Providing Ground Solutions

Walsh Associates

Camden Lock Village, London – Proposed Building E

Geotechnical and Geoenvironmental Interpretative Report – Revision 2

March, 2015

Card Geotechnics Limited
4 Godalming Business Centre, Woolsack Way,
Godalming, Surrey, GU7 1XW
Telephone: 01483 310 600
www.cgl-uk.com

Author	James Morrice, Engineer *MSc BEng (Hons) MCSM*				
Checked	Keisha Smith, Principal Engineer *MSc BSc (Hons) CEnv MIEnvSc*				
Approved	Nick Langdon, Director *MSc BEng DIC CEnv CEng CMgr FICE FGS FCMI MIoD*				
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EXECUTIVE SUMMARY

Card Geotechnics Limited (CGL) has been commissioned by Walsh Associates on behalf of Stanley Sidings Limited to complete a Geotechnical and Geoenvironmental Interpretative Report for a site at Camden Lock, London. The proposed development of the subject site (39 – 45 Kentish Town Road), known as Area E, is proposed to form part of the approved 2013 masterplan across the Hawley Warf area of Camden Lock. The subject site currently comprises open land covered with grass and weeds. The proposal is a multi-storey building with a basement comprising flexible class B1/D2 use in the basement and ground floors with residential above and communal landscaped areas.

Historical mapping indicates that the site consisted of open fields until the *Regent's Canal* was constructed along the southern and western boundaries in the early 1800s, with associated residential properties constructed across the site. These properties were later converted to retail units and are noted on the available maps. These buildings were demolished sometime between 1973 and the present day.

Historical mapping indicates that the area did not suffer bomb damage during the Second World War. A detailed unexploded ordnance (UXO) risk assessment undertaken by 6 Alpha Associates Limited for the area immediately to the north of the site (Building D) indicated that the risk posed by UXO in this area is 'low to medium' and it is considered that the same rating applies to the study site.

Local geological mapping and records indicates that the site is directly underlain by the London Clay Formation. An intrusive investigation, comprising ten window sampler boreholes to a maximum depth of 5.45mbgl was undertaken in January 2015 on Area E. A number of refusals were noted in the eastern part of the site due to concrete obstructions from approximately 1.0mbgl to 1.4mbgl, thought to be associated with the former buildings in this area. Ground gas and groundwater monitoring wells were installed in three of the boreholes, with subsequent monitoring visits undertaken.

The investigation encountered limited Made Ground (0.7m to 1.4m thick) underlain by the Weathered London Clay Formation, which extended to the base of the boreholes. No groundwater strikes were encountered during the investigation. However, perched groundwater was encountered in all three boreholes during the subsequent monitoring visits at 3.28mbgl to 4.78mbgl (21.01mOD to 22.66mOD).

Negligible concentrations and flow of ground gas were recorded during the monitoring visits and a gas screening value of 0.0198l/hr has been calculated for the site. The site therefore conforms to Characteristic Situation 1 and no ground gas protection measures are therefore required.

With the exception of asbestos, arsenic, lead and benzo(a)pyrene in the Made Ground, concentrations of contaminant analysed were found to be below the assessment criteria for the *Residential (without plant uptake)* land use. It is anticipated that the Made Ground at the site will be removed during construction of the proposed basement. However, where Made Ground remains, it is recommended that a capping layer, comprising a minimum 150mm topsoil over 300mm subsoil and a geotextile membrane, is installed in areas of permanent communal landscaping.

A preliminary assessment of the Topsoil/Made Ground for waste classification purposes indicates that the majority of this material may be classified as 'not hazardous' with respect to waste disposal. However, waste acceptance criteria (WAC) testing demonstrates that the 'not hazardous' samples should be disposed of in a non-hazardous landfill due to an exceedance of sulphate. The Made Ground in the area of WS11 where asbestos fibres have been identified would need to be disposed at a non-hazardous landfill that accepts asbestos waste, or a hazardous landfill depending on the quantity of asbestos present. Further asbestos quantification testing in this area would be required by the landfill prior to disposal.

Piled foundations are considered suitable for the proposed development of the site. A preliminary assessment of pile working loads demonstrates that a range of capacities from 530kN to 5,810kN is achievable using piles 0.45m to 1.2m in diameter and 10m to 25m in length, respectively, with the piles being bored from basement level. The final pile design should be undertaken by the specialist piling contractor engaged to undertake the works. The London Clay Formation has a medium to high volume change potential and floor slabs should therefore be designed as suspended in order to mitigate potential damage due to heave. It is anticipated that shallow excavations will remain stable in the short term.

Buried concrete within the London Clay Formation should be designed to DS-4 and AC-3s if disturbed during construction (i.e. during basement excavation), or DS-3 and AC-2s if undisturbed during construction, for example where piled foundations are employed. Buried concrete within the Made Ground should be designed to DS-1 and AC-1.

INTRODUCTION

Card Geotechnics Limited (CGL) has been commissioned by Walsh Associates on behalf of Stanley Sidings Limited to undertake a geotechnical and geoenvironmental intrusive investigation to assess the ground conditions at a site proposed for development at Camden Lock Village, London.

The proposed development of the site is part of a wider scheme across the Hawley Warf area of Camden Lock. Two previous reports have been issued by CGL and approved under the relevant planning authorities by Camden Council for the Proposed School Site[1] on Hawley Road and the remainder of the wider masterplan site[2]. In addition, the wider masterplan site has been the subject of a number of previous reports, by RPS, including;

- Phase 1 Environmental Risk Assessment (RPS 2009)[3]
- Archaeological Desk Based Assessment (RPS 2009)[4]

Pertinent information within the RPS reports is summarised in Sections 1 and 3 of this report and has been used to inform the ground model for the purpose of providing geotechnical recommendations. However, the full reports should be referred to for further details.

The objectives of this report are to:

- provide a summary of the site history and environmental setting;
- provide information on the ground conditions;
- provide an assessment and recommendations relating to the potential for soil and groundwater contamination and ground gas; and
- provide geotechnical recommendations to assist with foundation, floor slab and pavement design.

[1] CGL (2014) Camden Lock, London – Proposed School Site. *Geotechnical and Geoenvironmental Interpretative Report.* Ref: CG/18067. December 2014
[2] CGL (2015) Camden Lock Village, London. *Geotechnical and Geoenvironmental Interpretative Report.Rev1* Ref: CG/18067A February 2015
[3] RPS (2009) Camden Lock Village London Borough of Camden. *Phase 1 – Environmental Risk Assessment*. Ref: HLEI4880/001R. October 2009
[4] RPS (2009) Camden Lock Village London Borough of Camden. *An Archaeological Desk Based Assessment*. Ref: JLK0617 RO1. November 2009

1. SITE LOCATION AND DESCRIPTION

1.1 Site location

The site is situated off Kentish Town Road in Camden, northwest London. The Ordnance Survey grid reference for the approximate centre of the site is 528916N, 184174E.

A site location plan is presented as Figure 1.

1.2 Site description

The site is triangular in shape and is bordered by offices to the north, Kentish Town Road to the east and the *Regent's Canal* and *Grand Union Towpath* to the south and west. The London Underground Limited (LUL) Northern Line is known to run to the east of the site beneath Kentish Town Road.

At the time of the site works, the site comprised open land covered with grass and weeds. Some rubbish (cans, bottles and plastic bags) and stored materials (barriers and road signs) were noted across the site.

The site forms part of the wider proposed development of the Hawley Warf area of Camden Lock, with the proposed Building D situated immediately to the north of the site.

A site layout plan is presented as Figure 2.

1.3 Proposed development

It is proposed to construct a multi-storey building with a single storey basement and communal landscaped areas. The upper floors of the building will comprise residential properties, with flexible office and gym spaces on the ground and basement level. The proposal has been designed as an annex so that Area E will be joined with Area D to create one larger building.

Proposed development plans are included as Appendix A.

1.4 Historical development

Maps detailing the historical development of the site were included by RPS in their October 2009[3] and November 2009[4] reports. The information from these maps indicates that the site consisted of open fields until the *Regent's Canal* was constructed in the early 1800s, with associated residential properties constructed across the site. These properties are noted on the maps included within the RPS reports (1746 to 1973), indicating that they were demolished sometime between 1973 and the present day.

Anecdotal information from the Camden Council Planning website[5] indicates that the buildings on site were converted to retail units sometime prior to 1967. These buildings subsequently fell into disrepair and were demolished between 2006 to 2008, after which the site remained in its current state.

1.5 Bomb damage and unexploded ordnance

Historical mapping included within the November 2009 RPS report[4] indicates that the area did not suffer bomb damage during the Second World War.

A detailed unexploded ordnance (UXO) risk assessment[6] was undertaken by 6 Alpha Associates Limited in September 2014 for the area immediately to the north of the site (Building D). The report notes that the risk posed by UXO in this area is 'low to medium' and it is considered that the same rating applies to the study site.

1.6 Anticipated ground conditions

1.6.1 Published and unpublished geology

The British Geological Survey (BGS) map sheet 256[7] indicates that the site is directly underlain by the London Clay Formation, which consists of stiff blue grey silty clay, weathering to brown silty clay.

The BGS holds records of a number of historical ground investigations within 300m of the site. Selected logs are summarised in Table 1 and are included in Appendix B.

[5] www.camden.gov.uk/ccm/navigation/environment/planning-and-built-environment/ Accessed 20/02/15
[6] 6 Alpha Associates Limited (2014) *Detailed Unexploded Ordnance (UXO) Risk Assessment*. Ref: P4063. September 2014
[7] British Geological Survey. (1994) North London. Sheet 256. Solid and Drift Geology 1:50,000.

Table 1 - Summary of BGS historical borehole records

BH record reference	Distance (m)	Direction	Depth to base of BH (mbgl)	Ground water level (mbgl)	Depth to top of stratum (mbgl)				
					Made Ground	London Clay Formation	Lambeth Group	Thanet Sand	Chalk
TQ28SE5	80	SW	91.4	NR[1]	-[2]	0.0	42	-	64
TQ28SE1203	170	SE	18.7	1.1	0.0	1.5	-	-	-
TQ28SE1204	210	SE	18.4	NR	0.0	0.9	-	-	-
TQ28SE1206	180	SE	9.6	1.1	0.0	2.1	-	-	-
TQ28SE1208	210	SE	9.4	NR	0.0	1.37	-	-	-
TQ28SE1239	270	NW	3.0	-	0.0	0.63	-	-	-
TQ28SE1240	270	NW	3.0	-	0.0	0.5	-	-	-
TQ28SE1241	270	NW	3.0	-	0.0	0.8	-	-	-
TQ28SE1242	270	NW	3.0	-	0.0	0.6	-	-	-
TQ28SE1491	100	SE	198.7	91.7	0.0	6.7	44.8	53.9	125.0
TQ28SE2272	260	SW	1.1	-	0.0	1.08	-	-	-

Notes
1. NR = not recorded
2. - = Information not included on historical log

1.6.2 Hydrogeology and hydrology

1.7 Hydrogeology

The Environment Agency (EA)[8] has produced an aquifer designation system consistent with the requirements of the Water Framework Directive. The designations have been set for superficial and bedrock geology and are based on the importance of aquifers for potable water supply and their role in supporting surface water bodies and wetland ecosystems.

The underlying London Clay Formation is classified as an 'Unproductive Strata' and the site is not within a Groundwater Source Protection Zone (SPZ).

[8] www.environment-agency.gov.uk (September 2014)

1.8 Hydrology

Figure 11 of the Hampstead Heath Surface Water Catchments and Drainage of the Camden Geological, Hydrogeological and Hydrological report produced by Arup[9] presents a copy of the 'Lost Rivers of London' map produced by Barton. A number of springs outcrop at the base of the Bagshot Formation to the north, flowing through various drainage channels and in various directions into the watercourses of the district (most of which are now diverted underground), including the River Westbourne, River Tyburn and River Fleet. The map indicates that two tributaries of the River Fleet join some 34m to the northeast of the site, where the river then trends south east along Camden Street.

Historical mapping for the site (Survey of the Borough of St Marylebone 1834) provided by the client, indicates that before the River Fleet was culverted it passed through the northeastern part of the site. Little evidence of this historical river course was noted during the site investigation and it is expected that it may have been removed during the construction of the historical developments onsite and immediately to the north (Building D), and during construction of the *Regent's Canal*.

With reference to the Arup report[9], the site is approximately 2.2km southeast of the catchment for the pond chains on Hampstead Heath. Additionally, with reference to the EA website, the site is not within a Flood Risk Zone.

Current flood mapping (Figure 15 CPG4[10]) indicates that Kentish Town Road, on the eastern site boundary was impacted by flooding in 1975. However, this road was not impacted by the 2002 flooding in the region or by the serious national floods in 2007 and 2012. It is noted in the London Borough of Camden flood risk management strategy[11] and Report of the Floods Scrutiny Panel[12] that the 1975 flood event was caused by the heaviest and most concentrated rainfall event recorded in this part of Camden. This 1 in 100 year event was preceded by a very dry summer and is therefore not considered to be representative of typical conditions in the area. In addition, the site is not within an area identified by the EA to be at risk of surface water flooding. Following the 2002 flood event, new infrastructure, including larger diameter sewers and a holding tank, was installed in the Borough to mitigate the potential for future flooding.

[9] Ove Arup and Partners Limited (2010). *London Borough of Camden. Camden geological, hydrogeological and hydrological study. Guidance for subterranean development.* Issue 01, November 2010.
[10] Camden Planning Guidance, CPG4, Basements and Lightwells, September 2013.
[11] London Borough of Camden (2014) Managing Flood Risk in Camden: The London Borough of Camden flood risk management strategy
[12] London Borough of Camden (2003) Floods in Camden: Report of the Floods Scrutiny Panel

1.9 Environmental setting

The previous report by RPS[3] provides information on the environmental setting of the wider development site, including Building E, and possible sources of soil and groundwater contamination. The key points are summarised below:

- There are no recorded landfill sites within 500m of the wider site. However, there are two waste transfer sites, located 120m southwest and 130m south of the site.
- No 'major' or 'significant' pollution incidents are noted within 500m of the site.
- There is the potential for arsenic and lead contamination to be present within the soils at the site, resulting from the spreading of ash in private gardens during the pre-Victorian period to the 1950s.
- There are eleven industrial activities within 500m of the site, including vehicle respraying, petrol stations and dry cleaners.
- The site is not in a radon affected area.

1.10 Preliminary risk assessment

The October 2009 RPS report[3] included a preliminary risk assessment for the masterplan site. The maps and information obtained as part of the RPS report include the Building E area and it is considered that the findings of the report are applicable to the Building E area. The key points of the report are summarised below:

- It is likely that contamination is present within the soils due to historical land use on site and in the surrounding area.
- The potential pathways to human health receptors include dermal contact, inhalation and ingestion of contaminants. Due to the underlying London Clay Formation, there is not considered to be a pathway for contaminants to reach the underlying Chalk aquifer.

In addition to the potential risks identified by RPS, due to the age of the previously demolished buildings at the site, it is considered that there is the potential for asbestos or asbestos-containing material to be present within the Made Ground..

2. CURRENT GROUND INVESTIGATION

2.1 Fieldwork

Following the previous phases of investigation across the masterplan site (Phases 1 to 3), an intrusive investigation (Phase 4) was undertaken at the site on 14 January 2015. The investigation comprised ten window sampler boreholes (WS10 to WS15, WS11A, WS11B, WS14A, WS14B), which extended to a maximum depth of 20.33 metres above Ordinance Datum (mOD), or 5.45 metres below ground level (mbgl). The investigation was broadly undertaken in accordance with the requirements of BS 5930:1999[13] and BS 10175:2011[14].

The borehole arisings were recorded and representatively sampled by a suitably qualified geotechnical and geoenvironmental engineer from CGL in order to obtain samples for laboratory testing, and to characterise the near surface ground conditions across the site. Insitu testing, including SPTs (Standard Penetration Tests), undertaken in the boreholes, and hand shear vanes undertaken on the arisings. Soil samples were obtained for chemical and geotechnical laboratory analysis. Standpipes were installed in three boreholes (WS10, WS11B and WS12) to enable subsequent gas and groundwater monitoring to be undertaken.

The locations attempted on the eastern boundary of the site (WS11 and WS14) refused at approximately 1.0mbgl. This is anticipated to be due to historical foundations associated with the previous buildings in this area of the site. Window sampler holes WS14/WS14A/WS14B were abandoned due to the refusals and WS11 was moved approximately 5m to the west where WS11B progressed to 5.45mbgl.

A plan showing the location of the exploratory boreholes is presented as Figure 2 and the borehole logs are included as Appendix C.

2.2 Monitoring

Six ground gas and groundwater monitoring visits have been undertaken to date, on 20th and 26th January and 6th, 10th, 16th and 24th February 2015. Copies of the monitoring records are included as Appendix D.

[13] BS 5930:1999*; Code of practice for site investigations, Incorporating Amendment 2*, British Standards Institute. 1999.
[14] BS 10175:2011*; Code of practice for the Investigation of Potentially Contaminated Sites.* British Standards Institute. 2011.

2.3 Laboratory testing

2.3.1 Chemical

Ten representative soil samples (five Made Ground and five Weathered London Clay Formation) were submitted to i2 Analytical Limited (a UKAS and MCERTS accredited laboratory) for chemical testing. The analysis included the following determinants.

- Soil Organic Matter (SOM);
- Heavy metals including; arsenic, barium, beryllium, boron, cadmium, chromium, copper, lead, mercury, nickel, selenium, vanadium and zinc;
- Total Petroleum Hydrocarbons (TPH) and Polycyclic Aromatic Hydrocarbons (PAH);
- Total Monohydric Phenols;
- Total Cyanide;
- Asbestos screen and identification; and
- pH and sulfate determination.

The laboratory analysis results are presented in Appendix E.

2.3.2 Geotechnical

Four samples of Weathered London Clay Formation were sent for geotechnical laboratory analysis at Albury SI Limited. The analysis included:

- Moisture Content, and;
- Atterberg Limits.

The results of the analysis are presented in Appendix F.

3. GROUND AND GROUNDWATER CONDITIONS

3.1 Summary

The ground conditions encountered are summarised in Table 2. The window sample borehole logs are included in Appendix C.

Table 2. Summary of ground conditions

Stratum	Level to top of stratum (mOD) [mbgl]	Typical thickness (m)
Dark brown slightly clayey gravelly fine to coarse sand with frequent rootlets. Gravel is fine to coarse subrounded to subangular of flint. [MADE GROUND – TOPSOIL]	25.78 to 26.07 [0.0]	0.15 to 0.25
Firm brown grey to black slightly sandy gravelly clay. Sand is fine to coarse. Gravel is fine to coarse subrounded to angular of red and yellow brick, concrete and slate with occasional wood fragments and rare clinker. Obstructions were identified at 1.0 to 1.4mbgl within WS11, WS11A, WS14, WS14A and WS14B. [MADE GROUND]	25.59 to 25.92 [0.15 to 0.25]	0.50 to 1.25
Firm to very stiff, medium to high strength, very occasionally low strength, light brown occasionally mottled grey slightly silty occasionally slightly sandy CLAY. [WEATHERED LONDON CLAY FORMATION]	24.74 to 25.30 [0.7 to 1.4]	>4.75 Base not proved in borehole

The ground conditions encountered during the ground investigation generally correlated with the BGS mapping of the area, with varying Made Ground directly overlying the Weathered London Clay Formation. The upper surface of the Weathered London Clay Formation was found to be relatively consistent across the site. The ground conditions encountered are consistent with the boreholes undertaken across the wider development site (Phases 1 to 3 of the ground investigation), which have been used to inform the recommendations for the subject site.

3.2 Made Ground

The Made Ground was found to be relatively consistent across the site and comprised slightly sandy gravelly clay . The gravel consisted of flint, brick, concrete and slate with occasional fragments of wood and clinker. Although occasional black staining was noted, no visual or olfactory evidence of contamination was encountered in the boreholes or SPTs.

3.3 Weathered London Clay Formation

The Weathered London Clay Formation was proved to a maximum depth of 20.33mOD (5.45mbgl). No unweathered London Clay Formation was encountered during the investigation on the subject site. However, based on the nearby deep borehole (BH7) in the Building D area, some 1.0m north of the site, it is assumed that the clay becomes unweathered at around 16.9mbgl (8.9mOD).

SPT 'N' values within the Weathered London Clay Formation ranged from 6 to 23. Undrained shear strength values can be derived from SPT 'N' values using established correlations[15] (assuming f=4.5) and range from 27kPa to 104kPa, indicating that the clay is low to high strength. Plots of SPT 'N' values and correlated undrained shear strength against level (mOD) are presented as Figure 3 and Figure 4, respectively. These show the strength of the Weathered London Clay Formation to increase linearly with depth below ground level.

The moisture content and Atterberg Limits of the clay are summarised in Table 3.

Table 3. Summary of moisture content and Atterberg Limits

Strata	Moisture content (%)	Liquid limit (%)	Plastic limit (%)	Modified Plasticity Index, I' (%)
Weathered London Clay Formation	27.2 to 33.8	61 to 80	24 to 28	37 to 52

These results indicate that the London Clay Formation at this site is a high to very high plasticity clay of medium to high volume change potential.

[15] Tomlinson, M.J. (2001) *Foundations Design and Construction (7th Ed.)*. Pearson Prentice Hall

3.4 Groundwater

No groundwater was encountered in the window sample boreholes during drilling. However, groundwater was noted during the subsequent monitoring visits. The groundwater levels noted during the visits are summarised in Table 4.

Table 4. Summary of groundwater levels

Borehole	Level to groundwater (mOD) [Level to base of well (mOD)]					
	20/01/15	**26/01/15**	**06/01/15**	**10/02/15**	**16/02/15**	**24/02/15**
WS10	21.52 [21.0]	21.70 [21.0]	21.58 [21.0]	22.50 [21.0]	22.22 [21.0]	22.25 [21.0]
WS11B	21.01 [20.8]	21.34 [20.8]	21.05 [20.8]	21.62 [20.8]	21.26 [20.8]	21.29 [20.9]
WS12	21.38 [21.0]	21.64 [21.0]	21.40 [21.0]	22.66 [20.9]	21.82 [21.0]	21.85 [21.0]

The monitoring records indicate that standing groundwater recorded in monitoring wells across the site range from between 3.28mbgl to 4.78mbgl (21.01mOD to 22.66mOD). This is considered unlikely to represent a continuous water body across the site and is anticipated to be due to water seepage at the interface between the Made Ground and London Clay Formation and also potentially due to very slow seepage within the silty sandy layers/pockets within the Weathered London Clay Formation.

3.5 Sulfate and pH conditions

A total of five soil samples from across the site have been tested for pH and sulfate conditions. The results of the testing are summarised in Table 5.

Table 5. Summary of sulfate and pH conditions

Borehole	Depth (mbgl)	Strata	Water soluble sulfate (g/l)	Acid soluble sulfate (%)	Total sulfur (%)	Total potential sulfate (%)	pH
BH11B	0.5	Made Ground	0.57	1.1	550	1650	7.3
BH13	0.5	Made Ground	0.27	0.54	-	-	9.5
BH10	2.0	Weathered London Clay Formation	0.25	0.51	290	870	7.9
BH12	3.0	Weathered London Clay Formation	0.028	0.057	-	-	7.9
BH13	2.2	Weathered London Clay Formation	0.45	0.89	530	1590	7.8

The assessment of these results is discussed in further detail in Section 6.7.

4. CONTAMINATION ASSESSMENT

4.1 Risks to human health (long-term chronic risks)

Soil Guideline Values (SGVs) have not been issued by the Environment Agency for the "*Residential (without plant uptake)*" land-use category. The soil results have therefore been compared to *Generic Assessment Criteria* (GACs) that have been derived in-house by CGL using the *Contaminated Land Exposure Assessment (CLEA)* model[16] and version 1.06 of the CLEA software to assess the risk to human health from chemical contamination in the soils.

The GACs represent conservative screening criteria and have been calculated using the default parameters for the standard land use scenario set out in the CLEA technical report and toxicological inputs in line with the requirements of *Science Report SC050021/SR2*[17] and, in the case of petroleum hydrocarbons, Science *Report P5-080/TR3*[18]. In the case of selenium, mercury, arsenic, nickel and the BTEX compounds, SGVs have been issued by the Environment Agency for other land-use categories and the physical-chemical and toxicological inputs have been taken from the published SGV reports.

The GACs have been generated assuming a sandy loam soil type and a Soil Organic Matter of 2.5% for the Made Ground and 1.0% for the natural soils, which are suitable assumptions for the site in question. More detailed information on the derivation of the CGL GACs can be provided upon request. The results of the assessment are set out below in Table 6 to Table 9. The Made Ground and the natural soils have been assessed separately.

[16] Environment Agency. (January 2009). *Updated technical background to the CLEA model*. Science Report SC050021/SR3.
[17] Environment Agency. (January 2009). *Human health toxicological assessment of contaminants in soil*. Science Report SC050021/SR2.
[18] Environment Agency. (February 2005). *The UK Approach for Evaluating Human Health Risks from Petroleum Hydrocarbons in Soils*. Science Report P5-080/TR3.

In March 2014, the Department for Environment, Food and Regional Affairs (DEFRA) issued SP1010 Development of Category 4 Screening Levels (C4SLs) for assessment of land affected by contamination - Policy companion document[19], along with the results of the work by the C4SLs development team[20]. This includes a set of C4SL values for arsenic, benzene, benzo(a)pyrene, cadmium, chromium VI and lead for sandy loam soil with SOM =6%.

These values are primarily to support site assessment with respect to Part 2A of the Environmental Protection Act 1990, being indicative of low health risk and therefore of a site not determinable under Part2A. This is in comparison with the SGVs and GACs which represent minimal risk. The C4SLs are based on revised slightly less conservative exposure models and toxicology based on Low Level of Toxicological Concern (LLTC) rather than the Heath Criteria Values (HCV) on which the SGVs/GACs are based. The difference in risk level between HCV (minimal risk) and LLTC (low risk) is slight, and it is noted that both are still within the Category 4 level and below the Category 3/4 level boundary considered by DEFRA to be the likely de facto minimum standard chosen by developers. The C4SLs are still strongly conservative in accordance with the Contaminated Land Regulations and meet the objectives of the NPPF that:

- *the site is suitable for its new use taking account of ground conditions and land instability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation; and*

- *after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part IIA of the Environmental Protection Act 1990.*

On this basis CGL considers it is appropriate to use C4SLs for the published contaminants. In the event impacts are identified on a site above the GAC/SGV level for these contaminants, CGL will utilise the C4SLs to assess whether these pose a low risk to developments and Public Open Space applications.

It should be noted that due to the limited number of samples retrieved from the site, statistical analysis has not been undertaken. Additionally, the soils saturation limit (SSL) values have not been used, as no free product was noted during the intrusive investigation.

[19] DEFRA (March 2014) *SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination – Policy Companion Document*
[20] CL:AIRE (March 2014) *SP1010: Development of Category 4 Screening Levels for Assessment of Land Affected by Contamination*

Table 6. Summary of soil contamination (risks to human health) - Made Ground

Contaminant	SGV or GAC @ 2.5% SOM for Residential (without plant uptake) land-use (mg/kg)	Notes on soil saturation limits (SSL)[1]	Measured range (mg/kg)	Measured range > Assessment Criteria? (Y/N)
SOM (%)	*[2]		2.0 to 4.7	*
Arsenic	35[3]	-	**16 to 44.0**	**Y**
Cadmium	85[3]	-	<0.2	N
Chromium (total)	38	-	20.0 to 32.0	N
Lead	310[7]	-	**290.0 to 1,300.0**	**Y**
Mercury (inorganic)	240[3]	-	0.8 to 2.4	N
Selenium	600[3]	-	<1.0	N
Boron	*		0.4 to 2.8	*
Copper	6,700	-	47.0 to 220.0	N
Nickel	130[3]	-	16.0 to 44.0	N
Zinc	20,000	-	170.0 to 470.0	N
Antimony	*		2.5 to 44.0	*
Barium	*		160.0 to 350.0	*
Beryllium	26	-	0.6 to 2.7	N
Vanadium	210	-	41.0 to 89.0	N
Phenols[4]	420[3]	-	<1.0	N
Cyanide	*		<1.0	*
BTEX compounds				
Benzene	0.50[5]	-	<0.001	N
Toluene	1,300[5]	-	<0.001	N
Ethyl benzene	380[5]	-	<0.001	N
m-xylene[6]	130[5]	-	<0.001	N
o-xylene[6]	140[5]	-	<0.001	N
p-xylene^	130[5]	-	<0.001	N

Notes:

1. - = green; (a) = amber i.e. GAC set to model output, [SSL provided in square brackets] ; (b) = red i.e. SSL exceeded & considered to affect interpretation. GAC calculated in accordance with the CLEA Software Handbook ; (c) = based on direct contact; (d) GAC limited to SSL.
2. * = no value currently defined
3. Based on the published Soil Guideline Value (Environment Agency, 2009), adjusted for no plant uptake and 2.5% SOM
4. GAC relates to Phenol (C_6H_5OH) only.
5. Based on the published SGVs for BTEX at 6% SOM (Environment Agency, 2009), adjusted for 2.5% SOM and no plant uptake
6. Concentrations for total xylenes should be compared to the value for m-xylene for fresh spills and to o-xylene for all other cases.
7. Published C4SL for lead (DEFRA, 2014)

Table 7. Summary of soil contamination (risks to human health) - Made Ground cont.

Contaminant	SGV or GAC @ 2.5% SOM for Residential (without plant uptake) land-use (mg/kg)	Notes on soil saturation limits (SSL)[1]	Measured range (mg/kg)	Measured range > Assessment Criteria? (Y/N)
Total Petroleum Hydrocarbons (TPH)				
TPH aliphatic EC5-6	41	-	<0.1	N
TPH aliphatic EC>6-8	100	-	<0.1	N
TPH aliphatic EC>8-10	25	-	<0.1	N
TPH aliphatic EC>10-12	540	(b)	<1.0	N
TPH aliphatic EC>12-16	4,300	(b)	<2.0	N
TPH aliphatic EC>16-35	89,000	(b)	<16.0 to 229.0	N
TPH aromatic EC5-7	0.50	-	<0.1	N
TPH aromatic EC>7-8	1,300	-	<0.1	N
TPH aromatic EC>8-10	41	-	<0.1	N
TPH aromatic EC>10-12	210	-	<1.0 to 1.5	N
TPH aromatic EC>12-16	1,500	(b)	<2.0 to 12.0	N
TPH aromatic EC>16-21	1,100 [150]	(a)	<10.0 to 81.0	N
TPH aromatic EC>21-35	1,300 [12]	(a)	<10.0 to 550.0	N
Polycyclic Aromatic Hydrocarbons (PAH)				
Acenaphthene	4,500	(b)	<0.1 to 2.2	N
Anthracene	23,000 [19]	(a)	<0.1 to 4.5	N
Benzo(a)anthracene	13 [4.3]	(a)	0.26 to 7.5	N
Benzo(a)pyrene	2.4 [2.3]	(a)	**<0.1 to 7.7**	**Y**
Benzo(b)fluoranthene	24 [3.0]	(a)	0.35 to 9.3	N
Benzo(g,h,i)perylene	250 [0.05]	(a)	<0.05 to 2.8	N
Benzo(k)fluoranthene	24 [1.7]	(a)	0.18 to 2.4	N
Chrysene	210 [1.1]	(a)	0.29 to 7.3	N
Dibenzo(a,h)anthracene	2.3 [0.01]	(a)	<0.1 to 0.69	N
Fluoranthene	3,200 [47]	(a)	0.46 to 18.0	N
Fluorene	3,100	(b)	<0.1 to 2.9	N
Indeno(1,2,3-cd)pyrene	23 [0.15]	(a)	<0.1 to 2.5	N
Naphthalene	3.9	-	<0.05 to 1.1	N
Pyrene	2,400 [5.5]	(a)	0.38 to 14.0	N

Notes:

1. - = green; (a) = amber i.e. GAC set to model output, [SSL provided in square brackets] ; (b) = red i.e. SSL exceeded & considered to affect interpretation. GAC calculated in accordance with the CLEA Software Handbook ; (c) = based on direct contact; (d) GAC limited to SSL.

Table 8. Summary of soil contamination (risks to human health) - natural soil

Contaminant	SGV or GAC @ 1% SOM for Residential (without plant uptake) land-use (mg/kg)	Notes on soil saturation limits (SSL)[1]	Measured range (mg/kg)	Measured range > Assessment Criteria? (Y/N)
SOM (%)	*[2]		1.4 to 1.6	*
Arsenic	35[3]	-	9.7 to 14.0	N
Cadmium	85[3]	-	<0.2	N
Chromium (total)	38	-	32.0 to 52.0	Y
Chromium (III)	1,100	-	32.0 to 52.0	N
Chromium (VI)	4.2	-	<1.2	N
Lead	310[7]	-	22.0 to 150.0	N
Mercury (inorganic)	240[3]	-	<0.3 to 0.7	N
Selenium	600[3]	-	<1.0	N
Boron	*		<0.2 to 1.4	*
Copper	6,700	-	24.0 to 51.0	N
Nickel	130[3]	-	26.0	N
Zinc	20,000	-	76.0 to 79.0	N
Antimony	*		<0.1 to 2.1	*
Barium	*		82.0 to 150.0	*
Beryllium	26	-	1.2 to 1.7	N
Vanadium	210	-	64.0 to 89.0	N
Phenols[4]	310[3]	-	<1.0	N
Cyanide	*		<1.0	*
BTEX compounds				
Benzene	0.27[5]	-	<0.001	N
Toluene	610[5]	-	<0.001	N
Ethyl benzene	170[5]	-	<0.001	N
m-xylene[6]	55[5]	-	<0.001	N
o-xylene[6]	60[5]	-	<0.001	N
p-xylene^	53[5]	-	<0.001	N

Notes:

1. - = green; (a) = amber i.e. GAC set to model output, [SSL provided in square brackets] ; (b) = red i.e. SSL exceeded & considered to affect interpretation. GAC calculated in accordance with the CLEA Software Handbook ; (c) = based on direct contact; (d) GAC limited to SSL.
2. * = no value currently defined
3. Based on the published Soil Guideline Value (Environment Agency, 2009), adjusted for no plant uptake and 2.5% SOM
4. GAC relates to Phenol (C_6H_5OH) only.
5. Based on the published SGVs for BTEX at 6% SOM (Environment Agency, 2009), adjusted for 2.5% SOM and no plant uptake
6. Concentrations for total xylenes should be compared to the value for m-xylene for fresh spills and to o-xylene for all other cases.
7. Published C4SL for lead (DEFRA, 2014)

8. Exceedance is for total chromium. Further analysis indicates that the major component is chromium III (with concentrations below the assessment criteria for chromium III) and the concentration of the more toxic chromium VI is below the assessment criteria.

Table 9. Summary of soil contamination (risks to human health) - natural soil cont.

Contaminant	SGV or GAC @ 1% SOM for Residential (without plant uptake) land-use (mg/kg)	Notes on soil saturation limits (SSL)[1]	Measured range (mg/kg)	Measured range > Assessment Criteria? (Y/N)
Total Petroleum Hydrocarbons (TPH)				
TPH aliphatic EC5-6	24	-	<0.1	N
TPH aliphatic EC>6-8	49	-	<0.1	N
TPH aliphatic EC>8-10	10	-	<0.1	N
TPH aliphatic EC>10-12	540	(b)	<1.0	N
TPH aliphatic EC>12-16	1,500	(b)	<2.0	N
TPH aliphatic EC>16-35	89,000	(b)	<16.0 to 16.8	N
TPH aromatic EC5-7	0.27	-	<0.1	N
TPH aromatic EC>7-8	610	-	<0.1	N
TPH aromatic EC>8-10	17	-	<0.1	N
TPH aromatic EC>10-12	88	-	<1.0	N
TPH aromatic EC>12-16	1,500	(b)	<2.0	N
TPH aromatic EC>16-21	1,300	(a)	<10.0	N
TPH aromatic EC>21-35	1,300 [4.8]	(a)	<10.0 to 17.0	N
Polycyclic Aromatic Hydrocarbons (PAH)				
Acenaphthene	4,500	(b)	<0.1	N
Anthracene	24,000	(a)	<0.1	N
Benzo(a)anthracene	7.7 [1.7]	(a)	<0.1	N
Benzo(a)pyrene	2.3 [0.9]	(a)	<0.1	N
Benzo(b)fluoranthene	22 [1.2]	(a)	<0.1	N
Benzo(g,h,i)perylene	240 [0.02]	(a)	<0.05	N
Benzo(k)fluoranthene	23 [0.7]	(a)	<0.1	N
Chrysene	170 [0.4]	(a)	<0.05	N
Dibenzo(a,h)anthracene	2.1 [0.004]	(a)	<0.1	N
Fluoranthene	3,100 [19]	(a)	<0.1	N
Fluorene	3,100	(b)	<0.1	N
Indeno(1,2,3-cd)pyrene	21 [0.06]	(a)	<0.1	N
Naphthalene	1.6	-	<0.05	N
Pyrene	2,300 [2.2]	(a)	<0.1	N

Notes:

1. - = green; (a) = amber i.e. GAC set to model output, [SSL provided in square brackets] ; (b) = red i.e. SSL exceeded & considered to affect interpretation. GAC calculated in accordance with the CLEA Software Handbook ; (c) = based on direct contact; (d) GAC limited to SSL.

The assessment has indicated that the concentrations of arsenic, lead and benzo(a)pyrene within the Made Ground exceed the applicable human health assessment criteria. Further details of the locations where the elevated concentrations of these contaminants were found to be above the assessment criteria are presented in .

In addition, an asbestos screen was undertaken on 4 samples of Made Ground. Loose fibres of amosite asbestos were detected in one sample (WS11 at 0.5mbgl), which is also included in .

Table 10. Summary of contaminant exceedances

Borehole	**Depth (mbgl)**	**Contaminants which exceed assessment criteria**	**Contaminant concentration (mg/kg)**	**Assessment criteria for the *Residential (without plant uptake)* land use (mg/kg)**
WS10	0.5	Arsenic Lead Benzo(a)pyrene	44.0 1,200.0 7.7	35.0 310.0 2.4
WS11	0.5	Asbestos (amosite fibres) Lead	Present 560.0	No fibres detected 310.0
WS13	0.5	Arsenic Lead	43.0 1,300.0	35.0 310.0

The contaminant concentrations in the natural soils were generally below the assessment criteria for the contaminants tested. Although the testing indicated that concentrations of total chromium recorded in the London Clay were above the assessment criteria, further testing of these samples indicates that the concentrations of total chromium mostly comprised of chromium III (with concentrations below the chromium III criteria), with the recorded concentrations of the more toxic chromium VI being below the laboratory limit of detection and the assessment criterion. Therefore, the concentrations of chromium recorded are not considered to present an unacceptable risk to human health.

4.2 Ground gas assessment

Six rounds of ground gas monitoring have been undertaken in the standpipes installed across the site. The dates of the monitoring visits and the atmospheric pressure and local pressure system are summarised in Table 11.

Table 11. Summary of atmospheric pressures during ground gas monitoring visits

Borehole	**Date of monitoring visit**					
	20/01/15	**26/01/15**	**06/01/15**	**10/02/15**	**16/02/15**	**24/02/15**
Atmospheric Pressure (mb)	1005 to 1007	1022	1025 to 1026	1029	1017	1004 to 1005
Local pressure system	Falling	Rising	Rising	Rising	Falling	Rising

The monitoring records are presented in Appendix D and the results of the monitoring are summarised below:

- Maximum carbon dioxide concentration: 2.2% v/v;
- Maximum methane concentration: <0.1% v/v;
- Maximum flow rate: 0.9l/hr;
- Minimum oxygen concentration: 18.2% v/v.

Based on these findings, and with reference to CIRIA guidance[21], a gas screening value (GSV) of 0.0198l/hr has been calculated for the site, corresponding to Characteristic Situation 1.

[21] CIRIA (2007) *Assessing the risks posed by hazardous ground gases to buildings*

5. RISK ASSESSMENT

5.1 Introduction

In accordance with Contaminated Land Report (CLR) 11[22], a conceptual site model has been developed based on the information gathered during the intrusive investigation and the potential pollutant linkages have been evaluated through a semi-quantitative risk assessment. The risks ratings identified have been assigned in accordance with the DEFRA and Contaminated Land Report (CLR) 6[23], site prioritisation and categorisation rating system which is summarised in Table 12.

Table 12. Risk Rating Terminology

Risk Rating	Description
High Risk	Contaminants very likely to represent an unacceptable risk to identified targets Site probably not suitable for proposed use Enforcement action possible, Urgent action required
Medium Risk	Contaminants likely to represent an unacceptable risk to identified targets Site probably not suitable for proposed use Action required in the medium term
Low Risk	Contaminants may be present but unlikely to create unacceptable risk to identified targets Site probably suitable for proposed use Action unlikely to be needed whilst site remains in current use
Negligible Risk	If contamination sources are present they are considered to be minor in nature and extent Site suitable for proposed use No further action required

Based on the terminology within this table, a refined assessment of the risks posed by the potential pollutant linkages at the site is outlined in

Table 13. A diagrammatic representation of the conceptual site model is provided in Figure 5.

[22] The Environment Agency. (2004). *Model Procedures for the Management of Land* Contamination. CLR 11.
[23] M.J. Carter Associates. (1995*). Prioritisation and Categorisation Procedure for Sites which may be Contaminated*. Department of the Environment. CLR 6

Table 13. Semi-quantitative risk assessment

Source/Medium	Receptor	Potential Exposure Route	Risk Rating
Organic/inorganic contaminants and asbestos within Made Ground	Construction workers	Direct ingestion of soil & dust, inhalation of particulates & vapours and dermal contact	Medium *(due to contaminant concentrations recorded in Made Ground and likely close contact during construction)*
	Future site occupiers	Direct ingestion of soil & dust, inhalation of particulates & vapours and dermal contact	Low to medium *(where soil is exposed due to contaminant concentrations recorded in Made Ground)*
	Vegetation and plants	Root uptake	Low
	Buildings & structures	Direct contact and migration & accumulation within building spaces. Damage to water supply pipes.	Medium
	Groundwater	Leaching and vertical migration of contaminants	Negligible
	Surface water	Lateral migration of contaminants	Negligible
Explosive / asphyxiating gases from Made Ground on site.	Internal building spaces & future occupiers	Migration of gases through the surface and via permeable soils	Negligible to low *(based on the results of the six rounds of monitoring undertaken)*

5.1.1 Risks to human health

The risk to future site occupiers is considered to be low to medium where soils are exposed in soft landscaped areas, given the elevated concentrations of arsenic, lead and benzo(a)pyrene encountered in the Made Ground on site. Risks to site users will be mitigated by the presence of buildings and the basement, which is to extend beneath the whole site and will necessitate the removal of the majority of the Made Ground. In addition, where areas of soft landscaping are present in locations outside the basement footprint, a clean topsoil/subsoil capping cover can be used to act as a barrier to the underlying contamination.

The risk to construction workers from the Made Ground is considered to be medium. It is considered that the potential risks can be controlled through appropriate health and safety procedures and site working practices, including the use of personal protective equipment (PPE).

5.1.2 Risks to controlled waters

The site is not situated above an aquifer and the groundwater encountered during monitoring is considered to be perched water, and not representative of a groundwater body. The risk to groundwater is therefore considered to be negligible. The nearest surface water receptor (the *Regent's Canal*) is some 3m south of the site and consists of a clay-lined man-made canal. Given the generally low concentrations of contaminants, the cohesive nature of the underlying London Clay Formation and the lined nature of the canal, the risk to controlled waters is considered to be low.

5.1.3 Risks to buildings and structures

Due to the generally limited nature of the Made Ground and low concentrations of contaminants recorded, the risk to buildings and structures is considered to be low. The design of buried concrete should take into consideration the pyritic nature of the London Clay Formation and the resultant risk of sulfate attack on the concrete.

5.1.4 Risks to vegetation and plants

No exceedances of phytotoxic chemicals were noted at the site and the basement is to extend across the whole of the site. Therefore, the risk to vegetation and plants is considered to be low.

6. GEOTECHNICAL RECOMMENDATIONS

6.1 General

The following sections provide recommendations for the proposed development with regard to geotechnical aspects, based on the information obtained during the intrusive investigations at the site and across the wider development site and the laboratory results.

6.2 Geotechnical design parameters

Geotechnical design parameters are recommended based on the available information from the intrusive investigations at Building E and across the wider site (see Figure 6) and from published information. These are summarised in Table 14. The values are unfactored (Serviceability Limit State) parameters and are considered to be characteristic values for the local soils.

Table 14. Geotechnical parameters

Stratum	γ (kN/m^3)	ϕ' (°)	Cu (kPa) [c']	Eu (MPa) [E']
Made Ground	18	30[a]	30 [0]	18[b] [13.5[c]]
London Clay Formation	20	24[d]	50+6.9z[e,f] [5]	30+4.14z[e,f] [22.5+3.11z]

a. Burland et. al (Eds) (2001) Building response to tunnelling, CIRIA Special Publication 200, CIRIA
b. Based on 600c_u
c. Based on 0.75Eu
d. BS 8002:1994 Code of practice for Earth retaining structures, British Standards institution.
e. z = depth below surface of London Clay
f. based on information from the site investigations across the whole of the wider development site

6.3 Foundations

It is understood that a piled foundation solution is the preferred option for the proposed development of the site.

Indicative pile working loads (kN) are shown below in Table 15 and Figure 7, based on pile diameters of 0.45m to 1.2m and pile lengths of 10m to 25m. An overall design factor of safety of 2.6 and adhesion factor of 0.5 have been assumed. These factors may be modified based on the design approach adopted, the piling methodology and on the results of pre-construction pile testing. It is assumed that the piles will be driven from basement level.

These calculations are based on the geotechnical design parameters presented in Table 14.

Table 15. Indicative pile working loads (kN) – piled from basement level at Building E

Pile Length (m)	Pile diameter (m)				
	0.45	0.6	0.75	0.9	1.2
10	530	750	990	1,250	1,850
15	800	1,110	1,450	1,820	2,620
20	1,100	1,520	1,970	2,440	3,470
25	1,430	1,960	2,530	3,130	4,410

Early consultation with an appropriate piling contractor is recommended to confirm pile working capacities. Specialist piling contractors may potentially show greater load capacity than those shown in the above table based on specific knowledge of their piling equipment and supported by testing evidence that may be acceptable to the local authority.

Given the proximity of the site to the LUL Northern Line tunnels beneath Kentish Town Road, the effect of piling on these structures should be considered prior to construction. The exact location of the tunnels should be confirmed and the piles should be situated outside the exclusion zone surrounding the tunnels. Additionally, the effect of load spread from the piles should be considered.

6.4 Excavations and retaining structures

The proposed development at Building E includes a single storey basement which is assumed to extend to a maximum depth of 5mbgl. A 'bottom-up' construction methodology is recommended, utilising temporary berms and/or propping during installation of the contiguous piled wall.

It is recommended that a Basement Impact Assessment (BIA) is undertaken to assess the impact of the proposed basement on adjacent roads, buildings, the canal wall and infrastructure, including the nearby LUL Northern Line which runs beneath Kentish Town Road. This assessment may also incorporate the effect of piling on the nearby infrastructure.

It is anticipated that shallow excavations within the Made Ground and London Clay Formation will remain stable over the short term if dry. Where water is encountered in excavations, such as perched water within Made Ground or surface run-off, temporary sidewall support and dewatering (sump pumping) may be required to maintain excavation stability.

No operatives should enter unshored or otherwise protected excavations identified as unstable by a competent person, however shallow they are, in accordance with the guidelines presented in CIRIA Report 97[24].

6.5 Floor slabs and pavement design

The underlying London Clay Formation has been found to have a medium to high volume change potential. Floor and basement slabs should therefore be designed as suspended in order to prevent damage due to heave movements.

Recommendations for the design of the basement slabs in relation to the design groundwater level and calculation of the potential heave movements should be included within the Basement Impact Assessment for Building E. This assessment should also include recommendations for heave protection for the basement slabs.

Based on the geotechnical testing undertaken at the wider development site, a design CBR of 2.5% is recommended for pavement design.

6.6 Drainage

Soakaway drainage is not considered suitable for the site, given the cohesive nature of the underlying ground. Permeability of the London Clay Formation can be assumed to be in the order of 10^{-9} m/s, which is typical for such a plastic clay.

6.7 Buried concrete

The availability of total potential sulfate (TPS) in pyritic soils is dependent on the extent to which the soils are disturbed, and the level to which the soils may oxidise, resulting in sulfate ions that may reach the concrete. In this regard, BRE SD1 guidance states that *"Concrete in pyritic ground which is initially low in soluble sulfate does not have to be designed to withstand a high potential sulfate class unless it is exposed to ground which has been disturbed to the extent that contained pyrite might oxidise and the resultant*

[24] CIRIA (1992). *Trenching Practice (Second Edition).* Construction Industry Research and Information Association Report 97.

sulfate ions reach the concrete. This may prompt redesign of the structure or change to the construction process to avoid ground disturbance; for example, by using precast or cast-in-situ piles instead of constructing a spread footing within an excavation".

On this basis, the appropriate DS and ACEC class for the pyritic soils, i.e. based on water soluble sulfate (WSS) or total potential sulfate (TPS), should be adopted dependant on the extent to which the soils will be disturbed during construction.

Where open excavations will be required into the London Clay (i.e. during basement excavations), the soils may be disturbed to the extent that contained pyrite might oxidise and allow the resultant sulfate ions to reach the concrete, and as such the TPS DS and ACEC classes should be adopted. However, where the soils are undisturbed (i.e. where cast-in-situ piles are utilised), the lower WSS DS and ACEC classes may be adopted.

In addition to the five samples from the Building E site, a further thirty-one samples have been tested from across the wider development site, including samples from deep boreholes. Twelve of the thirty-six samples analysed for pH and sulfate were found to be pyritic. Of these twelve samples, two were noted to be high in total potential sulfate with a resultant DS and ACEC class of DS-5 and AC-4s (if disturbed).

As the proposed basement at the site is to extend to some 5mbgl and is to be constructed with contiguous piled walls with the building supported by piled foundations, it is considered that the proposed development works will not result in the soils with high total potential sulfate being disturbed by these works.

It is therefore recommended that buried concrete within the London Clay Formation should be designed to Design Class DS-3 and ACEC Class 2s if undisturbed (based on WSS). Design classes of DS-4 and AC-3s should be adopted for the basement slabs if they are exposed to disturbed soils for any length of time.

The Made Ground at the site is not pyritic and buried concrete in this stratum should be designed to Design Class DS-1 and ACEC Class AC-1.

7. GEOENVIRONMENTAL RECOMMENDATIONS

7.1 Contamination and remediation

The concentrations of arsenic, lead and benzo(a)pyrene recorded within the Made Ground present a potential unacceptable risk to human health where soil is exposed. The proposed basement is to extend across the entire site and it is anticipated that the Made Ground will therefore be removed from site. If areas of soft landscaping are present outside of the basement footprint, it is recommended that a capping layer is installed in order to mitigate the potential risk to human health. Risks to site users will be mitigated by the presence of buildings and hardstanding, where present.

The capping layer should generally comprise hardstanding or a minimum of 150mm topsoil over 300mm subsoil and a geotextile membrane in areas of communal landscaping.

Based on the results of the six ground gas monitoring visits undertaken, a gas screening value (GSV) of 0.0198l/hr has been calculated for the site, corresponding to Characteristic Situation 1. No ground gas protection measures are therefore required in the development.

7.2 Material management

A preliminary waste classification assessment of Made Ground samples indicates that this material may be classified as 'not hazardous' with respect to waste disposal. However, waste acceptance criteria (WAC) testing demonstrates that the 'not hazardous' samples should be disposed of in a non-hazardous landfill due to an exceedance of sulfate.

The Made Ground in the area of WS11 where asbestos fibres have been identified would need to be disposed at a non-hazardous landfill that accepts asbestos waste, or a hazardous landfill depending on the quantity of asbestos present (i.e. >0.1% of asbestos by weight would classify the soils as hazardous). Further asbestos quantification testing in this area would be required by the landfill prior to disposal. If asbestos or asbestos-containing material is visibly noted within the soil matrix, the material will be classified as *hazardous.* Hand picking of the visible asbestos containing material should be undertaken to reduce the volume of hazardous waste and potentially allow the residual soils to be disposed of to a non-hazardous facility, subject to the volume of fibres present. If visual asbestos-containing material is noted, or the quantity is >0.1%, the site would need to be registered with the Environment Agency as a producer of hazardous waste. Removal of impacted

material should only be undertaken by trained operatives with appropriate PPE, including respirators and dust suppression, as appropriate, and the material removed from site should be double bagged / lorries covered.

Uncontaminated natural soils, as encountered at the site, can be disposed of at an inert landfill as listed inert waste.

It should be noted that in May/June 2012 HMR&C issued Briefs 15/12 and 18/12 clarifying how construction spoil and excess soils will be assessed for landfill tax purposes. Detailed accurate descriptions of waste are required for all wastes to support the landfill tax assessment. Uncontaminated naturally occurring soils will remain inert by default and eligible for the lower rate of landfill tax. Similarly 'reworked soils' and demolition 'stone' comprising ONLY materials listed in the Schedule of the Landfill Tax (Qualifying Material) Order 2011 (SI 2011/1017) will also be eligible for the lower rate of landfill tax. However, Made Ground containing soil and foreign objects such as timber, plastic, rubber, metal, paper, plasterboard, asbestos, etc., regardless of the results of chemical analysis for waste classification purposes, will be eligible for the standard (higher) rate of landfill tax. Therefore, to maximise eligibility for lower rate landfill tax on waste construction spoil/ reworked ground, careful waste segregation and controls are necessary.

All material intended for offsite disposal should be transported and disposed in accordance with the Environmental Protection (Duty of Care) Regulations, 1991 and the Landfill (England and Wales) Regulations, 2002 (as amended). Waste legislation stipulates that hazardous and not hazardous waste should be pre-treated prior to disposal. Pre-treatment can be undertaken either at the site of origin or may be carried out at a licensed off-site facility and can include selective segregation of soils conducted on site.

7.3 Buried services

Based on the measured concentrations of contaminants within the Made Ground, it is anticipated that barrier pipe will be required for use at the site. However, it is recommended that the water supply company is contacted to confirm this recommendation is acceptable to them.

7.4 Discovery Strategy

The investigation was limited by the presence of obstructions, assumed to be due to historical foundations, in the eastern part of the site. A watching brief should therefore be undertaken by the Contractor during earthworks and construction works. Should areas of unexpected contamination be encountered or suspected, such as oily material or material of an unusual colour or odour, a qualified geoenvironmental engineer should be informed and the risk associated with the contamination assessed. Where necessary, an appropriate remediation strategy should be devised and implemented. The regulators should be informed of additional areas of contamination identified and should be provided with the risk assessment and proposed remediation methodology for agreement before undertaking such works. Appropriate verification works to be completed if remedial measures are required should also be identified and agreed.

The following nominal discovery strategy is recommended:

1. Work to cease in that area.

2. Notify geoenvironmental engineer, to attend site and sample material. Notify Environmental Health Officer at Camden Council.

3. Geoenvironmental engineer to supervise the excavation of contaminated material, which should be placed in a bunded area and covered to prevent rainwater infiltration.

4. Soil samples should be obtained by the geoenvironmental engineer from both the excavated material and the soils in the sides and base of the excavation to demonstrate that the full area of contamination has been excavated. If appropriate, in-situ testing should be undertaken on the sides and base of the excavation to assess the presence of residual contamination in the soils.

5. On receipt of chemical test results, the soils may be appropriately classified for treatment or disposal, and dealt with accordingly.

6. Detailed records, including photographs and duty of care records, of the excavations, stockpile sizes, source and location should be kept and regularly updated to allow materials to be easily tracked from excavation until disposal off site.

7. Backfilling to be undertaken with material certificated by a geoenvironmental engineer as acceptable for the proposed end land use.

7.5 Health and safety

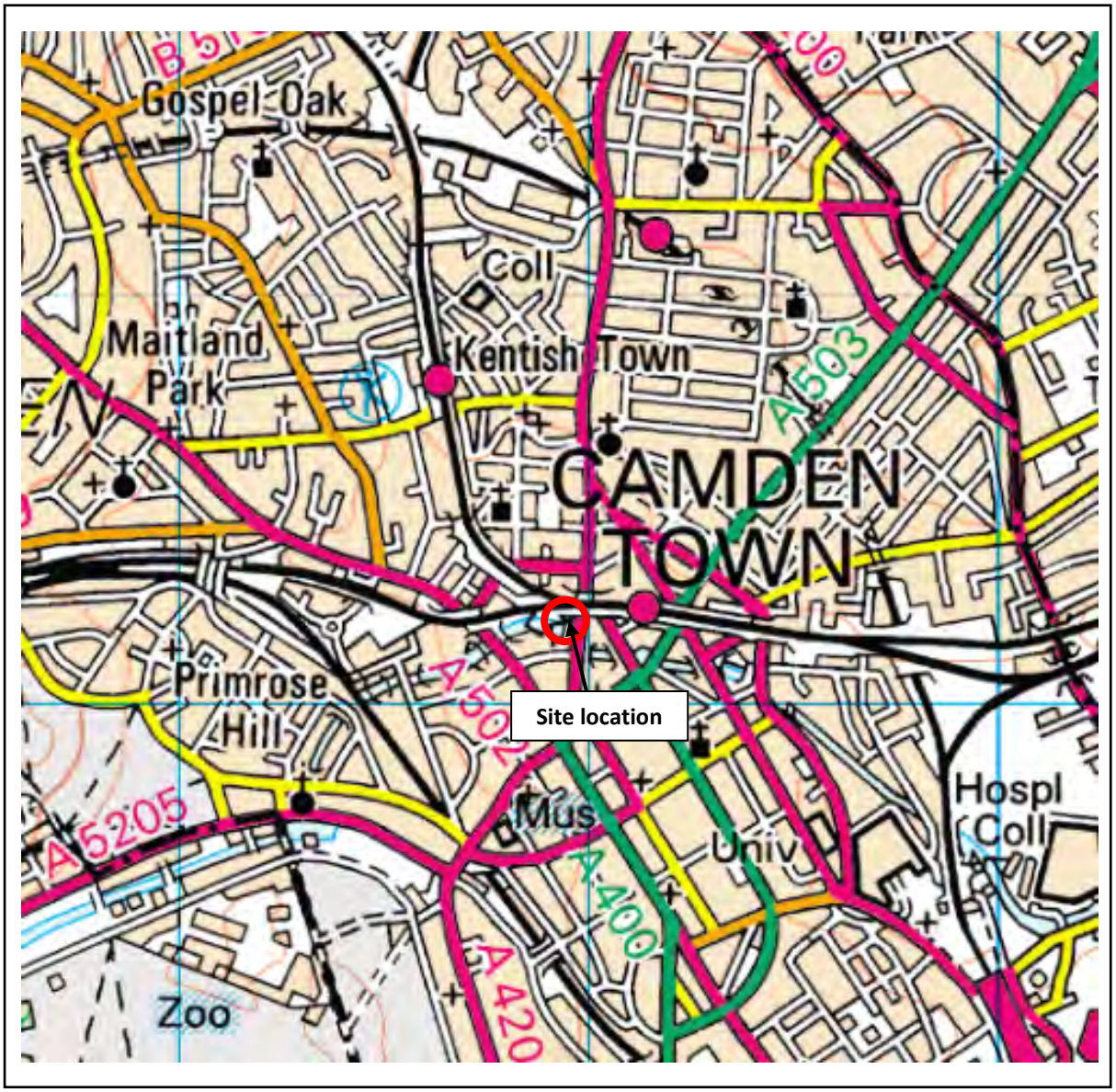
All site works will be undertaken in accordance with the guidelines provided by Health and Safety Executive (HSE, 1991)[25]. In this context, the risks will be low and nominal safety precautions should be acceptable (i.e. the adoption of good hygiene practices and the use of overalls, gloves and dust masks if necessary).

During redevelopment precautions should be taken to minimise exposure to construction workers and the general public to potentially harmful substances. Attention should be paid to limit off site nuisance such as dust and odour emissions. Such precautions should include but not be limited to:

- Personal hygiene, washing and changing procedures.
- Adequate PPE.
- Dust and vapour suppression methods, including damping down, minimising the working face exposed and covering stockpiles, where required.
- Regular cleaning of all site roads, access roads and the public highway.
- Safe storage of fuel and other potentially polluting liquids and the provision of spill control and clean up facilities.
- Positive collection and disposal of on-site run-off.
- Vehicles used in moving the soils should be covered and washed before leaving site to avoid carrying potential fugitive dust into the surrounding environment. The washings should be returned to stockpiled material and not allowed to enter the public drains where drying out could release dusts.

[25] HSE (1991). Protection of Workers and the General Public During the Development of Contamination Land. Guidance Note HS(G)66, Health and Safety Executive, HMSO, 1991.

FIGURES



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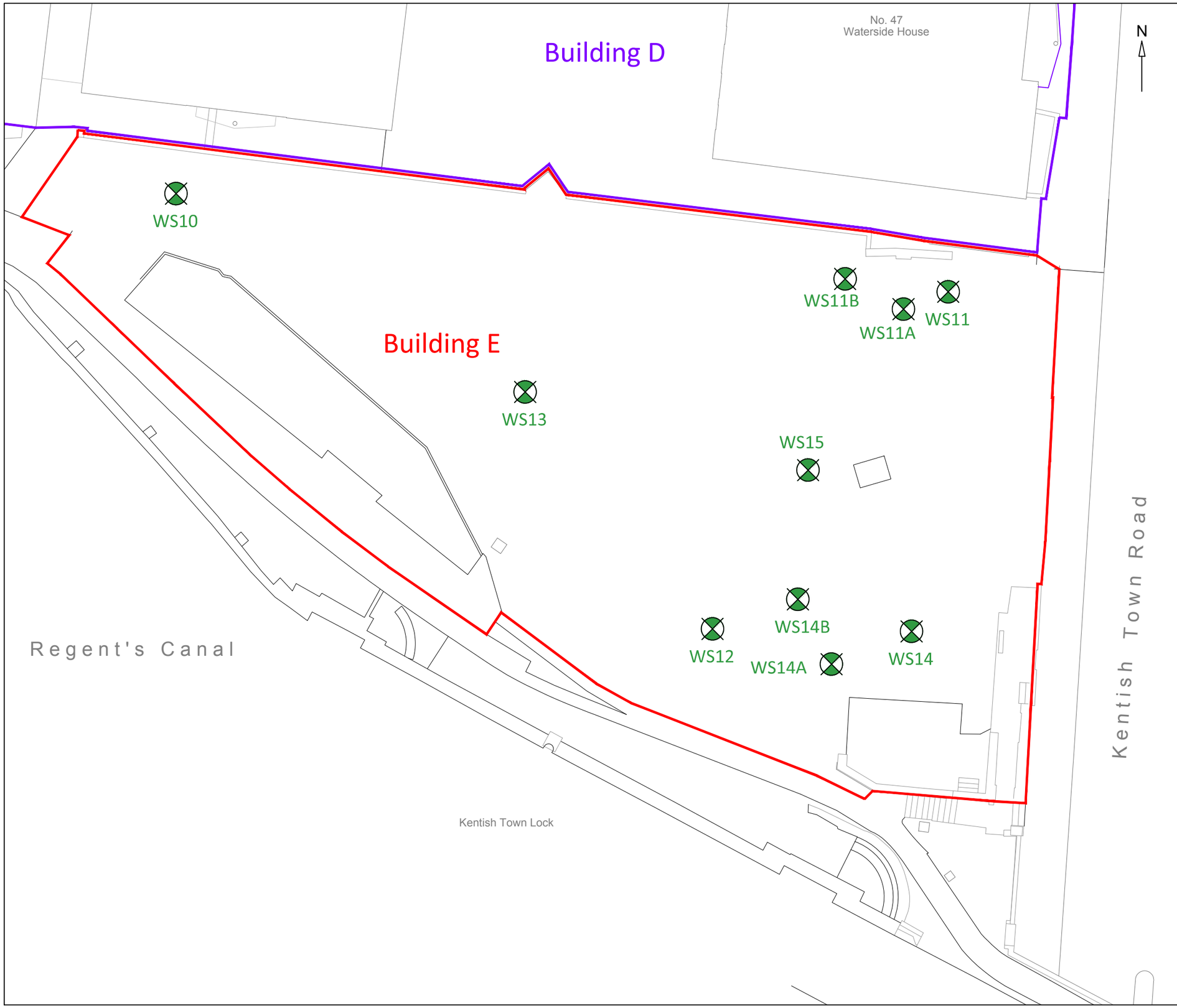
Client	Project	Job No
Walsh Associates	**Camden Lock Village, London – Proposed Building E**	**CG/18067C**
CGL	Title **Site location plan**	**Figure 1**



KEY

- WS01 — Window Sample
- Site Boundary (Building E)
- Site Boundary (Building D)

Rev	Date	Comments
*	*	*

Card Geotechnics Ltd
4 Godalming Business Centre
Woolsack Way
Godalming
Surrey
GU7 1XW
T: 01483 310600

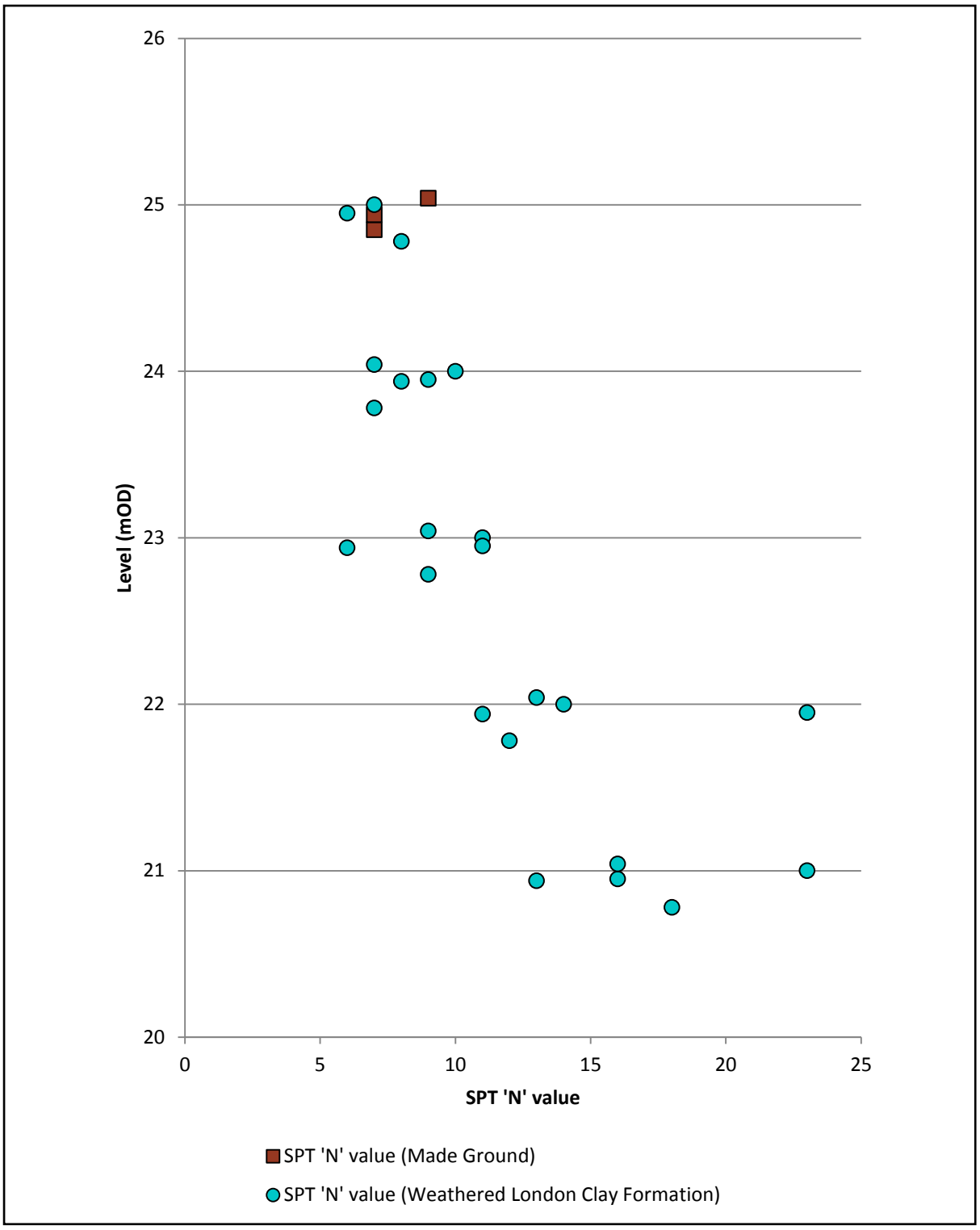
Project
Camden Lock Village - Building E

Client
Walsh Associates

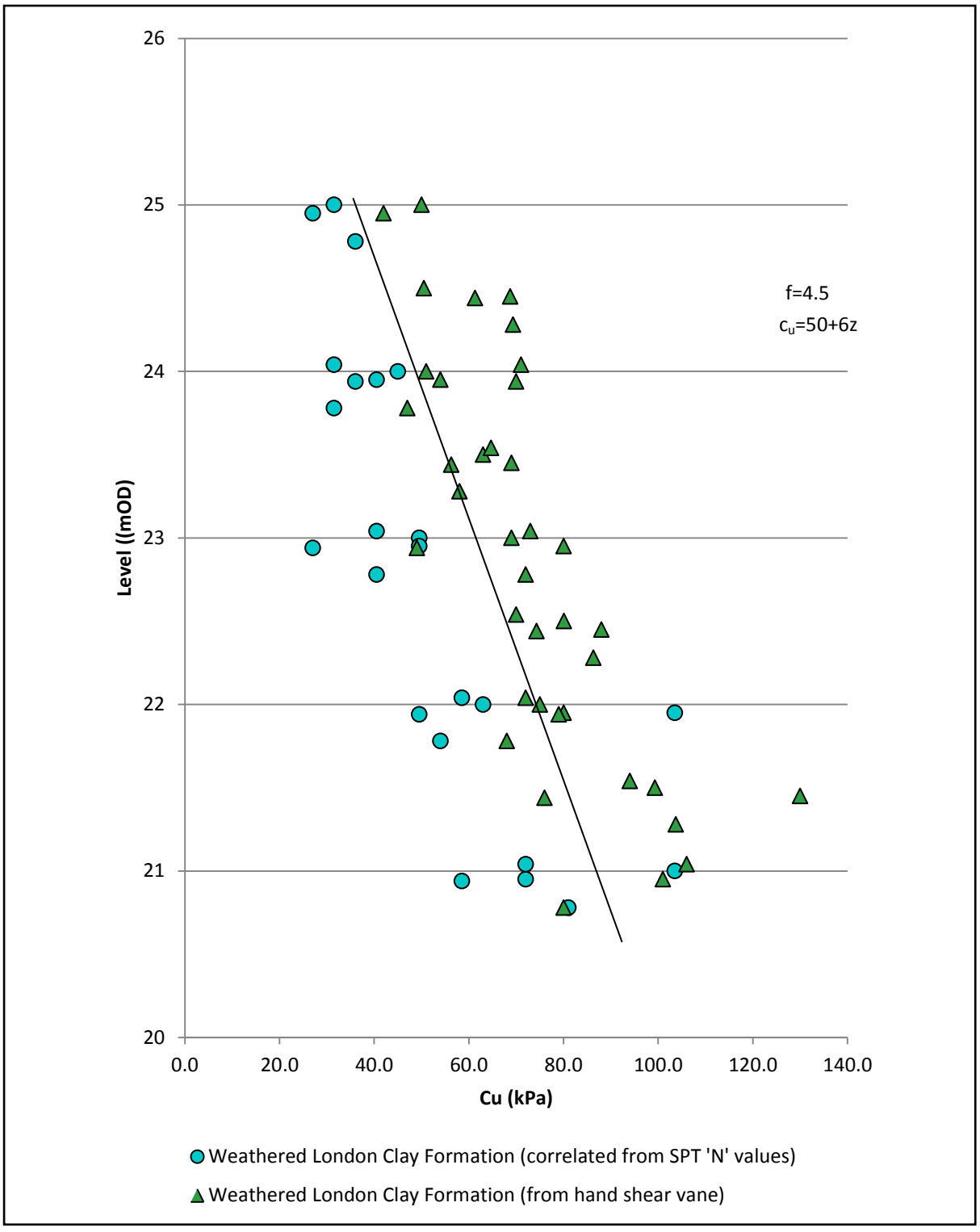
Drawing title
Figure 2 - Exploratory Hole Location Plan

Scale(s)	Job No.
NTS	**CG/18067C**

			Dwg No.	Rev.
Drawn	TSB	11/02/15	**CG/18067C-001**	*
Checked				
Approved				



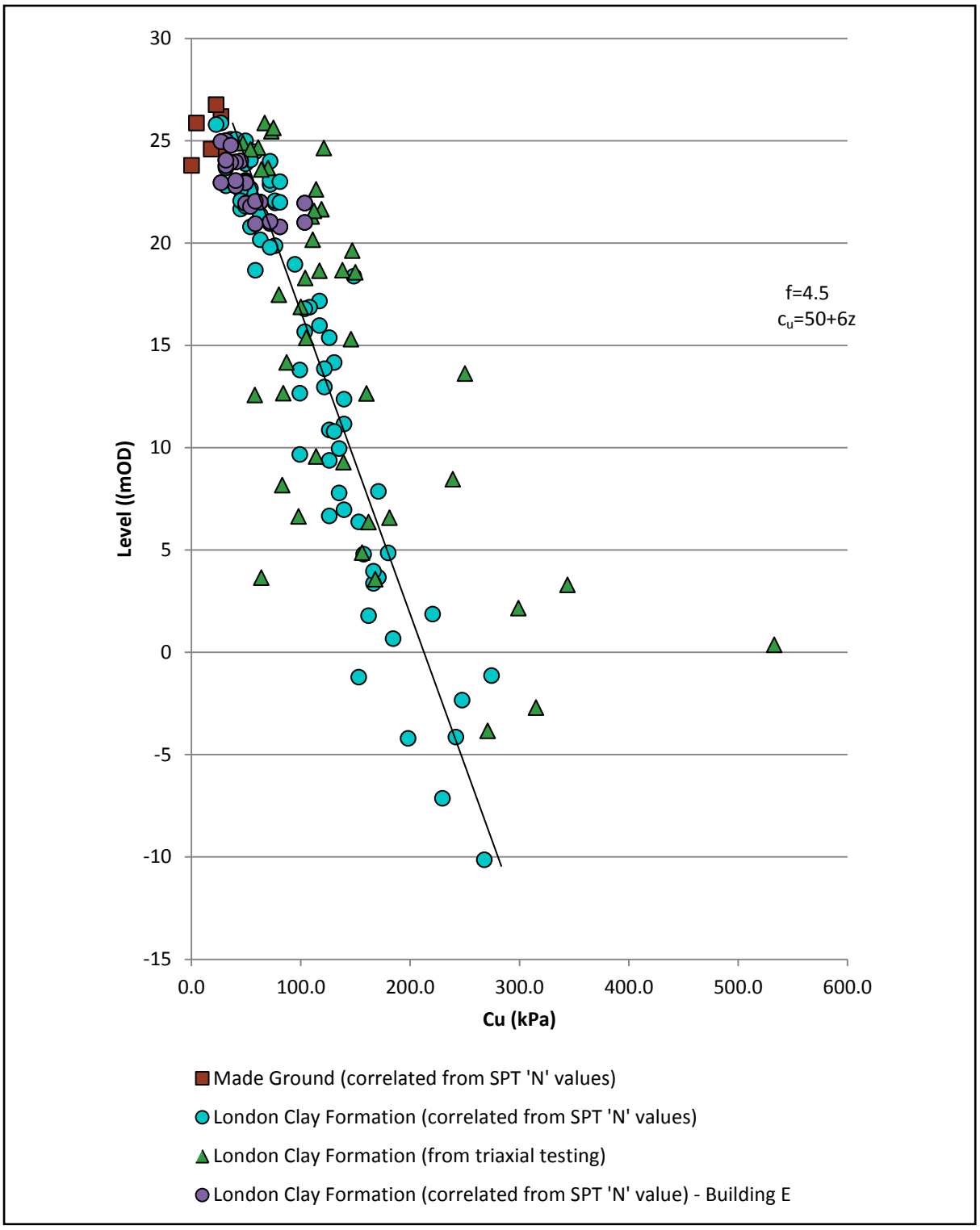
Client	Project	Job No
Walsh Associates	**Camden Lock Village – Proposed Building E**	**CG/18067C**
CGL	Title **Plot of SPT 'N' values against level**	**Figure 3**



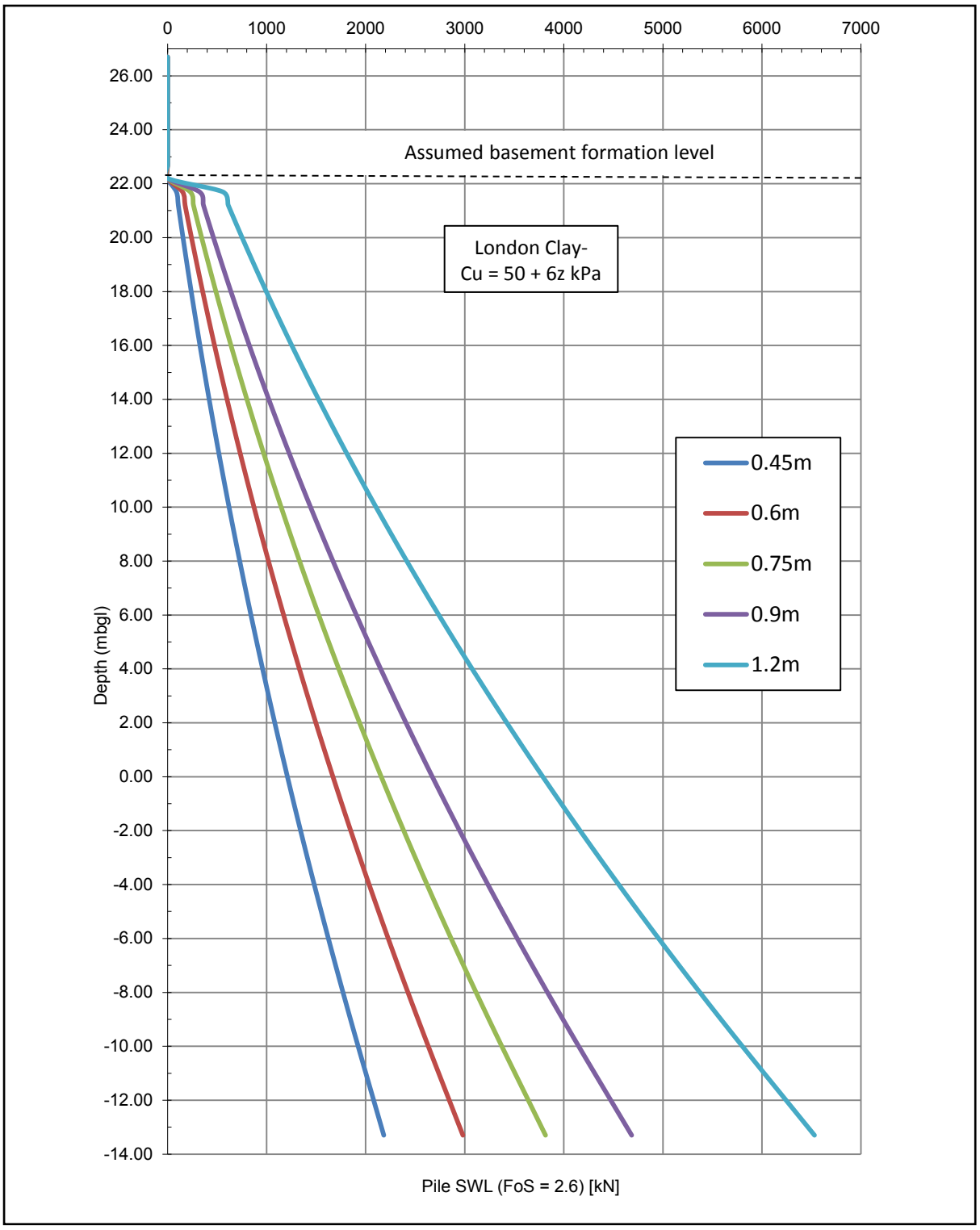
Client	Project	Job No
Walsh Associates	**Camden Lock Village – Proposed Building E**	**CG/18067C**
CGL	Title: **Plot of c_u against level**	**Figure 4**

Source	Pathway	Receptor
A. Contamination within Made Ground, including ground gas, metals (lead, arsenic), benzo(a)pyrene and asbestos.	1. Ingestion, inhalation and direct/dermal contact 2. Root uptake 3. Vertical and lateral migration	i. Future occupants ii. Construction workers iii. Vegetation and plants iv. Groundwater or surface water v. Buildings and structures

Client	Project	Job No
Walsh Associates	**Camden Lock Village, London – Proposed Building E**	**CG/18067C**
CGL	Title: **Conceptual site model**	**Figure 5**



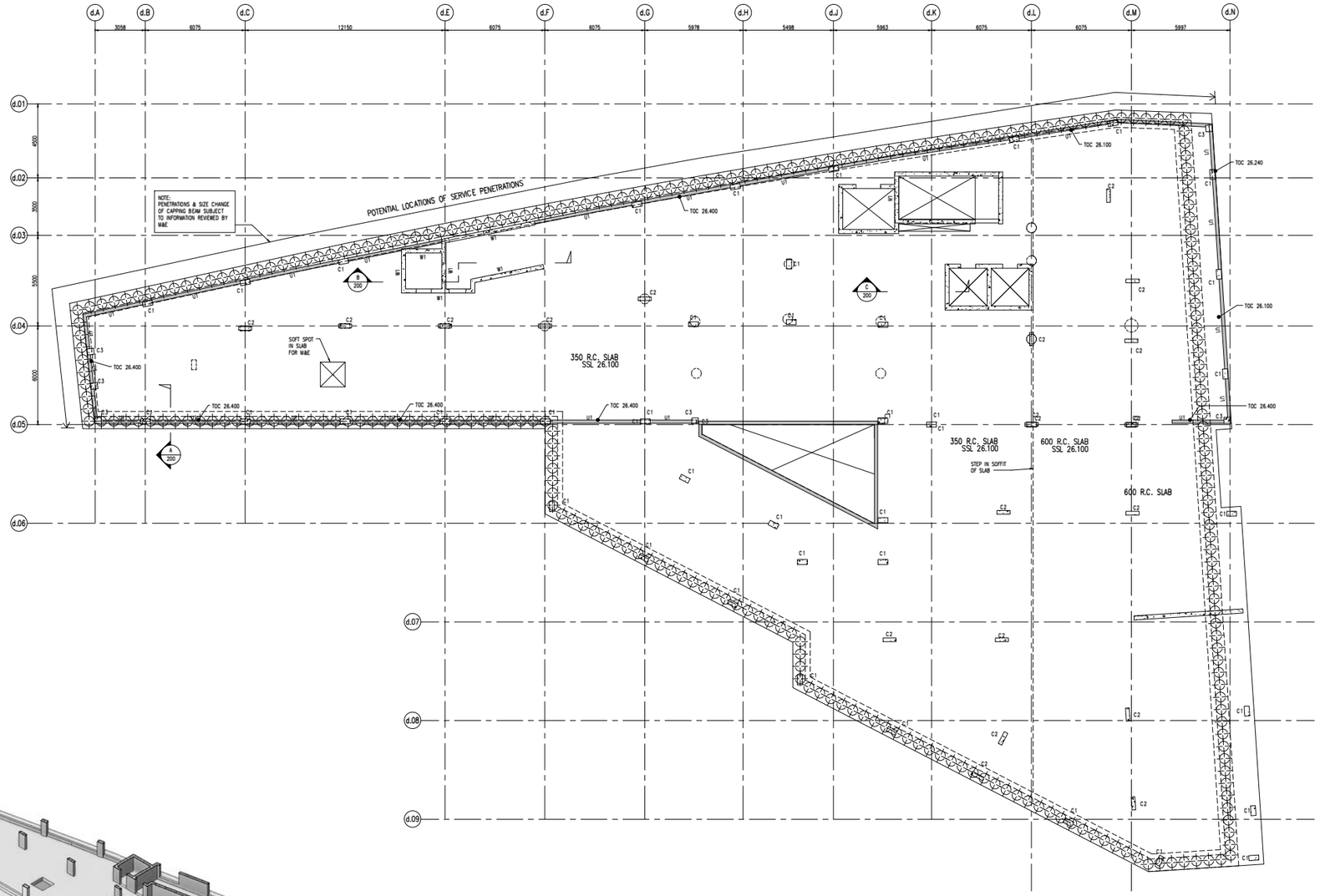
Client	Project	Job No
Walsh Associates	**Camden Lock Village – Proposed Building E**	**CG/18067C**
CGL	Title **Plot of c_u against level (wider development site)**	**Figure 6**

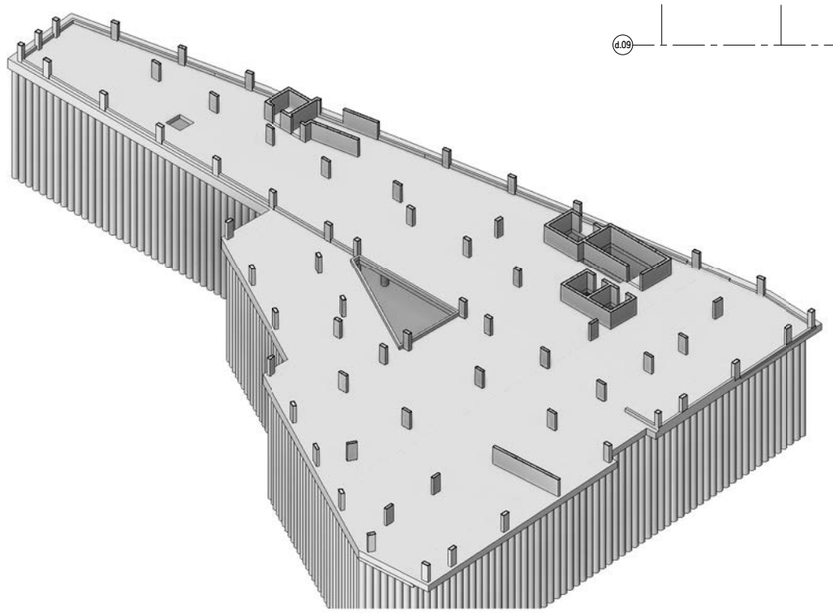


Client	Project	Job No
Walsh Associates	**Camden Lock Village, London – Proposed Building E**	**CG/18067C**
CGL	Title **Plot of safe working load against level (5m deep basement)**	**Figure 7**

APPENDIX A

Proposed development plans





STRUCTURAL WALL SCHEDULE	
WALL REF.	SIZE
W1	250 R.C. WALL
W2	300 R.C. LINER WALL

STRUCTURAL COLUMN SCHEDULE	
COLUMN REF.	SIZE
C1	300 x 600
C2	225 x 800
C3	375 x 400
C4	600ø
C5	800ø

STRUCTURAL UPSTAND...	
WALL REF.	SIZE
U1	200 R.C. UPSTAND

Notes

1. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS IN METRES.
2. THIS DRAWING TO BE READ IN CONJUNCTION WITH RELEVANT ARCHITECT'S AND ENGINEER'S DRAWINGS AND SPECIFICATIONS.
3. THIS DRAWING HAS BEEN PRODUCED ELECTRONICALLY AND MAY HAVE BEEN PHOTO REDUCED OR ENLARGED WHEN COPIED. HENCE, DO NOT RELY ON ANY SCALES QUOTED. WORK ONLY TO FIGURED DIMENSIONS (DO NOT SCALE). ALL DIMENSIONS TO BE CHECKED ON SITE. ANY ERRORS OR OMISSIONS TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
4. EXISTING PILES IN LOCAL AREA.
5. ALL CONCRETE TO BE MINIMUM C40 U.N.O
6. TEMPORARY PROPPING OF CAPPING BEAM WILL BE REQUIRED TO REDUCE LATERAL MOVEMENT.

NOTE:
SLAB LEVELS, CAPPING BEAM T.O.C. & STEPS TO BE CONFIRMED BY ARCHITECT.

C.D.M.
SIGNIFICANT RISKS AND HAZARDS:
BASEMENT EXCAVATION CLOSE TO VIADUCT, UKPN TRENCH & CANAL.
KEY DESIGN DECISIONS TO REDUCE OR ELIMINATE HAZARDS:
MOVEMENT MONITORING OF VARIOUS CONTIG WALLS.

Rev.	Date	By	Details Of Revision
P1	23.03.15	TH	WIP ISSUE

Client
STANLEY SIDINGS LTD

Project
CAMDEN LOCK VILLAGE
BUILDING D/E

Title
LEVEL 0 G.A.

Walsh Associates
Consulting Civil & Structural Engineers
32 Lafone Street, London, SE1 2LX
Tel: +44 (0)20 7089 6800
Fax: +44 (0)20 7089 6801
E-mail: london@walshgroup.eu.com

Status
PRELIMINARY

Drawn	BTR	A0 Scales	1 : 100		
Date	12/04/14	Eng.	NMC	Chk.	–	App'd.	Approver

File Ref.

ACTUAL SHEETSIZE = A0mm

Drawing No. 2765/D/010 Rev. P1

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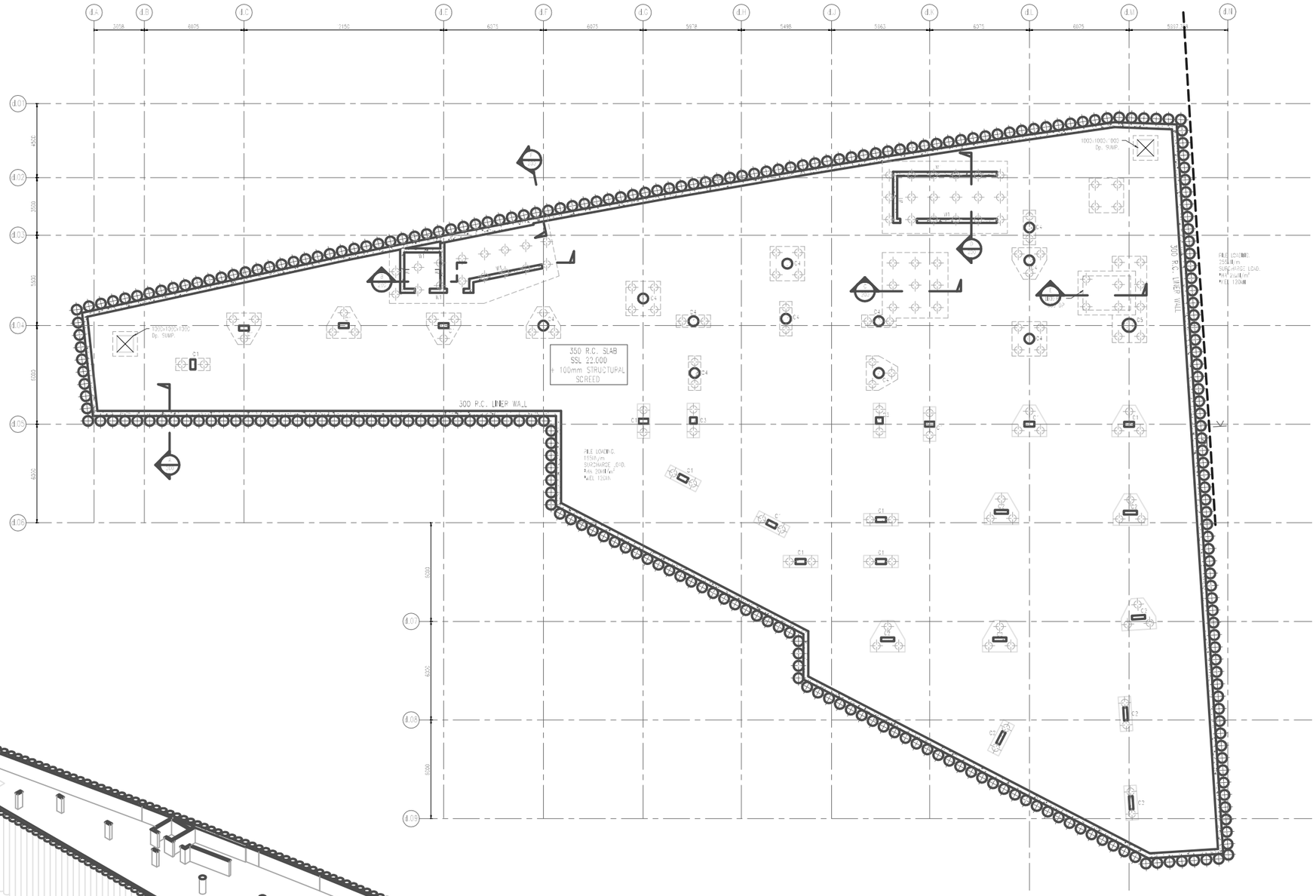
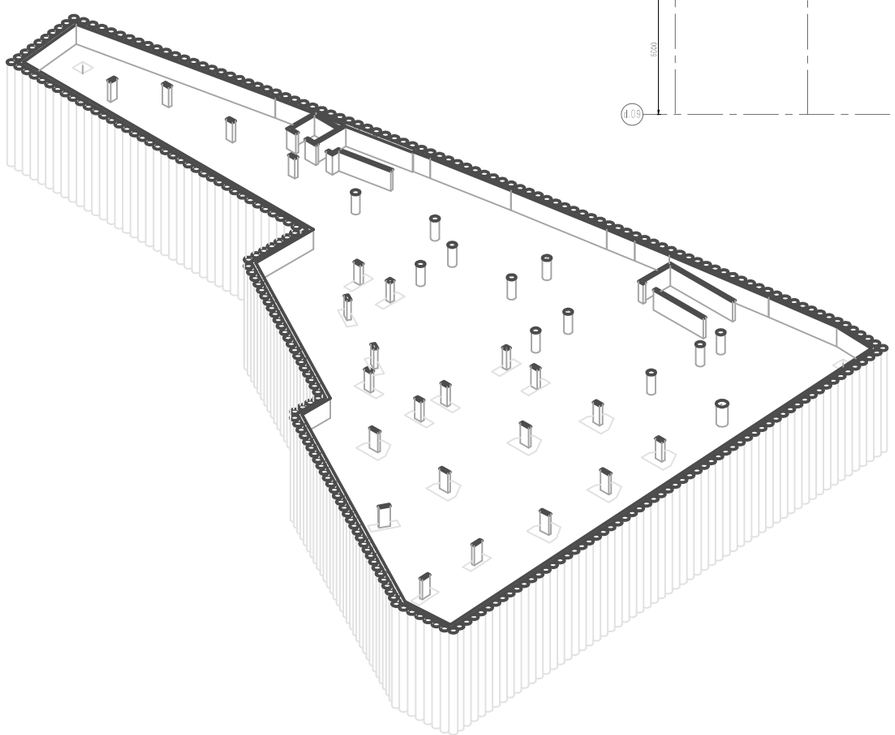




STRUCTURAL WALL SCHEDULE	
WALL REF.	SIZE
W1	250 R.C. WALL
W2	300 R.C. LINER WALL

STRUCTURAL COLUMN SCHEDULE	
COLUMN REF.	SIZE
C1	300 x 600
C2	225 x 600
C3	375 x 400
C4	600ø
C5	800ø

STRUCTURAL UPSTAND...	
WALL REF.	SIZE
U1	200 R.C. UPSTAND

Notes

1. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS IN METRES.
2. THIS DRAWING TO BE READ IN CONJUNCTION WITH RELEVANT ARCHITECT'S AND ENGINEER'S DRAWINGS AND SPECIFICATIONS.
3. THIS DRAWING HAS BEEN PRODUCED ELECTRONICALLY AND MAY HAVE BEEN PLOTTED REDUCED OR ENLARGED WHEN COPIED. HENCE, DO NOT RESCALE ANY SCALES QUOTED. WORK ONLY TO FIGURED DIMENSIONS WHICH ARE STATED. ALL DIMENSIONS TO BE CHECKED ON SITE AND ERRORS OR OMISSIONS TO BE REPORTED TO THE ENGINEER IMMEDIATELY.
4. EXISTING PILES IN LOCAL AREA.
5. ALL CONCRETE TO BE MINIMUM C40 U/NO
6. TEMPORARY PROPPING OF CANTILEVER BEAM WALL BS REQUIRED TO REDUCE LATERAL MOVEMENT.
7. ALLOW FOR 150mm THICK HEAVE LAYER BELOW SLAB.
8. REFER TO DRAWING 2765/500 FOR CAVITY DRAIN DETAILS.

Rev.	Date	By	Details Of Revision
P1	23.10.15	MS	FOR ISSUE

Client: STANLEY SIDINGS LTD

Project: CAMDEN LOCK VILLAGE BUILDING D/E

Title: LEVEL -1 G.A.

Walsh Associates
Consulting Civil & Structural Engineers
33 Lafone Street, London, SE1 2LX
Tel: +44 (0)20 7089 6800
Fax: +44 (0)20 7089 6801
Email: london@walshgroup.eu.com

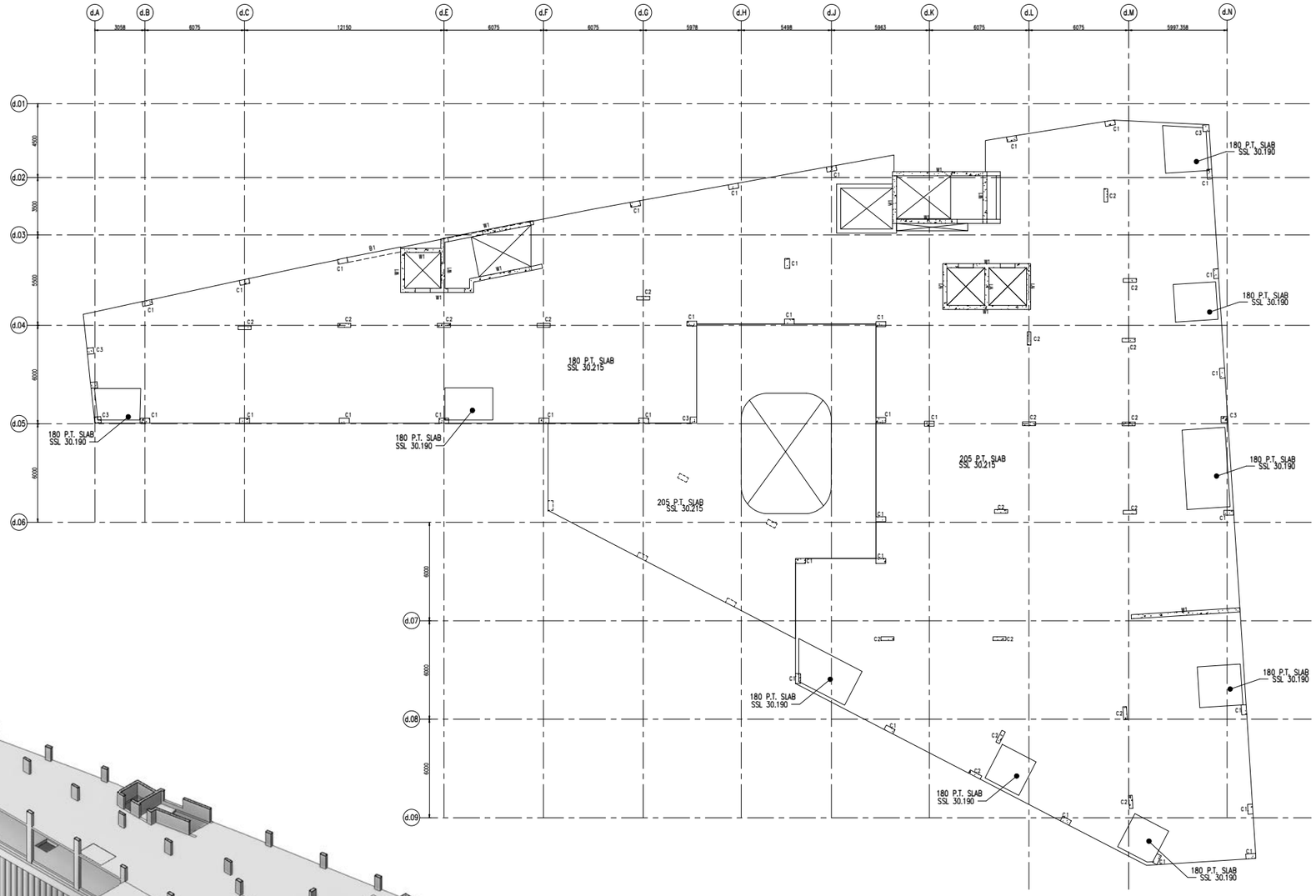
Status: **PRELIMINARY**

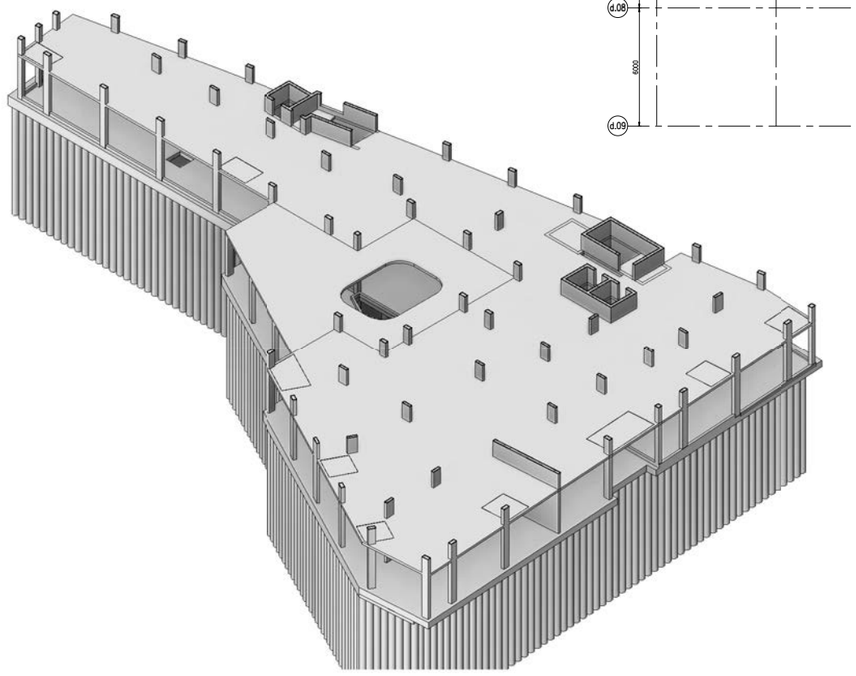
Drawn	SW	A0 Scales	1 : 100		
Date	OCT 15	Engs.	MBC	Chkd.	_	Appvd.	

File Ref.

Drawing No.: 2765/D/009

Rev.: P1





STRUCTURAL WALL SCHEDULE	
WALL REF.	SIZE
W1	250 R.C. WALL
W2	300 R.C. LINER WALL

STRUCTURAL COLUMN SCHEDULE	
COLUMN REF.	SIZE
C1	300 x 600
C2	225 x 800
C3	375 x 400
C4	600ø
C5	800ø

STRUCTURAL UPSTAND...	
WALL REF.	SIZE
U1	200 R.C. UPSTAND

Notes

1. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS IN METRES.

2. THIS DRAWING TO BE READ IN CONJUNCTION WITH RELEVANT ARCHITECT'S AND ENGINEER'S DRAWINGS AND SPECIFICATIONS.

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4. ALL CONCRETE TO BE MINIMUM C40 U.N.O

5. ALL STAIRS ASSUMED TO BE STAIR MASTER WITH INSITU LANDINGS.

C.D.M.

SIGNIFICANT RISKS AND HAZARDS:

BASEMENT EXCAVATION CLOSE TO VIADUCT, UKPN TRENCH & CANAL.

KEY DESIGN DECISIONS TO REDUCE OR ELIMINATE HAZARDS:

MOVEMENT MONITORING OF VARIOUS CONTIG WALLS.

Rev.	Date	By	Details Of Revision
P1	23.03.15	TH	WIP ISSUE

Client
STANLEY SIDINGS LTD

Project
CAMDEN LOCK VILLAGE
BUILDING D/E

Title
LEVEL 1 G.A.

Walsh Associates
Consulting Civil & Structural Engineers
32 Lafone Street, London, SE1 2LX
Tel: +44 (0)20 7089 6800
Fax: +44 (0)20 7089 6801
E-mail: london@walshgroup.eu.com

Status
PRELIMINARY

Drawn	BTR	A0 Scales	1 : 100		
Date	OCT 14	Eng.	NMC	Chk.	–	Appr'd.

File Ref.

ACTUAL DIMENSION = 80mm

Drawing No. 2765/DE/011 | Rev. P1

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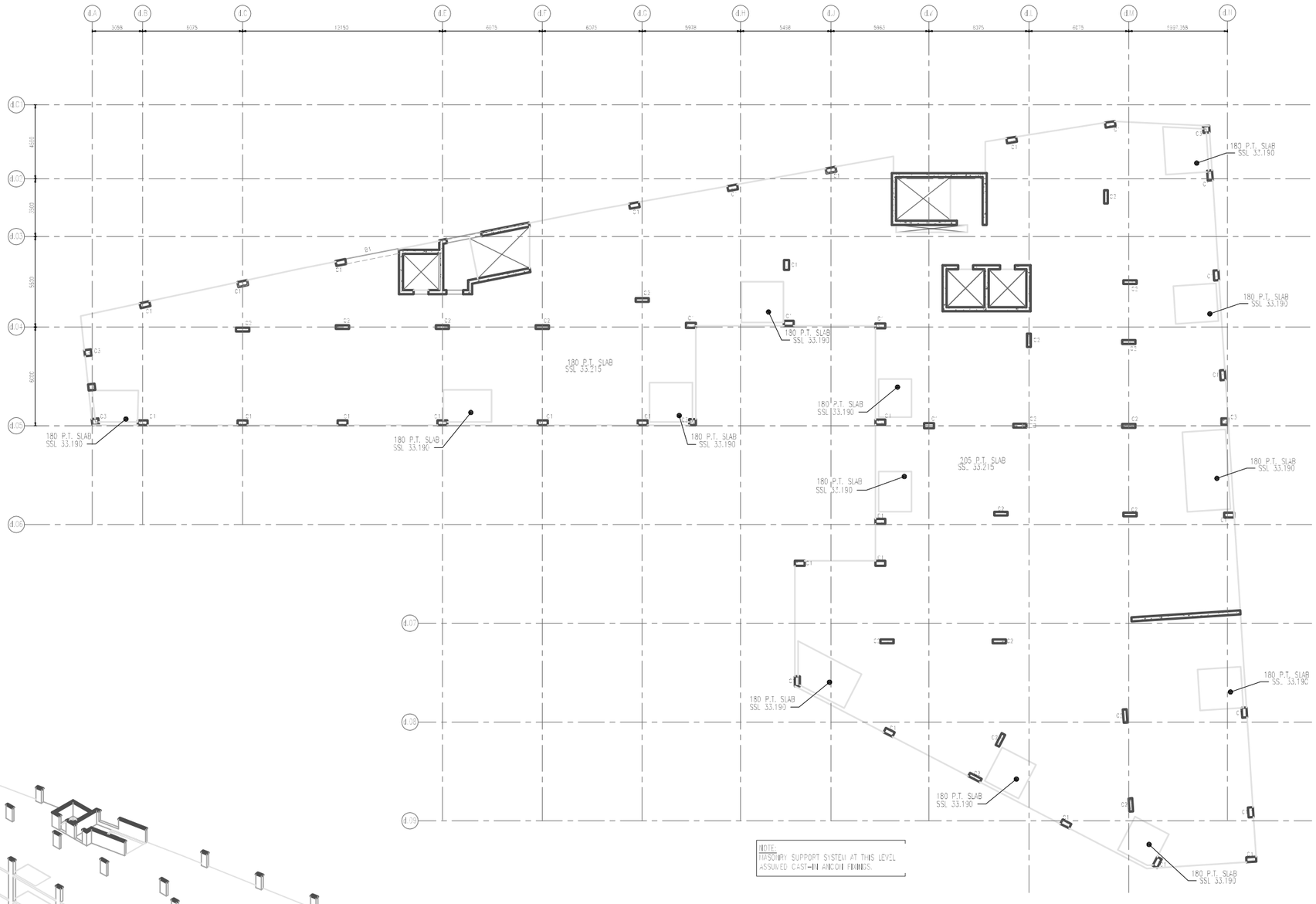
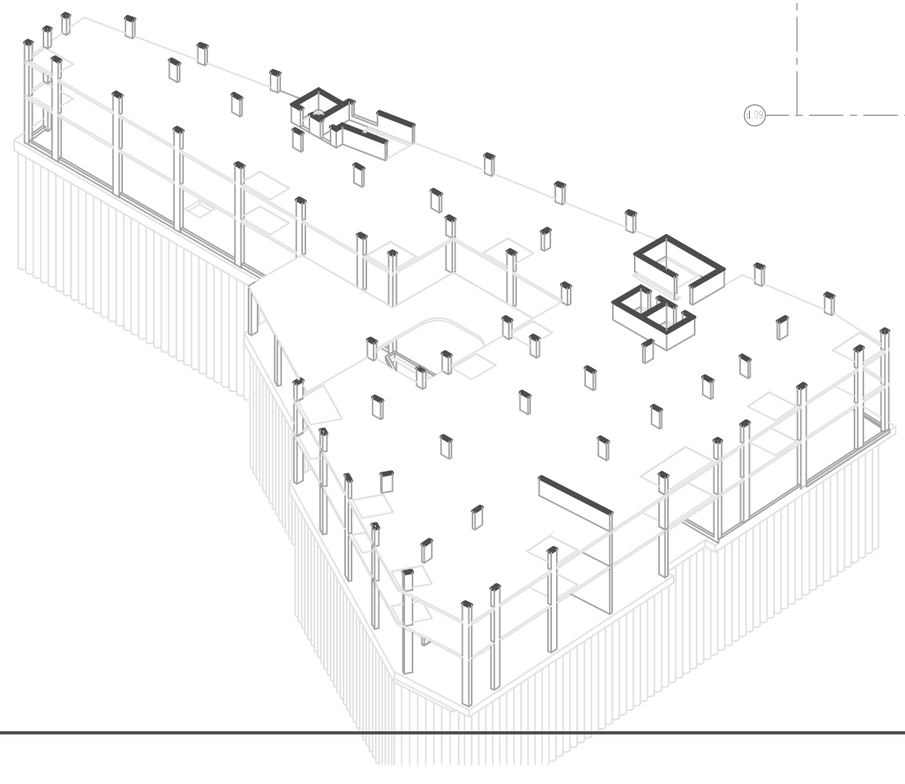




STRUCTURAL WALL SCHEDULE	
WALL REF.	SIZE
W1	250 R.C. WALL
W2	300 R.C. LIFT WELL

STRUCTURAL COLUMN SCHEDULE	
COLUMN REF.	SIZE
C1	300 x 600
C2	225 x 800
C3	375 x 400
C4	600ø
C5	800ø

STRUCTURAL UPSTAND...	
WALL REF.	SIZE
U1	200 R.C. UPSTAND

Notes

1. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS IN METRES.

2. THIS DRAWING TO BE READ IN CONJUNCTION WITH RELEVANT ARCHITECTS AND ENGINEERS DRAWINGS AND SPECIFICATIONS.

3. THIS DRAWING HAS BEEN PRODUCED ELECTRONICALLY AND MAY HAVE BEEN PHOTO REDUCED OR ENLARGED WHEN COPIED. FIGURED DIMENSIONS ONLY ARE TO BE USED. SCALES QUOTED ARE ONLY TO REQUIRED DIMENSIONS DO NOT SCALE. ALL DIMENSIONS TO BE CHECKED ON SITE AND ERRORS OR OMISSIONS TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

4. ALL CONCRETE TO BE MINIMUM C40 UNO.

5. ALL STAIRS ASSUMED TO BE STAIR MASTER WITH RISER HEIGHTS.

Rev.	Date	By	Details Of Revision
P1	23.03.15	RH	FIRST ISSUE

Client
STANLEY SIDINGS LTD

Project
CAMDEN LOCK VILLAGE
BUILDING D

Title
LEVEL 2 G.A.

Walsh Associates
Consulting Civil & Structural Engineers
32 Lafone Street, London, SE1 2LX
Tel: +44 (0)20 7089 6800
Fax: +44 (0)20 7089 6801
E-mail: london@walshgroup.eu.com

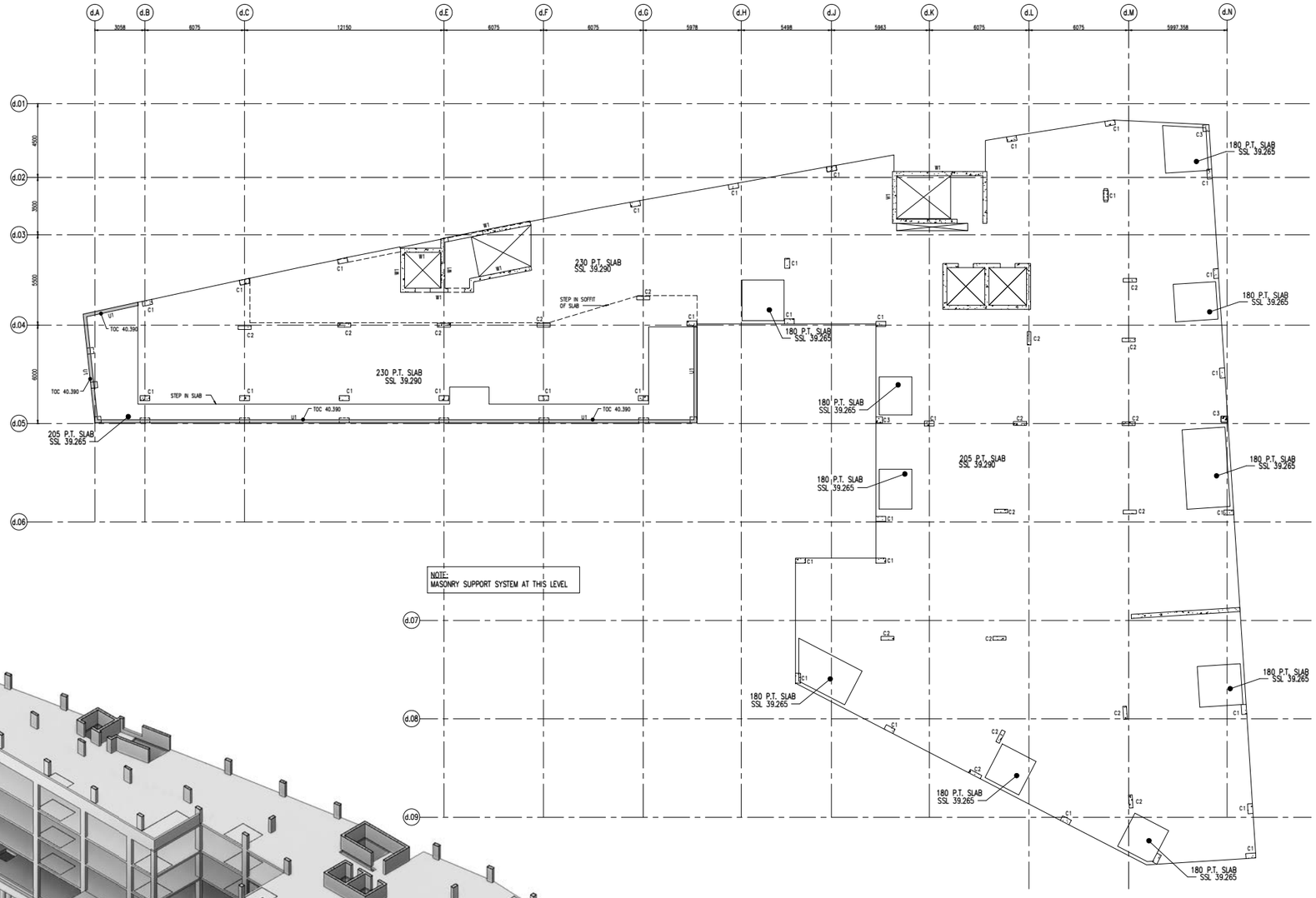
Status
PRELIMINARY

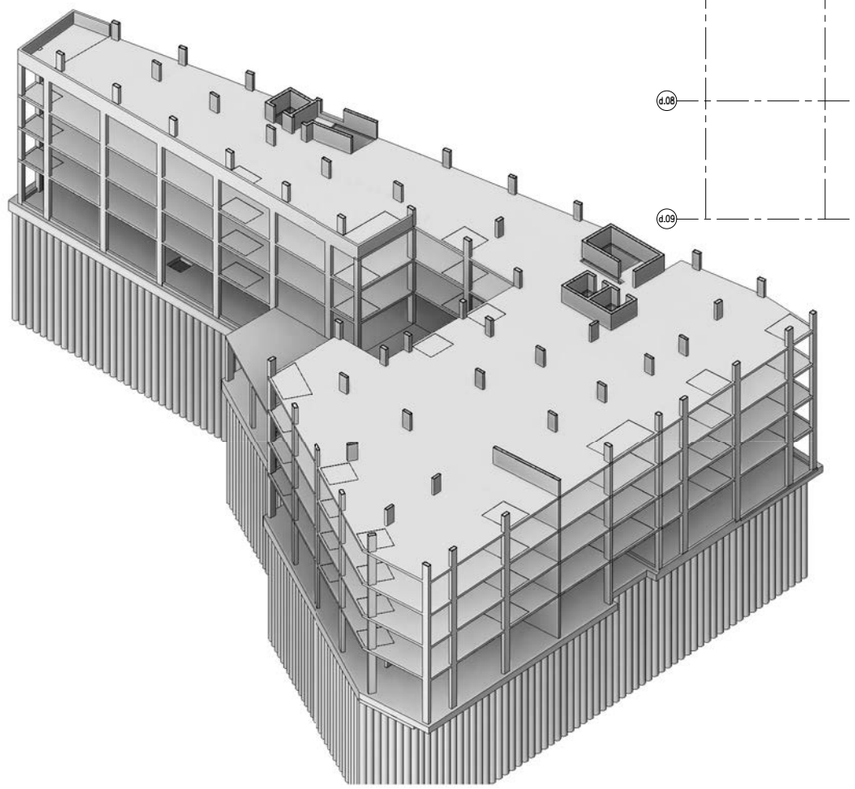
Drawn	STR	A0 Scales	1 : 100		
Date	12.04.14	Eng.	RDC	Chk.	--	App'd.	--

File Ref.

Drawing No. 2765/DE/012

Rev. P1





STRUCTURAL WALL SCHEDULE	
WALL REF.	SIZE
W1	250 R.C. WALL
W2	300 R.C. LINER WALL

STRUCTURAL COLUMN SCHEDULE	
COLUMN REF.	SIZE
C1	300 x 600
C2	225 x 800
C3	375 x 400
C4	600ø
C5	800ø

STRUCTURAL UPSTAND...	
WALL REF.	SIZE
U1	200 R.C. UPSTAND

Notes

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4. ALL CONCRETE TO BE MINIMUM C40 U.N.O

5. ALL STAIRS ASSUMED TO BE STAIR MASTER WITH INSITU LANDINGS.

C.D.M.
SIGNIFICANT RISKS AND HAZARDS:
BASEMENT EXCAVATION CLOSE TO VIADUCT, UKPN TRENCH & CANAL.
KEY DESIGN DECISIONS TO REDUCE OR ELIMINATE HAZARDS:
MOVEMENT MONITORING OF VARIOUS CONTIG WALLS.

Rev.	Date	By	Details Of Revision
P1	23.03.15	TH	WIP ISSUE

Client
STANLEY SIDINGS LTD

Project
CAMDEN LOCK VILLAGE
BUILDING D

Title
LEVEL 4 G.A.

Walsh Associates
Consulting Civil & Structural Engineers
32 Lafone Street, London, SE1 2LX
Tel: +44 (0)20 7089 6600
Fax: +44 (0)20 7089 6601
E-mail: london@walshgroup.eu.com

Status
PRELIMINARY

Drawn	BTR	A0 Scales	1 : 100		
Date	12/04/14	Eng.	NMC	Chk.	–
File Ref.					

Appr'd. Approver

ACTUAL DIMENSION = 80mm

Drawing No. 2765/D/014

Rev. P1

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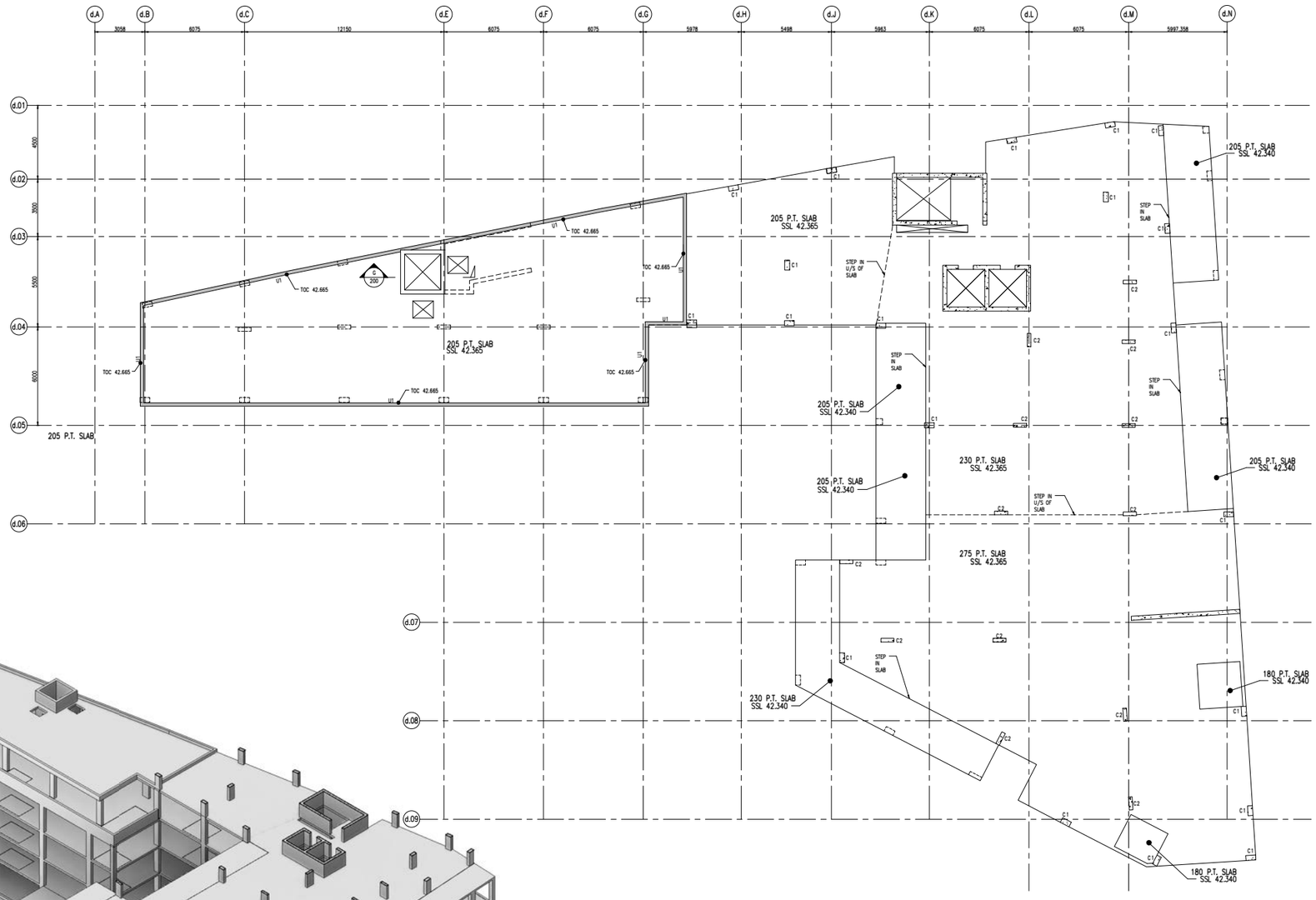

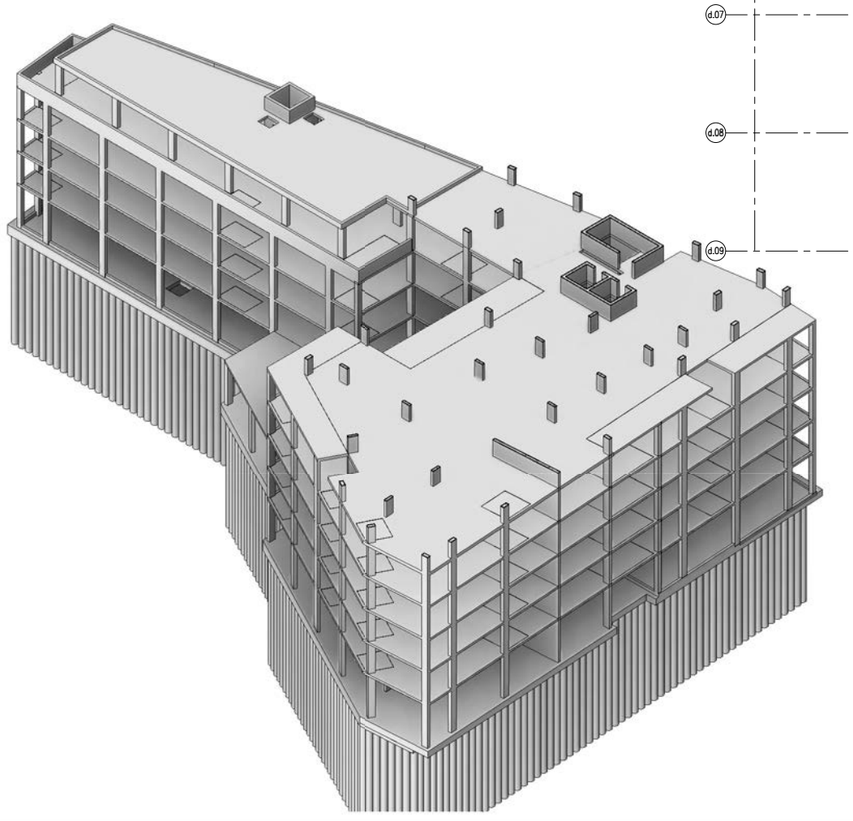

STRUCTURAL WALL SCHEDULE	
WALL REF.	SIZE
W1	250 R.C. WALL
W2	300 R.C. LINER WALL

STRUCTURAL COLUMN SCHEDULE	
COLUMN REF.	SIZE
C1	300 x 600
C2	225 x 800
C3	375 x 400
C4	600ø
C5	800ø

STRUCTURAL UPSTAND...	
WALL REF.	SIZE
U1	200 R.C. UPSTAND

Notes

1. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS IN METRES.

2. THIS DRAWING TO BE READ IN CONJUNCTION WITH RELEVANT ARCHITECT'S AND ENGINEER'S DRAWINGS AND SPECIFICATIONS.

3. THIS DRAWING HAS BEEN PRODUCED ELECTRONICALLY AND MAY HAVE BEEN PHOTO REDUCED OR ENLARGED WHEN COPIED. HENCE, DO NOT RELY ON ANY SCALES QUOTED. WORK ONLY TO FIGURED DIMENSIONS (DO NOT SCALE). ALL DIMENSIONS TO BE CHECKED ON SITE. ANY ERRORS OR OMISSIONS TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

4. ALL CONCRETE TO BE MINIMUM C40 U.N.O

5. ALL STAIRS ASSUMED TO BE STAIR MASTER WITH INSITU LANDINGS.

C.D.M.
SIGNIFICANT RISKS AND HAZARDS:
BASEMENT EXCAVATION CLOSE TO VIADUCT, UKPN TRENCH & CANAL.
KEY DESIGN DECISIONS TO REDUCE OR ELIMINATE HAZARDS:
MOVEMENT MONITORING OF VARIOUS CONTIG WALLS.

Rev.	Date	By	Details Of Revision
P1	23.03.15	TH	WIP ISSUE

Client: STANLEY SIDINGS LTD

Project: CAMDEN LOCK VILLAGE BUILDING D

Title: LEVEL 5 G.A.

Walsh Associates
Consulting Civil & Structural Engineers
52 Lafone Street, London, SE1 2LX
Tel: +44 (0)20 7089 6800
Fax: +44 (0)20 7089 6801
E-mail: london@walshgroup.eu.com

Status: **PRELIMINARY**

Drawn	BTR	A0 Scales	1 : 100		
Date	OCT 14	Eng.	NMC	Chk.	–	Appr'd.

File Ref.

ACTUAL DIMENSION = 80mm

Drawing No.: 2765/D/015 Rev.: P1

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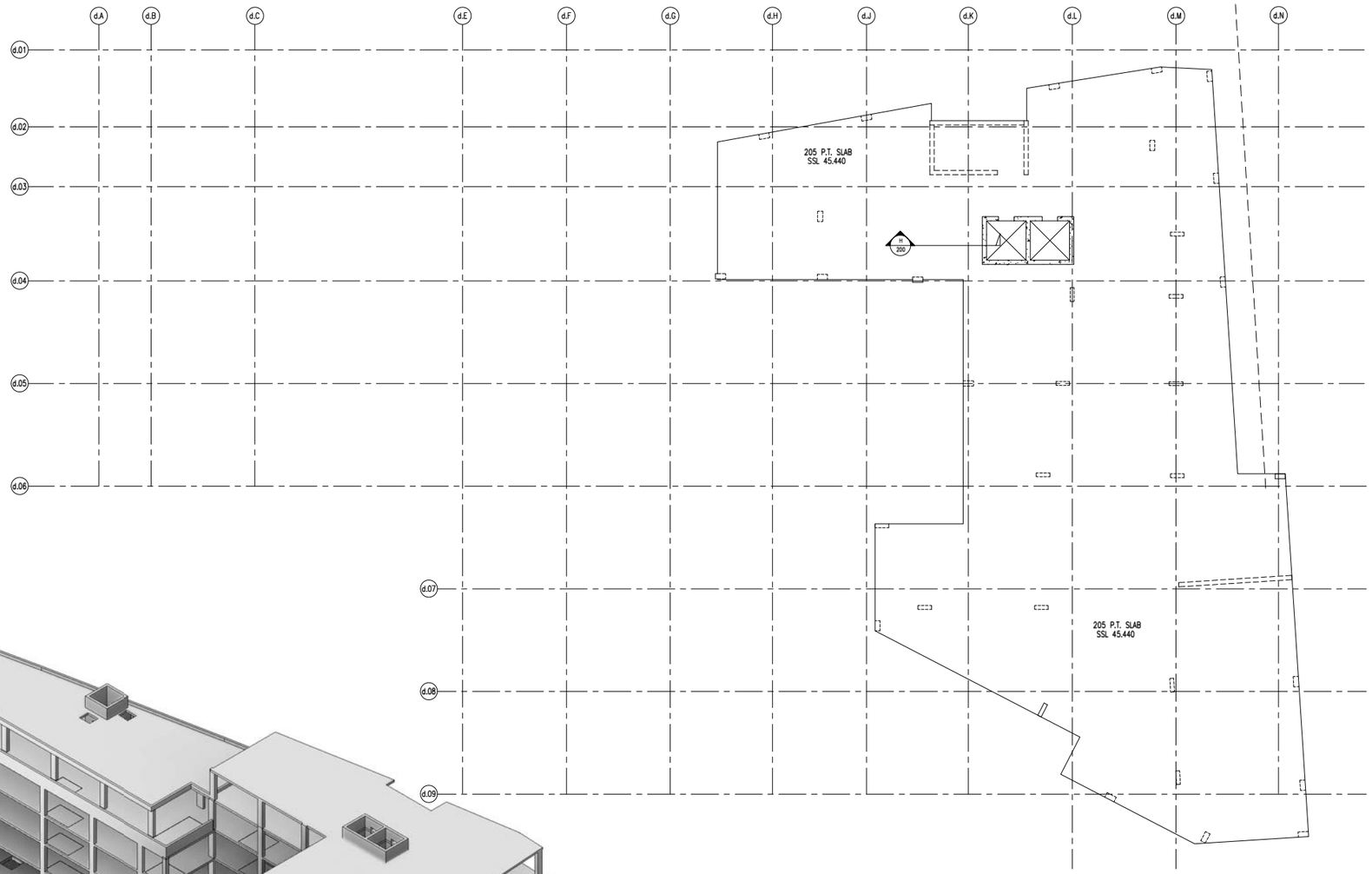

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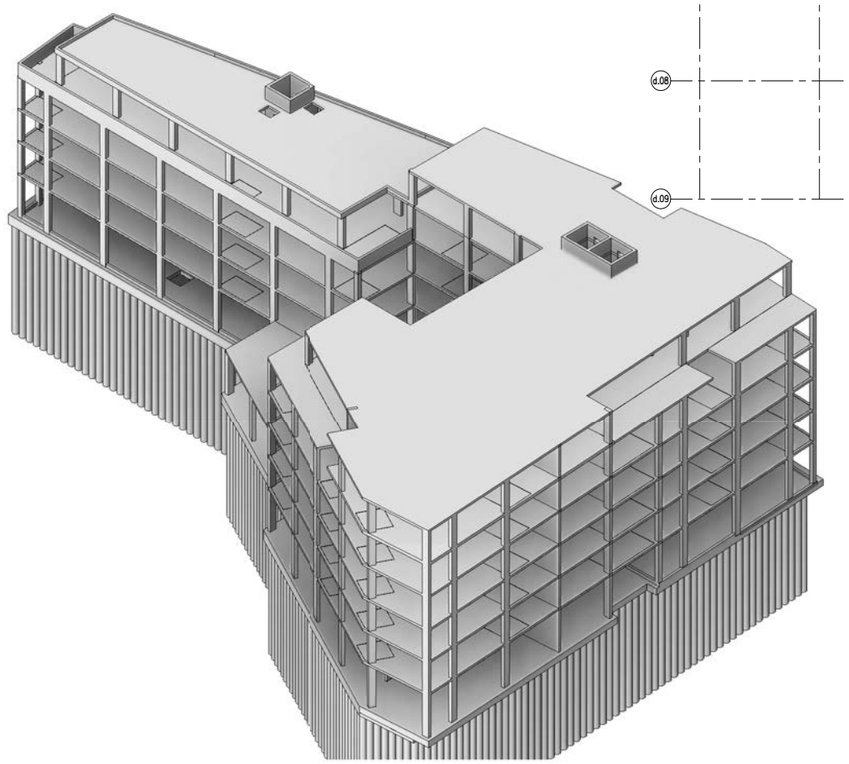


STRUCTURAL WALL SCHEDULE	
WALL REF.	SIZE
W1	250 R.C. WALL
W2	300 R.C. LINER WALL

STRUCTURAL COLUMN SCHEDULE	
COLUMN REF.	SIZE
C1	300 x 600
C2	225 x 800
C3	375 x 400
C4	600ø
C5	800ø

STRUCTURAL UPSTAND...	
WALL REF.	SIZE
U1	200 R.C. UPSTAND

Notes

1. ALL DIMENSIONS ARE IN MILLIMETRES AND LEVELS IN METRES.

2. THIS DRAWING TO BE READ IN CONJUNCTION WITH RELEVANT ARCHITECT'S AND ENGINEER'S DRAWINGS AND SPECIFICATIONS.

3. THIS DRAWING HAS BEEN PRODUCED ELECTRONICALLY AND MAY HAVE BEEN PHOTO REDUCED OR ENLARGED WHEN COPIED. HENCE, DO NOT RELY ON ANY SCALES QUOTED. WORK ONLY TO FIGURED DIMENSIONS (DO NOT SCALE). ALL DIMENSIONS TO BE CHECKED ON SITE. ANY ERRORS OR OMISSIONS TO BE REPORTED TO THE ENGINEER IMMEDIATELY.

4. ALL CONCRETE TO BE MINIMUM C40 U.N.O

C.D.M.

SIGNIFICANT RISKS AND HAZARDS:

BASEMENT EXCAVATION CLOSE TO VIADUCT, UKPN TRENCH & CANAL.

KEY DESIGN DECISIONS TO REDUCE OR ELIMINATE HAZARDS:

MOVEMENT MONITORING OF VARIOUS CONTIG WALLS.

Rev.	Date	By	Details Of Revision
P1	23.03.15	TH	WIP ISSUE

Client
STANLEY SIDINGS LTD

Project
CAMDEN LOCK VILLAGE
BUILDING D

Title
ROOF G.A.

Walsh Associates
Consulting Civil & Structural Engineers
32 Lafone Street, London, SE1 2LX
Tel: +44 (0)20 7089 6800
Fax: +44 (0)20 7089 6801
E-mail: london@walshgroup.eu.com

Status
PRELIMINARY

Drawn	BTR	A0 Scales	1 : 100		
Date	12/04/14	Eng.	NMC	Chk.	–

Appr'd. Approver

File Ref.

ACTUAL SHEETSIZE = 841x594

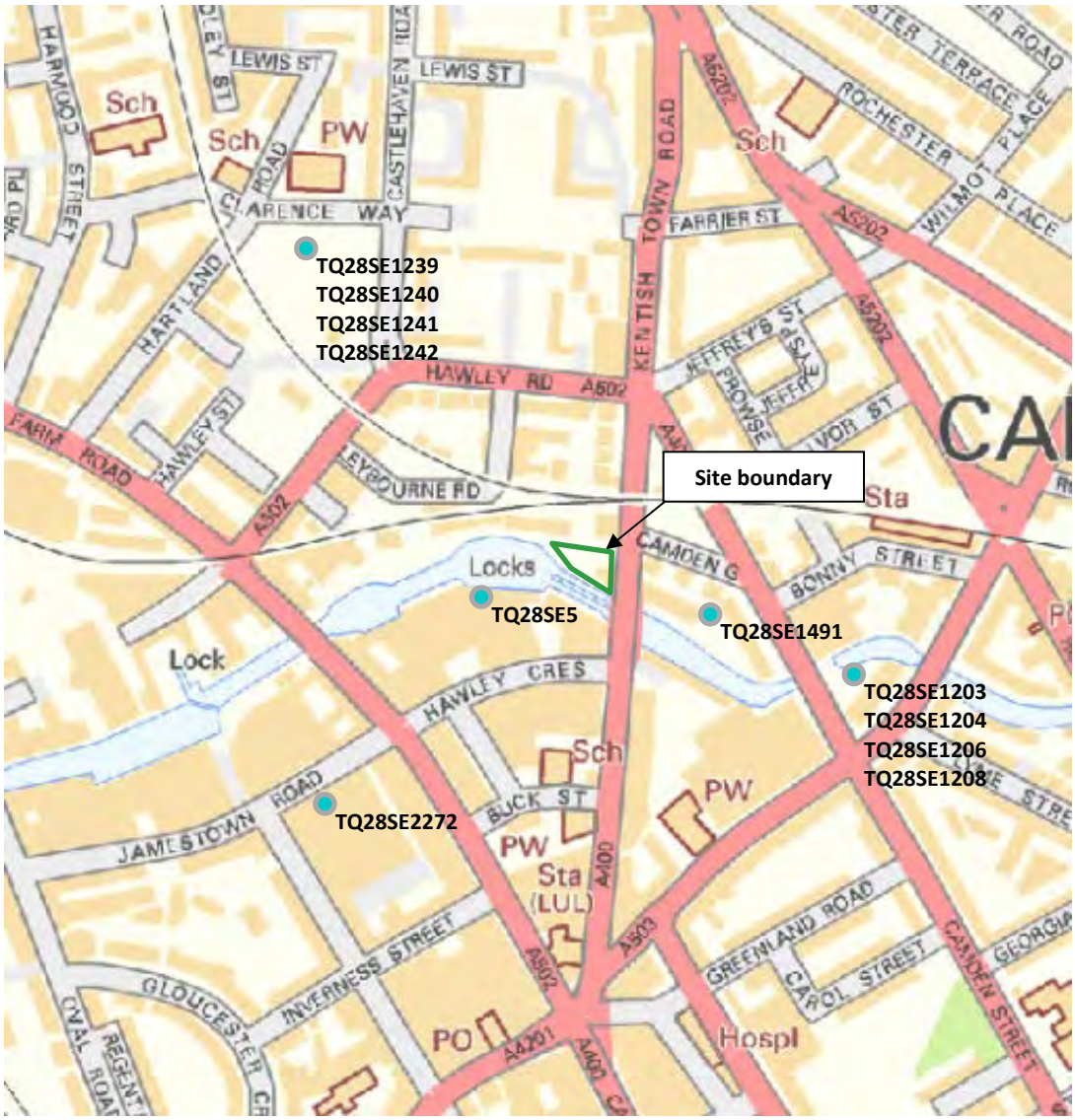
Drawing No. 2765/D/016

Rev. P1

C:\Users\thewson\Documents\2765_WC-SD-ZZ-M3-S-BuildingD_2015_thewson.rvt

APPENDIX B

Historical BGS boreholes logs



N

Base figure taken from BGS online

Not to scale

Client	Project	Job No
Walsh Associates	**Camden Lock Village, London – Proposed Building E**	**CG/18067C**
CGL	Title **BGS borehole location plan**	

Project: ARLINGTON HOUSE, 220 ARLINGTON ROAD, CAMDEN, LONDON	Client: [redacted]	Trial Pit Excavation Methods: BRADFORD WATTS HAND PIT	Hole No. **TH8A**
	Engineer: [redacted]	Pit Dimensions: Length - 1.80 m Width - 1.40 m	Sheet 1 of 1
Ground Level: 25.33 m.A.O.D.	Coordinates: m.E. m.N.	Orientation: Length -	Job No **10482**

WATER		STRATA				SAMPLING/IN SITU TEST			LAB TESTING				
Date/Time at Depth	Depth to Water m	Description	Legend	Level m.A.O.D.	Depth m	Depth m	Type & No.	Test Result	% <425	W %	W_P %	W_L %	OTHER TESTS AND NOTES
		Made Ground (Brickwork wall)				0.20	D1						TH8A logged from north west face of Trial hole CLEA screen with speciated polyaromatic hydrocarbons (D1)
						0.50	D2		100	34	27	75	No groundwater recorded during fieldwork
				24.60	0.73								
30/10/06	DRY C	Made Ground (Concrete)											Water in hole from Diamond Drilling corehole in wall above pit
				24.25	1.08								
													Trial pit complete at 1.09m

Pit Stability, Shoring, etc.

No collapse of sides of trial pit

Water Level observations during digging, depths below GL.					
Strike	Depth Obs.	Depth after 5min	10 min	15 min	20 min

WATER

- ▼ 1 First Strike
- ▽ 2 Subsequent Strike
- N - Overnight Depth
- C- Completion Depth
- S Seepage not rising

SAMPLE AND TEST KEY

- D Small disturbed sample
- B Bulk disturbed sample
- W Water sample
- U Undisturbed sample
- K Percolation Test
- PP Perth Penetrometer Test
- HV Hand shear vane test
- SRD Sand replacement density test
- CBR In situ CBR test
- PB Plate Bearing Test

TEST RESULT

- Np = Np Value
- V = Average Hand Shear Vane Strength - kN/m^2
- BD = In-Situ Bulk Density - Mg/m^3
- CBR = California Bearing Ratio - %

Fieldwork By	GJB
Dates	30/10/03
Log	GJB

Sheet 1 of 1

TH8A

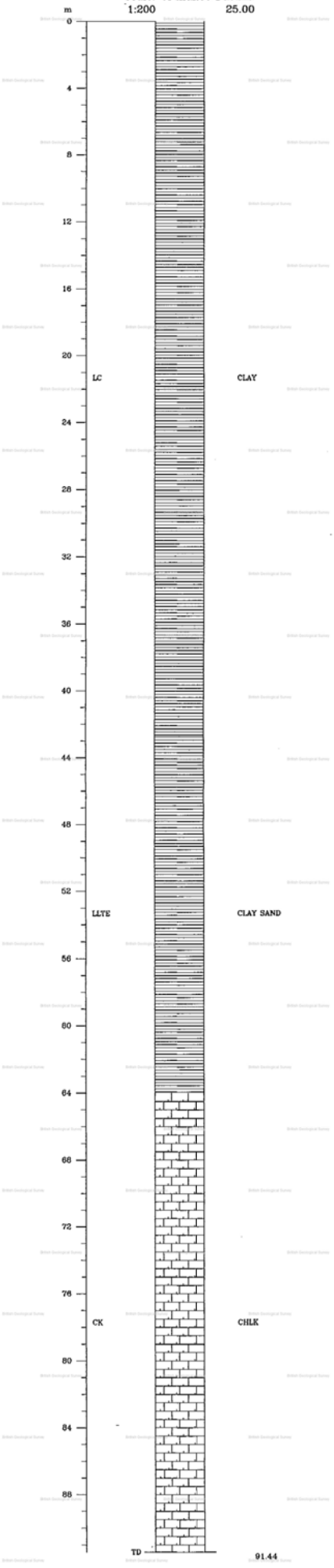
RSA GEOTECHNICS LTD (01449) 723723

5 TQ28SE 5

N-WHITAKERS BREWERY HAMPSTEAD

Grid Reference: 28850 84138

Scale: 1:200 Ordnance Datum: 25.00



TERRESEARCH LIMITED

BOREHOLE NO. 1 TQ28SE 1203

Contract Name Camden Town
Report No. S. 808/15
Client S. Bottis Ltd.
Site Address Corner of Camden Street and Camden Road
Engineers: Leonard & Partners, 344 - 360 South Lambeth Rd, London S.W.8.
2708 8'40

Standing Water Level 55'0" 17.6.65. 30'0" 21.6.65.
Diameter 8"
Water Struck 3'6"
Method of Boring Shell/Auger
Ground Level 78.49
Start 14.6.65. Finish 16.6.65.
Remarks:

Description of Strata	Thickness	Depth	Disturbed Samples	'U' Cores and 'N' P. Test
Made ground (sand, bricks stones etc.)	1'0"	1'0"	J2101 0'6"	
Soft brown mottled clay	2'6"	3'6"	J2102 2'6"	
Brown sandy clay with gravel	5'0"	8'6"	B2103 5'0" J2104 7'6"	5'0" N=14
Stiff brown mottled clay with layers of silt and sulphate crystals	8'0"	16'6"	J2106 12'6"	U2105 10'0" U2107 14'0"
Stiff fissured brown clay with sulphate crystals	5'6"	22'0"	J2108 17'6"	U2109 19'0"
Hard fissured grey silty clay with traces of organic material	6'0"	28'0"	J2110 22'6" J2112 27'6"	U2111 24'0"
Hard fissured silty grey clay	10'0"	38'0"	J2114 32'6" J2116 37'6"	U2113 29'0" U2115 34'0"
Hard fissured grey clay with layers of silt and occasional sulphate crystals	23'6"	61'6"	J2118 42'6" J2120 47'6" J2122 52'6" J2124 57'6"	U2117 39'0" J2119 45'0" U2121 49'0" U2123 54'0" U2125 60'0"
			W2126	
TOTALS	61'6"	61'6"		

NOTES: 1. Descriptions are given in accordance with the B.S. Civil Engineering Code of Practice C.P.2001 "Site Investigations"
2. J indicates Jar Samples.
B " Bulk Samples.
W " Water Samples.
U " Undisturbed Core Samples. These are nominal 4 in. diam. and 18 in. long. Depths shown are top of sample.
N " Number of blows per ft. penetration with Standard Penetration Tests.

TERRESEARCH LIMITED

BOREHOLE NO. 2 TQ28SE

Contract Name Camden Town — Report No. S. 808/15 1204

Client [illegible] — Site Address Corner of Camden Street.

Engineers: Leonard & Partners, — and Camden Road.

344 - 360 South Lambeth Rd., — London N.W.1.

London S.W.8. — 270, 3406

Standing Water Level None — Diameter 8"

Water Struck None — Method of Boring Shell/Auger

Ground Level 78.23 — Start 19.6.65. Finish 21.6.65.

Remarks:

Description of Strata	Thickness	Depth	Disturbed Samples	'U' Cores and 'N' P. Test
Made ground (concrete, grey silty clay with bricks)	3'0"	3'0"	J3724 2'6"	
Brown sandy clay with gravel	2'6"	5'6"	B3725 5'0"	
Stiff fissured mottled brown clay with occasional sulphate crystals and layers of silt	17'6"	23'0"	J3727 8'6" J3729 12'6" J3731 17'6" J3733 22'6"	U3726 6'0" U3728 10'0" U3730 14'0" U2732 19'0"
Hard silty mottled grey clay with sulphate crystals	5'0"	28'0"	J3735 27'6"	U3734 24'0"
Stiff to hard fissured grey silty clay with layers of light grey silt. Small crystalline aggregates of pyrites towards the base	32'6"	60'6"	J3737 32'6" J3739 37'6" J3741 42'6" J3743 47'6" J3745 52'6" J3747 57'6"	U3736 29'0" U3738 34'0" U3740 39'0" U3742 44'0" U3744 49'0" U3746 54'0" U3748 59'0"
TOTALS	60'6"	60'6"		

Notes: 1. Descriptions are given in accordance with the B.S. Civil Engineering Code of Practice C.P.2001 "Site Investigations"

2. J indicates Jar Samples.
   B " Bulk Samples.
   W " Water Samples.
   U " Undisturbed Core Samples. These are nominal 4 in. diam. and 18 in. long. Depths shown are top of sample.
   N " Number of blows per ft. penetration with Standard Penetration Tests.

TERRESEARCH LIMITED

BOREHOLE NO. 4 TQ28SE

Contract Name Camden Town
Client: G. Baltin Ltd.,
Engineers: Leonard & Partners.
344-360 South Lambeth Rd.
London. S.W.8.

Report No. S. 808/15 1206
Site Address Corner of Camden Street, and Camden Road
2910, 8410

Standing Water Level 25'0" 17.6.65.
25'9" 21.6.65.
Water Struck 3'6"
Ground Level 79.60

Diameter 8"
Method of Boring Shell/Auger
Start 16.6.65 Finish 16.6.65

Remarks:

Description of Strata		Thickness	Depth	Disturbed Samples	'U' Cores and 'N' P. Test
MADE GROUND	Sand bricks and stones etc.	0'9"	0'9"		
	Brown sandy clay with bricks and stones	2'9"	3'6"	J2127 2'6"	
Grey silty clay		7'0"	10'6"	B2128 5'0" J2129 7'6"	U2130 9'0"
Brown mottled clay		12'6"	23'0"	J2131 12'6" J2133 17'6" J2135 22'6"	U2132 14'0" U2134 19'0"
Grey clay		8'6"	31'6"	J3127 27'6"	U2136 24'0" U2138 30'0"
				W2139	
TOTALS		31'6"	31'6"		

NOTES: 1. Descriptions are given in accordance with the B.S. Civil Engineering Code of Practice C.P.2001 "Site Investigations"
2. J indicates Jar Samples.
B " Bulk Samples.
W " Water Samples.
U " Undisturbed Core Samples. These are nominal 4 in. diam. and 18 in. long. Depths shown are top of sample.
N " Number of blows per ft. penetration with Standard Penetration Tests.

TERRESEARCH LIMITED

BOREHOLE NO. 6 TQ28SE

Contract Name Camden Town Report No. S. 808/15 1208

Client LL.Baltic Ltd. Site Address Corner of Camden Street,

Engineers Halcrow and Partners, and Camden Road

344-360 South Lambeth Rd.

London, S.W.8. 2913, 8411

Standing Water Level Diameter 8"

Water Struck None Method of Boring Shell/Auger

Ground Level 76.27 Start 17.6.65 Finish 17.6.65

Remarks: 2 men breaking out concrete from ground level to 6" and pitting to 1'6".

Description of Strata		Thickness	Depth	Disturbed Samples	'U' Cores and 'N' P. Test
MADE GROUND	Concrete	0'6"	0'6"		
	Cobble stones	1'0"	1'6"		
Brown mottled silty clay clay		4'6"	6'0"	J3712 2'6" J3713 5'0"	
Mottled brown clay clay		14'0"	20'0"	J3714 7'6" J3716 12'6" J3718 17'6"	U3715 9'0" U3717 15'0" U3719 19'6"
Grey clay clay		4'0"	24'0"	J2720 22'6"	
Grey clay with layers of silt		7'0"	31'0"	J3722 27'6"	U3721 25'0" U3723 29'6"
TOTALS		31'0"	31'0"		

NOTES: 1. Descriptions are given in accordance with the B.S. Civil Engineering Code of Practice C.P.2001 "Site Investigations"

2. J indicates Jar Samples.
B " Bulk Samples.
W " Water Samples.
U " Undisturbed Core Samples. These are nominal 4 in. diam. and 18 in. long. Depths shown are top of sample.
N " Number of blows per ft. penetration with Standard Penetration Tests.

Terresearch

Contract: Hawley Road, Camden

Client: Materials Science Consultants Ltd

Borehole No. 1

Sheet No. 1 Of 1.
Depth 0 to 5 metres.

Equipment and Methods
Hand Auger 100mm diameter

Orientation : Vertical

Ground Level : m.O.D.

Coordinates : 287, 843

Job Number : S91/191
Location : TP28SE 1239
Dates : 20/11/91

Daily Prog.	Water Levels	Remarks	In Situ Tests	Samples Taken	Depth (Thick)	Reduced Level	Description	Legend
					0.00			
					0.05		MADE GROUND (tarmac)	
					0.15		MADE GROUND (concrete)	
				J 12	(0.48)		Firm greyish brown silty CLAY with scattered gravel traces	
				J 13	0.63		Firm to stiff brown slightly silty CLAY with occasional blue-grey reduction zones and traces of selenite crystals	
				U 14				
				J 15				
					(2.37)			
				U 16				
				J 17				
				J 18				
				U 19				
20/11					3.00		End of Borehole	

Operator
NF

General Remarks:

Appendix
1

Scale
5m/sheet

Sheet No.
1

Terresearch Limited, Taywood Road, Northolt, Middlesex UB5 6RL. Tel: 081 575 4901 Fax: 081 575 4462

Terresearch

Contract: Hawley Road, Camden

Client: Materials Science Consultants Ltd

Borehole No. 2

Sheet No. 1 Of 1.
Depth 0 to 5 metres.

Equipment and Methods
Hand Auger 100mm diameter

Orientation : Vertical

Ground Level : m.O.D.

Coordinates : 287,483

Job Number : S91/191

Location : TQ28SE 1240

Dates : 20/11/91

Daily Prog.	Water Levels	Remarks	In Situ Tests	Samples Taken	Depth (Thick)	Reduced Level	Description	Legend
					0.00			
					0.05		MADE GROUND (tarmac)	
					0.15		MADE GROUND (concrete)	
					(0.35)		Firm greyish brown silty CLAY	
				J 20	0.50		Firm brown silty CLAY with frequent blue-grey reduction zones, occasional pockets of orange-brown sandy clay and traces of selenite crystals becoming more abundant with depth	
				J 21				
				U*				
				U 22				
				J 23				
					(2.50)			
				U 24				
				J 25				
				J 26				
				U 27				
20/11					3.00		End of Borehole	

Operator NF

General Remarks:

Appendix 1

Scale 5m/sheet

Sheet No. 2

Terresearch Limited, Taywood Road, Northolt, Middlesex UB5 6RL. Tel: 081 575 4901 Fax: 081 575 4462

Terresearch

Contract: Hawley Road, Camden

Client: Materials Science Consultants Ltd

Borehole No. 3

Sheet No. 1 Of 1.
Depth 0 to 5 metres.

Equipment and Methods
Hand Auger 100mm diameter

Orientation : Vertical

Ground Level : m.O.D.

Coordinates : 287, 843

Job Number : S91/191
TQ 2 5 E
Location : 1241
Dates : 19/11/91

Daily Prog.	Water Levels	Remarks	In Situ Tests	Samples Taken	Depth (Thick)	Reduced Level	Description	Legend
					0.00			
				J 1	0.05		MADE GROUND (tarmac)	
					0.15		MADE GROUND (concrete)	
					(0.45)		MADE GROUND (dark grey clayey sand with bricks and stones)	
				J 2				
					0.60			
				J 3	(0.20)		MADE GROUND (ash with bricks and stones)	
	19/11			W 11	0.80			
				J 4			Firm brown silty CLAY with occasional blue-grey reduction zones	
				U 5				
				J 6				
					(2.20)			
				U 7				
				J 8				
				J 9				
				U 10				
19/11					3.00		End of Borehole	

Operator NF

General Remarks:

Appendix 1

Scale 5m/sheet

Sheet No. 3

Terresearch Limited, Taywood Road, Northolt, Middlesex UB5 6RL. Tel: 081 575 4901 Fax: 081 575 4462

Terresearch

Contract: Hawley Road, Camden
Client: Materials Science Consultants Ltd

Borehole No. 4
Sheet No. 1 Of 1.
Depth 0 to 5 metres.

Equipment and Methods
Hand Auger 100mm diameter

Orientation : Vertical

Ground Level : m.O.D.

Coordinates : 287, 843

Job Number : S91/191
Location : TQ28SE 1242
Dates : 20/11/91

Daily Prog.	Water Levels	Remarks	In Situ Tests	Samples Taken	Depth (Thick)	Reduced Level	Description	Legend
					0.00			
					0.05		MADE GROUND (tarmac)	
					0.15		MADE GROUND (concrete)	
					(0.45)		MADE GROUND (soft silty sandy brown clay with occasional gravel and brick traces)	
				J 28				
				J 29	0.60			
					(0.55)		Soft to firm dark brownish grey silty CLAY with organic traces	
				U 30				
				J 31	1.15			
				J 32			Firm to stiff brown silty CLAY with some blue-grey reduction zones and occasional organic traces	
				U 33				
				J 34	(1.85)			
				J 35				
				U 36				
20/11					3.00		End of Borehole	

Operator
NF

General Remarks:

Appendix
1

Scale
5m/sheet

Sheet No.
4

Terresearch Limited, Taywood Road, Northolt, Middlesex UB5 6RL. Tel: 081 575 4901 Fax: 081 575 4462

C16 2 598 398

RECORD of WELL or BORING

Survey No. 256
1" N.S.
1" O.S.

at Camden Road BH. No. 1

Town Camden Town NW. St. Pancras. County London

Six-inch map 1 5 NW

Situation (unless a tracing from a map is supplied, give distance and direction from parish church, cross-roads, or other object shown on maps). A little S of the SW from Camden Town Stn. (?) sheet 16 Vol 1

Popular edition of one-inch map. (Sheet, Square) TQ 28/50

Surface level of ground c 85 (65) ft. above Ordnance Datum. Well or Bore commenced at ...... ft. below surface level of ground.

Sunk 4 ft., diameter 4 x 4 ft. Bored ...... ft.; diameter of boring: at top ...... in., at bottom ...... in.

Details of lining tubes (internal diameters preferred) 34' 2" of 16 in. Top. 3' 4" b/o
197' 6" .. 12 .. .. 2' 6" ..

Water struck at depths of (feet) 301, 315, 333, NGR TQ 2902 8412

Rest-level of water below ~~above~~ top of well or bore 278 ft. Pumping level ?278 ft. Time of recovery ...... hours.

Suction at 598 ft. depth. Yield: (i) on test 7000/8000 galls. per hour, (ii) normal ...... galls. per ......

Quality (attach copy of analysis if available) Standard Temp. 0° Temp 4° Total 4°

Made by LE GRAND, SUTCLIFF & GELL, LD. for Aerated Bread Co. Ltd Date of boring Aug/Oct, 1934

Information from LE GRAND, SUTCLIFF & GELL, LD. S134/p. 673.

(For Survey use only). GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA. (and any additional remarks)	THICKNESS. Feet.	THICKNESS. Inches.	DEPTH. Feet.	DEPTH. Inches.
Made 2	Made ground	2	.	2	.
	Brown clay	50	.	52	.
L.C. 106	Blue clay	28	.	50	.
	Blue clay & stone	25	.	75	.
	Blue clay	33	.	108	.
	Mottled clay	39	.	147	.
W.R.B. 50	Conglomerate	6	.	153	.
	Green loamy sand	5	.	158	.
T.S. 20	Thanet Sand	19	.	177	.
	Green flints	1	.	178	.
CK. 474	Chalk & flints	232	.	410	.
	Hard grey Chalk	242	.	652	.

DB 26:10:35.

Site visited 30th July 1946.
Pumping controlled by demand &.
Well top in basement 10' below ground level.

Confidential Water very soft. - have to harden it.

2 July 1946

~~Rest L.~~ P.W.L. 300 Yield 10,328 Nov. 1937

For Survey use only.

Date received.	G.S.M.	M. of H. notified.	Site marked on 1" map.
Oct 1935			

Geological Survey and Museum, South Kensington, London, S.W. 7.

(11969B) Wt 10256/0175 2,500 9/32 H, J, R & L, Ld

APPENDIX C

CGL borehole logs

WINDOW SAMPLE LOG

Project				HOLE No
Camden Lock Village, London - Proposed Building E				**WS10**
Job No	Date	Ground Level (m)	Co-Ordinates (m)	
CG/18067C	14-01-15	26.00	E 528,894.1 N 184,187.2	
Client				Sheet
Walsh Associates				1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument /Backfill
Depth	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
				25.80		0.20	Dark brown slightly clayey gravelly fine to coarse sand. Gravel is fine to coarse, subrounded to angular of flint with occasional cobbles of flint. [MADE GROUND - TOPSOIL]	
0.50	ES450			25.30		(0.50) 0.70	Dark brown to black slightly clayey gravelly fine to coarse sand. Gravel is fine to coarse, subrounded to angular of brick and flint with rare fragments of plastic and wood. [MADE GROUND]	
0.80	ES451						Medium strength firm to stiff light brown CLAY. [WEATHERED LONDON CLAY FORMATION]	
1.00	HSV	50						
1.00		N7						
1.50	ES452							
1.50	HSV	50						
1.50	HSV	51					1.80 - 2.70 Frequent orange mottling noted.	
2.00	ES453							
2.00	HSV	51				(2.90)		
2.00		N10						
2.50	HSV	46						
2.50	HSV	68						
2.50	HSV	76					2.70 - 3.60 Orange mottling ceases, frequent grey mottling noted.	
3.00	D454							
3.00	HSV	69						
3.00		N11						
3.50	HSV	79		22.40		3.60		
3.50	HSV	77					Medium to hight strength firm light brown mottled grey slightly sandy CLAY. Sand is fine and orange. [WEATHERED LONDON CLAY FORMATION]	
3.50	HSV	86					3.60 - 4.10 Selenite crystals noted.	
4.00	D455							
4.00	HSV	75						
4.00		N14				(1.30)		
4.50	HSV	100					4.50 - 4.60 Claystone noted.	
4.50	HSV	101						
4.50	HSV	97						
				21.10		4.90		
5.00	D456						High strength stiff light brown silty CLAY. [WEATHERED LONDON CLAY FORMATION]	
5.00		N23				(0.55)		
				20.55		5.45		
							(Window sample terminated at 5.45m)	

Boring Progress and Water Observations

Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth

General Remarks

1. ES= environmental sample, D= disturbed sample, HSV= hand shear vane test, N = Standard Penetration Test 'N' value.
2. Installation details: 0.0m to 1.0m plain pipe with bentonite backfill, 1.0m to 5.0m slotted pipe with gravel backfill, 5.0m to 5.45m bentonite backfill. Gas tap, bung and flush cover installed.
3. No groundwater encountered in borehole.

Method/ Plant Used	Field Crew	Logged By	Checked By
Tracked window sampler rig	RP Drilling	DMH	KAS

WINDOW SAMPLE LOG

Project				HOLE No
Camden Lock Village, London - Proposed Building E				**WS11**
Job No	Date	Ground Level (m)	Co-Ordinates (m)	
CG/18067C	14-01-15	25.85	E 528,932.7 N 184,182.3	
Client				Sheet
Walsh Associates				1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument /Backfill
Depth	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
				25.70		0.15	Brown slightly clayey gravelly fine to coarse sand with frequent rootlets throughout. Gravel is fine to medium, angular to subrounded of flint. [MADE GROUND - TOPSOIL]	
0.50	ES457					(0.85)	Black with some orange bands, slightly clayey very gravelly fine to coarse sand. Gravel is fine to coarse, subrounded to angular of red brick, concrete, slate and wood fragments with occasional cobbles of angular red brick. [MADE GROUND]	
1.00		N7		24.85		1.00	*(Window sample terminated at 1.45m)*	

Boring Progress and Water Observations

Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth

General Remarks

1. ES= environmental sample, N = Standard Penetration Test 'N' value.
2. Borehole terminated due to concrete obstruction at 1.45mbgl and backfilled with arisings.
3. No groundwater encountered in borehole.

Method/ Plant Used	Field Crew	Logged By	Checked By
Tracked window sampler rig	RP Drilling	DMH	KAS

WINDOW SAMPLE LOG

Project				HOLE No
Camden Lock Village, London - Proposed Building E				**WS11A**
Job No	Date	Ground Level (m)	Co-Ordinates (m)	
CG/18067C	14-01-15	25.95	E 528,930.4 N 184,181.4	
Client				Sheet
Walsh Associates				1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument /Backfill
Depth	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
				25.80		0.15	Brown slightly clayey gravelly fine to coarse sand. Gravel is fine to medium, subrounded to angular of flint. [MADE GROUND - TOPSOIL]	
0.50	ES457					(1.25)	Dark brown slightly clayey gravelly fine to coarse sand. Gravel is fine to coarse, subrounded to angular of red brick, concrete and slate with occasional cobbles of angular red brick and concrete. [MADE GROUND]	
				24.55		1.40	*(Window sample terminated at 1.4m)*	

Boring Progress and Water Observations

Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth

General Remarks

1. ES= environmental sample.
2. Borehole terminated due to concrete obstruction at 1.4mbgl and backfilled with arisings.
3. No groundwater encountered in borehole.

Method/ Plant Used	Field Crew	Logged By	Checked By
Tracked window sampler rig	RP Drilling	DMH	KAS

WINDOW SAMPLE LOG

Project				HOLE No
Camden Lock Village, London - Proposed Building E				**WS11B**
Job No	Date	Ground Level (m)	Co-Ordinates (m)	
CG/18067C	14-01-15	25.79	E 528,927.5 N 184,182.9	
Client				Sheet
Walsh Associates				1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument /Backfill
Depth	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
				25.59		0.20	Brown slightly clayey, slightly gravelly fine to coarse sand with frequent rootlets throughout. Gravel is fine to medium, rounded to subangular of flint. [MADE GROUND - TOPSOIL]	
0.50	ES458					(0.65)	Brownish grey very gravelly fine to coarse sand. Gravel is fine to coarse, subrounded to very angular of flint, red brick and concrete with occasional cobbles of angular concrete. [MADE GROUND]	
				24.94		0.85		
1.00	HSV	42					Medium strength firm light brown slightly sandy CLAY. Sand is fine. [WEATHERED LONDON CLAY FORMATION]	
1.00		N6						
1.20	ES459					(0.75)		
1.50	HSV	58		24.19		1.60		
1.50	HSV	78					Medium to high strength firm to stiff light brown slightly silty CLAY. [WEATHERED LONDON CLAY FORMATION]	
1.50	HSV	70						
2.00	ES460							
2.00	HSV	54						
2.00		N9						
							2.40 - 4.20 Frequent grey mottling noted.	
2.50	HSV	67						
2.50	HSV	71						
2.50	HSV	69						
						(2.60)		
3.00	D461						3.00 - 3.65 Frequent selenite crystals noted.	
3.00	HSV	80						
3.00		N11						
							3.45 - 3.55 Band of claystone noted.	
3.50	HSV	83						
3.50	HSV	87						
3.50	HSV	94						
4.00	D462							
4.00	HSV	80		21.59		4.20		
4.00		N23		21.54		4.25	High strength firm light brown sandy CLAY. Sand is fine to medium. [WEATHERED LONDON CLAY FORMATION]	
4.50	HSV	130					Medium to high strength very stiff light brown slightly sandy CLAY. Sand is fine. [WEATHERED LONDON CLAY FORMATION]	
						(1.20)	4.80 Below 4.80mbgl: Frequent grey mottling.	
5.00	D463							
5.00	HSV	101						
5.00		N16						
				20.34		5.45		
							(Window sample terminated at 5.45m)	

Boring Progress and Water Observations

Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth

General Remarks

1. ES= environmental sample, D= disturbed sample, HSV= hand shear vane test, N = Standard Penetration Test 'N' value.
2. Installation details: 0.0m to 1.0m plain pipe with bentonite backfill, 1.0m to 5.0m slotted pipe with gravel backfill, 5.0m to 5.45m bentonite backfill. Gas tap, bung and flush cover installed.
3. No groundwater encountered in borehole.

Method/ Plant Used	Field Crew	Logged By	Checked By
Tracked window sampler rig	RP Drilling	DMH	KAS

WINDOW SAMPLE LOG

Project				HOLE No
Camden Lock Village, London - Proposed Building E				**WS12**
Job No	Date	Ground Level (m)	Co-Ordinates (m)	
CG/18067C	14-01-15	25.94	E 528,920.9 N 184,165.5	
Client				Sheet
Walsh Associates				1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument /Backfill
Depth	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
				25.69		0.25	Dark brown slightly clayey gravelly fine to coarse sand with frequent rootlets throughout. Sand is fine to coarse. Gravel is fine to medium, subrounded to subangular of flint. [MADE GROUND - TOPSOIL]	
				25.44		0.50	Black very gravelly fine to medium sand. Gravel is fine to coarse, subrounded to angular of red brick and concrete with rare chalk deposits. [MADE GROUND]	
0.60	ES464			25.24		0.70	Grey slightly gravelly fine to coarse sand. Gravel is fine to coarse, rounded to subangular of flint and concrete. [MADE GROUND]	
1.00	ES465					(0.50)		
1.00		N7		24.74		1.20	Firm light brown to brown slightly sandy, slightly gravelly clay. Sand is fine. Gravel is fine to coarse, subrounded to very angular of flint with rare red brick and occasional cobbles of very angular flint. [MADE GROUND]	
1.50	HSV	48				(0.60)		
1.50	HSV	57					Medium strength firm light brown slightly sandy CLAY. Sand is fine. [WEATHERED LONDON CLAY FORMATION]	
1.50	HSV	79		24.14		1.80		
							Medium strength firm light brown with dark staining slightly silty CLAY. No odour. [WEATHERED LONDON CLAY FORMATION]	
2.00	HSV	70				(0.70)		
2.00		N8						
2.20	ES466			23.44		2.50		
2.50	HSV	59					Medium strength stiff light brown mottled grey slightly silty CLAY. Mottling becomes more frequent with depth. [WEATHERED LONDON CLAY FORMATION]	
2.50	HSV	58						
2.50	HSV	52						
3.00	D467							
3.00	HSV	49						
3.00		N6						
						(2.00)		
3.50	HSV	68						
3.50	HSV	77						
3.50	HSV	78						
4.00	D468							
4.00	HSV	79						
4.00		N11						
				21.44		4.50		
4.50	HSV	63					Medium to high strength stiff light brown mottled grey slightly sandy CLAY. Sand is fine. [WEATHERED LONDON CLAY FORMATION]	
4.50	HSV	64				(0.30)		
4.50	HSV	101		21.14		4.80		
							Medium to high strength stiff light brown slightly sandy CLAY. Clay is friable. [WEATHERED LONDON CLAY FORMATION]	
5.00	D469							
5.00		N13				(0.65)		
				20.49		5.45		
							(Window sample terminated at 5.45m)	

Boring Progress and Water Observations

Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth

General Remarks

1. ES= environmental sample, D= disturbed sample, HSV= hand shear vane test, N = Standard Penetration Test 'N' value.
2. Installation details: 0.0m to 0.5m plain pipe with bentonite backfill, 0.5m to 5.0m slotted pipe with gravel backfill, 5.0m to 5.45m bentonite backfill. Gas tap, bung and flush cover installed.
3. No groundwater encountered in borehole.

Method/ Plant Used	Field Crew	Logged By	Checked By
Tracked window sampler rig	RP Drilling	DMH	KAS

WINDOW SAMPLE LOG

Project				HOLE No
Camden Lock Village, London - Proposed Building E				**WS13**
Job No	Date	Ground Level (m)	Co-Ordinates (m)	
CG/18067C	14-01-15	25.78	E 528,911.5 N 184,177.3	
Client				Sheet
Walsh Associates				1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument /Backfill
Depth	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
				25.63		0.15	Dark brown slightly clayey gravelly fine to coarse sand with infrequent rootlets throughout. Gravel is fine to coarse, subrounded to angular of flint. [MADE GROUND - TOPSOIL]	
0.50	ES470					(0.75)	Firm dark brown to black slightly sandy gravelly clay. Sand is fine to coarse. Gravel is fine to coarse, subrounded to angular of flint, red brick and concrete with rare slate. [MADE GROUND]	
				24.88		0.90		
1.00	ES471						Low to medium strength firm light brown CLAY. [WEATHERED LONDON CLAY FORMATION]	
1.00		N8						
1.50	HSV	61				(1.40)		
1.50	HSV	80						
1.50	HSV	67						
1.80	ES472							
2.00	HSV	47						
2.00		N7						
				23.48		2.30	2.20 - 2.30 Band of orange sandy CLAY. Sand is fine.	
2.50	HSV	59					Medium strength stiff light brown with occasional grey mottling slightly silty CLAY. [WEATHERED LONDON CLAY FORMATION]	
2.50	HSV	57						
3.00	D473							
3.00	HSV	72						
3.00		N9						
3.50	HSV	88						
3.50	HSV	78						
3.50	HSV	93				(3.15)		
4.00	D474							
4.00	HSV	68						
4.00		N12						
4.50	HSV	130						
4.50	HSV	79						
4.50	HSV	102						
5.00	D475							
5.00	HSV	80						
5.00		N18						
				20.33		5.45		
							(Window sample terminated at 5.45m)	

Boring Progress and Water Observations

Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth

General Remarks

1. ES= environmental sample, D= disturbed sample, HSV= hand shear vane test, N = Standard Penetration Test 'N' value.
2. Backfilled with arisings.
3. No groundwater encountered in borehole.

Method/ Plant Used	Field Crew	Logged By	Checked By
Tracked window sampler rig	RP Drilling	DMH	KAS

CGL WS LOG CG18067C.GPJ GINT STD AGS 3_1.GDT 23/2/15

WINDOW SAMPLE LOG

Project				HOLE No
Camden Lock Village, London - Proposed Building E				**WS14**
Job No	Date	Ground Level (m)	Co-Ordinates (m)	
CG/18067C	14-01-15	26.07	E 528,930.9 N 184,165.3	
Client				Sheet
Walsh Associates				1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument /Backfill
Depth	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
				25.92		0.15	Dark brown slightly clayey gravelly fine to coarse sand with frequent rootlets throughout. Gravel is fine to coarse, subrounded to angular of flint. [MADE GROUND - TOPSOIL]	
0.50	ES476					(0.85)	Firm brown to dark brown slightly sandy gravelly clay. Sand is fine to medium. Gravel is fine to coarse, subrounded to angular of red and yellow brick and concrete with rare slate and occasional cobbles of red and yellow brick. [MADE GROUND]	
				25.07		1.00	*(Window sample terminated at 1m)*	

Boring Progress and Water Observations

Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth

General Remarks

1. ES= environmental sample, N = Standard Penetration Test 'N' value.
2. Borehole terminated due to concrete obstruction at 1.0mbgl and backfilled with arisings.
3. No groundwater encountered in borehole.

Method/ Plant Used	Field Crew	Logged By	Checked By
Tracked window sampler rig	RP Drilling	DMH	KAS

WINDOW SAMPLE LOG

Project				HOLE No
Camden Lock Village, London - Proposed Building E				**WS14A**
Job No	Date	Ground Level (m)	Co-Ordinates (m)	
CG/18067C	14-01-15	25.92	E 528,926.9 N 184,163.7	
Client				Sheet
Walsh Associates				1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument /Backfill
Depth	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
				25.77		0.15	Dark brown slightly clayey gravelly fine to coarse sand with frequent rootlets throughout. Sand is fine to coarse. Gravel is fine to coarse, subrounded to angular of flint. [MADE GROUND - TOPSOIL]	
0.50	ES476					(0.85)	Dark brown slightly clayey sandy fine to coarse rounded to angular gravel of red and yellow brick and concrete with frequent cobbles of red and yellow brick. Sand is fine to coarse. Rare black staining throughout (no odour). [MADE GROUND]	
				24.92		1.00	*(Window sample terminated at 1m)*	

Boring Progress and Water Observations

Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth

General Remarks

1. ES= environmental sample, N = Standard Penetration Test 'N' value.
2. Borehole terminated due to concrete obstruction at 1.0mbgl and backfilled with arisings.
3. No groundwater encountered in borehole.

Method/ Plant Used	Field Crew	Logged By	Checked By
Tracked window sampler rig	RP Drilling	DMH	KAS

WINDOW SAMPLE LOG

Project				HOLE No
Camden Lock Village, London - Proposed Building E				**WS14B**
Job No	Date	Ground Level (m)	Co-Ordinates (m)	
CG/18067C	14-01-15	25.96	E 528,925.2 N 184,166.9	
Client				Sheet
Walsh Associates				1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument /Backfill
Depth	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
				25.81		0.15	Dark brown slightly clayey gravelly fine to coarse sand with frequent rootlets throughout. Sand is fine to coarse. Gravel is fine to coarse, subrounded to angular of flint. [MADE GROUND - TOPSOIL]	
0.50	ES476					(0.85)	Dark brown to black slightly clayey gravelly fine to coarse sand. Gravel is fine to coarse, rounded to angular of flint, red and yellow brick, concrete, slate and clinker with occasional cobbles of red and yellow brick and concrete. [MADE GROUND]	
				24.96		1.00	*(Window sample terminated at 1m)*	

Boring Progress and Water Observations

Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth

General Remarks

1. ES= environmental sample, N = Standard Penetration Test 'N' value.
2. Borehole terminated due to concrete obstruction at 1.0mbgl and backfilled with arisings.
3. No groundwater encountered in borehole.

Method/ Plant Used	Field Crew	Logged By	Checked By
Tracked window sampler rig	RP Drilling	DMH	KAS

WINDOW SAMPLE LOG

Project				HOLE No
Camden Lock Village, London - Proposed Building E				**WS15**
Job No	Date	Ground Level (m)	Co-Ordinates (m)	
CG/18067C	14-01-15	26.04	E 528,925.7 N 184,173.4	
Client				Sheet
Walsh Associates				1 of 1

SAMPLES & TESTS			Water	STRATA				Instrument /Backfill
Depth	Type No	Test Result (N/kPa/ppm)		Reduced Level	Legend	Depth (Thick-ness)	DESCRIPTION	
				25.89		0.15	Dark brown slightly clayey gravelly fine to coarse sand with rare rootlets throughout. Sand is fine to coarse. Gravel is fine to medium, subrounded to subangular of flint. [MADE GROUND - TOPSOIL]	
						(0.55)		
				25.34		0.70	Soft to firm dark brown with frequent black staining slightly sandy gravelly clay. Sand is fine to coarse. Gravel is fine to coarse, subrounded to angular of red and yellow brick, concrete and burnt material with a medium cobble content of angular red and yellow brick. No odour noted. [MADE GROUND]	
1.00		N9				(0.70)	Firm to stiff dark brown gravelly clay. Gravel is fine to coarse, subrounded to angular of flint and red brick with occasional cobbles of subangular red brick. Gravel content decreases at the base of the layer. [MADE GROUND]	
				24.64		1.40		
1.50	D477						Medium strength stiff light brown slightly silty CLAY. [WEATHERED LONDON CLAY FORMATION]	
2.00	HSV	71						
2.00		N7						
2.50	D478							
2.50	HSV	38						
2.50	HSV	72					2.70 - 2.75 Band of orange sandy CLAY. Sand is fine.	
2.50	HSV	84						
3.00	HSV	73						
3.00		N9						
						(4.05)		
3.50	HSV	59					3.50 Below 3.50mbgl: Frequent grey mottling noted.	
3.50	HSV	61						
3.50	HSV	90						
4.00	HSV	72						
4.00		N13						
4.50	HSV	88						
4.50	HSV	100						
5.00	D479							
5.00	HSV	106						
5.00		N16						
				20.59		5.45		
							(Window sample terminated at 5.45m)	

Boring Progress and Water Observations

Date	Strike depth	Casing depth	Comment	Time measured	Standing Depth

General Remarks

1. ES= environmental sample, D= disturbed sample, HSV= hand shear vane test, N = Standard Penetration Test 'N' value.
2. Backfilled with arisings.
3. No groundwater encountered in borehole.

Method/ Plant Used	Field Crew	Logged By	Checked By
Tracked window sampler rig	RP Drilling	DMH	KAS

APPENDIX D

Ground gas and groundwater monitoring records

GAS MONITORING RECORD SHEET

JOB DETAILS			
Site:	Camden Lock Market - Proposed Building E	Job No:	CG/18067C
Date:	20/01/2015	Engineer:	TOP
Time:	08:00am	Client	Walsh Associates

METEOROLOGICAL & SITE INFORMATION

State of ground:	Dry	X	Moist		Wet				
Wind:	Calm		Light	X	Moderate		Strong		
Cloud cover:	None		Slight	X	Cloudy		Overcast		
Precipitation:	None	X	Slight		Moderate		Heavy		

Barometric pressure (mb): 1005 - 1007 Local pressure system*: Falling Air temperature (°C): -2

Well No.	Time (s)	Flow (l/hr)	dA (PA)	O_2 (% vol. in air)	CO_2 (% vol. in air)	CH_4 (% vol. in air)	PID (ppm)	Depth to GW (mbgl)	Comments
WS10	0	0.7	2.0	18.7	2.2	<0.1	NR	4.48	Base of well at 4.98mbgl
	15	0.8	3.0	18.5	2.1	<0.1			
	30	0.9	3.0	18.4	2.1	<0.1			
	45	0.9	3.0	18.4	2.1	<0.1			
	60	0.9	3.0	18.4	2.1	<0.1			
	90	0.8	3.0	18.4	2.1	<0.1			
	120	0.8	3.0	18.4	2.1	<0.1			
	150	0.8	3.0	18.3	2.1	<0.1			
	180			18.3	2.1	<0.1			
	240			18.3	2.1	<0.1			
	300			18.2	2.1	<0.1			
WS11B	0	0.7	2.0	19.3	0.8	<0.1	NR	4.78	Base of well at 4.98mbgl
	15	0.8	3.0	19.2	0.8	<0.1			
	30	0.9	3.0	19.2	0.8	<0.1			
	45	0.9	3.0	19.1	0.8	<0.1			
	60	0.9	3.0	19.1	0.8	<0.1			
	90	0.8	3.0	19.1	0.8	<0.1			
	120	0.8	3.0	19.1	0.8	<0.1			
	150	0.8	3.0	19.1	0.8	<0.1			
	180			19.1	0.8	<0.1			
	240								
	300								
WS12	0	0.9	3.0	18.9	1.7	<0.1	NR	4.56	Base of well at 4.94mbgl
	15	0.8	3.0	18.5	1.7	<0.1			
	30	0.9	3.0	18.5	1.7	<0.1			
	45	0.9	3.0	18.4	1.7	<0.1			
	60	0.9	3.0	18.4	1.7	<0.1			
	90	0.9	3.0	18.4	1.7	<0.1			
	120	0.7	3.0	18.4	1.7	<0.1			
	150	0.8	3.0	18.4	1.7	<0.1			
	180	0.9	3.0	18.4	1.7	<0.1			
	240	0.8	3.0						
	300	0.9	3.0						

Notes:

The measurement of hydrogen sulphide and hydrocarbon free product is undertaken on a site specific basis, if deemed necessary.

** With reference to the Met Office rolling weather archive for Northolt weather station.*

GAS MONITORING RECORD SHEET

JOB DETAILS			
Site:	Camden Lock Market - Proposed Building E	Job No:	CG/18067C
Date:	26/01/2015	Engineer:	JJM
Time:	12:30pm	Client	Walsh Associates

METEOROLOGICAL & SITE INFORMATION

State of ground:	Dry		Moist	X	Wet				
Wind:	Calm		Light	X	Moderate		Strong		
Cloud cover:	None		Slight		Cloudy		Overcast	X	
Precipitation:	None	X	Slight		Moderate		Heavy		

Barometric pressure (mb): 1022 Local pressure system*: Rising Air temperature (°C): 9.2

Well No.	Time (s)	Flow (l/hr)	dA (PA)	O_2 (% vol. in air)	CO_2 (% vol. in air)	CH_4 (% vol. in air)	PID (ppm)	Depth to GW (mbgl)	Comments
WS10	0	0.1	2.0	18.9	0.9	<0.1	NR	4.30	Base of well at 4.99mbgl
	15	0.2	5.0	18.9	2.1	<0.1			
	30	0.1	2.0	18.3	2.2	<0.1			
	45	0.1	2.0	18.3	2.2	<0.1			
	60	0.1	3.0	18.3	2.2	<0.1			
	90	0.2	5.0	18.3	2.2	<0.1			
	120	0.1	2.0						
	150	0.1	2.0						
	180	0.1	2.0						
	240								
	300								
WS11B	0	<0.1	0.0	18.6	0.8	<0.1	NR	4.45	Base of well at 4.99mbgl
	15	<0.1	0.0	19.4	0.8	<0.1			
	30	<0.1	0.0	19.3	0.8	<0.1			
	45	<0.1	0.0	19.2	0.9	<0.1			
	60	<0.1	0.0	19.2	0.9	<0.1			
	90	<0.1	0.0	19.2	0.9	<0.1			
	120	<0.1	0.0	19.2	0.9	<0.1			
	150								
	180								
	240								
	300								
WS12	0	<0.1	0.0	18.9	0.8	<0.1	NR	4.30	Base of well at 4.94mbgl
	15	<0.1	0.0	19.4	0.9	<0.1			
	30	<0.1	0.0	19.1	1.1	<0.1			
	45	<0.1	0.0	18.8	1.4	<0.1			
	60	<0.1	0.0	18.6	1.6	<0.1			
	90	<0.1	0.0	18.4	1.8	<0.1			
	120	<0.1	0.0	18.4	1.8	<0.1			
	150			18.4	1.8	<0.1			
	180					<0.1			
	240								
	300								

Notes:

The measurement of hydrogen sulphide and hydrocarbon free product is undertaken on a site specific basis, if deemed necessary.

** With reference to the Met Office rolling weather archive for Northolt weather station.*

GAS MONITORING RECORD SHEET

JOB DETAILS			
Site:	Camden Lock Market - Proposed Building E	Job No:	CG/18067C
Date:	06/02/2015	Engineer:	TOP
Time:	09.40am	Client	Walsh Associates

METEOROLOGICAL & SITE INFORMATION

State of ground:	Dry	X	Moist		Wet				
Wind:	Calm	X	Light		Moderate		Strong		
Cloud cover:	None		Slight	X	Cloudy		Overcast		
Precipitation:	None	X	Slight		Moderate		Heavy		
Barometric pressure (mb):	1025 - 1026		Local pressure system*:		Rising		Air temperature (°C):		2

Well No.	Time (s)	Flow (l/hr)	dA (PA)	O_2 (% vol. in air)	CO_2 (% vol. in air)	CH_4 (% vol. in air)	PID (ppm)	Depth to GW (mbgl)	Comments
WS10	0	0.7	2.0	19.1	2.2	<0.1	<0.1	4.42	
	15	0.9	3.0	19.0	2.1	<0.1	<0.1		Base of well at 5.0mbgl
	30	0.9	3.0	18.8	2.0	<0.1	<0.1		
	45	0.8	3.0	18.7	2.0	<0.1	<0.1		
	60	0.7	2.0	18.6	2.0	<0.1			
	90	0.9	3.0	18.6	1.9	<0.1			
	120	0.7	2.0	18.6	2.0	<0.1			
	150	0.8	3.0	18.6	2.0	<0.1			
	180	0.9	3.0	18.5	2.0	<0.1			
	240			18.5	2.0	<0.1			
	300			18.5	1.9	<0.1			
WS11B	0	0.8	3.0	19.6	0.7	<0.1	<0.1	4.74	Base of well at 4.99mbgl
	15	0.7	2.0	19.5	0.7	<0.1	<0.1		
	30	0.7	2.0	19.5	0.7	<0.1	<0.1		
	45	0.8	3.0	19.4	0.7	<0.1	<0.1		
	60	0.8	3.0	19.4	0.6	<0.1			
	90	0.7	2.0	19.3	0.7	<0.1			
	120			19.3	0.7	<0.1			
	150			19.3	0.7	<0.1			
	180			19.3	0.7	<0.1			
	240			19.3	0.7	<0.1			
	300			19.2	0.7	<0.1			
WS12	0	0.8	3.0	19.5	1.5	<0.1	<0.1	4.54	Base of well at 4.95mbgl
	15	0.9	3.0	19.4	1.5	<0.1	<0.1		
	30	0.7	2.0	19.4	1.5	<0.1	<0.1		
	45	0.7	2.0	19.3	1.5	<0.1	<0.1		
	60	0.8	3.0	19.3	1.5	<0.1			
	90	0.7	2.0	19.2	1.5	<0.1			
	120	0.9	3.0	19.2	1.5	<0.1			
	150			19.1	1.5	<0.1			
	180			19.1	1.5	<0.1			
	240			18.9	1.6	<0.1			
	300			18.7	1.7	<0.1			

Notes:

The measurement of hydrogen sulphide and hydrocarbon free product is undertaken on a site specific basis, if deemed necessary.

** With reference to the Met Office rolling weather archive for Northolt weather station.*

GAS MONITORING RECORD SHEET

JOB DETAILS			
Site:	Camden Lock Market - Proposed Building E	Job No:	CG/18067C
Date:	10/02/2015	Engineer:	TOP
Time:	13:00pm	Client	Walsh Associates

METEOROLOGICAL & SITE INFORMATION

State of ground:	Dry	X	Moist		Wet				
Wind:	Calm		Light	X	Moderate		Strong		
Cloud cover:	None		Slight		Cloudy		Overcast	X	
Precipitation:	None	X	Slight		Moderate		Heavy		

Barometric pressure (mb): 1029 Local pressure system*: Rising Air temperature (°C): 5

Well No.	Time (s)	Flow (l/hr)	dA (PA)	O_2 (% vol. in air)	CO_2 (% vol. in air)	CH_4 (% vol. in air)	PID (ppm)	Depth to GW (mbgl)	Comments
WS10	0	0.3	1.0	19.2	2.1	<0.1	NR	3.50	Base of well at 4.98mbgl
	15	0.3	1.0	19.1	2.2	<0.1			
	30	0.4	1.0	19.0	2.2	<0.1			
	45	0.4	1.0	19.0	2.2	<0.1			
	60	0.3	1.0	19.0	2.2	<0.1			
	90	0.3	1.0	19.0	2.2	<0.1			
	120	0.3	1.0	19.0	2.1	<0.1			
	150			19.0	2.1	<0.1			
	180			19.0	2.1	<0.1			
	240								
	300								
WS11B	0	0.3	1.0	20.0	<0.1	<0.1	NR	4.17	
	15	0.3	1.0	20.1	<0.1	<0.1			Base of well at 5.0mbgl
	30	0.4	1.0	20.3	<0.1	<0.1			
	45	0.4	1.0	20.2	<0.1	<0.1			
	60	0.3	1.0	20.1	<0.1	<0.1			
	90	0.3	1.0	20.1	<0.1	<0.1			
	120	0.3	1.0	20.1	0.1	<0.1			
	150			20.1	0.2	<0.1			
	180			20.1	0.3	<0.1			
	240			20.0	0.4	<0.1			
	300			20.0	0.4	<0.1			
WS12	0	0.3	1.0	19.5	1.4	<0.1	NR	3.28	Base of well at 4.99mbgl
	15	0.3	1.0	19.3	1.5	<0.1			
	30	0.4	1.0	19.3	1.5	<0.1			
	45	0.4	1.0	19.3	1.5	<0.1			
	60	0.3	1.0	19.2	1.5	<0.1			
	90	0.3	1.0	19.2	1.4	<0.1			
	120	0.3	1.0	19.2	1.4	<0.1			
	150			19.2	1.4	<0.1			
	180			19.2	1.4	<0.1			
	240								
	300								

Notes:

The measurement of hydrogen sulphide and hydrocarbon free product is undertaken on a site specific basis, if deemed necessary.

** With reference to the Met Office rolling weather archive for Northolt weather station.*

GAS MONITORING RECORD SHEET

JOB DETAILS			
Site:	Camden Lock Market - Proposed Building E	Job No:	CG/18067C
Date:	16/02/2015	Engineer:	TOP
Time:	13:00pm	Client	Walsh Associates

METEOROLOGICAL & SITE INFORMATION

State of ground:	Dry	X	Moist		Wet				
Wind:	Calm		Light	X	Moderate		Strong		
Cloud cover:	None		Slight		Cloudy	X	Overcast		
Precipitation:	None	X	Slight		Moderate		Heavy		

Barometric pressure (mb): 1017 Local pressure system*: Falling Air temperature (°C): 8

Well No.	Time (s)	Flow (l/hr)	dA (PA)	O_2 (% vol. in air)	CO_2 (% vol. in air)	CH_4 (% vol. in air)	PID (ppm)	Depth to GW (mbgl)	Comments
WS10	0	0.5	2.0	18.8	2.1	<0.1	NR	3.78	Base of well at 4.99mbgl
	15	0.4	1.0	18.8	2.1	<0.1			
	30	0.4	1.0	18.7	2.1	<0.1			
	45	0.3	1.0	18.7	2.1	<0.1			
	60	0.5	2.0	18.6	2.1	<0.1			
	90	0.4	1.0	18.6	2.1	<0.1			
	120	0.5	2.0	18.6	2.1	<0.1			
	150			18.5	2.1	<0.1			
	180			18.5	2.1	<0.1			
	240			18.4	2.1	<0.1			
	300			18.4	2.1	<0.1			
WS11B	0	0.4	1.0	19.8	0.1	<0.1	NR	4.53	
	15	0.3	1.0	19.9	0.1	<0.1			Base of well at 5.0mbgl
	30	0.3	1.0	19.9	0.1	<0.1			
	45	0.4	1.0	20.0	0.1	<0.1			
	60	0.5	2.0	20.1	<0.1	<0.1			
	90	0.3	1.0	20.1	<0.1	<0.1			
	120	0.4	1.0	20.1	<0.1	<0.1			
	150			20.1	<0.1	<0.1			
	180			20.1	<0.1	<0.1			
	240			20.1	<0.1	<0.1			
	300			20.0	<0.1	<0.1			
WS12	0	0.5	2.0	19.3	1.3	<0.1	NR	4.12	Base of well at 4.96mbgl
	15	0.5	2.0	19.2	1.3	<0.1			
	30	0.4	1.0	19.2	1.2	<0.1			
	45	0.4	1.0	19.1	1.3	<0.1			
	60	0.4	1.0	19.1	1.3	<0.1			
	90	0.5	2.0	19.1	1.3	<0.1			
	120	0.3	1.0	19.0	1.3	<0.1			
	150			18.9	1.3	<0.1			
	180			18.9	1.3	<0.1			
	240			18.8	1.3	<0.1			
	300			18.7	1.3	<0.1			

Notes:

The measurement of hydrogen sulphide and hydrocarbon free product is undertaken on a site specific basis, if deemed necessary.

** With reference to the Met Office rolling weather archive for Northolt weather station.*

GAS MONITORING RECORD SHEET

JOB DETAILS			
Site:	Camden Lock Market - Proposed Building E	Job No:	CG/18067C
Date:	24/02/2015	Engineer:	TOP
Time:	9am	Client	Walsh Associates

METEOROLOGICAL & SITE INFORMATION

State of ground:	Dry	X	Moist		Wet				
Wind:	Calm		Light	X	Moderate		Strong		
Cloud cover:	None		Slight		Cloudy	X	Overcast		
Precipitation:	None	X	Slight		Moderate		Heavy		
Barometric pressure (mb):	1004 - 1005		Local pressure system*:		Rising		Air temperature (°C):	6	

Well No.	Time (s)	Flow (l/hr)	dA (PA)	O_2 (% vol. in air)	CO_2 (% vol. in air)	CH_4 (% vol. in air)	PID (ppm)	Depth to GW (mbgl)	Comments
WS10	0	0.3	1.0	19.2	2.0	<0.1	NR	3.75	Base of well at 4.98mbgl
	15	0.3	1.0	19.1	2.0	<0.1			
	30	0.2	1.0	19.1	2.0	<0.1			
	45	0.3	1.0	19.0	2.0	<0.1			
	60	0.3	1.0	19.0	2.0	<0.1			
	90	0.3	1.0	18.9	2.0	<0.1			
	120	0.2	1.0	18.9	2.0	<0.1			
	150			18.9	2.0	<0.1			
	180			18.9	2.0	<0.1			
	240			18.9	2.0	<0.1			
	300			18.8	2.0	<0.1			
WS11B	0	0.2	1.0	20.3	<0.1	<0.1	NR	4.50	
	15	0.2	1.0	20.2	<0.1	<0.1			Base of well at 4.9mbgl
	30	0.3	1.0	20.1	<0.1	<0.1			
	45	0.1	1.0	20.1	<0.1	<0.1			
	60	0.2	1.0	20.1	<0.1	<0.1			
	90	<0.1	1.0	20.1	<0.1	<0.1			
	120	0.1	1.0	20.1	<0.1	<0.1			
	150			20.0	<0.1	<0.1			
	180			20.0	<0.1	<0.1			
	240			20.0	<0.1	<0.1			
	300			20.0	<0.1	<0.1			
WS12	0	0.2	1.0	19.6	1.1	<0.1	NR	4.09	Base of well at 4.97mbgl
	15	0.1	1.0	19.6	1.1	<0.1			
	30	0.1	1.0	19.5	1.1	<0.1			
	45	<0.1	1.0	19.5	1.1	<0.1			
	60	0.1	1.0	19.5	1.2	<0.1			
	90	0.2	1.0	19.4	1.2	<0.1			
	120	0.3	1.0	19.4	1.1	<0.1			
	150			19.4	1.1	<0.1			
	180			19.3	1.1	<0.1			
	240			19.3	1.1	<0.1			
	300			19.4	1.1	<0.1			

Notes:

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

APPENDIX E

Chemical test results

James Morrice
Card Geotechnics Ltd
4 Godalming Business Centre
Woolsack Way
Godalming
Surrey
GU7 1XW

t: 01483 310600
f: 01483 527285
e:

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

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 15-65677

Replaces Analytical Report Number : 15-65677, issue no. 1

Project / Site name:	CLV P4 - Development E	**Samples received on:**	16/01/2015
Your job number:	CG-18067C	**Samples instructed on:**	19/01/2015
Your order number:	1431	**Analysis completed by:**	29/01/2015
Report Issue Number:	2	**Report issued on:**	29/01/2015
Samples Analysed:	10 soil samples		

Signed:

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

Signed:

Emma Winter
Assistant Reporting Manager
For & on behalf of i2 Analytical Ltd.

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

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

soils	- 4 weeks from reporting
leachates	- 2 weeks from reporting
waters	- 2 weeks from reporting
asbestos	- 6 months from reporting

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Analytical Report Number: 15-65677

Project / Site name: CLV P4 - Development E

Your Order No: 1431

Lab Sample Number				408549	408550	408551	408552	408553
Sample Reference				WS10	WS10	WS11	WS11B	WS11B
Sample Number				450	453	457	458	459
Depth (m)				0.50	2.00	0.50	0.50	1.50
Date Sampled				14/01/2015	14/01/2015	14/01/2015	14/01/2015	14/01/2015
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	10	20	11	7.0	16
Total mass of sample received	kg	0.001	NONE	0.94	0.99	1.0	1.0	1.1
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	Amosite - Loose fibres	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	Detected	-	-
General Inorganics								
pH	pH Units	N/A	MCERTS	7.5	7.3	10.0	9.5	8.6
Total Cyanide	mg/kg	1	MCERTS	< 1	-	< 1	-	< 1
Total Sulphate as SO_4	mg/kg	50	ISO 17025	1500	1400	3900	-	1300
Water Soluble Sulphate (Soil Equivalent)	g/l	0.0025	MCERTS	-	1.1	-	0.54	-
Water Soluble Sulphate as SO_4 (2:1)	mg/kg	2.5	MCERTS	-	1100	-	540	-
Water Soluble SO4 (BRE SD 2:1 Leach Equivalent)	g/l	0.00125	MCERTS	-	0.57	-	0.27	-
Total Sulphur	mg/kg	50	NONE	-	550	-	-	-
Organic Matter	%	0.1	MCERTS	4.7	-	3.0	-	1.6
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	1.1	-	< 0.05	-	< 0.05
Acenaphthylene	mg/kg	0.1	MCERTS	< 0.10	-	< 0.10	-	< 0.10
Acenaphthene	mg/kg	0.1	MCERTS	2.2	-	< 0.10	-	< 0.10
Fluorene	mg/kg	0.1	MCERTS	2.9	-	< 0.10	-	< 0.10
Phenanthrene	mg/kg	0.1	MCERTS	21	-	0.54	-	< 0.10
Anthracene	mg/kg	0.1	MCERTS	4.5	-	0.16	-	< 0.10
Fluoranthene	mg/kg	0.1	MCERTS	18	-	0.95	-	< 0.10
Pyrene	mg/kg	0.1	MCERTS	14	-	0.85	-	< 0.10
Benzo(a)anthracene	mg/kg	0.1	MCERTS	7.5	-	0.50	-	< 0.10
Chrysene	mg/kg	0.05	MCERTS	7.3	-	0.50	-	< 0.05
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	9.3	-	0.63	-	< 0.10
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	2.4	-	0.37	-	< 0.10
Benzo(a)pyrene	mg/kg	0.1	MCERTS	7.7	-	0.66	-	< 0.10
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	2.5	-	0.28	-	< 0.10
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	0.69	-	< 0.10	-	< 0.10
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	2.8	-	0.39	-	< 0.05
Coronene	mg/kg	0.05	NONE	1.1	-	< 0.05	-	< 0.05
Total PAH								
Total WAC-17 PAHs	mg/kg	1.6	NONE	100	-	5.8	-	< 1.6
Heavy Metals / Metalloids								
Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	44	-	3.7	-	< 1.0
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	44	-	16	-	14
Barium (aqua regia extractable)	mg/kg	1	MCERTS	270	-	250	-	150
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	2.1	-	0.6	-	1.2
Boron (water soluble)	mg/kg	0.2	MCERTS	2.8	-	2.5	-	1.4
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	-	< 0.2	-	< 0.2
Chromium (hexavalent)	mg/kg	1.2	MCERTS	-	-	-	-	-
Chromium (III)	mg/kg	1	NONE	-	-	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	21	-	20	-	32
Copper (aqua regia extractable)	mg/kg	1	MCERTS	220	-	47	-	51
Lead (aqua regia extractable)	mg/kg	1	MCERTS	1200	-	560	-	150
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	2.4	-	0.8	-	0.7
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	36	-	16	-	26
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	67	-	41	-	64
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	470	-	210	-	76

Analytical Report Number: 15-65677

Project / Site name: CLV P4 - Development E

Your Order No: 1431

Lab Sample Number				408549	408550	408551	408552	408553
Sample Reference				WS10	WS10	WS11	WS11B	WS11B
Sample Number				450	453	457	458	459
Depth (m)				0.50	2.00	0.50	0.50	1.50
Date Sampled				14/01/2015	14/01/2015	14/01/2015	14/01/2015	14/01/2015
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics								
Benzene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
Toluene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
p & m-xylene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
o-xylene	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	< 0.1
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	< 0.1
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	< 0.1
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	-	< 1.0	-	< 1.0
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	-	< 2.0	-	< 2.0
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	-	19	-	< 8.0
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	29	-	210	-	8.8
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	29	-	230	-	< 10
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	< 0.1
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	< 0.1
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	-	< 0.1	-	< 0.1
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	1.5	-	< 1.0	-	< 1.0
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	12	-	< 2.0	-	< 2.0
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	81	-	37	-	< 10
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	130	-	550	-	17
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	230	-	590	-	17

Analytical Report Number: 15-65677

Project / Site name: CLV P4 - Development E

Your Order No: 1431

Lab Sample Number				408554	408555	408556	408557	408558
Sample Reference				WS12	WS12	WS12	WS13	WS13
Sample Number				464	466	467	470	472
Depth (m)				0.60	2.20	3.00	0.50	2.20
Date Sampled				14/01/2015	14/01/2015	14/01/2015	14/01/2015	14/01/2015
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Stone Content	%	0.1	NONE	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Moisture Content	%	N/A	NONE	8.3	20	23	16	20
Total mass of sample received	kg	0.001	NONE	1.0	1.1	0.57	1.2	0.58
Asbestos in Soil Screen / Identification Name	Type	N/A	ISO 17025	-	-	-	-	-
Asbestos in Soil	Type	N/A	ISO 17025	Not-detected	-	-	Not-detected	-
General Inorganics								
pH	pH Units	N/A	MCERTS	8.5	7.7	7.9	7.9	7.8
Total Cyanide	mg/kg	1	MCERTS	< 1	< 1	-	< 1	-
Total Sulphate as SO_4	mg/kg	50	ISO 17025	2000	1300	800	950	1400
Water Soluble Sulphate (Soil Equivalent)	g/l	0.0025	MCERTS	-	-	0.51	0.057	0.89
Water Soluble Sulphate as SO_4 (2:1)	mg/kg	2.5	MCERTS	-	-	510	57	890
Water Soluble SO4 (BRE SD 2:1 Leach Equivalent)	g/l	0.00125	MCERTS	-	-	0.25	0.028	0.45
Total Sulphur	mg/kg	50	NONE	-	-	290	-	530
Organic Matter	%	0.1	MCERTS	2.0	1.4	-	4.4	-
Total Phenols								
Total Phenols (monohydric)	mg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	-
Speciated PAHs								
Naphthalene	mg/kg	0.05	MCERTS	0.11	< 0.05	-	< 0.05	-
Acenaphthylene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	-	< 0.10	-
Acenaphthene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	-	< 0.10	-
Fluorene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	-	< 0.10	-
Phenanthrene	mg/kg	0.1	MCERTS	0.61	< 0.10	-	0.25	-
Anthracene	mg/kg	0.1	MCERTS	0.17	< 0.10	-	< 0.10	-
Fluoranthene	mg/kg	0.1	MCERTS	1.3	< 0.10	-	0.46	-
Pyrene	mg/kg	0.1	MCERTS	1.1	< 0.10	-	0.38	-
Benzo(a)anthracene	mg/kg	0.1	MCERTS	0.79	< 0.10	-	0.26	-
Chrysene	mg/kg	0.05	MCERTS	0.85	< 0.05	-	0.29	-
Benzo(b)fluoranthene	mg/kg	0.1	MCERTS	1.3	< 0.10	-	0.35	-
Benzo(k)fluoranthene	mg/kg	0.1	MCERTS	0.38	< 0.10	-	0.18	-
Benzo(a)pyrene	mg/kg	0.1	MCERTS	1.0	< 0.10	-	0.33	-
Indeno(1,2,3-cd)pyrene	mg/kg	0.1	MCERTS	0.35	< 0.10	-	< 0.10	-
Dibenz(a,h)anthracene	mg/kg	0.1	MCERTS	< 0.10	< 0.10	-	< 0.10	-
Benzo(ghi)perylene	mg/kg	0.05	MCERTS	0.48	< 0.05	-	< 0.05	-
Coronene	mg/kg	0.05	NONE	< 0.05	< 0.05	-	< 0.05	-
Total PAH								
Total WAC-17 PAHs	mg/kg	1.6	NONE	8.5	< 1.6	-	2.5	-
Heavy Metals / Metalloids								
Antimony (aqua regia extractable)	mg/kg	1	ISO 17025	2.5	2.1	-	6.0	-
Arsenic (aqua regia extractable)	mg/kg	1	MCERTS	16	9.7	-	43	-
Barium (aqua regia extractable)	mg/kg	1	MCERTS	160	82	-	350	-
Beryllium (aqua regia extractable)	mg/kg	0.06	MCERTS	1.1	1.7	-	2.7	-
Boron (water soluble)	mg/kg	0.2	MCERTS	0.4	< 0.2	-	1.5	-
Cadmium (aqua regia extractable)	mg/kg	0.2	MCERTS	< 0.2	< 0.2	-	< 0.2	-
Chromium (hexavalent)	mg/kg	1.2	MCERTS	-	< 1.2	-	-	-
Chromium (III)	mg/kg	1	NONE	-	52	-	-	-
Chromium (aqua regia extractable)	mg/kg	1	MCERTS	23	52	-	32	-
Copper (aqua regia extractable)	mg/kg	1	MCERTS	78	24	-	200	-
Lead (aqua regia extractable)	mg/kg	1	MCERTS	290	22	-	1300	-
Mercury (aqua regia extractable)	mg/kg	0.3	MCERTS	1.1	< 0.3	-	1.8	-
Nickel (aqua regia extractable)	mg/kg	1	MCERTS	24	26	-	44	-
Selenium (aqua regia extractable)	mg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	-
Vanadium (aqua regia extractable)	mg/kg	1	MCERTS	56	89	-	89	-
Zinc (aqua regia extractable)	mg/kg	1	MCERTS	170	79	-	270	-

Analytical Report Number: 15-65677

Project / Site name: CLV P4 - Development E

Your Order No: 1431

Lab Sample Number				408554	408555	408556	408557	408558
Sample Reference				WS12	WS12	WS12	WS13	WS13
Sample Number				464	466	467	470	472
Depth (m)				0.60	2.20	3.00	0.50	2.20
Date Sampled				14/01/2015	14/01/2015	14/01/2015	14/01/2015	14/01/2015
Time Taken				None Supplied	None Supplied	None Supplied	None Supplied	None Supplied
Analytical Parameter (Soil Analysis)	**Units**	**Limit of detection**	**Accreditation Status**					
Monoaromatics								
Benzene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	-
Toluene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	-
Ethylbenzene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	-
p & m-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	-
o-xylene	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	-
MTBE (Methyl Tertiary Butyl Ether)	µg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	-
Petroleum Hydrocarbons								
TPH-CWG - Aliphatic >EC5 - EC6	mg/kg	0.1	MCERTS	< 0.1	< 0.1	-	< 0.1	-
TPH-CWG - Aliphatic >EC6 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	-	< 0.1	-
TPH-CWG - Aliphatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	-	< 0.1	-
TPH-CWG - Aliphatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	-
TPH-CWG - Aliphatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	-	< 2.0	-
TPH-CWG - Aliphatic >EC16 - EC21	mg/kg	8	MCERTS	< 8.0	< 8.0	-	< 8.0	-
TPH-CWG - Aliphatic >EC21 - EC35	mg/kg	8	MCERTS	< 8.0	< 8.0	-	< 8.0	-
TPH-CWG - Aliphatic (EC5 - EC35)	mg/kg	10	MCERTS	< 10	< 10	-	< 10	-
TPH-CWG - Aromatic >EC5 - EC7	mg/kg	0.1	MCERTS	< 0.1	< 0.1	-	< 0.1	-
TPH-CWG - Aromatic >EC7 - EC8	mg/kg	0.1	MCERTS	< 0.1	< 0.1	-	< 0.1	-
TPH-CWG - Aromatic >EC8 - EC10	mg/kg	0.1	MCERTS	< 0.1	< 0.1	-	< 0.1	-
TPH-CWG - Aromatic >EC10 - EC12	mg/kg	1	MCERTS	< 1.0	< 1.0	-	< 1.0	-
TPH-CWG - Aromatic >EC12 - EC16	mg/kg	2	MCERTS	< 2.0	< 2.0	-	< 2.0	-
TPH-CWG - Aromatic >EC16 - EC21	mg/kg	10	MCERTS	< 10	< 10	-	< 10	-
TPH-CWG - Aromatic >EC21 - EC35	mg/kg	10	MCERTS	31	< 10	-	< 10	-
TPH-CWG - Aromatic (EC5 - EC35)	mg/kg	10	MCERTS	31	< 10	-	< 10	-

Analytical Report Number : 15-65677

Project / Site name: CLV P4 - Development E

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
408549	WS10	450	0.50	Black topsoil and sand with gravel and vegetation.
408550	WS10	453	2.00	Light brown clay.
408551	WS11	457	0.50	Brown topsoil and clay with rubble.
408552	WS11B	458	0.50	Light brown topsoil and clay with rubble and brick.
408553	WS11B	459	1.50	Light brown clay and sand with rubble and vegetation.
408554	WS12	464	0.60	Brown topsoil and clay with rubble.
408555	WS12	466	2.20	Grey clay and sand.
408556	WS12	467	3.00	Light brown clay.
408557	WS13	470	0.50	Brown topsoil and clay with gravel and vegetation.
408558	WS13	472	2.20	Light brown clay.

Analytical Report Number : 15-65677

Project / Site name: CLV P4 - Development E

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Asbestos identification in soil	Asbestos Identification with the use of polarised light microscopy in conjunction with disperion staining techniques.	In house method based on HSG 248	A001-PL	D	ISO 17025
Boron, water soluble, in soil	Determination of water soluble boron in soil by hot water extract followed by ICP-OES.	In-house method based on Second Site Properties version 3	L038-PL	D	MCERTS
BTEX and MTBE in soil	Determination of BTEX in soil by headspace GC-MS.	In-house method based on USEPA8260	L073S-PL	W	MCERTS
chromium III in soil	In-house method by calculation from total Cr and Cr VI.	In-house method	L068-PL	D	NONE
Hexavalent chromium in soil (Lower Level)	Determination of hexavalent chromium in soil by extraction in water then by acidification, addition of 1,5 diphenylcarbazide followed by colorimetry.	In-house method	L080-PL	W	MCERTS
Metals in soil by ICP-OES	Determination of metals in soil by aqua-regia digestion followed by ICP-OES.	In-house method based on MEWAM 2006 Methods for the Determination of Metals in Soil.	L038-PL	D	MCERTS
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
Monohydric phenols in soil	Determination of phenols in soil by extraction with sodium hydroxide followed by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	MCERTS
Organic matter in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS
pH in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	MCERTS
Speciated WAC-17 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Stones not passing through a 10 mm sieve is determined gravimetrically and reported as a percentage of the dry weight. Sample results are not corrected for the stone content of the sample.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate, water soluble, in soil	Determination of water soluble sulphate by extraction with water followed by ICP-OES. Results reported corrected for extraction ratio (soil equivalent) as g/l and mg/kg; and upon the 2:1 leachate (g/l).	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	MCERTS
Total cyanide in soil	Determination of total cyanide by distillation followed by colorimetry.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (Skalar)	L080-PL	W	MCERTS
Total sulphate (as SO4 in soil)	Determination of total sulphate in soil by extraction with 10% HCl followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L038-PL	D	ISO 17025
Total Sulphur in soil	Determination of total sulphur in soil by extraction with aqua-regia, potassium bromide/bromate followed by ICP-OES.	In-house method based on BS1377 Part 3, 1990, and MEWAM 2006 Methods for the Determination of Metals in Soil	L038-PL	D	NONE

Analytical Report Number : 15-65677

Project / Site name: CLV P4 - Development E

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
TPHCWG (Soil)	Determination of pentane extractable hydrocarbons in soil by GC-MS/GC-FID.	In-house method	L076-PL	W	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

James Morrice
Card Geotechnics Ltd
4 Godalming Business Centre
Woolsack Way
Godalming
Surrey
GU7 1XW

t: 01483 310600
f: 01483 527285
e:

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

t: 01923 225404
f: 01923 237404
e: reception@i2analytical.com

Analytical Report Number : 15-65680

Replaces Analytical Report Number : 15-65680, issue no. 1

Project / Site name:	CLV P4 - Development E	**Samples received on:**	16/01/2015
Your job number:	CG-18067C	**Samples instructed on:**	19/01/2015
Your order number:	1431	**Analysis completed by:**	29/01/2015
Report Issue Number:	2	**Report issued on:**	29/01/2015
Samples Analysed:	1 wac multi sample		

Signed:

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

Signed:

Emma Winter
Assistant Reporting Manager
For & on behalf of i2 Analytical Ltd.

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

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

soils - 4 weeks from reporting
leachates - 2 weeks from reporting
waters - 2 weeks from reporting
asbestos - 6 months from reporting

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

i2 Analytical
7 Woodshots Meadow
Croxley Green Business Park
Watford, WD18 8YS

Telephone: 01923 225404
Fax: 01923 237404
email:reception@i2analytical.com

Waste Acceptance Criteria Analytical Results

Report No:	**15-65680**						
					Client:	**CARDGEO**	
Location	**CLV P4 - Development E**						
Lab Reference (Sample Number)	408570				**Landfill Waste Acceptance Criteria Limits**		
Sampling Date	14/01/2015				Inert Waste Landfill	Stable Non-reactive HAZARDOUS waste in non-hazardous Landfill	Hazardous Waste Landfill
Sample ID	WS14 476						
Depth (m)	0.50						
Solid Waste Analysis							
TOC (%)**	0.9				3%	5%	6%
Loss on Ignition (%) **	6.1				--	--	10%
BTEX (µg/kg) **	< 10				6000	--	--
Sum of PCBs (mg/kg) **	0.89				1	--	--
Mineral Oil (mg/kg)	< 10				500	--	--
Total PAH (WAC-17) (mg/kg)	7.5				100	--	--
pH (units)**	9.0				--	>6	--
Acid Neutralisation Capacity (mol / kg)	22				--	To be evaluated	To be evaluated
Eluate Analysis (BS EN 12457 - 3 preparation utilising end over end leaching procedure)	2:1	8:1		Cumulative 10:1	Limit values for compliance leaching test using BS EN 12457-3 at L/S 10 l/kg (mg/kg)		
	mg/l	mg/l		mg/kg			
Arsenic *	0.010	< 0.010		< 0.050	0.5	2	25
Barium *	0.087	0.019		0.30	20	100	300
Cadmium *	< 0.0005	< 0.0005		< 0.0020	0.04	1	5
Chromium *	0.013	0.0028		0.045	0.5	10	70
Copper *	0.11	0.029		0.42	2	50	100
Mercury *	< 0.0015	< 0.0015		< 0.010	0.01	0.2	2
Molybdenum *	0.014	< 0.0030		0.039	0.5	10	30
Nickel *	0.0065	0.0021		0.028	0.4	10	40
Lead *	0.017	0.017		0.17	0.5	10	50
Antimony *	< 0.0050	< 0.0050		< 0.020	0.06	0.7	5
Selenium *	< 0.010	< 0.010		< 0.040	0.1	0.5	7
Zinc *	0.0019	< 0.0010		< 0.020	4	50	200
Chloride *	16	< 4.0		45	800	4000	25000
Fluoride	0.34	0.28		2.9	10	150	500
Sulphate *	600	54		1400	1000	20000	50000
TDS	550	120		1900	4000	60000	100000
Phenol Index (Monhydric Phenols) *	< 0.13	< 0.13		< 0.50	1	-	-
DOC	12	5.9		69	500	800	1000
Leach Test Information							
Stone Content (%)	< 0.1						
Sample Mass (kg)	1.1						
Dry Matter (%)	91						
Moisture (%)	9.1						
Stage 1							
Volume Eluate L2 (litres)	0.33						
Filtered Eluate VE1 (litres)	0.28						

Results are expressed on a dry weight basis, after correction for moisture content where applicable
Stated limits are for guidance only and I2 cannot be held responsible for any discrepencies with current legislation

*= UKAS accredited (liquid eluate analysis only)
** = MCERTS accrediited

Analytical Report Number : 15-65680

Project / Site name: CLV P4 - Development E

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

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

Lab Sample Number	Sample Reference	Sample Number	Depth (m)	Sample Description *
408570	WS14	476	0.50	Light brown sandy topsoil with rubble and brick.

Analytical Report Number : 15-65680

Project / Site name: CLV P4 - Development E

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

Analytical Test Name	Analytical Method Description	Analytical Method Reference	Method number	Wet / Dry Analysis	Accreditation Status
Acid neutralisation capacity of soil	Determination of acid neutralisation capacity by addition of acid or alkali followed by electronic probe.	In-house method based on Guidance an Sampling and Testing of Wastes to Meet Landfill Waste Acceptance	L046-PL	W	NONE
BTEX (Sum of BTEX compounds) in soil	Determination of BTEX in soil by headspace GC-MS. Individual components MCERTS accredited	In-house method based on USEPA8260	L073S-PL	W	MCERTS
Chloride in WAC leachate (BS EN 12457-3 Prep)	Determination of chloride in leachate by Gallery discrete analyser.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L082-PL	W	ISO 17025
DOC in WAC leachate (BS EN 12457-3 Prep)	Determination of dissolved organic carbon in leachate by the measurement on a non-dispersive infrared analyser of carbon dioxide released by acidification.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L037-PL	W	NONE
Fluoride in WAC leachate (BS EN 12457-3 Prep)	Determination of fluoride in leachate by 1:1ratio with a buffer solution followed by Ion Selective Electrode.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L033-PL	W	NONE
Loss on ignition of soil @ 450oC	Determination of loss on ignition in soil by gravimetrically with the sample being ignited in a muffle furnace.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L047-PL	D	MCERTS
Metals in WAC leachate (BS EN 12457-3 Prep)	Determination of metals in leachate by acidification followed by ICP-OES.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L039-PL	W	ISO 17025
Mineral Oil in Soil	Determination of dichloromethane/hexane extractable hydrocarbons in soil by GC-MS.	In-house method based on USEPA 8270	L064-PL	D	NONE
Moisture Content	Moisture content, determined gravimetrically.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L019-UK/PL	W	NONE
PCB's by GC-MS in soil	Determination of PCB by extraction with acetone and hexane followed by GC-MS.	In-house method based on USEPA 8082	L027-PL	D	NONE
pH in soil	Determination of pH in soil by addition of water followed by electrometric measurement.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L005-PL	W	MCERTS
Phenol Index in WAC leachate (BS EN 12457-3 Prep)	Determination of monohydric phenols in leachate by continuous flow analyser.	In-house method based on Examination of Water and Wastewater 20th Edition: Clesceri, Greenberg & Eaton (skalar)	L080-PL	W	ISO 17025
Seciated WAC-17 PAHs in soil	Determination of PAH compounds in soil by extraction in dichloromethane and hexane followed by GC-MS with the use of surrogate and internal standards.	In-house method based on USEPA 8270	L064-PL	D	NONE
Stones content of soil	Standard preparation for all samples unless otherwise detailed. Stones not passing through a 10 mm sieve is determined gravimetrically and reported as a percentage of the dry weight. Sample results are not corrected for the stone content of the sample.	In-house method based on British Standard Methods and MCERTS requirements.	L019-UK/PL	D	NONE
Sulphate in WAC leachate (BS EN 12457-3 Prep)	Determination of sulphate in leachate by acidification followed by ICP-OES.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L039-PL	W	ISO 17025
TDS in WAC leachate (BS EN 12457-3 Prep)	Determination of total dissolved solids in leachate by electrometric measurement.	In-house method based on Standard Methods for the Examination of Water and Waste Water, 21st Ed.	L004-PL	W	NONE
Total organic carbon in soil	Determination of organic matter in soil by oxidising with potassium dichromate followed by titration with iron (II) sulphate.	In-house method based on BS1377 Part 3, 1990, Chemical and Electrochemical Tests	L023-PL	D	MCERTS

For method numbers ending in 'UK' analysis have been carried out in our laboratory in the United Kingdom.
For method numbers ending in 'PL' analysis have been carried out in our laboratory in Poland.
Soil analytical results are expressed on a dry weight basis. Where analysis is carried out on as-received the results obtained are multiplied by a moisture correction factor that is determined gravimetrically using the moisture content which is carried out at a maximum of 30oC.

APPENDIX F

Geotechnical test results

RESULTS OF INDEX PROPERTY AND WATER CONTENT TESTS

Contract: Camden Lock Village, Site E **Report No:** T14/1442

WS No	Sample		Water Content W,%	Liquid Limit W_L,%	Plastic Limit W_P,%	Plasticity Index IP%	% Passing 425micron sieve	Corrected Plasticity Index IPc %	Clay Fraction %	Colloidal Activity A	Soil Classification	Remarks
	Depth m	Description										
10	3.00	Brown clay	33.8	80	28	52	100	52			CV	
11B	5.00	Brown clay with occasional blue-grey veining and selenite crystals	29.7	76	27	49	100	49			CV	
13	3.00	Brown clay with occasional blue-grey veining	33.0	78	28	50	100	50			CV	
15	1.50	Grey-brown mottled brown clay	27.2	61	24	37	100	37			CH	

*Key: *Soils:* C - Clay M - Silt S - Sand O - Organic *Plasticities* L - Low I - Intermediate H - High V - Very high E - Extremely high

Albury S.I. Ltd Miltons Yard Petworth Road Witley Surrey GU8 5LH