

BASEMENT IMPACT ASSESSMENT

Ref: 25/40704-2 | Date: March 2026

**5 Firs Avenue,
Muswell Hill,
London,
N10 3LY**

Prepared for:
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Document Control

<i>Project</i>	5 Firs Avenue, Muswell Hill, London, N10 3LY
<i>Document Type</i>	Basement Impact Assessment
<i>Document Reference</i>	SAS 25/40704-2
<i>Document Status</i>	Final
<i>Revision</i>	2
<i>Changes</i>	Third issue accounting for changes in elevation, proposed loadings & basement layout.
<i>Date</i>	MArch 2026
<i>Document Version</i>	V1.0 – 3/21

Checked

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1.0 INTRODUCTION

1.1 Project Objectives

The purpose of this assessment is to consider the effects of a proposed basement construction on the local slope stability, surface water and groundwater regime at the residential property at 5 Firs Avenue, Muswell Hill, London, N10 3LY.

The recommendations and comments given in this report are based on the information contained from the sources cited and may include information provided by the Client and other parties, including anecdotal information. It must be noted that there may be special conditions prevailing at the site which have not been disclosed by the investigation and which have not been taken into account in the report. No liability can be accepted for any such conditions.

This report does not constitute a full environmental audit of either the site or its immediate environs.

1.2 Planning Policy Context

The London Borough of Haringey policies are set out in the Council's Basement Planning Policy (2016).

This document requires proposed developments to mitigate against the effects of ground and surface water flooding and to include drainage systems that do not impact neighbouring property of the site or the water environment by way of changing the groundwater regime.

This report is intended to address the issues set out in the council's basement policy. It will review existing site investigation data and provide a preliminary assessment of the issues identified by the Site Analytical Services Limited screening process.

This report also provides an impact assessment of the geotechnical impacts on adjacent structures and the surrounding area based on available site investigation data.

As part of this guidance a subterranean (groundwater) flow screening chart is provided which follows current planning procedure for basements and lightwells adopted by other London Borough's, including Camden, Westminster, Lambeth and Royal Borough of Kensington and Chelsea. The completed chart in relation to this development is provided as Table 1, to this report.

1.3 Qualifications

The report has been prepared by Mr Thomas Murray, a Fellow of the Geological Society (FGS) with 12+ years' experience.

2.0 SITE DETAILS

2.1 Site Location

The site is located along Firs Avenue on the east side of Birchwood Avenue – approximately 166m to the south-east of the A504 Fortis Green, in Muswell Hill, London, at approximate postcode N10 3LY. It is immediately bound by residential properties with associated private gardens in all directions, with public use north-east and east of the site (Fortis Green Road & B550 Muswell Hill Road).

The site is rectangular and covers an approximate area of 0.03 Hectares. The general area being under the authority of the London Borough of Haringey.

The National Grid Reference is: TQ 284 895.

A location map is presented below in Figure 1:



Figure 1. Site Location Plan

2.2 Site Layout and History

The site was attended on 18th September 2025 for the purposes of conducting the site investigation works and walkover.

The site comprises a 2-storey terraced building with associated private front and rear garden and a lower ground floor (Basement). A small garden shed is located in the rear garden.

The site is 90% Hardstanding (buildings, asphalt/concrete surfacing). With only 10% Soft Landscaping (Grassed and planted area in the rear garden).

There is a grassed area in the front of the property with a small bush, there are planted areas around the perimeter of the garden and three small to medium-sized trees. There is foliage present in the far end of the garden.

In the front of the property there are 7 steps down towards the door into the lower ground level, with three steps leading upwards to the front door of the property. The rear garden is tiered, there are 2 metal steps leading from the rear of the property onto the patio, with additional three steps leading down from the patio towards the rear door entrance to the lower ground level.

From historical map evidence it would appear that the site was first built on prior to 1864, with significant changes taking place to the property since its construction. The site comprises a long medium-sized structure running across the site boundary north to south but positioned on the western side of the site boundary which was later demolished in 1894 and redeveloped with two small to medium sized structures along the northern side of the site boundary and situated in the middle of the site. The far west of the site comprises non-coniferous trees. Between 1912-1914, the previous development has been removed, and the site consists of a terraced residential property with private front and rear gardens, which is still present today.

2.3 Geology

The Geological Survey of Great Britain (England and Wales) covering the area indicates the site to be underlain by the Lowestoft Formation over Dollis Hill Gravel Member over London Clay Formation at depth.

- The Lowestoft Formation forms an extensive sheet across East Anglia and parts of the East Midlands and is comprised predominately of moderately homogenous grey chalky till known as the Lowestoft Till Member. Other constituents within this formation include outwash sands, gravels, silts and clays.

- The rivers of the south-east of England, including the River Thames and its tributaries, have been subject to at least three changes of level since Pleistocene times. One result has been the formation of a complex series of River Terrace Gravels. The Dollis Hill Gravels are found on higher ground than the existing flood plains and comprise sands and gravels of roughly bedded flint or Chert gravels in a matrix of sand of varying degrees of coarseness.
- The London Clay mainly comprises bioturbated or poorly laminated, blue-grey or grey-brown, slightly calcareous, silty to very silty clay, clayey silt and sometimes silt, with some layers of sandy clay. It commonly contains thin courses of carbonate concretions ('cementstone nodules') and disseminated pyrite. It also includes a few thin beds of shells and fine sand partings or pockets of sand, which commonly increase towards the base and towards the top of the formation. At the base, and at some other levels, thin beds of black rounded flint gravel occur in places. Glauconite is present in some of the sands and in some clay beds, and white mica occurs at some levels.

The British Geological Survey maintains an archive of historical exploratory borehole logs throughout the UK. SAS Limited has searched the database and has not found a borehole located within 250m of the site.

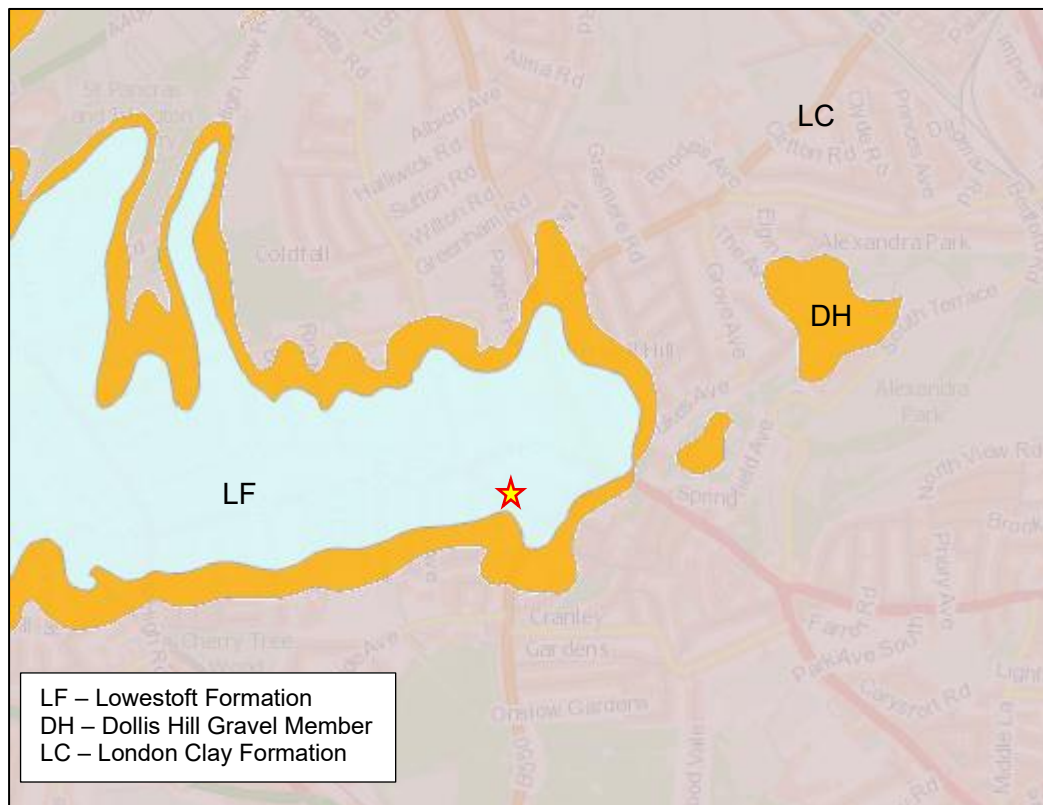


Figure 2. Superficial and Bedrock geology of the Site (Ref. BGS Geoindex)

2.4 Hydrology and drainage

2.4.1 Rainfall and run-off

According to Mayes (1997) rainfall in the local area averages around 610mm and is significantly less than the national average of around 900mm.

Evapotranspiration is typically 450mm/year resulting in about 160mm/year as 'hydrologically effective' rainfall which is available to infiltrate into the ground or run-off as surface water flow.

According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011), the site is not within 100m of a former river or watercourse. The closest is the Fleet located over 1km to the south of the site. The closest surface water feature is a Drain, located 358m to the south-east of the site at Parkland Walk.

The area located immediately around the site is a residential area with an estimated 85% of the surface covered with hardstanding. Some of the rainfall in the area will run-off hard surface areas and be collected by the local sewer network the rest will be absorbed through ground infiltration.

2.4.2 Drainage

Surface drainage from the site is assumed to be directed to drains along Firs Avenue towards the south.

2.4.3 Flood Risk

River or Tidal flooding

The site is not currently located within 1 kilometre of areas at risk from extreme flooding from rivers or sea without defences (Zone 2) or areas at risk from rivers or sea without defences (Zone 3).

Surface water flooding

Modelling of surface water flooding has been undertaken by the Environment Agency and was published on its website in January 2014; an extract from their model is presented within the Envirocheck Site Sensitivity maps. Whilst this map identifies three levels of risk (high, medium and low) it is understood that it is based at least in part on depths of flooding. The modelling shows very low / negligible risk of flooding on and adjacent to the site.

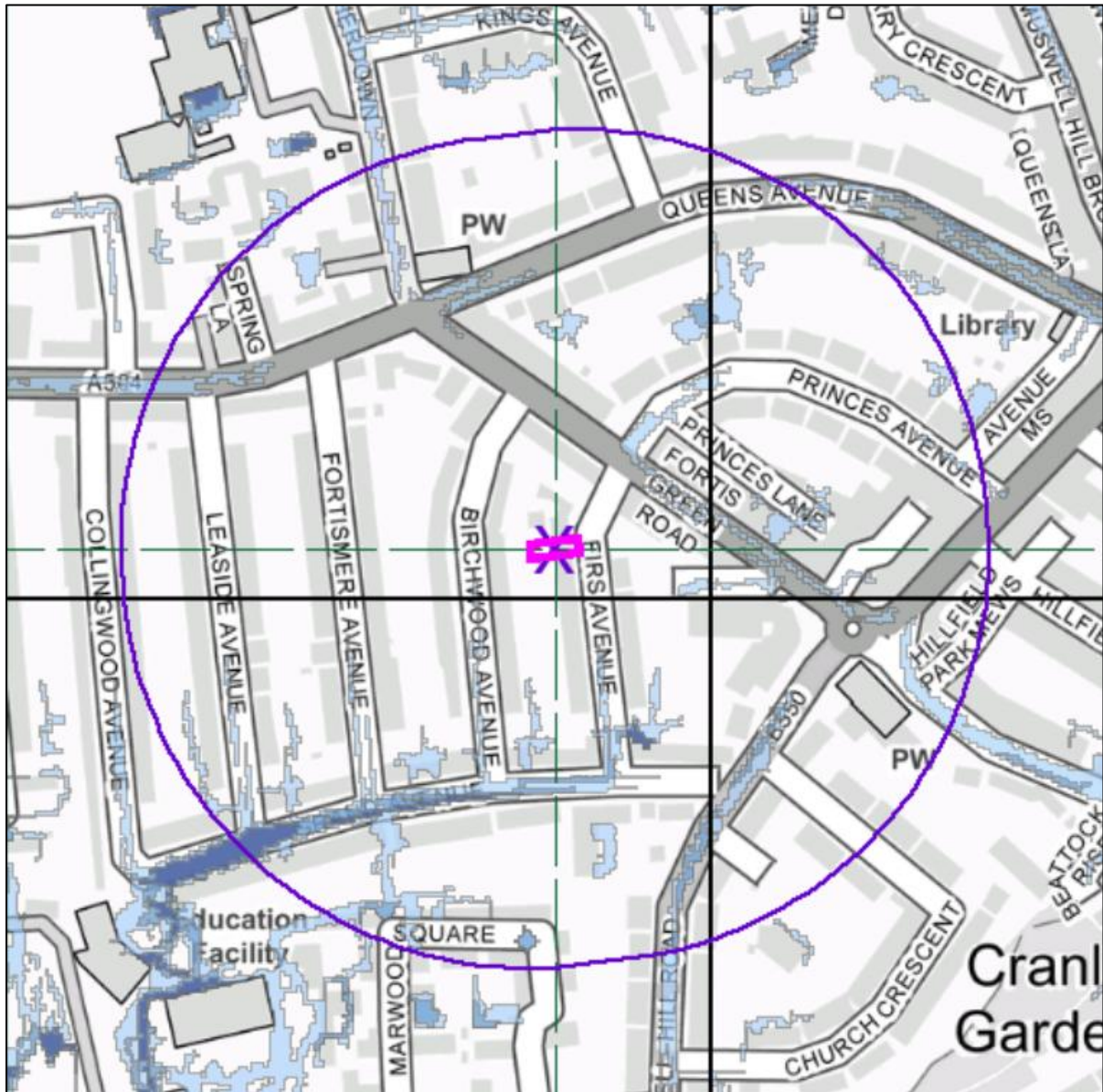


Figure 3. Extract from the Environment Agency's 'Risk of Flooding from Surface Water'.
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Sewer flooding

The London Regional Flood Risk Appraisal (2009) advises that foul sewer flooding is most likely to occur where properties are connected to the sewer system at a level below the hydraulic level of the sewage flow, which in general are often basement flats or premises in low lying areas. There is no record of sewer flooding having occurred at Firs Avenue and therefore the risk of sewer flooding is considered low.

2.5 Hydrogeology

The Environment Agency Groundwater Protection Policy uses aquifer designations that are consistent with the Water Framework Directive. These designations reflect the importance of aquifers in terms of groundwater as a resource (drinking water supply) and also their role in supporting surface water flows and wetland ecosystems.

The Superficial Geology underlying the site has been classified as a Secondary Undifferentiated Aquifer; has been assigned in cases where it has not been possible to attribute either Category A or B to a rock type. In most cases, this means that the layer in question has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

The Bedrock geology underlying the site has been classified as Unproductive Strata; rock layers or drift deposits with low permeability that have negligible significance for water supply or river base flow.

Groundwater levels have been monitored as part of this study and the results are described in Section 4.0 below.

Other hydrogeological data obtained and contained in Appendix B for the site include:

- The site is not located within 1km of a Source Protection Zone.
- There are no water abstraction licences within 1 kilometre of the site.

2.6 Previous Reports

The results from a Site Investigation are presented under separate cover in Site Analytical Services Limited report (Project No. 25/40704-1), dated September 2025. The findings from this report are described in this basement impact assessment.

2.7 Proposed Development

It is proposed to construct a new basement below the existing property adjacent to the existing lower ground floor level. Current plans (at time of writing this report) indicate the new basement floor slab to be located at 2.422m bgl, this includes the reduction of levels by 3.122m below the existing ground floor level.

2.8 Results of Basement Impact Assessment Screening

A screening process has been undertaken for the site and the results are summarised in Table 1 below:



Table 1: Summary of screening results

Item	Description	Response	Comment
Sub-terranean (Ground water Flow)	1a. Is the site located directly above an aquifer.	Yes	The site has been classified as being situated above a Secondary undifferentiated over a Secondary A aquifer formed by the Dollis Hill Gravel Member
	1b. Will the proposed basement extend beneath the water table surface.	Unknown – to be confirmed by Ground Investigation	Given the presence of an aquifer below the site it is possible that groundwater will be encountered during any excavations for the proposed basement, however this will be confirmed by the ground investigation.
	2. Is the site within 100m of a watercourse, well (used / disused) or potential spring line.	No	According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011), the site is not within 100m of a former river or watercourse. The closest is the River Fleet located over 1km to the south of the site. The closest surface water feature is a Drain, located 358m to the south-east of the site at Parkland Walk. From the British Geological Society 'Geoindex' the nearest water well is located approximately 600m southwest of the site.
	3. Will the proposed basement development result in a change in the proportion of hard surfaced / paved areas.	No	The amount of hardstanding in relation to the basement on-site is not expected to change.
	4. As part of site drainage, will more surface water (e.g. rainfall and run-off) than at present be discharged to the ground (e.g. via soakaways and/or SUDS).	No	Existing drainage paths are to be utilised where possible. The proposed basement will be beneath the existing building footprint.
	5. 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 or spring line.	No	According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011), the site is not within 100m of a former river or watercourse. The closest is the River Fleet located over 1km to the south of the site. The closest surface water feature is a Drain, located 358m to the south-east of the site at Parkland Walk. From the British Geological Society 'Geoindex' the nearest water well is located approximately 600m southwest of the site.
Slope Stability	1. Does the existing site include slopes, natural or man-made greater than 7 degrees (approximately 1 in 8).	No	The site appears to be tiered but no steep slopes.



Item	Description	Response	Comment
	2. Will the proposed re-profiling of landscaping at the site change slopes at the property boundary to more than 7 degrees (approximately 1 in 8).	No	Re-profiling of landscaping at the site is not proposed.
	3. Does the development neighbor land, including railway cuttings and the like, with a slope greater than 7 degrees (approximately 1 in 8).	No	The surrounding area is essentially flat.
	4. Is the site within a wider hillside setting in which the general slope is greater than 7 degrees (approximately 1 in 8).	No	There is no discernible slope across the area.
	5. Is the London Clay the shallowest strata at the site.	No	With reference to available BGS records, the Lowestoft Formation and Dollis Hill gravel Member is expected to exist above the London Clay Formation.
	6. Will any trees be felled as part of the development and/or are any works proposed within any tree protection zones where trees are to be retained.	No	It is understood that no trees are to be felled as part of the development.
	7. Is there a history of seasonal shrink-swell subsidence in the local area and/or evidence of such effects at the site.	No	The site lies above the Lowestoft Formation and Dollis Hill Gravel Member and this is not prone to seasonal shrink swell action.
	8. Is the site within 100m of a watercourse or a potential spring line.	No	According to publications regarding Lost Rivers of London (Barton, 1992) and (Talling, 2011), the site is not within 100m of a former river or watercourse. The closest is the River Fleet located over 1km to the south of the site. The closest surface water feature is a Drain, located 358m to the south-east of the site at Parkland Walk. From the British Geological Society 'Geoindex' the nearest water well is located approximately 600m southwest of the site.
	9. Is the site within an area of previously worked ground.	No	According to the records held by the BGS the site is not underlain by any worked ground, Made Ground, infilled ground or landscaped ground.
	10. Is the site within an aquifer. If so, will the proposed basement extend beneath the water table such that dewatering may be required during construction.	Unknown – to be confirmed by Ground Investigation	Given the presence of an aquifer below the site it is possible that groundwater will be encountered during any excavations for the proposed basement, however this will be confirmed by the ground investigation.



Item	Description	Response	Comment
	11. Is the site within 5m of a highway or pedestrian right of way.	Yes	The site lies within 5m of Firs Avenue.
	12. Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties.	Yes	The development will increase the depths of foundation at the site, although the foundation depths of adjacent properties are not known.
	13. Is the site over (or within the exclusion zone of) any tunnels, e.g. railway lines.	No	No TfL or London Underground Assets runs are within close proximity to the site.
Surface Water and Flooding	1. As part of the proposed site drainage, will surface water flows (e.g. volume of rainfall and peak run-off) be materially changed from the existing route.	No	The amount of hardstanding in relation to the basement constructions on-site is not expected to change.
	2. Will the proposed basement development result in a change in the proportion of hard surfaced / paved external areas.	No	The amount of hardstanding in relation to the basement constructions on-site is not expected to change.
	3. 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	All surface water for the site will be contained within the site boundaries and collected as described above; hence there will be no change from the development on the quantity or quality of surface water being received by adjoining sites.
	4. Will the proposed basement result in changes to the quality of surface water being received by adjacent properties or downstream watercourses.	No	The surface water quality will not be affected by the development, as in the permanent condition collected surface water will generally be from roofs, or domestic hard landscaping.
	5. Is the site in an area known to be at risk from surface water flooding.	No	According to Figure 3 from Environment Agency's 'Risk of Flooding from Surface Water' the area at very low to negligible risk from surface water flooding.

The Screening Exercise has identified the following potential issues which will be carried forward to the Scoping Phase

Subterranean Groundwater Flow

- Is the site located above an aquifer.
- Will the proposed basement extend beneath the water table surface.

Slope Stability

- Will the proposed basement extend beneath the water table surface
- Is the site within 5m of a highway or pedestrian right of way.
- Will the proposed basement significantly increase the differential depth of foundations relative to neighbouring properties.

3.0 SCOPING PHASE

The purpose of the scoping phase is to assess in more detail the factors to be investigated in the impact assessment. Potential impacts are assessed for each of the identified impact factors and recommendations are stated.

A conceptual ground model is usually compiled at the scoping stage however, because the ground investigation has already been undertaken for this project, the conceptual ground model including the findings of the ground investigation is described under Chapter 4.

Subterranean (Groundwater Flow)

Potential Issue (Screening Question)		Potential impacts and actions
1a	Is the site located above an aquifer.	Potential impact: Aquifer may imply groundwater at shallow depth. Local restriction of groundwater flows (perched groundwater or below groundwater table). Action: Ground investigation required, then review.
1b	Will the proposed basement extend beneath the water table surface?	Potential impact: Local restriction of groundwater flows (perched groundwater or below groundwater table). Action: Ground investigation required, then review.

Slope Stability

10	Will the proposed basement extend beneath the water table surface?	Potential impact: Local restriction of groundwater flows (perched groundwater or below groundwater table). Action: Ground investigation required, then review.
11	Is the site within 5m of a highway or a pedestrian right of way?	Potential impact: Excavation of basement causes loss of support to footway/highway and damage to the services beneath them. Action: Ensure adequate temporary and permanent support by use of best practice working methods.
12	Will the proposed basement substantially increase the differential depth of foundations relative to neighbouring properties?	Potential impact: Loss of support to the ground beneath the foundations to the surrounding properties if basement excavations are inadequately supported. Action: Ensure adequate temporary and permanent support by use of best practice methods.

These potential impacts have been further assessed through the ground investigation, as detailed in Section 4 below.

4.0 SITE INVESTIGATION DATA

4.1 Records of site investigations

The boreholes and trial pits were completed at existing ground level and revealed ground conditions that were generally consistent with the geological records and known history of the area and comprised Made Ground up to 0.90m in thickness (also found to the base of Trial Pit 2 at 1.30m below ground level) resting on the Lowestoft Formation with the London Clay formation at depth. The Dollis Hill Member was not encountered during site works.

These ground conditions are summarised in the following table. For detailed information on the ground conditions encountered reference should be made to the exploratory hole records presented in Appendix A.

Strata	Depth to top of strata (mbgl)	Depth to base of strata (mbgl)	Description
Made Ground	0.00	0.49 to 1.30	Silty sandy clay / clayey silty sand containing chalk, brick and concrete fragments.
Lowestoft Formation	0.49 to 0.90	2.30 to 2.80	Stiff silty slightly gravelly clay containing occasional chalk nodules.
London Clay Formation	2.30 to 2.80	10.00 (max depth of drilling)	Stiff silty sandy clay containing partings of silty fine sand and gypsum crystals.

Summary of Ground Conditions in Exploratory Holes

4.2 Groundwater

Groundwater was not encountered in any of the boreholes or trial pits and the material remained essentially dry throughout.

It must be noted that the speed of excavation is such that there may well be insufficient time for further light seepages of groundwater to enter the boreholes and trial pits and hence be detected, particularly within more cohesive soils.

Groundwater was encountered at respective depths of 3.08m and 2.25m below ground level in Boreholes 1 and 2 during the return monitoring visit.

Isolated pockets of groundwater may also be present perched within any less permeable material found at shallower depth on other parts of the site especially within any Made Ground.

It should be noted that the comments on groundwater conditions are based on observations made at the time of the investigation (September and October 2025) and that changes in the groundwater level could occur due to seasonal effects and also changes in drainage conditions.

5.0 FOUNDATION DESIGN

5.1 General

It is proposed to construct a new basement below the existing property adjacent to the existing lower ground floor level. Current plans (at time of writing this report) indicate the new basement floor slab to be located at 2.422m bgl, this includes the reduction of levels by 3.122m below the existing ground floor level.

5.2 Site Preparation Works

The main contractor should be informed of the site conditions and risk assessments should be undertaken to comply with the Construction Design Management (CDM) regulations. Site personnel are to be made aware of the site conditions. It is recommended that extensive searches of existing man-made services are undertaken over the site prior to final design works.

5.3 Foundation Design

A result of the inherent variability of uncontrolled fill, (Made Ground) is that it is usually unpredictable in terms of bearing capacity and settlement characteristics. Foundations should, therefore, be taken through any Made Ground and either into, or onto a suitable underlying natural stratum of adequate bearing characteristics.

Based on the ground and groundwater conditions encountered in the boreholes, it could, in theory, be possible to support lighter loaded areas of the proposed new development on conventional strip foundations taken down below the Made Ground and any weak superficial soils and placed in the natural stiff silty sandy clay deposits which occur at a depth of 1.30m across the site.

Using theory from Terzaghi (1943), strip foundations placed within natural soils may be designed to allowable net bearing pressures of approximately 180kN/m² at 2.50m depth below ground level in order to allow for a factor of safety of 2.5 against general shear failure. The actual allowable bearing pressure applicable will depend on the form of foundation, its geometry and depth in accordance with classical analytical methods, details of which can be obtained from "Foundation Design and Construction", Seventh Edition, 2001 by M J Tomlinson (see references) or similar texts.

Any soft or loose pockets encountered within otherwise competent formations should be removed and replaced with well compacted granular fill.

5.4 Piled Foundations

In the event that the use of conventional spread foundations proves either impracticable or uneconomical due to the size and depth of foundation required, then a piled foundation may be required. In these ground conditions, it is considered that some form of bored and in-situ cast concrete piled foundation with reinforced concrete ground beams should prove satisfactory.

The construction of a piled foundation is a specialist activity and the advice of a reputable contractor, familiar with the type of soil and groundwater conditions encountered at this site should be sought prior to finalising the foundation design. The actual pile working load will depend on the particular type of pile chosen and method of installation adopted.

To achieve the full bearing value a pile should penetrate the bearing stratum by at least five times the pile diameter.

Piling methods should be capable of advancing pile bores through the surface Made Ground into the underlying natural soils.

Where piles are to be constructed in groups the bearing value of each individual pile should be reduced by a factor of about 0.8 and a calculation made to check the factor of safety against block failure.

Driven piles could also be used and would develop much higher working loads approximately 2.5 to 3 times higher than bored piles of a similar diameter at the same depth. However, the close proximity of adjacent buildings will in all probability preclude their use due to noise and vibration.

5.5 Retaining Walls

Several methods of retaining wall construction could be considered. These may include retaining structures cast in an underpinning sequence, or the use of temporary or sacrificial works to facilitate the retaining structure's construction. The excavation of the basement must not compromise the integrity of adjacent structures.

The full design of temporary and permanent retaining structures is beyond the scope of this report. However, the following design parameters for each element of soil recorded in the relevant exploratory holes are provided in the table below to assist the design of these structures.

Stratum	Depth to top	Bulk Density (Mg/m ³) (γ)	Effective Angle of Internal Friction (Φ)
Lowestoft Formation	0.49 to 0.90	2.00	28
London Clay Formation	2.30 to 2.80	2.00	23

Retaining Wall Design Parameters

The designer should use these parameters to derive the active and passive earth pressure coefficients k_a and k_p . The determination of appropriate earth pressure coefficients, together with factors such as the pattern of the earth pressure distribution, will depend upon the type/geometry of the wall and overall design factors.

5.6 Basement Floor Slabs

Due to the presence of soils assessed to be of medium swelling and shrinkage potential below, it is recommended that ground slabs should be fully suspended.

Within the zone of influence of trees, either retained or removed, floor slabs should incorporate either underfloor voids or suitable depths of compressible material in accordance with NHBC requirements, for soils with high volume change potential.

5.7 Excavations

Shallow excavations for foundations and services are likely to require nominal side support in the short term and groundwater is unlikely to be encountered in significant quantities once any accumulated surface water has been removed. Deeper and longer excavations below approximately 1.50m below existing ground level will require close side support and some seepages of groundwater could be encountered.

No particular difficulties are envisaged in removing such water by conventional internal pumping methods from open sumps.

Normal safety precautions should be taken if excavations are to be entered.

It is recommended that the water levels in the monitoring borehole be periodically measured immediately prior to and during, the development. Should groundwater levels rise to within the excavation volume, or should significant groundwater inflow be observed during excavation, professional advice should be sought.

6.0 BASEMENT IMPACT ASSESSMENT

6.1 Summary

The screening identified a number of potential impacts. The table below summarises the previously identified potential impacts and the additional information that is now available from the site investigation in consideration of each impact.

Potential Impact	Site Investigation conclusions	Impact sufficiently addressed without further justification?
The site is located above an aquifer	The most recent soils investigation has proven that the site lies above the Lowestoft Formation. These are generally aquifers formerly classified as minor aquifers.	No – see below for further details.
The proposed basement extends beneath the water table surface.	The maximum proposed dig level for the basement excavation (understood to be 2.422mbgl) lies below the minimum indicated groundwater level of 2.20mbgl in BH2.	No – see below for further details.
The site is within 5m of a highway or pedestrian right of way.	The proposed basement is not to be extended below Firs Avenue and therefore it is suggested that the impact on these access roads is likely to be minimal. There is nothing unusual in the proposed development that would give rise to any concerns with regard to the stability of public highways.	Yes.
The proposed basement will significantly increase the differential depth of foundations relative to neighbouring properties.	The development will result in the extension of the foundation depth of the basement relative to neighbouring properties.	No – see below for further details.

6.2 Outstanding Risks and Issues

The significant impacts which require further information have been described in detail below in order to assess the likelihood of them occurring and the scope for reasonable engineering mitigation.

The site is located directly above an aquifer.

As proven from the site investigation, the site is underlain by aquifer sustaining Superficial (Drift) geology comprising permeable unconsolidated (loose) deposits. These deposits have been designated as Secondary Undifferentiated which could be classified as both A & B Classed; permeable layers capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

Due care and attention should be paid to ensure that no contamination incidents occur as a result of the development. No change to the existing drainage arrangements is proposed and therefore existing rates of rainfall infiltration and groundwater recharge will remain unchanged.

The proposed basement extends beneath the water table surface.

The maximum proposed dig level for the basement excavation (understood to be 2.422mbgl) lies below the minimum indicated groundwater level of 2.20mbgl in BH2.

It is suggested that excavating below the water level in this area may result in construction difficulties. Furthermore, if the inflow of water to the excavations results in erosion of fines or instability of the excavation sides, then ground may be lost from beneath the foundations of the adjacent structures, potentially resulting in a greater degree of damage than predicted below.

It is therefore recommended that trial excavations to the proposed basement depth be carried out by the main contractor to confirm the stability of the soil and to further investigate the presence of any groundwater inflows. It is also recommended that the water levels in the monitoring borehole be periodically measured immediately prior to and during, the development.

During any dewatering carried out for the trial investigations or indeed the main works it will be necessary to monitor the pumped water for fines. Care must be taken not to allow settlement of the neighbouring structures during any dewatering process and the main contractor should provide details of how they intend to control groundwater and maintain the stability of excavations.

The proposed basement will significantly increase the differential depth of foundations relative to neighbouring properties.

The excavation and construction of the basement at the site has the potential to cause some movements in the surrounding ground if not properly managed. However, it is understood that ground movements and/or instability will be managed through the proper design and construction of mitigation measures during the works. This will require close collaboration with the appointed contractor's temporary works coordinator.

The Party Wall Act (1996) will apply to this development because neighbouring houses lie within a defined space around the proposed building works. The party wall process should be followed and adhered to during this development.

A ground movement assessment was carried out at the site by Curtins under the instruction of Site Analytical Services Limited (Report Reference 088490-CUR-XX-XX-T-GE-00001). The report is provided as Appendix B to this report and concludes that providing that appropriate consideration is given to the detailed design of the basement in order to limit future movement, that good workmanship and construction sequences are used with appropriate support during excavations and that groundwater management is employed, then the proposed basement construction is unlikely to cause significant damage to the surrounding structures. Based on the predicted ground movements, the adjacent structures are expected to be at or less than CIRIA C760 Damage Category 0 (negligible).

A monitoring plan should be set out at design stage and should include a monitoring strategy, instrumentation and monitoring plans and action plans. Trigger levels on movements will need to be defined. Precise levelling or reflective survey targets should be installed at the garden walls and neighbouring buildings. Monitoring should take place in advance of the proposed works as a base-line survey, during the works and for a period following the completion of the works, to understand the long-term effects.

CIRIA C580 and C760 uses information on the damage to walls of buildings based on studies conducted by Burland et al. 1977, Boscardin and Cording 1989, and Burland 2001 which categorises damage in 5 categories, which can be seen in Figure 4 below.

Category of damage	Description of typical damage (ease of repair is underlined)	Approximate crack width (mm)	Limiting tensile strain ϵ_{lim} (per cent)
0 Negligible	Hairline cracks of less than about 0.1 mm are classed as negligible.	< 0.1	0.0–0.05
1 Very slight	<u>Fine cracks that can easily be treated during normal decoration.</u> Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection.	< 1	0.05–0.075
2 Slight	<u>Cracks easily filled. Redecoration probably required.</u> Several slight fractures showing inside of building. Cracks are visible externally and <u>some repointing may be required externally</u> to ensure weathertightness. Doors and windows may stick slightly.	< 5	0.075–0.15
3 Moderate	<u>The cracks require some opening up and can be patched by a mason. Recurrent cracks can be masked by suitable linings. Repointing of external brickwork and possibly a small amount of brickwork to be replaced.</u> Doors and windows sticking. Service pipes may fracture. Weathertightness often impaired.	5–15 or a number of cracks > 3	0.15–0.3
4 Severe	<u>Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows.</u> Windows and frames distorted, floor sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing in beams. Service pipes disrupted.	15–25 but also depends on number of cracks	> 0.3
5 Very severe	<u>This requires a major repair involving partial or complete rebuilding.</u> Beams lose bearings, walls lean badly and require shoring. Windows broken with distortion. Danger of instability.	usually > 25 but depends on number of cracks.	

Figure 4 - Building damage classification – relationship between category of damage and limiting strain ϵ_{lim} After Burland et al. 1977, Boscardin and Cording 1989, and Burland 2001

7.0 BIA CONCLUSIONS

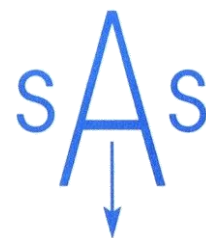
1. It is proposed to construct a new basement below the existing property adjacent to the existing lower ground floor level. Current plans (at time of writing this report) indicate the new basement floor slab to be located at 2.422m bgl, this includes the reduction of levels by 3.122m below the existing ground floor level.
2. Conditions at the site were investigated by Site Analytical Services Limited in October 2025 (SAS Report Reference 25/40704-1). The boreholes and trial pits were completed at existing ground level and revealed ground conditions that were generally consistent with the geological records and known history of the area and comprised Made Ground up to 0.90m in thickness (also found to the base of Trial Pit 2 at 1.30m below ground level) resting on the Lowestoft Formation with the London Clay formation at depth. The Dollis Hill Member was not encountered during site works.
3. The maximum proposed dig level for the basement excavation (understood to be 2.422mbgl) lies above the minimum indicated groundwater level of 2.20mbgl in BH2 and groundwater will be affected by the development.
4. A monitoring plan will be set out at design stage and will include a monitoring strategy, instrumentation and monitoring plans and action plans.
5. The proposed development will not increase flood risk at the site or the surrounding area. Also, since the development is on already developed land, it will not adversely impact the Council's sustainability objectives.
6. The excavation and construction of the basement at the site has the potential to cause some movements in the surrounding ground if not properly managed. However, it is understood that ground movements and/or instability will be managed through the proper design and construction of mitigation measures during the works.

8.0 REFERENCES

1. CIRIA Special Publication 69, 1989. The engineering implications of rising groundwater levels in the deep aquifer beneath London
2. Environment Agency, 2006. Groundwater levels in the Chalk-Basal Sands Aquifer in the London Basin
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6. CIRIA, 2000. Sustainable Urban Drainage Systems: Design Manual for England and Wales. CIRIA C522, Construction Industry Research and Information Association, London
7. Environment Agency Status Report 2010. Management of the London Basin Chalk Aquifer. Environment Agency
8. NHBC Standards, Chapter 4.1, "Land Quality - managing ground conditions", September 1999.
9. Mayles, J. 1997. Regional climates of the British Isles, p74: Average precipitation for the period 1961-1990 St James Park, London = 611mm. Routledge
10. NHBC Standards, Chapter 4.2, "Building near Trees", January 2023.
11. Environment Agency. (n.d.). Flood risk map. From <http://maps.environment-agency.gov.uk/>
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13. CIRIA C760– Guidance on Embedded Retaining Walls Design 2017



9.0 APPENDIX A – GROUND INVESTIGATION REPORT



Factual Report on a **GEOTECHNICAL GROUND INVESTIGATION**

Ref: 25/40704-1 | Date: October 2025

**5 Firs Avenue,
Muswell Hill,
London,
N10 3LY**

Prepared for:
Manh “Vince” Duy Van Cao

DOCUMENT CONTROL

<i>Project</i>	5 Firs Avenue, Muswell Hill, London, N10 3LY
<i>Document Type</i>	Factual Report on a Geotechnical Ground Investigation
<i>Document Reference</i>	SAS 25/40704-1
<i>Document Status</i>	FINAL
<i>Revision</i>	0
<i>Changes</i>	-
<i>Date</i>	October 2025
<i>Document Version</i>	V1.0 – 3/21

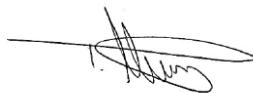
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SITE WORKS LOCATION PLANS

APPENDIX B

BOREHOLE & TRIAL PIT LOGS

APPENDIX C

LABORATORY TEST & GROUNDWATER MONITORING DATA

1.0 Introduction

1.1 Outline and Limitations of Report

At the request of Manh “Vince” Duy Van Cao, a ground investigation was carried out in connection with a proposed basement development at the above site. A Phase 1 Desk Study is presented under a separate cover in Site Analytical Services Limited Report Reference 25/40704, dated September 2025.

The information was required for the design and construction of foundations and infrastructure for the proposed development at the existing site, which includes the extension of the existing lower ground floor under the full extent of the main house.

The recommendations and comments given in this report are based on the ground conditions encountered in the exploratory holes made during the investigation and the results of the tests made in the field and the laboratory. It must be noted that there may be special conditions prevailing at the site remote from the exploratory hole locations which have not been disclosed by the investigation and which have not been taken into account in the report. No liability can be accepted for any such conditions.

2.0 Site Details

(National Grid Reference: TQ 284 895)

2.1 Site Location

The site is located along Firs Avenue on the east side of Birchwood Avenue – approximately 166m to the south-east of the A504 Fortis Green, in Muswell Hill, London, at approximate postcode N10 3LY. It is immediately bound by residential properties with associated private gardens in all directions, with public use north-east and east of the site (Fortis Green Road & B550 Muswell Hill Road).

The site is rectangular and covers an approximate area of 0.03 Hectares. The general area being under the authority of the London Borough of Haringey.

2.2 Published Geology

The Geological Survey of Great Britain (England and Wales) covering the area indicates the site to be underlain by the Lowestoft Formation over Dollis Hill Gravel Member over London Clay Formation at depth.

3.0 Scope of Work

3.1 Site Works

The proposed scope of works was agreed by the client prior to the commencement of the investigations. To achieve this, the following works were undertaken:-

- The drilling of two continuous flight auger boreholes to a depth of 10.00m below ground level (Boreholes 1 and 2).
- The installation of groundwater monitoring standpipes to an approximate depth of 5.00m in Boreholes 1 and 2, together with a single return monitoring visit.
- The excavation by hand of two trial pits, to 1.50m maximum depth to expose existing foundations on-site (Trial Pits 1 and 2).
- Sampling and in-situ testing as appropriate to the ground conditions encountered in the exploratory holes.
- Laboratory testing to determine the engineering properties of the soils encountered in the exploratory holes.

3.2 Ground Conditions

The approximate locations of the exploratory holes can be found in Appendix A.

The boreholes and trial pits were completed at existing ground level and revealed ground conditions that were generally consistent with the geological records and known history of the area and comprised Made Ground up to 0.90m in thickness (also found to the base of Trial Pit 2 at 1.30m below ground level) resting on the Lowestoft Formation with the London Clay formation at depth. The Dollis Hill Member was not encountered during site works.

These ground conditions are summarised in the following table. For detailed information on the ground conditions encountered in the boreholes and trial pits, reference should be made to the exploratory hole records presented in Appendix B.

Strata	Depth to top of strata (mbgl)	Depth to base of strata (mbgl)	Description
Made Ground	0.00	0.49 to 1.30	Silty sandy clay / clayey silty sand containing chalk, brick and concrete fragments.
Lowestoft Formation	0.49 to 0.90	2.30 to 2.80	Stiff silty slightly gravelly clay containing occasional chalk nodules.
London Clay Formation	2.30 to 2.80	10.00 (max depth of drilling)	Stiff silty sandy clay containing partings of silty fine sand and gypsum crystals.

Summary of Ground Conditions in Exploratory Holes

3.3 Groundwater

Groundwater was not encountered in any of the boreholes or trial pits and the material remained essentially dry throughout.

It must be noted that the speed of excavation is such that there may well be insufficient time for further light seepages of groundwater to enter the boreholes and trial pits and hence be detected, particularly within more cohesive soils.

Groundwater was encountered at respective depths of 3.08m and 2.25m below ground level in Boreholes 1 and 2 during the return monitoring visit.

Isolated pockets of groundwater may also be present perched within any less permeable material found at shallower depth on other parts of the site especially within any Made Ground.

It should be noted that the comments on groundwater conditions are based on observations made at the time of the investigation (September and October 2025) and that changes in the groundwater level could occur due to seasonal effects and also changes in drainage conditions.

4.0 In-Situ and Laboratory Tests

4.1 In-Situ Tests

In the essentially cohesive natural soils encountered at the site, in-situ shear vane tests were made at regular depth increments in order to assess the undrained shear strength of the materials. The results indicate that the natural soils are of a generally high strength in accordance with BS 5930 (2015).

The results of the in-situ tests are shown on the appropriate exploratory hole records contained in Appendix B.

4.2 Classification Tests

Atterberg Limit tests were conducted on four selected samples taken from the cohesive portion of the natural soils in Boreholes 1 and 2 and showed the samples tested to fall into Classes CI, CI/CH and CH according to the British Soil Classification System.

These are fine grained silty clay soils of intermediate to high plasticity and as such generally have a low permeability and a medium susceptibility to shrinkage and swelling movements with changes in moisture content, as defined by the NHBC Standards, Chapter 4.2. The results indicated Modified Plasticity Index values of between 25% and 30%, with all samples being below the 40% boundary between soils assessed as being of medium volume change potential and those assessed as being of high volume change potential.

The results of the tests are presented on Table 1, contained in Appendix C.

4.3 Chemical Attack on Buried Concrete

Using the results contained in Appendix B, the following table provides the highest values encountered for the BRE SD1 Suite D specification and the equivalent DS and ACEC classes, based on mobile groundwater:

Strata	pH	2:1 Water Soluble SO ₄ (mg/l)	2:1 Water Soluble Chloride (mg/l)	2:1 Water Soluble Nitrate (mg/l)	Total Sulphur (%)	Magnesium (mg/l)	DS Class	ACEC Class
Lowestoft Formation	7.7-8.0	2360	3600	<5.0	0.290	140	DS-3	AC-3
London Clay formation	7.5-7.9	2410	85	<5.0	0.839	180	DS-3	AC-3

Worst case DS and ACEC classes based on the BRE SD1 Suite D results

5.0 List of Appendices

Appendix A – Site Works Location Plans

Appendix A – Borehole and Trial Pit Logs

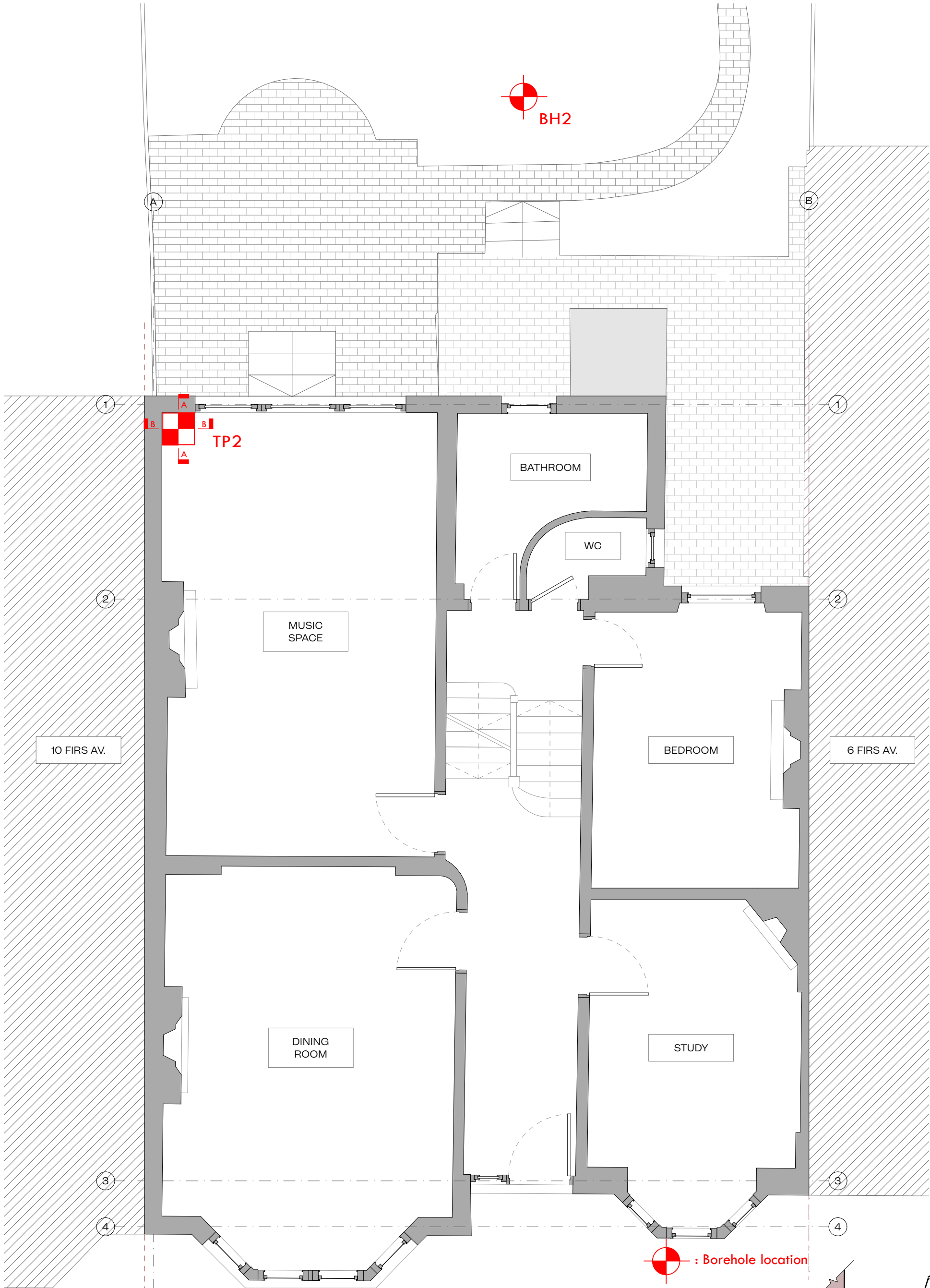
Appendix B – Laboratory Test & Groundwater Monitoring Data

6.0 References

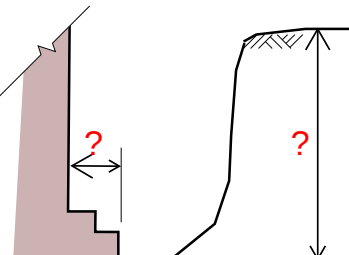
1. British Standards Institution, 2015. Code of practice for foundations, BS 8004, BSI, London.
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3. British Standards Institution, 1994. Code of practice for earth retaining structures, BS8002, BSI, London
4. British Standards Institution, Code of Practice for Site Investigations, BS5930: 2015, BSI, London
5. British Standards Institution, 2004. Geotechnical Design, BS EN 1997-1 BSI, London
6. NHBC Standards, Chapter 4.1, "Land Quality - managing ground conditions", September 1999.

APPENDIX A

Site Works Location Plans



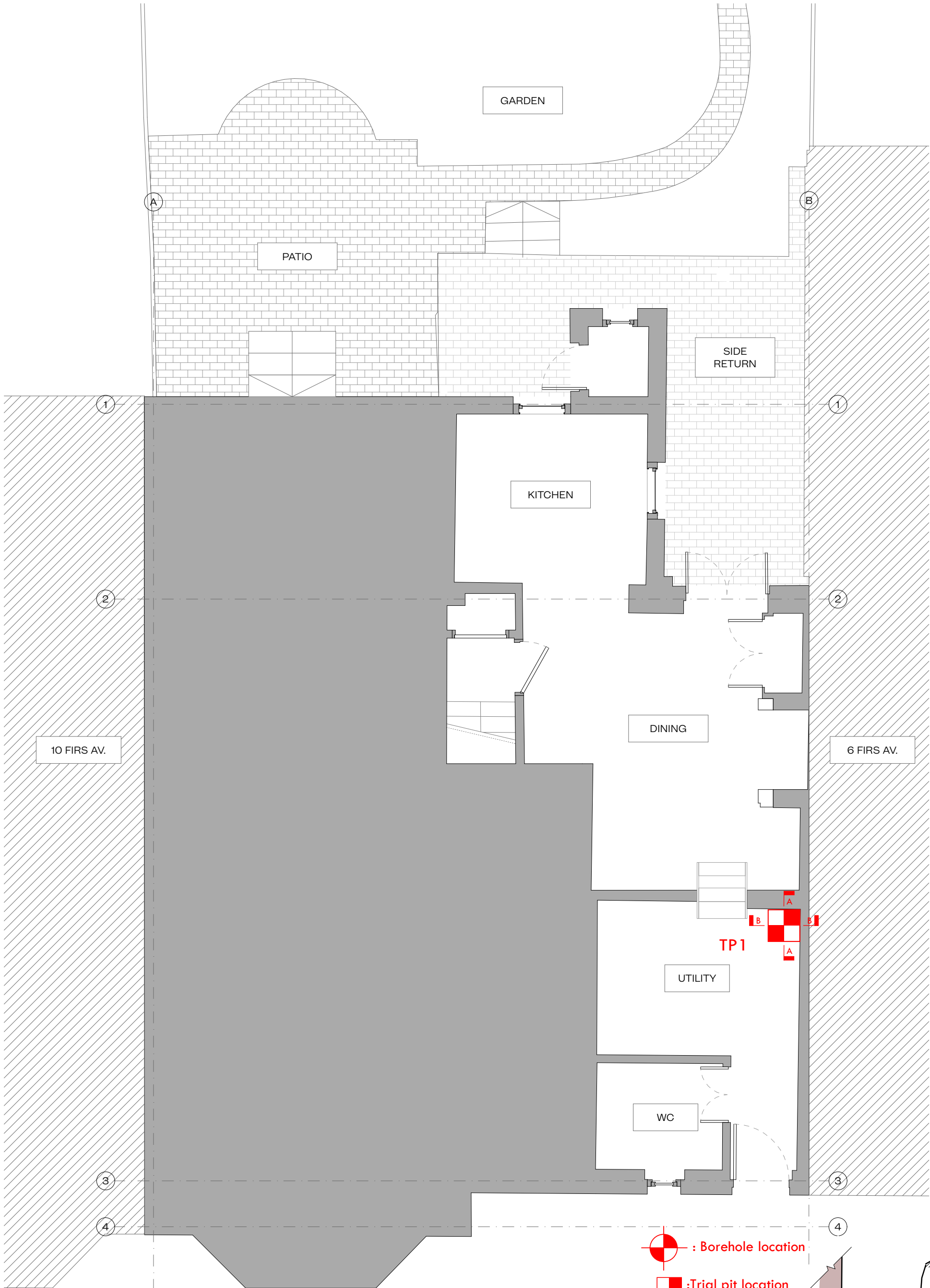
To reveal depth and profile of existing wall foundations in the directions shown



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5F CANONBURY YARD
LONDON N1 7BJ

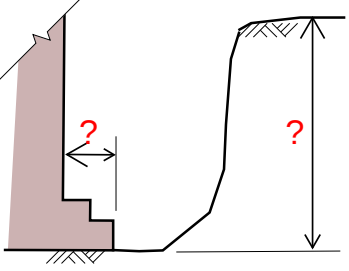
REF:	FIR	DRAWING:	Existing Ground Floor Plan	REV.	DATE	DESCRIPTION	1. Do not scale drawings for construction.
PROJECT:	5 Firs Avenue	STATUS:	Feasibility	01 -	Work in	Initial Issue	2. Neighbouring buildings are approximate.
	Muswell Hill,	SCALE:	1:50@A3	WIP	Progress		3. All dimensions, levels and conditions shall be checked on site before proceeding with the work.
	London, N10 3LY.	DATE:	09/07/2025				4. ELL Architects shall be notified of any discrepancies.
CLIENT:	Amy & Vince Cao	DRAWING NO.:	ELL-080-A-04-101				5. Spot levels are subjects to variation.
		REVISION:	01 - WIP				6. All drawings to be read in conjunction with all consultant information and specification.
							7. Do not use for construction unless expressly permitted.



 : Borehole location

 : Trial pit location

To reveal depth and profile of existing wall foundations in the directions shown



REF:	FIR	DRAWING:	Existing Lower Ground Floor	REV.	DATE	DESCRIPTION	1. Do not scale drawings for construction.
PROJECT:	5 Firs Avenue	STATUS:	Feasibility	01 -	Work in	Initial Issue	2. Neighbouring buildings are approximate.
	Muswell Hill,	SCALE:	1:50@A3	WIP	Progress		3. All dimensions, levels and conditions shall be checked on site before proceeding with the work.
	London, N10 3LY.	DATE:	09/07/2025				4. ElIELl Architects shall be notified of any discrepancies.
CLIENT:	Amy & Vince Cao	DRAWING NO.:	ELL-080-A-04-100				5. Spot levels are subjects to variation.
		REVISION:	01 - WIP				6. All drawings to be read in conjunction with all consultant information and specification.
							7. Do not use for construction unless expressly permitted.

APPENDIX B

Borehole & Trial Pit Logs

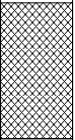
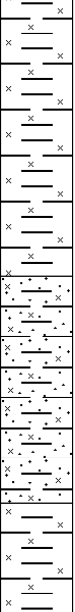
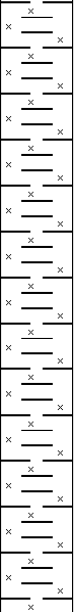
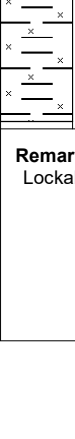
Site Analytical Services Ltd.							Site	Borehole Number	
							5 FIRS AVANUE, MUSWELL HILL, LONDON N10 3LY	BH1	
Boring Method		Casing Diameter		Ground Level (mOD)		Client		Job Number	
CONTINUOUS FLIGHT AUGER		100mm cased to 0.00m				MANH "VINCE" DUY VAA CAO		2540704	
		Location		Dates		Engineer		Sheet	
		TQ284894		18/09/2025		STRUCTURAL DESIGN STUDIO		1/1	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.25	D1					(0.27) 0.27	MADE GROUND grass over topsoil		
0.50	D2					(0.63) 0.63	MADE GROUND medium brown silty clayey sand containing chalk and brick fragments		
0.75	D3					0.90	Stiff medium brown orange silty slightly gravelly CLAY with occasional chalk nodules.		
1.00	D4								
1.00	V1 76								
1.50	D5					(1.40) 1.40			
1.50	V2 86						Stiff medium brown orange silty CLAY		
2.00	D6					2.30			
2.00	V3 89								
2.50	D7								
2.50	V4 94						(2.00) 2.00		
3.00	D8								
3.00	V5 140+								
3.50	D9								
3.50	V6 140+						Stiff dark brown grey silty CLAY		
4.00	D10					4.30			
4.00	V7 140+								
4.50	D11								
4.50	V8 140+						(5.70) 5.70		
5.00	D12								
5.00	V9 140+								
6.00	D13								
6.00	V10 140+								
7.00	D14								
7.00	V11 140+								
8.00	D15								
8.00	V12 140+								
9.00	D16								
9.00	V13 140+								
10.00	D17					10.00			
10.00	V14 140+								
Remarks Groundwater was not encountered during site works V=Vane test - Results in kPa D=Disturbed sample Breaking out from 0.00m to 1.00m for 1 HOUR hour.							Scale (approx)		Logged By
							1:50		SB
							Figure No. 2540704.BH1		

Site Analytical Services Ltd.						Site 5 FIRS AVANUE, MUSWELL HILL, LONDON N10 3LY				Borehole Number BH1											
Installation Type Single Installation		Dimensions Internal Diameter of Tube [A] = 50 mm Diameter of Filter Zone = 100 mm				Client MANH "VINCE" DUY VAA CAO				Job Number 2540704											
		Location TQ284894		Ground Level (mOD)		Engineer STRUCTURAL DESIGN STUDIO				Sheet 1/1											
Legend	Water	Instr (A)	Level (mOD)	Depth (m)	Description	Groundwater Strikes During Drilling															
				1.00	Bentonite Seal	Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings				Depth Sealed (m)						
											5 min	10 min	15 min	20 min							
						Groundwater Observations During Drilling															
						Date	Start of Shift					End of Shift									
							Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)					
						Instrument Groundwater Observations															
						Inst. [A] Type : Slotted Standpipe															
						Date	Instrument [A]			Remarks											
							Time	Depth (m)	Level (mOD)												
				5.00	Slotted Standpipe																
						Instrument Groundwater Observations															
						Inst. [A] Type : Slotted Standpipe															
						Date	Instrument [A]			Remarks											
							Time	Depth (m)	Level (mOD)												
										6.00	Bentonite Seal										
												Instrument Groundwater Observations									
												Inst. [A] Type : Slotted Standpipe									
												Date	Instrument [A]			Remarks					
Time	Depth (m)	Level (mOD)																			
				10.00	General Backfill																
												Instrument Groundwater Observations									
												Inst. [A] Type : Slotted Standpipe									
												Date	Instrument [A]			Remarks					
						Time	Depth (m)	Level (mOD)													

Remarks
Lockable cover set in concrete.

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Site Analytical Services Ltd.							Site 5 FIRS AVANUE, MUSWELL HILL, LONDON N10 3LY		Borehole Number BH2	
Boring Method CONTINUOUS FLIGHT AUGER		Casing Diameter 100mm cased to 0.00m			Ground Level (mOD)		Client MANH "VINCE" DUY VAA CAO		Job Number 2540704	
		Location TQ284894			Dates 18/09/2025		Engineer STRUCTURAL DESIGN STUDIO		Sheet 1/1	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
0.25	D1						MADE GROUND containing medium to dark brown silty clayey sand containing brick and concrete fragments			
0.50	D2					(0.90)				
0.75	D3					0.90				
1.00	D4									
1.00	V1 78						Stiff medium brown orange silty CLAY with occasional chalk nodules.			
1.50	D5									
1.50	V2 87					(1.90)				
2.00	D6									
2.00	V3 104						Stiff medium brown silty CLAY containing bands of fine sands.			
2.50	D7									
2.50	V4 124					2.80				
3.00	D8									
3.00	V5 140+						Stiff dark brown grey silty CLAY			
3.50	D9					(1.50)				
3.50	V6 140+									
4.00	D10					4.30				
4.00	V7 140+									
5.00	D11									
5.00	V8 140+									
6.00	D12									
6.00	V9 140+									
7.00	D13									
7.00	V10 140+					(5.70)				
8.00	D14									
8.00	V11 140+									
9.00	D15									
9.00	V12 140+									
10.00	D16									
10.00	V13 140+					10.00				
Remarks Groundwater was not encountered during site works D=Disturbed sample V=Vane test - results in kPa Breaking out from 0.00m to 1.00m for 1 HOUR hour.								Scale (approx) 1:50		Logged By SB
								Figure No. 2540704.BH2		

Site Analytical Services Ltd.						Site 5 FIRS AVANUE, MUSWELL HILL, LONDON N10 3LY				Borehole Number BH2											
Installation Type Single Installation		Dimensions Internal Diameter of Tube [A] = 50 mm Diameter of Filter Zone = 100 mm				Client MANH "VINCE" DUY VAA CAO				Job Number 2540704											
		Location TQ284894		Ground Level (mOD)		Engineer STRUCTURAL DESIGN STUDIO				Sheet 1/1											
Legend	Water	Instr (A)	Level (mOD)	Depth (m)	Description	Groundwater Strikes During Drilling															
				1.00	Bentonite Seal	Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings				Depth Sealed (m)						
											5 min	10 min	15 min	20 min							
						Groundwater Observations During Drilling															
						Date	Start of Shift					End of Shift									
							Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	Time	Depth Hole (m)	Casing Depth (m)		Water Depth (m)	Water Level (mOD)				
						Instrument Groundwater Observations															
						Inst. [A] Type : Slotted Standpipe															
						Date	Instrument [A]			Remarks											
							Time	Depth (m)	Level (mOD)												
				5.00	Slotted Standpipe																
						Instrument Groundwater Observations															
						Inst. [A] Type : Slotted Standpipe															
						Date	Instrument [A]			Remarks											
							Time	Depth (m)	Level (mOD)												
										6.00	Bentonite Seal										
												Instrument Groundwater Observations									
												Inst. [A] Type : Slotted Standpipe									
												Date	Instrument [A]			Remarks					
Time	Depth (m)	Level (mOD)																			
				10.00	General Backfill																
												Instrument Groundwater Observations									
												Inst. [A] Type : Slotted Standpipe									
												Date	Instrument [A]			Remarks					
						Time	Depth (m)	Level (mOD)													

Remarks
Lockable cover set in concrete

Produced by the GEOTECHNICAL DATABASE SYSTEM (GEODASY) © all rights reserved

Site	Trial Pit Number
5 FIRS AVANUE, MUSWELL HILL, LONDON N10 3LY	TP1

Client MANH "VINCE" DUY VAA CAO	Job Number 2540704
Engineer STRUCTURAL DESIGN STUDIO	Sheet 1/1

Description	Legend	Water
MADE GROUND Tiles over concrete		
MADE GROUND Medium brown silty sand containing brick and concrete fragments		
Firm medium brown grey veined silty CLAY		
Complete at 0.68m		

Remarks		
M+Mackintosh probe - Blows/Penetration (mm) D=Disturbed sample		
Scale (approx)	Logged By	Figure No.
1:50	SB	2540704.TP1

Site Analytical Services Ltd.			Site 5 FIRS AVANUE, MUSWELL HILL, LONDON N10 3LY		Trial Pit Number TP1	
Method Trial Pit		Dimensions m(W) x m(L) x 0.68m(D)	Ground Level (mOD)	Client MANH "VINCE" DUY VAA CAO		Job Number 2540704
Orientation A B C D ↑		Location TQ284894	Dates 18/09/2025	Engineer STRUCTURAL DESIGN STUDIO		Sheet 1/1
Depth 0.00 SKIRTING BOARD BRICK BRICK BRICK BRICK Concrete 100mm 75mm 75mm 75mm 150mm 50mm 50mm 50mm 100mm Level 0.00 </						

Site Analytical Services Ltd.						Site 5 FIRS AVANUE, MUSWELL HILL, LONDON N10 3LY		Trial Pit Number TP2	
Excavation Method HAND EXCAVATION		Dimensions 0.30m(W) x 0.30m(L) x 1.30m(D)		Ground Level (mOD)		Client MANH "VINCE" DUY VAA CAO		Job Number 2540704	
		Location TQ284894		Dates 18/09/2025		Engineer STRUCTURAL DESIGN STUDIO		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
					0.03 0.15 (0.60) 0.75 (0.55) 1.30	MADE GROUND floor boards MADE GROUND timber VOID MADE GROUND Medium brown silty sand containing brick and concrete fragments Complete at 1.30m			
Plan					Remarks				
.					Void from 0.15 to 0.7				
.									
.									
.									
.									
.									
					Scale (approx)		Logged By		Figure No.
					1:50		SB		2540704.TP2

Site Analytical Services Ltd.			Site 5 FIRS AVANUE, MUSWELL HILL, LONDON N10 3LY		Trial Pit Number TP2	
Method Trial Pit		Dimensions 0.30m(W) x 0.30m(L) x 1.30m(D)	Ground Level (mOD)	Client MANH "VINCE" DUY VAA CAO		Job Number 2540704
Orientation A D B C		Location TQ284894	Dates 18/09/2025	Engineer STRUCTURAL DESIGN STUDIO		Sheet 1/1
Depth 0.00 1.00 SKIRTING BOARDS BRICK BRICK 100mm TIMBER 100mm 250mm 1050mm UNDERSIDE WAS NOT ENCOUNTERED DURING EXCAVATION DUE TO TIGHT ACCESS CONSTRAINTS Level 0.00 -1.00 1300mm						
Strata				Samples and Tests		
Depth (m)	No.	Description	Depth (m)	Type	Field Records	
0.00-0.03	1	MADE GROUND floor boards				
0.03-0.15	2	MADE GROUND timber				
0.15-0.75	3	VOID				
0.75-1.30	4	MADE GROUND Medium brown silty sand containing brick and concrete fragments				
			Excavation Method:			
			HAND EXCAVATION			
			Shoring / Support:			
			Stability:			
			Backfill:			
Remarks Void from 0.15 to 0.7						
Logged By : SB Checked By : Figure No. : 2540704.TP2						

APPENDIX C

Laboratory Test & Groundwater Monitoring Data

PLASTICITY INDEX & MOISTURE CONTENT DETERMINATIONS

BH/TP No.	Depth (m)	Natural Moisture (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 μ m (%)	Modified Plasticity Index (%)	Class
BH1	1.50	13	39	12	27	94	25	CI
	3.00	24	47	19	28	100	28	CI
BH2	2.00	17	47	16	31	97	30	CI
	4.00	26	50	20	30	100	30	CI/CH

Table 1

GROUNDWATER MONITORING

GROUNDWATER MONITORING RECORD			
Date	Weather Conditions	Ground Conditions	Temperature (°C)
21/10/2025	Cloudy	Damp	13.0
Monitoring Point Location	Depth to water (mBGL)		Depth to Base of well (mBGL)
BH1	3.08		5.00
BH2	2.25		5.01

Table 2

Site Analytical Services Ltd
Units 14 -15
River Road Business Park
33 River Road
Barking
Essex
IG11 0EA

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e: services@siteanalytical.co.uk; lizw@siteanalytical.co.uk; jimw@siteanalytical.co.uk;
Maddiepotter@siteanalytical.co.uk

i2 Analytical Ltd.
7 Woodshots Meadow,
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Business Park,
Watford,
Herts,
WD18 8YS

t: 01923 225404

f: 01923 237404

e: info-i2analytical@normecgroup.com

Analytical Report Number : 25-053811

Project / Site name:	5 Firs Avenue Muswell Hill N10 3LY	Samples received on:	06/10/2025
Your job number:	25 40704	Samples instructed on/ Analysis started on:	06/10/2025
Your order number:	16837	Analysis completed by:	13/10/2025
Report Issue Number:	1	Report issued on:	13/10/2025
Samples Analysed:	7 soil samples		

Joanna Biolik

Signed:

Joanna Biolik
Senior Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting
air	- once the analysis is complete

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Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 25-053811

Project / Site name: 5 Firs Avenue Muswell Hill N10 3LY

Your Order No: 16837

Lab Sample Number				705818	705819	705820	705821	705822
Sample Reference				BH1	BH1	BH1	BH1	BH2
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A	N/A
Depth (m)				2.00	4.00	7.00	10.00	2.50
Date Sampled				18/09/2025	18/09/2025	18/09/2025	18/09/2025	18/09/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	6.9	13	13	16	9.7
Total mass of sample received	kg	0.1	NONE	1.7	1.6	1.4	1.7	1.7

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	8	7.5	7.8	7.9	7.7
Total Sulphate as SO ₄	%	0.005	MCERTS	0.062	0.819	0.285	0.184	0.982
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	410	4800	3100	1600	4700
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	205	2410	1560	778	2360
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	160	21	55	59 ^{ss}	3600
Total Sulphur	mg/kg	50	MCERTS	240	2900	5700	6700	2900
Total Sulphur	%	0.005	MCERTS	0.024	0.286	0.565	0.672	0.29
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	2	NONE	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Water Soluble Nitrate (2:1) as NO ₃ (leachate equivalent)	mg/l	5	NONE	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

Heavy Metals / Metalloids

Magnesium (water soluble)	mg/kg	5	NONE	24	370	270	170	270
Magnesium (leachate equivalent)	mg/l	2.5	NONE	12	180	130	87	140

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 25-053811

Project / Site name: 5 Firs Avenue Muswell Hill N10 3LY

Your Order No: 16837

Lab Sample Number				705823	705824
Sample Reference				BH2	BH2
Sample Number				None Supplied	None Supplied
Water Matrix				N/A	N/A
Depth (m)				6.00	9.00
Date Sampled				18/09/2025	18/09/2025
Time Taken				None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	14	16
Total mass of sample received	kg	0.1	NONE	1.4	1.5

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	7.8	7.7
Total Sulphate as SO ₄	%	0.005	MCERTS	0.329	0.226
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	3800	2200
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	1910	1080
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	57	85
Total Sulphur	mg/kg	50	MCERTS	5000	8400
Total Sulphur	%	0.005	MCERTS	0.497	0.839
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	2	NONE	< 2.0	< 2.0
Water Soluble Nitrate (2:1) as NO ₃ (leachate equivalent)	mg/l	5	NONE	< 5.0	< 5.0

Heavy Metals / Metalloids

Magnesium (water soluble)	mg/kg	5	NONE	330	230
Magnesium (leachate equivalent)	mg/l	2.5	NONE	170	110

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 25-053811

Project / Site name: 5 Firs Avenue Muswell Hill N10 3LY

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
705818	BH1	None Supplied	2	Brown clay
705819	BH1	None Supplied	4	Brown clay
705820	BH1	None Supplied	7	Brown clay
705821	BH1	None Supplied	10	Brown clay
705822	BH2	None Supplied	2.5	Brown clay
705823	BH2	None Supplied	6	Brown clay
705824	BH2	None Supplied	9	Brown clay

Analytical Report Number : 25-053811

Project / Site name: 5 Firs Avenue Muswell Hill N10 3LY

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES	In-house method based on TRL 447	L038B	D	NONE
Total sulphate (as SO ₄ in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES	In-house method	L038B	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Sulphate, water soluble, in soil (16hr extraction)	In-house method	L038B	D	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES	In-house method	L038B	D	MCERTS
Water Soluble Nitrate (leachate equivalent)	Determination of nitrate by reaction with sodium salicylate and colorimetry	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction	L078-PL	W	NONE
Nitrate, water soluble, in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction	L078-PL	W	NONE
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser	In-house method	L082B	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099-PL	D	MCERTS
Soil Descriptions	Textural classification	In-house method	L019B	W	NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Quality control parameter failure associated with individual result applies to calculated sum of individuals.

The result for sum should be interpreted with caution

\$\$- Result was reported from high dilution. The result should be interpreted with caution.

Analytical Report Number : 25-053811

Project / Site name: 5 Firs Avenue Muswell Hill N10 3LY

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis. Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container/Insufficient material provided c - Holding time d - Headspace e - Temperature

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
BH1	N/A	S	705818	c	Chloride, water soluble, in soil	L082B	c
BH1	N/A	S	705818	c	pH in soil (automated)	L099-PL	c
BH1	N/A	S	705819	c	Chloride, water soluble, in soil	L082B	c
BH1	N/A	S	705819	c	pH in soil (automated)	L099-PL	c
BH1	N/A	S	705820	c	Chloride, water soluble, in soil	L082B	c
BH1	N/A	S	705820	c	pH in soil (automated)	L099-PL	c
BH1	N/A	S	705821	c	Chloride, water soluble, in soil	L082B	c
BH1	N/A	S	705821	c	pH in soil (automated)	L099-PL	c
BH2	N/A	S	705822	c	Chloride, water soluble, in soil	L082B	c
BH2	N/A	S	705822	c	pH in soil (automated)	L099-PL	c
BH2	N/A	S	705823	c	Chloride, water soluble, in soil	L082B	c
BH2	N/A	S	705823	c	pH in soil (automated)	L099-PL	c
BH2	N/A	S	705824	c	Chloride, water soluble, in soil	L082B	c
BH2	N/A	S	705824	c	pH in soil (automated)	L099-PL	c



10.0 APPENDIX B – GROUND MOVEMENT ASSESSMENT

5 Firs Avenue, Muswell Hill

Ground Movement Assessment

Curtins Ref: 088490-CUR-XX-XX-T-GE-00001

Revision: P03

Issue Date: 12th March 2026

Client Name: Site Analytical Services

Client Address: Units 14 + 15, River Road Business Park, 33 River Road, Barking, Essex, IG11 0EA

Site Address: 5 Firs Avenue, Muswell Hill, London N10 3LY

Control Sheet

Rev	Description	Checked	Issued	Date
P01	First issue	AS	TK	31/10/2025
P02	Second issue accounting for changes in elevation, proposed loadings & basement layout.	AS	TK	09/01/2026
P03	Third issue accounting for changes in elevation, proposed loadings & basement layout.	AS	TK	12/03/2026

This report has been prepared for the sole benefit, use, and information for the client. The liability of Curtins Consulting Limited with respect to the information contained in the report will not extend to any third party.

Author	Signature	Date
Trevelyan Khor BSc (Hons) ACSM FGS Graduate Geotechnical Engineer		12/03/2026

Reviewed	Signature	Date
Andy Smith BSc (Hons) CGeol FGS EurGeol MCIWEM RoGEP Associate		12/03/2026

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Appendices

Appendix A Proposed Drawings

Appendix B Existing Drawings

Appendix C SAS Factual Report

Appendix D Structural Loadings

1.0 Introduction

1.1 Brief

Curtin have been appointed by Site Analytical Services (SAS) to complete a Ground Movement Assessment (GMA) in connection with a proposed residential basement development at 5 Firs Avenue, Muswell Hill, London N10 3LY which falls within the jurisdiction of Haringey Council.

The location of the site is detailed on **Figure 1.1** below. The purpose of this assessment is to determine what effects the permanent construction of the proposed basement may have on permanent structures adjacent to the property.

A site-specific ground investigation was carried out at the site by SAS in September 2025. Ground investigation data is summarised in the SAS Ground Investigation Factual Report Ref- 25/40704-1, dated October 2025. The ground investigation was designed and carried out by SAS and therefore Curtins cannot be held responsible for any inaccuracy in the factual data provided. Data from the SAS ground investigation has been used in the derivation of parameters utilised in this assessment.



Figure 1.1: Site Location (Site boundary in red) (Google Maps Imagery, 2025)

1.2 Development Proposals

Based on current development proposals (contained in **Appendix A**), the proposed development comprises the construction of new basement below the existing property adjacent to the existing lower ground floor level. Current plans (at time of writing this report) indicate the base of the new basement floor slab to be located at 2.422m bgl (100.578m AOD), this includes the reduction of levels by 3.122m (also 100.578m AOD) below the existing ground floor level. New plans also dictate the existing utility and bathroom area of the lower ground floor is to be reduced in level to 2.078m bgl (100.578m AOD), this includes reducing current levels by 1.088m.

It is understood that prior to construction of the basement, the existing masonry walls present above existing ground level will be underpinned with reinforced concrete (RC) walls down to the proposed basement foundation level and supported on mass concrete footings. The ground floor slab of the proposed basement is to include reinforced concrete edge thickenings across the perimeter of the new excavation.

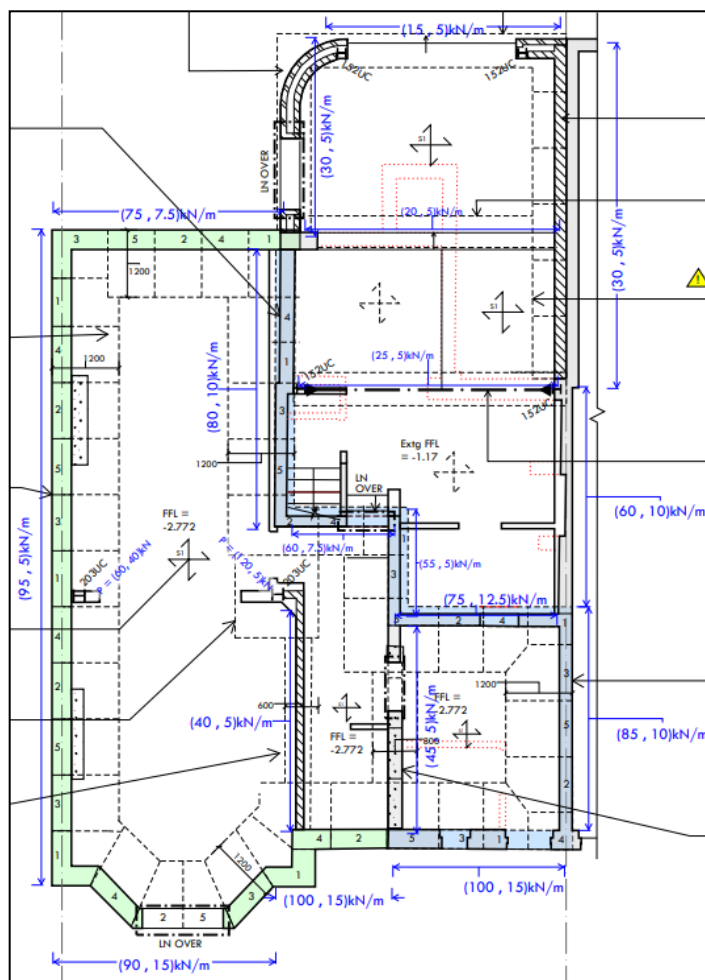


Figure 1.2: Proposed Lower Ground Floor Plan for 5 Firs Avenue extracted from 'Structural Design Studio', Loadings for GMA, SDS mark-up, ref: 225267, S090, P3 dated 03/03/2026.

1.3 Limitations

The conclusions and recommendations made in this report are made on the basis of the site-specific ground investigation undertaken by Site Analytical Services (SAS) in September 2025 and Serviceability Limit State (SLS) line and point loads of proposed basement provided by 'Structural Design Studio'. Ground investigation data is summarised in the SAS Ground Investigation Factual Report Ref- 25/40704-1, dated October 2025. The ground investigation was designed by Site Analytical Services (SAS), and the results of the work should be viewed in the context of the range of data sources consulted and the information provided along with the number of locations where the ground was sampled. No liability can be accepted for inaccuracies in the factual data, information in other data sources or conditions not revealed by the sampling or testing.

The effect of the proposed construction on existing subterranean assets (including services and tunnels), roads and any hydrological/dewatering assessments required are outside the scope of this report. It should be noted that the movements described in this report are indicative only for the purposes of providing pre-planning guidance with regards to the development and should not be relied upon for detailed design. It is anticipated the actual movement observed on site will be heavily affected by the level of workmanship and therefore should be reviewed at detailed design following discussions with the structural engineer and appointed contractor.

Levels used in this ground movement assessment have been based off proposed sections/plan view drawings provided by SAS.

2.0 Site Setting

2.1 Site Description

The site is located at 5 Firs Avenue, Muswell Hill, London N10 3LY and falls within the catchment authority of Haringey Council. The site is approximately 2.5km west from Horney Train Station and 1.2km east from East Finchley Underground Station.

The building is currently a three-storey residential terraced house with an existing partial lower ground floor. The site shares two party walls with adjacent properties (3 and 7 Firs Avenue). Extracts from EIIII architectural drawings (ELL-080-A-XX-XXX) show the proposed layout of the site (site section including current ground level) and proposed basement extension on **Figure 2.1 and 2.2** below.

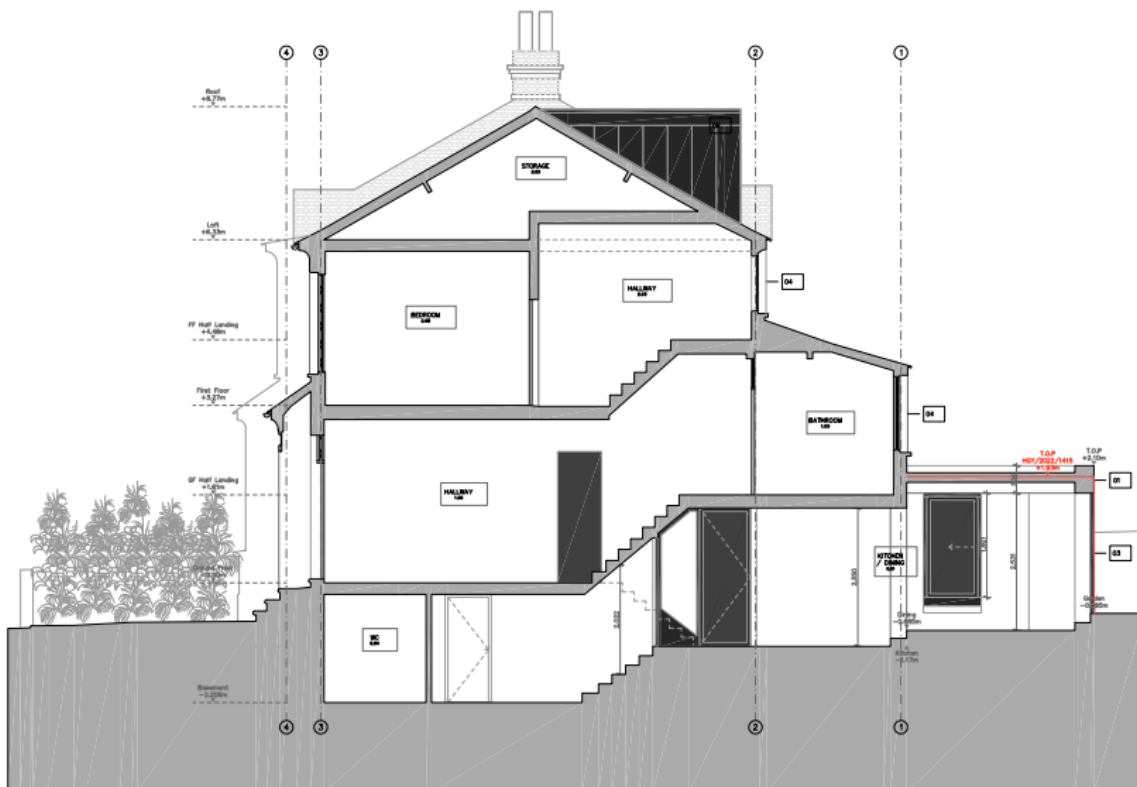


Figure 2.1 Proposed Basement Section view for 5 Firs Avenue extracted from EIIII Architects drawings Proposed Section AA ELL-080-A-XX-XXX

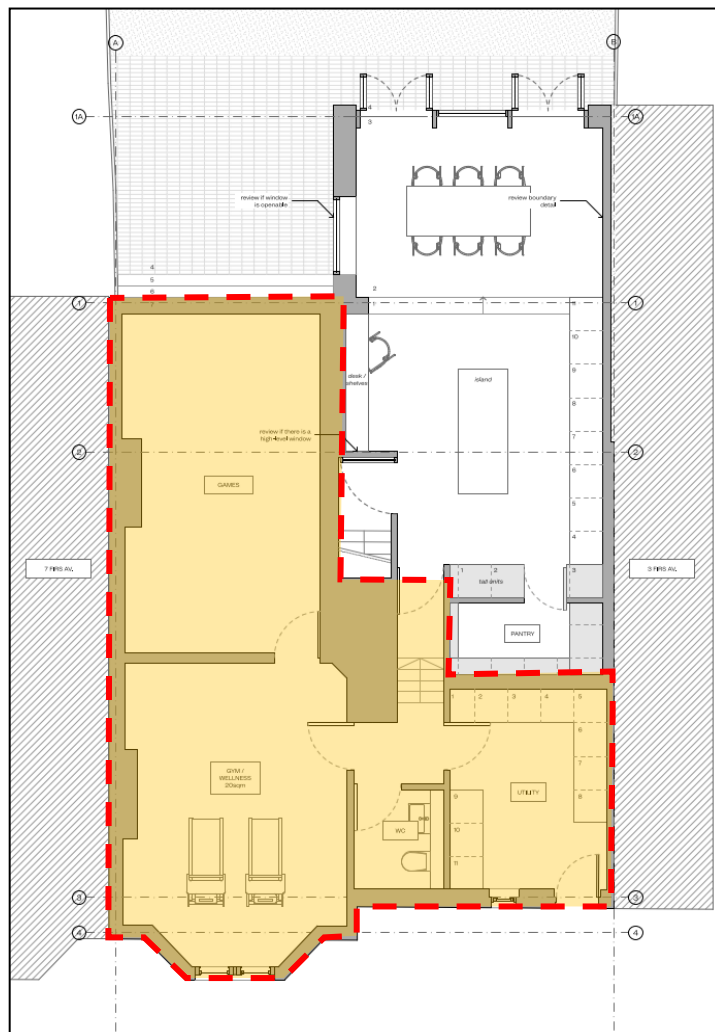


Figure 2.2 Proposed Basement Plan for 5 Firs Avenue extracted from EIEI Architects Drawings
Proposed Plan ELL-080-A-06-100. Basement works footprint outlined in red.

The existing ground level of the site in the area has been Google Earth data where street level is taken as 103.0m AOD. Ground Floor level is taken as 103.7m AOD.

Specific details of the buildings located in close proximity to the property which have been considered in the analysis are summarised in **Table 2.1** below.

Table 2.1: A summary of the neighbouring properties in close proximity to 5 Firs Avenue.

Building Name	Description	Approximate Height (from ground level to roof)	Distance from Proposed Basement
3 Firs Avenue	3 storey (including existing lower ground floor) red brick residential building	9.1m	Shares party wall
7 Firs Avenue	3-storey red brick residential building (including existing lower ground floor) red brick residential building	9.0m	Shares party wall

2.2 **Geology**

The British Geological Survey (BGS) 1:50,000 map of North London (Sheet 256) records the site to have been underlain by superficial deposits of the Lowestoft Formation (Quaternary Till) and Dollis Hill Gravel. There are also Head Deposits recorded close to the site (which would lie above these soils) as detailed by **Figure 2.3** below. The bedrock deposits of the London Clay Formation are situated below these soils.

Upon review, of the BGS GeoIndex online database there are no historical boreholes within 250m of the site.

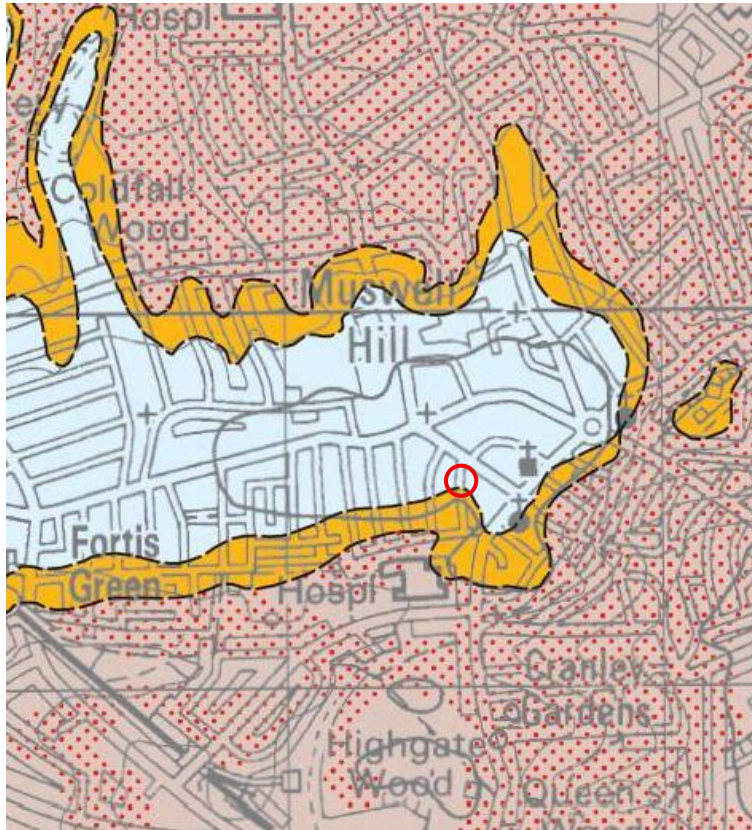


Figure 2.3: Extract from BGS 1:50,000 mapping (North London, Sheet 256, Solid and Drift, 2006) highlighting the superficial deposits in the surrounding area. Red line boundary showing approximate site location.

2.3 Hydrogeology

According to online sources (<https://magic.defra.gov.uk>), the Lowestoft Formation is designated as a Secondary (undifferentiated) Aquifer while the nearby Dollis Hill Gravel is a Secondary 'A' Aquifer. The bedrock comprising the London Clay Formation is designated as an Unproductive Aquifer (negligible significance for water supply or baseflow to rivers, lakes and wetlands). They consist of bedrock or superficial deposits with a low permeability that naturally offer protection to any aquifers that may be present beneath).

The site does not fall within a source protection zone and is located approximately 1500m away (east from site) from a Zone I Inner protection zone.

2.4 Hydrology

The closest water feature to the site is a pond found 450m north-north-east at Muswell Hill Methodist Church.

According to Lost Rivers of London Publication (Barton, 1992), the site is not located within 100m of a former historic river or watercourse with the closest being the New River, part of Hackney Brook, located approx. 2km away.

According to gov.uk, the site is not within a flood zone and at very low risk of surface water flooding (area has a chance of flooding of 0.1% each year) and is at very low risk of flooding from rivers and the sea (less than 0.1% chance of flooding).

3.0 Previous Ground Investigation

3.1 Encountered Ground Conditions

A site-specific Ground Investigation was undertaken by SAS at the site in September 2025 comprising the following:

- The drilling of two continuous flight auger boreholes to a depth of 10.00m below ground level (Boreholes 1 and 2).
- The installation of groundwater monitoring standpipes to an approximate depth of 5.00m in Boreholes 1 and 2, together with a single return monitoring visit.
- The excavation by hand of two trial pits, to 1.50m maximum depth to expose existing foundations on-site (Trial Pits 1 and 2).
- Sampling and in-situ testing as appropriate to the ground conditions encountered in the exploratory holes.
- Laboratory testing to determine the engineering properties of the soils encountered in the exploratory holes.

The exploratory hole logs including an exploratory hole location plan are contained in the SAS Ground Investigation Factual Report Ref- 25/40704-1, dated October 2025 in **Appendix C**, the ground conditions encountered are summarised in **Table 3.1** below.

Table 3.1: Summary of Ground Conditions encountered in SAS Ground Investigation September 2025.

Strata	Depth to top, m bgl (m AOD)	Thickness (m)	Description
Made Ground	0.00 (103)	0.9	0.27m of topsoil followed by 0.6m of medium brown silty clayey sand containing chalk and brick fragments.
Lowestoft Formation	0.49 to 0.90 (102.51 to 102.1)	1.9	Stiff medium brown, orange silty (slightly gravelly) clay with occasional chalk nodules
Weathered London Clay Formation	2.30 to 2.80 (100.7 to 100.2)	1.5 to 2.0	Stiff medium brown silty clay containing bands of fine sands.
London Clay Formation	4.30 (98.7)	Base of unit not confirmed	Stiff dark brown, grey silty clay

Boreholes are recording as collapsing to 4m indicating non-self-supporting soils to this depth.

3.2 Groundwater

Throughout the ground investigation, groundwater was not encountered in any of the intrusive GI works. During groundwater monitoring (21/10/2025) water was recorded at 3.08 and 2.25m bgl (99.92 and 100.95 m AOD respectively). These findings indicate groundwater may fluctuate in level close to that of the proposed basement excavation. Groundwater may be weather dependant and may be transported through the shallow, permeable made ground and gravelly Lowestoft Formation. Consideration as to the impact of groundwater must be had with good construction practices followed to mitigate risk/impact by the appointed contractor.

3.3 In Situ and Laboratory Testing

A summary of laboratory and in-situ test results undertaken within the geological strata encountered during the SAS and ground investigation is presented below. Further detailed results are available in the SAS Factual Report (**Appendix C**). The following results will all be interpreted in **Section 4.3**

3.3.1 Hand Shear Vane

28 No. Hand Vane tests were carried out in the Lowestoft Formation and London Clay Formation in BH1 and BH2 at depths from 1m to 10m bgl (-1.6 to -10.7m AOD). These results are discussed in Section 4.3.

4.0 Ground Movement Assessment

4.1 Introduction

In connection with the proposed basement construction, a ground movement and damage assessment has been undertaken at the site. The purpose of this assessment is to determine the effects of the proposed basement excavation upon neighbouring structures.

It is understood that the proposed basement will be constructed within the use of underpins as described in Structural Design Studio (SDS) Proposed Lower Ground Floor Plan, Drawing No. 225267 S090 P3, dated 3rd March 2026.

The soil behaviour over the footprint of the excavated area is different from the behaviour outside and the associated ground movements require assessment using different approaches.

In the area of the new basement excavations, the soil will tend to move as a result of change in vertical load on the ground due to both excavation and demolition. Movements in the long term would also be expected due to changes in the pore pressure in the clay layer/cohesive band under the basement area.

Around the site the construction activities that may result in ground movements during and after the works are mainly related to the excavation, which would induce a reduction of vertical and lateral stresses in the ground along the excavation boundaries.

The magnitude and distribution of ground movements inside and outside the excavated area are a function of changes of load in the ground and also, critically, are a function of workmanship.

Ground movements within the area of the proposed excavation have been estimated using Geotechnical Software (PDISP by OASYS) whilst the expected movements and impact assessment of the area around the site and surrounding structures have been estimated using Geotechnical Software (XDISP by OASYS). The latter software relies on CIRIA report C580 Embedded Retaining Walls - Guidance for Economic Design (3) (superseded by C760, 2017 (4)) which is based on field measurements of movements from a number of basement constructions across London.

The calculations provided are specific to the proposed development and the advice herein should be reviewed if the development proposals are amended.

4.2 Adjacent Properties

The properties or structures more likely to be affected by ground movements associated with the proposed basement construction, are shown in **Figure 4.1** below and include:

- No. 3 Firs Avenue (shares a party wall with No. 5 Firs Avenue)
- No. 7 Firs Avenue (shares a party wall with No. 5 Firs Avenue)

All walls under analysis are also illustrated in **Figure 4.1** below

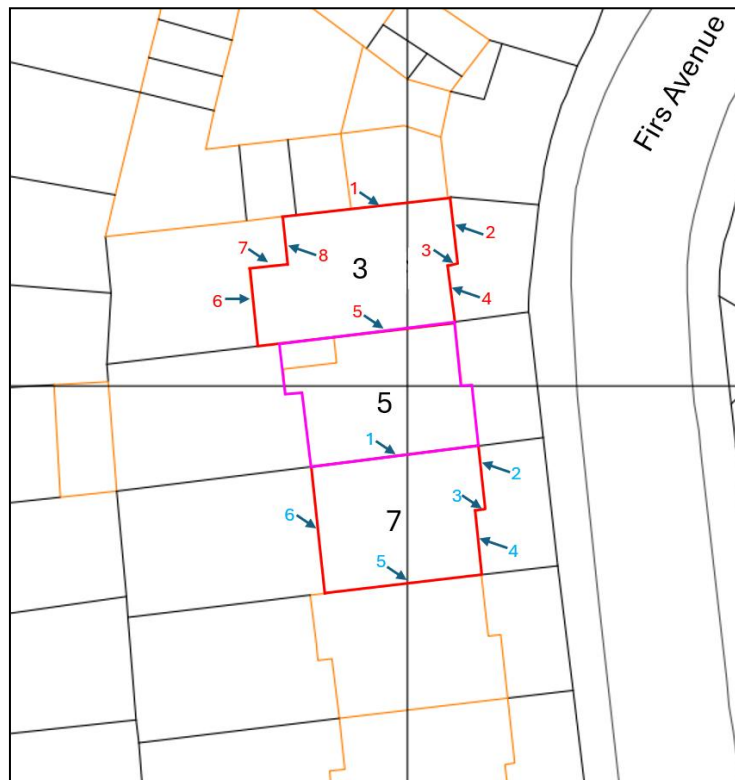


Figure 4.1: Plan view of 5 Firs Avenue with proposed basement overlay (pink). Red highlighted walls have been analysed within 'Oasys XDISP' software.

4.3 Ground Model

The ground model utilised for this assessment has been based on the SAS Ground Investigation Factual Report Ref- 25/40704-1, dated October 2025. It should be noted that Curtins can take no liability for inaccuracies in the factual data from the site-specific site investigation.

The ground conditions adopted within the model and analysis are taken as worst case, in accordance with the ground conditions from boreholes BH1 and BH2 and comprise of:

- Made Ground from 0.00 to 0.90 m bgl (103 to 102.1m AOD)- 0.9m thickness
- Lowestoft Formation from 0.90 to 2.80m bgl (102.1 to 100.2m AOD)- 1.9m thickness
- Weathered London Clay Formation from 2.80 to 4.30m bgl (100.2 to 98.7m AOD)
- London Clay Formation from 4.30m bgl (98.7m AOD). Stratum thickness is not confirmed but is assumed to be >5m below the base of the proposed basement level from geological information in the wider area.

Ground floor level has been taken as 103.7m AOD based on EIEII Architectural Drawings and Google Earth data with an existing lower ground floor level of 102.53m AOD and Existing Basement level of 101.5m AOD used for the model.

During groundwater monitoring (21/10/2025) water was recorded at 3.08 and 2.25m bgl (99.92 and 100.95 m AOD respectively). These findings indicate groundwater may fluctuate in level close to that of the proposed basement excavation. Groundwater may be weather dependant and may be transported through the shallow, permeable made ground and gravelly Lowestoft Formation. Consideration as to the impact of groundwater must be had with good construction practices followed to mitigate risk/impact by the appointed contractor.

Figure 4.2 shows the results of Hand Shear tests taken in BH1 and BH2. 28 No. Hand Vane tests were carried out in the Lowestoft Formation and London Clay Formation in BH1 and BH2 at depths from 1m to 10m bgl (102 to 93m AOD).

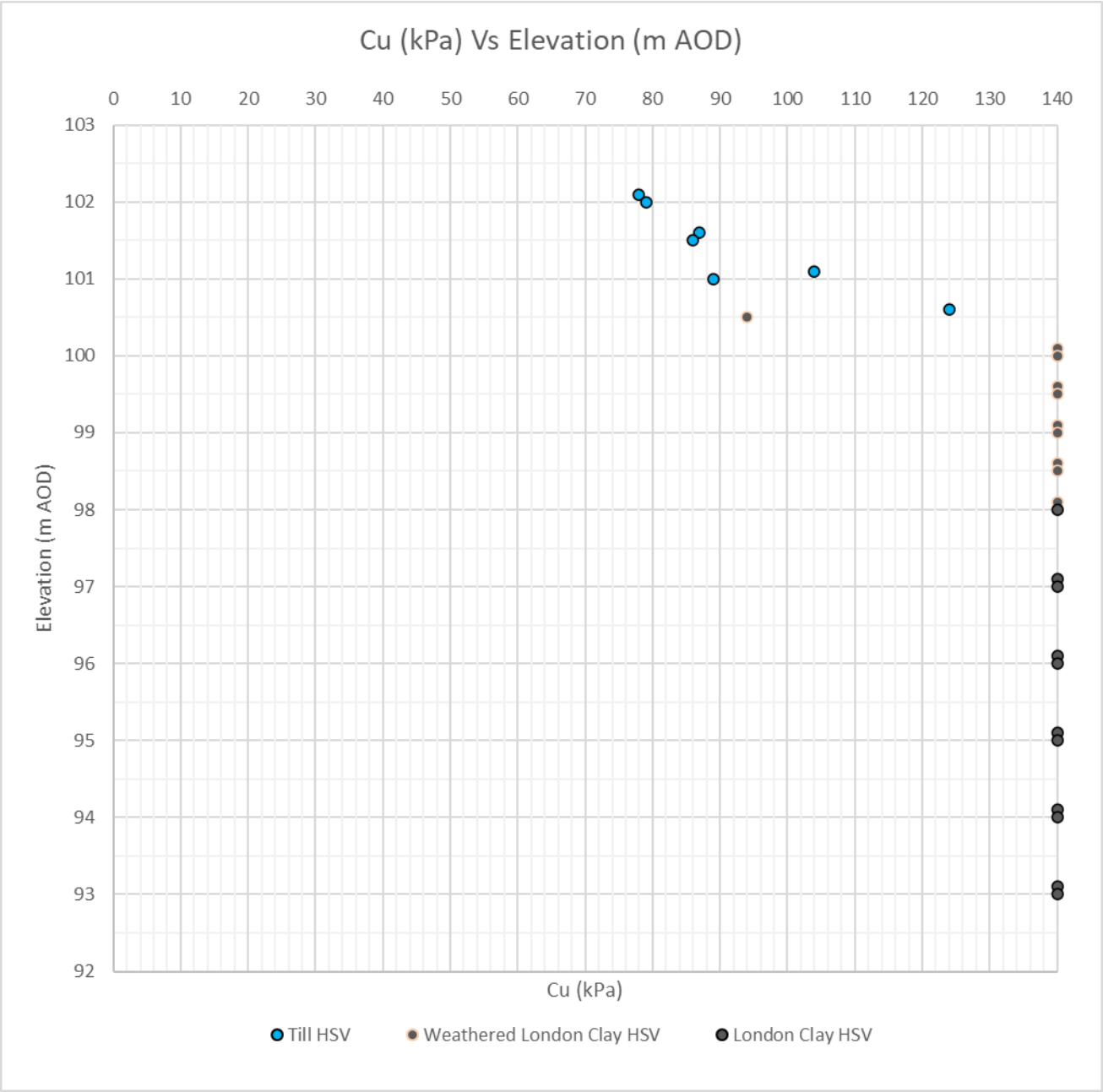


Figure 4.2: Shear Strength (kPa) Vs Elevation (m AOD)

Made Ground

The Made Ground encountered during SAS ground investigation was described as medium brown silty clayey sand containing chalk and brick fragments with topsoil encountered in the top 0.27m of BH1.

A bulk unit weight of 16kN/m³ is considered appropriate for design based on guidance from BS8004 (2015). A Poisson's Ratio of 0.2 is suitable for made ground.

Lowestoft Formation (Quaternary Till)

The Lowestoft Formation Deposits were described as stiff medium brown, orange silty (slightly gravelly) clay with occasional chalk nodules.

Hand shear vane (HSV) results taken in the Lowestoft Formation deposits are shown in **Figure 4.2**. These HSV values show a consistent increase of shear strength with depth from 78 to 124kPa. This material is inferred to be of high strength in line with guidance from BS5930 (2015+2020).

In accordance with guidance from BS8004 (2015) a suggested characteristic weight density of 20kN/m³ can be assigned to high strength clay soils.

The ratio of end of construction (undrained) settlement to total settlement (fully drained) was taken as 60% as specified in ICE manual of geotechnical engineering (2012), Volume II, chapter 53.6 (Page 783) (7). Therefore:

$$E' = 200 \times C_u \text{ (kN/m}^2\text{)} \quad \textbf{Equation 1}$$

Therefore, for Drained Young's Modulus, using **Equation 1**, this gives a range of 15.6 to 24.8MPa.

A Poisson's ratio of 0.3 is typical for cohesive soils in the long term and has been chosen for the Lowestoft Formation deposits, based on guidance from Tomlinson, 2001.

Weathered London Clay Formation

The Weathered London Clay was encountered during SAS ground investigation within BH1 and BH2, hand shear vanes (21 tests in total) were completed on the material to gauge shear strength.

Undrained shear strength values are displayed in **Figure 4.2**. A single result detailed 94kPa at 2.50m in BH2 in the weathered London Clay whilst all other tests recorded undrained shear strengths >140kPa which is the limit of the equipment. These results are all representative of high strength material in accordance with BS5930:2015+2020.

The ratio of end of construction (undrained) settlement to total settlement (fully drained) was taken as 60% as specified in ICE manual of geotechnical engineering (2012), Volume II, chapter 53.6 (Page 783) (7). Therefore:

$$E' = 200 \times C_u \text{ (kN/m}^2\text{)} \quad \textbf{Equation 1}$$

For Drained Young's Modulus, using **Equation 1**, we have used 18.8MPa for the Weathered London Clay.

A Poisson's ratio of 0.3 is typical for soils in the long term and has been chosen for the London Clay, based on guidance from Tomlinson, 2001. Unit weights of 20 kN/m³ are considered appropriate for the Weathered London Clay based on guidance from BS8004:2015+A1:2020 (5).

London Clay Formation

The London Clay was encountered during SAS ground investigation within BH1 and BH2, hand shear vanes (21 tests in total) were completed on the material to gauge shear strength.

Undrained shear strength values are displayed in **Figure 4.2**. Hand Shear Vane Tests recorded undrained shear strengths >140kPa which is the limit of the equipment. These results are representative of high strength material in accordance with BS5930:2015+2020.

The ratio of end of construction (undrained) settlement to total settlement (fully drained) was taken as 60% as specified in ICE manual of geotechnical engineering (2012), Volume II, chapter 53.6 (Page 783) (7). Therefore:

$$E' = 200 \times C_u \text{ (kN/m}^2\text{)}$$

Equation 1

For Drained Young’s Modulus, using **Equation 1**, we have calculated 28MPa for the competent London Clay.

A Poisson’s ratio of 0.3 is typical for soils in the long term and has been chosen for the London Clay, based on guidance from Tomlinson, 2001. Unit weights of 21 kN/m³ are considered appropriate for the Weathered London Clay and London Clay based on guidance from BS8004:2015+A1:2020 (5).

Ground Model Summary

The base of the model has been taken as 93m AOD based on the test undertaken at 10m bgl (93m AOD) according to SAS exploratory borehole logs for BH1.

The design parameters adopted for this analysis are summarised in **Table 4.1** below.

Table 4.1: Summary of Design Parameters for 5 Firs Avenue.

Strata	Depth to Top (m bgl)	Unit Weight (kN/m3)	Undrained Shear Strength (kPa)	Long Term (Drained)	
				E' (MPa)	Poisson's Ratio
Made Ground	0.00	16	-	-	0.2
Lowestoft Formation	0.90	20	78-90	15.6-18	0.3
Weathered London Clay	2.8	20	94	18.8	0.3
London Clay Formation	4.3	21	140	28	0.3

4.4 Construction and Load Cases

With reference to the following proposed drawings presented within **Appendix A**, the construction sequence is expected to take the following form:

1. Design of Temporary Works:

- All temporary works should be designed by an appropriately qualified structural engineer. It is likely that the designs may require checking by a party wall surveyor on the neighbouring properties. The chosen contractor should have a plan in place to deal with groundwater inflows.

2. Underpin the perimeter in a hit and miss sequence to be agreed with the Contractor.

3. Temporary propping to be provided to all underpins

4. Reloading:

- Construction of foundation slab to proposed basement
- Construct new ground floor slab to provide permanent support to underpinnings and basement wall as required.
- Removal of any temporary props once permanent supports are in place.

Structural loading at foundation level for use in the ground movement analysis has been calculated by the structural engineer as shown in **Appendix C**. This assessment is specific to the construction sequence and load case described above. If any changes are made to the proposed development, then this assessment should be revised and updated accordingly.

4.5 Ground Movement Inside the Proposed Basement

The stress conditions and resultant settlement/heave have been assessed using the Boussinesq's method and geotechnical software PDISP by Oasys. PDISP calculates vertical movements due to a uniformly distributed load applied to a specified plane of geometry within a 3-D space. The Boussinesq analysis method is used in this analysis.

The following assumptions have been made within the PDISP analysis:

- Assumes Boussinesq stress distributions.
- Uniform pressure loading.
- The proposed basement will be founded within soils at approximately 100.578m AOD (approximately 2.422m below ground level). This includes an assumed 350mm thick floor slab.

No allowance is made for the stiffness of the structures (foundation slab).

Structural loading at foundation level and calculations for use in the ground movement analysis have been provided by the structural engineer (**Appendix D**).

The vertical boundary of the model was fixed 10m bgl (93m AOD) due to the in-situ test undertaken the base of the borehole and to incorporate the London Clay Formation. At this depth, the effective vertical stress due to foundation unloading decreases to in excess of 20% of the effective overburden as required in EC7.

The results of PDISP analysis are based on an unrestrained excavation as the model is unable to take account of the mitigating effect of temporary works bounding the excavation, which in reality will combine to restrict these movements within the basement excavation. The movements predicted at or just beyond the site boundaries are unlikely to be realised and should not therefore have a detrimental impact upon any nearby structures.

Excavation unloading

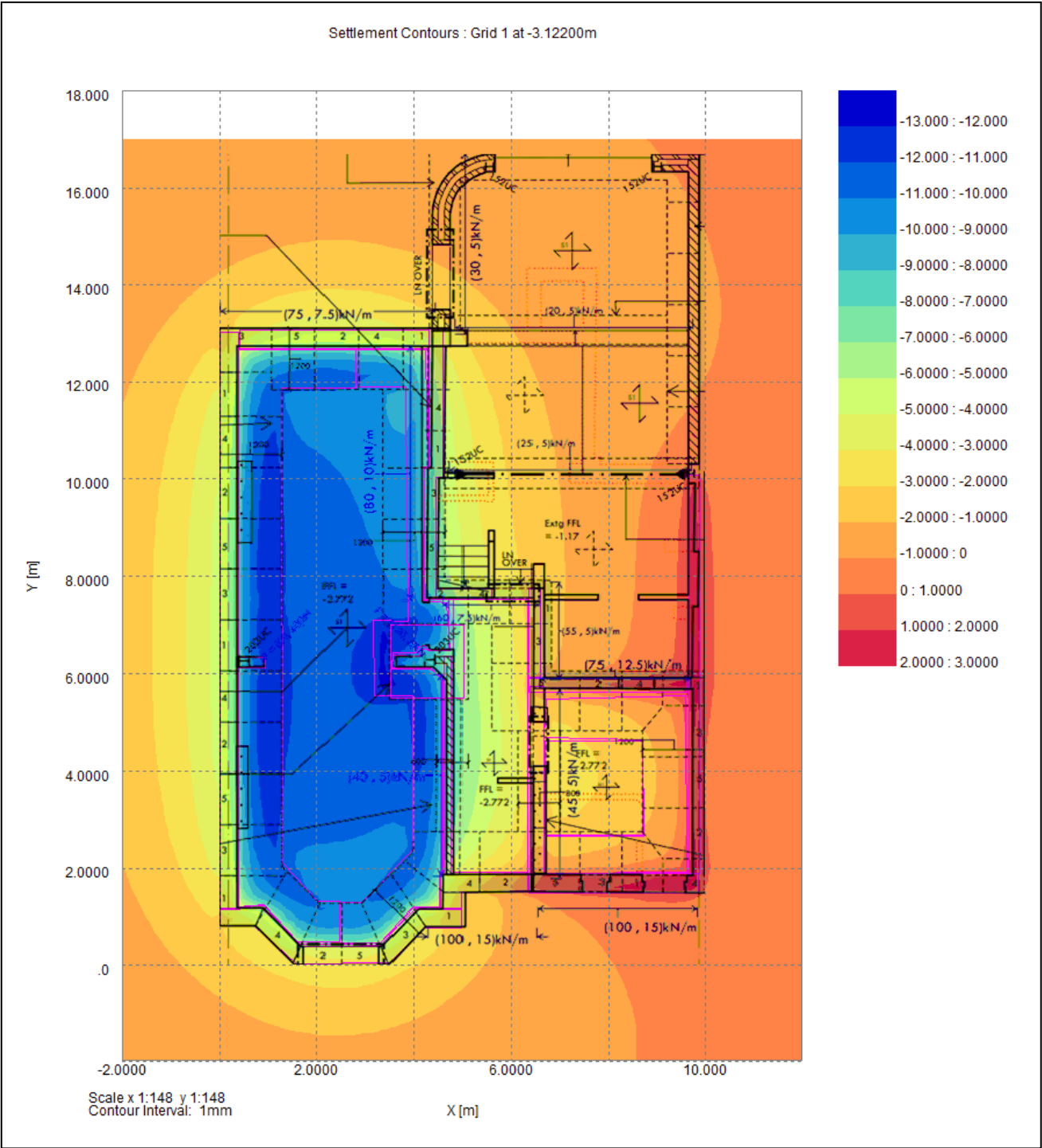
Circa. 3.18m of soil removal is expected across most of the new basement excavation and Approx. 1.2m over the deepened lower ground floor. Undrained removal of the overburden calculated using assumed unit weights shown in the ground model (**Table 4.1**), and the thickness of strata will therefore cause maximum unloading stresses of up to -58.84 kPa to the base of the slab of the new basement excavation and -17.26 kPa to the base of the slab of the deepened lower ground floor.

Loading, long term drained conditions

The results show that in the long-term following construction of the basement and taking account of the unloading pressures detailed above, -13.0mm to +3mm of settlement and is reported. These displacements are summarised in Figure 4.3 below.

PDISP uses individual layer properties to calculate the displacements resulting from applied stresses. The heave values described are considered to be overestimated and therefore conservative. It should be noted, Bowles in his text (Foundation Analysis and Design-Fifth Edition) states that *"In general, where heave is involved, considerable experience and engineering judgment are necessary in estimating probable soil response, for currently there is no reliable theories in for the problem"*.

Final designs for the basement retaining walls, basement slabs and internal load-bearing basement walls and columns should be designed to support the calculated movements. These movements should be driven into account particularly at party walls where additional loadings are proposed. Any proposed drainage system or pipe works within the vicinity should be designed to accommodate the predicted movements.



4.6 Ground Movement Outside the Proposed Basement

Ground movements have been analysed using XDISP by Oasys and a building damage assessment has been undertaken based on the results of the analysis. As detailed in the proposal drawings in **Appendix A**, the basement is to be constructed to a maximum depth of ~2.42m bgl (100.58m AOD).

The basement is to be constructed using a combination of mass concrete and traditional underpinning techniques. A ground bearing basement floor slab is also proposed. It has been assumed for the purposes of this analysis that propping will be included in the temporary and permanent cases over the proposed structure and therefore a high stiffness approach would apply to this situation. The proposed retaining walls are to be propped by the ground floor slab and lower ground floor slab in the permanent case resisting lateral ground loads. Underpins and lining wall is to be designed to support the surcharge from the soil & neighbouring buildings/road.

It is important to note that vertical wall movement related to underpinning is not defined by the CIRIA C580 / C760 data. Instead, the short-term settlement will be controlled by movements occurring during the underpin construction process.

On this basis the XDISP analysis considers both 'excavation in front a high stiffness wall in stiff clay' (CIRIA C760 Fig. 6.15(a)) (1) and 'installation of a secant bored pile wall in stiff clay' (CIRIA C760 Fig. 6.8(a) (1)) to simulate the effects from the underpinning on neighbouring structures. The combined cumulative movements resulting from the wall installation (which includes the underpinning) and basement excavation have been used to carry out an assessment of the likely damage to adjacent properties as a conservative approach. The model also includes modelling of the proposed secant piled wall at the southern and northern ends of the proposed basement.

Where necessary the basement area has been simplified in XDISP to replicate the basement as a whole. In accordance with guidance from Oasys (<https://www.oasys-software.com>) and to avoid re-entrant corners, no movements have been modelled to those sides of the excavations that form attachments within the centre of the proposed basement but cannot be eliminated. For the purposes of the XDISP model any existing lower ground floors and basements beneath adjacent buildings have been ignored in modelling for conservatism.

Building Damage Assessment

The building damage assessment has been carried out on the relevant adjacent structures, as detailed in **Figure 4.4** & **Figure 4.5**. Any existing lower ground floors from adjacent residential structures has been omitted in the assessment, this is considered a conservative approach.

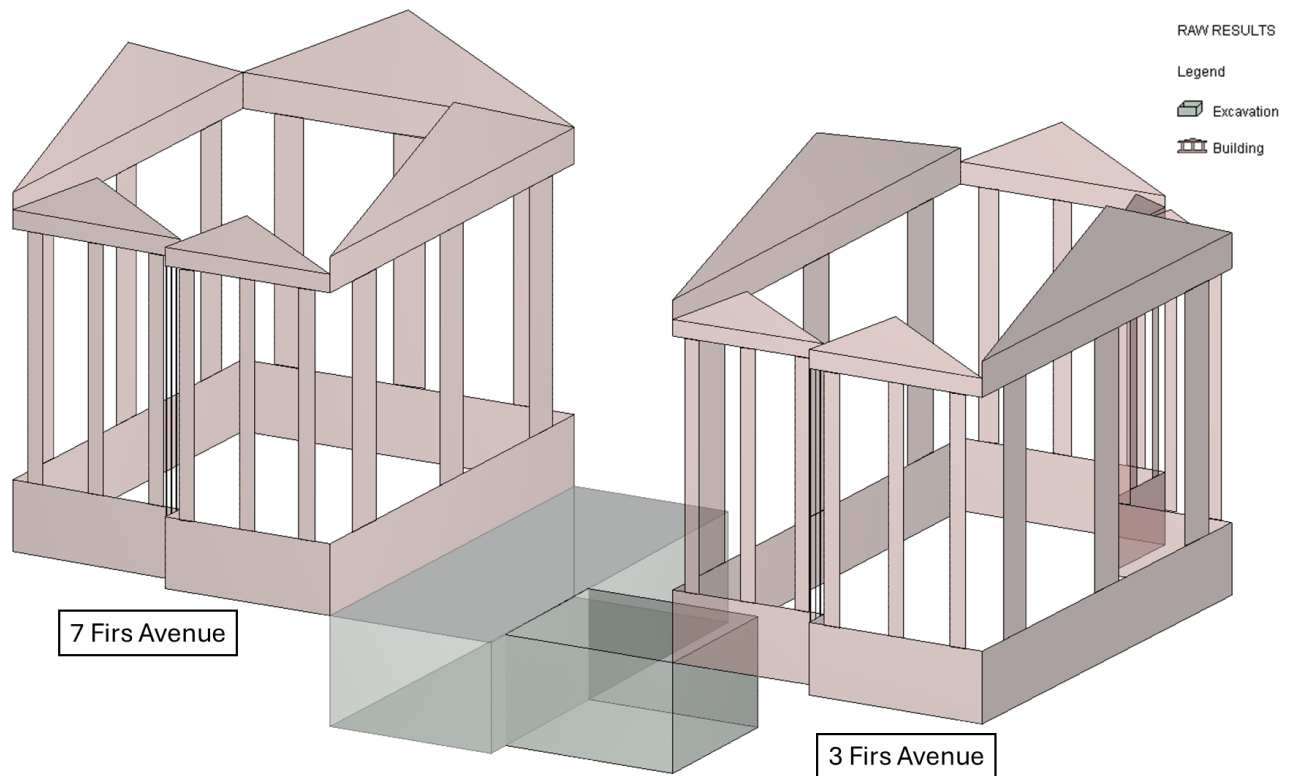


Figure 4.4: 3D view graphic displaying Neighbouring Structures and XDISP Modelling

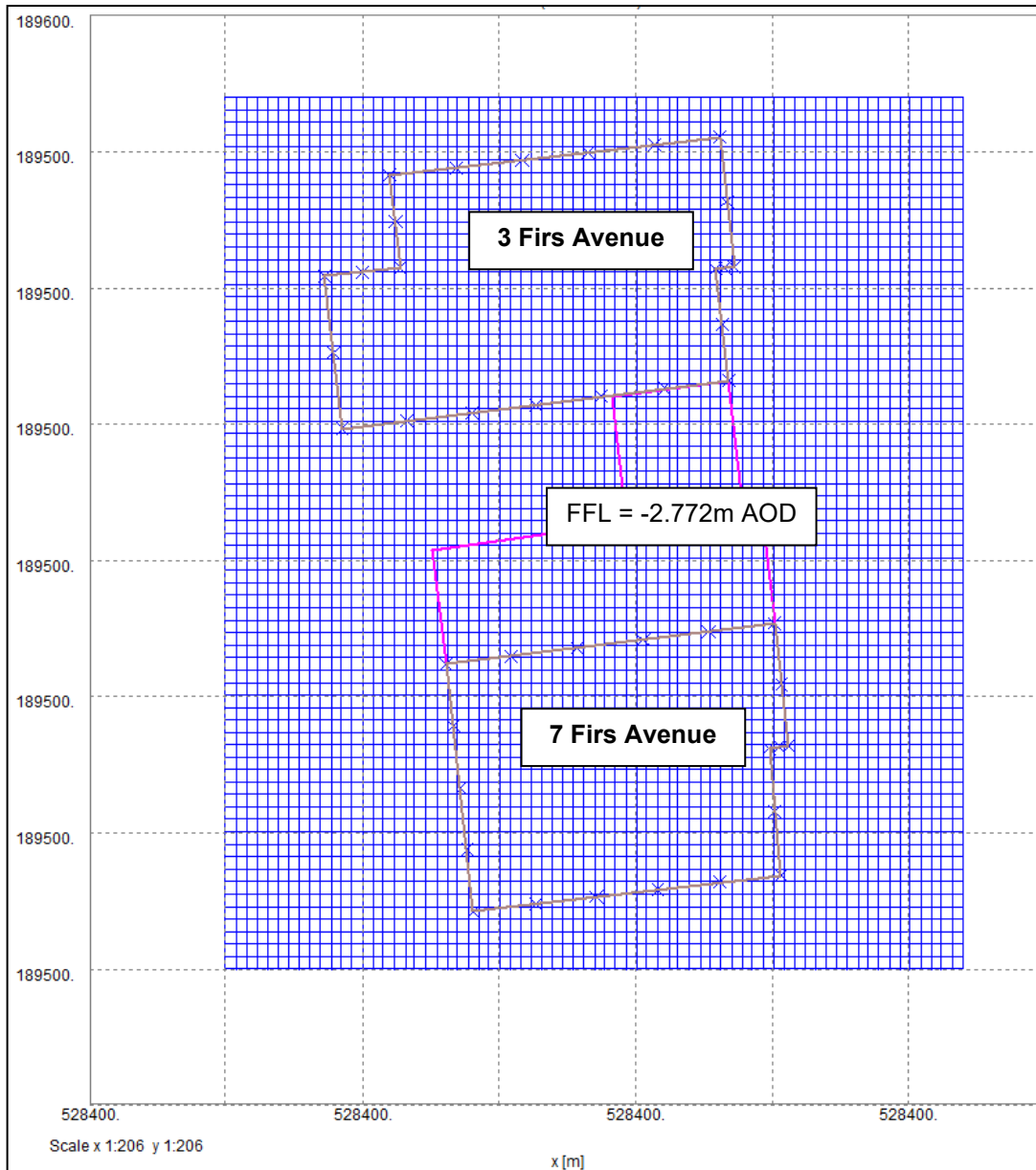


Figure 4.4: Plan view graphics displaying Neighbouring Structures and XDISP Modelling.

Tensile strains induced within the building walls have been evaluated based on the deflection ratios Δ/L and horizontal extension mechanisms estimated from the analyses. The assessment considers the well-established Burland (1977) (2) damage classification method, as presented and summarised in **Figure 4.5** and **4.6** below. This method involves a relatively simple but robust means of assessment, which is widely adopted and is considered to comprise an industry standard/best practice basis for impact assessments of this typology.

Potential damage categories are directly related to the tensile strains induced by the proposed construction stages, arising from a combination of direct tension, and bending induced tensile mechanisms.

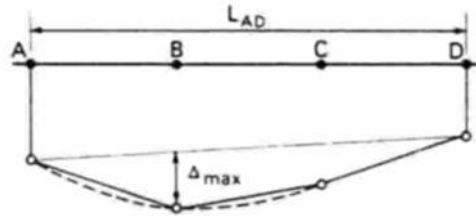


Figure 4.5: 3D Definition of relative deflection Δ and deflection ratio Δ/L

Category of damage	Description of typical damage (ease of repair is underlined)	Approximate crack width (mm)	Limiting tensile strain ϵ_{lim} (per cent)
0 Negligible	Hairline cracks of less than about 0.1 mm are classed as negligible.	< 0.1	0.0–0.05
1 Very slight	<u>Fine cracks that can easily be treated during normal decoration.</u> Perhaps isolated slight fracture in building. Cracks in external brickwork visible on inspection.	< 1	0.05–0.075
2 Slight	<u>Cracks easily filled. Redecoration probably required.</u> Several slight fractures showing inside of building. Cracks are visible externally and <u>some repointing may be required externally</u> to ensure weathertightness. Doors and windows may stick slightly.	< 5	0.075–0.15
3 Moderate	<u>The cracks require some opening up and can be patched by a mason. Recurrent cracks can be masked by suitable linings. Repointing of external brickwork and possibly a small amount of brickwork to be replaced.</u> Doors and windows sticking. Service pipes may fracture. Weathertightness often impaired.	5–15 or a number of cracks > 3	0.15–0.3
4 Severe	<u>Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows.</u> Windows and frames distorted, floor sloping noticeably. Walls leaning or bulging noticeably, some loss of bearing in beams. Service pipes disrupted.	15–25 but also depends on number of cracks	> 0.3
5 Very severe	<u>This requires a major repair involving partial or complete rebuilding.</u> Beams lose bearings, walls lean badly and require shoring. Windows broken with distortion. Danger of instability.	usually > 25 but depends on number of cracks.	

Figure 4.6: Building damage classification – relationship between category of damage and limiting strain ϵ_{lim} (After Burland et al. 1977, Boscardin and Cording 1989 and Burland 2001).

Results

A building impact/damage assessment has been undertaken, assuming the existing buildings walls to behave as equivalent beams subject to a combination of bending, shear, and axial extension/compression mechanisms, resulting from greenfield ground movements evaluated.

On the basis of the available information the predicted level of damage to the adjacent and nearby properties arising from the excavation of the basement at 5 Firs Avenue is Cat 0 (negligible), as defined in **Figure 4.6**.

Table 4.2: Results of the XDisp analysis showing Damage Category for each surrounding wall

Building	Wall References (See Fig 4.1)	Maximum Damage Category	
3 Firs Avenue	3-1 to 3-8	0	Negligible
7 Firs Avenue	7-1 to 7-6	0	Negligible

It should be noted that these movements are likely to be more affected by the quality of the workmanship and propping of the basement excavations. The construction details adopted at the junctions with the return walls will also have a significant influence on the likelihood of any future movements at these locations. Extra care should be taken in these sections to provide appropriate support to the existing walls to prevent any excessive deflection. Despite these results it is considered that appropriate consideration to the support and stability of neighbouring walls will be needed in the detailed structural design of the basement.

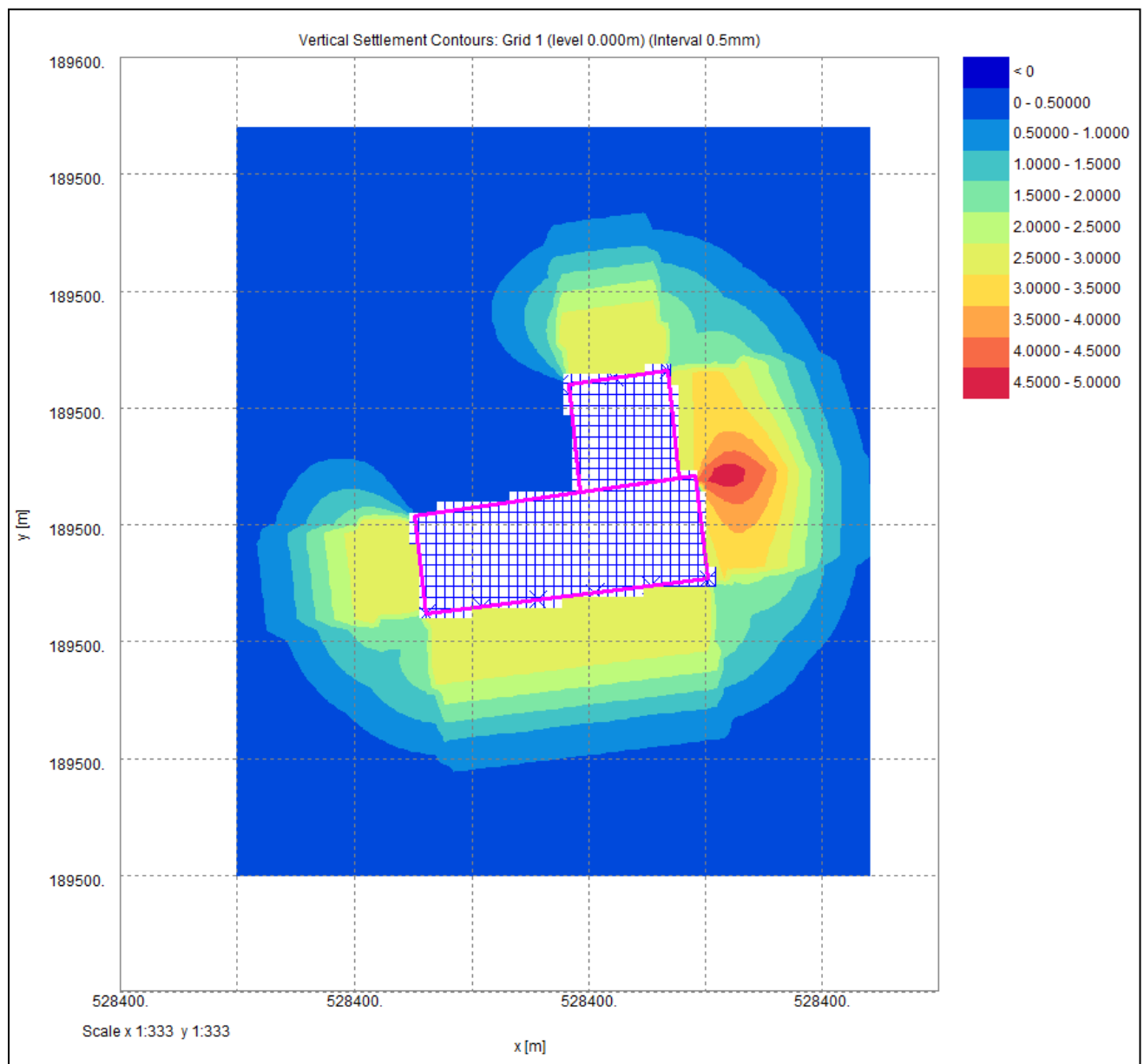


Figure 4.7: Plan view graphic displaying XDISP estimated settlements for external buildings (Pink lines denote excavation contours).

5.0 Conclusions

A ground movement assessment has been carried out for 5 Firs Avenue, London to assist with pre-planning document submissions to Haringey Council.

Providing that appropriate consideration is given to the detailed design of the basement in order to limit future movement, that good workmanship and construction sequences are used with appropriate support during excavations and that groundwater management is employed, then the proposed basement construction is unlikely to cause significant damage to the surrounding structures. Based on the predicted ground movements, the adjacent structures (No. 3 and No. 7 Firs Avenue) are expected to be at CIRIA C760 Damage Category 0 (Negligible).

Groundwater was encountered during monitoring at levels close to that of the proposed basement slab. Groundwater levels are likely to be weather dependant and may be perched in the permeable made ground and shallow, more gravelly strata. If groundwater is encountered during the basement excavations, excavating below the water level at the site could result in construction difficulties during excavations particularly during the underpinning works. Fluctuating groundwater levels within open excavations could result in washout of material fines resulting in instability to excavation faces and potentially resulting in a greater degree of damage than predicted within this assessment.

The contractor should demonstrate adequate control measures to ensure this risk is mitigated. It would be prudent to continue to monitor the existing installed standpipe for as long as possible in order to determine equilibrium level and the extent of any seasonal groundwater variations.

A specification for movement monitoring should be incorporated into the final construction scheme for the proposed development to monitor the adjacent properties and establish the extent of any future potential movement to the building. Any temporary and permanent works should be designed to limit eventual movement.

A geotechnical/structural review of the underpinning method should be undertaken to ascertain the requirements for stability of the walls in the long term with consideration of likely earth pressures and any potential live loading behind the walls.

6.0 References

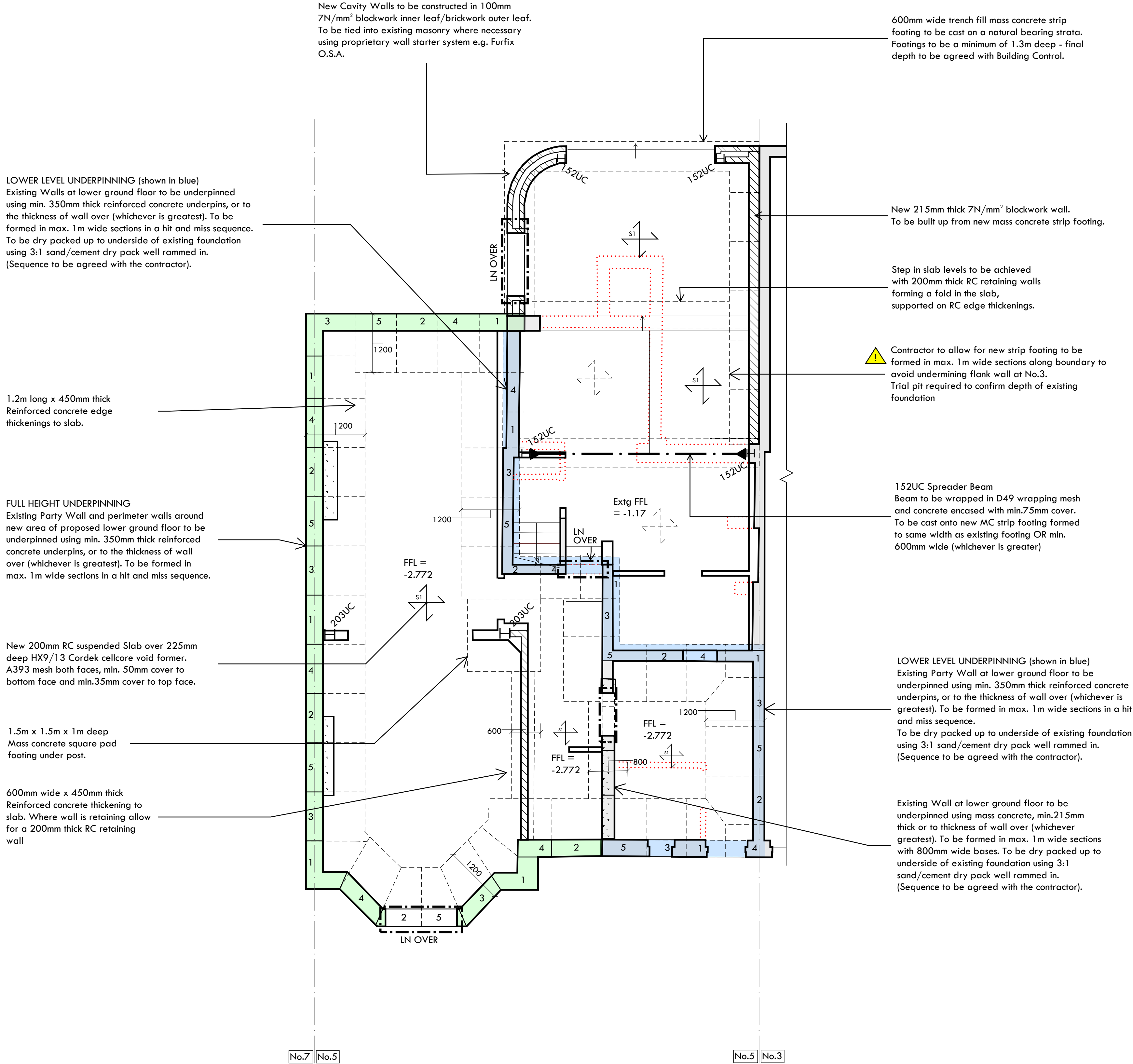
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Appendix

Appendix A Proposed Drawings with Structural Loadings

Key:	
	Structure under
	Structure removed
	New timber rafter/joist span (sizes and spacings as noted on plans)
	Assumed existing joist span direction. SDS to be notified if actual span differs from that shown
DJ/TJ	Double joist / Triple joist - to be bolted together as per SDS specification
	Moment Connection
PS	Mass concrete padstone
LN OVER	New Lintel over opening



All footings to be mass concrete trench fill footings cast onto suitable undisturbed ground and in accordance with Building Control Officers approval on site. Footings to be cast at least 1.3m below ground UNO, and at least as deep as existing foundations, whichever is the deeper. Anticipated Ground Conditions are - LONDON CLAY. SDS Ltd to be informed if found to be otherwise.

- General notes:**
1. Do not scale from this drawing
 2. To be read in conjunction with all other structural drawings and the structural specification
 3. To be read in conjunction with all other relevant disciplines drawings and specifications
 4. All levels, setting out, waterproofing and fireproofing to be confirmed with the Architect
 5. The Contractor is responsible for the temporary stability of the existing and proposed structure throughout the works. The sequencing and method of installation should be carefully considered and the temporary works should be designed and detailed by a suitably qualified person (appointed by the Contractor) prior to commencing the works
 6. Contractor to request splices if required for handling purposes

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Project

5 Firs Avenue, London, N10 3LY

Drawing Title:

Proposed Lower Ground Floor Plan

Job. No.

225267

Drawing no.

S090

Revision

Preliminary

Scale

1:50@A1

Date

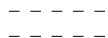
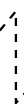
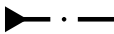
Sep 25

Drawn by

ED

Rev. no:

P3

Key:	
	Structure under
	Structure removed
	New timber rafter/joist span (sizes and spacings as noted on plans)
	Assumed existing joist span direction. SDS to be notified if actual span differs from that shown
DJ/TJ	Double joist / Triple joist - to be bolted together as per SDS specification
	Moment Connection
PS	Mass concrete padstone
LN OVER	New Lintel over opening

New Cavity Walls to be constructed in 100mm
7N/mm² blockwork inner leaf/brickwork outer leaf.
To be tied into existing masonry where necessary
using proprietary wall starter system e.g. Furfix
O.S.A.

600mm wide trench fill mass concrete strip footing to be cast on a natural bearing strata. Footings to be a minimum of 1.3m deep - final depth to be agreed with Building Control.

LOWER LEVEL UNDERPINNING (shown in blue)
Existing Walls at lower ground floor to be underpinned using min. 350mm thick reinforced concrete underpins, or to the thickness of wall over (whichever is greatest). To be formed in max. 1m wide sections in a hit and miss sequence. To be dry packed up to underside of existing foundation using 3:1 sand/cement dry pack well rammed in.
(Sequence to be agreed with the contractor).

New 215mm thick 7N/mm² blockwork wall.
To be built up from new mass concrete strip footing.

Step in slab levels to be achieved with 200mm thick RC retaining walls forming a fold in the slab, supported on RC edge thickenings.

 Contractor to allow for new strip footing to be formed in max. 1m wide sections along boundary to avoid undermining flank wall at No.3.
Trial pit required to confirm depth of existing foundation

1.2m long x 450mm thick
Reinforced concrete edge
thickenings to slab.

FULL HEIGHT UNDERPINNING
Existing Party Wall and perimeter walls around new area of proposed lower ground floor to be underpinned using min. 350mm thick reinforced concrete underpins, or to the thickness of wall over (whichever is greatest). To be formed in max. 1m wide sections in a hit and miss sequence.

152UC Spreader Beam
Beam to be wrapped in D49 wrapping mesh
and concrete encased with min.75mm cover.
To be cast onto new MC strip footing formed
to same width as existing footing OR min.
600mm wide (whichever is greater)

New 200mm RC suspended Slab over 225mm deep HX9/13 Cordek cellcore void former. A393 mesh both faces, min. 50mm cover to bottom face and min.35mm cover to top face.

1.5m x 1.5m x 1m deep
Mass concrete square pad
footing under post.

600mm wide x 450mm thick
Reinforced concrete thickening to
slab. Where wall is retaining allow
for a 200mm thick RC retaining
wall

LOWER LEVEL UNDERPINNING (shown in blue)
Existing Party Wall at lower ground floor to be underpinned using min. 350mm thick reinforced concrete underpins, or to the thickness of wall over (whichever is greatest). To be formed in max. 1m wide sections in a hit and miss sequence.
To be dry packed up to underside of existing foundation using 3:1 sand/cement dry pack well rammed in.
(Sequence to be agreed with the contractor).

Existing Wall at lower ground floor to be underpinned using mass concrete, min.215mm thick or to thickness of wall over (whichever greatest). To be formed in max. 1m wide sections with 800mm wide bases. To be dry packed up to underside of existing foundation using 3:1 sand/cement dry pack well rammed in. (Sequence to be agreed with the contractor).

All loads are SLS
w = Line Load
P = Point Load
Split into (Dead,Live)kN

All footings to be mass concrete trench fill footings cast onto suitable undisturbed ground and in accordance with Building Control Officers approval on site. Footings to be cast at least 1.3m below ground UNO, and at least as deep as existing foundations, whichever is the deeper. Anticipated Ground Conditions are - LONDON CLAY. SDS Ltd to be informed if found to be otherwise.

General notes:

1. Do not scale from this drawing
2. To be read in conjunction with all other structural drawings and the structural specification
3. To be read in conjunction with all other relevant disciplines drawings and specifications
4. All levels, setting out, waterproofing and fireproofing to be confirmed with the Architect
5. The Contractor is responsible for the temporary stability of the existing and proposed structure throughout the works. The sequencing and method of installation should be carefully considered and the temporary works should be designed and detailed by a suitably qualified person (appointed by the Contractor) prior to commencing the works
6. Contractor to request splices if required for handling purposes



Studio 1, Three Eastfields Avenue, SW18 1GN

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Project

5 Firs Avenue, London, N10 3LY

Drawing Title:

Proposed Lower Ground Floor Plan

Job. No.

Drawing no.
S090

Revision

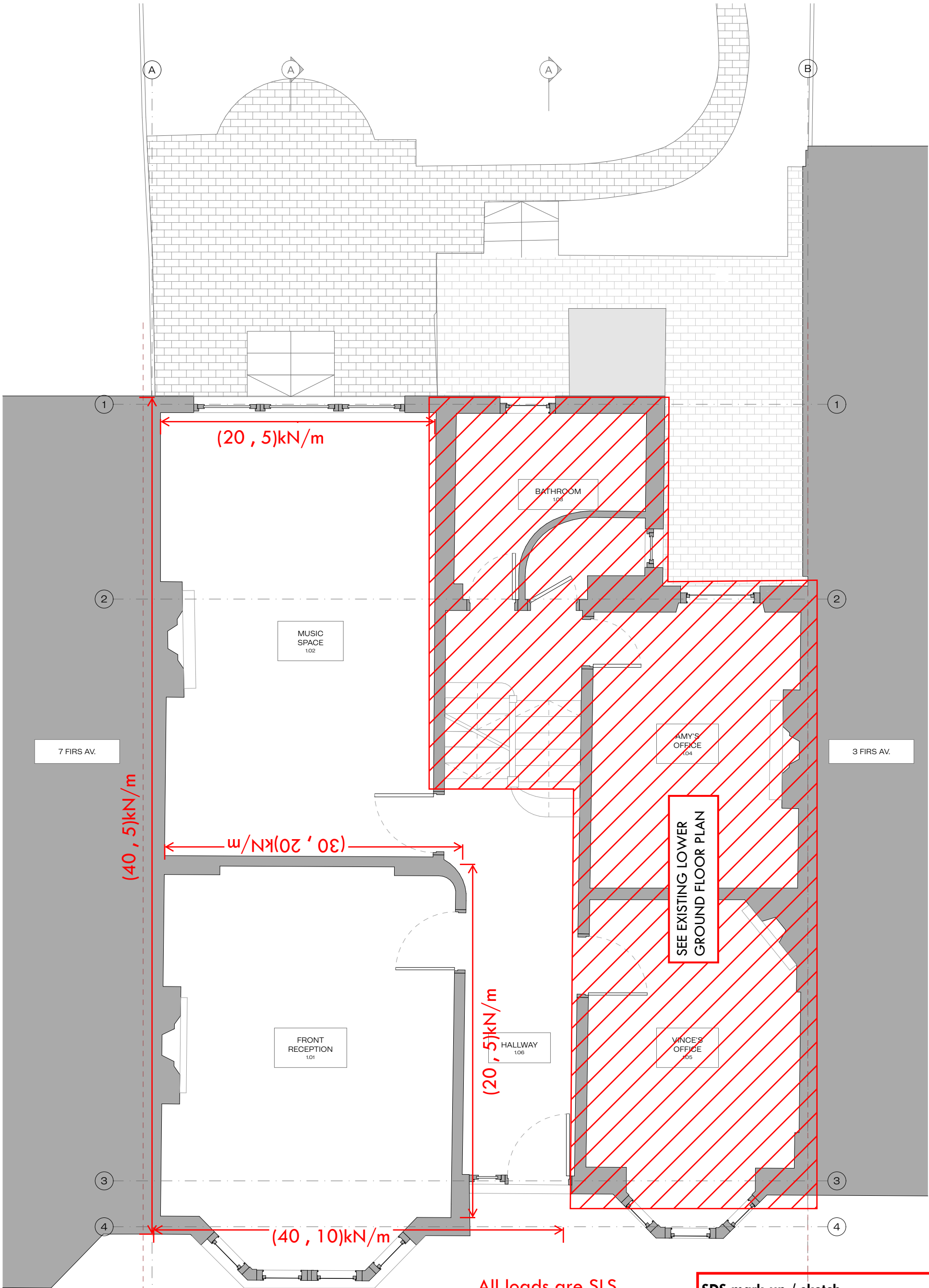
Preliminary

Scale
1:50@A1

Date
Sep 25

Drawn by
FD

Rev. no:
P3



EXISTING LOADINGS

All loads are SLS
w = Line Load
P = Point Load
Split into (Dead,Live)kN

SDS mark-up / sketch

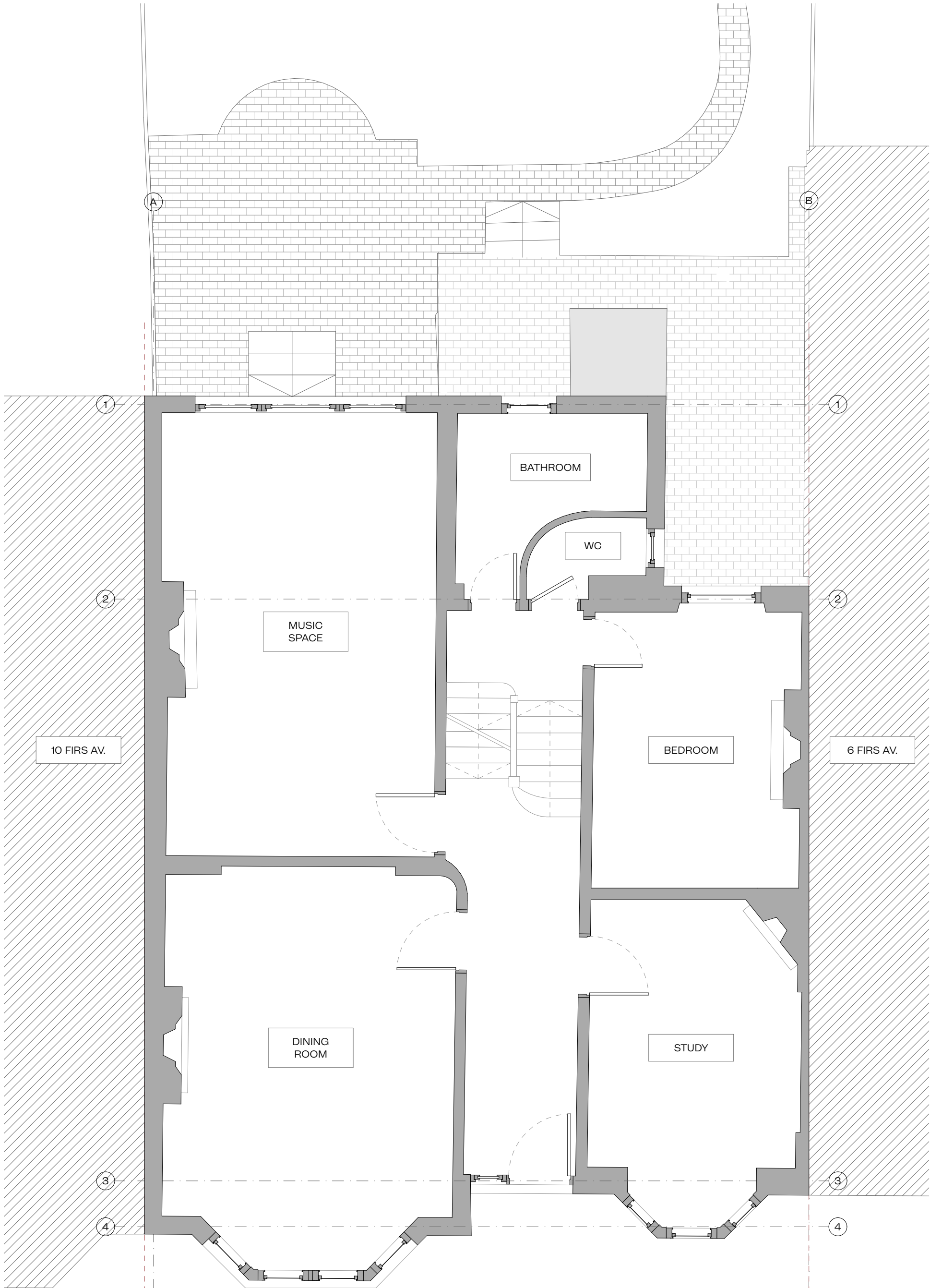
Project No:	Project name:
225267	5 Firs Avenue
Date:	Mark-up title:
19/12/25	LOADINGS FOR GMA

REF:	FIR	DRAWING:	Existing Ground Floor Plan	REV.	DATE	DESCRIPTION	1. Do not scale drawings for construction.
PROJECT:	5 Firs Avenue	STATUS:	Feasibility v1	01 -	Work in	Initial Issue	2. Neighbouring buildings are approximate.
	Muswell Hill,	SCALE:	1:50@A3	WIP	Progress		3. All dimensions, levels and conditions shall be checked on site before proceeding with the work.
	London, N10 3LY.	DATE:	04/09/2025				4. ELL Architects shall be notified of any discrepancies.
CLIENT:	Amy & Vince Cao	DRAWING NO.:	ELL-080-A-04-101				5. Spot levels are subjects to variation.
		REVISION:	01 - WIP				6. All drawings to be read in conjunction with all consultant information and specification.
							7. Do not use for construction unless expressly permitted.

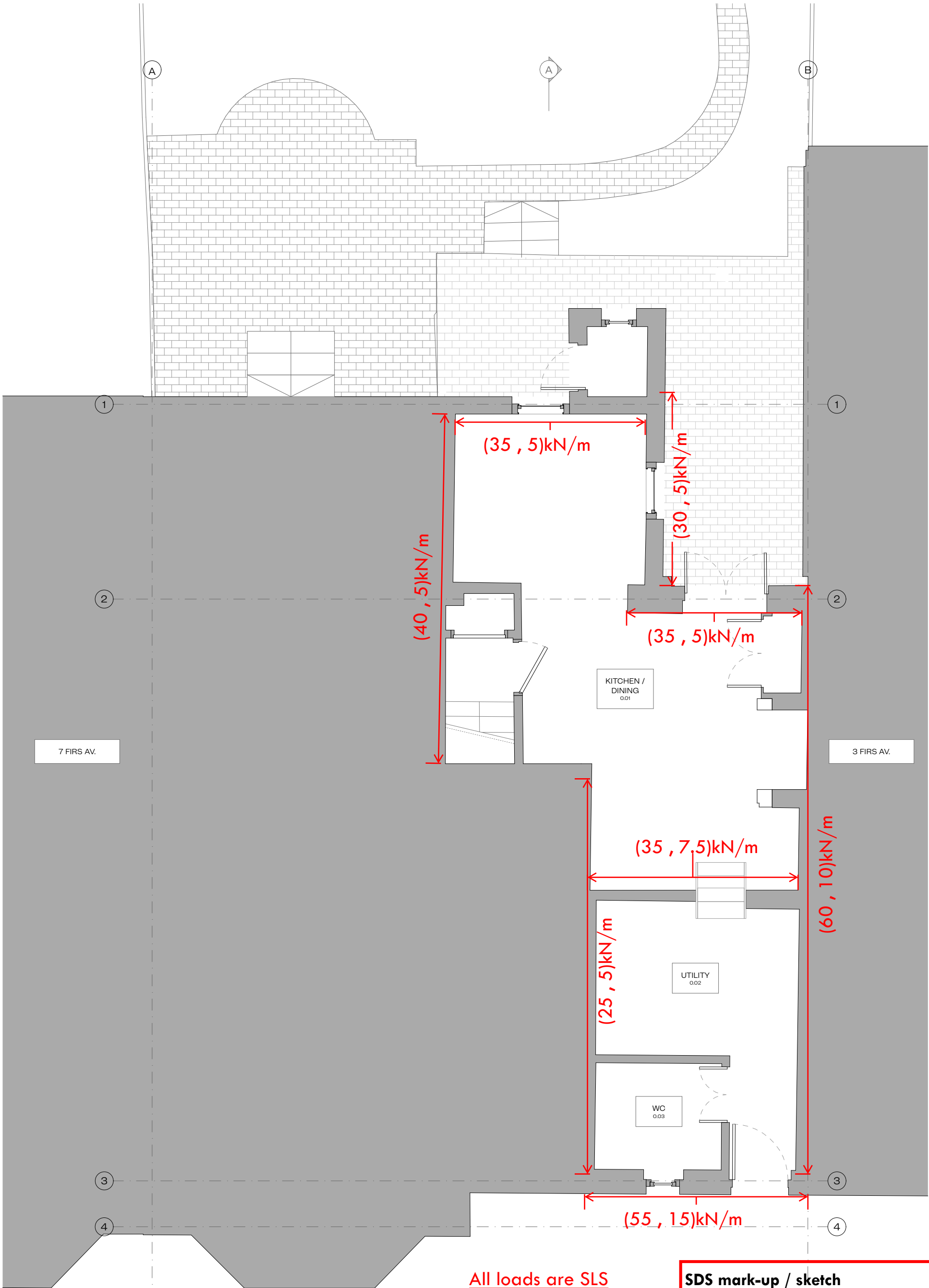
Note: Section for Illustrative Purposes ONLY, basement plan has been revised (deeper basement area).



Appendix B Existing Drawings



REF:	FIR	DRAWING:	Existing Ground Floor Plan	REV.	DATE	DESCRIPTION	1. Do not scale drawings for construction.
PROJECT:	5 Firs Avenue	STATUS:	Feasibility	01 -	Work in	Initial Issue	2. Neighbouring buildings are approximate.
	Muswell Hill,	SCALE:	1:50@A3	WIP	Progress		3. All dimensions, levels and conditions shall be checked on site before proceeding with the work.
	London, N10 3LY.	DATE:	09/07/2025				4. ELL Architects shall be notified of any discrepancies.
CLIENT:	Amy & Vince Cao	DRAWING NO.:	ELL-080-A-04-101				5. Spot levels are subjects to variation.
		REVISION:	01 - WIP				6. All drawings to be read in conjunction with all consultant information and specification.
							7. Do not use for construction unless expressly permitted.

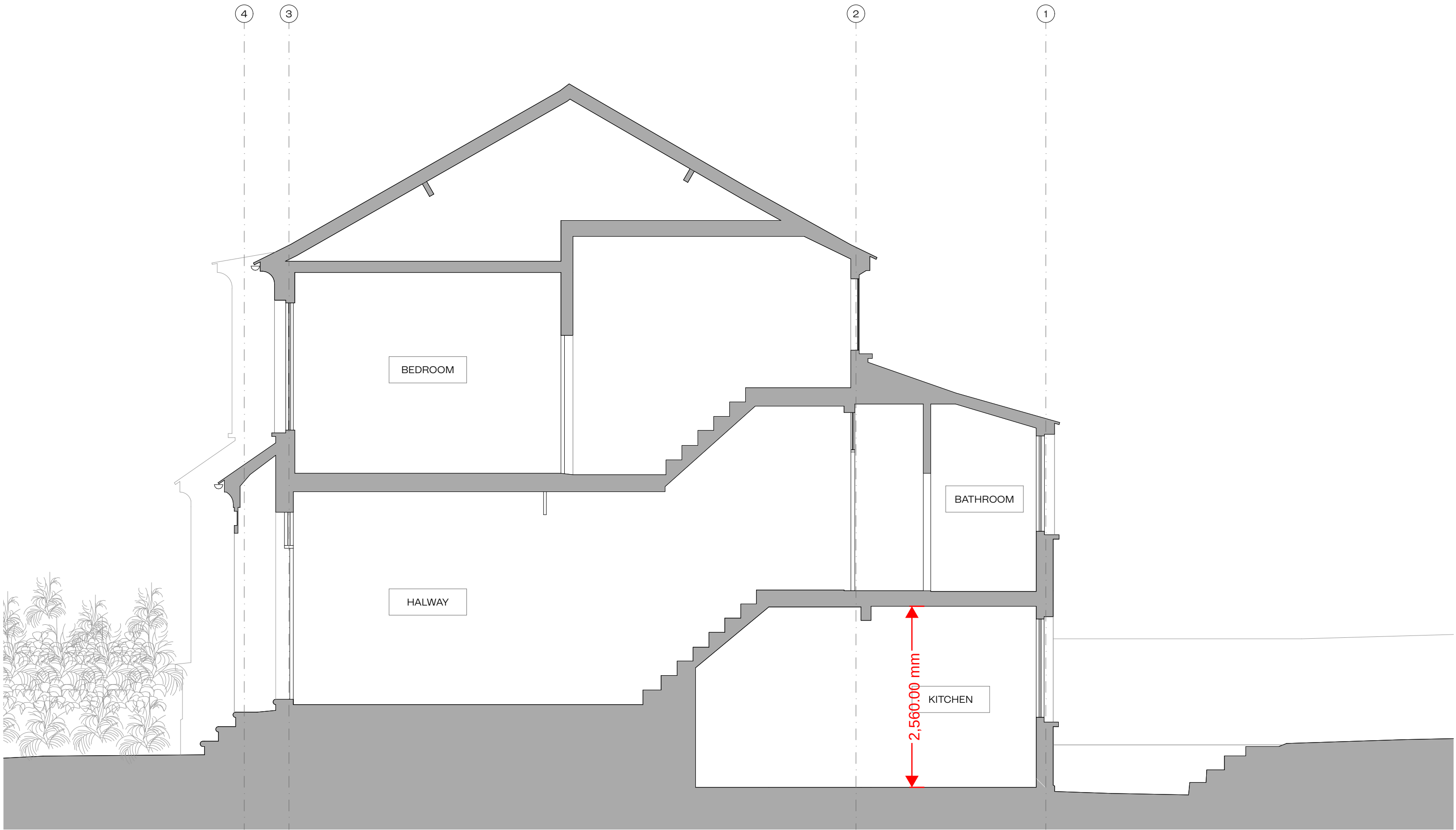


EXISTING LOADINGS

All loads are SLS
w = Line Load
P = Point Load
Split into (Dead,Live)kN

SDS mark-up / sketch	
Project No:	Project name:
225267	5 Firs Avenue
Date:	Mark-up title:
19/12/25	LOADINGS FOR GMA

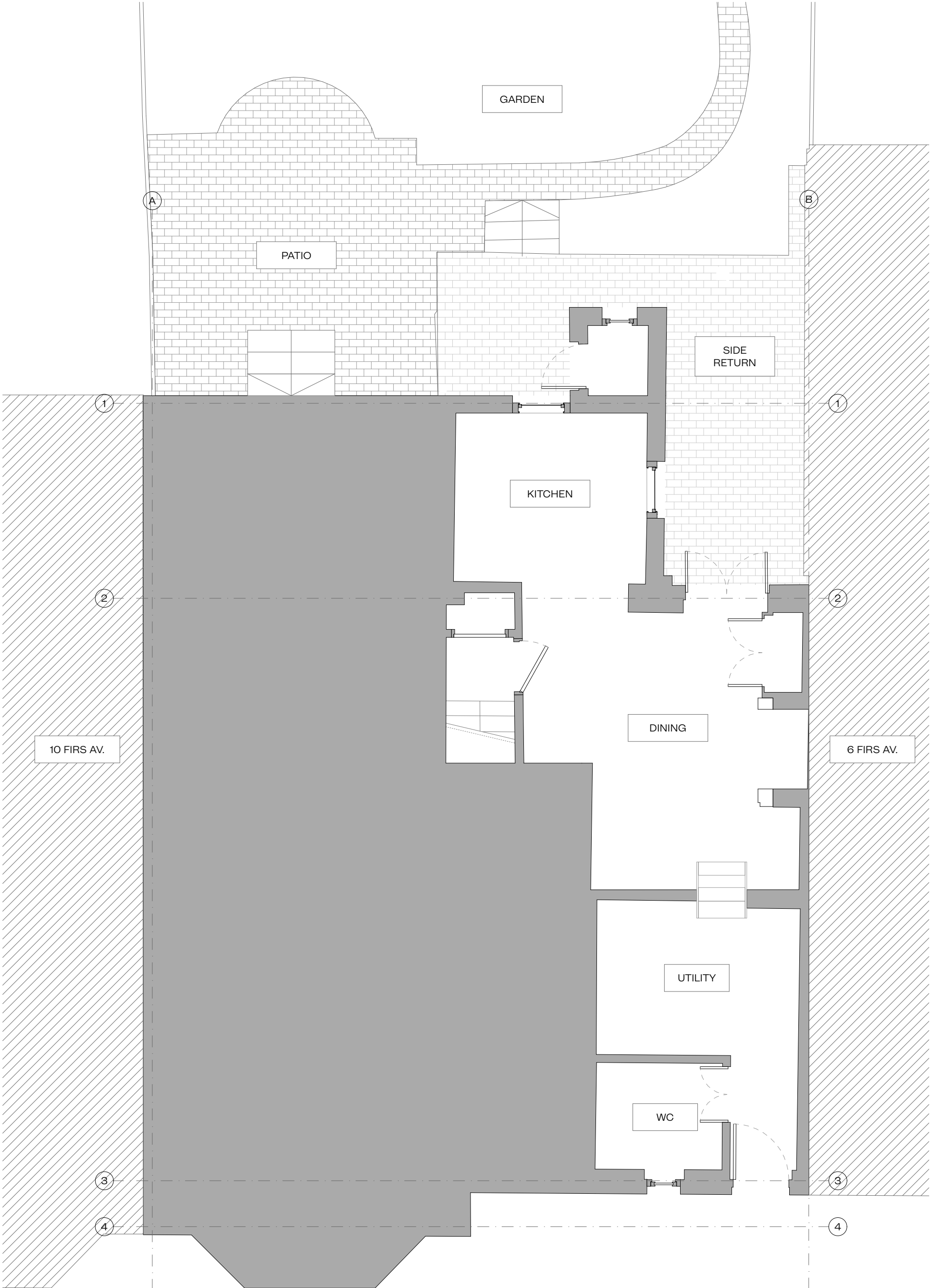
REF: PROJECT:	FIR 5 Firs Avenue Muswell Hill, London, N10 3LY.	DRAWING: STATUS: SCALE: DATE: DRAWING NO.: REVISION:	Existing Lower Ground Floor F Feasibility v1 1:50@A3 04/09/2025 ELL-080-A-04-100 01 - WIP	REV. DATE DESCRIPTION	01 - WIP Work in Progress Initial Issue	1. Do not scale drawings for construction. 2. Neighbouring buildings are approximate. 3. All dimensions, levels and conditions shall be checked on site before proceeding with the work. 4. ELL Architects shall be notified of any discrepancies. 5. Spot levels are subjects to variation. 6. All drawings to be read in conjunction with all consultant information and specification. 7. Do not use for construction unless expressly permitted.
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ELLE ARCHITECTS

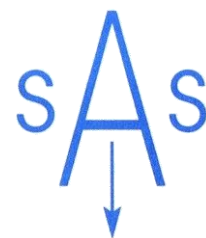
ELLELLARCHITECTS.COM
5F CANONBURY YARD
LONDON N1 7BJ

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PROJECT:	5 Firs Avenue	STATUS:	Feasibility	01 -	Work in	Initial Issue	2. Neighbouring buildings are approximate.
	Muswell Hill,	SCALE:	1:50@A3	WIP	Progress		3. All dimensions, levels and conditions shall be checked on site before proceeding with the work.
	London, N10 3LY.	DATE:	09/07/2025				4. ElIELl Architects shall be notified of any discrepancies.
CLIENT:	Amy & Vince Cao	DRAWING NO.:	ELL-080-A-04-200				5. Spot levels are subjects to variation.
		REVISION:	01 - WIP				6. All drawings to be read in conjunction with all consultant information and specification.
							7. Do not use for construction unless expressly permitted.



REF:	FIR	DRAWING:	Existing Lower Ground Floor	REV.	DATE	DESCRIPTION	1. Do not scale drawings for construction.
PROJECT:	5 Firs Avenue	STATUS:	Feasibility	01 -	Work in	Initial Issue	2. Neighbouring buildings are approximate.
	Muswell Hill,	SCALE:	1:50@A3	WIP	Progress		3. All dimensions, levels and conditions shall be checked on site before proceeding with the work.
	London, N10 3LY.	DATE:	09/07/2025				4. ELL Architects shall be notified of any discrepancies.
CLIENT:	Amy & Vince Cao	DRAWING NO.:	ELL-080-A-04-100				5. Spot levels are subjects to variation.
		REVISION:	01 - WIP				6. All drawings to be read in conjunction with all consultant information and specification.
							7. Do not use for construction unless expressly permitted.

Appendix C SAS Factual Report



Factual Report on a **GEOTECHNICAL GROUND INVESTIGATION**

Ref: 25/40704-1 | Date: October 2025

**5 Firs Avenue,
Muswell Hill,
London,
N10 3LY**

Prepared for:
Manh “Vince” Duy Van Cao

DOCUMENT CONTROL

<i>Project</i>	5 Firs Avenue, Muswell Hill, London, N10 3LY
<i>Document Type</i>	Factual Report on a Geotechnical Ground Investigation
<i>Document Reference</i>	SAS 25/40704-1
<i>Document Status</i>	FINAL
<i>Revision</i>	0
<i>Changes</i>	-
<i>Date</i>	October 2025
<i>Document Version</i>	V1.0 – 3/21

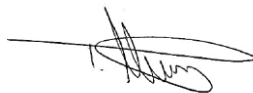
Checked

Author



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BSc (Hons) MSc FGS

Director - Geotechnical

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33 River Road, Barking, Essex IG11 0EA
Business Reg. No. 2255616

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4.1 IN-SITU TESTS	7
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APPENDIX A

SITE WORKS LOCATION PLANS

APPENDIX B

BOREHOLE & TRIAL PIT LOGS

APPENDIX C

LABORATORY TEST & GROUNDWATER MONITORING DATA

1.0 Introduction

1.1 Outline and Limitations of Report

At the request of Manh “Vince” Duy Van Cao, a ground investigation was carried out in connection with a proposed basement development at the above site. A Phase 1 Desk Study is presented under a separate cover in Site Analytical Services Limited Report Reference 25/40704, dated September 2025.

The information was required for the design and construction of foundations and infrastructure for the proposed development at the existing site, which includes the extension of the existing lower ground floor under the full extent of the main house.

The recommendations and comments given in this report are based on the ground conditions encountered in the exploratory holes made during the investigation and the results of the tests made in the field and the laboratory. It must be noted that there may be special conditions prevailing at the site remote from the exploratory hole locations which have not been disclosed by the investigation and which have not been taken into account in the report. No liability can be accepted for any such conditions.

2.0 Site Details

(National Grid Reference: TQ 284 895)

2.1 Site Location

The site is located along Firs Avenue on the east side of Birchwood Avenue – approximately 166m to the south-east of the A504 Fortis Green, in Muswell Hill, London, at approximate postcode N10 3LY. It is immediately bound by residential properties with associated private gardens in all directions, with public use north-east and east of the site (Fortis Green Road & B550 Muswell Hill Road).

The site is rectangular and covers an approximate area of 0.03 Hectares. The general area being under the authority of the London Borough of Haringey.

2.2 Published Geology

The Geological Survey of Great Britain (England and Wales) covering the area indicates the site to be underlain by the Lowestoft Formation over Dollis Hill Gravel Member over London Clay Formation at depth.

3.0 Scope of Work

3.1 Site Works

The proposed scope of works was agreed by the client prior to the commencement of the investigations. To achieve this, the following works were undertaken:-

- The drilling of two continuous flight auger boreholes to a depth of 10.00m below ground level (Boreholes 1 and 2).
- The installation of groundwater monitoring standpipes to an approximate depth of 5.00m in Boreholes 1 and 2, together with a single return monitoring visit.
- The excavation by hand of two trial pits, to 1.50m maximum depth to expose existing foundations on-site (Trial Pits 1 and 2).
- Sampling and in-situ testing as appropriate to the ground conditions encountered in the exploratory holes.
- Laboratory testing to determine the engineering properties of the soils encountered in the exploratory holes.

3.2 Ground Conditions

The approximate locations of the exploratory holes can be found in Appendix A.

The boreholes and trial pits were completed at existing ground level and revealed ground conditions that were generally consistent with the geological records and known history of the area and comprised Made Ground up to 0.90m in thickness (also found to the base of Trial Pit 2 at 1.30m below ground level) resting on the Lowestoft Formation with the London Clay formation at depth. The Dollis Hill Member was not encountered during site works.

These ground conditions are summarised in the following table. For detailed information on the ground conditions encountered in the boreholes and trial pits, reference should be made to the exploratory hole records presented in Appendix B.

Strata	Depth to top of strata (mbgl)	Depth to base of strata (mbgl)	Description
Made Ground	0.00	0.49 to 1.30	Silty sandy clay / clayey silty sand containing chalk, brick and concrete fragments.
Lowestoft Formation	0.49 to 0.90	2.30 to 2.80	Stiff silty slightly gravelly clay containing occasional chalk nodules.
London Clay Formation	2.30 to 2.80	10.00 (max depth of drilling)	Stiff silty sandy clay containing partings of silty fine sand and gypsum crystals.

Summary of Ground Conditions in Exploratory Holes

3.3 Groundwater

Groundwater was not encountered in any of the boreholes or trial pits and the material remained essentially dry throughout.

It must be noted that the speed of excavation is such that there may well be insufficient time for further light seepages of groundwater to enter the boreholes and trial pits and hence be detected, particularly within more cohesive soils.

Groundwater was encountered at respective depths of 3.08m and 2.25m below ground level in Boreholes 1 and 2 during the return monitoring visit.

Isolated pockets of groundwater may also be present perched within any less permeable material found at shallower depth on other parts of the site especially within any Made Ground.

It should be noted that the comments on groundwater conditions are based on observations made at the time of the investigation (September and October 2025) and that changes in the groundwater level could occur due to seasonal effects and also changes in drainage conditions.

4.0 In-Situ and Laboratory Tests

4.1 In-Situ Tests

In the essentially cohesive natural soils encountered at the site, in-situ shear vane tests were made at regular depth increments in order to assess the undrained shear strength of the materials. The results indicate that the natural soils are of a generally high strength in accordance with BS 5930 (2015).

The results of the in-situ tests are shown on the appropriate exploratory hole records contained in Appendix B.

4.2 Classification Tests

Atterberg Limit tests were conducted on four selected samples taken from the cohesive portion of the natural soils in Boreholes 1 and 2 and showed the samples tested to fall into Classes CI, CI/CH and CH according to the British Soil Classification System.

These are fine grained silty clay soils of intermediate to high plasticity and as such generally have a low permeability and a medium susceptibility to shrinkage and swelling movements with changes in moisture content, as defined by the NHBC Standards, Chapter 4.2. The results indicated Modified Plasticity Index values of between 25% and 30%, with all samples being below the 40% boundary between soils assessed as being of medium volume change potential and those assessed as being of high volume change potential.

The results of the tests are presented on Table 1, contained in Appendix C.

4.3 Chemical Attack on Buried Concrete

Using the results contained in Appendix B, the following table provides the highest values encountered for the BRE SD1 Suite D specification and the equivalent DS and ACEC classes, based on mobile groundwater:

Strata	pH	2:1 Water Soluble SO ₄ (mg/l)	2:1 Water Soluble Chloride (mg/l)	2:1 Water Soluble Nitrate (mg/l)	Total Sulphur (%)	Magnesium (mg/l)	DS Class	ACEC Class
Lowestoft Formation	7.7-8.0	2360	3600	<5.0	0.290	140	DS-3	AC-3
London Clay formation	7.5-7.9	2410	85	<5.0	0.839	180	DS-3	AC-3

Worst case DS and ACEC classes based on the BRE SD1 Suite D results

5.0 List of Appendices

Appendix A – Site Works Location Plans

Appendix A – Borehole and Trial Pit Logs

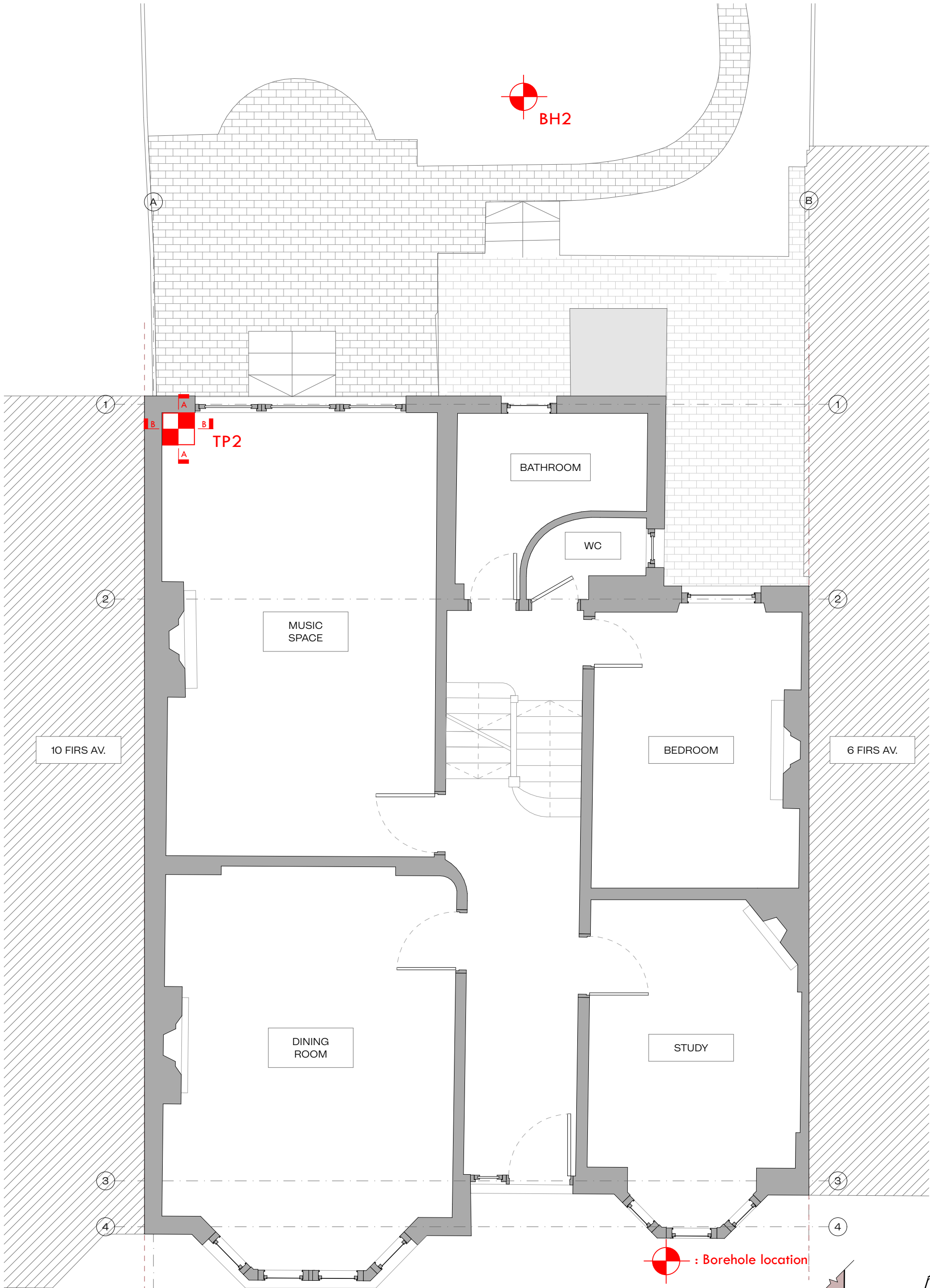
Appendix B – Laboratory Test & Groundwater Monitoring Data

6.0 References

1. British Standards Institution, 2015. Code of practice for foundations, BS 8004, BSI, London.
2. British Standards Institution, 1990. Methods for test for soils for civil engineering purposes, BS1377, BSI, London
3. British Standards Institution, 1994. Code of practice for earth retaining structures, BS8002, BSI, London
4. British Standards Institution, Code of Practice for Site Investigations, BS5930: 2015, BSI, London
5. British Standards Institution, 2004. Geotechnical Design, BS EN 1997-1 BSI, London
6. NHBC Standards, Chapter 4.1, "Land Quality - managing ground conditions", September 1999.

APPENDIX A

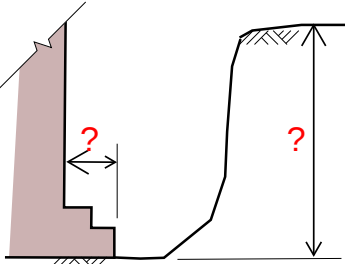
Site Works Location Plans



 : Borehole location

 : Trial pit location

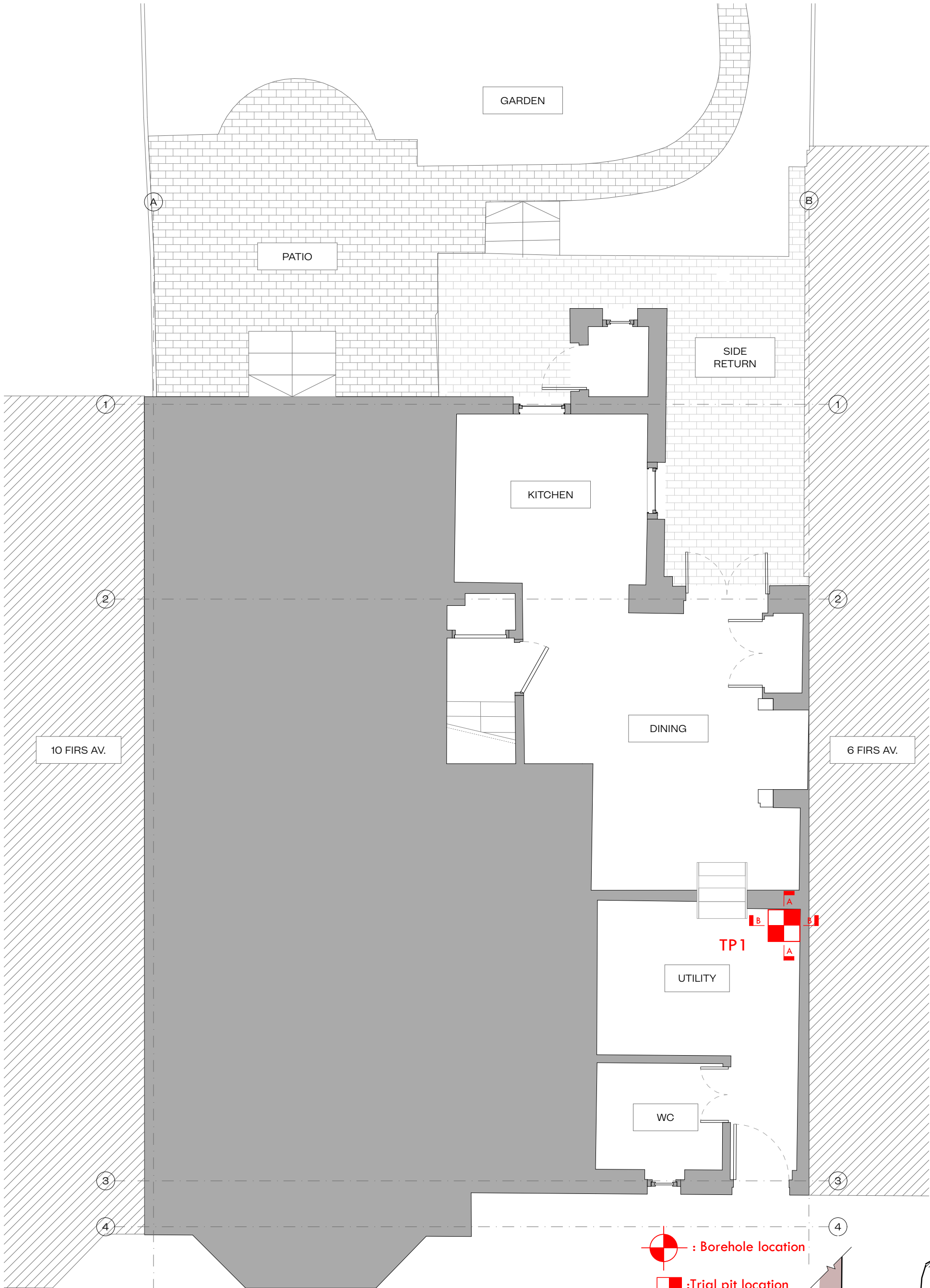
To reveal depth and
profile of existing wall
foundations in the
directions shown



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REF:	FIR	DRAWING:	Existing Ground Floor Plan	REV.	DATE	DESCRIPTION	1. Do not scale drawings for construction.
PROJECT:	5 Firs Avenue	STATUS:	Feasibility	01 -	Work in	Initial Issue	2. Neighbouring buildings are approximate.
	Muswell Hill,	SCALE:	1:50@A3	WIP	Progress		3. All dimensions, levels and conditions shall be checked on site before proceeding with the work.
	London, N10 3LY.	DATE:	09/07/2025				4. Ellell Architects shall be notified of any discrepancies.
CLIENT:	Amy & Vince Cao	DRAWING NO.:	ELL-080-A-04-101				5. Spot levels are subjects to variation.
		REVISION:	01 - WIP				6. All drawings to be read in conjunction with all consultant information and specification.
							7. Do not use for construction unless expressly permitted.



REF:	FIR	DRAWING:	Existing Lower Ground Floor	REV.	DATE	DESCRIPTION	1. Do not scale drawings for construction.
PROJECT:	5 Firs Avenue	STATUS:	Feasibility	01 -	Work in	Initial Issue	2. Neighbouring buildings are approximate.
	Muswell Hill,	SCALE:	1:50@A3	WIP	Progress		3. All dimensions, levels and conditions shall be checked on site before proceeding with the work.
	London, N10 3LY.	DATE:	09/07/2025				4. ELL Architects shall be notified of any discrepancies.
CLIENT:	Amy & Vince Cao	DRAWING NO.:	ELL-080-A-04-100				5. Spot levels are subjects to variation.
		REVISION:	01 - WIP				6. All drawings to be read in conjunction with all consultant information and specification.
							7. Do not use for construction unless expressly permitted.

APPENDIX B

Borehole & Trial Pit Logs

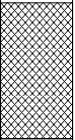
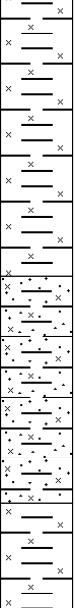
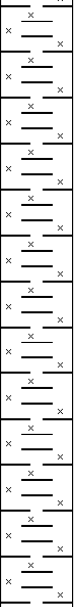
Site Analytical Services Ltd.							Site	Borehole Number	
							5 FIRS AVANUE, MUSWELL HILL, LONDON N10 3LY	BH1	
Boring Method		Casing Diameter		Ground Level (mOD)		Client		Job Number	
CONTINUOUS FLIGHT AUGER		100mm cased to 0.00m				MANH "VINCE" DUY VAA CAO		2540704	
		Location		Dates		Engineer		Sheet	
		TQ284894		18/09/2025		STRUCTURAL DESIGN STUDIO		1/1	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.25	D1					(0.27) 0.27	MADE GROUND grass over topsoil		
0.50	D2					(0.63) 0.63	MADE GROUND medium brown silty clayey sand containing chalk and brick fragments		
0.75	D3					0.90	Stiff medium brown orange silty slightly gravelly CLAY with occasional chalk nodules.		
1.00	D4								
1.00	V1 76								
1.50	D5					(1.40) 1.40			
1.50	V2 86						Stiff medium brown orange silty CLAY		
2.00	D6					2.30			
2.00	V3 89								
2.50	D7								
2.50	V4 94						(2.00) 2.00		
3.00	D8								
3.00	V5 140+								
3.50	D9								
3.50	V6 140+						Stiff dark brown grey silty CLAY		
4.00	D10					4.30			
4.00	V7 140+								
4.50	D11								
4.50	V8 140+						(5.70) 5.70		
5.00	D12								
5.00	V9 140+								
6.00	D13								
6.00	V10 140+								
7.00	D14								
7.00	V11 140+								
8.00	D15								
8.00	V12 140+								
9.00	D16								
9.00	V13 140+								
10.00	D17					10.00			
10.00	V14 140+								
Remarks Groundwater was not encountered during site works V=Vane test - Results in kPa D=Disturbed sample Breaking out from 0.00m to 1.00m for 1 HOUR hour.							Scale (approx)		Logged By
							1:50		SB
							Figure No. 2540704.BH1		

Site 5 FIRS AVANUE, MUSWELL HILL, LONDON N10 3LY	Borehole Number BH1
Client MANH "VINCE" DUY VAA CAO	Job Number 2540704
Engineer STRUCTURAL DESIGN STUDIO	Sheet 1/1

[illegible]

Remarks
Lockable cover set in concrete.

Site Analytical Services Ltd.							Site	Borehole Number	
							5 FIRS AVANUE, MUSWELL HILL, LONDON N10 3LY	BH2	
Boring Method		Casing Diameter		Ground Level (mOD)		Client		Job Number	
CONTINUOUS FLIGHT AUGER		100mm cased to 0.00m				MANH "VINCE" DUY VAA CAO		2540704	
		Location		Dates		Engineer		Sheet	
		TQ284894		18/09/2025		STRUCTURAL DESIGN STUDIO		1/1	
Depth (m)	Sample / Tests	Casing Depth (m)	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.25	D1					(0.90)	MADE GROUND containing medium to dark brown silty clayey sand containing brick and concrete fragments		
0.50	D2								
0.75	D3					0.90			
1.00	D4						Stiff medium brown orange silty CLAY with occasional chalk nodules.		
1.00	V1 78								
1.50	D5								
1.50	V2 87					(1.90)			
2.00	D6								
2.00	V3 104								
2.50	D7								
2.50	V4 124					2.80			
3.00	D8						Stiff medium brown silty CLAY containing bands of fine sands.		
3.00	V5 140+								
3.50	D9					(1.50)			
3.50	V6 140+								
4.00	D10								
4.00	V7 140+					4.30			
							Stiff dark brown grey silty CLAY		
5.00	D11								
5.00	V8 140+								
6.00	D12								
6.00	V9 140+								
7.00	D13					(5.70)			
7.00	V10 140+								
8.00	D14								
8.00	V11 140+								
9.00	D15								
9.00	V12 140+								
10.00	D16					10.00			
10.00	V13 140+								
Remarks Groundwater was not encountered during site works D=Disturbed sample V=Vane test - results in kPa Breaking out from 0.00m to 1.00m for 1 HOUR hour.							Scale (approx)		Logged By
							1:50		SB
							Figure No. 2540704.BH2		

Site Analytical Services Ltd.						Site 5 FIRS AVANUE, MUSWELL HILL, LONDON N10 3LY				Borehole Number BH2											
Installation Type Single Installation		Dimensions Internal Diameter of Tube [A] = 50 mm Diameter of Filter Zone = 100 mm				Client MANH "VINCE" DUY VAA CAO				Job Number 2540704											
		Location TQ284894		Ground Level (mOD)		Engineer STRUCTURAL DESIGN STUDIO				Sheet 1/1											
Legend	Water	Instr (A)	Level (mOD)	Depth (m)	Description	Groundwater Strikes During Drilling															
				1.00	Bentonite Seal	Date	Time	Depth Struck (m)	Casing Depth (m)	Inflow Rate	Readings				Depth Sealed (m)						
											5 min	10 min	15 min	20 min							
						Groundwater Observations During Drilling															
						Date	Start of Shift					End of Shift									
							Time	Depth Hole (m)	Casing Depth (m)	Water Depth (m)	Water Level (mOD)	Time	Depth Hole (m)	Casing Depth (m)		Water Depth (m)	Water Level (mOD)				
						Instrument Groundwater Observations															
						Inst. [A] Type : Slotted Standpipe															
						Date	Instrument [A]			Remarks											
							Time	Depth (m)	Level (mOD)												
				5.00	Slotted Standpipe																
						Instrument Groundwater Observations															
						Inst. [A] Type : Slotted Standpipe															
						Date	Instrument [A]			Remarks											
							Time	Depth (m)	Level (mOD)												
										6.00	Bentonite Seal										
												Instrument Groundwater Observations									
												Inst. [A] Type : Slotted Standpipe									
												Date	Instrument [A]			Remarks					
Time	Depth (m)	Level (mOD)																			
				10.00	General Backfill																
												Instrument Groundwater Observations									
												Inst. [A] Type : Slotted Standpipe									
												Date	Instrument [A]			Remarks					
						Time	Depth (m)	Level (mOD)													

Remarks
Lockable cover set in concrete

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Site Analytical Services Ltd.

Site

5 FIRS AVANUE, MUSWELL HILL, LONDON N10 3LY

**Trial Pit
Number**
TP1

Excavation Method

HAND EXCAVATION

Dimensions
m(W) x m(L) x 0.68m(D)

Ground Level (mOD)

Client

MANH "VINCE" DUY VAA CAO

**Job
Number**
2540704

Location

TQ284894

Dates

18/09/2025

Engineer

STRUCTURAL DESIGN STUDIO

Sheet

1/1

Depth
(m)

Sample / Tests

Water
Depth
(m)

Field Records

Level
(mOD)

Depth
(m)
(Thickness)

Description

Legend

water

0.48
0.48-0.58

D1
M2 95/125

(0.25)
0.25
(0.23)
0.48
(0.20)
0.68

MADE GROUND Tiles over concrete

MADE GROUND Medium brown silty sand containing brick and concrete fragments

Firm medium brown grey veined silty CLAY

Complete at 0.68m

Plan

Remarks

M+Mackintosh probe - Blows/Penetration (mm)
D=Disturbed sample

Scale (approx)

1:50

Logged By

SB

Figure No.

2540704.TP1

Site Analytical Services Ltd.			Site 5 FIRS AVANUE, MUSWELL HILL, LONDON N10 3LY		Trial Pit Number TP1	
Method Trial Pit		Dimensions m(W) x m(L) x 0.68m(D)	Ground Level (mOD)	Client MANH "VINCE" DUY VAA CAO		Job Number 2540704
Orientation A B C D ↑		Location TQ284894	Dates 18/09/2025	Engineer STRUCTURAL DESIGN STUDIO		Sheet 1/1
Depth 0.00 SKIRITING BOARD BRICK BRICK BRICK BRICK Concrete 100mm 75mm 75mm 75mm 150mm 50mm 50mm 50mm 100mm Level 0.00						

Site Analytical Services Ltd.						Site 5 FIRS AVANUE, MUSWELL HILL, LONDON N10 3LY		Trial Pit Number TP2	
Excavation Method HAND EXCAVATION		Dimensions 0.30m(W) x 0.30m(L) x 1.30m(D)		Ground Level (mOD)		Client MANH "VINCE" DUY VAA CAO		Job Number 2540704	
		Location TQ284894		Dates 18/09/2025		Engineer STRUCTURAL DESIGN STUDIO		Sheet 1/1	
Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water	
					0.03 0.15 (0.60) 0.75 (0.55) 1.30	MADE GROUND floor boards MADE GROUND timber VOID MADE GROUND Medium brown silty sand containing brick and concrete fragments Complete at 1.30m			
Plan					Remarks				
.					Void from 0.15 to 0.7				
.									
.									
.									
.									
.									
					Scale (approx)		Logged By		Figure No.
					1:50		SB		2540704.TP2

Site Analytical Services Ltd.			Site 5 FIRS AVANUE, MUSWELL HILL, LONDON N10 3LY		Trial Pit Number TP2	
Method Trial Pit		Dimensions 0.30m(W) x 0.30m(L) x 1.30m(D)	Ground Level (mOD)	Client MANH "VINCE" DUY VAA CAO		Job Number 2540704
Orientation A B C D		Location TQ284894	Dates 18/09/2025	Engineer STRUCTURAL DESIGN STUDIO		Sheet 1/1
Depth 0.00 1.00 SKIRTING BOARDS BRICK BRICK 1050mm 250mm 100mm TIMBER 100mm UNDERSIDE WAS NOT ENCOUNTERED DURING EXCAVATION DUE TO TIGHT ACCESS CONSTRAINTS Level 0.00 -1.00 1300mm						
Strata				Samples and Tests		
Depth (m)	No.	Description	Depth (m)	Type	Field Records	
0.00-0.03	1	MADE GROUND floor boards				
0.03-0.15	2	MADE GROUND timber				
0.15-0.75	3	VOID				
0.75-1.30	4	MADE GROUND Medium brown silty sand containing brick and concrete fragments				
			Excavation Method: HAND EXCAVATION			
			Shoring / Support:			
			Stability:			
			Backfill:			
Remarks Void from 0.15 to 0.7						
Logged By : SB Checked By : Figure No. : 2540704.TP2						

APPENDIX C

Laboratory Test & Groundwater Monitoring Data

PLASTICITY INDEX & MOISTURE CONTENT DETERMINATIONS

BH/TP No.	Depth (m)	Natural Moisture (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Passing 425 μ m (%)	Modified Plasticity Index (%)	Class
BH1	1.50	13	39	12	27	94	25	CI
	3.00	24	47	19	28	100	28	CI
BH2	2.00	17	47	16	31	97	30	CI
	4.00	26	50	20	30	100	30	CI/CH

Table 1

GROUNDWATER MONITORING

GROUNDWATER MONITORING RECORD			
Date	Weather Conditions	Ground Conditions	Temperature (°C)
21/10/2025	Cloudy	Damp	13.0
Monitoring Point Location	Depth to water (mBGL)		Depth to Base of well (mBGL)
BH1	3.08		5.00
BH2	2.25		5.01

Table 2

Site Analytical Services Ltd
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33 River Road
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e: services@siteanalytical.co.uk; lizw@siteanalytical.co.uk; jimw@siteanalytical.co.uk;
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i2 Analytical Ltd.
7 Woodshots Meadow,
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Watford,
Herts,
WD18 8YS

t: 01923 225404

f: 01923 237404

e: info-i2analytical@normecgroup.com

Analytical Report Number : 25-053811

Project / Site name:	5 Firs Avenue Muswell Hill N10 3LY	Samples received on:	06/10/2025
Your job number:	25 40704	Samples instructed on/ Analysis started on:	06/10/2025
Your order number:	16837	Analysis completed by:	13/10/2025
Report Issue Number:	1	Report issued on:	13/10/2025
Samples Analysed:	7 soil samples		

Joanna Biolik

Signed:

Joanna Biolik
Senior Reporting Specialist
For & on behalf of i2 Analytical Ltd.

Standard Geotechnical, Asbestos and Chemical Testing Laboratory located at: ul. Pionierów 39, 41-711 Ruda Śląska, Poland.

Accredited tests are defined within the report, opinions and interpretations expressed herein are outside the scope of accreditation.

Standard sample disposal times, unless otherwise agreed with the laboratory, are :

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting
air	- once the analysis is complete

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Retention period for records and reports is minimum 6 years from the date of issue of the final report.
Some records may be kept for longer according to other legal/best practice requirements.

Any assessments of compliance with specifications are based on actual analytical results with no contribution from uncertainty of measurement.
Application of uncertainty of measurement would provide a range within which the true result lies.
An estimate of measurement uncertainty can be provided on request.

Analytical Report Number: 25-053811

Project / Site name: 5 Firs Avenue Muswell Hill N10 3LY

Your Order No: 16837

Lab Sample Number				705818	705819	705820	705821	705822
Sample Reference				BH1	BH1	BH1	BH1	BH2
Sample Number				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Water Matrix				N/A	N/A	N/A	N/A	N/A
Depth (m)				2.00	4.00	7.00	10.00	2.50
Date Sampled				18/09/2025	18/09/2025	18/09/2025	18/09/2025	18/09/2025
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	6.9	13	13	16	9.7
Total mass of sample received	kg	0.1	NONE	1.7	1.6	1.4	1.7	1.7

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	8	7.5	7.8	7.9	7.7
Total Sulphate as SO ₄	%	0.005	MCERTS	0.062	0.819	0.285	0.184	0.982
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	410	4800	3100	1600	4700
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	205	2410	1560	778	2360
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	160	21	55	59 ^{ss}	3600
Total Sulphur	mg/kg	50	MCERTS	240	2900	5700	6700	2900
Total Sulphur	%	0.005	MCERTS	0.024	0.286	0.565	0.672	0.29
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	2	NONE	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Water Soluble Nitrate (2:1) as NO ₃ (leachate equivalent)	mg/l	5	NONE	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0

Heavy Metals / Metalloids

Magnesium (water soluble)	mg/kg	5	NONE	24	370	270	170	270
Magnesium (leachate equivalent)	mg/l	2.5	NONE	12	180	130	87	140

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number: 25-053811

Project / Site name: 5 Firs Avenue Muswell Hill N10 3LY

Your Order No: 16837

Lab Sample Number	705823			705824	
Sample Reference	BH2			BH2	
Sample Number	None Supplied			None Supplied	
Water Matrix	N/A			N/A	
Depth (m)	6.00			9.00	
Date Sampled	18/09/2025			18/09/2025	
Time Taken	None Supplied			None Supplied	
Analytical Parameter (Soil Analysis)	Units	Test Limit of detection	Test Accreditation Status		
Stone Content	%	0.1	NONE	< 0.1	< 0.1
Moisture Content	%	0.01	NONE	14	16
Total mass of sample received	kg	0.1	NONE	1.4	1.5

General Inorganics

pH (L099)	pH Units	N/A	MCERTS	7.8	7.7
Total Sulphate as SO ₄	%	0.005	MCERTS	0.329	0.226
Water Soluble Sulphate as SO ₄ 16hr extraction (2:1)	mg/kg	2.5	MCERTS	3800	2200
Water Soluble SO ₄ 16hr extraction (2:1 Leachate Equivalent)	mg/l	1.25	MCERTS	1910	1080
Water Soluble Chloride (2:1) (leachate equivalent)	mg/l	0.5	MCERTS	57	85
Total Sulphur	mg/kg	50	MCERTS	5000	8400
Total Sulphur	%	0.005	MCERTS	0.497	0.839
Water Soluble Nitrate (2:1) as NO ₃	mg/kg	2	NONE	< 2.0	< 2.0
Water Soluble Nitrate (2:1) as NO ₃ (leachate equivalent)	mg/l	5	NONE	< 5.0	< 5.0

Heavy Metals / Metalloids

Magnesium (water soluble)	mg/kg	5	NONE	330	230
Magnesium (leachate equivalent)	mg/l	2.5	NONE	170	110

U/S = Unsuitable Sample I/S = Insufficient Sample ND = Not detected

Analytical Report Number : 25-053811

Project / Site name: 5 Firs Avenue Muswell Hill N10 3LY

* These descriptions are only intended to act as a cross check if sample identities are questioned. The major constituent of the sample is intended to act with respect to MCERTS validation. The laboratory is accredited for sand, clay and loam (MCERTS) soil types. Data for unaccredited types of solid should be interpreted with care.

Stone content of a sample is calculated as the % weight of the stones not passing a 10 mm sieve. Results are not corrected for stone content.

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
705818	BH1	None Supplied	2	Brown clay
705819	BH1	None Supplied	4	Brown clay
705820	BH1	None Supplied	7	Brown clay
705821	BH1	None Supplied	10	Brown clay
705822	BH2	None Supplied	2.5	Brown clay
705823	BH2	None Supplied	6	Brown clay
705824	BH2	None Supplied	9	Brown clay

Analytical Report Number : 25-053811

Project / Site name: 5 Firs Avenue Muswell Hill N10 3LY

Water matrix abbreviations:

Surface Water (SW) Potable Water (PW) Ground Water (GW) Process Waters Heating/Cooling (PrW) DI Process Water (DI PrW)

Final Sewage Effluent (FSE) Landfill Leachate (LL)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Moisture Content	Moisture content, determined gravimetrically (up to 30°C)	In-house method	L019B	W	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Gravimetric determination of stone > 10 mm as % dry weight	In-house method based on British Standard Methods and MCERTS requirements.	L019B	D	NONE
Magnesium, water soluble, in soil	Determination of water soluble magnesium by extraction with water followed by ICP-OES	In-house method based on TRL 447	L038B	D	NONE
Total sulphate (as SO ₄ in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES	In-house method	L038B	D	MCERTS
Sulphate, water soluble, in soil (16hr extraction)	Sulphate, water soluble, in soil (16hr extraction)	In-house method	L038B	D	MCERTS
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES	In-house method	L038B	D	MCERTS
Water Soluble Nitrate (leachate equivalent)	Determination of nitrate by reaction with sodium salicylate and colorimetry	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction	L078-PL	W	NONE
Nitrate, water soluble, in soil	Determination of nitrate by reaction with sodium salicylate and colorimetry	In-house method based on Examination of Water and Wastewater & Polish Standard Method PN-82/C-04579.08, 2:1 extraction	L078-PL	W	NONE
Chloride, water soluble, in soil	Determination of Chloride colorimetrically by discrete analyser	In-house method	L082B	D	MCERTS
pH in soil (automated)	Determination of pH in soil by addition of water followed by automated electrometric measurement	In-house method	L099-PL	D	MCERTS
Soil Descriptions	Textural classification	In-house method	L019B	W	NONE

For method numbers ending in 'UK' or 'A' analysis have been carried out in our laboratory in the United Kingdom (Watford).

For method numbers ending in 'F' analysis have been carried out in our laboratory in the United Kingdom (East Kilbride).

For method numbers ending in 'PL' or 'B' analysis have been carried out in our laboratory in Poland.

Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30°C.

Unless otherwise indicated, site information, order number, project number, sampling date, time, sample reference and depth are provided by the client. The instructed on date indicates the date on which this information was provided to the laboratory.

Quality control parameter failure associated with individual result applies to calculated sum of individuals.

The result for sum should be interpreted with caution

\$\$- Result was reported from high dilution. The result should be interpreted with caution.

Analytical Report Number : 25-053811

Project / Site name: 5 Firs Avenue Muswell Hill N10 3LY

This deviation report indicates the sample and test deviations that apply to the samples submitted for analysis. Please note that the associated result(s) may be unreliable and should be interpreted with care.

Key: a - No sampling date b - Incorrect container/Insufficient material provided c - Holding time d - Headspace e - Temperature

Sample ID	Other ID	Sample Type	Lab Sample Number	Sample Deviation	Test Name	Test Ref	Test Deviation
BH1	N/A	S	705818	c	Chloride, water soluble, in soil	L082B	c
BH1	N/A	S	705818	c	pH in soil (automated)	L099-PL	c
BH1	N/A	S	705819	c	Chloride, water soluble, in soil	L082B	c
BH1	N/A	S	705819	c	pH in soil (automated)	L099-PL	c
BH1	N/A	S	705820	c	Chloride, water soluble, in soil	L082B	c
BH1	N/A	S	705820	c	pH in soil (automated)	L099-PL	c
BH1	N/A	S	705821	c	Chloride, water soluble, in soil	L082B	c
BH1	N/A	S	705821	c	pH in soil (automated)	L099-PL	c
BH2	N/A	S	705822	c	Chloride, water soluble, in soil	L082B	c
BH2	N/A	S	705822	c	pH in soil (automated)	L099-PL	c
BH2	N/A	S	705823	c	Chloride, water soluble, in soil	L082B	c
BH2	N/A	S	705823	c	pH in soil (automated)	L099-PL	c
BH2	N/A	S	705824	c	Chloride, water soluble, in soil	L082B	c
BH2	N/A	S	705824	c	pH in soil (automated)	L099-PL	c