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GROUND INVESTIGATION & BASEMENT IMPACT ASSESSMENT REPORT

24 BURGESS HILL
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NW2 2DA

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EXECUTIVE SUMMARY

Verve Concepts Limited ("The Client") has commissioned Jomas Associates Ltd ('Jomas'), to prepare a Basement Impact Assessment at a site referred to as 24 Burgess Hill, London, NW2 2DA.

The principle objectives of the study were as follows:

- To obtain geotechnical parameters to inform preliminary foundation design.
- To undertake a Basement Impact Assessment (BIA) based the methodology of the on the guidance given in the London Borough of Camden document "Camden Planning Guidance Basements" (CPGB) (January 2021).

It should be noted that the table below is an executive summary of the findings of this report and is for briefing purposes only. Reference should be made to the main report for detailed information and analysis

Ground Investigation	
Current Site Use	The site consists of a 3-storey residential building with a basement underneath the footprint of the building with an internal height of 1.68m.
Proposed Site Use	The proposed development is to comprise creation of a basement under the existing footprint, with lightwells formed to the front and rear. Small extensions are also proposed at ground and first floor levels.
Desk Study Summary	A Desk Study report has been produced for the site and issued separately (Jomas, June 2024). A brief overview of the desk study findings is presented below. Reference should be made to the full report for detailed information. On the earliest available map (1871), the site is undeveloped, presumably used for agricultural purposes. The site becomes part of Burgess Park in 1894. By the map dated 1915 a single building has been built in the middle of the site. No observational changes then occur to the site until the most recent map dated 2024. Historically, the surrounding area has comprised mainly for agricultural land until the late 1800s when the surrounding area was used as park and few ponds were within 250m. Ponds were infilled by the maps dated 1915 with residential properties having been built surrounding the site. Residential development of the area continued until the middle of the century, after which there have been no significant changes in land use. The British Geological Survey indicates that the site is directly underlain by solid deposits of the London Clay Formation, identified as Unproductive in terms of aquifer designation. The site is located within an EA Flood Zone 1. There are no water networks or surface water features reported within 250m of

Ground Investigation	
	the site. The site is not within an area with a RoFRaS rating. Groundsure states that the site is at negligible risk of both surface water and groundwater flooding
Intrusive Investigation	The ground investigation was undertaken on 7th August 2024, and consisted of the following: • 2No. windowless sampler boreholes, drilled up to 8.0m below ground level (bgl), with associated in situ testing and sampling; • 2No. combined gas and groundwater monitoring wells installed up to 5.00m bgl; • Laboratory analysis for chemical and geotechnical purposes; • 2No. return visits to monitor groundwater levels.
Ground Conditions	The results of the ground investigation revealed a ground profile comprising Made Ground (0.00m – 0.90m thick), overlying the London Clay Formation to a maximum proven depth of 8.0m bgl. Groundwater was not reported during drilling but return monitoring visits recorded groundwater levels of between 3.07-3.24m bgl.
Geotechnical Considerations	It is anticipated that the finished floor level of the basement would be approximately 3.5m - 4.0m below existing ground floor level. Based upon the information obtained to date, it is considered that a cast in-situ cantilever retaining wall formed at approximately 3.50 - 4.00m below the existing ground floor could be designed with an allowable bearing capacity of 125kPa. The floor slab (and basement walls) would need to be constructed to conform to BS: 8102 (2009). As soils of medium volume change potential are present, heave precautions will be required against the side of foundations and ground beams in accordance with the requirements set out in NHBC Standards Chapter 4.2. The stability of all excavations should be assessed during construction. The sides of any excavations into which personnel are required to enter, should be assessed and where necessary fully supported. Given the proximity of the adjacent properties it is considered unlikely that excavations could be battered back to a safe angle. If a secant or contiguous piled wall is utilised, then it is recommended that these are installed first and then the excavation is undertaken so that the piles support the excavation sides. The progression of the basement excavation will need to consider the potential impact to existing structures both on and off site and provide adequate and appropriate support. Based on the results of chemical testing, the required concrete class for the site is DS-2 assuming an Aggressive Chemical Environment for Concrete classification of AC-1s in accordance with the procedures outlined in BRE Special Digest 1.

Ground Investigation	
Basement Impact Assessment	The overall assessment of the site is that the creation of a basement for the proposed development should not adversely impact the site or its immediate environs, providing measures are taken to protect surrounding land and properties during construction. The proposed basement excavation will be within 5m of a public pavement. It is also laterally within 5m of neighbouring properties. Unavoidable lateral ground movements associated with the basement excavations must be controlled during temporary and permanent works so as not to impact adversely on the stability of the surrounding ground and any associated services. During the construction phase careful and regular monitoring will need to be undertaken to ensure that the neighbouring properties are not adversely affected. This may mean that structures will need to be suitably propped and supported.

1 INTRODUCTION

1.1 Terms of Reference

1.1.1 Verve Concepts Limited ("The Client") has commissioned Jomas Associates Ltd ('Jomas'), to prepare a Stage 1 & 2 Basement Impact Assessment (Screening & Scoping) at a site referred to as 24 Burgess Hill, London, NW2 2DA.

1.1.2 To this end a Desk Study and Basement Impact Assessment (Screening and Scoping) has been produced for the site and issued separately (Jomas, June 2024), followed by an intrusive investigation (detailed in this report).

1.1.3 A full list of previous reports undertaken for the site by Jomas are detailed in Table 1.1:

Table 1.1: Previous Reports - Jomas

Title	Author	Reference	Date
Stage 1 &2 Basement Impact Assessment fir 24 Burgees Hill, London, NW2 2DA	Jomas Associates Ltd	P5943J3029/RAY	27 June 2024

1.1.4 Jomas' work has been undertaken in accordance with the proposal dated 8 July 2024.

1.2 Proposed Development

1.2.1 The proposed development for this site is understood to comprise creation of a basement under the existing footprint, with lightwells formed to the front and rear. Small extensions are also proposed at ground and first floor levels.

1.2.2 A plan of the proposed development is included in Appendix 1.

1.2.3 For the purpose of geotechnical assessment, it is considered that the project could be classified as a Geotechnical Category (GC) 2 site in accordance with BS EN 1997 Part 1.

1.3 Objectives

1.3.1 The objectives of Jomas' investigation were as follows:

- To present a description of the present site status, based upon the published geology, hydrogeology and hydrology of the site and surrounding area;
- To review readily available historical information (i.e., Ordnance Survey maps and database search information) for the site and surrounding areas;
- To conduct an intrusive investigation, to assess ground conditions and obtain geotechnical parameters to inform preliminary foundation design;
- To undertake a Basement Impact Assessment to assess the potential impacts that the proposal may have on ground stability, the hydrogeology and hydrology on the site and its environs.

1.4 Scope of Works

1.4.1 The following tasks were undertaken to achieve the objectives listed above:

- An intrusive investigation to assess the underlying ground conditions;
- Undertaking of laboratory testing upon soil samples obtained;
- Return groundwater monitoring;
- Carrying out a Basement Impact Assessment;
- The compilation of this report, which collects and discusses the above data, and presents an assessment of the site conditions, conclusions and recommendations.

1.5 Scope of Basement Impact Assessment

1.5.1 Jomas has based the methodology of the BIA on the guidance given in the London Borough of Camden document “Camden Planning Guidance Basements” (CPGB) (January 2021).

1.5.2 The CPGB differentiates between lower ground floors and basements. Noting that storeys built partially below ground are common around London and especially in Camden, in particular in historic buildings. To be considered a lower ground floor and not a basement the storey must typically:

- Have a significant proportion above the prevailing ground level,
- Be accessible from the outside of the building at the front and rear of the property,
- Form part of the original fabric of a building, and Form part of the character of the area.

1.5.3 The proposed development does not meet these criteria so would be deemed a basement and therefore requires a BIA.

1.5.4 This BIA covers most items required under CPGB, with the exception of:

- Plans and sections to show foundation details of adjacent structures.
- Programme for enabling works, construction and restoration.
- Evidence of consultation with neighbours.
- Ground Movement Assessment (GMA), to include assessment of significant adverse impacts and specific mitigation measures required, as well as confirmatory and reasoned statement identifying likely damage to nearby properties according to the Burland Scale.
- Construction Sequence Methodology.
- Proposals for monitoring during construction.

- Drainage assessment.

1.5.5 This Jomas BIA also takes into account the Campbell Reith pro forma BIA produced on behalf of and published by the London Borough of Camden as guidance for applicants to ensure that all of the required information is provided.

1.5.6 A number of the requirements set out in the London Borough of Camden document CPGB will need to be addressed in a construction management plan, this stage is not within the scope of work that Jomas Associates have been commissioned to undertake.

1.6 Supplied Documentation

1.6.1 Jomas Associates have not been supplied with any previously produced reports at the time of writing this report.

1.7 Limitations

1.7.1 Jomas Associates Ltd ('Jomas') has prepared this report for the sole use of Verve Concepts Limited in accordance with the generally accepted consulting practices and for the intended purposes as stated in the agreement under which this work was completed. This report may not be relied upon by any other party without the explicit written agreement of Jomas. No other third party warranty, expressed or implied, is made as to the professional advice included in this report. This report must be used in its entirety.

1.7.2 The records search was limited to information available from public sources; this information is changing continually and frequently incomplete. Unless Jomas has actual knowledge to the contrary, information obtained from public sources or provided to Jomas by site personnel and other information sources, have been assumed to be correct. Jomas does not assume any liability for the misinterpretation of information or for items not visible, accessible or present on the subject property at the time of this study.

1.7.3 Whilst every effort has been made to ensure the accuracy of the data supplied, and any analysis derived from it, there may be conditions at the site that have not been disclosed by the investigation, and could not therefore be taken into account. As with any site, there may be differences in soil conditions between exploratory hole positions. Furthermore, it should be noted that groundwater conditions may vary due to seasonal and other effects and may at times be significantly different from those measured by the investigation. No liability can be accepted for any such variations in these conditions.

1.7.4 ***This report is not an engineering design and the figures and calculations contained in the report should be used by the Structural Engineer, taking note that variations may apply, depending on variations in design loading, in techniques used, and in site conditions. Our recommendations should therefore not supersede the Engineer's design.***

2 SITE SETTING & HISTORICAL INFORMATION

2.1 Site Information

2.1.1 The site location plan is appended to this report in Appendix 1.

Table 2.1: Site Information

Name of Site	-
Address of Site	24 Burgess Hill London NW2 2DA
Approx. National Grid Ref.	524989, 185883
Site Area (Approx)	0.04 hectares
Site Ownership	Residential
Site Occupation	London Borough of Camden
Local Authority	Residential with a basement located within the footprint of the building
Proposed Site Use	24 Burgess Hill London NW2 2DA

2.2 Desk Study Overview

2.2.1 A Desk Study report has been produced for the site, by Jomas dated 27 June 2024, and issued separately. A brief overview of the desk study findings is presented below. Reference should be made to the full report for detailed information.

2.2.2 On the earliest available map (1871), the site is undeveloped, presumably used for agricultural purposes. The site becomes part of Burgess Park in 1894. By the map dated 1915 a single building has been built in the middle of the site. No observational changes then occur to the site until the most recent map dated 2024.

2.2.3 The surrounding area has comprised mainly for agricultural land until the late 1800s when the surrounding area was used as park and few ponds were within 250m. Ponds were infilled by the maps dated 1915 with residential properties having been built surrounding the site. Residential development of the area continued until the middle of the century, after which there have been no significant changes in land use.

2.2.4 The British Geological Survey indicates that the site is directly underlain by solid deposits of the London Clay Formation, identified as Unproductive in terms of aquifer designation.

2.2.5 There are no artificial deposits reported within the site area.

2.2.6 A review of the EnviroInsight report indicates that the site is located within an EA Flood Zone 1.

2.2.7 There are no water networks or surface water features reported within 250m of the site.

2.2.8 The site is not within an area with a RoFRaS rating.

2.2.9 Groundsure states that the site is at negligible risk of both surface water and groundwater flooding.

2.2.10 An intrusive ground investigation is recommended to confirm the ground conditions and groundwater levels (if any) beneath the site, as well as to inform foundation design.

2.3 Basement Impact Assessment (Screening and Scoping)

2.3.1 In addition to the Preliminary Risk Assessment carried out as part of the Desk Study, the Screening and Scoping stage of the Basement Impact Assessment was also carried out.

2.3.2 Screening identifies the area that require further (usually intrusive) investigation whilst Scoping is the activity of defining in further detail the matters to be investigated as part of the BIA process. Scoping comprises of the definition of the required investigation needed in order to determine in detail the nature and significance of the potential impacts identified during screening.

2.3.3 These issues are summarised below:

2.3.4 The proposed development will comprise a basement within the existing footprint of the building and tow lightwells formed within areas of existing hardstanding. As a result, there is unlikely to be an increase in the proportion of hardstanding areas and it is not considered necessary to undertake further assessment in relation to the proposed changes to areas of external hardstanding.

2.3.5 The site was considered to be at low risk of flooding based on historic flooding

2.3.6 The published geological maps indicate that the site is directly underlain by solid deposits of the London Clay Formation. These soils may be prone to seasonal shrink-swell, and mitigation against this may need to be incorporated into basement design. This should be confirmed by an intrusive investigation.

2.3.7 The proposed basement excavation will be within 5m of neighbouring properties.

2.3.8 Unavoidable lateral ground movements associated with the basement excavations must be controlled during temporary and permanent works so as not to impact adversely on the stability of the surrounding ground, any associated services and structures.

2.3.9 It is recommended that the site is supported by suitably designed temporary support with a basement box construction. This will ensure that the adjacent land is adequately supported in the temporary and permanent construction. Alternatively, the excavation should proceed in a manner that maintains the integrity of the ground on all sides.

2.3.10 Careful and regular monitoring of the structure will need to be undertaken during the construction phase to ensure that vertical movements do not adversely affect the above property. If necessary, the works may have to be carried out in stages with the above structure suitably propped and supported.

2.3.11 Full details of the suitable engineering design of the scheme in addition to an appropriate construction method statement should be submitted by the Developer to the London Borough of Camden.

2.3.12 Groundsure data indicates that there are no tunnels reported within 250m of the site.

2.4 Previous Site Investigations

2.4.1 No previous site investigation reports were provided at the time of writing.

3 GROUND INVESTIGATION

3.1 Scope of Ground Investigation

3.1.1 The ground investigation was undertaken on 7th August 2024.

3.1.2 The work was undertaken in accordance with BS5930:2015+A1:2020 'Code of Practice for Site Investigation' and BS10175 'Investigation of Potentially Contaminated Sites', NHBC Standards, Chapter 4.1 and AGS Guidelines for Good Practice in Site Investigations.

3.1.3 The investigation focused on collecting data on the following:

- Quality of Made Ground/ natural ground within the site boundaries;
- Presence of groundwater beneath the site (if any), perched or otherwise;
- Obtaining geotechnical parameters to allow initial design to take place;
- Obtaining information relevant to the assessment of risk posed to the proposed basement identified during the Screening and Scoping stage of the BIA.

3.1.4 A summary of the fieldwork carried out at the site, with justifications for exploratory hole positions, are offered in Table 3.1 below.

Table 3.1: Scope of Intrusive Investigation

Investigation Type	No. of Exploratory Holes Achieved	Exploratory Hole Designation	Depth Achieved (m BGL)	Justification
Windowless Sampler Boreholes	2	WS1– 2	Up to 8.0 m bgl	Obtain shallow samples for laboratory contamination and geotechnical testing. To allow in-situ geotechnical testing.
Monitoring Wells	2	WS1– 2	Up to 5m bgl	Groundwater monitoring wells. WS1 and 2 - response zone in the London Clay Formation.

3.1.5 The exploratory holes were completed to allow soil samples to be taken in the areas of interest identified in Table 8.1 above. In all cases, all holes were logged in accordance with BS5930:2015.

3.1.6 Exploratory hole positions were located surveyed to national grid reference, as shown in the exploratory hole location plan presented in Appendix 1. The exploratory hole records are included in Appendix 2.

3.2 In-situ Geotechnical Testing

3.2.1 In-situ geotechnical testing included Standard Penetration Tests. The determined 'N' values have been used to determine the relative density of granular materials and have been used with standard correlations to infer various other derived geotechnical parameters including the undrained shear strength of the cohesive strata. The results of the individual tests are on the appropriate exploratory hole logs in Appendix 2.

3.3 Limitations

3.3.1 WS1 was drilled in the proposed position, to the proposed depths.

3.3.2 WS2 was moved further northeast as per the recommendation of a specialist utility surveyor.

3.3.3 During the intrusive ground investigation, no impenetrable obstructions were encountered. However, the possible presence of natural and/or manmade obstructions on site cannot be discounted.

3.4 Laboratory Analysis

3.4.1 A programme of laboratory testing, scheduled by Jomas, was carried out on selected samples of Made Ground and natural strata.

<u>Geotechnical Laboratory Testing</u>

3.4.2 In addition to the contamination assessment, soil samples were submitted to the UKAS Accredited laboratory of K4 Soils Ltd for a series of analyses.

3.4.3 This testing was specifically designed to:

- to classify the samples; and
- to obtain parameters (either directly or sufficient to allow relevant correlations to be used) relevant to the technical objectives of the investigation.

3.4.4 The following laboratory geotechnical testing (as summarised in Table 3.4) was carried out:

Table 3.4 Laboratory Geotechnical Analysis

Methodology	Test Description	Number of tests
BS1377:1990	Moisture Content Determination	3
BS1377:1990	Liquid and Plastic Limit Determination (Atterberg Limits)	3

3.4.5 In addition, 4No. soil samples were sent to the UKAS and MCerts accredited laboratory of Derwentside Environmental Testing Services Ltd and analysed for a modified BRE

Special Digest 1 suite (acid and water soluble sulphate, total sulphur and pH) to assist with the ACEC classification for buried concrete.

3.4.6 The results of the geotechnical laboratory testing are presented as Appendix 4 and discussed in Section 9 of this report.

4 GROUND CONDITIONS ENCOUNTERED

4.1.1 A factual record of the conditions encountered during the physical investigation of the site is presented in the following section.

4.1.2 For further details of the ground conditions, reference should be made to the exploratory hole location plan presented in Appendix 2, exploratory hole logs presented in Appendix 2, the geotechnical testing results in Appendix 3 and the chemical testing results in Appendix 4.

4.2 Ground Conditions

4.2.1 The ground conditions encountered were broadly consistent with those anticipated, i.e. a thickness of Made Ground overlying the London Clay Formation, and are summarised in Table 4.1 below.

Table 4.1: Ground Conditions Encountered

Stratum and Description	Encountered from (m bgl)	Base of strata (m bgl)	Thickness range (m)
Granite paving slabs over Concrete. (MADE GROUND)	0.0	0.25	0.25
Light brown gravelly sand. Sand is fine to coarse. Gravel consists of fine to coarse, angular to sub-rounded flint and brick. (MADE GROUND) Encountered in WS2 only.	0.25	0.60	0.45
Orangish brown sandy gravelly clay with occasional rootlets. Sand is fine to coarse. Gravel consists of sub-angular to sub-rounded flint with occasional brick. (MADE GROUND)	0.25-0.60	0.80-0.90	0.30-0.55
Soft becoming stiff consistency** light brown mottled brown CLAY. (LONDON CLAY FORMATION).	0.80-0.90	6.00 - 6.70	5.10-5.90
Stiff consistency** grey to dark CLAY. (LONDON CLAY FORMATION).	6.00 - 6.70	>8 [base not proven]	>2.0 - >2.3 [thickness not proven]

**Consistency estimated using semi-empirical correlations with SPT N-values, Plasticity Indices and published literature.

4.3 Hydrogeology

4.3.1 Groundwater was not encountered during the fieldworks.

4.3.2 2No. return monitoring visits were undertaken on 21st and 28th August 2024. The results are summarised below.

Table 4.3: Groundwater Monitoring Records

Exploratory Hole ID	Depth Encountered (mbgl)	Depth to Base of Well (mbgl)	Stratum
WS1	3.20-3.24	5.25	London Clay Formation
WS2	3.07-3.09	5.33-5.55	London Clay Formation

4.3.3 The groundwater encountered during post-investigation monitoring is considered to represent perched water bodies from the London Clay Formation, or surface water having flowed towards the site and collected in the wells.

4.3.4 It should be noted that changes in groundwater levels can occur for a number of reasons including seasonal effects and variations in drainage. Such fluctuations may only be recorded by the measurement of the groundwater level within a standpipe or piezometer installed within appropriate response zones. Changes in groundwater level can have a direct effect on excavation stability and dewatering requirements, and cohesive soils can soften under rising or high groundwater levels.

4.4 Physical and Olfactory Evidence of Contamination

4.4.1 No visual or olfactory evidence of contamination was observed during the course of the investigation.

4.5 Limitations

4.5.1 During the intrusive ground investigation, no impenetrable obstructions were encountered. However, the possible presence of natural and/or manmade obstructions on site cannot be discounted.

5 DERIVATION OF GEOTECHNICAL PARAMETERS

5.1 Introduction

5.1.1 A summary of ground conditions obtained from the ground investigation and the derived geotechnical parameters is provided below.

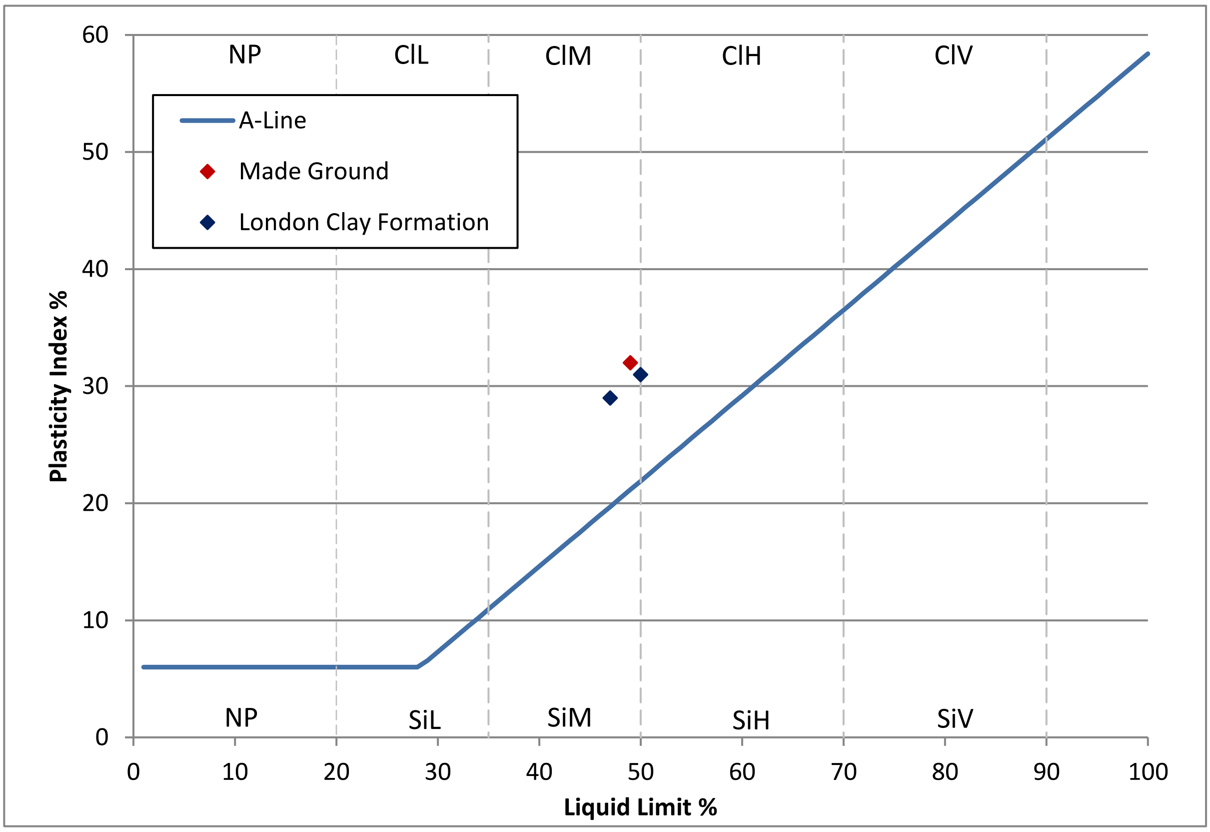
5.2 Plasticity of Cohesive Materials

5.2.1 Atterberg Limit determination was undertaken on 1No sample of the Made Ground at a depth of 0.5mbgl, and 2No samples of the London Clay Formation, at depths of 3.5m and 7.0m bgl.

5.2.2 A Plasticity Index value of 32% was recorded in the Made Ground, whilst values of 29% and 31% were recorded in the London Clay Formation, indicative of soils of intermediate plasticity, as illustrated in Figure 5.1 below.

5.2.3 Modified Plasticity Index values in these strata ranged from 28.16% to 31%, indicating soils with medium volume change potential.

Figure 5.1: Plasticity Chart



5.4 Undrained Shear Strength

5.4.1 Standard Penetration Tests were undertaken at regular intervals throughout the windowless sample boreholes. The results of the SPTs have been used to infer the undrained shear strength using the correlation suggested by Stroud (1974).

5.4.2 As discussed above, the N values recorded in the clay vary with depth, this infers that the undrained shear strength of the clay similarly varies. Figure 5.2 below shows the undrained shear strength inferred by the correlation suggested by Stroud (1974);

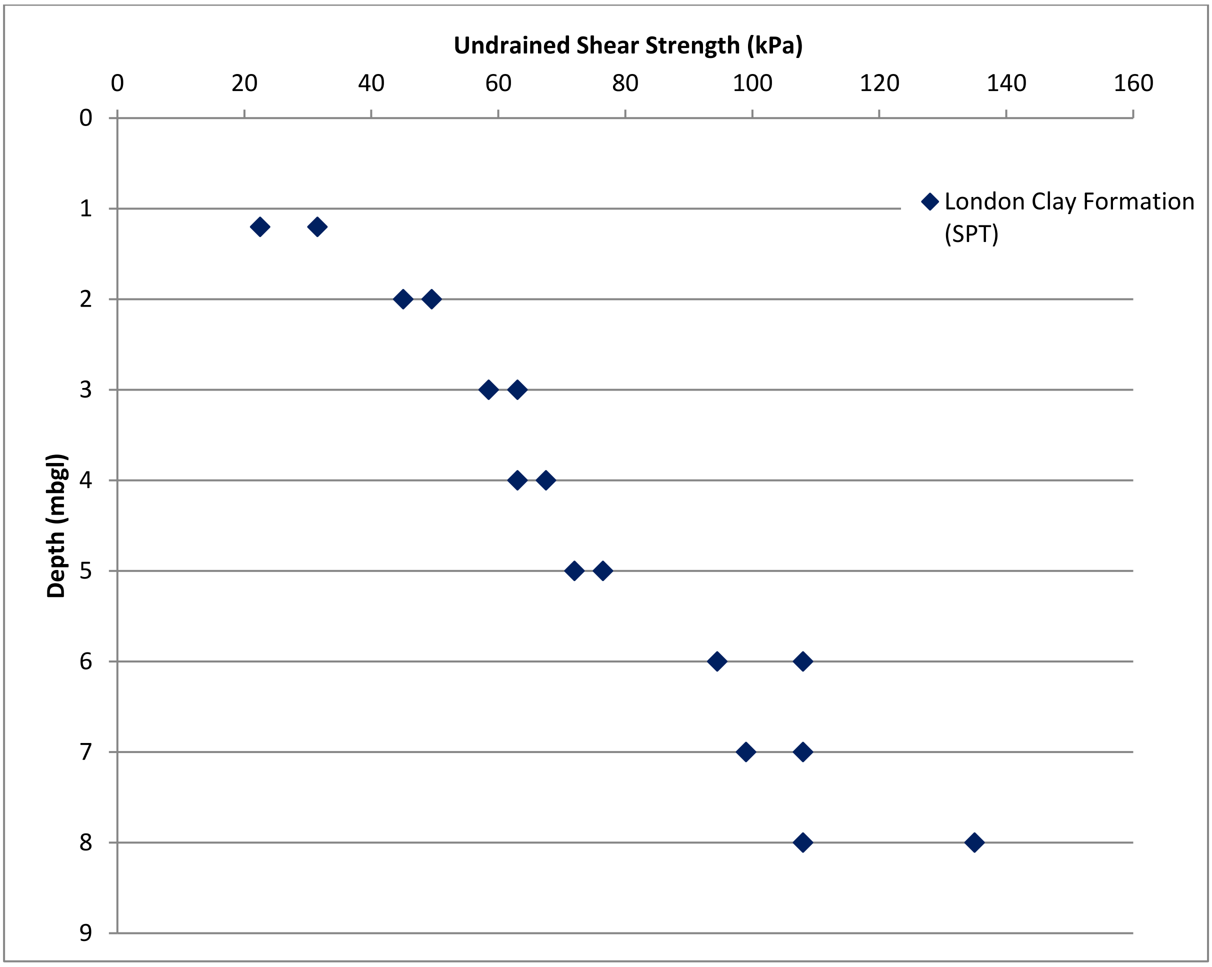
$c_u = f_1 \times N$ can be applied,

in which
c_u = mass shear strength (kN)
f_1 = constant
N = SPT value achieved during boring operations

5.4.3 In the above equation f_1 is dependent on the plasticity of the material that the SPT is being carried out in. As the plasticity indices were shown to be greater than 25% a value for f_1 of 4.5 has been adopted after Tomlinson (2001)

5.4.4 The graph below shows the shear strength profile of the encountered cohesive materials at the site, based on the SPT to shear strength correlation described above.

Figure 5.2: Undrained Shear Strength v Depth



5.4.5 As shown above, the shear strength of the London Clay Formation inferred from SPTs increases progressively with depth.

5.5 Coefficient of Compressibility

5.5.1 Stroud and Butler (1974) developed a relationship between the coefficient of compressibility (m_v) and SPT N-value.

$m_v = 1/ f_2 x N$ can be applied,

in which

m_v = coefficient of compressibility (m^2/MN)

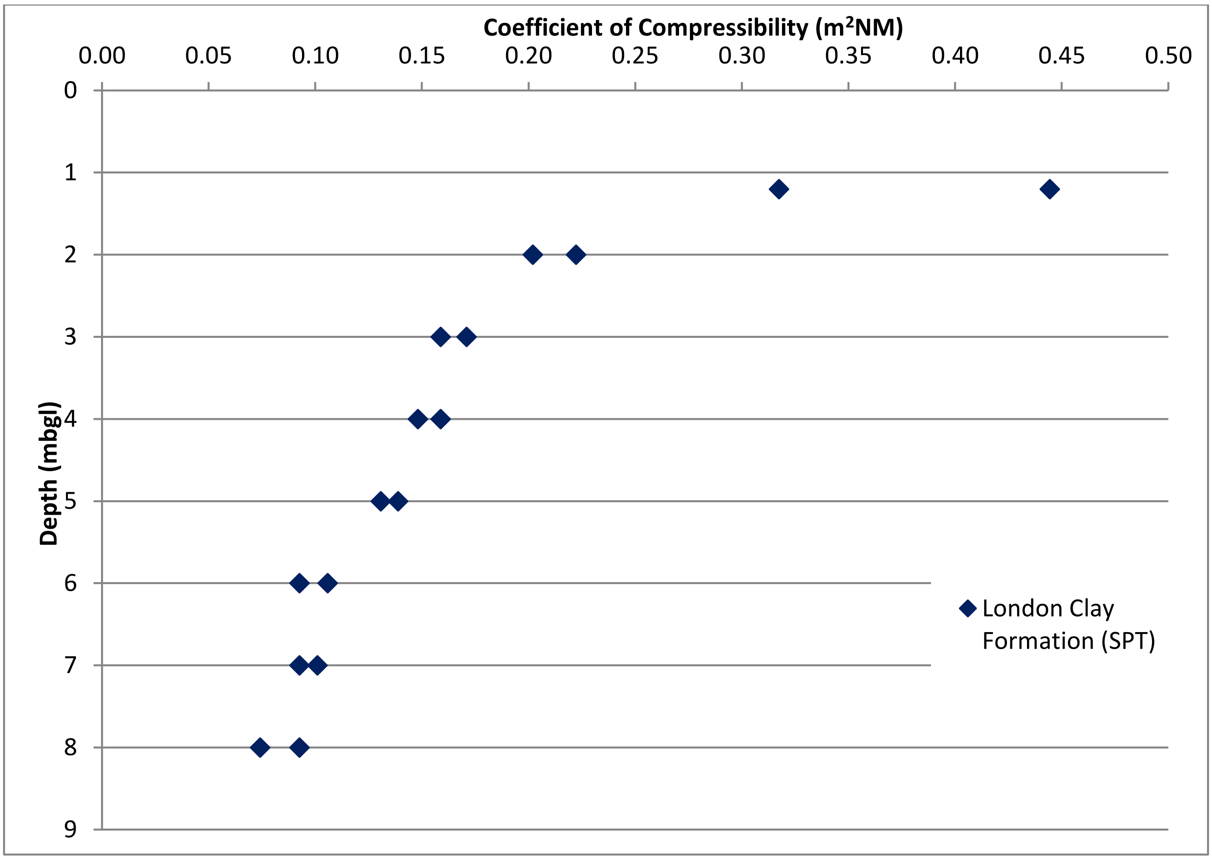
f_2 = constant dependent on the plasticity index

N = SPT value achieved during boring operations

5.5.2 Using the plasticity indices obtained and the graphs provided in Tomlinson (2001) a value of f_2 of 0.45 has been taken and used with the SPT N-values to infer coefficient of compressibility (m_v).

5.5.3 Where the undrained shear strength of the clays was measured using the quick undrained triaxial methodology, the m_v value was calculated by rearranging the equations for f_1 and f_2 and substituting in the measured undrained shear strength.

Figure 5.3: Coefficient of Volume Compressibility (mv) v Depth



5.5.4 As shown above, the values reduce with depth as the clay increases in strength and the over burden increases, reducing the potential for compressibility.

5.5.5 The shallow deposits of the London Clay Formation are generally of "medium compressibility". This is considered to be due to a combination of weathering and softening of the upper horizon of the London Clay, and the lack of overburden pressure at shallow depth allowing the clays to relax and so compress slightly when loaded.

5.6 Density

5.6.1 In the absence of geotechnical laboratory test results, the correlations and suggested values for both cohesive and granular materials given in BS8004:2015 have been used.

5.6.2 The derived Unit Weights are summarised below in Table 5-1.

Table 5-1: Derived Unit Weights

Strata	Unit Weight (kN/m³)
Made Ground	17
London Clay Formation	19

5.7 Effective Angle of Shearing Resistance / Angle of Friction

5.7.1 In cohesive soils, the effective angle of shearing resistance can be derived from the plasticity index of the soil, using the following equation presented in BS8004:2015.

$$\emptyset' = 42 - (12.5xLOG10(PI))$$

Where PI = Plasticity Index.

5.7.2 Values have been calculated for all available Plasticity Index results and are presented in Table 5-2.

Table 5-2: Derived Angles of Shearing Resistance

Sample	Stratum	Derived Angle of Shearing Resistance (°)
WS1 – 0.5m	Made Ground	23.2
WS2 – 3.5m	London Clay Formation	23.4
WS2 – 7m	London Clay Formation	23.7

5.8 Stiffness Moduli

5.8.1 In cohesive soils of the London Clay Formation, the undrained stiffness modulus (Young's Modulus) can be derived using the correlation with undrained shear strength as postulated by Jardine et al. (1985):

$$\underline{Eu\ (kPa) = 400 * Cu}$$

5.8.2 The drained Young's Modulus for the London Clay Formation can then be derived from Eu, as follows:

$$E' = 0.6 * Eu$$

5.9 Summary of Derived General Properties

5.9.1 Based on the analysis of the ground investigation data and past experience with similar deposits, the following derived general parameters are given in Table 5-3.

Table 5-3: Derived General Parameters

Property	Made Ground	London Clay Formation
Unit Weight$^{1)}$	17	19
Drained Friction, ϕ' (◦)	23.2$^{2)}$	23.4-23.7$^{2)}$
Drained Cohesion, c' (kPa)	0	0
SPT N-value	-	5-30
Undrained Young's Modulus, E_u (MPa) $^{4)}$	-	9.0 – 54.0
Drained Young's Modulus E' (MPa)	-	5.4 – 32.4$^{5)}$
Undrained Shear Strength, c_u (kPa) $^{6)}$	-	22.5-135
Plasticity Index (%)	32	29-31
Modified Plasticity Index (%)	28.16	29-31
Volume Change Potential [NHBC]	Medium	Medium
Modulus of Volume Compressibility, m_v (m^2/MN) $^{7)}$	-	0.074 – 0.444

$^{1)}$ Derived from Figures 1 and 2 of BS8004:2015

$^{2)}$ Calculated from: ϕ' = (42°- 12.5log10I_p) for 5% ≤ I_p ≤ 100% Where, I_p is the soil's plasticity index (BS8004:2015).

$^{3)}$ Calculated from Table 1 of BS8004:2015

$^{4)}$ Calculated from: E_u = 1.2 N MPa, based on the guidance given in CIRIA Report 143.

$^{5)}$ Calculated from E' = 0.9 N MPa, based on the guidance given in CIRIA Report 143.

$^{6)}$ The undrained shear strength (c_u) of the cohesive soils was correlated to the SPT N-values using Stroud (1974), where c_u=f_1N and f_1 is factor related to the Plasticity Index (PI) of the clay (a value of f_1 equal to 5.0 for PI ≤ 25% and a value of f_1 value equal to 4.5 for PI>25).

$^{7)}$ Calculated from: m_v = 1/f_2 N m^2/MN, f_2 is a coefficient proposed by Stroud and Butler (1975) and varies with Plasticity Index (PI) as presented in Figure 27 of CIRIA Report 27 or 10/c_u.

6 GEOTECHNICAL ENGINEERING RECOMMENDATIONS

6.1 General

6.1.1 Subsequent to intrusive investigation of the site and receipt of the laboratory test results, the following geotechnical assessments have been made.

6.2 Proposed Foundations

General

6.2.1 The Made Ground deposits are not considered to provide suitable bearing strata due to their variability and the unacceptable risk of total and differential settlement.

6.2.2 All foundations should be deepened beneath these deposits, soft clay, root or desiccated zones, or disturbed ground, and founded within underlying competent strata.

6.2.3 As soils of medium volume change potential are present, heave precautions will be required against the side of foundations and ground beams in accordance with the requirements set out in NHBC Standards Chapter 4.2.

Conventional Foundations

6.2.4 It is considered that cast in-situ cantilever retaining walls may be formed within the London Clay Formation at a depth of 4.0m bgl for an allowable bearing capacity of 125kPa. Total and differential settlements should be contained within tolerable limits.

6.2.5 If foundations span different strata, e.g. sand and clay, they should either be deepened to terminate in a single soil stratum, or suitable reinforcement included (to be detailed by the Structural Engineer).

6.2.6 Foundations greater than 2.50m deep require structure-specific design by a structural engineer. In this instance, consideration could be given to the use of piled foundations instead, which might be preferable in terms of economy and practicality.

6.2.7 Where any unexpected or soft ground conditions are encountered during the groundworks, works in that area should cease and the advice of a suitably qualified geotechnical engineer sought.

6.3 Retaining Walls

6.3.1 It is anticipated that retaining structure(s) will be required.

6.3.2 Based on the analysis of the available site investigation data and past experience with similar deposits the parameters in Table 6.2 are considered appropriate for the potential retaining structure(s).

Table 6-1: Geotechnical Parameters for Retaining Wall Design

	Made Ground	London Clay Formation
Critical state angle of shearing resistance (ϕ')°	23	23
Effective Cohesion kN/m^2	0	0
Saturated Bulk Weight (γ_{sat}) kN/m^3	17	19

6.3.3 In addition, the specialist contractor should ensure the stability of the cut-face during the temporary works.

6.3.4 As an alternative to cantilever retaining walls, fully embedded retaining walls comprising a contiguous/secant piled basement box could be formed. The piles would need to act as retaining walls as well as carry the structural loadings. The piles should be designed to withstand the earth pressures, and still meet the required structural requirements regarding issues such as deflection, deformation and bending.

6.3.5 To provide sufficient support for the excavation, it is recommended that un-propped piles are formed to at least three times the depth of excavation.

6.3.6 If these piles can be suitably propped, then this depth may be reduced. Suitable propping could be provided by the basement floor and the ground floor if they are suitably tied into the piles and suitably reinforced. This may require specialist construction techniques.

6.4 Aggressive Ground Conditions

6.4.1 Sulphate attack on building foundations occurs where sulphate solutions react with the various products of hydration in Ordinary Portland Cement (OPC) or converted High-Alumina Cement (HAC). The reaction is expansive, and therefore disruptive, not only due to the formation of minute cracks, but also due to loss of cohesion in the matrix.

6.4.2 In accordance with BRE Special Digest 1, the characteristic values of sulphate used to determine the concrete classification are determined using the methodology summarised in the table below.

Table 6-2: Concrete in the Ground Characteristic Value Determination

No Samples in the dataset	Method for determining the sulphate characteristic value
1 - 4	Highest value
5 - 9	Mean of the top 2No highest results
10 or greater	Mean of the top 20% highest results

6.4.3 Table 6-3 summarises the analysis of the aggressive nature of the ground for each of the strata encountered within the ground investigation.

Table 6-3: Concrete in the Ground Classes

Stratum	No Samples	pH range	Characteristic WS Sulphate (mg/l)	Characteristic Total Potential Sulphate (%)[1]	Design Sulphate Class	ACEC Class
Made Ground	1	7.8	12	n/a	DS-1	AC-1s
London Clay Formation	3	6.7-7.8	41	n/a	DS-2	AC-1s

1) Applies to soils containing more than 0.3% of oxidisable sulphides, calculated in accordance with BRE SD-1

6.4.4 Analysis of the results indicates that the underlying soils do not contain appreciable concentrations of oxidisable sulphates and therefore the Design Class is dependent on the soluble sulphate content and pH only.

6.4.5 It should be noted that the BGS description of the London Clay Formation notes that it includes “disseminated pyrite”. It is therefore common practice to ensure that buried concrete formed in London Clay Formation has a Design Sulphate Class of at least DS-2.

6.4.6 The concrete structures, including foundations, will need to be designed in accordance with BS EN 1992-1-1:2004+A1:2014. It is recommended that the advice of this publication be taken for the design and specification of all sub-surface concrete.

6.5 Ground Floor Slabs

6.5.1 It is anticipated that finished floor level of the proposed basement will be approximately 4.0m below the existing ground floor level.

6.5.2 If a cantilever retaining wall is utilised, then a ground bearing floor slab could be used. In this case, formations of the structures should be inspected by a competent person. Any loose or soft material should be removed and replaced with well-graded, properly compacted granular fill or lean mix concrete. The formation should be blinded if left exposed for more than a few hours or if inclement weather is experienced.

6.5.3 If a piled option is utilised then suspended floor slabs will be required. The loadings from the suspended floor slab will need to be carried by the foundations, which will need to be designed to not only carry the structural loadings but the additional floor loadings.

6.5.4 All floor slabs would also need to be suitably reinforced, not only to distribute the structural loading but also to ensure that the floor slab can prop the retaining walls and does not buckle from the lateral pressures imposed by the cantilever retaining walls.

6.5.5 The floor slab (and basement walls) would need to be constructed to conform to BS: 8102 (2009).

6.6 Excavations

6.6.1 Temporary excavations within the cohesive soils are likely to remain relatively stable in the short term though some spalling may be anticipated.

6.6.2 Ground works should always be designed in such a manner to avoid entry into excavations by construction or maintenance personnel. However, in the event that such works cannot be avoided or designed out, they should only be undertaken in accordance with a safe system of work, following an appropriate risk assessment and in accordance with any legislative requirements, e.g. Confined Spaces Regulations.

6.7 Groundwater Control

6.7.1 Groundwater was not reported during drilling of the boreholes

6.7.2 During return monitoring groundwater was reported at depths of between 3.07m and 3.24mbgl. It is considered that this represents a perched water body, as opposed to the natural groundwater table.

6.7.3 Given that the London Clay Formation is reported as an Unproductive stratum, it is unlikely that significant quantities of groundwater would be encountered during construction, though surface water/rainfall ingress into excavations is unlikely to drain away quickly.

6.7.4 Subject to seasonal variations, any groundwater, surface water or rainfall ingress encountered during site works could be readily dealt with by conventional pumping from a sump used to collate waters.

7 BASEMENT IMPACT ASSESSMENT

7.1 Geological Impact

7.1.1 The published geological maps indicate that the site is directly underlain by the London Clay Formation. Given that the site has been developed previously, a thickness of Made Ground was also expected to be present overlying the natural soils.

7.1.2 These ground conditions were confirmed by the ground investigation which reported Made Ground up to 0.9m bgl overlying the London Clay Formation to a maximum proven depth of 8m bgl. The proposed basement will be founded within the London Clay Formation.

7.1.3 Laboratory testing indicates that the underlying cohesive soils are of medium volume change potential. Heave precautions will be required in accordance with the guidance set out in NHBC Standards Chapter 4.2.

7.2 Hydrology and Hydrogeology Impact

7.2.1 Based on all the information available at the time of writing, the risk of flooding from groundwater is considered to be low. The proposed basement is unlikely to have a detectable impact on the local groundwater regime. Appropriate water proofing measures should be included within the whole of the proposed basement wall/floor design as a precaution.

7.2.2 The London Clay Formation is classed as Unproductive, and the creation of the basement is considered unlikely to have any impact upon the hydrogeology of the area.

7.2.3 The proposed development will lie outside of flood risk zones and is therefore assessed as being at a very low probability of fluvial flooding.

7.2.4 There are no surface water features on or in the immediate vicinity of the site. It is therefore not anticipated that the site will make any impact upon the hydrology of the area.

7.2.5 The proposed basement construction is considered unlikely to create a reduction of impermeable area in the post development scenario.

7.2.6 No risk of flooding to the site from artificial sources has been identified.

7.3 Impacts of Basement on Adjacent Properties and Pavement

7.3.1 Impacts such as changes to areas of external hardstanding and past flooding are addressed within the Stage 1 & 2 (Screening and Scoping) Basement Impact

Assessment for 24 Burgess Hill, London, NW2 2DA (Jomas Associates Ltd, P5943J3029/RAY, June 2024).

7.3.2 Impacts to adjacent properties will be assessed under separate cover by production of a Ground Movement Assessment report.

7.3.3 Full details of the suitable engineering design of the scheme in addition to an appropriate construction method statement should be submitted by the Developer to the London Borough of Camden.

7.4 Cumulative Impacts

7.4.1 The site has been identified as being directly underlain by unproductive London Clay Formation.

7.4.2 Such materials prevent the movement of groundwater and the ingress of surface water into the ground.

7.4.3 The development of the basement will therefore not significantly affect the groundwater flow on site or in the surrounding area.

7.5 Conclusion

7.5.1 The overall assessment of the site is that the creation of a basement for the existing development will not adversely impact the site or its immediate environs, providing measures are taken to protect surrounding land and properties during construction.

7.5.2 The proposed development is not expected to cause significant problems to the subterranean drainage.

8 REFERENCES

BRE Report BR211; Radon: Guidance on protective measures for new buildings, 2023

British Standards Institution (1999) BS 5930:2015 *Code of practice for site investigations*. Milton Keynes: BSI

Code of Practice for Site Investigations BS5930: 2015

Environment Agency (2020) Land contamination risk management (LCRM)

Groundsure EnviroInsight Report Ref GS-ITJ-XAJ-QR8-XWJ May 2024

Groundsure GeoInsight Report Ref GS-ITJ-XAJ-QR8-XWJ May 2024

Ministry of Housing, Communities and Local Government: *National Planning Policy Framework.* February 2019

Investigation of Potentially Contaminated Sites – Code of Practice BS10175: 2011

Jomas Associates Ltd (April 2019) "*Desk Study & Basement Impact Assessment for Whetstone Delivery Office, Oakleigh Road North, London, N20 9EY"*

London Borough of Camden (March 2018) *"Camden Planning Guidance Basements"*

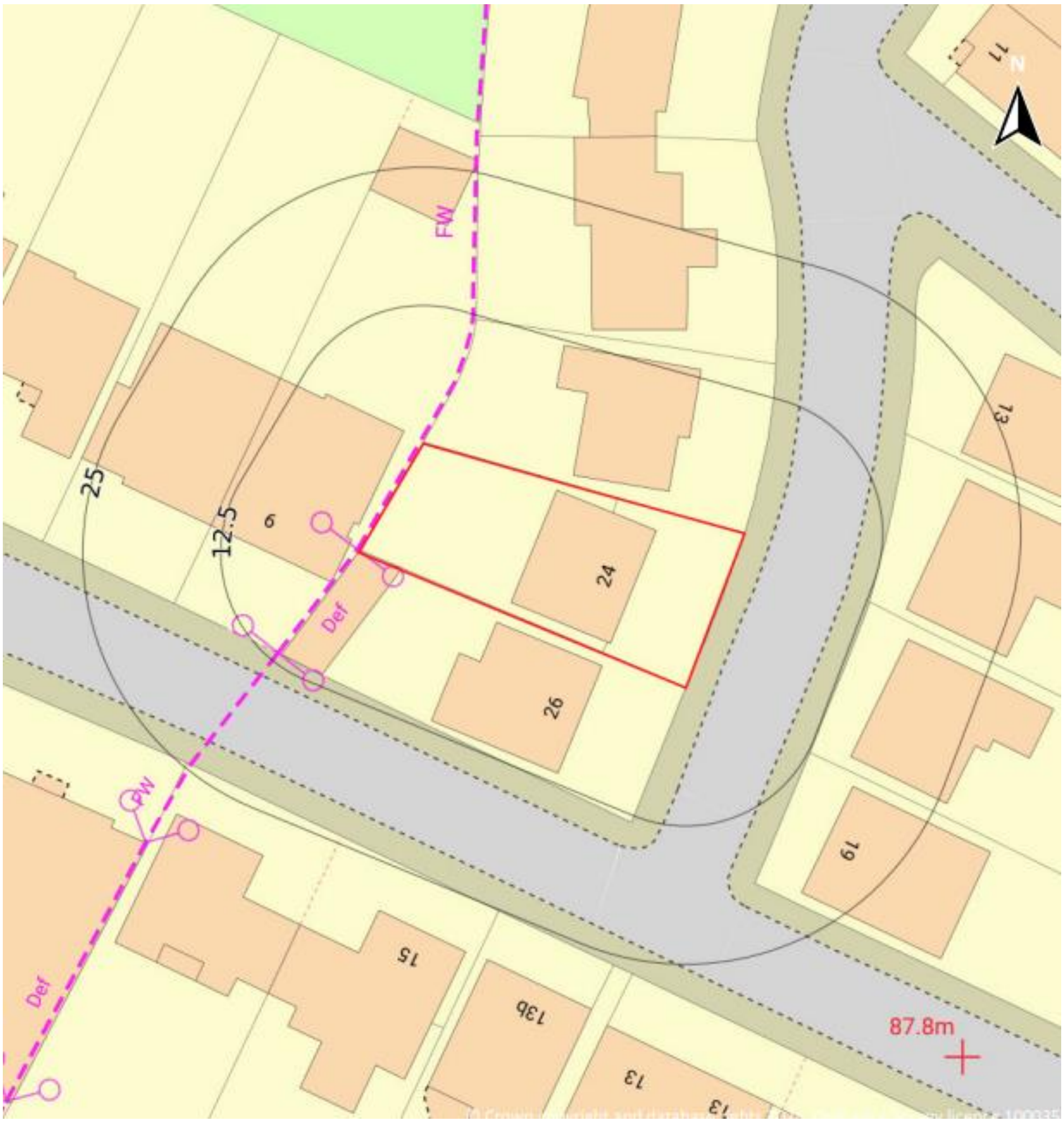
Campbell Reith (March 2018) *"Pro Forma Basement Impact Assessment*", London Borough of Camden

Other councils guidance and SFRA etc

APPENDICES

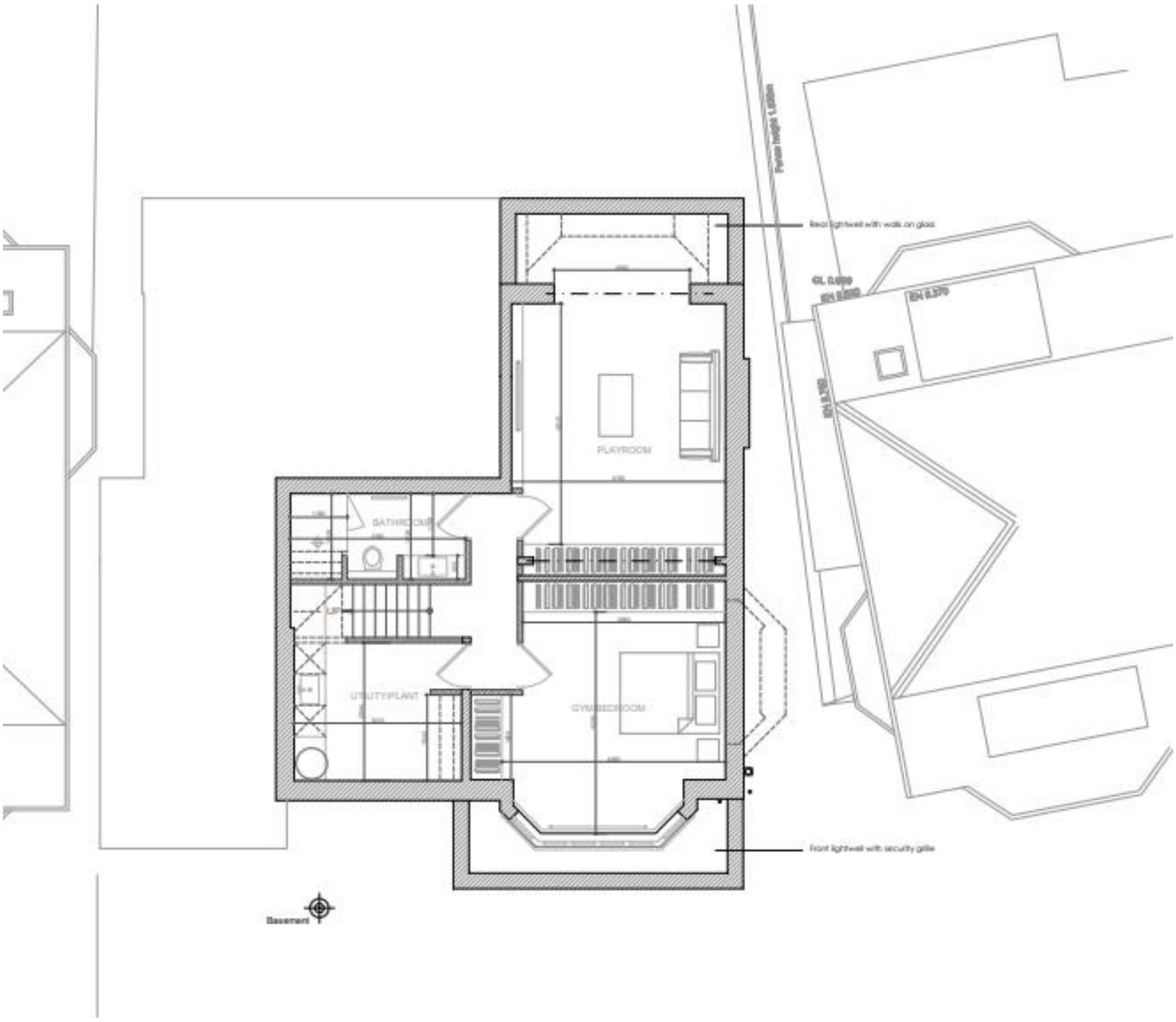
APPENDIX 1 – FIGURES

PROJECT NAME	24 Burgess Hill, London NW2 2DA	**CLIENT**	Verve Concepts Limited
TITLE	Site location Plan	**PROJECT NO.**	P5943J3029
DATE	June 2024	**FIGURE NO.**	1



PROJECT NAME	24 Burgess Hill, London NW2 2DA	**CLIENT**	Verve Concepts Limited
TITLE	Completed GI Plan	**PROJECT NO.**	P5943J3029
DATE	August 2024	**FIGURE NO.**	2

PROJECT NAME	24 Burgess Hill, London NW2 2DA	**CLIENT**	Verve Concepts Limited
TITLE	Site Proposed Plan	**PROJECT NO.**	P5943J3029
DATE	June 2024	**FIGURE NO.**	3



APENDIX 2 – EXPLORATORY HOLE RECORD

WINDOWLESS SAMPLER RECORD

Borehole Number
WS1

Project Name: 24 Burgess Hill	Client: Verve Concepts Limited	Date: 07/08/2024
Location: 24 Burgess Hill, London, NW2 2DA	Logged by: RAY	Co-ords: E525002.22 N185883.95
Project No. : P5943J3029	Crew Name: MD	Drilling Equipment: Windowless sampler

Log Status	Hole Type	Level	Approved By	Scale	Page Number
FINAL	WS	84.07m AoD	JLW	1:30	Sheet 1 of 2

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
					0.10	83.97		Granite paving slabs. (MADE GROUND)	
					0.25	83.82		Concrete. (MADE GROUND)	
		0.35	ES					Brown sandy gravelly clay with occasional rootlets. Sand is fine to coarse. Gravel consists of fine to coarse, sub-angular to sub-rounded flint, with occasional brick. (MADE GROUND)	
		0.50 0.50	D ES						
		0.75	ES						
					0.80	83.27		Soft becoming stiff consistency** light orangish brown mottled brown CLAY. (LONDON CLAY FORMATION)	
		1.00	ES						1
		1.20	SPT	N=7 (1,1/1,2,2,2)					
		1.50	D						
		2.00	SPT	N=11 (2,2/2,3,3,3)					2
		2.50	D						
		3.00	SPT	N=13 (2,2/2,3,3,4)					3
		3.50 3.50	D ES						
		4.00	SPT	N=14 (2,3/3,3,4,4)					4
		4.50	D						
		5.00	SPT	N=17 (3,3/3,4,5,5)					5
		5.50	D						
		6.00	SPT	N=24 (3,4/5,6,6,7)					6

Remarks:

*Field description.

**Consistency estimated using semi-empirical correlations with SPT N-values, Plasticity Indices and published literature.

Key:
ES - Environmental Sample
D - Small Disturbed Sample
B - Bulk Disturbed Sample
PID - Photo-ionisation Detector Reading

JOMAS
ENGINEERING
ENVIRONMENTAL
LAND REMEDIATION

WINDOWLESS SAMPLER RECORD

Borehole Number
WS1

Project Name: 24 Burgess Hill	Client: Verve Concepts Limited	Date: 07/08/2024
Location: 24 Burgess Hill, London, NW2 2DA	Logged by: RAY	Co-ords: E525002.22 N185883.95
Project No. : P5943J3029	Crew Name: MD	Drilling Equipment: Windowless sampler

Log Status	Hole Type	Level	Approved By	Scale	Page Number
FINAL	WS	84.07m AoD	JLW	1:30	Sheet 2 of 2

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
▨							▤	Soft becoming stiff consistency** light orangish brown mottled brown CLAY. (LONDON CLAY FORMATION)	
▨		6.50	D				▤		
▨					6.70	77.37	▤	Stiff consistency** grey CLAY. (LONDON CLAY FORMATION)	
▨		7.00	SPT	N=24 (3,4/5,6,6,7)			▤		7
▨		7.50 7.50	D ES				▤		
▨		8.00	SPT	N=30 (5,6/6,7,8,9)	8.00	76.07		End of Borehole at 8.00m	8
									9
									10
									11
									12

Remarks:

*Field description.

**Consistency estimated using semi-empirical correlations with SPT N-values, Plasticity Indices and published literature.

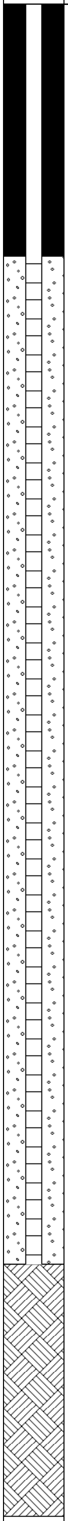
Key:
ES - Environmental Sample
D - Small Disturbed Sample
B - Bulk Disturbed Sample
PID - Photo-ionisation Detector Reading

WINDOWLESS SAMPLER RECORD

Borehole Number
WS2

Project Name: 24 Burgess Hill	Client: Verve Concepts Limited	Date: 07/08/2024
Location: 24 Burgess Hill, London, NW2 2DA	Logged by: RAY	Co-ords: E525002.50 N185879.54
Project No. : P5943J3029	Crew Name: MD	Drilling Equipment: Windowless sampler

Log Status	Hole Type	Level	Approved By	Scale	Page Number
FINAL	WS	84.08m AoD	JLW	1:30	Sheet 1 of 2



Sample and In Situ Testing

Depth (m)	Type	Results
0.30	ES	
0.50	D	
0.50	ES	
0.75	ES	
1.00	ES	
1.20	SPT	N=5 (1,1/1,1,1,2)
2.00	D	
2.00	SPT	N=10 (2,2/2,2,3,3)
3.00	D	
3.00	SPT	N=14 (2,3/3,3,4,4)
4.00	D	
4.00	ES	
4.00	SPT	N=15 (2,3/4,3,4,4)
5.00	D	
5.00	SPT	N=16 (3,3/4,4,4,4)
6.00	D	

Depth (m)	Level (m)	Stratum Description
0.10	83.98	Granite paving blocks. (MADE GROUND)
0.25	83.83	Concrete. (MADE GROUND)
0.60	83.48	Light brown gravelly sand. Sand is fine to coarse. Gravel consists of fine to coarse, angular to sub-rounded flint and brick. (MADE GROUND)
0.90	83.18	Orangish brown sandy gravelly clay with occasional rootlets. Sand is fine to coarse. Gravel consists of fine to coarse, sub-angular to sub-rounded flint, with occasional brick. (MADE GROUND)
6.00	78.08	Soft becoming firm consistency** light orangish brown mottled brown CLAY. (LONDON CLAY FORMATION)

Remarks:

*Field description.

**Consistency estimated using semi-empirical correlations with SPT N-values, Plasticity Indices and published literature.

Key:
ES - Environmental Sample
D - Small Disturbed Sample
B - Bulk Disturbed Sample
PID - Photo-ionisation Detector Reading

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ENVIRONMENTAL
LAND REMEDIATION

WINDOWLESS SAMPLER RECORD

Borehole Number
WS2

Project Name: 24 Burgess Hill	Client: Verve Concepts Limited	Date: 07/08/2024
Location: 24 Burgess Hill, London, NW2 2DA	Logged by: RAY	Co-ords: E525002.50 N185879.54
Project No. : P5943J3029	Crew Name: MD	Drilling Equipment: Windowless sampler

Log Status	Hole Type	Level	Approved By	Scale	Page Number
FINAL	WS	84.08m AoD	JLW	1:30	Sheet 2 of 2

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description
		Depth (m)	Type	Results				
		6.00	SPT	N=21 (3,3/4,5,6,6)				Stiff consistency** dark grey CLAY. (LONDON CLAY FORMATION)
		7.00	D					
		7.00	ES					
		7.00	SPT	N=22 (2,4/4,5,6,7)				
		7.90	D					
		8.00	SPT	N=24 (3,5/5,6,6,7)	8.00	76.08		End of Borehole at 8.00m

Remarks:

*Field description.

**Consistency estimated using semi-empirical correlations with SPT N-values, Plasticity Indices and published literature.

Key:
ES - Environmental Sample
D - Small Disturbed Sample
B - Bulk Disturbed Sample
PID - Photo-ionisation Detector Reading

APPENDIX 3 – CHEMICAL LABORATORY TEST RESULTS

Ray
Jomas Associates Limited
24 Sarum Complex
Salisbury Road
Uxbrdge
UB8 2RZ

Normec DETS Limited
Unit 1
Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Kent
ME17 2JN
t: 01622 850410

DETS Report No: 24-09316

Site Reference:	24 Burgess Hill, London, NW22DA
Project / Job Ref:	J3029
Order No:	P5943J3029.5
Sample Receipt Date:	14/08/2024
Sample Scheduled Date:	14/08/2024
Report Issue Number:	1
Reporting Date:	16/08/2024

Authorised by:

Kevin Old
Operations Director

Dates of laboratory activities for each tested analyte are available upon request.

Opinions and interpretations are outside the laboratory's scope of ISO 17025 accreditation. This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Soil Analysis Certificate

DETS Report No: 24-09316	**~Date Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	
Jomas Associates Limited	**~Time Sampled**	None Supplied	None Supplied	None Supplied	None Supplied	
~Site Reference: 24 Burgess Hill, London, NW22DA	**~TP / BH No**	WS1	WS1	WS2	WS2	
~Project / Job Ref: J3029	**~Additional Refs**	ES	ES	ES	ES	
~Order No: P5943J3029.5	**~Depth (m)**	0.35	1.00	4.00	7.00	
Reporting Date: 16/08/2024	**DETS Sample No**	732183	732184	732185	732186	

Determinand	**Unit**	**RL**	**Accreditation**					
pH	pH Units	N/a	**MCERTS**	7.8	6.7	7.1	7.8	
Total Sulphate as SO_4	mg/kg	< 200	**MCERTS**	273	< 200	< 200	< 200	
Total Sulphate as SO_4	%	< 0.02	**MCERTS**	0.03	< 0.02	< 0.02	< 0.02	
W/S Sulphate as SO_4 (2:1)	mg/l	< 10	**MCERTS**	12	19	23	41	
W/S Sulphate as SO_4 (2:1)	g/l	< 0.01	**MCERTS**	0.01	0.02	0.02	0.04	
Total Sulphur	%	< 0.02	NONE	< 0.02	< 0.02	< 0.02	< 0.02	

Analytical results are expressed on a dry weight basis where samples are assisted-dried at less than 30°C. The Method Description page describes if the test is performed on the dried or as-received portion
Subcontracted analysis (S)
~Sample details provided by customer and can affect the validity of results

Normec DETS Limited
Unit 1, Rose Lane Industrial Estate
Rose Lane
Lenham Heath
Maidstone
Kent ME17 2JN
Tel : 01622 850410

mCERTS
THE ENVIRONMENT AGENCY'S MONITORING CERTIFICATION SCHEME
UKAS TESTING
4480

Soil Analysis Certificate - Sample Descriptions

DETS Report No: 24-09316
Jomas Associates Limited
~Site Reference: 24 Burgess Hill, London, NW22DA
~Project / Job Ref: J3029
~Order No: P5943J3029.5
Reporting Date: 16/08/2024

DETS Sample No	~TP / BH No	~Additional Refs	~Depth (m)	Moisture Content (%)	Sample Matrix Description
^ 732183	WS1	ES	0.35	13.5	Brown sandy clay with stones
^ 732184	WS1	ES	1.00	16.3	Light brown sandy clay
^ 732185	WS2	ES	4.00	15.2	Light brown clay
^ 732186	WS2	ES	7.00	17.3	Light brown clay

Moisture content is part of procedure E003 & is not an accredited test
Insufficient Sample $^{I/S}$
Unsuitable Sample $^{U/S}$
~Sample details provided by customer and can affect the validity of results
^ no sampling date provided; unable to confirm if samples are within acceptable holding times

Soil Analysis Certificate - Methodology & Miscellaneous Information

DETS Report No: 24-09316
Jomas Associates Limited
~Site Reference: 24 Burgess Hill, London, NW22DA
~Project / Job Ref: J3029
~Order No: P5943J3029.5
Reporting Date: 16/08/2024

Matrix	Analysed On	Determinand	Brief Method Description	Method No
Soil	D	Boron - Water Soluble	Determination of water soluble boron in soil by 2:1 hot water extract followed by ICP-OES	E012
Soil	AR	BTEX	Determination of BTEX by headspace GC-MS	E001
Soil	D	Cations	Determination of cations in soil by aqua-regia digestion followed by ICP-OES	E002
Soil	D	Chloride - Water Soluble (2:1)	Determination of chloride by extraction with water & analysed by ion chromatography	E009
Soil	AR	Chromium - Hexavalent	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry	E016
Soil	AR	Cyanide - Complex	Determination of complex cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Free	Determination of free cyanide by distillation followed by colorimetry	E015
Soil	AR	Cyanide - Total	Determination of total cyanide by distillation followed by colorimetry	E015
Soil	D	Cyclohexane Extractable Matter (CEM)	Gravimetrically determined through extraction with cyclohexane	E011
Soil	AR	Diesel Range Organics (C10 - C24)	Determination of hexane/acetone extractable hydrocarbons by GC-FID	E004
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of saturated calcium sulphate followed by electrometric measurement	E022
Soil	AR	Electrical Conductivity	Determination of electrical conductivity by addition of water followed by electrometric measurement	E023
Soil	D	Elemental Sulphur	Determination of elemental sulphur by solvent extraction followed by GC-MS	E020
Soil	AR	EPH (C10 – C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH Product ID	Determination of acetone/hexane extractable hydrocarbons by GC-FID	E004
Soil	AR	EPH TEXAS (C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C40)	Determination of acetone/hexane extractable hydrocarbons by GC-FID for C8 to C40. C6 to C8 by headspace GC-MS	E004
Soil	D	Fluoride - Water Soluble	Determination of Fluoride by extraction with water & analysed by ion chromatography	E009
Soil	D	Fraction Organic Carbon (FOC)	Determination of TOC by combustion analyser.	E027
Soil	D	Organic Matter (SOM)	Determination of TOC by combustion analyser.	E027
Soil	D	TOC (Total Organic Carbon)	Determination of TOC by combustion analyser.	E027
Soil	AR	Exchangeable Ammonium	Determination of ammonium by discrete analyser.	E029
Soil	D	FOC (Fraction Organic Carbon)	Determination of fraction of organic carbon by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	D	Loss on Ignition @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace	E019
Soil	D	Magnesium - Water Soluble	Determination of water soluble magnesium by extraction with water followed by ICP-OES	E025
Soil	D	Metals	Determination of metals by aqua-regia digestion followed by ICP-OES	E002
Soil	AR	Mineral Oil (C10 - C40)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge	E004
Soil	AR	Moisture Content	Moisture content; determined gravimetrically	E003
Soil	D	Nitrate - Water Soluble (2:1)	Determination of nitrate by extraction with water & analysed by ion chromatography	E009
Soil	D	Organic Matter	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	PAH - Speciated (EPA 16)	Determination of PAH compounds by extraction in acetone and hexane followed by GC-MS with the use of surrogate and internal standards	E005
Soil	AR	PCB - 7 Congeners	Determination of PCB by extraction with acetone and hexane followed by GC-MS	E008
Soil	D	Petroleum Ether Extract (PEE)	Gravimetrically determined through extraction with petroleum ether	E011
Soil	AR	pH	Determination of pH by addition of water followed by electrometric measurement	E007
Soil	AR	Phenols - Total (monohydric)	Determination of phenols by distillation followed by colorimetry	E021
Soil	D	Phosphate - Water Soluble (2:1)	Determination of phosphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Total	Determination of total sulphate by extraction with 10% HCl followed by ICP-OES	E013
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of sulphate by extraction with water & analysed by ion chromatography	E009
Soil	D	Sulphate (as SO4) - Water Soluble (2:1)	Determination of water soluble sulphate by extraction with water followed by ICP-OES	E014
Soil	AR	Sulphide	Determination of sulphide by distillation followed by colorimetry	E018
Soil	D	Sulphur - Total	Determination of total sulphur by extraction with aqua-regia followed by ICP-OES	E024
Soil	AR	SVOC	Determination of semi-volatile organic compounds by extraction in acetone and hexane followed by GC-MS	E006
Soil	AR	Thiocyanate (as SCN)	Determination of thiocyanate by extraction in caustic soda followed by acidification followed by addition of ferric nitrate followed by colorimetry	E017
Soil	D	Toluene Extractable Matter (TEM)	Gravimetrically determined through extraction with toluene	E011
Soil	D	Total Organic Carbon (TOC)	Determination of organic matter by oxidising with potassium dichromate followed by titration with iron (II) sulphate	E010
Soil	AR	TPH CWG (ali: C5- C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C34, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C35. C5 to C8 by headspace GC-MS	E004
Soil	AR	TPH LQM (ali: C5-C6, C6-C8, C8-C10, C10-C12, C12-C16, C16-C35, C35-C44, aro: C5-C7, C7-C8, C8-C10, C10-C12, C12-C16, C16-C21, C21-C35, C35-C44)	Determination of hexane/acetone extractable hydrocarbons by GC-FID fractionating with SPE cartridge for C8 to C44. C5 to C8 by headspace GC-MS	E004
Soil	AR	VOCs	Determination of volatile organic compounds by headspace GC-MS	E001
Soil	AR	VPH (C6-C8 & C8-C10)	Determination of hydrocarbons C6-C8 by headspace GC-MS & C8-C10 by GC-FID	E001

D Dried
AR As Received
~Sample details provided by customer and can affect the validity of results

List of HWOL Acronyms and Operators

DETS Report No: 24-09316

Jomas Associates Limited

~Site Reference: 24 Burgess Hill, London, NW22DA

~Project / Job Ref: J3029

~Order No: P5943J3029.5

Reporting Date: 16/08/2024

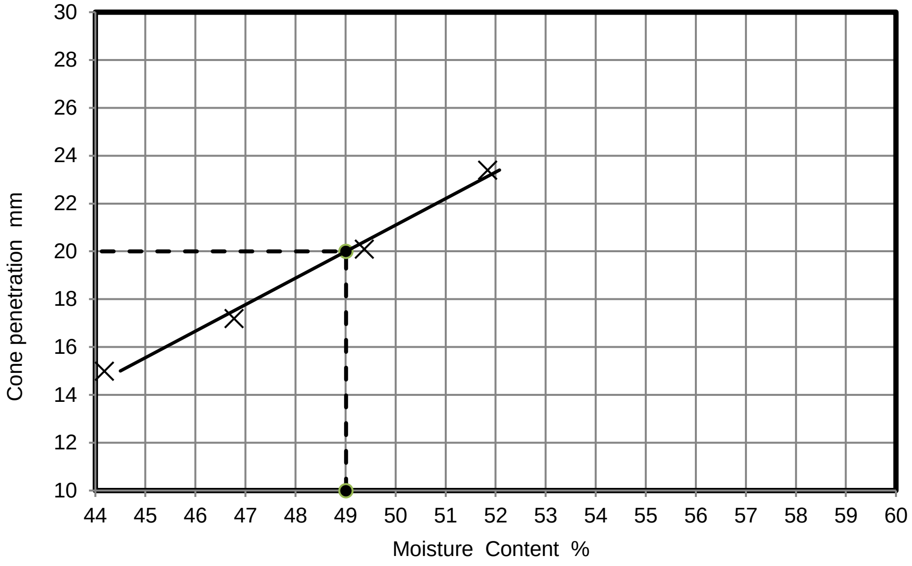
Acronym	Description
HS	Headspace analysis
EH	Extractable Hydrocarbons - i.e. everything extracted by the solvent
CU	Clean-up - e.g. by florisil, silica gel
1D	GC - Single coil gas chromatography
2D	GC-GC - Double coil gas chromatography
Total	Aliphatics & Aromatics
AL	Aliphatics only
AR	Aromatics only
#1	EH_2D_Total but with humics mathematically subtracted
#2	EH_2D_Total but with fatty acids mathematically subtracted
_	Operator - underscore to separate acronyms (exception for +)
+	Operator to indicate cumulative eg. EH+HS_Total or EH_CU+HS_Total
~	Sample details provided by customer and can affect the validity of results

Det - Acronym

APPENDIX 4 – GEOTECHNICAL LABORATORY TEST RESULTS

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

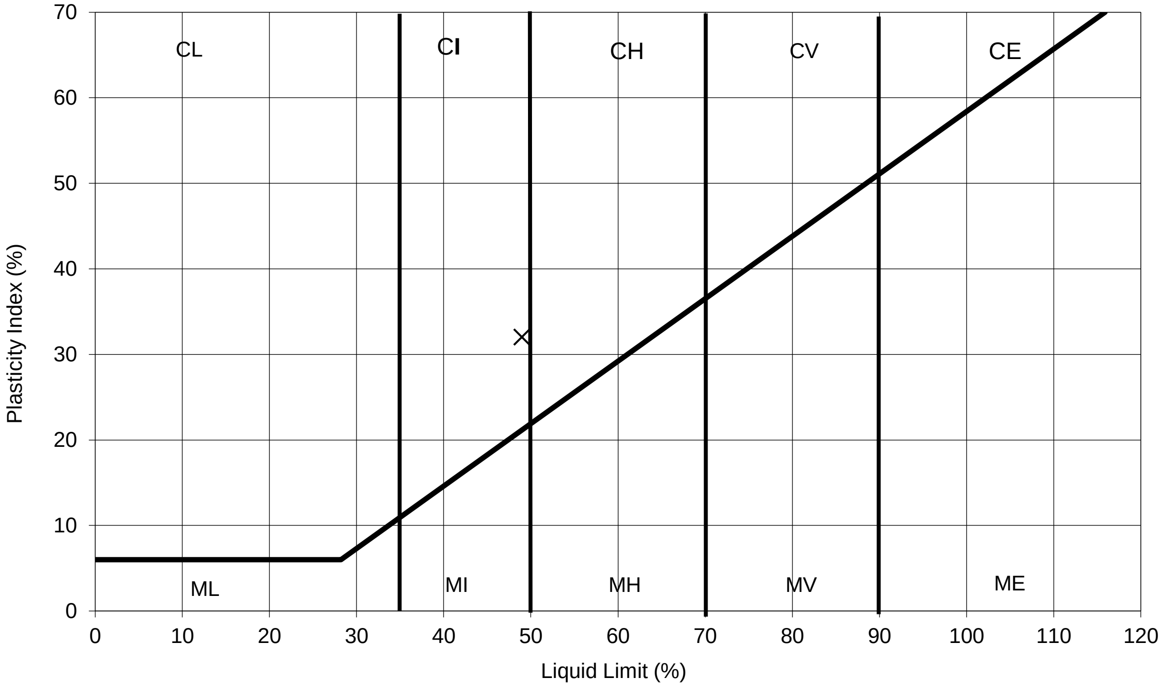
		Job No.	35851
		Borehole/Pit No.	WS1
Site Name	24 Burgess Hill, London, NW2 2DA	Sample No.	-
Project No.	J3029 Client Jomas Associates	Depth Top	0.50 m
Soil Description	Brown slightly gravelly slightly sandy silty CLAY with traces of fine rootlets (gravel is fmc and angular to sub-angular)	Depth Base	- m
		Sample Type	D
		Samples received	12/08/2024
		Schedules received	13/08/2024
		Project Started	14/08/2024
		Date Tested	21/08/2024



NATURAL MOISTURE CONTENT	**21**	**%**
% PASSING 425µm SIEVE	**88**	**%**
LIQUID LIMIT	**49**	**%**
PLASTIC LIMIT	**17**	**%**
PLASTICITY INDEX	**32**	**%**

Remarks

PLASTICITY INDEX



These results only apply to the items tested. The report shall not be reproduced except in full without authority of the laboratory

UKAS
TESTING
2519

TEST METHOD
BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method
BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index
BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying

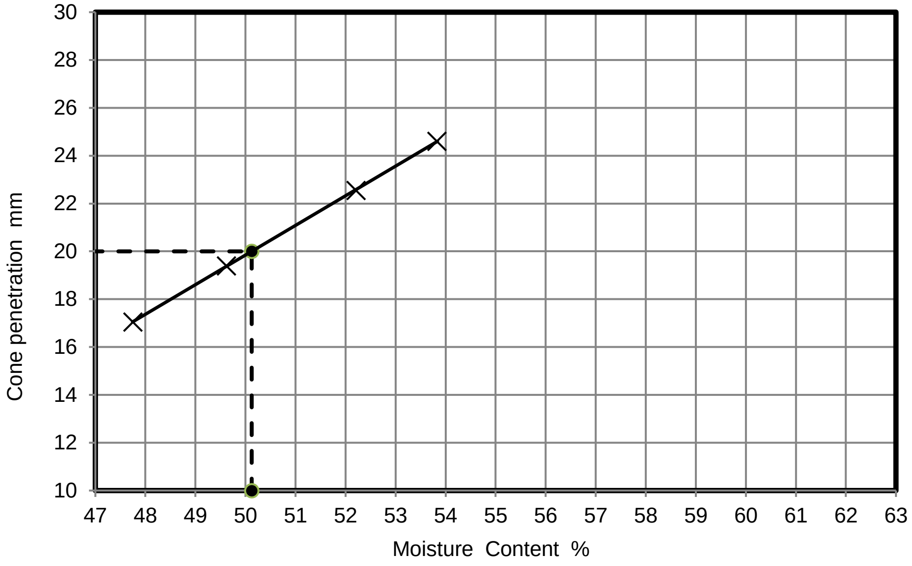
Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford Herts WD18 9RU
Tel: 01923 711 288 Email: James@k4soils.com

Checked and Approved
Initials: J.P
Date: 23/08/2024

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

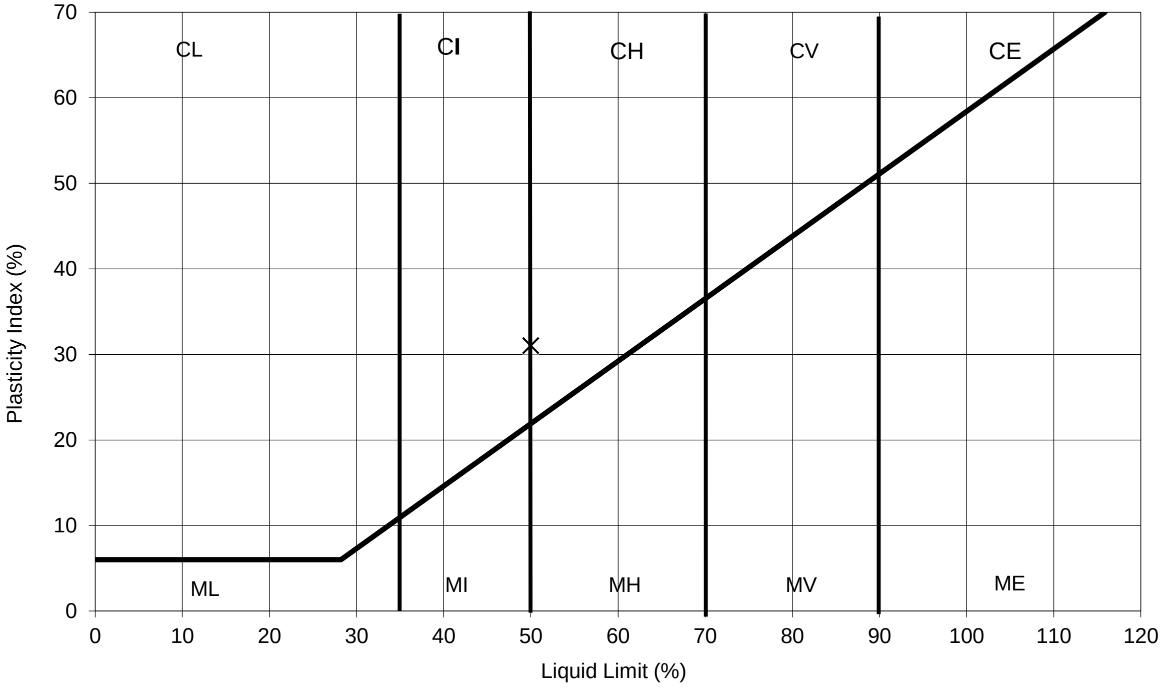
Job No.	35851			
Borehole/Pit No.	WS1			
Site Name	24 Burgess Hill, London, NW2 2DA	Sample No.	-	
Project No.	J3029	Client	Jomas Associates	
Depth Top	3.50	m		
Depth Base	-	m		
Sample Type	D			
Samples received	12/08/2024			
Schedules received	13/08/2024			
Project Started	14/08/2024			
Date Tested	22/08/2024			
Soil Description	Brown silty CLAY with rare yellowish brown silt			



NATURAL MOISTURE CONTENT	**25**	**%**
% PASSING 425µm SIEVE	**100**	**%**
LIQUID LIMIT	**50**	**%**
PLASTIC LIMIT	**19**	**%**
PLASTICITY INDEX	**31**	**%**

Remarks

PLASTICITY INDEX



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TEST METHOD

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BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index
BS1377: Part 2 :Clause 3.2 : 1990:Determination of the moisture content by the oven drying

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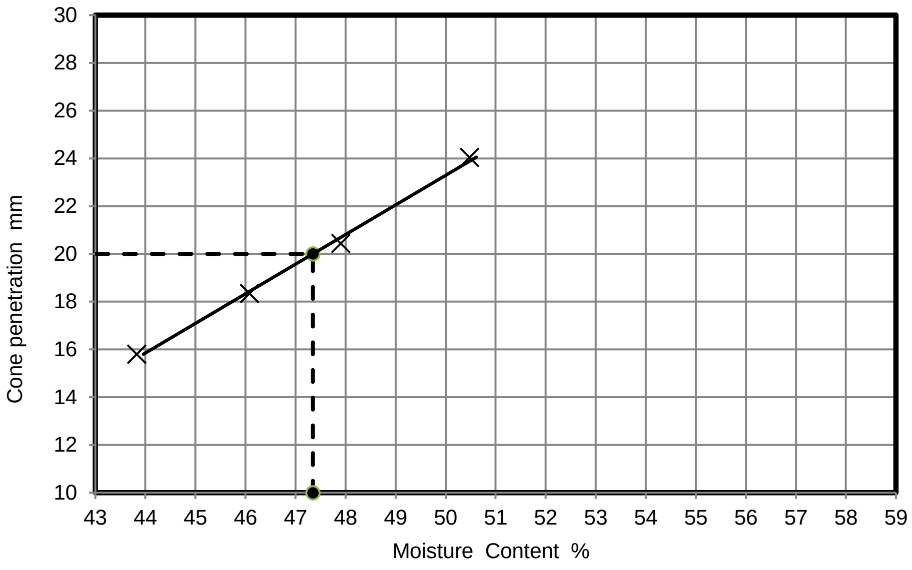
UKAS TESTING
2519

Approved Signatories: K.Phaure (Tech.Mgr) J.Phaure (Lab.Mgr)

LIQUID LIMIT, PLASTIC LIMIT AND PLASTICITY INDEX

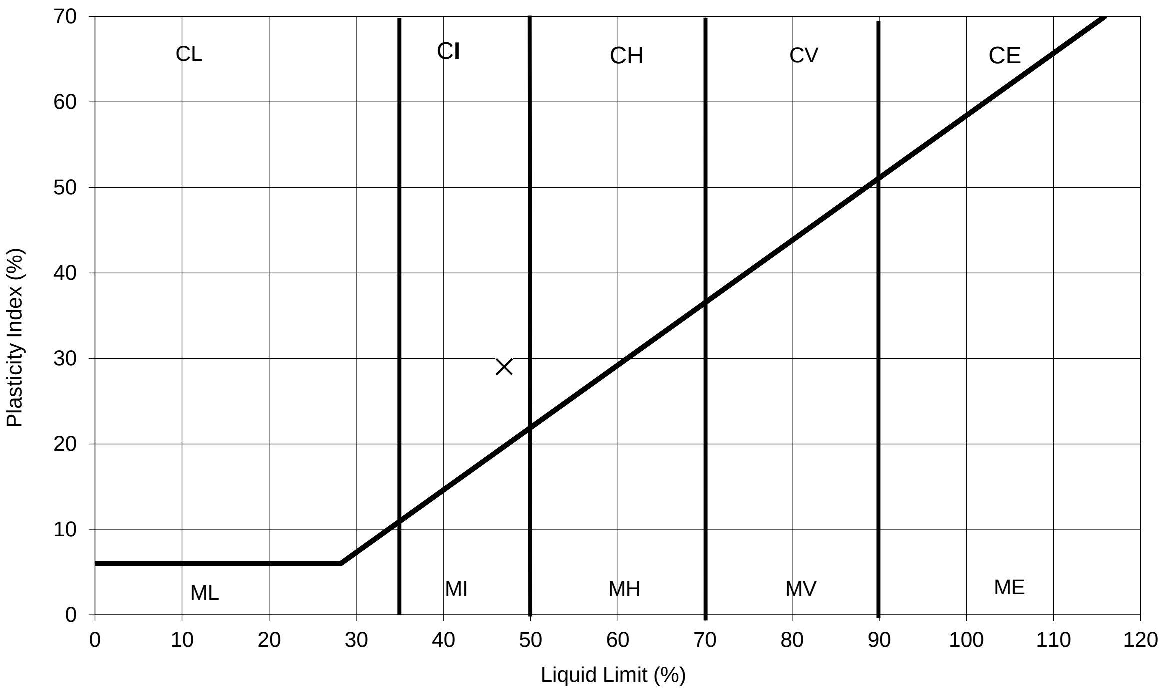
Job No.	35851	Borehole/Pit No.	WS2
Site Name	24 Burgess Hill, London, NW2 2DA	Sample No.	-
Project No.	J3029	Client	Jomas Associates
Depth Top	7.00 m	Depth Base	- m
Soil Description	Brown silty CLAY	Sample Type	D
Samples received	12/08/2024	Schedules received	13/08/2024
Project Started	14/08/2024	Date Tested	21/08/2024



NATURAL MOISTURE CONTENT	**27**	**%**
% PASSING 425µm SIEVE	**100**	**%**
LIQUID LIMIT	**47**	**%**
PLASTIC LIMIT	**18**	**%**
PLASTICITY INDEX	**29**	**%**

Remarks

PLASTICITY INDEX



UKAS TESTING

2519

TEST METHOD

BS1377: Part 2 :Clause 4.3 : 1990 Determination of the liquid limit by the cone penetrometer method
BS1377: Part 2 :Clause 5.0 : 1990: Determination of the plastic limit and plasticity index
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Checked and Approved

Initials: J.P
Date: 23/08/2024

APPENDIX 5 – GROUNDWATER MONITORING TEST RESULTS

GROUNDWATER MONITORING BOREHOLE RECORD SHEET					
Site: 24 Burgess Hill	**Operative(s):** JMH	**Date:** 21/08/2024	**Time:** 15:15	**Round:** 1	**Page:** 1

MONITORING EQUIPMENT

Instrument Type	**Instrument Make**	**Serial No.**	**Date Last Calibrated**
Dip Meter – Interface Probe	In-Situ	-	-

MONITORING CONDITIONS

Weather Conditions: Sunny with clouds	**Ground Conditions:** Dry	**Temperature:** 20°C
Barometric Pressure (mbar): N/A	**Barometric Pressure Trend (24hr):**	**Ambient Concentration:** N/A

MONITORING RESULTS

Monitoring Point Location	VOC (ppm)		Depth to product (mbgl)	Depth to water (mbgl)	Depth to base of well (mbgl)	Comments
	Peak	Steady				
WS1			-	3.24	5.25	
WS2			-	3.07	5.35	

*** NMP = No Measurable Product**

GROUNDWATER MONITORING BOREHOLE RECORD SHEET

Site: 24 Burgess Hill	**Operative(s):**DJH	**Date:** 28/08/2024	**Time:** 09:50	**Round:** 2	**Page:** 1

MONITORING EQUIPMENT

Instrument Type	**Instrument Make**	**Serial No.**	**Date Last Calibrated**
Dip Meter – Interface Probe	In-Situ	-	-

MONITORING CONDITIONS

Weather Conditions: Sunny with clouds	**Ground Conditions:** Dry	**Temperature:** 19°C
Barometric Pressure (mbar): N/A	**Barometric Pressure Trend (24hr):**	**Ambient Concentration:** N/A

MONITORING RESULTS

Monitoring Point Location	VOC (ppm)		Depth to product (mbgl)	Depth to water (mbgl)	Depth to base of well (mbgl)	Comments
	Peak	Steady				
WS1			-	3.20	5.25	
WS2			-	3.09	5.33	

*** NMP = No Measurable Product**

WE LISTEN, WE PLAN, WE DELIVER

Geotechnical Engineering and Envrionmental Services across the UK

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