Five Corners Limited

44 Dartmouth Park Road, London

Basement Impact Assessment – Investigation and Impact Assessment Stages 2, 3 and 4

June, 2015

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1. INTRODUCTION

It is proposed to develop the property at 44 Dartmouth Park Road in the London Borough of Camden. This will include the construction of a basement beneath part of the existing building footprint, and the construction of infill extensions on the ground floor and first floor at the rear of the building.

Card Geotechnics Limited (CGL) has previously been instructed to undertake a *Screening Stage 1* assessment for the proposed development to determine the potential effect of the new basement on nearby structures and services, surface water runoff and groundwater flow[1] in accordance with the London Borough of Camden's guidance document *"CPG4, Basements and Lightwells[2]".*

Following the completion of the screening assessment, concerns were raised by the owners of neighbouring properties about the impact of the proposed basement on groundwater levels, referring to the historical *River Fleet* located some 115m west of the site. In order to further investigate these concerns, a ground investigation has been undertaken to establish the underlying geological sequence, groundwater levels, and to derive geotechnical design parameters to support basement impact assessment calculations.

This report is intended to address the scoping, review and interpretation of the site investigation (Stages 2 and 3) and to provide an impact assessment with regard to the effect of the basement on nearby structures and the hydrogeology of the surrounding area for the purposes of planning (Stage 4).

[1] CGL (2015) *44 Dartmouth Park Road, London; Basement Impact Assessment – Screening Stage 1.* CG/18249. January 2015.

[2] Camden Planning Guidance, CPG4, Basements and Lightwells, September 2013.

2. SITE CONTEXT

2.1 Site location and layout

The site is located at 44 Dartmouth Park Road, London NW5 1SN. The National Grid Reference for the approximate centre of the site is 528764E, 186099N and a site location plan is shown in Figure 1.

The building fronts onto Dartmouth Park Road to the south-east of the site, with a pavement approximately 3m in width separating the site from the carriageway of Dartmouth Park Road. The north-east of the site is bounded a narrow path approximately 1m in width, beyond which is 46 Dartmouth Park Road. A single storey structure of 24A York Rise is located adjacent to the north-western boundary wall of the site beyond the garden. To the south-west the site is bounded by York Rise.

Three mature trees are present within close proximity of the site adjacent to York Rise and within the garden of 24A York Rise, estimated to be between 8m and 10m in height. Smaller trees approximately 4m in height were observed within the rear garden of 46 Dartmouth Park Road.

A site layout plan is included in Figure 2.

2.2 Hydrogeology and hydrology

The hydrology and hydrogeology of the site and surrounding area was assessed as part of the Stage 1 Screening report[1]. The site is directly underlain by the London Clay Formation which has been designated a 'non-productive stratum' by the Environment Agency (EA). However, EA mapping indicates the site is within a zone at of risk of flooding from reservoirs, and that York Rise and streets to the south-west of the site are at risk from surface water flooding.

Barton[3] suggests that the site lies some 115m east the historical *River Fleet*, one of London's 'lost rivers' which previously flowed south and south-east from Hampstead Heath into the River Thames at Blackfriars. Other sources, however, indicate that the course of

[3] Barton, N. (1983) *The Lost Rivers of London.* Hertfordshire Historical Publications.

the *River Fleet* may have been much closer than this to the site, running beneath York Rise adjacent to the western site boundary.

The former watercourse of the *River Fleet* is no longer open, having been culverted and constrained, however, owing to local topography it is considered that surface waters will drain towards the line of watercourse in a general southwest trend. This is illustrated in Figure 11 of the Guidance for Subterranean Development[5].

Additionally, published Ordnance Survey mapping indicates York Rise is located in a shallow valley which is consistent with the historical river. No. 44 Dartmouth Park Road is located on the eastern side of the valley, close to the base, on ground sloping up to a local highpoint in the east and in the north. It is therefore anticipated that water should be flowing down from the north and east towards the line of the river, in a south-west direction. Based on this, the neighbouring basement of 46 Dartmouth Park Road is located upstream of the proposed basement development.

2.3 Proposed development

Ground level on site is at approximately 50m above Ordnance Datum (mOD) in the rear garden to the north and at 50.8mOD in the front garden adjacent to Dartmouth Park Road. It is proposed to excavate predominantly beneath the footprint of the property to form a new single storey basement level at 48.19mOD, with the overall basement excavation being approximately 47.6mOD.

The basement will be constructed using traditional underpinning techniques with concrete underpins constructed in sequence typically 3m in height. The underpin walls are likely to be between 300mm and 600mm thick and would be supported during construction by the provision of temporary propping at top, centre, and bottom of the underpin to restrict movement and provide temporary support.

The basement will be approximately 1m offset from its closest neighbour, No. 46 Dartmouth Park Road, and will infill an existing section of garden over an area of some 2.7m x 4.3m in plan.

Plans of the proposed development are provided in Appendix A.

[5] Ove Arup and Partners (2010) *Camden Geological, Hydrogeological and Hydrological Study: Guidance for subterranean development.* London Borough of Camden.

3. STAGE 1 - SCREENING

3.1 Screening Stage 1 report

A screening assessment was undertaken by CGL[1] in January 2015 based on structured guidance presented in Camden Borough Council's CPG4, and the findings are summarised below.

3.1.1 Subterranean (Groundwater)

The proposed development will entirely be constructed within the London Clay which is designated as an 'unproductive stratum', and therefore groundwater is not expected to be encountered during the development. Shallow perched groundwater may be encountered within Made Ground or resting above the surface of the London Clay Formation, however, this is not expected to be laterally pervasive.

The rear garden of the site is currently covered in concrete hard-standing and therefore the proportion of hard-standing will not be increased as part of the proposed development. The proposed development is not considered to significantly affect run-off/surface attenuation characteristics given the impermeable nature of the London Clay.

3.1.2 Slope/Land Stability

Despite the construction of the basement significantly increasing the differential depth of foundations between No. 46 and No. 44, it is noted that the foundations of No. 46 are offset by approximately 1m and therefore will not be directly underpinned. Additionally, the proposed basement is partial, and will be constructed within the stable London Clay.

No impact is associated to neighbouring structures assuming good workmanship and a well-constructed scheme are carried out.

3.1.3 Surface Flow and Flooding

As the site will remain a residential property there will be no significant change of use that may increase discharge loads to the existing sewer and drainage systems. The basement will be constructed predominantly beneath existing building and therefore run-off/surface attenuation characteristics will not be significantly affected.

Whilst Dartmouth Park Road is not located within an area at risk from surface water, York Rise, directly to the south-west of the site, is within an area at risk from surface water and a Flood Risk Assessment is understood to have been carried out.

3.1.4 Cumulative impacts

It is expected that cumulative impacts from the construction of the basement may be negligible given that there are no recorded basements directly adjacent to the proposed development, and that groundwater flow is not anticipated within the London Clay.

3.2 Summary

On the basis of the screening exercise, it was originally considered that no further investigation or impact assessment would be required. On receipt of additional information and queries from neighbouring stakeholders, however, it was considered prudent to undertake additional investigation to address potential concerns as set out in Section 4, Scoping.

4. STAGE 2 – SCOPING

4.1 Introduction

Following the completion of the Stage 1 Screening Report, concerns were raised by owners of neighbouring properties on the potential impact of the basement on groundwater levels and flooding. The presence of the historical *River Fleet* was highlighted which is thought to have flowed north-south to the west of the site, between York Rise and up to 115m to the west of the site.

A ground investigation was subsequently commissioned by the Client to confirm the underlying geological sequence, establish groundwater levels and to derive geotechnical design parameters to support basement impact assessment calculations.

The ground investigation has:

1. Installed groundwater monitoring standpipes to determine groundwater levels and conditions on site;

2. Undertaken in-situ testing to assess the strengths of the ground and to support geotechnical assessment and;

3. Obtained soil samples for geotechnical laboratory testing in order to classify the soils on site and to support geotechnical design.

5. STAGE 3 – CURRENT GROUND INVESTIGATION

5.1 Fieldwork

A ground investigation was undertaken on 24th April 2015 and comprised four window sampler boreholes (WS1 to WS4) to 6.0m below ground level (mbgl) and three foundation inspection pits (TP1 to TP3) to a maximum depth of 1.10mbgl. The exploratory hole records are provided within Appendix B and an exploratory hole location plan is presented in Figure 3.

Standard Penetration Tests (SPTs) were undertaken throughout the boreholes at 1m intervals to a depth of 6mbgl and groundwater monitoring wells were installed in each borehole location. Hand shear vane (HSV) tests were carried out where possible on the borehole arisings.

Prior to commencing ground penetrating works, each exploratory hole location was cleared for buried services by a specialist location contractor using radio detection and ground penetrating radar techniques. A Thames Water plan provided by the Client indicated a water pipe diagonally crossing the rear courtyard in a north-south orientation.

Trial pits were excavated by hand internally to investigate existing foundations.

The exploratory holes arisings were logged and representatively sampled by a suitably qualified engineer from CGL. Samples were retrieved for geotechnical testing and to characterise the near surface conditions across the site. The investigation was undertaken generally in accordance with the requirements set out within BS 5930:1999[6].

5.2 Monitoring

A single groundwater monitoring visit was undertaken on 30th April 2015 following completion of the site works.

The monitoring results are included in Appendix C.

[6] British Standards Institution (1999 and 2010) *Code of practice for site investigations.* BS 5930:1999 + A2:2010.

5.3 Geotechnical laboratory analysis

Selected soil samples were submitted to an accredited laboratory for geotechnical testing including:

- Atterberg Limit tests; and
- Moisture content.

Additionally, soil samples were sent to an accredited chemical laboratory for organic content tests. The geotechnical analysis results are included in Appendix D.

5.4 Ground and groundwater conditions

The ground conditions encountered on site during the intrusive investigation are summarised in Table 1 and a Conceptual Site Model for the proposed development is presented in Figure 4.

Approximately 1m of Made Ground was encountered beneath concrete hard-standing within the north of the site and south shingle gravel within the front of the site. The Made Ground was found to overlie between 1.0m and 1.2m of firm to stiff grey clay, potentially Head Deposits, in the north of the site, however this material was absent in the south of the site. The Weathered London Clay Formation was encountered between 0.8mbgl and 2.2mbgl, and proven to the base of the boreholes at 6.0mbgl. Reworked Weathered London Clay was encountered in trial pit TP3 only at a depth of 0.28mbgl, and was proven to the base of the trial pit at 1.05mbgl.

Table 1. Summary of ground conditions

Stratum	**Depth to top (mbgl) [mOD]**	**Thickness (m)**
[MADE GROUND] Concrete/pea shingle gravel over soft dark brown grey black slightly sandy slightly gravelly silt / firm to stiff dark orange brown grey slightly sandy gravelly clay / dark grey slightly gravelly sand. Gravel is angular to subrounded fine to coarse of brick, ceramic tile, flint and concrete. Sand is fine to coarse. Frequent roots and rootlets. Clay is desiccated in WS3.	0.0 [50.84 to 49.96]	0.8 to 1.2
Firm to stiff dark grey brown speckled black silty CLAY. Occasional black organic material. *Encountered in WS1 and WS2 only.* [HEAD DEPOSITS]	0.9 to 1.2 [49.40 to 48.76]	1.0 to 1.1

Stratum	Depth to top (mbgl) [mOD]	Thickness (m)
Firm dark grey orange brown slightly gravelly silty clay. Gravel is angular to subangular fine to coarse of brick. Rare roots and rootlets. *Encountered in TP3 only.* [REWORKED WEATHERED LONDON CLAY]	0.28 [50.02]	Proven to 1.05mbgl
Stiff light orange brown to light grey brown mottled silty CLAY. Frequent fine to coarse selenite crystals. Frequent fine sand laminations and occasional claystone bands. Sand is fine to coarse. [WEATHERED LONDON CLAY FORMATION]	0.8 to 2.2 [50.04 to 47.76]	Proven to 6.0mbgl

Further details of the ground conditions encountered are set out in the following sections. A plot of SPT 'N' value versus level is presented in Figure 5. A plot of undrained shear strength against level is presented in Figure 6.

5.4.1 Made Ground

Made Ground was recorded in each exploratory hole location to depths between 0.8mbgl and 1.2mbgl. The stratum comprised soft, dark brown, grey, black slightly sand, slightly gravelly silt, firm to stiff, dark orange, brown, grey slightly sandy, slightly gravelly clay and dark grey, slightly gravelly sand. The gravel was recorded as angular to subrounded, fine to coarse brick, concrete, ceramic and flint. The clay encountered in WS3 was noted to be desiccated.

A single SPT was undertaken in the Made Ground and recorded an SPT 'N' value of N=6.

5.4.2 Reworked London Clay Formation

Reworked London Clay was encountered in trial pit TP3 only at a depth of 0.28mbgl, and comprised firm dark grey orange brown silty clay with occasional angular and subangular brick fragments.

5.4.3 Head Deposits

Head Deposits were encountered in boreholes WS1 and WS2 within the north of the site, and comprised firm to stiff dark grey brown speckled black silty clay with occasional black organic material. The clay has been interpreted as Head Deposits given the hillslope setting of the site and the stiffness of the material encountered. The stratum ranged between 1.0m and 1.2m in thickness

Two SPTs were undertaken in the Head Deposits and recorded SPT 'N' values of 6 and 7. Classification testing has been undertaken on three samples from the Head Deposits and indicated the following parameters:

- Moisture content between 35.4% and 41.1%;
- Liquid Limit between 79% and 86%;
- Plastic Limit between 26% and 31%; and
- Plasticity Indices between 48% and 59%.

Based on the above data, the Head Deposits may be classified as clay of very high plasticity[6] with a high volume change potential[7]. Chemical testing of the Head Deposits recorded organic matter contents between 0.1% and 2.9%. HSV tests undertaken in the Head Deposits recorded undrained shear strength (c_u) values between 37kPa and 39kPa.

5.4.4 Weathered London Clay Formation

The Weathered London Clay Formation was encountered in each borehole location and comprised firm to stiff, light orange brown silty clay. Fine partings of sand and selenite crystals were recorded throughout the stratum. Additionally, claystone bands were encountered in WS1 and WS4 at depths of 2.8mbgl and 5.4mbgl, respectively. The clay was found to be very stiff and mottled, light brown grey in colour from between 4.8mbgl to 5.6mbgl, indicating a transition into an un-weathered state.

SPT 'N' values for the Weathered London Clay ranged from 7 to 13, correlating to an undrained shear strength (Cu) of between 31.5kPa and 58.5kPa (where $c_u = 4.5N$[8]), correlating to a clay of medium strength[6]. An SPT 'N' value of 26 was recorded in WS4 at a depth of 5.0mbgl, however, a claystone band was observed at this depth and therefore the SPT is likely to have been influenced by this hard band. HSV tests undertaken in the Weathered London Clay ranged between 40kPa and 57kPa between 0.8mbgl and 3.2mbgl.

Classification testing has been undertaken on five samples from the Weathered London Clay and indicated the following parameters:

[7] NHBC (2013) *NHBC Standards. Chapter 4.2 Building near trees.*
[8] Stroud, M.A. (1957) The standard penetration test in insensitive clay and soft rock. *Proceedings of the European Symposium on Penetration Testing.* 2, 236-375.

- Moisture content between 30.4% and 33.9%;
- Liquid Limit between 69% and 81%;
- Plastic Limit between 24% and 28%; and
- Plasticity Indices between 43% and 53%.

Based on the above data, the Weathered London Clay may be classified as clay of high to very high plasticity[6] with a high volume change potential[7].

Based on laboratory testing and established correlations for the Weathered London Clay, there is no clear increase in strength with depth, and therefore an undrained shear strength (c_u) of 40kPa is recommended for design.

5.4.5 London Clay Formation

When considering the ground movement associated with the proposed development, it is unrealistic to assume a c_u of 40kPa for the entire London Clay Formation. The 'fresh', unweathered London Clay Formation is anticipated to underlie the Weathered London Clay encountered during the ground investigation as arisings from the window sampler boreholes were noted to become brown grey towards the base.

For the purpose of the ground movement analysis calculations, the following ground strength profile is recommended for the London Clay Formation based on published data for the well-studied London Geology[9]. The top of the unweathered London Clay Formation is assumed to be 43.0mOD (some 7mbgl):

$$c_u \text{ (kPa)} = 50 + 8z$$

where 'z' indicates the depth below the London Clay surface.

5.4.6 Groundwater

Groundwater seepages were encountered during the drilling of borehole WS4 at a depth of 5.4mbgl. A claystone band was encountered between 5.4mbgl and 5.45mbgl and this groundwater is considered as local perched water that is not laterally pervasive.

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[9] Burland, Standing J.R., and Jardine F.M. (eds) (2001), *Building response to tunnelling, case studies from construction of the Jubilee Line Extension London*, CIRIA Special Publication 200.

Groundwater seepage occurred during the excavation of trial pit TP3 from the Reworked London Clay at 1.0mbgl. A standing groundwater level of 1.01mbgl was recorded within trial pit TP3 upon completion of the excavation. This is considered as local perched groundwater within disturbed ground and around footings, which may have created voids in which infiltrating surface water and run-off can be stored.

A single groundwater monitoring visit was undertaken on 30th April 2015 and the results are summarised in Table 2 below.

Table 2. Summary of groundwater during monitoring

Exploratory Hole	Response zone (m) [Stratum*]	Depth to groundwater (mbgl) [mOD]
WS1	0.5 to 6.0 [MG, HD & WLC]	5.34 [44.62]
WS2	1.0 to 2.0 [HD]	1.84 [48.46]
WS3	0.5 to 6.0 [MG & WLC]	5.79 [44.95]
WS4	1.0 to 6.0 [WLC]	2.19 [48.65]

* MG = Made Ground; HD = Head Deposits; WLC = Weathered London Clay

The water levels recorded are not consistent across the site and for the most part appear to vary depending on the depth of the response zone. Water was generally recorded within 0.3m to 0.7m of the base of the standpipe. This result would generally suggest very slow seepage through the soils and into the standpipes, or possibly surface runoff into the standpipes over time. Window sample hole WS4 is an exception to this, and water in this location was recorded to be some 4m above the base of the standpipe. In this location a water-bearing claystone band was encountered, and may have given rise to a local influx of water. The claystone band was at a depth of 5.4mbgl (approximately 44.6mOD) and is significantly below the proposed level of the basement (formation at 47.6mOD).

The soils encountered have been found in all cases to contain a significant clay fraction, and permeabilities would be expected to be of the order of 10^{-9} or 10^{-10} m/s. Flow rates would therefore be expected to be very slow, with groundwater flowing at a rate of approximately 3mm to 30mm per year within the mass of the soils.

5.4.7 Ground gas

A single round of ground gas monitoring was undertaken as part of the current investigation on 30th April 2015 during a falling pressure system with atmospheric pressure system. A GFM435 gas analyser was used to monitor gas flow, oxygen, carbon dioxide and methane at each visit. The findings of the monitoring visit are summarised in Table 3 below.

Table 3. Summary of gas monitoring

Borehole	Maximum flow rate (l/hr)	Minimum O_2 (% vol in air)	Maximum CO_2 (% vol in air)	Maximum CH_4 (% vol in air)
WS1	<0.1	16.0	4.7	<0.1
WS2	<0.1	19.7	1.3	<0.1
WS3	<0.1	19.5	1.8	<0.1
WS4	<0.1	19.8	1.4	<0.1

Gas screening values have been calculated in accordance with CIRIA 665[10] using the data obtained during the four ground gas monitoring visits. Based on the worst case scenario for carbon dioxide (4.7% v/v) and methane (<0.1% v/v), and the maximum flow rate (<0.1l/hr) recorded across the site, the Gas Screening Values (GSVs) are <0.0047l/hr and <0.0001l/hr for carbon dioxide and methane, respectively which conforms to Characteristic Situation 1. Therefore, no specific ground gas protection measures are recommended on the basis of this single monitoring visit.

5.4.8 Boundary wall foundation levels

Trial pits TP1 and TP2 were excavated internally adjacent to the north-east boundary wall of the existing property at ground floor level (approximately 51mOD). Trial pit TP1 recorded the underside of the brick footing of the north-east boundary wall in the living room at 0.76mbgl (50.24mOD). Trial pit TP2 recorded the underside of the north-east boundary wall and party wall between the kitchen and the living room at 0.85mbgl (50.15mOD) in the kitchen.

Trial pit TP3 was excavated externally due to access restrictions within the kitchen adjacent to the kitchen wall and garden wall, and revealed the underside of the brick foundation of

[10] CIRIA (2007) *Assessing risks posed by hazardous ground gases to buildings.* CIRIA Report C665, London.

the existing building at 1.0mbgl (50mOD). The underside of the brick garden wall was encountered at 0.33mbgl (49.97mOD).

5.5 Geotechnical design parameters

Geotechnical design parameters and design levels for the ground conditions encountered in the intrusive investigation have been derived based on the soil descriptions and in-situ testing, published information on the well-studied London geology and nearby investigations, including previous CGL investigations in the area. The parameters are outlined in Table 4 below and are unfactored (Serviceability Limit State) and considered to be 'moderately conservative' design values.

Table 4. Geotechnical design parameters

Stratum	Design Level (mbgl) [mOD]	Bulk Unit Weight γ_b (kN/m^3)	Undrained Cohesion c_u (kPa) [c']	Friction Angle ϕ' (°)	Young's Modulus E_u (MPa) [E']
Made Ground (cohesive)	0.0 [50.0]	19	30 [0]	22[a]	10[b] [10][b]
Head Deposits	1.1 [48.9]	19	30	22[a]	18[b] [16.2][b]
Weathered London Clay Formation	2.1 [47.9]	20	40 [5]	24[a]	24[b] [18][b]
London Clay Formation	43.0	20	50 + 8z[c] [5]	24[a]	30 + 4.8z[b] [22.5 + 3.6z][b]

a. *BS 8002:1994 Code of practice for Earth retaining structures, British Standards institution.*
b. *Burland, Standing J.R., and Jardine F.M. (eds) (2001), Building response to tunnelling, case studies from construction of the Jubilee Line Extension London, CIRIA Special Publication 200.*
c. *z = depth below surface of London Clay*

5.6 Allowable bearing pressure

Based on the detailed drawings and ground conditions encountered during the ground investigation, the basement slab and underpins will be bearing into the top of the London Clay Formation. Based on a factor of safety of 3 to control settlements (i.e. less than 25mm) an allowable bearing pressure of 80kPa is recommended for the London Clay Formation at the basement formation level of 47.6mOD.

6. SUBTERRANEAN (GROUNDWATER) FLOW (STAGE 4)

6.1 Introduction

Shallow groundwater may be encountered during the excavation for the proposed basement in isolated pockets, or as very slow seepages within the clay soils on site. The proposed basement formation level is at 47.6mOD and groundwater has locally been recorded at perched levels slightly higher than this. It is anticipated that groundwater ingress will be very slow (if any) and controllable during construction with limited sump pumping equipment.

6.2 Impacts on drainage

The proposed development is to comprise two residential properties and therefore no significant change of use is anticipated that may increase discharge loads to the existing sewer and drainage systems. Perched water within the Made Ground, Head Deposits and London Clay is likely to be impersistent and of low flow rates. The rear garden area is currently covered in concrete hard-standing and no increase in the area of hardstanding on site is proposed. Therefore there is no reduction in the attenuation properties of the site, and no reduction in flood storage capacity.

The ground investigation has not recorded a consistent ‘water table’ within the soils on site and levels recorded to date have varied significantly and likely to have been controlled by surface runoff. A single groundwater strike was recorded within the boreholes during drilling, associated with a claystone band at a depth significantly below the proposed basement formation level. On this basis, the new basement will not have a noticeable effect on groundwater levels or moisture contents within the ground in the vicinity of the site. Flow rates within the soils of any groundwater that may be present generally on site, and that could potentially be established over the long term, would be so slow as to be effectively negligible.

A reduction in the volume of perched water would have a negligible effect on pore pressures within the thin layer of Made Ground encountered during the ground investigation and would not affect the foundations of the neighbouring properties. Additionally, the over-consolidated London Clay Formation would also be unaffected by changes to the volume of perched water within the Made Ground.

6.3 Recommendations for groundwater control

Observations on groundwater should be recorded during excavation and appropriate mitigation strategies put in place should limited volumes of perched water be encountered. It is anticipated that localised sump pumping would be sufficient to control anticipated limited inflows.

7. SURFACE FLOW AND FLOODING (STAGE 4)

No significant changes in peak drainage outflows are anticipated from the site as the site will remain a residential property. No increase in the area of hardstanding on site is proposed and therefore there is no reduction in the attenuation properties of the site, and no reduction in flood storage capacity.

The site lies outside EA designated Flood Zones or an area at risk from surface water flooding. However, York Rise which is located adjacent to the site is recorded to have flooding during 1975 and is at risk from surface water flooding. It is understood that a flood risk assessment has been undertaken for the site by others.

It is considered that the development will have a negligible impact on surface water flow and flooding. In addition, the basement is likely to produce enhanced attenuation given its requirement to be drained in accordance with Building Regulations.

It is understood that the neighbouring basements to the east of the site have reported flooding following heavy rainfall. It is noted that these buildings are constructed on sloping ground which slopes upwards to the east and away from the site at No. 44 Dartmouth Park Road. Runoff to those buildings is therefore controlled by properties upslope of them and the development at No. 44 will not affect the existing basements in this regard. Given the ground conditions prevalent on site, it is likely that the existing flooding is due to poor surface drainage leading to excess runoff from properties upslope of the site.

The risk to the proposed basement will be controlled through the design of appropriate basement drainage, which will be required in any case to satisfy Building Control requirements and to provide a habitable environment.

8. GROUND MOVEMENT ASSESSMENT (STAGE 4)

8.1 Introduction

This section provides calculations to assess ground movements that may result from the construction of the basement extension and how these may affect adjacent structures and differential settlement.

It is understood that reinforced concrete underpinning will be constructed to form the new basement wall and support to the existing perimeter foundations.

Ground movements are derived from:

- Heave movements: The Head Deposits and London Clay are susceptible to short term heave and time dependant swelling on unloading, which will occur as a result of basement excavation, generating upward ground movements.
- Underpin deflection: Underpins act as stiff concrete retaining walls, which limits the potential for wall deflection. Appropriate temporary works are critical in controlling such deflections.
- Settlement: Construction of underpins beneath existing foundations can lead to settlement. The amount of settlement depends on the quality of workmanship in constructing the underpins, in particular in dry-packing between the existing foundation and the new underpins. In addition, there may be settlement as structural loads are transferred to greater depth; on to soils that have not previously been loaded.
- Seasonal ground movements: The London Clay is susceptible to seasonal effects of fluctuating moisture content causing the clay to behave in a shrink-swell manner, thus potentially causing seasonal heave and settlement of the foundations. However, as no shared party walls exist at the site the impact of differential settlement from seasonal ground movements is considered to be negligible. Three existing mature trees between approximately 8m and 10m in height are located along York Rise and rear garden of 24A York Rise. Smaller trees approximately 4m in height were observed within the rear garden of 46 Dartmouth Park Road.

8.2 Conceptual Site Model and critical sections

A Conceptual Site Model (CSM) of the proposed site conditions has been developed based on the available data to illustrate the conceptual understanding of the ground model (see Figure 4). A critical section has been identified for the assessment:

- Critical Section A-A: Line of section approximately 12m in length orientated south-west/north-east, spanning the width of the structure of 46 Dartmouth Park. The section is taken mid span along the excavation, representing worst case conditions affecting 46 Dartmouth Park Road.

8.3 Underpin construction sequence

The basement beneath the existing property will be constructed using traditional underpinning techniques with pins excavated in sequence in bays typically 1.0m wide. It is assumed that the underpins will be constructed in a single lift within supported trenches. Temporary propping will be installed at the top, middle and bottom of the excavation to resist sliding and rotation of the wall prior to casting the lower and upper basement concrete floor slabs. Temporary propping should remain in place until the basement and ground floor slabs develop sufficient strength to sustain soil loads. The underpins will generally be supported in the permanent condition by the ground floor and basement slab, which should be cast before removing the temporary propping.

It is understood that a heave mat is proposed beneath the basement, the thickness and specification of which will be specified during the detailed design phase.

8.4 Underpin loading

Vertical line loads of a maximum of 100kN/m have been calculated for the new underpins and existing structure by the structural engineers (Constructure Ltd.) as presented in Appendix E.

Additionally, three mass concrete pads of 1.5m x 1.5m and 0.75m thickness have been designed by the structural engineers with a maximum bearing pressure of 100kN/m^2 at the underside of the pad. However, to limit the pressure of the concrete pads to the allowable bearing capacity of the soil (80kN/m^2), pad dimensions of 1.7m x 1.7m have been used in the long term ground movement analysis.

8.5 Ground movements arising from basement excavation

A ground movement assessment has been undertaken using OASYS Limited *VDISP* (***V**ertical **DISP**lacement*) analysis software. *VDISP* assumes that the ground behaves as an elastic material under loading, with movements calculated based on the applied loads and the soil stiffness (E_u and E') for each stratum input by the user. *VDISP* assumes perfectly flexible loaded areas and as such tends to overestimate the movements in the centre of loaded areas and underestimate movements around the perimeter. To account for this, the structure has not been modelled as an evenly loaded flexible raft and the loads from the underpins around the perimeter, as summarised in the previous sections, have been accounted for and modelled in the analysis.

The proposed development gives rise to a net unloading of the underlying strata both during construction and over the long term. The excavation will unload the soils at the basement formation level (47.6mOD) by some 65kPa. This value assumes an excavation depth of 3.1m and a typical bulk unit weight of 19kN/m^3 for the excavated Made Ground and Head Deposits, and an excavation depth of 0.3m and a typical bulk unit weight of 20kN/m^3 for the London Clay Formation to formation level.

It has been assumed in the analysis that the basement construction will be undertaken in one lift. During the analysis, the underpin loads are applied to the perimeter of the basement and the loads due to excavation (i.e. unloading of the ground) have been applied to the whole site, including below the underpins.

The heave/settlement assessment undertaken within *VDISP* assumes perfect workmanship in the underpin construction and does not allow for settlement of the dry pack between existing footings and the new concrete. With good construction practice, actual settlements would be expected to not exceed 5mm. This value is typically applied to the overall ground movement and corresponding impact assessment to calculate a predicted damage category for the adjacent properties.

The results of the settlement analysis are summarised in Table 5, showing predicted heave or settlement values beneath the perimeter underpins, which is represented visually as short and long term displacement contours in Figure 7.

Table 5. Summary of underpin displacements

Location	Predicted vertical displacement[a] (mm)			Allow workmanship settlement = 5mm[b]
	Short term conditions	Long term conditions	Total displacement (mm)	Total displacement (inc. workmanship) (mm)
Front basement wall	-8.0	-19.3	-27.3	-22.3
Rear basement wall	-3.7	-10.5	-14.2	-19.2
South-west basement wall	-2.1	-7.0	-9.1	-4.1
North-east basement wall	-2.6	-8.4	-11.0	-6.0
Central internal wall	-9.8	-18.7	-28.5	-23.5
Southern internal wall	-6.9	-18.1	-25.0	-20.0
Mass concrete pads	N/A	-14.7	-14.7	-9.7
46 Dartmouth Park Road	-1.8	-6.3	-8.1	N/A[c]

a. A positive number denotes settlement and a negative number denotes heave
b. Assumes a good standard of workmanship with appropriate temporary works procedures and quality assurance mechanisms during construction.
c. Not subject to workmanship settlement as party walls are not shared

Short term heave and long term heave is predicted to be at a maximum beneath the central wall at a basement excavation level of 47.6mOD with a values of 23.5mm.

A maximum of 1.8mm of short term leave is predicted to occur beneath the nearest wall of 46 Dartmouth Park Road (Critical Section A-A) and a further 6.3mm long term heave is predicted to give a maximum total heave of 8.1mm. Less than 1mm of settlement is predicted on the far side of 46 Dartmouth Park Road, some 14m from 44 Dartmouth Park Road.

It is noted that over the long-term, movements are likely to be restrained by the new structure and therefore, are unlikely to fully realise the predicted values.

Full *VDISP* output can be provided upon request.

8.6 Ground movement due to underpin wall deflection

Due to the relatively shallow basement depth and the high stiffness of the reinforced concrete underpins, long term deflection is considered to be negligible (i.e. <2mm). This is based on CGL's experience with similar underpinned basement developments in the area.

During the works, lateral displacements will be resisted by sequential propping of the underpinned foundations. Trench sheeting should be employed where required to prevent localised collapse of the soil. As the underpin stems are cast, the props should be removed, ensuring that the excavation is continually controlled, and will be replaced whilst the concrete cures. Initially, the underpins will be propped against the central soil retained in the centre of the site. Once this has been excavated, the props will be relocated to a sacrificial thrust block constructed beneath the level of the proposed floor slab.

8.7 Seasonal ground movement due to shrink/swell

As discussed in Section 8.7 above, the seasonal ground movements due to normal clay shrinkage and swelling may be influenced by the introduction of a basement structure. With reference to Section 5.4, the London Clay beneath the site has been classified as clay of 'high' to 'very high' plasticity with a high volume change potential, and is therefore susceptible to seasonal shrinking and swelling. Preliminary calculations based on the moisture contents and Liquid Limits of the Head Deposits and London Clay indicate that the clay is not desiccated.

Three existing mature trees between approximately 8m and 10m in height are located along York Rise and rear garden of 24A York Rise. A further semi-mature tree is located in the rear garden of 46 Dartmouth Park Road, approximately 5m from the proposed basement development and is estimated at 4m in height. Trees in shrinkable clay soil can cause significant volume changes giving rise to ground movement which may result in differential movement and cracking of walls depending on the variation of influence of trees on the property and the depth of the foundations. However, 44 Dartmouth Park Road is a detached property and does not share a party wall with the neighbouring properties and therefore the impact from differential settlement from seasonal ground movement due to shrink/swell is considered to be negligible.

NHBC guidelines[7] indicate that a minimum foundation depth of 1.95m is recommended for a mature, moderate water demand tree which is 20m in height and 5m away from the existing building. Therefore the surrounding trees are considered to have a negligible impact on the proposed construction at 44 Dartmouth Park Road due to shrinking and swelling of the clay as the basement foundations will be deeper than this depth.

9. BUILDING DAMAGE ASSESSMENT

9.1 Background and methodology

The calculated ground movements have been used to assess potential 'damage categories' that may apply to neighbouring properties/infrastructure due to the proposed basement construction. The methodology proposed by Burland and Wroth[11] and later supplemented by the work of Boscardin and Cording[12] has been used, as described in *CIRIA Special Publication 200*[13] and *CIRIA C580*[14].

General damage categories are summarised in Table 6 below:

Table 6. Classification of damage visible to walls (reproduction of Table 2.5, CIRIA C580)

Category	Description
0 (Negligible)	Negligible – hairline cracks
1 (Very slight)	Fine cracks that can easily be treated during normal decoration (crack width <1mm)
2 (Slight)	Cracks easily filled, redecoration probably required. Some repointing may be required externally (crack width <5mm).
3 (Moderate)	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 (crack width 5 to 15mm or a number of cracks > 3mm).
4 (Severe)	Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows (crack width 15mm to 25mm but also depends on number of cracks).
5 (Very Severe)	This requires a major repair involving partial or complete re-building (crack width usually >25mm but depends on number of cracks).

For the critical neighbouring developments (i.e. critical sections) the combined impact of short term heave and long term heave due to basement excavation have been combined

[11] Burland, J.B., and Wroth, C.P. (1974). *Settlement of buildings and associated damage*, State of the art review. Conf on Settlement of Structures, Cambridge, Pentech Press, London, pp611-654
[12] Boscardin, M.D., and Cording, E.G., (1989). *Building response to excavation induced settlement*. J Geotech Eng, ASCE, 115 (1); pp 1-21.
[13] Burland, Standing J.R., and Jardine F.M. (eds) (2001), *Building response to tunnelling, case studies from construction of the Jubilee Line Extension London*, CIRIA Special Publication 200.
[14] CIRIA C580 (2003) *Embedded Retaining Walls – guidance for economic design*

to determine the overall ground movement and impact on adjacent properties due to the construction of the basement.

9.2 Damage assessment of neighbouring structures

The maximum deflection ratio and horizontal strain of the neighbouring properties as derived from the ground movement assessment are summarised in Table 12. The method for calculating the deflection ratio for the structure of 46 Dartmouth Park Road is presented graphically in Figure 8. The deflection ratio is calculated by combining the ground movement profiles from heave due to excavation and settlement due to underpin loading.

A value of limiting horizontal movement is provided, setting out the maximum allowable horizontal movement of the underpins to restrict predicted damage to within 'very slight'. Movements above this would place the predicted damage category into Category 2, which, whilst acceptable in principle under CPG4 would not be desirable. With no horizontal movements, the predicted damage category is 0, or 'negligible'.

Table 7. Summary of ground movements and corresponding damage category

Boundary Wall Reference	Limiting horizontal movement [a] (mm)	Calculated maximum vertical deflection (mm)	Horizontal Strain, εh (%)	Deflection ratio Δ/L [b] (%)	Damage category
Section A-A: 46 Dartmouth Park Road	9.0	1.25	0.069	0.001	1 – very slight

a. See Box 2.5 (v) CIRIA C580 (2003) Embedded retaining walls guidance for economic design. (δ_h = horizontal movement in metres). Maximum movements to ensure horizontal strain of adjacent properties permits levels of damage at Category 1 'very slight'.

b. See Figure 2.18 (a) CIRIA C580 (2003) Embedded retaining walls guidance for economic design. (L = length of adjacent structure in meters, perpendicular to basement; Δ = relative deflection)

In Critical Section A-A, combined ground movements are likely to result in potential damage to the structure of 46 Dartmouth Park Road equivalent to Category 1 'very slight' damage if lateral movements can be limited to a maximum of 9.0mm. Further sensitivity analysis determines that if lateral deflections could be limited to 5.0mm for Critical Section A-A, damage Category 0 'negligible' is not exceeded, as represented graphically in Figure 9.

It is anticipated that total heave movements will have a damage Category 0 negligible effect on properties greater than 5.0m from the property. All calculations are made to represent a worst case scenario and do not consider mitigating actions such as skin friction against underpins.

10. CUMULATIVE EFFECTS

Basement development, on occasion, has been known to have a cumulative effect on groundwater movement where a number of adjoining basements create a barrier to the free flow of groundwater. Groundwater flow can be inhibited as groundwater is effectively 'backed up' by the development and surrounding basements.

For the current proposed development, there are no known existing basements immediately adjacent to the site (the closest being approximately 1m to the east beneath 46 Dartmouth Park Road) and there is no general groundwater flow that can be influenced by the basement development. Although there may be minor volumes of perched groundwater within the Made Ground, Head Deposits and London Clay, this is likely to be impersistent and of low flow rate. It is therefore considered that cumulative effects are effectively negligible at this time, and in this area.

11. MONITORING STRATEGY

The results of the ground movement analysis suggest that with good construction control, damage to adjacent boundary walls generated by the assumed construction methods and sequence can be controlled to within Category 0 ‘negligible’ damage.

A formal monitoring strategy should be implemented on site in order to observe and control ground movements during construction, and in particular movements of the adjacent properties.

The system should operate broadly in accordance with the ‘Observational Method’ as defined in CIRIA Report 185[15]. Monitoring can be undertaken by installing survey targets to the top of the wall and face of the adjacent buildings. Baseline values should be established prior to commencement of works. Monitoring of these targets should be carried out at regular time intervals and the results should be analysed to determine if horizontal translation of the wall or tilt/settlement of the neighbouring walls is occurring. Regular monitoring of these targets will allow ground movement trends to be detected in a timely manner such that mitigation strategies may be implemented if required.

Monitoring data should be checked against predefined trigger limits and reviewed regularly to assess and manage the damage category of the adjacent buildings as construction progresses.

It is recommended that a condition survey is undertaken on all adjacent walls and property façades prior to the works commencing and ideally when monitoring baseline values are established. Existing cracks or structural defects should be carefully recorded, documented and regularly inspected as construction progresses.

[15] Nicholson, D., Tse, Che-Ming., Penny, C., The Observational Method in ground engineering: principles and applications, CIRIA report R185, 1999.

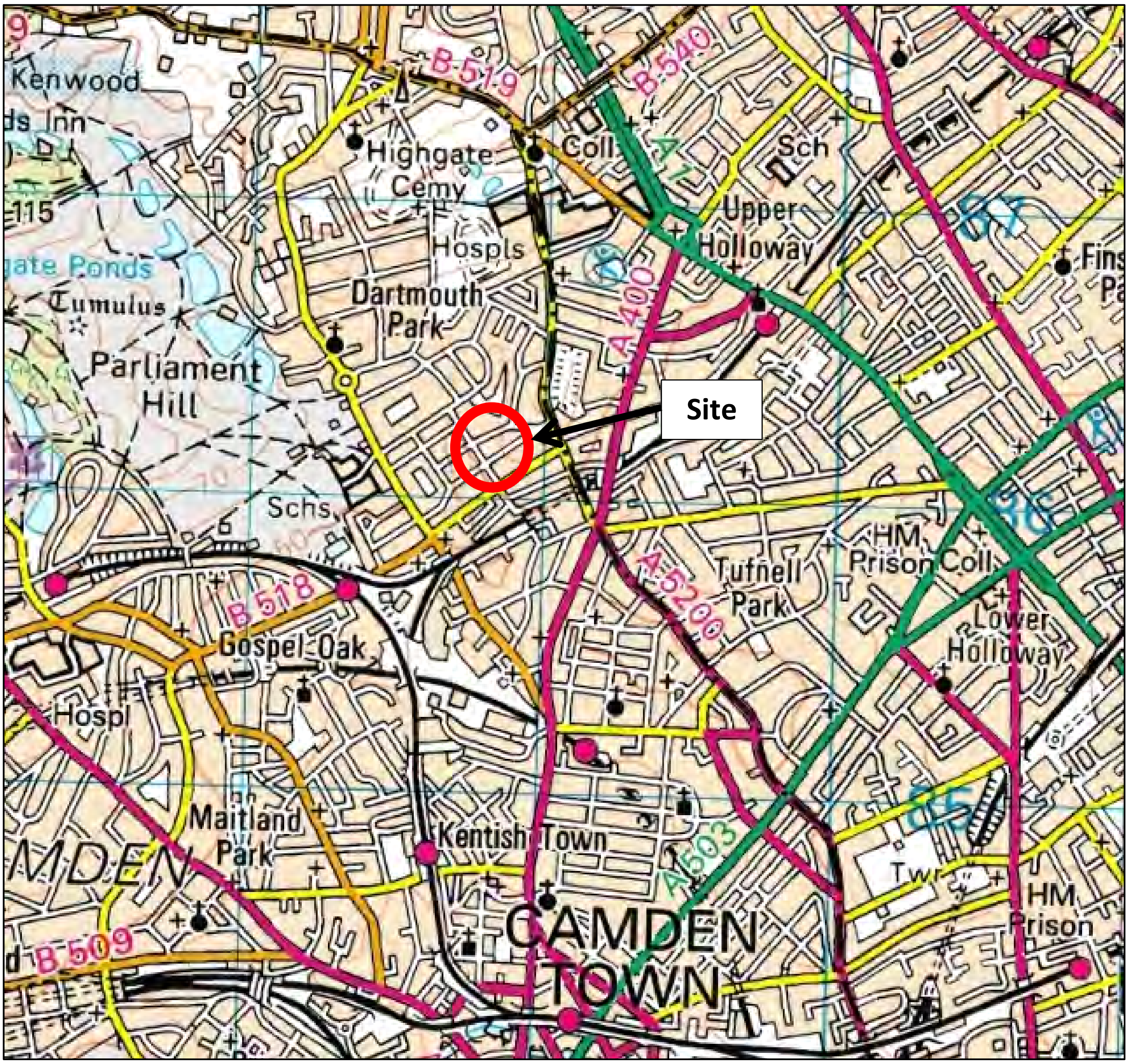
12. NON TECHNICAL SUMMARY

The findings of this Basement Impact Assessment are informed by site investigation data and proposed construction sequences and loadings provided by the structural engineer. The analysis is undertaken on the assumption of high quality workmanship during the construction of the basement.

- The basement excavation will be predominantly within Head Deposits and London Clay, and significant groundwater is not expected to be encountered.
- The development is expected to have a negligible impact on surface water flow and flooding.
- Based on the results of the ground movement assessment, a damage category of Category 0 “negligible” is predicted, with a limiting horizontal movement on the underpins of some 9mm required to control movements to within Category 1 “very slight”.
- It is recommended that a condition survey is undertaken and an appropriate monitoring regime is adopted to manage risk and potential damage to the neighbouring structures as construction progresses onsite.
- The overall heave regime does extend over the neighbouring 46 Dartmouth Park Road, with a combined total heave of 8mm at the closest wall of the property. It is recommended a monitoring regime is adopted to manage risk and potential damage to underlying infrastructure as construction progresses on site.
- There are no known cumulative effects of the proposed basement in conjunction with existing or proposed basements in the surrounding area.

Based on the assessment of basement foundations being at a depth below the level of anticipated shrink/swell effects in the underlying shrinkable clay and the lack of shared party walls with adjacent structures, it is anticipated that the risk to damage due to seasonal ground movements will be low.

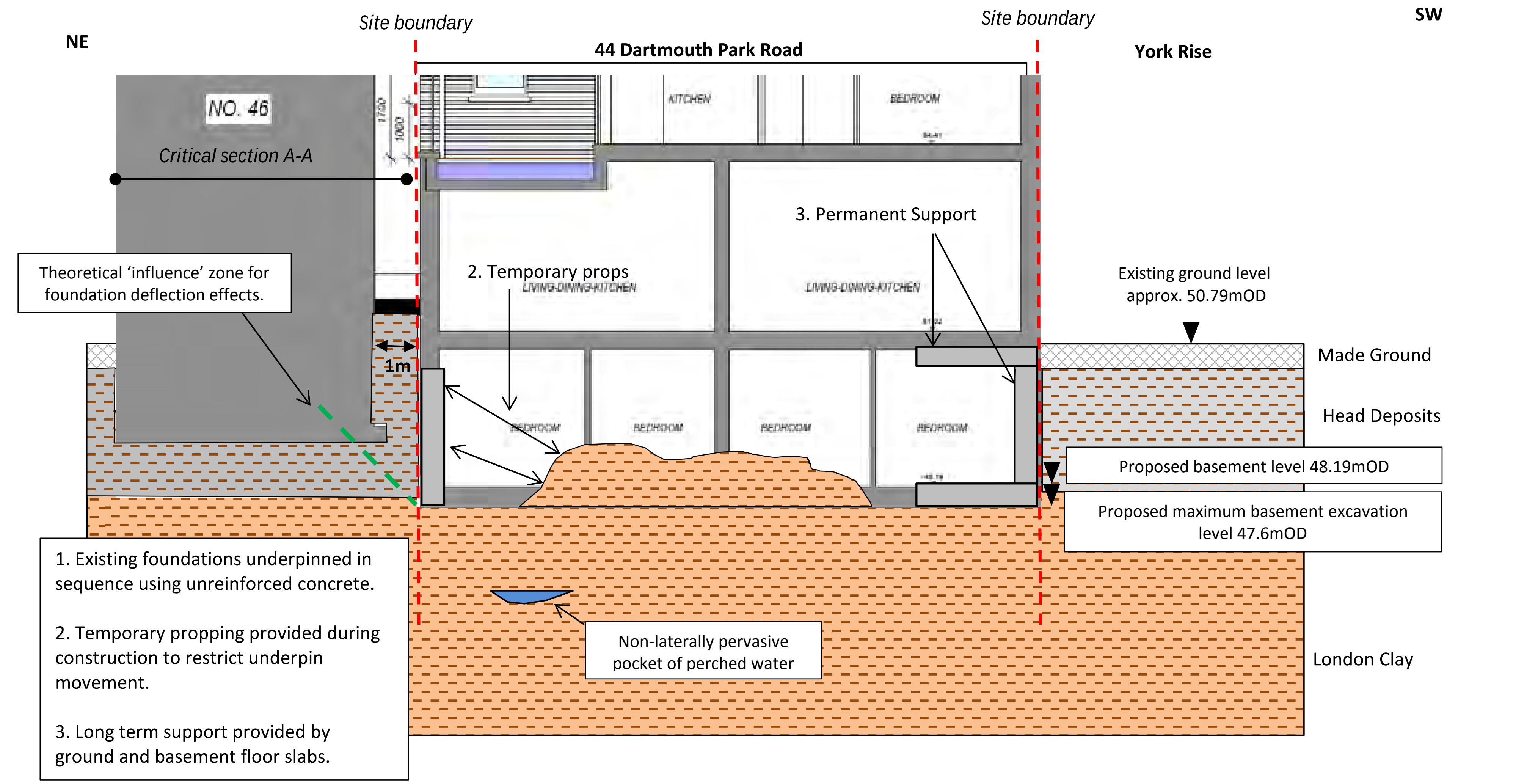
FIGURES



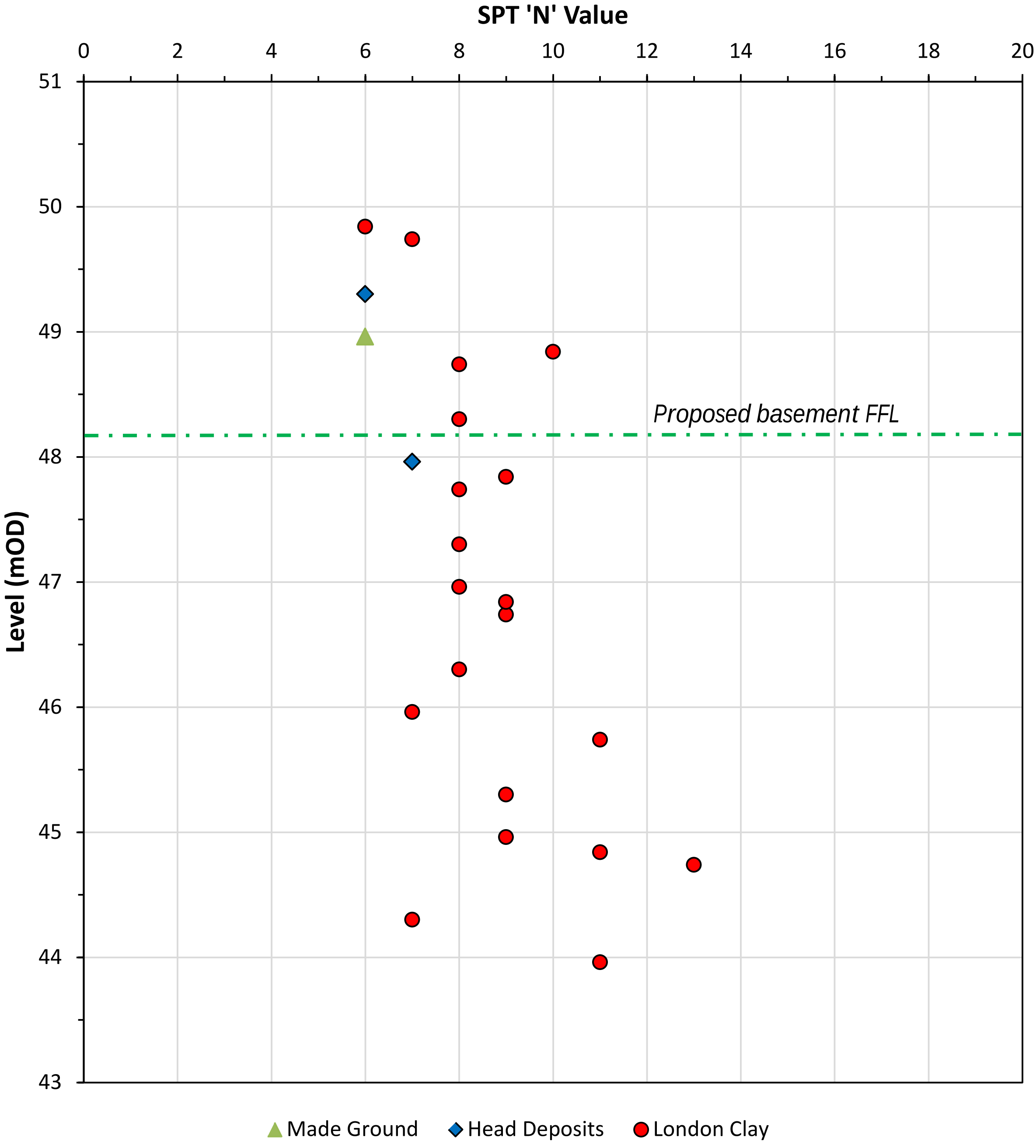
Client	Project	Job No
Five Corners Limited	**44 Dartmouth Park Road, London**	**CG/18249A**
CGL	Title **Site location plan**	**Figure 1**

Client	Project	Job No
Five Corners Limited	**44 Dartmouth Park Road, London**	**CG/18249A**
CGL	Title **Site layout plan**	**Figure 2**

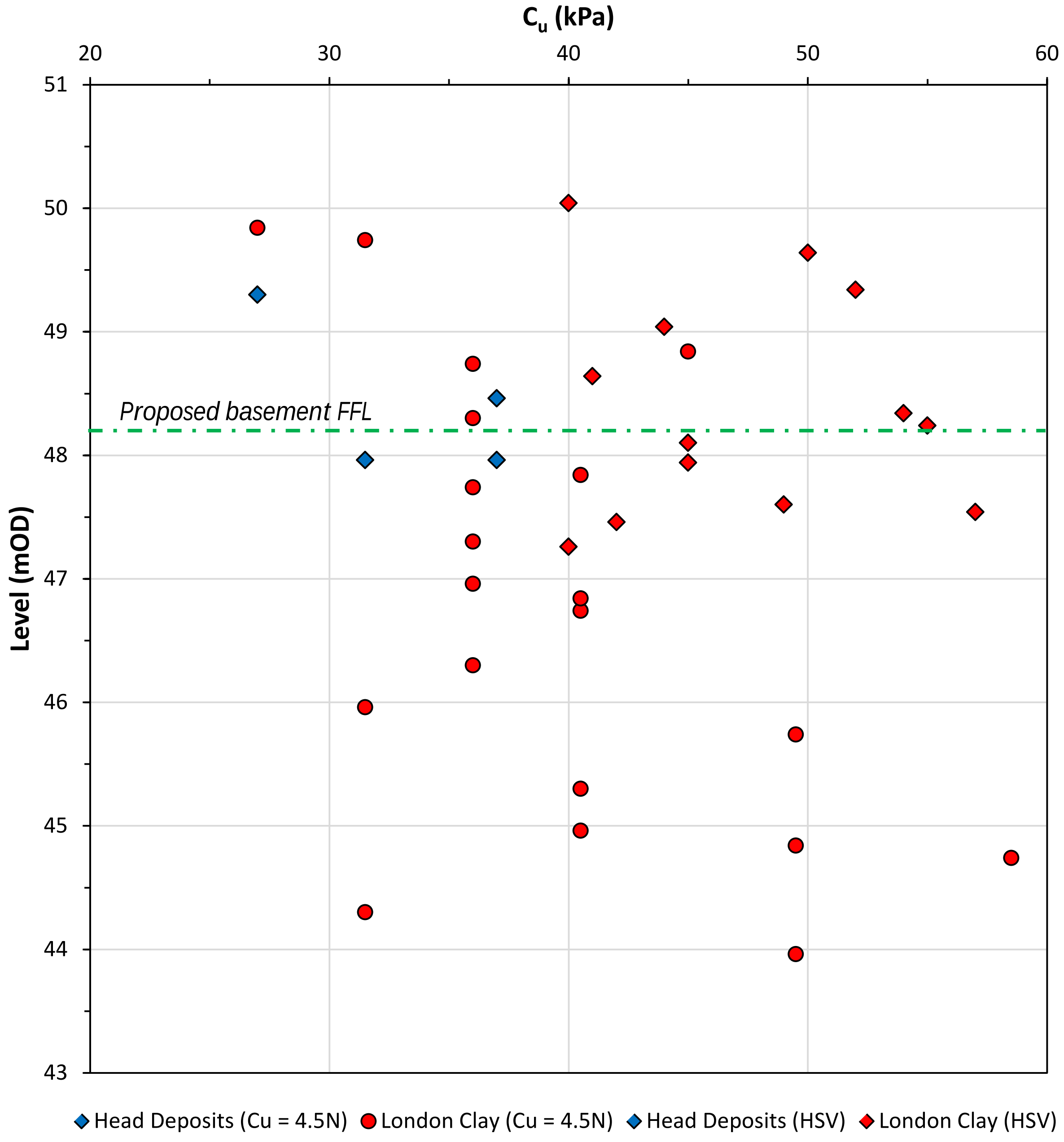
Client	Project	Job No
Five Corners Limited	**44 Dartmouth Park Road, London**	**CG/18249A**
CGL	Title **Exploratory hole location plan**	**Figure 3**



Client	Project	Job No
Five Corners Limited	**44 Dartmouth Park Road, London**	**CG/18249A**
CGL	Title **Conceptual Site Model – Section A-A**	**Figure 4**

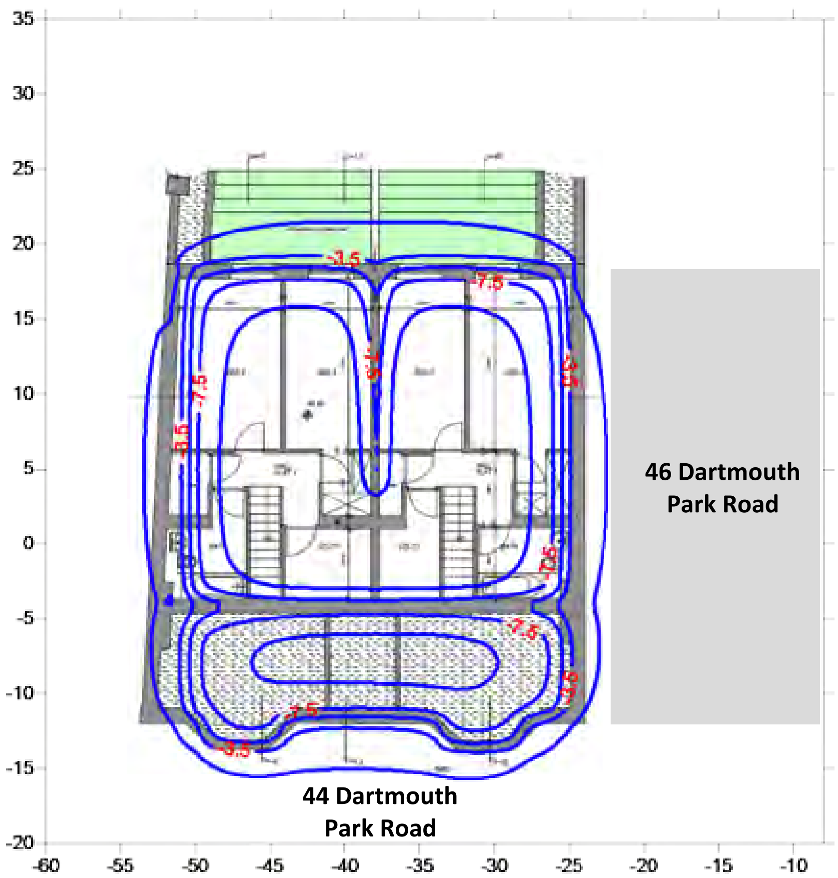


Client	Project	Job No
Five Corners Limited	**44 Dartmouth Park Road, London**	**CG/18249A**
CGL	Title **SPT 'N' value versus level**	**Figure 5**

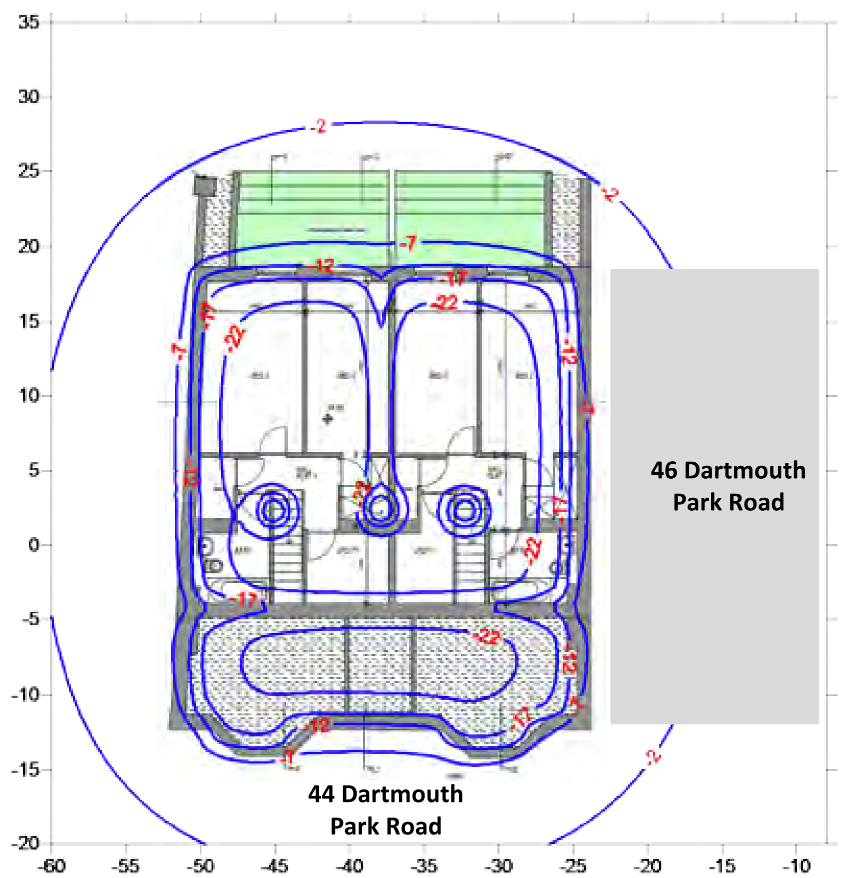


Client	Project	Job No
Five Corners Limited	**44 Dartmouth Park Road, London**	**CG/18249A**
CGL	Title **Undrained shear strength versus level**	**Figure 6**

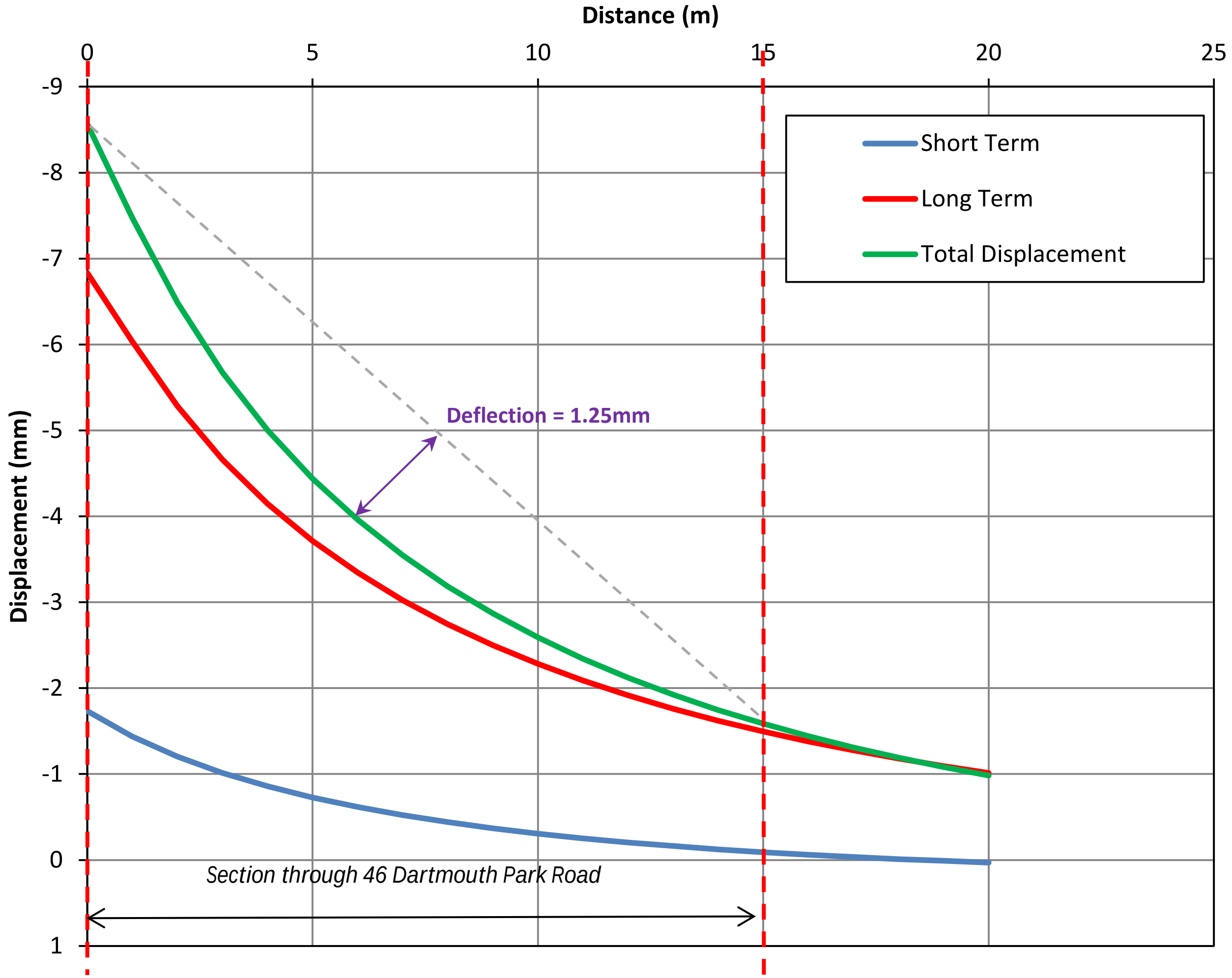
Undrained



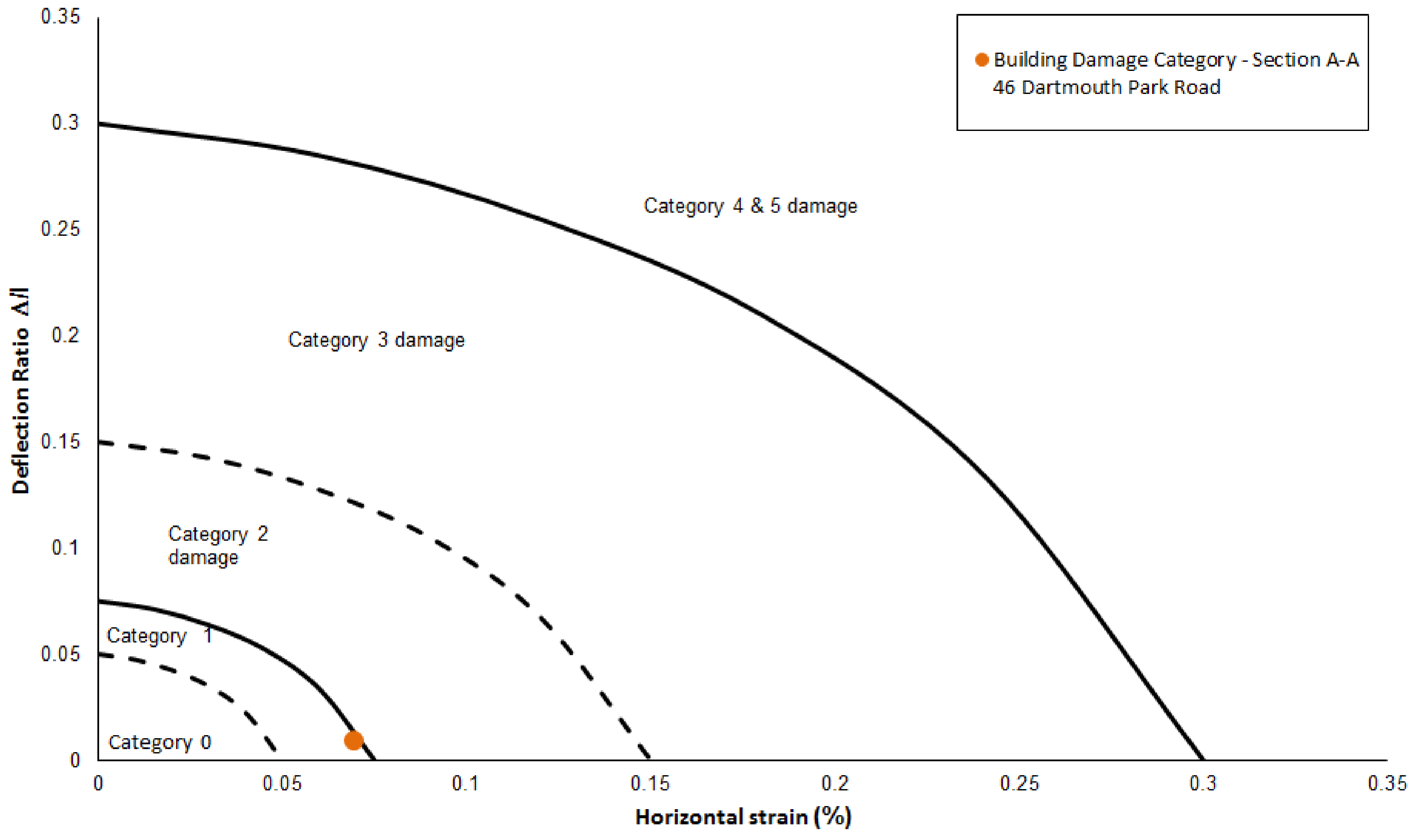
Drained



Client	Project	Job No
Five Corners Limited	44 Dartmouth Park Road	CG/18249A
CGL	Title: Short and long term vertical displacements – Contour overlay	Figure 7



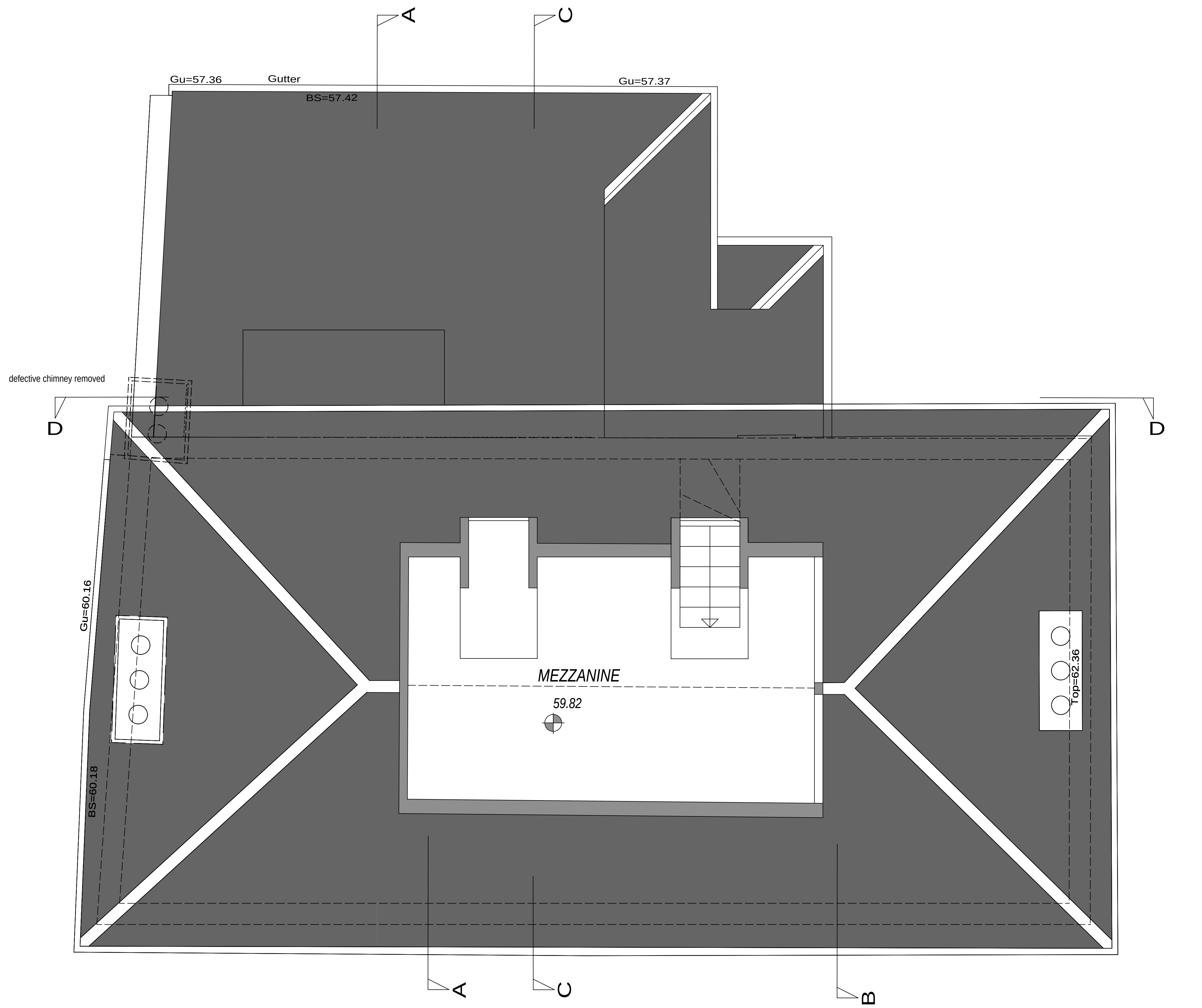
Client	Project	Job No
Five Corners Limited	**44 Dartmouth Park Road**	**CG/18249A**
CGL	Title **Vertical ground movement - Critical Section A-A**	**Figure 8**



Client	Project	Job No
Five Corners Limited	**44 Dartmouth Park Road**	**CG/18249A**
CGL	Title **Building interaction chart**	**Figure 9**

APPENDIX A

Proposed development plans and sections



ATTIC FLOOR PLAN

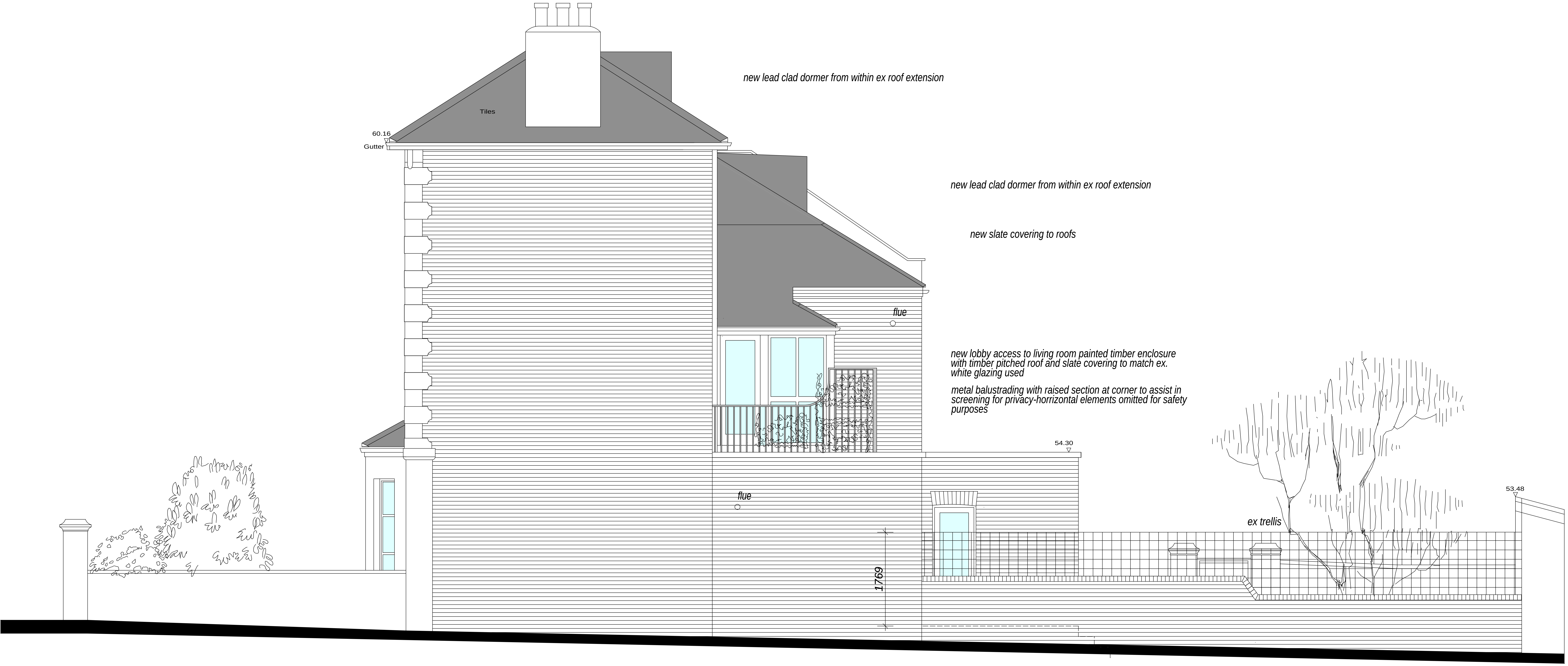
FLAT 4 - GIA 12M2

metres

0 1 2 3 4

Rev A 13.4.2015 amended layout on lower floor shown
Rev B 7.5.2015 amended layout to rear extension roof

CLIENT Five Corners Ltd	PETER STERN Architect & Designer	SCALE	1:50 at A2 1;100 at A4
JOB TITLE 44 Dartmouth Park Road NW5	33 Denman Drive North London NW11 6RD Tel: 020 8346 2547 mob: 07957 424946	DATE	january 2015
DRAWING TITLE scheme for 4 flats - plans	e-mail: ps@peterstern.co.uk web: www.peterstern.co.uk	DRAWN BY	
		DRAWING NO.	370/06B pl

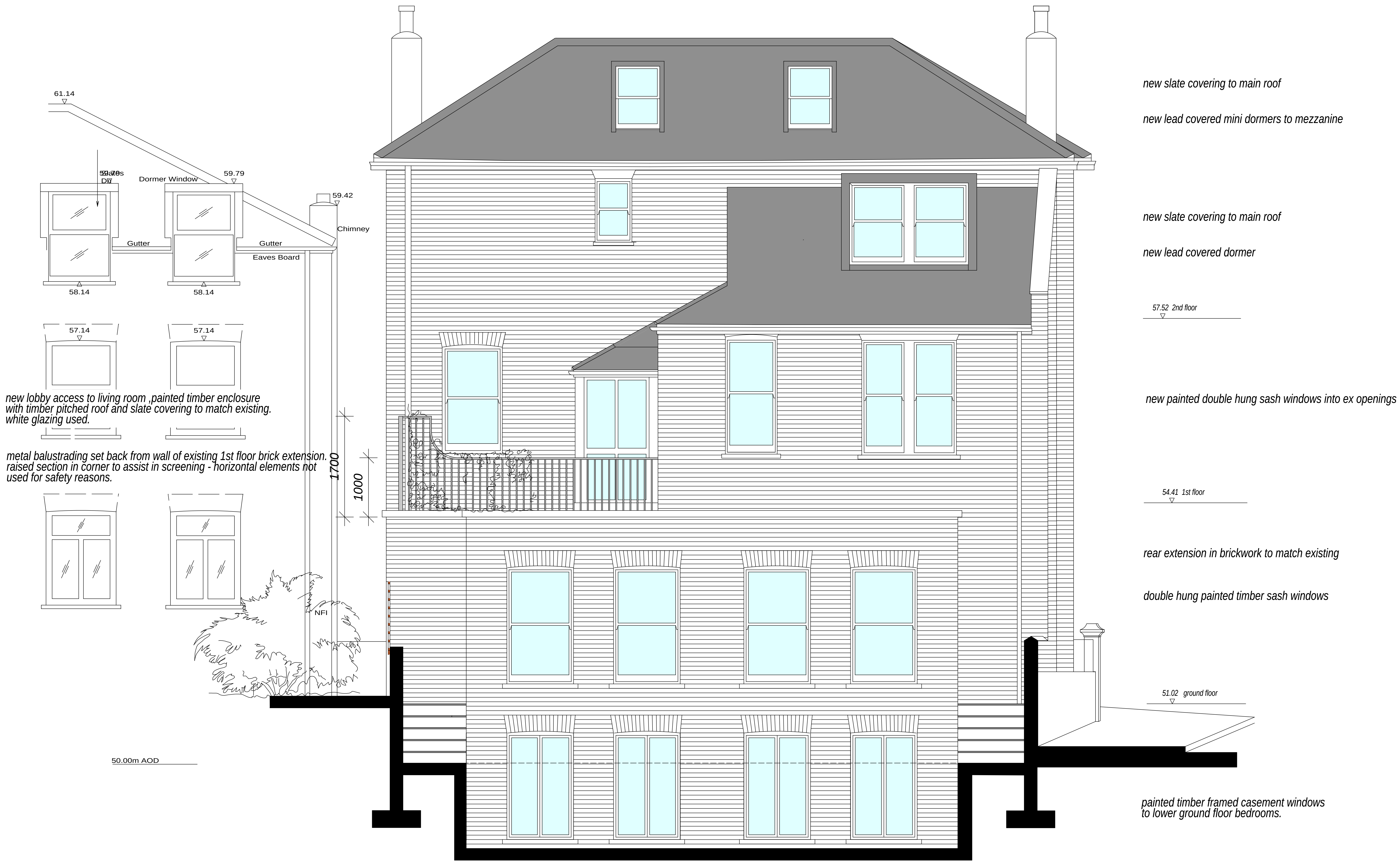


ELEVATION TO NO. 46 - NE

metres
0 1 2 3 4

Rev A 6.3.2015 screening to boundary wall shown
Rev B 12.4.2015 screening to boundary wall modified, rear extension reduced in height dormer modified flank to ex extension 1st floor now with door onto terrace
Rev C 8.5.2015 1st floor obby extension added with modification to extension roof, boundary wall retained at existing height with trellis providing screening, ground floor extension now in brickwork with single glazed door side access.

CLIENT Five Corners Ltd	PETER STERN Architect & Designer	SCALE 1:50 at A2 1;100 at A4
JOB TITLE 44 Dartmouth Park Road NW5	33 Denman Drive North London NW11 6RD Tel: 020 8346 2547 mob: 07957 424946 e-mail: ps@peterstern.co.uk web: www.peterstern.co.uk	DATE january 2015
DRAWING TITLE scheme for 4 flats - elevations		DRAWN BY DRAWING NO. 370/12 pl revB



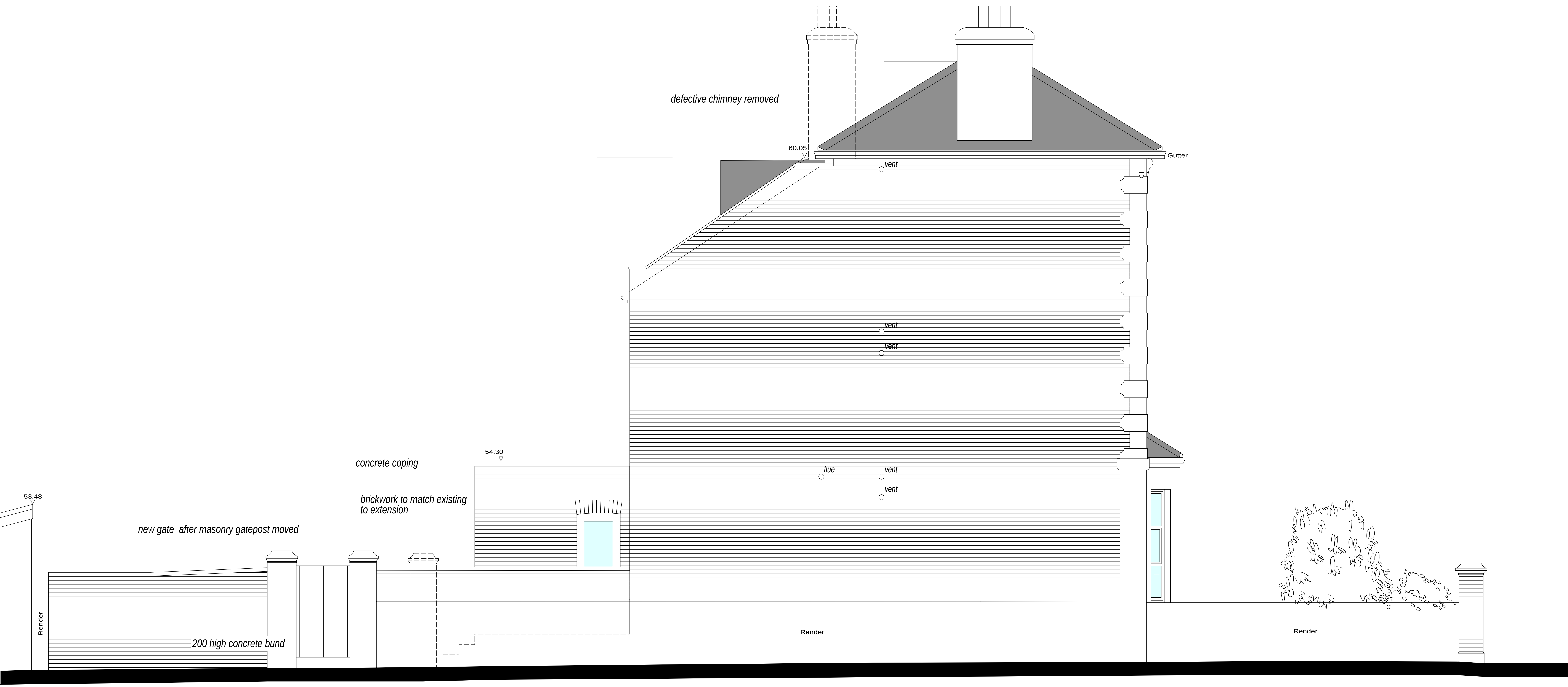
Rev A 13.4.2015 height and width of rear extension reduced, dormer 2nd floor reduced in width, balcony railings simplified, ex rear extension increased in width, roof configuraion modified, ex window opening moved over.
Rev B 7.5.2015 adjustments to 1st and 2nd floor rear extension & fenestration

ELEVATION TO GARDEN -NW- BRICKWORK ALTERNATIVE

metres

0 1 2 3 4

CLIENT Five Corners Ltd	PETER STERN Architect & Designer	SCALE 1:50 at A2 1;100 at A4	
JOB TITLE 44 Dartmouth Park Road NW5	33 Denman Drive North London NW11 6RD Tel: 020 8346 2547 mob: 07957 424946 e-mail: ps@peterstern.co.uk web: www.peterstern.co.uk	DATE january 2015	
DRAWING TITLE scheme for 4 flats - elevations		DRAWN BY	DRAWING NO. 370/11B pl



Rev A 12.4.2015 rear extension reduced in height, garden wall raised in part, dormer adjusted
Rev B 8.5.2015 rear extension now constructed in brickwork. boundary wall remains at ex. height

ELEVATION TO YORK RISE - SW

metres
0 1 2 3 4

CLIENT Five Corners Ltd	PETER STERN Architect & Designer	SCALE 1:50 at A2 1;100 at A4
JOB TITLE 44 Dartmouth Park Road NW5	33 Denman Drive North London NW11 6RD Tel: 020 8346 2547 mob: 07957 424946 e-mail: ps@peterstern.co.uk web: www.peterstern.co.uk	DATE january 2015
DRAWING TITLE scheme for 4 flats - elevations		DRAWN BY
		DRAWING NO. 370/10B pl

FIRST FLOOR PLAN

FLAT 3 - GIA 68M2
FLAT 4 - GIA 4M2

Rev A 6.3.2015 raised flank wall to provide screening to No. 46
Rev B 10.4.2015 modifications to ex rear extension, terrace, gr fl extension shown
Rev C 8.5.2015 modifications to ex rear extension now to include lobby.

CLIENT Five Corners Ltd	PETER STERN Architect & Designer	SCALE 1:50 at A2 1;100 at A4
JOB TITLE 44 Dartmouth Park Road NW5	33 Denman Drive North London NW11 6RD Tel: 020 8346 2547 mob: 07957 424946 e-mail: ps@peterstern.co.uk web: www.peterstern.co.uk	DATE january 2015
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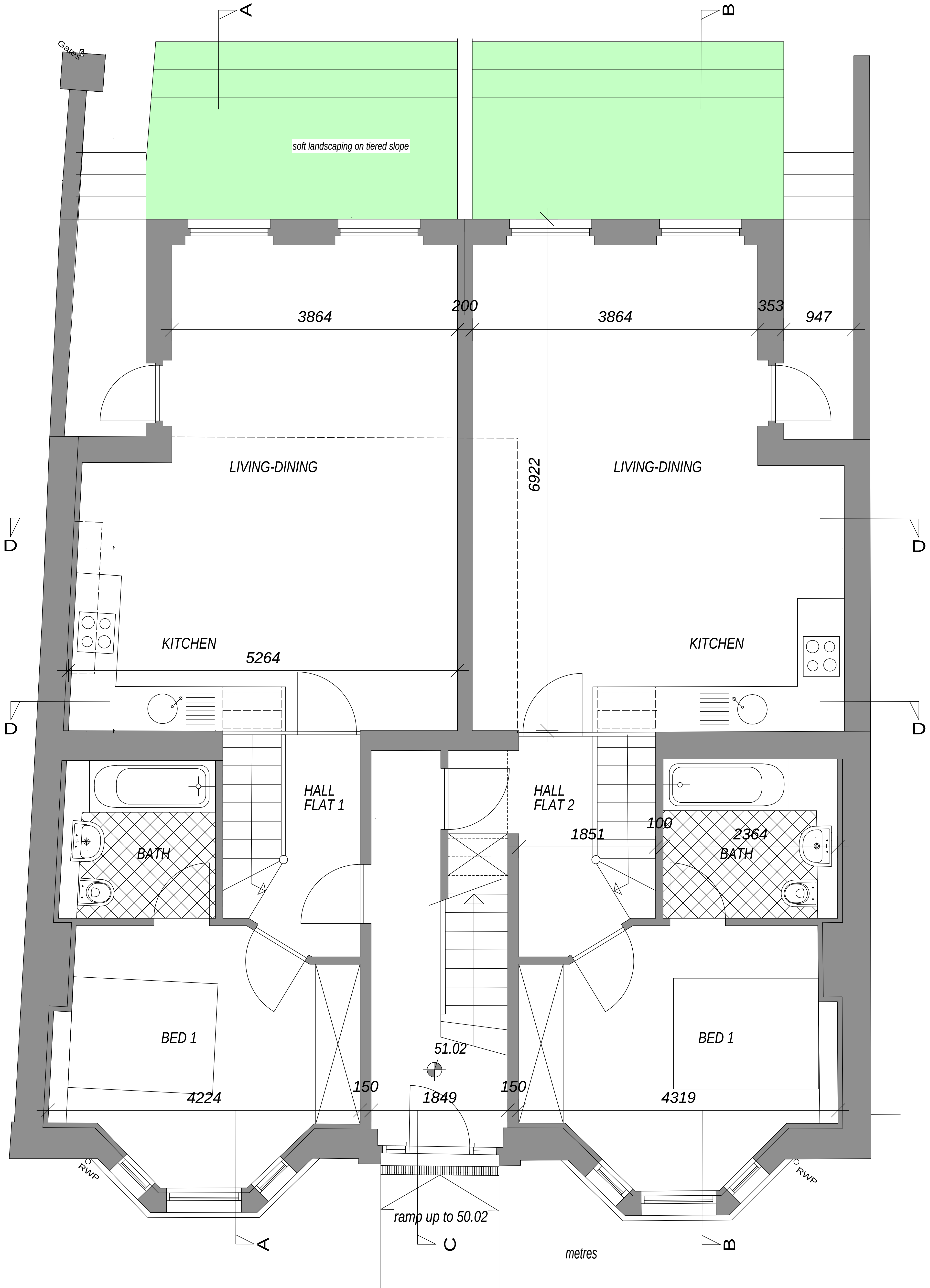

GROUND FLOOR PLAN

FLAT 1 - GIA 53.5M2

FLAT 2 - GIA 56M2

Rev A 10.4.2015 living dining areas reconfigured, light well enlarged
Rev B 7.5. 2015 living dining area windows amended.

CLIENT Five Corners Ltd	PETER STERN Architect & Designer	SCALE	1:50 at A2 1;100 at A4
JOB TITLE 44 Dartmouth Park Road NW5	33 Denman Drive North London NW11 6RD Tel: 020 8346 2547 mob: 07957 424946 e-mail: ps@peterstern.co.uk web: www.peterstern.co.uk	DATE	january 2015
DRAWING TITLE scheme for 4 flats - plans		DRAWN BY	
		DRAWING NO.	370/03B pl

LOWER GROUND FLOOR PLAN

FLAT 1 - GIA 46M2
FLAT 2 - GIA 44M2

Rev A 10.4.2015 bedroom windows reconfigured, light well enlarged
Rev B 7.5.2015 bedroom windows reconfigured.

CLIENT Five Corners Ltd	PETER STERN Architect & Designer	SCALE 1:50 at A2 1;100 at A4
JOB TITLE 44 Dartmouth Park Road NW5	33 Denman Drive North London NW11 6RD Tel: 020 8346 2547 mob: 07957 424946 e-mail: ps@peterstern.co.uk web: www.peterstern.co.uk	DATE january 2015
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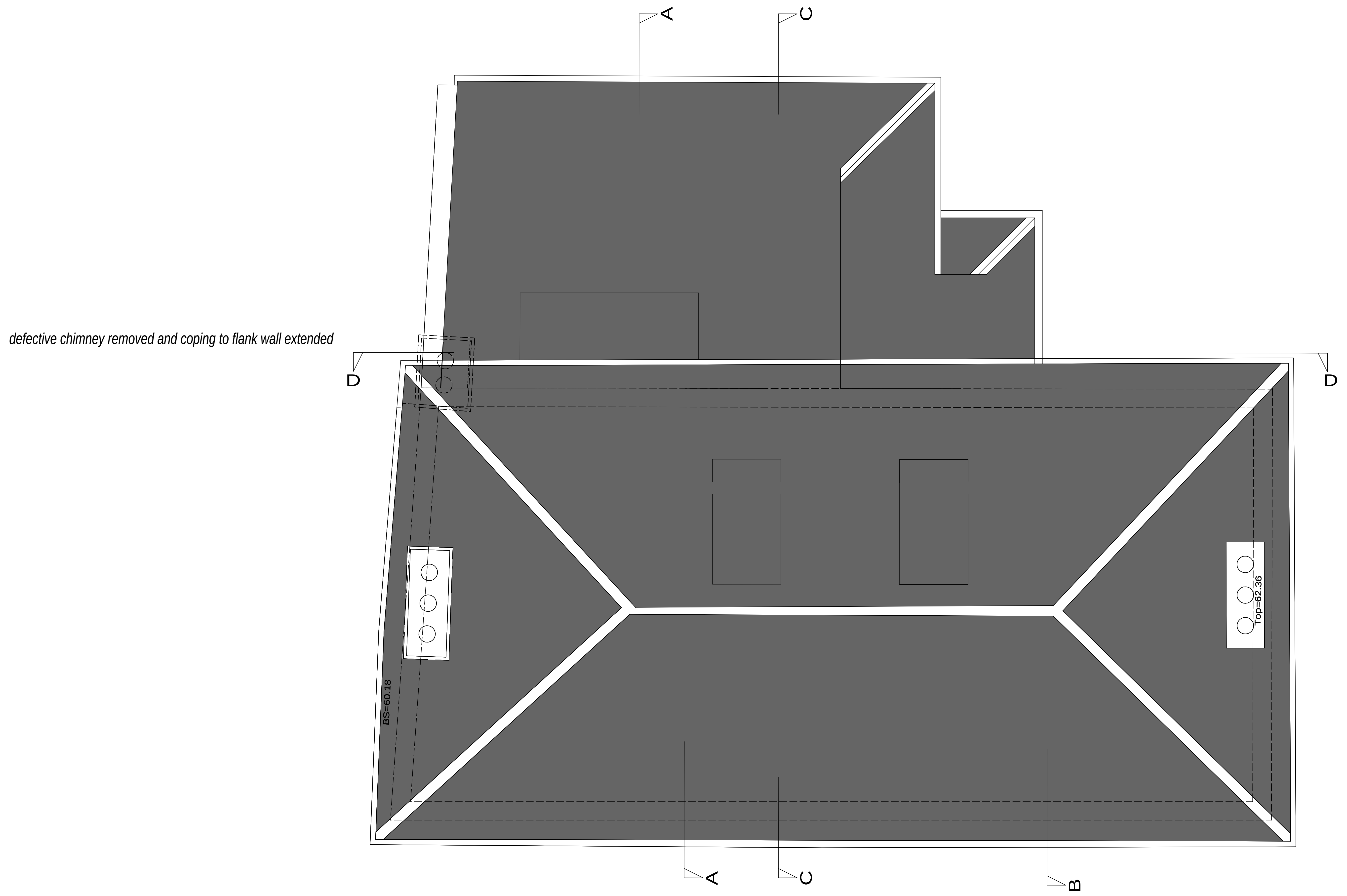
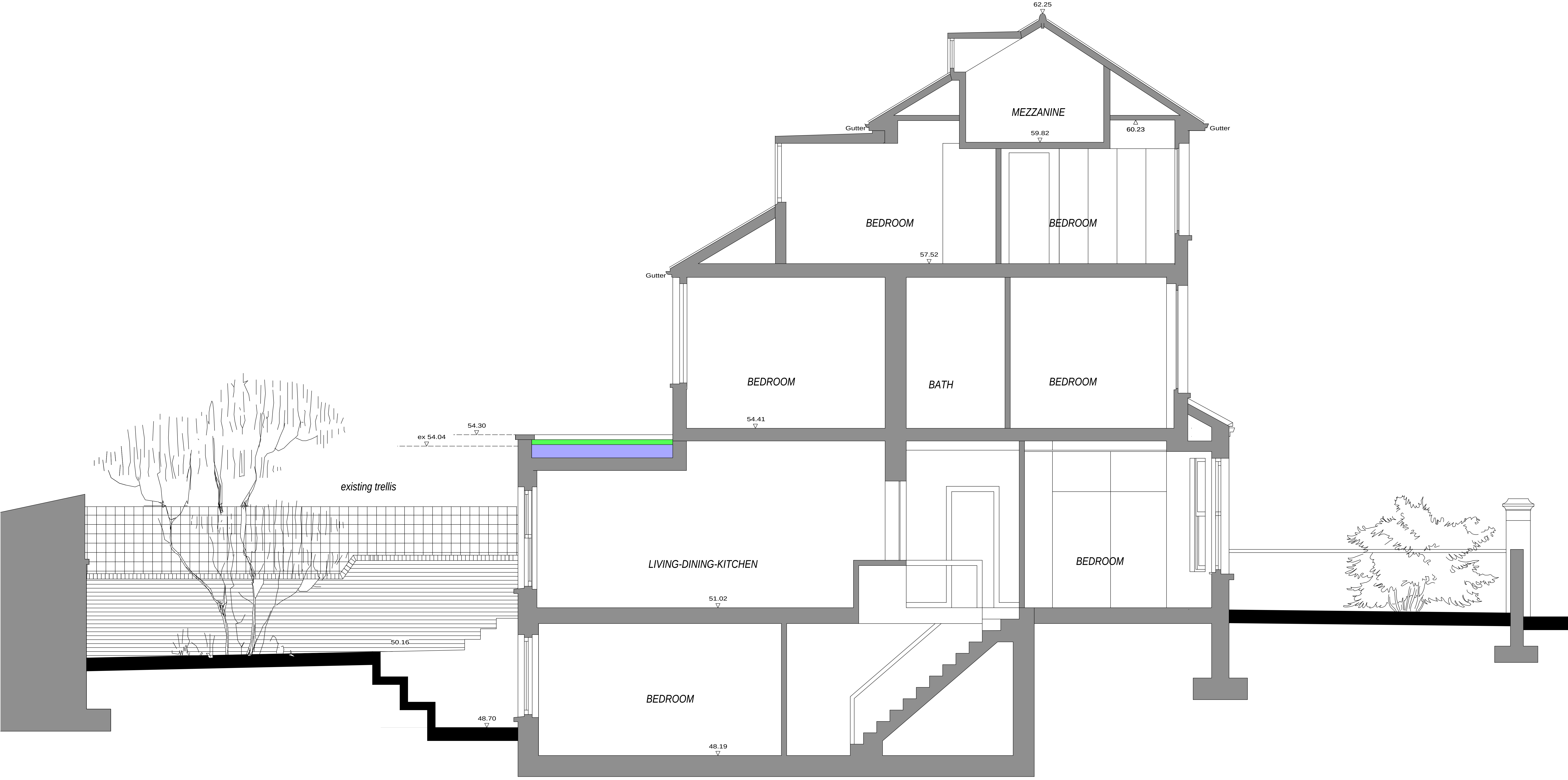


ROOF PLAN

metres
0 1 2 3 4

Rev A 13.4.2015 amended layout on lower floor shown
Rev B 7.5.2015 amended layout to rear extension roof

CLIENT Five Corners Ltd	PETER STERN Architect & Designer	SCALE	1:50 at A2 1;100 at A4
JOB TITLE 44 Dartmouth Park Road NW5	33 Denman Drive North London NW11 6RD Tel: 020 8346 2547 mob: 07957 424946 e-mail: ps@peterstern.co.uk web: www.peterstern.co.uk	DATE	january 2015
		DRAWN BY	
DRAWING TITLE scheme for 4 flats - plans		DRAWING NO.	370/07B pl



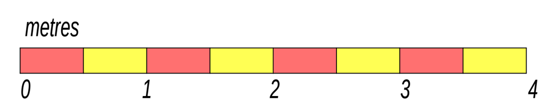
SECTION AA

metres
0 1 2 3 4

Rev A 12.4.2015 rear extension modified
Rev B 8.5.2015 rear extension on ground and 1st floor in brickwork
and window openings modified.

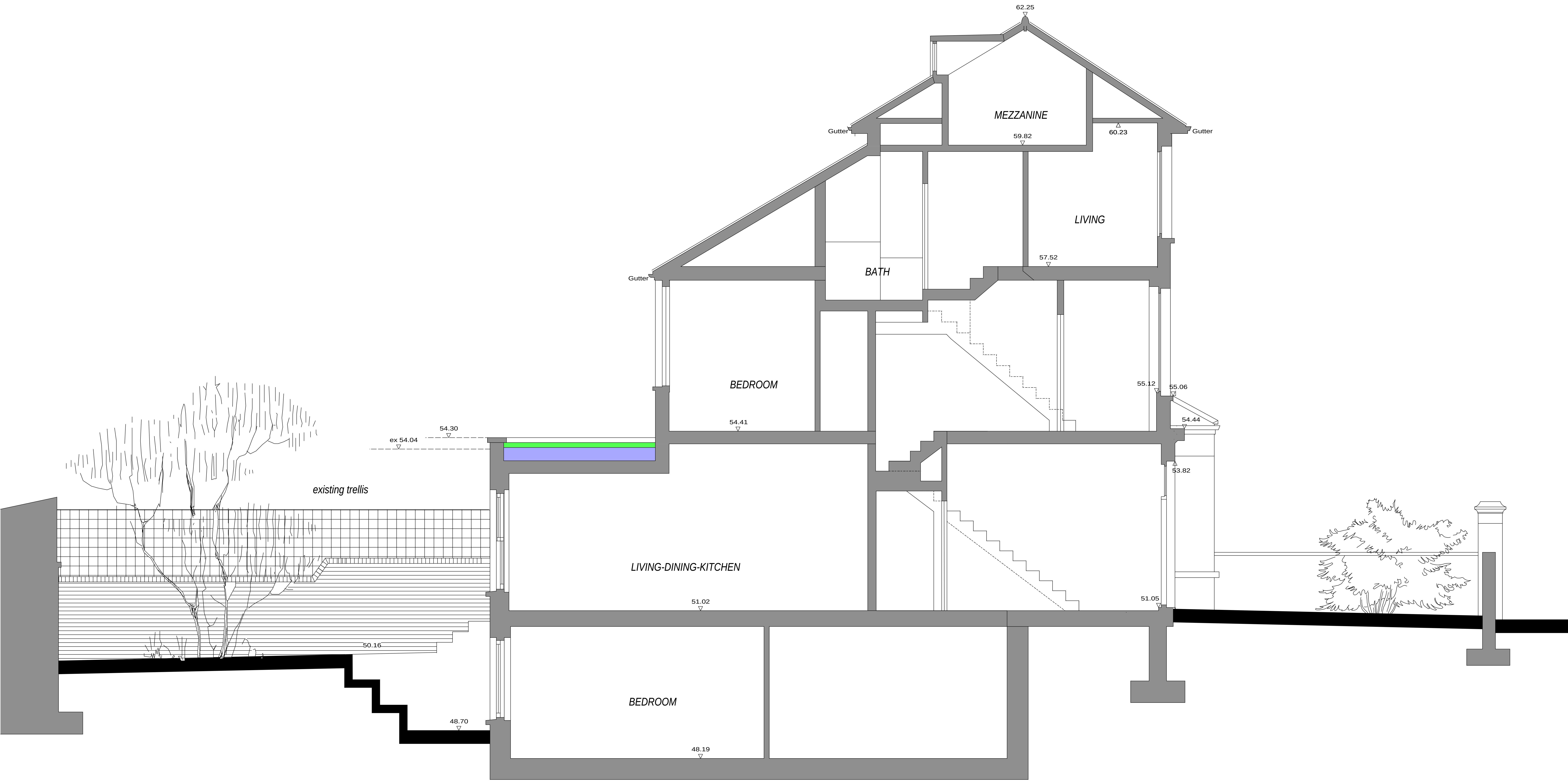
CLIENT Five Corners Ltd	PETER STERN Architect & Designer	SCALE 1:50 at A2 1;100 at A4	
JOB TITLE 44 Dartmouth Park Road NW5	33 Denman Drive North London NW11 6RD Tel: 020 8346 2547 mob: 07957 424946 e-mail: ps@peterstern.co.uk web: www.peterstern.co.uk	DATE january 2015	
DRAWING TITLE scheme for 4 flats - sections		DRAWN BY	DRAWING NO. 370/08B pl

SECTION BB



Rev A 12.4.2015 rear extension modified
Rev B 8.5.2015 rear extension on ground and 1st floor in brickwork and window openings modified.

CLIENT Five Corners Ltd	PETER STERN Architect & Designer	SCALE 1:50 at A1
JOB TITLE 44 Dartmouth Park Road NW5	33 Denman Drive North London NW11 6RD Tel: 020 8346 2547	DATE january 2015 DRAWN BY
DRAWING TITLE scheme for 4 flats - section BB thro' terrace	mob: 07957 424946 e-mail: ps@peterstern.co.uk web: www.peterstern.co.uk	DRAWING NO. 370/13B pl



SECTION CC THRO' STAIRS

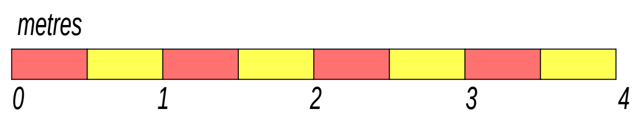
metres

0 1 2 3 4

rev A 7.5.2015 adjustments to bathroom and external wall on lower and ground floor

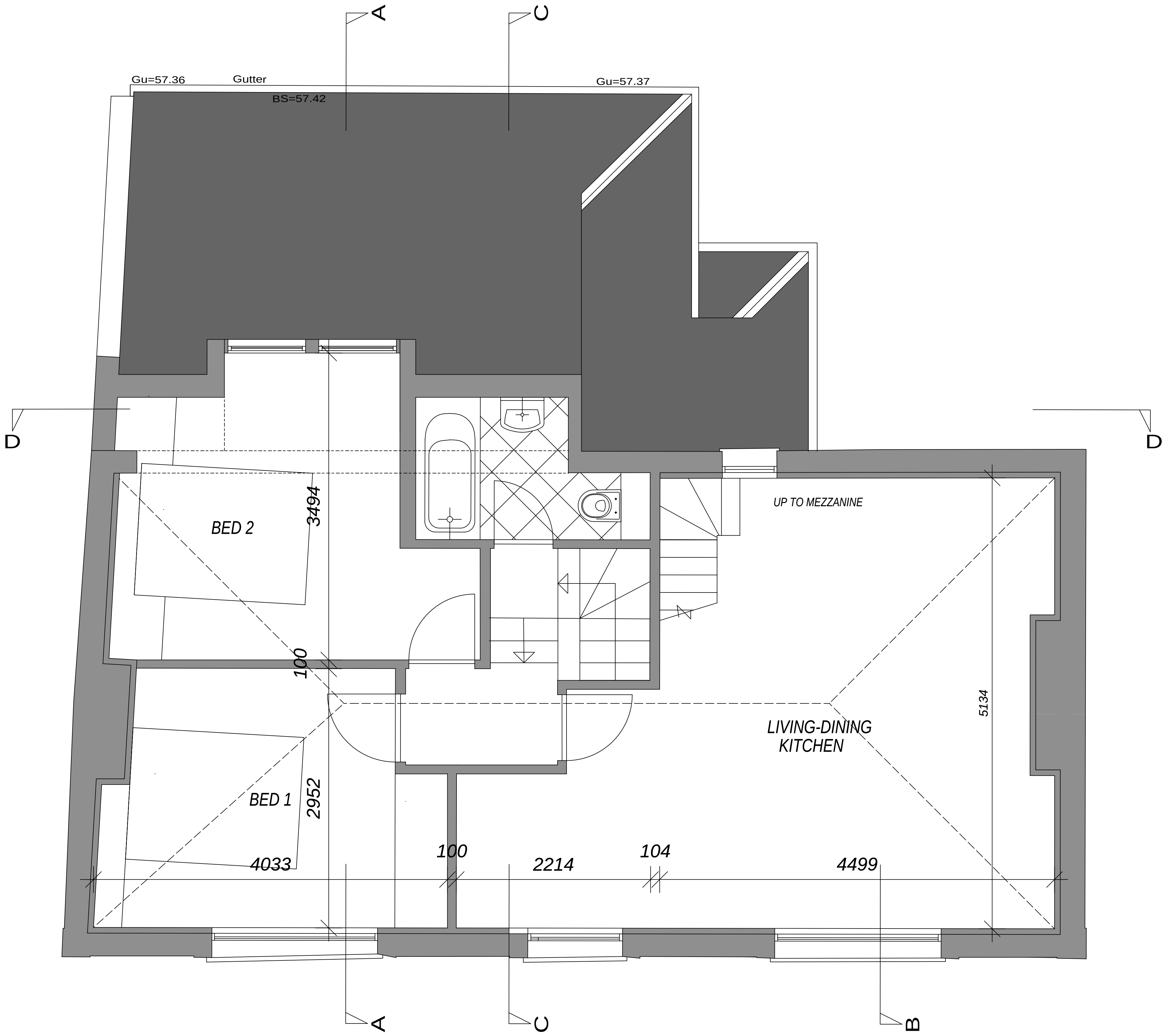
CLIENT Five Corners Ltd	PETER STERN Architect & Designer	SCALE 1:50 at A2 1;100 at A4
JOB TITLE 44 Dartmouth Park Road NW5	33 Denman Drive North London NW11 6RD Tel: 020 8346 2547 mob: 07957 424946 e-mail: ps@peterstern.co.uk web: www.peterstern.co.uk	DATE april 2015
DRAWING TITLE scheme for 4 flats - sections		DRAWN BY DRAWING NO. 370/14A pl

SECTION DD



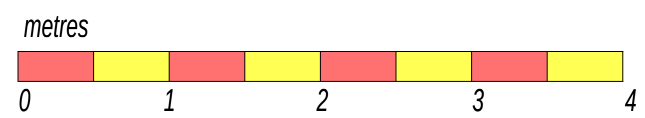
CLIENT Five Corners Ltd	SCALE 1:50 at A2 1;100 at A4
JOB TITLE 44 Dartmouth Park Road NW5	DATE may 2015
DRAWING TITLE scheme for 4 flats - sections	DRAWN BY
	DRAWING NO. 370/15

PETER STERN
Architect & Designer
33 Denman Drive North
London NW11 6RD
Tel: 020 8346 2547
mob: 07957 424946
e-mail: ps@peterstern.co.uk
web: www.peterstern.co.uk



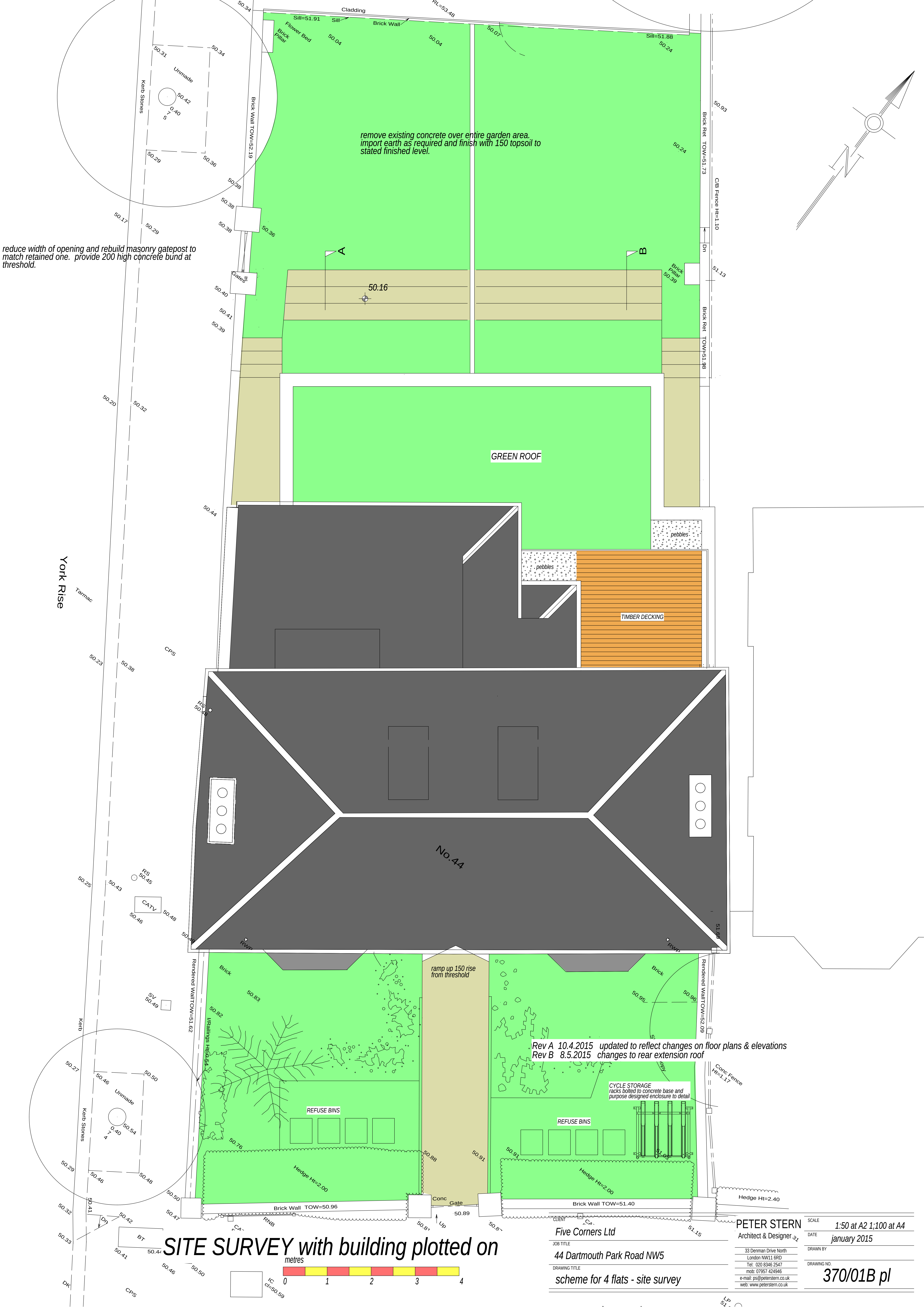
SECOND FLOOR PLAN

FLAT 4 - GIA 60M2



Rev A 13.4.2015 amended layout including dormer & bathroom
Rev B 7.5.2015 amended layout including bathroom & roofs

CLIENT Five Corners Ltd	PETER STERN Architect & Designer	SCALE 1:50 at A2 1;100 at A4
JOB TITLE 44 Dartmouth Park Road NW5	33 Denman Drive North London NW11 6RD Tel: 020 8346 2547 mob: 07957 424946 e-mail: ps@peterstern.co.uk web: www.peterstern.co.uk	DATE january 2015
		DRAWN BY
DRAWING TITLE scheme for 4 flats - plans		DRAWING NO. 370/05B pl



CLIENT
Five Corners Ltd

JOB TITLE
44 Dartmouth Park Road NW5

DRAWING TITLE
scheme for 4 flats - site survey

PETER STERN
Architect & Designer
33 Denman Drive North
London NW11 6RD
Tel: 020 8346 2547
mob: 07957 424946
e-mail: ps@peterstern.co.uk
web: www.peterstern.co.uk

SCALE 1:50 at A2 1;100 at A4

DATE january 2015

DRAWN BY

DRAWING NO. 370/01B pl

APPENDIX B

CGL exploratory hole records

WINDOW SAMPLE LOG

CGL

Project				HOLE No
44 Dartmouth Park Road				**WS1**
Job No: CG/18249A	Date: 24-04-15	Ground Level (m): 49.96	Co-Ordinates (m): E 528,749.2 N 186,115.2	
Client: Five Corners Limited				Sheet: 1 of 1

SAMPLES & TESTS / STRATA

Depth	Type No	Test Result (N/kPa/ppm)	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument /Backfill
				49.86		0.10	Concrete. [MADE GROUND]	
0.20	D			49.51		(0.35) 0.45	Soft dark brown grey black slightly sandy slightly gravelly silt. Gravel is angular to subangular fine to coarse of brick and concrete. Sand is fine to coarse. [MADE GROUND]	
0.90	D					(0.75)		
1.00	SPT	N6		48.76		1.20	Firm to stiff dark orange brown slightly sandy gravelly clay. Gravel is subangular fine to coarse of brick, ash, slate and concrete. Sand is fine to coarse. Frequent roots and rootlets. [MADE GROUND]	
1.30	D						Firm to stiff dark grey speckled black silty CLAY. [HEAD DEPOSITS]	
1.50	HSV	37						
1.70	D					(1.00)		
2.00	HSV	37						
2.00	SPT	N7		47.76		2.20		
2.10	D						Stiff light orange brown silty CLAY. Frequent fine to coarse selenite crystals. [WEATHERED LONDON CLAY FORMATION]	
2.50	HSV	42						
2.70	HSV	40					2.80 - 2.85 Claystone band.	
3.00	D							
3.00	SPT	N8						
							3.50 - 5.45 Fine sand laminations. Sand is fine to coarse.	
3.70	D							
4.00	SPT	N7				(3.80)		
4.50	D							
5.00	D							
5.00	SPT	N9						
							5.60 - 2.85 Becoming mottled light brown grey.	
				43.96		6.00		
6.00	D						*(Window sample terminated at 6m)*	
6.00	SPT	N11						

Boring Progress and Water Observations

Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth

General Remarks

1. Borehole terminated at 6.0m below ground level.

2. D = small disturbed sample; N = SPT 'N' value.

3. Installation details: 0m to 0.5m plain pipe with bentonite seal; 0.5m to 6.0m slotted pipe with gravel filter; gas tap and bung; flush cover at surface.

4. No groundwater encountered.

Method/Plant Used	Field Crew	Logged By	Checked By
Tracked window sample rig	RP Drilling	KJP	RJB

WINDOW SAMPLE LOG

CGL

Project				HOLE No
44 Dartmouth Park Road				**WS2**
Job No	Date	Ground Level (m)	Co-Ordinates (m)	
CG/18249A	24-04-15	50.30	E 528,756.8 N 186,115.3	
Client				Sheet
Five Corners Limited				1 of 1

SAMPLES & TESTS

Depth	Type No	Test Result (N/kPa/ppm)	Water
1.00	D		
1.00	SPT	N6	
1.50	D		
1.70	D		
1.80	HSV	39	
2.00	SPT	N8	
2.20	HSV	45	
2.50	D		
2.70	HSV	49	
3.00	SPT	N8	
4.00	D		
4.00	SPT	N8	
5.00	D		
5.00	SPT	N9	
5.50	D		
6.00	SPT	N7	

STRATA

Reduced Level	Depth (Thickness)	DESCRIPTION
50.20	0.10	Concrete.
50.15	0.15	[MADE GROUND]
49.70	(0.45) 0.60	Firm dark brown grey slightly sandy gravelly clay. Gravel is subangular to angular fine to coarse of brick, concrete, ceramic tile and flint. [MADE GROUND]
49.60	0.70	Firm to stiff dark brown orange grey slightly sandy slightly gravelly silty clay. Gravel is subangular to subrounded fine to medium of brick and flint. Sand is fine. [MADE GROUND]
49.40	0.90	Dark grey black slightly gravelly sand. Sand is fine to coarse. Gravel is angular of ceramic tile and brick. [MADE GROUND]
48.30	(1.10) 2.00	Firm to stiff dark brown orange grey slightly sandy slightly gravelly silty clay. Gravel is subangular to subrounded fine to medium of brick and flint. Sand is fine. [MADE GROUND] Firm to stiff dark brown grey silty CLAY. Occasional black organic material. [HEAD DEPOSITS] 1.90 - 5.45 Becoming dark orange brown grey.
44.30	(4.00) 6.00	Firm to stiff light orange brown silty CLAY. Frequent fine to medium selenite crystals. [WEATHERED LONDON CLAY FORMATION] 2.50 - 5.45 Fine sand laminations. Sand is fine to coarse. 2.90 - 5.45 Fine sand laminations. Sand is fine to coarse. 4.50 - 5.45 Fine sand laminations. Sand is fine to coarse.
		(Window sample terminated at 6m)

Instrument /Backfill

Boring Progress and Water Observations

Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth

General Remarks

1. Borehole terminated at 6.0m below ground level.

2. D = small disturbed sample; N = SPT 'N' value.

3. Installation details: 0m to 1m plain pipe with bentonite seal; 1m to 2m slotted pipe with gravel filter; 2m to 6m backfilled with arisings; gas tap and bung; flush cover at surface.

4. No groundwater encountered.

Method/ Plant Used	Field Crew	Logged By	Checked By
Tracked window sample rig	RP Drilling	KJP	RJB

WINDOW SAMPLE LOG

CGL

Project				HOLE No
44 Dartmouth Park Road				WS3
Job No: CG/18249A	Date: 24-04-15	Ground Level (m): 50.74	Co-Ordinates (m): E 528,762.4 N 186,096.0	
Client: Five Corners Limited				Sheet: 1 of 1

SAMPLES & TESTS / STRATA

Depth	Type No	Test Result (N/kPa/ppm)	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION	Instrument /Backfill
				50.44		0.30	Pea shingle gravel over firm dark brown slightly sandy slightly gravelly silt. Gravel is subangular to subrounded fine to medium of concrete and brick. Frequent rootlets. [MADE GROUND]	
				50.14		0.60	Stiff dark brown desiccated slightly gravelly slightly silty clay. Gravel is subangular to subrounded fine to coarse of brick and concrete. Frequent roots. [MADE GROUND]	
1.00	SPT	N7		49.64		(0.50) 1.10	Firm light brown grey silty gravelly clay. Gravel is subangular to subrounded of brick, flint and concrete. [MADE GROUND]	
1.10	D						Firm to stiff light orange brown silty CLAY. Frequent fine to medium selenite crystals. [WEATHERED LONDON CLAY FORMATION]	
1.50	D							
1.70	HSV	44						
2.00	D							
2.00	SPT	N8						
2.10	HSV	41						
2.30	D							
2.50	HSV	55						
2.60	D							
2.80	HSV	45						
3.00	D							
3.00	SPT	N8					3.10 - 3.60 Fine sand laminations. Sand is fine to coarse.	
3.20	HSV	57						
3.50	D					(4.90)		
3.90	D							
4.00	SPT	N9						
4.30	D						4.30 - 4.80 Fine sand laminations. Sand is fine to coarse.	
4.80	D						4.80 Becoming very stiff mottled light brown grey.	
5.00-5.30	D							
5.00	SPT	N11						
5.80-6.00	D			44.74		6.00		
6.00	SPT	N13					*(Window sample terminated at 6m)*	

Boring Progress and Water Observations

Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth

General Remarks

1. Borehole terminated at 6.0m below ground level.

2. D = small disturbed sample; N = SPT 'N' value.

3. Installation details: 0m to 0.5m plain pipe with bentonite seal; 0.5m to 6.0m slotted pipe with gravel filter; gas tap and bung; flush cover at surface.

4. No groundwater encountered.

Method/Plant Used	Field Crew	Logged By	Checked By
Tracked window sample rig	RP Drilling	KJP	RJB

WINDOW SAMPLE LOG

CGL

Project				HOLE No
44 Dartmouth Park Road				WS4
Job No: CG/18249A	Date: 24-04-15	Ground Level (m): 50.84	Co-Ordinates (m): E 528,767.1 N 186,100.5	
Client: Five Corners Limited				Sheet: 1 of 1

Depth	Type No	Test Result (N/kPa/ppm)	Water	Reduced Level	Legend	Depth (Thickness)	DESCRIPTION
0.50	D			50.04		(0.80) 0.80	Pea shingle gravel over firm to stiff dark brown slightly gravelly slightly sandy silt. Sand is fine to coarse. Gravel is subangular to subrounded fine to coarse of brick and concrete. Frequent rootlets. Occasional rounded cobble of flint. [MADE GROUND]
0.80	HSV	40					Firm to stiff dark brown orange silty CLAY. Occasional fine selenite crystals. [WEATHERED LONDON CLAY FORMATION]
1.00	SPT	N6					
1.20	HSV	50					
1.30	D						
1.50	HSV	52					
2.00	D						
2.00	SPT	N10					
2.50	HSV	54					
2.70	D						
3.00	SPT	N9					3.00 - 4.80 Becoming very stiff.
3.50	D					(5.20)	
4.00	SPT	N9					
4.50	D						
5.00	SPT	N26					
5.40-5.50	D		1				5.40 - 5.45 Claystone band.
							5.60 - 5.45 Becoming mottled light brown grey.
				44.84		6.00	
6.00	SPT	N10					*(Window sample terminated at 6m)*

Boring Progress and Water Observations

Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth
	5.4		Seepage		

General Remarks

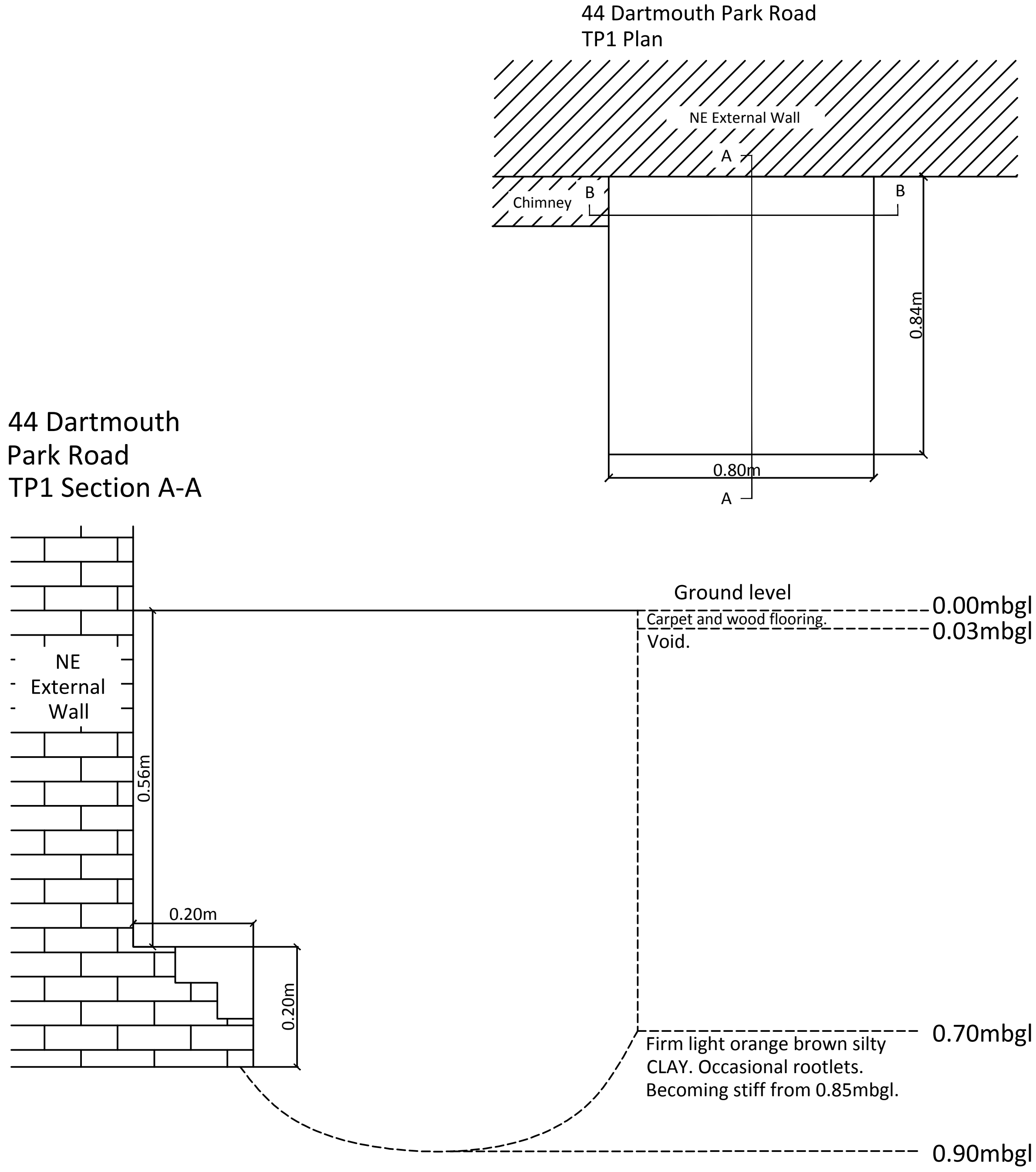
1. Borehole terminated at 6.0m below ground level.

2. D = small disturbed sample; N = SPT 'N' value.

3. Installation details: 0m to 1m plain pipe with bentonite seal; 1m to 6.0m slotted pipe with gravel filter; gas tap and bung; flush cover at surface.

4. Groundwater seepage at 5.4m below ground level.

Method/ Plant Used	Field Crew	Logged By	Checked By
Tracked window sample rig	RP Drilling	KJP	RJB

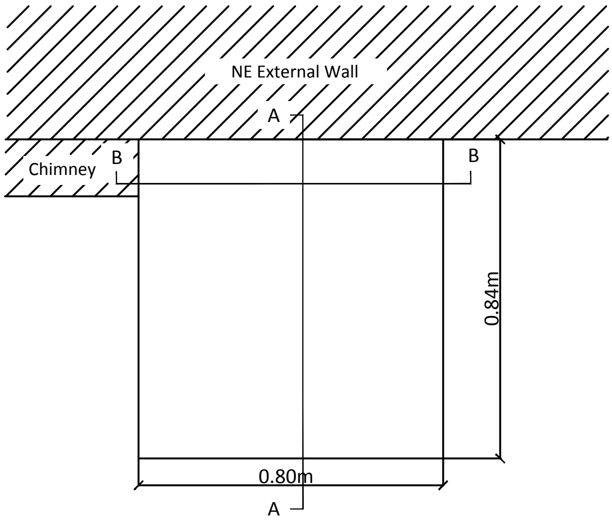


Notes

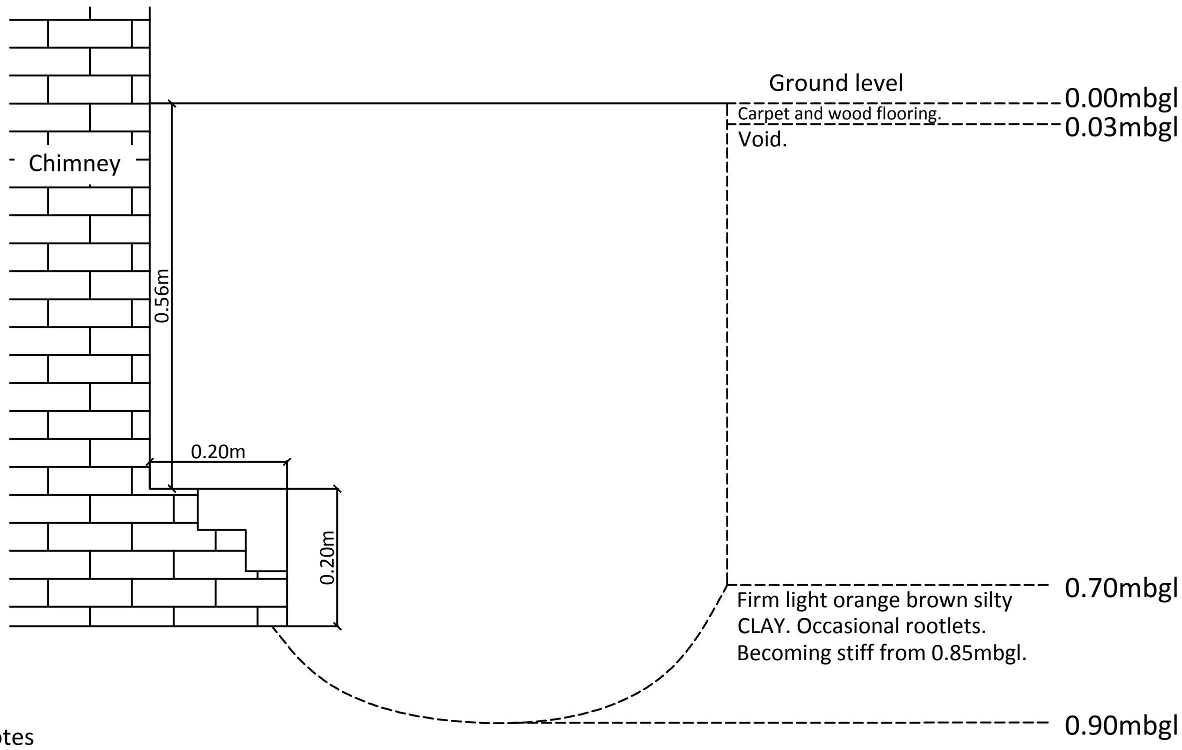
1. Trial pit terminated at 0.90mbgl.
2. No groundwater encountered.
3. HSV at 0.90mbgl = 64kPa
4. Trial pit backfilled on completion and reinstated with floorboards and carpet.
5. Disturbed sample at 0.90mbgl.

Client	Project	Job No	
Five Corners Limited	**44 Dartmouth Park Road, London**	**CG/18249A**	
	Title	Drawn by	TSB
	Foundation Inspection Pit TP1 Plan & Section A-A	Checked by	KJP
		Approved by	RJB
		APPENDIX B	

44 Dartmouth Park Road
TP1 Plan



44 Dartmouth
Park Road
TP1 Section B-B

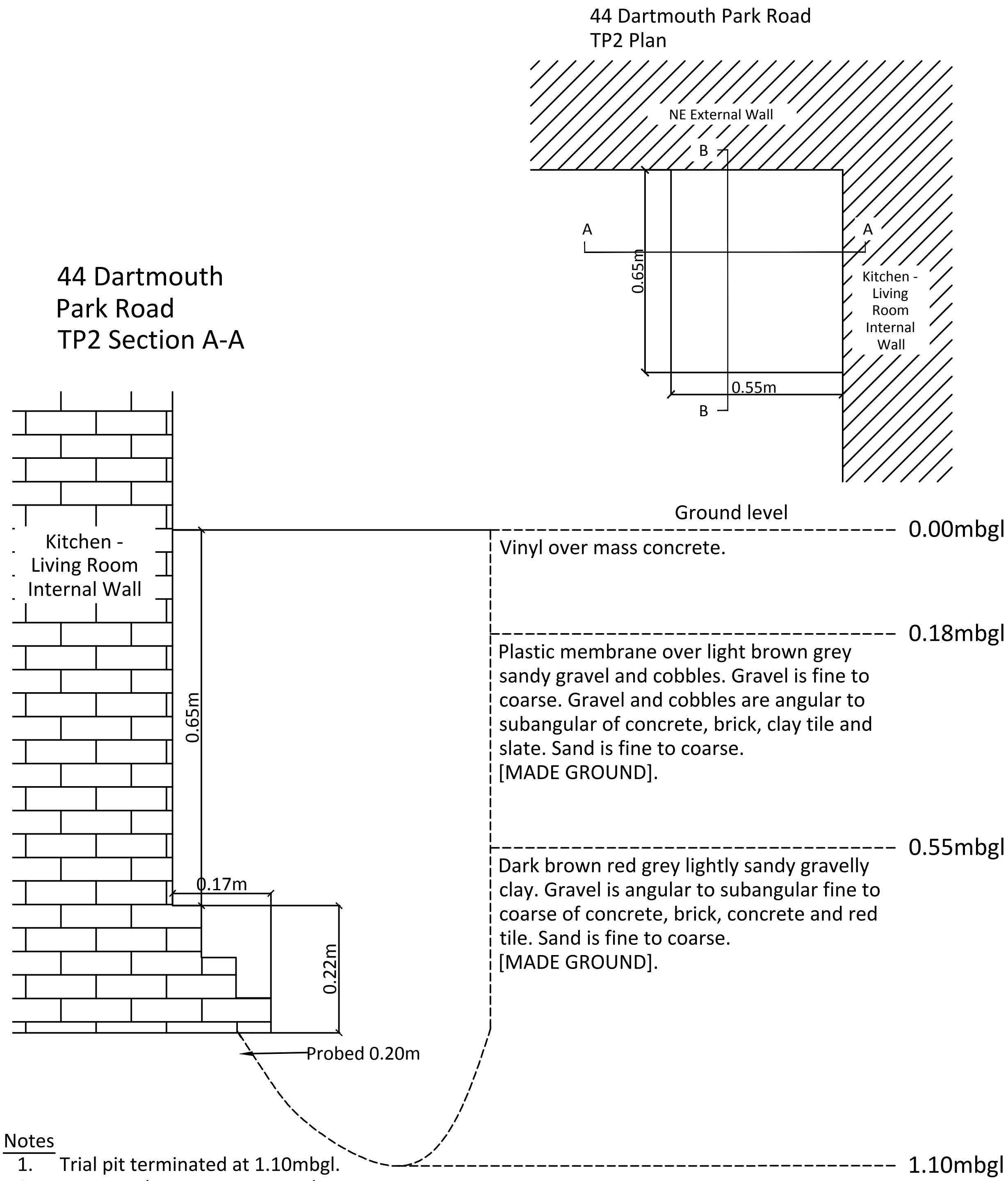


Notes

1. Trial pit terminated at 0.90mbgl.
2. No groundwater encountered.
3. HSV at 0.90mbgl = 64kPa
4. Trial pit backfilled on completion and reinstated with floorboards and carpet.
5. Disturbed sample at 0.90mbgl.

Client	Project	Job No
Five Corners Limited	**44 Dartmouth Park Road, London**	**CG/18249A**

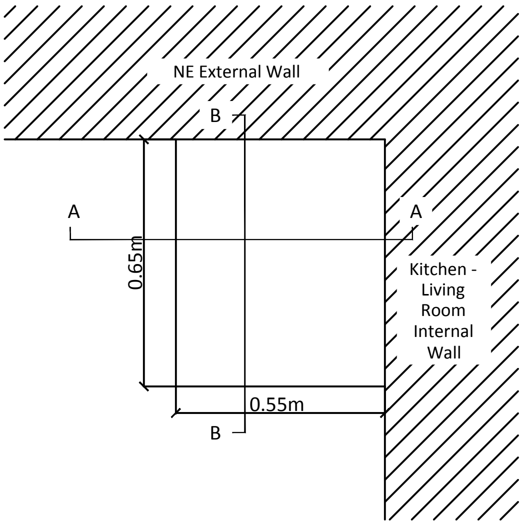
	Title		
	Foundation Inspection Pit TP1 Plan & Section B-B	Drawn by	TSB
		Checked by	KJP
		Approved by	RJB
		APPENDIX B	



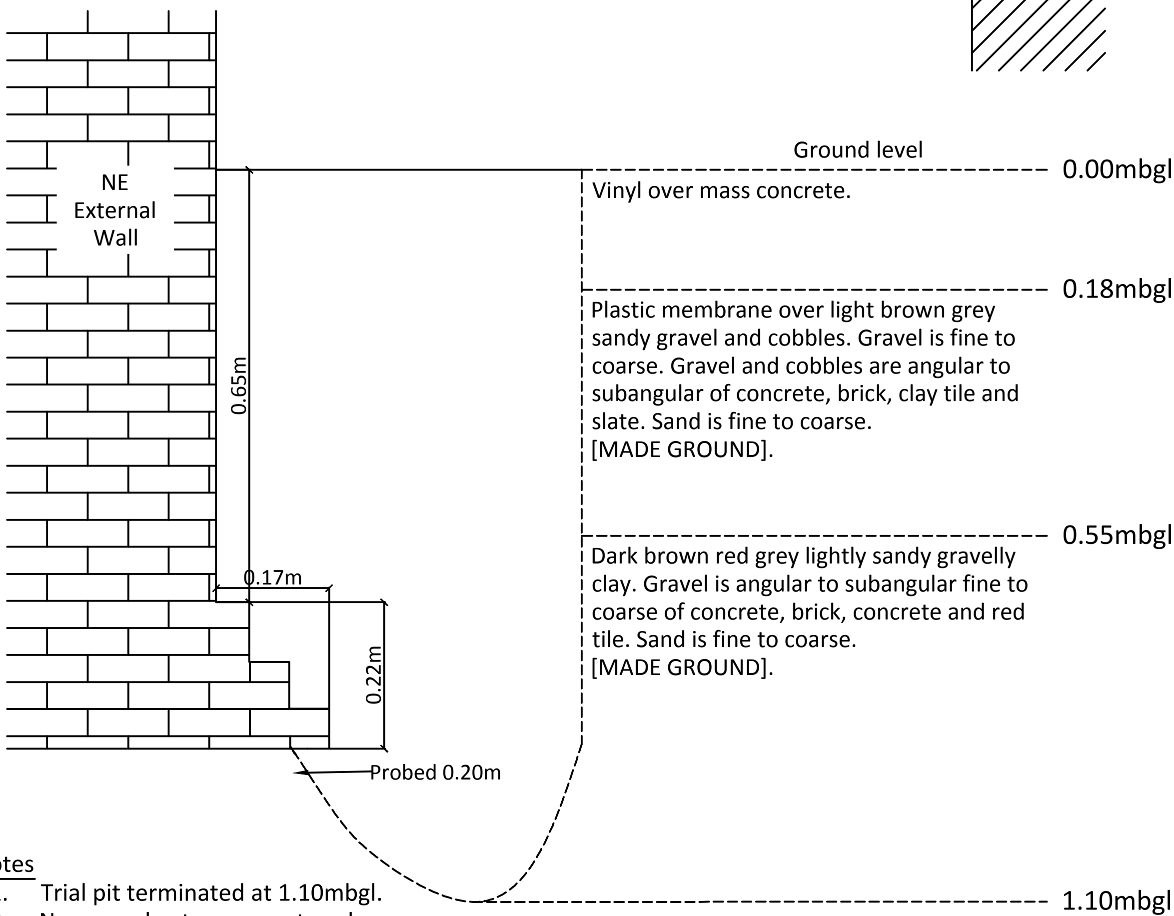
Notes
1. Trial pit terminated at 1.10mbgl.
2. No groundwater encountered.
3. Trial pit backfilled on completion and reinstated with concrete.
4. Disturbed sample at 1.10mbgl.

Client	Project	Job No	
Five Corners Limited	**44 Dartmouth Park Road, London**	**CG/18249A**	
CGL	Title: **Foundation Inspection Pit TP2 Plan & Section A-A**	Drawn by	TSB
		Checked by	KJP
		Approved by	RJB
		APPENDIX B	

44 Dartmouth Park Road
TP2 Plan



44 Dartmouth
Park Road
TP2 Section B-B

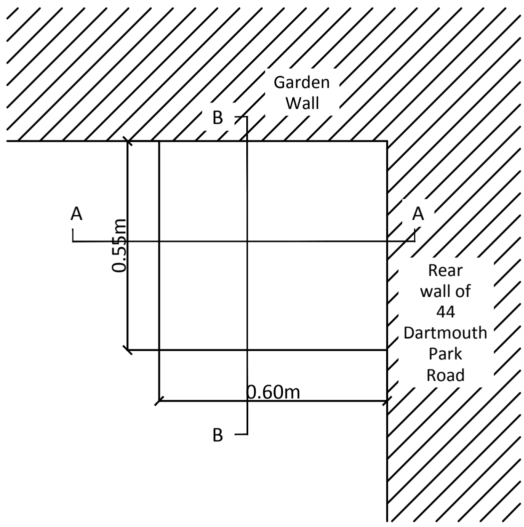


Notes
1. Trial pit terminated at 1.10mbgl.
2. No groundwater encountered.
3. Trial pit backfilled on completion and reinstated with concrete.
4. Disturbed sample at 1.10mbgl.

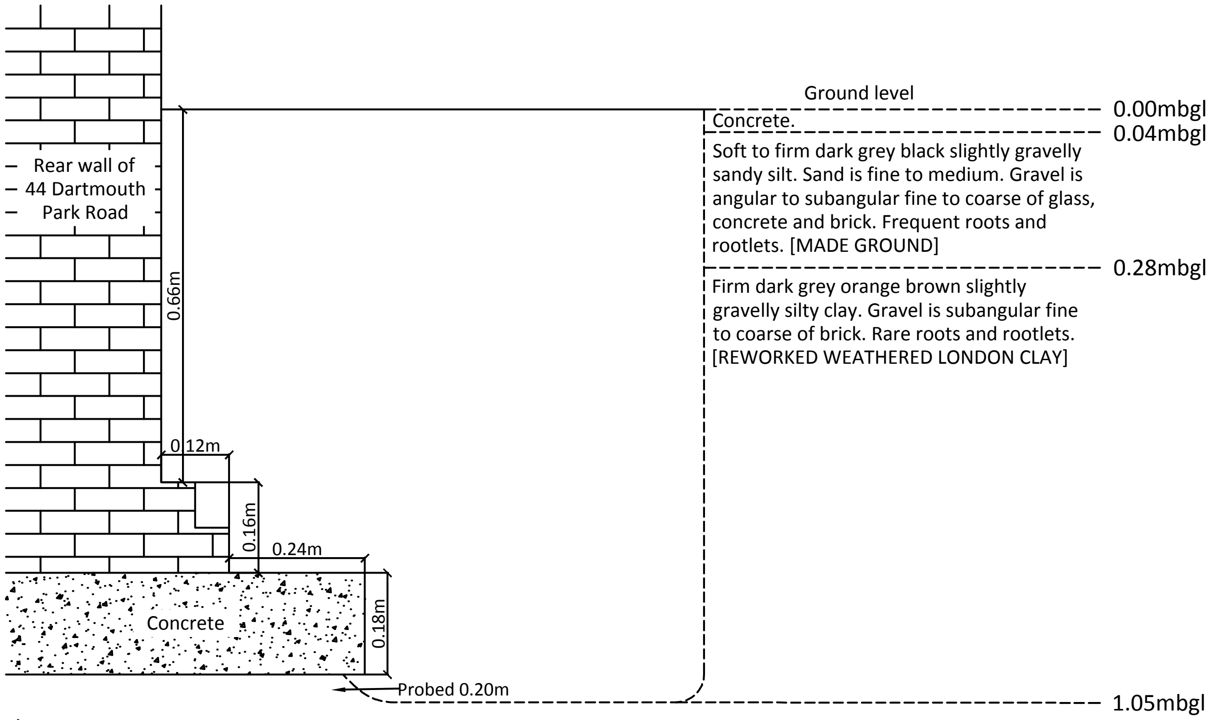
Client	Project	Job No
Five Corners Limited	**44 Dartmouth Park Road, London**	**CG/18249A**

	Title		
CGL	**Foundation Inspection Pit TP2 Plan & Section B-B**	Drawn by	TSB
		Checked by	KJP
		Approved by	RJB
		APPENDIX B	

44 Dartmouth Park Road
TP3 Plan



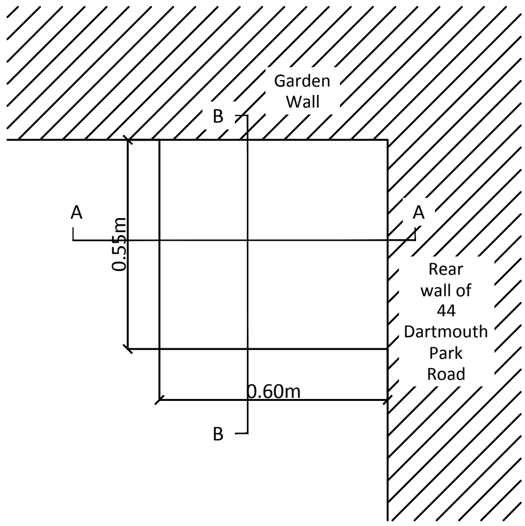
44 Dartmouth
Park Road
TP3 Section A-A



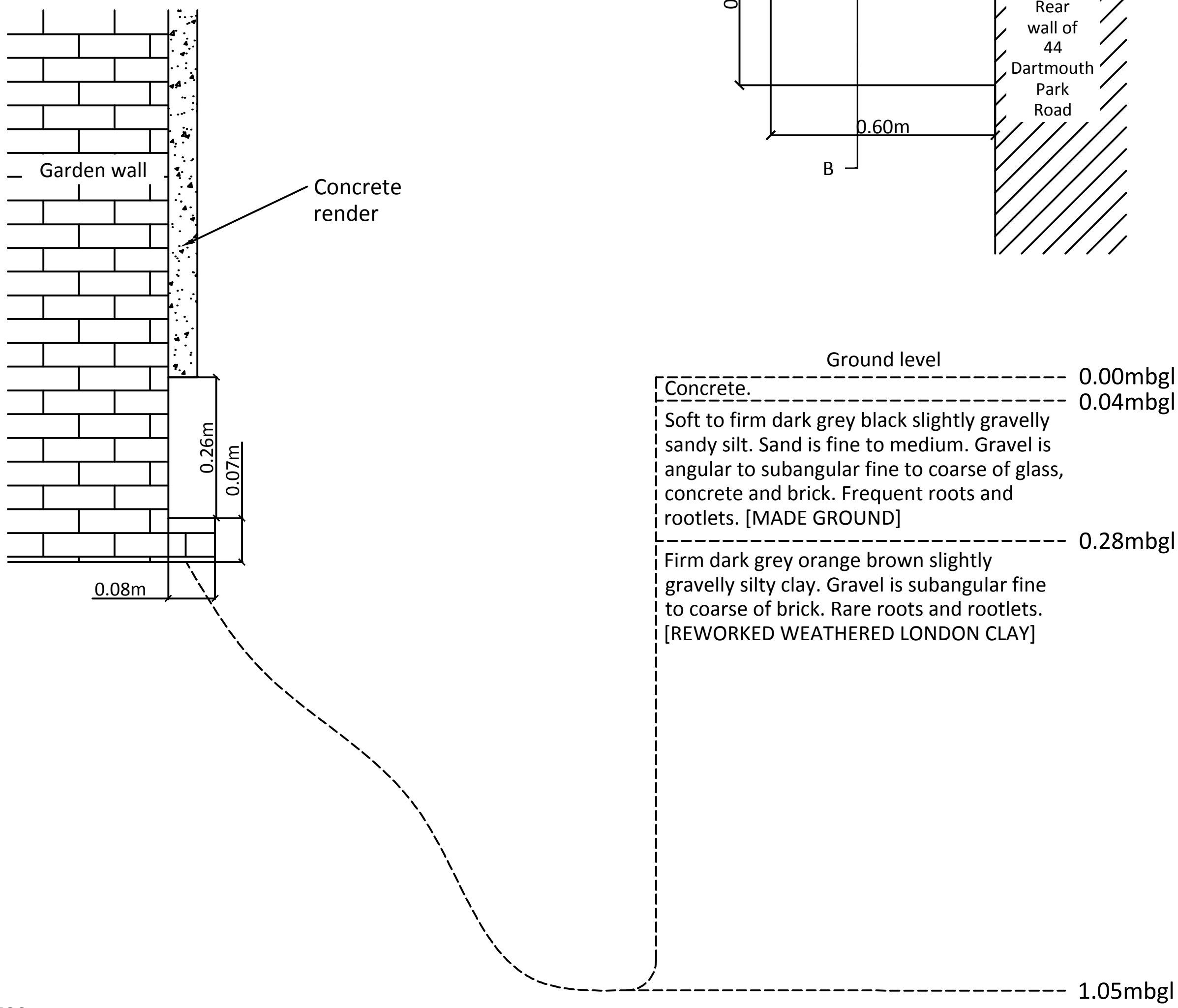
Notes
1. Trial pit terminated at 1.05mbgl.
2. Groundwater seepage at 1.00mbgl.
3. Standing groundwater depth at 1.01mbgl.
4. Trial pit backfilled on completion and reinstated with concrete.
5. Disturbed sample at 1.00mbgl.

Client	Project	Job No
Five Corners Limited	**44 Dartmouth Park Road, London**	**CG/18249A**
CGL	Title: **Foundation Inspection Pit TP3 Plan & Section A-A**	Drawn by: TSB Checked by: KJP Approved by: RJB **APPENDIX B**

44 Dartmouth Park Road
TP3 Plan



44 Dartmouth
Park Road
TP3 Section B-B



Notes

1. Trial pit terminated at 1.05mbgl.
2. Groundwater seepage at 1.00mbgl.
3. Standing groundwater depth at 1.01mbgl.
4. Trial pit backfilled on completion and reinstated with concrete.
5. Disturbed sample at 1.00mbgl.

Client	Project	Job No	
Five Corners Limited	**44 Dartmouth Park Road, London**	**CG/18249A**	
CGL	Title: **Foundation Inspection Pit TP3 Plan & Section B-B**	Drawn by	TSB
		Checked by	KJP
		Approved by	RJB
		APPENDIX B	

APPENDIX C

Monitoring records

GAS MONITORING RECORD SHEET

JOB DETAILS			
Site:	44 Dartmouth Part Road	Job No:	CG/18249A
Date:	30/04/2015	Engineer:	TOP
Time:	12:00	Client	Five Corners Limited

METEOROLOGICAL & SITE INFORMATION

State of ground:	Dry	x	Moist		Wet			
Wind:	Calm		Light	x	Moderate		Strong	
Cloud cover:	None		Slight	x	Cloudy		Overcast	
Precipitation:	None	x	Slight		Moderate		Heavy	
Barometric pressure (mb):	1003 - 1005		Local pressure system*:	Falling		Air temperature (°C):	12	

Well No.	Time (s)	Flow (l/hr)	dA (PA)	O_2 (% vol. in air)	CO_2 (% vol. in air)	CH_4 (% vol. in air)	PID (ppm)	Depth to GW (mbgl)	Comments
WS1	0	<0.1	0.0	16.2	4.6	<0.1	<0.1	5.34	Depth to base of borehole 5.91mbgl
	15	<0.1	0.0	16.1	4.6	<0.1	<0.1		
	30	<0.1	0.0	16.0	4.7	<0.1	<0.1		
	45	<0.1	0.0	16.0	4.7	<0.1	<0.1		
	60	<0.1	0.0	16.0	4.7	<0.1	<0.1		
	90	<0.1	0.0	16.0	4.7	<0.1	<0.1		
	120	<0.1	0.0	16.0	4.6	<0.1	<0.1		
	150	<0.1	0.0	16.1	4.6	<0.1	<0.1		
	180	<0.1	0.0	16.1	4.5	<0.1	<0.1		
	240	<0.1	0.0	16.6	4.1	<0.1	<0.1		
	300	<0.1	0.0	17.1	3.5	<0.1	<0.1		
WS2	0	<0.1	0.0	19.7	1.3	<0.1	<0.1	1.84	Depth to base of borehole 2.06mbgl
	15	<0.1	0.0	19.9	1.2	<0.1	<0.1		
	30	<0.1	0.0	19.9	1.2	<0.1	<0.1		
	45	<0.1	0.0	19.9	1.2	<0.1	<0.1		
	60	<0.1	0.0	19.9	1.2	<0.1	<0.1		
	90	<0.1	0.0	20.0	1.2	<0.1	<0.1		
	120	<0.1	0.0	19.9	1.2	<0.1	<0.1		
	150	<0.1	0.0	19.9	1.2	<0.1	<0.1		
	180	<0.1	0.0	19.9	1.2	<0.1	<0.1		
	240	<0.1	0.0	19.9	1.2	<0.1	<0.1		
	300	<0.1	0.0	19.9	1.2	<0.1	<0.1		
WS3	0	<0.1	0.0	19.7	1.8	<0.1	<0.1	5.79	Depth to base of borehole 5.85mbgl
	15	<0.1	0.0	19.5	1.8	<0.1	<0.1		
	30	<0.1	0.0	19.5	1.8	<0.1	<0.1		
	45	<0.1	0.0	19.5	1.8	<0.1	<0.1		
	60	<0.1	0.0	19.5	1.8	<0.1	<0.1		
	90	<0.1	0.0	19.5	1.8	<0.1	<0.1		
	120	<0.1	0.0	19.5	1.8	<0.1	<0.1		
	150	<0.1	0.0	19.5	1.7	<0.1	<0.1		
	180	<0.1	0.0	19.6	1.6	<0.1	<0.1		
	240	<0.1	0.0	19.7	1.4	<0.1	<0.1		
	300	<0.1	0.0	20.0	1.2	<0.1	<0.1		
WS4	0	<0.1	0.0	19.9	1.4	<0.1	<0.1	2.19	Depth to base of borehole 5.90mbgl
	15	<0.1	0.0	19.9	1.4	<0.1	<0.1		
	30	<0.1	0.0	19.8	1.4	<0.1	<0.1		
	45	<0.1	0.0	19.8	1.4	<0.1	<0.1		
	60	<0.1	0.0	19.8	1.4	<0.1	<0.1		
	90	<0.1	0.0	19.8	1.4	<0.1	<0.1		
	120	<0.1	0.0	19.8	1.4	<0.1	<0.1		
	150	<0.1	0.0	19.8	1.4	<0.1	<0.1		
	180	<0.1	0.0	19.8	1.4	<0.1	<0.1		
	240	<0.1	0.0	19.8	1.4	<0.1	<0.1		
	300	<0.1	0.0	19.8	1.4	<0.1	<0.1		

Notes:

The measurement of hydrogen sulphide and hydrocarbon free product is undertaken on a site specific basis, if deemed necessary.
** With reference to the Met Office rolling weather archive forr Northolt weather station.*

APPENDIX D

Geotechnical analysis results

INDEX PROPERTIES AND WATER CONTENTS

BS 1377 : Part 2 : 1990

Report Ref	T15/1487	**Contract**	44 Dartmouth Park Road

WS No.	Sample		Water Content W %	Liquid Limit W_L %	Plastic Limit W_P %	Plasticity Index IP %	% Passing 425 Micron Sieve	Corrected Plasticity Index IPc %	Clay Fraction %	Colloidal Activity A	Soil Classification	Remarks
	Depth m	Description										
1	1.30	Brown mottled dark green clay	35.5	79	26	53	100	53			CV	
	2.10	Brown clay	35.4	86	27	59	100	59			CV	
2	1.00	Brown and green-grey slightly gravelly clay	41.1	80	31	49	97	48			CV	
	2.50	Brown clay with occasional selenite crystals	30.9	70	25	45	100	45			CH/CV	
3	1.10	Made ground (brown clay with very occasional gravel, including brick fragments)	32.7	69	24	45	95	43			CH	
	2.00	Brown clay with occasional black flecking	33.9	81	28	53	100	53			CV	
4	1.30	Brown clay	30.4	76	27	49	100	49			CV	
	2.00	Brown clay with occasional black flecking	32.3	80	27	53	100	53			CV	

KEY: *Soil Type:* **C** - Clay **M** - Silt **S** - Sand **O** - Organic

Plasticity: **L** - Low **I** - Intermediate **H** - High **V** - Very High **E** - Extremely High

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Analytical Report Number : 15-70713

Project / Site name:	44 Dartmouth Park Road	**Samples received on:**	28/04/2015
Your job number:	CG18249A	**Samples instructed on:**	28/04/2015
Your order number:	1972	**Analysis completed by:**	08/05/2015
Report Issue Number:	1	**Report issued on:**	08/05/2015
Samples Analysed:	2 soil samples		

Signed: CCStone

Dr Claire Stone
Quality Manager
For & on behalf of i2 Analytical Ltd.

Signed: RRahman.

Rexona Rahman
Reporting Manager
For & on behalf of i2 Analytical Ltd.

Other office located at: ul. Pionierów 39, 41 -711 Ruda Śląska, Poland

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

Excel copies of reports are only valid when accompanied by this PDF certificate.

Analytical Report Number: 15-70713

Project / Site name: 44 Dartmouth Park Road

Your Order No: 1972

Lab Sample Number				439009	439010			
Sample Reference				WS1	WS2			
Sample Number				None Supplied	None Supplied			
Depth (m)				1.30	1.50			
Date Sampled				22/04/2015	22/04/2015			
Time Taken				None Supplied	None Supplied			
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1			
Moisture Content	%	N/A	NONE	25	23			
Total mass of sample received	kg	0.001	NONE	0.70	0.57			
General Inorganics								
Organic Matter	%	0.1	MCERTS	2.9	0.1			

Analytical Report Number : 15-70713

Project / Site name: 44 Dartmouth Park Road

* 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 topsoil/loam 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 *
439009	WS1	None Supplied	1.30	Brown clay and topsoil.
439010	WS2	None Supplied	1.50	Light brown clay and sand.

Analytical Report Number : 15-70713

Project / Site name: 44 Dartmouth Park Road

Water matrix abbreviations: Surface Water (SW) Potable Water (PW) Ground Water (GW)

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Organic matter in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Stones not passing through a 10 mm sieve is determined gravimetrically and reported as a percentage of the dry weight. Sample results are not corrected for the stone content of the sample.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE

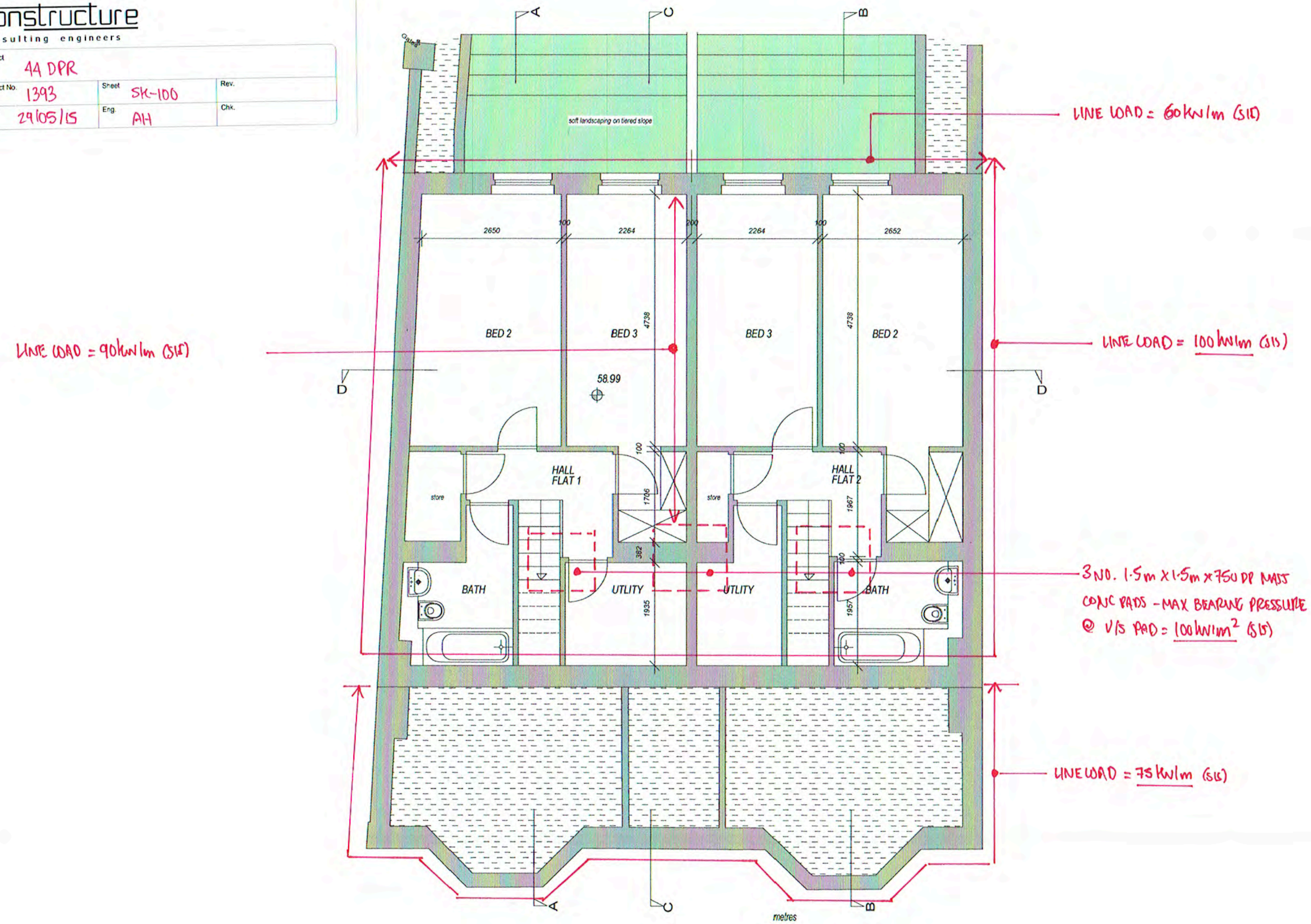
For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received 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 30oC.

APPENDIX E

Constructure Ltd. existing and underpin line loads

constructure
consulting engineers

Project	44 DPR	
Project No. 1393	Sheet SK-100	Rev.
Date 29/05/15	Eng. AH	Chk.



LOWER GROUND FLOOR PLAN
FLAT 1 - GIA 46M2
FLAT 2 - GIA 44M2

Rev A 10.4.2015 bedroom windows reconfigured, light well enlarged
Rev B 7.5.2015 bedroom windows reconfigured.

CLIENT	Five Corners Ltd	PETER STERN Architect & Designer	SCALE	1:50 at A2 1:100 at A4
JOB TITLE	44 Dartmouth Park Road NW5	33 Denman Drive North London NW11 6RD	DATE	january 2015
DRAWING TITLE	scheme for 4 flats - plans	Tel: 020 8346 2547 mob: 07957 424946 e-mail: ps@peterstern.co.uk web: www.peterstern.co.uk	DRAWING NO	370/02B pl