133.

Notably, a mature sycamore tree is present close to the garden wall in the rear garden of No 131, as shown on the site plan drawing.

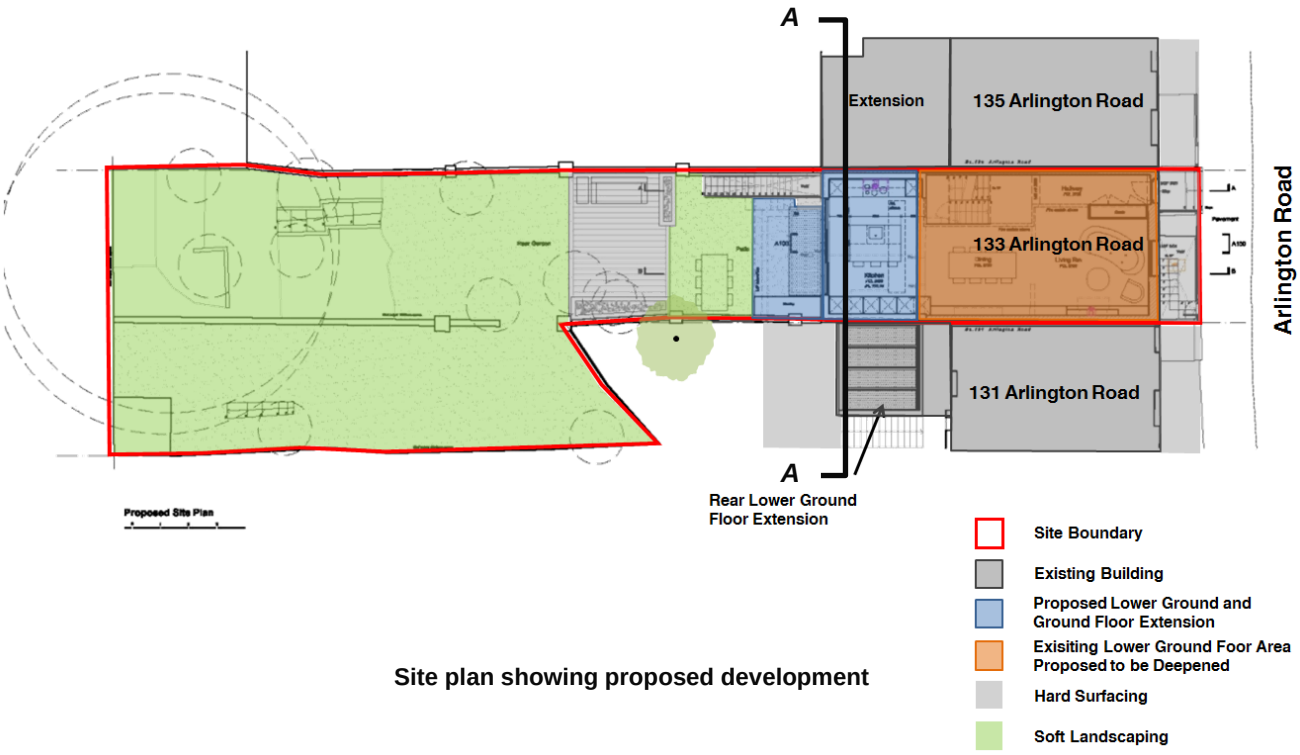
The rear of the garden to the southwest is bordered by the rear gardens of the properties fronting Albert Street.

Above: View of the rear garden

Left: View of the rear elevation

2.4 Proposed Development

Following demolition of the existing extension, it is proposed to extend the lower and upper ground floors to the rear of the building, with associated roof lights to the rear of the new extension. The existing lower ground floor level beneath the entire footprint of the building will also be lowered by 400mm, therefore requiring an excavation of approximately 1m.



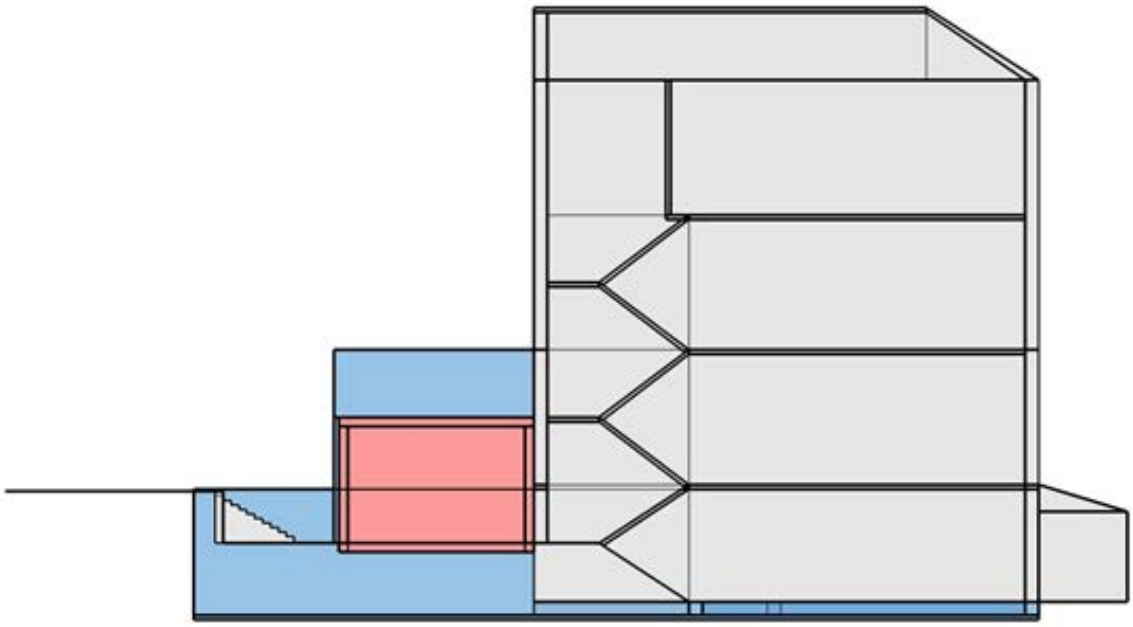
Site plan showing proposed development

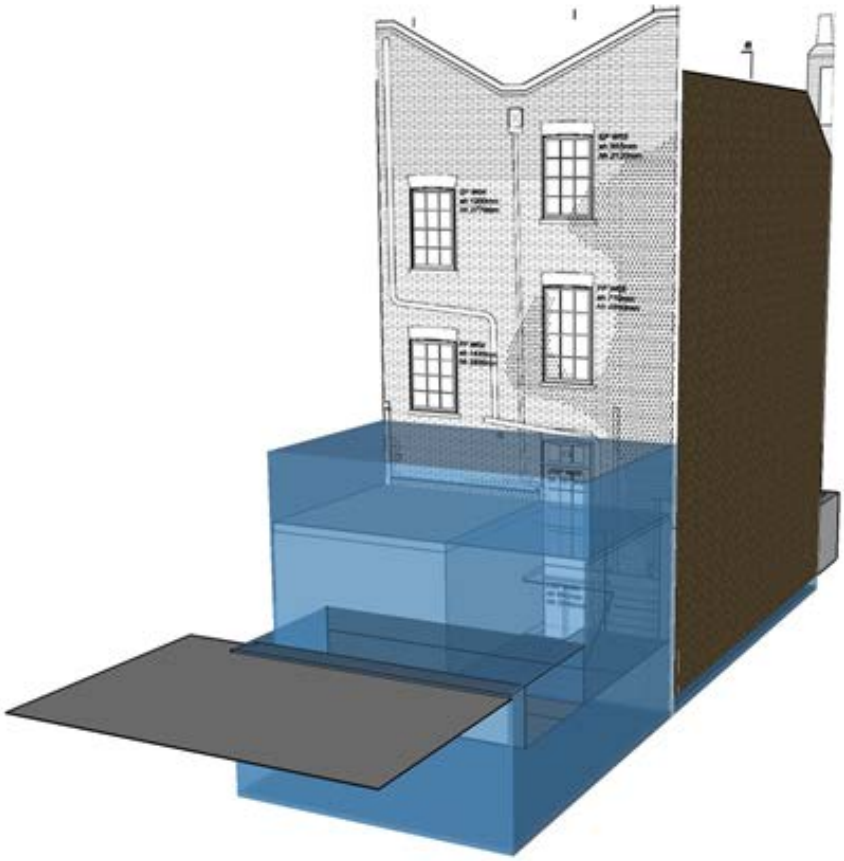
Section (A-A) drawing showing proposed rear extension (blue) against the assumed extent of the existing adjacent extensions

The proposed ground floor will laterally extend approximately 3.5m away from the main building, coincident with the ground floor extension at the neighbouring 135 Arlington Road.

The proposed lower ground floor is proposed to extend roughly 2m further into the rear patio area, creating space for a playroom. As well as internal access, the lower ground floor will be accessed via a staircase from the rear garden.

The basement slab of the lower ground floor across the entire proposed footprint will be set 0.4m below the existing lower ground floor.



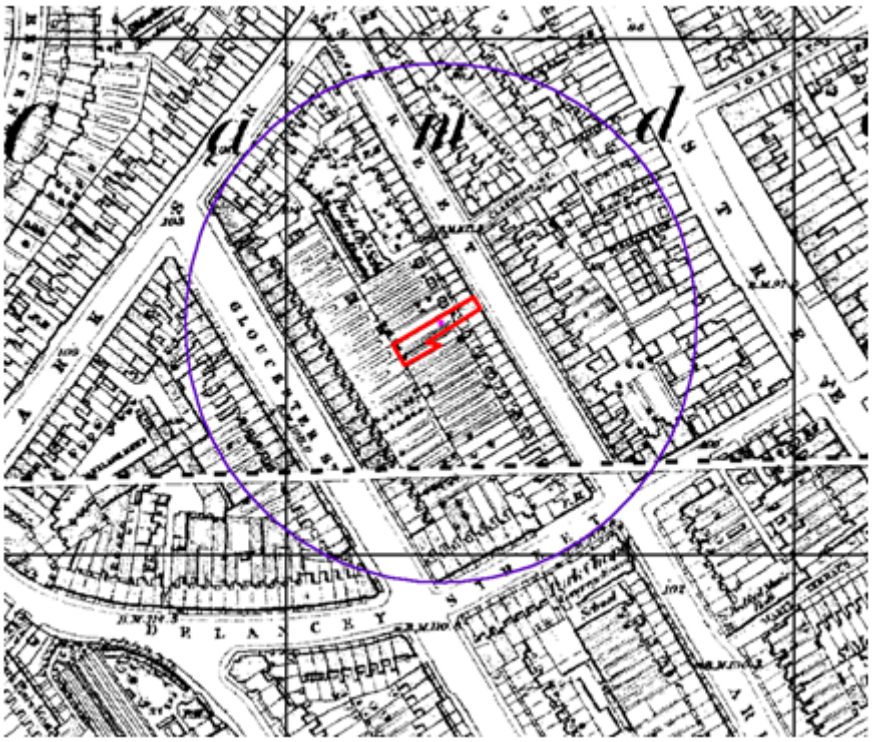


Visualisation of the proposed development
(showing proposed demolition in red and basement extension in blue)

3. Desk Study

3.1 Site History

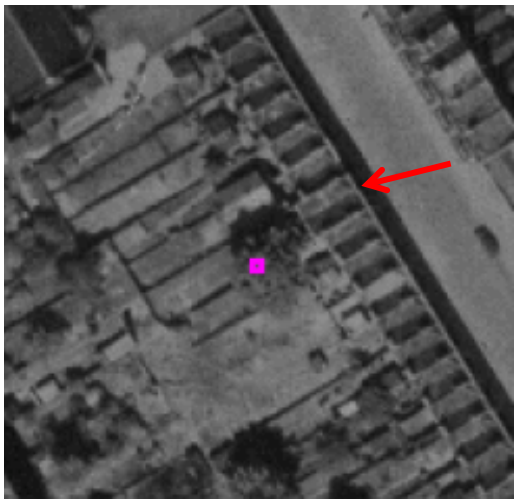
It is understood that the properties facing Arlington Road were originally constructed in the 1840s as accommodation for railway and canal construction workers. It appears No. 133 comprised a noticeably different layout to the adjacent structures, with a slightly extended rear structure. By 1875 all the terraced housing along both sides of Arlington Road, as well as a school present to the northwest of the site, had been constructed.



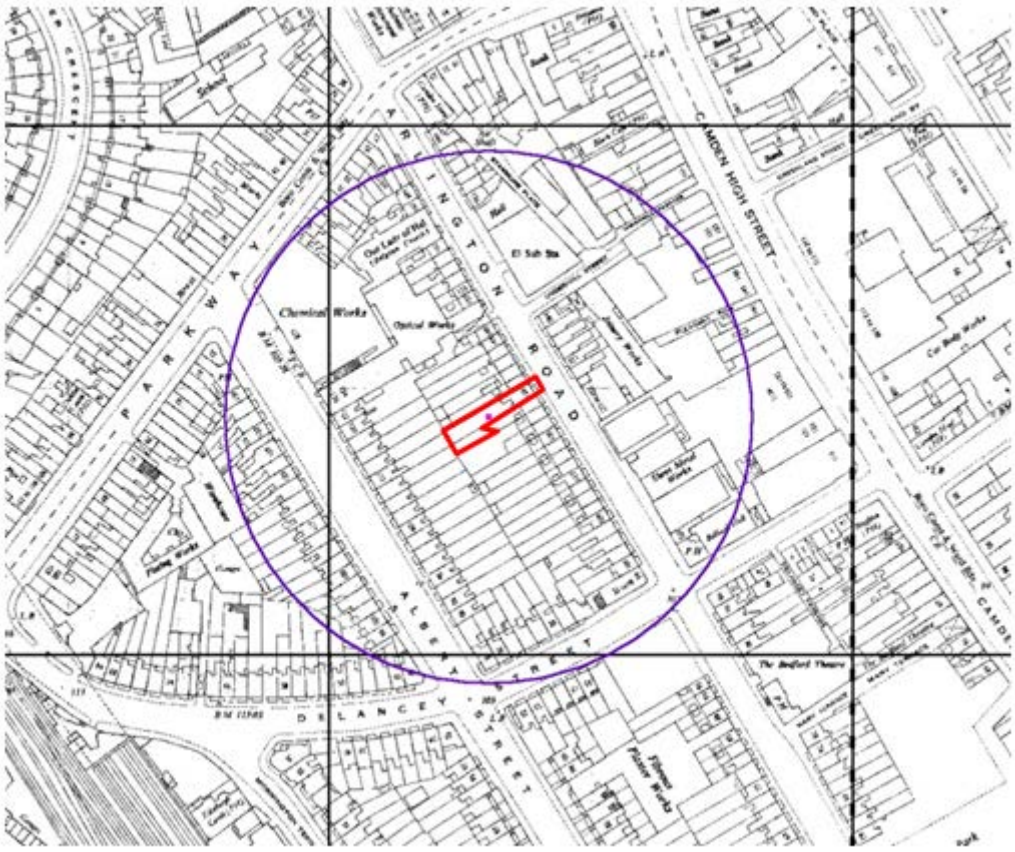
ca. 1875 plan

By the 1940s some of the terraced housing fronting the southern side of Arlington Road has been demolished in order to create a church named Our Lady of Hal.

Camden Town is recorded to have suffered during the Second World War bombing of London. Two explosive ordnances were recorded to have impacted near Arlington Road, although there was no damage to No 133, or any adjacent properties.



Aerial photo from 1946 showing a different layout of No 133 when compared to adjacent properties



ca. 1955 plan

The row of terraced housing along Arlington Road, including No 133, was Grade II listed in December 1999, as typical early Victorian London terraced housing.

With the exception of the rear extension, the site itself has remained relatively unchanged since the construction of the terraced houses along Arlington road.

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 / Hydrological 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 expected to occur beneath the site.

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.

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**	The Environment Agency (EA) maps indicate that the site is not directly underlain by an aquifer.
Will the proposed basement extend beneath the water table surface?	**No**	No groundwater is present beneath the site.
Is the site within 100m of a watercourse, well (used/disused) or potential spring line?	**No**	The nearest watercourse is the River Fleet, roughly 600m to the northeast of the site.
Is the site within the catchment of the pond chains on Hampstead Heath?	**No**	The site is not within catchment of the Hampstead Heath Ponds.
Will the proposed development result in a change in the area of hard-surfaced/paved areas?	**Yes**	An increase in the amount of hard surfacing may be expected due to the rear extension to the lower ground floor and the change in hard surfacing of the rear garden.
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)?	**No**	There is not expected to be any change to affect the current discharge.
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 pond is present near 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 is not within catchment of the Hampstead Heath Ponds.
As part of the site drainage, will surface water flows (e.g. rainfall and run-off) be materially changed from the existing route?	**No**	Surface water is envisaged to be disposed of using a drainage system connected with the existing connection to the sewers.
Will the proposed basement development result in a change in the proportion of hard-surfaced/paved areas?	**Yes**	An increase in the amount of hard surfacing may be expected due to the rear extension to the lower ground floor and the change in hard surfacing of the rear garden.
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**	Surface Water Drainage is to the sewer as per existing patio drainage.
Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses?	**No**	Surface Water Drainage is to the sewer as per existing drainage in the patio area.
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 identified as being 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**	There are no slopes greater than 7 degrees within 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?	**No**	The nearest railway cutting is situated around 200m away from the proposed basement.
Is the site within a wider hillside setting in which the general slope is greater than 7 degrees?	**No**	The general slope of the wider hillside is less than 7 degrees, as indicated on Fig. 16 of the CGHHS.

Is London Clay the shallowest strata at the site?	**Yes**	The British Geological Survey (BGS) records indicate that the site is underlain directly by 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**	It is envisaged the proposed lower ground floor extension is to be placed approximately 3m away from a nearby mature sycamore tree, present in the rear garden of the adjacent property.
Is there a history of seasonal shrink-swell subsidence in the local area, and/or evidence of such effects at the site?	**Yes**	No evidence of seasonal shrink-swell subsidence has been recorded in the area. However, evidence of possible past movement was observed on garden walls on site.
Is the site within 100m of a watercourse of a potential spring line?	**No**	The nearest watercourse is the River Fleet, roughly 600m to the northeast of the site.
Is the site within an area of previously worked ground?	**No**	The site is not underlain by worked ground, as shown on Fig. 5 of the CGHHS.
Is the site within an aquifer?	**No**	The Environment Agency (EA) maps indicate that the site is not directly underlain by an aquifer.
Will the proposed basement extend beneath the water table such that dewatering may be required during construction?	**No**	Water table is not present at the site.
Is the site within 50m of the Hampstead Heath ponds?	**No**	The site is more than 3000m away from the Hampstead Heath Ponds.
Is the site within 5m of a highway or pedestrian right of way?	**Yes**	The front of the site is bound by a pedestrian right of way; the proposed deepening of the lower ground floor is roughly 2m away from the pedestrian right of way.
Will the proposed basement significantly increase the differential depth of foundations relative to the neighbouring properties?	**Yes**	It is envisaged the proposed excavations will extend roughly 1m below the existing lower ground floor level at 135 and 131 Arlington Road.
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 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 development result in a change in the area 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.

4.2.2 Scoping for Surface Flow and Flooding

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

The guidance advises that a change 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.

4.2.3 Scoping for Stability

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

Of the at-surface soil strata present in the London Borough of Camden, the London Clay is the most prone to seasonal shrink-swell (subsidence and heave).

- **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?**

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 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 London Clay the shallowest strata at the site?**

The guidance advises that this could cause multiple potential impacts depending on the specific setting of the basement development. For example, in terraced properties, the implications of a deepened basement/foundation system on neighbouring properties should be considered.

- **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.

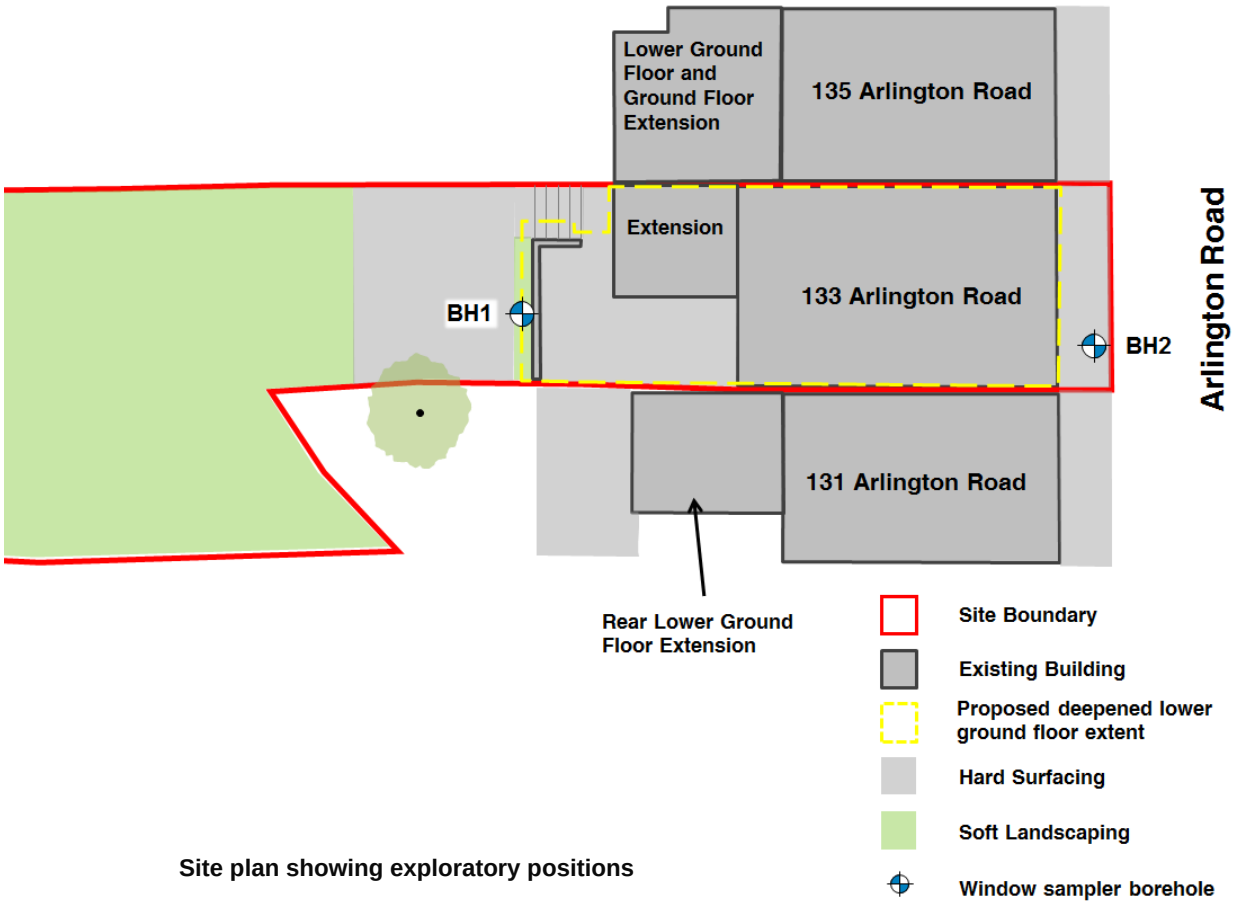
- **Will the proposed basement significantly increase the differential depth of foundations relative to the neighbouring properties?**

Excavation for a basement may result in structural damage to neighbouring properties if there is a significant differential depth between adjacent foundations.

5. Stage 3 – Site Investigation

An investigation comprising window sampler boreholes was carried out on 17th of November 2017, in order to assess the ground conditions and recover samples for geotechnical and chemical laboratory testing.

The site plan below indicates the approximate positions of the exploratory boreholes, while the associated borehole records and laboratory test results are appended.



Site plan showing exploratory positions

5.1 Ground Conditions

The ground investigation indicates that, beneath a limited thickness of made ground, the site is directly underlain by the London Clay Formation.

5.2 Made Ground

The made ground was generally found to be brown sandy clay with stones and fragments of brick and concrete, extending to approximately 1m depth.

Surfacing in the front lightwell comprised a concrete slab underlain by a sandy brick fill, while a surfacing of dark brown slightly clayey sandy topsoil with abundant rootlets and occasional stones and fragments of brick was encountered in the rear garden.

Left: Made Ground observed beneath the rear garden

Right: Made Ground observed beneath the front lightwell

5.3 London Clay Formation

The London Clay Formation underlies the made ground and consists of typical firm, becoming firm to stiff, pale brown mottled grey fissured silty clay with occasional partings of yellow sand and scattered selenite crystals.

The results of the plasticity index testing indicate that these soils are of high plasticity.

Cut sample of London Clay

5.4 Groundwater

No groundwater was encountered during the investigation and a shallow groundwater table is not present beneath the site.

6. Discussion of Geotechnical Issues

6.1 Basement Proposals

It is proposed to increase the headroom within the entire existing lower ground floor by 400mm and to laterally extend the basement into the rear garden of the property. It would appear that the level of the new basement will be approximately 1m lower than the existing basements in the neighbouring properties.

A new set of stairs will provide access to the proposed lower ground floor from the rear garden.

6.2 Existing Foundations

The lower ground floors of the adjoining buildings at 135 Arlington Road and 131 Arlington Road appear to be set at a similar level as the existing lower ground floor level of No 133. Both of these adjacent properties feature extensions to the rear which are also understood to be set at an approximately similar elevation to the existing lower ground floor at No 133.

The adjacent buildings are founded on strip foundations set slightly below the lower ground floor level, as evidenced by recent trial pit records and it is envisaged that the rear extensions will have necessitated underpinning of the original garden walls.

It is therefore envisaged that the existing foundations might need deepening by approximately 1m.

6.3 New Foundations

Excavation for the proposed rear extension is expected to extend down through any made ground and into the London Clay Formation.

In the absence of any expectation of substantial groundwater inflows into the excavation, any deepening of the existing foundations may be achieved by means of adopting conventional ‘hit and miss’ underpinning excavation methods.

The structural loads applied by the rear extension are to be accommodated by the perimeter walls, possibly together with internal spread foundations or thickened sections of the basement slab.

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

6.3.1 Effect of Trees

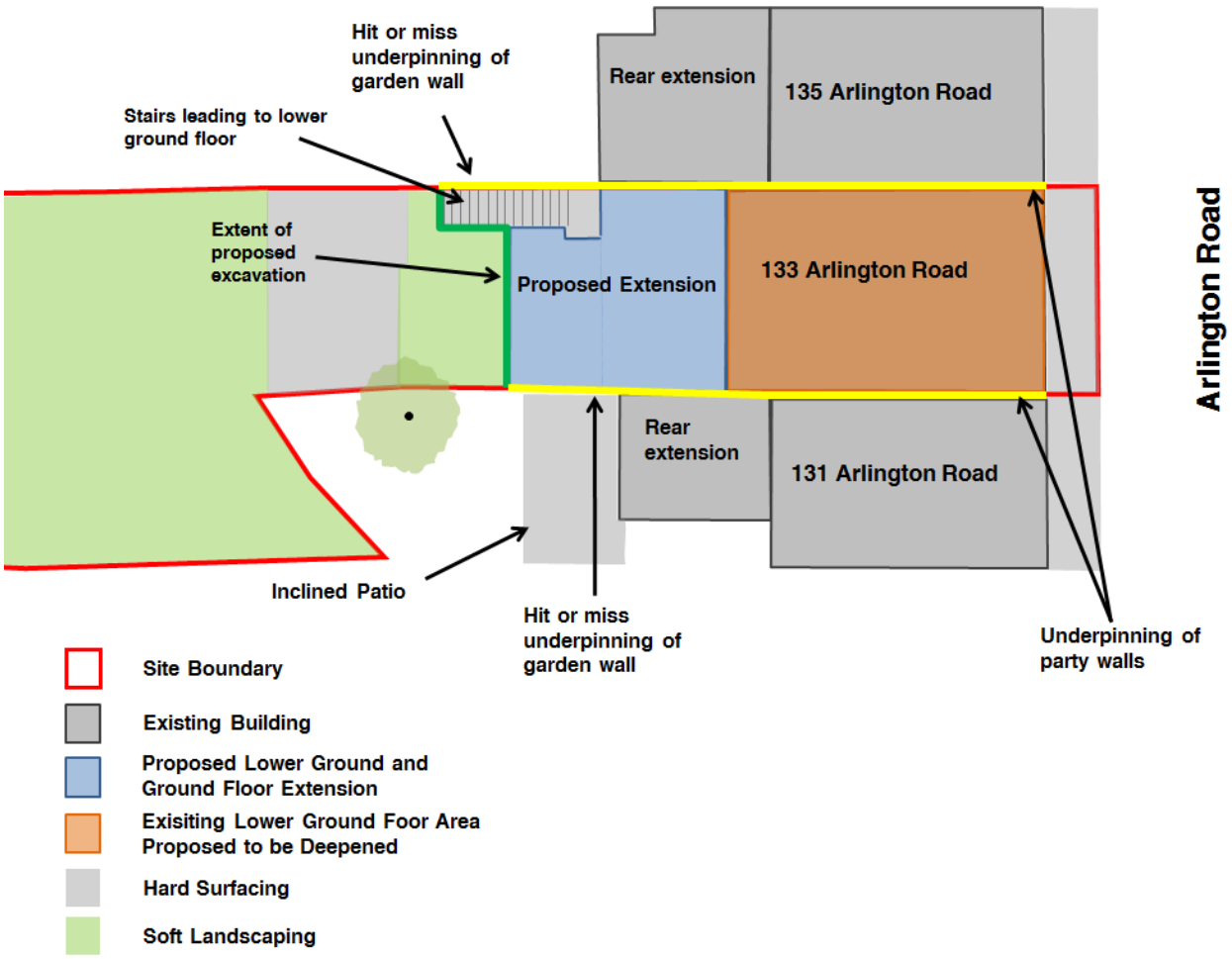
A mature sycamore tree is present approximately 3m away from the proposed lower ground floor extension, in the rear garden of No 131 Arlington Road.

Where foundations are constructed within the zone of influence of existing or proposed trees, there will be a potential for heave / shrinkage of the clay soils to occur and this will need to be taken account of in the design of the structure and foundations. The NHBC guidance for building near trees in high shrinkable soils should be followed.

6.4 Rear Garden Excavation

The basement excavation in the rear garden may require some form of temporary sheeting and propping to support nearby high-level garden party wall foundations. A maximum excavation face height of roughly 3.4m is envisaged.

The rear wall of the lower ground extension will need to be designed to act as a retaining wall against the rear garden in the post-construction situation.



6.5 Basement Waterproofing

Groundwater was not encountered within the envisaged depth of the basement excavation. Nevertheless, there is potential for water to collect around the basement structure in the long term unless perimeter and under floor drainage is assured. 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 below the external ground level would be prudent for the purposes of assessing hydrostatic pressures in order to allow for the possibility of surface water flooding due to a water main burst or similar.

6.5.1 Retaining Walls

The following parameters may be considered in the design of the retaining walls:-

Stratum	Bulk Density	Effective Cohesion	Effective Friction Angle
	(kg/m^3)	(c' - kN/m^2)	(ϕ'- degrees)
Made Ground	1900	Zero	20
London Clay Formation	2000	Zero	20

6.6 Foundation Concrete

The results of chemical analyses carried out on selected samples of the soils encountered indicate soluble sulphate concentrations falling within Class DS-2 as defined by BRE Special Digest 1 (2005). The recommendations of that guidance for Class DS-2 sulphate conditions should therefore be followed, assuming an Aggressive Chemical Environment for Concrete (ACEC) site classification of AC-2s for static groundwater.

6.7 Waste Disposal

All material to be disposed of off-site should be properly recorded, including the retention of any waste tickets, details of excavated soil export destinations and the waste classification.

The results of the chemical analyses have suggested that the made ground may be classed as Potentially Hazardous for waste disposal purposes by virtue of elevated concentrations of Total Petroleum Hydrocarbons (C6-C40), which are deemed to have Hazardous Property HP 3(i): Flammable. However, Hazardous Property HP3(i) is applicable only to soil wastes that have a free-draining liquid phase. The material recovered from this site does not include any free-draining liquid phase and hence the classification can be discarded and the material classed as Non-Hazardous.

The underlying natural soils may be expected to be Non-Hazardous and, provided that they can be adequately separated from any made ground, it may be possible to dispose of these natural soils to a tip licensed to accept Inert material.

7. 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.

7.1 Potential Hydrogeological Impacts

No groundwater is present at the site and, given the clay nature of the soils, no significant groundwater flow is envisaged.

Therefore, the development is not expected to have any impact upon groundwater flow and there is no scope for any cumulative impact.

7.2 Potential Hydrological Impacts

The proposed basement excavation will not result in any changes to the area of hard-surfacing, given the existing presence of a patio to the rear; however, the development also features additional hard surfacing within the rear garden, presumably to replace the lost patio. There will therefore be a net increase in the area of hard-surfacing, which may potentially result in an increase in surface water run-off discharged into the existing sewer.

It is currently envisaged that the drainage of the area of the proposed extension and the rear patio is to be designed similarly to the existing, connecting with the existing drainage layout.

A SUDS assessment will be undertaken and the new drainage scheme is to include attenuation in accordance with LBC and TW guidance and Policy CC3 ‘Water and Flooding’ of the Camden Local Plan.

7.3 Potential Stability Impacts

7.3.1 London Clay / Shrink-Swell

Limited depth of excavation into the natural London Clay is expected to minimise the risk of impact of seasonal shrink-swell on the proposed development.

7.3.2 Trees

The zone of influence of the existing mature sycamore tree at No 131 Arlington Road has been considered in terms of stability and the proposed foundation depth according to the NHBC Guidance.

The new basement will be designed in accordance with the NHBC guidance in order to protect the building from any potential shrink /swell movements of the clay.

7.3.3 Pedestrian Right of Way

The proposed deepening of the lower ground floor lies some 2m from the pedestrian right of way at its nearest point.

However, due to the envisaged depth of excavation being up to 1m the risk of adverse effects on the stability of Arlington Road can be minimised with standard temporary propping of the retained front lightwell walls.

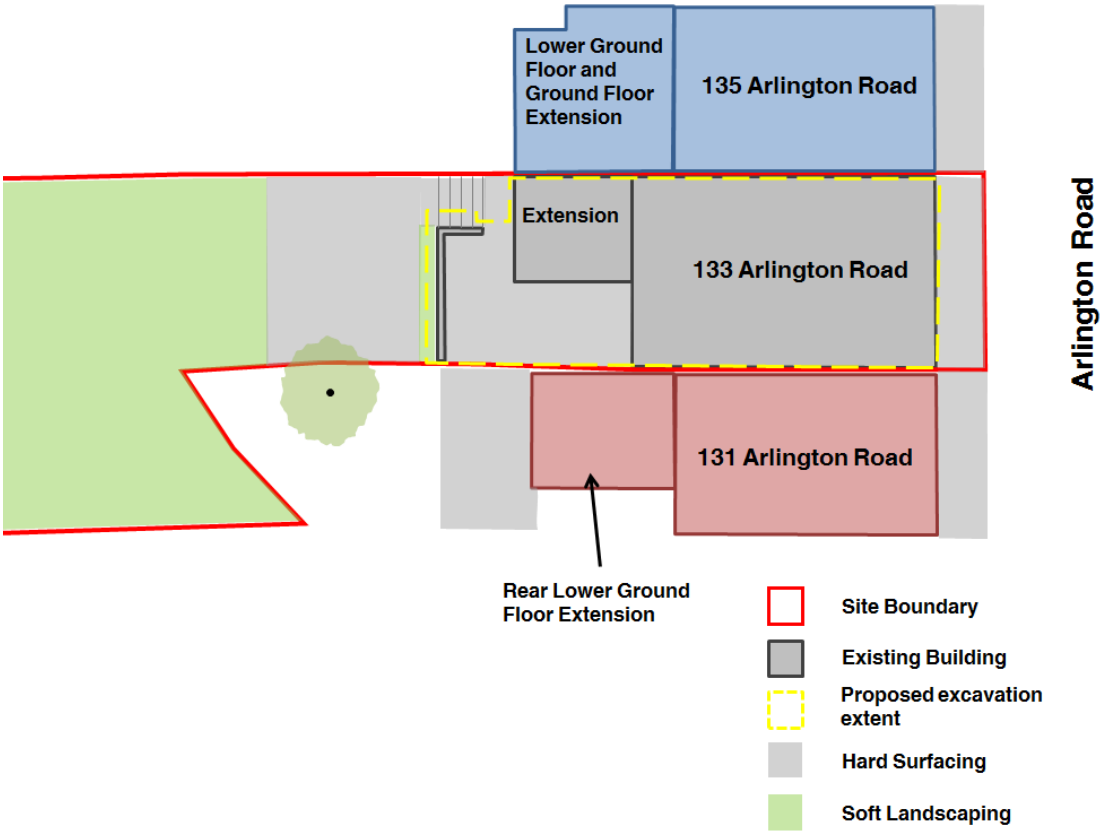
7.4 Ground Movement to Neighbouring Structures

The key factor to consider when undertaking a ground movement assessment for the development is that the design of the new basement will need to preserve the stability of the adjacent buildings and structures, both during excavation and construction and in the permanent situation.

A ground movement assessment has been undertaken to assess the potential damage that will be caused to the neighbouring structures as a result of the proposed development.

7.4.1 Structures Assessed for Ground Movement

There are two structures neighbouring the proposed development which have been assessed for the purpose of ground movement.



Site plan showing neighbouring structures assessed for the purpose of ground movement

7.4.1.1 131 Arlington Road (Red)

131 Arlington Road is a four storey terraced building present immediately to the southwest of the development. The building is understood to have been constructed at around the same time as No 133. A rear lower ground floor extension to this building was constructed in the late 1980s.

It is assumed the foundations to the building are set at the existing lower ground floor in order to represent a worst case scenario.

7.4.1.2 135 Arlington Road (Blue)

135 Arlington Road is a four storey terraced building present immediately to the northeast of the development. The building is understood to have been constructed at around the same time as No 133.

No 135 Arlington Road is reported to have been reconstructed from a stripped out state, notably with a demolished front wall down to the mid-point of the windows on the first floor. It is unknown whether the reconstruction altered the layout of the building. A rear extension to the lower ground and ground floors of No 135 has been constructed in the early 2010s.

Again, it is assumed the foundations to the building are set at the existing lower ground floor level in order to represent a worst case scenario.

7.4.2 Modelled Ground Conditions

Excavation of the basement will result in unloading of the clay leading to theoretical heave movement of the underlying soil in both the short and long term, depending upon the reapplication of loading.

Therefore, an analysis of the vertical movements has been carried out for a modelled situation, based on a soil model devised from the results of the ground investigation together with published information on the London Clay Formation.

The relation between the undrained shear strength (C_u) and depth (z) from the top of the London Clay Formation is therefore assumed to be $C_u = 50 + 8z$.

The soil layers of this model are detailed in the table overleaf.

Analysis Layer:	Upper Boundary (Approximate +m OD)	Thickness (m)	Average C_u (kN/m^2)	Soil Stiffness (kN/m^2)	
				E_u	E’
London Clay Formation	29.00	2	58	26100	12500
London Clay Formation	27.00	2	74	33300	16500
London Clay Formation	25.00	2	90	40500	20500
London Clay Formation	23.00	4	106	47700	24500
London Clay Formation	19.00	4	130	58500	28500
London Clay Formation	15.00	4	162	72900	34500
London Clay Formation	11.00	6	202	90900	40500
London Clay Formation	5.00	6	250	83700	46500
Assumed Rigid Boundary	-1.00				

The Undrained Modulus of Elasticity (Eu) has been based upon an empirical relationship of Eu = 450 x Cu, and the Drained Modulus of Elasticity (E’) has been based upon an empirical relationship of 250 x Cu.

Poisson’s Ratios of 0.5 and 0.2 have been used for short term (undrained) and long term (drained) conditions respectively.

Based on the above parameters and loading/unloading and ignoring any benefit gained from the loading of previous buildings on site, the potential vertical displacements and the post construction movements have been analysed.

The analysis uses classic modified Boussinesq elastic theory, assuming a fully flexible foundation applying a uniform loading/unloading to a semi-infinite elastic half-space, using the above parameters for stratified homogeneity and with the introduction of an assumed rigid boundary at approximately 30m depth (0.00m OD).

The programme calculates the theoretical Boussinesq elastic stress increase/decrease due to the applied net loadings/unloadings (over the given loaded/unloaded areas) at the mid-level of each stratum.

Short-term and long-term displacements are then calculated at each calculation point for each stratum, using the given values of Stiffness Moduli and Poisson's Ratio of the whole area of the site on a 1m calculation grid.

7.4.3 Short Term Movements

There are two components of short term movements that might potentially interact to affect the neighbouring structures. These are settlements associated with theoretical elastic heave movements from excavation of the basement and the underpinning process.

7.4.3.1 Underpinning

It is not possible to rigorously model the party wall settlements arising from conventional underpinning. However, experience indicates that the potential movements are very much dependent on workmanship.

It is suggested that given drive conditions and good workmanship, the amount of vertical movement of the perimeter walls can be expected to be approximately 5mm per stage of underpinning.

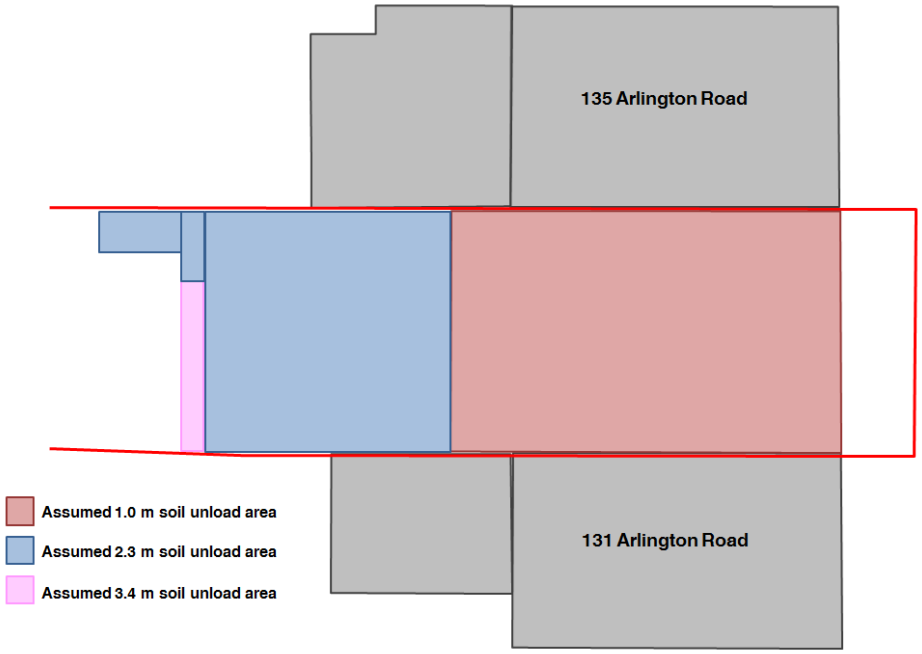
A single stage of underpinning is expected to take place; hence, 5mm of vertical settlement at the party walls may arguably be expected.

The subsequent ground horizontal movements that may occur due to yielding of the underpinned wall during the basement excavation may also be estimated. As a first approximation, the magnitude of the horizontal movement is assumed to be equal to the vertical movement at the underpinned wall; hence the horizontal movement expected at the party wall is also predicted to be 5mm.

7.4.3.2 Excavation

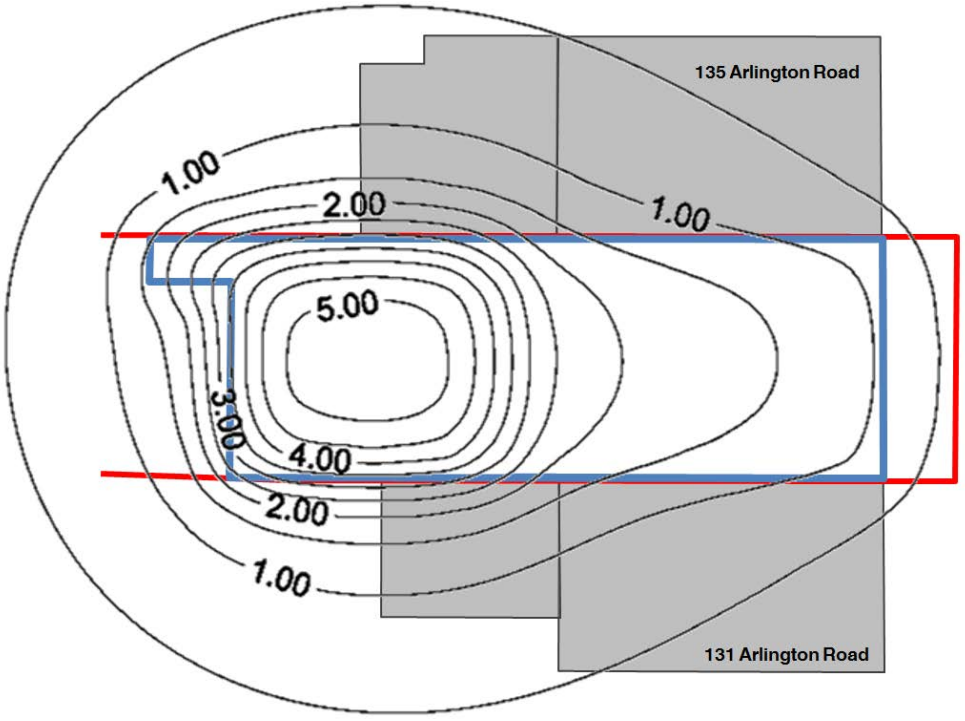
It is envisaged that the excavation will generally extend to approximately between 1m and 2.3m beneath the existing lower ground floor and the existing intermediate rear patio level, respectively. A limited area in the rear garden behind the existing retaining wall is expected to be excavated by approximately 3.4m.

As a result, the potential effect of the basement excavation has been considered by applying a net unloading of up to -20kN/m^2 due to soil loading to be removed due to deepening of the lower ground floor level, increasing to -46kN/m^2 and locally to -68kN/m^2 beneath the proposed extension.



Plan showing modelled unloaded areas due to soil excavation

The potential effect of this soil excavation may lead up to approximately 5mm of heave beneath the proposed extension reducing to roughly 2mm beneath both of the garden party walls with Nos. 131 and 135 Arlington Road.

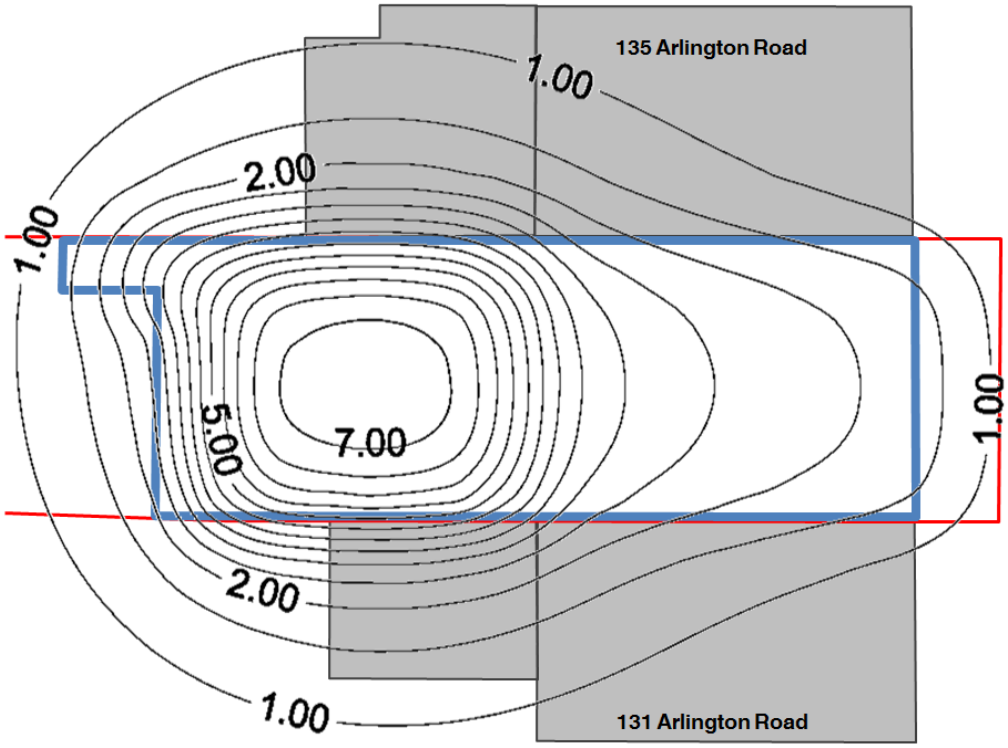


Plan showing theoretical approximate short term heave (mm) due to excavation

7.4.4 Post Construction Movements

In the area of the rear here will be a mismatch between the weight of the soil that is to be removed and the weight of the new structure that is to replace it. In this situation there will inevitably be a component of long-term heave that could proceed for several decades.

However, analysis suggests that the scale of this long term heave movement will be negligible (<10mm).



Plan showing theoretical approximate post construction heave (mm) due to excavation

7.4.5 Impacts

7.4.5.1 Impact on No 131 Arlington Road

In view of the potential counteracting movements described in the previous section, negligible net vertical movement is expected to affect the rear section of party wall and the garden party wall to No 131 Arlington Road. In the front of the property, where negligible heave is predicted, there may be up to 5mm of party wall settlement anticipated.

The potential damage to building has thus been assessed as Category 0 (negligible) to Category 1 (very slight).

7.4.5.2 Impact on No 135 Arlington Road

Similarly, negligible net vertical movements are expected to affect the party wall and the garden party wall to No 135 Arlington Road and again Category 0 (negligible) to Category 1 (very slight) damage is predicted.

7.4.6 Mitigation of Ground Movements

In line with DP27, Camden will ensure that harm is not caused to neighbouring properties by basement development. Camden Local Plan (June 2017) states that the BIA must demonstrate that the basement scheme has a risk of damage to the neighbouring properties no higher than Burland Scale 1 (very slight).

It is predicted that negligible to very slight damage Category 0 to 1 may be expected on the basis that the expected slight wall settlements associated with underpinning will be largely counteracted by heave movements in the rear extension area.

Given the possibility of up to Category 1 damage to neighbouring structures, precautionary mitigation measures have been adopted as part of the proposed scheme in order to limit the potential adverse effects. The basement has therefore been designed as a monolithic reinforced box, together with temporary propping.

It should also be noted that the above predictions are based upon good workmanship and robust propping of the excavations.

8. Conclusions

This assessment has demonstrated that, under the envisaged construction methodology, the proposed development can potentially be achieved without harm.

Appendix

Ground Investigation Records

Envirocheck Information (separate file)

PROJECT: 133 Arlington Road | LBH4501

CLIENT: Grant Parkinson & Masha Feigelman

BOREHOLE BH1

BORING METHOD: Modular Window Sampler Rig | Date: 20/11/17

GROUND WATER: No Groundwater Observed

REMARKS:

G.L Approximately +31.5m OD

Samples No	Samples Type	Depth m	Tests	Legend	Depth m	Description
					0.50	MADE GROUND (Dark brown slightly clayey sandy topsoil with abundant rootlets and occasional stones and fragments of brick, flint and slate)
1	D	0.70			1.00	MADE GROUND (Light brown clayey sand with stones and brick fragments)
	SPT	1.30	7			Firm to stiff pale brown silty CLAY with occasional partings of pale yellow fine sand and scattered selenite crystals
2	D	1.50				
3	D	2.00				
	SPT	2.30	12			Firm to stiff, becoming stiff, brown and grey mottled fissured silty CLAY with occasional partings of pale yellow fine sand and scattered selenite crystals
4	D	3.00				
	SPT	3.30	11			
5	D	4.00				
	SPT	4.30	16			

U=Undisturbed
B= Bulk
D=Disturbed
W=Water

LBH WEMBLEY ENGINEERING

PROJECT: 133 Arlington Road LBH4481

CLIENT: Grant Parkinson & Masha Feigelman

BOREHOLE BH1

BORING METHOD: Modular Window Sampler Rig

Date: 20/11/17

GROUND WATER: No Groundwater Observed

REMARKS:

G.L Approximately +31.5m OD

Samples No	Samples Type	Depth m	Tests	Legend	Depth m	Description
	SPT	5.30	14			Stiff brown and grey mottled fissured silty CLAY with occasional partings of pale yellow fine sand and scattered selenite crystals
	SPT	6.30	17		6.45	

U=Undisturbed
B= Bulk
D=Disturbed
W=Water

LBH WEMBLEY ENGINEERING

PROJECT: 133 Arlington Road
CLIENT: Grant Parkinson & Masha Feigelman

LBH4501

BOREHOLE BH2

BORING METHOD: Hand-held Window Sampler

Date: 20/11/17

GROUND WATER: No Groundwater Observed

REMARKS:

G.L Approximately +29 m OD

Samples No	Samples Type	Depth m	Tests	Legend	Depth m	Description
					0.35	MADE GROUND (concrete slab over brick fill with occasional sand and scattered stones with brick and concrete fragments)
1	D	0.50			0.80	MADE GROUND (dirty brown clay with scattered stones and fragments of brick and concrete)
2	D	1.50 - 2.00				Firm, becoming firm to stiff, brown and grey mottled silty CLAY with occasional partings of pale yellow fine sand
3	D	2.50 - 3.00			3.20	

U=Undisturbed
B= Bulk
D=Disturbed
W=Water

LBH WEMBLEY ENGINEERING

PROJECT: 133 Arlington Road LBH4501

CLIENT: Grant Parkinson & Masha Feigelman

SPT RESULTS

Borehole No	Depth at Start of Test (m)	Spoon or Cone	Blow for each successive 75mm penetration						Water Level (m)	Is Hole Blowing?	N Value
1	1.00	S	2	2	2	2	2	1	DRY	-	7
	2.00	S	1	2	3	3	3	3	DRY	-	12
	3.00	S	1	2	2	3	3	3	DRY	-	11
	4.00	S	2	2	2	4	5	5	DRY	-	16
	5.00	S	1	2	3	3	4	4	DRY	-	14
	6.00	S	2	3	3	4	5	5	DRY	-	17