Generic Quantitative Environmental Risk Assessment

1 Bedford Avenue, London, W1T 7RB

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1 Bedford Avenue, London, W1T 7RB

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This document has been prepared and checked in accordance with Waterman Group's IMS (BS EN ISO 9001: 2008, BS EN ISO 14001: 2004 and BS OHSAS 18001:2007))

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Site Setting

Current Use	Two interconnected mixed use (retail/office) buildings. 251-258 Tottenham Court Road, an eight storey building with single level basement and 1 Bedford Avenue, a five storey building with single level basement.
History	Numerous re-development phases since the late 19th century and in the late 1950s was developed into its present day footprint.
Ground Conditions	Made Ground over the Lynch Hill Gravel Member and the London Clay Formation. Based on the soil chemical data and the development proposals, contaminants present within the underlying soils do not represent a significant risk to human health receptors.
Controlled Waters	The Lynch Hill Gravel Member underlying the Site is classed as a secondary (A) aquifer. Comparison of the groundwater analytical results to the relevant guidelines found no exceedances; thus risks to controlled waters are considered to be low.
Ground Gas Regime	Characteristic Situation 1, whereby ground gas protection measures are not required.

Conceptual Model

No significant pollutant linkages have been identified for the Site.

Conclusions

It is considered that the completed development will represent a low risk with respect to ground contamination. Therefore, post development the site should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990. Subject to the recommendations set out in Section 11 are carried out, the development is expected to meet the requirements of the NPPF.

Recommendations

- A waste classification/options assessment should be produced to appropriately deal with the excavation waste produced during the basement extension. Materials marked for off-site disposal, other than natural Gravel or Clay, should be sampled post demolition and the construction programme should take into account a three week turnaround time of laboratory analysis;
- Construction workers should be provided with and use personal protective equipment and adhere to good hygiene practices;
- New water supply pipes should be installed in accordance with the UK Water Industry Research guidance;
- Concrete should be designed in accordance with DS-1 ACEC Site Class AC-1[d], as defined by the BRE digest 1 (2005);
- The water filled vaults beneath the basement should be surveyed, the water quality tested and the water removed in accordance with relevant discharge license, if applicable;
- A watching brief should be implemented during the demolition of the existing building with particular emphasis on the locations of the current electricity substations. Should any visual or olfactory evidence of contamination be encountered works should be stopped and the Environmental Consultant should be contacted to advise on further steps which are likely to include additional soil sampling, chemical testing and the production of a validation report; and
- This report should be submitted to Camden Council to facilitate the discharge of condition 11b of planning consent 2013/3880/P.

1. Introduction

1.1 Objectives

GVA Second London Wall instructed Waterman Energy, Environment & Design Limited ("Waterman") to carry out a Generic Quantitative Environmental Risk Assessment (GQRA) for the proposed redevelopment of 251-258 Tottenham Court Road and 1 Bedford Avenue, London, W1T 7RB (hereafter termed "the Site").

This report follows on from the Preliminary Environmental Risk Assessment (PERA) produced by Waterman (report ref. EED13325-100-R-3-3-1-JC) and Waterman's Interim Report (EED13325-101.R.1.1.2.KH) dated 17 November 2014.

1.2 Proposed Development

Currently the Site comprises two interconnected mixed use buildings, with basement. The proposed scheme is to demolish the current buildings and redevelop the Site into an eight storey building with single level basement, for mixed retail, office use. The existing basement will be extended downwards by 1.5m.

1.3 Regulatory Context

Planning permission has been granted for the redevelopment, with condition 11 (2013/3880/P) relating to contaminated land. Condition 11b states;

Before development commences:

(a) a written programme of ground investigation for the presence of soil and groundwater contamination and landfill gas shall be submitted to and approved by the local planning authority in writing; and

(b) following the approval detailed in paragraph (a), an investigation shall be carried out in accordance with the approved programme and the results and a written scheme of remediation measures [if necessary] shall be submitted to and approved by the local planning authority in writing.

The remediation measures shall be implemented strictly in accordance with the approved scheme and a written report detailing the remediation shall be submitted to and approved by the local planning authority in writing prior to occupation.

In order to assess the Site's contamination status, with respect to its end use, it is necessary to assess whether the Site could potentially be classified as "Contaminated Land", as defined in Part IIA of the Environmental Protection Act 1990 and Contaminated Land Statutory Guidance 2012. This is assessed by the identification and assessment of potential pollutant linkages. The linkage between the potential sources and potential receptors identified needs to be found and evaluated.

To fall within this definition, it is necessary that, as a result of the condition of the land, substances may be present in, on or under the land such that:

a) significant harm is being caused or there is a significant possibility of such harm being caused; or

b) significant pollution of controlled waters is being caused, or there is significant possibility of such pollution being caused.

It should be noted that DEFRA has advised (Ref. Section 4, DEFRA Contaminated Land Statutory Guidance 2012) Local Authorities that land should not be designated as "Contaminated Land" where:

a) the relevant substance(s) are already present in controlled waters;

b) entry into controlled waters of the substance(s) from land has ceased; and

c) it is not likely that that further entry will take place.

These exclusions do not necessarily preclude regulatory action under the Environmental Permitting (England and Wales) Regulations 2010, which make it a criminal offence to cause or knowingly permit a water discharge of any poisonous, noxious or polluting matter to controlled waters. In England and Wales, under The Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009, a works notice may be served by the regulator requiring appropriate investigation and clean-up.

1.4 Constraints

This report was carried out in accordance with the scope agreed between Waterman and GVA Second London Wall, as documented in Waterman's fee letter (EED13325-100/F/005CWS), dated December 2013), and with Waterman's standard Terms of Appointment.

The benefit of this report is made to GVA Second London Wall.

The data contained in this report is based on the findings of the PERA (Report Ref. EED13325-100-R-3-3-1-JC), observations made on site, borehole records, laboratory test results, and groundwater and ground gas monitoring.

The investigations constraints include:

Access to the basement of an electronic equipment retailer, several rooms below the layby, and pavement areas were not available. The rooms below the pavement are understood to be used for storage by a hotel on Bedford Avenue.

The ground conditions reported relate only to the point of excavation and do not necessarily guarantee a continuation of the ground conditions throughout the non-inspected area of the site. Whilst such exploratory holes would usually provide a reasonable indication as to the general ground conditions, these cannot be determined with complete certainty.

Waterman has endeavoured to assess all data given to them during this investigation, but makes no guarantees or warranties as to the accuracy or completeness of this data.

The scope of this site investigation includes an assessment of the presence of asbestos containing materials in the ground at the site but not within buildings or structures or below ground structures (basements, buried service ducts and the like).

The study's conclusions are not necessarily indicative of future conditions or operating practices at or adjacent to the site.

2. Procedures

This Generic Quantitative Environmental Risk Assessment has been undertaken in general accordance with the Model Procedures for Management of Land Contamination (Contaminated Land Report 11 – Environment Agency, September 2004).

The report includes the following:

- outline Conceptual Model for the Site;
- results of Intrusive Ground Investigation;
- confirmation of Generic Assessment Criteria used to assess risks;
- assessment of results against Generic Assessment Criteria;
- formulation of a new Conceptual Model for the Site;
- identification of potentially unacceptable risks; and
- recommendations for further action.

This report forms a decision record for the pollutant linkages identified, the generic assessment criteria used to assess risks, the unacceptable risks identified and the proposed next steps in relation to the site. The report also provides an explanation of the refinement of the outline conceptual model following the ground investigation, the selection of criteria and assumptions, the evaluation of potential risks and the basis for the decision on what happens next.

3. Outline Conceptual Model

3.1 The Site

Current Use

Currently the Site comprises two interconnected mixed use buildings. 251-258 Tottenham Court Road an eight storey building with single level basement, and 1 Bedford Avenue, a five storey building with single level basement.

The building was of mixed use with retail on the ground floor, and offices on the upper floors. The basement acted as the location of plant rooms, storage for retail units above and in the immediate surrounding area, and storage for offices located in the floors above. Potentially contaminative equipment in the basement included an old disused boiler, locked UK power Network room and three working oil-fired boilers with associated 13,000 litre oil tank. No significant staining was observed on the concrete immediately underlying the three working oil-fired-boilers.

The Landmark Envirocheck report identified three contemporary trade directory entries on Site, all located on the south western Site portion:

- A B M Electronics. Electronic component manufacturers and distributors;
- Kamla Electronics. Electronic goods sales, manufacturers and wholesalers; and
- Techno Talks. Mobile phone accessories and car kits.

Site History

Prior to the Site's redevelopment into its current form in the late 1950's, the Site comprised a number of buildings including a portion of Tavistock Mews during the 1870's. These remained relatively unchanged up until the 1890's. From the 1890's the buildings were replaced by a number of new buildings.. The buildings in the centre of the Site were demolished in the 1940's, with two buildings to the north and south remaining. In the mid to late 1950's the remaining two buildings were demolished, and the Site was developed into its present day footprint.

3.2 The Surrounding Area

The Site is located within a predominately commercial area, with no significant potential sources of contamination identified within the immediate surrounding area.

Historically, however the surrounding area has supported a number of potentially contaminative activities and land uses. Including a soap works, pickle manufacturer, breweries, unknown works, bottling works, a hospital, and a garage.

3.3 Environmental Setting

Data gathered from the PERA found the Site to be underlain by the geology presented in Table 1 below.

Table 1: Geological strata

Stratum	Area Covered	Estimated Thickness	Typical Description
Lynch Hill Gravel Member	Whole Site	3m to 4m	Sandy GRAVEL
London Clay Formation	Whole Site	30m	Stiff blue CLAY
Lambeth Group	Whole Site	15m	Brown or black CLAY, occasionally sandy.
Thanet Sand Formation	Whole Site	5m	Green SAND with black flints
Upper Chalk Formation	Whole Site	Not Proven	White CHALK with flints.

The PERA considered that during the current basement excavations, the majority of the Made Ground and some of the Lynch Hill Gravel Member was likely removed.

The closest groundwater abstraction is located 320m to the north. It is used to service a heat exchange pump, and is likely to be sourced from the principal aquifer in the underlying chalk formation, present at depth below the surface.

The nearest surface water feature was a small pond 959m to the south west, with the River Thames 1.2km to the south east at its closest point. Due to their distance from Site these two surface waters are considered not to be at risk from on-Site contamination. Furthermore, no sensitive surface water abstractions were identified within 1km of the Site.

The Site is not within a fluvial or tidal floodplain according to the Environment Agency (EA) flood data.

No protected habitats are within 1km of the Site.

3.4 Potentially Significant Pollution Linkages

Potentially significant pollutant linkages between contaminant sources and relevant receptors identified within the PERA are summarised in Table 2.

Table 2: Potentially significant pollutant linkages

Receptor	Potential Sources	Pathways	Risk	Justification / Mitigation	Residual Risk
Human Health					
Existing Site Users	Current land uses on-Site such as plant located in the basement, residual Made Ground around the basement, impacted soil as a result of fuel storage	Dermal contact, ingestion.	Low	It is likely that a significant quantity of Made Ground was removed from the Site during the basement construction. However, it cannot be discounted that some residual Made Ground is still present underlying areas of the Site not underlain by the basement. The entire Site is covered with either buildings or hardstanding which would eliminate potential pathways between potential contaminants in Made Ground and Site users. Whilst fuel stains were observed on the fuel tank, no significant staining or defects in the concrete slab were noted. . Drains were observed in parts of the concrete slab, notably within plant rooms. No significant historical contaminative land uses at the Site were identified.	Low
	Ground gas from potential Made Ground on-Site and impacted soil as a result of fuel storage.	Migration through granular deposits and accumulation in internal void spaces and inhalation.	Low to Medium	It is not known if ground gas protection measures are present on-Site. It is likely that a significant quantity of Made Ground was removed to accommodate the basement. It cannot be discounted that residual areas of Made Ground surround parts of the basement area. However, it is anticipated that these would not be significant. Whilst fuel stains were observed on the fuel tank, no significant staining or defects in the concrete slab were noted.	Low
Future Site Users	Potential contaminants present in any Made Ground on-Site remaining on-Site.	Dermal contact, ingestion.	Low	It is likely that any residual Made Ground underlying the Site would be removed to accommodate the new extended basement area. The Site will be covered with buildings and hardstanding which would restrict potential pollution pathways to future Site users.	Low
	Ground gas from residual Made Ground remaining on-Site.	Migration through granular deposits and accumulation	Low	It is likely that any residual Made Ground underlying the Site would be removed to accommodate the new extended basement area.	Low

Receptor	Potential Sources	Pathways	Risk	Justification / Mitigation	Residual Risk
	,Impacted soil as a result of fuel storage	in internal spaces and inhalation.		The new basement should be suitably well ventilated and waterproof which would limit the potential for the ingress and accumulation of ground gas. Monitoring is recommended to confirm the ground gas regime at the Site and assess the requirement for ground gas protection measures.	
Off site residents/users	Current land uses on-Site including plant located in the basement and potential for residual Made Ground around the basement.	Migration off-Site, and Direct contact, inhalation.	Low	Historical potentially contaminative uses at the Site have not been identified. Whilst fuel stains were observed on the fuel tank, no significant staining or defects in the concrete slab were noted. Drains were observed in parts of the concrete slab, notably within plant rooms Therefore migration of contaminants off-Site and impact on off-Site residents and users is considered unlikely.	Low
Construction Workers	Contaminants relating to current land uses on-Site. Impacted soil as a result of fuel storage. Potential for residual areas of Made Ground and potential for ACMs within in the Made Ground.	Direct contact, ingestion and inhalation	Low to Medium	Historical potentially contaminative uses at the Site have not been identified. Whilst fuel stains were observed on the fuel tank, no significant staining or defects in the concrete slab were noted. Drains were observed in parts of the concrete slab, notably within plant rooms The potential exists for ACMs to be present within areas of residual Made Ground as a result of historical demolition and construction at the Site. However, in line with legislative requirements the use of personal protective equipment (PPE), use of respiratory protective equipment (RPE) and the adoption of good hygiene measures would ensure the risk to construction workers is low.	Low
	Ground gas from residual Made Ground on-Site and impacted soil as a result of fuel storage.	Migration through granular deposits and accumulation in excavations. Inhalation.	Low to Medium	It is likely that a significant quantity of Made Ground, if present, was removed to accommodate the basement area. It cannot be discounted that residual areas of Made Ground surround parts of the basement area. However, it is not anticipated that these would be significant.	Low

Receptor	Potential Sources	Pathways	Risk	Justification / Mitigation	Residual Risk
				Whilst fuel stains were observed on the fuel tank, no significant staining or defects in the concrete slab were noted. Drains were observed in parts of the concrete slab, notably within plant rooms. In line with legislative requirements the use of personal protective equipment (PPE), use of respiratory protective equipment (RPE) and the adoption of good hygiene measures would ensure the risk to construction workers is low.	
Property					
On-site structures	Contaminants relating to current land uses on-Site. Impacted soil as a result of fuel storage Potential for residual areas of Made Ground	Direct Contact.	Low	No significant historical contaminative land uses at the Site have been identified. Whilst fuel stains were observed on the fuel tank, no significant staining or defects in the concrete slab were noted. Drains were observed in parts of the concrete slab, notably within plant rooms. It is likely that any residual Made Ground underlying the Site would be removed to accommodate the new extended basement area. Chemical analysis of soils to remain at the Site should be undertaken to assist in the selection of suitable materials for sub-surface structures.	Low
Off-site structures	Contaminants relating to current land uses on-Site. Impacted soil as a result of fuel storage Potential for residual areas of Made Ground.	Migration off-Site and Direct Contact	Low	No significant historical contaminative land uses at the Site have been identified. Whilst fuel stains were observed on the fuel tank, no significant staining or defects in the concrete slab were noted. Drains were observed in parts of the concrete slab, notably within plant rooms. It is likely that any residual Made Ground underlying the Site would be removed to accommodate the new extended basement area.	Low
Controlled Waters					
Secondary A Aquifer within the Lynch Hill Gravel Member.	Contaminants relating to current land uses on-Site. Impacted soil as a result of fuel storage	Vertical Migration	Low to Medium	No significant historical contaminative land uses at the Site have been identified. Whilst fuel stains were observed on the fuel tank, no significant staining or defects in the concrete slab were noted. Drains were observed in parts of the concrete slab, notably within plant rooms.	Low

Receptor	Potential Sources	Pathways	Risk	Justification / Mitigation	Residual Risk
	Potential for residual areas of Made Ground.			Groundwater monitoring should be undertaken to confirm the absence of contamination in groundwater underlying the Site.	
Secondary A Aquifers within the Lambeth Group and Thanet Sand Formation.	Contaminants relating to current land uses on-Site. Impacted soil as a result of fuel storage Potential for residual areas of Made Ground.	Vertical Migration	Low	No significant historical contaminative land uses at the Site have been identified. No evidence of significant leakage from the fuel oil tank or other plant in the basement was identified. Furthermore, no significant defects were noted on the concrete slab underlying the basement. Any future piled foundations would likely terminate within the overlying London Clay Formation which would act as an aquiclude to any contamination at shallower levels. Groundwater monitoring should be undertaken to confirm the absence of contamination in groundwater underlying the Site.	Low
Principal Aquifer within the Upper Chalk Formation.	Contaminants relating to current land uses on-Site. Impacted soil as a result of fuel storage Potential for residual areas of Made Ground.	Vertical Migration	Low	No significant historical contaminative land uses at the Site have been identified. No evidence of significant leakage from the fuel oil tank or other plant in the basement was identified. Furthermore, no significant defects were noted on the concrete slab underlying the basement. Any future piled foundations would likely terminate within the overlying London Clay Formation which would act as an aquiclude to any contamination at shallower levels.	Low

4. Rationale and Specific Objectives

The basement and ground floors will house retail units, whilst the upper floors will be used as office space. The current basement will be extended by 1.5m. No soft landscaping is proposed.

The investigations objective is to characterise the ground conditions, the hazard sources, pathways and receptors and to reduce uncertainties identified within the PERA.

5. Methodology

The ground investigation work was carried out in general accordance with the Code of Practice for Site Investigation BS 5930 (1999) and the Code of Practice for the Investigation of Potentially Contaminated Sites BS 10175 (2011).

5.1 Design of Investigation

The boreholes allowed the underlying strata to be characterised. Potentially contaminative areas identified in the PERA were targeted.

Due to access constraints and obstructions encountered within the ground, borehole and trial pit locations were restricted.

An exploratory hole location plan marked with the borehole and trail pits undertaken during the ground investigation is presented in the contractor's report included at Appendix B.

Groundwater samples were taken on two occasions and analysed for a range of determinands.

Ground gas was assessed on six occasions.

5.2 Quality Control

The soil and water samples were despatched under a chain of custody procedure to QTS Environmental Ltd who are a UKAS accredited laboratory, for subsequent chemical analysis. Where appropriate, samples were stored within cool boxes containing ice packs.

All contractors, used during this project have been approved by Waterman as a part of in-house Integrated Management System (BS ISO 9001, BS ISO 14001) procedure. This requires all third parties to demonstrate competence and a high standard of work during a regular audit scheme.

5.3 Health and Safety

All work carried out on-site was in accordance with the contractor's Health & Safety policy.

No incidents occurred during the ground investigation.

6. Site Activities

The works were procured to Soil Consultants Limited (SCL), with drilling of BH1 carried out between 11/09/14 and 16/09/14, BH2 between 23/09/14 and 25/09/14, and the excavation of TP12 between 23/09/14 and 25/09/14**.** Prior to drilling, services clearance was carried out by a qualified contractor appointed by SCL.

6.1 Ground Investigation

The two boreholes (BH1 and BH2) were advanced using a cable percussion rig to maximum depths of 25mbgl and 29mbgl respectively (below ground level – note: ground level refers to the position of the rig during drilling works). The drilling was carried out in such a manner as to avoid cross contamination between the strata. On completion of drilling, a 50mm diameter, slotted HDPE standpipe with gas tap and bung was installed in BH1 and BH2, enabling ground gas monitoring and groundwater sampling. In addition, a 19mm slotted HDPE standpipe was installed within BH2, allowing groundwater level within the London Clay to be assessed.

One trial pit reached the target depth (TP12). All trial pits were carried out using breakers and hand excavation techniques. Following completion or abandonment, all trial pits were backfilled and reinstated as far as practically possible to original conditions.

All trial pits and boreholes carried out were logged and sampled for contamination purposes by SCL.

SCL reported the presence of water filled vaults beneath the basement. The vaults are located centrally. Their lateral extent was not surveyed. The vaults' depth was indicated to be about 6m.

The investigation varied from the proposed and agreed original strategy as set out in Waterman's Interim Report (EED13325-101.R.1.1.2.KH) due to obstructions encountered and access constraints. Table **3** presents further details of the exploratory holes agreed and those completed during the ground investigation.

Table 3: Exploratory holes completion schedule

Layer / Target feature	Proposed Exploratory Holes	Groundwater Wells	Gas Wells	Comments
Lynch Hill Gravel Member Gravel	BH1	installed	installed	Borehole completed
Lynch Hill Gravel Member Gravel	BH2	installed	installed	Borehole completed
Lynch Hill Gravel Member Gravel	BH3	-	-	Not drilled
Made Ground	TP2	-	-	Not drilled
Made Ground	TP4	-	-	Not completed – concrete to 1950mm below ground level
Made Ground	TP8	-	-	Not completed
Made Ground	TP10	-	-	Not completed – concrete >600mm
Made Ground	TP12	Not applicable	Not applicable	Trial pit completed
Structural Investigation	CH2	Not applicable	Not applicable	Location not relevant to ground investigation
Structural Investigation	SI1	Not applicable	Not applicable	Location not relevant to ground investigation

6.2 Groundwater Monitoring

Groundwater monitoring was carried out by SCL over two visits, on the 23 October 2014 and 20 November 2014.

A full set of groundwater monitoring results, is shown in the contractor's report at Appendix B.

6.3 Ground Gas Monitoring

Ground gas monitoring was undertaken on six occasions between 02 October 2014 and 04 March 2015. On each of the monitoring visits, the peak and steady methane, carbon dioxide, and oxygen levels were recorded at each installed monitoring standpipe, together with borehole gas flow readings and atmospheric pressure. Groundwater levels were also measured on each visit.

A full set of results, including the model type and detection limits of the onsite equipment used for the fieldwork, is shown in the respective fieldwork report sheet in the contractors' report at Appendix **B.**

7. Results

Logs of the strata encountered, and records of the samples taken during the investigation, are provided in Appendix B. A summary of the geological strata and underground structures encountered is presented below.

7.1 Geological Strata

The Site was noted to be underlain by up to 2.35m of Made Ground over at least 2.70m of the Lynch Hill Gravel member. This confirms the anticipated geology, as shown on the British Geological Survey map for the area. A summary of the geological strata encountered is shown in Table 4.

Table 4: Geological strata encountered

Soil Type	Depth of Top of Stratum (mbgl)	Thickness (m)	Typical Description
Bituminous Surfacing over concrete/Steel mesh grid	0.4/0.03	0.4/0.03	Bituminous surfacing over concrete (BH1) / Steel grid mesh (BH2)
Basement void	0.03m – 0.40m	2.75m – 3.32m	N/A
Made Ground	2.75m – 3.32m	1.00m – 2.35m	Soft dark brown/grey or brown/orange silty sandy gravelly clay, with fragments of brick, ash and concrete. Slight hydrocarbon odour identified within BH2.
Lynch Hill Gravel Member	4.55m – 5.90m	1.50m – 2.70m	Dense to very dense, becoming medium dense brown/orange sandy to very sandy fine to coarse subangular to subrounded GRAVEL. Gravel of flint. Locally grades to gravelly sand.
London Clay Formation	7.25m – 7.40m	17.60m 17.75m	Stiff becoming very stiff brown becoming grey fissured slightly silty CLAY, with occasional pockets and partings of pale grey silt. Rare pyrite nodules present with depth.

7.2 Underground Structures and Obstructions

During the investigation, a concrete slab up to 1950mm thick was encountered. This acted to restrict effective soil sampling by hand digging techniques.

Anecdotal information indicated the presence of large water filled vaults or chambers, up to 6m in depth, underlying the basement slab, particularly in the centre of the Site.

No further information referring to these water filled faults or chambers has been received.

7.3 Chemical Analysis

The laboratory test results are shown in the contractors' report at Appendix B.

7.4 Controlled Waters

Groundwater levels were monitored on six occasions, the results of which are shown in the contractors' report in Appendix B. Based on the groundwater monitoring to date, the groundwater level within the Lynch Hill Gravel Member deposits has been recorded between 23.40mAOD and 23.46mAOD.

7.5 Ground Gas

As part of the Site investigation, the two installed boreholes were monitored on six occasions over a period of 6 months in order to detect the presence of ground gas. The design of the borehole installations allowed gas concentrations in the Made Ground and the uppermost horizons of natural ground, to be monitored.

A complete set of ground gas results is shown within the contractor's report at Appendix B. Table 5 presents the peak carbon dioxide and methane gas results that were recorded on the six monitoring visits.

Table 5: Ground gas monitoring summary

Monitoring Point	Peak Gas Concentration (%)			Steady Gas Concentration (%)		
	Methane	Carbon Dioxide	Oxygen	Methane	Carbon Dioxide	Oxygen
BH1	0.2	1.1	19.3	<0.1	0.7	19.3
BH2	0.2	0.2	20.5	<0.1	<0.1	20.5

Gas flows in the same monitoring wells were ranged between <0.01l/hr and 0.40l/hr.

8. Generic Assessment Criteria

The data requirements for generic quantitative risk assessment will depend on:

- The substance being assessed;
- The receptors being considered;
- The pathways being considered; and
- The complexity of the site.

The outline conceptual model for the Site identified a number of potential pollutant linkages. These have been investigated and the results assessed against generic assessment criteria. The generic assessment criteria for each potential pollutant linkage are summarised in Table 6:

Table 6: Generic assessment criteria

Source	Pathway	Receptor	Generic Assessment Criteria
Contaminated Soils	Direct contact, inhalation	Future users of the proposed Development	Generic Assessment Criteria (GAC) as outlined at Appendix E.
Contaminated Soils	Direct contact with groundwater	Secondary (A) Aquifer (Lynch Hill Gravel Member)	UK Drinking Water Supply Standards
Ground gas from Made Ground	Migration through soil matrix	Future users of the proposed Development	Gas Screening Value determination and assessment in accordance with CIRIA C665
Contaminated Soils	Direct Contact	New water supply pipes	UKWIR Guidance for the Selection of Water Supply Pipes to be used in Brownfield Sites

The generic assessment criteria used in this report are shown in Appendix E.

8.1 Site Specific Information used to Support the Generic Risk Assessment

The site specific data used to support the generic risk assessment carried out as part of this investigation are described in the sections below:

Human Health Risk

Given the commercial end use for the proposed development, the results of the soil analysis have been compared to the relevant guidelines appropriate for a commercial development. The redevelopment comprises the vertical extension of the existing basement. As a result Made Ground currently on Site is likely to be removed as part of these works. In addition, the presence of the water filled vaults reportedly up to 6m in depth located underneath the central part of the Site suggests previous removal of Made Ground in those locations. In view of the extensive use of hardstanding, without proposed soft landscaping, the direct contact and dust inhalation pathways for current and future site users are considered not relevant.

The GACs and other relevant guidelines have however been used as a reference point against which to contextualise the magnitude of the contaminant concentrations encountered.

Generic screening criteria have been updated since the issue of Waterman's Interim Report (EED13325-101.R.1.1.2.KH) dated 17 November 2014. New 'Suitable For Use Screening Levels' (S4USLs) were published by LQM and were used to re-assess all the soil laboratory data.

Construction Workers

A qualitative assessment of the risk to construction workers has been undertaken.

Controlled Waters

The secondary (A) aquifer within the Lynch Hill Gravel Member is the main controlled water receptor. However it is considered not to be highly sensitive due to the surrounding areas' historic industrial nature and that groundwater abstractions within 1km of the Site are likely to be from the Upper Chalk Formation aquifer.

The Secondary (A) Aquifers within the Lambeth Group and Thanet Sand Formation, and the Principal Aquifer within the Upper Chalk Formation, are all overlain by substantial depths of the London Clay Formation. The London Clay Formation is expected to act as an aquiclude, restricting the vertical migration of contaminants within the Made Ground to the identified aquifers.

The River Thames, located 1.2km to the south east at its closest point, is considered not to be a receptor owing to its distance from Site.

Ground Gas

The future development users are the potential receptors of ground gas generated on Site. A gas screening value (GSV) derived in accordance with CIRIA C665 will indicate whether or not there is a requirement for the inclusion of any gas protection measures in the new development.

9. Quantitative Environmental Risk Assessment

The potential pollutant linkages identified in Section 3.4 have been evaluated using the Generic Assessment Criteria described in Section 8 and Appendix E.

9.1 Risk to Human Health

As discussed in section 8 above, the new S4USLs were used for this assessment. When compared against the relevant screening level for a commercial end use (Soil Organic Matter Content of 2.5%), no exceedances were noted. As such, it is considered that there is no significant risk to human health from contaminants present within the Made Ground underlying the Site.

It is noted that Waterman reported in their letter (ref. EED13325-101.1.1.2KH, dated 17 November 2014) PAHs to exceed their respective screening levels when compared against now superseded residential screening criteria. As the development is of commercial nature, the complete set of laboratory results in this report were compared against commercial screening criteria. As a consequence, no exceedances were observed. Notwithstanding the above, PAH concentrations recorded comply with the S4USLs for residential without plant up-take end-use. The S4USLs were published in December 2014 and supersede the previous assessment included in Waterman's letter report of November 2014.

9.2 Risk to Controlled Waters

Groundwater samples were recovered from the underlying secondary (A) aquifer within the Lynch Hill Gravel Member deposits. Comparison of the results to the relevant guidelines identified nitrate (NO_3) to be exceeding its UK DWS threshold of 50mg/l on two occasions within BH2 (97.2mg/l and 115mg/l). No other contaminants of concern had exceeded their respective guideline threshold values. As such it can be considered that the Site poses a low risk to the quality of controlled water.

9.3 Risk to Structures

The results of the soil samples recovered from the exploratory holes indicated that buried concrete should provisionally be designed in accordance with DS-1 ACEC site class AC-1[d]. Similarly, groundwater samples recovered from the BH1 and BH2, identified chemical conditions consistent with concrete required to be designed in accordance with DS-1 ACEC Site Class AC-1[d]. Therefore concrete should be designed in accordance with DS-1 ACEC Site Class AC-1[d], as defined by the BRE digest 1 (2005) – Concrete in Aggressive Ground.

The two wells installed within BH1 and BH2, were monitored on six separate occasions over a period of six months, to allow a robust assessment of the Site's ground gas regime.

The maximum recorded carbon dioxide concentration was 1.1% in BH1. The maximum recorded methane concentration was 0.2% in BH1 and BH2. Maximum flow rate during the six monitoring visits was recorded at 0.4 l/hr

Given a proposed commercial end use, the Site for the purposes of ground gas assessment can be classified as Situation A, 'Any development other than Situation B, e.g. factories, shops, commercial, warehouses, schools, cinemas, sports centres, stadiums, high rise housing, housing with basements, etc'.

The data recovered indicates that a preliminary GSV for the Site can be calculated as 1.1% x 0.4L/hr, generating a value of 0.0044L/hr. This GSV would identify the Site as Characteristic Situation 1, whereby ground gas protection measures would not be required.

9.4 Risk to Water Supply Pipes

The UKWIR project steering group decided that barrier pipes would provide sufficient protection for the supply of drinking water in all Brownfield site conditions. However, this approach needs to be agreed with the local water company.

9.5 Risk to Construction Workers

Contaminants were recorded at levels below the respective guideline levels. However it is considered prudent that the appropriate PPE, RPE and maintenance of standard hygiene precautions are followed, to further limit and restrict any risks to construction workers health.

While asbestos was not found within the made ground, its presence should not be discounted. As such, precautions should be taken into account ahead of ground works.

10. Conclusions

The pollutant linkages identified during the PERA were re-evaluated in relation to the additional information obtained. On the basis of the assessment, it is considered that the completed development will represent a **low** risk with respect to ground contamination. Therefore, post development the Site should not be capable of being determined as contaminated land, under Part IIA of the Environmental Protection Act 1990, assuming the implementation of recommendations set out in Section 10, thus meeting the requirements of the NPPF. The results of the reassessment are summarised in Table 7:

Table 7: Estimation of environmental risks associated with the subject site

Receptor	Potential sources	Pathways	Risk	Justification
Human Health				
Existing and future site users and maintenance staff	Contaminants from current and historical Site uses	Direct contact, ingestion and Dust Inhalation	Low	The proposed development includes a basement extension which is expected to remove the majority of Made Ground. No areas of soft landscaping are proposed. The extensive hardstanding across the Site will act to disrupt the direct contact, ingestion, and dust inhalation pathways to existing and future human health receptors.
	Contaminants from current and historical Site uses	Vapour Inhalation	Low	No elevated hydrocarbons, VOC's, or SVOC's were recorded. In addition, the majority of the Made Ground will be removed as part of the basement extension, thereby removing the bulk of the contaminated material. As such, no significant sources are considered to be present post development.
	Ground gas from Made Ground	Accumulation in site structures	Low	Ground gas monitoring has identified that the Site would be classified as Characteristic Situation 1, whereby ground gas measures would not be required. SCL reported 6m deep water filled vaults be present underlying the Site. Made ground will likely be limited in extent. The proposed development plan for the basement identifies its use for retail, several plant rooms, shower units and cycle racks. It is not known whether mechanical filtration will be implemented.
Construction workers	Contaminants from current and historical site uses	Direct contact, ingestion and dust inhalation	Low	Construction workers may come into direct contact with contaminants present in the underlying soils and groundwater during intrusive groundworks. On the basis of soil and water chemical results risks are low. Risk to construction workers will be mitigated further through adherence of health and safety precautions, the use of appropriate PPE and maintenance of good hygiene precautions.
	Contaminants from current and historical site uses	Vapour inhalation	Low	No elevated hydrocarbons, VOC's, or SVOC's were encountered during the investigation. There is considered to be a low risk to construction workers from contaminant vapour. However, it is considered prudent that construction workers should wear the appropriate PPE, and maintain good hygiene standards during groundworks.

	Ground gas from Made Ground	Accumulation in trenches, inhalation	Low	Ground gas monitoring has not identified significantly elevated concentrations of methane or carbon dioxide, or depressed oxygen levels. However, during intrusive ground works appropriate health and safety measures should be implemented.
Off Site residents and workers	Contaminants from current and historical site uses	Dust inhalation	Low	This potential pollutant linkage will be mitigated through the use of appropriate measures carried out during demolition, intrusive ground works, and construction works.
	Contaminants from current and historical site uses	Lateral migration through the underlying secondary (A) aquifer, direct contact	Low	During the basement extensions, the majority of the Made Ground underlying the Site will be removed. Therefore facilitating source removal.
Property				
Site structures	Contaminants from current and historical site uses	Chemical attack on buried concrete, ingress into buried services	Low	The risk to structures and services will be addressed through the use of appropriately designed buried concrete, and the laying of appropriate barrier water supply pipes.
	Ground gas from Made Ground	Accumulation leading to explosion	Low	Ground gas monitoring has identified that the Site would be classified as Characteristic Situation 1, whereby ground gas measures would not be required. Made Ground will likely be limited in extent where 6m deep water filled vaults are present beneath the Site. The proposed development plan for the basement identifies its use for retail, several plant rooms, shower units, and cycle racks. It is not known whether mechanical filtration will be implemented.
Adjacent Property				
Adjacent residential/commercial developments	Contaminants from current and historical site uses	Lateral migration through underlying secondary (A) aquifer	Low	Groundwater quality at the Site largely complies with UK Drinking Water Supply Standards. Risks to off-site receptors are considered to be low.

Controlled Waters				
Secondary (A) aquifer within the Lynch Hill Gravel Member	Contaminants from current and historical site uses	Vertical migration	Low	Groundwater quality at the Site largely complies with UK Drinking Water Supply Standards. Risks to the underlying secondary (A) aquifer are low.
Secondary (A) aquifer within Lambeth group and Thanet Sand Formation, and the principal aquifer within the Upper Chalk Formation	Contaminants from current and historical site uses	Vertical migration	Low	The Secondary (A) Aquifers within the Lambeth Group and Thanet Sand Formation, and the Principal Aquifer within the Upper Chalk Formation, are all overlain by substantial depths of the London Clay Formation. The London Clay Formation acts as an aquiclude, restricting the vertical migration of contaminants within the Made Ground to the identified secondary (A) aquifers and principal aquifer.

11. Recommendations

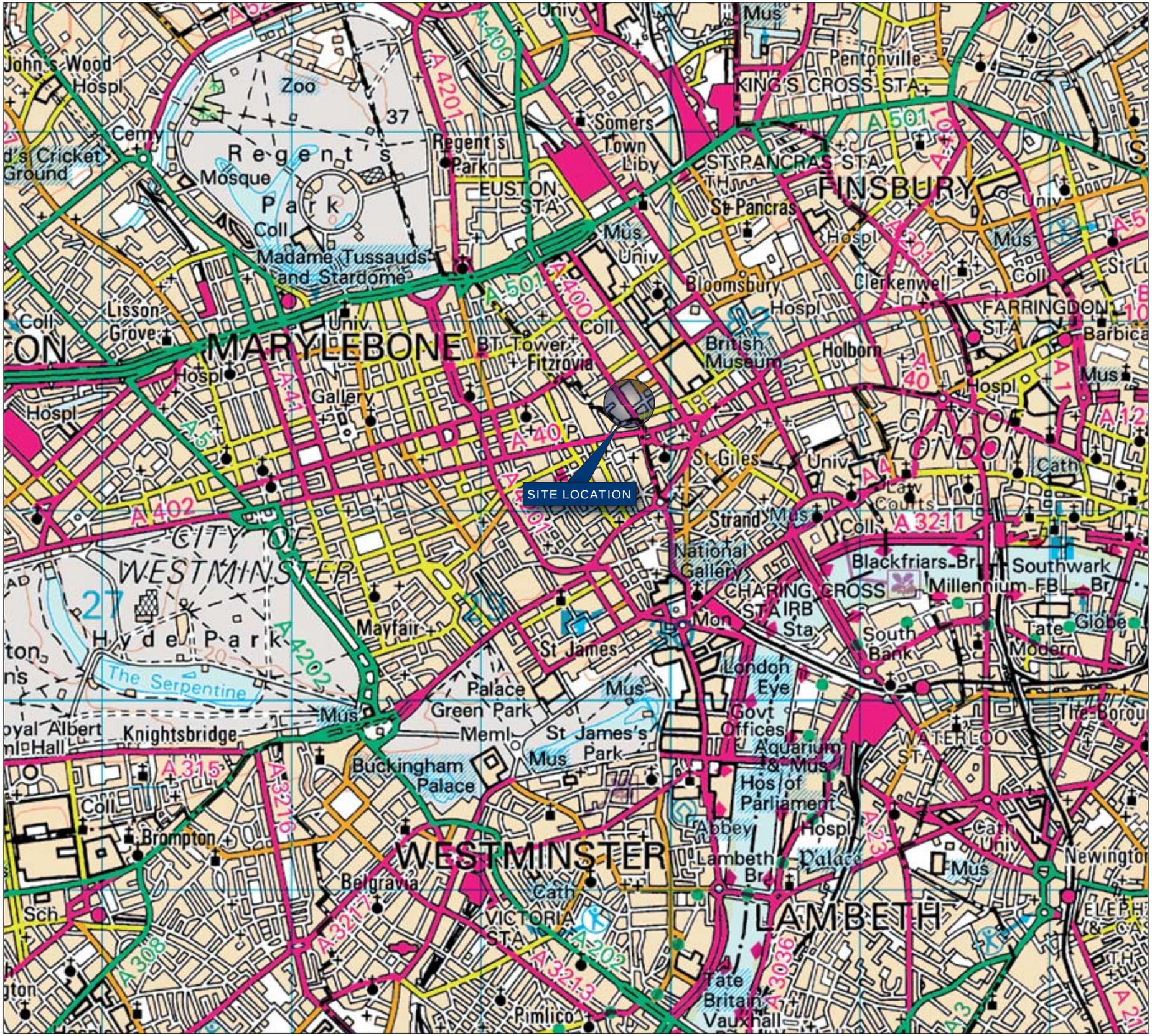
The following actions are recommended to address the potentially unacceptable risks that remain:

- A waste classification/options assessment should be produced to appropriately deal with the excavation waste produced during the basement extension. Materials marked for off-site disposal, other than natural Gravel or Clay, should be sampled post demolition and the construction programme should take into account a three week turnaround time of laboratory analysis;
- Construction workers should be provided with and use personal protective equipment and adhere to good hygiene practices;
- New water supply pipes should be installed in accordance with the UK Water Industry Research guidance;
- Concrete should be designed in accordance with DS-1 ACEC Site Class AC-1[d], as defined by the BRE digest 1 (2005);
- The water filled vaults beneath the basement should be surveyed, the water quality tested and the water removed in accordance with relevant discharge license, if applicable;
- A watching brief should be implemented during the demolition of the existing building with particular emphasis on the locations of the current electricity substations. Should any visual or olfactory evidence of contamination be encountered works should be stopped and the Environmental Consultant should be contacted to advise on further steps which are likely to include additional soil sampling, chemical testing and the production of a validation report; and
- This report should be submitted to Camden Council to facilitate the discharge of condition 11b of planning consent 2013/3880/P.

APPENDICES

Appendix A Site Plans

- **Site Location Plan (Fig. A1)**
- **Site Plan (Fig. A2)**



waterman
Energy, Environment & Design

N

Project Details	EED13325-100: One Bedford Avenue
Figure Title	Figure A1: Site Location Plan
Figure Ref	EED13325-100_GR_PERA_A1A
Date	January 2013
File Location	\\nt-lncs\weedl\projects\eed13325\100\graphics\pera\issued figures

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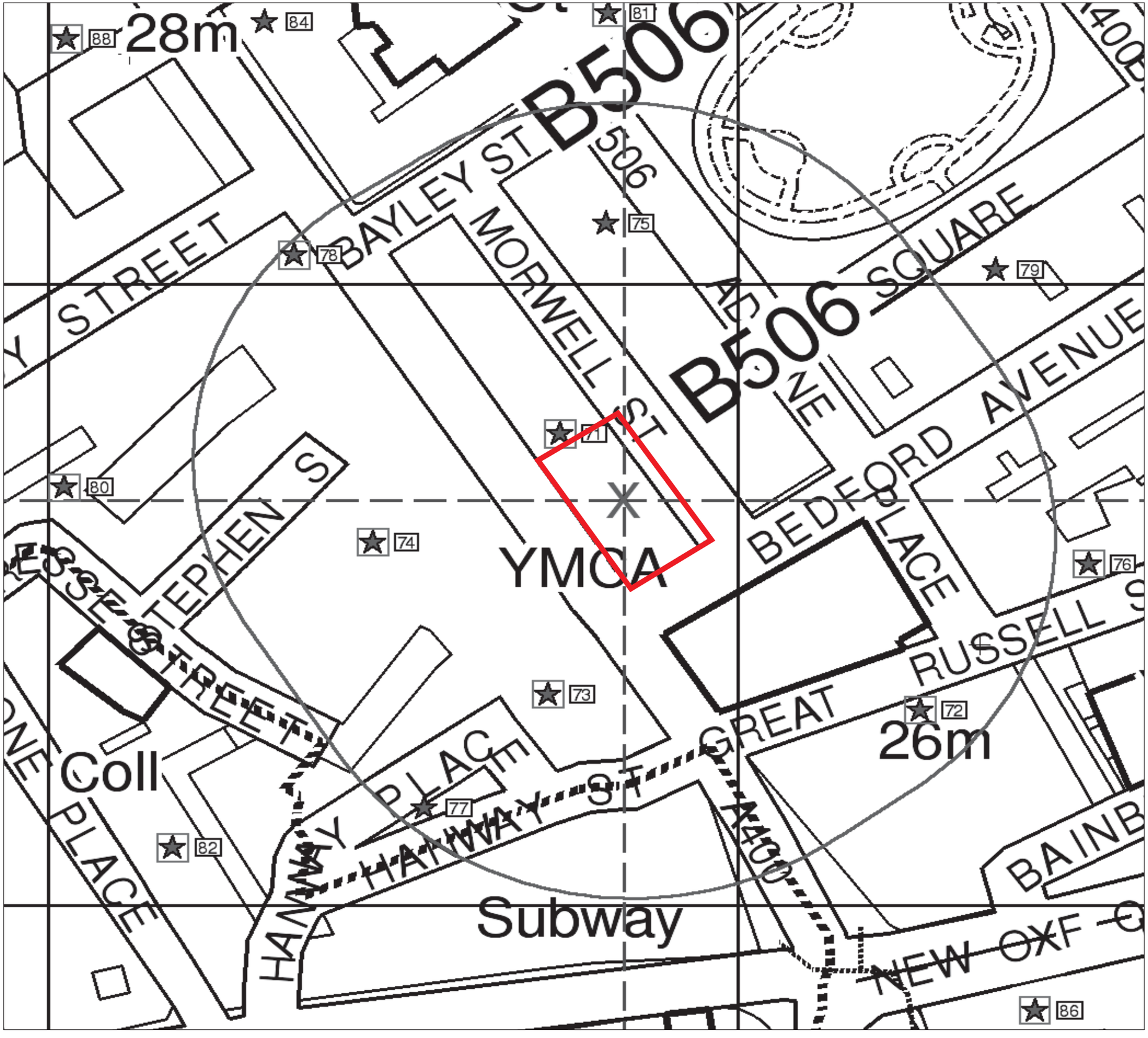

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Site Boundary

N

Project Details	EED13325-100: One Bedford Avenue
Figure Title	Figure A2: Site Plan
Figure Ref	EED13325-100_GR_PERA_A2A
Date	January 2013
File Location	\\nt-lncs\weedl\projects\eed13325\100\graphics\pera\issued figures

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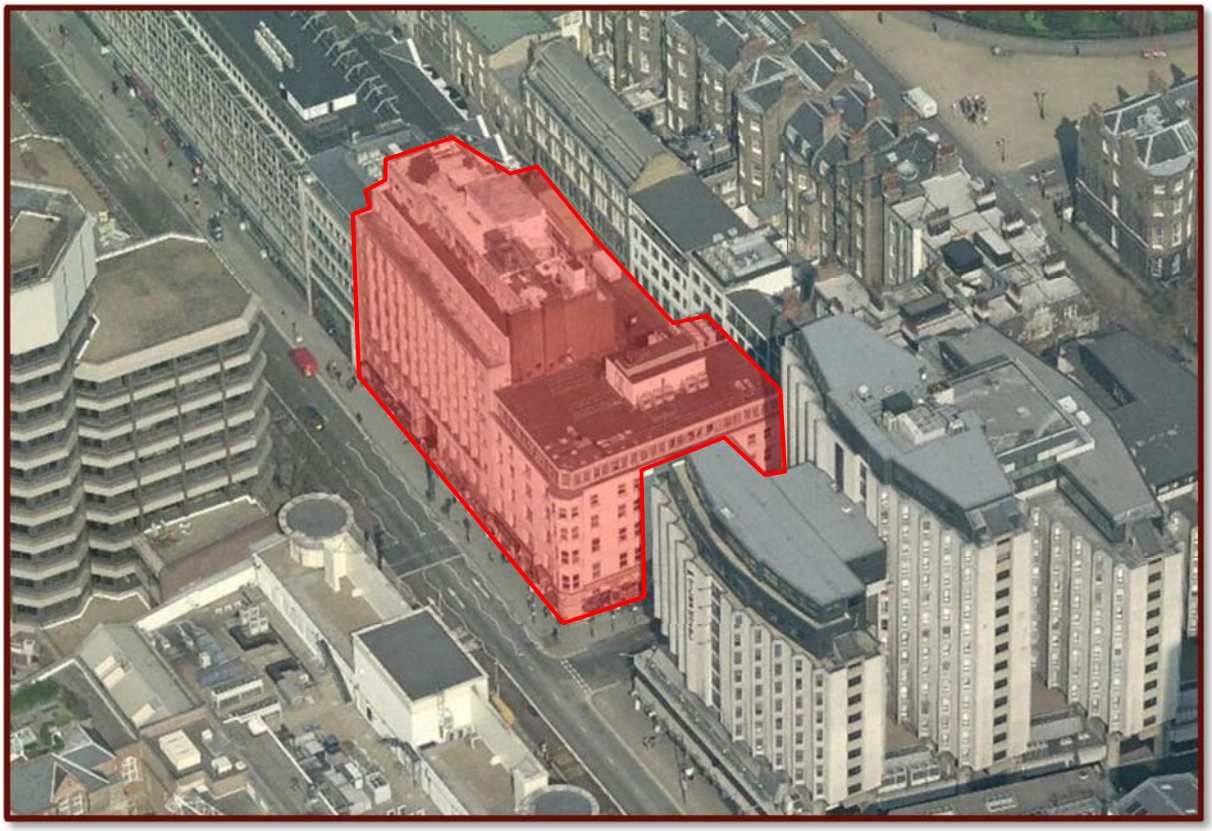
Appendix B Correspondence from Third Parties

- **Soil Consultants' Report on Preliminary Ground Investigation and Ground Movement Analysis, One Bedford Avenue, Camden, London WC1B 3AU, 9661/JRCB/SCW (Rev 1), Date: 24th April 2015 (295 Pages)**

REPORT ON PRELIMINARY GROUND INVESTIGATION AND GROUND MOVEMENT ANALYSIS

ONE BEDFORD AVENUE
BEDFORD AVENUE, CAMDEN, LONDON WC1B 3AU



Client:	**EXEMPLAR PROPERTIES (BEDFORD) LTD**
Consulting Engineers:	**WATERMAN GROUP** **Pickfords Wharf, Clink Street** **London SE1 9DG**
SCL Report ref:	**9661/JRCB/SCW (Rev 1)**
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REPORT ON PRELIMINARY GROUND INVESTIGATION AND GROUND MOVEMENT

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DOCUMENT ISSUE STATUS:

Issue	Date	Description	Author	Checked/ approved
Rev 0	06/11/14	First issue	John Bartley BSc, MSc, CGeol, FGS	Stuart Wagstaff BSc, MSc, CGeol, FGS
Rev 1	24/04/15	Additional monitoring and contamination results	John Bartley BSc, MSc, CGeol, FGS	Stuart Wagstaff BSc, MSc, CGeol, FGS

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- Monitoring results

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- Particle size distribution analyses
- Unconsolidated, undrained triaxial compression tests (SCL)
- Unconsolidated, undrained triaxial compression tests (K4)
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Ground profiles

- Schematic cross section (A-A)
- Plot of natural moisture content and index properties versus Ordnance Datum
- Plot of SPT 'N_{60}' and undrained cohesion versus Ordnance Datum

Plans & drawings

- Development plans and sections
- Site Plan
- Location Plan

APPENDIX B

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- Figures 1 to 9 (GMA input parameters and results)

APPENDIX C

Pressuremeter report (details TBC)

APPENDIX D

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- 14-24916
- 14-25327
- 14-25397
- 14-25909
- 14-26770

1.0 INTRODUCTION

Consideration is being given to the redevelopment of this site, comprising the demolition of the existing buildings and construction of a new 8-storey mixed use building; the existing basement level is to be deepened.

In connection with the proposed works, Soil Consultants Ltd (SCL) were commissioned by the Waterman Group (WG) to carry out a ground investigation to include the following elements:

- Identification of ground sequence
- Sampling for geotechnical testing
- Sampling and environmental testing in accordance with Waterman Energy, Environment & Design requirements (WatermanEED)
- Provision of recommendations for raft foundation and retaining wall design
- Assessment of ground movements at the level of the adjacent Northern Line tunnels

This report describes the investigation undertaken, gives a summary of the ground conditions encountered and then provides recommendations for the design of the proposed raft foundation and retaining walls.

A Preliminary Environmental Risk Assessment was provided by WatermanEED (Ref EED13325-100.R3.3.1.JC, dated May 2013). WatermanEED have addressed all contamination/environmental assessments for the project under separate issue.

2.0 SITE DESCRIPTION

The site is located in Camden Central London as is bound to the south by Bedford Avenue, to the west by Tottenham Court Road and to the east by Morwell Street. Mixed retail and office buildings are present to the north (Nos 248-250 Tottenham Court Road). The overall dimensions of the site are approximately 55m x 28m and its centre lies at approximate NGR 529767E 181530N.

The site is occupied by two separate buildings. The southern-most building which occupies about one third of the site fronts onto Bedford Avenue, is 6-storeys in height and includes No 1 Bedford Avenue, Nos 257-258 Tottenham Court Road and No 15 Morwell Street. The larger northern building includes Nos 251-256 Tottenham Court Road and is 9-storeys in height (above-ground). A single level basement is present beneath both buildings. At basement level within the northern building (former Timeout premises), a number of large water-filled 'vaults' were present beneath the basement slab, in excess of 5m x 5m in plan; these were not identified on the site survey drawing and accurate measurement of their number and extent would be advisable.

Existing external ground level (ie at road/pavement level) slopes down very slightly to the south, with a fall in ground level from about +26.7mOD to +26.4mOD. The existing basement floor levels vary between about +23.4mOD and +23.6mOD. These levels have been taken from the TFT Basement and Ground plans (Refs EL01 and EL02 respectively, May 2011).

The Northern Line tunnels lie beneath Tottenham Court Road immediately to the west of the site. Information provided by WG indicates the tunnels to be approximately 4.5m in diameter with a crown level of approximately -1.9mOD.

The site outline and some of the current features are shown on the Site Plan which is included in Appendix A.

3.0 EXPLORATORY WORK

The ground investigation was carried out in September and October 2014. The time of the investigation, only limited areas of the site were available and therefore full coverage was not possible. The investigation carried out at this time comprised the following elements:

Cable percussive boreholes

Two boreholes were carried out using a demountable, low headroom rig due to the access and headroom limitations. A schedule of the boreholes is as follows:

BH	NGR coords (approx)	GL (mOD)	BH depth (m)	Base level (mOD)	Notes and installation details
1	529772E 181542N	+26.75	25.00	+1.75	Located at ground level and taken down through the basement void 50mm monitoring pipe installed to 7.50m depth (+19.25mOD)
2	529788E 181515N	+26.80	29.00	-2.20	Located at ground level over an existing light well on the Bedford Avenue elevation 50mm monitoring pipe installed to 8.00m depth (+18.8mOD) Piezometer installed at 28.80m depth (-2mOD)

(Ground levels interpolated from TFT Ground and Basement floors plans referenced in Section 2.0)

'Undisturbed' sampling (U100) and in-situ Standard Penetration Tests (SPT) were carried out at regular intervals. Sampling for environmental testing and PID testing were carried out in accordance with WatermanEED requirements.

Self Boring Pressuremeter testing

Pressuremeter testing was carried out in BH 1 as detailed in the following schedule:

Test No	Test depth (m)	Test elevation (mOD)
T1	9.80	+16.95
T2	15.30	+11.45
T3	20.00	+6.75
T4	25.00	+1.75

A detailed description of the testing method, apparatus is presented in the report by Cambridge In-situ, together with the test results; the Cambridge In-situ report is included as Appendix C.

Trial pits

A number of trial pits were specified by WG within the areas of the buildings available. Unfortunately, due to significant thicknesses of concrete and the presence of the water-filled 'vaults', only one of these trial pits was successfully completed. This trial pit (designated TP12) was carried out at basement level on the eastern side of the site. The trial pit, which required 'stitch-drilling' of the basement slab using concrete coring techniques, was logged by a geotechnical engineer. Concrete coring was carried out at the locations of TP4 and TP10 and photographs of these cores are included in Appendix A.

Groundwater/gas monitoring

Monitoring of the ground gas and water levels was carried out on two occasions.

Geotechnical laboratory testing

The following geotechnical laboratory testing was completed:

- Index properties tests
- Particle size distribution tests
- Unconsolidated undrained triaxial testing
- Oedometer testing
- Soluble sulphate/pH (QTS Environmental)

Contamination testing

Environmental samples were dispatched to QTS Environmental Ltd. Testing was carried out in accordance with WatermanEED requirements.

The engineering logs of the exploratory holes and the geotechnical laboratory testing results are included as Appendix D.

4.0 GROUND CONDITIONS

Reference to published BGS data indicates that the Lynch Hill Gravel is present overlying the London Clay Formation. The Lambeth Group Formation is then shown to be present resting upon the Thanet Sand at about 40m depth.

The investigation encountered a variable thickness of made ground overlying the Lynch Hill Gravel. The boreholes extended through the London Clay and both terminated within the Lambeth Group clay.

The ground sequence is shown in the appended schematic cross section through the boreholes.

4.1 Basement slab and made ground

The basement slab at the borehole positions varied in thickness between 200mm (BH2) and 550mm (TP12). The underlying made ground extended to depths of between 1.20m and 2.75m below basement slab level; this is equivalent to +22.45mOD to +20.85mOD. The made ground generally comprised soft dark brown, brown/orange or pale brown silty sandy gravelly clay with variable brick/concrete fragments and occasional ash pockets. A further layer of concrete, 200mm thick, was present at the base of the made ground in BH2.

SPT N_{60} values measured within the made ground varied between 3 and 4.

4.2 Lynch Hill Gravel

The Lynch Hill Gravel predominantly comprised brown and brown/orange sandy to very sandy fine to coarse flint gravel which locally graded to gravelly sand. The gravel varied in thickness between 1.50m and 2.70m in the boreholes and extended to between +19.35mOD and +19.55mOD.

SPT N_{60} values of between 17 and >50 were measured, indicating a medium dense to very dense state of compaction.

4.3 London Clay

The upper surface of the London Clay was met at between +19.35mOD and +19.55mOD; this is equivalent to approximately 7m to 7.5m depth below street/pavement level. The London Clay comprised brown becoming grey fissured clay with occasional orange staining in its upper levels. The clay was generally slightly silty and contained occasional partings of silt and fine sand. Locally the clay was silty and slightly sandy but no distinct silty/sandy zones were observed, as might be expected within these basal layers of the London Clay. A profile of the natural moisture content and index properties is included in the Appendix.

Occasional claystones were encountered which required chiselling.

A plot showing the SPT N_{60} values and laboratory undrained cohesions is included in the Appendix. This indicates that the London Clay was generally of high strength to approximately +14mOD, then becoming very high strength.

4.4 Lambeth Group

The Lambeth Group was encountered at between +2.95mOD and +2.45mOD, equivalent to approximately 24m depth below general street/pavement level. Initially a layer of distinctive multi-coloured (brown, blue/grey and red/brown) slightly silty clay was present containing occasional partings of silt. Below about +0.55mOD in BH2 the clay was generally grey/brown in colour, silty and slightly sandy with occasional pockets/bands of grey silty fine sand.

SPT N_{60} values indicate the clay to be of very high strength.

The Lambeth Group soils extended to the full depth investigated, equivalent to -2.2mOD.

4.5 Groundwater

Groundwater inflows (assessed as 'fast' rate) occurred within the Lynch Hill Gravel in both boreholes. Monitoring of the standpipes (from basement floor level) indicated a rest level at between about +20.3mOD and +20.0mOD.

Slight water seepages were observed at various levels within the London Clay. A more substantial 'fast' inflow occurred from within the sands bands of the Lambeth Group at -0.95mOD in BH2; monitoring of the piezometer placed towards the base of the borehole indicated a standing level at +2.5mOD.

Of course ground water levels will vary seasonally, tending to rise during the wetter months and this may be particularly marked in the Lynch Hill Gravel. An ongoing programme of monitoring will be continued throughout winter 2014/15.

4.6 Environmental observations

PID readings were taken in the upper borehole samples and the results are indicated on the borehole logs. No visual or olfactory evidence of contamination was observed in any of the boreholes or trial pits.

5.0 GEOTECHNICAL ASSESSMENT AND GROUND MOVEMENT ANALYSIS

The proposed redevelopment comprises demolition of the existing buildings and construction of a new 8-storey mixed use building. The scheme will involve deepening of the existing basement with a new split-level basement with SSL between +22.24mOD and +21.58mOD. The new building is to be supported on a 1.5m thick reinforced raft foundation which will include a 'fold' to accommodate the two different basement levels. Details of the proposed sub-structure are shown on the appended development drawings.

The following sections discuss the proposed basement excavation, ground movement analysis and design of the raft foundation. The potential effects of the redevelopment on the adjacent Northern Line tube tunnels are then addressed.

5.1 Basement excavation and retaining walls

The existing basement level is approximately +23.6mOD and the formation level of the proposed new raft varies between approximately +20.75mOD and +20.1mOD; thus excavation depths of 2.85m and 3.5m are envisaged for the higher and lower raft levels respectively (measured from existing basement slab level). On the basis of the two boreholes completed, the basement excavation will encounter variable made ground and natural gravel. The highest level that groundwater was measured in the natural gravel was +20.32mOD (October 2014) and thus it is apparent that the excavation, at least for the lower raft, will encounter groundwater. We understand that a sheet piled wall is to be installed along the western, southern and eastern sides of the new basement and this should be successful in mitigating any risks with respect to ground stability and groundwater control. Along the northern boundary it is proposed to underpin the existing party wall down to the new raft level. If the excavations remain above the groundwater this should be relatively straightforward but based on current levels water control measures will be required at least along the lower raft section of the party wall. These could include localised lowering of the water level using well pumping, injection grouting (resin or cement based) or trench sheeting/sheet piling. The main groundworks contractor should provide their detailed proposals for the control of groundwater in the excavations.

The following table of coefficients may be used for the design of the basement retaining wall:

Stratum	Bulk density (Mg/m^3)	Effective cohesion, c' (kN/m^2)	Effective friction angle, ϕ' (degrees)
Made ground	1.80	0	23
Lynch Hill Gravel	2.00	0	35
London Clay:	2.00	0	22

(these parameters are 'most probable' best estimates - no partial factors have been applied)

In general terms Eurocode 7 stipulates that partial material factors must be applied to the best estimates of geotechnical soil properties during the design stage. The design engineer must ensure that the correct comparisons are made between Design Actions and Design Resistances after the application of appropriate partial factors. The designer should use the parameters to derive active and passive earth pressure coefficients, Ka and Kp. The determination of appropriate earth pressure coefficients, together with factors such as the pattern of earth pressure distribution, will depend upon the type/geometry of the wall and the overall design approach.

5.2 Foundation concrete

Low to moderate concentrations of soluble sulphates were measured in selected soil samples with near neutral pH values. The 'characteristic value' of the data set falls into Site Design Class DS-2 of Table C2

given in BRE Special Digest 1 (2005). We assess the site as having 'mobile' ground water and recommend that buried concrete is designed in accordance with ACEC Site Class AC-2.

5.3 Ground movement analysis (GMA)

Ground movement analysis has been carried out using PDISP (version 19.2) to model the response of the ground on unloading due to demolition/excavation and on reloading due to construction of the new raft-supported building. The following construction stages have been addressed:

- heave movement due to demolition of the existing buildings
- heave due to the excavation for the basement deepening
- settlement due to reloading by the new structure

5.3.1 Geometry and loading

The analytical technique depends on the selection of appropriate rectangular areas to simulate unload and re-application of load from the new structure to the ground. Our approach for the analyses assumes that all elements equate to loads over a series of rectangular areas representing the footprint of the basements with uniform loading below each of the represented areas. For the purposes of the heave/settlement analyses, the equivalent sustained loading has been taken as DL + 1/3LL, which in our experience is realistic.

Waterman Structures have provided load take-down details to estimate the weight of the existing buildings and this has been modelled using twenty one equivalent areas (U1 to U21); unload pressures vary from -32kPa to -195kPa. The excavation has been modelled using six areas (UX1 to UX6) with overall unload pressures between -45kPa and -58kPa. The unload areas are summarised in the following table:

Ref	Centre of load			Dimension		Pressure
	X (m)	Y (m)	Z level (mOD)	X (m)	Y (m)	(kPa)
U1	12.25	20.40	+23.00	2.90	7.60	-195
U2	28.70	20.40	+23.00	30.00	7.60	-128
U3	52.80	19.85	+23.00	18.20	8.90	-101
U4	49.55	13.90	+23.00	11.70	3.00	-35
U5	63.80	19.85	+23.00	3.80	8.90	-32
U6	12.25	28.05	+23.00	2.90	7.70	-111
U7	16.55	28.05	+23.00	5.70	7.70	-62
U8	22.95	28.05	+23.00	7.10	7.70	-192
U9	28.95	28.05	+23.00	4.90	7.70	-126
U10	37.55	28.05	+23.00	12.30	7.70	-73
U11	46.55	28.05	+23.00	5.70	7.70	-48
U12	52.10	28.05	+23.00	5.40	7.70	-177
U13	59.90	25.95	+23.00	10.20	3.50	-32
U14	59.90	29.80	+23.00	10.20	4.20	-107
U15	12.25	37.85	+23.00	2.90	11.90	-119
U16	20.10	37.85	+23.00	12.80	11.90	-79
U17	35.10	37.90	+23.00	17.20	12.00	-85
U18	46.30	35.85	+23.00	5.20	7.90	-54
U19	51.55	35.85	+23.00	5.30	7.90	-194
U20	59.35	35.85	+23.00	10.30	7.90	-75
U21	52.35	42.40	+23.00	17.30	5.20	-88
UX1	33.10	25.55	+20.75	44.60	17.90	-45
UX2	49.55	16.00	+20.75	11.70	1.20	-45
UX3	60.20	24.95	+20.75	9.60	19.10	-45
UX4	27.25	39.20	+20.10	32.90	9.40	-58
UX5	52.35	39.75	+20.10	17.30	10.50	-58

Ref	Centre of load			Dimension		Pressure
	X (m)	Y (m)	Z level (mOD)	X (m)	Y (m)	(kPa)
UX6	62.65	37.15	+20.10	3.30	5.30	-58

New raft loads have been provided by Waterman Structures in the form of individual column, core or line loads. This has resulted in the raft being divided into twelve separate loaded areas with the equivalent gross applied pressure varying between +39kPa and +105kPa. Dead and live loads on raft (including self-weight) have also been modelled. The new load areas are summarised as follows:

Ref	Centre of load			Dimension		Pressure
	X (m)	Y (m)	Z level (mOD)	X (m)	Y (m)	(kPa)
L1	16.25	23.20	20.75	10.90	13.20	90
L2	26.90	23.20	20.75	10.40	13.20	68
L3	36.60	23.20	20.75	9.00	13.20	86
L4	51.25	19.70	20.75	20.30	6.20	60
L5	45.95	26.30	20.75	9.70	7.00	93
L6	55.70	30.40	20.75	9.80	15.20	91
L7	16.25	35.15	20.10	10.90	10.70	105
L8	16.25	42.05	20.10	10.90	3.10	93
L9	26.90	36.75	20.10	10.40	13.90	55
L10	36.60	36.90	20.10	9.00	14.20	80
L11	45.95	37.15	20.10	9.70	14.70	61
L12	55.70	41.25	20.10	9.80	6.50	75
S1	35.70	25.80	20.10	49.80	18.40	39
S2	35.70	36.00	20.10	49.80	2.00	74
S3	35.70	40.75	20.10	49.80	7.50	39

The loads provided indicate that the new structure will be lighter than the existing building. Taking into account the deepening of the basement, it is assessed that there will generally be a net overall unloading.

5.3.2 Soil parameters

The unload/reload regime due to the proposed redevelopment will be relatively complex, with the stress reduction being variable due to the distribution of the existing buildings, the variable new basement level and the pattern of load on the new raft. As discussed above, there will probably be a net overall unloading and the response of the soils, both in heave and heave reversal (ie new loading) will be relatively stiff. We have therefore used 'stiff' parameters to estimate the heave/ reload cycle and these have been derived from the measured strengths of the various strata as summarised in Section 4.0 above. Correlation factors ('f') have been applied to the strength parameters to provide undrained and drained moduli and these are summarised as follows:

Stratum	Level	Strength	UNLOAD/LOAD			
		N/Su	Eu	Ed	νu	νd
Lynch Hill Gravel	+20.75mOD	N = 20	35MPa	35MPa	0.2	0.2

Stratum	Level	Strength N/Su	UNLOAD/LOAD Eu	Ed	νu	νd
London Clay	+19.35mOD	Su=100kPa at +19.35mOD ΔSu=8.13kPa/m	50MPa at +19.35mOD 120MPa at +2.5mOD (f=500)	25MPa at +19.35mOD 60MPa at +2.5mOD (f=250)	0.5	0.2
Lambeth Group	below +2.5mOD	Su=350kPa at +2.5mOD ΔSu=5kPa/m	175MPa at +2.5mOD 217.5MPa at -14.5mOD (f=500)	87.5MPa at +2.5mOD 108.75MPa at -14.5mOD (f=250)	0.5	0.2

Note: Rigid boundary level = -14.5mOD

5.3.3 Results of analysis

The results of the PDISP analysis are presented in Appendix B as contours of ground movement. It should be noted that the method used does not model the stiffness of the above and below ground structures and provides the predicted ground movement assuming a fully flexible response. This is valid for the heave response, but for a relatively stiff raft the magnitude of settlement tends to be about 80% of the calculated value at its centre.

The displacements of the buildings/tunnels have therefore been inferred from the predicted ground movements and these will tend to be conservative as the rigidity of the structures is ignored.

A summary of the results is as follows:

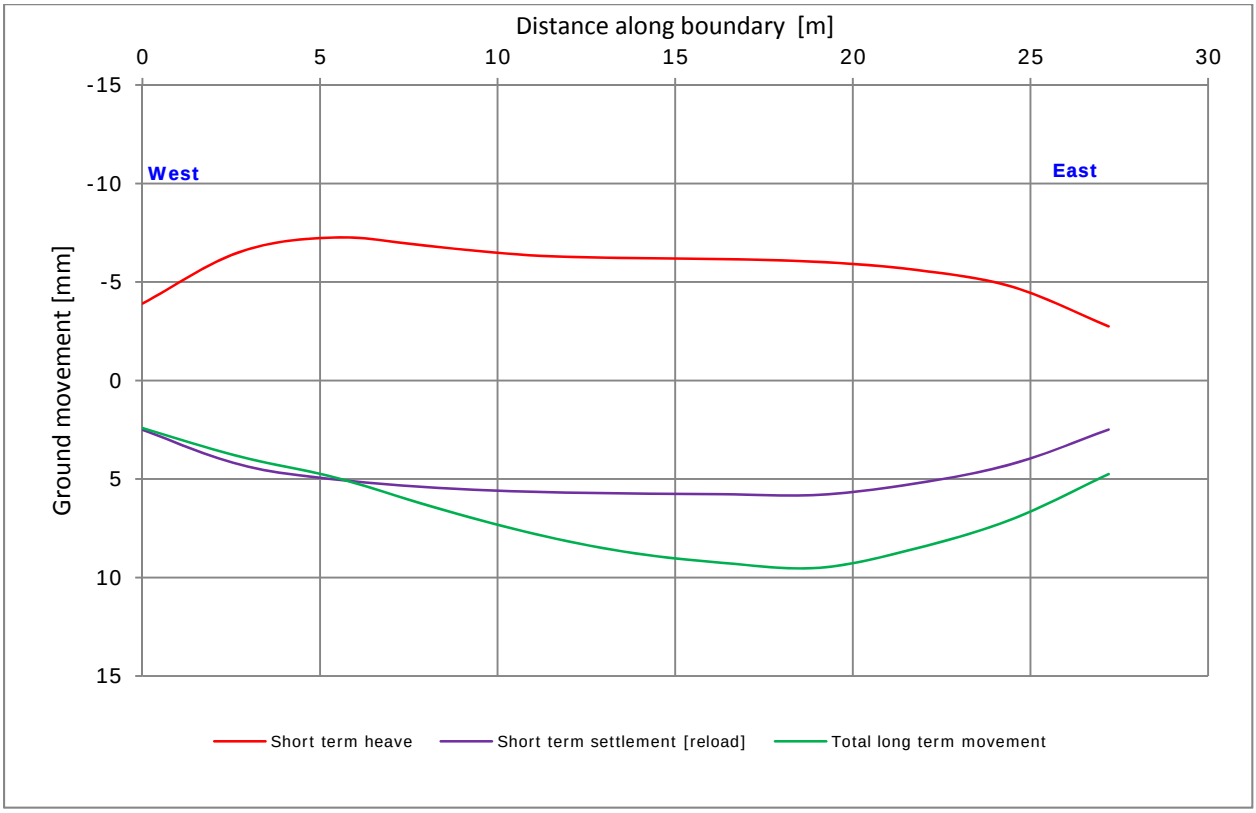
Building footprint/raft

Ground movements for the three construction stages are as follows:

- **Demolition and basement excavation**: the immediate heave is calculated to be a maximum of approximately 28mm, where unload is highest (see Figure 2). This is not relevant to the raft design and is provided for information only.
- **New raft load, short term:** the calculated settlements are shown in Figure 3. Applying a rigidity factor of 0.8 to the peak settlements (as discussed above), the analysis indicates that maximum short term settlements of approximately 16mm could occur due to the reloading.
- **New raft load, long term:** the calculated settlements are shown in Figure 4. These ground movements take into account the net loading conditions which will affect the long term heave/settlement response of the soil. We have assumed that approximately 50% of the total overall heave will occur during construction, leaving residual heave pressures equivalent to about half of the total unload pressures. When a 0.8 'rigidity' factor is applied to the peak movement areas, the analysis indicates that maximum settlements of approximately 22mm could occur where the net loading is highest. There will be a small net unloading in the south-western corner of the building and long term heave of approximately 5mm could occur in this area.

Northern boundary party wall

Predicted ground movements along the northern boundary party wall have been calculated for the various construction stages and these are summarised as follows (Figure 5):



It can be seen that maximum short term heave of approximately 7mm is calculated. In addition to the immediate heave, we would expect a small proportion of the long term to occur during the construction period (approximately 15%) and estimate heave movements of approximately 10mm could be expected before re-application of load via the new raft. The total net long term movement is calculated to be approximately 9mm settlement.

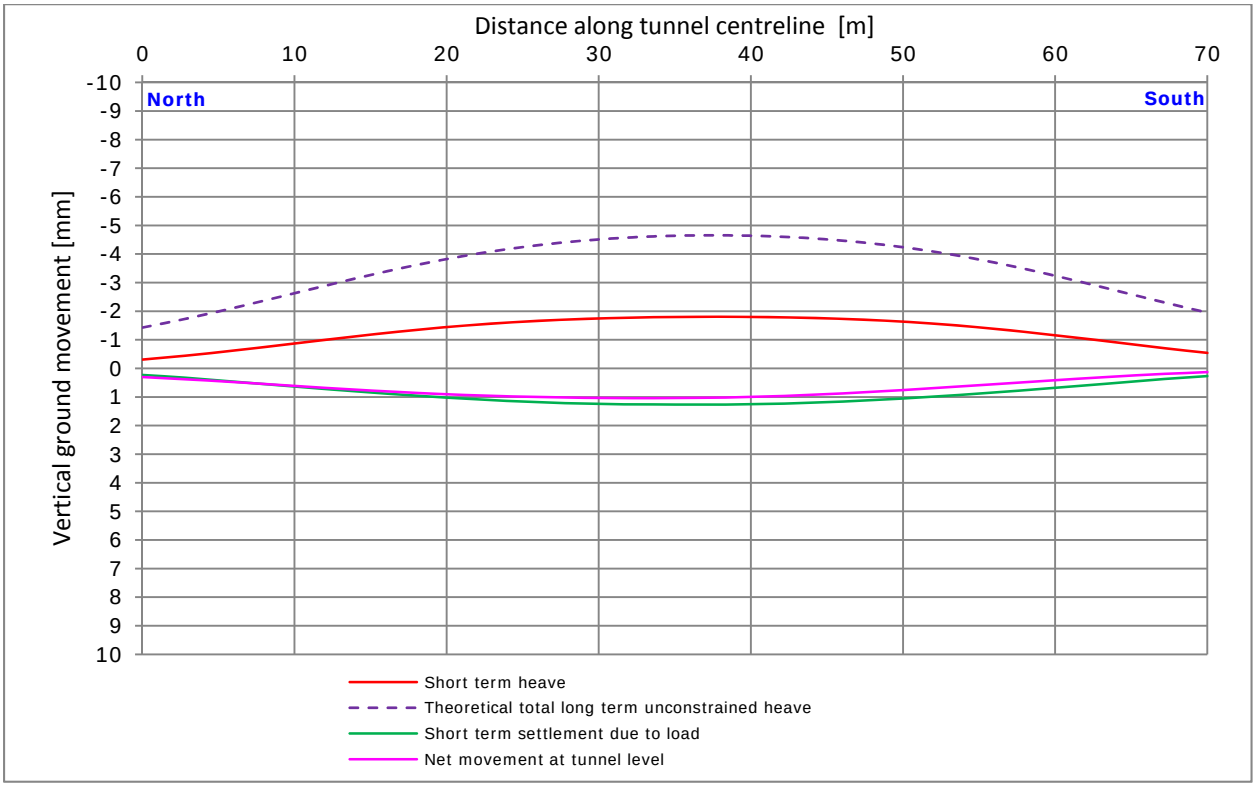
5.4 Raft foundation design

On the basis of the two boreholes completed, it is anticipated that the Lynch Hill Gravel will be present at raft formation level. The residual thickness of gravel will probably be <1m and if there is any significant variation in the level of the gravel/London Clay interface across the site then clay may well be present at formation level. Hence the load/deformation characteristics of the raft will be effectively controlled by the London Clay. Whilst the raft will distribute the loads to a great extent, there will be some 'flexibility' which will result in localised higher applied pressures on the formation where high load concentrations are present. We consider that a maximum 'safe' bearing pressure of 225kPa should be adopted for any localised areas with higher loading intensity.

The GMA has indicated that total settlements of between 20mm and 25mm could occur in the most heavily loaded areas of the raft. We recommend that an overall spring stiffness 'K' of 7MN/m^2/m is used for the structural design of the raft.

5.5 Northern Line tunnels

Two Northern Line tunnels are present beneath Tottenham Court Road immediately to the west of the site. Using the PDISP output, the calculated vertical movements along the centre-line of the closest eastern tunnel are summarised as follows for the various construction phases (see Figures 6 to 9 for tabular output):



The above settlement profiles indicate that negligible ground movements are likely to occur at tunnel level. A maximum of about 2mm heave is calculated to occur in the short term and this will be reversed to varying degrees by the re-application of load from the new structure. Net long term movements at tunnel level are calculated to be <1mm. With these very small levels of movement, maximum angular rotations should be well within tolerable limits for the tunnels.

The plot above also includes an estimation of the total long term heave which could occur if the demolition and basement excavation takes place and the there is a significant delay/cancellation of the project which would allow the full heave movement to occur. The analysis indicates that a maximum heave of approximately 5mm could occur in these circumstances, which again should be well within the tolerances of the tunnels.

The PDISP analysis allows an estimation of the lateral ground movement and this indicates that approximately 6mm could occur. However, it should be noted that the programme does not allow for anisotropy of the soil mass and both the London Clay and Lambeth Group formations are known to exhibit higher horizontal stiffness compared to vertical stiffness. The 6mm horizontal movement estimate is therefore considered to be an overestimate and we anticipate that lateral movements will in fact be of a similar order or less than the vertical movements.

The analysis indicated that the maximum net stress increase at tunnel level will probably be about 7kPa. The existing total overburden pressure at tunnel centrelines is probably of the order of 560kPa, and therefore the maximum net stress increase imposed by the new building will be <2% of the existing overburden.

Taking the above results into consideration, we conclude that the risk of the tunnel performance being adversely affected by the proposed redevelopment should be very low.

GENERAL INFORMATION, LIMITATIONS AND EXCEPTIONS

Unless otherwise stated, our Report should be construed as being a Ground Investigation Report (GIR) as defined in BS EN1997-2. Our Report is not intended to be and should not be viewed or treated as a Geotechnical Design Report (GDR) as defined in EN1997-2. Any 'design' recommendations which are provided are for guidance only and are intended to allow the designer to assess the results and implications of our investigation/testing and to permit preliminary design of relevant elements of the proposed scheme.

The methods of investigation used have been chosen taking into account the constraints of the site including but not limited to access and space limitations. Where it has not been possible to reasonably use an EC7 compliant investigation technique we have adopted a practical technique to obtain indicative soil parameters and any interpretation is based upon our engineering experience and relevant published information.

The Report is issued on the condition that Soil Consultants Ltd will under no circumstances be liable for any loss arising directly or indirectly from ground conditions between the exploratory points which differ from those identified during our investigation. In addition Soil Consultants Ltd will not be liable for any loss arising directly or indirectly from any opinion given on the possible configuration of strata both between the exploratory points and/or below the maximum depth of the investigation; such opinions, where given, are for guidance only and no liability can be accepted as to their accuracy. The results of any measurements taken may vary spatially or with time and further confirmatory measurements should be made after any significant delay in using this Report.

Comments made relating to ground-water or ground-gas are based upon observations made during our investigation unless otherwise stated. Ground-water and ground-gas conditions may vary with time from those reported due to factors such as seasonal effects, atmospheric effects and and/or tidal conditions. We recommend that if monitoring installations have been included as part of our investigation, continued monitoring should be carried out to maximise the information gained.

Specific geotechnical features/hazards such as (but not limited to) areas of root-related desiccation and dissolution features in chalk/soluble rock can exist in discrete localised areas - there can be no certainty that any or all of such features/hazards have been located, sampled or identified. Where a risk is identified the designer should provide appropriate contingencies to mitigate the risk through additional exploratory work and/or an engineered solution.

Where a specific risk of ground dissolution features has been identified in our Report (anything above a 'low' risk rating), reference should be made to the local building control to establish whether there are any specific local requirements for foundation design and appropriate allowances should be incorporated into the design. If such a risk assessment was not within the scope of our investigation and where it is deemed that the ground sequence may give rise to such a risk (for example near-surface chalk strata) it is recommended that an appropriate assessment should be undertaken prior to design of foundations.

Where spread foundations are used, we recommend that all excavations are inspected and approved by suitably experienced personnel; appropriate inspection records should be kept. This should also apply to any structures which are in direct contact with the soil where the soil could have a detrimental effect on performance or integrity of the structure.

Ground contamination often exists in small discrete areas - there can be no certainty that any or all such areas have been located, sampled or identified.

The findings and opinions conveyed in this Report may be based on information from a variety of sources such as previous desk studies, investigations or chemical analyses. Soil Consultants Limited cannot and does not provide any guarantee as to the authenticity, accuracy or reliability of such information from third parties; such information has not been independently verified unless stated in our Report.

Our Report is written in the context of an agreed scope of work between Soil Consultants Ltd and the Client and should not be used in any different context. In light of additional information becoming available, improved practices and changes in legislation, amendment or re-interpretation of the assessment or the Report in part or in whole may be necessary after its original publication.

Unless otherwise stated our investigation does not include an arboricultural survey, asbestos survey, ecological survey or flood risk assessment and these should be deemed to be outside the scope of our investigation.

(Rev_1_08_03_2013)

APPENDIX A

Fieldwork, in-situ testing and monitoring

- Borehole records
- Standard Penetration Test results
- Trial pit record
- Core photographs
- Monitoring results

Laboratory testing

- Index property testing
- Particle size distribution analyses
- Unconsolidated, undrained triaxial compression tests (SCL)
- Unconsolidated, undrained triaxial compression tests (K4)
- Oedometer tests (K4 Laboratories)

Ground profiles

- Schematic cross section (A-A)
- Plot of natural moisture content and index properties versus Ordnance Datum
- Plot of SPT 'N_{60}' and undrained cohesion versus Ordnance Datum

Plans & drawings

- Development plans and sections
- Site Plan
- Location Plan

APPENDIX B

Ground Movement Analysis

- Existing and proposed structural loads (Waterman Structures)
- Figures 1 to 9 (GMA input parameters and results)

APPENDIX C

Pressuremeter report (details TBC)

APPENDIX D

Contamination and soluble sulphate / pH results (QTS Environmental)

- 14-24916
- 14-25327
- 14-25397
- 14-25909
- 14-26770

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Fieldwork, in-situ testing and monitoring

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FOREWORD FOR CABLE PERCUSSIVE DRILLING - GUIDANCE NOTES

GENERAL

The Borehole Records are compiled from the driller's description of the strata encountered, an examination of the samples by our Geotechnical Engineer and the results of in-situ and laboratory tests. Based on this data, the report presents an opinion on the configuration of strata within the site. However, such reasonable assumptions are given for guidance only and no liability can be accepted for changes in conditions not revealed by the boreholes.

BORING METHODS

The Cable Percussion technique of boring is normally employed and allows the ground conditions to be reasonably well established. However, some disturbance of the ground is inevitable, particularly some "softening" of the upper zone of clay immediately beneath a granular soil. The presence of thin layers of different soils within a stratum may not always be detected.

GROUND WATER

The depth at which ground water was struck is entered on the Borehole Records. However, this observation may not indicate the true water level at that period. Due to the speed of boring and the relatively small diameter of the borehole, natural ground water may be present at a depth slightly higher than the water strike. Moreover, ground water levels are subject to variations caused by changes in the local drainage conditions and by seasonal effects. When a moderate inflow of water does take place, boring is suspended for at least 10 minutes to enable a more accurate short-term water level to be achieved. An estimate of the rate of inflow is also given. This is a relative term and serves only as a guide to the probable flow of water into an excavation.

Further observations of the water level made during the progress of the borehole are shown including end of shift and overnight readings and the depth at which water was sealed off by the borehole casing, if applicable.

Whilst drilling through granular soils, it is usually necessary to introduce water into the borehole to permit their extraction. When additional water has been used a remark is made on the Borehole Record and the implications are discussed in the text.

SAMPLES

Undisturbed samples of the predominantly cohesive soils are obtained using a 100mm diameter open-drive sampler. In granular soils, disturbed bulk samples are taken and placed in polythene bags. Small jar samples are taken at frequent intervals in all soils for subsequent visual examination. Where ground water is encountered in sufficient quantity, a sample of the ground water is also taken.

IN-SITU STANDARD PENETRATION TESTS

This test is performed in accordance with the procedure given in B.S.1377:1990. The individual blow count record for each test is given on a separate table. The 'N' value is normally the number of blows to achieve a penetration of 0.3m following a seating distance of 0.15m and is quoted at the mid-depth of the test zone. However if a change of stratum occurs within the test zone then a revised 'N' value is calculated to assess one layer in particular. In hard strata full penetration may not be obtained. In such cases the suffix + indicates that the result has been extrapolated from the limited penetration achieved. Where ground water has affected the measured values, the resultant 'N' values have been placed in brackets since it is unlikely to represent the true in-situ density of the soil.

Site & Location:	**One Bedford Avenue** **Bedford Avenue, Camden, London WC1B 3AU**	Borehole No:	**BH1**
Client:	**Exemplar Properties (Bedford) Ltd**	Coords (E/N): 529772.00 - 181542.00	Sheet 1 of 3
Engineer:	**Waterman Group**	Ground Level (m): 26.75	Report No: 9661/JRCB

Progress & Observations	Samples & Tests Type	Samples & Tests Depth (m)	Field Test Results	Strata Depth (m)	Strata Level (m)	Legend	Strata Description	Backfill / Installation
BH commenced: 11/09/2014							ASPHALT [100mm] over reinforced CONCRETE	
BH/casing dia: 150mm				0.40	26.35		Basement VOID	
				3.15	23.60		Reinforced CONCRETE with 50mm bituminous layer at 3.35m	
				3.55	23.20		MADE GROUND: soft dark brown/grey, brown and pale brown slightly silty gravelly clay with brick, concrete fragments and occasional ash. Locally sandy	
	E	3.70						
	PID	3.70	0.2					
	E	4.05						
	B	4.05						
	PID	4.05	0.1					
	SPT/S	4.05	N=4 N60=4					
	D	4.75						
	D	5.05						
	SPT/S	5.05	N=3 N60=3					
							....slight hydrocarbon odour	
Water inflow at 5.90m ['fast']; sealed at 7.65m				5.90	20.85		Dense becoming medium dense brown and brown/orange sandy to very sandy fine to coarse, subangular to subrounded flint GRAVEL. Locally grades to gravelly sand	
	E	6.05						
	SPT/C	6.05	N=31					
	B	6.05	N60=31					
Water added to assist drilling between 5.90m and 7.40m	PID	6.05	0.2					
	SPT/C	7.05	N=21					
	B	7.05	N60=21					
				7.40	19.35		Stiff brown becoming grey fissured slightly silty CLAY with orange/ brown staining in upper levels and occasional partings of pale grey silt. Rare pyrite nodules, selenite crystals and shell fragments	
	D	7.55						
BH cased to 7.90m								
	D	7.95						
	SPT/S	8.05	N=25					
	D	8.05	N60=25					
End of shift: 11/09/2014 BH depth: 8.50m Casing depth: 7.65m Water depth: Dry								
Start of shift: 15/09/2014 Water depth: Dry	D	9.00						
Pressuremeter test at 9.80m depth								
				10.00	16.75		Continued on next sheet	

Key: U = Undisturbed B = Bulk D = Small disturbed W = Water E = glass jar & plastic tub SPT/S = split spoon SPT/C = solid cone HV = Hand Vane [kPa]

PP = Pocket Penetrometer [kg/cm2] PID = Photo Ionisation Detector [ppmv] | Borehole type: Cable Percussion

Remarks :- Self-boring pressuremeter tests carried out by Cambridge Insitu at at 9.80m, 15.30m, 20.00m and 25.00m

Borehole No: **BH1**

[* = full SPT penetration not achieved - see summary sheet]

Soil Consultants

Site & Location:	**One Bedford Avenue** **Bedford Avenue, Camden, London WC1B 3AU**	Borehole No:	**BH1**
Client:	**Exemplar Properties (Bedford) Ltd**	Coords (E/N): 529772.00 - 181542.00	Sheet 2 of 3
Engineer:	**Waterman Group**	Ground Level (m): 26.75	Report No: 9661/JRCB

Progress & Observations	Samples & Tests Type	Samples & Tests Depth (m)	Field Test Results	Strata Depth (m)	Strata Level (m)	Legend	Strata Description	Backfill / Installation
							Stiff grey fissured slightly silty CLAY with occasional partings of pale grey silt and small pockets of fine sand. Rare pyrite nodules and shell fragments	
	U	10.55						11
Water inflow at 11.55m ['seepage']; not sealed Chiselling on claystone from 11.55m to 11.70m for 0.5hrs	D	11.50					*....claystone nodule between 11.55m and 11.70m*	
	SPT/S D	12.05 12.05	N=26 N60=26					12
	D	13.00						13
	U	13.55						14
	D	14.50						
End of shift: 15/09/2014 BH depth: 14.80m Casing depth: 7.90m Water depth: Dry Start of shift: 16/09/2014 Water depth: Dry Pressuremeter test at 15.30m depth				15.00	11.75		Very stiff grey fissured slightly silty CLAY occasional partings of pale grey silt. Locally silty with rare pyrite nodules	15
	D SPT/S	16.05 16.05	N=32 N60=32					16
	D	17.00						17
	U	17.55						
				18.00	8.75		Very stiff grey fissured slightly silty CLAY occasional pockets of pale grey silty fine sand and silt partings. Locally silty with rare pyrite nodules	18
	D	18.50						
	D SPT/S	19.05 19.05	N=38 N60=38					19
Pressuremeter test at 20.00m depth				20.00	6.75			20
							Continued on next sheet	

Key: U = Undisturbed B = Bulk D = Small disturbed W = Water E = glass jar & plastic tub SPT/S = split spoon SPT/C = solid cone HV = Hand Vane [kPa]

PP = Pocket Penetrometer [kg/cm2] PID = Photo Ionisation Detector [ppmv] | Borehole type: Cable Percussion

Remarks :- Self-boring pressuremeter tests carried out by Cambridge Insitu at at 9.80m, 15.30m, 20.00m and 25.00m

Borehole No: **BH1**

[* = full SPT penetration not achieved - see summary sheet]

Soil Consultants

Site & Location:	**One Bedford Avenue** **Bedford Avenue, Camden, London WC1B 3AU**	Borehole No:	**BH1**
Client:	**Exemplar Properties (Bedford) Ltd**	Coords (E/N): 529772.00 - 181542.00	Sheet 3 of 3
Engineer:	**Waterman Group**	Ground Level (m): 26.75	Report No: 9661/JRCB

Progress & Observations	Samples & Tests Type	Samples & Tests Depth (m)	Field Test Results	Strata Depth (m)	Strata Level (m)	Legend	Strata Description	Backfill / Installation
Water inflow at 20.00m ['seepage']; not sealed								
	D	20.50					Very stiff grey fissured slightly silty CLAY occasional pockets of pale grey silty fine sand and silt partings. Locally silty with rare pyrite nodules	
	U	21.05						
	D	22.00		22.00	4.75		Very stiff grey fissured silty CLAY occasional partings of pale grey silt. Locally sandy with pockets/bands of fine grey sand	
	D	22.55						
	SPT/S	22.55	N=44 N60=44					
	D	23.50						
	D	23.90		23.80	2.95		Very stiff brown, blue/grey and red/brown mottled slightly silty CLAY with occasional partings of silt	
Pressuremeter test at 25.00m depth	D	24.50						
	B	24.55						
BH complete: 16/09/2014 BH depth: 25.00m Casing depth: 7.90m Water depth: Dry				25.00	1.75		End of borehole at 25.00 m	

21 22 23 24 25 26 27 28 29 30

Key: U = Undisturbed B = Bulk D = Small disturbed W = Water E = glass jar & plastic tub SPT/S = split spoon SPT/C = solid cone HV = Hand Vane [kPa]

PP = Pocket Penetrometer [kg/cm2] PID = Photo Ionisation Detector [ppmv] | Borehole type: Cable Percussion

Remarks :- Self-boring pressuremeter tests carried out by Cambridge Insitu at at 9.80m, 15.30m, 20.00m and 25.00m

Borehole No: **BH1**

[* = full SPT penetration not achieved - see summary sheet]

Soil Consultants

Site & Location:	**One Bedford Avenue** **Bedford Avenue, Camden, London WC1B 3AU**	Borehole No:	**BH2**
Client:	**Exemplar Properties (Bedford) Ltd**	Coords (E/N): 529788.00 - 181515.00	Sheet 1 of 3
Engineer:	**Waterman Group**	Ground Level (m): 26.80	Report No: 9661/JRCB

Progress & Observations	Samples & Tests Type	Samples & Tests Depth (m)	Field Test Results	Strata Depth (m)	Strata Level (m)	Legend	Strata Description
BH commenced: 23/09/2014				0.03	26.77		Steel GRID/MESH Basement VOID
BH/casing dia: 150mm							
				3.35	23.45		CONCRETE
	PID	3.55	0.0	3.55	23.25		MADE GROUND: soft brown/orange slightly silty sandy gravelly to very gravelly clay with brick fragments and occasional ash
	E	3.55					
	D	3.75					
	PID	3.75	0.1				
	SPT/S	4.00	N>50*				
	D	4.00					
Chiselling on claystone from 4.35m to 4.55m for 1hrs				4.35	22.45		CONCRETE
				4.55	22.25		Very dense becoming medium dense brown and brown/orange sandy to very sandy fine to coarse, subangular to subrounded flint GRAVEL. Locally grades to gravelly sand
	SPT/C	5.00	N>50*				
	PID	5.00	0.0				
	E	5.00					
	B	5.00					
Water added to assist drilling between 4.55m and 7.00m							
	SPT/C	6.00	N>50*				
	B	6.00					
Water inflow at 6.50m ['fast']; sealed at 7.90m							
	SPT/C	7.00	N=17 N60=17				
				7.25	19.55		Stiff brown becoming grey fissured slightly silty CLAY with orange/ brown staining in upper levels. Occasional partings of pale grey silt and small pockets of grey fine sand. Rare pyrite nodules, selenite crystals and shell fragments
	D	7.45					
	SPT/S	7.65	N=21				
	D	7.65	N60=21				
BH cased to 7.90m							
	D	8.50					
	U	9.05					
	D	10.00		10.00	16.80		Continued on next sheet

Backfill / Installation: 1 2 3 4 5 6 7 8 9 10

Key: U = Undisturbed B = Bulk D = Small disturbed W = Water E = glass jar & plastic tub SPT/S = split spoon SPT/C = solid cone HV = Hand Vane [kPa]

PP = Pocket Penetrometer [kg/cm2] PID = Photo Ionisation Detector [ppmv] | Borehole type: Cable Percussion

Remarks :-

Borehole No: **BH2**

[* = full SPT penetration not achieved - see summary sheet]

Soil Consultants

Site & Location:	**One Bedford Avenue** **Bedford Avenue, Camden, London WC1B 3AU**	Borehole No:	**BH2**
Client:	**Exemplar Properties (Bedford) Ltd**	Coords (E/N): 529788.00 - 181515.00	Sheet 2 of 3
Engineer:	**Waterman Group**	Ground Level (m): 26.80	Report No: 9661/JRCB

Progress & Observations	Samples & Tests Type	Samples & Tests Depth (m)	Field Test Results	Strata Depth (m)	Strata Level (m)	Legend	Strata Description	Backfill / Installation
	D	10.55					Stiff grey fissured slightly silty CLAY with occasional partings of pale grey silt and small pockets of fine sand. Rare pyrite nodules and shell fragments	
	SPT/S	10.55	N=26 N60=26					
End of shift: 23/09/2014 BH depth: 11.00m Casing depth: 7.90m Water depth: Dry Start of shift: 24/09/2014 Water depth: Dry Chiselling on claystone from 11.70m to 11.85m for 0.5hrs								11
	D	11.50					*....claystone nodule between 11.70m and 11.85m*	
	U	12.05						12
	D	13.00		13.00	13.80		Very stiff grey fissured slightly silty CLAY occasional partings of pale grey silt and silty fine sand. Locally silty with rare pyrite nodules	13
	SPT/S	13.55	N=31					
	D	13.55	N60=31					14
	D	14.50						
	U	15.05						15
	D	16.00						16
	SPT/S	16.55	N=35					
	D	16.55	N60=35					
Water inflow at 17.00m ['seepage']; not sealed				16.90	9.90		Very stiff grey fissured slightly silty CLAY occasional pockets of pale grey silty fine sand and silt partings. Locally silty with rare pyrite nodules	17
	D	17.50						
	U	18.05						18
	D	19.00						19
	SPT/S	19.55	N=40					
	D	19.55	N60=40					
				20.00	6.80		Continued on next sheet	20

Key: U = Undisturbed B = Bulk D = Small disturbed W = Water E = glass jar & plastic tub SPT/S = split spoon SPT/C = solid cone HV = Hand Vane [kPa]

PP = Pocket Penetrometer [kg/cm2] PID = Photo Ionisation Detector [ppmv] | Borehole type: Cable Percussion

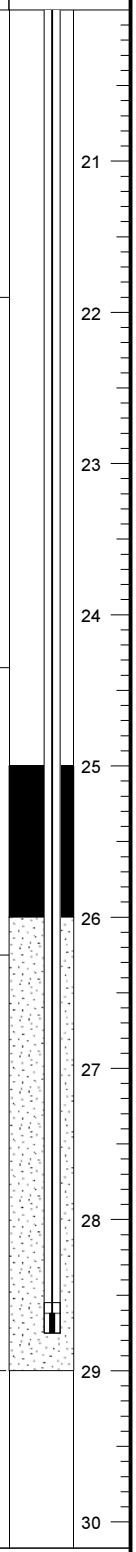
Remarks :-

Borehole No: **BH2**

[* = full SPT penetration not achieved - see summary sheet]

Site & Location:	**One Bedford Avenue** **Bedford Avenue, Camden, London WC1B 3AU**	Borehole No:	**BH2**
Client:	**Exemplar Properties (Bedford) Ltd**	Coords (E/N): 529788.00 - 181515.00	Sheet 3 of 3
Engineer:	**Waterman Group**	Ground Level (m): 26.80	Report No: 9661/JRCB

Progress & Observations	Samples & Tests Type	Samples & Tests Depth (m)	Field Test Results	Strata Depth (m)	Strata Level (m)	Legend	Strata Description	Backfill / Installation
	D	20.50					Very stiff grey fissured slightly silty CLAY occasional pockets of pale grey silty fine sand and silt partings. Locally silty with rare pyrite nodules	
	U	21.05						
	D	22.00		21.90	4.90		Very stiff grey fissured silty CLAY occasional partings of pale grey silt. Locally very silty and sandy with pockets/bands of fine grey sand	
	D	22.55						
	SPT/S	22.55	N=42 N60=42					
	D	23.75						
	D	24.45		24.35	2.45		Very stiff brown, blue/grey and red/brown mottled slightly silty CLAY with partings of silt	
	SPT/S	24.55	N=60					
End of shift: 24/09/2014 BH depth: 25.00m Casing depth: 7.90m Water depth: Dry Start of shift: 25/09/2014 Water depth: Dry	D	24.55	N60=59					
	D	25.75						
	D	26.30		26.25	0.55		Very stiff grey and brown silty locally sandy CLAY with occasional bands/pockets of grey silty fine sand	
	D	26.55						
	SPT/S	26.55	N>50*					
Water inflow at 27.75m ['fast']; not sealed	D	27.80						
	D	28.25						
	D	28.55						
	SPT/S	28.55	N=71 N60=70					
BH complete: 25/09/2014 BH depth: 29.00m Casing depth: 7.90m Water depth: 27.00m				29.00	-2.20		End of borehole at 29.00 m	



Key: U = Undisturbed B = Bulk D = Small disturbed W = Water E = glass jar & plastic tub SPT/S = split spoon SPT/C = solid cone HV = Hand Vane [kPa]

PP = Pocket Penetrometer [kg/cm2] PID = Photo Ionisation Detector [ppmv] | Borehole type: Cable Percussion

Remarks :-

Borehole No: **BH2**

[* = full SPT penetration not achieved - see summary sheet]

Soil Consultants

Site & Location	**One Bedford Avenue** **Bedford Avenue, Camden, London WC1B 3AU**	Report No:	**9661/JRCB**

STANDARD PENETRATION TEST SUMMARY

BH ID	Depth [m]	Test type	'N' value and blow-counts [Seating blows/Test blows]	N_{60}	N_{60} - ext	Casing depth [m]	Water depth [m]	Remarks
BH1	4.05	S	N = 4 :1 1/ 1 0 1 2	4		4.05	Dry	
BH1	5.05	S	N = 3 :1 0/ 0 0 1 2	3		5.05	Dry	
BH1	6.05	C	N = 31 :5 6/ 7 7 8 9	31		6.05	5.50	Water added
BH1	7.05	C	N = 21 :4 4/ 7 6 4 4	21		7.06	5.50	Water added
BH1	8.05	S	N = 25 :3 4/ 5 6 7 7	25		7.90	Dry	
BH1	12.05	S	N = 26 :2 2/ 5 6 7 8	26		7.90	Dry	
BH1	16.05	S	N = 32 :3 4/ 7 8 8 9	32		7.90	Dry	
BH1	19.05	S	N = 38 :4 5/ 8 9 10 11	38		7.90	Dry	
BH1	22.55	S	N = 44 :5 6/ 9 10 12 13	44		7.90	Dry	
BH2	4.00	S	67 :2 3/ 7 10 50	>50*	90**	4.00	Dry	
BH2	5.00	C	57 :15 14/ 25 32	>50*	115**	5.00	Dry	
BH2	6.00	C	57 :6 6/ 13 19 25	>50*	75**	6.00	Dry	
BH2	7.00	C	N = 17 :3 3/ 5 4 4 4	17		7.00	6.50	Water added
BH2	7.65	S	N = 21 :2 3/ 4 5 5 7	21		7.90	Dry	
BH2	10.55	S	N = 26 :3 3/ 5 6 7 8	26		7.90	Dry	
BH2	13.55	S	N = 31 :3 3/ 6 7 9 9	31		7.90	Dry	
BH2	16.55	S	N = 35 :3 4/ 8 8 9 10	35		7.90	Dry	
BH2	19.55	S	N = 40 :4 5/ 9 9 10 12	40		7.90	Dry	
BH2	22.55	S	N = 42 :4 5/ 8 10 12 12	42		7.90	Dry	
BH2	24.55	S	N = 60 :7 8/ 12 13 16 19	59		7.90	Dry	
BH2	26.55	S	77 :9 9/ 20 25 32	>50*	105**	7.90	Dry	
BH2	28.55	S	N = 71 :7 8/ 15 17 18 21	70		7.90	27.00	

Standard Penetration Test : BS EN ISO 22476:2005 Part 3 Hammer Energy Ratio, Er = 59.4%

* where full penetration not achieved, the reported N_{60} is based on maximum uncorrected blow-counts of 50

** extrapolated N_{60} value where full penetration not achieved - this is indicative only and should be used with caution

Soil Consultants

Site & Location:	**One Bedford Avenue** **Bedford Avenue, Camden, London WC1B 3AU**	Ref: **9661/JRCB**

Results of ground-gas and ground-water monitoring

Date:	02 Oct 14	22 Oct 14	19 Nov 14
Time [24hr]:	10:20	08:45	11:30
Barometric pressure:	1030		1017
a] Trend [24hrs]:	Falling	Steady	Steady
b] At start [mB]:	1030	1026	1017
c] At end [mB]:	1029	1025	1017
Recorded by:	MR	MR	MR
Surface ground conditions:	Dry	Dry	Damp
Weather conditions:	Mild, cloudy	Overcast	Mild, overcast
Ambient air temp [^{o}C]:	16	12	12

Monitoring equipment

Instrument: GA2000 Plus MC08/0126/00

Calibration check details: Within monitor tolerance

Next calibration date: 11/11/2015

Notes:

1] Barometric pressure trend and ambient air temperature is recorded from BBC weather website on the day of the monitoring visit

2] Calibration check is performed at start of monitoring against ambient air and also periodically with a 5% CH4, 5% CO2 and 6% O2 gas mixture

3] CH4 = methane; CO2 = carbon dioxide; CO = carbon monoxide; O2 = oxygen; H2S = hydrogen sulphide

Results

Date	Time [24hr]	Borehole	GW Depth	Depth to Base	CH4 [%]		CO2 [%]		O2 [%]		Highest [ppm]		Emission Rate	Relative Pressure
			[m]	[m]	Max	Steady	Max	Steady	Min	Steady	CO	H_2S	[l/hr]	[mb]
02/10/2014	11:15	BH1	3.30	4.29	0.00	0.00	0.80	0.70	19.30	19.60	0	0	0.00	0.00
		BH2 (50mm)	3.46	4.50	0.00	0.00	0.00	0.00	20.50	20.50	0	0	0.00	0.00
		BH2 (19 mm)	21.89	25.37	-	-	-	-	-	-	-	-	-	-
22/10/2014	08:50	BH1	3.28	4.26	0.20	0.20	1.10	1.10	19.70	19.70	0	0	0.00	0.00
	09:15	BH2 (50mm)	20.91	-	-	-	-	-	-	-	-	-	-	-
		BH2 (19 mm)	3.41	4.50	0.20	0.20	0.20	0.20	20.50	20.50	0	0	0.00	0.00
19/11/2014	11:30	BH2 (50mm)	3.40	4.50	0.00	0.00	0.20	0.20	20.40	20.40	0	0	0.00	-0.21
		BH2 (19mm)	20.60	25.37	-	-	-	-	-	-	-	-	-	-

Soil Consultants

Site & Location:	**One Bedford Avenue** **Bedford Avenue, Camden, London WC1B 3AU**	Ref: **9661/JRCB**

Results of ground-gas and ground-water monitoring

Date:	26 Nov 14	15 Jan 15	19 Feb 15
Time [24hr]:	11:20	13:00	12:00
Barometric pressure:	1010	993	1028
a] Trend [24hrs]:	Rising	Rising	Falling
b] At start [mB]:	1010	993	1028
c] At end [mB]:	1010	993	1028
Recorded by:	MR	MR	MR
Surface ground conditions:	Dry	Damp	Dry
Weather conditions:	Mild, overcast	Mild	Cold, bright
Ambient air temp [^{o}C]:	12	8	4

Monitoring equipment

Instrument: GA2000 Plus MC08/0126/00

Calibration check details: Within monitor tolerance

Next calibration date: 11/11/2015

Notes:

1] Barometric pressure trend and ambient air temperature is recorded from BBC weather website on the day of the monitoring visit

2] Calibration check is performed at start of monitoring against ambient air and also periodically with a 5% CH4, 5% CO2 and 6% O2 gas mixture

3] CH4 = methane; CO2 = carbon dioxide; CO = carbon monoxide; O2 = oxygen; H2S = hydrogen sulphide

Results

Date	Time [24hr]	Borehole	GW Depth	Depth to Base	CH4 [%]		CO2 [%]		O2 [%]		Highest [ppm]		Emission Rate	Relative Pressure
			[m]	[m]	Max	Steady	Max	Steady	Min	Steady	CO	H_2S	[l/hr]	[mb]
26/11/2014	11:20	BH1	3.27	3.90	0.00	0.00	0.40	0.40	20.10	20.10	0	0	0.40	-0.28
15/01/2015	13:15	BH1	3.22	3.43	0.00	0.00	1.10	1.10	20.00	20.00	0	0	0.00	0.00
	13:50	BH2 (50mm)	3.24	4.50	0.10	0.10	0.20	0.20	20.70	20.70	0	0	0.00	0.00
	13:52	BH2 (19 mm)	20.18	25.37	-	-	-	-	-	-	-	-	-	-
19/02/2015	12:00	BH1	3.27	3.43	0.10	0.10	1.00	1.00	19.30	19.30	0	0	0.00	0.01
	12:15	BH2 (50mm)	3.51	4.50	0.10	0.10	0.30	0.30	20.60	20.60	0	0	0.00	0.00
	12:15	BH2 (19 mm)	20.97	25.37	-	-	-	-	-	-	-	-	-	-

Soil Consultants

Site & Location:	**One Bedford Avenue** **Bedford Avenue, Camden, London WC1B 3AU**	Ref: **9661/JRCB**

Results of ground-gas and ground-water monitoring

Date:	04 Mar 15		
Time [24hr]:	15:00		
Barometric pressure:	1035		
a] Trend [24hrs]:	Rising		
b] At start [mB]:	1035		
c] At end [mB]:	1035		
Recorded by:	MR		
Surface ground conditions:	Dry		
Weather conditions:	Cold, bright		
Ambient air temp [^{o}C]:	6		

Monitoring equipment

Instrument: GA2000 Plus MC08/0126/00

Calibration check details: Within monitor tolerance

Next calibration date: 11/11/2015

Notes:

1] Barometric pressure trend and ambient air temperature is recorded from BBC weather website on the day of the monitoring visit

2] Calibration check is performed at start of monitoring against ambient air and also periodically with a 5% CH4, 5% CO2 and 6% O2 gas mixture

3] CH4 = methane; CO2 = carbon dioxide; CO = carbon monoxide; O2 = oxygen; H2S = hydrogen sulphide

Results

Date	Time [24hr]	Borehole	GW Depth	Depth to Base	CH4 [%]		CO2 [%]		O2 [%]		Highest [ppm]		Emission Rate	Relative Pressure
			[m]	[m]	Max	Steady	Max	Steady	Min	Steady	CO	H_2S	[l/hr]	[mb]
04/03/2015	15:00	BH1	3.51	4.30	0.10	0.10	0.20	0.20	20.80	20.80	0	0	0.00	0.00
	15:10	BH2 (50mm)	20.57	25.34	-	-	-	-	-	-	-	-	-	-
	15:10	BH2 (19 mm)	3.25	3.45	0.10	0.10	0.70	0.70	19.10	19.10	0	0	0.00	0.00

Soil Consultants

Site & Location: **One Bedford Avenue, Bedford Avenue, Camden, London WC1B 3AU**

Report No: **9661/JRCB**

SUMMARY OF CLASSIFICATION TEST RESULTS

BH ID	Depth (m)	Type	w (%)	w_L (%)	w_P (%)	Pass 425 (%)	I_P (%)	Mod I_P (%)	I_L (%)	LOI (%)	Description
BH1	7.95	D	27								Brown fissured slightly silty CLAY with orange/brown staining in upper levels and occasional partings of pale grey silt
BH1	9.00	D	26								Grey fissured slightly silty CLAY with orange/brown staining in upper levels and occasional partings of pale grey silt
BH1	11.50	D	27								Grey fissured slightly silty CLAY with occasional partings of pale grey silt and small pockets of fine sand
BH1	13.00	D	23								Grey fissured slightly silty CLAY with occasional partings of pale grey silt and small pockets of fine sand
BH1	13.55	U	25	71	27	>95	44		-0.06		Grey fissured slightly silty CLAY with occasional partings of pale grey silt and small pockets of fine sand
BH1	17.00	D	29								Grey fissured slightly silty CLAY occasional partings of pale grey silt. Locally silty
BH1	17.55	U	24	71	26	>95	45		-0.05		Grey fissured slightly silty CLAY occasional partings of pale grey silt. Locally silty
BH1	18.50	D	20								Grey fissured slightly silty CLAY occasional pockets of pale grey silty fine sand and silt partings. Locally silty
BH1	20.50	D	25								Grey fissured slightly silty CLAY occasional pockets of pale grey silty fine sand and silt partings. Locally silty
BH1	21.05	U	22	61	24	>95	37		-0.05		Grey fissured slightly silty CLAY occasional pockets of pale grey silty fine sand and silt partings. Locally silty
BH1	22.00	D	24	67	25	>95	42		-0.04		Grey fissured silty CLAY occasional partings of pale grey silt. Locally sandy with pockets/bands of fine grey sand
BH1	23.50	D	19	68	18	>95	50		0.03		Grey fissured silty CLAY occasional partings of pale grey silt. Locally sandy with pockets/bands of fine grey sand
BH1	24.55	U	20	53	16	>95	37		0.10		Brown, blue/grey and red/brown mottled slightly silty CLAY with occasional partings of silt
BH2	10.00	D	22								Grey fissured slightly silty CLAY with occasional partings of pale grey silt and small pockets of fine sand
BH2	11.50	D	24								Grey fissured slightly silty CLAY with occasional partings of pale grey silt and small pockets of fine sand
BH2	12.05	U	28	68	29	>95	39		-0.03		Grey fissured slightly silty CLAY with occasional partings of pale grey silt and small pockets of fine sand
BH2	13.00	D	20								Grey fissured slightly silty CLAY occasional partings of pale grey silt and silty fine sand. Locally silty
BH2	14.50	D	20								Grey fissured slightly silty CLAY occasional partings of pale grey silt and silty fine sand. Locally silty
BH2	15.05	U	25	72	26	>95	46		-0.03		Grey fissured slightly silty CLAY occasional partings of pale grey silt and silty fine sand. Locally silty

Testing in accordance with BS EN ISO 17892 unless specified otherwise

Date: 25 Feb 14

Modified Plasticity Index calculated in accordance with NHBC Standards Chapter 4.2 (reported if %passing 425mm <95%)

Percent passing 425μm: by estimation, by hand* or by sieving**

Soil Consultants

Site & Location: **One Bedford Avenue, Bedford Avenue, Camden, London WC1B 3AU**

Report No: **9661/JRCB**

SUMMARY OF CLASSIFICATION TEST RESULTS

BH ID	Depth (m)	Type	w (%)	w_L (%)	w_P (%)	Pass 425 (%)	I_P (%)	Mod I_P (%)	I_L (%)	LOI (%)	Description
BH2	16.00	D	20								Grey fissured slightly silty CLAY occasional partings of pale grey silt and silty fine sand. Locally silty
BH2	17.50	D	22								Grey fissured slightly silty CLAY occasional pockets of pale grey silty fine sand and silt partings. Locally silty
BH2	18.05	U	23								Grey fissured slightly silty CLAY occasional pockets of pale grey silty fine sand and silt partings. Locally silty
BH2	19.00	D	18								Grey fissured slightly silty CLAY occasional pockets of pale grey silty fine sand and silt partings. Locally silty
BH2	20.50	D	19	79	26	>95	53		-0.13		Grey fissured slightly silty CLAY occasional pockets of pale grey silty fine sand and silt partings. Locally silty
BH2	21.05	U	25	76	29	>95	47		-0.10		Grey fissured slightly silty CLAY occasional pockets of pale grey silty fine sand and silt partings. Locally silty
BH2	22.00	D	20	71	21	>95	50		-0.02		Grey fissured silty CLAY occasional partings of pale grey silt. Locally very silty and sandy with pockets/bands of fine grey sand
BH2	23.75	D	18	69	19	>95	50		-0.03		Grey fissured silty CLAY occasional partings of pale grey silt. Locally very silty and sandy with pockets/bands of fine grey sand
BH2	24.45	D	15	59	20	>95	39		-0.15		Brown, blue/grey and red/brown mottled slightly silty CLAY with partings of silt
BH2	25.75	D	16	62	21	>95	41		-0.13		Brown, blue/grey and red/brown mottled slightly silty CLAY with partings of silt
BH2	26.30	D	9	26	11	>95	15		-0.14		Grey and brown silty sandy CLAY/very silty fine SAND [interbedded]
BH2	28.25	D	16	54	19	>95	35		-0.10		Grey and brown silty locally sandy CLAY with occasional bands/pockets of grey silty fine sand

Testing in accordance with BS EN ISO 17892 unless specified otherwise

Date: 25 Feb 14

Modified Plasticity Index calculated in accordance with NHBC Standards Chapter 4.2 (reported if %passing 425mm <95%)

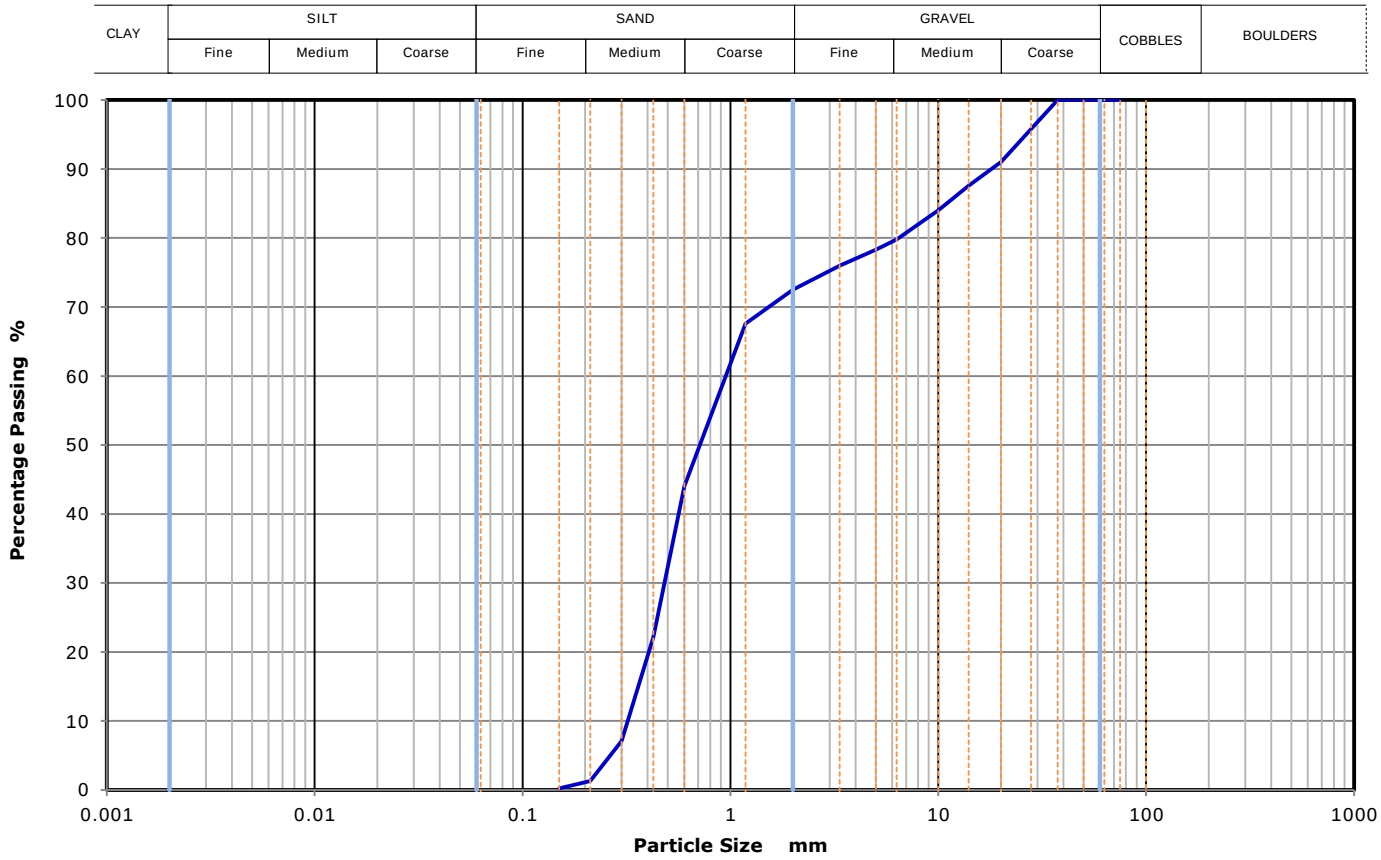
Percent passing 425μm: by estimation, by hand* or by sieving**

Soil Consultants

Site	**One Bedford Avenue**	Report No:	**9661/JRCB**
Location	**Bedford Avenue, Camden, London WC1B 3AU**		

PARTICLE SIZE DISTRIBUTION

Hole ID: **BH1** Depth [m]: **6.05**	Description: **Brown/orange gravelly fine to coarse SAND**



Sieving	
Size [mm]	% passing
75	100
63	100
50	100
37.5	100
28	95.8
20	91
14	87.6
10	84
6.3	79.8
5	78.3
3.35	76
2	72.5
1.18	67.6
0.6	44
0.425	22.1
0.3	7.1
0.212	1.3
0.15	0.2
0.063	#N/A

Sample proportions	%
Cobbles	0
Gravel	28
Sand	73
Fines <0.063mm	0

Grading analysis		
D60	mm	0.9
D30	mm	0.5
D10	mm	0.3
Uniformity Coefficient		3.0
Curvature Coefficient		0.8

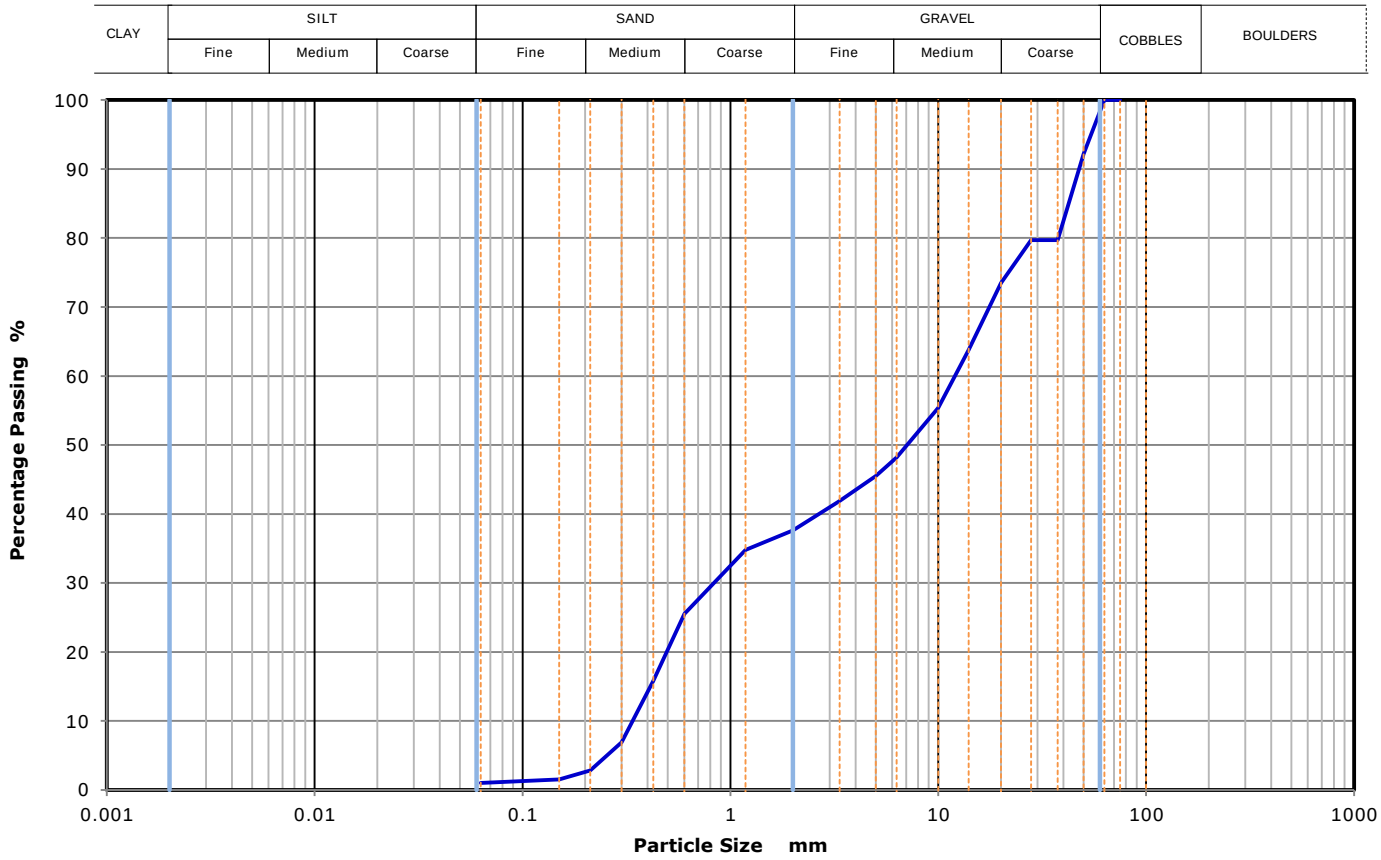
Test method and date	
Testing in accordance with BS EN ISO 17892:	
Wet sieving method	
Reporting date:	01 Oct 14

Soil Consultants

Site	**One Bedford Avenue**	Report No:	**9661/JRCB**
Location	**Bedford Avenue, Camden, London WC1B 3AU**		

PARTICLE SIZE DISTRIBUTION

Hole ID: **BH1** Depth [m]: **7.05**	Description: **Brown/orange very sandy fine to coarse flint GRAVEL**



Sieving	
Size [mm]	% passing
75	100
63	100
50	92.2
37.5	79.7
28	79.7
20	73.5
14	63.8
10	55.4
6.3	48.2
5	45.5
3.35	41.9
2	37.6
1.18	34.8
0.6	25.5
0.425	15.8
0.3	6.9
0.212	2.8
0.15	1.5
0.063	1

Sample proportions	%
Cobbles	0
Gravel	62
Sand	37
Fines <0.063mm	1

Grading analysis		
D60	mm	12.0
D30	mm	0.8
D10	mm	0.3
Uniformity Coefficient		35.5
Curvature Coefficient		0.2

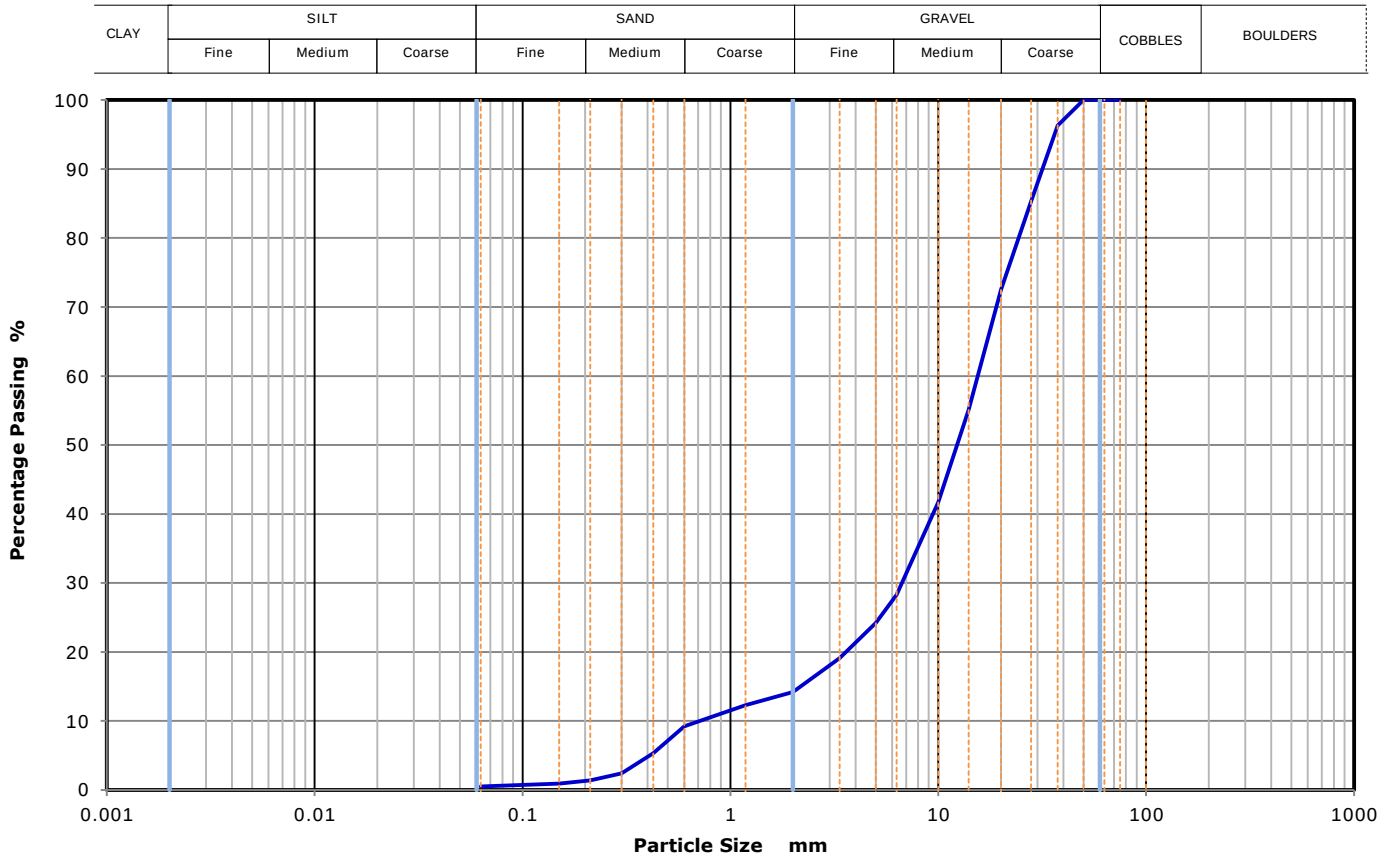
Test method and date	
Testing in accordance with BS EN ISO 17892:	
Wet sieving method	
Reporting date:	01 Oct 14

Soil Consultants

Site	**One Bedford Avenue**	Report No:	**9661/JRCB**
Location	**Bedford Avenue, Camden, London WC1B 3AU**		

PARTICLE SIZE DISTRIBUTION

Hole ID: **BH2** Depth [m]: **5.00**	Description: **Brown/orange sandy fine to coarse flint GRAVEL**



Sieving	
Size [mm]	% passing
75	100
63	100
50	100
37.5	96.3
28	85.3
20	72.5
14	55.1
10	41.7
6.3	28.3
5	24.2
3.35	19.1
2	14.2
1.18	12.3
0.6	9.2
0.425	5.3
0.3	2.4
0.212	1.4
0.15	0.9
0.063	0.5

Sample proportions	%
Cobbles	0
Gravel	86
Sand	14
Fines <0.063mm	1

Grading analysis		
D60	mm	15.5
D30	mm	6.7
D10	mm	0.7
Uniformity Coefficient		21.7
Curvature Coefficient		4.0

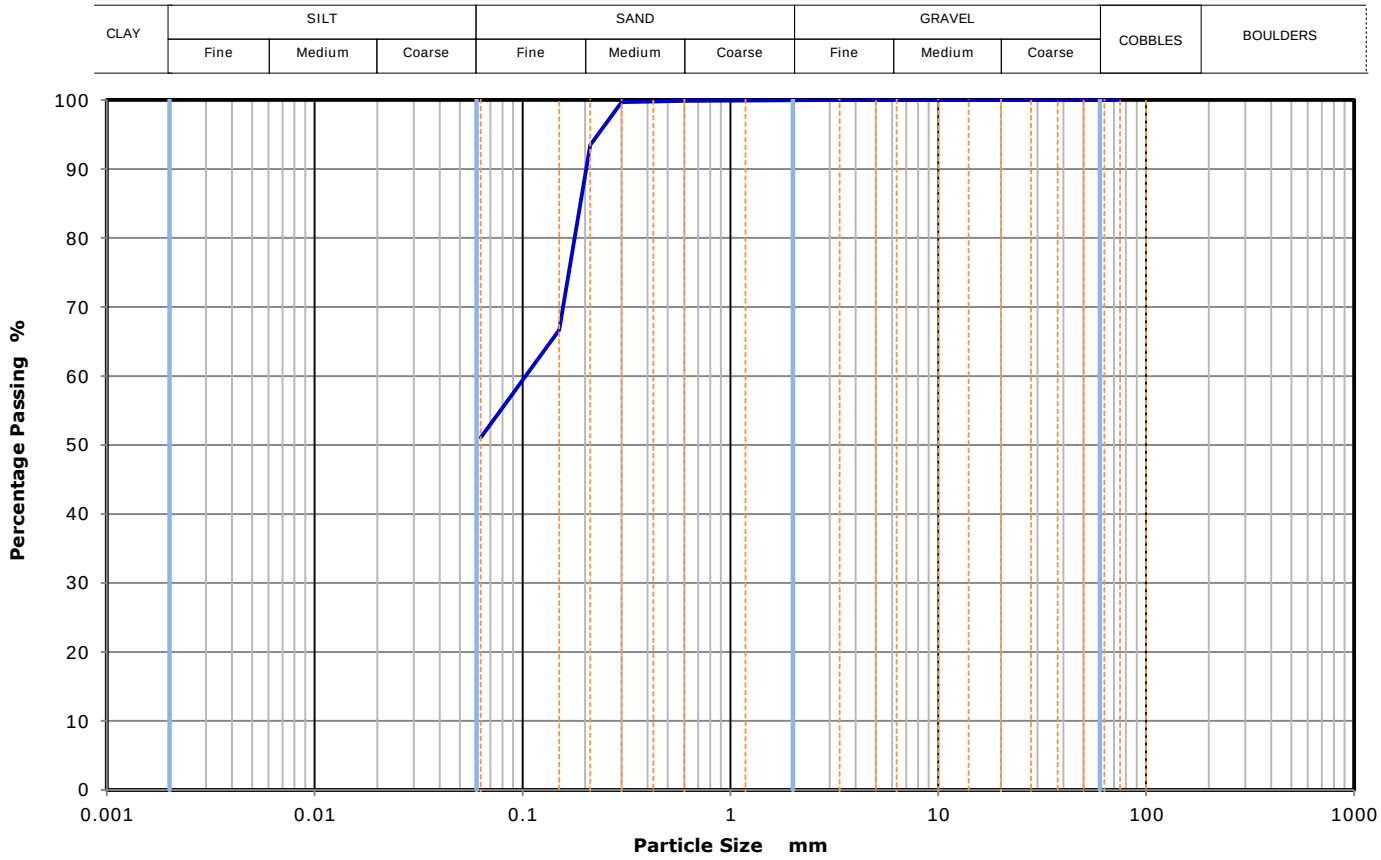
Test method and date	
Testing in accordance with BS EN ISO 17892:	
Wet sieving method	
Reporting date:	01 Oct 14

Soil Consultants

Site	**One Bedford Avenue**	Report No:	**9661/JRCB**
Location	**Bedford Avenue, Camden, London WC1B 3AU**		

PARTICLE SIZE DISTRIBUTION

Hole ID: **BH2** Depth [m]: **27.80**	Description: **Brown/grey silty sandy CLAY with bands/pockets of silty fine sand**



Sieving	
Size [mm]	% passing
75	100
63	100
50	100
37.5	100
28	100
20	100
14	100
10	100
6.3	100
5	100
3.35	100
2	99.98
1.18	99.92
0.6	99.86
0.425	99.78
0.3	99.68
0.212	93.48
0.15	66.68
0.063	51.08

Sample proportions	%
Cobbles	0
Gravel	0
Sand	49
Fines <0.063mm	51

Grading analysis		
D60	mm	0.1
D30	mm	
D10	mm	
Uniformity Coefficient		
Curvature Coefficient		

Test method and date	
Testing in accordance with BS EN ISO 17892:	
Wet sieving method	
Reporting date:	01 Oct 14

Soil Consultants

Site	One Bedford Avenue	Report No:	9661/JRCB
Location	Bedford Avenue, Camden, London WC1B 3AU		

SUMMARY OF UNDRAINED SHEAR STRENGTH TEST RESULTS

BH ID	Depth [m]	Moisture content [%]	Bulk density [Mg/m^3]	Dry density [Mg/m^3]	Cell pressure [kPa]	$(\sigma_1-\sigma_3)_f$ [kPa]	Failure strain [%]	Failure mode	Undrained cohesion [kPa]	Remarks
BH1	13.55	25	2.03	1.63	270	498	3.00	B	249	
BH1	17.55	24	2.03	1.64	350	421	3.00	B	211	
BH1	21.05	22	2.09	1.71	420	778	4.50	B	389	
BH2	12.05	28	1.99	1.56	240	226	2.50	I	113	
BH2	15.05	25	2.01	1.61	300	295	2.50	B	148	
BH2	18.05	23	2.05	1.66	360	402	2.50	B	201	
BH2	21.05	25	2.04	1.64	420	347	2.00	B	174	

Testing in accordance with BS EN ISO 17892 UU = unconsolidated, undrained; MUU = multistage, unconsolidated, ur Date: 06 October 14

Unless stated otherwise: Rate of strain = 2mm/min, Standard latex membrame used with thickness = 0.5mm

Failure modes: B = brittle, I = intermediate, P = plastic

Soil Consultants

K4 SOILS

Report of Undrained Triaxial Compression Test

BS 1377 : Part 7 : 1990 Clause 8.0

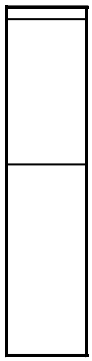
Project name:	Universal House, Bedford Avenue			**Samples Received:**	06/10/2014
				Project Started:	22/10/2014
Client:	Soils Consultants Ltd			**Testing Started:**	24/10/2014
Project no:	-	**Our job /report no:**	17689	**Date Reported:**	06/11/2014
BH / TP no:	BH1	**Sample no:**	U1	**Depth (m):**	10.55

Soil Description: High strength dark grey fissured silty CLAY

Sample Details		**Specimen** 1
Sample Condition		Undisturbed
Height	mm	198.0
Diameter	mm	102.0
Moisture Content	%	26
Bulk Density	Mg/m³	2.03
Dry Density	Mg/m³	1.61

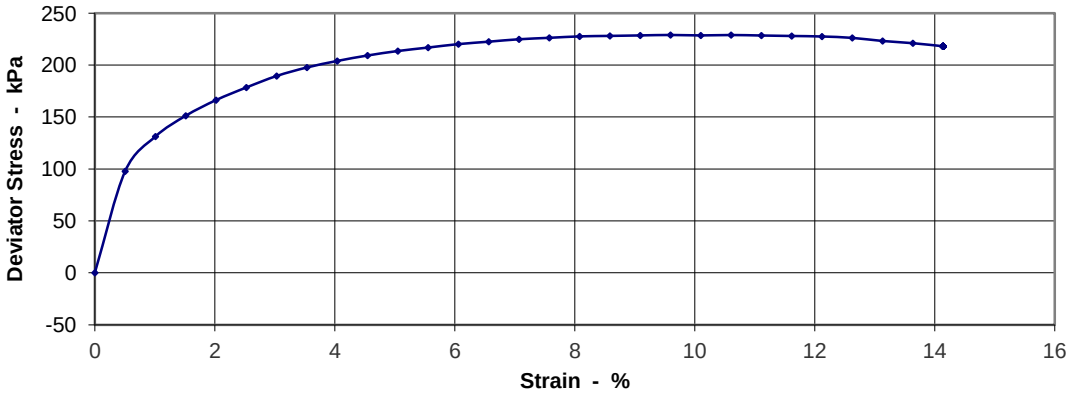
Test Details		
Membrane Thickness	mm	0.2
Membrane Correction	kPa	0.43
Rate of Axial Displacement	%/min	2.02
Cell Pressure	kPa	211
Strain at Failure	%	9.6
Maximum Deviator Stress	kPa	229
Shear Strength	kPa	114
Mode of Failure		Brittle

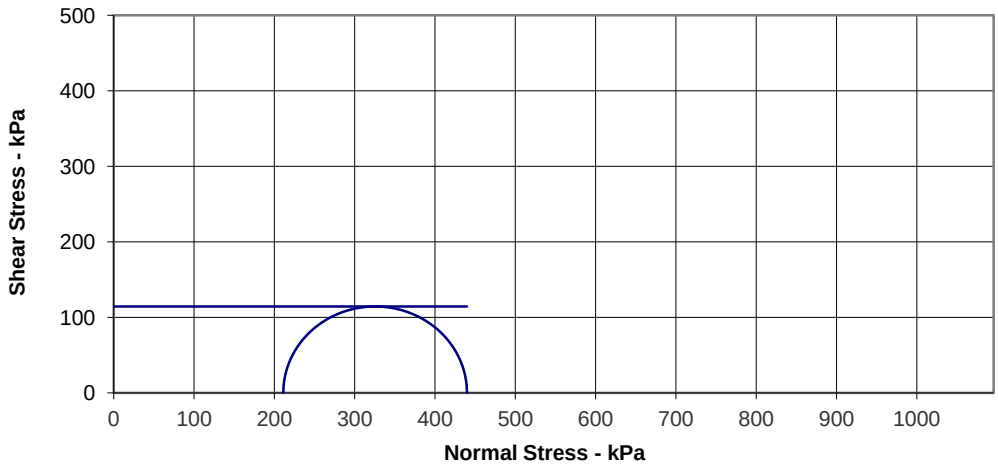
Position and orientation within the original sample



Shear Strength Parameters	
C	114 kPa
Phi	0.0 °

Specimen 1





K4 SOILS LABORATORY
Unit 8, Olds Close, Watford, Herts, WD18 9RU.
Tel:01923711288 Fax:01923711311
E-mail: k4soils@aol.com

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

Test results relate only to the sample numbers shown above

Checked and Approved
Initials: kp
Date: 06/11/2014

UKAS TESTING

2519

K4 SOILS

Report of Undrained Triaxial Compression Test

BS 1377 : Part 7 : 1990 Clause 8.0

Project name:	Universal House, Bedford Avenue			**Samples Received:**	06/10/2014
				Project Started:	22/10/2014
Client:	Soils Consultants Ltd			**Testing Started:**	24/10/2014
Project no:	-	**Our job /report no:**	17689	**Date Reported:**	06/11/2014
BH / TP no:	BH2	**Sample no:**	U1	**Depth (m):**	9.05

Soil Description: High strength dark grey fissured silty CLAY

Sample Details	**Specimen**	**1**
Sample Condition		Undisturbed
Height	mm	198.0
Diameter	mm	102.0
Moisture Content	%	26
Bulk Density	Mg/m³	2.05
Dry Density	Mg/m³	1.63

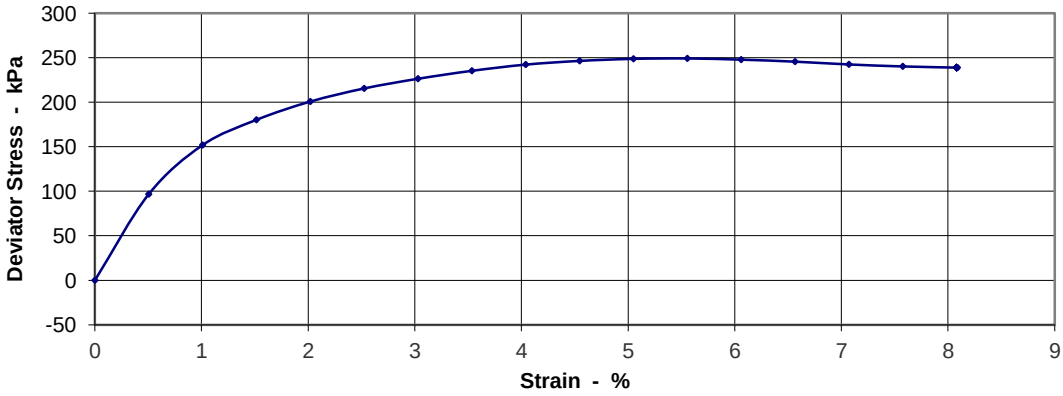
Position and orientation within the original sample

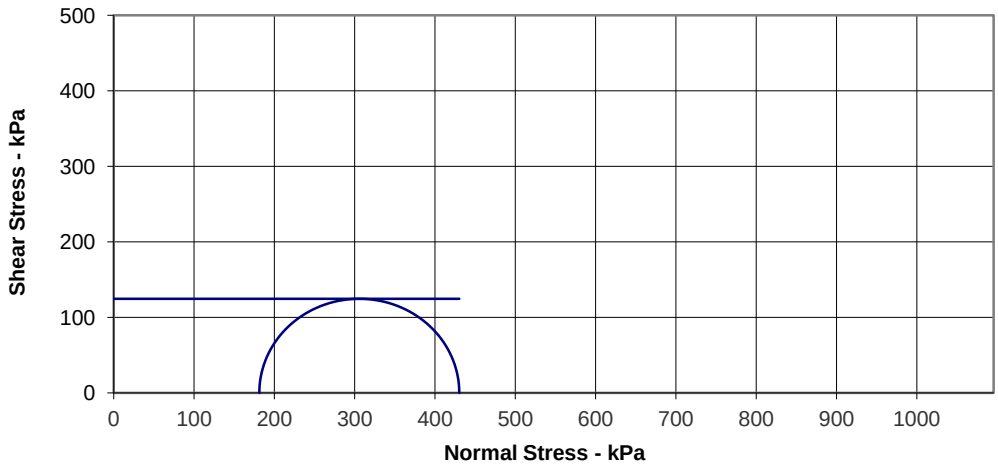
Test Details

Membrane Thickness	mm	0.2
Membrane Correction	kPa	0.28
Rate of Axial Displacement	%/min	2.02
Cell Pressure	kPa	181
Strain at Failure	%	5.6
Maximum Deviator Stress	kPa	249
Shear Strength	kPa	125
Mode of Failure		Brittle

Shear Strength Parameters	
C	125 kPa
Phi	0.0 °

Specimen 1





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Tel:01923711288 Fax:01923711311
E-mail: k4soils@aol.com

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

Test results relate only to the sample numbers shown above

Checked and Approved
Initials: kp
Date: 06/11/2014

UKAS TESTING

2519

Client :	Soils Consultants Ltd			**Our Job/report no:**	17689		**Samples Rec :**	06/10/2014	**Testing Started:**	24/10/2014		
Project name:	Universal House, Bedford Avenue			**Project No:**	-		**Project Started:**	22/10/2014	**Date reported:**	06/11/2014		
BH / TP No	Sample no / ref	Sample depth (m)	Description	Moisture content (%)	Bulk Density (Mg/m3)	Dry density (Mg/m3)	Cell Pressure (kPa)	Strain at failure (%)	Max Deviator Stress (kPa)	Mode of failure	Shear Strength (kPa)	Phi (deg)
BH1	U1	10.55	High strength dark grey fissured silty CLAY	26	2.03	1.61	211	9.6	229	Brittle	114	NA
BH2	U1	9.05	High strength dark grey fissured silty CLAY	26	2.05	1.63	181	5.6	249	Brittle	125	NA

K4 SOILS

Summary of Undrained Triaxial Compression Testing

BS 1377 : Part 7 : Clause 8 : 1990

Checked and approved

Initials kp

Client name & address:			**Samples Received**	06/10/2014	**K4 SOILS**
Soils Consultants Ltd			**Project Started**	22/10/2014	
Project Name:	Universal House, Bedford Avenue		**Testing Started**	28/10/2014	
Project No:	- **Our Job / report no:**	17689	**Date Reported:**	06/11/2014	
Sample description:			**Sample no/ type:**	U1	**BH no:** BH1
High strength dark grey fissured silty CLAY					**Depth (m):** 10.55

Test details

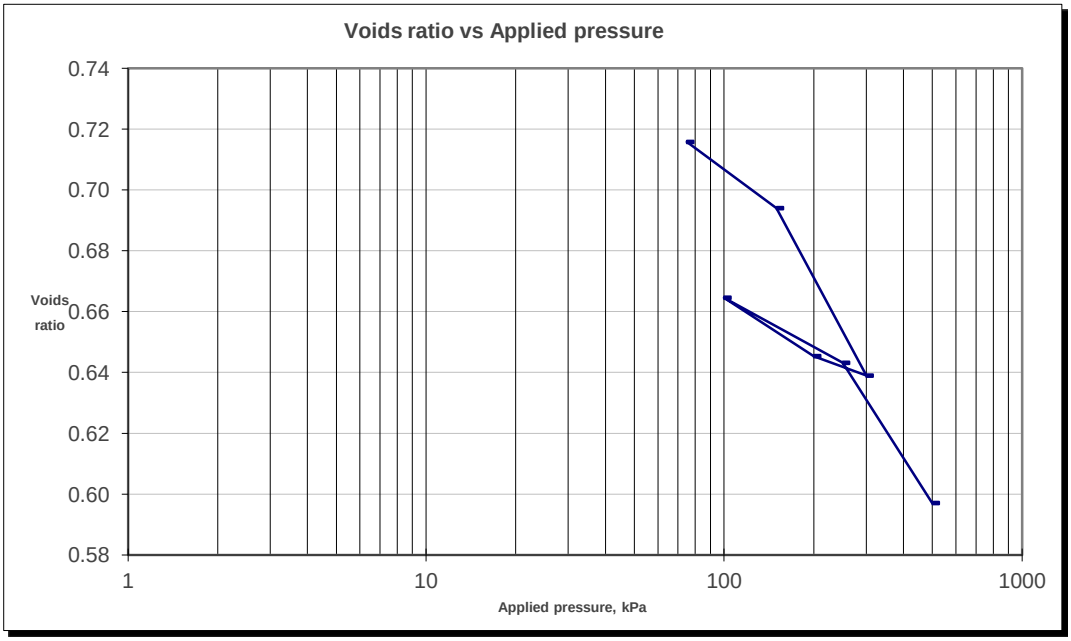
Depth within original sample m : 10.65 Orientation within original sample : Vertical

Specimen details

		Initial	Final
Height	mm :	19.04	17.46
Diameter	mm :	75	-
Bulk density	Mg/m3 :	1.95	2.14
Moisture content	% :	24	24
Dry density	Mg/m3 :	1.57	1.72
Voids Ratio	:	0.74	0.60
Degree of saturation	% :	89.6	-
Particle density	Mg/m3 :	2.74	-
Swelling pressure	kPa :	-	-

Consolidation Stage

Stage number	Applied Pressure kPa	Voids Ratio	Coefficient of Consolidation m2/year	Coefficient of Compressibility m2/MN	Stage number	Applied Pressure kPa	Voids Ratio	Coefficient of Consolidation m2/year	Coefficient of Compressibility m2/MN
1	75	0.7158	23.32	0.196	11				
2	150	0.6940	4.95	0.169	12				
3	300	0.6389	1.13	0.217	13				
4	200	0.6453	0.57	0.039	14				
5	100	0.6646	0.54	0.117	15				
6	250	0.6432	1.34	0.086	16				
7	500	0.5971	1.07	0.112	17				
8					18				
9					19				
10					20				



One-Dimensional Consolidation Test

BS 1377 : Part 5 : Clause 3 & 4 : 1990

Determination of the one-dimensional consolidation properties

UKAS TESTING 2519

Approved by

Initials : kp

Date : 06/11/2014

Test Report by K4 SOILS LABORATORY Unit 8 Olds Close Olds Approach Watford WD18 9RU

Client name & address:			**Samples Received**	06/10/2014	**K4 SOILS**
Soils Consultants Ltd			**Project Started**	22/10/2014	
Project Name:	Universal House, Bedford Avenue		**Testing Started**	28/10/2014	
Project No:	- **Our Job / report no:**	17689	**Date Reported:**	06/11/2014	
Sample description:			**Sample no/ type:**	U1	**BH no:** BH2
High strength dark grey fissured silty CLAY					**Depth (m):** 9.05

Test details

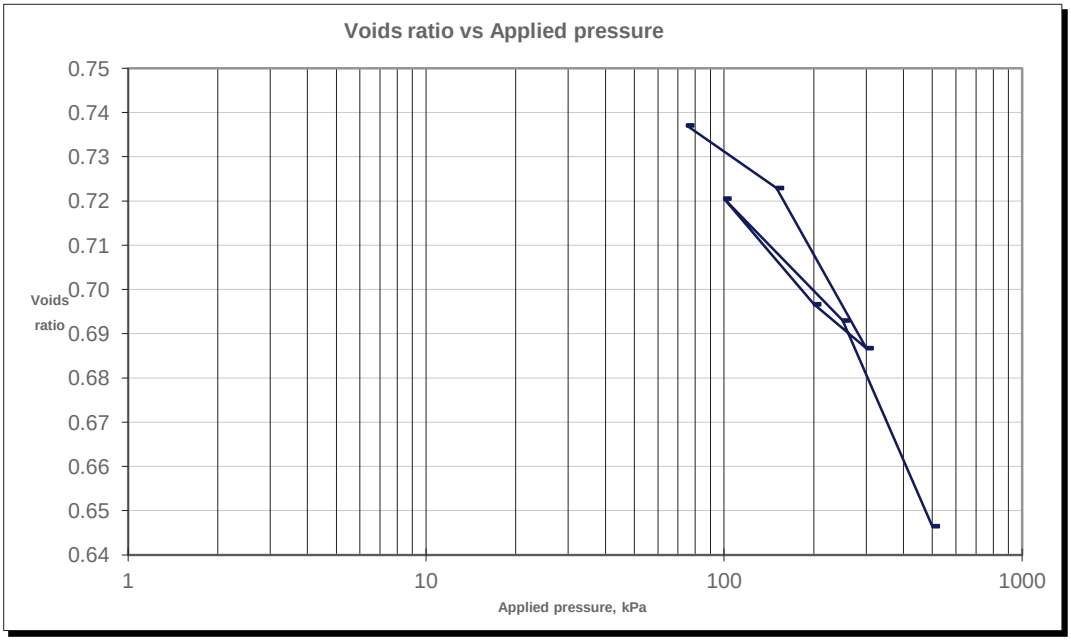
Depth within original sample m : 9.15 Orientation within original sample : Vertical

Specimen details

		Initial	Final
Height	mm :	19.07	17.92
Diameter	mm :	75	-
Bulk density	Mg/m3 :	1.97	2.09
Moisture content	% :	26	25
Dry density	Mg/m3 :	1.56	1.66
Voids Ratio	:	0.75	0.65
Degree of saturation	% :	95.3	-
Particle density	Mg/m3 :	2.74	-
Swelling pressure	kPa :	-	-

Consolidation Stage

Stage number	Applied Pressure kPa	Voids Ratio	Coefficient of Consolidation m2/year	Coefficient of Compressibility m2/MN	Stage number	Applied Pressure kPa	Voids Ratio	Coefficient of Consolidation m2/year	Coefficient of Compressibility m2/MN
1	75	0.7371	10.01	0.113	11				
2	150	0.7229	2.73	0.109	12				
3	300	0.6867	0.53	0.140	13				
4	200	0.6967	0.67	0.059	14				
5	100	0.7205	0.27	0.141	15				
6	250	0.6930	0.86	0.107	16				
7	500	0.6465	0.47	0.110	17				
8					18				
9					19				
10					20				



UKAS TESTING 2519

One-Dimensional Consolidation Test

BS 1377 : Part 5 : Clause 3 & 4 : 1990

Determination of the one-dimensional consolidation properties

Approved by

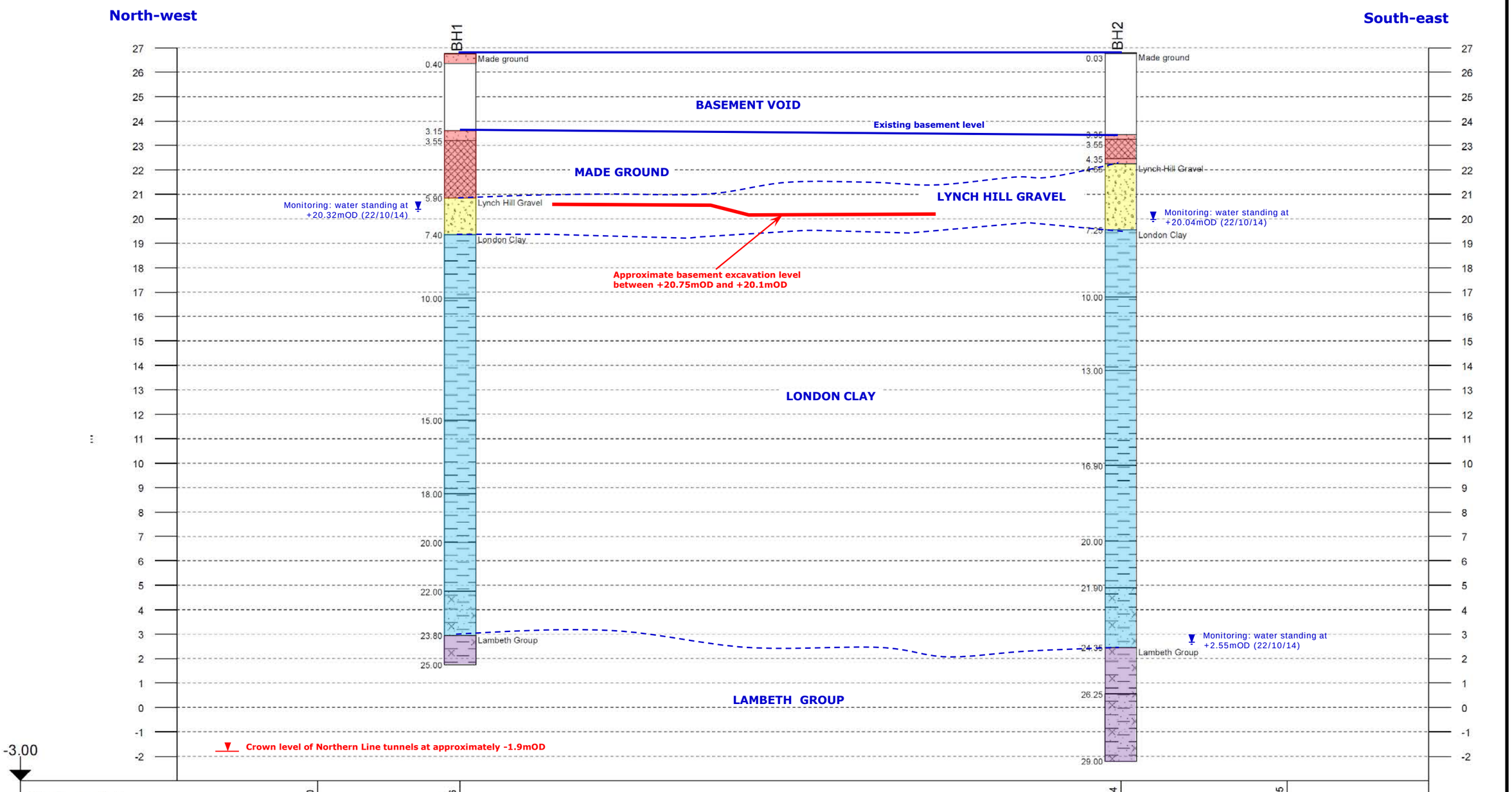
Initials : kp

Date : 06/11/2014

Project Id: 9661/JRCB
Project Title: One Bedford Avenue
Location: Bedford Avenue, Camden, London WC1B 3AU
Client: Exemplar Properties (Bedford) Ltd Engineer: Waterman Group

Soil Consultants

SECTION A-A

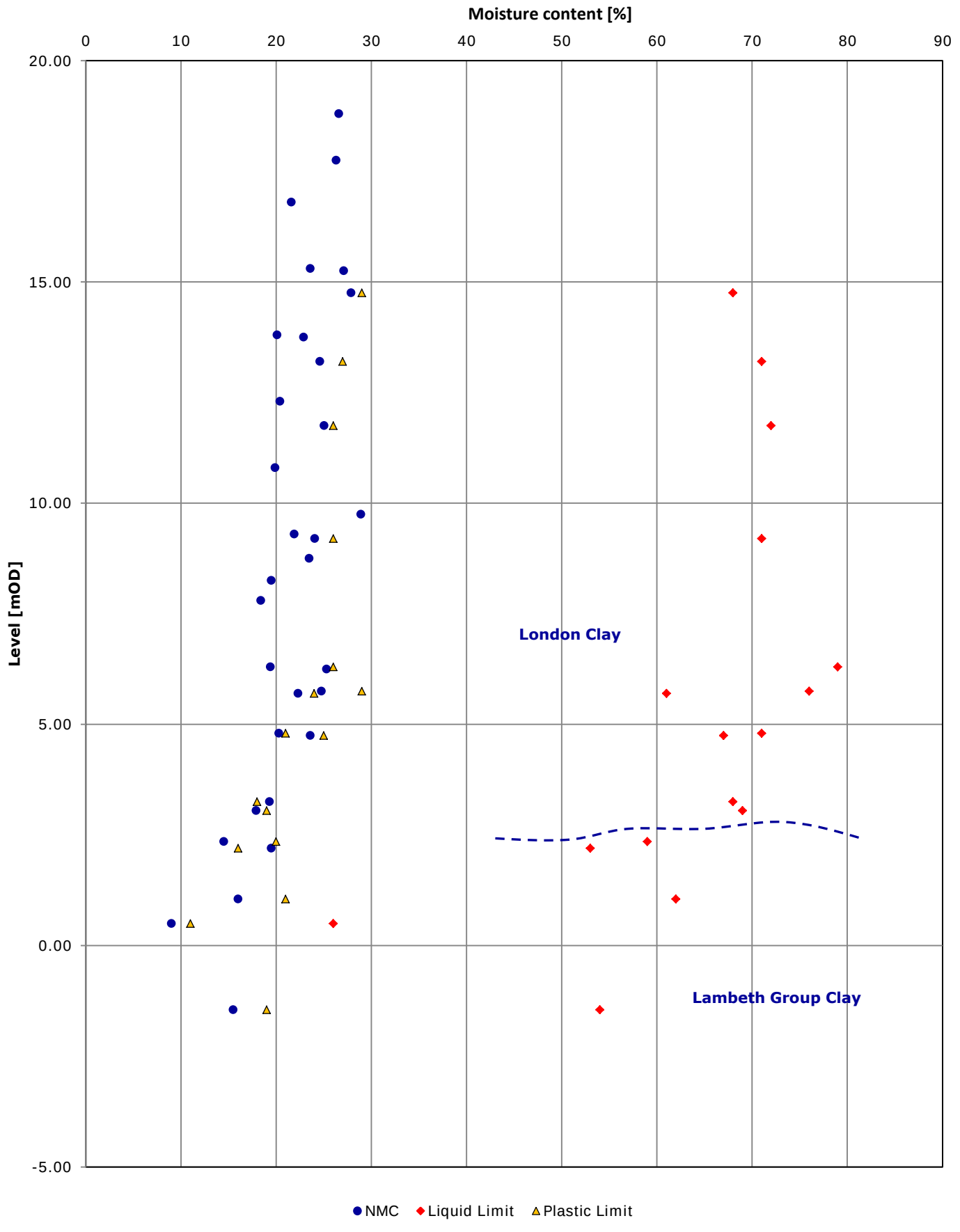


Chainage (m)	0.00	6.76	38.14	46.05	
Offset (m)	0.12		0.50		
Elevation (mAOD)	26.75		26.80		

STRATA BOUNDARIES INDICATIVE ONLY

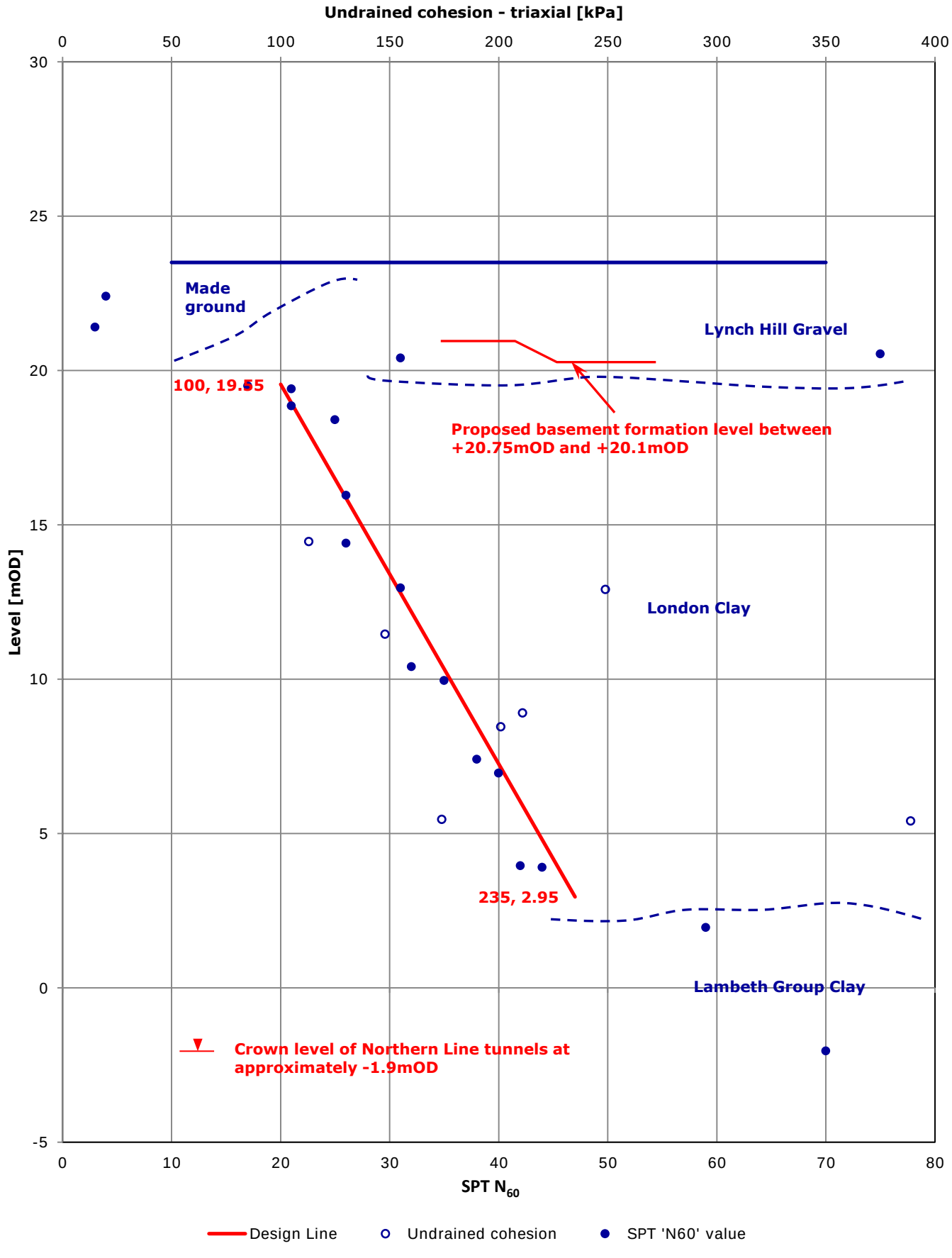
Site & Location	One Bedford Avenue Bedford Avenue, Camden, London WC1B 3AU	Report No:	9661/JRCB

Natural Moisture Content and Index Properties vs level



Site & Location	One Bedford Avenue Bedford Avenue, Camden, London WC1B 3AU	Report No:	9661/JRCB

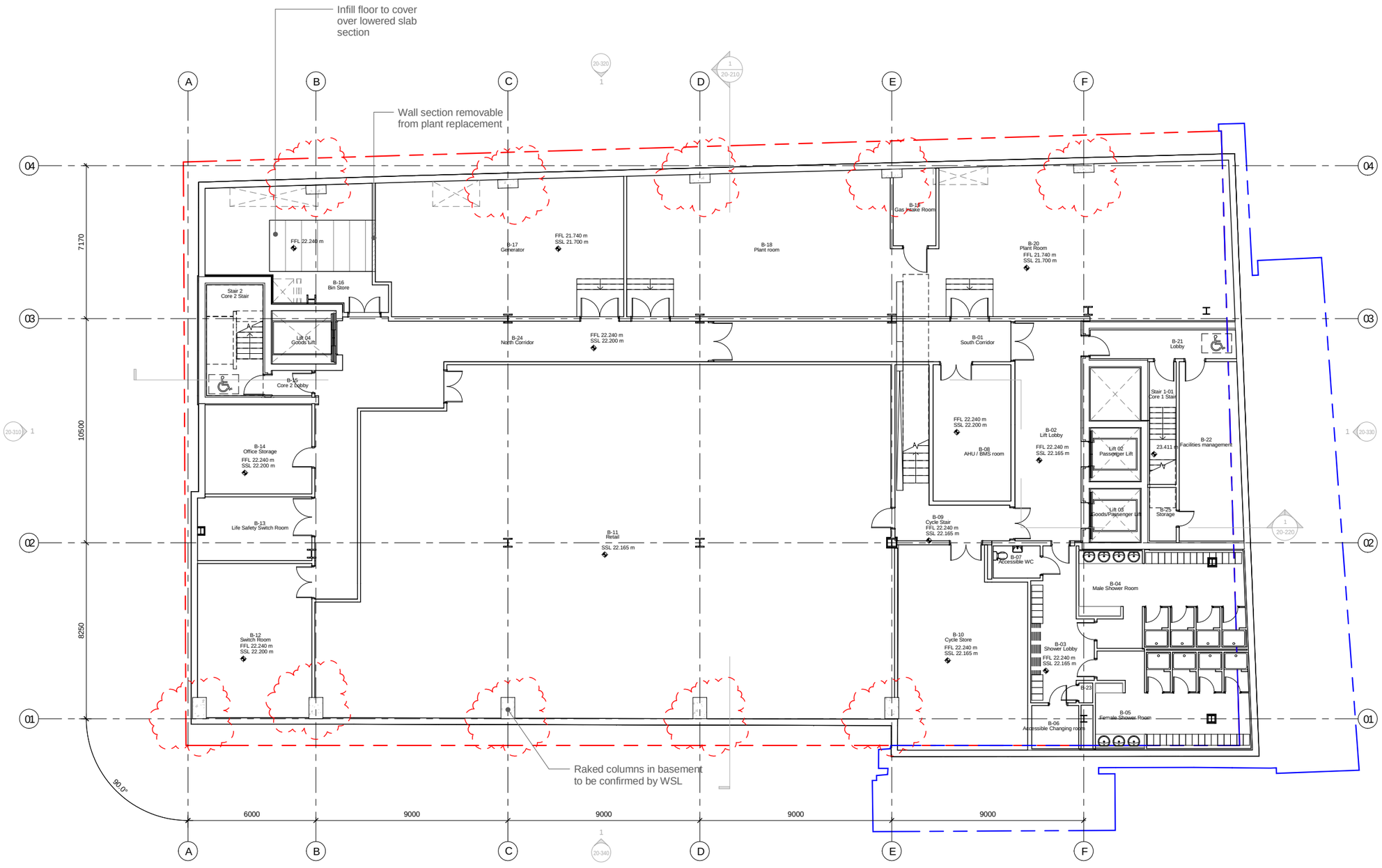
Undrained cohesion and SPT [N60] vs level



Design Line Δcu = 8.13kPa/m

Note: this plot may incorporate extrapolated results, generally where 'N' >50 - these are indicative only and should be used with caution

Soil Consultants



Revisions	By	Chk	Revisions	By	Chk
/ 140811 Issued for Design Freeze	PB	DW			

Notes

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E mail@bennettsassociates.com
For Bennetts Associates' electronic information issue disclaimer - www.bennettsassociates.com/informationdisclaimer/

Project
One Bedford Avenue
Exemplar Properties (Bedford) Ltd.

Project No. 1217

Drawing Title
General Arrangement
Basement Plan

Drawing Number
1217-20-099

Revision
/

Scale @ A3
1 : 200

Scale @ A1
1 : 100

Revision Date
140811
YY MM DD

Revisions	By	Chk	Revisions	By	Chk
/ 140811 Issued for Design Freeze	PB	DW			

Notes

Bennetts Associates Architects
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Project
One Bedford Avenue
Exemplar Properties (Bedford) Ltd.

Project No. 1217

Drawing Title
General Arrangement
Ground Floor Plan

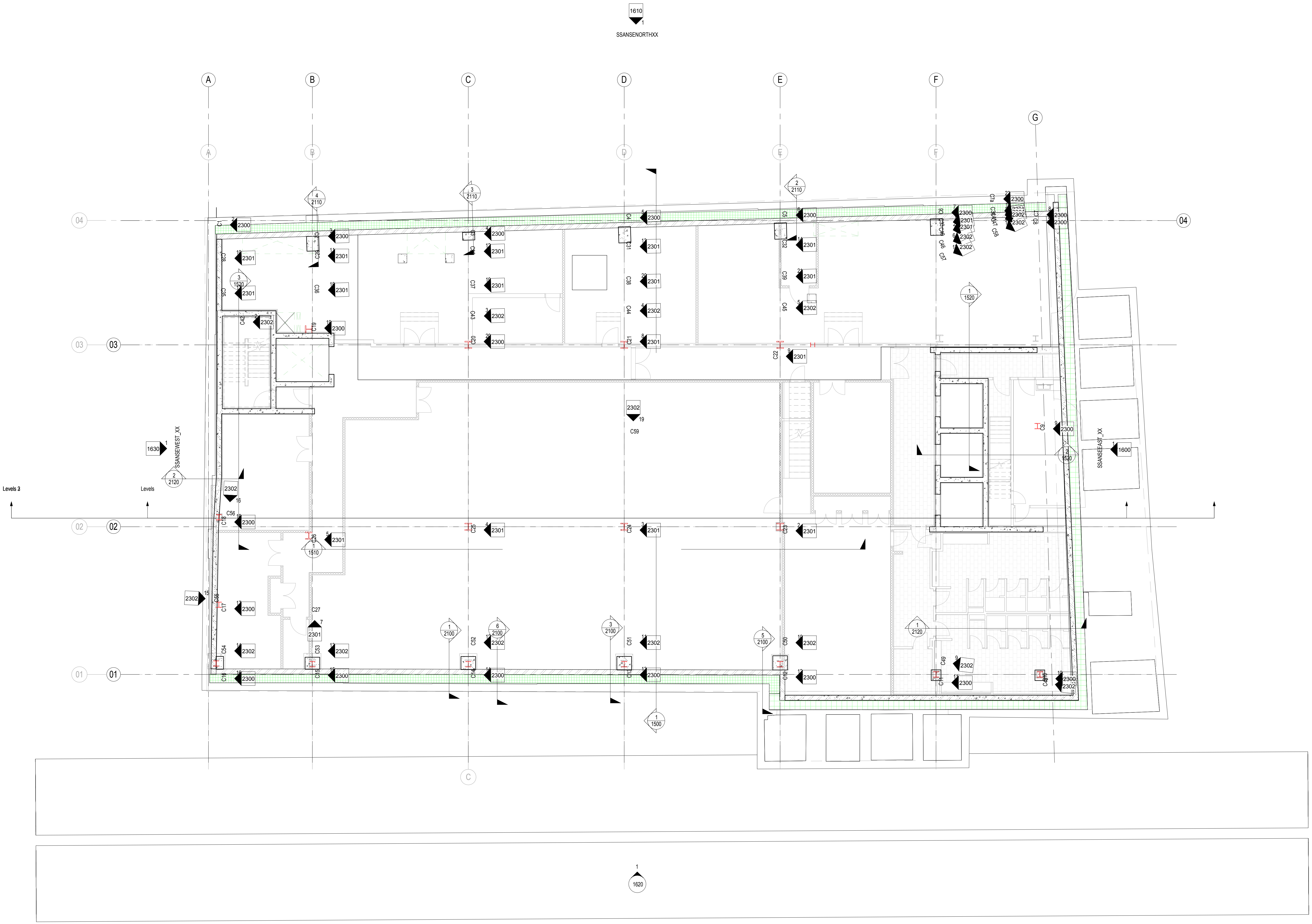
Drawing Number
1217-20-100

Revision
/

Scale @ A3
1 : 200

Scale @ A1
1 : 100

Revision Date
140811
YY MM DD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SSANSENORTHXX
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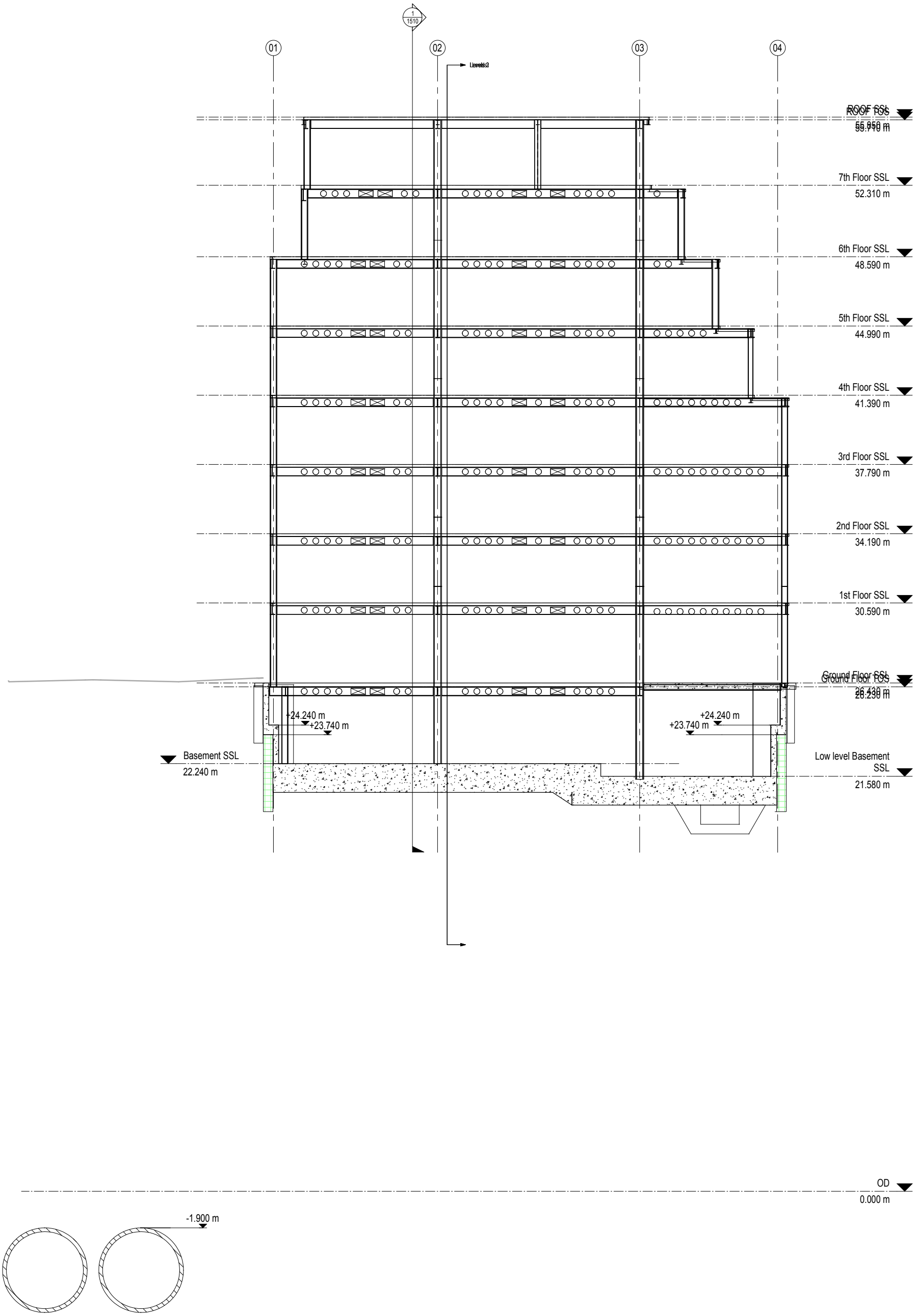
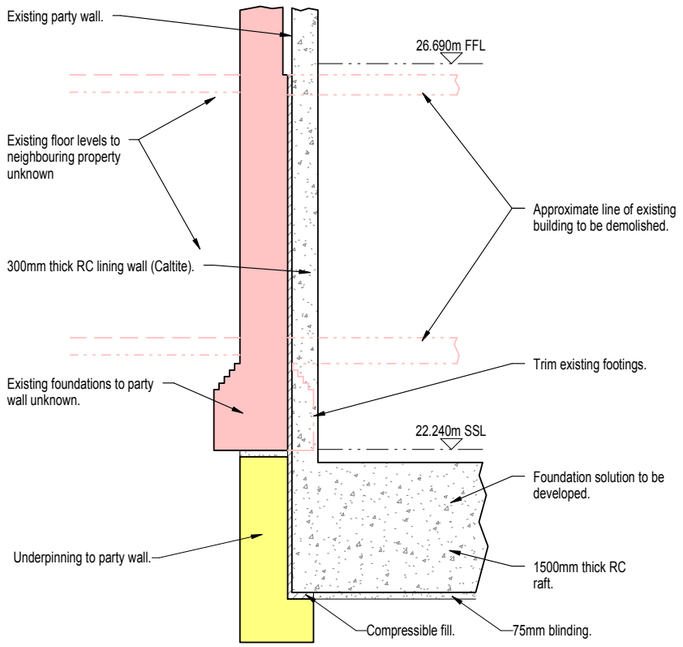
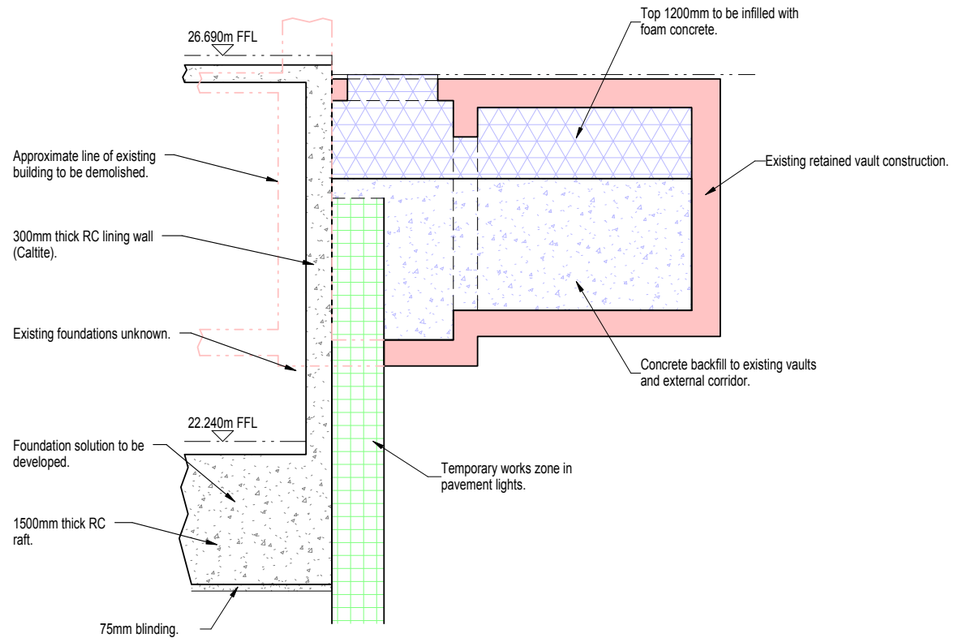
1600
SSANSEEAST_XX
Levels 2
Levels
1620

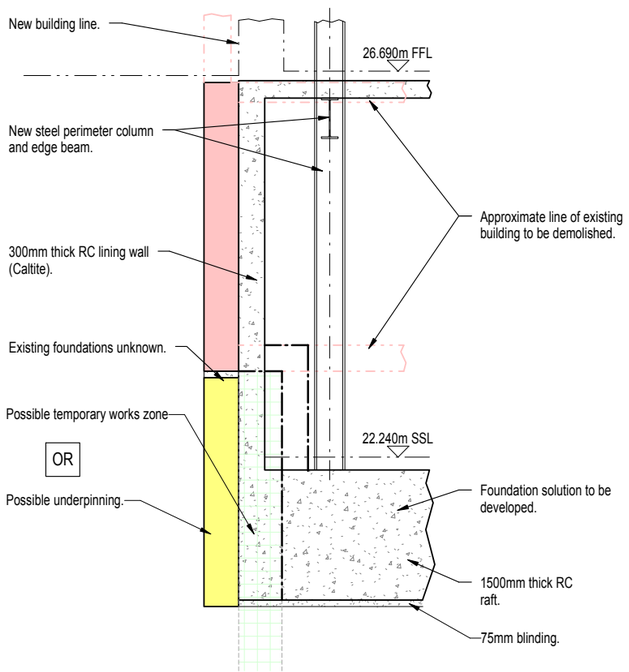

1
1510
01
02
03
04
Levels:2
ROOF SSL
55.950 m
ROOF TOS
55.950 m
7th Floor SSL
52.310 m
6th Floor SSL
48.590 m
5th Floor SSL
44.990 m
4th Floor SSL
41.390 m
3rd Floor SSL
37.790 m
2nd Floor SSL
34.190 m
1st Floor SSL
30.590 m
Ground Floor SSL
26.430 m
Ground Floor TOS
26.230 m
+24.240 m
+23.740 m
+24.240 m
+23.740 m
Basement SSL
22.240 m
Low level Basement SSL
21.580 m
OD
0.000 m
-1.900 m



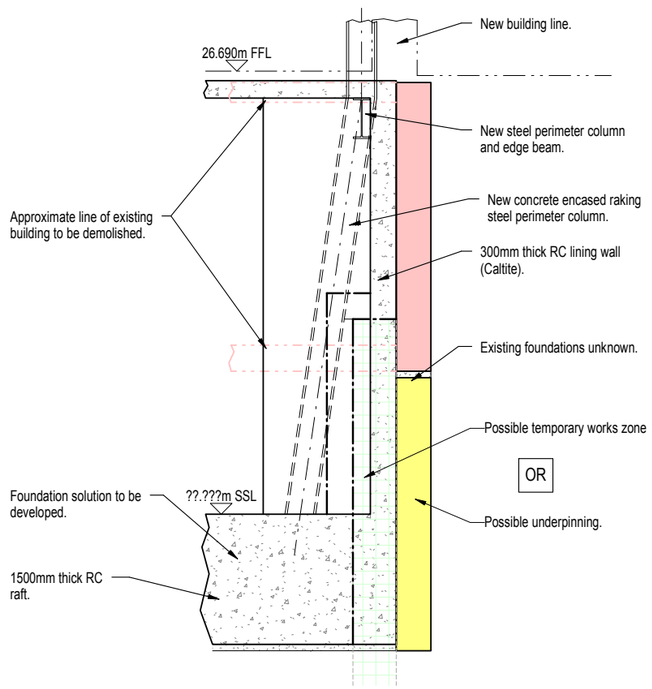
SECTION ALONG PARTY WALL BUILDING LINE



SECTION ALONG BEDFORD AVENUE BUILDING LINE AND TOTTENHAM COURT ROAD S.W. CORNER



SECTION ALONG TOTTENHAM COURT ROAD BUILDING LINE



SECTION ALONG MORWELL STREET BUILDING LINE

GENERAL NOTES

Rev	Date	Description	By
A01	27.06.14	PRELIMINARY ISSUE FOR INFORMATION.	KRM

Amendments

Project: One Bedford Avenue

Title: INDICATIVE BASEMENT PERIMETER SECTIONS SHOWING DESIGN INTENT

Client: Exemplar Properties (Bedford) Ltd

Pickfords Wharf Clink Street London SE1 9DG
United Kingdom
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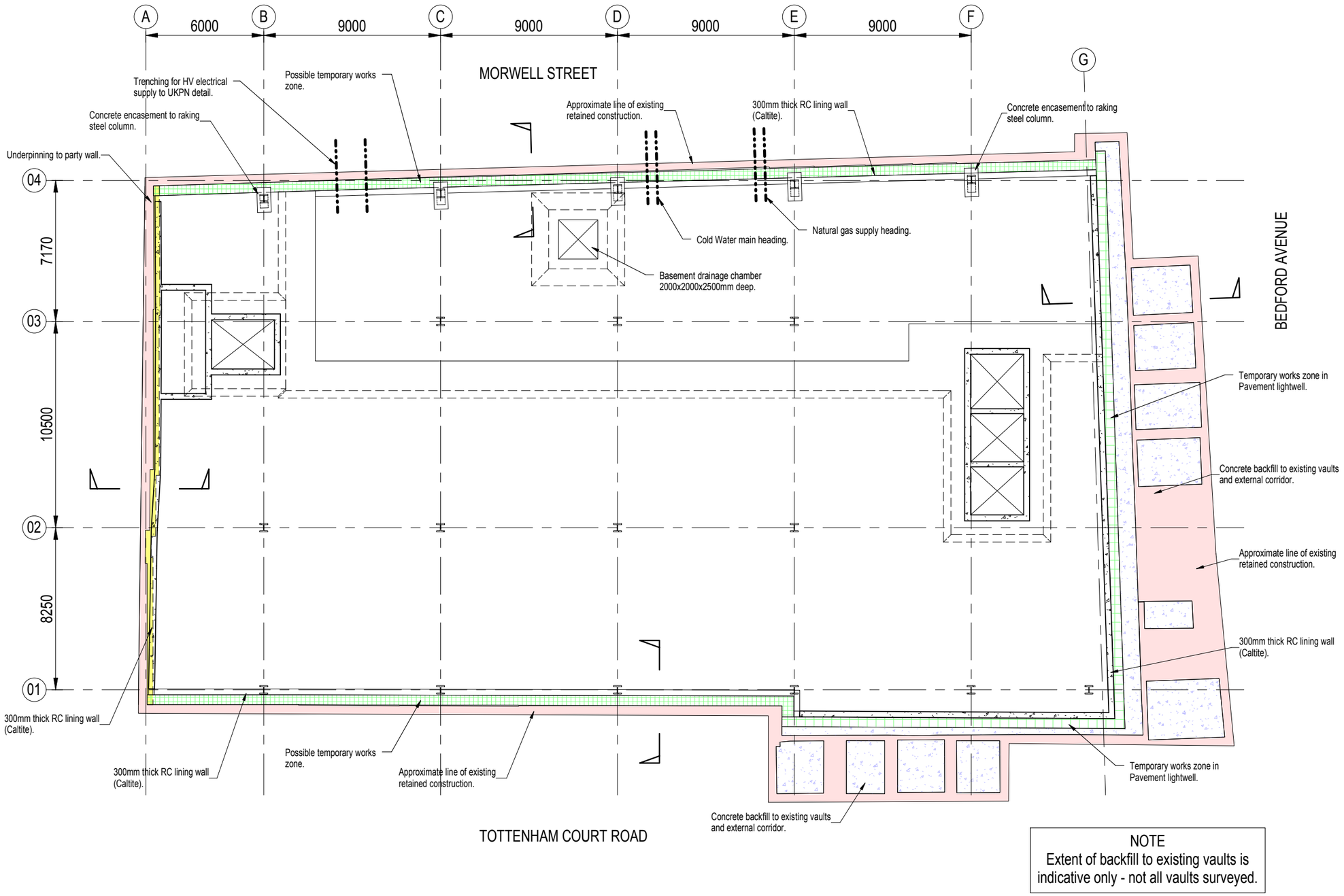
mail@watermangroup.com www.watermangroup.com

Drawing Status: PRELIMINARY

Designed By	Checked By	Project No
T.M.N.	-	STR11621
Drawn By	Date	Works Order No
K.R.M.	JUNE 2014	
Scales @ A2		
1 : 50		

Publisher	Zone	Category	Number	Revision
WSL	SA	SK	1001	A01

Central:-\\NT-LNCSWSL\Projects\STR11621\CAD\3D\STR11621-14-Stage D.rvt



NOTE
Extent of backfill to existing vaults is indicative only - not all vaults surveyed.

GENERAL NOTES

Rev	Date	Description	By
A01	27.06.14	PRELIMINARY ISSUE FOR INFORMATION.	KRM

Amendments

Project
One Bedford Avenue

Title
INDICATIVE BASEMENT PLAN SHOWING DESIGN INTENT

Client
Exemplar Properties (Bedford) Ltd

Pickfords Wharf Clink Street London SE1 9DG
United Kingdom
t +44 20 7928 7888 f +44 3333 444 501
mail@watermangroup.com www.watermangroup.com

Drawing Status
PRELIMINARY

Designed By	Checked By	Project No
T.M.N.	-	STR11621
Drawn By	Date	Works Order No
K.R.M.		
Scales @ A2		
1 : 150		

Publisher	Zone	Category	Number	Revision
WSL	SA	SK	1000	A01

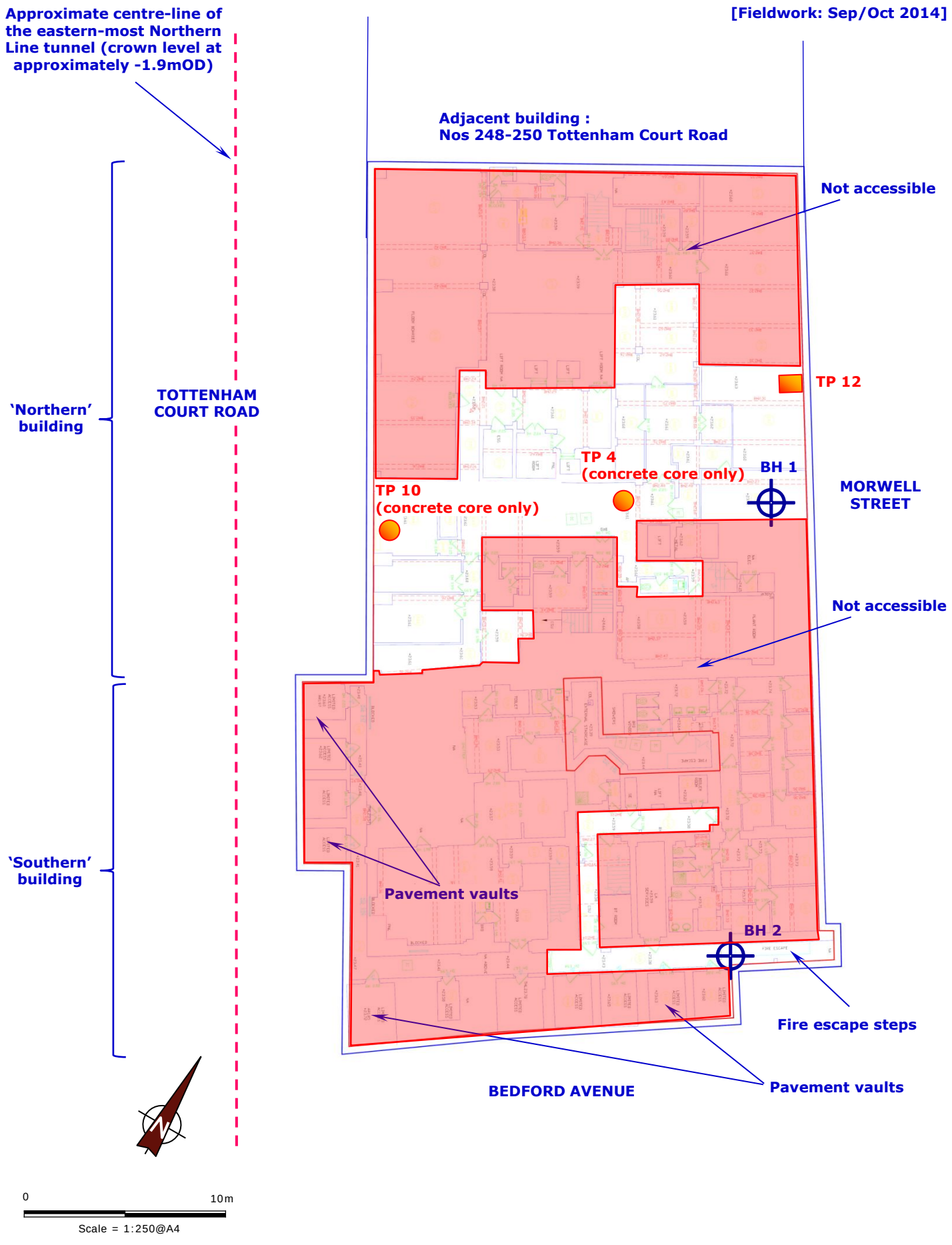
Central:-\\NT-LNCSWSL\Projects\STR11621\CAD\3D\STR11621-14-Stage D.rvt

Site Location

One Bedford Avenue
Bedford Avenue, Camden, London WC1B 3AU

Report No:
9661/JRCB

Site Plan [at basement level]



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Cardiff office:
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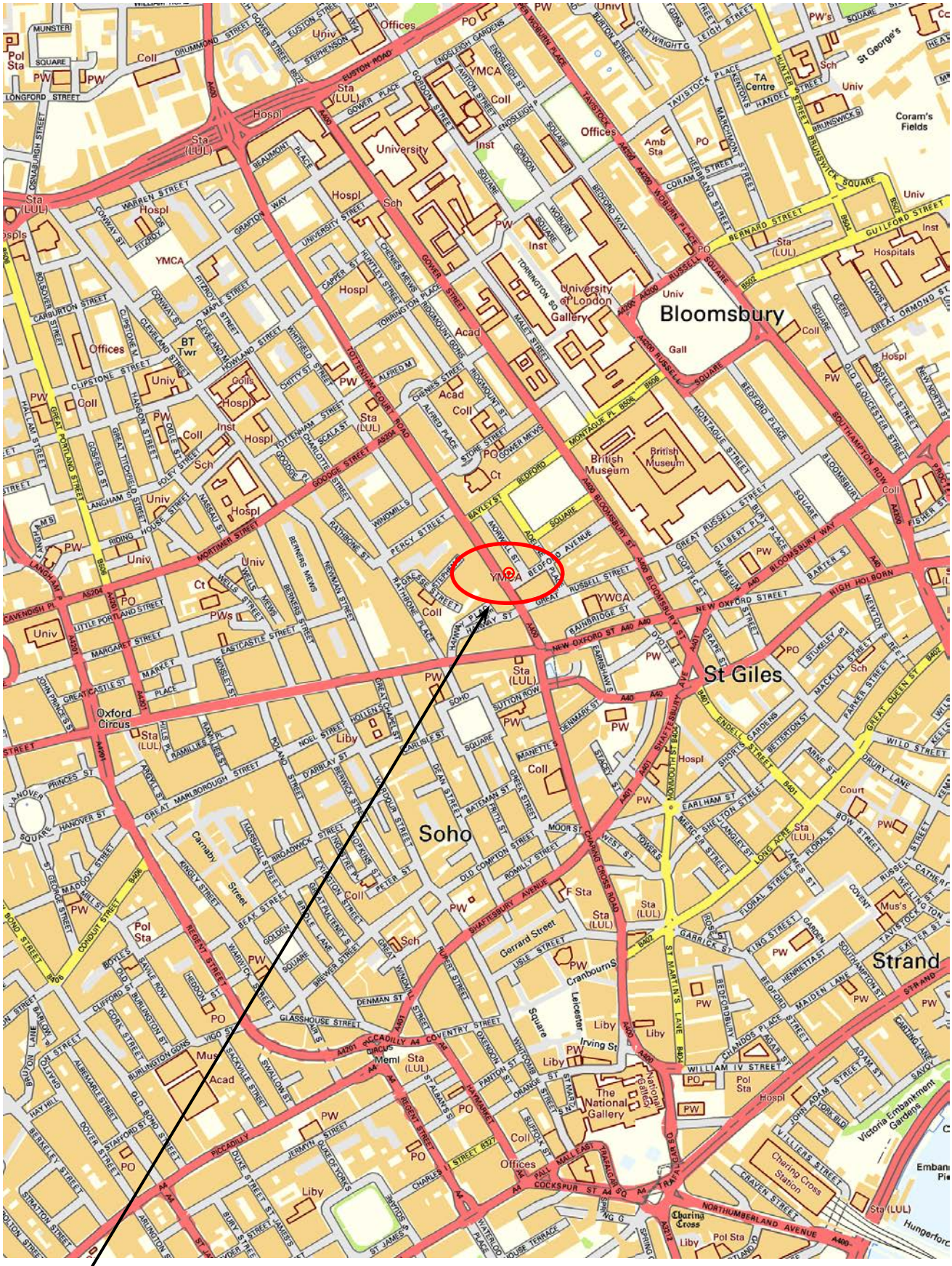
Harwich, Essex CO12 3HL
t: 01255 241639
e: harwich@soilconsultants.co.uk

Site Location	**One Bedford Avenue** **Bedford Avenue, Camden, London WC1B 3AU**	Report No: **9661/JRCB**

Location Plan



SITE LOCATION

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Cardiff office:
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Harwich Office:
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Harwich, Essex CO12 3HL
t: 01255 241639
e: harwich@soilconsultants.co.uk

Soil Consultants

APPENDIX B

Ground Movement Analysis

- Existing and proposed structural loads (Waterman Structures)
- Figures 1 to 9 (GMA input parameters and results)

Waterman Structures
Consulting Engineers

Calculations

Sheet No. 1 Job No. STR1162(
By TMN Date 1.10.24
Checked Date

TITLE 1BA AVENUE

LOCATION	CALCULATIONS	OPTIONS

EXISTING LOADS -

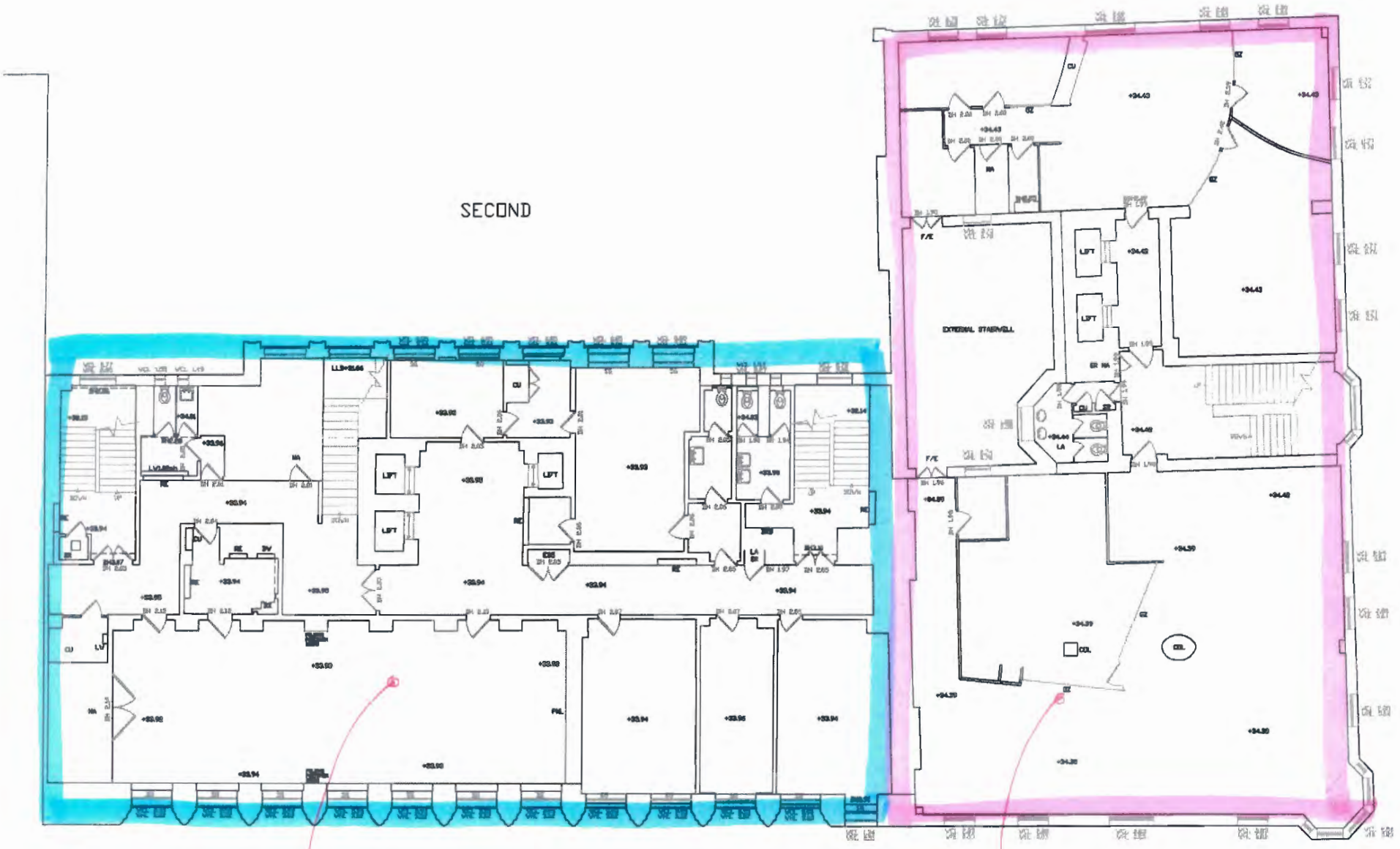
THE FOLLOWING PROVIDES AN ESTIMATE OF THE EXISTING LOADS ACTING ON THE SITE AT 1 BEDFORD AVENUE.

THE LOADS INDICATED ARE CHARACTERISTIC (UN-FACTORED) LOADS.

DEAD LOADS ARE BASED ON VISUAL SITE SURVEY AND TIME OF BUILDING DURING SOFT STRIP WITH A SMALL AMOUNT OF HARD DEMO HAVING BEEN DONE

IN GENERAL THE TIME OF BUILDING IS CONCRETE ENCASED STEEL FRAME WITH 225mm RC SLAB AND @ 40mm SCREED.

SECOND


EXTERNAL STAIRWELL
LIFT
LIFT
LIFT
LIFT
TIME OUT BUILDING
IBA (OFFICE)

Waterman Structures
Consulting Engineers

Sheet No. _____ Job No. 52.1621

By TMW Date 1.10.24

Checked _____ Date _____

Calculations

TITLE EXISTING LOADS IBA TIME OUT.

LOCATION	CALCULATIONS	OPTIONS
	TECH AZ Plan	DL LL
C1	AREA = 5.8m²	DL = 365 120
C2	AREA = 6.8m²	DL = 615 214
		LL =
C3	AREA = 5.2m²	DL = 490 167
C4	AREA = 7.5m²	DL = 673 236
C5	AREA = 9.0m²	DL = 798 254
EX C6	AREA = 10.0m²	DL = 882 315
C7	AREA = 5.5m²	DL = 490 167
C8	AREA = 2.1m²	DL = 1057 381
C9	AREA = 9.3	DL = 823 295
C10	AREA = 8.8m²	DL = 552 315
C11	AREA = 11.0m²	DL = 965 347
EX C12	AREA = 12.1m²	DL = 1057 381
X C13	AREA = 9.9m²	DL = 1619 634
IE3 6		

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Calculations

Sheet No. ____ Job No. 9211G2 1
By TMW Date 1.10.24
Checked ____ Date ____

TITLE ISA Ex. Loads Time Dep.

LOCATION	CALCULATIONS		OPTIONS DL	OPTIONS LL
	C14 A_{Trib} = 13.2 m²	DL =	1145	416
	C15 A_{Trib} = 5 m²	DL =	740	261
	C16 A_{Trib} = 10.8 m²	DL =	948	340
	C17 = 16.0 m²	DL =	1381	504
	C18 = 10.8	DL =	945	340
	C19 = 4.3	DL =	656	608
	C20 = 25.8	DL =	1498	813
Y×	C21 = 18.5	DL =	1510	553
	C22 = 15.8 m²	DL =	1195	425
	C24 = 11.5 m²	DL =	1007	362
	C25 = 18.8	DL =	1570	553
	C26 = 3.0 m²	DL =	132	40
	C25 C27 = 7.5 m²	DL =	1306	55

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Calculations

Sheet No. | Job No. 5121621
By ITW | Date 1.10.24
Checked | Date

TITLE 12A Ex Loads Time Out

LOCATION	CALCULATIONS	OPTIONS
		DL / LL
	C28 = 15 m²	DL 2131 / 788
	C29 = 19.2 m²	DL 1648 / 605
	C30 = 28.5 m²	DL 2131 / 788
	C31 = 19.2 m²	DL 648 / 605
	TOTAL AREA = 536.2 m²	
	CORE WALL LOADS	
	GIA = 31 × 20 = 620 m²	
	AREA NOT COVERED = 620 − 536.2 = 83.8 m²	
	TOTAL LENGTH OF CORE WALL = 5.4 + 4 + 4 + 4 + 2 + 3 + 9.2 = 31.6 m	
	UDL LOAD = (53.8 × 9.1 × 5) / 320 =	190 kN/m
	+ SELF WEIGHT OF WALL = 0.2 × 24 × 5.6 × 5 =	135 kN/m
		3286 kN/m

= 32.8 kN/m DL.

TIME OUT BUILDING

TO LOADS ACCU... THIS WALL REFER TO

1 BA (OFFICE) D.REAM

1 BA (OFFICE)

LL = 17.5 kN/m
DL = 67.0 kN/m

45.4 kN/m

LL = 17.5 kN/m

96.3 kN/m

152 kN/m

125.0 kN/m

152 kN/m

C1 C2 C3 C4 C5 C6 C7 C8 C9 C10 C11 C12 C13 C14 C15 C16 C17 C18 C19 C20 C21 C22 C23 C24 C25 C26 C27 C28 C29 C30 C31

ALL BASEMENT AREAS (TIME OUT BUILDING)
DL = 7.2 kN/m²
LL = 5.0 kN/m²

STR11621 - 1 BEDFORD AVENUE

ESTIMATE OF EXISTING LOADS

TIMEOUT BUILDING

Waterman Structures
Consulting Engineers

Calculations

Sheet No. ______ Job No. STR11621

By TMN Date 3.10.14

Checked ______ Date ______

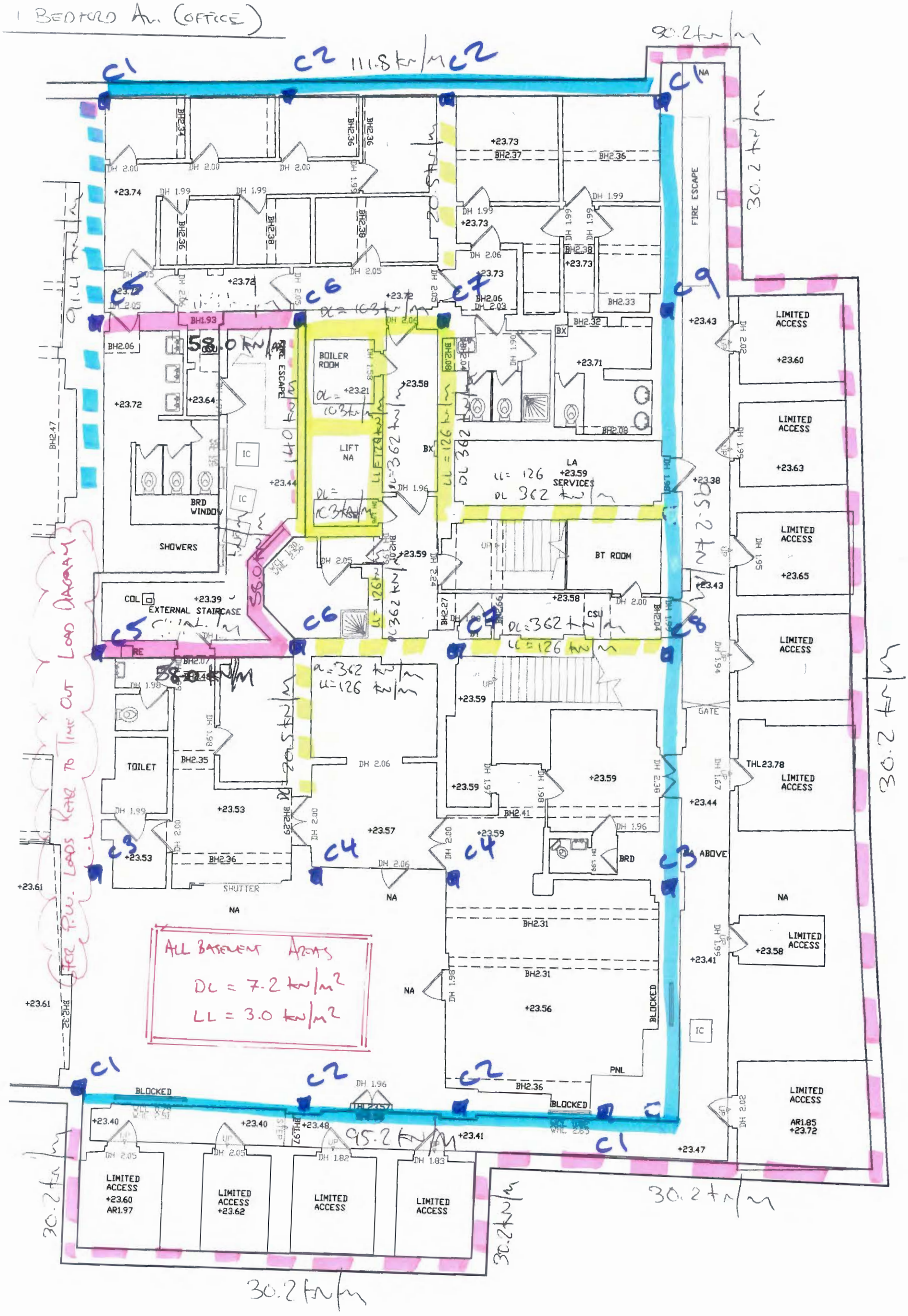
TITLE 13A Existing Loads.

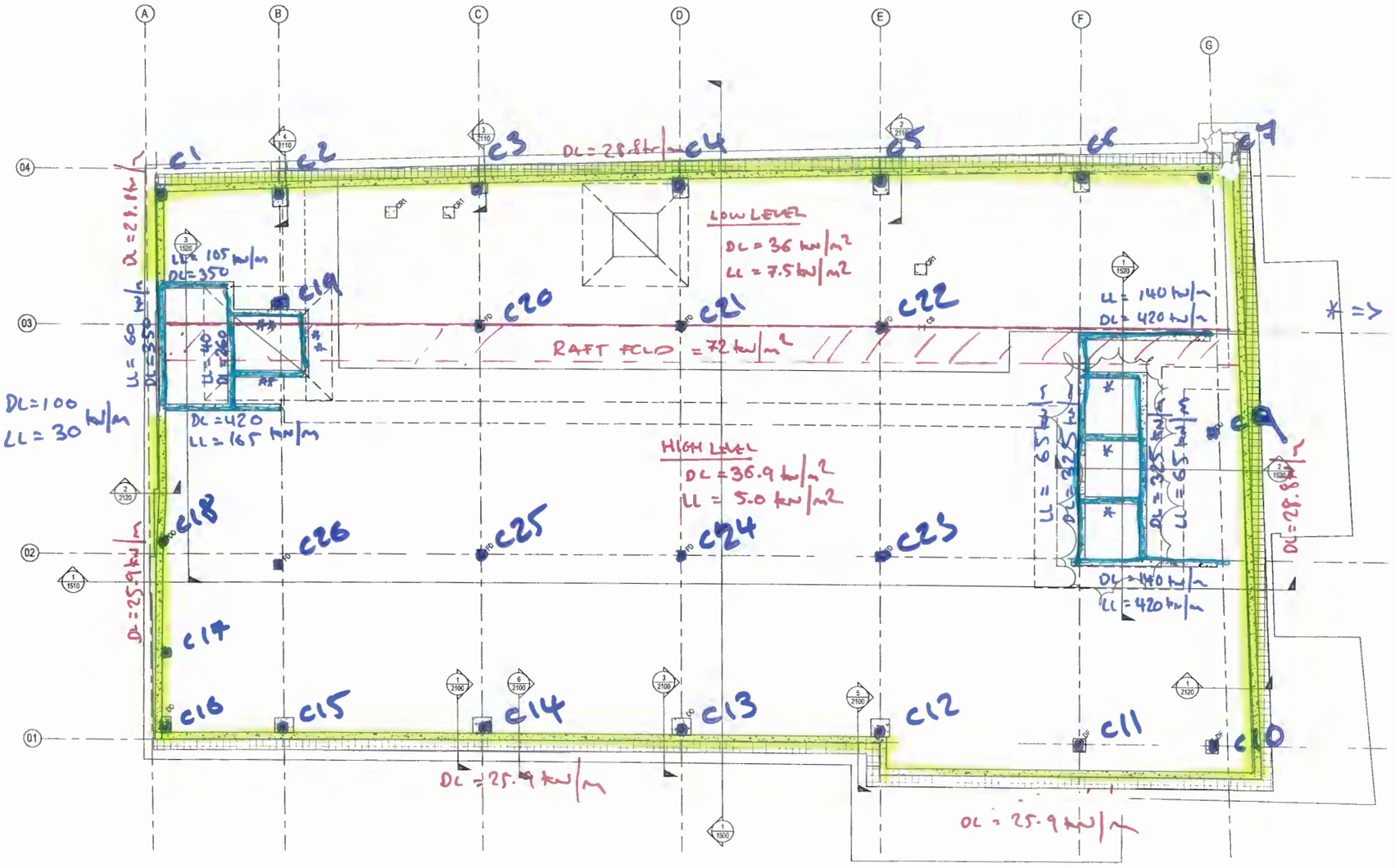
LOCATION	CALCULATIONS	OPTIONS	
	Loads for 13A are considered similar to the Cu 2A		
		DL	LL
	DL =	9.1	
	LL =		3.0
	Plant =		7.5
	Building 5 only 5 floors		
	From the attached plan		
		DL	LL
4x	C1 Area = 9.8m²	662	250
4x	C2 Area = 17.1m²	1127	436
2x	C3 Area = 20.3m²	1354	518
2x	C4 Area = 31.3m²	2075	798
2x	C5 Area = 9.8m²	662	250
2x	C6 Area = 16.2m²	1094	416
2x	C7 Area = 16.2m²	1094	416
	C8 Area = 9.8m²	662	250
	C9 Area = 18.4m²	1236	386
	Total Area = 323.8m²		

STE 1162 1 BEDFORD AVENUE

ESTIMATED EXISTING LOADS

1 BEDFORD AV. (OFFICE)





1 BEDFORD AVENUE

PROPOSED BUILDING LOADS

This drawing should not be scaled. Dimensions to be verified on site.
Any discrepancies should be referred to the Engineer prior to work being put in hand
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GENERAL NOTES

07/10/2014 13:59 A19
IN PROGRESS

Rev	Date	Description	By

Amendments

Project: One Bedford Avenue

Title: BASEMENT GENERAL ARRANGEMENT

Client: Exemplar Properties (Bedford) Ltd

Waterman

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Drawing status: PRELIMINARY

Designer: Designer	Checked By: Checker	Project No: STR11621
Drawn By: Author	Date:	Works Order No:
Scale @ A1: 1 100		
Publisher: WSL	Zone: SA	Level: 20	Number: 0090

Central:\INT-LNCS\WSL\Projects\STR11621\CAD\DGN\STR11621-14-Stage D.rvt

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Consulting Engineers

Sheet No. 1 Job No. 721621
By TMN Date 7/01/14
Checked ____ Date ____

Calculations

TITLE 1BA – PRECAST COLUMN LOADS

LOCATION	CALCULATIONS	OPTIONS	
	FROM LTD & EXCEL SPREADSHEET.	DL	LL
	C1	580	195
	C2	1815	840
	C3	2290	840
	C4	2890	1540
	C5	2400	970
	C6	2270	1270
	C7	1400	840
	C8 NOT IN SEGMENT		
	C9	840	600
	C10	1500	900
	C11	2770	1575
	C [illegible]	[illegible]10	162[illegible]
	[illegible]	89[illegible]	
	C14	2890	1540

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Consulting Engineers

Sheet No. 2 Job No. STR1162\

By. JMN Date 7-10 14

Checked Date

Calculations

TITLE. IBA - Revised Column Loads

LOCATION	CALCULATIONS	OPTIONS	
		D2	LL
	C15	2155	1045
	C16	810	370
	C17	1210	980
	C18	1310	930
	C19	3500	1940
	C20	4670	3020
	C21	4670	3020
	C22	4600	3300
	C23	5090	3420
	C24	5300	3570
	C25	4630	3130
	C26	3450	2580